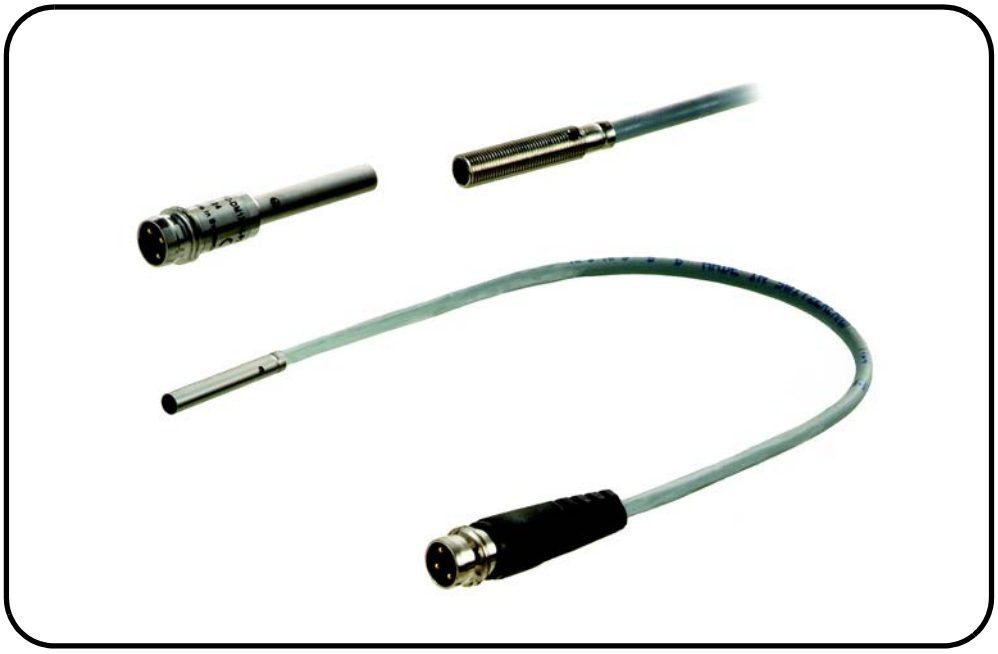
User Manual

Allen-Bradley

871C Miniature Inductive Sensors with IO-Link Interface

871C-D*NP*-**, 871C-DM*NP*-**, 871C-M*NP*-**, 871C-MM*NP*-**



IO-Link CE

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

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

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

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

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

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

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

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

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

Product Overview

Product Description

The 871C miniature inductive sensor reliably detects the presence of ferrous (iron) metals. Due to its small size, the 871C is targeted for small spaces in applications where a typical inductive-proximity switch would not fit.

The IO-Link interface enables consistent communication for diagnosing and parameterizing through to the sensor level and makes the intelligence that is already integrated in every 871C inductive sensor fully available to the user. This provides particular advantages in the service area (fault elimination, maintenance, and device replacement) during commissioning (identification, and configuration) and during operation (continuous parameter monitoring and online diagnosis).

The 871C sensor operates as a standard discrete sensor on pin four (black) or communicates via IO-Link on the same pin when connected to an IO-Link master.

Operating Modes

The sensor can operate in two modes:

Standard IO (SIO) Mode: The sensor default operation-mode. This mode of operation is active when the sensor is connected to digital input devices such as a PLC input module, a distribution box, or input terminal connection.

IO-Link Mode: This mode is automatically activated when the sensor is connected to an IO-Link enabled master device. Upon entering this mode, the yellow light-emitting diode (LED) on the sensor stays solid to indicate that IO-Link communication has been successfully established with the master. The sensor transmits more parameter and diagnostic information that can be accessed via the PLC process data. No user intervention is required to enable this functionality within the sensor.

Features

- 10...30V DC operating voltage
- Stainless steel housing
- Smooth and threaded barrels
- IP67 rated
- Cable, three-pin pico, and pico six-inch lead connection styles
- High switching frequency

- IO-Link communication protocol helps minimize downtime and increase productivity.
- IO-Link sensors are forward/backward compatible with standard sensors: the same sensors and same cables that are used in IO-Link and non-IO-Link applications.
- IO-Link provides
  - Remote detection of the health of the sensor
  - Margin status (low alarm)
  - Timer function
  - Counter-function

Specifications

	3 mm Smooth Barrel and 4 mm Threaded Barrel	4 mm Smooth Barrel and 5 mm Threaded Barrel
Certifications	UL Listed and CE Marked for all applicable directives	
Environmental		
Operating Environment	NEMA 1, 2, 3, 4, 12, 13; IP67 (IEC 529)	
Operating Temperature [C (F)]	-25…+70° (-13…+158°)	
Vibration	10…55 Hz, 1 mm amplitude, 3 planes	
Shock	30 g, 11 ms	
Electrical		
Load Current	≤100 mA	<200 mA
Leakage Current	≤0.1 mA	
Operating Voltage	10…30V DC	
Voltage Drop	≤2V	
Repeatability	≤5%	
Hysteresis	10% typical	
Protection Type	False pulse, transient noise, reverse polarity, and short circuit	
IO-Link		
Protocol	IO-Link V1.0	
Interface Type	IO-Link	
Mode	COM 2 (38.4 kBaud)	
Cycle Time	10.4 ms, minium	
SIO (standard I/O)	Supported (pin 4 for either IO-Link or SIO)	
Mechanical		
Housing Material	Stainless steel barrel, polyester face	
LED (SIO mode)	Yellow: Output energized	
LED (IO-Link Mode)	Solid yellow: Sensor in IO-Link mode	
Connection Type	Cable, pico QD, or pico with lead	

These products have been tested to comply with IO-Link test specification IEC 61131-9, note environmental EMC and Physical Layer testing have not been performed with the device running in IO-Link mode.

To determine the sensing distance for materials other than standard mild steel, a correction factor is used. The correction factors can be used as a general guideline for determining the de-rated sensing distance, if applicable.

Correction Factors

Sensor Type/ Target Material	Smooth		Smooth or Threaded		Threaded	
	3 mm Dia., 0.6 mm Sr	3 mm Dia., 1.0 mm Sr	4 mm Dia., 0.8 mm Sr	4 mm Dia., 1.5 mm Sr	5 mm Dia., 1 mm Sr	5 mm Dia., 1.5 mm Sr
Steel	1	1	1	1	1	1
Copper	0.5	0.45	0.45	0.4	0.45	0.4
Aluminum	0.55	0.5	0.5	0.4	0.5	0.4
Brass	0.65	0.6	0.55	0.5	0.55	0.5
Stainless Steel 304	0.8	0.8	0.8	0.75	0.8	0.75

Chapter 2

Installation

User Interface

LED Status

Standard IO Operation

LED Color	State	Condition
Yellow	OFF	Output is OFF
	Solid	Sensor output is triggered ON
	Blinking (margin indication)	Target is 80…100% of the maximum sensing range

IO-Link Operation

LED Color	State	Condition
Yellow	OFF	Power is OFF
	Solid	Sensor is connected to IO-Link master

Mounting

Securely mount the sensor on a firm, stable surface, or support for reliable operation. A mounting subject to excessive vibration or shifting could cause intermittent operation. Once securely mounted, the sensor can be wired per the wiring instructions in the next section.

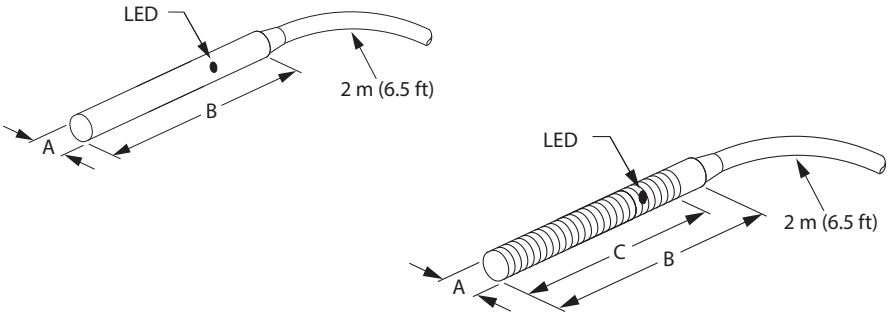
The user might need to adjust the sensor in the mounting due to the location of the target in relation to the sensor face. The 871C offers margin indication through the yellow LED. The LED blinks when the target is 80% of the maximum sensing distance or farther from the sensor face. It is recommended the user adjust the sensor to be closer to the target.

IMPORTANT When the sensor is connected to IO-Link, the LED will not indicate margin status. The margin status is shown as a process bit in Studio 5000 tag.

Dimensions

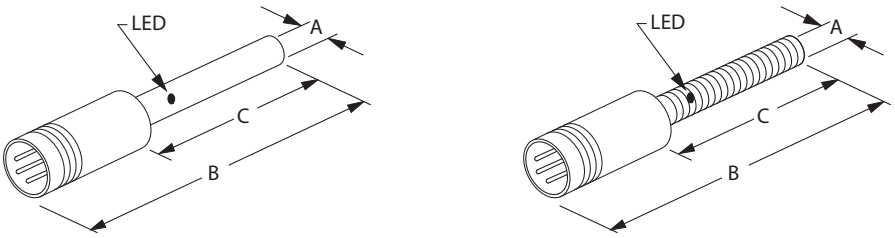
The following illustration shows the relevant device dimensions.

Cable Style



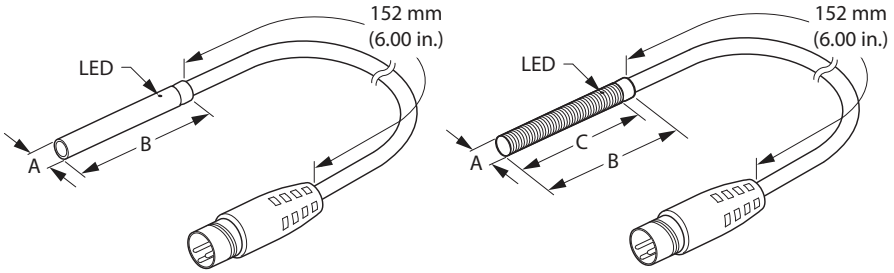
Barrel Diameter	Thread Size	Shielded	Thread Length [mm (in.)]		
			A	B	C
3.0	—	Yes	3.0 (0.12)	22.0 (0.87)	—
4.0	—		4.0 (0.16)	25.0 (0.98)	—
4.0	M4 x 0.5		4.0 (0.16)	22.0 (0.87)	19.0 (0.75)
5.0	M5 x 0.5		5.0 (0.20)	25.0 (0.98)	20.0 (0.79)

Pico Style [mm (in.)]



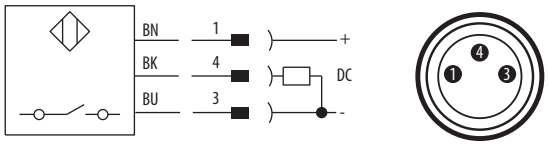
Barrel Diameter	Thread Size	Shielded	[mm (in.)]		
			A	B	C
4.0	—	Yes	4.0 (0.16)	38.0 (1.50)	19.0 (0.75)
5.0	M5 x 0.5		5.0 (0.20)	38.0 (1.50)	23.0 (0.90)

Pico with Lead Style



Barrel Diameter	Shielded	[mm (in.)]		
		A	B	C
3.0	Yes	3.0 (0.12)	22.0 (0.87)	—
4.0		4.0 (0.16)	22.0 (0.87)	19.0 (0.74)

Wiring



Pin	Signal	Description
1	+10…30V DC	Device supply
3	GND	GND for device
4	LOAD	IO-Link/Output/SIO

Rockwell Automation® recommends the use of the 889 Series of cordsets and patchcords for quick-disconnect (QD) model sensors. All external wiring must conform to the National Electric Code and all applicable local codes.

Chapter 3

Miniature Inductive Sensor with IO-Link Overview

What Is IO-Link?

The IO-Link technology is an open point-to-point communication standard and was launched as (IS) IEC 61131-9. IO-Link is now the first globally standardized technology for sensor and actuator communication with a field bus system. This technology provides benefits to both OEMs and End Users.

IO-Link provides communications-capable sensors to the control level by a cost-effective point-to-point connection. IO-Link provides a point-to-point link between the I/O module and sensor that is used for transferring detailed diagnostics, device identity information, process data, and parameterization.

IO-Link communication is based on a master-slave structure in which the master controls the interface access to the sensor. Using the intelligence that is integrated into the sensor provides the user with new commissioning methods. Benefits range from reduced installation time during startup to increased diagnostics over the lifetime of the machine. Benefits of IO-Link technology include:

- Reduced inventory and operating costs
- Increased uptime/productivity
- Simplified design, installation, set-up and maintenance
- Enhanced flexibility and scalability
- Detailed diagnostic information for preventative maintenance

Why IO-Link?

IO-Link Offers a Full Range of Advanced Features and Functions

Seamless Integration

- Forward and backward compatible, sensor catalog numbers remain the same
- No special cables required
- Connectivity options remain the same
- Access IO-Link functionality by simply connecting an IO-Link enabled device to an IO-Link master

Real-time Diagnostics and Trending

- Real-time monitoring of the entire machine down to the sensor level
- Optimized preventative maintenance—identify and correct issues before failures can occur
- Detect sensor malfunctions/failure

Sensor Health Status

- Real-time monitoring ensures that sensors are operating correctly

Device Profiles and Automatic Device Configuration

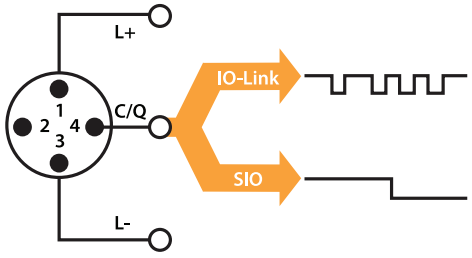
- “Golden” device configurations are stored in the IO-Link master module
- Within minutes instead of hours, modify sensor parameters to produce different finished goods

Descriptive tags

- Faster programming during initial setup
- More efficient troubleshooting process data tags are named based on the information they provide
- Easily monitor sensor data though intuitive tag names

How Does IO-Link Work?

IO-Link delivers data over the same standard field cabling used today. By connecting an IO-Link sensor to an IO-Link master, the field-device data and diagnostics are accessible. So go beyond detecting products on the machine—now the health of the machine can be MONITORED as it runs.



Pin	Signal	Remark
1	L+	24V
2	out	Depends on sensor
3	L-	Ground
4	C/Q	Communication/ switching signal

IMPORTANT The response time of an IO-Link system may not be fast enough for high-speed applications. In this case, it may be possible to monitor/configure the sensor through IO-Link on pin 4 of the sensor while connecting pin 2 (if the sensor offers a second output) of the sensor to a standard input card.

Transmission Rates

Three communication rates are specified for the IO-Link device:

- COM 1 = 4.8 kbaud
- COM 2 = 38.4 kbaud
- COM 3 = 230.4 kbaud

An IO-Link device typically supports only one of the specified transmissions rates, while the IO-Link V1.1 specifications requires an IO-Link master to support all three communication rates. (See Product Specifications for product communication rate.)

Transmission Quality

The IO-Link communication system operates at a 24V level. If a transmission fails, the frame is repeated two more times. If the transmission fails on the second try, the IO-Link master recognizes a communication failure and signals it to the controller.

Response Time of the I-O Link System

The device description file (IODD) of the device contains a value for the minimum cycle time of the device. This value indicates the time intervals at which the master might address the device. The value has a large influence on the response time. In addition, the master has an internal processing time that is included in the calculation of the system response time.

Devices with different minimum cycle times can be configured on one master. The response time differs for these devices. When configuring the master, you can specify a fixed cycle time and the device-specific minimum cycle time that is stored in the IODD. The master then addresses the device that is based on this specification. The typical response time for a device therefore results from the effective cycle time of the device and the typical internal processing time of the master. (See Product Specifications for minimum product cycle time.)

IO-Link Data Types

There are four data types available through IO-Link:

Process data	→	Cyclic data
Value status	→	Cyclic data
Device data	→	Acyclic data
Events	→	Acyclic data

Process Data

The process data of the devices are transmitted cyclically in a data frame in which the size of the process data is specified by the device. Depending on the device, 0...32 bytes of process data are possible (for each input and output). The consistency width of the transmission is not fixed and is thus dependent on the master.

Some devices can support multiple process data "modes," which allow the user to select different cyclic process data themes.

Value Status

The value status indicates whether the process data is valid or invalid. The value status can be transmitted cyclically with the process data.

Device Data

Device data supports device-specific configurable parameters, identification data, and diagnostic information. They are exchanged acyclically and at the request of the IO-Link master. Device data can be written to the device (Write) and also read from the device (Read).

Events

When an event occurs, the device signals the presence of the event to the master. The master then reads out the event. Events can be error messages and warnings/maintenance data. Error messages are transmitted from the device to the controller via the IO-Link master. The transmission of device parameters or events occurs independently from the cyclic transmission of process data (see Appendix C for device-specific events and associated codes).

Accessing IO-Link Data

Cyclic Data

In order to exchange the cyclic process data between an IO-Link device and a controller, the IO-Link data from the IO-Link master is placed on the address ranges assigned beforehand. The user program on the controller accesses the process values using these addresses and processes them. The cyclic data exchange from the controller to the IO-Link device (for example, IO-Link sensor) is performed in reverse.

Acyclic Data

Acyclic data, such as device parameters or events, are exchanged using a specified index and subindex range. The controller accesses these using explicit messaging. The use of the index and subindex ranges allows targeted access to the device data (for example, for reassigning the device or master parameters during operation).

Start-up of the I/O System

If the port of the master is set to IO-Link mode, the IO-Link master attempts to communicate with the connected IO-Link device. To do so, the IO-Link master sends a defined signal (wake up pulse) and waits for the IO-Link device to reply.

The IO-Link master initially attempts to communicate at the highest defined data transmission rate. If unsuccessful, the IO-Link master then attempts to communicate at the next lower data transmission rate.

If the master receives a reply, the communication begins. Next, it exchanges the communication parameters. If necessary, parameters that are saved in the system are transmitted to the device. Then, the cyclic exchange of the process data and value status begins.

Assigning Device Parameters

Setting up a device for a specific application requires changes to parameter settings. The device parameters and setting values are contained in the IODD of the device.

IO Device Description (IODD) files contain information about the device identity, parameters, process data, diagnostic data, and communication properties. These files are required to establish communication with the sensors via IO-Link.

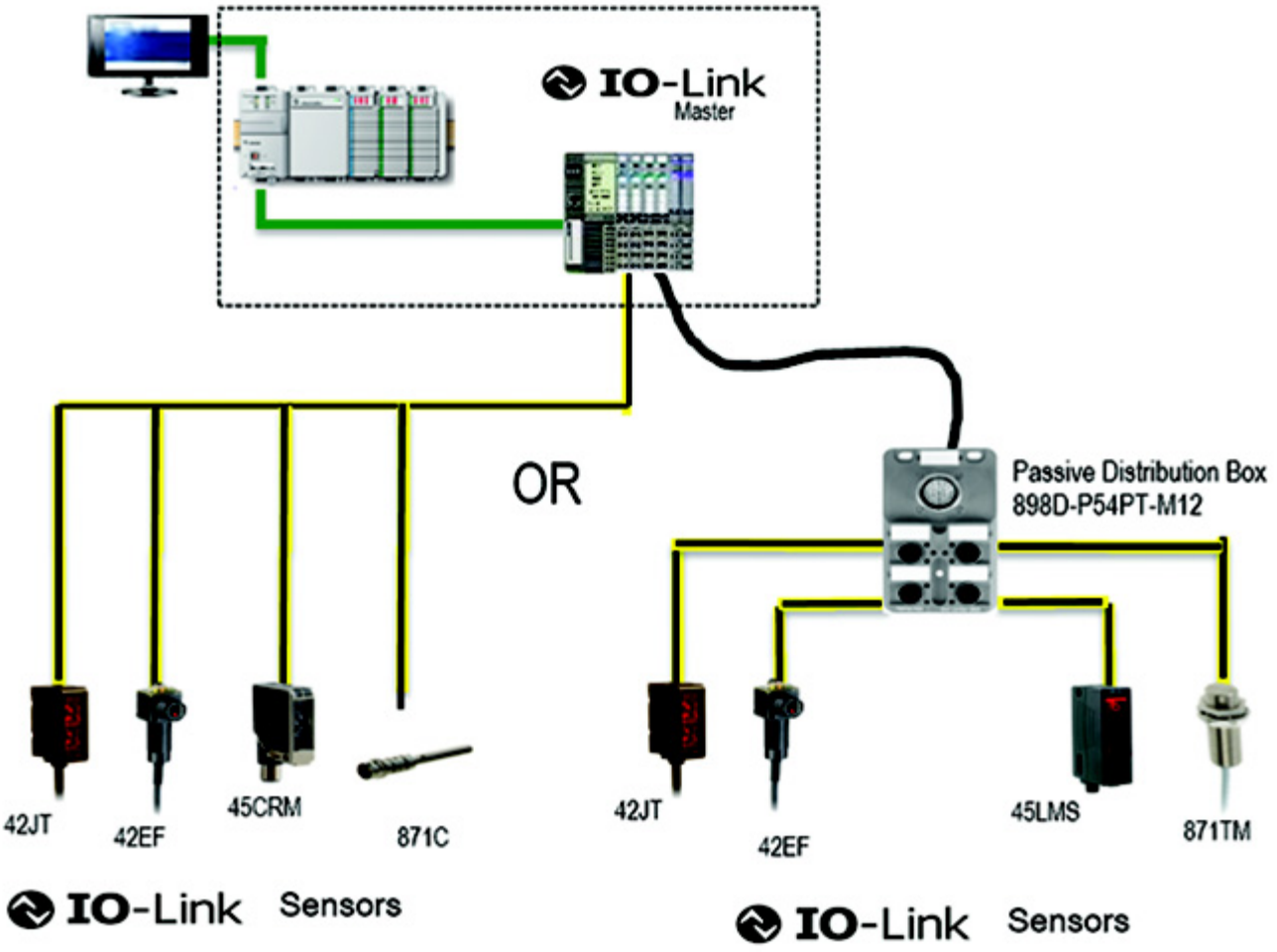
The IODD consists of multiple data files; the main file and several optional language files are in XML-format and graphic files are in PNG format (portable network graphics). These files adhere to the IO-Link open standard, which means that they can be used with any IO-Link masters.

IODD files are assigned using Studio 5000 and the 1734-4IOL Add-on Profile (when using the 1734-4IOL IO-Link master module).

Rockwell Automation Solution

Overview and Benefits

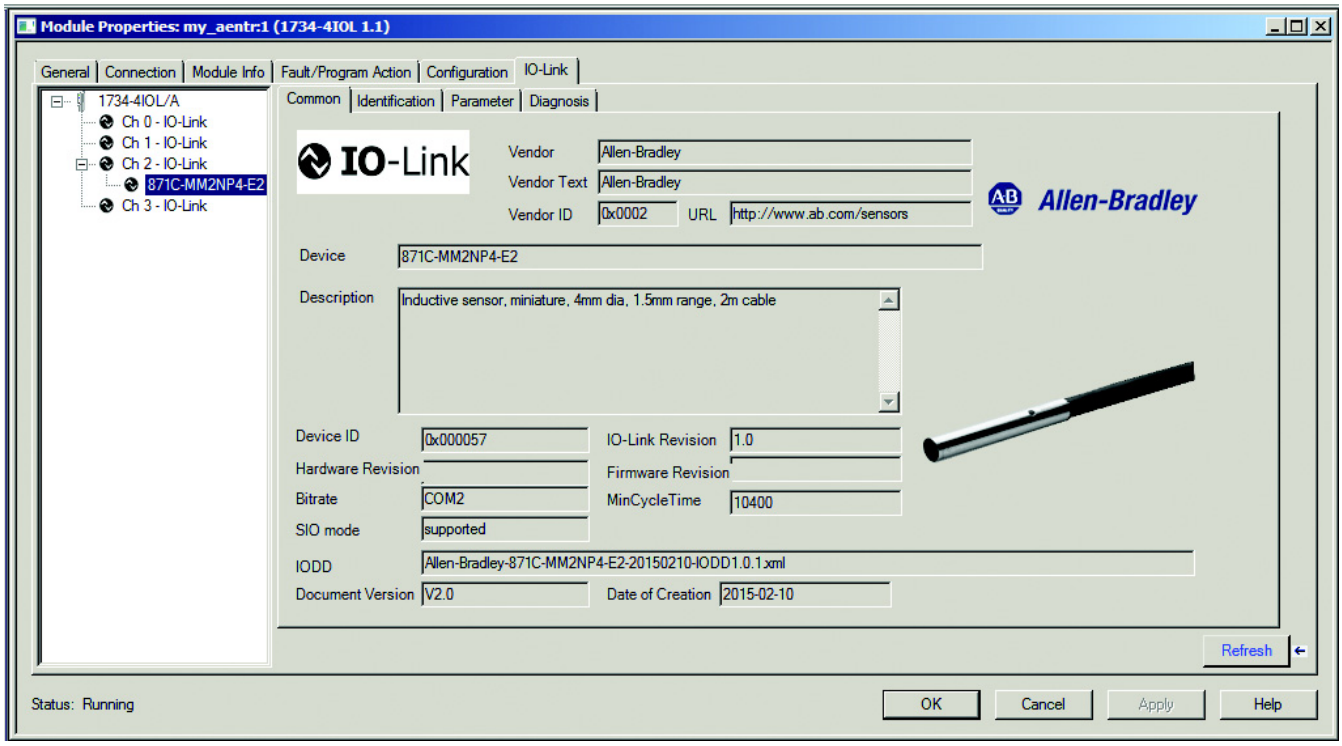
Rockwell Automation is the only supplier who provides every piece of the Connected Enterprise solution from top to bottom. Plus, exclusive features, and Premier Integration between Allen-Bradley® components and an Integrated Architecture system allow for a seamless connection and commission of control components. Empowering the ability to reap the benefits of an IO-Link solution with access to more detailed and customized plant-floor information than other solutions can offer.



Premier Integration

The Studio 5000 Logix Designer™ environment combines design and engineering elements in one interface, enabling users to access IO and configuration data across the Integrated Architecture system. A Rockwell Automation solution, provides a smooth, consistent integration of Allen-Bradley IO-Link enabled devices into the system.

To simplify the integration of the Rockwell Automation IO-Link devices to the Rockwell Automation architecture, there is an IO-Link Add-on Profile (AOP) available for the 1734-4IOL master module. The use of an AOP simplifies the setup of devices by providing the necessary fields in an organized manner that allows users to set-up and configure their systems in a quick and efficient manner.



871C IO-Link Features

These features are available in the 871C:

Triggered: Is the process data bit that communicates the change in state of the 871C upon the detection of a target. The status of the triggered bit can be viewed in a Studio 5000 controller tag.

Polarity: Changes the operation of the triggered parameter. It performs the same function as normally open or normally closed in standard I/O (SIO) mode.

Margin Status: Is the process data bit that communicates the target is within or beyond 80% of the maximum sensing range of the sensor. The margin status bit can be viewed in a Studio 5000 controller tag.

Switching Timer Mode: Ability to manipulate the output of the sensor in relation to timing. It is useful for precision applications where the output must be precisely triggered at a certain time.

Detection Counter: Counts when a target enters and leaves the sensing field of the 871C sensor. The detection counter uses a least significant bit and most significant bit for recording values.

Maximum Temperature: Provides maximum internal sensor temperature over the sensor lifetime.

Actual Temperature Since Startup: Live internal sensor temperature when read.

Automatic Device Configuration (ADC)

Replacing damaged sensors is easy. Simply remove the old Allen-Bradley sensor and connect the new sensor (with the same catalog number) —the controller will automatically send the configuration to the new sensor.

ADC capability within the sensor and controller enable flexibility and reliability in your application. When the sensor becomes damaged or fails and needs to be replaced, replace it with the exact same catalog number of the existing sensor. When the damaged sensor is removed and the new sensor is plugged in, the existing configuration is automatically stored in the sensor through the IO-Link Master. No additional steps are required on the sensor or in the controller. No personal computer is required and reteaching the sensor is not required.

Tag Naming for I/O Data: Rockwell Automation system solutions provide tag names that are based on the Allen-Bradley sensor connected. I/O data is converted, formatted, and named based on the Allen-Bradley sensor applied. Reduces commissioning time by the OEM and reduces troubleshooting time by the end user when searching for sensor data. Consistent naming techniques used.

Scope: kg_project Show: All Tags

Name	Value	Force Mask	Style	Data Type	Description	Constant
Actual_Temp_Deg_C	32.13516		Float	REAL		
Actual_Temp_Deg_F	89.843285		Float	REAL		
Clear_Old_Data	0		Decimal	BOOL		
Clear_Sensor_Config	0		Decimal	BOOL		
Copy_Data	0		Decimal	BOOL		
Count_Reset	0		Decimal	SINT		
Count_Value	0		Decimal	SINT		
Current_Operating_Temp_Raw	112.0		Float	REAL		
Max_Operating_Temp_Raw	-85		Decimal	SINT		
Max_Tem_Real	171.0		Float	REAL		
Max_Temp_Dint	171		Decimal	DINT		
my_aentr:1:C	{...}	{...}		AB:1734_4IOL1:C:0		
my_aentr:1:I	{...}	{...}		AB:1734_4IOLEE...		
my_aentr:1:I.Fault	2#0000_000...		Binary	DINT		
my_aentr:1:I.Status	{...}	{...}		AB:1734_4IOL_St...		
my_aentr:1:I.Ch0DiagEvent	{...}	{...}		AB:1734_4IOL_St...		
my_aentr:1:I.Ch1DiagEvent	{...}	{...}		AB:1734_4IOL_St...		
my_aentr:1:I.Ch2DiagEvent	{...}	{...}		AB:1734_4IOL_St...		
my_aentr:1:I.Ch3DiagEvent	{...}	{...}		AB:1734_4IOL_St...		
my_aentr:1:I.Ch0Triggered	0		Decimal	BOOL		
my_aentr:1:I.Ch0MarginStatus	0		Decimal	BOOL		

The Triggered and Margin Status as shown above are examples of consistent tag names used across all Allen-Bradley sensors. These tag names give insightful and descriptive meaning to the operation of the sensor output. The tags may change depending on the type of sensor being used and the functionality within the sensor.

Chapter 4

Setting up the 871C for IO-Link Mode

This chapter shows the physical hardware and software that is required to configure the 871C through IO-Link and provides a simple guide to setting up the hardware.

Products required:

Hardware

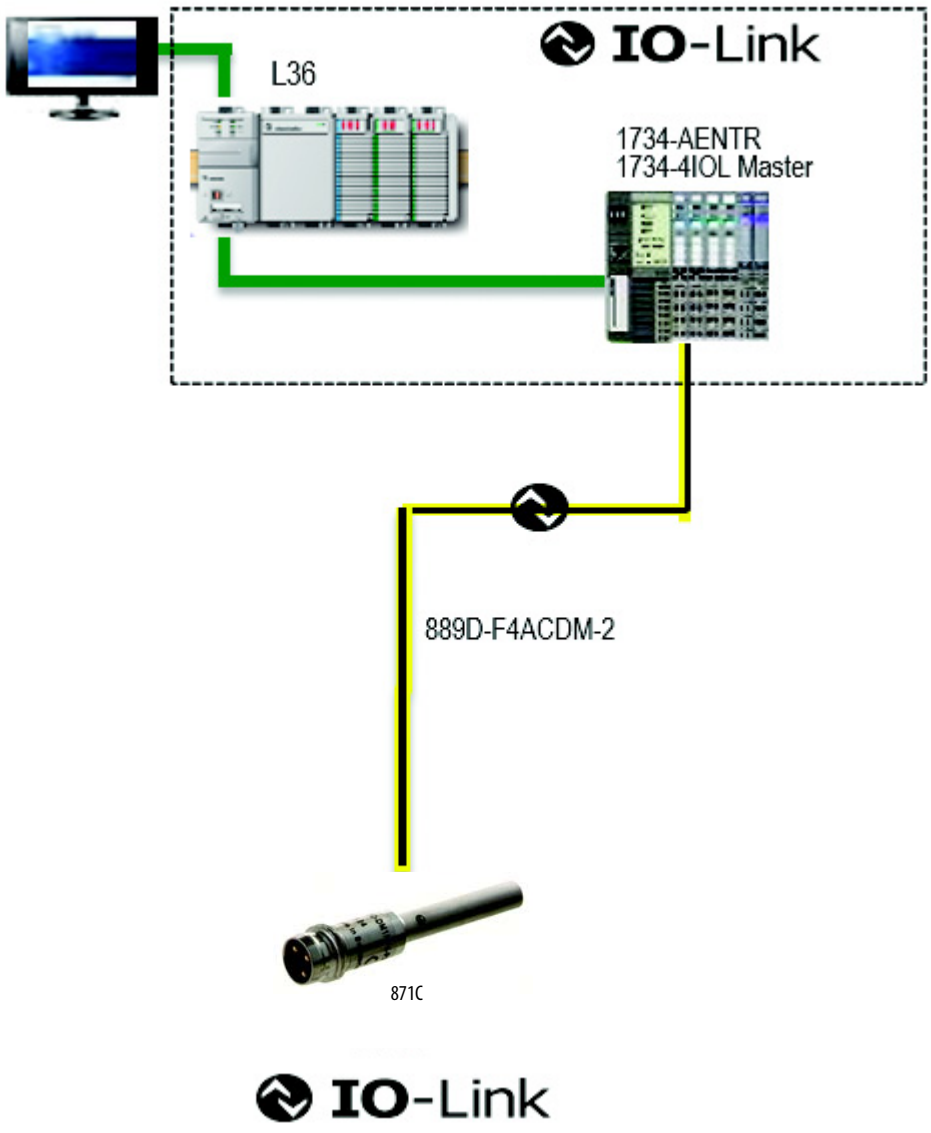
- 871C-* (compatible parts are normally open, PNP)
- CompactLogix or ControlLogix PLC Platform
- POINT I/O Communications Interface: 1734-AENTR
- POINT I/O IO-Link Master Module: 1734-4IOL
- POINT I/O Terminal Base: 1734-TB
- RJ45 network cable for EtherNet/IP connectivity: 1585J-M8TBJM-1M9*
- 889P cordsets (optional): 889P-F3AB-2 (IO-Link maximum acceptable cable length is 20 m)

Software:

- Studio 5000 environments, version 20 and higher
- Sensor specific IODD
- 1734-4IOL IO-Link Add-on Profile (AOP)

Example: Setting Up the Hardware

In this example, we are showing an Allen-Bradley POINT I/O chassis with a 1734-AENTR adapter module and a 1734-4IOL IO-Link master module in the first slot. The 1734-AENTR is communicating with a CompactLogix controller via EtherNet/IP.



When adding a 871C to the 1734-4IOL master module, complete the following steps:

1. Provide power to the 1734-AENTR adapter.
2. Set the node address on 1734-AENTR adapter.
3. Connect the 1734-AENTR to the Allen-Bradley controller with the recommended RJ45 Ethernet cable.
4. Wire the sensor cable to the desired location on the IO-Link master (in this example, we are showing the sensor that is wired to the channel 0).

5. Connect the 871C to the other end of the sensor cable.

6. After connecting the sensor, you will need to create/open a project in Studio 5000 to establish communication with the Allen-Bradley controller that is being used and to add the 1734-AENTR adapter and 1734-4IOL IO-Link master module to the Controller Organizer Tree (see Chapters 6 and 7 for detailed instructions).

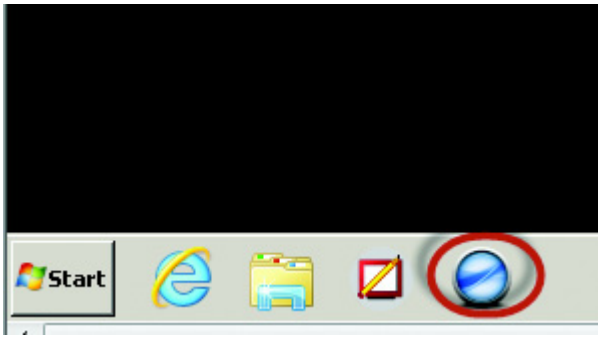
Chapter 5

Creating a Project

To begin a new project in Studio 5000, follow these steps.

If there's an existing project within Studio 5000 with CompactLogix or ControlLogix hardware that is installed and communicating online, go directly to Chapter 7 "Configuring the IO-Link Master."

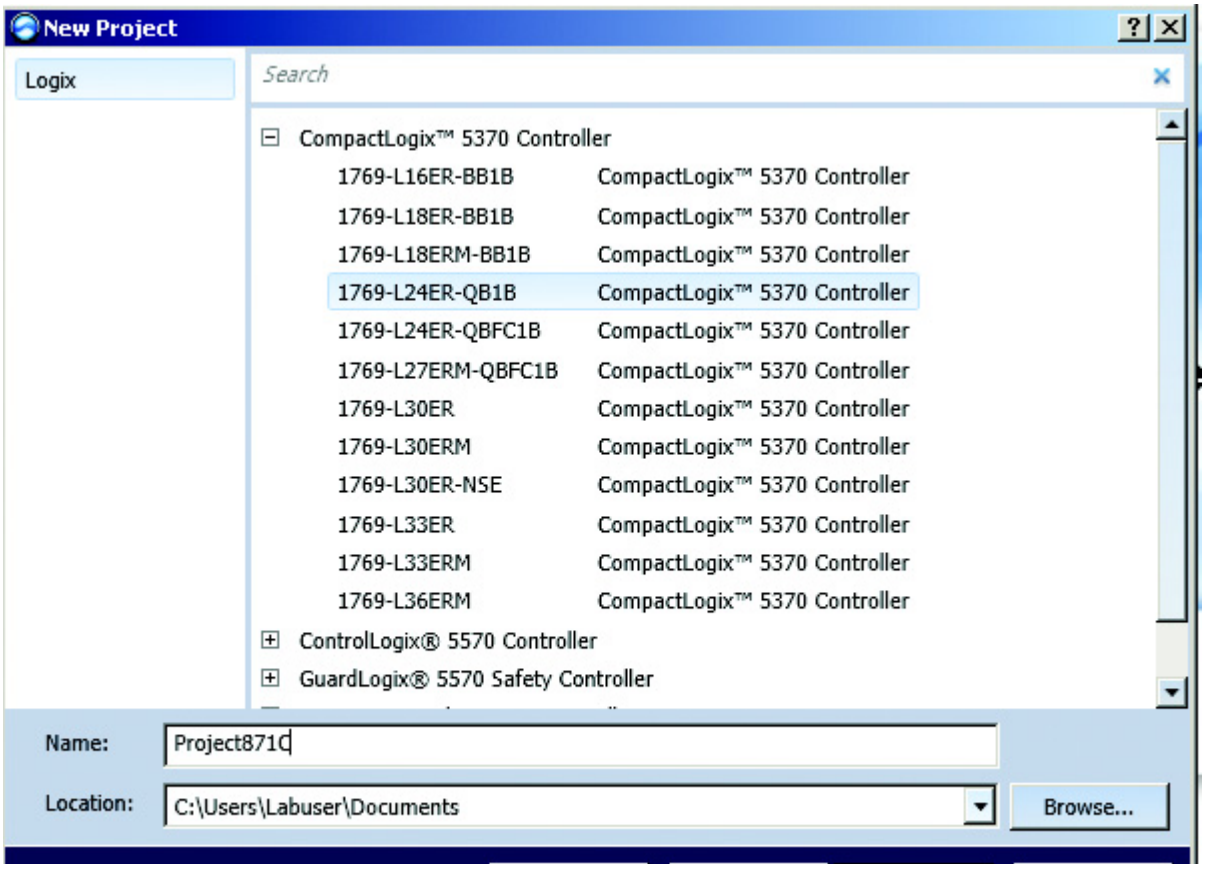
1. Double-click the Studio 5000 icon.



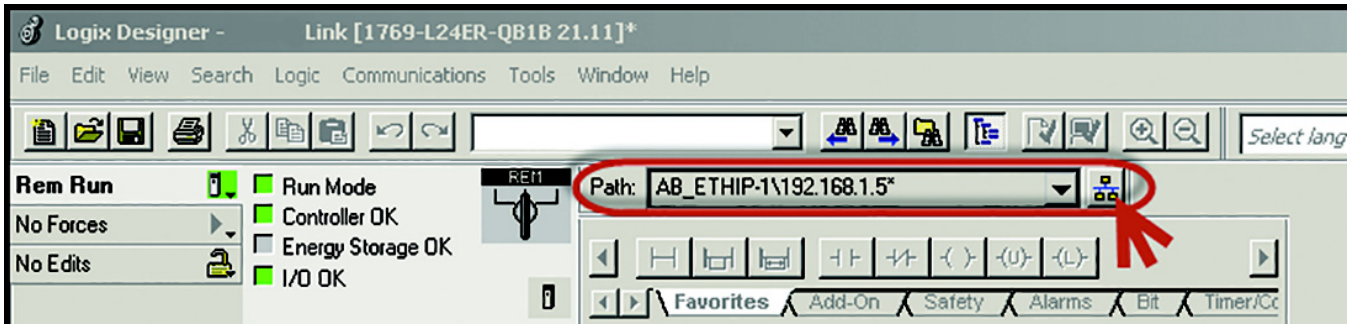
2. Click New Project.

3. To program the controller, select the controller that is used. In this example, it is the "1769 L24ER" CompactLogix.

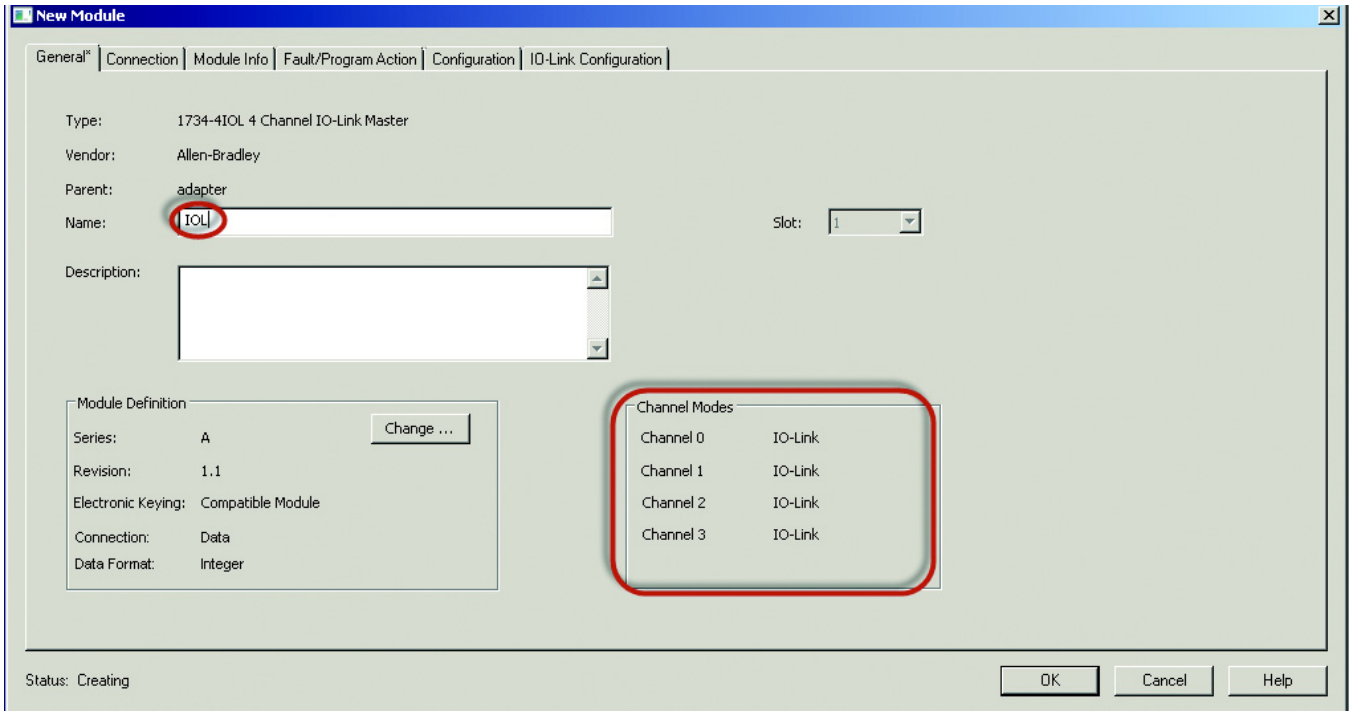
4. After selecting the controller, name the project, and click “Next.” In this example, the project name is “Project871C.”



5. Once the project opens up, set-up the IP address of the controller to help ensure communication. To set the IP address, click the browsing icon.



6. Select the controller that is being used for the project. In this example, we are using a 1769-L24ER-QB1B CompactLogix.



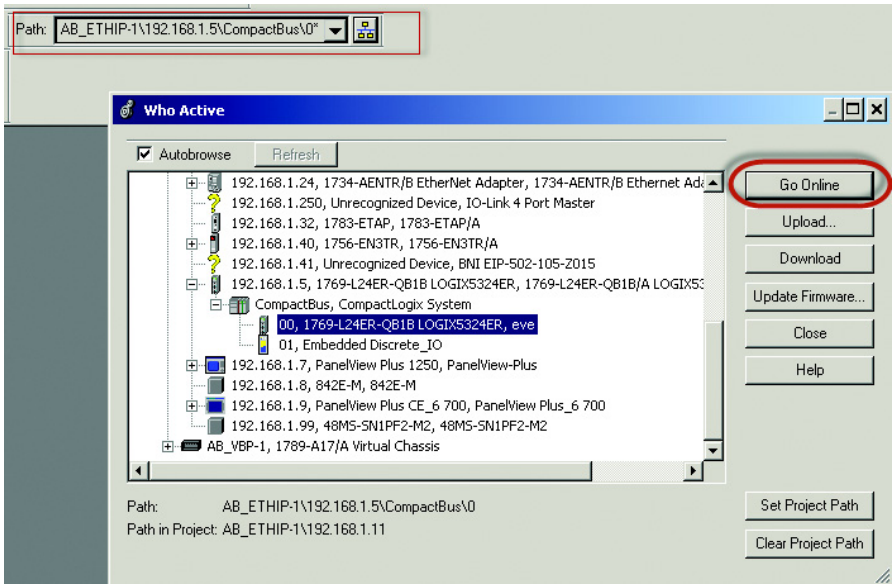
7. Click “Go Online” to start communicating.

The next step is to configure the IO-Link Master.

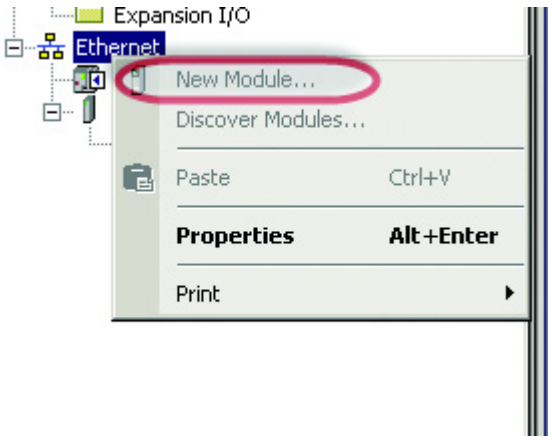
Chapter 6

Configuring the IO-Link Master

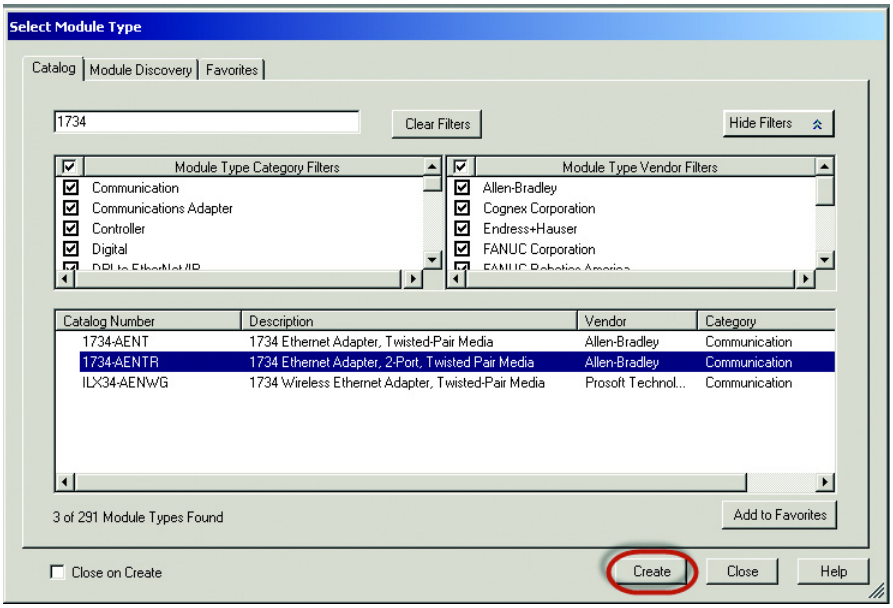
1. Make sure that the controller is offline to configure the IO-Link Master.



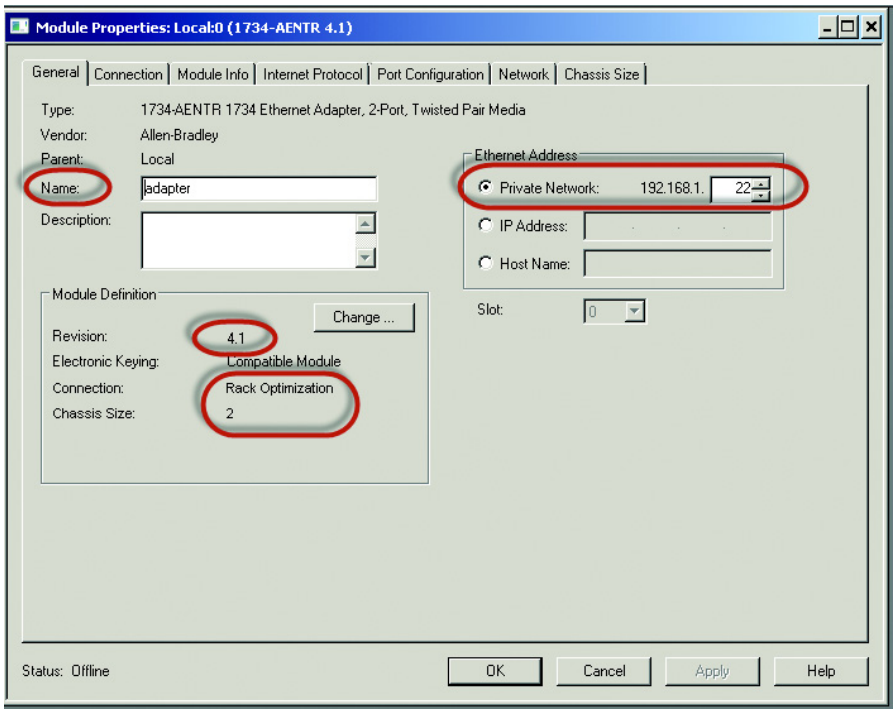
2. In the controller organizer tree, find Ethernet under I/O Configuration and right-click to “add new module.”



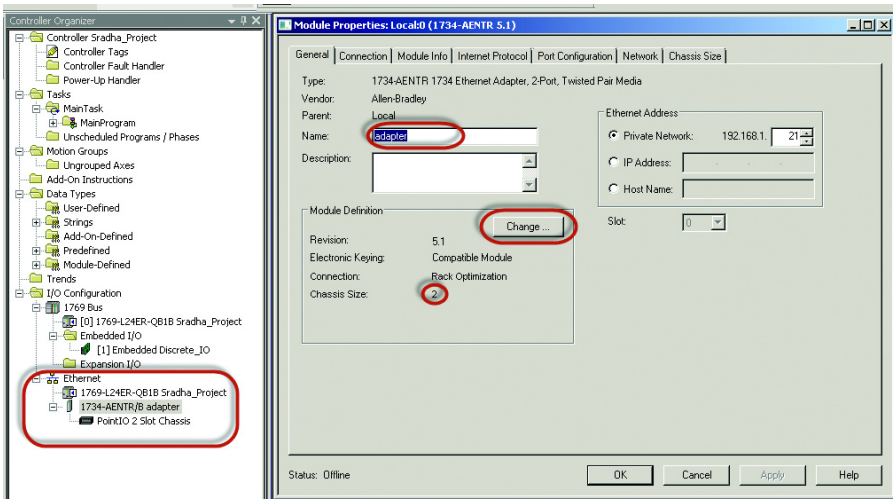
3. The module window pops up and shows the available modules. Select the "1734-AENTR, 1734 Ethernet adapter, two-port, twisted-pair media" and click Create.



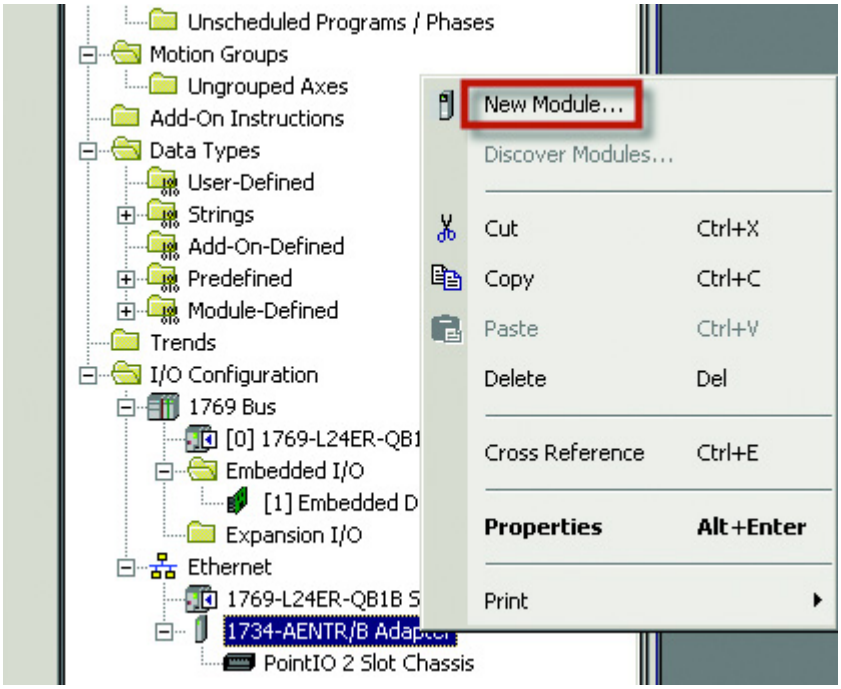
4. Name the Ethernet adapter (in this example our adapter name is "adapter"), set the chassis size, check the module revision and set-up the adapter IP address. Click OK and then Close.



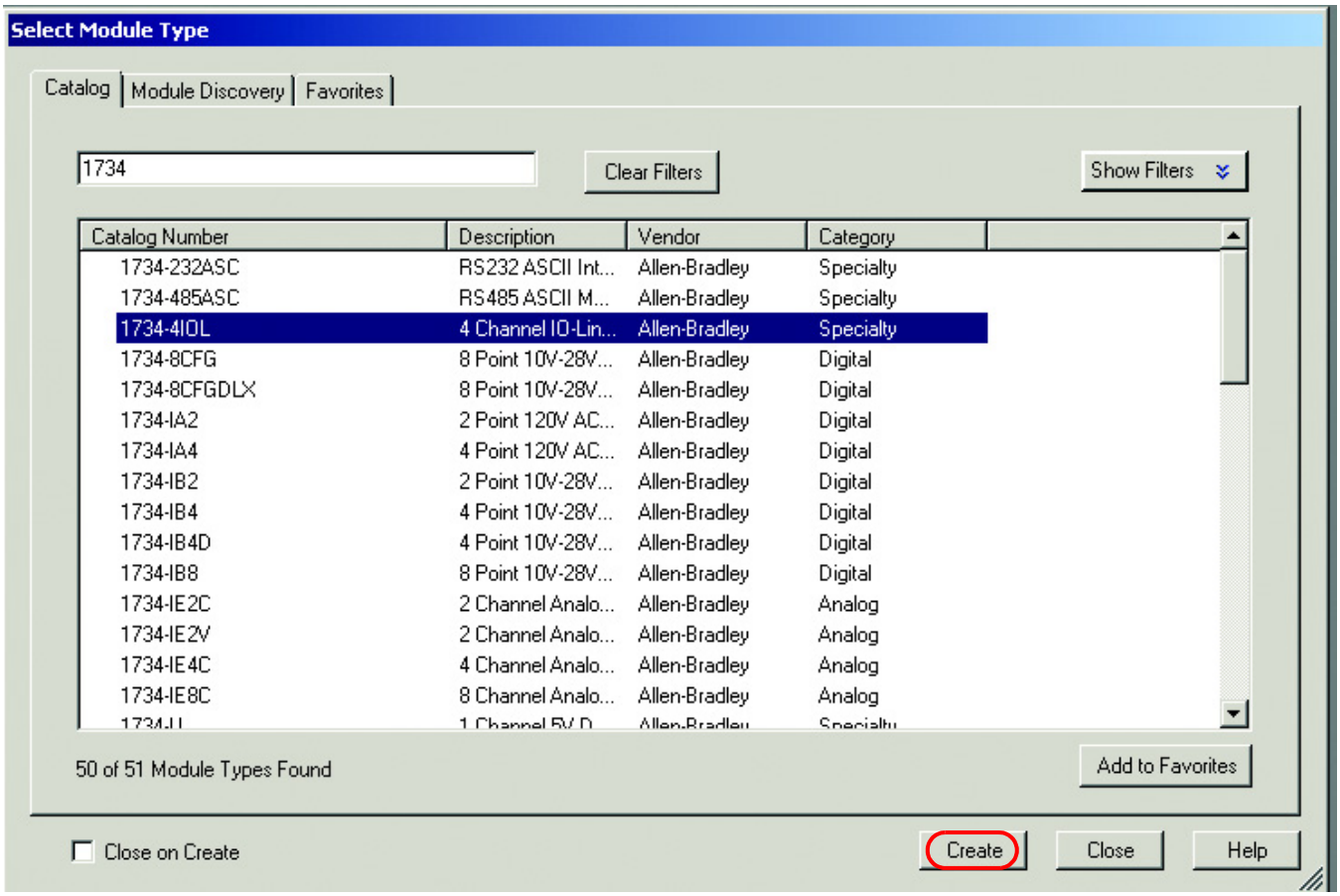
5. The 1734 AENTR now appears in the Controller Organizer tree.



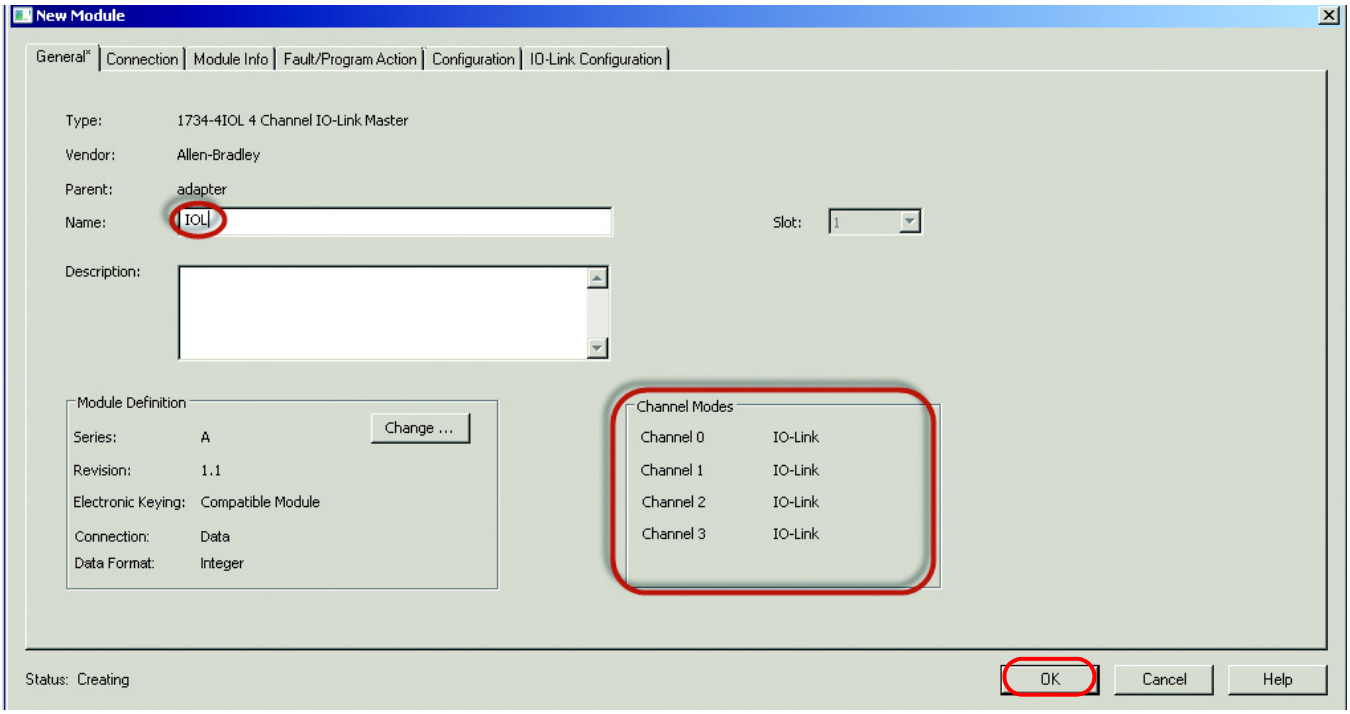
6. Right-click on 1734-AENTR adapter, and then select “New Module.”



7. Select “1734-4IOL” and click Create.



8. Another screen appears which displays the IO-Link Configuration screen.
9. Name the IO-Link Master and click OK.

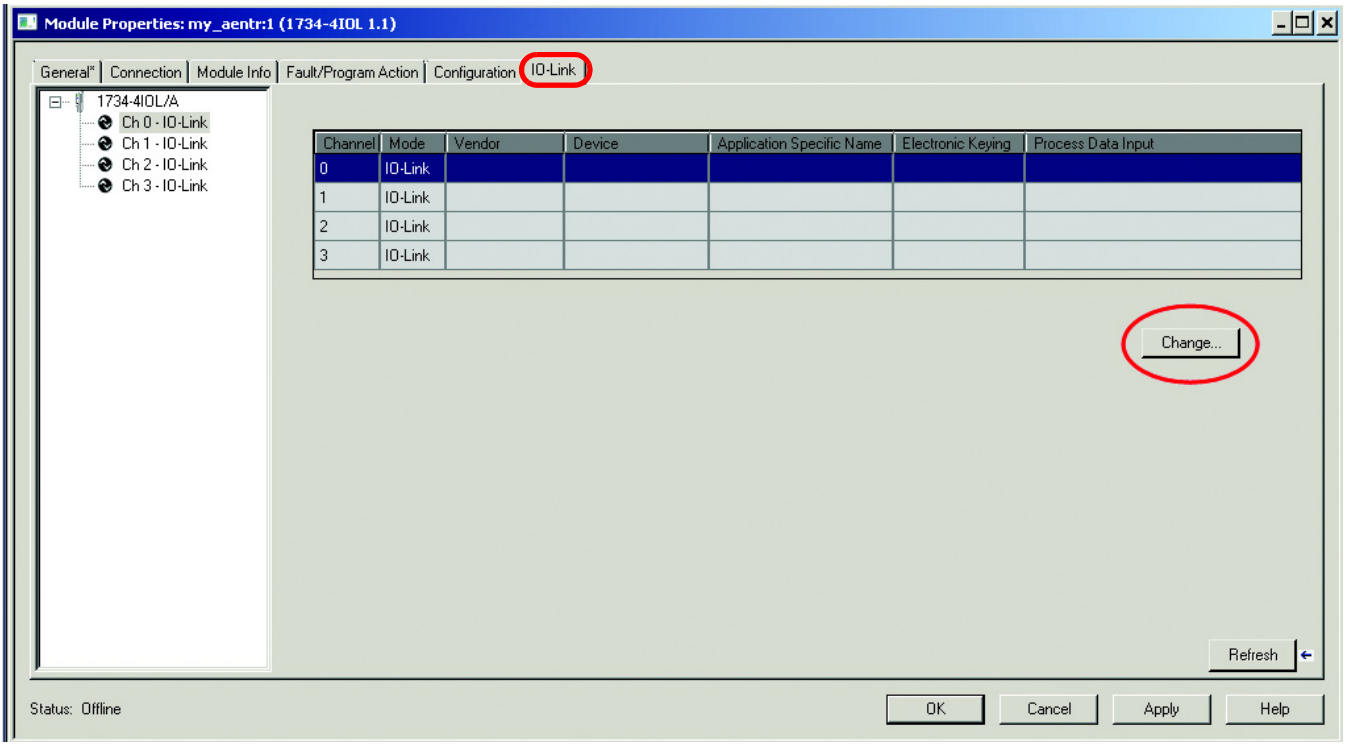


Chapter 7

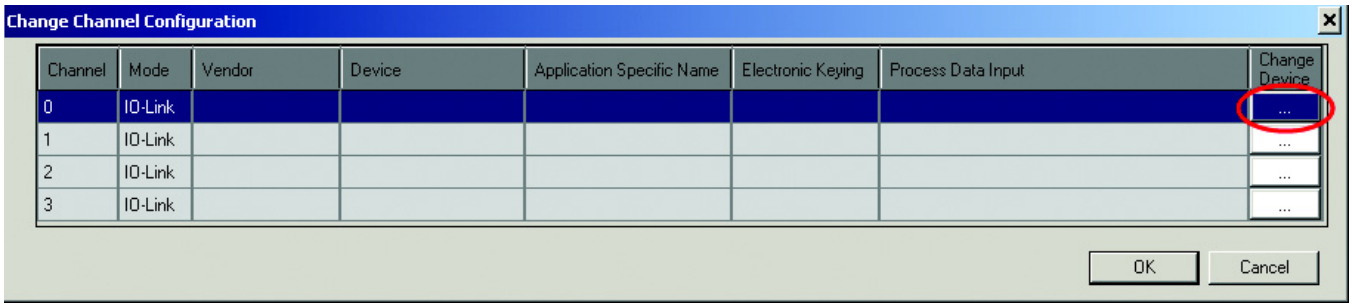
Connecting the 871C to the IO-Link Master

Once the IO-Link master is configured, connected the sensor to the IO-Link master. Take the controller off-line to add a device to the IO-Link master.

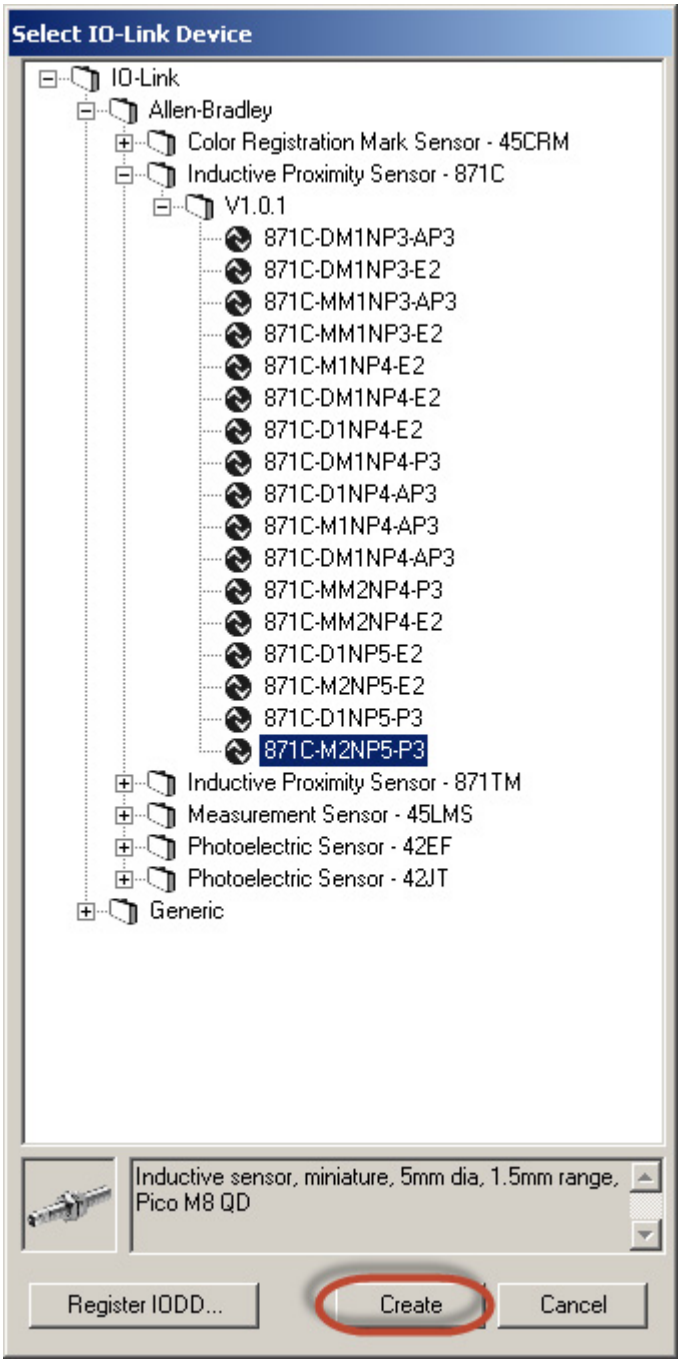
1. Go to the IO-Link tab and click “Change.”



2. Next click in the "Change Device" column for the IO-Link channel number the sensor will be added to.



3. A window containing a library of all the sensors that are currently registered in the IO-Link Device Library appears. Select the appropriate sensor and click "Create." (If the sensor does not appear in the library, go to Chapter 9 to learn how to Register the IODD.)



4. The sensor is now in the channel configuration window.

You can change the Application Specific Name, Electronic Keying, and Process Data Input configuration while the project is in the offline mode.

IMPORTANT The 871C IO-Link does not support Application Specific Name or Process Data Input configuration.

Modify the information:

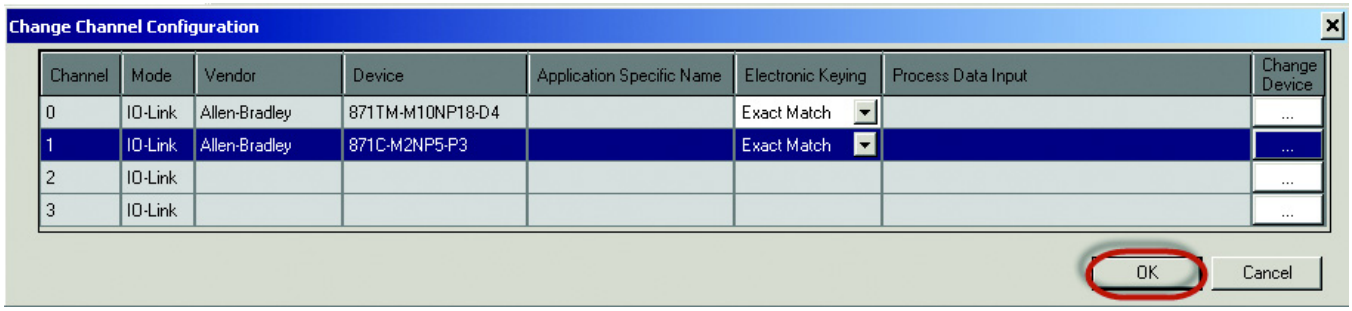
Application Specific Name (ASN): The purpose of the Application Specific Name is to add theme naming to distinguish the sensors within a machine and the associated project profile in the Add-on Profile. The ASN allows for easier maintenance and operation since the device is further identified by how it is used on the machine/project.

Electronic Keying Information: Select Exact Match or Disabled from the pull-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.

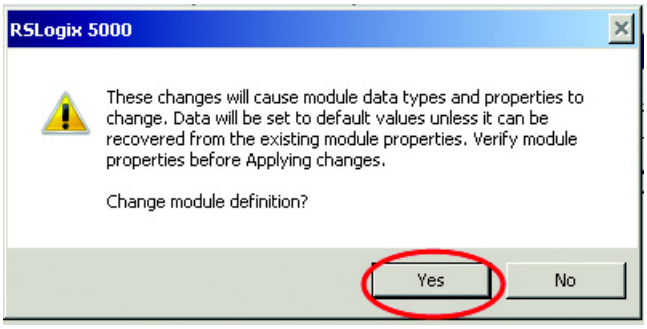
When Exact Match is selected, the connected IO-Link device must have the same Vendor ID, Device ID, and Revision information that has been configured for that channel. If they do not match, IO-Link communications are not established and a Keying Fault status bit is set. When Disabled is selected, key check is not performed.

Process Data Input: Select the input data from the pull-down menu (for devices that support multiple layouts of input data).

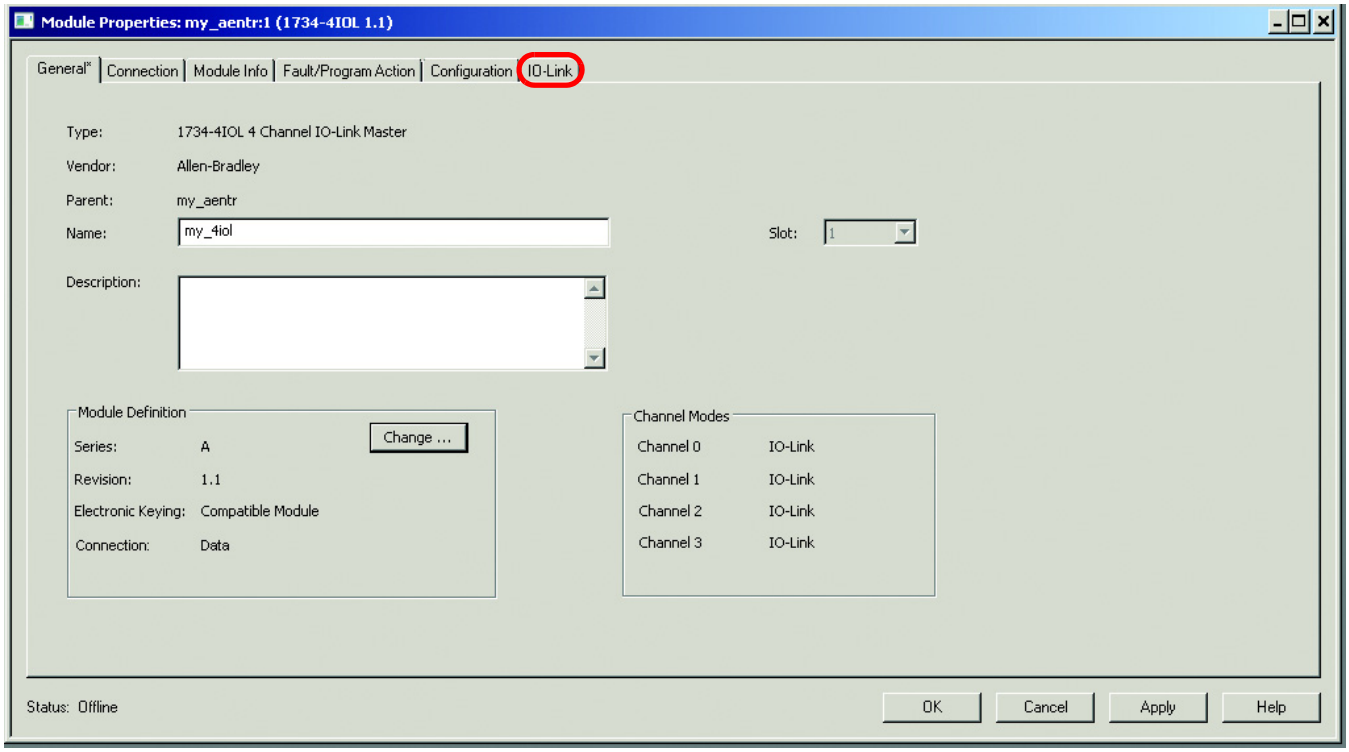
Click "OK."



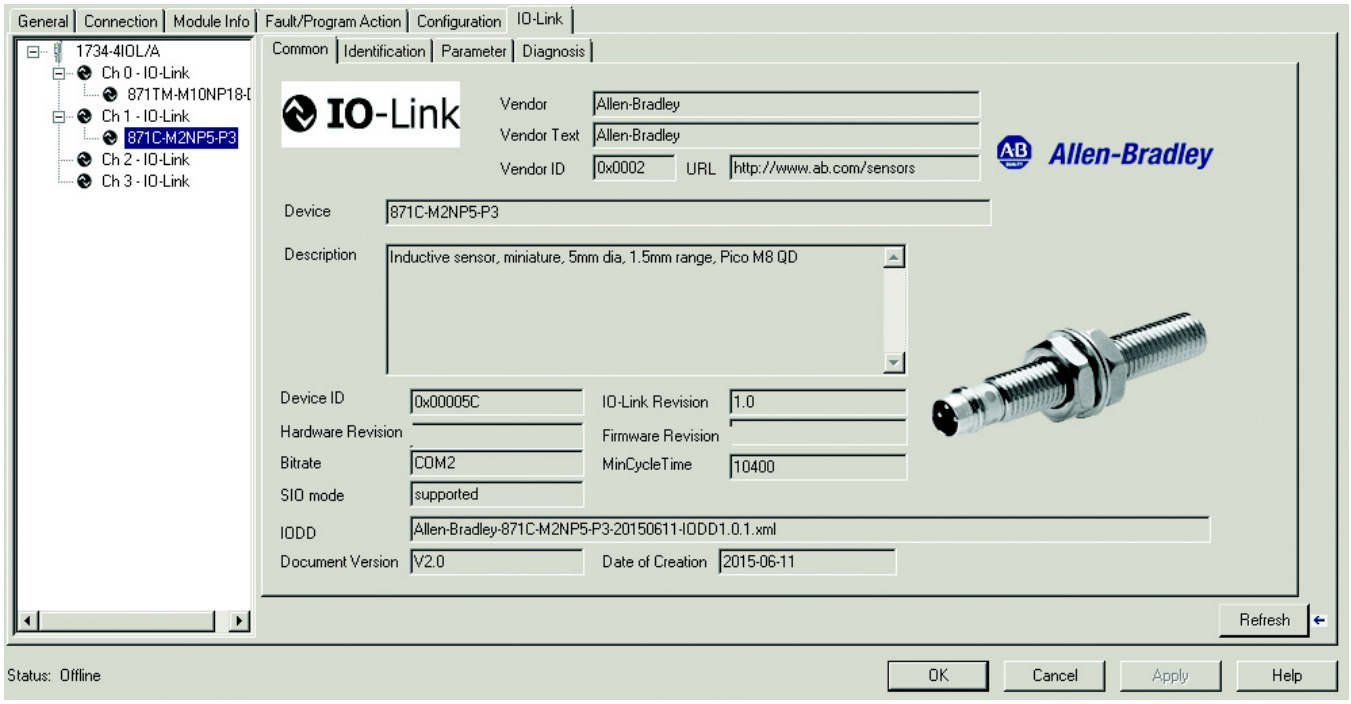
5. Next click "Yes" to confirm the sensor changes.



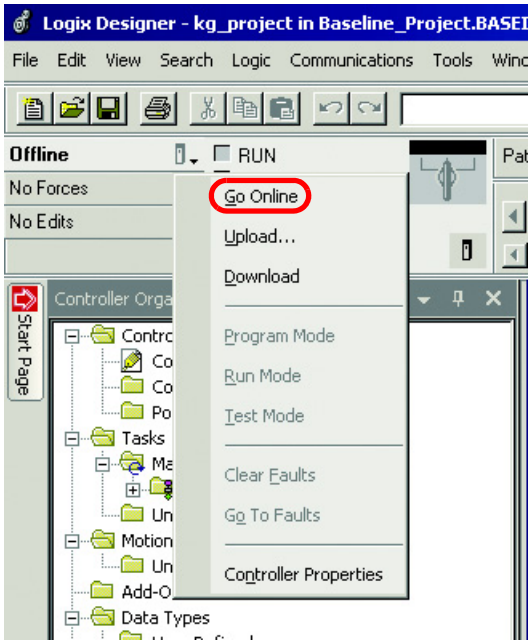
6. The module properties screen appears on the General Tab. Click the "IO-Link" tab.



7. Locate the sensor that you added in the organization tree and click it.



8. The sensor can now be configured through the Add-on Profile. Go online to communicate with the controller and sensor.



Proceed to Chapter 10 for a description of each tab that is associated with the 1734 AOP and a description of how the AOP can be used to configure the sensor.

Chapter 8

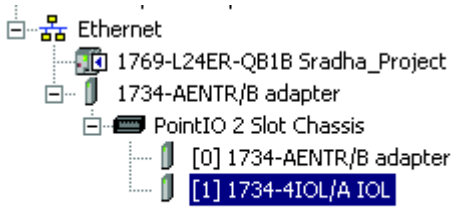
Registering the 871C IODD

If you are not able to locate the 871C in the IO-Link Sensor Library (as shown in the previous chapter), then you need to register the IODD of the sensor. By default, the IODDs are already located in the AOP, but as new products are released it is necessary to add products to the library.

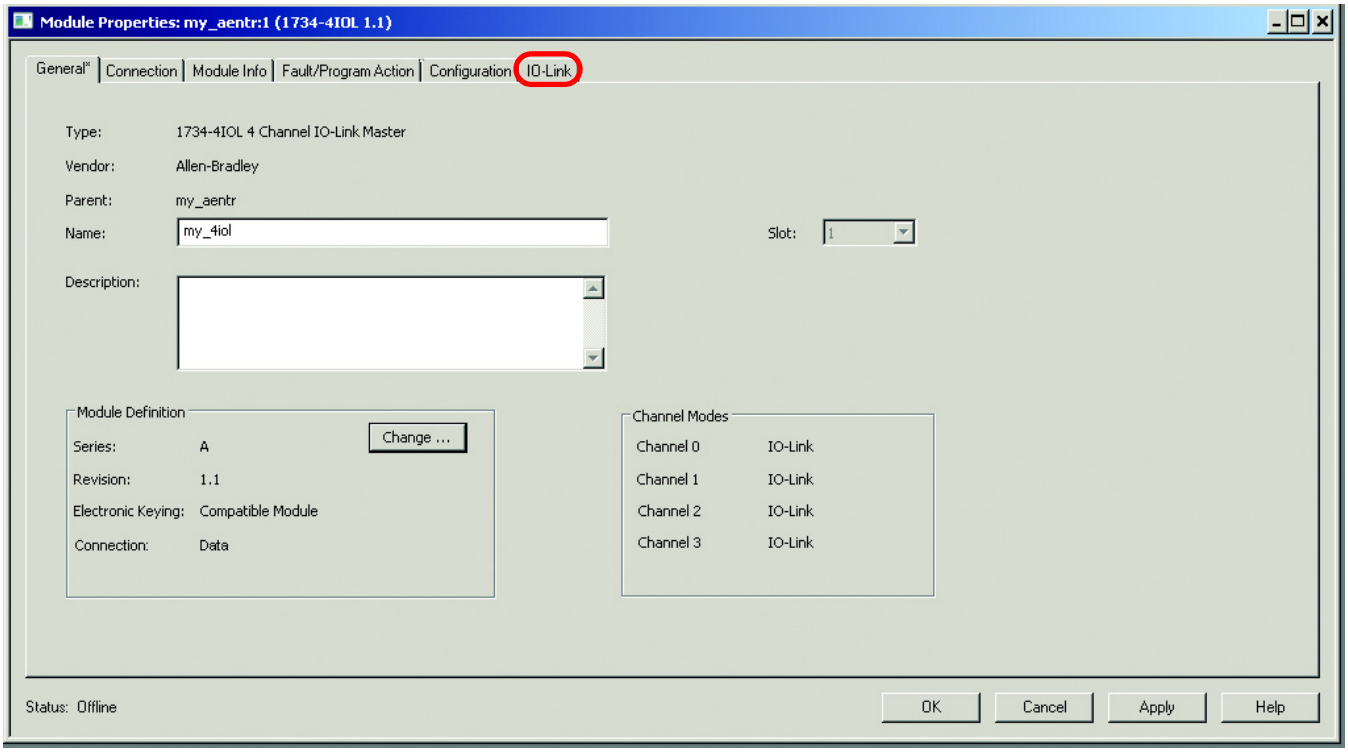
The IO Device Description (IODD) files contain the information that is related to the sensor, integrated into the system environment. To initialize a sensor on an IO-Link Master, registering the IODD of the sensor is required.

If the IODD file for the sensor cannot be located in the library, it can be downloaded from *http://ab.rockwellautomation.com*. Once the IODD is registered, there's no need to register the IODD again unless it is manually deleted from the Master Tree.

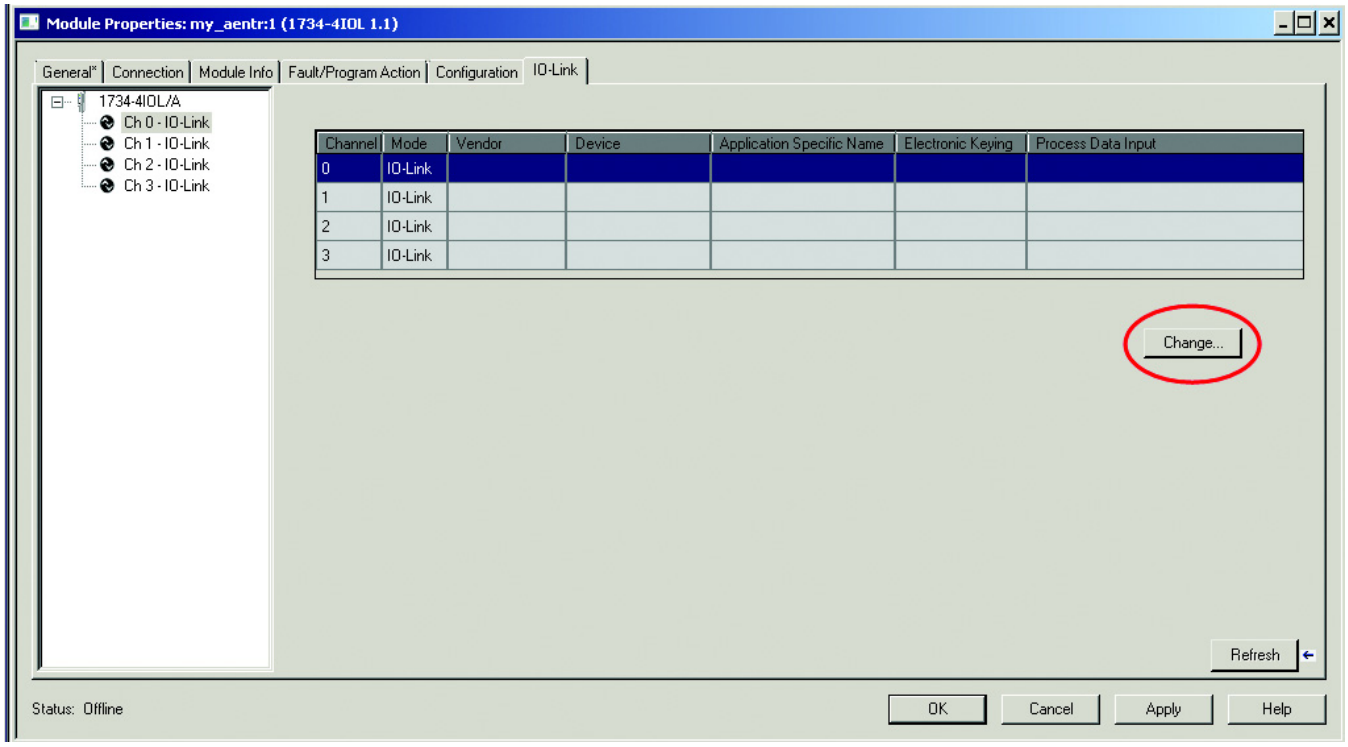
1. Double-click the "1734-4IOL" in the Controller Organizer Tree.



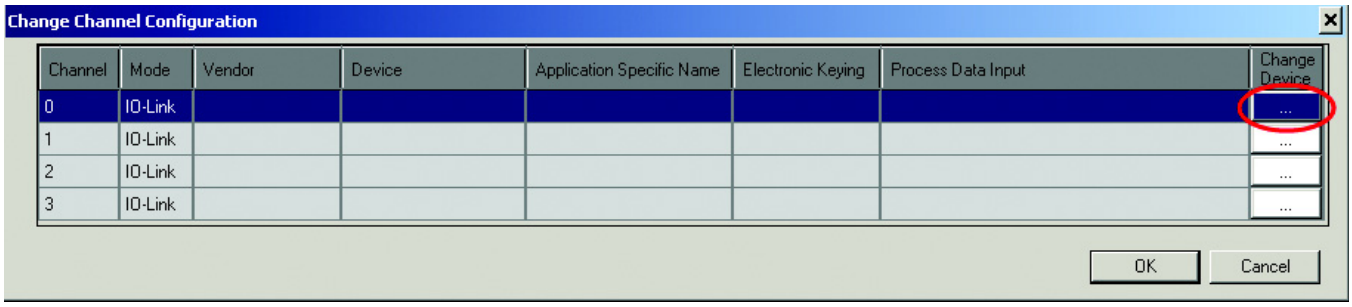
2. Select the IO-Link tab.



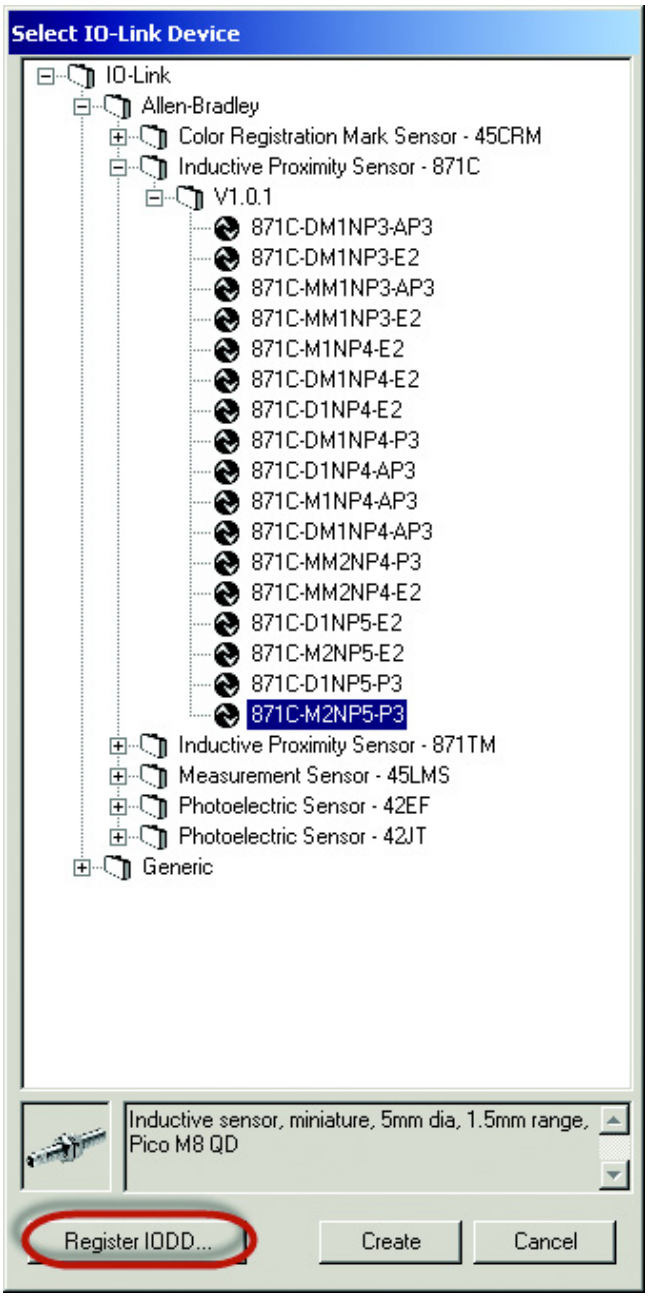
3. The IO-Link screen appears, click “Change.”



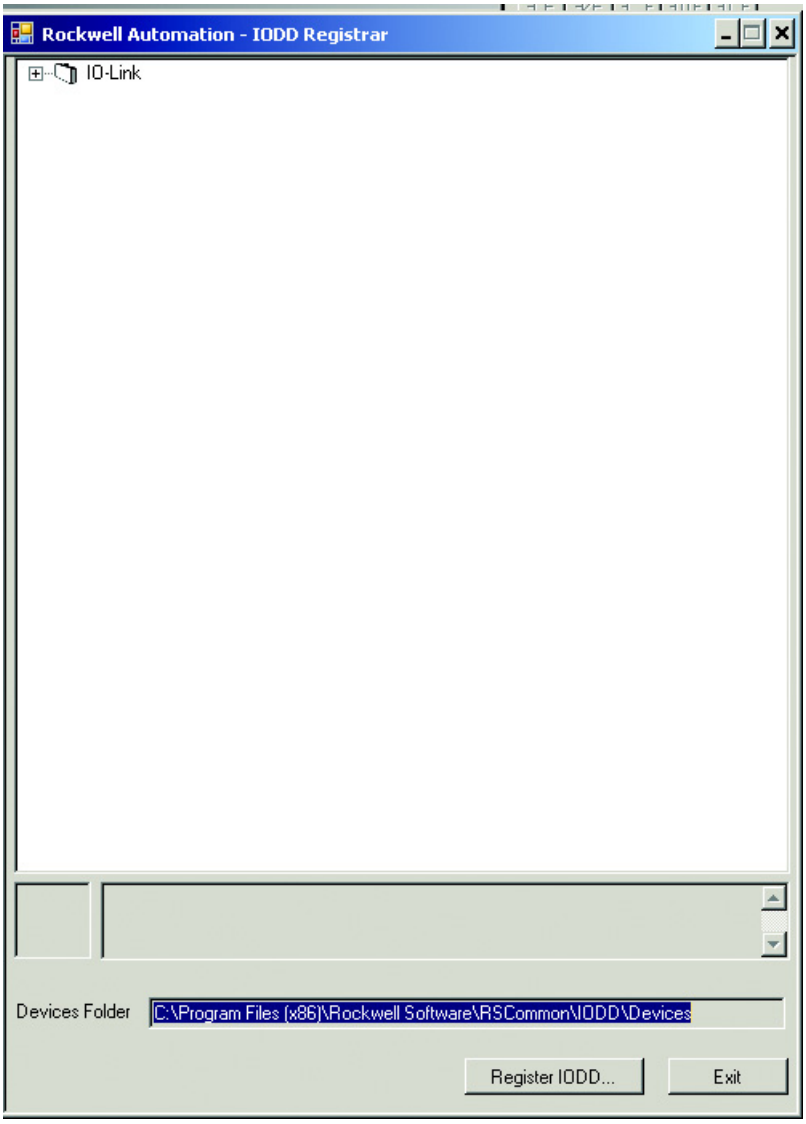
4. Next click in the “Change Device” column for the IO-Link channel number that the sensor is added to.



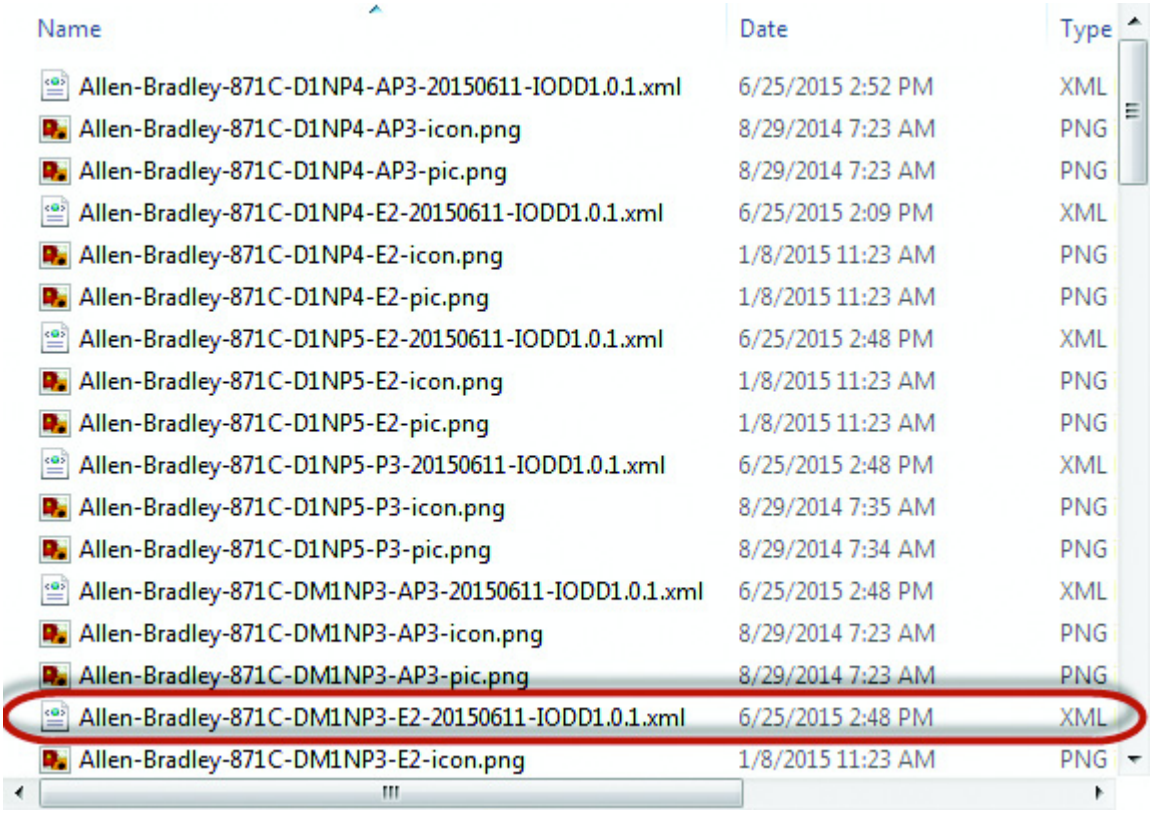
5. In the IO-Link Device Library window, select “Register IODD.”



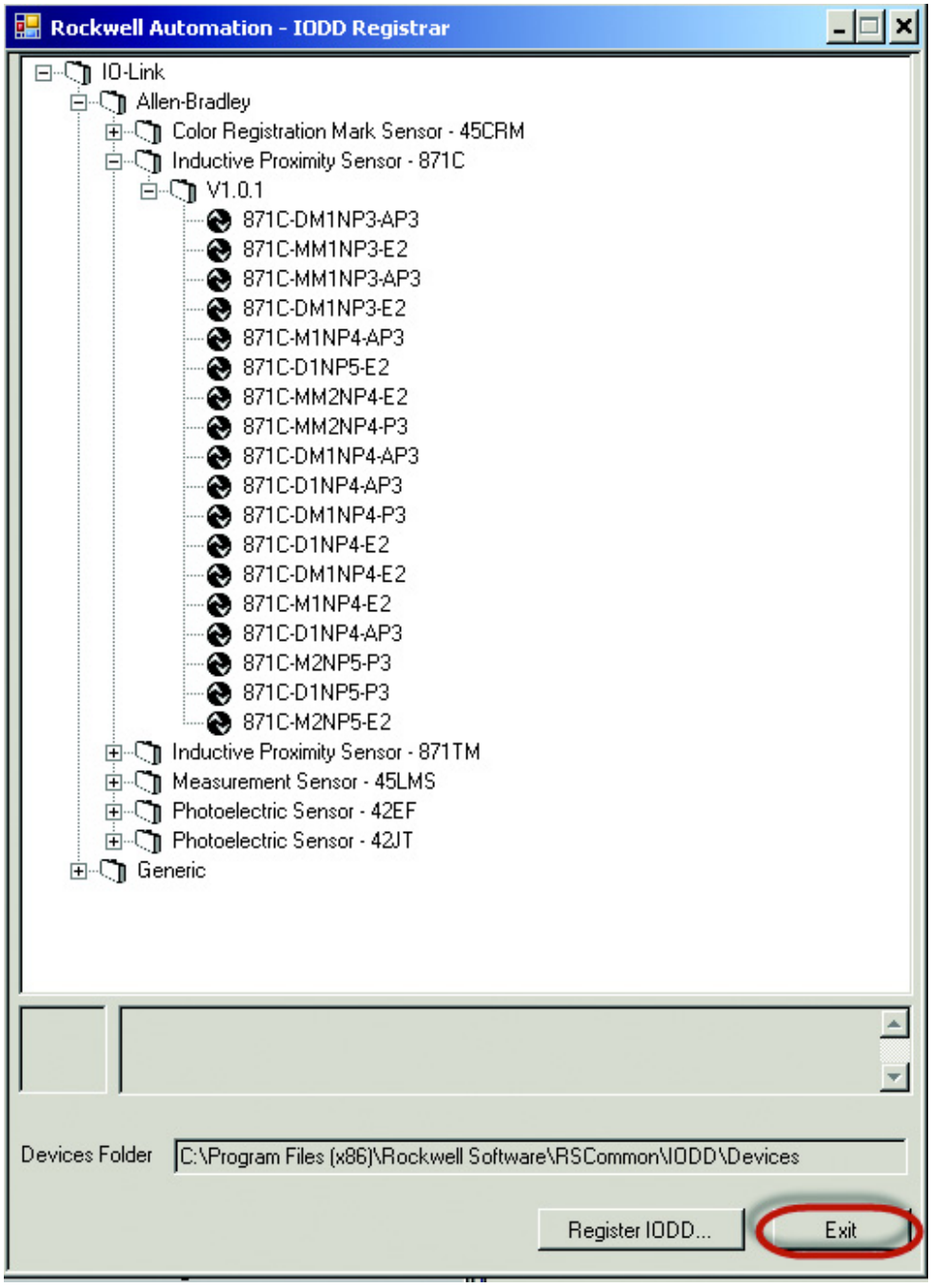
6. Click “Register IODD” in the following dialog box.



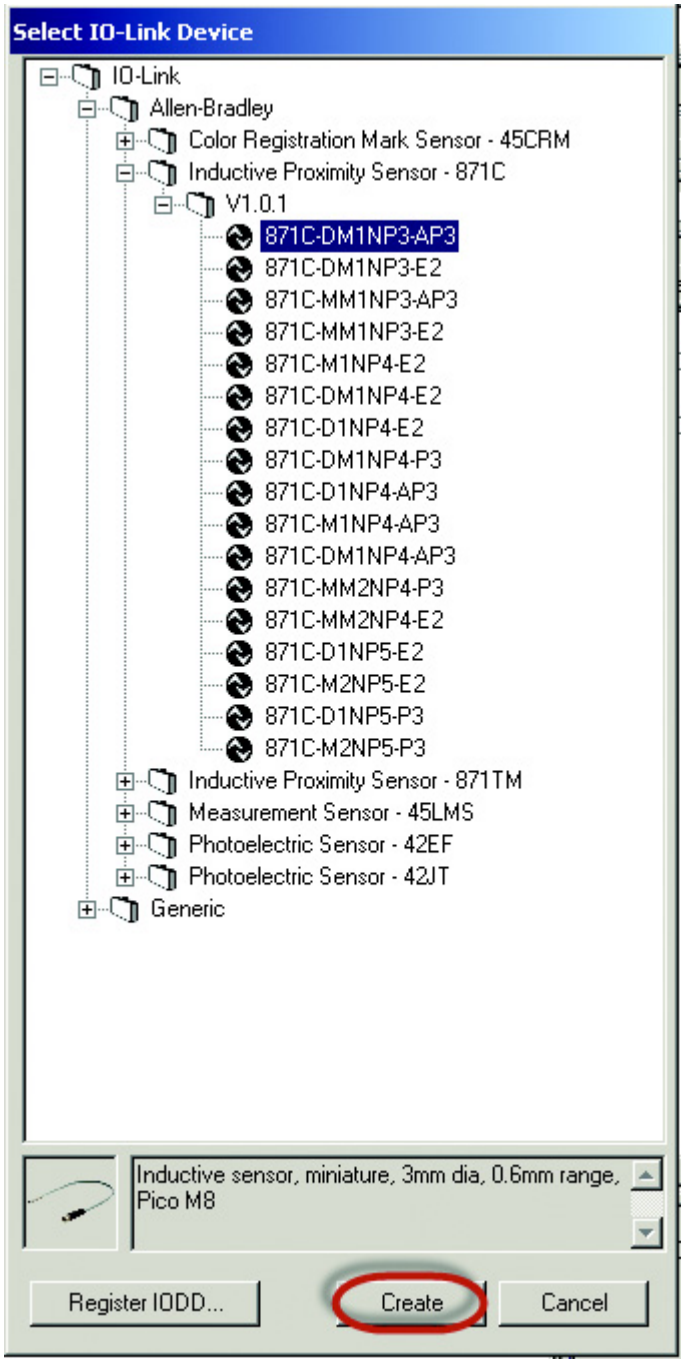
7. Locate the IODD XML file and double-click it. Then click “Open.”



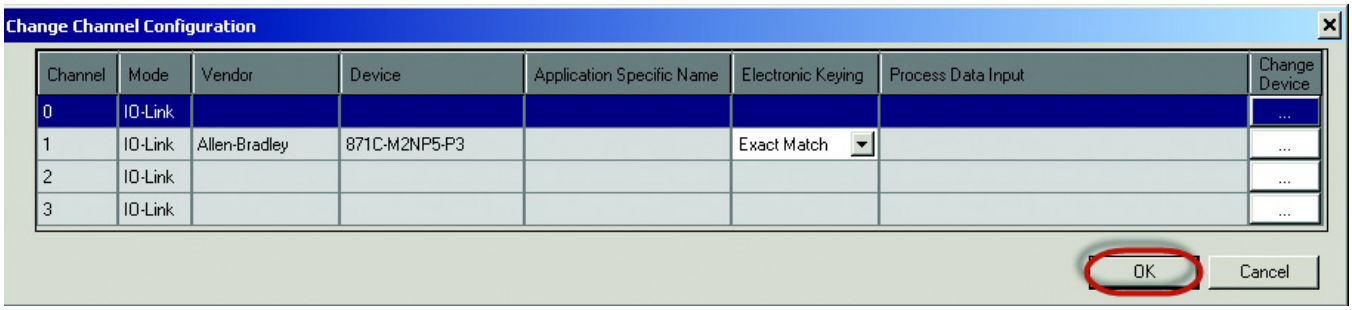
8. Then click “Exit.”



9. The 871C is now visible in the IO-Link Device Library. Select the appropriate sensor and click “Create.”



10. The sensor appears in the channel configuration window.



You can change the Application Specific Name, Electronic Keying, and Process Data Input configuration while the project is in the offline mode.

IMPORTANT The 871C IO-Link does not support Application Specific Name or Process Data Input configuration.

Modify the information:

Application Specific Name (ASN): The purpose of the Application Specific Name is to add theme naming to distinguish the sensors within a machine and the associated project profile in the Add-on Profile. The ASN allows for easier maintenance and operation since the device is further identified by how it is used on the machine/project.

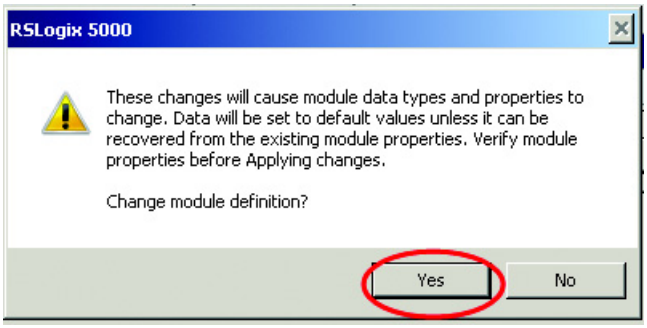
Electronic Keying Information: Select Exact Match or Disabled from the pull-down menu. The Exact Match and Disabled keying options in this dialog correspond to the Compatible and No Check keying options in IO-Link terminology, respectively.

When Exact Match is selected, the connected IO-Link device must have the same Vendor ID, Device ID, and Revision information that has been configured for that channel. If they do not match, IO-Link communications is not established and a Keying Fault status bit is set. When Disabled is selected, key check is not performed.

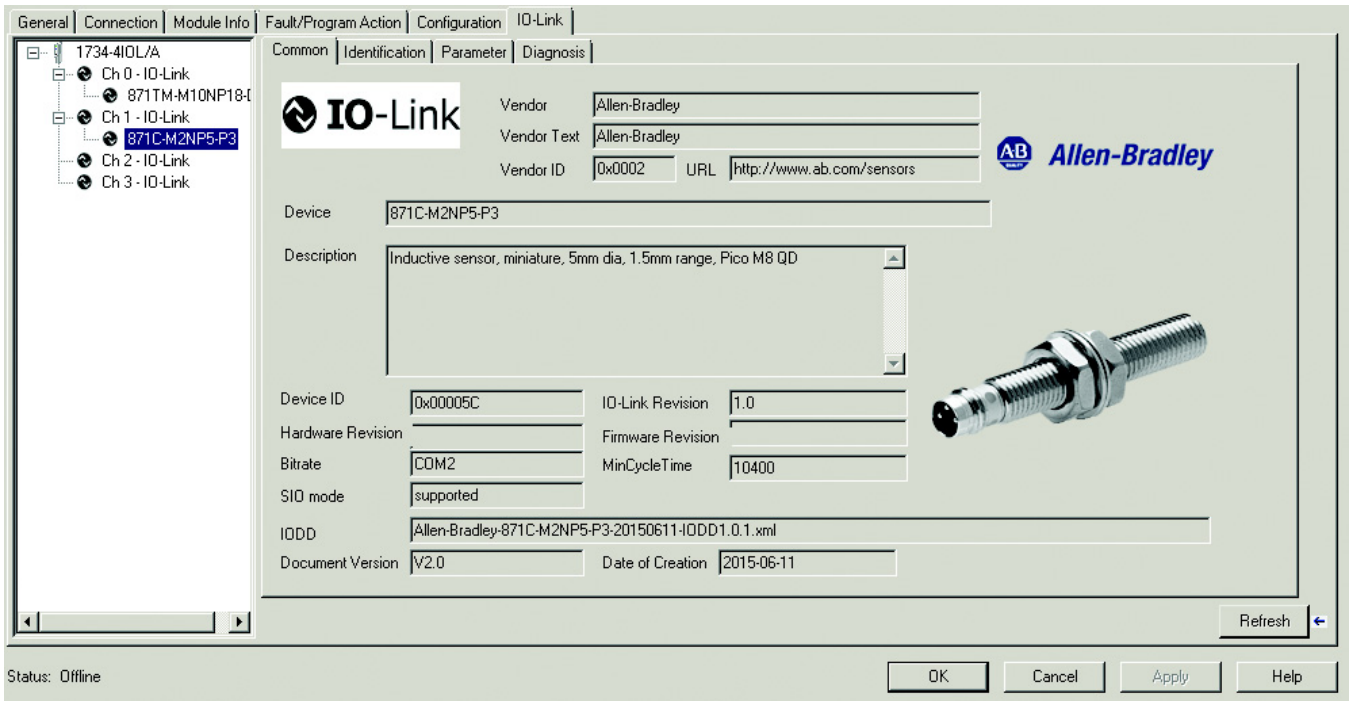
Process Data Input: Select the input data from the pull-down menu (for devices that support multiple layouts of input data).

Click “OK.”

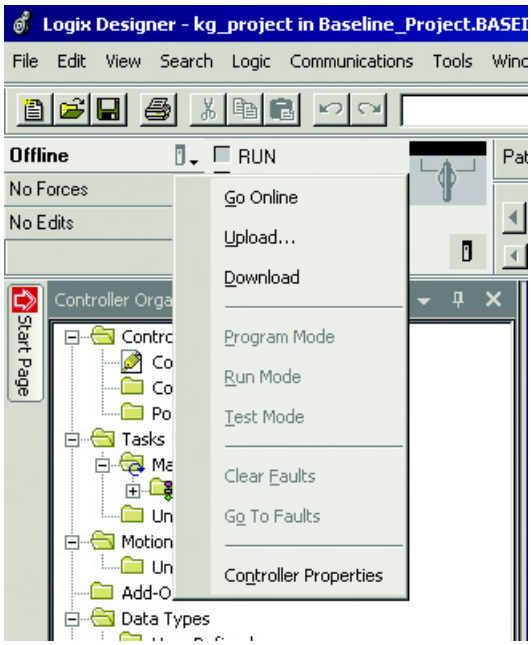
11. Next click “Yes” to confirm the sensor changes.



12. The module properties screen appears on the General Tab. Click the "IO-Link" tab and navigate to the sensor that was added. The sensor can now be programmed through the Add-on Profile.



13. Go online to communicate with the controller and sensor.



The IODD registration and connecting to the IO-Link master is complete.

Proceed to Chapter 9 for a description of each tab that is associated with the 1734 AOP and a description of how the AOP is used to configure the sensor.

Chapter 9

Reviewing the 1734-4IOL IO-Link AOP

Overview

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 whether the user is offline or online.

See Table 1 for more information:

Table 1 - 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" and "Apply" buttons are clicked.	Parameter values can be edited and changes made to the parameters are applied when the "OK" and "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 alter the Process Data are disabled. Other parameter buttons that are enabled, result in commands being sent to the connected IO-Link device.

The 1734-4IOL AOP offers four different tabs to describe the sensor functionality and operation. These tabs are:

Common Tab: Provides general product information about the sensor specifications and IO-link IODD information.

Identification Tab: Provides the sensor catalog number, series letter, general product description including the current product firmware, and hardware revisions.

Parameter Tab: Offers different configuration parameter functions available in the 871C.

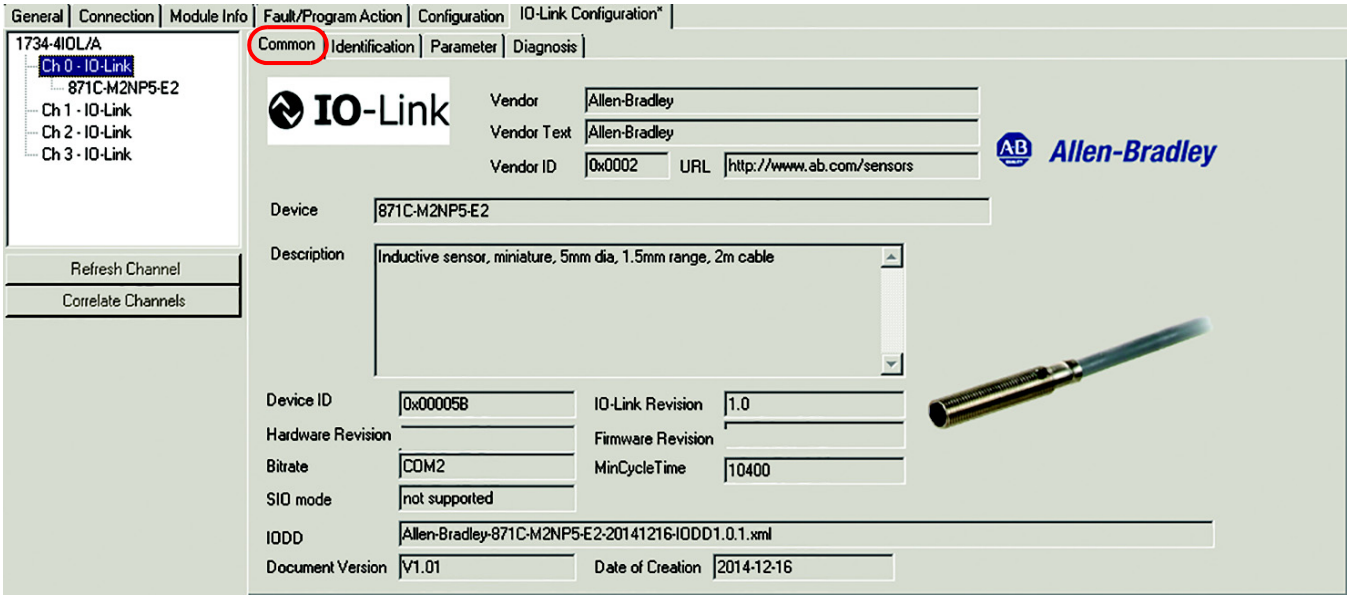
Diagnosis Tab: Provides the ability to monitor internal temperature and IO-Link communication characteristics.

For a complete listing of all sensor parameters and parameter definitions, see Appendix B.

Common Tab

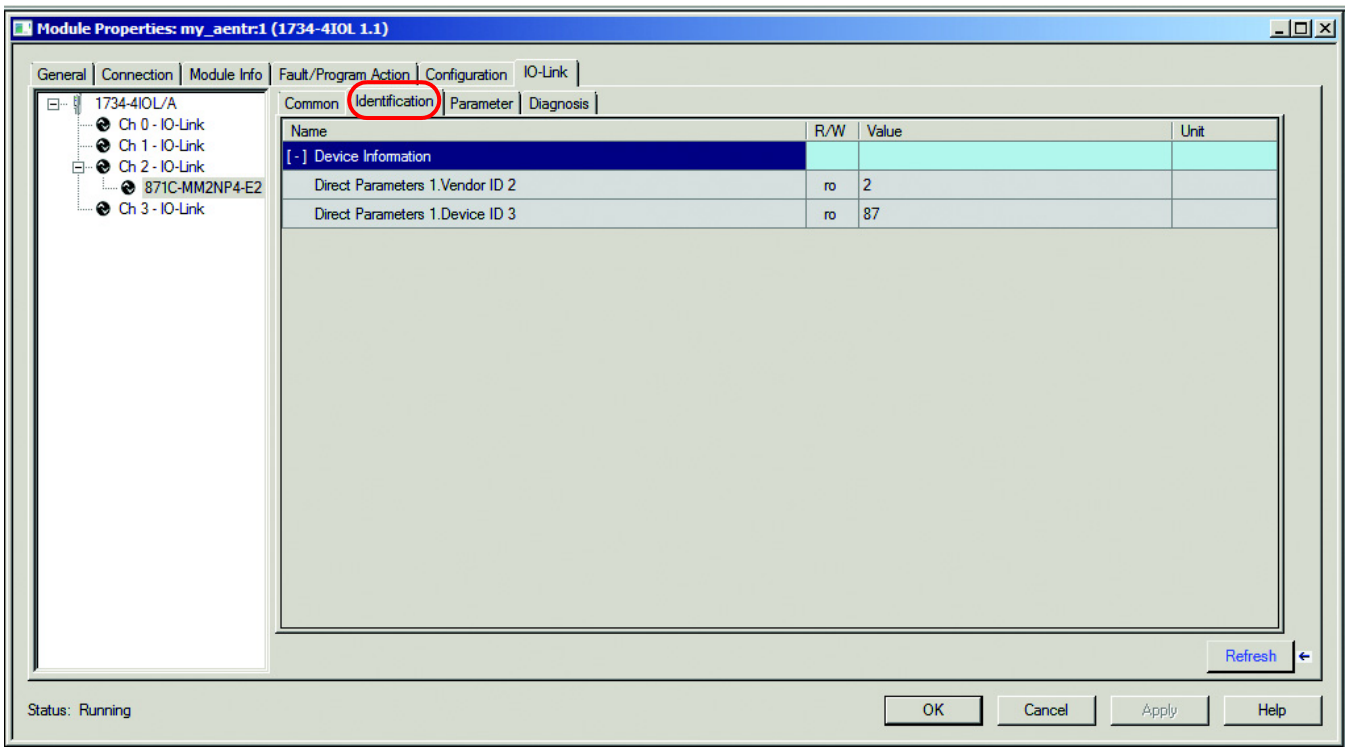
The common tab is automatically generated to give general information about the sensor. The tab contains:

- Vendor
- Vendor ID
- URL
- Device and Description
- Device ID
- IO-Link Revision
- Hardware and Firmware Revision
- Bitrate
- MinCycle Time
- IODD
- Document Version
- Date of creation



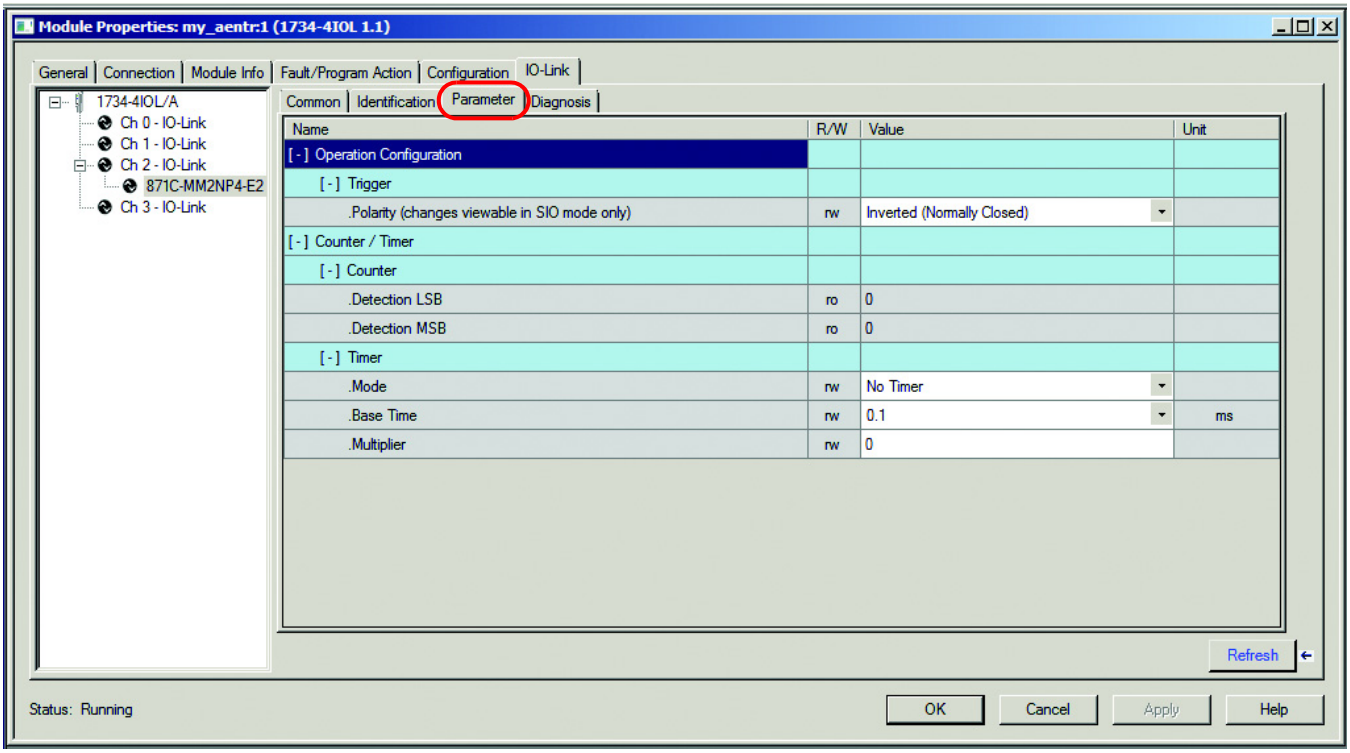
Identification Tab

The Device Information in the identification tab shows the specific Vendor ID and Device ID. These fields are automatically populated according to the sensor information. These fields are Read Only (R.O.).


Module Properties: my_aentr:1 (1734-4IOL 1.1)
General
Connection
Module Info
Fault/Program Action
Configuration
IO-Link
1734-4IOL/A
Ch 0 - IO-Link
Ch 1 - IO-Link
Ch 2 - IO-Link
871C-MM2NP4-E2
Ch 3 - IO-Link
Common
Identification
Parameter
Diagnosis
Name
R/W
Value
Unit
[-] Device Information
Direct Parameters 1.Vendor ID 2
ro
2
Direct Parameters 1.Device ID 3
ro
87
Refresh
Status: Running
OK
Cancel
Apply
Help

Parameter Tab

The parameter tab allows changes to the behavior of the output of the sensor. The IO-Link master uses these parameters for validation purposes.



Polarity

The 871C sensor features the ability to change the output switching mode. The factory default mode is Not Inverted (normally open). With the sensor in IO-Link mode, the user can change the polarity parameter to Inverted (normally closed). The sensor cannot operate in Inverted (normally closed) mode while operating in IO-Link mode. Therefore, to use the Inverted (normally closed) functionality, the sensor must be disconnected from IO-Link and used as a standard input/output (SIO) device.

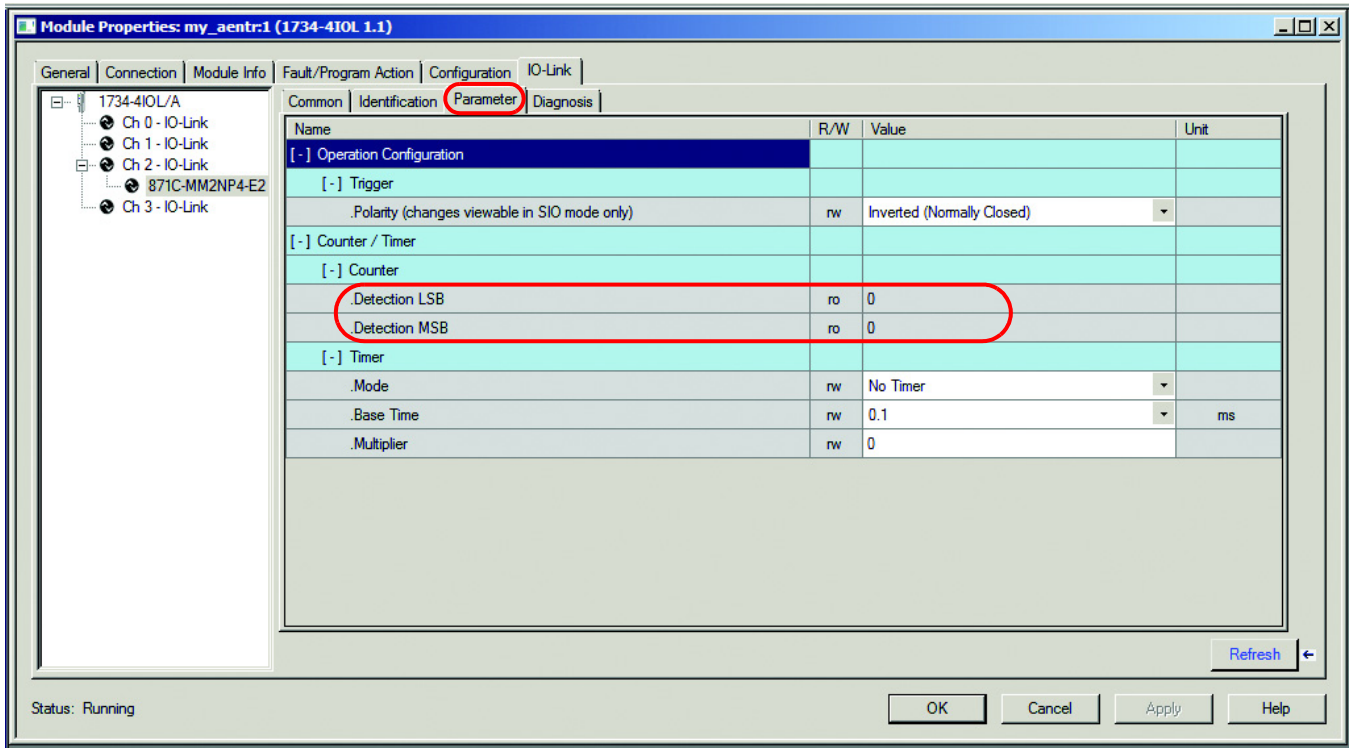
If the user wants to change the sensor back to “Not Inverted” (normally open), the user must connect the sensor back to the IO-Link master and change the setting under the polarity parameter.

Detection Counter—Least Significant Bit (LSB)

The detection counter (LSB) is a read-only parameter. The parameter starts at zero and increases for each triggered bit detection. The maximum value for the detection counter-LSB is 256. Once the counter reaches 256, it resets to zero and begins counting again. This value can be refreshed Ad-hoc by clicking the “Refresh Channel” button. The value resets to 0 by a power cycle or when it reaches 256 counts or by sending an explicit message.

Detection Counter—Most Significant Bit (MSB)

The detection counter (MSB) is a read-only parameter. The parameter starts at 0 and increases by one when the LSB counter reaches 256 counts. This value can be refreshed ad-hoc by clicking the “Refresh Channel” button. The value resets to 0 by a power cycle or when it reaches 256 counts or by sending an explicit message.



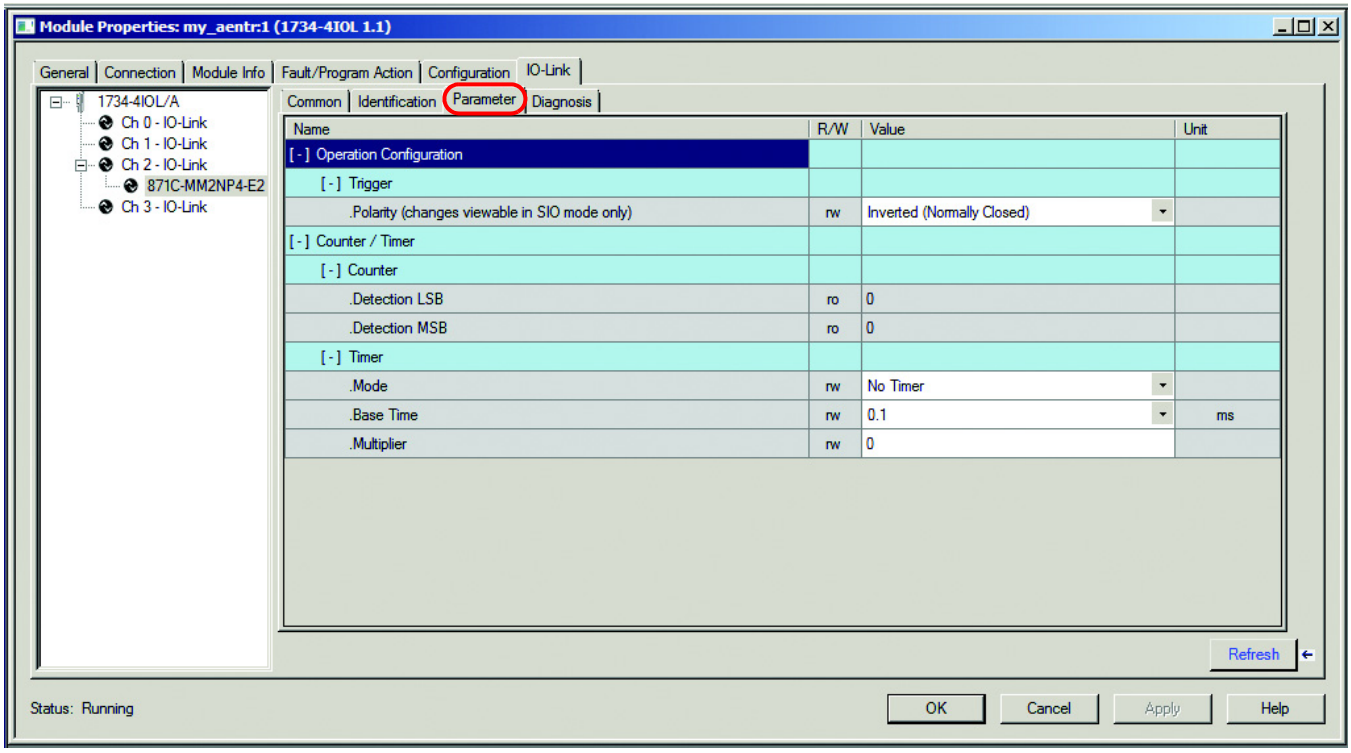
Switching Timer Mode

The switching timer is a useful function for manipulating the output of the sensor in relation to timing. It is useful for precision applications where the output of the sensor must be precisely triggered at a certain time. It is important to note there is a tolerance error of approximately ±2%.

Desired Time Delay = (Timer Multiplier) (Time Base)

Time Base	Timer Multiplier (ms)
0 = 0.1 ms	0…255
1 = 0.4 ms	
2 = 1.6 ms	
3 = 6.4 ms	

For this parameter, the default for the timer is “No Timer.” The sensor can operate with any time base and multiplier chosen to create a time delay, but it is best practice to use the lowest time base and multiplier.

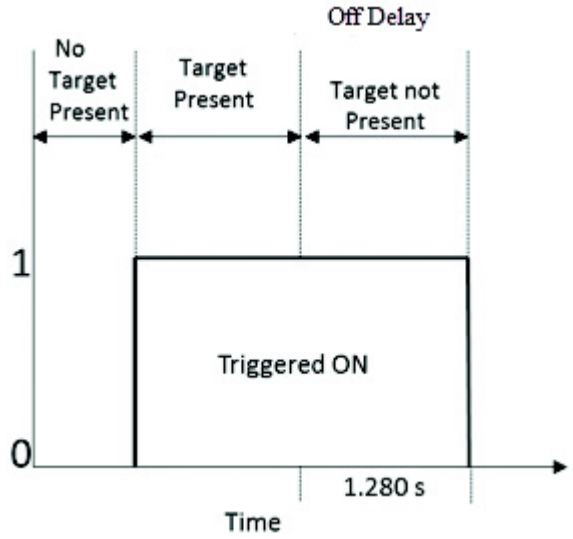


For example: To achieve a delay of 24 milliseconds, the user can use 240 multiplier with a 0.1 ms time base rather than 15 multiplier and 1.6 ms time base. The maximum multiplier is 255.

No Timer = sensor performs without any delays with the output before or after the target in presented in front of the sensor (this is the default setting).

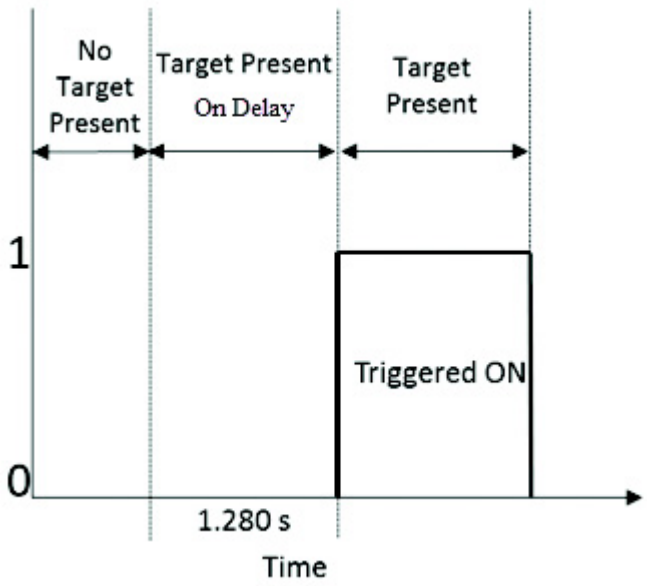
Off Delay = sensor triggered bit will stay ON after the target is removed from the face of the sensor. The time the output is triggered ON after the target is removed is dictated by the time base set and the multiplier used.

For example: Using a switching timer base of 6.4 ms with a multiplier of 200 yields 1.280 seconds (6.4 x 200) for an Off Delay.



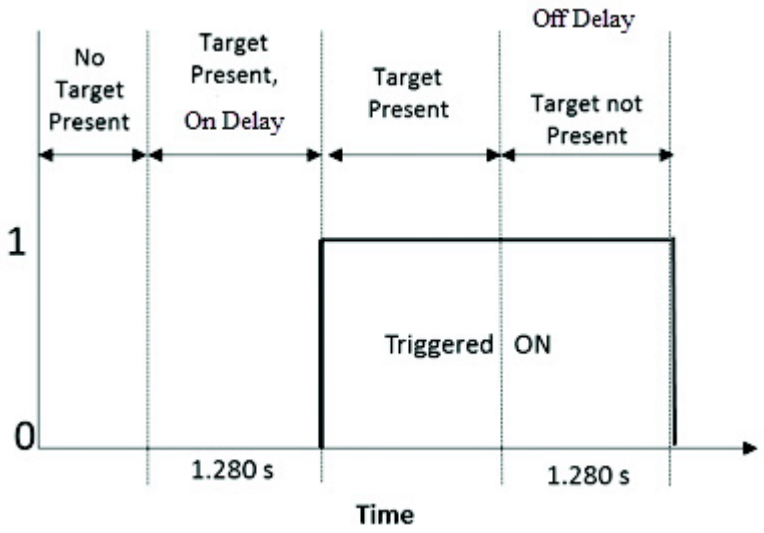
On Delay = target is presented in front of the sensor, sensor triggered bit stays OFF until switching time base and the multiplier time period have elapsed. Once that time frame has elapsed, the trigger bit turns ON.

For example: Using a switching timer base of 6.4 ms with a multiplier of 200 yields 1.280 seconds (6.4 x 200) for an On Delay.



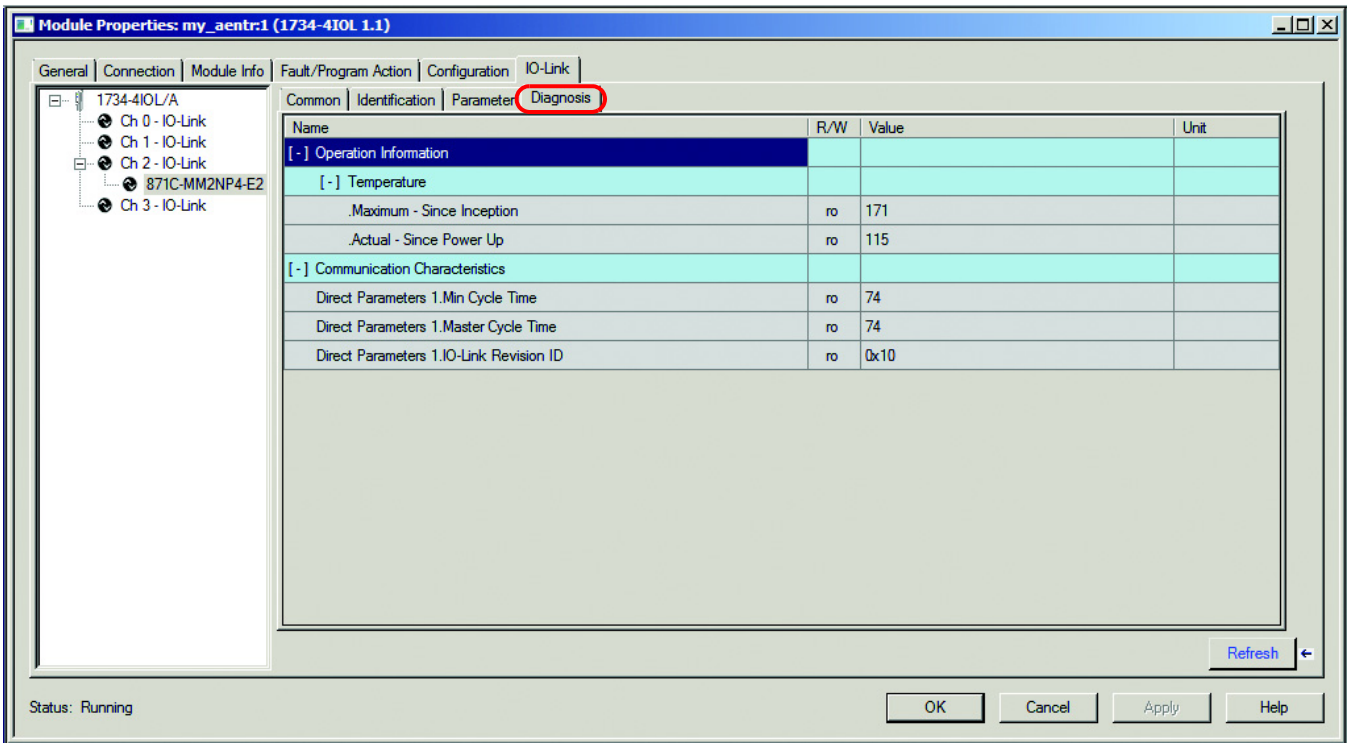
On Delay and Off Delay = Target is presented in front of the sensor, sensor triggered bit stays OFF until switching time-base and the multiplier have elapsed. Once that time frame has elapsed, the trigger bit turns ON as long as target is present. The sensor triggered bit will stay ON after the target is removed from the face of the sensor. The time the output is triggered ON after the target is removed is dictated by the time base set and the multiplier used.

For example: Using a switching timer base of 6.4 ms with a multiplier of 200 yields 1.280 s (6.4 x 200).



Diagnosis Tab

The Diagnosis Tab shows the user the temperature functions of the sensor along with details regarding the cycle time.



Maximum Temperature

Maximum internal sensor temperature over whole sensor lifetime. This parameter is ready only.

IMPORTANT The parameter value shown does not indicate a real temperature value. To calculate the temperature, use the following formula. The default value set in the sensor is 60°C (171°F).

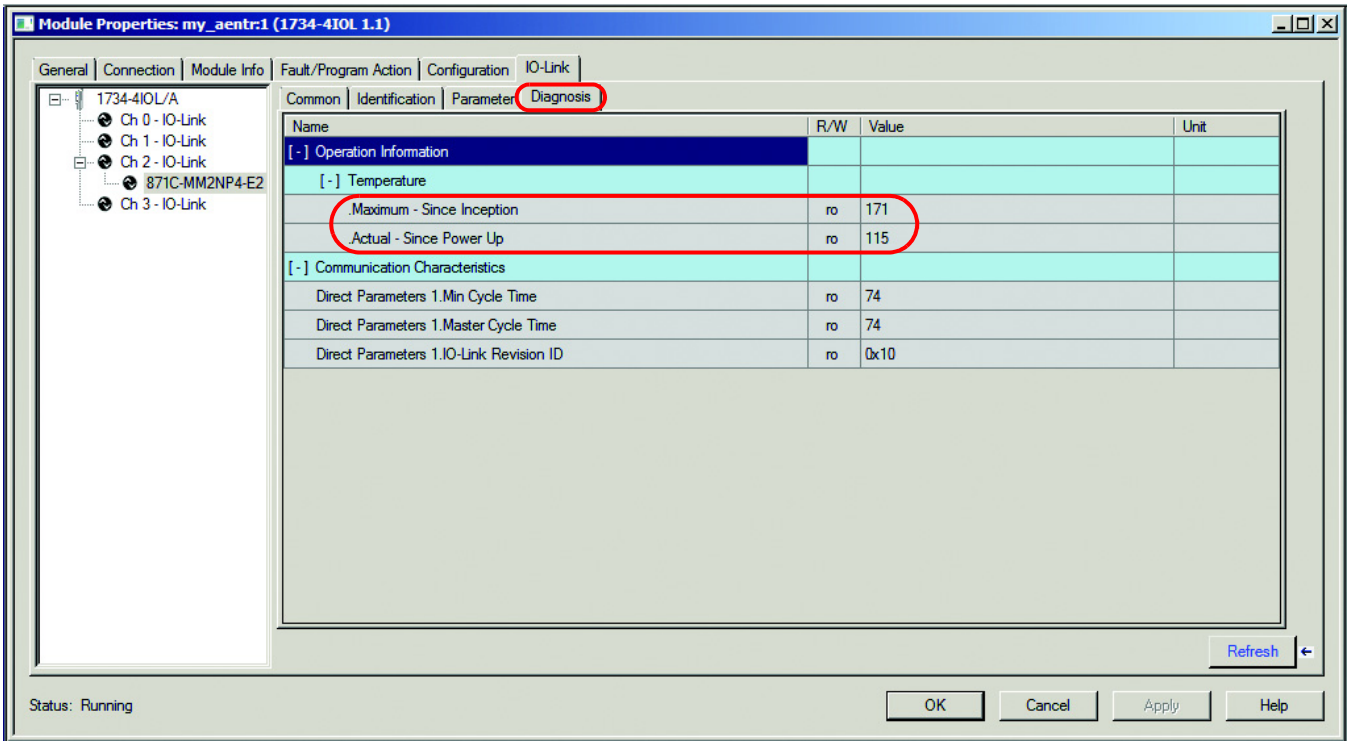
Maximum Temperature (C) = Max_Temp_Value -128/(128*0.01206)+42.5

IMPORTANT The maximum temperature parameter and actual temperature parameter are internal sensor temperatures.

Actual Temperature

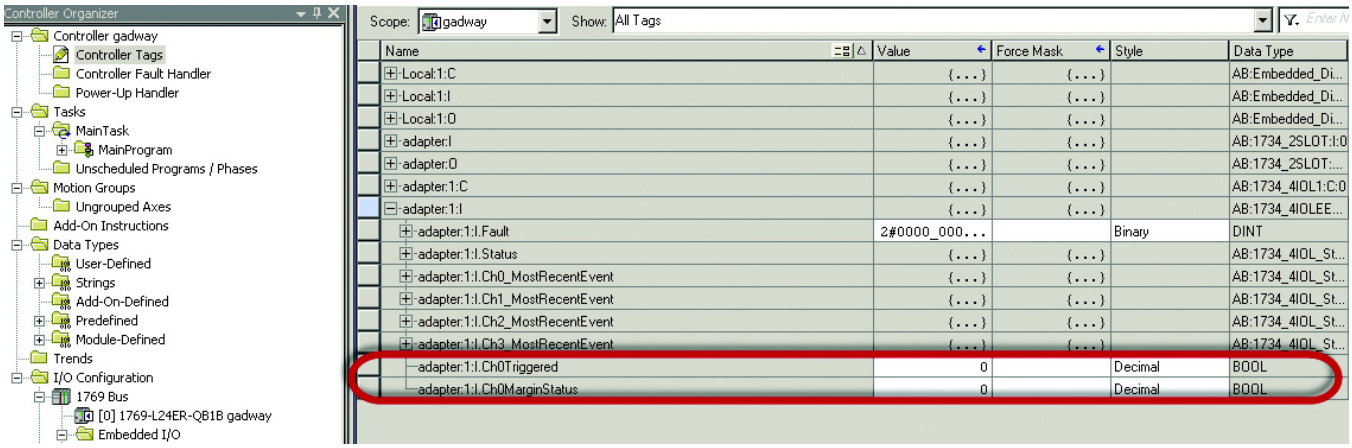
Actual internal sensor temperature. This parameter is read only. The value can be refreshed by clicking the “Refresh Channel” button.

Real Temperature (C) = (Act_Temp_Value -128)/ (128*0.01206) +42.5.



Controller Tags

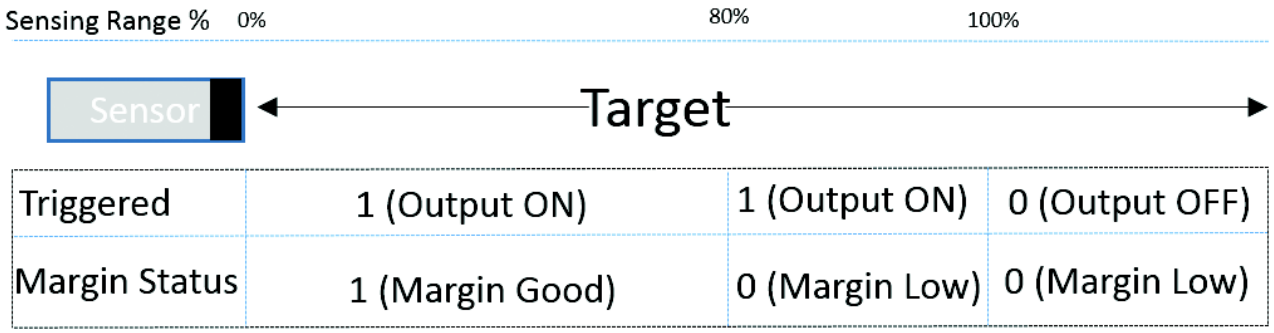
The controller tags have two process data tags that show the status of the sensor concerning the output and the margin status. The process data values are not viewable in the add-on profile, rather shown in the controller tags.



Triggered: This process bit turns toggles to (1) when the sensor detects the target and to (0) when the sensor does not detect the target. The sensor operates as normally open when connected to IO-Link regardless of whether it's normally closed.

Margin Status: The bit can be used as a low margin warning indicator to detect the target is beyond the recommended working range of the sensor. This process bit toggles to High (1) when a target is detected by the sensor AND the target is between 0...80% of the operating range of the sensor. The process bit toggles to Low (0) when a target is detected by the sensor beyond 80% of the specified operating range of the sensor.

The recommended working range of the sensor is less than 80% of the specified or nominal sensing range. Operation within the working range of the sensor helps ensure stable operation with typical environmental temperature, load, and supply voltage fluctuations and differences due to the manufacturer tolerances.



Triggered	1 (Output ON)	1 (Output ON)	0 (Output OFF)
Margin Status	1 (Margin Good)	0 (Margin Low)	0 (Margin Low)

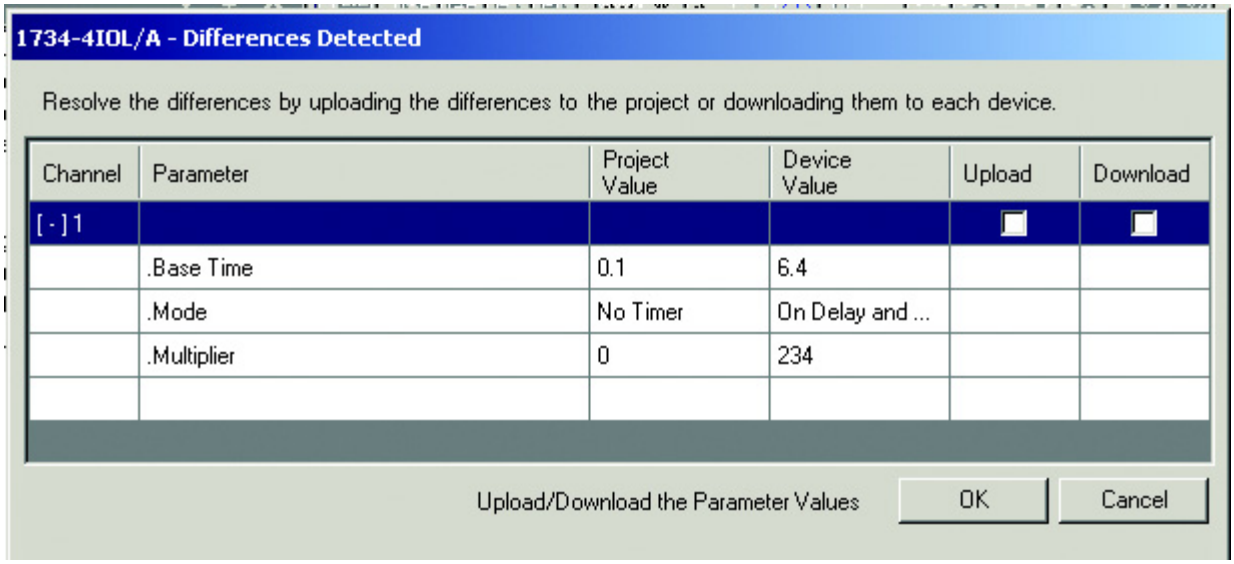
Other Features

Correlation

The AOP reads all configuration read-write (R.W.) parameters directly from the connected IO-Link devices and compare the values to ones stored in the controller. This determines if there are differences (note that the correlation does not work for read-only (R.O.) in the parameters or for competitive sensors.). This feature is for Rockwell Automation and Enabled IO-Link devices only and is an online only function that runs when opening up the AOP.

No differences: There are no differences, so the user goes directly into the AOP.

Differences: If there are differences, the user is provided with a differences dialogue that identifies the IO-Link parameters that, do not match for each channel. The user can then choose, on a channel by channel basis (where differences exist) to upload the parameters that are currently in the device and store them in the controller. OR the user can choose to download the parameters that are stored in the controller to the connected IO-Link device.



Automatic Device Configuration (ADC)

Replacing damaged sensors is easy. Simply remove the old Allen-Bradley sensor and connect the new one—the controller will automatically send the configuration to the new sensor.

ADC capability within the sensor and controller enable flexibility and reliability in your application. When the taught sensor becomes damaged or fails and needs to be replaced, replace it with the exact same catalog number of the existing sensor. When the damaged sensor is removed and the new sensor is plugged in, the previous sensor configuration is automatically downloaded in the sensor through the IO-Link Master. No additional steps are required on the sensor or in the controller. No personal computer is required and reteaching the sensor is not required.

Chapter 10

Setting up the Sensor with Studio 5000

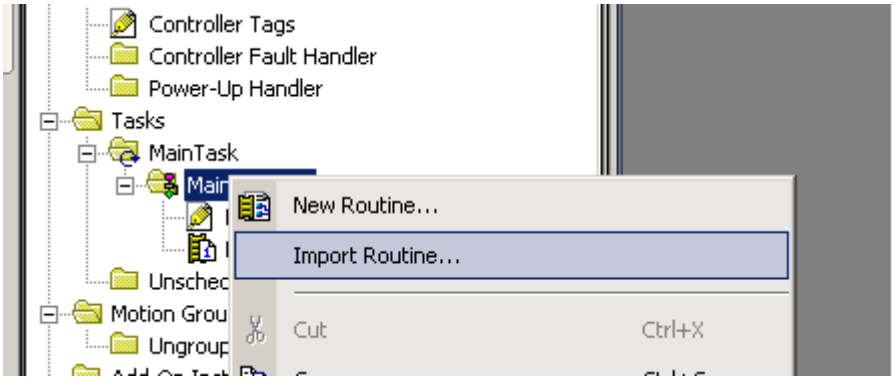
This chapter provides detailed instructions on setting up the 871C using message instructions in Studio 5000. The sample code that is shown allows the user to:

- Read the sensor configuration
- Set the time delay multiplier
- Read the current count value
- Reset the counter
- Read the maximum temperature since inception
- Read the current temperature
- Reset the sensor to default configuration

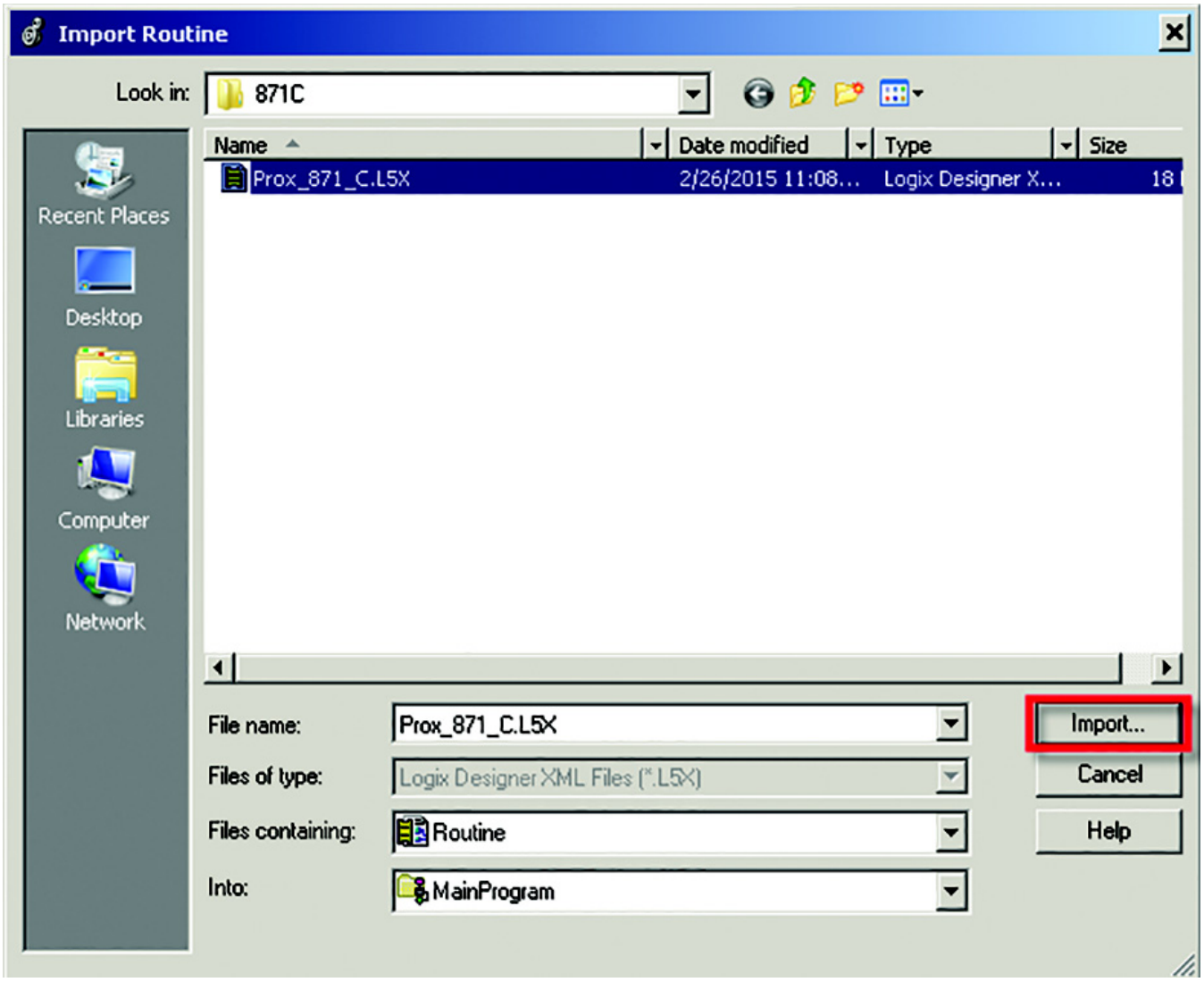
Sample Code

To download the sample that is shown in this chapter, go to www.ab.com, and follow these steps:

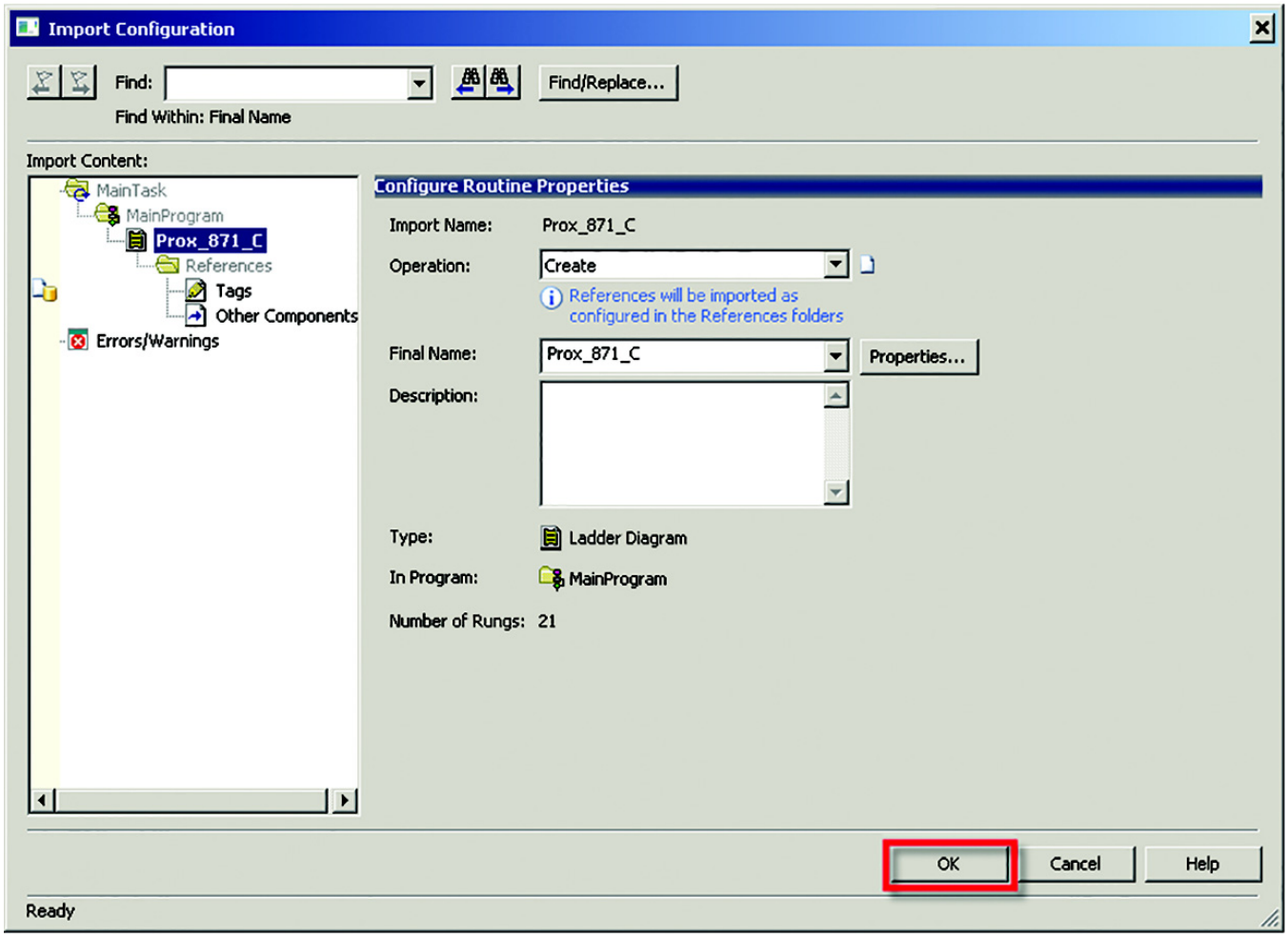
1. Visit ab.com and download “Prox_871_C.L5X” to your local computer.
2. Save and Extract Prox_871_C.L5X to a folder of your choice.
3. Within your Logix Studio program, right-click **MainProgram** and select import routine.



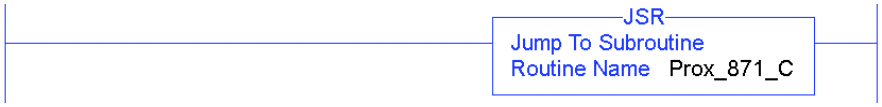
4. Browse to the folder containing the routine extracted in step 1. Select and click ‘Import.’


Import Routine
Look in:
871C
Recent Places
Desktop
Libraries
Computer
Network
Name
Date modified
Type
Size
Prox_871_C.L5X
2/26/2015 11:08...
Logix Designer X...
File name:
Prox_871_C.L5X
Files of type:
Logix Designer XML Files (*.L5X)
Files containing:
Routine
Into:
MainProgram
Import...
Cancel
Help

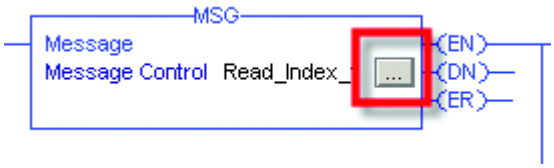
5. The 'Import Configuration' box displays, to accept the default settings click 'OK.'



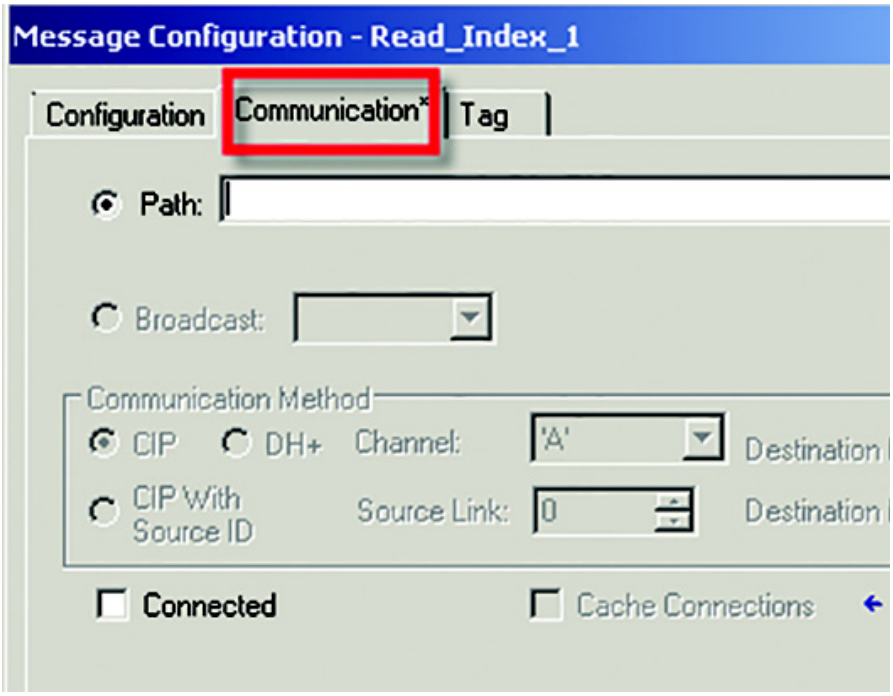
6. From the MainRoutine, create a rung of code that uses a jump to subroutine (JSR) to call the subroutine Prox_871_C.



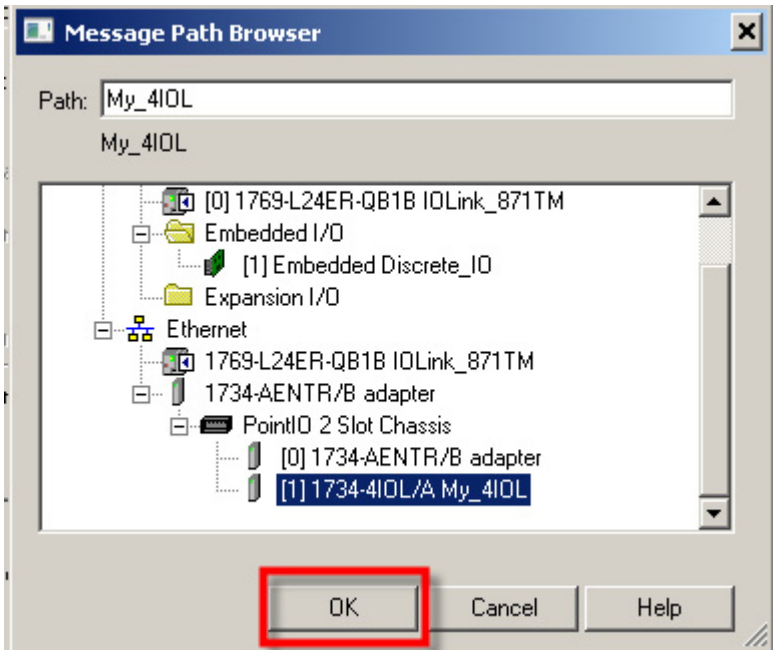
7. Open the Prox_871_C subroutine. On rung 1 within the MSG Instruction, click the square button to open the message configuration.



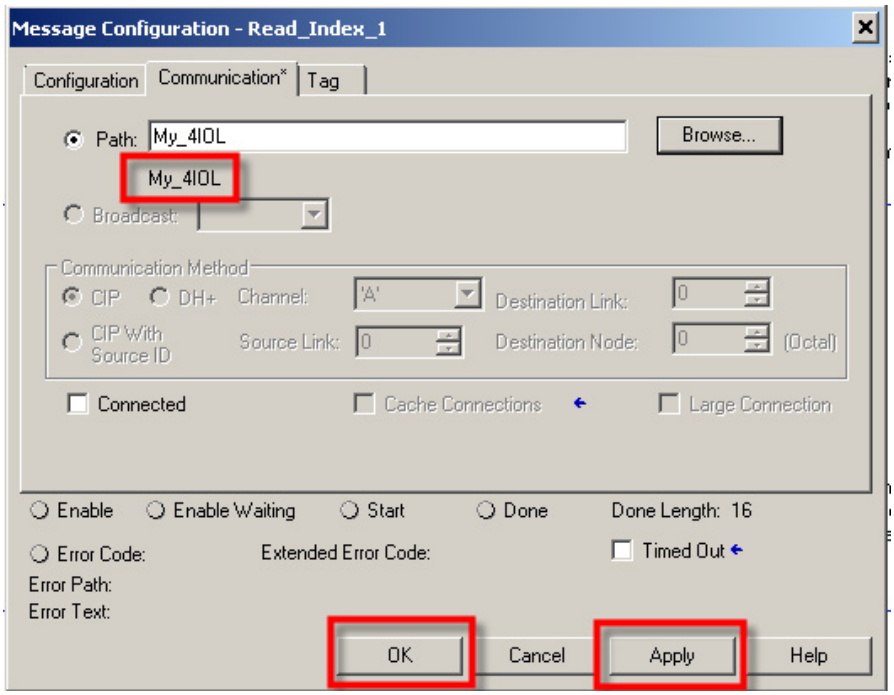
8. The Message configuration pop-up box is displayed. Click the Communication Tab. Select the Browse button.



9. Browse the Ethernet Network to the 1734-AENTR and select the 1734-4IOL My_4IOL. Click 'OK.'



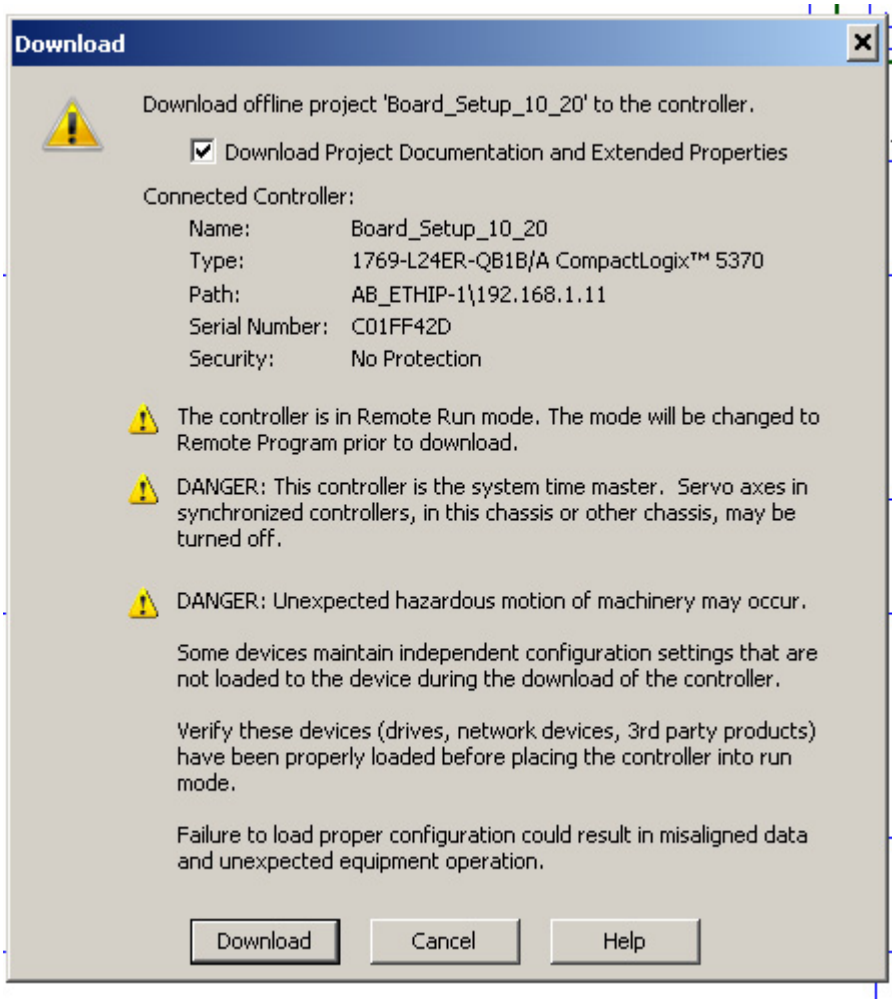
Notice that the path is now set to My_4IOL in the communication path. Click 'Apply' then 'OK.'



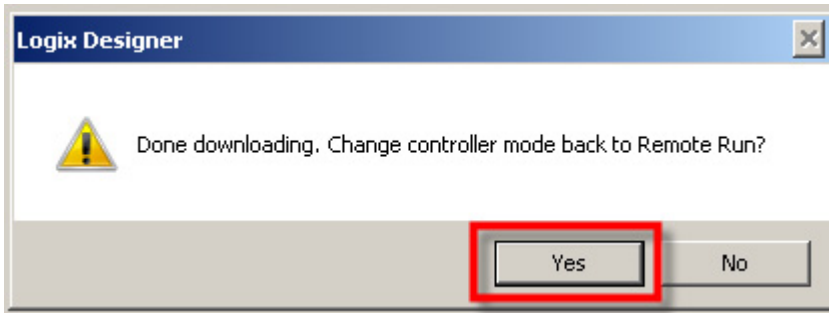
10. Repeat Step 8. For the Message instructions on rungs 8 and 9. (Rung 8 is Write_index_1 and rung 9 is Write_index_1_and_clear_count.)

11. Verify that the routine is free of Errors.

12. Download the Program to the controller.



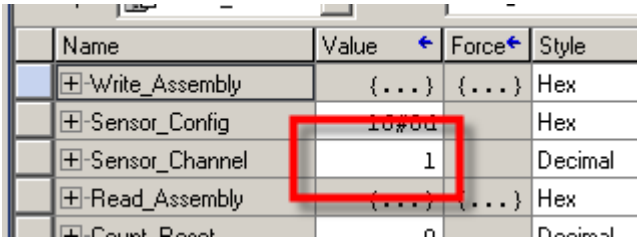
13. Put the Controller in 'Run' mode.



Operation

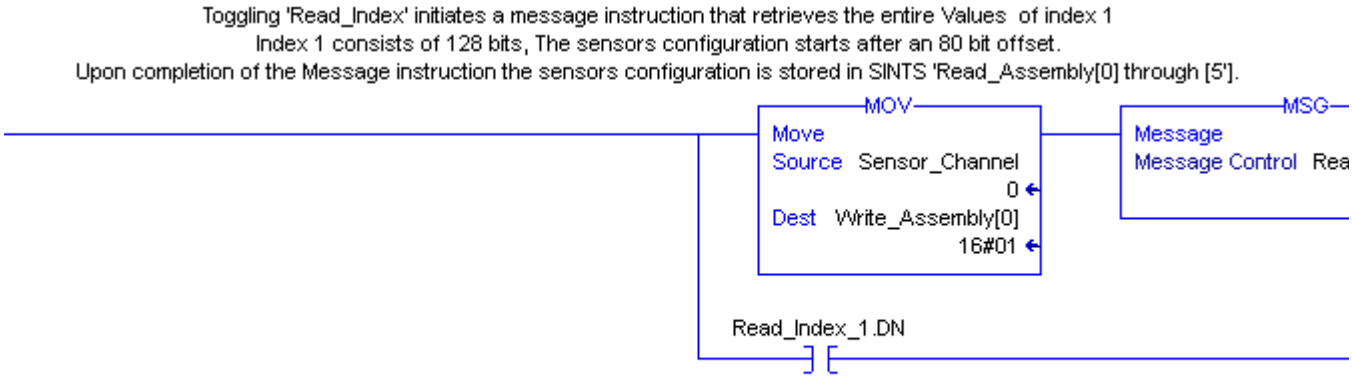
The Rockwell Automation 871C sensor conforms to V1.0 of the IO-Link standard. The sensors parameters are defined in Index 1. Index 1 consists of 128 bits of data. Data starts at an offset of 80 bits. When using an explicit message to read and change the sensor configuration, the whole index must be read/written to.

Open the Controller Tag viewer and locate the Tag that is named Sensor_Channel. Set this Tag to equal the channel number the 871C sensor is connected to on the 1734-4IOL module. In this example, it is set to Channel 1.

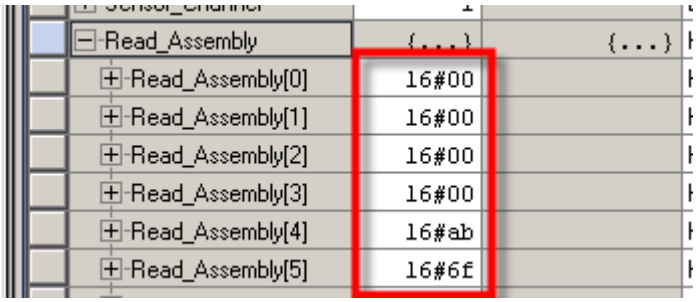


To read the 871C configuration via Explicit Message:

1. Toggle the Read_Index contact (Tip: Select the contact and press 'CNTRL' and 'T' simultaneously to toggle contacts) on rung 1. This runs the Message Instruction to read all the data that are contained in Index 1.



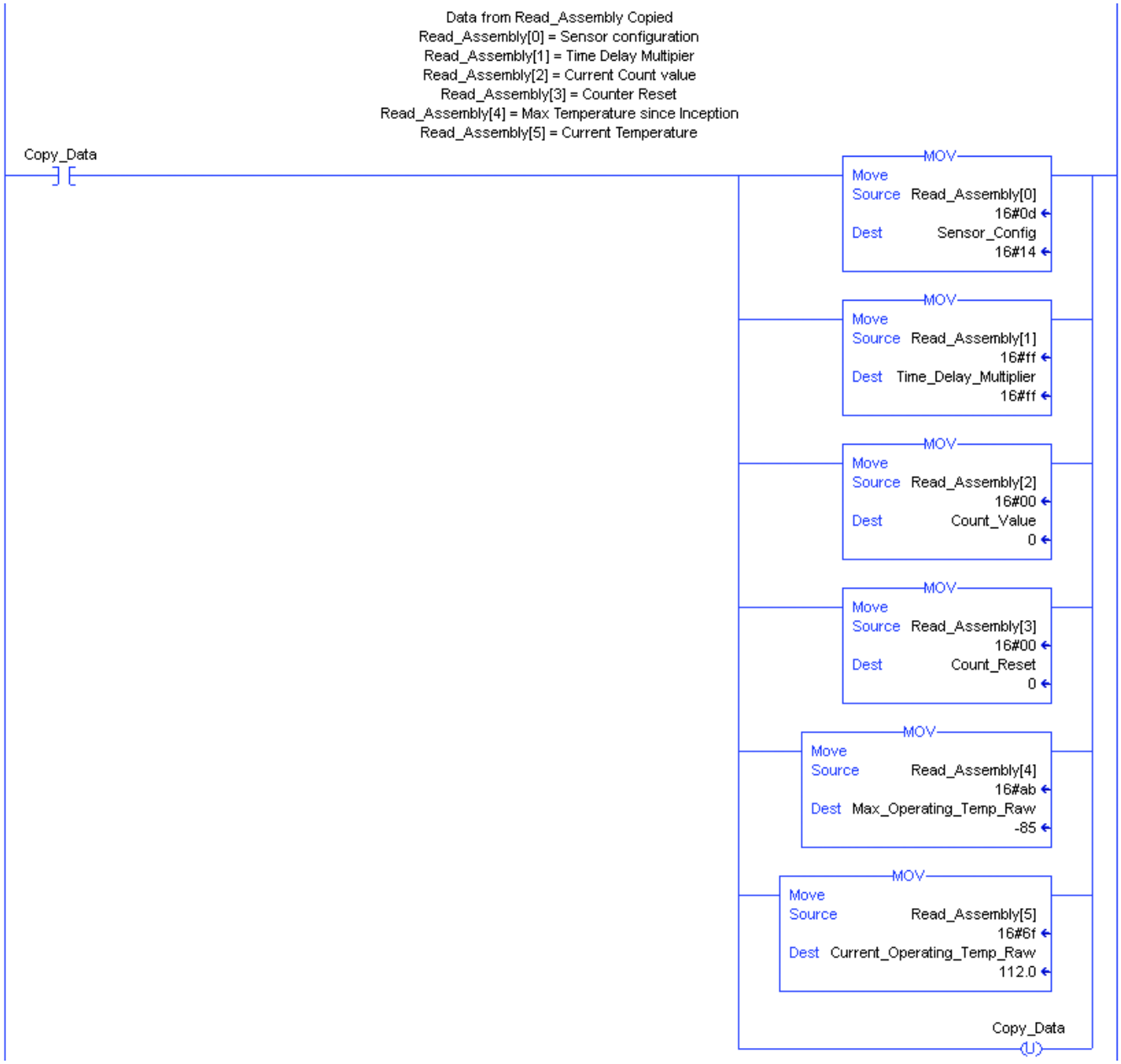
Sensors configuration is read back into the Read_ Assembly array. Open the Controller tags from within the controller organizer. Expand the Read_Assembly array. The configuration is detailed in Read_Assembly[0] through Read_Assembly[5].



(Default sensor configuration)

Deciphering the data. Data from Read_Assembly Copied

Read_Assembly[0] = Sensor configuration
Read_Assembly[1] = Time Delay Multiplier
Read_Assembly[2] = Current Count value
Read_Assembly[3] = Counter Reset
Read_Assembly[4] = Max Temperature since Inception (Raw value)
Read_Assembly[5] = Current Temperature (Raw value)



Sensor Configuration: This byte contains the configuration for N.O./N.C., Time delay base and delay type to aid the user who the different configurations can be set by toggling the contacts on rungs 10...20.

Time Delay Multiplier: This is a value between 0...255.

Total Time Delay = Time delay base X Time Delay Multiplier

Current Count Value: The number of times a target has been detected since power-up or the last reset.

Counter Reset: Writing a value < 0 > resets the current count value.

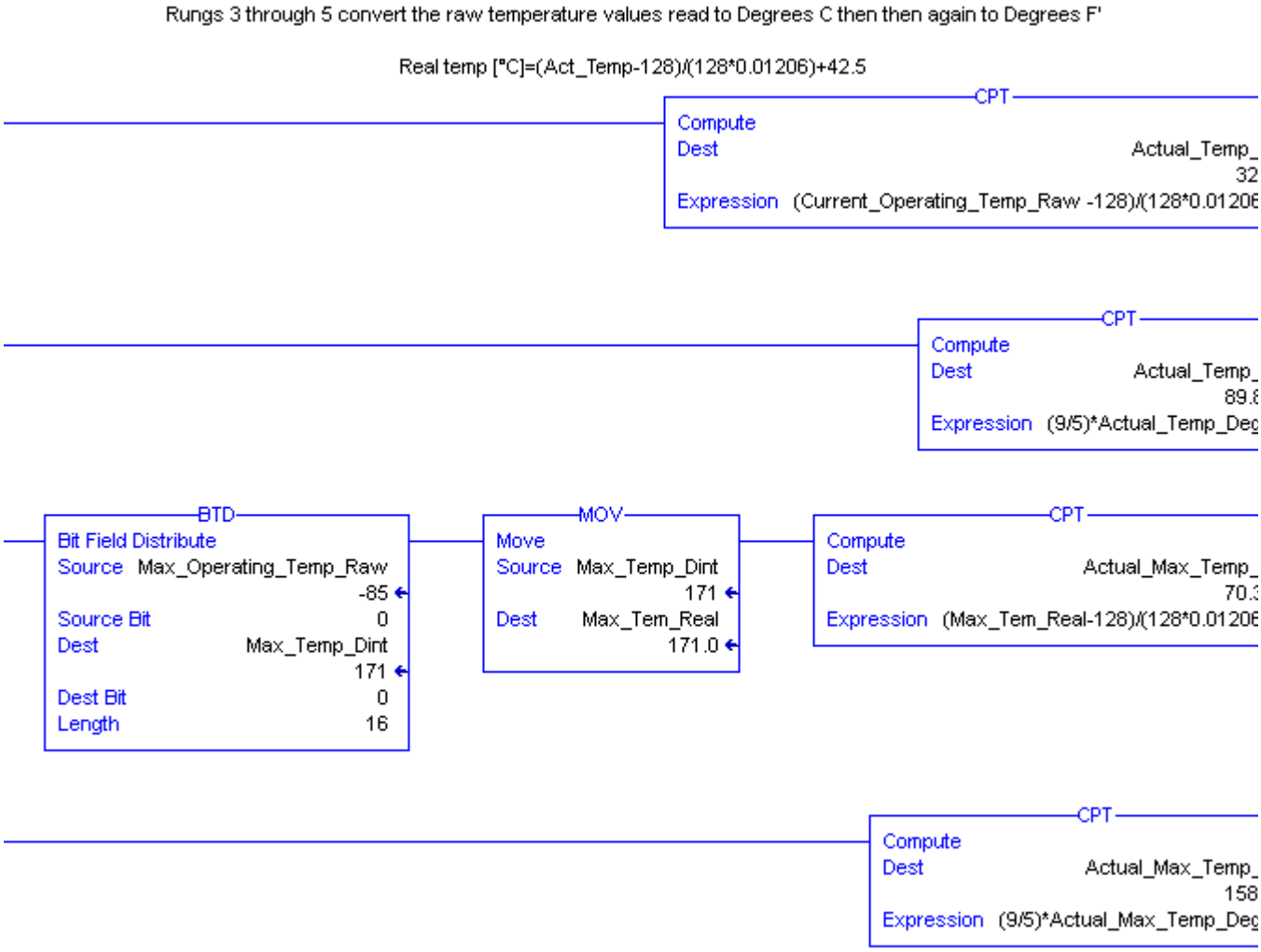
Maximum Temperature Since Inception: The raw value from the sensor (requires conversion).

Current Temperature: Raw temperature value at last read (requires conversion).

Temperature Conversion Formula:

Real temp [°C]=(Act_Temp-128)/(128*0.01206)+42.5

Temperature conversion code has been created in rungs three through six in the sample code provided.

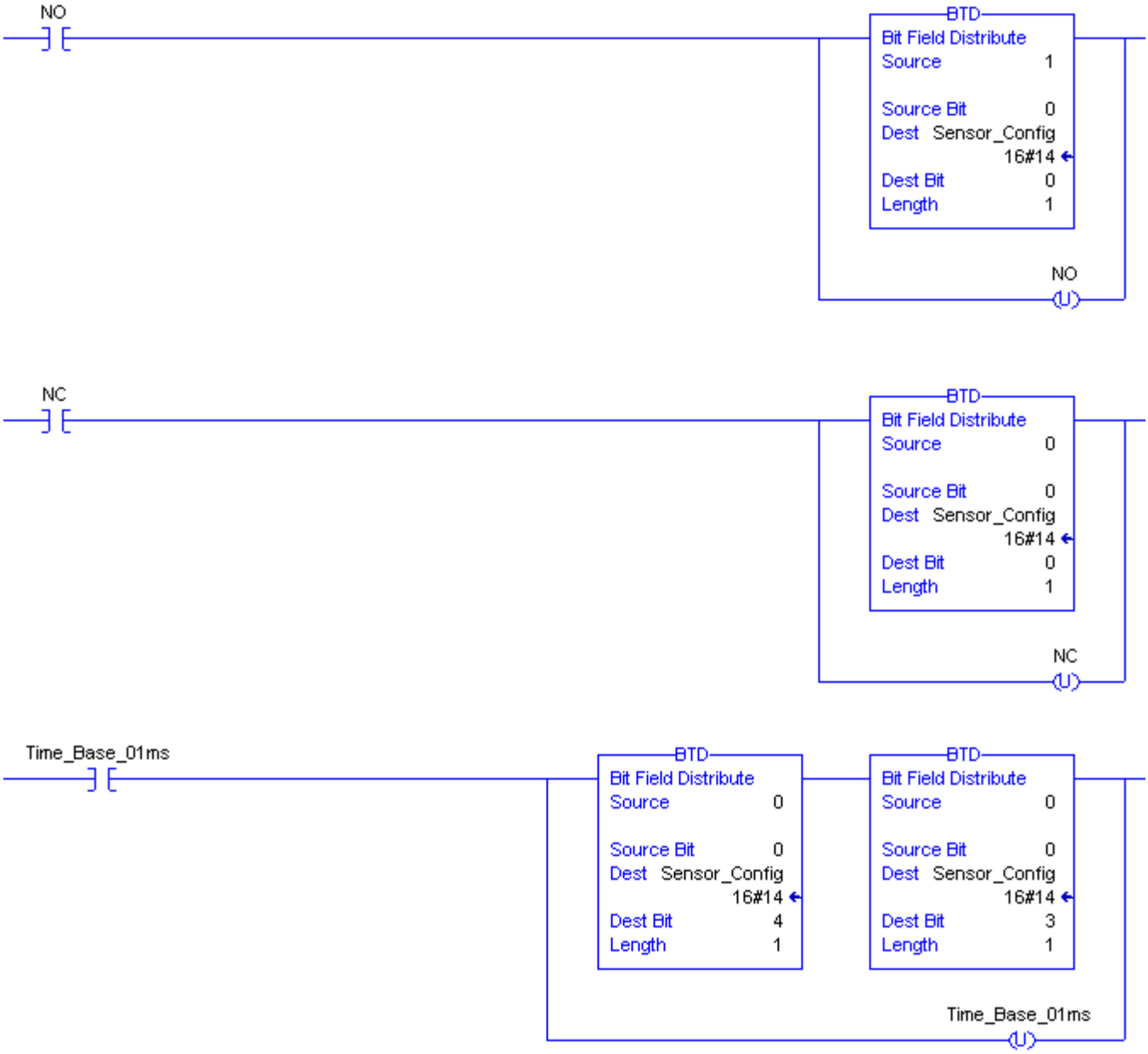


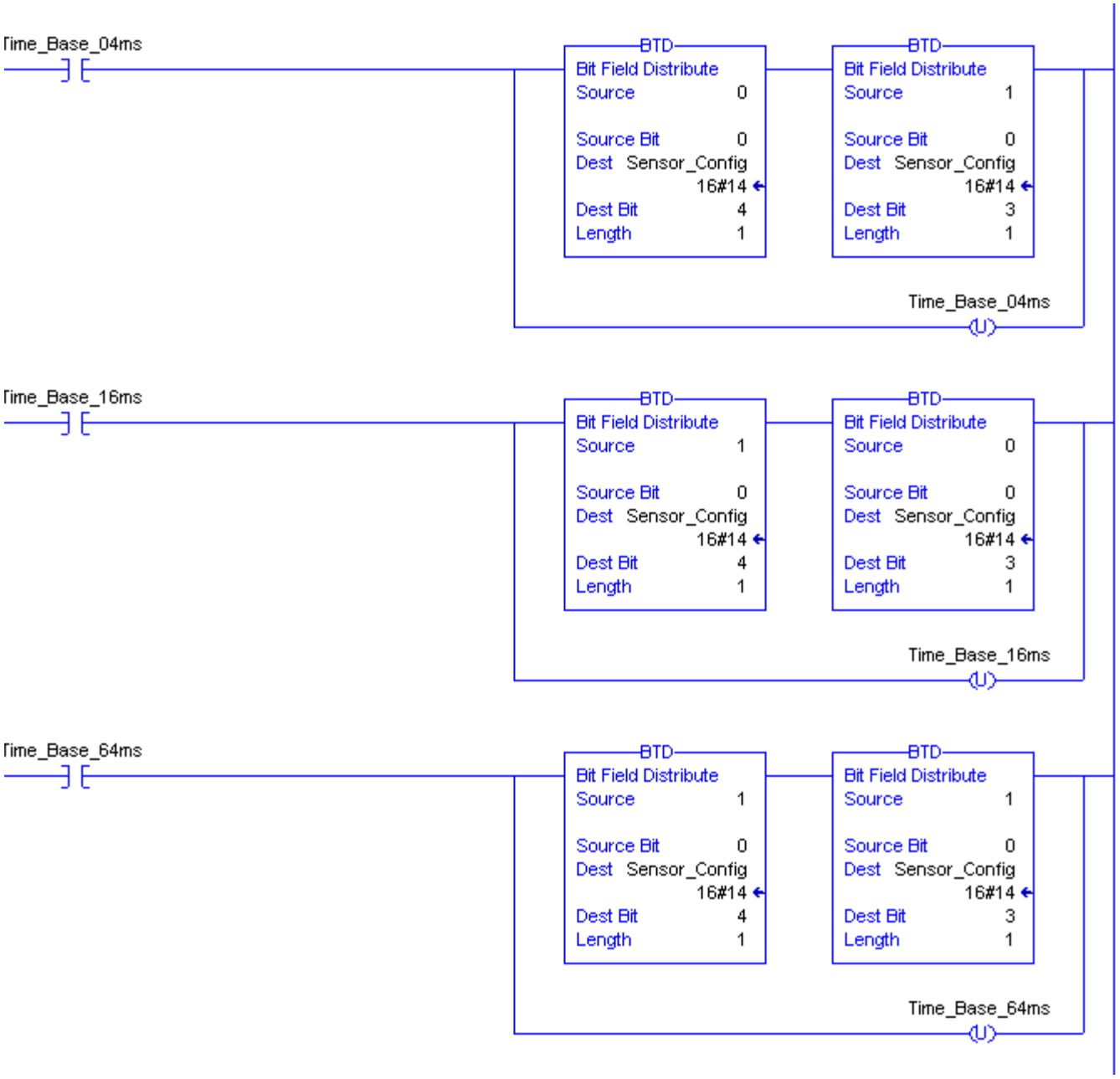
To write a new configuration to the 871C via Explicit Message

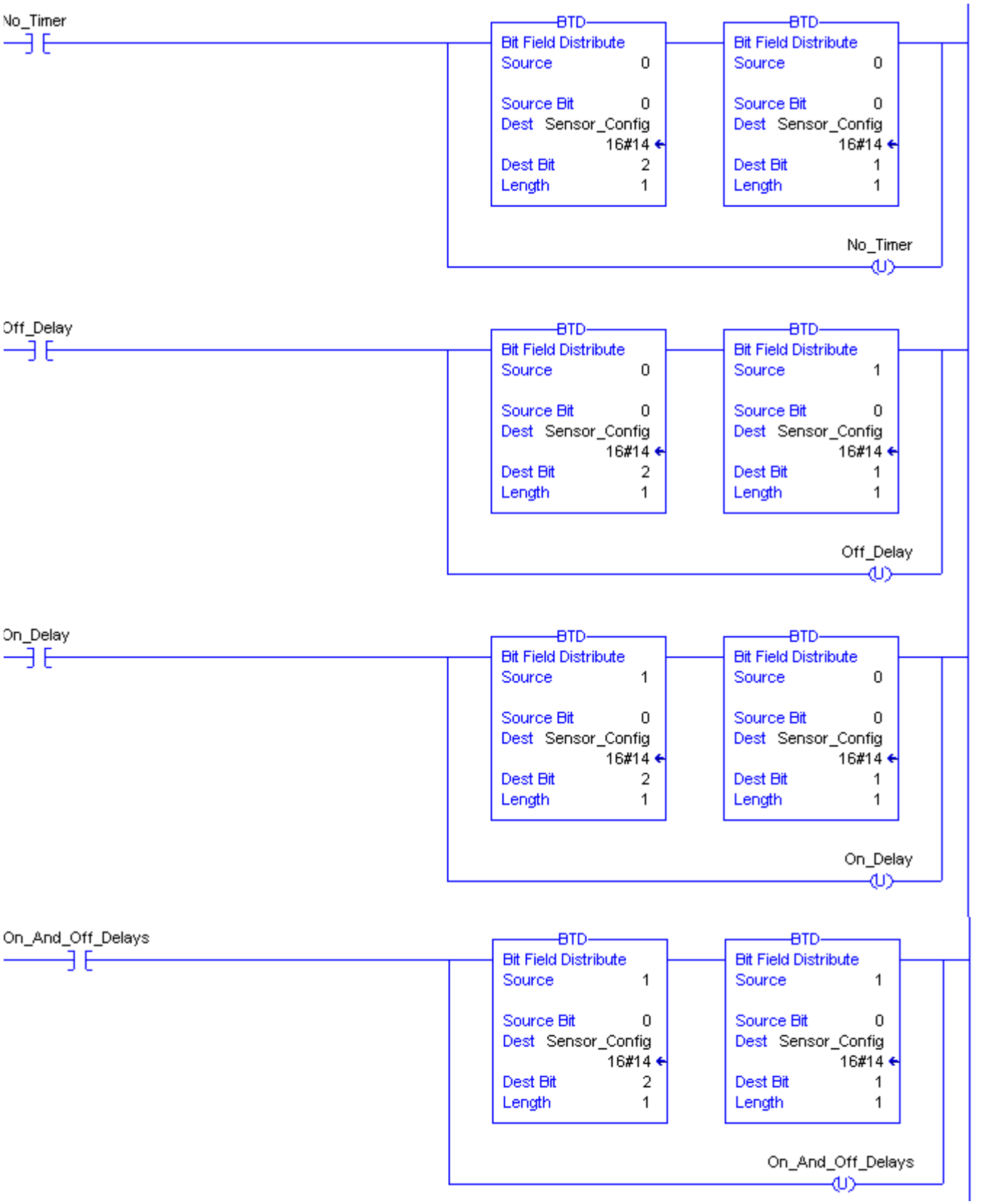
1. Toggle the required bits on rungs 10...20 to set the sensors configuration.

By toggling the Bits below, the new sensor configuration can be created, prior to writting the new configuration to the sensor.

The sensor timebase selected (if required) is then mutiplied by the Multiplier set in Write_Assembly[2]

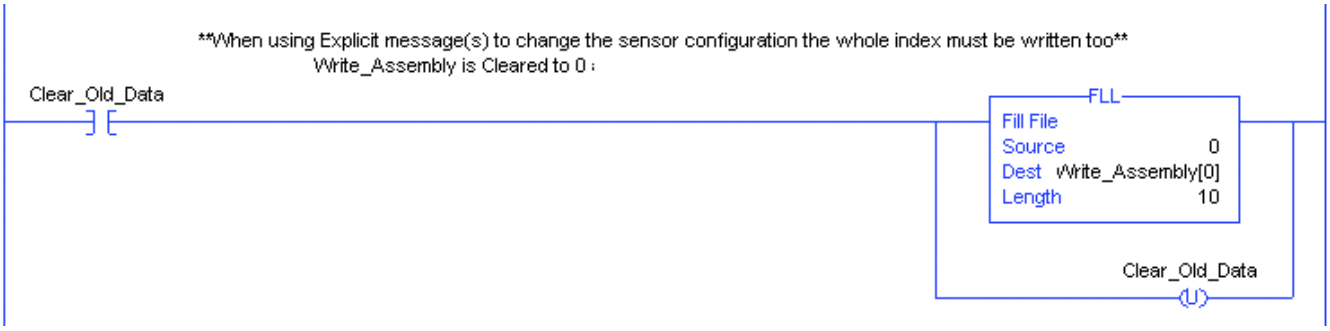



Time_Base_04ms
BTD
Bit Field Distribute
Source 0
Source Bit 0
Dest Sensor_Config
16#14
Dest Bit 4
Length 1
BTD
Bit Field Distribute
Source 1
Source Bit 0
Dest Sensor_Config
16#14
Dest Bit 3
Length 1
Time_Base_04ms
(U)
Time_Base_16ms
BTD
Bit Field Distribute
Source 1
Source Bit 0
Dest Sensor_Config
16#14
Dest Bit 4
Length 1
BTD
Bit Field Distribute
Source 0
Source Bit 0
Dest Sensor_Config
16#14
Dest Bit 3
Length 1
Time_Base_16ms
(U)
Time_Base_64ms
BTD
Bit Field Distribute
Source 1
Source Bit 0
Dest Sensor_Config
16#14
Dest Bit 4
Length 1
BTD
Bit Field Distribute
Source 1
Source Bit 0
Dest Sensor_Config
16#14
Dest Bit 3
Length 1
Time_Base_64ms
(U)

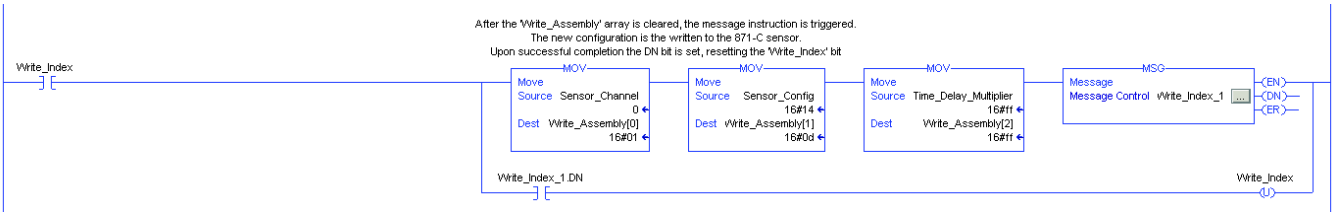


2. If using a time delay, enter the multiplier value in 'Time_Delay_ms' (enter the hex value) when viewing the controller tags.

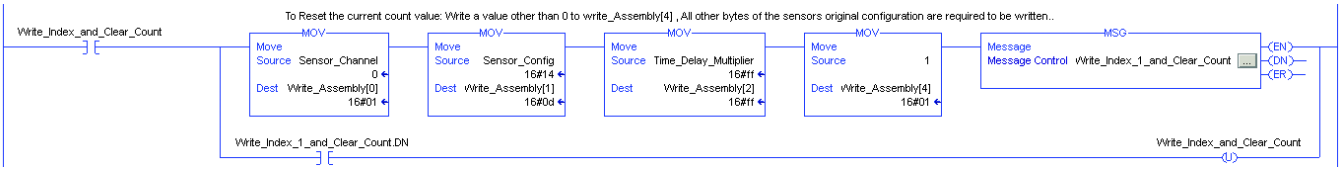
3. On rung seven, toggle the 'Clear_Old_Data' contact to clear out the 'Write_Assembly' Array.



4. On rung eight toggle the 'Write_Index' contact, this writes the new configuration to the sensor.



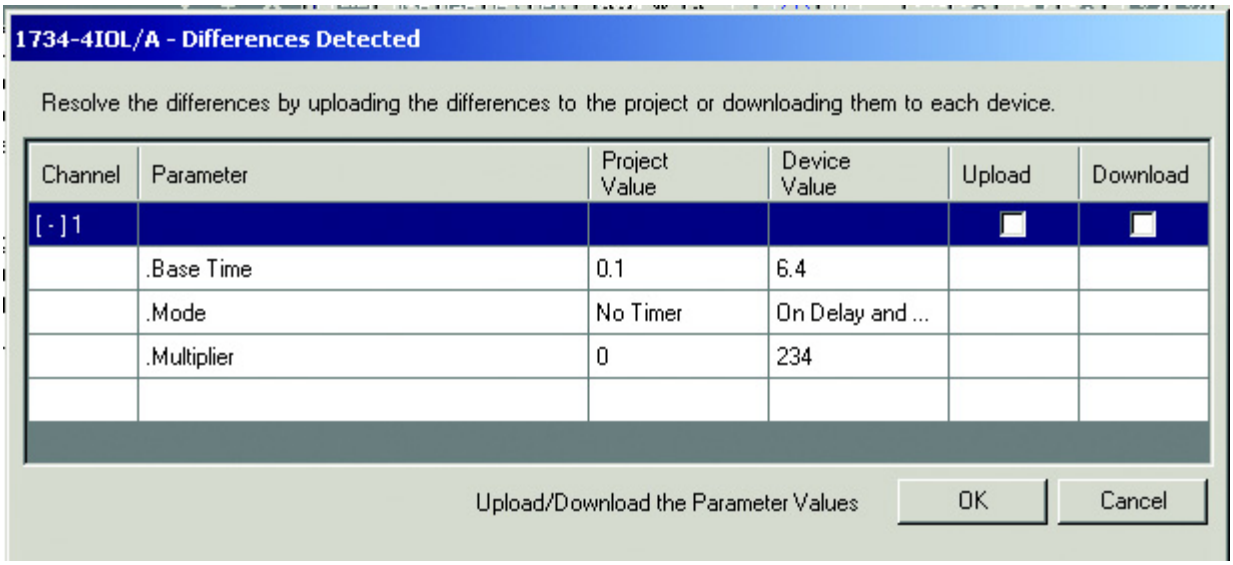
The current sensor count is retained, if you require to clear the current count value the toggle the 'Write_Index_and Clear_Count' contact on rung nine.



IMPORTANT The whole Index must be written to the sensor and it is required that both bytes be populated. If you only require changing one of the values, enter the value that you initially read into the other field.

5. After writing to the index, perform a read index and validate that the sensor settings have been changed from the controller tag viewer. Trigger the sensor several times, read the current count, and validate the count can be cleared.

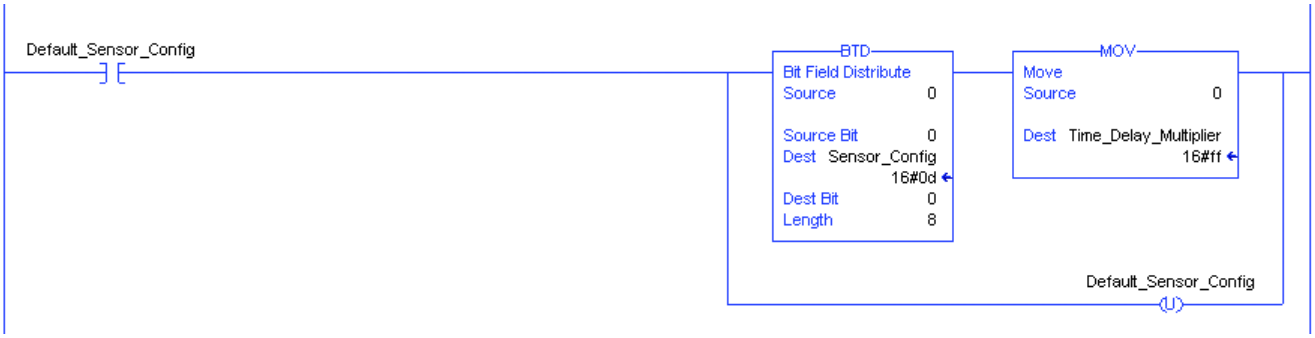
Additionally: Open up the Master by clicking the 1734-4IOL Master in the I/O Configuration. RS Studio detects there is a difference between the actual configuration of the sensor and the configuration in the project. A pop-up box is displayed. Expand the '+' sign and the differences are shown.



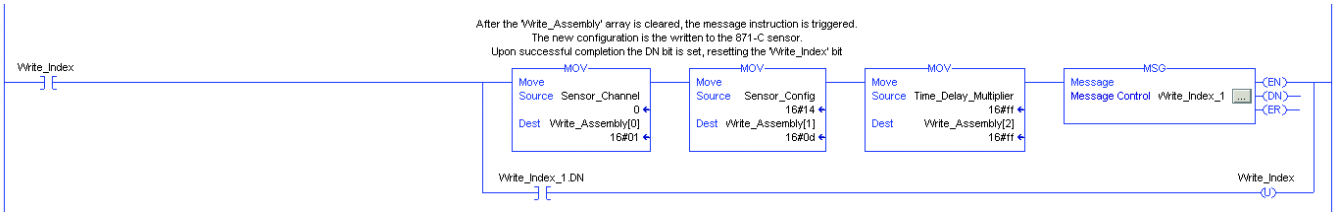
Separate the clear configuration to the factory default of normally open, no timer, off delay, and no counter.

To reset the sensor to default:

1. Toggle the 'Default_Sensor_Config' contact.



2. Then toggle the 'Write_Index' contact on rung nine.



Chapter 11

Troubleshooting

This guide is meant to help resolve common issues that occur when setting up the 871C.

Checklist

Error	Cause	Remedy
LED does not light up	The power supply is switched off.	Check to see if there's a reason for it to be switched off (installation or maintenance work, and so on). Switch on the power supply if appropriate.
LED does not light up	The pico QD plug is not connected to the connector on the sensor	Connect the pico QD plug to the sensor and tighten the cap nut by hand.
LED does not light up	Wiring fault in the splitter or control cabinet.	Check the wiring carefully and repair any wiring faults.
LED does not light up	Supply cable to the sensor is damaged.	Replace the damaged cable.
No IO-Link connection to the device	No power supply	See error LED does not light up.

Installing the Add-on Profile

Introduction

This appendix shows how to install the IO-Link add-on profile (AOP) with the RSLogix 5000 program. Add-on profiles are files that users add to their Rockwell Automation library. These files contain the pertinent information for configuring a device that will be added to the Rockwell Automation network.

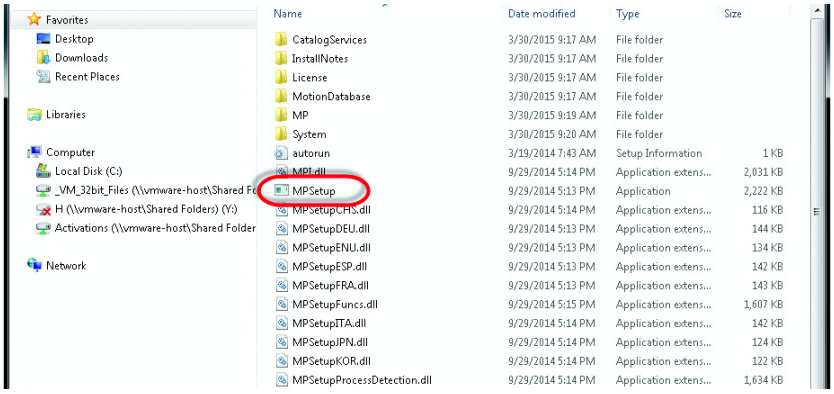
The add-on profile simplifies the setup of devices because it presents the necessary fields in an organized fashion. The add-on profile allows users to set up and configure their systems in a quick and efficient manner.

The add-on profile is a folder that contains numerous files for the device. It will come as an installation package.

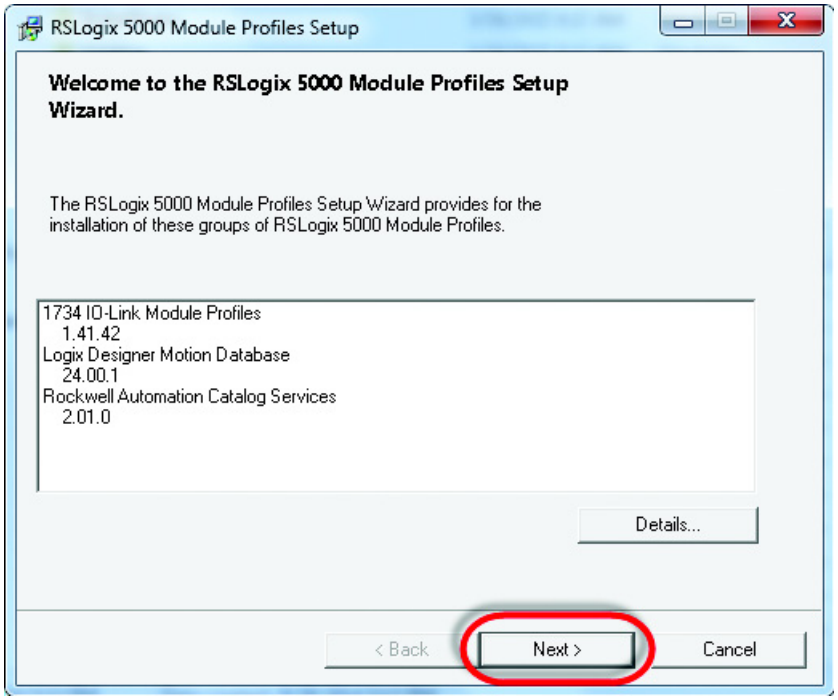
Performing the Installation

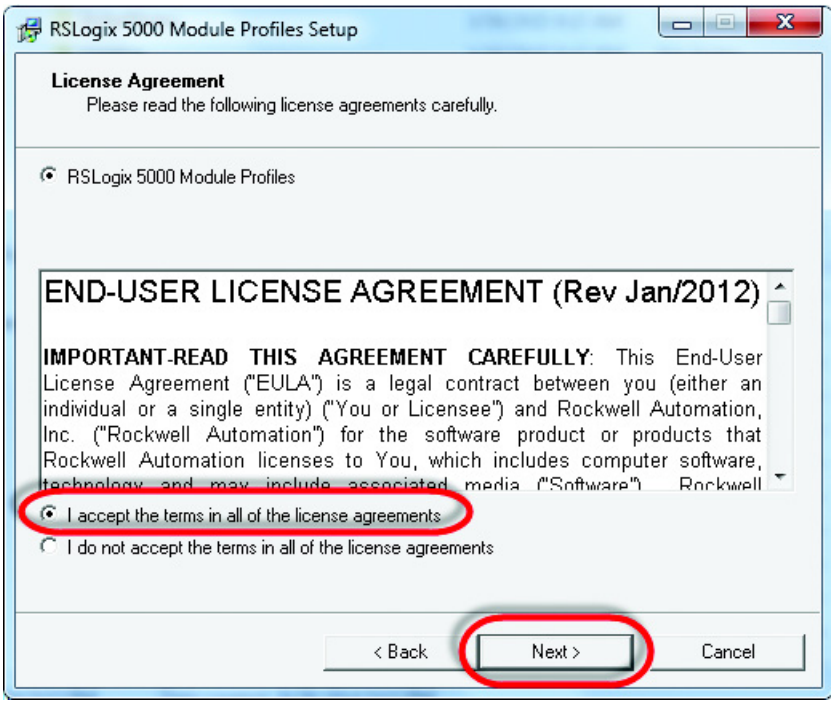
1. Download the latest IO-Link AOP file from the Add-On-Profiles website. https://download.rockwellautomation.com/esd/download.aspx?downloadid=addonprofiles

2. Extract the AOP zip file, open the folder and execute the “MPSetup” application file.

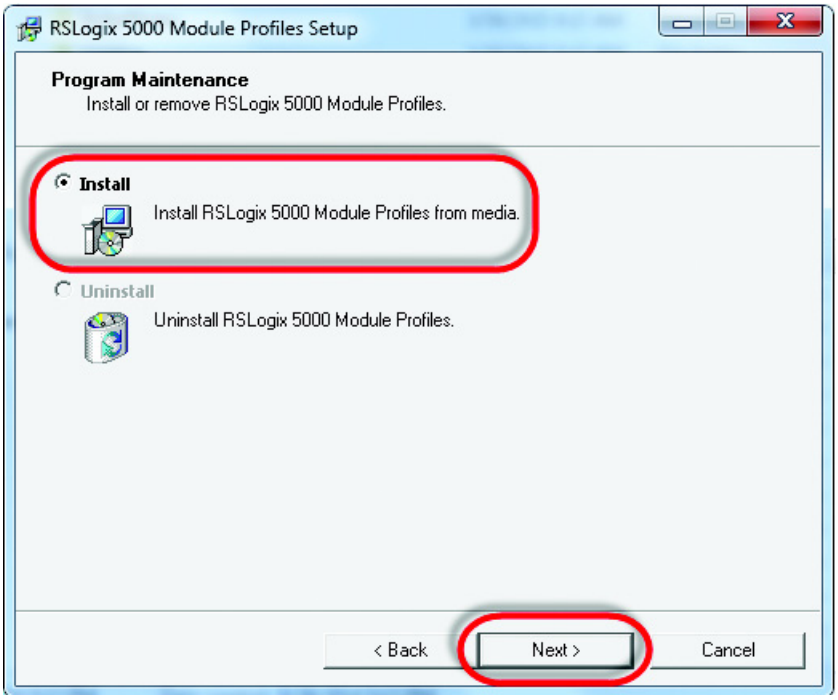


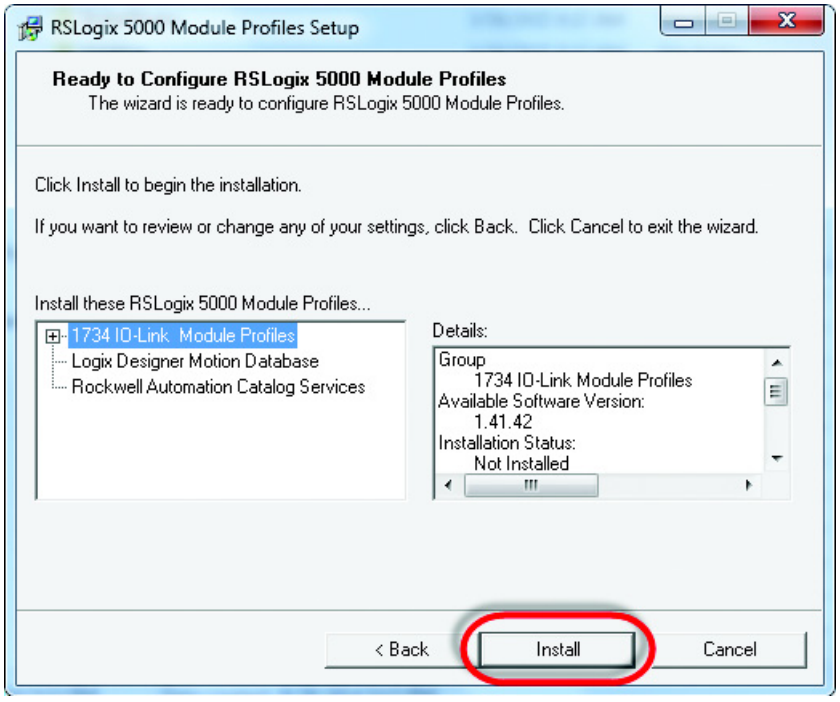
3. Select “Next” in order to install the IO-Link module profiles, accept the license agreements, select “Next” and follow the module profiles installation wizard.



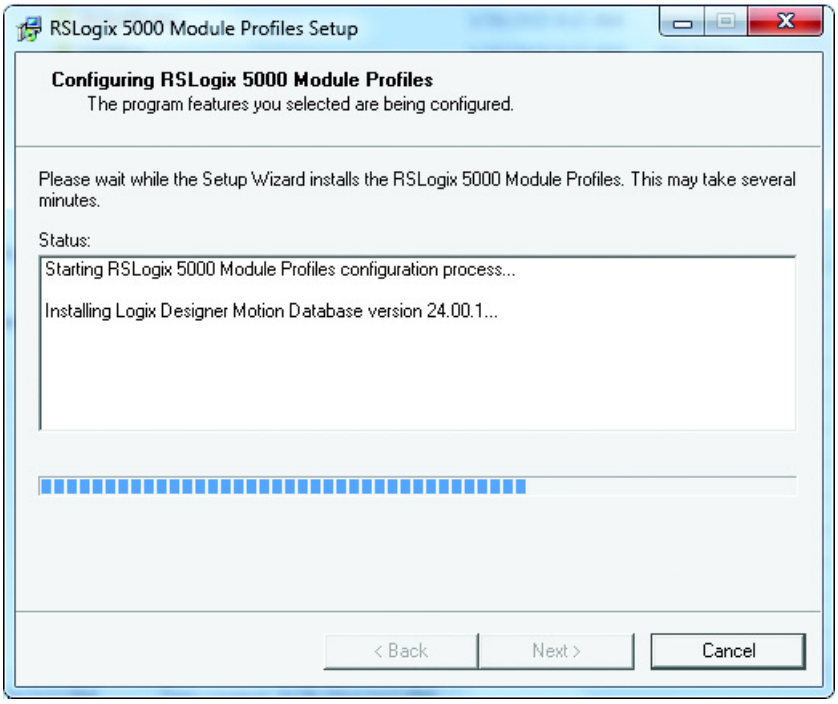


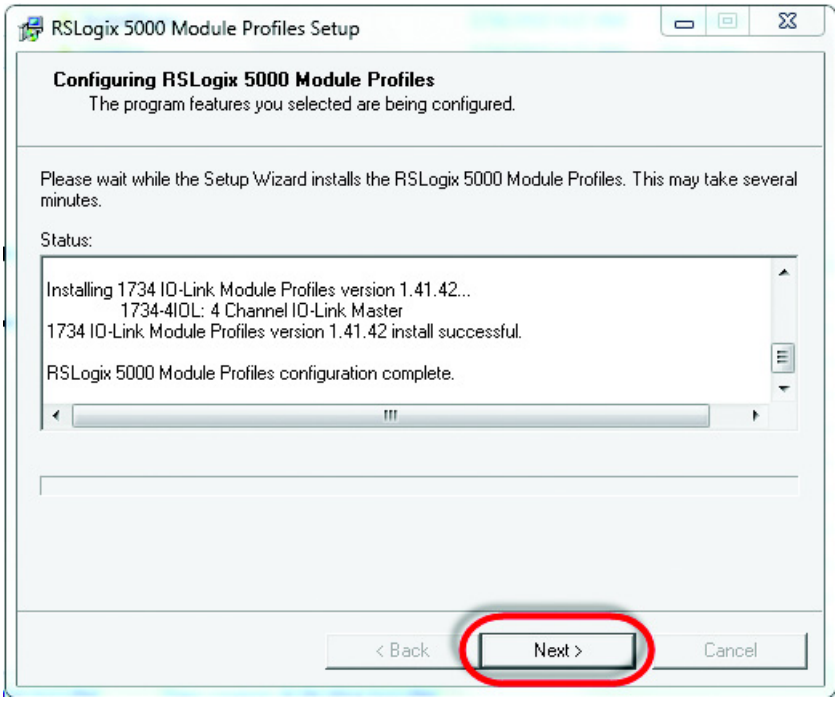
4. Ensure the "Install" option is selected, select "Next," review the install details and select "Install."



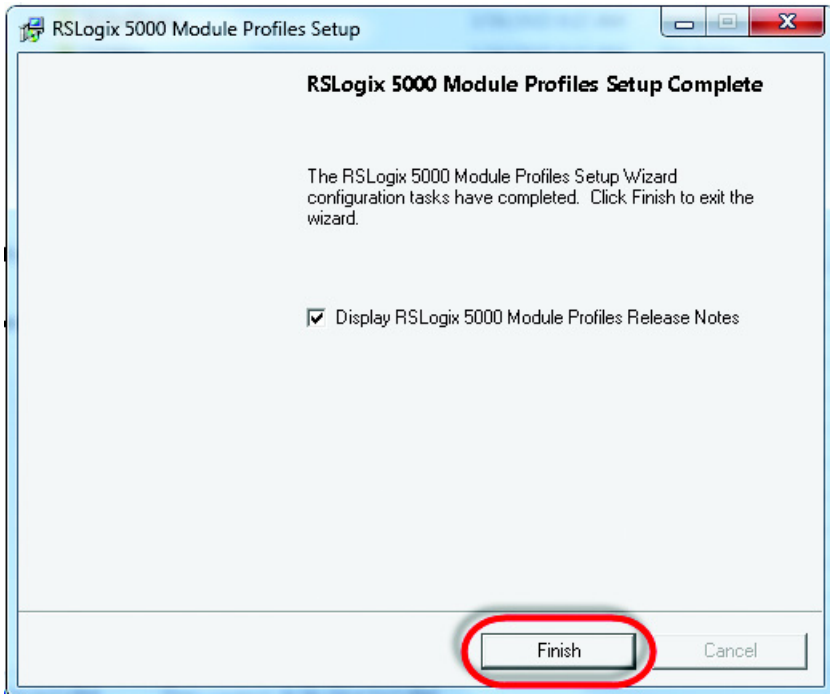


5. The installation process will begin. This may take several minutes. Once completed the “Next” button will be available, select “Next.”





6. Select “Finish” and review the release notes for any additional information. The IO-Link AOP installation is completed.



Appendix B

Device Parameters

When using Explicit Messages to Read/Write parameter values from/to the 871C the user will need to know the Index Number, Data Type, and Size of the Data that will be transmitted/received in the message. The attached table provides this information for each of the Device Parameters.

Identification

Parameter Name	Index Hex	Sub-Index Hex (Dec)	Access	Default	Allowed Value	Data Type (Length)
Direct Parameters 1. Vendor ID 2	0x00(0)	0x09(9)	RO	2 = Allen-Bradley	2 = Allen-Bradley	UIntegerT, bitLength = 8, bitOffset = 56
Direct Parameters 1. Device ID 3	0x00(0)	0x012(12)	RO	Blank	Depends on Device Variant	UIntegerT, bitLength = 8, bitOffset = 32

Parameter

Parameter Name	Index Hex	Sub-Index Hex (Dec)	Access	Default	Allowed Values	Data Type (Length)
Polarity (changed viewable in SIO mode only)	0x01(1)	0x03(3)	RW	1 = Not Inverted (Normally Open)	1 = Not Inverted (Normally Open) 0 = Inverted (Normally Closed))	871C - BooleanT, bitOffset = 120,
Detection LSB	0x01(1)	0x05(5)	RO	0	0 to 255	871C - UIntegerT, bitOffset=104, bitLength = 8
Detection MSB	0x01(1)	0x06(6)	RO	0	0 to 255	871C - UIntegerT, bitOffset=196, bitLength = 8
Switching Timer Mode	0x01(1)	0x02(2)	RW	0 = No Timer	0 = No Timer, 1 = Off Delay, 2 = On Delay, 3 = On Delay and Off Delay	871C - UIntegerT, bitLength = 2, bitOffset = 121
Base Time	0x01(1)	0x01(1)	RW	0 = 0.1 ms	0 = 0.1 ms, 1 = 0.4 ms, 2 = 1.6 ms, 3 = 6.4 ms	871C - UIntegerT, bitLength = 2, bitOffset = 123
Multiplier	0x01(1)	0x04(4)	RW	0	0 to 255	871C - UIntegerT, bitOffset = 112, bitLength = 8

Diagnosis

Parameter Name	Index Hex	Sub-Index Hex(Dec)	Access	Default	Allowed Values	Data Type (Length)
Maximum - Since Inception	0x07(7)	0x01(1)	RO	Default = 171	0 to 255	871C - UIntegerT, bitLength = 8, bitOffset = 88
Actual - Since Power Up	0x08(8)	0x01(1)	RO	0	0 to 255	871C - UIntegerT, bitLength = 8, bitOffset = 80
Direct Parameters 1. Minimum Cycle Time	0x00(0)	0x03(3)	RO	74		UIntegerT bitLength = 8 bitOffset = 104
Direct Parameters 1. Master Cycle Time	0x00(0)	0x02(2)	RO	74		UIntegerT bitLength = 8 bitOffset = 112
Direct Parameters 1.IO-Link Revision ID	0x00(0)	0x05(5)	RO	0x10		UIntegerT bitLength = 8 bitOffset = 88

Process Data (controller tag section of AOP)

Parameter Name	Index Hex	Sub-Index Hex(Dec)	Access	Default	Allowed Values	Data Type (Length)
Triggered	DT_ProcessDataIn	0x02(2)	RO		0 = Not Triggered 1 = Triggered	BooleanT bitOffset = 0
MarginStatus	DT_ProcessDataIn	0x01(1)	RO		1 = Margin Good, 0 = Margin Low	BooleanT bitOffset = 1

Appendix C

Error Codes and Events

When an event occurs, the device signals the presence of the event to the master. The master then reads out the event. Events can be error messages and warnings/ maintenance data. These messages provide insightful data from individual sensors. The user can act on these messages and remedy any issue.

Error messages are transmitted from the device to the controller via the IO-Link master. The transmission of device parameters or events occurs independently from the cyclic transmission of process data.

Error Codes

Bit	Value	Name	Description	Remedy
7	Always 0	n/a		
6	1	Invalid Process Data - LC Oscillator	The LC oscillator is not running (coil likely damaged / open)	Replace damaged sensor with exact sensor-Reference Automatic Device Configuration for sensor parameters
5	Always 0	n/a		
4	Always 0	n/a		
3	Always 0	n/a		
2	Always 0	n/a		
1	1	Warning - Voltage Underrun	Device voltage is currently being underrun	Check supply / source voltage Replace damaged sensor with exact sensor-Reference Automatic Device Configuration for sensor parameters
0	Always 0	n/a		

Location of Error Codes

In the “Controller Tags” view within Studio5000 Logix Designer, these two 871C events will show up in the “Status” section view as shown in the image below, changing from a 0 to a 1.

IMPORTANT In the Controller Tag view below, the 871C supported events are depicted as the following:

GREEN box = Status.Ch#DataInvalid, which refers to the 871C Bit 6 event (defined in matrix above)

BLUE box = Status.Ch#PowerFault, which refers to the 871C Bit 1 event (defined in matrix above)

my_aentr:1:I.Status	{...}	{...}		AB:1734_4IOL_Struct_Status:I:0
my_aentr:1:I.Status.Ch0Fault	0		Decimal	BOOL
my_aentr:1:I.Status.Ch0ConnectionFaulted	0		Decimal	BOOL
my_aentr:1:I.Status.Ch0ConfigurationInProgress	0		Decimal	BOOL
my_aentr:1:I.Status.Ch0ConfigurationFault	0		Decimal	BOOL
my_aentr:1:I.Status.Ch0KeyingFault	0		Decimal	BOOL
my_aentr:1:I.Status.Ch0ShortCircuit	0		Decimal	BOOL
my_aentr:1:I.Status.Ch0DataInvalid	0		Decimal	BOOL
my_aentr:1:I.Status.Ch0PowerFault	0		Decimal	BOOL
my_aentr:1:I.Status.Ch0ClampAlarm	0		Decimal	BOOL

Appendix ***D***

Abbreviations

ADC	Automatic Device Configuration
AOI	Add On Instruction
AOP	Add On Profile
ASN	Application Specific Name
IEC	International Electrotechnical Commission
IODD	I/O Device Description
NEC	National Electric Code
QD	Quick Disconnect
RGB	Red, Green, Blue
SIO	Standard I/O
TB	Teach Background
TD	Teach Dynamic
TM	Teach Mark

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In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit
http://www.rockwellautomation.com/services/online-phone.

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/rockwellautomation/support/overview.page, or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to help 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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