

U-GAGE™ Q45U Ultrasonic Sensors

*Piezoelectric Proximity Mode Sensors with Push Button
Programming of Sensing Window Limits – Bipolar Discrete Outputs*



- Analog models also available
- Models with other ranges also available

Features

- Ultrasonic proximity detection from 100 to 1400 millimeters (4" to 55")
- Push button TEACH mode programming of sensing window limits
- Digital filtering for exceptional immunity to electrical and acoustic "noise"
- 12 to 24V dc operation
- Bipolar outputs: one NPN (sinking) and one PNP (sourcing)
- ON/OFF presence detection or HIGH/LOW level control are switch-selectable
- Wide operating temperature range of -25° to +70°C; models available with temperature compensation
- Rugged design for use in demanding sensing environments; rated IEC IP67, NEMA 6P
- Choose models with integral 2 m (6.5') or 9 m (30') cable, or with Mini-style or Euro-style quick-disconnect fitting
- External enable/disable feature for remote gating control



Q45U Series Proximity Mode Sensor Models

Models	Temperature Compensation*	Range	Cable**	Supply Voltage	Output Type	Response Time
Q45UBB63DA Q45UBB63DAQ Q45UBB63DAQ6	No	100 mm - 1.4 m (4" - 55")	2 m (6.5') 5-Pin Mini QD 5-Pin Euro QD	12-24V dc	Bipolar NPN/PNP	Programmable for 20, 40, 160, or 640 milliseconds
Q45UBB63DAC Q45UBB63DACQ Q45UBB63DACQ6	Yes		2 m (6.5') 5-Pin Mini QD 5-Pin Euro QD			

***Models with Temperature Compensation:**

An increase in air temperature shifts both sensing window limits closer to the sensor. Conversely, a decrease in air temperature shifts both limits further away from the sensor. The shift is approximately 3.5% of the limit distance for a 20°C change in temperature.

Temperature compensated models maintain the position of both sensing window limits to within 1% of each limit distance over the range of from 0° to +50°C, and to within 2.5% over the full operating range of from -25° to +70°C.

****NOTES:**

- 9 m (30') cables are available by adding suffix "W/30" to the model number of any cabled sensor (e.g., **Q45UBB63DA W/30**).
- A model with a QD connector requires an optional mating cable, see page 8.



WARNING . . . Not To Be Used for Personnel Protection

Never use these products as sensing devices for personnel protection. Doing so could lead to serious injury or death.

These sensors do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition. Consult your current Banner Safety Products catalog for safety products which meet OSHA, ANSI and IEC standards for personnel protection.

U-GAGE™ Q45U Ultrasonic Sensors with Bipolar Discrete Outputs

Near and Far Sensing Limit Settings:

The Q45U features a single push button for programming of sensing window near and far limits (Figure 1). See the programming procedure on page 4.

Status Indicators:

Status indicator LEDs are visible through the transparent, o-ring sealed Lexan® top cover. Indicator function in the **RUN** mode is, as follows:

- The green LED is on steadily whenever power is applied to the sensor, and flashes to indicate an overloaded output.
- The red LED lights when an echo is received, and flashes at a rate that is proportional to echo strength.
- The yellow LED lights whenever the outputs are conducting.

The 5-segment moving dot LED indicator displays the relative position of the target within the programmed sensing window. The #1 LED flashes when the target is closer than the near limit. The #5 LED flashes when the target is beyond the far limit.

Output Response Settings:

IMPORTANT: Remove power before making any internal adjustments.

Using the two slots shown in Figure 1, a small flat-blade screwdriver may be used to lift up and remove the black inner cover to expose the 4-position DIP switch (Figure 2). Those switches are used to program the following functions:

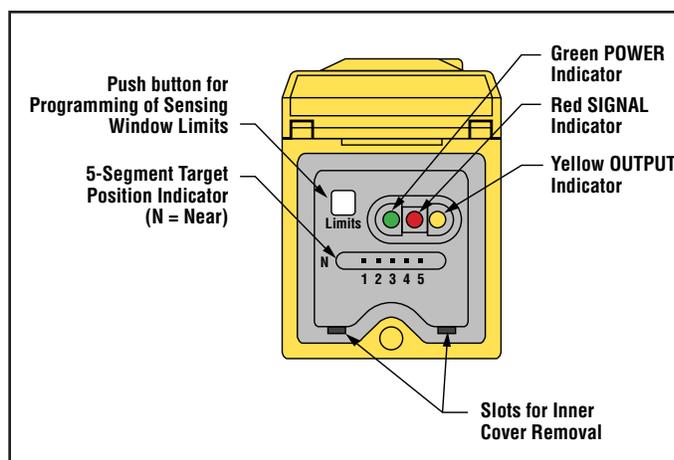


Figure 1. Q45U Features

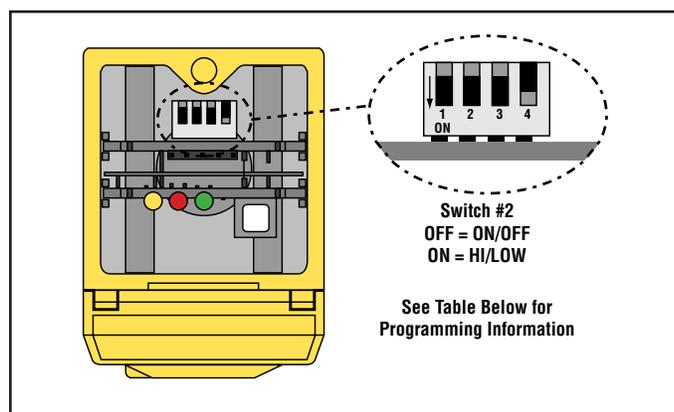


Figure 2. Q45U Programming Switches

Switch	Function		
1	ON/OFF Mode Output: On = normally closed (output energizes when target is absent) Off* = normally open (output energizes when target sensed)		HIGH/LOW Mode On = Pump Out Off = Pump In
2	Mode: On = HIGH/LOW (fill level control, see description, on page 3) Off* = ON/OFF (output follows sensing action)		
3 - 4	Response (20 ms/cycle)	Switch 3	Switch 4
	1 Cycle	Off	Off
	2 Cycles	On	Off
	8 Cycles*	Off	On
	32 Cycles	On	On

*Denotes factory settings.

NOTE: Response setting of 2 cycles, or higher, is recommended for optimum sonic and electrical noise immunity. Always use the slowest acceptable response speed for your application. Single cycle update is only recommended for short range (<50 cm) applications looking for a stationary target (i.e. reflector).

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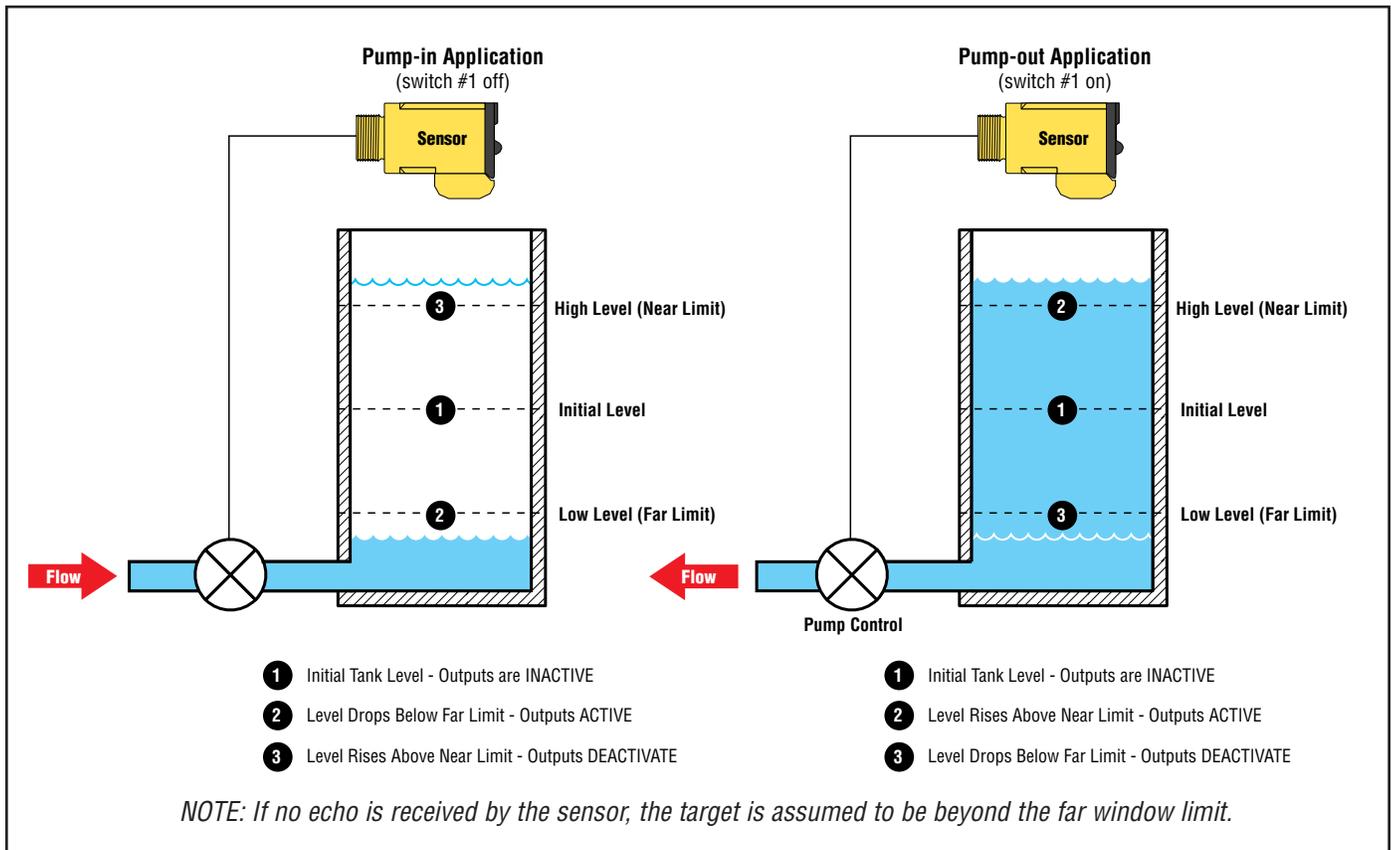


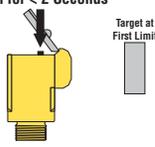
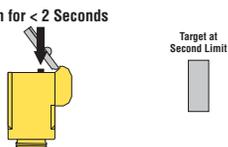
Figure 3. High/Low Level Control (switch #2 on)

The **HIGH/LOW** mode (switch #2 on) provides the switching logic required for fill-level, web tensioning control, and similar applications. In the HIGH/LOW mode, the output energizes when the target reaches the first sensing window limit, and stays energized until the target moves to the second limit. The output then de-energizes at the second limit and does not re-energize until the target moves, again, to the first limit. Figure 3 shows how pumping action might be controlled, directly, by the sensor in a fill-level application.

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Window Limit Programming

The “Limits” push button, located under the transparent top cover, is used to program the near and the far limits. The near limit may be set as close as 100 millimeters (4”) and the far limit may be set as far as 1400 mm (55”) from the transducer face. Minimum window width is 10 mm (0.4”). Whenever possible, use the actual target to be sensed when setting the window limits. The following procedure begins with the sensor in RUN mode.

Push Button	Indicator Status	
<p>Step 1</p> <p>Push and hold until green indicator turns off (approximately 2 seconds)</p>	<p>Push and Hold for ≥ 2 Seconds</p> 	<p>Green: Goes off Yellow: Is on steadily to indicate ready for teaching first limit Red: Flashes to indicate strength of echo or is off if no target is present</p>
<p>Step 2</p> <p>FIRST LIMIT (Near or Far) Place the target at the first limit and press the push button for less than 2 seconds</p>	<p>Push for < 2 Seconds</p> 	<p>Green: Remains off Yellow: Flashes at 2 Hz to indicate ready for teaching second limit Red: Comes on steadily for a moment, then resumes flashing to indicate strength of echo</p>
<p>Step 3</p> <p>SET SECOND LIMIT (Far or Near) Place the target at the second limit and press the push button for less than 2 seconds</p>	<p>Push for < 2 Seconds</p> 	<p>Green: Remains off, then comes on steadily (returns to RUN mode) Yellow: On steadily for a moment, then is either on or off to indicate output state (returns to RUN mode) Red: Comes on steadily for a moment, then resumes flashing to indicate strength of echo (returns to RUN mode)</p>

Notes regarding window limit programming:

- 1) Either the near or far limit may be programmed, first.
- 2) There is a 2-minute timeout for programming of the first limit. The sensor will return to RUN mode with the previously programmed limits. There is no timeout between programming of the first and second limit.
- 3) The programming sequence may be cancelled at any time by pressing and holding the push button for ≥ 2 seconds. The sensor returns to RUN mode with the previously programmed limits.
- 4) During limit programming, the 5-segment moving dot indicator displays the relative target position between 0 and 1500 millimeters (the maximum recommended far limit position is 1400 mm).
- 5) If the target is positioned between 1400 and 1500 mm, the 5th segment of the moving dot indicator flashes to indicate that a valid echo is received, but the target is beyond the recommended 1400 mm maximum far limit.
- 6) If a limit is rejected during either programming step, the sensor will revert to the first limit programming step (Step 2 in programming chart). This will be indicated by Green - off, Red - flashing to indicate signal strength, and Yellow - on steadily.
- 7) If both limits are accepted, the sensor will return to RUN mode, which is indicated by the Green LED coming on steadily.
- 8) If the target is held at the same position for programming of both limits, the sensor will establish a 10-mm wide sensing window, centered on the target position.

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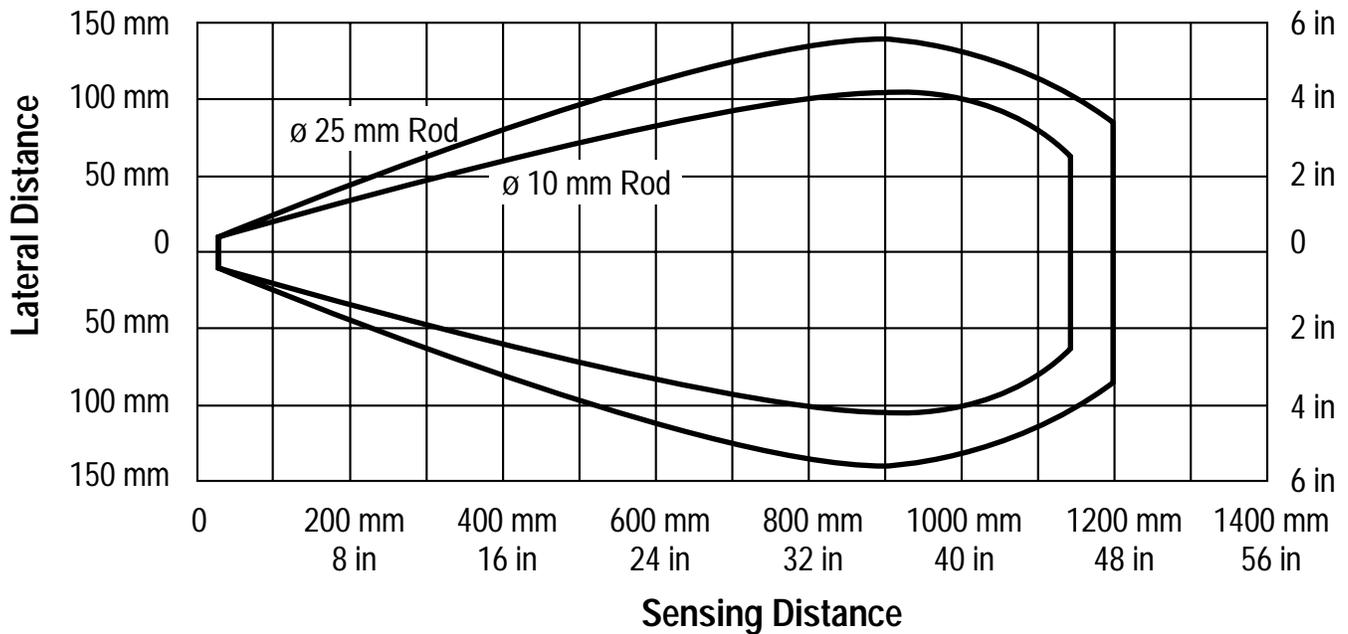
Q45U Series Sensor Specifications

Proximity Mode Range	Near limit: 100 mm (4.0") min Far limit: 1.4 m (55") max
Supply Voltage and Current	12 to 24V dc (10% maximum ripple) at 100 mA, exclusive of load
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Bipolar: one current sourcing (PNP) and one current sinking (NPN) open-collector transistor. The following may be selected by a 4-position DIP switch located on top of the sensor, beneath a transparent o-ring sealed acrylic cover (see page 2): Switch 1: Output normally open/normally closed (pump in/pump out) Switch 2: High/Low level control mode or on/off presence sensing mode Switch 3 & 4: Response speed selection (digital filter)
Output Rating	150 mA maximum (each) Off-state leakage current: < 25 microamp at 24V dc On-state saturation voltage: < 1.5V at 10 mA; < 2.0V at 150 mA
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short-circuit of outputs
Performance Specifications	Repeatability: ±0.1% of measured distance (±0.25 mm min) Minimum Window Width: 10 mm (0.4") Hysteresis: 5 mm (0.2")
Indicators	Three status LEDs: Green ON steady = power to sensor is ON Green flashing = output is overloaded Yellow ON steady = outputs are conducting (RUN mode) programming status (SETUP mode) Red flashing = indicates relative strength of received echo 5-segment moving dot LED indicates the position of the target within the sensing window
Construction	Molded PBT thermoplastic polyester housing, o-ring sealed transparent acrylic top cover, and stainless steel hardware. Q45U sensors are designed to withstand 1200 psi washdown. The base of cabled models has a 1/2"-14NPS internal conduit thread
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m (6.5') or 9 m (30') attached cable, or 5-pin Mini-style or 5-pin Euro-style quick-disconnect fitting
Operating Conditions	Temperature: -25° to +70°C (-13° to +158°F) Maximum relative humidity: 100%
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration: 10 to 60Hz max., double amplitude 0.06", maximum acceleration 10G). Method 213B conditions H & I (Shock: 75G with unit operating; 100G for non-operation) Also meets IEC 947-5-2 requirements: 30G, 11 ms duration, half sine wave.
Hysteresis	ON/OFF mode: 5 mm HIGH/LOW mode: 0 mm
Application Notes	Minimum target size: 10 mm x 10 mm aluminum plate at 500 mm (20") 35 mm x 35 mm aluminum plate at 1.4 m (55") Enable/Disable: Connect yellow wire to +5 to 24V dc to enable sensor and 0 to +2V dc to disable sensor. When the sensor is disabled, the last output state is held until the sensor is re-enabled. The wire must be held to the appropriate voltage for at least 40 ms for the sensor to enable or disable.

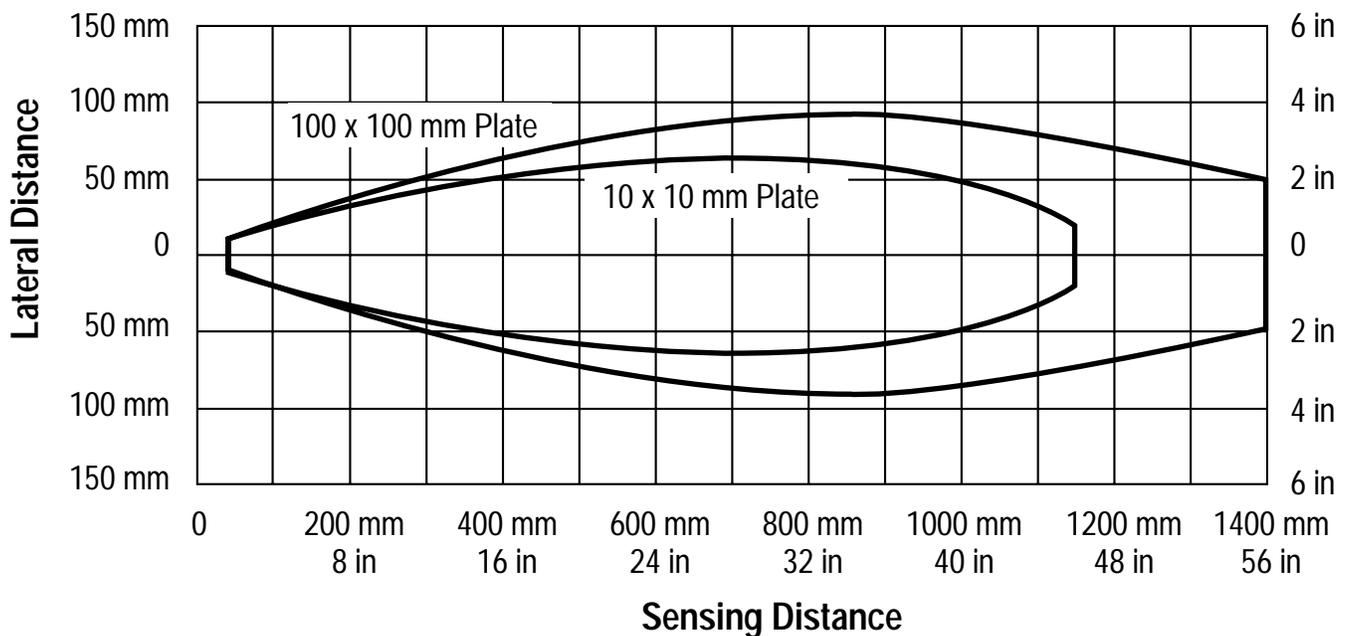
U-GAGE™ Q45U Ultrasonic Sensors with Bipolar Discrete Outputs

Q45U Response Curves

Q45U Effective Beam with Rod Target (Typical)



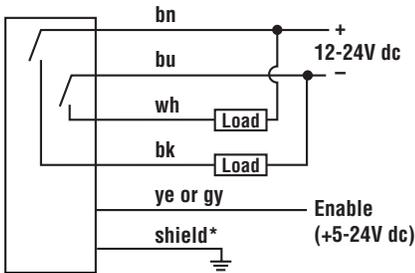
Q45U Effective Beam with Plate Target (Typical)



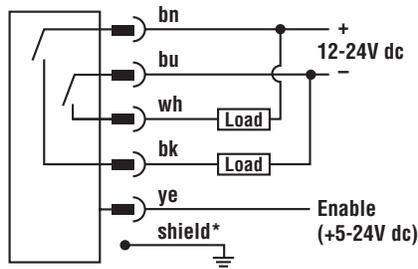
U-GAGE™ Q45U Ultrasonic Sensors with Bipolar Discrete Outputs

Q45U Series Hookup Diagrams

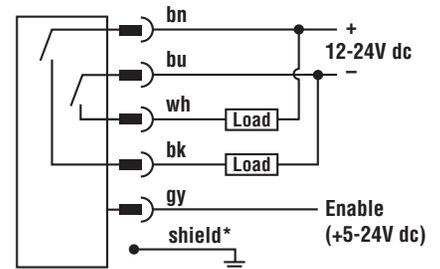
Q45U Sensor with Attached Cable



Q45U Sensor with 5-Pin Mini-Style QD ("Q" model Suffix)

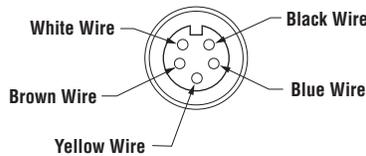


Q45U Sensor with 5-Pin Euro-Style QD ("Q6" model Suffix)

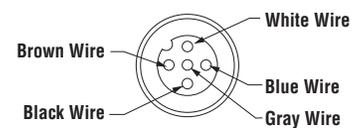


*It is recommended that the shield wire be connected to earth ground or dc common.

5-Pin Mini-Style Pin-out (Cable Connector Shown)

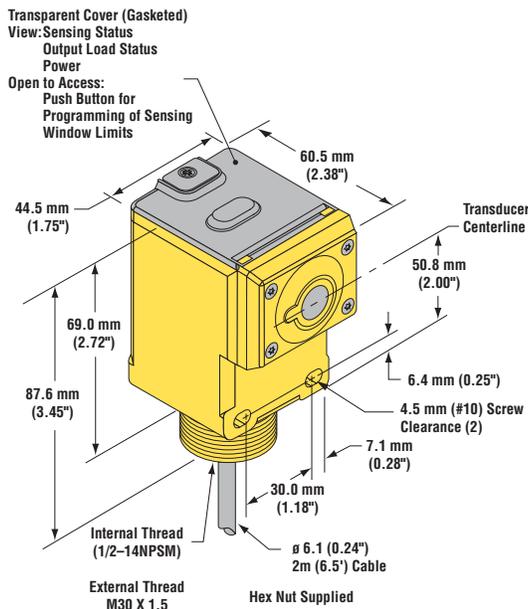


5-Pin Euro-Style Pin-out (Cable Connector Shown)

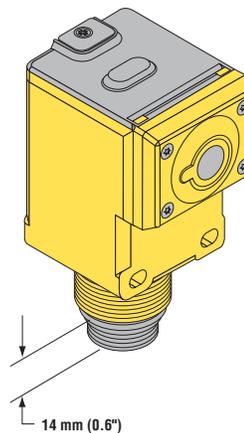


Q45U Series Dimensions

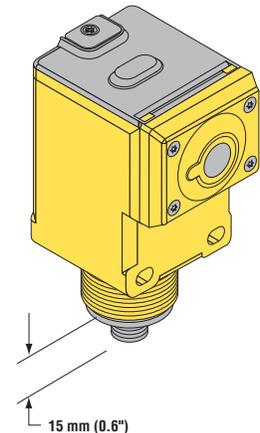
Q45U Sensor with Attached Cable



Q45U Sensor with 5-Pin Mini-Style QD ("Q" model Suffix)



Q45U Sensor with 5-Pin Euro-Style QD ("Q6" model Suffix)



U-GAGE™ Q45U Ultrasonic Sensors with Bipolar Discrete Outputs

Mounting Brackets	
SMB30C	<ul style="list-style-type: none"> • 30 mm split clamp, black PBT bracket • Stainless steel mounting hardware included
SMB30S	<ul style="list-style-type: none"> • 30 mm swivel, black PBT bracket • Stainless steel mounting hardware included
SMB30MM	<ul style="list-style-type: none"> • 30 mm, 11-gauge, stainless steel bracket with curved mounting slots for versatility and orientation • Clearance for M6 (1/4") hardware

Quick-Disconnect (QD) Cables			
Style	Model	Length	Connector
5-Pin Mini-style with shield	MBCC2-506	2 m (6.5')	
	MBCC2-512	4 m (12')	
	MBCC2-530	9 m (30')	
5-Pin Euro-style Straight with shield	MQDEC2-506	2 m (6.5')	
	MQDEC2-515	5 m (15')	
	MQDEC2-530	9 m (30')	
5-Pin Euro-style Right-angle with shield	MQDEC2-506RA	2 m (6.5')	
	MQDEC2-515RA	5 m (15')	
	MQDEC2-530RA	9 m (30')	

WARRANTY: Banner Engineering Corp. warrants its products to be free from defects for one year. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture found to be defective at the time it is returned to the factory during the warranty period. This warranty does not cover damage or liability for the improper application of Banner products. This warranty is in lieu of any other warranty either expressed or implied.

