



Ultrasonic Sensors with IO-Link Interface

Bulletin Number 873P



Allen-Bradley

by ROCKWELL AUTOMATION

User Manual

Original Instructions

Important User Information

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

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

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

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

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

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



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



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

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

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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About This Publication

This manual contains information for 873P Ultrasonic Sensors with IO-Link Interface. It describes the procedures that you use to install, wire, and troubleshoot your sensor.

Ultrasonic sensors are able to detect an object without making physical contact and determine its distance from the sensor. The sensor emits ultrasonic pulses that are then reflected by the object. The sensor measure the time difference between the emitted ultrasonic pulse and received echo and calculates the distance to the object using the speed of sound.

Who Should Use This Manual

Use this manual if your responsibilities include design, installation, programming, or troubleshooting of control systems that use solid-state ultrasonic sensors.

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

Terminology

The Industrial Automation Glossary (publication [AG-QR071](#)) contains terms and abbreviations that are used by Rockwell Automation to describe industrial automation systems. The following table lists specific terms and abbreviations that are used in this manual.

Table 1 - Terms and Abbreviations

Term	Definition
ADC	Automatic Device Configuration
AOI	Add-on Instruction
AOP	Add-on Profile
ASN	Application-specific name
Blind Zone	Located directly in front of the sensor and the object cannot be reliably detected in this area. All diffused type ultrasonic sensors have blind zone.
Hysteresis	The distance difference between operate (switch on) and release (switch off) points when the target is moving away from the sensor face. Without sufficient hysteresis, a proximity sensor will continuously switch on and off or 'chatter'.
IEC	International Electrotechnical Commission
IODD	I/O Device Description
Minimum Cycle Time	Describes the time between each transmission from IO-Link master to sensor. To 873P ultrasonic sensors, it is 3.2 ms.
NEC	National Electric Code
Output of analog signal	The distance can be converted to an analog value and issued via analog current outputs 4-20mA.
Output of IO-Link	The distance can be transmitted directly to a controller as a digital value. The distance can be internally compared with configured switching limits. If an object is in the switching area, it is indicated at a binary switching output.
QD	Quick disconnect
Repeatability	The ability of a sensor to detect the same object at the same distance time after time.
Resolution	The smallest change in object distance that affects the output current.

Table 1 - Terms and Abbreviations (Continued)

Term	Definition
Sensing Range	The shortest and longest distance, the area beyond the blind zone where the detection of objects is possible.
SIO	Standard Input Output
SIO Mode Compatibility	Describes if the sensor is also designed to operate without an IO-Link connection.
Sound Beam Diagram	The diagram shows the distance at which a particular object (for example, standard 200X200 mm [7.9x7.9 in.] plate or 25 mm [1 in.] diameter rod) can be reliably detected.
SSC	Switching Signal Channel
SP	Setpoint
Switching Frequency	Maximum number of possible switching cycles per second.

Summary of Changes

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

Topic	Page
Updated Product Description and Product Features.	7
Updated Figure 1 .	9
Added Figure 2 and Figure 4 .	10
Updated Figure 6 .	11
Updated Dual-switching and/or Analog Output section.	13
Updated Single-switching and/or Analog Output section.	14
Updated Technical Specifications.	31
Updated Figure 18 title.	32
Updated Table 3 and Table 4 .	33
Added Index.	37

Additional Resources

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

Resource	Description
EtherNet/IP Network Devices User Manual, ENET-UM006	Describes how to configure and use EtherNet/IP™ devices to communicate on the EtherNet/IP network.
Ethernet Reference Manual, ENET-RM002	Describes basic Ethernet concepts, infrastructure components, and infrastructure features.
System Security Design Guidelines Reference Manual, SECURE-RM001	Provides guidance on how to conduct security assessments, implement Rockwell Automation products in a secure system, harden the control system, manage user access, and dispose of equipment.
Industrial Components Preventive Maintenance, Enclosures, and Contact Ratings Specifications, publication IC-TD002	Provides a quick reference tool for Allen-Bradley industrial automation controls and assemblies.
Safety Guidelines for the Application, Installation, and Maintenance of Solid-State Control, publication SGI-1.1	Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications .	Provides declarations of conformity, certificates, and other certification details.
EtherNet/IP Network Devices User Manual, ENET-UM006	Describes how to configure and use EtherNet/IP devices to communicate on the EtherNet/IP network.
Ethernet Reference Manual, ENET-RM002	Describes basic Ethernet concepts, infrastructure components, and infrastructure features.
System Security Design Guidelines Reference Manual, SECURE-RM001	Provides guidance on how to conduct security assessments, implement Rockwell Automation products in a secure system, harden the control system, manage user access, and dispose of equipment.
Industrial Components Preventive Maintenance, Enclosures, and Contact Ratings Specifications, publication IC-TD002	Provides a quick reference tool for Allen-Bradley industrial automation controls and assemblies.

You can view or download publications at [rok.auto/literature](#).

Product Overview

Product Description

Bulletin 873P ultrasonic sensors offer sensing ranges from 400 mm...6 m (1.3...9.8 ft) with PNP discrete and/or analog outputs and also can directly transfer digital data via IO-Link interface. The sensors are ideal for applications such as level control with continuous distance measurement or the applications that can be challenging for other sensing technologies, such as in detection of clear, shiny, or non-reflective objects. New IO-Link enabled sensors are compatible for both standard I/O operation mode and IO-Link mode and can be easily configured with a Teach button or Studio 5000® Add-On Profile (AOP). Besides the known benefits of IO-Link, such as inexpensive wiring and self-diagnosis for predictive maintenance, 873P ultrasonic sensors provide new features like sound beam modification, value filter for non-static objects, and output time delay. These features help adapt the sensor perfectly for your application.

Product Features

- 18 mm and 30 mm diameter in IP67 PBT housing with sensing range from 400 mm...6 m (1.3...9.8 ft).
- Single/dual discrete outputs and analog outputs available in standard IO mode, which is ideal for continuous level/distance measurement with providing empty and overflow switching signals.
- Digital values like distance and switching outputs can be directly transmitted to controller via IO-Link interface. Compatible with rest of the Rockwell Automation architecture with fully unlocked data/information and security standards.
- Easy to configure sensors with a Teach button or Studio 5000 AOP; sensor operation modes and configuration parameters like switching limits, hysteresis, and sound beam properties can be precisely defined through AOP.
- IO-Link enabled sensors can be adapted perfectly for applications with the capability of adjusting sound beam width, providing foreground and background suppression, and configuring sensing range and boundaries with millimeter precision.
- Real-time temperature and echo signal strength monitoring for device self-diagnosis and predictive maintenance.

Operation Mode

The sensor can operate in two modes.

Standard I/O (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.

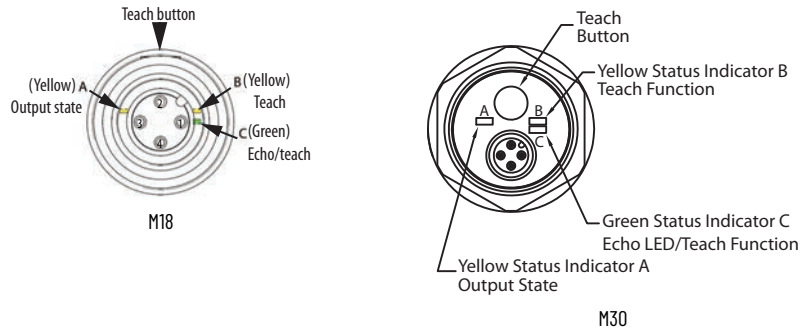
IO-Link Mode

This mode is automatically activated when the sensor is connected to an IO-Link enabled master device. Upon entering this mode, the green and yellow LEDs on the sensor stay solid when sensor is triggered 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 PLC process data. With IO Link, you can easily set the sensor parameters, display commends sent to and received by the sensor, and display real-time measured value. In addition, you can precisely control of features that are not found in standard sensors.

Installation

Status Indicators

Figure 1 - Status Indicators



Double PNP Output Status Indicator Functions

Indicator	Color	Function
A	Yellow	P1 Point in double digital output
B	Yellow	P2 Point in double digital output/Teach function
C	Green	ECHO Indicator/Teach function

Dual PNP Discrete Output and One Analog Output Status Indicators ⁽¹⁾

Operating Model	Green Indicator (Alignment)	Yellow Indicator A (Output)	Yellow Indicator B (Teach)
Standard Operation			
Target Present	ON ⁽²⁾	ON/OFF ⁽³⁾	ON/OFF ⁽³⁾
Target Absent	ON/OFF ⁽²⁾	ON/OFF ⁽³⁾	ON/OFF ⁽³⁾

(1) The analog output depends on the user-taught setpoints for the dual discrete sensor. Therefore, it does not have a separate status indicator.

(2) Green status indicator indicates that an echo is reflected back to the sensor by an object, not necessarily the target. Primary use is alignment.

(3) For single discrete sensors, status indicator A triggers ON/OFF depending on target position relative to the taught setpoints and if N.O. or N.C. logic is used.
For dual discrete sensors, status indicators A and B trigger ON/OFF depending on the target position relative to the taught setpoints and on the logic used (N.O. or N.C.).

Mounting

The sensor must be securely mounted on a firm stable support or surface. A mounting configuration that is unstable or subject to excessive vibration may cause intermittent operation. A mounting location should be chosen such that the sensor faces directly toward the surface of the target (perpendicular to the barrel axis of the sensor).

When using multiple 873P ultrasonic sensors, there is a potential for crosstalk (mutual interference) between the sensors. As a result, consideration should be given to the sensor spacing. See the beam diagrams for the minimum acceptable distance between sensors that are mounted side by side. When sensors must be mounted facing each other, they should be separated by a distance at least four times the maximum sensing range for the model.

Beam Diagrams

Beam diagram shows the distances at which a particular object can be reliably detected. Diagrams are created with standard objects such as 200 x 200 mm (7.87 x 7.87 in.) plate and 25 mm (0.98 in.) diameter bar. Narrow sound cone option can be applied to reduce sound beam width.

Figure 2 - 50...400 mm (1.97...15.75 in.) Sensing Range

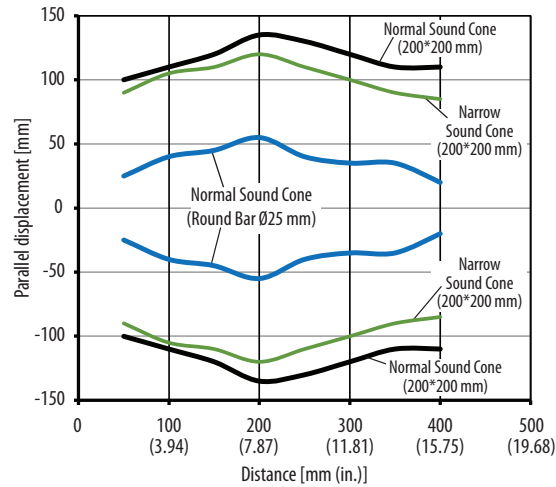


Figure 3 - 100...900 mm (100...35.43 in.) Sensing Range

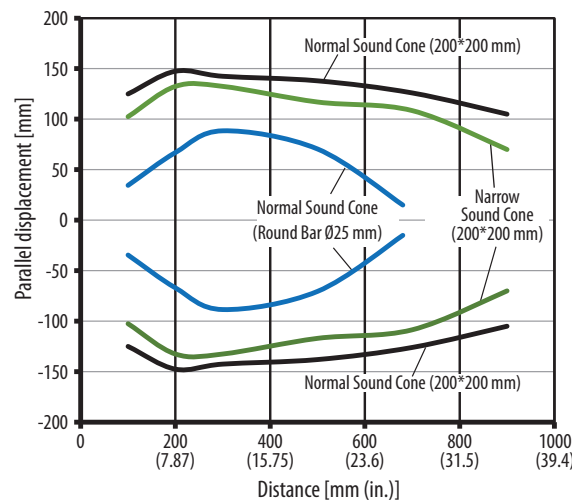


Figure 4 - 200...2200 mm (7.87...86.61 in.) Sensing Range

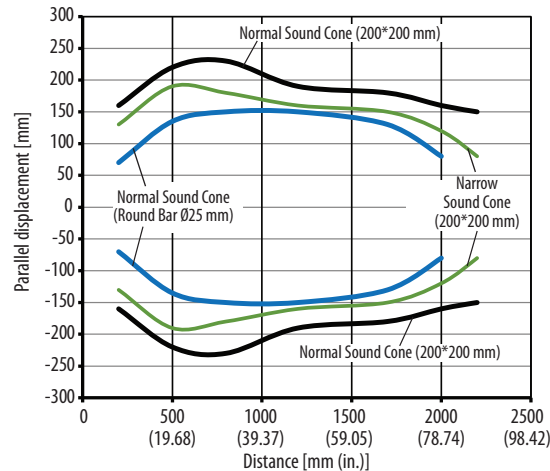
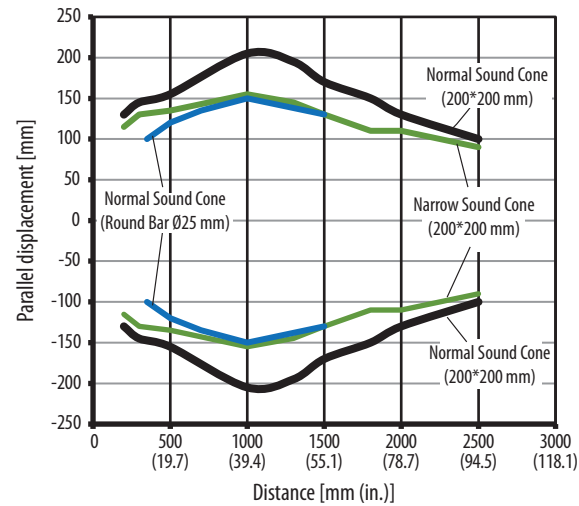
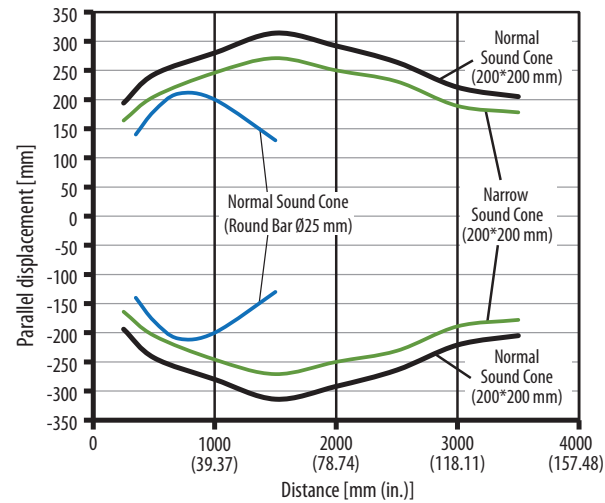
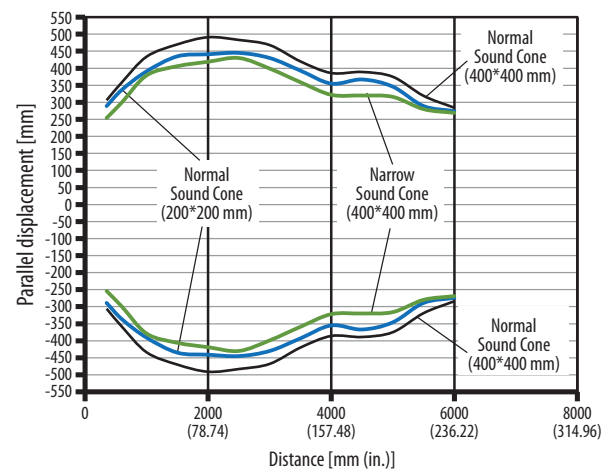


Figure 5 - 200...2500 mm (7.87...98.43 in.) Sensing Range**Figure 6 - 250...3500 mm (9.84...137.79 in.) Sensing Range****Figure 7 - 350...6000 mm (13.77...236.22 in.) Sensing Range**

Notes:

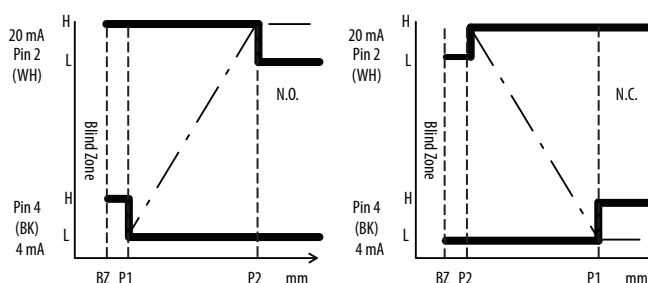
Configure in Standard I/O (SIO) Mode

Teach

873P ultrasonic sensors with dual discrete and single analog outputs feature two programmable independent setpoints with sourcing (PNP) outputs that can be configured for normally open (N.O.) or normally closed (N.C.) operation. Factory default setting is one setpoint mode with a maximum sensing range.

Dual-switching and/or Analog Output

In this sensing mode, you teach the sensor two switching points: P1 is the first taught point and P2 is the second taught point. For dual discrete switching outputs, P1 defines the switching point of Pin-4 outputs and P2 defines the switching point of Pin-2 outputs. For analog output, P1 determines 4 mA or 0V position and P2 determines 20 mA or 10V position. Output logic, Normally Open (N.O.) or Normally Closed (N.C.), is defined based on teaching sequence of the near setpoint and far setpoint: teach the near setpoint first for a N.O. / rising ramp output; teach the far setpoint first for a N.C./falling ramp output. The analog output is scaled between the two taught points (P1 and P2).



Setpoint 1

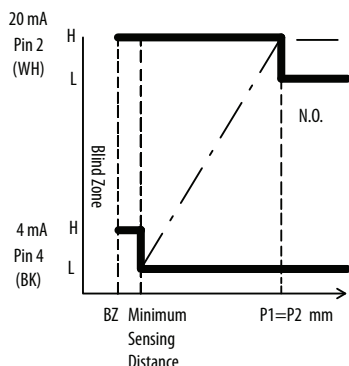
1. Place the target at the desired near/far setpoint.
 - a. Teaching the near setpoint first yields an N.O./rising ramp output.
 - b. Teaching the far setpoint first yields an N.C./falling ramp output.
2. With the target still in place, press and release the Teach button. The yellow and green status indicators flash simultaneously, which indicates that the first setpoint (P1) is set. The sensor is waiting for the second setpoint (P2).

Setpoint 2

1. Place the target at the desired near/far setpoint.
2. Press and release the Teach button while the green and yellow status indicators stop flashing. The sensor is ready to operate.

Single-switching and/or Analog Output

In this sensing mode, one switching point is taught within the defined sensing range of the sensor. The working range of the sensor becomes the minimum sensing distance (blind zone) to a user-taught setpoint. Depending on where the setpoint is taught, the output turns ON when the target passes between the minimum sensing distance and the taught setpoint. The analog output is scaled between minimum sensing distance and taught setpoint. When using the single-switching output mode, it is only possible to configure the sensor for Normally Open logic and rising ramp analog output.



Setpoint

1. Place the target at the desired setpoint.
2. With the target still in place, press and release the Teach button. The yellow and green status indicators flash simultaneously, which indicates that the first setpoint (P1) is now set. The sensor is waiting for the second setpoint. Keep the target and sensor in the same position, and press and release the Teach button again to set the second setpoint (P2). The yellow status indicator turns off and the green status indicator stops flashing, which indicates that the sensor is ready for use. The minimum sensing distance is shown in [Technical Specifications on page 31](#).

IMPORTANT

When you configure the sensor for single-switching mode, it is important that the target is at the exact same distance for both the first and second push of the Teach button. If the target or sensor has moved even slightly, the detected ranges are different for the two pushes of the Teach button, and the sensor is configured for dual-switching mode.

The green and yellow status indicators flash asynchronously for about 2 seconds, which indicates that there is no target present within the sensing range of the sensor and, therefore, no setpoint to teach. When no setpoint to teach occurs, the 873P sensor ignores the teach attempt and restores its previous settings. By comparison, when an object is detected during teach, the yellow and green status indicators flash synchronously and continue flashing until the second push of the Teach button.

Lockout Feature for Teach Button

The lockout feature locks the teach button to prevent unwanted teaching of the sensor.

Lock Teach Button

Press the teach button for 8 seconds until the yellow indicator A and B flash alternately with green. Release the button. The button is now locked.

Unlock Teach Button

Press the teach button for 8 seconds until the yellow indicator A and B flash alternately the green. Release the button. It is once again possible to teach the sensor.

Notes:

Configure with the IO-Link Interface

Studio 5000 Add-on Profile

IO-Link enabled sensors can be taught and precisely configured via Add-on Profile (AOP) of Studio 5000® or other IO-Link programming software. Through AOP, switching limits can be set with or without a reference object and are easily adjusted with millimeter precision. Configuration via AOP also provides the option of changing many other sensor parameters like sound beam width, echo integration level, switching time delay to adapt the sensor perfectly to its application.

IO-Link parameters are shown in the Add-on Profile (AOP) only for IO-Link devices with IODD advanced integration. 873P ultrasonic sensors offer the following tabs to describe the sensor functionality and operation:

- **Common Tab:** Provides general product information about sensor specifications and IO-Link IODD information.
- **Identification Tab:** Provides sensor catalog number, series letter, product firmware, and hardware revisions.
- **Observation Tab:** Displays real-time measurement information, including distance measurement value, switching outputs, and operation conditions.
- **Parameter Tab:** Allows you to configure sensors by modifying parameter settings.
- **Diagnosis Tab:** Provides information of operation status and sensor health diagnosis, and enables you to restore factory default settings and physically locate the sensor for troubleshooting.

For a complete listing of all sensor parameters and parameter definitions, See [Device Parameters on page 33](#).

873P IO-Link Parameters

Common Tab

Common Identification Observation Parameter Diagnosis



Vendor

Allen-Bradley

Vendor Text

www.ab.com/sensors

Vendor ID

0x0002

URL

www.ab.com/sensors



Device

873P-D18AIP2-900-D5

Description

Ultrasonic Distance Sensor

Device ID

0x0000D5

IO-Link Revision

1.1

Hardware Revision

01

Firmware Revision

01

Bitrate

COM3

MinCycleTime

3200

SIO mode

supported

IODD

Allen-Bradley-873P-900-20180503-IODD1.1.xml

Document Version

V1.5

Date of Creation

2018-05-03



Refresh

OK

Cancel

Apply

Help

This tab contains the following sensor information.

Table 2 - Common Tab

Item	Description
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 I/O-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 I/O-Link specifications.
I/O-Link Revision	Displays the current I/O-Link version that the device supports.
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 I/O-Link 1.1 standard.
SIO Mode	Describes whether the sensor is also designed to operate without and I/O-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 when the IODD file was creation.

Identification Tab

Name	R/W	Value	Unit
[-] Device Information			
Vendor Name	ro	Allen-Bradley	...
Product Name	ro	873P-D18AIP2-900-D5	...
Product ID	ro	873P-D18AIP2-900-D5	...
Product Text	ro	Ultrasonic Distance Sensor	...
Serial Number	ro	01UK_10000000004	...
[-] User Specific Information			
Application Specific Tag	rw		
User Tag 1	rw		
User Tag 2	rw		
[-] Revision Information			
Hardware Version	ro	01	...
Firmware Version	ro	01	...

Refresh

OK Cancel Apply Help

Device Information

Describes the information of the exact sensor that is configured including:

- Vendor Name
- Product Name
- Product ID
- Product Text
- Serial Number

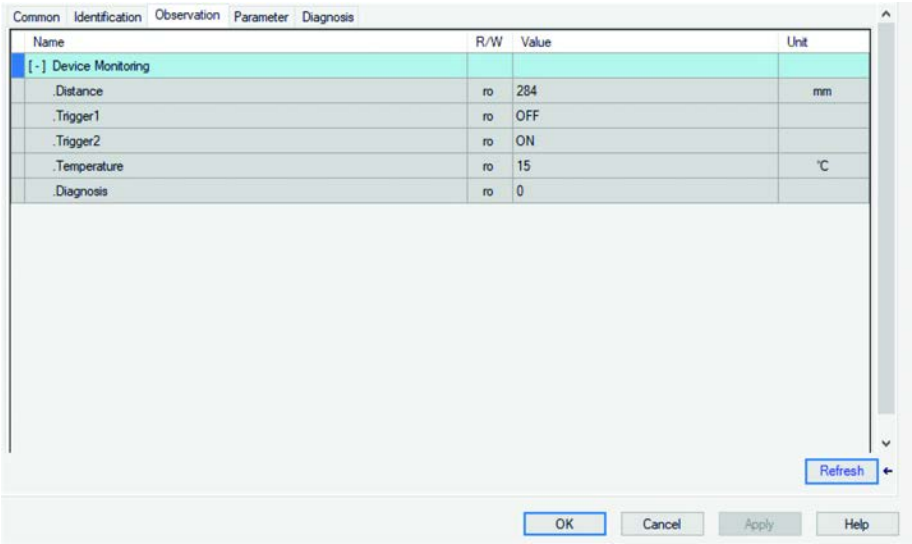
User Specific Information

Application Specific Name (ASN) is where you can name the sensor according to specific application. The ASN allows a unique identity of each sensor.

Revision Information

Shows the current hardware and firmware version.

Observation Tab



Observation tab displays real-time distance measurement value and device status. The tab contains the following information:

Device Monitoring

Item	Description
Distance	Distance measurement
Trigger 1 and 2	Outputs from two switching output channels
Temperature	Real-time temperature measurement
Diagnosis	Operation status of the sensor: • 0: Operation status is normal • 1: Certain events like over-temperature or over-current conditions are occurring.

Parameter Tab

The Parameter tab allows you to configure the sensor.

Figure 8 - Parameter Tab

Name	R/W	Value	Unit
[-] Output configuration			
Analog Output Slope	rw	Analog signal rising	
[-] Analog Output 2			
Analog Start Point 2 (ASP2)	rw	100	mm
Analog End Point 2 (AEP2)	rw	900	mm
[-] Signal			
Filter	rw	MEDl	
Echo	ro	LOW	
Suppression Mode	rw	Background Reflection	
Sound Cone Width	rw	normal sound cone	
[-] Teach			
Standard Command	wo	[SP2] one-point teach, determines the teach p	
Standard Command	wo	[SP1] one-point teach, determines the teach p	
Select Trigger	rw	SSC1	
Teach Status State	ro	Idle	
Suppression Distance	rw	900	mm

Output Configuration

Item	Description
Analog Output Slope	Applied to configure an analog output when the sensor is operated in the SIO mode. - Analog Rising Signal: Analog value increases with increasing distance. - Analog Falling Signal: Analog value decreases with increasing distance.

Analog Output 2

Item	Description
Analog Start Point	Applied to configure the analog output when the sensor is operated in the SIO mode. You can define an analog range with the Analog Starting Point (ASP) and the Analog Ending Point (AEP).
Analog End Point	

Signal

Item	Description
Filter	The integration of multiple echo signals to reduce measurement noises. The filter feature is applied for non-static objects such as liquid with a turbulent surface.
Echo	Applied to configure a sensor properly and monitor the quality of the echo signals during operation. Echo is a read-only parameter. A stronger echo signal makes sure of a longer sensing range and more reliable detection.
Suppression Mode	Allows you to select the following operation modes: - Background reflection - Background suppression
Sound Core Width	Allows for the adjustment of the acoustic beam width. A narrow sound cone has around 10% beam width reduction compared to the normal sound cone. See Beam Diagrams on page 10 .

Teach

Teach allows you to teach the sensor with a reference object.

Item	Description
Standard Command SP1	Set Point One (SP1, far setpoint) when teach with a reference object.
Standard Command SP2	Set Point Two (SP2, near setpoint) when teach with a reference object.
Select Trigger	Select the output channel: • SSC1 (output channel one-trigger 1) • SSC2 (output channel two-trigger 2)
Teach Status State (ro)	Indicates if the Teach command is successfully conducted.
Suppression Distance	Set the distance where objects behind it can be suppressed when Background Suppression mode is selected.

Figure 9 - Parameter Tab, Continued

The screenshot shows a software interface with tabs: Common, Identification, Observation, Parameter, and Diagnosis. The 'Parameter' tab is active. It displays a table with columns: Name, R/W, Value, and Unit. The table is organized into sections for Triggered1, Triggered2, and Counter.

Name	R/W	Value	Unit
[-] Triggered1			
Triggered1.SP1	rw	100	mm
Triggered1.SP2	rw	100	mm
Triggered1.Logic	rw	High active	
Triggered1.Mode	rw	Sng.P / Single Point	
Triggered1.Hyst	rw	5	
On Delay	rw	0	ms
Off Delay	rw	0	ms
[-] Triggered2			
Triggered2.SP1	rw	900	mm
Triggered2.SP2	rw	100	mm
Triggered2.Logic	rw	High active	
Triggered2.Mode	rw	Sng.P / Single Point	
Triggered2.Hyst	rw	5	
On Delay	rw	0	ms
Off Delay	rw	0	ms
[-] Counter			
.Mode	rw	Disabled	
.Reset	wo	Reset	
.Counter	ro	0	

At the bottom right of the table is a 'Refresh' button. At the bottom of the window are buttons for 'OK', 'Cancel', 'Apply', and 'Help'.

Triggered1/Triggered2

IO-Link output channel one and two allow you to configure the sensor by typing values without using a reference object to teach.

Item	Description
Triggered...SP1	Switching point one (far setpoint)
Triggered...SP2	Switching point two (near setpoint)
Triggered...Logic	• High Active: Normally Open (N.O.) • Low Active: Normally Closed (N.C.)
Triggered...Mode	Select the operation mode • Single Point • Window • Two Point • Deactivated
Triggered...Hyst	Distance difference between operate (switch on) and release (switch off) points. If an object approaches the sensor, the output trigger turns on at the switching point. When the object recedes, the hysteresis is added to the switching point.
On Delay	Additional 0...2000 ms time delay to switch from the OFF state to the ON state.
Off Delay	Additional 0...2000 ms time delay to switch from ON state to OFF state

Counter

Record the number of detections.

- Mode: Enable or disable this function. Default is 'disabled'
- Reset: Reset to zero
- Counter: Displays the times of detection

Diagnosis Tab

Diagnosis tab provides information on operation status and sensor health diagnosis.

Name	R/W	Value	Unit
[-] Device Access Locks			
Device Access Locks.Data Storage Lock	ro	false	
Device Access Locks.Local Parameterization Lock	nw	false	
[-] Service Function			
Standard Command	wo	Restore Factory Settings	
Device Status	ro	Device is OK	
.Locator Indicator	nw	Disabled	
.LEDs Enable	nw	Enabled	
[-] Operation Information			
Number_Of_Powercycles	ro	10	
Operating_Hours	ro	0	h
[-] Temperature			
.Actual - Since Power Up	ro	15	°C
.Maximum - Temperature	ro	29	°C
.Minimum - Temperature	ro	10	°C
.Maximum - Since Inception	ro	15	°C

Refresh

OK Cancel Apply Help

Device Access Locks

Item	Description
Data Storage Lock	Applied to enable or disable the use of data storage during the communication via IO-Link. • True: Data storage is enabled. • False: Data storage is disabled.
Local Parameterization Lock	Applied to enable or disable the teach button. • True: Teach button is disabled/locked. • False: Teach button is enabled.

Service Function

Item	Description
Standard Command	Applied to reset the sensor to factory default settings.
Device Status	Operation status of the sensor. • 0: Operation status is normal. • 1: Operation status is abnormal.
Locator Indicator	Applied to locate flashing sensors quickly.
LEDs Enable	Allows you to turn off or disable indicators at operation. Default is 'enabled.'

Operation Information

Item	Description
Number of Powercycles	Cycles of power-on.
Operating Hours	Operation hours since power on.

Temperature

Item	Description
Actual since power up	Real-time temperature measurement inside sensor.
Minimum and Maximum temperature	Min and max temperature since sensor is powered on.

Configure Sensor with Studio 5000 Application

Configuration Procedure

873P ultrasonic sensors have two switching output channels, which are also called triggers. For each trigger, you can select the operation mode and define two switching points (SP1 and SP2). By factory default settings, Trigger two is the only active output channel with single point mode and full sensing range.

Follow these steps to teach a sensor with AOP:

1. Select output channels (triggers)
2. Define the operation mode
3. Configure switching limits:
 - Configure without a reference object
 - Teach with a reference object
4. Configure outputs
5. Modify sound beam width and echo integration (filter) to fit your application

Step 1: Select Switching Output Channels (Triggers)

By factory default setting, trigger two is the only active output channel with one switching point (SP1) defined. As the following image shows, trigger two is activated with sensing range from 100 mm (3.9 in., blind zone) to 900 mm (3 ft, maximum sensing range) sensing range while trigger one is deactivated (SP1=SP2=100 mm). Users can set SP1 and SP2 values of trigger one if the second switching output is needed.

Name	R/W	Value	Unit
[-] Triggered1			
Triggered1.SP1	rw	100	mm
Triggered1.SP2	rw	100	mm
Triggered1.Logic	rw	High active	
Triggered1.Mode	rw	Sng P / Single Point	
Triggered1.Hyst	rw	5	
On Delay	rw	0	ms
Off Delay	rw	0	ms
[-] Triggered2			
Triggered2.SP1	rw	900	mm
Triggered2.SP2	rw	100	mm
Triggered2.Logic	rw	High active	
Triggered2.Mode	rw	Sng P / Single Point	
Triggered2.Hyst	rw	5	
On Delay	rw	0	ms
Off Delay	rw	0	ms

Buttons: OK, Cancel, Apply, Help, Refresh

Step 2: Select Operation Mode

There are four operation modes for each trigger/output

- Single point
- Window
- Two point
- Deactivated

Single Point Mode

One switching point can be set within the sensing range. If an object is located between the sensor head and the set switching point, the switching output reacts. Objects behind the switching point are suppressed. In this mode, SP1 should be set as switching point and SP2 is disabled.

Figure 10 - Switching Behavior in Single Point Mode (Normally Open)

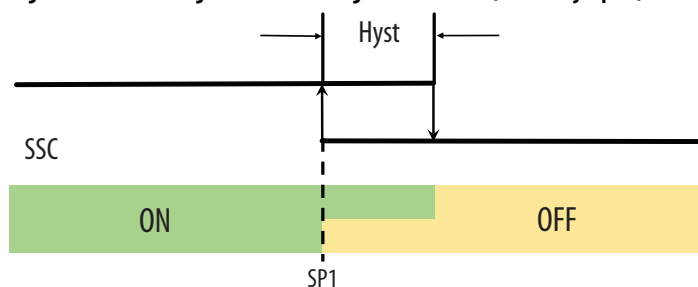
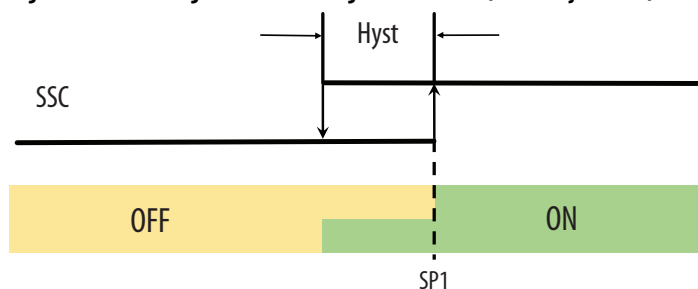


Figure 11 - Switching Behavior in Single Point Mode (Normally Closed)



Window Mode

Two switching points can be set within the sensing range. Two switching points create a switching window. Objects within the window cause a reaction at the switching output. Objects are detected only within a defined area. Both the SP1 and the SP2 should be set as switching points and the SP1 value should be higher than the SP2 value.

Figure 12 - Switching Behavior in Window Mode (Normally Open)

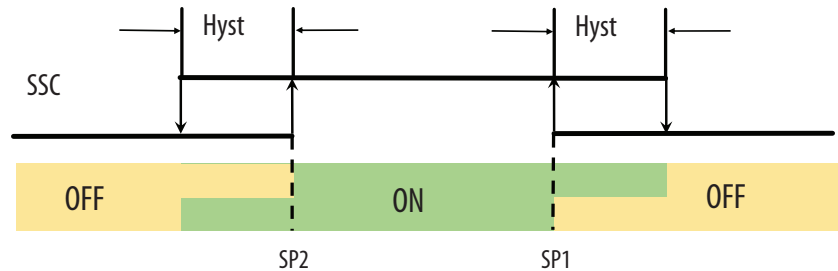
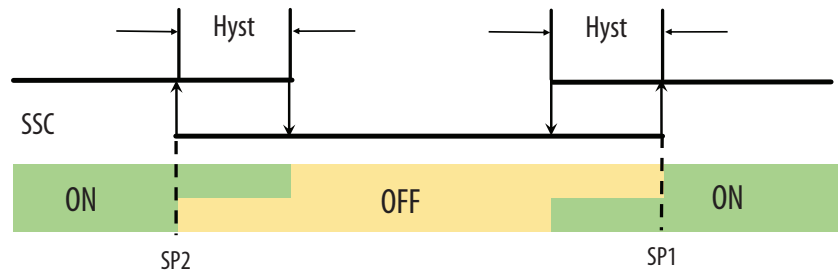


Figure 13 - Switching Behavior in Window Mode (Normally Closed)



Two Point Mode

This operation mode has the similar principle as single point mode while the SP2 is set to define hysteresis. The difference between the SP1 and the SP2 is hysteresis value.

Figure 14 - Switching Behavior in Two Point Mode (Normally Open)

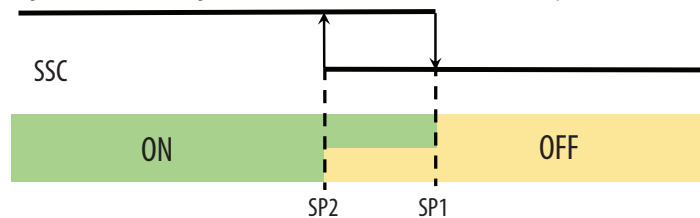
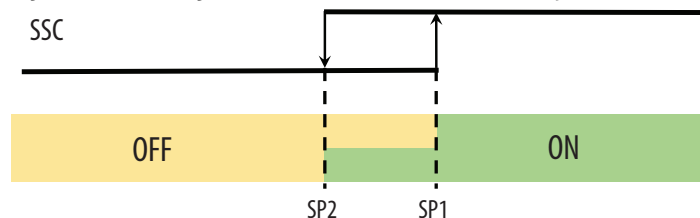


Figure 15 - Switching Behavior in Two Point Mode (Normally Closed)



Deactivated

This mode is applied to disable an output channel.

Step 3: Configure Switching Limits (SP1 and SP2)

Teach Without a Reference Object

The SP1 and the SP2 values can be directly typed in via AOP. The SP1 value should be always higher than the SP2 value.

Figure 16 - Set Up Switching Points by Typing in Values

[-] Triggered1				
Triggered1.SP1	nw	100		mm
Triggered1.SP2	nw	100		mm
Triggered1.Logic	nw	High active		
Triggered1.Mode	nw	Sng.P / Single Point		
Triggered1.Hyst	nw	5		
On Delay	nw	0		ms
Off Delay	nw	0		ms
[-] Triggered2				
Triggered2.SP1	nw	900		mm
Triggered2.SP2	nw	100		mm
Triggered2.Logic	nw	High active		
Triggered2.Mode	nw	Sng.P / Single Point		
Triggered2.Hyst	nw	5		
On Delay	nw	0		ms
Off Delay	nw	0		ms

Teach With a Reference Object

Sensors can also be taught using a reference object. During the teach process, an object is positioned in the sensing range and click SP1 button for far setpoint and SP2 teach button for near setpoint.

Figure 17 - Set Up Switching Points by Using a Target

Name	R/W	Value	Unit
[-] Output configuration			
Analog Output Slope	nw	Analog signal rising	
[-] Analog Output 2			
Analog Start Point 2 (ASP2)	nw	100	mm
Analog End Point 2 (AEP2)	nw	900	mm
[-] Signal			
Filter	nw	MEd1	
Echo	ro	LOW	
Suppression Mode	nw	Background Reflection	
Sound Cone Width	nw	normal sound cone	
[-] Teach			
Standard Command	wo	[SP2] one-point teach, determines the teach p	
Standard Command	wo	[SP1] one-point teach, determines the teach p	
Select Trigger	nw	SSC1	
Teach Status.State	ro	Idle	
Suppression Distance	nw	900	mm

Refresh

OK Cancel Apply Help

Step 4: Configure Outputs

For each output channel (trigger 1 or trigger 2), you can further define switching logic, hysteresis value, and switching time delay.

- Triggered.Logic
 - High Active: Normally Open (NO)
 - Low Active: Normally Closed (NC)
- Hysteresis: Switching hysteresis is applied to prevent the output from constantly switching on and off. The default hysteresis value is 5 mm.
- Output time delay: You can add 0...2000 ms to output response.
- On Delay: Additional 0...2000 ms time delay to switch from OFF state to ON state.
- Off Delay: Additional 0...2000 ms time delay to switch from ON state to OFF state.

Step 5: Fine-tuning for Applications

Modify the sound beam width and echo integration to fit for applications.

The 873P ultrasonic sensor allows you to modify acoustic beam width to reduce unwanted sound reflection, see [Beam Diagrams on page 10](#). Filter is a function for the applications having non-static targets, such as flowing liquid or objects subject to vibration, and stability of measurement can be improved with averaging the values of multiple measurements.

Notes:

Specifications

Technical Specifications

Attribute	873P-D18x-400-Dy ⁽¹⁾	873P-D18x-900-Dy ⁽¹⁾	873P-D18x-2200-Dy ⁽¹⁾	873P-D30x-2500-Dy ⁽¹⁾	873P-D30x-3500-Dy ⁽¹⁾	873P-D30x-6000-Dy ⁽¹⁾
Certification	c-UL-us Listed and CE Marked for all applicable directives					
Rated sensing distance [mm (in.)]	50...400 (1.97...15.75) ⁽²⁾	100...900 (3.94...35.43) ⁽²⁾	200...2200 (7.87...86.61) ⁽²⁾	200...2500 (7.87...98.42) ⁽²⁾	250...3500 (9.84...137.79) ⁽²⁾	350...6000 (13.78...236.22) ⁽³⁾
Teachable sensing range [mm (in.)]	50...400 (1.97...15.75)	100...900 (3.94...35.43)	200...2200 (7.87...86.61)	200...2500 (7.87...98.42)	250...3500 (9.84...137.79)	350...6000 (13.78...236.22)
Blind zone [mm (in.)]	0...50 (0...1.97)	0...100 (0...3.94)	0...200 (0...7.87)	0...200 (0...7.87)	0...250 (0...9.84)	0...350 (0...13.78)
Beam angle	15°±2°	14°±2°	14°±2°	10°±2°	12°±2°	15°±2°
Sensitivity adjustment	Push button					
Linearity	1%			<3%		
Resolution (SIO) [mm (in.)]	1 (0.04)	2 (0.08)	3 (0.12)	2 (0.08)	4 (0.16)	6 (0.24)
Resolution (IO-link)	1 mm					
Accuracy	0.50%			1%		
Hysteresis	<1%			<3%		
Ripple	5%					
Operating voltage	10...30V DC					
Current consumption	<50 mA			<30 mA		
Protection type	• Short circuit • Reverse polarity • Transient noise • Overload					
Output current	100 mA					
Leakage current	≤10 µA					
Transducer frequency	300 kHz	300 kHz	200 kHz	150 kHz	112 kHz	75 kHz
Output voltage drop, max	2.2V					
Output type	• P1 Model: PNP or IO-Link • P2 Model: Dual PNP or IO-Link • AI Model: Analog Current or IO-Link • AV Model: Analog Voltage or IO-Link • AIP2 Model: Dual PNP and Analog Current or IO-Link • AVP2 Model: Dual PNP and Analog Voltage or IO-Link					
Switching frequency	10 Hz	3 Hz	2 Hz	1 Hz		
Time delay before availability (Digital Output)	600 ms					
Response time (Analog Output)	400 ms			450 ms		
Time delay before availability (Analog Output)	650 ms			600 ms		
Temperature range	-20...+70 °C (-4...+158 °F)					
Temperature compensation	Yes					
Temperature drift	±2%			±5%		
Material	• Housing: Plastic - PBT • Active head: Epoxy - glass resin					
Ingress protection rating	IP67					

(1) Replace the x with P1, P2, AI, AV, AIP2, AVP2.
If x is P1, replace the y with D4 (Micro QD, 4-pin). Replace the y with D5 (Micro QD, 5-pin) for all other models.

(2) Metallic target 200 x 200 mm (7.87 x 7.87 in.)

(3) Metallic target 400 x 400 mm (15.75 x 15.75 in.)

Approximate Dimensions

Figure 18 - 18 mm Barrel for 400 mm (1.3 ft), 900 mm (3 ft), and 2200 mm (7.2 ft) Sensing Range

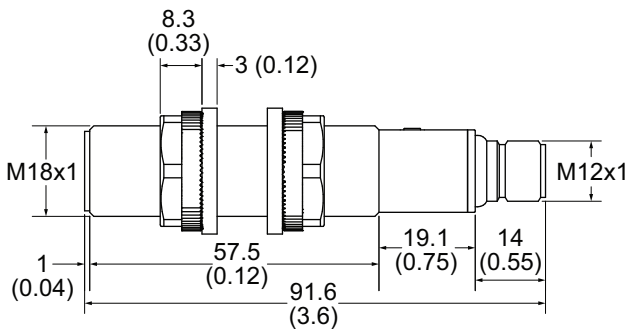


Figure 19 - 30 mm Barrel for 2500 and 3500 mm (8.2 and 11.5 ft) Sensing Range

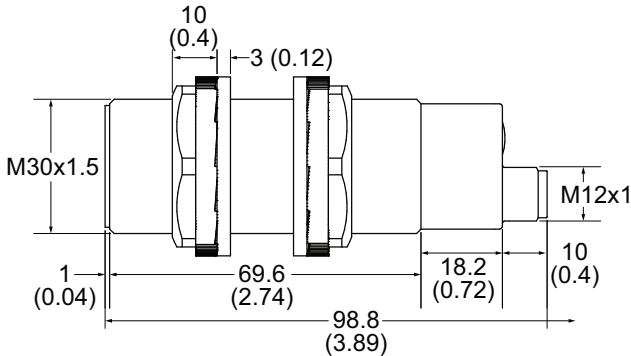
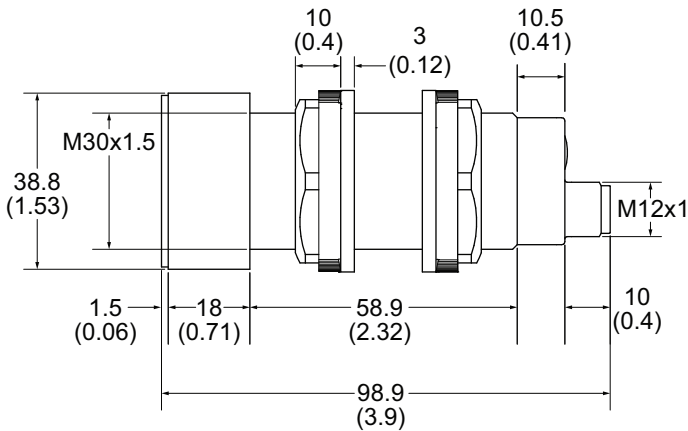


Figure 20 - 30 mm Barrel for 6000 mm (19.7 ft) Sensing Range



Device Parameters

Process Data

Table 3 - Process Data

Name	Description	Data Type	Bit Offset	Bit Length	Value Range	Single Values
Distance	Real-time distance measurement	IntegerT	16	16	40...450 80...950 150...2300 180...2600 200...3800 300...6200	UL (-32760), OL (32760)
Temperature	Temperature data	IntegerT	8	8	-	-
Diagnosis	Current device status	IntegerT	4	4	0...2	-
Trigger2	Output of SSC2	BooleanT	1	-	-	Off (false) ON (true)
Trigger1	Output of SSC1	BooleanT	0	-	-	Off (false) ON (true)

Variables

Table 4 - Variables

Name	Index	Subindex	Bit Offset	Data Type	Value Range	Default Value	Access Rights
Standard Command	2	0	-	UIntegerT_8	Restor Factory Settings (130) [SP1] one-point teach, determines the teach point for [SP1] (65), [SP2] one-point teach, determines the teach point for [SP2] (66)-	-	wo
Device Access Lock	12	0	-	RecordT	-	-	rm
Data Storage Lock	-	2	1	BooleanT	false (false), true (true)	-	-
Local Parameterization Lock	-	3	2	BooleanT	false (false), true (true)	-	-
Vendor Name	16	0	-	StringT (64)	-	Allen-Bradley	ro
Vendor Text	17	0	-	StringT (64)	-	www.ab.com/sensors	ro
Product Name	18	0	-	StringT (64)	-	873P-D18AIP2-900-D5*	ro
Product ID	19	0	-	StringT (64)	-	-	ro
Product Text	20	0	-	StringT (64)	-	Ultrasonic Distance Sensor	ro
Serial Number	21	0	-	StringT (64)	-	-	ro
Hardware Version	22	0	-	StringT (64)	-	-	ro
Firmware Version	23	0	-	StringT (64)	-	-	ro
Application Specific Tag	24	0	-	StringT (32)	-	-	rw
Device Status	36	0	-	UIntegerT_8	5...255 Device is OK (0), Maintenance required (1), Out of specification (2), Functional check (3), Failure (4)	Device is OK (0)	ro
Process Data Input	40	0	-	RecordT	-	-	ro
Distance	-	1	16	UIntegerT_16	40...450 80...950 150...2300 180...2600 200...3800 300...6200	-	-
Temperature	-	2	08	UIntegerT_8	-	-	-

Table 4 - Variables (Continued)

Name	Index	Subindex	Bit Offset	Data Type	Value Range	Default Value	Access Rights
Diagnosis	-	3	4	UIntegerT_4	0...2	-	-
Trigger2	-	6	214	BooleanT	OFF (false), ON (true)	-	-
Trigger1	-	7	160	BooleanT	OFF (false), ON (true)	-	-
Select Trigger	58	0	0	UIntegerT_8	SSC1(1), SSC2 (2)	SSC1(1)	rw
Teach Status	59	0		RecordT	-	-	ro
State	-	5	0	UIntegerT_4	Idle (0), SPT Success (1), SP2 Success (2), SP12 Success (3), Wait for command (4), Busy (5), Error (7)	-	-
SSC1 Pram_Triggered1	60	0		RecordT	-	-	rw
SP1	-	1	16	UIntegerT_16	50...400 100...900 200...2200 200...2500 250...3500 350...6000	50 100 200 200 250 350	-
SP2	-	2	0	UIntegerT_16	50...400 100...900 200...2200 200...2500 250...3500 350...6000	50 100 200 200 250 350	-
SSC1_Config_Triggered1	61	0		RecordT	-	-	rw
Logic	-	1	24	UIntegerT_8	High Active (0), Low Active (1)	High active (0)	-
Mode	-	2	16	UIntegerT_8	Deac/Deactivated (0), SNG. P/ Single Point (1), Wind/Window (2), Two.P/Two Points (3)	Sng.P/Single Point (1)	-
Hyst	-	3	0	UIntegerT_16	1...50	5	-
SSC1 Pram_Triggered2	62	0		RecordT	-	-	rw
SP1	-	1	16	UIntegerT_16	50...400 100...900 200...2200 200...2500 250...3500 350...6000	400 900 2200 2500 3500 6000	-
SP2	-	2	0	UIntegerT_16	50...400 100...900 200...2200 200...2500 250...3500 350...6000	50 100 200 200 250 350	-
SSC1_Config_Triggered2	63	0	-	RecordT	-	-	rw
Logic	-	1	24	UIntegerT_8	High Active (0), Low Active (1)	High active (0)	-
Mode	-	2	16	UIntegerT_8	Deac/Deactivated (0), SNG. P/ Single Point (1), Wind/Window (2), Two.P/Two Points (3)	Sng.P/Single Point (1)	-
Hyst	-	3	0	UIntegerT_16	1...50	5	-
SSC1 Switch-On Delay	75	0	-	UIntegerT_16	0...2000	0	rw
SSC1 Switch-Off Delay	76	0	-	UIntegerT_16	0...2000	0	rw
SSC2 Switch-On Delay	77	0	-	UIntegerT_16	0...2000	0	rw
SSC2 Switch-Off Delay	78	0	-	UIntegerT_16	0...2000	0	rw
Temperature	90	0	-	RecordT	-	-	ro
Actual Temp - Since Power Up	-	1	32	UIntegerT_8	-	-	-
Maximum Temperature	-	2	24	UIntegerT_8	-	-	-
Minimum Temperature	-	3	16	UIntegerT_8	-	-	-
Maximum Since Inception	-	4	8	UIntegerT_8	-	-	-
Minimum Since Inception	-	5	0	UIntegerT_8	-	-	-
Operating_Hours	91	0	-	UIntegerT_16	0...65535	0	ro
Counter	93	0	-	RecordT	-	-	rw
Mode	-	1	24	UIntegerT_8	Disabled (0), Enabled (1)	Disabled (0)	-

Table 4 - Variables (Continued)

Name	Index	Subindex	Bit Offset	Data Type	Value Range	Default Value	Access Rights
Reset	–	2	16	UIntegerT_8	No Reset (0), Reset(1)	–	–
Counter	–	3	0	UIntegerT_8	–	–	–
Indicator Control	94	0	–	RecordT	–	–	rw
Locator Indicator	–	1	8	UIntegerT_8	Disabled (0), Enabled (1)	Disabled (0)	–
Indicator Enable	–	2	0	UIntegerT_8	Disabled (0), Enabled (1)	Enabled (1)	–
Suppression Mode	98	0	–	UIntegerT_8	Background Reflection (0) Background Suppression (1)	0	rw
Suppression Distance	99	0	–	UIntegerT_16	100...400 150...900 300...2200 250...2500 300...3500 300...6000	400 900 2200 2500 3500 6000	rw
User Tag 1	192	0	–	StringT [16]	–	–	rw
User Tag 2	193	0	–	StringT [16]	–	–	rw
Analog Output Slope	300	0	–	UIntegerT_8	Analog signal rising (1) Analog signal falling (10)	Analog signal rising (1)	rw
Analog Start Point 2 (ASP2)	301	0	–	UIntegerT_16	50...400 100...900 200...2200 200...2500 250...3500 350...6000	50 100 200 200 250 350	rw
Analog End Point 2 (EP2)	302	0	–	UIntegerT_16	50...400 100...900 200...2200 200...2500 250...3500 350...6000	400 900 2200 2500 3500 6000	rw
Filter	303	0	–	UIntegerT_8	OFF (0), LOW (1), MEdi (2), HIGH (3)	MEdi (2)	rw
Echo	304	0	–	UIntegerT_8	no (0), LOW (1), MED (2), GOOD (3), HIGH (4)	–	ro
Sound Cone Width	305	0	–	UIntegerT_8	narrow sound cone (0), normal sound cone (1)	normal sound cone (1)	rw
Number_Of_Powercycles	306	0	–	UIntegerT_16	0...65535	0	ro

Events

Table 5 - Events

Code	Name	Type	Description
16912 (0x4210)	Device temperature over-run	Warning	Clear source of heat
30480 (0x7710)	Short circuit	Error	Check installation

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Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

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