S18 Series Sensor (AC Voltage) Product Manual

Original Instructions
p/n: 121521 Rev. F
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ПРОМЭЛЕКТРОНИКА/ sales@prom-elec.com

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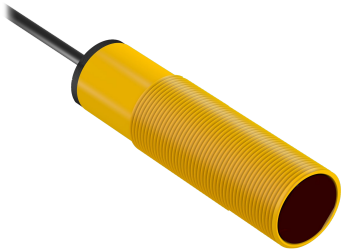
Chapter 1 Features



- 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

Opposed mode models

Models	Range	LED	Output	Connection
S183E Emitter	20 m (66 ft)	Infrared 950 nm	-	2 m cable
S18AW3R Receiver			LO	2 m cable
S18RW3R Receiver			DE	2 m cable

Retroreflective mode models

Models	Range	LED	Output	Connection
S18AW3L	2 m (79 in)	Infrared 950 nm	LO	2 m cable
S18RW3L			DO	2 m cable

Polarized retroreflective mode models

Models[1]	Range	LED	Output	Connection
S18AW3LP	2 m (79 in)	Visible Red 680 nm	LO	2 m cable
S18RW3LP			DO	2 m cable

Diffuse mode models

Models	Range	LED	Output	Connection
S18AW3D	100 mm (4 in)	Infrared 880 nm	LO	2 m cable
S18RW3D			DO	2 m cable
S18AW3DL	300 mm (12 in)		LO	2 m cable

Continued on page 4

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

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Continued from page 3

Models	Range	LED	Output	Connection
S18RW3DL			DO	2 m cable

Fixed-field mode models

Models	Range	LED	Output	Connection
S18AW3FF25	25 mm (1 in) cutoff	Infrared 880 nm	LO	2 m cable
S18RW3FF25			DO	2 m cable
S18AW3FF50	50 mm (2 in) cutoff		LO	2 m cable
S18RW3FF50			DO	2 m cable
S18AW3FF100	100 mm (4 in) cutoff		LO	2 m cable
S18RW3FF100			DO	2 m cable

- 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.

In light operate (LO) mode, the output is ON when the target returns the same or more light to the sensor and OFF when the sensor detects less light than the configured/taught target. In **opposed and retroreflective sensing modes**, light operate is active when the beam is unblocked. In **diffuse, fixed field, and adjustable field sensor modes**, light operate is active when the target is present.

In dark operate (DO) mode, the output is ON when the target returns less light to the sensor than the configured target and OFF when the sensor detects more light than the configured/taught target. In **opposed and retroreflective sensing modes**, dark operate is active when the beam is blocked. In **diffuse, fixed field, and adjustable field sensor modes**, dark operate is active when the target is absent.

For a list of discontinued models, see Discontinued 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 1.5×) 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

Output Protection Circuitry

Protected against false pulse on power-up

Output Configuration

SPST solid-state AC switch; Three-wire connections; Choose light operate or dark operate models

Light Operate: Output conducts when the 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 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.

Operating Conditions

–40 °C to +70 °C (–40 °F to +158 °F)

90% at +50 °C maximum relative humidity (non-condensing)

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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

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Park Lane, Culliganlaan 2F bus 3
1831 Diegem, BELGIUM

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

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	2.0	30	0.5

FCC Part 15 Class A for Unintentional Radiators

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

(Part 15.21) Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Industry Canada ICES-003(A)

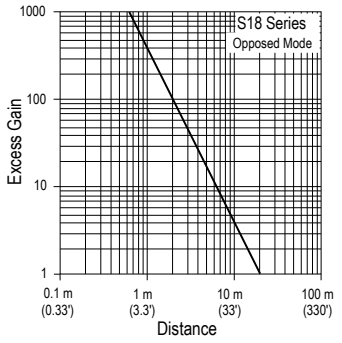
This device complies with CAN ICES-3 (A)/NMB-3(A). Operation is subject to the following two conditions: 1) This device may not cause harmful interference; and 2) This device must accept any interference received, including interference that may cause undesired operation.

Cet appareil est conforme à la norme NMB-3(A). Le fonctionnement est soumis aux deux conditions suivantes : (1) ce dispositif ne peut pas occasionner d'interférences, et (2) il doit tolérer toute interférence, y compris celles susceptibles de provoquer un fonctionnement non souhaité du dispositif.

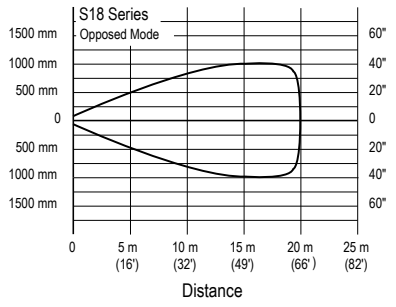
Performance Curves

Opposed mode sensors

Excess Gain



Beam Pattern



Retroreflective and **polarized retroreflective** mode sensor performance is based on the 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.

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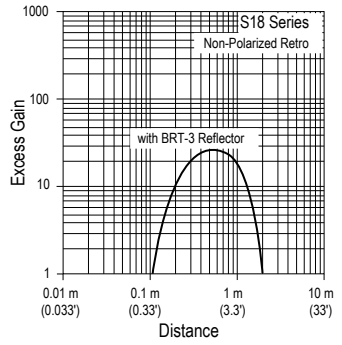
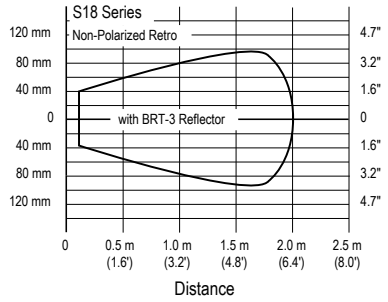
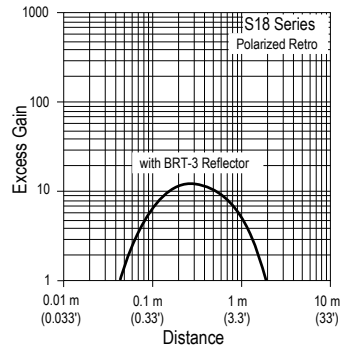
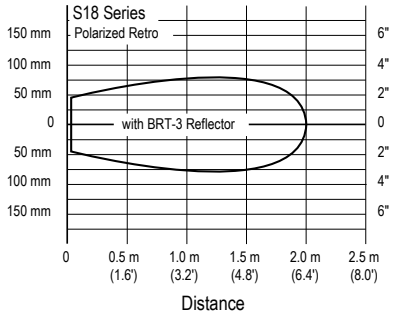
Retroreflective mode sensors

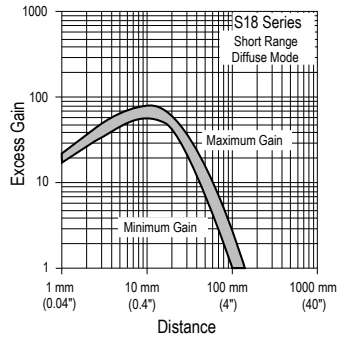
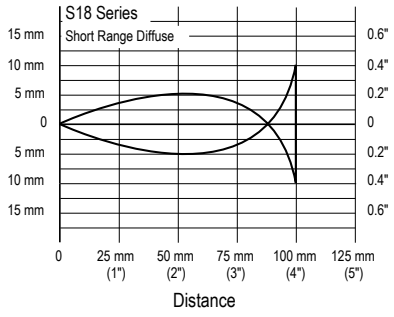
Excess Gain	Beam Pattern
	

Polarized retroreflective mode sensors

Excess Gain	Beam Pattern
	

Diffuse and **fixed-field** mode sensor performance is based on the use of a 90% reflectance white test card.

Diffuse 100 mm mode sensors

Excess Gain	Beam Pattern
	

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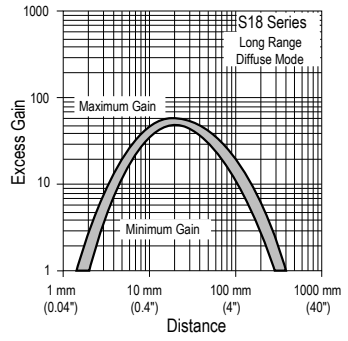
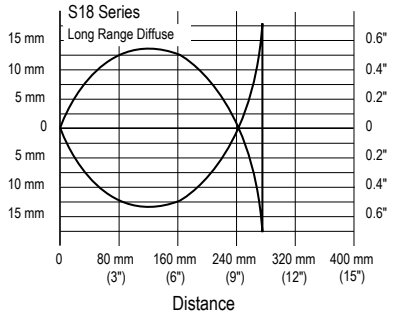
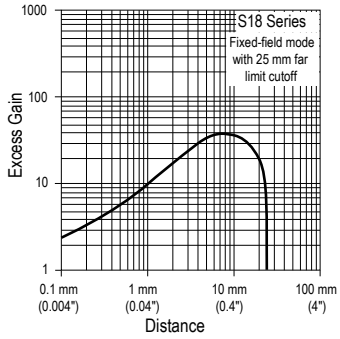
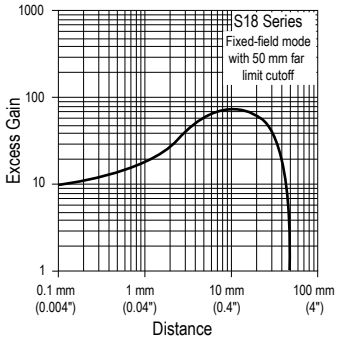
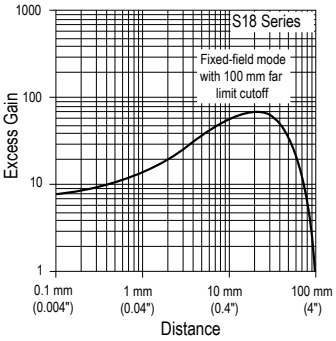
Diffuse 300 mm mode sensors

Excess Gain	Beam Pattern
	

Fixed-field mode sensors

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. Ø 10 mm spot size @ 8 mm focus Ø 10 mm spot size @ 25 mm cutoff	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. Ø 10 mm spot size @ 10 mm focus Ø 10 mm spot size @ 50 mm cutoff	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 @ 20 mm focus Ø 10 mm spot size @ 100 mm cutoff

Focus and spot sizes are typical.

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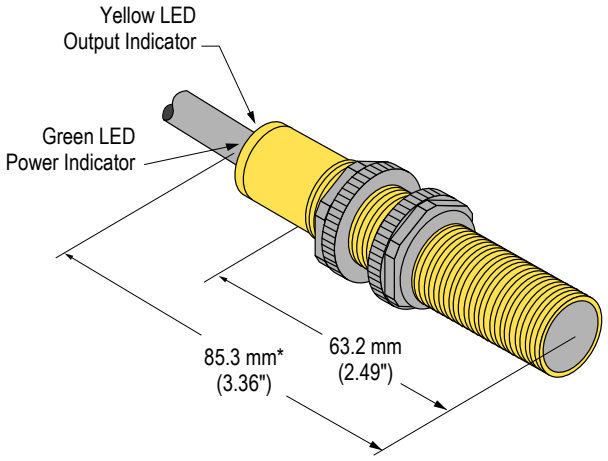
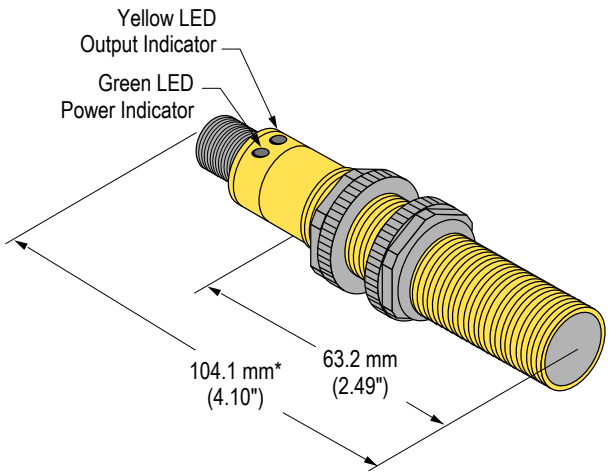
Dimensions

Cabled models



*Polarized retro and fixed-field models = 86.3 mm (3.40")

Quick disconnect models



*Polarized retro and fixed-field models = 105.1 mm (4.14")

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Chapter 2 Installation Instructions

Fixed-Field Mode Overview

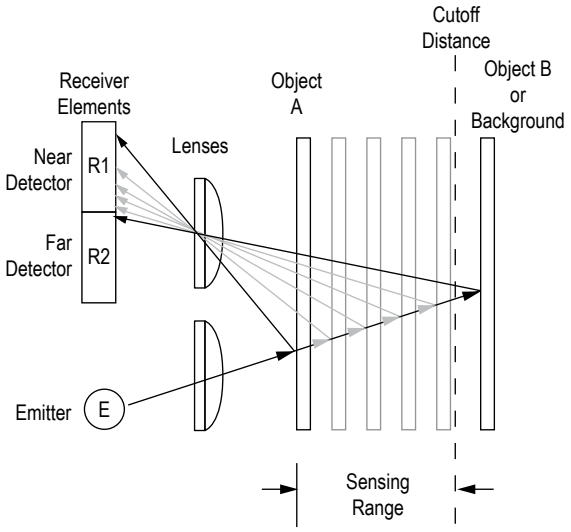
S18 self-contained fixed-field sensors are small, powerful, infrared diffuse mode sensors with far-limit cutoff (a type of background suppression). Their high excess gain and fixed-field technology allow them to detect objects of low reflectivity, while ignoring background surfaces.

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.

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).

Fixed-field concept



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

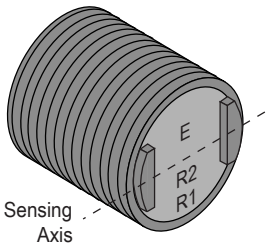
In the drawings and discussion on these pages, the letters E, R1, and R2 identify how the sensor's three optical elements (Emitter "E", Near Detector "R1", and Far Detector "R2") line up across the face of the sensor. The location of these elements defines the sensing axis (see "Sensor Setup" on page 9). The sensing axis becomes important in certain situations, such as those illustrated in "Figure: Object Beyond Cutoff - Problem" on page 10 and "Figure: Object Beyond Cutoff - Solution" on page 10.

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.

Fixed-field 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.

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: Reflective Background - Problem" on page 10). 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: Reflective Background - Solution" on page 10). Position the background as far beyond the cutoff distance as possible.

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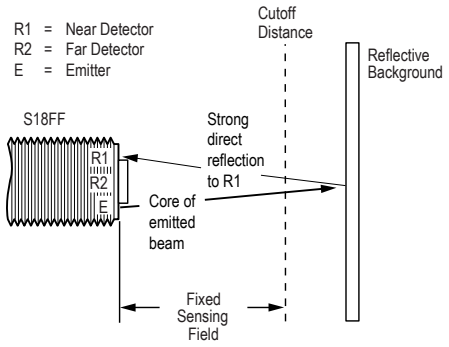
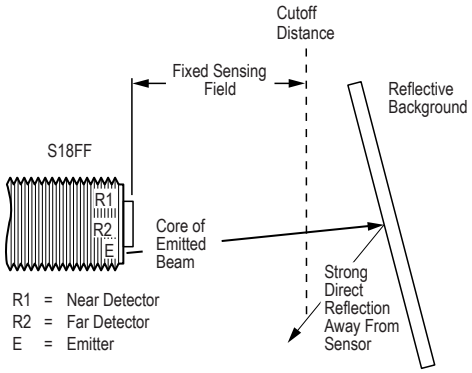
An object beyond the cutoff distance, either stationary (and when positioned as shown in "Figure: Object Beyond Cutoff - Problem" on page 10), or moving past the face of the sensor in a direction perpendicular to the sensing axis, can cause unwanted triggering of the sensor if more light is reflected to the near detector than to the far detector. The problem is easily remedied by rotating the sensor 90° ("Figure: Object Beyond Cutoff - Solution" on page 10). 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.

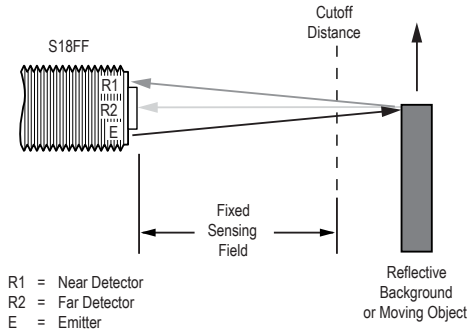
Reflective Background - Problem



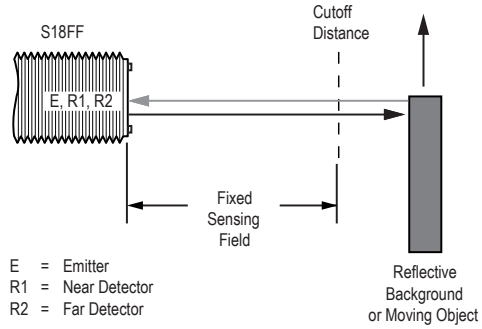
Reflective Background - Solution



Object Beyond Cutoff - Problem



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 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.

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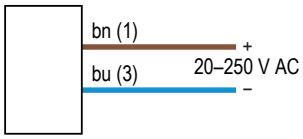
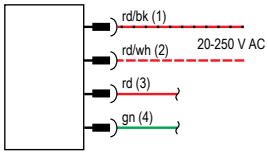
Wiring

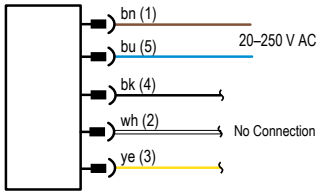
Cabled emitters



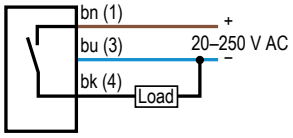
4-pin 1/2"-20UNF QD emitters



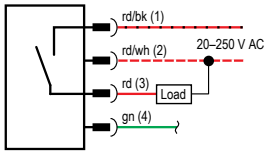
5-pin 1/2"-20UNF QD emitters



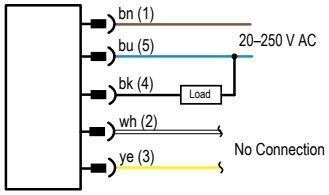
All other cabled models



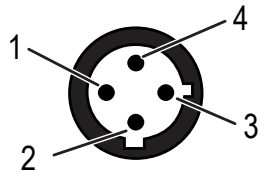
All other 4-pin 1/2"-20UNF QD Models



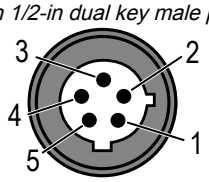
All other 5-pin 1/2"-20UNF QD Models



4-pin 1/2-in dual key male pinout



5-pin 1/2-in dual key male pinout



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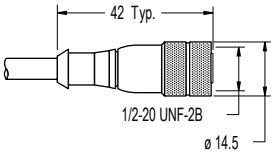
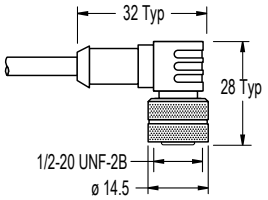
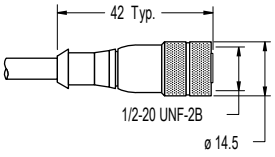
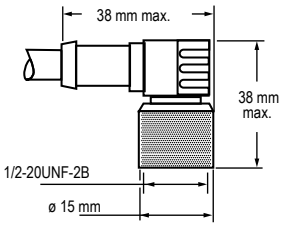
Chapter 3 Accessories

S18 Cordsets

4-Pin Single-Ended 1/2-in Dual Key Female Cordsets				
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**
MQAC-406	2 m (6.56 ft)	Straight		 1 = Red/Black 2 = Red/White 3 = Red 4 = Green
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 Single-Ended 1/2-in Dual Key Female Shielded Cordsets				
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**
MQVR3S-506	2 m (6.56 ft)	Straight		 1 = Brown 2 = White 3 = Yellow 4 = Black 5 = Blue
MQVR3S-515	5 m (16.4 ft)			
MQVR3S-530	10 m (32.8 ft)			
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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Chapter 4 Product Support and Maintenance

Clean Sensor with Compressed Air Then Isopropyl Alcohol

Handle the sensor with care during installation and operation. Sensor windows soiled by fingerprints, dust, water, oil, etc. create stray light that may degrade the peak performance of the sensor.

Blow dust from the sensor using filtered, compressed air. If the sensor is still dirty, gently wipe the sensor with a dry optical cloth. If the dry optical cloth does not remove all residue, use 70% isopropyl alcohol on a clean optical cloth, then dry with a clean dry optical cloth and blow with filtered, compressed air. Do not use any other chemicals for cleaning.

Repairs

Contact Banner Engineering for troubleshooting of this device. **Do not attempt any repairs to this Banner device; it contains no field-replaceable parts or components.** If the device, device part, or device component is determined to be defective by a Banner Applications Engineer, they will advise you of Banner's RMA (Return Merchandise Authorization) procedure.

> **IMPORTANT:** If instructed to return the device, pack it with care. Damage that occurs in return shipping is not covered by warranty.

Discontinued Models

The following models are no longer available for order but are still covered by the information in this document.

Opposed mode models

Models	Range	Output	Connection
S183EQ Emitter	20 m (66 ft)	-	4-pin 1/2"-20UNF QD
S18AW3R W/30 Receiver		LO	9 m cable

Polarized retroreflective mode models

Models	Range	Output	Connection
S18RW3LP W/30	2 m (79 in)	DO	9 m cable

Fixed-field mode models

Models	Range	Output	Connection
S18AW3FF25 W/30	25 mm (1 in) cutoff	LO	9 m cable
S18AW3FF25Q		LO	4-pin 1/2"-20UNF QD
S18RW3FF25 W/30		DO	9 m cable
S18RW3FF50Q	50 mm (2 in) cutoff	DO	4-pin 1/2"-20UNF QD
S18RW3FF100 W/30	100 mm (4 in) cutoff	DO	9 m cable

Banner Engineering Corp Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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