

SMI30 Series Intrinsically Safe Sensors

Rugged, NEMA 6P-plus sensors in 30 mm threaded PBT barrel housings



more sensors, more solutions

- Designed for use with approved amplifiers and intrinsically safe barriers in explosive environments
- Very high excess gain; 460 ft. range (standard 10 ms models)
- Fast 1 ms response models (200 ft. range) available by special order
- Totally sealed, self-contained, intrinsically safe threaded-barrel opposed mode sensor pairs in rugged 30 mm PBT housings
- Highly immune to noise: the best noise immunity of any self-contained emitter/receiver pair
- Internal alignment indicator LED may be viewed either from the side or from the front of the receiver through the lens
- Integral mini-type 3-pin "QD" (quick-disconnect) connector

Banner SMI30 Series intrinsically safe barrel sensors are extremely rugged and powerful opposed mode infrared sensor pairs designed for the most demanding industrial applications. Their high excess gain (460 foot range) provides enough sensing power to penetrate the heaviest contamination (excess gain curve, page 5). Electronics are fully epoxy-encapsulated for maximum resistance to mechanical shock and vibration. Positive sealing at both ends, with no exposed epoxy interfaces, eliminates all leak paths (including capillary leakage). Construction exceeds NEMA 6P (IEC IP 67) standards. Sensors are approximately 1.2" in diameter by 4" long.

SMI30 series dc receivers operate from 10 to 30V dc. These sensors carry entity approval from **Factory Mutual Research** and **CSA** for intrinsically safe operation in hazardous atmospheres. SMI30 Series sensors are certified as being intrinsically safe when used with approved intrinsic safety barriers. SMI30 Series sensors are suitable for intrinsically safe use in hazardous locations as defined by Article 500 of the National Electrical Code (see classifications, above right). SMI30 Series sensors are also certified by Factory Mutual and CSA as non-incendive devices when used in Division 2 locations (except Groups E and F) without intrinsic safety barriers.

SMI30 Series sensors may be wired for either two- or three-wire current-sinking operation. In the three-wire hookup, which requires two intrinsic-safety barriers (or one dual barrier), the sink current is 15mA. The two-wire hookup, which requires one barrier, sinks $\leq 10\text{mA}$ (OFF state) and $\geq 20\text{mA}$ (ON state).

Intrinsic safety barriers are available from Banner (see page 5). Current trip point amplifier CI3RC2 is also offered (page 4). Several mounting brackets are available (see page 6).

(continued on page 2)

Banner SMI30 Series Intrinsically Safe Sensors are designed to meet the following standards:

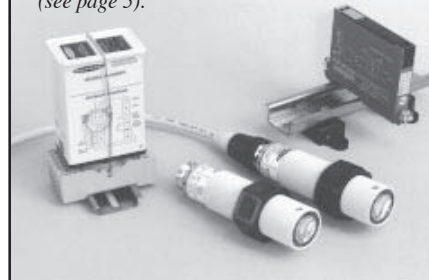
UL 913	CSA 22.2 #142-M1987	FM 3610
UL 1604	CSA 22.2 #157-92	FM3611
UL 508	CSA 22.2 #213-M1987	



WARNING These photoelectric presence sensors do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can result in *either* an energized or a de-energized sensor output condition.

Never use these products as sensing devices for personnel protection. Their use as safety devices may create an unsafe condition which could lead to serious injury or death. Only MACHINE-GUARD and PERIMETER-GUARD Systems, and other systems so designated, are designed to meet OSHA and ANSI machine safety standards for point-of-operation guarding devices. No other Banner sensors or controls are designed to meet these standards, and they must NOT be used as sensing devices for personnel protection.

SMI30 Series sensors, shown with Intrinsic Safety Kit (see page 5).



KEMA No. 03ATEX1441

II 2 G E Ex ib IIC T5



ENTITY - I.S. CL I, II, III
DIV. 1 GP A, B, C, D, E, F, G
N.I. CL I, II, III
DIV. 2 GP A, B, C, D, G



INTRINSICALLY SAFE/
SECURITE INTRINSEQUE
CL I DIV. 1 GP A, B, C, D
CL I DIV. 2 GP A, B, C, D

Specifications

SUPPLY VOLTAGE:

Emitters: 10 to 30V dc at 25mA.

Receivers: 10 to 30V dc at 15mA max. Division 1 use, with barriers, requires *minimum system supply voltage* of 10V. See hookup information, pages 3-4.

OUTPUT:

Receivers only: Current sinking NPN open-collector transistor. Three-wire hookup sinks 15mA maximum continuous, 10-30V dc. Two-wire hookup sinks $\leq 10\text{mA}$ (OFF state) and $\geq 20\text{mA}$ (ON state), 10-30V dc. Outputs are short-circuit protected.

SENSING BEAM: 880 nanometers, infrared; effective beam size 0.75" diameter.

RESPONSE TIME: 10 milliseconds on/off (models with 1ms response are available by special order)

REPEATABILITY: See chart, page 5

Response Time and *Repeatability* specifications are independent of signal strength.

INDICATOR: Internal red LED lights whenever the receiver sees its modulated light source. *Emitters* have red "power on" indicator LED. All indicators are visible through the lens or from side of the sensor.

CONSTRUCTION: NEMA 6P, IEC IP67.

30mm diameter tubular threaded PBT housing, positive sealing at both ends; quad-ring sealed acrylic lens. Electronics are fully epoxy encapsulated. Two PBT jam nuts are provided.

CABLE: Three-wire mini-type QD cable (12 ft. long model SMICC-312 or 30 ft. long model SMICC-330). Cable electrical properties: 40pf/ft.; .20 μH /ft. Order cable separately from sensor.

MOUNTING ALTERNATIVES:

30mm clearance hole;

SMB30C split clamp mounting bracket (page 6);

SMB30MM two-axis mounting bracket (page 6);

SMB30S swivel mounting bracket (page 6).

OPERATING TEMPERATURE RANGE:

-40 to +70°C (-40 to +18°F).

SMI30 Series Intrinsically Safe Sensors

SMI30 Series receivers have a red LED alignment indicator that lights whenever the receiver "sees" its modulated light source. Emitters have a red LED to indicate "power on". All LED indicators are mounted internally to preserve the waterproof integrity of the sensor housing, and are visible from both the side and front of the sensor through the sensor's quad-ring sealed acrylic lens.

The innovative circuitry used in SMI30 Series emitters and receivers provides the best noise immunity of any self-contained opposed mode sensor pair. For applications where optical crosstalk between sensors might be a problem, SMI30 Series emitters and receivers are available with a choice of three modulation frequencies (frequency "A", frequency "B", or frequency "C"). This makes it possible to use high-powered sensor pairs of different frequencies in close proximity to each other without crosstalk. (NOTE: frequency "A" is standard; frequencies "B" and "C" are available by special order. An emitter and its receiver must be of the same modulation frequency.) See the chart on page 5 for a summary of models.

Each unit is supplied with two hexagonal jam nuts. A 30mm clearance hole is required for mounting, and mounting bracket models SMB30MM, SMB30S, and SMB30C are available (page 6). All models have a built-in standard quick-disconnect ("QD") connector. "QD" models mate with 12-foot long model SMICC-312 or 30-foot long model SMICC-330 mini-type QD cable (sold separately from sensor).

Hookup Information

SMI30 Series sensors are certified intrinsically safe ONLY when used with certified energy-limiting intrinsically safe barriers. Emitter units use a two-wire hookup (there is no output connection). Note from the hookup diagram (page 3) that the receiver installation may be made using either a single barrier (2-wire hookup) or with a dual channel barrier (3-wire hookup). In the 2-wire configuration, the sensor acts as a current sink, drawing less than 10mA in the OFF state and more than 20mA in the ON state. The customer must provide a current sensing device ("current sensor" in the diagram) to convert the current to a logic level. SMI30 Series sensors may be used with Banner Current Amplifier Control Module CI3RC2.

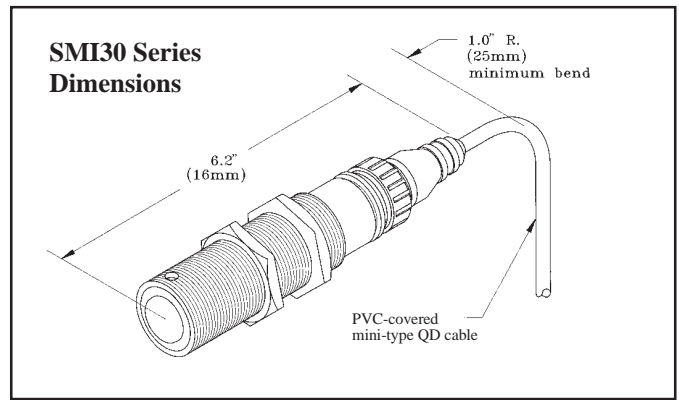
The CI3RC2 module may be purchased (with model RS-11 module socket, one dual-channel barrier, and DIN rail barrier mounts included) by specifying kit model CI2BK-2. One dual-channel intrinsic barrier (alone) may be ordered by specifying model CI2B-1. See the photo, page 5.

In the 3-wire configuration, the output may be used directly to control loads of less than 15mA.

In selecting the barrier, it is important to consider the barrier's resistance. *The sensors must have at least 10 volts across the brown and blue power leads for proper operation, and the barrier will cause a voltage drop due to its resistance.* The formula that determines how much resistance is allowed is:

$$R = 40 (\text{supply voltage} - 10 \text{ volts}).$$

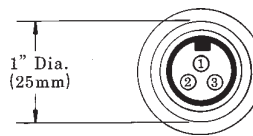
If the supply voltage is 24V dc, then the maximum resistance is 560 ohms. If the supply voltage is 18V dc, then the maximum resistance is 320 ohms. This includes the resistance of any current sensing device used (in the 2-wire configuration), so the barrier resistance must be further reduced by the current sensor resistance.



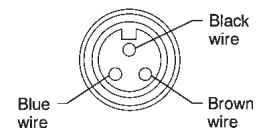
MBCC Series QD Cable (order separately)

SMICC-312 (12 feet, p/n 36356) or **SMICC-330** (30 feet, p/n 36357)
3-wire QD cable for emitters and receivers

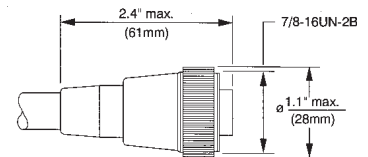
Sensor end (male connector)



Cable end (female connector)



Cable connector (female, for SMICC cable, side view)



Note that, in the 3-wire hookup, the barrier is in series with the load. This results in an apparent saturation voltage of the output that is higher than the sensor output by the amount of $I \times R$ (current times voltage) drop through the barrier.

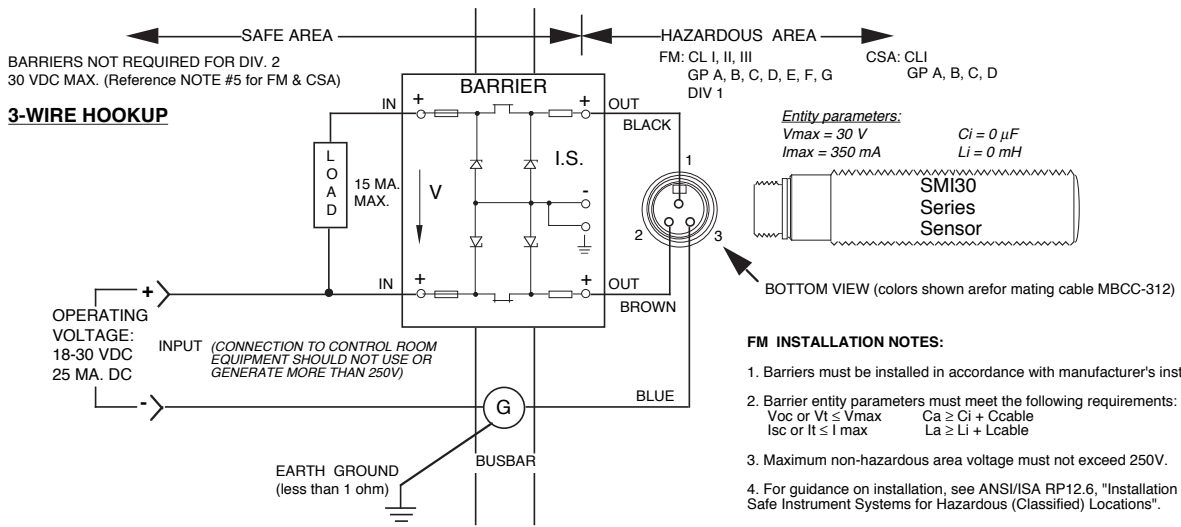
Emitters use the 2-wire hookup; receivers use either 2- or 3-wire hookup. See the chart (page 5) for a summary of models.

Barriers are generally classified as either "positive input" or "negative input". SMI30 Series intrinsically safe sensors require "positive input" barriers for both supply and load. The blue (negative supply) lead of the sensor is normally connected to the ground terminal of the barrier.

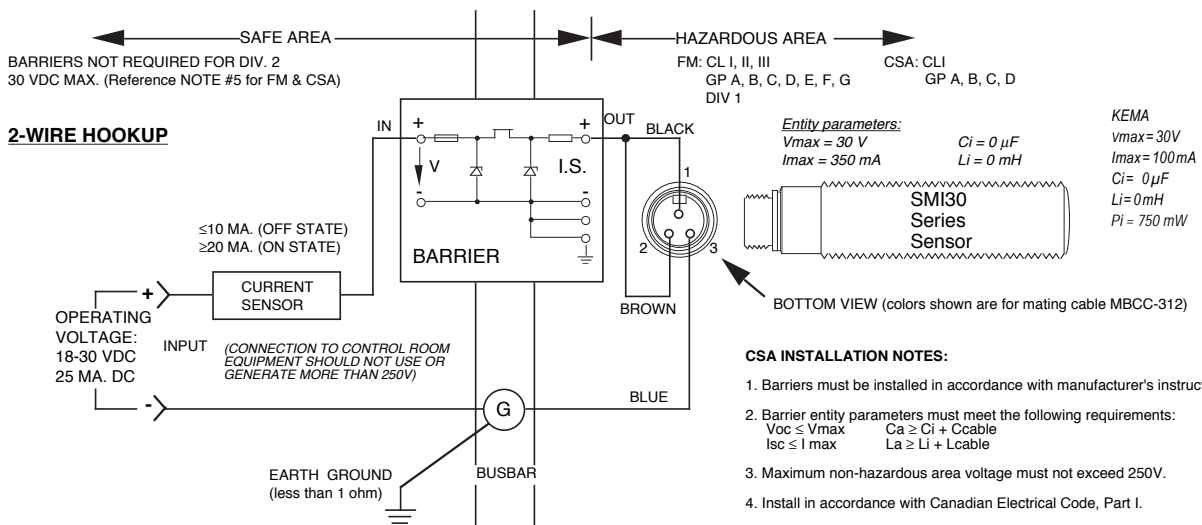
The user of this equipment is responsible for proper installation and maintenance of the equipment, and must conform with the certification requirements relating to barriers and to maximum allowable capacitance and inductance of the field wiring. If you are in doubt about these requirements, our applications engineers can refer you to the appropriate authority.

SMI30 Series Intrinsically Safe Sensors

Hookup Diagrams



NOTE: Emitters have no output connection (no connection to black wire)



CSA INSTALLATION NOTES:

- Barriers must be installed in accordance with manufacturer's instructions.
- Barrier entity parameters must meet the following requirements:
 $V_{oc} \leq V_{max}$ $C_a \geq C_i + C_{cable}$
 $I_{sc} \leq I_{max}$ $L_a \geq L_i + L_{cable}$
- Maximum non-hazardous area voltage must not exceed 250V.
- Install in accordance with Canadian Electrical Code, Part I.
- The sensors are suitable for installation without barriers in Class I Div. 2 Groups A, B, C, D when installed in (or through the wall of) a suitable enclosure with provision for connection of rigid metal conduit per the Canadian Electrical Code, as acceptable to the local inspection authority having jurisdiction.

In Div. 2 installations (without barriers), observe the following warnings:

WARNING: EXPLOSION HAZARD

DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

AVERTISSEMENT: RISQUE D'EXPLOSION

AVANT DE DECONNECTER L'EQUIPEMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENTS EST DESIGNÉ NON DANGEREUX.

6. If barriers with Volt/Ohm parameters are used, the following parameters shall apply:

One Single-Channel Barrier Systems
- one 28 V (max), 300 Ω (min)

Two Single-Channel Barrier or One Dual-Channel Systems
- two 28 V (max), 600 Ω (min)
- one 28 V (max), 300 Ω (min) and one 10 V (max), 50 Ω (min)
- one 28 V (max), 300 Ω (min) and one 28 V diode return

Sensor Models		Frequency "A"	Frequency "B"	Frequency "C"
10ms Models	Emitter	SMI306EQ	SMI306EBQ	SMI306ECQ
	Receiver Lt. Opr.	SMI30AN6RQ	SMI30AN6RBQ	SMI30AN6RCQ
	Receiver Dk. Opr.	SMI30RN6RQ	SMI30RN6RBQ	SMI30RN6RCQ
1ms Models	Emitter	SMI306EYQ	_____	SMI306EYCQ
	Receiver Lt. Opr.	SMI30AN6RYQ	_____	SMI30AN6RYCQ
	Receiver Dk. Opr.	SMI30RN6RYQ	_____	SMI30RN6RYCQ

NO CHANGES MAY BE MADE TO THIS DRAWING WITHOUT PRIOR APPROVAL OF FACTORY MUTUAL AND CSA



Banner Engineering Corp.
9714 Tenth Avenue North
Minneapolis, MN 55441

MANUFACTURING DRAWING #35392 rev. A

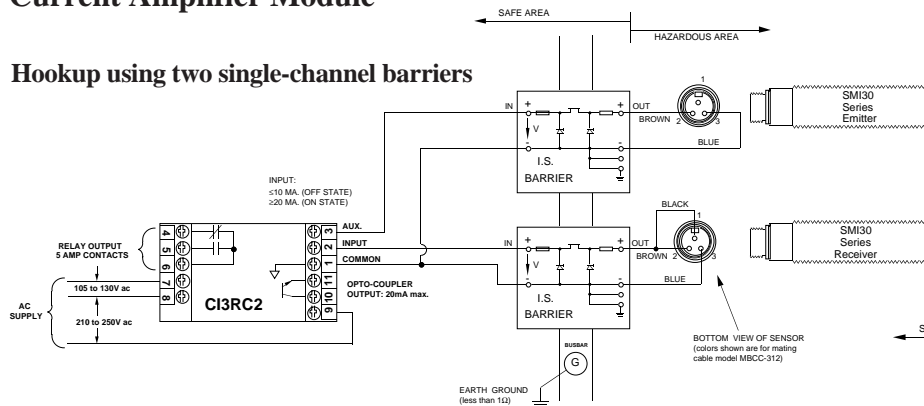
**HOOKUP DIAGRAM: SMI30 SERIES
INTRINSICALLY-SAFE SENSORS**

CI3RC2 Current Amplifier Module

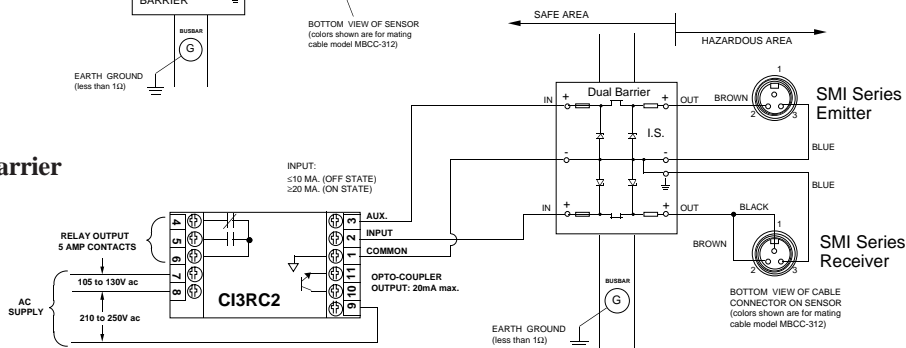
Hookup to Banner MAXI-AMP CI3RC2 Current Amplifier Module

(see the data sheet packed with the CI3RC2 for more information)

Hookup using two single-channel barriers



Hookup using one dual-channel barrier



MAXI-AMP™ CI3RC2 Module

Banner MAXI-AMP module model CI3RC2 (part number 36606) is a self-contained module which converts the current output signal of an SMI30 Series sensor to a trip point switch.

Both sensors of the opposed mode pair are wired to model CI3RC2 using the two-wire hookup, which requires the use of two single channel or one dual channel intrinsic safety barrier(s). In this mode, the SMI30 receiver sinks ≤ 10 milliamps in the "OFF" state and ≥ 20 milliamps in the "ON" state. The CI3RC2 senses this current change and switches internal relays which are easily wired to most loads and/or additional control circuitry.

Model CI3RC2 is powered by either 105-130 or 210-250V ac. The CI3RC2 supplies power to operate both the emitter and receiver.

Inputs are protected against short circuits. Built-in circuit diagnostics indicate an overload of either input by pulsing an LED status light.

The CI3RC2 module has two isolated output switches. There is a 5 amp rated SPDT electromechanical relay, and a solid-state transistor switch which may be used for logic-level interfaces.

SPECIFICATIONS, CI3RC2

SUPPLY VOLTAGE: 105 to 130 or 210 to 250V ac, 50/60 Hz (8VA).

OUTPUT CONFIGURATION:

SPDT electromechanical relay:

Contact rating: 250V ac max., 24V dc max., 5 amps max. (resistive load), 1/10 HP at 240V ac. Install transient suppressor (MOV) across contacts that switch inductive loads.

Closure time: 10 milliseconds max.

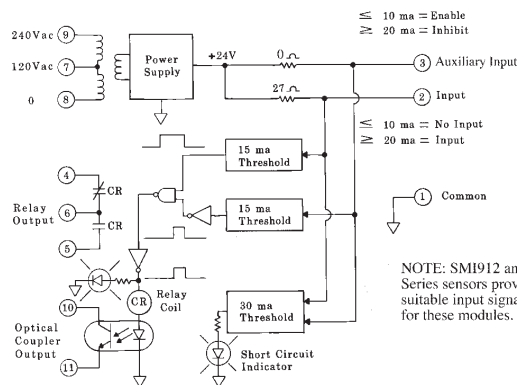
Release time: 10 milliseconds max.

Maximum switching speed: 20 operations/second.

Mechanical life: 20,000,000 operations

Solid-state dc relay: SPST optically-coupled transistor; 30V dc max., 20mA max.

Functional Schematic, CI3RC2



NOTE: SMI912 and SMI30 Series sensors provide suitable input signals for these modules.

INPUTS:

Trip point for output "OFF": ≤ 10 milliamps

Trip point for output "ON": ≥ 20 milliamps

Trip point range for input overload indication: $30\text{mA} \leq I \leq 80\text{mA}$.

INDICATOR LEDs: Status indicator for OUTPUT "ON" and INPUT overload/short.

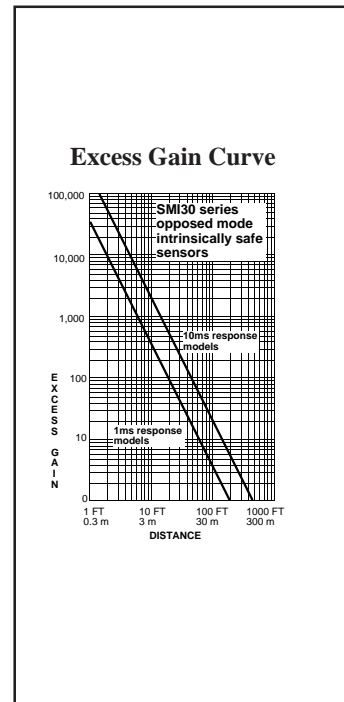
OPERATING TEMPERATURE: 0 to 50°C (32 to 122°F).

CONSTRUCTION: rugged NORYL® polyphenylene oxide (PPO™) housing, 1.6" x 2.3" x 4". Standard round-pin 11-pole base. Use RS-11 socket or equivalent.

SMI30 Series Intrinsically Safe Sensors

Models: part numbers, frequencies, and response times

SMI30 Series Intrinsically Safe Sensors and Part Numbers				
Sensor Models		Frequency "A" (standard)	Frequency "B" (special order)	Frequency "C" (special order)
Models with 10 ms response time	Emitters	<i>Repeatability: 1 ms</i> SMI306EQ (35268)	<i>Repeatability: 1.6 ms</i> SMI306EBQ (35269)	<i>Repeatability: 2.3 ms</i> SMI306ECQ (35270)
	Receivers (light operate)	SMI30AN6RQ (35271)	SMI30AN6RBQ (35272)	SMI30AN6RCQ (35273)
	Receivers (dark operate)	SMI30RN6RQ (35274)	SMI30RN6RBQ (35275)	SMI30RN6RCQ (35276)
Models with 1 ms response time	Emitters	<i>Repeatability: 360 μs</i> SMI306EYQ (35277)	—	<i>Repeatability: 210 μs</i> SMI306EYCQ (35278)
	Receivers (light operate)	SMI30AN6RYQ (35279)	—	SMI30AN6RYCQ (35280)
	Receivers (dark operate)	SMI30RN6RYQ (35281)	—	SMI30RN6RYCQ (35282)



Accessories: apertures, barriers, kits, and mounting brackets

APG30S Aperture Kit for SM30 Series Sensors (27533)

These new water-tight apertures for SM30 Series sensors may be used to size and shape the effective beam or to limit excess gain for avoiding "burn-through" effects. Apertures are sold as a kit, which includes a thread-on stainless steel housing, a flat glass lens, two quad-ring seals, and 3 round and 3 slotted aperture disks.



The stainless steel aperture housing functions equally well with VALOX® and stainless steel sensor models. The glass lens is useful for protecting the SM30's acrylic lens against substances that are hostile to acrylics, such as concentrated acids and alkalis and industrial solvents.



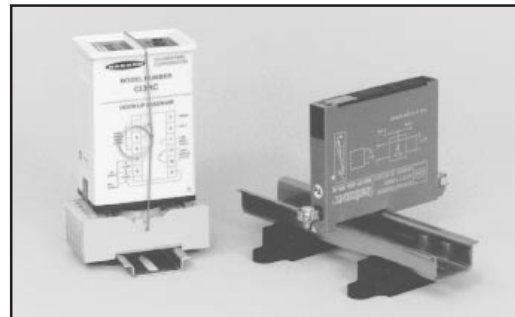
Aperture sizes include the following.

- Round: .06", .12", and .70" diameter
- Slotted: .04", .10", and .20" wide

Intrinsic Safety Kits for use with Intrinsic Safe Sensors

Kit CI2BK-1 (36860) includes a CI3RC2 current amplifier, one RS-11 socket, one DIN-rail mount, and one single-channel intrinsically safe barrier.

Kit CI2BK-2 (36605) includes a CI3RC2 current amplifier, one RS-11 socket, one DIN-rail mount, and one dual-channel intrinsically safe barrier.



Barriers are available separately:

- Single channel barrier (model CIB-1, p/n 27030)
- Dual channel barrier (model CI2B-1, p/n 36865)

Mounting Brackets

Accessory mounting bracket model SMB30MM (27162) has curved mounting slots for versatility in mounting and orientation. The sensor mounts to the bracket using the two jam nuts provided. Bracket material is 11-gauge zinc-plated steel. Curved mounting slots have clearance for 1/4" screws.

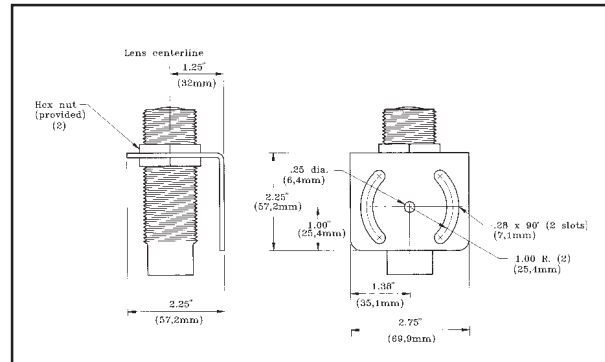
The model SMB30S swivel-mount bracket (33204, right) offers the ultimate in mounting versatility for SMI30s and other sensors with M30 x 1,5 threads. The SMI30 threads into the adjustable captive ball of the bracket, which is then held firmly in place when two locking bolts are tightened. Bracket material is black PBT. Stainless steel mounting hardware is included.

Split Clamp Bracket model SMB30C (32636, right) is similar to the SMB30S, but without the adjustable captive swivel ball. It grips an M30x1,5 threaded sensor by its threaded barrel (S30 EZ-BEAM sensor shown). Bracket material is black PBT. Stainless steel mounting hardware is included.

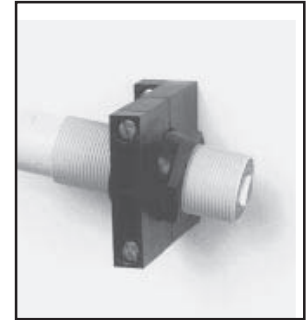
Special Conditions for Safe Use

Parts of the enclosure are non-conducting and may generate an ignition-capable level of ESD. Cleaning of the equipment shall be done only with a damp cloth.

SMB30MM Mounting Bracket (27162)



SMB30S Swivel Bracket (33204)



SMB30C Split Clamp (32636)



WARRANTY: Banner Engineering Corporation warrants its products to be free from defects for one year. Banner Engineering Corporation will repair or replace, free of charge, any product of its manufacture found to be defective at the time it is returned to the factory during the warranty period. This warranty does not cover damage or liability for the improper use of Banner products. This warranty is in lieu of any other warranty either expressed or implied.