QS18AF Sensors with Foreground Suppression

BANNER®
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Datasheet

Compact sensors featuring precise adjustment of cutoff distance and foreground suppression mode

- Short-range models for precise adjustment of cutoff distance
- Exceptional optical performance; 15 to 40 mm adjustable range in compact QS18 housing
- Foreground suppression models for reliable detection when a fixed background is present and the object color or shape varies
- Objects detected to the face of the sensor (no dead zone)
- 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
- Visible red emitter

⚠️ WARNING: Not To Be Used for Personnel Protection

Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

Models

Short Range Models			
Models[1]	Supply Voltage	Sensing Range	Output Type
QS18VN6AFF40			NPN
QS18VP6AFF40	10 to 30 V dc	15 to 40 mm adjustable range	PNP
QS18AB6AFF40			Bipolar (1 NPN & 1 PNP)

Overview

WORLD-BEAM® QS18 Adjustable-Field Sensors with Foreground Suppression detect the light reflected from the background. The output changes when the light from the background is blocked.

In general, if the background is fixed and the color or shape of the objects in the foreground vary, foreground suppression mode will provide reliable detection. A foreground suppression sensor uses the background in the same way a retroreflective sensor would use a reflector. The sensor output will change whenever an object passes between itself and the background.

The short range models offer precise cutoff capability for short range applications. With an adjustable cutoff distance of 15 to 40 mm, thinner objects closer to the background can be detected with even sharper background suppression.

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[1] Only standard 2 m (6.5 ft) cable models are listed.
- For 9 m (30 ft) cables: add suffix "W/30" to the model number (for example, QS18VN6AFF40 W/30).
- For 150 mm (6 in) pigtail with a 4-pin Pico-style add suffix "Q" to the model number (for example, QS18VN6AFF40Q); accessory mating cordset required, see *Quick-Disconnect (QD) Cordsets* on page 6.
- For 150 mm (6 in) pigtail with a 4-pin Euro-style: add suffix "Q5" to the model number (for example, QS18VN6AFF40Q5); accessory mating cordset required, see *Quick-Disconnect (QD) Cordsets* on page 6.
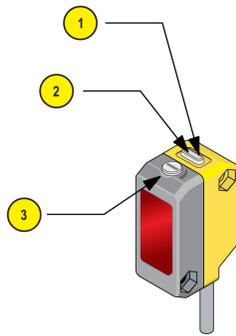
1. Green: Power Indicator
2. Amber: Light Sensed Indicator (Flashes for Marginal Conditions)
3. Cutoff Point Adjustment Screw

Figure 1. Sensor features

Sensor Orientation

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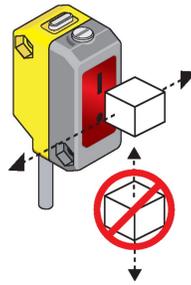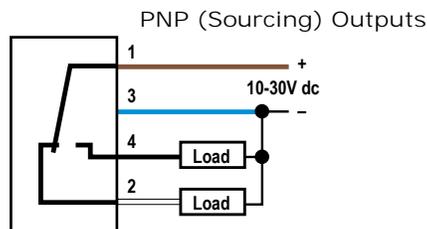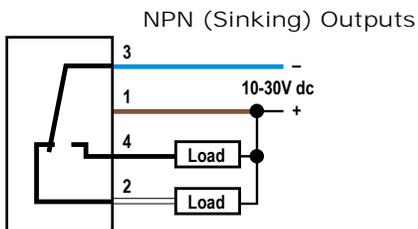

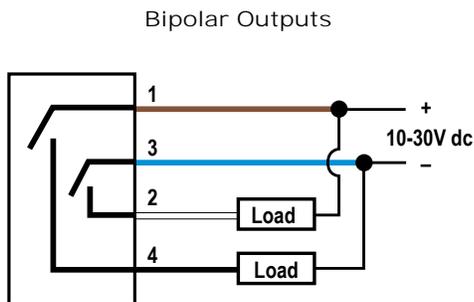*Figure 2. Optimal Orientation of Target to Sensor*

Wiring Diagrams

NPN (Sinking) Outputs

PNP (Sourcing) Outputs

Wiring Key

1 = Brown
2 = White
3 = Blue
4 = Black

Bipolar Outputs

Cabled wiring diagrams are shown. Quick disconnect (QD) wiring diagrams are functionally identical.

Sensor Setup - Foreground Suppression

Foreground Suppression Mode (also called Background Detection): The light reflected off the background is detected. The output changes when the light from the background is blocked.

In general, if the background is fixed and the color or shape of the objects in the foreground vary, foreground suppression mode will provide reliable detection. A foreground suppression sensor uses the background in the same way a retroreflective sensor would use a reflector. The sensor output will change whenever an object passes between itself and the background.

To ensure reliable foreground suppression, a minimum separation distance between the object and the background is necessary. See *Figure 6* on page 6 to determine the minimum separation distance.

1. Mount the sensor within 40 mm of the fixed background.
2. Turn the adjustment potentiometer clockwise until it clicks (5 turns).
3. Turn the adjustment potentiometer counter-clockwise until the yellow indicator turns on. This places the cutoff distance in front of the fixed background (see *Figure 3* on page 3).
4. Place the application's darkest object into the sensor's field of view at the maximum sensor to the object distance, and verify that the yellow indicator turns off. The sensor is optimized for detecting thin objects close to the fixed background and is ready for operation.

   For maximum sensing reliability in applications with variations in background position or color (for example, conveyor belts with flutter), follow these additional steps.
5. Continuing from step 4, turn the adjustment potentiometer counter-clockwise, counting the revolutions, until the yellow indicator turns on.
6. Turn the adjustment potentiometer clockwise half the number of revolutions from step 5. This places the cutoff distance midway between the object and the background. The sensor is optimized for reliable detection in applications with thick objects and modest variation in background. The sensor is ready for operation.
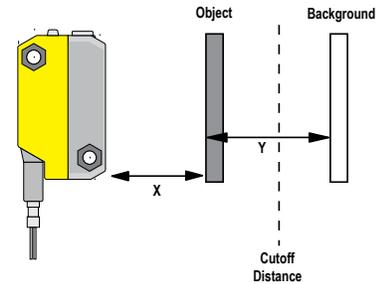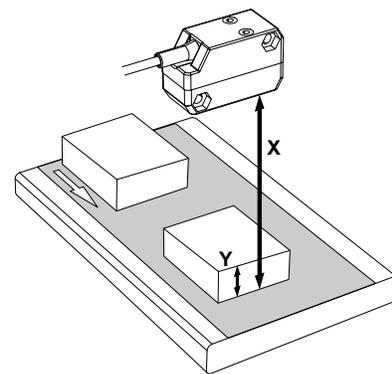

X: Distance to Background

Y: Minimum Separation Between Object and Background

Figure 3. Set the cutoff distance in front of the fixed background

Setup Example

The sensor is positioned above a black conveyor belt at a distance of 30 mm. The objects on the conveyor are boxes of varying colors. According to *Figure 6* on page 6, the box height must be greater than 0.7 mm for reliable detection against a black background. In this application, reliable detection will be achieved when set up according to the procedure outlined in *Sensor Setup - Foreground Suppression* on page 3.

Figure 4. Foreground Suppression Mode application example

1. Object
2. Background (Conveyor)
X: Distance to Background = 30 mm
Y: Minimum Separation Between Object and Background > 0.7 mm

Output States

Foreground Suppression Mode			
Sensor Model Type	Output	Object Between Sensor Face and Cutoff Distance	No Object Between Sensor Face and Fixed Background
All Models	Yellow Indicator Light	OFF	ON
Complementary Models	Black Wire (Pin 4)	OFF	ON
	White Wire (Pin 2)	ON	OFF
Bipolar Models	Black Wire (Pin 4)	OFF	ON
	White Wire (Pin 2)	OFF	ON

Specifications

Supply Voltage
  10 to 30 V dc (10% maximum ripple within specified limits) at less than 27 mA, exclusive of load

Sensing Beam
  Visible red LED, 630 nm

Supply Protection Circuitry
  Protected against reverse polarity and transient voltages

Output Configuration
  Solid-state complementary: NPN or PNP (current sinking or sourcing), or bipolar (both sinking and sourcing) depending on model;
  Rating: 100 mA total output current
  Off-state leakage current:
  NPN: less than 200 µA at 30 V dc (See Application Note 1)
  PNP: less than 10 µA at 30 V dc
  ON-state saturation voltage:
  NPN: less than 1.6 V at 100 mA
  PNP: less than 3.0 V at 100 mA
  Protected against false pulse on power-up and continuous overload or short circuit of outputs

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 http://www.bannerengineering.com.

Supply Wiring	Required Overcurrent Protection
20	5.0 Amps
22	3.0 Amps
24	2.0 Amps
26	1.0 Amps
28	0.8 Amps
30	0.5 Amps

Output Response
  2.8 millisecond ON/OFF
  Note: 200 millisecond delay on power-up; outputs do not conduct during this time

Adjustments
  Five-turn adjustment screw sets cutoff distance between min. and max. positions, clutched at both ends of travel

Repeatability
  250 µs

Indicators
  2 LED indicators on sensor top:
  Green solid: Power on
  Amber solid: Light sensed
  Amber flashing: Marginal sensing condition

Construction
  ABS housing, acrylic lens cover; PVC cable, nickel-plated brass connector, acetal adjustment pot

Environmental Rating
  IEC IP67; NEMA 6; UL Type 1

Connections
  2 m (6.5 ft) 4-wire PVC cable, 9 m (30 ft) PVC cable, or 4-pin Pico-style or Euro-style 150 mm (6 in) pigtail QD, depending on model

Operating Conditions
  Relative Humidity: 95% at 50 °C (non-condensing)
  Temperature: −20 °C to 55 °C (−4 °F to 131 °F)

Application Notes
  1. NPN off-state leakage current is < 200 µA for load resistances > 3 kΩ or optically isolated loads. For load current of 100 mA, leakage is < 1% of load current.
  2. For emitter spot alignment, cover the receiver (top lens position) to temporarily turn emitter for maximum brightness.
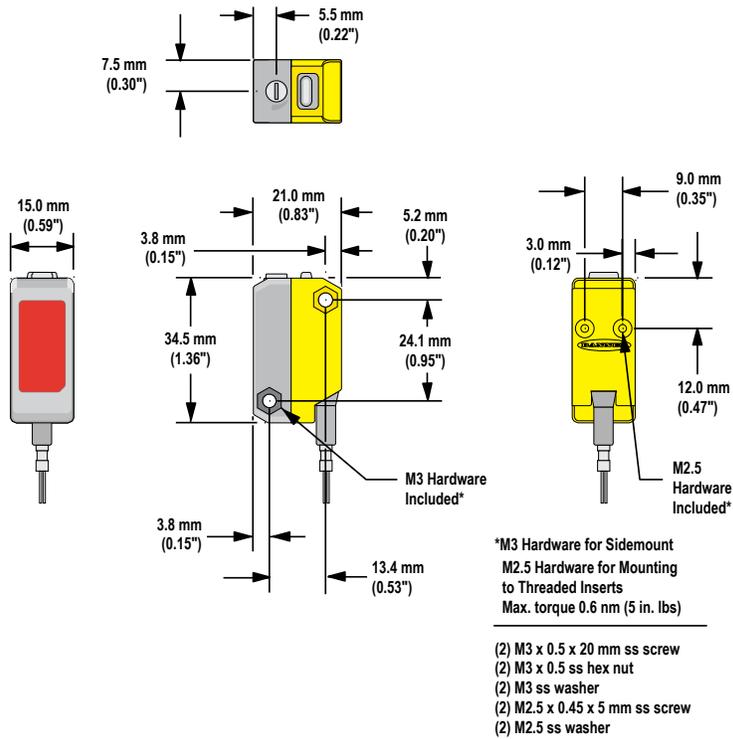 3. For mirror-like objects, minimize the sensor to object mounting distance and tilt the sensor so reflected light is directed away from the sensor when the object is present.

Certifications

CE

Dimensions

All measurements are listed in millimeters (inches), unless noted otherwise.

5.5 mm
(0.22")

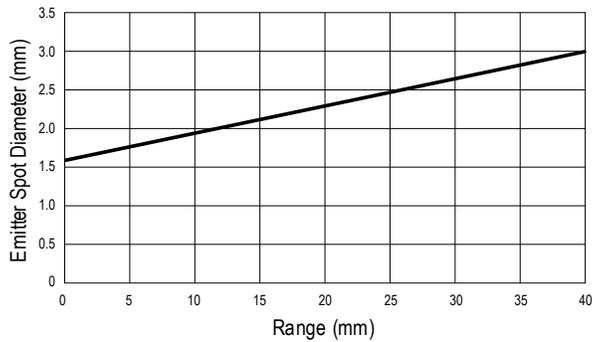7.5 mm
(0.30")

15.0 mm
(0.59")

3.8 mm
(0.15")

21.0 mm
(0.83")

5.2 mm
(0.20")

34.5 mm
(1.36")

24.1 mm
(0.95")

3.8 mm
(0.15")

13.4 mm
(0.53")

M3 Hardware
Included*

9.0 mm
(0.35")

3.0 mm
(0.12")

12.0 mm
(0.47")

M2.5
Hardware
Included*

*M3 Hardware for Sidemount
 M2.5 Hardware for Mounting
   to Threaded Inserts
 Max. torque 0.6 nm (5 in. lbs)

(2) M3 x 0.5 x 20 mm ss screw
(2) M3 x 0.5 ss hex nut
(2) M3 ss washer
(2) M2.5 x 0.45 x 5 mm ss screw
(2) M2.5 ss washer

Performance Curves

Figure 5. Typical Emitter Spot Diameter vs. Distance

Figure 6. Minimum Separation Distance Between Object and Background

X: Distance to Background (mm)

Y: Minimum Separation Between Object and Background (mm)

Excess Gain Curves

Figure 7. Excess Gain Curve with 15 mm Cutoff (based on 90% White Card)

Figure 8. Excess Gain Curve with 40 mm Cutoff (based on 90% White Card)
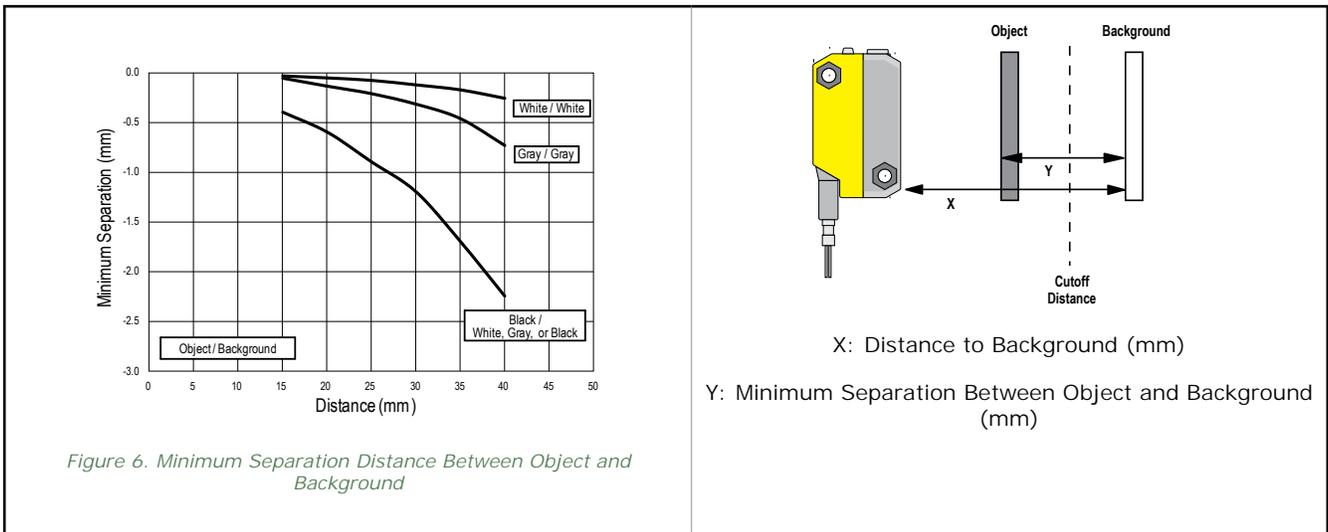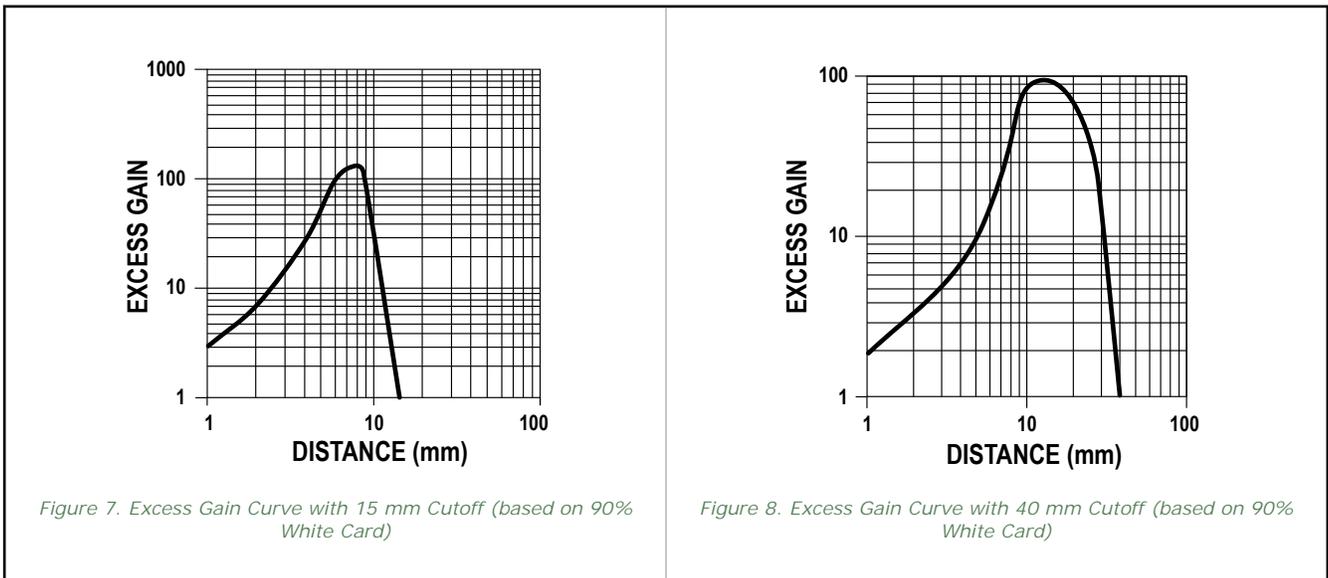
Accessories

Quick-Disconnect (QD) Cordsets

4-Pin Snap-on M8/Pico-Style Cordsets				
Model	Length	Style	Dimensions	Pinout (Female)
PKG4-2	2 m (6.56 ft)	Straight	32 Typ. ø 9.0	1 = Brown 2 = White 3 = Blue 4 = Black

4-Pin Threaded M12/Euro-Style Cordsets				
Model	Length	Style	Dimensions	Pinout (Female)
MQDC-406	1.83 m (6 ft)	Straight	44 Typ. M12 x 1 ø 14.5	1 = Brown 2 = White 3 = Blue 4 = Black
MQDC-415	4.57 m (15 ft)			
MQDC-430	9.14 m (30 ft)			
MQDC-450	15.2 m (50 ft)			

Mounting Brackets

All measurements are listed in millimeters, unless noted otherwise.

SMBQS18A
- Wrap-around protection bracket
- Die-cast bracket
- Base fits 18 mm threaded hole
- Metal hex nut, lock washer and grommet included
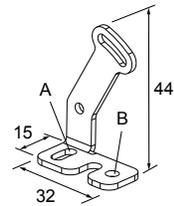- Mounting holes specially designed for QS18AF sensors
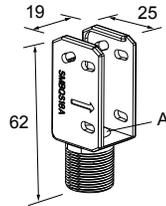
Hole size: A = ø 15.3

SMBQS18AF
- Right-angle mounting bracket
- 14-ga. 304 stainless steel

Hole center spacing: A to B = 20.3
Hole size: A = 4.3 × 9.4, B = ø 4.3

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