Compact 5000 Analog I/O Modules

Catalog Numbers 5069-IF4IH, 5069-IF8, 5069-IY4, 5069-IY4K, 5069-OF4, 5069-OF4K, 5069-OF4IH, 5069-OF8

Allen-Bradley
by ROCKWELL AUTOMATION

User Manual

Original Instructions

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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.

IMPORTANT Identifies information that is critical for successful application and understanding of the product.

These labels may also be on or inside the equipment to provide specific precautions.

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.

ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

The following icon may appear in the text of this document.

Identifies information that is useful and can help to make a process easier to do or easier to understand.

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About This Publication

This manual describes how to use Compact 5000® analog I/O modules in Logix 5000® control systems. Make sure that you are familiar with these concepts:

- Use of a controller in a Logix 5000 control system
- Use of an EtherNet/IP™ network, if the analog I/O modules are used remotely
- Use of Studio 5000 Logix Designer® environment

IMPORTANT This manual uses these conventions.

- standard I/O module = a non-HART-enabled analog I/O module
- HART I/O module = a HART-enabled analog I/O module
- Compact 5000 analog I/O module = both standard and HART analog I/O modules

Rockwell Automation recognizes that some of the terms that are currently used in our industry and in this presentation are not in alignment with the movement toward inclusive language in technology.

While we proactively collaborate with industry peers to find alternatives to such terms and change our products and content, please excuse the use of such terms in our content.

Download Firmware, AOP, EDS, and Other Files

Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes from the Product Compatibility and Download Center at rok.auto/pcdc.

Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

Topic	Page
Updated the Calibration section with 5069-IF4IH information for firmware revision 1.012	36
Updated the Notch Filter section for the 5069-IF4IH module with firmware revision 1.012 RPI values	75

Terminology

This table defines some of the terms that are used in this manual.

Acronym	Full Term	Definition
CIP™	Common Industrial Protocol	An industrial communication protocol that is used by Logix 5000-based automation systems on EtherNet/IP, ControlNet®, and DeviceNet® communication networks.
CIP Sync™	Common Industrial Protocol Synchronization	CIP Sync provides the increased control coordination that is needed for control applications where absolute time synchronization is vital to achieve real-time synchronization between distributed intelligent devices and systems.
—	Connection	Logical communication channel for communication between nodes. Connections are maintained and controlled between leaders and followers.
EDS	Electronic Data Sheet	A template that is used in RSNetWorx™ software to display the configuration parameters, I/O data profile, and connection type support for a given I/O module. RSNetWorx software uses these simple text files to identify products and commission them on a network.
EN	European Norm.	The official European Standard.
GSV	Get System Value	A ladder logic instruction that retrieves specified controller status information and places it in a destination tag.
HART	Highway Addressable Remote Transducer protocol	The HART protocol is a standard for digitally enhanced 4…20 mA communication with smart (microprocessor-based) field devices. A digital signal is superimposed on the 4…20 mA current loop to provide two means of communication from the device. The 4…20 mA analog channel communicates the primary process variable at the fastest possible rate while the digital channel communicates multiple process variables, data quality, and device status. The HART protocol lets you use these simultaneous communication channels in a complementary fashion.
—	Multicast	The transmission of information from one sender to multiple receivers.
—	Unicast	The transmission of information from one sender to one receiver.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation. You can view or download publications at rok.auto/literature.

Resource	Description
Compact 5000 Installation Instructions	Describes how to install and wire these Compact 5000 I/O and Specialty Modules.
Publication 5069-IN001	5069-FPD
Publication 5069-IN002	5069-ARM
Publication 5069-IN003	5069-AENTR
Publication 5069-IN004	5069-IB16, 5069-IB16F, 5069-IB16K
Publication 5069-IN006	5069-IB6F-3W
Publication 5069-IN007	5069-OB16, 5069-OB16F, 069-OB16K
Publication 5069-IN008	5069-OW4I
Publication 5069-IN009	5069-OX4I
Publication 5069-IN010	5069-IF8
Publication 5069-IN011	5069-IY4, 5069-IY4K
Publication 5069-IN012	5069-OF4, 5069-OF4K, 5069-OF8
Publication 5069-IN015	5069-IA16
Publication 5069-IN016	5069-OA16
Publication 5069-IN017	5069-OB8
Publication 5069-IN018	5069-OW16
Publication 5069-IN020	5069-IB8S, 5069-IB8SK
Publication 5069-IN021	5069-OBV8S, 5069-OBV8SK
Publication 5069-IN025	5069-IF4IH
Publication 5069-IN026	5069-OF4IH
Compact 5000 I/O and Specialty Modules Technical Data, publication 5069-TD001	Provides specifications, wiring diagrams, and module block diagrams for Compact 5000 I/O modules.
CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, publication 5069-UM001	Describes how to configure, operate, and troubleshoot CompactLogix™ 5380 and Compact GuardLogix® 5380 controllers.
CompactLogix 5480 Controllers User Manual, publication 5069-UM002	Describes how to configure, operate, and troubleshoot CompactLogix 5480 controllers.
Compact 5000 Digital I/O Modules User Manual, publication 5069-UM004	Describes how to use Compact 5000 I/O digital modules.
Compact 5000 High-speed Counter Module User Manual, publication 5069-UM006	Describes how to use Compact 5000 I/O high-speed counter modules.
GuardLogix and Compact GuardLogix 5380 Controller Systems Safety Reference Manual, publication 1756-RM012	Describes requirements for achieving and maintaining Safety Integrity Level (SIL) 2 and Performance Level (PL) d requirements with the GuardLogix 5580 controller system, with the Studio 5000 Logix Designer® application.
ControlLogix 5580 and GuardLogix 5580 Controllers User Manual, publication 1756-UM543	Describes how to configure, operate, and troubleshoot ControlLogix® 5580 and GuardLogix 5580 controllers.
Electronic Keying in Logix 5000 Control Systems Application Technique, publication LOGIX-AT001	Describes how to use electronic keying in Logix 5000 control system applications.
Integrated Architecture and CIP Sync Configuration Application Technique, publication IA-AT003	Provides information about CIP Sync technology and how to synchronize clocks within the Rockwell Automation® Integrated Architecture® system.
System Security Design Guidelines Reference Manual, publication SECURE-RM001	Provides guidance on how to conduct security assessments, implement Rockwell Automation products in a secure system, harden the control system, manage user access, and dispose of equipment.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications	Provides declarations of conformity, certificates, and other certification details.

Analog Module Operation in a Control System

Logix 5000® controllers use the Compact 5000® analog I/O modules to control devices in a control system.

Analog I/O modules convert analog signals to digital values for inputs and convert digital values to analog signals for outputs. Controllers use these signals for control purposes.

Compact 5000 analog I/O modules use removable terminal blocks (RTBs) to connect field-side wiring. Use the Studio 5000 Logix Designer® application to configure the modules.

IMPORTANT Controller and programming software compatibility requirements apply when you use Compact 5000 analog I/O modules.

For more information on controller and software compatibility, see Controller and Software Compatibility.

Compact 5000 analog I/O modules use the Producer/Consumer network communication model. This communication is an intelligent data exchange between modules and other system devices in which each module produces data without first being polled.

Controller and Software Compatibility

Controller and programming software compatibility requirements apply when you use Compact 5000 analog I/O modules.

- Compatibility between Logix 5000 controllers and Compact 5000 analog I/O modules varies based on whether the module is local or remote.
- Standard I/O modules are supported in the Studio 5000 Logix Designer application, version 28 or greater. However, the Logix 5000 controllers that are compatible with the I/O modules support different minimum versions of the Studio 5000 Logix Designer application.
- HART I/O modules are supported in the Studio 5000 Logix Designer application, version 33 or greater.

This table describes the module compatibility requirements when you use Compact 5000 analog I/O modules with Logix 5000 controllers. Consider the different device requirements when you design your system.

Compact 5000 I/O Analog Modules Controller and Software Compatibility Requirements

Module Type	Controllers		Studio 5000 Logix Designer Application	
	System	Controller Cat. Nos.	Standard I/O Modules	HART I/O Modules
Local I/O modules	CompactLogix® 5380	5069-L320ER, 5069-L320ERMK, 5069-L330ERMK, 5069-L340ERM, 5069-L350ERMK	Version 28.00.00 or later	Version 33.00.00 or later
		5069-L306ER, 5069-L306ERM, 5069-L310ER, 5069-L310ERM, 5069-L310ERMK, 5069-L310ER-NSE, 5069-L310ERS2, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP, 5069-L330ER, 5069-L330ERM, 5069-L330ERMK, 5069-L340ER, 5069-L340ERP	Version 29.00.00 or later	
		5069-L350ERM, 5069-L350ERMK, 5069-L380ERM, 5069-L3100ERM	Version 30.00.00 or later	
	CompactLogix 5480	5069-L46ERMW	Version 32.00.00 or later	
	Compact GuardLogix® 5380	5069-L306ERS2, 5069-L306ERMS2, 5069-L310ERS2, 5069-L310ERMS2, 5069-L320ERS2, 5069-L320ERS2K, 5069-L320ERMS2, 5069-L320ERMS2K, 5069-L330ERS2, 5069-L330ERS2K, 5069-L330ERMS2, 5069-L330ERMS2K, 5069-L340ERS2, 5069-L340ERMS2, 5069-L350ERS2, 5069-L350ERS2K, 5069-L350ERMS2, 5069-L350ERMS2K, 5069-L380ERS2, 5069-L380ERMS2, 5069-L3100ERS2, 5069-L3100ERMS2	Version 31.00.00 or later	
Remote I/O modules	CompactLogix 5380	5069-L320ER, 5069-L340ERM	Version 28.00.00 or later	
		5069-L306ER, 5069-L306ERM, 5069-L310ER, 5069-L310ERM, 5069-L310ERMK, 5069-L310ER-NSE, 5069-L310ERS2, 5069-L320ERM, 5069-L320ERP, 5069-L330ER, 5069-L330ERM, 5069-L340ER, 5069-L340ERP	Version 29.00.00 or later	
		5069-L350ERM, 5069-L380ERM, 5069-L3100ERM	Version 30.00.00 or later	
	CompactLogix 5480	5069-L46ERMW	Version 32.00.00 or later	
	Compact GuardLogix 5380	5069-L306ERS2, 5069-L306ERMS2, 5069-L310ERS2, 5069-L310ERMS2, 5069-L320ERS2, 5069-L320ERS2K, 5069-L320ERMS2, 5069-L320ERMS2K, 5069-L330ERS2, 5069-L330ERS2K, 5069-L330ERMS2, 5069-L330ERMS2K, 5069-L340ERS2, 5069-L340ERMS2, 5069-L350ERS2, 5069-L350ERS2K, 5069-L350ERMS2, 5069-L350ERMS2K, 5069-L380ERS2, 5069-L380ERMS2, 5069-L3100ERS2, 5069-L3100ERMS2	Version 31.00.00 or later	
	ControlLogix® 5580	1756-L83E, 1756-L85E	Version 28.00.00 or later	
		1756-L81E, 1756-L82E, 1756-L84E	Version 29.00.00 or later	
	GuardLogix 5580	1756-L81ES, 1756-L82ES, 1756-L83ES, 1756-L84ES	Version 31.00.00 or later	

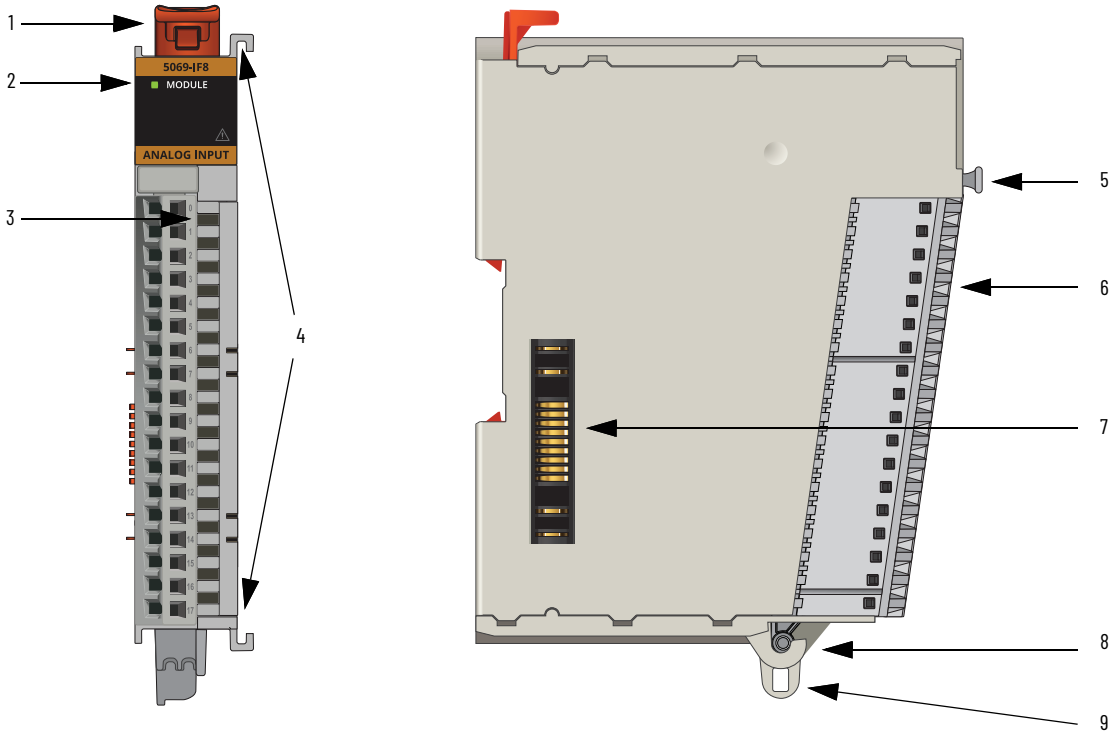
Types of Modules

This table describes the types of Compact 5000 analog I/O modules. Catalog numbers that end in 'K' are conformally coated.

Catalog Number	Description
5069-IF4IH	4-channel current/voltage/HART input module
5069-IF8	8-channel current/voltage input module
5069-IY4. 5069-IY4K	4-channel current/voltage/RTD/Thermocouple input module
5069-OF4, 5069-OF4K	4-channel current/voltage output module
5069-OF4IH	4-channel current/voltage/HART output module
5069-OF8	8-channel current/voltage output module

Module Overview

This figure shows the parts of an example Compact 5000 analog I/O module.



Item	Item	Description
1	DIN rail latch	Locks the module on the DIN rail.
2	Module status indicator	Displays the status of communication and module health.
3	I/O status indicators	Displays the status of the input/output point.
4	Interlocking pieces	Securely installs Compact 5000 analog I/O modules in the system.
5	RTB handle	Anchors the RTB on the module.
6	RTB	Provides a wiring interface for the module.
7	MOD power bus and SA power bus connectors	Pass system-side and field-side power across the internal circuitry of the module in a Compact 5000 I/O system. The connectors are isolated from each other.
8	RTB lower tab	Hooks RTB onto the module to begin installation.
9	Lower hook	Used with cable tie after you wire the module.

Local I/O Modules or Remote I/O Modules

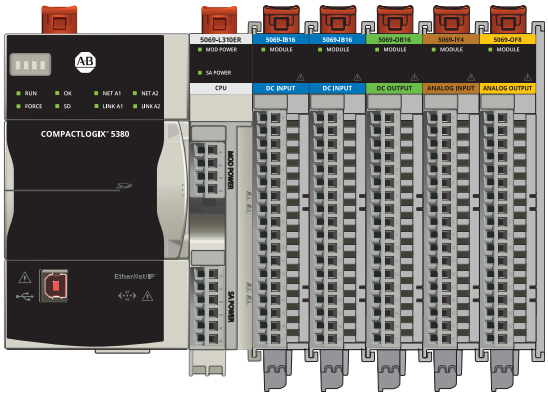
You can use Compact 5000 analog I/O modules as local or remotel/O modules, with some restrictions that are based on the module and controller type. Compatibility requirements apply and are described in Controller and Software Compatibility.

Local I/O Modules

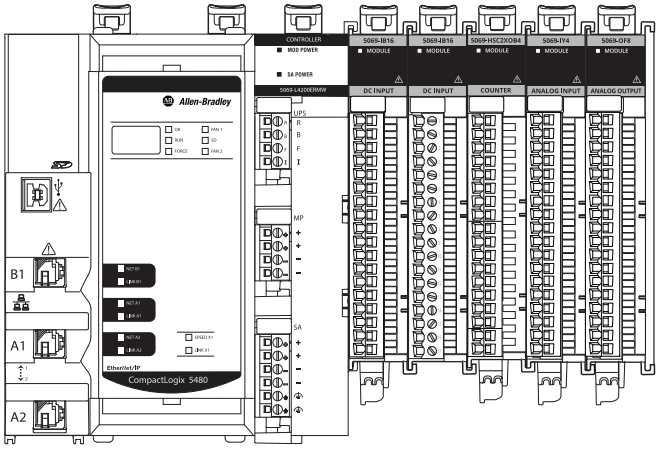
When Compact 5000 analog I/O modules reside in the same system as the controller, the modules are local I/O modules.

Local I/O modules are installed to the right of the controller and exchange data with the controller over the system backplane.

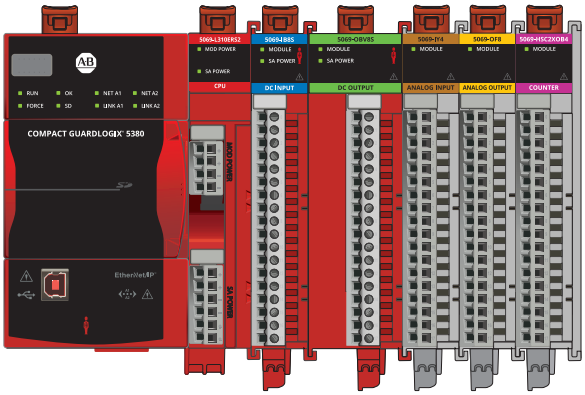
CompactLogix 5380 Controller Local Compact 5000 I/O Modules



CompactLogix 5480 Controller Local Compact 5000 I/O Modules



Compact GuardLogix 5380 Controller Local Compact 5000 I/O Modules

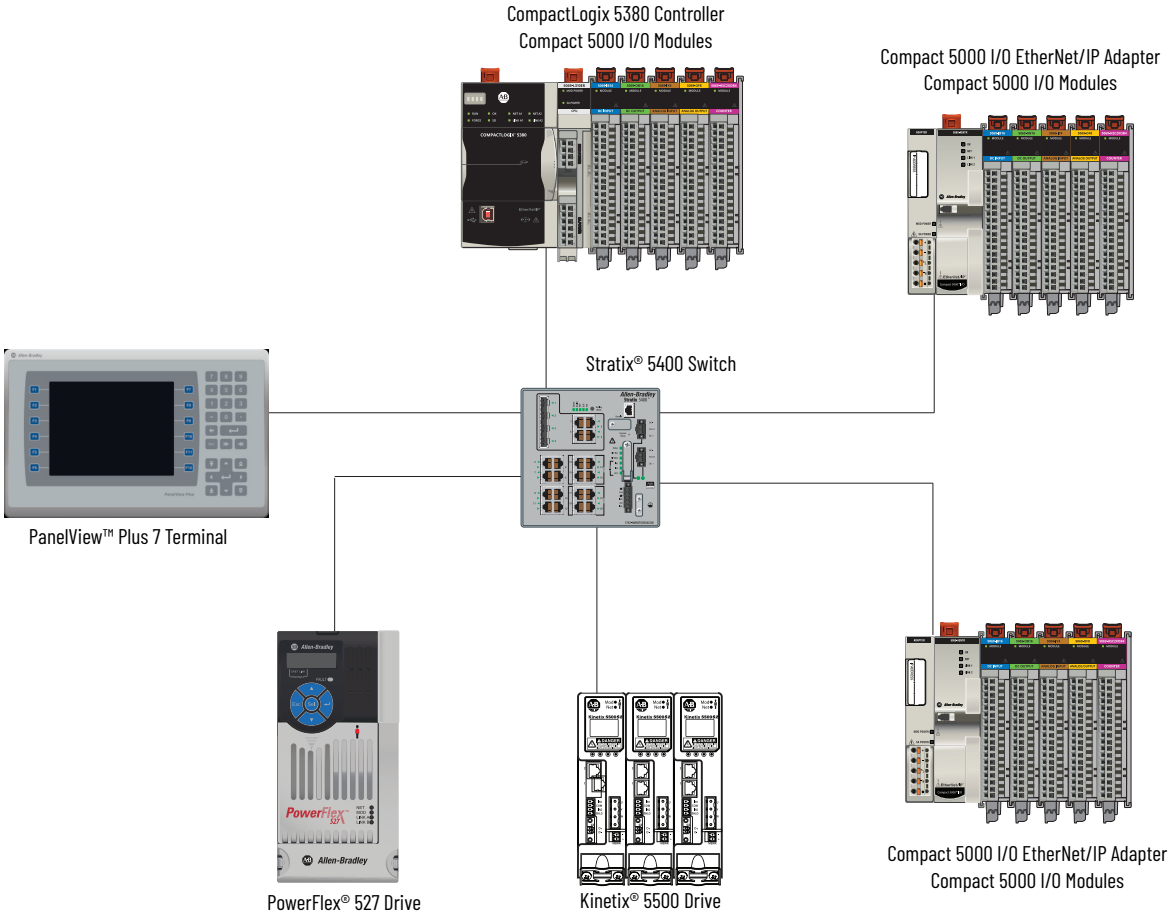


Remote I/O Modules

When Compact 5000 analog I/O modules reside in a separate location from Logix 5000 controllers, they are remote I/O modules. Remote Compact 5000 analog I/O modules are accessible over an EtherNet/IP™ network via a Compact 5000 I/O EtherNet/IP adapter.

The modules are installed to the right of the adapter and exchange data across the remote system backplane. The data is then exchanged with the controller over the EtherNet/IP network.

This figure shows remote Compact 5000 analog I/O modules in an example CompactLogix 5380 control system.



Limit Access to the System

To limit access to a Logix 5000 controller, Compact 5000 EtherNet/IP adapter, or I/O module, consider these options.

- Follow the guidelines provided in the System Security Design Guidelines Reference Manual, publication SECURE-RM001.
- Password protect the source and execution of the control program.
- Use EtherNet/IP devices in accordance with recommended architectures and concepts. See the Converged Plantwide Ethernet (CPwE) Design and Implementation Guide, publication ENET-TD001.
- Implement physical barriers, such as locked cabinets.

To limit access to the system, consider these options.

- Follow industry best practices to harden your PCs and servers, including antivirus/anti-malware and application solutions for allow lists.

  The recommendations are published in the Rockwell Automation Customer Hardening Guidelines, Knowledgebase Document ID PN767.
- Develop and use backup and disaster recovery policies and procedures. Test backups on a regular schedule.
- Minimize network exposure for all control system devices and systems, and make sure that they are not accessible from the Internet.
- Locate control system networks and devices behind firewalls and isolate them from the business network.

For access to information about security matters that affect Rockwell Automation products, visit the Rockwell Automation Security Advisories website and sign up for alerts.

Ownership

A controller must own every I/O module in a Logix 5000 control system, also known as the owner-controller. When you use the Compact 5000 analog I/O modules in a Logix 5000 control system, the owner-controller supports these actions.

- Stores configuration data for every module that it owns.
- Can reside in a location that differs from the Compact 5000 I/O system.
- Sends the I/O module configuration data to define module behavior and begin operation in the control system.

Each Compact 5000 analog I/O module must continuously maintain communication with its owner-controller during normal operation.

The Compact 5000 analog I/O modules are limited to one owner-controller that performs the functions that are listed previously. Other controllers can establish Listen-Only connections to the Compact 5000 analog I/O modules.

Construct a System

Before you use your Compact 5000 analog I/O modules, you must complete tasks that are based on the way that you use the modules. That is, if the modules are used locally, remotely or both locally and remotely.

Local I/O Modules

Complete the following:

1. Install a CompactLogix 5380, CompactLogix 5480, or Compact GuardLogix 5380 controller.
2. Install the modules to the right of the controller.
3. Install the end cap on the last module in the local system.

IMPORTANT The end cap in a CompactLogix 5380, CompactLogix 5480, or Compact GuardLogix 5380 control system covers the exposed interconnection on the last module on the DIN rail.

If you do not install an end cap on the last module on the DIN rail, equipment damage or injury can occur.

Remote I/O Modules

Complete the following:

1. Install a controller that is compatible with the remote Compact 5000 analog I/O modules to be used in the application via an EtherNet/IP network.
2. Install an EtherNet/IP network.
3. Connect the controller to the network.
4. Install a Compact 5000 EtherNet/IP adapter.
5. Connect the adapter to the network.
6. Install the Compact 5000 analog I/O modules to the right of the adapter.
7. Install the end cap on the last module in the local system.

IMPORTANT The end cap in a CompactLogix 5380, CompactLogix 5480, or Compact GuardLogix 5380 control system covers the exposed interconnection on the last module on the DIN rail.

If you do not install an end cap on the last module on the DIN rail, equipment damage or injury can occur.

For information on how to install compatible controllers, adapters, and Compact 5000 I/O modules, see the publications that are listed in Additional Resources.

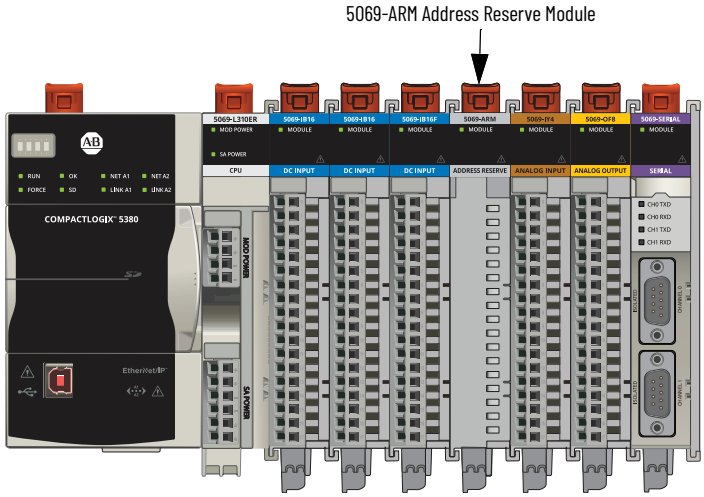
Use a 5069-ARM Address Reserve Module to Reserve a Node Address

Every Compact 5000 I/O digital module has a unique node address in a system. As modules are installed, the node addresses increment. The Studio 5000 Logix Designer project includes modules in the I/O Configuration that correspond to the physical modules.

If a module is not available during initial system installation and operation, you can use a 5069-ARM address reserve module to reserve the node address. The address reserve module remains installed until the functional I/O module is available.

When you install the address reserve module, you also make sure that the modules that are installed afterward have the correct node address.

You use the corresponding entry in the Studio 5000 Logix Designer project to reserve the node address. When you add modules to the I/O Configuration tree in the project, you add an address reserve module at the node address that matches the physical module location.



When the I/O module becomes available, complete the following tasks.

1. Remove the 5069-ARM module from the system.
2. Install the I/O module in the slot that previously contained the 5069-ARM module.
3. Replace the 5069-ARM module entry in the I/O Configuration section of the Studio 5000 Logix Designer project with the new I/O module.

   For more information on how to use a 5069-ARM module in a Studio 5000 Logix Designer project, see Reserve an I/O Module Slot.

Power the Modules

Compact 5000 analog I/O modules receive these power types from a controller or adapter.

Power Type	Location	Description
MOD power	System-side	• Powers the system and lets modules transfer data and execute logic. • Provided through the Module (MOD) power connector and passed to modules as they are added to the system. **IMPORTANT**: A system has only one MOD power bus.
SA power	Field-side	• Powers field-side devices that are connected to some Compact 5000 I/O analog modules. • Provided through the sensor actuator (SA) power connector and passed to modules as they are added to the system. **IMPORTANT**: A system can have multiple SA power buses. Use a 5069-FPD field potential distributor to establish new, isolated SA power buses in the same system. For more information, see Establish a New or Isolated SA Power Bus.

Power begins at the leftmost device in the system and passes across the I/O module internal circuitry via power buses. The MOD power bus and SA power bus are isolated from each other. The leftmost device is either a controller or an EtherNet/IP adapter.

For more information on how to power local Compact 5000 I/O modules, see these resources.

- CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, publication 5069-UM001
- CompactLogix 5480 Controller User Manual, publication 5069-UM002

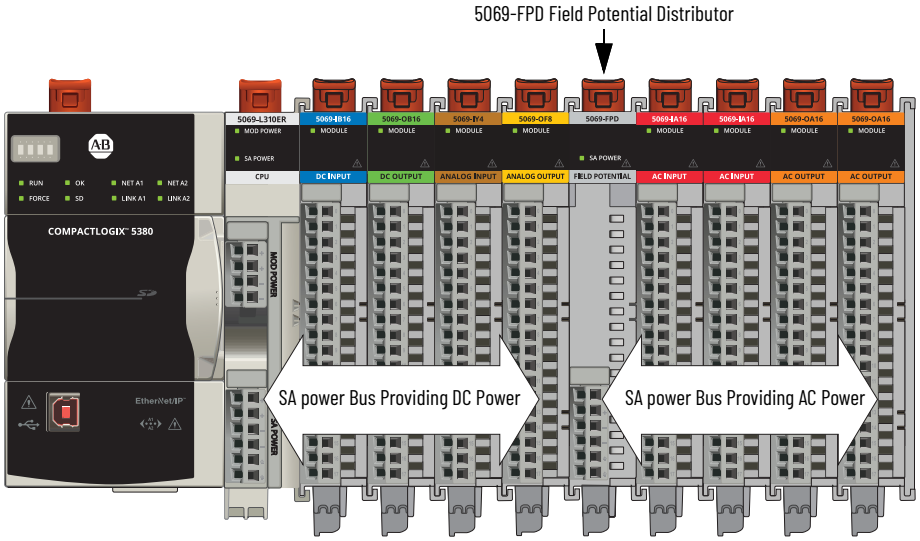
For more information on how to power remote Compact 5000 I/O modules, see the Compact 5000 EtherNet/IP Adapters User Manual, publication 5069-UM007.

Establish a New or Isolated SA Power Bus

Use a 5069-FPD field potential distributor to change the field-side power distribution source for modules that require additional power, or to isolate one type of power bus from another. A 5069-FPD field potential distributor performs these actions.

- Blocks the current that passes across the SA power bus to the left of the field potential distributor, and establishes a new SA power bus for modules to the right.
- Provides an SA power bus that functions in the same way as the SA power bus that a controller or adapter establishes.
- Extends the new SA power bus to the last module in the system or until another SA power bus is established.
- Passes MOD power bus signals through to the next module in the system.

Isolated SA Power Buses



IMPORTANT Compact 5000 analog I/O modules are DC-type modules. You must install them on an SA power bus that uses DC-type power. You **cannot** install Compact 5000 analog I/O modules on an SA power bus that uses AC-type power.

If you install modules in a system that uses both DC SA power and AC SA power, you must isolate SA power buses by type with a 5069-FPD field potential distributor. To create separate SA power buses, complete these steps.

1. To create the first SA power bus, install the modules that use one type of SA power, for example DC, to the right of the adapter or controller.
2. To create a second SA power bus, install the 5069-FPD field potential distributor to the right of these modules.
3. Install the modules that use the other type of SA power, for example AC, to the right of the 5069-FPD module.

Configure the Modules

You must create a Studio 5000 Logix Designer project for the Logix 5000 controller that owns the Compact 5000 analog I/O module. The project includes module configuration data for the Compact 5000 analog I/O modules.

The Studio 5000 Logix Designer application transfers the project to the owner-controller during the program download. Data is then transferred to the I/O modules either across the backplane or over an EtherNet/IP network.

The I/O modules can operate immediately after receiving the configuration data.

IMPORTANT This section shows some of the configurable parameters, but it is not a complete description of how to configure a module.

For more information on how to configure the Compact 5000 analog I/O modules, see Configure the Module.

Connections

During module configuration, you must choose a connection type in the Module Definition parameters. A connection is a real-time data transfer link between the owner-controller and the module that occupies the slot that the configuration references.

During the configuration of a HART I/O module, you must define the input and output tags for all connected HART devices.

When you download module configuration to a controller, the controller attempts to establish a connection to each module in the configuration.

Because part of the module configuration includes a slot number in the local or remote system, the owner-controller verifies the presence of a module, or a connected HART device, in that slot. If a module or device is detected, the owner-controller sends the configuration and one of these actions occurs.

- If the configuration is appropriate to the detected module or device, a connection is made and operation begins.
- If the configuration is not appropriate to the detected module or device, the data is rejected and the Studio 5000 Logix Designer application indicates an error.

  The configuration can be inappropriate for many reasons. For example, a mismatch in electronic keying that prevents normal operation.

The owner-controller monitors the connection with a module. Any break in the connection, for example, the loss of power to the system, causes a fault. The Studio 5000 Logix Designer application monitors the fault status tags to indicate when a fault occurs on a module.

Connection Types Available with Compact 5000 I/O Analog Modules

The Connection choice determines what data is exchanged between the owner-controller and the module.

This table describes the Connection choices that are available in the Module Definition parameters for local and remote Compact 5000 analog I/O modules.

Connection Type	Module Type	Description	
		Compact 5000 I/O Analog Input Modules	**Compact 5000 I/O Analog Output Modules**
Data with Calibration	Standard I/O modules	The modules return this data to the owner-controller:	
		• General fault data • Input data • Calibration data	• General fault data • Output data • Calibration data
Data	Standard I/O modules	The modules return this data to the owner-controller:	
		• General fault data • Input data	• General fault data • Output data
	HART I/O modules	The modules return this data to the owner-controller:	
		• General fault data • Input data • Calibration data	• General fault data • Output data • Calibration data
Listen Only	Standard and HART remote I/O modules	• When a Listen Only connection is used, another controller owns the module. • The listen-only controller establishes communication with the module but it does not send any configuration or output data to the module. • A full input data connection is established between the listen-only controller, but the controller only listens to the data exchanged between the owner-controller and the module. • All other connections to the module, like the connection to the owner-controller, must also use the Multicast option. **IMPORTANT**: If a controller uses a Listen Only connection, the connection must use the Multicast option. For more information, see Listen Only Connections.	

To set the Connection Type, see Module Definition.

Data Types Available with Compact 5000 I/O Analog Modules

These input and output data types are available to select in the Module Definition parameters.

Module Type	Available Data Types
HART input modules	• Analog • Analog and Discrete • Discrete
HART output modules	• Analog
Standard input modules	• Analog
Standard output modules	• Analog • None - only available when you select Listen Only for the Connection type

To set the Input or Output Data type, see Module Definition.

Requested Packet Interval

The Requested Packet Interval (RPI) is a configurable parameter that defines a specific rate at which data is exchanged between the owner-controller and the module.

Set the RPI value during initial module configuration, you can adjust it as necessary after module operation has begun. These are the valid RPI values for modules and devices.

- All Compact 5000 analog I/O modules: 0.2...750 ms
- HART devices: 500...9999.9 ms

IMPORTANT If you change the RPI while the project is online, the connection to the module closes and reopens in one of these ways.

- You inhibit the connection to the module, change the RPI value, and uninhibit the connection.
- You change the RPI value. In this case, the connection is closed and reopened immediately after you apply the change to the module configuration.

To set the RPI, see Connection.

For more information on guidelines for specifying RPI rates, see the Logix 5000 Controllers Design Considerations Reference Manual, publication 1756-RM094.

Connection Over EtherNet/IP

When you configure a remote Compact 5000 analog I/O module or a HART I/O module and devices, you must configure the Connection over EtherNet/IP parameter in the configuration for the remote adapter that connects the I/O modules to the network. The configuration choice dictates how input data is transmitted over the network

The Compact 5000 analog I/O modules use one of these methods to transmit data.

Parameter	Description
Multicast	Data is sent to all network devices. If you are using the I/O modules in a redundancy system, you must use Multicast.
Unicast (default)	Data is sent to one or more controllers depending on module configuration.

Input Module Data

Logix 5000 controllers do not poll the Compact 5000 analog input modules for input data.

At the RPI, the module sends input data, like channel and status data, to the controller and the controller sends data to the module inputs. For example, the controller sends data that unlatches or enables alarms.

The data exchange occurs over the system backplane for local modules, and over an EtherNet/IP network for remote modules.

Data Transmission Type	Events that Occur at RPI
Local Input Module to Controller	1. The input module scans its channels for input data. 2. The module sends the data to the system backplane. 3. The controller receives the data immediately.
Controller to Local Input Module	1. The controller broadcasts the data to the system backplane. 2. The module receives the data from the backplane and behaves as dictated by its configuration.
Remote Input Module to Controller	1. The input module scans its channels for input data. 2. The module sends the data to the remote system backplane. 3. The Compact 5000 I/O EtherNet/IP adapter sends the data over the EtherNet/IP network. 4. One of these events. – If the controller is connected directly to the EtherNet/IP network, it receives the input data immediately. – If the controller is connected to the EtherNet/IP network through an adapter, the module sends the data to its backplane and the controller receives it.
Controller to Remote Input Module	1. One of these events. – If the controller is connected directly to the EtherNet/IP network, it broadcasts the data to the network. Skip to step 3. – If the controller is connected to the EtherNet/IP network via an EtherNet/IP communication module, the controller transmits the data to its backplane. Continue to step 2. 2. The EtherNet/IP communication module transmits the data to the EtherNet/IP network. 3. The Compact 5000 I/O EtherNet/IP adapter receives the data from the network and transmits it to the remote system backplane. 4. The Compact 5000 analog input module receives the data from the backplane and behaves as dictated by its configuration.

IMPORTANT Use an EtherNet/IP communication module **only** if a ControlLogix 5580 or GuardLogix 5580 controller owns the I/O module.

CompactLogix 5380, CompactLogix 5480, and Compact GuardLogix 5380 controllers do not support the use of an EtherNet/IP communication module in the local system.

Output Module Data

Logix 5000 controllers send data to Compact 5000 analog output modules at the RPI or after an Immediate Output (IOT) instruction is executed.

- The RPI defines when the controller sends data to an output module and when the module sends data to the controller. For example, when the output module sends the channel data quality.
- The IOT instruction sends new data to an output module whenever it is produced.

IMPORTANT Only CompactLogix 5380 and CompactLogix 5480 controllers can send data to Compact 5000 analog output modules when an IOT instruction is executed.

Compact GuardLogix 5380 controllers **cannot** send data when an IOT instruction is executed.

Compact 5000 analog output modules receive output data from a controller and send data to the controller. Data is handled differently depending on the type of transmission.

Output Module to Controller	Controller to Output Module
• When a local Compact 5000 analog output module receives new data and the requested data value is present on the RTB, the output module sends, or echoes, a data value back to the controller and to the rest of the control system. The data value corresponds to the signal present at its terminals. This feature is called Data Echo. • The output module also sends other data to the controller at the RPI. For example, the module alerts the controller if a short circuit condition exists on the module.	• The controller broadcasts data to its local backplane at one of the following: – RPI – An IOT instruction is executed. **IMPORTANT**: An IOT instruction sends data to the output module immediately, and resets the RPI timer. • Based on the RPI rate and the length of the controller program scan, the output module can receive and send data multiple times during one program scan. • When the RPI is less than the program scan length, the output channels can change values multiple times during a program scan. The program scan does not need to be complete before the owner-controller sends data.

The data exchange occurs over the system backplane for local modules, and over an EtherNet/IP network for remote modules.

Data Transmission Type	Events that Occur when Data is Sent
Local Output Module to Controller	1. The module sends the data to the system backplane. 2. The controller receives the data immediately.
Controller to Local Output Module	1. The controller sends data to the system backplane at the RPI or when an IOT instruction is executed. 2. The module receives the data from the system backplane and behaves as dictated by its configuration.
Remote Output Module to Controller	1. The module sends the data to the remote system backplane. 2. The Compact 5000 I/O EtherNet/IP adapter sends the data over the EtherNet/IP network. 3. One of these events. – If the controller is connected directly to the EtherNet/IP network, it receives the input data immediately. – If the controller is connected to the EtherNet/IP network through an adapter, the module sends the data to its backplane and the controller receives it.
Controller to Remote Output Module	1. One of these events. – If the controller is connected directly to the EtherNet/IP network, it broadcasts the data to the network. Skip to step 3. – If the controller is connected to the EtherNet/IP network via an EtherNet/IP communication module, the controller transmits the data to its backplane. Continue to step 2. 2. The EtherNet/IP communication module transmits the data to the EtherNet/IP network. 3. The Compact 5000 EtherNet/IP adapter receives the data from the network and transmits it to the remote system backplane. 4. The module receives the data from the backplane and behaves as dictated by its configuration.

IMPORTANT Use an EtherNet/IP communication module **only** if a ControlLogix 5580 or GuardLogix 5580 controller owns the I/O module.

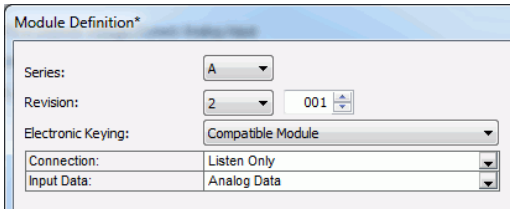
CompactLogix 5380, CompactLogix 5480, and Compact GuardLogix 5380 controllers do not support the use of an EtherNet/IP communication module in the local system.

Listen Only Connections

The owner-controller, as described in Ownership, exchanges data with I/O modules. The owner-controller owns the module configuration in its Studio 5000 Logix Designer project.

Other controllers, which do not own the module or exchange data with it, can listen to input data or echoed output data. While the listen-only controller does not own the module configuration, the module is included in the listen-only controller's Studio 5000 Logix Designer project.

In the project for the listen-only controller, select a Listen Only connection type. The Connection dropdown menu is available on the Module Definition dialog box.



For more information, see Connection Types Available with Compact 5000 I/O Analog Modules.

IMPORTANT These restrictions apply for Listen Only connections.

- The Listen Only connection type is only available with standard Compact 5000 I/O modules.
- The I/O modules must reside in a remote system. Controllers cannot make Listen Only connections to local I/O modules.
- You cannot add connected HART devices to Listen Only connections.

Connection Over EtherNet/IP

You must set the Connection Over EtherNet/IP parameter when you configure a remote Compact 5000 I/O module. The available choices are Unicast and Multicast.

To establish a Listen Only connection from a listen-only controller, the Connection over EtherNet/IP must be Multicast in the Studio 5000 Logix Designer project for both the owner-controller and the listen-only controller.

To set the Connection Over EtherNet/IP parameter, see Connection.

Connection Request Errors

Module faults and connection request errors occur if the Connection Over EtherNet/IP connection is not Multicast in both Studio 5000 Logix Designer projects.

Information about the fault is available on the Connection page.

Connection over EtherNet/IP Choice		Error Code
Owner-controller project	**Listen-only controller project**	
Multicast	Multicast	None - Connection established successfully.
Multicast	Unicast	16#0106 Connection Request Error: Module is owned and configured by another controller. If Unicast is used, the module can accept only one connection.
Unicast	Unicast or Multicast	16#0108: Connection Request Error: Unicast or Multicast are not supported as the connection type.
Inhibited or powered-down	Multicast	16#0119 Connection Request Error: Module not owned.

IMPORTANT:
In rare instances, the Studio 5000 Logix Designer application lets you configure a module with choices that result in connection request errors. However, the application does not alert you of the error until the project goes online. Verify the Connection Over EtherNet/IP choice in the listen-only controller project before you go online.

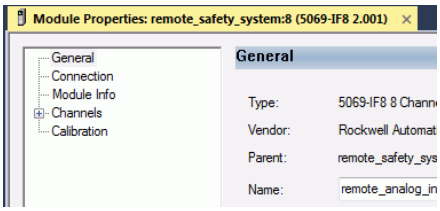
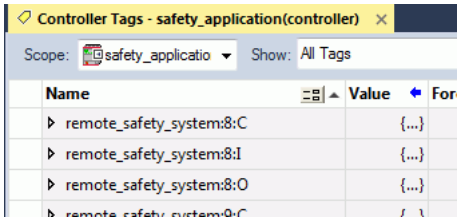
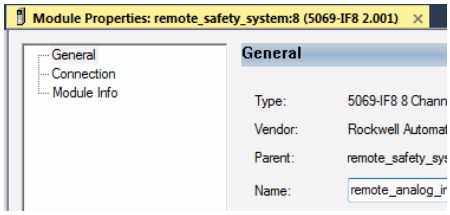
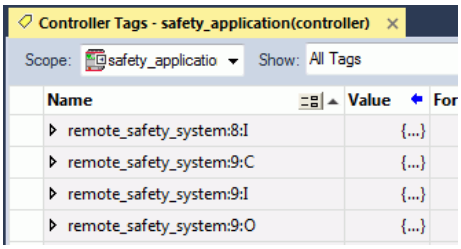
Additional Considerations With Listen Only Connections

Remember this information when you use Listen Only connections.

- Listen-only controllers receive data from the module as long as the connection between the owner-controller and the module is maintained.

  If the connection between an owner-controller and the module is broken, data is no longer sent and connections to all listen-only controllers are also broken.
- When a controller uses a Listen Only Data connection, configurable properties in the Module Properties are not available. And only Input tags are created in the Module tags.

  This table shows the categories and module tags that appear when a 5069-IF8 module is configured in an owner-controller or listen-only controller project.

Controller Type	Module Properties Pages	Module Tags Created
Owner-controller Project		
Listen-only Controller Project	 Channels and Calibration pages are not available.	 Only Input tags are created.

Protected Operations

Operations that can disrupt the operation of a Compact 5000 analog I/O module are restricted based on the current module operating mode. This list describes how requests and changes are handled in each of these circumstances.

- Connection is not established - all requests and changes are **accepted**
- Connection is established - behavior depends on the request or change
  See the following Protected Operation Behavior tables.
- Firmware update is in progress - all requests and changes are **rejected**
- Calibration is in progress - all requests and changes are **accepted**
  When the request or change is made, the calibration process is automatically aborted. We recommend that you wait for module calibration to finish before you attempt a request or change.

A Compact 5000 analog I/O module enters Protection Mode when you establish connection with the module. The module exits Protection Mode as soon the established connection stops.

Protected Operation Behavior in Protection Mode - Compact 5000 Analog I/O Modules

Request or Change	Protection Mode/Connection Established Behavior
Firmware Update request	**Rejected** - The Studio 5000 Logix Designer application attempts the request or change but it does not take effect, and you receive an alert that it is rejected.
Module Reset request	
Module Calibration request from Module Properties	**Accepted** if the module is connected and the owner-controller is in Program mode.
Connection request	**Accepted** if it is a Listen Only connection request.
Configuration change	**Accepted** when you complete one of these actions. • Change the Module Properties parameters and click Apply. • Change the Configuration tags and send a Reconfigure Module MSG to the module.
Connection or Data Format change	**Not allowed** - The Studio 5000 Logix Designer application does not attempt the not allowed activities, and you receive an alert that it is not allowed. If you are online, the Connection or Data Format fields are disabled in the Module Definition parameters.
Electronic Keying change	**Accepted** - The change occurs after the connection is closed and reopened. You can close and reopen the connection in these ways. • Change the project while it is offline and download the updated project before you go online again. • Change the project while it is online and click Apply or OK in the Module Properties parameters. In this case, before the change is made, a warning alerts you of the ramifications before the change is made.
RPI change	

Protected Operation Behavior in Protection Mode - HART Devices

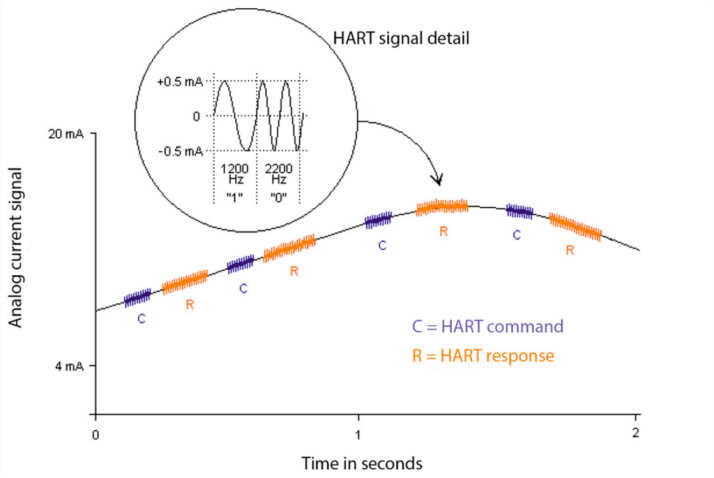
Request or Change	Protection Mode/Connection Established Behavior
Device Reset request	**Rejected** - The Studio 5000 Logix Designer application attempts the request or change but it does not take effect, and you receive an alert that it is rejected.
Connection request	
Device Configuration change	**Accepted** if changes are made using FTD/DTM, handheld device, and HART commands.
Device Connection or Data Format change	**Not allowed** - The Studio 5000 Logix Designer application does not attempt the not allowed activities, and you receive an alert that it is not allowed. If you are online, the Connection or Data Format fields are disabled in the Module Definition parameters.
Electronic Keying change	**Accepted** - The change occurs after the connection is closed and reopened. You can close and reopen the connection in these ways. • Change the project while it is offline and download the updated project before you go online again. • Change the project while it is online and click Apply or OK in the Module Properties parameters. In this case, before the change is made, a warning alerts you of the ramifications before the change is made. If there are changes to the RPI on one channel, the same change is applied to all channels in the configuration section.
RPI change	

HART Communication

The HART protocol supports two-way digital communication, complements traditional 4...20 mA analog signals, and includes these features.

- Predefined commands
  - Universal command
  - Common practice
  - Device specific
- Large installed base
- Worldwide support

HART Protocol[1]



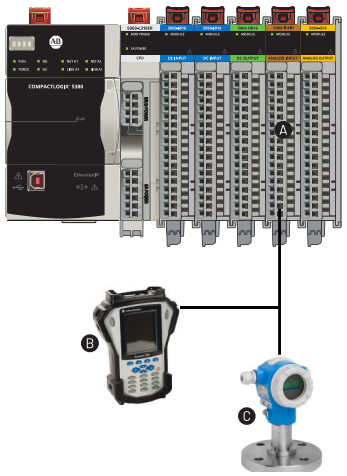
The HART I/O modules support the HART protocol and perform these operations.

- Conversion of 4...20 mA analog signals to digital numeric values in engineering units (such as kg, m, or percent) that are used in the Logix 5000 controller.
- Conversion of digital numeric values in engineering units to 4...20 mA analog signals to control process devices.
- Producer/Consumer network communication model directly to each HART device.
- Automatic collection of dynamic process data from the connected HART device. For example, temperature, pressure, flow, or valve position.
- Automatic collection of device-specific variables from the connected HART device.
- Execution of commands through Studio 5000 Logix Designer application using input and output tags.
- Facilitation of configuration and troubleshooting of the HART field device from your control room with FDT/DTM-supported software.

The HART I/O modules also provide these features.

- Access to field device data and for both the controller and the software.
  - Dynamic variables, device-specific variables, device status, and command execution are all available through input and output controller tags in the Studio 5000 Logix Designer application.
- Command-response communication protocol in a point-to-point wiring architecture.
- Provides additional information with no changes to the existing 4...20 mA wiring.

(1) This figure is from the FieldComm Group at fdtgroup.org. All Rights Reserved.



A HART I/O module is the primary device, or host, and continuously obtains information from the connected HART devices. The secondary device can be used for device maintenance, for example a handheld communicator, as shown in this figure.

Letter	Description
A	Primary device
B	Handheld communicator as secondary device
C	Field device

Most 4...20 mA transmitters are available with a HART protocol interface. The type of data available depends on the type of instrument.

An example application is a HART enabled mass flowmeter. The standard mA signal from the flowmeter provides one primary measurement: flow. With the HART protocol, more process information is provided. You can set the HART configuration of the flowmeter to communicate the primary variable (PV), secondary variable (SV), tertiary variable (TV), and quaternary variable (QV). These values can represent mass flow, static pressure, temperature, total flow, and other conditions.

HART I/O Modules and Devices

The HART I/O modules have built-in HART modems, so there is no need to install external HART multiplexers or clip-on HART modems. The modules have separate HART modems for each channel.

HART I/O modules provide a connection between the controller and each HART device. A HART device that is connected to a HART I/O module supports configurable connections and configurable message instructions.

HART Device Limits

Number of...	5069-IF4IH, 5069-OF4IH
Device variables	8
Dynamic variables	4
HART commands	4
Unconnected message instructions per device	2
Connected message instructions per device	2

Common Analog I/O Module Features

Compact 5000® analog I/O modules convert analog signals and digital values. The HART I/O modules also decode HART information from signals embedded within the channel.

Module Type	Converts	Supports
Standard analog input modules	Analog signals to digital values	• Volts • Millivolts • Milliamps • Ohms
HART input modules		• Volts • Milliamps
HART input modules that are configured to support digital input signals for channel-to-channel isolation	–	• Digital input device • IEC 61131-2 Type 3-d digital input device
All analog output modules	Digital values to analog signals	• Volts • Milliamps

Software Configurable

The Studio 5000 Logix Designer® application provides an interface to configure each module. All module features are enabled or disabled through the I/O configuration within the software.

All module features are enabled or disabled through the I/O configuration in the Studio 5000 Logix Designer application. You can use the Studio 5000 Logix Designer application to retrieve the following information from any module in the system:

- Serial number
- Firmware revision information
- Product code
- Vendor
- Error and fault information
- Diagnostic information

By minimizing the need for tasks, such as setting hardware switches and jumpers, the software makes module configuration easier and more predictable.

Module Data Quality Reporting

The Compact 5000 analog I/O modules indicate the quality of channel data that is returned to the owner-controller. Data quality represents accuracy. Levels of data quality are reported via module input tags.

These input tags indicate the level of data quality.

Input Tag	Data Quality Description	Example Causes	Recommendation
I.Chxx.Fault	When set to 1, this tag indicates that the reported channel data is inaccurate and cannot be trusted for use in your application. Do not use the data for control. Troubleshoot the module to correct the cause of the inaccuracy.	• Channel is disabled • Open Wire on input modules • No Load condition on output modules • Underrange/Overrange condition • Short Circuit condition	• Troubleshoot the module for the typical causes first. • Monitor the tags in your program to make sure that the application is operating as expected with accurate channel input data.
I.Chxx.Uncertain	When set to 1, this tag indicates that the reported channel data can be inaccurate but the degree of inaccuracy is unknown. We recommend that you do not use the reported channel data for control. Troubleshoot the module to discover what degree of inaccuracy exists.	• Data signal is slightly outside of the channel operating range • The channel is slightly over temperature • Invalid sensor offset value • Calibration fault on the channel • Calibration is in process on a channel	

IMPORTANT
Once the condition that causes the Fault or Uncertain tag to change to 1 is removed, the tag automatically resets to 0. The Studio 5000 Logix Designer application controls the tags. You cannot change the status of the tags.
Remember that in some system configurations, after the condition is removed, the tag typically resets after a small delay.

Fault and Status Reports

The Compact 5000 analog I/O modules report fault and status data along with channel data. Fault and status data is reported in these ways.

- Studio 5000 Logix Designer application
- Module status indicators
- I/O status indicators

For more information on fault and status reports, see these sections.

- 5069-IF8 module - Fault and Status Reports
- 5069-IY4 and 5069-IY4K modules - Fault and Status Reports
- 5069-OF4, 5069-OF4K, and 5069-OF8 modules - Fault and Status Reports
- HART I/O modules - Fault and Status Reports
- Troubleshoot the Module

Inhibit a Module

When you inhibit a module you indefinitely suspend a connection, including Listen Only connections, between an owner-controller and an analog module without removing the module from the configuration. This process lets you temporarily disable a module, such as to perform maintenance.

IMPORTANT Once a HART I/O module is inhibited, the connections to the module and attached HART devices are also closed and the CIP™ messaging to the HART devices is disabled.

This table explains when to use the Inhibit Module feature.

Inhibit the Module	Description	Example
Before the controller connects to a module	You can write a configuration for a module and inhibit the module to stop communication with the owner-controller. The owner does not establish a connection and the configuration is not sent to the module until the connection is uninhibited.	To update the firmware on a module, use this procedure. 1. Inhibit the module. 2. Perform the update. 3. Uninhibit the module.
After the controller connects to the module	Your controller already owns a module, has downloaded the configuration to the module, and is exchanging data over the connection between the devices. When you inhibit the module, the owner-controller behaves as if the connection to the module does not exist.	In a program that includes a module that is not installed yet, inhibit the module until it is installed so the controller does not look for it.

IMPORTANT When you inhibit an output module that has ProgMode enabled, it enters Program mode, and all outputs change to the state configured for Program mode.

For example, if an output module is configured so that the state of the outputs transition to zero during Program mode, whenever that module is inhibited, the outputs transition to zero.

To inhibit a module, see Connection.

Electronic Keying

Electronic Keying reduces the possibility that you use the wrong device in a control system. It compares the device that is defined in your project to the installed device. If keying fails, a fault occurs. These attributes are compared.

Attribute	Description
Vendor	The device manufacturer.
Device Type	The general type of the product, for example, digital I/O module.
Product Code	The specific type of the product. The Product Code maps to a catalog number.
Major Revision	A number that represents the functional capabilities of a device.
Minor Revision	A number that represents behavior changes in the device.

The following Electronic Keying options are available.

Keying Option	Description
Compatible Module	Allows the installed device to accept the key of the device that is defined in the project when the installed device can emulate the defined device. When you use the Compatible Module option, you can typically replace a device with another device that has these characteristics. • Same catalog number • Same or higher Major Revision • Minor Revision as follows: – If the Major Revision is the same, the Minor Revision must be the same or higher. – If the Major Revision is higher, the Minor Revision can be any number.
Disable Keying	Indicates that the keying attributes are not considered when attempting to communicate with a device. With Disable Keying, communication can occur with a device other than the type specified in the project. **WARNING**: Be cautious when you use Disable Keying; if used incorrectly, this option can lead to personal injury or death, property damage, or economic loss. We strongly recommend that you **do not use** Disable Keying. If you use Disable Keying, you must take full responsibility for understanding whether the device being used can fulfill the functional requirements of the application.
Exact Match	Indicates that all keying attributes must match to establish communication. If any attribute does not match precisely, communication with the device does not occur.

Carefully consider the implications of each keying option when selecting one.

IMPORTANT If you change the Electronic Keying parameters while the project is online, you interrupt connections to the device and any devices that are connected through the device. Connections from other controllers can also be broken.

If an I/O connection to a device is interrupted, the result can be a loss of data.

For more detailed information on Electronic Keying, see the Logix 5000® Control Systems Application Technique, publication LOGIX-AT001.

Module Firmware

The Compact 5000 analog I/O modules are manufactured with module firmware installed. If updated module firmware revisions are available in the future, you can update the firmware.

Updated firmware revisions are made available for various reasons, for example, to correct an anomaly that existed in previous module firmware revisions.

Download updated firmware files from the Rockwell Automation® Product Compatibility and Download Center (PCDC) at rok.auto/pcdc.

Do not download firmware from non-Rockwell Automation sites.

Producer/Consumer Communication

Compact 5000 analog I/O modules use the Producer/Consumer communication model to produce data before a controller polls them. The modules produce the data and the controllers consume the data. That is, the owner-controller and controllers with a Listen Only connection to the module can consume it.

When an input module produces data, the controllers can consume the data simultaneously. Simultaneous data consumption removes the need for one controller to send the data to other controllers.

IMPORTANT Keep in mind, **only one controller** can own the I/O module. The Compact 5000 analog I/O modules do not support multiple owners of the same module.

Other controllers must use a Listen Only connection to the module.

Rolling Time Stamp of Data

The rolling time stamp is a 15-bit timer that runs continuously and counts in milliseconds from 0...32,767 ms.

The rolling time stamp value is reported in the *I.Chxx.RollingTimestamp* tag for the Compact 5000 analog I/O modules.

Module Type	Description
Analog input	Typically, the analog input modules scan their inputs at the RPI. The module also updates the rolling time stamp data at the RPI. The controller program uses the last two rolling time stamp values to calculate the amount of time between the samples. A system time change can cause a slight change in input sample timing. The rolling time stamp accurately reflects the change. There can be jitter in the timing between samples before and after the system time change.
Analog output	For the analog output modules, the rolling time stamp value is updated only when new values are applied to the Digital to Analog Converter (DAC).

Floating Point Data Format

The Compact 5000 analog I/O modules return channel data to the controller in the IEEE 32-bit floating point data format. In your Studio 5000 Logix Designer application, the data type is REAL.

The floating point data format lets you change the data representation of the selected channel. Although the full range of the module does not change, you can scale your module to represent I/O data in specific terms for your application.

For more information, see Scaling.

Calibration

The Compact 5000 analog I/O modules use precise analog components that maintain their specifications over time. The modules are calibrated via the following methods:

- Factory calibration when the modules are built.
- User-executed calibration.

For more information, see Calibrate the Module.

Uncertain Data Quality Indication on Input Module Groups

During the calibration of a channel on a Compact 5000 analog input module, the Notch Filter setting changes to 5 Hz and the I.Chxx.Uncertain tag is set to 1 for that channel.

Grouped inputs share an Analog-to-Digital converter. As a result, during the calibration of any input channel, the I.Chxx.Uncertain tag is set to 1 for the other input channels in that group. This change happens because the data sample rate slows for all input channels in the group. The Notch Filter settings do not change for the other input channels in the group.

Calibration of the HART Input Module

During calibration of the 5069-IF4IH module, two Notch Filter settings (5 Hz and 10 Hz) are applied and the I.CHxx.Uncertain tag is set to 1 for that channel.

Two sets of calibration Gain and Offset are generated for each notch filter setting. These are the Gain and Offset values used for the Notch Filter settings.

- If the Notch Filter setting = 5 Hz, the Gain and Offset = 5 Hz
- If the Notch Filter setting = 10 Hz...10,000 Hz, the Gain and Offset = 10 Hz

Grouped inputs are handled in the same way as the standard input modules, as described above.

Alarm Latching

When enabled, Alarm Latching lets you latch a module alarm in the set position once the alarm is triggered. The alarm remains set even if the condition that caused it to occur disappears, until the alarm is unlatched.

Alarm latching is available on a per channel basis. You can latch the following alarms:

- Input modules - Process and Rate alarms
- Output modules - Clamp and Rate alarms

For more information on alarm latching, see these sections.

- 5069-IF8 module - Process Alarms and Rate Alarm
- 5069-IY4 and 5069-IY4K modules - Process Alarms and Rate Alarm
- 5069-OF4, 5069-OF4K, and 5069-OF8 modules - Clamp Alarming
- 5069-IF4IH module - Process Alarms and Rate Alarm
- 5069-OF4IH module - Clamp Alarming

Enable Latching

To enable alarm latching, see these sections.

- Module Properties:
  - Input modules - Alarms
  - Output modules - Limits
- Module and Device Tags - The alarm type determines which tag to change.

Unlatch Alarms

IMPORTANT Before you unlatch an alarm, make sure the condition that triggered the alarm no longer exists.

Once an alarm is latched, you must manually unlatch it. You can use the module tags to unlatch an alarm. The alarm type determines which module tag to change.

For example, to unlatch a Low Low alarm on a Compact 5000 analog input module, you set the Ch*xx*.LLAlarmUnlatch output tag to 1.

For more information, see Module and Device Tags.

Scaling

When you scale a channel, you select two points that represent signal units, that is, a Low Signal and a High Signal. You also select two points that represent engineering units, that is, Low Engineering and High Engineering.

The Low Signal point equates to the Low Engineering point and the High Signal point matches the High Engineering point.

IMPORTANT When you choose the two points for the low and high value of your application, you do not limit the range of the module. The module range remains constant regardless of how you scale it.

Scaling lets you configure the module to return data to the controller in signal units or in engineering units. It is listed as **Percent of Full Scale** in the Studio 5000 Logix Designer application.

For example, if you use the 5069-IF8 module in Current mode with an input range of 4...20 mA, use one of these configurations.

Parameter	To receive values in	
	Signal Units	Percent of Full Scale
Low Signal	4 mA	4 mA
High Signal	20 mA	20 mA
Low Engineering	4 EU	0%
High Engineering	20 EU	100%

The returned value is indicated in the *I.Chxx.Data* tag.

The following table shows the values that can occur when you use Percent of Full Scale.

Current	Engineering Units Value		Value in *I.Chxx.Data* Tag	
	Standard I/O Modules	HART I/O Modules	Standard I/O Modules	HART I/O Modules
3.0 mA	-6.00%	-6.25%	-6.00	-6.25
4.0 mA	0.0%		0.00	
12.0 mA	50.0%		50.0	
20.0 mA	100.0%		100.0	
23.0 mA	118.75%		118.75	

To configure Scaling, see Chxx.

Data Offset

The Compact 5000 analog I/O modules support offset features that compensate for any inaccuracy inherent to the input or output device that is connected to the channel. The offset value adjusts the input or output data value.

These channel-offset features are available.

- 5069-IF8 module - Sensor Offset
- 5069-IY4 and 5069-IY4K modules - Sensor Offset
- 5069-OF4, 5069-OF4K, and 5069-OF8 modules - Channel Offset
- 5069-IF4IH modules - Sensor Offset
- 5069-OF4, 5069-OF4K, and 5069-OF8 modules - Channel Offset

Module Accuracy

Module accuracy represents the module accuracy when its ambient temperature is the same as the temperature at which the module was calibrated.

The following specifications are related to Module Accuracy:

- Absolute Accuracy at 25 °C (77 °F)
- Module Accuracy Drift with Temperature

Absolute Accuracy at 25 °C (77 °F)

This specification matches the temperature at which the module was calibrated in the factory during manufacturing. When the Compact 5000 analog I/O modules operate in 25 °C (77 °F) conditions absolute accuracy is as follows.

- Standard I/O modules - 0.10%
- HART I/O modules - 0.05%

The level of module accuracy remains 0.10% whether it is operating in Current, Voltage, RTD, or Thermocouple mode. Only the 5069-IY4 and 5069-IY4K modules support the RTD or Thermocouple modes.

Module Accuracy Drift with Temperature

Module Accuracy Drift with Temperature represents the error that occurs if the module's ambient temperature changes a total of 60 °C (140 °F). For example, from 0…60 °C (32…140 °F) or 60…0 °C (140…32 °F).

The module accuracy drift with temperature varies by module and the mode being used. The following table lists module accuracy drift values.

Cat. No.	Module Accuracy Drift with Temperature			
	Voltage	Current	RTD	Thermocouple
5069-IF8	0.2%	0.3%	–	
5069-IY4, 5069-IY4K	0.2%	0.3%	0.2%	0.2%
5069-OF4, 5069-OF4K, 5069-OF8	0.3%	0.5%	–	
5069-IF4IH, 5069-OF4IH	0.1%		–	

Use CIP Sync Time with HART I/O Modules

CIP Sync is a CIP™ implementation of the IEEE 1588 PTP (Precision Time Protocol). CIP Sync provides accurate Real-World Time (real-time) or Universal Coordinated Time (UTC) synchronization of controllers and devices that are connected over CIP networks. This technology supports highly distributed applications that require time stamps, a sequence of recorded events, distributed motion control, and increased control coordination.

The HART I/O modules are CIP Sync follower-only devices. There must be another module on the network that functions as a leader clock. For more information on how to use CIP Sync technology, see the Integrated Architecture® System and CIP Sync Configuration Application Technique, publication IA-AT003.

Notes:

Current/Voltage Analog Input Module Features - 5069-IF8

The 5069-IF8 input module has eight non-isolated channels that are either differential (Series A) or single-ended (Series B). Each channel supports connection to the following input types:

- Current
- Voltage

Differential inputs have a greater resistance to the effects of electromagnetic noise and provide improved cable length flexibility when you wire the module. Single-ended inputs provide improved flexibility in wiring configuration.

IMPORTANT Remember the following:

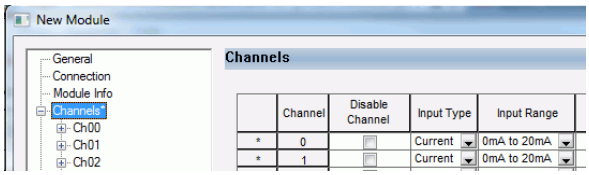
- This module also has features that apply to all Compact 5000® analog I/O modules that are described in Common Analog I/O Module Features.
- You can configure the features that are described in this chapter with the Studio 5000 Logix Designer® application. For information on how to configure the module, see Configure the Module.

Analog Device Support

The 5069-IF8 module does not support connection to all analog devices. This table lists the analog devices that the 5069-IF8 module supports.

IMPORTANT Verify that the channel configuration in your Studio 5000 Logix Designer project matches the input device type that is connected to the channel. Choose the input type on the Channels page in the Module Properties.

For example, if a current input device is connected to channel 0 on the module, the channel configuration must be Input Type = Current.

Device	Mode	Supported	Example Channel Configuration
2-wire analog device 4-wire analog device(1)	Current	Yes	In this example, current devices are connected to channels 0 and 1. 
	Voltage		In this example, voltage devices are connected to channels 0 and 1. 
	Combination of current and voltage		In this example, a current device is connected to channel 0 and a voltage device is connected to channel 1. 
1-wire analog device 3-wire analog device	These devices are not supported regardless of the channel mode configuration.	No	–
2-wire Thermocouple device			
2-wire RTD device 3-wire RTD device			

(1) These devices are 2-wire current and voltage devices with 2-wire sensor power connections.

For more module configuration information, see Module-specific Parameters

For more information on how to wire devices to the 5069-IF8 modules, see the Compact 5000 I/O Modules and EtherNet/IP™ Adapters Specification Technical Data, publication 5069-TD001.

Multiple Input Ranges

The 5069-IF8 module supports multiple input ranges. The input type that you choose during module configuration determines the available input ranges. An input type is chosen on a channel-by-channel basis.

Input Type	Available Input Range
Current (mA)	• 0...20 mA • 4...20 mA
Voltage (V)	• -10...10V • 0...5V • 0...10V

To select the input range, see Chxx.

Notch Filter

The Notch Filter is a built-in feature of the Analog-to-Digital converter (ADC) that removes line noise in your application. The removal of line noise is also known as noise immunity. The Notch Filter attenuates the input signal at the specified frequency.

Select a Notch Filter based on what noise frequencies are present in the operating environment and what sample requirements are needed for control. For example, if the Notch Filter setting is 60 Hz, the 60 Hz AC line noise and the associated overtones are removed.

Available Notch Filter Settings		
• 5 Hz	• 100 Hz	• 10,000 Hz
• 10 Hz	• 200 Hz	• 15,625 Hz
• 15 Hz	• 500 Hz	• 25,000 Hz
• 20 Hz	• 1000 Hz	• 31,250 Hz
• 50 Hz	• 2500 Hz	• 62,500 Hz
• 60 Hz	• 5000 Hz	

If you filter lower frequency noise, you get a slower input sample rate.

To choose a notch filter for the 5069-IF8 module, see Chxx.

Relationship between Notch Filter Settings and RPI Setting

There is a relationship between a Notch Filter setting and the RPI rate.

For...	Use...
Greater noise suppression and improved resolution at the selected Notch Filter frequency	A slower input sample rate
Faster input samples at the selected Notch Filter frequency, with less noise suppression and resolution	A faster input sample rate

In this table, each Notch Filter setting has two recommended minimum module RPI values that allow the required time to collect samples from each channel. One setting provides faster sample speed and the other provides slightly better resolution at slower sample speeds.

Notch Filter	Recommended Minimum Module RPI Value			
	Application with Only One Channel Enabled		Application with All Channels Enabled and the Same Notch Filter Setting on All Channels	
	Faster Sample Speed	Better Noise Rejection	Faster Sample Speed	Better Noise Rejection
5 Hz	215 ms	635 ms	750 ms(1)	–
10 Hz	110 ms	320 ms	440 ms	–
15 Hz	65 ms	195 ms	260 ms	–
20 Hz	60 ms	165 ms	240 ms	660 ms
50 Hz	25 ms	70 ms	100 ms	280 ms
60 Hz (default)	20 ms	60 ms	80 ms	240 ms
100 Hz	15 ms	35 ms	60 ms	140 ms
200 Hz	10 ms	20 ms	40 ms	80 ms
500 Hz	5 ms	10 ms	20 ms	40 ms
1000 Hz	2 ms	5 ms	8 ms	20 ms
2500 Hz	1.5 ms	2.5 ms	6 ms	10 ms
5000 Hz	1 ms	2 ms	4 ms	8 ms
10,000 Hz	0.8 ms	1 ms	3.2 ms	4 ms
15,625 Hz	0.8 ms	0.9 ms	3.2 ms	3.5 ms
25,000 Hz	0.8 ms	0.8 ms	3.2 ms	3.2 ms
31,250 Hz	0.8 ms	0.8 ms	3.2 ms	3.2 ms
62,500 Hz	–	0.7 ms	–	2.8 ms

(1) If you use the 5 Hz Notch Filter setting with four or more channels, the input data cannot be refreshed at every RPI, even if the maximum RPI allowed is used. Instead, fresh data is delivered approximately every other RPI.

Noise Rejection with Different Notch Filter Frequencies

When input channels on the same module use different Notch Filter frequencies, you must consider the sample time for each channel to find the recommended RPI that provides enough time to sample all channels.

The eight input channels on the 5069-IF8 module are grouped into two groups; channels 00...03 are grouped, and channels 04...07 are grouped. When you determine the recommended minimum module RPI value, remember these items.

- The channel groups determine the recommended minimum module RPI value.
- If any channel in the other group is enabled, 0.2 ms is added to the recommended minimum RPI rate for all enabled channels in each group.
- The recommended minimum RPI rates for all enabled channels are combined to produce the recommended minimum module RPI for the group.
- If the groups have different recommended minimum RPI values, use the higher RPI value when you configure the module.

Example Configuration for Faster Sample Speed

Channel Group	Channel	Notch Filter	Recommended Minimum Module RPI for Each Channel (1)	Combined Minimum Module RPI for the Group	Highest Group RPI to use in Module Configuration
Grouped	Ch00	50 Hz	25.2 ms	28.3 ms	80.8 ms
	Ch01	1000 Hz	2.2 ms		
	Ch02	Disabled			
	Ch03	62,500 Hz	0.9 ms		
Grouped	Ch04	60 Hz	20.2 ms	80.8 ms	
	Ch05	60 Hz	20.2 ms		
	Ch06	60 Hz	20.2 ms		
	Ch07	60 Hz	20.2 ms		

(1) The values in this column represent the corresponding recommended minimum RPI value from the Notch Filter table with 0.2 ms added because at least one channel is enabled in the other group.

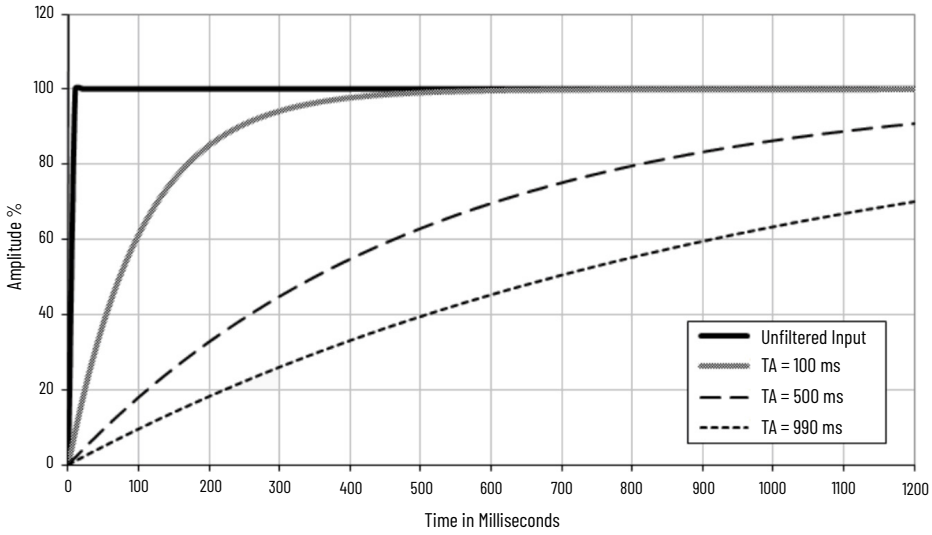
Example Configuration for Better Noise Rejection

Channel Group	Channel	Notch Filter	Recommended Minimum Module RPI for Each Channel(1)	Combined Minimum Module RPI for the Group	Highest Group RPI to use in Module Configuration
Grouped	Ch00	50 Hz	70.2 ms	76.3 ms	240.8 ms
	Ch01	1000 Hz	5.2 ms		
	Ch02	Disabled			
	Ch03	62,500 Hz	0.9 ms		
Grouped	Ch04	60 Hz	60.2 ms	240.8 ms	
	Ch05	60 Hz	60.2 ms		
	Ch06	60 Hz	60.2 ms		
	Ch07	60 Hz	60.2 ms		

(1) The values in this column represent the corresponding recommended minimum RPI value from the Notch Filter table with 0.2 ms added because at least one channel is enabled in the other group.

Digital Filter

The Digital Filter is a first-order lag filter. It smooths input data noise transients on **each input channel**. This value specifies the time constant for a digital, first-order lag filter on the input. The input is 63% of the step change after the first time constant elapses.



The filter value is specified in units of milliseconds. A value of 0 (zero) disables the filter. The digital filter equation is as shown.

$$Y_n = Y_{n-1} + \frac{\Delta t \quad * (X_n - Y_{n-1})}{\Delta t + TA}$$

Y_n = Present Output, Filtered Peak Voltage (PV)
Y_{n-1} = Previous Output, Filtered PV
Δt = Module Channel Update Time (seconds)
TA = Digital Filter time Constant (seconds)
X_n = Present Input, Unfiltered PV

IMPORTANT Remember the following:

- Digital Filter input data changes only when new input data is collected.
- If an Overrange or Underrange condition is detected before the Digital Filter input data is collected, the condition is indicated immediately. An immediate indication also applies to the Fault data for the input.

To set the digital filter, see Chxx.

Underrange/Overrange Detection

Underrange/Overrange Detection detects when the 5069-IF8 module is operating beyond limits set by the input range.

The module can read input signal levels outside the low and high signal values for each input range. The signal limits to which the module can read are thresholds. Only when the signal is beyond a threshold is an underrange or overrange condition that is detected and indicated.

For example, if you configure a 5069-IF8 module channel to use the ± 10V input range, an overrange condition does not exist until the input signal exceeds 12V.

This table lists the input ranges of the 5069-IF8 module and the thresholds in each range before the module detects an underrange/overrange condition.

Input Type	Range	Underrange Threshold	Overrange Threshold	Deadband
Current	0...20 mA	≤ -0.07 mA	≥ 23.00 mA	0.07 mA
	4...20 mA	≤ 3 mA		
Voltage	±10.00V	≤ -12.00V	≥12.00V	0.04V
	0...5V	≤ -0.02V	≥ 6.00V	0.02V
	0...10V	≤ -0.04V	≥ 12.00V	0.04

- The Deadband Value is the amount of change past the threshold that is required for the alarm condition to clear. For example, if a module uses a Current input type in the 4...20 mA range and the signal value goes below 3 mA, the underrange condition is triggered. Due to the 0.07 mA deadband, the condition is not cleared until the signal value reaches 3.07 mA. For more information, see Alarm Deadband.
- When the underrange is set at < 3 mA, the I:Chxx.Data tag reports values as low as 0.0 mA. The condition is clamped when the signal reaches 3 mA.

IMPORTANT The Disable All Alarms feature does not disable the Underrange/Overrange Detection feature because underrange/overrange detection is not an alarm.

To disable the Underrange/Overrange detection feature, you must disable the channel.

Underrange/overrange conditions are indicated when one of these tags changes to 1.

- I.Chxx.Underrange
- I.Chxx.Overrange

For more information, see Module and Device Tags.

Process Alarms

Process alarms alert you when the module has exceeded configured high or low limits for **each channel**. This list is the user-configurable alarm trigger points.

- High high
- High
- Low
- Low low

To use the Process Alarms, you must complete the following tasks:

- Enable the alarms
- Configure the trigger points

Enable Process Alarms

When the module tags are created, the Process Alarm tags are disabled by default.

To enable Process Alarms, see Alarms.

Configure Alarm Trigger Points

You must configure the Process Alarm with a trigger point. That is, set values in engineering units that, once the signal reaches the value, the alarm is triggered.

Process Alarm trigger points are related to the Scaling parameters that you configure for the channel. The engineering units that are established in Scaling determine the Process Alarm trigger points. That is, the available trigger point values can be in signal units or engineering units.

For example, consider a channel that uses the Current input type, the 4 mA...20 mA input range, and scales the High and Low Engineering values of 100 and 0, respectively. The available Process Alarm values range from 0...100.

In this case, if the High Limit alarm is set to 50 EU, when the input signal reaches 12 mA, the High Limit alarm is set. The alarm is set because Scaling was configured for Percentage of Full Scale and a signal value of 12 mA is 50% of the full scale of engineering units.

To set the Process Alarm trigger points, see Alarms.

Latch Alarms

Select the Latch Process Alarms checkbox on the *Alarms* tab to latch the process alarms. To latch Process Alarms, see Alarms.

Unlatch Alarms

IMPORTANT Before you unlatch an alarm, make sure the condition that triggered the alarm no longer exists.

Once an alarm is latched, you must manually unlatch it. To unlatch an alarm, toggle the output tag for that alarm from 0 to 1. Use these tags to unlatch alarms.

- O.Chxx.LLAlarmUnlatch
- O.Chxx.LAlarmUnlatch
- O.Chxx.HAlarmUnlatch
- O.Chxx.HHAlarmUnlatch
- O.Chxx.RateAlarmUnlatch

IMPORTANT You must toggle the tag from 0 to 1 to unlatch the alarm each time it is triggered.

You must also toggle the tag back to 0 after the alarm is unlatched. If you do not change the tag back to 0 and the alarm is latched again in the future, the alarm remains latched despite the tag value being 1.

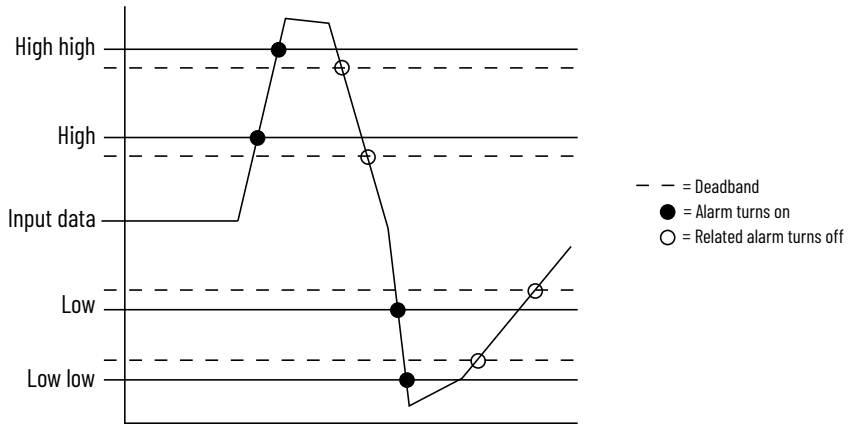
For more information, see Module and Device Tags.

Alarm Deadband

You can set an alarm deadband when you configure the process alarms. If the alarm condition is removed, the alarm status bit remains set as long as the input data stays within the deadband of the alarm.

This graphic shows input data that sets each of the alarms during module operation. In this example, a deadband is set and alarm latching is disabled, so each alarm turns Off when the condition that caused it to turn On is removed and the input data exits the deadband.

Alarm Deadband Example



Also, the High alarm remains On during the High high alarm, and the Low alarm remains On during the Low low alarm.

To to set the alarm deadband, see Alarms.

Rate Alarm

The Rate Alarm defines the maximum rate of change between input samples in engineering units per second. If the Rate Alarm Limit is exceeded, the I.Chxx.RateAlarm tag is set to 1.

You can enable or disable Rate Alarm Latching on each channel. To enable the Rate Alarm, see Alarms.

To unlatch the alarm, toggle the O.Chxx.RateAlarmUnlatch tag to 1.

You can unlatch the alarm at any point in the system operation. If you change the unlatch tag to 1 and the triggering condition remains, the alarm immediately latches again.

We suggest that you unlatch the Rate Alarm only after the rate of change between input samples has returned to below the Rate Alarm Limit value.

Sensor Offset

The Sensor Offset compensates for any known error on the sensor or channel to which the sensor is connected. The value is set in signal units and is added to the data value.

For example, consider an application that uses the Current input type with the 4...20 mA range and scaling at 0...100%. If a sensor has an error and the channel consistently reports current signal values by 0.2 mA lower than the actual value, you must set Sensor Offset to 1.25%.

You must use the O.Chxx.SensorOffset tag to set the Sensor Offset. In the example above, the O.Chxx.SensorOffset tag = 1.25.

For more information, see Module and Device Tags.

Open Wire Detection

Open Wire Detection indicates when a wire is disconnected from the channel.

To enable Open Wire Detection, see Chxx.

Open Wire Conditions

Mode	Cause of Detection	Module Behavior
Current	The input signal for a channel is below 100 µA.	• Input data for the channel changes to a specific scaled value that corresponds to the Underrange value for the Input Range. • The I:Chxx.OpenWire tag changes to 1. • A fault occurs and the I:Chxx.Fault tag is set to 1.
Voltage	The input signal value reaches full-scale of the input range.	• The I:Chxx.OpenWire tag changes to 1. • A fault occurs and the I:Chxx.Fault tag is set to 1.

IMPORTANT The Disable All Alarms feature does not disable the Open Wire Detection feature because Open Wire Detection is not an alarm.

To disable the Open Wire Detection feature, you must clear the Open Wire Detection checkbox in the module configuration.

Over Temperature Detection

The Over Temperature Detection feature indicates if the temperature of the environment within which the module is operating is higher than the module operating limits.

IMPORTANT Each module detects an ambient temperature that varies and is dependent on how it is loaded and mounted, and the configuration conditions.

When an Over Temperature condition exists, the I.Chxx.OverTemperature tag is set to 1.

IMPORTANT The Disable All Alarms feature does not disable the Over Temperature Detection feature because Over Temperature Detection is not an alarm.

Fault and Status Reports

The 5069-IF8 module sends fault and status data with channel data to the owner-controller and listen-only controllers. The data is returned via module tags that you can monitor in your Studio 5000 Logix Designer application.

With some exceptions, the 5069-IF8 module provides the fault and data status in a channel-specific format. In this table, the tag names that include Chxx represent channel-specific data, where xx is the channel number.

Fault Tags - 5069-IF8

Tag Name	Triggering Event That Sets Tag
ConnectionFaulted	The owner-controller loses its connection to the module. This tag provides module-wide data and affects all channels simultaneously.
Chxx.Fault	The channel data quality is bad.
Chxx.OpenWire	One of these conditions. • The channel uses a **Voltage** input type in any input range and the input signal value reaches full-scale. • The channel uses a **Current** input type in any input range and the input signal goes below 100 µA. The input signal at the channel is below 100 µA.
Chxx.Underrange	The channel data is beneath the absolute minimum for this channel.
Chxx.Overrange	The channel data is above the absolute maximum for this channel.
Chxx.OverTemperature	The module is at a higher temperature than its rated operating limits.

Status Tags - 5069-IF8

Tag Name	Description
RunMode	The module is in Run Mode. This tag provides module-wide data and affects all channels simultaneously.
DiagnosticActive	Indicates if any diagnostics are active.
DiagnosticSequenceCount	A counter that increments when a diagnostic condition occurs or goes away. This is a rolling counter that skips 0 on rollovers.
Chxx.Uncertain	Indicates that the channel data can be imperfect but the degree of inaccuracy is unknown.
Chxx.FieldPowerOff	Field power is not present on the channel.
Chxx.NotANumber	The most recently received data value was not a number.
Chxx.LLAlarm	The alarm triggers when these conditions exist. • The I.Chxx.Data tag value is less than the C.Chxx.LLAlarmLimit tag value or the alarm is latched. • The O.Chxx.LLAlarmEn tag is set. • Alarms are enabled for the channel.
Chxx.LAlarm	The alarm triggers when these conditions exist. • The I.Chxx.Data tag value is less than the C.Chxx.LAlarmLimit tag value or the alarm is latched. • The O.Chxx.LAlarmEn tag is set. • Alarms are enabled for the channel.
Chxx.HAlarm	The alarm triggers when these conditions exist. • The I.Chxx.Data tag value is greater than the C.Chxx.HAlarmLimit tag value or the alarm is latched. • The O.Chxx.HAlarmEn tag is set. • Alarms are enabled for the channel.
Chxx.HHAlarm	The alarm triggers when these conditions exist. • The I.Chxx.Data tag value is greater than the C.Chxx.HHAlarmLimit tag value or the alarm is latched. • The O.Chxx.HHAlarmEn tag is set. • Alarms are enabled for the channel.
Chxx.RateAlarm	The alarm triggers when these conditions exist. • The absolute change between consecutive channel samples exceeds the C.Chxx.RateAlarmLimit tag value or the alarm is latched. • The O.Chxx.RateAlarmEn tag is set. • Alarms are enabled for the channel.

Data Tags - 5069-IF8

Tag Name	Description
Chxx.Data	The channel data in scaled engineering units.
RollingTimestamp	15-bit timer that runs continuously and counts in milliseconds. It is not related to the CST. The value of RollingTimestamp is recorded whenever a module scans its channels. The controller program uses the last two rolling timestamp values to calculate the amount of time between the samples. This tag provides module-wide data and affects all channels simultaneously.

Current/Voltage/RTD/Temperature Analog Input Module Features - 5069-IY4, 5069-IY4K

The 5069-IY4 and 5069-IY4K input modules have four differential, non-isolated channels. Each channel supports connection to these types.

- Current
- Voltage
- RTD
- Thermocouple

Differential inputs have a greater resistance to the effects of electromagnetic noise and provide improved flexibility regarding cable length when wiring your module.

IMPORTANT Remember the following:

- These modules also have features that apply to all Compact 5000® analog I/O modules that are described in Common Analog I/O Module Features.
- You can configure the features that are described in this chapter with the Studio 5000 Logix Designer® application. For information on how to configure the module, see Configure the Module.

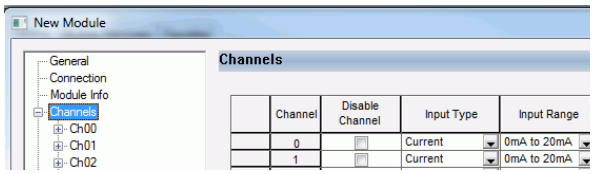
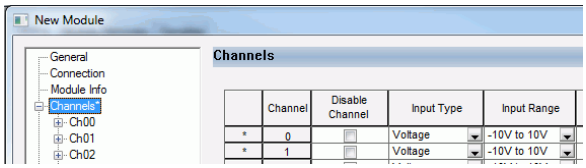
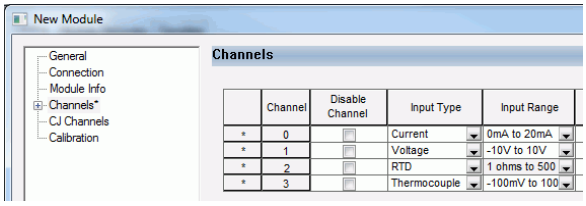
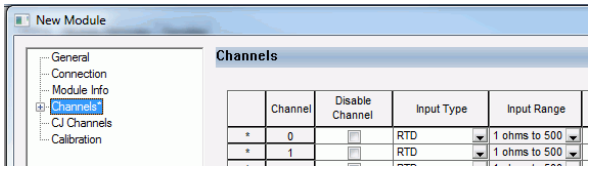
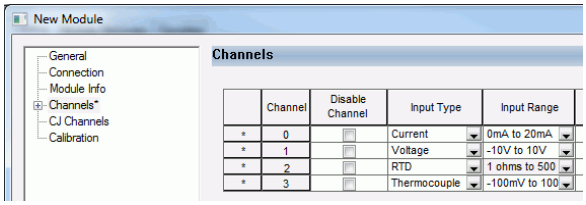
Analog Device Support

The 5069-IY4 and 5069-IY4K modules do not support connection to all analog devices. This table lists the analog devices that the 5069-IY4 and 5069-IY4K modules support.

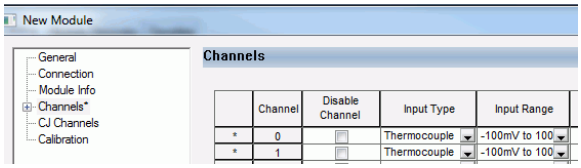
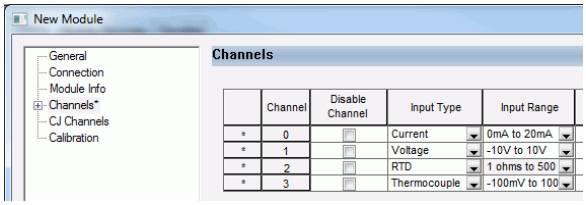
IMPORTANT Make sure that the channel configuration in your Studio 5000 Logix Designer project matches the input device type that is connected to the channel. Choose the input type on the Channels page in the Module Properties.

For example, if a current input device is connected to channel 0 on the module, the channel configuration must be Input Type = Current.

Analog Devices Supported - 5069-IY4, 5069-IY4K

Device	Modes	Supported	Example Channel Configuration
2-wire analog device 4-wire analog device[1]	Current	Yes	In this example, current devices are connected to channels 0 and 1. 
	Voltage		In this example, voltage devices are connected to channels 0 and 1. 
	Any combination of current, voltage, RTD, Thermocouple[2]	Yes	In this example, a current device is connected to channel 0, a voltage device is connected to channel 1, an RTD is connected to channel 3, a thermocouple is connected to channel 4. 
2-wire RTD device 3-wire RTD device	RTD	Yes	In this example, RTDs are connected to channels 0 and 1. 
	Any combination of current, voltage, RTD, Thermocouple[2]	Yes	In this example, a current device is connected to channel 0, a voltage device is connected to channel 1, an RTD is connected to channel 3, a thermocouple is connected to channel 4. 

Analog Devices Supported - 5069-IY4, 5069-IY4K (Continued)

Device	Modes	Supported	Example Channel Configuration
	Thermocouple	Yes	In this example, thermocouples are connected to channels 0 and 1. 
2-wire Thermocouple device	Any combination of current, voltage, RTD, Thermocouple	Yes	In this example, a current device is connected to channel 0, a voltage device is connected to channel 1, an RTD is connected to channel 3, a thermocouple is connected to channel 4. 
1-wire analog device 3-wire analog device	— These devices are not supported regardless of the channel mode configuration.	No	—

(1) These devices are 2-wire current and voltage devices with 2-wire sensor power connections.
(2) You must use the 5069-RTB14CJC RTB if at least one thermocouple is connected to the module. If there are no thermocouples that are connected to the module, we recommend that you use the 5069-RTB18 RTB.

For more module configuration information, see Configure the Module Parameters.

For more information on how to wire devices to the 5069-IY4 and 5069-IY4K modules, see the Compact 5000 I/O Modules and EtherNet/IP™ Adapters Specification Technical Data, publication 5069-TD001.

Multiple Input Ranges

The 5069-IY4 and 5069-IY4K modules offer multiple input ranges. The input type that you choose during module configuration determines the available input ranges.

For the RTD input type, the sensor type that you choose determines the available input ranges. The Studio 5000 Logix Designer application automatically sets the Input Range to the valid setting after you select a sensor type.

Input Type	Sensor Type	Available Input Ranges
Current (mA)	–	One of the following: • 0...20 mA • 4...20 mA
Voltage (V)	–	One of the following: • -10...10V • 0...5V • 0...10V
RTD	100 Ω PT 385	1...500 Ω
	200 Ω PT 385	2...1000 Ω
	500 Ω PT 385	4...2000 Ω
	1000 Ω PT 385	8...4000 Ω
	100 Ω PT 3916	1...500 Ω
	200 Ω PT 3916	2...1000 Ω
	500 Ω PT 3916	4...2000 Ω
	1000 Ω PT 3916	8...4000 Ω
	10 Ω CU 427	1...500 Ω
	120 Ω NI 672	1...500 Ω
	100 Ω NI 618	1...500 Ω
	120 Ω NI 618	1...500 Ω
	200 Ω NI 618	2...1000 Ω
	500 Ω NI 618	4...2000 Ω
Thermocouple	mV or any Thermocouple type	-100...+100 mV

To choose an input range, see Chxx.

Multiple Temperature Units

You can use these temperature units with the 5069-IY4 and 5069-IY4K modules.

- Celsius
- Kelvin
- Fahrenheit
- Rankine
- Custom

Each channel is individually configurable for its temperature units.

To select the temperature units for a channel, see Chxx.

Notch Filter

The Notch Filter is a built-in feature of the Analog-to-Digital converter (ADC) that removes line noise in your application. The removal of line noise is also known as noise immunity.

The Notch Filter attenuates the input signal at the specified frequency.

Select a Notch Filter based on what noise frequencies are present in the operating environment and what sample requirements are needed for control. For example, if the Notch Filter setting is 60 Hz, the 60 Hz AC line noise and the associated overtones are removed.

Available Notch Filter Settings		
• 5 Hz	• 100 Hz	• 10,000 Hz
• 10 Hz	• 200 Hz	• 15,625 Hz
• 15 Hz	• 500 Hz	• 25,000 Hz
• 20 Hz	• 1000 Hz	• 31,250 Hz
• 50 Hz	• 2500 Hz	• 62,500 Hz
• 60 Hz	• 5000 Hz	

If you filter lower frequency noise, you get a slower input sample rate.

To set the notch filter, see Chxx.

Relationship between Notch Filter Settings and RPI Setting

There is a relationship between a Notch Filter setting and the RPI rate.

For...	Use...
Greater noise suppression and improved resolution at the selected Notch Filter frequency	A slower input sample rate
Faster input samples at the selected Notch Filter frequency, with less noise suppression and resolution	A faster input sample rate

In this table, each Notch Filter setting has two recommended minimum module RPI values that allow the required time to collect samples from each channel. One setting provides faster sample speed and the other provides slightly better resolution at slower sample speeds.

Notch Filter	Recommended Minimum Module RPI Value			
	Application with Only One Channel Enabled		Application with All Channels Enabled and the Same Notch Filter Setting on All Channels	
	Faster Sample Speed	Better Noise Rejection	Faster Sample Speed	Better Noise Rejection
5 Hz	215 ms	635 ms	750 ms(1)	–
10 Hz	110 ms	320 ms	440 ms	–
15 Hz	65 ms	195 ms	260 ms	–
20 Hz	60 ms	165 ms	240 ms	660 ms
50 Hz	25 ms	70 ms	100 ms	280 ms
60 Hz (default)	20 ms	60 ms	80 ms	240 ms
100 Hz	15 ms	35 ms	60 ms	140 ms
200 Hz	10 ms	20 ms	40 ms	80 ms
500 Hz	5 ms	10 ms	20 ms	40 ms
1000 Hz	2 ms	5 ms	8 ms	20 ms
2500 Hz	1.5 ms	2.5 ms	6 ms	10 ms
5000 Hz	1 ms	2 ms	4 ms	8 ms
10,000 Hz	0.8 ms	1 ms	3.2 ms	4 ms
15,625 Hz	0.8 ms	0.9 ms	3.2 ms	3.5 ms
25,000 Hz	0.8 ms	0.8 ms	3.2 ms	3.2 ms
31,250 Hz	0.8 ms	0.8 ms	3.2 ms	3.2 ms
62,500 Hz	–	0.7 ms	–	2.8 ms

(1) If you use the 5 Hz Notch Filter setting with four channels, the input data cannot be refreshed at every RPI, even if the maximum RPI allowed is used. Instead, fresh data is delivered approximately every other RPI.

Noise Rejection with Different Notch Filter Frequencies

When input channels on the same module use different Notch Filter frequencies, you must consider the sample time for each channel to find the recommended RPI that provides enough time to sample all channels.

When input channels on the same module use different Notch Filter selections, the recommended minimum RPI rates for all enabled channels are combined to produce the recommended minimum module RPI.

Example Configuration for Faster Sample Speed

Channel	Notch Filter	Recommended Minimum Module RPI for Each Channel(1)	Combined Minimum Module RPI to Use in Module Configuration
Ch00	50 Hz	25 ms	37.7 ms
Ch01	1000 Hz	2 ms	
Ch02	200 Hz	10 ms	
Ch03	625,000 Hz	0.7 ms	

(1) The values in this column are listed in the Notch Filter table.

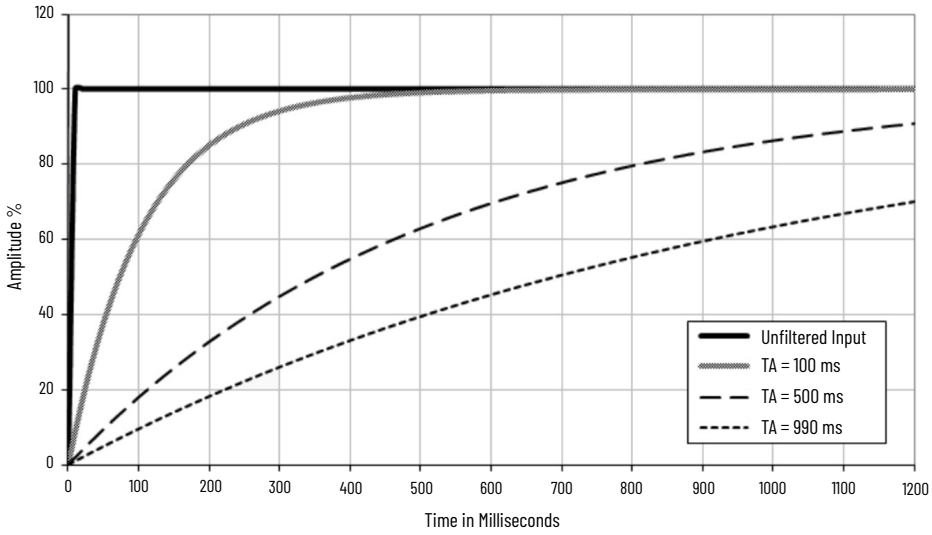
Example Configuration for Better Noise Rejection

Channel	Notch Filter	Recommended Minimum Module RPI for Each Channel(1)	Combined Minimum Module RPI to Use in Module Configuration
Ch00	50 Hz	70 ms	85.7 ms
Ch01	1000 Hz	5 ms	
Ch02	200 Hz	10 ms	
Ch03	625,000 Hz	0.7 ms	

(1) The values in this column are listed in the Notch Filter table.

Digital Filter

The Digital Filter is a first-order lag filter. It smooths input data noise transients on **each input channel**. This value specifies the time constant for a digital, first-order lag filter on the input. The input is 63% of the step change after the first time constant elapses.



The filter value is specified in units of milliseconds. A value of 0 (zero) disables the filter. The digital filter equation is as shown.

$$Y_n = Y_{n-1} + \frac{\Delta t \quad * (X_n - Y_{n-1})}{\Delta t + TA}$$

Y_n = Present Output, Filtered Peak Voltage (PV)
Y_{n-1} = Previous Output, Filtered PV
Δt = Module Channel Update Time (seconds)
TA = Digital Filter time Constant (seconds)
X_n = Present Input, Unfiltered PV

IMPORTANT Remember the following:

- Digital Filter input data changes only when new input data is collected.
- If an Overrange or Underrange condition is detected before the Digital Filter input data is collected, the condition is indicated immediately. An immediate indication also applies to the Fault data for the input.

To choose a digital filter, see Chxx.

Underrange/Overrange Detection

Underrange/Overrange Detection detects when the 5069-IY4 or 5069-IY4K module is operating beyond limits set by the input range.

The module can read input signal levels outside the low and high signal values for each input range. The signal limits to which the module can read are thresholds. Only when the signal is beyond a threshold is an underrange or overrange condition that is detected and indicated.

For example, if a 5069-IY4 module channel uses the ± 10V input range, an overrange condition does not exist until the input signal is greater than 12V.

Input Ranges, Sensor Types, and Thresholds

Input Type	Range or Sensor Type	Underrange Threshold	Overrange Threshold	Deadband[1]
Current	0...20 mA	≤ -0.07 mA	≥ 23.00 mA	0.07 mA
	4...20 mA	≤ 3 mA[2]		
Voltage	±10.00V	≤ -12.00V	≥12.00V	0.04V
	0...5V	≤ -0.02V	≥ 6.00V	0.02V
	0...10V	≤ -0.04V	≥ 12.00V	0.04
RTD	Pt385	≤ -200 °C ≤ -328 °F ≤ 73 °K ≤ 132 °R	≥ 870 °C ≥ 1598 °F ≥ 1143 °K ≥ 2058 °R	–
	Pt3916	≤ -200 °C ≤ -328 °F ≤ 73 °K ≤ 132 °R	≥ 630 °C ≥ 1166 °F ≥ 903 °K ≥ 1626 °R	
	Cu427	≤ -200 °C ≤ -328 °F ≤ 73 °K ≤ 132 °R	≥ 260 °C ≥ 500 °F ≥ 533 °K ≥ 960 °R	
	Ni672	≤ -80 °C ≤ -112 °F ≤ 193 °K ≤ 348 °R	≥ 320 °C ≥ 608 °F ≥ 593 °K ≥ 1068 °R	
	Ni618	≤ -60 °C ≤ -76 °F ≤ 213 °K ≤ 384 °R	≥ 250 °C ≥ 482 °F ≥ 523 °K ≥ 942 °R	
Thermocouple	B	≤ 21 °C ≤ 68 °F ≤ 293 °K ≤ 528 °R	≥ 1820 °C ≥ 3308 °F ≥ 2093 °K ≥ 3768 °R	–
	C	≤ 0.00 °C ≤ 32 °F ≤ 273 °K ≤ 492 °R	≥ 2320 °C ≥ 4208 °F ≥ 2593 °K ≥ 4668 °R	
	E	≤ -270 °C ≤ -454 °F ≤ 3 °K ≤ 6 °R	≥ 1000 °C ≥ 1832 °F ≥ 1273 °K ≥ 2292 °R	
	J	≤ -210 °C ≤ -346 °F ≤ 63 °K ≤ 114 °R	≥ 1200 °C ≥ 2192 °F ≥ 1473 °K ≥ 2652 °R	
	K	≤ -270 °C ≤ -454 °F ≤ 3 °K ≤ 6 °R	≥ 1372 °C ≥ 2502 °F ≥ 1645 °K ≥ 2961 °R	
	N	≤ -270 °C ≤ -454 °F ≤ 3 °K ≤ 6 °R	≥ 1300 °C ≥ 2372 °F ≥ 1573 °K ≥ 2832 °R	
	R	≤ -50 °C ≤ -58 °F ≤ 223 °K ≤ 402 °R	≥ 1768 °C ≥ 3215 °F ≥ 2041 °K ≥ 3674 °R	

Input Ranges, Sensor Types, and Thresholds (Continued)

Input Type	Range or Sensor Type	Underrange Threshold	Overrange Threshold	Deadband[1]
Thermostat	S	≤ -50 °C ≤ -58 °F ≤ 223 °K ≤ 402 °R	≥ 1768 °C ≥ 3215 °F ≥ 2041 °K ≥ 3674 °R	–
	T	≤ -270 °C ≤ -454 °F ≤ 3 °K ≤ 6 °R	≥ 400 °C ≥ 752 °F ≥ 673 °K ≥ 1212 °R	
	TXK/XK(L)	≤ -200 °C ≤ -328 °F ≤ 73 °K ≤ 132 °R	≥ 800 °C ≥ 1472 °F ≥ 1073 °K ≥ 1932 °R	
	D	≤ 0.00 °C ≤ 32 °F ≤ 273 °K ≤ 492 °R	≥ 2320 °C ≥ 4208 °F ≥ 2593 °K ≥ 4668 °R	

(1) The module has alarm deadband values for each range. The deadband keeps the alarm status bit set, despite the removal of the alarm condition. For example, if a module uses a Current input type in the 4...20 mA range and the signal value goes below 3 mA, the underrange condition is triggered. Because of the 0.07 mA deadband, the condition is not cleared until the signal value reaches 3.07 mA. For more information, see Alarm Deadband.

(2) Underrange is set at ≤ 3 mA, but the I:Chxx.Data tag reports values as low as 0.0 mA. The condition is clamped when the signal reaches 3 mA.

IMPORTANT The Disable All Alarms feature does not disable the underrange/overrange detection feature.

The Disable All Alarms feature disables **alarms** on the module. Underrange/Overrange detection is not an alarm. It is an indicator that channel data has gone beyond the absolute maximum or minimum, respectively, for the channel range.

To disable the Underrange/Overrange detection feature, you must disable the channel.

Underrange/overrange conditions are indicated when these tags change to 1.

- I.Chxx.Underrange
- I.Chxx.Overrange

For more information, see Module and Device Tags.

Process Alarms

Process alarms alert you when the module has exceeded configured high or low limits for **each channel**. This is a list of the user-configurable alarm trigger points.

- High high
- High
- Low
- Low low

To use the Process Alarms, you must complete these tasks.

- Enable the alarms
- Configure the trigger points

Enable Process Alarms

When the module tags are created, the Process Alarm tags are disabled by default.

To enable Process Alarms, see Alarms.

Configure Alarm Trigger Points

You must configure the Process Alarm with a trigger point. That is, set values in engineering units that, once the signal reaches the value, the alarm is triggered.

Process Alarm trigger points are related to the Scaling parameters that you configure for the channel. The engineering units that are established in Scaling determine the Process Alarm trigger points. That is, the available trigger point values can be in signal units or engineering units.

For example, consider a channel that uses the Current input type, the 4 mA...20 mA input range, and scales the High and Low Engineering values of 100 and 0, respectively. The available Process Alarm values range from 0...100.

In this case, if the High Limit alarm is set to 50 EU, when the input signal reaches 12 mA, the High Limit alarm is set. The alarm is set because Scaling was configured for Percentage of Full Scale and a signal value of 12 mA is 50% of the full scale of engineering units.

To set the Process Alarm trigger points, see Alarms.

Latch Alarms

Select the Latch Process Alarms checkbox on the Alarms page to latch the process alarms. For more information, see Alarms.

Unlatch Alarms

IMPORTANT Before you unlatch an alarm, make sure the condition that triggered the alarm no longer exists.

Once an alarm is latched, you must manually unlatch it. To unlatch an alarm, toggle the output tag for that alarm from 0 to 1. Use these tags to unlatch alarms.

- O.Chxx.LLAlarmUnlatch
- O.Chxx.LAlarmUnlatch
- O.Chxx.HAlarmUnlatch
- O.Chxx.HHAlarmUnlatch
- O.Chxx.RateAlarmUnlatch

IMPORTANT You must toggle the tag from 0 to 1 to unlatch the alarm each time it is triggered.

You must also toggle the tag back to 0 after the alarm is unlatched. If you do not change the tag back to 0 and the alarm is latched again in the future, the alarm remains latched despite the tag value being 1.

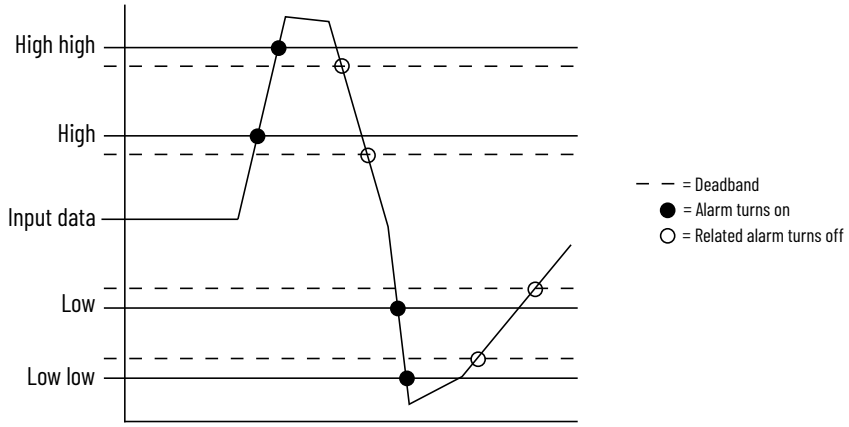
For more information on how to use the module tags, see Module and Device Tags.

Alarm Deadband

You can set an alarm deadband when you configure the process alarms. If the alarm condition is removed, the alarm status bit remains set as long as the input data stays within the deadband of the alarm.

This graphic shows input data that sets each of the alarms during module operation. In this example, a deadband is set and alarm latching is disabled, so each alarm turns Off when the condition that caused it to turn On is removed and the input data exits the deadband.

Alarm Deadband Example



Also, the High alarm remains On during the High high alarm, and the Low alarm remains On during the Low low alarm.

To to set the alarm deadband, see Alarms.

Rate Alarm

The Rate Alarm defines the maximum rate of change between input samples in engineering units per second. If the Rate Alarm Limit is exceeded, the I.Chxx.RateAlarm tag is set to 1.

You can enable or disable Rate Alarm Latching on each channel. To enable the Rate Alarm, see Alarms.

To unlatch the alarm, toggle the O.Chxx.RateAlarmUnlatch tag to 1.

You can unlatch the alarm at any point in the system operation. If you change the unlatch tag to 1 and the triggering condition remains, the alarm is immediately latched again.

We suggest that you unlatch the Rate Alarm only after the rate of change between input samples has returned below the Rate Alarm Limit value.

Sensor Types

This module supports multiple sensor types. The input type configuration dictates the available selections.

Input Type	Available Sensor Types		
RTD	100 Ω PT 385 200 Ω PT 385 500 Ω PT 385 1000 Ω PT 385 100 Ω PT 3916	200 Ω PT 3916 500 Ω PT 3916 1000 Ω PT 3916 10 Ω CU 427 120 Ω NI 672	100 Ω NI 618 120 Ω NI 618 200 Ω NI 618 500 Ω NI 618
Thermocouple	B, C, D, E, J, K, N, R, S, T, TXK/XK (L)		

To select a Sensor Type for a channel, see Chxx.

Sensor Type Temperature Limits

The 5069-IY4 lets you set temperature limits when the module uses the RTD or Thermocouple input types.

The choices that are made during module configuration for the following parameters determine Sensor Type temperature limits:

- Input Type
- Sensor Type
- Temperature Units

To set the parameters that affect the temperature limits, see Chxx.

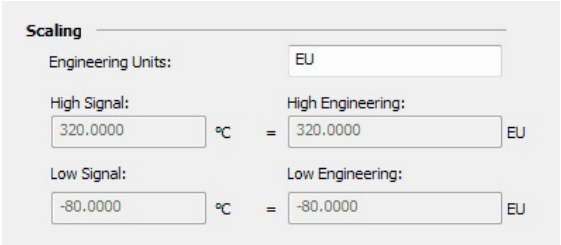
IMPORTANT When you configure the Input Type, Sensor Type, and Temperature Units, the Scaling parameters are automatically set on the Chxx page in the Module Properties. They cannot be changed manually.

The Low Signal value equals the Low Engineering value. The High Signal value equals the High Engineering value.

For example, if you configure a channel with these parameters:

- Input Type = RTD
- Sensor Type = 120 Ω NI 672
- Temperature Units = Celsius

The Scaling parameters are set as shown:



Temperature Limits for RTD and Thermocouple Sensor Types

Input Type	Sensor Type	Temperature Range Limits
RTD	100 Ω PT 385 200 Ω PT 385 500 Ω PT 385 1000 Ω PT 385	-200...+870 °C -328...+1598 °F 73...1143 °K 132...2058 °R
	100 Ω PT 3916 200 Ω PT 3916 500 Ω PT 3916 1000 Ω PT 3916	-200...+630 °C -328...+1166 °F 73...903 °K 132...1626 °R
	10 Ω CU 427	-200...+260 °C -328...+500 °F 73...533 °K 132...960 °R
	120 Ω NI 672	-80...+320 °C -112...+608 °F 193...593 °K 348...1068 °R
	100 Ω NI 618 120 Ω NI 618 200 Ω NI 618 500 Ω NI 618	-60...+250 °C -76...+482 °F 213...523 °K 384...942 °R
Thermocouple (mV)	B	21...1820 °C 68...3308 °F 293...2093 °K 528...3768 °R
	C	0...2320 °C 32...4208 °F 273...2593 °K 492...4668 °R
	D	0...2320 °C 32...4208 °F 273...2593 °K 492...4668 °R
	E	-270...+1000 °C -454...+1832 °F 3...1273 °K 6...2292 °R
	J	-210...+1200 °C -346...+2192 °F 63...1473 °K 114...2652 °R
	K	-270...+1372 °C -454...+2502 °F 3...1645 °K 6...2961 °R
	N	-270...+1300 °C -454...+2372 °F 3...1573 °K 6...2832 °R
	R	-50...+1768 °C -58...+3215 °F 223...2041 °K 402...3674 °R
	S	-50...+1768 °C -58...+3215 °F 223...2041 °K 402...3674 °R
	T	-270...+400 °C -454...+752 °F 3...673 °K 6...1212 °R
	TXK/XK (L)	-200...+800 °C -328...+1472 °F 73...1073 °K 132...1932 °R

Sensor Offset

The Sensor Offset compensates for any known error on the sensor or channel to which the sensor is connected. The value is set in signal units and is added to the data value.

For example, consider an application that uses the Current input type with the 4...20 mA range and scaling at 0...100%. If a sensor has an error and the channel consistently reports current signal values by 0.2 mA lower than the actual value, you must set Sensor Offset to 1.25%.

You must use the O.Chxx.SensorOffset tag to set the Sensor Offset. In the example above, the O.Chxx.SensorOffset tag = 1.25.

For more information, see Module and Device Tags.

10 Ohm Copper Offset

With the 10 Ohm Copper Offset feature, you can compensate for a small offset error in a 10 Ω copper RTD. The channel must be connected to the 10 Ω CU 427 Sensor Type to use this feature. The offset value is indicated in units of 0.01 Ω.

For example, if the resistance of a copper RTD used with a channel is 9.74 Ω at 25 °C (77 °F), the 10 Ohm Copper Offset lets you account for the error. You must set the 10 Ohm Copper Offset field on the Configuration tab to -0.26 or by setting the C.Chxx.TenOhmOffset to -26.

To set the 10 Ohm Copper Offset, see Chxx.

Open Wire Detection

Open Wire Detection detects when a wire is disconnected from the channel. To enable Open Wire Detection, see Chxx.

On the 5069-IY4 and 5069-IY4K modules, this feature is available in these modes.

- Current
- Voltage
- RTD
- Thermocouple

Mode	Cause of Detection	Module Behavior
Current	The input signal for a channel is below 100 µA.	• The I:Chxx.OpenWire tag changes to 1. • A fault occurs and the I:Chxx.Fault tag is set to 1.
Voltage	The input signal value reaches full-scale of the input range.	• The I:Chxx.OpenWire tag changes to 1. • A fault occurs and the I:Chxx.Fault tag is set to 1.
RTD	A wire is disconnected from the channel.	• The I:Chxx.OpenWire tag changes to 1. • A fault occurs and the I:Chxx.Fault tag is set to 1.
Thermocouple with Sensor Type = Any TC Type	A wire is disconnected from the channel.	• The I:Chxx.OpenWire tag changes to 1. • A fault occurs and the I:Chxx.Fault tag is set to 1.
Thermocouple with Sensor Type = mV	A wire is disconnected from the channel.	• The I:Chxx.OpenWire tag changes to 1. • A fault occurs and the I:Chxx.Fault tag is set to 1.

IMPORTANT The Disable All Alarms feature does not disable the Open Wire Detection feature because Open Wire Detection is not an alarm.

To disable the Open Wire Detection feature, you must clear the Open Wire Detection checkbox in the module configuration.

Over Temperature Detection

The Over Temperature Detection feature indicates that the temperature of the conditions within which the module is operating are higher than the module operating limits.

IMPORTANT Each module detects an ambient temperature that varies and is dependent on how it is loaded and mounted, and the configuration conditions.

When an Over Temperature condition exists, the I.Ch*xx*.OverTemperature tag is set to 1.

IMPORTANT The Disable All Alarms feature does not disable the Over Temperature Detection feature because Over Temperature Detection is not an alarm.

Cold Junction Compensation

When you use the 5069-IY4 and 5069-IY4K modules with a thermocouple input type, the channel must account for the thermoelectric effect of a junction of the thermocouple field wires and the RTB terminals.

IMPORTANT You must use a cold junction compensation (CJC) RTB when a 5069-IY4 or 5069-IY4K modules uses a thermocouple input type. The CJC RTBs account for the thermoelectric effect.

The following CJC RTBs are available for order:

- 5069-RTB14CJC-SPRING
- 5069-RTB14CJC-SCREW

The junction at which temperature is measured is the hot junction. The junction where the thermocouple wire interfaces with copper are the cold junction. The transition from thermocouple wire to copper typically happens at the RTB terminal.

The thermoelectric effect alters the input signal and must be compensated for to measure temperatures accurately. To compensate the input signal from your module accurately, you must use cold junction compensation to account for the increased voltage.

To disable cold junction compensation, see CJ Channels.

Fault and Status Reports

The 5069-IY4 and 5069-IY4K modules send fault and status data with channel data to the owner-controller and listen-only controllers. The data is returned via module tags that you can monitor in your Studio 5000 Logix Designer application.

With some exceptions, the 5069-IY4 and 5069-IY4K modules provide the fault and data status in a channel-specific format. In this table, the tag names that include Chxx represent channel-specific data, where xx is the channel number.

Fault Tags - 5069-IY4, 5069-IY4K

Tag Name	Trigger That Sets Tag
ConnectionFaulted	The owner-controller loses its connection to the module. This tag provides module-wide data and affects all channels simultaneously.
Chxx.Fault	The channel data quality is bad.
CJChxx.Fault	The cold junction data quality is bad.
Chxx.OpenWire	One of these conditions. • The channel uses the Voltage input type in any input range and the input signal value reaches full-scale. • The channel uses the Current input type in any input range and the input signal goes below 100 µA. The input signal at the channel is below 100 µA. • The channel uses the RTD or Thermocouple input type and a wire is disconnected from the channel.
CJChxx.OpenWire	A wire is disconnected from the cold junction.
Chxx.Underrange	The channel data is beneath the absolute minimum for this channel.
CJChxx.Underrange	The cold junction at the channel is beneath the absolute minimum for this channel.
Chxx.Overrange	The channel data is above the absolute maximum for this channel.
CJChxx.Overrange	The cold junction at the channel is above the absolute maximum for this channel.

Status Tags - 5069-IY4, 5069-IY4K

Tag Name	Description
RunMode	The module is in Run Mode. This tag provides module-wide data and affects all channels simultaneously.
DiagnosticActive	Indicates if any diagnostics are active.
DiagnosticSequenceCount	A counter that increments when a diagnostic condition occurs or goes away. This is a rolling counter that skips 0 on rollovers.
Chxx.Uncertain	Indicates that the channel data can be imperfect but the degree of inaccuracy is unknown.
CJChxx.Uncertain	Indicates that the cold junction data can be imperfect but the degree of inaccuracy is unknown.
Chxx.OverTemperature	Indicates that the module is operating at a higher temperature than its rated operating limits.
CJChxx.Temperature	Current temperature of the cold junction.
Chxx.FieldPowerOff	Indicates that field power is not present on the channel.
CJChxx.FieldPowerOff	Indicates that field power is not present at the cold junction.
Chxx.NotANumber	Indicates that the most recently received data value was not a number.
Chxx.LLAlarm	The alarm triggers when these conditions exist. • The I.Chxx.Data tag value is less than the C.Chxx.LLAlarmLimit tag value or the alarm is latched. • The O.Chxx.LLAlarmEn tag is set. • Alarms are enabled for the channel.
Chxx.LAlarm	The alarm triggers when these conditions exist. • The I.Chxx.Data tag value is less than the C.Chxx.LAlarmLimit tag value or the alarm is latched. • The O.Chxx.LAlarmEn tag is set. • Alarms are enabled for the channel.
Chxx.HAlarm	The alarm triggers when these conditions exist. • The I.Chxx.Data tag value is greater than the C.Chxx.HAlarmLimit tag value or the alarm is latched. • The O.Chxx.HAlarmEn tag is set. • Alarms are enabled for the channel.
Chxx.HHAlarm	The alarm triggers when these conditions exist. • The I.Chxx.Data tag value is greater than the C.Chxx.HHAlarmLimit tag value or the alarm is latched. • The O.Chxx.HHAlarmEn tag is set. • Alarms are enabled for the channel.
Chxx.RateAlarm	The alarm triggers when the following conditions exist: • The absolute change between consecutive channel samples exceeds the C.Chxx.RateAlarmLimit tag value or the alarm is latched. • The O.Chxx.RateAlarmEn tag is set. • Alarms are enabled for the channel.

Data Tags - 5069-IY4, 5069-IY4K

Tag Name	Description
Chxx.Data	The channel data in scaled engineering units.
RollingTimestamp	15-bit timer that runs continuously and counts in milliseconds. It is not related to the CST. The value of RollingTimestamp is recorded whenever a module scans its channels. The controller program uses the last two rolling timestamp values to calculate the amount of time between the samples. This tag provides module-wide data and affects all channels simultaneously.

Current/Voltage Analog Output Module Features - 5069-OF4, 5069-OF4K, 5069-OF8

The 5069-OF4, 5069-OF4K, and 5069-OF8 output modules have four and eight non-isolated channels, respectively. Each channel supports connection to these output types.

- Current
- Voltage

IMPORTANT Remember the following:

- This module also has features that apply to all Compact 5000® I/O analog modules that are described in Common Analog I/O Module Features.
- You can configure the features that are described in this chapter with the Studio 5000 Logix Designer® application. For more information, see Configure the Module.

Multiple Output Ranges

The Compact 5000 I/O analog output modules offer multiple output ranges. The output type that you choose during module configuration determines the available ranges.

Output Type	Available Output Range
Current (mA)	• 0...20 mA • 4...20 mA
Voltage (V)	• -10...10V • 0...5V • 0...10V

To select the output range, see Chxx.

Channel Offset

The Channel Offset feature compensates for any known error on the sensor or channel to which the sensor is connected. The value is set in signal units and is added to the output data.

For example, consider an application that uses the Current input type with the 4...20 mA range and scaling at 0...100%. If a channel used in the 4...20 mA output range has an error that results in consistent reports of 8 mA as 7.8 mA, you must set the Channel Offset to 1.25 to account for the error.

To set the channel offset, see Chxx.

Hold for Initialization

The Hold for Initialization feature causes outputs to hold the current state until the value that the controller requests matches the value at the output screw terminal, within 0.1% of full-scale. This hold causes a bumpless transfer.

If Hold for Initialization is selected, outputs hold if there is an occurrence of any of these conditions.

- Initial connection is established after power-up.
- A new connection is established after a communication fault occurs.
- There is a transition to Run mode from Program state.
- The module loses SA power. In this case, the data echo value goes to 0.0.
- The I.Chxx.InHold tag for a channel indicates that the channel is holding.

To enable Hold for Initialization, see Chxx.

Connection Fault Handling

You can configure the output module behavior when a connection fault occurs, that is, the connection breaks between the owner-controller and the output module. This table describes the parameters that you can configure.

Parameter	Description	Available Values
Output state in fault mode	If a connection fault occurs, the output state changes to the selected option.	• Hold Last State - the output remains at that value until the following occurs: – The connection to the owner-controller is re-established. – The output returns to normal operation, as defined in the module configuration. • User Defined Value - the output transitions to the set value.
Fault state duration (after a fault)	If you configure the output to transition to a specific value after the connection fault, you must define how long the output remains at the specified value before it transitions to a final fault state value.	• Forever • 1, 2, 5, or 10 seconds
Final fault state value		User-defined

Once the connection between the owner-controller and output module is re-established, the output resumes normal operation.

To set the Connection Fault Handling parameters, see Chxx.

Output Clamping

Output Clamping limits the output from the analog module to remain within a range that is controller-configured, even when the controller commands an output outside that range.

Once clamp values are set, if data received from the controller exceeds those clamps, the following events occur:

- The output value transitions to the clamp limit but not to the requested value.
- The appropriate limit alarm is triggered.

  For more information on limit alarms, see Clamp Alarming.

For example, an application can set the high clamp on a module to 8V and the low clamp to -8V. If a controller sends a value to the module that corresponds to 9V, the module applies only 8V to its screw terminals.

You can disable or latch clamping alarms on a per channel basis. The alarms are disabled by default.

IMPORTANT Clamp values are in engineering units and are **not automatically updated** when the scaling high and low engineering units are changed. Failure to update the clamp values can generate a small output signal that could be misinterpreted as a hardware problem.

For example, a Compact 5000 I/O analog output module channel that uses the Current output type with Clamping enabled has the following configuration parameters:

- Scaling values: High Engineering = 100.0000%, Low Engineering = 0.0000%
- Clamp Limits: High Clamp = 100.0000%, Low Clamp = 0.0000%

If you change the Scaling High Engineering value to 90.0000%, the High Clamp value remains at 100.0000.

You must change the High Clamp value to 90.0000 to make sure that the application continues to operate as expected.

To set the high clamp and low clamp parameters, see Limits.

Clamp Alarming

Clamp Alarming works directly with Output Clamping. When a module receives a data value from the controller that exceeds the limits for clamping, it applies signal values to the clamping limit. In addition, a limit alarm is triggered.

The following tags indicate that a clamping alarm was triggered. That is, the tag is set to 1.

- I.Chxx.LLimitAlarm
- I.Chxx.HLimitAlarm

For more information, see Module and Device Tags.

Output Ramping/Rate Limiting

Output Ramping limits the speed at which an analog output signal can change. This feature helps to prevent fast transitions in the output from damaging the devices that an output module controls. Output Ramping is also known as Rate Limiting.

Type of Ramping	Description
Ramp in Run mode	When the module is in Run mode, ramping occurs to all new output values at the maximum ramp rate.
Ramp to Program mode	When the current output value changes to the Program value after a Program command is received from the controller.
Ramp to Fault mode	When the current output value changes to the Fault value after a communication fault occurs.

The maximum rate of change in outputs is expressed in engineering units per second (EU/s), is called the maximum ramp rate and set in the Ramp Rate field.

To enable the Ramp in Run mode, select the checkbox on the Limits page. To enable the Ramp to Program mode or Ramp to Fault checkboxes, change these module tags to 1.

- C.Chxx.RampToProg
- C.Chxx.RampToFault

For more information, see Module and Device Tags.

Data Echo

Data Echo automatically sends channel data values that match the analog value that was sent to the module's screw terminals.

At the RPI, the output module sends fault and status data, and returns a value that was sent to it by the owner-controller. The echoed value is indicated in the I.Chxx.Data and is represented in engineering units.

For more information, see Output Module Data.

No Load Detection

The No Load Detection feature detects when a wire is disconnected from an output channel or a load is missing for each output channel.

IMPORTANT This feature is only available in Current mode.

The output range that is used with the output channel determines whether a load is missing. If the load draws less than the minimum level of current in the range, it is considered missing.

For example, if an output channel on a 5069-OF4 module uses in the 4...20 mA range, the presence of a no load condition is detected when the channel is connected to a load that draws less than 4 mA.

To Enable No Load Detection	To Monitor for a No Load Condition
• Select the Enable No Load Diagnostic checkbox on the Chxx page. -OR- • Change the C.Chxx.NoLoadEn tag to 1 in the Output Module Tags.	• in your Studio 5000 Logix Designer project. • Access the channel diagnostics available on the Chxx page. • Observe the I/O Status Indicators - Analog Output Modules.

This table describes what happens when a No Load condition is detected and when it is corrected. To correct the issue, reconnect the disconnected wires or troubleshoot the application to correct the level of current that is driven from the channel.

Attribute	No Load Condition Detected	No Load Condition Corrected
I.Chxx.NoLoad tag value	1	0
No Load diagnostic value	1	0
I/O status indicator state	Flashing red	Steady Yellow

Short Circuit Protection

Short Circuit Protection helps prevent damage that can result from driving a current from the channel greater than the maximum current level the channel can handle.

IMPORTANT This feature is available only in Voltage mode.

This table describes what happens when a short circuit is detected and when it is corrected. To correct the issue, remove the short circuit condition.

Attribute	Short Circuit Detected	Short Circuit Corrected
Output behavior	• Faults • Electronically limited to 16 mA or less	Restarts in its commanded state
I.Chxx.ShortCircuit tag value	1	0
Short Circuit diagnostic value	1	0
I/O status indicator state	Flashing red	Steady Yellow

Over Temperature Detection

The Over Temperature Detection feature indicates that the temperature of the conditions within which the module is operating are higher than the module operating limits.

IMPORTANT Each module detects an ambient temperature that varies and is dependent on how it is loaded and mounted, and the configuration conditions.

When an Over Temperature condition exists, the I.Ch*xx*.OverTemperature tag is set to 1. If the Digital to Analog Converter (DAC) reports an Over Temperature condition, a channel-level fault is sent to the controller to identify the faulted channel.

IMPORTANT The Disable All Alarms feature does not disable the Over Temperature Detection feature because Over Temperature Detection is not an alarm.

Fault and Status Reports

The 5069-OF4, 5069-OF4K, and 5069-OF8 modules send fault and status data with channel data to the owner and listen-only controllers. The data is returned via module tags that you can monitor in your Studio 5000 Logix Designer application.

With some exceptions, the 5069-OF4, 5069-OF4K, and 5069-OF8 modules provide the fault and data status in a channel-specific format. In this table, the tag names that include Chxx represent channel-specific data, where xx is the channel number.

Fault Tags - 5069-OF4, 5069-OF4K, 5069-OF8

Tag Name	Trigger That Sets Tag
ConnectionFaulted	The owner-controller loses its connection to the module. This tag provides module-wide data and affects all channels simultaneously.
Chxx.Fault	The channel data quality is bad.
Chxx.NoLoad	A no load condition exists on the channel.
Chxx.ShortCircuit	A short circuit condition exists on the channel.
Chxx.OverTemperature	The module is at a higher temperature than its rated operating limits.

Status Tags - 5069-OF4, 5069-OF4K, 5069-OF8

Tag Name	Description
RunMode	The module is in Run Mode. This tag provides module-wide data and affects all channels simultaneously.
DiagnosticActive	Indicates if any diagnostics are active.
DiagnosticSequenceCount	A counter that increments when a diagnostic condition occurs or goes away. This is a rolling counter that skips 0 on rollovers.
Chxx.Uncertain	Indicates that the channel data can be imperfect but the degree of inaccuracy is unknown.
Chxx.FieldPowerOff	Indicates that field power is not present on the channel.
Chxx.InHold	Indicates that the channel is holding until the received channel data is within 0.1% of the current channel data value.
Chxx.NotANumber	Indicates that the most recently received data value was not a number.
Chxx.LLimitAlarm	The alarm triggers when these conditions exist. • Alarms are enabled on this channel. • The channel data requested, indicated in the O.Chxx.Data tag, is less than the configured LowLimit or the alarm is latched.
Chxx.HLimitAlarm	The alarm triggers when these conditions exist. • Alarms are enabled on this channel. • The channel data requested, indicated in the O.Chxx.Data tag, is greater than the configured HighLimit or the alarm is latched.
Chxx.RampAlarm	Indicates that the channel is limited to changing the output at the Maximum Ramp rate, or that it once was limited and is now latched.

Data Tags - 5069-OF4, 5069-OF4K, 5069-OF8

Tag Name	Description
Chxx.Data	The channel data in scaled engineering units. This data is the Output Data Echo data that is returned from the D/A converter.
RollingTimestamp	15-bit timer that runs continuously and counts in milliseconds. It is not related to the CST. The value of RollingTimestamp is recorded whenever a module scans its channels. The controller program uses the last two rolling timestamp values to calculate the amount of time between the samples. This tag provides module-wide data and affects all channels simultaneously.

Current/Voltage/HART Analog Input Module Features - 5069-IF4IH

The 5069-IF4IH analog 4-channel isolated current/voltage/HART input module offers channel-to-channel isolated input channels that can connect to current, voltage, and HART input devices. The module supports multiple ranges for each input type.

The HART I/O modules support these features.

- HART device connection
- PlantPAx® HART instruction compatible device connection

IMPORTANT Remember the following:

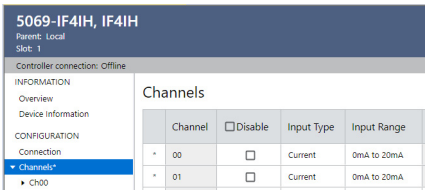
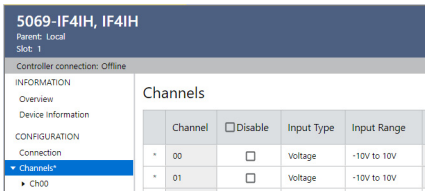
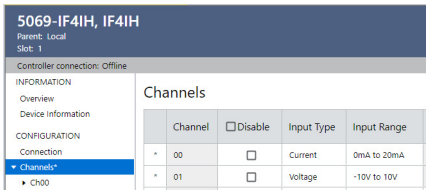
- These modules also have features that apply to all Compact 5000® analog I/O modules that are described in Common Analog I/O Module Features.
- You can configure the features that are described in this chapter with the Studio 5000 Logix Designer® application. For information on how to configure the module, see Configure the Module.

Analog Device Support

The 5069-IF4IH module does not support connection to all analog devices. This table lists the analog devices that the 5069-IF4IH module supports.

IMPORTANT Verify that the channel configuration in your Studio 5000 Logix Designer project matches the input device type that is connected to the channel. Choose the input type on the Channels page in the Module Properties.

For example, if a current input device is connected to channel 0 on the module, the channel configuration must be Input Type = Current.

Device	Mode	Supported	Example Channel Configuration
2-wire analog device 4-wire analog device(1)	Current	Yes	In this example, current devices are connected to channels 0 and 1. 
	Voltage		In this example, voltage devices are connected to channels 0 and 1. 
	Combination of current and voltage		In this example, a current device is connected to channel 0 and a voltage device is connected to channel 1. 
1-wire analog device 3-wire analog device	These devices are not supported regardless of the channel mode configuration.	No	–
2-wire Thermocouple device			
2-wire RTD device 3-wire RTD device			

(1) These devices are 2-wire current and voltage devices with 2-wire sensor power connections.

For more module configuration information, see Module-specific Parameters

For more information on how to wire devices to the 5069-IF4IH modules, see the Compact 5000 I/O Modules and EtherNet/IP™ Adapters Specification Technical Data, publication 5069-TD001.

Multiple Input Ranges

The 5069-IF4IH module supports multiple input ranges. The input type that you choose during module configuration determines the available input ranges. An input type is chosen on a channel-by-channel basis.

Input Type	Available Input Range
Current (mA)	• 0...20 mA • 4...20 mA (HART)
Voltage (V)	• -10...10V • 0...5V • 0...10V

To select the input range, see Chxx.

Notch Filter

The Notch Filter is a built-in feature of the Analog-to-Digital converter (ADC) that removes line noise in your application. The removal of line noise is also known as noise immunity. The Notch Filter attenuates the input signal at the specified frequency.

Choose a Notch Filter based on what noise frequencies are present in the module operating environment and any sample requirements that are needed for control. For example, if the Notch Filter setting is 60 Hz, the 60 Hz AC line noise and the associated overtones are removed.

If you filter lower frequency noise, you get a slower input sample rate. Also, if you filter the high frequency noise the effective resolution of the channel is limited.

Available Notch Filter Settings		
• 5 Hz • 10 Hz • 15 Hz • 20 Hz	• 50 Hz • 60 Hz • 100 Hz • 200 Hz • 500 Hz	• 1000 Hz • 2500 Hz • 5000 Hz • 10,000 Hz
HART is supported from 5...500 Hz only.		

To set the notch filter, see Chxx.

Relationship between Notch Filter Settings and RPI Setting

There is a relationship between a Notch Filter setting and the RPI rate.

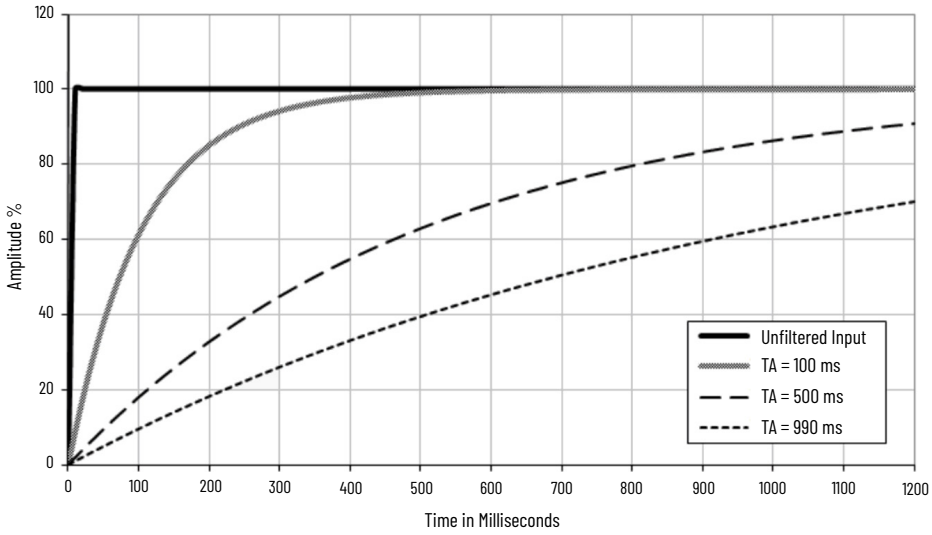
For...	Use...	Example
Greater noise suppression and improved resolution at the selected Notch Filter frequency	A slower input sample rate	For better noise suppression and resolution with the 60 Hz notch filter setting, the recommended minimum module RPI is 60 ms.
Faster input samples at the selected Notch Filter frequency, with less noise suppression and resolution	A faster input sample rate	For faster input samples with the 60 Hz notch filter setting, the recommended minimum module RPI is 20 ms.

If the RPI is smaller than the channel scan time, the controller might not receive new data with each RPI. To help prevent over sampling, use these minimum recommended RPI values.

Notch Filter	Min RPI Without Over Sampling	
	Firmware Revision 1.011	Firmware Revision 1.012
5 Hz	605 ms	
10 Hz	305 ms	
15 Hz	205 ms	
20 Hz	155 ms	
50 Hz	65 ms	
60 Hz	55 ms	
100 Hz	35 ms	
200 Hz	20 ms	
500 Hz	10 ms	8 ms
1000 Hz	8 ms	6 ms
2500 Hz	3 ms	2.5 ms
5000 Hz	2.5 ms	2 ms
10,000 Hz	2 ms	1 ms

Digital Filter

The Digital Filter is a first-order lag filter. It smooths input data noise transients on **each input channel**. This value specifies the time constant for a digital, first-order lag filter on the input. The input is 63% of the step change after the first time constant elapses.



The filter value is specified in units of milliseconds. A value of 0 (zero) disables the filter.

Digital Filter Equation

$$Y_n = Y_{n-1} + \frac{\Delta t \quad * \ (X_n - Y_{n-1})}{\Delta t + TA}$$

Y_n = Present Output, Filtered Peak Voltage (PV)
Y_{n-1} = Previous Output, Filtered PV
Δt = Module Channel Update Time (seconds)
TA = Digital Filter time Constant (seconds)
X_n = Present Input, Unfiltered PV

IMPORTANT Remember the following:

- Digital Filter input data changes only when new input data is collected.
- If an Overrange or Underrange condition is detected before the Digital Filter input data is collected, the condition is indicated immediately. An immediate indication also applies to the Fault data for the input.

To set the digital filter, see Chxx.

Underrange/Overrange Detection

Underrange/Overrange Detection detects when the 5069-IF4IH module is operating beyond limits set by the input range.

The module can read input signal levels outside the low and high signal values for each input range. The signal limits to which the module can read are thresholds. Only when the signal is beyond a threshold is an underrange or overrange condition that is detected and indicated.

For example, if you configure a 5069-IF4IH module channel to use the ± 10V input range, an overrange condition does not exist until the input signal exceeds 10.7V.

This table lists the input ranges of the 5069-IF4IH module and the thresholds in each range before the module detects an underrange/overrange condition.

Input Type	Range	Underrange Threshold	Overrange Threshold	Deadband Value
Current	0...20 mA	< 0.11 mA	> 23.00 mA	0.066 mA
	4...20 mA	< 3.00 mA		
Voltage	± 10.00V	< -10.70V	> 10.70V	0.0413V
	0...5V	< -0.0206V	> 5.35V	0.0206V
	0...10V	< -0.0413V	> 10.70V	0.0413V

- The Deadband Value is the amount of change that is required past the threshold for the alarm condition to clear. For example, if a module uses a Current input type in the 4...20 mA range and the signal value goes below 3 mA, the underrange condition is triggered. Due to the 0.07 mA deadband, the condition is not cleared until the signal value reaches 3.07 mA. For more information, see Alarm Deadband.
- When the underrange is set at < 3 mA, the I:Ch0x.Data tag reports values as low as 0.0 mA. The condition is clamped when the signal reaches 3 mA.

IMPORTANT The Disable All Alarms feature does not disable the underrange/overrange detection feature because underrange/overrange detection is not an alarm.

To disable the Underrange/Overrange detection feature, you must disable the channel.

Underrange/overrange conditions are indicated when one of these tags changes to 1.

- I.Chxx.Underrange
- I.Chxx.Overrange

For more information, see Module and Device Tags.

Process Alarms

For HART input modules, alarms alert you when the module has exceeded configured high or low limits for **each channel**. This list is the user-configurable alarm trigger points.

- High high
- High
- Low
- Low low

To use the Process Alarms, you must complete the following tasks:

- Enable the alarms
- Configure the trigger points

Enable Process Alarms

When the module tags are created, the Process Alarm tags are disabled by default.

To enable Process Alarms, see Alarms.

Configure Alarm Trigger Points

You must configure the Process Alarm with a trigger point. That is, set values in engineering units that, once the signal reaches the value, the alarm is triggered.

Process Alarm trigger points are related to the Scaling parameters that you configure for the channel. The engineering units that are established in Scaling determine the Process Alarm trigger points. That is, the available trigger point values can be in signal units or engineering units.

For example, consider a channel that uses the Current input type, the 4 mA...20 mA input range, and scales the High and Low Engineering values of 100 and 0, respectively. The available Process Alarm values range from 0...100.

In this case, if the High Limit alarm is set to 50 EU, when the input signal reaches 12 mA, the High Limit alarm is set. The alarm is set because Scaling was configured for Percentage of Full Scale and a signal value of 12 mA is 50% of the full scale of engineering units.

To set the Process Alarm trigger points, see Alarms.

Latch Alarms

Select the Latch Process Alarms checkbox on the *Alarms* tab to latch the process alarms. To latch Process Alarms, see Alarms.

Unlatch Alarms

IMPORTANT Before you unlatch an alarm, make sure the condition that triggered the alarm no longer exists.

Once an alarm is latched, you must manually unlatch it. To unlatch an alarm, toggle the output tag for that alarm from 0 to 1. Use these tags to unlatch alarms.

- O.Chxx.LLAlarmUnlatch
- O.Chxx.LAlarmUnlatch
- O.Chxx.HAlarmUnlatch
- O.Chxx.HHAlarmUnlatch
- O.Chxx.RateAlarmUnlatch

IMPORTANT You must toggle the tag from 0 to 1 to unlatch the alarm each time it is triggered.

You must also toggle the tag back to 0 after the alarm is unlatched. If you do not change the tag back to 0 and the alarm is latched again in the future, the alarm remains latched despite the tag value being 1.

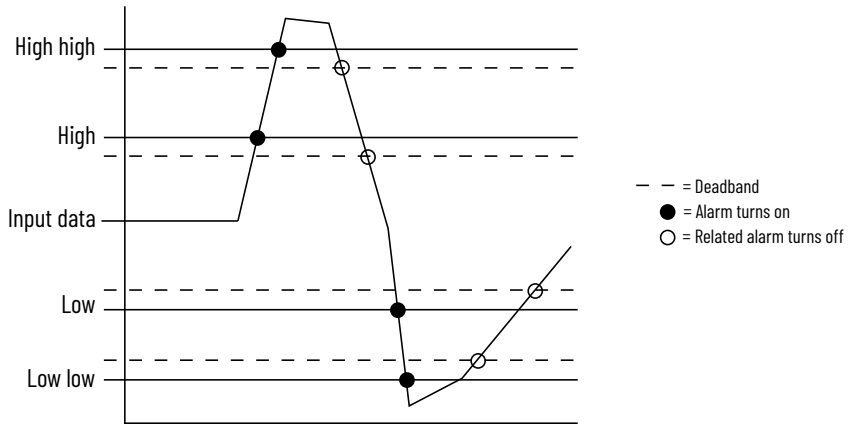
For more information, see Module and Device Tags.

Alarm Deadband

You can set an alarm deadband when you configure the process alarms. If the alarm condition is removed, the alarm status bit remains set as long as the input data stays within the deadband of the alarm.

This graphic shows input data that sets each of the alarms during module operation. In this example, a deadband is set and alarm latching is disabled, so each alarm turns Off when the condition that caused it to turn On is removed and the input data exits the deadband.

Alarm Deadband Example



The High alarm remains On during the High high alarm, and the Low alarm remains On during the Low low alarm.

To to set the alarm Deadband, see Alarms.

Rate Alarm

For HART input modules, the Rate Alarm defines the maximum rate of change between input samples in engineering units per second. If the Rate Alarm Limit is exceeded, the I.Chxx.RateAlarm tag is set to 1.

You can enable or disable Rate Alarm Latching on each channel. To enable the Rate Alarm, see Alarms.

To unlatch the alarm, toggle the O.Chxx.RateAlarmUnlatch tag to 1.

You can unlatch the alarm at any point in the system operation. If you change the unlatch tag to 1 and the triggering condition remains, the alarm is immediately latched again.

We suggest that you unlatch the Rate Alarm only after the rate of change between input samples has returned below the Rate Alarm Limit value.

Clamp Alarming

For HART output modules, Clamp Alarming works directly with Output Clamping. When a module receives a data value from the controller that exceeds the limits for clamping, it applies signal values to the clamping limit. In addition, a limit alarm is triggered.

The following tags indicate that a clamping alarm was triggered. That is, the tag is set to 1.

- I.Chxx.LLimitAlarm
- I.Chxx.HLimitAlarm

For more information, see Module and Device Tags.

Sensor Offset

For HART input modules, Sensor Offset compensates for any known error on the sensor or channel to which the sensor is connected. The value is set in signal units and is added to the data value. The Sensor Offset feature is used in the same way for both the Current and Voltage input types.

For example, consider an application that uses the Current input type with the 4...20 mA range and scaling at 0...100%. If a sensor has an error and the channel consistently reports current signal values by 0.2 mA lower than the actual value, you must set the Sensor Offset to 1.25%.

Use the O.Chxx.SensorOffset tag to set the Sensor Offset. In the example above, the *O.Chxx.SensorOffset* tag = 1.25.

For more information, see Module and Device Tags.

Channel Offset

For HART output modules, the Channel Offset feature compensates for any known error on the sensor or channel to which the sensor is connected. The value is set in signal units and is added to the output data.

For example, consider an application that uses the Current input type with the 4...20 mA range and scaling at 0...100%. If a channel used in the 4...20 mA output range has an error that results in consistent reports of 8 mA as 7.8 mA, you must set the Channel Offset to 1.25 to account for the error.

To set the channel offset, see Chxx.

Open Wire Detection

The Open Wire Detection feature indicates that a wire is disconnected from the channel. To enable Open Wire Detection, see Chxx.

Open Wire Conditions

Mode	Cause of Detection	Module Behavior
Current	The input signal for a channel is below 100 µA.	• Input data for the channel changes to a specific scaled value that corresponds to the Underrange value for the Input Range. • The I:Chxx.OpenWire tag changes to 1. • A fault occurs and the I:Chxx.Fault tag is set to 1.
Voltage	The input signal value is within +/- 0.1V.	• Input data for the channel shows the scaled engineering value of the actual signal. • The I:Chxx.OpenWire tag changes to 1. • A fault occurs and the I:Chxx.Fault tag is set to 1.

IMPORTANT The Disable All Alarms feature does not disable the Open Wire Detection feature because Open Wire Detection is not an alarm.

To disable the Open Wire Detection feature, you must clear the Open Wire Detection checkbox in the module configuration.

Over Temperature Detection

The Over Temperature Detection feature indicates that the temperature of the conditions within which the module is operating are higher than the module operating limits.

IMPORTANT Each module detects an ambient temperature that varies and is dependent on how it is loaded and mounted, and the configuration conditions.

When an Over Temperature condition exists, the Ch*xx*.OverTemperature tag is set to 1.

IMPORTANT The Disable All Alarms feature does not disable the Over Temperature Detection feature because Over Temperature Detection is not an alarm.

Field Power Loss Detection

Field Power Loss Detection monitors for the loss of power at an input module channel. When field power to the module is lost, and when SA power is out of range, a channel-level fault is sent to the controller to identify the faulted channel.

When field power is lost, the I.Chxx.FieldPowerOff tag is set to 1.

IMPORTANT The Disable All Alarms feature does not disable the Field Power Loss Detection feature because Field Power Loss Detection is not an alarm.

Fault and Status Reports

The 5069-IF4IH module sends fault and status data with channel data to the owner-controller and listen-only controllers. The data is returned via module tags that you can monitor in your Studio 5000 Logix Designer application.

With some exceptions, the 5069-IF4IH module provides the fault and data status in a channel-specific format. In this table, the tag names that include Chxx represent channel-specific data, where xx is the channel number.

Fault Tags - 5069-IF4IH

Tag Name	Triggering Event That Sets Tag
ConnectionFaulted	The owner-controller loses its connection to the module. This tag provides module-wide data and affects all channels simultaneously.
Chxx.FieldPowerOff	Field power is not present on the channel.
Chxx.Fault	The channel data quality is bad.
Chxx.OpenWire	One of these conditions. • The channel uses a Voltage input type in any input range and the input signal value reaches full-scale. • The channel uses a Current input type in any input range and the input signal goes below 100 µA. The input signal at the channel is below 100 µA.
Chxx.Underrange	The channel data is beneath the absolute minimum for this channel.
Chxx.Overrange	The channel data is above the absolute maximum for this channel.
Chxx.OverTemperature	The module is at a higher temperature than its rated operating limits.

Status Tags - 5069-IF4IH

Tag Name	Description
RunMode	The module is in Run Mode. This tag provides module-wide data and affects all channels simultaneously.
DiagnosticActive	Indicates if any diagnostics are active.
DiagnosticSequenceCount	A counter that increments when a diagnostic condition occurs or goes away. This is a rolling counter that skips 0 on rollovers.
Chxx.Uncertain	Indicates that the channel data can be imperfect but the degree of inaccuracy is unknown.
Chxx.NotANumber	Indicates that the most recently received data value was not a number.
Chxx.LLAlarm	The alarm is triggered if these conditions exist. • The I.Chxx.Data tag value is less than the C.Chxx.LLAlarmLimit tag value or the alarm is latched. • The O.Chxx.LLAlarmEn tag is set. • Alarms are enabled for the channel.
Chxx.LAlarm	The alarm is triggered if these conditions exist. • The I.Chxx.Data tag value is less than the C.Chxx.LAlarmLimit tag value or the alarm is latched. • The O.Chxx.LAlarmEn tag is set. • Alarms are enabled for the channel.
Chxx.HAlarm	The alarm is triggered if these conditions exist. • The I.Chxx.Data tag value is greater than the C.Chxx.HAlarmLimit tag value or the alarm is latched. • The O.Chxx.HAlarmEn tag is set. • Alarms are enabled for the channel.
Chxx.HHAlarm	The alarm is triggered if these conditions exist. • The I.Chxx.Data tag value is greater than the C.Chxx.HHAlarmLimit tag value or the alarm is latched. • The O.Chxx.HHAlarmEn tag is set. • Alarms are enabled for the channel.
Chxx.RateAlarm	The alarm is triggered if these conditions exist. • The absolute change between consecutive channel samples exceeds the C.Chxx.RateAlarmLimit tag value or the alarm is latched. • The O.Chxx.RateAlarmEn tag is set. • Alarms are enabled for the channel.

Data Tags - 5069-IF4IH

Tag Name	Description
Chxx.Data	The channel data in scaled engineering units.
RollingTimestamp	15-bit timer that runs continuously and counts in milliseconds. It is not related to the CST. The value of RollingTimestamp is recorded whenever a module scans its channels. The controller program uses the last two rolling timestamp values to calculate the amount of time between the samples. This tag provides module-wide data and affects all channels simultaneously.

Current/Voltage/HART Analog Output Module Features - 5069-OF4IH

The 5069-OF4IH analog 4-channel isolated current/voltage/HART output module converts digital values to analog signals. The output channels on the module can connect to current, voltage, or 4...20 mA HART output devices. The channels support multiple ranges for each output type.

The HART I/O modules support these features.

- HART device connection
- PlantPAx® HART instruction compatible device connection

IMPORTANT Remember the following:

- This module also has features that apply to all Compact 5000® analog I/O modules that are described in Common Analog I/O Module Features.
- You can configure the features that are described in this chapter with the Studio 5000 Logix Designer® application. For more information, see Configure the Module.

Multiple Output Ranges

The HART output modules offer multiple output ranges. The output type that you choose during module configuration determines the available ranges.

Output Type	Available Output Range
Current (mA)	• 0...20 mA • 4...20 mA (HART)
Voltage (V)	• -10...10V • 0...5V • 0...10V

To select the output range, see Chxx.

Channel Offset

The Channel Offset compensates for any known error in actuator operation. The value is set in engineering units (EU) and the default is 0.0.

For example, consider an application that uses the Current input type with the 4...20 mA range and scaling at 0...100%. If a channel has an error that results in consistent reports of 7.8 mA instead of 8 mA, you must set the Channel Offset to 1.25 to account for the error.

IMPORTANT The Output Readback data value that is reported via I.Chxx.Data excludes the Channel Offset.

To set the Channel Offset, see Chxx.

Hold for Initialization

Hold for Initialization causes outputs to hold the current state until the value that the controller requests matches the value at the RTB within 0.1% of full-scale. This hold causes a bumpless transfer.

If Hold for Initialization is selected, the current state is held if any of these conditions occur.

- Initial connection is established after power-up.
- A new connection is established after a communication fault occurs, or the module is uninhibited.
- There is a transition to Run mode from Program state.
- The module loses SA power and the data echo value goes to 0.0V or 0.0 mA.
- The I.Chxx.InHold tag indicates that the channel is holding.

To enable Hold for Initialization, see Chxx.

Configure Channel Output State

You can configure individual output channels to specific states when the module is in Program mode or Communications Fault mode. These output states are available.

- Off
- Hold Last State
- User-Defined Value

To configure the output states in Program mode or Communications Fault mode, see Chxx.

Connection Fault Handling

You can configure the output module behavior when a connection breaks between the owner-controller and the output module and causes a connection fault. This table describes the parameters that you can configure.

Parameter	Description	Available Values
Output state in fault mode	If a connection fault occurs, the output state changes to the selected option.	• User Defined Value - the output transitions to the set value. • Hold Last State - the output remains at that value until the following occurs: – The connection to the owner-controller is re-established. – The output returns to normal operation, as defined in the module configuration.
Fault state duration (after a fault)	If you configure the output to transition to a specific value after the connection fault, you must define how long the output remains at the specified value before it transitions to a final fault state value.	• Forever • 1, 2, 5, or 10 seconds
Final fault state value		User-defined

Once the connection between the owner-controller and output module is re-established, the output resumes normal operation.

To set the Connection Fault Handling parameters, see Chxx.

Output Clamping

Output Clamping limits the output from the analog module to remain within a range that is controller-configured, even when the controller commands an output outside that range.

Once clamp values are set, if data received from the controller exceeds those clamps, the following events occur:

- The output value transitions to the clamp limit but not to the requested value.
- The appropriate limit alarm is triggered.

  For more information on limit alarms, see Clamp Alarming.

For example, an application can set the high clamp on a module to 8V and the low clamp to -8V. If a controller sends a value to the module that corresponds to 9V, the module applies only 8V to its screw terminals.

You can disable or latch clamping alarms on a per channel basis. The alarms are disabled by default.

IMPORTANT Clamp values are in engineering units (EU) and are **not automatically updated** when the scaling high and low EUs are changed. Failure to update the clamp values can generate a small output signal that could be misinterpreted as a hardware problem.

For example, a Compact 5000 analog output module channel that uses the Current output type with Clamping enabled has the following configuration parameters:

- Scaling: High Engineering = 100.0000%, Low Engineering = 0.0000%
- Clamp Limits: High Clamp = 100.0000%, Low Clamp = 0.0000%

If you change the High Engineering value to 90.0000%, the High Clamp value remains at 100.0000%.

You must change the High Clamp value to 90.0000 to make sure that the application continues to operate as expected.

To set the Output Clamping parameters, see Limits.

Clamp Alarming

Clamp Alarming works directly with Output Clamping. When a module receives a data value from the controller that exceeds the limits for clamping, it applies signal values to the clamping limit. In addition, a limit alarm is triggered.

These tags are set to 1 to indicate that a clamping alarm is triggered.

- I.Chxx.LLimitAlarm
- I.Chxx.HLimitAlarm

For more information, see Module and Device Tags.

Output Ramping/Rate Limiting

Output Ramping limits the speed at which an analog output signal can change. This feature helps to prevent fast transitions in the output from damaging the devices that an output module controls. Output Ramping is also known as Rate Limiting.

Type of Ramping	Description
Ramp in Run mode	When the module is in Run mode, ramping occurs to all new output values at the maximum ramp rate.
Ramp to Program mode	When the current output value changes to the Program value after a Program command is received from the controller.
Ramp to Fault mode	When the current output value changes to the Fault value after a communication fault occurs.

The maximum rate of change in outputs is expressed in engineering units per second (EU/s), is called the maximum ramp rate and set in the Ramp Rate field.

To enable the Ramp in Run mode, see Limits.

To enable the other Output Ramping parameters, change these module tags to 1.

- C.Chxx.RampToProg - Ramp to Program Mode
- C.Chxx.RampToFault - Ramp to Fault Mode and Final Fault State

For more information, see Module and Device Tags.

Data Echo

Data Echo automatically sends channel data values that match the analog value that was sent to the module's RTB.

At the RPI, the output module sends fault and status data, and returns a value that was sent to it by the owner-controller. The echoed value is indicated in the I.Chxx.Data and is represented in engineering units.

For more information, see Output Module Data.

No Load Detection

No Load Detection indicates when a wire is disconnected from an output channel or a load is missing for each output channel.

IMPORTANT This feature is available only in Current mode.

The output range that is used with the output channel determines whether a load is missing. If the load draws less than the minimum level of current in the range, it is considered missing.

To Enable No Load Detection	To Monitor for a No Load Condition
• Select the Enable No Load Diagnostic checkbox on the Chxx page. -OR- • Change the C.Chxx.NoLoadEn tag to 1 in the Output Module Tags.	• in your Studio 5000 Logix Designer project. • Access the channel diagnostics available on the Chxx page. • Observe the I/O Status Indicators - Analog Output Modules.

This table describes what happens when a No Load condition is detected and when it is corrected. To correct the issue, reconnect the disconnected wires or troubleshoot the application to correct the level of current that is driven from the channel.

Attribute	No Load Condition Detected	No Load Condition Corrected
I.Chxx.NoLoad tag value	1	0
No Load diagnostic value	1	0
I/O status indicator state	Flashing red	Steady Yellow

Short Circuit Protection

Short Circuit Protection helps prevent damage that can result from driving a current from the channel greater than the maximum current level the channel can handle.

IMPORTANT This feature is available only in Voltage mode.

This table describes what happens when a short circuit is detected and when it is corrected. To correct the issue, remove the short circuit condition.

Attribute	Short Circuit Detected	Short Circuit Corrected
Output behavior	Faults	Restarts in its commanded state
I.Chxx.ShortCircuit tag value	1	0
Short Circuit diagnostic value	1	0
I/O status indicator state	Flashing red	Steady Yellow

Over Temperature Detection

The Over Temperature Detection feature indicates that the temperature of the conditions within which the module is operating are higher than the module operating limits.

IMPORTANT Each module detects an ambient temperature that varies and is dependent on how it is loaded and mounted, and the configuration conditions.

When an Over Temperature condition exists, the I.Ch*xx*.OverTemperature tag is set to 1. If the Digital to Analog Converter (DAC) reports an Over Temperature condition, a channel-level fault is sent to the controller to identify the faulted channel.

IMPORTANT The Disable All Alarms feature does not disable the Over Temperature Detection feature because Over Temperature Detection is not an alarm.

Field Power Loss Detection

Field Power Loss Detection monitors for the loss of power at an input module channel. When field power to the module is lost, and when SA power is out of range, a channel-level fault is sent to the controller to identify the faulted channel.

When field power is lost, the I.Chxx.FieldPowerOff tag is set to 1.

IMPORTANT The Disable All Alarms feature does not disable the Field Power Loss Detection feature because Field Power Loss Detection is not an alarm.

Fault and Status Reports

The HART output modules send fault and status data with channel data to the owner and listen-only controllers. The data is returned via module tags that you can monitor in your Studio 5000 Logix Designer application.

With some exceptions, as noted in this table, the HART output modules provide the fault and data status in a channel-specific format. In this table, the tag names that include Chxx represent channel-specific data, where xx is the channel number.

Fault Tags - 5069-OF4IH

Tag Name	Trigger That Sets Tag
ConnectionFaulted	The owner-controller loses its connection to the module. This tag provides module-wide data and affects all channels simultaneously.
Chxx.FieldPowerOff	Field power is not present on the channel.
Chxx.Fault	The channel data quality is bad.
Chxx.NoLoad	A no load condition exists on the channel.
Chxx.ShortCircuit	A short circuit condition exists on the channel.
Chxx.OverTemperature	The module is at a higher temperature than its rated operating limits.
Chxx.Underrange	The channel data is beneath the underrange threshold for this channel.
Chxx.Overrange	The channel data is above the overrange threshold for this channel.

Status Tags - 5069-OF4IH

Tag Name	Description
RunMode	The module is in Run Mode. This tag provides module-wide data and affects all channels simultaneously.
DiagnosticActive	Indicates if any diagnostics are active.
DiagnosticSequenceCount	A counter that increments when a diagnostic condition occurs or goes away. This is a rolling counter that skips 0 on rollovers.
Chxx.Uncertain	Indicates that the channel data can be imperfect but the degree of inaccuracy is unknown.
Chxx.InHold	Indicates that the channel is holding until the received channel data is within 0.1% of the current channel data value.
Chxx.NotANumber	Indicates that the most recently received data value was not a number.
Chxx.LLimitAlarm	The alarm triggers when these conditions exist. • Alarms are enabled on this channel. • The channel data requested, indicated in the O.Chxx.Data tag, is less than the configured LowLimit or the alarm is latched.
Chxx.HLimitAlarm	The alarm triggers when these conditions exist. • Alarms are enabled on this channel. • The channel data requested, indicated in the O.Chxx.Data tag, is greater than the configured HighLimit or the alarm is latched.
Chxx.RampAlarm	The channel is limited to changing the output at the Maximum Ramp rate, or it once was limited and is now latched.
Chxx.CalFault	Indicates that a channel calibration is interrupted or failed. The CalFault tag through a module reset or power cycle.
Chxx.Calibrating	Indicates that the channel is in the process of calibration.

Data Tags - 5069-OF4IH

Tag Name	Description
Chxx.Data	The channel data in scaled engineering units. This data is the Output Data Echo data that is returned from the D/A converter.
Chxx.RollingTimestamp	15-bit timer that runs continuously and counts in milliseconds. It is not related to the CST. The value of RollingTimestamp is recorded whenever a module scans its channels. The controller program uses the last two rolling timestamp values to calculate the amount of time between the samples. This tag provides module-wide data and affects all channels simultaneously.

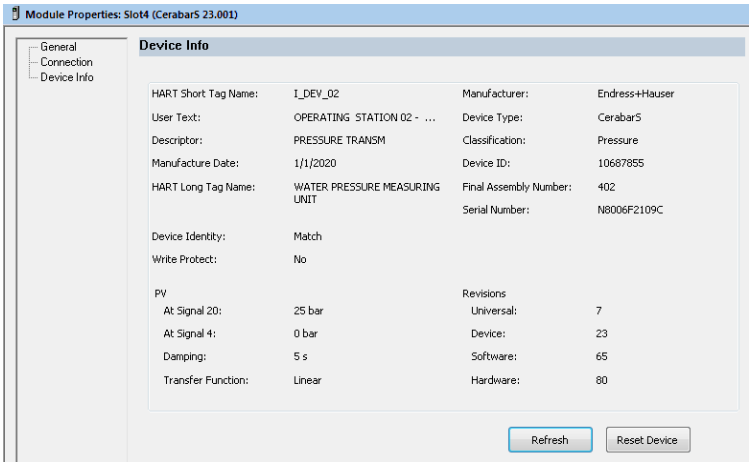
HART Device Features

This chapter describes the features of HART devices when they are used with the Compact 5000® HART I/O modules.

Information and Identity

Use the Studio 5000 Logix Designer® application to retrieve this information from a HART device in the system.

- HART Short Tag Name
- User Text
- Descriptor
- Manufacture Date
- HART Long Tag Name
- Manufacturer
- Device Type
- Classification
- Device ID
- Final Assembly Number



IMPORTANT After a configuration change occurs in the device, the module needs some time to refresh the data, typically within 30 seconds. Therefore, the latest configuration of the device that is reflected on the Device Info page could be delayed.

Inhibit Device

You can suspend data exchange between the controller and individual HART devices in online mode, or in offline mode after download. Inhibition does not make the device to cease operation. This option allows for maintenance of the device without faults being reported to the controller.

Inhibit HART devices on the device Connection page.

Electronic Keying

The electronic keying feature for HART devices automatically compares the expected device to the physical device before HART device connection is established. You can use electronic keying to help prevent connection to a HART device that does not match the expected type and revision.

For each HART device, the user-selected keying option determines if and how an electronic keying check is performed.

Available Keying Options

Keying Type	Description
Exact Match	A protective mode that requires a match between the physical HART device and the HART device that is configured in the software, according to HART Expanded Device Type, major revision, and minor revision.
Compatible Module (default)	This mode allows the physical HART device to accept the key of the HART device configured in the software, if the configured device is one that the physical device can emulate. These requirements make a device compatible. • HART Expanded Device Type must match. • Major revision of the physical device must be greater or equal than the configured major revision. • If the major revision exactly matches, the minor revision of the physical device must be greater or equal than the configured minor revision if the configured minor revision is not 0.
Disable Keying	This mode allows the software to ignore the keying attributes when it attempts to communicate with a HART device. Other attributes, like data size and format, must match before HART connection is established. **WARNING**: With Disabled Keying, HART connection can occur with a device other than the type specified in the I/O configuration tree with unpredictable results. If used incorrectly, this option can lead to personal injury or death, property damage, or economic loss. We strongly recommend that you do not use Disable Keying. If you use Disable Keying, you take full responsibility to understand if the device can fulfill the functional requirements of the application.

Configuration Change Notification

If any configuration parameters are changed in a HART device for any reason, the ConfigurationChanged tag is set to 1 in the producer data. When this tag is set to 1, the device completes these actions.

1. Toggles the ResetConfigurationChanged tag from 0 to 1 in the consumer data.
2. Executes the Get HART Device Information Service.
   For more information, see CIP Object Model of HART Devices.
3. Performs the other HART services that are needed to get the other configuration data that the Studio 5000 Logix Designer application manages.

Rolling Timestamp of Dynamic or Device Variable Data

Whenever a HART I/O module receives new HART Dynamic or Device variable data from a HART device, the module also records the value of RollingTimestamp. The Logix 5000® controller uses the last two rolling timestamp values to calculate the amount of time between the samples.

Producer/Consumer Communication

The Producer/Consumer communication between a controller and a HART device allows you to complete these actions.

- Monitor HART device status or configuration change.
- Get PlantPAx® specific data required for the PlantPAx HART instruction on a PlantPAx connection.
- Get periodical updates of dynamic variable data and status.
- Get periodical updates of device variable data and status.
- Execute HART commands on-demand.

You can configure this information for the Producer/Consumer data.

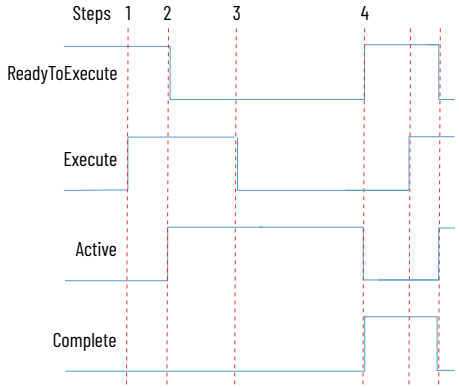
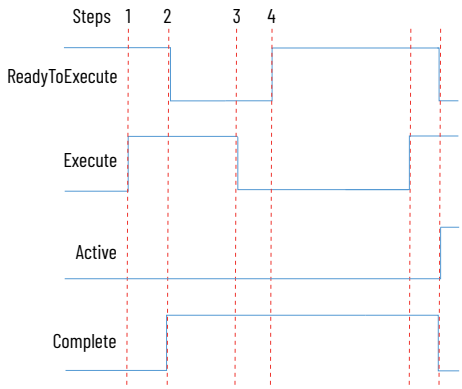
Item	Description
Producer/Consumer Data Connection Type	The Producer/Consumer data can be configured to communicate with a Data or a PlantPAx data connection type. A PlantPAx connection includes specific data that is required for the PlantPAx HART instruction.
Producer/Consumer Data	The Producer/Consumer data can be configured to include the following for each HART device: • Up to four dynamic variables • Up to eight device variables • Up to four HART commands

Execute HART Commands Through Producer/ Consumer Data

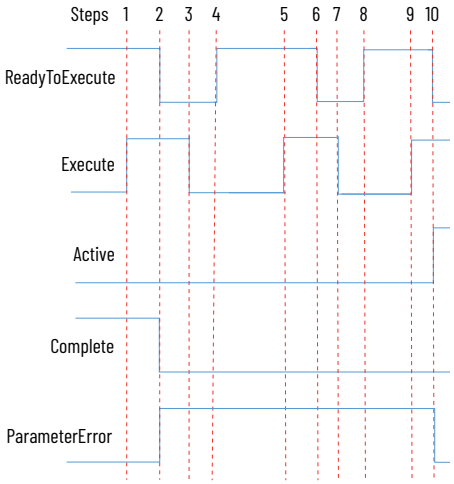
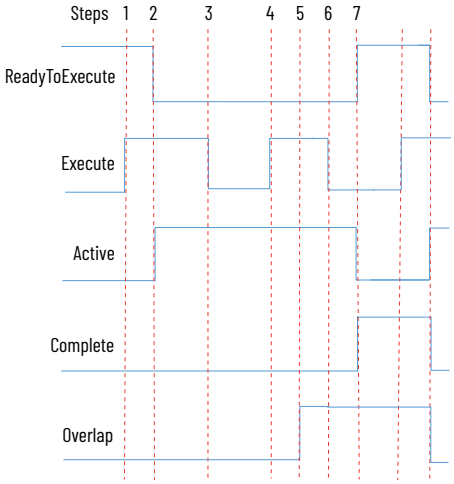
Use this information and guidelines to execute HART commands through Producer/Consumer Data.

- A command execution starts with a rising edge of Command.Execute in the consumer data.
- In the producer data, Command.ReadyToExecute = 1 when the HART device has no outstanding commands from the consumer data and Command.Execute = 0 in the most recent consumer data.
- Toggle Command.Execute to 1 only when Command.ReadyToExecute = 1.
- After you execute a command, you can toggle Command.Execute back to 0 once Command.ReadyToExecute = 0. The transition of Command.ReadyToExecute from 1 to 0 indicates that the HART I/O module has received the command execution request.
- After a command is complete, check the status of the producer data in the Command tag before you retrieve the response data from the command.

Command Execution Examples

Example Type	Sequence	Steps
Typical Command Execution		1. To execute a HART command, toggle Command.Execute to 1 in the consumer data when Command.ReadyToExec = 1 in the producer data of the HART device. 2. After the HART I/O module receives the consumer data, Command.Active = 1 and Command.ReadyToExec = 0 are reported in the producer data of the HART device. 3. Once the module receives the execution request and the controller receives Command.ReadyToExec = 0, toggle Command.Execute to 0 in the consumer data. 4. When the HART command execution is complete, the HART I/O module reports Command.Completed = 1 and Command.ReadyToExec = 1 in the producer data of the HART device together with the command result and response data. To initiate another command execution, repeat steps 1...3.
Command Completed within an RPI		1. To execute a HART command, toggle Command.Execute to 1 in the consumer data when Command.ReadyToExec = 1 in the producer data of the HART device. 2. After the HART I/O module receives the consumer data, the HART command is completed within an RPI. Hence, Command.Completed = 1 and Command.ReadyToExec = 0 are reported in the next producer data of the HART device. An active state is not reported for the command. 3. Once the controller receives Command.ReadyToExec = 0, toggle Command.Execute to 0 in the consumer data. 4. When the HART I/O module receives the consumer data, the next producer data of the HART device reports Command.ReadyToExec = 1. To initiate another command execution, repeat steps 1...3.

Command Execution Examples

Example Type	Sequence	Steps
Command with a Parameter Error		1. To execute a HART command, toggle Command.Execute to 1 in the consumer data when Command.ReadyToExec = 1 in the producer data of the HART device. 2. After the HART I/O module receives the consumer data, it verifies the request data and finds the parameters that cannot be converted to HART type successfully, like invalid characters for Packed ASCII or string length longer than configured. The HART I/O module reports Command.Active = 0, <nameofcommand>.Command.ReadyToExec = 0, Command.Complete = 0, and Command.ParameterError = 1 in the producer data of the HART device. 3. When the module receives Command.ReadyToExec = 0, toggle Command.Execute to 0 in the consumer data. If ParameterError = 1, the execution is rejected due to errors in the command request data. Command.ParameterErrorNumber in the producer data indicates the index of the first invalid parameter in the command request data. 4. Once the HART I/O module receives Command.Execute = 0, it reports Command.ReadyToExec = 1 in the producer data of the HART device. 5. To initiate a new execution, toggle Command.Execute to 1 in the consumer data. 6. When the HART I/O module receives the consumer data and finds that the command request data in the consumer data still has errors, it reports Command.ReadyToExec = 0 and Command.ParameterError = 1 in the producer data of the HART device again. 7. Once the HART I/O module receives Command.ReadyToExec = 0, the module receives the latest execution request and you can toggle Command.Execute to 0 in the consumer data. If ParameterError = 1, the latest execution request is rejected due to errors in the command request data. 8. The HART I/O module reports Command.ReadyToExec = 1 in the producer data of the HART device. 9. To start a new execution, toggle Command.Execute to 1 in the consumer data. 10. When the HART I/O module receives the consumer data and verifies that all command request data are valid, it sends the command to the HART device and reports Command.ReadyToExec = 0, Command.Active = 1, and Command.ParameterError = 0 in the producer data of the HART device.
Command Overlap		1. To execute a HART command, toggle Command.Execute to 1 in the consumer data when Command.ReadyToExec = 1 in the producer data of the HART device. 2. After the HART I/O module receives the consumer data, Command.Active = 1 and Command.ReadyToExec = 0 are reported in producer data of the HART device. 3. Once the controller receives Command.ReadyToExec = 0, the module receives the execution request and you can toggle Command.Execute to 0 in the consumer data. 4. Without waiting for the outstanding command to complete, toggle Command.Execute to 1 again in the consumer data again. 5. The HART I/O module reports Command.Overlap = 1 in the producer data of the HART device. 6. Toggle Command.Execute to 0 in the consumer data. 7. If Command.Execute = 0 after the HART command execution is complete, the HART I/O module reports Command.Completed = 1 and Command.ReadyToExec = 1 in the producer data of the HART device together with the command result and response data. To initiate another command execution, repeat steps 1...6. When a new command executes successfully, The HART I/O module reports Command.Overlap = 0 in the producer data of the HART device.

Execute HART Commands Through Explicit Messaging

The HART I/O modules allow you to define message instructions to send commands to HART devices. The CIP™ service is Service 0x4C of HART Process Device Object that is defined in CIP Volume 7B, “Integration of HART Devices into the CIP Architecture”, with an exception that Class ID 0x3B8 must be used for HART Process Device Object.

Periodic command execution through explicit messaging, like connected and cached message instruction, is not recommended because the execution of HART commands through explicit messaging causes update delays in dynamic or device variables in the producer data of the HART device.s

Fault and Status Reporting

The HART I/O modules send fault and status data, configured dynamic variables, and device variables in the producer data for each HART device.

This table lists the HART device fault and status tags available in the Studio 5000 Logix Designer application.

Fault Tags - HART Devices

Tag Name	Trigger that Sets the Tag
ConnectionFaulted	The owner-controller loses its connection to the module. This tag provides module-wide data and affects all channels simultaneously.
CurrentMismatch	The HART digital value does not match the analog module channel value.
Malfunction	The device has detected a hardware error or failure.
<NameOfVariable>.Ch.Fault	Data is inaccurate and cannot be trusted for use in the application.
<NameOfVariable>.Ch.Underrange	The input signal at the channel is less than, or equal to, the min detectable signal.
<NameOfVariable>.Ch.Overrange	The input signal at the channel is greater than, or equal to, the max detectable signal.
Static.Fault	Indicates if the set of static data is valid. For PlantPAx connection only.

Status Tags - HART Devices

Tag Name	Description
RunMode	The module is in Run mode. This tag provides module-wide data and affects all channels simultaneously.
DiagnosticActive	Indicates if any diagnostics are active or if the prognostics threshold is reached.
DiagnosticSequenceCount	A counter that increments when a diagnostic condition occurs or goes away. The counter is a rolling counter that skips 0 on rollovers.
CurrentSaturated	Indicates that the loop current has reached its upper or lower endpoint limit and cannot increase or decrease any further.
CurrentFixed	Indicates that the loop current is being held at a fixed value and is not responding to process variations.
MoreStatusAvailable	Indicates that more status information is available than can be returned in the Field Device Status.
ConfigurationChanged	Indicates that the HART device configuration has changed and the module has retrieved all HART device configuration data that the Get HART Device Information service returns.
<NameOfVariable>.Ch.Uncertain	Indicates that the channel data can be inaccurate but the degree of inaccuracy is not known.
<NameOfVariable>.Ch.Data	Indicates the last good value that was received from the device.
<NameOfVariable>.Ch.RollingTimestamp	15-bit timer that runs continuously and counts in milliseconds.
<NameOfVariable>.Class	Indicates the Device Variable Classification.
<NameOfVariable>.Unit	Indicates the Unit code.
<NameOfVariable>.Manual	Indicates that the data value is manually controlled.
<NameOfVariable>.Constant	Indicates that the data value is constant. The bit is set to 1 when the variable status = Constant.
Static.PVUnit	For PlantPAx connections only - Indicates the unit code of PV.
Static.HARTRevision	For PlantPAx connections only - Indicates the HART protocol major revision number.
Static.HARTTagName	For PlantPAx connections only - Indicates the assigned name of the HART device. Same as Identity attribute 15.
Static.Descriptor	For PlantPAx connections only - Indicates the descriptor of the HART device.
Static.PVAtSignal4	For PlantPAx connections only - Indicates the PV Lower Range value.
Static.PVAtSignal20	For PlantPAx connections only - Indicates the PV Higher Range value.
Static.AdditionalDeviceStatus	For PlantPAx connections only - Indicates the Additional Device Status from HART command 48.
ChDataAtSignal4	For PlantPAx connections only - This member is the engineering unit value of 4 mA according to the corresponding analog input channel configuration of the module.
ChDataAtSignal20	For PlantPAx connections only - This member is the engineering unit value of 20 mA according to the corresponding analog input channel configuration of the module.

Configure the Module

This chapter describes how to configure your Compact 5000® analog I/O modules in a Studio 5000 Logix Designer® project. You can use the default module configuration or edit the module configuration.

For detailed information about module features, see these sections.

- Common Analog I/O Module Features
- Current/Voltage Analog Input Module Features - 5069-IF8
- Current/Voltage/RTD/Temperature Analog Input Module Features - 5069-IY4, 5069-IY4K
- Current/Voltage Analog Output Module Features - 5069-OF4, 5069-OF4K, 5069-OF8
- Current/Voltage/HART Analog Input Module Features - 5069-IF4IH
- Current/Voltage/HART Analog Output Module Features - 5069-OF4IH

For information about the tags created when you configure the modules, see Module and Device Tags

Before You Begin

You must complete these tasks before you configure the module.

1. Create a Studio 5000 Logix Designer® project.
2. If you use the standard I/O modules as remote modules, add a Compact 5000 EtherNet/IP™ adapter to the project.

   For more information on how to add a Compact 5000 I/O EtherNet/IP adapter to a Studio 5000 Logix Designer project, see the Compact 5000 EtherNet/IP Adapters User Manual, publication 5069-UM007.

Create a New Module

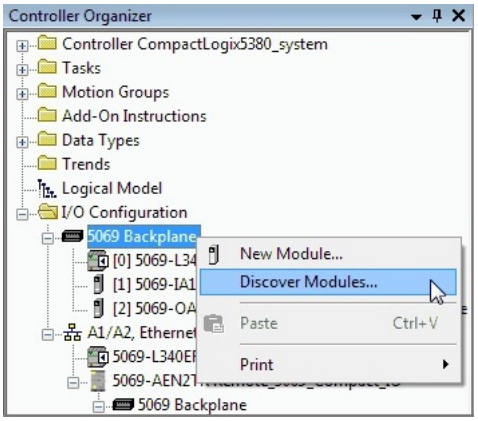
Use one of these methods to add modules to the project.

- Go Online and Discover Local I/O Modules
- Remain Offline and Add New Local I/O Modules
- Go Online and Discover Remote I/O Modules
- Remain Offline and Add New Remote I/O Modules

Go Online and Discover Local I/O Modules

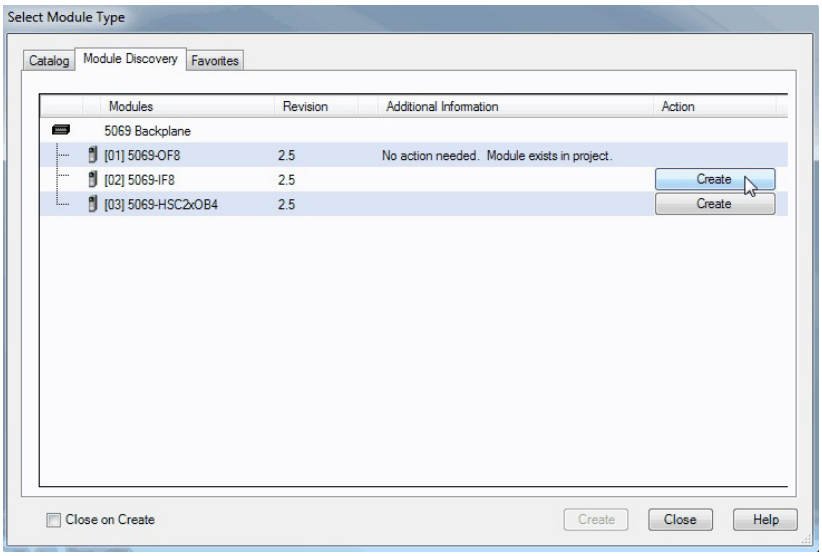
To use the Discover Modules method with local I/O modules, complete these steps.

1. Go online with your Studio 5000 Logix Designer application.
2. Right-click the 5069 Backplane and select Discover Modules.



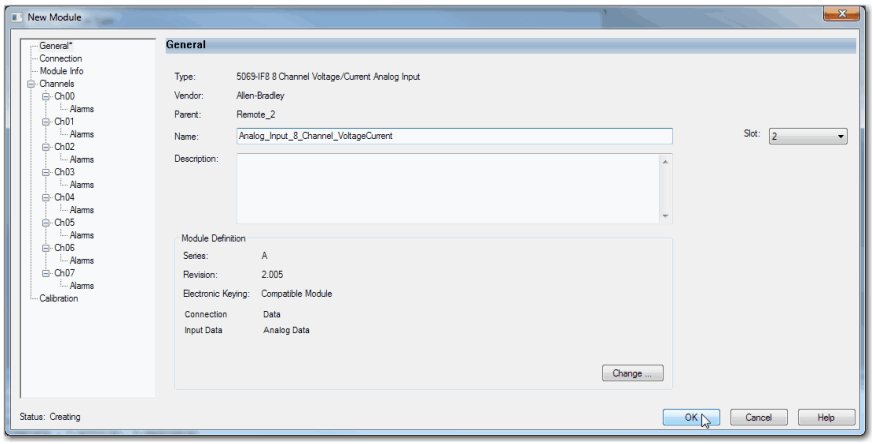
The Studio 5000 Logix Designer application automatically detects available modules that are connected to the backplane and the Select Module Type dialog opens.

If you have more than one module to add, **do not** select the Close on Create checkbox.

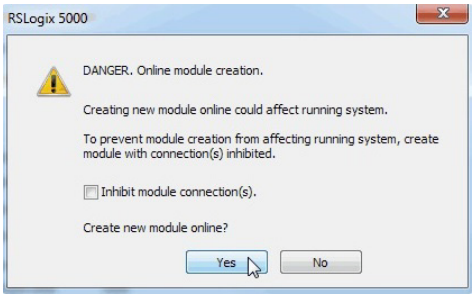


3. To add the discovered module to your project, click Create.

4. At the New Module dialog, configure the module properties and click OK.



A warning opens.



5. Verify that the Inhibit module connection(s) checkbox is selected and click Yes.

When you inhibit the module connection, you must remember to uninhibit the connection later.

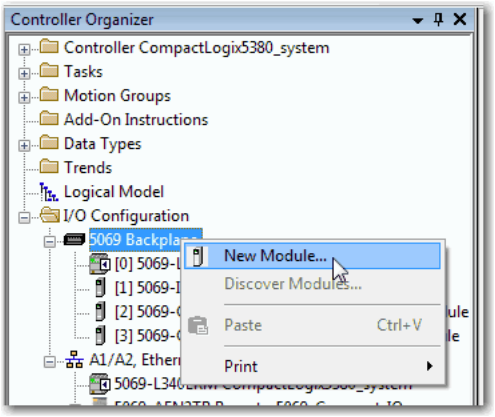
6. To add additional local I/O modules with this method, repeat steps 3...5.

Remain Offline and Add New Local I/O Modules

To add local I/O modules when the Studio 5000 Logix Designer project is offline, complete these steps.

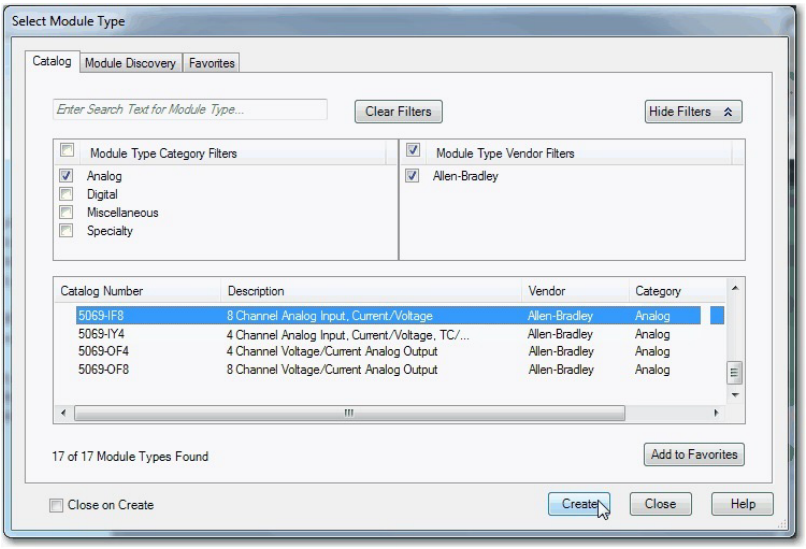
To add new local I/O modules when the project is online, complete the steps in Go Online and Discover Local I/O Modules, but select New Module instead of Discover Modules in step 2.

1. Right-click the 5069 Backplane and choose New Module.

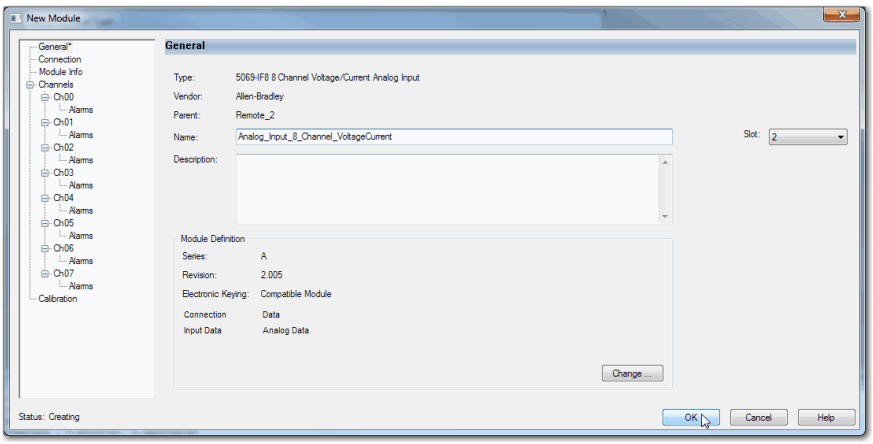


The Select Module Type dialog opens.

If you have more than one module to add, **do not** select the Close on Create checkbox.



2. Navigate to the catalog number for the module that you are adding, and click Create.
3. At the New Module dialog, configure the module properties and click OK.

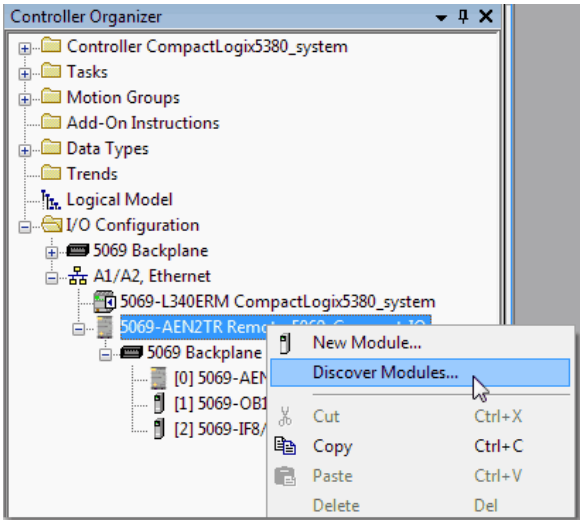


4. To add additional local I/O modules with this method, repeat steps 2...3.

Go Online and Discover Remote I/O Modules

To use the Discover Modules method with remote I/O modules, complete these steps.

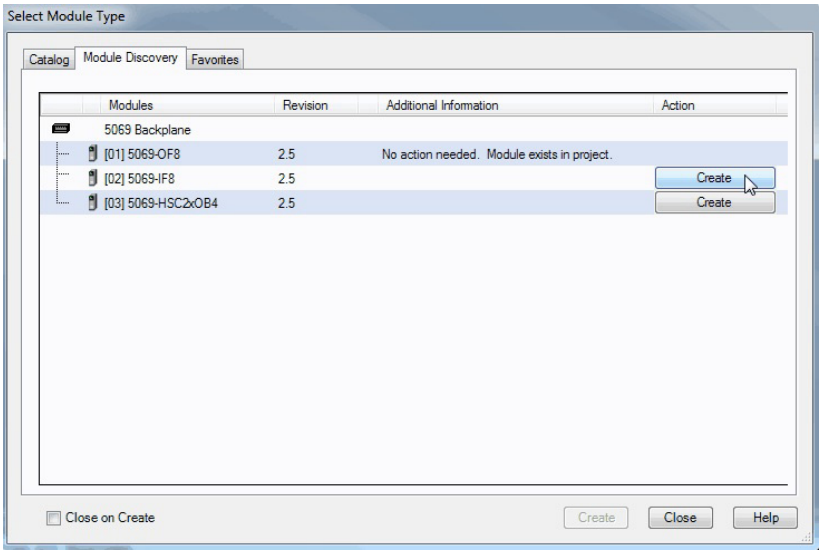
1. Go online with your Studio 5000 Logix Designer application.
   The project must include a Compact 5000 I/O EtherNet/IP adapter.
2. Right-click the Compact EtherNet/IP adapter and choose Discover Modules.



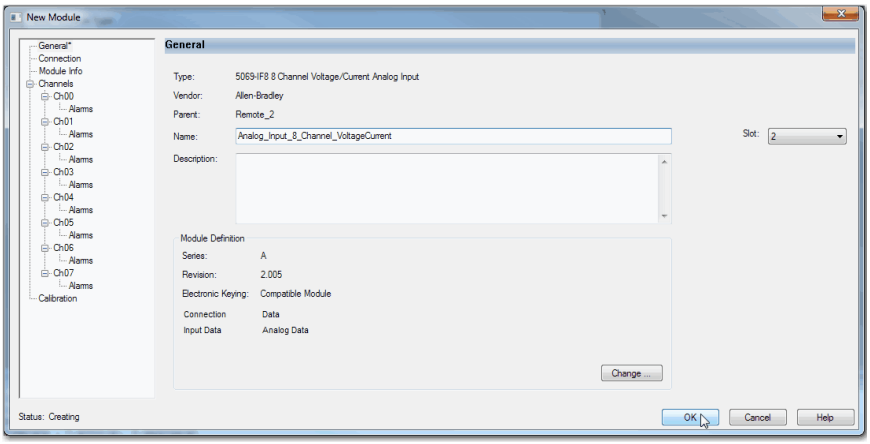
The Studio 5000 Logix Designer application automatically detects available modules that are connected to the adapter and the Select Module Type dialog opens.

If you have more than one module to add, **do not** select the Close on Create checkbox.

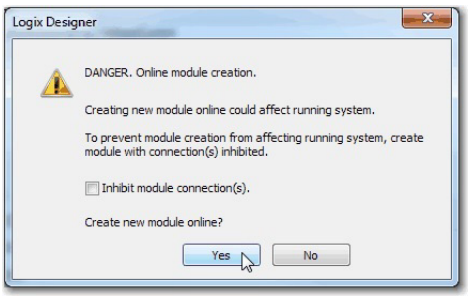
3. At the Select Module Type dialog, click Create to add the discovered module to your project.



4. At the New Module dialog, configure the module properties and click OK.



A warning opens.



5. Verify that the Inhibit module connection(s) checkbox is selected and click Yes.

When you inhibit the module connection, you must remember to uninhibit the connection later.

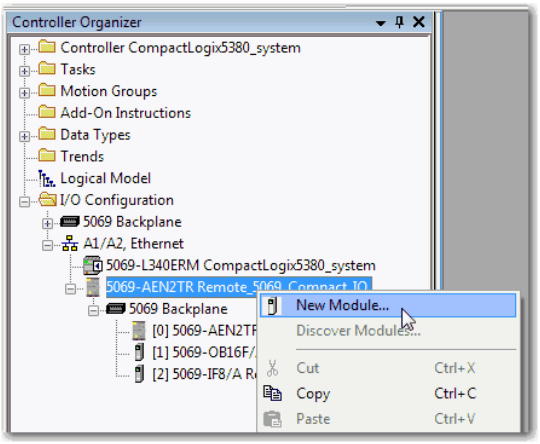
6. To add additional local I/O modules with this method, repeat steps 3...5.

Remain Offline and Add New Remote I/O Modules

To add remote I/O modules when the Studio 5000 Logix Designer project is offline, complete these steps.

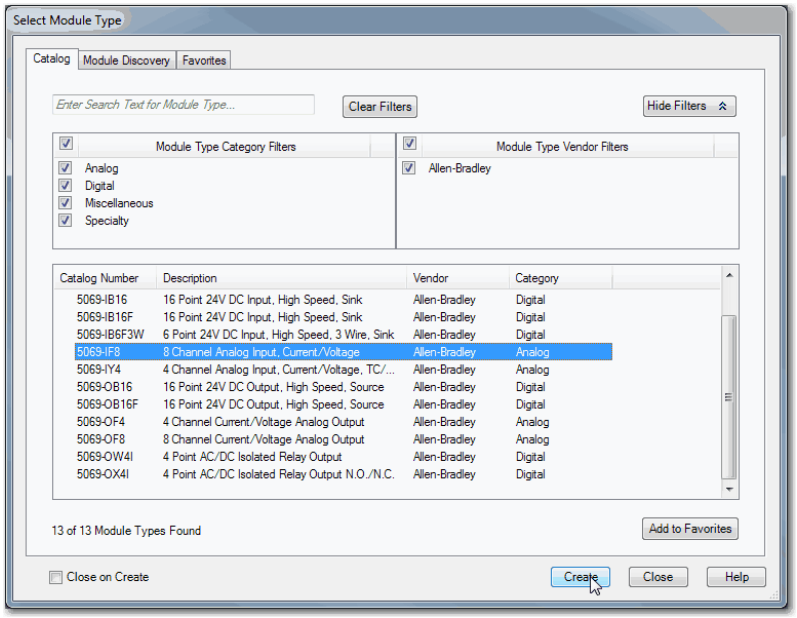
To add new remote I/O modules when the project is online, complete the steps in Go Online and Discover Remote I/O Modules, but select New Module instead of Discover Modules in step 2.

1. Right-click the Compact 5000 I/O EtherNet/IP adapter and choose New Module.

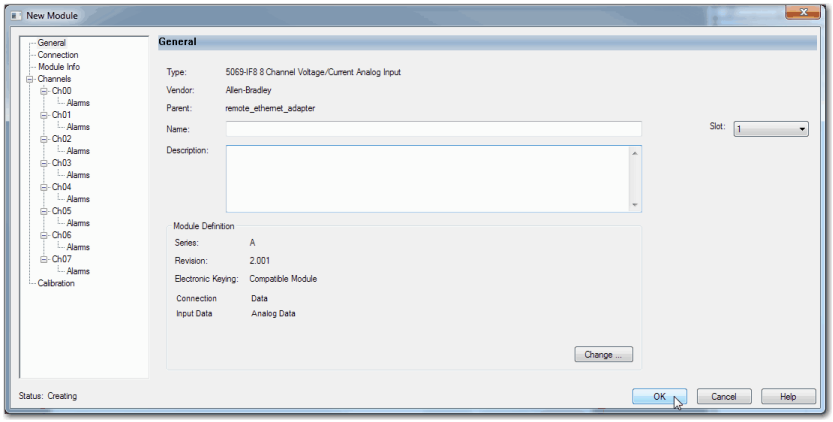


The Select Module Type dialog opens.

If you have more than one module to add, **do not** select the Close on Create checkbox.



2. Navigate to the catalog number for the module that you are adding, and click Create.
3. At the New Module dialog, configure the module properties and click OK.



4. To add additional local I/O modules with this method, repeat steps 2...3.

Reserve an I/O Module Slot

As described in Use a 5069-ARM Address Reserve Module to Reserve a Node Address, the 5069-ARM address reserve module reserves a module slot in the physical system and in the Studio 5000 Logix Designer project that is configured for the system.

Add the 5069-ARM Module to the Project

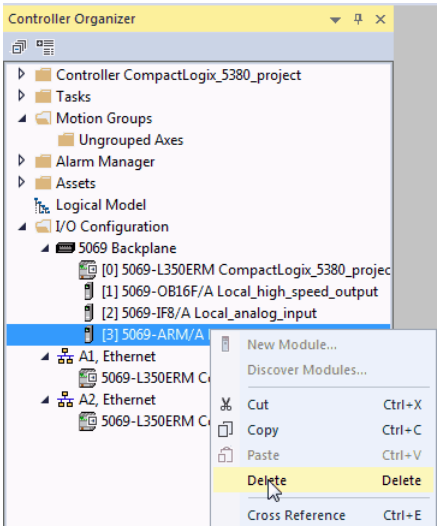
To add an address reserve module to the project, use one of the methods in Create a New Module.

Delete the 5069-ARM Module From the Project

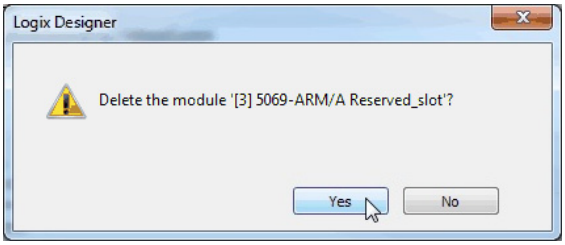
When you remove the 5069-ARM module from the system and install the Compact 5000 I/O module that is intended for that node address, you must also change the Studio 5000 Logix Designer project.

You must delete the 5069-ARM module from the project as these steps show.

1. Right-click the module name and choose Delete.



2. To confirm the module deletion, click Yes on the dialog box.



3. To add the Compact 5000 I/O module that uses the node address that the 5069-ARM module reserved, use one of the methods in Create a New Module.

Configure the Module Parameters

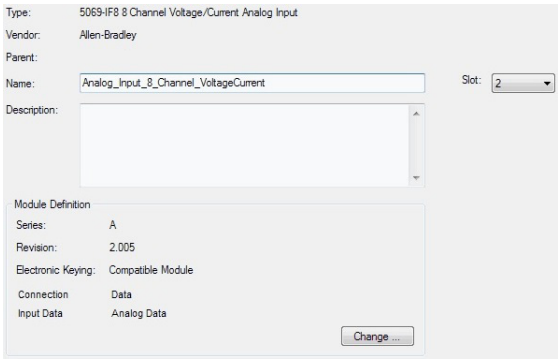
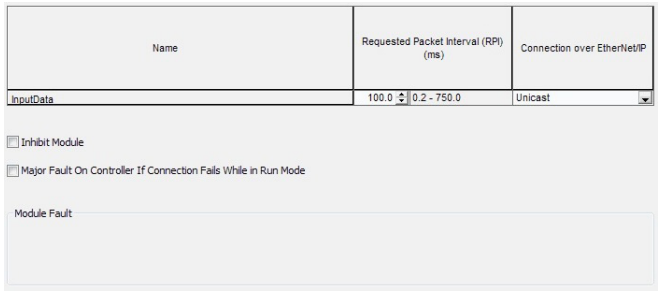
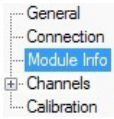
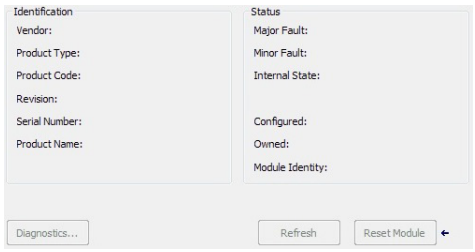
Click the parameter pages in the New Module dialog box to view and change the parameters that are associated with that module.

IMPORTANT This chapter shows how to configure the parameters as you add the module to the Studio 5000 Logix Designer project in the New Module dialog box.

If you access the parameters after the module has been added to the project, the dialog box is named Module Properties. The Module Properties dialog box shows the same parameters as the New Module dialog box.

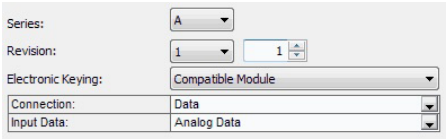
Common Module Parameters

These parameters apply to all Compact 5000 analog I/O modules.

Parameter Page	Available Actions	Configurable Parameters
General 	• Name the module • Assign a slot number (required) • Describe the module • Access the Module Definition For more information, see the Module Definition table.	
Connection 	• Set the RPI rate For more information, see Requested Packet Interval. • Set the connection type to use on the EtherNet/IP network • Inhibit the module For more information, see Inhibit a Module. • Select if a major or minor fault occurs when there is a connection failure while the controller is in Run mode **TIP:** Use the Module Fault box to help troubleshoot the module when the project is online.	
Module Info 	These actions are available when the project is online. • View module information and status • Access module diagnostics • Refresh the data on the screen • Reset the module	

Module Definition

Click Change... on the General parameters page to access the configurable module definition parameters.



Parameter	Description	Available Selections (vary by module type)
Series	Module hardware series	Module-specific
Revision	Module firmware revision, including major and minor revision levels	Module-specific
Electronic Keying	Software method by which you reduce the possibility of using the wrong device in a control system. For more information, see the following: • Electronic Keying • Electronic Keying in Logix 5000® Control Systems Application Technique, publication LOGIX-AT001	• Exact Match • Compatible Module • Disable Keying
Connection	Determines these items for the module type that you configure. • Available configuration parameters • Data type transferred between the module and the controller • Which tags are generated when the configuration is complete	• Data • Data with Calibration Data • Listen Only For more information, see Connection Types Available with Compact 5000 I/O Analog Modules.
Input Data - Input modules only	All available configuration, input, and output data for the input module that is being defined.	• Analog Data • Analog and Discrete - HART I/O modules only • Discrete - HART I/O modules only
Output Data - Output module only	All available configuration, input, and output data for the output module that is being defined.	• Analog Data • None - Available only when Connection = Listen Only.

Module-specific Parameters

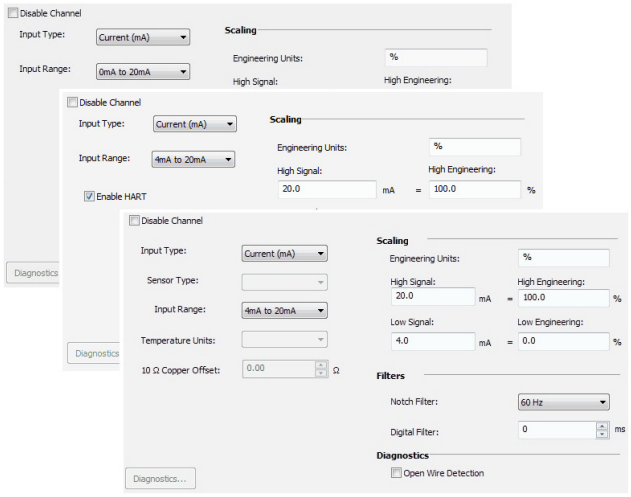
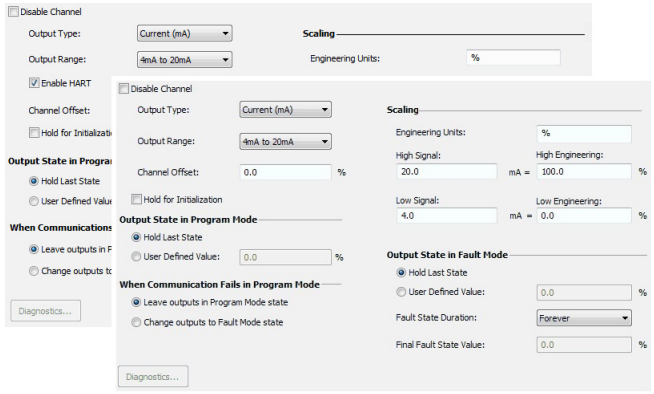
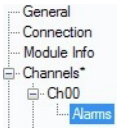
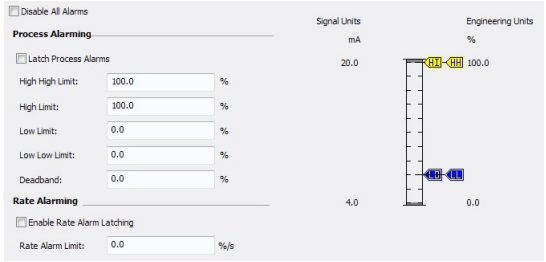
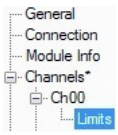
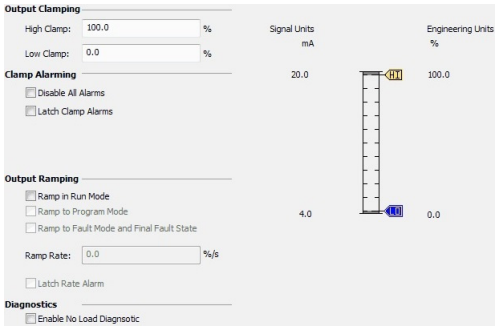
Some parameters are specific to the module type. This table describes the additional parameters and the modules to which these parameters apply.

IMPORTANT If you use the Listen Only connection type, the Channels and Calibration pages are not available.

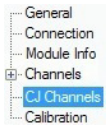
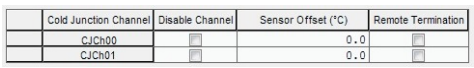
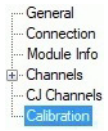
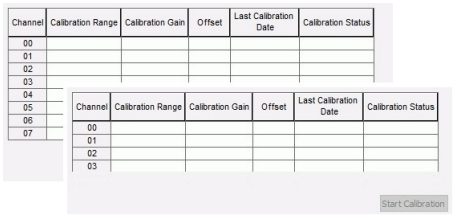
Module-specific Parameters

Parameter Page	Description	Modules	Configurable Parameters
Channels General Connection Module Info Channels* Calibration	Overview of the configuration values for all module channels. The values for each parameter indicate how each channel is configured on the Chxx page.	5069-IF4IH	Channel, Disable, Input Type, Input Range, Enable HART, High Signal, Low Signal, Units, High Engineering, Low Engineering, Units, Digital Filter, Disable Alarms 00 Current 4mA to 20mA 20.0 4.0 mA 100.0 0.0 % 0 ms 01 Current 4mA to 20mA 20.0 4.0 mA 100.0 0.0 % 0 ms 02 Current 4mA to 20mA 20.0 4.0 mA 100.0 0.0 EU 0 ms 03 Current 4mA to 20mA 20.0 4.0 mA 100.0 0.0 EU 0 ms
		5069-IF8	Channel, Disable, Input Type, Input Range, High Signal, Low Signal, Units, High Engineering, Low Engineering, Units, Digital Filter, Disable Alarms 00–07 Current 0mA to 20mA 20.0 0.0 mA 100.0 0.0 % 0 ms
		5069-IY4, 5069-IY4K	Channel, Disable, Input Type, Input Range, High Signal, Low Signal, Units, High Engineering, Low Engineering, Units, Digital Filter, Disable Alarms 00–03 Current 0mA to 20mA 20.0 0.0 mA 100.0 0.0 % 0 ms
		5069-OF4, 5069-OF4K	Channel, Disable, Output Type, Output Range, Output State During (Program Mode, Fault Mode), High Signal, Low Signal, Units, High Engineering, Low Engineering, Ur 00–03 Current 0mA to 20mA Hold Last State Hold Last State 20.0 0.0 mA 100.0 0.0 %
		5069-OF4IH	Channel, Disable, Output Type, Output Range, Enable HART, Output State During (Program Mode, Fault Mode), High Signal, Low Signal, Units, High Engineering, Low Engineering, Ur 00–03 Current 4mA to 20mA Hold Last State Hold Last State 20.0 4.0 mA 100.0 0.0 %
		5069-OF8	Channel, Disable, Output Type, Output Range, Output State During (Program Mode, Fault Mode), High Signal, Low Signal, Units, High Engineering, Low Engineering, Ur 00–07 Current 0mA to 20mA Hold Last State Hold Last State 20.0 0.0 mA 100.0 0.0 %

Module-specific Parameters (Continued)

Parameter Page	Description	Modules	Configurable Parameters
Chxx 	The configuration options available for the channel, where xx represents the channel number. Scaling and Filter options correspond to the type and range of the channel. These actions are also available. • Disable the channel • Enable Open Wire Detection • Enable HART for the HART I/O modules	5069-IF4IH, 5069-IF8, 5069-IY4, 5069-IY4K	
		5069-OF4, 5069-OF4K, 5069-OF4IH, 5069-OF8	
Alarms 	Each input channel has an associated alarm. The Signal Units correspond to the input type and range for the channel. You can also disable all alarms on this page.	5069-IF4IH, 5069-IF8, 5069-IY4, 5069-IY4K	
Limits 	Each output channel has an associated limit. The Signal Units options correspond to the input type and range for the channel.	5069-OF4, 5069-OF4K, 5069-OF4IH, 5069-OF8	

Module-specific Parameters (Continued)

Parameter Page	Description	Modules	Configurable Parameters
CJ Channels 	Configuration for a Thermocouple input type.	5069-IY4, 5069-IY4K	
Calibration 	Provides calibration information for all channels on the module. Calibration information is not displayed when the Logic Designer application is offline. For more information, see Calibrate the Module.	5069-IF4IH, 5069-IF8, 5069-IY4, 5069-IY4K, 5069-OF4, 5069-OF4K, 5069-OF4IH, 5069-OF8	

Notes:

Configure HART Devices

This chapter describes how to configure the HART devices that are connected to your HART I/O modules in a Studio 5000 Logix Designer® project. You can use the default device configuration or edit the device configuration.

- Some HART device profiles are pre-loaded in the Studio 5000 Logix Designer application and are recognized when you connect them to HART enabled channels.
- Some HART devices need Electronic Device Description (EDD) information updates before you can use them.
- Some HART devices are not recognized and need generic profiles to connect to the channels.

For detailed information about device features, see HART Device Features.

Before You Begin

You must complete these tasks before you configure the device.

1. Create a Studio 5000 Logix Designer project.
2. If you use the standard I/O modules as remote modules, add a Compact 5000® EtherNet/IP™ adapter to the project.

   For more information on how to add a Compact 5000 I/O EtherNet/IP adapter to a Studio 5000 Logix Designer project, see the Compact 5000 EtherNet/IP Adapters User Manual, publication 5069-UM007.
3. Configure the HART I/O module. For more information, see Configure the Module.

   Set at least one channel Input Type to Current, the Input Range to 4...20 mA, and select the Enable HART checkbox.

Before you use the HART capabilities, verify these items.

- The field device is HART capable.
- The HART I/O module and the associated field device work properly in the analog 4...20 mA mode.
- No more than one HART field device is connected to each channel.
- Input filtering is set to a valid or defined value.

Create a New Device

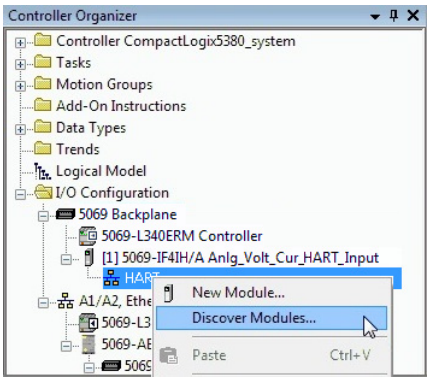
Use one of these methods to add devices to the project if they are already in the device list in the application.

- Go Online and Discover Local HART Devices
- Remain Offline and Add New Local HART Devices
- Go Online and Discover Remote HART Devices
- Remain Offline and Add New Remote HART Devices

Go Online and Discover Local HART Devices

To use the discover method with local HART devices, complete these steps.

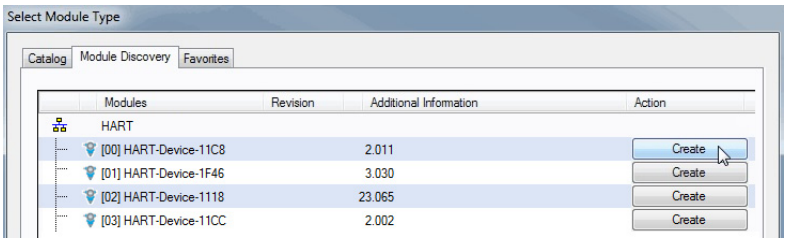
1. Go online with your Studio 5000 Logix Designer application.
2. Right-click the virtual HART bus under the HART I/O module and select Discover Modules.



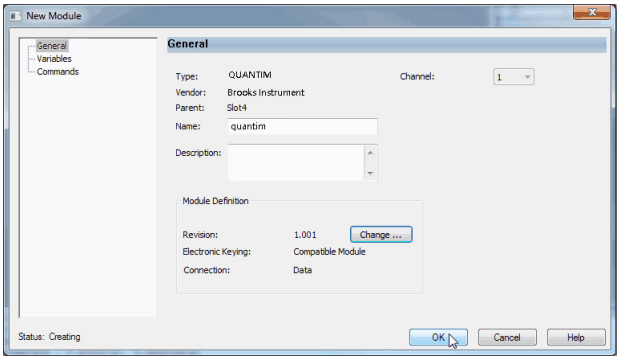
The Studio 5000 Logix Designer application automatically detects available devices that are connected to the HART I/O module and the Select Module Type dialog opens.

If you have more than one device to add, **do not** select the Close on Create checkbox.

3. To add the discovered device to your project, click Create.



4. At the New Module dialog, configure the device properties and click OK.



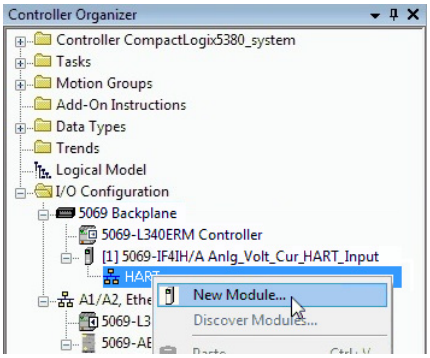
5. To add additional local HART devices with this method, repeat steps 3...4.

Remain Offline and Add New Local HART Devices

To add local HART devices when the Studio 5000 Logix Designer project is offline, complete these steps.

To add new local HART devices when the project is online, complete the steps in Go Online and Discover Local HART Devices, but select New Module instead of Discover Modules in step 2.

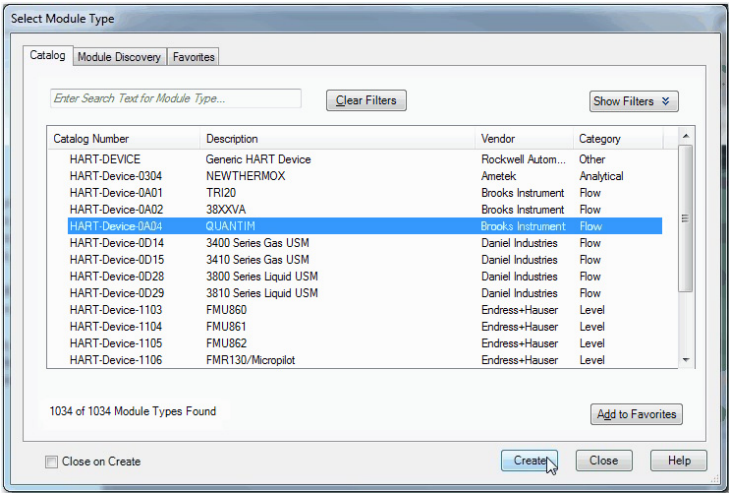
1. Right-click the virtual HART bus under the HART I/O module and select New Module.



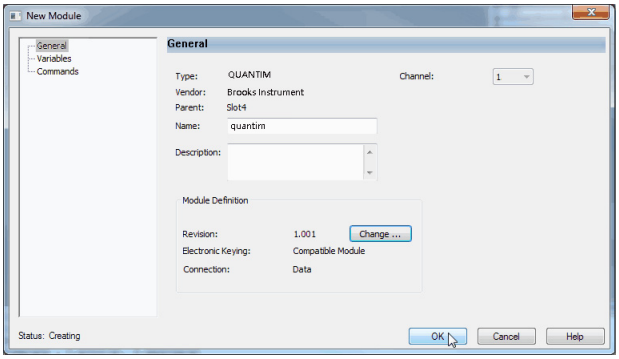
The Select Module Type dialog opens.

If you have more than one device to add, **do not** select the Close on Create checkbox.

2. Navigate to the catalog number for the device that you are adding, and click Create.



3. At the New Module dialog, configure the device properties and click OK.

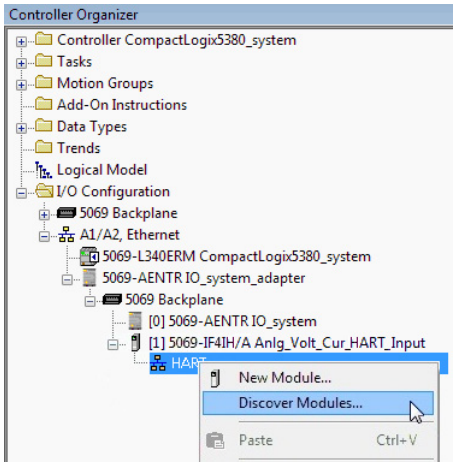


4. To add additional local HART devices with this method, repeat steps 2...3.

Go Online and Discover Remote HART Devices

To discover remote HART devices when you are online, complete these steps.

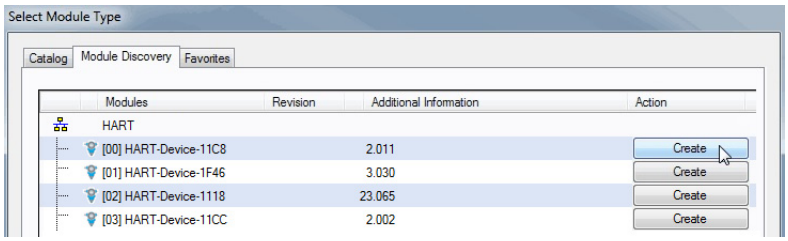
1. Go online with your Studio 5000 Logix Designer application.
2. Right-click the virtual HART bus under the remote HART I/O module and select Discover Modules.



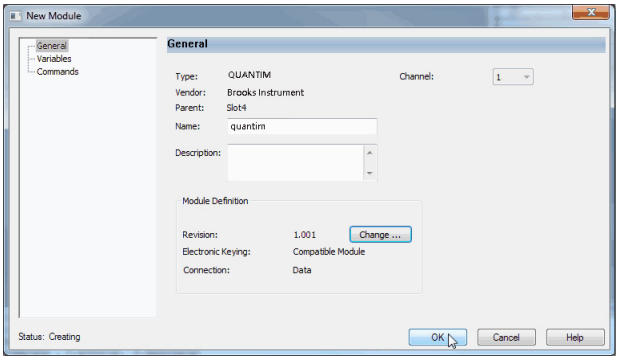
The Studio 5000 Logix Designer application automatically detects available devices that are connected to the HART I/O module and the Select Module Type dialog opens.

If you have more than one device to add, **do not** select the Close on Create checkbox.

3. To add the discovered device to your project, click Create.



4. At the New Module dialog, configure the device properties and click OK.



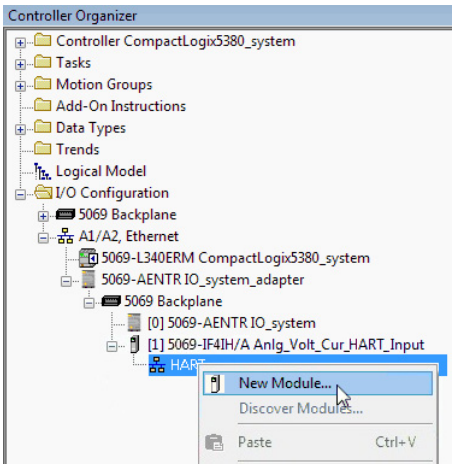
5. To add additional local HART devices with this method, repeat steps 3...4.

Remain Offline and Add New Remote HART Devices

To add remote HART devices when the Studio 5000 Logix Designer project is offline, complete these steps.

To add new remote HART devices when the project is online, complete the steps in Go Online and Discover Remote HART Devices, but select New Module instead of Discover Modules in step 2.

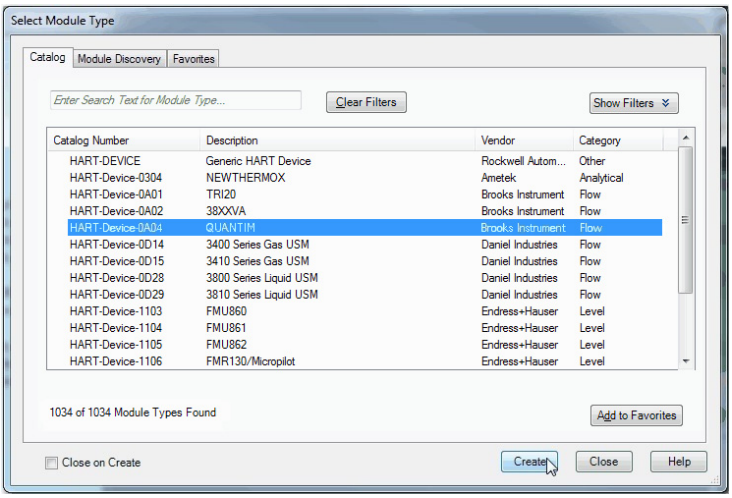
1. Right-click the virtual HART bus under the remote HART I/O module and select New Module.



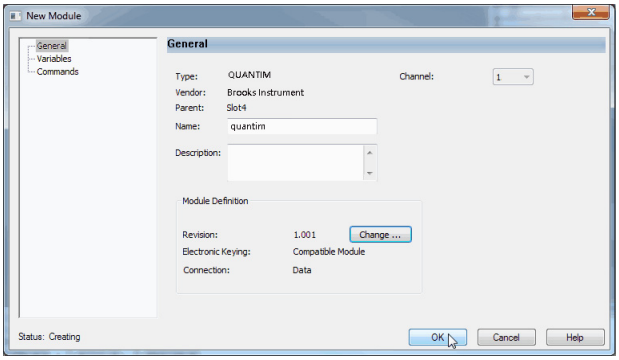
The Select Module Type dialog opens.

If you have more than one device to add, **do not** select the Close on Create checkbox.

2. Navigate to the catalog number for the device that you are adding, and click Create.



3. At the New Module dialog, configure the device properties and click OK.



4. To add additional remote HART devices with this method, repeat steps 2...3.

Update or Add a HART EDD File

The HART device EDD files are included with most HART device profiles. If you require additional or updated EDD files, you must download them. Some EDD files are available on the Registered Products page at the FieldComm Group™ website. Otherwise, request the file from the HART device vendor.

You can add or update the EDD file in one of these ways.

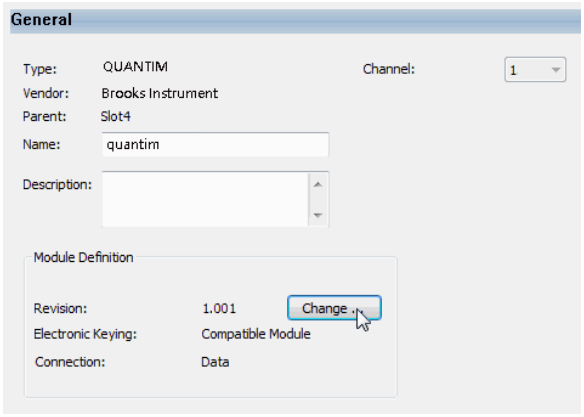
- Update an EDD File for a Specific HART Device
- Add an EDD File for a Generic HART Device

HART EDD File Error Messages

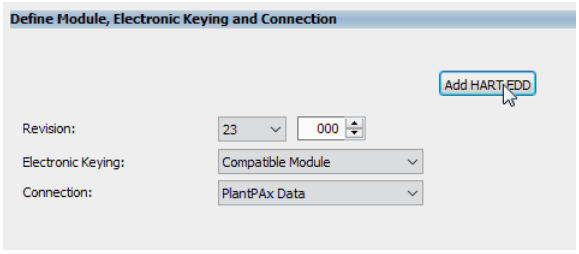
Message	Description
EDD file does not exist or cannot be opened.	The EDD file cannot be found. **EXAMPLE:** An existing or new device is added on a computer that does not have the EDD file installed, and/or the EDD file was not used to configure the device variables or commands.
EDD file that is used for device configuration does not exist or cannot be opened.	The EDD file cannot be found. **EXAMPLE:** An existing device, with previously configured device variables or commands is added on a computer that does not have the EDD file installed.
No Device Variables defined in EDD file.	The EDD file was found, but it does not define the device variables.
Registered EDD file does not match EDD file that is used for device configuration.	One or more configured device variables or commands are not specified in the EDD file. **EXAMPLE:** The EDD file is modified and device variables are removed.
No Expanded Device Type specified.	Use Expanded Device Type is not selected from the general profile.

Update an EDD File for a Specific HART Device

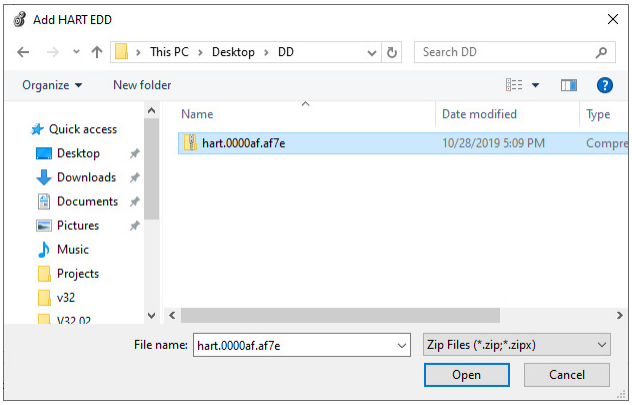
1. On the General page, click Change....



2. On the Module Definition dialog, Click Add HART EDD.



3. Navigate to the location of the EDD file, select it, and click Open.

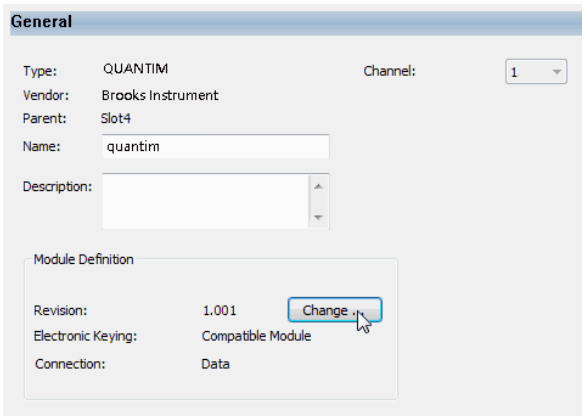


4. Click Open.
   A Successfully added EDD alert opens.

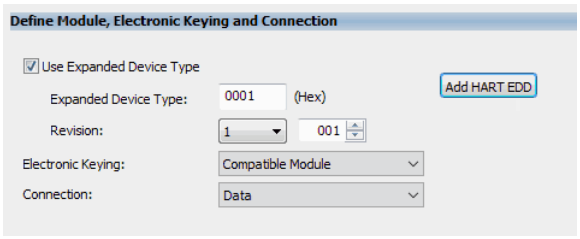
5. Click OK.

Add an EDD File for a Generic HART Device

1. On the General page, click Change....

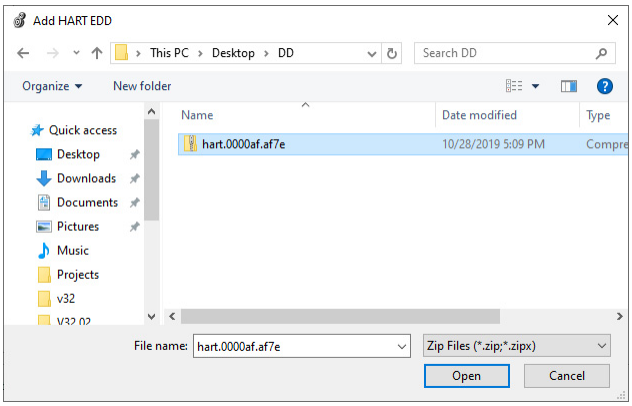


2. On the Module Definition dialog, enter the correct Expanded Device Type ID for the HART device.



IMPORTANT To add an EDD file successfully, the Expanded Device Type ID must match your device.

3. Click Add HART EDD.
4. Navigate to the location of the EDD file and select it.



5. Click Open.

   A Successfully added EDD alert opens.

6. Click OK.

Configure the Device Parameters

Click the parameter pages in the New Module dialog box to view and change the parameters that are associated with that device.

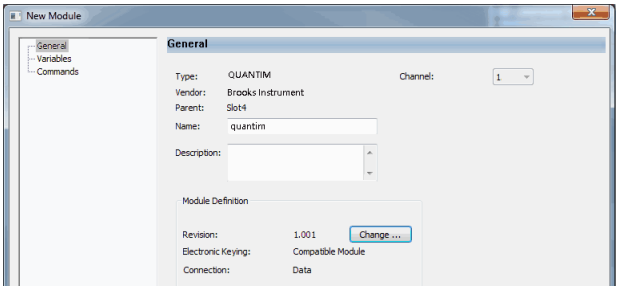
IMPORTANT This section shows how to configure the parameters in the New Module dialog box as you add the device to the Studio 5000 Logix Designer project.

If you access the parameters after the device is added to the project, the dialog box is named Module Properties. The Module Properties dialog box shows the same parameters as the New Module dialog box.

General Page

These actions are available on the General Page.

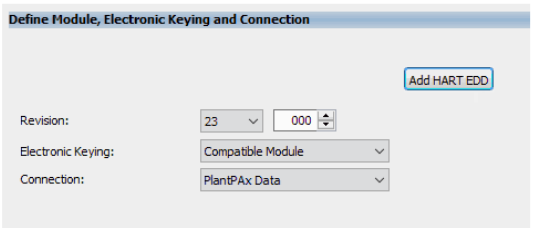
- Name the device.
- Describe the device.
- Access the device definition.



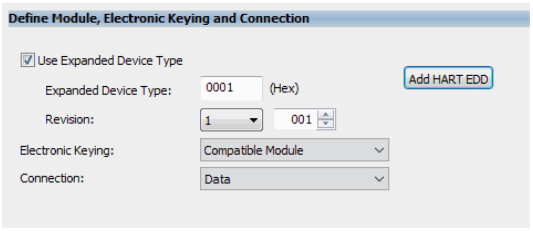
Device Definition

Click Change... on the General page to access the configurable device definition parameters.

Specific HART Device



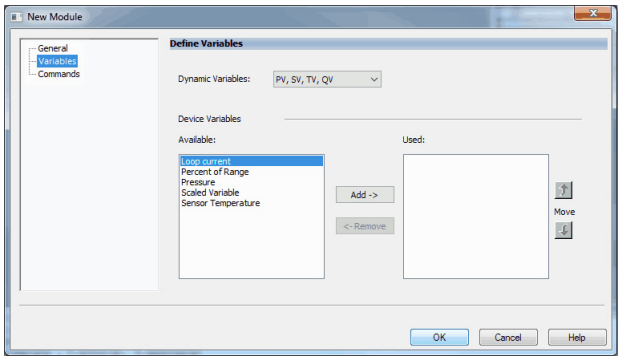
Generic HART Device



Parameter	Description or Action	Available Selections (varies by device type)
Use Expanded Device Type	Select the checkbox to enable Expanded Device Type. **WARNING:** If you disable Expanded Device Type, Disable Keying is the only option available for Electronic Keying. We recommend that you do not use Disable Keying. For more information, see Electronic Keying.	Enabled Disabled
Expanded Device Type	Enter the device-specific device type ID.	Device-specific
Revision	Displays the device revision.	
Electronic Keying	When Electronic Keying is used, it decreases the possibility of using the wrong device in a control system. **WARNING:** We recommend that you do not use Disable Keying. For more information, see Electronic Keying.	Exact Match Compatible Module Disable Keying
Connection	Displays the I/O connection to the device.	Data PlantPAx® Data
Add HART EDD	See Update or Add a HART EDD File	–

Variables Page

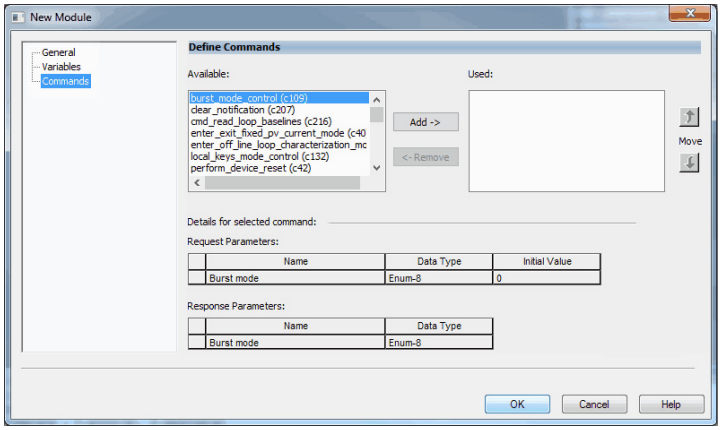
You can configure the dynamic and device variables that are included in the input tag of the HART device on this page.



Attribute	Description
Dynamic Variables	Displays the included Dynamic Variables.
Available	Displays the names of the supported Device Variables. Right-click to sort the list.
Used	Displays the list of Device Variables that are in use. The list can contain a maximum of 8 variables.
Add/Remove	Moves variables between the Available and Used lists.
Move	Modifies the order in which the variables occur.

Commands Page

You can configure the command variables for the HART device on this page.



Attribute	Description
Available	Displays the names of the supported commands. Right-click to sort the list.
Used	Displays the list of commands that are in use. The list can contain a maximum of 4 commands.
Add/Remove	Moves commands between the Available and Used lists.
Move	Modifies the order in which the commands occur.
Request Parameters	Displays the name, HART data type, and initial value for each request parameter.
Response Parameters	Displays the name and data type for each response parameter.

Calibrate the Module

The Compact 5000® analog I/O modules are calibrated during the manufacturing process. The accuracy of each module remains high throughout its lifespan. You are not required to calibrate the module.

You can calibrate on a per channel basis or in groups.

IMPORTANT This chapter describes a few example module calibration scenarios. It does not cover how to calibrate every Compact 5000 analog I/O module in all operating modes that the module supports.

Before You Begin

Consider this information before you begin.

Controller State During Calibration

You must add the module to your Studio 5000 Logix Designer® project, as described in Configure the Module, before you can calibrate it.

The project must be online with the owner-controller to calibrate Compact 5000 analog I/O modules.

The controller must be in Program mode or Remote Program to calibrate the module. We **recommend** that your module is in Program mode and not actively controlling a process when you calibrate it.

Calibration Impacts Data Quality on Entire Input Module Group

When a channel on a Compact 5000 analog input module is in the calibration process, the Notch Filter setting for that channel changes to 5 Hz. This change results in the *I.Chxx.Uncertain* tag being set to 1 for that channel until calibration is completed.

Grouped inputs share an Analog-to-Digital converter, so when any input channel is in the calibration process, the *I.Chxx.Uncertain* tag is set to 1 for the other input channels in that group. This change happens because the data sample rate slows for all input channels in the group.

Calibration Differences and Accuracy

The purpose of calibrating the Compact 5000 analog I/O modules is the same for input and output modules, to improve the module's accuracy and repeatability. The procedures used to calibrate the module differ by module type:

- When you calibrate input modules, you use current, voltage, or ohms reference signals to send a signal to the module to calibrate it.
- When you calibrate output modules, you use a digital multimeter (DMM) to measure the current or voltage signal the module is sending out.

To maintain your module's factory calibration accuracy, we recommend instrumentation with the specifications that are listed in the following table. You can use a high-resolution DMM to adjust a voltage/current calibrating source to its value.

Cat. No.	Channel Input Type	Recommended Instrument Specifications
5069-IF4IH, 5069-IF8, 5069-IY4	Current	1.00...20.00 mA source ±100 nA current
	Voltage	0...10V source ±2 µV voltage
5069-IY4	RTD	1.0...487.0 Ω resistors ±0.01%
	Thermocouple	0...100 mV source ±0.5 µV
5069-OF4, 5069-OF4K, 5069-OF4IH, 5069-OF8	Current	DMM with resolution better than 0.15 µA
	Voltage	DMM with resolution better than 1.0 µV

IMPORTANT If you calibrate your module with an instrument that is less accurate than the recommendation, the following events can result:

- Calibration appears to occur normally but the module gives inaccurate data during operation.
- A calibration fault occurs that forces you to cancel calibration.
- The *I.Chxx.CalFault* tag is set for the channel that you tried to calibrate.

To clear the tag, complete a valid calibration or cycle power to the module. In this case, you must recalibrate the module with an instrument as accurate as recommended.

Calibrate the Input Modules

Apply low and high signal references to the Compact 5000 analog input module to calibrate it. The references must match the input range of the channel is using.

Compact 5000 I/O Analog Input Module Calibration References

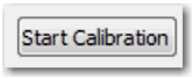
Input Type	Input Range	Low Calibration Reference	High Calibration Reference
Voltage	-10...10V 0...10V	0.0V	10.0V
	0...5V	0.0V	5.0V
Current	0...20 mA 4...20 mA	4.0 mA	20.0 mA
RTD (5069-IY4 only)	1...500 Ω 2...1000 Ω 4...2000 Ω 8...4000 Ω	1 Ω	487 Ω
Thermocouple (5069-IY4 only)	-100...+100 mV	0.0 mV	100.0 mV

Calibrate the 5069-IF8 or 5069-IF4IH Module

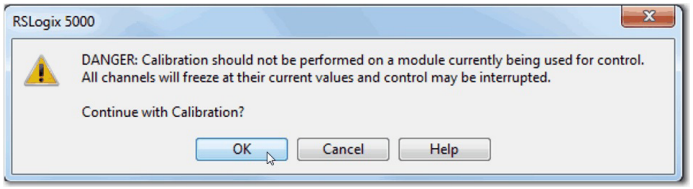
This example describes how to calibrate a channel on the 5069-IF8 module for use with the Voltage input type. The steps are the same for the 5069-IF4IH module.

Complete these steps to calibrate the module.

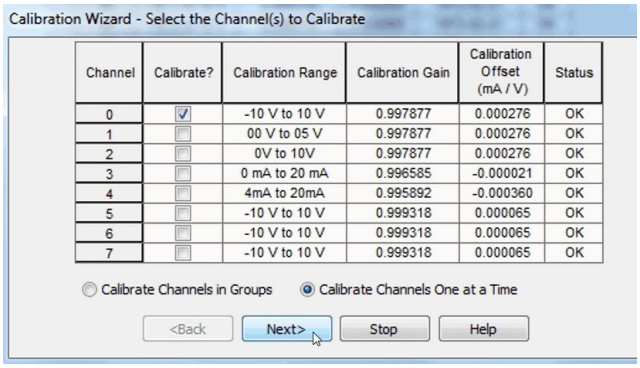
1. Connect the voltage calibrator to the channel that you want to calibrate.
2. Go online with the project and make sure that the controller is in Program mode.
3. Confirm that the channel to be calibrated is configured for the correct Input Range.
4. On the Calibration page in the Module Properties, click Start Calibration.



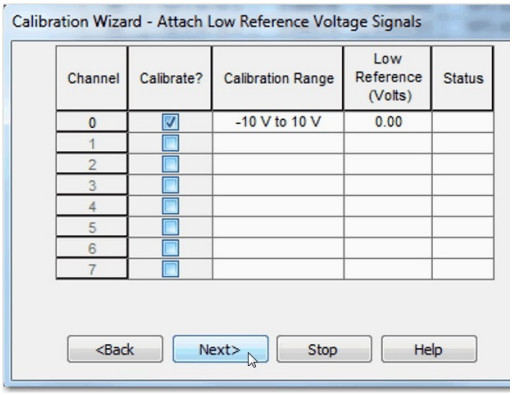
5. At the warning, click OK.



6. Select the checkbox of the channel that you want to calibrate, and click Next.

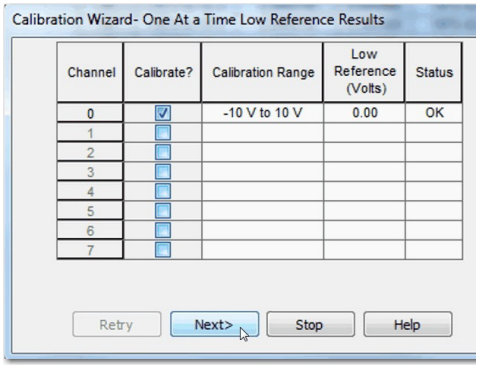


7. At the Attach Low Reference Voltage Signals dialog, set the calibrator to the low reference and apply it to the channel.



8. Click Next.

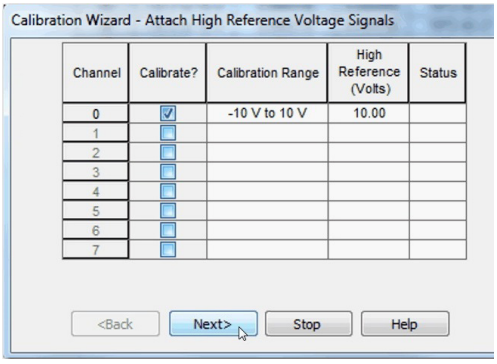
The One at a Time Low Reference Results dialog opens and indicates the status of the channel after applying the low reference.



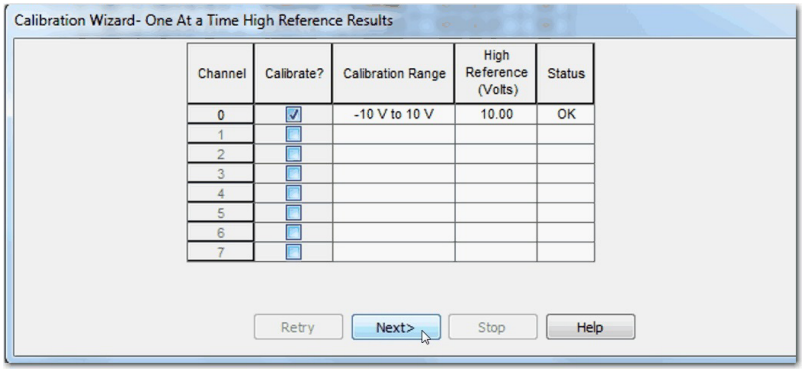
9. If the status is OK, click Next.

   If the status reports an error, repeat the calibration process.

10. At the Attach High Reference Voltage Signals dialog, set the calibrator to the high reference and click Next.



The One at a Time High Reference Results dialog opens and indicates the status of the channel after applying the low reference.



11. If the status is OK, click Next.

    If the status reports an error, repeat the calibration process.

12. At the Calibration Completed dialog, click Finish.

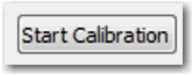
Calibrate the 5069-IY4 and 5069-IY4K Modules

This example describes how to calibrate a channel on the module for use with the RTD input type. The 5069-IY4 and 5069-IY4K modules use the following resistors to calibrate in ohms:

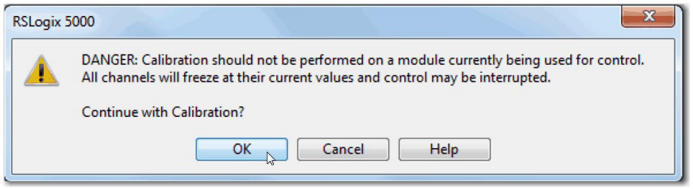
- 1 Ω resistor for low reference calibration
- 487 Ω resistor for high reference calibration

Complete these steps to calibrate the module.

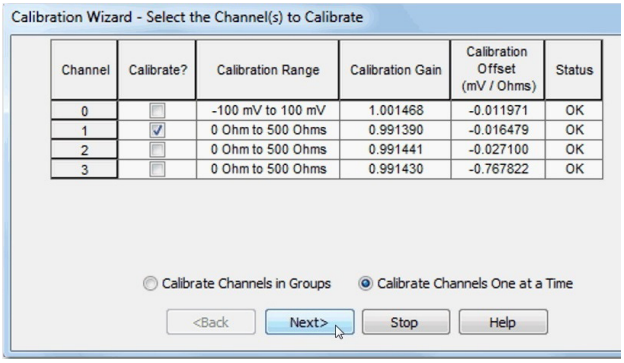
1. Connect the low reference resistor to the channel being calibrated.
2. Go online with the project and make sure that the controller is in Program mode.
3. Confirm that the channel to be calibrated is configured for the correct Input Range.
4. On the Calibration page in the Module Properties dialog, click Start Calibration.



5. At the warning, click OK.



6. Select the checkbox of the channel that you want to calibrate, and click Next.



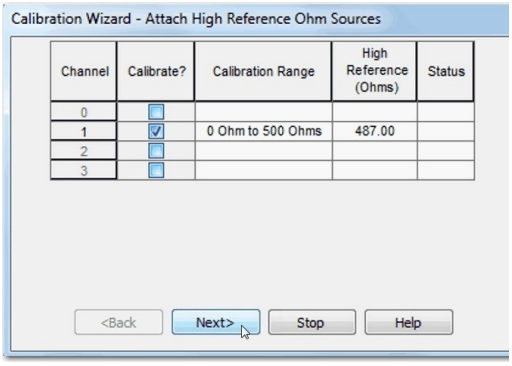
7. At the Attach Low Reference Ohm Sources dialog, connect a 1 Ω resistor to the channel being calibrated and click Next.

The One at a Time Low Reference Results dialog opens and indicates the status of the channel after calibrating for the low reference.

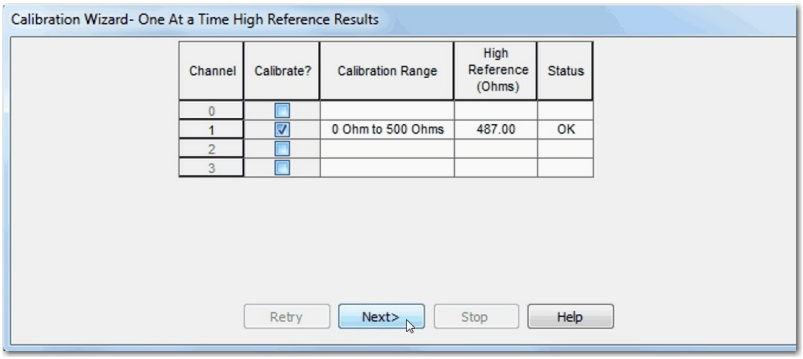
8. If the status is OK, click Next.

   If the status reports an error, return to step 7 until the status is OK.

9. At the Attach High Reference Ohm Sources dialog, connect a 487 Ω resistor to the channel being calibrated and click Next.



The One at a Time High Reference Results dialog opens and indicates the status of the channel after calibrating for a high reference



10. If the status is OK, click Next.

    If the status reports an error, return to step 9 until the status is OK.

11. At the Calibration Completed dialog, click Finish.

Calibrate the Output Modules

When calibrating a Compact 5000 analog output channel, the Studio 5000 Logix Designer application commands the module to output specific signal levels. The channel output type determines the signal type.

Compact 5000 I/O Analog Output Module Calibration References

Output Type	Output Range	Low Calibration Reference Level	High Calibration Reference Level
Voltage	-10...10V	-10.0V	10.0V
	0...10V	1.0V	10.0V
	0...5V	1.0V	5.0V
Current	0...20 mA	1.0 mA	20.0 mA
	4...20 mA	5.0 mA	20.0 mA

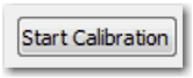
You must measure the actual level and record the results to account for any module inaccuracies.

Calibrate the Output Modules

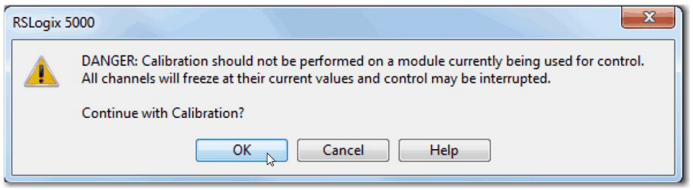
This example describes how to calibrate a channel on the 5069-OF8 module for use with the Voltage output type. The steps are the same for the 5069-OF4, 5069-OF4K, and 5069-OF4IH modules.

Complete the following steps:

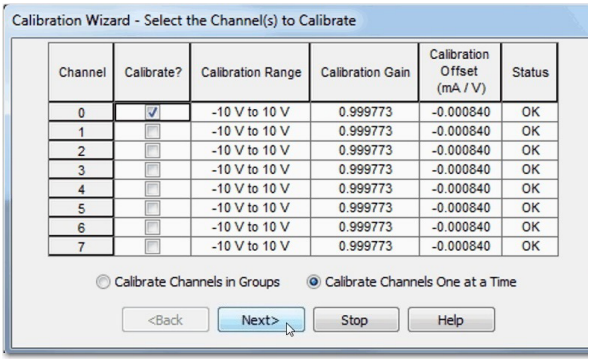
1. Connect the DMM to the channel being calibrated.
2. Go online with the project and make sure that the controller is in Program mode.
3. Confirm that the channel to be calibrated is configured for the correct Output Range.
4. On the Calibration page in the Module Properties dialog, click Start Calibration.



5. At the warning, click OK.

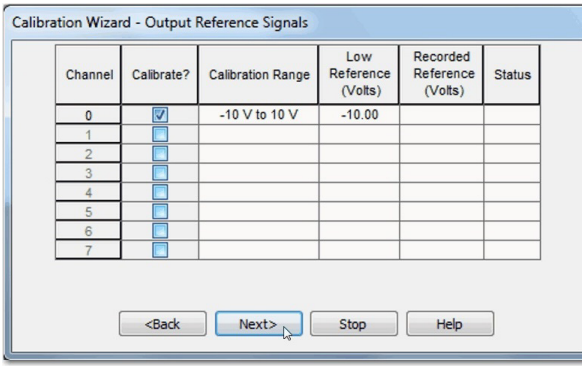


6. Select the checkbox of the channel that you want to calibrate, or select Calibrate Channels in Groups.



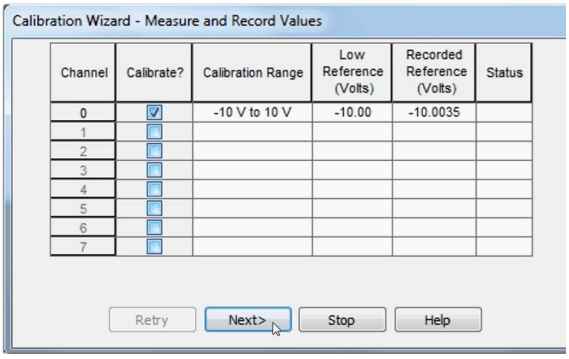
7. Click Next.

8. At the Output Reference Signals dialog, click Next.

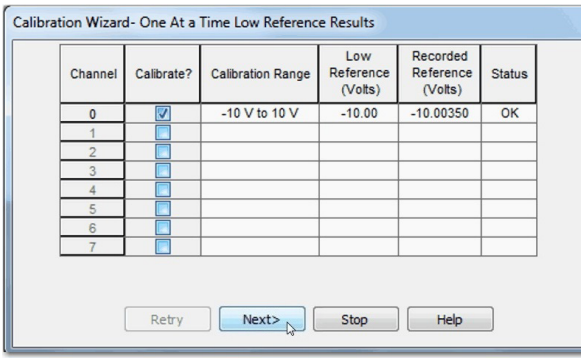


The Measure and Record Values dialog opens.

9. Use a multimeter to measure the reference value of the channel.
10. In the Recorded Reference (Volts) column, enter the measured value and click Next.



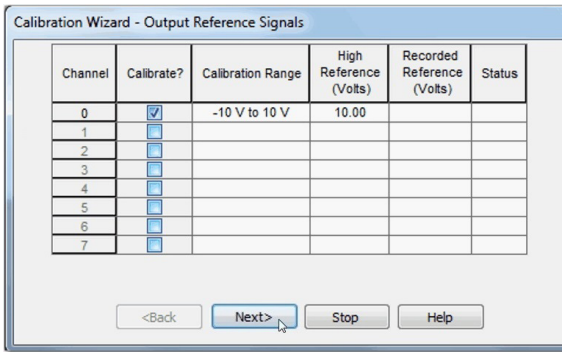
The One At a Time Low Reference Results dialog opens and indicates the status of the calibrated channel.



11. If the status is OK, click Next.

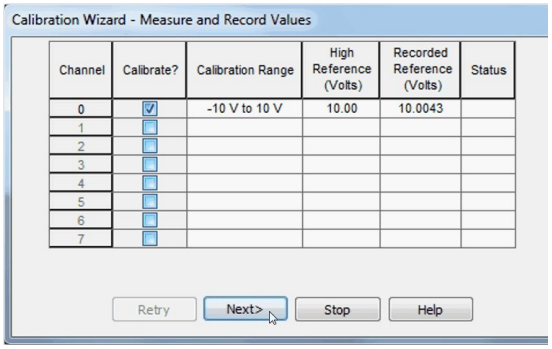
    If the status is not OK, repeat the calibration process.

12. The Output Reference Signals dialog opens and indicates the channel to be calibrated for the high reference, click Next.

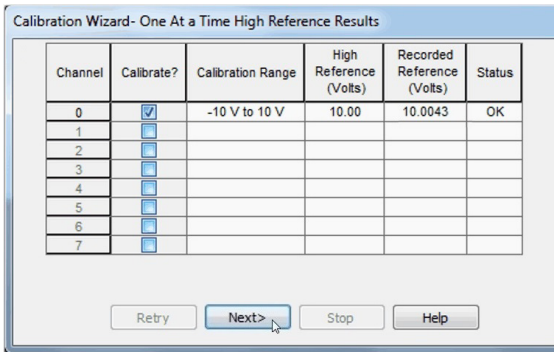


The Measure and Record Values dialog opens.

13. Use a multimeter to measure the reference value of the channel.
14. In the Recorded Reference (Volts) column, record the measured value and click Next.



The One At a Time High Reference Results dialog opens and indicates the status of the calibrated channel.



15. If the status is OK, click Next.

    If the status is not OK, repeat the calibration process.
16. When the Calibration Completed dialog box appears, click Finish.

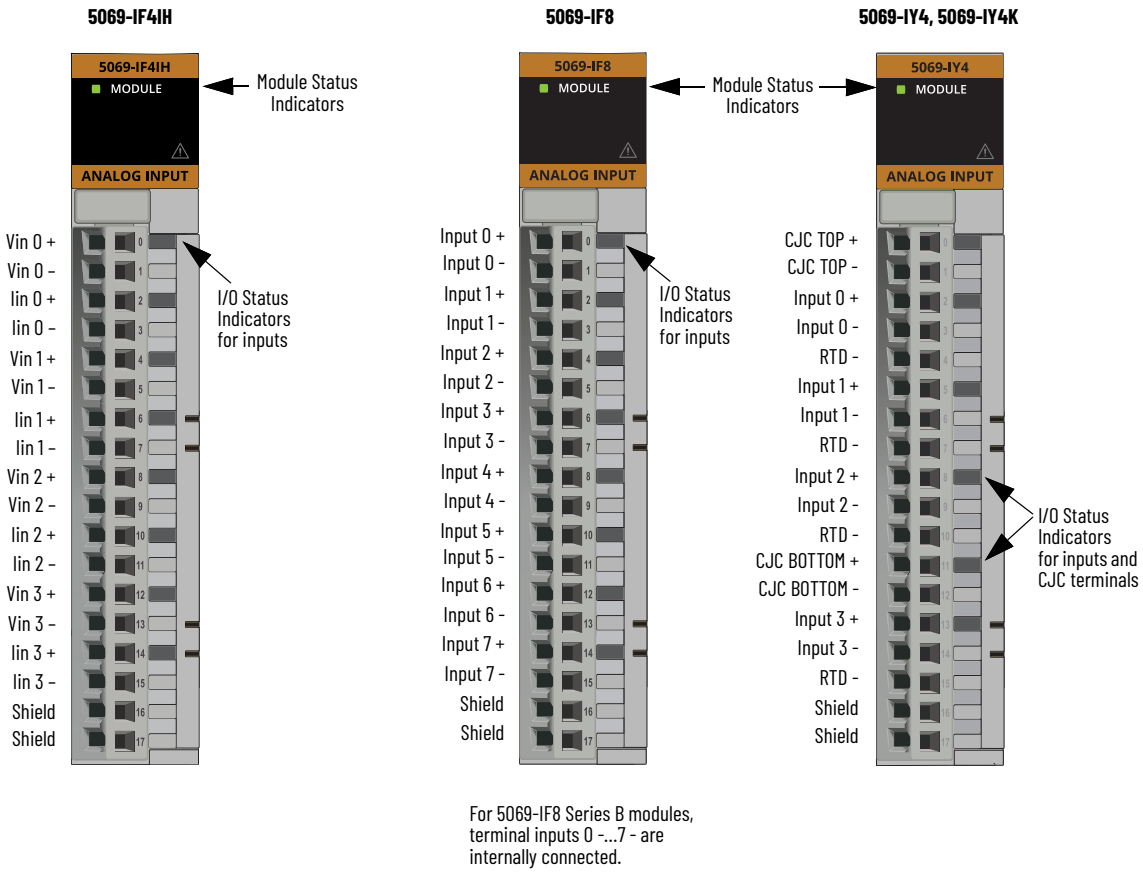
Notes:

Troubleshoot the Module

Troubleshoot with the Status Indicators

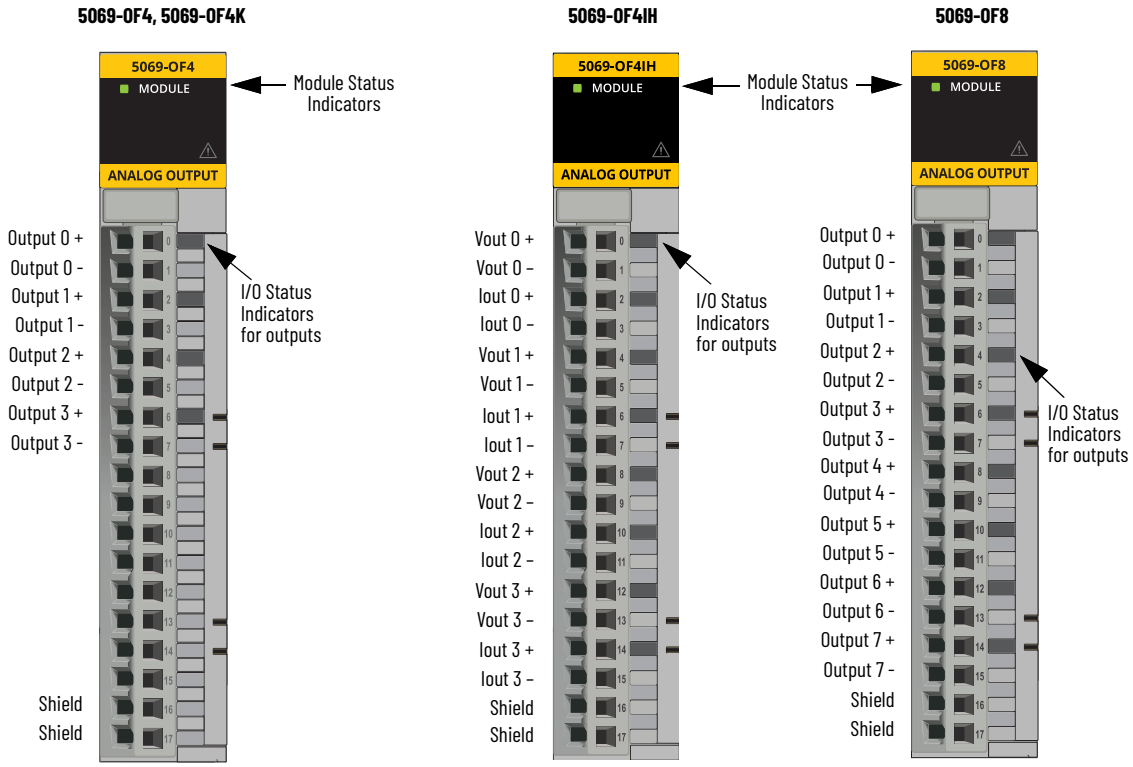
Use this information to troubleshoot with the status indicators.

Status Indicators - Compact 5000 Analog Input Modules



For 5069-IF8 Series B modules, terminal inputs 0 -...7 - are internally connected.

Status Indicators - Compact 5000 Analog Input Modules



Module Status Indicator

This table describes the Module (MOD) Status indicator on the Compact 5000® analog I/O modules.

Indicator State	Description	Recommended Action
Off	The module is not powered.	None - If your application does not use the module. If your application uses the module and it is expected to be operating, complete the following: • Confirm that the system is powered. • Confirm that the module is installed properly.
Steady green	The module has a connection to the owner-controller and is operating as expected.	None
Flashing green	The module is powered, but does not have a connection to the controller.	Troubleshoot your Studio 5000 Logix Designer project to determine what is preventing a connection from the module to the controller and correct the issue. This condition can result from missing, incomplete, or incorrect module configuration, or an inhibited module.
Steady red	The module has experienced a nonrecoverable fault.	Replace the module.
Flashing red	One of these conditions exists. • A module firmware update is in progress. • A module firmware update attempt failed. • The device has experienced a recoverable fault. • A connection to the module has timed out.	Complete one of these actions. • Let the firmware update complete. • If a firmware update fails, reattempt the update. • Use the Studio 5000 Logix Designer application to determine the cause of the module fault. The Connection and Module Info categories of the module's configuration indicate the fault type. To clear a recoverable fault, complete one of these actions. – Cycle module power. – Click Reset Module on the Module Info page of the Module Properties. If the fault does not clear after you cycle power and reset the Module, contact Rockwell Automation Technical Support. • Use the Studio 5000 Logix Designer application to determine if a connection has timed out. The Connection page in the Module Properties indicates the module state, including if a connection has timed out. If a connection has timed out, determine the cause and correct it. For example, a cable failure can cause a connection timeout.
1. Steady red for approximately 2 seconds 2. Flashing green indefinitely	The power-up sequence is in progress on the module.	Wait for the power-up sequence to finish.

I/O Status Indicators - Analog Input Modules

This table describes the I/O status indicator on Compact 5000 analog input modules.

Indicator State	Description	Recommended Action
Off	One of these conditions exists. • The module is not powered. • The module is powered, but there is no connection from the controller to the module. • The module is powered, but the input channel is disabled.	Complete one of these actions. • None - If your application does not use the input channel. • If you expect the module to be powered but it is not, complete these actions. – Confirm that the system is powered. – Confirm that the module is installed properly. • If the module is powered but the channel is not operating as expected, use the Studio 5000 Logix Designer application to verify that the module is connected to the controller and that the channel is not disabled. The Connection page in the Module Properties indicates if the module is active or faulted. If the module is faulted, the Connection page displays information about errors that affect the state of the module.
Steady yellow	The input channel is operating normally.	None
Steady red	An issue has occurred that is internal to the module. These are examples of issues that can cause this indication. • The module has experienced a nonrecoverable fault. • A calibration fault occurred on the channel. • An Over Temperature condition exists - the module is operating over its specified temperature.	Complete one of these actions. • If the indicator is in the steady red state following the initial power-up sequence and remains in that state, replace the module. • If a calibration fault occurred, cycle power to the module. When the power-up sequence completes, the channel returns to the factory calibration setting. • If the indicator remains in the steady red state after you cycle power, replace the module. • To return the module to the specified operating temperature range, complete these actions. – Correct the temperature at the module installation location if necessary. – Verify that the module has the proper level of current applied. Module specifications, for example, acceptable operating temperature or applied current levels, are available in the Compact 5000 I/O Modules and Ethernet Adapter Specifications, publication 5069-TD001.
Flashing red	An external device caused a fault on the input channel. These are examples of issues that can cause the fault. • The input signal is overrange or underrange. • The signal range is set in your Studio 5000 Logix Designer project. • An Open Wire condition exists - a wire is disconnected from the input channel. • Power is supplied by the SA bus power, but the power is not available or correct.	Complete one of these actions. • Correct the input signal if it is overrange or underrange. • Check the wiring at the input channel and reconnect it if necessary. • Check the SA connector, available on a 5069-AEN2TR adapter or a 5069-FPD module to make sure 24V DC power is present. If 24V DC power is not present, troubleshoot the SA power connection. For more information on the SA connector, see the 5069-AEN2TR adapter and 5069-FPD module documentation that is listed in Additional Resources.
Alternating yellow/red	Calibration is in progress.	Finish the calibration process in the Studio 5000 Logix Designer application.

I/O Status Indicators - Analog Output Modules

This table describes the I/O status indicator on Compact 5000 analog output modules.

Indicator State	Description	Recommended Action
Off	One of these conditions exists. • The module is not powered. • The module is powered but does not have a connection to the controller. • The module is powered, but the output channel is disabled.	Complete one of these actions. • None - If your application does not use the output channel. • If you expect the module to be powered but it is not, complete one of these actions. – Confirm that the system is powered. – Confirm that the module is installed properly. • If the module is powered but the channel is not operating as expected, use the Studio 5000 Logix Designer application to verify that the module is connected to the controller and that the channel is not disabled. The Connection page in the Module Properties indicates if the module is active or faulted. If the module is faulted, the Connection page displays information about errors that affect the state of the module.
Steady yellow	The output channel is operating normally.	–
Steady red	An issue has occurred that is internal to the module. These are examples of issues that can cause this indication. • The module has experienced a nonrecoverable fault. • A calibration fault has occurred on the channel. • An Over Temperature condition exists - the module is operating over its specified temperature.	Complete one of these actions. • If the indicator is in the steady red state following the initial power-up sequence and remains in that state, replace the module. • If a calibration fault occurred, cycle power to the module. When the power-up sequence completes, the channel returns to the factory calibration setting. • If the indicator remains in the steady red state after you cycle power, replace the module. • To return the module to the specified operating temperature range, complete these actions. – Correct the temperature at the module installation location if necessary. – Verify that the module has the proper level of current applied. Module specifications, for example, acceptable operating temperature or applied current levels, are available in the Compact 5000 I/O Modules Specifications Technical Data, publication 5069-TD001.
Flashing red	An external device caused a fault on the output channel. These are examples of issues that can cause the fault. • A No Load condition exists - a wire is disconnected from the output. • A Short Circuit condition exists - the module is driving a current from the channel that is greater than the maximum current level that the channel can handle. • Power is supplied by the SA bus power, but the power is not available or correct.	Complete one of these actions. • Check the wiring at the output channel. • If necessary, reconnect the wire. • Troubleshoot the application to make sure an acceptable level of current is driven from the channel. • Verify that 24V DC power is present at the SA connector, available on a 5069-AEN2TR adapter or a 5069-FPD module. If 24V DC power is not present, troubleshoot the SA power connection. For more information on the SA connector, see the 5069-AEN2TR adapter and 5069-FPD module documentation that is listed in Additional Resources.
Alternating yellow/red	Calibration is in progress in the Studio 5000 Logix Designer application.	Allow the calibration process to complete.

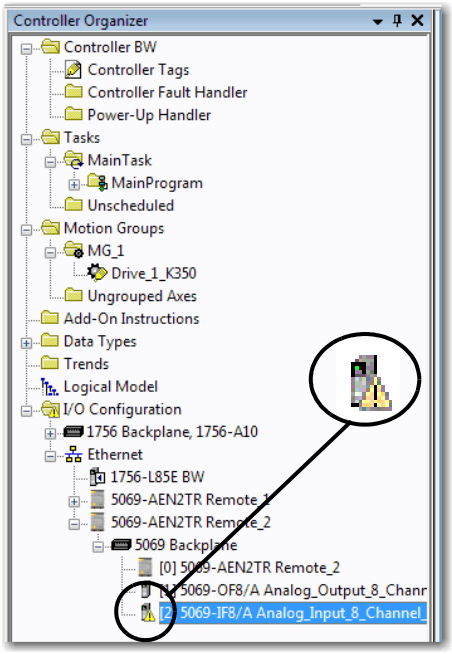
Troubleshoot with the Studio 5000 Logix Designer Application

The Studio 5000 Logix Designer application indicates the presence of fault conditions in these ways.

- Warning Signal in the I/O Configuration Tree
- Status and Fault Information in the Module Properties
- Studio 5000 Logix Designer Tag Editor

Warning Signal in the I/O Configuration Tree

A warning icon appears in the I/O Configuration tree when a fault occurs.



Status and Fault Information in the Module Properties

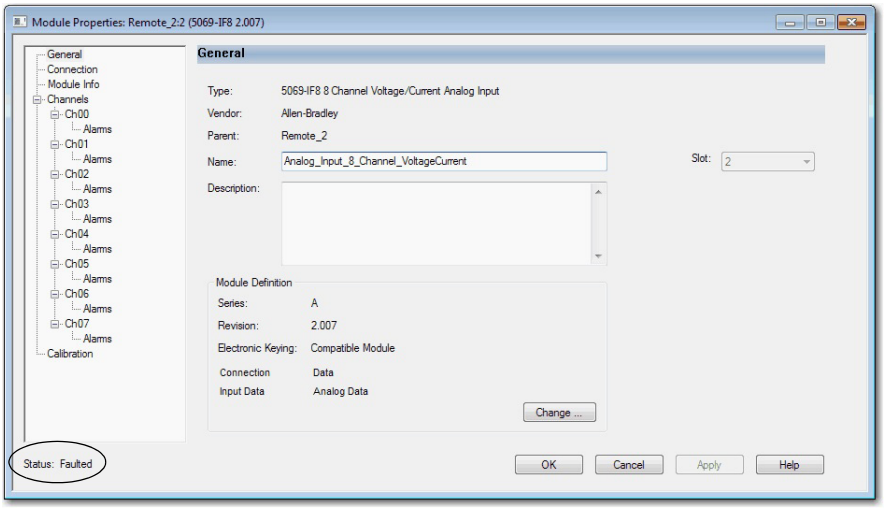
You can monitor and configure the module on the Module Properties pages. The pages vary due to module type.

You can monitor a module's state for faults in these ways.

- Module Status on the General Page
- Module Fault Descriptions on the Connection Page

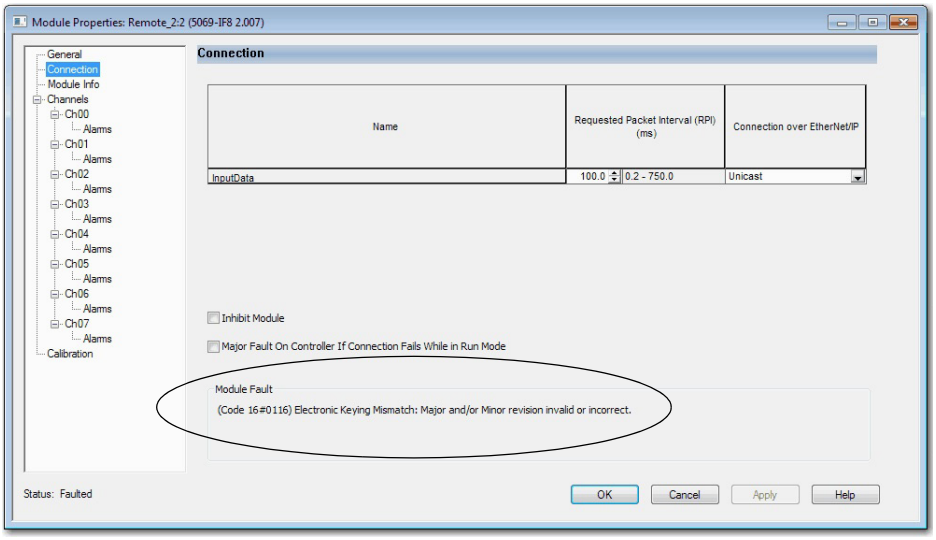
Module Status on the General Page

The module status is indicated on the General page of the Modules Properties.



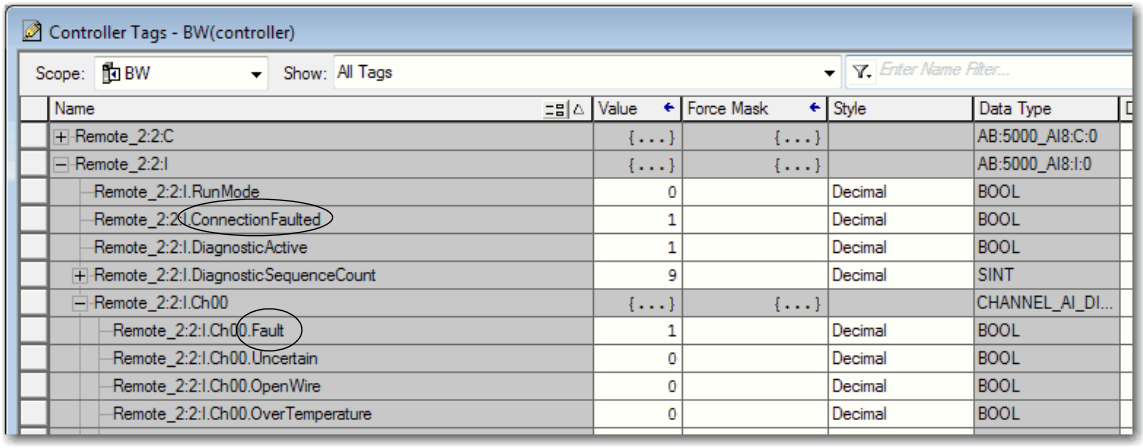
Module Fault Descriptions on the Connection Page

The Module Fault box on the Connection page lists fault descriptions. The description includes an error code that is associated with the specific fault type.



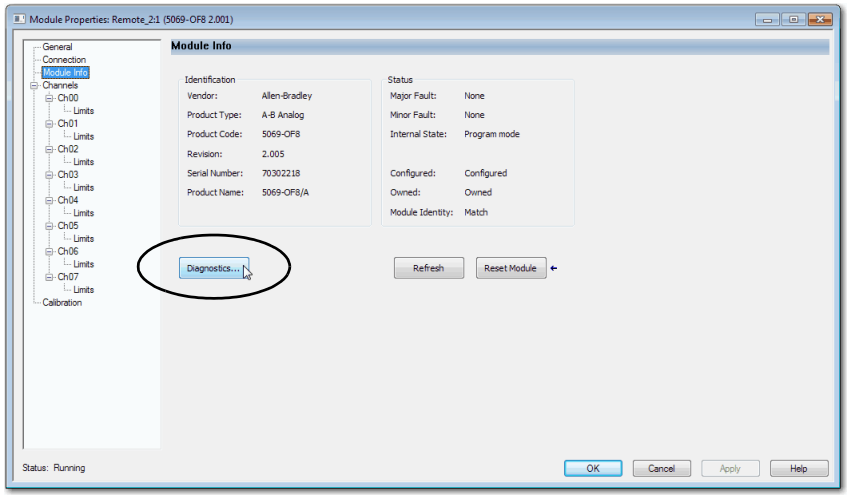
Studio 5000 Logix Designer Tag Editor

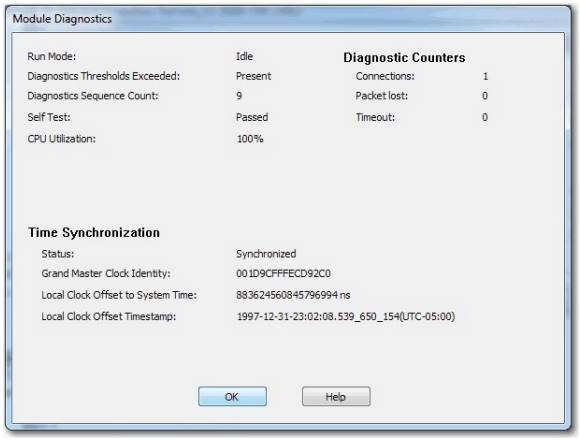
Fault conditions are indicated in the controller tags for the module.



Module Diagnostics

Module Diagnostics are accessible from the Module Info page.





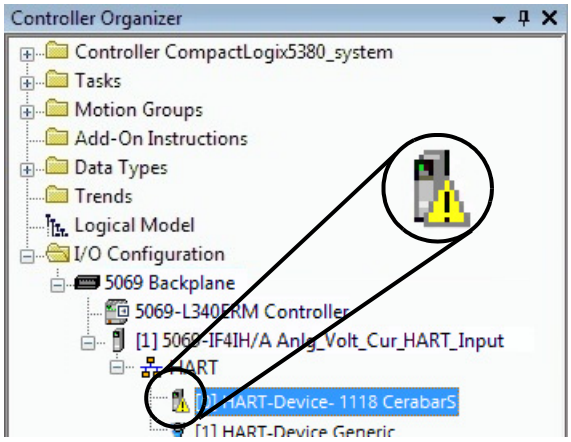
Troubleshoot a HART Device

The Studio 5000 Logix Designer application indicates the presence of device fault conditions in these ways.

- Warning Symbol in the I/O Configuration Tree
- Status and Fault Information in the Module Properties
- Studio 5000 Logix Designer Tag Editor

Warning Symbol in the I/O Configuration Tree

A warning icon appears in the I/O Configuration tree when a fault occurs.

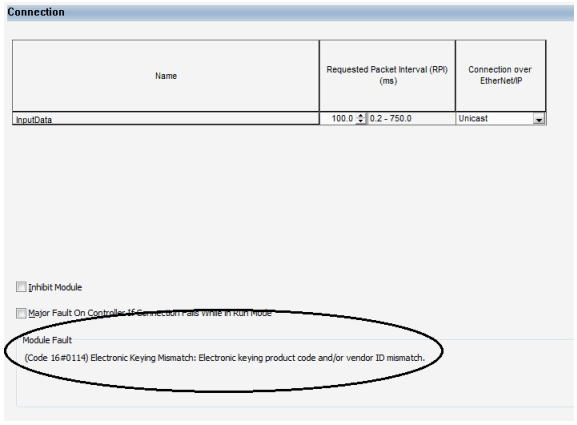


If a warning signal appears in the I/O Configuration tree, verify these items.

- The device is powered up and properly wired to the module.
- There are no electronic keying mismatches.
- There is no fault status on the analog channel.

Status and Fault Information in the Module Properties

The Module Fault box on the Connection page lists device fault descriptions. The description includes an error code that is associated with the specific fault type.



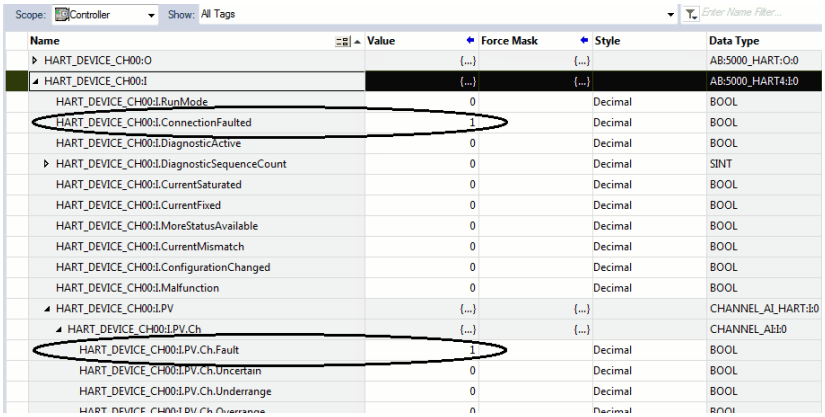
Common CIP Error Codes for HART Devices

Some fault error codes are returned with the CIP™ messages that are sent to HART devices. Either the Connection page or the CIP messaging responses report these error codes.

Error Code	Description
0x01/0x204	Timeout - one of these conditions exists. • The channel is not configured as HART-enabled • The owner controller connection is down between the HART I/O module and the controller • No HART device is wired on the channel • The HART device is rebooting • The discovery with Command 0 is in progress on the HART device
0x0C	The object is in the wrong mode
0x01/0x114	• Electronic Keying mismatch • HART expanded device type mismatch
0x01/0x116	• Electronic Keying mismatch • Major or Minor Revision mismatch
0x02	No resource
0x20	Invalid parameter found in the CIP request
0x1E	Service failed – the HART command failed due to a link layer error

Studio 5000 Logix Designer Tag Editor

Fault conditions are indicated in the controller tags for the device.



Module and Device Tags

Module tags are created when you add a module to the Studio 5000 Logix Designer® project.

The tag types are available with the Compact 5000® analog I/O modules:

- Configuration (C)
- Input (I)
- Output (O)

The available set of module tags depends on the module type and the parameters that you select during module configuration. For example, if you select a Listen Only connection, the Studio 5000 Logix Designer application creates only Input tags for that module.

The tables in this section list all tags available with each module. Not all tags in the list are available when a module is first added to a project. More tags are available as you configure the module.

Conventions for Tag Names

This table defines the name conventions for tags.

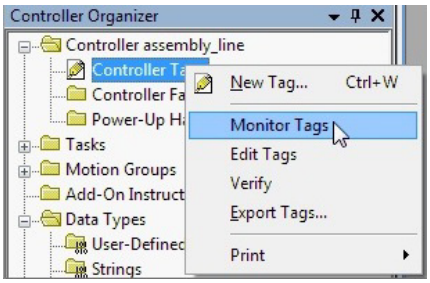
For Modules in a	Example	Location	Slot Number	Tag Type	Module Channel No. (if applicable)	Tag Function
Local system	Local:1:I.Ch00.Data	Local	1	I	Ch00	Data
Remote system	remote_ethernet_adapter:1:I.CH00.Data	Remote	1	I	Ch00	Data

The Data Tag Function represents the input data that is returned to the owner-controller.

View the Tags

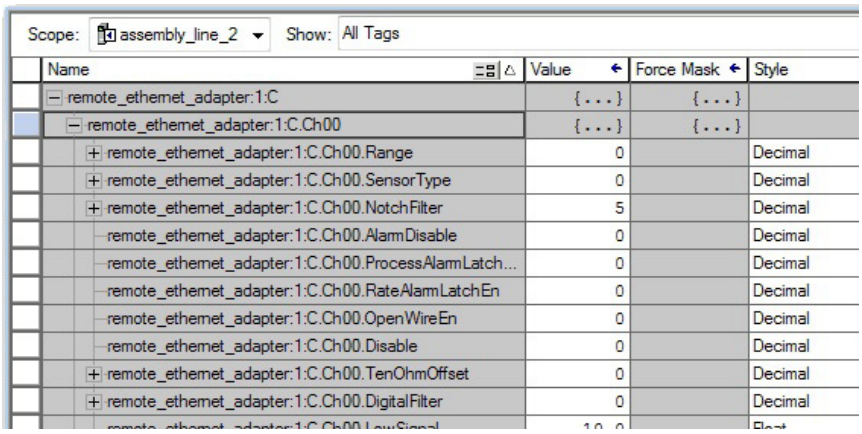
Complete these steps to view the tags.

1. In the Studio 5000 Logix Designer project, right-click Controller Tags and select Monitor Tags.



The Controller Tags window opens and displays the data.

2. To view the additional tags as shown, click the + symbols.



Input Module Tags

This section describes the tags that are associated with the 5069-IF4IH, 5069-IF8, 5069-IY4, and 5069-IY4K modules. For more information, see View the Tags.

Configuration Tags - 5069-IF4IH, 5069-IF8, 5069-IY4, 5069-IY4K

Name	Size	Description	Valid Values		
			5069-IF4IH	5069-IF8	5069-IY4, 5069-IY4K
CJChxx.Disable	BOOL	The CJ measurement is not used when the module calculates the CJ compensation. There are two CJ measurements that can be taken on the module. The combination of configuration values determines how CJ compensation is affected. Consider the following: • If you enable CJCh00 and CJCh01 measurements, both measurements are used to calculate CJ compensation. • If you enable only one CJChxx measurement, only that measurement is used to calculate CJ compensation. • If you disable both CJChxx measurements, it is assumed that the cold junction temperature is 0 in the CJ compensation.	-		0 = Cold junction measurement is used to calculate CJ compensation 1 = Cold junction measurement is not used to calculate CJ compensation
CJChxx.Remote	BOOL	Indicates if the cold junction sensor is mounted on a remote termination block when set, rather than on the local terminal block. Needed for proper cold junction compensation when you have linear thermocouples. If the cold junction sensor is mounted on a remote termination block, CJCh00 is used with channels 00 and 01, and CJCh01 is used with channels 02 and 03.			0 = Cold junction sensor is not mounted on a remote termination block 1 = Cold junction sensor is mounted on a remote termination block
CJChxx.SensorOffset	REAL	Offset added directly to the measured CJ temperature. Used to compensate for cold junction temperature sensor error.			Any
Chxx.Range	SINT	Channel's operating range	-	0 = -10...10V 1 = 0...5V 2 = 0...10V 4 = 0...20 mA 5 = 4...20 mA	0 = -10...10V 1 = 0...5V 2 = 0...10V 4 = 0...20 mA 5 = 4...20 mA 6 = -100...100 mV 7 = unused 8 = 1...500 Ω 9 = 2...1,000 Ω 10 = 4...2,000 Ω 11 = 8...4,000 Ω
Chxx.NotchFilter	SINT	Notch Filter removes line noise for the channel.	0 = 10 Hz (simultaneous 50/60Hz rejection) 1 = 50 Hz 2 = 60 Hz 3 = 100 Hz 4 = 200 Hz 5 = 500 Hz 6 = 1000 Hz 7 = 2500 Hz		8 = 5000 Hz 9 = 10,000 Hz 10 = 15,625 Hz 11 = 25,000 Hz 12 = 31,250 Hz 13 = 5 Hz 14 = 62,500 Hz 15 = 15 Hz 16 = 20 Hz
Chxx.SensorType	SINT	Displays the selected type for the RTD or Thermocouple sensor.	-		**RTD Mode:** • 0 = no linearization, Ω • 1 = 100 Ω Platinum 385 • 2 = 200 Ω Platinum 385 • 3 = 500 Ω Platinum 385 • 4 = 1000 Ω Platinum 385 • 5 = 100 Ω Platinum 3916 • 6 = 200 Ω Platinum 3916 • 7 = 500 Ω Platinum 3916 • 8 = 1000 Ω Platinum 3916 • 9 = 10 Ω Copper 427 • 10 = 120 Ω Nickel 672 • 11 = 100 Ω Nickel 618 • 12 = 120 Ω Nickel 618 • 13 = 200 Ω Nickel 618 • 14 = 500 Ω Nickel 618 **Thermocouple Mode:** • 0 = mV • 1 = B • 2 = C • 3 = E • 4 = J • 5 = K • 6 = N • 7 = R • 8 = S • 9 = T • 10 = TXK/XK (L)

Configuration Tags - 5069-IF4IH, 5069-IF8, 5069-IY4, 5069-IY4K (Continued)

Name	Size	Description	Valid Values		
			5069-IF4IH	5069-IF8	5069-IY4, 5069-IY4K
Chxx.AlarmDisable	BOOL	Disables all alarms on the channel. **IMPORTANT** - Consider the following: • When if you change this tag to 0, that is, so alarms are not disabled, you must also enable the individual alarms for them to work. • For example, if you want to use the Low Low alarm for a channel, you must set the Chxx.AlarmDisable to 0 and set the Chxx.LLAlarmEn output tag to 1 so the alarm is enabled. • Applies to all alarms on the module. • Conversely, if you set this tag to 1, alarms are disabled regardless of the setting on the alarm enable tag for any alarm.	• 0 = Alarms are not disabled • 1 = Alarms are disabled (default)		
Chxx.ProcessAlarmLatchEn	BOOL	Configures Process alarms to latch until they are explicitly unlatched. The Process alarms include: • HighHigh alarm • High alarm • Low alarm • LowLow alarm	• 0 = Latching disabled (default) • 1 = Latching enabled		
Chxx.RateAlarmLatchEn	BOOL	Configures the Rate alarm to latch until it is explicitly unlatched.	• 0 = Latching disabled (default) • 1 = Latching enabled		
Chxx.OpenWireEn	BOOL	Enable the input Open Wire diagnostic	• 0 = Disabled (default) • 1 = Enabled		
Chxx.Disable	BOOL	Disables the channel. When a channel is disabled, the following occurs: • The I/O status indicator for the channel turns off. • The Chxx.Fault input tag is set to 1.	• 0 = Channel is enabled (default) • 1 = Channel is disabled		
Chxx.DigitalFilter	INT	A nonzero value enables the filter, providing a time constant that is used in a first order lag filter to smooth the input signal. Represented in milliseconds.	0 = Filter is turned off. Any value greater than zero = Filter value		All positive values
Chxx.LowSignal	REAL	Corresponds to the low engineering term when scaled, and is in terms of the input signal units.	**Current applications** - Any value less than the high signal in the range. • 0 = default for 0…20 mA range • 4 = default for 4…20 mA **Voltage applications** - Any value less than the high signal in the range. • -10 = default for -10…+10V range • 0 = default for 0…5V and 0…10V ranges		
			–		**RTD applications** - By default, this tag value is the lowest temperature in °C that the connected Sensor Type supports. You can change the value, if necessary. For a list of the temperature values associated with each sensor type, see Input Ranges, Sensor Types, and Thresholds. **Thermocouple applications** - By default, this tag value is the lowest temperature in °C that the connected Thermocouple type supports. You can change the value, if necessary. For a list of the temperature values associated with each sensor type, see Input Ranges, Sensor Types, and Thresholds.
Chxx.HighSignal	REAL	Corresponds to the high engineering term when scaled, and is in terms of the input signal units.	**Current applications** - Any value greater than the low signal in the range, 20 = default for either current input range **Voltage applications** - Any value greater than the low signal in the range. • 10 = default for 0…10V and -10…10V ranges • 5 = default for 0…5V range		
			–		**RTD applications** - By default, this tag value is the highest temperature in °C that the connected Sensor Type supports. You can change the value, if necessary. For a list of the temperature values associated with each sensor type, see Input Ranges, Sensor Types, and Thresholds. **Thermocouple applications** - By default, the tag value is the highest temperature in °C that the connected Thermocouple type supports. You can change the value, if necessary. For a list of the temperature values associated with each sensor type, see Input Ranges, Sensor Types, and Thresholds.

Configuration Tags - 5069-IF4IH, 5069-IF8, 5069-IY4, 5069-IY4K (Continued)

Name	Size	Description	Valid Values		
			5069-IF4IH	5069-IF8	5069-IY4, 5069-IY4K
Chxx.LowEngineering	REAL	Determines the engineering units that the signal values scale into. The low engineering term corresponds to the low signal value.	**Current mode** - Any value less than the high engineering value, 0.0 = default **Voltage mode** – Any value less than the high engineering value, LowSignal = default. For example, with the -10...10V range, the default = -10.		
			–		**RTD mode** - By default, the tag value is the lowest temperature that the connected Sensor Type supports. You can change the value, if necessary. The engineering units match the Temperature Units that you select. For a list of the temperature values associated with each sensor type, see Input Ranges, Sensor Types, and Thresholds. **Thermocouple mode** - By default, the tag value is the lowest temperature that the connected Thermocouple type supports. You can change the value, if necessary. The engineering units match the Temperature Units that you select. For a list of the temperature values associated with each sensor type, see Input Ranges, Sensor Types, and Thresholds.
Chxx.HighEngineering	REAL	Determines the engineering units that the signal values scale into. The high engineering term corresponds to the high signal value.	**Current mode** - Any value greater than the low engineering value, 100.0 = default **Voltage mode** - Any value greater than the low engineering value, High signal = default. For example, with the -10...10V range, the default = 10.		
			–		**RTD mode** - By default, the tag value is the highest temperature that the connected Sensor Type supports. You can change the value, if necessary. The engineering units match the Temperature Units that you select. For a list of the temperature values associated with each sensor type, see Input Ranges, Sensor Types, and Thresholds. **Thermocouple mode** - By default, the tag value is the highest temperature that the connected Thermocouple type supports. You can change the value, if necessary. The engineering units match the Temperature Units that you select. For a list of the temperature values associated with each sensor type, see Input Ranges, Sensor Types, and Thresholds.
Chxx.LLAlarmLimit	REAL	The Low Low alarm trigger point in terms of engineering units. Causes the Chxx.LLAlarm to trigger when the input signal moves beneath the configured trigger point.	0.0 = default		
Chxx.LAlarmLimit	REAL	The Low alarm trigger point in terms of engineering units. Causes the ChxxLAlarm to trigger when the input signal moves beneath the configured trigger point.	0.0 = default		
Chxx.HAlarmLimit	REAL	The High alarm trigger point in terms of engineering units. Causes the ChxxHAlarm to trigger when the input signal moves above the configured trigger point.	100.0 = default		
Chxx.HHAlarmLimit	REAL	The High High alarm trigger point in terms of engineering units. Causes the ChxxHHAlarm to trigger when the input signal moves above the configured trigger point.	100.0 = default		
Chxx.RateAlarmLimit	REAL	The Rate alarm trigger point in terms of engineering units per second. Causes the ChxxRateAlarm to trigger when the input signal changes at a rate faster than the configured rate alarm.	0 = Rate Alarm is not used Any value >0 = Trigger point		0...100 0 = default
Chxx.AlarmDeadband	REAL	Allows a process alarm to remain set, despite the removal of the alarm condition, as long as the input data remains within the deadband of the process alarm. The deadband value is subtracted from the High and High High Alarm Limits to calculate the deadband thresholds for these alarms. The deadband value is added to the Low and Low Low Alarm Limits to calculate the deadband thresholds for these alarms.	Any non-negative value, 0 = default		

Input Tags - 5069-IF4IH, 5069-IF8, 5069-IY4, 5069-IY4K

Name	Size	Definition			Valid Values
		5069-IF4IH	5069-IF8	5069-IY4, 5069-IY4K	
RunMode	BOOL	Channel's operating state			0 = Idle 1 = Run
ConnectionFaulted	BOOL	Indicates if there is a connection or not.			0 = Connected 1 = Not connected
DiagnosticActive	BOOL	Indicates if any diagnostics are active.			0 = No diagnostics active 1 = One or more diagnostics are active The following can trigger the diagnostic to be active: • Open Wire condition • Over Temperature condition • Field Power Off condition • Underrange/Overrange condition We recommend that you first troubleshoot the module to determine the trigger.
DiagnosticSequence Count	SINT	Increments for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected. Wraps from 255 or -1 to 1, and skips zero. A module reset or power cycle sets this bit to 0.			-128...+127
Chxx.Fault, CJChxx.Fault	BOOL	Indicates that the data is inaccurate and cannot be trusted for use in the application. If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.			0 = Good 1 = Bad, causes a fault These are the typical causes of fault data: • Channel is disabled • Open Wire condition • Underrange/Overrange condition • Short Circuit condition We recommend that you first troubleshoot the module to see if the typical causes exist.
Chxx.Uncertain, CJChxx.Uncertain	BOOL	Indicates that the data may be inaccurate but the degree of inaccuracy is not known. If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.			0 = Good data 1 = Uncertain data These are the typical causes of uncertain data: • Data signal slightly outside the channel operating range • The channel is slightly over temperature. • Invalid sensor offset value • Calibration fault on the channel • Calibration is in process on the channel We recommend that you first troubleshoot the module to see if the typical causes exist.
Chxx.OpenWire, CJChxx.OpenWire	BOOL	The signal wire is disconnected from the channel or the RTB is removed from the module.			0 = Open Wire condition does not exist or Open Wire Detection is disabled 1 = Open Wire condition exists. That is, a signal wire is disconnected from the channel or the RTB is removed from the module.
		–		If this condition exists, confirm that you are using one of these RTBs: 5069-RTB14CJC-SPRING, 5069-RTB14CJC-SCREW	
Chxx.OverTemperature	BOOL	The temperature of the module is higher than its operating limits. If this tag is set to 1 but a fault does not exist on the channel, this tag is only an indication of operating conditions but the channel is functioning. If this tag is set to 1 and a fault exists on the channel, the channel is not functioning.			0 = Module temperature is not over the operating limits 1 = Module temperature is over the operating limits
Chxx.FieldPowerOff, CJChxx.FieldPowerOff	BOOL	Field power is present or not present at the channel. Field power is provided through the SA power connector on the controller, EtherNet/IP™ adapter, or field potential distributor.			0 = Field Power is present 1 = Field Power is not present
Chxx.NotANumber	BOOL	Indicates that the last value received for the channel input data value was not a number.			0 = Last received channel data was a number 1 = Last received channel data was not a number
Chxx.Underrange, CJChxx.Underrange	BOOL	Indicates that the channel data is below the underrange threshold for this channel. For example, when the channel operates in the 4...20 mA input range, the underrange threshold on the channel is ≤ 3.0 mA. If the input signal is 0 mA, this tag is set to 1.		The cold junction at the channel is below the minimum of its operating range.	0 = Channel data is not beneath the underrange threshold/absolute minimum 1 = Channel data is beneath the underrange threshold/absolute minimum
Chxx.Overrange, CJChxx.Overrange	BOOL	Indicates that the channel data is above the overrange threshold for this channel. For example, when the channel operates in the 4...20 mA output range, the overrange threshold on the channel is ≥ 23.0 mA. If the input signal is 24 mA, this tag is set to 1.		The cold junction at the channel is above the maximum of its operating range.	0 = Channel data is not above the overrange threshold/absolute minimum 1 = Channel data is above the overrange threshold/ absolute minimum
CJChxx.Temperature	REAL	–		Current temperature of the cold junction in °C. This tag **must** use °C.	Any
Chxx.LLAlarm	BOOL	Triggered when the input data value is less than the Low Low alarm value.			0 = Alarm is not triggered 1 = Alarm is triggered
		If latched, this alarm remains triggered until unlatched. If not latched, the alarm clears after the input data value is greater than the Low Low limit and the Alarm Deadband.		If latched, this alarm remains triggered until unlatched or if the input data value is within Deadband.	

Input Tags - 5069-IF4IH, 5069-IF8, 5069-IY4, 5069-IY4K (Continued)

Name	Size	Definition			Valid Values
		5069-IF4IH	5069-IF8	5069-IY4, 5069-IY4K	
Chxx.LAlarm	BOOL	Triggered when the input data value is less than the Low alarm value. If latched, this alarm remains triggered until unlatched. If not latched, the alarm clears after the input data value is greater than the Low limit and the Alarm Deadband.			0 = Alarm is not triggered 1 = Alarm is triggered
Chxx.HAlarm	BOOL	Triggered when the input data value is greater than the High alarm value. If latched, this alarm remains triggered until unlatched. If not latched, the alarm clears after the input data value is less than the High limit and the Alarm Deadband.		If latched, this alarm remains triggered until unlatched or if the input data value is within Deadband.	0 = Alarm is not triggered 1 = Alarm is triggered
Chxx.HHAlarm	BOOL	Triggered when the input data value is greater than the High High alarm value. If latched, this alarm remains triggered until unlatched. If not latched, the alarm clears after the input data value is less than the High High limit and the Alarm Deadband.		If latched, this alarm remains triggered until unlatched or if the input data value is within Deadband.	0 = Alarm is not triggered 1 = Alarm is triggered
Chxx.RateAlarm	BOOL	Triggered when the change between consecutive channel samples divided by the time when the samples were taken exceeds the Rate Alarm. If latched, this tag remains set until it is unlatched.			0 = Alarm is not triggered 1 = Alarm is triggered
Chxx.CalFault	BOOL	Indicates that the last attempted Calibration for this channel failed or there is no calibration data present. This tag is cleared, that is, set to 0, when power is cycled to the module.			0 = Calibration did not fail 1 = Calibration failed
Chxx.Calibrating	BOOL	Indicates that the channel calibration is in progress.			0 = Channel calibration is not in progress 1 = Channel calibration is in progress
Chxx.CalGoodLowRef	BOOL	–	Indicates that a valid Low Reference signal has been sampled on this channel. **IMPORTANT**: This tag is available only when you select the Data with Calibration connection type in the Module Definition. If you select the Data connection type, this tag does not appear in the module tags. For more information, see Module Definition.		0 = Valid Low Reference signal has not been sampled on this channel 1 = Valid Low Reference signal has been sampled on this channel
Chxx.CalBadLowRef	BOOL		Indicates that an invalid Low Reference signal has been sampled on the channel. You must correct this condition to calibrate the module. If calibration is aborted with an invalid Low Reference signal, the Chxx.CalFault tag is set for this channel until a successful calibration is performed. **IMPORTANT**: This tag is available only when you select the Data with Calibration connection type in the Module Definition. If you select the Data connection type, this tag does not appear in the module tags. For more information, see Module Definition.		0 = Invalid Low Reference signal has not been sampled on this channel 1 = Invalid Low Reference signal has been sampled on this channel
Chxx.CalGoodHighRef	BOOL		Indicates that a valid High Reference signal has been sampled on this channel. **IMPORTANT**: This tag is available only when you select the Data with Calibration connection type in the Module Definition. If you select the Data connection type, this tag does not appear in the module tags. For more information, see Module Definition.		0 = Valid High Reference signal has not been sampled on this channel 1 = Valid High Reference signal has been sampled on this channel
Chxx.CalBadHighRef	BOOL		Indicates that an invalid High Reference signal has been sampled on this channel. You must correct this condition to calibrate the module. If calibration is aborted with an invalid High Reference signal, the Chxx.CalFault tag is set for this channel until a successful calibration is performed. **IMPORTANT**: This tag is available only when you select the Data with Calibration connection type in the Module Definition. If you select the Data connection type, this tag does not appear in the module tags. For more information, see Module Definition.		0 = Invalid High Reference signal has not been sampled on this channel 1 = Invalid High Reference signal has been sampled on this channel
Chxx.CalSuccessful	BOOL		Indicates that calibration on this channel is complete and the Calibrating state has been exited. This tag remains set after valid calibration as long as the connection is open. **IMPORTANT**: This tag is available only when you select the Data with Calibration connection type in the Module Definition. If you select the Data connection type, this tag does not appear in the module tags. For more information, see Module Definition.		0 = Calibration was not successful 1 = One of the following: • Calibration is complete and successful. • Calibration data is present and applied.
Chxx.Data	REAL	Channel data in scaled Engineering engineering units.			Any positive or negative value.
Chxx.RollingTimestamp	INT	A 15 timer that runs continuously and counts in milliseconds. The value of RollingTimestamp is recorded whenever a module scans its channels. The controller program uses the last two rolling timestamp values to calculate the amount of time between the samples.			0...32767

Output Tags - 5069-IF4IH, 5069-IF8, 5069-IY4, 5069-IY4K

Name	Size	Definition	Valid Values
Chxx.LLAlarmEn	BOOL	Enables the Low Low alarm. **IMPORTANT**: To use this alarm, you must set the tag to 1 **and** verify that the Chxx.AlarmDisable tag for the same channel is set to 0. If all alarms are disabled, the Low Low alarm cannot be enabled.	0 = Alarm is disabled 1 = Alarm is enabled
Chxx.LAlarmEn	BOOL	Enables the Low alarm. **IMPORTANT**: To use this alarm, you must set the tag to 1 **and** verify that the Chxx.AlarmDisable tag for the same channel is set to 0. If all alarms are disabled, the Low alarm cannot be enabled.	0 = Alarm is disabled 1 = Alarm is enabled
Chxx.HAlarmEn	BOOL	Enables the High alarm. **IMPORTANT**: To use this alarm, you must set the tag to 1 **and** verify that the Chxx.AlarmDisable tag for the same channel is set to 0. If all alarms are disabled, the High alarm cannot be enabled.	0 = Alarm is disabled 1 = Alarm is enabled

Output Tags - 5069-IF4IH, 5069-IF8, 5069-IY4, 5069-IY4K

Name	Size	Definition	Valid Values
Chxx.HHAlarmEn	BOOL	Enables the High High alarm. **IMPORTANT**: To use this alarm, you must set the tag to 1 **and** verify that the Chxx.AlarmDisable tag for the same channel is set to 0. If all alarms are disabled, the High High alarm cannot be enabled.	0 = Alarm is disabled 1 = Alarm is enabled
Chxx.RateAlarmEn	BOOL	Enables the Rate alarm. **IMPORTANT**: To use this alarm, you must set the tag to 1 **and** verify that the Chxx.AlarmDisable configuration tag for the same channel is set to 0. If all alarms are disabled, the Rate alarm cannot be enabled.	0 = Alarm is disabled 1 = Alarm is enabled
Chxx.LLAlarmUnlatch	BOOL	Unlatches a latched Low Low Alarm when the bit first transitions from 0 to 1.	0 = Low Low Alarm remains latched 1 = Low Low Alarm unlatches
Chxx.LAlarmUnlatch	BOOL	Unlatches a latched Low Alarm when the bit first transitions from 0 to 1.	0 = Low Alarm remains latched 1 = Low Alarm unlatches
Chxx.HAlarmUnlatch	BOOL	Unlatches a latched High Alarm when the bit first transitions from 0 to 1.	0 = High Alarm remains latched 1 = High Alarm unlatches
Chxx.HHAlarmUnlatch	BOOL	Unlatches a set High High Alarm when the bit first transitions from 0 to 1.	0 = High High Alarm remains latched 1 = High High Alarm unlatches
Chxx.RateAlarmUnlatch	BOOL	Unlatches a set Rate Alarm when the bit first transitions from 0 to 1.	0 = Rate Alarm remains latched 1 = Rate Alarm unlatches
Chxx.Calibrate	BOOL	Initiates the Calibration process. This tag must remain set until a valid Low Reference and High Reference values are applied to the input. If the tag value transitions to 0 before calibration is finished, the process stops and calibration fails.	0 = Calibration process is not started 1 = Calibration process is started
Chxx.CalLowRef	BOOL	The rising edge triggers the Low Calibration at the Low Reference Point for the current input range value. A valid Low Reference signal must be connected to the channel before you set this tag. **IMPORTANT**: This tag is available only when you select the Data with Calibration connection type in the Module Definition. If you select the Data connection type, this tag does not appear in the module tags. For more information, see Module Definition.	0 = Low Reference Signal is not applied to the RTB 1 = Low Reference Signal is applied to RTB
Chxx.CalHighRef	BOOL	The rising edge triggers a High Calibration at the High Reference Point for the current input range value. A valid High Reference signal must be connected to the channel before you set this tag. **IMPORTANT**: This tag is available only when you select the Data with Calibration connection type in the Module Definition. If you select the Data connection type, this tag does not appear in the module tags. For more information, see Module Definition.	0 = High Reference Signal is not applied to the RTB 1 = High Reference Signal is applied to RTB
Chxx.SensorOffset	REAL	Compensates for any known offset error on the sensor or channel to which the sensor is connected, and is in terms of engineering units. The value of this tag is added to the measured value in engineering units and is used in the Chxx.Data input tag.	Any valid float value, 0.0 = default We recommend that you use a value in the channel's operating range.

Output Module Tags

These tables describe the tags that are associated with the 5069-OF4, 5069-OF4K, 5069-OF4IH, and 5069-OF8 modules. For more information, see View the Tags.

Configuration Tags - 5069-OF4, 5069-OF4K, 5069-OF4IH, 5069-OF8

Name	Size	Definition	Valid Values	
			5069-OF4IH	5069-OF4, 5069-OF4K, 5069-OF8
Chxx.Range	SINT	Channel's operating range	-	0 = -10...10V 1 = 0...5V 2 = 0...10V 4 = 0...20 mA 5 = 4...20 mA
Chxx.AlarmDisable	BOOL	Disables all alarms on the channel.	0 = Alarms are enabled 1 = Alarms are disabled (default)	
Chxx.LimitAlarmLatchEn	BOOL	Configures Limit alarms to latch until they are explicitly unlatched.	0 = Latching disabled (default) 1 = Latching enabled	
Chxx.RampAlarmLatchEn	BOOL	Latches Ramp alarm when set so that it does not clear until manually unlatched.	0 = Latching disabled (default) 1 = Latching enabled	
Chxx.NoLoadEn	BOOL	Enable the input No Load diagnostic	0 = Disabled (default) 1 = Enabled	
Chxx.Disable	BOOL	Disables the channel.	0 = Channel is enabled (default) 1 = Channel is disabled	
Chxx.FaultMode	BOOL	Determines output action when a connection fault occurs. At the fault occurrence, the output holds its last state or transitions to the value set in the Fault Value parameter. The channel continues the Fault Mode for the length of time set in the Fault Value State Duration parameter.	0 = Transition to user-defined value 1 = Hold Last State (default)	
Chxx.ProgMode	BOOL	Determines output action when the controller transitions to Program mode or the connection to the module is inhibited. At the transition to Program mode, the output holds its last state or transitions to the value set in the Program Value parameter.	0 = Transition to user-defined value 1 = Hold Last State (default)	
Chxx.ProgramToFaultEn	BOOL	Determines channel action if a connection faults while the module is in a safe state for Program mode. The channel can remain in the safe state for Program mode or transition to a safe state for Fault mode. If the channel remains in a safe state for Program mode, the Final Fault State parameter is ignored.	0 = Remains in the Program state 1 = Transitions to the safe state for the Fault mode	
Chxx.RampInRun	BOOL	Enables Output Ramping when the module is in Run mode. Output changes in Run mode are limited to the Maximum Ramp Rate value.	0 = Ramping disabled (default) 1 = Ramping enabled in Run mode	
Chxx.RampToProg	BOOL	Enables Output Ramping when the controller transitions to Program mode. Output changes in Program mode are limited to the Maximum Ramp Rate value.	0 = Ramping disabled (default) 1 = Ramping enabled to Program mode state	
Chxx.RampToFault	BOOL	Enables Output Ramping when the connection to the module faults. Output transitions to FaultValue and FaultFinalState are limited to the MaximumRampRate.	0 = Ramping disabled (default) 1 = Ramping enabled to Fault mode state	
Chxx.HoldForInit	BOOL	Instructs the channel to hold the last signal until it is initialized with a value within 0.1% of full-scale of its current value when one of these conditions occurs. • Module initial connection (power up) • Controller transition from Program mode back to Run mode • Module re-establishes communication after a fault • SA power is restored after being lost.	0 = Output 0.Chxx.Data signal immediately 1 = Hold last signal until initialization match	
Chxx.FaultValue StateDuration	SINT	Determines the length of time the FaultMode or FaultValue parameter value is held before the Final Fault State.	0 = Hold forever (default) 1, 2, 5, or 10 seconds	
Chxx.MaxRampRate	REAL	Maximum rate at which the channel can transition to in Engineering Units/s. This tag is used only if at least one of these output ramping modes is enabled: • Ramp In Run • Ramp To Fault • Ramp To Program	Any value ≥ 0.0 1,000,000.00 = default If the MaxRampRate = 0.0, the ramp rate is limited to ramping the range full scale in one RPI.	
Chxx.LowSignal	REAL	Corresponds to the low engineering term when scaled, and is in terms of the input signal units.	**Current mode** - Any value less than the high signal in the range. • 0 = default for 0...20 mA range • 4 = default for 4...20 mA **Voltage mode** - Any value less than the high signal in the range. • -10 = default for -10...10V range • 0 = default for 0...5V and 0...10V range	
Chxx.HighSignal	REAL	Corresponds to the high engineering term when scaled, and is in terms of the input signal units.	**Current mode** - Any value greater than the low signal in the range, 20 = default for either current input range **Voltage mode** - Any value greater than the low signal in the range. • 10 = default for 0...10V and -10...10V ranges • 5 = default for 0...5V range	
Chxx.LowEngineering	REAL	Determines the engineering units that the signal values scale into. Corresponds to the low signal value.	Current mode - Any value less than the high engineering value, 0.0 = default Voltage mode - Any value less than the high engineering value, Low signal = default. For example, with the -10...10V range, the default = -10.	

Configuration Tags - 5069-OF4, 5069-OF4K, 5069-OF4IH, 5069-OF8 (Continued)

Name	Size	Definition	Valid Values	
			5069-OF4IH	5069-OF4, 5069-OF4K, 5069-OF8
Chxx.HighEngineering	REAL	Determines the engineering units that the signal values scale into. Corresponds to the high signal value.	**Current mode** - Any value greater than the low engineering value, 100.0 = default **Voltage mode** - Any value greater than the low engineering value, High signal = default. For example, with the -10...10V range, the default = 10.	
Chxx.LowLimit	REAL	The lowest value to which the output can go based on the operating range that the Output Clamping feature establishes. The tag value is in engineering units.	Any value lower than the HighLimit 0.0 = default	
Chxx.HighLimit	REAL	The highest value to which the output can go based on the operating range that the Output Clamping feature establishes. The tag value is in engineering units.	Any value higher than the LowLimit 0.0 = default	
Chxx.Offset	REAL	Compensates for any known error on the sensor or channel to which the sensor is connected. The tag value is in engineering units.	Any value - We recommend that you use a small value. 0.0 = default	
Chxx.FaultValue	REAL	The output changes to this value if these events exist. • Fault Mode = 0 • Either of the following: – The controller is in Run mode and the connection is lost – The controller is in Program mode, the connection is lost, and the ProgamToFaultEn tag is set	Any value 0.0 = default	
Chxx.ProgValue	REAL	The channel changes to this value if these events exist. • Program Mode = 0 • Controller transitions to Program mode	Any value 0.0 = default	
Chxx.FaultFinalState	REAL	The channel changes to this value if these events exist. • Connection is lost • The time that the FaultValueStateDuration parameter defines has been exceeded Output transitions to FaultValue and FaultFinalState are limited to the MaximumRampRate.	Any value 0.0 = default	

Input Tags - 5069-OF4, 5069-OF4K, 5069-OF4IH, 5069-OF8

Name	Size	Definition		Valid Values
		5069-OF4IH	5069-OF4, 5069-OF4K, 5069-OF8	
RunMode	BOOL	Indicates the operating state of the channel.		0 = Idle 1 = Run
ConnectionFaulted	BOOL	Indicates if there is a connection or not.		0 = Connected 1 = Not connected
DiagnosticActive	BOOL	Indicates if any diagnostics are active.		0 = No diagnostics active 1 = One or more diagnostics are active
DiagnosticSequenceCount	SINT	Increments for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected. Wraps from 255 or -1 to 1, and skips zero. A module reset or power cycle sets this bit to 0.		-128...+127
Chxx.Fault	BOOL	Indicates that channel data is inaccurate and cannot be trusted for use in the application. If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.		0 = Good 1 = Bad, causes a fault These are the typical causes of fault data. • Channel is disabled • No Load condition • Short Circuit condition We recommend that you first troubleshoot the module to see if the typical causes exist.
Chxx.Uncertain	BOOL	Indicates that the channel data may be inaccurate but the degree of inaccuracy is not known. If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.		0 = Good data 1 = Uncertain data These are the typical causes of uncertain data. • Data signal outside the channel operating range • The channel is slightly over temperature. • Invalid sensor offset value • Calibration fault on the channel • Calibration is in process on the channel We recommend that you first troubleshoot the module to see if the typical causes exist.
Chxx.NoLoad	BOOL	The signal wire is disconnected from the channel or the RTB is removed from the module. This condition is detected only when the channel is used in current mode.		0 = No Load condition does not exist 1 = No Load condition exists. That is, a signal wire is disconnected from the channel or the RTB is removed from the module.
Chxx.ShortCircuit	BOOL	A Short Circuit or Overcurrent condition exists. This condition is detected only when the channel is used in voltage mode.		0 = No Short Circuit or Overcurrent condition exists 1 = Short Circuit or Overcurrent condition exists
Chxx.OverTemperature	BOOL	The module is higher temperature than its operating limits. If this tag is set to 1 but a fault does not exist on the channel, this tag is only an indication of operating conditions but the channel is functioning. If this tag is set to 1 and a fault exists on the channel, the channel is not functioning.		0 = Module temperature is not over the operating limits 1 = Module temperature is over the operating limits

Input Tags - 5069-OF4, 5069-OF4K, 5069-OF4IH, 5069-OF8 (Continued)

Name	Size	Definition		Valid Values
		5069-OF4IH	5069-OF4, 5069-OF4K, 5069-OF8	
Chxx.FieldPowerOff	BOOL	Field power is not present at the channel. Field power is provided through the SA power connector on the controller, EtherNet/IP adapter, or field potential distributor.		0 = Field Power is present 1 = Field Power is not present
Chxx.InHold	BOOL	Indicates that the channel is holding until the received data value is within 0.1% range full-scale of the current data value.		0 = Channel is not holding 1 = Channel is holding
Chxx.NotANumber	BOOL	Indicates that the last value received for the channel output data value was not a number.		0 = Last received channel data was a number 1 = Last received channel data was not a number
Chxx.Underrange	BOOL	Indicates that the channel data is beneath the underrange threshold for this channel. For example, when the channel operates in the 4...20 mA output range, the underrange threshold on the channel is ≤ 3.6 mA. If the output signal is 0 mA, this tag is set to 1.		0 = Channel data is not beneath the underrange threshold 1 = Channel data is beneath the underrange threshold
Chxx.Overrange	BOOL	Indicates that the channel data is above the overrange threshold for this channel. For example, when the channel operates in the 4...20 mA output range, the overrange threshold on the channel is ≥ 21.0 mA. If the output signal is 21 mA, this tag is set to 1.		0 = Channel data is not above the overrange threshold 1 = Channel data is above the overrange threshold
Chxx.LLimitAlarm	BOOL	Triggered when the requested output value is below the configured Low Limit value. It remains set until the requested output is above the Low Limit. If the Chxx.AlarmDisable tag is set to 1, that is, the output signal is still clamped at the Low Limit value. But the Low Limit alarm is not triggered.		0 = Alarm is not triggered 1 = Alarm is triggered
Chxx.HLimitAlarm	BOOL	Triggered when the requested output value is above the configured High Limit value. It remains set until the requested output is below the High Limit. If the Chxx.AlarmDisable tag is set to 1, that is, the output signal is still clamped at the High Limit value. But the High Limit alarm is not triggered.		0 = Alarm is not triggered 1 = Alarm is triggered
Chxx.RampAlarm	BOOL	Indicates that the analog output has been commanded to change value in a way such that the Maximum Ramp Rate is exceeded		0 = Alarm is not triggered 1 = Alarm is triggered
Chxx.CalFault	BOOL	Indicates that the last attempted Calibration for this channel failed. This tag is cleared, that is, set to 0, when power is cycled to the module.		0 = Calibration did not fail 1 = Calibration failed
Chxx.Calibrating	BOOL	Indicates that the channel calibration is in progress.		0 = Channel calibration is not in progress 1 = Channel calibration is in progress
Chxx.CalGoodLowRef	BOOL	-	Indicates that a valid Low Reference measurement was passed through the output tag to the module. **IMPORTANT**: This tag is available only when you select the Data with Calibration connection type in the Module Definition. If you select the Data connection type, this tag does not appear in the module tags. For more information, see Module Definition.	0 = Valid Low Reference measurement was not passed to the module 1 = Valid Low Reference measurement was passed to the module
Chxx.CalBadLowRef	BOOL		Indicates that an invalid Low Reference signal has been sampled on the channel. You must correct this condition to calibrate the module. If calibration is aborted with an invalid Low Reference signal, the Chxx.CalFault tag is set for this channel until a successful calibration is performed. **IMPORTANT**: This tag is available only when you select the Data with Calibration connection type in the Module Definition. If you select the Data connection type, this tag does not appear in the module tags. For more information, see Module Definition.	0 = Invalid Low Reference signal has not been sampled on this channel 1 = Invalid Low Reference signal has been sampled on this channel
Chxx.CalGoodHighRef	BOOL		Indicates that a valid High Reference measurement was passed through the output tag to the module. **IMPORTANT**: This tag is available only when you select the Data with Calibration connection type in the Module Definition. If you select the Data connection type, this tag does not appear in the module tags. For more information, see Module Definition.	0 = Valid High Reference measurement was not passed to the module 1 = Valid High Reference measurement was passed to the module
Chxx.CalBadHighRef	BOOL		Indicates that an invalid High Reference signal has been sampled on this channel. You must correct this condition to calibrate the module. If calibration is aborted with an invalid High Reference signal, the Chxx.CalFault tag is set for this channel until a successful calibration is performed. **IMPORTANT**: This tag is available only when you select the Data with Calibration connection type in the Module Definition. If you select the Data connection type, this tag does not appear in the module tags. For more information, see Module Definition.	0 = Invalid High Reference signal has not been sampled on this channel 1 = Invalid High Reference signal has been sampled on this channel
Chxx.CalSuccessful	BOOL		Indicates that calibration on this channel is complete and the Calibrating state has been exited. This tag remains set after valid calibration as long as the connection is open. **IMPORTANT**: This tag is available only when you select the Data with Calibration connection type in the Module Definition. If you select the Data connection type, this tag does not appear in the module tags. For more information, see Module Definition.	0 = Calibration was not successful 1 = Calibration is complete and successful.
Chxx.Data	REAL	Indicates the current RTB output signal value in scaled engineering units.		Any positive or negative value.
Chxx.RollingTimestamp	INT	A 15 timer that runs continuously and counts in milliseconds. Whenever the data echo value changes, the output module updates the value of the RollingTimestamp.		0...32767

Output Tags - 5069-OF4, 5069-OF4K, 5069-OF4IH, 5069-OF8

Name	Size	Definition	Valid Values
Chxx.LLimitUnlatch	BOOL	Unlatches a latched Low Limit alarm when the bit first transitions from 0 to 1.	0 = Alarm remains latched (default) 1 = Alarm is unlatched
Chxx.HLimitUnlatch	BOOL	Unlatches a latched High Limit alarm when the bit first transitions from 0 to 1.	0 = Alarm remains latched (default) 1 = Alarm is unlatched
Chxx.RampAlarmUnlatch	BOOL	Unlatches a latched Ramp alarm when the bit first transitions from 0 to 1.	0 = Alarm remains latched (default) 1 = Alarm is unlatched
Chxx.Calibrate	BOOL	Initiates the Calibration process. This tag must remain set until a valid Low Reference and High Reference values are applied to the channel.	0 = Calibration process is not started (default) 1 = Calibration process is started
Chxx.CalOutputLowRef	BOOL	When this bit transitions from 0 to 1, it instructs the channel to produce the Low Calibration Reference Point for the chosen current or voltage output range.	0 = Do not output Cal Low Reference 1 = Output Calibration Low Reference Do not set this tag and the CalOutputHighRef tag to 1 simultaneously.
Chxx.CalOutputHighRef	BOOL	When this bit transitions from 0 to 1, it instructs the channel to produce the High Calibration Reference Point for the chosen current or voltage output range.	0 = Do not Output Cal High Reference 1 = Output Calibration High Reference Signal Do not set this tag and the CalOutputLowRef tag to 1 simultaneously.
Chxx.CalLowRefPassed	BOOL	A transition from 0 to 1 indicates that the Chxx.Data output tag data contains the recorded Low Reference value for the channel that the module uses in Calibration.	0 = Not sending Recorded Cal Low Ref 1 = Sending Recorded Cal Low Reference in Output Data for Calibration Verification
Chxx.CalHighRefPassed	BOOL	A transition from 0 to 1 indicates that the Chxx.Data output tag data contains the recorded High Reference value for the channel that is the module uses in Calibration.	0 = Not sending Cal High Reference 1 = Sending recorded Calibration High Reference Signal in Output Data for Calibration Verification
Chxx.CalFinishCalibration	BOOL	Data value change that triggers the channel to complete the Calibration procedure, and to apply the received valid Low and High References. Channel exits the Calibration state if successful.	0 = Channel not triggered to complete the calibration procedure 1 = Channel triggered to complete the calibration procedure
Chxx.Data	REAL	The value that is converted to the signal on the RTB in scaled engineering units.	Any valid engineering unit

HART Device Tags

These tables describe the tags that are associated with HART devices.

Input Tags - HART Devices

Name	Data Type	Definition		Valid Values
RunMode	BOOL	Channel operating state		0 = Idle 1 = Run
ConnectionFaulted	BOOL	Indicates if there is a connection or not.		0 = Connected 1 = Not connected
DiagnosticActive	BOOL	Indicates if any diagnostics are active or if the prognostics threshold is reached. This bit is set when any of these conditions exist: • Any channel Fault is set • HART CMD #48 returns nonzero data • Malfunction is set • MoreStatusAvailable is set • CurrentMismatch is set		0 = No diagnostics active 1 = One or more diagnostics are active or the prognostics threshold is reached
DiagnosticSequenceCount	SINT	Increments for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected. Wraps from 255 or -1 to 1, and skips zero. A device reset or power cycle sets this bit to 0.		-128...+127
CurrentSaturated	BOOL	The loop current has reached its upper (or lower) endpoint limit and cannot increase (or decrease) any further.		0 = Current not saturated 1 = Current saturated
CurrentFixed	BOOL	The loop current is being held at a fixed value and is not responding to process variations.		0 = Current not fixed 1 = Current fixed
MoreStatusAvailable	BOOL	More status information is available than can be returned in the Field Device Status. HART CMD #48, Read Additional Status Information, provides this additional status information.		0 = More status not available 1 = More status available
CurrentMismatch	BOOL	Set to 1 if the HART digital value does not match analog module channel value.		0 = Current match 1 = Current mismatch
ConfigurationChanged	BOOL	Set to 1 after the HART device configuration changes and the module retrieves all HART device configuration data that the Get HART Device Information service returns. The Studio 5000 Logix Designer application uses this bit to perform logic when the HART device configuration has changed. For more information on how to use the command, see Configuration Change Notification. **Note:** If the HART device does not support HART CMD #38, only the first configuration change after the device start up can be detected and ConfigurationChanged in the input tag is set. All configuration changes after that are not detectable and ConfigurationChanged in the input tag is not set for these changes.		0 = Configuration not changed 1 = Configuration changed
Malfunction	BOOL	Indicates that the device detects a hardware error or failure. Further information may be available through HART CMD #48.		0 = No hardware error or failure is detected 1 = Hardware error or failure is detected
LoopCurrent.Fault	BOOL	For PlantPAx® connections only	The bit is set to 1 in these conditions. • Device Malfunction in Field Device Status is set in the response of HART CMD #3/#9. • Loop Current Saturated in Field Device Status is set in the response of any HART command. • The command response returns any of these items. – HART command is not successful – No valid command response after three attempts – Communication error – Response Code indicates an error • The value that is returned is NAN (there are no reported cases of this). • The Underrange or Overrange bit is set.	0 = Normal good data 1 = Data is definitely bad
LoopCurrent.Uncertain	BOOL		This tag is to 1 when Loop Current Fixed in the Field Device Status is set in response to HART CMD #3.	0 = No question about data validity 1 = Data validity is questionable
LoopCurrent.Underrange	BOOL		The input signal at the channel is less than or equal to the minimum detectable signal.	0 = Loop Current > 3.8 mA 1 = Loop Current is ≤ 3.6 mA
LoopCurrent.Overrange	BOOL		The input signal at the channel is greater than or equal to the maximum detectable signal.	0 = Loop Current is < 20.5 mA 1 = Loop Current is ≥ 21.0 mA
LoopCurrent.Data	REAL		Current loop current value, Floating Point.	Any positive or negative value
LoopCurrent.RollingTimestamp	INT		A 15-bit timer that runs continuously and counts in milliseconds (unrelated to the CST). The value of RollingTimestamp is recorded whenever a module scans its channels. The controller program uses the last two rolling timestamp values to calculate the amount of time between the samples.	0...32767

Input Tags - HART Devices (Continued)

Name	Data Type	Definition		Valid Values
<NameOfVariable>.Ch.Fault	BOOL	Indicates that the data is inaccurate and cannot be trusted for use in the application. • <NameOfVariable> could be PV, SV, TV, QV, or <NameOfDeviceVariable> • For PlantPAx connections only - <NameOfVariable> could be LoopCurrent **IMPORTANT:** Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0. The bit is set to 1 in these conditions. • Device Malfunction in the field device status is set in the response of the command to retrieve this HART variable. • The command response returns any of these items. – HART command is not successful – No valid command response after three attempts – Communication error – Response Code indicates an error • The HART variable value that is returned is NAN. • The device variable status indicates "process data status bad". • If this Device Variable is PV – when "primary variable out of limits in the field device status" is set in the response of the command to retrieve PV. • For HART 5 and 6 devices, and if this variable is SV, TV, or QV, when "non PV out of limits in field device status" is set in the response of the command to retrieve this HART variable. • The Underrange or Overrange bit is set.		0 = Good 1 = Bad, causes a fault
<NameOfVariable>.Ch.Uncertain	BOOL	Indicates that the channel data can be inaccurate but the degree of inaccuracy is not known. **IMPORTANT:** Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0. The bit is set to 1 in these conditions. • The device variable status is Process Data Status Manual/Fixed or Poor Accuracy. • The device variable status is Limit Status Constant and process data status is Not Bad.		0 = Good data 1 = Uncertain data
<NameOfVariable>.Ch.Underrange	BOOL	Indicates that the input signal at the channel is less than, or equal to, the minimum detectable signal. The bit is set to 1 when the device variable status is Low Limited.		0 = Not underrange 1 = Underrange
<NameOfVariable>.Ch.Overrange	BOOL	Indicates that the input signal at the channel is greater than, or equal to, the maximum detectable signal. The bit is set to 1 when the device variable status is High Limited.		0 = Not overrange 1 =Overrange
<NameOfVariable>.Ch.Data	REAL	The last good value received from the device. If a value has not yet been received from the device, the value is 0.0.		Any positive or negative value
<NameOfVariable>. Ch.RollingTimestamp	INT	A 15-bit timer that runs continuously and counts in milliseconds. It is not related to CIP Sync™. The value of RollingTimestamp is recorded whenever a module scans its channels. The controller program uses the last two rolling timestamp values to calculate the amount of time between the samples.		0...32767
<NameOfVariable>.Class	USINT	Device Variable Classification If the HART device does not support device variables, this bit is set to 0.		0...255
<NameOfVariable>.Unit	USINT	Unit code of the variable.		0...255
<NameOfVariable>.Manual	BOOL	Indicates that the data value is manually controlled. It is set to 1 when the device variable status is Process Data Status Manual/Fixed and the limit status is Not Limited.		0 = Data is not manual 1 = Data is manual
<NameOfVariable>.Constant	BOOL	Indicates that the data value is constant. It is set to 1 when the variable status is Constant.		0 = Data is not constant 1 = Data is constant
Static.Fault	BOOL	For PlantPAx connections only	Indicates if the set of static data is valid.	0 = Static data is good 1 = Static data is bad
Static.PVUnit	USINT		Unit code of PV.	1...253
Static.HARTRevision	USINT		HART protocol major revision number.	5, 6, or 7
Static.HARTTagName	STRING		Assigned name of HART device. Same as Identity attribute 15.	String with 32 characters, max
Static.Descriptor	STRING		Descriptor of HART device.	String with 16 characters, max
Static.PVAtSignal4	REAL		PV Lower Range value.	Any value less than Static.PVAtSignal20
Static.PVAtSignal20	REAL		PV Higher Range value.	Any value greater than Static.PVAtSignal4
Static.AdditionalDeviceStatus	SINT[25]		Additional Device Status from HART CMD #48.	0 = More status not available 1 = More status available
ChDataAtSignal4	REAL		This member is the engineering unit value of 4 mA according to the corresponding analog input channel configuration of the module.	Any value less than ChDataAtSignal20
ChDataAtSignal20	REAL		This member is the engineering unit value of 20 mA according to the corresponding analog input channel configuration of the module.	Any value greater than ChDataAtSignal4
<NameOfCommand>.ReadyToExecute	BOOL	Indicates that the data value is constant and that it is ready for a new command execution. The bit is set to 1 when the variable status is Constant. For more information, see Execute HART Commands Through Producer/Consumer Data.		0 = Ready to accept a new execution 1 = Not ready to accept a new execution
<NameOfCommand>.Completed	BOOL	Indicates that the command execution is complete. For more information, see Execute HART Commands Through Producer/Consumer Data.		0 = No command has been completed or the current command execution is in progress 1 = Execution has been completed
<NameOfCommand>.Active	BOOL	Indicates that the command execution is on-going. For more information, see Execute HART Commands Through Producer/Consumer Data.		0 = No command has been completed or the current command execution is in progress 1 = Execution has been completed

Input Tags - HART Devices (Continued)

Name	Data Type	Definition	Valid Values
<NameOfCommand>.Overlap	BOOL	Indicates that it has received a new command execution request while the current execution is still on-going. The bit returns to 0 only when a new command execution successfully starts. For more information, see Execute HART Commands Through Producer/Consumer Data.	0 = No overlapped execution request received after the last successfully started command execution 1 = Overlapped execution request received
<NameOfCommand>.ERR	BOOL	Indicates that an unexpected result occurred for the latest command execution. These are the possible error conditions. • Command timeout • HART communication status bit set • HART I/O module detects a communications error • *ResponseCode* value in the response packet indicates an error. The bit is cleared when a new execution is requested.	0 = No error in latest execution 1 = Error in latest execution
<NameOfCommand>.Warning	BOOL	Indicates that the ResponseCode value in the response packet includes a warning. The bit returns to 0 when a new execution is requested.	0 = No warning in latest execution 1 = Warning in latest execution
<NameOfCommand>.ParameterError	BOOL	Indicates that one of the request parameter values cannot be converted from CIP™ to HART. The bit returns to 0 when a new execution successfully starts with a valid request parameter. For more information, see Execute HART Commands Through Producer/Consumer Data.	0 = No parameter error in latest execution 1 = Parameter error in latest execution
<NameOfCommand>. ParameterErrorNumber	SINT	If ParameterError = 1, this value indicates the index of the first request parameter that contains a value that cannot be converted from CIP to HART. This number is zero-based. **Note:** Command request parameters that are not included in the consumer assembly (constants) are not included in the numbering.	0...127
<NameOfCommand>.ResponseCode	SINT	The HART command response code of the last completed command execution.	0...127
<NameOfCommand>. <CommandResponseParameterName>	Variable	Indicates the response parameter of the command. The parameter name and type come from the HART EDD file.	Variable

Output Tags - HART Devices

Name	Data Type	Definition	Valid Values
ResetConfigurationChanged	BOOL	When the HART I/O module reads this bit transition from 0 to 1, it resets the ConfigurationChanged bit in the producer data. For more information, see Configuration Change Notification.	0 = Configuration change not reset 1 = Configuration change reset
<NameOfCommand>.Execute	BOOL	When the HART I/O module reads this bit transition from 0 to 1, it initiates this HART command.	0 = HART command not executed 1 = HART command executed
<NameOfCommand>. <CommandRequestParameterName>	Variable	Request parameter of the command. The parameter name and type come from the HART EDD file.	Variable

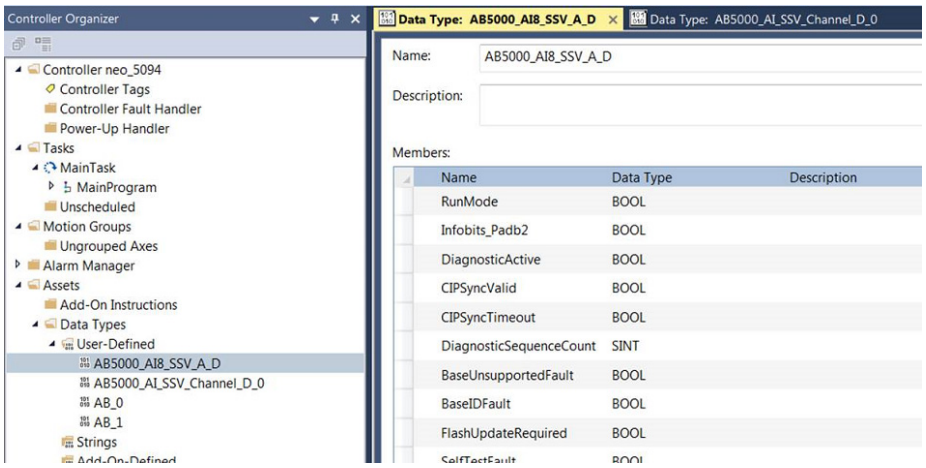
Notes:

HART I/O Module Diagnostic Assembly

This appendix explains how to create and configure Diagnostic Assembly types for the HART I/O Modules.

Create User-defined Diagnostic Assembly Types

Use the Studio 5000 Logix Designer® application to create user-defined Diagnostic Assembly and Channel Data types for the HART I/O modules. From the Controller Organizer pane, expand Data Types to configure each data type. The Channel Data types must be retrieved as a part of the Diagnostic Assemblies Instance.



IMPORTANT The members that are indicated in the tables are arranged according to the Data Alignment Rules of controllers. If you do not strictly follow the Data Type and sequence of the members that are indicated in these tables, data misalignment can occur after a Get Attribute Single Message Instruction.

HART Input Module Diagnostics

This module includes one Diagnostic Assembly with one type of Diagnostic Channel.

Analog Input 4 Channel Diagnostic Assembly

DATATYPE: AB:5000_AI4:D:1
Instance ID: 0x384 (900)
Size = 336 bytes

Member	Data Type	Bytes	Valid Values
RunMode	BOOL	1	0 = Idle 1 = Run
InfoBits_Pad1			These data types act as padding to achieve byte alignment. They can be renamed.
DiagnosticActive			0 = No diagnostics are active. 1 = One or more diagnostics are active or the prognostics threshold is reached.
CIPSyncValid			0 = CIP Sync™ is not available. 1 = CIP Sync is available.
CIPSyncTimeout			0 = A valid time leader has not timed out. 1 = A valid time leader was detected on the backplane, but the time leader has timed out. The module is using its local clock and can be drifting away from the last known time leader.
InfoBits_Pad2			These data types act as padding to achieve byte alignment. They can be renamed.
FieldPowerOff			1 = Field Power is not present. 0 = Field Power is present.
InfoBits_Pad3			These data types act as padding to achieve byte alignment. They can be renamed.
DiagnosticSequence Count	SINT		0...255 Count that increases in these conditions. • Each time a distinct diagnostic condition is detected, and • Each time a distinct diagnostic condition transitions from detected to not detected. Wraps from 255 to 1, and skips zero. A device reset or power cycle sets the count to 0.
Diagbits_Pad1... Diagbits_Pad12	BOOL	2	–
FlashUpdateRequired			0 = Flash update is not required. 1 = Flash update is required.
SelfTestFault			0 = Module initialization code did not detect an error. 1 = Module initialization code detected an error.
Diagbits_Pad13... Diagbits_Pad14			–
Pad	DINT	4	
LocalClockOffset	LINT	8	The offset in nanoseconds from the local clock to the system time. Use this value to detect steps in time. This value updates when a Precision Time Protocol (PTP) update is received.
LocalClockOffset Timestamp			The time when the Local Clock Offset was most recently sampled. The initial value is zero and the first time stamp occurs when the module synchronizes with the leader clock.
GrandMasterClockID	SINT[8]		The EUI-64 Identity of the CIP Sync Grand leader clock to which the module is synced.
FieldPowerOnTimestamp	LINT		The most recent time when the field power transitioned from off to on.
FieldPowerOffTimestamp			The most recent time when the field power transitioned from on to off.
Diag_Channel_00	User defined	288	See AB:5000_AI_Channel:D:1
Diag_Channel_01			
Diag_Channel_02			
Diag_Channel_03			

AB:5000_AI_Channel:D:1

Member	Data Type	Bytes	Valid Values
DataBits_Pad1	BOOL	2	–
Fault			0 = No fault exists. 1 = A fault exists. A fault is a roll-up of all diagnostic conditions that the module can detect and indicates bad data. If there is a detailed data type member that indicates a given detected condition, this fault member does not affect the DiagnosticActive or DiagnosticSequenceCount members. However, if there is no detailed data type for a given detected condition, this fault member triggers both the DiagnosticActive member and increases or decreases the Diagnostic Sequence Count.
Uncertain			0 = Data is valid. 1 = Data validity is uncertain. The device is operating outside of the designed operating range, or the data is under manual or override control.
OpenWire			0 = The signal wire is connected to the channel or RTB, or open wire detection is disabled. 1 = The signal wire is disconnected from the channel or RTB.
DataBits_Pad2			–
OverTemperature			0 = Module temperature is not over the operating limits. 1 = Module temperature is over the operating limits.
FieldPowerOff			0 = Field power is present. 1 = Field power is not present.
PowerOffRangeMismatch			0 = No Power Off Range mismatch. 1 = The Analog Input product has exceeded its design limit for the number of times that the range of a channel can be changed while it still supports loop current when powered off.
DataBits_Pad3... DataBits_Pad10			–
CalFault			0 = Calibration was successful. 1 = Set to 1 in these conditions. • Channel calibration was interrupted or failed. A device reset or power cycle resets CalFault. • Valid configuration data is not found in nonvolatile memory.
Underrange			0 = The input signal at the channel is greater than the minimum detectable signal. 1 = The input signal at the channel is less than the minimum detectable signal.
Overrange			0 = The input signal at the channel is less than the maximum detectable signal. 1 = The input signal at the channel is greater than the maximum detectable signal.
DiagBits_Pad1... DiagBits_Pad13			–
Pad	INT		
InternalErrorCount	SINT	1	0...255 A count of CRC failures on internal communication busses. Acts as a Threshold Diagnostic that rolls up into the channel Fault, DiagnosticActive, and DiagnosticSequence count when 5 or more failures in a row are detected. Wraps from 255 to 1, and skips zero. A device reset or power up sets the count to 0.
CalRange			0...5 The range that was used to calibrate the current channel. If a connection is open, this is the currently configured range. If a connection is not open, this is the most-recent configured range.
CalOffset	REAL	4	The Offset result of the last successful calibration.
CalGain			The Gain result of the last successful calibration.
CalLastDate	LINT	8	The time at which the most-recent calibration occurred.
OpenWire Timestamp			The most-recent time at which the signal wire was disconnected.
OverTemperatureTimestamp			The most-recent time at which the module reached a higher temperature than its operating limits.
Underrange Timestamp			The time at which the channel input signal became less than the minimum detectable signal.
Overrange Timestamp			The time at which the channel input signal became greater than the minimum detectable signal.
FieldPowerOnTimestamp			The most-recent time at which the field power transitioned from off to on.
FieldPowerOffTimestamp			The most-recent time at which the field power transitioned from on to off.

HART Output Module Diagnostics

This module includes one Diagnostic Assembly with one type of Diagnostic Channel.

Analog Output 4 Channel Diagnostic Assembly

DATATYPE: AB:5000_A04:D:1
Instance ID: 0x383 (899)
Size = 304 bytes

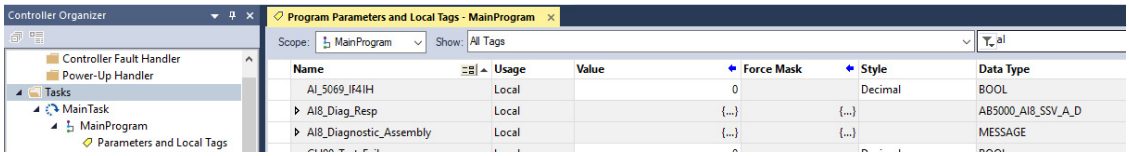
Member	Data Type	Bytes	Valid Values
RunMode	BOOL	1	0 = Idle 1 = Run
InfoBits_Pad1			These data types act as padding to achieve byte alignment. They can be renamed.
DiagnosticActive			0 = No diagnostics are active. 1 = One or more diagnostics are active or the prognostics threshold is reached.
CIPSyncValid			0 = CIP Sync is not available 1 = CIP Sync is available
CIPSyncTimeout			0 = A valid time leader has not timed out. 1 = A valid time leader was detected on the backplane, but the time leader has timed out. The module is using its local clock and can be drifting away from the last known time leader.
InfoBits_Pad2			These data types act as padding to achieve byte alignment. They can be renamed.
FieldPowerOff			1 = Field Power is not present. 0 = Field Power is present.
InfoBits_Pad3			These data types act as padding to achieve byte alignment. They can be renamed.
DiagnosticSequence Count	SINT		0...255 Count that increases in these conditions. • Each time a distinct diagnostic condition is detected, and • Each time a distinct diagnostic condition transitions from detected to not detected. Wraps from 255 to 1, and skips zero. A device reset or power cycle sets the count to 0.
Diagbits_Pad1... Diagbits_Pad12	BOOL	2	–
FlashUpdateRequired			0 = Flash update is not required. 1 = Flash update is required.
SelfTestFault			0 = Module initialization code did not detect an error. 1 = Module initialization code detected an error.
Diagbits_Pad13... Diagbits_Pad14			–
Pad	DINT	4	
LocalClockOffset	LINT	8	The offset in nanoseconds from the local clock to the system time. Use this value to detect steps in time. This value updates when a PTP update is received.
LocalClockOffset Timestamp			The most-recent time when the Local Clock Offset was sampled. The initial value is zero and the first time stamp occurs when the module synchronizes with the leader clock.
GrandMasterClockID	SINT[8]		The EUI-64 Identity of the CIP Sync Grandmaster clock that the module is synced to.
FieldPowerOn Timestamp	LINT		The most-recent time when the field power transitioned from off to on.
FieldPowerOff Timestamp			The most-recent time when the field power transitioned from on to off.
Diag_Channel_00... Diag_Channel_03	User defined	256	See AB:5000_A0_Channel:D:1

AB:5000_AO_Channel:D:1

Member	Data Type	Bytes	Valid Values
DataBits_Pad1	BOOL	2	–
Fault			0 = No fault exists. 1 = A fault exists. A fault is a roll-up of all diagnostic conditions that the module can detect and indicates bad data. If there is a detailed data type member that indicates a given detected condition, this fault member does not affect the DiagnosticActive or DiagnosticSequenceCount members. However, if there is no detailed data type for a given detected condition, this fault member triggers both the DiagnosticActive member and increments/decrements the Diagnostic Sequence Count.
Uncertain			0 = Data is valid. 1 = Data validity is uncertain. The module is operating outside its designed operating range, or data is under manual or override control.
NoLoad			0 = No Load condition is not detected. 1 = No Load condition is detected.
ShortCircuit			0 = No short circuit or over current is detected. 1 = A short circuit or over current is detected.
OverTemperature			0 = Module temperature is not over the operating limits. 1 = Module temperature is over the operating limits.
FieldPowerOff			0 = Field power is present. 1 = Field power is not present.
DataBits_Pad2... DataBits_Pad10	SINT		–
CalFault	BOOL		0 = Calibration was successful. 1 = Channel calibration was interrupted or failed. A device reset or power cycle sets CalFault to 0.
Diagbits_Pad1... Diagbits_Pad115	SINT		–
Pad	INT		
InternalErrorCount	SINT	1	0...255 A count of CRC failures on internal communication busses. Acts as a Threshold Diagnostic that rolls up into the channel Fault, DiagnosticActive, and DiagnosticSequence count when 5 or more failures in a row are detected. Wraps from 255 to 1, and skips zero. A device reset or power cycle sets the count to 0.
CalRange			0...5 The range that was used to calibrate the current channel. If a connection is open, this is the currently configured range. If a connection is not open, this is the most-recent configured range.
CalOffset	REAL	4	The Offset result of the last successful calibration.
CalGain			The Gain result of the last successful calibration.
CalLastDate	LINT	8	The time that the most recent calibration occurred.
NoLoadTimestamp			The most-recent time at which a NoLoad condition was detected.
ShortCircuitTimestamp			The most-recent time at which a short circuit or over current was detected.
OverTemperatureTimestamp			The most-recent time at which the module reached a higher temperature than its operating limits.
FieldPowerOnTimestamp			The most-recent time at which the field power transitioned from off to on.
FieldPowerOffTimestamp			The most-recent time at which the field power transitioned from on to off.

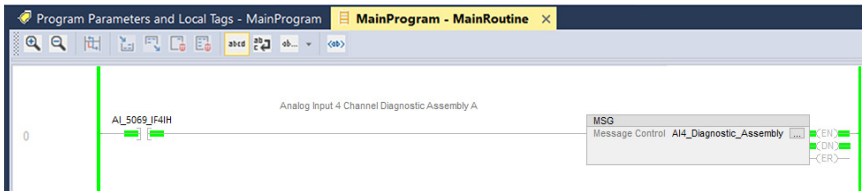
Configure the Message Type User Tags

Create Message type user tags for requests and associated response user tags for each of the new user-defined diagnostic assembly types.



From the Controller Organizer pane, select Tasks > MainTask > MainProgram.

1. Create the Message type user tags for each request.
2. Create the associated response user tags for each new user-defined diagnostic assembly type.
3. Add the user tags to your ladder program.
4. Click the ... button to open the message configuration page.

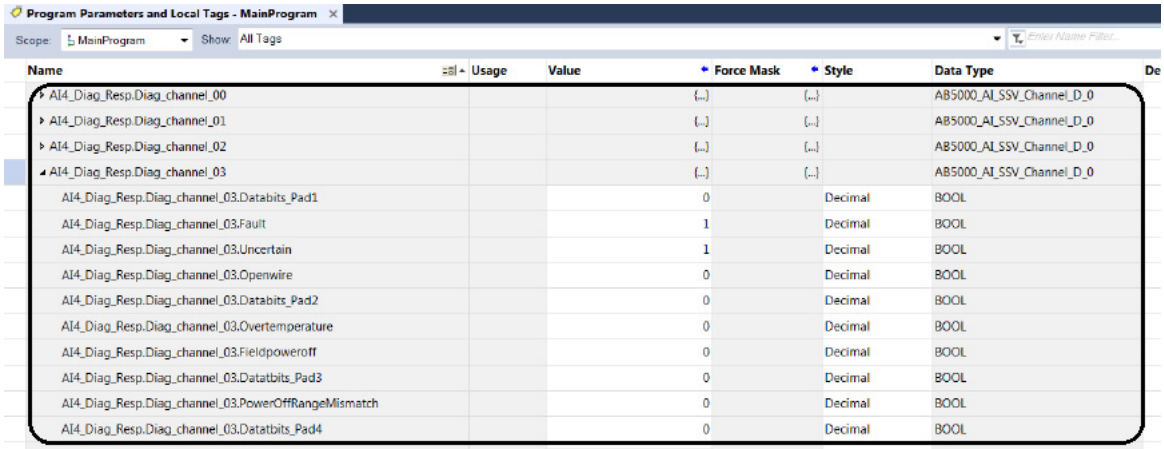


5. On the Configuration tab, select these settings.

Service Type	Class	Attribute	Instance	Destination Element
Get Attribute Single	4	3	For the 5069-IF4IH module: 900: Analog Input 4 Channel Diagnostic Assembly For the 5069-OF4IH module: 899: Analog Output 4 Channel Diagnostic Assembly	User-defined data type suitable for the instance entered

6. On the Communication tab, select the path to the module to which you wish to send the messages.
7. Download the project and set it to Run mode.

You can monitor the user-defined tag values from the Program Parameters and Local Tags window.



CIP Object Model of HART Devices

These tables provide guidelines for communicating with ControlLogix® 5580 controllers that use CIP™.

CIP Object Model of HART Devices

Object Class	Number of Instances	Supported Services
Identity (1, 1_{hex})	1	See CIP Specification Volume 7B.
Message Router (2, 2_{hex})		• Get_Attribute_Single – get attribute 1 • Get_Attributes_All – get attribute 1
Connection Manager Object (6, 6_{hex})		• Get_Attribute_Single – get attributes 1...8 • Set Attribute – reset attributes 1...8 to 0 • Get_Attributes_All – get attributes 1...8 • Set Attributes All – reset attributes 1...8 to 0 • Forward Open and Forward Close for Class 3 connections
Extended HART Process Device (952, $3B8_{hex}$)		See Object-specific Services of Extended HART Process Devices

Object-specific Services of Extended HART Process Devices

Service Code	Class	Instance	Service Name	Service Description
0x4B	$3B8_{hex}$	1	Execute_Command_HART_Types	Defined in HART Process Device object, Chapter 5 of CIP Specification Volume 7B.
0x4C			Execute_Command_CIP_Types	Executes the specified HART command. The Command Request and Response Data Bytes are specified in CIP types.
0x4E			Get_HART_Device_Information	Returns a copy of cached Device Configuration Information read previously from the HART device. Data that this service returns is relatively static, like identity, tag, dynamic variable device, variable code, and unit.

Execute_Command_CIP_Types Service (0x4C)

Service 4C of the Extended HART Process Device follows the definition of Service 4C of the HART Process Device Object in CIP Specification, Volume 7B with these exceptions. This table includes the mapping override exceptions for HART to CIP type.

HART Type	HART Type Definition	CIP Type
Latin-1	67 (43) followed by USINT that specifies the number of characters	Logix STRING
Packed	68 (44) followed by USINT that specifies the number of characters	Logix STRING
Logix STRING consists of two members: Logix STRING.LEN (DINT) and Logix STRING.DATA (Array of SINT). The value of the LEN member is the index of the first DATA member with a value of 0. If there is no DATA member with a value of 0, the LEN member value is set to the size of the DATA array. This applies to the unpacked version of the string.		

GET_HART_DEVICE_INFORMATION Service (0x4E) - Successful Response Parameters

Bytes Offset in Response	Name	Data Type	Parameter Description
0	ExpandedDeviceType	USINT	CMD#0, Bytes 1...2
2	Preamble		CMD#0, Byte 3
3	UnivCmdCode		CMD#0, Byte 4
4	TransSpecRev		CMD#0, Byte 5
5	SoftwareRevision		CMD#0, Byte 6
6	HardwareRevision		CMD#0, Byte 7
7	Flags		CMD#0, Byte 8
8	DeviceIDNumber	BYTE	CMD#0, Bytes 9...11 (3 bytes) Device ID number plus a byte of pad (value 0), in little-endian format.
12	MinPreambles	UDINT	CMD#0, Byte 12, 0 if UnivCmdCode = 5
13	MaxDeviceVariables	USINT	CMD#0, Byte 13, 0 if UnivCmdCode = 5
14	ConfigChangeCounter		CMD#0, Bytes 14...15, 0 if UnivCmdCode = 5
16	ExtendedFieldDeviceStatus	BYTE	CMD#0, Byte 16, 0 if UnivCmdCode = 5
17	Pad 1 for alignment	Octet	The value is 0.
18	ManufacturerIDCode	UINT	CMD#0, Bytes 17...18 if UnivCmdCode ≥ 7 CMD#0, Byte 1 cast to a UINT if UnivCmdCode = 5 or 6
20	PrivateLabelDistCode		CMD#0, Bytes 19...20, 0 if UnivCmdCode = 5 or 6
22	DeviceProfile	USINT	CMD#0, Byte 21, 0 if UnivCmdCode = 5 or 6
23	Pad 2 for alignment	Octet	The value is 0.
24	TagSize	UDINT	Number of characters in TagString. Always 8 bytes. TagSize and TagString can be represented in the application as a String data type, with a max length of 8.
28	TagString	USINT[8] (8 bytes unpacked ASCII)	CMD#13, Bytes 0...5 TagSize and TagString can be represented in the application as a String data type, with a max length of 8. HART representation packs ASCII characters into 6 bits each. This is an expanded representation, suitable for direct display on ASCII devices.
36	DescriptorSize	UDINT	Number of characters in DescriptorString. Always 16 bytes. DescriptorSize and DescriptorString combine to form a Logix String data type.
40	DescriptorString	USINT[16] (16 bytes unpacked ASCII)	CMD#13, Bytes 6...17 DescriptorSize and DescriptorString combine to form a Logix String data type.
56	DateDay	USINT	CMD#13, Byte 18. A Date code that is used by the leader for record keeping. For example, Last Or Next Calibration Date.
57	DateMonth		CMD#13, Byte 19
58	DateYear		CMD#13, Byte 20 (+ 1900)
60	LongTagSize		Number of characters in LongTagString. Either 0 bytes or 32 bytes. LongTagSize and LongTagString can be represented in the application as a String data type, with a max length of 32. This value is 0 when the HART Device does not support CMD#20.
64	LongTagString	USINT[32] (32 bytes unpacked ASCII)	CMD#20, Bytes 0...31 LongTagSize and LongTagString can be represented in the application as a String data type, with a max length of 32. This value is 0 when the HART Device does not support CMD#20.
96	FinalAssemblyNumber	UDINT	CMD#16, Bytes 0...2 (3 bytes) plus a pad byte (value 0) for 32-bit alignment, in little-endian format. Namely, CIP representation, not HART representation. This value normally identifies the materials and electronics that comprise the device.
100	MessageSize		Number of characters in MessageString. Always 32 bytes. Some can be spaces and other special characters. MessageSize and MessageString combine to form a standard Logix String data type.
104	MessageString	USINT[32] (32 bytes unpacked ASCII)	CMD#12, Byte 0...23, unpacked to normal ASCII representation MessageSize and MessageString combine to form a standard Logix String data type.
136	PVCode	USINT	CMD#50, Byte 0, 0xff if not supported. PV assignment code
137	SVCode		CMD#50, Byte 1, 0xff if not supported. SV assignment code
138	TVCode		CMD#50, Byte 2, 0xff if not supported. TV assignment code
139	QVCode		CMD#50, Byte 3, 0xff if not supported. QV assignment code
140	PVUnits		CMD#3, Byte 4
141	SVUnits		CMD#3, Byte 9, 0 if not present
142	TVUnits		CMD#3, Byte 14, 0 if not present
143	QVUnits		CMD#3, Byte 19, 0 if not present
144	TransferFunction		CMD#15, Byte 1
145	RangeUnits		CMD#15, Byte 2
146	Pad 3 for alignment	Octet[2]	The value is 0.
148	PVUpperRange	REAL	CMD#15, Bytes 3...6
152	PVLowerRange		CMD#15, Bytes 7...10
156	DampingValue		CMD#15, Bytes 11...14
160	WriteProtectCode	USINT	CMD#15, Byte 15
161	Pad 4 for alignment	Octet[3]	The value is 0.

Numerics

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Notes:

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, Knowledgebase, and product notification updates.	rok.auto/support
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Technical Documentation Center	Quickly access and download technical specifications, installation instructions, and user manuals.	rok.auto/techdocs
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

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Your comments help us serve your documentation needs better. If you have any suggestions on how to improve our content, complete the form at rok.auto/docfeedback.

Waste Electrical and Electronic Equipment (WEEE)

At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental compliance information on its website at rok.auto/pec.

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