PointMax 4-Channel IO-Link Master Module User Manual

5034-IOL4, 5034-IOL4XT

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.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

Reproduction of the contents of this manual, in whole or in part, without written permission of Rockwell Automation, Inc., is prohibited.

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.

Table of Contents

Preface

This manual describes how to use PointMax™ 4-channel IO-Link master module in Logix 5000® control systems.

Make sure that you are familiar with the following:

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

If you are not familiar with them, refer to your software documentation or online help before attempting to use this module.

Additional Resources

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

Table 1. Additional Resources

Resources	Description
PointMax I/O System Specifications Technical Data, publication 5034-TD001	Provides PointMax I/O system specifications.
PointMax I/O System Installation Instructions, publication 5034-IN001	Provides instructions on installing a complete PointMax I/O system.
PointMax EtherNet/IP Adapter User Manual, publication 5034-UM001	Provides information on how to configure and operate PointMax EtherNet/IP adapters.
PointMax Digital I/O Modules User Manual, publication 5034-UM002	Provides information on how to configure and operate PointMax digital I/O modules.
PointMax Analog I/O Modules User Manual, publication 5034-UM003	Provides information on how to configure and operate PointMax analog I/O modules.
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.
Safety Guidelines for the Application, Installation, and Maintenance of Solid-state Control, publication SGI-1.1	Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Selection and Configuration tools website, rok.auto/systemtools	Helps configure complete, valid catalog numbers and build complete quotes based on detailed product information.
Product Certifications website, rok.auto/certifications	Provides declarations of conformity, certificates, and other certification details.

Download Firmware, AOP, EDS, and Other Files

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

Terminology

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

Table 2. Terminology

Acronym	Full Term	Definition
BP	Backplane Power	Power that is generated by the adapter and expansion power, then supplied to the I/O system through the backplane.
CIP™	Common Industrial Protocol	An industrial communication protocol that is used by Logix 5000® based automation systems on EtherNet/IP™, ControlNet®, and DeviceNet® communication networks.
CIP Sync™	Common Industrial Protocol Synchronization	CIP Sync provides the increased control coordination needed for control applications where absolute time synchronization is vital to achieve real-time synchronization between distributed intelligent devices and systems.
MB	Mounting Base	A device that provides data and power connections from the backplane to the installed module.
MP	Module Power	Power that is supplied to the adapter and expansion power.
ODVA	Open DeviceNet Vendor Association	A nonprofit association of vendors that are established for the promotion of CIP networks.
RIUP	Removal and Insertion Under Power	A feature that enables the device to be connected and disconnected from the system without having to remove power from the system.
RPI	Requested Packet Interval	Time interval (usually in milliseconds) that users are requesting their data be exchanged at
RTB	Removable Terminal Block	A component that is used for wiring field devices to.
SA	Sensor Actuator	A term that is used to describe field-side devices.
SELV	Safety Extra Low Voltage	An electrical system where the voltage level is considered safe under normal or fault conditions, as defined in the EN and IEC standards.
SIO	Standard Input/Output	Describes the function of a port on an IO-Link master device.
SSV	Sensor Source Voltage	Voltage that is supplied to a sensor.
XT	Harsh Environment	These modules have additional conformal coating and design considerations that add a greater degree of protection when exposed to harsh, corrosive environments.

IO-Link Master Module

The PointMax 4-channel IO-Link master module provides four IO-Link channels and four configurable standard digital I/O channels. The IO-Link channels can be used as standard digital I/O. The IO-Link master module can be configured to fit any IO-Link and/or discrete application.

The module has four IO-Link Class A ports with the following assignment:

Port Number	**Port 0**		**Port 1**		**Port 2**		**Port 3**	
IO-Link Port Class	A		A		A		A	
Channel Number	Channel 0	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
Channel Type	C/Q	I/Q	C/Q	I/Q	C/Q	I/Q	C/Q	I/Q

Each IO-Link port supports two independent channels that are C/Q channel and I/Q channel:

- Channels 0, 2, 4, and 6 are C/Q channels. You can configure these channels as IO-Link channel, digital input, and digital output.
- Channels 1, 3, 5, and 7 are I/Q channels. You can configure these channels as digital input and digital output.

IMPORTANT: Only C/Q channels can be configured as IO-Link channels.

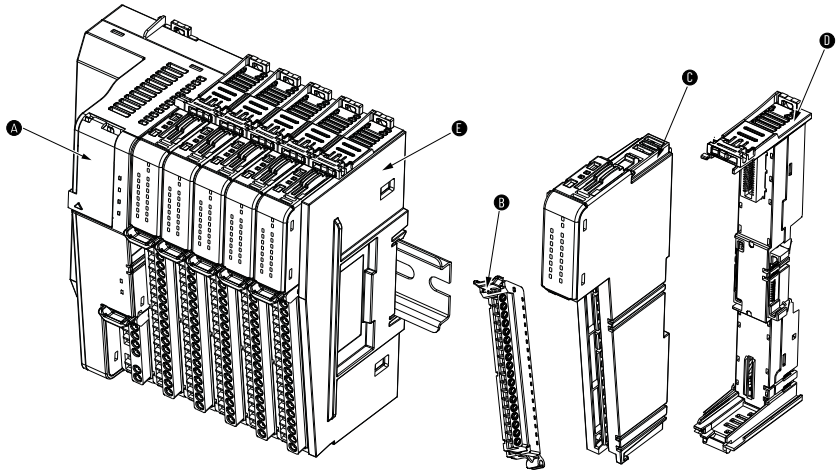
IO-Link master module supports removal and insertion under power (RIUP). You must remove the RTB first and then the IO-Link master module.

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

Construct a PointMax I/O System

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

Figure 1. PointMax I/O System



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

For PointMax I/O system power requirements, see PointMax I/O System Installation Instructions, publication 5034-IN001.

IMPORTANT: You must limit the SA field-side power source to 10 A max, at 20...30V DC.

Secure Access to the System

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

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

To secure access to the system, consider these options:

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

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

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

PointMax I/O in a Logix 5000 Control System

IMPORTANT: Throughout this publication, the term Logix 5000 controller refers to the controllers with which you can use PointMax I/O modules in a given capacity. You can use PointMax I/O modules with Logix 5000 controllers as remote I/O modules only. You cannot use PointMax I/O modules with all Logix 5000 controllers. For example, you can use PointMax I/O modules with CompactLogix® 5380 and ControlLogix® 5580 controllers but not with CompactLogix 5370 and ControlLogix 5570 controllers.

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

See Connections on page 12 for the communication model between controller and I/O modules.

Controller and Software Compatibility

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

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

If you use GuardLogix® controllers and need to use up to chassis slot 32, you must use Studio 5000 Logix Designer application version 37 or later.

Module Firmware Updates

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

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

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

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

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

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

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

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 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.

Connections

A connection is a real-time data transfer link between the owner-controller and the module that occupies the slot that the configuration references.

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

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

Producer/Consumer Communication

PointMax I/O modules use the Producer/Consumer communication model to produce data without a controller polling them first. The modules produce the data and controllers consume it. That is, the owner-controller and controllers with a Listen Only connection to the module can consume it.

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

Ownership

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

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

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

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

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

Requested Packet Interval

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

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

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

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

Connection Optimization

PointMax I/O system supports automatic optimization for I/O connections.

The following conditions must be met for connections to be included in the optimization:

- I/O modules on the rack have the same RPI
- Unicast
- Sum of data sizes are within the packet limit

This is similar to how I/O systems such as POINT I/O™ support rack optimization or enhanced rack optimization. Functional safety modules, HART modules, and IO-Link master modules are excluded from the optimization.

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 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.

Fault and Status Reporting

The 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. Fault and Status Tags – IO-Link Master Module

Data Type	Tag Name	Triggering Event That Sets the Tag
Fault	*ConnectionFaulted*	The controller loses its connection to the module.  *ConnectionFaulted* tag provides module-wide data and affects all channels simultaneously.
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.

Table 4. Fault Tags – I/O 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.

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.

For more information on fault reporting in the Studio 5000 Logix Designer application and module status indicators, see 5034-IOL4 and 5034-IOL4XT Details on page 70.

Input Events

The IO-Link master module can be configured with four input event definitions.

To use Input Events, select the "Data with Events" connection type in the Device definition dialog while configuring the module.

To change the connection type, see Overview View on page 70.

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.

IMPORTANT: No input event is generated, if any of the participating channel is in fault condition.

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.
- 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.

CIP Sync Time

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

These modules are CIP Sync slave-only devices. There must be another module on the network that functions as a master clock. For more information on how to use CIP Sync technology, see the Integrated Architecture and CIP Sync Configuration Application Technique, publication IA-AT003.

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

IMPORTANT: *I.CIPSyncValid* = 1 is not sufficient for an application to confirm that the module is ready for application requiring a system time synchronization to start operation. See Grandmaster Clock Verification on page 16 for extra verification needed.

Grandmaster Clock Verification

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

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

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

If Status connection is not selected in the PointMax EtherNet/IP adapter Device Definition dialog, verify that all following conditions are true:

- I/O module's *I.CipSyncValid* is 1
- I/O module's *GrandmasterClockID* in GrandMasterClockInfo attribute of TimeSync object is the same as the controller's *GrandmasterClockID*
  - Class: 0x43
  - Instance: 0x01
  - Attribute: 0x08
  - Response: GrandMasterClockInfo (See the structure below)

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

To get controller's GrandMasterClockID, access the TIMESYNCHRONE object through the GSV instruction. See Access the TimeSynchronize object.

Protected Operations

If one of the module I/O connections is open and running, it is considered as the module is in Protection Mode. Protection Mode is a state where the device is operational but has

implemented defenses against disruptive changes that could take the product out of service. The following operations are restricted when the module is in Protection Mode:

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

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

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

I/O channel configuration change is allowed when the module is in Protection Mode. To apply configuration change without interrupting the I/O connections, there are two methods:

- Change configurations and apply in Module Properties
- Change configuration tag values and send a Reconfigure Module MSG to the module to apply the changes.

Inhibit the module to come out of the Protection Mode.

Unicast or Multicast Connection

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

The IO-Link master module use one of the following methods to broadcast data:

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

IMPORTANT: If you are using a ControlLogix 5580 controller in a high availability system, you must use Multicast.

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.

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 to inhibit and uninhibit the module:

1. Inhibit the module – Go to Connection view in the Module Properties dialog, select Inhibit Module and then select Apply or OK.
2. Perform the necessary update.
3. Uninhibit the module – Go to Connection view in the Module Properties dialog, clear Inhibit Module and then select Apply or OK.

Electronic Keying

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

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

Table 5. Electronic Keying Options

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 or compatible 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. • You can use an XT version of the module in place of a non-XT module or non-XT version of the module in place of XT module.
Disable Keying	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.  **ATTENTION:** Be cautious when using Disable Keying; if used incorrectly, this option can lead to personal injury or death, property damage, or economic loss. We strongly suggest 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. When XT module is configured in Studio 5000 Logix Designer application project, only XT Module residing on XT MB is considered as Exact Match. When non-XT module is configured, only non-XT module (with any MB) is considered as exact match.

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

IMPORTANT: Changing Electronic Keying parameters online interrupts connections to the device and any devices that are connected through the device. Connections from other controllers can also be broken. If an I/O connection to a device is interrupted, the result can be a loss of data.

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

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 6. Digital Input Filter Settings for Channels 1, 3, 5, and 7

Filter Time Off → On	Filter Time On → Off
0 µs	0 µs
100 µs	100 µs
200 µs	200 µs
500 µs (default)	500 µs (default)
1 ms	1 ms
2 ms	2 ms
5 ms	5 ms
10 ms	10 ms
20 ms	20 ms
50 ms	50 ms

Table 7. Digital Input Filter Settings for Channels 0, 2, 4, and 6

Filter Time Off → On	Filter Time On → Off
0 µs	0 µs
2 ms (default)	2 ms (default)
5 ms	5 ms
10 ms	10 ms
20 ms	20 ms
50 ms	50 ms

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 timestamps are only recorded with valid transitions.

To set the input filter values, see Channels View on page 75.

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 IO-Link master module offers submillisecond timestamping on a per channel basis.

Pulse Latching

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

To use Pulse Latching, you must configure the channel as "Digital Input, Timestamp" or "Digital, Input, Timestamp, Fallback". See Device Definition - Channel Assignments View on page 72.

Location in Studio 5000 Logix Designer Application Project	Action
Module Properties → Overview → Device Definition → Channel Assignments	Check the input transition type where you must latch short-duration pulses. For example, for short-duration pulses that are latched for Off to On transitions, select Off → On input transition.
Module tags	One or both of these actions. • Change the *C.Ptxx.CaptureOffOnEn* tag to 1. • Change the *C.Ptxx.CaptureOnOffEn* tag to 1.

When the module detects a short-duration pulse at an input point, the changes that are described in this table occur.

Input Transition Type Where Pulse Is Captured	Change in Studio 5000 Logix Designer Application Project
Off to On	• The *I.Ptxx.TimestampOffOnNumber* tag increments. • The timestamp is recorded in the *I.Ptxx.TimestampOffOn* tag.
On to Off	• The *I.Ptxx.TimestampOnOffNumber* tag increments. • The time stamp is recorded in the *I.Ptxx.TimestampOnOff* tag.

When subsequent short-duration pulses are detected at the same input point, the Latching configuration dictates what changes, if any, occur in the Studio 5000 Logix Designer application project.

Latching Configuration	Input Transition Type Where Pulse Is Captured	Change in Studio 5000 Logix Designer Application Project
Disabled (default) These conditions disable Timestamp Latching. • The Enable Timestamp Latching checkbox on the PTxx page is cleared. • The *C.Ptxx.TimestampLatchEn* tag = 0	Off to On	The *I.Ptxx.TimestampOffOnNumber* tag increments. The new time stamp is recorded in the *I.Ptxx.TimestampOffOn* tag, which overwrites the previous time stamp.
	On to Off	The *I.Ptxx.TimestampOnOffNumber* tag increments. The new time stamp is recorded in the *I.Ptxx.TimestampOnOff* tag, which overwrites the previous time stamp.
Enabled These conditions enable Timestamp Latching. • The Enable Timestamp Latching checkbox on the PTxx page is selected. • The *C.Ptxx.TimestampLatchEn* tag = 1	Off to On	The *I.Ptxx.TimestampOffOnNumber* and *I.Ptxx.TimestampOffOn* tags remain latched until the last captured pulse is acknowledged. In other words, the tag values remain the same until the last captured pulse is acknowledged.

Latching Configuration	Input Transition Type Where Pulse Is Captured	Change in Studio 5000 Logix Designer Application Project
	On to Off	The *I.Ptxx.TimestampOnOffNumber* and *I.Ptxx.TimestampOnOff* tags remain latched until the last captured pulse is acknowledged. In other words, the tag values remain the same until the last captured pulse is acknowledged.

To acknowledge the last captured pulse, set the output tag of the last input pulse as follows:

- Off to On transition - Set the *O.Ptxx.TimestampOffOnNumberAck* tag = *I.Ptxx.TimestampOffOnNumber* tag.
- On to Off transition - Set the *O.Ptxx.TimestampOnOffNumberAck* tag = *I.Ptxx.TimestampOnOffNumber* tag.

Once a pulse latch is acknowledged for an input point, the next pulse at that point increments the corresponding *I.Ptxx.TimestampOffOnNumber* and records the time stamp in *I.Ptxx.TimestampOffOn*.

You can change tag values in program logic while normal module operation continues or through the Studio 5000 Logix Designer application tag editor.

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 timestamps 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 Chxx - Digital Input, Timestamp View on page 78 or Chxx - Digital Input, Timestamp, Fallback View on page 80.

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 Chxx - Digital Output View on page 76.

Configure Channel Output State in Communication 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 "Communication fault state" 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 “Communication fault state duration”.

Communication Fault 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 communication 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 "Communication fault state duration" time expires, the output transitions to the user-defined "Final communication fault state".

Final Communication Fault State

The "Final communication fault state" defines the state to which the output goes after the "Communication fault state duration" time expires.

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

To configure the output states in communication Fault mode, see Chxx - Digital Output View on page 76.

When Communication Fails in Program Mode

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

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

Short Circuit Detection

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

Table 8. Short Circuit Detection for Output Channels

Ports	Short Circuit Conditions with Detection	Description
0, 1, 2, 3	SSV Power Short Circuit	Short between terminals V+ and COM
	Odd Channel Output Short Circuit	Short between terminals I/O and COM
	Even Channel Output Short Circuit	Short between terminals C/O and COM

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 75.

For more information on how to retrieve diagnostic assemblies, see Diagnostic Assembly on page 94.

For more information on using module tags, see 5034-IOL4 and 5034-IOL4XT Details on page 70 .

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, 5, and 7 as “Digital Output, Short Circuit, No Load”.

To enable No Load Diagnostics, see Chxx - Digital Output View on page 76.

For more information on how to retrieve diagnostic assemblies, see Diagnostic Assembly on page 94.

For more information on using module tags, see 5034-IOL4 and 5034-IOL4XT Details on page 70.

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

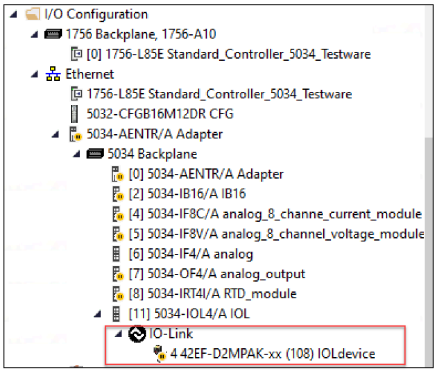
With the highly integrated IO-Link device feature, every IO-Link device has its own independent CIP identity.

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 33 and Import/Export IODD Files on page 34.

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 RTB screw 9) 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 55.

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 timestamp, 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 104.

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 Device Definition dialog. See Device Definition View on page 70.

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 62.

To inhibit the device connection, see Connection View on page 104.

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
- 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. 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 61.

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

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 Chxx - IO-Link View on page 78 and Module Definition on page 102.

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 108.

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 108.

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 104.

Fault and Status Reporting

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

The tags that are available depend on the connection type that you have configured in the Device definition.

Table 9. Fault and Status Tags for IO-Link Device

Data Type	Tag Name	Triggering Event That Sets the Tag
Fault	ConnectionFaulted	The controller loses its connection to the IO-Link device. When this bit is set, the Fault bit is set automatically.
	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.

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 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.

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 10. 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.
- For extra Class 3 connection limitation that applies on the chassis level, see PointMax EtherNet/IP Adapter User Manual, publication 5034-UM001.

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 59.

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 IO-Link master module supports both IO-Link port-level and IO-Link device-level reporting of IO-Link events.

Table 11. Number of IO-Link Events Supported

Port/Device	With Timestamp	Maximum Number of Events
IO-Link Port	Yes	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 75.

To enable timestamps for device-level IO-Link events and view the device-level IO-Link event log, see Event Log View on page 108.

For more information on the IO-Link Event Log, see IO-Link Event Log on page 68.

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 45.

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 45.

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 46.

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 53.

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 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.

IO-Link Module Applications

This chapter describes how to configure your IO-Link master module in a Studio 5000 Logix Designer application project. You can use the default module configuration or edit the module configuration.

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

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

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

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

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

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

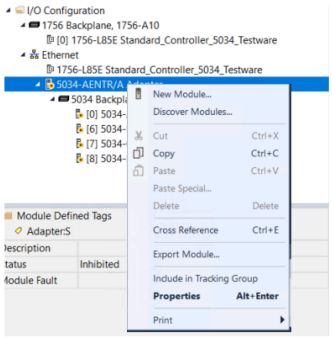
- Discover Modules
- New Module

Discover Modules

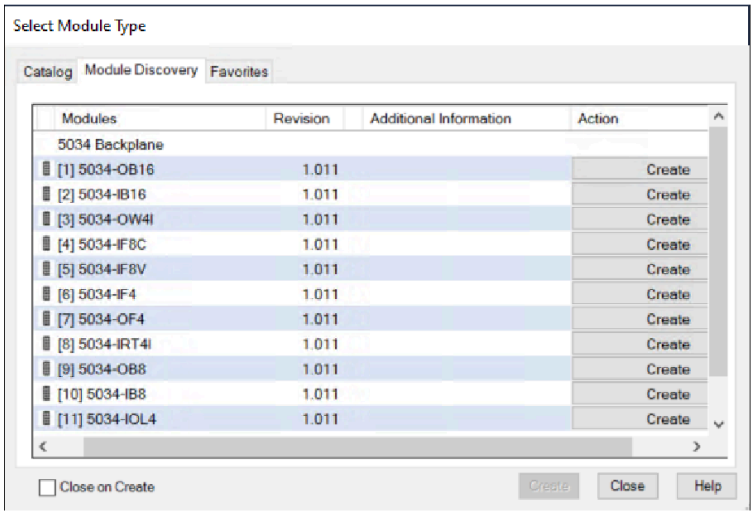
To use the Discover Modules method with PointMax I/O modules, complete these steps:

1. Go online with your Studio 5000 Logix Designer application.

   The project must include a PointMax EtherNet/IP adapter.
2. Right-click the PointMax EtherNet/IP adapter and select Discover Modules.



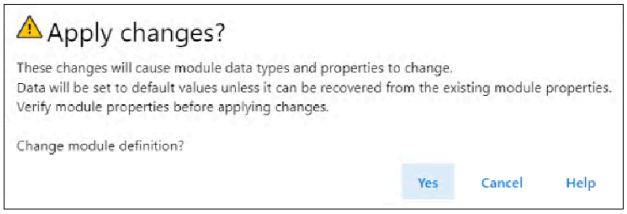
   The Studio 5000 Logix Designer application automatically detects available modules that are connected to the backplane. The Select Module Type dialog appears with list of modules detected.
3. In the Select Module Type window, select Create in the Action column to add the module to the project.



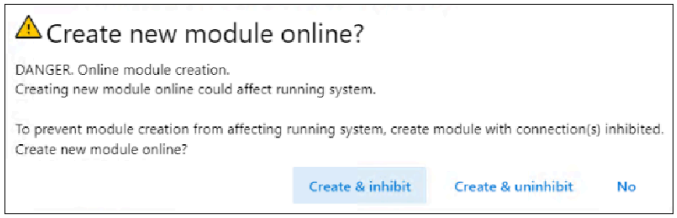
The New Module window with Device definition dialog appears.

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

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



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



7. After adding as many as module you need, close the Select Module Type dialog.

To add additional I/O modules with this method, complete one of the following:

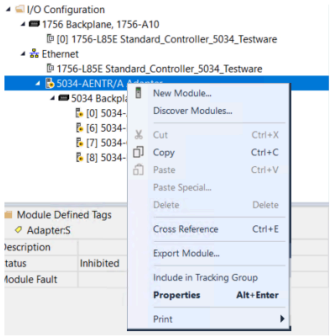
- If you selected the Close on Create checkbox when you created the first I/O module, repeat steps 2...6.
- If you did not select the Close on Create checkbox when you created the first I/O module, repeat steps 3...6.

Add a New Module

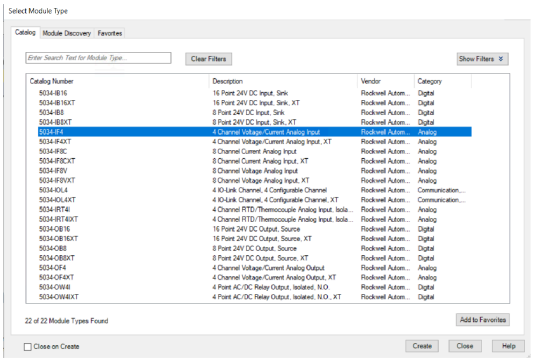
To use the New Module method with PointMax I/O modules, complete these steps.

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

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



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



The New Module window appears with Device definition dialog.

3. You can select OK to use the default configuration as shown or edit the module configuration.

To add additional remote I/O modules with this method, complete one of the following:

- If you selected the Close on Create checkbox when you created the first I/O module, repeat steps 1...3.
- If you did not select the Close on Create checkbox when you created the first I/O module, repeat steps 2...3.

I/O Tag Name Conventions

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

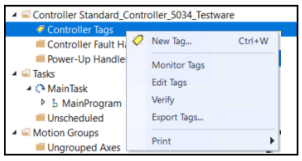
Example tag name = Adapter1:I.Pt00.Data

- Adapter = Name of the EtherNet/IP adapter in the system
- 1 = Slot number
- I = Tag type
  The possible tag types are C (configuration), EI (event input), EO (event output), I (input), and O (output)
- Pt00 = Module point number
- Data = Tag function
  In this case, Data represents the input data that is returned to the ownercontroller.

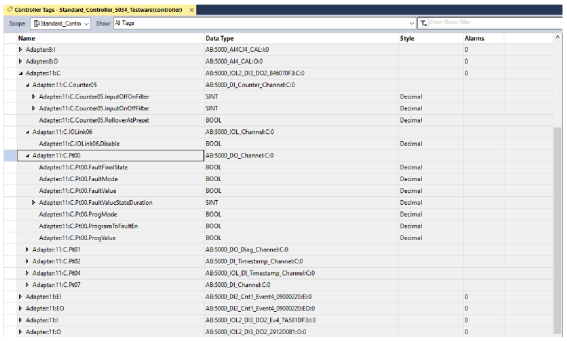
Access I/O Tags

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

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



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



Troubleshoot Your IO-Link Master Module

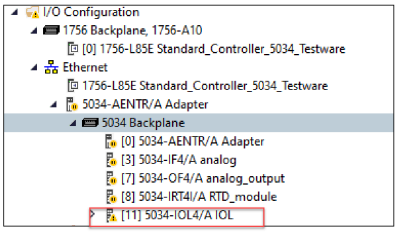
You can following methods to troubleshoot your module:

- Use Module Status Indicators to troubleshoot your module. For more information, see Use the Status Indicators for Troubleshooting on page 83.
- Use Studio 5000 Logix Designer application.

Use Studio 5000 Logix Designer Application

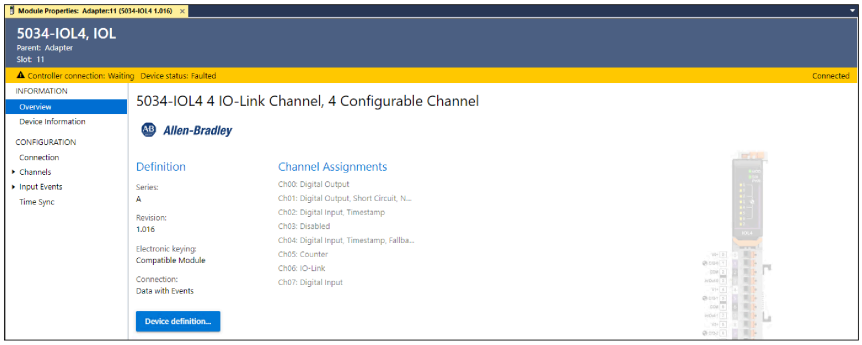
Check the Controller Organizer to see if there is a warning icon on the module.

Figure 2. Warning Icon in Controller Organizer



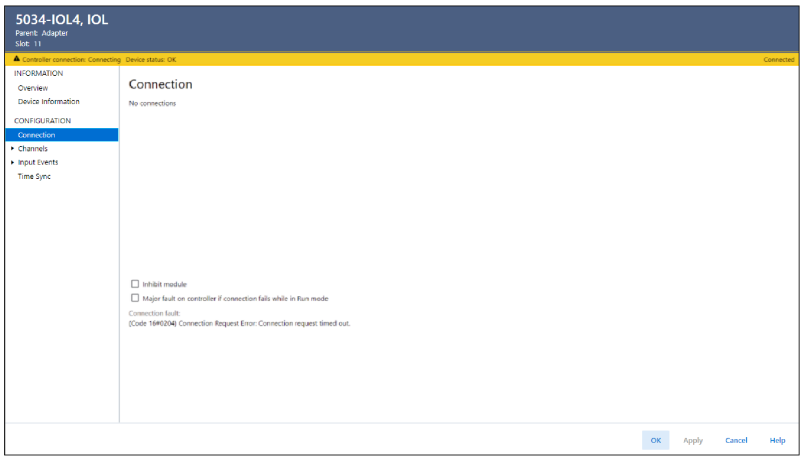
If a warning icon is present, open the Module Properties and check the status bar to identify the type of fault.

Figure 3. Fault Message in Status Bar



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

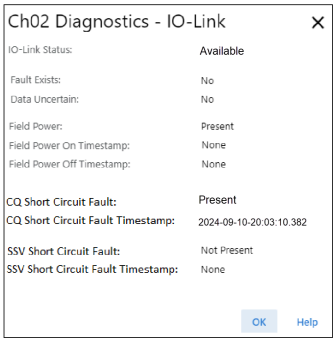
Figure 4. Connection Fault Description with Error Code



Error Code	Action
0x204	1. Open the Module Properties of the adapter. 2. Go to Chassis Information view and check the base status. If there is a fault, check the base details to identify the fault.
Keying Error	Go to Device Information view to confirm that the physical module is compliant or matches the configured identity. For more information, see Electronic Keying in Logix 5000 Control Systems Application Technique, publication LOGIX-AT001.
0x10	Go to Device Information view and check the firmware revision and major fault status. • If firmware update is required, update the firmware. • If the major fault is recoverable, reset the module. • If the major fault is unrecoverable, replace the module.

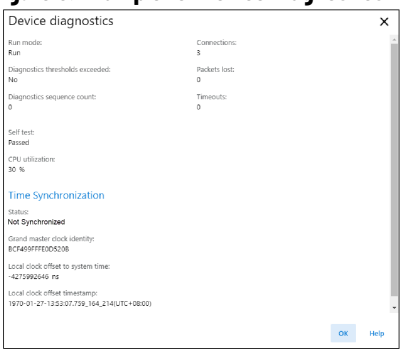
If a channel is faulted, go to the Channels → Chxx view and select the Diagnostics to see the diagnostic condition of the channel.

Figure 5. Example for Channel Diagnostics with CQ Short Circuit Fault



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

Figure 6. Example for Device Diagnostics with Time Sync not Synchronized



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

Troubleshoot Wiring Issues

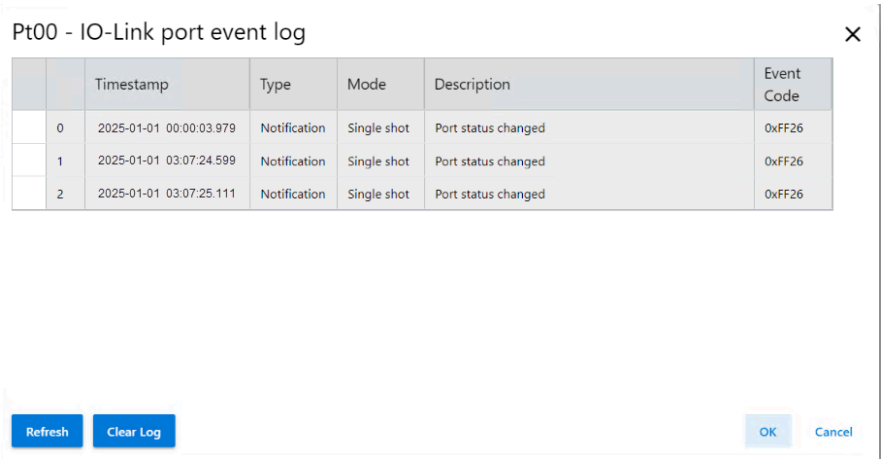
The possible faults that can occur due to incorrect usage or when wiring IO-Link master module are listed here.

System/Function	Fault	Description	Recommended Action
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.

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 7. IO-Link Port Event Log Example



To access the port-level IO-Link event log, see Chxx - IO-Link View on page 78.

Table 12. 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 V+ – Check wire connection
0x1807	Error	Overcurrent at V+ – 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
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

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. See IO-Link Interface and System Specification at io-link.com.

Table 13. 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

IO-Link Device Applications

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

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 IO-Link master module.
   For more information, see Add a New Module to a Studio 5000 Logix Designer Application Project on page 35.
4. Set at least one channel mode to one of the following:
   - IO-Link
   - Digital Input, Fallback
   - Digital Input, Timestamp, Fallback

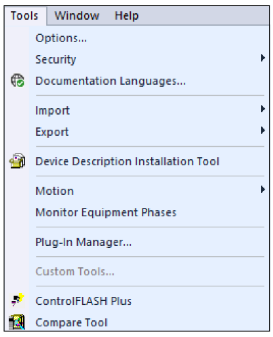
Before using the IO-Link capabilities, verify the following:

- 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.

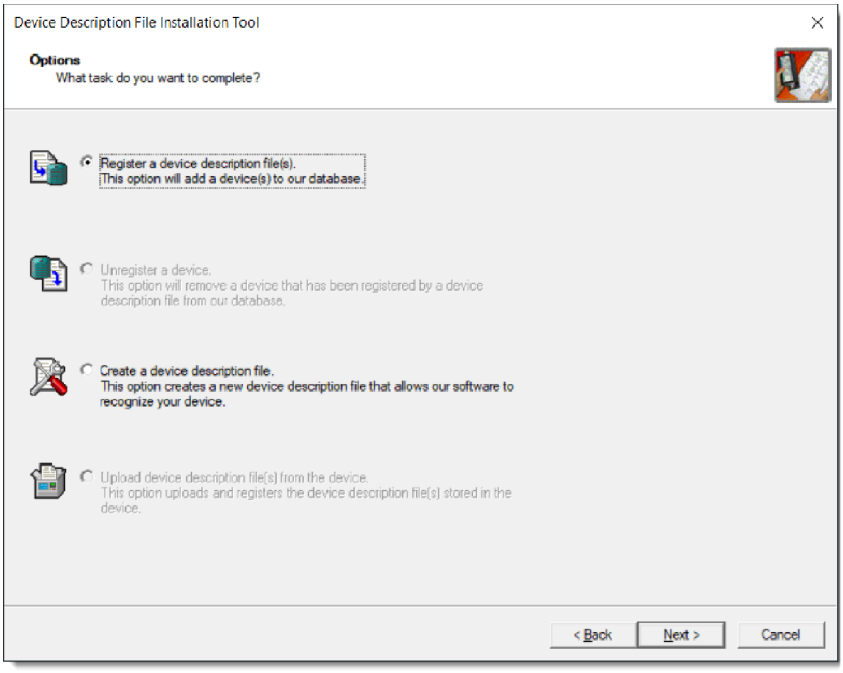
Register IO-Link Device IODD

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

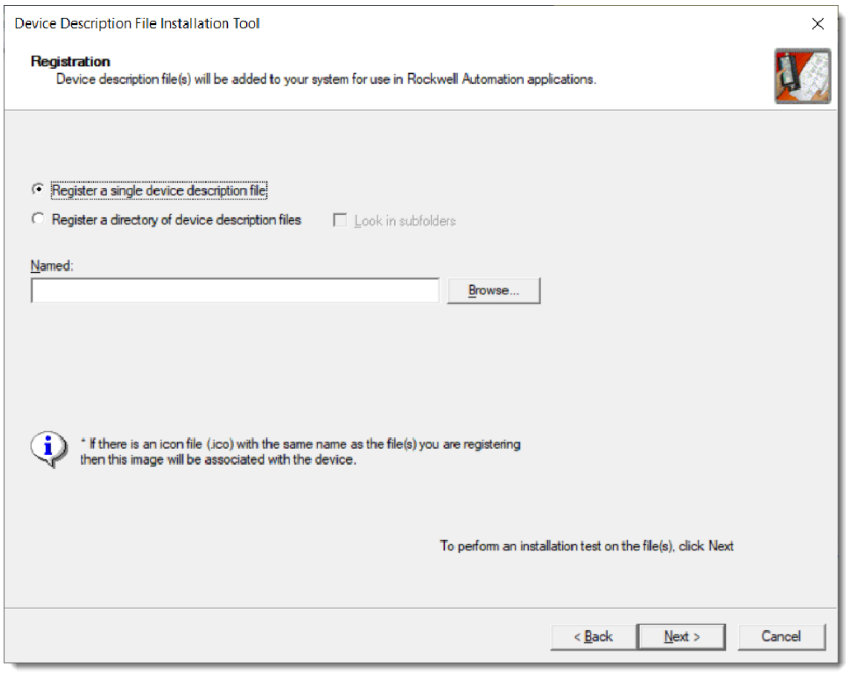
1. In the Studio 5000 Logix Designer application, select Tools → Device Description Installation Tool.



   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:



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 on-screen 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.

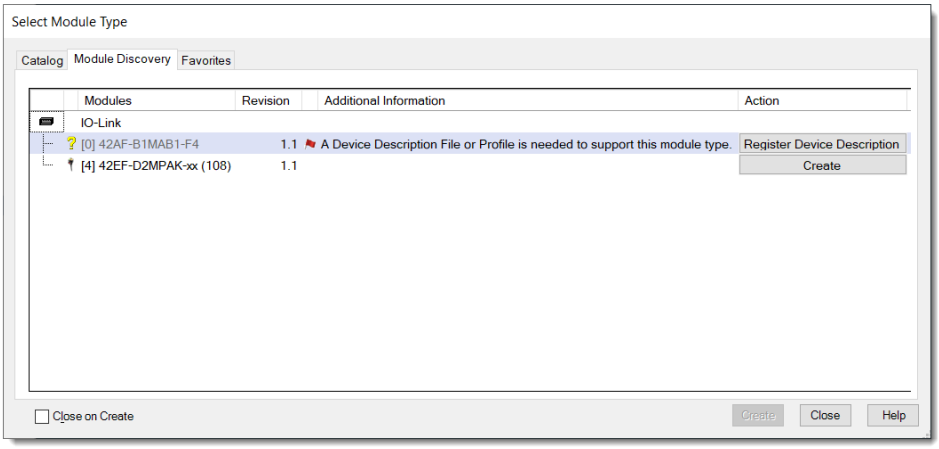
1. In the FactoryTalk Linx Network Browser, select a device in the communication tree.
2. Right-click the device and select EDS / Device Description Upload.
3. If the target device has registered a device description file, the following warning message shows:

   "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.

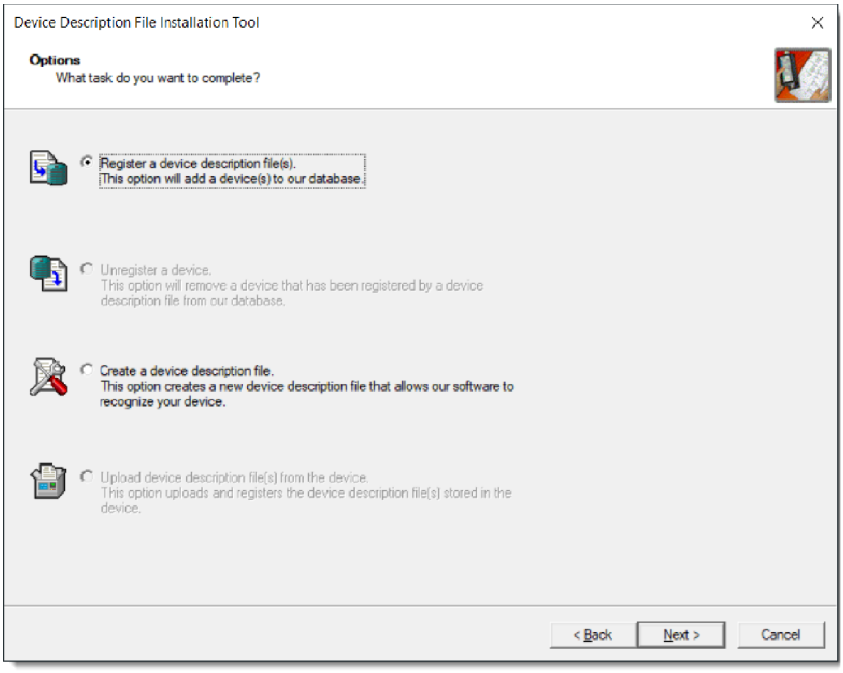


The steps to register the IODD file are identical, regardless of where you register the device from.

To register the IODD file, complete these steps.

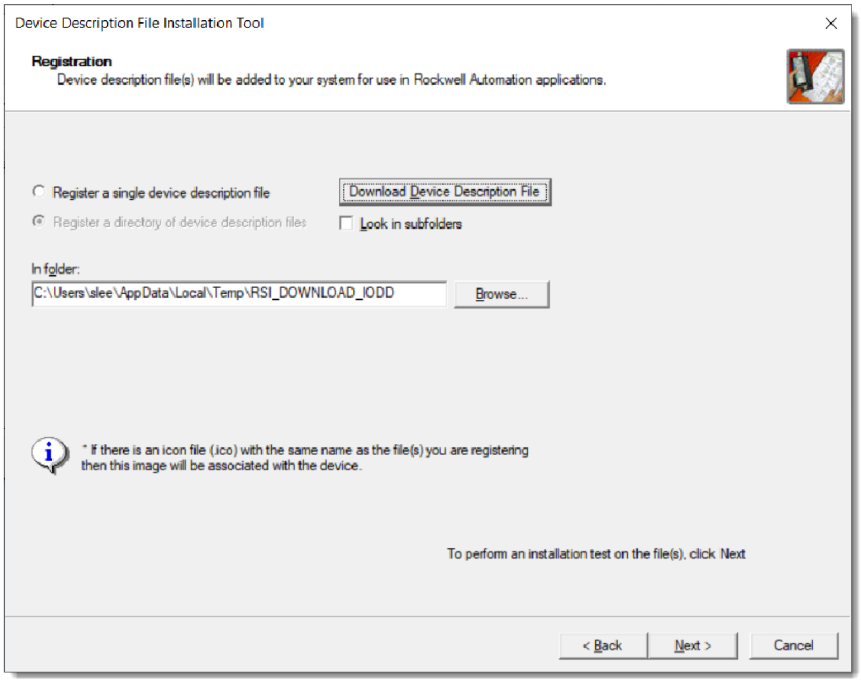
1. Select Register Device Description (File).

   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.

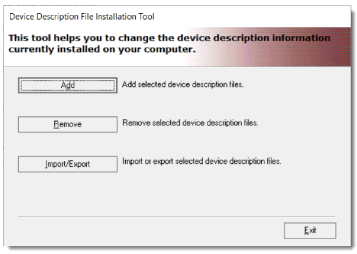
Import/Export IODD Files

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

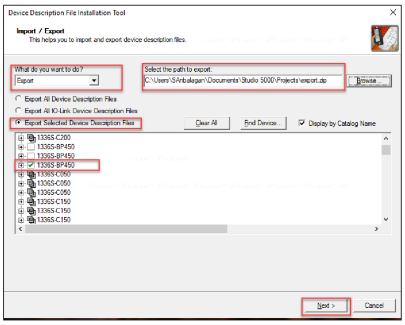
Export IODD Files

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.



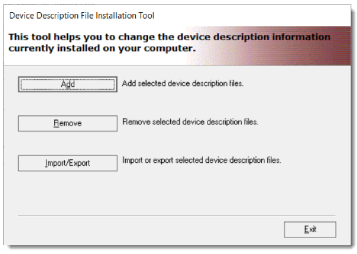
4. Choose the Export Selected Device Description Files option.
   - Export All Device Description Files – Export the device description file for all registered devices.
   - Export All IO-Link Device Description Files – Export the device description file for all registered IO-Link devices.
   - Export 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.

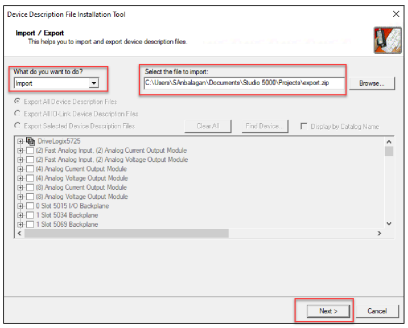
Import IODD Files

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.

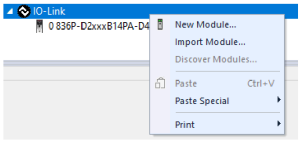
- Discover Modules on page 48
- Add a New Module on page 50
- Add a Preconfigured Device on page 51

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

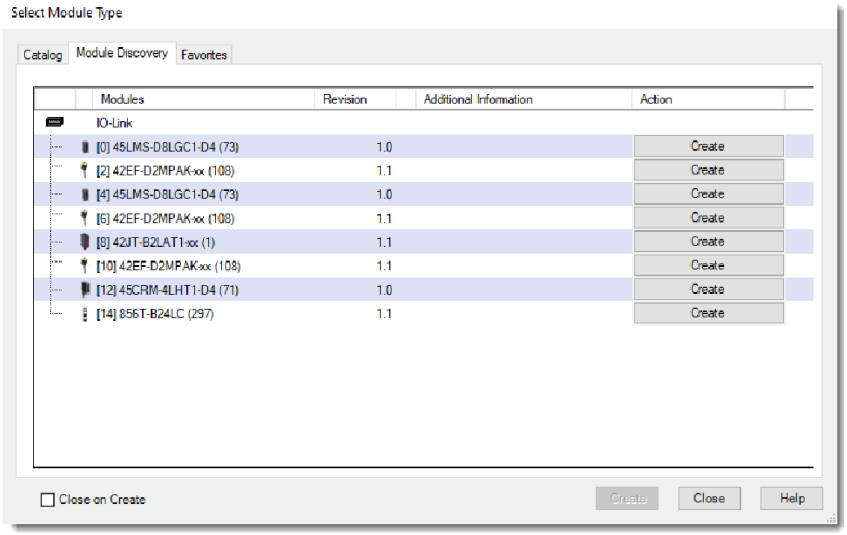
Discover Modules

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.



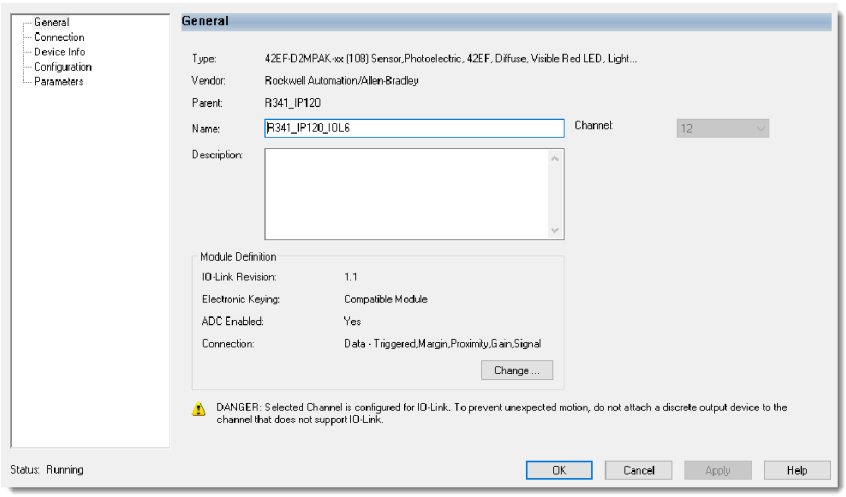
3. Select Create for the device that you want to add to your project.

   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 43.

   The New Module dialog appears and shows the General view. A list of different views is shown on the left side.

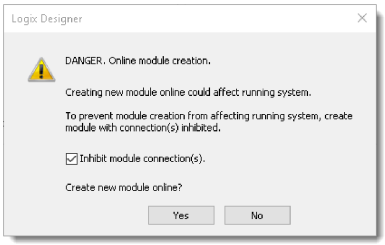
4. Enter a Name for the device, which is also used in the name of the Tag elements that are created for the device.

   If you want to configure the other settings during this step, see IO-Link Device Configuration on page 102 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 Step 3...Step 5 to add another device, or close the Select Module Type dialog when done.

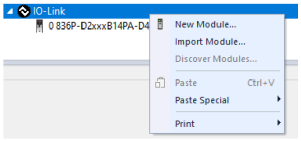
   If you selected the Close on Create checkbox in Step 3, the Select Module Type dialog automatically closes and you must start from Step 2 to add another device.

Add a New Module

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

To use the New Module method, complete these steps.

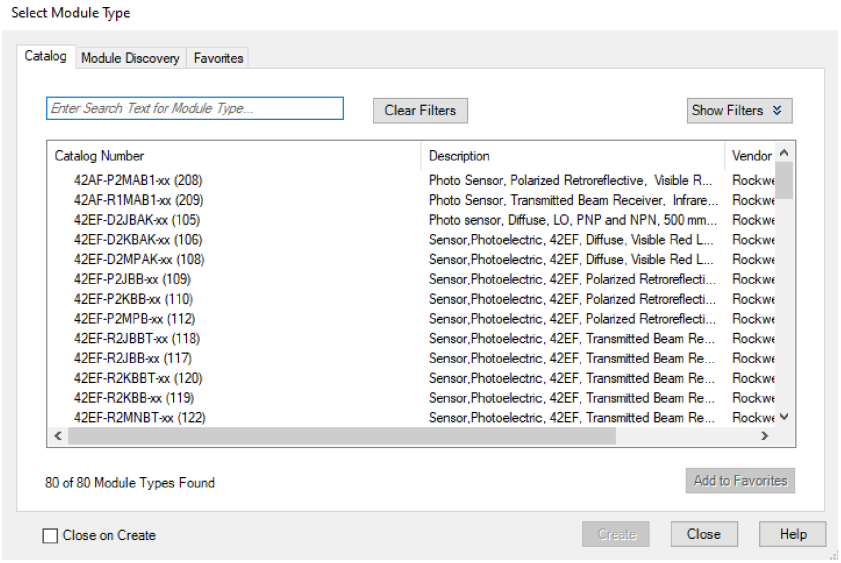
1. In the I/O Configuration tree, right-click the IO-Link bus and select New Module.



   The Select Module Type dialog appears.

2. Select the device and select Create.

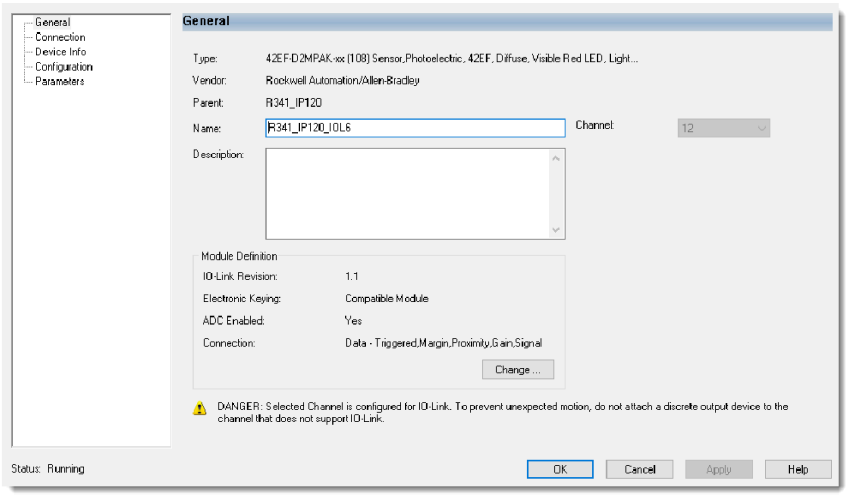
   To narrow down the list of devices, use the filters or search with keywords.



   The New Module window appears and shows the General view.

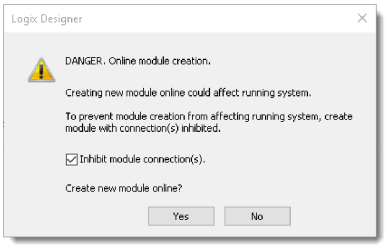
3. Enter a Name for the device.

If you want to configure the other settings during this step, see IO-Link Device Configuration on page 102 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 Step 2...Step 4 to add another device, or close the Select Module Type dialog. If you selected the Close on Create checkbox in Step 2, you must start from Step 1 to add another device.

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.

Add Preconfigured Device with New or Factory Reset IO-Link Master

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.

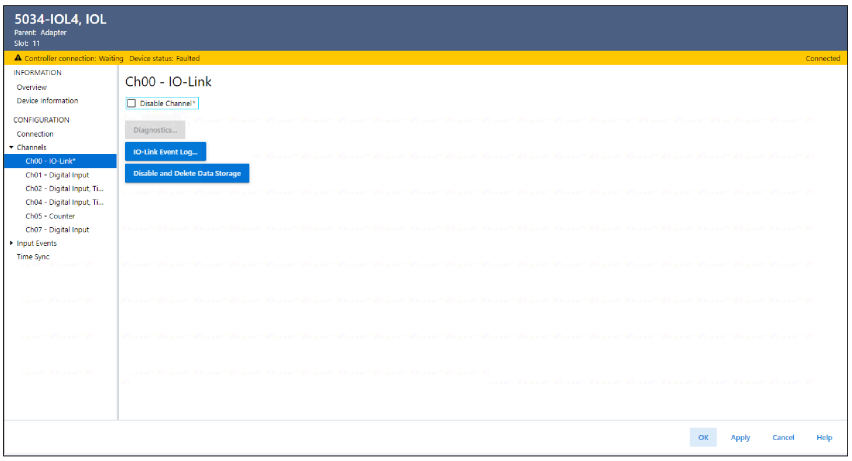
1. Go online with your project.
2. Attach your preconfigured IO-Link device to an IO-Link or Fallback channel.

3. Follow the steps as described in Discover Modules on page 48 to add the device.
4. In the device Module Properties → Configuration view, perform Device Correlation Check, select "Use Device Values", and select Apply.

Add a Preconfigured Device with Used IO-Link Master

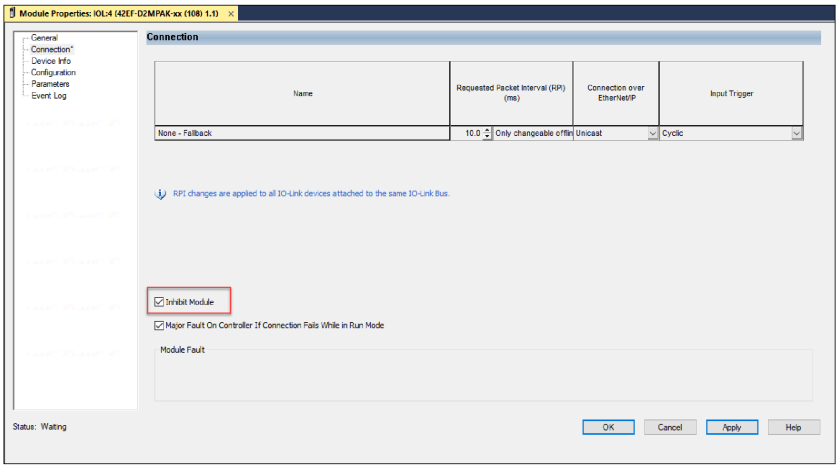
If you use an IO-Link master module that is used, follow these steps to add your preconfigured device.

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 → Chxx - IO-Link view, clear the Disable Channel checkbox and select Apply.

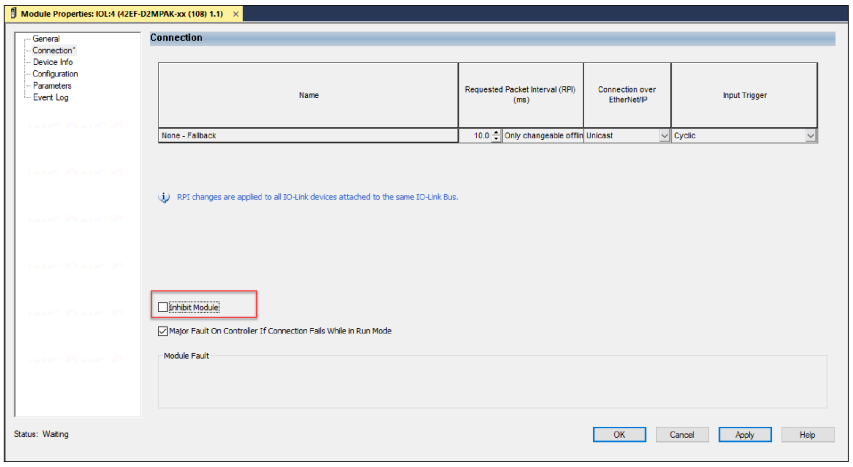


5. Follow the steps as described in Discover Modules on page 48 to add the device.

   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.

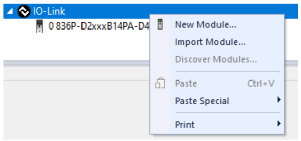
Add a Generic IO-Link Device

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.

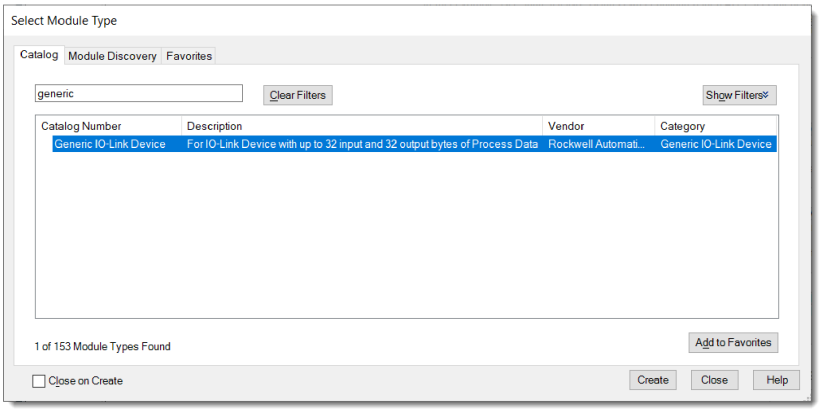
1. In the I/O Configuration tree, right-click the IO-Link bus and select New Module.



The Select Module Type dialog appears.

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

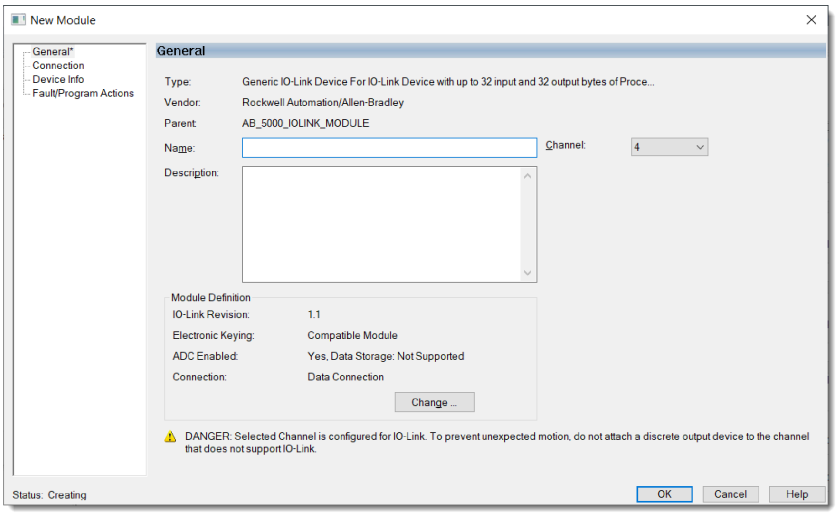
To narrow down the list of devices, use the filters or search with keywords.



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 IO-Link Device Configuration on page 102 for more information.



4. Select OK to save the configuration.

I/O Tag Name Conventions

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

- Device = Name of the IO-Link device
- I = Tag type

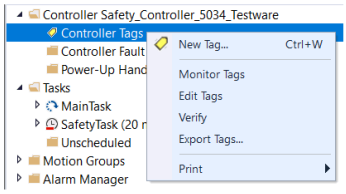
  The possible tag types are C (configuration), I (input), and O (output).
- Data = Tag function

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

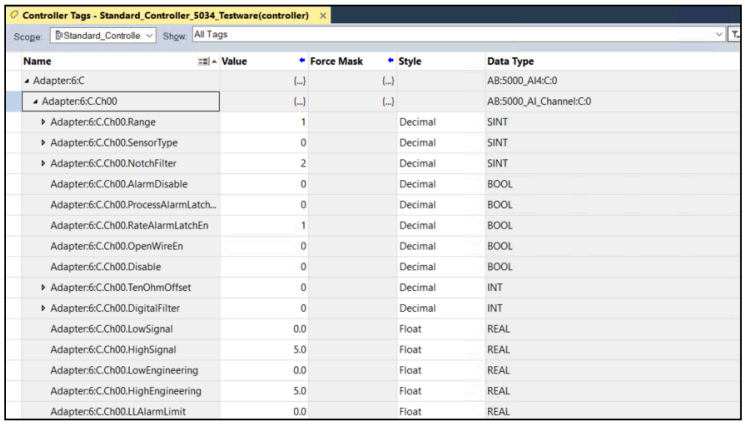
Access I/O Tags

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

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



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



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 on page 56
- Replace a Device with ADC Disabled and DS Not Supported or Disabled on page 56
- Replace with a Used Device when ADC Disabled and DS Backup/Restore Enabled on page 56
- Replace a Device on a Fallback Channel on page 57
- Replace with a Used Master Module when any Device DS Backup/Restore Enabled and ADC Disabled on page 57
- Replace a Master Module and Devices with Device ADC Disabled on page 58

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 56.
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

1. Verify that you have completed the procedure as described in Prerequisite Steps on page 56. To replace a device in this scenario, complete these steps.
   a. Replace the physical device.
   b. Go online with your project.
   c. 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.
2. 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.
   a. Go online with your project.
   b. While the IO-Link master module is uninhibited, in the IO-Link master Module Properties → Chxx - IO-Link 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.

c. While the IO-Link master module is uninhibited, in the IO-Link master Module Properties → Chxx - IO-Link view, clear the Disable Channel checkbox and select Apply.
d. In the IO-Link device Module Properties → Connection view, select the Inhibit Module checkbox and select Apply.
e. Replace the physical device.
f. In the IO-Link device Module Properties → Device Info view, select Reset Module to Factory Default.
g. 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 → Chxx - 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 56.

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 27.
- 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 Table 16: Fault and Status Information on page 65 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.

Table 14. 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.

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.

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.

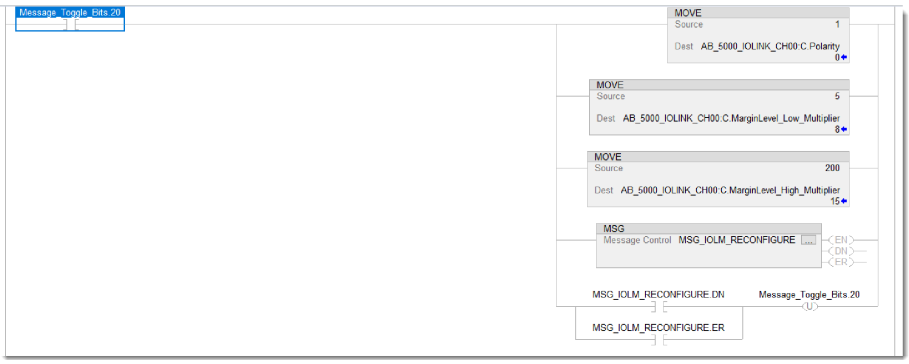
   When a controller is connected to the IO-Link master module, you must select the 'Connected' checkbox to write parameters with message instructions. If the 'Connected' checkbox is not selected, the messages may fail with a connection error. This error occurs because the controller owns the module, which 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 32.

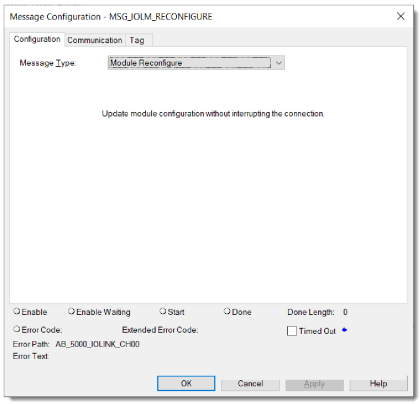
Configure IO-Link Device through Configuration Tags

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 Information view, select Reset Module to Factory Default.
2. Select Apply.

Troubleshoot Your IO-Link Device

This topic 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.

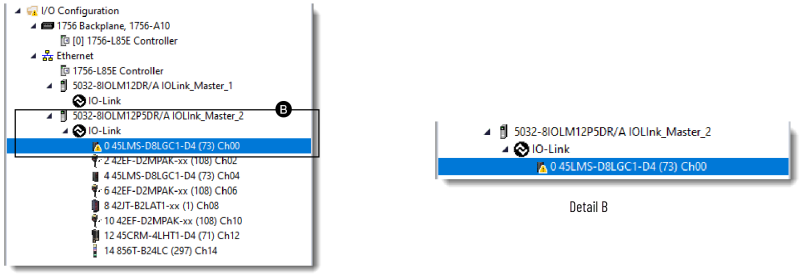
Fault conditions are reported in the following ways:

- Warning Signal in the I/O Configuration Tree on page 62
- Status and Fault Information in Module Properties on page 63
- Studio 5000 Logix Designer Application Tag Editor on page 66

Warning Signal in the I/O Configuration Tree

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

Figure 8. 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 ChXX 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 Ptxx - IO-Link port event log dialog for more information.

You can access the ChXX Diagnostics - IO-Link and Ptxx- IO-Link port event log dialogs from the IO-Link master Module Properties → ChXX - IO-Link view. For more information, see Chxx - IO-Link View on page 78.

Figure 9. ChXX Diagnostics - IO-Link view

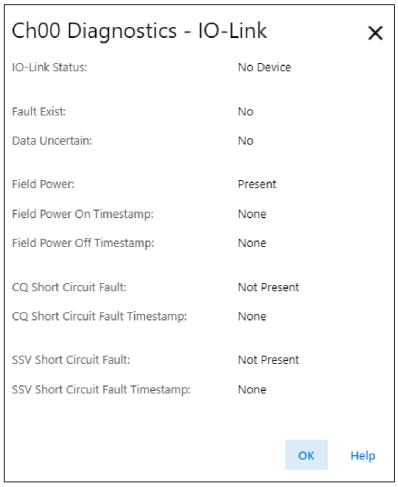
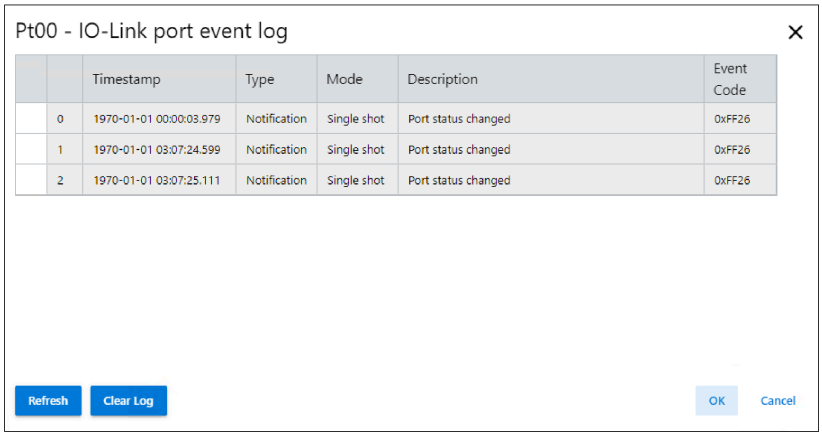


Figure 10. Ptxx- IO-Link port event log view



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.

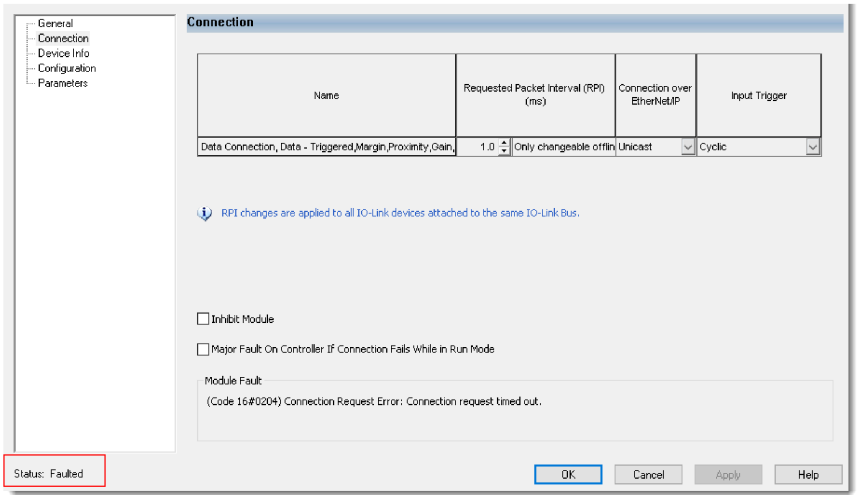
Each view includes options to configure the device or monitor the status of the device. The following are ways to monitor the state of a device for faults:

- Device Status on Module Properties Window on page 63
- Module Fault Descriptions on Connection View on page 64
- Fault and Status Information on Device Info View on page 65

Device Status on Module Properties Window

Figure 11: Fault Message in Status Line on page 64 shows where the status of a device is indicated on the Module Properties window.

Figure 11. Fault Message in Status Line



Module Fault Descriptions on Connection View

Figure 12: Fault Description with Error Code on Connection View on page 64 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.

Figure 12. Fault Description with Error Code on Connection View

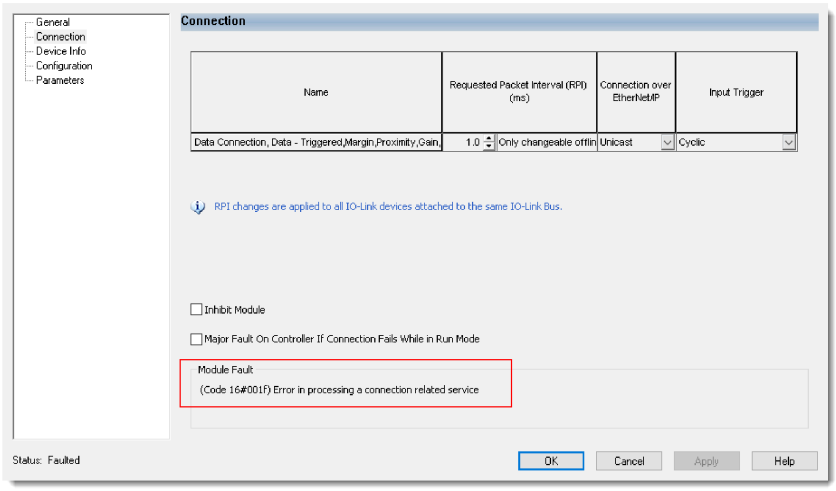


Table 15. Special Connection Error Codes for IO-Link Device

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 68.
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 67. If the error persists, contact technical support.

Table 15. Special Connection Error Codes for IO-Link Device (continued)

Code	Description	Recommended Action
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 67. If the error persists, contact technical support.

Fault and Status Information on Device Info View

Figure 13: Major and Minor Fault Information and Data Storage Match Status on page 65 shows where the major and minor fault information, and the Data Storage Match status are indicated on the Device Info view.

Figure 13. Major and Minor Fault Information and Data Storage Match Status

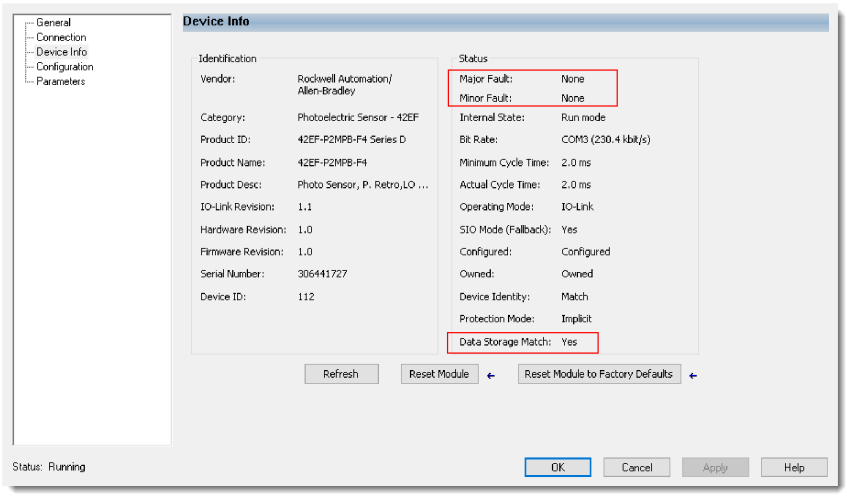


Table 16. Fault and Status Information

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.	

Table 16. Fault and Status Information (continued)

Parameter	Description	Recommended Action
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 14: Fault Indication in Controller Tags for IO-Link Devices on page 66 shows how fault and status conditions are indicated in the controller tags for the IO-Link device.

Figure 14. Fault Indication in Controller Tags for IO-Link Devices

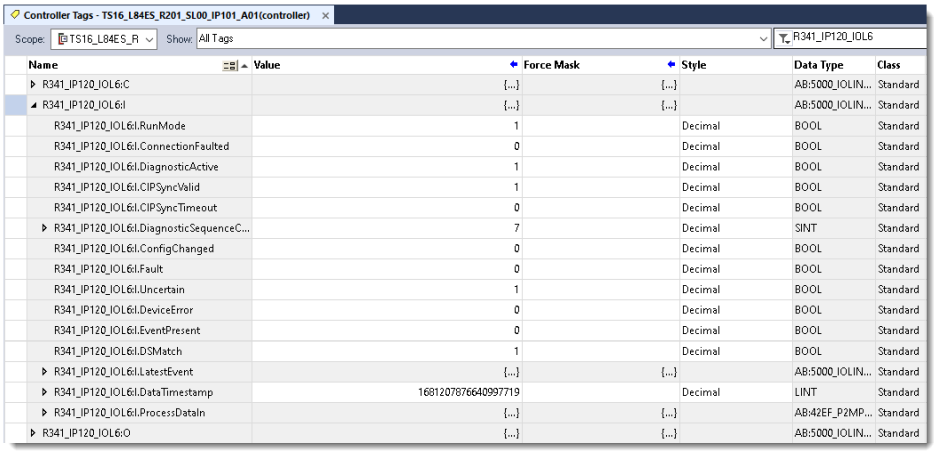


Table 17. Fault and Status Tags for IO-Link Devices

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 67.

Table 17. Fault and Status Tags for IO-Link Devices (continued)

Tag Name	Description	Recommended Action
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 30.	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 68.
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 68.
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 68.
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.

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.

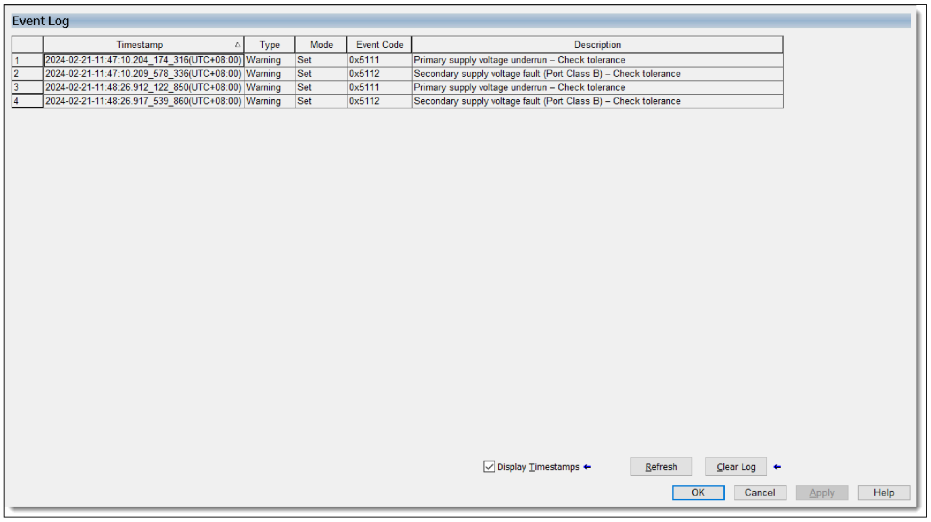
1. Go online with your project.
2. In the IO-Link device Module Properties → Device Info view, select the Inhibit Module checkbox and select Apply.
3. In the IO-Link device Module Properties → Configuration view, perform Device Correlation Check.
   a. If the check fails, an error message appears to 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.

IO-Link Event Log

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



To access the IO-Link device event log, see Event Log View on page 108.

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.

Following table defines the format of each event log entry.

Table 18. 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 device, use a CIP message with the following specifications:

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

5034-IOL4 and 5034-IOL4XT Details

This chapter covers the detailed instructions on how to configure and troubleshoot your 5034-IOL4 and 5034-IOL4XT modules. It also describes the module tag definitions for input, output, and configuration tags.

Module Configuration

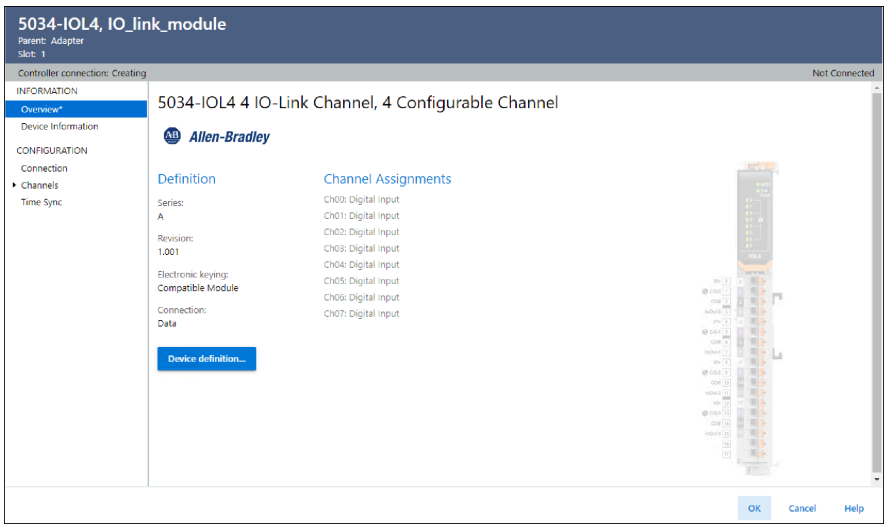
Before you start configuring your I/O module, you must create a Studio 5000 Logix Designer application project for the Logix 5000 controller that owns the PointMax I/O modules. See Add a New Module to a Studio 5000 Logix Designer Application Project on page 35 for more information.The project includes module configuration data for the PointMax I/O modules.

The Studio 5000 Logix Designer application transfers the project to the owner-controller during the program download. Data is then transferred to the PointMax I/O modules when the connection is established. The PointMax I/O modules can operate immediately after receiving and applying the configuration data.

Overview View

Use Overview to view the definition of a device, including the device type, revision, electronic keying, connection, and operating mode of each channel.

Figure 15. Overview View Example



Device Definition View

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

Device Definition dialog has following views to define your device and configure the channel operating mode:

- Overview View
- Channel Assignments View

Device Definition - Overview View

The Device Definition - Overview View appears first when you create a module. Use this view to define the module.

If you have already created the module and want to modify these parameters, go to Overview → Device definition, then select Overview tab.

IMPORTANT: When controller status is online, you can only change the parameters Name, Revision (only minor revision), and Electronic keying from this view.

Figure 16. Device Definition - Overview View Example

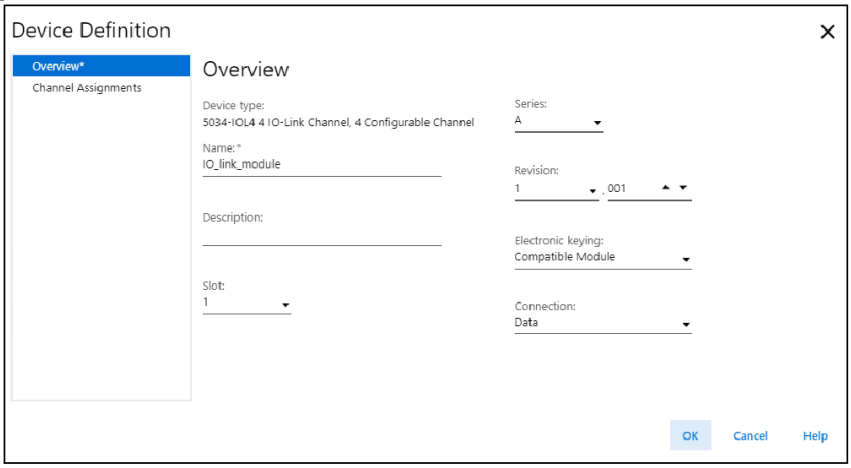


Table 19. Device Definition - Overview View Parameters

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

Table 19. Device Definition - Overview View Parameters (continued)

Parameter	Definition	Available Choices
Revision	Specifies the major and minor revisions of the device. The valid range for minor revision is from 1...255.	Device-specific
Electronic Keying	Defines the electronic keying used for the device. Electronic keying compares the device defined in the project to the installed device. If keying fails, a fault occurs. For detailed information on Electronic keying, see Electronic Keying in Logix 5000 Control Systems Application Technique, publication LOGIX-AT001	• Exact Match • Compatible Module • Disable Keying **ATTENTION:** Be extremely cautious when using Disable Keying; if used incorrectly, this option can lead to personal injury or death, property damage, or economic loss. You must 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.
Connection	Determines the following for the module type you configure: • Available configuration parameters • Data type transferred between the module and the controller • Which tags are generated when configuration is complete	• Data (default) • Data with Events

Device Definition - Channel Assignments View

Use this view to configure the channel operating mode. Not all channel modes can be configured for each channel.

Figure 17. Device Definition - Channel Assignments View Example

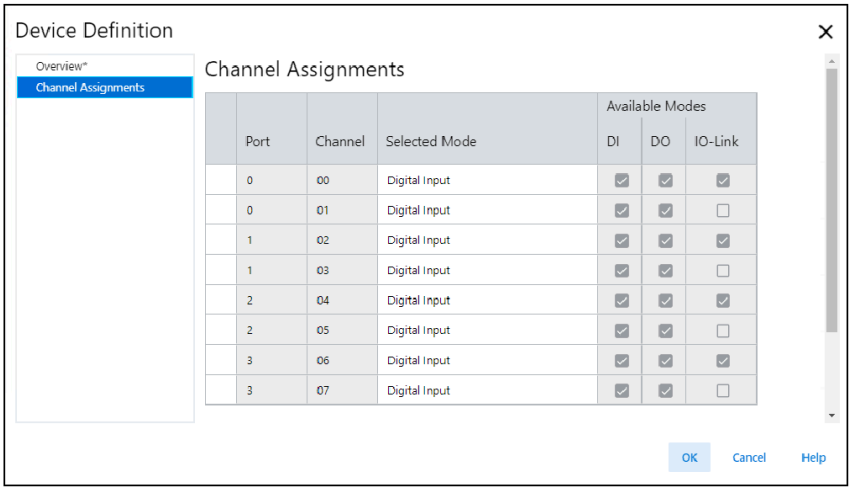


Table 20. Device Definition - Channel Assignments View Parameters

Parameter	Definition	Available Choices
Port	Displays the module port numbers.	Not configurable

Table 20. Device Definition - Channel Assignments View Parameters (continued)

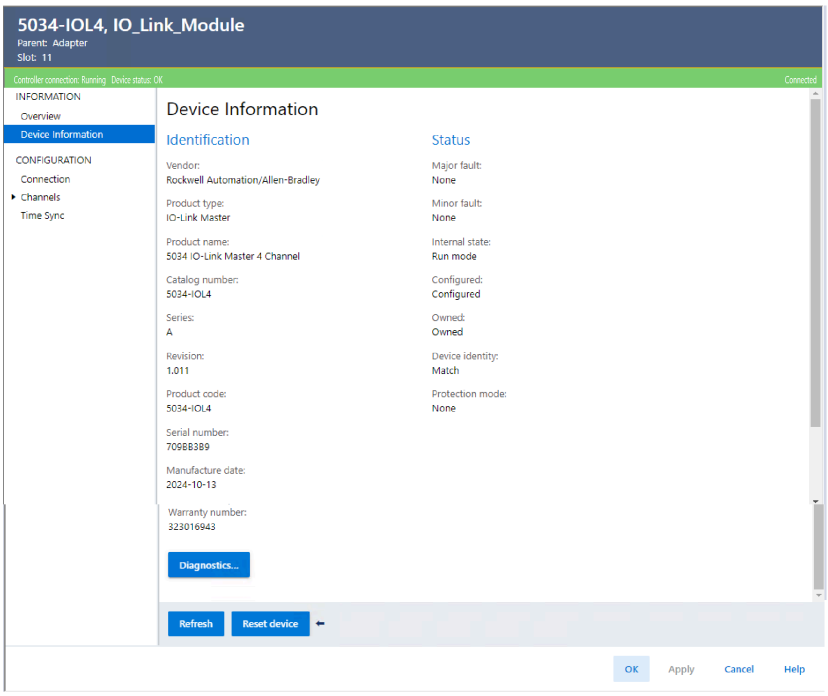
Parameter	Definition	Available Choices
Channel	Displays the module channel numbers	Not configurable
Selected Mode	Displays the mode for the channel.	• Disabled • Digital Input • Digital Input, Timestamp • Digital Input, Counter • Digital Input, Fallback • Digital Input, Timestamp, Fallback • Digital Output, Short Circuit • Digital Output, Short Circuit, No Load • IO-Link
Available Modes	Displays the different types of channel modes supported by each channel. • Digital Input (DI) • Digital Output (DO) • IO-Link	Not configurable

Device Information View

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

- Determine the identity of the module.
- View the device's current operational state.
- View whether the device was configured by the owner controller.
- View whether an owner controller is currently connected to the device.
- Retrieve the latest information from the device.
- Reset a device to its power-up state.
- If supported, view the protection mode of the device.
- Access device diagnostics.

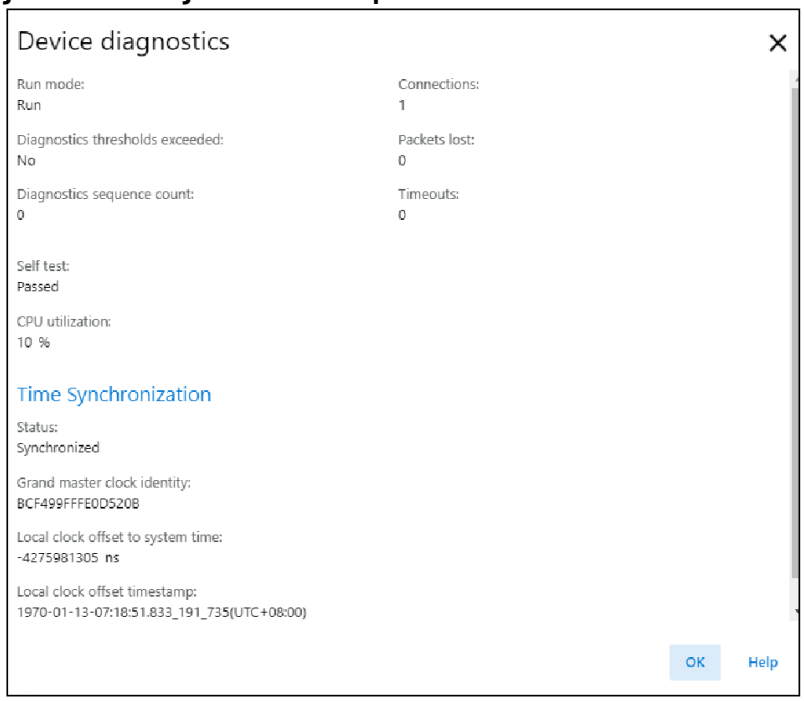
Figure 18. Device Information View



Device Diagnostics

To view the device diagnostics, select Diagnostics in the Device Information view. It displays the diagnostics information of the device.

Figure 19. Device Diagnostics View Example



Connection View

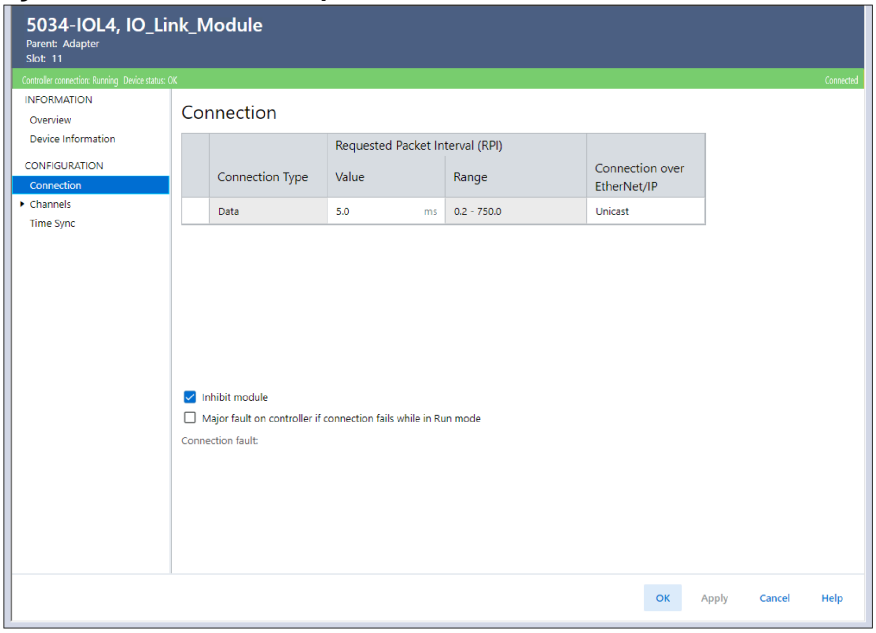
Use the Connection view to configure the following parameters:

- Set the RPI rate. For more information, see Requested Packet Interval on page 13.
- Select Unicast or Multicast connection to use on the EtherNet/IP network. For more information, see Unicast or Multicast Connection on page .
- View the reason of Connection Fault.

> If there is a connection fault, Connection Fault area displays an error code with description that helps you to troubleshoot the module. For more information, see Troubleshoot Your IO-Link Master Module on page 39.

- Inhibit the module. For more information, see Module Inhibiting on page 17.
- Configure fault response for connection failure while the controller is in Run mode.

Figure 20. Connection View Example

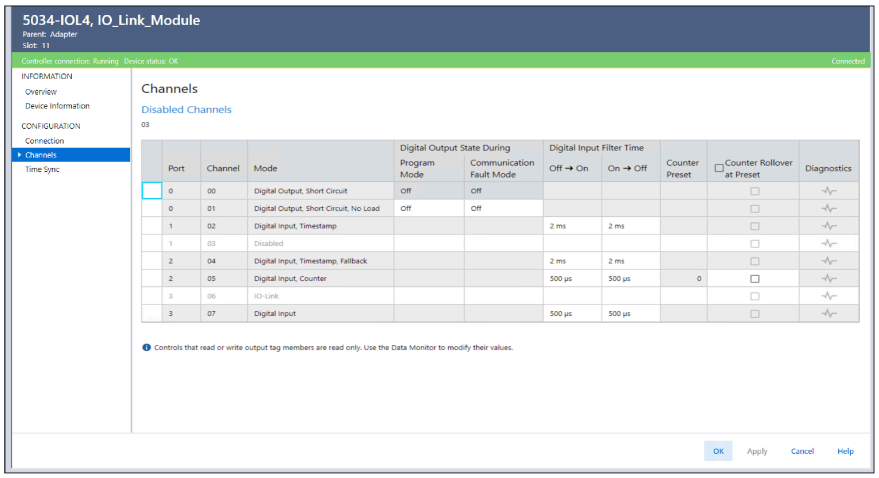


Channels View

The Channels page shows an overview of the configuration values for all module channels. The values for each channel indicate how that particular channel is configured on that channel's page. You can change certain configuration parameters in this view, not all of them.

> To view or change the complete set of the channel configuration, use Chxx view.

Figure 21. Channels View Example



Chxx Views

The Chxx views are displayed based on the channel modes configured in the Channel Assignments tab under Device Definition dialog.

Available Chxx views are:

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

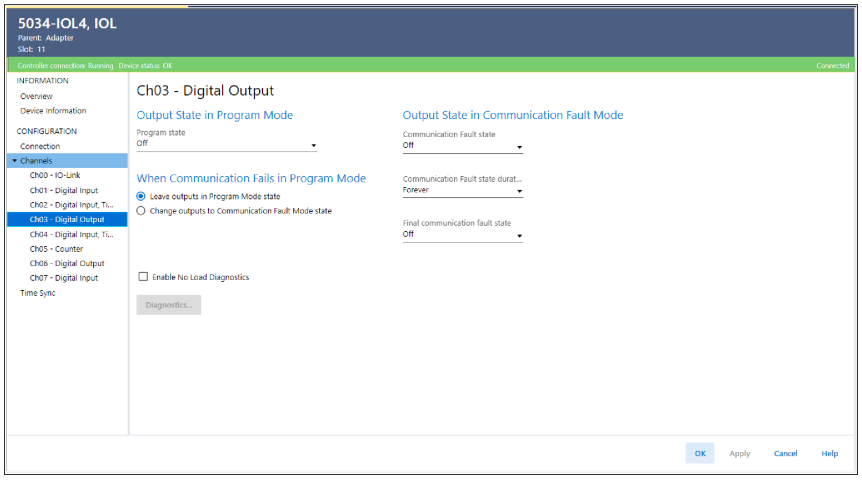
Chxx - Digital Output View

This view is available when the channel is configured as “Digital Output, 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 Communication Fault Mode Output states.
- Enable or disable No Load Diagnostics (only available when the channel is configured as “Digital Output, Short Circuit, No Load”).
- Access the channel diagnostics.

Figure 22. Chxx - Digital Output View Example



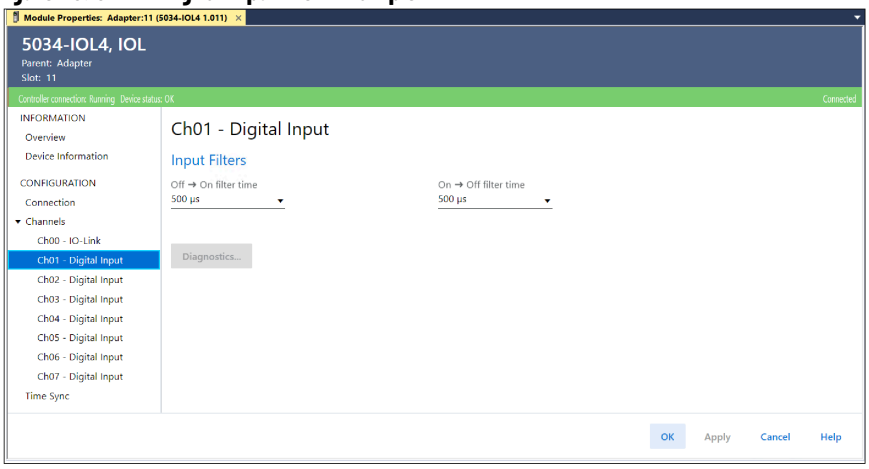
Chxx - Digital Input View

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.

Figure 23. Chxx - Digital Input View Example



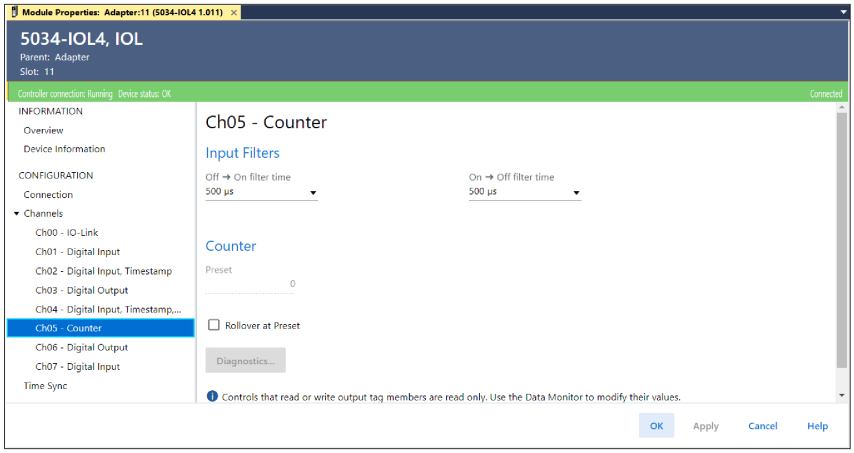
Chxx - Counter View

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.

Figure 24. Chxx - Counter View Example



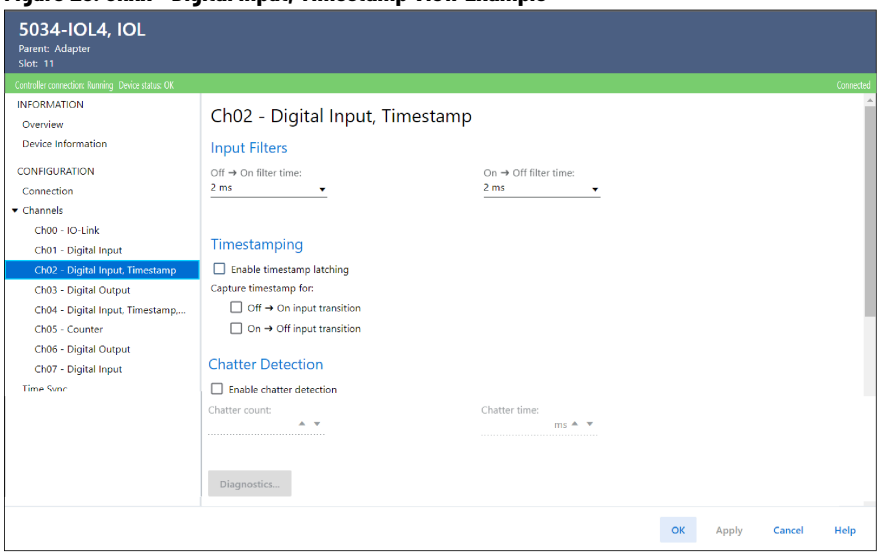
Chxx - Digital Input, Timestamp View

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 timestamps for Input transitions.
- Enable or disable Timestamp Latching.
- Enable or disable Chatter Detection.
- Configure the Chatter Detection options.
- Access the channel diagnostics.

Figure 25. Chxx - Digital Input, Timestamp View Example



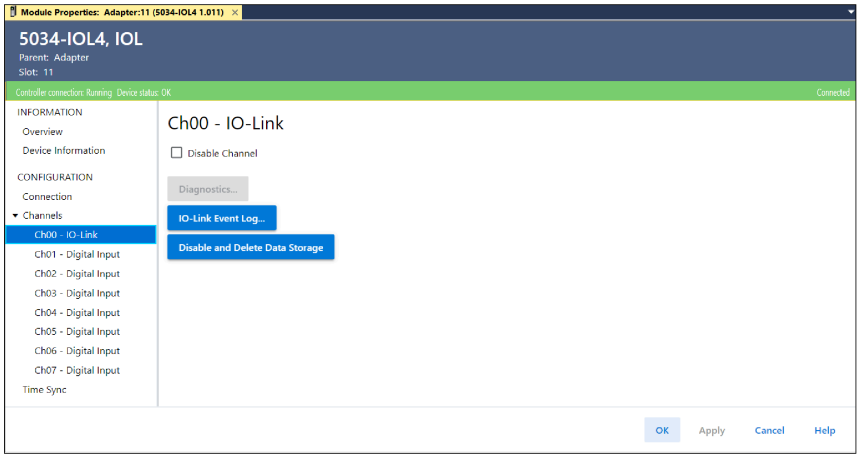
Chxx - IO-Link View

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.

Figure 26. Chxx - IO-Link View Example



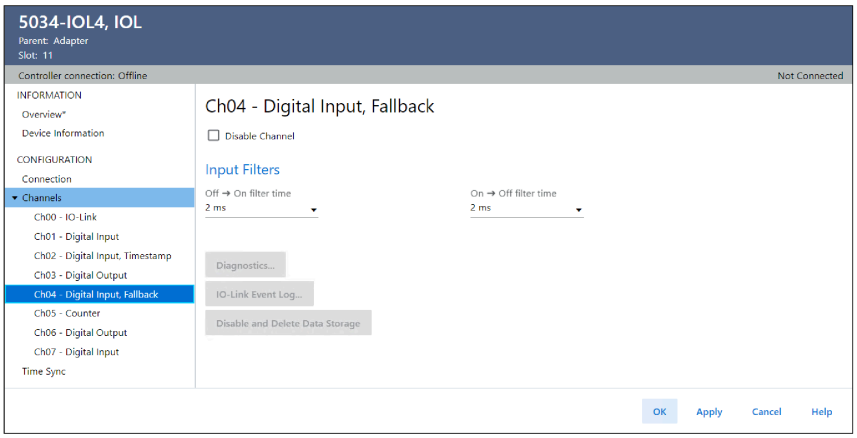
Chxx - Digital Input, Fallback View

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

Use this view to complete the following tasks:

- Enable or disable the channel.
- Select the Input Filter Time.
- 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.

Figure 27. Chxx - Digital Input, Fallback View Example



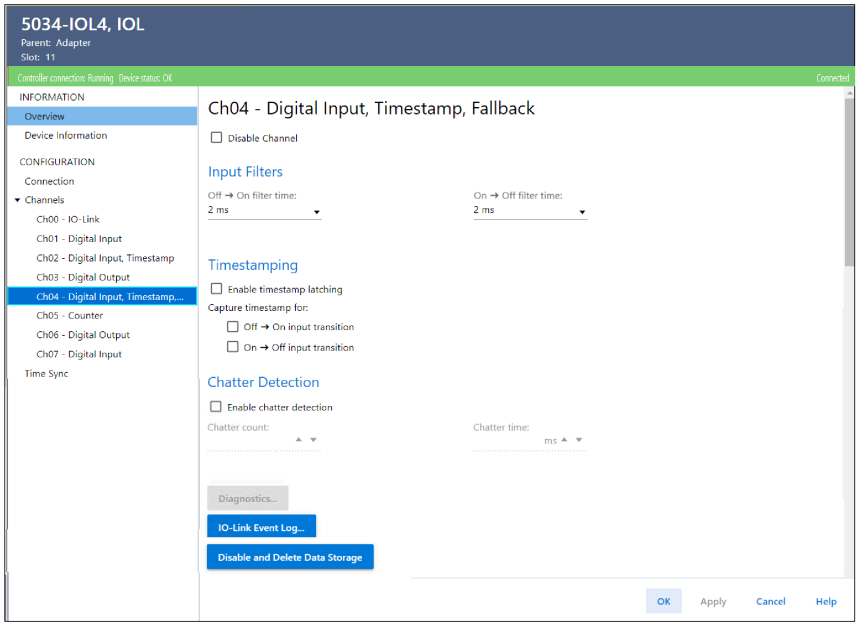
Chxx - Digital Input, Timestamp, Fallback View

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.

Use this view to complete the following tasks:

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

Figure 28. Chxx - Digital Input, Timestamp, Fallback View Example



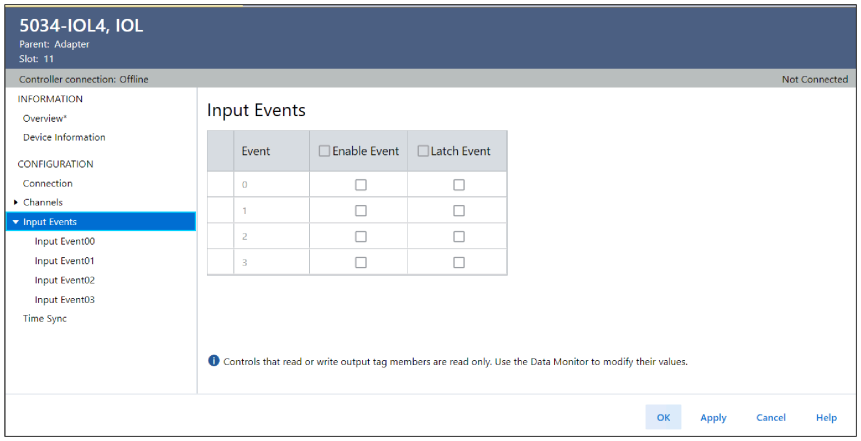
Input Events View

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" connection type in the Device definition. See Device Definition View on page 70.

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 Tag Definitions on page 93.

Figure 29. Input Events View Example



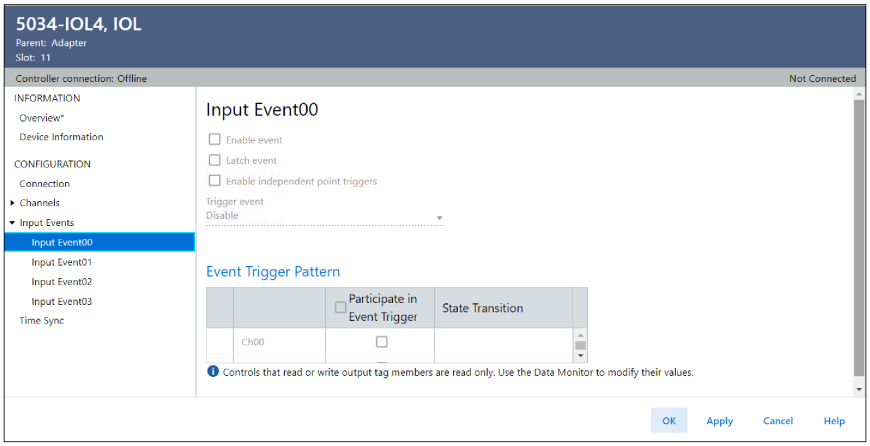
Input Eventxx View

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.

Figure 30. Input Eventxx View Example



Event Definition

See Event Output Tag Definitions on page 93 for the event definition parameters that you can configure using the Event Output tags.

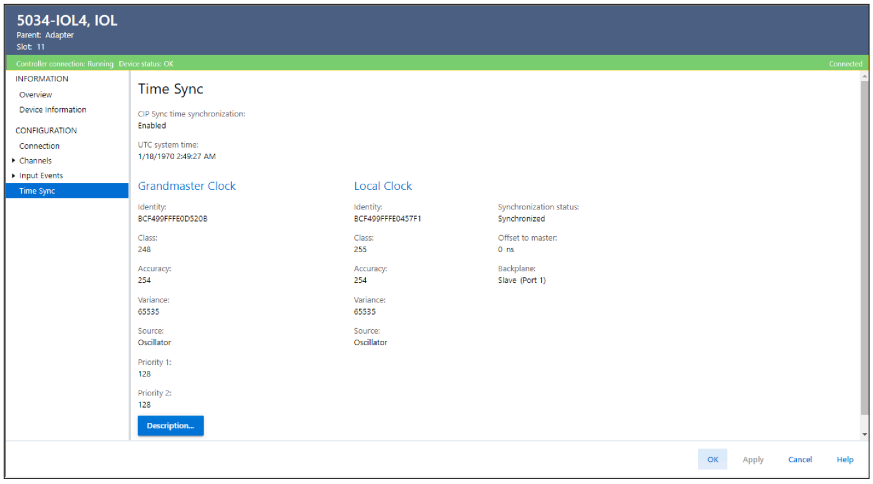
Time Sync View

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

- CIP Sync time synchronization
- UTC system time

- Grandmaster Clock information
- Grandmaster Clock description
- Local Clock information

Figure 31. Time Sync View Example

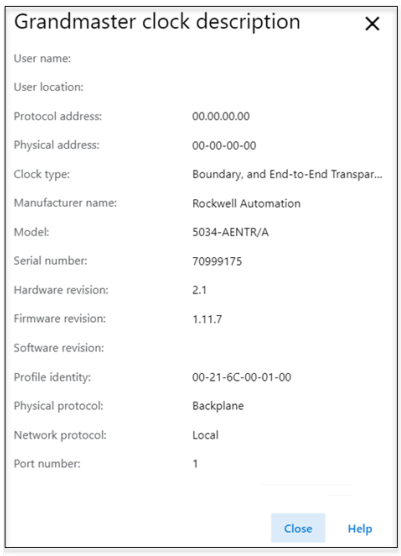


Grandmaster Clock Description

The Grandmaster clock description dialog provides detailed information about the grandmaster clock.

To view the Grandmaster clock description, select Description in the Time Sync view.

Figure 32. Grandmaster Clock Description Example



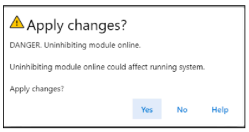
Switch Channel Mode from IO-Link or Fallback to Digital Output

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. Go to IO-Link master Module Properties → Connection, clear the Inhibit module checkbox and select Apply.

   If Apply changes warning appears, select Yes.



3. Go to IO-Link master Module Properties → Channels → Chxx - 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.

   If Apply changes to module configuration warning appears, select Yes without inhibit.
4. Go offline with your project.
5. In the IO-Link master Module Properties → Overview → Device Definition → Channel Assignments, change the channel mode from the Selected Mode dropdown list to a Digital Output.
6. Select OK. If Apply changes warning dialog appears, select Yes.
7. Connect the output device to the IO-Link master module.
8. Go online with your project.

Use the Status Indicators for Troubleshooting

PointMax I/O modules use the following status indicators:

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

SA Power Indicator

Table 21. Interpret SA Power Indicator

Indicator State	Description	Recommended Action
Off	The module is not powered or outside its designed operating range.	Complete the following actions: • Confirm that the system is powered. • Confirm that the module is installed properly.
Steady green	There is SA power to the module.	None

Table 21. Interpret SA Power Indicator (continued)

Indicator State	Description	Recommended Action
Steady red	There is no SA power to the module or SA power is not in the valid range.	Complete the following actions: • Confirm that SA power wiring is properly connected to the adapter, expansion power module, or 5034-MBSA mounting base. • Check the following: ◦ Check that the SA voltage is in the correct range. ◦ If an external power supply is used, confirm that the power supply is turned on. ◦ Confirm that there is sufficient voltage supplied to the module. ◦ Make sure that the mounting base to mounting base connection is properly secured. Go to Chassis Information view in the Module Properties of the adapter module to check the Field Power status of mounting bases installed in all slots.

Module Status Indicator

Table 22. Interpret Module Status Indicator

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

Table 22. Interpret Module Status Indicator (continued)

Indicator State	Description	Recommended Action
Steady red	The module experienced a nonrecoverable fault.	Complete the following actions: 1. Cycle power to the module. 2. If the status indicator remains in the steady red state, replace the module.

Channel Status Indicators

Table 23. Interpret Channel Status Indicator

Channel Mode	Indicator State	Description	Recommended Action
Disabled	Off	The channel is disabled.	–
DI	Off	The input is Off.	–
	Steady yellow	The input is On.	–
	Flashing red	One of the following conditions exists: • No SA power • SSV short circuit condition is present.	Correct SA power fault or SSV short circuit condition.
DO	Off	The output is Off.	–
	Steady yellow	The output is On.	–
	Flashing red	A recoverable fault. One of the following conditions exists: • There is no SA power. • There is an overload or short circuit fault. • There is No Load fault in I/Q channel.	Correct the No Load fault, overload, short circuit condition, or the SA power fault.
IO-Link	Off	IO-Link communication is disabled, or input is Off (when the channel fallback to DI)	–
	Steady yellow	One of the following conditions exists: • IO-Link communication established between the IO-Link master module and IO-Link device. • The input is On (when the channel fallback to DI).	–
	Flashing yellow	One of the following conditions exists: • IO-Link communication establishment between the IO-Link master module and IO-Link device is in progress. • No IO-Link device is attached to the channel. • IO-Link device identity mismatch is present.	Disconnect and reconnect the IO-Link device.
	Flashing red	One of the following conditions exists: • CQ line short circuit condition is present. • SSV (V+) short circuit condition is present. • SA power loss condition is present.	Correct the CQ line short circuit, SSV (V+) short circuit, or the SA power loss condition.

Module Tag Definitions

Module tags are created when you add a module to the Studio 5000 Logix Designer application project.

The set of module tags associated with the module depends on the Connection type selected during the module configuration. For example, if you configured Data as a connection type in the Device Definition - Overview view, the Studio 5000 Logix Designer application creates input, output, configuration, and status tags but not event input and event output tags. Event input and event output tags are created when you configure the connection as Data with Events.

The tables contained in this section list all of the tags available in the module. Not all tags in the list are used when that module type is added to a project. Tag use varies by module configuration.

Configuration Tag Definitions

Table 24. 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.	For Channels 01, 03, 05, and 07: • 4 = 0 µs • 10 = 100 µs • 11 = 200 µs • 12 = 500 µs • 13 = 1 ms • 14 = 2 ms • 15 = 5 ms • 16 = 10 ms • 17 = 20 ms • 18 = 50 ms For Channels 00, 02, 04, and 06: • 4 = 0 µs • 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.	
Counterxx.RolloverAtPreset	BOOL	Determines whether the simple counter will rollover to 0 at the Preset value.	0 = No rollover at the Preset value When the counter counts to the Preset value, the Done bit is set. When the counter reaches maximum DINT (2,147,483,647) and continues counting, it rolls over to 0 and the Rollover bit is set. 1 = Rollover at the Preset value When the counter reaches Preset-1 and continues counting, it rolls over to 0 and the Rollover bit is set. The Done bit is always 0.
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 1 = IO-Link communication is disabled

Table 24. IO-Link Master Module Configuration Tags (continued)

Name	Data Type	Definition	Valid Values
Ptxx.InputOffOnFilter 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.	For Channels 01, 03, 05, and 07: • 4 = 0 µs • 10 = 100 µs • 11 = 200 µs • 12 = 500 µs • 13 = 1 ms • 14 = 2 ms • 15 = 5 ms • 16 = 10 ms • 17 = 20 ms • 18 = 50 ms For Channels 00, 02, 04, and 06: • 4 = 0 µs • 14 = 2 ms • 15 = 5 ms • 16 = 10 ms • 17 = 20 ms • 18 = 50 ms
Ptxx.InputOnOffFilter 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.	
Ptxx.ChatterTime Ptxx.DiConfig.ChatterTime	INT	The amount of time within which the number of input transitions are counted.	1...10000 ms
Ptxx.ChatterCount Ptxx.DiConfig.ChatterCount	SINT	The number of input transitions that are considered chatter. Chatter can cause the module to timestamp invalid input transitions. Typically, chattering signals cause inputs to transition falsely many times in a relatively short period.	• 0 = Disabled • 1 = Invalid value • 2...127 = Enabled
Ptxx.CaptureOffOnEn Ptxx.DiConfig.CaptureOffOnEn	BOOL	Enables capturing Off to On timestamps. If cleared, the point does not record Off to On timestamps.	0 = Capture disabled for Off to On input transitions 1 = Capture enabled for Off to On input transitions
Ptxx.CaptureOnOffEn Ptxx.DiConfig.CaptureOnOffEn	BOOL	Enables capturing On to Off timestamps. If cleared, the point does not record On to Off timestamps.	0 = Capture disabled for On to Off input transitions 1 = Capture enabled for On to Off input transitions
Ptxx.TimestampLatchEn Ptxx.DiConfig.TimestampLatchEn	BOOL	Determines whether timestamps latching is enabled.	0 = Timestamps are overwritten with each successive transition The new timestamp overwrites the reported timestamp immediately, even if the controller has yet to extract that data. 1 = Timestamps are latched until acknowledged The reported timestamp is not overwritten until acknowledged. All subsequent transitions on that point are ignored until acknowledged/reset. Timestamp is acknowledged by writing the value from input tag TimestampOffOnNumber/TimestampOnOffNumber to output tag TimestampOffOnNumberAck/TimestampOnOffNumberAck. The acknowledgment also clears TimestampOverflowOffOn/TimestampOverflowOnOff.
Ptxx.FaultMode	BOOL	Selects the behavior that the output point takes if a communication fault occurs. FaultValue defines the value to go to when set to user-defined value.	0 = Go to a user-defined value 1 = Hold last state
Ptxx.FaultValue	BOOL	Defines the value that the discrete output assumes if a communication fault occurs when FaultMode = 0.	0 = Output is off 1 = Output is on

Table 24. IO-Link Master Module Configuration Tags (continued)

Name	Data Type	Definition	Valid Values
Ptxx.ProgMode	BOOL	Selects the behavior that the output point takes when transitioned into Program Mode or Inhibit mode. ProgValue defines the value to go to when set to user-defined value.	0 = Go to a user-defined value 1 = Hold last state
Ptxx.ProgValue	BOOL	Defines the value that the output takes when the connection transitions to Program Mode or Inhibit mode if the ProgMode bit is set to user-defined value.	0 = The output state is Off during Program Mode or Inhibit mode 1 = The output state is On during Program Mode or Inhibit mode
Ptxx.FaultFinalState	BOOL	If FaultValueStateDuration is nonzero, determines the final Output state after the configured FaultValueStateDuration time out occurs.	0 = The output state is Off after the FaultValueStateDuration time expires 1 = The output state is On after the FaultValueStateDuration time expires
Ptxx.FaultValueStateDuration	SINT	This value determines the length of time the FaultMode state is held before the FaultFinalState is applied.	• 0 = Hold forever • 1 = 1 s • 2 = 2 s • 5 = 5 s • 10 = 10 s
Ptxx.ProgramToFaultEn	BOOL	Determines if an output transitions to the FaultMode if the connection faults while in Program Mode.	0 = Stay in Program Mode 1 = Go to Fault Mode
Ptxx.NoLoadEn	BOOL	Enables no load detection for output points.	0 = Disable 1 = Enable
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 1 = IO-Link communication/Digital Input is disabled

Input Tag Definitions

Table 25. 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 When the value is 0, it means one of the following: • Connection is not up. • Connection has been opened but the module has not started producing data for the connection. • Because the controller is in Program Mode, the module is not applying output tag data but is applying the Program Mode states of Output channels instead. When the value is 1, it means the following: • Connection is up. • Module is producing data for the connection. • Output tag data is being applied.
ConnectionFaulted	BOOL	Indicates if a connection to the target is running. The module always returns a zero in this member. The controller overwrites the zero with a one when the connection is not up.	0 = Connection is running 1 = Connection is not running
DiagnosticActive	BOOL	Indicates if any diagnostics are active or if the prognostics threshold is reached.	0 = No diagnostics are active 1 = One or more diagnostics are active or the prognostics threshold is reached.

Table 25. IO-Link Master Module Input Tags (continued)

Name	Data Type	Definition	Valid Values
CIPSyncValid	BOOL	Indicates whether the module is synced with a 1588 master. A set bit alone cannot indicate that it is synced to the same master clock of the owner controller. You must compare the Grandmaster Clock ID of both the module and the owner controller.	0 = CIP Sync is not available 1 = CIP Sync is available
CIPSyncTimeout	BOOL	Indicates if the module was previously synchronized with a 1588 master but the module is not synced 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 master time.
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.	-128...+127 The value of 0 is skipped except during module powerup.
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. If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT:** Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.	0 = No fault exists 1 = Fault exists
Counterxx.Uncertain	BOOL	Indicates that counter data can be inaccurate but the degree of inaccuracy is not known. If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT:** Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.	0 = Good data 1 = Uncertain data
Counterxx.Done	BOOL	If RolloverAtPreset is set, indicates if Count ≥ Preset. If RolloverAtPreset is not set, always 0.	0 = Counter has not reached the Preset value 1 = Counter has reached the Preset value
Counterxx.Rollover	BOOL	The counter counted up to Preset -1 and continued counting from 0. The RolloverAck bit transitioning from 0 to 1 or the Reset 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. If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT:** Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.	0 = Good 1 = Bad, causing fault

Table 25. IO-Link Master Module Input Tags (continued)

Name	Data Type	Definition	Valid Values
IOLinkxx.Uncertain	BOOL	Indicates that IO-Link data can be inaccurate but the degree of inaccuracy is not known. If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT:** Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.	0 = Good data 1 = Uncertain data
Ptxx.Data	BOOL	Indicates the state of the input or echo of the digital output state applied.	0 = Off 1 = On
Ptxx.Fault	BOOL	Indicates that channel data is inaccurate and cannot be trusted for use in the application. If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT:** Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.	0 = Good 1 = Bad, causing fault
Ptxx.Uncertain	BOOL	Indicates that channel data can be inaccurate but the degree of inaccuracy is not known. If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT:** Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.	0 = Good data 1 = Uncertain data
Ptxx.Chatter	BOOL	Indicates if the input is chattering per the ChatterTime and ChatterCount settings.	0 = Normal 1 = Input is chattering
Ptxx.TimestampOverflowOffOn	BOOL	Indicates an Off to On timestamp was lost. A timestamp can be lost when TimestampLatchEn is set but the reported timestamp is not acknowledged in time. If TimestampLatchEn is clear, a timestamp was overwritten.	0 or 1
Ptxx.TimestampOverflowOnOff	BOOL	Indicates an On to Off timestamp was lost. A timestamp can be lost when TimestampLatchEn is set but the reported timestamp is not acknowledged in time. If TimestampLatchEn is clear, a timestamp was overwritten.	0 or 1
Ptxx.CIPSyncValid	BOOL	Indicates whether the module is synced with a 1588 master. A set bit alone cannot indicate that it is synced to the same master clock of the owner controller. You must compare the Grandmaster Clock ID of both the module and the owner controller.	0 = CIP Sync is not available 1 = CIP Sync is available
Ptxx.CIPSyncTimeout	BOOL	Indicates if the module was previously synchronized with a 1588 master but the module is not synced now due to a timeout.	0 = A valid time master has not timed out 1 = A valid time master has timed out
Ptxx.TimestampOffOnNumber	INT	An Off to On timestamp identifier for the currently produced timestamp.	All values
Ptxx.TimestampOnOfNumber	INT	An On to Off timestamp identifier for the currently produced timestamp.	All values
Ptxx.TimestampOffOn	LINT	64-bit timestamp that corresponds to when a change of state Off to On was recorded at the input.	All values

Table 25. IO-Link Master Module Input Tags (continued)

Name	Data Type	Definition	Valid Values
Ptxx.TimestampOnOff	LINT	64-bit timestamp 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 whether the module is synced with a 1588 master when the event occurred. A set bit alone cannot indicate that it is synced to the same master clock of the owner controller.	0 = CIP Sync is not available 1 = CIP Sync is available
EventStatus[x].CIPSyncTimeout	BOOL	Indicates if the module was previously synchronized with a 1588 master but the module is not synced now due to a timeout when the event occurred.	0 = A valid time master has not timed out 1 = A valid time master has timed out
EventStatus[x].EventReset	BOOL	When Eventxx.ResetEvent transitions from 0 to 1, EventStatus[x].EventReset transitions to 1 to indicate that the reset was received and completed. It stays 1 until 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 for each new time event. The originator sets Eventxx.EventNumberAck to 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 Tag Definitions

Table 26. IO-Link Master Module Output Tags

Name	Data Type	Definition	Valid Values
Counterxx.Reset	BOOL	When this bit transitions from 0 to 1, Count and Rollover are set to 0.	0 = Count and Rollover are not set to 0 1 = Count and Rollover are set to 0
Counterxx.RolloverAck	BOOL	Clears the Rollover bit in the input tag when it transitions from 0 to 1.	0 = Rollover bit is not cleared 1 = Rollover bit is cleared
Counterxx.Preset	DINT	• If RolloverAtPreset is set, when the counter reaches Preset-1 and continues counting, it rolls over to 0 and Rollover bit is set. The Done bit is always 0. • If RolloverAtPreset is not set, when the counter counts to the Preset value, Done bit is set. When Count reaches maximum DINT (2,147,483,647) and continues counting, it rolls over to 0 and Rollover bit is set.	0...2,147,483,647
Ptxx.Data	BOOL	Indicates the state of the output.	0 = Off 1 = On
Ptxx.ResetTimestamps	BOOL	Erases all recorded timestamps for the input channel when it transitions from 0 to 1.	0 = Timestamps are not erased 1 = Timestamps are erased

Table 26. IO-Link Master Module Output Tags (continued)

Name	Data Type	Definition	Valid Values
Ptxx.TimestampOffOnNumberAck	INT	An Off to On timestamp identifier that is written by the controller to indicate that the identified timestamp has been seen and acted on. When Latching is enabled and the Timestamp Number that is received from the controller matches the most recent timestamp that is produced, the module is then allowed to produce a new timestamp.	All values
Ptxx.TimestampOnOffNumberAck	INT	An On to Off timestamp identifier that is written by the controller to indicate that the identified timestamp has been seen and acted on. When Latching is enabled and the Timestamp Number that is received from the controller matches the most recent timestamp that is produced, the module is then allowed to produce a new timestamp.	All values

Event Input Tag Definitions

Table 27. IO-Link Master Module Event Input Tags

Name	Data Type	Definition	Valid Vaules
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.	-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. **IMPORTANT:** Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.	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. **IMPORTANT:** Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.	0 = Good data 1 = Uncertain data
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

Table 27. IO-Link Master Module Event Input Tags (continued)

Name	Data Type	Definition	Valid Vaules
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 when the event is occurred. A set bit alone cannot indicate that it is synced to the same master clock of the owner controller.	0 = CIP Sync is not available 1 = CIP Sync is available
Eventxx.CIPSyncTimeout	BOOL	Indicates that the module was once synced with a 1588 master, but is not now due to a timeout when the event is occurred.	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 for each new time event. The originator sets EventNumberAck to 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	Indicates the data value of Input Ptxx when event was triggered.	0 = Off 1 = On
Eventxx.CounterxxDone	BOOL	Indicates the Done status of Counterxx when event was triggered.	0 = Not done 1 = Done
Eventxx.PtxxFault	BOOL	Indicates the fault status of Input Ptxx when event is triggered.	0 = No fault 1 = Faulted
Eventxx.CounterxxFault	BOOL	Indicates the fault status of Counterxx when event is triggered.	0 = No fault 1 = Faulted

Event Output Tag Definitions

Table 28. 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

Table 28. IO-Link Master Module Event Output Tags (continued)

Name	Data Type	Definition	Valid Values
Eventxx.EventRisingEn	BOOL	Triggers an event each time a condition change results in conditions that match the event trigger definition.	Values (EventRisingEn, EventFallingEn) represent: • (0, 0): Event trigger is disabled. • (1, 0): Event triggers on input transitions to matching the configured pattern. • (0, 1): Event triggers on input transitions to not matching the configured pattern. • (1, 1): Event triggers on input transitions to either matching or not matching the configured pattern.
Eventxx.EventFallingEn	BOOL	Triggers an event each time a condition change results in conditions that do not match the event trigger definition.	
Eventxx.LatchEn	BOOL	When set, events are latched until 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 Eventxx.	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 EventNumber into 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 to match after the transition.	0 = Off 1 = On
Eventxx.CounterxxValue	BOOL	Determines the done state of the counter to match after the transition.	0 = Not done 1 = Done

Diagnostic Assembly

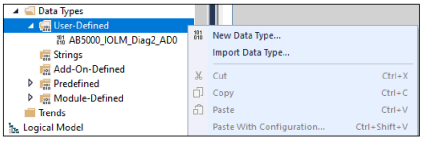
Diagnostic assembly helps you troubleshoot and diagnose the fault in your system.

Create User-defined Diagnostic Assembly Types

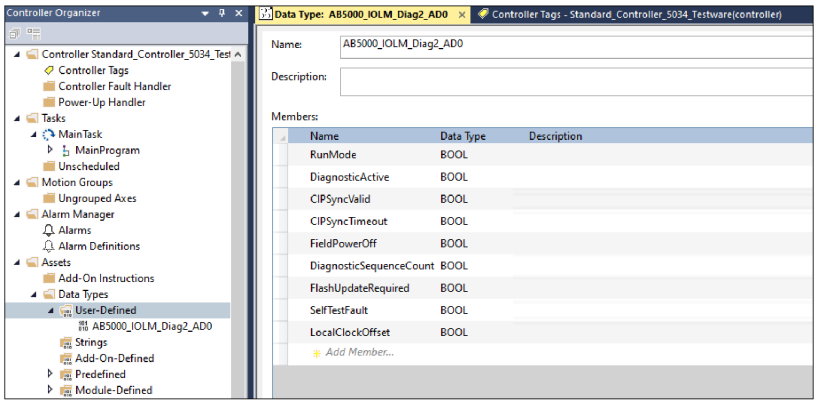
You can use the Studio 5000 Logix Designer application to create user-defined Diagnostic Assembly types.

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

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



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



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

Diagnostic Assemblies

1. Diagnostic IO-Link Master Assembly A
   - Instance ID = 0x801B (32795)
   - Size = 232 bytes

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

Table 29. Diagnostic Assembly Instance 32795

Name	Data Type	Size in Bytes
RunMode	BOOL	1
InfoBit_Pad1	BOOL	
DiagnosticActive	BOOL	
CIPSyncValid	BOOL	
CIPSyncTimeout	BOOL	
InfoBit_Pad5	BOOL	
FieldPowerOff	BOOL	
InfoBit_Pad7	BOOL	
DiagnosticSequenceCount	SINT	1
DiagBit_Pad0	BOOL	2
DiagBit_Pad1	BOOL	
DiagBit_Pad2	BOOL	
DiagBit_Pad3	BOOL	
DiagBit_Pad4	BOOL	
DiagBit_Pad5	BOOL	
DiagBit_Pad6	BOOL	
DiagBit_Pad7	BOOL	
DiagBit_Pad8	BOOL	
DiagBit_Pad9	BOOL	
DiagBit_Pad10	BOOL	
DiagBit_Pad11	BOOL	
FlashUpdateRequired	BOOL	
SelfTestFault	BOOL	
DiagBit_Pad14	BOOL	
DiagBit_Pad15	BOOL	
Pad	DINT	4
LocalClockOffset	LINT	8

Name	Data Type	Size in Bytes
LocalClockOffsetTimestamp	LINT	8
GrandMasterClockID	SINT	8
ChannelMode00	SINT	1
ChannelMode01	SINT	1
ChannelMode02	SINT	1
ChannelMode03	SINT	1
Pad	DINT	4
Ch00	Diagnostic_Channel_Struct	48
Ch01	Diagnostic_Channel_Struct	48
Ch02	Diagnostic_Channel_Struct	48
Ch03	Diagnostic_Channel_Struct	48

2. Diagnostic IO-Link Master Assembly B
   - Instance ID = 0x801C (32796)
   - Size = 200 bytes

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

Table 30. Diagnostic Assembly Instance 32796

Name	Data Type	Size in Bytes
ChannelMode04	SINT	1
ChannelMode05	SINT	1
ChannelMode06	SINT	1
ChannelMode07	SINT	1
Pad	DINT	4
Ch04	Diagnostic_Channel_Struct	48
Ch05	Diagnostic_Channel_Struct	48
Ch06	Diagnostic_Channel_Struct	48
Ch07	Diagnostic_Channel_Struct	48

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

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

Table 31. Diagnostic Assembly Instance 769

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

Diagnostic Channels

Diagnostic IO-Link Master Channel

- Size = 48 bytes

The following Data Types must be retrieved as part of the Diagnostic Assembly Instance. Follow the information in the following table to add each member.

Table 32. Structure for Diagnostic IO-Link Master Channel

Name	Data Type	Size in Bytes
Fault	BOOL	2
Uncertain	BOOL	
NoLoad	BOOL	
ShortCircuit	BOOL	
DiagBit_Pad5	BOOL	
FieldPowerOff	BOOL	
DiagBit_Pad7	BOOL	
DiagBit_Pad8	BOOL	
DiagBit_Pad9	BOOL	
SSVShortCircuit	BOOL	
DiagBit_Pad11	BOOL	
DiagBit_Pad12	BOOL	
DiagBit_Pad13	BOOL	
DiagBit_Pad14	BOOL	
DiagBit_Pad15	BOOL	
PortStatusInfo	USINT	1
Pad1	SINT	1
Pad2	DINT	4
NoLoadTimstamp	SINT	8
ShortCircuitTimestamp	SINT	8
FieldPowerOnTimestamp	SINT	8
FieldPowerOffTimestamp	SINT	8
SSVShortCircuitTimestamp	SINT	8

Definitions for Diagnostic Assembly Members

Table 33. Definition of Members in Diagnostic Assembly Data Types

Name	Data Type	Definition	Valid Values
RunMode	BOOL	Module's operating state	0 = Idle 1 = Run When the value is 0, it means one of the following: • Connection is not up. • Connection has been opened but the module has not started producing data for the connection. • Because the controller is in Program Mode, the module is not applying output tag data but is applying the Program Mode states of Output channels instead. When the value is 1, it means the following: • Connection is up. • Module is producing data for the connection. • Output tag data is being applied.
DiagnosticActive	BOOL	Indicates if any diagnostics are active or if the prognostics threshold is reached.	0 = No diagnostics are active 1 = One or more diagnostics are active or the prognostics threshold is reached.
CIPSyncValid	BOOL	Indicates whether the module is synced with a 1588 master. A set bit alone cannot indicate that it is synced to the same master clock of the owner controller. You must compare the Grandmaster Clock ID of both the module and the owner controller.	0 = CIP Sync is not available 1 = CIP Sync is available
CIPSyncTimeout	BOOL	Indicates if the module was previously synchronized with a 1588 master but the module is not synced 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 master time.
FieldPowerOff	BOOL	Indicates that a field power loss condition exists on the channel.	• 0 = No field power off condition • 1 = Field power off condition
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.	-128...+127 The value of 0 is skipped except during module powerup.
FlashUpdateRequired	BOOL	Indicates whether flash update is required.	• 0 = Flash update not required • 1 = Module has no application firmware
SelfTestFault	BOOL	Indicate whether the fault is present during module self test.	• 0 = Module initialization code did not detect an error • 1 = Module initialization code detected an error
LocalClockOffset	LINT	The offset from the local clock to the system time. This value helps to detect steps in time. This value updates when a PTP update is received.	All
LocalClockOffsetTimestamp	LINT	Indicates the timestamp of the local clock offset.	A valid time or None if there is no recorded event time.
GrandMasterClockID	SINT[8]	The EUI-64 Identity of the CIP Sync Grandmaster clock the module is synced to.	All

Table 33. Definition of Members in Diagnostic Assembly Data Types (continued)

Name	Data Type	Definition	Valid Values
FieldPowerOnTimestamp	LINT	Indicates the timestamp of the last time field power turned on.	A valid time or None if there is no recorded event time. Time format is YYYY-MM-DD-HH:mm:SS.mmm. • YYYY = year • MM = month • DD = day • HH = hour (24 hour) • mm = minutes • SS = seconds • mmm = milliseconds
FieldPowerOffTimestamp	LINT	Indicates the timestamp of the last time field power turned off.	A valid time or None if there is no recorded event time. Time format is YYYY-MM-DD-HH:mm:SS.mmm. • YYYY = year • MM = month • DD = day • HH = hour (24 hour) • mm = minutes • SS = seconds • mmm = milliseconds
ChannelMode00	SINT	Indicates the operating mode of the channel.	For C/Q channel: • 0x00 = Disabled (default) • 0x21 = Digital Output, Short Circuit • 0x02 = Digital Input • 0x22 = Digital Input, Timestamp • 0x12 = Digital Input, Counter • 0x03 - IO Link • 0x13 = Digital Input, Fallback • 0x23 = Digital Input, Timestamp, Fallback For I/Q channels: • 0x00 = Disabled (default) • 0x01 = Digital Output, Short Circuit, No Load • 0x02 = Digital Input • 0x22 = Digital Input, Timestamp • 0x12 = Digital Input, Counter
ChannelMode01	SINT		
ChannelMode02	SINT		
ChannelMode03	SINT		
ChannelMode04	SINT		
ChannelMode05	SINT		
ChannelMode06	SINT		
ChannelMode07	SINT		
Fault	BOOL	Indicates that counter data is inaccurate and cannot be trusted for use in the application.	• 0 = Good • 1 = Bad, causing fault If the bit is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy.
	IMPORTANT: Once the condition that caused the tag to change to 1 is removed, the bit automatically resets to 0.		
Uncertain	BOOL	Indicates that the counter data can be inaccurate but the degree of inaccuracy is not known.	• 0 = Good data • 1 = Uncertain data If the bit is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy.

Table 33. Definition of Members in Diagnostic Assembly Data Types (continued)

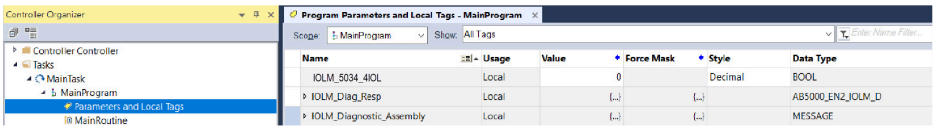
Name	Data Type	Definition	Valid Values
	IMPORTANT: Once the condition that caused the tag to change to 1 is removed, the bit automatically resets to 0.		
NoLoad	BOOL	Indicates if a load fault is present.	• 0 = No Load condition does not exist • 1 = No Load condition exists
NoLoadTimestamp	LINT	Indicates the timestamp of the last No Load fault.	A valid time or None if there is no recorded event time. Time format is YYYY-MM-DD-HH:mm:SS.mmm. • YYYY = year • MM = month • DD = day • HH = hour (24 hour) • mm = minutes • SS = seconds • mmm = milliseconds
ShortCircuit	BOOL	Indicates if an output short circuit or overcurrent fault is present on the point.	• 0 = No Short Circuit condition exists • 1 = Short Circuit condition is present
ShortCircuitTimestamp	LINT	Indicates the timestamp of the last short circuit fault.	A valid time or None if there is no recorded event time. Time format is YYYY-MM-DD-HH:mm:SS.mmm. • YYYY = year • MM = month • DD = day • HH = hour (24 hour) • mm = minutes • SS = seconds • mmm = milliseconds
SSVShortCircuit	BOOL	Indicates if the channel has a SSV short circuit fault.	• Present • Not Present
SSVShortCircuitTimestamp	LINT	Indicates the timestamp of the last SSV short circuit fault.	A valid time or None if there is no recorded event time. Time format is YYYY-MM-DD-HH:mm:SS.mmm. • YYYY = year • MM = month • DD = day • HH = hour (24 hour) • mm = minutes • SS = seconds • mmm = milliseconds
PortStatusInfo	USINT	Indicates the status of the connected device.	• No Device • Deactivated • Port Diag • Pre-Operate • Operate • Digital Input • Digital Output • Power Off • Not Available • Unknown

Table 33. Definition of Members in Diagnostic Assembly Data Types (continued)

Name	Data Type	Definition	Valid Values
CIPConnections	INT	Indicates the number of CIP connections currently open.	0...24
CIPLostPackets	DINT	Indicates the running sum of the number of Sequenced Address Item Sequence Numbers that are skipped in Class 0 and Class 1 connections consumed by the adapter and its children.	0...2,147,483,647
CIPTimeouts	DINT	Indicates the running count of the number of connections that time out, both originated and targeted, to and through the adapter.	0...2,147,483,647
CPUUtilization	INT	Indicates the usage of the compute engine.	0...100%

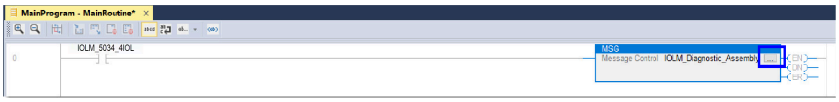
Create Message Type User Tags

Create MESSAGE type user tags for requests and associated response user tags for each of the new user-defined diagnostic assembly types.



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

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



4. Expand the message tag to open the message configuration dialog.
5. On the Configuration tab, select:
   - Service type: Get Attribute Single
   - Class: 4
   - Attribute: 3
   - Instance:
     - **5034-IOL4 and 5034-IOL4XT**
       0x801B (32795) Diagnostic IO-Link Master Assembly A
       0x801C (32796) Diagnostic IO-Link Master Assembly B
       0x301 (769) Diagnostic Counters Base I/O Assembly
   - Destination element: User-defined data type suitable for the instance entered.
6. On the Communication tab, select the path to the module that you wish to send the messages to.
7. Download the project and set to Run mode.

   You can monitor the user-defined tag values from the Program Parameters and Local Tags window, under the MainProgram task in the Controller Organizer pane.

IO-Link Device Details

This chapter covers the detailed instructions on how to configure IO-Link devices that are connected to your IO-Link master module in a Studio 5000 Logix Designer application project. It also describes the module tag definitions for input, output, and configuration tags.

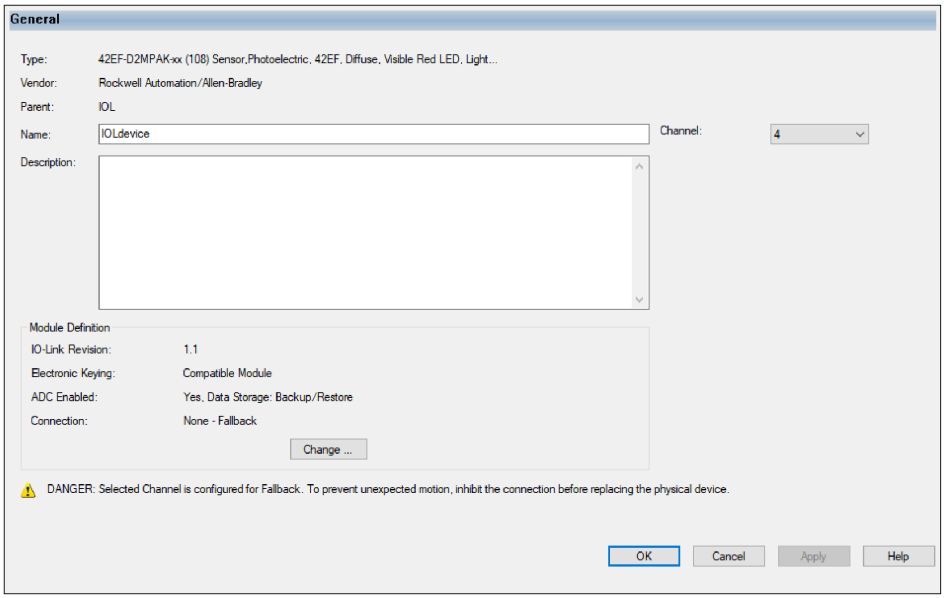
IO-Link Device Configuration

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.

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.

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

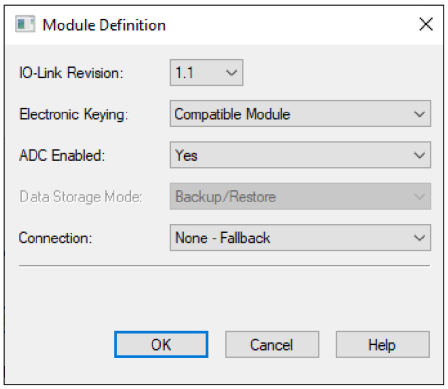


Table 34. IO-Link Device Module Definition Parameters

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 26.	• Compatible Module • Disable Keying ◦ This option is available only when the Rockwell Automation IO-Link device supports Exact Keying. • Exact Match
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 26.	• 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 27.	• 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 25.	Device-specific

Connection View

Use this view to complete the following tasks:

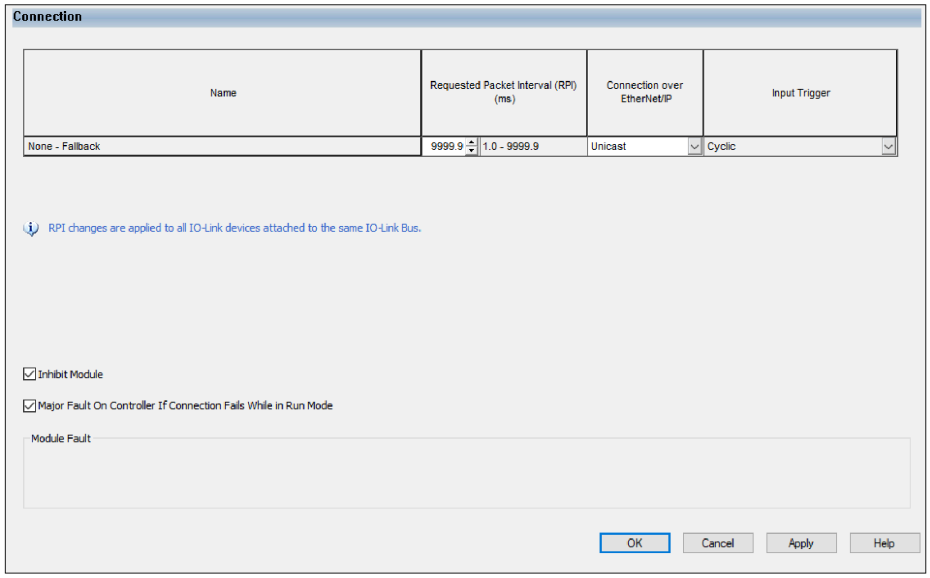
- Set the RPI rate.

  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 13.
- Set the connection type to use on the EtherNet/IP network.
  For more information on unicast and multicast connections, see the following:
  - Unicast or Multicast Connection on page
  - Ethernet Reference Manual, publication ENET-RM002.
- Inhibit the device. For more information on inhibiting the device, see IO-Link Device Inhibiting on page 25.
- Configure fault response for connection failure while the controller is in Run mode.

The Module Fault area of the Connection view is useful for troubleshooting. For more information on the Module Fault area, see Module Fault Descriptions on Connection View on page 64.

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



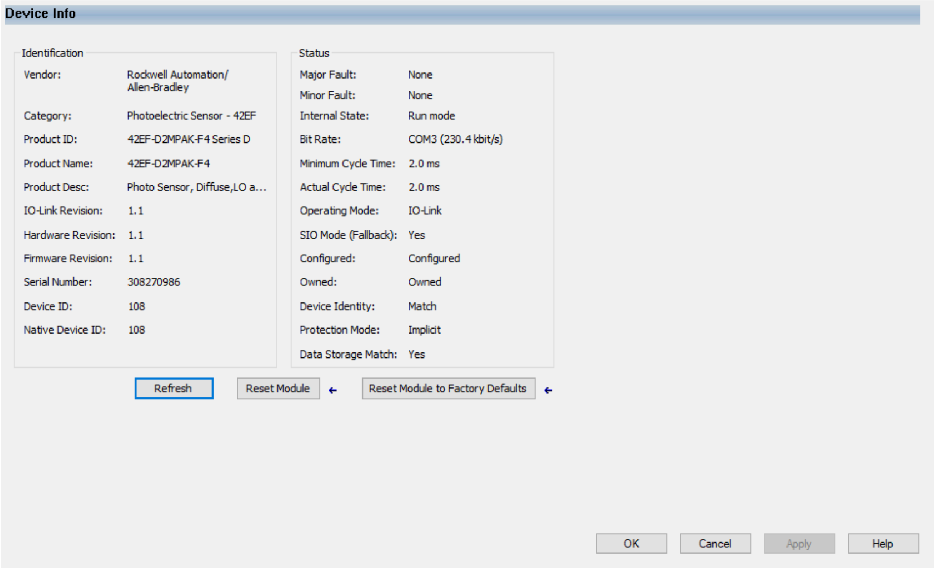
Device Info View

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

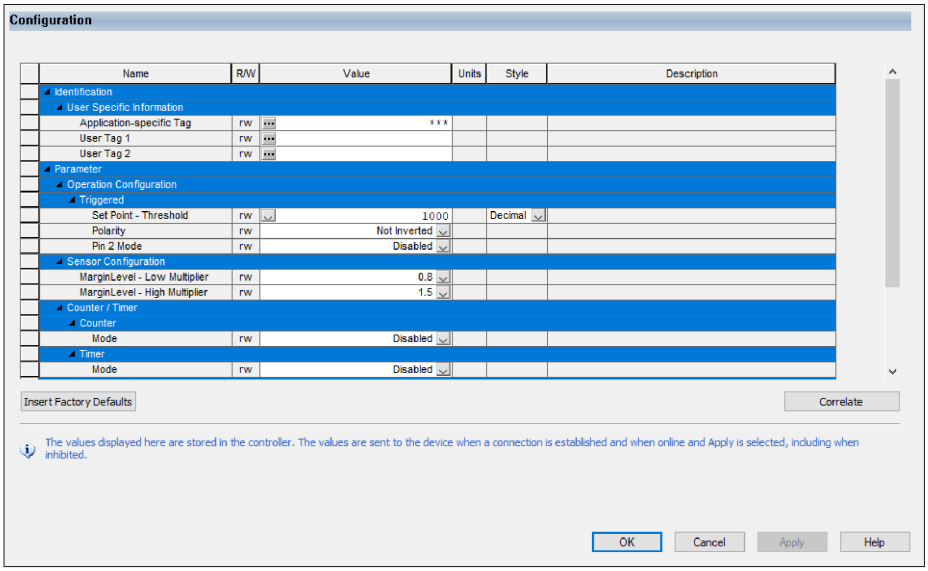
The Configuration view displays only the configuration parameters and their project values. For more information, see IO-Link Device Parameters Classification on page 28.

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.

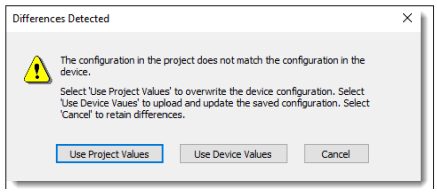
WARNING: After changing a measurement unit, you must verify that all configuration parameters that use this measurement unit have appropriate values before applying the configuration to the device.

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 62.

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.

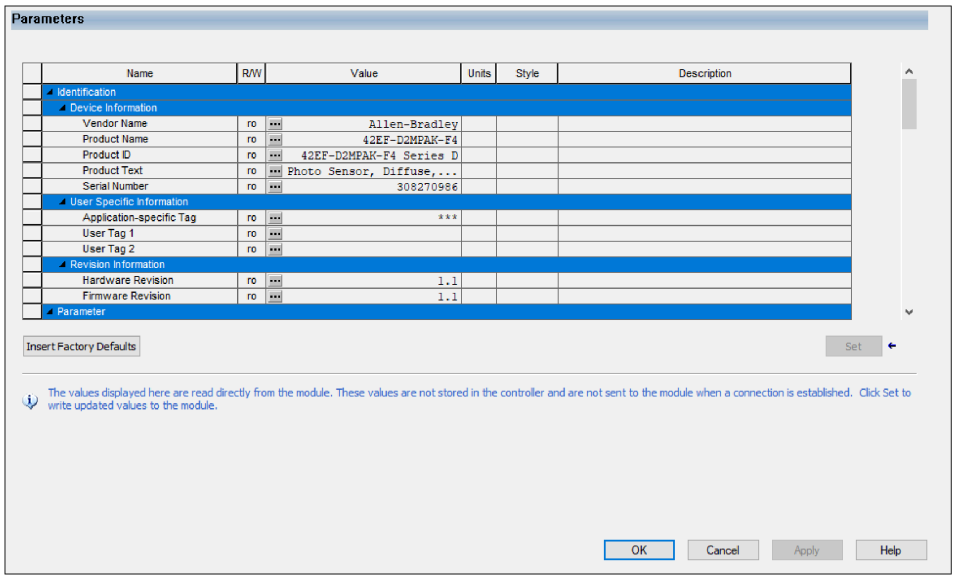
  Although you cannot change configuration parameters of the device in this view, you can verify their actual values. Use the Configuration view to change the values of configuration parameters.

- 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 28.

- Perform a command that is supported by the device by selecting the associated button.

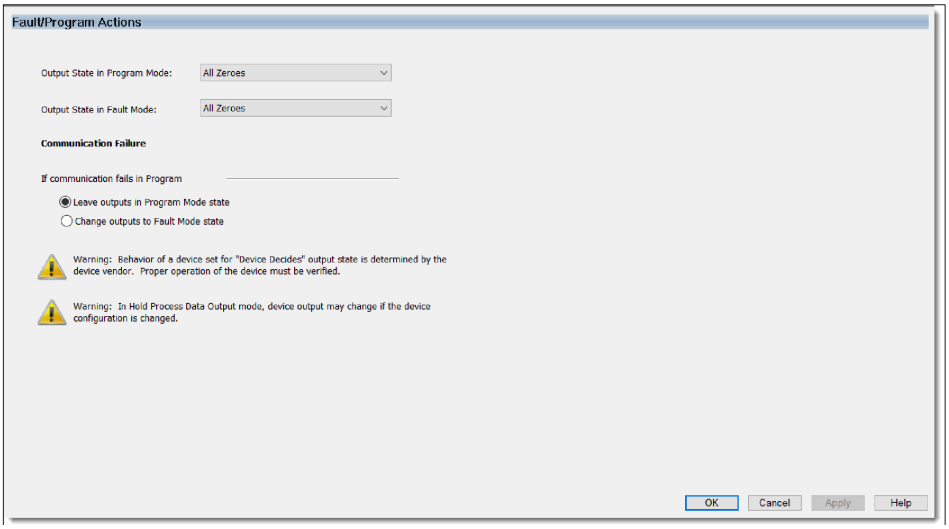


If the device is attached to an IO-Link (non-Fallback) channel, you cannot set parameters or execute commands on the device when the device is uninhibited. You can still view the parameters of the device.

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.

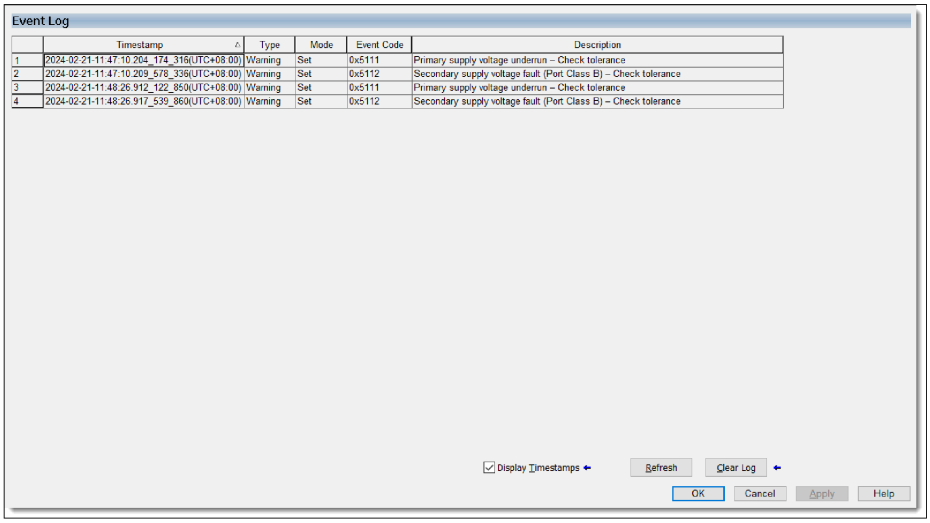


This view is available only for devices that support output process data.

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.



IO-Link Device Tag Definitions

When you create an 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 device has a distinct tag that is available for use in the controller ladder program.

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

IO-Link Device Common Configuration Tag Definitions

Table 35. 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

IO-Link Device Common Input Tag Definitions

Table 36. 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 is running • 1 = Connection is 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.
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 31.	• 0 = Configuration is not changed • 1 = Configuration is 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 30.	• 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 30.	• 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

Table 36. IO-Link Device Input Tags (continued)

Name	Data Type	Definition	Valid Values
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 timestamp of the event.	All positive values
DataTimestamp	LINT	The timestamp of the data.	All positive values
ProcessDataIn.xxxx	Process data input from the device.	Device-specific	

IO-Link Device Common Output Tag Definitions

Table 37. 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 31.	• 0 = Configuration change not reset • 1 = Configuration change reset
ProcessDataOut.xxxx	Process data output from the device.		Device-specific

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	rok.auto/support
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Technical Documentation Center	Quickly access and download technical specifications, installation instructions, and user manuals.	rok.auto/techdocs
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	rok.auto/pcdc

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 information on its website at rok.auto/pec.

Rockwell Automation NV Commercial Registration Number 0424.293.935

Rockwell Otomasyon Ticaret A.Ş. Kar Plaza İş Merkezi E Blok Kat:6 34752 İçerenköy, İstanbul, Tel: +90 (216) 5698400 EEE Yönetmeliğine Uygundur

Connect with us.

rockwellautomation.com — expanding **human possibility**®

AMERICAS: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000
EUROPE/MIDDLE EAST/AFRICA: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2663 0600
ASIA PACIFIC: Rockwell Automation SEA Pte Ltd, 2 Corporation Road, #04-05, Main Lobby, Corporation Place, Singapore 618494, Tel: (65) 6510 6608
UNITED KINGDOM: Rockwell Automation Ltd., Pitfield, Kiln Farm, Milton Keynes, MK11 3DR, United Kingdom, Tel: (44) (1908) 838-800

Publication 5034-UM004A-EN-P - April 2025