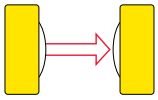
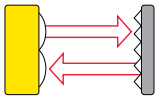
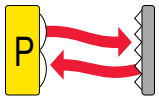
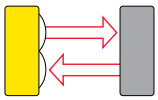
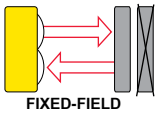
S18 Sensors (DC-Voltage Series)

Datasheet

- Featuring EZ-BEAM® technology for reliable sensing without the need for adjustments
- Completely epoxy-encapsulated to provide superior durability, designed to meet rigorous IP69K standards for use in 1200 psi washdowns
- Innovative dual-indicator system for simple sensor performance monitoring
- Advanced diagnostics to warn of marginal sensing conditions or output overload
- 10 to 30V dc; choose SPDT (complementary) NPN or PNP outputs (150 mA max. ea.)

Sensing Mode	Range	LED	Output	Model
 OPPOSED	20 m (66 ft)	Infrared 950 nm	-	S186E
			NPN	S18SN6R
			PNP	S18SP6R
 RETRO	2 m (79 inches)	Infrared 950 nm	NPN	S18SN6L
			PNP	S18SP6L
 POLAR RETRO [1]	2 m (79 inches)	Visible Red 680 nm	NPN	S18SN6LP
			PNP	S18SP6LP
 DIFFUSE	100 mm (4 inches)	Infrared 880 nm	NPN	S18SN6D
			PNP	S18SP6D
	300 mm (12 inches)		NPN	S18SN6DL
			PNP	S18SP6DL
 FIXED-FIELD	25 mm (1 inch) cutoff	Infrared 880 nm	NPN	S18SN6FF25
			PNP	S18SP6FF25
	50 mm (2 inches) cutoff		NPN	S18SN6FF50
			PNP	S18SP6FF50
	100 mm (4 inches) cutoff		NPN	S18SN6FF100
			PNP	S18SP6FF100

To order the 9 m (30 ft) cable model, add suffix "W/30" to the cabled model number. For example, S186E W/30. To order the 4-pin Euro-style QD models, add suffix "Q". Models with a QD connector require a mating cable.

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.

[1] Use polarized models when shiny objects will be sensed.

Fixed-Field Mode Overview

S18 Series self-contained fixed-field sensors are small, powerful, infrared diffuse mode sensors with far-limit cutoff (a type of background suppression). Their high excess gain and fixed-field technology allow them to detect objects of low reflectivity, while ignoring background surfaces.

The cutoff distance is fixed. Backgrounds and background objects must always be placed beyond the cutoff distance.

Fixed-Field Sensing – Theory of Operation

The S18FF compares the reflections of its emitted light beam (E) from an object back to the sensor's two differently aimed detectors, R1 and R2. If the near detector (R1) light signal is stronger than the far detector (R2) light signal (see object A, closer than the cutoff distance), the sensor responds to the object. If the far detector (R2) light signal is stronger than the near detector (R1) light signal (see object B, beyond the cutoff distance), the sensor ignores the object.

The cutoff distance for model S18FF sensors is fixed at 25, 50 or 100 millimeters (1", 2", or 4"). Objects lying beyond the cutoff distance usually are ignored, even if they are highly reflective. However, it is possible to falsely detect a background object, under certain conditions (see Background Reflectivity and Placement).

In the drawings and discussion on these pages, the letters E, R1, and R2 identify how the sensor's three optical elements (Emitter "E", Near Detector "R1", and Far Detector "R2") line up across the face of the sensor. The location of these elements defines the sensing axis (see *Figure 2* on page 2). The sensing axis becomes important in certain situations, such as those illustrated in *Figure 5* on page 3 and *Figure 6* on page 3.

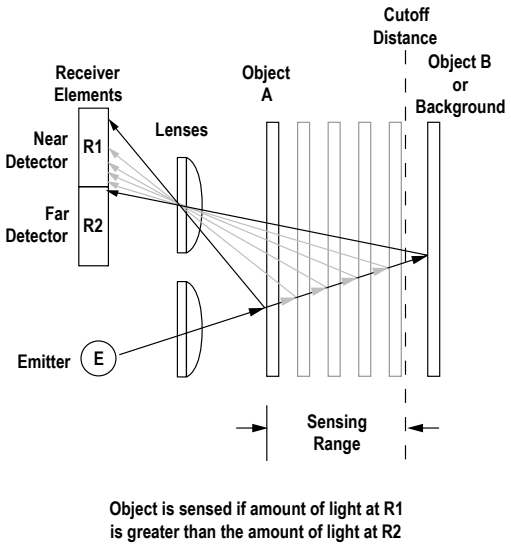


Figure 1. Fixed-field concept

Sensor Setup

Sensing Reliability

As a general rule, the most reliable sensing of an object approaching from the side occurs when the line of approach is parallel to the sensing axis.

For highest sensitivity, position the target object for sensing at or near the point of maximum excess gain. The excess gain curves for these products are shown on page 5. Maximum excess gain for the 25 mm models occurs at a lens-to-object distance of about 7 mm; for 50 mm models, at about 10 mm; and for the 100 mm models, at about 20 mm. Sensing at or near this distance will make maximum use of each sensor's available sensing power. The background must be placed beyond the cutoff distance. (Note that the reflectivity of the background surface also may affect the cutoff distance.) Following these two guidelines will improve sensing reliability.

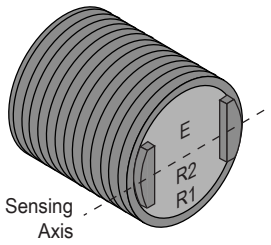


Figure 2. Fixed-field sensing axis

Background Reflectivity and Placement

Avoid mirror-like backgrounds that produce specular reflections. False sensor response will occur if a background surface reflects the sensor's light more strongly to the near detector, or "sensing" detector (R1), than to the far detector, or "cutoff" detector (R2). The result is a false ON condition (see *Figure 3* on page 3). To cure this problem, use a diffusely

reflective (matte) background, or angle either the sensor or the background (in any plane) so the background does not reflect light back to the sensor (see *Figure 4* on page 3). Position the background as far beyond the cutoff distance as possible.

An object beyond the cutoff distance, either stationary (and when positioned as shown in *Figure 5* on page 3), or moving past the face of the sensor in a direction perpendicular to the sensing axis, can cause unwanted triggering of the sensor if more light is reflected to the near detector than to the far detector. The problem is easily remedied by rotating the sensor 90° (*Figure 6* on page 3). The object then reflects the R1 and R2 fields equally, resulting in no false triggering. A better solution, if possible, may be to reposition the object or the sensor.

Color Sensitivity

The effects of object reflectivity on cutoff distance, though small, may be important for some applications. It is expected that at any given cutoff setting, the actual cutoff distance for lower reflectance targets will be slightly shorter than for higher reflectance targets (see *Performance Curves* on page 4). This behavior is known as color sensitivity.

For example, an excess gain of 1 for an object that reflects 1/10 as much light as the 90% white card is represented by the horizontal graph line at excess gain = 10. An object of this reflectivity results in a far limit cutoff of approximately 20 mm (0.8 inches), for the 25 mm (1 inch) cutoff model for example; thus 20 mm represents the cutoff for this sensor and target.

These excess gain curves were generated using a white test card of 90% reflectance. Objects with reflectivity of less than 90% reflect less light back to the sensor, and thus require proportionately more excess gain in order to be sensed with the same reliability as more reflective objects. When sensing an object of very low reflectivity, it may be especially important to sense it at or near the distance of maximum excess gain.

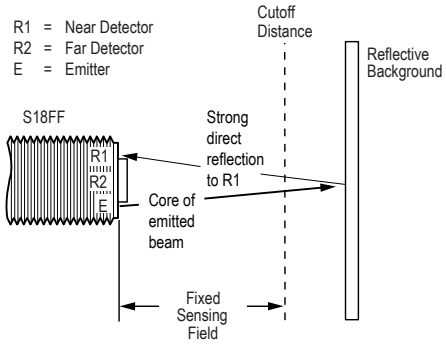


Figure 3. Reflective Background - Problem

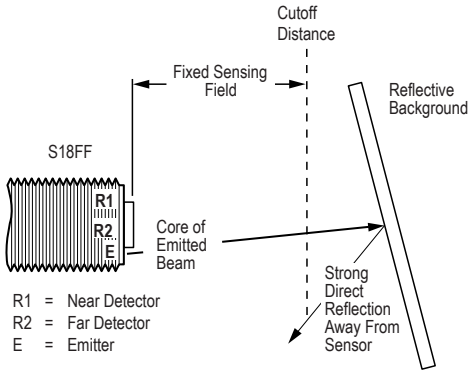


Figure 4. Reflective Background - Solution

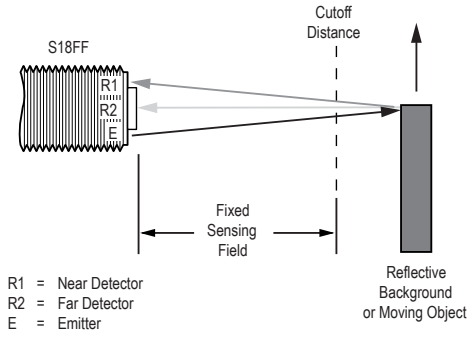


Figure 5. Object Beyond Cutoff - Problem

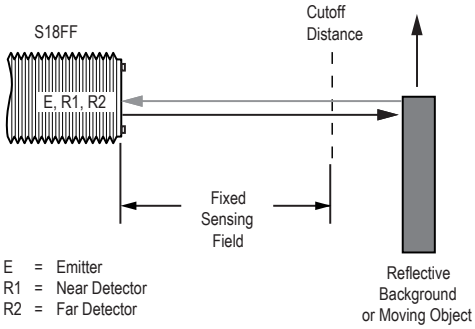


Figure 6. Object Beyond Cutoff - Solution

A reflective background object in this position or moving across the sensor face in this axis and direction may cause false sensor response.

A reflective background object in this position or moving across the sensor face in this axis will be ignored.

Specifications

Supply Voltage and Current
10 to 30V dc (10% max. ripple); supply current (exclusive of load current):
Emitters, Non-Polarized, Retro, Diffuse: 25 mA
Receivers: 20 mA
Polarized Retroreflective: 30 mA
Fixed-Field: 35 mA

Supply Protection Circuitry
Protected against reverse polarity and transient voltages

Indicators
Two LEDs (Green and Yellow)
Green ON solid: power to sensor is ON
Green flashing: output is overloaded
Amber ON solid: N.O. output is conducting
Amber flashing: excess gain marginal (1 to 1.5x) in light condition

Construction
PBT polyester housing; polycarbonate (opposed-mode) or acrylic lens

Environmental Rating
Leakproof design rated NEMA 6P, DIN 40050 (IP69K)

Connections
2 m (6.5 ft) or 9 m (30 ft) attached cable or 4-pin Euro-style quick-disconnect fitting

Operating Conditions
Temperature: –40 to +70 °C (–40 to +158 °F)
Maximum relative humidity: 90% at 50 °C (non-condensing)

Vibration and Mechanical Shock
All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max., double amplitude 0.06" acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)

Output Configuration
SPDT solid-state dc switch; NPN (current sinking) or PNP (current sourcing), depending on model
Light Operate: N.O. output conducts when sensor sees its own (or the emitter's) modulated light
Dark Operate: N.C. output conducts when the sensor sees dark; the N.C. (normally closed) output may be wired as a normally open marginal signal alarm output, depending upon hookup to power supply

Output Rating
150 mA maximum (each) in standard hookup. When wired for alarm output, the total load may not exceed 150 mA.
OFF-state leakage current: < 1 microamp @ 30V dc
ON-state saturation voltage: < 1V @ 10 mA dc; < 1.5V @ 150 mA dc

Output Protection Circuitry
Protected against false pulse on power-up and continuous overload or short circuit of outputs

Output Response Time
Opposed mode: 3 ms ON, 1.5 ms OFF
Retro, Fixed-Field and Diffuse: 3 ms ON and OFF
NOTE: 100 ms delay on power-up; outputs do not conduct during this time.

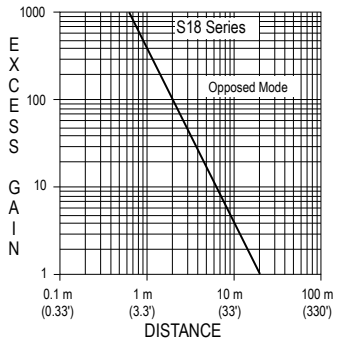
Repeatability
Opposed mode: 375 µs
Retro, Fixed-Field and Diffuse: 750 µs
Repeatability and response are independent of signal strength.

Certifications

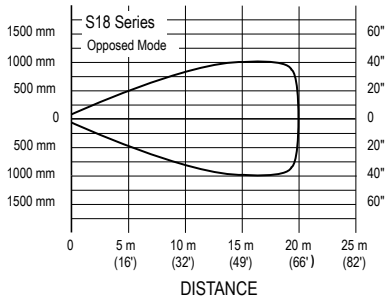
Performance Curves

Opposed Mode

Excess Gain

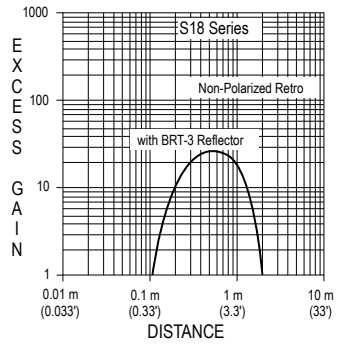


Beam Pattern

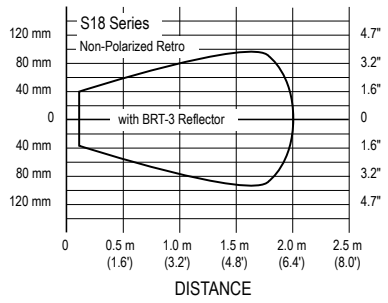


Retroreflective Mode [2]

Excess Gain

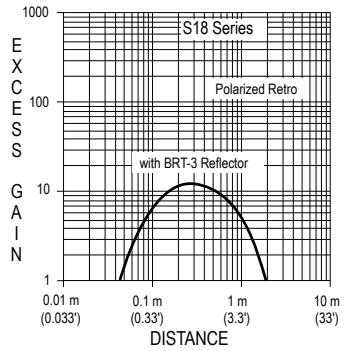


Beam Pattern

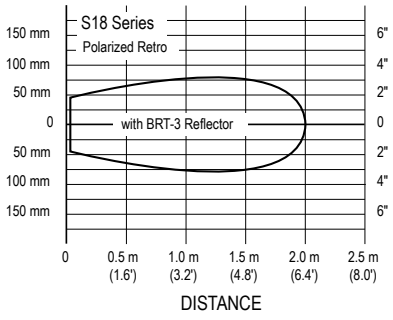


Polarized Retroreflective Mode [2]

Excess Gain

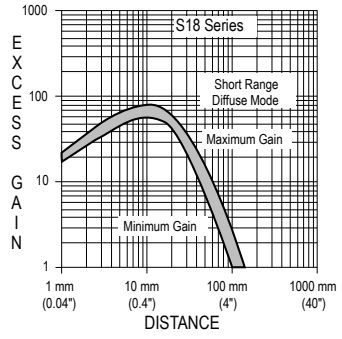


Beam Pattern

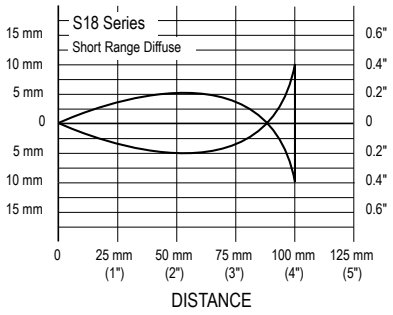


Diffuse 100 mm Mode [3]

Excess Gain



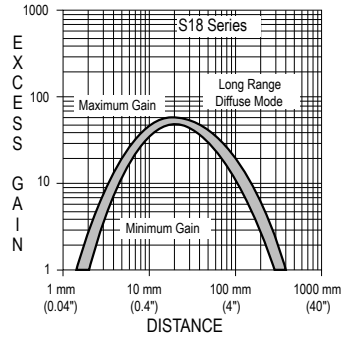
Beam Pattern



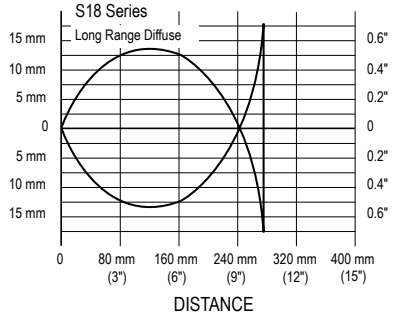
[2] Performance based on use of a model BRT-3 retroreflector (3" diameter). Actual sensing range may be more or less than specified, depending on the efficiency and reflective area of the retroreflector used.
[3] Performance based on use of a 90% reflectance white test card.

Diffuse 300 mm Mode[3]

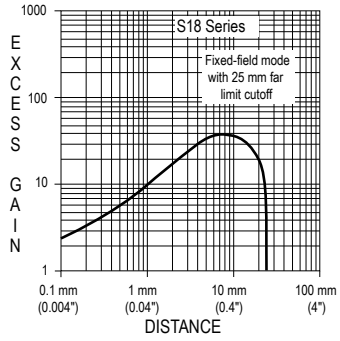
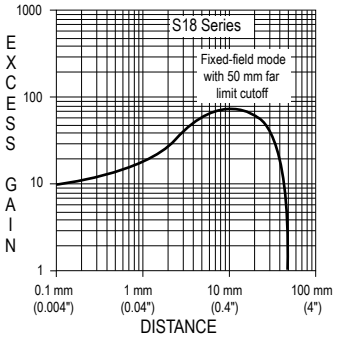
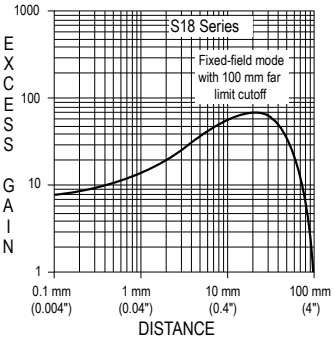
Excess Gain



Beam Pattern



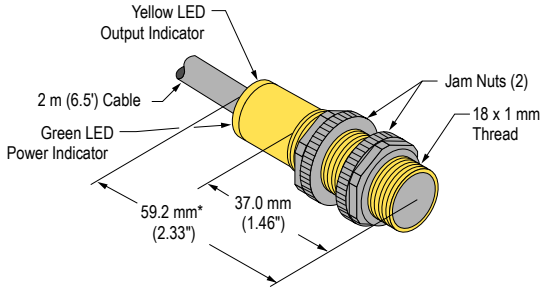
Fixed-Field [3]

25 mm Mode	50 mm Mode	100 mm Mode
Excess Gain	Excess Gain	Excess Gain
		
Using 18% gray test card: Cutoff distance will be 95% of value shown. Using 6% black test card: Cutoff distance will be 90% of value shown.	Using 18% gray test card: Cutoff distance will be 90% of value shown. Using 6% black test card: Cutoff distance will be 85% of value shown.	Using 18% gray test card: Cutoff distance will be 85% of value shown. Using 6% black test card: Cutoff distance will be 75% of value shown.
Ø 10 mm spot size @ 8 mm focus	Ø 10 mm spot size @ 10 mm focus	Ø 10 mm spot size @ 20 mm focus
Ø 10 mm spot size @ 25 mm cutoff	Ø 10 mm spot size @ 50 mm cutoff	Ø 10 mm spot size @ 100 mm cutoff

Focus and spot sizes are typical.

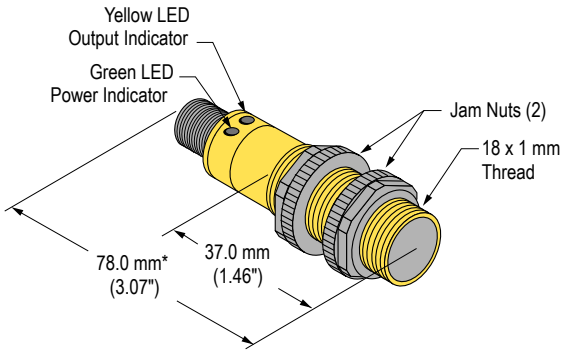
Dimensions

Cabled Models



*Polarized retro and fixed-field models = 65.0 mm (2.56")

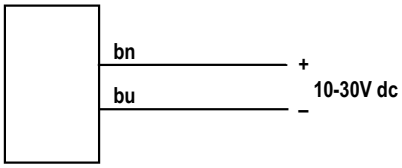
QD Models



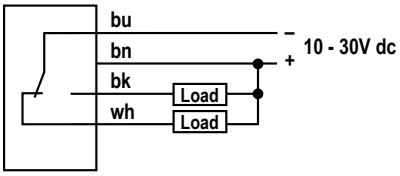
*Polarized retro and fixed-field models = 83.8 mm (3.30")

Wiring Diagrams

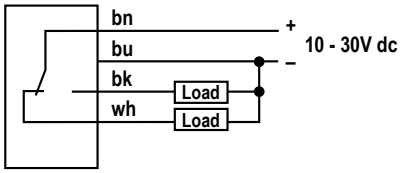
Cabled Emitters



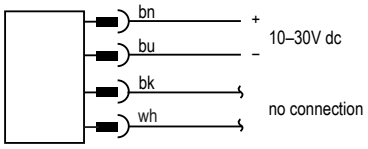
NPN (Sinking) Outputs (Standard)



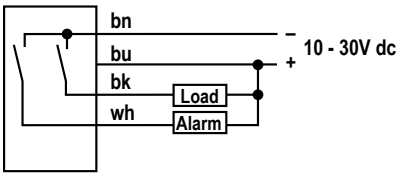
PNP (Sourcing) Outputs (Standard)



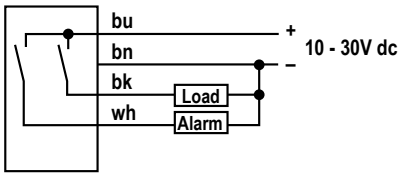
QD Emitters



NPN (Sinking) Outputs (Alarm)

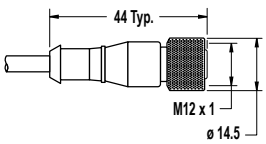
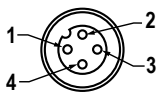


PNP (Sourcing) Outputs (Alarm)

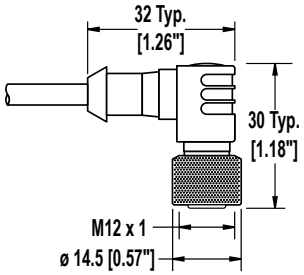
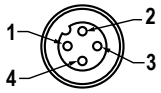


QD hookups are functionally identical.

Accessories

4-Pin Threaded M12/Euro-Style Cordsets				
Model	Length	Style	Dimensions	Pinout
MQDC-406	1.83 m (6 ft)	Straight		
MQDC-415	4.57 m (15 ft)			
MQDC-430	9.14 m (30 ft)			
MQDC-450	15.2 m (50 ft)			

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

4-Pin Threaded M12/Euro-Style Cordsets				
Model	Length	Style	Dimensions	Pinout
MQDC-406RA	1.83 m (6 ft)	Right-Angle		 1 = Brown 2 = White 3 = Blue 4 = Black
MQDC-415RA	4.57 m (15 ft)			
MQDC-430RA	9.14 m (30 ft)			
MQDC-450RA	15.2 m (50 ft)			

Banner Engineering Corp Limited Warranty

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