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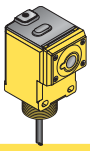
U-GAGE™ Analog Q45UR Remote Ultrasonic Sensors

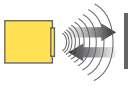
Piezoelectric Analog Proximity Mode Sensors with Push Button or Remote Programming of Sensing Window

CE



Analog Q45UR Series Features

- Ultrasonic ranging from 50 to 250 mm (2" to 10")
- Push-button TEACH-mode programming of sensing window limits
- Window limits may be set in two ways: by individually setting the near and far window limits, or by programming a set point to be centered within a 5-mm sensing window.
- Digital filtering for exceptional immunity to random electrical and acoustic “noise”
- Selectable 0 to 10V dc voltage sourcing or 4 to 20mA current sourcing analog outputs
- Selectable output slope: positive or negative with increasing target distance
- Wide operating temperature range of -25° to +70°C; all models include temperature compensation
- Rugged design for use in demanding sensing environments; rated IEC IP67, NEMA 6P (controller), IP65 (sensor)
- Choose models with integral 2 m (6.5') or 9 m (30') cable, or with Mini-style or Euro-style quick disconnect fitting
- Choose from 3 remote sensors: 18 mm threaded-barrel models in either stainless steel or molded PBT polyester, and a molded flat-pak model
- Remote sensors connect to controller via an integral 2 m (6.5') cable
- Input for remote TEACH-mode programming of window limits
- 0.10 mm resolution (0.004")
- Kit includes both controller and sensor; components also sold separately
- Response time is adjustable from 10 to 320 milliseconds


Ultrasonic

Q45UR Series Ultrasonic Sensor Models

Kit Models	Kit Includes Controller Model	Controller Cable*	Controller Output	Supply Voltage	Kit Includes Sensor Model	Sensor Range
Q45UR3LIU64CK **Q45UR3LIU64CQK** **Q45UR3LIU64CQ6K**	**Q45UR3LIU64C** **Q45UR3LIU64CQ** **Q45UR3LIU64CQ6**	2 m (6.5') 5-Pin Mini QD 5-Pin Euro QD	Selectable 0-10V dc or 4-20mA Sourcing	15-24V dc	 **M18C2.0 Stainless Steel Barrel**	50 to 250 mm (2" to 10")
Q45UR3LIU64CKQ **Q45UR3LIU64CQKQ** **Q45UR3LIU64CQ6KQ**	**Q45UR3LIU64C** **Q45UR3LIU64CQ** **Q45UR3LIU64CQ6**	2 m (6.5') 5-Pin Mini QD 5-Pin Euro QD			 **Q13C2.0 Flat-Pak**	
Q45UR3LIU64CKS **Q45UR3LIU64CQKS** **Q45UR3LIU64CQ6KS**	**Q45UR3LIU64C** **Q45UR3LIU64CQ** **Q45UR3LIU64CQ6**	2 m (6.5') 5-Pin Mini QD 5-Pin Euro QD			 **S18C2.0 Molded Barrel**	

*NOTES:
- 9 m (30') cables are available by adding suffix **“W/30”** to the model number of any cabled sensor (e.g., **Q45UR3LIU64CK W/30**).
- A model with a QD connector requires a mating cable; see page 9.

Programming the Sensing Window Limits

The Q45UR controller features a single push button for programming the sensing window limits (Figure 1). The window limits may be set in one of two ways: programming two independent window limits, or defining a sensing distance set point, which will be centered automatically within a 5-mm window (specific steps are described on page 5).

Independent Window Limits: The target is placed at the desired position to set the first limit, then the second limit is set using the same procedure. In order to set two independent limits, the window must at least 5 mm.

Sensing Distance Set Point: The sensor is taught the same set point for both window limits. The set point is automatically centered within a 5-mm (0.2") window.

See page 5 for detailed programming instructions.

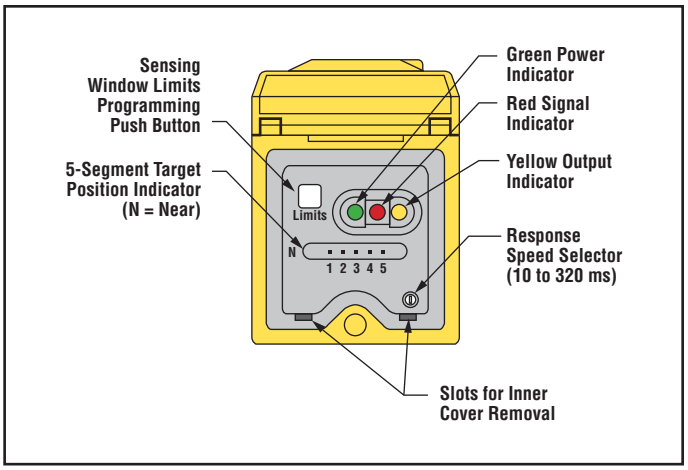


Figure 1. Analog Q45UR controller features

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 a current output fault.
- 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 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. 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.

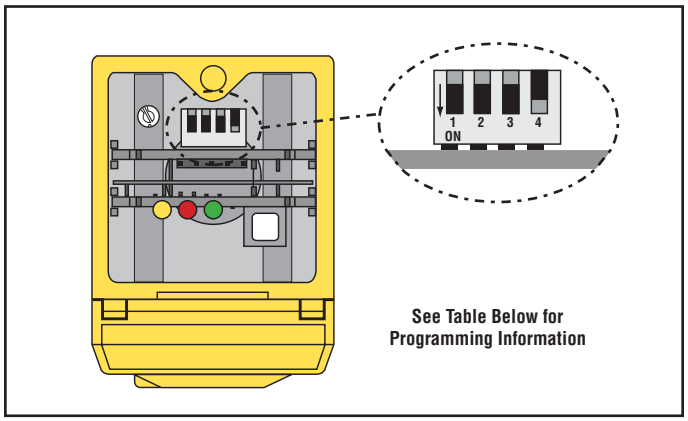


Figure 2. Analog Q45UR controller programming DIP switches (factory default settings)

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:

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	ON* = Default to maximum output value OFF = Default to minimum output value

Explanation of Programmable Output Functions:

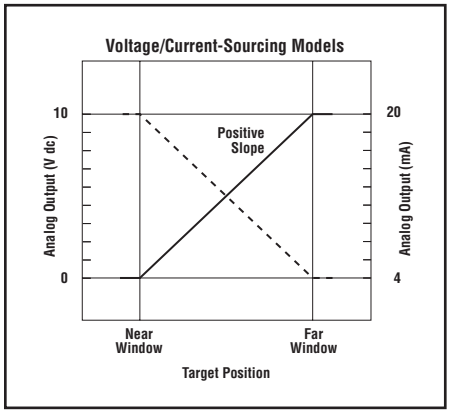


Figure 3. Output as a function of target position

Switch 1: Output Slope Select

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

Switch 2: Output Mode Select

ON = The 4 to 20mA current output (white wire) is enabled
OFF* = The 0 to 10V dc voltage output (black wire) is enabled

This switch configures the D/A driver to use either the current output or the voltage output driver.

Switch 3: Loss of Echo Mode Select

ON = Min - Max Mode
OFF* = Hold Mode

This switch determines the output response to the loss of echo. The “Hold Mode” (Switch 3 Off*) maintains the output at the value which was present at the time of echo loss. The “Min - Max Mode” (Switch 3 On) drives the output to either the minimum value (0V or 4mA or the maximum value (10V or 20mA) when the echo is lost. Minimum or maximum value is selected by Switch 4.

Switch 4: Min - Max Default

ON* = Default to maximum output value at loss of echo
OFF = Default to minimum output value at loss of echo

Switch 4 selects the output response to loss of echo when “Min - Max Mode” is selected by Switch 3 (see above).

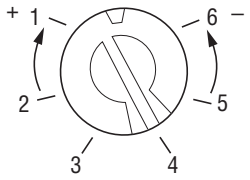
* Factory default setting

Response Speed Adjustment

The speed of the output response is set using the single-turn potentiometer (see Figures 1 and 4). There are six values for response speed, which relate directly to the number of sensing cycles over which the output value is averaged (see the Response Speed Settings table, below). The response value is set by aligning the slot of the potentiometer with one of the marked positions. The positions are identified in Figure 4.

Response Speed Settings

Position	Response Speed
1	10 milliseconds (2 cycles)
2	20 milliseconds (4 cycles)
3	40 milliseconds (8 cycles)
4	80 milliseconds (16 cycles)
5	160 milliseconds (32 cycles)
6	320 milliseconds (64 cycles)

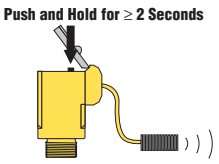
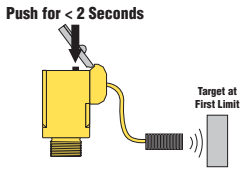
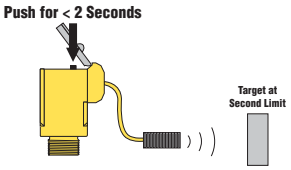


NOTE: This example shows the potentiometer set at position number 4. There are no numbers on the actual product label.

Figure 4. Response adjustment positions

Window Limit Programming

Either the “Limits” push button (located under the transparent top cover) or the Remote TEACH wire may be used to program the near and the far limits. The near limit may be set as close as 50 mm (2") and the far limit may be set as far as 250 mm (10") from the transducer face. Minimum window width is 5 mm (0.2"). 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
Step 1 **Access Limit Programming Mode** Push and hold until green indicator turns OFF (approximately 2 seconds)		**Green:** Goes OFF **Yellow:** ON steady to indicate ready for teaching first limit **Red:** Flashes to indicate strength of echo or is off if no target is present
Step 2 **Set First Limit (Near or Far)** Place the target at the first limit and press the push button for less than 2 seconds		**Green:** Remains OFF **Yellow:** Flashes at 2 Hz to indicate ready for teaching second limit **Red:** Comes ON steady for a moment, then resumes flashing to indicate echo strength
Step 3 **Set Second Limit (Far or Near)** Place the target at the second limit and press the push button for less than 2 seconds If the target is held at the same position for programming of both limits, the sensor will establish a 5 mm-wide sensing window, centered on the target position		**Green:** Remains OFF, then comes ON steady (returns to RUN mode) **Yellow:** ON steady for a moment, then either ON or OFF to indicate output state (returns to RUN mode) **Red:** Comes ON steady for a moment, then resumes flashing to indicate echo strength (returns to RUN mode)

NOTES:

1) Either the near or far limit may be programmed first.
2) There is a 2 minute time-out for programming of the first limit. If more than 2 minutes elapses, the sensor will return to RUN mode with the previously programmed limits. There is no time-out 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 50 and 250 mm (the maximum recommended far limit position is 250 mm).
5) If the target is farther than 250 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 250 mm maximum far limit.
6) If a limit is rejected during either programming step, the sensor will revert to the first limit programming step (end of Step 1 in programming chart). This will be indicated by: Green OFF, Red Flashing to indicate signal strength, and Yellow ON steady.
7) If both limits are accepted, the sensor will return to RUN mode, indicated by: Green goes ON steady.

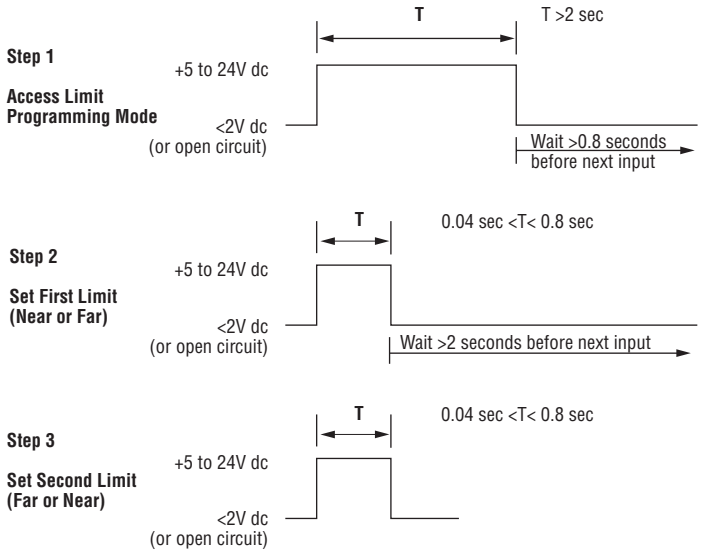
U-GAGE™ Analog Q45UR Remote Ultrasonic Sensors

Remote Window Limit Programming

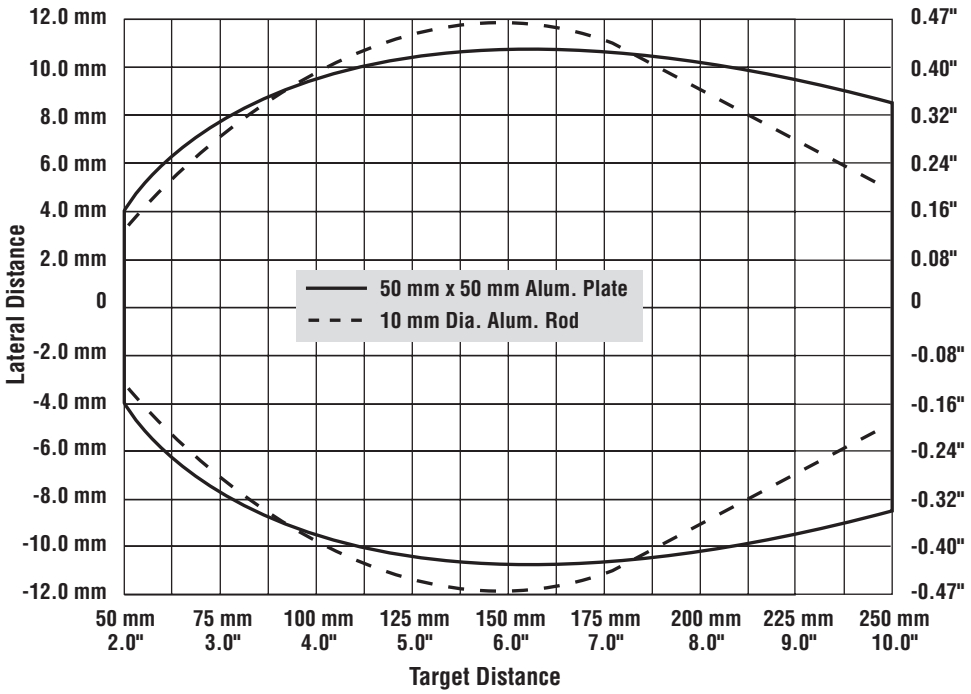
The yellow wire of the Analog Q45UR may be connected to a switch or process controller for remote programming of the sensing window limits. The programming procedure is the same as for the push button (see page 4).

A remote programming input is generated when +5 to 24V dc is applied to the yellow wire. The timing diagrams, right, define the required input pulses.

NOTES:
1) The push 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 on page 4.



Analog Q45UR Series Response Curves



NOTE: The pattern displayed for the 50 mm x 50 mm Aluminum plate is referenced to the EDGE of the plate. The pattern displayed for the 10 mm dia. Aluminum rod is referenced to the CENTER of the rod.

U-GAGE™ Analog Q45UR Remote Ultrasonic Sensors

Analog Q45UR Series Specifications

Range for Nominal Sensing Position	**Near Limit:** 50 mm (2") min. **Far Limit:** 250 mm (10") max.
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
Output Configuration	One voltage sourcing and one current sourcing; one or the other output is enabled by internal programming switch #2 (see page 2).
Output Rating	**Voltage Sourcing:** 0 to 10V dc, 10mA maximum **Current Sourcing:** 4 to 20mA, 1 to 500 ohm impedance
Output Protection Circuitry	Both outputs are protected against continuous overload and short circuit
Performance Specifications * Resolution and linearity are specified using a 50 mm x 50 mm (2" x 2") aluminum plate at 22ºC under fixed sensing conditions using the 4-20 mA output @15V dc.	**Resolution*:** 0.2% of sensing distance at 320 ms response 0.4% of sensing distance at 10 ms response **Linearity*:** ±1.0 mm (0.04") with 100 to 200 mm sensing window ±2.0 mm (0.08") with 50 to 250 mm sensing window **Temperature stability:** ±0.03% of sensing distance per ºC from 0 to 50ºC (±0.05% per ºC over remainder of operating temperature) **Ultrasonic beam angle:** ±3.5º Also see response curve on page 5 Minimum target size is specified as a 10 x 10 mm (0.4" x 0.4") aluminum plate (at any point within the 50 to 150 mm sensing range).
Adjustments	Push-button TEACH-mode programming of window limits (see page 2) The following may be selected by a 4-position DIP switch located on top of the controller, beneath the transparent acrylic and black inner covers (see page 2) **Switch 1:** Output slope: output value increases or decreases with distance **Switch 2:** Output mode: current output or voltage output **Switches 3&4:** Response to loss of echo: (see page 3) **Response Speed Adjustment:** Single-turn potentiometer selects six response values from 10 to 320 milliseconds (see page 3)
Indicators	**Three status LEDs:** **Green ON steady** = Power to controller is ON **Green flashing** = Current output fault detected (indicates that the 4-20 mA current path to ground has been opened) **Yellow ON steady** = Target is sensed within the window limits (Yellow LED also indicates programming status during setup mode) **Red flashing** = Relative strength of received echo **5-segment moving dot LED** indicates the position of the target within the sensing window
Construction	**Controller:** Molded thermoplastic polyester housing, o-ring sealed transparent acrylic top cover, and stainless steel hardware **Sensors:** **M18C2.0:** Stainless steel M18 threaded barrel housing and jam nuts, ULTEM® polyetherimide front cover, ceramic transducer, TEXIN® polyurethane rear cover **S18C2.0:** Thermoplastic polyester S18 threaded barrel housing and jam nuts, ULTEM® polyetherimide front cover, ceramic transducer, TEXIN® polyurethane rear cover **Q13C2.0:** Molded 30% glass reinforced thermoplastic polyester housing, ceramic transducer, fully epoxy-encapsulated
Environmental Rating	**Controller:** IEC IP67; NEMA 6P **Sensor:** IEC IP65; NEMA 4

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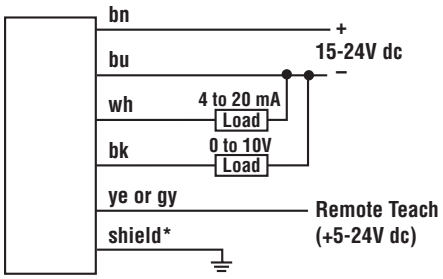
U-GAGE™ Analog Q45UR Remote Ultrasonic Sensors

Analog Q45UR Series Specifications, continued

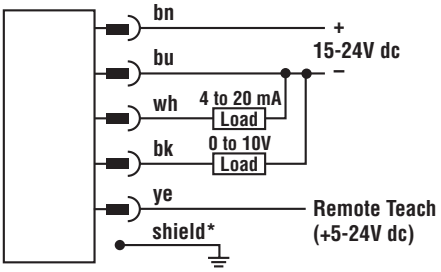
Connections	**Controller:** 2m (6.5') or 9 m (30') attached cable, or 5-pin Mini-style or Euro-style quick-disconnect fitting **Sensor:** 2m (6.5') attached PVC cable terminated with 4-pin Euro-style quick-disconnect fitting for connection to controller
Operating Temperature	**Controller and sensor:** -25° to +70°C (-13° to +158°F) **Maximum relative humidity:** 85% (non-condensing)
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.
Certifications	CE
Application Notes	The controller has non-volatile memory which remembers the last sensing window setting if power is removed and later reapplied. The sensing window may be programmed via the Remote Teach input (see hookup diagrams). Acceptable target angle is within ±5° of normal for a smooth, flat target; target rotation does affect the apparent target location with respect to the sensor.

Q45UR Series Controller Hookups

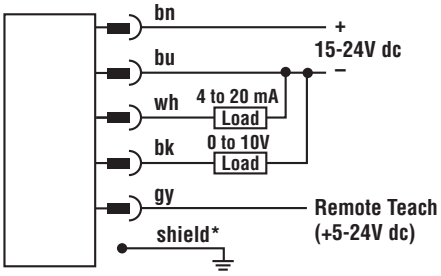
Q45UR Controller with Attached Cable



Q45UR Controller with 5-Pin Mini-Style QD ("Q" Model Suffix)

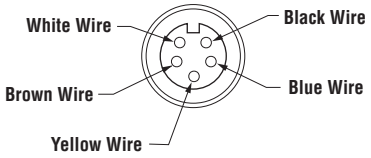


Q45UR Controller with 5-Pin Euro-Style QD ("Q6" Model Suffix)

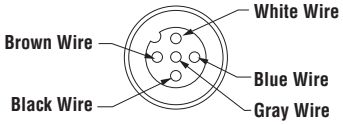


* It is recommended that the shield wire be connected to earth ground or dc common.

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



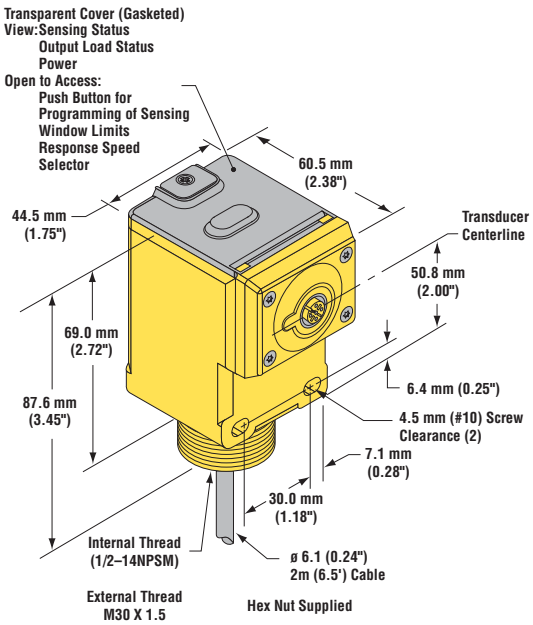
5-Pin Euro-Style Pin-Out (Cable Connector Shown)



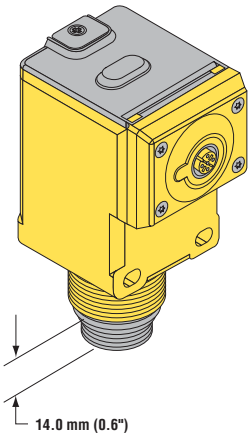
U-GAGE™ Analog Q45UR Remote Ultrasonic Sensors

Q45UR Series Controller Dimensions

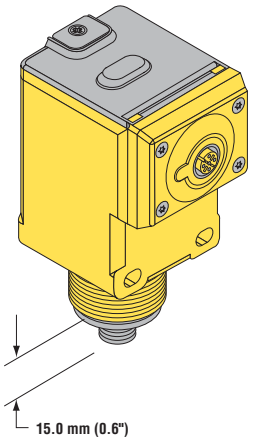
Q45UR Controller with Attached Cable



Q45UR Controller with 5-Pin Mini-Style QD ("Q" model Suffix)

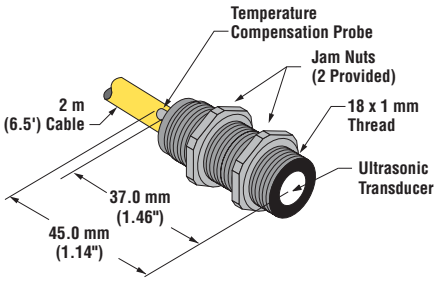


Q45UR Controller with 5-Pin Euro-Style QD ("Q6" model Suffix)

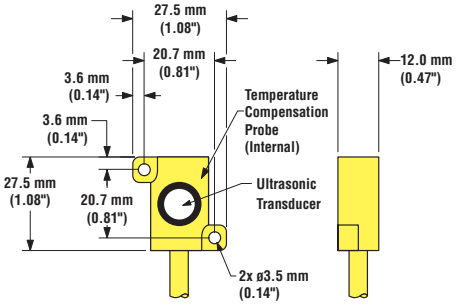


Remote Sensor Dimensions

M18C2.0 and S18C2.0 Sensors

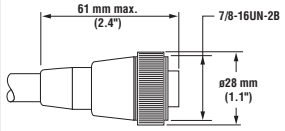
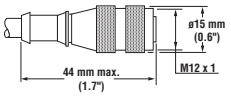
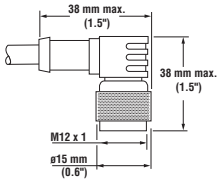


Q13C2.0 Sensors



Accessories

Quick-disconnect (QD) Cables

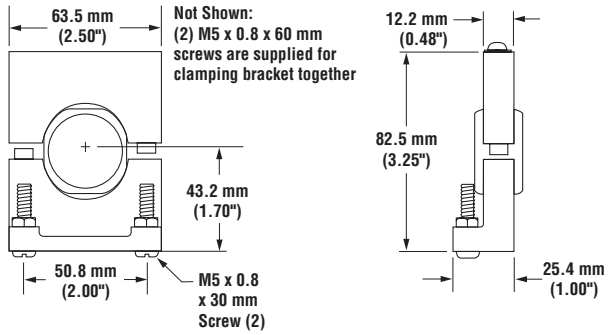
Description	Model	Length	Connector
5-Pin Mini-style with shield	**MBCC2-506** **MBCC2-512** **MBCC2-530**	2 m (6.5') 4 m (12') 9 m (30')	
5-Pin Euro-style Straight with shield	**MQDEC2-506** **MQDEC2-515** **MQDEC2-530**	2 m (6.5') 5 m (15') 9 m (30')	
5-Pin Euro-style Right-angle with shield	**MQDEC2-506RA**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

U-GAGE™ Analog Q45UR Remote Ultrasonic Sensors

Mounting Brackets for Q45UR Series Controllers

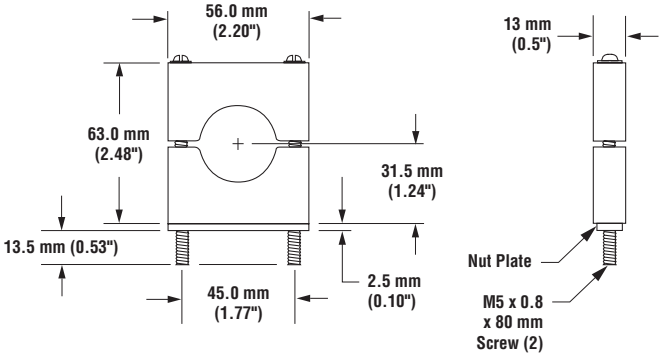
SMB30S

- 30 mm swivel, black PBT polyester bracket
- Stainless steel mounting hardware included



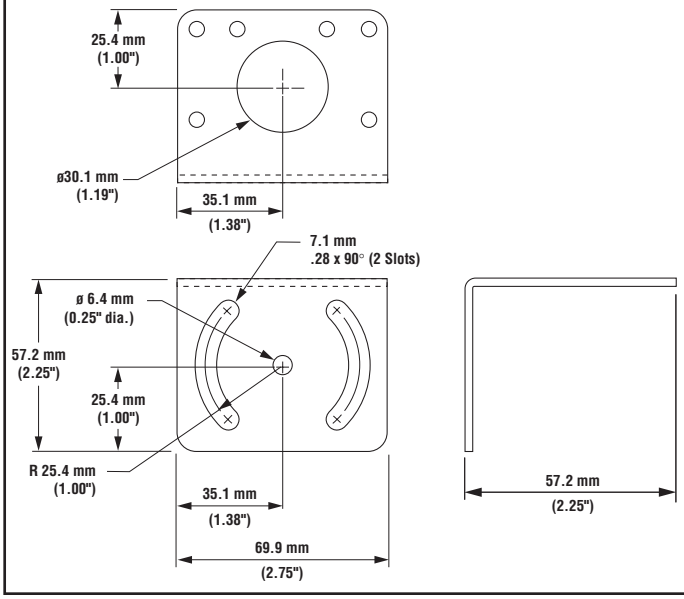
SMB30C

- 30 mm split clamp, black PBT polyester bracket
- Stainless steel mounting hardware included



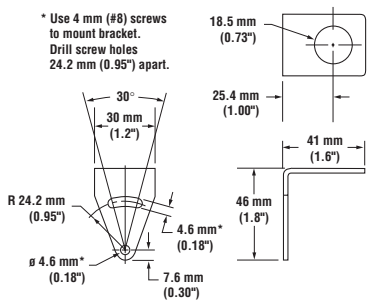
SMB30MM

- 30 mm, 11-gauge stainless steel bracket
- Curved mounting slots for versatility and orientation

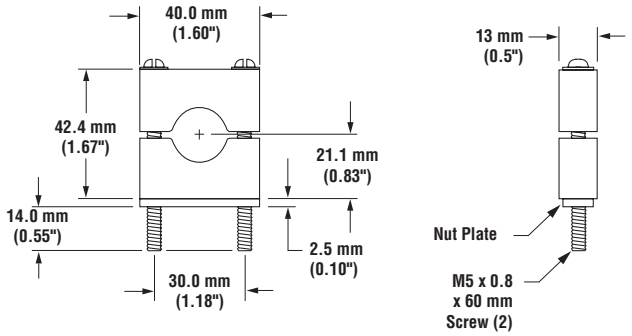


Mounting Brackets for M18C2.0 and S18C2.0 Sensors

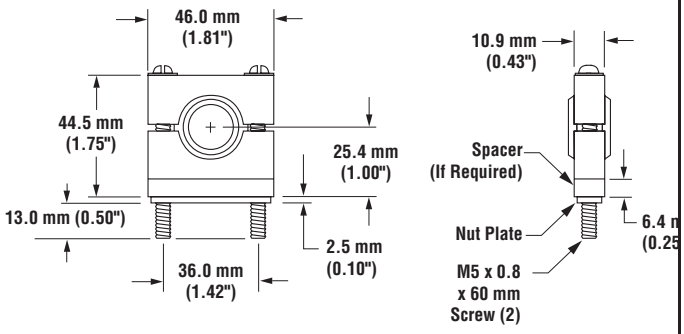
SMB18A	• 11-gauge, stainless steel right-angle bracket • Curved mounting slot for versatility and orientation



SMB18C	• 18 mm split clamp black PBT polyester bracket • Stainless steel mounting hardware included



SMB18S	• 18 mm swivel, black PBT polyester bracket • Stainless steel mounting hardware included

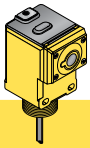


U-GAGE™ Q45UR Remote Ultrasonic Sensors

Piezoelectric Proximity Mode Sensors with Push-Button or Remote Programming of Sensing Windows

Q45UR Series Features

- Ultrasonic proximity detection from 50 to 250 mm (2" to 10")
- Precision programmability that can resolve object presence to within 0.6 mm
- Window limits may be set in two ways: by individually setting the near and far window limits, or by programming a set point to be centered within one of four selectable window sizes
- Simple push-button TEACH-mode programming; input for remote programming
- Digital filtering for exceptional immunity to random electrical and acoustic "noise"
- 12 to 24V dc operation; bipolar outputs: sinking (NPN) and sourcing (PNP)
- Wide operating temperature range of -25° to +70°C; temperature compensation circuitry is included
- User-selectable response speeds
- Easy-to-use in-window/out-of-window output; ideal for gauging and similar inspection applications
- Exceptional sensing repeatability: ±0.2% of the measured distance
- Choose from 3 remote sensors: 18 mm threaded-barrel models in either stainless steel or molded PBT polyester, and a molded flat-pak model
- Remote sensors connect to controller via an integral 2 m (6.5') cable
- Kit includes both controller and sensor; components also sold separately



Q45UR Series Ultrasonic Sensor Models

Kit Models	Kit Includes Controller Model	Controller Cable*	Controller Output	Supply Voltage	Kit Includes Sensor Model	Sensing Range
Q45UR3BA63CK **Q45UR3BA63CQK** **Q45UR3BA63CQ6K**	**Q45UR3BA63C** **Q45UR3BA63CQ** **Q45UR3BA63CQ6**	2 m (6.5') 5-Pin Mini QD 5-Pin Euro QD	Bipolar NPN/PNP	12-24V dc	 **M18C2.0 Stainless Steel Barrel**	50 to 250 mm (2" to 10")
Q45UR3BA63CKQ **Q45UR3BA63CQKQ** **Q45UR3BA63CQ6KQ**	**Q45UR3BA63C** **Q45UR3BA63CQ** **Q45UR3BA63CQ6**	2 m (6.5') 5-Pin Mini QD 5-Pin Euro QD			 **Q13C2.0 Flat-Pak**	
Q45UR3BA63CKS **Q45UR3BA63CQKS** **Q45UR3BA63CQ6KS**	**Q45UR3BA63C** **Q45UR3BA63CQ** **Q45UR3BA63CQ6**	2 m (6.5') 5-Pin Mini QD 5-Pin Euro QD			 **S18C2.0 Molded Barrel**	

*NOTES:

- 9 m (30') cables are available by adding suffix **"W/30"** to the model number of any cabled sensor (e.g., **Q45UR3BA63C W/30**).
- A model with a QD connector requires a mating cable; see page 7.

U-GAGE™ Q45UR Remote Ultrasonic Sensors

Programming the Sensing Window Limits

The Q45UR controller features a single push button for programming the sensing window limits (Figure 1). The window limits may be set in one of two ways: programming two independent window limits, or defining a sensing distance set point, which will be centered within a window whose size is determined by the setting of DIP switches 2 and 3 (specific steps are described on page 3).

Independent Window Limits: The target is placed at the desired position to set the first limit, then the second limit is set using the same procedure. In order to set two independent limits, the window must be at least 5 mm.

Sensing Distance Set Point: The sensor is taught the same set point for both window limits. This set point is centered within an overall window size of 1, 2, 3, or 4 mm (0.04", 0.08", 0.12", or 0.16"), determined by the DIP switch settings. DIP switches are located inside the controller, under the inner cover (Figure 1).

See page 4 for detailed programming instructions.

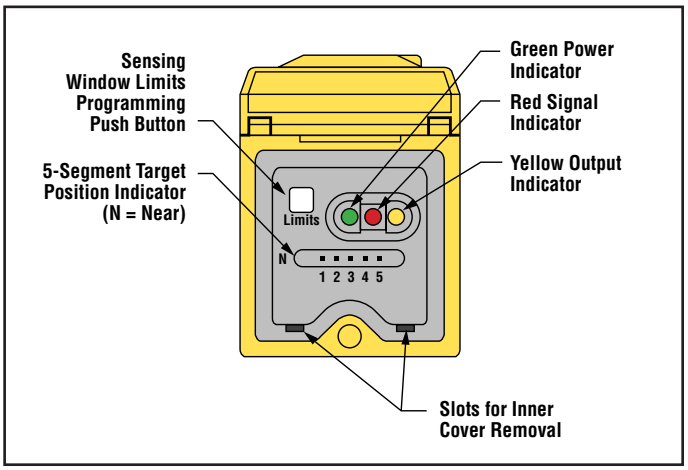


Figure 1. Q45UR controller features

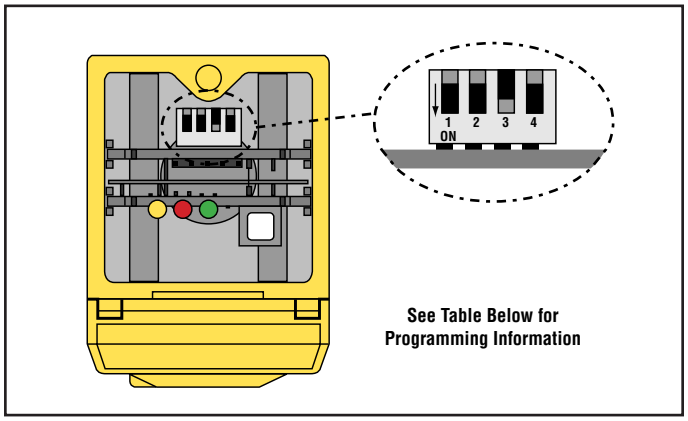


Figure 2. Q45UR controller programming DIP switches (factory default settings)

Status Indicators

Status indicator LEDs are visible through the transparent, o-ring sealed Lexan® top cover. Their function is as follows:

LED	Condition	Description
Green	ON Steady Flashing	Power is applied to the sensor Overloaded output
Red	Flashing	An echo is received; rate is proportional to echo strength
Yellow	ON Steady	Outputs are conducting

The 5-segment moving dot LED indicator tracks the position of the target relative to the programmed window limits.

For Independent Window Limits (> 5 mm windows): LED #1 flashes when the target is closer than the near window limit. LED #5 flashes when the target is beyond the far window limit. LED #3 comes ON when the target is near the center of the two limits.

For Sensing Distance Set Points (1, 2, 3,or 4 mm windows): LED #1 flashes when the target is closer than the near window limit. LED #3 comes ON steady when the target is within the sensing window. LED #5 flashes when the target is beyond the far sensing window.

Setting the Q45UR Programming Switches

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 programming DIP switch (Figure 2). These switches program the following functions:

Switch	Function		
1	**ON/OFF Mode** **Output:** ON = normally closed (output energizes when target is absent or outside the window limits) OFF* = normally open (output energizes when target is sensed inside the window limits)		
2 - 3	**Window Size (If a Set Point is Programmed)****	**Switch 2**	**Switch 3**
	1 mm (Sensing set point ± 0.5 mm)	OFF	OFF
	2 mm (Sensing set point ± 1 mm)	ON	OFF
	3 mm* (Sensing set point ± 1.5 mm)	OFF	ON
	4 mm (Sensing set point ± 2 mm)	ON	ON
4	**Response:** ON = 40 ms OFF* = 160 ms		

* Denotes factory settings.

** If two independent window limits are programmed, these switch settings are disregarded.

NOTE: Hysteresis is 0.5 mm for all window tolerance settings.

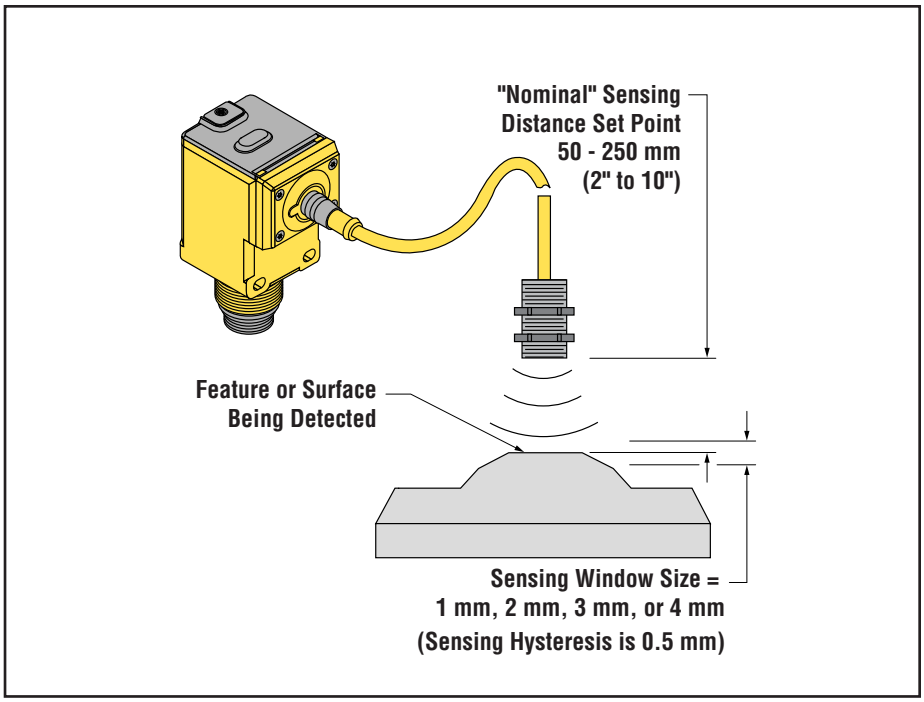
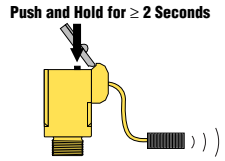
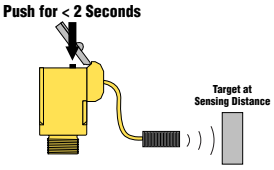
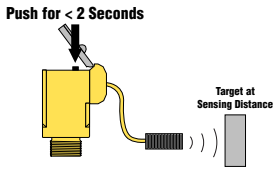


Figure 3. Sensing distance set point and window size

U-GAGE™ Q45UR Remote Ultrasonic Sensors

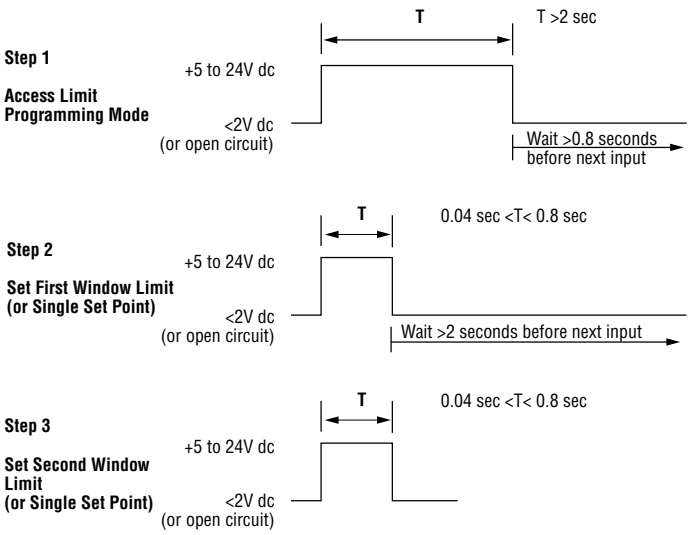
Programming Procedure

Whenever possible, use the actual target to be sensed when programming the window limits. The following procedures begin with the sensor operating in RUN mode.

Push Button		Indicator Status
Step 1 **Enter Program Mode** Push and hold until green indicator turns OFF (approximately 2 seconds)		**Green:** Goes OFF **Yellow:** Is ON steadily to indicate ready for teaching **Red:** Flashes to indicate echo strength; or OFF if no target is present
Step 2 **Set the First Window Limit (or the Set Point)** Place the target at the first window limit or the sensing distance set point and press the push button for less than 2 seconds		**Green:** Remains OFF **Yellow:** Flashes at 2 Hz to indicate ready for teaching **Red:** Comes ON steadily for a moment, then resumes flashing to indicate echo strength
Step 3 **Set the Second Window Limit** Place the target at the second window limit and press the push button for less than 2 seconds. If the target is held at the same position for programming of both limits, the sensor will establish a sensing window centered on the target position.		**Green:** Remains OFF, then comes on steadily (returns to RUN mode) **Yellow:** ON steadily for a moment, then either ON or OFF to indicate output state (returns to RUN mode) **Red:** Comes ON steadily for a moment, then resumes flashing to indicate echo strength (returns to RUN mode)

NOTES:

1) There is a 2-minute timeout for programming the first window limit. After this time, the sensor will return to RUN mode with the previously programmed distance. There is no timeout for programming the second limit.
2) The programming sequence may be cancelled at any time by pressing and holding the push button for ≥ 2 seconds. The sensor will return to RUN mode with the previously programmed limits.
3) If programming is rejected during either programming step, the sensor will revert to step 1 above, and wait for programming of the first window limit. This will be indicated by: Green OFF, Red Flashing to indicate signal strength, Yellow ON Steady.
4) If the sensing distance is accepted, the sensor will return to RUN mode, indicated by: Green ON Steady.
5) During limit programming, the 5-segment moving dot indicator displays the relative target position between 50 and 250 mm (the maximum recommended far limit position is 250 mm).
6) If the target is farther than 250 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 250 mm maximum far limit.



Remote Window Limit Programming

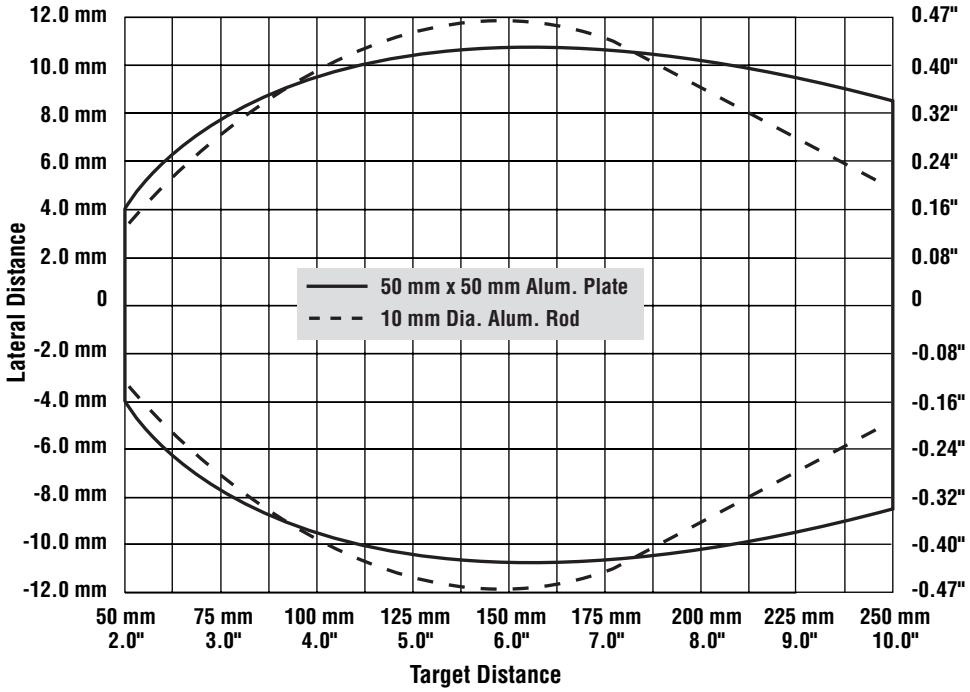
The yellow wire of the Q45UR may be connected to a switch or process controller for remote programming of the sensing window limits. The programming procedure is the same as for the push button (see page 3).

A remote programming input is generated when +5 to 24V dc is applied to the yellow wire. The timing diagrams, right, define the required input pulses.

NOTES:

1) The push 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 on page 3.

Q45UR Series Response Curves



NOTE: The pattern displayed for the 50 mm x 50 mm Aluminum plate is referenced to the EDGE of the plate. The pattern displayed for the 10 mm dia. Aluminum rod is referenced to the CENTER of the rod.

U-GAGE™ Q45UR Remote Ultrasonic Sensors

Q45UR Series Specifications

Sensing Distance Range	50 to 250 mm (2" to 10")
Supply Voltage and Current	12 to 24V dc (10% maximum ripple) at 100mA, 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
Output Rating	150mA maximum (each output) **OFF-state leakage current:** <25 microamps at 24V dc **ON-state saturation voltage:** <1.5V at 10mA; <2.0V at 150mA
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short-circuit of outputs
Performance Specifications * Repeatablility is specified using a 50 mm x 50 mm (2" x 2") aluminum plate at 22ºC under fixed sensing conditions.	**Response speed:** 40 or 160 milliseconds (switch selectable) **Repeatability*:** ±0.2% of measured distance **Temperature stability:** ±0.03% of the window limit positions per °C from 0° to 50°C (±0.05% per °C over remainder of operating temperature range) **Sensing window width:** 5 mm to 200 mm, when independent near and far limits are taught; 1, 2, 3, or 4 mm (switch selectable), when a sensing distance set point is taught **Hysteresis:** 0.5 mm **Ultrasonic beam angle:** ±3.5° Also see Response Curve, page 4
Adjustments	The following may be selected by a 4-position DIP switch located on top of the controller, beneath a transparent o-ring sealed acrylic cover and beneath the black inner cover (see page 2): **Switch 1:** Output normally open (output is energized when target is within sensing window limits), or normally closed (output is energized when target is outside sensing window limits) **Switches 2 & 3:** Sensing window size (1 mm, 2 mm, 3 mm or 4 mm; see Application Notes, page 5) **Switch 4:** Response speed selection (40 or 160ms)
Indicators	**Three status LEDs:** Green ON steadily = power to controller is ON Green flashing = output is overloaded Yellow glowing steadily = outputs are conducting (yellow also indicates programming status during setup; see page 3) Red flashing = relative strength of received echo **5-segment red LED indicates the following:** #3 ON steadily = Target within sensing window #1 flashing = Target closer than near window limit #5 flashing = Target further than far window limit All OFF = No target present
Construction	**Controller:** Molded thermoplastic polyester housing, o-ring sealed transparent acrylic top cover, and stainless steel hardware **Sensors:** **M18C2.0:** Stainless steel M18 threaded barrel housing and jam nuts, ULTEM® polyetherimide front cover, ceramic transducer, TEXIN® polyurethane rear cover **S18C2.0:** Thermoplastic polyester S18 threaded barrel housing and jam nuts, ULTEM® polyetherimide front cover, ceramic transducer, TEXIN® polyurethane rear cover **Q13C2.0:** Molded 30% glass reinforced thermoplastic polyester housing, ceramic transducer, fully epoxy-encapsulated
Environmental Rating	**Controller:** IEC IP67; NEMA 6P **Sensor:** IEC IP65; NEMA 4
Connections	**Controller:** 2m (6.5') or 9 m (30') attached cable, or 5-pin Mini-style or Euro-style quick-disconnect fitting **Sensor:** 2m (6.5') attached PVC cable terminated with 4-pin Euro-style quick-disconnect fitting for connection to controller

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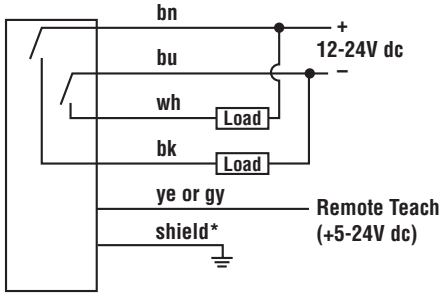
Q45UR Series Specifications, continued

Operating Temperature	**Controller and sensor:** -25 to +70°C (-13 to +158°F) **Maximum relative humidity:** 85% (non-condensing)
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.
Certifications	CE
Application Notes	The Teach-mode function of the controller (see page 2) is used to set the sensing distance set point. The sensing window size is set using DIP switches #2 and #3 (page 3). The sensing distance set point is centered within the sensing window. The size of the sensing window may be adjusted at any time, with or without power applied, and without re-teaching the sensing distance set point. If the sensor is taught a window larger than 5 mm, the size of the window remains "fixed," disabling switches 2 and 3. The controller has non-volatile memory which remembers the last sensing distance set point setting if power is removed and later reapplied. The sensing distance set point may be programmed via the Remote Teach input (see hookup diagrams). Minimum target size is specified as a 10 x 10 mm aluminum plate (at any point within the 50 to 150 mm sensing range). Acceptable target angle is within ±5° of normal for a smooth, flat target; target rotation does affect the apparent target location with respect to the sensor.

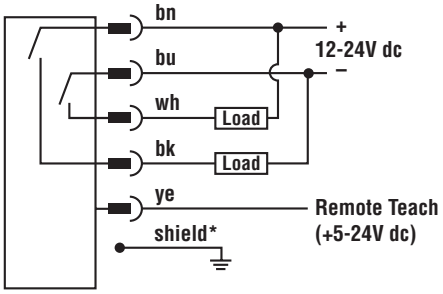
Q45UR Series Controller Hookups

Q45UR Controller with Attached Cable

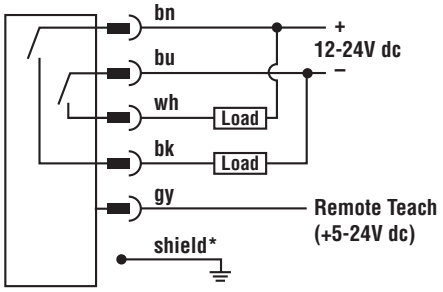


*Shield wire must be connected to ground

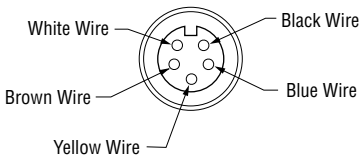
Q45UR Controller with Quick-Disconnect (5-Pin Mini-Style) ("Q" model Suffix)



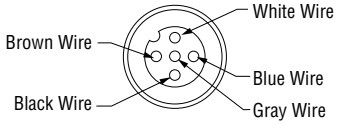
Q45UR Controller with Quick-Disconnect (5-Pin Euro-Style) ("Q6" model Suffix)



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



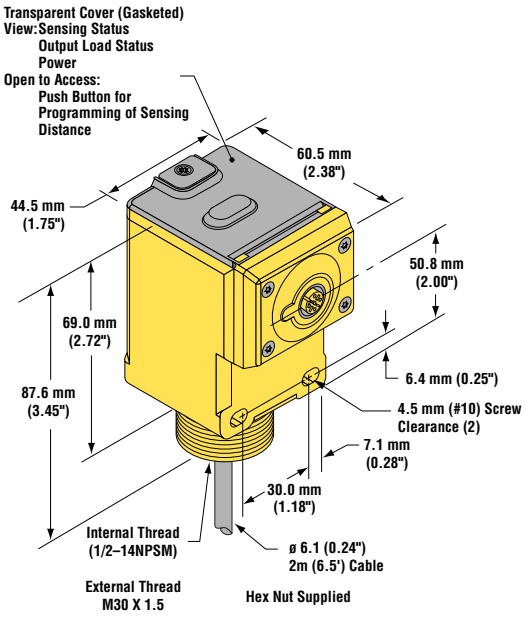
5-Pin Euro-Style Pin-out (Cable Connector Shown)



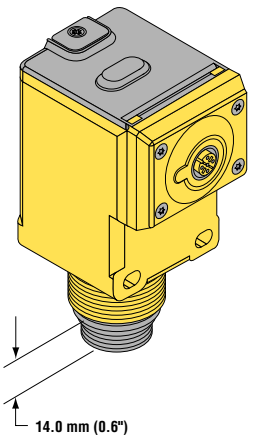
U-GAGE™ Q45UR Remote Ultrasonic Sensors

Q45UR Series Controller Dimensions

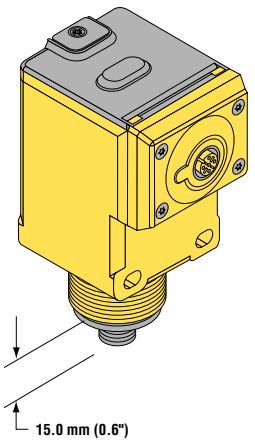
Q45UR Controller with Attached Cable



Q45UR Controller with 5-Pin Mini-Style QD ("Q" model Suffix)

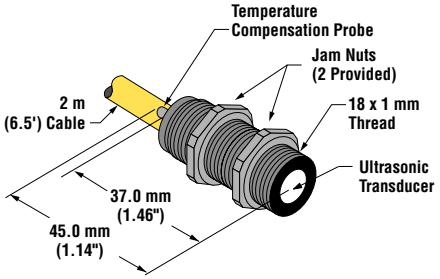


Q45UR Controller with 5-Pin Euro-Style QD ("Q6" model Suffix)

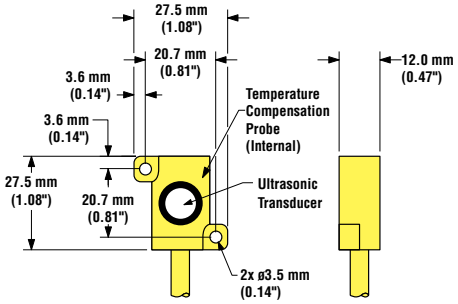


Remote Sensor Dimensions

M18C2.0 and S18C2.0 Sensors

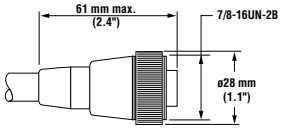
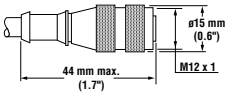
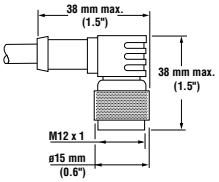


Q13C2.0 Sensors



Accessories

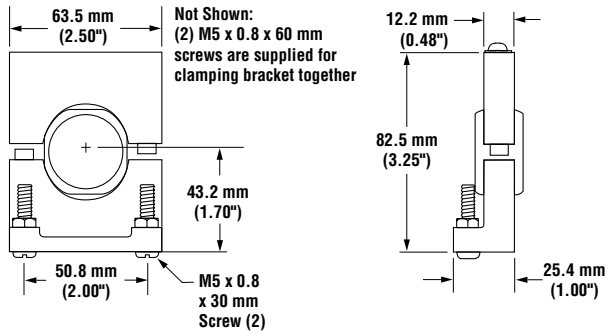
Quick-disconnect (QD) Cables

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

Mounting Brackets for Q45UR Series Controllers

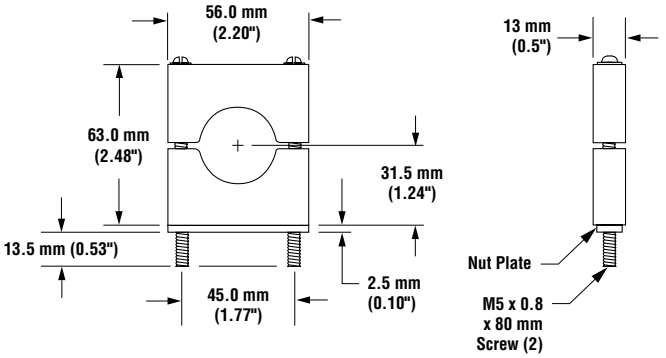
SMB30S

- 30 mm swivel, black PBT polyester bracket
- Stainless steel mounting hardware included



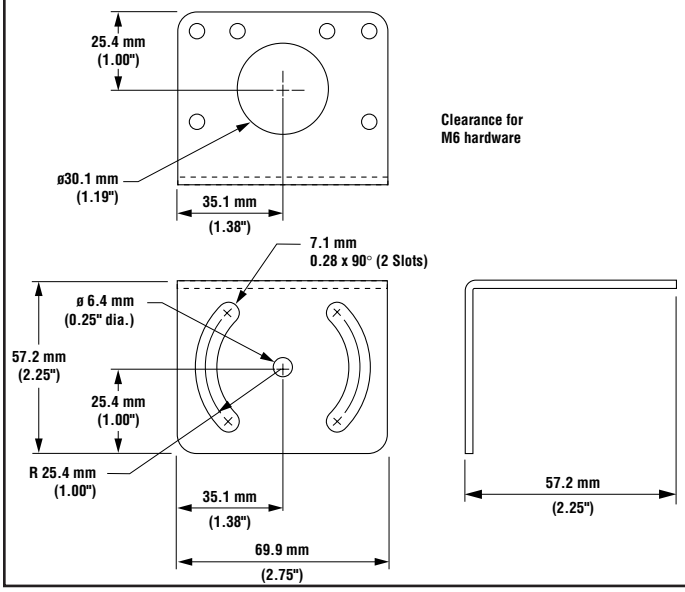
SMB30C

- 30 mm split clamp, black PBT polyester bracket
- Stainless steel mounting hardware included



SMB30MM

- 30 mm, 11-gauge stainless steel bracket
- Curved mounting slots for versatility and orientation

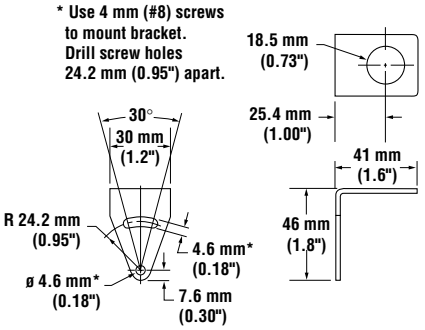


U-GAGE™ Q45UR Remote Ultrasonic Sensors

Mounting Brackets for M18C2.0 and S18C2.0 Sensors

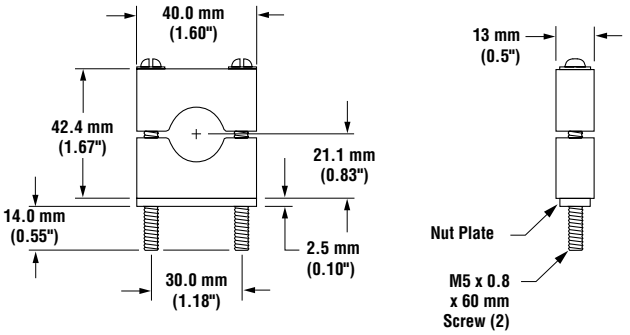
SMB18A

- 11-gauge, stainless steel right-angle bracket
- Curved mounting slot for versatility and orientation



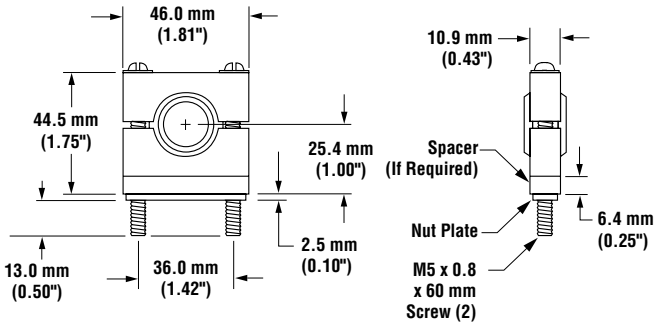
SMB18C

- 18 mm split clamp black PBT polyester bracket
- Stainless steel mounting hardware included



SMB18S

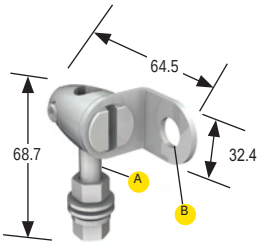
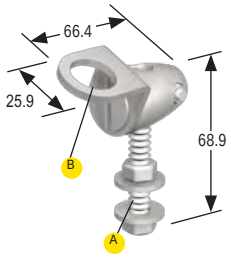
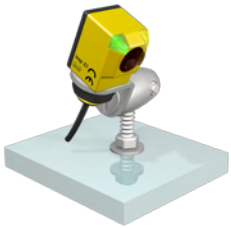
- 18 mm swivel, black PBT polyester bracket
- Stainless steel mounting hardware included



Accessory Mounting Brackets

Mounting Brackets for Photoelectric Sensors

Mounting Brackets

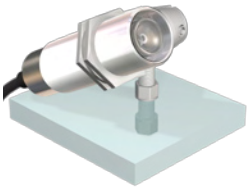
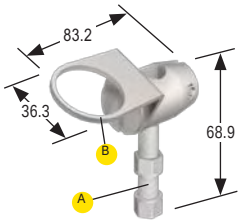
Model		Used With	Features	Dimensions (all measurements in mm)
SMB12FA	Barrel Mount 	• **M12** • **MINI-BEAM**©2	• Swivel bracket with tilt and pan movement for precision adjustment • 12 mm sensor mounting hole	 Ⓐ = 3/8 - 16 x 50.8 Hole size: Ⓑ = ø 12.1
SMB18FA	Barrel Mount 	• **QS18** • **MINI-BEAM** • **S18/M18/T18** • **S18U** • **QS18U** • **Q45UR M18C2** • **Q45UR S18C2** • **T18U** • **T-GAGE M18T** • **EZ-LIGHT M18** • **EZ-LIGHT T18**	• Swivel bracket with tilt and pan movement for precision adjustment • 18 mm sensor mounting hole	 Ⓐ = 3/8 - 16 x 50.8 Hole size: Ⓑ = ø 18.1
	Bracket-to-Bracket 	• **SMBQS18A** • **SMBQS18Y** • **SMBQS18YL** • **SMB4050YL**		
	Base Mount 	• **Q25** • **QS18 Universal** Voltage		

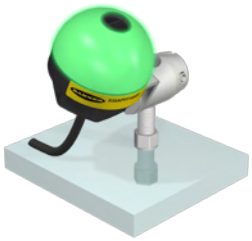
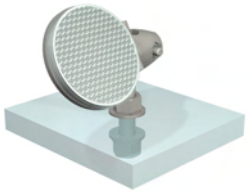
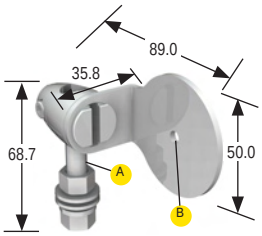
⚠ WARNING . . . Not To Be Used for Personnel Protection

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.

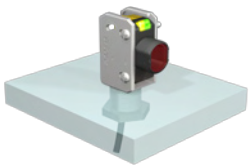
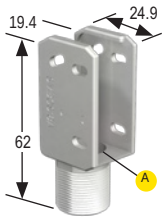
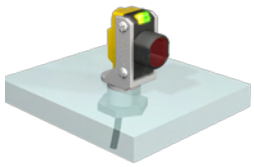
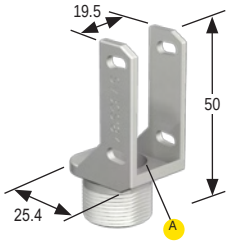
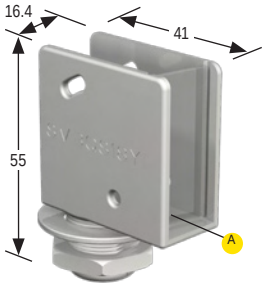
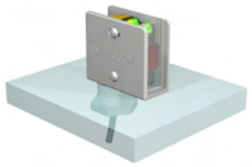
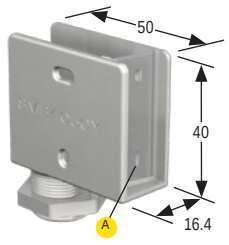
Accessory Mounting Brackets

<table>
<tr>
<td rowspan="2">SMB30FA</td>
<td>Barrel Mount
  </td>
<td>• QS30
• SM30/SMI30
• S30
• T30
• T30U
• EZ-LIGHT T30</td>
<td rowspan="2">• Swivel bracket with tilt and pan movement for precision adjustment
• 30 mm sensor mounting hole</td>
<td rowspan="2"> 

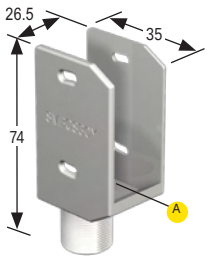
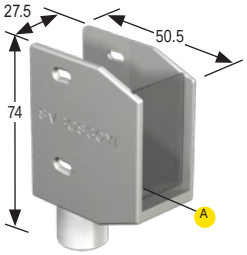
A = 3/8 -16 x 50.8
Hole size: B = ø 30.1</td>
</tr>
<tr>
<td>Base Mount
  </td>
<td>• Q40
• Q45
• Q45U
• Q45UR
• QT50U
• OMNI-BEAM
• OTB/LTB
• VTB
• STB
• K50
• QT50R
• EZ-LIGHT K50L</td>
</tr>
<tr>
<td>SMB50RFA</td>
<td>Round Reflector Mount
  </td>
<td>• BRT-35DM
• BRT-50D
• BRT-42D
• BRT-34T</td>
<td>• Swivel bracket with tilt and pan movement for precision adjustment
• 50 mm diameter plate for mounting a round reflector</td>
<td> 

A = 3/8 -16 x 50.8
Hole size: B = ø 5.4</td>
</tr>
</table>

Accessory Mounting Brackets

SMBQS18A	Side Mount 	• **QS18 (DC only)** • **QS18U** • **QS18AF**	• Wrap-around, die-cast protection bracket • Base fits 18 mm hole • Metal hex nut, lock washer and grommet included	 Hole size: A = ø 15,3
SMBQS18Y	Side Mount 	• **QS18 (DC only)** • **QS18U**	• Die-cast bracket for 18 mm holes • Metal hex nut and lock washer included • Allows ± 8° tilt adjustment for cabled sensors	 Hole size: A = ø 15.3
SMBQS18YL	Side Mount 	• **QS18AF**	• Heavy-duty die-cast bracket for industrial protection • M18 vertical mount option • Nut and lock washer included • Replaceable window (QS18LAF250 only)	 Hole size: A = ø 15.3
SMB4050YL	Base Mount 	• **QS18 (DC only) (except QS18AF)**	• Heavy-duty die-cast bracket designed for industrial protection • M18 vertical mount option • Nut and lock washer included • Replaceable window for use with some sensor models • See datasheet 140733 for compatibility information	 Hole size: A = ø 15.3

Accessory Mounting Brackets

SMBQS30Y	Side Mount 	• **QS30 (DC only)**	• Wrap-around die-cast bracket • M18 vertical mount option • ± 8° tilt adjustment with cabled units • Nut and lock washer included	 Hole size: A = ø 15.3
SMBQS30YL	Side Mount 	• **QS30 (DC only)**	• Heavy-duty die-cast bracket designed for industrial protection • M18 vertical mount option • Replaceable window • Nut and lock washer included	 Hole size: A = ø 15.3

For additional mounting options, see applicable product datasheets

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