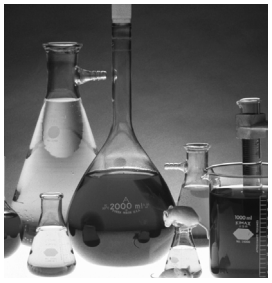
ArmorBlock I/O 8 Channel IO-Link Master Module



User Manual

(Catalog Number 1732E-8IOLM12R)

ALLEN-BRADLEY • ROCKWELL SOFTWARE

Rockwell Automation

Important User Information

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

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

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

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

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
	**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
	**WARNING:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**WARNING:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

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Purpose of This Manual

This manual describes how to install, configure, and troubleshoot your ArmorBlock® IO-link Master module.

The ArmorBlock I/O 8 Channel IO-Link Master module can only be used in EtherNet/IP™ systems. See EtherNet/IP publications in addition to this manual.

Who Should Use This Manual

This manual is intended for qualified personnel. You should be familiar with Studio 5000®, EtherNet/IP Network, and IO-Link terminology. If you do not qualify, refer to your software documentation or online help before attempting to use these modules.

Related Publications

See this table for a list of related ArmorBlock I/O products and documentation. The publications are available from https://literature.rockwellautomation.com/. For specification and safety certification information, see the installation instructions.

Resource	Description
ArmorBlock I/O 8 Channel IO-Link Master	
ArmorBlock I/O 8 Channel IO-Link Master Module Installation Instructions, publication 1732E-IN001	Provides installation information and wiring diagrams for the 1732E-8IOLM12R module.
ArmorBlock IO-Link Master Module Wiring Diagrams, publication 1732E-WD008	Provides connector pinout guide for wiring the 1732E-8IOLM12R module.
ArmorBlock I/O Selection Guide, publication 1732-SG001	Selection guide for choosing ArmorBlock I/O products.
EtherNet/IP, CIP, Miscellaneous	
EtherNet/IP Network Configuration User Manual, publication ENET-UM001.	Provides detailed information on EtherNet/IP network configuration.
EtherNet/IP Embedded Switch Technology Application Guide publication ENET-AT005	Provides detailed information on alternative network topologies for interconnecting EtherNet/IP devices by embedding switches.
Integrated Architecture and CIP Sync Configuration Application Technique, publication IA-AT003	Provides detailed information on configuring CIP Sync features for an EtherNet/ network.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Detailed information on proper wiring and grounding techniques.

Notes:

Introduction

Overview

The ArmorBlock I/O 8 Channel IO-Link Master provides eight channels that can be individually configured as IO-Link Master or as a standard digital I/O module on four M12 connectors. The IO-Link Master module can be configured to fit any IO-Link and/or discrete application. The module also provides time stamping functionality for discrete inputs and IO-Link input data.

In IO-Link mode, the module supports eight channels for IO-Link Master communication with IO-Link compatible devices. In standard digital I/O mode, the module supports eight channels of standard digital input or standard digital output. Standard digital input channels support IEC61131-2 type 1 input. Channels can also be disabled if not in use.

You must use this master module with Studio 5000 Logix Designer®[(1)] application, version 20 or later.

The ArmorBlock I/O 8 Channel IO-Link Master operates in v1.1 mode and is compatible with both V1.0 and V1.1 IO-Link devices. You cannot configure the IO-Link master to operate in v1.0 mode.

Modes of Usage

The module can be used in one of the following modes:

- as IO-Link Master,
- as standard digital input or standard digital output modules,
- as mixed IO-Link Master and standard digital input or standard digital output modules.
- Individual channels can also be disabled if not in use.
- Fallback mode

ArmorBlock I/O 8 Channel IO-Link Master - IO-Link Mode

The ArmorBlock I/O 8 Channel IO-Link Master can support IO-Link communications to IO-Link enabled devices in IO-Link Master mode.

See Chapter 5, Configure the ArmorBlock I/O 8 Channel IO-Link Master as IO-Link Master Using the Studio 5000 Add-on Profile.

(1) Studio 5000 Logix Designer is the replacement for RSLogix 5000® (v20 or later). It provides one software package for discrete, process, batch, motion, safety, and drive-based applications.

ArmorBlock I/O 8 Channel IO-Link Master - Standard Digital Input or Standard Digital Output Mode

The module can be used as a standard digital ArmorBlock module.

See Chapter 6, Configure the ArmorBlock I/O 8 Channel IO-Link Master Module as Standard Digital Input or Output Using the Studio 5000 Add-on Profile.

ArmorBlock I/O 8 Channel IO-Link Master - Fallback Mode

When a module has channels in Fallback mode, you can configure them in the same way as channels in IO-Link mode. During operation the channel functions as a Digital Input.

The Fallback feature allows an IO-link master to configure an IO-link device, and then to instruct the device to fall back to discrete input mode. When you set the channel to Fallback mode, a single input bit is provided in the controller tag.

Once you configure the channel for Fallback, a wakeup command is issued to the target device if:

1. The project is online with the controller and the IO-link Add-On profile is open, including when
   a. Correlating connected devices.
   b. Making changes to the device parameters.
   c. Clicking Refresh on the Add-On profile.
2. You change the device parameters in the Add-On profile, and then download the changes to the IO-link master through the controller.

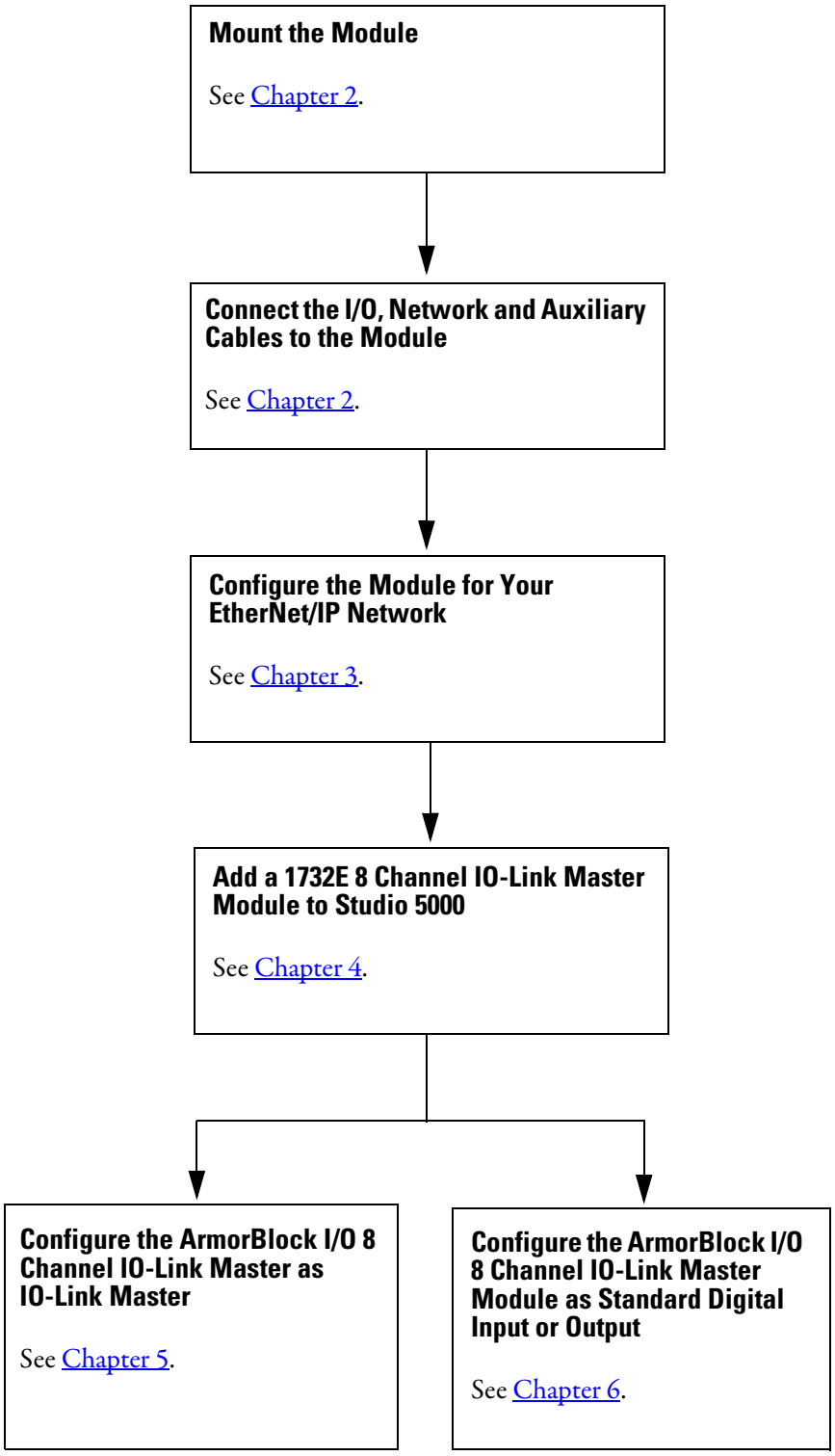
In either case, the devices return to Fallback mode once the operations are completed.

You can also issue a wakeup command to the target device using a CIP™ message instruction.

ATTENTION: When devices wake up from fallback to IO-link mode, response time for the devices may be impacted. Take necessary precautions to avoid unintended operation of machines or processes.

See Chapter 5, Configure IO-Link Device Parameters Using Message Instructions.

Quick Start - Prepare the Module to Work on EtherNet/IP



Hardware/Software Compatibility

The module and the applications described in this manual are compatible with the following firmware revisions and software versions.

The latest firmware and software upgrades can be downloaded from the Product Compatibility and Download Center (PCDC) website at: https://www.rockwellautomation.com/rockwellautomation/support/pcdc.page

Product	Firmware Revision
1732E-8IOLM12R	1.001 or later
1756-EN2T, 1756-EN2TR, 1756-EN3TR	3.001 or later when using Studio 5000 version 20.00.00 or later
CompactLogix or ControlLogix controllers	20.001 or later

Product	Software Version
Studio 5000 Logix Designer[1]	20.00.00 or later
Studio 5000 Add-on Profile	1.39.00 or later
RSLinx® software	2.56.00 or later

(1) Studio 5000 Logix Designer is the replacement for RSLogix 5000 (version 20.00.00 or later). It provides one software package for discrete, process, batch, motion, safety, and drive-based applications.

Introduction to CIP Sync

CIP is the Common Industrial Protocol that we use to let all Rockwell Automation products communicate with each other whether it be on a DeviceNet®, ControlNet®, and/or a CIP network. Since it is an ODVA standard, other industrial product manufacturers develop products to communicate via the CIP protocol.

CIP Sync™ is a CIP implementation of the IEEE 1588 PTP (Precision Time Protocol) in which devices can bridge the PTP time across backplanes and on to other networks via EtherNet/IP ports.

What is IEEE 1588 PTP (Precision Time Protocol)?

The IEEE 1588 standard specifies a protocol to synchronize independent clocks running on separate nodes of a distributed measurement and control system to a high degree of accuracy and precision. The clocks communicate with each other over a communication network. In its basic form, the protocol is intended to be administration free. The protocol generates a master slave relationship among the clocks in the system. Within a given subnet of a network, there will be a single master clock. All clocks ultimately derive their time from a clock known as the grandmaster clock. This is called Precision Time Protocol (PTP).

The PTP is a time-transfer protocol defined in the IEEE 1588-2008 standard that allows precise synchronization of networks, for example, Ethernet. Accuracy within the nanosecond range can be achieved with this protocol when using hardware-generated synchronization.

IEEE 1588 is designed for local systems requiring very high accuracies beyond those attainable using Network Time Protocol (NTP). NTP is used to synchronize the time of a computer client or server to another server or reference time source, such as a GPS.

CIP Sync Support

CIP Sync supports the IEEE 1588-2008 synchronization standard. In this architecture, a grandmaster clock provides a master time reference for the system time. The 1732E-8IOLM12R module is a CIP Sync slave only device. There must be another module on the network that will function as a master clock. The grandmaster could be:

- A 1756 ControlLogix® L6 or L7 controller when using Studio 5000 software v20 or later.
- An Ethernet bridge that supports IEEE 1588 V2, or
- A Symmetricom Grand Master GPS or equivalent.

What Is CIP Sync?

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 connected over CIP networks. This technology supports highly distributed applications that require time stamping, sequence of events recording, distributed motion control, and increased control coordination.

What Is Time Stamping?

Each input has its own individual timestamp recorded for each change of value. The offset from the timestamp to the local clock is also recorded so that steps in time can be detected and resolved.

Time stamping uses the 64-bit system time whose time base is determined by the module's master clock resolved in microseconds. Each timestamp is updated as soon as an input transition is detected, before input filtering occurs. When filtering is enabled, the transition is only recorded if the transition passes the filter.

The module starts Time Stamping as soon as it powers up, even if it is not synchronized to a master clock. If it is synchronized to a master clock and then becomes unsynchronized it continues to time stamp. All time stamps and offsets have a value of zero at power-up.

For more information on how to use CIP Sync technology, see the Integrated Architecture® and CIP Sync Configuration Application Technique, publication IA-AT003.

Use of the Common Industrial Protocol (CIP)

The 1732E-8IOLM12R IO-Link Master module uses the Common Industrial Protocol (CIP). CIP is the application layer protocol specified for EtherNet/IP, the Ethernet Industrial Protocol. It is a message-based protocol that implements a relative path to send a message from the “producing” device in a system to the "consuming” devices.

The producing device contains the path information that steers the message along the proper route to reach its consumers. Because the producing device holds this information, other devices along the path simply pass this information; they do not need to store it.

This has two significant benefits:

- You do not need to configure routing tables in the bridging modules, which greatly simplifies maintenance and module replacement.
- You maintain full control over the route taken by each message, which enables you to select alternative paths for the same end device.

Understand the Producer/Consumer Model

The CIP "producer/consumer" networking model replaces the old source/ destination ("master/slave") model. The producer/consumer model reduces network traffic and increases speed of transmission. In traditional I/O systems, controllers poll input modules to obtain their input status. In the CIP system, input modules are not polled by a controller. Instead, they produce their data either upon a change-of-state (CoS) or periodically. The frequency of update depends upon the options chosen during configuration and where the input modules resides on the network. The input module, therefore, is a producer of input data and the controller is a consumer of the data.

The controller can also produce data for other controllers to consume. The produced and consumed data is accessible by multiple controllers and other devices over the EtherNet/IP network. This data exchange conforms to the producer/ consumer model.

Specify the Requested Packet Interval (RPI)

The Requested Packet Interval (RPI) is the update rate specified for a particular piece of data on the network. This value specifies how often to produce the data for that device. For example, if you specify an RPI of 50 ms, it means that every 50 ms the device sends its data to the controller or the controller sends its data to the device.

RPIs are only used for devices that exchange data. For example, a ControlLogix EtherNet/IP bridge module in the same chassis as the controller does not require

an RPI because it is not a data-producing member of the system; it is used only as a bridge to remote modules.

Introduction to Time Stamping of the Input Data

The 1732E-8IOLM12R is an input module that offers time stamping on a per channel basis in addition to providing the basic ON/OFF and OFF / ON detection of all change of state (CoS) input data (also commonly known as the process data). This IO-Link Master module provides a new timestamp for any CoS on any of the input data from a configured IO-Link enabled device. Each IO-Link enabled device can support up to 32 bytes of input process data partitioned dependent on the manufacturer of the IO-Link enabled device.

As a result, one timestamp is available for the entire input process data, and using ladder logic, the user can specify when to capture the timestamp for any particular data transition.

Most often the data of interest is a Boolean value with instructions such as "examine if open" and "examine if closed" paired with a one-time instruction to only capture the transition itself. In this case, the user can accurately collect the data transition and the time at which it occurred.

Note that only the input data can be timestamped and that this 1732E-8IOLM12R master module does not support time stamping for the output data.

Time stamping is a feature that registers a time reference to a change in input data. For the 1732E-8IOLM12R, the time mechanism used for time stamping is (PTP) system time. The 1732E-8IOLM12R module is a PTP slave-only device. There must be another module on the network that functions as a master clock.

Note that the input time stamping supports all CoS transitions of input data for IO-Link and/or discrete input data.

Each of the eight channels has a unique timestamp value which can be seen in the Controller Tags view.

This is ideal for numerous scenarios such as identifying “output” triggering state times from the sensor to the controller. Another example would be for identifying time indication as to when the margin low transition time occurred in the input data for learning when the “dirty lens” event occurred.

Chapter Summary and What's Next

In this chapter, you were given an overview of the ArmorBlock I/O 8 Channel IO-Link Master. In the next chapter, you will learn how to install and prepare your module for configuration.

Notes:

Install the ArmorBlock I/O 8 Channel IO-Link Master Module

Overview

This chapter shows you how to install and wire the ArmorBlock I/O 8 Channel IO-Link Master. The only tools you require are a flat or Phillips head screwdriver, and a drill. This chapter includes the following topics:

Install the Module

To install the module:

- Set the network address
- Mount the module
- Connect the I/O, Network and Auxiliary cables to the module.

Set the Network Address

The module ships with the rotary switches set to 999 and DHCP enabled. To change the network address, you can do one of the following:

- adjust the node address switches on the front of the module.
- use a Dynamic Host Configuration Protocol (DHCP) server, such as Rockwell Automation BootP/DHCP.
- retrieve the IP address from nonvolatile memory.

The module reads the switches first to determine if the switches are set to a valid number. To set the network address:

1. Remove power.
2. Remove the switch dust caps.
3. Rotate the three (3) switches on the front of the module using a small blade screwdriver.
4. Line up the small notch on the switch with the number setting you wish to use.

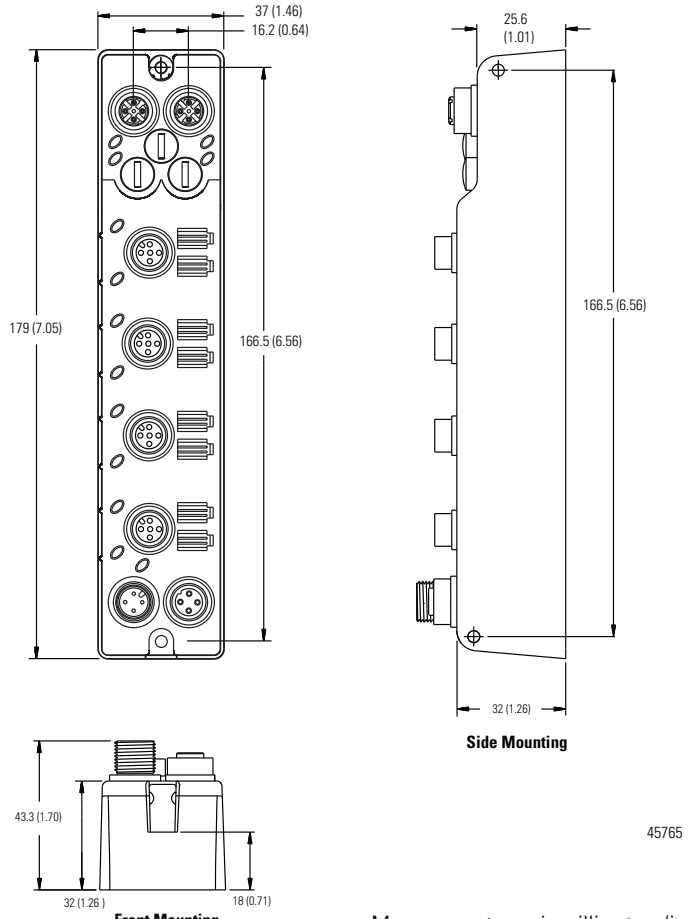
Valid settings range from 001...254.

5. Replace switch dust caps. Make sure not to over tighten.
6. Reapply power.

Mount the Module

To mount the module on a wall or panel, use the screw holes provided in the module. Refer to the mounting dimensions illustration to guide you in mounting the module.

Module Dimensions



Measurements are in millimeters (inches)

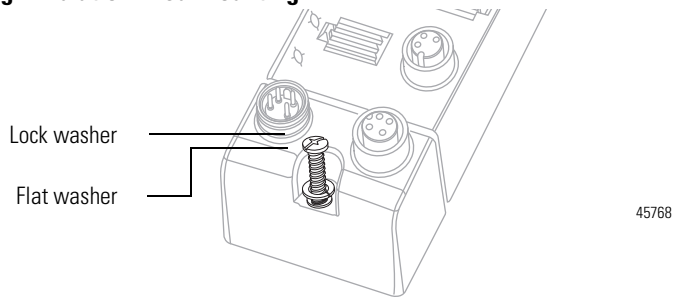
Install the mounting base as follows:

1. Lay out the required points as shown in the drilling dimension drawing.
2. Drill the necessary holes for #6 (M3) pan head screws.
3. Mount the module using #6 (M3) screws.

Mount the Module in High Vibration Areas

If you mount the module in an area that is subject to shock or vibration, we recommend you use a flat and a lock washer to mount the module. Mount the flat and the lock washer as shown in the mounting illustration. Torque the mounting screws to 0.68 Nm (6 lb-in.).

High Vibration Area Mounting



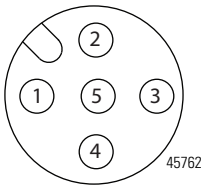
Connect the I/O, Network and Auxiliary Cables to the Module

The ArmorBlock I/O 8 Channel IO-Link Master module has four 5-pin micro-style M12 I/O connectors. We provide caps to cover the unused connectors on your module. Connect the quick-disconnect cord sets you selected for your module to the appropriate ports.

I/O Connectors

Refer to the pinout diagrams for the I/O connectors.

Micro-style 5-Pin I/O Female Connector

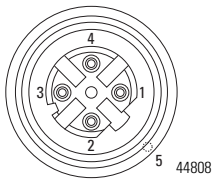


(View into connector)

Pin 1	Sensor source voltage
Pin 2	IO-Link, Input/output
Pin 3	Return
Pin 4	IO-Link, Input/output
Pin 5	PE

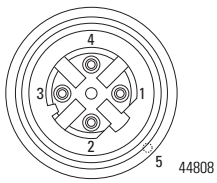
EtherNet/IP Connector

D-Code Micro Network Female Connector



(View into connector 1)

Pin 1	M12_Tx+
Pin 2	M12_Rx+
Pin 3	M12_Tx-
Pin 4	M12_Rx-
Pin 5	Connector shell shield GND



(View into connector 2)

Pin 1	M12_Rx+
Pin 2	M12_Tx+
Pin 3	M12_Rx-
Pin 4	M12_Tx-
Pin 5	Connector shell shield GND

IMPORTANT Use the 1585D–M4DC–H: Polyamide small body unshielded mating connectors for the D-Code M12 female network connector.

Note that the distance between the center of each Ethernet connector is 16.2 mm (refer to Module Dimensions on page 18). Rockwell Automation recommends the use of suitable cable based on this measurement. Some of the recommended cables are 1585D-M4TBJM-x and 1585D-M4TBDM-x for daisychains.

IMPORTANT Use two twisted pair CAT5E UTP or STP cables

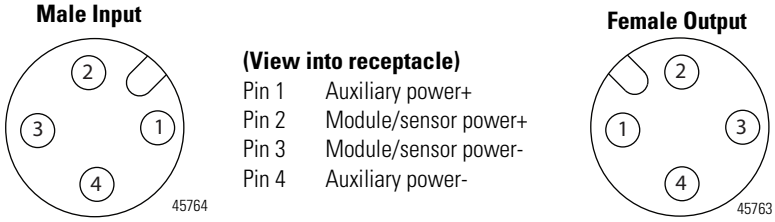
D-Code M12 Pin	Wire Color	Signal	8-way Modular RJ45 Pin
1	White-orange	TX+	1
2	White-green	RX+	3
3	Orange	TX-	2
4	Green	RX-	6

ATTENTION: Make sure all connectors and caps are securely tightened to properly seal the connections against leaks and maintain IP enclosure type requirements.

Auxiliary Power Connectors

Attach the micro-style 4-pin connector to the micro-style 4-pin receptacle as shown below.

Auxiliary Power Micro-style 4-Pin Receptacles



IMPORTANT The maximum current that any pin on the power connectors can carry is 4 A.

The power required by the module is based on a 4-pin micro-style connector system. The module receives its required power through the male connector on the left. A female connector on the right is also provided so that power can be daisy-chained from module to module.

The module requires two 24V DC (nominal) supplies. These supplies are called the Module Power and the Auxiliary Power. The Module power powers the microprocessor and Ethernet portions of the module. The Auxiliary Power provides power for the Digital Outputs, the Digital Inputs, and the Sensor Voltage.

Internally, the Module Power and Auxiliary Power are isolated from each other.

The Module Power current required for a module can be estimated as 2.4W/(Module Power Voltage). For example, if the Module Power Voltage is 24V DC, then the Module Power current (Imp) would be,

Imp ~ 2.4W/24VDC = 100 mA DC

If the power for four modules were daisy-chained together and the voltage is 24V DC, then the Module Power current through the first connector in the daisy-chain would be 4 x Im ~ 400 mA which is less than 4 A, so Module Power current is within acceptable limits.

The Auxiliary Power current is more complicated. The equation is below:

Iap ~ Iapm + Isp0 + Isp1+ Isp2+ Isp3 + Isp5+ Isp5 + Isp6 + Isp7 + IDO0 + IDO1 + IDO2 + IDO3 + IDO4 + IDO5 + IDO6 + IDO7 + IAPDC

Where:

Iap is the Auxiliary Power current through the first connector in the daisy-chain.
Iapm is the Auxiliary Power current required by the module itself.
IspN is the Sensor Power current for Digital Input N (0...7).
IDON is the Digital Output current for Digital Output N (0...7).
IAPDC is the Auxiliary Power current requirement for the remaining modules in the daisy-chain.

Iapm can be approximated by 0.5 W/(Auxiliary Power Voltage).

The table Auxiliary Power Calculation shows the resulting Auxiliary Power current calculation for a system of four modules. The Auxiliary Power voltage is 24V DC in this example. As can be seen in the cell with value set in bold, the Auxiliary Power current through the first connector in the daisy-chain is 3.898 A which is less than 4 A, so this system is adequate.

Auxiliary Power Calculation

	Module 1	Module 2	Module 3	Module 4
IAPDC	3.108A	2.772A	1.301A	0.000A
Iapm	0.021A	0.021A	0.021A	0.021A
Isp0	0.000A	0.000A	0.300A	0.050A
Isp1	0.000A	0.000A	0.000A	0.000A
Isp2	0.000A	0.000A	0.000A	0.000A

Auxiliary Power Calculation

	Module 1	Module 2	Module 3	Module 4
Isp3	0.000A	0.000A	0.000A	0.000A
Isp4	0.000A	0.000A	0.000A	0.000A
Isp5	0.000A	0.000A	0.000A	0.000A
Isp6	0.000A	0.000A	0.000A	0.000A
Isp7	0.000A	0.000A	0.000A	0.000A
IDO0	0.270A	0.025A	0.500A	0.025A
IDO1	0.200A	0.290A	0.300A	0.500A
IDO2	0.300A	0.000A	0.250A	0.300A
IDO3	0.000A	0.000A	0.100A	0.125A
IDO4	0.000A	0.000A	0.000A	0.030A
IDO5	0.000A	0.000A	0.000A	0.000A
IDO6	0.000A	0.000A	0.000A	0.000A
IDO7	0.000A	0.000A	0.000A	0.000A
Iapm	3.898A	3.108A	2.772A	1.301A

ATTENTION: To comply with the CE Low Voltage Directive (LVD), this equipment and all connected I/O must be powered from a source compliant with the following:
Safety Extra Low Voltage (SELV) or Protected Extra Low Voltage (PELV).

ATTENTION: To comply with UL restrictions, this equipment must be powered from a source compliant with the following: Limited Voltage.
ATTENTION: The device meets UL Type 1 Enclosure rating.

Chapter Summary and What's Next

In this chapter, you learned how to install and wire your module. The following chapter describes how to configure your module to communicate on the EtherNet/IP network by providing an IP address, gateway address, and Subnet mask.

Configure the Module for Your EtherNet/IP Network

Introduction

Before using the module in an EtherNet/IP network, you need to configure it with an IP address, subnet mask, and optional Gateway address. This chapter describes these configuration requirements and the procedures for providing them. Here are the ways you can do this:

- Use the Rockwell Automation BootP/DHCP utility, version 2.3 or greater, that ships with Studio 5000 or RSLinx software. You can also use this utility to reconfigure a device whose IP address must be changed.
- Use a third party DHCP (Dynamic Host Configuration Protocol) server.
- Use the Network Address switches.
- Have your network administrator configure the module via the network server.

See the table for a list of where to find specific information in this chapter.

Configuration Requirements

Before you can use your module, you must configure its IP address, its subnet mask, and optionally, gateway address. You have the option to use the Rockwell Automation BootP/DHCP utility, version 2.3 or greater, to perform the configuration. You also have the option to use a DHCP server or the network address switches to configure these parameters.

If the module needs to be reset to factory defaults, set the switches on the module to the value 888 and then cycle power to the module.

IMPORTANT

If using the BootP/DHCP utility, you will need to know the Ethernet hardware address of your module.

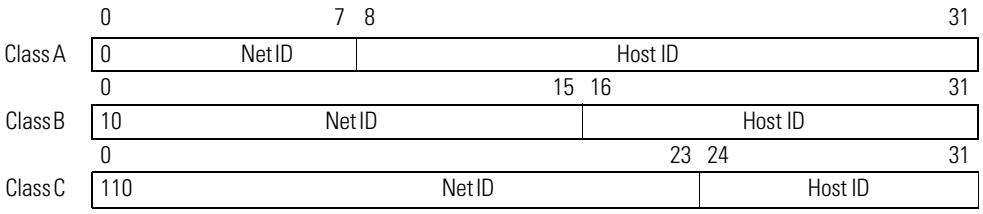
Rockwell Automation assigns each module a unique 48-bit hardware address at the factory. The address is printed on a label on the side of your module. It consists of six hexadecimal digits separated by colons. This address is fixed by the hardware and cannot be changed.

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

IP Address

The IP address identifies each node on the IP network (or system of connected networks). Each TCP/IP node on a network (including your module) must have a unique IP address.

The IP address is 32 bits long and has a net ID part and a Host ID part. Networks are classified A, B, C, or other. The class of the network determines how an IP address is formatted.



You can distinguish the class of the IP address from the first integer in its dotted-decimal IP address as follows:

Classes of IP Addresses

Range of first integer	Class	Range of first integer	Class
0…127	A	192…223	C
128...191	B	224…255	other

Each node on the same logical network must have an IP address of the same class and must have the same net ID. Each node on the same network must have a different Host ID thus giving it a unique IP address.

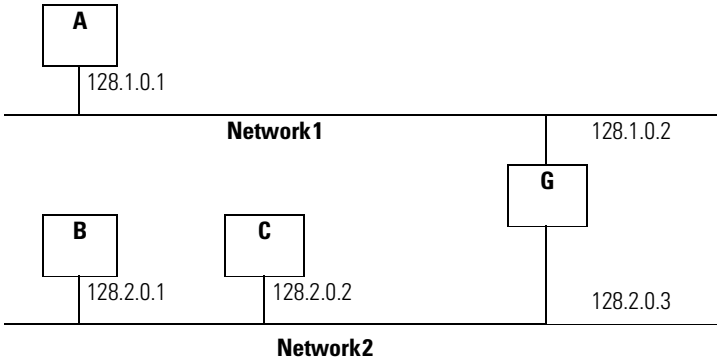
IP addresses are written as four decimal integers (0...255) separated by periods where each integer gives the value of one byte of the IP address.

EXAMPLE For example, the 32-bit IP address: 10000000 00000001 **00000000** 00000001 is written as 128.1.0.1.

Gateway Address

This section applies to multi-network systems. If you have a single network system, go to the next section.

The gateway address is the default address of a network, It provides a single domain name and point of entry to the site. Gateways connect individual networks into a system of networks. When a node needs to communicate with a node on another network, a gateway transfers the data between the two networks. The following figure shows gateway G connecting Network 1 with Network 2.



When host B with IP address 128.2.0.1 communicates with host C, it knows from C's IP address that C is on the same network. In an Ethernet environment, B then resolves C's IP address into a hardware address (MAC address) and communicates with C directly.

When host B communicates with host A, it knows from A's IP address that A is on another network (the net IDs are different). In order to send data to A, B must have the IP address of the gateway connecting the two networks. In this example, the gateway's IP address on Network 2 is 128.2.0.3.

The gateway has two IP addresses (128.1.0.2 and 128.2.0.3). The first must be used by hosts on Network 1 and the second must be used by hosts on Network 2. To be usable, a host's gateway must be addressed using a net ID matching its own.

Subnet Mask

The subnet mask is used for splitting IP networks into a series of subgroups, or subnets. The mask is a binary pattern that is matched up with the IP address to turn part of the Host ID address field into a field for subnets.

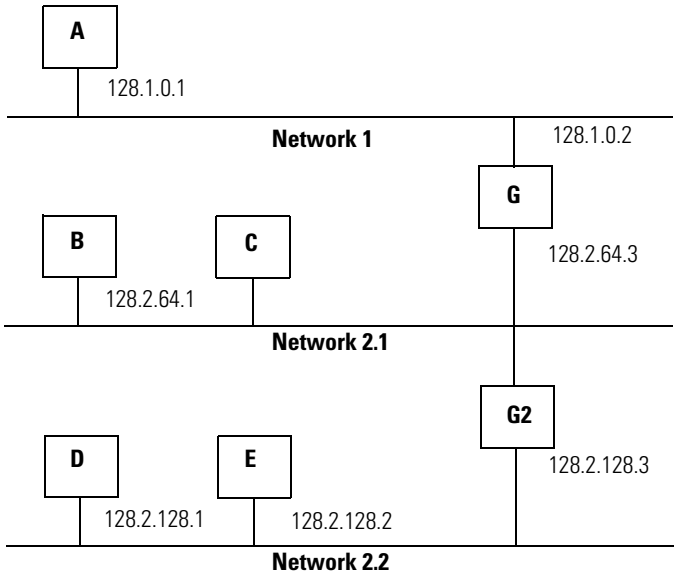
EXAMPLE Take Network 2 (a Class B network) in the previous example and add another network. Selecting the following subnet mask would add two additional net ID bits, allowing for four logical networks:

1111111 11111111 **11**000000 00000001 = 255.255.192.0

These two bits of the host ID used to extend the net ID

Two bits of the Class B host ID have been used to extend the net ID. Each unique combination of bits in the part of the Host ID where subnet mask bits are 1 specifies a different logical network.

The new configuration is:



A second network with Hosts D and E was added. Gateway G2 connects Network 2.1 with Network 2.2.
Hosts D and E use Gateway G2 to communicate with hosts not on Network 2.2.
Hosts B and C use Gateway G to communicate with hosts not on Network 2.1.
When B is communicating with D, G (the configured gateway for B) routes the data from B to D through G2.

Set the Network Address

The module ships with the rotary switches set to 999 and DHCP enabled. To change the network address, you can do one of the following:

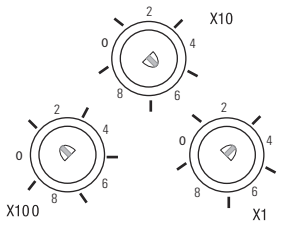
1. Adjust the switches on the front of the module.
2. Use a Dynamic Host Configuration Protocol (DHCP) server, such as Rockwell Automation BootP/DHCP.
3. Retrieve the IP address from nonvolatile memory.

The module reads the switches first to determine if the switches are set to a valid number. Set the network address by adjusting the 3 switches on the front of the module. Use a small blade screwdriver to rotate the switches. Line up the small notch on the switch with the number setting you wish to use. Valid settings range from 001...254.

Network Address Example

This example shows the network address set at 163

Note: You need to remove the protective switch dust caps before you can adjust the address settings.



When the switches are set to a valid number, the module's IP address is 192.168.1.xxx (where xxx represents the number set on the switches). The module's subnet mask is 255.255.255.0 and the gateway address is set to 0.0.0.0. When the module uses the network address set on the switches, the module does not have a host name assigned to it or use any Domain Name Server.

If the switches are set to an invalid number (for example, 000 or a value greater than 254, excluding 888), the module checks to see if DHCP is enabled. If DHCP is enabled, the module asks for an address from a DHCP server. The DHCP server also assigns other Transport Control Protocol (TCP) parameters.

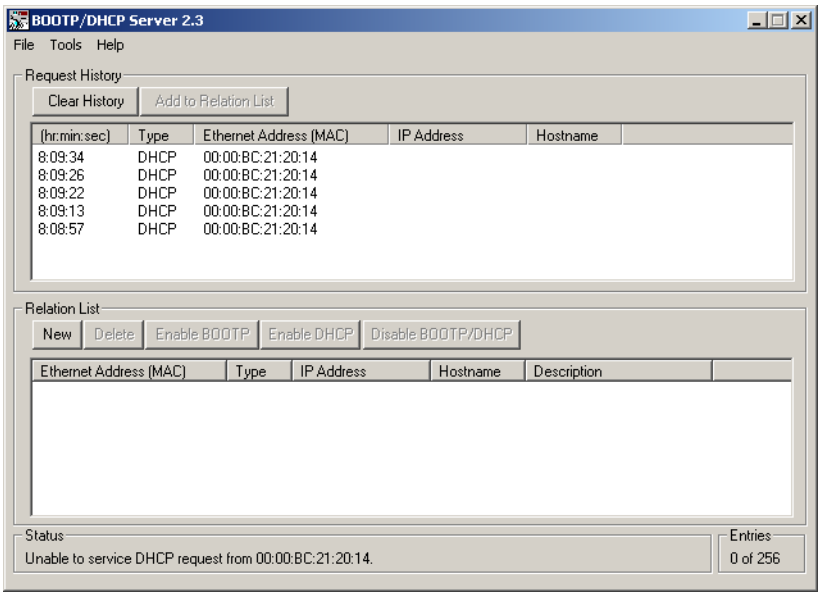
4. If DHCP is not enabled, and the switches are set to an invalid number, the module uses the IP address (along with other TCP configurable parameters) stored in nonvolatile memory.

Use the Rockwell Automation BootP/DHCP Utility

The Rockwell Automation BootP/DHCP utility is a standalone program that incorporates the functionality of standard BootP/DHCP software with a user-friendly graphical interface. It is located in the Utils directory on the Studio 5000 installation CD. The module must have DHCP enabled (factory default and the network address switches set to an illegal value) to use the utility.

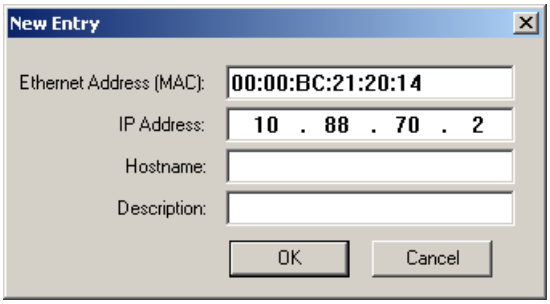
To configure your module using the BootP/DHCP utility, perform the following steps:

1. Run the BootP/DHCP software.
   The BOOTP/DHCP Request History dialog appears showing the hardware addresses of devices issuing BootP/DHCP requests.



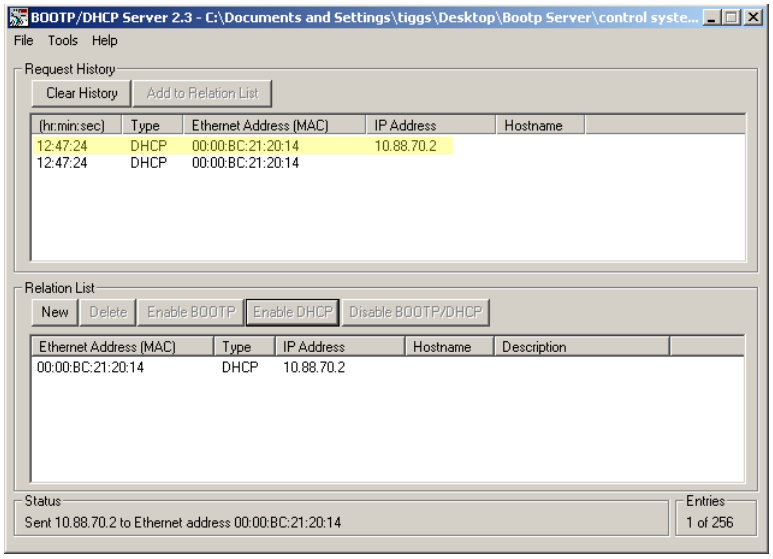
2. Double-click the hardware address of the device you want to configure.

   The New Entry dialog appears showing the device's Ethernet Address (MAC).



3. Enter the IP Address you want to assign to the device and click OK.

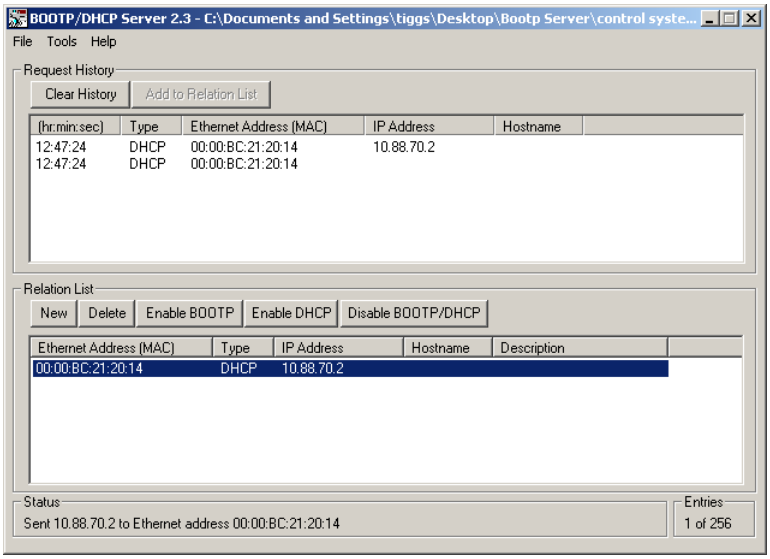
The device is added to the Relation List, displaying the Ethernet Address (MAC) and corresponding IP Address, Hostname and Description (if applicable).



When the IP address assignment is made, the address displays in the IP Address column in the Request History section.

4. To assign this configuration to the device, highlight the device in the Relation List panel and click Disable BOOTP/DHCP. When power is cycled to the device, it uses the configuration you assigned and does not issue a DHCP request.

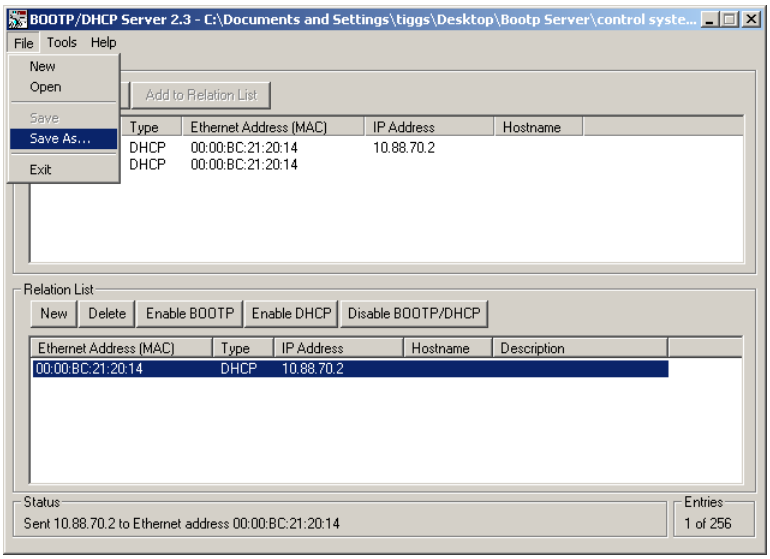
TIP To enable DHCP for a device that has had DHCP disabled, highlight the device in the Relation List and click Enable DHCP. You must have an entry for the device in the Relation List panel to re-enable DHCP.



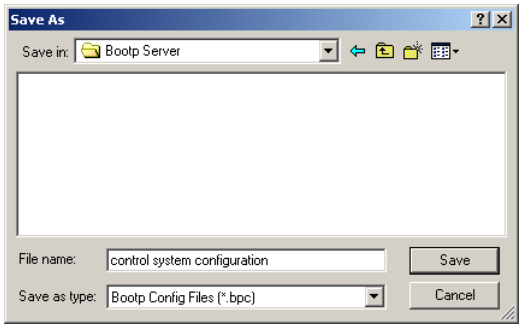
Save the Relation List

You can save the Relation List to use later. To save the Relation List do the following:

1. Select Save As... from the File menu.



   The Save As dialog box appears.



2. Select the folder you want to save the list to.
3. Enter a file name for the Relation List (for example, control system configuration) and click Save.
4. If you want to see your saved file names in the Open dialog box, save your files using the default file type (*.bpc).

Use DHCP Software to Configure Your Module

Dynamic Host Configuration Protocol (DHCP) software automatically assigns IP addresses to client stations logging onto a TCP/IP network. DHCP is based on BootP and maintains some backward compatibility. The main difference is that BootP was designed for manual configuration, while DHCP allows for dynamic allocation of network addresses and configurations to newly attached devices.

Be aware that a DHCP server typically assigns a finite lease time to the offered IP address. When 50 percent of the leased time has expired, the module will attempt to renew its IP address with the DHCP server. The module could be assigned a different IP address, which would cause communicating with the ControlLogix controller to cease.L

ATTENTION: To avoid unintentional control, the module must be assigned a fixed IP address. The IP address of this module should not be dynamically provided. If a DHCP server is used, it must be configured to assign a fixed IP address for your module.

ATTENTION: Failure to observe this precaution may result in unintended machine motion or loss of process control.

Chapter Summary and What's Next

In this chapter, you learned how to configure the module to communicate on your EtherNet/IP network by providing an IP address, gateway address, and Subnet mask. The next chapter describes an example application in which you configure discrete I/O.

Notes:

Configure the ArmorBlock I/O 8 Channel IO-Link Master Module Using the Studio 5000 Add-on Profile

About This Chapter

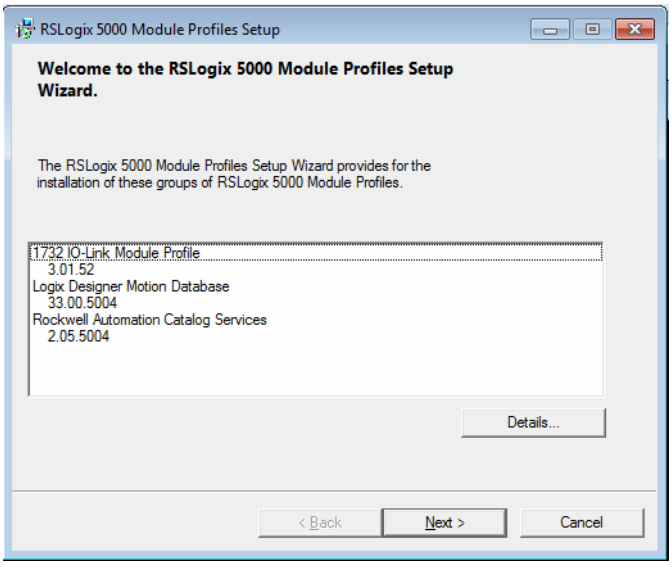
Before you can use your ArmorBlock I/O 8 Channel IO-Link Master in Studio 5000, you must set up the module profile so that it can be recognized. If the profile does not exist in your version of Studio 5000, follow these steps to set it up.

IMPORTANT The illustrations of the Studio 5000 Module Profile Setup software dialog boxes shown in this manual are samples.

Because your system configurations or the firmware kits are different, the dialog boxes you see when running the tool may be different from the ones you see here

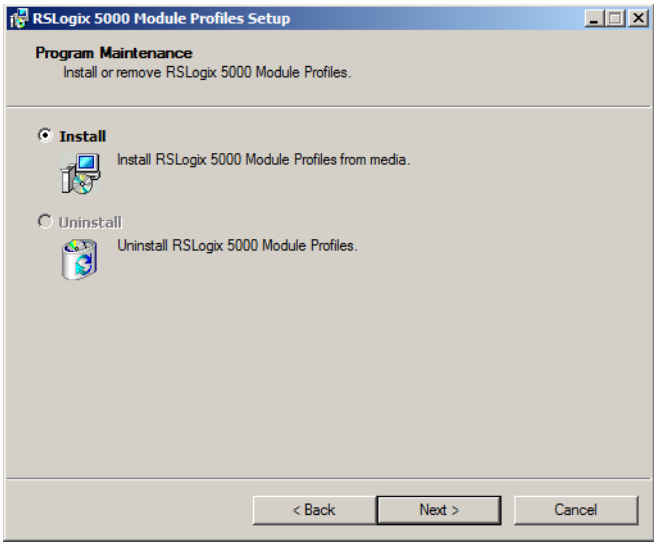
Install the 1732E-8IOLM12R Add-On Profile

1. In the installation package, double-click MPSetup.exe. The Welcome dialog box appears. Click Next

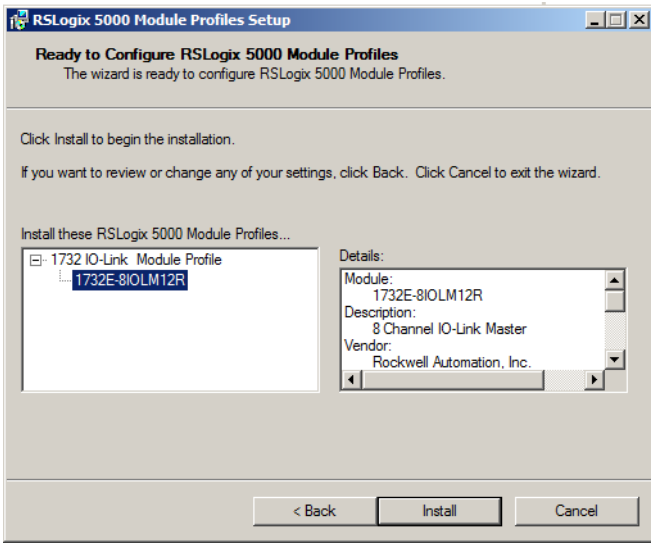


2. Read and agree to the license, and then click Next.

3. Select the option to install Studio 5000 Module Profile, and then click Next.

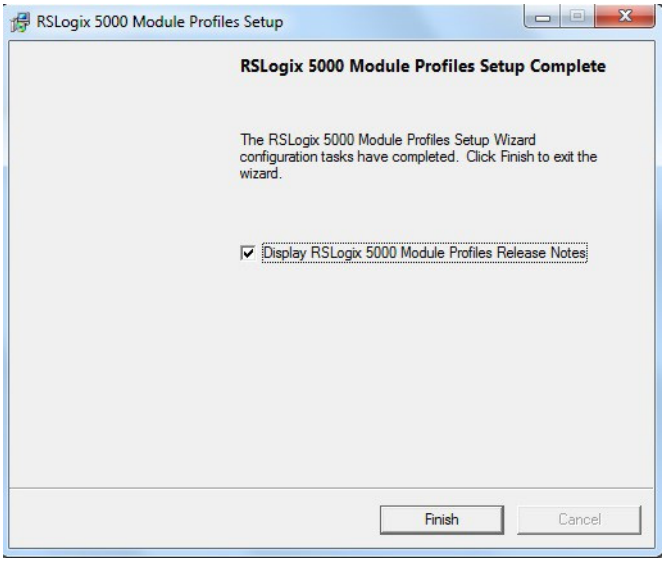


4. The Setup Wizard displays the profiles to be installed. Click Install to start the installation.



The Setup Wizard installs the profiles.

5. Follow the instructions on the next dialog boxes to complete the installation and configuration.
6. When installation is complete the following dialog box appears. Click Finish.

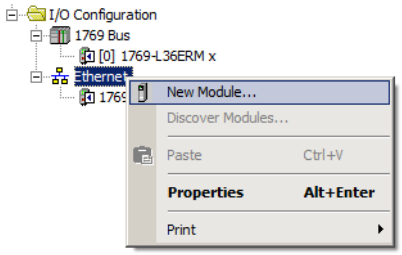


Add a ArmorBlock I/O 8 Channel IO-Link Master Module to Studio 5000

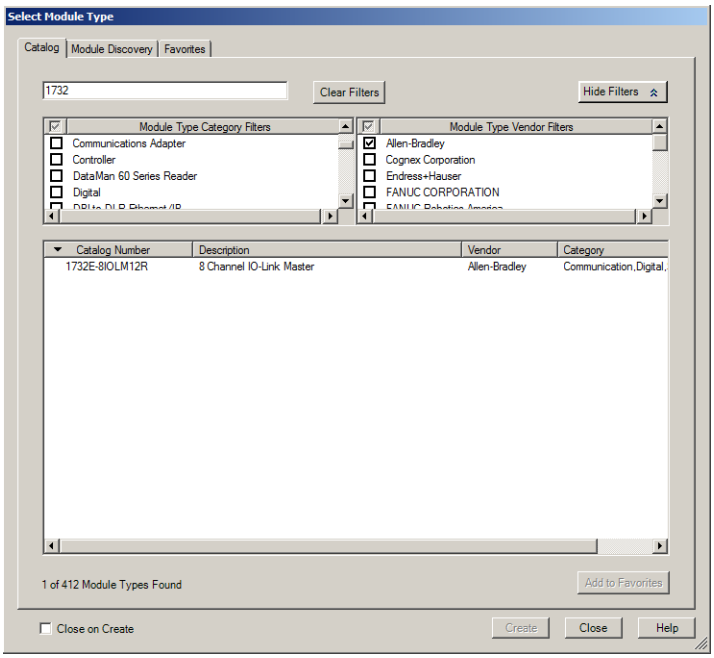
To add the ArmorBlock I/O 8 Channel IO-Link Master module to Studio 5000, do the following.

1. In the I/O Configuration tree, find the Controller.
   In this example, we use the 1769-L36ERM CompactLogix™ Controller.

2. Right-click the Ethernet and select New Module.

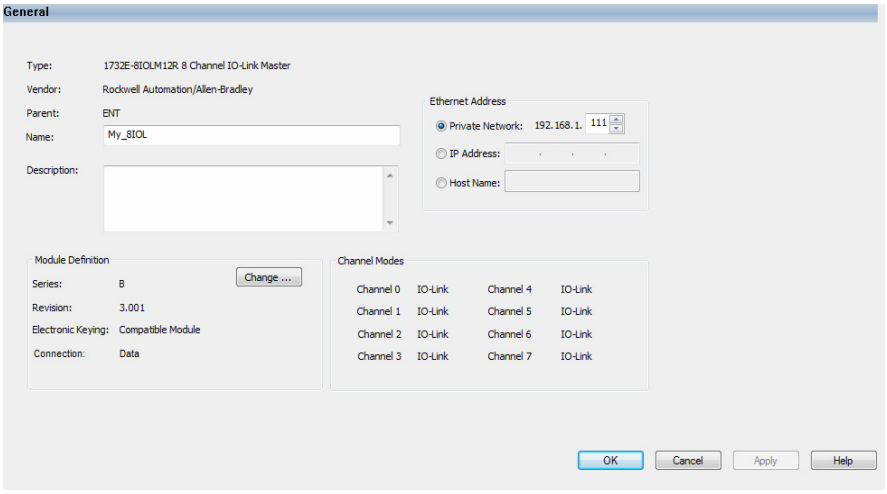


3. Under the Specialty or Communications category, double-click the 1732E-8IOLM12R 8 Channel IO-Link Master Module.

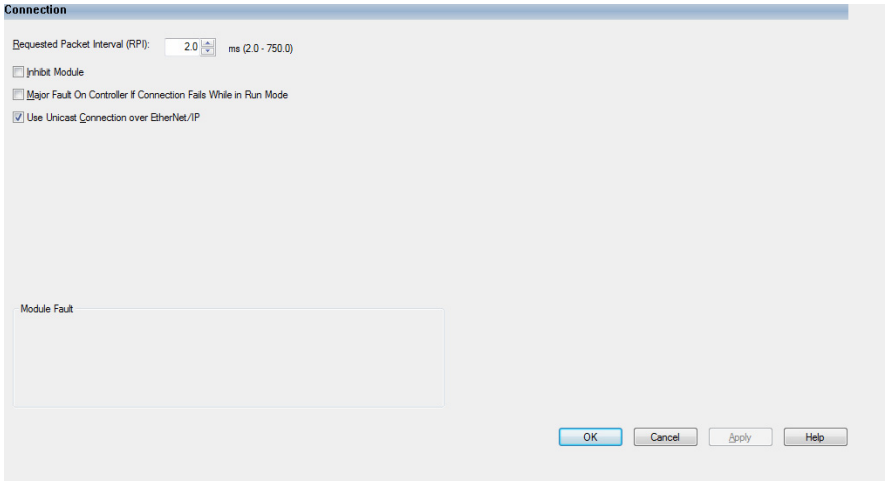


The General tab of the Add-on Profile appears.

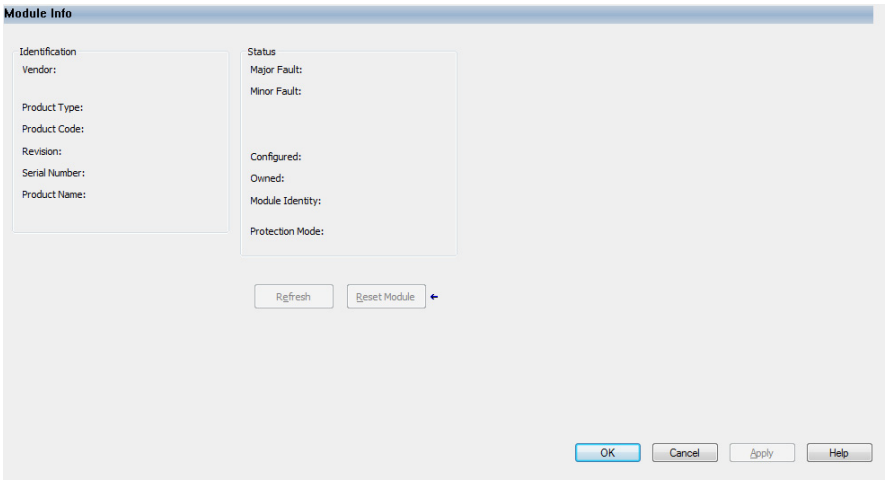
4. On the General tab, you can give the module a Name which is also used in the name of the Tag elements that get created for the module, change the Electronic Keying for the module, and configure the module channel modes using the Change button under Module Definition.



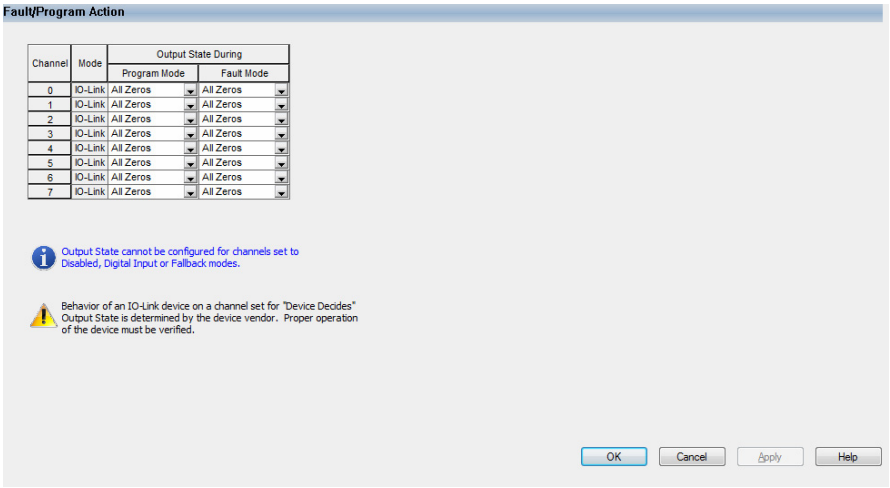
On the Connection tab, you can change the Requested Packet Interval (RPI) (the default is 2 ms.), choose to inhibit the module, configure the controller so that a loss of connection to this module causes a major fault, and view module faults. For the IO-Link Master module, the lowest allowable RPI is 2ms.



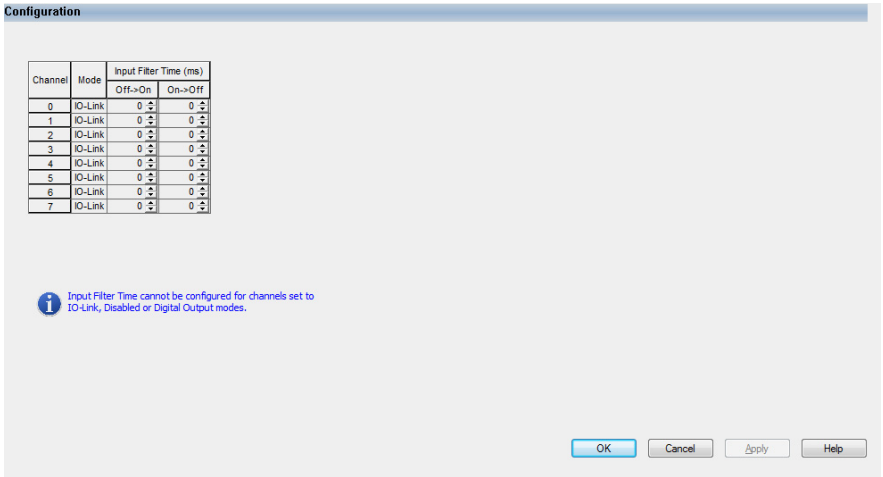
The Module Info tab will display the status and identity information of the IO-Link Master module when the module is online.



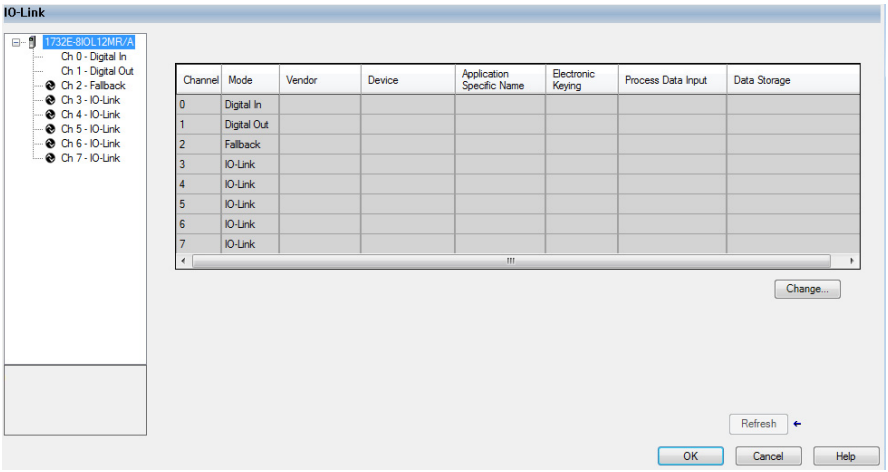
On the Fault/Program tab, you can configure the state of the outputs during Program and Fault modes for channels that are configured as standard digital output or IO-Link.



On the Configuration tab, you can change the Input Filter Time for each channel configured as fallback or standard digital input.



On the IO-Link tab, you can add and delete IO-Link devices to the channels of the Master Module configured as IO-Link, modify information for IO-Link channels, register IO-Link Device Description (IODD) files, and configure parameters for IO-Link devices.



IO-Link Tag Elements

Logix tag elements get created by the Add-on Profile based on the level of integration for each IO-Link device. There are three levels currently offered:

- Generic integration is available for all IO-Link devices and does not require an IODD file.
- IODD Basic integration is available for all IO-Link devices and requires that an IODD file be registered with Studio 5000 software.
- IODD Advanced integration is available for Rockwell Automation and partner IO-Link devices, and is heavily dependent on a well-formed IODD file being registered with Studio 5000 software.

The Generic level of integration allows any IO-Link device to communicate with the Logix controller. SINT arrays are created for the device's Process Data. The size of the arrays default to 32 bytes in/out but can be modified. Device level keying is supported but there is no device parameter management provided. This must be done using message instructions to read/write data from the device. Further, data type conversion and endian swapping may be required in ladder logic.

The IODD Basic level of integration is similar to the Generic integration described above except that the size of the SINT arrays created for the device's Process Data is taken from the device's IODD file.

For the IODD Advanced level of integration, Logix tag elements are determined by the Process Data available for each IO-Link device, with detailed tag member names being created based on information from the IODD file. The Master Module translates and maps the information from IO-Link data types to Logix

data types and also performs big-endian to little-endian (and little-endian to big-endian) swapping as required. Additionally, the device's configuration parameters are stored by the controller and automatically provided to the device and/or IO-Link Master on power loss and/or replacement.

I/O Tags

For channels that are configured for standard digital input, standard digital output, or fallback, standard Logix tag elements are created in line with the other ArmorBlock I/O catalogs.

Configuration Data

A Configuration tag is created for each Master Module. The Configuration Data Type includes the following:

- Fault/Program mode setting – For channels configured as standard digital output and IO-Link.
  Valid values for channels configured as standard digital output are as follows:
  - **Off** – value set to 100 (default)
  - **On** – value set to 101
  - **Hold** – value set to 102

  Valid values for channels configured as IO-Link are as follows:
  - **All Zeros** – value set to 103 (default)
  - **Hold** – value set to 104
  - **Device Decides** – value set to 105. The IO-Link Master module gives the control to the IO-Link device, and the IO-Link device would follow what the device vendor had specified as a fault or program state for that device.

  For channels configured as disabled, fallback, or standard digital input, the fault or program mode is -1 (default).
- **Digital filter settings** – For channels configured as standard digital input or fallback. The valid range is from zero to 65 milliseconds with the default setting of zero.

Details on configuring the module can be found in Chapter 5 and Chapter 6.

Chapter Summary and What's Next

In this chapter, you learned how to add and configure the module using the Studio 5000 Add-on Profile software. The next chapter describes how to configure the module to function as an IO-Link Master module.

Configure the ArmorBlock I/O 8 Channel IO-Link Master as IO-Link Master Using the Studio 5000 Add-on Profile

About This Chapter

In this chapter, you will learn how to configure the module as an IO-Link Master using the Studio 5000 Add-on Profile.

This chapter covers the following topics:

- Typical IO-Link user interface roles, and what is accessible from the Add-on Profile
- Different IO-Link device integration levels
- Configuration of the ArmorBlock I/O 8 Channel IO-Link Master module as IO-Link Master in the Studio 5000 Add-on Profile
- Configuration of IO-Link device parameters from the Add-on Profile and by message instructions

User Roles

IO-Link user interfaces are typically divided into three separate role types, which are Observation, Maintenance, and Specialist roles. The device vendor decides how to organize and allow access for the roles in view in the interface.

- Observation Role – This menu type role is designed for users who may not carry out any modification on the device and are often more restricted by read-only access. This assures that while visibility is allowed, critical parameters are not changed.
- Maintenance Role – This menu type role is designed for users who undertake functional editing, but are allowed limited access to more critical parameter types.
- Specialist Role – This menu type role is designed for users to have total access to the device and all associated parameter types. For example, all read-write parameters could be viewed and changed.

The ArmorBlock I/O 8 Channel IO-Link Master module assumes the visibility of the Specialist Role in the IODD file. Anything that is available in Specialist Role view is available in the Add-on Profile. The Observation Role and Maintenance views are not supported in the Add-on Profile.

IO-Link Device Integration Levels

There are three levels of IO-Link device integration. Each level offers a different user experience.

- **IODD Advanced**

  This integration level is available for Rockwell Automation and partner IO-Link devices, and is heavily dependent on a well-formed IODD file being registered with the Studio 5000 software.

  IODD Advanced integration provides the ability to:

  – configure the IO-Link device and its parameters from the Add-on Profile

  – store the device configuration in the controller (and the IO-Link Master module) and have the configuration automatically downloaded by the IO-Link Master module or controller after power cycle or replacement of IO-Link Master or device (also known as Automatic Device Configuration or ADC).

  – perform correlation checks of configuration parameters between connected IO-Link devices and the controller, with the ability to take corrective action from the Add-on Profile. This check is performed to sync up the device parameter between IO-Link device and Controller.

  TIP Automatic Device Configuration and correlation checks can only be performed if the module channel is set to ADC mode. Additional configuration tabs are also available when ADC is enabled. All devices supporting data storage are default to data storage.

- **IODD Basic**

  This integration level is available for all IO-Link devices and requires that an IODD file be registered with the Studio 5000 software.

  IODD Basic integration has the following limitations:

  – Only the Common tab, which provides general IO-Link device information from the IODD file, is displayed when offline.

  – Additional configuration tabs are available when you are online with the device through the controller.

  – Message instructions to the IO-Link Device Parameter Object must be used to read and change device parameters. See Configure IO-Link Device Parameters Using Message Instructions on page 59 for more information.

  – Correlation function and Automatic Device Configuration are not supported.

- **Generic**

  This level of integration is available for all IO-Link devices and does not require an IODD file.

  Generic integration has the following limitations:

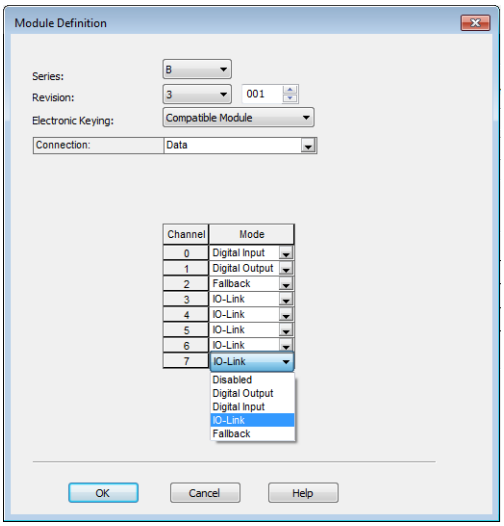
  – In the Add-on Profile, you can configure only the Vendor ID, Device ID, Input and Output lengths, and Electronic keying information.

- General device information found in the Common tab for IODD Basic and IODD Advanced integrated IO-Link devices are not shown.
- No user interface is provided for device configuration parameters (read-write, write-only, and read-only parameters). Message instructions to the IO-Link Device Parameter Object must be used to read and change device parameters.
- Correlation function and Automatic Device Configuration are not supported.

Configure Channel Mode

The 1732E-8IOLM12R 8 Channel IO-Link Master Module has eight channels that can be individually configured as standard digital input, standard digital output, IO-Link, fallback, or disabled.

1. From the General tab, in the Module Definition section, click the Change button. The following dialog box appears.



   Note that Electronic Keying on this dialog is for the IO-Link Master module and not for the IO-Link devices that are connected to the IO-Link Master module.
   The default mode for the Channel is IO-Link.

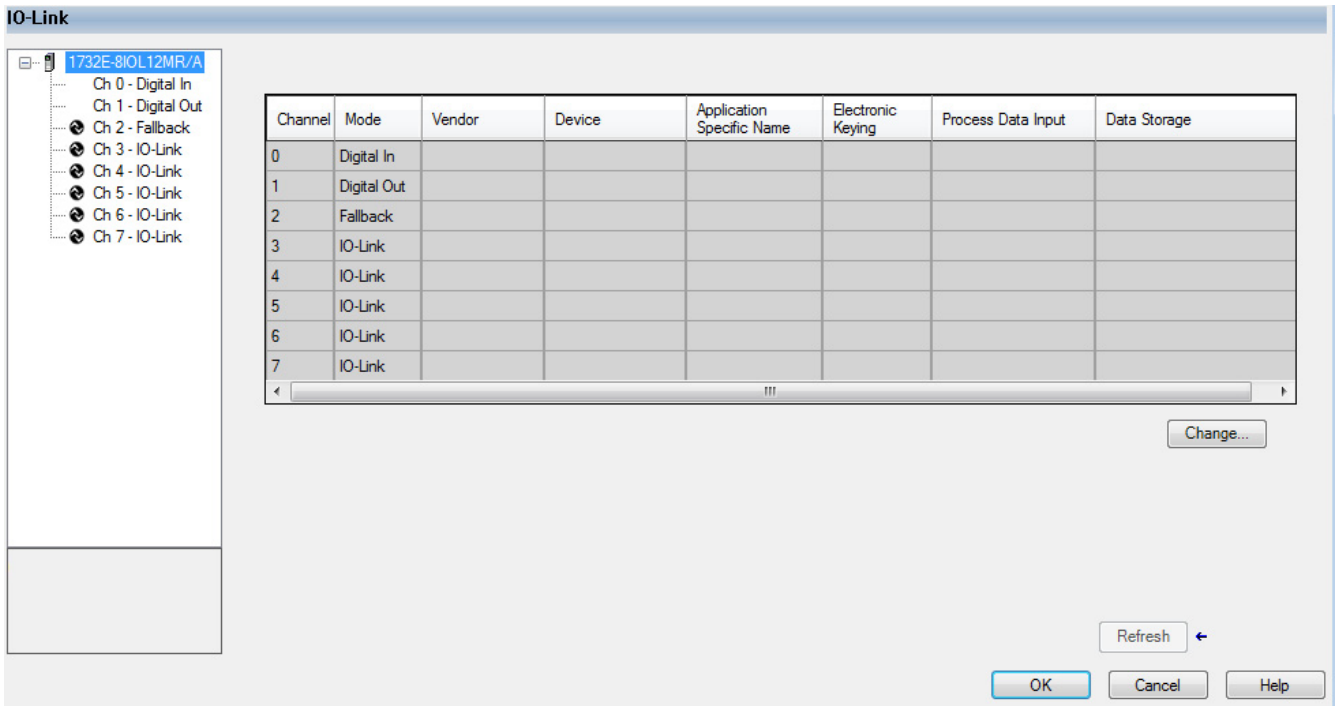
2. For each channel, select the mode from the drop-down menu.
3. Click OK.
   A pop-up dialog box displays.
4. Click Yes.
5. Click Apply to save the changes.
6. Click OK.

For information about configuration of individual output states for IO-Link and standard digital output channels, refer to Parameters on the Fault/Program Action Tab on page 65.

Configure IO-Link Devices

IO-Link devices are configured in the IO-Link tab of the Add-on Profile.

The IO-Link tab consists of a Channel tree on the left and a working pane on the right.



The Channel tree shows the master module (the 1732E-8IOLM12R module) at the top, followed by the channels below it. Channels show their mode configuration (standard digital input, standard digital output, IO-Link, fallback, or Disabled) as assigned in the General tab. For channels configured as IO-Link, you can:

- Register IO-Link Device Description (IODD) files
- Add, change, or delete an IO-Link device

The working pane on the right shows information about the selected channel or device from the Channel tree. From this pane, you can:

- Change channel configuration
  - Add, change, or delete an IO-Link device
  - Configure IO-Link device parameters
- Refresh IO-Link device parameters

Register an IODD file

An IO-Link Device Description (IODD) file is a set of multiple files including a file in XML format, which describes all parameters associated with the device. The IODD set also includes graphic image files of the device and vendor logo.

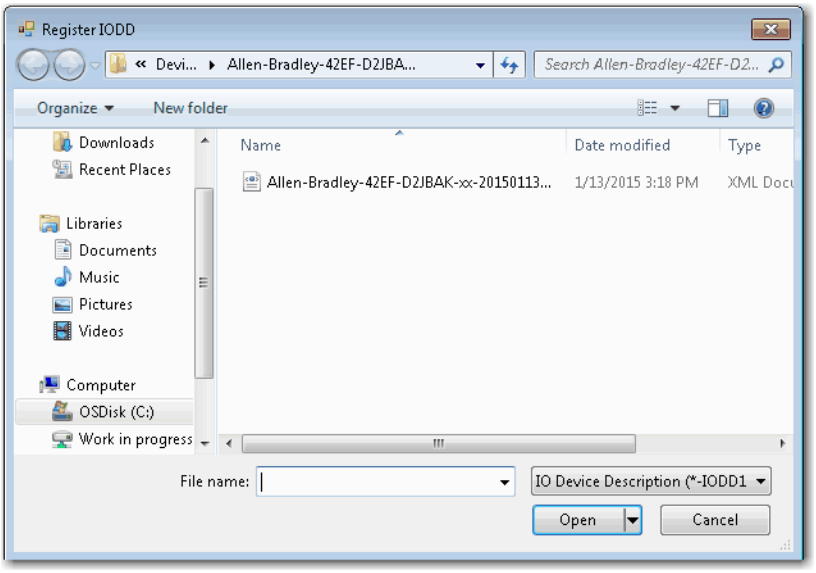
Before you proceed with this task, take note that:

- Only IODD files based on IO-Link specification v1.0.1 or v1.1 can be registered.
- You need administrator rights for the machine where the Add-on Profile is installed to be able to register an IODD file.

To register an IODD file:

1. From the IO-Link tab, in the Channel tree, right-click on the IO-Link channel.
2. Select Register IODD.
   The following dialog box appears.

3. Click Register IODD. The following dialog box appears.

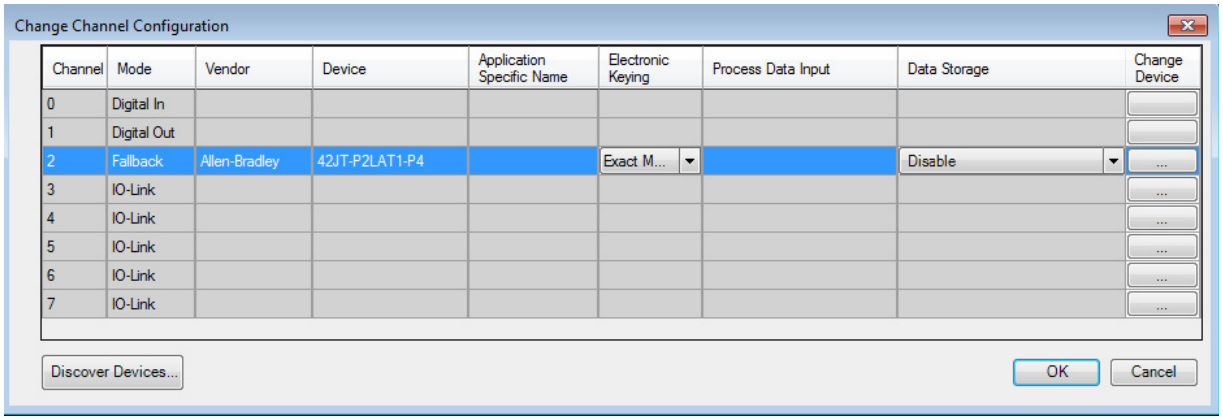


4. Locate the IODD XML file, and then click Open.
   This returns you to the previous dialog box that shows the tree list view of registered IODD files.
5. Click Exit.

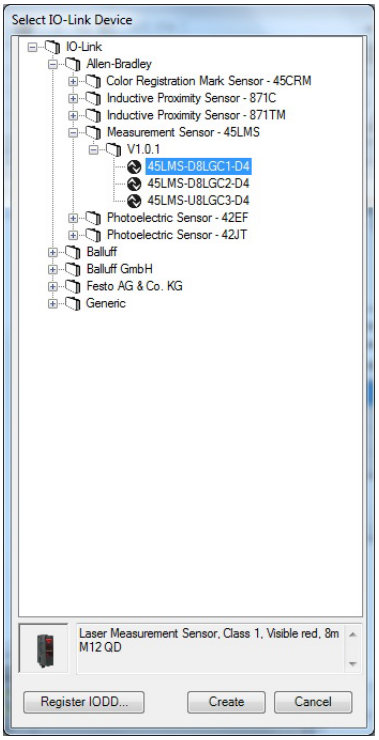
Add an IO-Link Device

After you register an IODD file, you can add an IO-Link device to an IO-Link channel. This configuration can only be done while the project is offline.

1. In the channel tree, right-click on the IO-Link channel, and then select Change.
   Alternatively, you can click the Change button on the working pane.
   The following dialog box appears.



2. Click the button in the Change Device column for the IO-Link channel. The following dialog box appears.



3. Select the IO-Link device from the tree.
4. Click Create.
5. Click the OK button from the Change Channel Configuration dialog box. A pop-up dialog box displays.
6. Click Yes. You will be reverted to the General tab.
7. Click Apply to save the changes, and then click OK.

Note that you can also add a Generic IO-Link device that does not have an IODD file. See Configure IO-Link Device Parameters Using Message Instructions on page 59 for more information.

Change IO-Link Channel Configuration

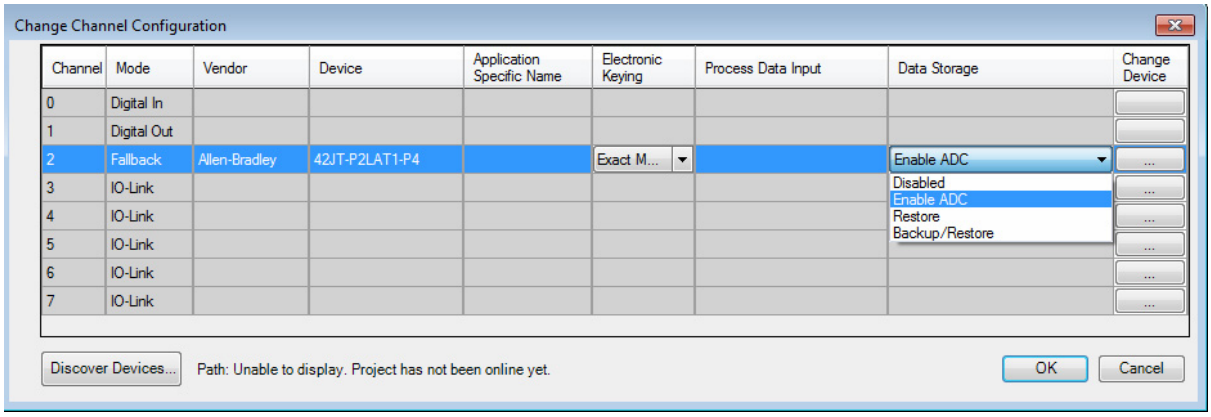
You can change the Application Specific Name, Electronic Keying, Process Data Input configuration, and Device Discovery for an IO-Link channel while the project is in Offline mode.

Before you proceed with this task, take note that:

- The Application Specific Name cannot be changed for a Generic IO-Link device.
- For a Generic IO-Link device, the Vendor ID and Device ID cannot be 0 when Electronic Keying is set to Exact Match.

To change IO-Link Channel configuration:

1. In the IO-Link tab, click Change.
   The following dialog box appears.



2. Modify the information.
   a. Application Specific Name – Enter an application-specific name.
      The purpose of the Application Specific Name is to add themed naming to distinguish the sensors within the machine and the associated project profile in the Add-on Profile. This allows for easier maintenance and operation since the device is further identified by how it is used on the machine/project.
      The application specific name can also be changed from the IO-Link device's Identification tab if the tab is available.
   b. Electronic Keying Information –Select Exact Match or Disabled from the drop-down menu.
      The Exact Match and Disabled keying options in this dialog correspond to the Compatible and No Check keying options in IO-Link terminology respectively.
      When Exact Match is selected, the connected IO-Link device must have the same Vendor ID and Device ID information that has been configured for that channel. If they do not match, IO-Link communications will not be established and a Keying Fault status bit will be set.
      When Disabled is selected, key check is not performed.
   c. Process Data Input – Select the input data from the drop-down menu (for devices that support multiple layouts of input data).
   d. Data Storage – Select how to store the data from the drop-down menu.
      When data storage is enabled, the device parameters are stored in the IO-link master. This allows you to replace those parameterized devices without using configuration tools.

      The data storage options are:
      Disable – Data storage is not used.
      Backup/Restore – Changes to parameters within the device are copied and saved to the IO-link master. Any replacement device with factory default settings is overwritten by the copy in the master.

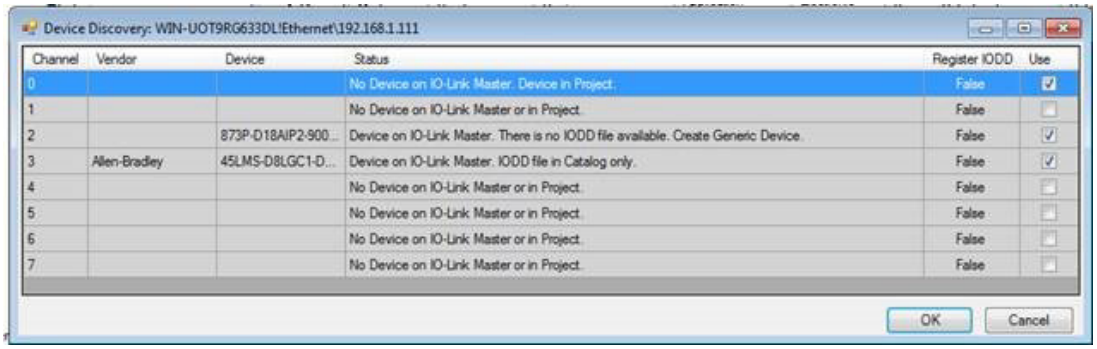
Restore – The master restores parameters to the device. Changes to the parameters within the device are not saved to the IO-link master. Any replacement device with factory default settings is overwritten by the copy in the master.
Enable ADC – For Rockwell Automation and supported Encompass™ partner devices, Automatic Device Configuration (ADC) option is available. ADC only stores the configuration data in the controller and in the offline project file. The data is downloaded to the IO-link device, when the device is replaced, with no user action needed.
To allow ADC and data storage, you must enable Exact Match keying. Only devices that support IO-link version 1.1 support data storage.

e. Discover Devices – This control is only enabled when the project is offline or when there is no controller connected to the master. If you select Discover Devices when there is a connection to the master, an error message is displayed. You need to inhibit the controller connection to the IO-link master before you can perform a device discovery.
1. When the project tries to discover devices connected to the IO-link master, use FTWho to obtain a device path.
2. Once you select the path to IO-link master, the path is saved.
3. Select Discover Devices again to use the saved path.
4. Verify that the saved path is accurate before connecting to the IO-link master.
Device discovery works by asking the IO-Link master for information about which devices are connected to it. Device Discovery then queries the devices to see if they contain IODD file information that can be retrieved should you choose to do so. The Device Discovery process uses version information and the IODD file registry to determine what level of support exists for a given device found during device discovery.
See Device Discovery Dialog on page 50 for more information.

3. Click OK. A pop-up dialog box displays.
4. Click Yes. You will be reverted to the General tab.
5. Click Apply to save the changes.
6. Click OK.

TIP All devices that support data storage, including Rockwell Automation and Encompass partner devices, default to Data Storage. When data storage is enabled for Rockwell Automation and Encompass partner devices, change data storage to ADC to view other tabs when offline. For other devices, you need to go online with the device to view additional tabs.

Rockwell Automation and Encompass partner devices that do not support data storage default to ADC. All other devices that do not support data storage, the data storage option is disabled.



Device Discovery Dialog

Parameter	Description
Channel	The number of the channel. This does not appear if the channel is not in IO-Link mode.
Vendor	The name of the vendor as retrieved from the device's parameter.
Status	A descriptive message indicating the state of the channel. Options are: 1. **No Device on IO-Link Master. Device in Project.** There is no device connected to the master but there is a device configured for the channel in the project. You can choose to "use" this channel configuration. Doing so removes the device that was configured for the channel. 2. **No Device on IO-Link Master or in Project.** There is no device connected to the master and no device configured for this channel in the project. 3. **Device on IO-Link Master and in Project differ.** There is a device connected to the master but it does not match the device configured for the channel in the project. The device has an IODD file that is already registered in the device catalog on the workstation. You can choose to "use" this channel configuration. Doing so replaces the device configured for the channel with the device that was discovered. 4. **Device on IO-Link Master. The IODD file is already registered.** There is a device connected to the master but no device configured for the channel in the project. The device has an IODD file that is already registered in the device catalog on the workstation. You can choose to "use" this channel configuration. Doing so configures the channel with the device that was discovered. 5. **Device on IO-Link Master and in Project differ. IODD file in Device only.** There is a device connected to the master but it does not match the device configured for the channel in the project. The device has an IODD file that is not registered in the device catalog on the workstation. You can choose to "use" this channel configuration. Doing so retrieves the IODD file from the device and registers it on the workstation. This action also replaces the device configured for the channel with the device that was discovered. 6. **Device on IO-Link Master. IODD file in Device only.** There is a device connected to the master but no device configured for the channel in the project. The device has an IODD file that is not registered in the device catalog on the workstation. You can choose to "use" this channel configuration. Doing so retrieves the IODD file from the device and registers it on the workstation. This action also configures the channel with the device that was discovered. 7. **Device on IO-Link Master and in Project are the same. The IODD file in the Device is older.** There is a device connected to the master that matches the device configured for the channel in the project. The device has an IODD file that is older than the file registered in the device catalog on the workstation. You do not have to take any action. You can choose to register the IODD file but only the latest IODD file in the device catalog is used. 8. **Device on IO-Link Master and in Project differ. The IODD file in the Device is older.** There is a device connected to the master but it does not match the device configured for the channel in the project. The device has an IODD file that is older than the file registered in the device catalog on the workstation. You can choose to "use" this channel configuration. Doing so replaces the device configured for the channel with the device that was discovered. You can also choose to register the IODD file, but only the latest IODD file in the device catalog is used. 9. **Device on IO-Link Master. The IODD file in the Device is older.** There is a device connected to the master but no device configured for the channel in the project. The device has an IODD file that is older than the file registered in the device catalog on the workstation. You can choose to "use" this channel configuration. Doing so configures the channel with the device that was discovered.

Device Discovery Dialog

Parameter	Description
Status (continued)	10.**Device on IO-Link Master and in the Project are the same. The IODD file in the Device is newer.** There is a device connected to the master that matches the device configured for the channel in the project. The device has an IODD file that is newer than the file registered in the device catalog on the workstation. You can choose to "use" this channel configuration. Doing so retrieves the IODD file from the device and registers it on the workstation. 11.**Device on IO-Link Master and in the Project differ. The IODD file in the Device is newer.** There is a device connected to the master but it does not match the device configured for the channel in the project. The device has an IODD file that is newer than the file registered in the device catalog on the workstation. You can choose to "use" this channel configuration. Doing so replaces the device configured for the channel with the device that was discovered. You can also choose to register the IODD file. Doing so retrieves the IODD file from the device and registers it on the workstation. 12.**Device on IO-Link Master. The IODD file in the Device is newer.** There is a device connected to the master but no device configured for the channel in the project. The device has an IODD file that is newer than the file registered in the device catalog on the workstation. You can choose to "use" this channel configuration. Doing so configures the channel with the device that was discovered. You can also choose to register the IODD file. Doing so retrieves the IODD file from the device and registers it on the workstation. 13.**Device on IO-Link Master and in the Project differ. IODD file in Catalog only.** There is a device connected to the master but it does not match the device configured for the channel in the project. The device has no IODD file but there is a file for the device registered in the device catalog on the workstation. You can choose to "use" this channel configuration. Doing so replaces the device configured for the channel with the device that was discovered. 14.**Device on IO-Link Master. IODD file in Catalog only.** There is a device connected to the master but no device configured for the channel in the project. The device has no IODD file but there is a file for the device registered in the device catalog on the workstation. You can choose to "use" this channel configuration. Doing so configures the channel with the device that was discovered. 15.**Device on IO-Link Master and in the Project differ. No IODD file available. Create Generic Device.** There is a device connected to the master but it does not match the device configured for the channel in the project. The device has no IODD file and there is no file for the device registered in the device catalog on the workstation. You can choose to "use" this channel configuration. Doing so replaces the device configured for the channel with a generic device profile. 16.**Device on IO-Link Master. There is no IODD file available. Create Generic Device.** There is a device connected to the master but no device configured for the channel in the project. The device has no IODD file and there is no file for the device registered in the device catalog on the workstation. You can choose to "use" this channel configuration. Doing so replaces the device configured for the channel with a generic device profile. 17.**Device on IO-Link Master and in the Project are the same. The IODD file is already registered.** There is a device connected to the master that matches the device configured for the channel in the project. The device has an IODD file that matches the file for the device registered in the device catalog on the workstation. You can choose to register the IODD file. 18.**Device on IO-Link Master and in Project are the same. IODD File in Catalog only.** There is a device connected to the master that matches the device configured for the channel in the project. The device has no IODD file but there is a file for the device registered in the device catalog on the workstation. 19.**Device on IO-Link Master. IODD File in Catalog only.** There is a device connected to the master but no device configured for the channel in the project. The device has no IODD file but there is a file for the device registered in the device catalog on the workstation. You can choose to "use" this channel configuration. Doing so configures the channel with the device that was discovered. 20.**Channel mode is not IO-Link.** The channel is not configured for IO-Link mode. No information is displayed and you cannot "use" this channel configuration. The word "False" appears where the checkbox in the "Use" column normally would.
Register IODD	Selecting the checkbox in this column causes the master to upload the IODD file found in the device and register it locally. The checkbox is disabled if there is no IODD file embedded in the device.
Use	The rows in the Device Discovery dialog represent what is found connected to the device. You can choose to use what is discovered by selecting the checkbox in this column. The checkboxes are selected by default. A row is automatically selected if any sort of difference is found between what is configured on the device and what is configured (or not configured) in the project.

Configure IO-Link Device Parameters Using the Add-on Profile

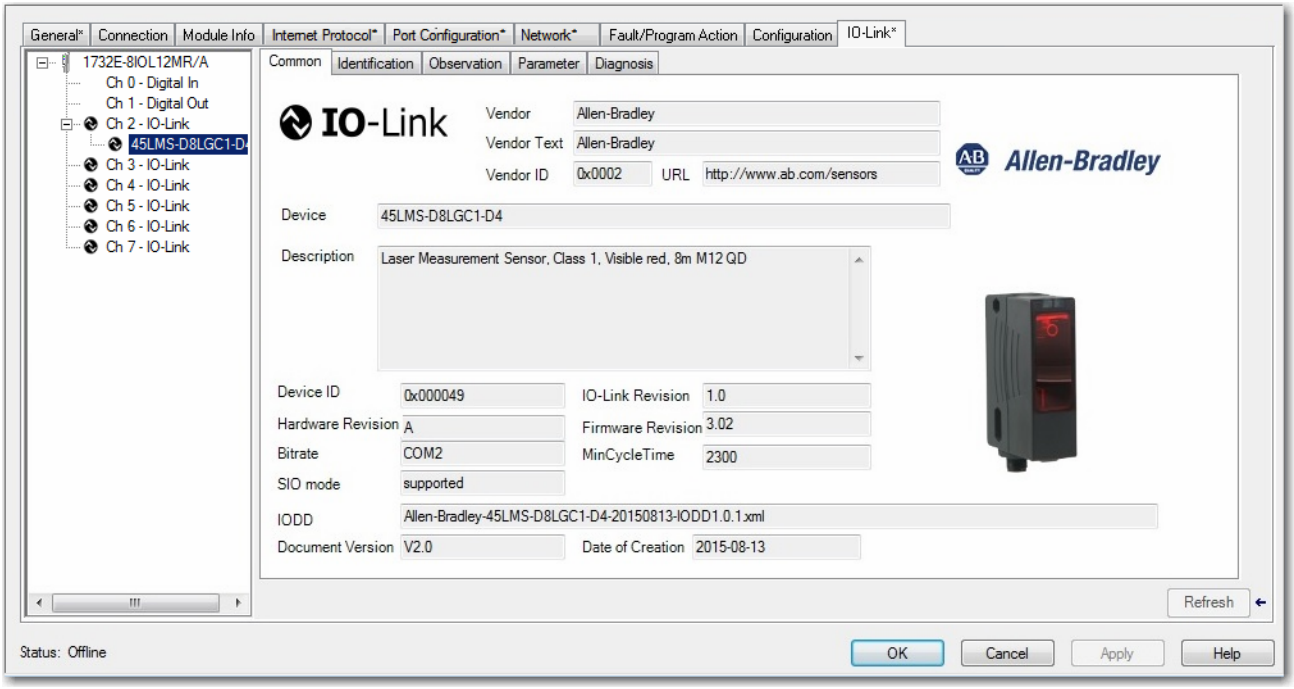
After you add an IO-Link device, you can configure device parameters for IO-link devices with IODD Advanced integration level from the Add-on Profile.

Before you proceed with this task, take note that:

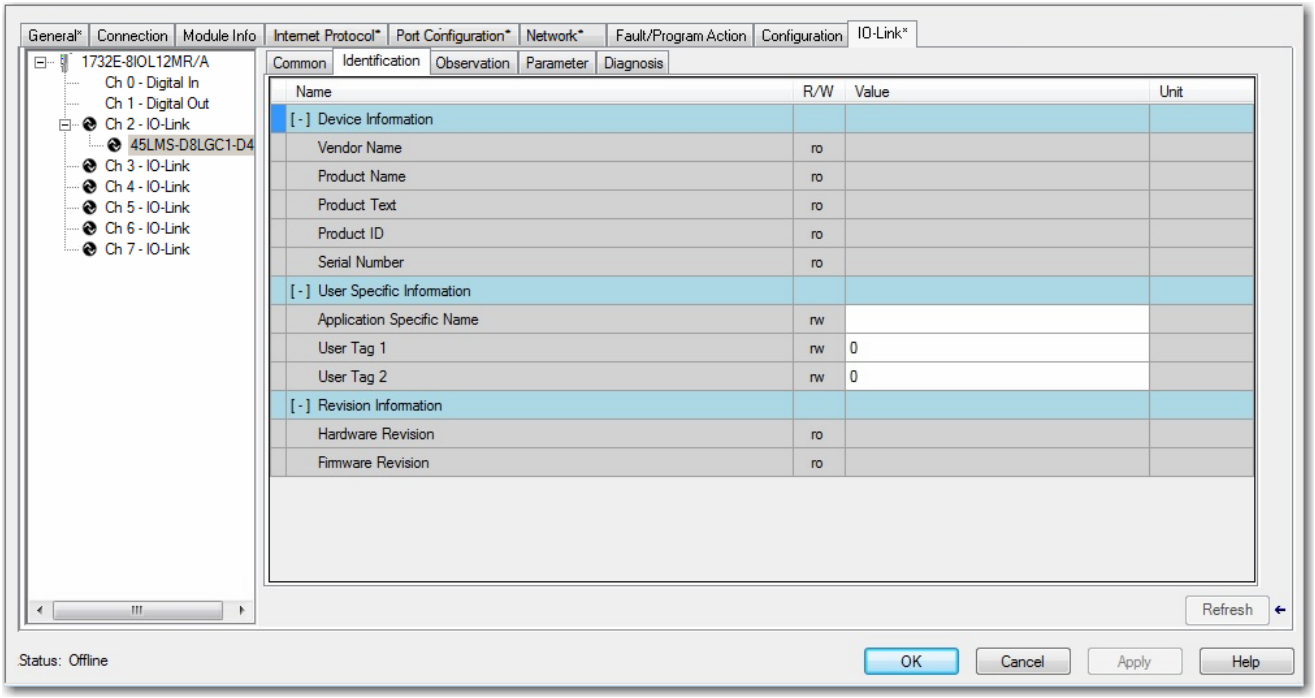
- Parameters vary depending on data provided in the IODD file of an IO-Link device.
- You cannot change or read a Generic IO-Link device's parameters from the Add-on Profile. See Configure IO-Link Device Parameters Using Message Instructions on page 59 for more information.

1. In the Channel tree, click the IO-Link device under the IO-Link channel. The Common tab appears on the working pane.
   Depending on the data provided in the IODD file, up to four more tabs may be shown for the selected device: Identification, Observation, Parameter, and Diagnosis.

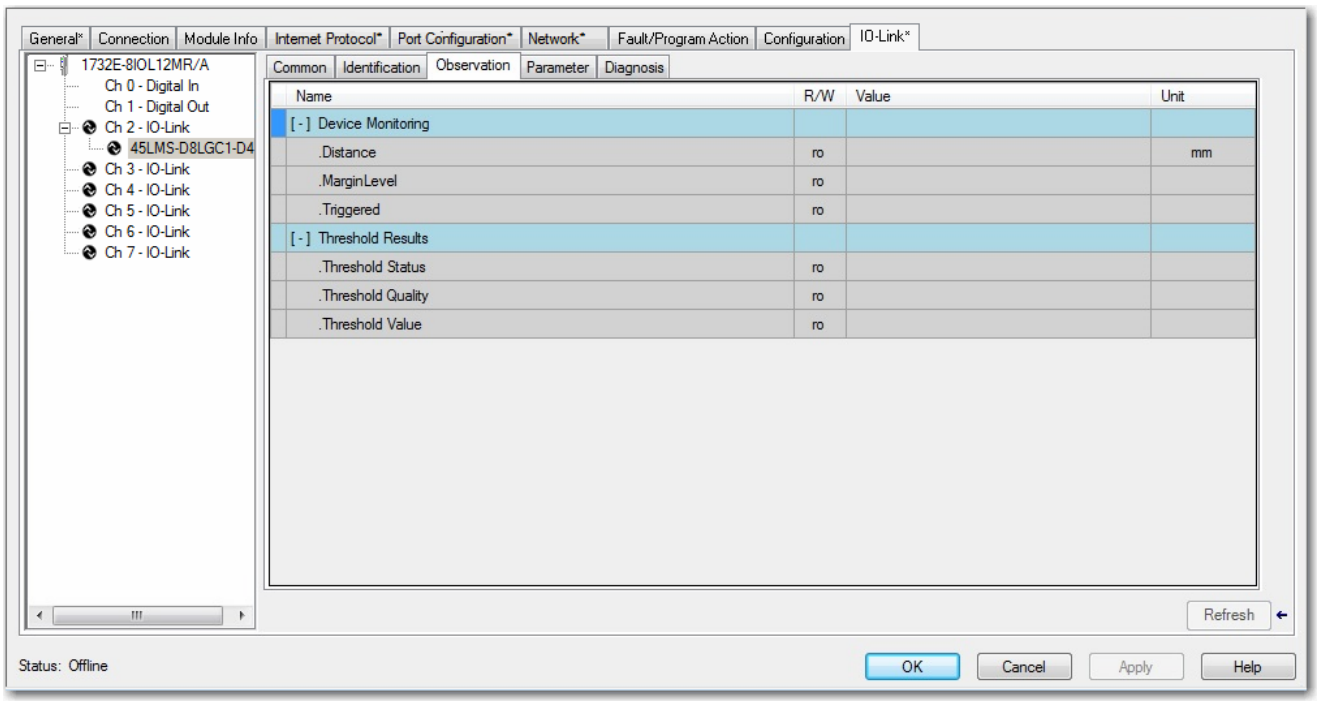
   The Common tab provides general device information taken from the IODD file including the vendor logo and an image of the device.



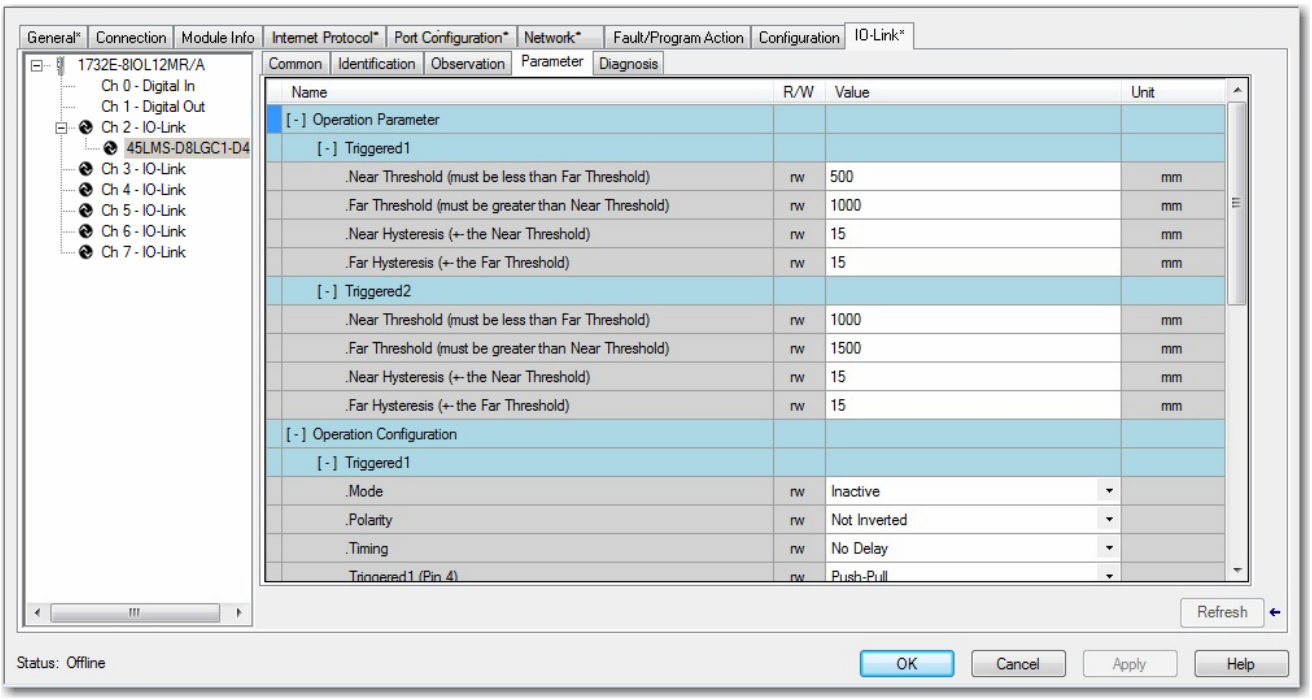
The Identification tab contains parameters with device identity information such as revisions and serial number. The application specific name of the device can also be changed from this tab.



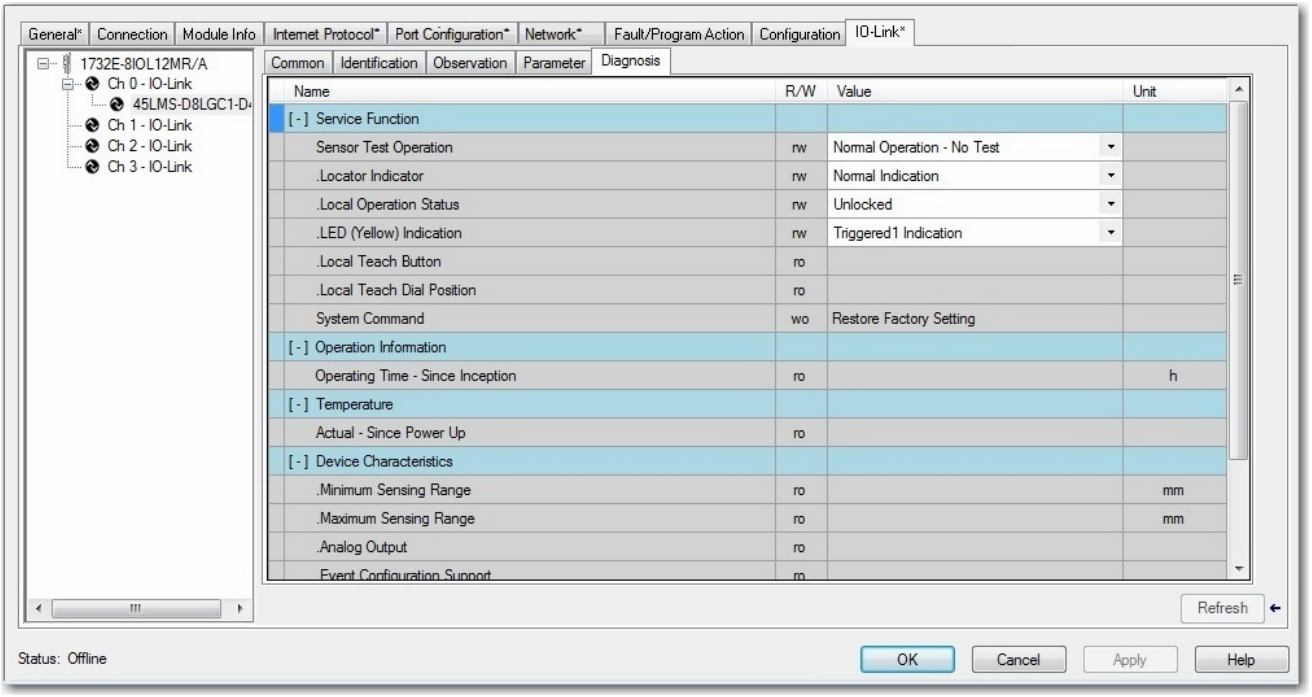
The Observation tab contains only I/O data, which can be used for debugging.



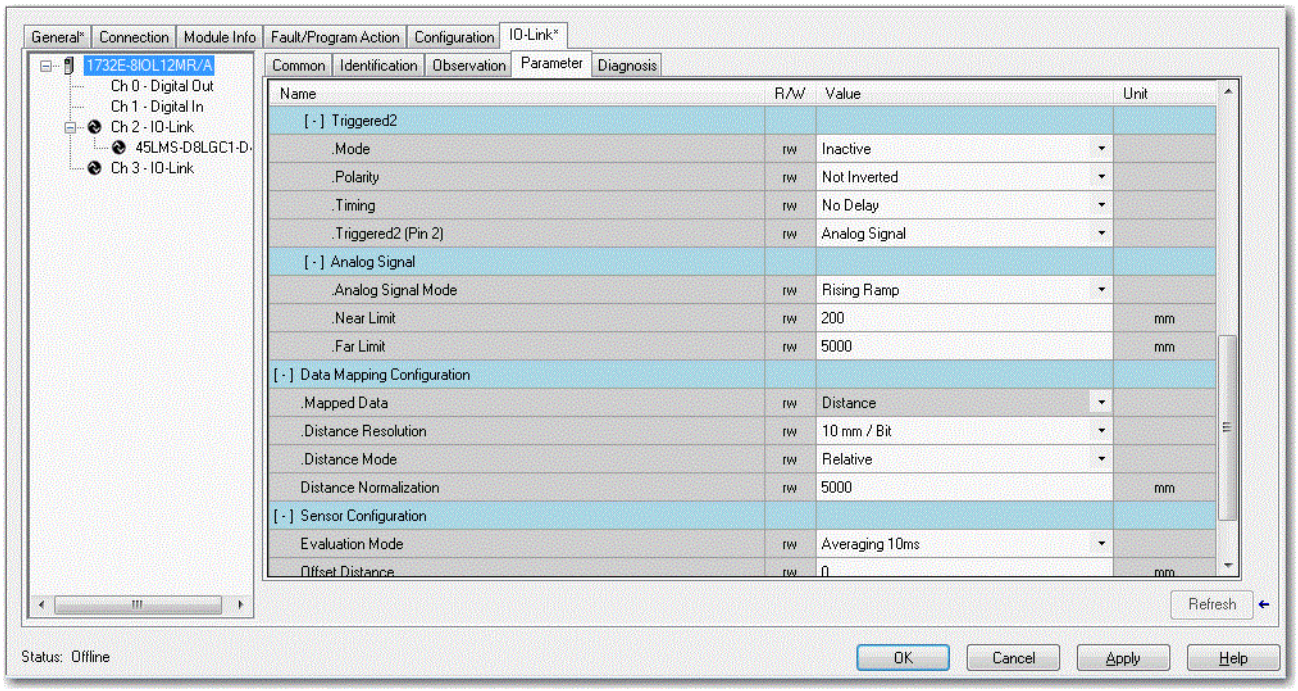
The Parameter tab holds the most commonly used parameters to set up an IO-Link device. Parameters with the highest usage are placed at the top.



The Diagnosis tab contains parameters for trouble-shooting the IO-Link device such as temperature.



2. Select the tab where the parameter is located.
   Parameters are listed with their name, read-write attribute, value, and units (if available in the IODD file).



3. Change the value of read-write parameters (through either edit controls or drop-down lists) and trigger write-only parameters by pressing the button for the parameter.
   Ranges and enumerated choices are derived from the IODD file.
4. Click Apply.

IO-Link Device Parameter Behavior

IO-Link parameters are shown in the Add-on Profile only for IO-Link devices with IODD Advanced integration. Each parameter can have an attribute of read-only (ro), read-write (rw), or write-only (wo). The behavior of parameters and the source for their values differ when offline and when online.

See the following table for more information.

IO-Link Device Parameter Behavior

Attribute	Offline	Online
Read-only "ro"	Parameters are blank.	Parameter values are read from the connected IO-Link device. Parameters show "??" when communication breaks.
Read-write "rw"	Parameter values are read from the IODD file when the IO-Link device is added. Changes made to the parameters are applied when the OK or Apply buttons are clicked.	Parameter values can be edited and changes made to the parameters are applied when the OK or Apply buttons are clicked. Changes are sent to the Master Module, which then writes the changes to the connected IO-Link device.
Write-only "wo"	Parameter buttons are disabled.	Parameter buttons that could potentially impact the Process Data are disabled. Other parameter buttons enabled and result in commands being sent to the connected IO-Link device.

Manage Parameter Differences Between IO-Link Devices and the Controller

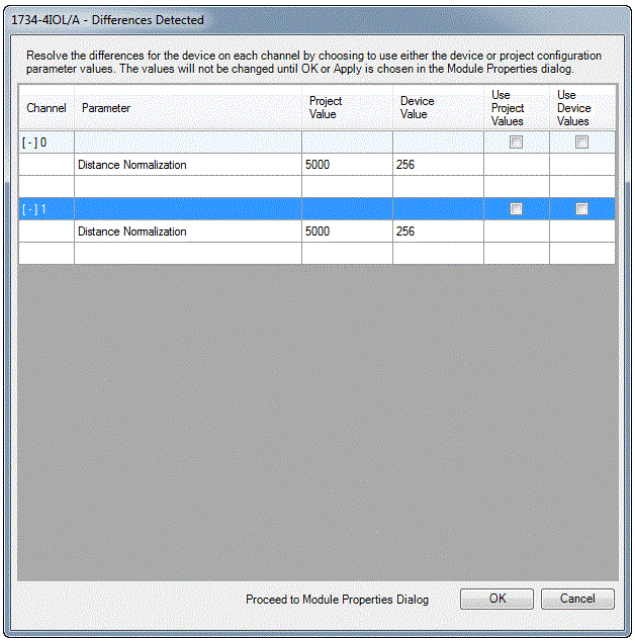
The Add-on Profile has a Refresh button that updates the read-only parameters for all channels with IO-Link devices. It also performs a Correlation check of the read-write parameters in all connected IO-Link devices and in the controller.

Differences in parameter values can happen when device configuration is changed externally, such as through a device console during operation. When the channel is in ADC mode, if there are differences found after running a Correlation check, you can choose, on a per channel basis, to use the parameters that are currently in the connected IO-Link device or to use the parameters that are stored in the controller.

Before you proceed with this task, take note of the following:

- The Refresh button is only enabled in Online mode.
- Correlation check is performed initially when the Add-on Profile is launched in Online mode.
- Correlation check is only performed on IO-Link devices with IODD Advanced integration.

1. From the IO-Link tab, on the working pane, click the Refresh button.
   If differences are detected, a dialog box appears and displays mismatch information per channel, including the parameters and the values present in the device and in the controller.



2. For each channel, select the checkbox for the corrective action:
   - Use Project Values – downloads the parameters values from the project to the connected IO-Link device.
   - Use Device Values – uploads the parameters values read from the connected IO-Link device to the project.
3. Click OK.
   If you click the Cancel button without choosing a corrective action, the read-write parameters of the affected channels will display "??".
4. Click Apply to save the changes.

Add a Generic IO-Link Device

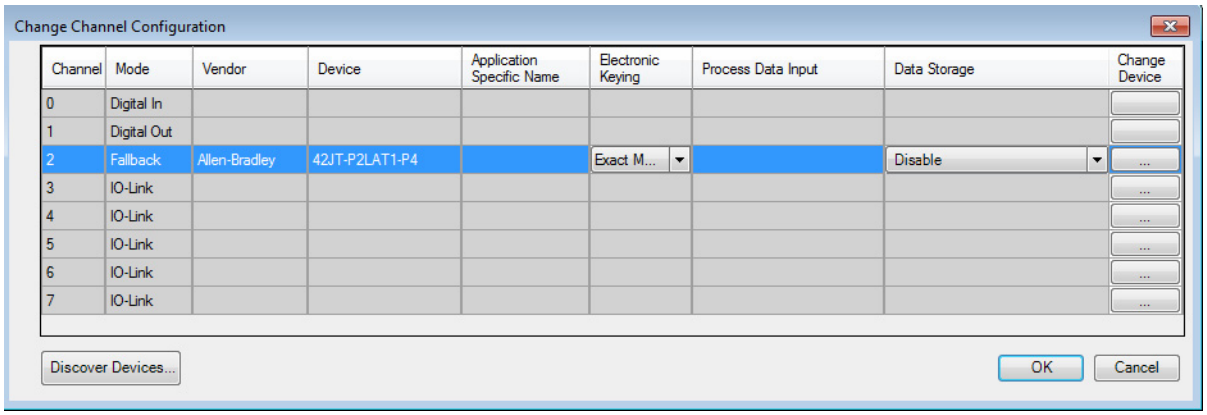
You can add a Generic IO-Link device, which does not have an IODD file, to an IO-Link channel and edit its properties using the Add-on Profile.

When adding a Generic IO-Link device, take note of the following:

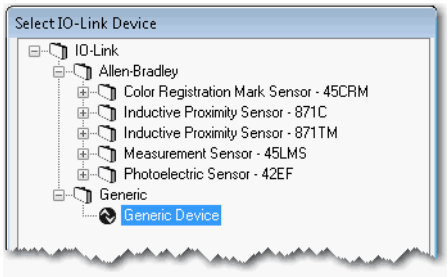
- Automatic Device Configuration and the Correlation function are not supported for Generic IO-Link devices.
- You cannot change or read the Generic IO-Link device's parameter values through the Add-on Profile. Instead, message instructions to the IO-Link Device Parameter Object must be used.

1. In the channel tree, right-click on the IO-Link channel, and then select Change.

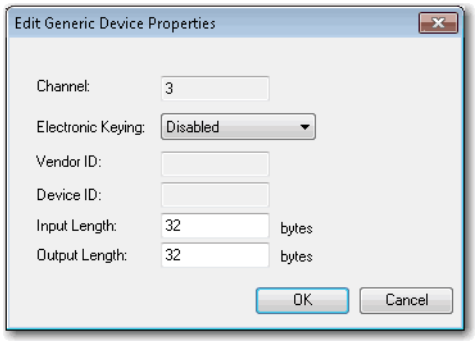
Alternatively, you can click the Change button on the working pane. The following dialog box appears.



2. Click the button in the Change Device column for the IO-Link channel. The following dialog box appears.



3. Expand the tree selection, and then select Generic Device (last item on the list).
4. Click Create. The following dialog appears.



5. Edit generic IO-Link device properties.
   a. Electronic Keying – Select Disabled (default) or Exact Match. The Vendor ID and Device ID cannot be 0 if the Electronic Keying is set to Exact Match.
   b. Vendor ID – Enter the vendor ID of the IO-Link device. This field is disabled if Electronic Keying is Disabled.
   c. Device ID – Enter the device ID of the IO-Link device. This field is disabled if Electronic Keying is Disabled

d. Input length – Enter the input length in bytes of the IO-Link device. Valid range is 0...32. The value is obtained from the device vendor.

e. Output length – Enter the output length in bytes of the IO-Link device. Valid range is 0...32. The value is obtained from the device vendor.

6. Click OK. A pop-up dialog box displays.
7. Click Yes.
8. Click Apply to save the changes.
9. Click OK.

Configure IO-Link Device Parameters Using Message Instructions

Use message instructions to the IO-Link Device Parameter Object to read or change configuration parameters for IO-Link devices with IODD Basic or Generic integration.

About the IO-Link Device Parameter Object

IO-Link device configuration parameters include multiple sets of index/subindex pairs, a length, and a data value that is sent to the Master Module through instances of the IO-Link Device Parameter Object.

The IO-Link Device Parameter Object provides a mechanism for a CIP client to access parameters within an IO-Link device. Within this class, the instance number maps to an IO-Link index value.

The details of each index and subindex depend entirely on the IO-Link device and are described in the IO-Link Data Description (IODD) XML file for that device or data sheet provided by the device vendor.

Create a Message Instruction for the IO-Link Device

Before you proceed, take note of the following:

- For IODD Advanced integration, when you change IO-Link device parameters by message instruction, a correlation check is performed when the Add-on Profile is launched. You can then select to use either the device or controller parameter values.
- Messages to/from IO-Link parameters are raw IO-Link data format. As such, unsigned, packed bits and endian/byte swapping issue need to be handled accordingly. Ladders have to be created to enable byte swapping of values from the MSG instruction.
- Refer to the Studio 5000 help for more information on how to create message instructions.

To configure IO-Link device parameters using message instructions:

1. In Studio 5000, go to Input/Output Instruction set and create a MSG instruction.
2. Create a controller tag for this instance of message instruction.
3. Configure the message instruction as follows.

Message Configuration

In this tab	For this item	Type or choose		
Communication	Path	the IO-Link Master module.		
Configuration	Message Type	CIP Generic		
	Service Type	Custom		
	Service Code (Hex)	the applicable service code		
		Service Code	**Service Name**	**Description**
		4B	Read_Subindex	Reads a parameter value from the IO-Link device.
		4C	Write_Subindex	Writes a parameter value to the IO-Link device.
		4D	Read_Index	Reads an entire index (all parameters within an index) from the IO-Link device (uses subindex 0)
		4E	Write_Index	Writes an entire index (all parameters within an index) to the IO-Link device (uses subindex 0).
	Class	3A3		
	Instance	the device-specific parameter index value as specified by the device vendor. Refer to Locate the Parameter Index or Subindex Value in the IODD File on page 62 for more information.		
	Attribute	0		
	Source Element	one of the following according to the service code.		
		4B (read subindex)	*source_array* where source element data type is SINT[2]. In this case SINT[0] is subindex as provided by the Device vendor, SINT[1] is the channel number from where the data has to be read. The channel value ranges from 0 to 3. The value must be in hex. Refer to Read Subindex Request Parameters on page 61 for more information.	
		4C (write subindex)	a local source tag that contains data that is to be sent with the service. The source element will have a byte for the subindex number, a byte for the channel number, followed by the bytes of data that need to be written. Refer to Write Subindex Request Parameters on page 61 for more information.	
		4D (read index)	*source_array* where source element data type is SINT. In this case the SINT is the channel number from where the data has to be read. The channel value ranges from 0 to 3. The value must be in hex. Refer to Read Index Request Parameters on page 61 for more information.	
		4E (write index)	a local source tag that contains data that is to be sent with the service. The source element will have a byte for the index number, a byte for the channel number, followed by the bytes of data that need to be written. Refer to Write Index Request Parameters on page 61 for more information.	
		Refer to Locate the Parameter Index or Subindex Value in the IODD File on page 62 for more information.		

Message Configuration

In this tab	For this item	Type or choose	
Configuration	Source Length (bytes)	one of the following according to the service code.	
		4B (read subindex)	the length of the source element.
		4C (write subindex)	the length of the source element.
		4D (read index)	the length of the source element.
		4E (write index)	the length of the source element.
	Destination Element	*destination_array* tag that will contain data received from the service. The controller tag specified in destination element must be SINT[X] or DINT[X] data type, where X refers to number of bytes of data. This size is to be provided by the device vendor. This size is the size of parameter that is being read or written to the IO-Link device.	

Read Subindex Request Parameters

Name	Data Type	Description of Parameter
Subindex	USINT	Subindex value of parameter to retrieve.
Port	USINT	IO-Link channel for the IO-Link device which the request is destined for. The maximum port number supported is indicated in class attribute 8, Number of ports.

Write Subindex Request Parameters

Name	Data Type	Description of Parameter
Subindex	USINT	Subindex value of parameter to retrieve.
Port	USINT	IO-Link channel for the IO-Link device which the request is destined for. The maximum port number supported is indicated in class attribute 8, Number of ports.
Parameter value	Array of octet	Data value to be written to the IO-Link device parameter, in IO-Link format (i.e. big endian not translated to CIP data type)

Read Index Request Parameters

Name	Data Type	Description of Parameter
Port	USINT	IO-Link channel for the IO-Link device which the request is destined for. The maximum port number supported is indicated in class attribute 8, Number of ports.

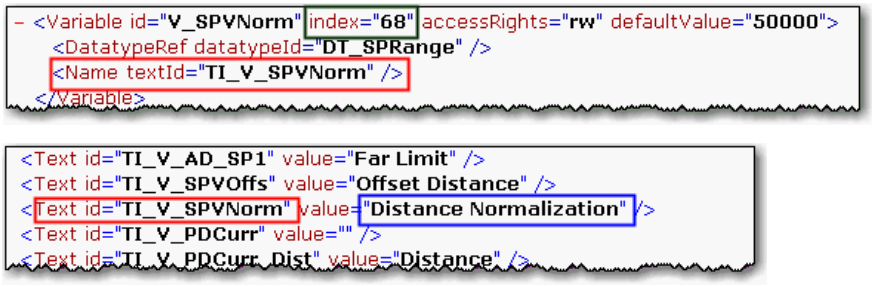
Write Index Request Parameters

Name	Data Type	Description of Parameter
Port	USINT	IO-Link channel for the IO-Link device which the request is destined for. The maximum port number supported is indicated in class attribute 8, Number of ports.
Parameter values	Array of octet	Value of IO-Link parameters

Locate the Parameter Index or Subindex Value in the IODD File

The details of each index and subindex depend entirely on the IO-Link device and are described in the IO-Link Data Description (IODD) XML file for that device or data sheet provided by the device vendor.

Using the Distance Normalization parameter for an Allen-Bradley sensor (model 45LMS-U8LGC3) as an example, refer to the following diagram to see where a specific parameter can be found on the device's IODD file.



Chapter Summary and What's Next

In this chapter you learned how to configure the module as an IO-Link Master module using the Studio 5000 Add-on Profile software. The next chapter describes how to configure the module to function as a standard digital input or output module.

Configure the ArmorBlock I/O 8 Channel IO-Link Master Module as Standard Digital Input or Output Using the Studio 5000 Add-on Profile

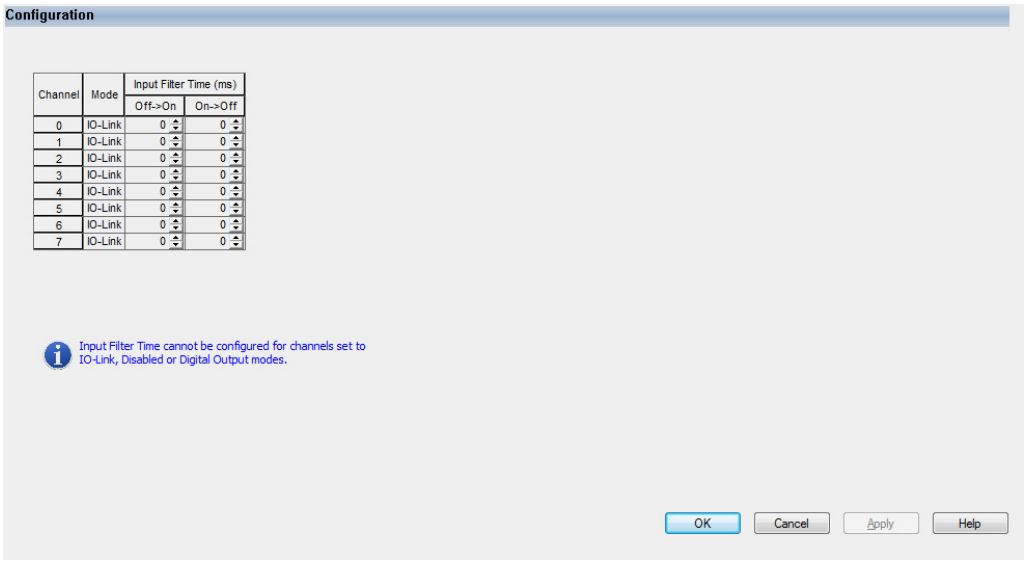
About This Chapter

In this chapter, you will learn how to do the following:

- Configure the Module as Standard Digital Input or Fallback Using the Configuration Tab
- Configure the Module as Standard Digital Output Using the Fault/Program Action Tab

Configure the Module as Standard Digital Input or Fallback Using the Configuration Tab

The following diagram shows the Configuration tab of a ArmorBlock I/O 8 Channel IO-Link Master module in Studio 5000 using the Add-on Profile.



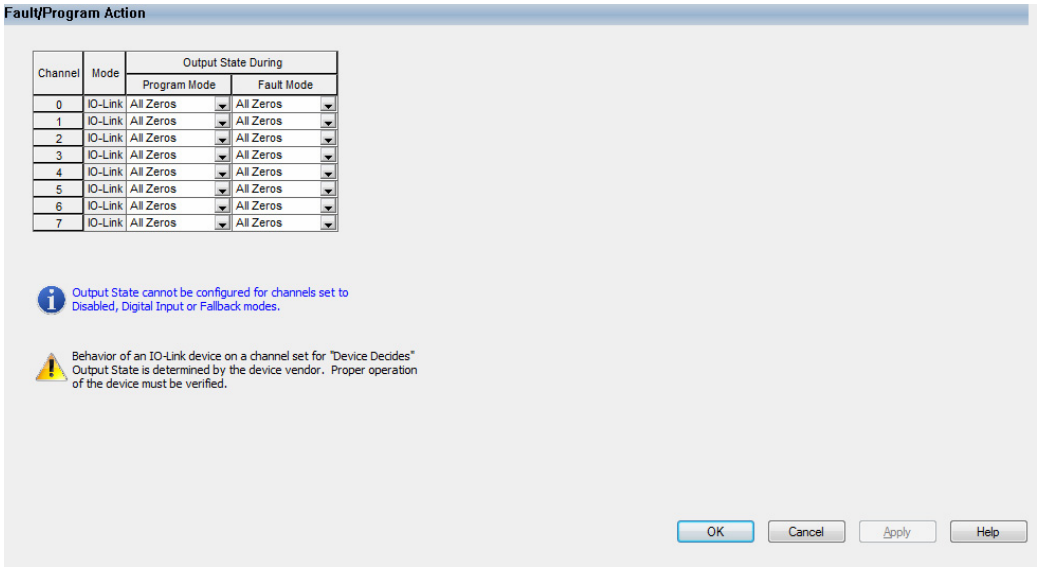
Each channel of your ArmorBlock I/O 8 Channel IO-Link Master module that is set to standard digital input or fallback mode can be configured with individual input filter times. The following table describes each parameter on the Configuration tab.

Parameters on the Configuration Tab

Parameter	Description
Channel	Displays channels that are used to set the channel's configuration parameters.
Mode	Displays channel mode for each channel.
Input Filter Time (ms)	
Off->On	This is the OFF to ON filter constant for all inputs on the module. A high signal must be present for this amount of time before the module will report an ON. The value must be entered in milliseconds (ms). The default value is 0 ms. The minimum value is 0 and the maximum is 65 ms.
On->Off	This is the ON to OFF filter constant for all inputs on the module. A low signal must be present for this amount of time before the module will report an OFF. The value must be entered in milliseconds (ms). The default value is 0 ms. The minimum value is 0 and the maximum is 65 ms.

Configure the Module as Standard Digital Output Using the Fault/Program Action Tab

The following diagram shows the Fault/Program tab of a ArmorBlock I/O 8 Channel IO-Link Master module in Studio 5000 using the Add-on Profile.



Each channel of your ArmorBlock I/O 8 Channel IO-Link Master module that is set to standard digital output or IO-Link mode can be configured with individual output states.

The following table describes each parameter on the Fault/Program tab.

Parameters on the Fault/Program Action Tab

Parameter	Description
Channel	Displays the channels that are used to set the channel's configuration parameters
Mode	Displays the mode that has been configured for each channel.
Output State During	
Program Mode	For each channel that has been configured as standard digital output or IO-Link, select the behavior of each output when the controller transitions to Program Mode. The available selections for each standard digital output channel are Off (default), On, or Hold. The available selections for each IO-Link channel are All Zeros, Hold, or Device Decides. • When All Zeros is selected, any IO-Link output values for that channel will be set to zero. • When Hold is selected, any IO-Link output values will be held at the current value. • When Device Decides is selected, the Device Operate command will be sent to the IO-Link device. What the outputs of the IO-Link device do during Device Operate is determined by the device vendor. If communication with the controller fails while in Program Mode, the output values will use the Fault Mode selection.
Fault Mode	For each channel that has been configured as standard digital output or IO-Link, select the behavior of each output when communication with the controller fails. The available selections for each standard digital output channel are Off (default), On, or Hold. The available selections for each IO-Link channel are All Zeros, Hold, or Device Decides. • When All Zeros is selected, any IO-Link output values for that channel will be set to zero. • When Hold is selected, any IO-Link output values will be held at the current value. • When Device Decides is selected, the Device Operate command will be sent to the IO-Link device. What the outputs of the IO-Link device do during Device Operate is determined by the device vendor.

Chapter Summary and What's Next

In this chapter you learned how to configure the module as a standard digital input module, as a standard digital output module, or in fallback mode using the Studio 5000 Add-on Profile software. The next chapter details the IO-Link Master module unique features.

Notes:

Module Overview and Features

Introduction

This chapter describes the features specific to the ArmorBlock I/O 8 Channel IO-Link Master module.

These features can be configured through the Studio 5000 software.

Time Stamping of the Input Data

The 1732E-8IOLM12R is an input module that offers sub-millisecond time stamping on a per point basis in addition to providing the basic ON/OFF and OFF / ON detection of all change of state (CoS) input data (also commonly known as the process data). Note that this input data is cyclically produced at the rate the master module is configured.

All process input data is timestamped based on when a change of state is detected by the 1732E-8IOLM12R module. An IO-Link enabled device can support up to 32 bytes of process input data and this data is allocated (bits/bytes) dependent on the manufacturer of the IO-Link enabled device. Therefore, the IO-Link Master module only monitors if any of the process input data has changed since the IO-Link enabled device last sent process data to the IO-Link Master module. When a CoS occurs, the timestamp is updated.

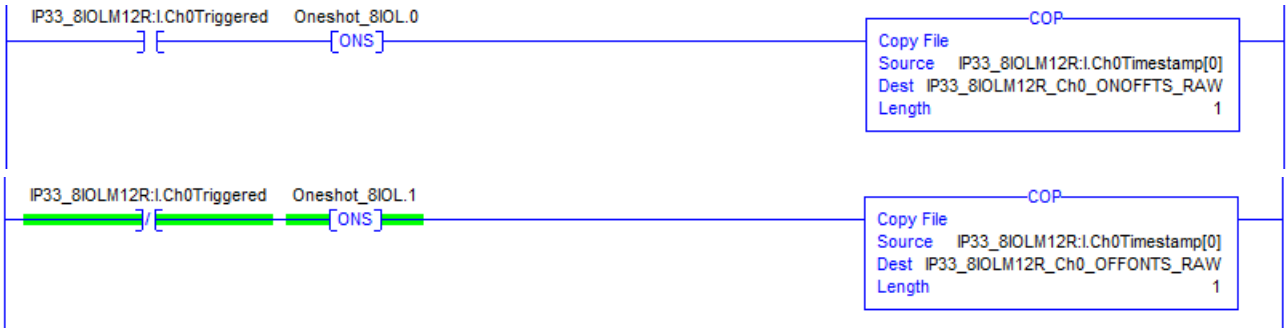
Most often, the first bit represents the detection or absence of an object for the sensor. For Rockwell sensors this is the “triggered” bit. To capture when this bit changes:

1. Use an XIC/XIO instruction to monitor the “triggered” bit
2. Then use a ONS (one-shot) to ensure that only the first transition is captured until the next CoS occurs.

   When both events are true, copy the timestamp value to another location to process this for your application.

⊞-IP33_8IOLM12R:I.Ch0Timestamp			DINT[2]
⊞-IP33_8IOLM12R:I.Ch1Timestamp			DINT[2]
⊞-IP33_8IOLM12R:I.Ch2Timestamp			DINT[2]
⊞-IP33_8IOLM12R:I.Ch3Timestamp			DINT[2]
⊞-IP33_8IOLM12R:I.Ch4Timestamp			DINT[2]
⊞-IP33_8IOLM12R:I.Ch5Timestamp			DINT[2]
⊞-IP33_8IOLM12R:I.Ch6Timestamp			DINT[2]
⊞-IP33_8IOLM12R:I.Ch7Timestamp			DINT[2]

In the following example, the first rung is monitoring when the IO-Link enabled device detects the presence of a target and copies the timestamp value to another location. The second rung captures when the target is no longer present to the IO-Link enabled device.



Each channel has its own timestamp which updates upon all CoS of the input data on that particular channel.

The timestamp data for each channel is not stored by the IO-Link Master module. Once a new CoS is detected, the last timestamp value is overwritten.

Note: The timestamp for each channel is updated when the IO-Link Master module receives a new process data input message and it is compared to the previous message. Although the timestamp data has microsecond accuracy, most IO-Link devices available today support approximately 2 ms cycle times. In this case the IO-Link device (sensor) updates the IO-Link Master module every 2 ms with its process data (both input and output). To avoid missing messages between the IO-Link Master module and the IO-Link enabled device, calculate double the IO-Link cycle time as the response time for the data to get to the IO-Link Master.

The IO-Link communication between the IO-Link device and the EtherNet/IP communication is also asynchronous. This means that it could take up to 1 ms for the IO-Link Master module to process the IO-Link communication from all IO-Link enabled devices.

For IO-Link enabled devices that support 2 ms cycle time, expect the timestamp to have an accuracy of 0 to 5 ms once the actual transition has occurred.

The IO-Link Master module supports IO-Link enabled devices with a cycle time down to 1.3 ms. In these applications the typical accuracy of the timestamp for the data transition ranges from 0 to 3.6 ms once the IO-Link enabled device or sensor detects the actual transition.

Note that only the input data can be timestamped and that this 1732E-8IOLM12R master module does not support time stamping for the output data.

Time stamping is a feature that registers a time reference to a change in input data. For the 1732E-8IOLM12R, the time mechanism used for time stamping is (PTP) system time. The 1732E-8IOLM12R module is a PTP slave-only device. There must be another module on the network that functions as a master clock.

Note that the input time stamping supports all change-of-state (COS) transitions of input data for IO-Link and/or discrete input data.

Each of the eight channels has a unique timestamp value which can be seen in the Controller Tags view.

This is ideal for numerous scenarios such as identifying “output” triggering state times from the sensor to the controller. Another example would be for identifying time indication as to when the margin low transition time occurred in the input data for learning when the “dirty lens” event occurred.

Time Stamping of the Event Data

The 1732E-8IOLM12R is an input module that also offers sub-millisecond time stamping on a per point basis in addition to providing the basic First-in-First-out (FIFO) detection of both Master and IO-Link Device event data. Therefore, if multiple events occur at the IO-Link enabled device or IO-Link Master module level, the actual timestamp of the event could be delayed from the actual time that the event occurred.

Each channel has a dedicated timestamp for all events that occur. The events can originate from the IO-Link Master module and/or the IO-Link enabled device connected to that sensor. "Ch0DiagEvent.Timestamp" is the location of the Ch0 timestamp for any events that occur on that channel. This tag is overwritten as new events occur.

Each event requires a minimum of 3 cycle times to get from the sensor to the IO-Link Master module according to IO-Link specifications. If an IO-Link enabled device or sensor supports 2 ms cycle time, concurrent events would have a timestamp gap of approximately 6 ms or longer. Typically this timestamp gap is sufficient given the diagnostic nature of the event information sent back to the controller.

When using a Factory Talk historian, or similar system, to record events, the above mechanism is a suitable solution. As each event is captured at the controller, the historical tracking tool can capture the event details along with the timestamp, and then trace any issue that might occur within the application.

When the event information is not being tracked by external means, a limited amount of events can be stored by the IO-Link Master module itself. The IO-Link Master module stores the last 40 events, per channel along with the timestamp, and can also store the last 124 events without the timestamp. These events can be read at any time for any channel. If a "get and clear" command is used, the event information is sent back to the requested message instruction in an array and all stored events are cleared for the channel that was read.

The last 40 events per channel with the specific timestamp in which each event occurred can be read using a message instructions at Class 930, Instance (Channel #) and Attribute 25.

The last 124 events per channel without the associated timestamp at Class 930, Instance (Channel #), Attribute 15.

Message Instructions for Reading Timestamped Event

Attribute ID	Access Rule	Name	Data Type	Description of Attribute
15	Get	IO-Link Events	Array of Struct	Events from IO-Link enabled device (Remote) or Master module (Local)
		Sequence Count	USINT	Count value assigned to each event
		Event Qualifier	BYTE	Type, mode and source of the event
		Event Code	UINT	The identifier of an actual event
25	Get	IO-Link Events with Timestamp	Array of Struct	Event from IO-Link enabled device (Remote) or Master module (Local)
		Sequence Count	USINT	Count value assigned to each event
		Event Qualifier	BYTE	Type, mode and source of the event
		Event Code	UINT	The identifier of an actual event
		Event timestamp	ULINT	Timestamp when event occurred (µs)

Messaging Example

-IP33_8IOLM12R:I.Ch0DiagEvent			AB:1732_8IOLTI...
+IP33_8IOLM12R:I.Ch0DiagEvent.SequenceC...			SINT
+IP33_8IOLM12R:I.Ch0DiagEvent.Qualifier			SINT
IP33_8IOLM12R:I.Ch0DiagEvent.Source_0			BOOL
IP33_8IOLM12R:I.Ch0DiagEvent.Source_1			BOOL
IP33_8IOLM12R:I.Ch0DiagEvent.Source_2			BOOL
IP33_8IOLM12R:I.Ch0DiagEvent.Location			BOOL
IP33_8IOLM12R:I.Ch0DiagEvent.Type_0			BOOL
IP33_8IOLM12R:I.Ch0DiagEvent.Type_1			BOOL
IP33_8IOLM12R:I.Ch0DiagEvent.Mode_0			BOOL
IP33_8IOLM12R:I.Ch0DiagEvent.Mode_1			BOOL
+IP33_8IOLM12R:I.Ch0DiagEvent.Code			INT
+IP33_8IOLM12R:I.Ch0DiagEvent.Timestamp			DINT[2]

The IO-Link Master module can generate events such as under voltage and communication loss. IO-Link enabled device or sensor generate other events that are device-specific.

Example Scenarios

The 45CRM contrast sensor, for example, supports a "parameter change" event. You can use this to notify the control system that the sensor has successfully accepted a new set of RGB colors. This could be helpful to the control system during a line change or tool change.

The 42EF sensor product family supports under temperature and over temperature events. When either of these events occurs, it will notify the control system that the sensor is still working within acceptable limits but the sensor is close to the acceptable limits. If the temperature continues to change, the sensor will be outside its rated temperature range and may not detect objects as intended.

The event data can be used to detect numerous conditions such as identifying when communication is lost between the master and a sensor, or when an operator has performed a re-teach operation locally on the device – indicating the configuration has been changed from its original state. These events can be seen in the Controller Tags view.

Definition (for Timestamp)

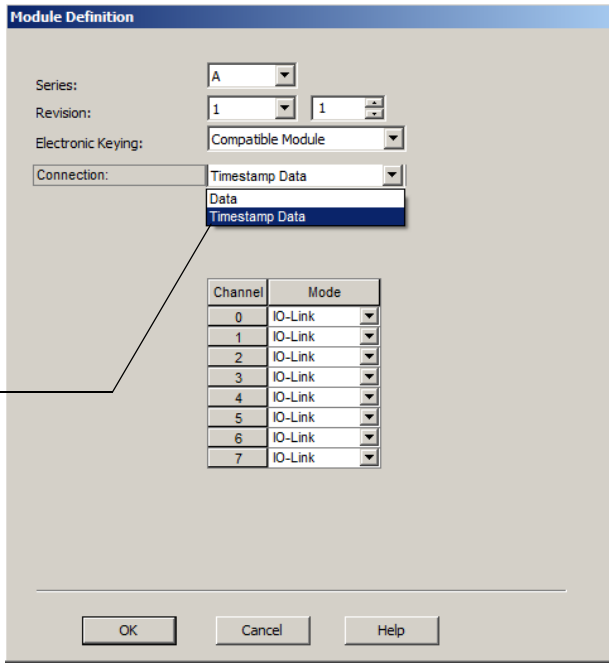
The 1732E-8IOLM12R ArmorBlock I/O 8 Channel IO-Link Master has eight channels that can be individually configured as Data or with Timestamp Data. Each input has its own individual timestamp recorded for both ON and OFF transitions. The offset from the timestamp to the local clock is also recorded so that steps in time can be detected.

1. If you click Change... in step C on page 72, you can change the Module Definition information. Select the tabs on the Module Properties dialog to edit specific configuration for your module in Studio 5000 software, for example the Configuration tab.

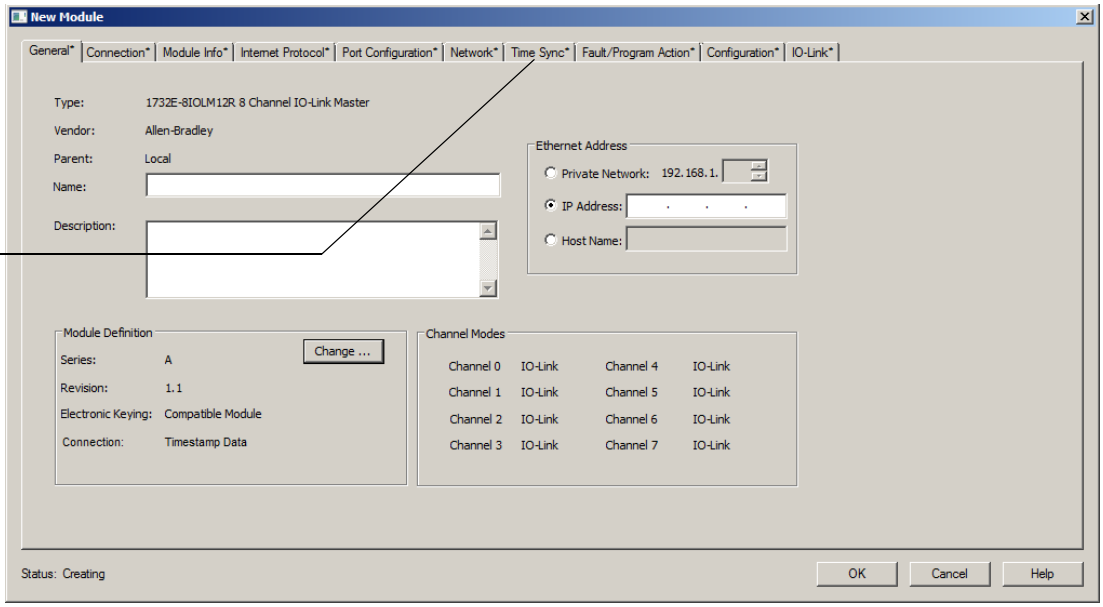
   Some of the screens that appear during this initial module configuration process are blank (such as Module Info, Network, and Time Sync) and are not shown here. These screens mostly provide information and status and can be important during online monitoring.

When you click Change, the module Definition dialog is shown. Through the Module Definition dialog you can:

- **A.** Select the module series.
- **B.** Make sure the Major and Minor Revision numbers match your module revision.
- **C.** Chose an electronic keying method.
- **D.** On the 1732E-8IOLM12R module, select the Connection type. Available options are Data and Timestamp Data.
- **E.** Select the Timestamp Data format.
- **F.** Click OK to return to the General tab of the Module Properties dialog.
- **G.** On the General tab, you can click OK to close the Module Properties dialog and download your configuration, or
- **H.** Click the Connection tab to configure the connection properties.

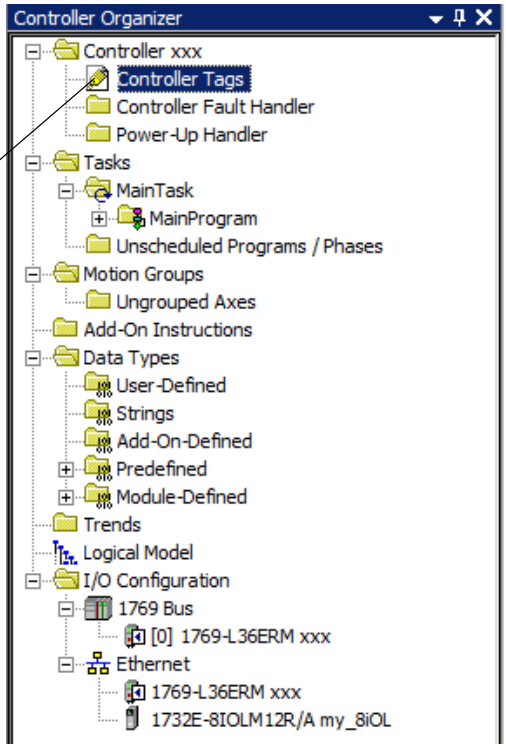


Note that when Timestamp Data has been selected as in section E above, the Time Sync tab will now appear in the Module Properties view.



2. The module sends all of its input data, including the new data from the most recent transition, to the controller immediately after time stamping the transition and passing the input filter to make sure the transition was valid.
3. You copy new data from the controller tags to a separate data structure for later sorting.
4. Once the data is copied to a separate data structure, you may sort the data in the controller to determine the order of events.

In the Controller Organizer window (on the left side in Studio5000 Logix Designer), click on the Controller Tags in the tree to see the Controller Tags view of the 1732E-8IOLM12R IO-Link module.



Controller Tags view for Module Defintion selected as Data connection type wherein there are no timestamp rows included.

Scope: xxx Show: All Tags

Name	Value	Force Mask	Style	Data Type	Description	Constant
my_8iOL:C	{...}	{...}		AB:1732_8IOL1:C:0		
my_8iOL:I	{...}	{...}		AB:1732_8IOL72...		
my_8iOL:I.Ch0DiagEvent	{...}	{...}		AB:1732_8IOL_St...		
my_8iOL:I.Ch1DiagEvent	{...}	{...}		AB:1732_8IOL_St...		
my_8iOL:I.Ch2DiagEvent	{...}	{...}		AB:1732_8IOL_St...		
my_8iOL:I.Ch3DiagEvent	{...}	{...}		AB:1732_8IOL_St...		
my_8iOL:I.Ch4DiagEvent	{...}	{...}		AB:1732_8IOL_St...		
my_8iOL:I.Ch5DiagEvent	{...}	{...}		AB:1732_8IOL_St...		
my_8iOL:I.Ch6DiagEvent	{...}	{...}		AB:1732_8IOL_St...		
my_8iOL:I.Ch7DiagEvent	{...}	{...}		AB:1732_8IOL_St...		
my_8iOL:I.Fault	2#0000_0000...		Binary	DINT		
my_8iOL:I.Status	{...}	{...}		AB:1732_8IOL_St...		

Controller Tags view for Module Definition selected as Timestamp Data connection type wherein the timestamp rows are included now for all eight channels (0 through 7).

Scope: xxx Show: All Tags

Name	Value	Force Mask	Style	Data Type	Description	Constant
my_8iOL:C	{...}	{...}		AB:1732_8IOL1:C:0		
my_8iOL:I	{...}	{...}		AB:1732_8IOLTI...		
my_8iOL:I.Ch0DiagEvent	{...}	{...}		AB:1732_8IOLTI...		
my_8iOL:I.Ch0Timestamp	{...}	{...}	Decimal	DINT[2]		
my_8iOL:I.Ch1DiagEvent	{...}	{...}		AB:1732_8IOLTI...		
my_8iOL:I.Ch1Timestamp	{...}	{...}	Decimal	DINT[2]		
my_8iOL:I.Ch2DiagEvent	{...}	{...}		AB:1732_8IOLTI...		
my_8iOL:I.Ch2Timestamp	{...}	{...}	Decimal	DINT[2]		
my_8iOL:I.Ch3DiagEvent	{...}	{...}		AB:1732_8IOLTI...		
my_8iOL:I.Ch3Timestamp	{...}	{...}	Decimal	DINT[2]		
my_8iOL:I.Ch4DiagEvent	{...}	{...}		AB:1732_8IOLTI...		
my_8iOL:I.Ch4Timestamp	{...}	{...}	Decimal	DINT[2]		
my_8iOL:I.Ch5DiagEvent	{...}	{...}		AB:1732_8IOLTI...		
my_8iOL:I.Ch5Timestamp	{...}	{...}	Decimal	DINT[2]		
my_8iOL:I.Ch6DiagEvent	{...}	{...}		AB:1732_8IOLTI...		
my_8iOL:I.Ch6Timestamp	{...}	{...}	Decimal	DINT[2]		
my_8iOL:I.Ch7DiagEvent	{...}	{...}		AB:1732_8IOLTI...		
my_8iOL:I.Ch7Timestamp	{...}	{...}	Decimal	DINT[2]		
my_8iOL:I.Fault	2#0000_0000...		Binary	DINT		
my_8iOL:I.GrandmasterClockId	{...}	{...}	Decimal	SINT[8]		
my_8iOL:I.LocalClockOffset	{...}	{...}	Decimal	DINT[2]		
my_8iOL:I.OffsetTimestamp	{...}	{...}	Decimal	DINT[2]		
my_8iOL:I.Status	{...}	{...}		AB:1732_8IOL_St...		
my_8iOL:I.SynchedToMaster	0		Decimal	BOOL		

Chapter Summary

In this chapter, you learned more about the features that are specific to the ArmorBlock I/O 8 Channel IO-Link Master module.

I/O Data Mapping Representation

About This Appendix

This appendix contains information to help you properly route the data to and from the IO-Link Master module.

Assembly Support for the 1732E-8IOLM12R

Application Connection Type	Application Path Type	Assembly Instance
Exclusive Owner, Data Only	Configuration	110
	Consumption	111
	Production	112
Exclusive Owner, Data plus Input Timestamps	Configuration	110
	Consumption	111
	Production	113

Configuration Assembly Header

The configuration assembly is prefixed with a 4 byte header (DWORD). This header (the Configuration Header) contains the Configuration Revision Number (CRN) used in Logix systems.

The configuration assembly listed in this section does not show this header, and therefore the fields start at byte offset 4. The Configuration Header assembly is shown below, and is the first member of the configuration assembly.

Configuration Assembly Instance 124 Data Structure – Configuration Header

Message size: 46 Bytes

Configuration Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved (Ignored)							CRN
1	Reserved (Ignored)							
2	Reserved (Ignored)							
3	Reserved (Ignored)							

CRN – Configuration Revision Number, see Rockwell CIP/System Specification Revision B for details on use

The EDS file declares the Configuration Header assembly to be the first member of the configuration assemblies, and thus only one configuration assembly (Config Part 1) is used in the Connection definitions under the Connection Manager section. Config Part 2 is null.

IO-Link Configuration Assembly Definition

Some configuration data can be sent to the module in a single assembly, facilitating use during connection establishment. Typically, this configuration assembly will be written to via a Forward Open service request.

Configuration data for target IO-Link devices can be up to 2K bytes in length. Because of this large size, the IO-Link device configuration is sent to the adapter using instances of the File Object.

Configuration Assembly Instance 110 Data Structure

Consumed Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	Channel 0 Mode[1]							
5	Channel 1 Mode							
6	Channel 2 Mode							
7	Channel 3 Mode							
8	Channel 4 Mode							
9	Channel 5 Mode							
10	Channel 6 Mode							
11	Channel 7 Mode							
12	IO-Link Channel 0 Vendor ID							
14	IO-Link Channel 0 Device ID							
17	Reserved					Ch0 Data Storage Backup Levels		Ch0 Send Config[5]
18	IO-Link Channel 1 Vendor ID							
20	IO-Link Channel 1 Device ID							
23	Reserved					Ch1 Data Storage Backup Levels		Ch1 Send Config
24	IO-Link Channel 2 Vendor ID							
26	IO-Link Channel 2 Device ID							
29	Reserved					Ch2 Data Storage Backup Levels		Ch2 Send Config
30	IO-Link Channel 3 Vendor ID							
32	IO-Link Channel 3 Device ID							
35	Reserved					Ch3 Data Storage Backup Levels		Ch3 Send Config
36	IO-Link Channel 4 Vendor ID							
38	IO-Link Channel 4 Device ID							
41	Reserved					Ch4 Data Storage Backup Levels		Ch4 Send Config
42	IO-Link Channel 5 Vendor ID							
44	IO-Link Channel 5 Device ID							
47	Reserved					Ch5 Data Storage Backup Levels		Ch5 Send Config
48	IO-Link Channel 6 Vendor ID							
50	IO-Link Channel 6 Device ID							

Configuration Assembly Instance 110 Data Structure

Consumed Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
53	Reserved					Ch6 Data Storage Backup Levels		Ch6 Send Config
54	IO-Link Channel 7 Vendor ID							
56	IO-Link Channel 7 Device ID							
59	Reserved					Ch7 Data Storage Backup Levels		Ch7 Send Config
60	IO-Link Channel 0 Consumed Size[2]							
61	IO-Link Channel 0 Produced Size							
62	IO-Link Channel 1 Consumed Size							
63	IO-Link Channel 1 Produced Size							
64	IO-Link Channel 2 Consumed Size							
65	IO-Link Channel 2 Produced Size							
66	IO-Link Channel 3 Consumed Size							
67	IO-Link Channel 3 Produced Size							
68	IO-Link Channel 4 Consumed Size							
69	IO-Link Channel 4 Produced Size							
70	IO-Link Channel 5 Consumed Size							
71	IO-Link Channel 5 Produced Size							
72	IO-Link Channel 6 Consumed Size							
73	IO-Link Channel 6 Produced Size							
74	IO-Link Channel 7 Consumed Size							
75	IO-Link Channel 7 Produced Size							
76	Channel 0 Fault Mode[3]							
77	Channel 0 Idle Mode							
78	Channel 1 Fault Mode							
79	Channel 1 Idle Mode							
80	Channel 2 Fault Mode							
81	Channel 2 Idle Mode							
82	Channel 3 Fault Mode							
83	Channel 3 Idle Mode							
84	Channel 4 Fault Mode							
85	Channel 4 Idle Mode							
86	Channel 5 Fault Mode							
87	Channel 5 Idle Mode							
88	Channel 6 Fault Mode							
89	Channel 6 Idle Mode							
90	Channel 7 Fault Mode							
91	Channel 7 Idle Mode							
92	Channel 0 Input Off to On Time Delay[4]							
93	Channel 0 Input On to Off Time Delay							
94	Channel 1 Input Off to On Time Delay							
95	Channel 1 Input On to Off Time Delay							
96	Channel 2 Input Off to On Time Delay							
97	Channel 2 Input On to Off Time Delay							
98	Channel 3 Input Off to On Time Delay							

Configuration Assembly Instance 110 Data Structure

Consumed Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
99	Channel 3 Input On to Off Time Delay							
100	Channel 4 Input Off to On Time Delay							
101	Channel 4 Input On to Off Time Delay							
102	Channel 5 Input Off to On Time Delay							
103	Channel 5 Input On to Off Time Delay							
104	Channel 6 Input Off to On Time Delay							
105	Channel 6 Input On to Off Time Delay							
106	Channel 7 Input Off to On Time Delay							
107	Channel 7 Input On to Off Time Delay							
108								Master Sync Enable(6)

(1) The channel mode selects the type of I/O for the channel. Valid values are:
0: Disabled
1: Standard Output (DO)
2: Standard Input (DI)
3: IO-Link
4: Fallback

(2) Consumed and produced connection sizes can be in the range of 0 to 32. This value is only valid when the channel is configured for IO-Link. In DI and fallback modes, 1 byte is produced and 0 are consumed, in DO mode 0 bytes are produced and 1 byte is consumed. When the channel is disabled no data is produced or consumed.

(3) Fault and Idle conditions are only valid when the channel is configured for IO-Link or DO.

(4) Time delays are specified in 1ms increments, valid range is 0…65 (a value of zero disables the input filter).

(5) This bit is examined only when the configuration assembly is received while a connection is established (a connection reconfiguration). If this bit is set the IO-Link device configuration (stored in the associated file instance) is downloaded to the device on this channel, otherwise it is not. The IO-Link device configuration is always sent on an initial connection establishment.

(6) This is a PTP enable bit which will indicate if the module is expected to sync to a master clock. If enabled (1) then the Module LED will flash green if the module is not synchronized to a master clock. Disabling the bit does not prevent the module from synchronizing to a master clock. This bit is ignored if the connection request is for the Data Only connection set.

IO-Link I/O Assembly Definitions

The data structure of each I/O Assembly instance defined in the tables below. The size of the input and output data from each channel is variable based on the configuration within the IO-Link Module object, and the length will be padded (if necessary) such that the starting location of the data for a subsequent channel is 32-bit word aligned.

Consumption Assembly Instance 111 Data Structure

Consumed Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0…a	Output data for Channel 0 (1)							
a+1…b	Output data for Channel 1 (1)							
b+1…c	Output data for Channel 2 (1)							
c+1…d	Output data for Channel 3 (1)							

Consumption Assembly Instance 111 Data Structure

Consumed Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
d+1…e	Output data for Channel 4 (1)							
e+1…f	Output data for Channel 5 (1)							
f+1…g	Output data for Channel 6 (1)							
g+1…h	Output data for Channel 7 (1)							

(1) Consumed sizes can be in the range of 0…32. Output data for each channel always begin on a 32-bit boundary, and is enforced by software using the data description for the channel.

Production Assembly Instance 112 Data Structure

Message size: 0...132 Bytes

Produced Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Channel 0 Status (1)							
2	Channel 1 Status (1)							
4	Channel 2 Status (1)							
6	Channel 3 Status (1)							
8	Channel 4 Status (1)							
10	Channel 5 Status (1)							
12	Channel 6 Status (1)							
14	Channel 7 Status (1)							
16	Channel 0 Most Recent Event(2)							
20	Channel 1 Most Recent Event (2)							
24	Channel 2 Most Recent Event (2)							
28	Channel 3 Most Recent Event (2)							
32	Channel 4 Most Recent Event (2)							
36	Channel 5 Most Recent Event (2)							
40	Channel 6 Most Recent Event (2)							
44	Channel 7 Most Recent Event (2)							
48…a	Input data from Channel 0 (3)							
a+1…b	Input data from Channel 1 (3)							
b+1…c	Input data from Channel 2 (3)							
c+1…d	Input data from Channel 3 (3)							
d+1…e	Input data from Channel 4 (3)							
e+1…f	Input data from Channel 5 (3)							
f+1…g	Input data from Channel 6 (3)							
g+1…h	Input data from Channel 7 (3)							

Production Assembly Instance 113 Data with Timestamp Structure

Produced Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Channel 0 Status (1)							
2	Channel 1 Status (1)							
4	Channel 2 Status (1)							
6	Channel 3 Status (1)							
8	Channel 4 Status (1)							
10	Channel 5 Status (1)							
12	Channel 6 Status (1)							
14	Channel 7 Status (1)							

(1) Channel Status:
Bit 0: 1 = Roll Up Status, an OR of bits 1 through 7
Bit 1: 0 = Connection to device, 1 = No Connection to device
Bit 2: 1 = Configuration to device in progress
Bit 3: 1 = Device configuration failed
Bit 4: 1 = IO-Link Key failure
Bit 5: 1 = DO Short Circuit
Bit 6: 1 = Process Data Invalid
Bit 7: 1 = Low Power Fault
Bit 8: 1 = IO-Link output value is forced to limit
Bit 9: 1 = No IO-Link size configured
Bit 10: 0 = Channel configured as Fallback is in the IO-Link operating state or channel not configured for Fallback, 1 = Channel configured as Fallback is in the DI operating state (this bit is not included in the roll-up status).
Bits 11…15 = Reserved

(2) The most recent event is produced on each channel. The format of the event data is defined in attribute 15 of the IO-Link Channel object. Event data is four octets in length. An event containing a sequence count value of zero is not valid and indicates no event has been received on the channel since the connection was established, or the events have been cleared.

(3) Produced sizes can be in the range of 0…32. Input data for each channel will always begin on a 32-bit boundary, and is enforced by software using the data description for the channel.

Production Assembly Instance 113 Data with Timestamp Structure

Produced Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
16	Channel 0 Most Recent Event[2]							
20	Channel 1 Most Recent Event[2]							
24	Channel 2 Most Recent Event[2]							
28	Channel 3 Most Recent Event[2]							
32	Channel 4 Most Recent Event[2]							
36	Channel 5 Most Recent Event[2]							
40	Channel 6 Most Recent Event[2]							
44	Channel 7 Most Recent Event[2]							
48…55	Lock Clock Offset[3] (64 bit)							
56…63	Offset Time Stamp[3] (64 bit)							
64…71	Grandmaster Clock ID (64 bit) 8 bytes SINT array							
72…79	Input Time Stamp[3] – Channel 0 (64 bit)							
80…57	Input Time Stamp – Channel 1 (64 bit)							
88…95	Input Time Stamp – Channel 2 (64 bit)							
96…103	Input Time Stamp – Channel 3 (64 bit)							
104…111	Input Time Stamp – Channel 4 (64 bit)							
112…119	Input Time Stamp – Channel 5 (64 bit)							
120…127	Input Time Stamp – Channel 6 (64 bit)							
128…135	Input Time Stamp – Channel 7 (64 bit)							
136	Reserved (Must be 0)							Synched to Master
137…139	Pad (3 octets)							
140…a	Input data from Channel 0 [4]							
a+1…b	Input data from Channel 1 [3]							
b+1…c	Input data from Channel 2 [3]							
c+1…d	Input data from Channel 3 [3]							
d+1…e	Input data from Channel 4 [3]							

Production Assembly Instance 113 Data with Timestamp Structure

Produced Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
e+1…f	Input data from Channel 5 (3)							
f+1…g	Input data from Channel 6 (3)							
g+1…h	Input data from Channel 7 (3)							

(1) Channel Status:
Bit 0: 1 = Roll Up Status, an OR of bits 1 through 7
Bit 1: 0 = Connection to device, 1 = No Connection to device
Bit 2: 1 = Configuration to device in progress
Bit 3: 1 = Device configuration failed
Bit 4: 1 = IO-Link Key failure
Bit 5: 1 = DO Short Circuit
Bit 6: 1 = Process Data Invalid
Bit 7: 1 = Low Power Fault
Bit 8: 1 = IO-Link output value is forced to limit
Bit 9: 1 = No IO-Link size configured
Bit 10: 0 = Channel configured as Fallback is in the IO-Link operating state or channel not configured for Fallback, 1 = Channel configured as Fallback is in the DI operating state (this bit is not included in the roll-up status).
Bits 11…15 = Reserved

(2) The most recent event is produced on each channel. The format of the event data is defined in attribute 15 of the IO-Link Channel object. Event data is four octets in length. An event containing a sequence count value of zero is not valid and indicates no event has been received on the channel since the connection was established, or the events have been cleared.

(3) Time is reported in microseconds.

(4) Produced sizes can be in the range of 0…32. Input data for each channel will always begin on a 32-bit boundary, and is enforced by software using the data description for the channel.

Notes:

Supported IO-Link Master Events

About This Appendix

This appendix provides information about events that are defined in the IO-Link Master stack. This appendix also shows where the most recent events are viewable in the Controller Tags view of the Studio 5000 program.

IO-Link Master Module Events

IO-Link events can be accessed through Explicit Messaging by querying the Events attribute of an IO-Link Channel object. This attribute contains a list of events logged from the IO-Link channel. The 40 most recent events can be viewed by querying that attribute. See the following guide for more information.

Querying the Events from the master to view 40 most recent events

Class: 0x3A2 hex
Service: 0E hex
Instance: refers to channel number and can be from 0 to 3
Attribute: 15 decimal or 0F hex

Structure of the Returned Data

Name	Data Type	Description of Attribute
IO-Link Events	Array of Struct	Events from IO-Link Device (Remote) or Master (Local)
Sequence Count	USINT	Count value assigned to each event (refer to sequence count section)
Event Qualifier	BYTE	Type, mode and source of the Event (refer to event qualifier table)
Event Code	UINT	The identifier of an actual Event (refer to event code table)

Configuration Assembly Header

The configuration assembly is prefixed with a 4 byte header (DWORD). This header (the Configuration Header) contains the Configuration Revision Number (CRN) used in Logix systems,.

The configuration assembly listed in this section does not show this header, and therefore the fields start at byte offset 4. The Configuration Header assembly is shown below, and is the first member of the configuration assembly.

IO-Link Master Event Codes

The IO-Link Interface and System Specification document provides an enumeration and definition of IO-Link defined events. Unique event conditions can also be defined by the IO-Link device or the IO-Link Master stack. Events defined by the stack are shown in the table below.

IO-Link Master Module Events

Event Code	Description
0x0002	The Sensor had sent a wrong PDU. After three retries the connection will be aborted and the device lost event DEVICE_LOST. The stack will automatically reconnect the sensor.
0x000C	This event is used if only a change in the data valid bit has been detected.
0x0010	This event will be generated if a connection could not be established due to a absent sensor or if a running connection has been aborted (e.g. by pulling a sensor). The stack will automatically attempt to reconnect the sensor.
0x001B	This event will be generated if a retry occurs.
0x001E	A short circuit was detected.
0x001F	An undervoltage of the system sensor power supply has been detected.
0x0020	An undervoltage of the system actor power supply has been detected.
0x0021	An undervoltage of the power supply of a single port has been detected.
0x0022	Reset of a channel has been done.
0x0024	This event will be generated when the connection to a sensor has been established, but the connection is not in operate state.
0x0040	Process data input length does not match
0x0041	Process data output length does not match
0x0043	Vendor id is wrong V1.1 sensor
0x0044	Device id is wrong V1.1 sensor
0x0045	Vendor id is wrong V1.0 sensor
0x0046	Device id is wrong V1.0 sensor

Event Count

The Event Sequence Count is a count value assigned to each event. The value increments for each received event. Range of values is -127...127; a value of zero is not valid and can indicate that no event is present in a fixed field within I/O produced input data.

Event Qualifier

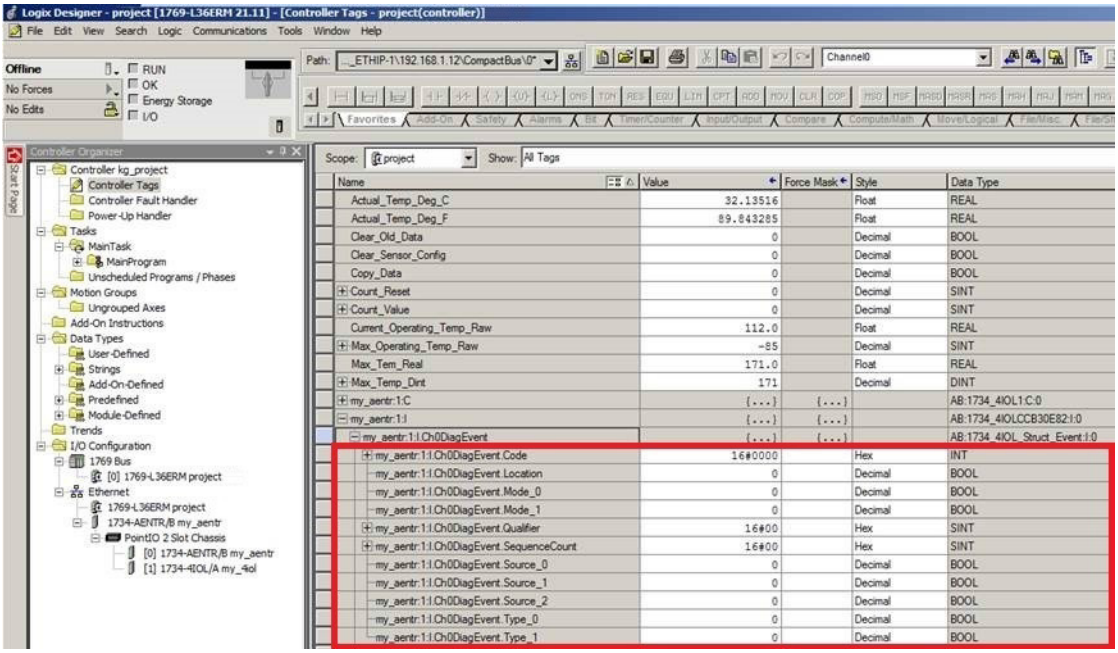
The Event Qualifier provides details about the type event, as shown in the table below.

Event Qualifier

Bit(s)	Name	Definition
0 - 2	Source	These bits indicate the source of an Event: 0: Unknown 1: Physical Layer 2: Data Layer 3: Application Layer 4: Application 5-7: Reserved
3	Location	This bit indicates the location of the Event. 0: Device application (remote) 1: Master application (local)
4 - 5	Type	These bits indicate the Event category 0: Reserved 1: Notification 2: Warning 3: Error
6 - 7	Mode	These bits indicate the Event mode 0: Reserved 1: Event single shot 2: Event disappears 3: Event appears

Recent Events Controller Tag View

The following graphic shows where the most recent events are viewable in the Studio 5000 program for the 1732E-8IOLM12R IO-Link Master module and/or any Rockwell Automation IO-Link-supported device.



Notes:

Troubleshooting

About This Appendix

This appendix provides information about module diagnostics, and about troubleshooting with the following indicators:

- Module status
- Network status
- Channel status

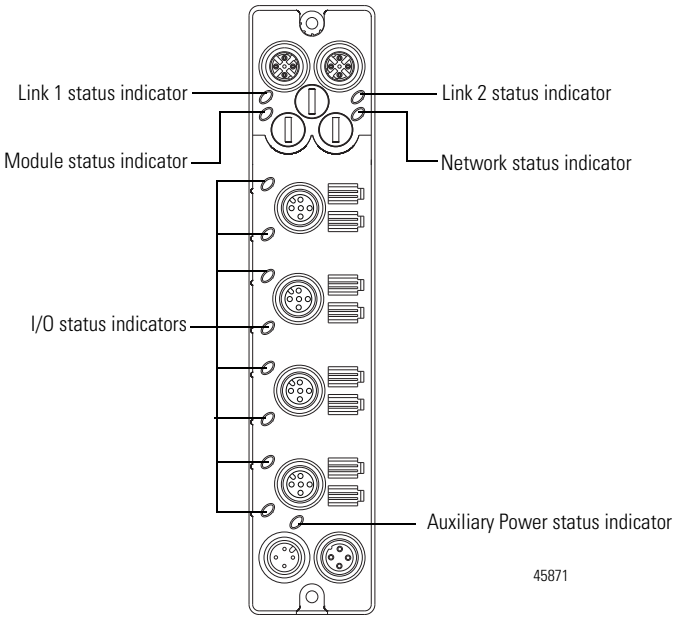
In addition, the following troubleshooting scenarios are provided:

- Second Data I/O connection rejected
- Controller goes to fault when enabling/disabling Unicast
- Generic device with zero length input and output is accepted by the Add-on Profile
- The ChxMostRecentEvent.EventSequenceCount is an unsigned value

Interpret LED Indicators

Refer to the following diagram and table for information on how to interpret the status indicators.

ArmorBlock I/O 8 Channel IO-Link Master Module – 1732E-8IOLM12R



Indicator Status for Modules

Indicator	Status	Description
Module status	Off	No power applied to the device.
	Flashing green	The device has not been configured. If Master Sync Enable bit is set, and the device is not synchronized to a PTP master, the device is not configured.
	Green	Device operating normally.
	Red	Unrecoverable fault – may require device replacement.
	Flashing red	One or more recoverable minor faults detected. Possible minor faults indicated are: • The device is performing a firmware flash update. • The IO-Link stack is faulted. • IP Address switches do not match configuration in use • The device has completed a reset to factory default request due to the switches being set to 888 at power up, and a power cycle is required.
	Flashing red/green	The module is performing POST (Power-On Self Test), which completes within 30 s.
Network status	Off	The device is not initialized or the module does not have an IP address.
	Flashing green	The device has an IP address, but no connections are established.
	Green	The device is online, has an IP address, and at least one connection is established.
	Flashing red	One or more connections have timed out.
	Red	The module has detected that its IP address is already in use.

Indicator Status for Modules

Indicator	Status	Description
Link status	Off	No link established.
	Green	Link established on indicated port at 100 Mbps.
	Flashing green	Link activity present on indicated port at 100 Mbps.
	Yellow	Link established on indicated port at 10 Mbps.
	Flashing yellow	Link activity present on indicated port at 10 Mbps.
Auxiliary power status	Off	No power to device or input not valid.
	Green	Power applied to device.

Channel LED Indicator Status for Module

Indicator	Status	Mode	Description
Channel LED status	Off	Both	Output/input is in off state, is in IO-Link mode, or is not energized.
	Yellow	Standard I/O	Output/input is in on state.
	Flashing green	IO-Link	Port startup or IO-Link device not found.
	Green	IO-Link	IO-Link enabled.
	Flashing red	IO-Link	IO-Link device connected to channel does not match configured electronic key.
	Red	Both	Output is shorted or over-current condition exists.

IMPORTANT The Module Status LED indicator will flash red and green for a maximum 30 s while the module completes its POST (Power-On Self Test).

Troubleshooting Scenarios

The following are scenarios you may encounter while using the modules.

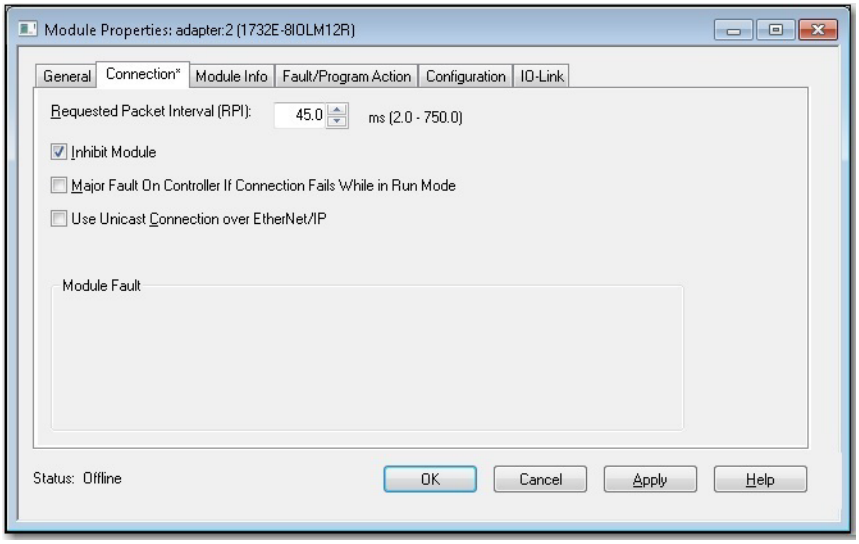
Second Data I/O connection rejected

The 1732E-8IOLM12R module does not support a Listen-Only or Input-Only connection. A connection attempt from a second Logix controller will be rejected.

Controller goes to fault when enabling/disabling Unicast

If the you check the “Major Fault on Controller if Connection Faults While in Run Mode” check box and uncheck the “Use Unicast Connection over EtherNet/IP” check box while online and apply the changes, the Logix controller will fault.

The work-around is to first inhibit the connection, make the changes to the two check boxes, then un-inhibit the connection.



Generic device with zero length input and output is accepted by the Add-on Profile

The input and output length for a generic device can both be set to zero. These settings will cause the communication fault bit to be set for the channel.

The ChxMostRecentEvent.EventSequenceCount is an unsigned value

The ChxMostRecentEvent.EventSequenceCount is a count value assigned to each event. The value increments for each received event. Range of values is 1 to 255; a value of zero is not valid and can indicate that no event is present.

Because this is an unsigned number the count values from 128 through 255 appear as negative numbers in the Logix Designer software.

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products.
At http://www.rockwellautomation.com/support/, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

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

Installation Assistance

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

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

New Product Satisfaction Return

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

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

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Publication 1732E-UM007B-EN-E - August 2019
Supersedes Publication 1732E-UM007A-EN-E - August 2016