WORLD-BEAM QS18U Ultrasonic Sensors

Miniature Ultrasonic Sensors with TEACH-Mode Programming

Features

- Fast, easy-to-use TEACH-Mode programming; no potentiometer adjustments
- Ultra-compact housing
- One discrete output: NPN or PNP, depending on model
- Two bi-colored status LEDs
- Rugged encapsulated version for harsh environments
- Choose 2 meter or 9 meter unterminated cable, 4-pin Euro-style or 4-pin Pico-style QD connectors (either integral or with 150 mm pigtail)
- Wide operating range of -20° to +60° C (-13° to +140° F)
- Temperature compensation
- Configurable for normally open or normally closed operation
- Fast response time (15 milliseconds)

Models

Models	Sensing Range	TEACH Option	Cable*	Supply Voltage	Output
QS18UNA	50 mm to 500 mm (2 in to 20 in)	Integral push button or remote TEACH (IP67, NEMA 6P)	4-wire, 2 m (6.5 ft) cable with shield	12-30V dc	NPN
QS18UPA					PNP
QS18UNAE		Remote TEACH (epoxy-encapsulated, IP68, NEMA 6P)			NPN
QS18UPAE					PNP

Overview

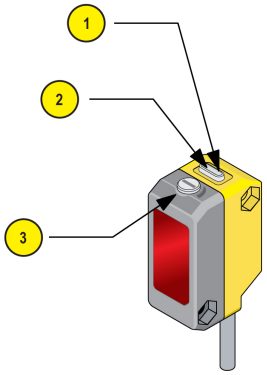

Figure 1. Sensor features

1	Green: Power Indicator
2	Yellow: Light Sensed Indicator
3	Cutoff Point Adjustment Screw

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Sensor Installation

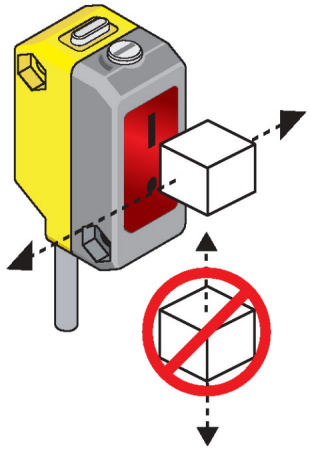

Figure 2. Required Orientation of Object to Sensor

Principles of Operation

Ultrasonic sensors emit one or multiple pulses of ultrasonic energy, which travel through the air at the speed of sound. A portion of this energy reflects off the target and travels back to the sensor. The sensor measures the total time required for the energy to reach the target and return to the sensor. The distance to the object is then calculated using the following formula:

$$D = \frac{ct}{2}$$

D = distance from the sensor to the target
c = speed of sound in air
t = transit time for the ultrasonic pulse

To improve accuracy, an ultrasonic sensor may average the results of several pulses before outputting a new value.

Temperature Effects

The speed of sound is dependent upon the composition, pressure and temperature of the gas in which it is traveling. For most ultrasonic applications, the composition and pressure of the gas are relatively fixed, while the temperature may fluctuate.

In air, the speed of sound varies with temperature according to the following approximation:

In metric units: $C_{m/s} = 20\sqrt{273 + T_C}$

$C_{m/s}$ = speed of sound in meters per second

T_C = temperature in °C

In English units: $C_{ft/s} = 49\sqrt{460 + T_F}$

$C_{ft/s}$ = speed of sound in feet per second

T_F = temperature in °F

Temperature Compensation

Changes in air temperature affect the speed of sound, which in turn affects the distance reading measured by the sensor. An increase in air temperature shifts both sensing window limits closer to the sensor. Conversely, a decrease in air temperature shifts both limits farther away from the sensor. This shift is approximately 3.5% of the limit distance for a 20° C change in temperature.

The QS18U series ultrasonic sensors are temperature compensated This reduces the error due to temperature by about 90%. The sensor will maintain its window limits to within 1.8% over the -20° to +60° C (−4° to +140° F) range.