Installation Instructions
Bulletin 873P Ultrasonic Proximity Sensor

IMPORTANT: Save these instructions for future use.

IMPORTANT: Solid state devices can be susceptible to radio frequency (RF) interference depending on the power and the frequency of the transmitting source. If RF transmitting equipment is to be used in the vicinity of the solid state devices, thorough testing should be performed to assure that transmitter operation is restricted to a safe operating distance from the sensor equipment and its wiring.

ATTENTION: If a hazardous condition can result from unintended operation of this device, access to the sensing area should be guarded.

Description

Bulletin 873P Ultrasonic Sensors are self-contained solid-state devices designed for noncontact sensing of solid and liquid objects. They are available in several sensing ranges with either an analog or discrete output depending on the model.

The discrete output models have a normally open PNP output that is switched when the target is within range. They have a four-turn potentiometer to adjust the far limit of the sensing range in order to ignore background targets.

The analog output models provide an output current or voltage that varies linearly with the target distance within its specified sensing range. Analog models are equipped with either 4–20mA or 0–10V DC outputs. These devices can be useful for many applications including: level monitoring, diameter measurement, distance measurement, and web tension.

873P Models

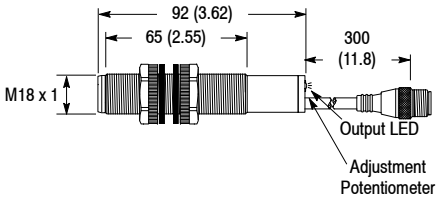
Sensing Range mm (inches)	Output Configuration		
	PNP Normally Open	4 to 20mA	0 to 10V DC
100 to 600 (3.94 to 23.62)	**873P-DBNP1-F4**	**873P-DBAC1-D4**	**873P-DBAV1-D4**
200 to 1500 (7.87 to 59.06)	**873P-DBNP2-F4**	**873P-DBAC2-D4**	**873P-DBAV2-D4**
300 to 2500 (11.81 to 98.43)	**873P-DCNP1-D5**	**873P-DCAC1-D5**	**873P-DCAV1-D5**

Specifications

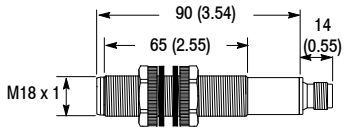
	Discrete	Analog Current	Analog Voltage
Output Configuration	Normally Open, PNP	4 to 20mA	0 to 10V DC
Load Current	<500mA	—	
Leakage Current	<0.5mA	—	
Current Consumption	< 35mA		
Operating Voltage	18 to 30V DC		
Voltage Drop	< 3.5V DC	—	
Repeatability	0.2%		
Hysteresis	2.5% typical	—	
Linearity	—	±0.3	
Ultrasonic Frequency	130, 180, 300kHz		
Ultrasonic Beam Angle	8°		
Short Circuit Protection	Incorporated		
Overload Protection	Incorporated		
False Pulse Protection	Incorporated		
Transient Noise Protection	Incorporated		
Reverse Polarity Protection	Incorporated		
Approvals	cULus listed and CE marked for all applicable directives		
Housing Material	Plastic - PBT		
Enclosure Rating	IP67		
Connection	Micro quick-disconnect (18mm discrete models have 12 inch pigtail)		
Output LED	Yellow	—	
Adjustment	Potentiometer	—	
Operating Temperature	-15 to 70°C (5 to 158°F)		
Shock	30g, 11ms		
Vibration	55Hz, 1mm amplitude, 3 planes		

Dimensions

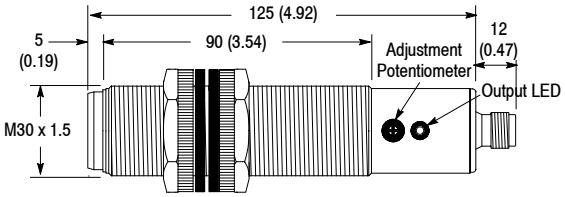
18mm Discrete



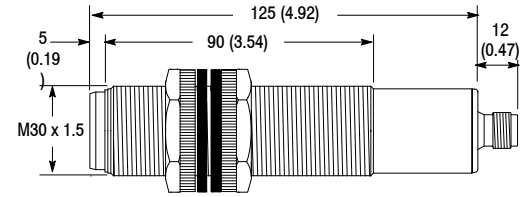
18mm Analog



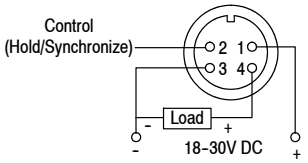
30mm Discrete

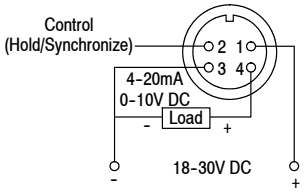


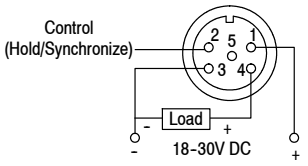
30mm Analog

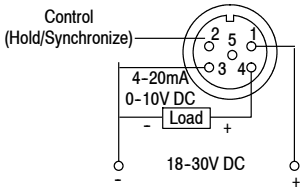


Wiring Diagrams









Control Pin

Normal Operation

For normal operation do not connect the control pin. Hold and synchronize features can be used for special applications.

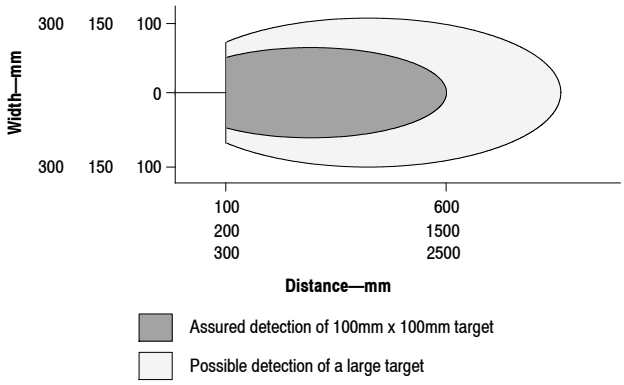
Hold

To inhibit sensor operation and hold the output to its present state connect the control pin (2) to 0V DC. The sensor will not transmit or receive ultrasonic pulses until this voltage is removed from the control pin. Switching output models will be latched and analog output models will hold their value during this period.

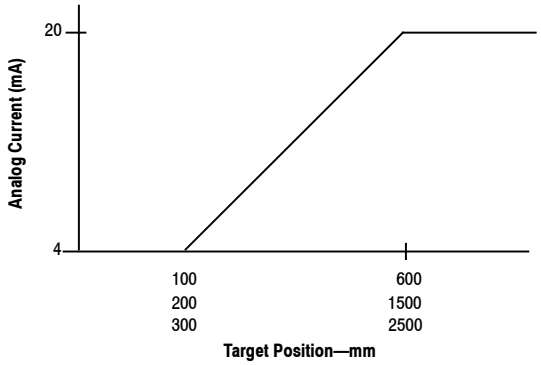
Synchronize

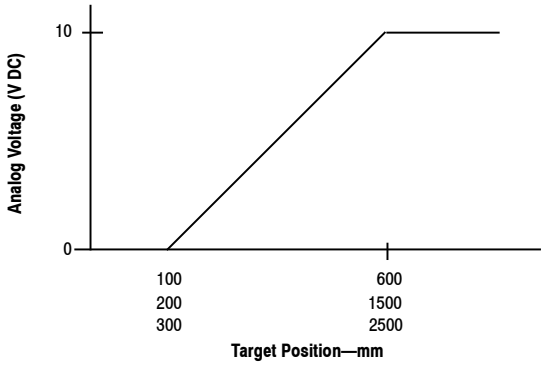
To synchronize the transmission of ultrasonic pulses between several sensors connect the control pins together. This feature reduces the potential for sensor crosstalk between models that are mounted in close proximity to one another.

Beam Pattern



Analog Output





Operation Principle

Ultrasonic sensors utilize a transducer that emits bursts of high frequency sound waves in a cone shaped beam pattern. These pulses are reflected or “echoed” from the target back to the sensor and detected by the transducer. The device determines the distance from the sensor to the target by measuring the length of time for this echo to return. Discrete models compare this duration to that of the far limit which can be set by adjusting the potentiometer. The output of the sensor is switched if the echo is returned within this timeframe. The analog models convert the time value to a DC current or voltage depending on the model. There is an unusable area or deadband directly in front of the sensor since there is a necessary time interval between transmission and detection of the soundwave by the transducer. This is the minimum distance at which the target can be detected.

Sensing Distance

Bulletin 873P analog and discrete ultrasonic sensors are available in three sensing ranges: 100–600mm, 200–1500mm, 300–2500mm. The sensing ranges are determined using an industry standard 100mm X 100mm flat steel target.

Target Considerations

Since the actual sensing distance to an object depends on a reflected sound wave, target material, shape, size, temperature, and position will influence operation; it is possible that the sensing distance can be reduced or the target may not be detected based on these characteristics. The ideal target is a smooth, flat surface. Target material that is not relatively sound reflective (fabric, foam rubber, etc.) may be difficult to detect depending on the application. Rounded or uneven objects can also be detected, but the sensing distance may be reduced. For best performance, the sensor should be aligned such that the sensor face is parallel to the target surface.

Environmental Factors

The velocity of sound in air is dependent upon temperature (sound waves travel faster at higher temperatures). Bulletin 873P ultrasonic sensors have internal temperature compensation to adjust the ultrasonic frequency to compensate for these changes in the ambient air temperature. However, while this feature does compensate for ambient temperature changes, temperature variations within the sensing range due to convection currents, heating/cooling elements, etc., may still divert or refract the sound wave and adversely affect sensor performance. Strong air turbulence can also influence the signal and adversely affect the stability and overall sensor operation. Humidity does not significantly affect ultrasonic sensor operation, but changes in humidity can have a slight affect in some instances due to the absorption of sound.

Mounting Considerations

The sensor must be securely mounted on a firm stable surface or support. 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 target’s surface (perpendicular to the barrel axis of the sensor).

When using more than one 873P there is a potential for cross-talk (mutual interference) between the sensors. As a result, consideration should be given to the spacing between the sensors. See the beam pattern chart for the minimum acceptable distance between sensors that are mounted side by side. When the sensors must be mounted facing each other they should be separated by a distance at least 4 times the maximum sensing range for the model.

If the sensors must be mounted close together due to application requirements, the **Hold** or **Synchronize** functions can be used to reduce cross-talk.

The **Hold** function stops the sensor from transmitting and receiving ultrasonic pulses, which eliminates the potential for cross-talk. This function also can be used to hold the output to its existing state or value. For details see the **Hold** function in the Wiring/Control Pin section.

Synchronizing the ultrasonic pulses for a group of sensors can also reduce the possibility of mutual interference. In order for the **Synchronize** function to work effectively, the sensors should be properly aligned and mounted at the same distance from the target. For details see the **Synchronize** function in the Wiring/Control Pin section.

Background Suppression

The discrete sensor models offer a background suppression feature that allows the sensor to ignore all objects beyond a specified distance. The user can set this distance during installation by turning the four-turn potentiometer at the rear of the sensor. The far limit of the sensing range can be adjusted to detect valid targets and ignore background targets such as the side of a conveyor.

Profile Reduction Beam Deflectors

Beam deflectors are available to reduce the mounting profile for space critical applications that cannot accommodate the barrel length of the sensor. They can also be used to protect the sensor face from target collisions. These accessories deflect the ultrasonic beam at 90° and are available in plastic and stainless steel versions. In addition to the profile reduction, the stainless steel models provide mounting capability and focus the ultrasonic beam.

Catalog Number	Description
60-2757	Stainless Steel focused beam deflector and mounting bracket for 18mm models
60-2758	Stainless Steel focused beam deflector and mounting bracket for 30mm models
60-2759	Plastic beam deflector for 18mm models
60-2760	Plastic beam deflector for 30mm models

Stilling Tubes

For applications where the target may be a liquid with a turbulent surface, a stilling tube can be used to diminish this instability. The tube should have a smooth inner diameter and its size should be a minimum of 50mm depending on the application. The sensor should be mounted such that the barrel is parallel to the sides of the tube but not touching.

Allen-Bradley

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