User Manual

Original Instructions

Allen-Bradley

Solid-state Temperature Sensors with IO-Link

Catalog Number 837T-D3*x*

CE

Important User Information

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

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

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

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

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

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

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

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).

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Notes:

This manual is a reference guide for the 837T Solid State Temperature Sensors. It describes the procedures that you use to install, wire, and troubleshoot your relay. This manual also gives an overview of the operation of the solid state temperature sensors.

Who Should Use This Manual

Use this manual if your responsibilities include design, installation, programming, or troubleshooting of control systems that use solid state temperature sensors including catalog numbers:

- 837T-xxxxxxxPP-D4
- 837T-xxxxxxxPA-D4

You must have a basic understanding of electrical circuitry and familiarity with solid state temperature sensors. If you do not have this knowledge, obtain the proper training before using this product.

Definitions

Publication AG-7.1 contains a glossary of terms and abbreviations that are used by Rockwell Automation to describe industrial automation systems. The following is a list of specific terms and abbreviations that are used in this manual.

- N.C. (Normally Closed) - An electrical contact whose normal state is in the closed position.
- N.O. (Normally Open) - An electrical contact whose normal state is in the open position.
- PLC - A programmable logic controller or a programmable automation controller.
- Response Time - Describes the time between the trigger of one input to the OFF state of the output. Throughout this manual, the safety outputs are described as turning off immediately, which means that the safety outputs turn off within the response time.

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
SIO	Standard I/O

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/global/literature-library/overview.page. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Product Overview

Product Description

The Allen-Bradley® Solid-state Temperature Display with IO-Link sensors are designed for the continuous monitoring of temperature where the control of this variable is critical for optimal machine operation. The large 14 segment status indicator display and the three-key tactile push button make it easy for operators to configure and troubleshoot the sensor in the application quickly.

Operation Modes

The sensor can operate in two modes:

Standard IO (SIO) Mode: The sensor default-operation mode. The sensor outputs and user interface behave as described in the installation instructions included with the product. This mode of operation is active when the sensor is connected to digital input devices such as a PLC inputs modules, distribution boxes, and input terminal connections.

IO-Link Mode: This mode is automatically activated when the sensor is connected to an IO-Link enabled master device. The sensor transmits parameters 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

- Temperature ranges: -20...+80 °C (-4...+178 °F)
- Embedded IO-Link communication protocol helps minimize downtime and increase productivity
- Available in various process connections to fit your application needs
- Rotatable housing (320°) and head (330°) provide application flexibility
- Large visual display rotates 180° to optimize the temperature indication for the application
- IP67
- IO-Link Features:
  - Teaching the Sensor setpoints can be achieved via the Add-on Profile through Studio 5000®
  - Process data that are shown in Fahrenheit eliminates the need to scale the 4...20 mA information on the PLC reducing commissioning time.
  - Lock options are available to lock local settings when operating in IO-Link mode, and therefore the user changes do not affect the sensor settings.

Notes:

Installation

Safety Considerations

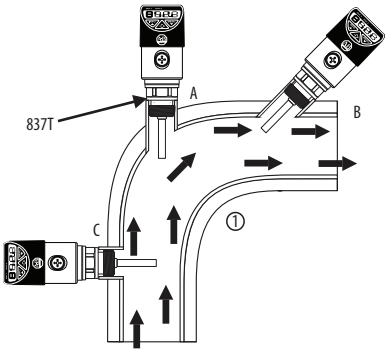
- Read this document for information on installation, handling, mounting, general product specifications, and operation of this product. These installation instructions contain important information on handling the instrument.
- Working safety requires that all safety instructions and work instructions are observed.
- Observe the relevant local accident prevention regulations and general safety regulations for the range of use of the instrument.
- The installation instructions are part of the product and must be kept in the immediate vicinity of the instrument and readily accessible to skilled personnel at any time.
- Skilled personnel must have carefully read and understood the operating instructions before any work begins.
- The Bulletin 837T-D is a temperature sensor that converts for temperature into an electrical signal indoors and outdoors. The device has been safely built with state-of-the-art technology and meets the applicable requirements and EC directives. It can, however, be a source of danger if used incorrectly or for anything other than the designated use.
- Qualified individuals are required for installation and commissioning. Failure to comply results in personal injury or equipment damage.
- Before installation, commissioning and operation, be sure that the appropriate temperature sensor has been selected in terms of measuring range, design, and specific measuring conditions.

Qualified Personnel

Qualified personnel are required to conduct the work that is described and recognize potential hazards.

Installation

Figure 1 - Recommended Installation for Optimal Performance



a. Installation at angle pieces, against the direction of flow
b. Installation in smaller pipes, which are inclined against the direction of flow
c. Installation vertical to the direction of flow.

Specifications

Attribute	837T-D3x
Certifications	CE conformity -EMC directive 2004/108/EC/, EN 61326 emission (group 1, class B), and interference immunity (industrial application) RoHs conformity - 2011/65/EU
Environment: Operating Conditions	
Ambient Temperature Range [1]	-20…+80 °C (-4…+176 °F)
Storage Temperature [1]	-20…+80 °C (-4…+176 °F)
Vibration Resistance	Probe Length <-150 mm (5.91 in.): 6 g (0.21 oz) (IEC 60068-2-6, under resonance) Probe Length >=250 mm (9.84 in.): 2 g (0.07 oz) (IEC 60068-2-6, under resonance)
Operating Temperature	150 bar (2175 psi) maximum
Shock Resistance	50 g (1.76 oz) (IEC 60068-2-27, mechanical)
Humidity	45…75% r. h.
Ingress Protection	IP65 and IP67. The stated ingress protection (per IEC 60529) only applies when plugged in with mating connectors that have the appropriate ingress protection.
Electrical	
Power Supply	15…35V DC
Current Consumption	Switching outputs with: Analog signal 4…20 mA; 70 mA;
Total Current Consumption	Maximum 450 mA including switching current
Outputs	
Output Type	IO-Link - Version 1.1 (Pin 4).
Zero Offset Adjustment	Maximum 3% of span
Output Thresholds	OUT 1 and OUT 2 are individually adjustable
Output Modes	Selectable - Normally open, normally closed, window, hysteresis
Output Voltage	(Power Supply -1V)
Output Current	OUT1 maximum 100 mA, OUT2 maximum 250 mA
Load	Analog signal 4…20 mA: ≤ 0.5 kΩ
Service Life	100 million switching cycles
Response Time	T05 < 5 s (per DIN EN 60751) T09 < 10 s (per DIN EN 60751)
Accuracy Data	
Analog Signal	≤ ±0.5% of span ± temperature sensor error
Adjustment Accuracy Switching Points	≤ ±0.5% of span
Scaling Analog Signal	0…25% of span Full scale: 75…100% of span
Switching Output	≤ ±0.8% of span ± temperature sensor error

Attribute	837T-D3x
Display	≤ ±0.8 % of span ± temperature sensor error ± 1 digit
Temperature Error [2]	±0.15K + 0.002 t[3] per EN 60751 (±1.8 * (0.15 + 0.002 (t - 32)/1.8)
Reference Operation Conditions	
Temperature	15…25 °C (59…77 °F)
Atmospheric Pressure	950…1,050 mbar (13.78…15.23 psi)
Humidity	45…75 % r. h.
Nominal Position	Process connection lower mount (LM)
Power Supply	24V DC
Electrical Safety	
Short-circuit protection	4…20 mA, Out 1/Out 2 vs. V-
Reverse polarity protection	V+ vs. V-
Insulation voltage	500V DC
Overvoltage protection	40V DC
Material	
Wetted Parts	
Temperature sensor	Stainless Steel 316Ti
Non-wetted Parts	
Housing	Stainless Steel 304
Keyboard	TPE-E
Display Window	Polycarbonate
Display Head	PC + ABS-blend

[1] At high, medium, or ambient temperature, helps maintain (by suitable measures) that the instrument case temperature does not exceed 80 °C (176 °F) in continuous operation (the temperature is measured hexagon of the process connection). At medium temperatures (above 80 °C (176 °F), the thread must not be immersed into the medium.

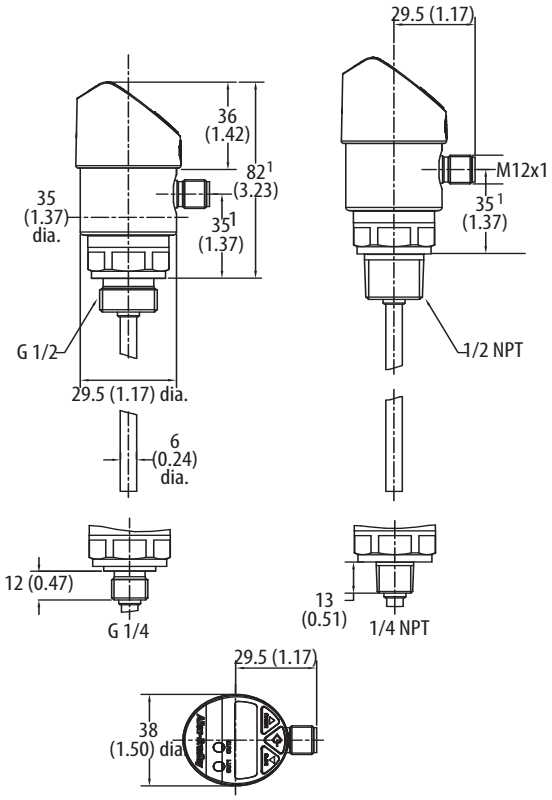
[2] The mounting situation determines the achievable accuracy (immersion depth, sensor length, operating conditions). This situation is especially the case for large temperature gradients between the environment and the medium.

[3] Absolute value of temperature (standard = -20…*80 °C (-4…176 °F).

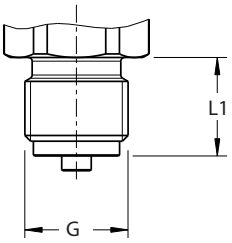
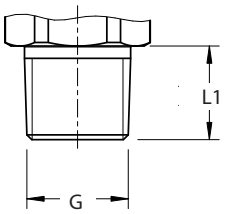
Dimensions [mm (in.)]

Attribute	Description
Measuring Element	Pt1000, 2-wire, DIN EN 60751/Class A
Application	Measurement and monitoring of set temperatures
Process Connection	Thread – 1/4 in. NPT male – 1/2 in. NPT male – G 1/2 in. BSPP male – G 1/4 in. BSPP male

Process Connection [mm (in.)]

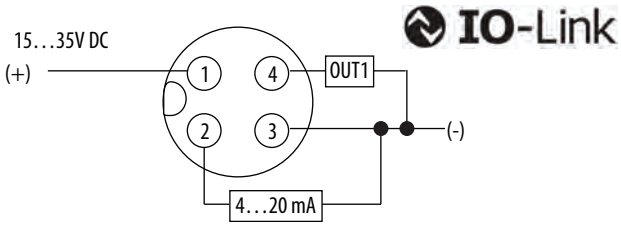


[1] Dimensions are for reference only and are variable depending on the process connection.

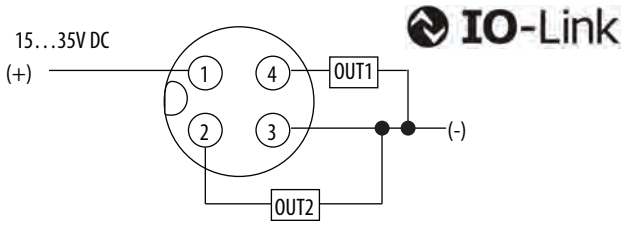
G Male		NPT Male	
			
G	**L1 [mm (in.)]**	**G**	**L1 [mm (in.)]**
G 1/4	12 (0.47)	1/4 in. NPT	13 (0.51)
G 1/2	14 (0.55)	1/2 in. NPT	19 (0.75)

Wiring Diagrams

1 PNP x 4…20 mA



2 PNP



Mating Cables Cordsets

889D – F4AC-2 (M12x1 connector).

889D-R4AC-2 (M12x1 right angle connector).

Switching Output 1	Switching Output 2	Analog Signal
PNP	—	4…20 mA (3 wire)
PNP	PNP	—

Commissioning

ATTENTION: Only for use with the temperature sensor if it is in perfect condition concerning safety.

Check the following points before commissioning:

- Leaking fluid is indicative of damage.
- Check the diaphragm for any visible damage.

Required tool: Spanner size 27 open-ended spanner and screwdriver.

Making the Mechanical Connection

- While mounting, make sure that the sealing faces at the instrument are clean and undamaged.
- Only screw in or unscrew the instrument via the spanner flats. Never use the case as a working surface.
- The correct torque depends on the dimensions of the process connection and the gasket used (form/material).
- When screwing in, be careful not to cross the threads.

Types of Sealing

Figure 2 - Parallel Thread **Tapered Thread (NPT)**

per EN 837 per DIN 3852-E NPT

Correct sealing of the process connections with parallel threads at the sealing face must be made using suitable flat gaskets and sealing rings.

The sealing of the tapered threads (for example, NPT thread) is made by providing the thread with additional sealing material such as, PTFE tape (EN 837-2).

Making the Electrical Connection

- The instrument must be earthed via the process connection.
- The power supply for the temperature switch must be made via an energy-limited electrical circuit in accordance with section 9.3 of UL/EN/IEC 61010-1 or an LPS to UL/EN/IEC 60950-1 or class 2 in accordance with UL1310/UL1585 (NEC or CEC). The power supply must be suitable for operation above 2,000 m (6,561.6 ft) if the temperature switch is used at this altitude.
- For cable outlets, make sure that no moisture enters at the cable end.

Dismantle

Let the instrument cool down sufficiently before dismantling.

ATTENTION: Residual media in the dismantled temperature transmitter can result in a risk to persons, the environment, and equipment. Take sufficient precautionary measures.

BURN HAZARD: Let the instrument cool down sufficiently before the dismantle process. During the dismantle process, there is a risk of dangerously hot temperature media escaping.

Disposal

Incorrect disposal can put the environment at risk.

Dispose of instrument and packaging materials in an environmentally compatible way and in accordance with the country-specific waste disposal regulations.

Programming

The 837T Solid-state Temperature sensor set and reset points can be programmed by following the instructions listed below.

Keys and Functions

Note: Short press equals three seconds; long press equals five seconds.

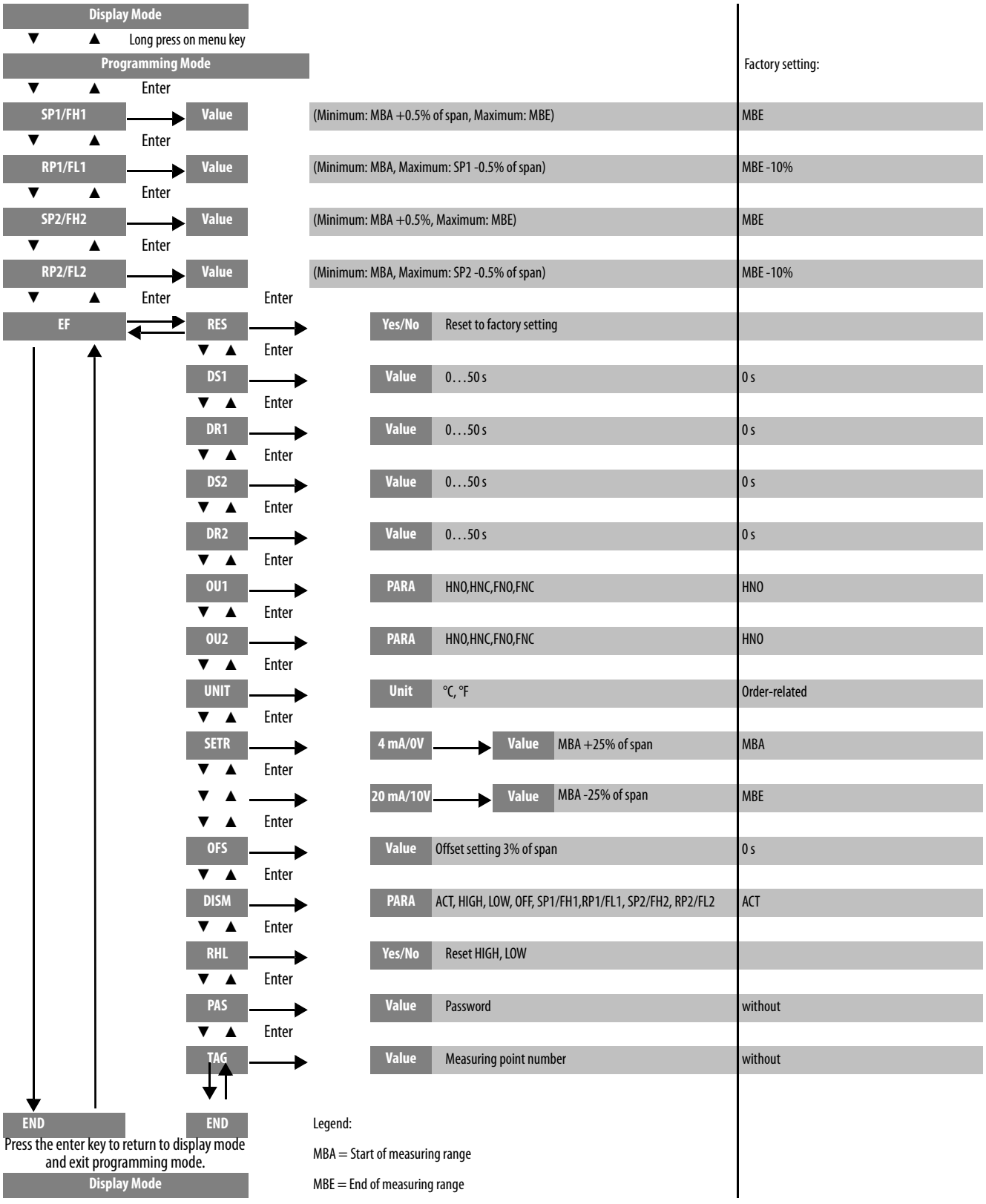
Keys (Simultaneously pressing the info and menu keys exits the programming mode and returns to display mode.)	**Function**		
	Display Mode	**Programming Mode** (Press the menu key for five seconds to enter programming mode.)	
	Short Press: • Display of the unit Long Press: • Display of set parameters	Short press: toggle parameter up (step-wise)	Long press: toggle parameter up (fast scroll)
	Short Press: • Display of the unit Long Press: • Enters programming mode	Short press: toggle parameter down (step-wise)	Long press: toggle parameter down (fast scroll)

Parameters

Parameter	Description
SP1/SP2	Hysteresis function: Switch point switching output (1 or 2)
FH1/FH2	Window function: Window high switching output (1 or 2)
RP1/RP2	Hysteresis function: reset point switching output (1 or 2)
FL1/FL2	Window function: Window low switch output (1 or 2)
EF	Extended programming functions
RES	Return the set parameter to the factory settings
DS1/DS2	Switch delay time, which must occur without interruption before any electrical signal change occurs (SP1 or SP2)
DR1/DR2	Switch delay time, which must occur without interruption before any electrical signal change occurs (RP1 or RP2)
OU1	Switch function switch output (1 or 2)
OU2	HNO = hysteresis function, normally open HNC = hysteresis function, normally closed FNO = window function, normally open FNC = window function, normally closed

Parameter	Description
UNIT	Unit switching
OSET	Offset adjustment (3% of span)
DISM	Display value in display mode CT= actual temperature value; LOW, HIGH = minimum, maximum temperature value OFF= display off; SP1/FH1 = function switch point 1, RP1/FL1 = function reset point 1, SP2/FH2= function switch point 2, RP2/FL2 = function reset point 2
DISU	Display update 1, 2, 5, 10 updates/second
DISR	Rotate display indicator by 180°
RHL	Clear the minimum and maximum value memories
PAS	Password input, 0000= no password Password input digit by digit
TAG	Input of a 16-figure alphanumeric measuring point number

Menu (Programming and Factory Setting)



Notes:

837T Temperature 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. The option of 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, creation, 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
- Analog devices no longer require a dedicated input card

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 helps ensure that sensors are operating correctly
- Detect damaged sensors and pinpoint their exact location for quick troubleshooting through Application Specific Name parameter

Device Profiles and Automatic Device Configuration

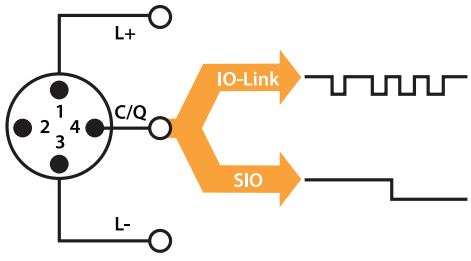
- Predefined device configurations are stored in the IO-Link master module
- Multiple configurations can be stored in controller to support changes in machine production, for example tool changes
- Within minutes instead of hours, modify sensor parameters to produce different finished goods

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. You can go beyond product detection 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

Transmission Rates

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

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

An IO-Link device typically supports only one of the specified transmissions rates. However, the IO-Link V1.1 specifications requires an IO-Link master to support all three communication rates (see Specifications on page 12 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 IO-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 addresses 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 so 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 Specifications on page 12 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 device specifies the size of the process data. 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 allows for selection of 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.

Accessing IO-Link Data

Cyclic Data

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.

Assign Device Parameters

Building a device for a specific application requires changes to parameter settings. The device parameters and setting values are contained in the IO Device Desciption (IODD) of the device.

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.

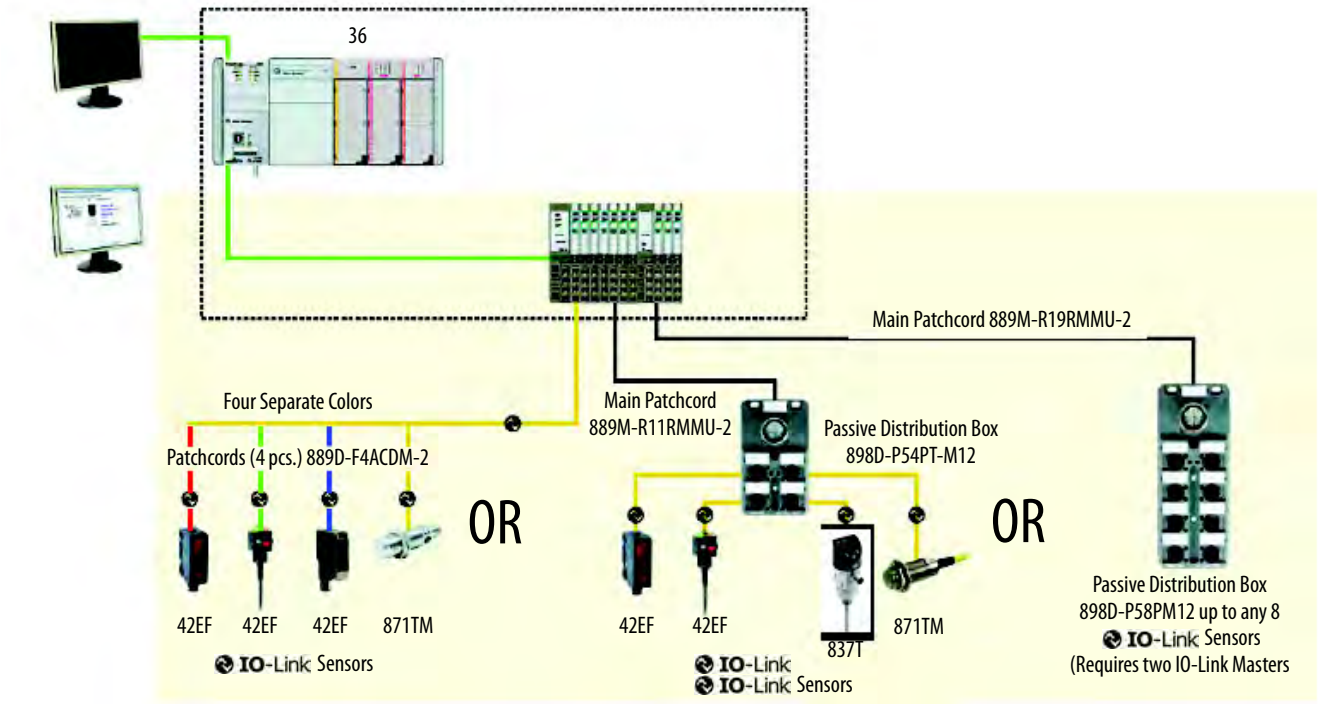
The IODD consists of multiple data files; the main file and several optional language files are in XML-format and graphic files are in PNG format (portable network graphics). These files adhere to the IO-Link open standard, which means that they can be used with any IO-Link masters.

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

Overview and Benefits of Rockwell Automation Solution

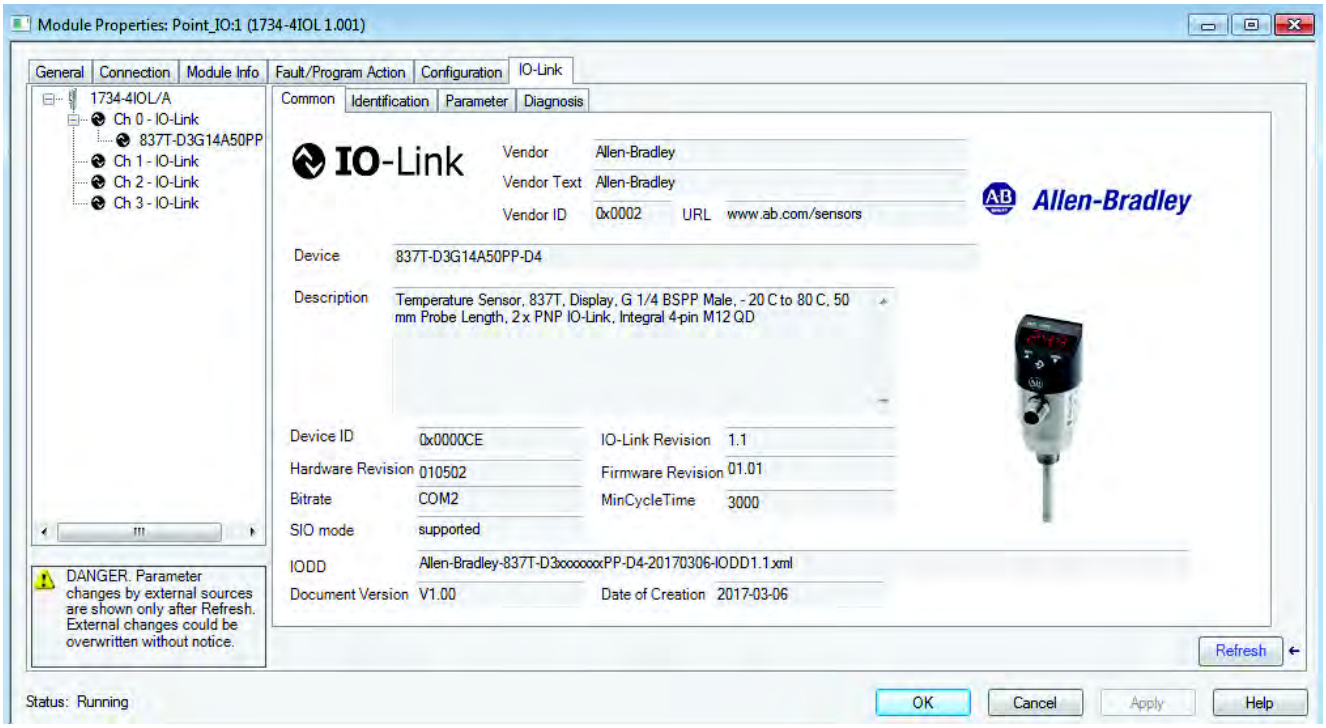
Rockwell Automation is the only supplier who provides every piece of the Connected Enterprise solution from top to bottom. Plus, exclusive features, and Premier Integration between Allen-Bradley® components and an Integrated Architecture® system allow for a seamless connection and commission of control 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. Rockwell Automation solutions, provide 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. The AOP allows design and configuration of the system in a quick and efficient manner.



837T IO-Link Features

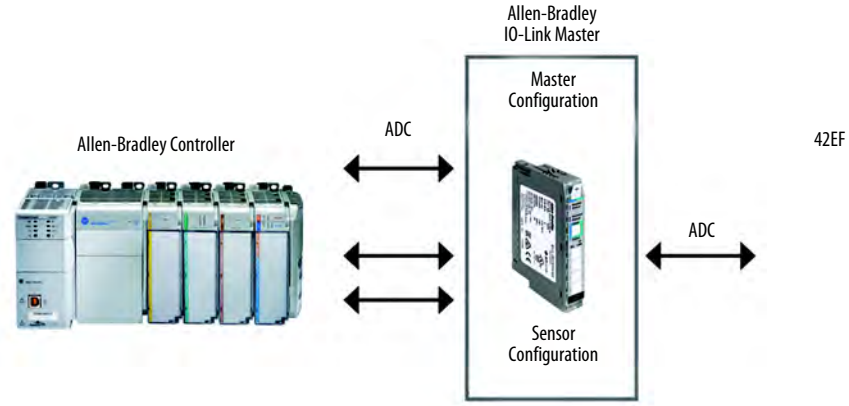
The 837T communicates the following parameters via IO-Link:

- Teach the sensor setpoints is achieved via the Add-on Profile through Studio 5000
- Process data show in Fahrenheit eliminates the need to scale the 4...20 mA information on the PLC reducing commissioning time
- Locking options are available to lock local settings when operating in IO-Link mode, and therefore any user changes do not change the settings of the sensor

Process Data Maps allow the selection of the type of information that is continuously sent to the PLC as a process data parameter.

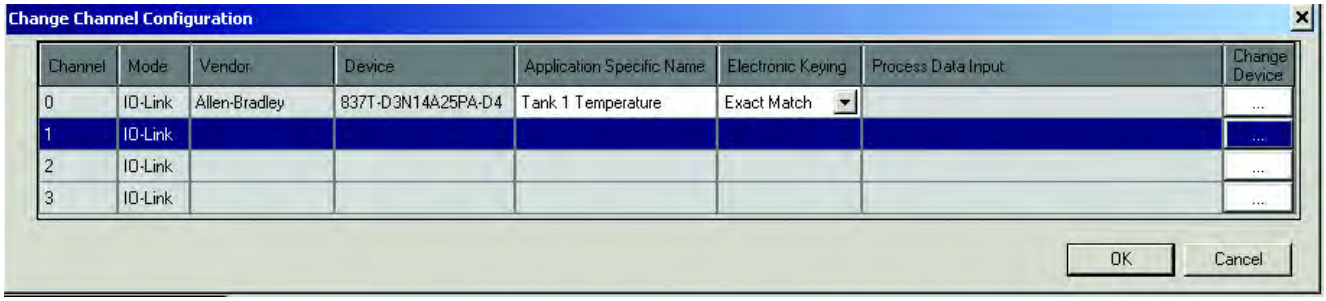
Automatic Device Configuration (ADC)

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



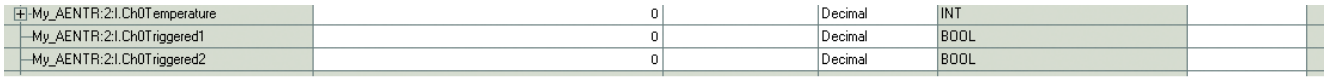
Application Specific Name (ASN)

The ASN parameter makes it easy to identify the sensor during commissioning and the lifetime of the machine when collecting data. The name resides in the project and the sensor itself.



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.



Set-up of the Solid-state Temperature Sensors for IO-Link Mode

This chapter shows the physical hardware and software that is required to configure the temperature sensor through IO-Link and provides a simple guide to install the hardware.

Products required:

Hardware

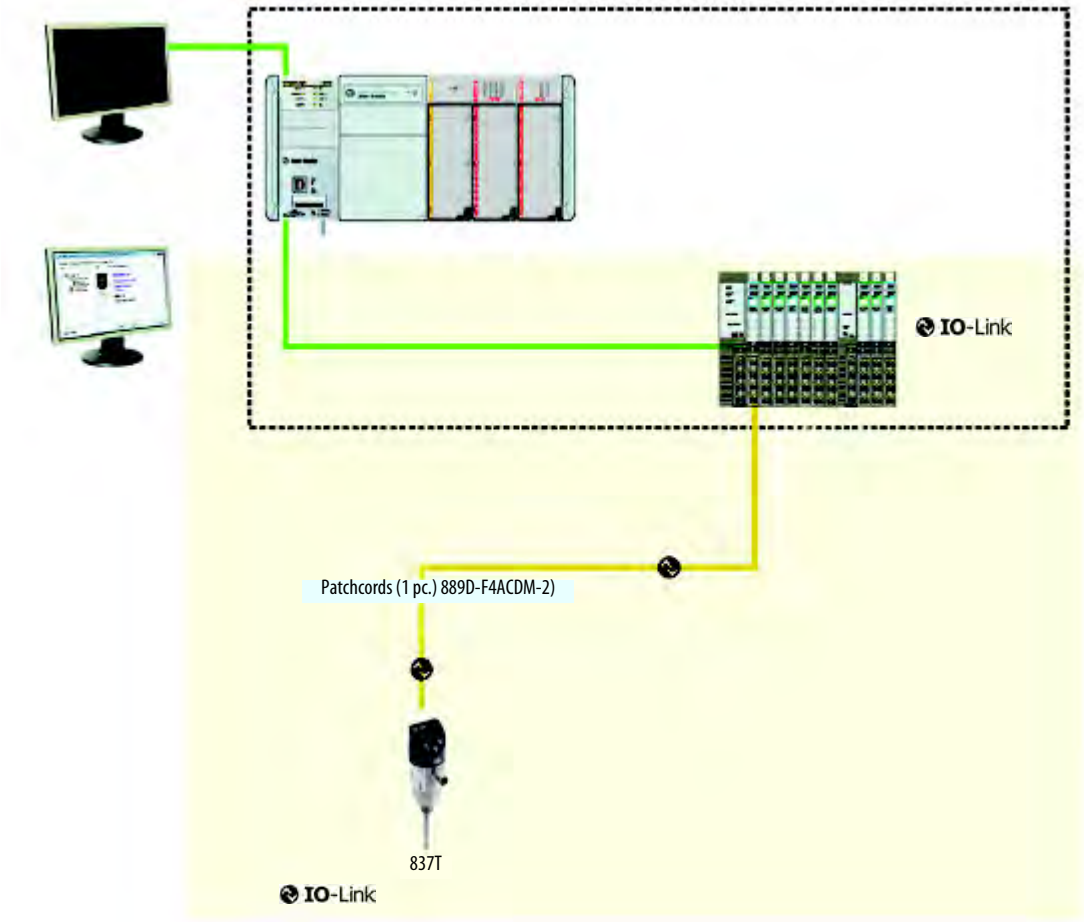
- 837T solid-state temperature display sensor
- CompactLogix™ or ControlLogix® PLC platform
- POINT I/O™ communications interface: 1734-AENTR
- POINT I/O IO-Link master module: 1734-4IOL
- POINT I/O terminal base: 1734-TB
- RJ45 network cable for EtherNet/IP connectivity: 1585J-M8TBJM-1M9*x*
- 889D cordsets (optional): 889D-F4AC-5*xx* (IO-Link maximum acceptable cable length is 20 m (65.6 ft))

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 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 837T to the 1734-4IOL master module, complete the following steps:

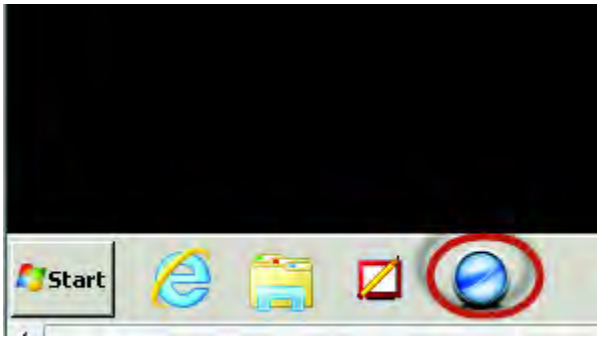
1. Provide power to the 1734-AENTR adapter.
2. Set the node address on 1734-A ENTR adapter.
3. Connect the 1734-AENTR to the Allen-Bradley controller with the recommended RJ45 Ethernet cable.
4. Wire the sensor cable to the desired location on the IO-Link master (in this example, we are showing the sensor that is wired to the channel 0).
5. Connect the 837T to the other end of the sensor cable.
6. Create or open a project in Studio 5000 to establish communication with the Allen-Bradley controller. Add the 1734-AENTR adapter and the 17344IOL IO-Link master module to the controller organizer tree (see page 35 and page 41 for detailed instructions).

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 online, go to Configuring the IO-Link Master on page 35.

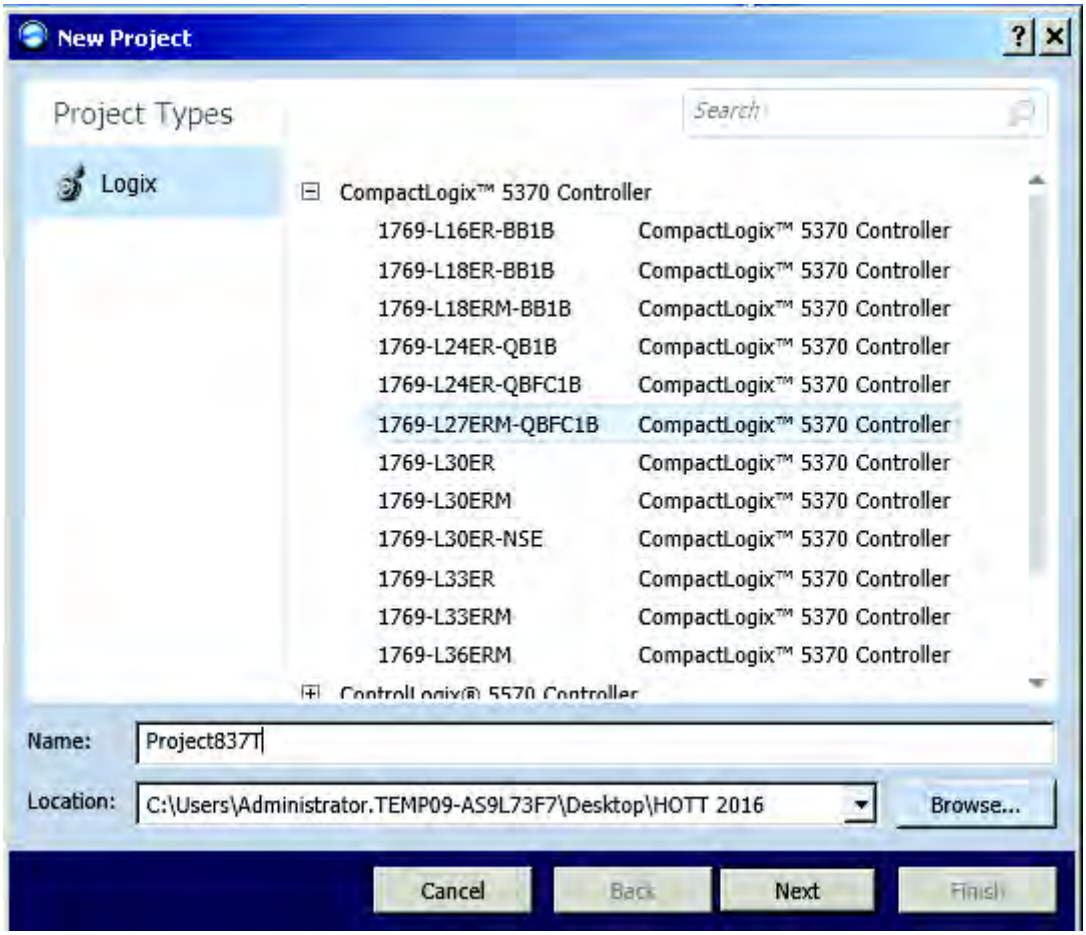
1. Double-click the Studio 5000 icon.



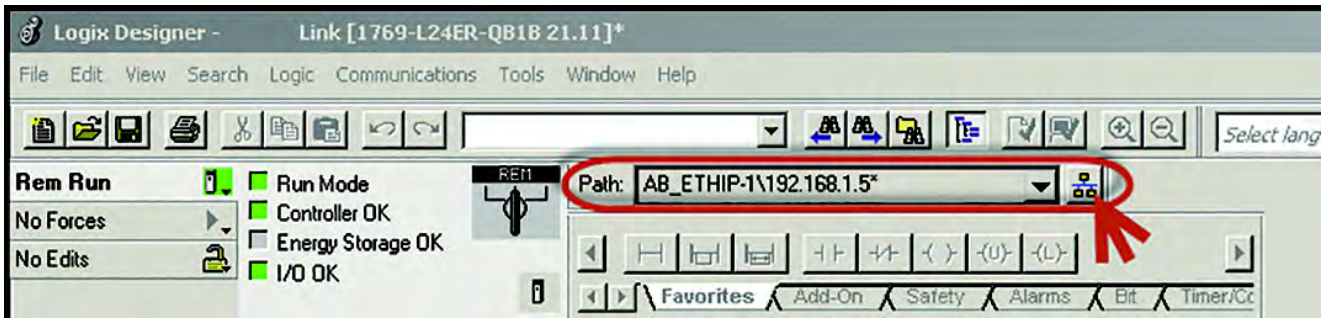
2. Click New Project.

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

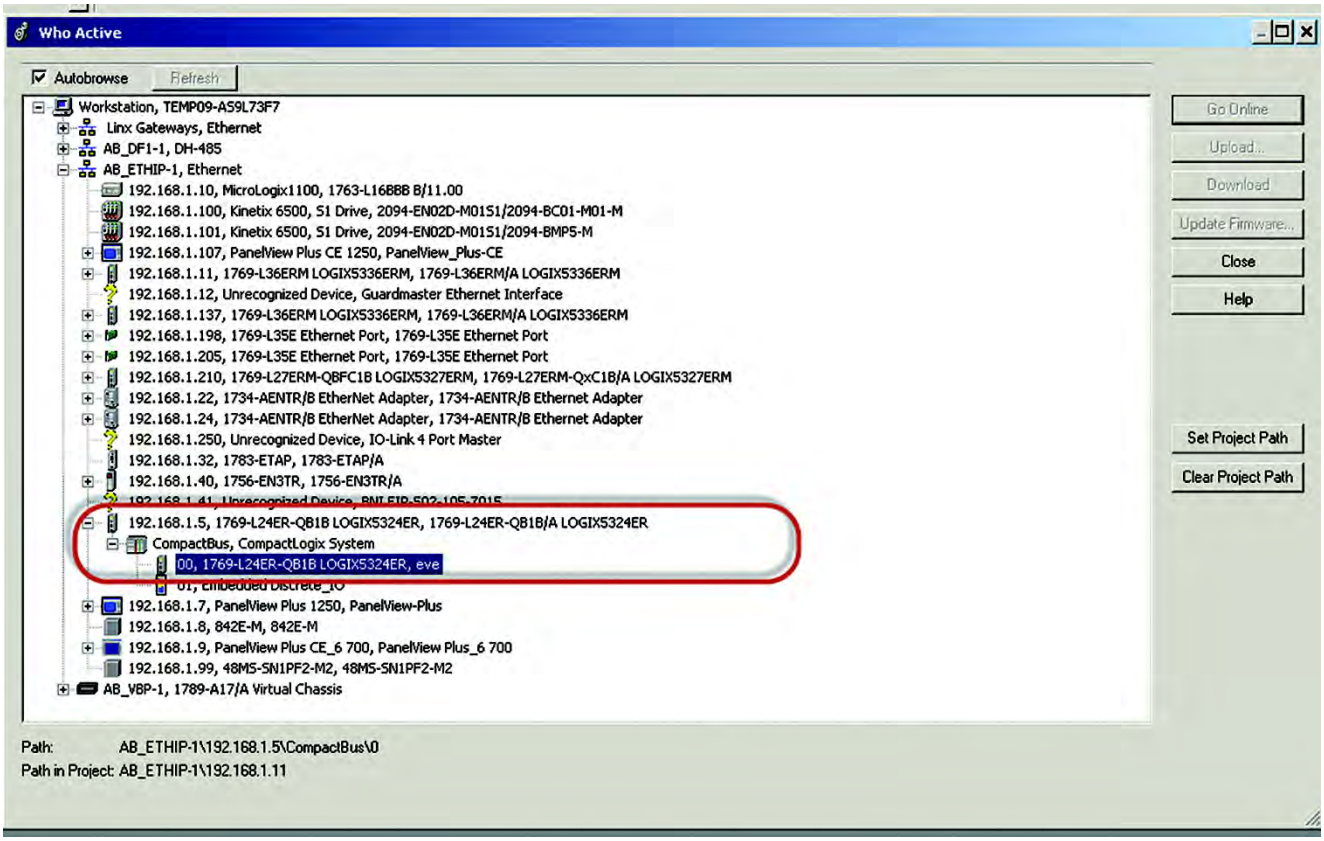
4. After selecting the controller, name the project and click "Next." In this example, the project name is "Project837T."



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 Configuring the IO-Link Master on page 35

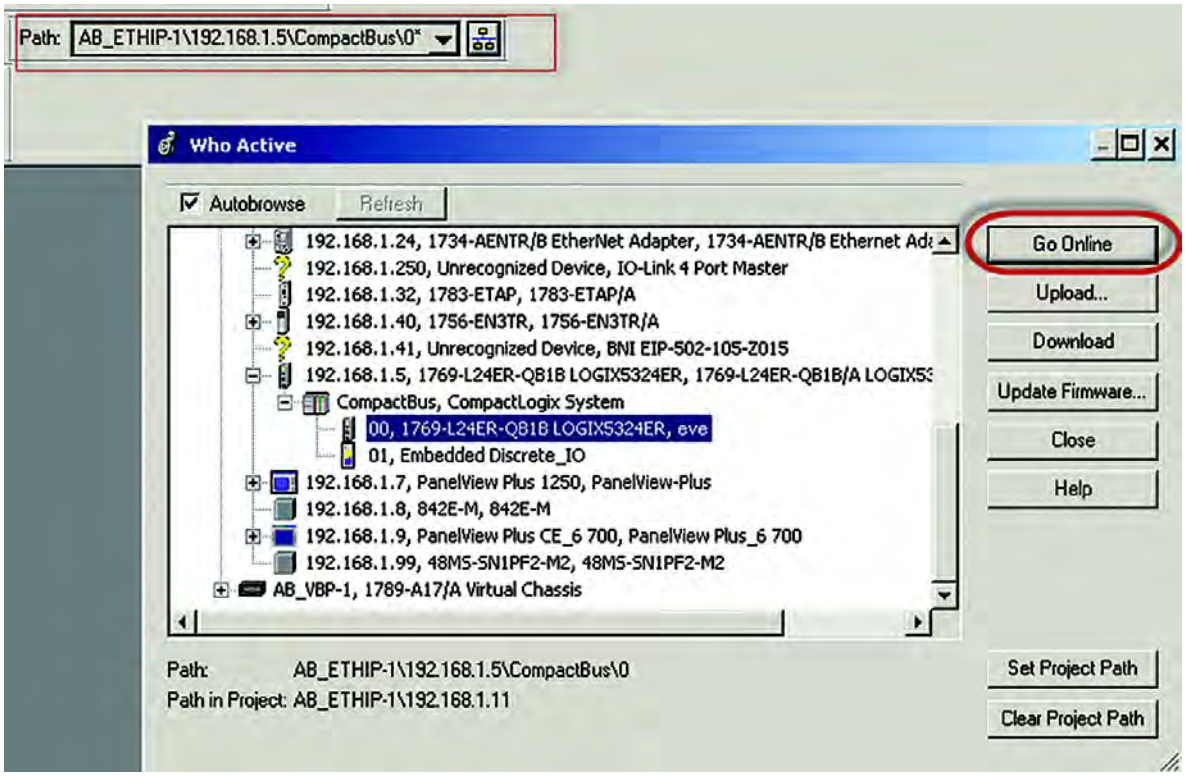
AOP Installation

Next, verify that Studio 5000 contains the 1734-4IOL IO-Link AOP. Version 20 or higher of Studio 5000 supports this module and AOP. To verify that the 1734-4IOL is installed, helps ensure the 1734 AENT(R) contains the 1734–4IOL in the library. If the AOP is required to be downloaded, reference Installing the Add-on Profile on page 63 for more information.

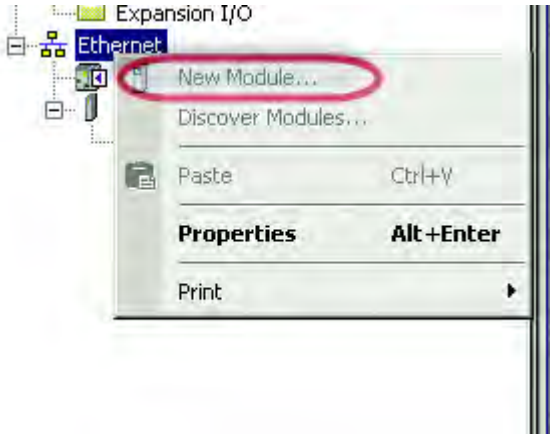
Notes:

Configuring the IO-Link Master

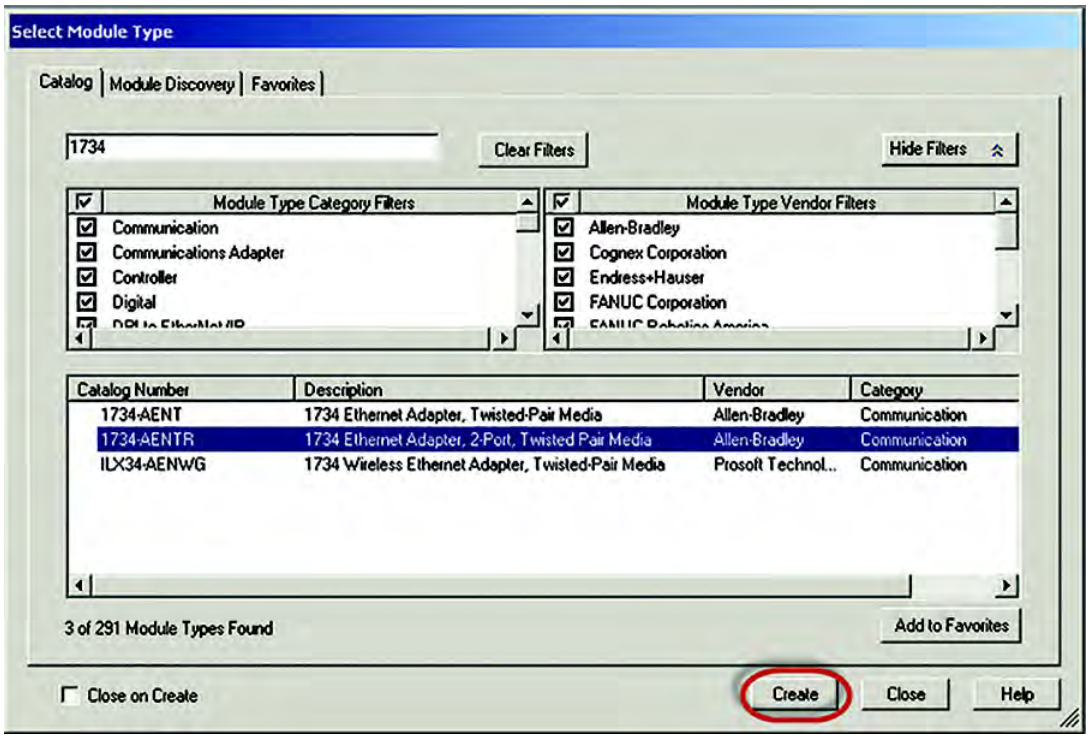
1. Make sure that the controller is offline to configure the IO-Link Master.



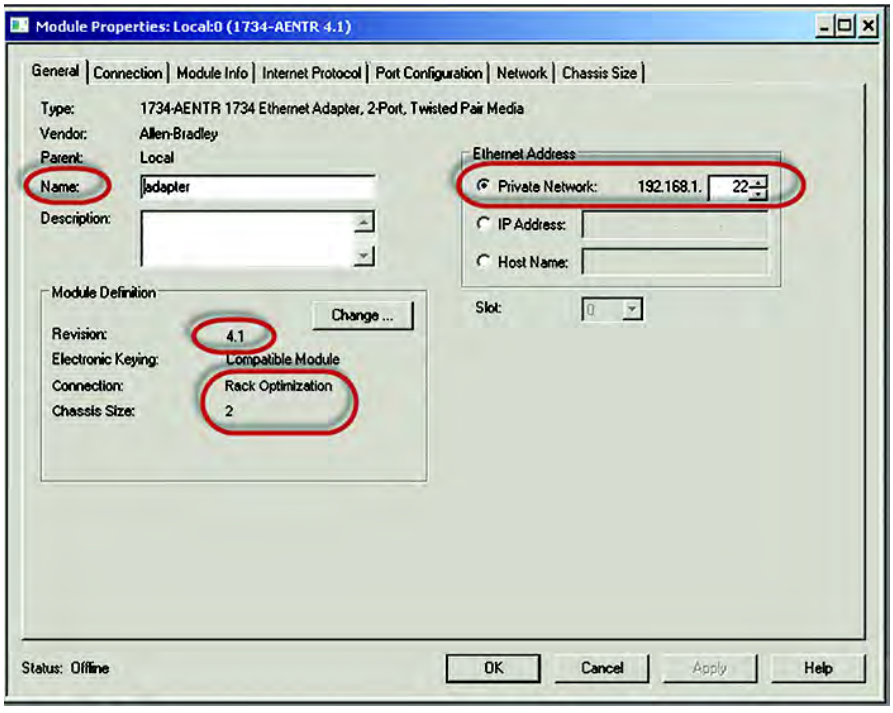
2. In the controller organizer tree, find Ethernet under I/O Configuration and right-click to "add new module."



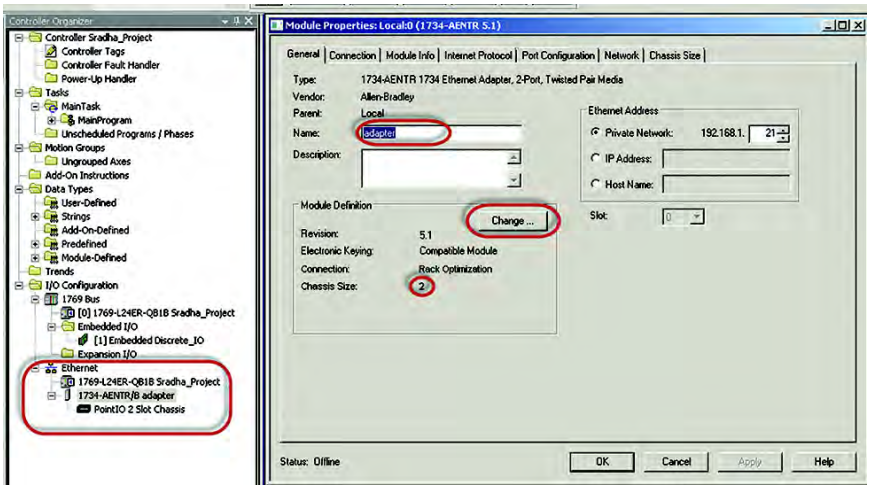
3. The module window pops up and shows the available modules. Select the "1734-AENTR, 1734 Ethernet adapter, two-port, twisted-pair media" and click Create.



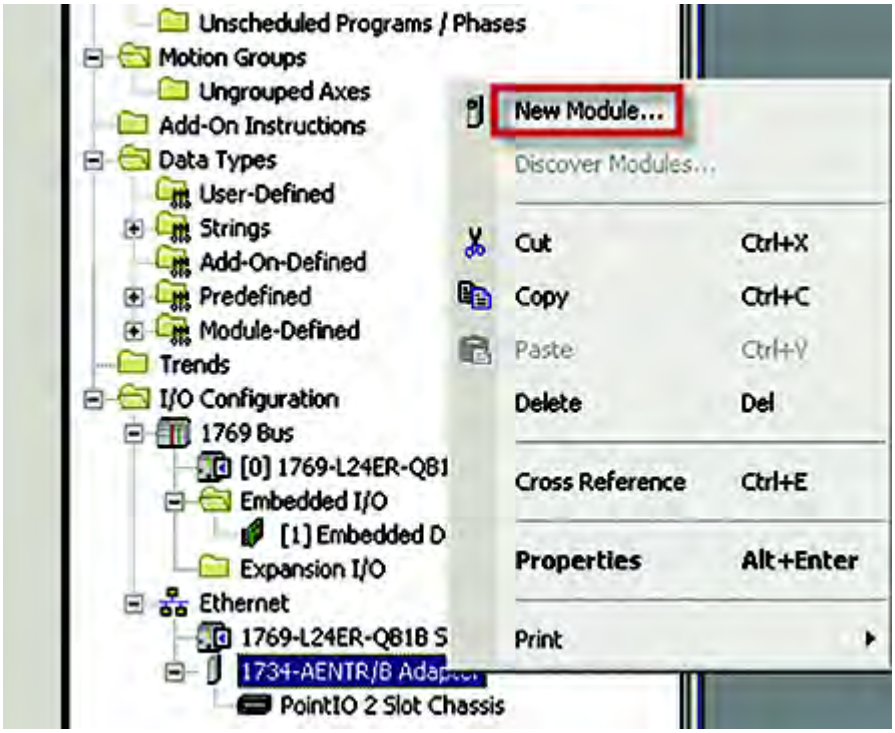
4. Name the Ethernet adapter (in this example our adapter name is "adapter"), set the chassis size, check the module revision and set-up the adapter IP address. Click OK and then Close.



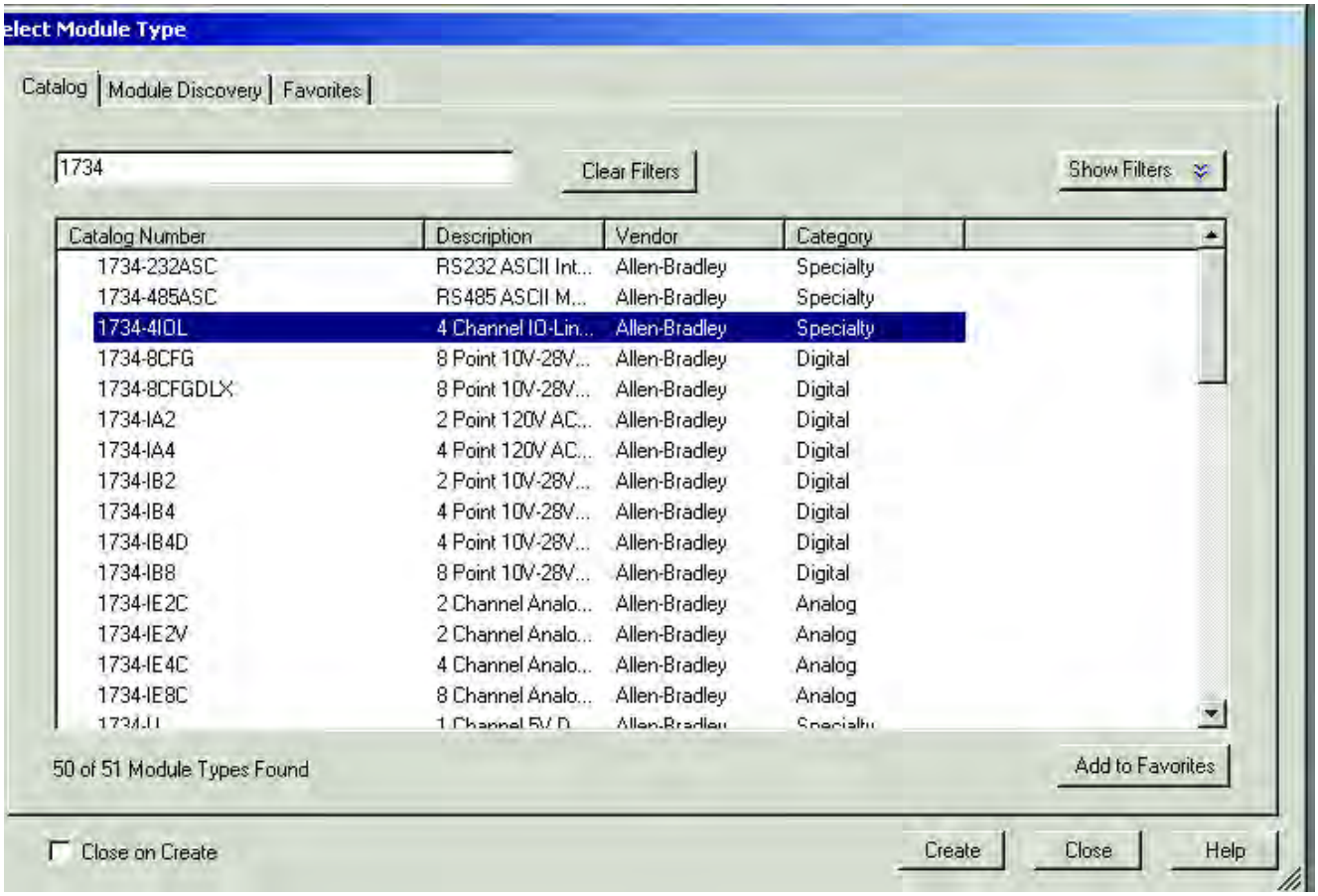
5. The 1734 AENTR now appears in the Controller Organizer tree.



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

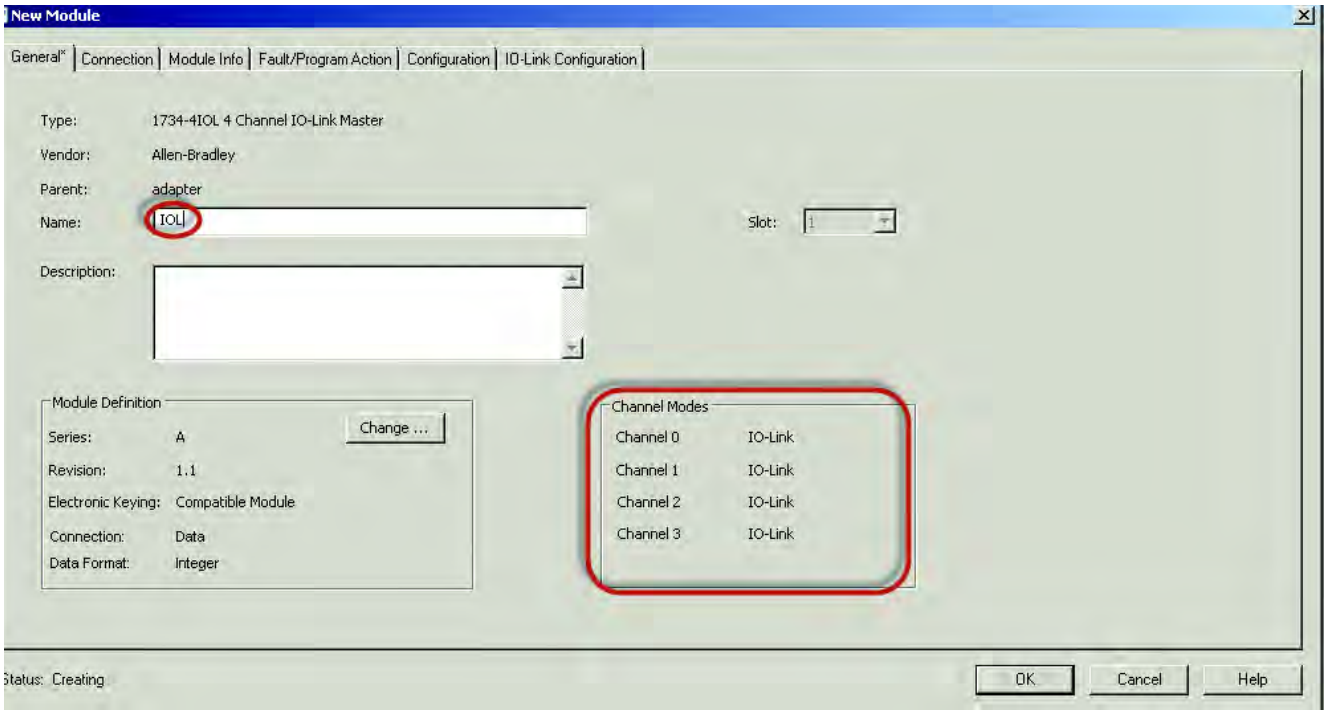


7. Select “1734-4IOL” and click Create.



8. Another screen appears showing the IO-Link Configuration screen.

9. Name the IO-Link Master and click OK.



The 837T can now be configured. To configure the sensor, a sensor-specific IODD (IO Device Description) file is required. The next steps will show how to Registering the 837T IODD on page 41

Notes:

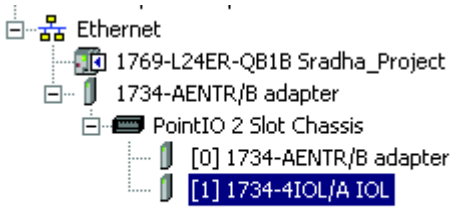
Registering the 837T IODD

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

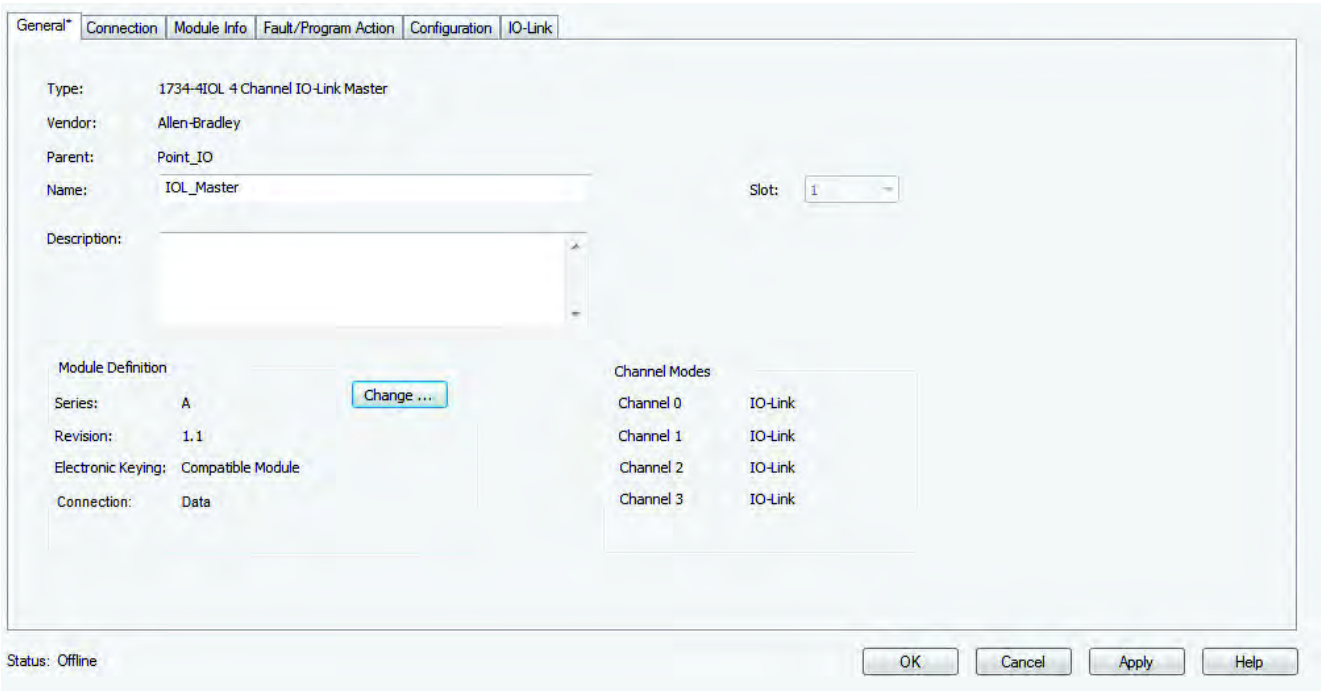
By default, the IODDs are already located in the AOP Library.

If the IODD file for the 837T cannot be located in the library, it can be downloaded from *http://compatibility.rockwellautomation.com/Pages/MultiProductDownload.aspx*. Once the IODD is registered, there's no need to register the IODD again unless it is manually deleted from the Master Tree.

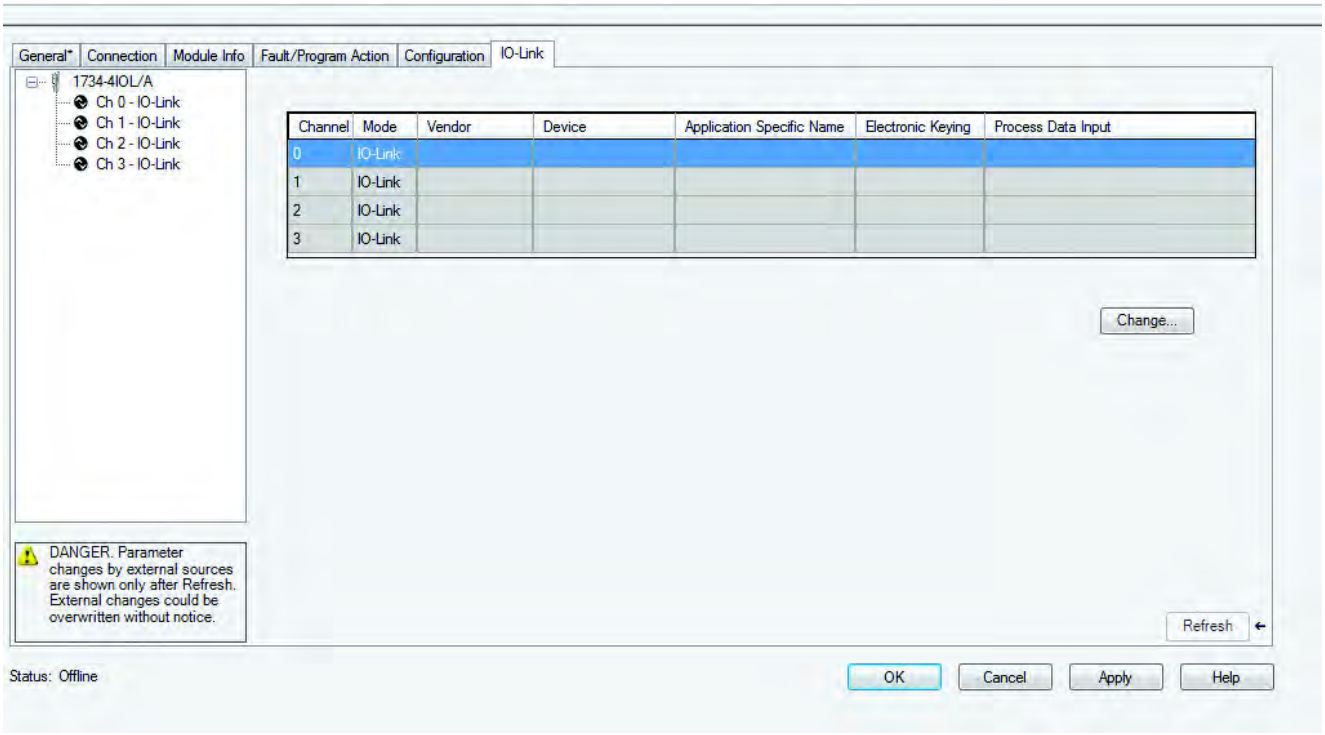
1. Double-click the 1734-4IOL in the Controller Organizer Tree.



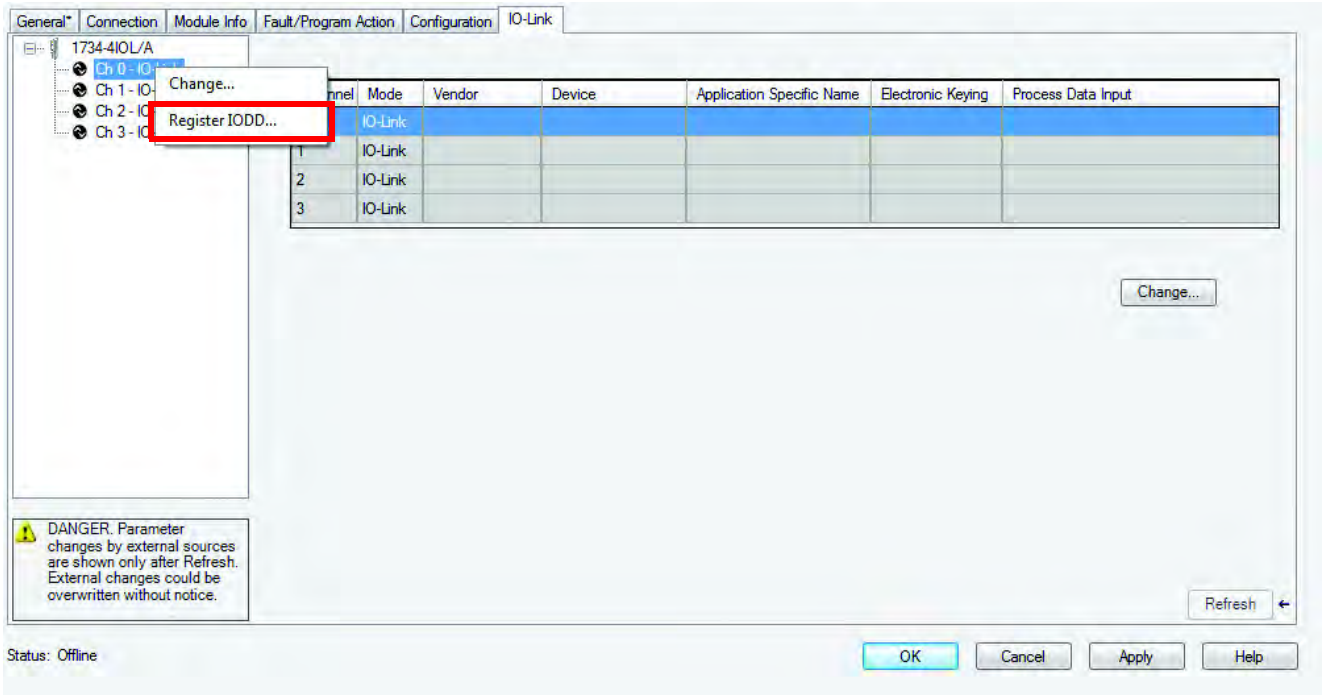
2. Select the IO-Link configuration tab.



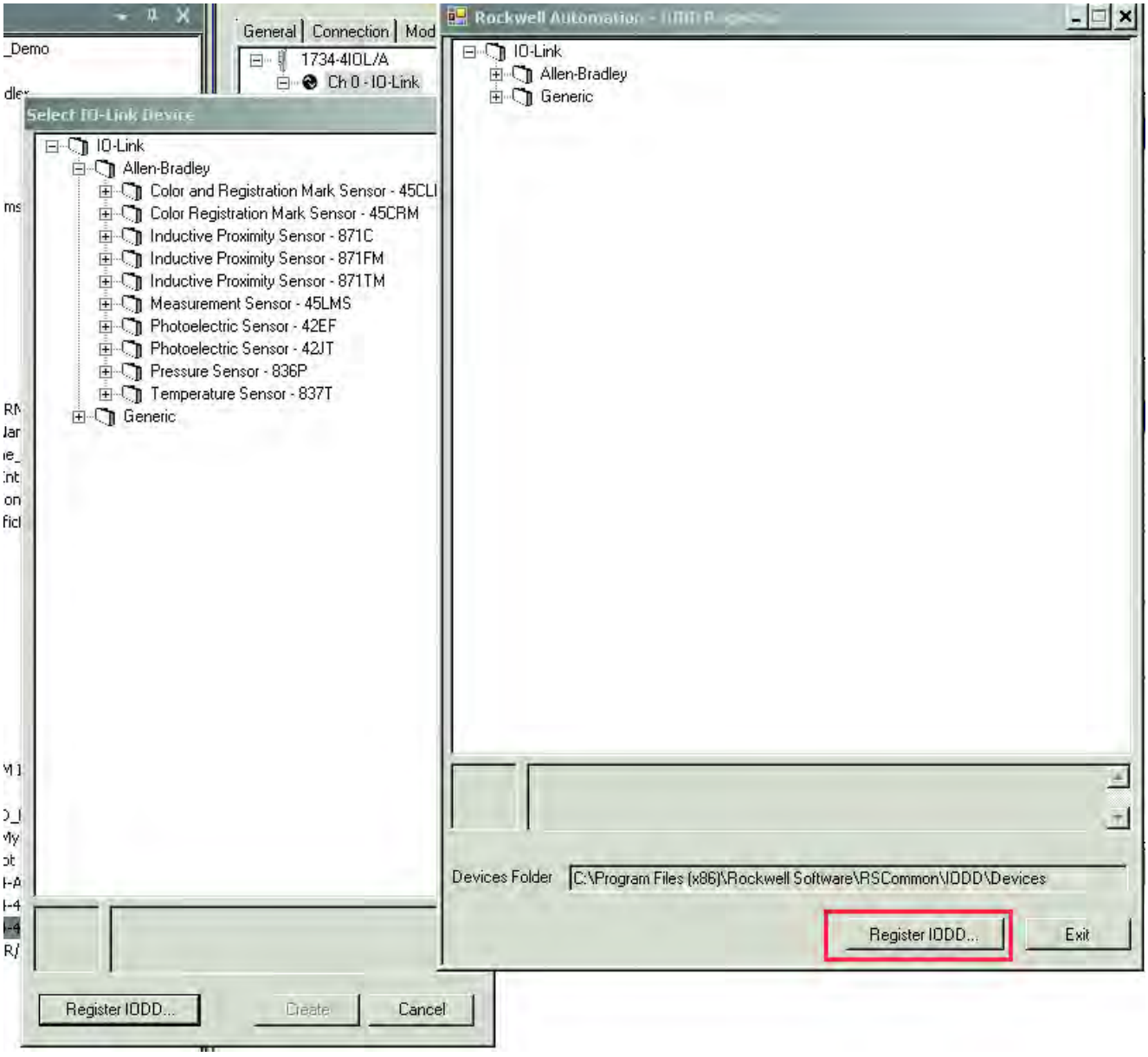
3. The IO-Link configuration screen appears.



4. Right-click the left section of the screen where the channel information is located and click "Register IODD."



5. Click the Register IODD button. A new window appears. Click the Register IODD button of the new window. The new window enables you to locate the IODD file in your computer.



6. Then click “Exit.”

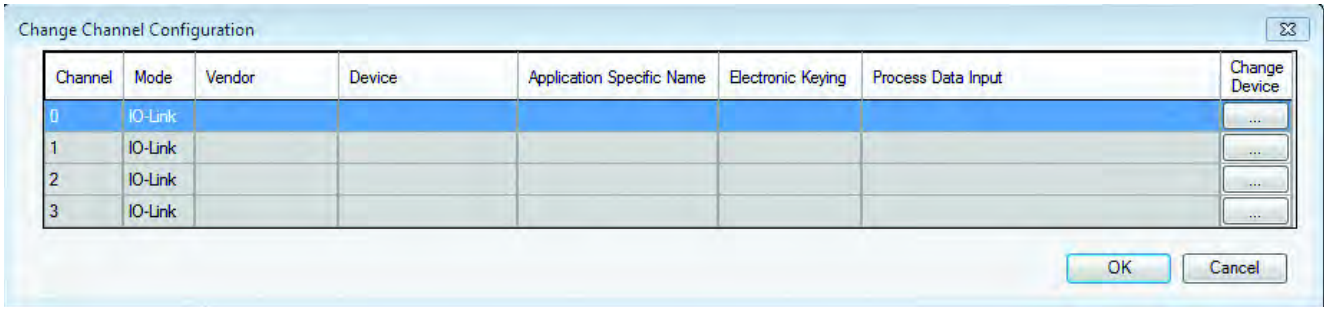
The IODD registration is complete.

Notes:

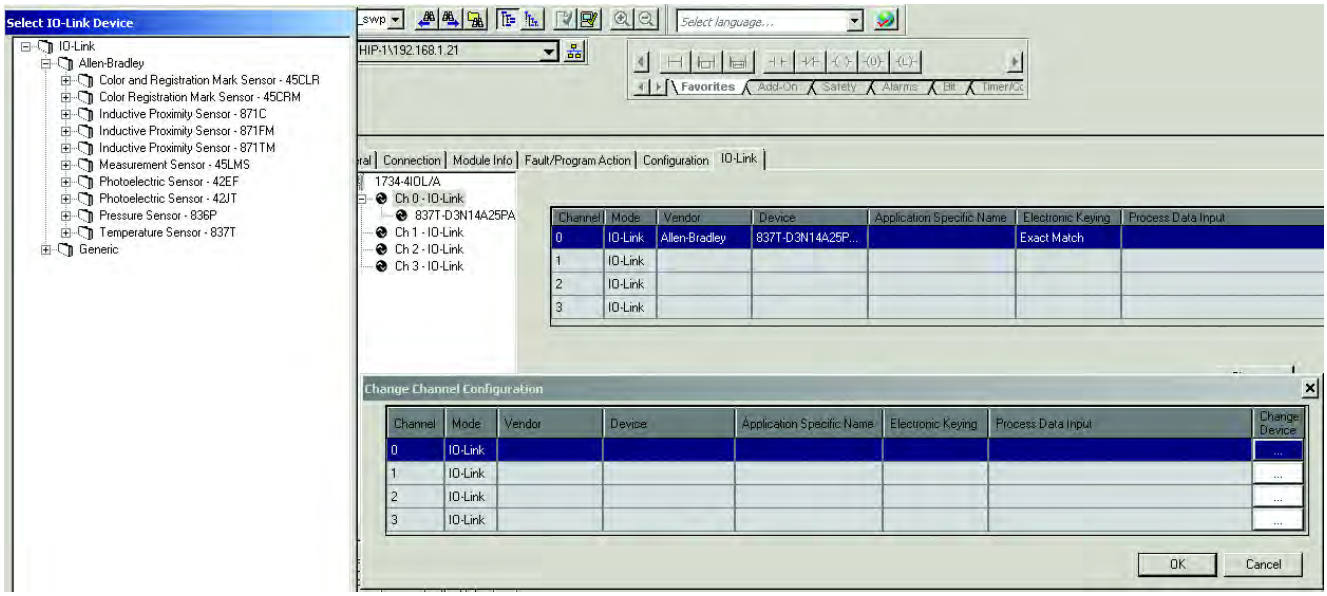
Connecting the 837T to the IO-Link Master

Once the IODD file is registered, the sensor must be connected to the IO-Link master. The controller must always be off line to add a device to the IO-Link Master.

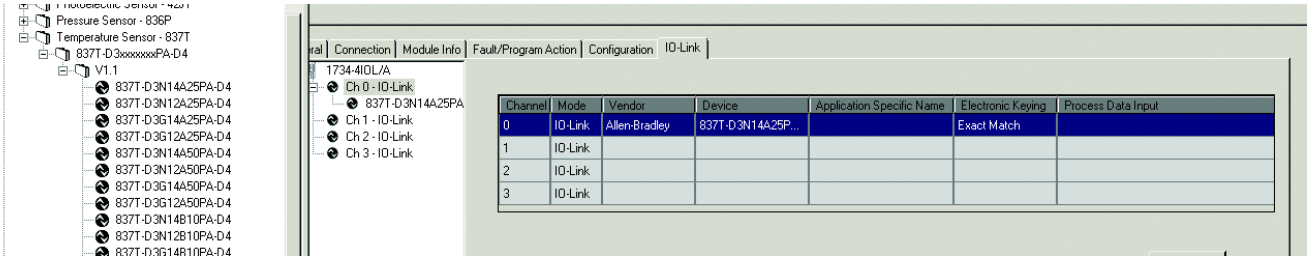
1. Right-click the channel number where the sensor is configured and click "Change."



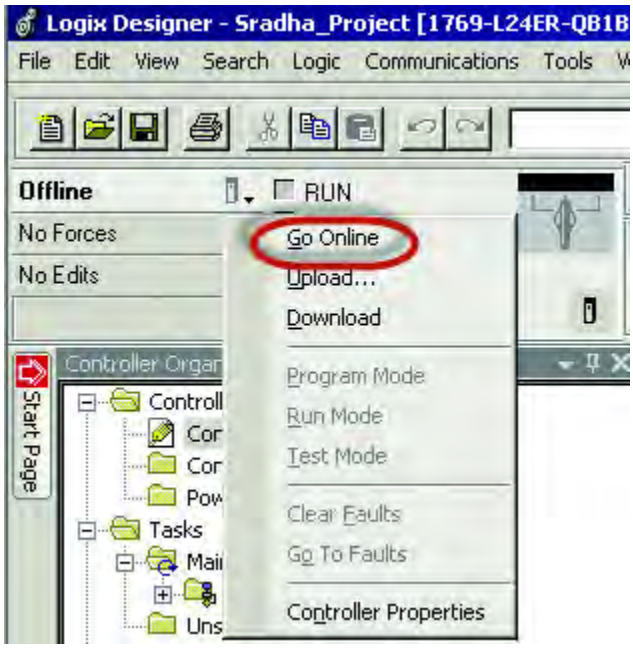
2. Click ... to select the appropriate sensor.



3. Select the appropriate sensor and double-click or click "Create."



4. Go “OK” to accept configuration.



5. Go online to communicate. Chapter 9 describes each tab of the 1734-4IOL AOP in detail and how to teach the sensor.

The following pages describe each tab of the 1734-4IOL AOP in detail and how to teach the sensor.

Exploring the 837T IO-Link Parameters

IO-Link Configuration

The 837T offers four different tabs to describe the sensor functionality and operation. These tabs are:

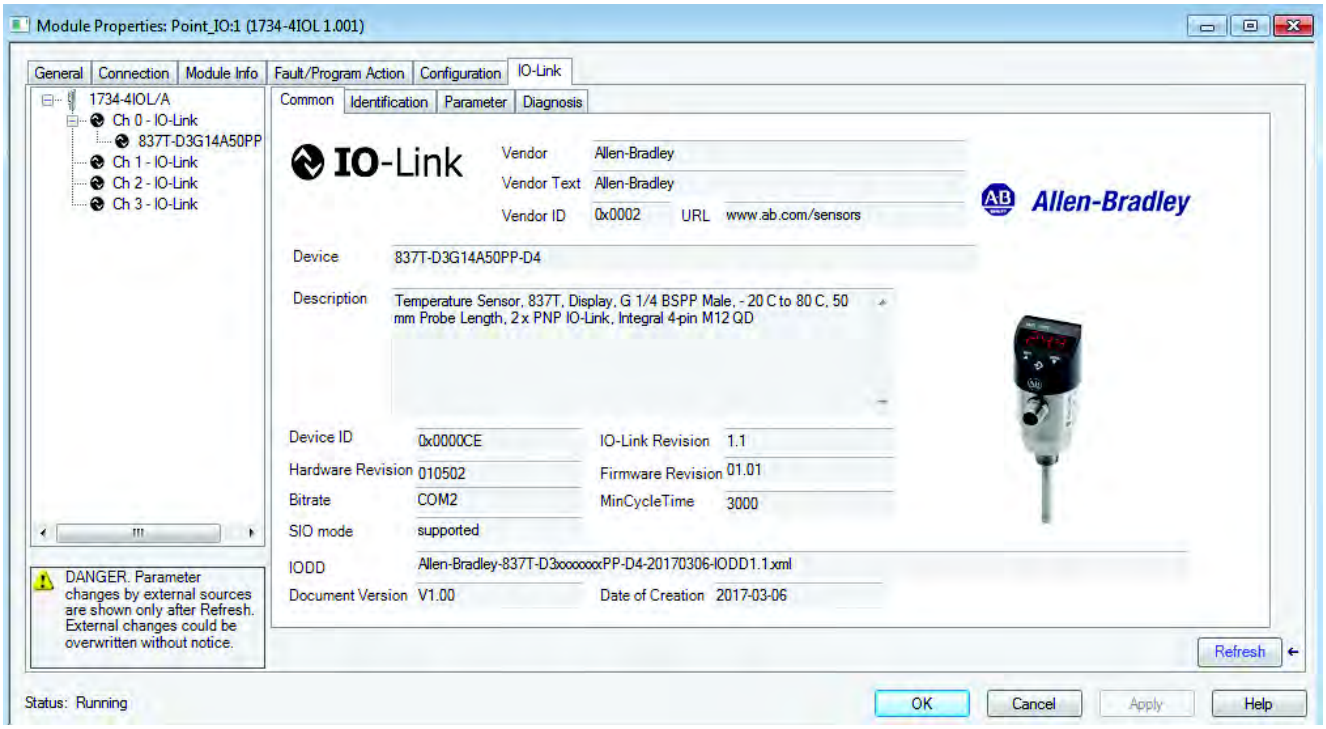
Common Tab: Provides general product information about the sensor specifications and IO-link IODD information.

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

Parameter Tab: Displays and allows you to change the IO-Link parameters that are offered by the 42EF VisiSight™ Sensor.

Diagnosis Tab: Offers the different teach functions available in the 837T.

Common Tab IO-Link Configuration



This tab contains the following sensor information:

Vendor: Provides the vendor name of the product.

Vendor Text: Field that is used to describe additional product information.

Vendor ID: Describes the vendor ID of the manufacturer of the product as designated in the IO-Link consortium.

URL: Displays the vendor URL.

Device: Provides the specific catalog number of the product.

Description: Describes the sensor features and range performance.

Device ID: Displays the unique device ID as defined in the IO-Link specifications.

IO-Link Revision: Displays the current IO-Link version that is supported by the device.

Hardware Revision: Displays the latest sensor hardware information.

Firmware Revision: Displays the latest sensor firmware information.

Bitrate: Displays the supported bitrate for communications as defined in the IO-link 1.1 standard.

Minimum Cycle Time

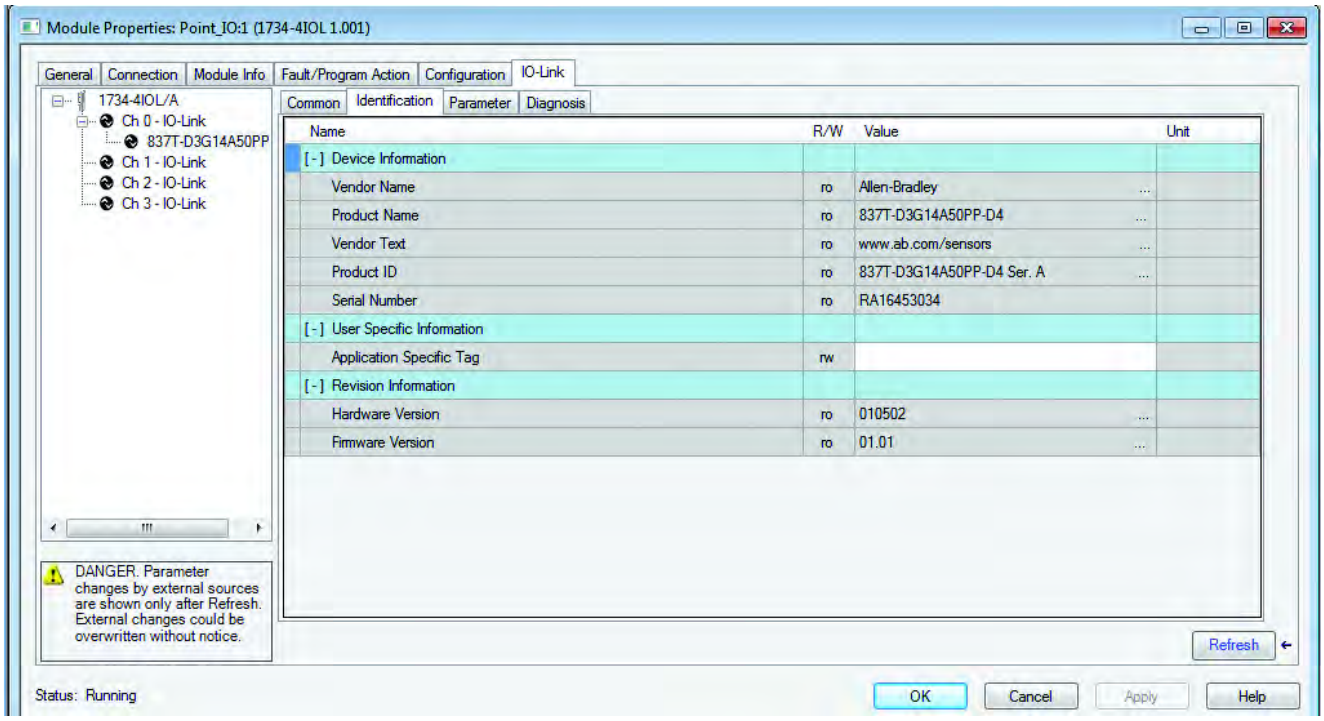
SIO Mode: Describes if the sensor is also designed to operate without an IO-Link connection.

IODD: Displays the complete file name of the IODD that is assigned to the product.

Document Version: Displays the version control for the IODD.

Date of Creation: Displays the IODD file was created.

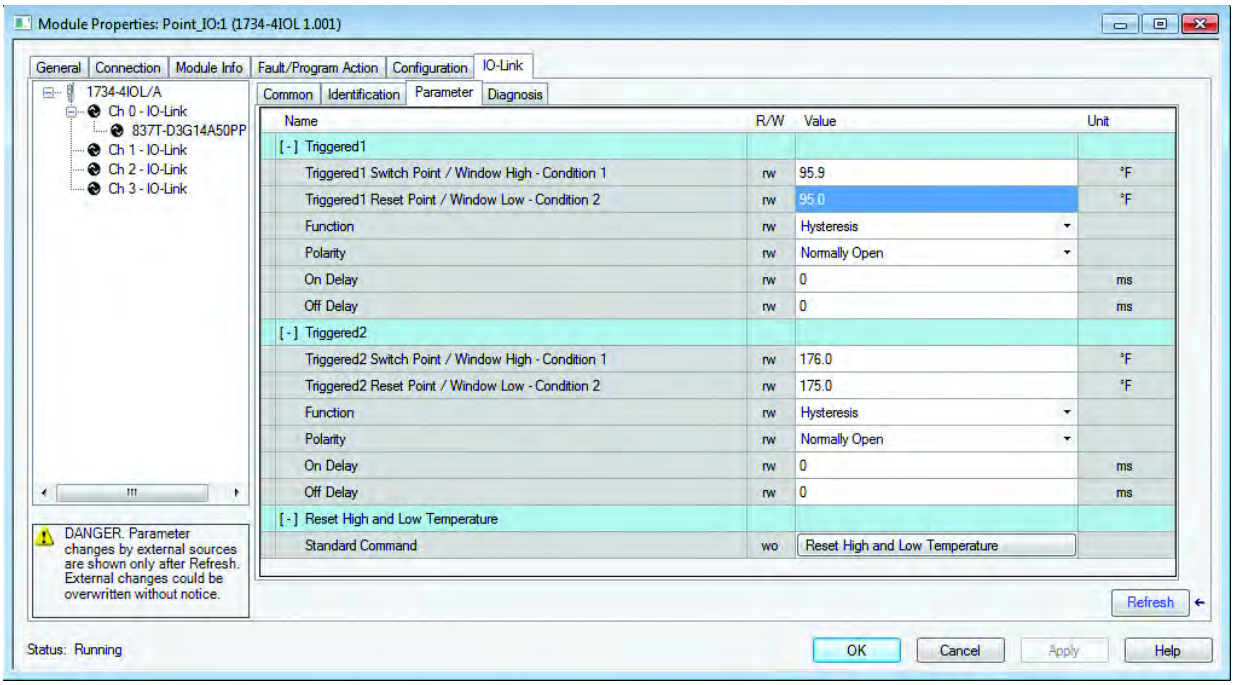
Identification Tab



The Device Information shows us the Vendor Name, Product Name, Product Text, Product ID, and Serial Number of the exact sensor that is configured. These fields are automatically populated according to the sensor information. These fields are Read Only (RO).

The User Specific Information contains the Application Specific Name (ASN) where you can name the sensor with a unique text string for identification. The ASN allows a unique identity of each sensor. These fields can be custom (that is populated and is Read/Write).

Parameter Tab



The parameter tab displays the sensor parameter settings and enables you to read data from the sensor or teach the sensor by writing new values.

The parameter section is divided into five sections:

- Triggered1
- Reset Point
- Triggered2 (only available on two PNP output models)
- Function
- Polarity
- On Delay
- Off Delay
- Reset High and Low Temperature
- Adjust Zero Point

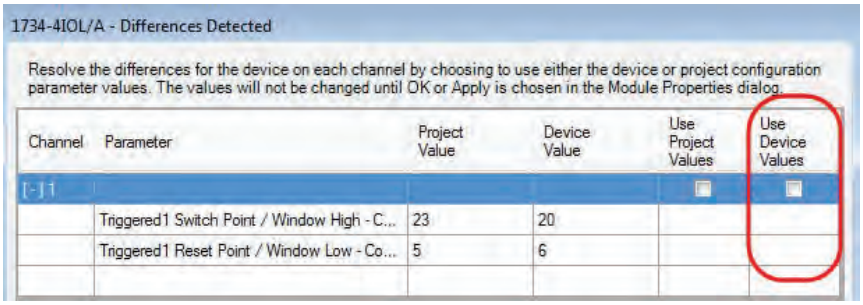
Triggered1: In this section, operators can change the configuration of the sensor output one while operating in Standard IO and IO Link Mode. You can access the following parameters.

Triggered1 Switch Point/Window High—Condition 1: Sets the system temperature that turns the sensor output ON when operating in Hysteresis Mode. Or turns the sensor output OFF when the system temperature exceeds the set value in Window Mode. The operating mode for Triggered1 can be changed by modifying the Function parameter.

The Temperature value in this field should be higher than the Reset Point and it's the first parameter to be configured. Since the sensor provides different

decimal point resolutions based on the temperature measuring range, the following guidelines must be followed when defining the setpoint.

IMPORTANT The Triggered1 temperature value in your project can be rounded by the sensor to the nearest acceptable value. Any discrepancy between the Triggered1 temperature value and the sensor temperature value activates the correlation popup window of the 1734-4IOL. We recommend that you always accept the Device Values as your project stored value once a teach set point has been performed via IO-Link.



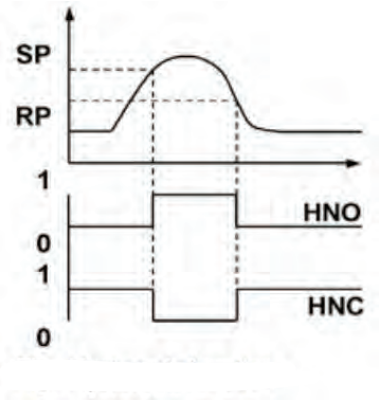
Triggered1 Reset Point/Window Low—Condition 2: Sets the system temperature that turns the sensor output OFF when operating in Hysteresis Mode. Or it turns the sensor output ON when the system temperature exceeds the set value in Window Mode. The operating mode for Triggered1 can be changed by modifying the Function parameter.

The Temperature value in this field must be at least 10 % lower than the Switch Point and it's the second parameter to be configured. Since the sensor provides different decimal point resolutions based on the temperature measuring range, the following guidelines must be followed when defining the setpoint.

Function: This parameter defines the operating mode for Triggered1 sensor output. The output can be configured to operate in the following modes.

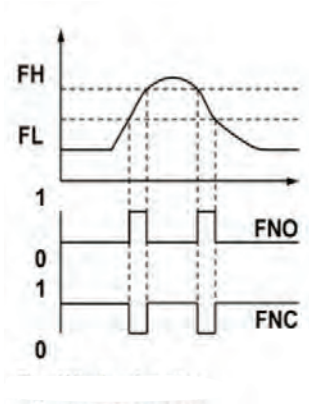
Hysteresis Mode: Output1 and the Triggered1 process data parameter turn ON when the temperature value is higher than the Switch Point. And turns OFF when the temperature value is lower than the reset point.

Figure 3 - Hysteresis Function



Window Mode: Output1 and the Triggered1 process data parameter turn ON when the temperature value is between the Switch Point and the Reset Point. It turns OFF when the temperature value is higher than the Switch Point or lower than the Reset Point.

Figure 4 - Window Function



Polarity: Changes the sensor output to operate as either Normally Open or Normally Closed.

On Delay: Delays the change of state from OFF to ON for the Triggered1 parameter (Output1 in SIO) for up to 50 seconds when the polarity is defined as Normally Open. This parameter helps operators filter out unwanted temperature peaks in their systems.

The desired ON delay time must be entered in milliseconds (ms). For example, for a 30 second ON delay for Triggered1, requires the operator to enter the value 30000.

Off Delay: Delays the change of state from ON to OFF for the Triggered1 parameter (Output1 in SIO) for up to 50 seconds when the polarity is defined as Normally Open. This parameter helps operators filter out unwanted temperature peaks in their systems.

The desired ON delay time must be entered in milliseconds (ms). For example, for a 30 second ON delay for Triggered1, requires the operator to enter the value 30000.

Triggered2 (Only Available in 2 x PNP Models)

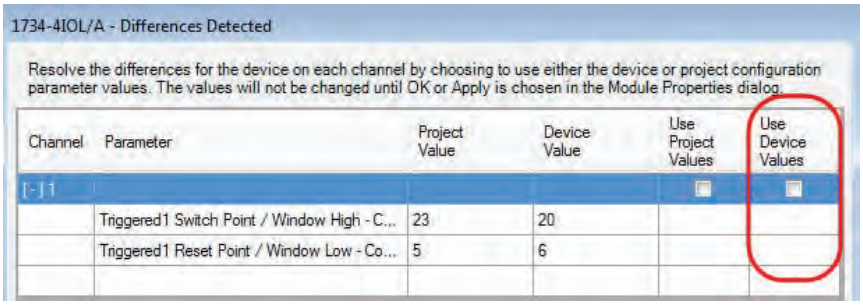
Triggered2: In this section, operators can change the configuration of the sensor output two while operating in Standard IO and IO Link Mode. You can access the following parameters.

Triggered2 Switch Point/Window High—Condition 1: Sets the system temperature that turns the sensor output ON when operating in Hysteresis Mode. Or turns the sensor output OFF when the system temperature exceeds

the set value in Window Mode. The operating mode for Triggered1 can be changed by modifying the Function parameter.

The Temperature value in this field should be higher than the Reset Point and it's the first parameter to be configured. Since the sensor provides different decimal point resolutions based on the temperature measuring range, the following guidelines must be followed when defining the set point:

IMPORTANT Depending on the temperature range of the unit and the decimal point resolution, the Triggered1 temperature value in your project may be rounded by the sensor to the nearest acceptable value. Any discrepancy between the project Triggered1 temperature value and the sensor temperature value will activate the correlation pop-up window of the 1734-4IOL. We recommend that you always accept the Device Values as your project stored value once a teach set point has been performed via IO-Link.



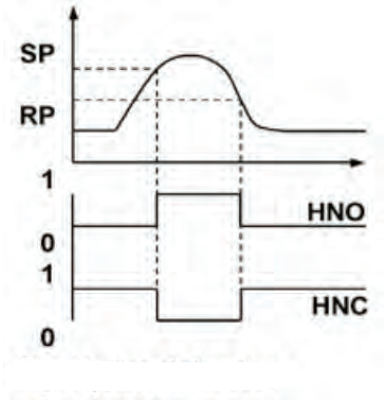
Triggered2 Reset Point/Window Low—Condition 2: Sets the system temperature that turns the sensor output OFF when operating in Hysteresis Mode. Or turns the sensor output ON when the system temperature exceeds the set value in Window Mode. The operating mode for Triggered2 can be changed by modifying the Function parameter.

The Temperature value in this field should always be at least 10% lower than the Switch Point and it's the second parameter to be configured. Since the sensor provides different decimal point resolutions based on the temperature measuring range, the following guidelines must be followed when defining the set point.

Function: This parameter defines the operating mode for Triggered2 sensor output. The output can be configured to operate in the following modes.

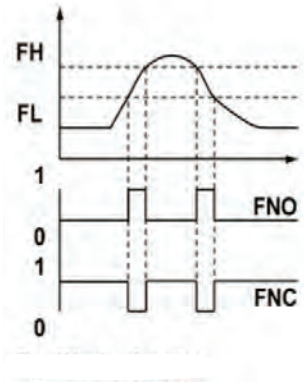
Hysteresis Mode: In this mode, output two in SIO Mode and the Triggered2 process data parameter turn ON when the temperature value is higher than the Switch Point and turn OFF when the temperature value is lower than the reset point.

Figure 5 - Hysteresis Function



Window Mode: In this mode, output two in SIO Mode and the Triggered2 process data parameter turn ON when the temperature value is between the Switch Point and the Reset Point and turn OFF when the temperature value is higher than the Switch Point or lower than the Reset Point.

Figure 6 - Window Function



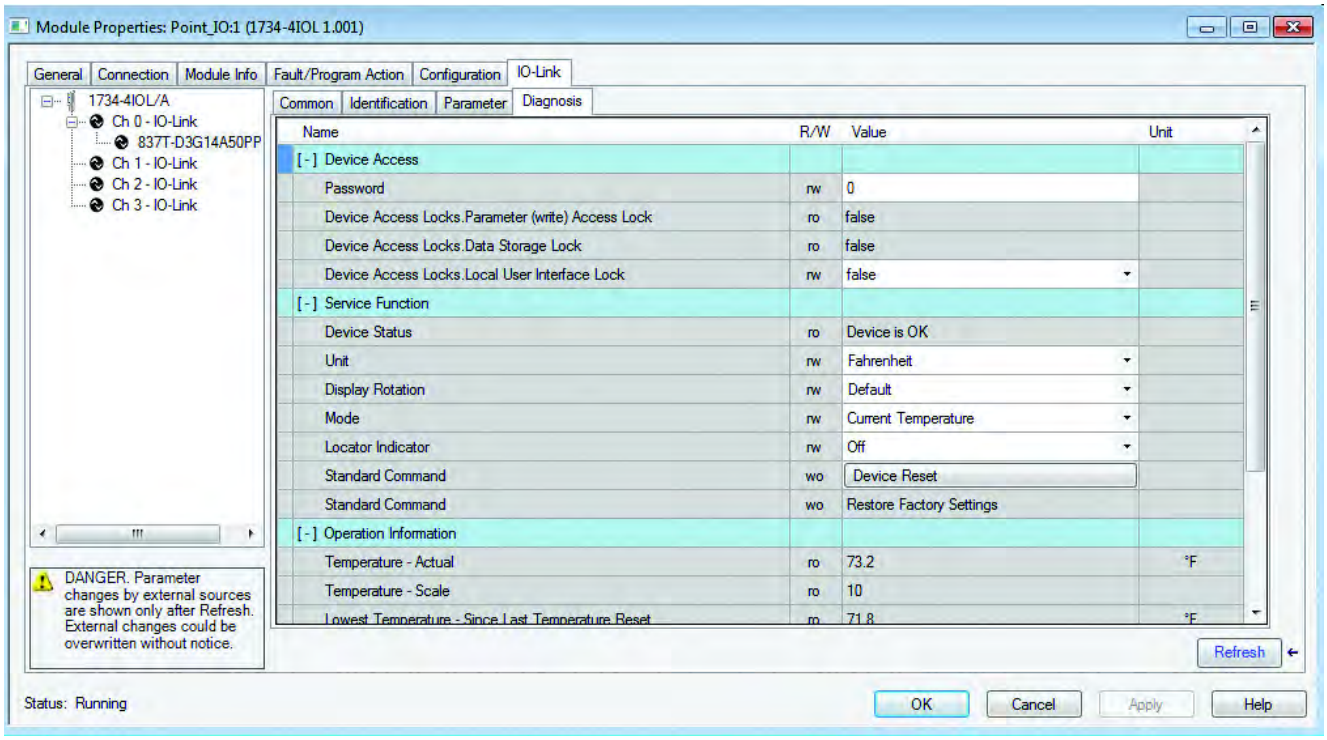
Polarity: Changes the sensor output to operate as either Normally Open or Normally Closed.

On Delay: Enables the operator to delay the change of state from OFF to ON for the Triggered2 parameter (Output1 in SIO) for up to 50 seconds when the polarity is defined as Normally Open. This parameter helps operators filter out unwanted temperature peaks in their systems. The desired ON delay time must be entered in milliseconds (ms). For example, for a 30 second ON delay for Triggered2, requires the operator to enter the value 30000.

OFF Delay: Enables the operator to delay the change of state from ON to OFF for the Triggered2 parameter (Output1 in SIO) for up to 50 seconds when the polarity is defined as Normally Open. This parameter helps operators ensure that the temperature value has stabilized for their application. The desired OFF delay time must be entered in milliseconds (ms). For example, for a 30 second OFF delay for Triggered2, requires the operator to enter the value 30000.

Reset High and Low Temperature: This parameter resets the high and low temperature values stored in the sensor since the last device Reset.

Diagnosis Tab



The Diagnosis Tab is divided into five sections:

- Device Access Locks,
- Service Function,
- Operating Information,
- Temperature, and
- Communications Characteristics

Device Access Locks: This section provides access to the following parameters.

1. Password: Sets a user defined password to prevent unauthorized users from changing the sensor settings. This parameter is enabled when a value different than 0 is entered on the field. Acceptable values range from 0...9999.
2. Parameter Write Access Lock: Is a read-only parameter that describes that write access for the sensor parameters storage on the sensor cannot be locked.
3. Device Storage Lock: Is a read-only parameter that describes that data storage on the sensor cannot be locked.
4. User Interface Lock Parameters: The Local User Interface Lock keeps unauthorized operators from changing the sensor settings when using the local push buttons.

Service Function: This section contains multiple parameters that allow operators to enable additional sensing functionality. This section provides access to the following parameters.

1. Device Status: Displays the current device status.
2. Display Measuring Unit: Allows operators to change the temperature measurement shown in the sensor display. Acceptable units are celsius and fahrenheit. Default display unit for these sensors is psi.
3. Display Rotation: This parameter allows operators to change the orientation of the status indicator by 180°. This feature is ideal for applications where the display may be in a direction that's not visible to the operator and needs to be rotated for ease of use.
4. Mode: Allows operators to change the type of information that should be shown on the unit display. Operators can select to display the following information:
   a. Current Temperature – Displays the actual current temperature
   b. Highest Temperature Measured – Displays the highest temperature measured by the sensor
   c. Lowest Temperature Measured – Displays the lowest temperature measured by the sensor
   d. Triggered 1 Set Temperature – Displays the temperature set point for Triggered1 (Output 1)
   e. Triggered 1 Reset Temperature – Displays the reset temperature point for Triggered1 (Output1)
   f. Triggered2 Set Temperature (only available in 2 PNP models) – Displays the temperature set point for Triggered2(Output 2)
   g. Triggered2 Reset Temperature (only available in 2 x PNP models) – Displays the temperature set point for Triggered2 (Output 2).
   h. Display OFF – Turns the sensor display OFF.
5. Locator Indicator: This parameter activates the location indication sensor functionality. When enabled, the two sensor output status indicators start flashing synchronously and the display shows the letters LOC to indicate that the location indicator is active. This parameter is ideal for applications where the operator needs to locate a sensor in the application and where there may be multiple sensors in close proximity to each other.
6. Restore Factory Settings: This parameter resets the sensor to the default factory settings and it's only accessible through explicit messaging.

Operation Information: This section contains multiple parameters that provide additional information about the sensor temperature and operating hours. This section displays the following parameters.

Temperature – Actual: This parameter displays the current temperature measurement from the sensor.

Temperature – Scale: This parameter displays the defined temperature scale for this device. For sensors that measure a temperature value from 0...99 °, this scale is 100 for a two decimal point resolution in the process data temperature measurement. For sensors that measure a temperature value from 0...999 °, this scale is 10 for a one decimal point resolution in the process data temperature measurement. For sensors that measure a temperature value from 0...8000 °, this scale is one for a zero decimal point resolution in the process data measurement.

Lowest Temperature – Since Last Temperature Reset: This parameter displays the lowest temperature value recorded by the unit since the last temperature reset. For new devices, this value may be less than zero. We recommend that you reset the High and Low Temperature values to accurately capture the lowest recorded temperature value in your application.

Highest Temperature – Since Last Temperature Reset: This parameter displays the last highest temperature value recorded by the unit since the last temperature reset.

Operating Hours – Since Inception: This parameter displays the total sensor operating hours since the sensor was first powered ON. This parameter helps customers determine how many total hours the sensor has been operating in the application.

Communication Characteristics: In this section of the Diagnosis Tab, the user can see read only (ro) values for the Minimum Cycle Time (response time of the sensor) and the Master Cycle Time (time that is used by the master to address the sensor), while in IO-Link mode. The user can also visualize the IO-Link Revision of the sensor in this section.

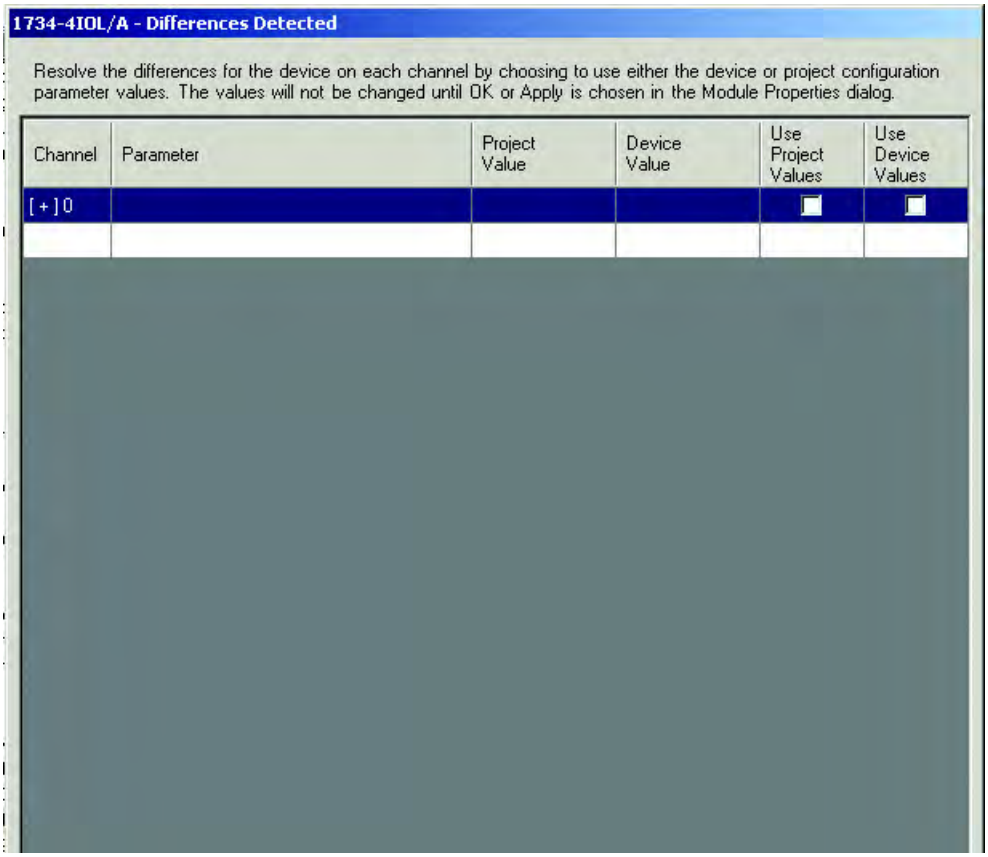
Manage Parameter Differences between IO-Link Devices and Controllers

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 the device configuration is changed externally, such as through a device console during operation. If there are differences after running a Correlation check, you can choose to use the parameters that are currently in the connected IO-Link device or to use the parameters that are stored in the controller. The changes can be done on a per channel basis.

Before you proceed with this task, take note that the Refresh function:

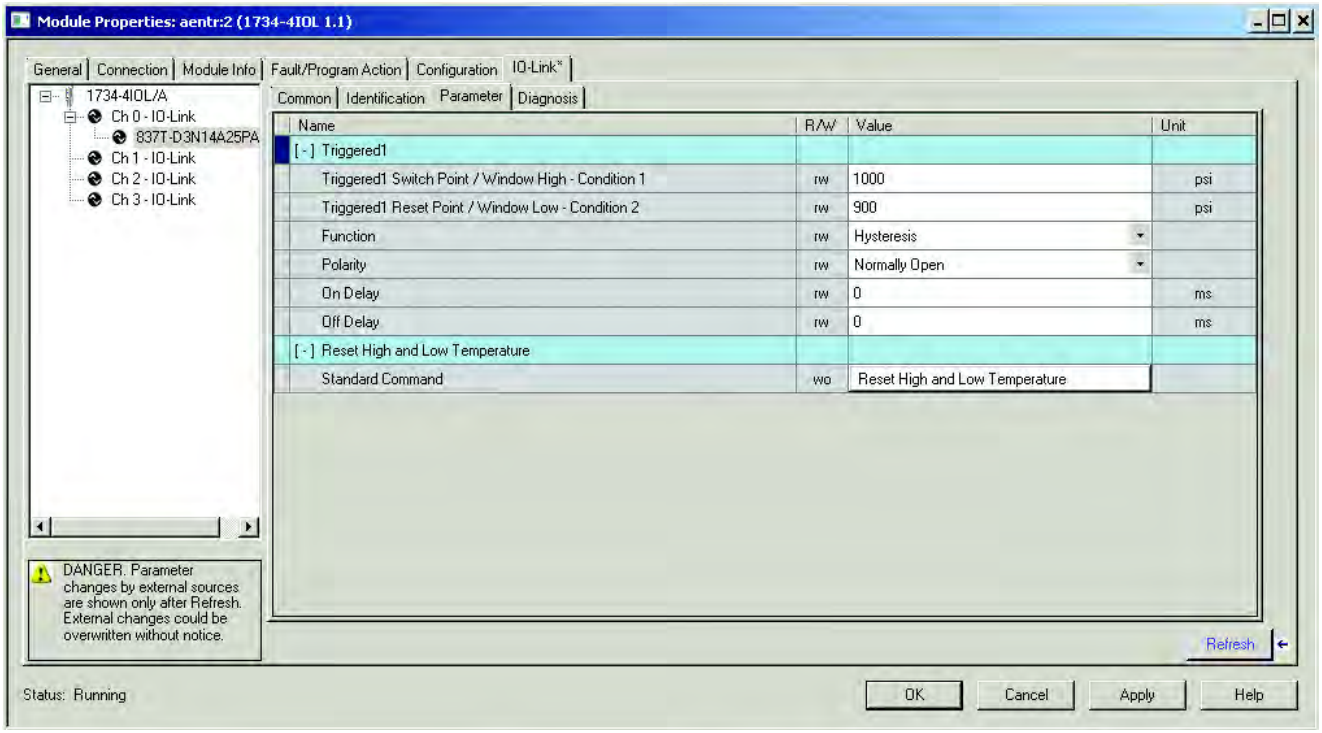
- Is only enabled in online mode.
- Is performed initially when the Add-on Profile is launched in online mode.

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



Communication errors (if applicable) are indicated in the dialog for each channel. A link becomes available for you to click to retry communication.

The Triggered1 temperature value in your project can be rounded by the sensor to the nearest acceptable value. Any discrepancy between the Triggered1 temperature value and the sensor temperature value activates the correlation popup window of the 1734-4IOL. We recommend that you always accept the Device Values as your project stored value once a teach set point has been performed via IO Link.



2. For each channel, select the checkbox for the corrective action:
   - Use Device Values: Uploads the parameter values that are read from the connected IO-Link device to the project.
   - Use Project Values: Downloads the parameter values from the project to the connected IO-Link device.
3. Click "OK." If you click the "OK" button without fixing the errors, the read/write parameters of the affected channels are displayed.

Controller Tags

In the Controller Tag view, it is possible to view the status of the sensor process data (The process data values are not viewable in the Add-on Profile.).

Point_IO:1:I.Ch0Triggered1	0		Decimal	BOOL
Point_IO:1:I.Ch0Triggered2	0		Decimal	BOOL
+ Point_IO:1:I.Ch0Temperature	350		Decimal	INT

Triggered1: This process bit toggles between one or zero depending on the polarity configuration when the temperature value is equal to the defined temperature set for Triggered 1 (output 1).

Triggered2: The process bit toggles between on or zero depending on the polarity configuration when the pressue value is equal to the defined temperature set for Triggered2 (output 2). This parameter is shown in both the 2 x PNP and 1 x PNP + 4 - 20 mA models, however, this parameter only changes states in the 2 x PNP models.

Temperature: This parameter displays the current temperature values. For temperature sensors with a measuring range from 0...99 °, the sensor provides a two decimal point resolution so the value shown reflects two decimal points. For example, if the temperature read b the sensor is 50.20 °, the temperature parameter will display the value of 5020 in the process data parameter.

For temperature sensors with a measuring range from 0...999 °, the sensor provides one decimal point resolution so the shown value reflects one decimal point. For example, if the temperature read by the sensor is 50.20 °, the temperature parameter will display the value of 502 in the process data parameter.

For temperature sensors with a measuring range from 0...8000 °, the sensor provides no decimal point resolution shown an ddoes not reflect any decimal point. For example, if the temperature read by the sensor is 50.20 °, the temperature parameter will display the value of 50 in the process data parameter.

Troubleshooting

This guide is meant to help resolve common issues that occur when installing the 837T.

Checklist

Error	Cause	Remedy
Power indicator Status indicator 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.
Power indicator Status indicator does not light up	The 4-pin M12 plug is not connected to the connector on the sensor	Connect the 4-pin M12 plug to the sensor and tighten the cap nut by hand.
Power indicator Status indicator does not light up	Wiring fault in the splitter or control cabinet.	Check the wiring carefully and repair any wiring faults.
"Operator indicator" Status indicator does not light up	Supply cable to the sensor is damaged.	Replace the damaged cable.
No IO-Link connection to the device	The C/Q communication port on the sensor is not connected to the IO-Link master	Make sure that the C/Q communication port is connected to the IO-Link master.
No IO-Link connection to the device	No power supply	See error "Operator indicator" status indicator does not light up.
Push button does not respond to user interface	Local operation has been de-activated.	Activate local operation.

Notes:

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 is 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 for install and configuration of systems in a quick and efficient manner.

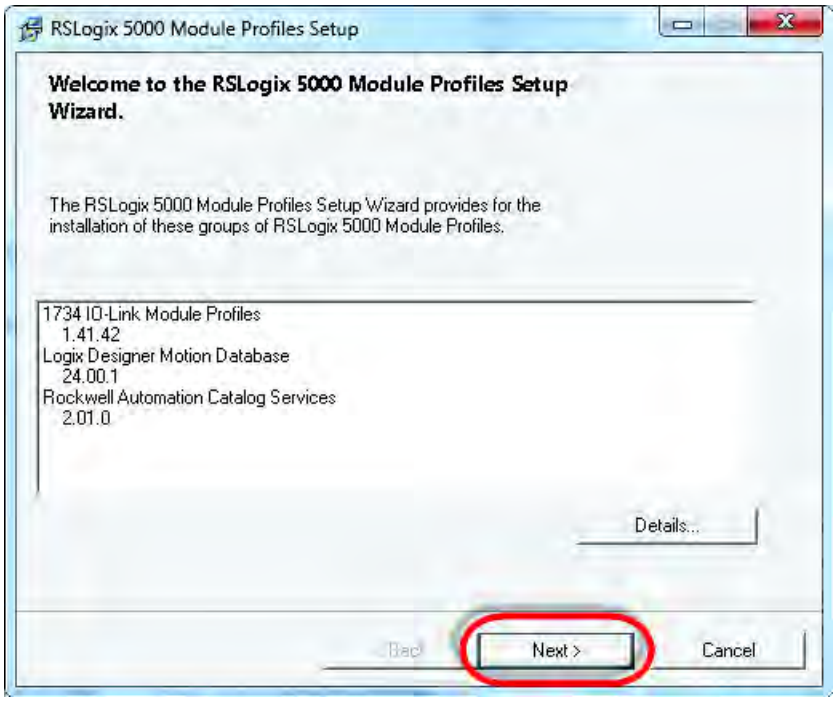
The Add-on Profile is a folder that contains numerous files for the device. It comes as an installation package.

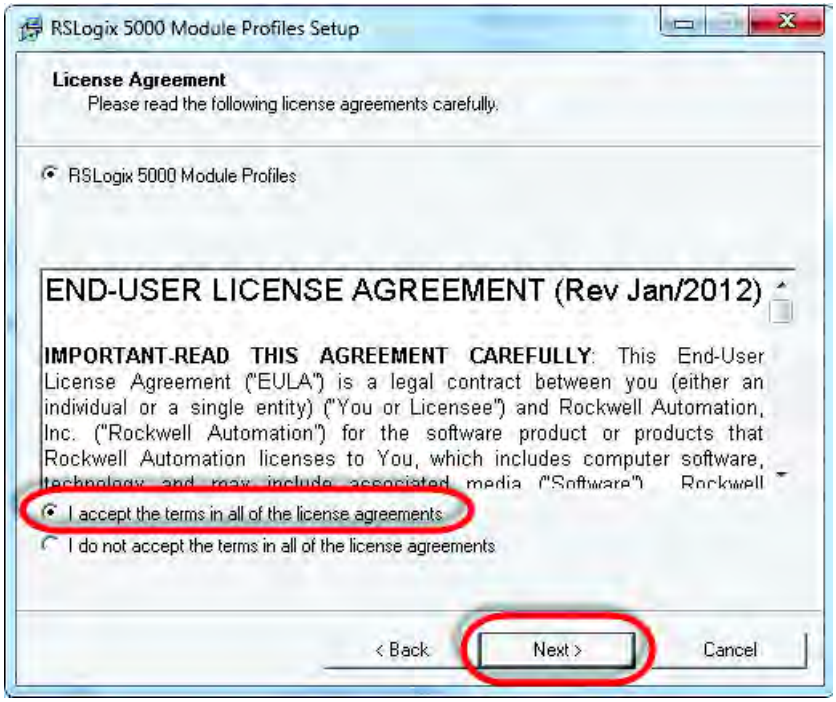
Performing the Installation

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

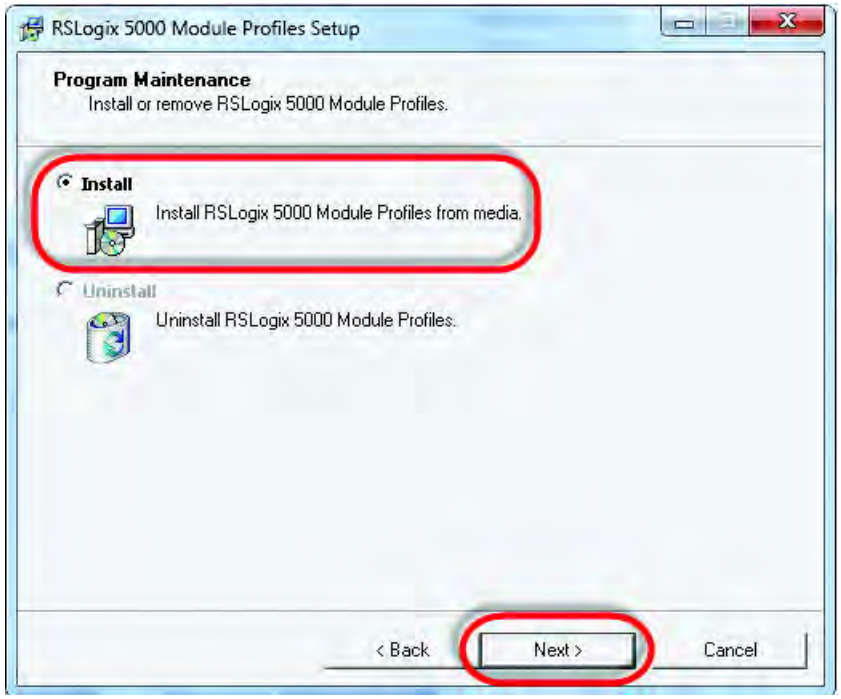
2. Extract the AOP zip file, open the folder, and execute the “MPSetup” application file.

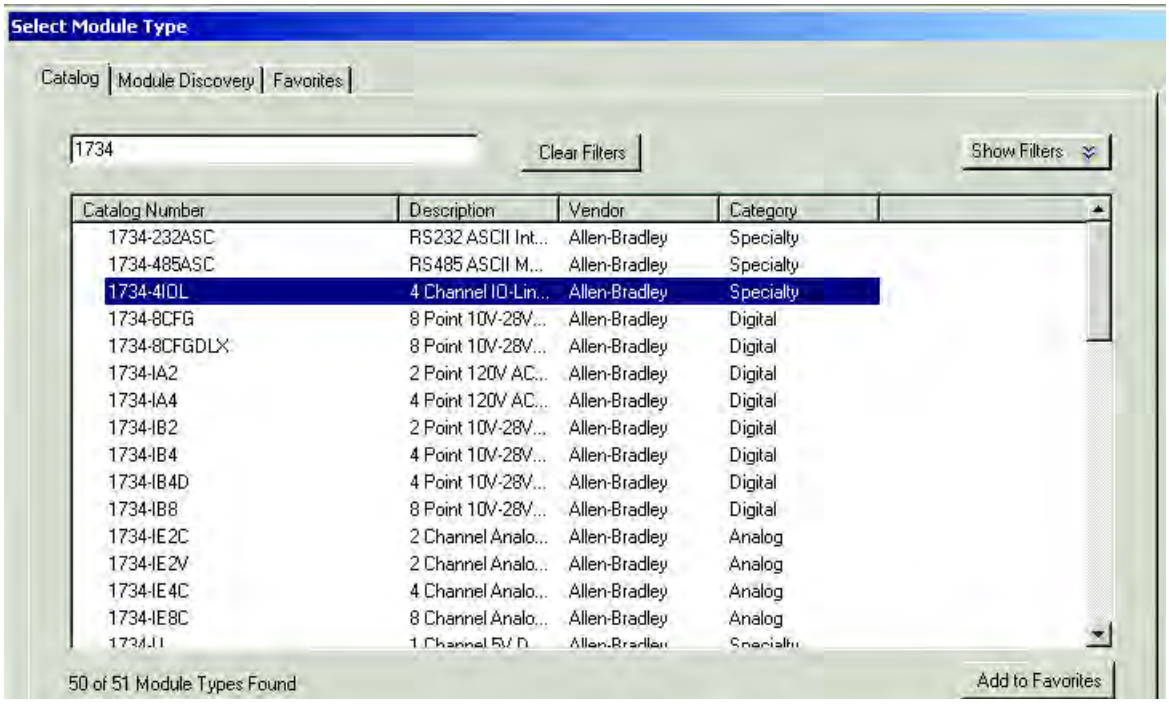
3. Select “Next” to install the IO-Link module profiles, accept the license agreements, select “Next” and follow the module-profiles installation wizard.



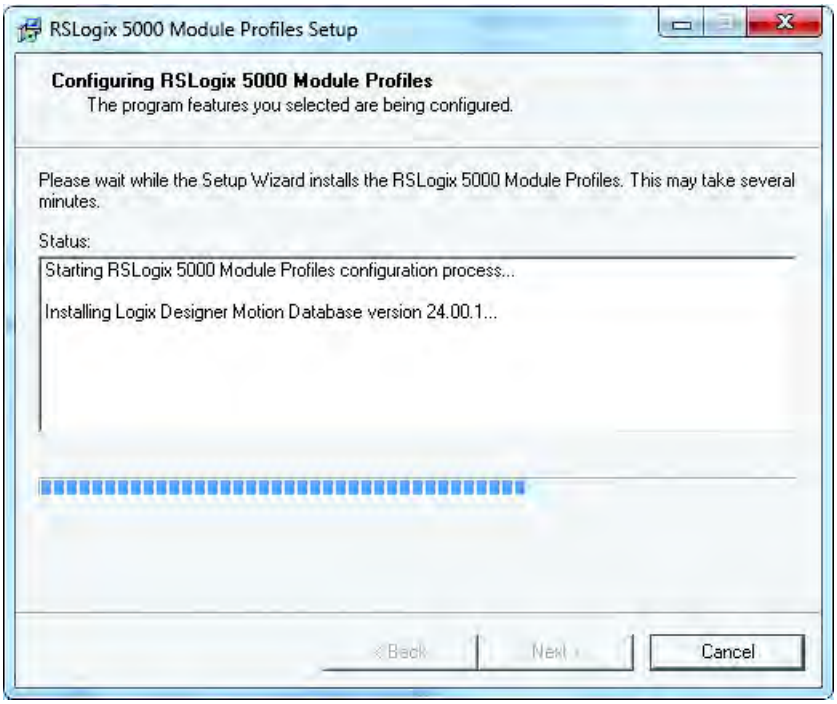


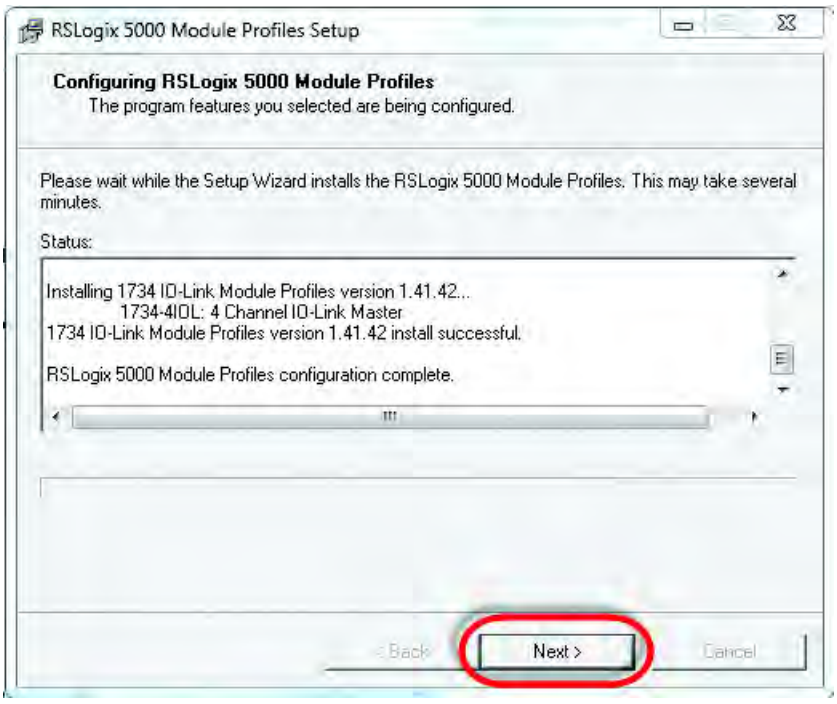
4. Be sure the "Install" option is selected, select "Next," review the install details and select "Install."



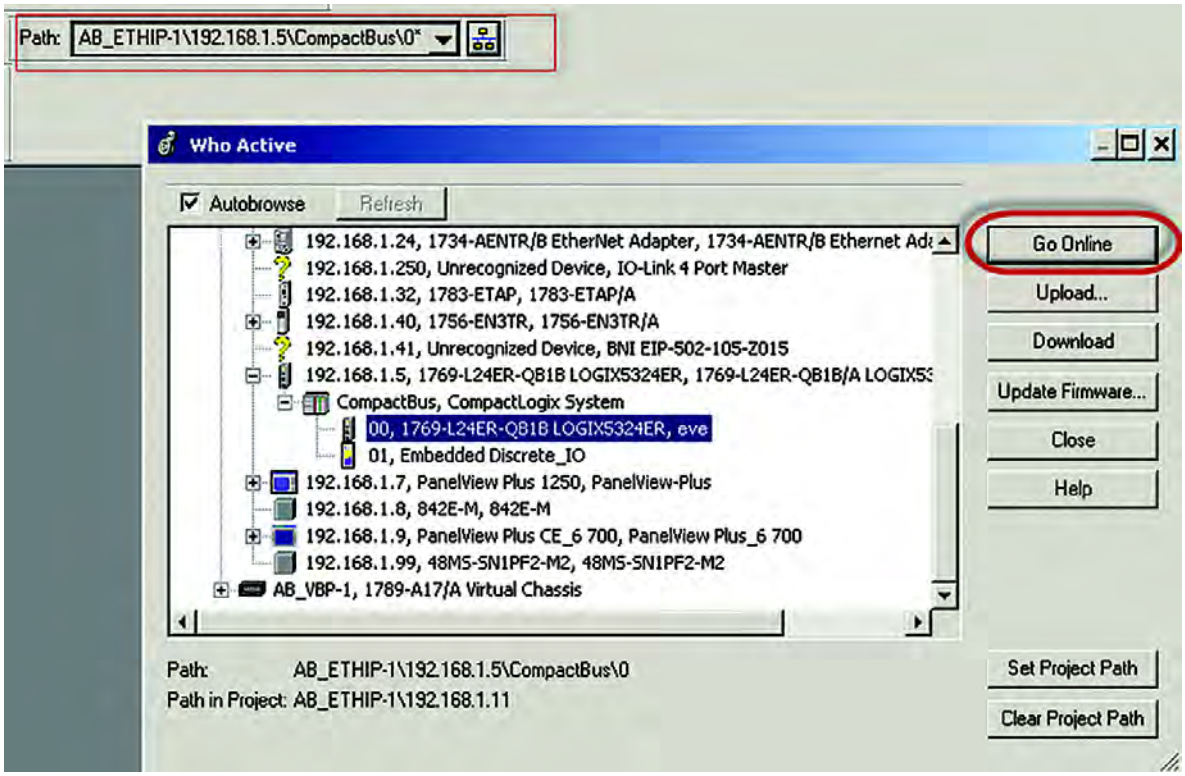


5. The installation process begins. The process may take several minutes. Once completed the "Next" button is available, select "Next."





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



Notes:

Device Parameters

When using Explicit Messages to Read/Write parameter values from/to the 837T, it's important to know the Index Number, Data Type, and Size of the Data that is transmitted/received in the message. The Identification table provides this information for each of the Device Parameters.

Identification Tab

Parameter Name	Index Hex(Dec)	Sub-Index Hex (Dec)	Access	Default	Allowed Value	Data Type (Length)
Device Information						
Vendor Name	0x10(16)	0x00(0)	RO	Allen-Bradley	Allen-Bradley	StringT
Product Name	0x12(18)	0x00(0)	RO	CatalogNumber 837T-Dxxxxxx-D4	837T-Dxxxxxx-D4	StringT
Product ID	0x13(19)	0x00(0)	RO	837T-Dxxxxx-D4	837T-Dxxxxx-D4 Ser A.	StringT
Serial Number	0x15(21)	0x00(0)	RO	RAYYWWXXXX	RAYYWWXXXX	StringT
User Specific Information						
Application Specific Tag	0x18(24)	0x00(0)	RW	0	—	StringT
Revision Information						
Hardware Revision	0x16(22)	0x00(0)	RO	10502	—	StringT
Firmware Revision	0x17(23)	0x00(0)	RO	1.01	—	StringT

Parameter Tab

Parameter Name	Index Hex(Dec)	Sub-index Hex	Access	Default	Allowed Value	Data Type (Length)
Triggered1						
Triggered1 Switch Point / Window High – Condition 1	0x41(65)	0x00	RW	xxC (176°F)	xxC (-3.0…+176°F)	Integer (16 bits)
Triggered1 Reset Point / Window High – Condition 2	0x42(66)	0x00	RW	C (175°F)	C (-4.0…+175°F)	Integer (16 bits)
Function	0x55(85)	0x00	RO	0-Hysteresis	0-Hysteresis 1-Window	Unsigned Integer (8 bits)
Polarity	0x54(84)	0x00	RW	0-Normally Open	0-Normally Open 1-Normally Closed	Unsigned Integer (8 bits)
On Delay	0x4b(75)	0x00	RW	0	0…50,000	Integer (16 bits)
Off Delay	0x4c(76)	0x00	RW	0	0…50,000	Integer (16 bits)

Triggered2 (Only Available in 2xPNP Models)

Parameter Name	Index Hex(Dec)	Sub-index Hex	Access	Default	Allowed Value	Data Type (Length)
Triggered2						
Triggered2 Switch Point / Window High – Condition 1	0x44(68)	0x00	RW	C (176°F)	C (-3.0…+176°F)	Integer (16 bits)
Triggered2 Reset Point / Window High – Condition 2	0x45(69)	00x00	RW	C (175°F)	C (-4.0…+175°F)	Integer (16 bits)
Function	0x57(87)	0x00	RO	0-Hysteresis	0-Hysteresis 1-Window	Unsigned Integer (8 bits)
Polarity	0x56(86)	0x00	RW	0-Normally Open	0-Normally Open 1-Normally Closed	Unsigned Integer (8 bits)
On Delay	0x4d(77)	0x00	RW	0	0…50,000	Integer (16 bits)
Off Delay	0x4e(78)	0x00	RW	0	0…50,000	Integer (16 bits)

Parameter Name	Index Hex(Dec)	Sub-index Hex	Access	Default	Allowed Value
Reset High and Low Temperature					
Standard Command	0x02(2)	0x00(0)	WO	—	176

Diagnostic Tab

Parameter Name	Index Hex(Dec)	Sub-index Hex	Access	Default	Allowed Values	Data Type (Length)
Device Access Locks						
Password	0xFC(252)	0x00 (0)	RW	0	0…9999	Unsigned Integer (16 bits)
Device Access Locks. Parameter (Write) Access Locks	0x0C(12)	0x00(0)	RO	0 - False	0 - False	
Device Access Locks. Data Storage Lock	0x0C(12)	0x01(1)	RO	0 - False	0 - False	
Device Access Locks. Local User Interface Lock	0x0C(12)	0x02(2)	RW	0 - False	0 - False 1 - True	
Service Function						
Device Status	0x24(36)	0x00	RO		0 – Device OK	Unsigned Integer
					1 – Maintenance Required	(8 bits)
					2 – Out of Specification	
Display Measuring Unit	0x48(72)	0x00	RW	1-Fahrenheit	0- Celsius 1-Fahrenheit	Unsigned Integer (8 bits)
Display Rotation	0xFA(250)	0x00	RW	0-Default	0-Default 1-Rotate 180 degrees	Unsigned Integer (8 bits)
Mode	0xFB(251)	0x00	RW	0 – Current Temperature	0 – Current Temperature 1 – Highest Temperature Since Last Reset 2 – Lowest Temperature Since Last Reset 3 – Set Point for Triggered1 4 – Reset Point for Triggered1 5 – Set Point for Triggered2 6 – Reset Point for Triggered2 7 – Turn Display OFF	Unsigned Integer (8 bits)
Locator Indicator	0x51(81)	0x00	RW	0 – OFF	0 – OFF 1 – ON	Unsigned Integer (8 bits)
Restore Factory Settings	0x02(2)	0x00	RW	0 – OFF	0 – OFF 1 – ON	Unsigned Integer (8 bits)
Operation Information						
Temperature - Actual	0xF2(242)	0x00	RO	Current Media Temperature	-8192…8192	Unsigned Integer (16 bits)
Temperature - Scale	0xF4(244)	0x00	RO	Temperature Scale	1 – 0 Decimal Points 10 – 1 Decimal Points	Integer (16 bits)
Highest Temperature – Since Last Temperature Reset	0x49(73)	0x00	RO	Factory Set Cleared upon Sensor Temperature Reset	Highest Temperature Value	Integer (16 bits)
Lowest Temperature – Since Last Temperature Reset	0x4A(74)	0x00	RO	Factory Set Cleared upon Sensor Temperature Reset	Lowest Temperature Value	Integer (16 bits)

Diagnostic Tab (continued)

Parameter Name	Index Hex(Dec)	Sub-index Hex	Access	Default	Allowed Values	Data Type (Length)
Communications Characteristics						
Direct parameters. Min Cycle Time	0x00	0x03 (3)	RO	30	30	Unsigned Integer (16 bits)
Direct Parameters 1. Master Cycle Time	0x00	0x02 (2)	RO	30	30	Integer (16 bits)
Direct Parameters 1. IO-Link Revision ID	0x00	0x05 (5)	RO	0x11	0x11	Integer (16 bits)
Process Data						
Triggered1	0x00	0x01(1)	RO	0	0 – OFF 1 - Triggered	Boolean bitOffset =0 bitLength=16
Trigerred2	0x00	0x02 (2)	RO	0	0 – OFF 1 - Triggered	Boolean bitOffset =1 bitLength=16
Temperature	0x00	0x03 (3)	RO	0	-8192…8191	Integer bitOffset=2 bitLength=16

Message Structure and Configuration Examples

Configuring a Message Instruction

This appendix provides additional information and examples that explain how to configure a Message Instruction.

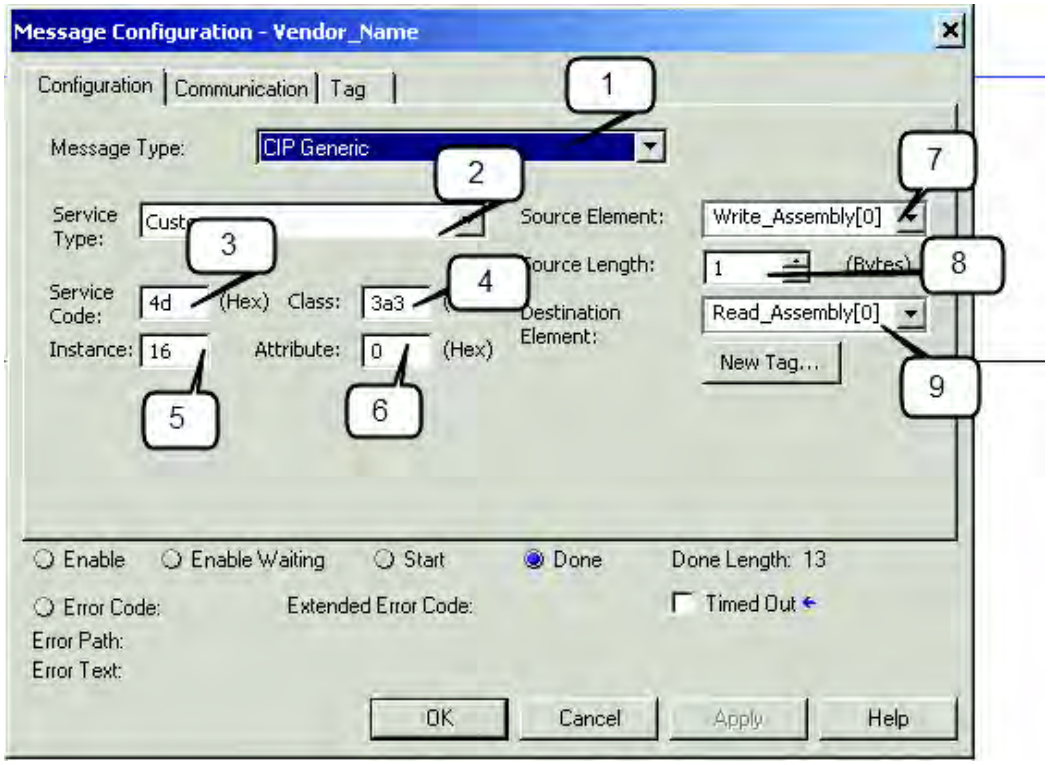
In the examples that we show, we are assuming the use of the ControlLogix® controller. A ControlLogix controller can accommodate both downloading Explicit Message Requests and uploading Explicit Message Responses. The Message Instruction dialog blocks must be formatted as shown in the examples shown.

Example Format of a Read Message

In this example, the steps necessary to Read the IO-Link Parameter value for "Vendor Name:" from the 837T are shown. The screen capture that is shown is the Message Configuration dialog box that shows all the information that is needed to complete this task. To open this dialog box, click the blue square box in the Message Instruction.

Some of the data that are required to complete the Message Configuration dialog box comes from Appendix B. It shows the Index Number, Data Type, and Size of the Parameters that are available in the 837T. To complete the dialog box, the Service Code and Source Length must be provided.

A table of the different Read and Write Service Codes and their associated Source Lengths are shown on page 78.



The following table identifies the data that are required to complete the Message Configuration dialog box to Read the "Vendor Name" from the 837T:

Box	Description	Value
1	**Message Type** The message type is CIP Generic.	CIP Generic
2	**Service Type** The service type is Custom.	Custom
3	**Service Code** Established from Service Code Table.	4D
4	**Class** The class is 3a3.	3a3
5	**Instance** Established from Appendix A. Identifies the Index for the Parameter being read.	16
6	**Attribute** The Attribute value is 0.	0
7	**Source Element** Contains the name of the tag of the channel number to be read.	Write_Assembly[0]
8	**Source Length** This box contains the number of bytes of service data to be sent or received in message. Defined in Data Structure Tables.	1 byte
9	**Destination Element** First element of the destination Array.	Read_Assembly[0]

Read Data from the Sensor

Once the data in the Message Instruction dialog box has been populated, trigger the rung of logic that contains the message instruction. The "Vendor Name" is read from the 837T and copied into the "Read_Assembly" Array. When viewed as ASCII the name Allen-Bradley is displayed.

Read_Assembly	{...}	{...}	ASCII
Read_Assembly[0]	'A'		ASCII
Read_Assembly[1]	'l'		ASCII
Read_Assembly[2]	'l'		ASCII
Read_Assembly[3]	'e'		ASCII
Read_Assembly[4]	'n'		ASCII
Read_Assembly[5]	'-'		ASCII
Read_Assembly[6]	'B'		ASCII
Read_Assembly[7]	'r'		ASCII
Read_Assembly[8]	'a'		ASCII
Read_Assembly[9]	'd'		ASCII
Read_Assembly[10]	'l'		ASCII
Read_Assembly[11]	'e'		ASCII
Read_Assembly[12]	'y'		ASCII
Read_Assembly[13]	'$00'		ASCII
Read_Assembly[14]	'$00'		ASCII

Example Format of a Write Message

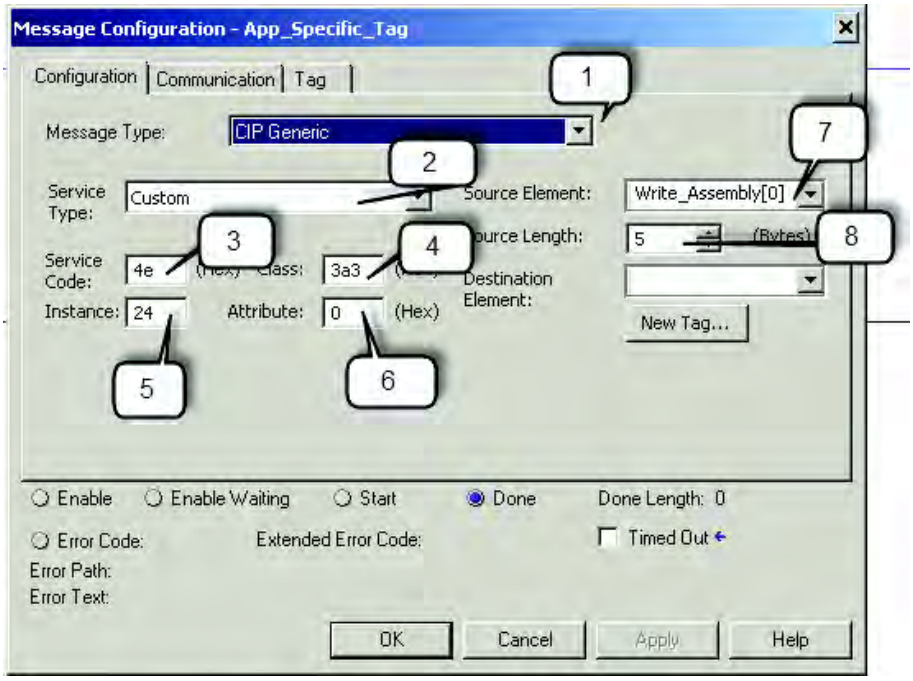
It is possible to Write a unique name to the 837T sensor. This Parameter is called "Application Specific Name." In Appendix B we can find the Index Number for this Parameter (24) and the maximum length of the String (32 characters). Each character is equivalent to one byte. This example shows the steps necessary to write "Test" to the Application Specific Name index.

The source element Array is "Write_Assembly," byte zero is the channel followed by the data to be written.

Write_Assembly	{...}	{...}	ASCII
Write_Assembly[0]	'$00'		ASCII
Write_Assembly[1]	'T'		ASCII
Write_Assembly[2]	'E'		ASCII
Write_Assembly[3]	'S'		ASCII
Write_Assembly[4]	'T'		ASCII
Write_Assembly[5]	'$00'		ASCII
Write_Assembly[6]	'$00'		ASCII

The screen capture that is shown is the Message Configuration dialog box. It shows all the information that is necessary to Write to the Application Specific

Name Parameter in the 837T. To open the Message Instruction dialog box, click the blue square box in the Message Instruction.



The following table identifies the data that are required to complete the Message Configuration dialog box to Write "Test" to the Application Specific Name in the 837T:

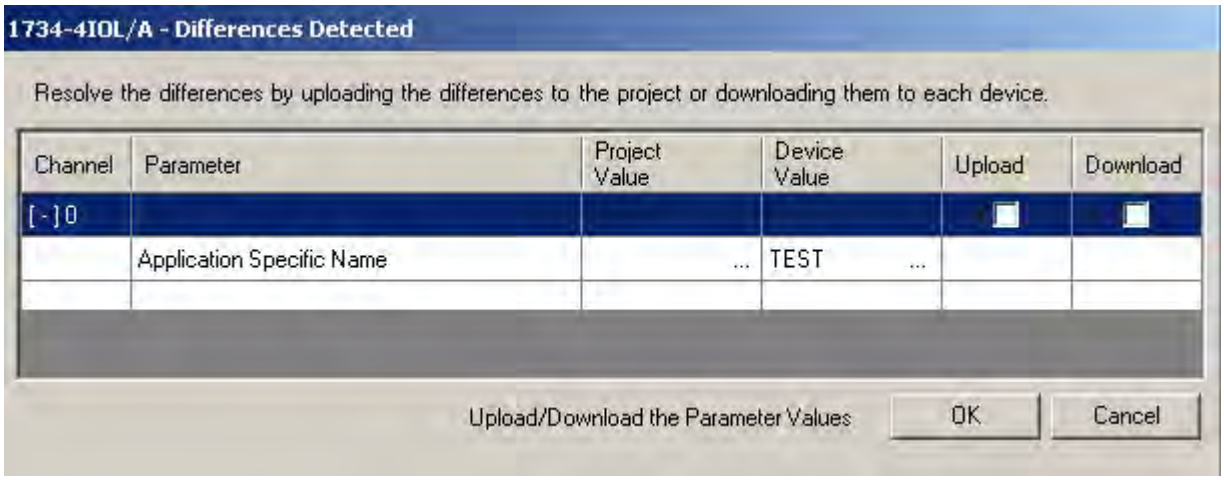
Box	Description	Value
1	**Message Type** The message type is CIP Generic.	CIP Generic
2	**Service Type** The service type is Custom.	Custom
3	**Service Code** Established from Service Code Table.	4E
4	**Class** The class is 3a3.	3a3
5	**Instance** Established from Appendix A. Identifies the Index for the Parameter being read.	24
6	**Attribute** The Attribute value is 0.	0
7	**Source Element** Contains the name of the first tag of the data array to be written.	Write_Assembly[0]
8	**Source Length** This box contains the number of bytes of service data to be sent or received in a message. Defined in Data Structure Tables.	5 bytes
9	**Destination Element** N/A	N/A

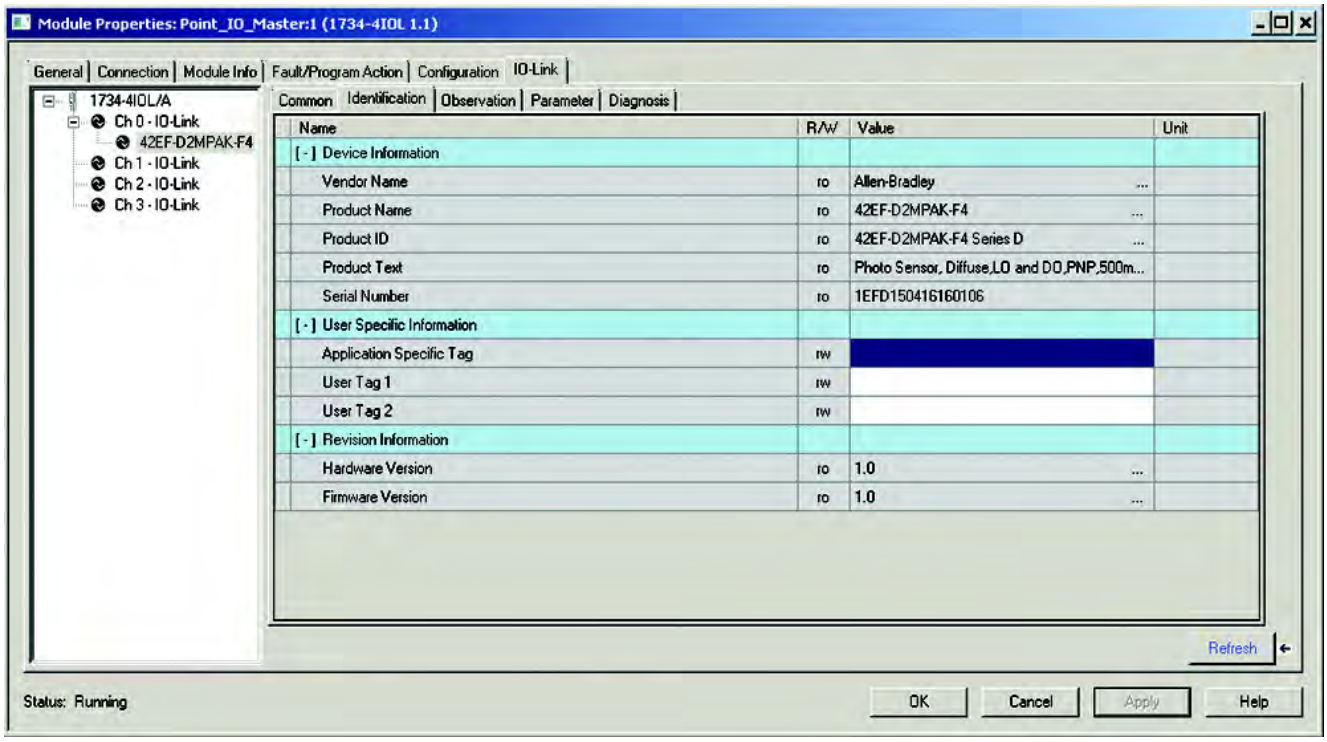
Validation of Write

Once the data in the Message Instruction dialog box has been populated; trigger the rung of logic that contains the message instruction. "Test" is written from the "Write_Assembly" to the Application Specific Name Parameter Index in the 837T.

The data is validated either by reading the value of Index 24 in the sensor or viewing the 1734-4IOL configuration. To view the configuration of the 1734-4IOL follow these steps:

1. Click the 1734-4IOL in the IO Configuration.
2. A pop-up box is displayed and advises that changes within the sensor have been detected. Expand the settings and to see that the Application Specific Name has changed to Test.
3. Click "Upload" then "OK" and the new parameter values are uploaded into the controller. The new Application Specific Name can be seen when viewing the Identification Tab of the AOP for the 837T sensor.





Service Code

The table that is shown is used to determine the Service Code that is needed for a specific Message Instruction.

Service Code (Hex	Need in Implementation		Service Name	Description of Service
	Class	Instance		
4B	Required	Required	Read Subindex	Reads a parameter value from the IO-Link device
4C	N/A	Required	Write Subindex	Writes a parameter value from the IO-Link device
4D	Required	Required	Read Subindex	Reads an entire index (all parameters within an index) from the IO-Link device (uses subindex 0)
4E	N/A	Required	Write Subindex	Writes an entire index (all parameters within an index) from the IO-Link device (uses subindex 0)

Source Length: from Data Structure Tables

The following tables can be used to determine the source length that is based on the Service Code that is used and the number of bytes being written.

Read Subindex (4B)
Message Data Format:

Byte 0	Byte 1
Subindex Number	Channel Number

Source Length= 2 bytes

Read Subindex (4C)
Message Data Format:

Byte 0	Byte 1	Byte 2	Byte 3
Subindex Number	Channel Number	Data 0	Data 1

Source Length= 2 bytes + Number of bytes of data being written

Read Subindex (4D)
Message Data Format:

Byte 0
Channel Number = 1 byte

Source Length= 1 byte

Write Index (4E)
Message Data Format:

Byte 0	Byte 1	Byte 2	Byte 3
Channel Number	Data 0	Data 1	Data 3

Source Length= 1 byte + Number of bytes of data being written

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. 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

Error code	Instance	Code	Note
No error	APP	ZERO	Only applies for response telegram
Unspecific application fault	APP	0x8000	
Invalid index	APP	0x8011	
Invalid subindex	APP	0x8012	
Service temporarily unavailable	APP	0x8020	
Service temporarily unavailable (control)	APP	0x8021	
Service temporarily unavailable (sensor)	APP	0x8022	
Access denied	APP	0x8023	Write attempt to read-only address
Invalid value range, parameter	APP	0x8030	
Parameter value too large	APP	0x8031	
Parameter value too small	APP	0x8032	
Application error	APP	0x8081	Application does not respond
Application not ready	APP	0x8082	Application does not respond

Events

Name	Bit	Name >>>	837T						
				Temperature			Hardware Fault	Voltage Overrun	Short Circuit
		Description >>>	No Malfunction	Fault Overload	Overrun	Underrun			
Event Code	-	See “1734-4IOL Events” tab	0x0000	0x4000	0x4210	0x4220	0x5000	0x5111	0x7710
Event Location	3	0 - Device application (Remote) 1 - Master application (Local)							
Event Mode 0	6	0 - Reserved 1 - Event single shot 2 - Event disappears 3 - Event appears	1	1	3	3	3	3	3
Event Mode 1	7				2	2	2	2	2
Event Qualifier	-	See "Event Qualifier" tab							
Event Sequence Count	-	1...255 (can never be 0)							
Event Source 0	0	0 - Unknown 1 - Physical Layer (PL) 2 - Data Layer (DL) 3 - Application Layer (AL) 4 - Application (APP) 5-7 - Reserved							
Event Source 1	1								
Event Source 2	2								
Event Type 0	4	0 - Reserved 1 - Notification 2 - Warning 3 - Error	1	1	3	2	3	2	3
Event Type 1	5								
Status Bit		0 - Device OK 1 - Device Fault	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

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