

# S18 Series Sensor (AC Voltage)



## Instruction Manual



- 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
- 20 V AC to 250 V AC (3-wire connection); SPST solid-state switch output, maximum load 300 mA



### 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

Sensing Mode	Range	LED	Output	Model
 OPPOSED	20 m (66 ft)	Infrared 950 nm	-	<b>S183E</b>
			LO	<b>S18AW3R</b>
			DO	<b>S18RW3R</b>
 RETRO	2 m (79 in)	Infrared 950 nm	LO	<b>S18AW3L</b>
			DO	<b>S18RW3L</b>
 POLAR RETRO <sup>1</sup>	2 m (79 in)	Visible Red 680 nm	LO	<b>S18AW3LP</b>
			DO	<b>S18RW3LP</b>
 DIFFUSE	100 mm (4 in)	Infrared 880 nm	LO	<b>S18AW3D</b>
	300 mm (12 in)		DO	<b>S18RW3D</b>
			LO	<b>S18AW3DL</b>
	DO		<b>S18RW3DL</b>	
 FIXED-FIELD	25 mm (1 in) cutoff	Infrared 880 nm	LO	<b>S18AW3FF25</b>
	50 mm (2 in) cutoff		DO	<b>S18RW3FF25</b>
			LO	<b>S18AW3FF50</b>
	100 mm (4 in) cutoff		DO	<b>S18RW3FF50</b>
			LO	<b>S18AW3FF100</b>
	DO		<b>S18RW3FF100</b>	

Standard 2 m (6.5 ft) cable models are listed.

- To order the 9 m (30 ft) cable models, add suffix **W/30** (for example, **S183E W/30**).
- To order the 4-pin 1/2"-20UNF QD models, add suffix **Q1** (for example, **S183EQ1**). A model with a QD connector requires a mating cable.
- To order the 5-pin 1/2"-20UNF QD models, add suffix **Q** (for example, **S183EQ**). A model with a QD connector requires a mating cable.

<sup>1</sup> Use polarized models when shiny objects will be sensed.

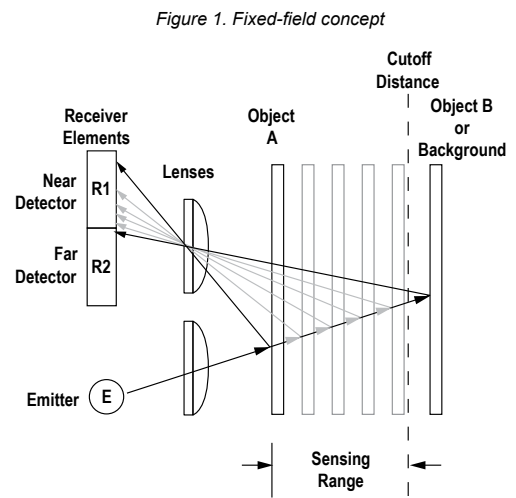


## Fixed-Field Mode Overview

S18 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.

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.



Object is sensed if amount of light at R1 is greater than the amount of light at R2

The cutoff distance for model S18FF sensors is fixed at 25, 50 or 100 millimeters (1 in, 2 in, or 4 in). 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 p. 2). The sensing axis becomes important in certain situations, such as those illustrated in Figure 5 on p. 3 and Figure 6 on p. 3.

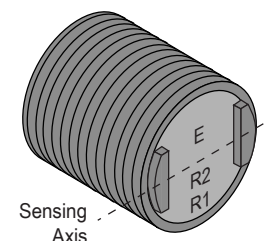
## Sensor Setup

### 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. 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 p. 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 p. 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 p. 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 p. 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.

Figure 3. Reflective Background - Problem

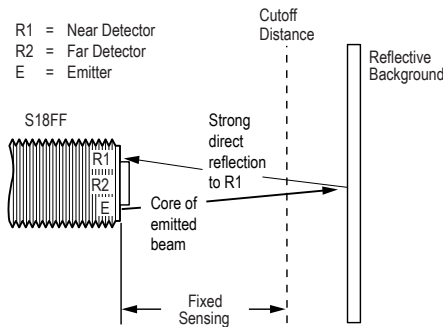


Figure 4. Reflective Background - Solution

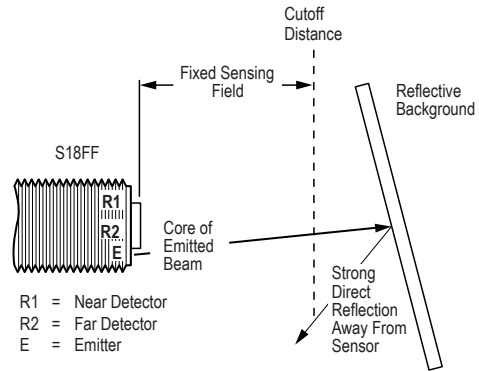


Figure 5. Object Beyond Cutoff - Problem

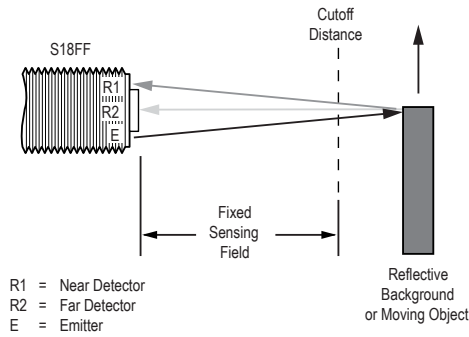
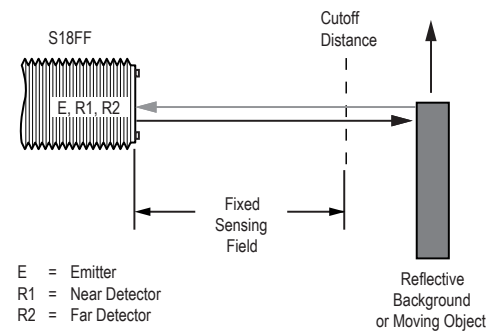


Figure 6. Object Beyond Cutoff - Solution



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.

## 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*). 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.

## Wiring

Figure 7. Cabled emitters

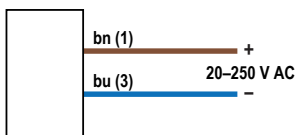


Figure 8. 4-pin 1/2"-20UNF QD emitters

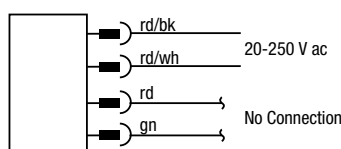


Figure 9. 5-pin 1/2"-20UNF QD emitters

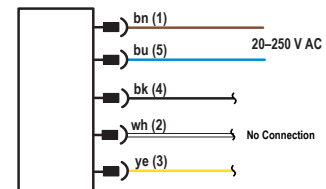


Figure 10. All other cabled models

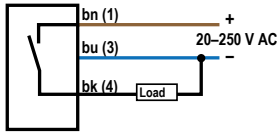


Figure 11. All other 4-pin 1/2"-20UNF QD Models

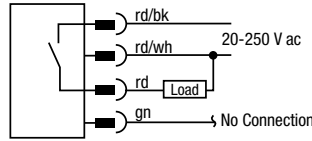
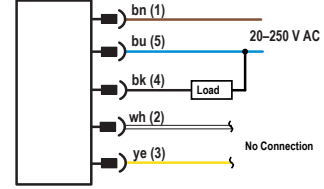


Figure 12. All other 5-pin 1/2"-20UNF QD Models



## Specifications

### Supply Voltage and Current

20 to 250 V AC (50/60 Hz)  
 Average current: 20 mA  
 Peak current: 200 mA at 20 V AC, 500 mA at 120 V AC, 750 mA at 250 V AC

### Supply Protection Circuitry

Protected against transient voltages

### Indicators

Two LEDs (green and amber)  
 Green on: power to sensor is on  
 Amber on: sensor sees light  
 Amber flashing: excess gain marginal (1 to 1.5x) in light condition

### Construction

Housing: PBT polyester housing  
 Lens: polycarbonate (opposed-mode) or acrylic (other models)

### Connections

2 m (6.5 ft) integral cable; 9 m (30 ft) integral cable; 4-pin 1/2"-20UNF quick-disconnect fitting; or 5-pin 1/2"-20UNF quick-disconnect fitting

### Operating Conditions

-40 °C to +70 °C (-40 °F to +158 °F)  
 90% at +50 °C maximum relative humidity (non-condensing)

### Environmental Rating

Leakproof design rated NEMA 6P and IEC IP67 per IEC 60529  
 IP69K per DIN40050 for quick disconnect and cable models when the cables are protected from direct spray

### 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

### Certifications



### Output Configuration

SPST solid-state AC switch; Three-wire connections; Choose light operate or dark operate models  
 Light Operate: Output conducts when sensor sees its own (or the emitter's) modulated light  
 Dark Operate: Output conducts when the sensor sees dark

### Output Rating

300 mA maximum (continuous)  
 Fixed-field models: derate 5 mA/°C above +50 °C (+122 °F)  
 Inrush Capability 1 amp for 20 milliseconds, non-repetitive  
 OFF-state leakage current: < 100 microamps  
 ON-state saturation voltage: 3 V at 300 mA AC; 2 V at 15 mA AC

### Output Protection Circuitry

Protected against false pulse on power-up

### Output Response Time

Opposed mode models: 16 ms ON, 8 ms OFF  
 Other models: 16 ms ON and OFF  
 NOTE: 100 ms delay on power-up

### Repeatability

Opposed mode models: 2 ms  
 Other models: 4 ms  
 Repeatability and response are independent of signal strength.

### Required Overcurrent Protection

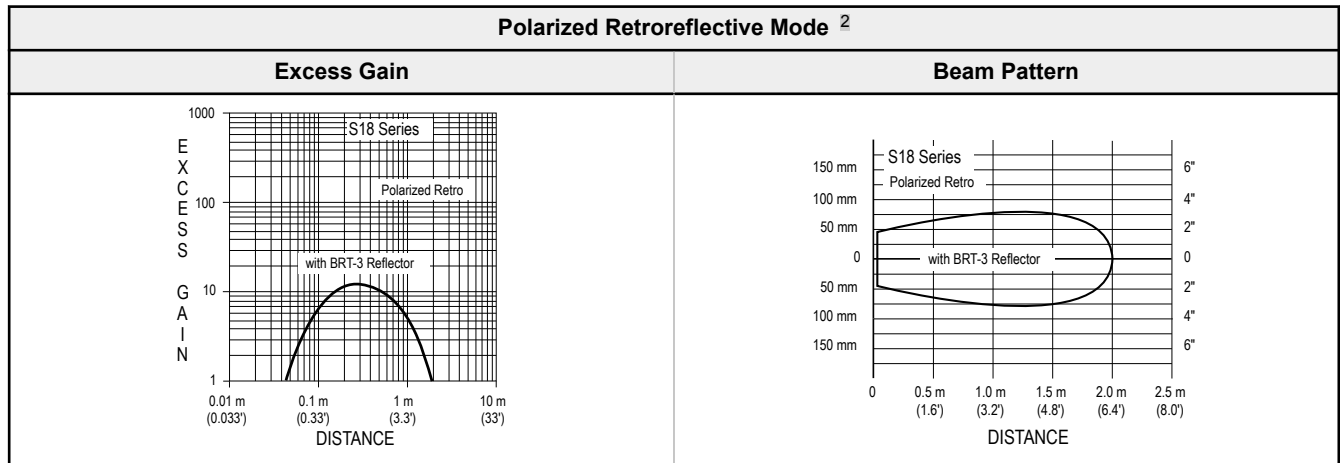
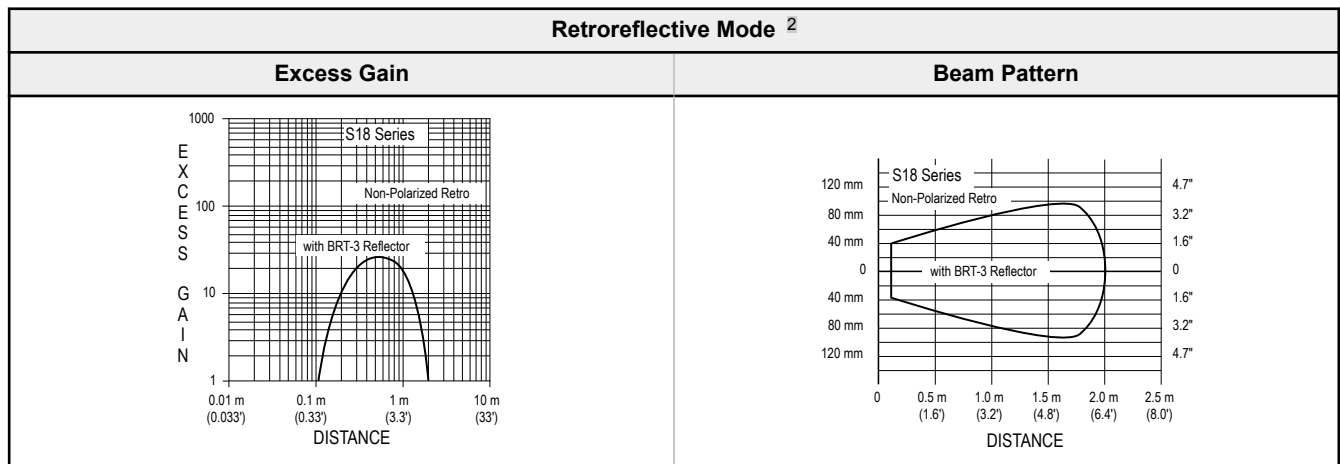
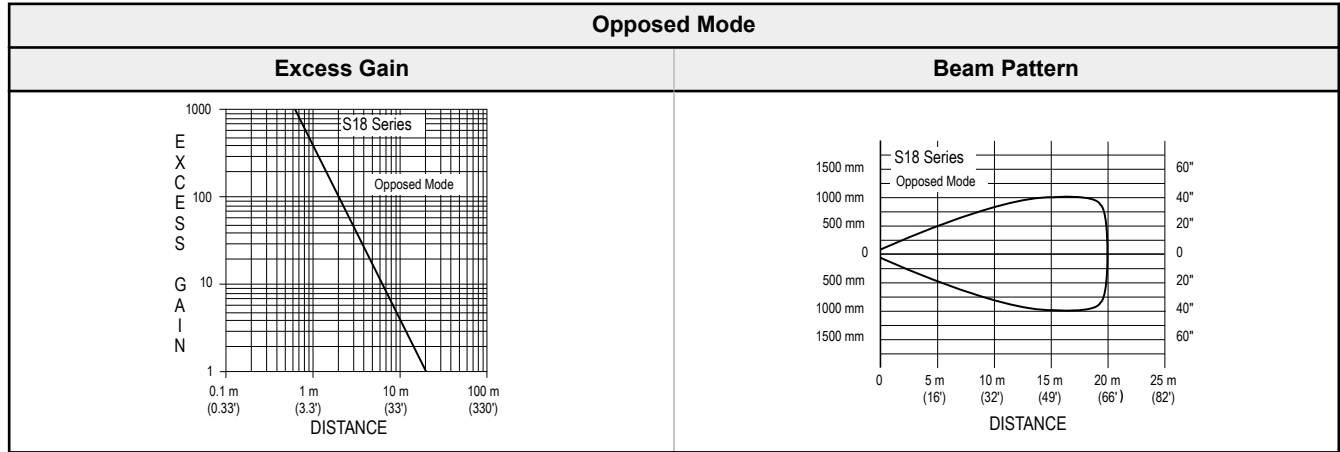


**WARNING:** Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

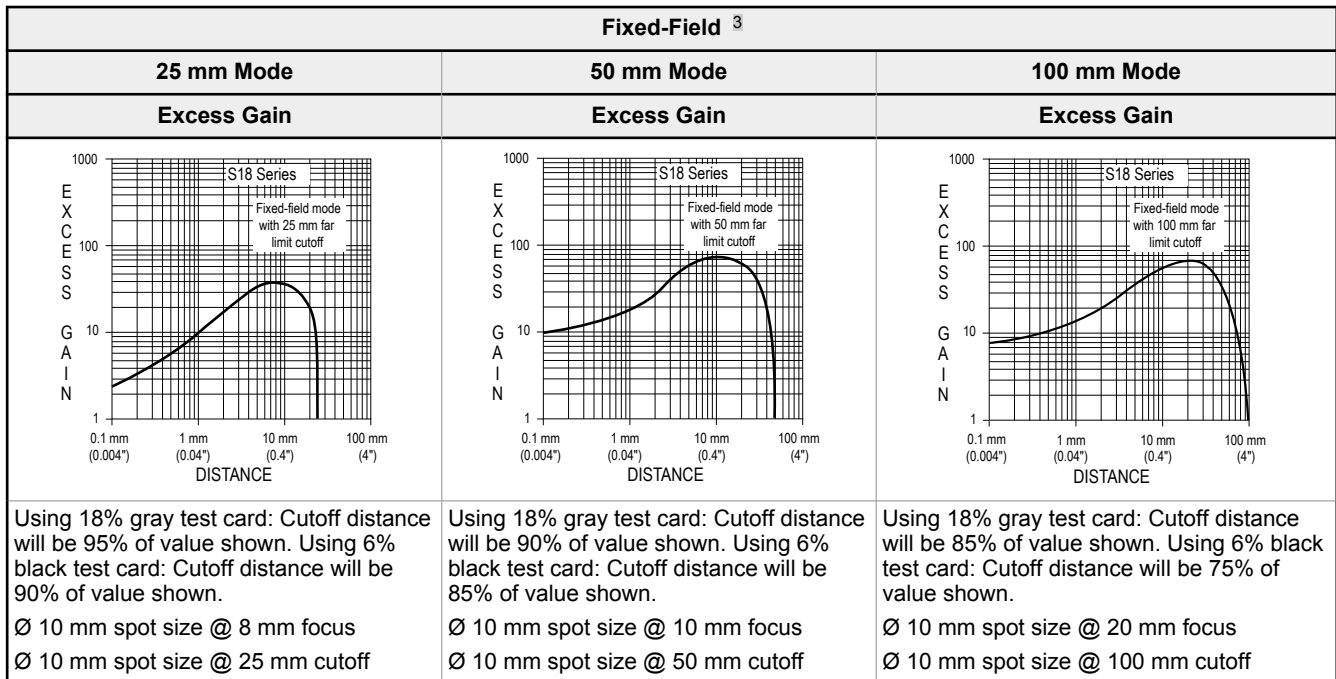
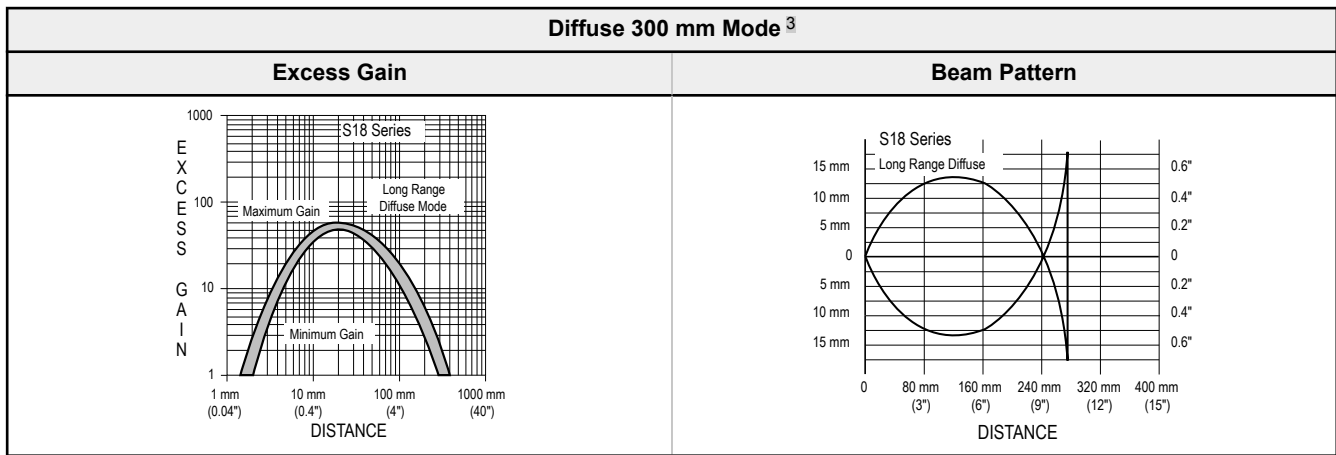
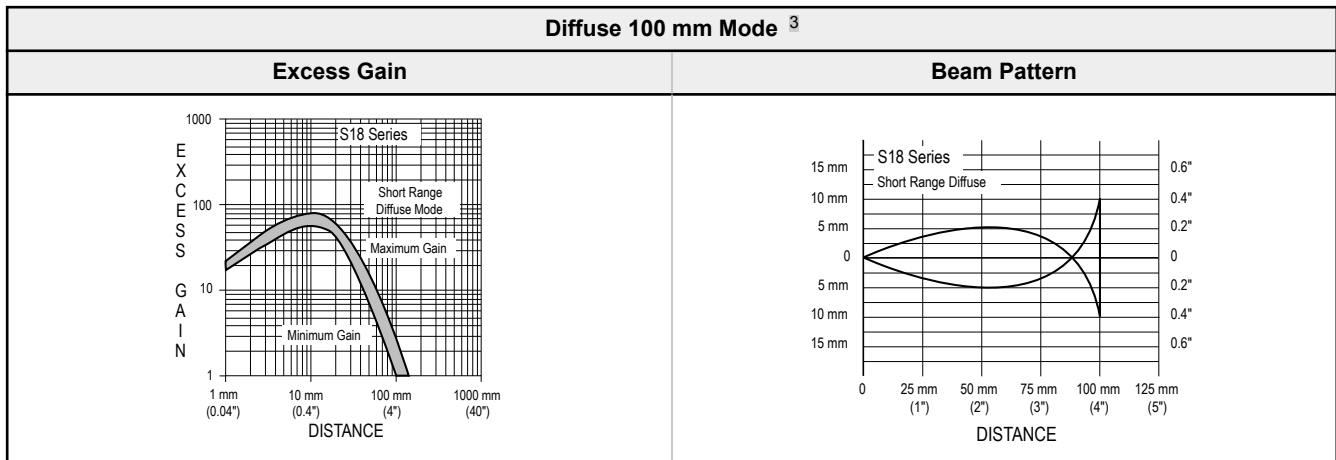
Overcurrent protection is required to be provided by end product application per the supplied table.  
 Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.  
 Supply wiring leads < 24 AWG shall not be spliced.  
 For additional product support, go to [www.bannerengineering.com](http://www.bannerengineering.com).

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

Performance Curves



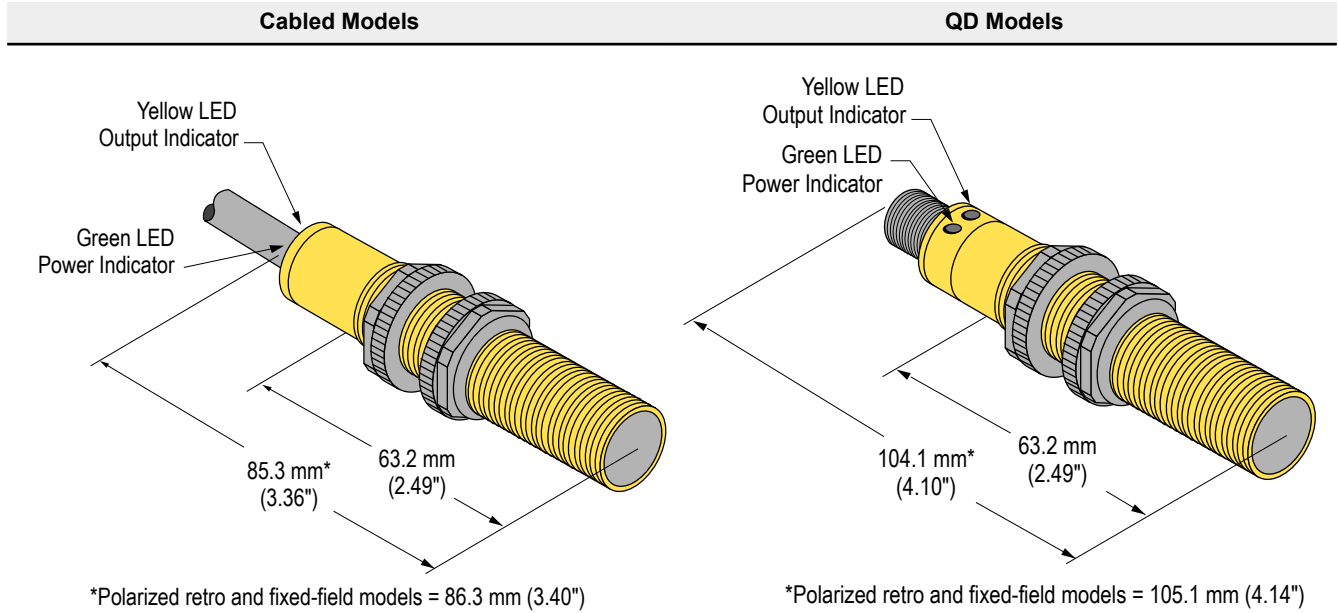
<sup>2</sup> Performance based on use of a model BRT-3 retroreflector (3" diameter). Actual sensing range may be more or less than specified, depending on the efficiency and reflective area of the retroreflector used.



Focus and spot sizes are typical.

<sup>3</sup> Performance based on use of a 90% reflectance white test card.

## Dimensions



## Accessories

### Cordsets

4-Pin 1/2-in Dual Key Cordsets—Single Ended				
Model	Length	Style	Dimensions	Pinout (Female)
MQAC-406	2 m (6.56 ft)	Straight		<p>1 = Red/Black 2 = Red/White 3 = Red 4 = Green</p>
MQAC-415	5 m (16.4 ft)			
MQAC-430	9.14 m (30 ft)			
MQAC-406RA	1.83 m (6 ft)	Right-Angle		
MQAC-415RA	5 m (16.4 ft)			
MQAC-430RA	9.14 m (30 ft)			

5-Pin 1/2-in Dual Key Cordsets with Shield—Single Ended				
Model	Length	Style	Dimensions	Pinout (Female)
MQVR3S-506	2 m (6.56 ft)	Straight		<p>1 = Brown 2 = White 3 = Yellow 4 = Black 5 = Blue</p>
MQVR3S-515	5 m (16.4 ft)			
MQVR3S-530	10 m (32.8 ft)			

5-Pin 1/2-in Dual Key Cordsets with Shield—Single Ended				
Model	Length	Style	Dimensions	Pinout (Female)
MQVR3S-506RA	2 m (6.56 ft)	Right Angle		
MQVR3S-515RA	5 m (16.4 ft)			
MQVR3S-530RA	10 m (32.8 ft)			

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