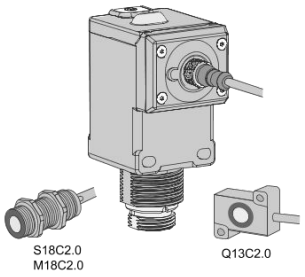
Q45UR Remote Ultrasonic Sensor with Analog Outputs (Short Range)

Features

Piezoelectric proximity mode sensors with push-button or remote programming of sensing windows



- Ultrasonic proximity detection from 50 mm to 250 mm (2 in to 10 in)
- 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 electrical and acoustic noise
- 15 DC to 24 V DC operation
- Selectable 0 V DC to 10 V DC voltage PNP or 4 mA to 20 mA current PNP analog outputs
- Selectable output slope: positive or negative with increasing target distance
- Wide operating temperature range of –25 °C to +70 °C (–13 °F to +158 °F); all models include temperature compensation
- Rugged design for use in demanding sensing environments; rated IP67, NEMA 6P (controller), IP65 (sensor)
- Choose models with an integral unterminated 2 m (6.5 ft) or 9 m (30 ft) cable, or with a 7/8 in-16UNF or M12 quick-disconnect connector
- Choose from 3 remote sensors: 18 mm threaded-barrel models in either stainless steel or molded PBT polyester, and a molded flat-pack model
- Remote sensors connect to the controller via an integral 2 m (6.5 ft) cable
- Input for remote TEACH-mode programming of window limits
- 0.10 mm resolution (0.004 in)
- Kit includes both a controller and a sensor; components are also sold separately
- Response time is adjustable from 10 milliseconds to 320 milliseconds

WARNING:

- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

Models

Kit Models	Kit Includes Controller Model	Controller Cable	Kit Includes Sensor Model
Q45UR3LIU64CK	Q45UR3LIU64C	2 m (6.5 ft)	M18C2.0 Stainless Steel Barrel
Q45UR3LIU64CQK	Q45UR3LIU64CQ	Integral 5-pin Mini male quick-disconnect connector	
Q45UR3LIU64CQ6KQ	Q45UR3LIU64CQ6	Integral 5-pin M12 male quick-disconnect connector	Q13C2.0 Flat-Pak

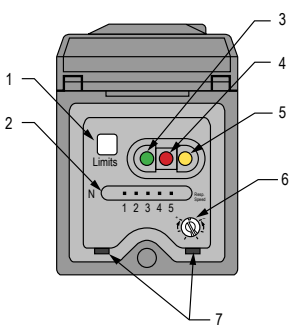
To order the 9 m (30 ft) cable models, add suffix **W/30** to the model number of any cabled sensor (for example, **Q45UR3LIU64CK W/30**). Models with a quick disconnect connector require a mating cable.

For a list of discontinued models, see Discontinued Models.

Overview

The Q45UR controller features a single push button for programming the sensing window limits. Set the window limits in one of two ways: program two independent window limits, or define a sensing distance set point that centers automatically within a 5-mm window.

Q45UR Features



Independent Window Limits. Place the target at the desired position to set the first limit. Set the second limit using the same procedure. To set two independent limits, the window must at least 5 mm.

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

1. Button for programming the sensing window limits
2. 5-Segment target position indicator (N = Near)
3. Green power indicator
4. Red signal indicator
5. Amber output indicator
6. Response speed selector (10 ms to 320 ms)
7. Slots for removing the inner cover

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ПРОМЭЛЕКТРОНИКА/ sales@prom-elec.com

Status Indicators

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

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

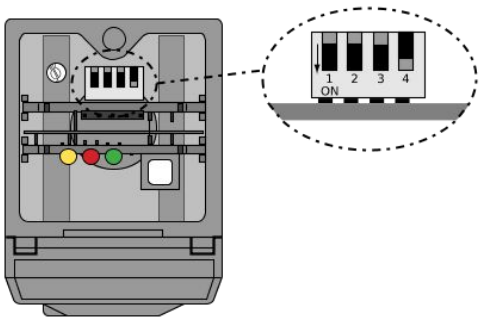
The 5-segment moving dot LED indicator displays the relative position of the target within the programmed sensing window. LED 1 flashes when the target is closer than the near limit. LED 5 flashes when the target is beyond the far limit.

Configuring a Sensor

Output Response Settings

IMPORTANT: Remove power before making any internal adjustments.

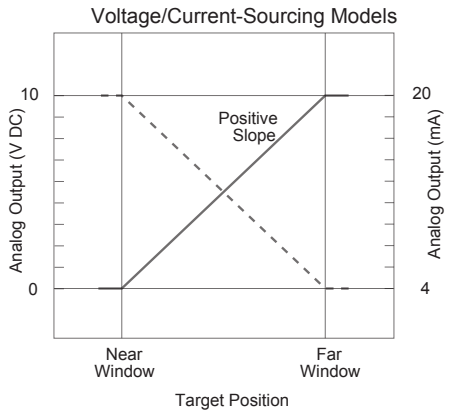
Insert a small, flat-blade screwdriver into the two slots shown in Overview. Lift up and remove the black inner cover to expose the 4-position DIP switch. Use these DIP switches to program the output slope, output mode, loss of echo, and min./max. output value default.

DIP Switch	Function	Settings	
1	Output slope	On = Output value increases with distance	*DIP Switches for Q45U Sensors* 
		Off* = Output value decreases with distance	
2	Output mode	On = Current output enabled	
		Off* = Voltage output enabled	
3	Loss of echo	On = Min - Max Mode	
		Off* = Hold Mode	
4	Min-Max Default	On* = Default to maximum output value	
		Off = Default to minimum output value	

* Factory default settings.

DIP Switch 1: Output Slope

Output as a function of target position



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

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

DIP Switch 2: Output Mode

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

On = The 4 mA to 20 mA current output (white wire) is enabled
Off = The 0 V DC to 10 V DC voltage output (black wire) is enabled (default setting)

DIP Switch 3: Loss of Echo Mode

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

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On = Min-Max Mode
Off = Hold Mode (default setting)

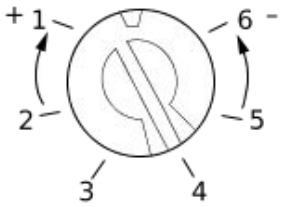
DIP Switch 4: Min-Max Default

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

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

Q45UR Response Speed Adjustments

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

Position	Response Speed	Potentiometer Positions
1	10 milliseconds (2 cycles)	*Response adjustment positions*  This example shows the potentiometer set at position number 4. There are no numbers on the actual product label.
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)	

Programming the Window Limits

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

The near limit may be set as close as 50 mm (2 in) and the far limit may be set as far as 250 mm (10 in) from the transducer face. Minimum window width is 5 mm (0.2 in). When possible, use the actual target to be sensed when setting the window limits.

The following procedure begins with the sensor in Run mode.

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

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

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

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

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

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

Notes Regarding Window Limit Programming

1. Either the near or far limit may be programmed first.
2. There is a 2-minute time-out for programming the first limit. The sensor returns to Run mode with the previously programmed limits. There is no time-out between programming of the first and second limit.
3. Cancel the programming sequence at any time by pressing and holding the button for longer than 2 seconds. The sensor returns to Run mode with the previously programmed limits.
4. If a limit is rejected during either programming step, the sensor reverts to the first limit programming step, indicated by the Green LED (off), the Red LED (flashing to indicate signal strength), and the Amber LED (on).
5. If both limits are accepted, the sensor returns to Run mode, which is indicated by the Green LED (on).
6. During limit programming, the 5-segment moving dot indicator displays the relative target position between 50 mm (2 in) and 250 mm (the maximum recommended far limit position is 250 mm (10 in)).

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7. If the target is father than 250 mm (10 in), 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 (10 in) maximum far limit.
8. If the target is held at the same position for programming of both limits, the sensor establishes a 5 mm (0.2 in)-wide sensing window, centered on the target position.

Remote Programming the Window Limits

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

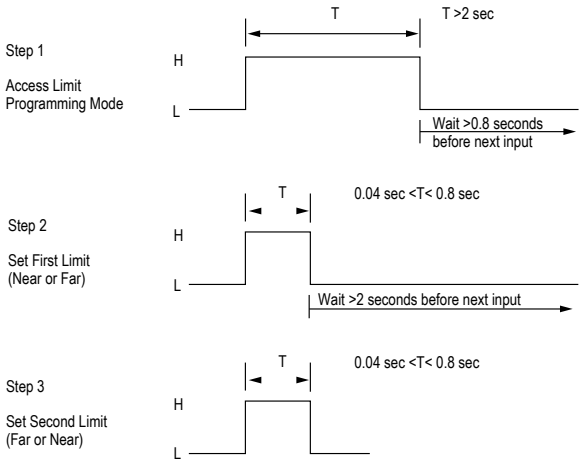
`H = +5 V DC to 24 V DC`

`L = Less than 2 V DC (or open circuit)`

Notes regarding remote window limit programming:

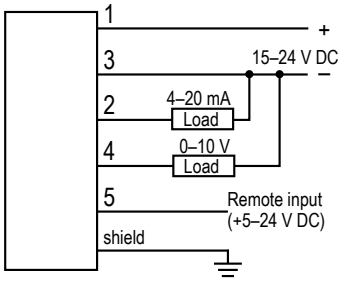
1. The button is disabled during remote limit programming. (The remote programming input is disabled during push button programming.)
2. Also see the notes regarding window limit programming.

Remote programming the window limits



Wiring Diagrams

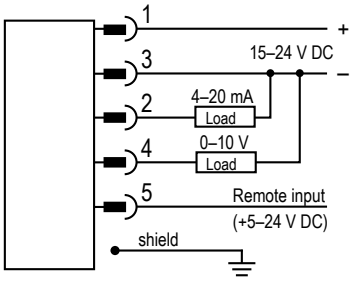
Sensor with attached cable



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

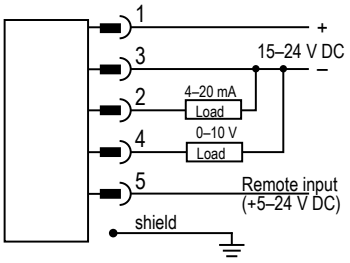
1 = brown
2 = white
3 = blue
4 = black
5 = gray or yellow

Sensor with 5-pin Mini Quick Disconnect



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

Sensor with 5-pin M12 Quick Disconnect



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

Specifications

Proximity Mode Range

Near limit: 50 mm (2 inches) min

Far limit: 250 mm (10 inches) max

Supply Voltage and Current

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

Supply Protection Circuitry

Protected against reverse polarity and transient voltages

Output Configuration

One voltage PNP and one current PNP; one or the other output is enabled by internal programming switch #2.

Output Rating

Voltage PNP: 0 V DC to 10 V DC, 10 mA maximum

Current PNP: 4 mA to 20 mA, 1 ohm to 500 ohm impedance

Output Protection Circuitry

Both outputs are protected against continuous overload and short circuit

Adjustments

Push-button TEACH-mode programming of window limits

4-position DIP switch

Response Speed Adjustment

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Resolution

0.2% of sensing distance at 320 ms response

0.4% of sensing distance at 10 ms response

Linearity

±1.0 mm (0.04 in) with 100 mm to 200 mm sensing window

±2.0 mm (0.08 in) with 50 mm to 250 mm sensing window

Temperature Stability

±0.03% of sensing distance per ºC from 0 °C to 50 ºC (±0.05% per ºC over remainder of operating temperature)

Ultrasonic Beam Angle

±3.5º

Also see the performance response curve

Application Notes

The controller has non-volatile memory that 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 wiring diagrams).

Acceptable target angle is within ±5º of normal for a smooth, flat target; target rotation affects the apparent target location with respect to the sensor.

Resolution and linearity are specified using a 50 mm × 50 mm (2 in × 2 in) aluminum plate at 22 °C under fixed sensing conditions using the 4 mA to 20 mA output at 15 V DC.

Minimum target size is specified as a 10 × 10 mm (0.4 in × 0.4 in) aluminum plate (at any point within the 50 mm to 150 mm sensing range).

Indicators

Three status LEDs

5-segment moving dot LED

Construction

Molded PBT thermoplastic polyester housing, o-ring sealed transparent acrylic top cover, and stainless steel hardware.

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

ULTEM® is a registered trademark of General Electric; TEXIN® is a registered trademark of Bayer Corporation

Connections

Controller: 2 m (6.5 ft) or 9 m (30 ft) attached cable, integral 5-pin 7/8 in-16UNF male quick-disconnect connector, or integral 5-pin M12 male quick-disconnect connector

Sensor: 2 m (6.5 ft) integral PVC-jacketed cable with a 4-pin M12 male quick-disconnect connector for connection to controller

Environmental Rating

Controller: IP67; NEMA 6P

Sensor: IP65; NEMA 4

Operating Temperature

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

85% at +50 °C maximum relative humidity (non-condensing)

Vibration and Mechanical Shock

All models meet MIL-STD-202F, Method 201A (Vibration: 10 Hz to 60 Hz maximum, 0.06 inch (1.52 mm) double amplitude, 10G acceleration) requirements. Method 213B conditions H&I (Shock: 75G with device operating; 100G for non-operation). Also meets IEC 60947-5-2 requirements: 30G 11 ms duration, half sine wave.

Certifications

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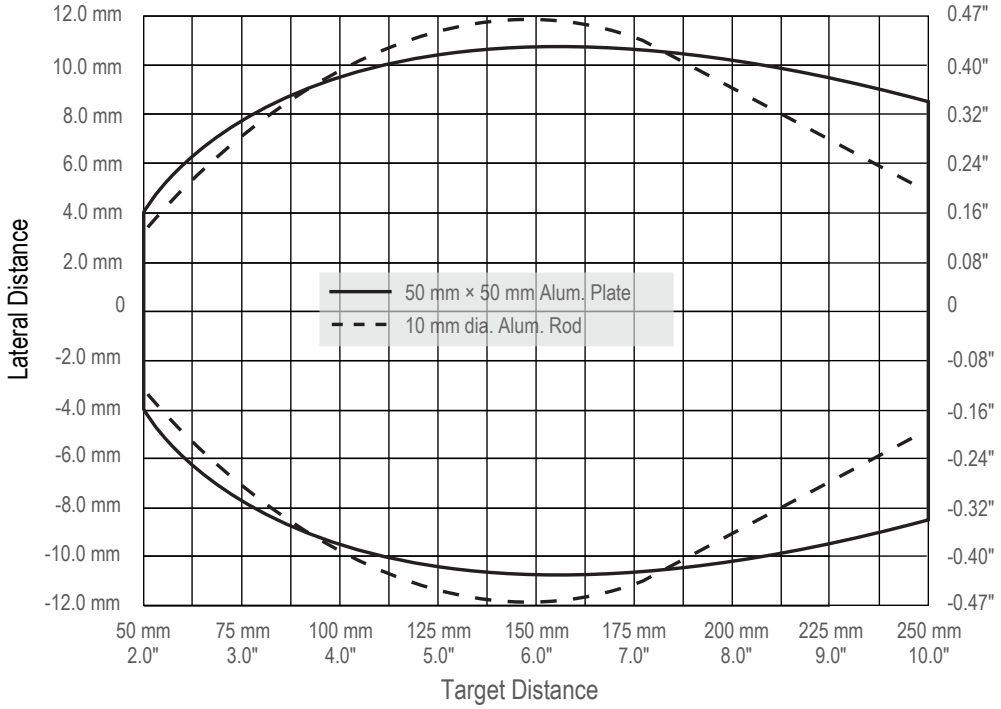
Performance Curves



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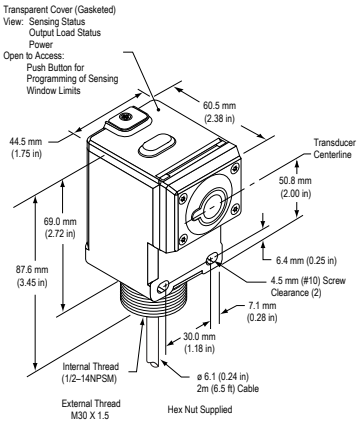
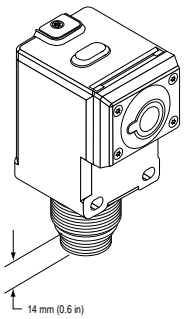
NOTE: The pattern displayed for the 50 mm × 50 mm aluminum plate is referenced to the edge of the plate. The pattern displayed for the 10 mm dia. aluminum rod is referenced to the center of the rod.

Q45Ux Dimensions

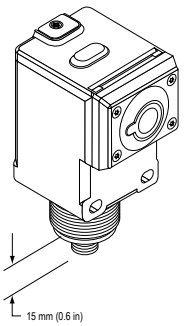
Cabled models



5-pin Mini QD models

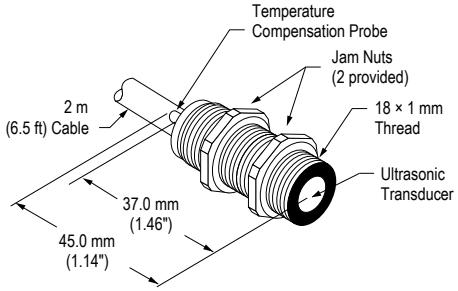


5-pin M12 QD models

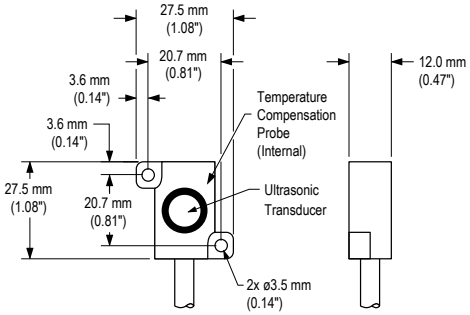


Remote Sensor Dimensions

M18C2.0 and S18C2.0 Remote Sensors

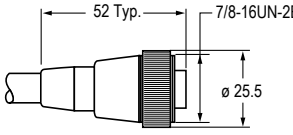
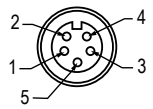


Q13C2.0 Remote Sensors



Accessories

Cordsets

5-Pin Single-Ended Mini Female Shielded Cordsets				
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**
MBCC2-506	2 m (6.56 ft)	Straight		 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow
MBCC2-512	4 m (13.1 ft)			
MBCC2-530	9 m (29.5 ft)			

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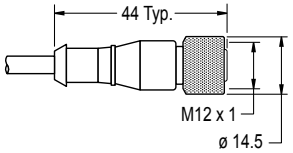
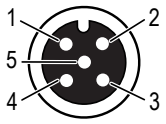
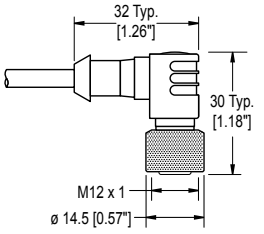
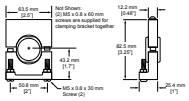
5-Pin Single-Ended M12 Female Shielded Cordsets				
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**
MQDEC2-506	2 m (6.56 ft)	Straight		 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
MQDEC2-515	5 m (16.4 ft)			
MQDEC2-530	9 m (29.5 ft)			
MQDEC2-550	15 m (49.2 ft)			
MQDEC2-575	23 m (75.44 ft)			
MQDEC2-5100	30.5 m (100 ft)			
MQDEC2-506RA	2 m (6.56 ft)	Right-Angle		
MQDEC2-515RA	5 m (16.4 ft)			
MQDEC2-530RA	9 m (29.5 ft)			
MQDEC2-550RA	15 m (49.2 ft)			
MQDEC2-575RA	23 m (75.44 ft)			
MQDEC2-5100RA	31 m (101.68 ft)			

Brackets

SMB30S

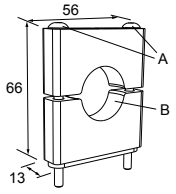
- Swivel bracket with 30 mm mounting hole for sensor
- Adjustable captive swivel ball
- Black reinforced thermoplastic polyester
- Stainless steel mounting and swivel locking hardware included
- CAD Files: DXF, PDF, IGS, STP



SMB30C

- 30 mm split clamp, black PBT bracket
- Stainless steel mounting hardware included
- Mounting hole for 30 mm sensor
- CAD Files: DXF, PDF, IGS, STP

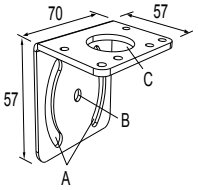
Hole center spacing: A=ø 45
Hole size: B=ø 27.2



SMB30MM

- 12-gauge stainless steel bracket with curved mounting slots for versatile orientation
- Clearance for M6 (¼ in) hardware
- Mounting hole for 30 mm sensor
- CAD Files: DXF, PDF, IGS, STP

Hole center spacing: A=51, A to B=25.4
Hole size: A=42.6 × 7, B=ø 6.4, C=ø 30.1

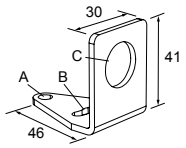


Brackets for M18C2.0 and S18C2.0 Sensors

SMB18A

- Right-angle mounting bracket with a curved slot for versatile orientation
- 12-ga. stainless steel
- 18 mm sensor mounting hole
- Clearance for M4 (#8) hardware
- CAD Files: DXF, PDF, IGS, STP

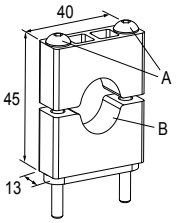
Hole center spacing: A to B = 24.2
Hole size: A = ø 4.6, B = 17.0 × 4.6, C = ø 18.5



SMB18C

- 18 mm split clamp, black thermoplastic polyester
- Stainless steel mounting hardware included
- CAD Files: DXF, PDF, IGS, STP

A = ø 3 mm (2)
Hole size: B = ø 18 mm



Continued on page 8

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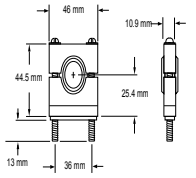
Continued from page 7

SMB18S

- 18 mm swivel bracket
- Black thermoplastic polyester
- Stainless steel mounting hardware included (Two M5 x 0.8 x 60 mm screws)
- CAD Files: DXF, PDF, IGS, STP



Product Support and Maintenance

Discontinued Models

The following models are no longer available for order but are still covered by the information in this document.

Kit Models	Kit Includes Controller Model	Controller Cable	Kit Includes Sensor Model
Q45UR3LIU64CQ6K	Q45UR3LIU64CQ6	Integral 5-pin M12 male quick-disconnect connector	M18C2.0 Stainless Steel Barrel
Q45UR3LIU64CKQ	Q45UR3LIU64C	2 m (6.5 ft)	Q13C2.0 Flat-Pak
Q45UR3LIU64CQKQ	Q45UR3LIU64CQ	Integral 5-pin Mini male quick-disconnect connector	
Q45UR3LIU64CKS	Q45UR3LIU64C	2 m (6.5 ft)	S18C2.0 Molded Barrel
Q45UR3LIU64CQKS	Q45UR3LIU64CQ	Integral 5-pin Mini male quick-disconnect connector	
Q45UR3LIU64CQ6KS	Q45UR3LIU64CQ6	Integral 5-pin M12 male quick-disconnect connector	

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