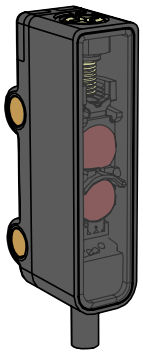
Datasheet



- Miniature sensor for installation in the smallest of spaces
- Exceptional optical performance; up to 150 mm sensing range in miniature Q2X housing
- Background suppression models for reliable detection of objects when the background condition is not controlled or fixed
- Simple multi-turn screw adjustment of cutoff distance
- Enhanced immunity to fluorescent lights
- Crosstalk immunity algorithm allows two sensors to be used in close proximity
- Small visible red LED or Class 1 laser emitter spot

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.

Q2XAF Models

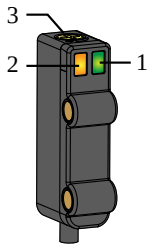
Sensing Mode	Models	Sensing Range	Connection	Output Type
Adjustable Field, Visible red, 645 nm	Q2XAPAF150-2M	Adjustable Cutoff: 18 mm to 150 mm Minimum sensing range: < 1.6 mm depending on cutoff and target reflectivity	2 m (6.5 ft) unterminated 3-wire PVC-jacketed cable	1 PNP Light Operate (LO)
	Q2XANAF150-2M			1 NPN LO
	Q2XABAF150-Q		150 mm (6 in) PVC-jacketed cable with a 4-pin M8 male quick-disconnect connector	Bipolar LO
Adjustable Field, Visible red Class 1 laser, 680 nm	Q2XAPLAF100-2M	Adjustable Cutoff: 18 mm to 100 mm Minimum sensing range: < 1.6 mm depending on cutoff and target reflectivity	2 m (6.5 ft) unterminated 3-wire PVC-jacketed cable	1 PNP LO
	Q2XANLAF100-2M			1 NPN LO
	Q2XABLAF100-Q		150 mm (6 in) PVC-jacketed cable with a 4-pin M8 male quick-disconnect connector	Bipolar LO

- To order Dark Operate (DO) models, replace "AP", "AN", or "AB" with "RP", "RN", or "RB", respectively.
- To order PNP or NPN models with a 150 mm (6 in) PVC cable and a 3-pin M8 male quick disconnect, replace "-2M" with "-Q3".
- To order Bipolar models with a 150 mm (6 in) PVC cable and a 4-pin M12 male quick disconnect, replace "-Q" with "-Q5".

Overview

Q2X Adjustable-Field Sensors with Background Suppression ignore objects beyond the set cutoff distance. Background suppression mode can be used in most situations with varying object color and position or with varying background conditions.

Sensor features



1. Green: Power Indicator
2. Yellow: Light Sensed Indicator (Flashes for Marginal Conditions)
3. Cutoff Point Adjustment Screw

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Q2X AF Laser Description and Safety Information

CAUTION:
- **Return defective units to the manufacturer.**
- Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
- Do not attempt to disassemble this sensor for repair. A defective unit must be returned to the manufacturer.

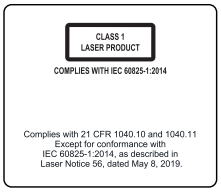
Laser Model - IEC 60825-1:2014 Class 1 Laser

Class 1 lasers are lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

Laser Wavelength
680 nm

Pulse Width
3 microseconds

Rep Rate
87 microseconds

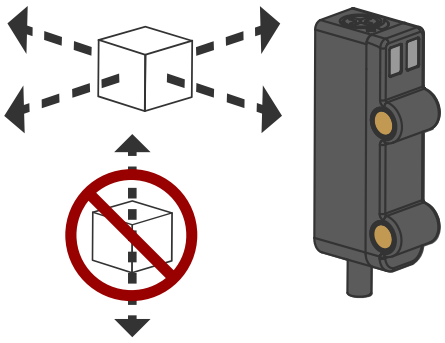


Installation

Sensor Orientation

To ensure reliable detection, orient the sensor as shown in relation to the target to be detected.

Optimal Orientation of Target to Sensor



Mount the Device

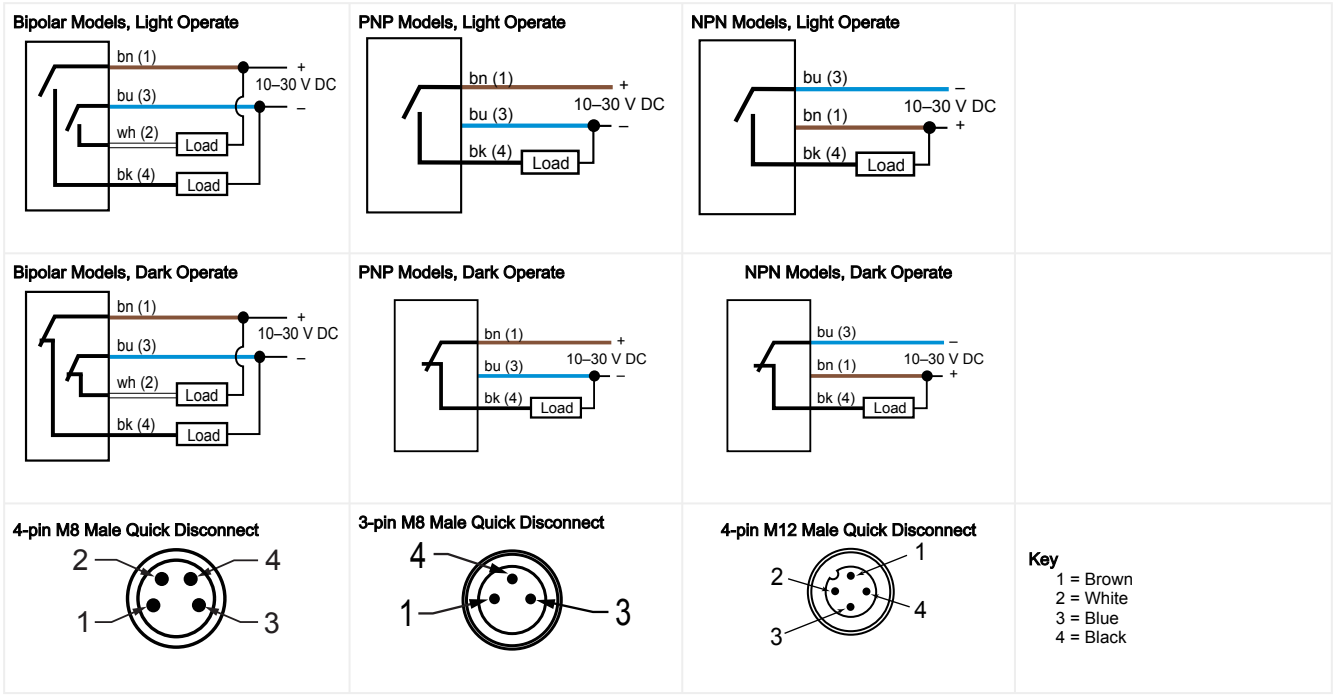
1. If a bracket is needed, mount the device onto the bracket.
2. Mount the device (or the device and the bracket) to the machine or equipment at the desired location. Do not tighten the mounting screws at this time.
3. Check the device alignment.
4. Tighten the mounting screws to secure the device (or the device and the bracket) in the aligned position.

Q2X Wiring

Cabled wiring diagrams are shown. Quick disconnect wiring diagrams are functionally identical.

CAUTION: Observe proper ESD precautions (grounding) when connecting quick disconnect models.

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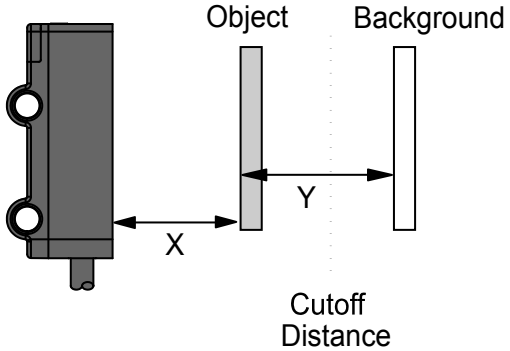
Sensor Setup - Background Suppression

Background Suppression Mode: Detect objects closer than the set cutoff distance. Ignore objects more than the minimum separation distance and further than the set cutoff distance.

To ensure reliable background suppression, a minimum separation distance between the object to be detected and the background to be ignored is necessary. See Minimum Separation Distance in "Q2XAF Performance Curves" on page 5 to determine the minimum separation distance for the sensor's emitter type: LED or laser.

1. Mount the sensor with the darkest object at the longest application distance. The distance to the object must be less than shown in the *Minimum Separation Distance* figure in "Q2XAF Performance Curves" on page 5 for your object color.
2. Turn the adjustment potentiometer **counter-clockwise** until the yellow indicator turns **off** (3 turns maximum).
3. Turn the adjustment potentiometer **clockwise** until the yellow indicator turns **on**.
4. Replace the darkest object with the brightest background at the closest application distance.
5. Turn the adjustment potentiometer **clockwise**, counting the revolutions, until the yellow indicator turns **on**.
    a. **Application Note:** If the background turns the sensor **on** before adjusting the potentiometer, the object to background distance is too close for reliable operation, and the Minimum Separation Distance is not met.
6. Turn the adjustment potentiometer **counter-clockwise** half of the number of turns from step 5. This places the cutoff distance midway between the object and the background switchpoints (see "Set the cutoff distance approximately midway between the farthest object and the closest background" on page 3). The sensor is ready for operation.

Set the cutoff distance approximately midway between the farthest object and the closest background



X: Distance to the Object

Y: Minimum Separation Between the Object and the Background

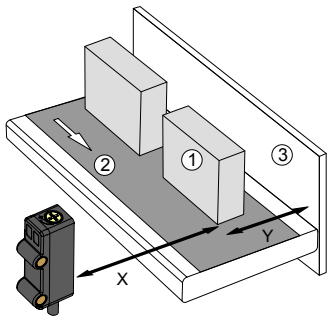
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Setup Example

An object with a reflectivity similar to black paper is set 75 mm away from the sensor. A background with a reflectivity similar to white paper is set 90 mm away from the sensor. According to the *Minimum Separation Distance* figure in "Q2XAF Performance Curves" on page 5, the LED sensor requires a minimum separation distance of 4 mm between the object and the background for reliable operation, and the laser sensor requires a minimum separation distance of 10 mm. In this application, reliable detection for both sensor types is achieved when set up according to the procedure outlined in "Sensor Setup - Background Suppression" on page 3.

Application Notes: Laser sensors can be influenced by the lateral motion of some objects as they laterally pass by the sensor as shown in "Background Suppression Mode Application Example " on page 4. If the object causes output instability when moving past the sensor laterally, move the sensor closer to the object or turn the adjustment potentiometer clockwise to slightly move the cutoff distance further past the object to stabilize the output.

Background Suppression Mode Application Example



1. Object
2. Conveyor
3. Background

X: Distance to the Object = 75 mm
Y: Minimum Separation Between the Object and the Background > 4 mm or 10 mm, depending on the sensor type

Specifications

Supply Voltage
10 V DC to 30 V DC (10% maximum ripple within specified limits) at less than 16 mA, exclusive of load

Sensing Beam
Q2XAF150 (LED): Visible red LED, 645 nm

Q2XLAF100 (Laser): Visible red (see below)

Supply Protection Circuitry
Protected against reverse polarity and transient voltages

Output Configuration
Bipolar (1 NPN and 1 PNP) solid-state output or single output (PNP or NPN), light operate (LO) or dark operate (DO), depending on model

Rating: 50 mA total output current

Off-state leakage current: < 10 µA at 30 V DC

ON-state saturation voltage: < 2 V at 50 mA

Protected against output short-circuit, continuous overload, and false pulse on power-up

Connections
2 m (6.5 ft) unterminated 3-wire PVC-jacketed cable,150 mm (6 in) PVC-jacketed cable with a 3-pin M8 male quick-disconnect connector, 150 mm (6 in) PVC-jacketed cable with a 4-pin M8 male quick-disconnect connector, or 150 mm (6 in) PVC-jacketed cable with a 4-pin M12 male quick-disconnect connector, depending on model.

Construction
PC/ABS housing, acrylic lens cover; PVC cable, acetal adjustment potentiometer

Certifications

Banner Engineering BV
Park Lane, Culliganlaan 2F bus 3
1831 Diegem, BELGIUM

Output Response
850 microseconds, OFF to ON and ON to OFF

Note: 120 millisecond delay on power-up; outputs do not conduct during this time

Adjustments
Three-turn adjustment potentiometer sets cutoff distance between minimum and maximum positions, clutched at both ends of travel

Repeatability
125 µs

Indicators
2 LED indicators on sensor top:

Green solid: Power on

Amber solid: Light sensed

Amber flashing: Marginal sensing condition

Environmental Rating
IP67

Operating Conditions
95% at +50 °C maximum relative humidity (non-condensing)

Temperature: –25 °C to +50 °C (–13 °F to +122 °F)

Application Notes
For mirror-like objects, minimize the sensor-to-object mounting distance and tilt the sensor so reflected light is directed away from the sensor when the object is present

Turck Banner LTD Blenheim House
Blenheim Court
Wickford, Essex SS11 8YT
GREAT BRITAIN

Industrial Control Equipment 3TJJ

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Required Overcurrent Protection

WARNING: Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

Overcurrent protection is required to be provided by end product application per the supplied table.

Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.

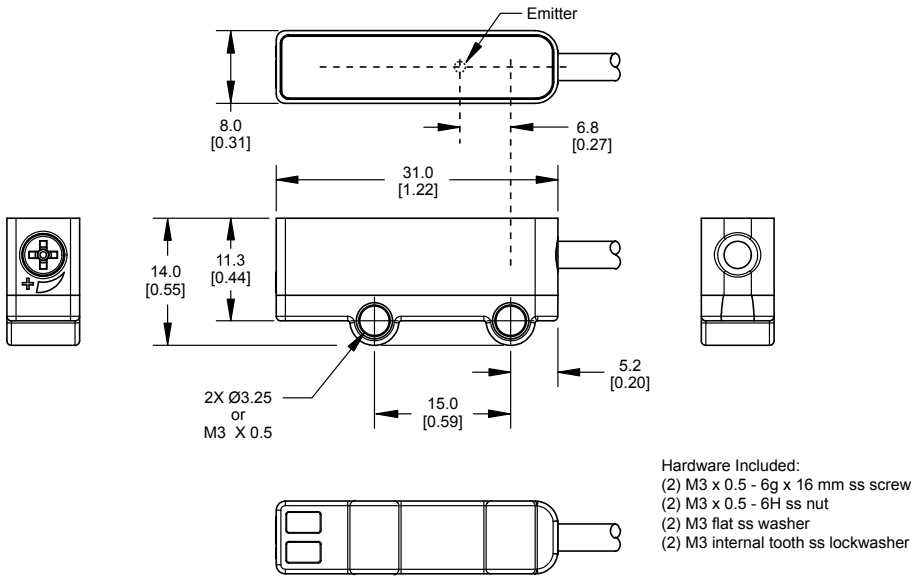
Supply wiring leads < 24 AWG shall not be spliced.

For additional product support, go to www.bannerengineering.com.

Supply Wiring (AWG)	Required Overcurrent Protection (A)	Supply Wiring (AWG)	Required Overcurrent Protection (A)
20	5.0	26	1.0
22	3.0	28	0.8
24	1.0	30	0.5

Q2X AF Dimensions

All measurements are listed in millimeters [inches], unless noted otherwise.

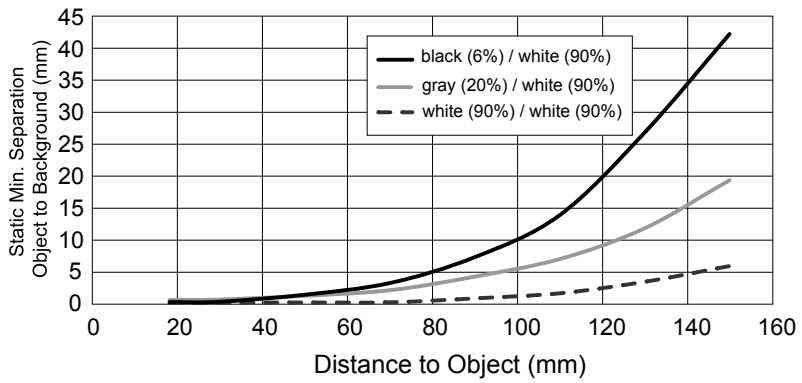


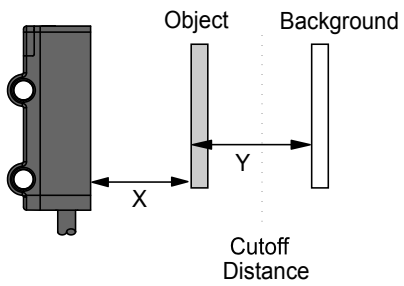
Hardware Included:
(2) M3 x 0.5 - 6g x 16 mm ss screw
(2) M3 x 0.5 - 6H ss nut
(2) M3 flat ss washer
(2) M3 internal tooth ss lockwasher

Maximum torque 0.9 Nm (8 in-lbf)

Q2XAF Performance Curves

Q2XAF150 (LED) Static Minimum Separation Distance Between Object and Background: Background Suppression Mode





X: Distance to Object (mm)

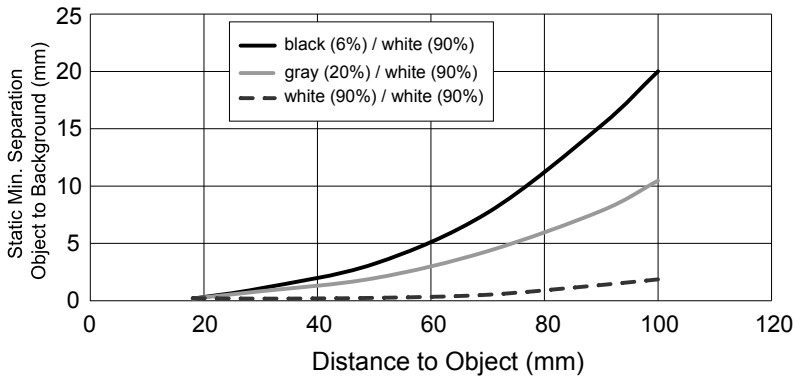
Y: Minimum Separation Between Object and Background (mm)

Continued on page 6

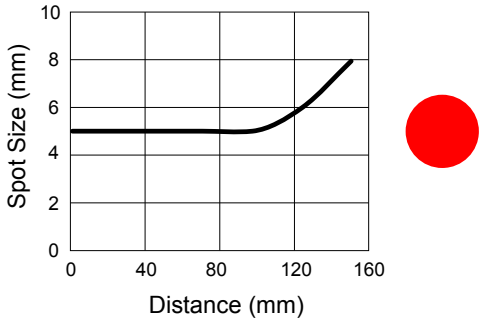
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Continued from page 5

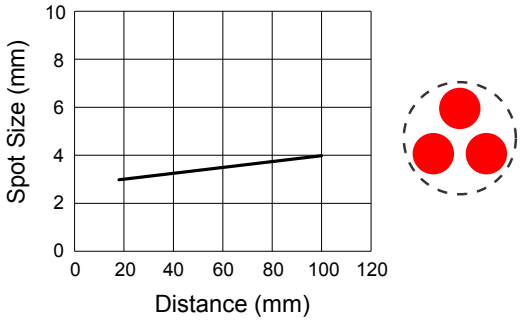
Q2XLAF100 (Laser) Static Minimum Separation Distance Between Object and Background: Background Suppression Mode



Q2XAF150 (LED) Typical Emitter Spot Diameter vs. Distance

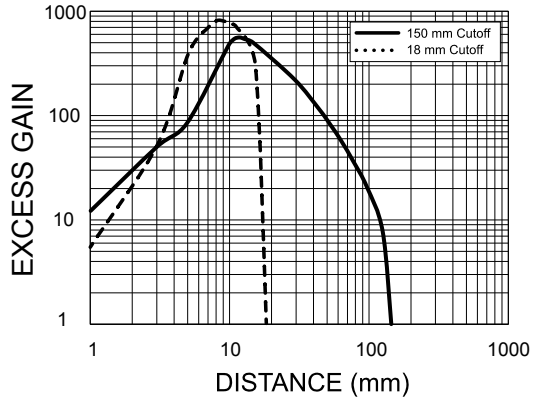


Q2XLAF100 (Laser) Typical Emitter Spot Diameter vs. Distance

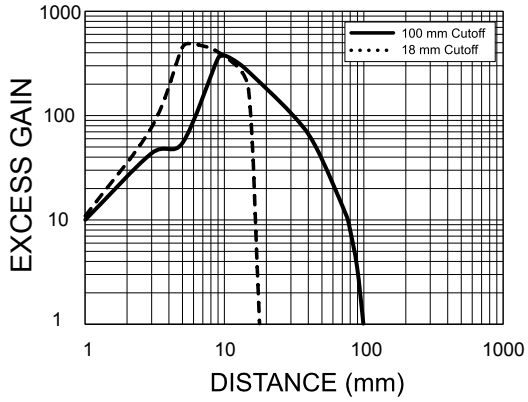


Q2X AF Excess Gain Curves

Q2XAF150 (LED) Excess Gain Curve with 18 mm Cutoff and 150 mm Cutoff (based on 90% White Card)



Q2XLAF100 (Laser) Excess Gain Curve with 18 mm Cutoff and 100 mm Cutoff (based on 90% White Card)

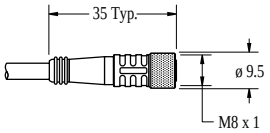
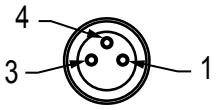
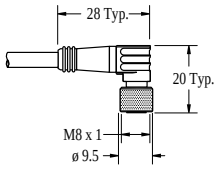


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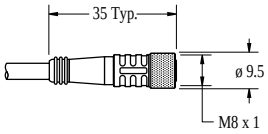
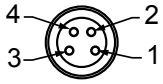
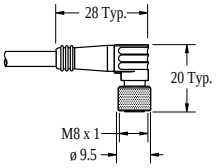
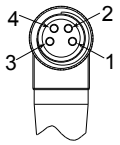
Accessories

Cordsets

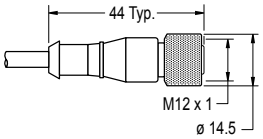
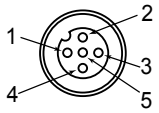
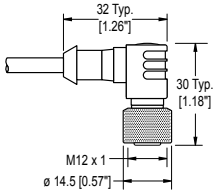
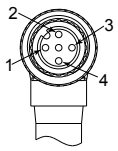
3-pin Threaded M8 Cordsets—Single Ended

Model	Length	Style	Dimensions	Pinout (Female)
PKG3M-2	2.035 m (6.68 ft)	Straight		 1 = Brown 3 = Blue 4 = Black
PKG3M-5	5.035 m (16.51 ft)			
PKG3M-7	7.035 m (23.08 ft)			
PKG3M-9	9.035 m (29.64 ft)			
PKG3M-10	10.035 m (32.92 ft)			
PKW3M-2	2 m (6.56 ft)	Right-Angle		
PKW3M-5	5 m (16.40 ft)			
PKW3M-9	9 m (29.53 ft)			

4-Pin Threaded M8 Cordsets—Single Ended

Model	Length	Style	Dimensions	Pinout (Female)	
PKG4M-2	2.04 m (6.68 ft)	Straight			1 = Brown 2 = White 3 = Blue 4 = Black
PKG4M-5	5 m (16.4 ft)				
PKG4M-9	9.04 m (29.6 ft)				
PKW4M-2	2 m (6.56 ft)	Right Angle			
PKW4M-5	5 m (16.4 ft)				
PKW4M-9	9 m (29.5 ft)				

4-Pin Threaded M12 Cordsets—Single Ended

Model	Length	Style	Dimensions	Pinout (Female)	
MQDC-406	2 m (6.56 ft)	Straight			1 = Brown 2 = White 3 = Blue 4 = Black 5 = Unused
MQDC-415	5 m (16.4 ft)				
MQDC-430	9 m (29.5 ft)				
MQDC-450	15 m (49.2 ft)				
MQDC-406RA	2 m (6.56 ft)	Right-Angle			
MQDC-415RA	5 m (16.4 ft)				
MQDC-430RA	9 m (29.5 ft)				
MQDC-450RA	15 m (49.2 ft)				

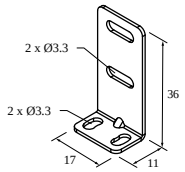
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Brackets

All measurements are listed in millimeters, unless noted otherwise.

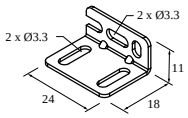
SMBQ2XA

- Vertical L-shaped bracket
- 20-ga stainless steel



SMBQ2XB

- Rear L-shaped bracket
- 20-ga stainless steel



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For patent information, see www.bannerengineering.com/patents.

Document title: Q2XAF Mechanically Adjustable Background Suppression Sensor Datasheet
Part number: 217279
Revision: E
Original Instructions
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217279