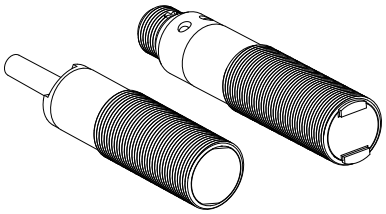
Features



- 18 mm threaded-barrel sensor
- 10 V DC to 30 V DC; choose SPDT (complementary) NPN or PNP outputs (150 mA maximum, each)
- Easy to use; no adjustments are necessary
- Advanced self-diagnostics with separate alarm output (U.S. patent 5087838 (see *Specifications*)); dual LED system indicates sensor performance
- Choice of integral cable or M12 quick disconnect connector
- Completely epoxy-encapsulated to provide superior durability, designed to meet rigorous IP69K standards for use in high pressure washdowns
- Brackets available for a wide array of mounting options

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

M18 Series Sensing Mode Options

To order the 9 m (30 ft) cable model (not available for all models), add the suffix **W/30** (M18SN6R W/30). Models with a QD connector require a mating cable.

Opposed-Mode Emitter (E) and Receiver (R)

Models (Infrared, 950 nm)	Range	Cable	Output Type
M186E	20 m (66 ft)	2 m (6.5 ft)	-
M186EQ		4-pin M12 QD	
M186EQP		150 mm cable with a 4-pin M12 QD	
M18SN6R		2 m (6.5 ft)	NPN
M18SN6RQ		4-pin M12 QD	
M18SP6R		2 m (6.5 ft)	PNP
M18SP6RQ		4-pin M12 QD	
M18SP6RQP		150 mm cable with a 4-pin M12 QD	

Retroreflective Mode (Infrared, 950 nm)

Models	Range	Cable	Output Type
M18SN6L	2 m (79 in)	2 m (6.5 ft)	NPN
M18SN6LQ		4-pin M12 QD	
M18SP6L		2 m (6.5 ft)	PNP
M18SP6LQ		4-pin M12 QD	

Polarized Retroreflective Mode (Visible Red, 680 nm)

Models	Range	Cable	Output Type
M18SN6LP	2 m (79 in)	2 m (6.5 ft)	NPN
M18SN6LPQ		4-pin M12 QD	

Continued on page 2

49201
p/n: 49201 Rev E

Continued from page 1

Models	Range	Cable	Output Type
M18SP6LP		2 m (6.5 ft)	PNP
M18SP6LPQ		4-pin M12 QD	

Diffuse Mode (Infrared, 880 nm)

Models	Range	Cable	Output Type
M18SN6D	100 mm (4 in)	2 m (6.5 ft)	NPN
M18SN6DQ		4-pin M12 QD	
M18SP6D		2 m (6.5 ft)	PNP
M18SP6DQ		4-pin M12 QD	
M18SN6DL	300 mm (12 in)	2 m (6.5 ft)	NPN
M18SN6DLQ		4-pin M12 QD	
M18SP6DL		2 m (6.5 ft)	PNP
M18SP6DLQ		4-pin M12 QD	

Fixed-Field Mode

Models	Cutoff Point	Cable	Output Type
M18SN6FF25Q	25 mm (1 in)	4-pin M12 QD	NPN
M18SP6FF25		2 m (6.5 ft)	PNP
M18SP6FF25Q		4-pin M12 QD	
M18SN6FF50	50 mm (2 in)	2 m (6.5 ft)	NPN
M18SN6FF50Q		4-pin M12 QD	
M18SP6FF50		2 m (6.5 ft)	PNP
M18SP6FF50Q		4-pin M12 QD	
M18SN6FF100	100 mm (4 in)	2 m (6.5 ft)	NPN
M18SN6FF100Q		4-pin M12 QD	
M18SP6FF100		2 m (6.5 ft)	PNP
M18SP6FF100Q		4-pin M12 QD	

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

- M18SN6FF25
- Several 9 m cable (W/ 30) models

Fixed-Field Tips

For highest sensitivity, the sensor-to-object distance should be such that the object will be sensed at or near the point of maximum excess gain.

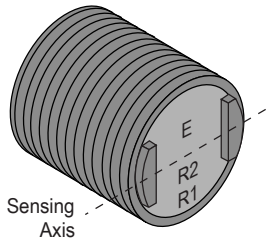
The background must be beyond the cutoff distance. Following these two guidelines makes it possible to detect objects of low reflectivity, even against close-in reflective backgrounds.

In the drawings and discussion, 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. In "Figure: Reflective Background - Problem" on page 3, "Figure: Reflective Background - Solution" on page 3, and "Figure: Object Beyond Cutoff - Problem" on page 3, these elements align vertically. In "Figure: Object Beyond Cutoff - Solution" on page 3, the elements align horizontally.

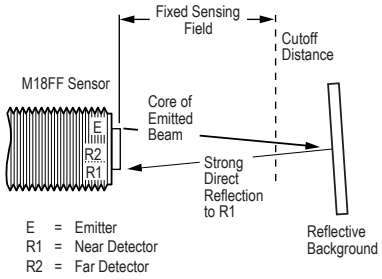
Note how the position of the tabs on the front of the sensor helps to define the sensing axis of the sensor (Sensing Axis). The sensing axis becomes important in situations like those illustrated in "Figure: Object Beyond Cutoff - Problem" on page 3 and "Figure: Object Beyond Cutoff - Solution" on page 3.

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.

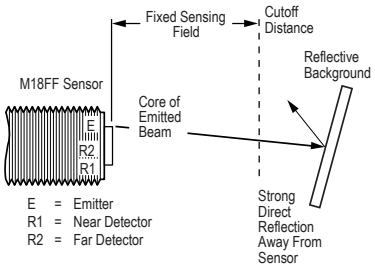
Sensing Axis



Reflective Background - Problem



Reflective Background - Solution

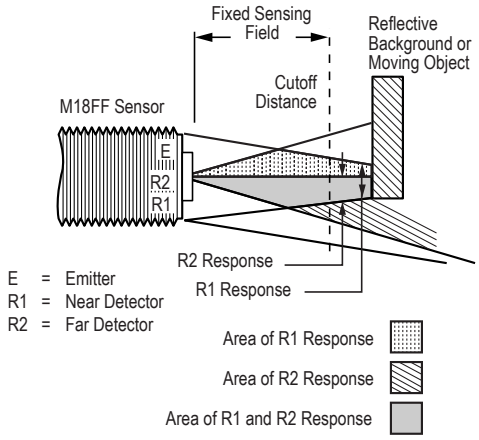


Background Reflectivity and Placement. Avoid mirror-like backgrounds that produce specular reflections. False sensor response will occur if a background surface reflects the sensor's light more strongly to the near detector (R1) than to the far detector (R2). The result is a false ON condition ("Figure: Reflective Background - Problem" on page 3). Use of a diffusely-reflective (matte) background will cure this problem. Other possible solutions are to either angle the sensor or angle the background (in any plane) so that the background does not reflect back to the sensor ("Figure: Reflective Background - Solution" on page 3).

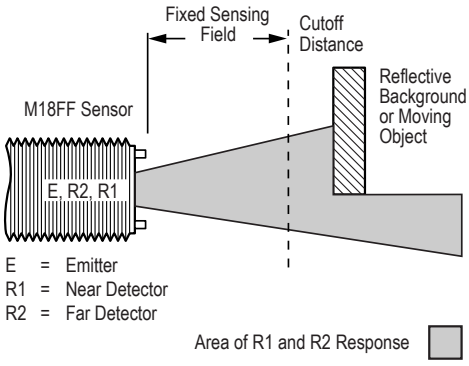
An object beyond the cutoff distance, either moving or stationary (and when positioned as shown in "Figure: Object Beyond Cutoff - Problem" on page 3), can cause unwanted triggering of the sensor because it reflects more light to the near detector than to the far detector. Remedy the problem easily by rotating the sensor 90° ("Figure: Object Beyond Cutoff - Solution" on page 3) to align the sensing axis horizontally. 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.

Unwanted triggering of the sensor from an object beyond the cutoff can also be caused by attempting to sense a small object moving perpendicular to the sensor face, or by an object moving through the off-center position shown. Making the object larger, centering the sensor relative to the object, or rotating the sensor to place the sensing axis perpendicular to the longer dimension of the object ("Figure: Object Beyond Cutoff - Solution" on page 3) will solve the problem.

Object Beyond Cutoff - Problem

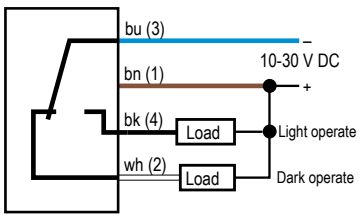


Object Beyond Cutoff - Solution

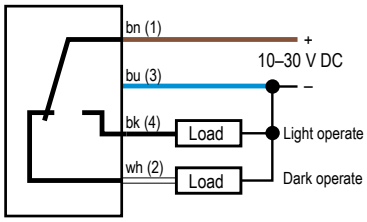


Wiring

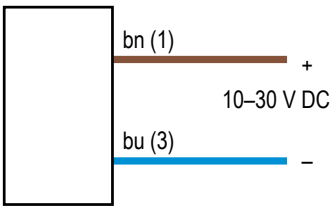
NPN Standard



PNP Standard



Emitters Standard



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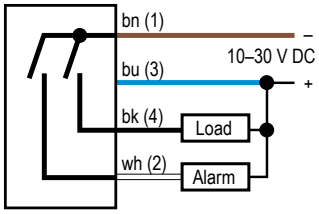
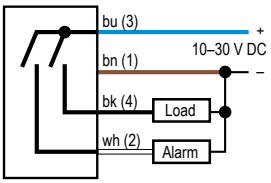
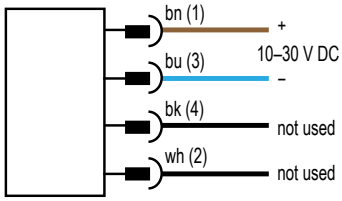
NPN Alarm Connections



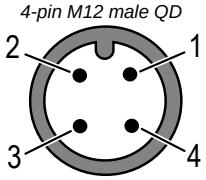
PNP Alarm Connections



Emitter Alarm Connections



4-pin M12 male QD



1. brown
2. white
3. blue
4. black

Specifications

Supply Voltage

10 to 30 V DC (10% maximum ripple)

Supply Current (Exclusive of Load Current)

Diffuse: 25 mA

Fixed-field: 35 mA

Opposed Mode Emitters: 25 mA

Opposed Mode Receivers: 20 mA

Retroreflective, Non-Polarized: 25 mA

Retroreflective, Polarized: 30 mA

Supply Protection Circuitry

Protected against reverse polarity and transient voltages

Indicators

Two LEDs (green and yellow)

Green solid: power to the sensor is ON

Green flashing: output is overloaded

Amber solid: normally open output is conducting

Amber flashing: excess gain marginal (1-1.5×) in light condition

Construction

Housings: Stainless Steel

Lenses: Lexan® (opposed models) or acrylic

Connections

2 m (6.5 ft) unterminated 4-wire PVC-jacketed cable, 9 m (30 ft) unterminated 4-wire PVC-jacketed cable, or Integral 4-pin M12 male quick-disconnect connector

Configuration

SPDT (complementary) solid-state DC switch; choose NPN (current sinking) or PNP (current sourcing) models.

Light operate: Normally open output conducts when the sensor sees its own (or the emitter's) modulated light

Dark operate: Normally closed output conducts when the sensor sees dark; the normally closed output may be wired as a normally open alarm output, depending upon connection to the power supply (U.S. patent 5087838)

Output Rating

150 mA maximum (each) in standard wiring; When wired for alarm output, the total load may not exceed 150 mA

OFF-State Leakage Current: < 1 microamp at 30 V DC

ON-State Saturation Voltage: < 1V at 10 mA dc; < 1.5 V at 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 milliseconds ON, 1.5 milliseconds OFF

Polarized Retro, Non-polarized Retro, Fixed-field, and Diffuse: 3 milliseconds ON and OFF

NOTE: 100 millisecond delay on power-up; outputs do not conduct during this time

Repeatability

Opposed mode: 375 microseconds

Polarized Retro, Non-Polarized Retro, Fixed-field and Diffuse modes: 750 microseconds

Repeatability and response are independent of signal strength

Rating

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

* Cabled models meet IP69K if the cable is protected from high-pressure spray

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)

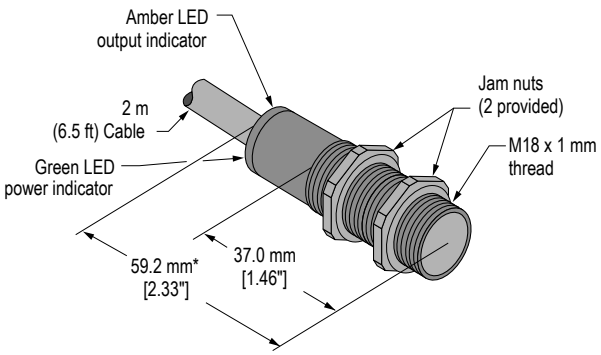
Operating Conditions

–40 °C to +70 °C (–40 °F to +158 °F)

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

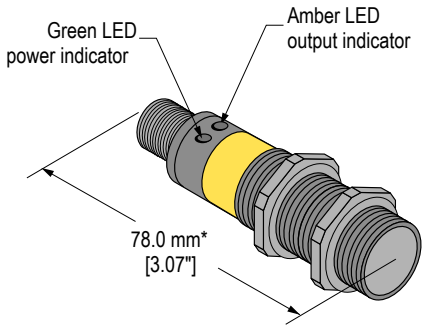
Dimensions

Models with Attached Cable



* Polarized retroreflective and fixed-field cabled models = 65.0 mm (2.56 in)

Models with 4-pin M12 Quick Disconnect



* Polarized retroreflective and fixed-field QD models = 83.8 mm (3.30 in)

Performance Curves

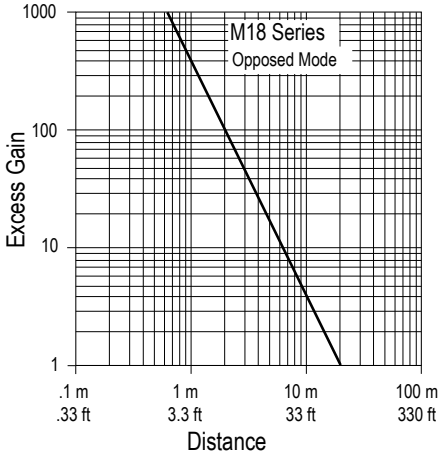
The excess gain curves above show excess gain vs. sensing distance for M18 Series fixed-field sensors with 25-, 50- and 100-millimeter cutoffs. Maximum excess gain for the 25-mm models occurs at a lens-to-object distance of about 7 mm; for the 50-mm models, at about 10 mm; and for the 100-mm models, at about 20 mm. Sensing at or near these distances will make maximum use of each sensor's available sensing power. Backgrounds and background objects must always be placed beyond the cutoff distance.

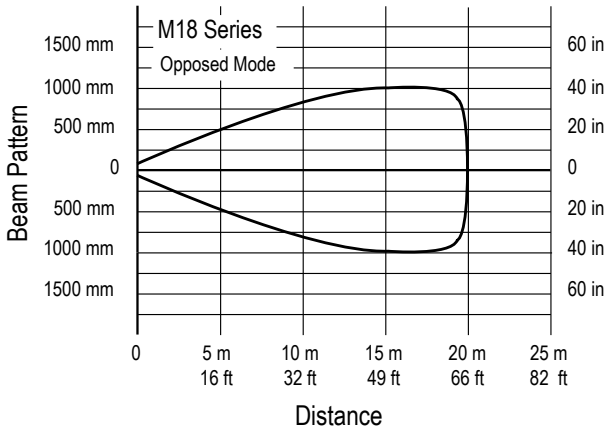
These excess gain curves were generated using a white test card of 90% reflectance. Objects with reflectivity of less than 90% reflect less light back to the sensor, and thus require proportionately more excess gain in order to be sensed with the same reliability as more reflective objects. When sensing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

The effects of object reflectivity on cutoff distance, though small, may be important for some applications. Sensing of objects of less than 90% reflectivity causes the cutoff distances to be "pulled" slightly closer to the sensor. 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 heavy horizontal graph line at excess gain = 10. An object of this reflectivity results in far limit cutoffs of approximately 20, 40 and 70 mm (for 25-, 50- and 100-mm cutoff models, respectively).

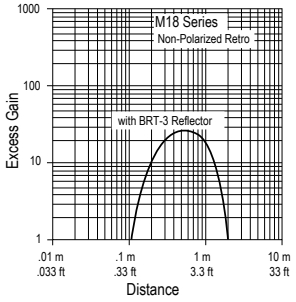
Objects with reflectivity greater than 90% return more light to the sensor. For this reason, highly reflective backgrounds or background objects such as mirrors, polished metal, and other sources of specular reflections require special consideration. To use a highly reflective background, place it as far beyond the cutoff distance as possible and angle it to direct reflected light away from the sensor.

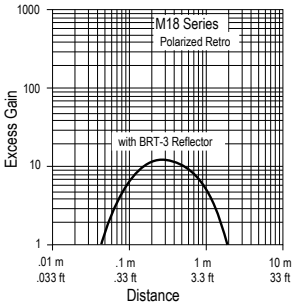
Opposed-Mode Emitter (E) and Receiver (R)

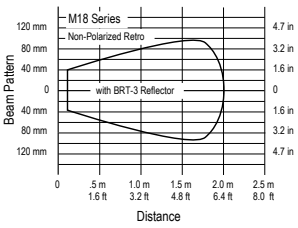


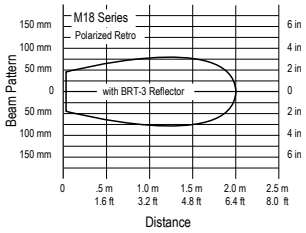


Retroreflective Mode

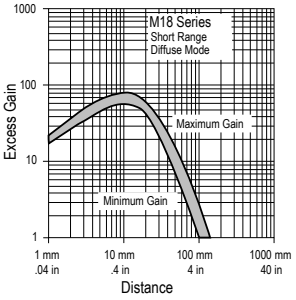


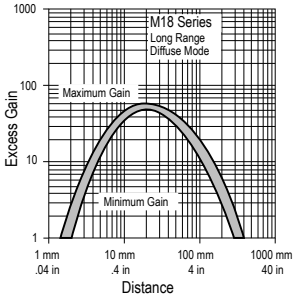


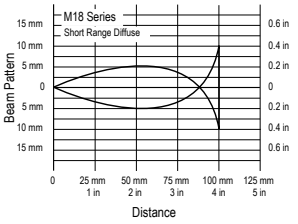


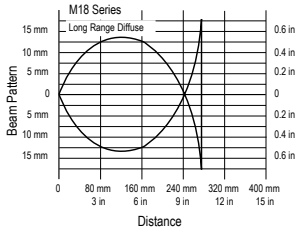


Diffuse Mode

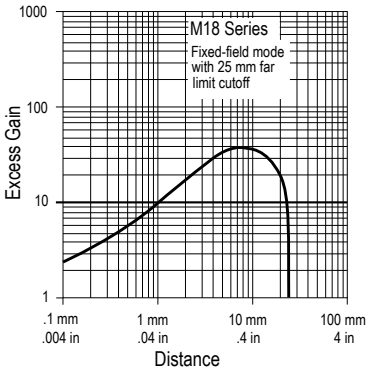


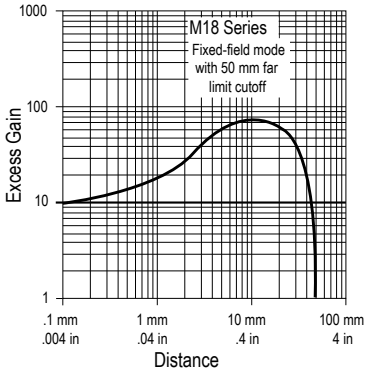


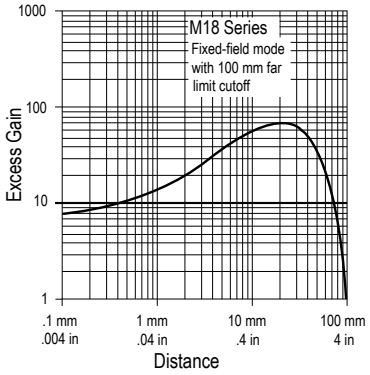




Fixed-Field Mode

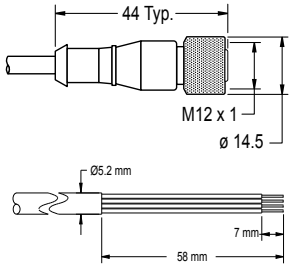






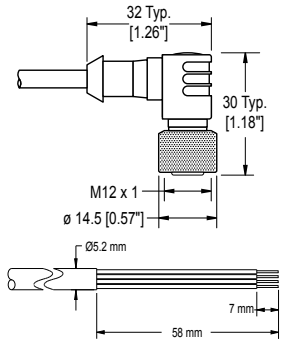
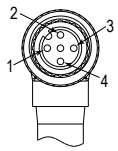
Accessories

Cordsets

4-Pin Single-Ended M12 Female Cordsets					
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**	
MQDC-406	2 m (6.56 ft)	Straight			1 = Brown 2 = White 3 = Blue 4 = Black 5 = Not used
MQDC-415	5 m (16.4 ft)				
MQDC-430	9 m (29.5 ft)				
MQDC-450	15 m (49.2 ft)				

Continued on page 7

Continued from page 6

4-Pin Single-Ended M12 Female Cordsets					
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**	
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)				

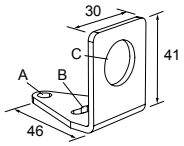
Mounting Brackets

All measurements are listed in millimeters, unless noted otherwise. The measurements provided are subject to change.

SMB18A

- Right-angle mounting bracket with a curved slot for versatile orientation
- 12-ga. stainless steel
- 18 mm sensor mounting hole
- Clearance for M4 (#8) hardware
- CAD Files: DXF, PDF, IGS, STP

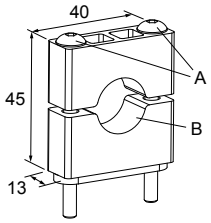
Hole center spacing: A to B = 24.2
Hole size: A = ø 4.6, B = 17.0 × 4.6, C = ø 18.5



SMB18C

- 18 mm split clamp, black thermoplastic polyester
- Stainless steel mounting hardware included
- CAD Files: DXF, PDF, IGS, STP

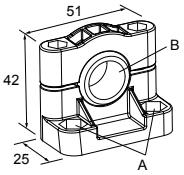
A = ø 3 mm (2)
Hole size: B = ø 18 mm



SMB18SF

- 18 mm swivel bracket with M18 × 1 internal thread
- Black thermoplastic polyester
- Stainless steel swivel locking hardware included
- CAD Files: DXF, PDF, IGS, STP

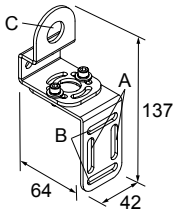
Hole center spacing: A = 36.0
Hole size: A = ø 5.3, B = ø 18.0



SMB18UR

- 2-piece universal swivel bracket
- 300 series stainless steel
- Stainless steel swivel locking hardware included
- Mounting hole for 18 mm sensor
- CAD Files: DXF, PDF, IGS, STP

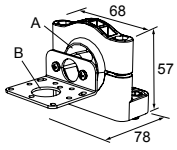
Hole center spacing: A = 25.4, B = 46.7
Hole size: B = 6.9 × 32.0, C = ø 18.3



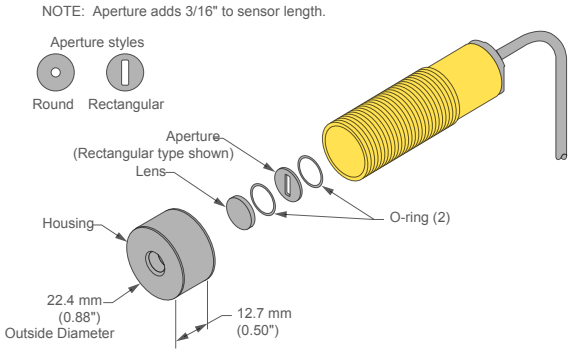
SMB30SK

- Flat-mount swivel bracket with extended range of motion
- Black reinforced thermoplastic polyester and 316 stainless steel
- Stainless steel swivel locking hardware included
- CAD Files: DXF, PDF, IGS, STP

Hole center spacing: A=50.8
Hole size: A=ø 7, B=ø 18



Aperture Kits



AP18SC Aperture Kit Kit includes black acetal round apertures of 0.5 mm (0.02 in), 1 mm (0.04 in), and 2.5 mm (0.10 in) diameter. Each kit also includes a thread-on aperture housing, a Teflon FEP® lens, and two 0-rings. Used with S18, M18.	
AP18SR Aperture Kit Kit includes black acetal rectangular apertures of 0.5 mm (0.02 in) wide, 1.0 mm (0.04 in) wide, and 2.5 mm (0.10 in) wide. Each kit also includes a thread-on aperture housing, a Teflon FEP® lens, and two 0-rings. Used with S18, M18.	

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