



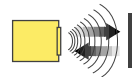
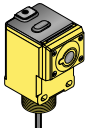
Q45U Ultrasonic Sensors

*Piezoelectric Proximity Mode Sensors with Push button
Programming of Sensing Window Limits*



Features

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



Ultrasonic

Q45U Series Proximity Mode

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

Models with Temperature Compensation:

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

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

For Q45U Ultrasonic Sensors:

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

Q45U Ultrasonic Sensor

Near and Far Sensing Limit Settings:

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

Status Indicators:

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

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

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

Output Response Settings:

IMPORTANT: Remove power before making any internal adjustments.

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

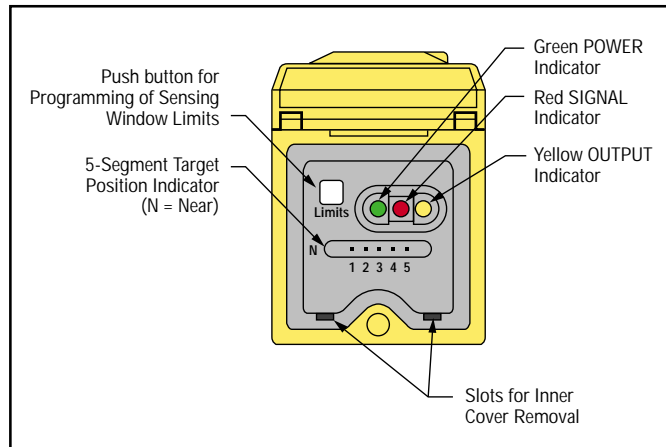


Figure 1. Q45U Features

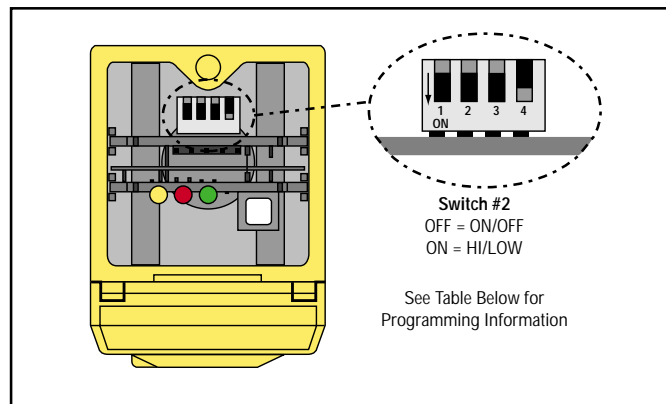


Figure 2. Q45U Programming Switches

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

*Denotes factory settings.

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

Q45U Ultrasonic Sensor

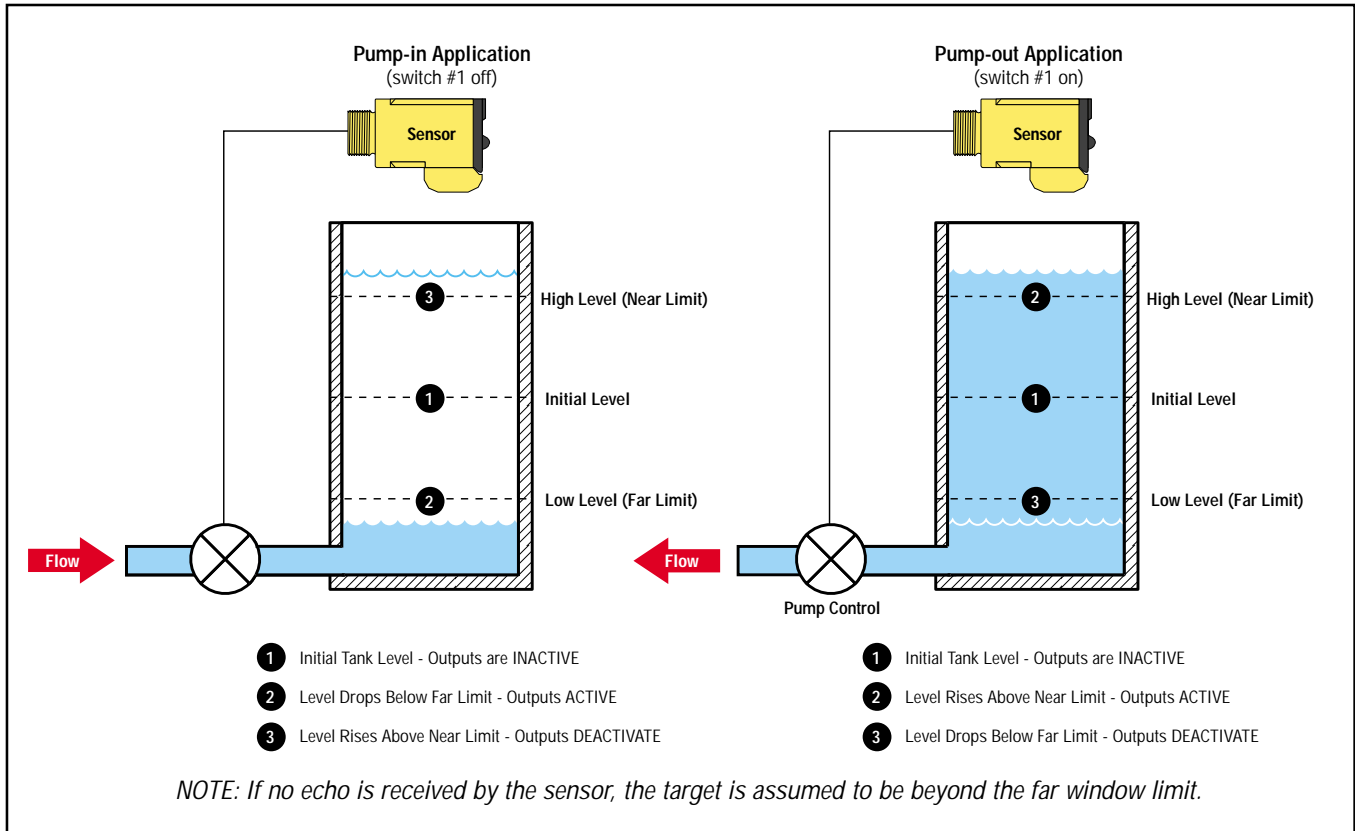



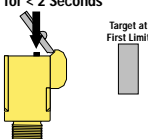
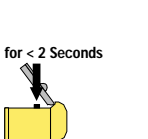
Figure 3. High/Low Level Control (switch #2 on)

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

Q45U Ultrasonic Sensor

Window Limit Programming

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

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

Notes regarding window limit programming:

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

Q45U Ultrasonic Sensor

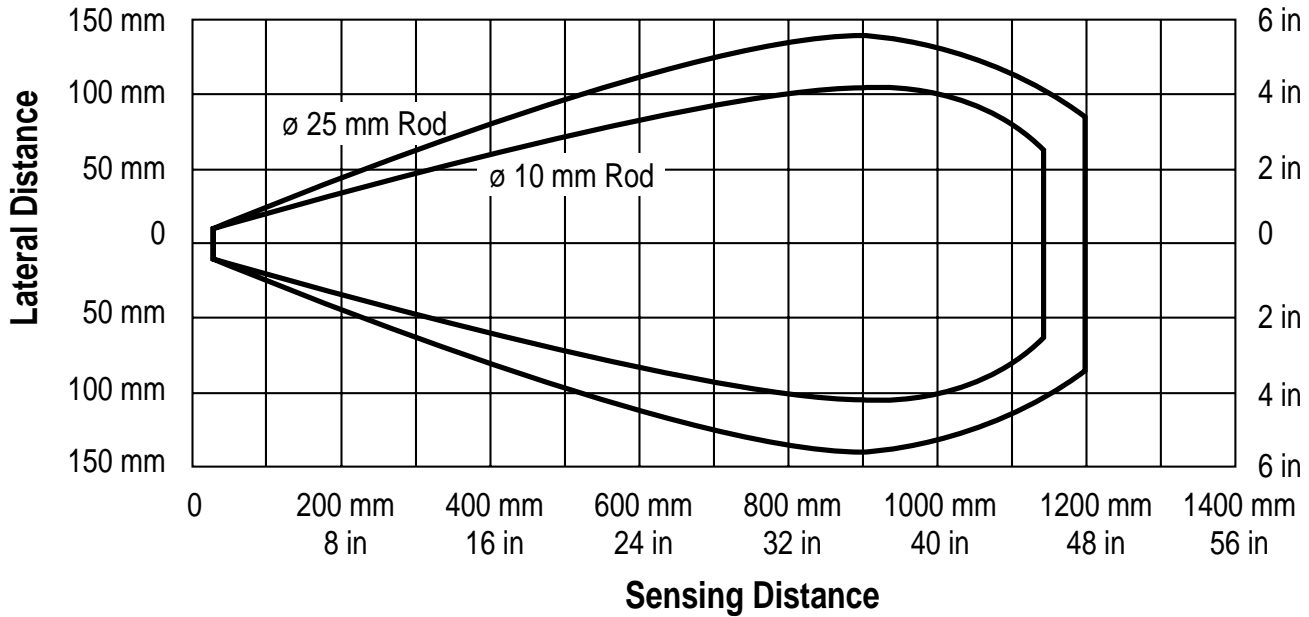
Q45U Series Product Specifications	
Proximity Mode Range	Near limit: 100 mm (4.0 in) min Far limit: 1.4 m (55 in) max
Supply Voltage and Current	12 to 24V dc (10% maximum ripple) at 100mA, exclusive of load
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Bipolar: one current sourcing (PNP) and one current sinking (NPN) open-collector transistor; The following may be selected by a 4-position DIP switch located on top of the sensor, beneath a transparent o-ring sealed LEXAN® cover (see page 2): Switch 1: Output normally open/normally closed (pump in/pump out) Switch 2: High/Low level control mode or on/off presence sensing mode Switch 3 & 4: Response speed selection (digital filter)
Output Rating	150mA maximum (each) Off-state leakage current <25 microamp 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	Repeatability: ±0.1% of measured distance (±.25 mm min) Minimum Window Width: 1 cm Hysteresis: 5 mm
Indicators	Three status LEDs: GREEN glowing steadily = power to sensor is “on” GREEN flashing = output is overloaded YELLOW glowing steadily = outputs are conducting (Yellow 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 VALOX® thermoplastic polyester housing, o-ring sealed transparent LEXAN® top cover, and stainless steel hardware. Q45U sensors are designed to withstand 1200 psi washdown. The base of cabled models has a 1/2”-14NPS internal conduit thread
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m (6.5 ft) or 9 m (30 ft) attached cable, or 5-pin mini-style or 5-pin euro-style quick disconnect fitting
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 non-operation) Also meets IEC 947-5-2 requirements: 30G, 11 ms duration, half sine wave
Hysteresis	ON/OFF mode: 5 mm HIGH/LOW mode: 0 mm
Application Notes	Minimum target size: 10 mm x 10 mm aluminum plate at 500 mm (20 in) 35 mm x 35 mm aluminum plate at 1.4 m (55 in) Enable/Disable: Connect yellow wire to +5 to 24V dc to enable sensor and 0 to +2V dc to disable sensor. When the sensor is disabled, the last output state is held until the sensor is re-enabled. The wire must be held to the appropriate voltage for at least 20 ms for the sensor to enable or disable.

VALOX® and LEXAN® are registered trademarks of General Electric Company

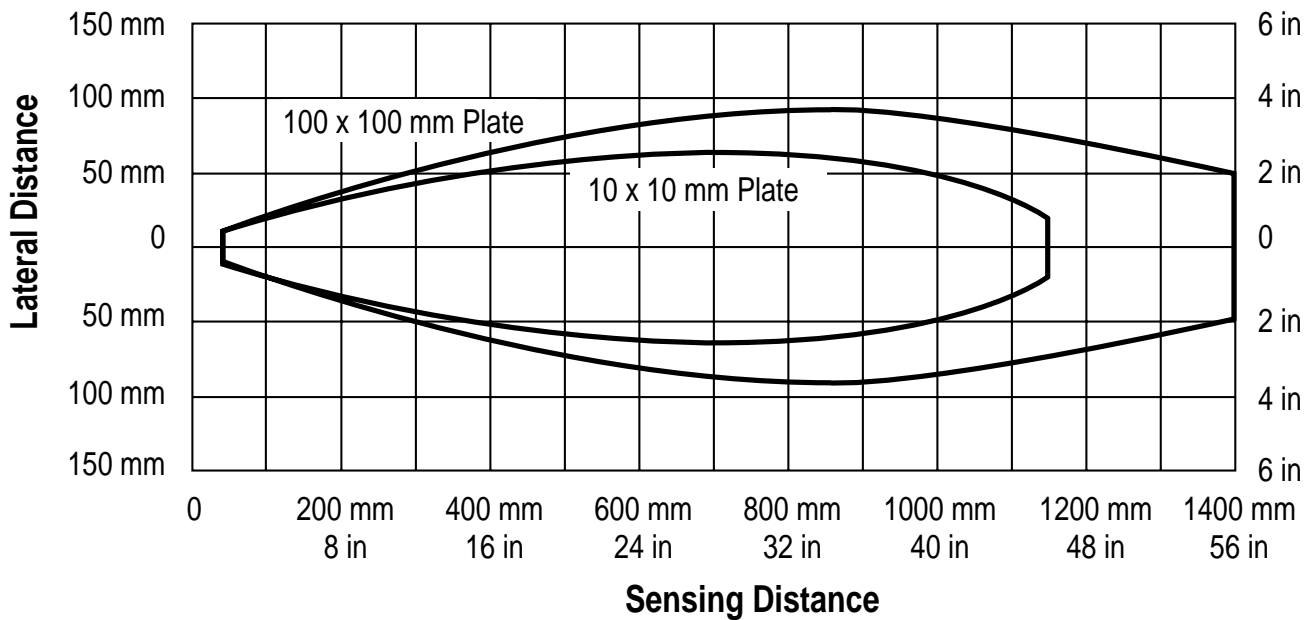
Q45U Ultrasonic Sensor

Q45U Response Curves

Q45U Effective Beam with Rod Target (Typical)



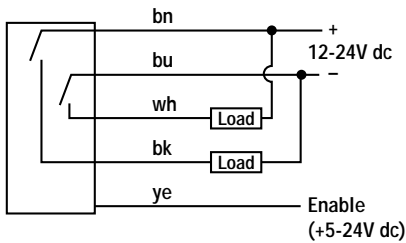
Q45U Effective Beam with Plate Target (Typical)



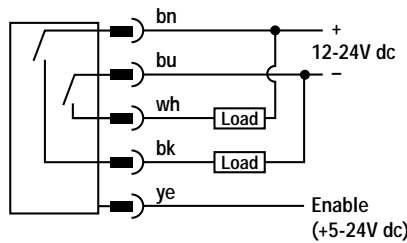
Q45U Ultrasonic Sensor

Q45U Series Hookup Diagrams

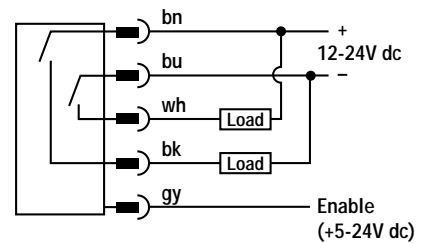
Q45U Sensor with Attached Cable



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



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

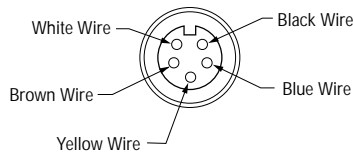


Quick Disconnect (QD) Option

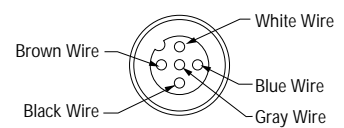
Q45U Ultrasonic sensors are sold with either a 2 m (6.5 ft) or a 9 m (30 ft) attached cable, or with a 5-pin mini-style or 5-pin euro-style QD cable fitting.

For information on QD cables, see next page.

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

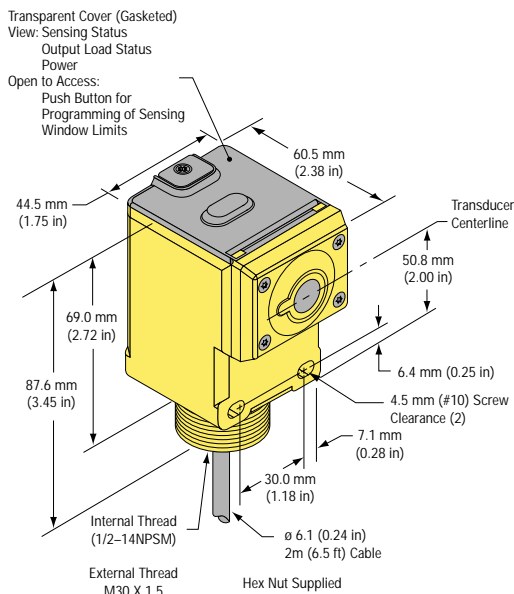


5-Pin Euro-Style Pin-out (Cable Connector Shown)

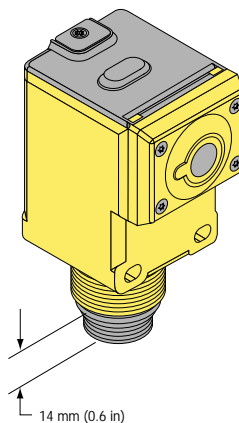


Q45U Series Dimension Information

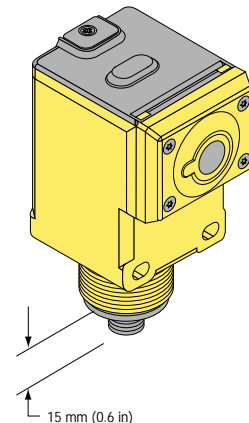
Q45U Sensor with Cable Attached



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

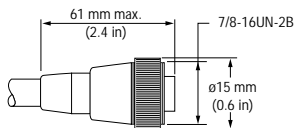
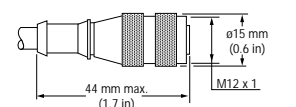
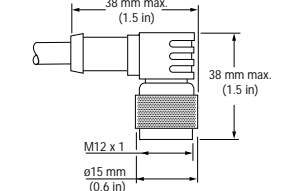


Q45U Sensor with 5-Pin Euro-Style QD ("Q6" model Suffix)



Q45U Ultrasonic Sensor

QUICK DISCONNECT (QD) CABLES

Style	Model	Length	Connector
5-Pin Mini	MBCC-506 MBCC-512 MBCC-530	2 meters (6.5 ft) 4 meters (12 ft) 9 meters (30 ft)	
5-Pin Euro Straight	MQDC1-506 MQDC1-515 MQDC1-530	2 meters (6.5 ft) 5 meters (15 ft) 10 meters (30 ft)	
5-Pin Euro Right-angle	MQDC1-506RA MQDC1-515RA MQDC1-530RA	2 meters (6.5 ft) 4 meters (12 ft) 9 meters (30 ft)	

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



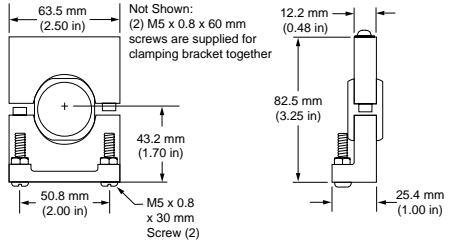
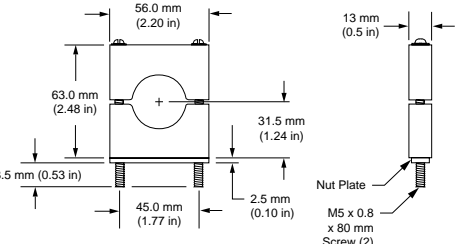
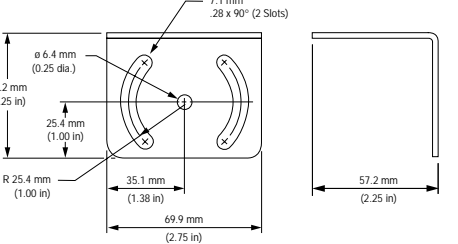
WARNING These ultrasonic presence sensors do NOT include the self-checking redundant circuitry

necessary to allow their use in personnel safety applications. A sensor failure or malfunction can result in either an energized or a de-energized sensor output condition.

Never use these products as sensing devices for personnel protection. Their use as a safety device may create an unsafe condition which could lead to serious injury or death.

Only MICRO-SCREEN™, MINI-SCREEN®, MULTI-SCREEN®, MACHINE-GUARD™ and PERIMETER-GUARD™ Systems, and other systems so designated, are designed to meet OSHA and ANSI machine safety standards for point-of-operation guarding devices. No other Banner sensors or controls are designed to meet these standards, and they must NOT be used as sensing devices for personnel protection.

Mounting Brackets

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





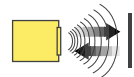
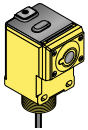
Analog Q45U Ultrasonic Sensors

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



Features

- Ultrasonic proximity detection from 100 to 1400 millimeters (4 to 55 inches)
- Push button TEACH mode programming of sensing window limits
- Digital filtering for exceptional immunity to 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
- Choose models with integral 2 meter (6.5 foot) or 9 meter (30 foot) cable, or with mini-style or euro-style quick disconnect fitting
- Input for remote TEACH mode programming of window limits



Ultrasonic

Analog Q45U Series Proximity Mode

Models	Temperature Compensation	Range	Cable	Supply Voltage	Output Type	Response Time
Q45ULIU64ACR Q45ULIU64ACRQ Q45ULIU64ACRQ6	Yes	100 mm - 1.4 m (4 - 55 in)	2 m (6.5 ft) 5-Pin Mini QD 5-Pin Euro QD	15-24V dc	Selectable 0-10V dc or 4 - 20mA sourcing	Adjustable from 40 milliseconds to 1.28 seconds

Models with Temperature Compensation:

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

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

For Q45U Ultrasonic Sensors:

- 9 m (30 ft) cables are available by adding suffix "W/30" to the model number of the cabled sensor (e.g. - Q45ULIU64ACR W/30)
- A model with a QD connector requires an optional mating cable, see page 8.

Analog Q45U Ultrasonic Sensor

Near and Far Sensing Limit Settings:

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

Status Indicators:

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

- The green LED is on steadily whenever power is applied to the sensor, and flashes to indicate 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.

Output Response Settings:

IMPORTANT: Remove power before making any internal adjustments.

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

Those switches are used to program the following functions:

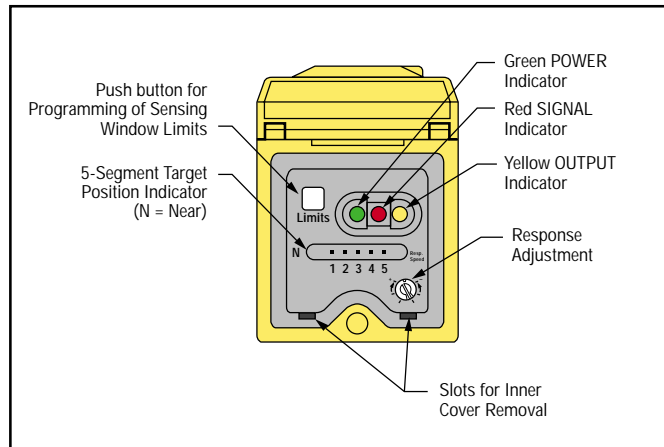


Figure 1. Analog Q45U Features

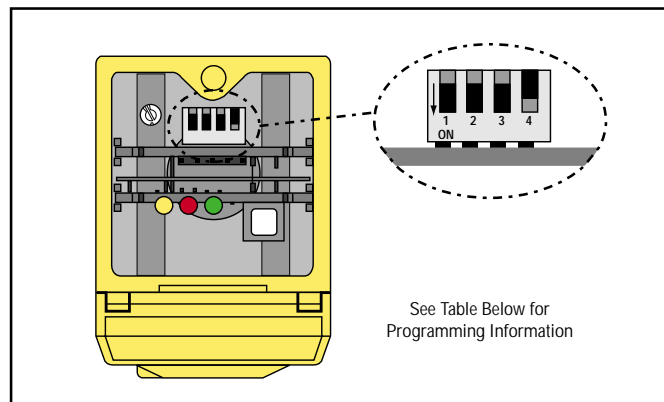


Figure 2. Analog Q45U Programming Switches

Switch	Function	Settings
1	Output Slope	On = Output value <i>increases</i> with distance Off* = Output value <i>decreases</i> 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

*Indicates factory settings

Analog Q45U Ultrasonic Sensor

Explanation of Programmable Output Functions:

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. **This output function can only be set with the power to the sensor turned off.**

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).

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	40 milliseconds (2 cycles)
2	80 milliseconds (4 cycles)
3	160 milliseconds (8 cycles)
4	320 milliseconds (16 cycles)
5	640 milliseconds (32 cycles)
6	1280 milliseconds (64 cycles)

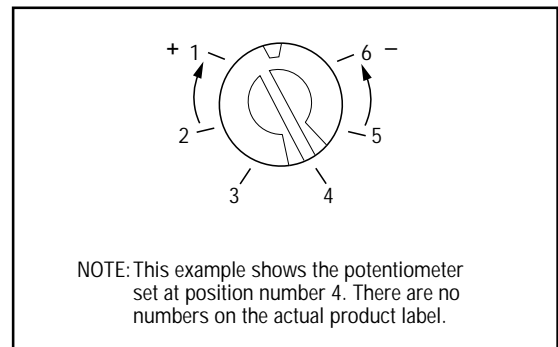


Figure 4. Response Adjustment Positions

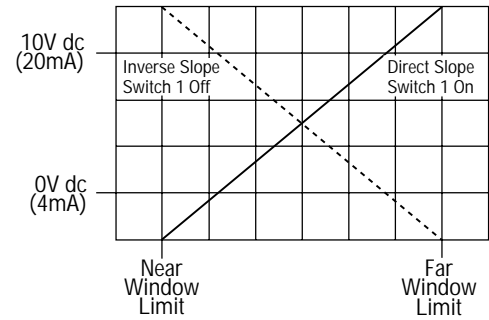

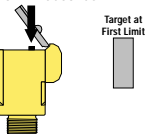
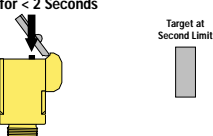


Figure 3. Output Slope

Analog Q45U Ultrasonic Sensor

Window Limit Programming

The "Limits" push button, located under the transparent top cover, is used to program the near and the far limits. The near limit may be set as close as 100 millimeters (4 inches) and the far limit may be set as far as 1400 millimeters (55 inches) from the transducer face. Minimum window width is 10 millimeters (0.4 inches). 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)	Push and Hold for ≥ 2 Seconds 	Green: Goes off Yellow: Is on steadily to indicate ready for teaching first limit Red: Flashes to indicate strength of echo or is off if no target is present
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	Push for < 2 Seconds 	Green: Remains off Yellow: Flashes at 2 Hz to indicate ready for teaching second limit Red: Comes on steadily for a moment, then resumes flashing to indicate strength of echo
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	Push for < 2 Seconds 	Green: Remains off, then comes on steadily (returns to RUN mode) Yellow: On steadily for a moment, then is either on or off to indicate output state (returns to RUN mode) Red: Comes on steadily for a moment, then resumes flashing to indicate strength of echo (returns to RUN mode)

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 of the first limit. 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 0 and 1500 millimeters (the maximum recommended far limit position is 1400 millimeters).
- 5) If the target is positioned between 1400 and 1500 millimeters, 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 millimeter maximum far limit.
- 6) If a limit is rejected during either programming step, the sensor will revert to the first limit programming step (Step 2 in programming chart). This will be indicated by Green - off, Red - flashing to indicate signal strength, and Yellow - on steadily.
- 7) If both limits are accepted, the sensor will return to RUN mode, which is indicated by the Green LED coming on steadily.
- 8) If the target is held at the same position for programming of both limits, the sensor will establish a 10-millimeter wide sensing window, centered on the target position.

Analog Q45U Ultrasonic Sensor

Analog Q45U Series Product Specifications	
Proximity Mode Range	Near limit: 100 mm (4.0 in) min Far limit: 1.4 m (55 in) max
Supply Voltage and Current	15 to 24V dc (10% maximum ripple) at 100mA, 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. Output function may be programmed by a 4-position DIP switch located on top of the sensor, beneath the transparent o-ring sealed LEXAN® cover (see page 3 for complete information)
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	Sensing Repeatability: $\pm 0.1\%$ of the measured distance (± 0.25 mm minimum) Sensing Resolution: 0.25 mm (0.01 in) Analog Output Resolutions: 2mV, 3 μ A
Indicators	Three status LEDs: GREEN glowing steadily = power to sensor is "on" GREEN flashing = current output fault detected (indicates that the 4-20mA current path to ground has been opened) YELLOW glowing steadily = target is sensed within the window limits (Yellow 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 VALOX® thermoplastic polyester housing, o-ring sealed transparent LEXAN® top cover, and stainless steel hardware. Q45U sensors are designed to withstand 1200 psi washdown. The base of cabled models has a 1/2"-14NPS internal conduit thread
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m (6.5 ft) or 9 m (30 ft) attached cable, or 5-pin mini-style or 5-pin euro-style quick disconnect fitting
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 non-operation) 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)

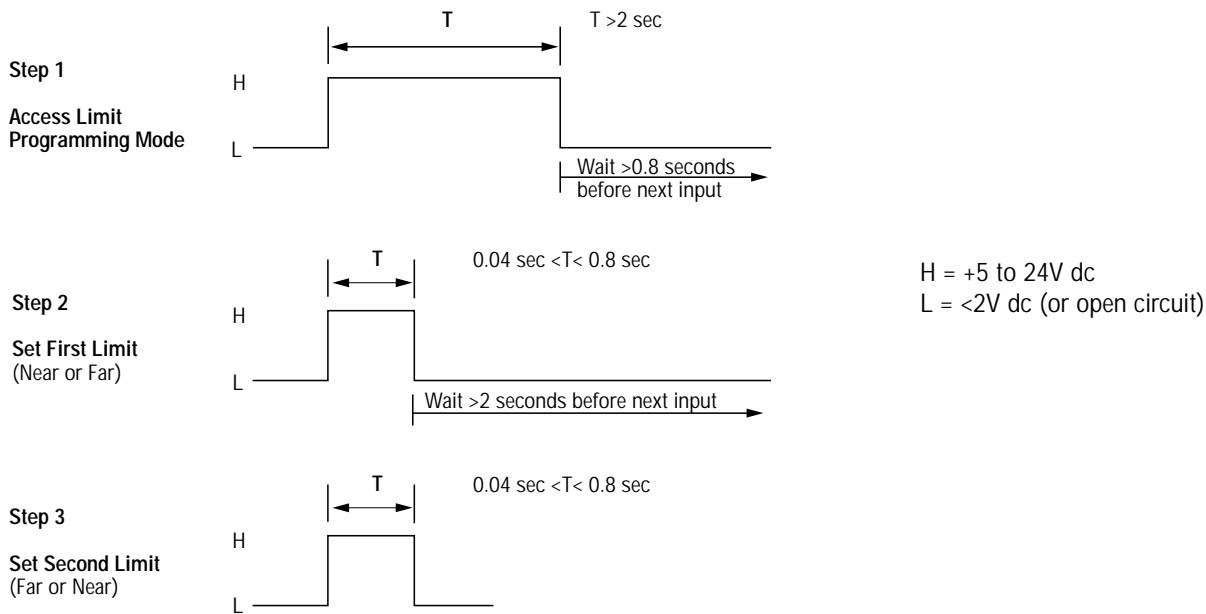
VALOX® and LEXAN® are registered trademarks of General Electric Company

Analog Q45U Ultrasonic Sensor

Remote Window Limit Programming

The yellow wire of the Analog Q45U 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, below, define the required input pulses.

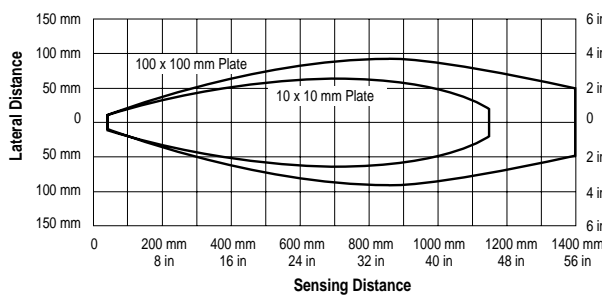


Notes regarding remote window limit programming:

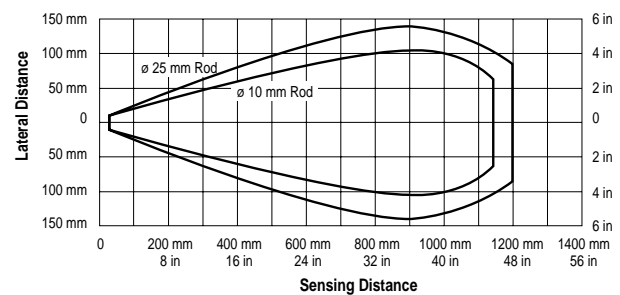
- 1) The push button is disabled during remote limit programming. (The remote programming input is disabled during push button programming.)
- 2) Also see the notes regarding window limit programming on page 4.

Analog Q45U Response Curves

Analog Q45U Effective Beam with Plate Target (Typical)



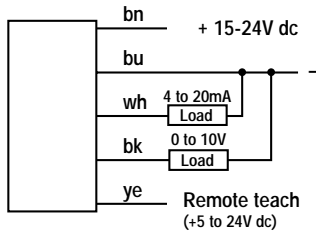
Analog Q45U Effective Beam with Rod Target (Typical)



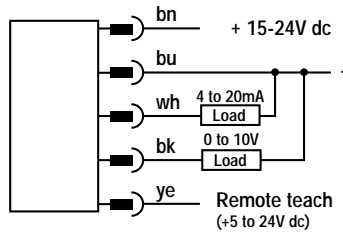
Analog Q45U Ultrasonic Sensor

Analog Q45U Series Hookup Diagrams

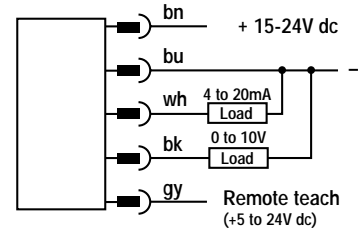
Analog Q45U Sensor with Attached Cable



Analog Q45U Sensor with Quick Disconnect (5-Pin Mini-Style) ("Q" model Suffix)



Analog Q45U Sensor with Quick Disconnect (5-Pin Euro-Style) ("Q6" model Suffix)

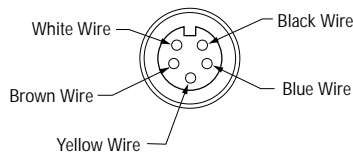


Quick Disconnect (QD) Option

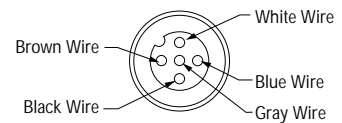
Q45U Ultrasonic sensors are sold with either a 2 m (6.5 ft) or a 9 m (30 ft) attached cable, or with a 5-pin mini-style or 5-pin euro-style QD cable fitting.

For information on QD cables, see next page.

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

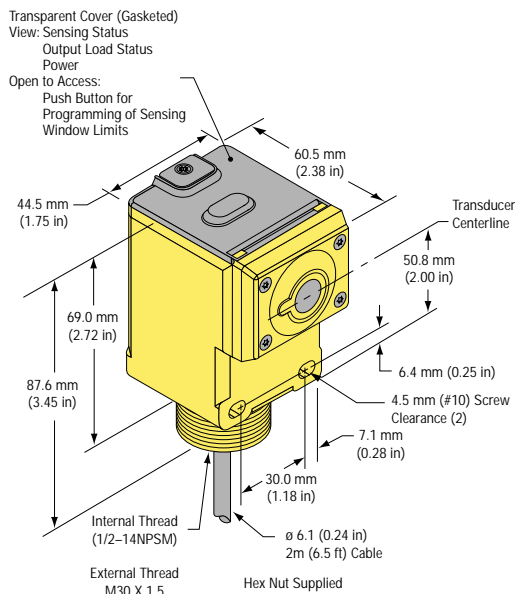


5-Pin Euro-Style Pin-out (Cable Connector Shown)

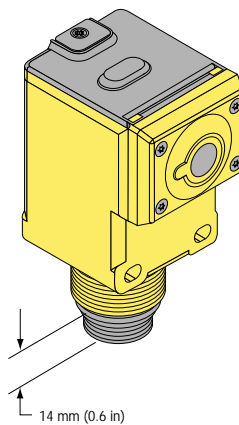


Q45U Series Dimension Information

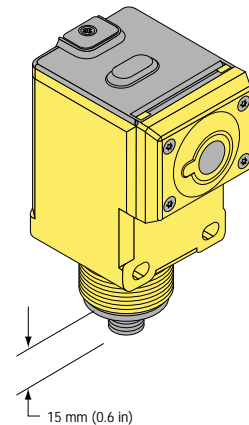
Q45U Sensor with Cable Attached



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

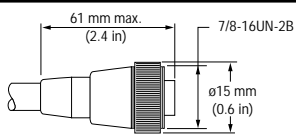
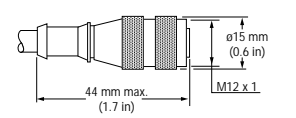
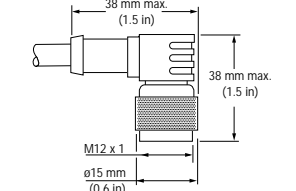


Q45U Sensor with 5-Pin Euro-Style QD ("Q6" model Suffix)



Analog Q45U Ultrasonic Sensor

QUICK DISCONNECT (QD) CABLES

Style	Model	Length	Connector
5-Pin Mini	MBCC-506 MBCC-512 MBCC-530	2 meters (6.5 ft) 4 meters (12 ft) 9 meters (30 ft)	
5-Pin Euro Straight	MQDC1-506 MQDC1-515 MQDC1-530	2 meters (6.5 ft) 5 meters (15 ft) 10 meters (30 ft)	
5-Pin Euro Right-angle	MQDC1-506RA MQDC1-515RA MQDC1-530RA	2 meters (6.5 ft) 4 meters (12 ft) 9 meters (30 ft)	

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



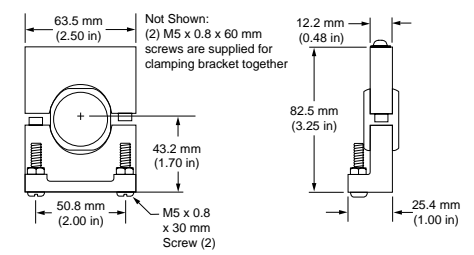
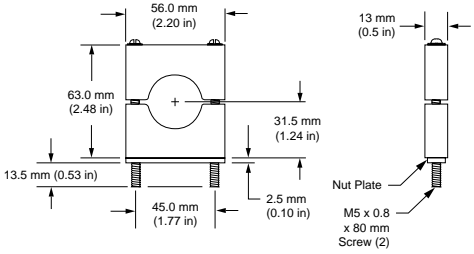
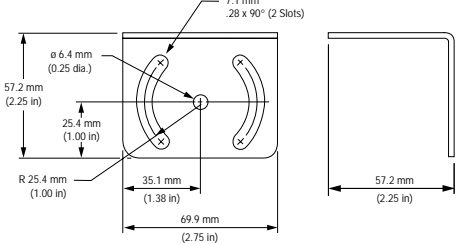
WARNING These ultrasonic presence sensors do NOT include the self-checking redundant circuitry

necessary to allow their use in personnel safety applications. A sensor failure or malfunction can result in either an energized or a de-energized sensor output condition.

Never use these products as sensing devices for personnel protection. Their use as a safety device may create an unsafe condition which could lead to serious injury or death.

Only MICRO-SCREEN™, MINI-SCREEN®, MULTI-SCREEN®, MACHINE-GUARD™ and PERIMETER-GUARD™ Systems, and other systems so designated, are designed to meet OSHA and ANSI machine safety standards for point-of-operation guarding devices. No other Banner sensors or controls are designed to meet these standards, and they must NOT be used as sensing devices for personnel protection.

Mounting Brackets

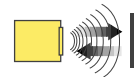
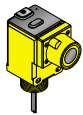
Model	Description	Dimensions
SMB30S	<ul style="list-style-type: none"> 30 mm swivel, black VALOX® bracket Stainless steel mounting hardware included 	
SMB30C	<ul style="list-style-type: none"> 30 mm split clamp, black VALOX® bracket Stainless steel mounting hardware included 	
SMB30MM	<ul style="list-style-type: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





Q45U Long Range Ultrasonic Sensors

*Piezoelectric Proximity Mode Sensors with Push button
Programming of Sensing Window Limits*



Ultrasonic

Features

- Ultrasonic proximity detection from 0.25 to 3.0 meters (9.8 to 118 inches)
- Push button TEACH mode programming of sensing window limits
- Digital filtering for exceptional immunity to electrical and acoustic "noise"
- 12 to 24V dc operation; Bipolar outputs: one NPN (sinking) and one PNP (sourcing)
- ON/OFF presence detection or HIGH/LOW level control are switch-selectable
- Wide operating temperature range of -25° to +70°C; models available with temperature compensation
- Rugged design for use in demanding sensing environments; rated IEC IP67, NEMA 6P
- Choose models with integral 2 meter (6.5 foot) or 9 meter (30 foot) cable, or with mini-style or euro-style quick disconnect fitting
- External enable/disable feature for remote gating control

Q45U Series Proximity Mode

Models	Temperature Compensation	Range	Cable	Supply Voltage	Output Type	Response Time
Q45UBB63BC Q45UBB63BCQ Q45UBB63BCQ6	Yes	250 mm - 3.0 m (9.8 - 118 in)	2 m (6.5 ft) 5-Pin Mini QD 5-Pin Euro QD	12-24V dc	Bipolar NPN/PNP	Programmable for 40, 80, 320, or 1280 milliseconds

Models with Temperature Compensation:

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

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

For Q45U Ultrasonic Sensors:

- 9 m (30 ft) cables are available by adding suffix "W/30" to the model number of any cabled sensor (e.g. - Q45UBB63BC W/30)
- A model with a QD connector requires an optional mating cable, see page 8.

Q45U Long Range Ultrasonic Sensor

Near and Far Sensing Limit Settings:

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

Status Indicators:

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

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

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

Output Response Settings:

IMPORTANT: Remove power before making any internal adjustments.

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

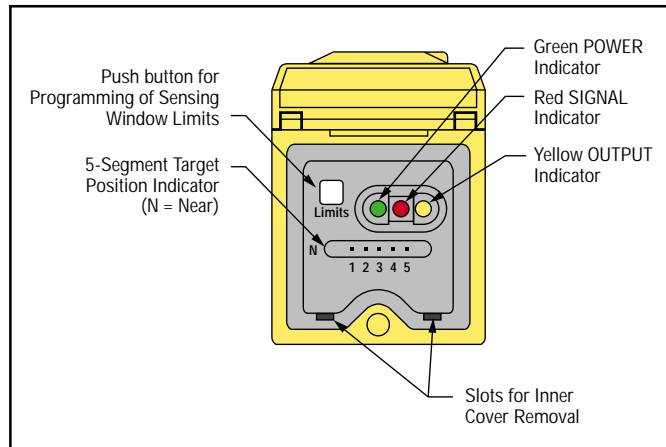


Figure 1. Q45U Features

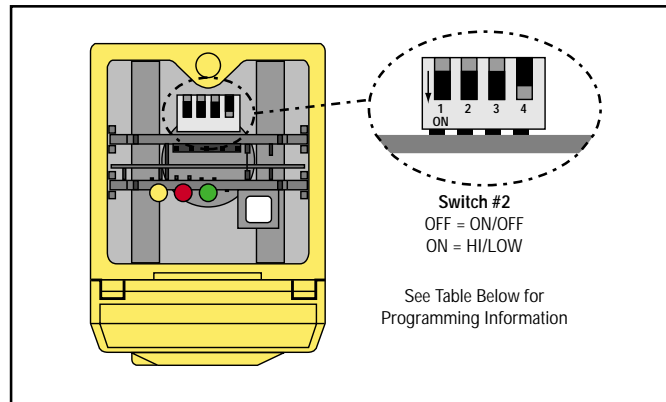


Figure 2. Q45U Programming Switches

Switch	Function		
1	ON/OFF Mode Output: On = normally closed (output energizes when target is absent) Off* = normally open (output energizes when target sensed)		HIGH/LOW Mode On = Pump Out Off = Pump In
2	Mode: On = HIGH/LOW (fill level control, see description, on page 3) Off* = ON/OFF (output follows sensing action)		
3 - 4	Response (40 ms/cycle)	Switch 3	Switch 4
	1 Cycle 2 Cycles 8 Cycles* 32 Cycles	Off On Off On	Off Off On On

*Denotes factory settings.

NOTE: Response setting of 2 cycles, or higher, is recommended for optimum sonic and electrical noise immunity. Always use the slowest acceptable response speed for your application. Single cycle update is only recommended for short range (>1.0 m) applications looking for a stationary background target.

Q45U Long Range Ultrasonic Sensor

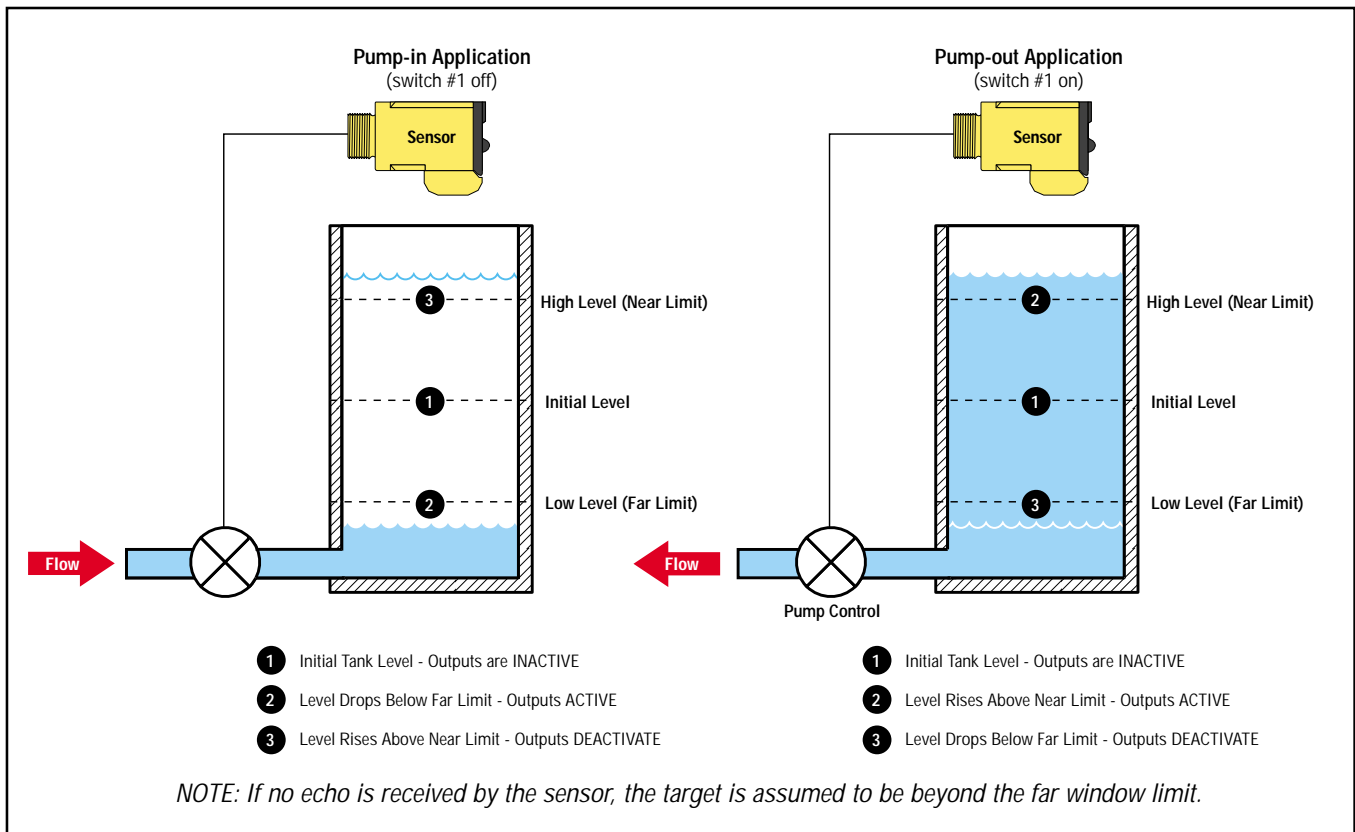



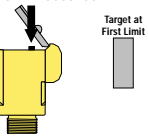
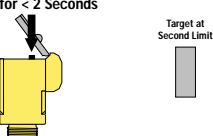
Figure 3. High/Low Level Control (switch #2 on)

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

Q45U Long Range Ultrasonic Sensor

Window Limit Programming

The "Limits" push button, located under the transparent top cover, is used to program the near and the far limits. The near limit may be set as close as 250 millimeters (9.8 inches) and the far limit may be set as far as 3.0 meters (118 inches) from the transducer face. Minimum window width is 25 millimeters (1.0 inch). 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 Push and hold until green indicator turns off (approximately 2 seconds)	Push and Hold for ≥ 2 Seconds 	Green: Goes off Yellow: Is on steadily to indicate ready for teaching first limit Red: Flashes to indicate strength of echo or is off if no target is present
Step 2 FIRST LIMIT (Near or Far) Place the target at the first limit and press the push button for less than 2 seconds	Push for < 2 Seconds 	Green: Remains off Yellow: Flashes at 2 Hz to indicate ready for teaching second limit Red: Comes on steadily for a moment, then resumes flashing to indicate strength of echo
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	Push for < 2 Seconds 	Green: Remains off, then comes on steadily (returns to RUN mode) Yellow: On steadily for a moment, then is either on or off to indicate output state (returns to RUN mode) Red: Comes on steadily for a moment, then resumes flashing to indicate strength of echo (returns to RUN mode)

Notes regarding window limit programming:

- 1) Either the near or far limit may be programmed, first.
- 2) There is a 2 minute timeout for programming of the first limit. The sensor will return to RUN mode with the previously programmed limits. There is no timeout between programming of the first and second limit.
- 3) The programming sequence may be cancelled at any time by pressing and holding the push button for ≥ 2 seconds. The sensor returns to RUN mode with the previously programmed limits.
- 4) During limit programming, the 5-segment moving dot indicator displays the relative target position between 0 and 4.0 meters (the maximum recommended far limit position is 3.0 meters).
- 5) If the target is positioned between 3.0 and 4.0 meters, 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 meter maximum far limit.
- 6) If a limit is rejected during either programming step, the sensor will revert to the first limit programming step (Step 2 in programming chart). This will be indicated by Green - off, Red - flashing to indicate signal strength, and Yellow - on steadily.
- 7) If both limits are accepted, the sensor will return to RUN mode, which is indicated by the Green LED coming on steadily.
- 8) If the target is held at the same position for programming of both limits, the sensor will establish a 50-millimeter wide sensing window, centered on the target position.

Q45U Long Range Ultrasonic Sensor

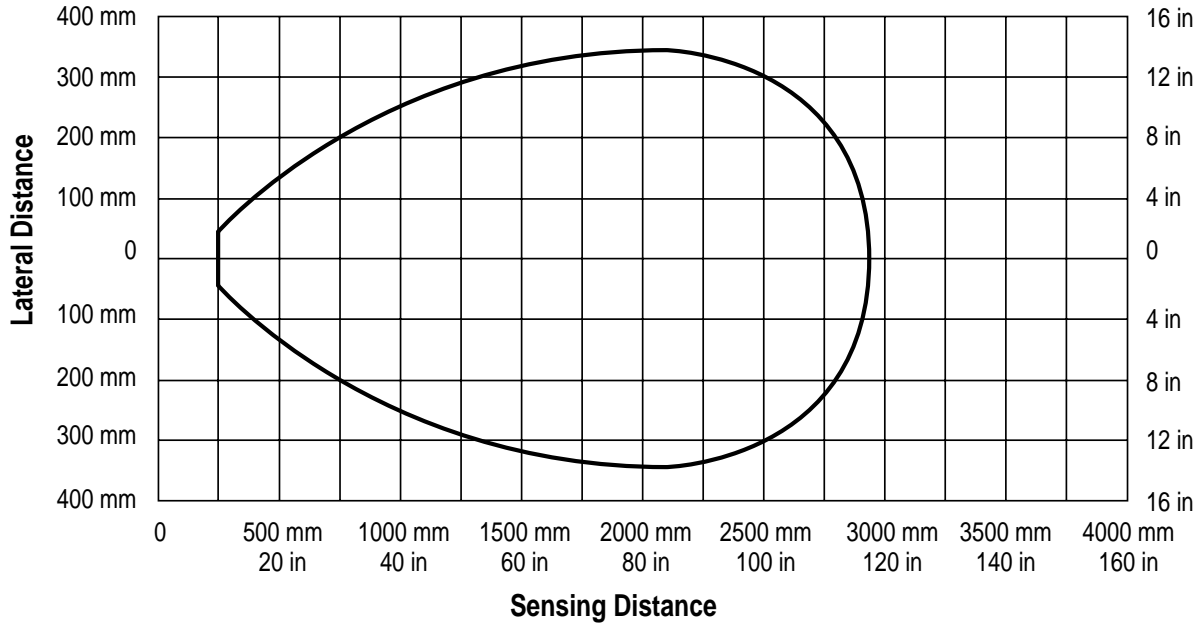
Q45U Series Product Specifications	
Proximity Mode Range	Near limit: 250 mm (9.8 in) min Far limit: 3.0 m (118 in) Note: The far limit may be extended as far as 3.9 m for good acoustical targets (hard surfaces with area > 100 cm ²)
Supply Voltage and Current	12 to 24V dc (10% maximum ripple) at 100mA, 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; The following may be selected by a 4-position DIP switch located on top of the sensor, beneath a transparent o-ring sealed LEXAN® cover (see page 2): Switch 1: Output normally open/normally closed (pump in/pump out) Switch 2: High/Low level control mode or on/off presence sensing mode Switch 3 & 4: Response speed selection (digital filter)
Output Rating	150mA maximum (each) Off-state leakage current <25 microamp 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	Repeatability: ±0.1% of measured distance (±.50 mm min) Minimum Window Width: 25 mm (1.0 in) Hysteresis: 10 mm (0.4 in)
Indicators	Three status LEDs: GREEN glowing steadily = power to sensor is "on" GREEN flashing = output is overloaded YELLOW glowing steadily = outputs are conducting (Yellow 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 VALOX® thermoplastic polyester housing, o-ring sealed transparent LEXAN® top cover, and stainless steel hardware. Q45U sensors are designed to withstand 1200 psi washdown. The base of cabled models has a 1/2"-14NPS internal conduit thread
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m (6.5 ft) or 9 m (30 ft) attached cable, or 5-pin mini-style or 5-pin euro-style quick disconnect fitting
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 non-operation) Also meets IEC 947-5-2 requirements: 30G, 11 ms duration, half sine wave
Hysteresis	ON/OFF mode: 10 mm HIGH/LOW mode: 0 mm
Application Notes	Minimum target size: 50 mm x 50 mm aluminum plate at 3.0 m (118 in) Enable/Disable: Connect yellow wire to +5 to 24V dc to enable sensor and 0 to +2V dc to disable sensor. When the sensor is disabled, the last output state is held until the sensor is re-enabled. The wire must be held to the appropriate voltage for at least 20 ms for the sensor to enable or disable.

VALOX® and LEXAN® are registered trademarks of General Electric Company

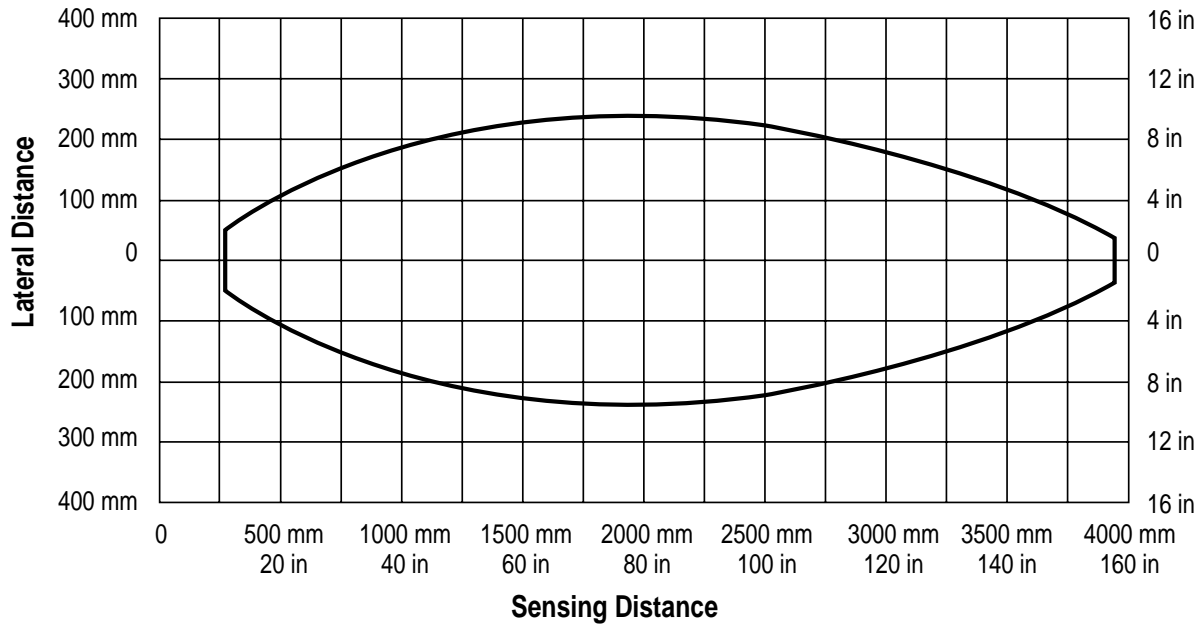
Q45U Long Range Ultrasonic Sensor

Q45U Response Curves

Q45U Effective Beam with 2.5 cm Rod Target (Typical)



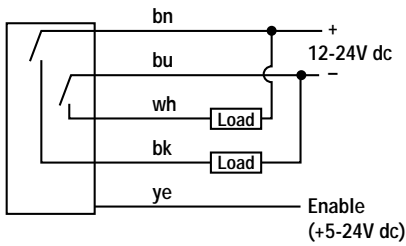
Q45U Effective Beam with 100 mm x 100 mm Plate Target (Typical)



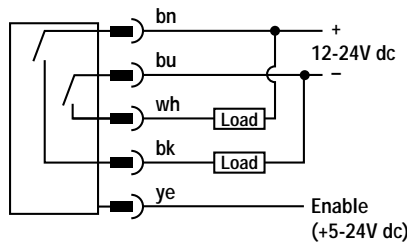
Q45U Long Range Ultrasonic Sensor

Q45U Series Hookup Diagrams

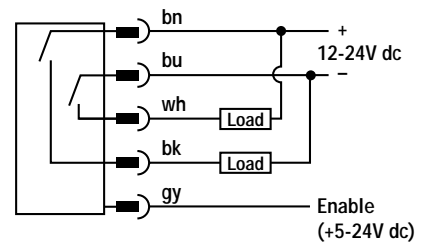
Q45U Sensor with Attached Cable



Q45U Sensor with Quick Disconnect (5-Pin Mini-Style) ("Q" model suffix)



Q45U Sensor with Quick Disconnect (5-Pin Euro-Style) ("Q6" model suffix)

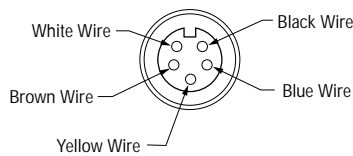


Quick Disconnect (QD) Option

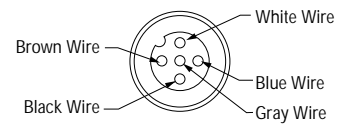
Q45U Ultrasonic sensors are sold with either a 2 m (6.5 ft) or a 9 m (30 ft) attached cable, or with a 5-pin mini-style or 5-pin euro-style QD cable fitting.

For information on QD cables, see next page.

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

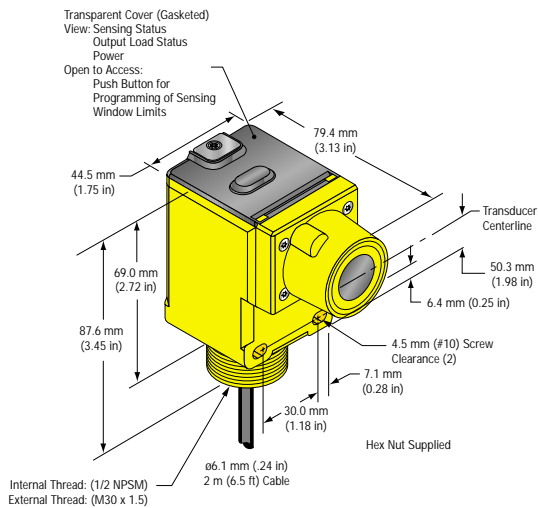


5-Pin Euro-Style Pin-out (Cable Connector Shown)

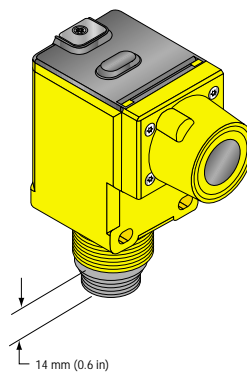


Analog Q45U Series Dimension Information

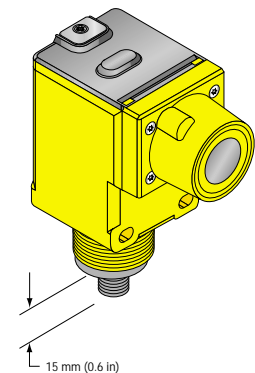
Analog Q45U Sensor with Cable Attached



Analog Q45U Sensor with 5-Pin Mini-Style QD

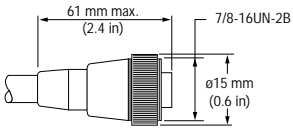
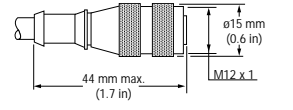
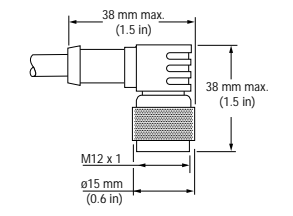


Analog Q45U Sensor with 5-Pin Euro-Style QD



Q45U Long Range Ultrasonic Sensor

QUICK DISCONNECT (QD) CABLES

Style	Model	Length	Connector
5-Pin Mini	MBCC-506 MBCC-512 MBCC-530	2 meters (6.5 ft) 4 meters (12 ft) 9 meters (30 ft)	
5-Pin Euro Straight	MQDC1-506 MQDC1-515 MQDC1-530	2 meters (6.5 ft) 5 meters (15 ft) 10 meters (30 ft)	
5-Pin Euro Right -angle	MQDC1-506RA MQDC1-515RA MQDC1-530RA	2 meters (6.5 ft) 4 meters (12 ft) 9 meters (30 ft)	

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



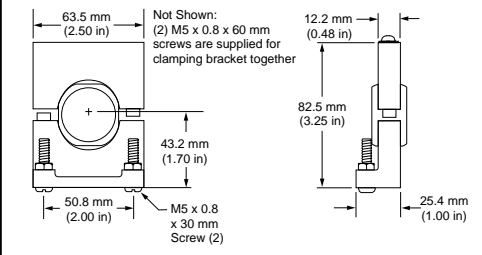
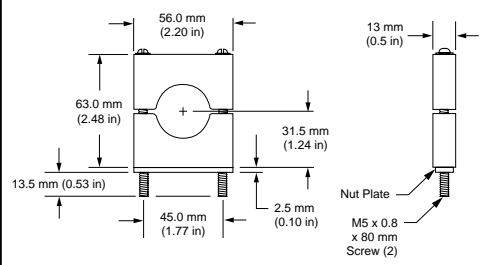
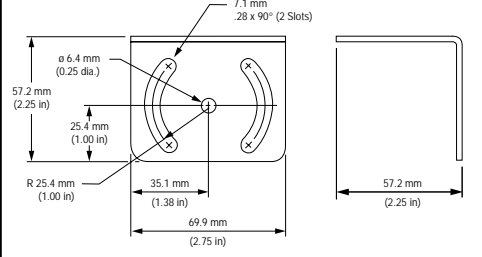
WARNING These ultrasonic presence sensors do NOT include the self-checking redundant circuitry

necessary to allow their use in personnel safety applications. A sensor failure or malfunction can result in either an energized or a de-energized sensor output condition.

Never use these products as sensing devices for personnel protection. Their use as a safety device may create an unsafe condition which could lead to serious injury or death.

Only MICRO-SCREEN™, MINI-SCREEN®, MULTI-SCREEN®, MACHINE-GUARD™ and PERIMETER-GUARD™ Systems, and other systems so designated, are designed to meet OSHA and ANSI machine safety standards for point-of-operation guarding devices. No other Banner sensors or controls are designed to meet these standards, and they must NOT be used as sensing devices for personnel protection.

Mounting Brackets

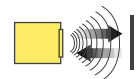
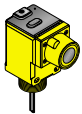
Model	Description	Dimensions
SMB30S	<ul style="list-style-type: none"> 30 mm swivel, black VALOX® bracket Stainless steel mounting hardware included 	
SMB30C	<ul style="list-style-type: none"> 30 mm split clamp, black VALOX® bracket Stainless steel mounting hardware included 	
SMB30MM	<ul style="list-style-type: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

BANNER[®]
the photoelectric specialist



Analog Q45U Long Range Ultrasonic Sensors

*Piezoelectric Proximity Mode Sensors with Push button
Programming of Sensing Window Limits*



Ultrasonic

Features

- Ultrasonic proximity detection from 0.25 to 3.0 meters (9.8 to 118 inches)
- Push button TEACH mode programming of sensing window limits
- Digital filtering for exceptional immunity to 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
- Choose models with integral 2 meter (6.5 foot) or 9 meter (30 foot) cable, or with mini-style or euro-style quick disconnect fitting
- Input for remote TEACH mode programming of window limits

Analog Q45U Series Proximity Mode

Models	Temperature Compensation	Range	Cable	Supply Voltage	Output Type	Response Time
Q45ULIU64BCR Q45ULIU64BCRQ Q45ULIU64BCRQ6	Yes	250 mm - 3.0 m (9.8 - 118 in)	2 m (6.5 ft) 5-Pin Mini QD 5-Pin Euro QD	15-24V dc	Selectable 0-10V dc or 4 - 20mA sourcing	Adjustable from 80 milliseconds to 2.56 seconds

Models with Temperature Compensation:

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

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

For Q45U Ultrasonic Sensors:

- 9 m (30 ft) cables are available by adding suffix "W/30" to the model number of the cabled sensor (e.g. - Q45ULIU64BCR W/30)
- A model with a QD connector requires an optional mating cable, see page 8.

Analog Q45U Long Range Ultrasonic Sensor

Near and Far Sensing Limit Settings:

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

Status Indicators:

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

- The green LED is on steadily whenever power is applied to the sensor, and flashes to indicate 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.

Output Response Settings:

IMPORTANT: Remove power before making any internal adjustments.

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

Those switches are used to program the following functions:

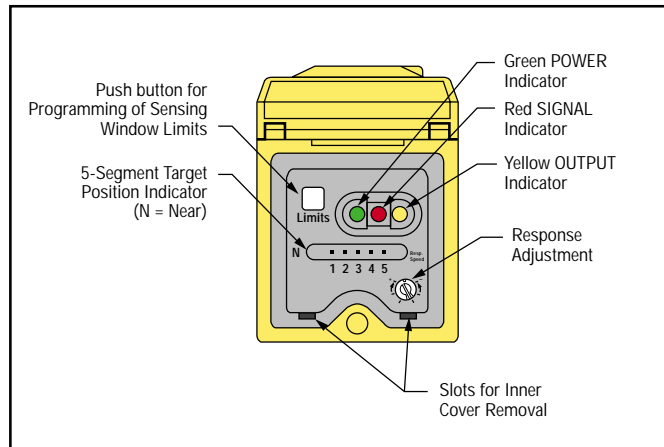


Figure 1. Analog Q45U Features

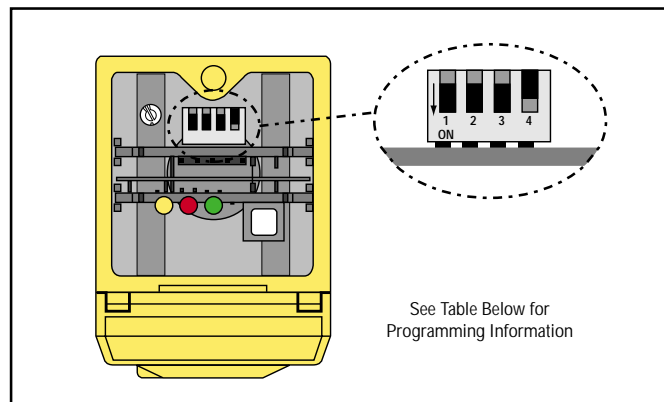


Figure 2. Analog Q45U Programming Switches

Switch	Function	Settings
1	Output Slope	On = Output value <i>increases</i> with distance Off* = Output value <i>decreases</i> 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

*Indicates factory settings

Analog Q45U Long Range Ultrasonic Sensor

Explanation of Programmable Output Functions:

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. **This output function can only be set with the power to the sensor turned off.**

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).

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	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)

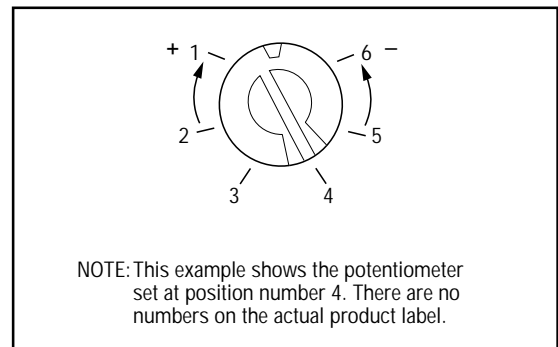


Figure 4. Response Adjustment Positions

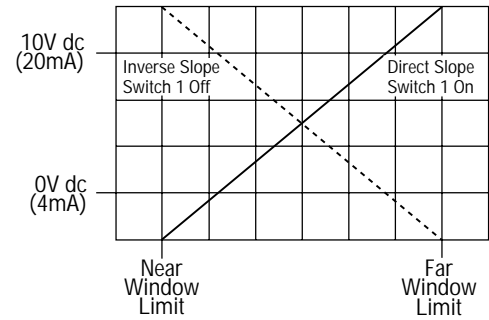

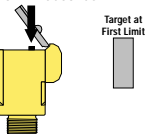
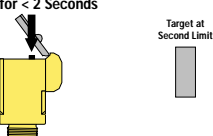


Figure 3. Output Slope

Analog Q45U Long Range Ultrasonic Sensor

Window Limit Programming

The "Limits" push button, located under the transparent top cover, is used to program the near and the far limits. The near limit may be set as close as 250 millimeters (9.8 inches) and the far limit may be set as far as 3.0 meters (118 inches) from the transducer face. Minimum window width is 25 millimeters (1 inch). 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)	Push and Hold for ≥ 2 Seconds 	Green: Goes off Yellow: Is on steadily to indicate ready for teaching first limit Red: Flashes to indicate strength of echo or is off if no target is present
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	Push for < 2 Seconds 	Green: Remains off Yellow: Flashes at 2 Hz to indicate ready for teaching second limit Red: Comes on steadily for a moment, then resumes flashing to indicate strength of echo
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	Push for < 2 Seconds 	Green: Remains off, then comes on steadily (returns to RUN mode) Yellow: On steadily for a moment, then is either on or off to indicate output state (returns to RUN mode) Red: Comes on steadily for a moment, then resumes flashing to indicate strength of echo (returns to RUN mode)

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 of the first limit. 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 0 and 4.0 meters (the maximum recommended far limit position is 3.0 meters).
- 5) If the target is positioned between 3.0 and 4.0 meters, 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 meter maximum far limit.
- 6) If a limit is rejected during either programming step, the sensor will revert to the first limit programming step (Step 2 in programming chart). This will be indicated by Green - off, Red - flashing to indicate signal strength, and Yellow - on steadily.
- 7) If both limits are accepted, the sensor will return to RUN mode, which is indicated by the Green LED coming on steadily.
- 8) If the target is held at the same position for programming of both limits, the sensor will establish a 50-millimeter wide sensing window, centered on the target position.

Analog Q45U Long Range Ultrasonic Sensor

Analog Q45U Series Product Specifications	
Proximity Mode Range	Near limit: 250 mm (9.8 in) min Far limit: 3.0 m (118 in) Note: the far limit may be extended as far as 3.9 m for good acoustical targets (hard surfaces with area > 100 cm ²)
Supply Voltage and Current	15 to 24V dc (10% maximum ripple) at 100mA, 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. Output function may be programmed by a 4-position DIP switch located on top of the sensor, beneath the transparent o-ring sealed LEXAN® cover (see page 3 for complete information)
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	Sensing Repeatability: ±0.1% of the measured distance (±0.50 mm minimum) Sensing Resolution: 0.50 mm (0.02 in) Analog Output Resolutions: 2mV, 3µA
Indicators	Three status LEDs: GREEN glowing steadily = power to sensor is "on" GREEN flashing = current output fault detected (indicates that the 4-20mA current path to ground has been opened) YELLOW glowing steadily = target is sensed within the window limits (Yellow 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 VALOX® thermoplastic polyester housing, o-ring sealed transparent LEXAN® top cover, and stainless steel hardware. Q45U sensors are designed to withstand 1200 psi washdown. The base of cabled models has a 1/2"-14NPS internal conduit thread
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m (6.5 ft) or 9 m (30 ft) attached cable, or 5-pin mini-style or 5-pin euro-style quick disconnect fitting
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 non-operation) 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 in)

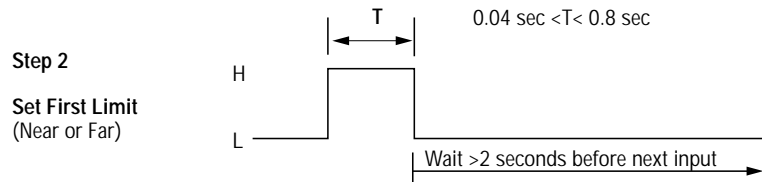
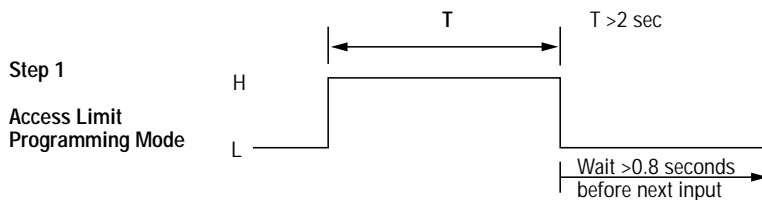
VALOX® and LEXAN® are registered trademarks of General Electric Company

Analog Q45U Long Range Ultrasonic Sensor

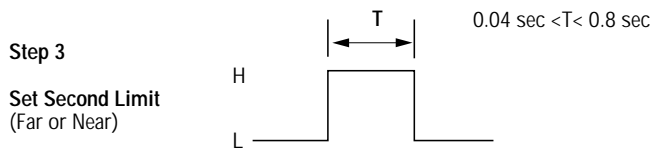
Remote Window Limit Programming

The yellow wire of the Analog Q45U 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, below, define the required input pulses.



H = +5 to 24V dc
L = <2V dc (or open circuit)

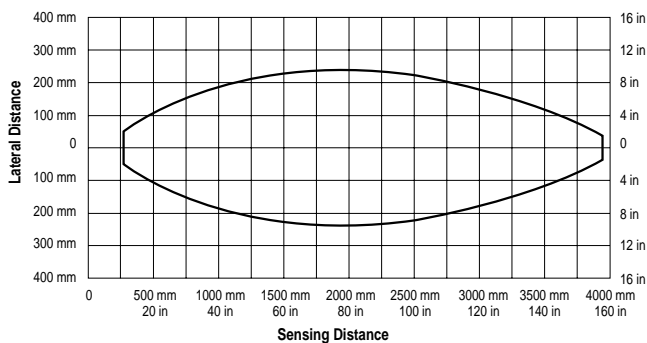


Notes regarding remote window limit programming:

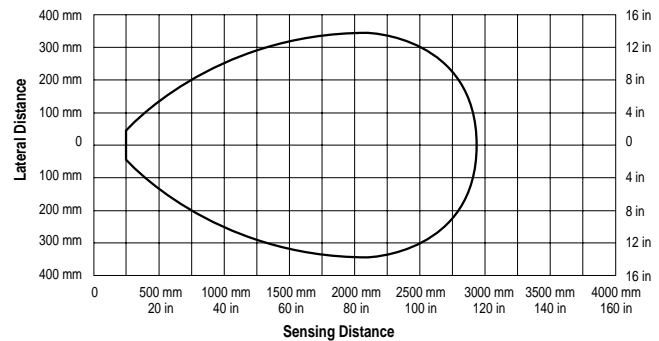
- 1) The push button is disabled during remote limit programming. (The remote programming input is disabled during push button programming.)
- 2) Also see the notes regarding window limit programming on page 4.

Analog Q45U Response Curves

Analog Q45U Effective Beam with 100 mm x 100 mm Plate Target (Typical)



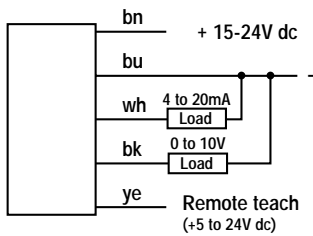
Analog Q45U Effective Beam with 2.5 cm Dia. Rod Target (Typical)



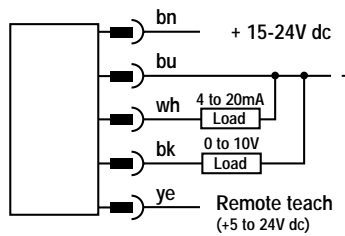
Analog Q45U Long Range Ultrasonic Sensor

Analog Q45U Series Hookup Diagrams

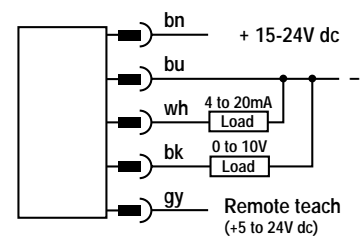
Analog Q45U Sensor with Attached Cable



Analog Q45U Sensor with Quick Disconnect (5-Pin Mini-Style) ("Q" model suffix)



Analog Q45U Sensor with Quick Disconnect (5-Pin Euro-Style) ("Q" model suffix)

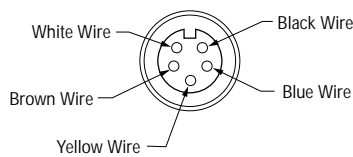


Quick Disconnect (QD) Option

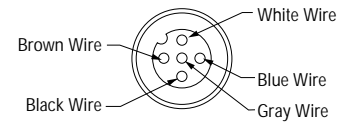
Q45U Ultrasonic sensors are sold with either a 2 m (6.5 ft) or a 9 m (30 ft) attached cable, or with a 5-pin mini-style or 5-pin euro-style QD cable fitting.

For information on QD cables, see next page.

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

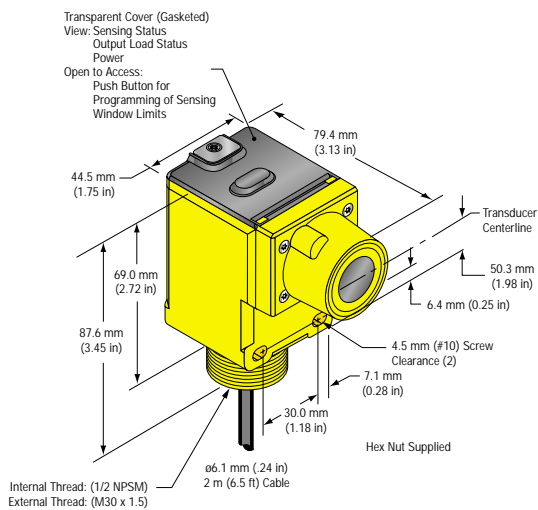


5-Pin Euro-Style Pin-out (Cable Connector Shown)

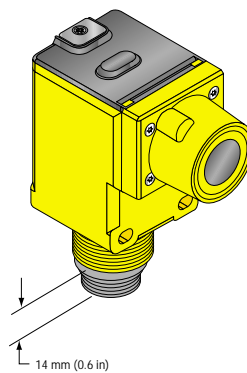


Analog Q45U Series Dimension Information

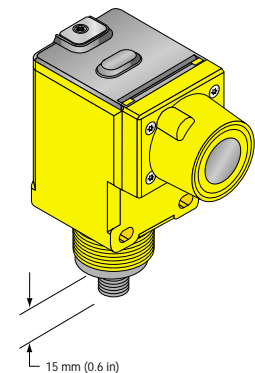
Analog Q45U Sensor with Cable Attached



Analog Q45U Sensor with 5-Pin Mini-Style QD

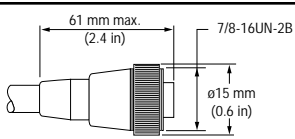
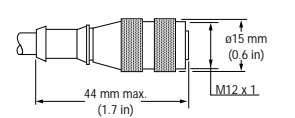
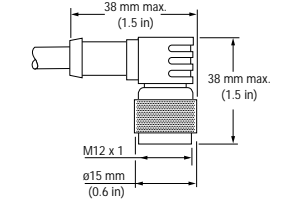


Analog Q45U Sensor with 5-Pin Euro-Style QD



Analog Q45U Long Range Ultrasonic Sensor

QUICK DISCONNECT (QD) CABLES

Style	Model	Length	Connector
5-Pin Mini	MBCC-506 MBCC-512 MBCC-530	2 meters (6.5 ft) 4 meters (12 ft) 9 meters (30 ft)	
5-Pin Euro Straight	MQDC1-506 MQDC1-515 MQDC1-530	2 meters (6.5 ft) 5 meters (15 ft) 10 meters (30 ft)	
5-Pin Euro Right -angle	MQDC1-506RA MQDC1-515RA MQDC1-530RA	2 meters (6.5 ft) 4 meters (12 ft) 9 meters (30 ft)	

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



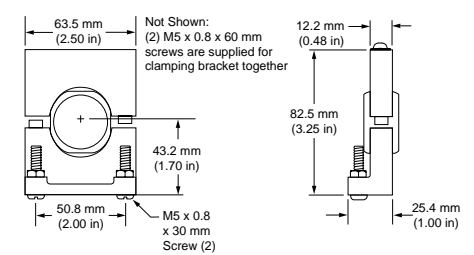
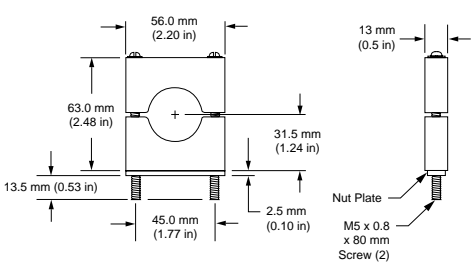
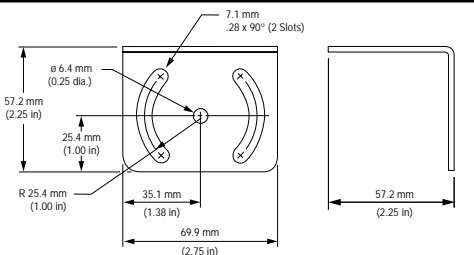
WARNING These ultrasonic presence sensors do NOT include the self-checking redundant circuitry

necessary to allow their use in personnel safety applications. A sensor failure or malfunction can result in either an energized or a de-energized sensor output condition.

Never use these products as sensing devices for personnel protection. Their use as a safety device may create an unsafe condition which could lead to serious injury or death.

Only MICRO-SCREEN™, MINI-SCREEN®, MULTI-SCREEN®, MACHINE-GUARD™ and PERIMETER-GUARD™ Systems, and other systems so designated, are designed to meet OSHA and ANSI machine safety standards for point-of-operation guarding devices. No other Banner sensors or controls are designed to meet these standards, and they must NOT be used as sensing devices for personnel protection.

Mounting Brackets

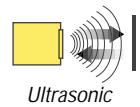
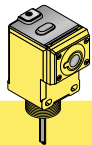
Model	Description	Dimensions
SMB30S	<ul style="list-style-type: none"> 30 mm swivel, black VALOX® bracket Stainless steel mounting hardware included 	 <p>Not Shown: (2) M5 x 0.8 x 60 mm screws are supplied for clamping bracket together</p>
SMB30C	<ul style="list-style-type: none"> 30 mm split clamp, black VALOX® bracket Stainless steel mounting hardware included 	 <p>Nut Plate</p>
SMB30MM	<ul style="list-style-type: none"> 30 mm, 11-gauge, stainless steel bracket with curved mounting slots for versatility and orientation Clearance for M6 (1/4 in) hardware 	

BANNER[®]
the photoelectric specialist



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	

* 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.

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.

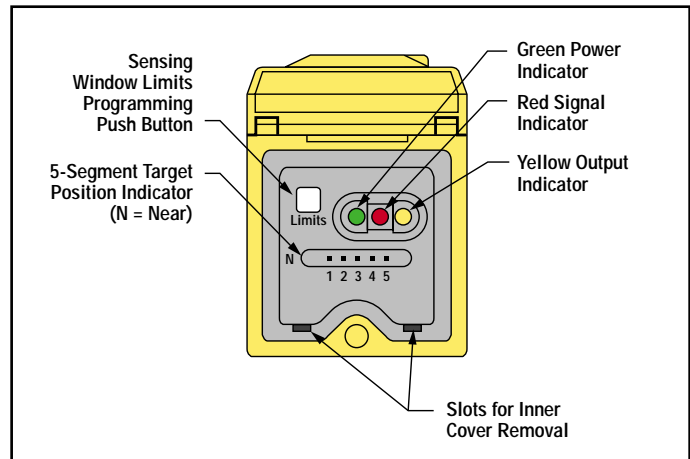


Figure 1. Q45UR controller features

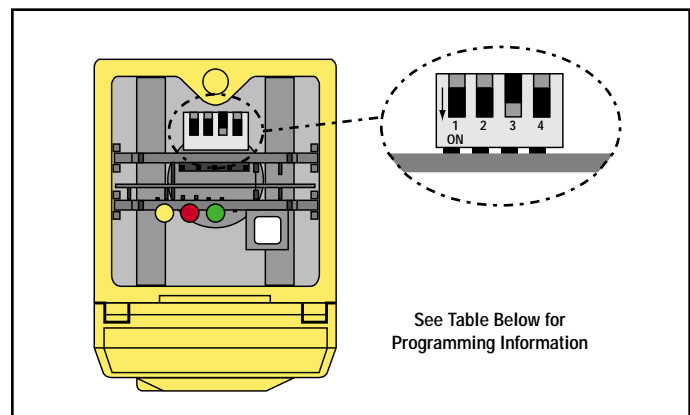


Figure 2. Q45UR controller programming DIP switches (factory default settings)

U-GAGE™ Q45UR Remote Ultrasonic Sensors

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 \pm 0.5 mm)	OFF	OFF
	2 mm (Sensing set point \pm 1 mm)	ON	OFF
	3 mm* (Sensing set point \pm 1.5 mm)	OFF	ON
	4 mm (Sensing set point \pm 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.

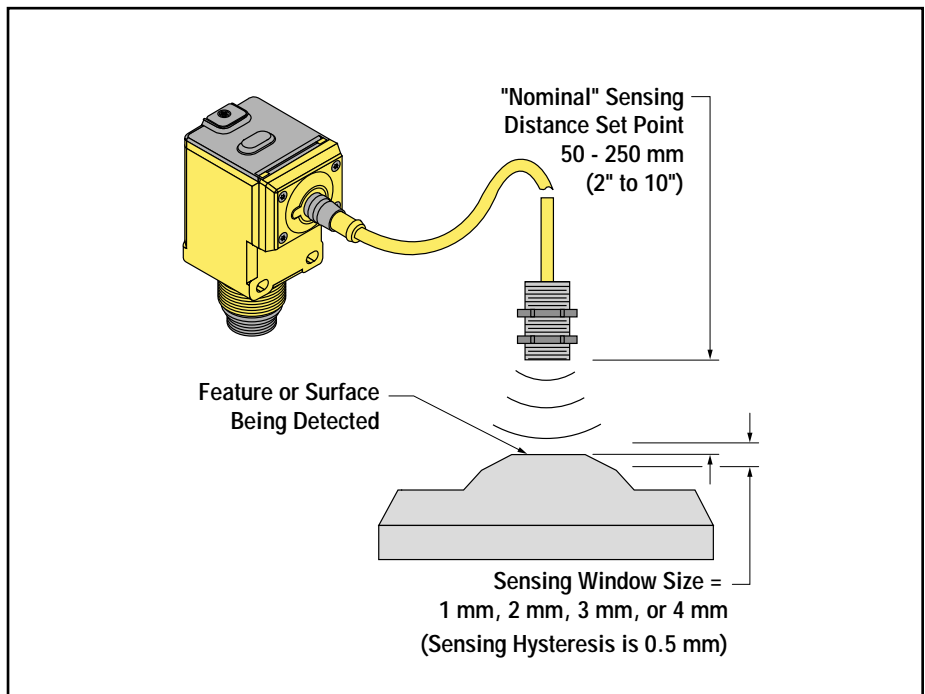
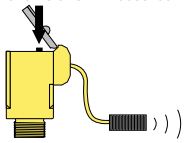
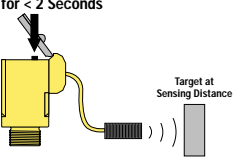
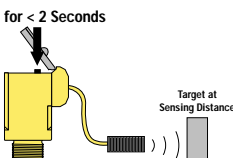


Figure 3. Sensing distance set point and window size

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.

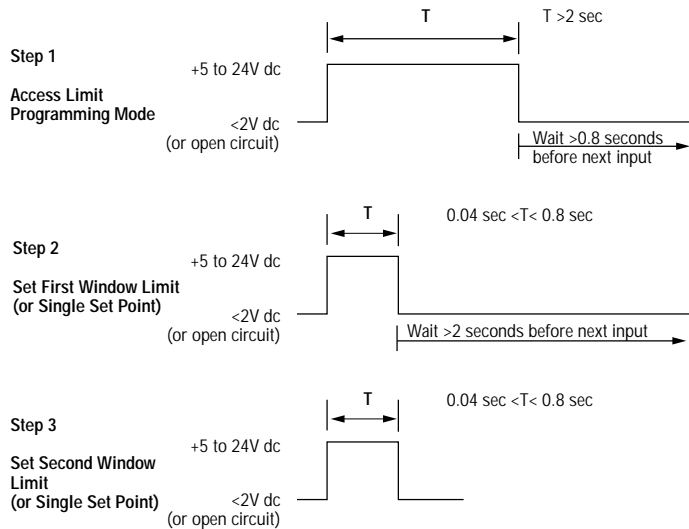
Push Button		Indicator Status
<p>Step 1 Enter Program Mode Push and hold until green indicator turns OFF (approximately 2 seconds)</p>	<p>Push and Hold for ≥ 2 Seconds</p> 	<p>Green: Goes OFF Yellow: Is ON steadily to indicate ready for teaching Red: Flashes to indicate echo strength; or OFF if no target is present</p>
<p>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</p>	<p>Push for < 2 Seconds</p> 	<p>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</p>
<p>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.</p>	<p>Push for < 2 Seconds</p> 	<p>Green: Remains OFF, then comes on steadily (returns to RUN mode) Yellow: ON steadily for a moment, then 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)</p>

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.

U-GAGE™ Q45UR Remote Ultrasonic Sensors

Remote Window Limit Programming



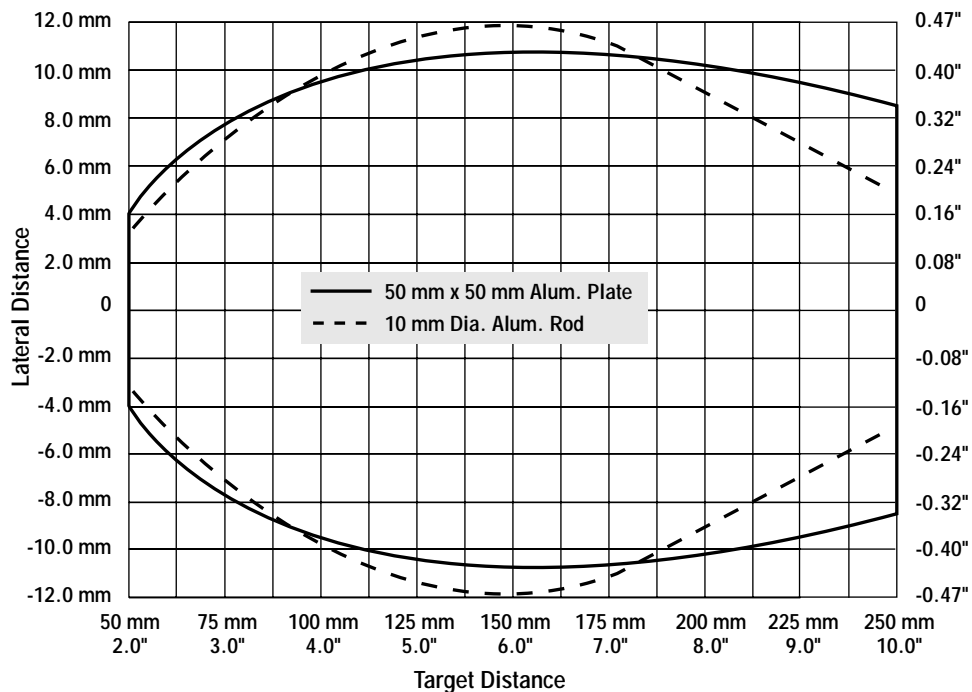
The yellow wire of the Q45UR may be connected to a switch or process controller for remote programming of the sensing window limits. The programming procedure is the same as for the push button (see page 3).

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 * Repeatability is specified using a 50 mm x 50 mm (2" x 2") aluminum plate at 22°C 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 LEXAN® 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 LEXAN® 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

LEXAN® and ULTEM® are registered trademarks of General Electric
TEXIN® is a registered trademark of Bayer Corporation

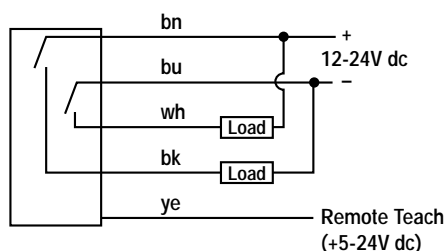
U-GAGE™ Q45UR Remote Ultrasonic Sensors

Q45UR Series Specifications, continued

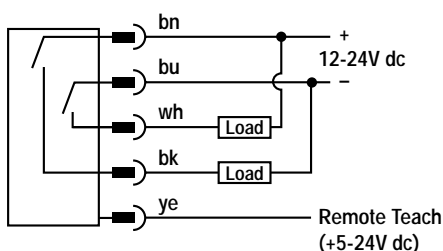
Operating Temperature	Controller and sensor: -25 to +70°C (-13 to +158°F) Maximum relative humidity: 85% (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A Vibration: 10 to 60Hz max., double amplitude 0.06" (maximum acceleration 10G). Method 213B 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	<p>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.</p> <p>If the sensor is taught a window larger than 5 mm, the size of the window remains "fixed," disabling switches 2 and 3.</p> <p>The controller has non-volatile memory which remembers the last sensing distance set point setting if power is removed and later reapplied.</p> <p>The sensing distance set point may be programmed via the Remote Teach input (see hookup diagrams).</p> <p>Minimum target size is specified as a 10 x 10 mm aluminum plate (at any point within the 50 to 150 mm sensing range).</p> <p>Acceptable target angle is within $\pm 5^\circ$ of normal for a smooth, flat target; target rotation does affect the apparent target location with respect to the sensor.</p>

Q45UR Series Controller Hookups

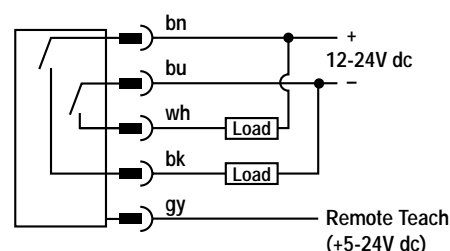
Q45UR Controller with Attached Cable



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



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

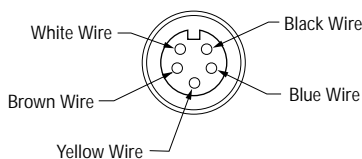


Quick-Disconnect (QD) Option

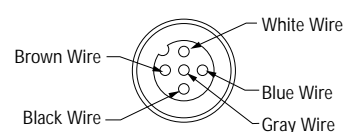
Q45UR Ultrasonic controllers are sold with either an unterminated 2 m (6.5') or a 9 m (30') attached cable, or with a 5-pin Mini-style or 5-pin Euro-style QD cable fitting.

For information on QD cables, see page 7.

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



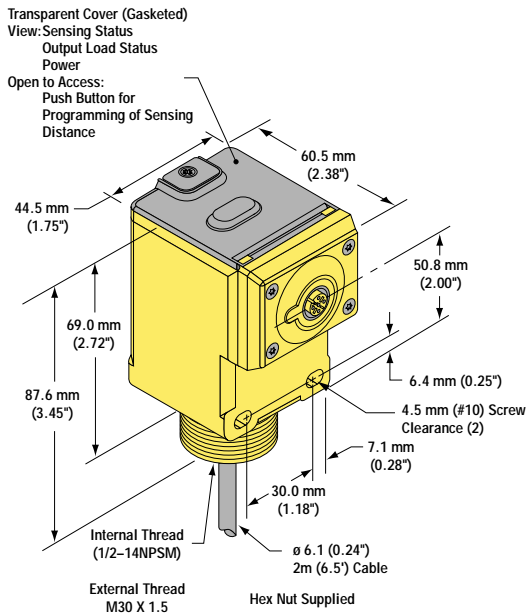
5-Pin Euro-Style Pin-out (Cable Connector Shown)



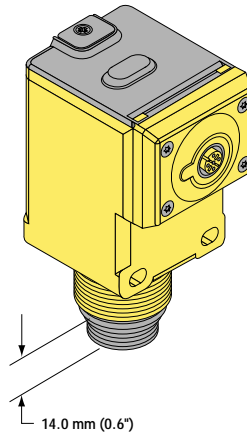
U-GAGE™ Q45UR Remote Ultrasonic Sensors

Q45UR Series Controller Dimensions

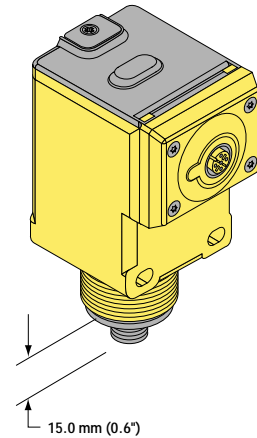
Q45UR Controller with Attached Cable



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

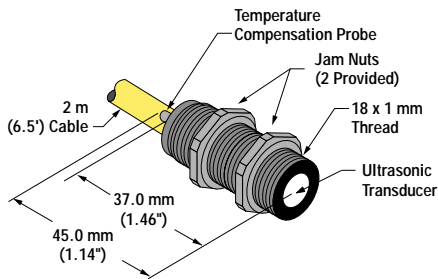


Q45UR Controller with 5-Pin Euro-Style QD ("Q6" model Suffix)

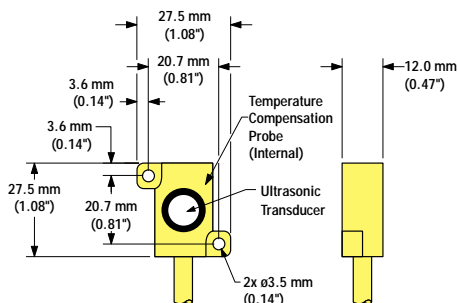


Remote Sensor Dimensions

M18C2.0 and S18C2.0 Sensors



Q13C2.0 Sensors



Accessories

Quick-disconnect (QD) Cables

Style	Model	Length	Connector
5-Pin Mini	MBCC-506 MBCC-512 MBCC-530	2 m (6.5') 4 m (12') 9 m (30')	
5-Pin Euro Straight	MQDC1-506 MQDC1-515 MQDC1-530	2 m (6.5') 5 m (15') 10 m (30')	
5-Pin Euro Right-angle	MQDC1-506RA MQDC1-515RA MQDC1-530RA	2 m (6.5') 4 m (12') 9 m (30')	

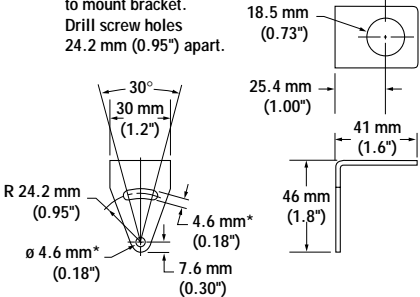
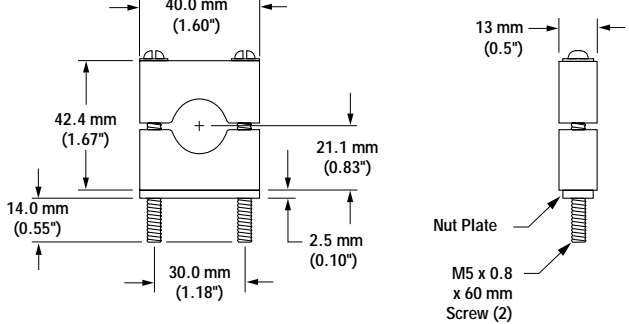
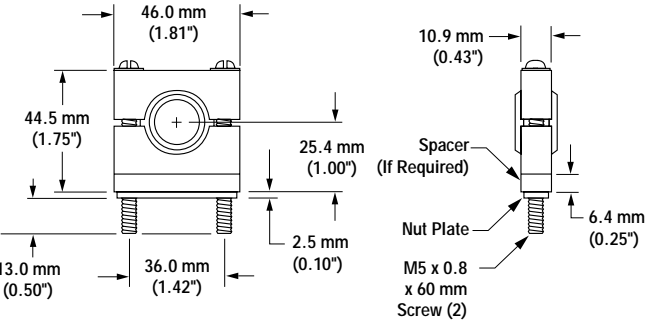
U-GAGE™ Q45UR Remote Ultrasonic Sensors

Mounting Brackets for Q45UR Series Controllers

<p>SMB30S</p>	<ul style="list-style-type: none"> • 30 mm swivel, black PBT polyester bracket • Stainless steel mounting hardware included 	<p>SMB30C</p>	<ul style="list-style-type: none"> • 30 mm split clamp, black PBT polyester bracket • Stainless steel mounting hardware included
<p>SMB30MM</p>	<ul style="list-style-type: none"> • 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

<p>SMB18A</p>	<ul style="list-style-type: none"> • 11-gauge, stainless steel right-angle bracket • Curved mounting slot for versatility and orientation 	<p>SMB18C</p>	<ul style="list-style-type: none"> • 18 mm split clamp black PBT polyester bracket • Stainless steel mounting hardware included
<p>* Use 4 mm (#8) screws to mount bracket. Drill screw holes 24.2 mm (0.95") apart.</p> 			
<p>SMB18S</p>	<ul style="list-style-type: none"> • 18 mm swivel, black PBT polyester bracket • Stainless steel mounting hardware included 		

Analog U-GAGE™ Q45UR Remote Ultrasonic Sensors

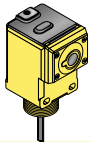
Piezoelectric Analog Proximity Mode Sensors with Push Button or Remote Programming of Sensing Window



M18C2.0
Stainless
Steel
Barrel

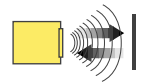
S18C2.0
Molded
Barrel

Q13C2.0
Flat-Pak



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	

* 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™ Analog 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 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.

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.

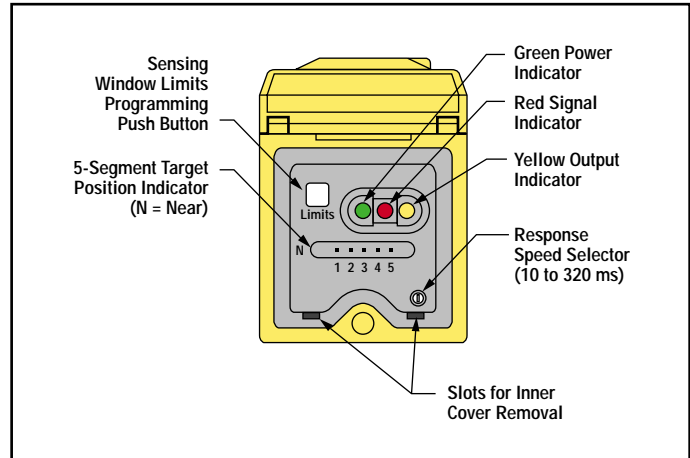


Figure 1. Analog Q45UR controller features

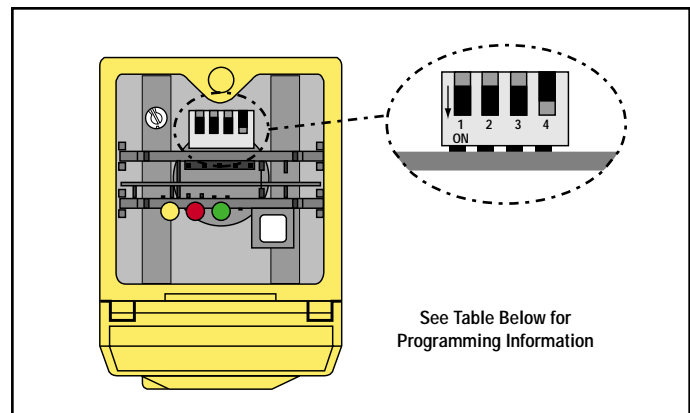


Figure 2. Analog Q45UR controller programming DIP switches (factory default settings)

U-GAGE™ Analog Q45UR Remote Ultrasonic Sensors

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 <i>increases</i> with distance OFF* = Output value <i>decreases</i> 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:

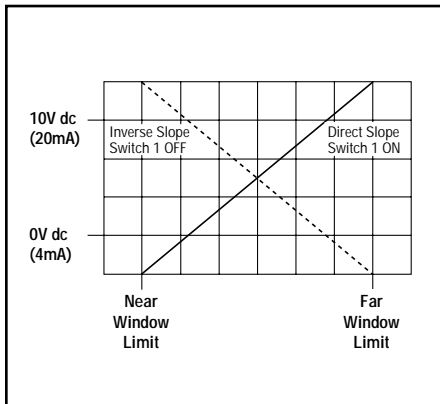


Figure 3. Output slope

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

U-GAGE™ Analog Q45UR Remote Ultrasonic Sensors

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)

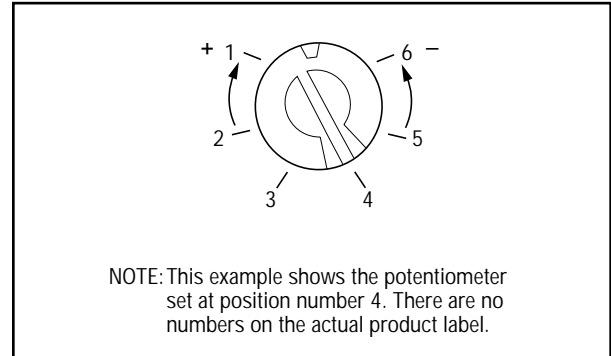
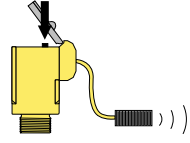
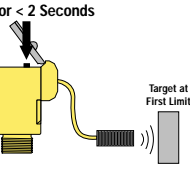
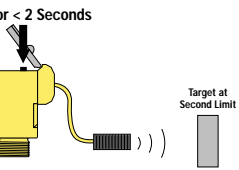


Figure 4. Response adjustment positions

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.

U-GAGE™ Analog Q45UR Remote Ultrasonic Sensors

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

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

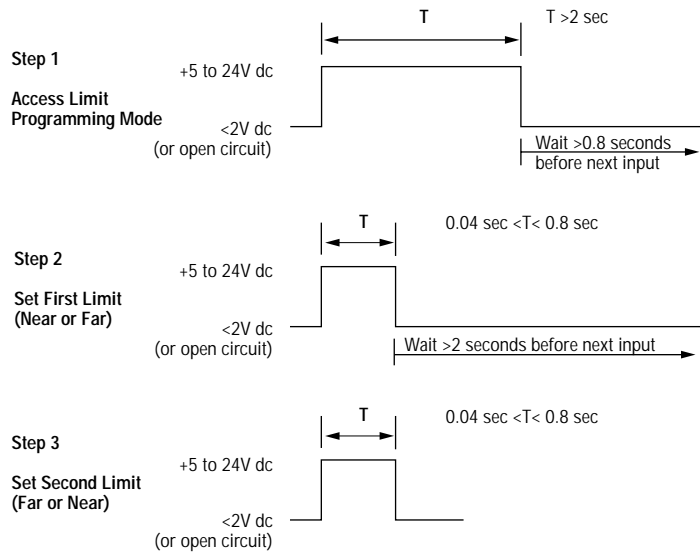
Remote Window Limit Programming

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).

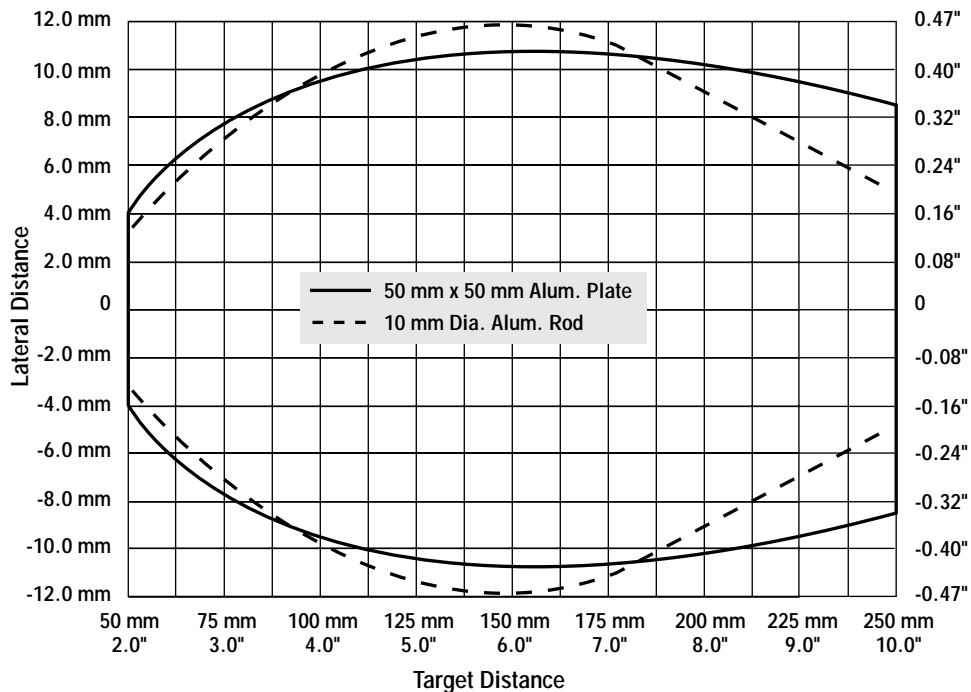
A remote programming input is generated when +5 to 24V dc is applied to the yellow wire. The timing diagrams, right, define the required input pulses.

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 100mA, 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	<p>Resolution*: 0.2% of sensing distance at 320 ms response 0.4% of sensing distance at 10 ms response</p> <p>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</p> <p>Temperature stability: ±0.03% of sensing distance per °C from 0 to 50°C (±0.05% per °C over remainder of operating temperature)</p> <p>Ultrasonic beam angle: ±3.5° Also see response curve on page 5</p> <p>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).</p>
Adjustments	<p>Push-button TEACH-mode programming of window limits (see page 2)</p> <p>The following may be selected by a 4-position DIP switch located on top of the controller, beneath a transparent O-ring sealed LEXAN® cover and beneath the black inner cover (see page 2)</p> <p>Switch 1: Output slope: output value increases or decreases with distance</p> <p>Switches 2: Output mode: current output or voltage output</p> <p>Switch 3&4: Response to loss of echo: (see page 3)</p> <p>Response Speed Adjustment: Single-turn potentiometer selects six response values from 10 to 320 milliseconds (see page 3)</p>
Indicators	<p>Three status LEDs:</p> <p>GREEN ON steadily = Power to controller is ON</p> <p>GREEN flashing = Current output fault detected (indicates that the 4-20mA current path to ground has been opened)</p> <p>YELLOW ON steadily = Target is sensed within the window limits (Yellow LED also indicates programming status during setup mode)</p> <p>RED flashing = Relative strength of received echo</p> <p>5-segment moving dot LED indicates the position of the target within the sensing window</p>
Construction	<p>Controller: Molded thermoplastic polyester housing, o-ring sealed transparent LEXAN® top cover, and stainless steel hardware</p> <p>Sensors: M18C2.0: Stainless steel M18 threaded barrel housing and jam nuts, ULTEM® polyetherimide front cover, ceramic transducer, TEXIN® polyurethane rear cover</p> <p>S18C2.0: Thermoplastic polyester S18 threaded barrel housing and jam nuts, ULTEM® polyetherimide front cover, ceramic transducer, TEXIN® polyurethane rear cover</p> <p>Q13C2.0: Molded 30% glass reinforced thermoplastic polyester housing, ceramic transducer, fully epoxy-encapsulated</p>
Environmental Rating	Controller: IEC IP67; NEMA 6P Sensor: IEC IP65; NEMA 4

LEXAN® and ULTEM® are registered trademarks of General Electric
TEXIN® is a registered trademark of Bayer Corporation

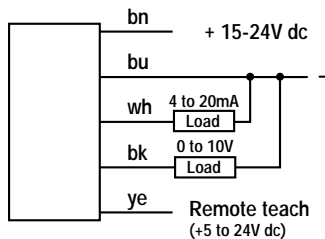
U-GAGE™ Analog Q45UR Remote Ultrasonic Sensors

Analog Q45UR Series Specifications, continued

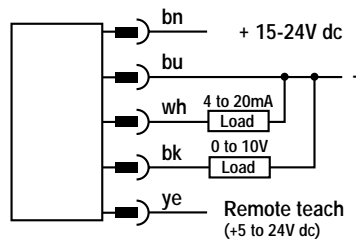
Connections	Controller: 2m (6.5') or 9 m (30') attached cable, or 5-pin Mini-style or Euro-style quick-disconnect fitting Sensor: 2m (6.5') attached PVC cable terminated with 4-pin Euro-style quick-disconnect fitting for connection to controller
Operating Temperature	Controller and sensor: -25° to +70°C (-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	
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

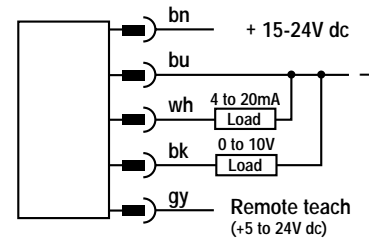
Q45UR Controller with Attached Cable



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



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

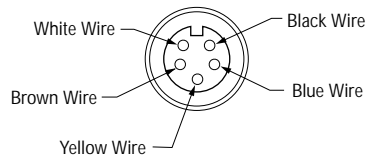


Quick-Disconnect (QD) Option

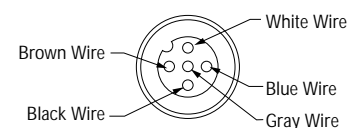
Analog Q45UR Ultrasonic controllers are sold with either a 2 m (6.5') or a 9 m (30') attached cable, or with a 5-pin Mini-style or 5-pin Euro-style QD cable fitting.

For information on mating QD cables for QD models, see next page.

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



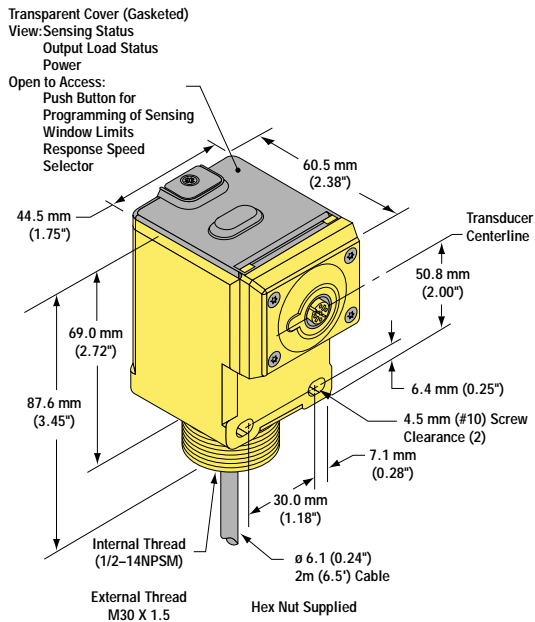
5-Pin Euro-Style Pin-Out (Cable Connector Shown)



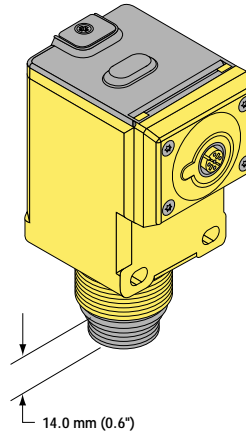
U-GAGE™ Analog Q45UR Remote Ultrasonic Sensors

Q45UR Series Controller Dimensions

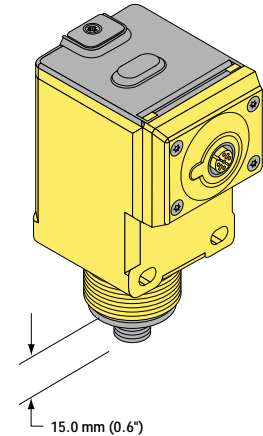
Q45UR Controller with Attached Cable



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

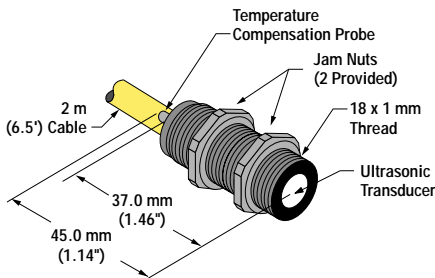


Q45UR Controller with 5-Pin Euro-Style QD ("Q6" model Suffix)

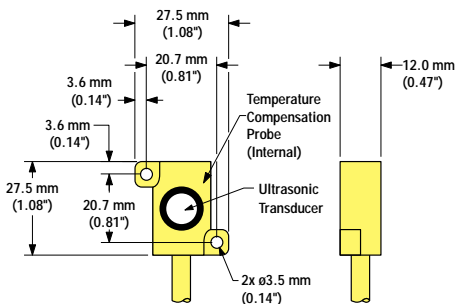


Remote Sensor Dimensions

M18C2.0 and S18C2.0 Sensors



Q13C2.0 Sensors



Accessories

Quick-disconnect (QD) Cables

Style	Model	Length	Connector
5-Pin Mini	MBCC-506 MBCC-512 MBCC-530	2 m (6.5') 4 m (12') 9 m (30')	
5-Pin Euro Straight	MQDC1-506 MQDC1-515 MQDC1-530	2 m (6.5') 5 m (15') 10 m (30')	
5-Pin Euro Right-angle	MQDC1-506RA MQDC1-515RA MQDC1-530RA	2 m (6.5') 4 m (12') 9 m (30')	

U-GAGE™ Analog Q45UR Remote Ultrasonic Sensors

Mounting Brackets for Q45UR Series Controllers

<p>SMB30S</p>	<ul style="list-style-type: none"> • 30 mm swivel, black PBT polyester bracket • Stainless steel mounting hardware included 	<p>SMB30C</p>	<ul style="list-style-type: none"> • 30 mm split clamp, black PBT polyester bracket • Stainless steel mounting hardware included
<p>SMB30MM</p>	<ul style="list-style-type: none"> • 30 mm, 11-gauge stainless steel bracket • Curved mounting slots for versatility and orientation 		

U-GAGE™ Analog Q45UR Remote Ultrasonic Sensors

Mounting Brackets for M18C2.0 and S18C2.0 Sensors

<p>SMB18A</p>	<ul style="list-style-type: none"> • 11-gauge, stainless steel right-angle bracket • Curved mounting slot for versatility and orientation 	<p>SMB18C</p>	<ul style="list-style-type: none"> • 18 mm split clamp black PBT polyester bracket • Stainless steel mounting hardware included
<p>* Use 4 mm (#8) screws to mount bracket. Drill screw holes 24.2 mm (0.95") apart.</p>		<p>Nut Plate M5 x 0.8 x 60 mm Screw (2)</p>	
<p>SMB18S</p>	<ul style="list-style-type: none"> • 18 mm swivel, black PBT polyester bracket • Stainless steel mounting hardware included 	<p>Spacer (If Required) Nut Plate M5 x 0.8 x 60 mm Screw (2)</p>	