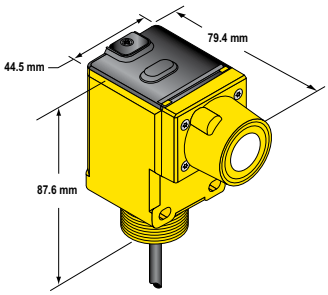
U-GAGE® Q45U
Flexible Ultrasonic Sensors

- Push-button TEACH programming makes it easy to set the near/far limits of the sensing window.
- Available ranges are 100 to 1400 mm for the short-range models and 0.25 to 3.0 m for the long-range models.
- Bipolar discrete models have switches for ON/OFF presence detection and HIGH/LOW level control.
  - In ON/OFF mode, detects either when the target is within the set range or when it is outside the range.
  - In HIGH/LOW mode, detects when the target is outside the configured range, for fill level control, web tensioning control and similar applications.
- Response time is programmed with switches in discrete models and with a potentiometer in analog models.
- For remote programming, analog models can be wired directly to an external switch, controller or computer to set window limits—ideal for inaccessible applications such as roll diameter detection for overhead cranes.

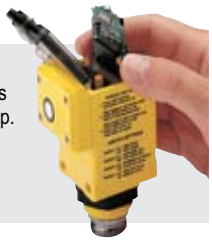
ACCESSORIES page 335

Short-range Models



Long-range Models

Program storage cards
After you set up window limits, you can store the limits on circuit cards with non-volatile memory for fast setup. Just store the settings from any Q45U sensor on the Q45UML card, and then transfer the settings to any Q45U sensor with the same available sensing range.



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U-GAGE® Q45U Discrete Output, 12-24V dc

Range	Temperature Compensation	Connection	Output Type	Response Time	Models
100 mm - 1.4 m	No	2 m	Bipolar NPN/PNP	Programmable for 20, 40, 160 or 640 ms	**Q45UBB63DA**
		5-pin Mini QD			**Q45UBB63DAQ**
		5-pin Euro QD			**Q45UBB63DAQ6**
	Yes	2 m			**Q45UBB63DAC**
		5-pin Mini QD			**Q45UBB63DACQ**
		5-pin Euro QD			**Q45UBB63DACQ6**

More on next page

Connection options: A model with a QD requires a mating cordset (see page 335).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q45UBB63DA W/30**).

U-GAGE® Q45U Discrete Output, 12-24V dc (cont'd)

Range	Temperature Compensation	Connection	Output Type	Response Time	Models
250 mm - 3 m†	Yes	2 m	Bipolar NPN/PNP	Programmable for 40, 80, 320 or 1280 ms	**Q45UBB63BC**
		5-pin Mini QD			**Q45UBB63BCQ**
		5-pin Euro QD			**Q45UBB63BCQ6**

U-GAGE® Q45U Analog Output, 15-24V dc

Range	Temperature Compensation	Connection *	Output Type	Response Time	Models
100 mm - 1.4 m	Yes	2 m	Selectable 0 to 10V dc or 4 to 20 mA	Adjustable from 40 to 1280 ms	**Q45ULIU64ACR**
		5-pin Mini QD			**Q45ULIU64ACRQ**
		5-pin Euro QD			**Q45ULIU64ACRQ6**
250 mm - 3 m†	Yes	2 m		Adjustable from 80 to 2560 ms	**Q45ULIU64BCR**
		5-pin Mini QD			**Q45ULIU64BCRQ**
		5-pin Euro QD			**Q45ULIU64BCRQ6**

Connection options: A model with a QD requires a mating cordset (see page 335).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q45UBB63DA W/30**).

† The far limit may be extended as far as 3.9 m for good acoustical targets–hard surfaces with area greater than 100 cm².

U-GAGE® Q45U Specifications

Sensing Range	**Short Range:** Near limit: 100 mm min. **Long Range:** Near limit: 250 mm min. **Short Range:** Far limit: 1.4 m max. **Long Range:** Far limit: 3.0 m max. NOTE: The far limit may be extended on long range units, as far as 3.9 m for good acoustical targets (hard surfaces with area greater than 100 cm²)
Supply Voltage and Current	**Discrete:** 12 to 24V dc (10% max. ripple); 100 mA (exclusive of load) **Analog:** 15 to 24V dc (10% max. ripple); 100 mA (exclusive of load)
Ultrasonic Frequency	**Long Range:** 128 kHz **Short Range:** 230 kHz
Supply Protection Circuitry	Protected against reverse polarity and transient voltages.
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short-circuit of outputs.
Output Configuration	**Discrete: Bipolar:** One current sourcing (PNP) and one current sinking (NPN) open-collector transistor. **Analog:** One voltage sourcing and one current sourcing; one or the other output is enabled by internal programming switch #2.
Output Ratings	**Discrete:** 150 mA max. (each) **OFF-state leakage current:** less than 25 µA at 24V dc **ON-state saturation voltage**: less than 1.5V at 10 mA; less than 2.0V at 150 mA **Analog:** **Voltage sourcing:** 0 to 10V dc, 10 mA max. **Current sourcing:** 4 to 20 mA, 1 to 500 Ω impedance

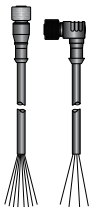
More on next page

U-GAGE® Q45U Specifications (cont'd)

Performance Specifications	**Short Range** / **Long Range** **Analog resolution or discrete repeatability:** ± 0.1% of sensing distance (± 0.25 mm min.) / ± 0.1% of sensing distance (± 0.5 mm min.) **Analog Linearity:** 1% of full scale / 1% of full scale **Temperature effect:** 0.05% of sensing distance/ ° C with temp. comp. 0.2% of sensing distance/ ° C without temp. comp. / 0.05% of sensing distance/° C **Min. window size:** 10 mm / 25 mm **Hysteresis (discrete output):** 5 mm / 10 mm
Effective Beam	See EBPC-1 to EBPC-4 on page 335.
Adjustments	The following may be selected by a 4-position DIP switch. **Discrete:** **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) **Analog:** **Switch 1:** Output slope positive or output slope negative **Switch 2:** Current output mode or voltage output mode **Switch 3:** Loss of echo min/max mode or loss of echo Hold Mode **Switch 4:** Loss of echo min/max default output value
Indicators	**Discrete: Three status LEDs:** **Green:** power ON **Yellow:** outputs are conducting (Yellow LED also indicates programming status during setup mode) **Red:** indicates relative strength of received echo **Analog: Three status LEDs:** **Green:** power ON **Yellow:** 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. See data sheet for detailed information.
Construction	Molded PBT polyester thermoplastic polyester housing, o-ring sealed transparent acrylic top cover, and stainless steel hardware. Q45U sensors are designed to withstand 1200 psi washdown. The base of cabled models has a ½"-14NPS internal conduit thread.
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m or 9 m attached cable, or 5-pin Mini-style or 5-pin Euro-style QD fitting. QD cordsets are ordered separately. See pages 335.
Operating Conditions	**Temperature:** -25° to +70° C **Relative humidity:** 100%
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration: 10 to 60Hz max., double amplitude 0.06", maximum acceleration 10G). Method 213B conditions H & I (Shock: 75G with unit operating; 100G for non-operation). Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.
Application Notes	**Short Range:** **Min. target size:** 10 x 10 mm aluminum plate at 500 mm 35 x 35 mm aluminum plate at 1.4 m **Long Range:** **Min. target size:** 50 x 50 mm aluminum plate at 3 m **Discrete:** Enable/Disable; Connect yellow wire to +5 to 24V dc to enable sensor and 0 to +2V dc to disable sensor. When the sensor is disabled, the last output state is held until the sensor is re-enabled. The wire must be held to the appropriate voltage for at least 40 milliseconds for the sensor to enable or disable.
Certifications	CE
Hookup Diagrams	MI18 (p. 762)

Cordsets

Euro QD (With Shield)		
See page 687		
Length	Threaded 5-Pin	
	Straight	Right-Angle
2 m	MQDEC2-506	MQDEC2-506RA
5 m	MQDEC2-515	MQDEC2-515RA
9 m	MQDEC2-530	MQDEC2-530RA



Mini QD (With Shield)	
See page 701	
Length	Threaded 5-Pin
	Straight
2 m	MBCC2-506
4 m	MBCC2-512
10 m	MBCC2-530

Additional cordset information available. See page 679.

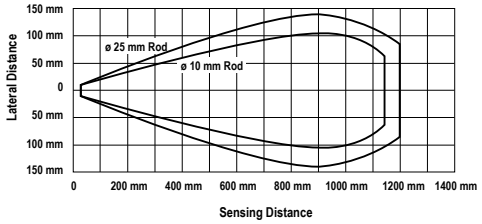
Brackets

Q45U		
		
pg. 639	pg. 640	pg. 641
SMB30A	SMB30MM	SMB30SC

Additional bracket information available. See page 620.

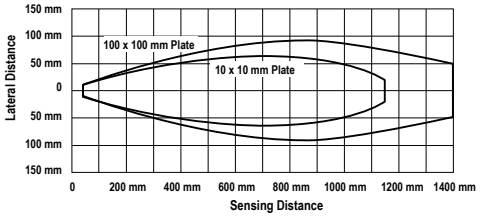
Effective Beam Patterns

Q45U Short Range with Rod Target (Typical)



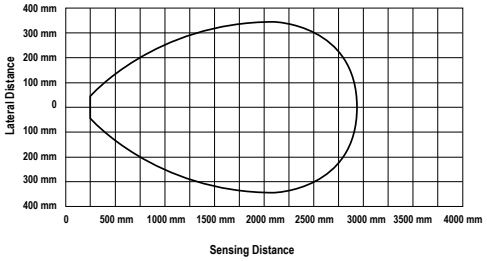
EBPC-1

Q45U Short Range with Plate Target (Typical)



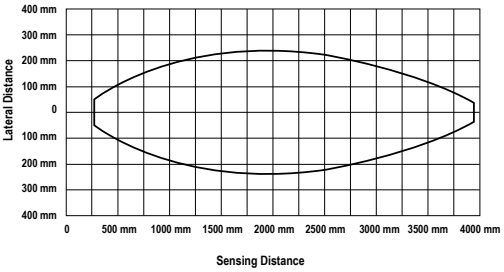
EBPC-2

Q45U Long Range with 25 mm Rod Target (Typical)



EBPC-3

Q45U Long Range with 100 x 100 mm Plate Target (Typical)



EBPC-4

U-GAGE® Q45UR
Remote Ultrasonic Sensors

- Sensing head choices are 18 mm diameter threaded barrel housing in plastic or stainless steel, or ultra-compact plastic Flat-Pak.
- Sensing range is 50 to 250 mm.
- All models feature built-in temperature compensation and an operating temperature range from -25° to +70° C.
- Analog models feature a selectable positive or negative output slope.
- Resolution is 0.1 mm for analog models and 0.6 mm for bipolar discrete models.
- Push-button TEACH-mode programming enables exact programming of sensing ranges and sensing windows.
- Environmental rating is IEC IP65 and NEMA 4.
- Digital filtering provides immunity from random electrical and acoustic noise.
- Response time is programmed with switches in discrete models and with a potentiometer in analog models.

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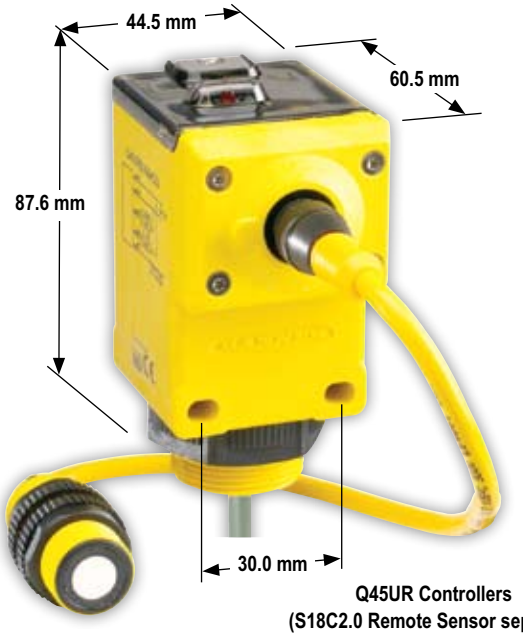
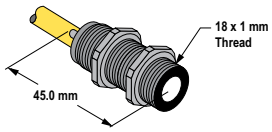
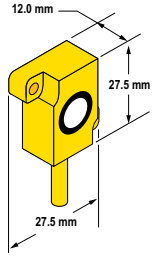


Q45UR Controllers
(S18C2.0 Remote Sensor separate)



M18C2.0 & S18C2.0 Remote Sensors



Q13C2.0 Remote Sensors

U-GAGE® Q45UR Discrete Output, 12-24V dc

Sensor Range	Controller Connection	Controller Output	Kit Models	Kit Includes		
				Controller Models	Sensor Models	
50 - 250 mm	2 m	Bipolar NPN/PNP	Q45UR3BA63CK	Q45UR3BA63C		M18C2.0 Stainless Steel Barrel
	5-pin Mini QD		Q45UR3BA63CQK	Q45UR3BA63CQ		
	5-pin Euro QD		Q45UR3BA63CQ6K	Q45UR3BA63CQ6		
50 - 250 mm	2 m	Bipolar NPN/PNP	Q45UR3BA63CKQ	Q45UR3BA63C		Q13C2.0 Flat-Pak
	5-pin Mini QD		Q45UR3BA63CQKQ	Q45UR3BA63CQ		
	5-pin Euro QD		Q45UR3BA63CQ6KQ	Q45UR3BA63CQ6		
50 - 250 mm	2 m	Bipolar NPN/PNP	Q45UR3BA63CKS	Q45UR3BA63C		S18C2.0 Molded Barrel
	5-pin Mini QD		Q45UR3BA63CQKS	Q45UR3BA63CQ		
	5-pin Euro QD		Q45UR3BA63CQ6KS	Q45UR3BA63CQ6		

Connection options: A model with a QD requires a mating cordset (see page 339).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q45UR3BA63CK W/30**).

ACCESSORIES page 339

U-GAGE® Q45UR Analog Output, 15-24V dc

Sensor Range	Controller Cable	Controller Output	Kit Models	Kit Includes		
				Controller Models	Sensor Models	
50 - 250 mm	2 m	Selectable 0 to 10V dc or 4 to 20 mA	Q45UR3LIU64CK	Q45UR3LIU64C		M18C2.0 Stainless Steel Barrel
	5-pin Mini QD		Q45UR3LIU64CQK	Q45UR3LIU64CQ		
	5-pin Euro QD		Q45UR3LIU64CQ6K	Q45UR3LIU64CQ6		
50 - 250 mm	2 m		Q45UR3LIU64CKQ	Q45UR3LIU64C		Q13C2.0 Flat-Pak
	5-pin Mini QD		Q45UR3LIU64CQKQ	Q45UR3LIU64CQ		
	5-pin Euro QD		Q45UR3LIU64CQ6KQ	Q45UR3LIU64CQ6		
50 - 250 mm	2 m		Q45UR3LIU64CKS	Q45UR3LIU64C		S18C2.0 Molded Barrel
	5-pin Mini QD		Q45UR3LIU64CQKS	Q45UR3LIU64CQ		
	5-pin Euro QD		Q45UR3LIU64CQ6KS	Q45UR3LIU64CQ6		

Connection options: A model with a QD requires a mating cordset (see page 339).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q45UR3BA63CK W/30**).

U-GAGE® Q45UR High-Gain Controllers

Product P/N	Version	
63060	Q45UR3BA63CQ6-63060	Discrete
63667	Q45UR3LIU64CQ6-63667	Analog

NOTE: Special High-Gain controllers are available for small object detection. Contact factory for more information.

U-GAGE® Q45UR Remote Sensors Specifications

Supply Voltage and Current	**Discrete:** 12 to 24V dc (10% max. ripple); 100 mA (exclusive of load) **Analog:** 15 to 24V dc (10% max. ripple); 100 mA (exclusive of load)
Ultrasonic Frequency	400 kHz
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Protection Circuitry	Both outputs are protected against continuous overload and short circuit
Output Rating	**Discrete:** 150 mA max. (each output) **OFF-state leakage current:** less than 25 µA at 24V dc **ON-state saturation voltage:** less than 1.5V at 10 mA; less than 2.0V at 150 mA **Analog:** **Voltage sourcing:** 0 to 10V dc, 10 mA max. **Current sourcing:** 4 to 20 mA, 1 to 500 Ω impedance
Output Configuration	**Discrete: Bipolar:** One current sourcing (PNP) and one current sinking (NPN) open collector transistor **Analog:** One voltage sourcing and one current sourcing; one or the other output is enabled by internal programming switch #2

More on next page

U-GAGE® Q45UR Remote Sensors Specifications (cont'd)

Performance Specifications	**Discrete:** **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 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˚ **Analog:** **Response Speed:** 10 to 320 milliseconds (2 to 64 cycles) selectable **Resolution*:** 0.2% of sensing distance at 320 milliseconds response, 0.4% of sensing distance at 10 milliseconds response **Linearity*:** 1% of full scale **Temperature stability:** ±0.03% of sensing distance per ° C from 0° to 50° C, (±0.05% per ° C over remainder of operating temperature) **Ultrasonic beam angle:** ±3.5° * Repeatability and analog resolution and linearity are specified using a 50 x 50 mm aluminum plate at 22° C under fixed sensing conditions (Analog: using the 4 to 20 mA output @ 15V dc)
Effective Beam	See page 339.
Adjustments	**Discrete:** The following may be selected by a 4-position DIP switch **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, 2, 3 or 4 mm) **Switch 4:** Response speed selection (40 or 160 milliseconds) **Analog:** Push-button TEACH-mode programming of window limits. The following may be selected by a 4-position DIP switch located on top of the controller, beneath a transparent O-ring sealed acrylic cover and beneath the black inner cover **Switch 1:** Output slope: output value increases or decreases with distance **Switch 2:** Output mode: current output or voltage output **Switches 3 & 4:** Response to loss of echo **Response Speed Adjustment:** Single-turn potentiometer selects six response values from 10 to 320 milliseconds
Indicators	**Discrete: Three status LEDs:** **Green:** Power ON **Yellow:** Output are conducting (Yellow also indicates programming status during setup) **Red:** Relative strength of received echo 5-segment moving dot LED indicates the position of the target within the sensing window **Analog: Three status LEDs:** **Green:** Power ON **Yellow:** Target is sensed within the window limits (Yellow LED also indicates programming status during setup mode) **Red:** Relative strength of received echo 5-segment moving dot LED indicates the position of the target within the sensing window See data sheet for detailed information
Construction	**Controller:** Molded thermoplastic polyester housing, o-ring sealed transparent acrylic top cover, and stainless steel hardware **Sensors:** **M18C2.0:** Stainless steel M18 threaded barrel housing and jam nuts, polyetherimide front cover, ceramic transducer, polyurethane rear cover **S18C2.0:** Thermoplastic polyester S18 threaded barrel housing and jam nuts, polyetherimide front cover, ceramic transducer, 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:** 2 m or 9 m attached cable, or 5-pin Mini-style or Euro-style quick-disconnect fitting. See page 339. **Sensor:** 2 m attached PVC cable terminated with 4-pin Euro-style quick-disconnect fitting for connection to controller.
Operating Conditions	**Controller and sensor:** -25° to +70° C **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 milliseconds duration, half sine wave.

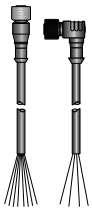
More on next page

U-GAGE® Q45UR Remote Sensors Specifications (cont'd)

Application Notes	**Discrete:** The TEACH-mode function of the controller is used to set the sensing distance set point. The sensing window size is set using DIP switches #2 and #3. The sensing distance set point is centered within the sensing widow. 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. The controller has non-volatile memory which remembers the last sensing distance set point setting if power is removed and later reapplied. The sensing distance set point may be programmed using 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. **Analog:** The controller has non-volatile memory which remembers the last sensing distance set point setting if power is removed and later reapplied. The sensing distance set point may be programmed using 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.
Certifications	CE
Hookup Diagrams	MI18 (p. 762)

Cordsets

Euro QD (With Shield)		
See page 687		
	Threaded 5-Pin	
Length	Straight	Right-Angle
2 m	MQDEC2-506	MQDEC2-506RA
5 m	MQDEC2-515	MQDEC2-515RA
9 m	MQDEC2-530	MQDEC2-530RA



Mini QD (With Shield)	
See page 701	
	Threaded 5-Pin
Length	Straight
2 m	MBCC2-506
4 m	MBCC2-512
10 m	MBCC2-530

Additional cordset information available. See page 687.

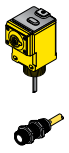
Brackets

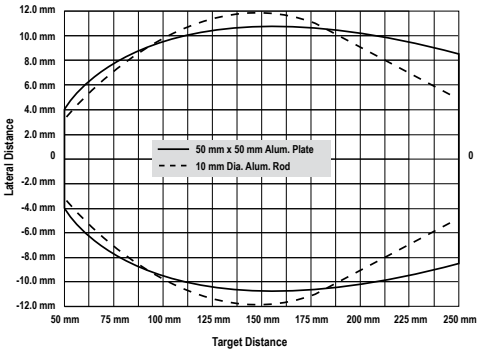
Q45UR		
		
pg. 639	pg. 640	pg. 641
SMB30A	SMB30MM	SMB30SC

Additional bracket information available. See page 620.

Effective Beam Patterns

Q45UR





EBPC-1