

ArmorBlock 5000 8-channel IO-Link Master Module

Catalog Numbers 5032-8IOLM12DR, 5032-8IOLM12M12LDR, 5032-8IOLM12P5DR

Allen-Bradley
by ROCKWELL AUTOMATION

User Manual

Original Instructions

Important User Information

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

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

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

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

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

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

WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.

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

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

SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.

BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

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

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

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

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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About This Publication

This manual describes how to configure and troubleshoot your ArmorBlock 5000® 8-channel IO-Link master module.

Download Firmware, AOP, EDS, and Other Files

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

Summary of Changes

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

Summary of Changes

Topic	Page
Updated Attention in topic Power the Module	15
Added Attention in topic Power the Module	15
Removed obsolete publication reference IA-AT003 from topic Use CIP Sync Time	22
Updated section Read from the IO-Link Device	94
Updated section Write to the IO-Link Device	95
Updated tag PortStatusInfo in table Structure for Diagnostic IO-Link Master Channel	132

Additional Resources

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

Resource	Description
ArmorBlock 5000 I/O Modules Technical Data, publication 5032-TD001	Provides specifications for ArmorBlock 5000 I/O modules and accessories.
ArmorBlock 5000 8-channel IO-Link Master Module Installation Instructions, publication 5032-IN001	Describes how to install and wire the ArmorBlock 5000 8-channel IO-Link master 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.
UL Standards Listing for Industrial Control Products, publication CMPNTS-SR002	Assists original equipment manufacturers (OEMs) with construction of panels, to help ensure that they conform to the requirements of Underwriters Laboratories.
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.

Notes:

Introduction

The ArmorBlock 5000 8-channel IO-Link master module provides 16 channels that can be configured for IO-Link, digital input, and digital output. The module supports up to 8 channels for IO-Link master communication with IO-Link compatible devices. In standard digital I/O mode, the module supports up to 12 channels of digital inputs and up to 16 channels of digital outputs. Standard digital input channels support IEC 61131-2 type 3 input. Channels can also be disabled if not in use.

The module provides isolated power for Class B IO-Link devices and provides diagnostics for module and individual channels. The module also supports CIP Sync™ with time stamps for input events and faults.

Highly Integrated IO-Link

Highly integrated IO-Link is the integration of IO-Link technology into the Studio 5000® design environment. All IO-Link devices become CIP™ nodes and are configured in the same way as other CIP devices. For example, all registered IO-Link devices have their unique identity, Add-on Profiles (AOP), tags, and appear in the I/O configuration tree under the IO-Link bus.

IO-Link technology is a worldwide open-standard protocol that integrates sensors and other field devices into our Connected Enterprise® by connecting the IO-Link enabled device to an IO-Link master module. You can use it to deliver data from smart devices directly into a control system. The flexibility of IO-Link capable devices allows machines to operate more effectively by providing diagnostics and data including detailed machine health status to improve uptime and increase productivity.

The benefits of IO-Link technology include:

- A worldwide open-standard peer-to-peer serial communication protocol according to IEC 61131-9
- Forward/backward compatibility with standard sensors
- Uses the same cables as standard sensors
- Allows exchange of I/O, diagnostic, and configuration data simultaneously

The benefits of integration into the Studio 5000 Logix Designer® application include:

- Each IO-Link device has its own independent identity and connection. You can inhibit an individual device connection.
- Add and view IO-Link devices in the I/O configuration tree.
- Each IO-Link device has an AOP and can be configured like a CIP device.
- Supports Automatic Device Configuration (ADC) and if applicable, the Data Storage feature.
- Named Configuration/Input/Output tags are created for each IO-Link device.
- Configure IO-Link devices in both offline and online mode.
- Import/Export configuration for individual IO-Link devices.
- Back up configuration data for IO-Link devices into a project file in both ADC and non-ADC (Data Storage) modes.
- Provides recovery of configuration data for IO-Link devices in both ADC and non-ADC (Data Storage) modes by restoring the device configuration that is saved in a project file to the devices.

- Ease of commissioning by cloning the configuration data to another system with the same physical setup.

Controller and Software Compatibility

Controller and programming software compatibility requirements apply when you use the ArmorBlock 5000 8-channel IO-Link master module, as described in Table 1.

Table 1 - Module Compatibility

Module	Controllers		Logix Designer Application Version	FactoryTalk® Linx Software Version
	System	Catalog Numbers		
5032-8IOLM12DR 5032-8IOLM12M12LDR 5032-8IOLM12P5DR	CompactLogix 5380 Standard and Process controllers	5069-L306ER, 5069-L306ERM, 5069-L310ER, 5069-L310ERM, 5069-L310ERMK, 5069-L310ER-NSE, 5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP, 5069-L330ER, 5069-L330ERM, 5069-L330ERMK, 5069-L340ER, 5069-L340ERM, 5069-L340ERP, 5069-L350ERM, 5069-L350ERMK, 5069-L380ERM, 5069-L3100ERM	35.00.00 or later	6.40.00 or later
	Compact GuardLogix 5380 SIL 2 controllers	5069-L306ERS2, 5069-L306ERMS2, 5069-L310ERS2, 5069-L310ERS2K, 5069-L310ERMS2, 5069-L310ERMS2K, 5069-L320ERS2, 5069-L320ERS2K, 5069-L320ERMS2, 5069-L320ERMS2K, 5069-L330ERS2, 5069-L330ERS2K, 5069-L330ERMS2, 5069-L330ERMS2K, 5069-L340ERS2, 5069-L340ERMS2, 5069-L350ERS2, 5069-L350ERS2K, 5069-L350ERMS2, 5069-L350ERMS2K, 5069-L380ERS2, 5069-L380ERMS2, 5069-L3100ERS2, 5069-L3100ERMS2		
	Compact GuardLogix 5380 SIL 3 controllers	5069-L306ERMS3, 5069-L310ERMS3, 5069-L310ERMS3K, 5069-L320ERMS3, 5069-L320ERMS3K, 5069-L330ERMS3, 5069-L330ERMS3K, 5069-L340ERMS3, 5069-L350ERMS3, 5069-L350ERMS3K, 5069-L380ERMS3, 5069-L3100ERMS3		
	CompactLogix 5480 controllers	5069-L430ERMW, 5069-L450ERMW, 5069-4100ERMW, 5069-L4200ERMW, 5069-L46ERMW		
	ControlLogix 5580 Standard and Process controllers	1756-L81E, 1756-L81EK, 1756-L81E-NSE, 1756-L81EXT, 1756-L81EP, 1756-L82E, 1756-L82EK, 1756-L82E-NSE, 1756-L82EXT, 1756-L83E, 1756-L83EK, 1756-L83E-NSE, 1756-L83EXT, 1756-L83EP, 1756-L84E, 1756-L84EK, 1756-L84E-NSE, 1756-L84EXT, 1756-L85E, 1756-L85EK, 1756-L85E-NSE, 1756-L85EXT, 1756-L85EP		
	GuardLogix 5580 controllers	1756-L81ES, 1756-L81ESK, 1756-L82ES, 1756-L82ESK, 1756-L83ES, 1756-L83ESK, 1756-L84ES, 1756-L84ESK, 1756-L8SP, 1756-L8SPK, 1756-L81EXTS, 1756-L82EXTS, 1756-L83EXTS, 1756-L84EXTS, 1756-L8XTSP		

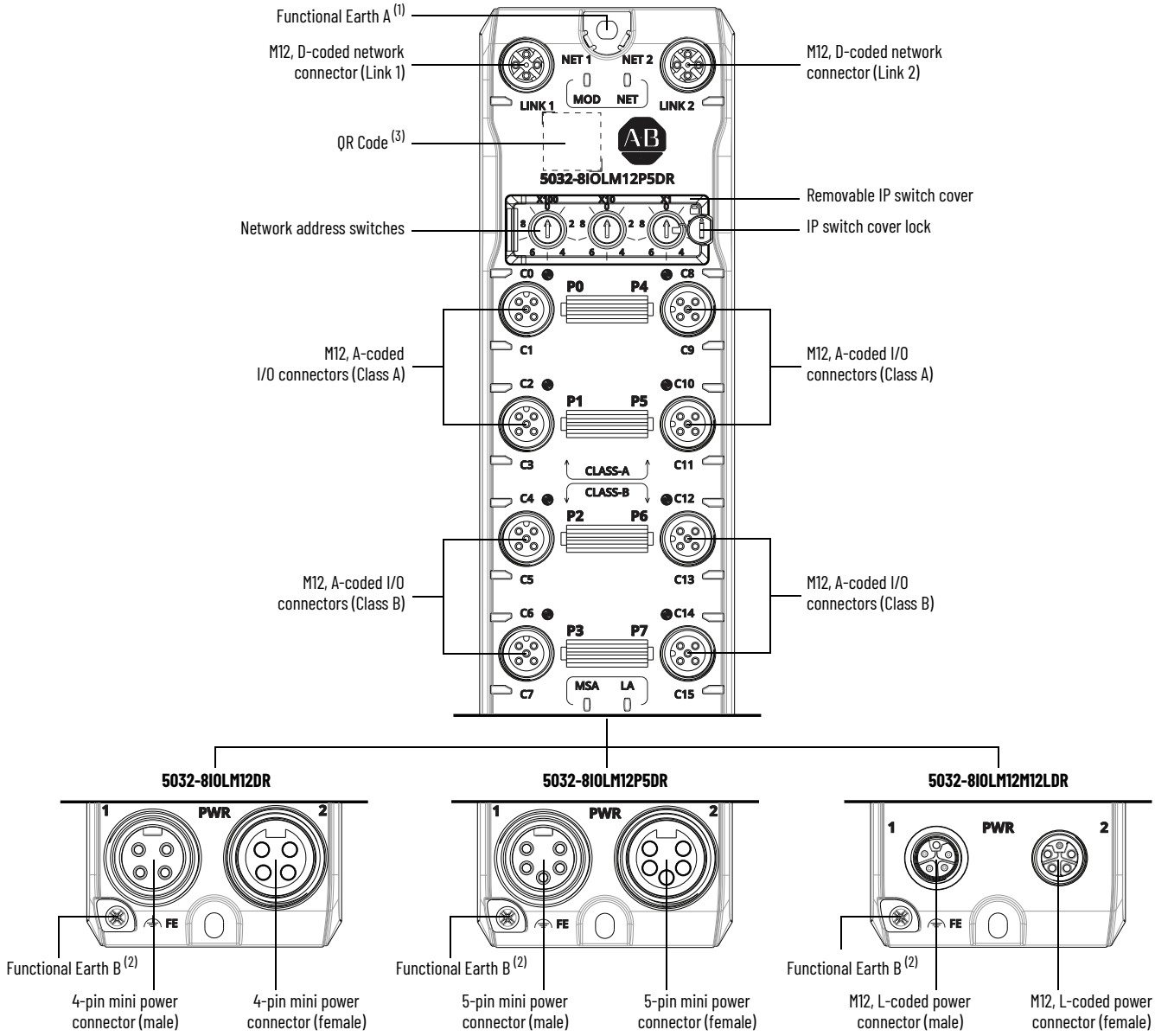
For more information on the controllers, see the following publications:

- CompactLogix® 5380 and Compact GuardLogix® 5380 Controllers User Manual, publication 5069-UM001
- CompactLogix 5480 Controllers User Manual, publication 5069-UM002
- ControlLogix® 5580 and GuardLogix 5580 Controllers User Manual, publication 1756-UM543

Module Overview

Figure 1 shows the parts of an ArmorBlock 5000 8-channel IO-Link master module.

Figure 1 - ArmorBlock 5000 8-channel IO-Link Master Module Overview



(1) Functional Earth A grounds the module EtherNet/IP communication circuitry, which is designed to mitigate the effect of noise on the network. The module requires a solid earth ground connection, either through a metal screw to a grounded metal panel or through a wire.

(2) Functional Earth B grounds the module I/O and power circuitries to mitigate the effect of noise on the network. Functional Earth B is internally connected to pin 5 of power connectors in 5032-8IOLM12P5DR and 5032-8IOLM12M12LDR. The module requires a solid earth ground connection, either through the 5-pin mini or M12 L-coded power patchcord, or through a wire to the screw point.

(3) The QR Code contains a link to the product webpage that provides details on the product such as lifecycle status and documentation.

Secure Access to the System

To secure access to a Logix 5000® controller, ArmorBlock 5000 8-channel IO-Link master module, and IO-Link devices by authorized users only, consider the following options:

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

To secure access to the system, consider the following options:

- Follow industry best practices to harden your PCs and servers, including anti-virus/anti-malware and application whitelisting solutions.

  The recommendations are published at the Rockwell Automation technical support center in Knowledgebase article *Rockwell Automation Customer Hardening Guidelines, #546987*. The technical support center is available at: rok.auto/knowledgebase.
- 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 make sure that they are not accessible from the Internet.
- Locate control system networks and devices behind firewalls and isolate them from the business network.
- Subscribe to Knowledgebase article *Industrial Security Advisory Index, #54102* at the Rockwell Automation technical support center so you have access to information about security matters that affect Rockwell Automation products. The technical support center is available at: rok.auto/knowledgebase.

Ownership

Every IO-Link master module and IO-Link device in a Logix 5000 control system must be owned by a controller. In a Logix 5000 control system, the controller performs the following:

- Establishes the connection to the IO-Link master module and IO-Link devices to begin operation in the control system.
- Sends the configuration data to the IO-Link master module and IO-Link devices (only when Automatic Device Configuration (ADC) is enabled).

Each IO-Link master module and IO-Link device must continuously maintain communication with its controller during normal operation.

Power the Module

The ArmorBlock 5000 8-channel IO-Link master module uses two 24V DC (nominal) power supplies. These supplies are called the MSA power (Module/Sensor/Actuator) and LA power (Local Actuator). Internally, the MSA power and LA power are isolated from each other.

- MSA power provides power to the module and all eight IO-Link channels of the module.
- LA power provides power for the IO-Link Class B isolated extra power supply or 2 A for digital outputs.

Power can be daisy chained from one module to the next. You can also install a separate power supply to each module.

Take note of the following when supplying power to your system:

- The voltage range for MSA power is 18...30V DC for digital I/O mode.
- The voltage range for MSA power is 20...30V DC for IO-Link master mode.
- The maximum current that any module can carry is 10 A.
- The maximum current that any pin on the 4-pin or 5-pin mini power connectors can carry is 10 A.

- The maximum current that any pin on the M12 L-coded power connectors can carry is 16 A.
- Confirm that the external module power supply is adequately sized for the total current draw of the module power bus in the system.
- Not all power supplies are certified for use in all applications, for example, nonhazardous and hazardous environments.

ATTENTION: You must use two separate Safety Extra Low Voltage (SELV) or Protected Extra Low Voltage (PELV) listed power supplies, or one SELV-listed or PELV-listed power supply with two pairs of separately isolated terminals for module power.

ATTENTION: Power to this equipment and all connected I/O must be supplied from a source compliant with the following:
- The ArmorBlock 5000 8-channel IO-Link master module connects to an external power supply and offers a capability of up to 10 A @ 24V DC, which is >100VA.
- If any I/O devices that are connected to this equipment require <100VA (Class 2) power to operate, the ArmorBlock 5000 8-channel IO-Link master module must be powered by UL-certified Class 2 sources (one for MSA and one for LA).

Module and Device Configuration

You must create a Studio 5000 Logix Designer application project for the controller that owns the ArmorBlock 5000 8-channel IO-Link master module and the IO-Link devices. You can configure the IO-Link master module and the IO-Link devices in the project.

The Studio 5000 Logix Designer application transfers the project to the controller during the program download.

For more information on how to configure an IO-Link master module or IO-Link device, see the following:

- Configure the IO-Link Master Module on page 47
- Configure the IO-Link Device on page 73

Module and Device Operation

Both the IO-Link master module and IO-Link device operate through connections. Connections work in either cyclic mode or Change of State (COS) mode.

Requested Packet Interval

The Requested Packet Interval (RPI) is a configurable parameter that defines a specific rate at which the controller exchanges data with the IO-Link master module or IO-Link device.

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

IMPORTANT You can change the RPI while the project is online. If you change the RPI while the project is online, however, the connection to the IO-Link master module or IO-Link device is closed and reopened in one of the following ways:
- You inhibit the connection to the module or device, 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 or device configuration.

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

Cyclic Mode

All connections work in cyclic mode, except for input event connections. In cyclic mode, both the IO-Link master module and the IO-Link device send input data at the time that is defined in the Requested Packet Interval (RPI). Similarly, the controller sends output data at the time that is defined in the RPI.

Change of State Mode

For input event connections, the IO-Link master module uses Change of State (COS) mode to update the input data. New data is sent to the controller immediately when a transition occurs. When there is no change of state, the data is sent at the time that is defined in the RPI.

Connections

You can define connections for the IO-Link master module and IO-Link devices by choosing a connection type. A connection is a real-time data transfer link between the controller and the module or device that the project references.

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

One of the following occurs:

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

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

  For more information on how to troubleshoot issues, see the following:

  - Troubleshoot Your IO-Link Master Module on page 97.
  - Troubleshoot Your IO-Link Device on page 107.

The controller monitors its connection with an IO-Link master module and IO-Link devices. Any break in the connection, for example, the loss of power to the system, causes a fault. The Studio 5000 Logix Designer application monitors the fault status tags to indicate when a fault occurs on an IO-Link master module or IO-Link device.

To see where to change the connection type:

- For the IO-Link master module, see Module Definition on page 54.
- For the IO-Link device, see Module Definition on page 84.

Protected Operations

To maintain the secure operation of your IO-Link master module and IO-Link devices, operations that can disrupt the module and device operations are restricted based on the operating mode.

Table 2 describes the restrictions.

Table 2 - Protected Operations on ArmorBlock 5000 8-channel IO-Link Master Modules and IO-Link Devices

Current Operation	Activity						
	Firmware Update Request	Reset Request	Connection Request	Configuration Change	Connection or Data Format Change	Electronic Keying Change	RPI Change
Connection not running	Accepted						
Connection running	Rejected		Rejected	Accepted (1)	Not allowed (2)	Accepted (3)	
Firmware update in process	Rejected						

(1) Configuration change is accepted in the following scenarios:
- Changes are made in the Module Properties window and you select Apply.
- Changes are made in the Configuration tags and you send a Reconfigure Module MSG instruction to the module or device.
- IO-Link device configuration changes are made in the ladder diagram through connected explicit messaging.

(2) The difference between Rejected and Not allowed is that rejected activities can be attempted in the Studio 5000 Logix Designer application but do not take effect. The activities that are not allowed, that is, attempts to change the Connection or Data Format used, do not occur in the Studio 5000 Logix Designer application.
For example, if you attempt to reset a module that is connected to the controller, the Studio 5000 Logix Designer application executes the request and alerts you that it was rejected. If you attempt to change the data format on a module that is connected to a controller, the Studio 5000 Logix Designer application does not execute the attempted change. The application only alerts you that the change is not allowed. In this case, if the change is attempted online, the Module Definition dialog field that changes the data format is disabled.

(3) The change occurs after the connection is closed and reopened. You can close and reopen the connection in the following ways:
- Change the project while it is online and select Apply or OK in the Module Properties window. In this case, before the change is made, a dialog box alerts you of the ramifications before the change is made.
- Change the project while it is offline and download the updated project before going online again.

For more information on the protected operating modes, see the following:

- Protection Mode for IO-Link Master Module on page 23.
- Protection Mode for IO-Link Devices on page 43.

Notes:

Module Features

This chapter describes the general features of the ArmorBlock 5000 8-channel IO-Link master module.

To learn more about the other features of the IO-Link master module, see the following:

- I/O Channel Features on page 29
- Common Features of IO-Link Device Integration on page 35

Software Configurable

You use the Studio 5000 Logix Designer application to configure the module, monitor system operation, and troubleshoot issues.

The software makes module configuration easier and more reliable by minimizing the need for tasks such as setting hardware switches and jumpers.

Configurable Channel Modes

You can configure each channel of the ArmorBlock 5000 8-channel IO-Link master module as IO-Link, digital input, or digital output mode. You can also configure some channels as a Class B power supply for IO-Link devices.

To configure the channel mode, see General View on page 54.

Fault and Status Reporting

The ArmorBlock 5000 8-channel IO-Link master module reports fault and status data along with channel data. Fault and status data is reported in the following ways:

- Fault and status bits in the input data tags
- Studio 5000 Logix Designer application
- Module status indicators

Table 3 lists the fault and status tags that are available for the IO-Link master module in the Studio 5000 Logix Designer application.

Table 3 - Fault and Status Tags for ArmorBlock 5000 8-channel IO-Link Master Module

Data Type	Tag Name	Triggering Event That Sets the Tag
Fault	ConnectionFaulted (1)	The controller loses its connection to the module.
Status	RunMode	The module is in Run Mode.
	DiagnosticActive	Indicates if any diagnostics are active or if the prognostics threshold is reached.
	DiagnosticSequenceCount	The count increments each time a diagnostic condition is detected or removed. You can monitor this count during module operation and check the channel diagnostics when the count value changes.

(1) This tag provides module-wide data and affects all channels simultaneously.

For more information on fault reporting in the Studio 5000 Logix Designer application and module status indicators, see Troubleshoot Your IO-Link Master Module on page 97.

Module Inhibiting

Module inhibiting lets you indefinitely suspend a connection 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.

For more information, see Configure Channel Output State in Fault Mode on page 31.

You can use module inhibiting in the following scenarios.

- You want to perform maintenance on the module.
- You want to update a module, for example, update the module firmware revision.
- 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.

1. Inhibit the module.
2. Perform the action on the module.
3. Uninhibit the module.

To inhibit a module, see Connection View on page 57.

Electronic Keying

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

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

The following Electronic Keying options are available.

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

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

IMPORTANT	Changing Electronic Keying parameters while the project is 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.

Update Module Firmware

The ArmorBlock 5000 8-channel IO-Link master module is manufactured with module firmware installed. If updated module firmware revisions are available in the future, you can update the firmware.

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

IMPORTANT	Verify that you are using the correct firmware revisions for your modules before commissioning your system.

You access updated firmware files at the Rockwell Automation Product Compatibility and Download Center (PCDC) 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, no updates exist then.

Input Events

The ArmorBlock 5000 8-channel IO-Link master module can be configured with four input event definitions.

To use Input Events, select the "Data with Events" or "Data with Events and Ethernet Status" connection type in the IO-Link master Module Definition dialog.

To change the connection type, see General View on page 54.

The following conditions can trigger events:

- An input state change
- A counting input done bit change
- A pattern of input state changes on multiple module inputs

When the module reports an input event to the controller, the module can trigger an event task to execute in the controller. The event task lets you execute a section of logic immediately when an event, or receipt of new data, occurs.

For more information on event tasks, see the Logix 5000 Controllers Tasks, Programs, and Routines Programming Manual, publication 1756-PM005.

Independent Point Trigger

An input state change or a counting input bit done change that triggers an event is known as an independent point trigger.

To use this type of trigger, you must enable the Independent Point Trigger option in the event definition. Set the *EO.Eventxx.IndependentConditionTriggerEn* tag to 1.

Pattern Match Trigger

When a pattern of input state changes triggers an event, multiple points participate in the event trigger. To use this type of trigger, you must disable the Independent Point Trigger option in the event definition. Set the *EO.Eventxx.IndependentConditionTriggerEn* tag to 0.

Every point that participates in an event trigger is configured separately. Depending on the event definition, the collective status of all points that matches the pattern triggers the event.

Input Event Latching

To use input event latching, you must select the Latch Event checkbox for that input event. Set the *EO.Eventxx.LatchEn* tag to 1.

When input event latching is used, the event in the input data must be acknowledged before a new event is sent out.

To acknowledge the current event in the input data, set the *EO.Eventxx.EventNumberAck* tag to the event number (*EI.Eventxx.EventNumber* tag) in the input data.

If the current event is not acknowledged, subsequent events are stored in a queue. The queue can store up to four events. If the queue is full, excess events are dropped.

Additional Event Considerations

When you use the Input Events feature, also consider the following:

- An Event task only actuates if an event occurs.

  IMPORTANT Make sure that you link the Event task to the Event Input tag, not the Input tag.
  Keep in mind that when the Event task executes, the input tag data can have the same data that was sent at the last RPI.

- An event is recognized only when it maintains the same state for the minimum duration that is determined by the input filter time specified.

  For example, if the input filter time is set at 2 ms, and the input filter time accuracy is -50…+400 µs (except for 0 µs filter time setting), this means that:

  - A pulse width that is shorter than 1.95 ms is not detected.
  - A pulse width that is longer than 2.4 ms is detected.
  - A pulse width that is between 1.95…2.4 ms may or may not be detected.

- When you configure the RPI of the input event connection, consider that the minimum interval between two input data packets of event connection is one quarter of the RPI connection.
- After the event task executes, it does not execute again until the event occurs again.
- When the input event connection is reopened, the *EI.Eventxx.PtxxData* tag is reset to 0.

Use CIP Sync Time

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.

The ArmorBlock 5000 8-channel IO-Link master module is a CIP Sync slave-only device. There must be another module on the network that functions as a master clock.

You can use the IO-Link master module to capture time stamps. The advantage is that CIP Sync is system-wide, so time stamp values are consistent across all modules in the system.

Protection Mode for IO-Link Master Module

Protection Mode is a state where the device is operational, but has implemented defenses against disruptive changes that would take the product out of service for the process.

There are two types of Protection Mode: Implicit and Explicit. These modes differ in how a device is entered in such state and what type of action is prohibited in each of these modes.

Implicit Protection Mode is a security enhancement that is automatically triggered as soon as I/O connection to the module is established.

Explicit Protection Mode is a security enhancement that is triggered when a certain rotary switches pattern is selected. This security enhancement occurs on the module level and helps prevent unauthorized configuration changes that can affect system behavior and cause unintended and unforeseen changes.

Enter and Exit Implicit Protection Mode

The module enters Implicit Protection Mode as soon as I/O connections are established to the module. The module exits Implicit Protection Mode as soon as all I/O connections to the module are stopped.

Enter and Exit Explicit Protection Mode

The module enters Explicit Protection Mode when rotary switches are set to value 900 during powerup.

To enter Explicit Protection Mode, do the following:

1. Note the current position of the rotary switches.
2. Power down the device.
3. Set the rotary switches to 900, then power up the device.

   The module confirms entering into Explicit Protection Mode with the following status indicator flashing sequence:

   - Module status indicator = Flashing red
   - All other indicators = Off
4. Power down the device and restore previous values to the rotary switches.
5. Power up the device to normal operation with Explicit Protection Mode enabled.

To exit Explicit Protection Mode, do the following:

1. Note the current position of the rotary switches.
2. Power down the device.
3. Set the rotary switches to 000, then power up the device.

   The adapter confirms exiting Explicit Protection Mode with the following status indicator flashing sequence:

   - Module status indicator = Flashing red
   - All other indicators = Off
4. Power down the device and restore previous values to the rotary switches.
5. Power up the device to normal operation with Explicit Protection Mode disabled.

Restrictions Imposed By Implicit Protection Mode

Protection Mode prevents access to services that are not required after the 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 it is in Implicit Protection Mode, the module prevents execution of the following tasks:

- Change Ethernet configuration settings, such as port speed
- Change IP settings, such as IP address, mask, and DHCP mode
- Disable or re-enable Ethernet ports
- Update the module firmware revision
- Perform remote module resets
- Change configuration on Quality of Service (QoS) and Time Sync
- Change channel operation mode (with certain exceptions on Class B pin 2 channels)
- Disable or enable the secure web server
- Disable or enable the SNMP server
- Web server configuration pages cannot be updated

Restrictions Imposed By Explicit Protection Mode

Protection Mode prevents access to services that are not required after the 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 it is in Explicit Protection Mode, the module prevents execution of the following tasks:

- Change Ethernet configuration settings, such as port speed
- Change IP settings, such as IP address, mask, and DHCP mode
- Disable or re-enable Ethernet ports
- Update the module firmware revision
- Perform remote module resets
- Change configuration on QoS and Time Sync
- Disable or enable the secure web server
- Disable or enable the SNMP server
- Web server configuration pages cannot be updated

Perform Tasks When Restricted

If the module is in Protection Mode and you attempt to perform any of the restricted tasks, you are alerted that such a task cannot be performed because the module is in Protection Mode.

IMPORTANT Protection Mode restrictions are not configurable.

If the module is not in Protection Mode, the module accepts attempts to perform the tasks that are described previously.

For example, after the module is initially powered up, but no I/O connections are established yet, the module is not in Explicit Protection Mode. As long as you are not in Explicit Protection Mode, you can attempt to update the module firmware revision and the module accepts the attempt.

If the module enters Protection Mode each time the module powers up, check the application controllers to determine if there are active I/O connections that are opened through the module.

Change Module Type

With the Change Type feature, you can change your ArmorBlock 5000 8-channel IO-Link master module to a different power variant.

For example, you can change a 5032-8IOLM12DR module to a 5032-8IOLM12M12LDR module, while retaining all IO-Link devices that were connected to the module in the IO-Link bus.

When you change your module type, all configuration data for your IO-Link master module is retained exactly as-is. All device configuration and device tags remain the same and no program changes are required. You do not have to recreate your entire configuration and manually add devices again.

To change the module type, see Change Type on page 56.

This feature is available with firmware revision 2.011 or later.

Syslog Event Logging

The ArmorBlock 5000 8-channel IO-Link master module supports syslog event logging for security-related events.

When syslog operates over a network, it uses a client-server architecture in which a syslog event collector monitors for, and logs, messages that are coming from clients. Events are stored on a remote syslog server and do not affect the local event log.

Choose a syslog event collector that supports the RFC 5424 syslog protocol.

IMPORTANT The ArmorBlock 5000 8-channel IO-Link master module and the syslog event collector must be connected to the same Ethernet network.

You need to send explicit CIP messages to Class 0x3B4, Instance 0x01, Service Code 0x10 of the module to configure it to use syslog.

Table 4 - Syslog Event Configuration

Attribute	Name	Data Type	Description	Value
1	Enabled	BOOL	This attribute controls whether events are transmitted to the collector.	False (default) Set to True for the product to send events.
2	Collector Address	STRING	The network address of the syslog event collector.	Empty string (default) Enter the DNS name or IPv4 address of the collector.
3	Protocol	USINT	Enumerates the transport protocol that is used to transmit event records.	• 0x00 = UDP (default) • 0x02 = TCP
4	Collector Port	UINT	The TCP or UDP port on which the collector accepts event records.	Defaults to 514 when the Protocol is defined as UDP or TCP.
10	Severity Filter	USINT	Defines the minimum severity of events that are delivered.	Events with the defined severity and higher severities are delivered. Others are filtered out. • 0x00 = Emergency • 0x01 = Alert • 0x02 = Critical • 0x03 = Error (default) • 0x04 = Warning • 0x05 = Notice • 0x06 = Information • 0x07 = Audit • 0x08 = Debug All other values are reserved

This feature is available with firmware revision 2.011 or later.

Symbolic Data Access

The ArmorBlock 5000 8-channel IO-Link master module supports data access using symbolic data in FactoryTalk software.

The IO-Link master module supports the following symbol template:

- Identity
- State
- Runtime

Table 5 - Identity Template

Elements	Data Type	Description
ProductName	SHORT_STRING	The product name of the catalog
CatalogNumber	SHORT_STRING	The catalog number
SerialNumber	UDINT	The CIP serial number (ASA number)
MajorRevision	USINT	The major firmware revision
MinorRevision	USINT	The minor firmware revision
VendorID	UINT	The CIP vendor ID
DeviceType	UINT	The CIP type
ProductCode	UINT	The product code
IoConnectionStatus	USINT	The I/O connection state: • 0 = Self-testing or unknown • 1 = Firmware update in progress • 2 = At least one I/O connection faulted • 3 = No I/O connections established • 5 = Major fault present • 6 = At least one I/O connection in Run mode • 7 = At least one I/O connection established, all in Idle mode
HardwareMajorRevision	USINT	The major hardware revision
HardwareMinorRevision	USINT	The minor hardware revision
ManufacturerSerialNumber	SHORT_STRING	The manufacturer serial number (warranty number)
Series	SHORT_STRING	The series

Table 6 - State Module Template

Elements	Data Type	Description
Health	State.Module.Health	The module health, see Table 7

Table 7 - State.Module.Health

Elements	Data Type	Description
MinorRecoverableFault	BOOL	Indicates whether a minor recoverable fault is present
MinorUnRecoverableFault	BOOL	Indicates whether a minor unrecoverable fault is present
MajorRecoverableFault	BOOL	Indicates whether a major recoverable fault is present
MajorUnrecoverableFault	BOOL	Indicates whether a major unrecoverable fault is present
Owned	BOOL	Indicates whether the device has an owner
Ready	BOOL	Indicates whether the device is ready to operate (configured and no faults)

Table 8 - Runtime Template

Elements	Data Type	Description
UpTime	DINT	The length of time since the module was powered up or reset
UpTimeUnits	SHORT_STRING	Unit is hours

To set up communications in FactoryTalk software to read the symbolic data from the IO-Link master module, see Use Symbolic Data Access on page 70.

This feature is available with firmware revision 2.011 or later.

Configure Module with Web Server

The web server feature provides a secure interface that allows you to view network diagnostic information and configure network settings of the ArmorBlock 5000 8-channel IO-Link master module.

To use the web server, see Secure Web Server on page 137.

This feature is available with firmware revision 2.011 or later.

Custom IP Subnet for Network Address Switches

You can change the default IP subnet (192.168.1) to a custom subnet with FactoryTalk Linx or the web server when the network address switches are used to configure the IP address.

To set a custom IP subnet, see Use the FactoryTalk Linx Software on page 48.

This feature is available with firmware revision 2.011 or later.

Notes:

I/O Channel Features

This chapter describes channel features that are supported on the ArmorBlock 5000 8-channel IO-Link master module.

Software Configurable Input Filters

You can adjust On-to-Off and Off-to-On filter times through the Studio 5000 Logix Designer application for all digital input channels. These filters improve noise immunity within a signal.

A larger filter value affects the length of delay times for signals from these modules. The filter values are adjustable in the individual input channels view of the Module Properties window.

Table 9 - Digital Input Filter

Filter Time Off > On	Filter Time On > Off
0 µs	0 µs
500 µs	500 µs
1 ms	1 ms
2 ms	2 ms
5 ms	5 ms
10 ms	10 ms
20 ms	20 ms
50 ms	50 ms

To set the input filter values, see Channels View on page 58.

The input filter is implemented with a step filtering algorithm, which means that an input signal must remain in the new state for at least the filter time duration before the transition is valid and the input changes state.

If the input state fluctuates, it may take a longer time to determine if the transition is valid. If the input changes state again before the chosen input filter time elapses, the transition is not valid.

Input and Event time stamps are only recorded with valid transitions.

Input Timestamping

Timestamping registers a time reference to a change in input data. CIP Sync is used for timestamping when the channel is configured as “Digital Input, Timestamp” or “Digital Input, Timestamp, Fallback”.

The ArmorBlock 5000 8-channel IO-Link master module offers submillisecond timestamping on a per channel basis.

Pulse Latching

You can use Pulse Latching to detect or latch short duration pulses. Pulse Latching is supported through the Timestamping feature and Timestamp Latching.

To use Pulse Latching, you must complete the following:

- In the Module Definition dialog, configure the channel as "Digital Input, Timestamp" or "Digital, Input, Timestamp, Fallback".

  See Module Definition on page 54.
- In the Module Properties for the channel, select which input transitions you want to capture time stamps for.
- Select the Enable Timestamp Latching checkbox for the channel.

  See XX - Digital Input, Timestamp on page 61.

Chatter Detection

Chatter Detection is a feature that is directly related to Timestamping. You use the feature to detect when a device that is connected to the module input causes chatter.

Chatter occurs when the device causes the inputs to transition falsely many times in a relatively short period. As a result, the module time stamps invalid input transitions.

You can configure the following:

- Chatter Count – Determines the number of acceptable input transitions that can occur in a given time period before considering the input to be chatter.

  Valid chatter count values range from 2...127.
- Chatter Time – Determines the amount of time within which the number of input transitions are counted.

  Valid chatter time values range from 1...10000 ms.

To set the Chatter Detection options, see XX - Digital Input, Timestamp on page 61.

Configure Channel Output State When Module is in Program Mode or Inhibited

You can configure individual output channels to specific states when the IO-Link master module is in Program mode or when the module is inhibited.

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

- Turn off - Default
- Turn on
- Hold its last state

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

To configure the output states in Program mode or when the module is inhibited, see XX - Digital Output on page 62.

Configure Channel Output State in Fault Mode

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

Output Behavior Immediately After a Connection Fault

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

- Turn off - Default
- Turn on
- Hold its last state

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 "Fault Mode State Duration".

Fault Mode State Duration After Connection Fault

For output behavior after a connection fault, you must define how long the output remains at the specified value before it transitions to a Final Fault State.

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 Fault State Duration time expires, the output transitions to the user-defined Final Fault Mode State value.

Final Fault Mode State Value

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

Output State Once Connection is Re-established

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

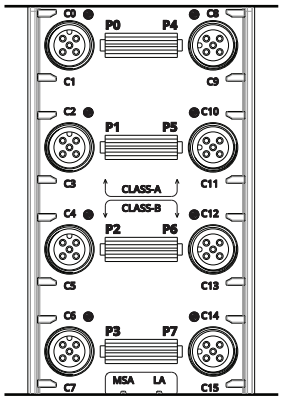
To configure the output states in Fault mode, see XX - Digital Output on page 62.

Short Circuit Protection

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

Figure 2 shows the short circuit conditions and protections that are provided on the different ports.

Figure 2 - Short Circuit Protection for Output Channels



Ports	Short Circuit Conditions with Protection	Description
0, 1, 4, 5	SA Power Short Circuit	Short between pins 1 and 3
	Odd Channel Output Short Circuit	Short between pins 2 and 3
	Even Channel Output Short Circuit	Short between pins 4 and 3
2, 3, 6, 7	SA Power Short Circuit	Short between pins 1 and 3
	Odd Channel Output Short Circuit/ LA Power Short Circuit	Short between pins 2 and 5 Group Short Circuit For more information, see Group Short Circuit on page 32.
	Even Channel Output Short Circuit	Short between pins 4 and 3

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

- The channel limits the output current and monitors for the short circuit condition to be removed.
- The I/O status indicator for the channel flashes red.
- The *I.IOLinkxx.Fault* or *I.Ptxx.Fault* tag is set to 1.

  Check the channel diagnostic or retrieve the information from the diagnostic assembly to verify that the short circuit condition is present.

When the short circuit condition is removed, the following occurs:

- The channel restarts in its commanded state.
- The I/O status indicator for the channel turns back to steady yellow.
- The *I.IOLinkxx.Fault* or *I.Ptxx.Fault* tag is reset to 0.

  Check the channel diagnostic or retrieve the information from the diagnostic assembly to verify that the short circuit condition is removed.

To check the channel diagnostics, see Channels View on page 58.

For more information on how to retrieve diagnostic assemblies, see Module Diagnostic Assembly on page 127.

For more information on using module tags, see IO-Link Master Module and IO-Link Device Tag Definitions on page 115.

Group Short Circuit

When one of the Group Short Circuit channels experiences a short circuit condition, the other three channels experience a momentary fault and the fault bit automatically clears.

No Load Diagnostics

No Load Diagnostics detects when a signal wire is disconnected from an output channel. When the *I.Ptxxx.Fault* tag is set to 1, check the channel diagnostic or retrieve the information from the diagnostic assembly to verify that the No Load condition is present.

You can only configure channels 1, 3, 9, and 11 as "Digital Output, Short Circuit, No Load Diagnostics".

To enable No Load Diagnostics, see XX - Digital Output on page 62.

For more information on how to retrieve diagnostic assemblies, see Module Diagnostic Assembly on page 127.

For more information on using module tags, see IO-Link Master Module and IO-Link Device Tag Definitions on page 115.

Fault and Status Reporting

The module sends fault and status data with channel data to the controller. The data is returned through module tags that you can monitor in your Studio 5000 Logix Designer application.

The ArmorBlock 5000 8-channel IO-Link master module provides the fault and data status in a channel-centric format.

Table 10 lists the fault and status tags that are available for the IO-Link master module channels in the Studio 5000 Logix Designer application.

Table 10 - Fault and Status Tags for ArmorBlock 5000 8-channel IO-Link Master Module Channels

Data Type	Tag Name	Triggering Event That Sets the Tag
Fault	Ptxx.Fault	The channel data quality is bad.
	Counterxx.Fault	The counter data quality is bad.
	IOLinkxx.Fault	The IO-Link data quality is bad.
Status	Ptxx.Data	The point input status is 0 or 1.
	Counterxx.Data	The counter input status is 0 or 1.
	IOLinkxx.Uncertain	LA power for Class B device is faulted.

We recommend that you monitor the tags in your program to make sure that the application is operating as expected.

IMPORTANT Once the condition that causes the Fault or Uncertain tag to change to 1 is removed, the tag automatically resets to 0. The Studio 5000 Logix Designer application controls the tags. You cannot change the status of the tags.

Remember that in some system configurations, the tag is not reset immediately after the condition is removed. The tag typically resets after a short delay.

Table 11 lists the conditions that are shown in the channel diagnostics and diagnostic assemblies.

Table 11 - Diagnostic Conditions

Diagnostic Condition	Description
SAPowerFault	Indicates whether a fault exists on SA power
SAPowerFaultTimestamp	The most recent time a fault on SA power occurred
LAPowerFault	Indicates whether a fault exists on LA power
LAPowerFaultTimestamp	The most recent time a fault on LA power occurred
SAPowerShortCircuit	Indicates whether a short circuit or overcurrent condition exists on SA power
SAPowerShortCircuitTimestamp	The most recent time a short circuit or overcurrent condition on SA power occurred
LAPowerShortCircuit	Indicates whether a short circuit or overcurrent condition exists on LA power
LAPowerShortCircuitTimestamp	The most recent time a short circuit or overcurrent condition on LA power occurred
NoLoad	Indicates whether a No Load condition exists
NoLoadTimestamp	The most recent time a No Load condition occurred
ShortCircuit	Indicates whether a short circuit condition exists
ShortCircuitTimestamp	The most recent time a No Load condition occurred

For more information on fault reporting, see Troubleshoot Your IO-Link Master Module on page 97.

Notes:

Common Features of IO-Link Device Integration

This chapter describes the common features that are available with IO-Link integration in the Studio 5000 Logix Designer application

IO-Link Device Identity

With the highly integrated IO-Link device feature, every IO-Link device has its own independent CIP identity.

The IO-Link device properties that uniquely identify the type of device are:

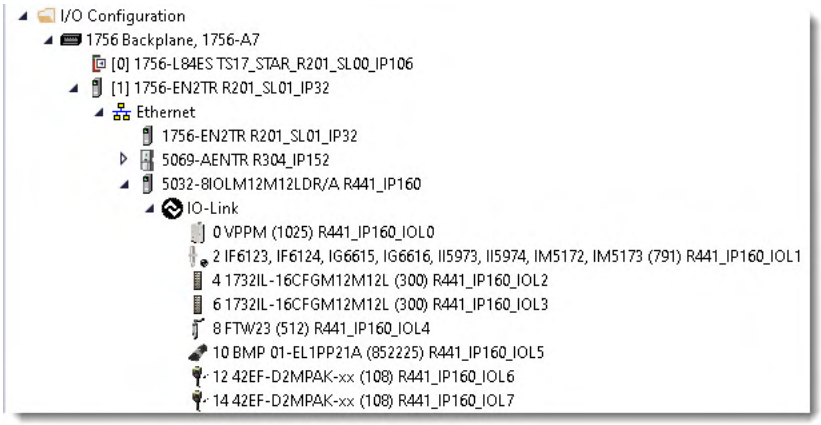
- IO-Link Vendor ID
- IO-Link Device ID
- IO-Link Revision

IO-Link Bus

Every IO-Link device is added as a CIP node on the IO-Link bus that is associated with the IO-Link master module.

You can use the IO-Link bus in the I/O Configuration tree to:

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



IODD-Based AOP for IO-Link Devices

Every IO-Link device has its own Add-on Profile (AOP) in the Studio 5000 Logix Designer application project. The features that are available in the IO-Link Device Description (IODD) are integrated into the AOP.

Once the IODD for the device is registered, you can add the device under the IO-Link bus, where you can access the device Module Properties window to define/control connections, configure, and monitor the status of the device.

To register the IODD for your device, see Register IO-Link Device IODD on page 44 and Import/Export IODD Files on page 45.

Fallback Mode

Fallback mode provides the benefits of configuration in IO-Link mode and the same performance of "Digital Input" or "Digital Input, Timestamp" modes. When a channel is set to a Fallback mode:

- You can configure the device through the IO-Link interface.
- The device operates in "Digital Input" or "Digital Input, Timestamp" mode.

The device operates in Fallback mode when you configure the channel as "Digital Input, Fallback" or "Digital Input, Timestamp, Fallback".

You can easily switch the device to digital input mode for operation by uninhibiting the device, or switch to IO-Link mode for configuration by inhibiting the device.

When the device is used in Fallback mode, no input tag or output tag is generated for the device connection. Input data is available in the input tag of the IO-Link master module for that channel – *name:I:Ptxx*, where xx is the channel number.

For example, if the device is attached to Port 2 (Ch04 for pin 4) and the channel mode is set to "Digital Input, Fallback" or "Digital Input, Timestamp, Fallback", then input data for the device is available in the tag *IOLM:I:Pt04*.

WARNING: If you replace an IO-Link device without first inhibiting the device, the device configuration is not synchronized with the project.
For more information on device replacement, see Replace IO-Link Devices on page 90.

IO-Link Device Connection

Every IO-Link device has its own connection to the controller. When an IO-Link device is attached to a non-Fallback channel, the following data is provided through the connection:

- Input tag – Process data input with time stamp, fault and status reporting, configuration change detection, and latest IO-Link event from the device
- Output tag – Process data output and reset configuration change

To set the RPI of the connection, see Connection View on page 85.

Connection Types

IO-Link devices may support multiple sets of process data. Each set of process data is mapped to a connection type. Input and output tags for each connection type is generated from their respective set of process data that is defined in the device IODD.

To determine the type of process data that the device provides, select the type of connection in the Module Definition dialog. See Module Definition on page 84.

IO-Link Device Inhibiting

You can suspend data exchange between the controller and individual IO-Link devices by inhibiting the device.

While the device is inhibited, you can still retrieve parameter values and change the configuration by using the Module Properties window or explicit messaging.

When you inhibit the device, you can do the following:

- Perform maintenance of the device without faults being reported to the controller.
- Change the device configuration in both Fallback and non-Fallback channels.
- Troubleshoot configuration issues. See Troubleshoot Your IO-Link Device on page 107.

To inhibit the device connection, see Connection View on page 85.

IO-Link Device Electronic Keying

The Electronic Keying feature for IO-Link 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

  Requires firmware revision 2.011 or later, and Rockwell Automation devices that support Exact Match keying.
- Disable Keying

Compatible Module is the default setting. The following three keying attributes of the configured device and the physical device must match:

- IO-Link Vendor ID
- IO-Link Device ID
- IO-Link Revision

If the Exact Match option is selected, the following four keying attributes of the configured device and the physical device must match:

- IO-Link Vendor ID
- IO-Link Device ID
- IO-Link Revision
- Device Firmware Revision

Also for Exact Match, the physical device must not be emulating another device (if the device supports multiple device IDs).

Disable Keying indicates that the keying attributes are not considered when attempting to communicate with a IO-Link device. With Disabled Keying, the IO-Link 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.
We strongly recommend that you do not use Disable Keying.
If you use Disable Keying, you must take full responsibility for understanding whether the device being used can fulfill the functional requirements of the application.

Automatic Device Configuration

Automatic Device Configuration (ADC) provides an automated download of an IO-Link device configuration from the controller to the IO-Link device when the controller opens the device connection.

You can use ADC to help simplify device replacement, or to clone your device configuration across multiple systems with the same physical setup easily.

Whenever a connection is established, the IO-Link device configuration that is saved in the controller is set to the device. This device configuration is accessible from the Module Properties window in the Studio 5000 Logix Designer application or device configuration tag.

Configuration Tags

When you add an IO-Link device with ADC enabled, configuration tags are created based on the configuration parameters that are available in the device IODD.

The benefit of having configuration tags is that the ladder program can use the configuration tags to change the device configuration with programming logic.

The configuration tags can be used before or when the connection is open.

- Before the connection is open, the ladder program inhibits the device, changes the configuration tag, and uninhibits the device.
- During an open connection, the ladder program changes the configuration tag and issues a reconfiguration instruction. For more information, see Configure IO-Link Device through Configuration Tags on page 95.

Data Storage

Data Storage (DS) is a feature that is available from IO-Link Revision 1.1 onwards. When an IO-Link device supports Data Storage, the Data Storage Backup/Restore function is used when ADC is disabled. Data Storage Backup/Restore automatically backs up IO-Link device configuration to the IO-Link master and automatically restores stored values to the device during device replacement.

Device configuration is backed up to the IO-Link master module when one of the following conditions is met:

- There is no Data Storage copy for the device type on the port of the IO-Link master module.

  The Data Storage copy that is stored in the port of the IO-Link master module is cleared in the following scenarios:

  - The IO-Link master module is in the out-of-box state. All ports are cleared.
  - The IO-Link master module is reset to factory default. All ports are cleared.
  - An IO-Link master module channel mode is changed from "IO-Link", "Digital Input, Fallback", or "Digital Input, Timestamp, Fallback" to any non IO-Link modes (for example, "Digital Input" or "Digital Output") and the configuration is downloaded to the module.
  - When a connection to another IO-Link device type (different IO-Link Vendor ID, IO-Link Device ID, or IO-Link Revision) is established on the port.
- Device configuration has been updated and the DS_UPLOAD_FLAG is set in the IO-Link device.

  The DS_UPLOAD_FLAG is set in the IO-Link device when the *ParamDownloadStore* command (IO-Link index 02, value 0x05) is sent to the device.

A successful device connection establishment, online application of device configuration/reconfiguration, or reconfiguration instruction in the ladder program automatically triggers Data Storage Backup as needed.

The Data Storage copy that is stored on a port of the IO-Link master module is restored to the device attached to the port when the device type matches and one of the following conditions is met.

- An IO-Link device in the factory default state is connected to the IO-Link master module.
- The DS_UPLOAD_FLAG is not set in the IO-Link device.

  The DS_UPLOAD_FLAG is stored in nonvolatile memory and is cleared in the IO-Link device in one of the following scenarios.

  - The flag is cleared automatically after a successful Data Storage Backup or Data Storage Restore operation.
  - The flag is cleared after resetting the device to factory default or out-of-box state.

You can check whether the Data Storage copy in the IO-Link master module is synchronized with the IO-Link device by checking the Data Storage Match status in the Device Info view of the device Module Properties window.

Disable and Delete Data Storage

With firmware revision 2.011 or later, you can disable and delete the master copy of the Data Storage on an IO-Link port in the Studio 5000 Logix Designer application.

To disable and delete the master copy of the Data Storage on the IO-Link port, see XX - IO-Link on page 59 and Module Definition on page 84.

IO-Link Device Parameters Classification

IO-Link device parameters are classified into two categories:

- Configuration parameters

  For devices that support Data Storage, configuration parameters are read/write parameters that are defined in the IODD, which are not excluded from Data Storage.

  For devices that do not support Data Storage, read/write parameters that are defined in the IODD are configuration parameters.
- Non-configuration parameters

  All parameters that are defined in the IODD that do not match the conditions that are defined under configuration parameters are non-configuration parameters.

The Configuration view and the Parameters view of the IO-Link device Module Properties window are used to handle device parameters.

Only configuration parameters are shown in the Configuration view. Configuration parameters can only be changed in the Configuration view. The Configuration view only shows the project values of the configuration parameters.

Use the Parameters view to access non-configuration parameters and retrieve device values of configuration parameters. All parameter values that are shown in the Parameters view are device values.

Device Configuration

You can use the Configuration view to change configurations for the IO-Link device. The parameters that are shown in the Configuration view are based on the device IODD.

The Configuration view shows the parameter values that are saved in the Studio 5000 Logix Designer application project. The values that are shown in the Configuration view do not reflect the actual values of the parameters in the device.

All configuration parameters are stored in the project, but the device may have the set of configuration parameters that are shown in the Configuration view change based on the conditional parameters that are defined in the device IODD.

One exception is the parameter that is used to select which set of process data to use. When the device is on an IO-Link channel (excluding Fallback channels), this parameter is not shown in the Configuration view because it affects the input/output data tag definitions and can only be changed through the connection type selection in the Module Definition dialog in offline mode.

In offline mode, you can use the Configuration view to change the device configuration and save the values to the project.

In online mode, when you apply the configuration, the configuration is saved to the project and set to the device.

If a parameter is not listed under any menu in the IO-Link device IODD, the parameter is ignored and not shown on any view in the IO-Link device Module Properties.

Device Correlation Check

Use the Device Correlation Check feature to synchronize the Studio 5000 Logix Designer application project and IO-Link device copies of the configuration parameters values. You can use this feature to back up the configuration parameters from the IO-Link device to the project, or to restore the configuration parameters from the project to the device.

When ADC is enabled:

- The project values are synchronized to the device automatically when connection is established.
- The project values are stored in the configuration tags and are visible to the ladder program.

When ADC is disabled:

- The project values are only accessible through the IO-Link device properties. You must apply the configuration or perform Device Correlation Check to synchronize the project values and device values.
- Device Correlation Check is automatically performed when the Configuration view is opened.

Get/Set IO-Link Device Parameters

You can use the Parameters view to retrieve or set the parameters in the IO-Link device.

- You can retrieve the value of all parameters in the device, including configuration parameters.
- You can set non-configuration read/write parameters.
- You can issue IODD-defined commands that are specific to that IO-Link device to the device in the Parameters view.

Configure IO-Link Process Data Output State When IO-Link Device is in Program Mode or Inhibited

You can configure the IO-Link process data output to specific states when the IO-Link device is in Program mode or when the device is inhibited.

When the controller switches from Run mode to Program mode, the output can behave in the following ways, depending on how you configure the Process Data Output State in Program Mode parameter (*C.ProgMode* tag):

- Device Decides

  The IO-Link master module disables the process data output and the device determines the actual state of the output.

  WARNING: The device vendor determines the behavior of a device that is set for the "Device Decides" output state. You must verify proper operation of the device.

- Hold Process Data Output

  The process data output remains enabled and the last received output process data is sent to the device.

  WARNING: For the "Hold Process Data Output" output state, the device output may change if the device configuration changes.

- All Zeros

  The process data output remains enabled and all zeros output process data is sent to the device.

When the IO-Link device is inhibited, the process data output behavior follows the Process Data Output State in Program Mode configuration.

To configure the IO-Link process data output state, see Fault/Program Action View on page 89.

Configure IO-Link Process Data Output State in Fault Mode

You can configure the IO-Link process data output to specific states when the IO-Link device connection is in Fault mode.

When the IO-Link device connection is faulted, the process data output can behave in the following ways, depending on how you configure the Process Data Output State in Fault Mode parameter (*C.FaultMode* tag):

- Device Decides

  The IO-Link master module disables the process data output and the device determines the actual state of the output.

  WARNING: The device vendor determines the behavior of a device that is set for the "Device Decides" output state. You must verify proper operation of the device.

- Hold Process Data Output

  The process data output remains enabled and the last received output process data is sent to the device.

  WARNING: For the "Hold Process Data Output" output state, the device output may change if the device configuration changes.

- All Zeros

  The process data output remains enabled and all zeros output process data is sent to the device.

When the IO-Link device connection is faulted when the connection is in Program Mode, if the value of the device *C.ProgramtoFaultEn* tag is set to 1, the output process data behavior follows the device *C.FaultMode* tag setting; If set to 0, the output process data output behavior follows the device *C.ProgMode* tag setting.

To configure the IO-Link process data output state, see Fault/Program Action View on page 89.

IO-Link Device Information and Diagnostics

You can view the identity information and diagnostic information of an IO-Link device in the Device Info view of the device Module Properties window.

To view the IO-Link device information and access diagnostic information, see Device Info View on page 86.

Fault and Status Reporting

The IO-Link device provides fault and status information through the input tags.

Table 12 lists the fault and status tags for an IO-Link device that are available in the Studio 5000 Logix Designer application.

Table 12 - Fault and Status Tags for IO-Link Device

Data Type	Tag Name (1)	Triggering Event That Sets the Tag
Fault	ConnectionFaulted (2)	The controller loses its connection to the IO-Link device.
	Fault	The IO-Link device data quality is bad.
	DeviceError	The IO-Link device has an error.
Status	RunMode	Indicates the operating state of the IO-Link device
	DiagnosticActive	Indicates if diagnostics are active or the prognostics threshold is reached
	DiagnosticSequenceCount	The count increments when a diagnostic condition is detected or removed. You can monitor this count during module operation and check the channel diagnostics when the count value changes.
	ConfigChanged	The IO-Link device configuration is changed and the IO-Link master module has retrieved all IO-Link device configuration data to be returned by the Get IO-Link Device Information service.
	Uncertain	Indicates that the port data is inaccurate and cannot be trusted for use in the application
	EventPresent	Indicates that an event has occurred on the IO-Link device
	LatestEvent	Provides details on the latest event that occurred on the IO-Link device

(1) The tags that are available depend on the connection type that you have configured in the Module Definition.
(2) When this bit is set, the Fault bit is set automatically.

IO-Link Device Configuration Change Notification

If any configuration parameters are changed in an IO-Link device while the connection is active, the *ConfigChanged* tag is set to 1 in the input data of the device. You can set the *ResetConfigChanged* tag from 0 to 1 in the output data to acknowledge the configuration change.

This feature is only supported when the device supports Data Storage. The notification is triggered when the Data Storage checksum in the device is changed due to any external configuration change.

Examples of external change are explicit messaging or local change through the physical panel/switch on the device. Configuration changes through the Studio 5000 Logix Designer application or reconfiguration instructions are not considered external changes.

To acknowledge the configuration change, do the following:

1. Trigger a rising edge of the *ResetConfigChanged* tag in the output data to clear the *ConfigChanged* tag.
2. In the IO-Link device Module Properties > Configuration view, perform Device Correlation Check and select “Use Device Values”.
3. Review the new values of all parameters.
4. If the new values are appropriate, select Apply to save the values to the project.

   Otherwise, select Cancel to revert to the original configuration. Then perform Device Correlation Check again and select “Use Project Values” to restore the original configuration to the device.
5. Check that the *ConfigChanged* bit has changed to 0 to verify that the configuration change is acknowledged.

   If the bit is 1, it means that the external configuration change is still in progress. Repeat the steps to acknowledge the configuration change and synchronize the project values and device values of the device configuration.

Execute IO-Link Commands Through Explicit Messaging

The ArmorBlock 5000 8-channel IO-Link master module allows you to define message instructions to use the IO-Link Service Parameter object that is defined in the CIP Specification Volume 7C "Integration of IO-Link Devices into the CIP Architecture" to Get or Set IO-Link parameters in the IO-Link devices in either IO-Link data format or CIP data format.

With firmware revision 2.011 or later, the IO-Link master module supports two vendor-specific services in the IO-Link Service Parameter object. Each of these services (Raw_Get and Raw_Set) can be used for parameter access with or without subindex.

Table 13 - Vendor-specific Services for IO-Link Service Parameter Object

Service Code	Service Name	Description
0x32	Raw_Get	This service behaves the same as Raw_Get_Single if the application path in the request contains a nonzero Attribute ID. Otherwise it behaves the same as Raw_Get_All.
0x33	Raw_Set	This service behaves the same as Raw_Set_Single if the application path in the request contains a nonzero Attribute ID. Otherwise it behaves the same as Raw_Set_All.

During IO-Link device operation, sending an excessive number of explicit messages might cause a delay for IO-Link parameter Get or Set tasks for configuration or operation of the IO-Link device. Periodic explicit messaging, for example, connected and cached message instruction, is not recommended.

For connected messaging:

- Up to two concurrent Class 3 connections are supported for every IO-Link device.
- The recommended number of concurrent Class 3 connections for the IO-Link master module and all attached IO-Link devices is up to 8.

For unconnected messaging:

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

To use explicit messaging with IO-Link devices, see Use Explicit Messages to Read and Write IO-Link Device Parameters on page 94.

Protection Mode for IO-Link Devices

Protection Mode is a state where the IO-Link device is operational and disruptive changes that would take the product out of service are not allowed.

Enter and Exit Protection Mode

The IO-Link 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 IO-Link 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 IO-Link device is in Protection Mode, the device prevents execution of the following tasks:

- Perform remote device resets
- Perform device firmware updates
- Perform unconnected messaging to the Service Parameter object of the device

- Perform connected messaging to the Service Parameter object of the device from a node other than the owner-controller
- Change Electronic Keying parameters
- Change data storage mode
- Delete data storage

IO-Link Events

The ArmorBlock 5000 8-channel IO-Link master module supports both IO-Link port-level and IO-Link device-level reporting of IO-Link events.

Table 14 describes the maximum number of events that are supported for each IO-Link port and IO-Link device.

Table 14 - Number of IO-Link Events Supported

Port/Device	With Timestamp	Maximum Number of Events
IO-Link Port	Yes	40 per port
	No	40 per port
IO-Link Device	Yes	40 per device
	No	124 per device

Timestamps for port-level IO-Link events are always enabled. To view the port-level IO-Link event log, see Channels View on page 58.

To enable timestamps for device-level IO-Link events and view the device-level IO-Link event log, see Event Log View on page 90.

For more information on the IO-Link Event Log, see IO-Link Event Log on page 113.

Register IO-Link Device IODD

Each IO-Link device has an associated IODD that contains information that is related to the device.

Installing the AOP for IO-Link automatically registers the IODDs for a set of Rockwell Automation IO-Link devices. If the IO-Link device that you want to use is not part of this set, you must register the IODD for the device separately.

You can download IODD files for Rockwell Automation IO-Link devices from the Product Compatibility and Download Center (PCDC) at rok.auto/pcdc.

For third-party IO-Link devices, you can download the IODD files from the manufacturer's website or use the "IODDfinder" tool that is available on the IO-Link website at io-link.com to search for the IODD files.

Automatically Download IODD File From IODDFinder

If there are unregistered IO-Link devices in your project or through discovery, you can use the Device Description File Installation Tool to download the IODD files automatically from the IODDFinder website and register the files.

For more information, see Automatically Download IODD File From IODDFinder on page 75.

This feature is available with firmware revision 2.011 or later.

Register Embedded IODD Files

You can use the FactoryTalk Linx Network Browser to upload and register device description files for Rockwell Automation IO-Link devices that have an embedded device description file. For example, the RightSight™ M30 Background Suppression and Reflection sensor (42AF-B1MAB1 and 42AF-B1MAC1).

To upload and register a device description file from a device, see Register Embedded IODD Files on page 75.

This feature is available with firmware revision 2.011 or later.

Import/Export IODD Files

You can export the IODD files of the devices that you are using in your application to share with others to help make sure that everyone uses the same device descriptions when working across multiple systems.

For example:

- You can export the IODD files for the devices that are used in your machine into one file and provide it to your customers so that they can use the same devices and IODD file versions in their configuration.
- If you are collaborating on a project and you have unidentified devices in your setup, you can import the shared IODD files into your system to help make sure that you are working in the same programming environment.

Use the Device Description File Installation Tool, which is installed along with FactoryTalk Linx software, to import and export the IODD files of your devices.

To import or export IODD files, see Import/Export IODD Files on page 77.

This feature is available with firmware revision 2.011 or later.

Use Generic IO-Link Device Profile

With the generic IO-Link device profile, you can add an IO-Link device without a unique identity.

When you use the generic IO-Link device profile, there is no full IO-Link integration. You have to configure the device either with an external method or send messages to the IO-Link Service Parameter object. The process data is presented in raw IO-Link data format.

To use the generic IO-Link device profile, see Add a Generic IO-Link Device on page 81.

This feature is available with firmware revision 2.011 or later.

Update Device Firmware

If your Rockwell Automation IO-Link device has firmware revisions that are available in PCDC, you can use ControlFLASH Plus™ software version 6.00 or later to update the firmware of the device that is attached to your ArmorBlock 5000 8-channel IO-Link master module.

During the firmware update process, you cannot change the operating mode of the channel.

For more information on how to use the ControlFLASH Plus software, see the ControlFLASH Plus Quick Start Guide, publication CFP-QS001G.

This feature is available with firmware revision 2.011 or later.

Notes:

Configure the IO-Link Master Module

This chapter describes how to add and configure ArmorBlock 5000 8-channel IO-Link master modules to your system in a Studio 5000 Logix Designer application project.

Configure the Module IP Address

Before you can use your module in an EtherNet/IP network, you must configure its IP address, subnet mask, and optional Gateway address. The IP address identifies each node on the network or system of connected networks. Each node on a network (including your module) must have a unique IP address.

You can configure the module IP address in the following ways:

- Use the network address switches on the module.
- Use the FactoryTalk Linx software.
- Use the secure web server.
- Use the BOOTP/DHCP tool that ships with the Studio 5000 Logix Designer application.

IMPORTANT To use the BOOTP/DHCP tool, you must know the Ethernet hardware address (MAC ID) of your module.

Rockwell Automation assigns each module a unique 48-bit hardware address at the factory. The address is printed on a label on the side of your module. It consists of six hexadecimal digits that are separated by colons. This address is fixed by the hardware and cannot be changed.

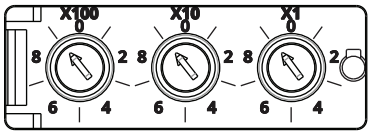
If you change or replace the module, you must enter the new Ethernet hardware address of the module when you configure the new module.

Set the Network Address Switches

The module reads the network address switches first to determine if the switches are set to a valid number. See Table 15 for the available values. The module ships with the network address switches set to 999 and Dynamic Host Configuration Protocol (DHCP) enabled.

For instructions on how to adjust the network address switches, see the ArmorBlock 5000 8-channel IO-Link Master Module Installation Instructions, publication 5032-IN001.

Figure 3 - Network Address Example



Network address switches set to default value of 999.

Table 15 - Values for Network Address Switches

Value	Description
000	Exits Protection Mode Cycle power to the module, then restore the switches to their previous values. For more information, see Protection Mode for IO-Link Master Module on page 23.
001...254	Sets the module IP address to a.b.c.*xxx* a.b.c is the subnet address, which is configurable, and *xxx* is the value of the network address switches. In the out-of-box state or after a reset to factory default settings with the switch value "888", the default subnet address is 192.168.1.xxx/255.255.255.0 and the default gateway is 192.168.1.1. However, if the network address switch value is 1, the default gateway is set to 0.0.0.0 to avoid conflict. The network address switch values "1" and "254" are not recommended because they are typically used by network routers.
888	Resets the module to factory default settings
900	Enters Protection Mode Cycle power to the module, then restore the switches to their previous values. For more information, see Protection Mode for IO-Link Master Module on page 23.
999	The module checks to see if DHCP is enabled. • If DHCP is enabled, the module requests for an IP address from a DHCP server. The DHCP server also assigns other network address parameters. • If DHCP is not enabled, the module uses the IP address and other network address parameters that are stored in nonvolatile memory.

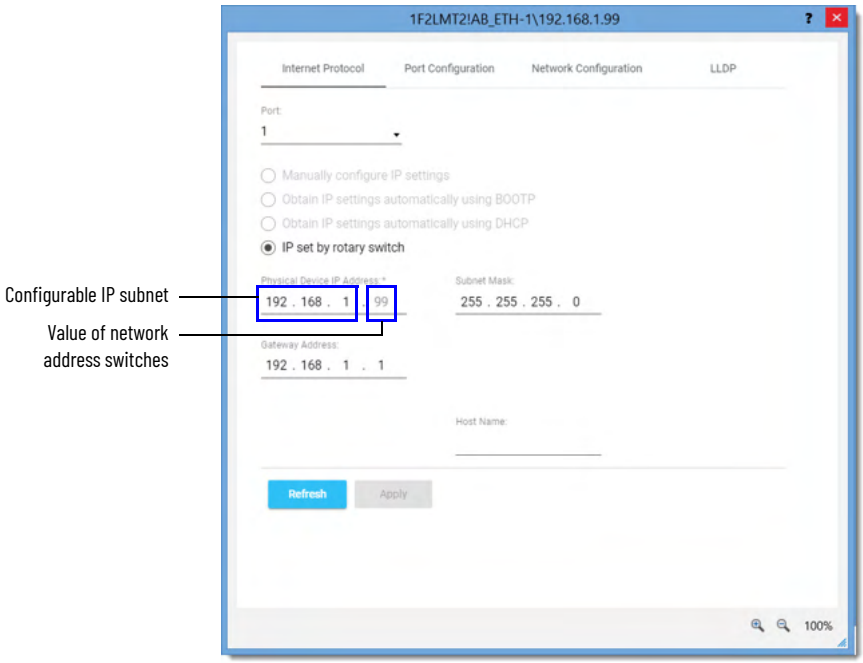
Use the FactoryTalk Linx Software

To use FactoryTalk Linx software to set the IP address, follow these steps.

1. Open the FactoryTalk Linx Network Browser and browse to your device.
2. To set the IP address, select the wrench  next to your device.

Set a Custom IP Subnet for Network Address Switches

When you use the network address switch to configure the IP address, you can change the default IP subnet (192.168.1) to a custom value.



To set a custom IP subnet, complete these steps.

1. On the Internet Protocol tab, verify that the IP set by rotary switch option is selected.
2. Set the IP subnet to the desired value.
3. Set the gateway address to correspond with the new IP subnet.
4. Select Apply.

Use the Secure Web Server

To use the secure web server to set the IP address, follow these steps.

1. Open your Internet browser and enter the IP address of the module.
2. Sign-in to the web server to access the configuration pages.
3. Go to the Internet Protocol page and configure the IP settings.

The steps to set custom IP subnet for network address switches with the web server is similar to Use the FactoryTalk Linx Software on page 48.

For more information on the web server, see Secure Web Server on page 137.

Use the BOOTP/DHCP Tool

The BOOTP/DHCP tool is a standalone server that you can use to set an IP address.
The BOOTP/DHCP tool sets an IP address and other TCP parameters.

You can use the BOOTP/DHCP tool to set the IP address when the device powers up in the out-of-box state. The out-of-box state assumes that the network address switches on the module are not set to a valid IP address (see Table 15), and the module is DHCP enabled.

For instructions on how to use the BOOTP/DHCP tool to set the IP address, see the EtherNet/IP Network Devices User Manual, publication ENET-UM006.

Add the Module to a Studio 5000 Logix Designer Application Project

You must complete the following tasks before you can add the module:

- Create a Studio 5000 Logix Designer application project.
- Add a controller to the project.

For more information on how to add a controller to a Studio 5000 Logix Designer application project, see the User Manual for the controller.

After you create a Studio 5000 Logix Designer application project and add a controller to the project, you can use the following methods to add modules to the project.

- Discover Modules
- New Module

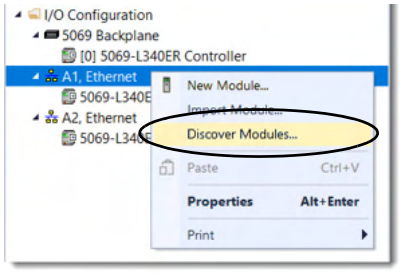
Discover Modules

To use the Discover Modules method, complete these steps.

1. Go online with your project.

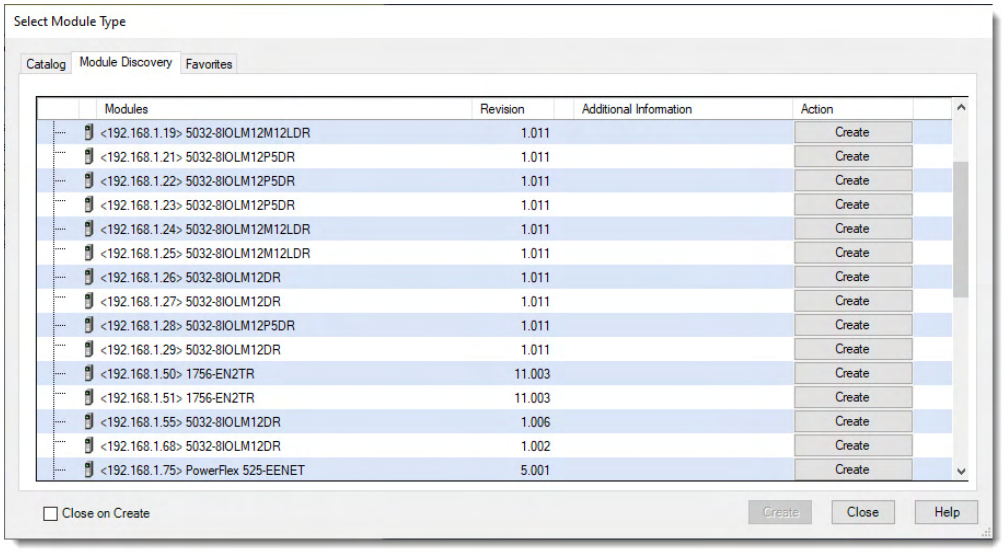
   The project must include a controller.

2. In the I/O Configuration tree, right-click the Ethernet network and select Discover Modules.



   The Select Module Type dialog appears. The Module Discovery tab shows the available modules that are connected to the Ethernet network.

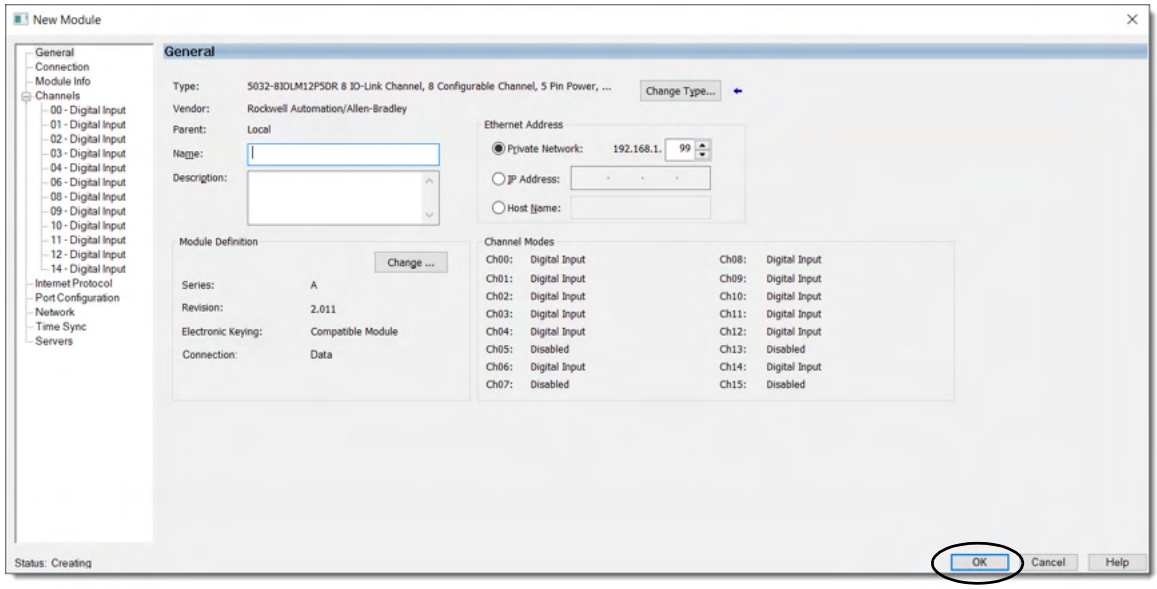
3. Select Create for the module that you want to add.



   The New Module window appears and shows the General view. A list of different views is shown on the left side. The number and type of views that are shown depend on your Module Definition configuration.

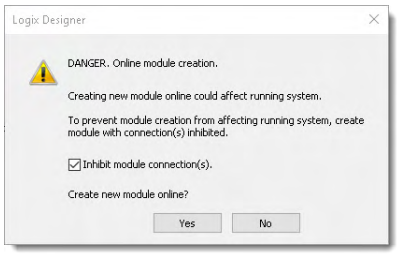
4. Enter a name for the module, which is also used in the name of the Tag elements that get created for the module.

If you want to configure the other settings during this step, see Edit the Module Properties on page 53 for more information.



5. Select OK to save the configuration.

   A prompt appears to request to inhibit the module. We recommend inhibiting the module if the module is not fully configured or not ready to be put into operation currently.



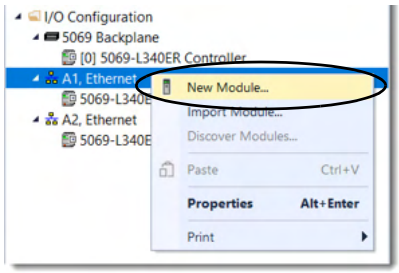
6. Repeat steps 3...5 to add another module, or close the Select Module Type dialog. If you selected the Close on Create checkbox in step 3, you must start from step 2 to add another module.

New Module

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

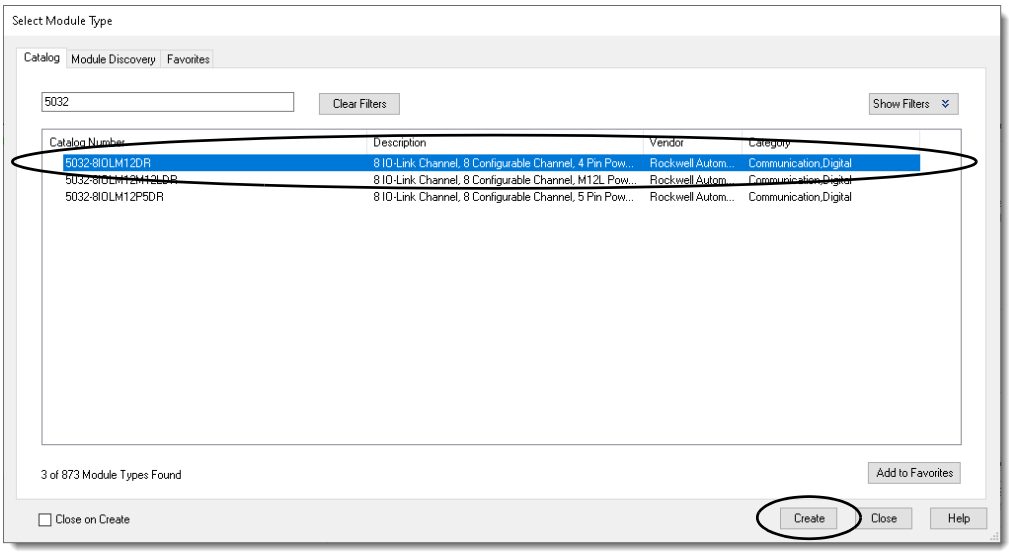
To use the New Module method, complete these steps.

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



   The Select Module Type dialog appears.

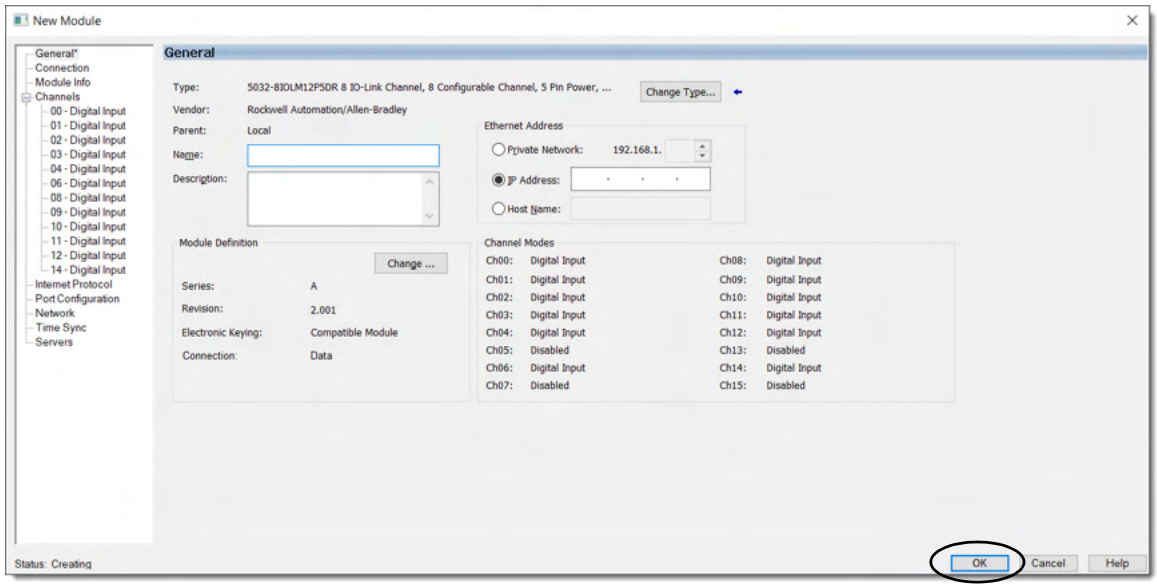
2. Select the module and select Create.



The New Module window appears and shows the General view. A list of different views is shown on the left side. The number and type of views that are shown depend on your Module Definition configuration.

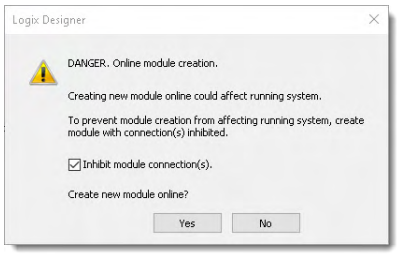
3. Configure the following:
   - Enter a Name for the module.
   - Enter the Ethernet Address for the module.
   - Change the Module Definition and configure the following:
     - Select the appropriate Connection type for your module.
     - Select the individual Channel Modes for your application.

   If you want to configure the other settings during this step, see Edit the Module Properties on page 53 for more information.



4. Select OK to save the configuration.

A prompt appears to request to inhibit the module. We recommend inhibiting the module if the module is not fully configured or not ready to be put into operation currently.



5. Repeat steps 2...4 to add another module, 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 module.

Edit the Module Properties

Select the views in the New Module or Module Properties window to view and change the module configuration.

The following views for the IO-Link master module are described in this section.

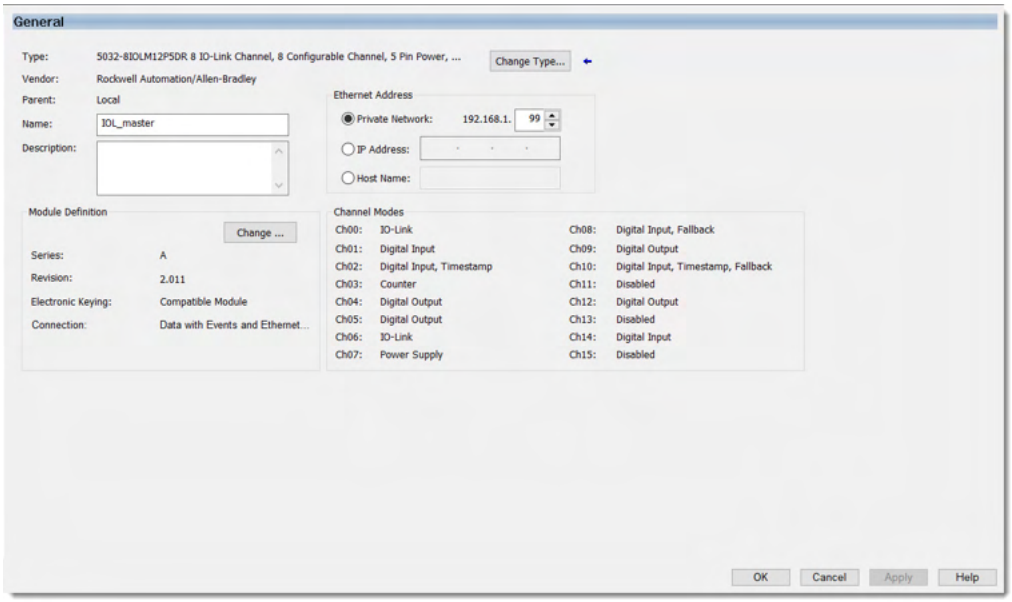
- General View
- Connection View
- Module Info View
- Channels View
- Input Events View
- Internet Protocol View
- Port Configuration View
- Network View
- Time Sync View
- Servers View

General View

The General view appears first when you create a module.

Use this view to complete the following tasks:

- Name the module.
- Describe the module.
- Change the module type.
- Configure the Ethernet Address.
- Access the Module Definition.



Module Definition

Access Module Definition parameters from the General view of the Module Properties window.

Table 16 describes the parameters on the Module Definition dialog.

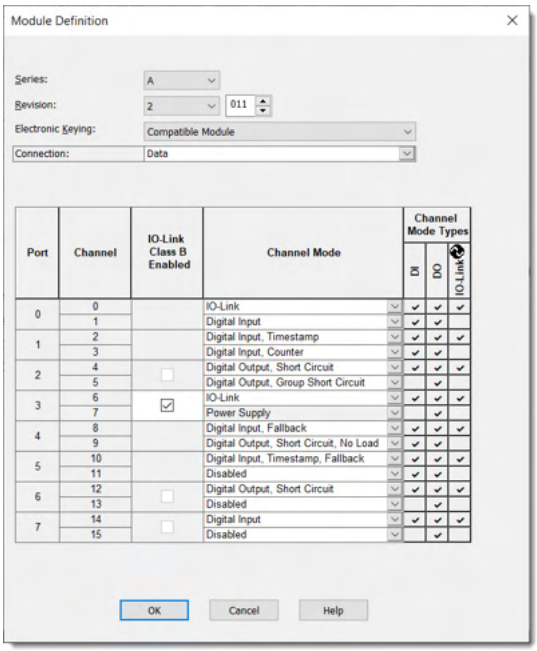


Table 16 - IO-Link Master Module Definition Parameters

Parameter	Definition	Available Choices
Series	Shows the module hardware series	Module-specific
Revision	Shows the module firmware revision, including major and minor revision levels	Module-specific
Electronic Keying	Software method by which you reduce the possibility of using the wrong device in a control system For more information, see the following: • IO-Link Master Module and IO-Link Device Tag Definitions on page 115 • Electronic Keying in Logix 5000 Control Systems Application Technique, publication LOGIX-AT001	• Exact Match • Compatible Module • Disable Keying
Connection	Determines the following for the module type that you configure: • Available configuration parameters • Type of data that is transferred between the module and the controller • Which tags are generated when configuration is complete	• Data • Data and Ethernet Status • Data with Events • Data with Events and Ethernet Status
Port	Shows the module port numbers	Not configurable
Channel	Shows the module channel numbers	Not configurable
IO-Link Class B Enabled	Enables Class B for the selected port	Cleared Selected
Channel Mode	Shows the mode for the channel Power Supply mode is displayed if you select the IO-Link Class B Enabled checkbox.	• Disabled • IO-Link • Digital Input • Digital Input, Timestamp • Digital Output, Short Circuit • Digital Output, Group Short Circuit • Digital Output, Short Circuit, No Load • Digital Input, Fallback • Digital Input, Timestamp, Fallback • Power Supply (not selectable)
Channel Mode Types	Shows the different type of channel modes available for that channel: • Digital Input (DI) • Digital Output (DO) • IO-Link	Not configurable

WARNING: Do not use an output channel as a power supply for Class B devices.

In online mode, only the Electronic Keying and IO-Link Class B Enabled parameters can be changed.

Available Connection Types

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

Table 17 describes the connection types that you can use with the ArmorBlock 5000 8-channel IO-Link master module.

Table 17 - Connection Types for ArmorBlock 5000 8-channel IO-Link Master Module

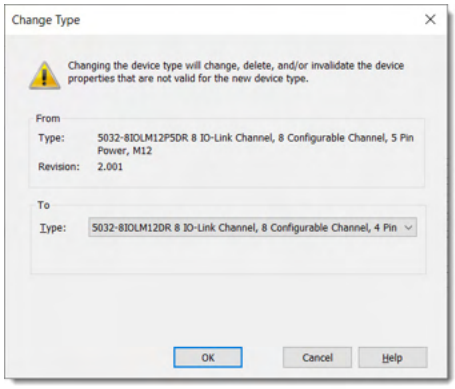
Connection Type	Description
Data	The module returns the following to the controller: • General fault data • Input data • Counter data The controller returns the following to the module: • Output data
Data and Ethernet Status	The module returns the following to the controller: • General fault data • Input data • Counter data • Ethernet Status data The controller returns the following to the module: • Output data
Data with Events	The module returns the following to the controller: • General fault data • Input data • Counter data • Event input data The controller returns the following to the module: • Output data • Event output data
Data with Events and Ethernet Status	The module returns the following to the controller: • General fault data • Input data • Counter data • Ethernet Status data • Event input data The controller returns the following to the module: • Output data • Event output data

For more information on how to use the Module Definition parameters for ArmorBlock 5000 8-channel IO-Link master modules, see the Studio 5000 Logix Designer application online Help.

Change Type

Access the Change Type dialog from the General view of the Module Properties window.

Select the power variant that you want to change the IO-Link master module to.



Connection View

Use the Connection view to complete the following tasks:

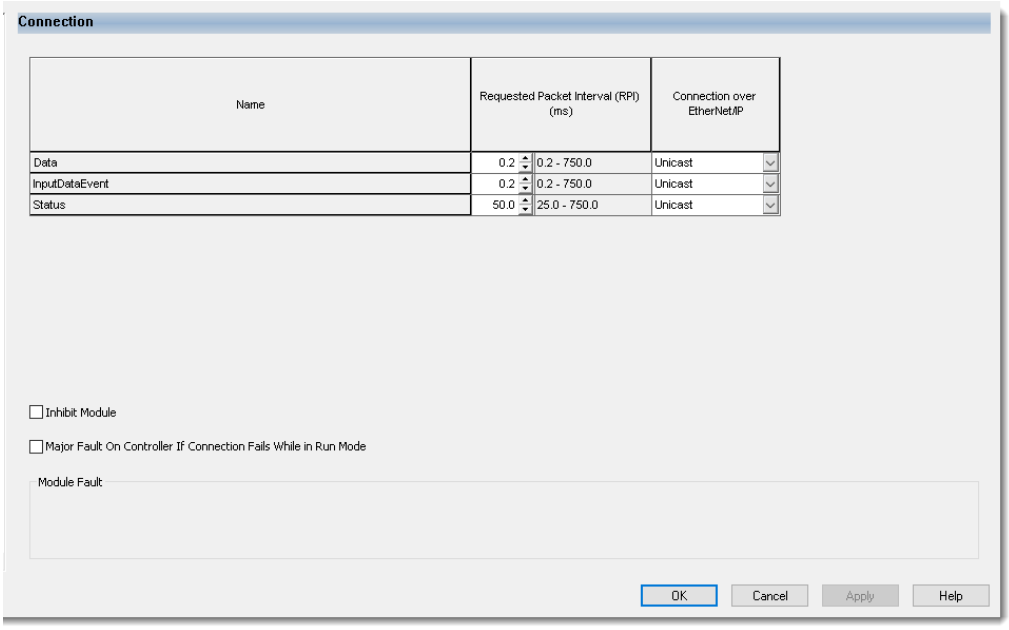
- Set the RPI rate. The valid RPI values are 0.2...750 ms.

  For more information on RPI, see Requested Packet Interval on page 15.
- Set the connection type to use on the EtherNet/IP network.

  For more information on unicast and multicast connections, see the Ethernet Reference Manual, publication ENET-RM002.
- Inhibit or uninhibit the module.

  For more information on inhibiting the module, see Module Inhibiting on page 20.
- Configure whether a connection failure while the controller is in Run mode causes a major or minor fault.

The Module Fault area of the Connection view is useful for troubleshooting. For more information on the Module Fault area, see Module Fault Descriptions on Connection View on page 101.



Connection Over an EtherNet/IP Network

When you configure a module, you must configure the Connection over EtherNet/IP parameter. The configuration choice dictates how input data is transmitted over the network.

The module uses one of the following methods to transmit 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 depending on the module configuration.

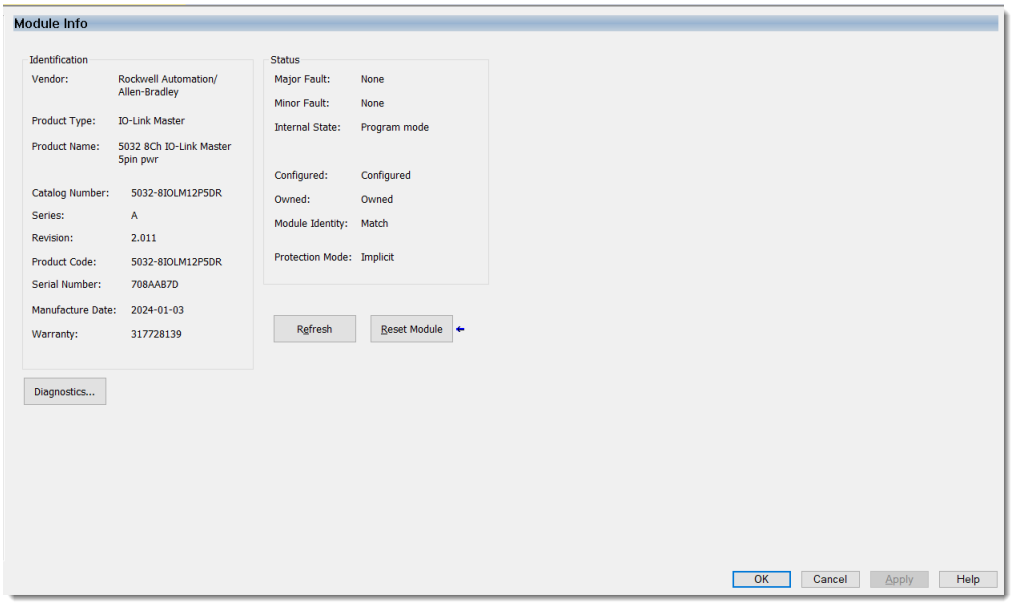
Unicast is the default setting. We recommend that you use Unicast because it reduces network bandwidth usage. However, if you are using a ControlLogix 5580 controller in a high availability system, you must use Multicast.

Module Info View

The Module Info view shows the module and status information when the project is online and lets you reset the module.

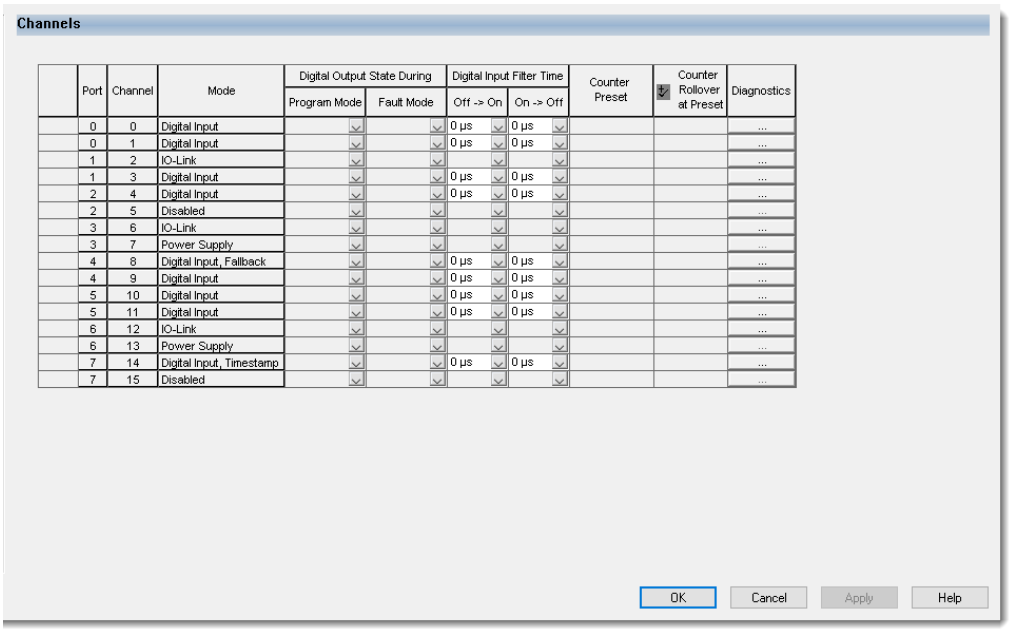
Use the Module Info view to complete the following tasks:

- Determine the identity of the module.
- Access module diagnostic.
- Refresh the data on the screen.
- Reset the module.



Channels View

The Channels view shows an overview of the configuration values for all module channels. The values for each parameter indicate how that particular channel is configured on that specific channel view.



IMPORTANT You can edit the fields on the Channels view. However, we recommend that you change channel configuration on the specific channel view as described in the rest of this section.

Use this view to monitor the configuration for all module channels.

Channel XX Views

The channel XX views, where XX represents the channel number, shows the configuration options available for that channel.

The following channel modes are available:

- XX - IO-Link
- XX - Digital Input
- XX - Digital Input, Timestamp
- XX - Counter
- XX - Digital Output
- XX - Digital Input, Fallback
- XX - Digital Input, Timestamp, Fallback

The channel modes are configured in the Module Definition dialog box, see Module Definition on page 54. Not all channel modes can be configured for each channel.

XX - IO-Link

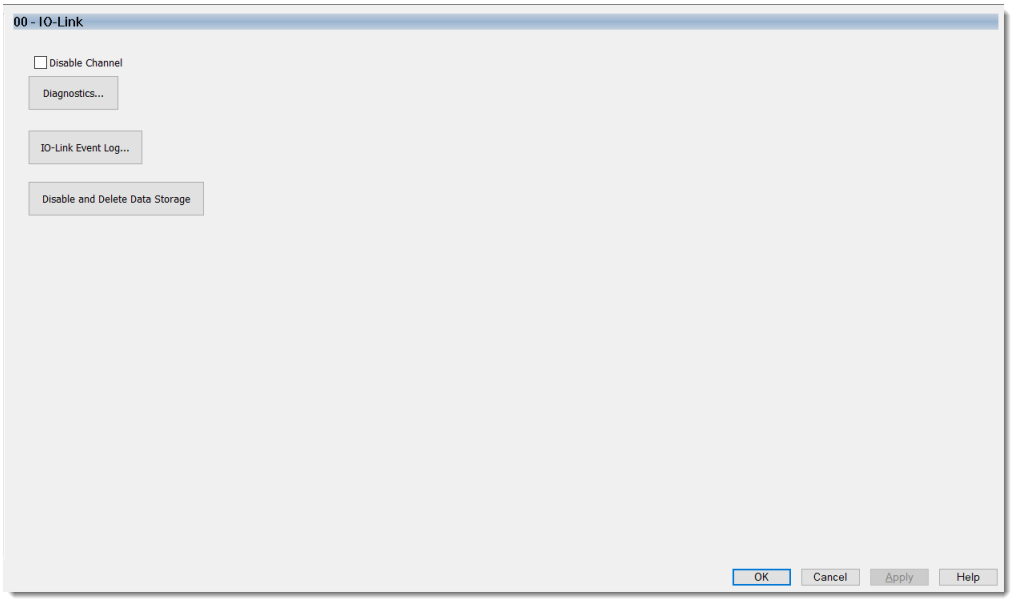
This view is available when the channel is configured as "IO-Link". You can perform certain tasks only when the project is online.

Use this view to complete the following tasks:

- Enable or disable the channel.

  Use this checkbox to disable the channel temporarily to:

  - Stop IO-Link communication for safety considerations. For example, when you change the channel mode from "IO-Link" to "Digital Output".
  - Disable Data Storage for the IO-Link port to prevent unexpected Data Storage Backup/Restore operation. Data Storage is re-enabled on the IO-Link port when the connection to the device is established again.
- Access the channel diagnostics.
- Access the port-level IO-Link event log.
- Disable and Delete the master copy of the Data Storage on the IO-Link port.

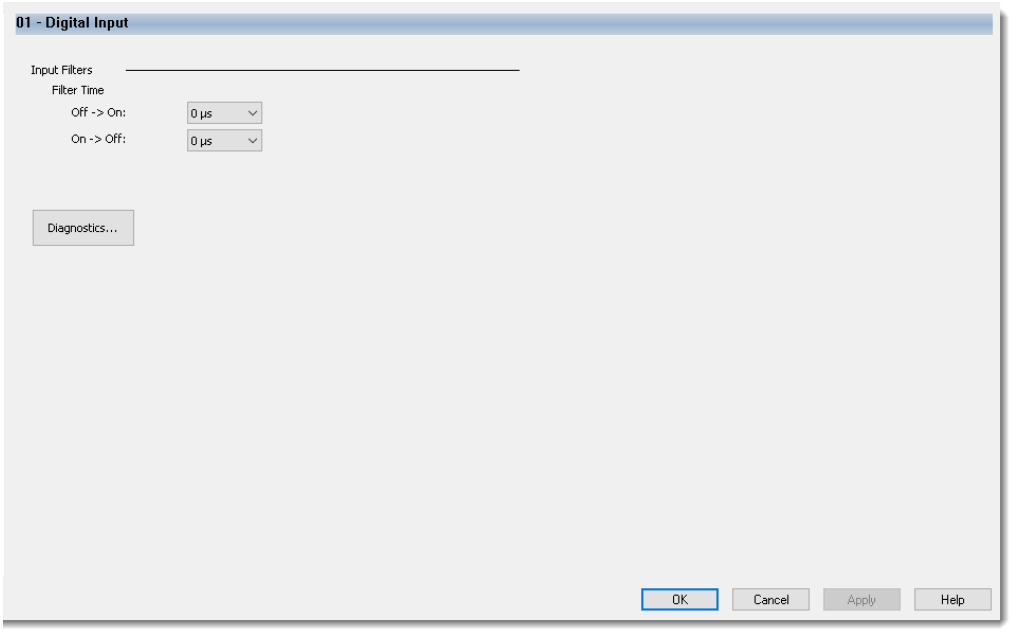


XX - Digital Input

This view is available when the channel is configured as “Digital Input”. You can perform certain tasks only when the project is online.

Use this view to complete the following tasks:

- Select the Input Filter Time.
- Access the channel diagnostics.

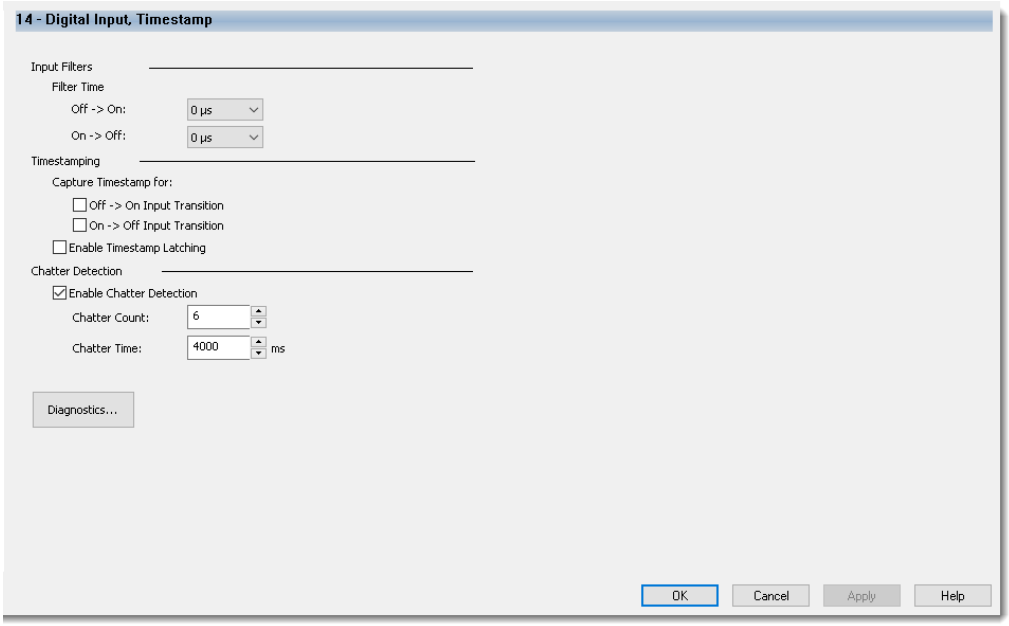


XX - Digital Input, Timestamp

This view is available when the channel is configured as “Digital Input, Timestamp”. You can perform certain tasks only when the project is online.

Use this view to complete the following tasks:

- Select the Input Filter Time.
- Capture time stamps for Input transitions.
- Enable or disable Timestamp Latching.
- Enable or disable Chatter Detection.
- Configure the Chatter Detection options.
- Access the channel diagnostics.

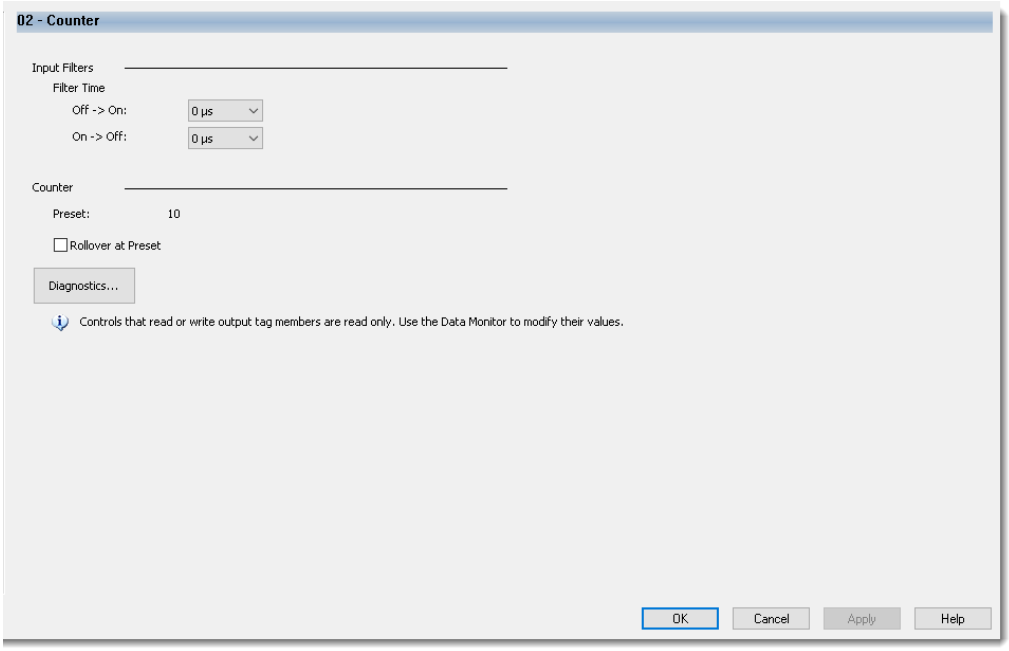


XX - Counter

This view is available when the channel is configured as “Digital Input, Counter”. You can perform certain tasks only when the project is online.

Use this view to complete the following tasks:

- Select the Input Filter Time.
- Enable or disable Counter Rollover at Preset.
- Access the channel diagnostics.

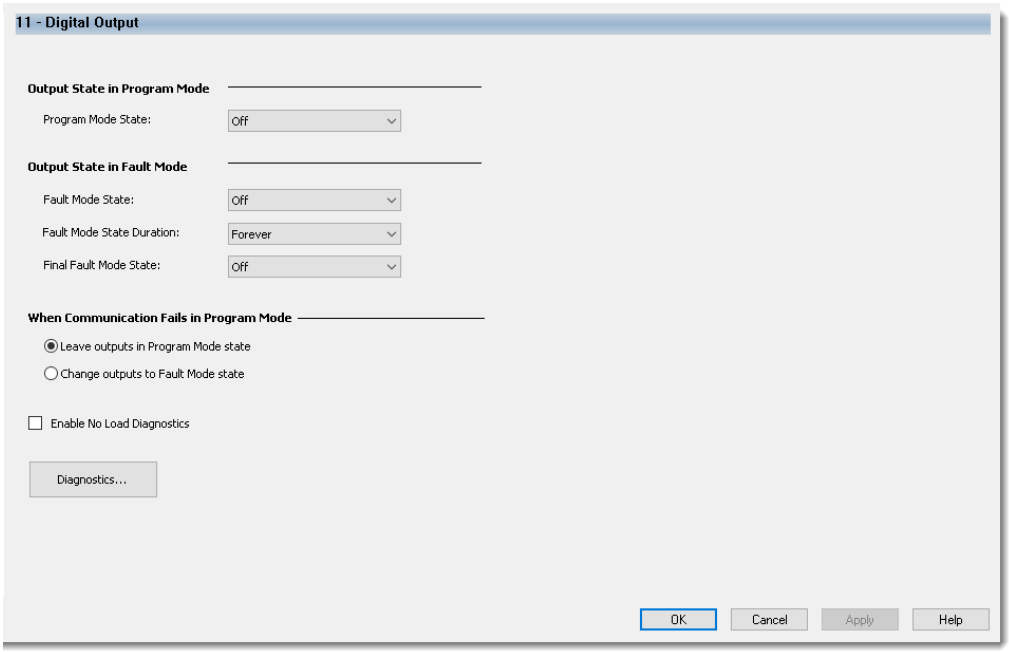


XX - Digital Output

This view is available when the channel is configured as "Digital Output, Short Circuit", "Digital Output, Group Short Circuit" or "Digital Output, Short Circuit, No Load". You can perform certain tasks only when the project is online.

Use this view to complete the following tasks:

- Select the Program Mode and Fault Mode Output states.
- Enable or disable No Load Diagnostics only when the channel is configured as "Digital Output, Short Circuit, No Load".
- Access the channel diagnostics.



XX - Digital Input, Fallback

This view is available when the channel is configured as "Digital Input, Fallback". You can perform certain tasks only when the project is online.

This view is a combination of the views for "IO-Link" and "Digital Input". For more information, see the following:

- XX - IO-Link on page 59
- XX - Digital Input on page 60

XX - Digital Input, Timestamp, Fallback

This view is available when the channel is configured as "Digital Input, Timestamp, Fallback". You can perform certain tasks only when the project is online.

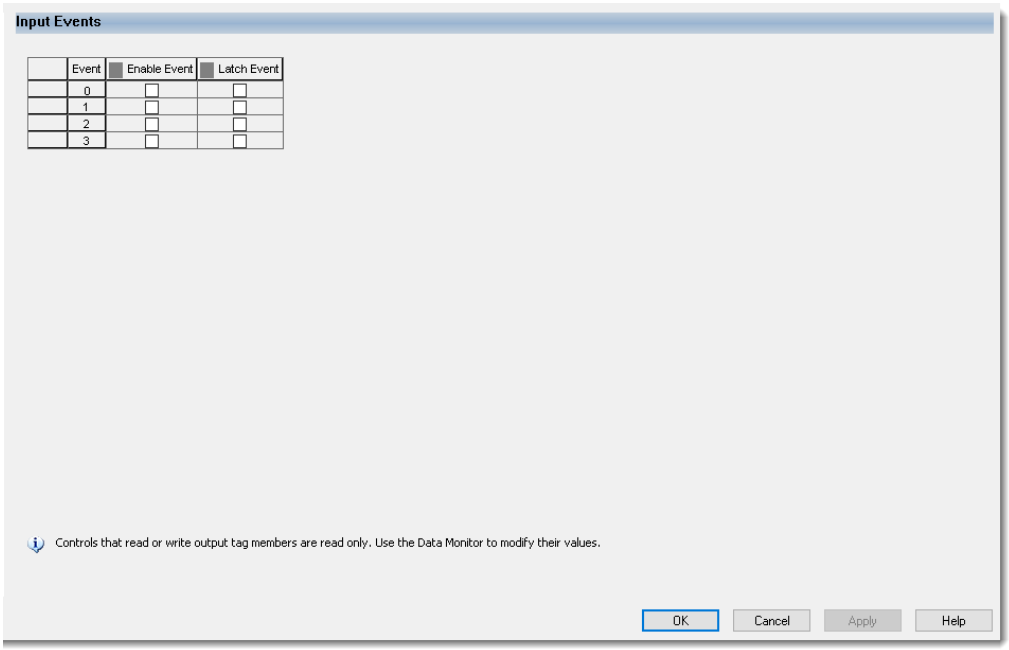
This view is a combination of the views for "IO-Link" and "Digital Input, Timestamp". For more information, see the following:

- XX - IO-Link on page 59
- XX - Digital Input, Timestamp on page 61

Input Events View

The Input Events view shows an overview of the configuration values for all input events. You can perform certain tasks only when the project is online.

This view is only available when you select the "Data with Events" or "Data with Events and Ethernet Status" connection type in the Module Definition. See Module Definition on page 54.



IMPORTANT You cannot configure events on the Input Events view. The parameters that are displayed in this view are read-only.

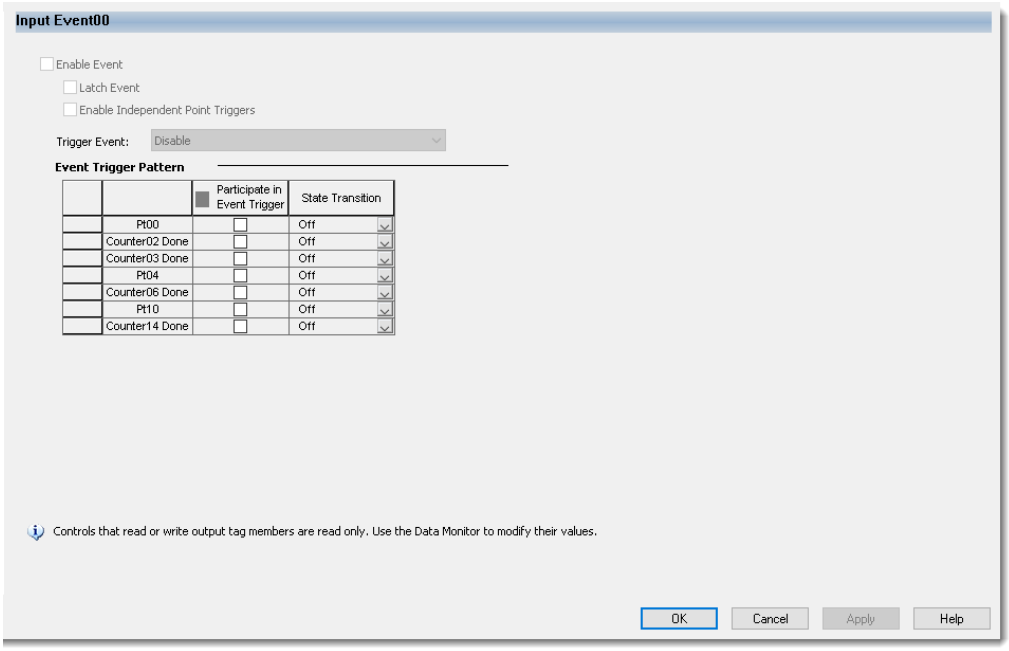
You must use the Event Output tags to configure an event. For more information, see Event Output Tags for IO-Link Master Module on page 122.

Input Eventxx View

The Input Eventxx view, where xx represents the index of an event definition, shows the configuration options available for that event. You cannot configure the parameters from this view, you must use the configuration tags.

Use this view to review the following tasks:

- Whether the input event is enabled.
- Whether the input event is latched.
- Whether Independent Point Triggers for the input event is enabled.
- Check the trigger condition for the input event.
- Check the participants and their State Transition behavior for the input event.



Event Definition

Table 18 describes the event definition parameters that you can configure using the Event Output tags.

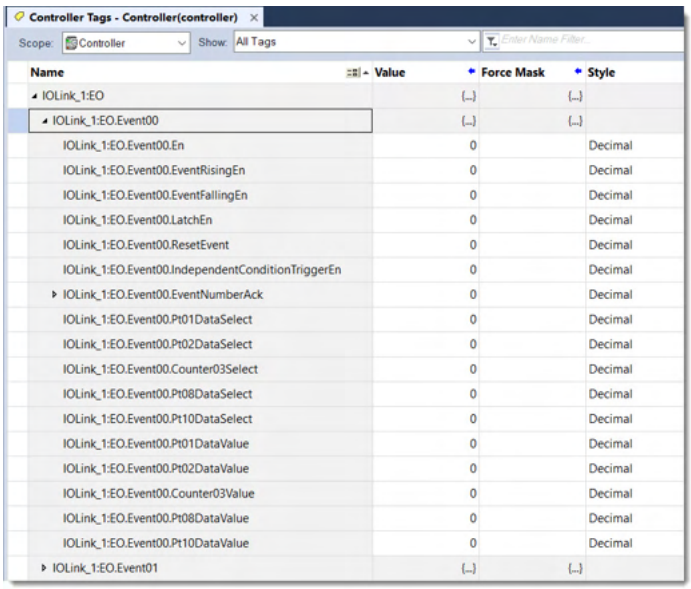


Table 18 - Event Definition Tags

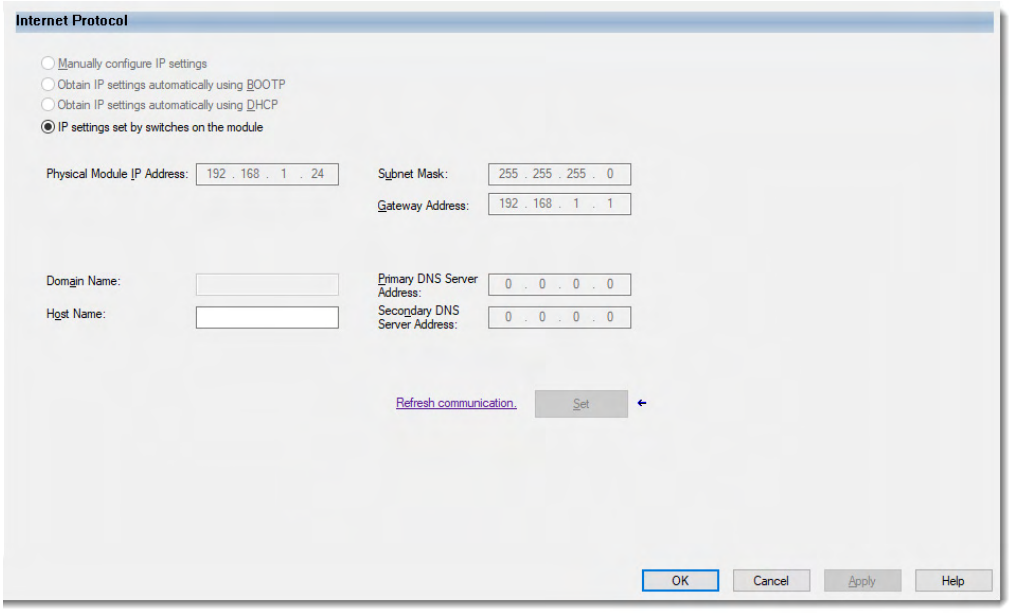
Task	Event Output Tag to Change	Valid Values
Enable the event.	*E0.Eventxx.En*	0 = Event is disabled 1 = Event is enabled
Determine if an input state change on any single selected point or a pattern of input state changes across all selected points triggers the event.	*E0.Eventxx.IndependentConditionTriggerEn*	0 = Pattern of input state changes triggers the event 1 = Single input state change triggers the event
Select at least one channel on the module to participate in the event.	The tag name changes based on the input function. The following names are available: • *E0.Eventxx.PtxxDataSelect* – This tag appears for any channel that is configured as "Digital Input" or "Digital Input, Timestamp". • *E0.Eventxx.CounterxxSelect* – This tag appears for any channel that is configured as "Digital Input, Counter".	0 = Point does not participate in the event trigger 1 = Point participates in the event trigger
For all channels that participate in the event, determine what constitutes an event state.	The tag name changes based on the input function. The following names are available: • *E0.Eventxx.PtxxDataValue* – This tag appears for any channel that is configured as "Digital Input" or "Digital Input, Timestamp". • *E0.Eventxx.CounterxxValue* – This tag appears for any channel that is configured as "Digital Input, Counter".	0 = On to Off state transition 1 = Off to On state transition
Determine which edge of the event triggers the event. That is, the rising edge, falling edge, or either edge of the event.	Both of the following: • *E0.Eventxx.EventRisingEn* • *E0.Eventxx.EventFallingEn*	The combination of the tag settings determines which edge triggers the event: • This combination triggers the event on a rising edge: – *E0.Eventxx.EventRisingEn* = 1 – *E0.Eventxx.EventFallingEn* = 0 • This combination triggers the event on a falling edge: – *E0.Eventxx.EventRisingEn* = 0 – *E0.Eventxx.EventFallingEn* = 1 • This combination triggers the event on either a rising or falling edge: – *E0.Eventxx.EventRisingEn* = 1 – *E0.Eventxx.EventFallingEn* = 1
Determines whether to latch the event.	*E0.Eventxx.LatchEn*	0 = Event is not latched 1 = Event is latched

Internet Protocol View

The Internet Protocol view shows the IP settings for the IO-Link master module. You can perform certain tasks only when the project is online.

Use the Internet Protocol view to complete the following tasks:

- Select how IP settings are configured.
- Configure IP settings manually.
- Set Domain and Host Names.
- Configure Primary and Secondary DNS Server Addresses.
- Refresh communication.

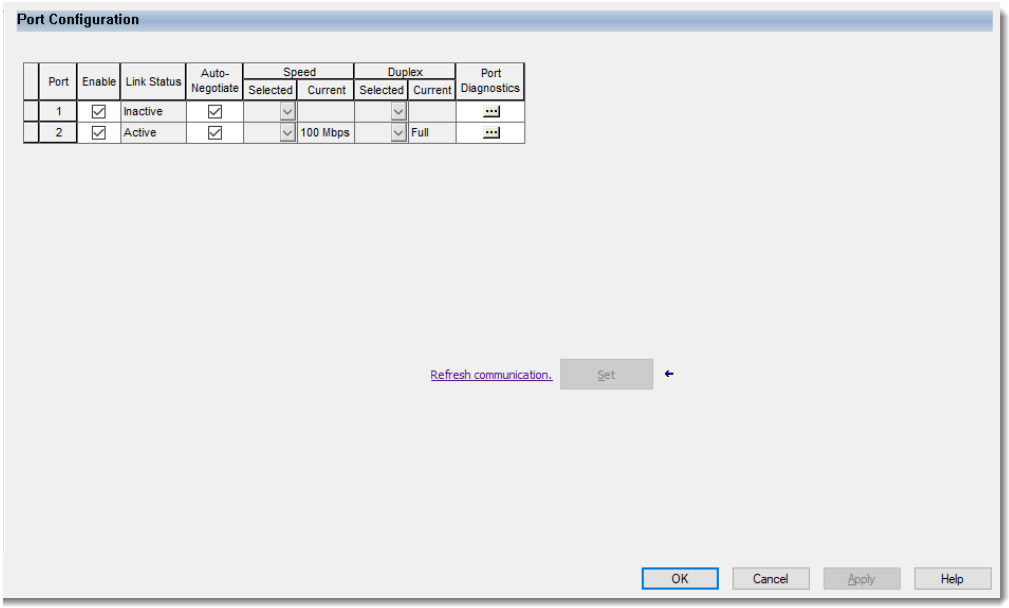


Port Configuration View

The Port Configuration view shows the status information of the network ports. You can perform certain tasks only when the project is online.

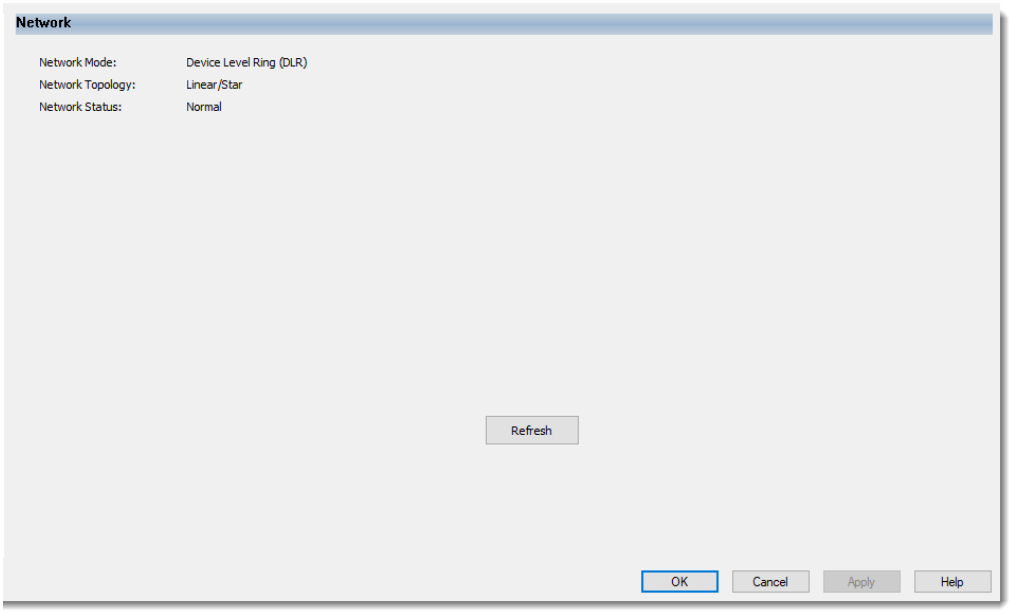
Use the Port Configuration view to complete the following tasks:

- Enable or disable network ports.
- Enable or disable Auto-Negotiate.
- Select communication speed.
- Select Duplex mode.
- Access Port Diagnostics.



Network View

The Network view shows the status information that is related to the Device Level Ring (DLR) Network Mode when the project is online.



Time Sync View

The Time Sync view shows information that is related to CIP Sync Time Synchronization. The information appears only if the project is online and CIP Sync is enabled.

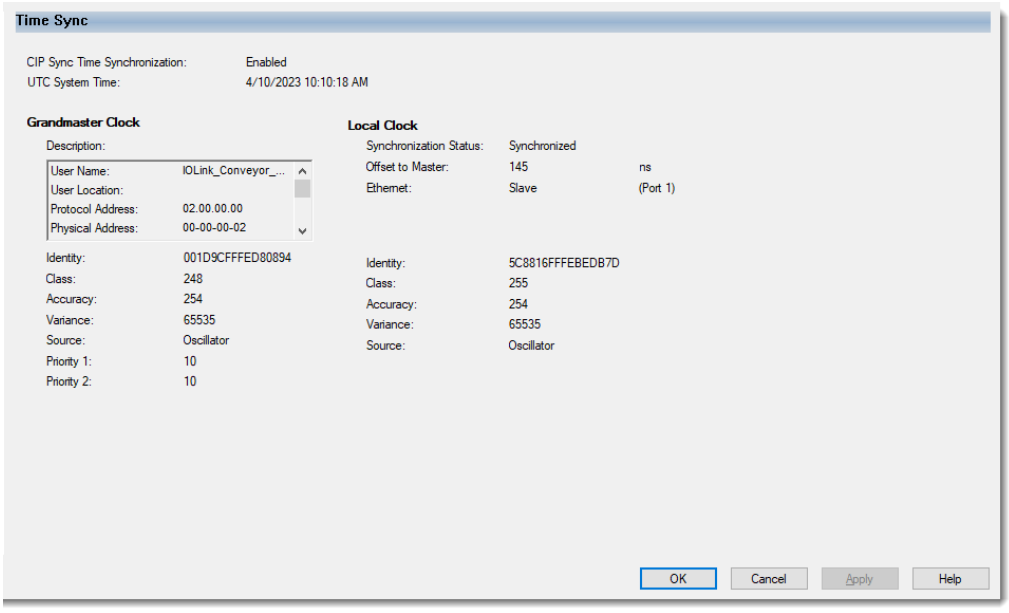


Table 19 - Time Sync Parameters

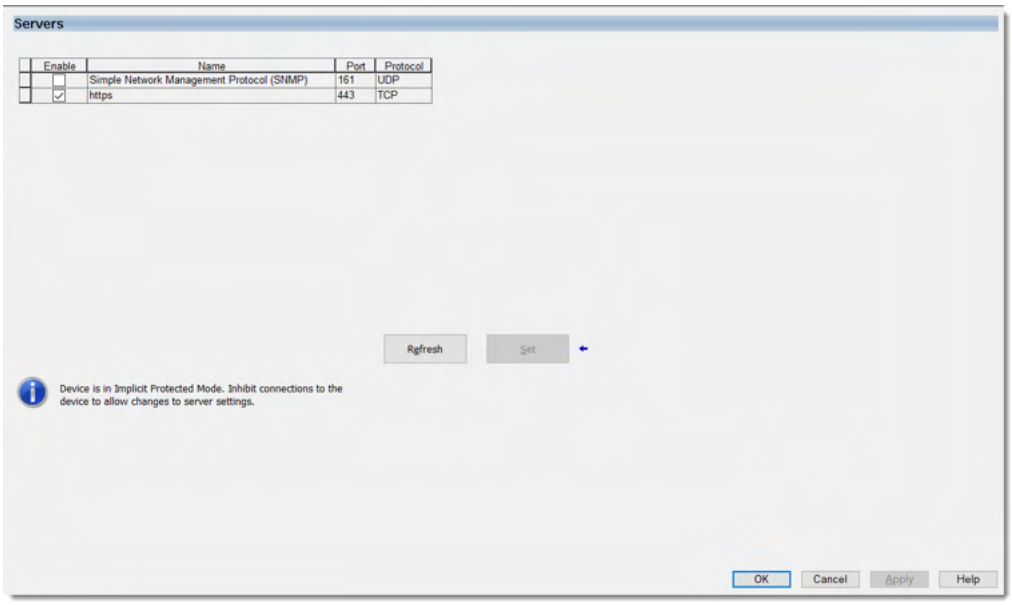
Parameter	Description
CIP Sync Time Synchronization	Displays the status of the time synchronization
UTC System Time	Displays the current system time
Grandmaster Clock	
Description	Displays information about the Grandmaster clock. The vendor of the Grandmaster device controls this information. The following information is specified: • User Name • User Location • Protocol Address • Physical Address • Clock Type • Manufacturer Name • Model • Serial Number • Hardware Revision • Firmware Revision • Software Version • Profile Identity • Physical Protocol • Network Protocol • Port Number Use the vertical scroll bar to view the data.
Identity	Displays the unique identifier for the Grandmaster clock. The format depends on the network protocol. Ethernet network encodes the MAC ID into the identifier.
Class	Displays a measure of the quality of the Grandmaster clock. Values are defined from 0…255 with zero as the best clock.
Accuracy	Indicates the expected absolute accuracy of the Grandmaster clock relative to the PTP epoch. The accuracy is specified as a graduated scale that starts at 25 nanoseconds and ends at greater than 10 seconds or unknown. The lower the accuracy value, the better the clock.
Variance	Displays the measure of inherent stability properties of the Grandmaster clock. The value is represented in offset scaled log units. The lower the variance, the better the clock.
Source	Displays the time source of the Grandmaster clock. The available values are: • PTP • Oscillator
Priority 1 / Priority 2	Displays the relative priority of the Grandmaster clock to other clocks in the system. The priority values range from 0…255. The highest priority is zero. The default value for both settings is 128.
Local Clock	
Synchronization Status	Displays whether the local clock is synchronized or not synchronized with the Grandmaster reference clock. A clock is synchronized if it has one port in the slave state and is receiving updates from the time master.
Offset to Master	Displays the amount of deviation between the local clock and the Grandmaster clock in nanoseconds.
Ethernet	Displays the state of the Ethernet port. The available values are: Initializing, Faulty, Disabled, Listening, PreMaster, Master, Passive, Uncalibration, Slave, or None.
Identity	Displays the unique identifier for the local clock. The format depends on the network protocol. Ethernet network encodes the MAC ID into the identifier.
Class	Displays a measure of quality of the local clock. Values are defined from 0…255, with zero as the best clock.
Accuracy	Indicates the expected absolute accuracy of the Grandmaster clock relative to the PTP epoch. The accuracy is specified as a graduated scale that starts at 25 nanoseconds and ends at greater than 10 seconds or unknown. The lower the accuracy value, the better the clock.
Variance	Displays the measure of inherent stability properties of the local clock. The value is represented in offset scaled log units. The lower the variance, the better the clock.
Source	Displays the time source of the Grandmaster clock. The available values are: • PTP • Oscillator

Servers View

The Servers view shows information about the Simple Network Management Protocol (SNMP) and Hypertext Transfer Protocol (HTTPS) server for the IO-Link master module.

Use the Servers view to complete the following tasks:

- Enable or disable the SNMP server.
- Enable or disable the HTTPS server.



IMPORTANT The Servers view is not available under the following conditions:

- While the module is being created (New Module dialog)
- While the project is offline

Enable or Disable the SNMP or HTTPS Server

By default, the HTTPS server is enabled and the SNMP server is disabled. Disabling the server and using Protection Mode helps to decrease the possibility of a security breach.

Verify that the module is not in Protection Mode before you enable or disable the servers. To exit Protection Mode, see Protection Mode for IO-Link Master Module on page 23 for instructions.

To enable or disable the SNMP or HTTPS Server, complete the following steps.

1. Go online with your project.
2. In the IO-Link master Module Properties > Servers view, select or clear the Enable checkbox and select Apply.

   You do not need to cycle power to the module for the changes to take effect.

Switch Channel Mode from IO-Link or Fallback to Digital Output

To change the channel mode from IO-Link or Fallback to Digital Output, you must follow the steps that are described in this section.

WARNING: If the channel mode is IO-Link or Fallback, the IO-Link master module periodically generates a wake-up pulse. If an output device is connected to the channel, it may trigger an unexpected action from the device.

To change the channel mode, complete these steps.

1. Go online with your project.
2. In the IO-Link master Module Properties > Connection, clear the Inhibit Module checkbox and select Apply.
3. In the IO-Link master Module Properties > Channels > IO-Link or Fallback, select the Disable Channel checkbox and select Apply.

   IMPORTANT The project must be online and the connection to the IO-Link master module must be uninhibited when you select Apply to enable or disable the channel. Otherwise the enable or disable channel request is not sent to the master module.
4. Go offline with your project.
5. In the IO-Link master Module Properties > General > Module Definition, change the channel mode to a Digital Output.
6. Connect the output device to the IO-Link master module.
7. Go online with your project.

Use Symbolic Data Access

In FactoryTalk software, you can access the IO-Link master module information using symbolic data.

Before you can use symbolic data, you must upload the EDS file from a connected ArmorBlock 5000 8-channel IO-Link master module with FactoryTalk Linx software.

To configure the communication setup to use symbolic data, you can use the following methods.

- Configure with FactoryTalk Adminstration Console
- Configure with FactoryTalk View ME/SE Software

Configure with FactoryTalk Adminstration Console

To configure the communication setup with FactoryTalk Administration Console, complete these steps.

1. Open the FactoryTalk Administration Console.
2. Create an application, then create an area for your application.
3. Add a Rockwell Automation Device Server (FactoryTalk Linx) for your area.
4. Open the Communication Setup for your server.
5. Create a Device Shortcut for the IO-Link master module.
6. In the communication tree, select the IO-Link master module.
7. Change the Shortcut Type to Symbolic, then select OK.

After you have configured the communication setup, you can use the FactoryTalk Live Data Test Client to test the communication with your IO-Link master module.

To verify that the configuration is working correctly, complete these steps.

1. Open the FactoryTalk Live Data Test Client.
2. In the Initial Connection dialog, select the area that you have created for the IO-Link master module and select OK.
3. In the Add Item dialog, go to your Device Shortcut > Online node in the hierarchy tree.

   You can see the different nodes and elements included in the data model.
4. Select the elements that you want to add, then select OK.
5. The connection status and value of the elements that you have selected are shown in the main window.

Configure with FactoryTalk View ME/SE Software

To configure the communications setup with FactoryTalk View software, complete these steps.

1. In FactoryTalk View Studio, go to FactoryTalk Linx > Communication Setup.
2. Create a Device Shortcut for the IO-Link master module.
3. In the communication tree, select the IO-Link master module.
4. Change the Shortcut Type to Symbolic, then select OK.
5. Add a Numeric Display or String object in one display and open the properties.
6. Go to the Connections tab and select the Value Tag button. The Tag Browser window opens.
7. Go to your Device Shortcut > Online folder.

   You can see the different elements included in the data model. If you do not see any node, right-click on the Device Shortcut and select Refresh All Folders.
8. Go to one node and select one element.
9. Close the Tag Browser window and the object properties.
10. Use the Test display button to monitor the value of the element.

Reset Module to Factory Default

When you reset an IO-Link master module to factory default, the following occurs:

- All parameters are reset to their default values.
- All Data Storage copies on the module are cleared.
- The web server certification is cleared.
- The web server password is reset to the default password.

To reset the IO-Link master module to factory default, complete these steps.

1. Power down the module.
2. Set the network address switches to 888.
3. Power up the module and wait until the module status indicator becomes steady green.
4. Power down the module.
5. Set the network address switches to valid values.
6. Power up the module.

For more information on the network address switches, see Set the Network Address Switches on page 47.

Notes:

Configure the IO-Link Device

This chapter describes how to add and configure IO-Link devices that are connected to your ArmorBlock 5000 8-channel IO-Link master module in a Studio 5000 Logix Designer application project.

Before You Begin

You must complete the following tasks before you can configure the IO-Link device.

1. Create a Studio 5000 Logix Designer application project.
2. Add a controller to the project.
3. Add and configure an ArmorBlock 5000 8-channel IO-Link master module.

   For more information, see Add the Module to a Studio 5000 Logix Designer Application Project on page 49.
4. Set at least one channel mode to one of the following:
   - IO-Link
   - Digital Input, Fallback
   - Digital Input, Timestamp, Fallback

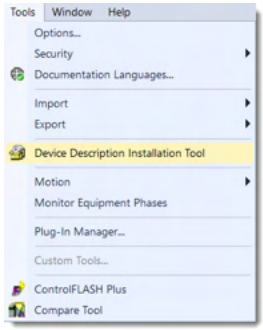
Before using the IO-Link capabilities, verify the following:

- The IO-Link master module and any associated field devices are working properly.
- The field device is IO-Link capable.
- Only one IO-Link device is connected to each port.
- The IO-Link master module has established connection with the controller at least once after the module has cycled power or has been reset.

Register IO-Link Device IODD

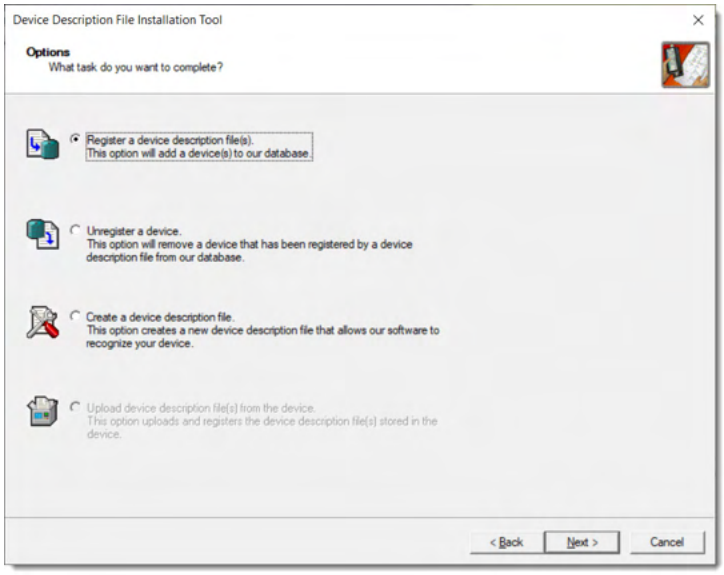
To register the IODD for new devices, complete these steps.

1. In the Studio 5000 Logix Designer application, select Tools > Device Description Installation Tool.

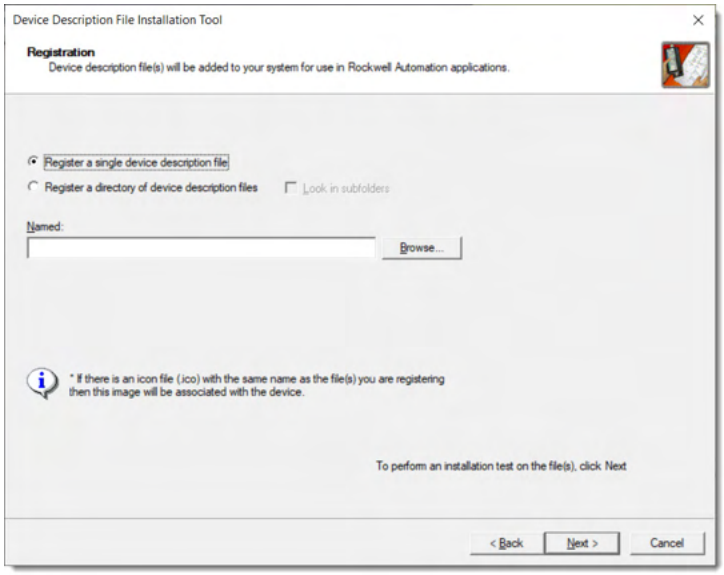


   The Device Description File Installation Tool dialog appears.
2. Select Next to begin.

3. Select Register a device description file(s) and select Next.



4. Select either to register one file or a directory of files, and select Browse.



If you selected to register one file:

a. Browse to the location of your IODD file.

b. Select the file and select Open.

If you selected to register a directory of files:

a. In the Browse for Folder dialog, browse to the folder with your IODD files.

b. Select the folder and select OK.

5. Select Next and follow the onscreen prompts to complete the installation.

IMPORTANT	If the IODD is already registered and you have selected to register the same version or an older version, you must confirm whether you want to overwrite the current version.

Register Embedded IODD Files

IMPORTANT This section applies only to IO-Link devices from Rockwell Automation that have an embedded IODD file.

To use FactoryTalk Linx software version 6.40 or later to upload and register the embedded IODD file in IO-Link devices, complete these steps.

1. In the FactoryTalk Linx Network Browser, select a device in the communication tree.
2. Right-click the device and select EDS / Device Description Upload.
3. If the target device has registered a device description file, the following warning message shows:

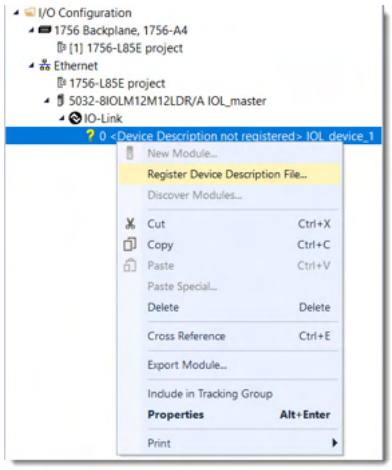
   "An EDS / Device Description is already registered for this device. Are you sure you still want to upload and register this EDS / Device Description file?"

   Select OK to continue and replace the existing device description file, or select Cancel to stop the upload process and retain the existing device description file.

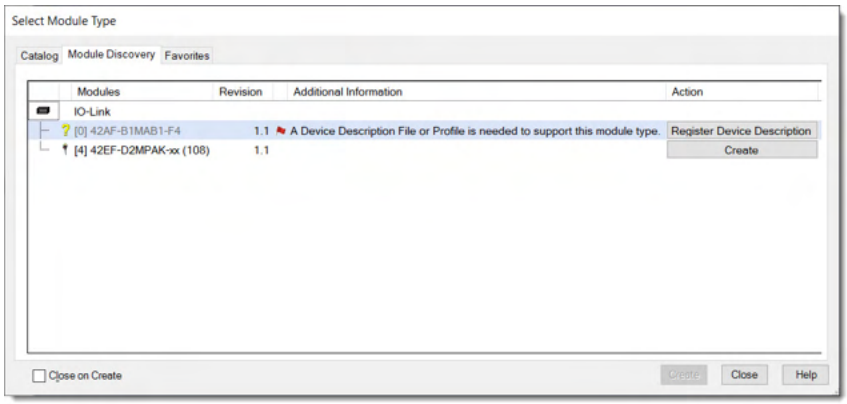
Automatically Download IODD File From IODDFinder

If there are unregistered IO-Link devices in your project or that are found during device discovery, you can use the Device Description File Installation Tool to download the IODD file automatically from the IODDFinder website.

Unregistered device in project



Unregistered device found during device discovery

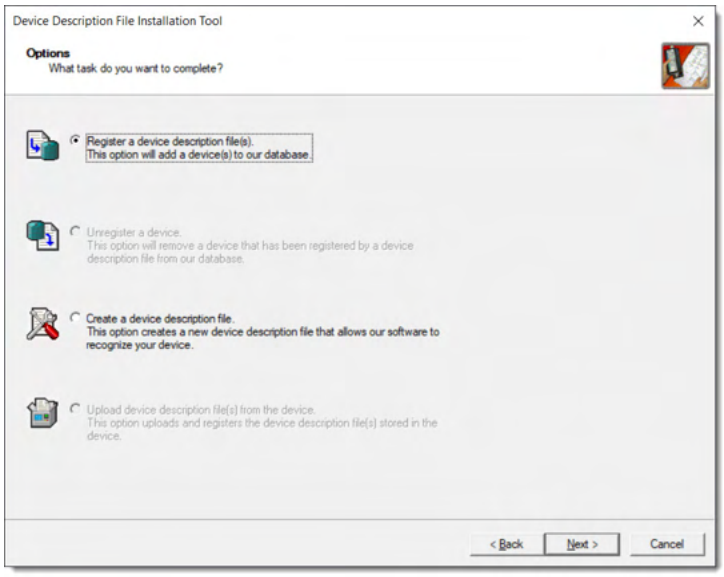


The steps to register the IODD file are identical, regardless of where you register the device from.

To register the IODD file, complete these steps.

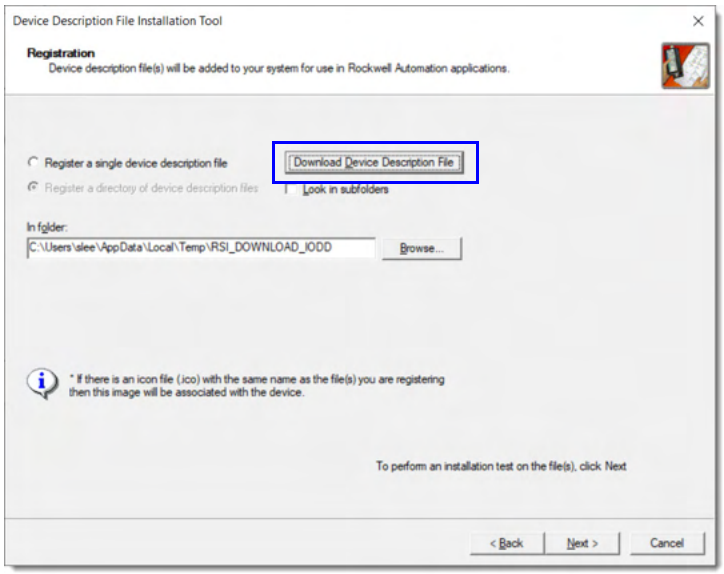
1. Select Register Device Description (File).

   The Device Description File Installation Tool dialog appears.
2. Select Next to begin.
3. Select Register a device description file(s) and select Next.



4. Select Download Device Description File.

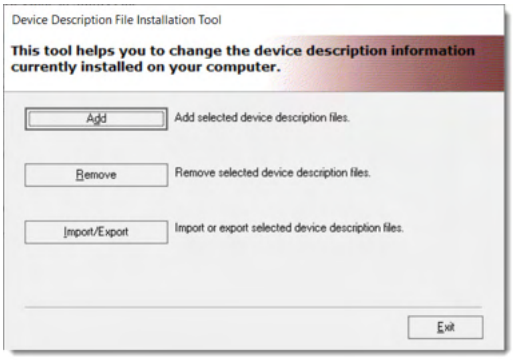
   If the IODD file download is successful, a default file path to save the IODD file is provided.



   If an error message appears that indicates that the IODD file cannot be found, contact the device manufacturer for the required IODD file.
5. Follow the onscreen prompts to complete the installation.

Import/Export IODD Files

You can use the Device Description File Installation Tool to import and export the IODD files of your devices.



To export IODD files, complete these steps.

1. Launch the Device Description File Installation Tool.
2. Select Import/Export.
3. Select Export from the dropdown menu.
4. Choose the Export Selected Device Description Files option.
   - Export All Device Description Files – Export the device description file for all registered devices.
   - Export All IO-Link Device Description Files – Export the device description file for all registered IO-Link devices.
   - Export Selected Device Description Files – Export the device description file for selected devices. If a device has multiple revisions, you can select one or more revisions to export.
5. Enter the location to save the exported file.
6. Select the devices that you want to export, then select Next.

The device description files for your selected devices are saved to your chosen location as one zip (*.zip) file.

To import IODD files, complete these steps.

1. Launch the Device Description File Installation Tool.
2. Select Import/Export.
3. Select Import from the dropdown menu.
4. Select Browse and go to the location of the file that you want to import.
5. Select the zip (*.zip) file, then select Next.

The device description files are imported into your system.

Add IO-Link Devices to Your Project

To add IO-Link devices to your project, you can use the following methods.

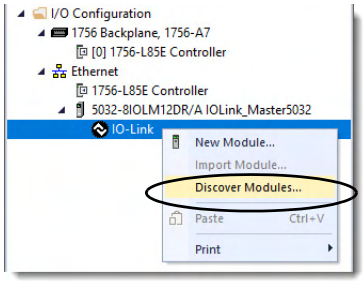
- Discover Modules
- New Module
- Add a Preconfigured Device

IMPORTANT	You cannot add a device on a channel that is configured as Fallback if the device does not support standard I/O mode.

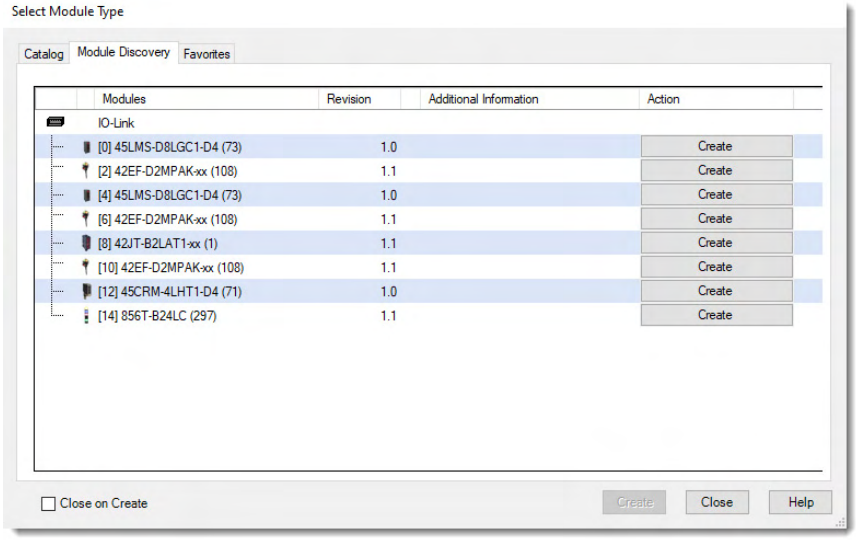
Discover Modules

To use the Discover Modules method with IO-Link devices, complete these steps.

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



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

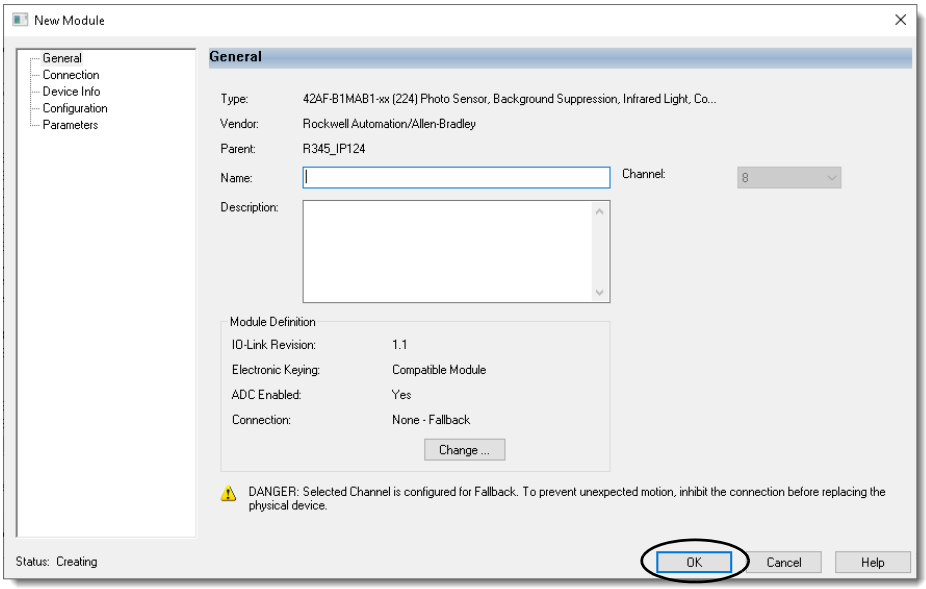


3. Select Create for the device that you want to add to your project.

   If a device shows Register, it means that there is no IODD registered for the device. Select Register to go through the registration process as described in Register IO-Link Device IODD on page 73.

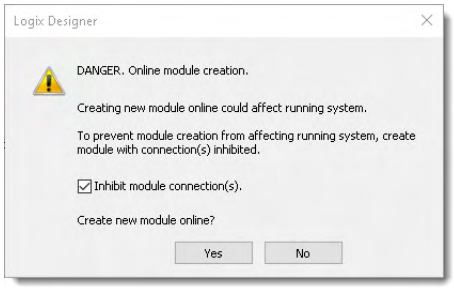
   The New Module dialog appears and shows the General view. A list of different views is shown on the left side.
4. Enter a Name for the device, which is also used in the name of the Tag elements that are created for the device.

If you want to configure the other settings during this step, see Edit the IO-Link Device Properties on page 83 for more information.



5. Select OK to save the configuration.

   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.



6. Repeat steps 3...5 to add another device, or close the Select Module Type dialog when done.

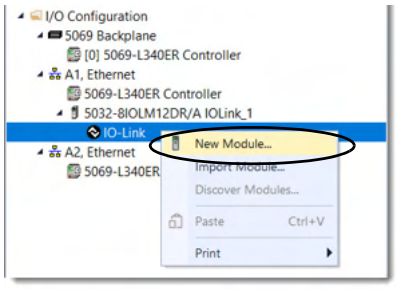
   If you selected the Close on Create checkbox in step 3, the Select Module Type dialog automatically closes and you must start from step 2 to add another device.

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.

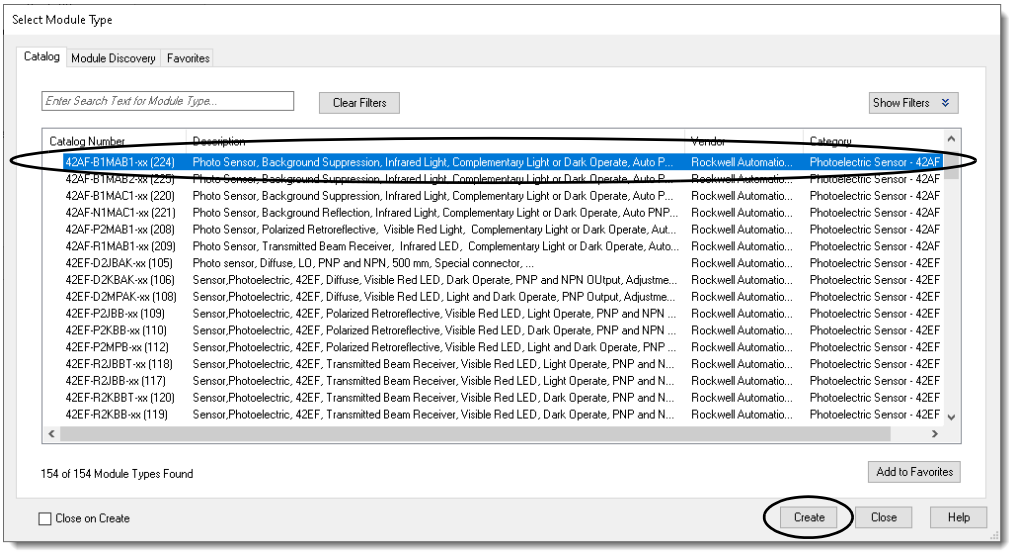
1. In the I/O Configuration tree, right-click the IO-Link bus and select New Module.



   The Select Module Type dialog appears.

2. Select the device and select Create.

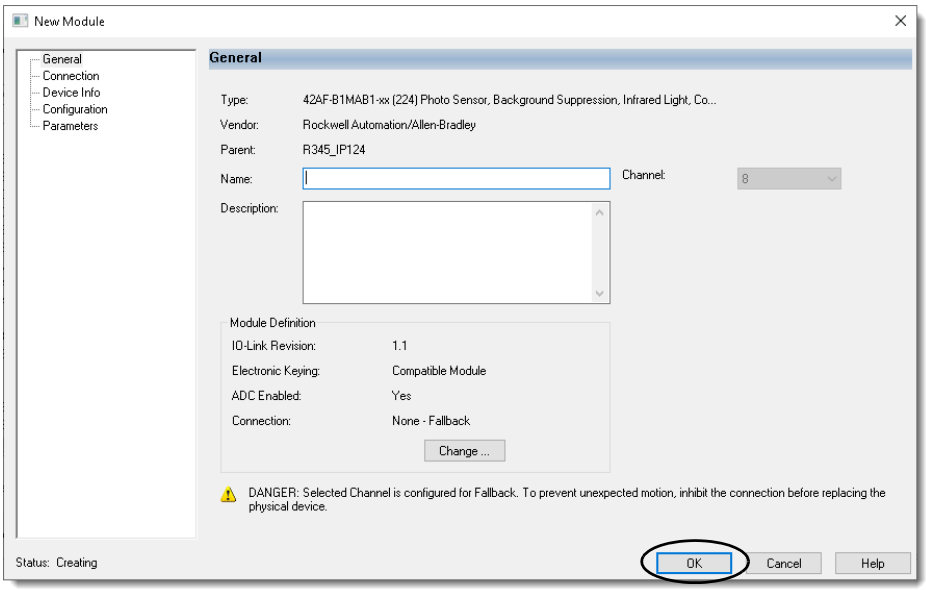
   To narrow down the list of devices, use the filters or search with keywords.



   The New Module window appears and shows the General view.

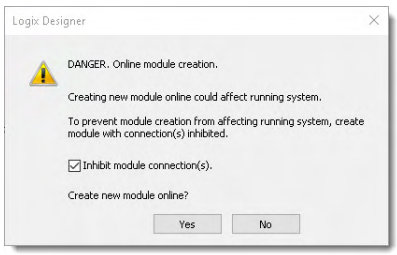
3. Enter a Name for the device.

   If you want to configure the other settings during this step, see Edit the IO-Link Device Properties on page 83 for more information.



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 steps 2...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.

Add a Preconfigured Device

You can add a preconfigured IO-Link device to your system and use this device configuration across other devices in the system.

We recommend attaching your preconfigured IO-Link device to a new IO-Link master module, or a used IO-Link master module that is restored to the factory default state, to help ensure that the previous device configuration in the IO-Link master module does not overwrite the configuration in the device. Restoring the module to the factory default state clears all device configuration that is stored on all ports from the module.

If you use an IO-Link master module that is new or has been reset to the factory default state, follow these steps to add your preconfigured device.

1. Go online with your project.
2. Attach your preconfigured IO-Link device to an IO-Link or Fallback channel.
3. Follow the steps as described in Discover Modules to add the device.
4. In the device Module Properties > Configuration view, perform Device Correlation Check, select "Use Device Values", and select Apply.

If you use an IO-Link master module that is used, follow these steps to add your preconfigured device.

1. Go online with your project.
2. In the IO-Link master Module Properties, complete these steps to disable Data Storage on the IO-Link port.
   a. In the IO-Link channel view, select the Disable Channel checkbox.
   b. In the Connection view, clear the Inhibit Module checkbox.
   c. Select Apply.
3. Attach your preconfigured device to the IO-Link port that was disabled in step 2.
4. In the IO-Link master Module Properties > IO-Link channel view, clear the Disable Channel checkbox and select Apply.
5. Follow the steps as described in Discover Modules to add the device.

   Before you select OK, select Inhibit Module in the IO-Link device Module Properties > Connection view.
6. In the IO-Link device Module Properties > Configuration view, perform Device Correlation Check, select "Use Device Values", and select Apply. The preconfigured device configuration is backed up to the project.
7. In the IO-Link device Module Properties > Connection view, clear the Inhibit Module checkbox and select Apply. Data Storage is enabled on the IO-Link port.
8. When the connection is running, perform a Device Correlation Check. If there are differences, it means that the Data Storage copy in the IO-Link master module has overwritten the configuration in the device. Inhibit the device, perform Device Correlation Check again, select "Use Project Values", and select Apply to restore the preconfigured device configuration to the device. After successfully restoring the device configuration, the preconfigured device configuration is automatically backed up to the IO-Link master module.

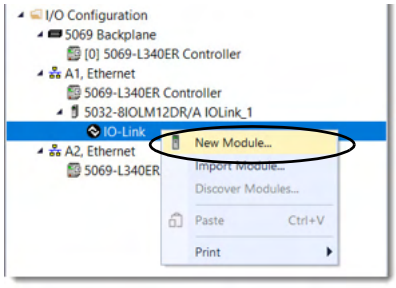
Add a Generic IO-Link Device

When you use a generic IO-Link device profile, note the following:

- The Data Storage mode and the Device Correlation features are not supported.
- You cannot change or read the generic IO-Link device's parameter values through the Module Properties window. Instead, you must send message instructions to the IO-Link Device Parameter object.
- The process data tags for input and output support up to 32 bytes of raw data.

To add a device using the generic IO-Link device profile, complete these steps.

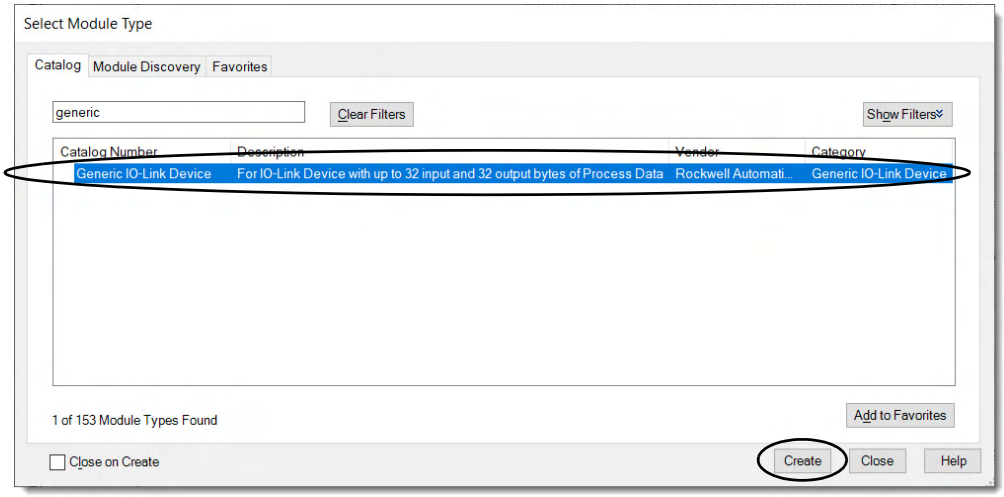
1. In the I/O Configuration tree, right-click the IO-Link bus and select New Module.



The Select Module Type dialog appears.

2. Select Generic IO-Link Device and select Create.

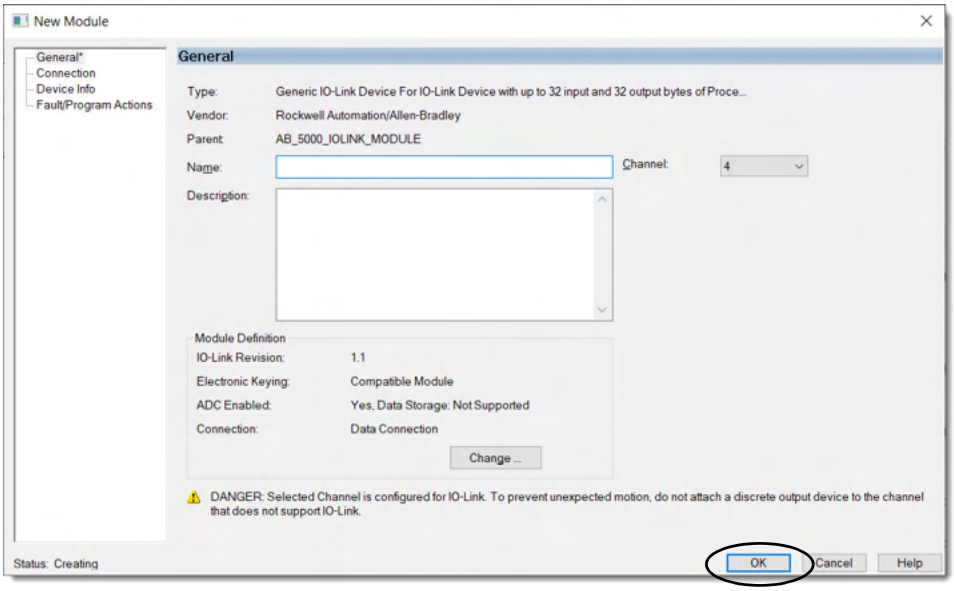
To narrow down the list of devices, use the filters or search with keywords.



The New Module window appears and shows the General view.

3. Enter a Name for the device.

If you want to configure the other settings during this step, see Edit the IO-Link Device Properties on page 83 for more information.



4. Select OK to save the configuration.

Edit the IO-Link Device Properties

After you have added the IO-Link device to your project, you can use the different views in the device Module Properties window to change the device properties.

The following views for the IO-Link device are described in this section.

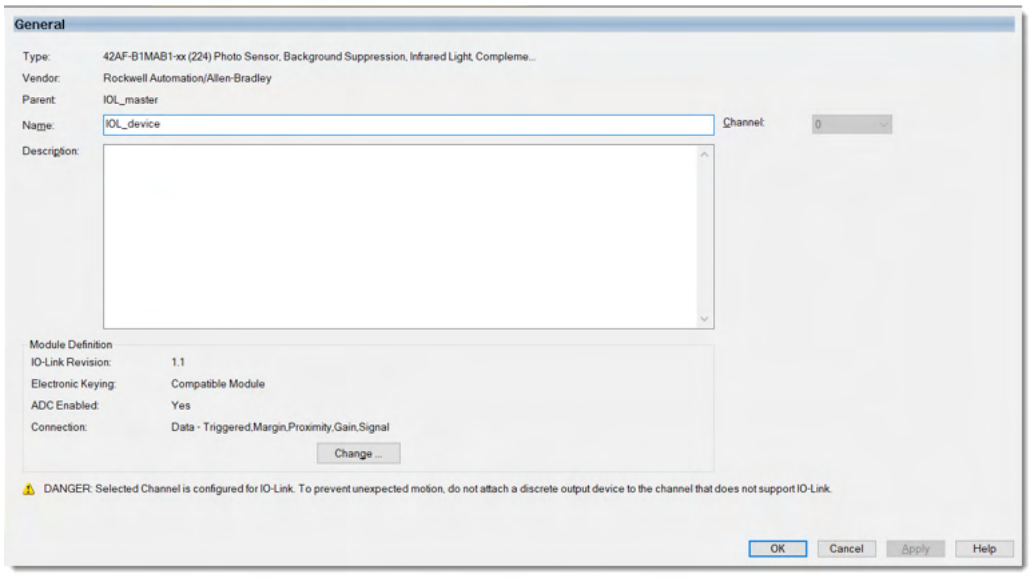
- General View
- Connection View
- Device Info View
- Configuration View
- Parameters View
- Fault/Program Action View
- Event Log View

General View

The General view appears first when you create an IO-Link device.

Use this view to complete the following tasks:

- Name the device.
- Describe the device.
- Change the Channel number.
- Access the Module Definition.



Module Definition

Module Definition parameters are accessed from the General view of the Module Properties window.

Table 20 describes the Module Definition parameters for IO-Link devices.

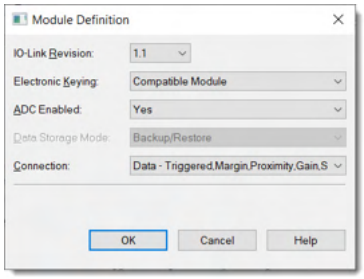


Table 20 - IO-Link Device Module Definition Parameters

Parameter	Definition	Available Choices
IO-Link Revision	Device IO-Link protocol revision You can switch between IO-Link revision 1.0 and 1.1 if the IODD for both revisions is registered.	• 1.0 • 1.1
Electronic Keying	Software method by which you reduce the possibility of using the wrong device in a control system For more information, see IO-Link Device Electronic Keying on page 37.	• Compatible Module • Disable Keying • Exact Match (1)
Firmware Revision	Device firmware revision This control is enabled only when you configure Electronic Keying as Exact Match.	Device-specific
ADC Enabled	When ADC is enabled, it is used to back up and restore the device configuration. For more information, see Automatic Device Configuration on page 37.	• Yes • No
Data Storage	When ADC is disabled and the device supports Data Storage, you can configure either to use Data Storage Backup/Restore or to disable Data Storage on the port. For more information, see Data Storage on page 38.	• Backup/Restore • Disabled • Not Supported
Connection	When the device is attached to an IO-Link (non-Fallback) channel, determines which set of process data to use if the device supports multiple sets. Only "Data" is available if the device only supports one set of process data. When the device is attached to a Fallback channel, you must select "None - Fallback" as the connection type. For more information, see IO-Link Device Connection on page 36.	Device-specific

(1) This option is available only when the Rockwell Automation IO-Link device supports Exact Keying.

In online mode, only the Electronic Keying parameter can be changed.

Connection View

Use this view to complete the following tasks:

- Set the RPI rate.

  All IO-Link devices that are attached to the same IO-Link master module share the same RPI. If the RPI for one device is changed, the RPI for all other devices under the same IO-Link master module are also changed.

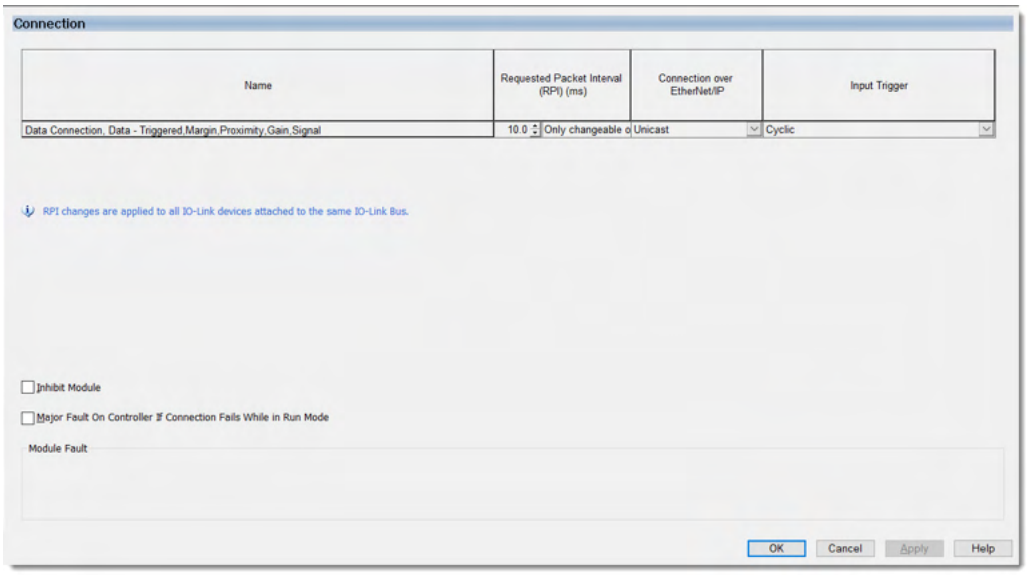
  For more information about RPI, see Requested Packet Interval on page 15.
- Set the connection type to use on the EtherNet/IP network.

  For more information on unicast and multicast connections, see the following:

  - Connection Over an EtherNet/IP Network on page 57
  - Ethernet Reference Manual, publication ENET-RM002.
- Inhibit the device. For more information on inhibiting the device, see IO-Link Device Inhibiting on page 36.
- Configure whether a connection failure while the controller is in Run mode causes a major or minor fault.

The Module Fault area of the Connection view is useful for troubleshooting. For more information on the Module Fault area, see page 101.

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

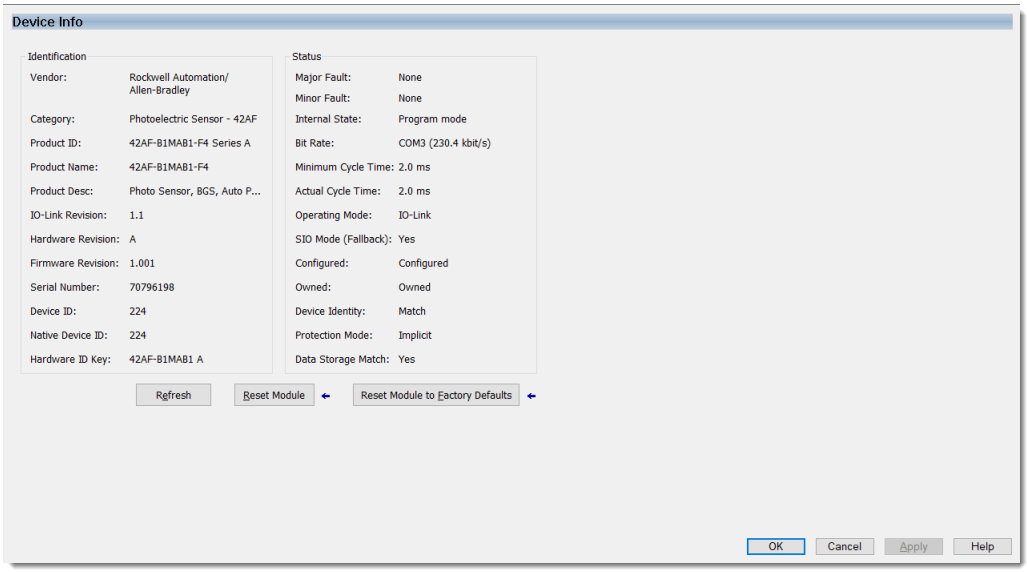


Device Info View

The Device Info view displays device and status information about the device when the project is online and lets you reset the module.

Use this view to complete the following tasks during configuration:

- Determine the identity of the device.
- Monitor the Status of the device.
- Refresh the data on the screen.
- Reset the device.
- Reset the device to Factory Defaults.



WARNING: If *StdDirectVariableRef* or *DirectParameterOverly* is present in the device IODD, the device might not return an error if the device does not support or cannot execute the reset command.

Configuration View

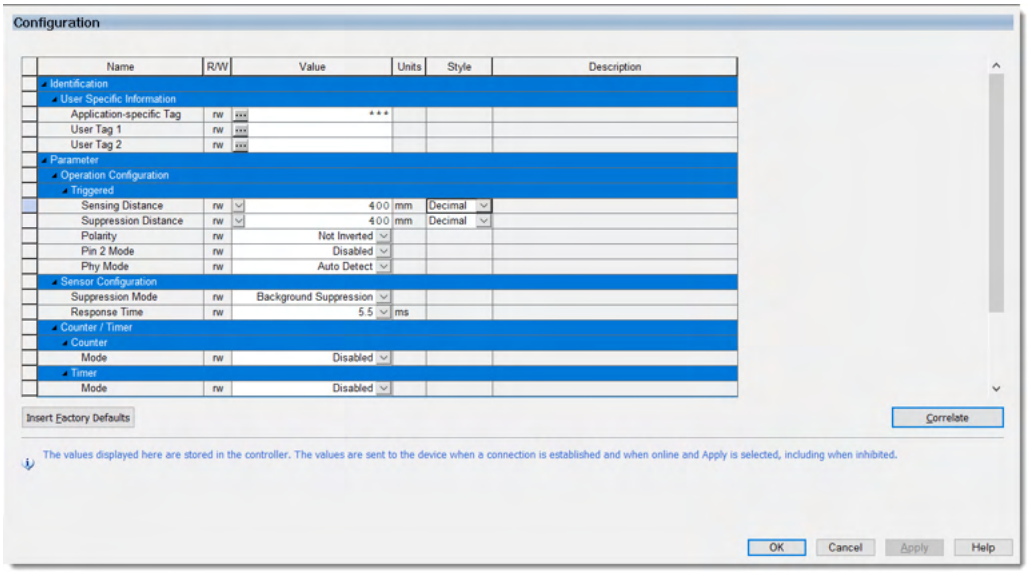
The Configuration view displays only the configuration parameters and their project values. For more information, see IO-Link Device Parameters Classification on page 39.

This view is not available for the generic IO-Link device profile.

Use the Configuration view to view the project values of the device configuration and change the device configuration.

Use Insert Factory Default to revert project values of all configuration parameters to the default values that are defined in the IODD. In offline mode, the values are only saved to the project when you select Apply or OK. In online mode, the values are saved to the project and applied to the device when you select Apply or OK, regardless of whether the device is inhibited or uninhibited.

If ADC is disabled, you can only use this view after a successful Device Correlation Check is performed and the project values and device values are synchronized.



You should verify all device configurations before applying the configurations to the device.

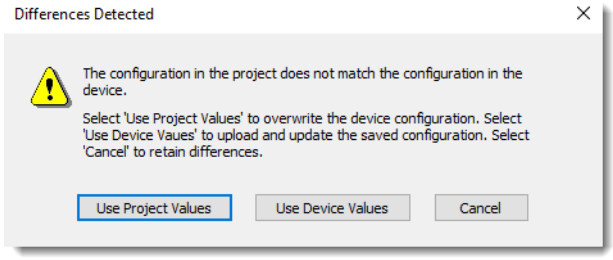
WARNING: After changing a measurement unit, you must verify that all configuration parameters that use this measurement unit have appropriate values before applying the configuration to the device.

IMPORTANT After applying the configuration, we strongly recommend using Device Correlation Check to verify that the values in the device match the configured values. If there are any differences, see Troubleshoot Your IO-Link Device on page 107.

WARNING: If *StdDirectVariableRef* or *DirectParameterOverly* is present in the device IODD, the device might not return an error if the device is not able to Get/Set a parameter. Use Device Correlation Check or the Parameters view to verify that the values in the device match the configured values.

Device Correlation Check

Device Correlation Check triggers when you select Correlation or when the Configuration view is selected while ADC is disabled. If a difference is detected, the following message prompt appears.



You can decide which values (device or project) to use and apply the selected values to resolve conflicts.

- If you select "Use Project Values", the current project values are saved to the project and immediately applied to the device, regardless of whether the device is inhibited or uninhibited.
- If you select "Use Device Values", the values of the configuration parameters replace the project values. Select Apply to save the values to the project or Cancel to revert to the original project values.

IMPORTANT After you select "Use Device Values", you must select Apply to save the new values into the project.

Parameters View

The Parameters view displays all device parameters and their device values. Information in this view is only populated when the project is online.

This view is not available for the generic IO-Link device profile.

Use Insert Factory Defaults to revert the read/write values of all non-configuration parameters to the default values that are defined in the IODD.

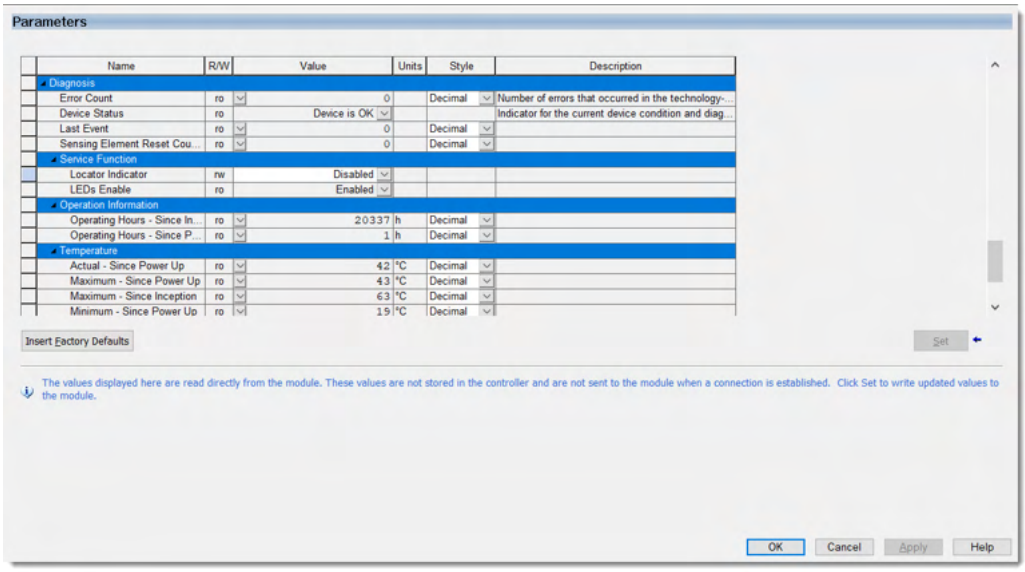
Use this view to complete the following tasks:

- View device values of all device parameters.

  Although you cannot change configuration parameters of the device in this view, you can verify their actual values. Use the Configuration view to change the values of configuration parameters.
- Change non-configuration read/write parameters.

  The new values are only set to the device when you select Set.

  For more information, see IO-Link Device Parameters Classification on page 39.
- Perform a command that is supported by the device by selecting the associated button.

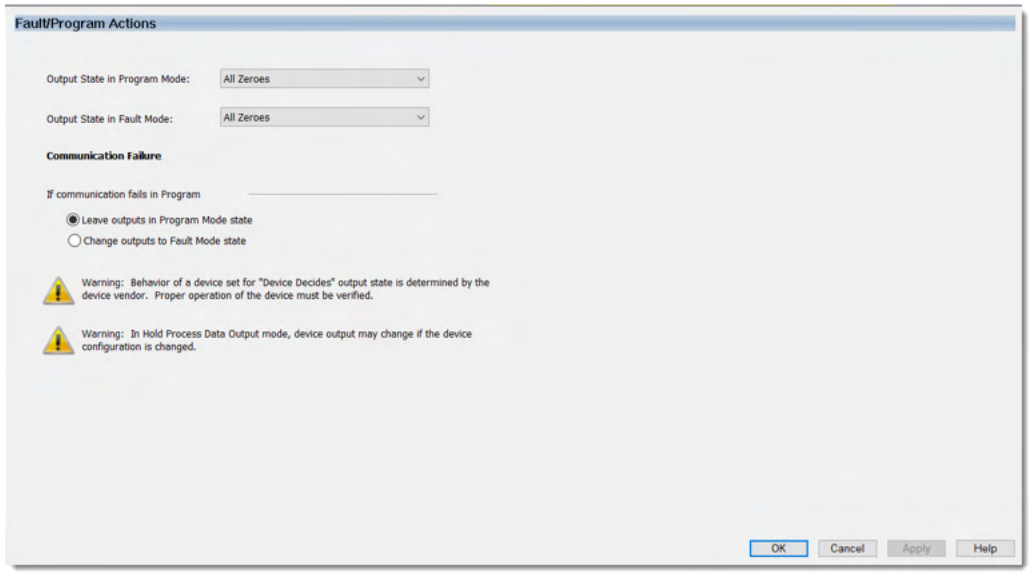


If the device is attached to an IO-Link (non-Fallback) channel, you cannot set parameters or execute commands on the device when the device is uninhibited. You can still view the parameters of the device.

If the device is attached to a Fallback channel, this view is disabled when the device is uninhibited.

Fault/Program Action View

The Fault/Program Action view lets you configure what IO-Link output process data is written to the device when the device is in Program mode, inhibited, or the connection is faulted.



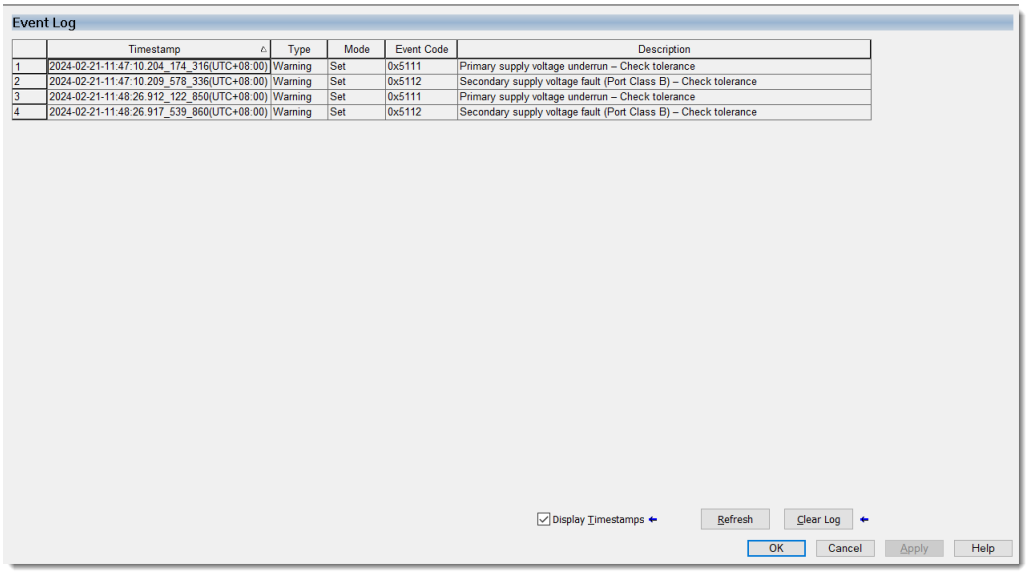
This view is available only for devices that support output process data.

Event Log View

The Event Log view displays the reported events that are stored in the event log of the device.

Use this view to complete the following tasks:

- Choose whether to display timestamps for the events.
- Refresh the data on the screen.
- Clear the event log.



Replace IO-Link Devices

In the following scenarios, you do not have to perform additional steps other than to replace the physical device itself.

- When ADC is enabled, the device configuration is restored from the controller to the device when device connection is established.
- When ADC is disabled, Data Storage Backup / Restore is enabled, and the replacement device is in factory default or out-of-box state, the device configuration is restored from the IO-Link master module to the device automatically when the device is attached to the port.

IMPORTANT The prerequisite to help ensure that the above scenario "Replacing a device when ADC is disabled" works is that the latest device configuration is saved in the IO-Link master module and verified by checking the Data Storage Match parameter in the Device Info view of the old device when it was running in operation.

If your scenario does not fall into the above, see the following sections for additional steps.

- Prerequisite Steps
- Replace a Device with ADC Disabled and DS Not Supported or Disabled
- Replace with a Used Device when ADC Disabled and DS Backup/ Restore Enabled
- Replace a Device on a Fallback Channel
- Replace with a Used Master Module when any Device DS Backup/Restore Enabled and ADC Disabled
- Replace a Master Module and Devices with Device ADC Disabled

Prerequisite Steps

To help ensure that replacing an IO-Link device is successful in the following scenarios, first back up the device configuration to the project in advance by completing these steps.

1. While the old device is attached to the port of the IO-Link master module, go online with your project.
2. In the IO-Link device Module Properties > Configuration view, perform Device Correlation Check.
3. If there are differences, select "Use Device Values" to back up the device configuration to the project.

Replace a Device with ADC Disabled and DS Not Supported or Disabled

Verify that you have completed the procedure as described in Prerequisite Steps on page 91.

To replace a device in this scenario, complete these steps.

1. Replace the physical device.
2. Go online with your project.
3. In the IO-Link device Module Properties > Configuration view, perform Device Correlation Check and select "Use Project Values" to download the configuration to the replacement device.

If the device configuration that is saved in the project is outdated, you must manually configure the replacement device.

Replace with a Used Device when ADC Disabled and DS Backup/ Restore Enabled

Verify that you have completed the procedure as described in Prerequisite Steps on page 91.

To replace a device in this scenario, complete these steps.

1. Replace the physical device.
2. Go online with your project.
3. In the IO-Link device Module Properties > Configuration view, perform Device Correlation Check and select "Use Project Values" to download the configuration to the replacement device.

If the device configuration that is saved in the project is outdated, but the device Data Storage copy in the IO-Link master module is up to date, complete these steps to replace the device.

1. Go online with your project.
2. While the IO-Link master module is uninhibited, in the IO-Link master Module Properties > Channel XX view, select the Disable Channel checkbox and select Apply.

   IMPORTANT You must perform this step to disable the Data Storage Backup/ Restore feature on the port temporarily while you replace with a used device.

   This step is to help prevent the configuration of the used device from overwriting the device configuration that is saved in the IO-Link master module.

3. While the IO-Link master module is uninhibited, in the IO-Link master Module Properties > Channel XX view, clear the Disable Channel checkbox and select Apply.
4. In the IO-Link device Module Properties > Connection view, select the Inhibit Module checkbox and select Apply.
5. Replace the physical device.

6. In the IO-Link device Module Properties > Device Info view, select Reset Module to Factory Default.
7. In the IO-Link device Module Properties > Connection view, clear the Inhibit Module checkbox and select Apply.

   Data Storage Backup/Restore is enabled on the port when connection is established and the device configuration that is stored in the IO-Link master module is downloaded to the replacement device.

Replace a Device on a Fallback Channel

WARNING: Before you replace a device that is assigned to a Fallback channel, you must first inhibit the device.

To replace a device on a Fallback channel, complete these steps.

1. Go online with your project.
2. In the IO-Link device Module Properties > Connection view, select the Inhibit Module checkbox and select Apply.
3. Follow the steps that are described in the other scenarios that apply to your device.
4. After you have completed those steps, in the IO-Link device Module Properties > Connection view, clear the Inhibit Module checkbox and select Apply.

Replace with a Used Master Module when any Device DS Backup/ Restore Enabled and ADC Disabled

To replace an IO-Link master module in this scenario, complete these steps.

1. In the IO-Link master Module Properties > Connection view, select the Inhibit Module checkbox and select Apply.
2. Replace the IO-Link master module.
3. In the IO-Link master Module Properties > XX - IO-Link view, select Disable and Delete Data Storage to delete the IO-Link storage. Repeat this step for all IO-Link channels.

   IMPORTANT You must clear all local Data Storage copies to prevent the device configurations from being overwritten by the Data Storage in the used IO-Link master module.
4. In the IO-Link master Module Properties > Connection view, clear the Inhibit Module checkbox and select Apply.

   The device configurations are backed up to the replacement IO-Link master module when device connections are established.

Replace a Master Module and Devices with Device ADC Disabled

Verify that you have completed the procedure as described in Prerequisite Steps on page 91.

To replace an IO-Link master module and all IO-Link devices in this scenario, complete these steps.

1. In the IO-Link master Module Properties > Connection view, select the Inhibit Module checkbox and select Apply.
2. Replace the IO-Link master module and IO-Link devices.
3. In the IO-Link device Module Properties > Configuration view, perform Device Correlation Check and select “Use Project Values”.

   Repeat this step for all IO-Link devices with ADC disabled.

4. In the IO-Link master Module Properties > Connection view, clear the Inhibit Module checkbox and select Apply.

Adjust Device Configuration After Replacement

After you have successfully replaced an IO-Link device, you can adjust the device configuration with one of the following methods.

- Use the Configuration view in the IO-Link device Module Properties.
- If ADC is enabled for the IO-Link device, you can change the configuration tag values and apply the reconfigure instruction from the ladder program.
- Send connected explicit messages from the controller ladder program to change the device configuration and use the *ParamDownloadStore* command (index 02, value 0x05) to trigger a back up to the IO-Link master module. For more information, see Data Storage on page 38.
- Use the physical controls on the IO-Link device.

After Adjusting the Device Configuration

After you have adjusted your IO-Link device configuration, do the following:

- Perform Device Correlation Check and select "Use Device Values".

  IMPORTANT If ADC is enabled and the adjustments are not performed in the IO-Link master Module Properties or through the configuration tags, it is necessary to perform a Device Correlation Check and select "Use Device Values". Otherwise the new configuration is lost when the connection is dropped and reopened for any reason.

- If the device supports Data Storage, check the Data Storage Match parameter in the Device Info view to verify if the Data Storage copy in the IO-Link master module is synchronized to the device. It may take up to a minute for the status to be updated.

  If the Data Storage copy is not synchronized, see Data Storage Match on page 111 for troubleshooting steps.

Clone/Duplicate a Machine

In the Studio 5000 Logix Designer application, configurations for all IO-Link devices in a system can be saved into one project file (.ACD).

The IO-Link device configuration values are saved when ADC is enabled, or when ADC is disabled but Device Correlation Check has been performed.

With one ACD file, you can manage and replicate an entire project onto another system with the same physical setup by downloading the identical configuration to the controller and devices.

You can also use the ACD file to recover the configuration data for your IO-Link devices.

To help ensure that your ACD file contains the latest IO-Link device configuration values, complete these steps.

1. Go online with your project.
2. In the IO-Link device Module Properties > Configuration view, perform Device Correlation Check.
3. Select either "Use Project Values" or "Use Device Values" as appropriate and select Apply.
4. Repeat these steps for each device in your system configuration.
5. After you have synchronized the configuration data for all your devices, save the project.

Use Explicit Messages to Read and Write IO-Link Device Parameters

You can use message instructions to read from and write to IO-Link device parameters.

The data in the controller is big endian, whereas the data of the IO-Link devices is little endian. If any of the data is larger than one byte, then reverse the byte order with a swap byte command with order mode set to 'reverse' to get the correct values.

In Protection Mode, the messages should have the 'Connected' checkbox selected. You do not need to cache the messages. If the 'Connected' checkbox is not selected, the messages may fail with a connection error.

With firmware revision 2.011 or later, the IO-Link master module supports two vendor-specific services in the IO-Link Service Parameter object.

Table 21 - Vendor-specific Services for IO-Link Service Parameter Object

Service Code	Service Name	Description
0x32	Raw_Get	This service behaves the same as Raw_Get_Single if the application path in the request contains a nonzero Attribute ID. Otherwise it behaves the same as Raw_Get_All.
0x33	Raw_Set	This service behaves the same as Raw_Set_Single if the application path in the request contains a nonzero Attribute ID. Otherwise it behaves the same as Raw_Set_All.

Read from the IO-Link Device

This example uses the Raw_Get (0x32) service in the IO-Link Service Parameter object and requires firmware revision 2.011 or later.

To read parameters from the IO-Link device, complete these steps.

1. Create a message instruction and the message tag.
2. Create the associated destination tag of the correct data types for the IO-Link data. You can also use an array.
3. Open the Message Configuration dialog and enter the following information in the Configuration tab.
   - Service Type = Custom
   - Service Code = 0x32 (hex)
   - Class = 0x10B (hex)
   - Instance = IO-Link index number

     For IO-Link index 0, the instance is represented as 0x10000, since CIP Instance 0 is used to address class attribute.
   - Attribute = 0 or the IO-Link subindex number (hex)
   - Source Element = Leave blank
   - Source Length = 0
   - Destination Element = The tag to hold the subindex data
4. On the Communication tab, select the path to the IO-Link device.
5. Select OK. The message is now configured and ready to use.

   If any element of the return data is larger than one byte, you must reverse the byte order of the element.

Write to the IO-Link Device

This example uses the Raw_Set (0x33) service in the IO-Link Service Parameter object and requires firmware revision 2.011 or later.

To write parameters to the IO-Link device, complete these steps.

1. Create a message instruction and the message tag.
2. Create the associated destination tag of the correct data types for the IO-Link data. You can also use an array.
3. Open the Message Configuration dialog and enter the following information in the Configuration tab.
   - Service Type = Custom
   - Service Code = 0x33 (hex)
   - Class = 0x10B (hex)
   - Instance = IO-Link index number

     For IO-Link index 0, the instance is represented as 0x10000, since CIP Instance 0 is used to address class attribute.
   - Attribute = 0 or the IO-Link subindex number (hex)
   - Source Element = The tag that holds the data for the desired subindex
   - Source Length = The number of bytes of data in the source tag
   - Destination Element = Leave blank
4. On the Communication tab, select the path to the IO-Link device.
5. Select OK. The message is now configured and ready to use.

   If any element of the return data is larger than one byte, you must reverse the byte order of the element.

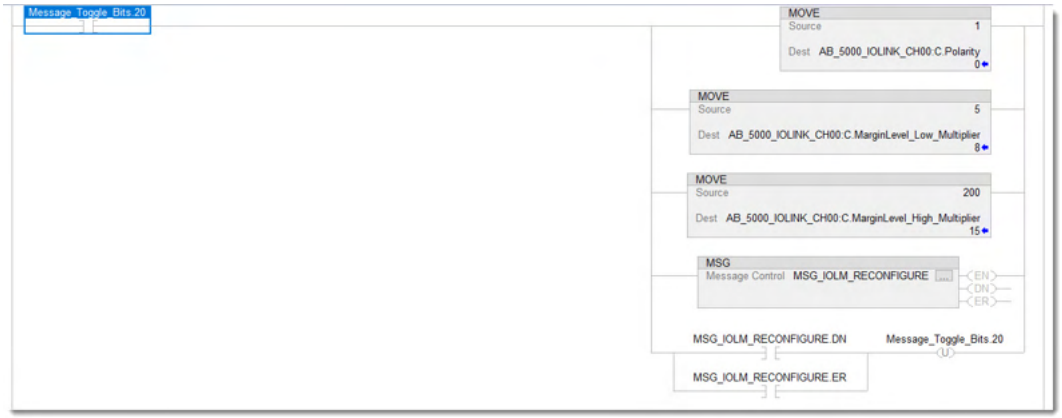
When a controller is connected to the IO-Link master module, you must select the 'Connected' checkbox to write parameters with message instructions. If the 'Connected' checkbox is not selected, the messages may fail with a connection error. This error occurs because the controller owns the module, which is in Protection Mode, and does not allow external changes.

Verify that the parameter you want to write to is writable. Parameters can be read-only, write-only, or read and write.

For more information on the vendor-specific services in the IO-Link Service Parameter object, see Execute IO-Link Commands Through Explicit Messaging on page 43

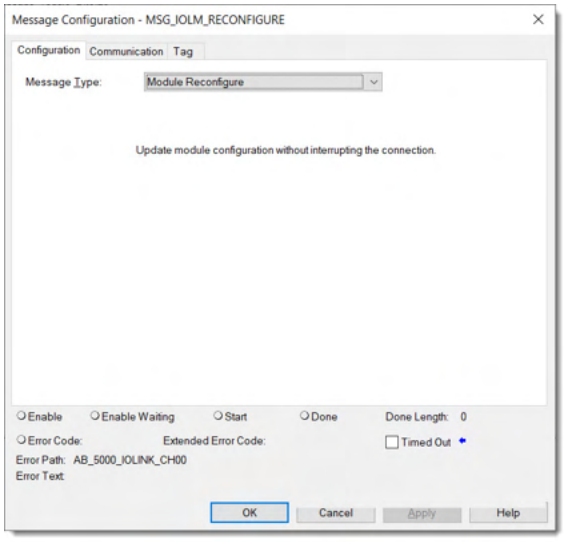
Configure IO-Link Device through Configuration Tags

You can use instructions in your ladder program to change the values of configuration tags of an IO-Link device. Then use a message configuration instruction to write the values to the device tags.

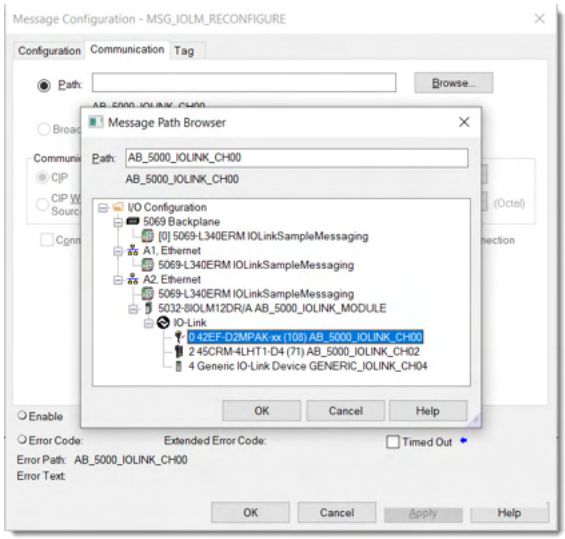


This example shows you how to configure your IO-Link Device through the configuration tags.

1. Create instructions to change the values of the device configuration tags.
2. On the last rung, add a message instruction and open the Message Configurator dialog.
3. On the Configuration tab, select Module Reconfigure as the Message Type.



4. On the Communication tab, select Browse, then select the device and select OK.



5. Select OK again to close the Message Configuration dialog.
6. Download the project to the controller and verify that the program works.

Reset IO-Link Device to Factory Default

When you reset an IO-Link device to factory default, all parameters are reset to their default values.

To reset an IO-Link device to factory default, complete these steps.

1. In the IO-Link device Module Properties > Device Info view, select Reset Module to Factory Default.
2. Select Apply.

Troubleshoot Your IO-Link Master Module

This appendix describes how to identify and troubleshoot issues with your ArmorBlock 5000 8-channel IO-Link master module.

Module Status Indicator

Table 22 describes the module status indicator for the ArmorBlock 5000 8-channel IO-Link master module.

Table 22 - Module Status Indicator

Indicator State	Description	Recommended Action
Off	The module is not powered.	Apply power as necessary.
Steady green	The module is operating in a normal condition.	None
Flashing green	The IP address is not set.	Set the IP address using one of the recommended methods. For more information, see Configure the IO-Link Master Module on page 47.
Steady red	The module experienced a nonrecoverable fault.	Cycle power to the module. If the fault persists, replace the module.
Flashing red	One of the following conditions exists: • A module firmware update is in progress. • IP address switches do not match the configuration in use. • The device has a recoverable fault. See the module diagnostics for more information. • The module has powered up and is in the Factory Default state. In this case, all other indicators flash red and green.	Complete one of the following: • Wait for the firmware update to finish. • Cycle power to the module. • Use module as necessary.
Flashing red/green	The module is performing a POST (power on self test), which completes within 30 seconds.	None

Network Status Indicator

Table 23 describes the network status indicator for the ArmorBlock 5000 8-channel IO-Link master module.

Table 23 - Network Status Indicator

Indicator State	Description	Recommended Action
Off	The module is not configured or does not have an IP address.	Configure the module or assign an IP address.
Steady green	The module has an IP address and at least one established active connection.	None
Flashing green	The module has an IP address, but no active connections are established.	Establish connections as required by the project.
Steady red	There is a duplicate IP address condition or invalid configuration.	Troubleshoot the issue and remedy the cause. For example, if a duplicate IP address condition exists, determine which devices on the network use the same IP address and change the IP address to unique values.
Flashing red	One or more connections have timed out.	Use module as necessary.

Link Status Indicator

Table 24 describes the link status indicator for the ArmorBlock 5000 8-channel IO-Link master module.

Table 24 - Link 1 and Link 2 Status Indicator

Indicator State	Description	Recommended Action
Off	One of the following conditions exists: • The module is not powered. • The Ethernet cables are not properly seated in the module and connected devices. • No link has been established. • The port is administratively disabled. • The port configuration is configured in a manner that can result in issues. For example, the port can be configured to Autonegotiate and the port at the other end of the cable is configured such that Autonegotiate is disabled.	Complete one of the following: • Apply power as necessary. • Verify that the cables are properly seated in the module and connected devices. • Check if the port is disabled in the Studio 5000 Logix Designer application and confirm if that is the desired state. • Check the configuration for the links at both ends of the cable and verify that they are correct to perform normal operations.
Steady green	Link has been established on the indicated port at 100 Mbps.	None
Flashing green	Link activity exists on the indicated port at 100 Mbps.	None
Steady yellow	Link is established on the indicated port at 10 Mbps.	None
Flashing yellow	Link activity exists on the indicated port at 10 Mbps.	None

Power Status Indicator

Table 25 describes the MSA power and Table 26 describes the LA power status indicator for the ArmorBlock 5000 IO-Link master module.

Table 25 - MSA Power Status Indicator

Indicator State	Description	Recommended Action
Off	There is no MSA power.	Apply power as necessary.
Steady green	MSA power is within the valid range of 18...30V.	None
Flashing red	MSA power is outside the valid range of 18...30V.	Verify that the power supply meets the module specifications.

Table 26 - LA Power Status Indicator

Indicator State	Description	Recommended Action
Steady green	LA power is within valid range of 18...30V.	None
Flashing red	One of the following conditions exists: • There is no LA power. • LA power is outside the valid range of 18...30V.	Complete one of the following: • Apply power as necessary. • Verify that the power supply meets the module specifications.

Channel Status Indicator

Table 27 describes the channel status indicator for the ArmorBlock 5000 IO-Link master module.

Table 27 - Channel Status Indicator

Channel Mode	Indicator State	Description	Recommended Action
DI	Off	The input is off.	None
	Steady yellow	The input is on.	None
	Flashing red	Short circuit condition or SA power on the port is faulted.	Correct the short circuit condition or SA power fault.
DO	Off	The output is off.	None
	Steady yellow	The output is on.	None
	Flashing red	No Load (if No Load Diagnostic is enabled) or output short circuit condition exists, or power on the port is faulted.	Correct the No Load or output short circuit condition, or power fault.
IO-Link	Off	Not applicable	None
	Steady yellow	IO-Link communication is established between the IO-Link master module and IO-Link device.	None
	Flashing yellow	No IO-Link device is attached to the port or IO-Link communication is not established.	Disconnect and reconnect the IO-Link device.
	Flashing red	CQ line short circuit or short circuit condition exists, or SA power on the port is faulted.	Correct the CQ line short circuit or short circuit condition, or SA power fault.

Table 27 - Channel Status Indicator (Continued)

Channel Mode	Indicator State	Description	Recommended Action
Fallback	Off	The input is off when the device is operating in standard I/O mode.	None
	Steady yellow	One of the following conditions exists: • The input is on when the device is operating in standard I/O mode. • IO-Link communication is established between the IO-Link master module and device when the device is operating in IO-Link mode.	None
	Flashing yellow	No IO-Link device is attached to the port or IO-Link communication is not established.	Disconnect and reconnect the IO-Link device.
	Flashing red	CQ line short circuit or short circuit condition exists, or SA power on the port is faulted.	Correct the CQ line short circuit or short circuit condition, or SA power fault.

Troubleshoot Wiring Issues

Table 28 describes the possible faults that can occur due to incorrect usage or when wiring the ArmorBlock 5000 8-channel IO-Link master module.

Table 28 - Possible Faults due to Incorrect Usage or Wiring

System/Function	Fault	Description	Recommended Action
Power Port			
POWER IN	Lower/higher voltage input used.	Module unable to operate. Next module in daisy chain unable to operate.	Complete the following steps: 1. Verify that the system is powered. 2. Verify that the POWER Input is within the operating voltage range.
POWER OUT Used to provide power to another daisy chained module as input to POWER IN.	Unable to provide enough power.	Module unable to operate. Next module in daisy chain unable to operate.	Complete the following steps: 1. Verify that the system is powered. 2. Verify that all modules in the daisy chain receive sufficient power. 3. Verify that the power passing through the daisy chain is within the specifications of the module.
POWER IN	Reversed polarized power input used.	Module unable to power up. No damage is caused to module.	Complete the following steps: 1. Verify that the system is powered. 2. Verify that the power cable wiring is installed properly.
I/O Port			
Configurable I/O	Configured as output but wired as input. Two operating outputs are joined.	Module operates. However, a fault is reported if excess current is drawn from the module due to the difference in potentials and the affected channel switches off.	Complete the following steps: 1. Verify that the cable is installed properly. 2. Check the channel status indicators. If the indicator is showing flashing red, confirm that the I/O cable is installed properly.

Use the Studio 5000 Logix Designer Application for Troubleshooting

The Studio 5000 Logix Designer application indicates the presence of fault conditions.

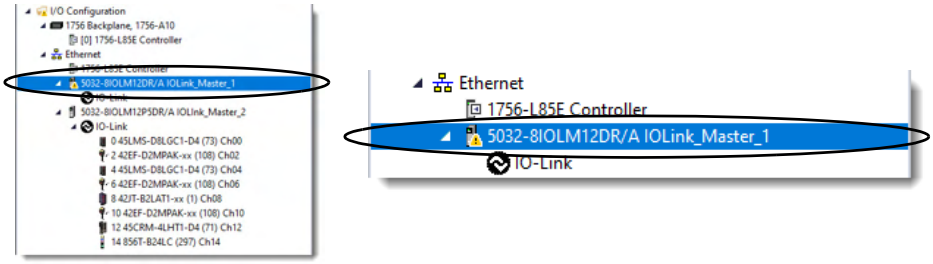
Fault conditions are reported in the following ways:

- Warning Signal in the I/O Configuration Tree
- Status and Fault Information in Module Properties
- Diagnostics in Studio 5000 Logix Designer Application
- Studio 5000 Logix Designer Application Tag Editor

Warning Signal in the I/O Configuration Tree

As shown in Figure 4, a warning icon appears in the I/O Configuration tree when a fault occurs.

Figure 4 - Warning Icon in I/O Configuration Tree



Status and Fault Information in Module Properties

The Module Properties window in the Studio 5000 Logix Designer application includes a series of views for the IO-Link master module. The numbers and types of views depend on the module configuration.

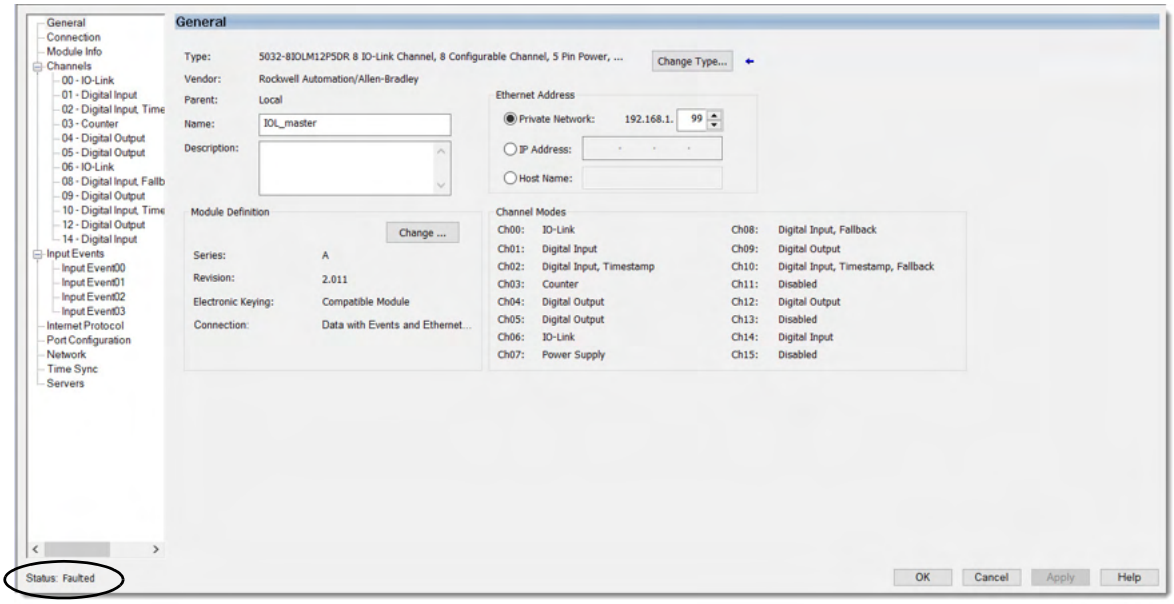
Each view includes options to configure the module or monitor the status of the module. The following are ways to monitor the state of a module for faults:

- Module Status on Module Properties Window
- Module Fault Descriptions on Connection View
- Module Fault Information and Diagnostics on Module Info View

Module Status on Module Properties Window

Figure 5 shows where the status of a module is indicated on the Module Properties window.

Figure 5 - Fault Message in Status Line



Module Fault Descriptions on Connection View

Figure 6 shows where a module fault description, which includes an error code that is associated with the specific fault type, is indicated on the Connection view.

Table 29 describes the special connection error code for the ArmorBlock 5000 8-channel IO-Link master module.

Figure 6 - Fault Description with Error Code

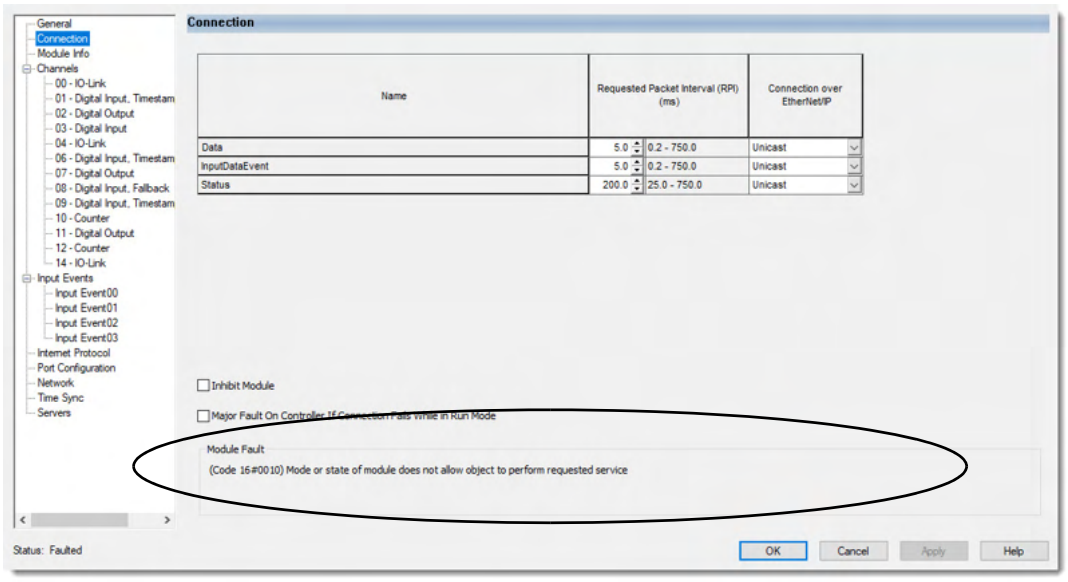


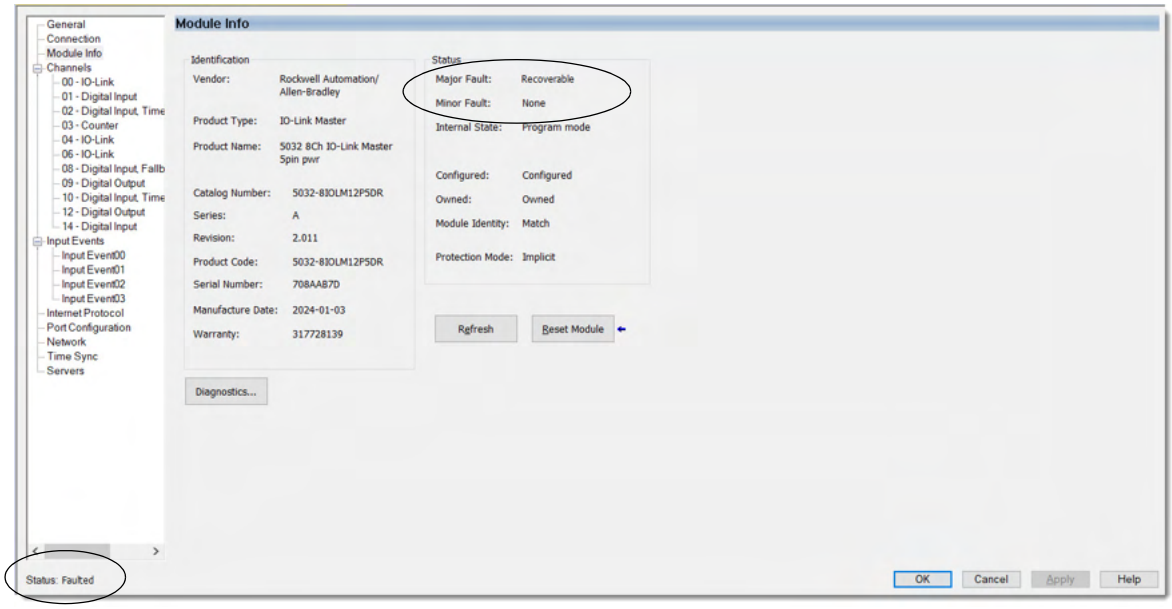
Table 29 - Special Connection Error Code for IO-Link Master Module

Code	Description	Recommended Action
16#033A	This error is returned when the connection configuration for an IO-Link master module tries to enable the auxiliary power of a Class B IO-Link actuator but the actuator is the regular output operation state.	Complete the following steps: 1. In the IO-Link master Module Properties > General > Module Definition, clear the IO-Link Class B Enabled checkbox that corresponds to the channel that the Class B IO-Link actuator is connected to and select OK. 2. In the IO-Link master Module Properties > XX - IO-Link view, select the Disable Channel checkbox and select Apply to send the configuration to the IO-Link master module. You should see the module connection status as 'Running'. 3. In the IO-Link master Module Properties > General > Module Definition, select the IO-Link Class B Enabled checkbox that corresponds to the channel that the Class B IO-Link actuator is connected to and select OK. 4. In the IO-Link master Module Properties > XX - IO-Link view, clear the Disable Channel checkbox and select Apply to send the configuration to the IO-Link master module.

Module Fault Information and Diagnostics on Module Info View

Figure 7 shows where the major and minor fault information, and where to access module diagnostic information are indicated on the Module Info view.

Figure 7 - Major and Minor Fault Information and Diagnostic



Diagnostics in Studio 5000 Logix Designer Application

You can use diagnostics in the Studio 5000 Logix Designer application to monitor the module and/or channel operating conditions and to troubleshoot issues that affect a module and/or channel. You can use diagnostics only when the project is online.

The following are the different diagnostics that you can monitor:

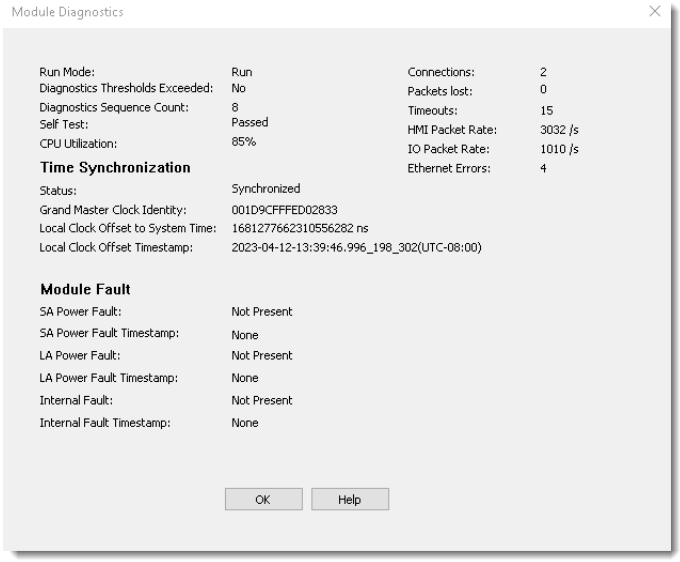
- Module Diagnostics
- Port Diagnostics
- Channel Diagnostics

Module Diagnostics

Figure 8 shows the Module Diagnostics, which provides information on a module-wide basis.

To access the Module Diagnostics, see Module Info View on page 58.

Figure 8 - Module Diagnostics

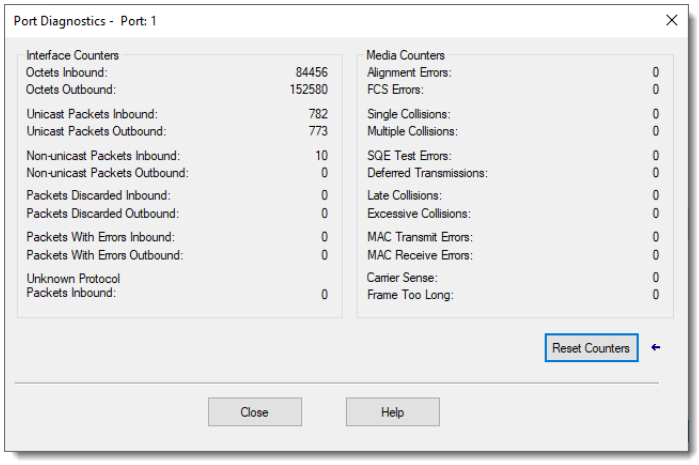


Port Diagnostics

Figure 9 shows the Port Diagnostics, which provide information on an individual port basis.

To access the Port Diagnostics, see Port Configuration View on page 66.

Figure 9 - Port Diagnostics

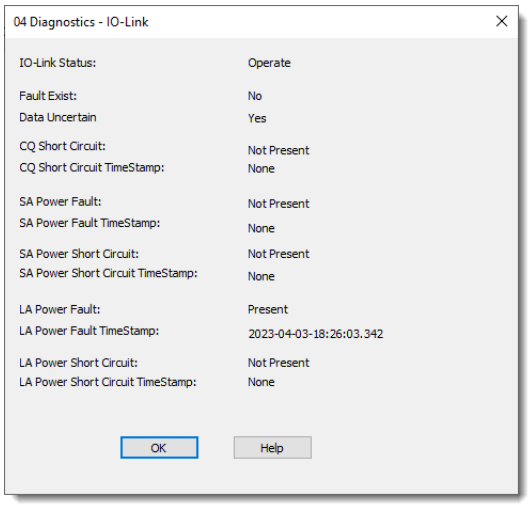


Channel Diagnostics

Figure 10 shows the Channel Diagnostics, which provide information on an individual channel basis.

To access the Channel Diagnostics, see Channels View on page 58.

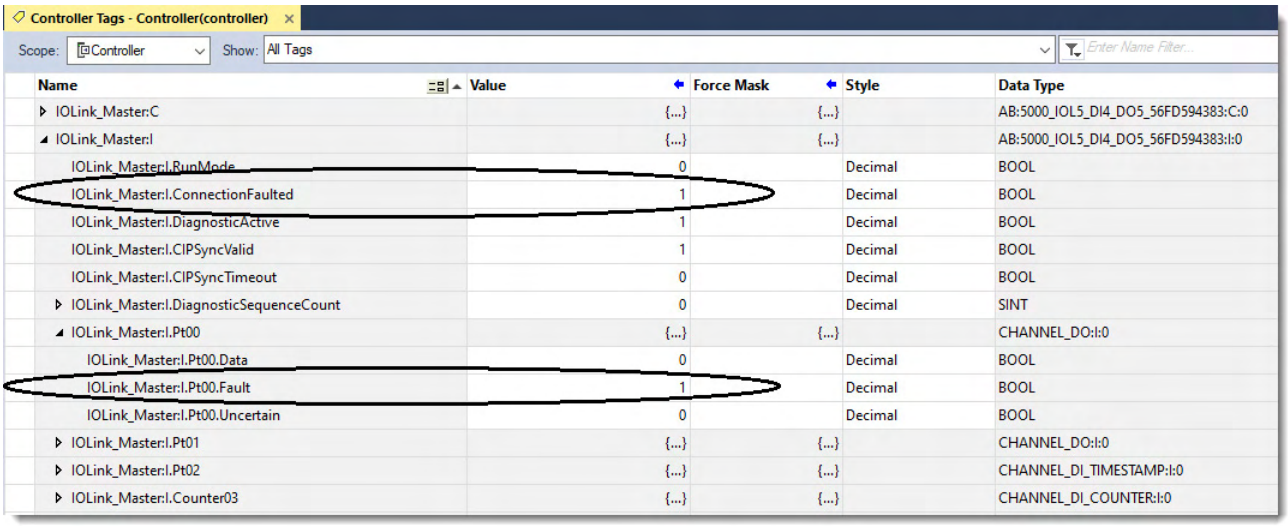
Figure 10 - Channel Diagnostics



Studio 5000 Logix Designer Application Tag Editor

Figure 11 shows how fault conditions are indicated in the controller tags for the module.

Figure 11 - Fault Indication in Controller Tags for IO-Link Master Module



Module Diagnostic Webpages

With firmware revision 2.011 or later, you can view the diagnostic information of the ArmorBlock 5000 8-channel IO-Link master module using the secure web server.

Use the diagnostics pages of the secure web server to help troubleshoot possible problems with your EtherNet/IP communication. For more information on how to troubleshoot problems that you diagnose, see the Troubleshoot EtherNet/IP Networks Application Technique, publication ENET-AT003.

The diagnostic webpages for the IO-Link master module include the following:

- Diagnostic Overview – Shows the module resource utilization and status of the network ports
- Network Settings – Shows the details for the network connection such as Network Interface, Ethernet Interface Configuration, and the Ethernet ports of the module
- IO Connections – Shows the status of the I/O connections of the module
- Ethernet Statistics – Shows the details of communication activity on the Ethernet network

For more information, see Secure Web Server on page 137.

Notes:

Troubleshoot Your IO-Link Device

This appendix describes how to identify and troubleshoot issues with your IO-Link devices.

Use the Studio 5000 Logix Designer Application for Troubleshooting

The Studio 5000 Logix Designer application indicates the presence of fault conditions.

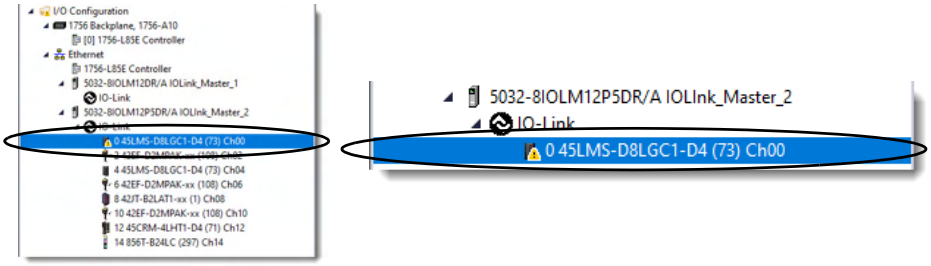
Fault conditions are reported in the following ways:

- Warning Signal in the I/O Configuration Tree
- Status and Fault Information in Module Properties
- Studio 5000 Logix Designer Application Tag Editor

Warning Signal in the I/O Configuration Tree

As shown in Figure 12, a warning icon appears in the I/O Configuration tree when a fault occurs.

Figure 12 - Warning Signal in I/O Configuration Tree



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 is no fault status on the channel.

  In the XX Diagnostics - IO-Link dialog, check if the IO-Link Status parameter is in the Operate state. If the parameter is not in the Operate state, check the XX - IO-Link Port Event Log dialog for more information.

  You can access the XX Diagnostics - IO-Link and XX - IO-Link Port Event Log dialogs from the IO-Link master Module Properties > XX - IO-Link view. For more information, see XX - IO-Link on page 59.

Status and Fault Information in Module Properties

The Module Properties window in the Studio 5000 Logix Designer application includes a series of views for the IO-Link device.

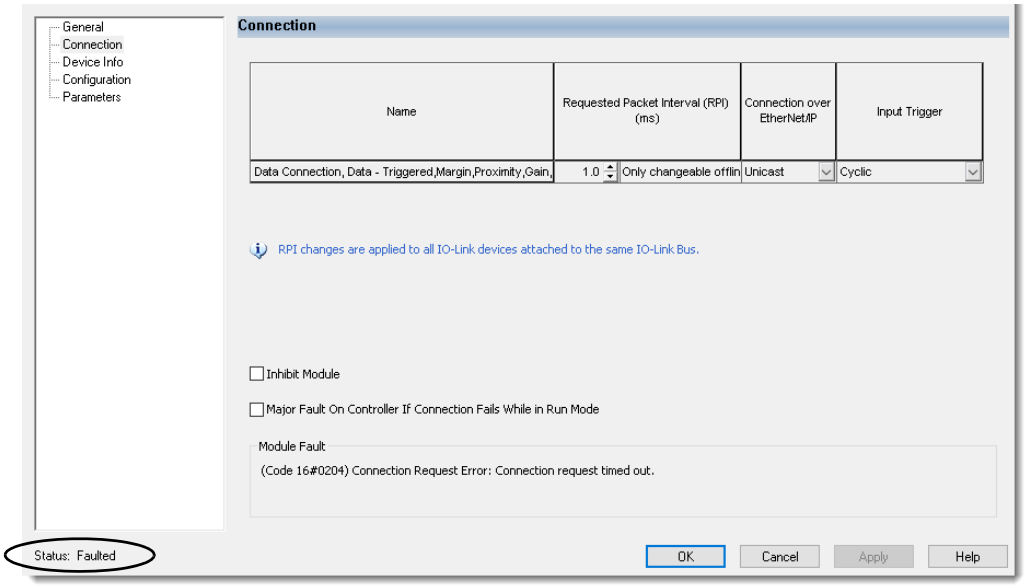
Each view includes options to configure the device or monitor the status of the device. The following are ways to monitor the state of a device for faults:

- Device Status on Module Properties Window
- Module Fault Descriptions on Connection View
- Fault and Status Information on Device Info View

Device Status on Module Properties Window

Figure 13 shows where the status of a device is indicated on the Module Properties window.

Figure 13 - Fault Message in Status Line



Module Fault Descriptions on Connection View

Figure 14 shows where a device fault description, which includes an error code that is associated with the specific fault type, is indicated on the Connection view.

Table 30 describes the special connection error codes for IO-Link devices.

Figure 14 - Fault Description with Error Code on Connection View

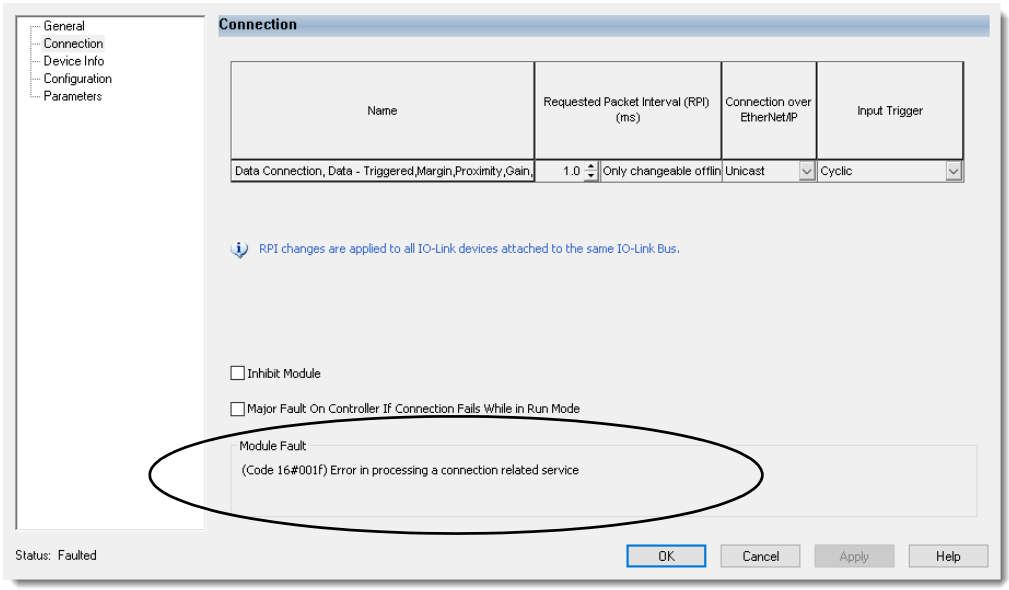


Table 30 - Special Connection Error Codes for IO-Link Device

Code	Description	Recommended Action
16x033B	This error is returned when a connection to an IO-Link device cannot be opened due to an IO-Link Data Storage Backup/Restore operation that is in progress.	No action required. The connection is established after the Data Storage operation is completed.
16x033C	This error is returned when a connection to an IO-Link device cannot be opened because the device is not in the IO-Link Operate state.	No action required if this is a temporary error. If the error persists, check the IO-Link Status parameter in the XX Diagnostics - IO-Link dialog. If the IO-Link Status parameter is not in the Operate state, check the port-level IO-Link event log in the XX - IO-Link view. For more information, see IO-Link Event Log on page 113.
16x033D	This error is returned when an IO-Link device cannot enter its regular operating state due to a failed Data Storage Backup/Restore operation in the IO-Link startup stage.	This is usually caused by anomalous behavior of the IO-Link device. Perform the steps as described in General Troubleshooting Tips for Configuration and Connection Issues on page 110. If the error persists, contact technical support.
16x033F	This error is returned when ADC is disabled and the selected connection type does not match the process data set currently used in the device.	Complete one of the following: 1. If you want to use the selected connection type, go to the Configuration view, perform Device Correlation Check, and select "Use Project Values". 2. If you want to use the process data set that is currently used in the device, go offline with your project, go to the device Module Definition, and change the connection type to match the device.
16x001F	This error is returned when there is an issue with the configuration of the device.	Perform the steps as described in General Troubleshooting Tips for Configuration and Connection Issues on page 110. If the error persists, contact technical support.

General Troubleshooting Tips for Configuration and Connection Issues

When you encounter issues during device connection and cannot identify the cause of the issue, follow this procedure to help troubleshoot.

1. Go online with your project.
2. In the IO-Link device Module Properties > Device Info view, select the Inhibit Module checkbox and select Apply.
3. In the IO-Link device Module Properties > Configuration view, perform Device Correlation Check.
   a. If the check fails, an error message appears to indicate which parameter and the reason. Change the parameter value to correct the error.
   b. If the check succeeds and there are differences, select "Use Project Values" if ADC is enabled and select Apply.

      If this step fails, an error message appears to indicate which parameter and the reason. Change the parameter value to correct the error.
4. If you have verified that the configuration parameter values are appropriate, but selecting "Use Project Values" still fails, or the connection cannot be established, repeat Device Correlation Check and select "Use Device Values".

   You must review the new parameter values that have changed from the initial project value and update the required configuration parameters before you select Apply.

If Device Correlation Check still reports differences after a successful apply or "Use Project Values", a common way to resolve this issue is to select "Use Device Values" and apply.

For example, some IO-Link devices do not update parameters according to the configured values and do not report any errors. For example, the lower limit for a parameter is 1000 but the configured value is 0. The device sets the value to 1000 and does not return any error.

If you select "Use Device Values" and there is no change of parameter values in the Configuration view, it means that the changed parameters are not displayed due to the current value of the conditional parameters. This is not an issue and you can proceed to apply the changes.

Fault and Status Information on Device Info View

Figure 15 shows where the major and minor fault information, and the Data Storage Match status are indicated on the Device Info view.

Table 31 describes the fault and status information for the IO-Link device.

Figure 15 - Major and Minor Fault Information and Data Storage Match Status

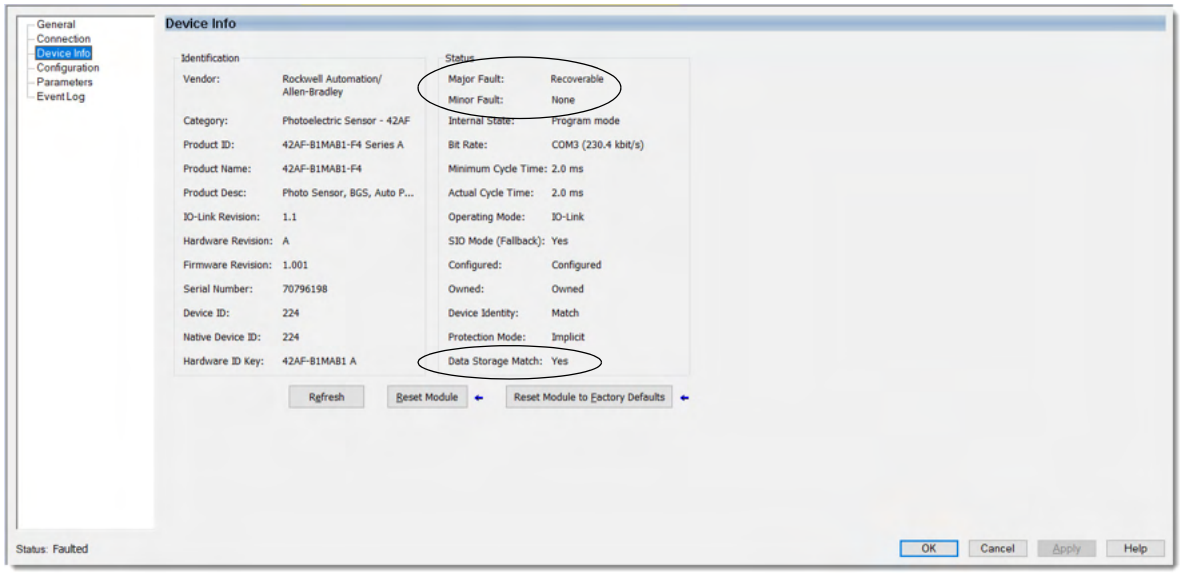


Table 31 - Fault and Status Information

Parameter	Description	Recommended Action
Major Fault	Indicates whether a major fault is present on the device.	Complete the following: • Check the device-level IO-Link event log. • Check the device status in the Parameters view. • Follow the instructions in the documentation for your device to troubleshoot the fault.
Minor Fault	Indicates whether a minor fault is present on the device.	
Data Storage Match	Indicates whether the Data Storage copy in the IO-Link master module is synchronized with the IO-Link device.	If the device is attached to an IO-Link (non-Fallback) channel and the device connection is running but the Data Storage Match parameter shows that it is not matched, contact your device manufacturer. If the device is on a Fallback channel, complete the following steps: • Uninhibit the device and verify that the connection is running. • Inhibit the device and apply the change. • Go to the Device Info view and refresh the view until the Data Storage Match parameter shows that it is matched. • If the Data Storage Match parameter does not show that it is matched after some time, contact your device manufacturer. **NOTE:** After you uninhibit the device, you cannot see the actual status of the Data Storage Match parameter in the Device Info view.

Studio 5000 Logix Designer Application Tag Editor

Figure 16 shows how fault and status conditions are indicated in the controller tags for the IO-Link device.

Table 32 describes the fault and status conditions, and provides steps to help resolve the conditions.

Figure 16 - Fault Indication in Controller Tags for IO-Link Devices

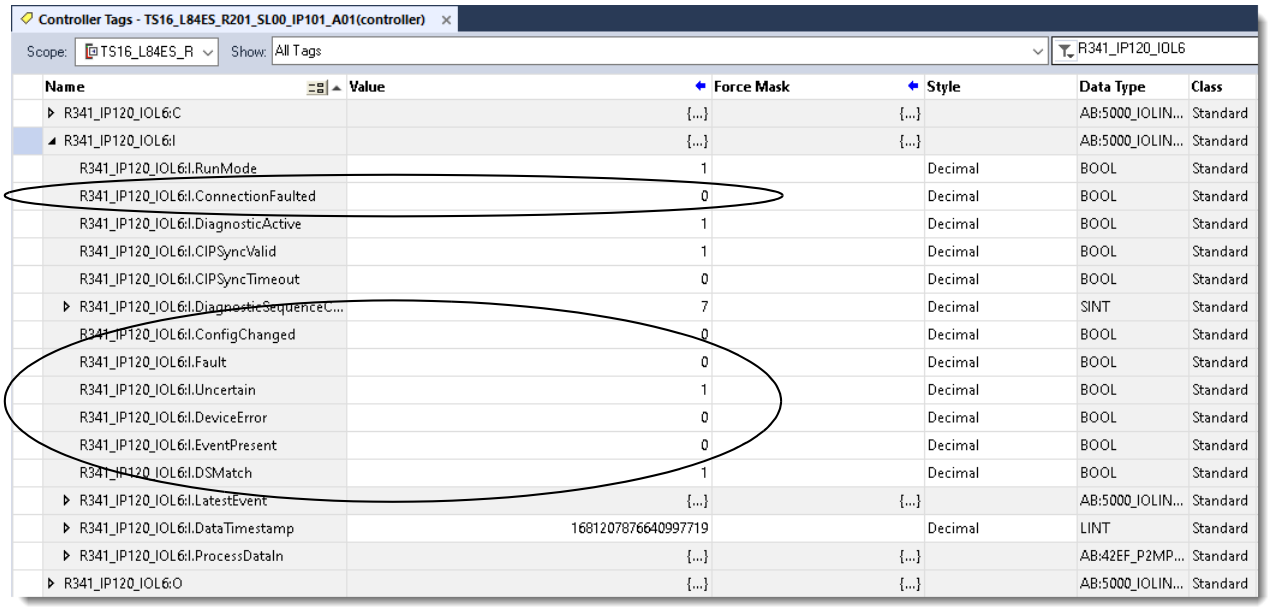


Table 32 - Fault and Status Tags for IO-Link Devices

Tag Name	Description	Recommended Action
I.ConnectionFaulted	Indicates if a connection is running. The device sets this tag to 0 when connected. If the device is not connected, it sets this tag to 1.	Complete the following steps: • Check the physical connection of the device. • Perform the steps as described in General Troubleshooting Tips for Configuration and Connection Issues on page 110.
I.Fault	Indicates that port data is inaccurate and cannot be trusted for use in the application. For more information, see Fault and Status Reporting on page 19.	Check the IO-Link Status parameter in the XX Diagnostics - IO-Link dialog. If the IO-Link Status parameter is not in the Operate state, check the port-level IO-Link event log in the XX - IO-Link view. Otherwise, check the device-level IO-Link event log. For more information, see IO-Link Event Log on page 113.
I.Uncertain	Indicates that the device parameter values are being updated.	It is automatically cleared when the Class 3 connection of changing device values is closed.
I.DeviceError	Indicates that there is an outstanding error or warning event from the port or the device.	Perform the following steps: • Check the XX Diagnostics - IO-Link dialog for the error or warning. • Check the port-level IO-Link event log in the XX - IO-Link view. • Check the device-level IO-Link event log. For more information, see IO-Link Event Log on page 113.
I.EventPresent	Indicates that there is an outstanding IO-Link event.	Perform the following steps: • Check the port-level IO-Link event log in the XX - IO-Link view. • Check the device-level IO-Link event log. • Take the appropriate action to resolve the event. For more information, see IO-Link Event Log on page 113.
I.LatestEvent	Indicates that this is the latest IO-Link event from the device.	Take the appropriate action according to the event definition if necessary.

IO-Link Event Log

This section provides information about IO-Link events, event data structure, and a list of port-level IO-Link events.

Figure 17 shows an example of a port-level IO-Link event log.

To access the port-level IO-Link event log, see XX - IO-Link on page 59.

Figure 17 - IO-Link Port Event Log Example

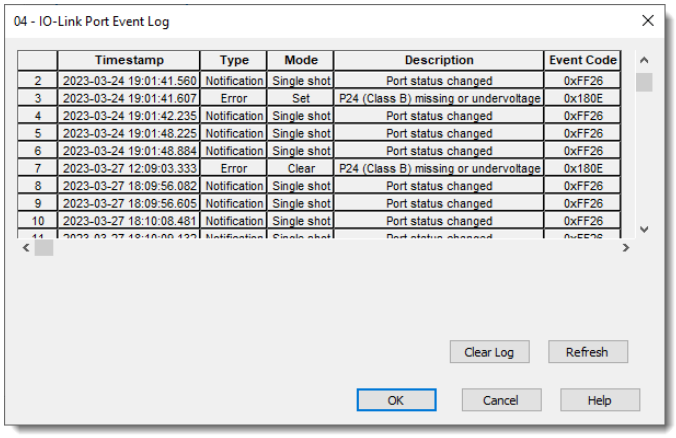


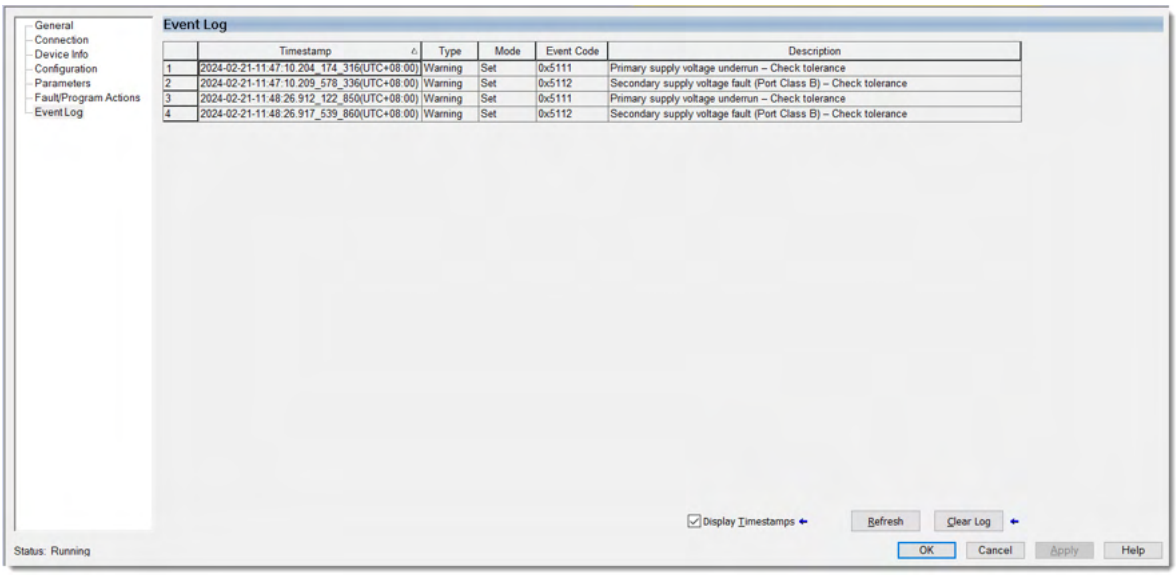
Table 33 describes the enumeration and definition of port-level IO-Link events. For more information, see the IO-Link Interface and System Specification at io-link.com.

Table 33 - IO-Link Port-Level Event Codes

Event Code ID	Event Type	Description
0x1800	Error	No Device (communication)
0x1802	Error	Incorrect VendorID – Inspection Level mismatch
0x1803	Error	Incorrect DeviceID – Inspection Level mismatch
0x1804	Error	Short circuit at C/Q – Check wire connection
0x1805	Error	PHY overtemperature – Check Master temperature and load
0x1806	Error	Short circuit at L+ – Check wire connection
0x1807	Error	Overcurrent at L+ – Check power supply (for example, L1+)
0x1809	Error	Backup inconsistency – Memory out of range (2048 octets)
0x180A	Error	Backup inconsistency – Identity fault
0x180B	Error	Backup inconsistency – Data Storage unspecific error
0x180C	Error	Backup inconsistency – Upload fault
0x180D	Error	Parameter inconsistency – Download fault
0x180E	Error	P24 (Class B) missing or undervoltage
0x180F	Error	Short circuit at P24 (Class B) – Check wire connection (for example, L2+)
0x1810	Error	Short circuit at I/Q – Check wiring
0x1811	Error	Short circuit at C/Q (if digital output) – Check wiring
0x1812	Error	Overcurrent at I/Q – Check load
0x1813	Error	Overcurrent at C/Q (if digital output) – Check load
0x1FF1	Error	IO-Link PHY communication error
0x1FF2	Notification	IO-Link port restarted
0x6000	Error	Invalid cycle time
0x6001	Error	Revision fault – Incompatible protocol version
0xFF26	Notification	Port status changed
0xFF27	Notification	Data Storage upload completed

Figure 18 shows an example of an IO-Link device event log.

Figure 18 - IO-Link Device Event Log Example



To access the IO-Link device event log, see Event Log View on page 90.

For IO-Link device event codes, see the IO-Link Interface and System Specification at io-link.com, and the documentation for the device for more information.

Use CIP Messages to Retrieve the IO-Link Event Log

To retrieve the IO-Link event log, follow the definition of the Event Log object (class 0x41) that is defined in the CIP Specification Volume 1 and Volume 7C.

Table 34 defines the format of each event log entry.

Table 34 - Event Log Entry in Get IO-Link Event Log Response

Byte Offset	Bit Offset	Parameter
0	0...2	Reserved
	3	Event Location (always 1 for IO-Link master module)
	4...5	Event Type
	6...7	Event Mode
1...2	–	Event Code
3...10	–	Timestamp (only exists when *IO-Link Event Timestamp* is enabled)

You can use either attribute 14 or 22 to retrieve the event log.

To retrieve the Event Log for an IO-Link port, use a CIP message with the following specifications:

- Communication Path = To IO-Link master module
- Instance = Port Number + 1

To retrieve the Event Log for an IO-Link device, use a CIP message with the following specifications:

- Communication Path = To IO-Link device
- Instance = 1

IO-Link Master Module and IO-Link Device Tag Definitions

When you create an IO-Link master module or IO-Link 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 module or device has a distinct tag that is available for use in the controller ladder program.

Tag Name Conventions

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

Example module tag name = *Name:I.Pt01.Data*

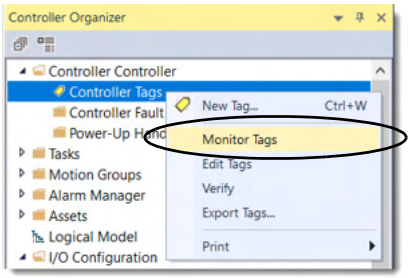
- Name = Name of the module
- I = Tag type
- Pt01 = Module channel number
- Data = Tag function

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

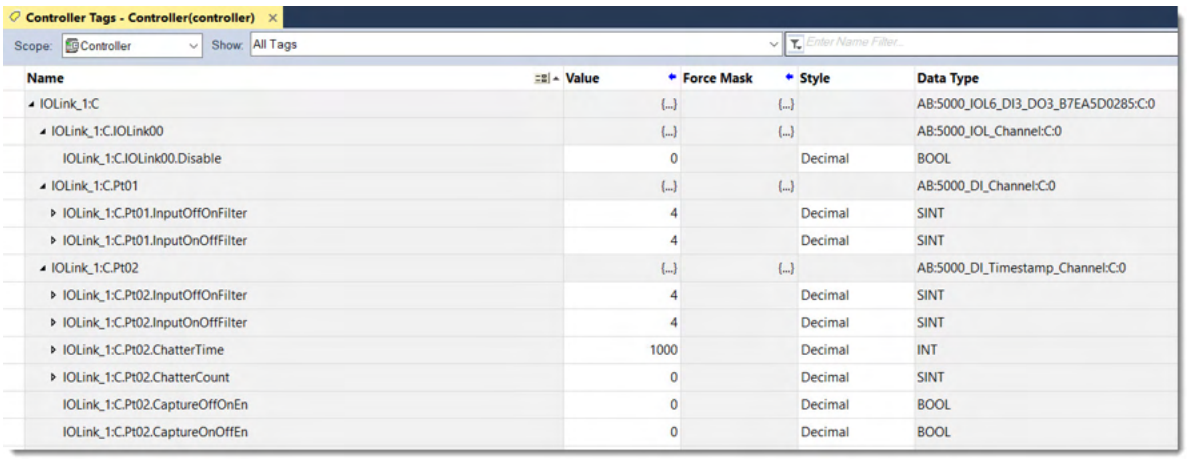
Access the Tags

You view tags from the Tag Editor.

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.



IO-Link Master Module Tags

This section describes the tags that are available for the ArmorBlock 5000 8-channel IO-Link master module. The tables contained in this section list all tags that are available for the module. Not all tags in the lists are used when the module is added to a project. Tag use varies by module configuration.

The following types of tags are available:

- Configuration Tags for IO-Link Master Module (as indicated by a 'C')
- Input Tags for IO-Link Master Module (as indicated by an 'I')
- Output Tags for IO-Link Master Module (as indicated by an 'O')
- Event Input Tags for IO-Link Master Module (as indicated by an 'EI')
- Event Output Tags for IO-Link Master Module (as indicated by an 'EO')
- Status Tags for IO-Link Master Module (as indicated by an 'S')

Configuration Tags for IO-Link Master Module

Table 35 describes the available configuration tags ('C').

Table 35 - IO-Link Master Module Configuration Tags

Name	Data Type	Definition	Valid Values
Counterxx.InputOffOnFilter	SINT	The amount of time that a signal must be in the On state before the input data indicates the On state. The amount of time is indicated using an enumeration.	• 4 = 0 µs (default) • 12 = 500 µs • 13 = 1 ms • 14 = 2 ms • 15 = 5 ms • 16 = 10 ms • 17 = 20 ms • 18 = 50 ms
Counterxx.InputOnOffFilter	SINT	The amount of time that a signal must be in the Off state before the input data indicates the Off state. The amount of time is indicated using an enumeration.	• 4 = 0 µs (default) • 12 = 500 µs • 13 = 1 ms • 14 = 2 ms • 15 = 5 ms • 16 = 10 ms • 17 = 20 ms • 18 = 50 ms
Counterxx.RolloverAtPreset	BOOL	Set the counter to rollover to 0 at the preset value.	0 = Do not rollover (default) 1 = Rollover
IOLinkxx.Disable	BOOL	Set to disable the channel temporarily. When the channel is disabled, IO-Link communication on the channel is deactivated.	0 = IO-Link communication is enabled (default) 1 = IO-Link communication is disabled
Ptxx.InputOffOnFilter	SINT	The amount of time that a signal must be in the On state before the input data indicates the On state. The amount of time is indicated using an enumeration.	• 4 = 0 µs (default) • 12 = 500 µs • 13 = 1 ms • 14 = 2 ms • 15 = 5 ms • 16 = 10 ms • 17 = 20 ms • 18 = 50 ms
Ptxx.InputOnOffFilter	SINT	The amount of time that a signal must be in the Off state before the input data indicates the Off state. The amount of time is indicated using an enumeration.	• 4 = 0 µs (default) • 12 = 500 µs • 13 = 1 ms • 14 = 2 ms • 15 = 5 ms • 16 = 10 ms • 17 = 20 ms • 18 = 50 ms
Ptxx.ChatterTime	INT	The amount of time within which the number of input transitions are counted.	1...10000 ms

Table 35 - IO-Link Master Module Configuration Tags (Continued)

Name	Data Type	Definition	Valid Values
Ptxx.ChatterCount	SINT	The number of input transitions that are considered chatter. Chatter can cause the module to time stamp invalid input transitions. Typically, chattering signals cause inputs to transition falsely many times in a relatively short period.	0 = Disabled (default) 2...127 = Enabled
Ptxx.CaptureOffOnEn	BOOL	Set to capture a time stamp when the input transitions from Off to On.	0 = Do not capture (default) 1 = Capture
Ptxx.CaptureOnOffEn	BOOL	Set to capture a time stamp when the input transitions from On to Off.	0 = Do not capture (default) 1 = Capture
Ptxx.TimestampLatchEn	BOOL	Set to latch time stamps. When a time stamp is latched, it is not overwritten until acknowledged.	0 = Do not latch (default) 1 = Latch
Ptxx.FaultMode	BOOL	Determines the action that the output takes when a connection fault occurs. At fault occurrence, the output holds its last state or transitions to the value set in *FaultValue*. The channel continues this action for the length of time set in *FaultValueStateDuration*.	0 = Transition to user-defined value (default) 1 = Hold last state
Ptxx.FaultValue	BOOL	Defines the state that the output assumes if a communication fault occurs when *FaultMode* = 0.	0 = Output is off (default) 1 = Output is on
Ptxx.ProgMode	BOOL	Determines the action that the output takes when the controller transitions to Program mode or the connection to the module is inhibited. At the transition to Program mode, the output holds its last state or transitions to the value set in *ProgValue*.	0 = Transition to user-defined value (default) 1 = Hold last state
Ptxx.ProgValue	BOOL	Defines the state that the output assumes when the connection transitions to Program mode when *ProgMode* = 0.	0 = Output is off (default) 1 = Output is on
Ptxx.FaultFinalState	BOOL	If *FaultValueStateDuration* is nonzero, set the final output state after the configured *FalueValueStateDuration* timeout occurs.	0 = Output is off (default) 1 = Output is on
Ptxx.FaultValueStateDuration	SINT	Set the length of time that the *FaultMode* state is held before the *FinalFaultState* being applied.	• 0 = Forever (default) • 1 = 1 s • 2 = 2 s • 5 = 5 s • 10 = 10 s
Ptxx.ProgramToFaultEn	BOOL	Determines if the output transitions to Fault mode when the connection faults while in Program mode.	0 = Remain in Program mode (default) 1 = Transition to Fault mode
Ptxx.NoLoadEn	BOOL	Set to enable No Load detection. When enabled, if a wire is disconnected from an output that is turned Off (No Load condition), the *I.Ptxx.NoLoad* tag changes to 1. This tag is not available when the channel mode is set to "Digital Output, Short Circuit" or "Digital Output, Group Short Circuit".	0 = No Load detection disabled 1 = No Load detection enabled
Ptxx.DiConfig.InputOffOnFilter	SINT	The amount of time that a signal must be in the On state before the input data indicates the On state. The amount of time is indicated using an enumeration.	• 4 = 0 µs (default) • 12 = 500 µs • 13 = 1 ms • 14 = 2 ms • 15 = 5 ms • 16 = 10 ms • 17 = 20 ms • 18 = 50 ms
Ptxx.DiConfig.InputOnOffFilter	SINT	The amount of time that a signal must be in the Off state before the input data indicates the Off state. The amount of time is indicated using an enumeration.	• 4 = 0 µs (default) • 12 = 500 µs • 13 = 1 ms • 14 = 2 ms • 15 = 5 ms • 16 = 10 ms • 17 = 20 ms • 18 = 50 ms
Ptxx.DiConfig.ChatterTime	INT	The amount of time within which the number of input transitions are counted.	1...10000 ms

Table 35 - IO-Link Master Module Configuration Tags (Continued)

Name	Data Type	Definition	Valid Values
Ptxx.DiConfig.ChatterCount	SINT	The number of input transitions that are considered chatter. Chatter can cause the module to time stamp invalid input transitions. Typically, chattering signals cause inputs to transition falsely many times in a relatively short period.	0 = Disabled (default) 2...127 = Enabled
Ptxx.DiConfig.CaptureOffOnEn	BOOL	Set to capture a time stamp when the input transitions from Off to On.	0 = Do not capture (default) 1 = Capture
Ptxx.DiConfig.CaptureOnOffEn	BOOL	Set to capture a time stamp when the input transitions from On to Off.	0 = Do not capture (default) 1 = Capture
Ptxx.DiConfig.TimestampLatchEn	BOOL	Set to latch time stamps. When a time stamp is latched, it is not overwritten until acknowledged.	0 = Do not latch (default) 1 = Latch
Ptxx.IolConfig.Disable	BOOL	Set to disable the channel temporarily. When the channel is disabled, both IO-Link communication and digital input on the channel are deactivated.	0 = IO-Link communication/digital input is enabled (default) 1 = IO-Link communication/digital input is disabled

Input Tags for IO-Link Master Module

Table 36 describes the available input tags ('I').

Table 36 - IO-Link Master Module Input Tags

Name	Data Type	Definition	Valid Values
RunMode	BOOL	Indicates the operating state of the input.	0 = Idle 1 = Run mode
ConnectionFaulted	BOOL	Indicates if a connection is running. The module sets this tag to 0 when connected. If the module is not connected, it sets this tag to 1.	0 = Connection running 1 = Connection not running
DiagnosticActive	BOOL	Indicates if any diagnostics are active or if the prognostics threshold is reached.	0 = No diagnostics active 1 = One or more diagnostics are active or the prognostics threshold is reached
CIPSyncValid	BOOL	Indicates if the module is synchronized with a 1588 master.	0 = Module not synchronized 1 = Module synchronized
CIPSyncTimeout	BOOL	Indicates if the module was previously synchronized with a 1588 master but is now timed out.	0 = A valid time master has not timed out 1 = A valid time master has timed out
DiagnosticSequenceCount	SINT	Increments each time that a distinct diagnostic condition is detected, and each time a distinct diagnostic condition transitions from detected to not detected. Reset to zero on power cycle. Wraps from 255 (-1) to 1, skipping zero.	-128...+127 The value of 0 is skipped except during module power-up.
Counterxx.Data	BOOL	Indicates the state of the input.	0 = Off 1 = On
Counterxx.Fault	BOOL	Indicates that counter data is inaccurate and cannot be trusted for use in the application. For more information, see Fault and Status Reporting on page 19.	0 = No fault exists 1 = Fault exists 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.
Counterxx.Uncertain	BOOL	Indicates that counter data can be inaccurate but the degree of inaccuracy is not known. For more information, see Fault and Status Reporting on page 19.	0 = Good data 1 = Uncertain data 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.
Counterxx.Done	BOOL	When set, indicates the corresponding counter Done bit (rising or falling depending on configuration) triggered the event.	0 = Corresponding Done bit did not trigger the event 1 = Corresponding Done bit triggered the event

Table 36 - IO-Link Master Module Input Tags (Continued)

Name	Data Type	Definition	Valid Values
Counterxx.Rollover	BOOL	The counter counted up to Preset -1 and continued counting from or 0. The *O.CounterxxRolloverAck* bit transitioning from 0 to 1 or the *O.CounterxxReset* transitioning from 0 to 1 clears this bit.	0 = Counter has not counted up to Preset -1 1 = Counter counted up to Preset -1 and continued counting from 0
Counterxx.Count	BOOL	The number of input transitions counted by a counter.	All values
IOLinkxx.Fault	BOOL	Indicates that IO-Link data is inaccurate and cannot be trusted for use in the application. For more information, see Fault and Status Reporting on page 19.	0 = Good 1 = Bad, causing fault 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.
IOLinkxx.Uncertain	BOOL	Indicates that IO-Link data can be inaccurate but the degree of inaccuracy is not known. For more information, see Fault and Status Reporting on page 19.	0 = Good data 1 = Uncertain data 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.
Ptxx.Data	BOOL	Indicates the state of the input.	0 = Off 1 = On
Ptxx.Fault	BOOL	Indicates that channel data is inaccurate and cannot be trusted for use in the application. For more information, see Fault and Status Reporting on page 19.	0 = Good 1 = Bad, causing fault 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.
Ptxx.Uncertain	BOOL	Indicates that channel data can be inaccurate but the degree of inaccuracy is not known. For more information, see Fault and Status Reporting on page 19.	0 = Good data 1 = Uncertain data 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.
Ptxx.Chatter	BOOL	Indicates if the input is chattering per the *C.Ptxx.ChatterTime* and *C.Ptxx.ChatterCount* settings.	0 = Normal 1 = Input is chattering
Ptxx.TimestampOverflowOffOn	BOOL	Indicates an Off to On time stamp was lost in a discrete product. If *C.Ptxx.TimestampLatchEn* is set, then a new time stamp was not recorded because one is already latched. If *C.Ptxx.TimestampLatchEn* is clear, then a time stamp was overwritten.	0 or 1
Ptxx.TimestampOverflowOnOff	BOOL	Indicates an On to Off time stamp was lost in a discrete product. If *C.Ptxx.TimestampLatchEn* is set, then a new time stamp was not recorded because one is already latched. If *C.Ptxx.TimestampLatchEn* is clear, then a time stamp was overwritten.	0 or 1
Ptxx.CIPSyncValid	BOOL	Indicates if the module is synchronized with a 1588 master.	0 = Module not synchronized 1 = Module synchronized
Ptxx.CIPSyncTimeout	BOOL	Indicates if the module was previously synchronized with a 1588 master but is now timed out.	0 = A valid time master has not timed out 1 = A valid time master has timed out
Ptxx.TimestampOffOnNumber	INT	An Off to On time stamp identifier for the currently produced time stamp.	All values
Ptxx.TimestampOnOfNumber	INT	An On to Off time stamp identifier for the currently produced time stamp.	All values
Ptxx.TimestampOffOn	LINT	64-bit time stamp that corresponds to when a change of state Off to On was recorded at the input.	All values
Ptxx.TimestampOnOff	LINT	64-bit time stamp that corresponds to when a change of state On to Off was recorded at the input.	All values
EventStatus[x].EventDropped	BOOL	Indicates when an event has been discarded because events are occurring faster than they are being acknowledged.	0 = An event status has not been dropped 1 = An event status has been dropped
EventStatus[x].CIPSyncValid	BOOL	Indicates if the module is synchronized with a 1588 master.	0 = Module not synchronized 1 = Module synchronized
EventStatus[x].CIPSyncTimeout	BOOL	Indicates if the module was previously synchronized with a 1588 master but is now timed out.	0 = A valid time master has not timed out 1 = A valid time master has timed out

Table 36 - IO-Link Master Module Input Tags (Continued)

Name	Data Type	Definition	Valid Values
EventStatus[x].EventReset	BOOL	When *EO.Eventxx.ResetEvent* transitions from 0 to 1, *I.EventStatus[x].EventReset* transitions to 1 to indicate that the reset was received and completed. It stays 1 until *EO.Eventxx.ResetEvent* transition to zero.	0 = Do not reset 1 = Reset
EventStatus[x].EventsPending	SINT	The number of events currently queued in the module. A value greater than zero indicates that the controller is not currently keeping up with the rate of events.	All positive values
EventStatus[x].EventNumber	DINT	Running count of events, which increments by one each new time event. The originator sets *EO.Eventxx.EventNumberAck* to *EI.Eventxx.EventNumber* to acknowledge receipt of the event. When the number of events reaches its maximum value and rolls over, it rolls over to 1, not 0.	All values

Output Tags for IO-Link Master Module

Table 37 describes the available output tags ('O').

Table 37 - IO-Link Master Module Output Tags

Name	Data Type	Definition	Valid Values
Counterxx.Reset	BOOL	When this bit transitions from 0 to 1, *I.Counterxx.Count* and *I.Counterxx.Rollover* is set to 0.	0 = *I.Counterxx.Count* and *I.Counterxx.Rollover* are not set to 0 1 = *I.Counterxx.Count* and *I.Counterxx.Rollover* are set to 0
Counterxx.RolloverAck	BOOL	When this bit transitions from 0 to 1, *I.Counterxx.Rollover* is set to 0.	0 = *I.Counterxx.Rollover* is not set to 0 1 = *I.Counterxx.Rollover* is set to 0
Counterxx.Preset	DINT	• If RolloverAtPreset is set, the counter counts to the Preset value and then rolls over to zero. • If RolloverAtPreset is not set, the counter sets the Done bit and continues counting up to maximum DINT value. • If *C.Counterxx.RolloverAtPreset* = 1 Then if *I.Counterxx.Count* ≥ *O.Counterxx.Preset* *I.Counterxx.Count* = 0 Else *I.Counterxx.Done* = always 0. Set *I.Counterxx.Rollover* bit when *I.Counterxx.Count* transitions from *O.Counterxx.Preset* – 1 to 0. • If *C.Counterxx.RolloverAtPreset* = 0 Then if *I.Counterxx.Count* ≥ *O.Counterxx.Preset* *I.Counterxx.Done* = 1 Else *I.Counterxx.Done* = 0. Set *I.Counterxx.Rollover* bit when *I.Counterxx.Count* transitions from 2,147,483,647 to 0.	0…2,147,483,647
Ptxx.Data	BOOL	Indicates the state of the output.	0 = Off 1 = On
Ptxx.ResetTimestamps	BOOL	Erases all recorded time stamps for the input channel when it transitions from 0 to 1.	0 = Time stamps are not erased 1 = Time stamps are erased
Ptxx.TimestampOffOnNumberAck	INT	An Off to On time stamp identifier that is written by the controller to indicate that the identified time stamp has been seen and acted on. When Latching is enabled and the Timestamp Number that is received from the controller matches the most recent time stamp that is produced, the module is then allowed to produce a new time stamp.	All values
Ptxx.TimestampOnOffNumberAck	INT	An On to Off time stamp identifier that is written by the controller to indicate that the identified time stamp has been seen and acted on. When Latching is enabled and the Timestamp Number that is received from the controller matches the most recent time stamp that is produced, the module is then allowed to produce a new time stamp.	All values

Event Input Tags for IO-Link Master Module

Table 38 describes the available event input tags ('EI').

Table 38 - IO-Link Master Module Event Input Tags

Name	Data Type	Definition	Valid Values
RunMode	BOOL	Indicates the operating state of the input.	0 = Idle 1 = Run mode
ConnectionFaulted	BOOL	Indicates if a connection is running. The module sets this tag to 0 when connected. If the module is not connected, it sets this tag to 1.	0 = Connection running 1 = Connection not running
DiagnosticActive	BOOL	Indicates if any diagnostics are active or if the prognostics threshold is reached.	0 = No diagnostics active 1 = One or more diagnostics are active or the prognostics threshold is reached
DiagnosticSequenceCount	SINT	Increments each time that a distinct diagnostic condition is detected, and each time a distinct diagnostic condition transitions from detected to not detected. Resets to zero on power cycle. Wraps from 255 (-1) to 1, skipping zero.	-128...+127 The value of 0 is skipped except during module powerup.
Eventxx.Fault	BOOL	Detects whether the signal is good data. The fault is set to 1 by the originator when the connection is lost.	0 = Good 1 = Bad, causing fault
Eventxx.Uncertain	BOOL	Indicates that the channel data can be inaccurate but the degree of inaccuracy is not known. For more information, see Fault and Status Reporting on page 19.	0 = Good data 1 = Uncertain data 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.
Eventxx.EventDropped	BOOL	Indicates when an event has been discarded because events are occurring faster than they are being acknowledged.	0 = An event status has not been dropped 1 = An event status has been dropped
Eventxx.EventRising	BOOL	Indicates whether an event triggered when an input transition results in an event pattern being matched.	0 or 1
Eventxx.EventFalling	BOOL	Indicates whether an event triggered when an input transition resulted in an event pattern no longer being matched.	0 or 1
Eventxx.CIPSyncValid	BOOL	Indicates whether the module is synced with a 1588 master.	0 = Module not synchronized 1 = Module synchronized
Eventxx.CIPSyncTimeout	BOOL	Indicates that the module was once synced with a 1588 master, but is not now due to a timeout.	0 = A valid time master has not timed out. 1 = A valid time master was 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.
Eventxx.EventsPending	SINT	The number of events currently queued in the modules. A value greater than 0 indicates that the controller is not currently keeping up with the rate of events.	All positive values
Eventxx.EventNumber	DINT	Running count of events, which increments by one each new time event. The originator sets *EO.Eventxx.EventNumberAck* to *EI.Eventxx.EventNumber* to acknowledge receipt of the event. When the number of events reaches its maximum value and rolls over, it rolls over to 1, not 0.	All values
Eventxx.EventTimestamp	LINT	The time the event occurred.	All positive values
Eventxx.PtxxData	BOOL	When set, indicates the corresponding data value (rising or falling depending on configuration) triggered the event.	0 = Corresponding data value did not trigger the event 1 = Corresponding data value triggered the event

Table 38 - IO-Link Master Module Event Input Tags (Continued)

Name	Data Type	Definition	Valid Values
Eventxx.CounterxxDone	BOOL	When set, indicates the corresponding counter Done bit (rising or falling depending on configuration) triggered the event.	0 = Corresponding counter Done bit did not trigger the event 1 = Corresponding counter Done bit triggered the event
Eventxx.PtxxFault	BOOL	Indicates that channel data is inaccurate and cannot be trusted for use in the application. For more information, see Fault and Status Reporting on page 19.	0 = Good 1 = Bad, causing fault 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.
Eventxx.CounterxxFault	BOOL	When set, indicates that the corresponding counter had a fault indicated when the event occurred.	0 = Corresponding counter did not have a fault indicated when the event occurred 1 = Corresponding counter did have a fault indicated when the event occurred

Event Output Tags for IO-Link Master Module

Table 39 describes the available event output tags ('EO').

Table 39 - IO-Link Master Module Event Output Tags

Name	Data Type	Definition	Valid Values
Eventxx.En	BOOL	When set, the corresponding event trigger definition is active and events are triggered when conditions match the definition.	0 = Event trigger definition is not active and events are not triggered when conditions match the definition 1 = Event trigger definition is active and events are triggered when conditions match the definition
Eventxx.EventRisingEn	BOOL	Triggers an event each time a condition change results in conditions that match the event trigger definition.	When *EO.Eventxx.IndependentConditionTriggerEn* = 0 Trigger event (EventRisingEn, EventFallingEn): • Disable (0, 0) • On input transition to match pattern (1, 0) • On input transition to not match pattern (0, 1) • On input transition to match or not match pattern (1, 1) When *EO.Eventxx.IndependentConditionTriggerEn* = 1 Trigger event (EventRisingEn, EventFallingEn): • Disable (0, 0) • On transition (1, 0) • On inverted transition (0, 1) • On any transition (1, 1)
Eventxx.EventFallingEn	BOOL		
Eventxx.LatchEn	BOOL	When set, events are latched until acknowledged. A new event is lost if the previous event has not been acknowledged. When not set, new events overwrite old events.	0 = Event is not latched 1 = Event is latched
Eventxx.ResetEvent	BOOL	A transition from 0 to 1 resets all events and clears the event queue on the channel.	0 or 1
Eventxx.IndependentConditionTriggerEn	BOOL	Determines whether an input state change or a pattern of input state changes triggers an event.	0 = Event is triggered when all participating inputs in the event trigger achieve their configured values 1 = Event is triggered when any participating input in the event trigger achieves their configured value
Eventxx.EventNumberAck	DINT	The controller writes back *EI.Eventxx.EventNumber* into *EO.Eventxx.EventNumberAck* to indicate receipt of the event.	All values
Eventxx.PtxxDataSelect	BOOL	Determines whether the input participates in the event trigger.	0 = Does not participate in event trigger 1 = Participates in event trigger
Eventxx.CounterxxSelect	BOOL	Determines whether the counter participates in the event trigger.	0 = Does not participate in event trigger 1 = Participates in event trigger
Eventxx.PtxxDataValue	BOOL	Determines the state of the input that triggers the event.	0 = Off 1 = On
Eventxx.CounterxxValue	BOOL	Determines the state of the counter that triggers the event.	0 = Not done 1 = Done

Status Tags for IO-Link Master Module

Table 40 describes the available status tags ('S').

Table 40 - IO-Link Master Module Status Tags

Name	Data Type	Definition	Valid Values
RunMode	BOOL	Indicates the operating state of the input.	0 = Idle 1 = Run mode
ConnectionFaulted	BOOL	Indicates if a connection is running. The module sets this tag to 0 when connected. If the module is not connected, it sets this tag to 1.	0 = Connection running 1 = Connection not running
DiagnosticActive	BOOL	Indicates if any diagnostics are active or if the prognostics threshold is reached.	0 = No diagnostics active 1 = One or more diagnostics are active or the prognostics threshold is reached
CIPSyncValid	BOOL	Indicates if the module is synchronized with a 1588 master.	0 = Module not synchronized 1 = Module synchronized
CIPSyncTimeout	BOOL	Indicates if the module was previously synchronized with a 1588 master but is now timed out.	0 = A valid time master has not timed out 1 = A valid time master has timed out
DiagnosticSequenceCount	SINT	Increments for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected. Sets to zero by product reset or power cycle. Wraps from 255 (-1) to 1 skipping zero.	-128...+127 The value of 0 is skipped except during module powerup.
Portx.Fault	BOOL	Indicates that port data is inaccurate and cannot be trusted for use in the application. For more information, see Fault and Status Reporting on page 19.	0 = Good 1 = Bad, causing fault 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.
Portx.Uncertain	BOOL	Indicates that the port data can be inaccurate but the degree of inaccuracy is not known. For more information, see Fault and Status Reporting on page 19.	0 = Good data 1 = Uncertain data 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.
Portx.Connected	BOOL	Indicates whether the Ethernet port is active.	0 = Ethernet port is inactive 1 = Ethernet port is active
Portx.FullDuplex	BOOL	Indicates whether the Ethernet port is running full-duplex mode or half-duplex mode when connected.	0 = Ethernet port is running in half-duplex mode 1 = Ethernet port is running in full-duplex mode
Portx.AutonegotiationStatus	SINT	Indicates the status of link auto-negotiation.	• 0 = Auto-negotiation in progress. • 1 = Auto-negotiation and speed detection failed. Using default values for speed and duplex. Default values are product-dependent; recommended defaults are 10 Mbps and half-duplex. • 2 = Auto negotiation failed, but detected speed. Duplex was defaulted. Default value is product-dependent; recommended default is half-duplex mode. • 3 = Successfully negotiated speed and duplex mode. • 4 = Auto-negotiation not attempted. Forced speed and duplex mode.
Portx.Speed	INT	Indicates the actual port speed in Mbps. A value of 0 means that the speed is undetermined.	• 10 • 100
TCPConnections	INT	Total number of active TCP connections.	All positive values
CIPConnections	INT	Total number of active CIP connections.	All positive values
CIPLostPackets	DINT	Total number of lost CIP packets.	All positive values
CIPTimeouts	DINT	Total number of connection timeouts that have occurred.	All positive values
HMIPacketRate	DINT	The packet rate between the module and HMI.	All positive values
IOPacketRate	DINT	The packet rate to and from the module.	All positive values
EthernetErrors	DINT	Total number of Ethernet errors.	All positive values
CPUUtilization	INT	Total CPU load.	0...100%

Table 40 - IO-Link Master Module Status Tags (Continued)

Name	Data Type	Definition	Valid Values
DLRNetworkState	SINT	The status of the network.	• 0 = Normal • 1 = Ring Fault • 2 = Unexpected Loop Detected • 3 = Partial Network Fault • 4 = Rapid Fault/Restore Cycle
DLRSupervisorState	SINT	The status of the network supervisor.	• 0 = Device is functioning as a backup • 1 = Device is functioning as the active ring supervisor • 2 = Device is functioning as a normal ring node • 3 = Device is operating in a non-DLR topology • 4 = Device cannot support the current ring parameters (Beacon Interval and Beacon Timeout)
DLREnabled	BOOL	Indicates if DRL network redundancy mode is enabled.	0 = DLR is not enabled 1 = DLR is enabled
LocalClockOffset	LINT	The offset in nanoseconds from the local clock to the system time. Use this value to detect steps in time. This value updates when a PTP update is received.	All values
LocalClockOffsetTimestamp	LINT	The most recent time the LocalClockOffset was sampled. The initial value is zero and the first time stamp occurs when the module synchronizes with the master clock.	N/A
GrandMasterClockID	SINT[8]	The EUI-64 Identity of the CIP Sync Grandmaster clock that the module is synced to.	All values
ChxxChyyDiagEvent.EventType	USINT	Indicates the type of event.	• 1 = Notification • 2 = Warning • 3 = Error
ChxxChyyDiagEvent.EventMode	USINT	Indicates the event mode.	• 1 = Event single shot • 2 = Event disappears • 3 = Event appears
ChxxChyyDiagEvent.EventCode	UINT	The value that represents the event.	All positive values
ChxxChyyDiagEvent.EventTimestamp	LINT	The time stamp of the event.	All positive values

IO-Link Device Tags

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

The following types of tags are available:

- Configuration Tags for IO-Link Device (as indicated by a 'C')
- Input Tags for IO-Link Device (as indicated by an 'I')
- Output Tags for IO-Link Device (as indicated by an 'O')

Configuration Tags for IO-Link Device

Table 41 describes the available configuration tags ('I').

Table 41 - IO-Link Device Configuration Tags

Name	Data Type	Definition	Valid Values
ProgramToFaultEn	BOOL	Determines if the output process data behavior follows the *FaultMode* or *ProgMode* setting when a connection fault occurs in Program mode.	0 = Follows the *ProgMode* setting 1 = Follows the *FaultMode* setting
FaultMode	SINT	Determines the behavior the IO-Link channel takes with output process data if a communication fault occurs.	• 0 = Device Decides Output process data is disabled when the connection is faulted. • 1 = Hold Last Process Data Output Output process data remains enabled and the IO-Link master module holds the last output process data received when the connection is faulted. • 2 = All Zeros Output process data remains enabled and the IO-Link master module sends all zeros as output process data when the connection is faulted.
ProgMode	SINT	Determines the behavior the IO-Link channel takes with output process data if the connection transitions to Program mode.	• 0 = Device Decides Output process data is disabled when the connection transitions to Program mode. • 1 = Hold Last Process Data Output Output process data remains enabled and the IO-Link master module holds the last output process data received when the connection transitions to Program mode. • 2 = All Zeros Output process data remains enabled and the IO-Link master module sends all zeros as output process data when the connection transitions to Program mode.
Device Configuration Parameter Name	Device configuration parameters.		Device-specific

Input Tags for IO-Link Device

Table 42 describes the available input tags ('I').

Table 42 - IO-Link Device Input Tags

Name	Data Type	Definition	Valid Values
RunMode	BOOL	Indicates the operating state of the input.	0 = Idle 1 = Run mode
ConnectionFaulted	BOOL	Indicates if a connection is running. The device sets this tag to 0 when connected. If the device is not connected, it sets this tag to 1.	0 = Connection running 1 = Connection not running
DiagnosticActive	BOOL	Indicates if any diagnostics are active or if the prognostics threshold is reached.	0 = No diagnostics active 1 = One or more diagnostics are active or the prognostics threshold is reached
CIPSyncValid	BOOL	Indicates if the device is synchronized with a 1588 master.	0 = Device not synchronized 1 = Device synchronized
CIPSyncTimeout	BOOL	Indicates if the device was previously synchronized with a 1588 master but is now timed out.	0 = A valid time master has not timed out 1 = A valid time master has timed out
DiagnosticSequenceCount	SINT	Increments for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected. Sets to zero by product reset or power cycle. Wraps from 255 (-1) to 1 skipping zero.	-128...+127 The value of 0 is skipped except during device power-up.

Table 42 - IO-Link Device Input Tags (Continued)

Name	Data Type	Definition	Valid Values
ConfigChanged	BOOL	This tag is set to 1 after IO-Link device configuration is changed and the IO-Link master module has retrieved all IO-Link device configuration data to be returned by the Get IO-Link Device Information service. This bit allows the Studio 5000 Logix Designer application to perform any logic when the IO-Link device configuration has changed. For more information on how to use the command, see IO-Link Device Configuration Change Notification on page 42.	0 = Configuration not changed 1 = Configuration changed
Fault	BOOL	Indicates that port data is inaccurate and cannot be trusted for use in the application. For more information, see Fault and Status Reporting on page 19.	0 = Good 1 = Bad, causing fault 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.
Uncertain	BOOL	Indicates that the port data can be inaccurate but the degree of inaccuracy is not known. For more information, see Fault and Status Reporting on page 19.	0 = Good data 1 = Uncertain data 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.
DeviceError	BOOL	Indicates if the device has an error.	0 = No error exists 1 = Error exists
EventPresent	BOOL	Indicates if an event has occurred on the device.	0 = No event occurred 1 = Event occurred
LatestEvent.EventType	USINT	Indicates the specific type of event.	• 1 = Notification • 2 = Warning • 3 = Error
LatestEvent.EventMode	USINT	Indicates the event mode.	• 1 = Event single shot • 2 = Event disappears • 3 = Event appears
LatestEvent.EventCode	LINT	The hexadecimal value that represents the event.	All positive values
LatestEvent.EventTimestamp	LINT	The time stamp of the event.	All positive values
DataTimestamp	LINT	The time stamp of the data.	All positive values
ProcessDataIn.xxxx	Process data input from the device.		Device-specific

Output Tags for IO-Link Device

Table 43 describes the available output tags ('0').

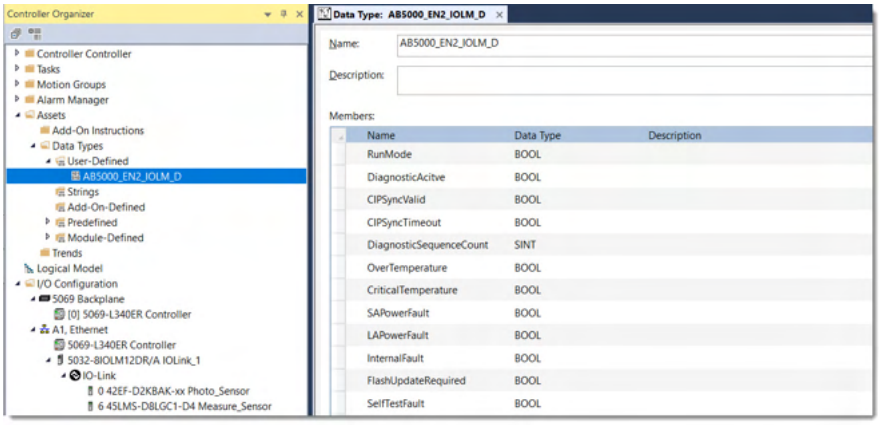
Table 43 - IO-Link Device Output Tags

Name	Data Type	Definition	Valid Values
ResetConfigChanged	BOOL	When the IO-Link master module reads this bit transition from 0 to 1, it resets the *ConfigChanged* bit in the input data. For more information on how to use the command, see IO-Link Device Configuration Change Notification on page 42.	0 = Configuration change not reset 1 = Configuration change reset
ProcessDataOut.xxxx	Process data output from the device.		Device-specific

Module Diagnostic Assembly

Create User-defined Diagnostic Assembly Types

You can use the Studio 5000 Logix Designer application to create user-defined Diagnostic Assembly types for the ArmorBlock IO-Link master module.



IMPORTANT The members that are indicated in the tables are arranged according to the Data Alignment Rules of controllers. Strictly follow the Data Type and sequence of the members that are indicated in the tables of this Appendix. Data misalignment after executing 'Get Attribute Single' Message (MSG) instruction may occur if the Data Type and sequence are not followed.

Diagnostic Assemblies

1. Diagnostic IO-Link Master 2 Port Ethernet Assembly
   - Instance ID = 0x8007 (32,775)
   - Size = 104 bytes

Follow the information in Table 44 to add each member.

Table 44 - Diagnostic Assembly Instance 32775

Name	Data Type	Byte	Valid Values
RunMode	BOOL	1	0 = Idle 1 = Run mode
InfoBits_Pad1	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
DiagnosticActive	BOOL		0 = No diagnostics active 1 = One or more diagnostics are active or the prognostics threshold is reached
CIPSyncValid	BOOL		0 = Module not synchronized 1 = Module synchronized
CIPSyncTimeout	BOOL		0 = A valid time master has not timed out 1 = A valid time master has timed out
InfoBits_Pad5	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
InfoBits_Pad6	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
InfoBits_Pad7	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.

Table 44 - Diagnostic Assembly Instance 32775 (Continued)

Name	Data Type	Byte	Valid Values
DiagnosticSequenceCount	SINT	1	-128...+127 The value of 0 is skipped except during module power-up.
OverTemperature	BOOL	2	0 = Module temperature not over operating limits 1 = Module temperature over operating limits
CriticalTemperature	BOOL		0 = Module not above critical temperature limit for proper operation 1 = Module above critical temperature limit for proper operation and may shut down without further warning
DiagBits_Pad2	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
DiagBits_Pad3	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
SAPowerFault	BOOL		0 = No fault on SA power exists 1 = Fault on SA power exists
LAPowerFault	BOOL		0 = No fault on LA power exists 1 = Fault on LA power exists
DiagBits_Pad6	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
InternalFault	BOOL		0 = No internal fault detected 1 = One or more internal diagnostics indicate an internal issue in the module. Fault is latched until the channel or device is reset
DiagBits_Pad8	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
DiagBits_Pad9	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
DiagBits_Pad10	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
DiagBits_Pad11	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
FlashUpdateRequired	BOOL		0 = Flash update not required 1 = Module has no application firmware
SelfTestFault	BOOL		0 = Module initialization code did not detect an error 1 = Module initialization code detected an error
DiagBits_Pad14	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
DiagBits_Pad15	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
ModuleStatus_Pad0	BOOL	2	This member acts as padding to ensure byte alignment. It can be renamed.
ModuleStatus_Pad1	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
ModuleStatus_Pad2	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
ModuleStatus_Pad3	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
ModuleStatus_Pad4	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
ModuleStatus_Pad5	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
ModuleStatus_Pad6	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
ModuleStatus_Pad7	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
DLREnabled	BOOL		0 = DLR is not enabled 1 = DLR is enabled
ModuleStatus_Pad9	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
ModuleStatus_Pad10	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
DLRNetworkState	SINT	1	The status of the network.
DLRSupervisorState	SINT	1	The status of the network supervisor.
LocalClockOffset	LINT	8	The offset in nanoseconds from the local clock to the system time. Use this value to detect steps in time. This value updates when a PTP update is received.
LocalClockOffsetTimestamp	LINT	8	The most recent time the *LocalClockOffset* is sampled. The initial value is zero and the first time stamp occurs when the module synchronizes with the master clock.
GrandMasterClockID	SINT[8]	8	The EUI-64 Identity of the CIP Sync Grand Master clock that the module is synced to.
SAPowerFaultTimestamp	LINT	8	The most recent time an SA power fault occurred.
LAPowerFaultTimestamp	LINT	8	The most recent time an LA power fault occurred.
OverTemperatureTimestamp	LINT	8	The most recent time the module reached a higher temperature than its operating limits.
CriticalTemperatureTimestamp	LINT	8	The most recent time the module temperature transitioned above the Critical Temperature.
InternalFaultTimestamp	LINT	8	The most recent time an internal fault condition occurred.
AB:Ethernet_Port_Channel:D:0 Port1	User-defined	16	User-defined data type for AB:Ethernet_Port_Channel_D:0, see Table 50.
AB:Ethernet_Port_Channel:D:0 Port2	User-defined	16	

2. Diagnostic IO-Link Master Assembly A
   - Instance ID = 0x8008 (32,776)
   - Size = 232 bytes

Follow the information in Table 45 to add each member.

Table 45 - Diagnostic Assembly Instance 32776

Name	Data Type	Byte	Valid Values
ChannelMode00	SINT	1	The operating mode of the channel.
ChannelMode01	SINT	1	The operating mode of the channel.
ChannelMode02	SINT	1	The operating mode of the channel.
ChannelMode03	SINT	1	The operating mode of the channel.
Pad	DINT	4	This member acts as padding to ensure byte alignment. It can be renamed.
AB:5000_IOLM_Channel:D:0 Ch00	User-defined	56	User-defined data type for AB:5000_IOLM_Channel:D:0, see Table 51.
AB:5000_IOLM_Channel:D:0 Ch01	User-defined	56	
AB:5000_IOLM_Channel:D:0 Ch02	User-defined	56	
AB:5000_IOLM_Channel:D:0 Ch03	User-defined	56	

3. Diagnostic IO-Link Master Assembly B
   - Instance ID = 0x8009 (32,777)
   - Size = 232 bytes

Follow the information in Table 46 to add each member.

Table 46 - Diagnostic Assembly Instance 32777

Name	Data Type	Byte	Valid Values
ChannelMode04	SINT	1	The operating mode of the channel.
ChannelMode05	SINT	1	The operating mode of the channel.
ChannelMode06	SINT	1	The operating mode of the channel.
ChannelMode07	SINT	1	The operating mode of the channel.
Pad	DINT	4	This member acts as padding to ensure byte alignment. It can be renamed.
AB:5000_IOLM_Channel:D:0 Ch04	User-defined	56	User-defined data type for AB:5000_IOLM_Channel:D:0, see Table 51.
AB:5000_IOLM_Channel:D:0 Ch05	User-defined	56	
AB:5000_IOLM_Channel:D:0 Ch06	User-defined	56	
AB:5000_IOLM_Channel:D:0 Ch07	User-defined	56	

4. Diagnostic IO-Link Master Assembly C
   - Instance ID = 0x800A (32,778)
   - Size = 232 bytes

Follow the information in Table 47 to add each member.

Table 47 - Diagnostic Assembly Instance 32778

Name	Data Type	Byte	Valid Values
ChannelMode08	SINT	1	The operating mode of the channel.
ChannelMode09	SINT	1	The operating mode of the channel.
ChannelMode10	SINT	1	The operating mode of the channel.
ChannelMode11	SINT	1	The operating mode of the channel.
Pad	DINT	4	This member acts as padding to ensure byte alignment. It can be renamed.
AB:5000_IOLM_Channel:D:0 Ch08	User-defined	56	User-defined type for AB:5000_IOLM_Channel:D:0, see Table 51.
AB:5000_IOLM_Channel:D:0 Ch09	User-defined	56	
AB:5000_IOLM_Channel:D:0 Ch10	User-defined	56	
AB:5000_IOLM_Channel:D:0 Ch11	User-defined	56	

5. Diagnostic IO-Link Master Assembly D
   - Instance ID = 0x800B (32,779)
   - Size = 232 bytes

Follow the information in Table 48 to add each member.

Table 48 - Diagnostic Assembly Instance 32779

Name	Data Type	Byte	Valid Values
ChannelMode12	SINT	1	The operating mode of the channel.
ChannelMode13	SINT	1	The operating mode of the channel.
ChannelMode14	SINT	1	The operating mode of the channel.
ChannelMode15	SINT	1	The operating mode of the channel.
Pad	DINT	4	This member acts as padding to ensure byte alignment. It can be renamed.
AB:5000_IOLM_Channel:D:0 Ch12	User-defined	56	User-defined type for AB:5000_IOLM_Channel:D:0, see Table 51.
AB:5000_IOLM_Channel:D:0 Ch13	User-defined	56	
AB:5000_IOLM_Channel:D:0 Ch14	User-defined	56	
AB:5000_IOLM_Channel:D:0 Ch15	User-defined	56	

6. Diagnostic Counters Ethernet Adapter Assembly
   - Instance ID = 0x303 (771)
   - Size = 28 bytes

Follow the information in Table 49 to add each member.

Table 49 - Diagnostic Assembly Instance 771

Name	Data Type	Byte	Valid Values
RunMode	BOOL	1	0 = Idle 1 = Run mode
InfoBits_Pad1	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
DiagnosticActive	BOOL		0 = No diagnostics active 1 = One or more diagnostics are active or the prognostics threshold is reached
InfoBits_Pad3	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
InfoBits_Pad4	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
InfoBits_Pad5	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
InfoBits_Pad6	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
InfoBits_Pad7	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
DiagnosticSequenceCount	SINT	1	-128...+127 The value of 0 is skipped except during module power-up.
TCPConnections	INT	2	Total number of active TCP connections.
CIPConnections	INT	2	Total number of active CIP connections.
CIPLostPackets	DINT	4	Total number of lost CIP packets.
CIPTimeouts	DINT	4	Total number of connection timeouts that have occurred.
HMIPacketRate	DINT	4	The packet rate between the module and HMI.
IOPacketRate	DINT	4	The packet rate to and from the module.
EthernetErrors	DINT	4	Total number of Ethernet errors.
CPUUtilization	INT	2	Total CPU load.

Diagnostic Channels

The following data types are retrieved as part of the Diagnostic Assembly Instance.

1. Diagnostic Ethernet Channel
   - Size: 16 bytes

Follow the information in Table 50 to add each member.

Table 50 - Structure for Diagnostic Ethernet Channel

Name	Data Type	Byte	Valid Values
PortStatus_Pad0	BOOL	1	This member acts as padding to ensure byte alignment. It can be renamed.
Fault	BOOL		0 = No fault exists 1 = Fault exists
Uncertain	BOOL		0 = Good data 1 = Uncertain data 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.
Connected	BOOL		0 = Ethernet port is inactive 1 = Ethernet port is active
FullDuplex	BOOL		0 = Ethernet port is running in half-duplex mode 1 = Ethernet port is running in full-duplex mode
PortStatus_Pad5	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
PortStatus_Pad6	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
PortStatus_Pad7	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
AutonegotiationStatus	SINT	1	0 = Auto-negotiation in progress. 1 = Auto-negotiation and speed detection failed. Using default values for speed and duplex. Default values are product-dependent; recommended defaults are 10 Mbps and half-duplex. 2 = Auto negotiation failed, but detected speed. Duplex was defaulted. Default value is product-dependent; recommended default is half-duplex mode. 3 = Successfully negotiated speed and duplex mode. 4 = Auto-negotiation not attempted. Forced speed and duplex mode.
Speed	INT	2	• 10 Mbps • 100 Mbps
Pad	DINT	4	This member acts as padding to ensure byte alignment. It can be renamed.
DisconnectedTimestamp	LINT	8	The most recent time the port is disconnected.

2. Diagnostic IO-Link Master Channel
   - Size = 56 bytes

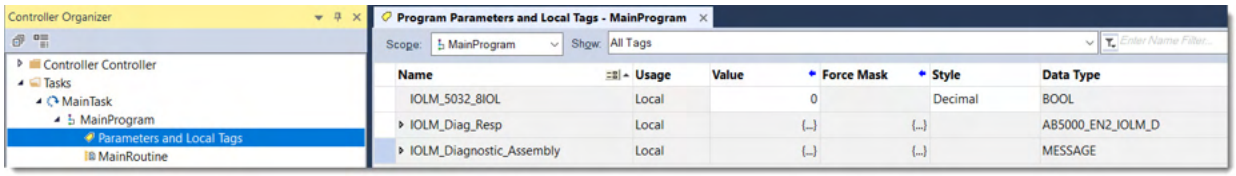
Follow the information in Table 51 to add each member.

Table 51 - Structure for Diagnostic IO-Link Master Channel

Name	Data Type	Byte	Valid Values
DiagBits_Pad0	BOOL	2	This member acts as padding to ensure byte alignment. It can be renamed.
Fault	BOOL		0 = No fault exists 1 = Fault exists
Uncertain	BOOL		0 = Good data 1 = Uncertain data 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.
NoLoad	BOOL		0 = No Load condition does not exists 1 = No Load condition exists, meaning a signal wire is disconnected from the channel
ShortCircuit	BOOL		0 = No short circuit or overcurrent condition exists 1 = Short circuit or overcurrent condition exists
DiagBits_Pad5	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
DiagBits_Pad6	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
DiagBits_Pad7	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
DiagBits_Pad8	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
SAPowerFault	BOOL		0 = No fault on SA power exists 1 = Fault on SA power exists
SAPowerShortCircuit	BOOL		0 = No short circuit on SA power exists 1 = Short circuit on SA power exists
DiagBits_Pad11	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
LAPowerFault	BOOL		0 = No fault on LA power exists 1 = Fault on LA power exists
LAPowerShortCircuit	BOOL		0 = No short circuit on LA power exists 1 = Short circuit on LA power exists
DiagBits_Pad14	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
DiagBits_Pad15	BOOL		This member acts as padding to ensure byte alignment. It can be renamed.
PortStatusInfo	USINT	1	The status of the port in “IO-Link”, “Digital Input, Fallback”, and “Digital Input, Timestamp, Fallback” channel modes. 0 = NO_DEVICE – No communication 1 = DEACTIVATED – Port configuration is deactivated 2 = PORT_DIAG – Diagnosis of the port during startup 4 = OPERATE – This value is set if the device is in OPERATE, even if a device error is present 5 = DI_C/Q – Port configuration ‘DI’ is set 255 = NOT_AVAILABLE – PortStatusInfo is not available
Pad1	SINT	1	This member acts as padding to ensure byte alignment. It can be renamed.
Pad2	DINT	4	This member acts as padding to ensure byte alignment. It can be renamed.
NoLoadTimestamp	LINT	8	The most recent time a No Load condition occurred.
ShortCircuitTimestamp	LINT	8	The most recent time a short circuit occurred.
SAPowerFaultTimestamp	LINT	8	The most recent time a fault on SA power occurred.
SAPowerShortCircuitTimestamp	LINT	8	The most recent time a short circuit on SA power occurred.
LAPowerFaultTimestamp	LINT	8	The most recent time a fault on LA power occurred.
LAPowerShortCircuitTimestamp	LINT	8	The most recent time a short circuit on LA power occurred.

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.

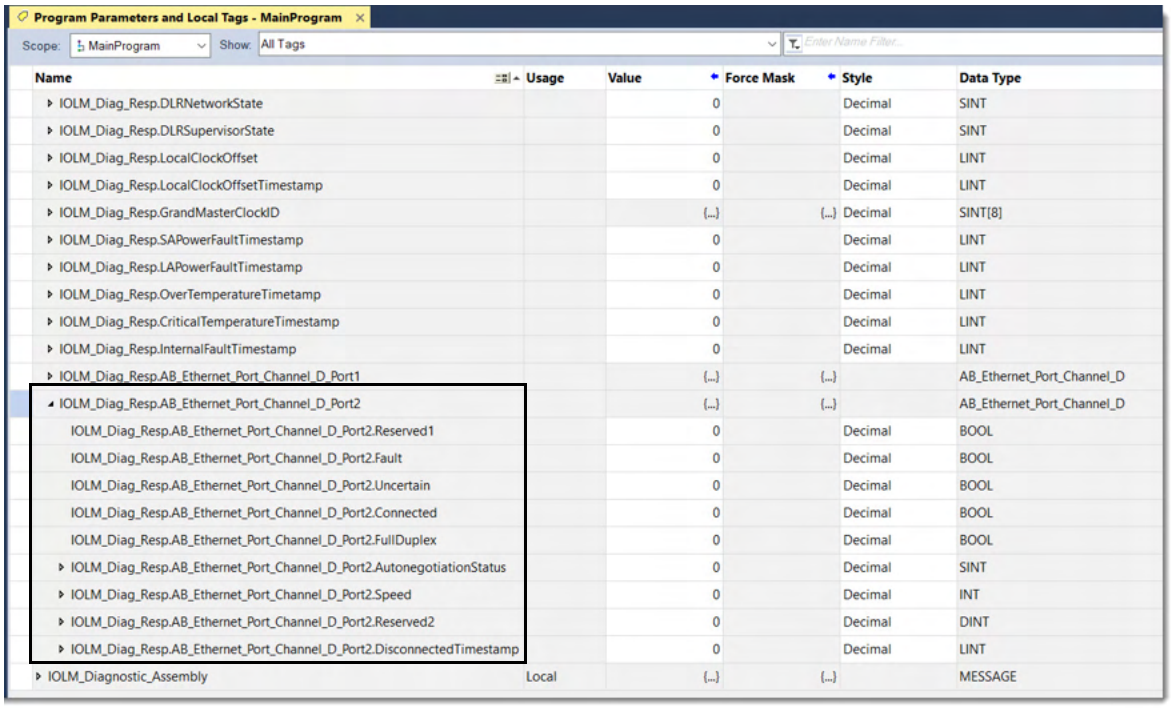


From the Controller Organizer pane, expand Tasks > Main Task > MainProgram.

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, enter the following information:
   - Service Type = Get Attribute Single
   - Class = 4
   - Instance =
     - 32775 (0x8007) Diagnostic IO-Link Master 2 Port Ethernet Assembly
     - 32776 (0x8008) Diagnostic IO-Link Master Assembly A
     - 32777 (0x8009) Diagnostic IO-Link Master Assembly B
     - 32778 (0x800A) Diagnostic IO-Link Master Assembly C
     - 32779 (0x800B) Diagnostic IO-Link Master Assembly D
     - 771 (0x303) Diagnostic Counters Ethernet Adapter Assembly
   - Attribute = 3
   - Destination Element = User-defined type suitable for the instance entered
6. On the Communication tab, select the path to the module that you wish to send the message to.
7. Select OK.
8. 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.

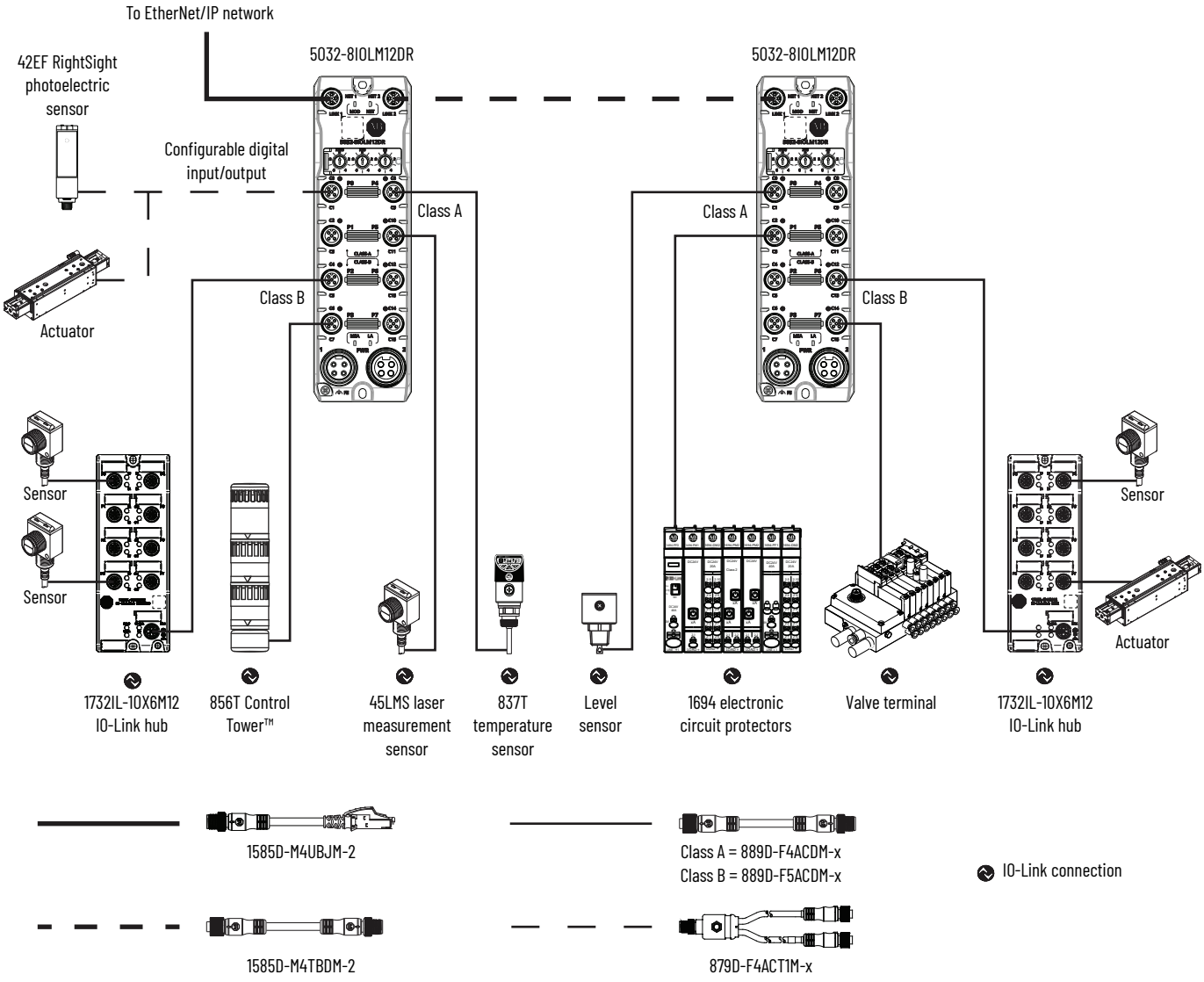


IO-Link Connectivity

Example Diagram

Figure 19 provides an example of the different IO-Link devices that you can connect to your ArmorBlock 5000 8-channel IO-Link master module.

Figure 19 - IO-Link Connectivity Example



Notes:

Secure Web Server

The ArmorBlock 5000 8-channel IO-Link master module allows you to view network diagnostic information and configure network settings of the module through a secure web server interface.

To view the web server interface, enter the IP address of the IO-Link master module into your browser, preceded by "https://".

For example, https://192.168.1.99

IMPORTANT	Make sure that your LAN and TCP/IP settings are configured to access the subnet on which your ArmorBlock 5000 8-channel IO-Link master module communicates. We recommend that you only use a secure network environment as it retains default settings.

This feature is available with firmware revision 2.011 or later.

Browser Requirements

To access the ArmorBlock 5000 8-channel IO-Link master module web server pages, you must use the latest versions of the following browsers:

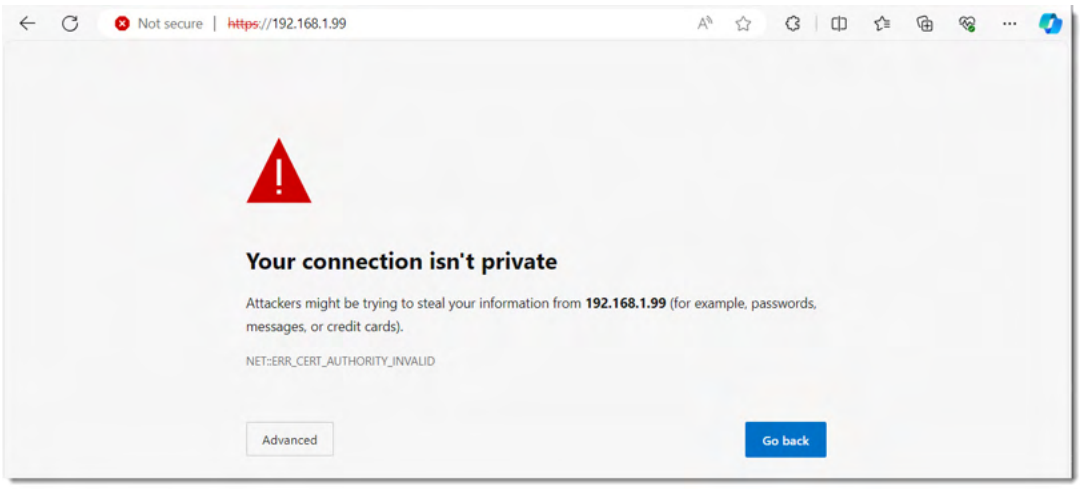
- Microsoft® Edge™ version 116 or later
- Google Chrome version 116 or later
- Mozilla Firefox version 109 or later

To access data view web server pages, your browser requires JavaScript support.

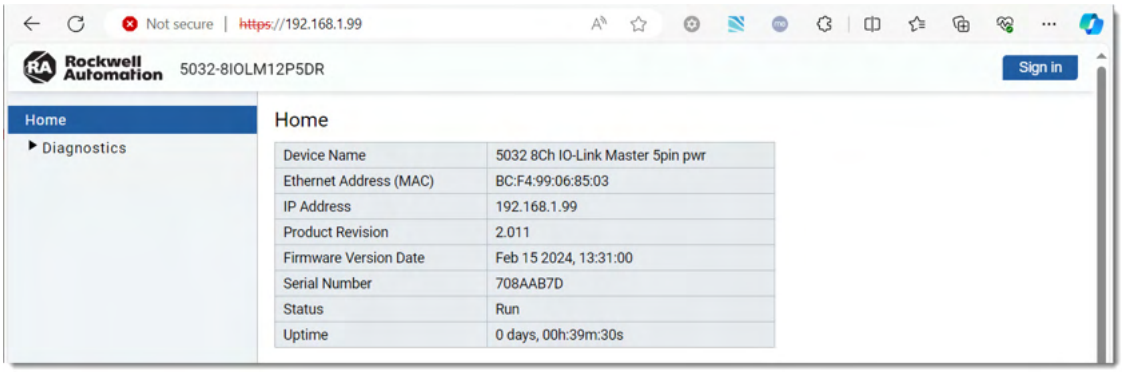
Access the Web Server Home Page

The first time that you enter the IP address of the module into your web browser, a privacy error page opens. This occurs due to a self-signed certificate used to establish a secure HTTP connection.

Figure 20 - Example of Web Server Privacy Error



To proceed, you must acknowledge the privacy error. The steps to acknowledge the error vary depending on the browser that you use. Follow the instructions on the error page. Once you have acknowledged the error, the web server home page displays.



Without signing in, you can only view the diagnostics pages for the module. If you want to view the configuration pages and make changes, you must authenticate with your credentials.

Sign in to the Web Server

Many of the ArmorBlock 5000 8-channel IO-Link master module features require you to sign in with the appropriate access. If you want to view the configuration pages and make changes, you must sign in with your username and password.

Select Sign in on the top right of the page to launch the sign in dialog.

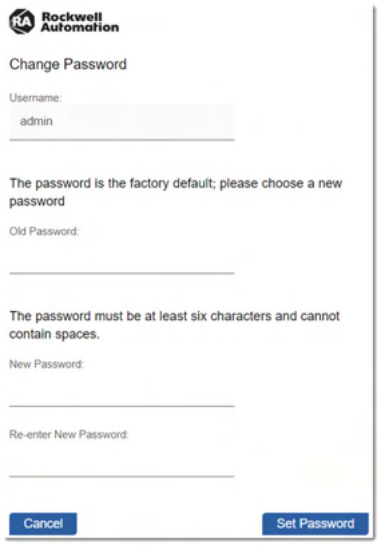
Mandatory First-time Password Change

You must change the default password when you access the web server for a module that is in the out-of-box state, or when the module has been reset to factory default.

If you do not change the default password before establishing an initial I/O connection, the web server remains in the read-only state and you can only access the diagnostics pages. To access the configuration pages, you must perform a factory reset and change the default password before establishing an initial I/O connection.

The first time that you access the web server, the Change Password dialog appears as shown in Figure 21.

Figure 21 - Change Password Example



- Factory default username: “admin”
- Factory default password: “password”

The newly set password must adhere to the following criteria:

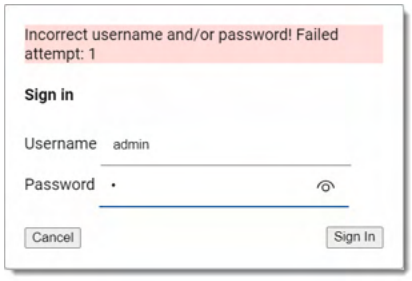
- Does not contain spaces
- Does not match the default password
- Password length must contain 8...64 characters
- Username and password are case sensitive

Maximum Limit of Unsuccessful Sign in Attempts

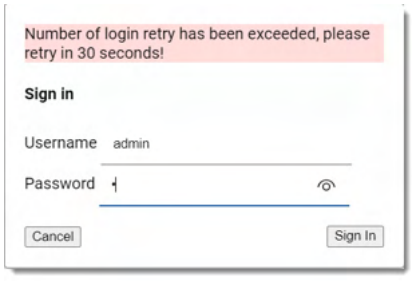
You are allowed up to three unsuccessful attempts to sign in to the web server.

The error message “Incorrect username and/or password! Failed attempt: x” displays, where x is the number of attempts. After three unsuccessful attempts, the message “Number of login retry has been exceeded, please retry in 30 seconds!” displays and you are locked out of the web server for 30 seconds.

An unsuccessful sign in attempt



After three unsuccessful sign in attempts



Session Timeout - Inactivity Timeout

The web server monitors webpage usage and locks you out of the current session if no input or movement is detected for three minutes. The webpage goes to the default home page. If you wish to continue the session with user access, you can sign in again using the Sign in option at the top.

Session timeout is based on the request that is sent to the web server from the Configuration pages only. If there are no requests that are processed from the Configuration pages for three minutes, the session times out.

Configure Module IP Settings

You can configure the IP settings for the IO-Link master module using the Internet Protocol Page on page 146.

Web Server Security

The web server employs HTTPS for secure and encrypted connections with clients. HTTPS uses SSL/TLS certificates to achieve its security goals.

The ArmorBlock 5000 8-channel IO-Link master module uses two types of certificates:

- A self-signed certificate — Automatically generated by the module itself during its initial power-on following a factory reset
- A CA-signed certificate — Obtained by having the certificate signed through a Certificate Authority

Generate a Self-signed Certificate

The module comes with an out-of-box self-signed certificate that is generated using the ECC algorithm.

Figure 22 - Self-signed Certificate Web Security Setup

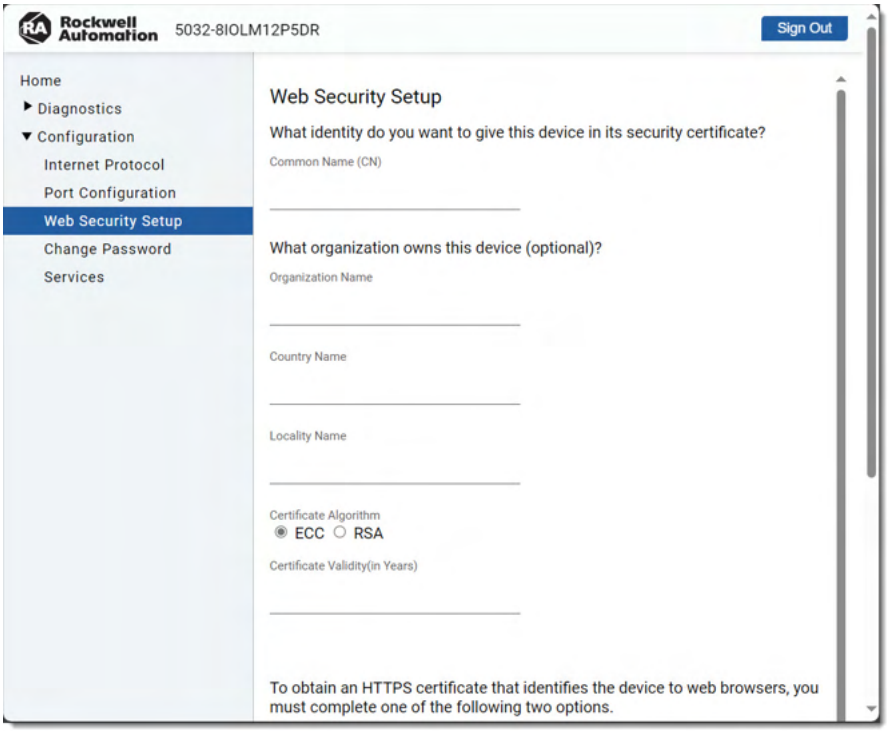


Table 52 - Web Security Setup Requirements

Parameter	Accepted Value	Length
Common Name	Any character	8...64
Organization Name	Alphabet, number, and space only	1...64
Country Name	Alphabet only	2
Locality Name	Alphabet only	1...64
Certificate Validity	Numeric value only	1...82 (years)

To generate a self-signed certificate, complete these steps:

1. From the Web Security Setup page, enter the necessary details that are shown in Figure 22. **You must enter the Common Name**.
2. Select whether to generate the certificate using the ECC or the RSA algorithm.
3. Select Self-sign a certificate.

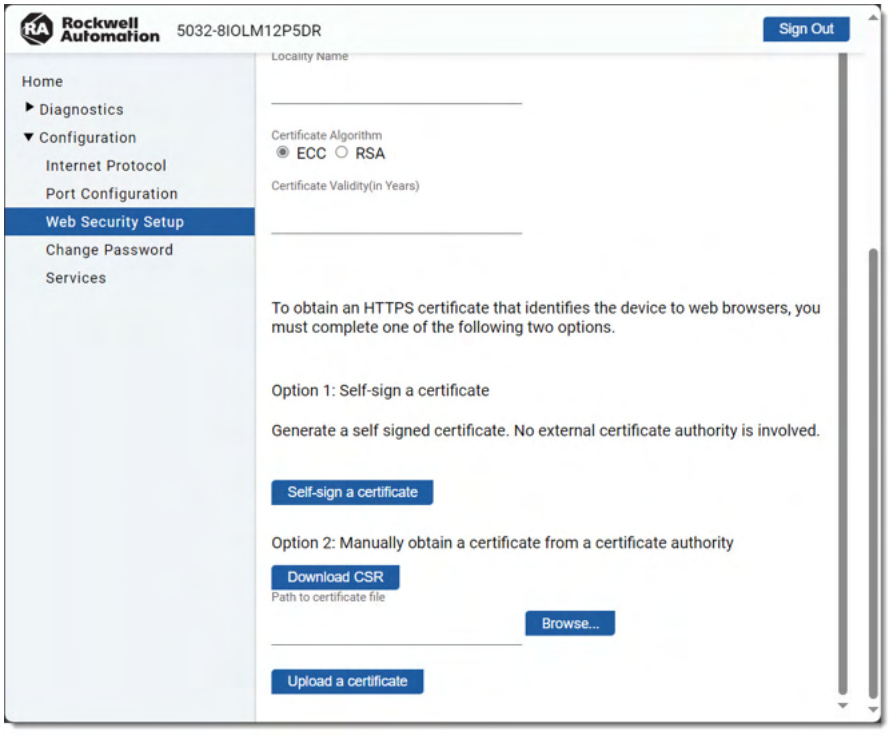
   The self-signed ECC certificate generates in approximately five seconds, whereas the RSA certificate generates in approximately 50 seconds. Once the certificate is generated, the web server restarts, and the generated certificate is used.

A self-signed certificate is automatically generated whenever you change the IP settings.

Upload a CA-signed Certificate

You can upload a CA-signed certificate that is based on the Certificate Signing request (CSR) generated from the module.

Figure 23 - CA-signed Certificate Web Security Setup



To upload a CA-signed certificate, complete these steps:

1. From the Web Security Setup page, enter the necessary details that are shown in Figure 23. **You must enter the Common Name**.
2. Select whether to generate the CSR using the ECC or the RSA algorithm.
3. Select Download CSR.

The CSR generates in approximately five seconds for the ECC algorithm, whereas the CSR generates in approximately 50 seconds for the RSA algorithm. Once the CSR is generated, you can retrieve the CSR in the Downloads folder.

4. Use the generated CSR to have a Certificate Authority (CA).
5. Once you have the CSR signed by a CA, you can use the Browse... option to go to the location where you stored the certificate.
6. Select Upload a certificate.

   Once the certificate is uploaded, the web server restarts, and the uploaded certificate is used.

- We recommend that you close the browser and reopen it to see the newly generated or uploaded certificates.
- Once you upload a CA-signed certificate, the web server will only use the CA-signed certificate. If you regenerate a self-signed certificate, it will not take effect.

Enable or Disable the Web Server

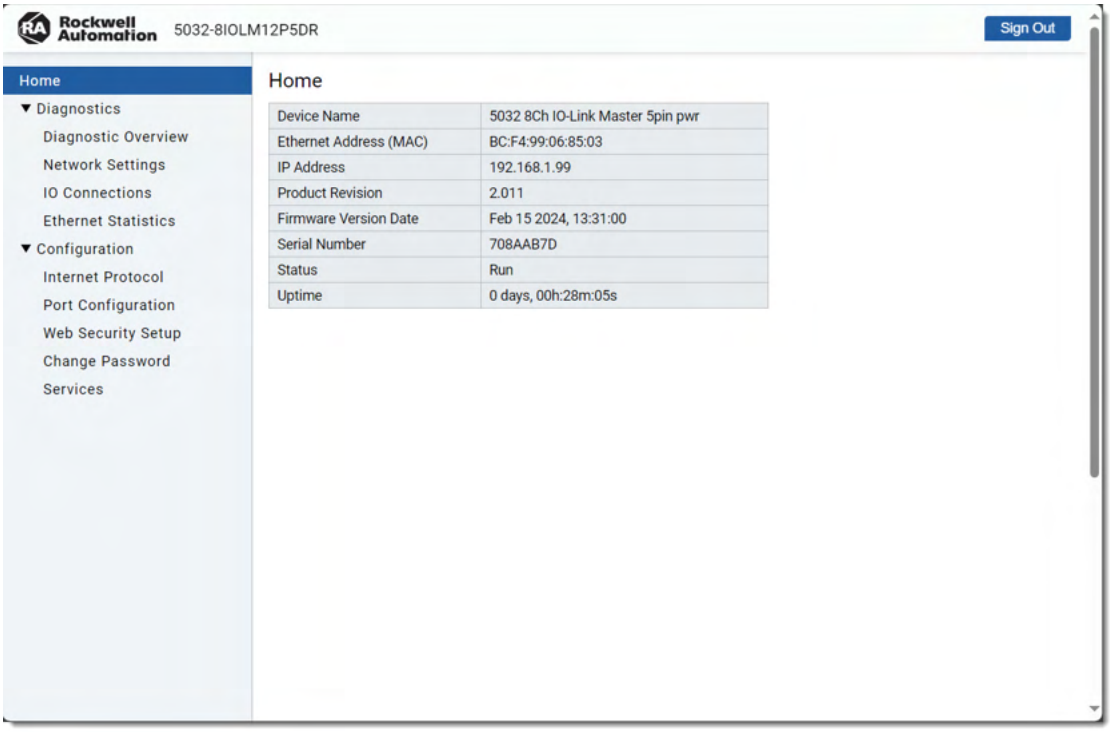
The web server functionality is enabled by default. Disabling the web server and using the Protection Mode helps to decrease the possibility of a security breach.

To disable the web server, see Services Page on page 148.

Navigate the Web Server

Navigate the web server pages by using the navigation panel on the left of the screen.

Figure 24 - Navigate the Web Server Pages



Diagnostic Pages

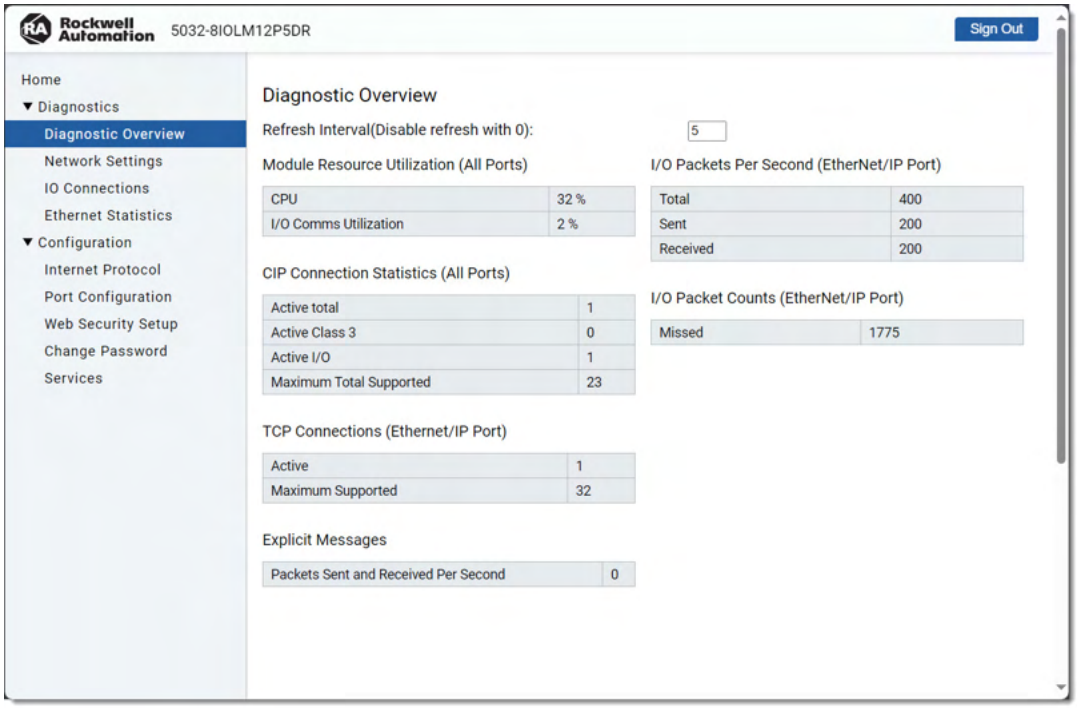
Diagnostics pages are read-only. Read-only pages automatically refresh according to the configured Refresh Interval, set in seconds. The default Refresh Interval is set to 5 seconds, which is both the minimum and initial value. You can adjust the Refresh Interval up to a maximum of 15 seconds. If you set the Refresh Interval to 0, auto-refresh is disabled.

The following diagnostics pages are described in this section.

- Diagnostic Overview Page
- Network Settings Page
- IO Connections Page
- Ethernet Statistics Page

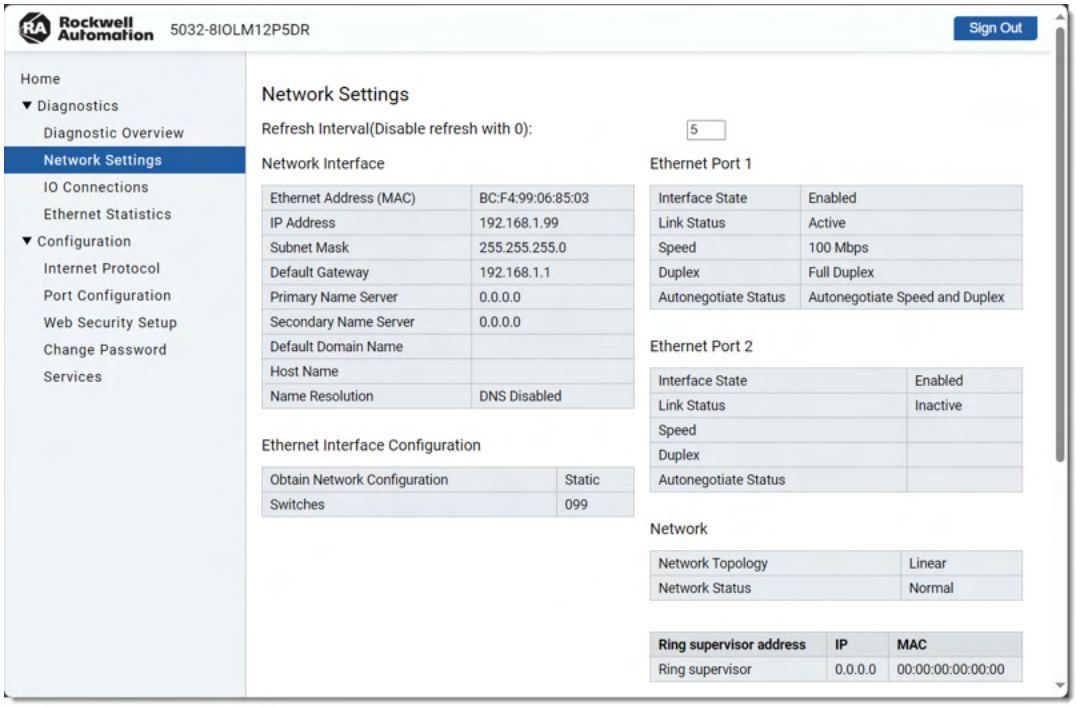
Diagnostic Overview Page

The Diagnostic Overview Page shows the module resource utilization and status of the network ports.



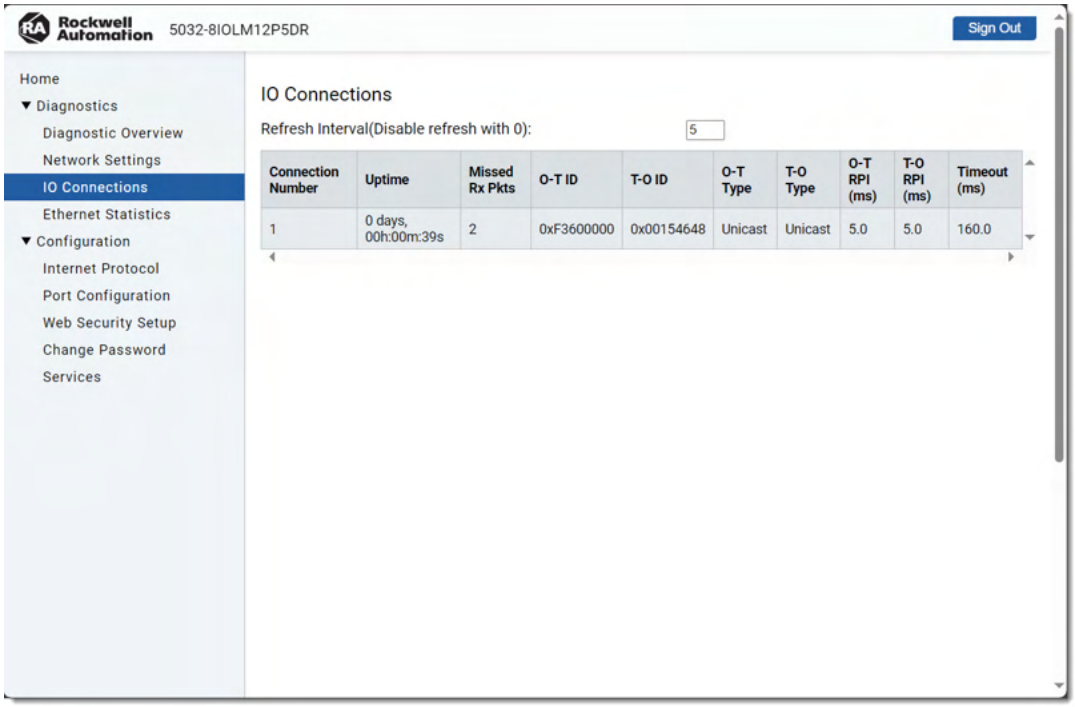
Network Settings Page

The Network Settings page shows the details of the network connection.



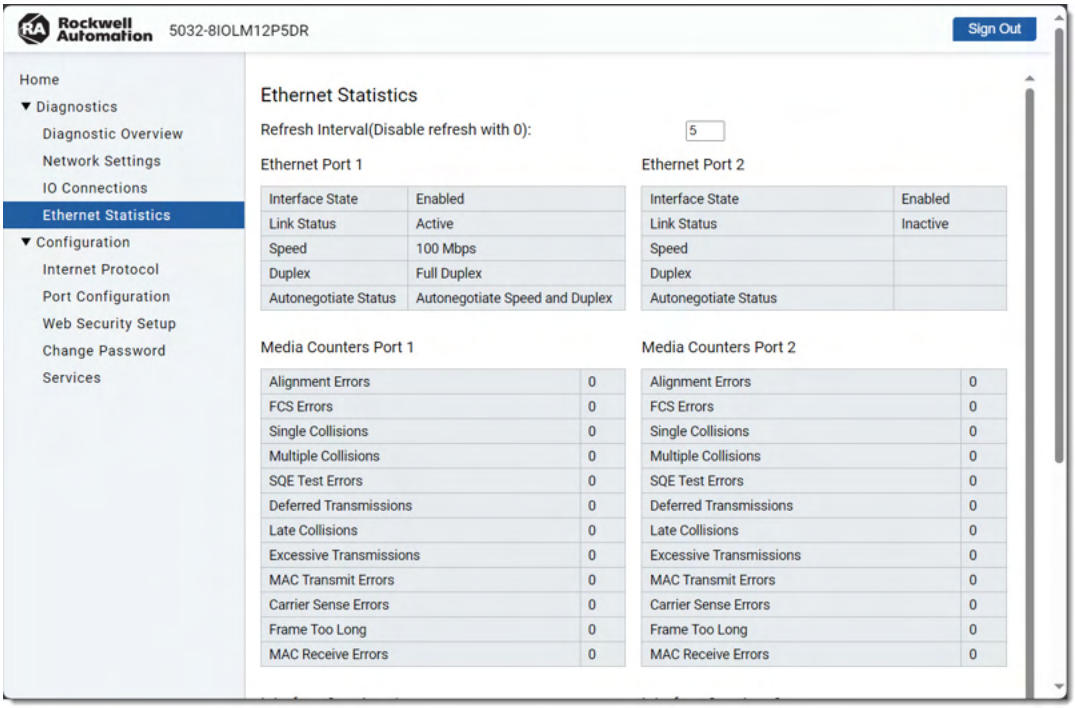
IO Connections Page

The IO Connections page shows the status of the module I/O channels.



Ethernet Statistics Page

The Ethernet Statistics page shows the details of the Ethernet connection.



Configuration Pages

To view the configuration pages and make changes, you must sign in to the web server.

The following configuration pages are described in this section.

- Internet Protocol Page
- Port Configuration Page
- Web Security Setup Page
- Change Password Page
- Services Page

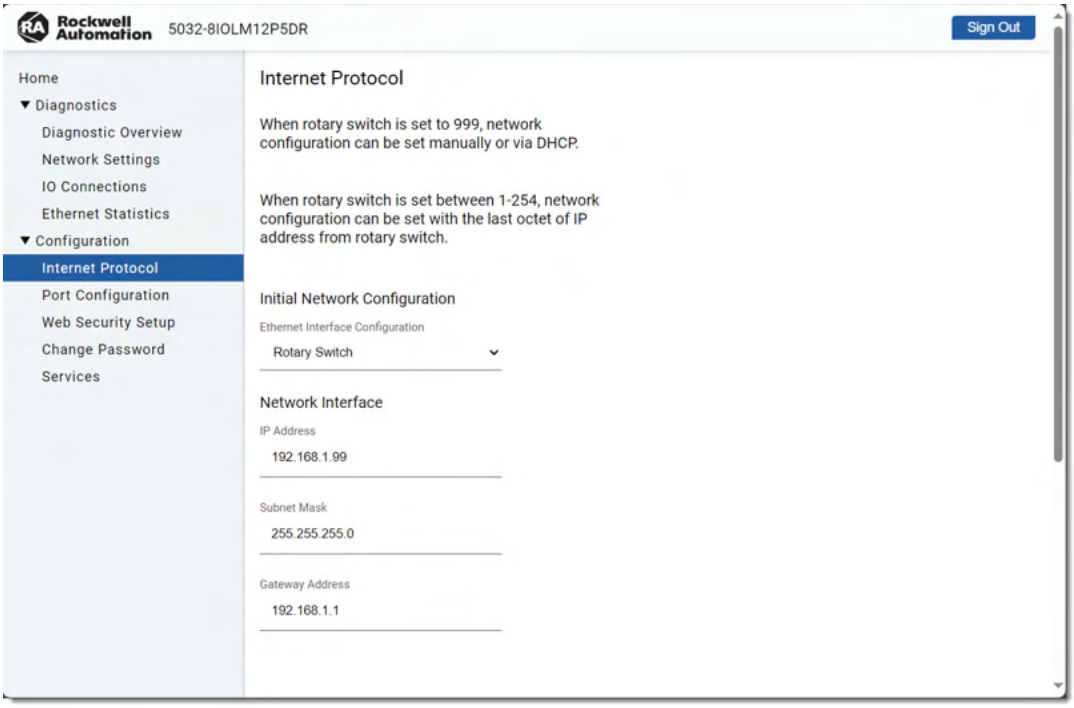
You cannot update the pages while the module is in Explicit or Implicit Protection mode.

Internet Protocol Page

The Internet Protocol page shows the IP settings for the IO-Link master module.

Use the Internet Protocol page to complete the following tasks:

- Select how IP settings are configured.
- Configure IP settings.

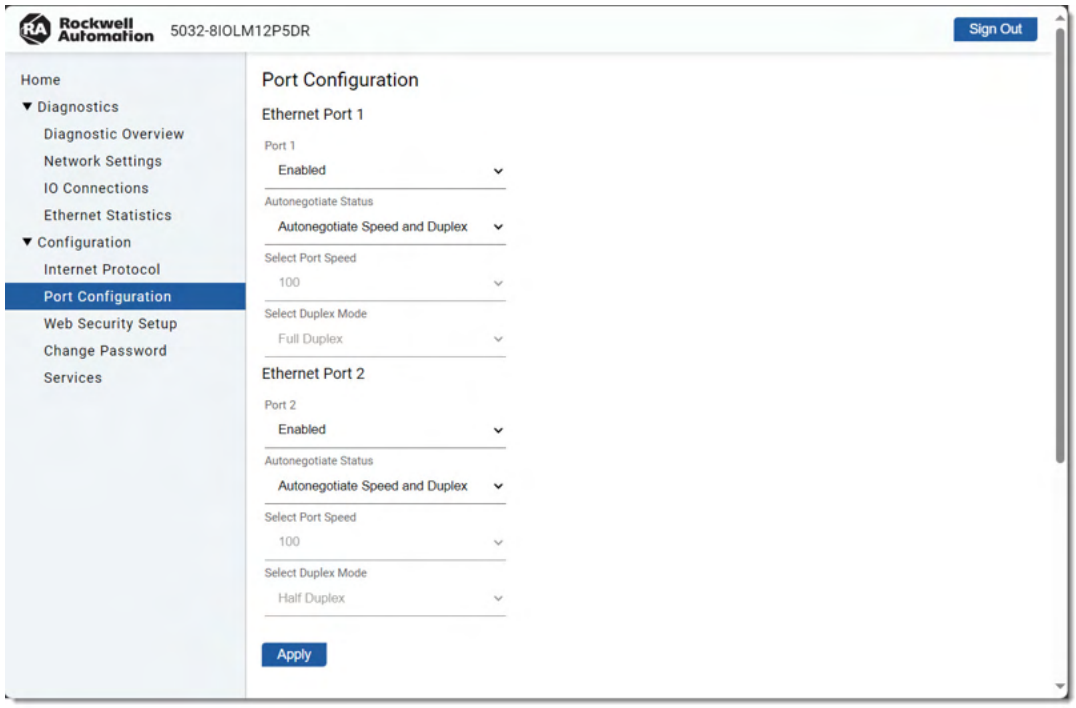


Port Configuration Page

The Port Configuration page shows the status information of the network ports.

Use the Port Configuration page to complete the following tasks:

- Enable or disable network ports.
- Select whether to configure the port setings automatically or manually.
- Select the port speed.
- Select the port duplex mode.

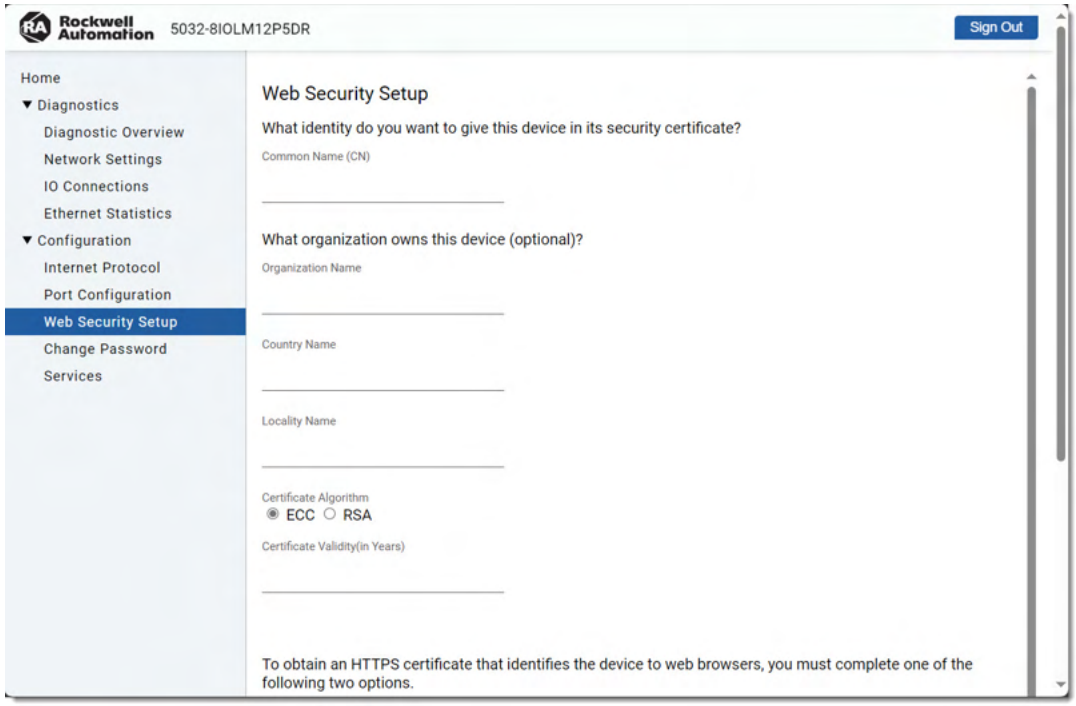


Web Security Setup Page

The Web Certificate Setup page shows the information on the HTTPS certificate for the web server.

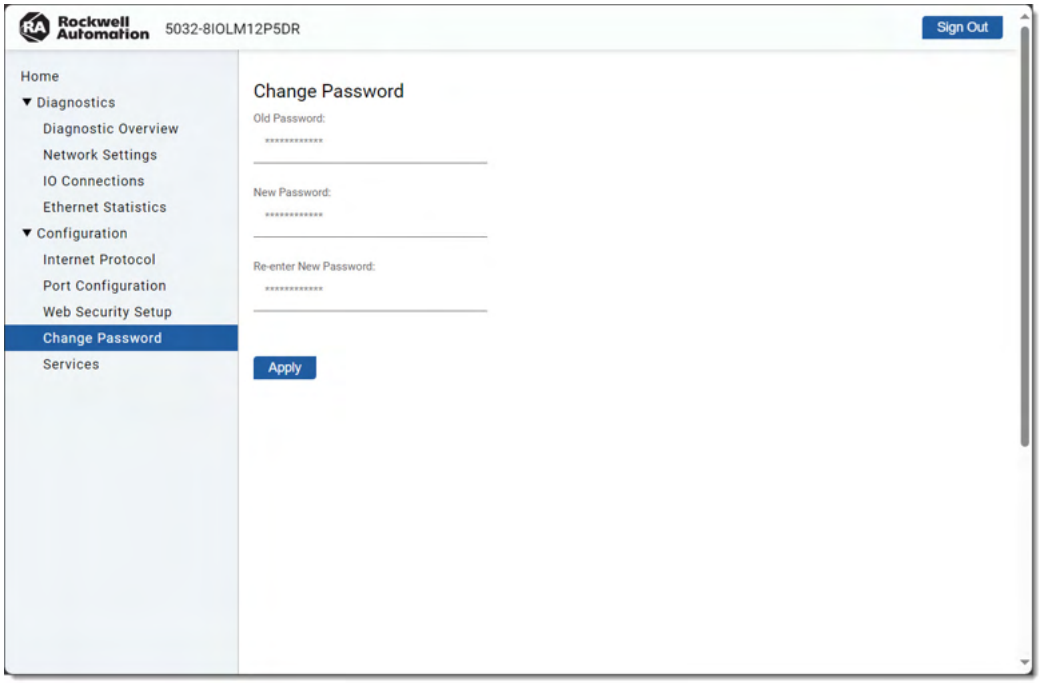
Use this page to complete the following tasks:

- Generate a self-signed certificate.
- Generate a CSR.
- Upload a CA-signed certificate.



Change Password Page

The Change Password page provides the option to change the web server password.

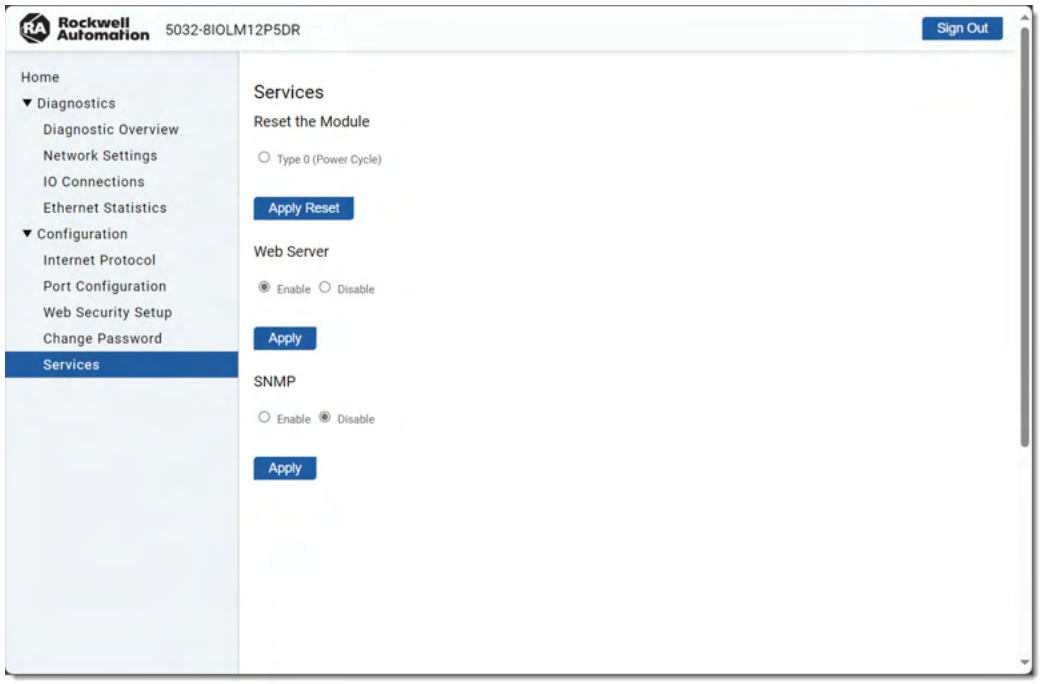


Services Page

The Services page shows the status of the web server and SNMP server.

Use the Services page to complete the following tasks:

- Reset the module.
- Enable or disable the web server.
- Enable or disable the SNMP server.



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Notes:

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, Knowledgebase, and product notification updates.	rok.auto/support
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Technical Documentation Center	Quickly access and download technical specifications, installation instructions, and user manuals.	rok.auto/techdocs
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

Documentation Feedback

Your comments help us serve your documentation needs better. If you have any suggestions on how to improve our content, complete the form at rok.auto/docfeedback.

Waste Electrical and Electronic Equipment (WEEE)

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

Rockwell Automation maintains current product environmental compliance information on its website at rok.auto/pec.

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