



PointMax Analog HART I/O Modules

5034-IF4IH, 5034-IF4IHXT, 5034-OF4IH, 5034-OF4IHXT



Allen-Bradley

by ROCKWELL AUTOMATION

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.

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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.

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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.

Rockwell Automation recognizes that some of the terms that are currently used in our industry and in this publication are not in alignment with the movement toward inclusive language in technology. We are proactively collaborating with industry peers to find alternatives to such terms and making changes to our products and content. Please excuse the use of such terms in our content while we implement these changes.

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Preface

About This Publication

This manual describes how to use PointMax™ analog HART I/O modules in Logix 5000® control systems.

Make sure that you are familiar with the following:

- Use of a controller in a Logix 5000 control system
- Use of an EtherNet/IP™ network
- Studio 5000 Logix Designer® application environment

Additional Resources

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

Table 1. Additional Resources

Resources	Description
PointMax I/O System Specifications Technical Data, publication 5034-TD001	Provides PointMax I/O system specifications.
PointMax I/O System Installation Instructions, publication 5034-IN001	Provides instructions on installing a complete PointMax I/O system.
PointMax EtherNet/IP Adapter User Manual, publication 5034-UM001	Provides information on how to configure and operate PointMax EtherNet/IP adapters.
PointMax Digital I/O Modules User Manual, publication 5034-UM002	Provides information on how to configure and operate PointMax digital I/O modules.
PointMax Analog I/O Modules User Manual, publication 5034-UM003	Provides information on how to configure and operate PointMax analog I/O modules.
PointMax 4-Channel IO-Link Master Module User Manual, publication 5034-UM004	Provides information on how to configure and operate the PointMax IO-Link master module.
PointMax Serial Module User Manual, publication 5034-UM005	Provides information on how to configure and operate the PointMax serial module.
PointMax High-speed Counter/SSI Encoder Module User Manual, publication 5034-UM006	Provides information on how to configure and operate the PointMax high-speed counter/SSI encoder module.
PointMax Analog HART I/O Modules User Manual, publication 5034-UM007	Provides information on how to configure and operate PointMax analog HART I/O modules.
EtherNet/IP Network Devices User Manual, publication ENET-UM006	Describes how to configure and use EtherNet/IP devices to communicate on the EtherNet/IP network.
Ethernet Reference Manual, publication ENET-RM002	Describes basic Ethernet concepts, infrastructure components, and infrastructure features.
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.

Table 1. Additional Resources (continued)

Resources	Description
Safety Guidelines for the Application, Installation, and Maintenance of Solid-state Control, publication SGI-1.1	Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Selection and Configuration tools website, rok.auto/systemtools	Helps configure complete, valid catalog numbers and build complete quotes based on detailed product information.
Product Certifications website, rok.auto/certifications	Provides declarations of conformity, certificates, and other certification details.

Download Firmware, AOP, EDS, and Other Files

You can 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.

Terminology

This table defines the terms that are used in this publication.

Table 2. Terminology

Acronym	Full Term	Definition
BP	Backplane Power	Power that is generated from module power by the adapter and expansion power, then supplied to the I/O system through the backplane.
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 needed for control applications where absolute time synchronization is vital to achieve real-time synchronization between distributed intelligent devices and systems.
DTM	Data Type Manager	DTMs allow Field Device Tools (FDT) to communicate with HART devices.
HART	Highway Addressable Remote Transducer	A protocol that enables both analog and digital communication over the same wiring, including device diagnostic and status information.
MB	Mounting Base	A device that provides data and power connections from the backplane to the installed module.
MP	Module Power	Power that is supplied to the adapter and expansion power.
ODVA	Open DeviceNet Vendor Association	A nonprofit association of vendors that is been established for the promotion of CIP networks.
RIUP	Removal and Insertion Under Power	A feature that enables the device to be connected and disconnected from the system without having to remove power from the system.
RPI	Requested Packet Interval	Time interval (usually in milliseconds) that users are requesting their data be exchanged at
RTB	Removable Terminal Block	A component that is used for wiring field devices to.
RTD	Resistance Temperature Detector	A type of sensor whose resistances change as its temperature changes.
SA	Sensor Actuator	A term that is used to describe field-side devices.
SELV	Safety Extra Low Voltage	An electrical system where the voltage level is considered safe under normal or fault conditions, as defined in the EN and IEC standards.
TC	Thermocouple	A thermocouple is a device that measures temperature by joining two different metal wires at one end. When the junction between the wires heats or cools, it generates a voltage that can be measured. This voltage can be translated into a temperature reading.
XT	Harsh Environment	These modules have additional conformal coating and design considerations that add a greater degree of protection when exposed to harsh, corrosive environments.

Analog HART I/O Modules

This chapter describes the analog HART I/O module types and features that are common between analog HART input and HART output modules, and how to construct a PointMax I/O system.

Table 3. Analog HART I/O Module Types

I/O Type	Catalog Number	Description
Input modules	5034-IF4IH, 5034-IF4IHXT	4-channel isolated voltage/current input module with HART It supports 4 channels that accept voltage or current input.
Output modules	5034-OF4IH, 5034-OF4IHXT	4-channel isolated voltage/current output module with HART It supports 4 channels that produce voltage or current output.

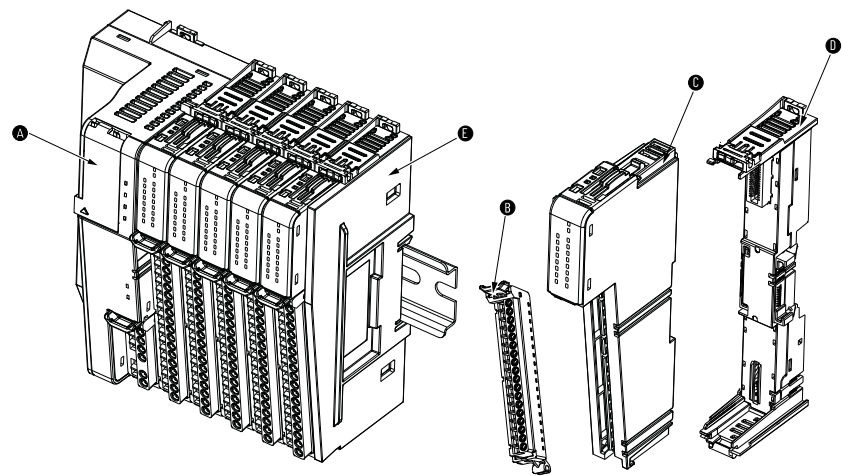
All I/O modules support removal and insertion under power (RIUP). You must remove the RTB first and then the I/O modules.

For technical and environmental specifications details, see PointMax I/O System Specifications Technical Data, publication [5034-TD001](#).

Construct a PointMax I/O System

PointMax I/O system contains the components that are pictured below.

Figure 1. PointMax I/O System



Item	Component Name	Description
A	Adapter	The adapter transfers data between the I/O module and the controller.

Item	Component Name	Description
B	Removable Terminal Block (RTB)	The RTB contains terminals to terminate wiring for field devices. Also it has interfaces to establish the connection between the RTB and the I/O module.
C	I/O module	The I/O module contains the SA or field power interface and circuitry that is needed to perform specific functions that are related to your application.
D	Mounting Base (MB)	The MB contains mechanical and electrical interfaces to establish the connection between I/O module and the backplane.
E	End cap	It is a dust protection cap for the last module in a rack.

For PointMax I/O system power requirements, see PointMax I/O System Installation Instructions, publication [5034-IN001](#).

Secure Access to the System

To secure access to the device by authorized users only, consider these options:

- Password helps protect the source and execution of the control program
- Remove the key from the controller
- Implement physical barriers, such as locked cabinets

To secure access to the system, consider these options:

- Follow industry best practices to harden your personal computers and servers, including anti-virus/anti-malware and application allow list solutions.
The recommendations are published at the Rockwell Automation technical support center in Knowledgebase Technote [Rockwell Automation Customer Hardening Guidelines](#).
- Develop and deploy backup and disaster recovery policies and procedures. Test backups on a regular schedule.
- Minimize network exposure for all control system devices and systems, and confirm that they are not accessible from the Internet.
- Locate control system networks and devices behind firewalls and isolate them from the business network.
- Subscribe to the Knowledgebase Technote [Security Advisory Index](#), so you have access to information about security matters that affect Rockwell Automation products.

Follow recommended network practices for products with network interfaces, such as communication ports or web servers. These practices help minimize risk or exposure by unauthorized activity or users. For more information, see:

- Converged Plantwide Ethernet (CPwE) Design and Implementation Guide, publication [ENET-TD001](#)
- EtherNet/IP Network Devices User Manual, publication [ENET-UM006](#)
- Configure System Security Features User Manual, publication [SECURE-UM001](#)

PointMax I/O in a Logix 5000 Control System

IMPORTANT: Throughout this publication, the term Logix 5000 controller refers to the controllers with which you can use PointMax I/O modules in a given capacity.

You can use PointMax I/O modules with Logix 5000 controllers as remote I/O modules only.

You cannot use PointMax I/O modules with all Logix 5000 controllers. For example, you can use PointMax I/O modules with CompactLogix® 5380 and ControlLogix® 5580 controllers but not with CompactLogix 5370 and ControlLogix 5570 controllers.

Logix 5000 controllers use I/O modules to control devices in a control system. The controllers access the modules over an EtherNet/IP network.

See [Connections on page 17](#) for the communication model between controller and I/O modules.

Controller and Software Compatibility

Controller and programming software compatibility requirements apply when you use PointMax I/O modules. A module type and how it is used affect which requirements apply.

You must use Studio 5000 Logix Designer application version 36 or later. For more information, see the Product Compatibility and Download Center at rok.auto/pcdc.

If you use GuardLogix® controllers and need to use up to chassis slot 32, you must use Studio 5000 Logix Designer application version 36.1 or later.

Module Firmware Updates

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

Firmware information for I/O modules is available at the Rockwell Automation Product Compatibility and Download Center (PCDC). The PCDC is available at: rok.auto/pcdc. At the PCDC, you can use the module catalog number to check for firmware updates. If the catalog number is not available, then no updates exist.

IMPORTANT: Only download firmware and access product release notes from the Rockwell Automation PCDC. Do not download firmware from non-Rockwell Automation sites.

Verify that the firmware revision of the I/O modules that you use is correct before commissioning the system. For more information on how to update your module firmware, see the ControlFLASH Plus® Quick Start Guide, publication [CFP-QS001](#).

When the firmware update is in progress, you cannot perform the following operations:

- Another firmware update request
- Module connection request
- Module reset request

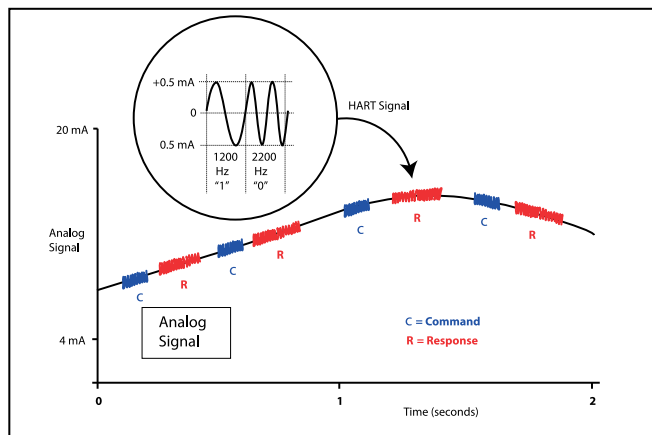


WARNING: When you update the PointMax EtherNet/IP adapter firmware, the I/O modules in its chassis may reset and unable to maintain their Program Mode or Inhibit Mode states. Verify that all equipment controlled by the modules in this chassis is in a stopped state and that all safety-critical functions are unaffected.

HART Communication

The HART field communication protocol is widely accepted in industry as 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 lets the primary process variable be communicated at the fastest possible rate while the digital channel communicates multiple process variables, data quality, and device status. The HART protocol lets these simultaneous communication channels be used in a complementary fashion.

Figure 2. HART Protocol⁽¹⁾



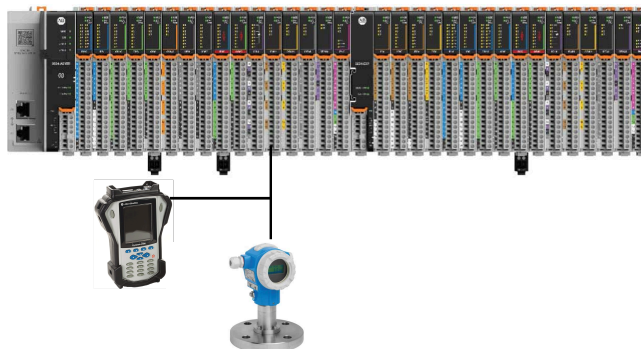
⁽¹⁾ This figure is from the HART Communication Protocol Specifications, April 2001, Revision 6.0, HART Communication Foundation. All Rights Reserved.

PointMax analog 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.
- 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 using DTM supported software.

With the analog HART modules, both the controller and software for device maintenance and management can access field device data. The analog HART modules support command-response communication protocol in a point-to-point wiring architecture.

The analog HART module is the primary master device and continuously obtains information from the connected HART devices. The secondary master can be used for device maintenance, for example a handheld communicator.



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. The mA signal with HART provides more process information. The mA signal that represents flow is still available. The HART configuration of the flowmeter can be set to communicate 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.

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.

Device status information is also provided through HART.

HART connectivity provides all this information with no changes to the existing 4...20 mA wiring.

DTM technology through HART connectivity is supported and also provides remote configuration and troubleshooting of HART devices through software.

HART-enabled I/O Modules

PointMax analog 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 implementation in PointMax analog HART I/O modules provide a connection between the controller and each HART device.

A HART device that is connected to a PointMax analog HART I/O module supports both connected and unconnected message instructions.

The configurable connection to each HART device can support:

- Up to four Dynamic Variables
- Up to eight Device Variables
- Up to four HART commands

For connected messaging:

- Up to two concurrent Class 3 connections are supported for every HART device.
- Up to 16 concurrent Class 3 connections are supported for the HART module and all attached HART devices.

For unconnected messaging:

- Up to two concurrent unconnected messages are supported for every HART device.
- Up to 16 concurrent unconnected messages are supported for the HART module and all attached HART devices.

Input Module

Table 4. Input Modules Features

Feature	5034-IF4IH, 5034-IF4IHXT
Requested Packet Interval	✓
Listen Only Mode	✓
Module Inhibiting	✓
Electronic Keying	✓
Protected Operations	✓
HART Device Integration	✓
Alarm Latching	✓
Scaling	✓
CIP Sync Time	✓
Rolling Timestamp of Data	✓
Module Data Quality Reporting (Fault and Uncertain)	✓
Notch Filter	✓
Digital Filter	✓
Process Alarms	✓
Rate Alarms	✓
Sensor Offset	✓
Open Wire Detection	✓
Field Power Loss Detection	✓
Overcurrent Detection	✓
Underrange/Overrange Detection	✓
Fault and Status Reporting	✓

Table 4. Input Modules Features (continued)

Feature	5034-IF4IH, 5034-IF4IHXT
Calibration (via AOP or Module Tags)	✓

Output Module

Table 5. Output Module Features

Feature	5034-OF4IH, 5034-OF4IHXT
Requested Packet Interval	✓
Listen Only Mode	✓
Module Inhibiting	✓
Electronic Keying	✓
Protected Operations	✓
HART Device Integration	✓
Alarm Latching	✓
Scaling	✓
CIP Sync Time	✓
Data Echo	✓
Module Data Quality Reporting (Fault and Uncertain)	✓
Program and Inhibit Mode Handling	✓
Connection Fault Handling	✓
Channel Offset	✓
Hold for Initialization	✓
Output Clamping	✓
Output Ramping Rate Limiting	✓
Field Power Loss Detection	✓
No Load Detection	✓
Short-Circuit Protection	✓
Fault and Status Reporting	✓

Table 5. Output Module Features (continued)

Feature	5034-0F4IH, 5034-0F4IHXT
Calibration (via AOP or Module Tags)	✓

Connections

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 module configuration, the connection type determines what data is exchanged between the controller and the module. When you uninhibit a module in online mode, or download the project with modules that are uninhibited to the controller, the controller attempts to establish a connection to each module.

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

Producer/Consumer Communication

PointMax I/O modules use the Producer/Consumer communication model to produce data without a controller polling them first. The modules produce the data and controllers consume it. 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 eliminates the need for one controller to send the data to other controllers.

Ownership

Every I/O module in a Logix 5000 control system must be owned by a controller, also known as the owner-controller. When the PointMax I/O modules are used in a Logix 5000 control system, the owner-controller performs the following:

- Stores configuration data for every module that it owns.
- Sends the I/O module configuration data to define module behavior and begin operation in the control system.

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

When the owner-controller establishes I/O connection to the module, it sends the configuration data of the module. Two possible results are:

- If the configuration is appropriate to the module, a connection is established and operation begins.
- If the configuration is not appropriate to the module, the data is rejected and the Connection view in the Module Properties indicates that an error occurred. The configuration can be inappropriate for many reasons. For example, a mismatch in electronic keying that helps prevent operation on incompatible module.

Requested Packet Interval

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

You set the RPI value during initial module configuration and can adjust it as necessary after module operation has begun.

IMPORTANT: If you change the RPI while the project is online, the connection to the module is closed and reopened in one of the following 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.
-

Unicast or Multicast Connection

During module configuration, you must configure the Connection over Ethernet/IP parameter. The configuration choice dictates how input data is broadcast over the network.

The PointMax I/O modules use one of the following methods to broadcast data:

- Multicast - Multicast connections deliver information from one sender to multiple receivers simultaneously. Copies of one transmission are passed to a selected subset of possible destinations.
- Unicast - Unicast connections are point-to-point transmissions between a source node and destination node on the network. A transmission is sent to one destination controller.

IMPORTANT: Unicast is the default setting. Use Unicast because it reduces network bandwidth usage. However, if you are using a ControlLogix 5580 controller in a high availability system, you must use Multicast.

Listen Only Mode

Any controller in the system can listen to the data from an I/O module. An owner-controller, as described in [Ownership on page 17](#) exchanges data with I/O modules. Other controllers can use a Listen Only connection with the I/O module. In this case, the 'listening' controller can only listen to the data produced by the module. The listening controller does not own the module configuration or exchange other data with the module.

During the I/O configuration process, you can specify a Listen Only connection.

IMPORTANT:

Remember the following:

- The Listen Only mode applies only to standard I/O modules.
- If a controller uses a Listen Only connection, the connection must use the Multicast option. In this case, all other connections to the module, for example, the connection of the owner-controller, must also use the Multicast option.

The Listen Only connection RPI value must be the same as owner connection RPI value.

- If a controller attempts to use a Listen Only connection to a module but the owner-controller connection uses the Unicast option, the attempt at a Listen Only connection fails.
 - The Listen Only controller receives data from the module as long as a connection between an owner-controller and module is maintained.
 - RPI of the Listen Only connection must be the same as owner connection.
 - If the connection between an owner-controller and the module is broken, the module stops sending data and connections to all 'listening controllers' are also broken.
 - Due to Multicast, adding a Listen Only connection does not increase network bandwidth.
 - Only one controller can own the I/O module. The PointMax I/O modules do not support multiple owners of the same module. Other controllers must use a Listen Only connection to the module.
 - Connected HART devices do not support Listen Only connections.
-

Module Inhibiting

Module inhibiting lets you indefinitely suspend a connection, including Listen Only connections, between a controller and a module without removing the module from the configuration. This process temporarily stops the connection between the controller and the module.

IMPORTANT: Whenever you inhibit a module with outputs, all outputs change to the state that is configured for Program Mode.

Use the module inhibiting in the following scenarios:

- To perform maintenance on the module.
- To update a module, for example, update the module firmware revision.
- If you use a program that includes a module that you do not physically possess yet. You do not want the controller to look for a module that does not yet exist. In this case, you can inhibit the module in your program until it physically resides in the system.

Use the following procedure to inhibit and uninhibit the module:

1. Inhibit the module:
 - a. Go to Connection view in the Module Properties dialog and select the Inhibit Module checkbox.
 - b. Select Apply or OK.
2. Perform the necessary update.
3. Uninhibit the module:
 - a. Go to Connection view in the Module Properties dialog and clear the Inhibit Module checkbox.
 - b. Select Apply or OK.

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, an 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

Table 6. Electronic Keying Options

Keying Option	Description
Compatible Module	<p>Lets the installed device accept the key of the device that is defined in the project when the installed device can emulate the defined device. With Compatible Module, you can typically replace a device with another device that has the following characteristics:</p> <ul style="list-style-type: none"> • Same or compatible catalog number • Same or higher Major Revision • Minor Revision as follows: <ul style="list-style-type: none"> - 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. • You can use an XT version of the module in place of a non-XT module or non-XT version of the module in place of XT module.
Disable Keying	<p>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.</p> <hr/> <div style="display: flex; align-items: center;">  <div> <p>ATTENTION: Be cautious when using Disable Keying; if used incorrectly, this option can lead to personal injury or death, property damage, or economic loss.</p> <p>We strongly suggest that you do not use Disable Keying.</p> <p>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.</p> </div> </div> <hr/>
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.

Table 6. Electronic Keying Options (continued)

Keying Option	Description
	When XT module is configured in Studio 5000 Logix Designer application project, only XT Module residing on XT MB is considered as Exact Match. When non-XT module is configured, only non-XT module (with any MB) is considered as exact match.

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

IMPORTANT: Changing Electronic Keying parameters online interrupts 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 Electronic Keying in Logix 5000 Control Systems Application Technique, publication [LOGIX-AT001](#).

Protected Operations

If one of the module I/O connections is open and running, it is considered as the module is in Protection Mode. Protection Mode is a state where the device is operational but has implemented defenses against disruptive changes that could take the product out of service. The following operations are restricted when the module is in Protection Mode:

- Firmware update request
- Module reset request
- Module calibration request
- Connection or data format change

The following operations can be applied in Studio 5000 Logix Designer application when the module is in Protection Mode but as a consequence, the I/O connections are closed and reopened:

- Change Electronic Keying
- Change RPI
- Change Unicast/Multicast

The following operations are allowed when the module is in Protection Mode:

- Listen-only connection requests from other controllers
- I/O channel configuration change. To apply configuration change without interrupting the I/O connections, there are two methods:
 - Change configurations and apply in Module Properties.
 - Change configuration tag values and send a Reconfigure Module MSG to the module to apply the changes



Inhibit the module to come out of the Protection Mode.

Alarm Latching

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 triggered the alarm disappears, until the alarm is unlatched.

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

I/O Type	Available Alarms
Input modules	<ul style="list-style-type: none">• Process Alarms• Rate Alarm
Output modules	<ul style="list-style-type: none">• Clamp Alarms• Output Ramping Alarm

Enable Latching

You can enable alarm latching in Module Properties:

- For input modules, go to Chxx - Alarms view to enable latching for Process Alarms and Rate Alarm.
- For output modules, go to Chxx - Limits view to enable latching for Clamp Alarms and Rate Alarm.

Unlatch Alarms

IMPORTANT: Before you unlatch an alarm, make sure that the condition that triggered the alarm is 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 you must change.

For example, to unlatch a Low Low alarm on the analog input module, set the *Chxx.LLAlarmUnlatch* output tag to 1.

IMPORTANT: After an alarm is unlatched, change the module tag back from 1 to 0.

You must change the module tag from 0 to 1 to unlatch the alarm each time an alarm is triggered.

If you do not change the module tag back to 0 and the alarm is latched again in future, the alarm remains latched despite the *Unlatch* tag value being 1.

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: In choosing 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 engineering units.

For example, if you use the 5034-IF4IH module in Current mode with an input range of 4...20 mA, to receive values in Percent of Full Scale, configure the module as follows:

- Low Signal = 4 mA
- High Signal = 20 mA
- Low Engineering = 0%
- High Engineering = 100%

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

The following table shows values that can appear when using Percent of Full Scale.

Table 7. Current Values Represented in Engineering Units

Current (mA)	Engineering Units Value (%) in <i>I.Chxx.Data</i> tag
0.0	-25.00
3.0	-6.00
4.0	0.0
12.0	50.0
20.0	100.0
23.0	118.75

CIP Sync Time

I/O modules use CIP Sync for timestamps. CIP Sync is a CIP implementation of the IEEE 1588 PTP (Precision Time Protocol). CIP Sync provides accurate real-time (Real-World 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 timestamping, sequence of events recording, distributed motion control, and increased control coordination.

These modules are CIP Sync slave-only devices. There must be another module on the network that functions as a master clock.

I/O modules can be used to capture timestamps. The advantage is that CIP Sync is system-wide, so timestamp values are consistent across all modules in the system.

IMPORTANT: *I.CIPSyncValid* = 1 is not sufficient for an application to confirm that the module is ready for application requiring a system time synchronization to start operation. See [Grandmaster Clock Verification on page 23](#) for extra verification needed.

Grandmaster Clock Verification

The application must verify that the module is synchronized with the same Grandmaster Clock as the owner-controller.

If Status connection is selected in the PointMax EtherNet/IP adapter Device Definition dialog, verify that all following conditions are true:

- I/O module's *I.CipSyncValid* is 1
- Adapter's *S.CipSyncValid* is 1
- Adapter's *S.GrandmasterClockID* is the same as the controller's *GrandMasterClockID*

- If Status connection is not selected in the PointMax EtherNet/IP adapter Device Definition dialog, verify that all following conditions are true:
- I/O module's *I.CipSyncValid* is 1
 - I/O module's *GrandmasterClockID* in *GrandMasterClockInfo* attribute of *TimeSync* object is the same as the controller's *GrandmasterClockID*
 - Class: 0x43
 - Instance: 0x01
 - Attribute: 0x08
 - Response: *GrandMasterClockInfo* (See the structure below)

GrandMasterClockInfo	STRUCT of
ClockIdentity	USINT[8]
ClockClass	UINT
TimeAccuracy	UINT
OffsetScaledLogVariance	UINT
CurrentUtcOffset	UINT
TimePropertyFlags	WORD
TimeSource	UINT
Priority1	UINT
Priority2	UINT

To get controller's *GrandMasterClockID*, access the *TIMESYNCHRONE* object through the GSV instruction. See [Access the TimeSynchronize object](#).

HART Device Integration

This chapter describes the common features that are available with HART integration in the Studio 5000 Logix Designer application.

HART Device Identity

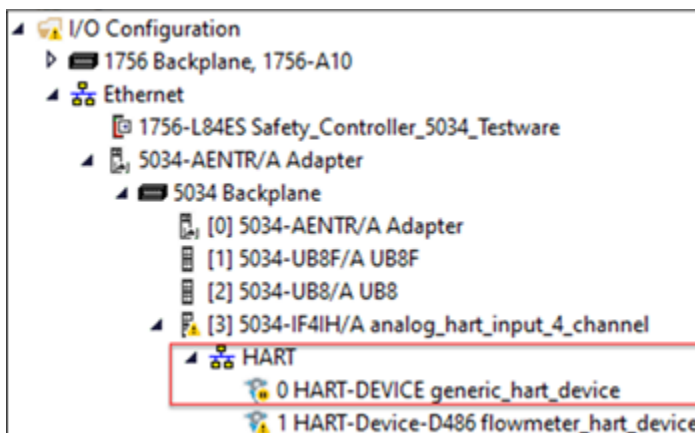
With the highly integrated HART device feature, every HART device has its own independent CIP identity.

The HART device properties that uniquely identify the type of device are:

- HART Expanded Device Type
- HART Device Revision Level type

HART Bus

Every HART device is added as a CIP node on the HART bus that is associated with the HART I/O module.



You can use the HART bus in the I/O Configuration tree to:

- Add or remove a HART device.
- See the warning or inhibit status icon of an attached HART device.
- Open the properties for the HART device.

HART Device Inhibiting

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

You can inhibit HART devices on the Connection view of the Properties window for the HART device.

HART Device Electronic Keying

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

For each device, the selected keying option determines if, and how, an Electronic Keying check is performed.

The three keying options that are available are:

- Compatible Module (default)
- Exact Match
- Disable Keying

Compatible Module is the default setting. It allows the physical device to accept the key of the device configured in the software, if the configured device is one that the physical device is capable of emulating. The exact level of emulation that is required is defined as follows:

- HART Expanded Device Type must match.
- Major revision of the physical device must be greater or equal than the configured major revision.
- If major revision exactly matched, 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 indicates that the keying attributes are not considered when attempting to communicate with a device. Other attributes, such as data size and format, are considered and must be acceptable before connection is established. With Disabled Keying, connection can occur with a device other than the type specified in the I/O configuration tree with unpredictable results.



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

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.

Producer/Consumer Data Connection Type Configuration

The Producer/Consumer data can be configured to communicate using a Data or a PlantPAx® data connection type.

PlantPAx connection includes specific data that is required for the PlantPAx HART instruction.

Producer/Consumer Communication of HART Device

The Producer/Consumer communication between controller and HART device allows you to:

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

Producer/Consumer Data Configuration

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

Fault and Status Reporting

The PointMax analog HART I/O module sends fault and status data for HART device, configured dynamic variables, and device variables in the producer data for each HART device.

Table 8. Fault and Status Tags for HART Device

Data Type	Tag Name	Triggering Event That Sets the Tag
Fault	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	RunMode	The module is in Run mode.
	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	The loop current has reached its upper (or lower) endpoint limit and cannot increase (or decrease) any further.

Table 8. Fault and Status Tags for HART Device (continued)

Data Type	Tag Name	Triggering Event That Sets the Tag
	CurrentFixed	The loop current is being held at a fixed value and is not responding to process variations.
	MoreStatusAvailable	More status information is available than can be returned in the Field Device Status.
	ConfigurationChanged	HART device configuration is changed and the module has retrieved all HART device configuration data to be returned by the <i>Get HART Device Information</i> service.
	<NameOfVariable>.Ch.Uncertain	Indicates that the channel data can be inaccurate but the degree of inaccuracy is not known.
	<NameOfVariable>.Ch.Data	The last good value received from the device.
	<NameOfVariable>.Ch.RollingTimestamp	RollingTimestamp is continuously running a 15-bit timer that counts in milliseconds.
	<NameOfVariable>.Class	Device Variable Classification
	<NameOfVariable>.Unit	Unit code
	<NameOfVariable>.Manual	Indicates that the data value is manually controlled.
	<NameOfVariable>.Constant	Indicates that the data value is constant. It is set to 1 when variable status indicates constant.
	Static.PVUnit	Unit code of PV. For PlantPAx connection only.
	Static.HARTRevision	HART protocol major revision number. For PlantPAx connection only.
	Static.HARTTagName	Assigned name of HART device. Same as Identity attribute 15. For PlantPAx connection only.
	Static.Descriptor	Descriptor of HART device. For PlantPAx connection only.
	Static.PVAtSignal4	PV Lower Range value. For PlantPAx connection only.
	Static.PVAtSignal20	PV Higher Range value. For PlantPAx connection only.
	Static.AdditionalDeviceStatus	Additional Device Status from HART command 48. For PlantPAx connection only.
	ChDataAtSignal4	This member is the engineering unit value of 4 mA according to the corresponding analog input channel configuration of the module. For PlantPAx connection only.
	ChDataAtSignal20	This member is the engineering unit value of 20 mA according to the corresponding analog input channel

Table 8. Fault and Status Tags for HART Device (continued)

Data Type	Tag Name	Triggering Event That Sets the Tag
		configuration of the module. For PlantPAx connection only.

HART Device Configuration Change Notification

If any configuration parameters are changed in a HART device for any reason, *ConfigChanged* bit is set to 1 in the producer data of the HART device that is used in Logix 5000 controller to inform the Studio 5000 Logix Designer application about the change. When this occurs, the application should:

1. Transit *ResetConfigChanged* bit from 0 to 1 in the consumer data.
2. Execute the Get HART Device Information Service. For more information on the Get HART Device Information Service, See [CIP Object Model of HART Device on page 173](#).
3. Perform any other HART services needed to get other configuration data being managed by the Studio 5000 Logix Designer application.

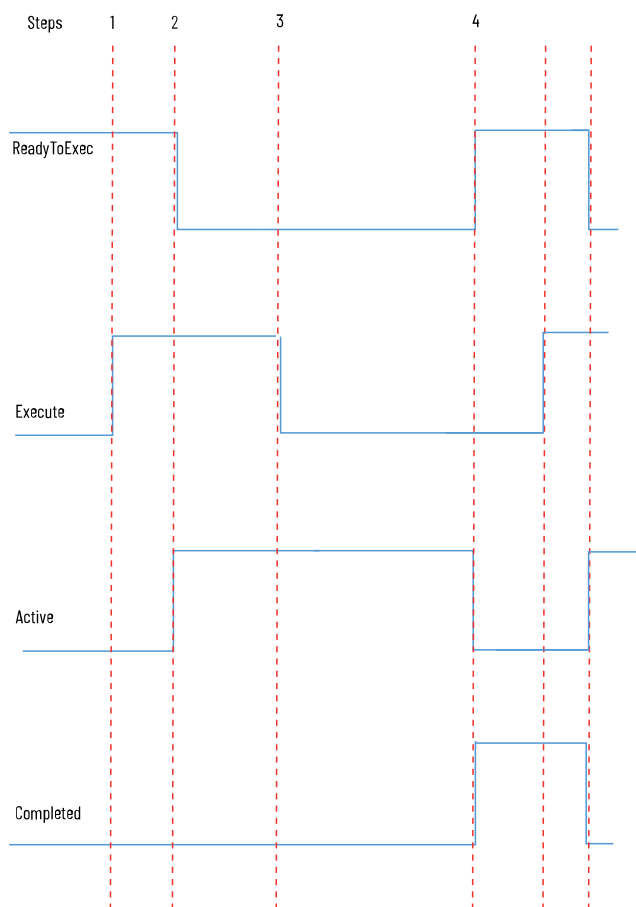
Rolling Timestamp of Dynamic/Device Variable Data

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

Execute HART Commands Through Producer/Consumer Data

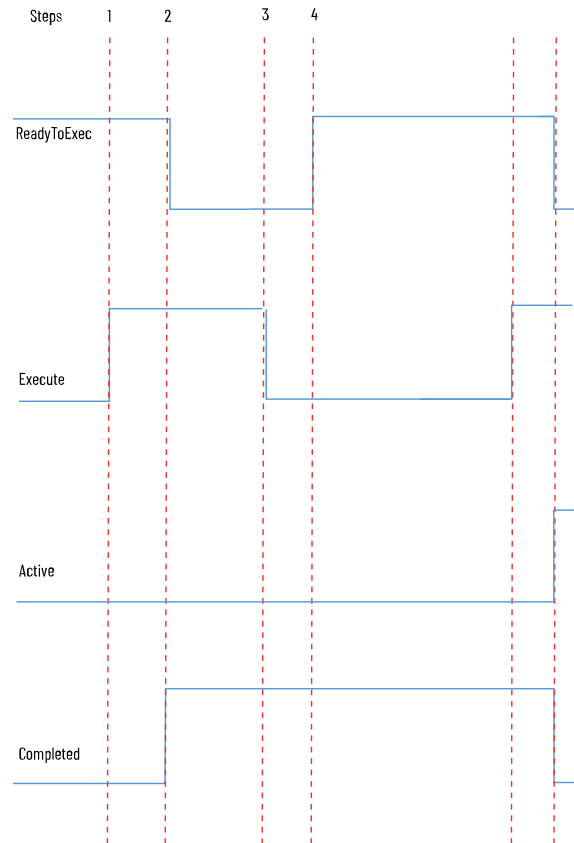
These are some guidelines to execute HART commands through Producer/Consumer Data.

- A command execution starts with a rising edge of *Command.Execute* in the consumer data.
- *Command.ReadyToExecute* in the producer data is reported as 1 for a HART device when the HART device has no outstanding commands that are initiated from the consumer data and *Command.Execute* is 0 in the latest received consumer data.
- Set *Command.Execute* to 1 only when *Command.ReadyToExecute* is 1.
- After initiating a command execution, set it back to 0 once *Command.ReadyToExecute* of 0 in producer data is received. *Command.ReadyToExecute* transitioning from 1 to 0 indicates that the HART module has received the command execution request.
- After a command is complete, check the status of all producer data in the *Command* tag before retrieving the response data of the command.

Figure 3. A Typical Command Execution Sequence

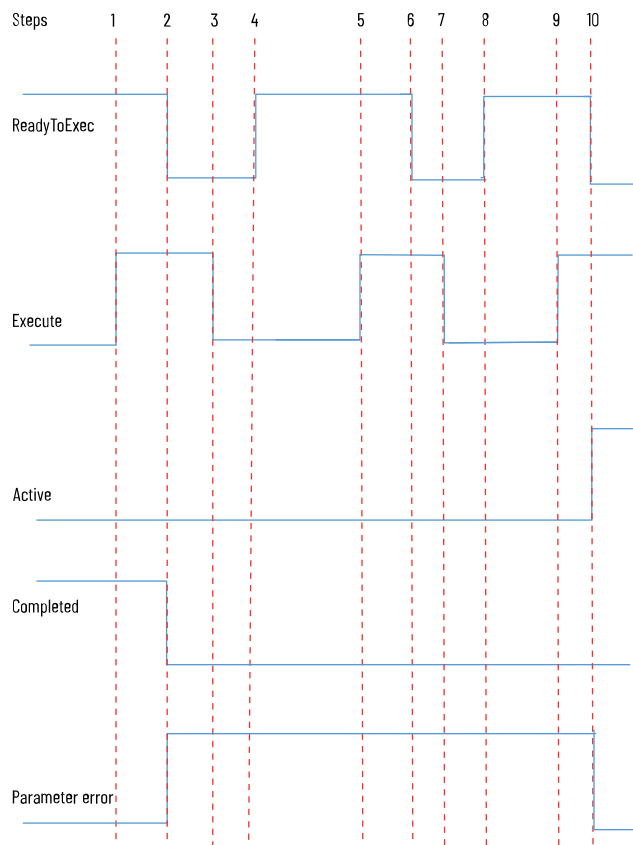
1. To execute a HART command, set *Command.Execute* to 1 in the consumer data when *Command.ReadyToExecute* = 1 in the producer data of the HART device.
2. After the HART module receives the consumer data, *Command.Active* = 1 and *Command.ReadyToExecute* = 0 are reported in the producer data of the HART device.
3. Once the controller receives *Command.ReadyToExecute* = 0, which means that the module has received the execution request, you can set *Command.Execute* to 0 in the consumer data.
4. When the HART command execution is complete, the HART module reports *Command.Completed* = 1 and *Command.ReadyToExecute* = 1 in the producer data of the HART device together with the command result and response data.
5. To initiate another command execution, repeat steps 1 to 4.

Figure 4. Command Completed within an RPI



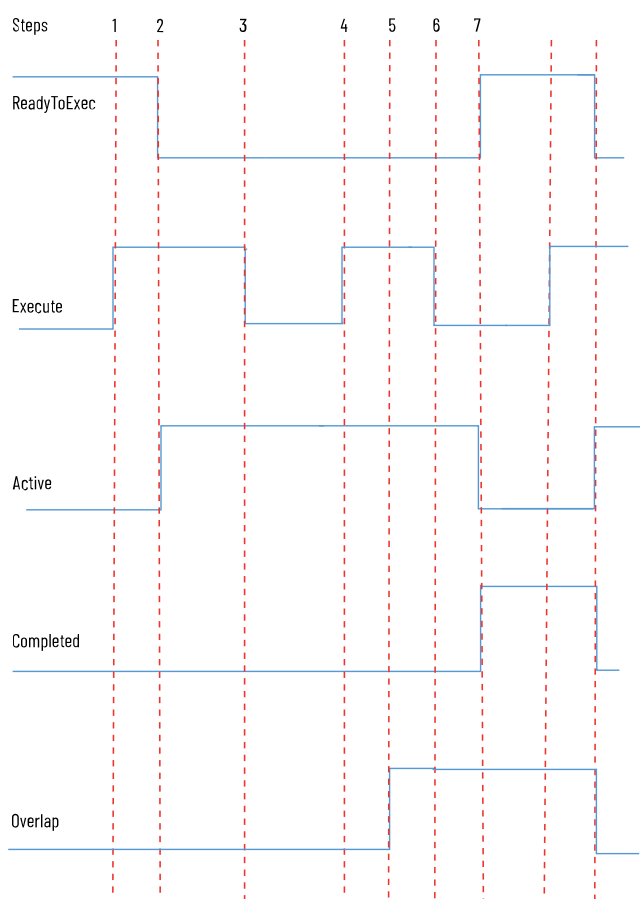
1. To execute a HART command, set *Command.Execute* to 1 in the consumer data when *Command.ReadyToExecute* = 1 in the producer data of the HART device.
2. After the HART module receives the consumer data, the HART command is completed within an RPI. Hence *Command.Completed* = 1 and *Command.ReadyToExecute* = 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.ReadyToExecute* = 0, set *Command.Execute* to 0 in the consumer data.
4. When the HART module receives the consumer data, the next producer data of the HART device reports *Command.ReadyToExecute* = 1.
5. To initiate another command execution, repeat steps 1 to 4.

Figure 5. Command with a Parameter Error



1. To execute a HART command, set *Command.Execute* to 1 in the consumer data when *Command.ReadyToExecute* = 1 in the producer data of the HART device.
2. After the HART module receives the consumer data, it verifies the request data and finds some parameters (for example, invalid characters for Packed ASCII or string length longer than configured) that cannot be converted to HART type successfully. The HART module reports *Command.Active* = 0, *<nameofcommand>.Command.ReadyToExecute* = 0, *Command.Complete* = 0, and *Command.ParameterError* = 1 in the producer data of the HART device.
3. When the module receives *Command.ReadyToExecute* = 0, set *Command.Execute* to 0 in the consumer data. With *ParameterError* bit set, 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 controller receives *Command.ReadyToExecute* = 0, set *Command.Execute* to 1 in the producer data of the HART device.
5. Initiate a new execution by setting *Command.Execute* to 1 in the consumer data.
6. When the HART module receives the consumer data and finds that the command request data in the consumer data still has errors, it reports *Command.ReadyToExecute* = 0 and *Command.ParameterError* = 1 in the producer data of the HART device again.
7. Once the HART module receives *Command.ReadyToExecute* = 0, the module receives the latest execution request and you can set *Command.Execute* to 0 in the consumer data. With *ParameterError* bit set, the latest execution request is rejected due to errors in the command request data.

8. The HART module reports *Command.ReadyToExecute* = 1 in the producer data of the HART device.
9. To start a new execution, set *Command.Execute* to 1 in the consumer data.
10. When the HART module receives the consumer data and verifies that the command request data are all valid, it sends the command to the HART device and reports *Command.ReadyToExecute* = 0, *Command.Active* = 1, and *Command.ParameterError* = 0 in the producer data of the HART device.

Figure 6. Command Overlap

1. Set *Command.Execute* to 1 in the consumer data when *Command.ReadyToExecute* = 1 in the producer data of the HART device.
2. After the HART module receives the consumer data, *Command.Active* = 1 and *Command.ReadyToExecute* = 0 are reported in producer data of the HART device.
3. Once the controller receives *Command.ReadyToExecute* = 0, the module receives the execution request and you can set *Command.Execute* to 0 in the consumer data.
4. Without waiting for the outstanding command to complete, set *Command.Execute* to 1 in the consumer data again.
5. The HART module reports *Command.Overlap* = 1 in the producer data of the HART device.
6. Set *Command.Execute* to 0 in the consumer data.

7. If *Command.Execute* is set to 0 in Step 6, after HART command execution is complete, the HART module reports *Command.Completed* = 1 and *Command.ReadyToExecute* = 1 in the producer data of the HART device together with the command result and response data.
8. To initiate another command execution, repeat steps 1 to 7. *Command.Overlap* is only cleared when a new command execution is started successfully.

Execute HART Commands Through Explicit Messaging

PointMax analog 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 should be used for HART Process Device Object.

As executing HART commands through explicit messaging causes delays of updating dynamic or device variables in the producer data of the HART device, periodical command execution through explicit messaging, for example, connected and cached message instruction, is not recommended.

Protected Operations for HART Devices

Enter and Exit Protection Mode

The HART device enters Protection Mode as soon as the connection to the device is established and exits Protection Mode as soon as the connection to the device is closed.

Restrictions Imposed By Protection Mode

Protection Mode prevents access to services that are not required after the HART device is configured and in normal operation. Protection Mode disables features that can make the device vulnerable to disruptive actions. By doing so, Protection Mode helps to reduce the attack surface.

When the HART device is in Protection Mode, the device prevents execution of the following tasks:

- Perform remote device resets
- Change RPI parameters
- Connect device or change data format
- Change Electronic Keying parameters

Analog HART Input Modules

Analog HART input modules convert an analog signal to a digital value. For example, the modules can convert the following:

- Volts
- Milliamps

Rolling Timestamp of Data

Rolling timestamp represents the time when the current *I.Chxx.Data* is sampled. It is a continuously running 15-bit rolling timestamp that counts in milliseconds from 0...32,767 ms. The rolling timestamp value is reported in the *I.Chxx.RollingTimestamp* tag for the analog I/O modules.

The controller program uses the last two rolling timestamp 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 timestamp accurately reflects the change. There can be jitter in the timing between samples before and after the system time change.

Module Data Quality Reporting

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

IMPORTANT: Once the condition that causes the Fault or Uncertain tag to change to 1 is removed, the tag automatically resets to 0. You cannot change the status of the tags. These tags are not always reset immediately after the condition is removed and typically resets after a small delay.

The following input tags indicate the level of data quality:

- *I.Chxx.Fault* - When the fault bit is set, this tag indicates that the reported channel data is inaccurate and cannot be trusted for use in your application. Do not use the reported channel data for control.

If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy.

Example causes of inaccurate data include the following:

- Channel is disabled
- Connection fault is detected
- Open Wire condition
- Underrange/Overrange condition
- Field Power Loss condition



You must troubleshoot the module for the typical causes first.

- *I.Chxx.Uncertain* - This tag indicates that the reported channel data can be inaccurate but the degree of inaccuracy is unknown. Do not use the reported channel data for control.

If the tag is set to 1, you know that the data can be inaccurate. You must troubleshoot the module to discover what degree of inaccuracy exists.

Example causes of uncertain data include the following:

- Data signal outside the channel operating range
- Sensor Offset data is not a number
- Calibration fault on the channel
- Calibration is in process on the current channel or another channel in the module.

See [Calibration Causes Uncertain Data Quality Indication on page 36](#) for more information.



You must monitor the tags in your program to make sure that the application is operating as expected with accurate channel input data.

Calibration Causes Uncertain Data Quality Indication

When a channel on the analog input module is being calibrated, the Notch Filter setting for that channel changes to 10 Hz. This results in the *I.Chxx.Uncertain* tag being set to 1 for that channel until calibration is completed.

The Notch Filter settings for the other input channels in the module are unchanged. However, since multiple input channels share an Analog to Digital converter in 5034-IF4IH module, all input channels in the same group slows during the calibration process. As a result, *I.Chxx.Uncertain* tag is set to 1 for the other input channels in that group as well.

See Connection section under chapter 5034-IF4IH Details for the grouping information of the input channels.

Multiple Input Ranges

The analog HART input 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.

Table 9. Input Ranges

Input Type	Available Input Range
Current (mA)	<ul style="list-style-type: none">• 0...20 mA• 4...20 mA
Voltage (V)	<ul style="list-style-type: none">• -10...10V• 0...5V• 0...10V

See Chxx view under chapter 5034-IF4IH Details for information on choosing an input range.

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.

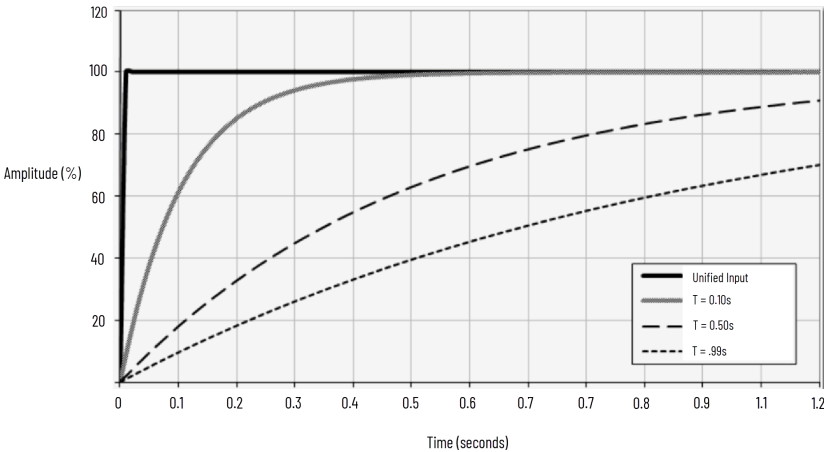
Choose a Notch Filter based on what noise frequencies are present in the module operating environment and any sampling requirements that are needed for control. For example if the Notch Filter setting is 10 Hz, 10 Hz AC line noise and its overtones are filtered out.

- 10 Hz
- 20 Hz with 50/60 Hz noise rejection
- 200 Hz
- 1,200 Hz
- 4,800 Hz for non-HART
- 9,600 Hz for non-HART

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

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. Default value is 0. The digital filter is characterized by the following equation.

$$Y[n] = Y[n-1] + dt * (X[n] - Y[n-1]) / (dt + T)$$

Where:

T

Configured time constant (Digital Filter in 'ms')

dt

Length of time between samples

X[n]

Unfiltered sample value at time n

Y[n]

Filtered sample value at time n

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.
-

Process Alarms

Process alarms alert you when the module has exceeded configured high or low limits for each channel. You can configure the following alarm trigger points in Engineering Units:

- 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, uncheck Disable All Alarms, and then enable individual process alarms in output tags (example, *O.Chxx.LAlarmEn* = 1).

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 are in engineering units.

For example, consider a channel that uses the Current (mA) input type, the 4...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%, 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.

IMPORTANT: Process Alarm values are in engineering units and must be recalculated when the scaling parameters are changed. Recalculate Units in the Module Properties dialog helps to recalculate the Process Alarm values and all other configurations with engineering units. Failure to update the Process Alarm values can cause the alarm alert not to take effect that could be misinterpreted as a hardware problem.

For example, an analog input module channel that uses Current (mA) input type with Process Alarms enabled has the following configuration parameters:

- Scaling values:
 - High Engineering = 100.0000%
 - Low Engineering = 0.0000%
- Process Alarming:
 - High High Limit = 100.0000%
 - High Limit = 100.0000%
 - Low Limit = 0.0000%
 - Low Low Limit = 0.0000%

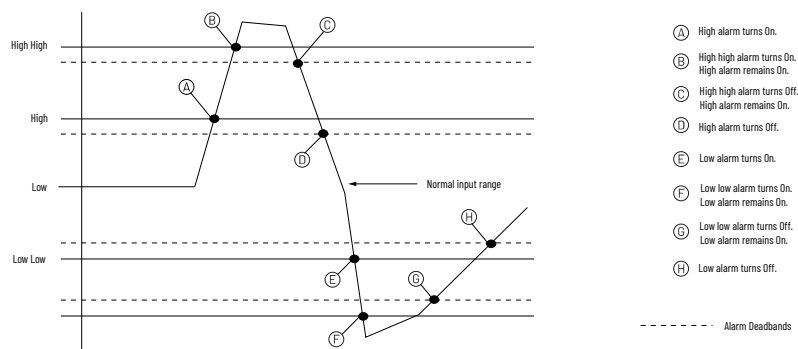
If you change the scaling High/Low Engineering values to 5 Kg/0 Kg, Recalculate Units suggest changing the Process Alarm values to 5/0 to make sure that the application continues to operate as expected.

Alarm Deadband

You can configure an alarm deadband to work with these alarms. The deadband lets the process alarm status bit remain set, despite the alarm condition disappearing, as long as the input data remains within the deadband of the process alarm.

The following graphic shows input data that sets each of the four alarms at some point during module operation. In this example, latching is disabled; therefore, each alarm turns Off when the condition that caused it to set ceases to exist.

Figure 7. Alarm Deadband Alarm Settings



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.

To enable Rate Alarm, go to Chxx - Alarms view in Module Properties, clear the Disable All Alarms checkbox, then set *O.Chxx.RateAlarmEn* tag to 1.

To enable Rate Alarm Latching, go to Chxx - Alarms view in Module Properties, select Enable Rate Alarm Latching checkbox, then Set the Rate Alarm Limit. Once the Rate Alarm is latched, you must change the *O.Chxx.RateAlarmUnlatch* tag to 1.

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 engineering units and is added to the data value.

For example, consider an application that uses the Current (mA) 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.

Open Wire Detection

Open Wire detection detects when a wire is disconnected from the channel. To enable Open Wire detection, go to Channels → Chxx view in Module Properties and select Enable Open Wire Detection checkbox.

Table 10. Open Wire Conditions - 5034-IF4IH Modules

Mode	Cause of Detection	Resulting Module Behavior
Current (mA)	The input signal for a channel is below 92 μ A.	<ul style="list-style-type: none">The <i>I:Chxx.OpenWire</i> tag changes to 1.A fault occurs and the <i>I:Chxx.Fault</i> tag is set to 1.The <i>I.Chxx.Underrange</i> tag set to 1.
Voltage (V)	The input signal value is above 11V.	<ul style="list-style-type: none">The <i>I:Chxx.OpenWire</i> tag changes to 1.A fault occurs and the <i>I:Chxx.Fault</i> tag is set to 1.The <i>I.Chxx.Overrange</i> tag set to 1.

IMPORTANT: The Disable All Alarms feature does not disable the Open Wire detection feature but it disables all alarms on the module.

The Open Wire detection feature is not an alarm. It is an indicator that a wire has been disconnected from the channel but does not trigger an alarm.

To disable the Open Wire detection feature, you must clear the Enable Open Wire Detection checkbox in the Chxx view.

Field Power (SA Power) Loss Detection

The Field Power Loss Detection feature monitors for the loss of field-side power on the SA power bus. It has a corresponding channel level tag that can be examined in the user program if a fault occurs. When field power to the module is lost, the channel level field power loss bit and fault bit are set for all channels and sent to the controller.

IMPORTANT: When SA power drops below 10V, it is possible that you may encounter a rise in the analog input data. You can use the Rate Alarm to monitor the data change rate and discard the input data when Rate Alarm is set.

Overcurrent Detection

The module includes built-in protection against overcurrent conditions caused by mis-wiring. Common mis-wiring scenarios include:

- Sensor power (24V) V+n is shorted to RTNn at the terminal screws.
During this state:
 - *SSVOverCurrent* and *SSVOverCurrentTimestamp* appear in Channel Diagnostics.
 - Overrange Fault, Channel Fault, and Uncertain status displays in the input tag.
- The module is externally powered and input current causes an overrange condition.
During this state:
 - Overrange Fault, Channel Fault, and Uncertain status displays in the input tag.

When such conditions are detected, the module automatically limits current to protect internal components.

NOTE: The module uses internal current limiting to safeguard hardware.

Underrange/Ovrerrange Detection

Underrange/Ovrerrange Detection detects when signal 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 5034-IF4IH module channel to use the + 10V input range, an overrange condition does not exist until the input signal exceeds 10.70V.

The module has deadband values for each range. The deadband lets a condition remain set despite it disappearing. 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. See [Alarm Deadband on page 39](#) for more information.

The following table lists the input ranges of the input modules and the thresholds in each range before the module detects an underrange/overrange condition.

Table 11. Input Signal Threshold Ranges - 5034-IF4IH

Input Type	Range	Underrange Threshold	Uncertain Threshold		Overrange Threshold
			Low	High	
Current (mA)	0...20 mA	Not Applicable	Not Applicable	20.633 mA	23.00 mA
	4...20 mA	3 mA	3.667 mA	20.633 mA	
Voltage (V)	-10...+10V	-10.7V	-10.5V	+10.5V	+10.7V
	0...5V	Not Applicable	Not Applicable	+5.25V	+5.35V
	0...10V	Not Applicable	Not Applicable	+10.5V	+10.7V

IMPORTANT: The Disable All Alarms feature does not disable the Underrange/Overrange Detection feature but it disables alarms on the module.

Underrange/Overrange detection is not an alarm. It is an indicator that channel data has gone beyond the maximum or minimum threshold, respectively, for the channel range.

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

Underrange/Overrange conditions are indicated when the following tags change to 1:

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

Fault and Status Reporting

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

With some exceptions, the analog input module provides the fault and data status in a channel-centric format. The tag names in the following table that include Chxx represent channel-centric data. The xx represents channel number.

Table 12. Fault and Status Data Tags

Data Type	Tag Name	Description
Fault	ConnectionFaulted	Indicates if a connection is running. The module sets this tag to 0 when connected. If the module is not connected, it changes the tag to 1.
	Chxx.Fault	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.
Status	RunMode	Channel's operating state.
	DiagnosticActive	Indicates if any diagnostics are active or if the prognostics threshold is reached.
	DiagnosticSequenceCount	Increments for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected.
	Chxx.Uncertain	Indicates that the channel data can 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.

Calibration

The analog I/O modules are calibrated during the manufacturing process. Each module's accuracy remains high throughout its lifespan. You are not required to calibrate the module.

During the manufacturing process, analog I/O modules are calibrated at room temperature. If the module is intended to operate in an environment that is different from the room temperature, you may perform field calibration at the specific operating environment to

improve the accuracy. For example, if intended operating temperature is more than 40 °C (104 °F).

There are two ways to perform calibration:

- Go to Module Properties dialog → Calibration view
- Use the input and output tags to perform calibration.

To use this method, you must select Connection type as Data with Calibration in Device Definition dialog.

Analog HART Output Modules

Analog HART output modules convert a digital value to an analog signal. For example, the modules can convert the following:

- Volts
- Milliamps

Analog HART enabled modules decode HART information from signal embedded within the channel.

Output Module Operation

The controller sends data to an output module at one of the following:

- At the RPI
- After an Immediate Output (IOT) instruction is executed

IMPORTANT: An IOT instruction sends data to the module immediately, and resets the RPI timer.

Data Echo

Data Echo automatically sends channel data values that match the analog value that was sent to the module's screw terminals then. The echoed value is indicated in the *I.Chxx.Data* and is represented in Engineering Units. This data is sent at the RPI.

Rolling Timestamp of Data

For the analog output modules, the rolling timestamp value is updated only when new values are applied to the Digital to Analog Converter (DAC). The echoed data is updated at the same time.

The rolling timestamp is a continuously running 15-bit rolling timestamp that counts in milliseconds from 0...32,767 ms. The rolling timestamp value is reported in the *I.Chxx.RollingTimestamp* tag for the analog I/O modules.

Module Data Quality Reporting

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

IMPORTANT: Once the condition that causes the *Fault* or *Uncertain* tag to change to 1 is removed, the tag automatically resets to 0. You cannot change the status of the tags. These tags are not always reset immediately after the condition is removed and typically resets after a small delay.

The following input tags indicate the level of data quality:

- *I.Chxx.Fault* - When the fault bit is set, this tag indicates that the reported channel data is inaccurate and cannot be trusted for use in your application. Do not use the reported channel data for control.

If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy.

Example causes of inaccurate data include the following:

- Channel is disabled
- Connection fault is detected

- Short Circuit condition
- No Load condition
- Field Power Loss condition



You must troubleshoot the module for the typical causes first.

- *I.Chxx.Uncertain* - This tag indicates that the reported channel data can be inaccurate but the degree of inaccuracy is unknown. You do not use the reported channel data for control.
If the tag is set to 1, you know that the data can be inaccurate. You must troubleshoot the module to discover what degree of inaccuracy exists.
Example causes of uncertain data include the following:
 - Requested output signal is outside of maximum operating range
 - Received output data is "Not a Number"
 - Calibration data missing on the channel
 - Calibration is ongoing on the channel



You must monitor the tags in your program to make sure that the application is operating as expected.

Program and Inhibit Mode Handling

You can configure individual output channels to specific states when the module is in Program Mode or the module is Inhibited.

Output State in Program or Inhibited Mode

When the controller switches from Run Mode to Program Mode or Inhibited, the output can behave in the following ways, depending on how you configure the Output State in Program Mode parameter:

- Hold Last State - It causes the output to remain at the last value that is sent from the controller before being placed in Program Mode or Inhibit Mode.
- User Defined Value - It forces the output to transition to a specific, user-defined value.

When the module is inhibited, the output behavior follows the Output State in Program Mode configuration.

Connection Fault Handling

You can configure individual output channels to specific states when a connection fault occurs, that is, the connection between the owner-controller and the output module breaks unexpectedly.

You must define the following:

- Output Behavior Immediately After a Connection Fault
- Communication Fault State Duration After Connection Fault
- Final Communication Fault State Value

Output Behavior Immediately After a Connection Fault

When the connection between an owner-controller and output module breaks, the output can behave in the following ways depending on how the Output State in Communication Fault Mode parameter is configured:

- Hold Last State – It causes the output to remain at the last value that is sent from the controller before the connection fault occurs.
- User Defined Value – It forces the output to transition to a specific, user-defined value.

The output remains at that state value until the following occurs:

- The connection to the controller is re-established.
- The duration expired, which is based on the value that is defined in the Communication Fault Mode State Duration.

Communication Fault State Duration After Connection Fault

If you configure the output to transition to a specific value after the connection breaks, you must define how long the output remains at the specified value before it transitions to a Final Communication Fault State Value.

You can configure the output to remain at the specific value for the following times:

- Forever
- 1 second
- 2 seconds
- 5 seconds
- 10 seconds

After the Communication Fault State Duration time expires, the output transitions to user defined Final Communication Fault State Value.

Final Communication Fault State Value

The Final Communication Fault State Value defines the value to which the output goes after the Communication Fault State Duration time expires.

When Communication Fails in Program Mode

When communication fails in Program Mode, the output can behave in the following ways, depending on how you configure the When Communication Fails in Program Mode parameter:

- Leave Outputs in Program Mode State – It causes the output to behave as defined by the Output State in Program Mode selection.
- Change Outputs to Communication Fault Mode State – It causes the output to behave as defined by the Output State in Communication Fault Mode selection.

Output State Once Connection is Re-established

Once the connection between the owner-controller and output module is re-established, the output resumes normal operation if the controller is in Run mode or goes to the configured Program Mode state if the controller is in Program Mode.

Channel Offset

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

For example, consider an application that uses the Current (mA) input type with the 4...20 mA range and scaling at 0...100%. If a channel used in the output range 4...20 mA has an error that results in it consistently outputting 7.8 mA when 0.Chxx.Data is 8 mA, you must account for the error by setting the Channel Offset to 1.25.

Hold for Initialization

Hold for Initialization causes outputs to hold present state until the value commanded by the controller matches the value at the output screw terminal within 0.1% of full scale, providing a bumpless transfer.

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

Output Clamping

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

IMPORTANT: Output clamping does not apply during Program Mode and Communication Fault Mode.

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

Clamping alarms are enabled by default. You can disable the alarms or configure latching behavior of the alarms on a per channel basis.

IMPORTANT: Clamp Limit values are in engineering units and must be recalculated when the scaling parameters are changed. Recalculate Units in the Module Properties dialog helps to recalculate the Clamp Limit values and all other configurations with engineering units. Failure to update the Clamp Limit values can cause clamping not to take effect or generate a small output signal that could be misinterpreted as a hardware problem.

For example, an analog output module channel that uses Current (mA) 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/Low Engineering values to 2 Bar/0 Bar, the Recalculate Units suggest changing the High/Low Clamp Limit values to 2/0 to make sure that the application continues to operate as expected.

Output Ramping Rate Limiting

Output Ramping Rate Limiting limits the speed at which an analog output signal can change. This prevents fast transitions in the output from damaging the devices that an output module controls.

Table 13. Output Ramping Types

Output Ramping	Scenario in which Output Ramping Rate Limiting applies
Ramp in Run Mode	When the output value changes to the new output value received from the owner-controller in Run Mode.
Ramp to Program Mode	When the present output value changes to the Program value after a Program command is received from the controller.
Ramp to Fault Mode and Final Fault State	When the present output value changes to the Fault value after a communication fault occurs.

In Module Properties dialog, go to Chxx - Limits view to configure the Output Ramping Rate Limiting parameters.

The maximum rate of change in outputs is expressed in engineering units per second and set in the Ramp Rate field.

IMPORTANT: When HART is enabled, the max ramping rate allowed in Run Mode is 833.33%/s.

Field Power (SA Power) Loss Detection

The Field Power Loss Detection feature monitors for the loss of field-side power on the SA power bus. It has a corresponding channel level tag that can be examined in the user program if a fault occurs. When field power to the module is lost, the channel level field power loss bit and fault bit are set for all channels and sent to the controller.

No Load Detection

IMPORTANT: This feature is available only in Current (mA) mode.

No Load Detection detects when a wire is disconnected from the channel or a missing load for each output channel. The output range that is used with the analog output module determines the current below which a load is considered missing.

The *I.Chxx.NoLoad* tag indicates the presence of a no load condition when it is set to 1.

The No Load Detection feature is disabled by default. You must enable the feature in your Studio 5000 Logix Designer application project. To enable No Load Detection, go to Channels, then Chxx view and select the Enable No Load Detection checkbox. Select Apply or OK to save the configuration.

Short Circuit Detection

IMPORTANT: This feature is available only in Voltage (V) mode.

Short Circuit Detection helps prevent damage that can result from a mis-wiring or driving a current from the channel greater than the maximum current level the channel can handle.

When a short circuit condition is detected, the following occurs:

- The output turns off.
- The *I.Chxx.ShortCircuit* tag is set to 1.

For more information on the maximum current that you can apply to an output, see the PointMax I/O System Specifications Technical Data, publication [5034-TD001](#).

Fault and Status Reporting

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

Table 14. Fault and Status Data Tags

Data Type	Tag Name	Description
Fault	ConnectionFaulted	Indicates if a connection is running. The module sets this tag to 0 when connected. If the module is not connected, it changes the tag to 1.
	Chxx.Fault	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.
Status	RunMode	Channel's operating state.
	DiagnosticActive	Indicates if any diagnostics are active or if the prognostics threshold is reached.
	DiagnosticSequenceCount	Increments for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected.
	Chxx.Uncertain	Indicates that the channel data can 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.

Calibration

The analog I/O modules are calibrated during the manufacturing process. Each module's accuracy remains high throughout its lifespan. You are not required to calibrate the module.

During the manufacturing process, analog I/O modules are calibrated at room temperature. If the module is intended to operate in an environment that is different from the room temperature, you may perform field calibration at the specific operating environment to improve the accuracy. For example, if intended operating temperature is more than 40 °C (104 °F).

There are two ways to perform calibration:

- Go to Module Properties dialog → Calibration view
- Use the input and output tags to perform calibration.

To use this method, you must select Connection type as Data with Calibration in Device Definition dialog.

IMPORTANT: During calibration, the screw output goes to low reference or high reference signal values. Make sure that the output module is not connected to the actuator.

Analog HART I/O Module Applications

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

This chapter does not explain the user-configurable module features that you can edit on different screens in your Studio 5000 Logix Designer application project.

Add a New Module to a Studio 5000 Logix Designer Application Project

You must complete the following tasks before you configure the module:

1. Create a Studio 5000 Logix Designer application project.
2. Add a Logix 5000 controller to the project.
3. Add a PointMax EtherNet/IP adapter to the project.

For more information on how to add a PointMax EtherNet/IP adapter to the Studio 5000 Logix Designer application project, see the PointMax EtherNet/IP Adapter User Manual, publication [5034-UM001](#).

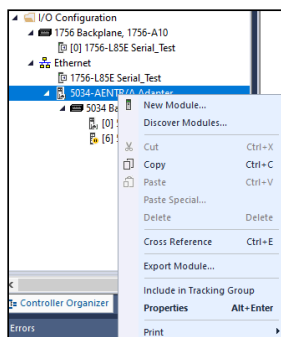
After completing above steps, add your I/O module to the project by following one of the methods:

- Discover Modules
- New Module

Discover Modules

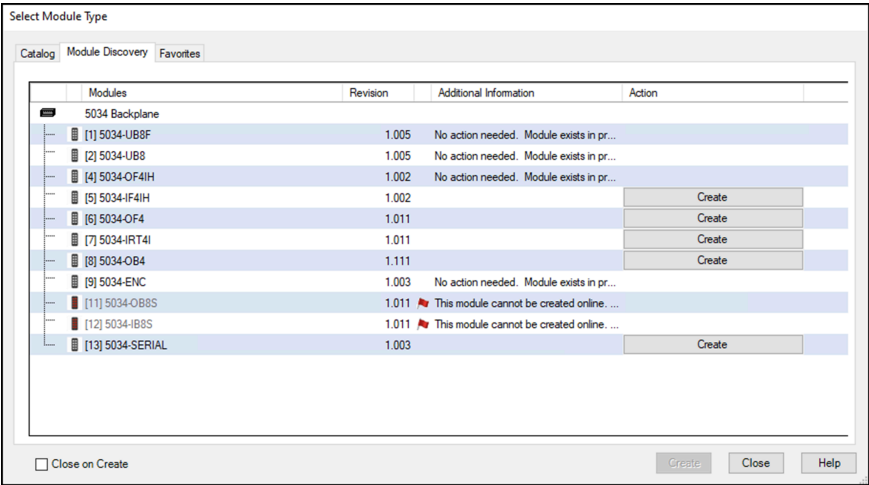
To use the Discover Modules method with PointMax I/O modules, complete these steps:

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



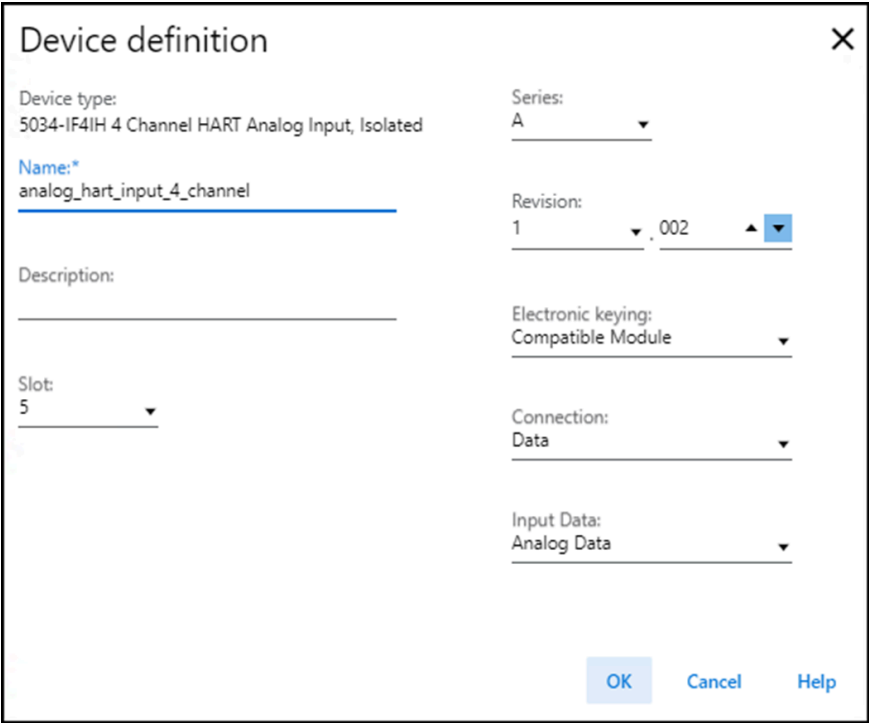
The Studio 5000 Logix Designer application automatically detects available modules that are connected to the backplane. The Select Module Type dialog appears with list of modules detected.

3. In the Select Module Type window, select Create in the Action column to add the module to the project.

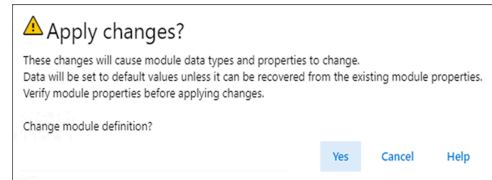


The New Module window with Device definition dialog appears.

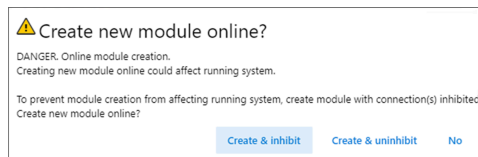
- 4. In the Device definition dialog, configure the module properties and select OK.



- 5. If Apply changes warning dialog appears, select Yes.



- 6. In the Create new module online warning dialog, select Create & inhibit.



7. After adding as many as module you need, close the Select Module Type dialog. To add additional I/O modules with this method, complete one of the following:
 - If you selected the Close on Create checkbox when you created the first I/O module, repeat steps 2...6.
 - If you did not select the Close on Create checkbox when you created the first I/O module, repeat steps 3...6.

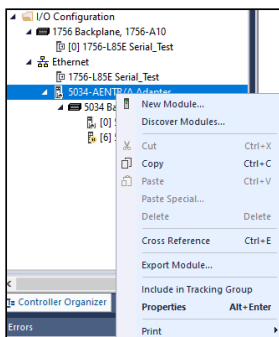
Add a New Module

To use the New Module method with PointMax I/O modules, complete these steps:

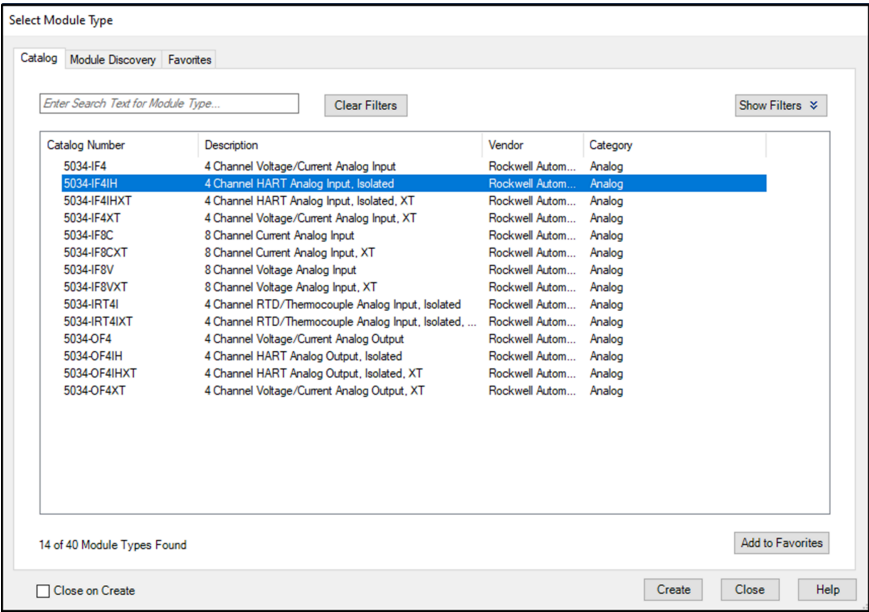


Example shows how to add a module when the Studio 5000 Logix Designer application project is offline. You can add new modules when the project is online, if desired. In this case, the steps are similar to the steps described in Discover Modules. One exception is that, in Step 1, you must choose New Module instead of Discover Modules.

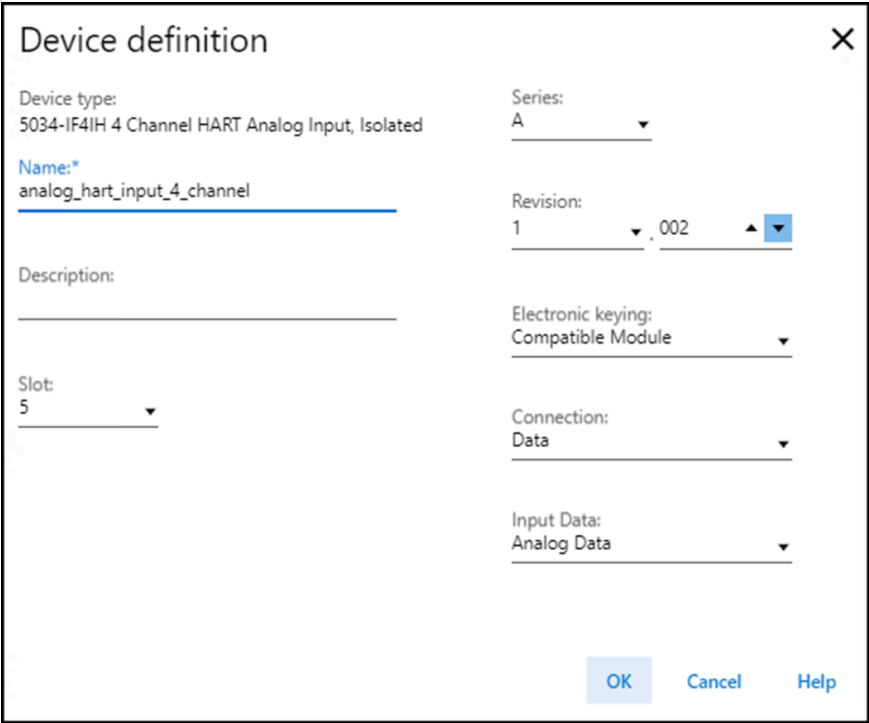
1. Right-click the PointMax EtherNet/IP adapter and select New Module.



2. In the Select Module Type dialog, choose the module you want to add and select Create.



- The New Module window appears with Device definition dialog.
3. You can select OK to use the default configuration as shown or edit the module configuration.



- To add additional remote I/O modules with this method, complete one of the following:
- If you selected the Close on Create checkbox when you created the first I/O module, repeat steps 1...3.
 - If you did not select the Close on Create checkbox when you created the first I/O module, repeat steps 2...3.

I/O Tag Name Conventions

The module tag names use defined naming conventions. The conventions are as follows:

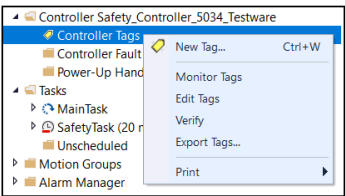
Example tag name = Adapter:1:I.Ch00.Data

- Adapter = Name of the PointMax EtherNet/IP adapter in the PointMax I/O system
- 1 = Slot number
- I = Tag type
The possible PointMax analog module tag types are C (configuration), I (input), and O (output).
- Ch00 = Module channel number
- Data = Tag function
In this case, Data represents the input data that is returned to the owner-controller.

Access I/O Tags

To access the I/O tags in the Studio 5000 Logix Designer application, proceed as follows:

1. Open your Studio 5000 Logix Designer application project.
2. Right-click Controller Tags and select Monitor Tags.



3. Open the tags as necessary to view specific tags.

A screenshot of the 'Controller Tags - Safety_Controller_5034_Testware(controller)' window. The window shows a list of tags with columns: Name, Value, Force Mask, Style, and Data Type. The 'Scope' is set to 'Safety_Controller' and 'Show' is set to 'All Tags'. The list includes tags like 'generic_hart_device:I', 'generic_hart_device:I.ConfigurationChanged', 'generic_hart_device:I.ConnectionFaulted', etc.

Name	Value	Force Mask	Style	Data Type
generic_hart_device:I	{...}	{...}	{...}	AB:5000_HART4:I:0
generic_hart_device:I.ConfigurationChanged	0		Decimal	BOOL
generic_hart_device:I.ConnectionFaulted	1		Decimal	BOOL
generic_hart_device:I.CurrentFixed	0		Decimal	BOOL
generic_hart_device:I.CurrentMismatch	0		Decimal	BOOL
generic_hart_device:I.CurrentSaturated	0		Decimal	BOOL
generic_hart_device:I.DiagnosticActive	0		Decimal	BOOL
generic_hart_device:I.DiagnosticSequenceCount	0		Decimal	SINT
generic_hart_device:I.Malfunction	0		Decimal	BOOL
generic_hart_device:I.MoreStatusAvailable	0		Decimal	BOOL
generic_hart_device:I.PV	{...}	{...}	{...}	CHANNEL_AI_HART:I:0
generic_hart_device:I.QV	{...}	{...}	{...}	CHANNEL_AI_HART:I:0
generic_hart_device:I.RunMode	0		Decimal	BOOL
generic_hart_device:I.SV	{...}	{...}	{...}	CHANNEL_AI_HART:I:0
generic_hart_device:I.TV	{...}	{...}	{...}	CHANNEL_AI_HART:I:0
generic_hart_device:O	{...}	{...}	{...}	AB:5000_HART:O:0

Troubleshoot Your Module

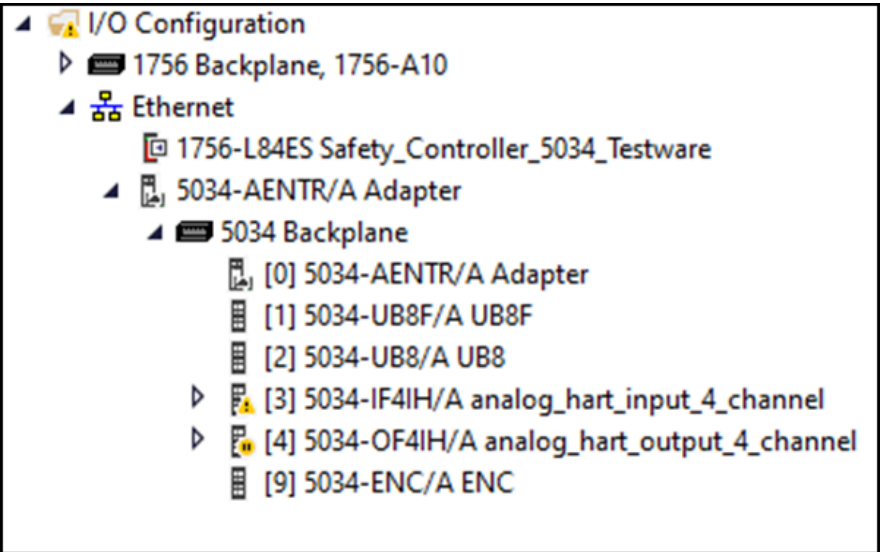
You can use the following methods to troubleshoot your module:

- Module Status Indicators
See the respective module-specific sections for more information on how to troubleshoot using module status indicators.
- Studio 5000 Logix Designer application.

Troubleshooting using Studio 5000 Logix Designer Application

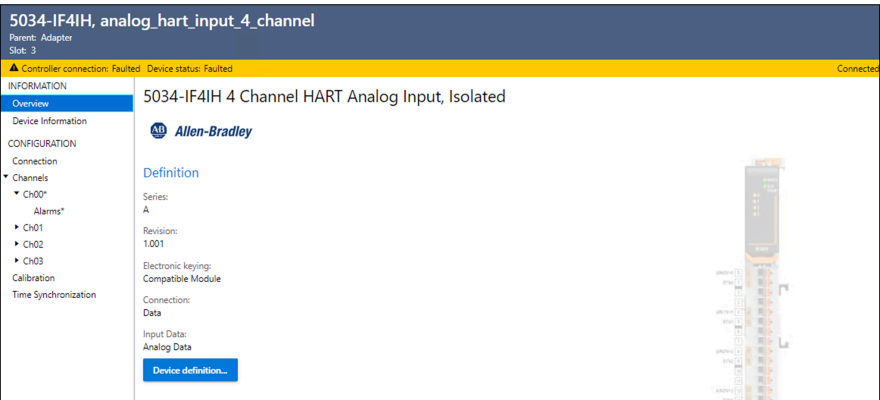
Check the Controller Organizer to see if there is a warning icon on the module.

Figure 8. Warning Icon in Controller Organizer



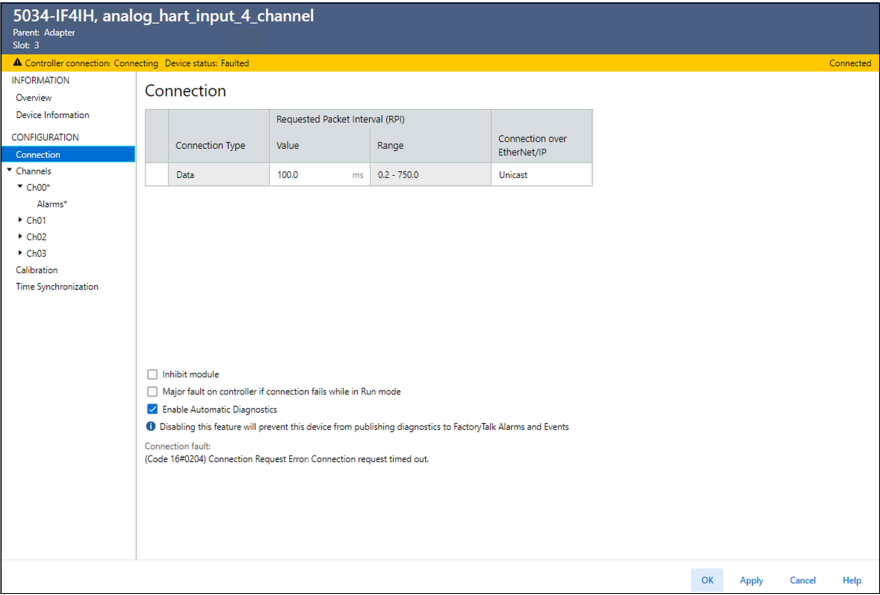
If a warning icon is present, open the Module Properties and check the status bar to identify the type of fault.

Figure 9. Fault Message in Status Bar



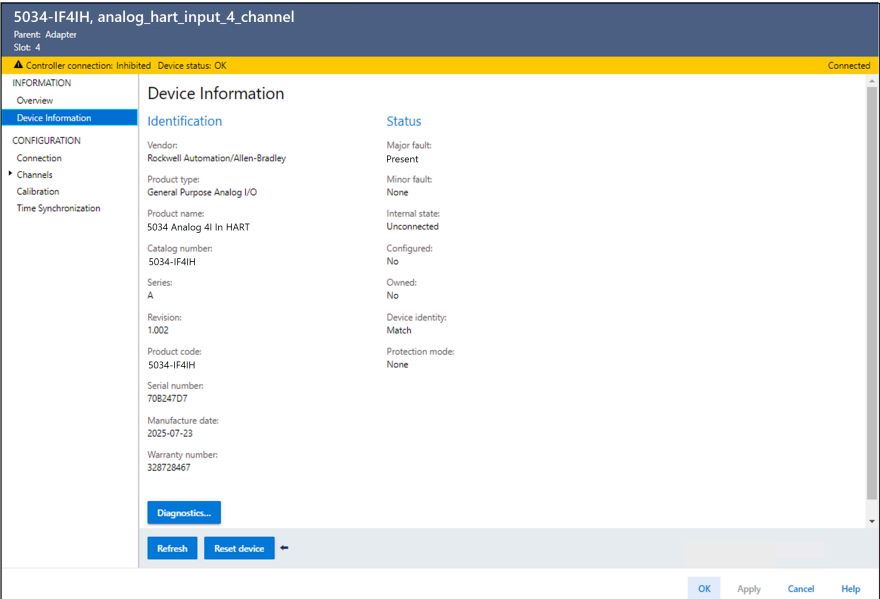
If connection is faulted, go to the Connection view and check the error code in the Connection Fault area.

Figure 10. Connection Fault Description with Error Code



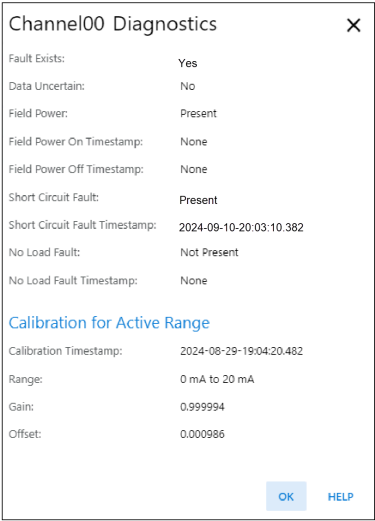
Error Code	Action
0x204	<ol style="list-style-type: none"> 1. Open the Module Properties of the adapter. 2. Go to Chassis Information view and check the base status. If there is a fault, check the base details to identify the fault.
Keying Error	<p>Go to Device Information view to confirm that the physical module is compliant or matches the configured identity.</p> <p>For more information, see Electronic Keying in Logix 5000 Control Systems Application Technique, publication LOGIX-AT001.</p>
0x10	<p>Go to Device Information view and check the firmware revision and major fault status:</p> <ul style="list-style-type: none"> • If firmware update is required, update the firmware. • If the major fault is recoverable, reset the module. • If the major fault is unrecoverable, replace the module.

Figure 11. Example for Device Information View with Major Fault Present



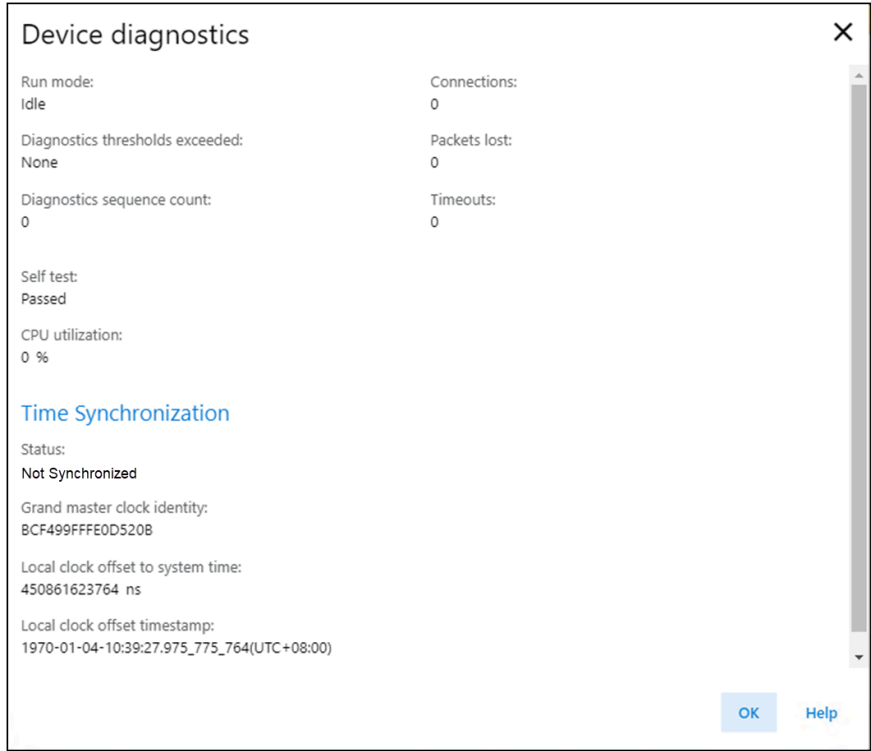
If a channel is faulted, go to the Channels → Chxx view and select the Diagnostics to see the diagnostic condition of the channel.

Figure 12. Example for Channel Diagnostics Dialog with Short Circuit Fault



If a Time Sync fault is present, go to the Device Diagnostics dialog to check the Time Synchronization status and Grandmaster clock identity.

Figure 13. Example for Device Diagnostics with Time Sync not Synchronized



The Grandmaster clock identity must match with the network Grandmaster clock identity. Also, check the Time Synchronization status of the adapter in the adapter Device Diagnostics dialog.

HART Device Applications

This chapter describes how to add and monitor HART devices that are connected to your HART input or output module in a Studio 5000 Logix Designer application project.

You must complete the following tasks before you can configure connection for the HART device:

1. Create a Studio 5000 Logix Designer application project.
2. Add a controller to the project.
3. Add and configure an analog HART I/O module.

Before using the HART capabilities, verify the following:

- The I/O module and the associated field device are working properly in the analog 4...20 mA mode.
- The channel is configured as 4...20 mA range with HART enabled.
- The field device is HART capable.
- No more than one HART field device is connected to each channel.
- Notch Filter of input channel or Ramping Rate of output channel is set to a valid value.

Input data of HART device that is device status, dynamic, or device variable values and status, are sent to Logix 5000 controller at the RPI. At the RPI, not only does the module send input data of the HART devices to the controller, but also the controller sends data for the HART devices to the module. For example, the controller sends data to reset Configuration Changed status or initiate an execution of a pre-configured HART command.

IMPORTANT: If you switch the controller to Program mode or inhibit an output module, it may cause the output channels to de-energize and the HART device to not power up.

To power up the HART device, switch the controller to Run mode and uninhibit the output module.

Add HART Devices to Your Project

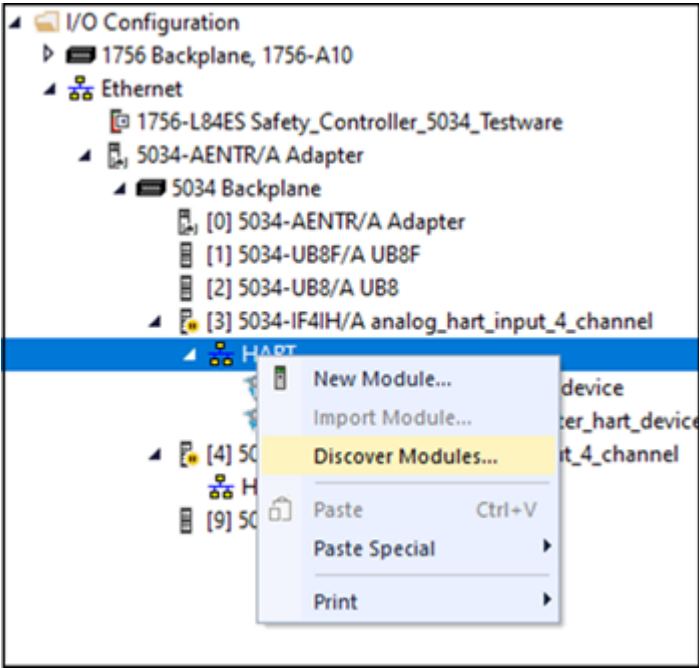
To add HART devices to your project, you can use the following methods.

- [Discover Modules on page 60](#)
- [Add a New Module on page 62](#)
- [Import HART Device on page 64](#)

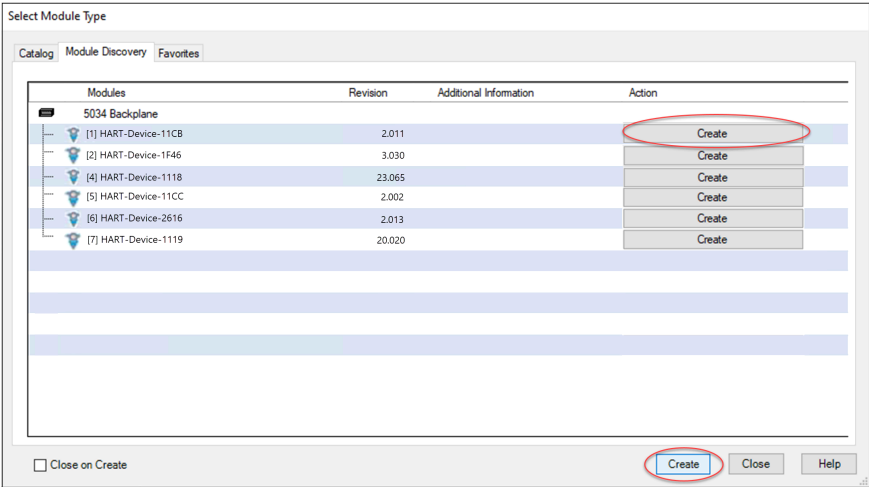
Discover Modules

To use the Discover Modules method with HART devices, complete these steps.

1. Go online with your project.
2. In the I/O Configuration tree, right-click the HART bus and select Discover Modules.



The Select Module Type dialog appears. The Module Discovery tab shows the available devices that are connected to the HART bus.



3. Select the HART device and choose Create to add the discovered module to your project.

NOTE: If you selected the Close on Create checkbox, the Select Module Type dialog automatically closes and you must start from Step 2 to add another device.

The New Module dialog box appears. It includes a list of views on the left side. The number and type of views varies by module type.

4. You can select OK to use the default configuration as shown or edit the device configuration.

The screenshot shows the 'New Module' dialog box. The 'General' tab is selected in the left sidebar. The main area contains the following fields and options:

- Type: Crocus P
- Vendor: Endress+Hauser
- Parent: analog_hart_output_4_channel
- Name: (empty text box)
- Description: (empty text box)
- Module Definition section:
 - Revision: 1.001 (with a 'Change ...' button)
 - Electronic Keying: Compatible Module
 - Connection: Data

At the bottom of the dialog are 'OK', 'Cancel', and 'Help' buttons. The status bar at the bottom left indicates 'Status: Creating'.

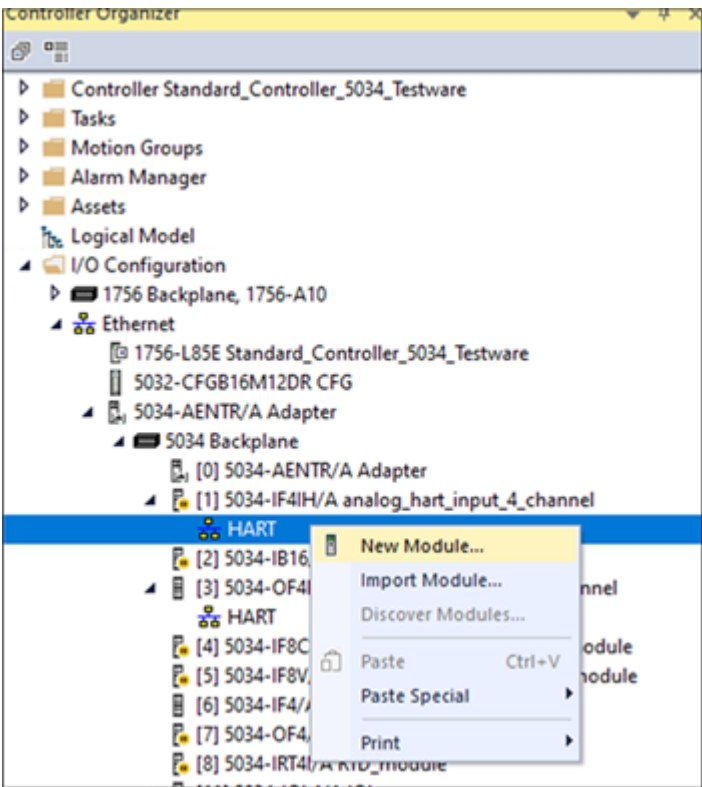
Add a New Module



You can use the new module method when the project is offline or online.

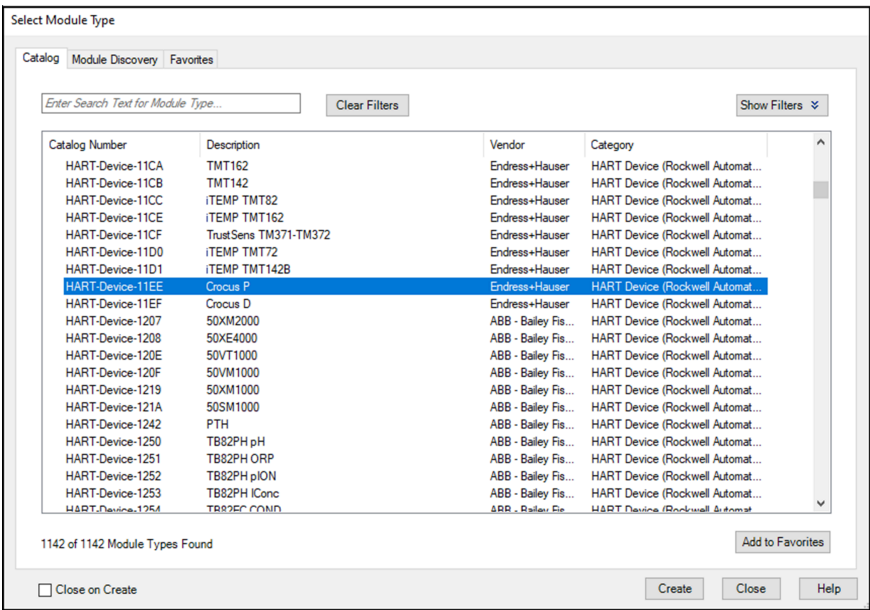
To use the New Module method, complete these steps.

1. In the I/O Configuration tree, right-click the HART bus and select New Module.



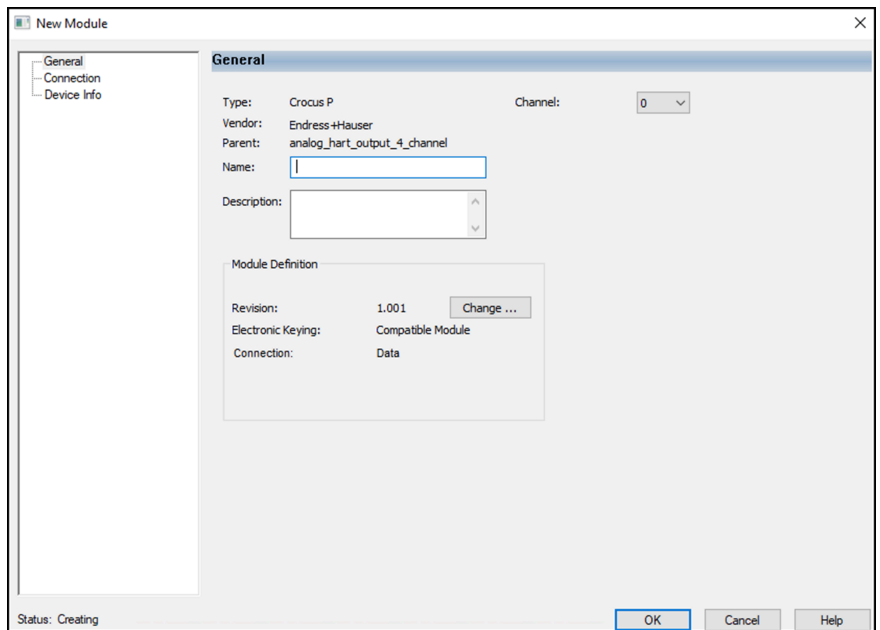
The Select Module Type dialog appears.

2. Select the device and select Create.
To narrow down the list of devices, use the filters or search with keywords.

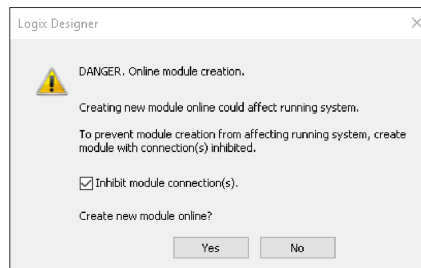


The New Module window appears and shows the General view.

3. Enter a Name for the device.



4. Select OK to save the configuration.
If you are in online mode, a prompt appears to request to inhibit the device. We recommend inhibiting the device if the device is not fully configured or not ready to be put into operation currently.



5. Repeat Step 2...Step 4 to add another device, or close the Select Module Type dialog. If you selected the Close on Create checkbox in Step 2, you must start from Step 1 to add another device.

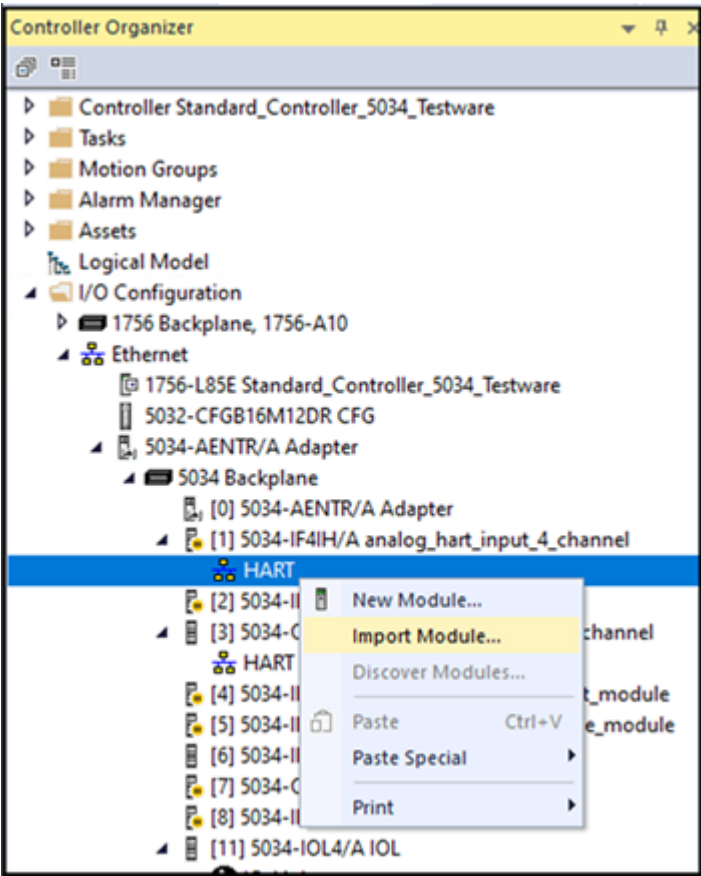
Import HART Device



You can use the import module method when the project is offline or online.

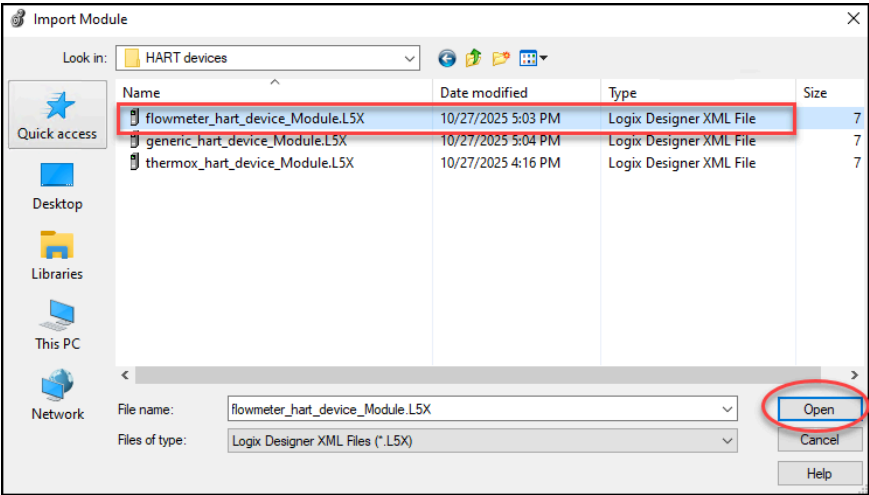
You can import a previously exported HART device configuration to add to your project. To use the Import Module method, complete these steps.

1. In the I/O Configuration tree, right-click the HART bus and select Import Module.

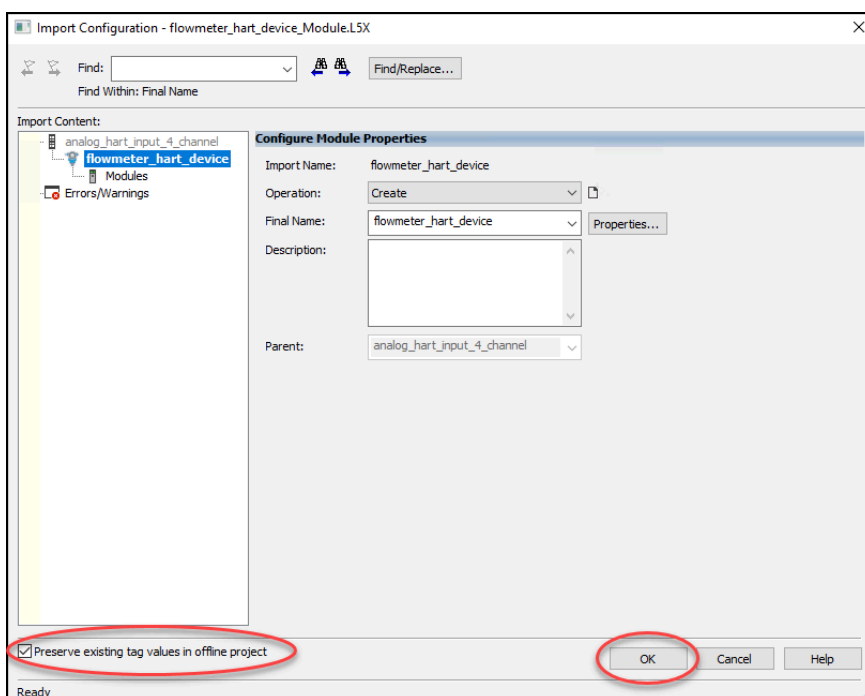


The Import Module dialog appears.

2. Browse to the location of the Logix Designer XML (L5X) file and select Open.



3. The Import Configuration dialog opens. Confirm whether you want to preserve the existing tag values in the offline project.



4. Select OK and the dialog closes.

Add HART EDD File

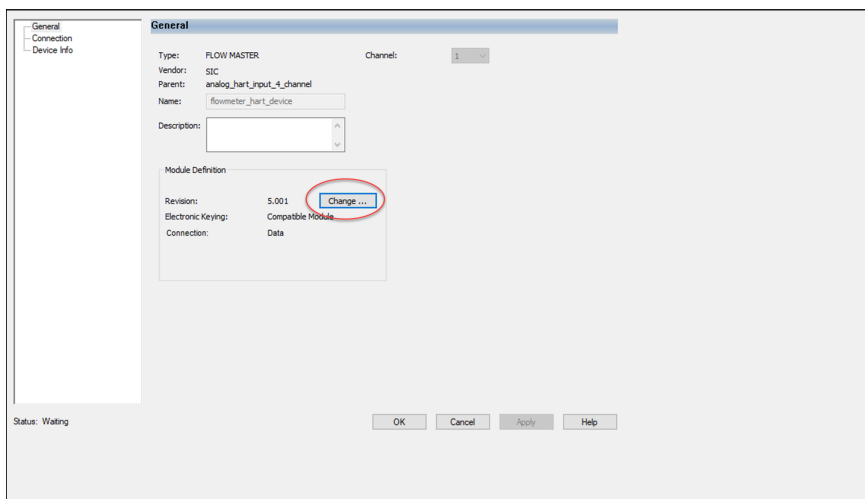
There are two scenarios for adding HART devices from the Module Definition dialog box:

- Update an EDD file for a specific HART device.
- Add an EDD file for a generic HART device.

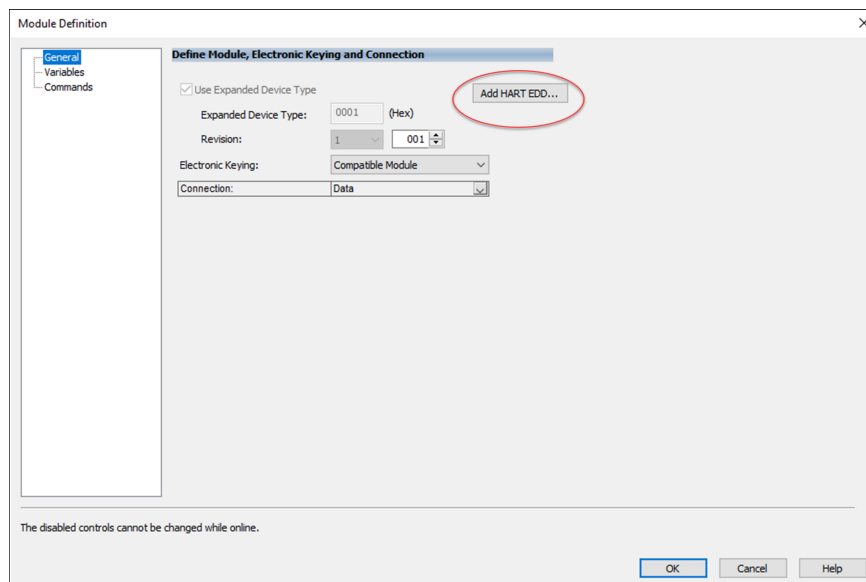
The HART device EDD files are included with most HART device profiles. If additional or newer EDD files are required, download the EDD file. This file may be available from the Documents and Downloads page at the FieldComm Group website www.fieldcommgroup.org. Otherwise request the file from the HART Device vendor.

Update an EDD file for a specific HART device

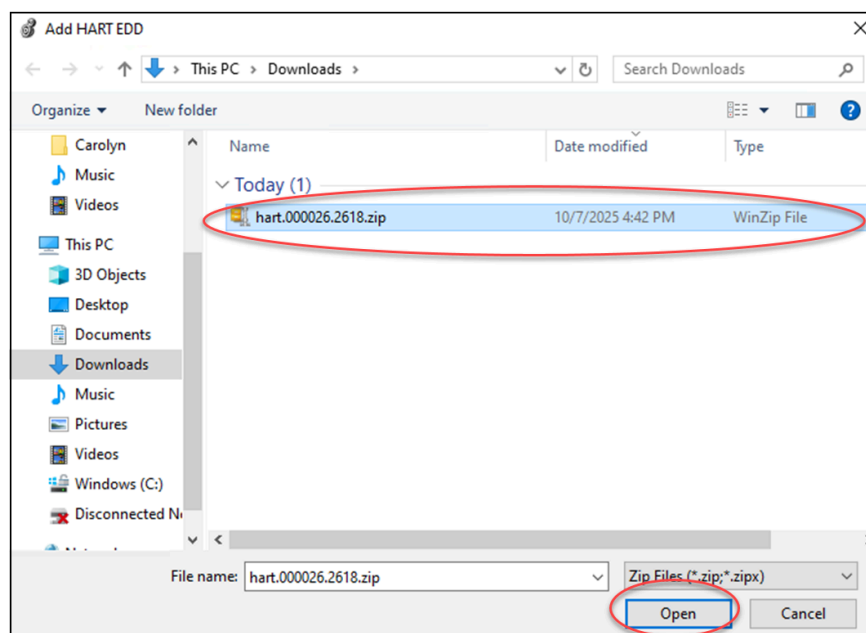
1. From the Module Properties dialog - General view, select Change...



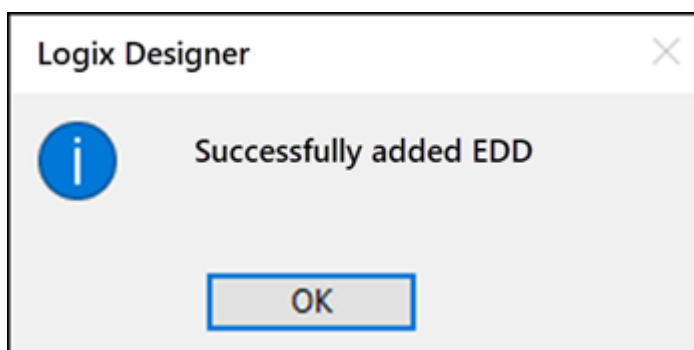
- From the Module Definition dialog, select Add HART EDD...



- In the Add HART EDD dialog box, browse to the location of the EDD file.



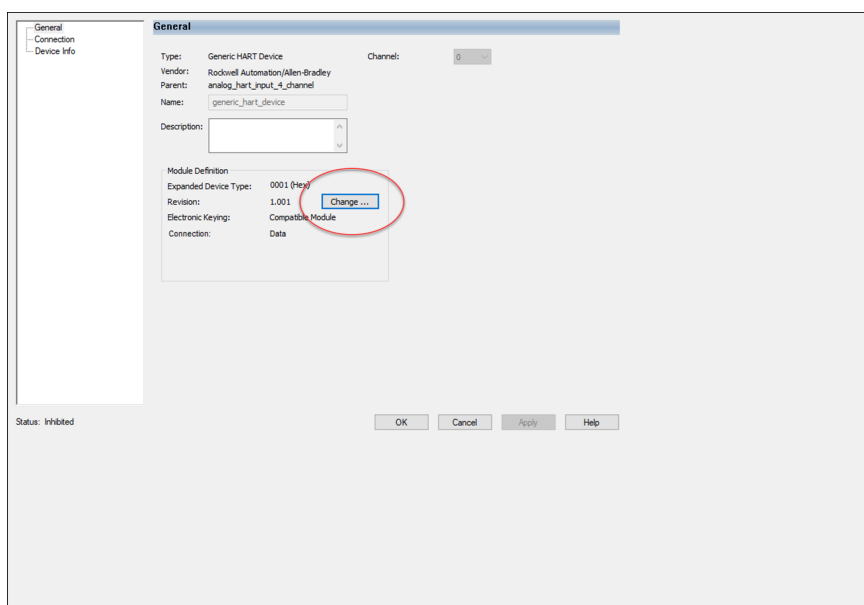
- Select the HART EDD file and select Open.
The message Successfully added EDD appears.



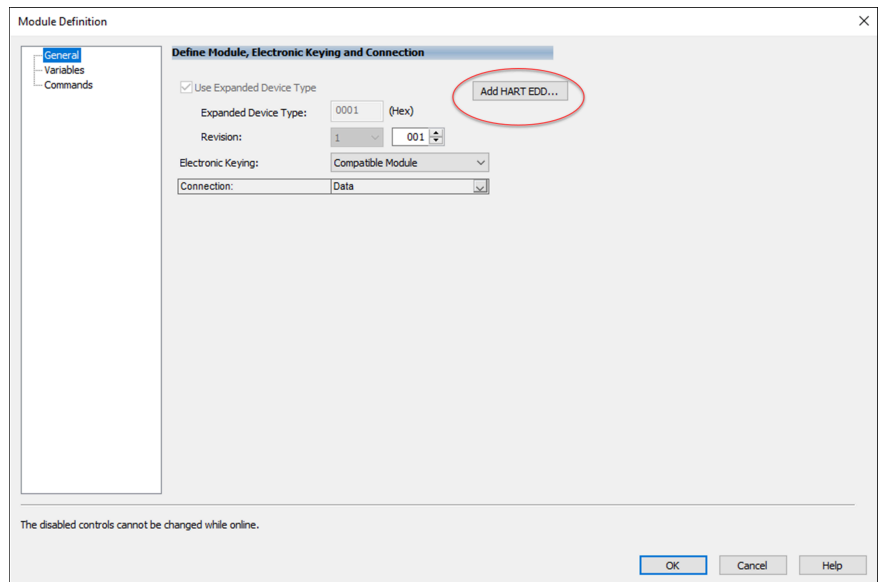
5. Select OK to close the dialog box.

Add an EDD file for a generic HART device

1. From the Module Properties dialog - General view, select Change...

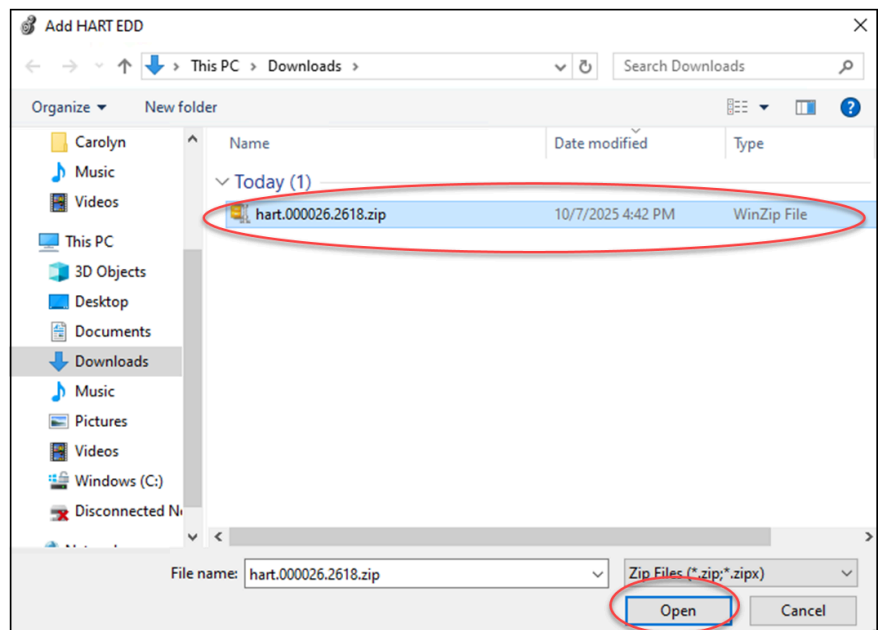


2. From the Module Definition dialog, enter the correct Expanded Device Type ID for the HART device, then select Add HART EDD...

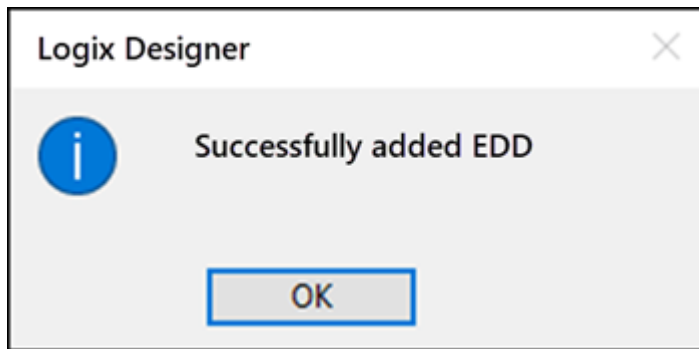


IMPORTANT: The Expanded Device Type ID must match your device. If not, you are not able to add an EDD file properly.

3. In the Add HART EDD dialog box, browse to the location of the EDD file.



4. Select the HART EDD file and select Open.
The message Successfully added EDD appears.



5. Select OK to close the dialog box.



When configuring a device, an error message appears when:

- The selected file is not an EDD file.
- An EDD file for the device is not included.

I/O Tag Name Conventions

The tag names use defined naming conventions. The conventions for an example module tag name *Device:I:Data* are as follows:

- Device = Name of the HART device
- I = Tag type

The possible tag types are I (input), and O (output).

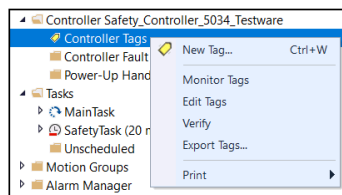
- Data = Tag function

In this example, Data represents the input data that is returned to the controller.

Access I/O Tags

To access the I/O tags in the Studio 5000 Logix Designer application, proceed as follows:

1. Open your Studio 5000 Logix Designer application project.
2. Right-click Controller Tags and select Monitor Tags.



3. Open the tags as necessary to view specific tags.

Name	Value	Force Mask	Style	Data Type
generic_hart_device	{...}	{...}	{...}	AB:5000_HART4:I:0
generic_hart_device.ConfigurationChanged	0		Decimal	BOOL
generic_hart_device.ConnectionFaulted	1		Decimal	BOOL
generic_hart_device.CurrentFixed	0		Decimal	BOOL
generic_hart_device.CurrentMismatch	0		Decimal	BOOL
generic_hart_device.CurrentSaturated	0		Decimal	BOOL
generic_hart_device.DiagnosticActive	0		Decimal	BOOL
generic_hart_device.DiagnosticSequenceCount	0		SINT	BOOL
generic_hart_device.Malfunction	0		Decimal	BOOL
generic_hart_device.MoreStatusAvailable	0		Decimal	BOOL
generic_hart_device.PV	{...}	{...}		CHANNEL_AI_HART:I:0
generic_hart_device.QV	{...}	{...}		CHANNEL_AI_HART:I:0
generic_hart_device.RunMode	0		Decimal	BOOL
generic_hart_device.SV	{...}	{...}		CHANNEL_AI_HART:I:0
generic_hart_device.TV	{...}	{...}		CHANNEL_AI_HART:I:0
generic_hart_device.O	{...}	{...}		AB:5000_HART:O:0

Troubleshoot Your HART Device

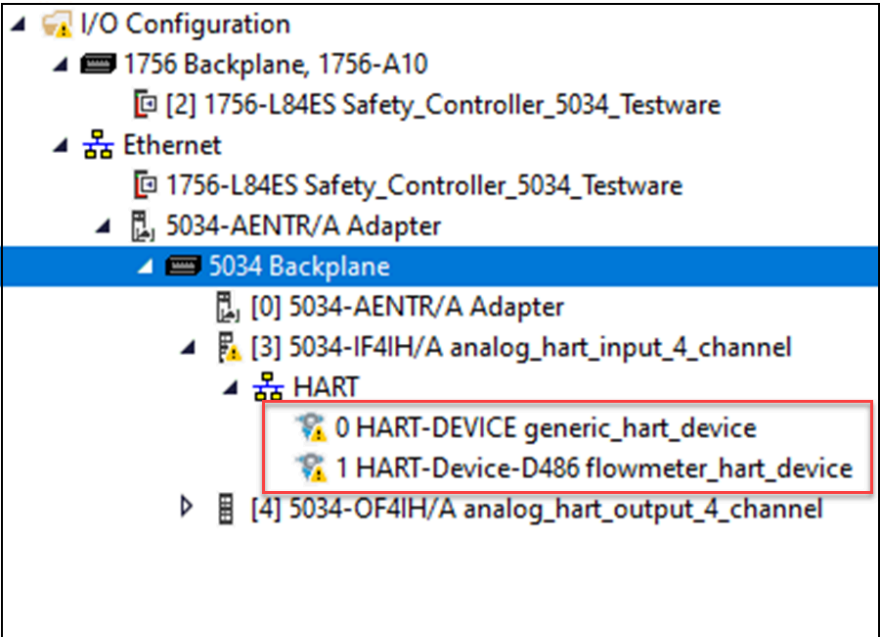
The Studio 5000 Logix Designer application indicates the presence of fault conditions. Fault conditions are reported in the following ways:

- [Warning Icon in Controller Organizer on page 71](#)
- [Status and Fault Information in Module Properties on page 72](#)
- [Studio 5000 Logix Designer Application Tag Editor on page 72](#)

Warning Icon in Controller Organizer

Check the Controller Organizer to see if there is a warning icon on the HART device.

Figure 14. Warning Icon in Controller Organizer



If a warning signal appears in the I/O Configuration tree, make sure that:

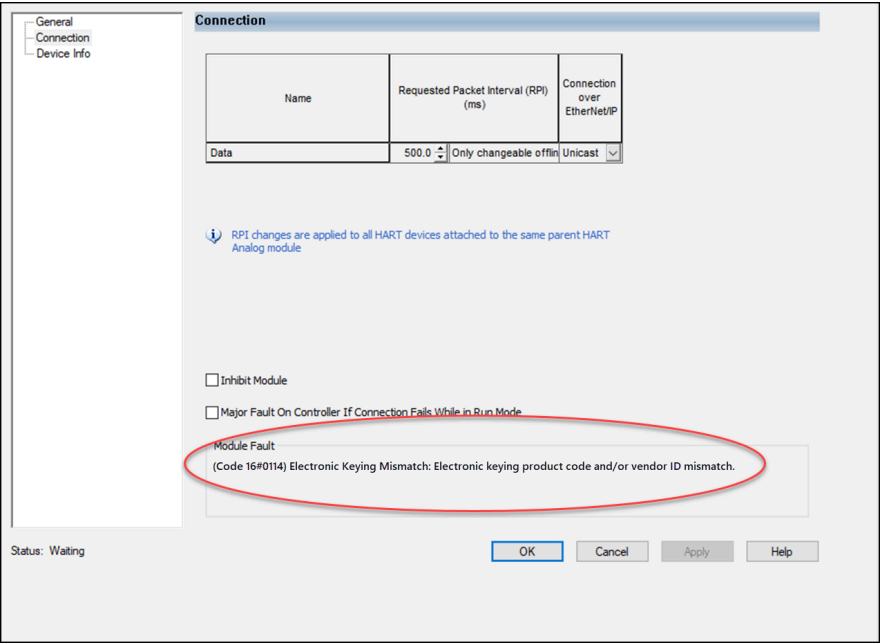
- The device is powered up and properly wired to the module.
- There are no electronic keying mismatches.
- There is no fault status on the analog channel.

Status and Fault Information in Module Properties

Module Properties in the Studio 5000 Logix Designer application includes a series of views. The Connection view displays error messages.

The Connection view displays a device fault description that includes an error code that is associated with the specific fault type.

Figure 15. Connection Fault Description with Error Code



Studio 5000 Logix Designer Application Tag Editor

Fault conditions are indicated in the controller tags for the HART device.

Figure 16. Fault Indication in Controller Tags for HART Devices

Controller Tags - Safety_Controller_5034_Testware(controller)					
Scope: Safety_Controller		Show: All Tags		Enter Name or Description Filter	
Name	Value	Force Mask	Style	Data Type	
flowmeter_hart_device1		[...]	[...]	AB:5000_HART4:0	
flowmeter_hart_device1.ConfigurationChanged	0		Decimal	BOOL	
flowmeter_hart_device1.ConnectionFaulted	1		Decimal	BOOL	
flowmeter_hart_device1.CurrentFixed	0		Decimal	BOOL	
flowmeter_hart_device1.CurrentMismatch	0		Decimal	BOOL	
flowmeter_hart_device1.CurrentSaturated	0		Decimal	BOOL	
flowmeter_hart_device1.DiagnosticActive	0		Decimal	BOOL	
flowmeter_hart_device1.DiagnosticSequenceCount	0		Decimal	SINT	
flowmeter_hart_device1.Malfunction	0		Decimal	BOOL	
flowmeter_hart_device1.MoreStatusAvailable	0		Decimal	BOOL	
flowmeter_hart_device1.LPV	[...]		[...]	CHANNEL_AI_HART4:0	
flowmeter_hart_device1.QV	[...]		[...]	CHANNEL_AI_HART4:0	
flowmeter_hart_device1.RunMode	0		Decimal	BOOL	
flowmeter_hart_device1.SV	[...]		[...]	CHANNEL_AI_HART4:0	
flowmeter_hart_device1.TV	[...]		[...]	CHANNEL_AI_HART4:0	
flowmeter_hart_device1.O	[...]		[...]	AB:5000_HART0:0	
generic_hart_device1		[...]	[...]	AB:5000_HART4:0	
generic_hart_device1.ConfigurationChanged	0		Decimal	BOOL	
generic_hart_device1.ConnectionFaulted	1		Decimal	BOOL	
generic_hart_device1.CurrentFixed	0		Decimal	BOOL	
generic_hart_device1.CurrentMismatch	0		Decimal	BOOL	
generic_hart_device1.CurrentSaturated	0		Decimal	BOOL	
generic_hart_device1.DiagnosticActive	0		Decimal	BOOL	

CIP Error Codes for HART Devices

Under different error conditions, error codes are returned for CIP messaging sent to HART devices. These error codes either display on the Connection view or show in CIP messaging responses. The following table describes HART device common error codes and the recommended action.

Error Code	Description	Action
0x01/0x204	Timeout. Possible timeout conditions: <ul style="list-style-type: none"> Channel is not configured as HART-enabled. I/O module owner connection to the controller is down. No HART device is wired on the channel. 	<ul style="list-style-type: none"> Enable HART for the channel. Make sure that the owner connection to the module is up. Wire a HART device on the channel.
	<ul style="list-style-type: none"> HART device is rebooting. HART device discovery with Command 0 is in progress. 	Retry.
0x0C	Object is in the wrong mode.	Retry.
0x01/0x114	<ul style="list-style-type: none"> Electronic Keying mismatch. HART expanded device type mismatch. 	Correct the mismatch.
0x01/0x116	<ul style="list-style-type: none"> Electronic Keying mismatch. Major or Minor Revision mismatch. 	
0x02	No resource	Retry.
0x20	Invalid parameter found in the CIP request.	Correct the parameter.
0x1E	Service failed – HART command failed due to a link layer error.	Retry.

5034-IF4IH and 5034-IF4IHXT Details

This chapter covers the detailed instructions on how to configure, calibrate, and troubleshoot your 5034-IF4IH and 5034-IF4IHXT modules. It also describes the module tag definitions for input, output, and configuration tags.

5034-IF4IH and 5034-IF4IHXT Analog 4 Input Isolated HART Modules

Figure 17. 5034-IF4IH and 5034-IF4IHXT Wiring Diagram – Current Mode

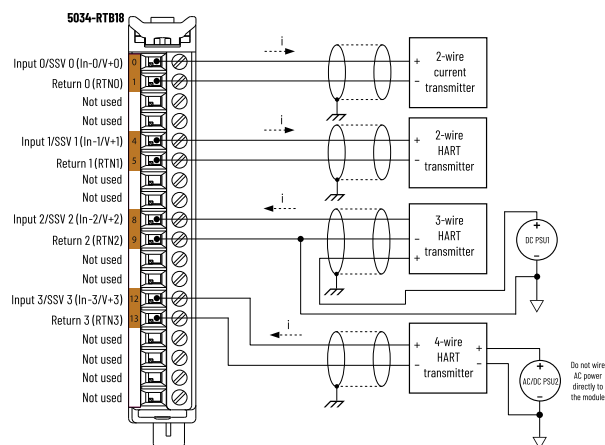


Figure 18. 5034-IF4IH and 5034-IF4IHXT Wiring Diagram – Voltage Mode

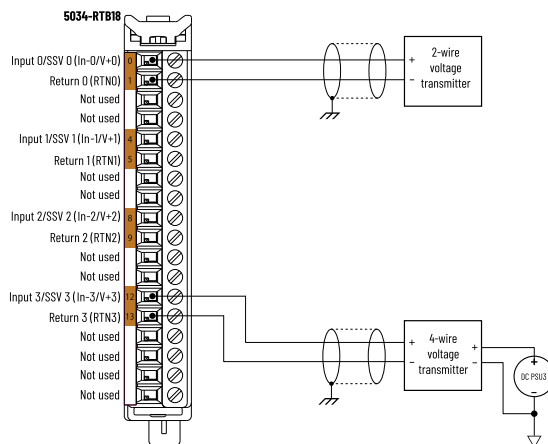


Figure 19. 5034-IF4IH and 5034-IF4IHXT Functional Block Diagram

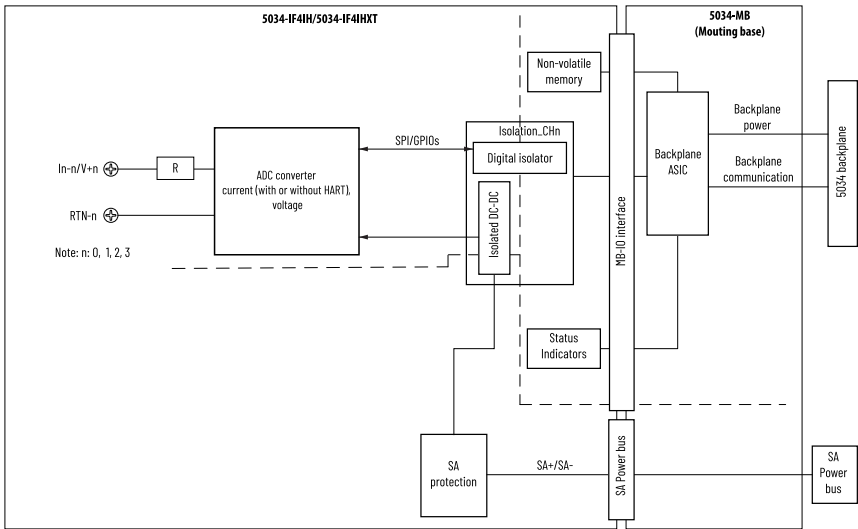


Table 15. Technical Specifications - 5034-IF4IH, 5034-IF4IHXT

Attribute	5034-IF4IH, 5034-IF4IHXT
Input range, voltage	-10...+10V 0...10V 0...5V
Input range, current	0...20 mA 4...20 mA 4...20 mA - HART
Input impedance, voltage	≥ 1 MΩ
Input impedance, current, typical without HART	155 Ω
Input impedance, current, typical with HART	265 Ω
Module conversion method	Sigma-delta 16-bit ADC per channel
HART update rate	Typically 1 s Additional device variables, configured commands, pass through messages, handheld communicators, secondary masters, communication errors, or configuration changes can significantly increase the update time.
Resolution, voltage At 20 Hz notch filter	-10...+10V: 16 bits (366 μV/bit) 0...10V: 15 bits (366 μV/bit) 0...5V: 14 bits (732 μV/bit)
Resolution, current	0...20 mA: 15 bits (763 μA/bit)

Table 15. Technical Specifications - 5034-IF4IH, 5034-IF4IHXT (continued)

Attribute	5034-IF4IH, 5034-IF4IHXT
At 20 Hz notch filter	4...20 mA: 15 bits (763 μ A/bit)
Calibrated accuracy at 25 °C (77 °F), HART disabled	Voltage: -10...+10V, $\pm$ 0.1% full scale with 20 Hz filter Voltage: 0...10V, $\pm$ 0.1% full scale with 20 Hz filter Voltage: 0...5V, $\pm$ 0.2% full scale with 20 Hz filter Current: 0...20 mA, $\pm$ 0.1% full scale with 20 Hz filter Current: 4...20 mA, $\pm$ 0.1% full scale with 20 Hz filter
Calibrated accuracy at 25 °C (77 °F), HART enabled	Current: 4...20 mA, $\pm$ 0.1% full scale with 10 Hz filter Current: 4...20 mA, $\pm$ 0.1% full scale with 20 Hz filter Current: 4...20 mA, $\pm$ 0.3% full scale with 200 Hz filter Current: 4...20 mA, $\pm$ 0.6% full scale with 1200 Hz filter
Calibrated accuracy over temperature range -25...+60 °C (-13...+140 °F) HART disabled	Voltage: -10...+10V, $\pm$ 0.2% full scale with 20 Hz filter Voltage: 0...10V, $\pm$ 0.2% full scale with 20 Hz filter Voltage: 0...5V, $\pm$ 0.4% full scale with 20 Hz filter Current: 0...20 mA, $\pm$ 0.2% full scale with 20 Hz filter Current: 4...20 mA, $\pm$ 0.2% full scale with 20 Hz filter
Calibrated accuracy over temperature range -25...+60 °C (-13...+140 °F) HART enabled	Current: 4...20 mA, $\pm$ 0.2% full scale with 10 Hz filter Current: 4...20 mA, $\pm$ 0.2% full scale with 20 Hz filter Current: 4...20 mA, $\pm$ 0.35% full scale with 200 Hz filter Current: 4...20 mA, $\pm$ 0.65% full scale with 1200 Hz filter
Fastest scan time	1.0 ms with 9600 Hz notch filter
Fastest scan time, per module	1.0 ms
Input notch filter (Hz) selections	HART disabled: 10, 20 with 50/60 Hz noise rejection (Default), 200, 1200, 4800, 9600 HART enabled: 10, 20 with 50/60 Hz noise rejection (Default), 200, 1200
Input digital filter	First order lag, 0 ms (Default) 0...32,767 ms (32.767 s)
Input overvoltage protection, max	$\pm$ 32V DC
Overcurrent protection	Yes, 25 mA typical
Data value during overload condition	Full scale, overrange flag, data uncertain/data fault
Open circuit detection time	Voltage: 4 s typical Current: 0.5 ms typical

Table 15. Technical Specifications - 5034-IF4IH, 5034-IF4IHXT (continued)

Attribute	5034-IF4IH, 5034-IF4IHXT
Onboard data alarming	Yes
Scaling to engineering units	Yes
Real-time channel sampling	Yes
Data format	IEEE 754 32-bit floating point
Timestamp of inputs	Yes
CIP Sync	Yes

Table 16. General Specifications - 5034-IF4IH, 5034-IF4IHXT

Attribute	5034-IF4IH, 5034-IF4IHXT
Number of inputs	4 channels, individually isolated Supports current sourcing and differential signal Configurable voltage or current mode at channel level
SA power voltage, nom	24V DC
SA power voltage range	10...30V DC (Derate to 3 channels for 10...18V DC)
SA power current, nom	125 mA
SA power current, max	300 mA
SA power current at no load	27 mA
Isolated sourcing voltage, min ⁽¹⁾	20 V DC
Sourcing current limit per channel, max	25 mA, typical
SSV overcurrent detection	Yes
Power dissipation, max	1.60 W
Thermal dissipation, max	5.46 BTU/hr
Isolation voltage	250V (continuous), Basic Insulation Type, between system and SA power 250V (continuous), Basic Insulation Type, between SA power and input ports 250V (continuous), Basic Insulation Type, between individual input ports 250V (continuous), Basic Insulation Type, between system and input ports
Calibration	Factory-calibrated

Table 16. General Specifications - 5034-IF4IH, 5034-IF4IHXT (continued)

Attribute	5034-IF4IH, 5034-IF4IHXT
	Manual calibration supported
RIUP support	Yes
Electronic keying	Electronic keying via programming software
RTB key position (slot)	2, 6, 10
RTB supported	5034-RTB18, 5034-RTB18S
Wiring category ⁽²⁾	2 - Signal ports 2 - Power ports
Wiring specification	See Wiring Specifications for Removable Terminal Blocks in the PointMax I/O System Specifications Technical Data, publication 5034-TD001
Indicators	1 green/red module status indicator 1 green/red SA power status indicator 4 yellow/red I/O status indicators
Dimensions (HxWxD), approx	123.6 x 15.0 x 66.4 mm (4.87 x 0.59 x 2.61 in.)
Weight, approx	51.0 g (1.80 oz.) - 5034-IF4IH 53.0 g (1.87 oz.) - 5034-IF4IHXT
Enclosure type	None (Open-style)
North American temp code	T4
UKEX/ATEX temp code	T4
IECEX temp code	T4

(1) 20V DC is connected to screw via series impedance. Series impedance is as per value published. Measured voltage is Sourcing Voltage minus Voltage drop across series impedance based on the current drawn.

(2) Use this Conductor Category information for planning conductor routing. See the Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#). Use this Conductor Category information for planning conductor routing as described in the appropriate System Level Installation Manual.

Module Configuration

Before you start configuring your I/O module, you must create a Studio 5000 Logix Designer application project for the Logix 5000 controller that owns the I/O module. The project includes configuration data for the module.

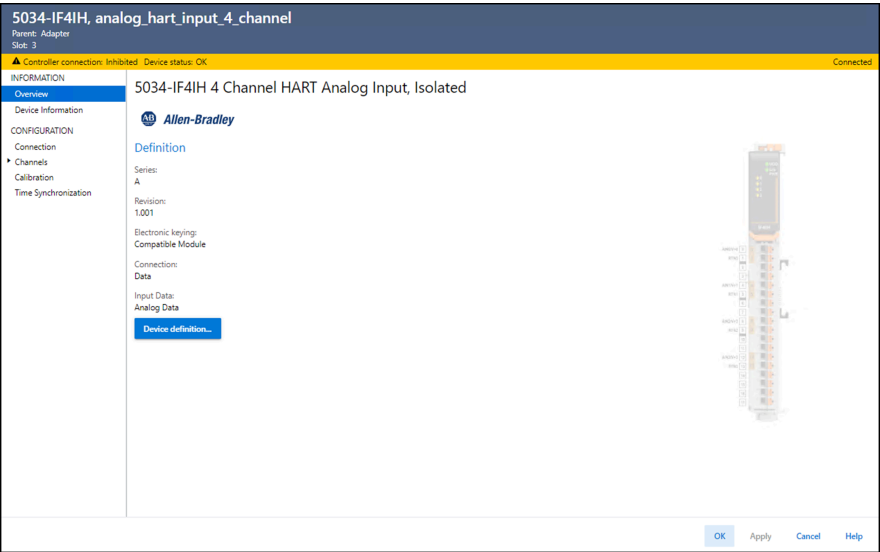
The Studio 5000 Logix Designer application transfers the project to the owner-controller during the program download. Data is then transferred to the I/O modules over the EtherNet/IP network.

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

Overview View

Use Overview to view the definition of a device, including the device type, revision, electronic keying, connection, and other device-specific values.

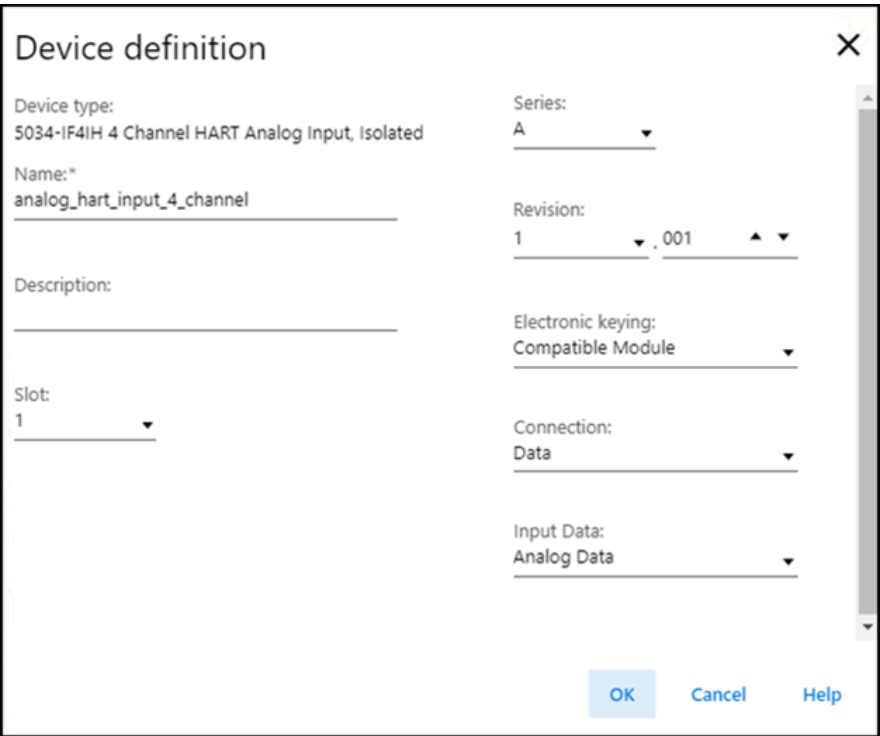
Figure 20. Overview View Example



Device Definition

To change the definition of a device, select Device definition in the Overview view.

Figure 21. Device Definition Example



Device Definition includes these parameters:

Table 17. Device Definition Parameters

Parameter	Definition	Available Choices
Device Type	Displays the device catalog number and type.	Device-specific
Name	Enter an IEC 61131 compliant device name. If an invalid character is entered in this field, or if the name exceeds 40 characters, the software ignores the character.	All valid values
Description	Enter the description of the device.	All valid values
Slot	Specify the slot number where the device resides. Only slots between 1 and the maximum number of I/O devices are valid depending on the platform. When the device is created, the slot number defaults to the first available slot position. When the controller is changed to one supporting a smaller maximum I/O count, the current slot value may no longer be valid.	1...32
Series	Specifies the series of the device.	Device-specific
Revision	Specifies the major and minor revisions of the device. The valid range for minor revision is from 1...255.	Device-specific
Electronic Keying	Defines the electronic keying used for the device. Electronic keying compares the device defined in the project to the installed device. If keying fails, a fault occurs. For detailed information on Electronic keying, see Electronic Keying in Logix 5000	<ul style="list-style-type: none"> Exact Match Compatible Module Disable Keying

Table 17. Device Definition Parameters (continued)

Parameter	Definition	Available Choices
	Control Systems Application Technique, publication LOGIX-AT001 .	<div>  <p>ATTENTION: Be extremely cautious when using Disable Keying; if used incorrectly, this option can lead to personal injury or death, property damage, or economic loss.</p> <p>We strongly suggest that you do not use Disable Keying.</p> <p>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.</p> </div>
Connection	<p>Specify the type of data transferred between the device and controller.</p> <p>For the Listen Only choice, the controller and device establish communication without the controller sending any configuration or output data to the device. A full input data connection is established but depends on the connection between the owner-controller and the device.</p>	<ul style="list-style-type: none"> • Data with Calibration • Data (default) • Listen Only
Input Data	Select the input data type for the device.	Analog Data

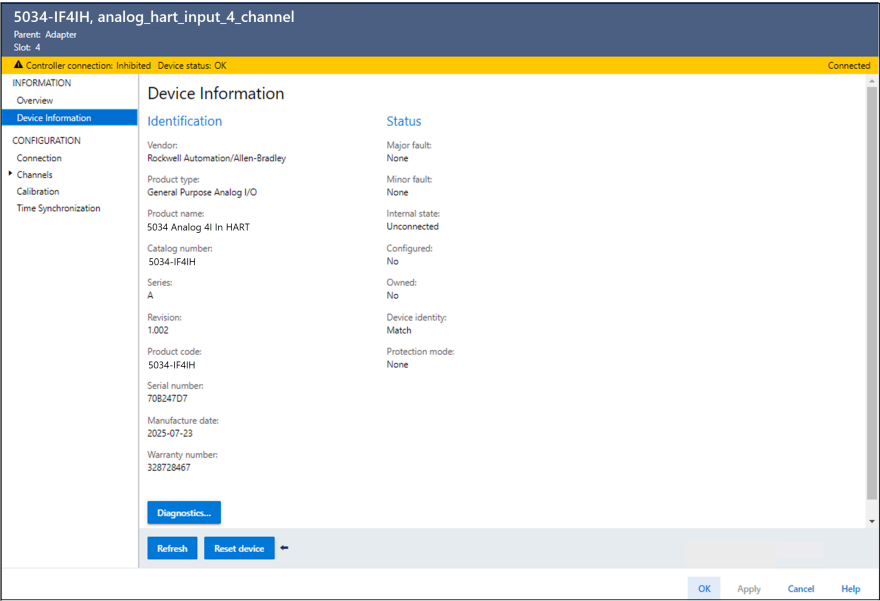
Device Information View

Use Device Information to view device and status information when the device is online.

Use Device Information to:

- Determine the identity of the device.
- View the device's current operational state.
- View whether an owner controller is currently connected to the device.
- Retrieve the latest information from the device.
- Reset a device to its power-up state.

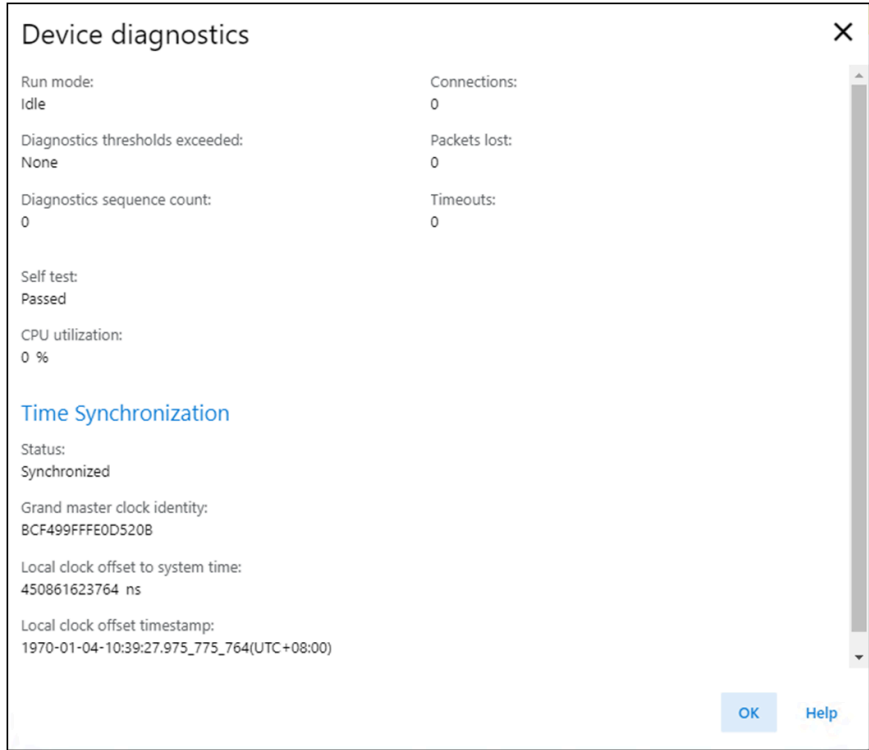
Figure 22. Device Information View Example



Device Diagnostics

To view the device diagnostics, select Diagnostics in the Device Information view.

Figure 23. Device Diagnostics Example



Connection View

Use Connection to define controller-to-device behavior:

- Set the RPI rate. For more information, see [Requested Packet Interval on page 18](#).
- Select Unicast or Multicast connection to use on the EtherNet/IP network. For more information, see [Unicast or Multicast Connection on page 18](#).

- View the reason of Connection Fault.



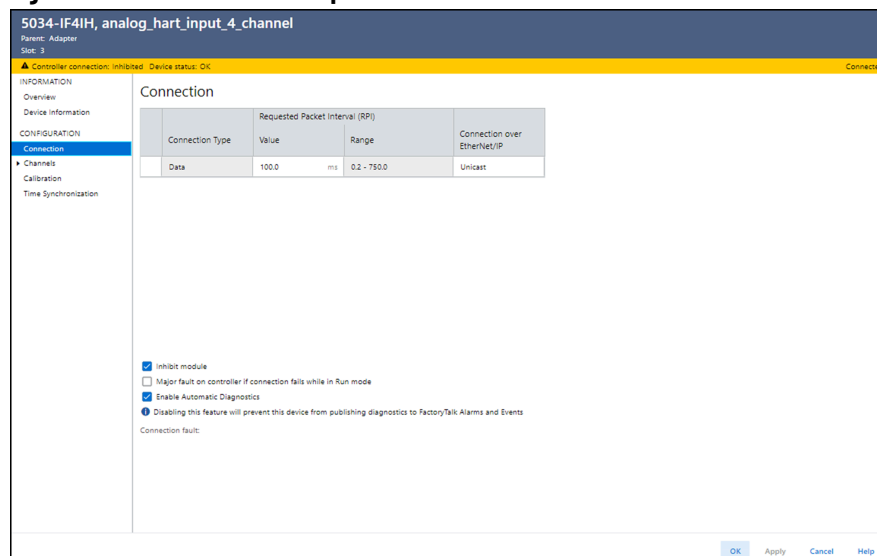
If there is a connection fault, Connection Fault area displays the error code with description that helps you to troubleshoot the module. For more information, see [Troubleshoot Your Module](#) on page .

- Inhibit the module. For more information, see [Module Inhibiting on page 19](#).
- Configure fault response for connection failure while the controller is in Run Mode.
- Enable or disable the Automatic Diagnostics.



ATTENTION: If you do not enable Automatic Diagnostics, the device does not publish diagnostics to FactoryTalk Alarms and Events.

Figure 24. Connection View Example



Channels View

The Channels view shows an overview of the configuration values for all module channels.



Not all channel configurations are included in Channels view. To view or change the complete set of the channel configuration and also to view the diagnostics information for the channel, use Chxx view.

You can do the following actions on this view for all the channels:

- Disable the channel, if desired.
- Change the input type and input range.
- Enable or disable HART
- Enable or disable source loop power
- Enable or disable open wire detection
- Set the notch filter
- Set the scaling and recalculate all configurations with engineering unit
- Set digital filter
- Disable alarms

Figure 25. Channels View Example

Channel	Disable	Input Type	Input Range	Enable HART	Source Loop Power	Enable Open Wire Detection	Notch Filter	High Signal	Low Signal	Engineering Units	High Engineering	Low Engineering	Recalculate Units	Digital Filter	Enable Alarms
00	☐	Current	4mA to 20mA	☒	☐	☐	60 Hz	200 mA	40 mA	%	1000 %	0.0 %	☐	0 ms	☒
01	☐	Current	4mA to 20mA	☒	☐	☐	60 Hz	200 mA	40 mA	%	1000 %	0.0 %	☐	0 ms	☒
02	☐	Current	4mA to 20mA	☒	☐	☐	60 Hz	200 mA	40 mA	%	1000 %	0.0 %	☐	0 ms	☒
03	☐	Current	4mA to 20mA	☒	☐	☐	60 Hz	200 mA	40 mA	%	1000 %	0.0 %	☐	0 ms	☒

Chxx View

The Chxx view, where xx represents the channel number, shows the configuration options available for the respective channel.

You can do the following actions on this view:

- Disable the channel, if desired
- Change the input type and input range
- Enable or disable HART
- Enable or disable source loop power
- Enable or disable open wire detection
- Set the scaling and recalculate all configurations with engineering unit
- Set the notch filter
- Set digital filter
- View channel diagnostics information



To latch and configure alarm parameters, go to Alarms view.

Figure 26. Chxx View Example

Recalculate Units

Recalculate Units lets you recalculate all configurations with engineering unit after a scaling change. Consider the following:

- The Recalculate Units option is enabled when the scaling configuration is changed.
- Upon selecting Recalculate Units option, the recalculated new values based on the new scaling configuration are displayed together with the old values for you to verify before changing.
- If you select "Yes" to proceed with the change, the new values will be set but it gets applied when you select "Apply/OK".
- If you select "No" to cancel the change, the old values are retained. You can either select the Recalculate Units again or manually change those configurations based on the new scaling.

Figure 27. Recalculate Units Example

Change to new configuration values in engineering units?

Configuration	Old Value	New Value
High High Limit	100 %	114.2857 %
High Limit	100 %	114.2857 %
Low Limit	0 %	0 %
Low Low Limit	0 %	0 %
Deadband	0 %	0 %
Rate Alarm Limit	0 %/s	0 %/s

Yes
No
Help

Channelxx Diagnostics

Displays the channel diagnostics information when connected with the module. When online with the module, select the Diagnostics on the Chxx view to see the diagnostic information.

Figure 28. Channelxx Diagnostics Example

Channel00 Diagnostics

Fault Exists:

Yes

Data Uncertain:

Yes

Field Power:

Present

Field Power On Timestamp:

None

Field Power Off Timestamp:

None

Open Wire Fault:

Not Present

Fault Timestamp:

None

Overrange Fault:

Not Present

Fault Timestamp:

None

Underrange Fault:

Present

Underrange Fault Timestamp:

2025-01-08-09:45:56.841

Calibration for Active Range

Calibration Timestamp:

2025-01-02-09:45:56.841

Range:

4 mA to 20 mA

Gain:

0.999637

Offset:

0.001097

OK

HELP

Alarms View

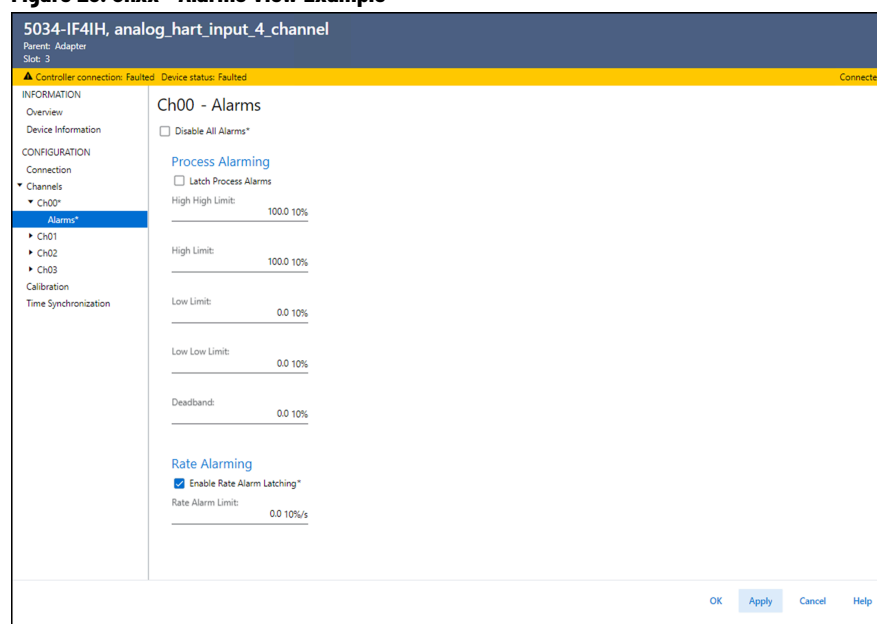
Each channel on the input module has an Alarms view. You can do the following actions on this view:

- Disable all the alarms.
- Enable/Disable latching and set the alarm limits for the process alarms:
 - High High
 - High
 - Low
 - Low Low
 - Deadband
- Enable/Disable latching and set limit for the rate alarm.



Rate Alarm Limit of 0.0 disables the rate alarm.

Figure 29. Chxx - Alarms View Example



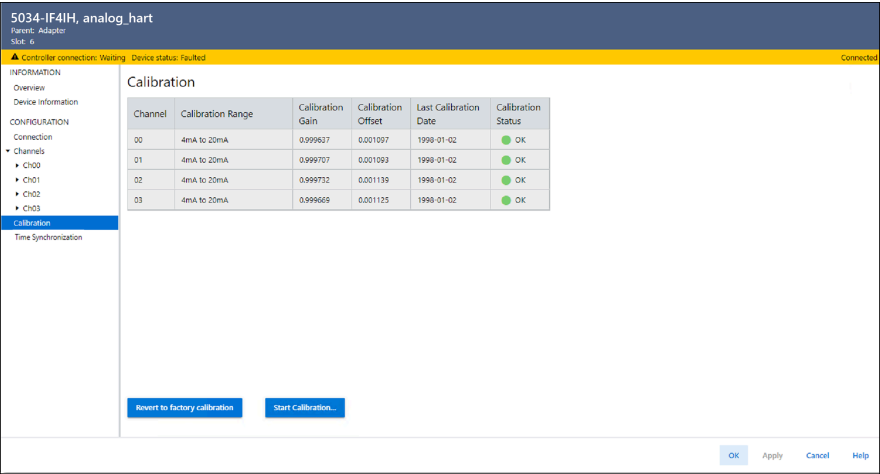
Calibration View

The Calibration view provides calibration information for all channels on the module. You can do the following actions on this view for all the channels:

- View calibration parameters and calibration status for the currently configured input ranges.
- Perform user calibration for one or multiple channels.
- Revert calibration parameters to the factory default values.

For more information on how to calibrate a module, see [Module Calibration \(Interactive\) on page 88](#)

Figure 30. Calibration View Example

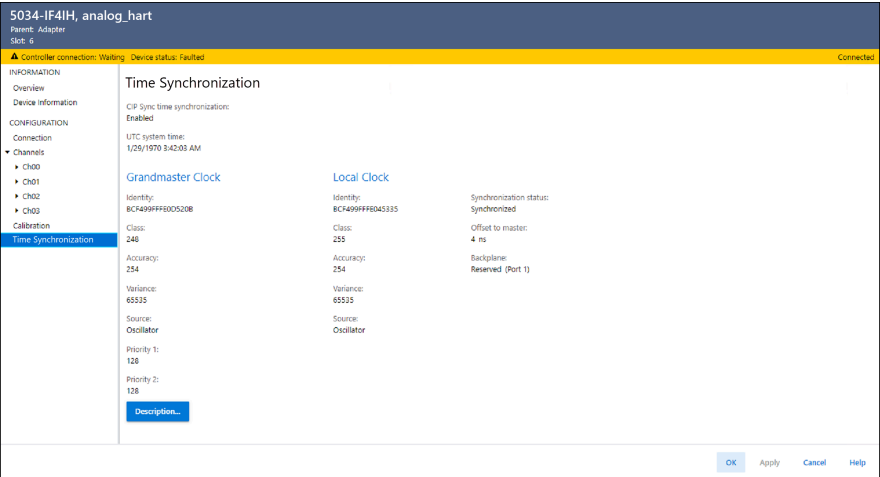


Time Synchronization View

The Time Synchronization view is read-only and displays the CIP Sync status information about the module when the project is online. The Time Synchronization category displays the following information:

- CIP Sync time synchronization status
- UTC system time
- Grandmaster Clock information
- Grandmaster Clock description
- Local Clock information

Figure 31. Time Sync View Example



Grandmaster Clock Description

The Grandmaster clock description dialog provides detailed information about the grandmaster clock. To view the Grandmaster clock description, select Description in the Time Sync view.

Figure 32. Grandmaster Clock Description Example

Grandmaster clock description

User name:

User location:

Protocol address:00.00.00.00

Physical address:00-00-00-00

Clock type:Boundary, and End-to-End Transpar...

Manufacturer name:Rockwell Automation

Model:5034-AENTR/A

Serial number:70999175

Hardware revision:2.1

Firmware revision:1.11.7

Software revision:

Profile identity:00-21-6C-00-01-00

Physical protocol:Backplane

Network protocol:Local

Port number:1

Close

Help

Module Calibration (Interactive)

You can use Calibration view in Module Properties to interactively calibrate the module on a per channel basis or in group.

Controller State During Calibration

You must add the module to your Studio 5000 Logix Designer application project before you can calibrate it.

The project must be online with the owner-controller to calibrate the PointMax analog modules. You can calibrate under any of the following conditions:

- The controller is in Program Mode, that is, either Remote Program or Program Mode.
Your module must be in Program Mode and not be actively controlling a process when you calibrate it.
- There are no connections to the module.

Calibration Impacts Data Quality

When a channel on an analog input module is being calibrated, the Notch Filter setting for that channel changes to 10 Hz. The I.Chxx.Uncertain tag is set to 1 for that channel until calibration is completed.

Calibration Instrumentation Specifications

When you calibrate the analog input modules, send current or voltage reference signals to the module to calibrate it. To maintain your module's factory calibration accuracy, use the instrumentation with the specifications listed in the following table.

IMPORTANT: Do not calibrate your module with an instrument that is less accurate than those specified in following table. The following events can result:

- Calibration appears to occur normally but the module gives inaccurate data during operation.
- A calibration fault occurs, forcing you to abort calibration. When this happens, I.Chxx.CalFault tag is set for the channel you attempted to calibrate. You can clear this tag by completing a valid calibration or cycling power to the module.

Table 18. Instrument Specifications

Catalog Number	Channel Input Type	Calibration Instrumentation Specifications
5034-IF4IH, 5034-IF4IHXT	Current (mA)	4.00...20.00 mA source ± 100 nA current
	Voltage (V)	0...10V source ± 2 μ V voltage

Calibration Procedure

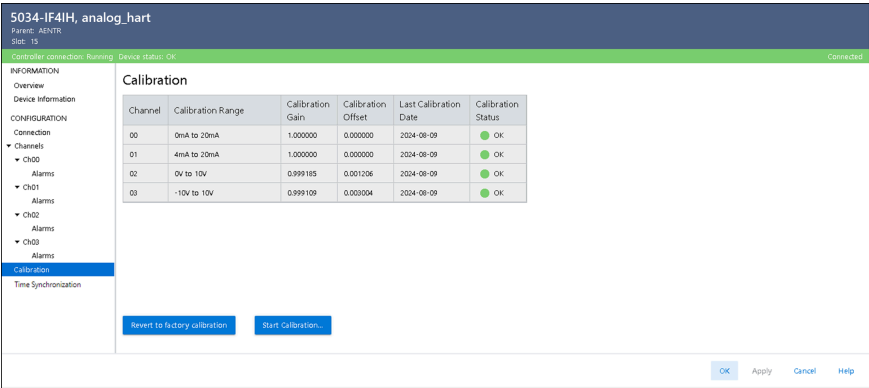
This procedure describes how to calibrate a channel on the analog input module for use with a Current (mA) input type. You can follow the same procedure for voltage input type, but make sure connect the voltage calibrator to the channel.

Apply Low and High Signal references to the analog input module to calibrate it. The references must match the input range the channel is using.

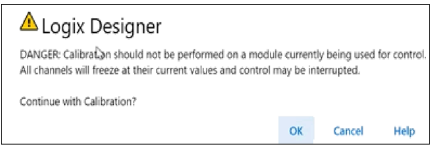
Table 19. Analog Input Module Calibration References

Input Type	Input Range	Low Calibration Reference	High Calibration Reference
Voltage (V)	-10...10V	0.0V	10.0V
	0...10V	0.5V	10.0V
	0...5V	0.5V	5.0V
Current (mA)	0...20 mA	4.0 mA	20.0 mA
	4...20 mA		

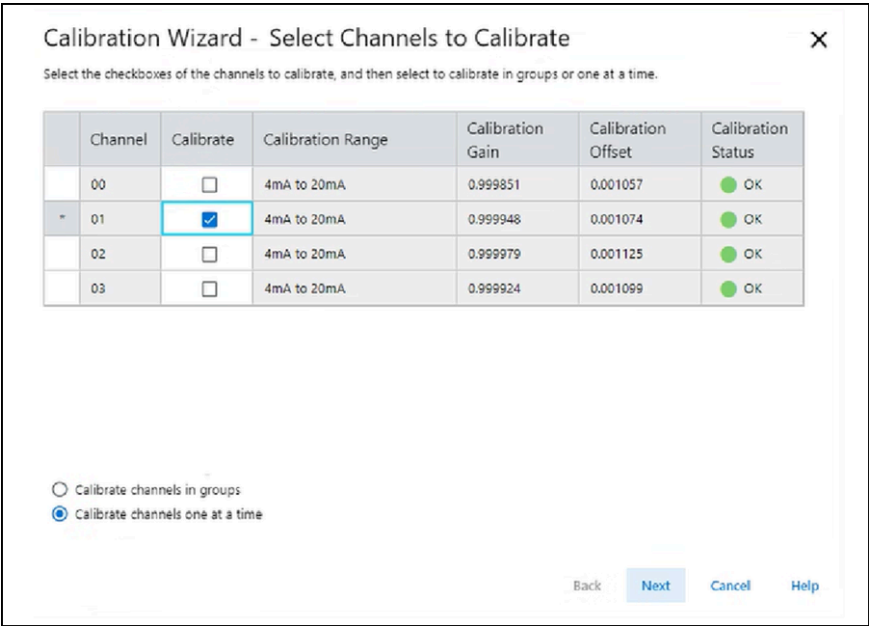
1. Connect the current calibrator to the channel being calibrated.
2. Go online with the project and make sure that the controller is in Program Mode.
3. Confirm that the channel to be calibrated is configured for the correct Input Range.
4. On the Calibration view in the Module Properties dialog, select Start Calibration.



5. When the dialog appears to confirm that you want to calibrate the channel, select OK.



6. Select the channels one at a time or in groups to calibrate and then select Next.



7. When the Attach Low Reference dialog appears, set the calibrator to the low reference and apply it to the channel.

Calibration Wizard - Attach Low Reference

×

Attach reference signals to selected channels. Select Next to continue.

Channel: 01

Channel	Calibrate	Calibration Range	Low Reference
00	☐		
01	☒	4mA to 20mA	4.00 mA
02	☐		
03	☐		

Back

Next

Cancel

Help

8. Select Next. The Low Reference Results dialog appears and indicates the status of the calibrated channel.

Calibration Wizard - Calibration Completed

Select Next to continue.

Channel	Calibrate	Calibration Range	High Reference	Status
00	☐			
01	☒	4mA to 20mA	20.00	mA OK
02	☐			
03	☐			

Retry

Back

Next

Cancel

Help

9. If the Status is OK, select Next. If the Status is not OK, repeat the calibration process.
10. When the Attach High Reference dialog appears, set the calibrator to the high reference and apply it to the channel.

Calibration Wizard - Attach High Reference

Attach reference signals to selected channels. Select Next to continue.

Channel: 01

Channel	Calibrate	Calibration Range	High Reference
00	☐		
01	☒	4mA to 20mA	20.00 mA
02	☐		
03	☐		

Back

Next

Cancel

Help

11. Select Next. The High Reference Results dialog appears and indicates the status of the calibrated channel.

Calibration Wizard - Calibration Completed

Select Next to continue.

Channel	Calibrate	Calibration Range	High Reference	Status
00	☐			
01	☒	4mA to 20mA	20.00 mA	OK
02	☐			
03	☐			

Retry

Back

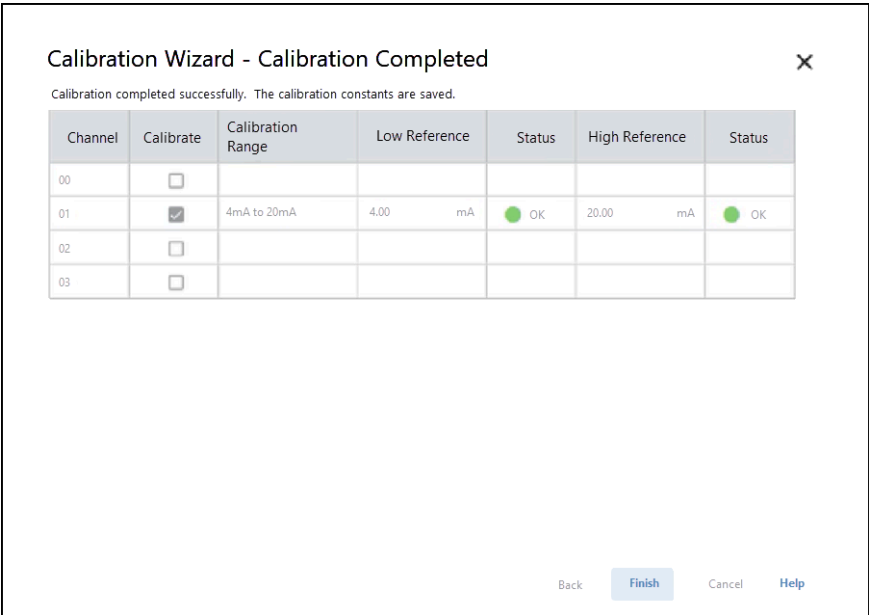
Next

Cancel

Help

12. If the Status is OK, select Next. If the Status is not OK, repeat the calibration process.

13. When the Calibration Completed dialog appears, select Finish.



Use the Status Indicators for Troubleshooting

- PointMax I/O modules use the following status indicators:
- SA Power Indicator - This indicator operates the same for all PointMax I/O modules.
 - Module Status Indicator - This indicator operates the same for all PointMax I/O modules.
 - Channel Status Indicator - This indicator operates differently based on the module type that you are using.

SA Power Status Indicator

Table 20. Interpret SA Power Status Indicator

Indicator State	Description	Recommended Action
Off	The module is not powered.	Complete the following actions: 1. Confirm that the system is powered. 2. Confirm that the module is installed properly.
Steady green	There is SA power to the module.	None
Steady red	There is no SA power to the module or SA power voltage is not in the valid range.	Complete the following actions: 1. Confirm that SA power wiring is properly connected to the adapter, expansion power module, or 5034-MBSA mounting base. 2. Check the following: - Check that the SA voltage is in the correct range. - If an external power supply is used, confirm that the power supply is turned on.

Table 20. Interpret SA Power Status Indicator (continued)

Indicator State	Description	Recommended Action
		<ul style="list-style-type: none"> - Make sure that the mounting base to mounting base connection is properly secured. <p>Go to Chassis Information view in the Module Properties of the adapter to check the Field Power status of mounting bases installed in all slots.</p>

Module Status Indicator

Table 21. Interpret Module Status Indicator

Indicator State	Description	Recommended Action
Off	The module is not powered.	<p>Complete the following actions:</p> <ol style="list-style-type: none"> 1. Confirm that the system is powered. 2. Confirm that the module is installed properly.
Steady green	The module is operational and all I/O connections are active.	None
Flashing green	The module has no I/O connections.	Troubleshoot your Studio 5000 Logix Designer application to determine what is preventing a connection from the module to the controller and correct the issue.
Flashing red	<p>One of the following conditions exists:</p> <ul style="list-style-type: none"> • 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. 	<p>Complete one of the following:</p> <ul style="list-style-type: none"> • Let the firmware update process complete. • Reattempt a firmware update after one fails. • Use the Studio 5000 Logix Designer application to determine whether a module recoverable fault is occurred. It is shown in Device Information view. <p>To clear a recoverable fault, complete one of the following:</p> <ul style="list-style-type: none"> - Cycle module power. - Select Reset device in the Studio 5000 Logix Designer project via the Device Information view of the Module Properties dialog. <p>If the fault does not clear after cycling power and module reset, contact Rockwell Automation Technical Support.</p> <ul style="list-style-type: none"> • Use the Studio 5000 Logix Designer application to determine if a connection has timed out. The Connection view in the Module Properties indicates whether a connection request has timed out. <p>If a connection has timed out, determine the cause and correct it. For example, a cable failure can cause a connection timeout.</p>
Steady red	The module experienced a nonrecoverable fault.	<p>Complete the following actions:</p> <ol style="list-style-type: none"> 1. Cycle power to the module. 2. If the status indicator remains in the steady red state, replace the module.

Channel Status Indicators

Table 22. Interpret Analog Input Channel Status Indicators

Indicator State	Description	Recommended Action
Off	One of the following conditions exists: <ul style="list-style-type: none"> The module is not powered. The module is powered but connection is not established from the controller to module. The module is powered, but the input channel is disabled. 	Complete one of the following: <ul style="list-style-type: none"> If you expect the module to be powered but it is not, complete the following: <ul style="list-style-type: none"> 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 confirm that the channel is not disabled and the module has a connection to the controller. The Connection view in the Module Properties indicates if the connection is running or faulted. If the connection is faulted, the Connection view indicates error information. If the channel is disabled, no action is needed.
Steady yellow	The input channel is operating normally.	None
Flashing red	One of the following conditions exists: <ul style="list-style-type: none"> There is no SA power to the module, or SA power voltage is not in the valid range. The input signal is overrange or underrange. The signal range is set in your Studio 5000 Logix Designer application project. An Open Wire condition, that is, a wire is disconnected from the input channel. 	Complete one of the following: <ul style="list-style-type: none"> If there is a SA power fault, see the recommended action given for steady red indicator state in SA Power Indicator table above. Check the input signal to determine if it is overrange or underrange. If so, make changes to return the input signal to within the range limits. Check the wiring at the input channel. If necessary, reconnect the wire.
Flashing yellow/red	Calibration is in progress.	Successfully complete the calibration process.
Steady red	An issue has occurred that is internal to the module. The following are example issues that can cause the status indicator to be steady red: <ul style="list-style-type: none"> A calibration fault occurred on the channel. The module has experienced a nonrecoverable fault. 	Complete one of the following: <ul style="list-style-type: none"> If the indicator turns steady red after a calibration process, you can either perform a successful calibration or cycle the power to recover the fault. If it is not caused by the calibration, cycle the power to recover the fault. If the condition is still present, replace the module.

Module Tag Definitions

Module tags are created when you add a module to the Studio 5000 Logix Designer application project. The set of module tags associated with a module depends on the module type and Device Definition choices made during module configuration. The tables contained in this section list all of the tags available with a module. Not all tags in the list are used when that module type is added to a project. Tag use varies by module configuration.

Table 23. Configuration Tags

Name	Data Type	Definition	Valid Values
Chxx.Sourcing	BOOL	Controls whether the channel provides loop power to connected devices.	<ul style="list-style-type: none"> 0 = The channel does not supply loop power. External power must be provided. 1 = The channel supplies loop power.
Chxx.SensorType	SINT	Not applicable	Not applicable to this module
Chxx.NotchFilter	SINT	Notch Filter removes line noise for the channel.	<ul style="list-style-type: none"> 0 = 10 Hz 16 = 20 Hz with 50/60 Hz noise rejection 4 = 200 Hz 21 = 1,200 Hz 22 = 4,800 Hz for non-HART 23 = 9,600 Hz for non-HART
Chxx.AlarmDisable	BOOL	<p>Disables all alarms on the channel.</p> <hr/> <p>IMPORTANT: Consider the following:</p> <ul style="list-style-type: none"> If you change this tag to 0, that is, so that the alarms are not disabled, you must also enable the individual alarms for them to work. <p>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 that the alarm is enabled.</p> <p>This applies to all alarms on the module.</p> <ul style="list-style-type: none"> Conversely, if you set this tag to 1, alarms are disabled regardless of the setting on the alarm enable tag for any alarm. <hr/>	<ul style="list-style-type: none"> 0 = Alarms are enabled 1 = Alarms are disabled
Chxx.ProcessAlarmLatchEn	BOOL	<p>Configures Process alarms to latch until they are explicitly unlatched.</p> <p>The Process alarms include:</p> <ul style="list-style-type: none"> HighHigh Alarm High Alarm Low Alarm LowLow Alarm 	<ul style="list-style-type: none"> 0 = Latching disabled 1 = Latching enabled
Chxx.RateAlarmLatchEn	BOOL	Configures the Rate Alarm to latch until it is explicitly unlatched.	<ul style="list-style-type: none"> 0 = Latching disabled 1 = Latching enabled
Chxx.OpenWireEn	BOOL	Configures OpenWire detection when the signal wire is disconnected from one of its channels or the RTB.	<ul style="list-style-type: none"> 0 = OpenWire detection is disabled 1 = OpenWire detection is enabled
Chxx.Disable	BOOL	Disables the channel.	<ul style="list-style-type: none"> 0 = Channel is enabled 1 = Channel is disabled

Table 23. Configuration Tags (continued)

Name	Data Type	Definition	Valid Values
Chxx.TenOhmOffset	INT	Not Applicable	0
Chxx.DigitalFilter	INT	One of four points used in scaling. The high engineering helps determine the engineering units the signal values scale into. The high engineering term corresponds to the high signal value.	0...32,767 ms
Chxx.LowSignal	REAL	One of four points used in scaling. The high engineering helps determine the engineering units the signal values scale into. The high engineering term corresponds to the high signal value.	Any value
Chxx.HighSignal	REAL	One of four points used in scaling. The high engineering helps determine the engineering units the signal values scale into. The high engineering term corresponds to the high signal value.	Any value
Chxx.LowEngineering	REAL	One of four points used in scaling. The low engineering helps determine the engineering units the signal values scale into. The low engineering term corresponds to the low signal value.	Any value
Chxx.HighEngineering	REAL	One of four points used in scaling. The high engineering helps determine the engineering units the signal values scale into. The high engineering term corresponds to the high signal value.	Any value
Chxx.LLAlarmLimit	REAL	The Low Low Alarm trigger point. Causes the Chxx.LLAlarm to trigger when the input signal moves beneath the configured trigger point. Value is in terms of engineering units.	Any value
Chxx.LAlarmLimit	REAL	The Low Alarm trigger point. Causes the Chxx.LAlarm to trigger when the input signal moves beneath the configured trigger point. Value is in terms of engineering units.	Any value
Chxx.HAlarmLimit	REAL	The High Alarm trigger point. Causes the Chxx.HAlarm to trigger when the input signal moves above the configured trigger point. Value is in terms of engineering units.	Any value
Chxx.HHAlarmLimit	REAL	The High High Alarm trigger point. Causes the Chxx.HHAlarm to trigger when the input signal moves above the configured trigger point. Value is in terms of engineering units.	Any value
Chxx.RateAlarmLimit	REAL	The Rate Alarm trigger point. Causes the Chxx.RateAlarm to trigger when the input signal changes at a rate faster than the configured Rate Alarm. Configured in Engineering Units per second.	0 = Rate Alarm is not used Any value greater than zero = Trigger point

Table 23. Configuration Tags (continued)

Name	Data Type	Definition	Valid Values
Chxx.AlarmDeadband	REAL	<p>Allows a process alarm to remain set, despite the alarm condition disappearing, as long as the input data remains within the deadband of the process alarm.</p> <p>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.</p>	Any non-negative value

Input Tag Definitions

Table 24. Input Tags

Name	Data Type	Definition	Valid Values
RunMode	BOOL	Channel's operating state	<ul style="list-style-type: none"> 0 = Idle 1 = Run <p>When the value is 0, it means one of the following:</p> <ul style="list-style-type: none"> Connection is up. Connection has been opened but the module has not started producing data for the connection. Module is not applying new Output tag data because the controller is in Program Mode. <p>When the value is 1, it means the following:</p> <ul style="list-style-type: none"> Connection is up. Module is producing data for the connection. Output tag data is being applied.
ConnectionFaulted	BOOL	<p>Indicates if a connection is running.</p> <p>The module sets this tag to 0 when connected. If the module is not connected, it changes the tag to 1.</p>	<ul style="list-style-type: none"> 0 = A connection exists between the module and the controller 1 = Connection is timed out or inhibited
DiagnosticActive	BOOL	Indicates if any diagnostics are active or if the prognostics threshold is reached.	<ul style="list-style-type: none"> 0 = No diagnostics are 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.	<p>-128...+127</p> <p>The value of 0 is skipped except during module powerup.</p>
Chxx.Fault	BOOL	<p>Indicates that channel data is inaccurate and cannot be trusted for use in the application.</p> <p>If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy.</p>	<ul style="list-style-type: none"> 0 = No fault exists 1 = Fault exists

Table 24. Input Tags (continued)

Name	Data Type	Definition	Valid Values
		<p>IMPORTANT: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.</p>	
Chxx.Uncertain	BOOL	<p>Indicates that the channel data can be inaccurate but the degree of inaccuracy is not known.</p> <p>If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy.</p> <p>IMPORTANT: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.</p>	<ul style="list-style-type: none"> 0 = Valid data 1 = Data validity uncertain
Chxx.OpenWire	BOOL	The signal wire is disconnected from the channel or the RTB is removed from the module.	<ul style="list-style-type: none"> 0 = Open wire condition does not exist or open wire detection is disabled. 1 = Open wire condition exists, which means the signal wire is disconnected from the channel or the RTB is removed from the module.
Chxx.OverTemperature	BOOL	Not applicable for this module.	N/A
Chxx.FieldPowerOff	BOOL	Field power is not present at the channel.	<ul style="list-style-type: none"> 0 = Field power is present 1 = Field power is not present
Chxx.NotANumber	BOOL	Indicates that the last value received for the channel output data value was not a number.	<ul style="list-style-type: none"> 0 = Last channel data received was a number 1 = Last channel data received was not a number
Chxx.Underrange	BOOL	<p>Indicates that the channel data is beneath the underrange threshold for this channel.</p> <p>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.</p>	<ul style="list-style-type: none"> 0 = Channel data is not beneath the underrange threshold 1 = Channel data is beneath the underrange threshold
Chxx.Ovrange	BOOL	<p>Indicates that the channel data is above the overrange threshold for this channel.</p> <p>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.</p>	<ul style="list-style-type: none"> 0 = Channel data is not above the overrange threshold 1 = Channel data is above the overrange threshold
Chxx.LLAlarm	BOOL	<p>Triggered when the input data value is less than the Low Low Alarm value.</p> <p>If latching is enabled, this alarm remains triggered until unlatched. If latching is not enabled, the alarm clears</p>	<ul style="list-style-type: none"> 0 = Alarm is not triggered 1 = Alarm is triggered

Table 24. Input Tags (continued)

Name	Data Type	Definition	Valid Values
		after the input data value is greater than the Low Low Limit plus the Alarm Deadband.	
Chxx.LAlarm	BOOL	<p>Triggered when the input data value is less than the Low Alarm value.</p> <p>If latching is enabled, this alarm remains triggered until unlatched. If latching is not enabled, the alarm clears after the input data value is greater than the Low Limit plus the Alarm Deadband.</p>	<ul style="list-style-type: none"> 0 = Alarm is not triggered 1 = Alarm is triggered
Chxx.HAlarm	BOOL	<p>Triggered when the input data value is greater than the High Alarm value.</p> <p>If latching is enabled, this alarm remains triggered until unlatched. If latching is not enabled, the alarm clears after the input data value is less than the High Limit minus the Alarm Deadband.</p>	<ul style="list-style-type: none"> 0 = Alarm is not triggered 1 = Alarm is triggered
Chxx.HHAlarm	BOOL	<p>Triggered when the input data value is greater than the High High Alarm value.</p> <p>If latching is enabled, this alarm remains triggered until unlatched. If latching is not enabled, the alarm clears after the input data value is less than the High High Limit minus the Alarm Deadband.</p>	<ul style="list-style-type: none"> 0 = Alarm is not triggered 1 = Alarm is triggered
Chxx.RateAlarm	BOOL	Triggered when the change between consecutive channel samples divided by the period of time between when the samples were taken exceeds the Rate Alarm. If latched, this tag remains set until it is unlatched.	<ul style="list-style-type: none"> 0 = Alarm is not triggered 1 = Alarm is triggered
Chxx.CalFault	BOOL	<p>Indicates that the last attempted Calibration for this channel failed or there is no calibration data present.</p> <p>This tag is cleared, that is, set to 0, when power is cycled to the module or a successful calibration for the range on the channel is performed.</p>	<ul style="list-style-type: none"> 0 = Calibration did not fail 1 = Calibration failed
Chxx.Calibrating	BOOL	Indicates that the channel is currently being calibrated.	<ul style="list-style-type: none"> 0 = Channel is not being calibrated 1 = Channel is being calibrated
Chxx.CalGoodLowRef	BOOL	Indicates that a valid Low Reference signal is sampled on this channel in the calibration process.	<ul style="list-style-type: none"> 0 = Valid Low Reference signal has not been sampled on this channel 1 = Valid Low Reference signal has been sampled on this channel

Table 24. Input Tags (continued)

Name	Data Type	Definition	Valid Values
		<p>IMPORTANT: This tag is available only when you use the Data with Calibration connection type in the Device definition dialog. If you use the Data connection type, this tag does not appear in the module tags.</p>	
Chxx.CalBadLowRef	BOOL	<p>Indicates that an invalid Low Reference signal is sampled on this channel in the calibration process. You must correct this condition to successfully calibrate the module.</p> <p>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.</p> <p>IMPORTANT: This tag is available only when you use the Data with Calibration connection type in the Device definition dialog. If you use the Data connection type, this tag does not appear in the module tags.</p>	<ul style="list-style-type: none"> 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	<p>Indicates that a valid High Reference signal is sampled on this channel in the calibration process.</p> <p>IMPORTANT: This tag is available only when you use the Data with Calibration connection type in the Device definition dialog. If you use the Data connection type, this tag does not appear in the module tags.</p>	<ul style="list-style-type: none"> 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	<p>Indicates that an invalid High Reference signal is sampled on this channel in the calibration process.</p> <p>You must correct this condition to successfully calibrate the module.</p> <p>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.</p>	<ul style="list-style-type: none"> 0 = Invalid High Reference signal has not been sampled on this channel 1 = Invalid High Reference signal has been sampled on this channel

Table 24. Input Tags (continued)

Name	Data Type	Definition	Valid Values
		<p>IMPORTANT: This tag is available only when you use the Data with Calibration connection type in the Device definition dialog. If you use the Data connection type, this tag does not appear in the module tags.</p>	
Chxx.CalSuccessful	BOOL	<p>Indicates calibration on this channel is complete and the Calibrating state has been exited.</p> <p>This tag remains set after valid calibration and until a new calibration process is started or the connection is closed.</p> <p>IMPORTANT: This tag is available only when you use the Data with Calibration connection type in the Device definition dialog. If you use the Data connection type, this tag does not appear in the module tags.</p>	<ul style="list-style-type: none"> 0 = Calibration was not successful 1 = One of the following: <ul style="list-style-type: none"> Calibration was successful and calibrating state has been exited. Calibration data is present and applied.
Chxx.Data	REAL	Channel data in scaled Engineering Units.	Any value
Chxx.RollingTimestamp	INT	<p>Continuously-running 15-bit timer that counts in milliseconds.</p> <p>Whenever an input module scans its channels, it also records the value of RollingTimestamp at that time. The user program uses the last two RollingTimestamp values and calculates the interval between receipt of data.</p>	0...32,767

Output Tag Definitions

Table 25. Output Tags

Name	Data Type	Definition	Valid Values
Chxx.LLAlarmEn	BOOL	<p>Enables the Low Low Alarm.</p> <p>IMPORTANT: To use this alarm, set this tag to 1 and confirm that the Chxx.AlarmDisable configuration tag for the same channel is set to 0.</p> <p>If the Chxx.AlarmDisable configuration tag is set to 1, that is, alarms are disabled, this alarm does not work regardless of the tag value.</p>	<ul style="list-style-type: none"> 0 = Disable alarm 1 = Enable alarm
Chxx.LAlarmEn	BOOL	Enables the Low Alarm.	<ul style="list-style-type: none"> 0 = Disable alarm 1 = Enable alarm

Table 25. Output Tags (continued)

Name	Data Type	Definition	Valid Values
		<p>IMPORTANT: To use this alarm, set this tag to 1 and confirm that the Chxx.AlarmDisable configuration tag for the same channel is set to 0.</p> <p>If the Chxx.AlarmDisable configuration tag is set to 1, that is, alarms are disabled, this alarm does not work regardless of the tag value.</p>	
Chxx.HAlarmEn	BOOL	<p>Enables the High Alarm.</p> <p>IMPORTANT: To use this alarm, set this tag to 1 and confirm that the Chxx.AlarmDisable configuration tag for the same channel is set to 0.</p> <p>If the Chxx.AlarmDisable configuration tag is set to 1, that is, alarms are disabled, this alarm does not work regardless of the tag value.</p>	<ul style="list-style-type: none"> 0 = Disable alarm 1 = Enable alarm
Chxx.HHAlarmEn	BOOL	<p>Enables the High High Alarm.</p> <p>IMPORTANT: To use this alarm, set this tag to 1 and confirm that the Chxx.AlarmDisable configuration tag for the same channel is set to 0.</p> <p>If the Chxx.AlarmDisable configuration tag is set to 1, that is, alarms are disabled, this alarm does not work regardless of the tag value.</p>	<ul style="list-style-type: none"> 0 = Disable alarm 1 = Enable alarm
Chxx.RateAlarmEn	BOOL	Enables the Rate Alarm.	<ul style="list-style-type: none"> 0 = Disable alarm 1 = Enable alarm

Table 25. Output Tags (continued)

Name	Data Type	Definition	Valid Values
		<p>IMPORTANT: To use this alarm, set this tag to 1 and confirm that the Chxx.AlarmDisable configuration tag for the same channel is set to 0.</p> <p>If the Chxx.AlarmDisable configuration tag is set to 1, that is, alarms are disabled, this alarm does not work regardless of the tag value.</p>	
Chxx.LLAlarmUnlatch	BOOL	Unlatches a latched Low Low Alarm at the first instance of the bit transitioning from 0 to 1.	<ul style="list-style-type: none"> 0 = Low Low Alarm remains latched 1 = Low Low Alarm unlatched
Chxx.LAlarmUnlatch	BOOL	Unlatches a latched Low Alarm at the first instance of the bit transition from 0 to 1.	<ul style="list-style-type: none"> 0 = Low Alarm remains latched 1 = Low Alarm unlatched
Chxx.HAlarmUnlatch	BOOL	Unlatches a latched High Alarm at the first instance of the bit transition from 0 to 1.	<ul style="list-style-type: none"> 0 = High Alarm remains latched 1 = High Alarm unlatched
Chxx.HHAlarmUnlatch	BOOL	Unlatches a set High High Alarm at the first instance of the bit transition from 0 to 1.	<ul style="list-style-type: none"> 0 = High High Alarm remains latched 1 = High High Alarm unlatched
Chxx.RateAlarmUnlatch	BOOL	Unlatches a set Rate Alarm at the first instance of the bit transition from 0 to 1.	<ul style="list-style-type: none"> 0 = Rate Alarm remains latched 1 = Rate Alarm unlatched
Chxx.Calibrate	BOOL	<p>Initiates the Calibration process.</p> <p>This tag must remain set until a valid Low Reference and High Reference values are applied to the input.</p> <p>If the tag value transitions to 0 before calibration is finished, the process stops and calibration fails.</p>	<ul style="list-style-type: none"> 0 = Not to start calibration process 1 = Start calibration process
Chxx.CallowRef	BOOL	<p>Rising edge triggers the Low Calibration at the Low Reference Point for the current input range value.</p> <p>A valid Low Reference signal must be connected to the channel before setting this tag.</p> <p>IMPORTANT: This tag is available only when you use the Data with Calibration connection type in the Device Definition. If you use the Data connection type, this tag does not appear in the module tags.</p>	<ul style="list-style-type: none"> 0 = Not to start low reference sampling 1 = Start low reference sampling
Chxx.CallowRef	BOOL	<p>Rising edge triggers a High Calibration at the High Reference Point for the current input range value.</p> <p>A valid High Reference signal must be connected to the channel before setting tag.</p>	<ul style="list-style-type: none"> 0 = Not to start high reference sampling 1 = Start high reference sampling

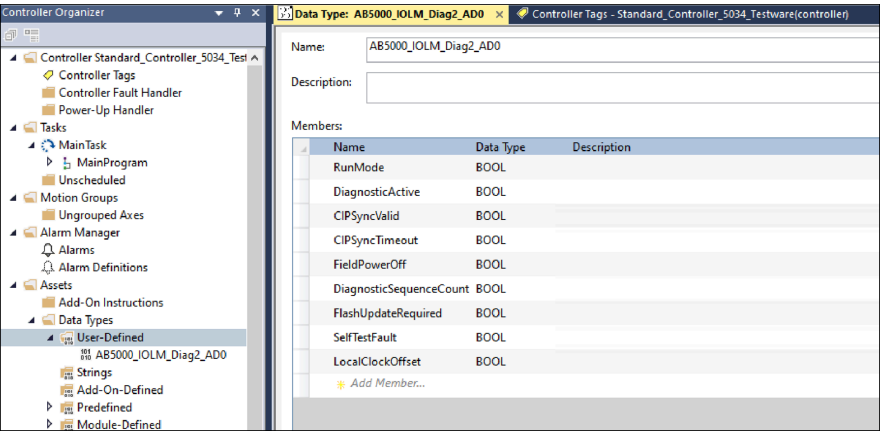
Table 25. Output Tags (continued)

Name	Data Type	Definition	Valid Values
		IMPORTANT: This tag is available only when you use the Data with Calibration connection type in the Device Definition. If you use the Data connection type, this tag does not appear in the module tags.	
Chxx.SensorOffset	REAL	Compensates for any known offset error on the sensor or channel to which the sensor is connected. Value 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 Use a value in the channel's operating range.

Diagnostic Assembly

Diagnostic assembly helps you troubleshoot and diagnose the fault in your system.

Create User-defined Diagnostic Assembly Types



IMPORTANT: The members indicated in the tables are arranged according to Data Alignment Rules of controllers. Strictly follow the data type and the sequence of the members that are indicated in the tables of this appendix. If the data type and the sequence are not followed, data misalignment may occur after executing Get Attribute Single Message (MSG) instruction.

Diagnostic Assemblies

- Diagnostic Assembly for Analog 4 Channel Input Module
 - Instance ID: 0x801D (32797)
 - Size = 368 bytes

Follow the information in the following table to add each member.

Table 26. Diagnostic Assembly Instance 32797

Name	Date Type	Size in Bytes
RunMode	BOOL	1

Name	Date Type	Size in Bytes
Infobit_Pad1	BOOL	
DiagnosticActive	BOOL	
CIPSyncValid	BOOL	
CIPSyncTimeout	BOOL	
Infobit_Pad5	BOOL	
FieldPowerOff	BOOL	
Infobit_Pad7	BOOL	
DiagnosticSequenceCount	SINT	1
Diagbit_Pad0	BOOL	2
Diagbit_Pad1	BOOL	
Diagbit_Pad2	BOOL	
Diagbit_Pad3	BOOL	
Diagbit_Pad4	BOOL	
Diagbit_Pad5	BOOL	
Diagbit_Pad6	BOOL	
Diagbit_Pad7	BOOL	
Diagbit_Pad8	BOOL	
Diagbit_Pad9	BOOL	
Diagbit_Pad10	BOOL	
Diagbit_Pad11	BOOL	
FlashUpdateRequired	BOOL	
SelfTestFault	BOOL	
Diagbit_Pad14	BOOL	
Diagbit_Pad15	BOOL	
Pad	DINT	4
LocalClockOffset	LINT	8
LocalClockOffsetTimestamp	LINT	8
GrandMasterClockID	SINT[8]	8
FieldPowerOnTimestamp	LINT	8
FieldPowerOffTimestamp	LINT	8
Ch00	Diagnostic_Channel_Structure	72
Ch01	Diagnostic_Channel_Structure	72
Ch02	Diagnostic_Channel_Structure	72
Ch03	Diagnostic_Channel_Structure	72

2. Diagnostic Counters Assembly for I/O
 - Instance ID: 0x301 (769)
 - Size = 16 bytes

Follow the information in the following table to add each member.

Table 27. Diagnostic Assembly Instance 769

Name	Date Type	Size in Bytes
RunMode	BOOL	1
Infobit_Pad1	BOOL	
DiagnosticActive	BOOL	
Infobit_Pad3	BOOL	
Infobit_Pad4	BOOL	
Infobit_Pad5	BOOL	
Infobit_Pad6	BOOL	
Infobit_Pad7	BOOL	
DiagnosticSequenceCount	SINT	1
CIPConnections	INT	2
CIPLostPackets	DINT	4
CIPTimeouts	DINT	4
CPUUtilization	INT	2
Pad	INT	2

Diagnostic Channel

1. Diagnostic SSV Channel
 - Size = 80 bytes

This data type is retrieved as part of the diagnostic assembly instance.

Follow the information in the following table to add each member.

Table 28. 5034-IF4IH Diagnostic SSV Channel Structure

Name	Date Type	Size in Bytes
Databit_Pad0	BOOL	2
Fault	BOOL	
Uncertain	BOOL	
OpenWire	BOOL	
Databit_Pad4	BOOL	
OverTemperature	BOOL	
FieldPowerOff	BOOL	
Databit_Pad7	BOOL	

Name	Date Type	Size in Bytes
Databit_Pad8	BOOL	
Disabled	BOOL	
Databit_Pad10	BOOL	
Databit_Pad11	BOOL	
Databit_Pad12	BOOL	
Databit_Pad13	BOOL	
Databit_Pad14	BOOL	
Databit_Pad15	BOOL	
CalFault	BOOL	2
Underrange	BOOL	
Overrange	BOOL	
Diagbit_Pad3	BOOL	
Diagbit_Pad4	BOOL	
Diagbit_Pad5	BOOL	
Diagbit_Pad6	BOOL	
Diagbit_Pad7	BOOL	
Diagbit_Pad8	BOOL	
Diagbit_Pad9	BOOL	
Diagbit_Pad10	BOOL	
Diagbit_Pad11	BOOL	
Diagbit_Pad12	BOOL	
Diagbit_Pad13	BOOL	
Diagbit_Pad14	BOOL	
Diagbit_Pad15	BOOL	
Pad1	INT	2
Pad2	SINT	1
CalRange	SINT	1
CalOffset	REAL	4
CalGain	REAL	4
CalLastDate	LINT	8
OpenWireTimestamp	LINT	8
Pad3	LINT	8
UnderrangeTimestamp	LINT	8
OverrangeTimestamp	LINT	8

Name	Date Type	Size in Bytes
FieldPowerOnTimestamp	LINT	8
FieldPowerOffTimestamp	LINT	8

Definitions for Diagnostic Assembly Types

Table 29. Definition of Members in Diagnostic Assembly Data Types

Name	Data Type	Definition	Valid Values
RunMode	BOOL	Channel's operating state	<ul style="list-style-type: none"> 0 = Idle – It means one of the following: <ul style="list-style-type: none"> Connection is not up. Connection has been opened but the module has not started producing data for the connection. Module is not applying new Output tag data because the controller is in Program Mode. 1 = Run – It means the following: <ul style="list-style-type: none"> Connection is up. Module is producing data for the connection. Output tag data is being applied.
DiagnosticActive	BOOL	Indicates if any diagnostics are active or if the prognostics threshold is reached.	<ul style="list-style-type: none"> 0 = No diagnostics active 1 = One or more diagnostics are active or the prognostics threshold is reached.
CIPSyncValid	BOOL	Indicates if the module is synced with a 1588 master.	<ul style="list-style-type: none"> 0 = Module is not synced 1 = Module is synced
DiagnosticSequenceCount	SINT	Increments for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected.	<p>-128...+127</p> <p>The value of 0 is skipped except during module power-up.</p>
CIPSyncTimeout	BOOL	Indicates if the module was once synced with a 1588 master, but is not now due to a timeout	<ul style="list-style-type: none"> 0 = A valid time master has not timed out. 1 = A valid time master is detected on the backplane, but the time master has timed

Table 29. Definition of Members in Diagnostic Assembly Data Types (continued)

Name	Data Type	Definition	Valid Values
			out. The module is using its local clock and can be drifting away from the last known time master.
FieldPowerOff	BOOL	Field power is not present at the channel.	<ul style="list-style-type: none"> 0 = Field power is present 1 = Field power is not present
FlashUpdateRequired	BOOL	Indicates whether flash update is required.	<ul style="list-style-type: none"> 0 = Flash update is not required 1 = Module has no application firmware
SelfTestFault	BOOL	Indicate whether the fault is present during module self-test.	<ul style="list-style-type: none"> 0 = Module initialization code did not detect an error 1 = Module initialization code detected an error
LocalClockOffset	LINT	The offset from the local clock to the system time. This value helps to detect steps in time. This value updates when a PTP update is received.	Any value
LocalClockOffsetTimestamp	LINT	Indicates the timestamp of the local clock offset.	<p>A valid time or None if there is no recorded event time.</p> <p>Time format is YYYY-MMDD-HH:mm:ss_mmm_uuu_nnn(UTC-00:00)</p> <ul style="list-style-type: none"> YYYY = year MM = month DD = day HH = hour (24 hour) mm = minutes SS = seconds mmm = milliseconds uuu = microseconds nnn = nanoseconds UTC-00:00 = Time zone
GrandMasterClockID	SINT	The EUI-64 Identity of the CIP Sync Grandmaster clock the module is synced to.	Any value
FieldPowerOnTimestamp	LINT	Indicates the timestamp of the last time field power turned on.	<p>A valid time or None if there is no recorded event time.</p> <p>Time format is YYYY-MM-DD-HH:mm:ss.mmm.</p> <ul style="list-style-type: none"> YYYY = year MM = month DD = day HH = hour (24 hour) mm = minutes SS = seconds mmm = milliseconds

Table 29. Definition of Members in Diagnostic Assembly Data Types (continued)

Name	Data Type	Definition	Valid Values
FieldPowerOffTimestamp	LINT	Indicates the timestamp of the last time field power turned off.	<p>A valid time or None if there is no recorded event time.</p> <p>Time format is YYYY-MM-DD-HH:mm:ss.mmm.</p> <ul style="list-style-type: none"> • YYYY = year • MM = month • DD = day • HH = hour (24 hour) • mm = minutes • SS = seconds • mmm = milliseconds
Fault	BOOL	<p>Indicates that channel data is inaccurate and cannot be trusted for use in the application.</p> <p>If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy.</p>	<ul style="list-style-type: none"> • 0 = No fault exists • 1 = Fault exists <p>The typical causes of a fault are the following:</p> <ul style="list-style-type: none"> • Channel is disabled • Open Wire condition • Underrange/Ovrange condition • SA power loss condition <p>You must troubleshoot the module first to see if the typical causes exist.</p>
Uncertain	BOOL	<p>Indicates that the channel data can be inaccurate but the degree of inaccuracy is not known.</p> <p>If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy.</p>	<ul style="list-style-type: none"> • 0 = Valid data • 1 = Data validity uncertain
OpenWire	BOOL	The signal wire is disconnected from the channel or the RTB is removed from the module.	<ul style="list-style-type: none"> • 0 = Open wire condition does not exist or open wire detection is disabled. • 1 = Open wire condition exists, that means the signal wire is disconnected from the channel or the RTB is removed from the module.
CalFault	BOOL	Indicates 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.	<ul style="list-style-type: none"> • 0 = Calibration did not fail • 1 = Calibration failed
Underrange	BOOL	<p>Indicates the channel data is beneath the underrange threshold for this channel.</p> <p>For example, when the channel operates in the 4...20 mA input range, the underrange threshold</p>	<ul style="list-style-type: none"> • 0 = Channel data is not beneath the underrange threshold • 1 = Channel data is beneath the underrange threshold

Table 29. Definition of Members in Diagnostic Assembly Data Types (continued)

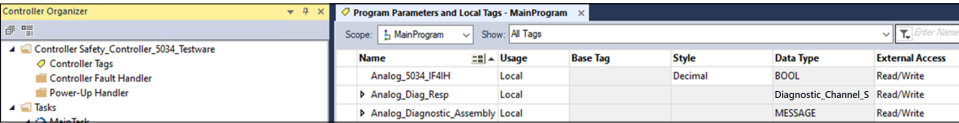
Name	Data Type	Definition	Valid Values
		on the channel is < 3.0 mA. If the input signal is 0 mA, this tag is set to 1.	
Overrange	BOOL	Indicates the channel data is above the overrange threshold for this channel. For example, when the channel operates in the 4...20 mA output range, the overrange threshold on the channel is > 23.0 mA. If the input signal is 24 mA, this tag is set to 1.	<ul style="list-style-type: none"> 0 = Channel data is not above the overrange threshold 1 = Channel data is above the overrange threshold
CalRange	SINT	Indicates the value currently configured for the channel. Values display according to the Input Type selected.	<ul style="list-style-type: none"> 0 = -10...+10V 1 = 0...5V 2 = 0...10V 4 = 0...20 mA 5 = 4...20 mA
CalOffset	REAL	Indicates the offset in signal units as reported by the device.	Any value
CalGain	REAL	Indicates the calibration gain reported by the device.	Any value
CalLastDate	LINT	Indicates the time of the last calibration date for the channel.	Any value
OpenWireTimestamp	LINT	Indicates the timestamp of the last time when the open wire condition is detected.	A valid time or None if there is no recorded event time.
UnderrangeTimestamp	LINT	Indicates the timestamp of the last underrange fault.	A valid time or None if there is no recorded event time. Time format is YYYY-MM-DD-HH:mm:SS.mmm. <ul style="list-style-type: none"> YYYY = year MM = month DD = day HH = hour (24 hour) mm = minutes SS = seconds mmm = milliseconds
OverrangeTimestamp	LINT	Indicates the timestamp of the last overrange fault.	A valid time or None if there is no recorded event time. Time format is YYYY-MM-DD-HH:mm:SS.mmm. <ul style="list-style-type: none"> YYYY = year MM = month DD = day HH = hour (24 hour) mm = minutes

Table 29. Definition of Members in Diagnostic Assembly Data Types (continued)

Name	Data Type	Definition	Valid Values
			<ul style="list-style-type: none">SS = secondsmmm = milliseconds
CIPConnections	INT	Indicates the number of CIP connections currently open.	0...24
CIPLostPackets	DINT	Indicates the running sum of the number of Sequenced Address Item Sequence Numbers that are skipped in Class 0 and Class 1 connections consumed by the adapter and its children.	0...2,147,483,647
CIPTimeouts	DINT	Indicates the running count of the number of connections that time out, both originated and targeted, to and through the adapter.	0...2,147,483,647
CPUUtilization	INT	Indicates the usage of the compute engine.	0...100%

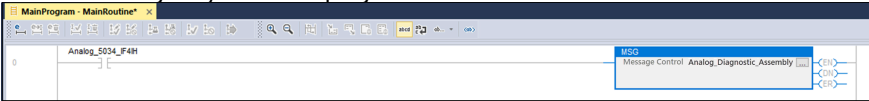
Create Message Type User Tags

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, expand Tasks → MainTask → MainProgram:

1. Create MESSAGE type user tags for each request.
2. Create associated response user tags for each new user-defined diagnostic assembly type.
3. Add the user tags to your ladder program.



4. Expand the message tag to open the message configuration dialog.
5. On the Configuration tab, select:
 - Service type: Get Attribute Single
 - Class: 4
 - Attribute: 3
 - Instance:
 - 0x801D (32797) Diagnostic Assembly for Analog 4 Channel Input Module
 - 0x301 (769) Diagnostic Counters Base I/O Assembly
 - Destination element: User-defined data type suitable for the instance entered.
6. On the Communication tab, select the path to the module that you wish to send the messages to.

7. Download the project and set to Run Mode.
You can monitor the user-defined tag values from the Program Parameters and Local Tags window, under the MainProgram task in the Controller Organizer pane.

5034-OF4IH and 5034-OF4IHXT Details

This chapter covers the detailed instructions on how to configure, calibrate, and troubleshoot your 5034-OF4IH and 5034-OF4IHXT modules. It also describes the module tag definitions for input, output, and configuration tags.

5034-OF4IH and 5034-OF4IHXT Analog 4 Output Modules

Figure 33. 5034-OF4IH and 5034-OF4IHXT Wiring Diagram — Current Mode

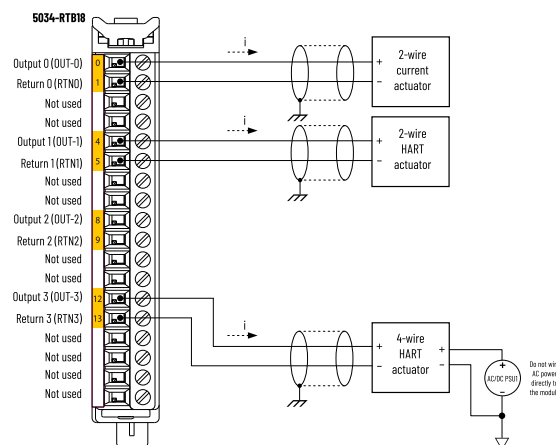


Figure 34. 5034-OF4IH and 5034-OF4IHXT Wiring Diagram — Voltage Mode

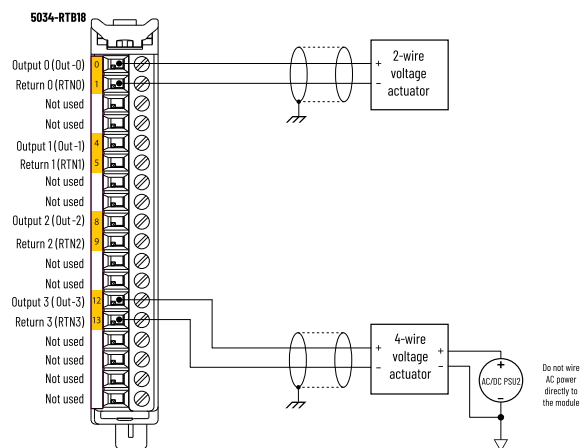


Figure 35. 5034-OF4IH and 5034-OF4IHXT Functional Block Diagram

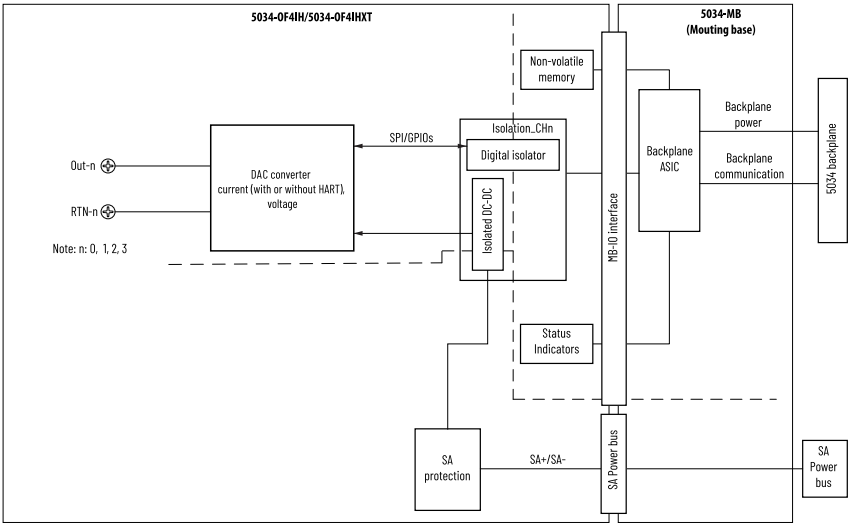


Table 30. Technical Specifications - 5034-OF4IH, 5034-OF4IHXT

Attribute	5034-OF4IH, 5034-OF4IHXT
Output range, voltage	-10...+10V 0...10V 0...5V
Output range, current	0...20 mA 4...20 mA 4...20 mA - HART
Resolution, voltage	-10...+10V: 14 bits (1.465 mV/bit) 0...10V: 14 bits (732 μ V/bit) 0...5V: 13 bits (732 μ V/bit)
Resolution, current	0...20 mA range: 14 bits (1.526 μ A/bit) 4...20 mA range: 14 bits (1.526 μ V/bit)
Calibrated accuracy at 25 °C (77 °F) HART disabled	Voltage +10...+10V, 0.1% full scale Voltage 0...10V, $\pm$ 0.1% full scale Voltage: 0...5V, $\pm$ 0.2% full scale Current: 0...20 mA, $\pm$ 0.1% full scale Current: 4...20 mA, $\pm$ 0.1% full scale
Calibrated accuracy over full temperature range -25...+60 °C (-13...+140 °F) HART disabled	Voltage: -10...+10V, $\pm$ 0.2% full scale Voltage: 0...10V, $\pm$ 0.2% full scale Voltage: 0...5V, $\pm$ 0.4% full scale Current: 0...20 mA, $\pm$ 0.2% full scale Current: 4...20 mA, $\pm$ 0.2% full scale

Table 30. Technical Specifications - 5034-OF4IH, 5034-OF4IHXT (continued)

Attribute	5034-OF4IH, 5034-OF4IHXT
Drive capability	Voltage: 3000 Ω Current: 750 Ω
Capacitive load, max Voltage mode	1 μ F
Inductive load, max Current mode	1 mH
Open wire detection	Current mode only
Short circuit detection	Voltage mode only
Data format	IEEE 754 32-bit floating point
Module conversion method	DAC
HART update rate	Typically 1 s Additional device variables, configured commands, pass through messages, handheld communicators, secondary masters, communication errors, or configuration changes can significantly increase the update time.
Update rate Voltage and current mode	1 ms
Step response time to 63% of value, typical HART disabled	Voltage mode: 90 μ s typical Current mode: 50 μ s typical
Backplane to screw response time (63% of full scale) HART disabled	Voltage mode: <ul style="list-style-type: none"> 1 channel: 0.4 ms typical All channel: 0.4 ms typical Current mode: <ul style="list-style-type: none"> 1 channel: 0.4 ms typical All channel: 0.6 ms typical
Overvoltage protection, max	32V DC

Table 31. General Specifications - 5034-OF4IH, 5034-OF4IHXT

Attribute	5034-OF4IH, 5034-OF4IHXT
Number of outputs	4 channels, individually isolated Configurable voltage or current mode at channel level
SA power voltage, nom	24V DC

Table 31. General Specifications - 5034-OF4IH, 5034-OF4IHXT (continued)

Attribute	5034-OF4IH, 5034-OF4IHXT
SA power voltage range	10...30V DC
SA power current, nom	110 mA
SA power current, max	275 mA
SA power current at no load	27 mA
SA reverse polarity protection	Yes
Power dissipation, max	1.55 W
Thermal dissipation, max	5.29 BTU/hr
Isolation voltage	250V (continuous), Basic Insulation Type, between system and SA power 250V (continuous), Basic Insulation Type, between SA power and input ports 250V (continuous), Basic Insulation Type, between individual input ports 250V (continuous), Basic Insulation Type, between system and input ports
Calibration	Factory-calibrated Manual calibration supported
RIUP support	Yes
Electronic keying	Electronic keying via programming software
RTB key positions (slot)	2, 6, 10
RTB supported	5034-RTB18, 5034-RTB18S
Wiring category ⁽¹⁾	2 - Signal ports 2 - Power ports
Wiring specification	See Wiring Specifications for Removable Terminal Blocks in the PointMax I/O System Specifications Technical Data, publication 5034-TD001
Indicators	1 green/red module status indicator 1 green/red SA power status indicator 4 yellow/red I/O status indicators
Dimensions (HxWxD), approx	123.6 x 15.0 x 66.4 mm (4.87 x 0.59 x 2.61 in.)
Weight, approx	51.0 g (1.80 oz.) - 5034-OF4IH 55.0 g (1.94 oz.) - 5034-OF4IHXT
Enclosure type	None (Open-style)
North American temp code	T4

Table 31. General Specifications - 5034-OF4IH, 5034-OF4IHXT (continued)

Attribute	5034-OF4IH, 5034-OF4IHXT
UKEX/ATEX temp code	T4
IECEx temp code	T4

(1) Use this Conductor Category information for planning conductor routing. See the Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#). Use this Conductor Category information for planning conductor routing as described in the appropriate System Level Installation Manual.

Module Configuration

Before you start configuring your I/O module, you must create a Studio 5000 Logix Designer application project for the Logix 5000 controller that owns the I/O module. The project includes configuration data for the module.

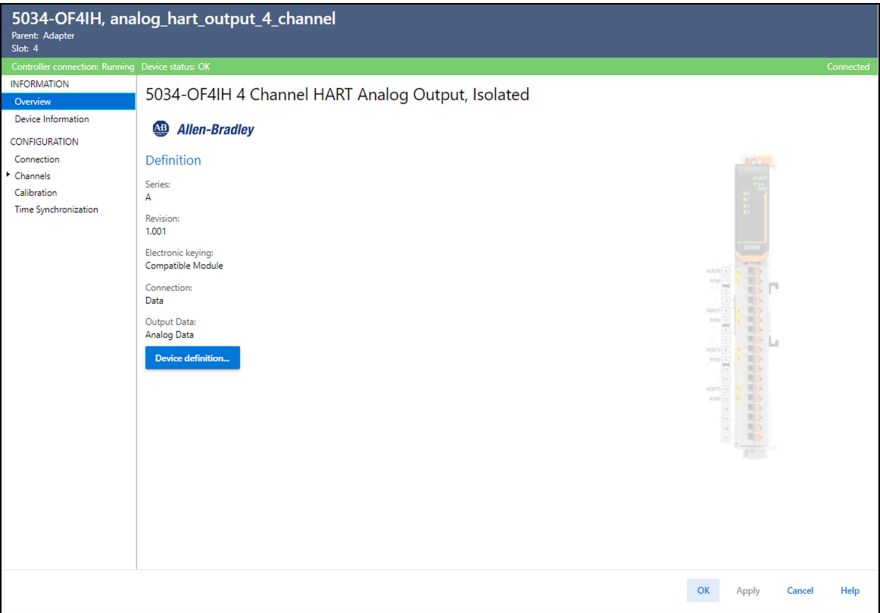
The Studio 5000 Logix Designer application transfers the project to the owner-controller during the program download. Data is then transferred to the I/O modules over the EtherNet/IP network.

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

Overview View

Use Overview to view the definition of a device, including the device type, revision, electronic keying, connection, and other device-specific values.

Figure 36. Overview View Example



Device Definition

To change the definition of a device, select Device definition in the Overview view.

Figure 37. Device Definition Example

Device definition

Device type:
5034-OF4IH 4 Channel HART Analog Output, Isolated

Series:
A

Name:
analog_hart_output_4_channel

Revision:
1, 001

Description:

Electronic keying:
Compatible Module

Slot:
3

Connection:
Data

Output Data:
Analog Data

OK

Cancel

Help

Device Definition includes these parameters:

Table 32. Device Definition Parameters

Parameter	Definition	Available Choices
Device Type	Displays the device catalog number and type.	Device-specific
Name	Enter an IEC 61131 compliant device name. If an invalid character is entered in this field, or if the name exceeds 40 characters, the software ignores the character.	All valid values
Description	Enter the description of the device.	All valid values
Slot	Specify the slot number where the device resides. Only slots between 1 and the maximum number of I/O devices are valid depending on the platform. When the device is created, the slot number defaults to the first available slot position. When the controller is changed to one supporting a smaller maximum I/O count, the current slot value may no longer be valid.	1...32
Series	Specifies the series of the device.	Device-specific

Table 32. Device Definition Parameters (continued)

Parameter	Definition	Available Choices
Revision	Specifies the major and minor revisions of the device. The valid range for minor revision is from 1...255.	Device-specific
Electronic Keying	<p>Defines the electronic keying used for the device. Electronic keying compares the device defined in the project to the installed device. If keying fails, a fault occurs.</p> <p>For detailed information on Electronic keying, see Electronic Keying in Logix 5000 Control Systems Application Technique, publication LOGIX-AT001.</p>	<ul style="list-style-type: none"> Exact Match Compatible Module Disable Keying <hr/> <div>  <p>ATTENTION: Be extremely cautious when using Disable Keying; if used incorrectly, this option can lead to personal injury or death, property damage, or economic loss.</p> <p>We strongly suggest that you do not use Disable Keying.</p> <p>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.</p> </div> <hr/>
Connection	<p>Specify the type of data transferred between the device and controller.</p> <p>For the Listen Only choice, the controller and device establish communication without the controller sending any configuration or output data to the device. A full input data connection is established but depends on the connection between the owner-controller and the device.</p>	<ul style="list-style-type: none"> Data with Calibration Data (default) Listen Only
Output Data	Select the output data type for the device.	Analog Data

Device Information View

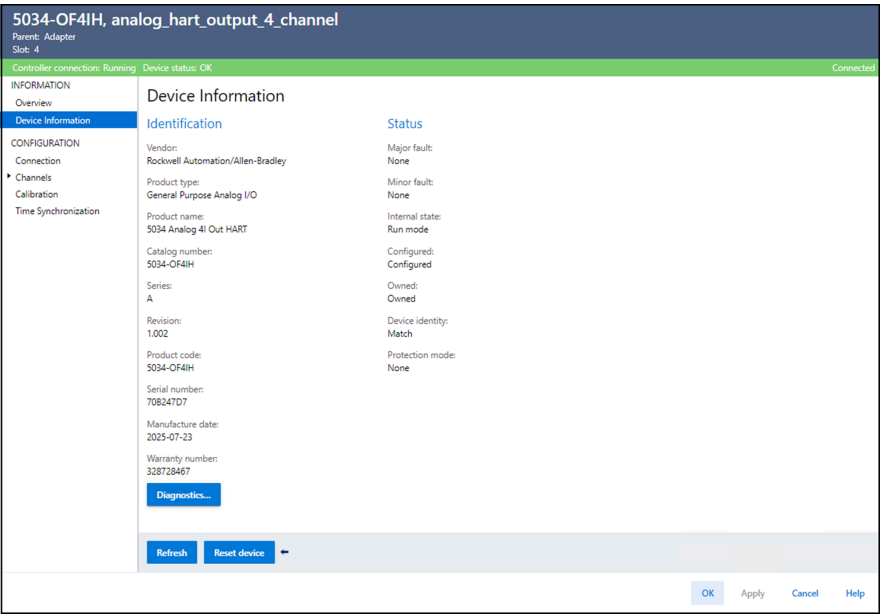
Use Device Information to view device and status information when the device is online.

Use Device Information to:

- Determine the identity of the device.
- View the device's current operational state.
- View whether an owner controller is currently connected to the device.

- Retrieve the latest information from the device.
- Reset a device to its power-up state.

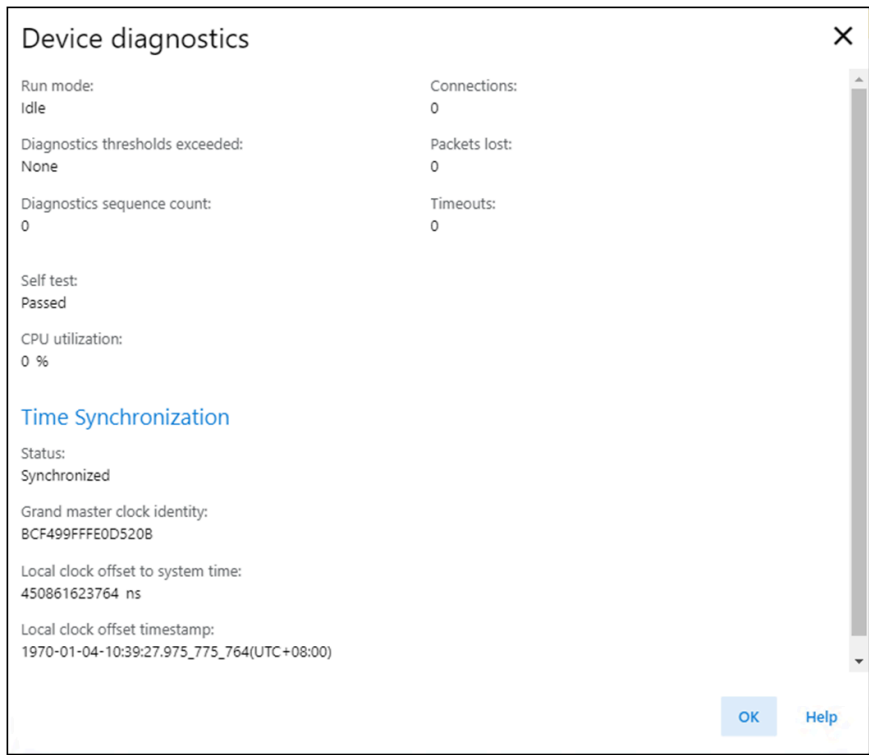
Figure 38. Device Information View Example



Device Diagnostics

To view the device diagnostics, select Diagnostics in the Device Information view.

Figure 39. Device Diagnostics Example



Connection View

Use Connection to define controller-to-device behavior:

- Set the RPI rate. For more information, see [Requested Packet Interval on page 18](#).
- Select Unicast or Multicast connection to use on the EtherNet/IP network. For more information, see [Unicast or Multicast Connection on page 18](#).
- View the reason of Connection Fault.



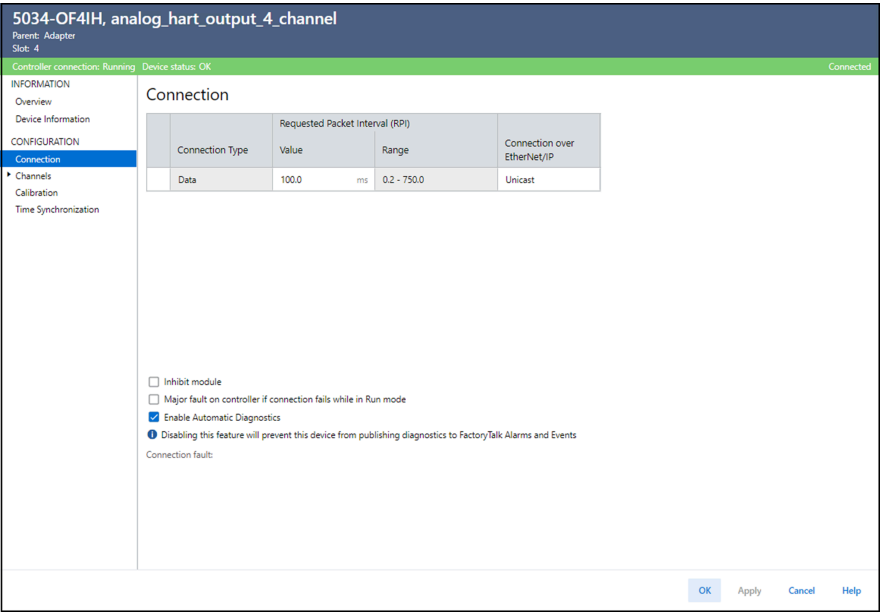
If there is a connection fault, Connection Fault area displays the error code with description that helps you to troubleshoot the module. For more information, see [Troubleshoot Your Module on page 18](#).

- Inhibit the module. For more information, see [Module Inhibiting on page 19](#).
- Configure fault response for connection failure while the controller is in Run Mode.
- Enable or disable the Automatic Diagnostics.



ATTENTION: If you do not enable Automatic Diagnostics, the device does not publish diagnostics to FactoryTalk Alarms and Events.

Figure 40. Connection View Example



Channels View

The Channels view shows an overview of the configuration values for all module channels.



Not all channel configurations are included in Channels view. To view or change the complete set of the channel configuration and also to view the diagnostics information for the channel, use Chxx view.

You can do the following actions on this view for all the channels:

- Disable the channel, if desired.
- Change the output type and output range.
- Enable or disable no load detection
- Enable or disable hold for initialization

- Set the scaling and recalculate all configurations with engineering unit.
- Configure the connection fault handling

You can use this view to monitor the configuration for all channels in the module. To view the diagnostics information for the channel, go to respective Chxx view.

Figure 41. Channels View Example

Channel	☐ Disable	Output Type	Output Range	☒ Enable HART	Output State During Program Mode	Communication Fault Mode	☐ Enable No Load Detection	High Signal	Low Signal	Engineering Units	High Engineering	Low Engineering	Recalculate Units
Ch00	☐	Current	4mA to 20mA	☒	Hold Last State	Hold Last State	☐	20.0 mA	4.0 mA	%	100.0 %	0.0 %	<input type="button" value="C"/>
Ch01	☐	Current	4mA to 20mA	☒	Hold Last State	Hold Last State	☐	20.0 mA	4.0 mA	%	100.0 %	0.0 %	<input type="button" value="C"/>
Ch02	☐	Current	4mA to 20mA	☒	Hold Last State	Hold Last State	☐	20.0 mA	4.0 mA	%	100.0 %	0.0 %	<input type="button" value="C"/>
Ch03	☐	Current	4mA to 20mA	☒	Hold Last State	Hold Last State	☐	20.0 mA	4.0 mA	%	100.0 %	0.0 %	<input type="button" value="C"/>

Chxx View

The Chxx view, where xx represents the channel number, shows the configuration options available for the respective channel.

You can do the following actions on this view:

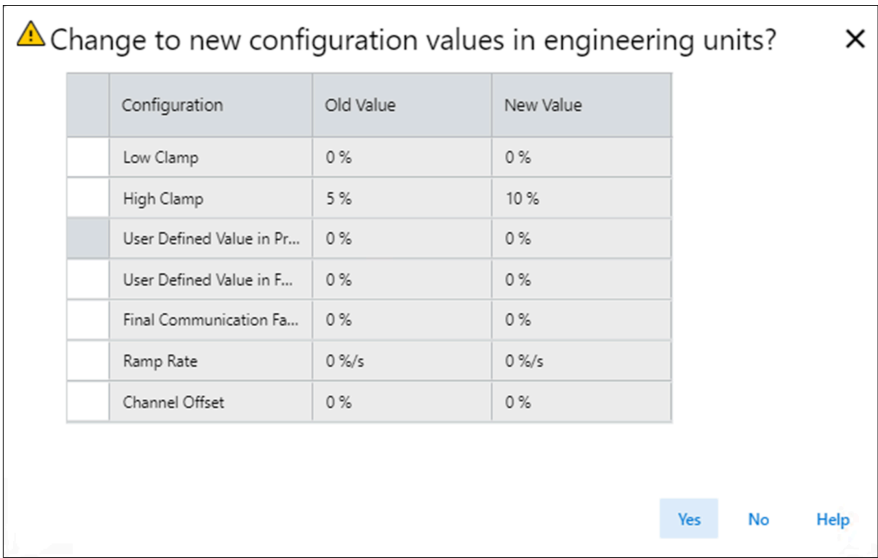
- Disable the channel, if desired
- Change the output type and output range.
- Enable or disable HART.
- Enable or disable no load detection
- Enable or disable hold for initialization
- Set the scaling settings.
- Recalculate the engineering units if configuration is changed.
- Configure the connection fault handling
- View channel diagnostics information

Figure 42. Chxx View Example

Recalculate Units

- Recalculate Units lets you recalculate all configurations with engineering unit after a scaling change. Consider the following:
- The Recalculate Units option is enabled when the scaling configuration is changed.
 - Upon selecting Recalculate Units option, the recalculated new values based on the new scaling configuration are displayed together with the old values for you to verify before changing.
 - If you select "Yes" to proceed with the change, the new values will be set but it gets applied when you select "Apply/OK".
 - If you select "No" to cancel the change, the old values are retained. You can either select the Recalculate Units again or manually change those configurations based on the new scaling.

Figure 43. Recalculate Units Example



Channelxx Diagnostics

Displays the channel diagnostics information when connected with the module. When online with the module, select the Diagnostics on the Chxx view to see the diagnostic information.

Figure 44. Channelxx Diagnostics Example

Channel00 Diagnostics

Fault Exists:

No

Data Uncertain:

No

Field Power:

Present

Field Power On Timestamp:

None

Field Power Off Timestamp:

None

Short Circuit Fault:

Not Present

Short Circuit Fault Timestamp:

None

No Load Fault:

Not Present

No Load Fault Timestamp:

None

Calibration for Active Range

Calibration Timestamp:

2024-08-29-19:04:20.482

Range:

0 mA to 20 mA

Gain:

0.999994

Offset:

0.000986

OK

HELP

Limits View

Each channel on the analog output module has a Limits view with which it is associated. The Signal Units options correspond to the output type and range for the channel.

You can do the following actions on this view:

- Disable all the alarms.
- Latch clamp alarms and configure output clamping
- Enable/disable the output ramping in different modes and configure the ramp rate (if any ramp mode is enabled).

IMPORTANT: When HART is enabled, the max ramping rate allowed in Run Mode is 833.33%/s.

Figure 45. Chxx - Limits View Example

5034-OF4, Analog_Output_Module

Parent: AEV1H

Slot: 1

Controller connection: Running

Device status: OK

Connected

INFORMATION

Overview

Device Information

CONFIGURATION

Connection

Channels

Ch00

Limits

Ch01

Limits

Ch02

Limits

Ch03

Limits

Calibration

Time Sync

Ch00 - Limits

Output Clamping

High Clamp: 100.0 %

Low Clamp: 0.0 %

Output Ramping

Output clamping does not apply during Program Mode and Communication Fault Mode.

Ramp in Run Mode

☐

 Latch State Alarm

☐

 Ramp to Program Mode

☐

 Ramp to Fault Mode and Final Fault State

Ramp Rate: 0.0 %/s

Clamp Alarming

☐

 Disable All Alarms

☐

 Latch Clamp Alarms

OK

Apply

Cancel

Help

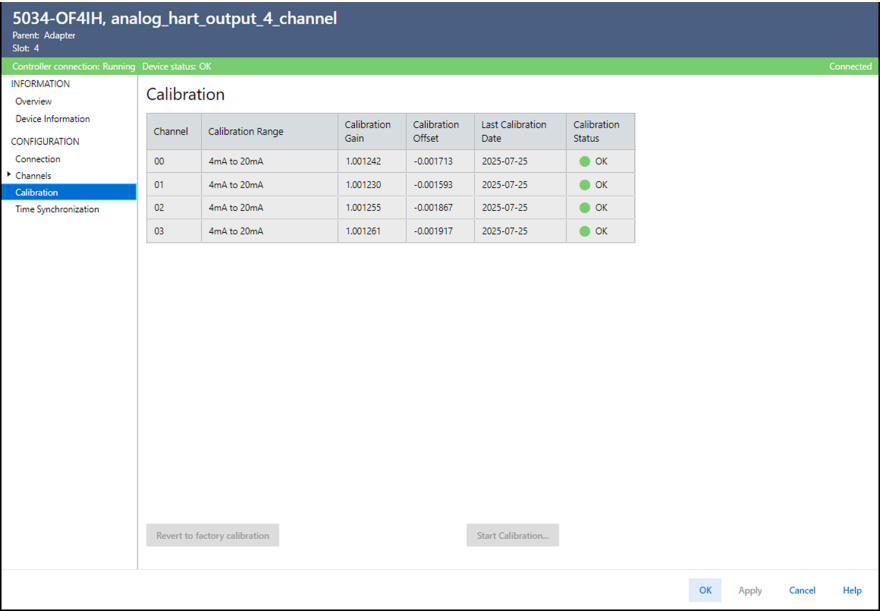
Calibration View

The Calibration view provides calibration information for all channels on the module. You can do the following actions on this view for all the channels:

- View calibration parameters and calibration status for the currently configured input ranges.
- Perform user calibration for one or multiple channels.
- Revert calibration parameters to the factory default values.

For more information on how to calibrate a module, see [Module Calibration \(Interactive\) on page 128](#)

Figure 46. Calibration View Example

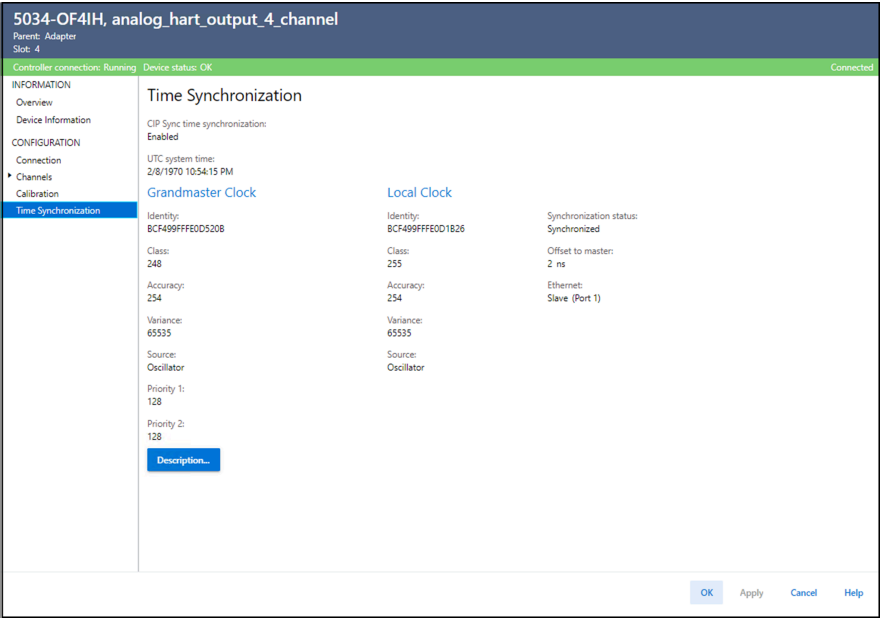


Time Synchronization View

The Time Synchronization view is read-only and displays the CIP Sync status information about the module when the project is online. The Time Synchronization category displays the following information:

- CIP Sync time synchronization status
- UTC system time
- Grandmaster Clock information
- Grandmaster Clock description
- Local Clock information

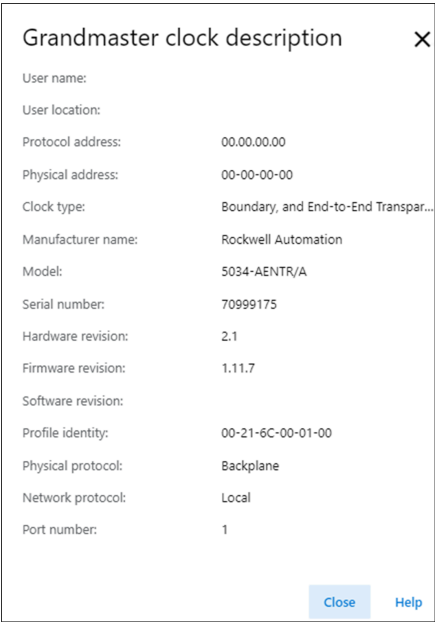
Figure 47. Time Synchronization View Example



Grandmaster Clock Description

The Grandmaster clock description dialog provides detailed information about the grandmaster clock. To view the Grandmaster clock description, select Description in the Time Sync view.

Figure 48. Grandmaster Clock Description Example



Module Calibration (Interactive)

You can use Calibration view in Module Properties to interactively calibrate the module on a per channel basis or in group.

Controller State During Calibration

You must add the module to your Studio 5000 Logix Designer application project before you can calibrate it.

The project must be online with the owner-controller to calibrate the PointMax analog modules. You can calibrate under any of the following conditions:

- The controller is in Program Mode, that is, either Remote Program or Program Mode.

Your module must be in Program Mode and not be actively controlling a process when you calibrate it.

- There are no connections to the module.

Calibration Instrumentation Specifications

When you calibrate output modules, 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, use the instrumentation with the specifications listed in the following table.

IMPORTANT: Do not calibrate your module with an instrument that is less accurate than those specified in following table. The following events can result:

- Calibration appears to occur normally but the module gives inaccurate data during operation.
- A calibration fault occurs, forcing you to abort calibration. When this happens, I.Chxx.CalFault tag is set for the channel you attempted to calibrate. You can clear this tag by completing a valid calibration or cycling power to the module.

Table 33. Calibration Instrument Specifications

Catalog Number	Channel Output Type	Calibration Instrumentation Specifications
5034-OF4IH and 5034-OF4IHXT	Current (mA)	DMM with resolution better than 0.15 μ A
	Voltage (V)	DMM with resolution better than 1.0 μ V

Calibration Procedure

When calibrating an analog output channel, the Studio 5000 Logix Designer application commands the module to output specific signal levels. The signal type is determined by the output type being used by the channel.

Table 34. Analog Output Module Calibration References

Output Type	Output Range	Low Calibration Reference Level	High Calibration Reference Level
Voltage (V)	-10...10V	-10.0V	10.0V
	0...10V	1.0V	10.0V
	0...5V	1.0V	5.0V
Current (mA)	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.
- This example describes how to calibrate a channel on the analog output module for use with a Current (mA) output type. 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 view in the Module Properties dialog, select Start Calibration.

5034-OF4IH, analog_hart_output_4_channel

Parent: Adapter

Slot: 4

Controller connection: Running

Device status: OK

Connected

INFORMATION

Overview

Device Information

CONFIGURATION

Connection

Channels

Calibration

Time Synchronization

Calibration

Channel	Calibration Range	Calibration Gain	Calibration Offset	Last Calibration Date	Calibration Status
00	4mA to 20mA	1.001242	-0.001713	2025-07-25	OK
01	4mA to 20mA	1.001230	-0.001593	2025-07-25	OK
02	4mA to 20mA	1.001255	-0.001867	2025-07-25	OK
03	4mA to 20mA	1.001261	-0.001917	2025-07-25	OK

Revert to factory calibration

Start Calibration...

OK

Apply

Cancel

Help

5. When the dialog appears to confirm that you want to calibrate the channel, select OK.

⚠

Logix Designer

DANGER: Calibration should not be performed on a module currently being used for control. All channels will freeze at their current values and control may be interrupted.

Continue with Calibration?

OK

Cancel

Help

6. Select the channels one at a time or in groups to calibrate and then select Next.

Calibration Wizard - Select Channels to Calibrate

Select the checkboxes of the channels to calibrate, and then select to calibrate in groups or one at a time.

	Channel	Calibrate	Calibration Range	Calibration Gain	Calibration Offset	Calibration Status
	00	☐	0mA to 20mA	0.999851	0.001057	OK
*	01	☒	0mA to 20mA	0.999948	0.001074	OK
	02	☐	0mA to 20mA	0.999979	0.001125	OK
	03	☐	0mA to 20mA	0.999924	0.001099	OK

☐ Calibrate channels in groups

☒ Calibrate channels one at a time

Back

Next

Cancel

Help

7. When the Output Reference dialog appears and indicates the channel to be calibrated for the low reference, select Next.

Calibration Wizard - Output Reference

Select Next to continue.

Channel: 00

Channel	Calibrate	Calibration Range	Low Reference
00	☒	0mA to 20mA	4.00 mA
01	☐		
02	☐		
03	☐		

Back

Next

Cancel

Help

The Measure and Record Values dialog appears for low reference value.

Calibration Wizard - Measure and Record Values

Use multimeter to measure the output values for selected channels. The multimeter accuracy must be at least 4 decimal places. Enter the measured value as Recorded Reference, and then select Next to continue.

Channel: 00

	Channel	Calibrate	Calibration Range	Low Reference	Recorded Reference
*	00	☒	0mA to 20mA	4.00 mA	3.9988000 mA
	01	☐			
	02	☐			
	03	☐			

Back

Next

Cancel

Help

8.

Use a multimeter to measure the low reference value of the channel.
9.

In the Recorded Reference column, record the measured value and select Next. The Low Reference Results dialog appears and indicates the status of the calibrated channel.

Calibration Wizard - Low Reference Results

Select Next to continue.

Channel	Calibrate	Calibration Range	Low Reference	Recorded Reference	Status
00	☒	0mA to 20mA	4.00 mA	3.9988000 mA	<div>OK</div>
01	☐				
02	☐				
03	☐				

Retry

Back

Next

Cancel

Help

10.

If the Status is OK, select Next.
If the Status is not OK, repeat the calibration process.
11.

When the Output Reference dialog appears and indicates the channel to be calibrated for the high reference, select Next.

Calibration Wizard - Output Reference

✕

Select Next to continue.

Channel: 00

Channel	Calibrate	Calibration Range	High Reference
00	☒	0mA to 20mA	20.00 mA
01	☐		
02	☐		
03	☐		

Back

Next

Cancel

Help

The Measure and Record Values dialog appears.

Calibration Wizard - Measure and Record Values

✕

Use multimeter to measure the output values for selected channels. The multimeter accuracy must be at least 4 decimal places.
Enter the measured value as Recorded Reference, and then select Next to continue.

Channel: 00

	Channel	Calibrate	Calibration Range	High Reference	Recorded Reference
*	00	☒	0mA to 20mA	20.00 mA	19.9968000 mA
	01	☐			
	02	☐			
	03	☐			

Back

Next

Cancel

Help

12. Use a multimeter to measure the high reference value of the channel.
13. In the Recorded Reference column, record the measured value and select Next.
The High Reference Results dialog appears and indicates the status of the calibrated channel.

Calibration Wizard - High Reference Results

×

Select Next to continue.

Channel	Calibrate	Calibration Range	High Reference	Recorded Reference	Status
00	☒	0mA to 20mA	20.00 mA	19.9968000 mA	<div>OK</div>
01	☐				
02	☐				
03	☐				

Retry

BackNextCancelHelp

14. If the Status is OK, select Next.
If the Status is not OK, repeat the calibration process.
15. When the Calibration Completed dialog appears, select Finish.

Calibration Wizard - Calibration Completed

×

Calibration completed successfully. The calibration constants are saved.

Channel	Calibrate	Calibration Range	Low Recorded	Status	High Recorded	Status
00	☒	0mA to 20mA	3.9988000 mA	<div>OK</div>	19.9968000 mA	<div>OK</div>
01	☐					
02	☐					
03	☐					

BackFinishCancelHelp

Use the Status Indicators for Troubleshooting

- PointMax I/O modules use the following status indicators:
- SA Power Indicator - This indicator operates the same for all PointMax I/O modules.
 - Module Status Indicator - This indicator operates the same for all PointMax I/O modules.
 - Channel Status Indicator - This indicator operates differently based on the module type that you are using.

SA Power Status Indicator

Table 35. Interpret SA Power Status Indicator

Indicator State	Description	Recommended Action
Off	The module is not powered.	Complete the following actions: 1. Confirm that the system is powered. 2. Confirm that the module is installed properly.
Steady green	There is SA power to the module.	None
Steady red	There is no SA power to the module or SA power voltage is not in the valid range.	Complete the following actions: 1. Confirm that SA power wiring is properly connected to the adapter, expansion power module, or 5034-MBSA mounting base. 2. Check the following: <ul style="list-style-type: none"> - Check that the SA voltage is in the correct range. - If an external power supply is used, confirm that the power supply is turned on. - Make sure that the mounting base to mounting base connection is properly secured. Go to Chassis Information view in the Module Properties of the adapter to check the Field Power status of mounting bases installed in all slots.

Module Status Indicator

Table 36. Interpret Module Status Indicator

Indicator State	Description	Recommended Action
Off	The module is not powered.	Complete the following actions: 1. Confirm that the system is powered. 2. Confirm that the module is installed properly.
Steady green	The module is operational and all I/O connections are active.	None
Flashing green	The module has no I/O connections.	Troubleshoot your Studio 5000 Logix Designer application to determine what is preventing a connection from the module to the controller and correct the issue.
Flashing red	One of the following conditions exists: <ul style="list-style-type: none"> • 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 the following: <ul style="list-style-type: none"> • Let the firmware update process complete. • Reattempt a firmware update after one fails. • Use the Studio 5000 Logix Designer application to determine whether a module recoverable fault is occurred. It is shown in Device Information view.

Table 36. Interpret Module Status Indicator (continued)

Indicator State	Description	Recommended Action
		<p>To clear a recoverable fault, complete one of the following:</p> <ul style="list-style-type: none"> - Cycle module power. - Select Reset device in the Studio 5000 Logix Designer project via the Device Information view of the Module Properties dialog. <p>If the fault does not clear after cycling power and module reset, contact Rockwell Automation Technical Support.</p> <ul style="list-style-type: none"> • Use the Studio 5000 Logix Designer application to determine if a connection has timed out. The Connection view in the Module Properties indicates whether a connection request has timed out. <p>If a connection has timed out, determine the cause and correct it. For example, a cable failure can cause a connection timeout.</p>
Steady red	The module experienced a nonrecoverable fault.	<p>Complete the following actions:</p> <ol style="list-style-type: none"> 1. Cycle power to the module. 2. If the status indicator remains in the steady red state, replace the module.

Channel Status Indicators

Table 37. Interpret Output Channel Status Indicators

Indicator State	Description	Recommended Action
Off	<p>One of the following conditions exists:</p> <ul style="list-style-type: none"> • The module is not powered. • The module is powered but connection is not established from the controller to module. • The module is powered, but the input channel is disabled. 	<p>Complete one of the following:</p> <ul style="list-style-type: none"> • If you expect the module to be powered but it is not, complete the following: <ul style="list-style-type: none"> - 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 confirm that the channel is not disabled and the module has a connection to the controller. <p>The Connection view in the Module Properties indicates if the connection is running or faulted. If the connection is faulted, the Connection view indicates error information.</p> <ul style="list-style-type: none"> • If the channel is disabled, no action is needed.
Steady yellow	The output channel is operating normally.	None

Table 37. Interpret Output Channel Status Indicators (continued)

Indicator State	Description	Recommended Action
Flashing red	One of the following conditions exists: <ul style="list-style-type: none"> There is no SA power to the module, or SA power voltage is not in the valid range. A wire is disconnected from the output. That is, a No Load condition exists. The module is driving a current from the channel greater than the maximum current level the channel can handle. That is, a Short Circuit condition exists. 	One of the following: <ul style="list-style-type: none"> If there is a SA power fault, see the recommended action given for steady red indicator state in SA Power Indicator table above. 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.
Alternating yellow/red	Calibration is in progress.	Successfully complete the calibration process.
Steady red	An issue has occurred that is internal to the module. The following are example issues that can cause the status indicator to be steady red: <ul style="list-style-type: none"> A calibration fault occurred on the channel. The module has experienced a nonrecoverable fault. 	Complete one of the following: <ul style="list-style-type: none"> If the indicator turns steady red after a calibration process, you can either perform a successful calibration or cycle the power to recover the fault. If it is not caused by the calibration, cycle the power to recover the fault. If the condition is still present, replace the module.

Module Tag Definitions

Module tags are created when you add a module to the Studio 5000 Logix Designer application project. The set of module tags associated with a module depends on the module type and Device Definition choices made during module configuration. The tables contained in this section list all of the tags available with a module. Not all tags in the list are used when that module type is added to a project. Tag use varies by module configuration.

Configuration Tag Definitions

Table 38. Configuration Tags

Name	Data Type	Definition	Valid Values
Chxx.Range	SINT	Channel's operating range	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 0 = Alarms are enabled 1 = Alarms are disabled

Table 38. Configuration Tags (continued)

Name	Data Type	Definition	Valid Values
		<p>IMPORTANT: Consider the following:</p> <ul style="list-style-type: none"> If you change this tag to 0, that is, so that the alarms are not disabled, you must also enable the individual alarms for them to work. <p>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 that the alarm is enabled.</p> <p>This applies to all alarms on the module.</p> <ul style="list-style-type: none"> Conversely, if you set this tag to 1, alarms are disabled regardless of the setting on the alarm enable tag for any alarm. 	
Chxx.LimitAlarmLatchEn	BOOL	Configures Limit alarms to latch until they are explicitly unlatched.	<ul style="list-style-type: none"> 0 = Latching disabled 1 = Latching enabled
Chxx.RampAlarmLatchEn	BOOL	Latches Ramp Alarm when set so that it does not clear until explicitly unlatched.	<ul style="list-style-type: none"> 0 = Latching disabled 1 = Latching enabled
Chxx.NoLoadEn	BOOL	Enables the input No Load diagnostic.	<ul style="list-style-type: none"> 0 = Disabled 1 = Enabled
Chxx.Disable	BOOL	Disables the channel.	<ul style="list-style-type: none"> 0 = Channel is enabled 1 = Channel is disabled
Chxx.FaultMode	BOOL	<p>Determines output action when a connection fault occurs.</p> <p>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.</p>	<ul style="list-style-type: none"> 0 = Transition to user-defined value 1 = Hold Last State
Chxx.ProgMode	BOOL	<p>Determines output action when the controller transitions to Program Mode or Inhibit mode.</p> <p>At the transition to Program Mode or Inhibit mode, the output holds its last state or transitions to the value set in the Program Value parameter.</p>	<ul style="list-style-type: none"> 0 = Transition to user-defined value 1 = Hold Last State
Chxx.ProgramToFaultEn	BOOL	<p>Determines channel action if a connection faults while the module is in a safe state for Program Mode.</p> <p>The channel can remain in a safe state for Program Mode or transition to a safe state for Communication Fault mode.</p>	<ul style="list-style-type: none"> 0 = Remains in the Program state 1 = Transitions to the safe state for the Fault mode

Table 38. Configuration Tags (continued)

Name	Data Type	Definition	Valid Values
		If the channel remains in a safe state for Program Mode, the Final Fault State parameter is ignored.	
Chxx.FaultValueStateDuration	SINT	Determines the length of time the FaultMode or FaultValue parameter value is held prior to the Final Fault State.	<ul style="list-style-type: none"> 0 = Forever 1 = 1 s 2 = 2 s 5 = 5 s 10 = 10 s
Chxx.FaultValue	REAL	Value to which the output changes if the following events exist: <ul style="list-style-type: none"> Fault Mode = 0 Either of the following: <ul style="list-style-type: none"> Controller is in Run Mode and the connection is lost Controller is in Program Mode, the connection is lost, and the ProgramToFaultEn tag is set 	Any value
Chxx.ProgValue	REAL	Value to which the channel changes if the following events exist: <ul style="list-style-type: none"> Program Mode = 0 Controller transitions to Program Mode 	Any value
Chxx.FaultFinalState	REAL	If FaultValueStateDuration is nonzero, this value determines the final Output state after the configured FaultValueStateDuration timeout occurs.	Any value
Chxx.RampInRun	BOOL	Enables Output Ramping when the module is in Run Mode. Output changes during Run Mode are limited to the Maximum Ramp Rate value.	<ul style="list-style-type: none"> 0 = Ramping disabled 1 = Ramping enabled in Run Mode
Chxx.RampToProg	BOOL	Enables Output Ramping when the controller transitions to Program Mode. Output changes during Program Mode are limited to the Maximum Ramp Rate value.	<ul style="list-style-type: none"> 0 = Ramping disabled 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.	<ul style="list-style-type: none"> 0 = Ramping disabled 1 = Ramping enabled to Fault mode state
Chxx.HoldForInit	BOOL	When set, configures the channel to hold, or not change, until initialized with a value within 0.1% of full scale of	<ul style="list-style-type: none"> 0 = Output 0.Chxx.Data signal immediately 1 = Hold last signal until initialization match

Table 38. Configuration Tags (continued)

Name	Data Type	Definition	Valid Values
		its current value when one of the following conditions occurs. <ul style="list-style-type: none"> Module initial connection (powerup) Controller transition from Program Mode back to Run Mode Module re-establishes communication after a fault SA power is restored after being lost. 	
Chxx.MaxRampRate	REAL	Maximum rate at which the channel can transition to in Engineering Units/Second. This tag is used only if at least one of the following output ramping modes is enabled: <ul style="list-style-type: none"> Ramp In Run Ramp To Fault Ramp To Program 	If the MaxRampRate = 0.0, the ramp rate is limited to ramping the range full scale in one RPI. Any value greater than zero = Trigger point
Chxx.LowSignal	REAL	One of four points used in scaling. The low signal is in terms of the inputs signal units and corresponds to the low engineering term when scaled.	Any value less than the high signal in range
Chxx.HighSignal	REAL	One of four points used in scaling. The high signal is in terms of the inputs signal units and corresponds to the high engineering term when scaled.	Any value greater than the low signal in range
Chxx.LowEngineering	REAL	One of four points used in scaling. The low engineering helps determine the engineering units the signal values scale into. The low engineering term corresponds to the low signal value.	Any value
Chxx.HighEngineering	REAL	One of four points used in scaling. The high engineering helps determine the engineering units the signal values scale into. The high engineering term corresponds to the high signal value.	Any value
Chxx.LowLimit	REAL	Lowest value to which the output can go. The tag value is engineering units.	Any value lower than the HighLimit
Chxx.HighLimit	REAL	Highest value to which the output can go. The tag value is engineering units.	Any value higher than the LowLimit
Chxx.Offset	REAL	Compensates for any known error on the sensor or channel to which the sensor is connected. The value is set in engineering units.	Any value Use a small value.

Input Tag Definitions

Table 39. Input Tags

Name	Data Type	Definition	Valid Values
RunMode	BOOL	Channel's operating state	<ul style="list-style-type: none"> 0 = Idle – It means one of the following: <ul style="list-style-type: none"> Connection is not up. Connection has been opened but the module has not started producing data for the connection. Because the controller is in Program Mode, the module is not applying the Output tag data but is applying the Program Mode state of the channels instead. 1 = Run – It means the following: <ul style="list-style-type: none"> Connection is up. Module is producing data for the connection. Output tag data is being applied.
ConnectionFaulted	BOOL	Indicates if a connection is running. The module sets this tag to 0 when connected. If the module is not connected, it changes the tag to 1.	<ul style="list-style-type: none"> 0 = A connection exists between the module and the controller 1 = Connection is timed out or inhibited
DiagnosticActive	BOOL	Indicates if any diagnostics are active or if the prognostics threshold is reached.	<ul style="list-style-type: none"> 0 = No diagnostics are 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.	-128...+127 The value of 0 is skipped except during module powerup.
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.	<ul style="list-style-type: none"> 0 = No fault exists 1 = Fault exists
Chxx.Uncertain	BOOL	Indicates that the channel data can 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.	<ul style="list-style-type: none"> 0 = Valid data 1 = Data validity uncertain

Table 39. Input Tags (continued)

Name	Data Type	Definition	Valid Values
		<p>IMPORTANT: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.</p>	
Chxx.NoLoad	BOOL	<p>The signal wire is disconnected from the channel or the RTB is removed from the module.</p> <p>This condition is detected only when the channel is used in current mode.</p>	<ul style="list-style-type: none"> 0 = No Load condition does not exist 1 = No Load condition exists
Chxx.ShortCircuit	BOOL	<p>A Short Circuit or Overcurrent condition exists.</p> <p>This condition is detected only when the channel is used in voltage mode.</p>	<ul style="list-style-type: none"> 0 = No Short Circuit or Overcurrent condition exists 1 = Short Circuit or Overcurrent condition exists
Chxx.OverTemperature	BOOL	Not applicable for this module.	N/A
Chxx.FieldPowerOff	BOOL	Field power is not present at the channel.	<ul style="list-style-type: none"> 0 = Field power is present 1 = Field power is not present
Chxx.NotANumber	BOOL	Indicates that the last value received for the channel output data value was not a number.	<ul style="list-style-type: none"> 0 = Last channel data received was a number 1 = Last channel data received was not a number
Chxx.InHold	BOOL	Indicates that the channel is currently holding until the received data value is within 0.1% range full scale of the current data value.	<ul style="list-style-type: none"> 0 = Channel is not holding 1 = Channel is holding
Chxx.Underrange	BOOL	Indicates that the commanded output data in output tag is below the Underrange threshold. When it happens, the actual output signal is limited at the threshold or the configured Low Limit (whichever is higher).	<ul style="list-style-type: none"> 0 = Commanded output data is not below the underrange threshold 1 = Commanded output data is below the underrange threshold
Chxx.Overrange	BOOL	Indicates that the commanded output data in output tag is above the Overrange threshold. When it happens, the actual output signal is limited at the threshold or the configured High Limit (whichever is lower).	<ul style="list-style-type: none"> 0 = Commanded output data is not above the overrange threshold 1 = Commanded output data is above the overrange threshold
Chxx.LLimitAlarm	BOOL	<p>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.</p> <p>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.</p>	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 0 = Alarm is not triggered 1 = Alarm is triggered

Table 39. Input Tags (continued)

Name	Data Type	Definition	Valid Values
		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.	
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.	<ul style="list-style-type: none"> 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 or a successful calibration for the range on the channel is performed.	<ul style="list-style-type: none"> 0 = Calibration did not fail 1 = Calibration failed
Chxx.Calibrating	BOOL	Indicates that the channel is currently being calibrated.	<ul style="list-style-type: none"> 0 = Channel is not being calibrated 1 = Channel is being calibrated
Chxx.CalGoodLowRef	BOOL	Indicates that a valid Low Reference signal is sampled on this channel in the calibration process. IMPORTANT: This tag is available only when you use the Data with Calibration connection type in the Device definition dialog. If you use the Data connection type, this tag does not appear in the module tags.	<ul style="list-style-type: none"> 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 is sampled on this channel in the calibration process. You must correct this condition to successfully 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 use the Data with Calibration connection type in the Device definition dialog. If you use the Data connection type, this tag does not appear in the module tags.	<ul style="list-style-type: none"> 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 is sampled on this channel in the calibration process.	<ul style="list-style-type: none"> 0 = Valid High Reference signal has not been sampled on this channel 1 = Valid High Reference signal has been sampled on this channel

Table 39. Input Tags (continued)

Name	Data Type	Definition	Valid Values
		<p>IMPORTANT: This tag is available only when you use the Data with Calibration connection type in the Device definition dialog. If you use the Data connection type, this tag does not appear in the module tags.</p>	
Chxx.CalBadHighRef	BOOL	<p>Indicates that an invalid High Reference signal is sampled on this channel in the calibration process.</p> <p>You must correct this condition to successfully calibrate the module.</p> <p>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.</p> <p>IMPORTANT: This tag is available only when you use the Data with Calibration connection type in the Device definition dialog. If you use the Data connection type, this tag does not appear in the module tags.</p>	<ul style="list-style-type: none"> 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	<p>Indicates calibration on this channel is complete and the Calibrating state has been exited.</p> <p>This tag remains set after valid calibration and until a new calibration process is started or the connection is closed.</p> <p>IMPORTANT: This tag is available only when you use the Data with Calibration connection type in the Device definition dialog. If you use the Data connection type, this tag does not appear in the module tags.</p>	<ul style="list-style-type: none"> 0 = Calibration was not successful 1 = One of the following: <ul style="list-style-type: none"> Calibration was successful and calibrating state has been exited. Calibration data is present and applied.
Chxx.Data	REAL	Indicates the signal value currently output at the RTB in scaled Engineering Units.	Any value
Chxx.RollingTimestamp	INT	<p>Continuously-running 15-bit timer that counts in milliseconds.</p> <p>Whenever the data echo value changes, the output module updates the value of the RollingTimestamp.</p>	0...32767

Output Tag Definitions

Table 40. Output Tags

Name	Data Type	Definition	Valid Values
Chxx.LLimitAlarmUnlatch	BOOL	Unlatches a latched Low Limit Alarm at the first instance of the bit transitioning from 0 to 1.	<ul style="list-style-type: none"> 0 = Alarm remains latched 1 = Alarm is unlatched
Chxx.HLimitAlarmUnlatch	BOOL	Unlatches a latched High Limit Alarm at the first instance of the bit transitioning from 0 to 1.	<ul style="list-style-type: none"> 0 = Alarm remains latched 1 = Alarm is unlatched
Chxx.RampAlarmUnlatch	BOOL	Unlatches a latched Ramp Alarm at the first instance of the bit transitioning from 0 to 1.	<ul style="list-style-type: none"> 0 = Alarm remains latched 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.	<ul style="list-style-type: none"> 0 = Not to start calibration process 1 = Start calibration process
Chxx.CalOutputLowRef	BOOL	A 0 to 1 transition commands the channel to produce the Low Calibration Reference Point for the chosen current or voltage output range.	<ul style="list-style-type: none"> 0 = Do not output Calibration Low Reference Signal 1 = Output Calibration Low Reference Signal <p>Do not set this tag and the CalOutputHighRef tag to 1 simultaneously.</p>
Chxx.CalOutputHighRef	BOOL	A 0 to 1 transition commands the channel to produce the High Calibration Reference Point for the chosen current or voltage output range.	<ul style="list-style-type: none"> 0 = Do not Output Calibration High Reference Signal 1 = Output Calibration High Reference Signal <p>Do not set this tag and the CalOutputLowRef tag to 1 simultaneously.</p>
Chxx.CalLowRefPassed	BOOL	A 0 to 1 transition indicates that the Chxx.Data output tag data contains the recorded Low Reference value for the channel that is used by the module in Calibration.	<ul style="list-style-type: none"> 0 = Not sending recorded Calibration Low Reference Signal in Output Data 1 = Sending recorded Calibration Low Reference Signal in Output Data for Calibration Verification
Chxx.CalHighRefPassed	BOOL	A 0 to 1 transition indicates that the Chxx.Data output tag data contains the recorded High Reference value for the channel that is used by the module in Calibration.	<ul style="list-style-type: none"> 0 = Not sending recorded Calibration High Reference Signal in Output Data 1 = Sending recorded Calibration High Reference Signal in Output Data for Calibration Verification
Chxx.CalFinish	BOOL	Data value change that triggers the channel to complete the Calibration procedure, applying the valid Low and High References received. Channel exits the Calibration state if successful.	<ul style="list-style-type: none"> 0 = Do not complete the calibration procedure 1 = Complete the calibration procedure
Chxx.Data	REAL	The value that is converted to the signal on the RTB in scaled Engineering Units.	Any value

Diagnostic Assembly

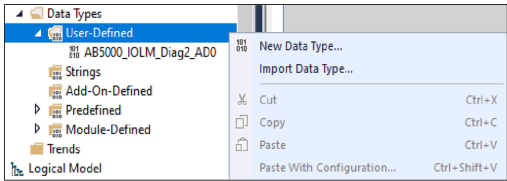
Diagnostic assembly helps you troubleshoot and diagnose the fault in your system.

Create User-defined Diagnostic Assembly Types

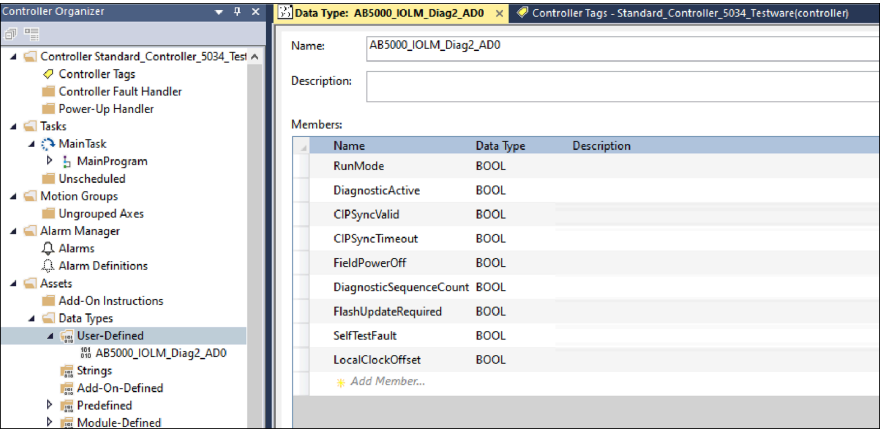
You can use the Studio 5000 Logix Designer application to create user-defined Diagnostic Assembly types.

Create user-defined diagnostic assembly by following the below steps:

- 1. From the Controller Organizer pane, go to Assets → Data types → User-Defined.
- 2. Right-click on the User-Defined folder and select New Data Type.



- 3. Add a Name and Description (optional) for your diagnostic assembly.
- 4. Under Members area, add the data members based on the diagnostic assembly detailed below.



IMPORTANT: The members indicated in the tables are arranged according to Data Alignment Rules of controllers. Strictly follow the data type and the sequence of the members that are indicated in the tables of this appendix. If the data type and the sequence are not followed, data misalignment may occur after executing Get Attribute Single Message (MSG) instruction.

Diagnostic Assemblies

- 1. Diagnostic Assembly for Analog 4 Channel Output Module
 - Instance ID: 0x8020 (32800)
 - Size = 304 bytes

Follow the information in the following table to add each member.

Table 41. Diagnostic Assembly Instance 32800

Name	Date Type	Size in Bytes
RunMode	BOOL	1
Infobit_Pad1	BOOL	
DiagnosticActive	BOOL	

Name	Date Type	Size in Bytes
CIPSyncValid	BOOL	
CIPSyncTimeout	BOOL	
Infobit_Pad5	BOOL	
FieldPowerOff	BOOL	
Infobit_Pad7	BOOL	
DiagnosticSequenceCount	SINT	1
Diagbit_Pad0	BOOL	2
Diagbit_Pad1	BOOL	
Diagbit_Pad2	BOOL	
Diagbit_Pad3	BOOL	
Diagbit_Pad4	BOOL	
Diagbit_Pad5	BOOL	
Diagbit_Pad6	BOOL	
Diagbit_Pad7	BOOL	
Diagbit_Pad8	BOOL	
Diagbit_Pad9	BOOL	
Diagbit_Pad10	BOOL	
Diagbit_Pad11	BOOL	
FlashUpdateRequired	BOOL	
SelfTestFault	BOOL	
Diagbit_Pad14	BOOL	
Diagbit_Pad15	BOOL	
Pad	DINT	4
LocalClockOffset	LINT	8
LocalClockOffsetTimestamp	LINT	8
GrandMasterClockID	SINT[8]	8
FieldPowerOnTimestamp	LINT	8
FieldPowerOffTimestamp	LINT	8
Ch00	Diagnostic_Channel_Structure	64
Ch01	Diagnostic_Channel_Structure	64
Ch02	Diagnostic_Channel_Structure	64
Ch03	Diagnostic_Channel_Structure	64

2. Diagnostic Counters Assembly for I/O
 - Instance ID: 0x301 (769)
 - Size = 16 bytes

Follow the information in the following table to add each member.

Table 42. Diagnostic Assembly Instance 769

Name	Date Type	Size in Bytes
RunMode	BOOL	1
Infobit_Pad1	BOOL	
DiagnosticActive	BOOL	
Infobit_Pad3	BOOL	
Infobit_Pad4	BOOL	
Infobit_Pad5	BOOL	
Infobit_Pad6	BOOL	
Infobit_Pad7	BOOL	
DiagnosticSequenceCount	SINT	1
CIPConnections	INT	2
CIPLostPackets	DINT	4
CIPTimeouts	DINT	4
CPUUtilization	INT	2
Pad	INT	2

Diagnostic Channels

1. Diagnostic Channel
 - Size = 64 bytes

This data type is retrieved as part of the diagnostic assembly instance.

Follow the information in the following table to add each member.

Table 43. 5034-OF4IH Diagnostic Channel Structure

Name	Date Type	Size in Bytes
Databit_Pad0	BOOL	2
Fault	BOOL	
Uncertain	BOOL	
NoLoad	BOOL	
ShortCircuit	BOOL	
Databit_Pad5	BOOL	
FieldPowerOff	BOOL	
Databit_Pad7	BOOL	

Name	Date Type	Size in Bytes
Databit_Pad8	BOOL	
Disabled	BOOL	
Databit_Pad10	BOOL	
Databit_Pad11	BOOL	
Databit_Pad12	BOOL	
Databit_Pad13	BOOL	
Databit_Pad14	BOOL	
Databit_Pad15	BOOL	
CalFault	BOOL	2
Diagbit_Pad1	BOOL	
Diagbit_Pad2	BOOL	
Diagbit_Pad3	BOOL	
Diagbit_Pad4	BOOL	
Diagbit_Pad5	BOOL	
Diagbit_Pad6	BOOL	
Diagbit_Pad7	BOOL	
Diagbit_Pad8	BOOL	
Diagbit_Pad9	BOOL	
Diagbit_Pad10	BOOL	
Diagbit_Pad11	BOOL	
Diagbit_Pad12	BOOL	
Diagbit_Pad13	BOOL	
Diagbit_Pad14	BOOL	
Diagbit_Pad15	BOOL	
Pad1	INT	2
InternalErrorCount	SINT	1
CalRange	SINT	1
CalOffset	REAL	4
CalGain	REAL	4
CalLastDate	LINT	8
NoLoadTimestamp	LINT	8
ShortCircuitTimestamp	LINT	8
Pad2	LINT	8

Name	Date Type	Size in Bytes
FieldPowerOnTimestamp	LINT	8
FieldPowerOffTimestamp	LINT	8

Definitions for Diagnostic Assembly Types

Table 44. Definition of Members in Diagnostic Assembly Data Types

Name	Data Type	Definition	Valid Values
RunMode	BOOL	Channel's operating state	<ul style="list-style-type: none"> 0 = Idle – It means one of the following: <ul style="list-style-type: none"> Connection is not up. Connection has been opened but the module has not started producing data for the connection. Because the controller is in Program Mode, the module is not applying the Output tag data but is applying the Program Mode state of the channels instead. 1 = Run – It means the following: <ul style="list-style-type: none"> Connection is up. Module is producing data for the connection. Output tag data is being applied.
DiagnosticActive	BOOL	Indicates if any diagnostics are active or if the prognostics threshold is reached.	<ul style="list-style-type: none"> 0 = No diagnostics active 1 = One or more diagnostics are active or the prognostics threshold is reached.
CIPSyncValid	BOOL	Indicates if the module is synced with a 1588 master.	<ul style="list-style-type: none"> 0 = Module is not synced 1 = Module is synced
CIPSyncTimeout	BOOL	Indicates if the module was once synced with a 1588 master, but is not now due to a timeout	<ul style="list-style-type: none"> 0 = A valid time master has not timed out. 1 = A valid time master is detected on the backplane, but the time master has timed out. The module is using its local clock and can be drifting away from the last known time master.
FieldPowerOff	BOOL	Field power is not present at the channel.	<ul style="list-style-type: none"> 0 = Field power is present 1 = Field power is not present
DiagnosticSequenceCount	SINT	Increments for each time a distinct diagnostic condition is detected, and when a distinct	<p>-128...+127</p> <p>The value of 0 is skipped except during module power-up.</p>

Table 44. Definition of Members in Diagnostic Assembly Data Types (continued)

Name	Data Type	Definition	Valid Values
		diagnostic condition transitions from detected to not detected.	
FlashUpdateRequired	BOOL	Indicates whether flash update is required.	<ul style="list-style-type: none"> 0 = Flash update is not required 1 = Module has no application firmware
SelfTestFault	BOOL	Indicate whether the fault is present during module self-test.	<ul style="list-style-type: none"> 0 = Module initialization code did not detect an error 1 = Module initialization code detected an error
LocalClockOffset	LINT	The offset from the local clock to the system time. This value helps to detect steps in time. This value updates when a PTP update is received.	Any value
LocalClockOffsetTimestamp	LINT	Indicates the timestamp of the local clock offset.	<p>A valid time or None if there is no recorded event time.</p> <p>Time format is YYYY-MMDD-HH:mm:ss_mmm_uuu_nnn(UTC-00:00)</p> <ul style="list-style-type: none"> YYYY = year MM = month DD = day HH = hour (24 hour) mm = minutes SS = seconds mmm = milliseconds uuu = microseconds nnn = nanoseconds UTC-00:00 = Time zone
GrandMasterClockID	SINT	The EUI-64 Identity of the CIP Sync Grandmaster clock the module is synced to.	Any value
FieldPowerOnTimestamp	LINT	Indicates the timestamp of the last time field power turned on.	<p>A valid time or None if there is no recorded event time.</p> <p>Time format is YYYY-MM-DD-HH:mm:ss.mmm.</p> <ul style="list-style-type: none"> YYYY = year MM = month DD = day HH = hour (24 hour) mm = minutes SS = seconds mmm = milliseconds
FieldPowerOffTimestamp	LINT	Indicates the timestamp of the last time field power turned off.	A valid time or None if there is no recorded event time.

Table 44. Definition of Members in Diagnostic Assembly Data Types (continued)

Name	Data Type	Definition	Valid Values
			Time format is YYYY-MM-DD-HH:mm:ss.mmm. <ul style="list-style-type: none"> • YYYY = year • MM = month • DD = day • HH = hour (24 hour) • mm = minutes • SS = seconds • mmm = milliseconds
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.	<ul style="list-style-type: none"> • 0 = No fault exists • 1 = Fault exists The typical causes of a fault are the following: <ul style="list-style-type: none"> • Channel is disabled • Open Wire condition • Underrange/Ovrange condition • SA power loss condition You must troubleshoot the module first to see if the typical causes exist.
Uncertain	BOOL	Indicates that the channel data can 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.	<ul style="list-style-type: none"> • 0 = Valid data • 1 = Data validity uncertain
OpenWire	BOOL	The signal wire is disconnected from the channel or the RTB is removed from the module.	<ul style="list-style-type: none"> • 0 = Open wire condition does not exist or open wire detection is disabled. • 1 = Open wire condition exists, that means the signal wire is disconnected from the channel or the RTB is removed from the module.
CalFault	BOOL	Indicates 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.	<ul style="list-style-type: none"> • 0 = Calibration did not fail • 1 = Calibration failed
Underrange	BOOL	Indicates the channel data is beneath the underrange threshold for this channel. For example, when the channel operates in the 4...20 mA input range, the underrange threshold	<ul style="list-style-type: none"> • 0 = Channel data is not beneath the underrange threshold • 1 = Channel data is beneath the underrange threshold

Table 44. Definition of Members in Diagnostic Assembly Data Types (continued)

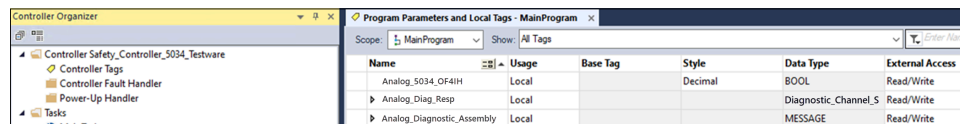
Name	Data Type	Definition	Valid Values
		on the channel is < 3.0 mA. If the input signal is 0 mA, this tag is set to 1.	
Overrange	BOOL	Indicates the channel data is above the overrange threshold for this channel. For example, when the channel operates in the 4...20 mA output range, the overrange threshold on the channel is > 23.0 mA. If the input signal is 24 mA, this tag is set to 1.	<ul style="list-style-type: none"> 0 = Channel data is not above the overrange threshold 1 = Channel data is above the overrange threshold
CalRange	SINT	Indicates the value currently configured for the channel. Values display according to the Input Type selected.	<ul style="list-style-type: none"> 0 = -10...+10V 1 = 0...5V 2 = 0...10V 4 = 0...20 mA 5 = 4...20 mA
CalOffset	REAL	Indicates the offset in signal units as reported by the device.	Any value
CalGain	REAL	Indicates the calibration gain reported by the device.	Any value
CalLastDate	LINT	Indicates the time of the last calibration date for the channel.	Any value
OpenWireTimestamp	LINT	Indicates the timestamp of the last time when the open wire condition is detected.	A valid time or None if there is no recorded event time.
UnderrangeTimestamp	LINT	Indicates the timestamp of the last underrange fault.	A valid time or None if there is no recorded event time. Time format is YYYY-MM-DD-HH:mm:SS.mmm. <ul style="list-style-type: none"> YYYY = year MM = month DD = day HH = hour (24 hour) mm = minutes SS = seconds mmm = milliseconds
OverrangeTimestamp	LINT	Indicates the timestamp of the last overrange fault.	A valid time or None if there is no recorded event time. Time format is YYYY-MM-DD-HH:mm:SS.mmm. <ul style="list-style-type: none"> YYYY = year MM = month DD = day HH = hour (24 hour) mm = minutes

Table 44. Definition of Members in Diagnostic Assembly Data Types (continued)

Name	Data Type	Definition	Valid Values
			<ul style="list-style-type: none"> SS = seconds mmm = milliseconds
NoLoad	BOOL	Indicates whether a load fault is present.	<ul style="list-style-type: none"> 0 = No Load condition does not exist. 1 = No Load condition exists.
NoLoadTimestamp	LINT	Indicates the timestamp of the last time a no load fault has occurred.	<p>A valid time or None if there is no recorded event time.</p> <p>Time format is YYYY-MM-DD-HH:mm:SS.mmm.</p> <ul style="list-style-type: none"> YYYY = year MM = month DD = day HH = hour (24 hour) mm = minutes SS = seconds mmm = milliseconds
ShortCircuit	BOOL	Indicates whether an output short circuit or overcurrent fault is present on the point.	<ul style="list-style-type: none"> 0 = No Short Circuit condition exists. 1 = Short Circuit condition is present.
ShortCircuitTimestamp	LINT	Indicates the timestamp of the last time short-circuit fault has occurred.	<p>A valid time or None if there is no recorded event time.</p> <p>Time format is YYYY-MM-DD-HH:mm:SS.mmm.</p> <ul style="list-style-type: none"> YYYY = year MM = month DD = day HH = hour (24 hour) mm = minutes SS = seconds mmm = milliseconds
Disable	BOOL	Indicates whether the channel is enabled or disabled.	<ul style="list-style-type: none"> 0 = Channel is enabled 1 = Channel is disabled
CIPConnections	INT	Indicates the number of CIP connections currently open.	0...24
CIPLostPackets	DINT	Indicates the running sum of the number of Sequenced Address Item Sequence Numbers that are skipped in Class 0 and Class 1 connections consumed by the adapter and its children.	0...2,147,483,647
CIPTimeouts	DINT	Indicates the running count of the number of connections that time out, both originated and targeted, to and through the adapter.	0...2,147,483,647
CPUUtilization	INT	Indicates the usage of the compute engine.	0...100%

Create 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.

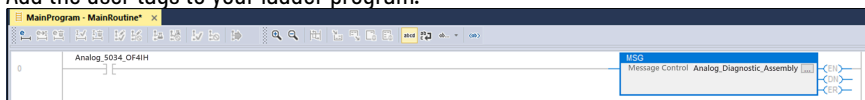


The screenshot shows two windows. The 'Controller Organizer' window on the left displays a tree structure with 'MainTask' expanded, showing 'MainProgram'. The 'Program Parameters and Local Tags - MainProgram' window on the right shows a table of user-defined tags.

Name	Usage	Base Tag	Style	Data Type	External Access
Analog_5034_OF4IH	Local		Decimal	BOOL	Read/Write
Analog_Diag_Resp	Local			Diagnostic_Channel_S	Read/Write
Analog_Diagnostic_Assembly	Local			MESSAGE	Read/Write

From the Controller Organizer pane, expand Tasks → MainTask → MainProgram:

1. Create MESSAGE type user tags for each request.
2. Create associated response user tags for each new user-defined diagnostic assembly type.
3. Add the user tags to your ladder program.



4. Expand the message tag to open the message configuration dialog.
 5. On the Configuration tab, select:
 - Service type: Get Attribute Single
 - Class: 4
 - Attribute: 3
 - Instance:
 - 0x8020 (32800) Diagnostic Assembly for Analog 4 Channel Output Module
 - 0x301 (769) Diagnostic Counters Base I/O Assembly
 - Destination element: User-defined data type suitable for the instance entered.
 6. On the Communication tab, select the path to the module that you wish to send the messages to.
 7. Download the project and set to Run Mode.
- You can monitor the user-defined tag values from the Program Parameters and Local Tags window, under the MainProgram task in the Controller Organizer pane.

PointMax I/O HART Device Details

This chapter covers the detailed views available for HART devices that are connected to your analog HART input or output modules in a Studio 5000 Logix Designer application project. It also describes the module tag definitions for input and output tags.

Device Configuration

This section describes how to add and monitor HART devices that are connected to your analog HART input or output module in a Studio 5000 Logix Designer application project.

- 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.



In an output module, the power to the field device is provided by the channel. If the channel is not energized, the HART device is not powered on.

General View

The General view appears first when you create a HART device. The parameters in this view vary depending on the type of device.

Use this category to configure:

- Device revision and software version for the HART device.
- Electronic keying for the HART device.

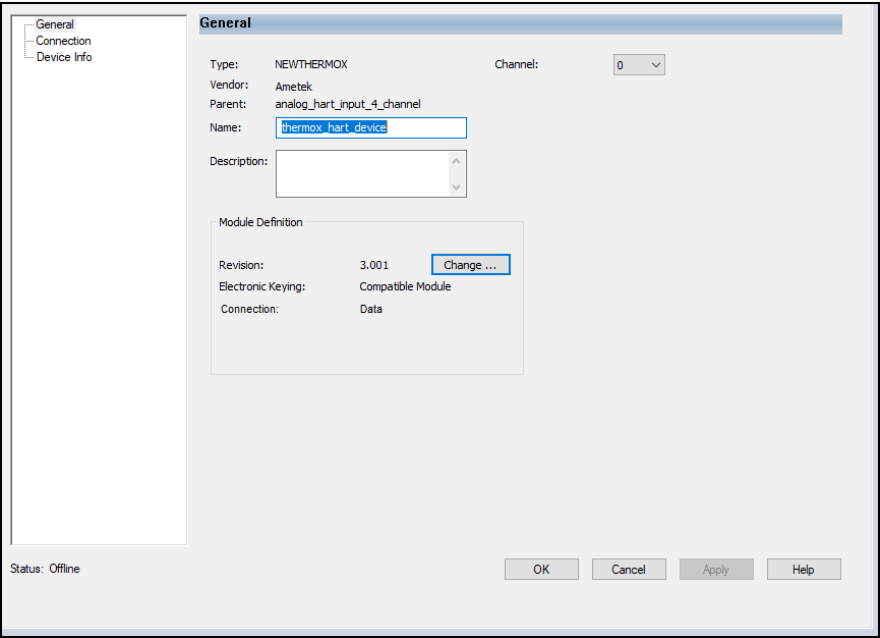
IMPORTANT: Changing Electronic Keying when online interrupts connection to the device and any device that is connected through the device. If an I/O connection to a device is interrupted, data loss can occur.

- The type of connection used with the HART device.



The Connection parameter affects the configuration options available for Input Data and Output Data, and determines what data is exchanged between the owner-controller and the module.

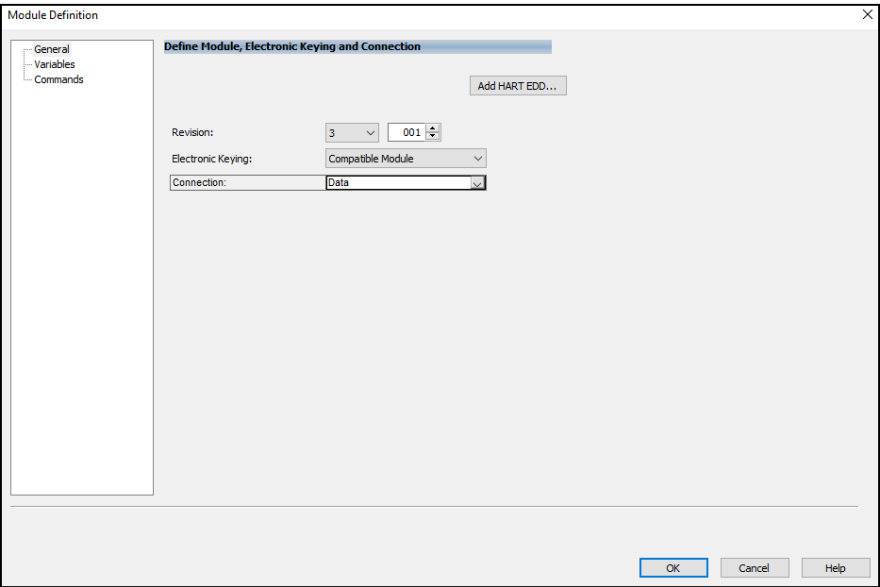
Figure 49. General View Example



Module Definition View

Module Definition parameters are available from the General view of the Module Properties dialog in the Studio 5000 Logix Designer application project. The categories and parameters vary depending on the type of HART device.

Figure 50. Module Definition View Example - Generic HART Device



Variables View

Use the Variables view to configure dynamic and device variables to be included in the input tag of the HART device. Use this view to complete the following tasks:

- Select Dynamic Variables.
- Select Device Variables.

Figure 51. Variables View Example

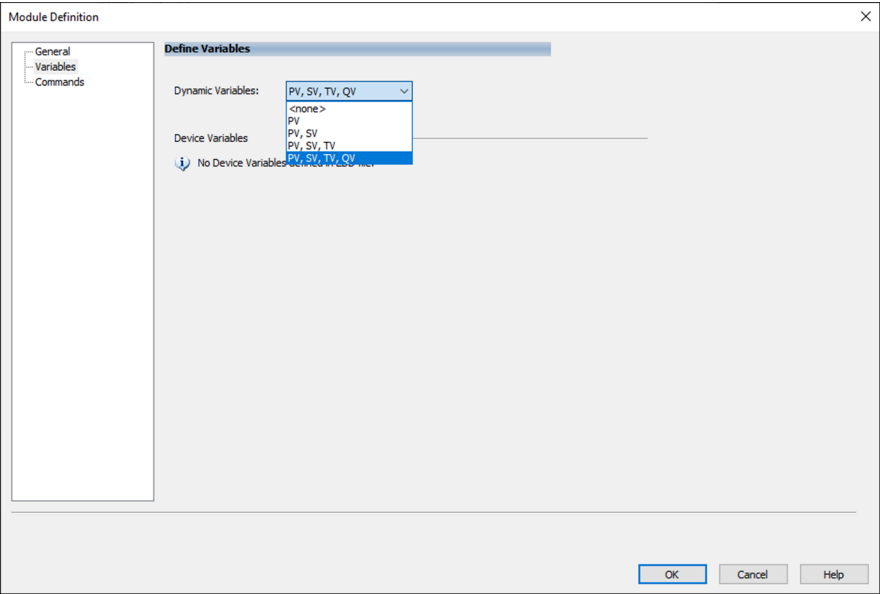


Table 45. Variables Parameters

Parameter	Definition	Available Choices
Dynamic Variables	Displays the included Dynamic Variables.	<ul style="list-style-type: none"> • <none> • PV • PV, SV • PV, SV, TV • PV, SV, TV, QV
Device Variables	<p>Displays the Available and Used Device Variables.</p> <p>The Available list includes the names of all supported device variables, not including those in the Used list.</p> <p>The Used list contains the names of the selected device variables. The Used list is limited to eight Device Variables.</p> <p>Move the Device Variables between the lists using Add and Remove.</p>	—
EDD file information	<p>Displays information about the EDD file.</p> <ul style="list-style-type: none"> • EDD file does not exist or cannot be opened. <p>Appears if the not used EDD file cannot be found. For example, when an existing or new device is invoked on a computer that</p>	—

Table 45. Variables Parameters (continued)

Parameter	Definition	Available Choices
	<p>does not have the EDD file installed, and this EDD file was not used to configure the Device Variables or commands.</p> <ul style="list-style-type: none">• EDD file that is used for device configuration does not exist or cannot be opened. If the used EDD file cannot be found. For example, when an existing device is invoked on a computer that does not have the EDD file installed, and Device Variables and/or commands were configured.• No Device Variables defined in EDD file. If the EDD file is found, but does not define Device Variables.• Registered EDD file does not match EDD file that is used for device configuration. If one or more configured Device Variables and/or commands are not specified in the EDD file. For example, when the EDD file is modified and Device Variables are removed.• No Expanded Device Type specified. If Use Expanded Device Type is not selected from the general profile.	

Commands View

The Commands view only appears when there is an associated EDD file and it displays the commands that are supported by the device. You can use the Commands view to define commands to be executed through input and output tags.

Figure 52. Commands View Example

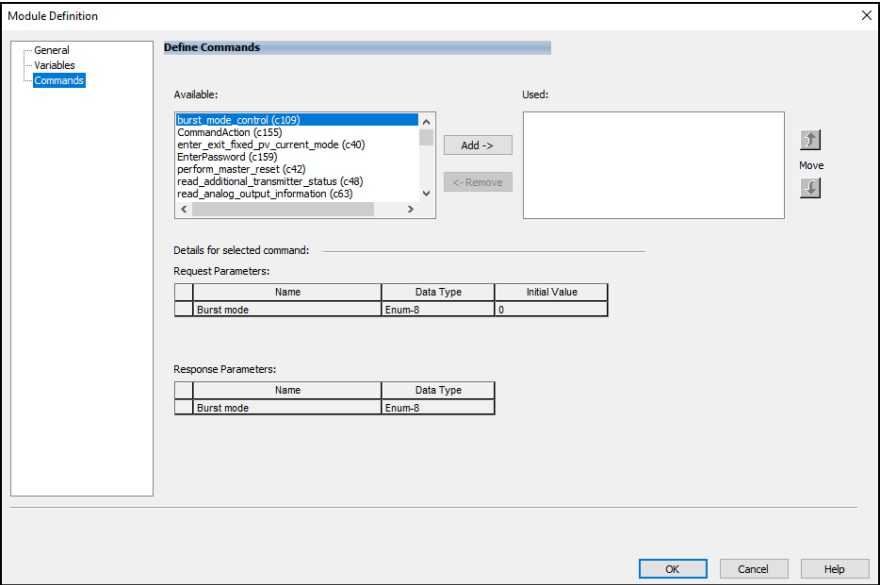


Table 46. Variables Parameters

Parameter	Definition	Available Choices
Available	Displays the names of all supported Commands. The list excludes commands that are contained in the Used command list. Right-click to sort the list.	<ul style="list-style-type: none">Sort Commands by NumberSort Commands by NameSort Commands by Type
Used	Displays the list of commands that are selected for use. The Used list can contain four Commands (max).	—
Add/Remove	Moves commands between the Available and Used lists.	—
Move	Modifies the order Commands appear in the Used list.	—
Details for selected commands	<ul style="list-style-type: none">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.	—

Table 46. Variables Parameters (continued)

Parameter	Definition	Available Choices
EDD file information	<p>Displays information about the EDD file.</p> <ul style="list-style-type: none"> EDD file does not exist or cannot be opened. Appears if the not used EDD file cannot be found. For example, when an existing or new device is invoked on a computer that does not have the EDD file installed, and this 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. If the used EDD file cannot be found. For example, when an existing device is invoked on a computer that does not have the EDD file installed, and Device Variables and/or commands were configured. No Device Variables defined in EDD file. If the EDD file is found, but does not define Device Variables. Registered EDD file does not match EDD file that is used for device configuration. If one or more configured Device Variables and/or commands are not specified in the EDD file. For example, when the EDD file is modified and Device Variables are removed. No Expanded Device Type specified. If Use Expanded Device Type is not selected from the general profile. 	—

Connection View

Use this view to complete the following tasks:

- Set the RPI rate. All HART devices attached to the same HART module share the same RPI rate.
- Set the connection type to use on the EtherNet/IP network.
- Inhibit the device.
- Configure fault response for connection failure while the controller is in Run mode.



The Module Fault area of the Connection view is useful for troubleshooting.



WARNING: You cannot test the process data output of an output device while the device is inhibited.

The screenshot shows the 'Connection' view of the software. On the left is a sidebar with 'General', 'Connection*', and 'Device Info'. The main area is titled 'Connection' and contains a table with columns: Name, Requested Packet Interval (RPI) (ms), and Connection over EtherNet/IP. The table has one row for 'Data' with an RPI of 500.0 and a connection type of Unicast. Below the table is a note: 'RPI changes are applied to all HART devices attached to the same parent HART Analog module'. There are two checkboxes: 'Inhibit Module' (checked) and 'Major Fault On Controller If Connection Fails While in Run Mode' (unchecked). Below these is a 'Module Fault' text area. At the bottom left, it says 'Status: Offline'. At the bottom right are buttons for 'OK', 'Cancel', 'Apply', and 'Help'.

Name	Requested Packet Interval (RPI) (ms)	Connection over EtherNet/IP
Data	500.0	Unicast

RPI changes are applied to all HART devices attached to the same parent HART Analog module

☒ Inhibit Module

☐ Major Fault On Controller If Connection Fails While in Run Mode

Module Fault

Status: Offline

OK Cancel Apply Help

Device Information View

Use Device Information to view device and status information when the device is online.

Use Device Information to:

- Determine the identity of the device.
- View the device's current operational state.
- View whether an owner controller is currently connected to the device.
- Retrieve the latest information from the device.
- Reset a device to its power-up state.

Figure 53. Device Information View Example

General

Connection

Device Info

Device Info

HART Short Tag Name:	O_DEV_04	Manufacturer:	Valmet Flow Control Oy
User Text:	HART_DEVICE_TEST_MESSA...	Device Type:	ND9000H/ND9100H
Descriptor:	DESCRIP_O_DEV_04		
Manufacture Date:	5/16/2019	Device ID:	823773
		Final Assembly Number:	0
Device Identity:	Match		
Write Protect:	No		
PV		Revisions	
At Signal 20:	100 Unknown (250)	Universal:	6
At Signal 4:	0 Unknown (250)	Device:	3
Damping:	0 s	Software:	171
Transfer Function:	Not Used	Hardware:	8

Refresh

Reset Device

Status: Running

OK

Cancel

Apply

Help

HART Device Tag Definitions

When you create a HART device, the Studio 5000 Logix Designer application creates a set of tags that you can view in the Tag Editor. Each configured feature on your device has a distinct tag that is available for use in the controller ladder program.

Every type of HART device has a set of common tags. For device-specific HART tags, see the documentation for that device.

Table 47. Input Tags

Name	Data Type	Definition	Valid Values
ConnectionFaulted	BOOL	Indicates if a connection is running. The module sets this tag to 0 when connected. If the module is not connected, it changes the tag to 1.	<ul style="list-style-type: none"> 0 = Connection is running 1 = Connection is not running
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: <ul style="list-style-type: none"> Any channel Fault is set HART CMD #48 returns nonzero data <i>Malfunction</i> is set <i>MoreStatusAvailable</i> is set <i>CurrentMismatch</i> is set 	<ul style="list-style-type: none"> 0 = -10...10V 1 = 0...5V 2 = 0...10V
DiagnosticSequenceCount	SINT	Increments for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected. Reset device or cycle power to set it to zero. It wraps from 255 (-1) to 1, skipping zero.	<ul style="list-style-type: none"> -128...+127 If the input type is RTD, the range values vary based on sensor type:
CurrentSaturated	BOOL	The loop current has reached its upper (or lower) endpoint limit and cannot increase (or decrease) any further.	<ul style="list-style-type: none"> 0 = Current is not saturated 1 = Current is saturated
CurrentFixed	BOOL	The loop current is being held at a fixed value and is not responding to process variations.	<ul style="list-style-type: none"> 0 = Current is not fixed 1 = Current is fixed
MoreStatusAvailable	BOOL	More status information is available than can be returned in the Field Device Status.	If the input type is RTD: <ul style="list-style-type: none"> 0 = More status is not available 1 = More status is available

Table 47. Input Tags (continued)

Name	Data Type	Definition	Valid Values
		HART CMD #48, <i>Read Additional Status Information</i> , provides this additional status information.	
CurrentMismatch	BOOL	It is set to 1 if the HART digital value does not match analog module channel value.	<ul style="list-style-type: none"> 0 = Current match 1 = Current mismatch
ConfigurationChanged	BOOL	<p>It is set to 1 after HART device configuration is changed and the module has retrieved all HART device configuration data to be returned by the Get HART Device Information service. This bit is used by the Studio 5000 Logix Designer application to allow it to perform any logic when the HART device configuration has changed.</p> <p>See HART Device Configuration Change Notification on page 67 on page 29 for more information on how to use the command.</p> <hr/> <p>NOTE: If the HART device does not support HART CMD #38, only the first configuration change after the device boot-up can be detected and <i>ConfigurationChanged</i> in the input tag is set. All configuration changes after that are not detectable and <i>ConfigurationChanged</i> in the input tag is not set for these changes.</p>	<ul style="list-style-type: none"> 0 = Configuration has not changed 1 = Configuration has changed
Malfunction	BOOL	<p>A hardware error or failure has been detected by the device.</p> <p>Further information may be available through HART CMD #48.</p>	<ul style="list-style-type: none"> 0 = No hardware error or failure is detected by the device 1 = Hardware error or failure is detected by the device
LoopCurrent.Fault	BOOL	<p>Present when PlantPAx connection is configured. Set to 1 when:</p> <ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 0 = Normal good data 1 = Data is definitely bad

Table 47. Input Tags (continued)

Name	Data Type	Definition	Valid Values
		<p>the response of any HART command.</p> <ul style="list-style-type: none"> Any HART command is not successful, no valid command response received after three attempts, Communication Error returned, or Response Code indicating an error returned in the command response. The value that is returned is NAN. The Underrange or Overrange bit is set. 	
LoopCurrent.Uncertain	BOOL	Present when PlantPAx connection is configured. Set to 1 when Loop Current Fixed in Field Device Status is set in the response of HART CMD #3.	<ul style="list-style-type: none"> 0 = No question about data validity 1 = Data validity is questionable
LoopCurrent.Underrange	BOOL	<p>Present when PlantPAx connection is configured.</p> <p>The input signal at the channel is less than or equal to the minimum detectable signal.</p>	<ul style="list-style-type: none"> 0 = Loop Current is > 3.8 mA 1 = Loop Current is ≤ 3.6 mA
LoopCurrent.Overrange	BOOL	<p>Present when PlantPAx connection is configured.</p> <p>The input signal at the channel is greater than or equal to the maximum detectable signal.</p>	<ul style="list-style-type: none"> 0 = Loop Current is < 20.5 mA 1 = Loop Current is ≥ 21.0 mA
LoopCurrent.Data	REAL	<p>Present when PlantPAx connection is configured.</p> <p>Current loop current value, Floating Point.</p>	Any positive or negative value
LoopCurrent.RollingTimestamp	INT	<p>Present when PlantPAx connection is configured.</p> <p><i>RollingTimestamp</i> is a continuously running 15-bit timer that counts in milliseconds (unrelated to the CST).</p> <p>For input modules, whenever a module scans its channels, it also records the value of <i>RollingTimestamp</i> at that time. The user program can then use the</p>	0...32767

Table 47. Input Tags (continued)

Name	Data Type	Definition	Valid Values
		last two <i>RollingTimestamp</i> values and calculate the interval between receipt of data, or the time when new data has been received.	
<NameOfVariable>.Ch.Fault (1)(2)	BOOL	<p>Indicates that data is inaccurate and cannot be trusted for use in the application.</p> <hr/> <p>IMPORTANT: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.</p> <hr/> <p>It is set to 1 when:</p> <ul style="list-style-type: none"> • Device Malfunction in the field device status is set in the response of the command to retrieve this HART variable. • The command to retrieve this HART variable is not successful; no valid command response is received after 3 attempts; communication error is returned; or response code indicating an error is returned in the command response. • 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. 	<ul style="list-style-type: none"> • 0 = Good • 1 = Bad, causing fault
<NameOfVariable>.Ch.Uncertain	BOOL	Indicates that the channel data can be inaccurate but the degree of inaccuracy is not known.	<ul style="list-style-type: none"> • 0 = Good data • 1 = Uncertain data

Table 47. Input Tags (continued)

Name	Data Type	Definition	Valid Values
		<p>IMPORTANT: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.</p> <hr/> <p>It is set to 1 when:</p> <ul style="list-style-type: none"> The device variable status indicates “process data status manual/fixed” or “poor accuracy”. The device variable status indicates “limit status constant” and process data status indicates “not bad”. 	
<NameOfVariable>.Ch.Under range	BOOL	<p>Indicates that the input signal at the channel is less than, or equal to, the minimum detectable signal.</p> <p>It is set to 1 when device variable status indicates “low limited”.</p>	<ul style="list-style-type: none"> 0 = Not underrange 1 = Underrange
<NameOfVariable>.Ch.Over range	BOOL	<p>Indicates that the input signal at the channel is greater than, or equal to, the maximum detectable signal.</p> <p>It is set to 1 when device variable status indicates “high limited”.</p>	<ul style="list-style-type: none"> 0 = Not overrange 1 = Overrange
<NameOfVariable>.Ch.Data	REAL	<p>The last good value received from the device.</p> <p>If a value has not yet been received from the device, the value is 0.0.</p>	Any positive or negative value
<NameOfVariable>.Ch.RollingTimestamp	INT	<p><i>RollingTimestamp</i> is a continuously running a 15-bit timer that counts in milliseconds (unrelated to the CIP Sync).</p> <p>For input modules, whenever a module scans its channels, it also records the value of <i>RollingTimestamp</i> at that time. Studio 5000 Logix Designer application can then use the last two <i>RollingTimestamp</i> values and calculate the interval between receipt of data or the time when a new data is received.</p>	0...32767

Table 47. Input Tags (continued)

Name	Data Type	Definition	Valid Values
<NameOfVariable>.Class	USINT	Device Variable Classification If the HART device does not support device variables, it is set to 0.	0...255
<NameOfVariable>.Unit	USINT	Unit code	0...255
<NameOfVariable>.Manual	BOOL	Indicates that the data value is manually controlled. It is set to 1 when device variable status indicates "process data status manual/fixed" and limit status is "not limited".	<ul style="list-style-type: none"> 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 variable status indicates "constant".	<ul style="list-style-type: none"> 0 = Data is not constant 1 = Data is constant
Static.Fault	BOOL	Indicates if the set of static data is valid. For PlantPax connection only.	<ul style="list-style-type: none"> 0 = Static data is good 1 = Static data is bad
Static.PVUnit	USINT	Unit code of PV. For PlantPax connection only.	1...253
Static.HARTRevision	USINT	HART protocol major revision number. For PlantPax connection only.	5, 6, or 7
Static.HARTTagName	STRING	Assigned name of HART device. Same as Identity attribute 15. For PlantPax connection only.	String with maximum 32 characters
Static.Descriptor	STRING	Descriptor of HART device. For PlantPax connection only.	String with maximum 16 characters
Static.PVAtSignal4	REAL	PV Lower Range value. For PlantPax connection only.	Any value less than <i>Static.PVAtSignal20</i>
Static.PVAtSignal20	REAL	PV Higher Range value. For PlantPax connection only.	Any value greater than <i>Static.PVAtSignal4</i>
Static.AdditionalDeviceStatus	SINT[25]	Additional Device Status from HART CMD #48. For PlantPax connection only.	<ul style="list-style-type: none"> 0 = More status not available 1 = More status available
ChDataAtSignal4	REAL	This member is the engineering unit value of 4 mA according to the	Any value less than <i>ChDataAtSignal20</i>

Table 47. Input Tags (continued)

Name	Data Type	Definition	Valid Values
		corresponding analog input channel configuration of the module. For PlantPAx connection only.	
ChDataAtSignal20	REAL	This member is the engineering unit value of 20 mA according to the corresponding analog input channel configuration of the module. For PlantPAx connection only.	Any value greater than <i>ChDataAtSignal4</i>
<NameOfCommand>.ReadyToExecute	BOOL	Indicates that the data value is constant. It is set to 1 when variable status indicates “constant”. See Execute HART Commands Through Producer/Consumer Data on page 29	<ul style="list-style-type: none"> 0 = Ready to accept a new execution 1 = Not ready to accept a new execution
<NameOfCommand>.Completed	BOOL	Indicates that a command execution is completed. See Execute HART Commands Through Producer/Consumer Data on page 29	<ul style="list-style-type: none"> 0 = No command has been completed or the current command execution is on-going 1 = Execution has been completed
<NameOfCommand>.Active	BOOL	Indicates that a command execution is on-going. See Execute HART Commands Through Producer/Consumer Data on page 29	<ul style="list-style-type: none"> 0 = No command has been completed or the current command execution is on-going 1 = Execution has been completed
<NameOfCommand>.Overlap	BOOL	Indicates that a new command execution request is received when the current execution is still on-going. It is only cleared when a new command execution has been started successfully. See Execute HART Commands Through Producer/Consumer Data on page 29	<ul style="list-style-type: none"> 0 = No overlapped execution request received after the last successfully started command execution. 1 = Overlapped execution request received
<NameOfCommand>.ERR	BOOL	Indicates that some unexpected result occurred for the latest command execution. The possible error conditions include: <ul style="list-style-type: none"> Command timeout HART communication status bit set 	<ul style="list-style-type: none"> 0 = No error in latest execution 1 = Error in latest execution

Table 47. Input Tags (continued)

Name	Data Type	Definition	Valid Values
		<ul style="list-style-type: none"> HART module detects a communications error <i>ResponseCode</i> value in the response packet indicates an error. <p>The bit is cleared when a new execution is requested.</p>	
<NameOfCommand>.Warning	BOOL	<p>It is set when the <i>ResponseCode</i> value in the response packet indicates a warning.</p> <p>The bit is cleared when a new execution is requested.</p>	<ul style="list-style-type: none"> 0 = No warning in latest execution 1 = Warning in latest execution
<NameOfCommand>.ParameterError	BOOL	<p>Indicates that one of the request parameter values cannot be converted from CIP to HART.</p> <p>It is cleared when a new execution successfully starts with valid request parameter.</p> <p>See Execute HART Commands Through Producer/Consumer Data on page 29</p>	<ul style="list-style-type: none"> 0 = No parameter error in latest execution 1 = Parameter error in latest execution
<NameOfCommand>.ParameterErrorNumber	SINT	<p>If the <i>ParameterError</i> bit is set, this value indicates the index of the first request parameter that contains a value that cannot be converted from CIP to HART.</p> <p>This number is zero-based.</p> <hr/> <p>NOTE: Command request parameters that are not included in the consumer assembly (constants) are not included in the numbering.</p> <hr/>	0...127
<NameOfCommand>.ResponseCode	SINT	HART command response code of the last completed command execution.	0...127
<NameOfCommand>.<CommandResponseParameterName>	Variable	<p>Response parameter of the command.</p> <p>The parameter name and type come from HART EDD file.</p>	Variable

(1) <NameOfVariable> could be PV, SV, TV, QV, or <NameOfDeviceVariable>.

Table 47. Input Tags (continued)

Name	Data Type	Definition	Valid Values
(2) <NameOfVariable> could be LoopCurrent (for PlantPAx connection only).			

Table 48. Output Tags

Name	Data Type	Definition	Valid Values
ResetConfigurationChanged	BOOL	When the HART module reads this bit transition from 0 to 1, it resets the ConfigurationChanged bit in the producer data. See HART Device Configuration Change Notification on page 67 on page 29 for more information on how to use the command.	<ul style="list-style-type: none">0 = Configuration change is not reset1 = Configuration change is reset
<NameOfCommand>.Execute	BOOL	When the HART module reads this bit transition from 0 to 1, it initiates this HART command.	<ul style="list-style-type: none">0 = HART command is not executed1 = HART command is executed
<NameOfCommand>.<CommandRequestParameterName>	Variable	Request parameter of the command. The parameter name and type come from HART EDD file.	Variable

CIP Object Model of HART Device

The information in this chapter provides guidelines for communicating with ControlLogix 5580 controllers that use CIP.

Object Model of HART Device

The following table defines the CIP objects for each HART device.

Table 49. CIP Object Model of HART Device

Object Class	Number of Instances	Supported Services
Identity (1, 1 _{hex})	1	See CIP Specification Volume 7B.
Message Router (2, 2 _{hex})	1	<ul style="list-style-type: none"> Get_Attribute_Single – get attribute 1 Get_Attributes_All – get attribute 1
Connection Manager Object (6, 6 _{hex})	1	<ul style="list-style-type: none"> 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})	1	See Table 50: Object-specific Services of Extended HART Process Device on page 173

Object-specific Services of Extended HART Process Device

The following table defines additional object-specific services of the extended HART process device.

Table 50. Object-specific Services of Extended HART Process Device

Service Code (Hex)	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	3B8 _{hex}	1	Execute_Command_CIP_Types	Executes the specified HART command. The

Table 50. Object-specific Services of Extended HART Process Device (continued)

Service Code (Hex)	Class	Instance	Service Name	Service Description
				Command Request and Response Data Bytes are specified in CIP types.
0x4E	3B8 _{hex}	1	Get_HART_Device_Information	Returns a copy of cached Device Configuration Information read previously from the HART device. Data that is returned by this service are relatively static – identity, tag, dynamic variable device, variable code, unit, and so on.

Execute_Command_CIP_Types Service (0x4C)

Service 4C of Extended HART Process Device follows the definition of Service 4C of HART Process Device Object in CIP Specification, Volume 7B with some exceptions.

The following table defines the exceptions that override some of the HART to CIP Type mapping defined in CIP Specification, Volume 7B.

Table 51. HART to CIP Type Mapping Overrides

HART Type	HART Type Definition	CIP Type
Latin-1	67 (43) followed by USINT specifying number of characters	Logix String ⁽¹⁾⁽²⁾
Packed	68 (44) followed by USINT specifying number of characters	Logix Str1 ⁽¹⁾⁽²⁾

(1) 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.

(2) Footnote (1) applies to the unpacked version of the string.

GET_HART_DEVICE_INFORMATION Service (0x4E)

The following table defines the parameters of successful Get response.

Bytes Offset in Response	Name	Data Type	Parameter Description
0	ExpandedDeviceType	USINT	CMD#0, Bytes 1...2

Bytes Offset in Response	Name	Data Type	Parameter Description
2	Preamble	USINT	CMD#0, Byte 3
3	UnivCmdCode	USINT	CMD#0, Byte 4
4	TransSpecRev	USINT	CMD#0, Byte 5
5	SoftwareRevision	USINT	CMD#0, Byte 6
6	HardwareRevision	USINT	CMD#0, Byte 7
7	Flags	USINT	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 <i>UnivCmdCode</i> is 5)
13	MaxDeviceVariables	USINT	CMD#0, Byte 13 (0 if <i>UnivCmdCode</i> is 5)
14	ConfigChangeCounter	USINT	CMD#0, Bytes 14...15 (0 if <i>UnivCmdCode</i> is 5)
16	ExtendedFieldDeviceStatus	BYTE	CMD#0, Byte 16 (0 if <i>UnivCmdCode</i> is 5)
17	Pad 1 for alignment	Octet	The value is 0.
18	ManufacturerIDCode	UINT	CMD#0, Bytes 17...18 if <i>UnivCmdCode</i> is 7 or higher CMD#0, Byte 1 cast to a UINT if <i>UnivCmdCode</i> is 5 or 6
20	PrivateLabelDistCode	UINT	CMD#0, Bytes 19...20 (0 if <i>UnivCmdCode</i> is 5 or 6)
22	DeviceProfile	USINT	CMD#0, Byte 21 (0 if <i>UnivCmdCode</i> is 5 or 6)
23	Pad 2 for alignment	Octet	The value is 0.
24	TagSize	UDINT	Number of characters in <i>TagString</i> . Always 8 bytes.

Bytes Offset in Response	Name	Data Type	Parameter Description
			NOTE: <i>TagSize</i> and <i>TagString</i> can be represented in Studio 5000 Logix Designer application as a String data type (with max length 8).
28	TagString	USINT[8] (8 bytes unpacked ASCII)	CMD#13, Bytes 0...5 ⁽¹⁾
36	DescriptorSize	UDINT	Number of characters in <i>DescriptorString</i> . Always 8 bytes. NOTE: <i>DescriptorSize</i> and <i>DescriptorString</i> combine to form a Logix String data type.
40	DescriptorString	USINT[16] (16 bytes unpacked ASCII)	CMD#13, Bytes 6...17
56	DateDay	USINT	CMD#13, Byte 18 ⁽²⁾
57	DateMonth	USINT	CMD#13, Byte 19
58	DateYear	UINT	CMD#13, Byte 20 (+ 1900)
60	LongTagSize	UDINT	Number of characters in <i>LongTagString</i> . Either 0 bytes or 32 bytes. NOTE: <i>LongTagSize</i> and <i>LongTagString</i> can be represented in Studio 5000 Logix Designer application as a String data type (with max length 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
96	FinalAssemblyNumber	UDINT	CMD#16, Bytes 0...2 (3 bytes) plus a pad byte (value 0) for 32-bit

Bytes Offset in Response	Name	Data Type	Parameter Description
			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	UDINT	Number of characters in MessageString. Always 32 bytes. Some can be spaces and other special characters. This and the following field 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
136	PVCode	USINT	CMD#50, Byte 0, 0xff if not supported. PV assignment code
137	SVCode	USINT	CMD#50, Byte 1, 0xff if not supported. SV assignment code
138	TVCode	USINT	CMD#50, Byte 2, 0xff if not supported. TV assignment code
139	QVCode	USINT	CMD#50, Byte 3, 0xff if not supported. QV assignment code
140	PVUnits	USINT	CMD#3, Byte 4
141	SVUnits	USINT	CMD#3, Byte 9, 0 if not present
142	TVUnits	USINT	CMD#3, Byte 14, 0 if not present
143	QVUnits	USINT	CMD#3, Byte 19, 0 if not present
144	TransferFunction	USINT	CMD#15, Byte 1

Bytes Offset in Response	Name	Data Type	Parameter Description
145	RangeUnits	USINT	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	REAL	CMD#15, Bytes 7...10
156	DampingValue	REAL	CMD#15, Bytes 11...14
160	WriteProtectCode	USINT	CMD#15, Byte 15
161	Pad 4 for alignment	Octet [3]	The value is 0.

(1) HART native representation packs ASCII characters into 6 bits each. This is an expanded representation, suitable for direct display on ASCII devices.

(2) A Date code that is used by the master for record keeping (For example, Last Or Next Calibration Date).

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, 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)	Get help determining how products interact, check features and capabilities, and find associated firmware.	rok.auto/pcdc

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Waste Electrical and Electronic Equipment (WEEE)



At the end of life, this equipment should be collected separately from any unsorted municipal waste.

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