Installation Instructions
Ultrasonic Single & Dual Discrete Output Sensors

IMPORTANT: SAVE THESE INSTRUCTIONS FOR FUTURE USE.

Specifications

Model	873P-D18❶-400-D❷	873P-D18❶-900-D❷	873P-D18❶-2200-D❷	873P-D30❶-2500-D❷	873P-D30❶-3500-D❷	873P-D30❶-6000-D❷
Certifications	cULus Listed and CE Marked for all applicable directives					
Rated Sensing Distance	50…400 mm ❸ (1.97…15.7 in.)	100…900 mm ❹ (3.94…35.4 in.)	200…2200 mm ❸ (7.87…88.6 in.)	200…2500 mm ❹ (7.87…98.4 in.)	250…3500 mm ❹ (9.84…137.8 in.)	350…6000 mm ❺ (13.8…236.2 in.)
Teachable Sensing Range	50…400 mm ❸ (1.97…15.7 in.)	100…900 mm ❹ (3.94…35.4 in.)	200…2200 mm ❸ (7.87…86.6 in.)	200…2500 mm ❹ (7.87…98.4 in.)	250…3500 mm ❹ (9.84…137.8 in.)	350…6000 mm ❺ (13.78…236.22 in.)
Blind Zone	0…50 mm (0…1.97 in.)	0…100 mm (0…3.94 in.)	0…200 mm (0…7.87 in.)	0…200 mm (0…7.87 in.)	0…250 mm (0…9.84 in.)	0…350 mm (0…137.8 in.)
Beam Angle	±8°	±7°		14° ±1°	15° ±2°	
Sensitivity Adjustment	Push button					
Repeatability	0.1% up to 3.5 m (11.5 ft) and 0.2% to 6 m (19.7 ft)					
Hysteresis	<1% of the full scale value					
Resolution	1 mm (0.04 in.)	2 mm (0.08 in.)	3 mm (0.12 in.)	2 mm (0.08 in.)	4 mm (0.16 in.)	6 mm (0.24 in.)
Accuracy	0.1% of sensing range					
Ripple	5%					
Current Consumption	≤50 mA					
Protection Type	Short circuit, reverse polarity, transient noise, overload					
Output Current	100 mA					
Leakage Current	≤10 µA @ 30 V					
Transducer Frequency	300 kHz		200 kHz	150 kHz	112 kHz	75 kHz
Voltage Drop	2.2V max					
Output Type ❶	**P1** *or* **P2**					
Switching Frequency	10 Hz	4 Hz	1 Hz	2 Hz		1 Hz
Response Time	50 ms	125 ms	500 ms	250 ms		500 ms
Time Delay before Availability	≤500 ms (single discrete output); ≤900 ms (double discrete output)					
Temperature Range	-20…+60° C (-4…+140° F)			-20…+70° C (-4…+158° F)		
Temperature Compensation	Yes					
Temperature Drift	±5%					
Housing Material	Plastic—PBT					
Active Head Material	Epoxy—glass resin					
Ingress Protection Rating	IP67 (EN 60529)					

❶ **P1**–(1) PNP discrete output *or* **P2**–(2) PNP discrete outputs
❷ If **P1**, the suffix of the sensor is D4 (QD, 4-pin); if **P2**, the suffix of the sensor is D5 (QD, 5-pin).
❸ Metallic target 100 x 100 mm (3.94 x 3.94 in.)
❹ Metallic target 200 x 200 mm (7.87 x 7.87 in.)
❺ Metallic target 400 x 400 mm (15.7 x 15.7 in.)

Operating Voltage	Catalog Numbers
12…30V DC	873P-D30P1-2500-D4, 873P-D30P2-2500-D5, 873P-D30P1-3500-D4, 873P-D30P2-3500-D5, 873P-D30P1-6000-D4, 873P-D30P2-6000-D5,
15…30V DC	873P-D18P1-400-D4, 873P-D18P2-400-D5, 873P-D18P1-900-D4, 873P-D18P2-900-D5, 873P-D18P1-2200-D4, 873P-D18P2-2200-D5

IMPORTANT The 873P sensor is set to a one-set point mode with maximum sensing range from the factory.

Single Discrete N.O./N.C. Output

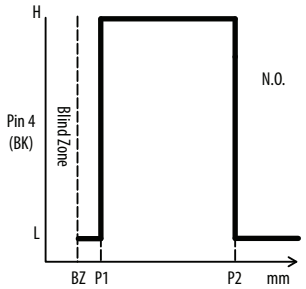
Normally-open Logic: If near point is set first, far point is set second. The output is ON between the two points, and the output is OFF outside of these two points.

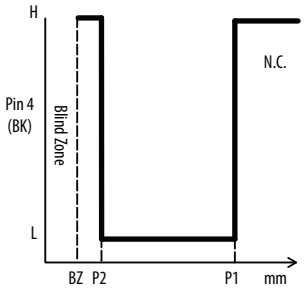
Normally-closed Logic: If far point is set first, near point is set second. The output is OFF between the two points, and the output is ON outside of these two points.

Window Function

In this sensing mode, you teach the sensor a near set point and a far set point within the defined sensing range of the sensor.

With normally-open logic, if an object passes through the defined window, the discrete output turns ON or the opposite if the logic is normally-closed.





Set Point 1 (P1)

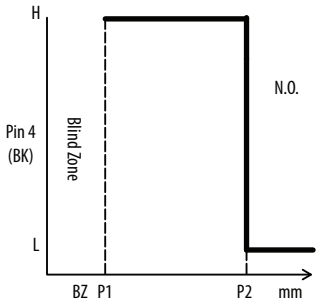
1. Place the target at the desired near/far set point.
   a. The near set point first yields normally-open.
   b. The far set point first yields normally-closed.
2. With target at the desired near/far location, press the teach button, then release.
3. The yellow and green LEDs flash simultaneously, indicating that the first set point P1 is now set. The sensor is waiting for the last set point.

Set Point 2 (P2)

1. Place the target at the desired near/far set point location based upon set point 1 location.
2. While green and yellow LEDs are flashing, press the teach button, then release. The sensor is ready to operate.

One Set Point Function

In this sensing mode, a set point is taught in the defined sensing range. The working range of the sensor becomes the minimum sensing distance to a user-taught set point. Depending on where the set point is taught, the output will turn ON when the target passes between the minimum sensing distance of the sensor and the taught set point. **When using the one set point mode it is only possible to configure the sensor for normally open logic. It is not possible to configure the sensor for N.C.**



Set Point 1 (P1):

1. Place the target at the desired set point.
2. With the target still in place, press the teach button, then release.
3. The yellow and green LEDs flash simultaneously, indicating that the first set point P1 is now set. The sensor is waiting for the sensor reference point.

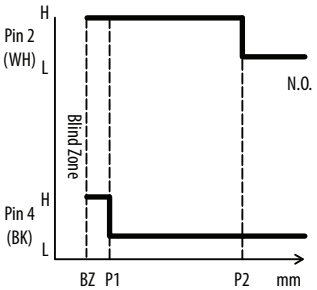
Sensor Reference Point

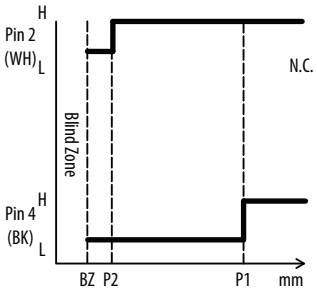
Keep the target in the same position used to set P1.

With the target still in place, press the teach button. While the yellow and green LEDs flash simultaneously, press the teach button, then release. The sensor is ready for use. The minimum sensing distance is indicated in the Specifications.

Dual Discrete N.O./N.C. Outputs

These sensors feature two programmable independent outputs with sourcing (PNP) outputs configurable for N.O. or N.C. operation.





Window Function

Two set points are taught in the defined sensing range, thus creating a sensing window. When a target is detected between the taught set points, the sensor output triggers ON or OFF, depending on the type of logic used (N.O. or N.C.).

Set Point 1 (P1)

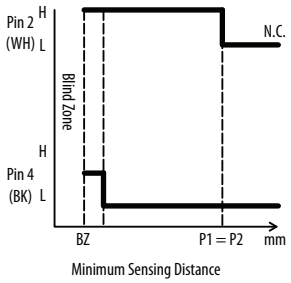
1. Place the target at the desired near/far set point.
   a. The near set point (i.e. nearest to sensor face) yields a normally-open logic.
   b. The far set point (i.e. furthest from the sensor face) yields a normally-closed logic.
2. With target in the desired near/far location, press the teach button, then release.
3. The yellow and green LEDs flash simultaneously, indicating that the first set point P1 is now set. The sensor is waiting for the last set point.

Set Point 2 (P2)

1. Place the target at the desired near/far set point location based upon set point 1 location.
2. While green and yellow LEDs are flashing, press the teach button, then release. The sensor is ready to operate.

One Set Point Function

Dual discrete sensors will trigger ON when a target is detected between the minimum sensing distance and the user-taught set point. **In this mode, only normally-open logic can be taught.**



Set Point 1 (P1)

1. Place the target at the desired set point.
2. With the target still in place, press the teach button.
3. The yellow and green LEDs flash simultaneously, indicating that the first set point P1 is now set. The sensor is waiting for the sensor reference point.

Sensor Reference Point

Keep the target in the same position you used to set P1.

With the target still in place, press the teach button for at least two seconds. With the yellow and green LEDs flashing simultaneously, press the teach button, then release. The sensor is ready for use. The minimum sensing distance is indicated in the Specifications table on page 1.

IMPORTANT	For both Sensor Types: When configuring the sensor for one set point mode it is very 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 will be different for the two pushes of the teach button, and the sensor will be configured for Window Mode.

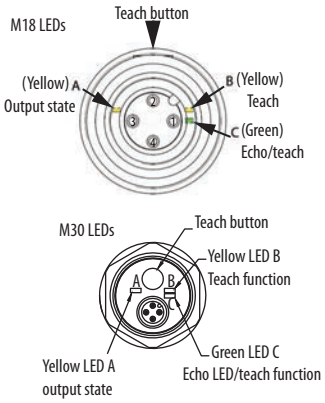
IMPORTANT	For both Sensor Types: The green and yellow LEDs flash asynchronously for about two seconds indicating there is no target present within the sensing range of the sensor and therefore no set point to teach. When this happens, the 873P ignores this teach attempt and restores its previous settings. By comparison, when an object is detected during the teach, the yellow and green LEDs flash synchronously and continue flashing until the second push of the teach button.

Single PNP Indicator LED Functions

LED	Color	Function
A	Yellow	Output state
B	Yellow	Teach function
C	Green	ECHO LED/ Teach function

Double PNP Output LED Function

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



LED Indicators: Single PNP Discrete Output

Operating Mode	Green LED (Alignment)	Yellow LED A (Output)	Yellow LED B (Teach)
Standard Operation			
Target Present	ON §	ON/OFF ‡	OFF
Target Absent	ON/OFF §	ON/OFF ‡	OFF

LED Indicators: Dual PNP Discrete Output

Operating Mode	Green LED (Alignment)	Yellow LED A (Output)	Yellow LED B (Teach)
Standard Operation			
Target Present	ON §	ON/OFF ‡	ON/OFF ‡
Target Absent	ON/OFF	ON/OFF ‡	ON/OFF ‡

§ Green LED indicates that an echo is reflected back to the sensor by an object, not necessarily the target. Its primary use is for alignment.

‡ For single discrete sensors, LED A will trigger ON/OFF depending on target position relative to the taught set point(s) and if Normally-open or Normally-closed logic is used. In the case of a dual discrete sensor, LEDs A and B will trigger ON/OFF depending on the target position relative to the taught set points and on the logic used (N.C. or N.O.).

Other Functions

Hold Function

Proceed as follows to inhibit sensor operation and hold the output to its present state.

PNP Logic: If the SYNC pin is connected to the NEG, the ultrasonic wave emission is stopped and the digital output is frozen in the current state. If the SYNC pin is either connected to POS or not connected, the sensor operates normally.

Lockout Feature for Teach Button

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

Lock Teach Button: Press the teach button for eight seconds, until the yellow LEDs A and B flash alternately with the green LED C. Release the teach button. The push button is now locked.

Unlock Teach Button: Press the teach button for eight seconds, until the yellow LEDs A and B flash alternately with the green LED C. Release the teach button. It is once again possible to teach the sensor.

Synchronization of Ultrasonic Sensors

In this mode, all sensors are connected to a same output on the PLC. A SYNC pulse simultaneously drives all sensors connected to the PLC output. When mounting the sensors, attention must be paid to a minimum distance between the sensors; said distance varies depending on the type(s) of sensors used (see below). The target must be positioned at the same distance from each synchronized sensor; the target position should overall be flat. When mounted correctly, the synchronized sensors perform like a single sensor with an extended detection angle.

Please note that sensor response times will increase proportionally to the number of synchronized sensors.

How it Works:

Connect Pin 2 (white) to all sensors to be synchronized.

All sensors will trigger at the same time. Any eventual crosstalk signal related to a longer sensing distance will be ignored. An external synchronization pulse controls the sensors.

All minimum distances depend on target distance and material. “T” is the pulse time period applied on the SYNC wire, and “Width” refers to the pulse width.

- <u>400 mm Sensing Range Sensors</u>
  T ≥ 4 msec
  500 µsec ≤ Width ≤ 1 msec
  Minimum distance between sensors: 50…100 mm.
- <u>2500 mm Sensing Range Sensors</u>
  T ≥ 25 msec
  500 µsec ≤ Width ≤ 5 msec
  Minimum distance between sensors: 100 mm for working distances up to 1.5 m, and 50 mm for distances > 1.5 m.
- <u>900 mm Sensing Range Sensors</u>
  T ≥ 7.5 msec
  500 µsec ≤ Width ≤ 1 msec
  Minimum distance between sensors: 30…50 mm.
- <u>3500 mm Sensing Range Sensors</u>
  T ≥ 35 msec
  500 µsec ≤ Width ≤ 5 msec
  Minimum distance between sensors: 100 mm for working distances up to 1.5 m, and 50 mm for distances > 1.5 m.

- 2200 mm Sensing Range Sensors
  T ≥ 17.5 msec
  500 µsec ≤ Width ≤ 1 msec
  Minimum distance between sensors: 30…40 mm.
- 6000 mm Sensing Range Sensors
  T ≥ 60 msec
  500 µsec ≤ Width ≤ 1 msec
  Minimum distance between sensors is 200 mm for working distances up to 1.5 m, and 50 mm for distances > 1.5 m.

ATTENTION

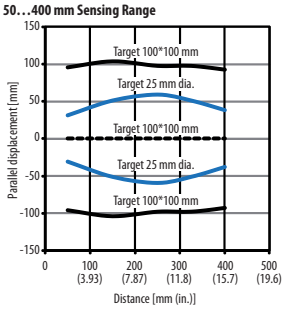
If a hazardous condition can result from unintended operation of this device, access to the sensing area should be guarded.

IMPORTANT

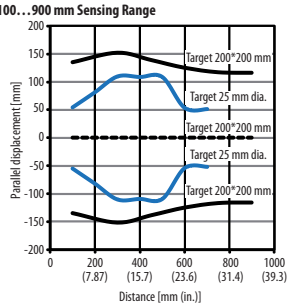
Solid-state devices can be susceptible to radio frequency (RF) interference depending on the power and the frequency of the transmitting source. If RF transmitting equipment is to be used in the vicinity of the solid-state devices, thorough testing should be performed to assure that transmitter operation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

Beam Diagrams

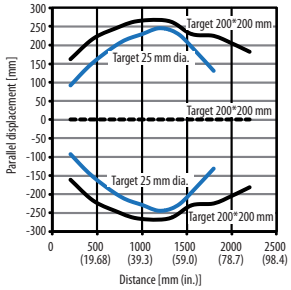
50…400 mm Sensing Range



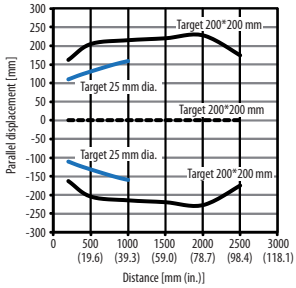
100…900 mm Sensing Range



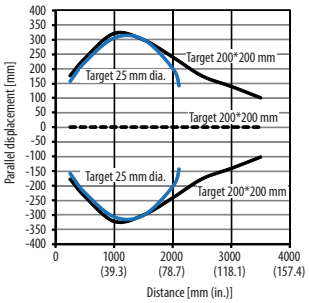
200…2200 mm Sensing Range



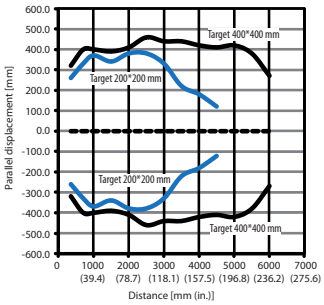
200…2500 mm Sensing Range



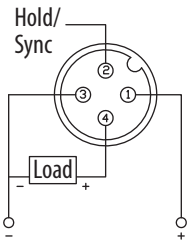
250…3500 mm



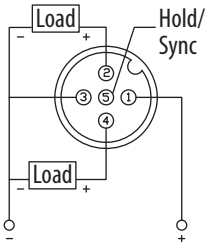
350…6000 mm



Wiring Diagrams



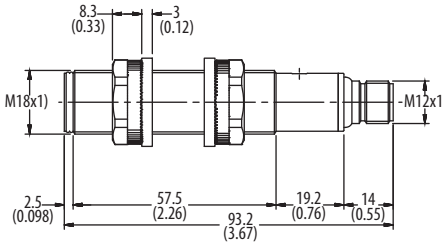
Single PNP Discrete Models



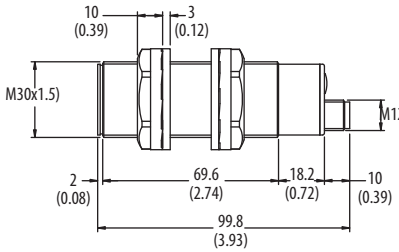
Dual PNP Discrete Models

Dimensions [mm (in.)]

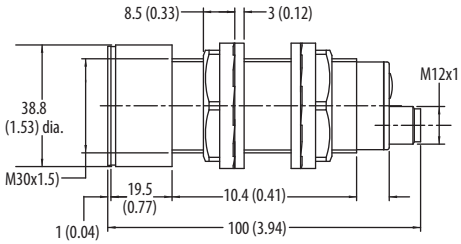
M18



M30



M30 (maximum diameter 38.8 mm (1.53 in.)



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