

Datasheet

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



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

- Ultrasonic proximity detection from 250 mm to 3.0 m (9.8 in to 118 in)
- Push-button TEACH-mode programming of sensing window limits
- Digital filtering for exceptional immunity to electrical and acoustic noise
- 12 to 24 V 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 °C to +70 °C (-13 °F to +158 °F); all models include temperature compensation
- Rugged design for use in demanding sensing environments; rated IEC IP67, NEMA 6P
- Choose models with an integral unterminated 2 m (6.5 ft) or 9 m (30 ft) cable, or with a Mini-style or M12/Euro-style quick-disconnect connection
- External enable/disable feature for remote gating control

Models	Connection ¹	Output Type	Response Time
Q45UBB63BC	2 m (6.5 ft) unterminated cable	Bipolar NPN/PNP	Programmable for 40, 80, 320, or 1280 milliseconds
Q45UBB63BCQ	5-Pin Mini quick disconnect		
Q45UBB63BCQ6	5-Pin M12/Euro-style quick disconnect		



WARNING: Not To Be Used for Personnel Protection

Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

Temperature Compensation

All models listed above feature 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 0 °C to +50 °C (+32 °F to +122 °F) range, and to within 2.5% over the full operating range of -25 °C to +70 °C (-13 °F to +158 °F).

Overview

Near and Far Sensing Limit Settings. The Q45U features a single push button for programming the sensing window near and far limits.

Status Indicators. Status indicator LEDs are visible through the transparent, o-ring sealed polycarbonate top cover. Indicator function in the Run mode is as follows:

¹ To order 9 m (30 ft) cable models, add the suffix "W/30" to the model number of any cabled sensor (for example, Q45UBB63BC W/30). Models with a quick-disconnect connector require an optional mating cable.



- The green LED is on when power is applied to the sensor and flashes to indicate an overloaded output.
- The red LED flashes when an echo is received; the flash rate is proportional to echo strength.
- The amber LED is on when the outputs are conducting.

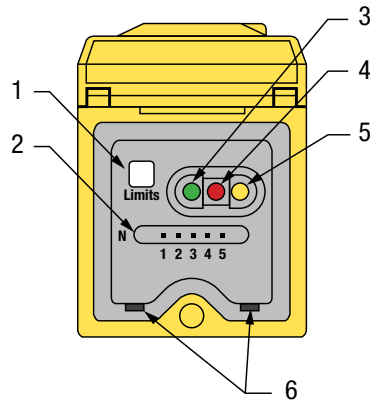


Figure 1. Q45U Long-Range Features

1. Button for programming the sensing window limits
2. 5-Segment target position indicator (N = Near)
3. Green power indicator
4. Red signal indicator
5. Amber output indicator
6. Slots for removing the inner cover

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.

Setting the DIP Switches

Output Response Settings.



Important: Disconnect the power before making any internal adjustments.

1. Insert a small flat-blade screwdriver into the slots.
2. Lift up and remove the black inner cover to expose the 4-position DIP switch.
3. Use the DIP switches to program the following functions:

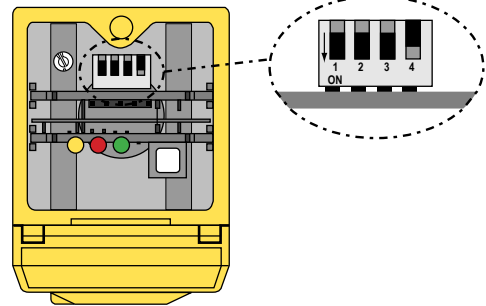


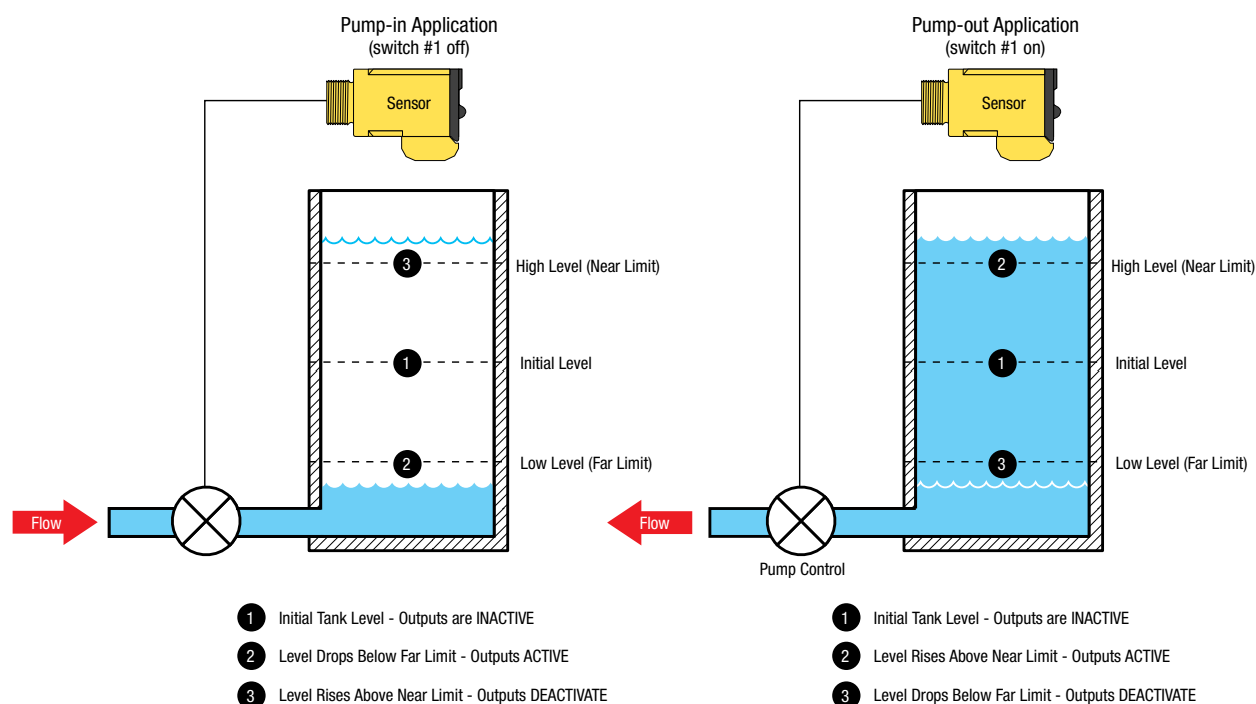
Figure 2. Q45U Programming Switches

DIP Switches	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) Off * = ON/OFF (output follows sensing action)		
3 and 4	Response (40 ms/cycle)	Switch 3	Switch 4
	1 cycle	OFF	OFF
	2 cycles	ON	OFF
	8 cycles *	OFF *	ON *
	32 cycles	ON	ON

* Factory default setting.



Important: A 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 (>1.0 m) applications looking for a stationary background target.



Note: If no echo is received by the sensor, the target is assumed to be beyond the far window limit.

Figure 3. High/Low Control (DIP Switch 2 in ON)

The **HIGH/LOW** mode (DIP switch 2 is 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. This example shows how pumping action might be controlled, directly, by the sensor in a fill-level application.

Programming the Window Limit

Use the **Limits** button, located under the transparent top cover, to program the near and the far limits.

The near limit may be set as close as 250 mm (9.8 in) and the far limit may be set as far as 3.0 m (118 in) from the transducer face. The minimum window width is 25 mm (1.0 in). When possible, use the actual target to be sensed when setting the window limits. Programming the window limit begins with the sensor in Run mode.

1. Push and hold the **Limits** button until the green LED turns off (approximately 2 seconds).

Green LED	Amber LED	Red LED
Off	On to indicate the sensor is ready to program the first limit	Flashes to indicate the strength of the echo; Off if no target is present

2. Set the first limit (near or far) by placing the target at the first limit and pressing the **Limits** button for less than 2 seconds.

Green LED	Amber LED	Red LED
Off	Flashes at 2 Hz to indicate the sensor is ready to program the second limit	On for a moment, then resumes flashing to indicate the strength of the echo

3. Set the second limit (far or near) by placing the target at the second limit and pressing the **Limits** button for less than 2 seconds.

Green LED	Amber LED	Red LED
Off, then turns on when the sensor returns to Run mode	On for a moment, then is either on or off to indicate the output state when the sensor returns to Run mode	On for a moment, then resumes flashing to indicate the strength of the echo when the sensor returns to Run mode

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 returns to Run mode with the previously programmed limits. There is no timeout between the programming of the first and second limit.
3. Cancel the programming sequence at any time by pressing and holding the **Limits** 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 m and 4.0 m (0 ft and 13.1 ft). The maximum recommended far limit position is 3.0 m (9.84 ft).
5. If the target is positioned between 3.0 and 4.0 m (9.84 ft to 13.1 ft), the 5th segment of the moving dot indicator flashes to indicate that a valid echo is received, but the target is beyond the recommended 3.0 m (9.84 ft) maximum far limit.
6. If a limit is rejected during either programming step, the sensor reverts to the first limit programming step. This is indicated by the green LED (OFF), red LED (flashing to indicate signal strength), and the amber LED (ON).
7. If both limits are accepted, the sensor returns to Run mode, which is indicated by the green LED (ON).
8. If the target is held at the same position for programming of both limits, the sensor establishes a 50 mm wide sensing window, centered on the target position.

Specifications

Supply Voltage and Current

12 to 24 V dc (10% maximum ripple) at 100 mA, exclusive of load

Proximity Mode Range

Near limit: 250 mm (9.8 in) minimum

Far limit: 3.0 m (118 in)

Note: The far limit may be extended as far as 3.9 m (12.79 ft) for good acoustical targets (hard surfaces with an area $> 100 \text{ cm}^2$)

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

Use the 4-position DIP switch to select the following:

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 24 V dc

On-state saturation voltage: $< 1.5 \text{ V}$ at 10 mA; $< 2.0 \text{ V}$ at 150 mA

Output Protection Circuitry

Protected against false pulse on power-up and continuous overload or short-circuit of outputs

Hysteresis

ON/OFF mode: 10 mm

HIGH/LOW mode: 0 mm

Certifications



Performance Specifications

Repeatability: $\pm 0.1\%$ of measured distance ($\pm 0.50 \text{ mm min}$)

Minimum Window Width: 25 mm (1.0 in)

Hysteresis: 10 mm (0.4 in)

Indicators

Three status LEDs:

Green ON = power to sensor is ON

Green flashing = output is overloaded

Amber ON = outputs are conducting (in Run mode); or programming status (in 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"-14 NPS internal conduit thread

Connections

2 m (6.5 ft) or 9 m (30 ft) attached cable, or 5-pin Mini-style or 5-pin M12/Euro-style quick disconnect fitting

Environmental Rating

Leakproof design is rated IEC IP67; NEMA 6P

Operating Conditions

Temperature: -25°C to $+70^\circ\text{C}$ (-13°F to $+158^\circ\text{F}$)

Maximum relative humidity: 100%

Vibration and Mechanical Shock

All models meet Mil Std. 202F requirements. Method 201A (vibration: 10 Hz to 60 Hz max., double amplitude 0.06 inch, maximum acceleration 10G).

Also meets IEC 947-5-2 requirements: 30G 11 ms duration, half sine wave.

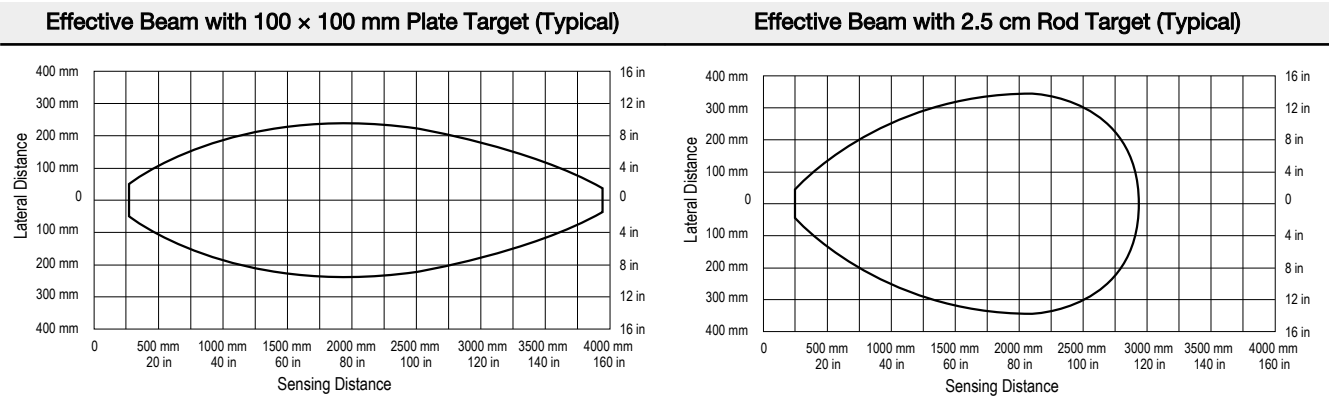
Method 213B conditions H & I (Shock: 75G with unit operating; 100G for non-operation).

Application Notes

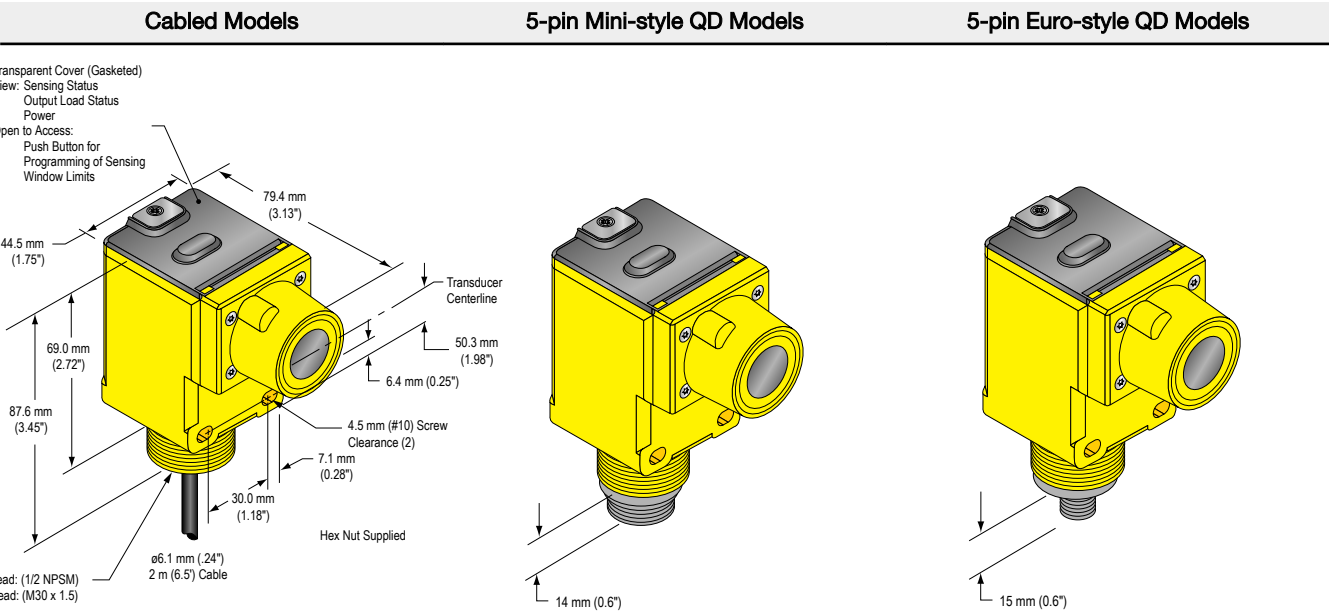
Minimum target size: 50 mm \times 50 mm aluminum plate at 3.0 m (118 in)

Enable/Disable: Connect the yellow wire to +5 to 24 V dc to enable the sensor and 0 to +2 V dc to disable the sensor. When the sensor is disabled, the last output state is held until the sensor is re-enabled. Hold the wire to the appropriate voltage for at least 40 ms to enable or disable the sensor.

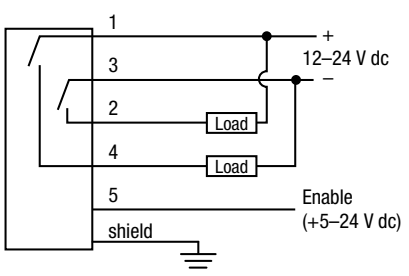
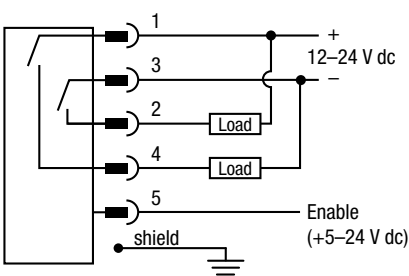
Performance Curves



Dimensions

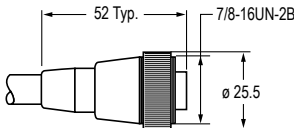
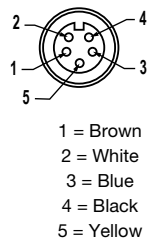


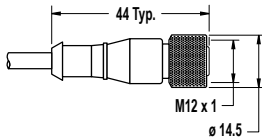
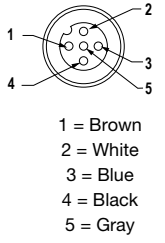
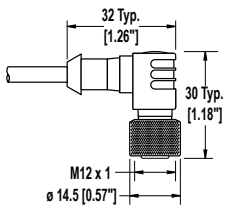
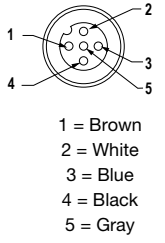
Wiring Diagrams

Q45U Sensor with Attached Cable	Q45U Sensor with 5-pin Mini-style or Euro-style QD	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray (Euro-style) or yellow (Mini-style)</p> <p>Banner Engineering Corp. recommends that the shield wire be connected to earth ground or dc common.</p>

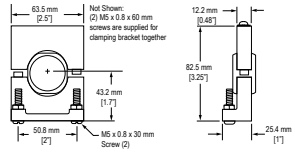
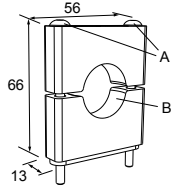
Accessories

Cordsets

5-Pin Mini-Style Cordsets—with Shield				
Model	Length	Style	Dimensions	Pinout (Female)
MBCC2-506	1.83 m (6 ft)	Straight		 <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow</p>
MBCC2-512	3.66 m (12 ft)			
MBCC2-530	9.14 m (30 ft)			

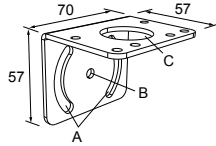
5-Pin Threaded M12/Euro-Style Cordsets—with Shield				
Model	Length	Style	Dimensions	Pinout (Female)
MQDEC2-506	1.83 m (6 ft)	Straight		 <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
MQDEC2-515	4.57 m (15 ft)			
MQDEC2-530	9.14 m (30 ft)			
MQDEC2-550	15.2 m (50 ft)			
MQDEC2-506RA	1.83 m (6 ft)	Right-Angle		 <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
MQDEC2-515RA	4.57 m (15 ft)			
MQDEC2-530RA	9.14 m (30 ft)			
MQDEC2-550RA	15.2 m (50 ft)			

Brackets

SMB30S <ul style="list-style-type: none"> Swivel bracket with 30 mm mounting hole for sensor Adjustable captive swivel ball Black reinforced thermoplastic polyester Stainless steel mounting and swivel locking hardware included  <p>Not Shown: (2) M5 x 0.8 x 60 mm screws are supplied for clamping bracket together</p>	SMB30C <ul style="list-style-type: none"> 30 mm split clamp, black PBT bracket Stainless steel mounting hardware included Mounting hole for 30 mm sensor  <p>Hole center spacing: A=ø 45 Hole size: B=ø 27.2</p>
--	---

SMB30MM

- 12-ga. stainless steel bracket with curved mounting slots for versatile orientation
- Clearance for M6 (1/4 in) hardware
- Mounting hole for 30 mm sensor



Hole center spacing: A = 51, A to B = 25.4

Hole size: A = 42.6 x 7, B = ϕ 6.4, C = ϕ 30.1

Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

THIS LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED (INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), AND WHETHER ARISING UNDER COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.

This Warranty is exclusive and limited to repair or, at the discretion of Banner Engineering Corp., replacement. **IN NO EVENT SHALL BANNER ENGINEERING CORP. BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR ANY EXTRA COSTS, EXPENSES, LOSSES, LOSS OF PROFITS, OR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT OR FROM THE USE OR INABILITY TO USE THE PRODUCT, WHETHER ARISING IN CONTRACT OR WARRANTY, STATUTE, TORT, STRICT LIABILITY, NEGLIGENCE, OR OTHERWISE.**

Banner Engineering Corp. reserves the right to change, modify or improve the design of the product without assuming any obligations or liabilities relating to any product previously manufactured by Banner Engineering Corp. Any misuse, abuse, or improper application or installation of this product or use of the product for personal protection applications when the product is identified as not intended for such purposes will void the product warranty. Any modifications to this product without prior express approval by Banner Engineering Corp will void the product warranties. All specifications published in this document are subject to change; Banner reserves the right to modify product specifications or update documentation at any time. Specifications and product information in English supersede that which is provided in any other language. For the most recent version of any documentation, refer to:

www.bannerengineering.com.

Q45U Ultrasonic Sensors with Analog Outputs (Long Range)



Datasheet

Piezoelectric proximity mode sensors with push-button programming of sensing window limits



- Ultrasonic proximity detection from 250 mm to 3.0 m (9.8 in to 118 in)
- Push-button TEACH-mode programming of sensing window limits
- Digital filtering for exceptional immunity to electrical and acoustic noise
- 15 to 24 V dc operation
- Selectable 0 to 10 V dc voltage sourcing or 4 to 20 mA current sourcing analog outputs
- Selectable output slope: positive or negative with increasing target distance
- Wide operating temperature range of -25°C to $+70^{\circ}\text{C}$ (-13°F to $+158^{\circ}\text{F}$); all models include temperature compensation
- Rugged design for use in demanding sensing environments; rated IEC IP67, NEMA 6P
- Choose models with an integral unterminated 2 m (6.5 ft) or 9 m (30 ft) cable, or with a Mini-style or M12/Euro-style quick-disconnect connection
- Input for remote TEACH-mode programming of window limits

Models	Cable ¹	Output Type	Response Time
Q45ULIU64BCR	2 m (6.5 ft)	Selectable 0 to 10 V dc or 4 to 20 mA sourcing	Adjustable from 80 milliseconds to 2.56 seconds
Q45ULIU64BCRQ	5-pin Mini-style QD		
Q45ULIU64BCRQ6	5-pin M12/Euro-style QD		



WARNING: Not To Be Used for Personnel Protection

Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

Temperature Compensation

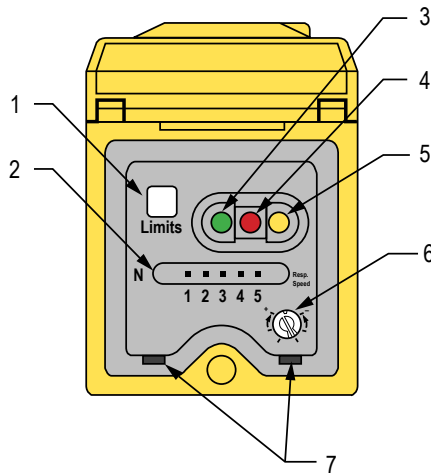
All models listed above feature temperature compensation. An increase in air temperature shifts both sensing window limits closer to the sensor. Conversely, a decrease in air temperature shifts both limits further away from the sensor. The shift is approximately 3.5% of the limit distance for a 20°C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

Temperature compensated models maintain the position of both sensing window limits to within 1% of each limit distance over the 0°C to $+50^{\circ}\text{C}$ ($+32^{\circ}\text{F}$ to $+122^{\circ}\text{F}$) range, and to within 2.5% over the full operating range of -25°C to $+70^{\circ}\text{C}$ (-13°F to $+158^{\circ}\text{F}$).

¹ To order the 9 m (30 ft) cable models, add the suffix "W/30" to the cabled model number. For example, Q45ULIU64BCR W/30. Models with a quick disconnect (QD) connector require a mating cable.



Overview



- 1 - Push button for programming sensing window limits
- 2 - 5-segment target position indicator (N = near)
- 3 - Green POWER indicator LED
- 4 - Red SIGNAL indicator LED
- 5 - Amber OUTPUT indicator LED
- 6 - Response adjustment
- 7 - Slots for removing inner cover

Figure 1. Q45U with Analog Outputs Features

Status Indicators

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

- The green LED is on when power is applied to the sensor and flashes to indicate a current output fault.
- The red LED is on when an echo is received and flashes at a rate proportional to echo strength.
- The amber LED is on when the target is within the operating window limits.

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

Configuring a Sensor

Output Response Settings



Important: Remove power before making any internal adjustments.

Insert a small, flat-blade screwdriver into the two slots shown in [Figure 1](#). Lift up and remove the black inner cover to expose the 4-position DIP switch. Use these DIP switches to program the output slope, output mode, loss of echo, and min./max. output value default.

DIP Switch	Function	Settings	
1	Output slope	On = Output value increases with distance Off* = Output value decreases with distance	
2	Output mode	On = Current output enabled Off* = Voltage output enabled	
3	Loss of echo	On = Min - Max Mode Off* = Hold Mode	
4	Min-Max Default	On* = Default to maximum output value Off = Default to minimum output value	

Figure 2. DIP Switches for Q45U Sensors

* Factory default settings.

DIP Switch 1: Output Slope

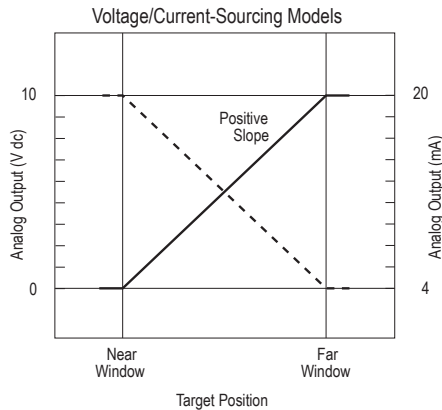


Figure 3. Output as a function of target position

On = Direct = Output value (voltage or current) increases with increasing distance of the target from the sensor

Off = Inverse = Output value decreases with increasing distance of the target from the sensor (default setting)

DIP Switch 2: Output Mode

Configure the D/A driver to use either the current output or the voltage output driver. This output function can only be set with the power to the sensor turned off.

On = The 4 to 20 mA current output (white wire) is enabled

Off = The 0 to 10V dc voltage output (black wire) is enabled (default setting)

DIP Switch 3: Loss of Echo Mode

Select the output response to the loss of echo. Hold Mode maintains the output at the value present at the time of echo loss. Min-Max Mode drives the output to either the minimum value (0 V or 4 mA) or the maximum value (10 V or 20 mA) when the echo is lost.

On = Min-Max Mode

Off = Hold Mode (default setting)

DIP Switch 4: Min-Max Default

Select the output response to loss of echo when Min-Max Mode is selected by DIP switch 3.

On = Default to maximum output value at loss of echo (default setting)

Off = Default to minimum output value at loss of echo

Response Speed Adjustments

Set the output response speed by aligning the slot of the single-turn potentiometer with one of the marked positions. There are six values for response speed, which relate directly to the number of sensing cycles over which the output value is averaged.

Position	Response Speed	Potentiometer Positions
1	80 milliseconds (2 cycles)	
2	160 milliseconds (4 cycles)	
3	320 milliseconds (8 cycles)	
4	640 milliseconds (16 cycles)	
5	1.28 seconds (32 cycles)	
6	2.56 seconds (64 cycles)	

Figure 4. Response adjustment positions

This example shows the potentiometer set at position number 4. There are no numbers on the actual product label.

Programming the Window Limits

Use the **Limits** button, located under the transparent top cover, to program the near and the far limits.

The near limit may be set as close as 250 mm (9.8 inches) and the far limit may be set as far as 3.0 m (118 inches) from the transducer face. Minimum window width is 25 mm (1 inch). When possible, use the actual target to be sensed when setting the window limits.

The following procedure begins with the sensor in Run mode.

1. Access Programming Mode. Push and hold the **Limits** button until the green indicator LED turns off (approximately 2 seconds).

LED Indicator	Status
Green	Turns off
Amber	On to indicate the sensor is ready to learn the first limit
Red	Flashes to indicate the strength of the echo, or it is off if no target is present

2. Set the first limit (or single set point). Place the target at the first limit and press the **Limits** button for less than 2 seconds.

LED Indicator	Status
Green	Remains off
Amber	Flashes at 2 Hz to indicate the sensor is ready to learn the second limit
Red	On for a moment, then resumes flashing to indicate the strength of echo

3. Set the second limit. Place the target at the second limit and press the **Limits** button for less than 2 seconds.

LED Indicator	Status
Green	Remains off, then turns on (returns to Run mode)
Amber	On for a moment, then is either on or off to indicate the output state (returns to Run mode)
Red	On for a moment, then resumes flashing to indicate the strength of the echo (returns to Run mode)

Notes Regarding Window Limit Programming

1. Either the near or far limit may be programmed first.
2. There is a 2-minute time-out for programming the first limit. The sensor returns to Run mode with the previously programmed limits. There is no time-out between programming of the first and second limit.
3. Cancel the programming sequence at any time by pressing and holding the button for longer than 2 seconds. The sensor returns to Run mode with the previously programmed limits.
4. If a limit is rejected during either programming step, the sensor reverts to the first limit programming step, indicated by the Green LED (off), the Red LED (flashing to indicate signal strength), and the Amber LED (on).
5. If both limits are accepted, the sensor returns to Run mode, which is indicated by the Green LED (on).
6. During limit programming, the 5-segment moving dot indicator displays the relative target position between 250 mm (9.8 inches) and 4.0 m (the maximum recommended far limit position is 3.0 m (118 inches)).
7. If the target is farther than 3.0 m (118 inches), the 5th segment of the moving dot indicator flashes to indicate that a valid echo is received, but the target is beyond the recommended 3.0 m (118 inches) maximum far limit.
8. If the target is held at the same position for programming of both limits, the sensor establishes a 50 mm-wide sensing window, centered on the target position.

Remote Programming the Window Limits

Connect the yellow wire of the sensor to a switch or process controller for remote programming of the sensing window limits. The programming procedure is the same as for the button. A remote programming input is generated when +5 to 24 V dc is applied to the yellow wire. The timing diagrams define the required input pulses.

H = +5 to 24 V dc

L = Less than 2 V dc (or open circuit)

Notes regarding remote window limit programming:

1. The button is disabled during remote limit programming. (The remote programming input is disabled during push button programming.)
2. Also see the notes regarding window limit programming.

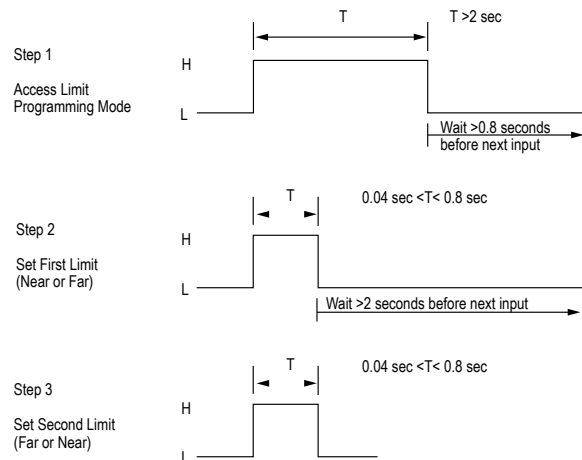


Figure 5. Remote programming the window limits

Specifications

Proximity Mode Range

Near limit: 250 mm (9.8 inches) min
 Far limit: 3.0 m (118 inches) max
 The far limit may be extended as far as 3.9 m for good acoustical targets (hard surfaces with area > 100 cm²)

Supply Voltage and Current

15 to 24V dc (10% maximum ripple) at 100 mA, exclusive of load

Supply Protection Circuitry

Protected against reverse polarity and transient voltages

Indicators

Three status LEDs:
 Green solid = power to sensor is ON
 Green flashing = current output fault detected (indicates that the 4-20 mA current path to ground has been opened)
 Amber solid = target is sensed within the window limits (Amber LED also indicates programming status during 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

Connections

2 m (6.5 ft) or 9 m (30 ft) attached cable, or 5-pin Mini-style or 5-pin Euro-style quick-disconnect fitting

Certifications



Output Configuration

One voltage sourcing and one current sourcing; one or the other output is enabled by internal programming switch #2. Output function may be programmed by a 4-position DIP switch located on top of the sensor, beneath the transparent o-ring sealed acrylic cover.

Output Rating

Voltage sourcing: 0 to 10V dc, 10 mA maximum
 Current sourcing: 4 to 20 mA, 1 to 500 ohm impedance

Output Protection Circuitry

Both outputs are protected against continuous overload and short circuit

Performance Specifications

Sensing Repeatability: $\pm 0.1\%$ of the measured distance (± 0.50 mm minimum)
 Sensing Resolution: 0.50 mm (0.02 in)
 Analog Output Resolutions: 2 mV, 3 μ A

Environmental Rating

Leakproof design is rated IEC IP67; NEMA 6P

Operating Temperature

Temperature: -25 to +70 °C (-13 to +158 °F)
 Maximum relative humidity: 100%

Vibration and Mechanical Shock

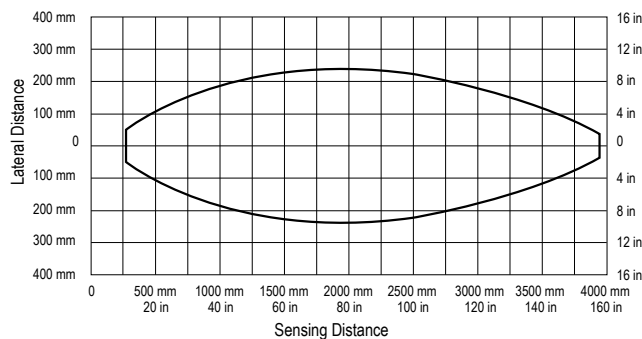
All models meet Mil. Std. 202F requirements. Method 201A (Vibration: 10 to 60Hz max., double amplitude 0.06-inch, maximum acceleration 10G). Method 213B conditions H & I (Shock: 75G with unit operating; 100G for nonoperation). Also meets IEC 947-5-2 requirements: 30G, 11 ms duration, half sine wave

Application Notes

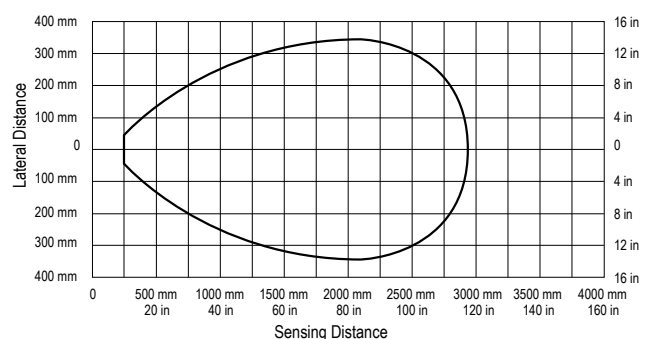
Minimum target size: 50 mm x 50 mm aluminum plate at 3.0 m (118")

Performance Curves

Effective Beam with 100 × 100 mm Plate Target (Typical)



Effective Beam with 2.5 cm Rod Target (Typical)

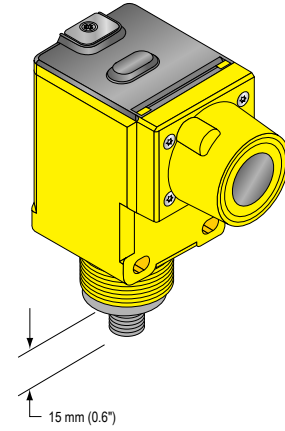
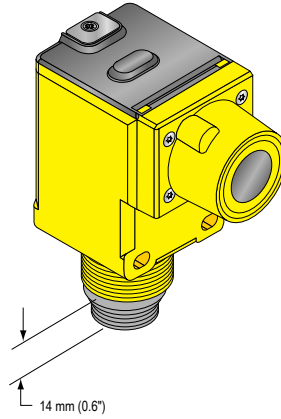
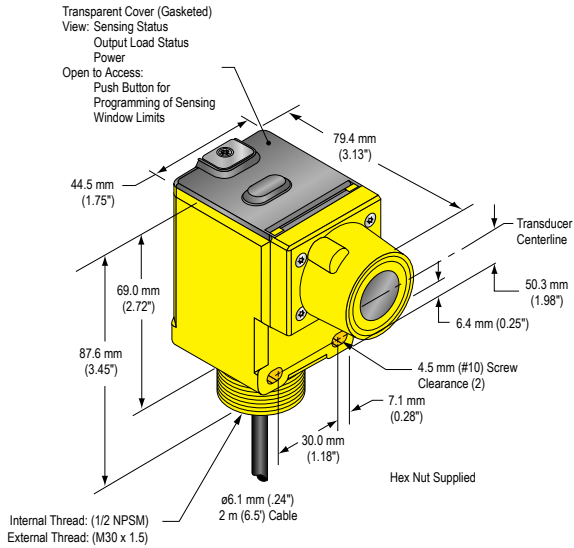


Dimensions

Cabled Models

5-pin Mini-style QD Models

5-pin Euro-style QD Models

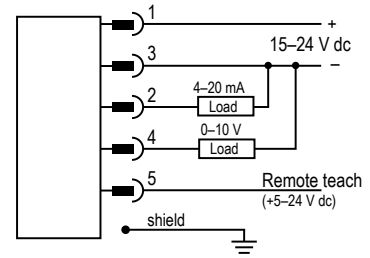
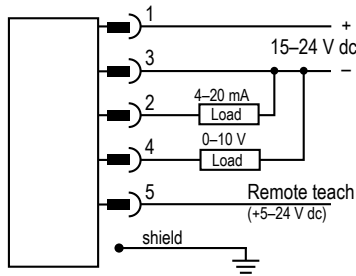
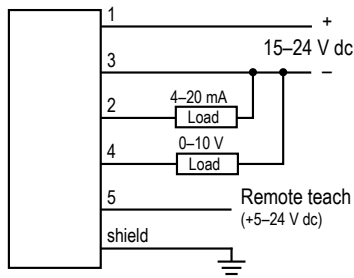


Wiring Diagrams for Q45U Sensors with Analog Outputs

Sensor with Attached Cable

Sensor with 5-pin Mini-style Quick Disconnect

Sensor with 5-pin M12/Euro-style Quick Disconnect



Banner Engineering Corp recommends the shield wire be connected to earth ground or dc common.

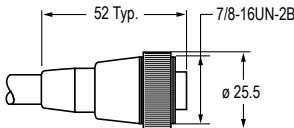
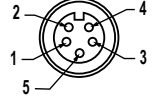
- 1 = brown
- 2 = white
- 3 = blue
- 4 = black
- 5 = gray or yellow

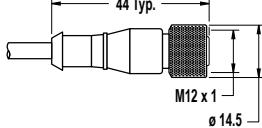
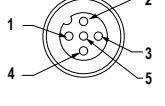
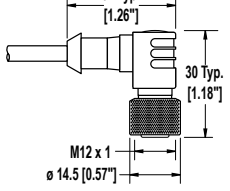
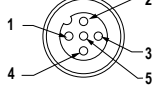
- 1 = brown
- 2 = white
- 3 = blue
- 4 = black
- 5 = yellow

- 1 = brown
- 2 = white
- 3 = blue
- 4 = black
- 5 = gray

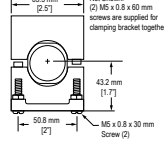
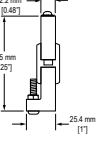
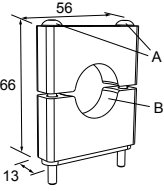
Accessories

Cordsets

5-Pin Mini-Style Cordsets—with Shield				
Model	Length	Style	Dimensions	Pinout (Female)
MBCC2-506	1.83 m (6 ft)	Straight		 <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow</p>
MBCC2-512	3.66 m (12 ft)			
MBCC2-530	9.14 m (30 ft)			

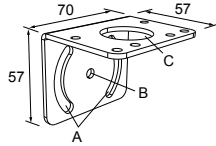
5-Pin Threaded M12/Euro-Style Cordsets—with Shield				
Model	Length	Style	Dimensions	Pinout (Female)
MQDEC2-506	1.83 m (6 ft)	Straight		 <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
MQDEC2-515	4.57 m (15 ft)			
MQDEC2-530	9.14 m (30 ft)			
MQDEC2-550	15.2 m (50 ft)			
MQDEC2-506RA	1.83 m (6 ft)	Right-Angle		 <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
MQDEC2-515RA	4.57 m (15 ft)			
MQDEC2-530RA	9.14 m (30 ft)			
MQDEC2-550RA	15.2 m (50 ft)			

Brackets

SMB30S <ul style="list-style-type: none"> Swivel bracket with 30 mm mounting hole for sensor Adjustable captive swivel ball Black reinforced thermoplastic polyester Stainless steel mounting and swivel locking hardware included  <p>Not Shown: (2) M5 x 0.8 x 60 mm screws are supplied for clamping bracket together</p> 	SMB30C <ul style="list-style-type: none"> 30 mm split clamp, black PBT bracket Stainless steel mounting hardware included Mounting hole for 30 mm sensor  <p>Hole center spacing: A=ø 45 Hole size: B=ø 27.2</p>
---	---

SMB30MM

- 12-ga. stainless steel bracket with curved mounting slots for versatile orientation
- Clearance for M6 (1/4 in) hardware
- Mounting hole for 30 mm sensor



Hole center spacing: A = 51, A to B = 25.4

Hole size: A = 42.6 x 7, B = \varnothing 6.4, C = \varnothing 30.1

Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

THIS LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED (INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), AND WHETHER ARISING UNDER COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.

This Warranty is exclusive and limited to repair or, at the discretion of Banner Engineering Corp., replacement. **IN NO EVENT SHALL BANNER ENGINEERING CORP. BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR ANY EXTRA COSTS, EXPENSES, LOSSES, LOSS OF PROFITS, OR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT OR FROM THE USE OR INABILITY TO USE THE PRODUCT, WHETHER ARISING IN CONTRACT OR WARRANTY, STATUTE, TORT, STRICT LIABILITY, NEGLIGENCE, OR OTHERWISE.**

Banner Engineering Corp. reserves the right to change, modify or improve the design of the product without assuming any obligations or liabilities relating to any product previously manufactured by Banner Engineering Corp. Any misuse, abuse, or improper application or installation of this product or use of the product for personal protection applications when the product is identified as not intended for such purposes will void the product warranty. Any modifications to this product without prior express approval by Banner Engineering Corp will void the product warranties. All specifications published in this document are subject to change; Banner reserves the right to modify product specifications or update documentation at any time. Specifications and product information in English supersede that which is provided in any other language. For the most recent version of any documentation, refer to:

www.bannerengineering.com.

Q45U Ultrasonic Sensors with Analog Outputs (Short Range)



Datasheet

Piezoelectric analog proximity mode sensors with push-button or remote programming of sensing window limits



- Ultrasonic proximity detection from 100 mm to 1400 mm (4 in to 55 in)
- Push-button TEACH-mode programming of sensing window limits
- Digital filtering for exceptional immunity to electrical and acoustic noise
- 15 to 24 V dc operation
- Selectable 0 to 10 V dc voltage sourcing or 4 to 20 mA current sourcing analog outputs
- Selectable output slope: positive or negative with increasing target distance
- Wide operating temperature range of -25°C to $+70^{\circ}\text{C}$ (-13°F to $+158^{\circ}\text{F}$); all models include temperature compensation
- Rugged design for use in demanding sensing environments; rated IEC IP67, NEMA 6P
- Choose models with an integral unterminated 2 m (6.5 ft) or 9 m (30 ft) cable, or with a Mini-style or M12/Euro-style quick-disconnect connection
- Input for remote TEACH-mode programming of window limits

Models	Cable ¹	Output Type	Response Time
Q45ULIU64ACR	2 m (6.5 ft)	Selectable 0 to 10 V dc or 4 to 20 mA sourcing	Adjustable from 40 milliseconds to 1.28 seconds
Q45ULIU64ACRQ	5-pin Mini-style quick disconnect		
Q45ULIU64ACRQ6	5-pin M12/Euro-style quick disconnect		



WARNING: Not To Be Used for Personnel Protection

Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

Temperature Compensation

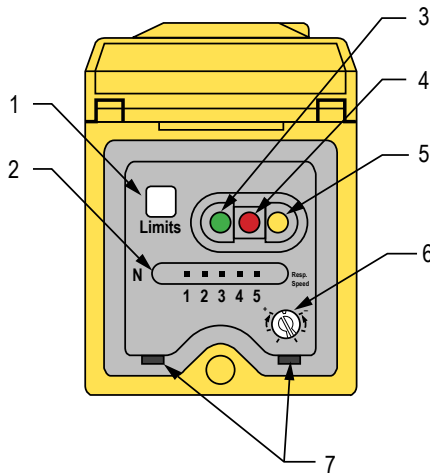
All models listed above feature temperature compensation. An increase in air temperature shifts both sensing window limits closer to the sensor. Conversely, a decrease in air temperature shifts both limits further away from the sensor. The shift is approximately 3.5% of the limit distance for a 20°C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

Temperature compensated models maintain the position of both sensing window limits to within 1% of each limit distance over the 0°C to $+50^{\circ}\text{C}$ ($+32^{\circ}\text{F}$ to $+122^{\circ}\text{F}$) range, and to within 2.5% over the full operating range of -25°C to $+70^{\circ}\text{C}$ (-13°F to $+158^{\circ}\text{F}$).

¹ To order the 9 m (30 ft) cable models, add the suffix "W/30" to the cabled model number. For example, Q45ULIU64ACR W/30. Models with a quick disconnect (QD) connector require a mating cable.



Overview



- 1 - Push button for programming sensing window limits
- 2 - 5-segment target position indicator (N = near)
- 3 - Green POWER indicator LED
- 4 - Red SIGNAL indicator LED
- 5 - Amber OUTPUT indicator LED
- 6 - Response adjustment
- 7 - Slots for removing inner cover

Figure 1. Q45U with Analog Outputs Features

Status Indicators

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

- The green LED is on when power is applied to the sensor and flashes to indicate a current output fault.
- The red LED is on when an echo is received and flashes at a rate proportional to echo strength.
- The amber LED is on when the target is within the operating window limits.

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

Configuring a Sensor

Output Response Settings



Important: Remove power before making any internal adjustments.

Insert a small, flat-blade screwdriver into the two slots shown in [Figure 1](#). Lift up and remove the black inner cover to expose the 4-position DIP switch. Use these DIP switches to program the output slope, output mode, loss of echo, and min./max. output value default.

DIP Switch	Function	Settings	
1	Output slope	On = Output value increases with distance Off* = Output value decreases with distance	
2	Output mode	On = Current output enabled Off* = Voltage output enabled	
3	Loss of echo	On = Min - Max Mode Off* = Hold Mode	
4	Min-Max Default	On* = Default to maximum output value Off = Default to minimum output value	

Figure 2. DIP Switches for Q45U Sensors

* Factory default settings.

DIP Switch 1: Output Slope

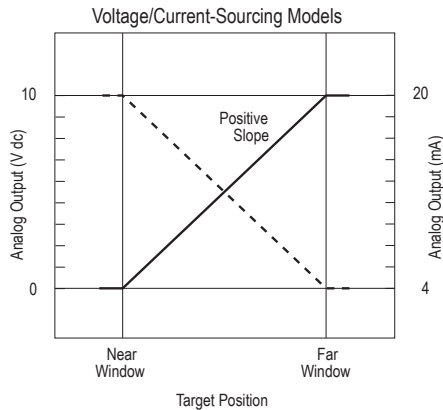


Figure 3. Output as a function of target position

On = Direct = Output value (voltage or current) increases with increasing distance of the target from the sensor

Off = Inverse = Output value decreases with increasing distance of the target from the sensor (default setting)

DIP Switch 2: Output Mode

Configure the D/A driver to use either the current output or the voltage output driver. This output function can only be set with the power to the sensor turned off.

On = The 4 to 20 mA current output (white wire) is enabled

Off = The 0 to 10V dc voltage output (black wire) is enabled (default setting)

DIP Switch 3: Loss of Echo Mode

Select the output response to the loss of echo. Hold Mode maintains the output at the value present at the time of echo loss. Min-Max Mode drives the output to either the minimum value (0 V or 4 mA) or the maximum value (10 V or 20 mA) when the echo is lost.

On = Min-Max Mode

Off = Hold Mode (default setting)

DIP Switch 4: Min-Max Default

Select the output response to loss of echo when Min-Max Mode is selected by DIP switch 3.

On = Default to maximum output value at loss of echo (default setting)

Off = Default to minimum output value at loss of echo

Response Speed Adjustments

Set the output response speed by aligning the slot of the single-turn potentiometer with one of the marked positions. There are six values for response speed, which relate directly to the number of sensing cycles over which the output value is averaged.

Position	Response Speed	Potentiometer Positions
1	80 milliseconds (2 cycles)	
2	160 milliseconds (4 cycles)	
3	320 milliseconds (8 cycles)	
4	640 milliseconds (16 cycles)	
5	1.28 seconds (32 cycles)	
6	2.56 seconds (64 cycles)	

Figure 4. Response adjustment positions

This example shows the potentiometer set at position number 4. There are no numbers on the actual product label.

Programming the Window Limits

Use the **Limits** button, located under the transparent top cover, to program the near and the far limits.

The near limit may be set as close as 100 mm (4 inches) and the far limit may be set as far as 1400 mm (55 inches) from the transducer face. Minimum window width is 10 mm (0.4 inches). When possible, use the actual target to be sensed when setting the window limits.

The following procedure begins with the sensor in Run mode.

1. Access Programming Mode. Push and hold the **Limits** button until the green indicator LED turns off (approximately 2 seconds).

LED Indicator	Status
Green	Turns off
Amber	On to indicate the sensor is ready to learn the first limit
Red	Flashes to indicate the strength of the echo, or it is off if no target is present

2. Set the first limit (or single set point). Place the target at the first limit and press the **Limits** button for less than 2 seconds.

LED Indicator	Status
Green	Remains off
Amber	Flashes at 2 Hz to indicate the sensor is ready to learn the second limit
Red	On for a moment, then resumes flashing to indicate the strength of echo

3. Set the second limit. Place the target at the second limit and press the **Limits** button for less than 2 seconds.

LED Indicator	Status
Green	Remains off, then turns on (returns to Run mode)
Amber	On for a moment, then is either on or off to indicate the output state (returns to Run mode)
Red	On for a moment, then resumes flashing to indicate the strength of the echo (returns to Run mode)

Notes Regarding Window Limit Programming

1. Either the near or far limit may be programmed first.
2. There is a 2-minute time-out for programming the first limit. The sensor returns to Run mode with the previously programmed limits. There is no time-out between programming of the first and second limit.
3. Cancel the programming sequence at any time by pressing and holding the button for longer than 2 seconds. The sensor returns to Run mode with the previously programmed limits.
4. If a limit is rejected during either programming step, the sensor reverts to the first limit programming step, indicated by the Green LED (off), the Red LED (flashing to indicate signal strength), and the Amber LED (on).
5. If both limits are accepted, the sensor returns to Run mode, which is indicated by the Green LED (on).
6. During limit programming, the 5-segment moving dot indicator displays the relative target position between 100 mm (4 inches) and 1500 mm (the maximum recommended far limit position is 1400 mm (55 inches)).
7. If the target is farther than 1400 mm (55 inches), 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 (55 inches) maximum far limit.
8. If the target is held at the same position for programming of both limits, the sensor establishes a 10 mm-wide sensing window, centered on the target position.

Remote Programming the Window Limits

Connect the yellow wire of the sensor to a switch or process controller for remote programming of the sensing window limits. The programming procedure is the same as for the button. A remote programming input is generated when +5 to 24 V dc is applied to the yellow wire. The timing diagrams define the required input pulses.

H = +5 to 24 V dc

L = Less than 2 V dc (or open circuit)

Notes regarding remote window limit programming:

1. The button is disabled during remote limit programming. (The remote programming input is disabled during push button programming.)
2. Also see the notes regarding window limit programming.

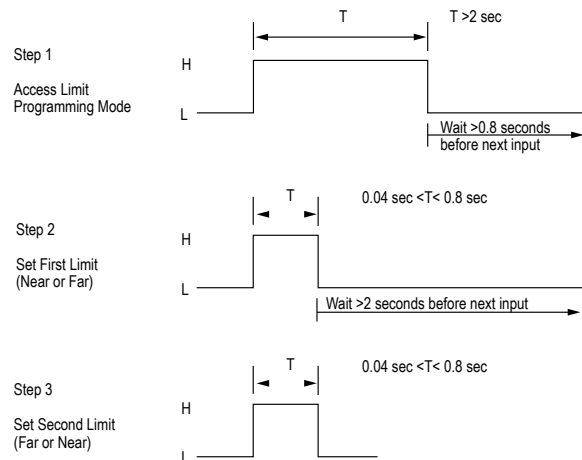


Figure 5. Remote programming the window limits

Specifications

Proximity Mode Range

Near limit: 100 mm (4.0 inches) min
Far limit: 1.4 m (55 inches) max

Supply Voltage and Current

15 to 24 V dc (10% maximum ripple) at 100 mA, exclusive of load

Supply Protection Circuitry

Protected against reverse polarity and transient voltages

Performance Specifications

Sensing Repeatability: $\pm 0.1\%$ of the measured distance (± 0.25 mm minimum)
Sensing Resolution: 0.25 mm (0.01 in)
Analog Output Resolutions: 2 mV, 3 μ A

Indicators

Three status LEDs:
Green solid = power to sensor is ON
Green flashing = current output fault detected (indicates that the 4-20 mA current path to ground has been opened)
Amber solid = target is sensed within the window limits (Amber LED also indicates programming status during 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

Connections

2 m (6.5 ft) or 9 m (30 ft) attached cable, or 5-pin Mini-style or 5-pin Euro-style quick-disconnect fitting

Output Configuration

One voltage sourcing and one current sourcing; one or the other output is enabled by internal programming switch #2. Output function may be programmed by a 4-position DIP switch located on top of the sensor, beneath the transparent o-ring sealed acrylic cover.

Output Rating

Voltage sourcing: 0 to 10 V dc, 10 mA maximum
Current sourcing: 4 to 20 mA, 1 to 500 ohm impedance

Output Protection Circuitry

Both outputs are protected against continuous overload and short circuit

Environmental Rating

Leakproof design is rated IEC IP67; NEMA 6P

Operating Temperature

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-inch, maximum acceleration 10G). Method 213B conditions H & I (Shock: 75G with unit operating; 100G for nonoperation). Also meets IEC 947-5-2 requirements: 30G, 11 ms duration, half sine wave

Application Notes

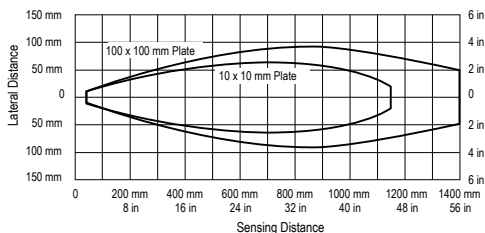
Minimum target size: 10 mm x 10 mm aluminum plate at 500 mm (20 in)
35 mm x 35 mm aluminum plate at 1.4 m (55 in)

Certifications

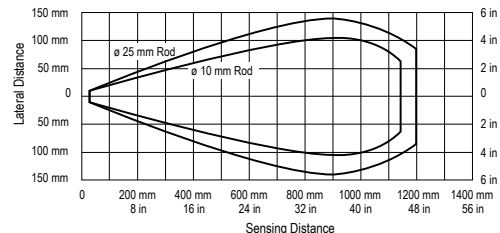


Performance Curves

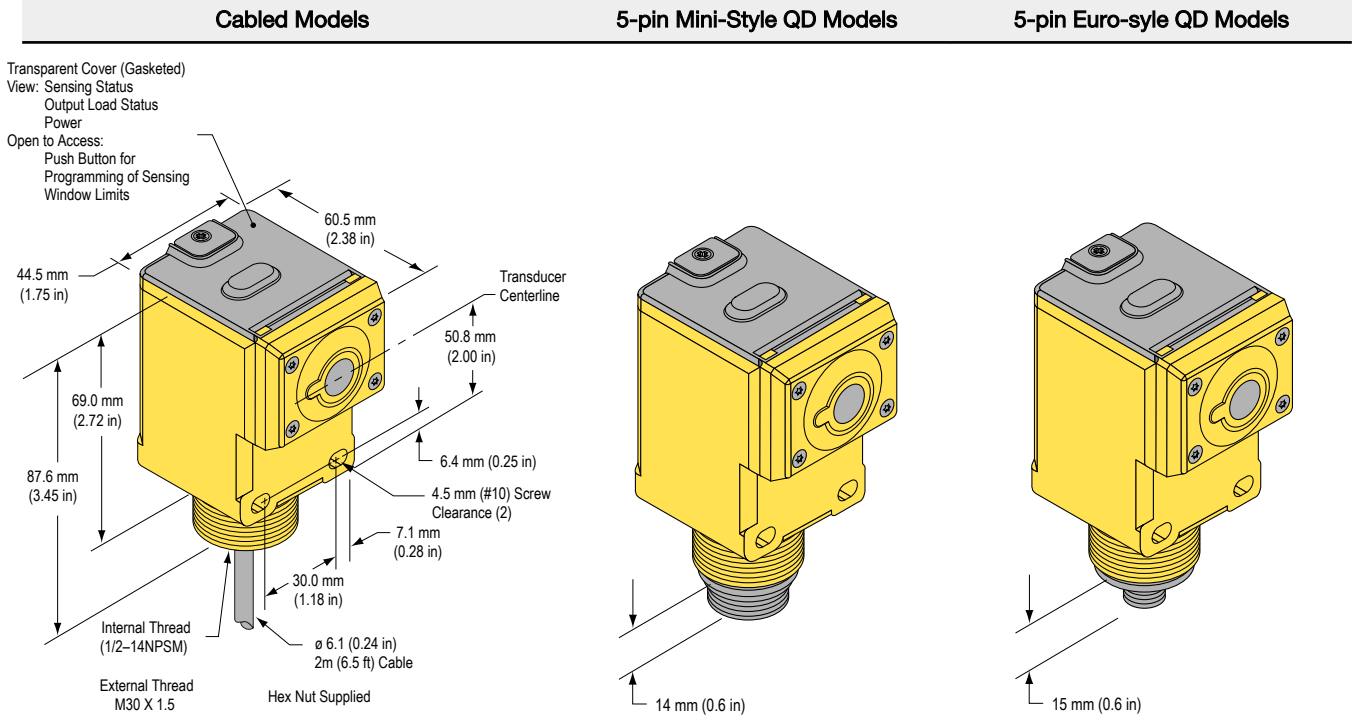
Effective Beam with Plate Target (Typical)



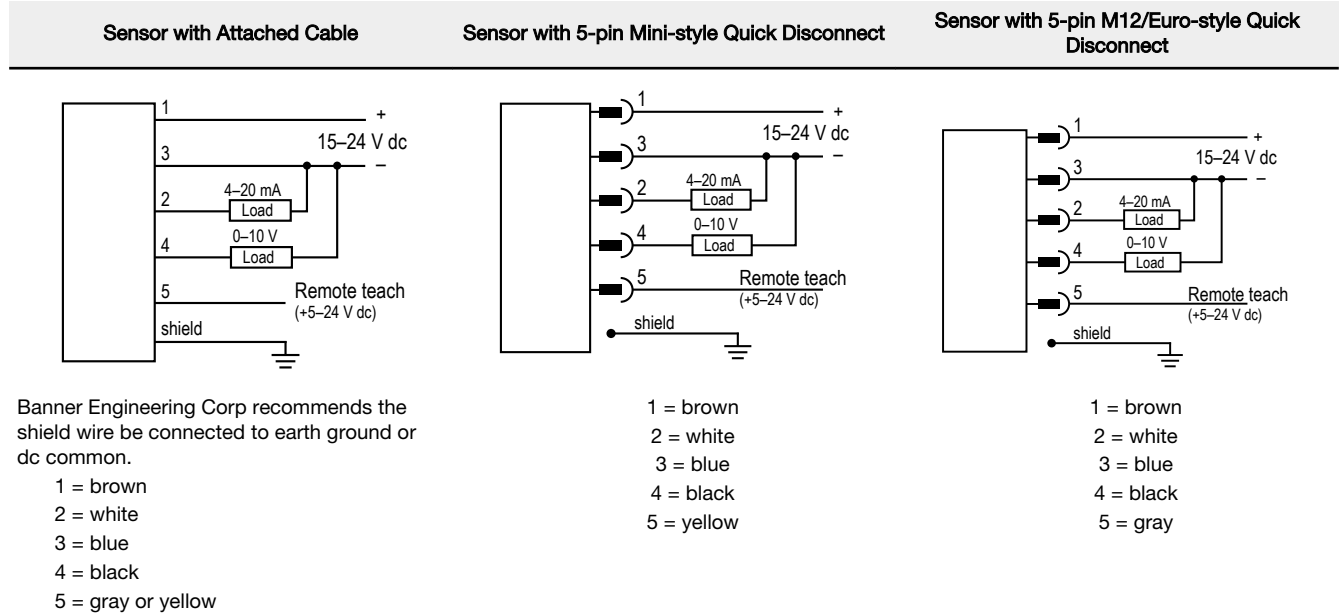
Effective Beam with Rod Target (Typical)



Dimensions

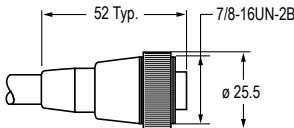
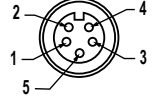


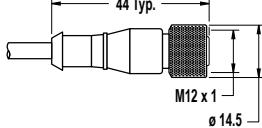
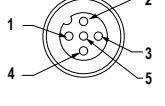
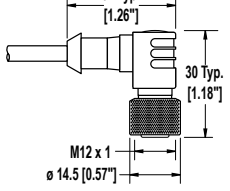
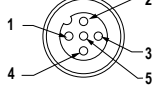
Wiring Diagrams for Q45U Sensors with Analog Outputs



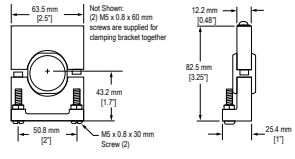
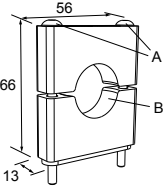
Accessories

Cordsets

5-Pin Mini-Style Cordsets—with Shield				
Model	Length	Style	Dimensions	Pinout (Female)
MBCC2-506	1.83 m (6 ft)	Straight		 <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow</p>
MBCC2-512	3.66 m (12 ft)			
MBCC2-530	9.14 m (30 ft)			

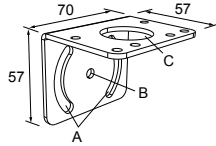
5-Pin Threaded M12/Euro-Style Cordsets—with Shield				
Model	Length	Style	Dimensions	Pinout (Female)
MQDEC2-506	1.83 m (6 ft)	Straight		 <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
MQDEC2-515	4.57 m (15 ft)			
MQDEC2-530	9.14 m (30 ft)			
MQDEC2-550	15.2 m (50 ft)			
MQDEC2-506RA	1.83 m (6 ft)	Right-Angle		 <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
MQDEC2-515RA	4.57 m (15 ft)			
MQDEC2-530RA	9.14 m (30 ft)			
MQDEC2-550RA	15.2 m (50 ft)			

Brackets

SMB30S <ul style="list-style-type: none"> Swivel bracket with 30 mm mounting hole for sensor Adjustable captive swivel ball Black reinforced thermoplastic polyester Stainless steel mounting and swivel locking hardware included  <p>Not Shown: (2) M5 x 0.8 x 60 mm screws are supplied for clamping bracket together</p>	SMB30C <ul style="list-style-type: none"> 30 mm split clamp, black PBT bracket Stainless steel mounting hardware included Mounting hole for 30 mm sensor  <p>Hole center spacing: A=ø 45 Hole size: B=ø 27.2</p>
--	---

SMB30MM

- 12-ga. stainless steel bracket with curved mounting slots for versatile orientation
- Clearance for M6 (1/4 in) hardware
- Mounting hole for 30 mm sensor



Hole center spacing: A = 51, A to B = 25.4

Hole size: A = 42.6 x 7, B = \varnothing 6.4, C = \varnothing 30.1

Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

THIS LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED (INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), AND WHETHER ARISING UNDER COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.

This Warranty is exclusive and limited to repair or, at the discretion of Banner Engineering Corp., replacement. **IN NO EVENT SHALL BANNER ENGINEERING CORP. BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR ANY EXTRA COSTS, EXPENSES, LOSSES, LOSS OF PROFITS, OR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT OR FROM THE USE OR INABILITY TO USE THE PRODUCT, WHETHER ARISING IN CONTRACT OR WARRANTY, STATUTE, TORT, STRICT LIABILITY, NEGLIGENCE, OR OTHERWISE.**

Banner Engineering Corp. reserves the right to change, modify or improve the design of the product without assuming any obligations or liabilities relating to any product previously manufactured by Banner Engineering Corp. Any misuse, abuse, or improper application or installation of this product or use of the product for personal protection applications when the product is identified as not intended for such purposes will void the product warranty. Any modifications to this product without prior express approval by Banner Engineering Corp will void the product warranties. All specifications published in this document are subject to change; Banner reserves the right to modify product specifications or update documentation at any time. Specifications and product information in English supersede that which is provided in any other language. For the most recent version of any documentation, refer to:

www.bannerengineering.com.

U-GAGE® Q45UBB Ultrasonic Sensor



Datasheet

Piezoelectric proximity mode sensor with push button programming of sensing window limits; bipolar discrete outputs



- Ultrasonic proximity detection from 100 mm to 1400 mm (4 in to 55 in)
- Push-button TEACH-mode programming of sensing window limits
- Digital filtering for exceptional immunity to electrical and acoustic noise
- 12 to 24 V 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°C to $+70^{\circ}\text{C}$ (-13°F to $+158^{\circ}\text{F}$); some models are available with temperature compensation
- Rugged design for use in demanding sensing environments; rated IEC IP67, NEMA 6P
- Choose models with an integral unterminated 2 m (6.5 ft) or 9 m (30 ft) cable, or with a Mini-style or M12/Euro-style quick-disconnect connection
- External enable/disable feature for remote gating control

Analog models and models with other ranges are also available



WARNING: Not To Be Used for Personnel Protection

Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

Models

Model	Temperature Compensation	Connection	Response Time
Q45UBB63DA	No	2 m (6.5 ft)	Programmable for 20, 40, 160, or 640 milliseconds
Q45UBB63DAQ		Integral 5-pin Mini quick disconnect	
Q45UBB63DAQ6		Integral 5-pin M12/Euro-style male quick disconnect (QD)	
Q45UBB63DAC	Yes	2 m (6.5 ft)	
Q45UBB63DACQ		Integral 5-pin Mini quick disconnect	
Q45UBB63DACQ6		Integral 5-pin M12/Euro-style male quick disconnect (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 $+50^{\circ}\text{C}$, and to within 2.5% over the full operating range of from -25° to $+70^{\circ}\text{C}$.

To order the 9 m (30 ft) cable models, add the suffix “W/30” to the model number of any cabled sensor (e.g., Q45UBB63DA W/30).

Models with a QD connector require an optional mating cable.

Overview

Near and Far Sensing Limit Settings. The Q45U features a single push button for programming the sensing window near and far limits.

Status Indicators. Status indicator LEDs are visible through the transparent, o-ring sealed polycarbonate top cover. Indicator function in the Run mode is as follows:

- The green LED is on when power is applied to the sensor and flashes to indicate an overloaded output.
- The red LED flashes when an echo is received; the flash rate is proportional to echo strength.



- The amber LED is on when the outputs are conducting.

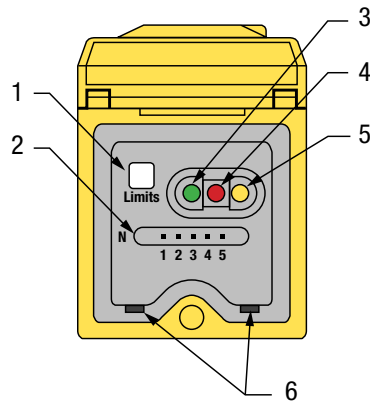


Figure 1. Q45U Long-Range Features

1. Button for programming the sensing window limits
2. 5-Segment target position indicator (N = Near)
3. Green power indicator
4. Red signal indicator
5. Amber output indicator
6. Slots for removing the inner cover

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.

Setting the DIP Switches

Follow these steps to select the output response settings.



Important: Disconnect the power before making any internal adjustments.

1. Insert a small flat-blade screwdriver into the slots.
2. Lift up and remove the black inner cover to expose the 4-position DIP switch.
3. Use the DIP switches to program the following functions:

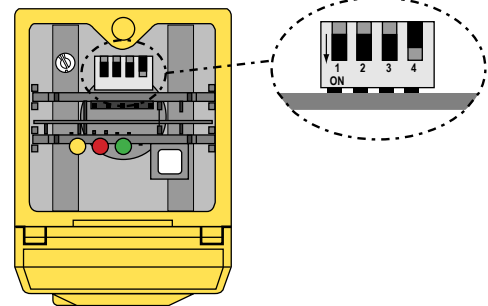


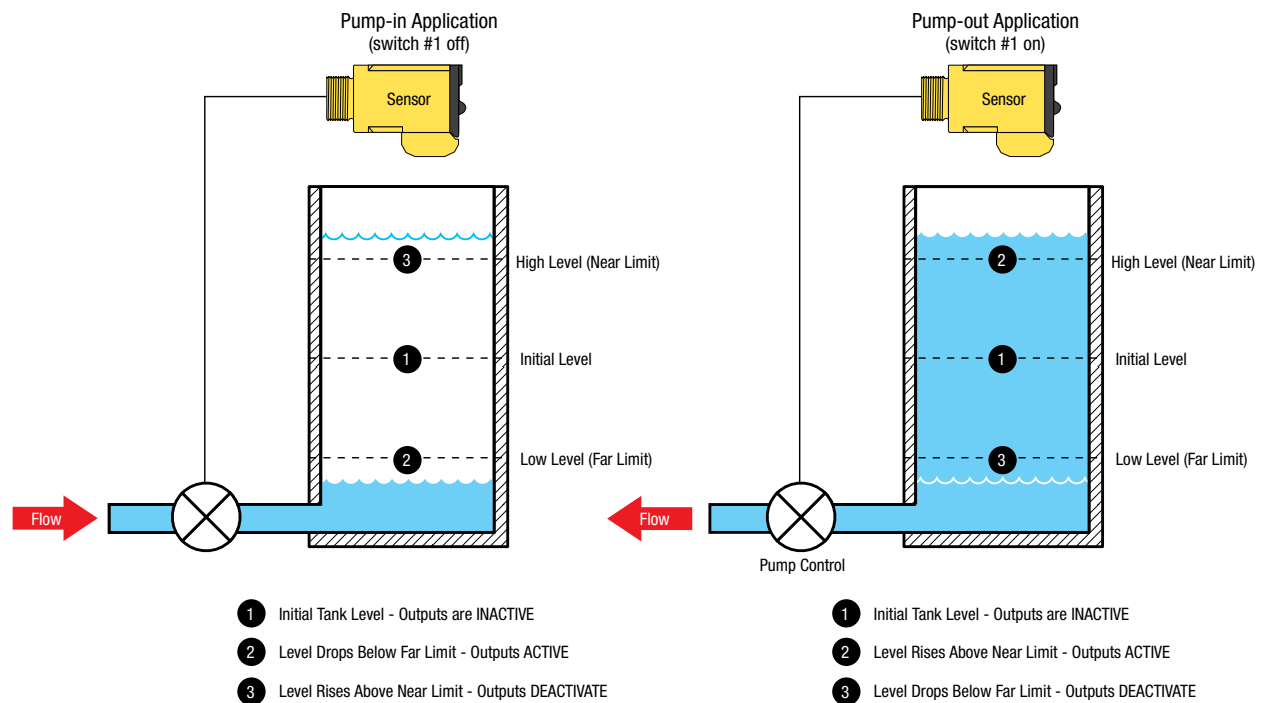
Figure 2. Q45U Programming Switches

* Factory default setting

Description	1	2	3	4
ON/OFF Mode: Normally closed output (output energizes when target is absent) HIGH/LOW Mode: Pump out	ON			
ON/OFF Mode: Normally open (output energizes when target sensed) HIGH/LOW Mode: Pump in	OFF *			
Select HIGH/LOW Mode (fill level control)		ON		
Select ON/OFF Mode (the output follows the sensing action)		OFF *		
Response time (20 ms/cycle): 1 cycle (20 ms)			OFF	OFF
Response time (20 ms/cycle): 2 cycles (40 ms)			ON	OFF
Response time (20 ms/cycle): 8 cycles (160 ms)			OFF *	ON *
Response time (20 ms/cycle): 32 cycles (640 ms)			ON	ON



Important: A 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.



Note: If no echo is received by the sensor, the target is assumed to be beyond the far window limit.

Figure 3. High/Low Control (DIP Switch 2 in ON)

The HIGH/LOW mode (DIP switch 2 is 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. The figure shows how pumping action might be controlled, directly, by the sensor in a fill-level application.

Programming the Window Limit

Use the **Limits** button, located under the transparent top cover, to program the near and the far limits.

The near limit may be set as close as 100 mm (4 in) and the far limit may be set as far as 1400 mm (55 in) from the transducer face. The minimum window width is 10 mm (0.4 in). When possible, use the actual target to be sensed when setting the window limits. Programming the window limit begins with the sensor in Run mode.

1. Push and hold the **Limits** button until the green LED turns off (approximately 2 seconds).

Green LED	Amber LED	Red LED
Off	On to indicate the sensor is ready to program the first limit	Flashes to indicate the strength of the echo; Off if no target is present

2. Set the first limit (near or far) by placing the target at the first limit and pressing the **Limits** button for less than 2 seconds.

Green LED	Amber LED	Red LED
Off	Flashes at 2 Hz to indicate the sensor is ready to program the second limit	On for a moment, then resumes flashing to indicate the strength of the echo

3. Set the second limit (far or near) by placing the target at the second limit and pressing the **Limits** button for less than 2 seconds.

Green LED	Amber LED	Red LED
Off, then turns on when the sensor returns to Run mode	On for a moment, then is either on or off to indicate the output state when the sensor returns to Run mode	On for a moment, then resumes flashing to indicate the strength of the echo when the sensor returns to Run mode

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 returns to Run mode with the previously programmed limits. There is no timeout between the programming of the first and second limit.
3. Cancel the programming sequence at any time by pressing and holding the **Limits** 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 m and 1500 mm. The maximum recommended far limit position is 1400 mm.
5. If the target is positioned between 1400 mm 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 reverts to the first limit programming step. This is indicated by the green LED (OFF), red LED (flashing to indicate signal strength), and the amber LED (ON).
7. If both limits are accepted, the sensor returns to Run mode, which is indicated by the green LED (ON).
8. If the target is held at the same position for programming of both limits, the sensor establishes a 10 mm wide sensing window, centered on the target position.

Specifications

Supply Voltage and Current

12 to 24 V dc (10% maximum ripple) at 100 mA, exclusive of load

Proximity Mode Range

Near limit: 100 mm (4 in) minimum

Far limit: 1.4 m (55 in)

Supply Protection Circuitry

Protected against reverse polarity and transient voltages

Output Rating

150 mA maximum (each)

Off-state leakage current: < 25 microamp at 24 V dc

On-state saturation voltage: < 1.5 V at 10 mA; < 2.0 V at 150 mA

Performance Specifications

Repeatability: $\pm 0.1\%$ of measured distance (± 0.25 mm min)

Minimum Window Width: 10 mm (0.4 in)

Hysteresis: 5 mm (0.2 in)

Output Protection Circuitry

Protected against false pulse on power-up and continuous overload or short-circuit of outputs

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"-14 NPS internal conduit thread

Connections

2 m (6.5 ft) or 9 m (30 ft) attached cable, or 5-pin Mini-style or 5-pin M12/Euro-style quick disconnect fitting

Hysteresis

ON/OFF mode: 5 mm

HIGH/LOW mode: 0 mm

Certifications



Output Configuration

Bipolar: one current sourcing (PNP) and one current sinking (NPN) open-collector transistor

Use the 4-position DIP switch to select the following:

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)

Environmental Rating

Leakproof design is rated IEC IP67; NEMA 6P

Indicators

Three status LEDs:

Green ON = power to sensor is ON

Green flashing = output is overloaded

Amber ON = outputs are conducting (in Run mode); or programming status (in 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

Operating Conditions

Temperature: -25 °C to $+70$ °C (-13 °F to $+158$ °F)

Maximum relative humidity: 100%

Vibration and Mechanical Shock

All models meet Mil Std. 202F requirements. Method 201A (vibration: 10 Hz to 60 Hz max., double amplitude 0.06 inch, maximum acceleration 10G).

Also meets IEC 947-5-2 requirements: 30G 11 ms duration, half sine wave.

Method 213B conditions H & I (Shock: 75G with unit operating; 100G for non-operation).

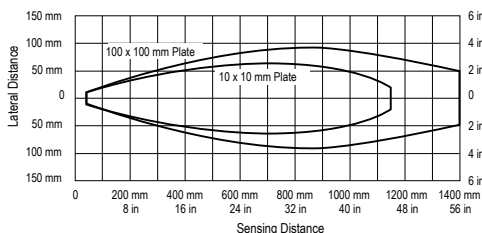
Application Notes

Minimum target size: 10 mm \times 10 mm aluminum plate at 500 mm (20 in) and 35 mm \times 35 mm aluminum plate at 1.4 m (55 in)

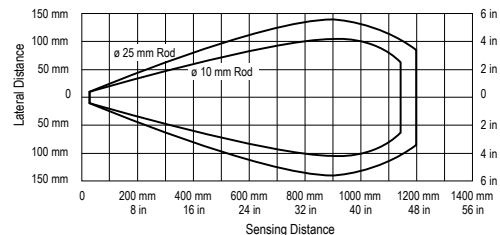
Enable/Disable: Connect the yellow wire to +5 to 24 V dc to enable the sensor and 0 to +2 V dc to disable the sensor. When the sensor is disabled, the last output state is held until the sensor is re-enabled. Hold the wire to the appropriate voltage for at least 40 ms to enable or disable the sensor.

Performance Curves

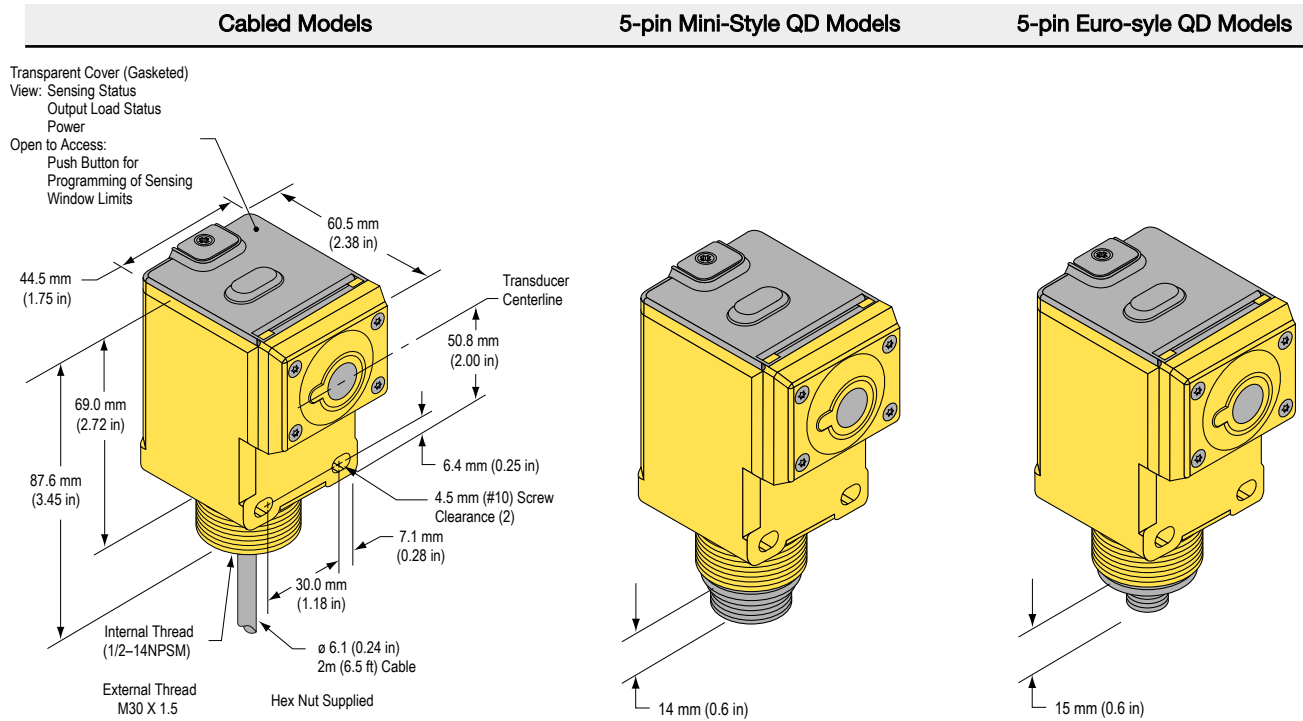
Effective Beam with Plate Target (Typical)



Effective Beam with Rod Target (Typical)



Dimensions



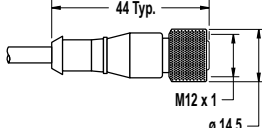
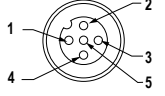
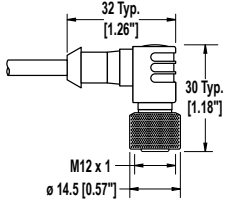
Wiring Diagrams

Q45U Sensor with Attached Cable	Q45U Sensor with 5-pin Mini-style or Euro-style QD	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray (Euro-style) or yellow (Mini-style)</p> <p>Banner Engineering Corp. recommends that the shield wire be connected to earth ground or dc common.</p>

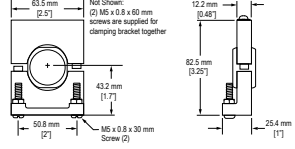
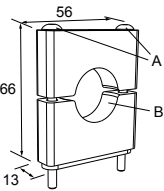
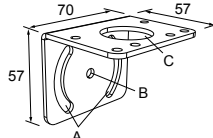
Accessories

Cordsets

5-Pin Mini-Style Cordsets—with Shield				
Model	Length	Style	Dimensions	Pinout (Female)
MBCC2-506	1.83 m (6 ft)	Straight		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow</p>
MBCC2-512	3.66 m (12 ft)			
MBCC2-530	9.14 m (30 ft)			

5-Pin Threaded M12/Euro-Style Cordsets—with Shield				
Model	Length	Style	Dimensions	Pinout (Female)
MQDEC2-506	1.83 m (6 ft)	Straight		
MQDEC2-515	4.57 m (15 ft)			
MQDEC2-530	9.14 m (30 ft)			
MQDEC2-550	15.2 m (50 ft)			
MQDEC2-506RA	1.83 m (6 ft)	Right-Angle		1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
MQDEC2-515RA	4.57 m (15 ft)			
MQDEC2-530RA	9.14 m (30 ft)			
MQDEC2-550RA	15.2 m (50 ft)			

Brackets

SMB30S <ul style="list-style-type: none"> Swivel bracket with 30 mm mounting hole for sensor Adjustable captive swivel ball Black reinforced thermoplastic polyester Stainless steel mounting and swivel locking hardware included 	SMB30C <ul style="list-style-type: none"> 30 mm split clamp, black PBT bracket Stainless steel mounting hardware included Mounting hole for 30 mm sensor  <p>Hole center spacing: A=ø 45 Hole size: B=ø 27.2</p>
SMB30MM <ul style="list-style-type: none"> 12-ga. stainless steel bracket with curved mounting slots for versatile orientation Clearance for M6 (¼ in) hardware Mounting hole for 30 mm sensor  <p>Hole center spacing: A = 51, A to B = 25.4 Hole size: A = 42.6 x 7, B = ø 6.4, C = ø 30.1</p>	

Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

THIS LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED (INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), AND WHETHER ARISING UNDER COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.

This Warranty is exclusive and limited to repair or, at the discretion of Banner Engineering Corp., replacement. **IN NO EVENT SHALL BANNER ENGINEERING CORP. BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR ANY EXTRA COSTS, EXPENSES, LOSSES, LOSS OF PROFITS, OR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT OR FROM THE USE OR INABILITY TO USE THE PRODUCT, WHETHER ARISING IN CONTRACT OR WARRANTY, STATUTE, TORT, STRICT LIABILITY, NEGLIGENCE, OR OTHERWISE.**

Banner Engineering Corp. reserves the right to change, modify or improve the design of the product without assuming any obligations or liabilities relating to any product previously manufactured by Banner Engineering Corp. Any misuse, abuse, or improper application or installation of this product or use of the product for personal protection applications when the product is identified as not intended for such purposes will void the product warranty. Any modifications to this product without prior express approval by Banner Engineering Corp will void the product warranties. All specifications published in this document are subject to change; Banner reserves the right to modify product specifications or update documentation at any time. Specifications and product information in English supersede that which is provided in any other language. For the most recent version of any documentation, refer to:

www.bannerengineering.com.