

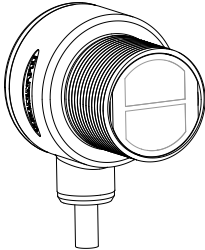
# T30AD9 NAMUR Series Fixed-Field Sensor



## Datasheet

No revision without agency approval.

To view or download the latest technical information about this product, including specifications, dimensions, accessories, and wiring, go to [www.bannerengineering.com](http://www.bannerengineering.com).



- Designed for use with approved amplifiers and intrinsically safe barriers in explosive environments
- NAMUR compliant sensor featuring EZ-BEAM® technology; the specially designed optics and electronics provide reliable sensing without the need for adjustments
- "T" style plastic housing with 30 mm threaded lens
- Completely epoxy-encapsulated to provide superior durability, even in harsh sensing environments; Banner tested to IP69K
- Innovative dual-indicator system takes the guesswork out of sensor performance monitoring
- Advanced diagnostics to warn of marginal sensing conditions or output overload
- 5 to 30 V DC; constant current output;  $\leq 1.2$  mA in the "dark" condition and  $\geq 2.1$  mA in the "light" condition



### 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

Model	Connection	Far-Limit Cutoff	LED	Output Type
T30AD9FF150	2 m (6.5 ft) unterminated 3-wire PVC-jacketed cable	150 mm (5.9 in)	Infrared, 880 nm	Constant current $\leq 1.2$ mA dark $\geq 2.1$ mA light
T30AD9FF150Q	Integral 4-pin M12 male quick disconnect			

## Overview

T30AD9FF150 NAMUR Series Sensor is a self-contained fixed-field sensors are small, powerful, infrared diffuse mode sensors with far-limit cutoff (a type of background suppression). The sensor is designed for use with certified intrinsically safe switching amplifiers and barriers (Approved Apparatus) with intrinsically safe circuits. The T30AD9FF150 NAMUR Series Sensor is designed in accordance with DIN 19234 (IEC/EN 60947-5-6) for operation via two-wire connection to an Approved Apparatus controlled by the variable internal resistance of the sensor.

Their high excess gain and fixed-field technology allow detection of 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.

Models are available with either a 2 m (6.5 ft) long attached PVC-covered cable or a 4-pin M12/Euro-style quick disconnect (QD) connector. Quick disconnect models (with "Q" in the model number suffix) use MQD9-4.. mating cable (either straight or right angle connector; see [Accessories](#) on p. 7). Contact Banner Engineering for availability of sensor models with 9 m (30 ft) long attached cable.

## Fixed-Field Sensing – Theory of Operation

The T30AD9FF150 NAMUR Series Sensor compares the reflections of its emitted light beam (E) from an object back to the sensor's two differently aimed detectors, R1 and R2. See [Figure 1](#) on p. 2. If the near detector's (R1) light signal is stronger than the far detector's (R2) light signal (see object A in the Figure below, closer than the cutoff distance), the sensor responds to the object. If the far detector's (R2) light signal is stronger than the near detector's (R1) light signal (see object B in the Figure below, beyond the cutoff distance), the sensor ignores the object.

The cutoff distance for the T30AD9 is fixed at 150 mm (5.9 in). Objects lying beyond the cutoff distance are usually ignored, even if they are highly reflective. However, under certain conditions, it is possible to falsely detect a background object (see [Background Reflectivity and Placement](#) on p. 3).



Figure 1. Fixed-Field Concept

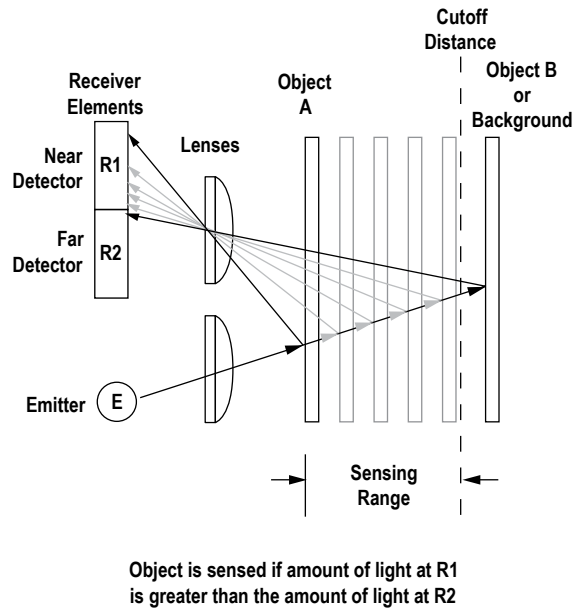
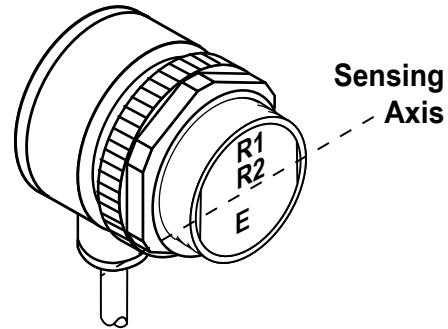


Figure 2. Fixed-Field Sensing Axis



In the drawings and information provided in this document, 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. 4 and [Figure 6](#) on p. 4.

## Installation Instructions

### Ex/HazLoc Applications



#### WARNING:

- **Explosive Atmospheres/Hazardous Locations**
- It is the user's responsibility to ensure that all local, state, and national laws, rules, codes, or regulations relating to the installation and use of this device in any particular application are satisfied. This device must be installed by a Qualified Person<sup>1</sup>, in accordance with this document and applicable regulations.



#### WARNING:

- **Explosion Hazard**
- Do not disconnect equipment unless the power has been switched off or the area is known to be non-hazardous.



#### CAUTION:

- **Electrostatic Discharge (ESD) Special Conditions for Safe Use**
- Parts of the enclosure are non-conducting and can generate an ignition-capable level of ESD.
- Clean the equipment with only a damp cloth.

#### General Notes and Conditions for Use:

- See Specifications and Wiring Diagrams for important information concerning entity parameters, permissible locations, electrical connections and certifications.
- In addition to the warning above concerning user responsibility, the installation must comply with the following:
  - All installations must comply with all manufacturer's instructions.
  - U.S. Installations: The relevant requirements of the National Electrical Code® (ANSI/NFPA-70 (NEC®) and when appropriate ANSI/ISA-RP12.06.01 Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations.
  - Canadian Installations: The relevant requirements of the Canadian Electrical Code (CSA C22.1).
  - ATEX and IECEx Installations: The relevant requirements of EN 60079-14 and applicable National regulations.
  - For quick disconnect (QD) models only: Use Banner **MQD9-4##** cordsets (see [Cordsets](#) on p. 7), or suitable M12 quick disconnect cordsets with threaded retaining nut (see [Specifications](#) on p. 5). The cordset must be securely fastened using the M12x1 QD retaining nut to prevent disconnection. Maximum connector torque: 6 ft-lbs.

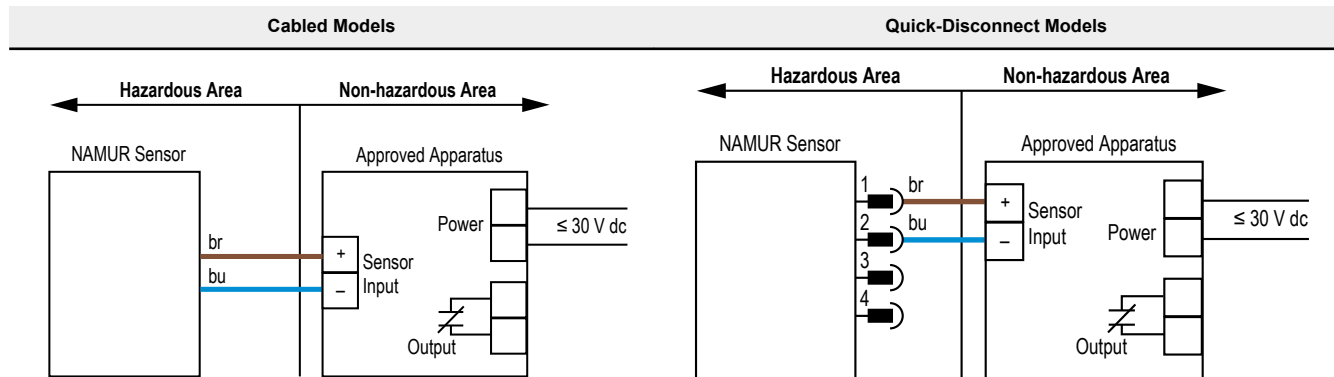
<sup>1</sup> A Qualified Person is a person who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work.

- Do not attempt any repairs to this device; it contains no field-replaceable parts or components. Tampering and/or replacement with non-factory components may adversely affect the safe use of the system.
- Approved Apparatus entity parameters must meet the following requirements:
  - $V_{oc}$  or  $V_t \leq V_{max}$
  - $C_a \geq C_i + C_{cable}$
  - $I_{sc}$  or  $I_t \leq I_{max}$
  - $L_a \geq L_i + L_{cable}$
- Sensor Entity Parameters:
  - $V_{max}(U_i) \leq 30 \text{ V dc}$
  - $I_{max}(I_i) \leq 35 \text{ mA}$
  - $C_i = 0 \text{ } \mu\text{F}$
  - $L_i = 0 \text{ mH}$
- Cable Entity Parameters (if unknown):
  - $C_{cable} = 60 \text{ pF/ft}$
  - $L_{cable} = 0.2 \text{ } \mu\text{H/ft}$
- The ambient operating temperature range of the Sensors is  $-40^\circ\text{C}$  to  $+70^\circ\text{C}$  ( $-40^\circ\text{F}$  to  $+158^\circ\text{F}$ ).
- For intrinsically safe installations, sensors must be used with certified intrinsically safe switching amplifiers and barriers (Approved Apparatus) with intrinsically safe circuits that limit supply voltage and current in the event of failures.
- Maximum non-hazardous area voltage that the Approved Apparatus (intrinsically safe circuit) is connected to must not exceed 250V.
- Intrinsic safety ground, if required for the Associated Apparatus, shall be less than 1 ohm.

## Wiring Connections

The T30AD9FF150 NAMUR Series Sensor is intrinsically safe ONLY when used with certified intrinsically safe switching amplifiers and barriers (Approved Apparatus) with intrinsically safe circuits. Banner does not manufacture such devices; however, our applications engineers can refer you to suppliers of certified devices that will interface with Banner sensors.

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



## Configuration Instructions

### Sensing Reliability

For highest sensitivity, position the target for sensing at or near the point of maximum excess gain. Maximum excess gain for all models occurs at a lens-to-object distance of about 40 mm (1.5 in). Sensing at or near this distance makes the 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 guidelines improves sensing reliability.

### Background Reflectivity and Placement

Avoid mirror-like backgrounds that produce specular reflections. A false sensor response occurs if a background surface reflects the sensor's light more to the near detector (R1) than to the far detector (R2). The result is a false ON condition (Figure 3 on p. 4). Correct this problem by using a diffusely reflective (matte) background, or angling either the sensor or the background (in any plane) so the background does not reflect light back to the sensor (Figure 4 on p. 4). 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. 4), or moving past the face of the sensor in a direction perpendicular to the sensing axis, may cause unwanted triggering of the sensor if more light is reflected to the near detector than to the far detector. Correct the problem by rotating the sensor 90° ([Figure 6](#) on p. 4). 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

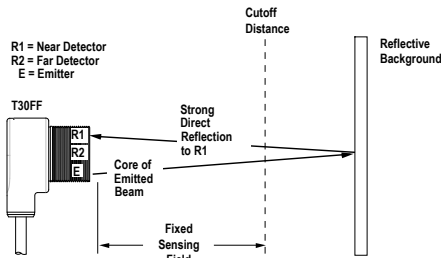
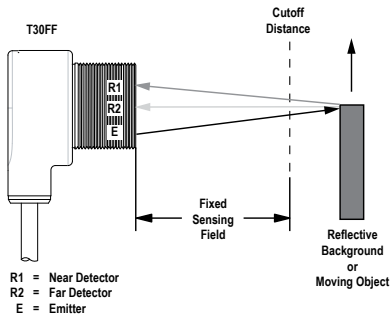


Figure 5. Object Beyond Cutoff - Problem



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

Figure 4. Reflective Background - Solution

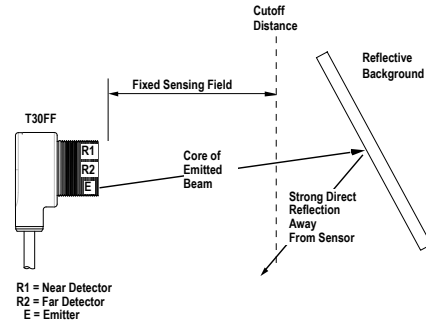
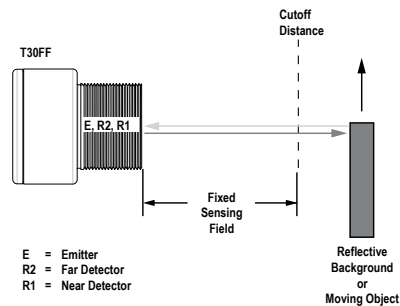


Figure 6. Object Beyond Cutoff - Solution



A reflective background object in this position or moving across the sensor face in this axis is 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 is slightly shorter than for higher reflectance targets. 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 130 mm (5.1 in) cutoff model, for example; and 130 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.

## Specifications

### Supply Voltage and Current

5 to 30 V DC (provided by the amplifier to which the sensor is connected)

### Output

Constant current output;  $\leq 1.2$  mA in the dark condition and  $\geq 2.1$  mA in the light condition

### Output Response Time

10 ms on/off (does not include amplifier response)

### Sensing Beam

Infrared (880 nm)

### Cutoff Distance

150 mm (5.9 in), referenced to a 90% reflectance white test card. See excess gain curve.

### Indicators

Red indicator LED on rear panel turns on when the sensor sees a light condition.

### Operating Conditions

$-40^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$  to  $+158^{\circ}\text{F}$ )

### Application Note

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 must be done only with a damp cloth.

### Construction

Yellow PBT enclosure, PBT rear cover. Acrylic lens. M30x1,5 threaded lens housing with two mounting nuts supplied. Banner tested to NEMA standards 1, 2, 3, 3S, 4, 4X, 6, 6P, 12, and 13. IEC IP67.

### Connections

2 m (6.5 ft) attached PVC covered cable or 4-pin M12 quick-disconnect (QD) fitting, depending on model. QD cable must be purchased separately.

Connecting 4-pin M12 QD Cordsets (see [Cordsets](#) on p. 7): Female single-ended Multiconductor cable (at minimum): UL Style 2517, 24 AWG wire, rated  $\geq 80^{\circ}\text{C}$ ; M12 QD connector: per IEC 61076-2-101, must have threaded M12  $\times$  1 retaining nut.

### Vibration and Mechanical Shock

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

### Certifications



**Banner Engineering Europe** Park  
Lane, Culliganlaan 2F bus 3,  
Diegem B-1831 BELGIUM



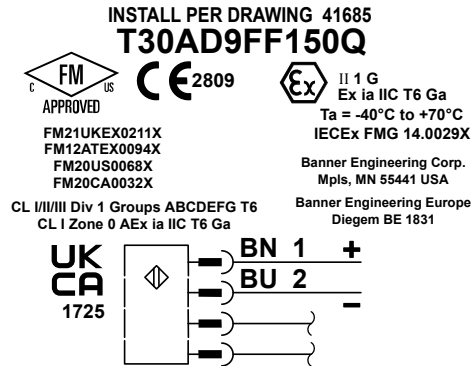
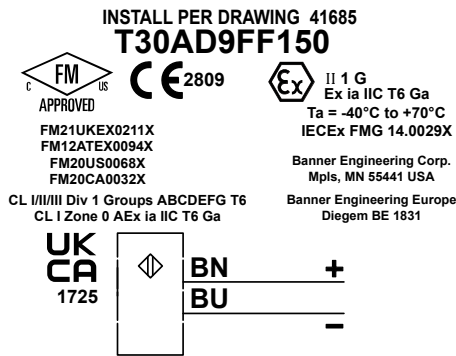
**Turck Banner LTD** Blenheim House, Blenheim  
Court, Wickford, Essex SS11 8YT, Great Britain



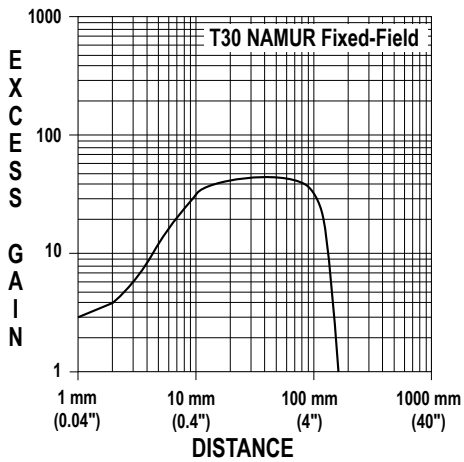
IEC IECEx FMG 14.0029X  
ATEX FM12ATEX0094X  
FM21UKEX0211X  
FM CoC 0003046293 (US)  
FM CoC 0003046293C (CAN)

Design Standards	
ATEX (European)	EN IEC 60079-0, EN 60079-11
Canada	CAN/CSA C22.2: No.0-M91, No.142-M1987, No.157-92, No.213-M1987, No.1010.1, E60079-0 and E60079-11
United States	FM Class 3600, 3610, and 3810; ANSI/ISA 61010-1 (82.02.01), 60079-0 and 60079-11
IECEX	IEC 60079-0, IEC 60079-11

Approvals	
<b>T30AD9FF150, T30AD9FF150Q</b>	
ATEX (European)	II 1 G Ex ia IIC T6 Ga Ta = $-40^{\circ}\text{C}$ to $70^{\circ}\text{C}$ - 41685; Entity Entity Parameters: $U_i = 30$ V dc, $I_i = 35$ mA, $C_i = 0$ $\mu\text{F}$ , $L_i = 0$ mH.
Canadian	IS / I,II,III / 1 / ABCDEFG / T6 Ta = $-40^{\circ}\text{C}$ to $70^{\circ}\text{C}$ - 41685; Entity I / 0 / Ex ia / IIC / T6 Ta = $-40^{\circ}\text{C}$ to $70^{\circ}\text{C}$ - 41685; Entity Entity Parameters: $V_{\text{Max}} = 30$ V dc, $I_{\text{Max}} = 35$ mA, $C_i = 0$ $\mu\text{F}$ , $L_i = 0$ mH
United States	IS / I,II,III / 1 / ABCDEFG / T6 Ta = $-40^{\circ}\text{C}$ to $70^{\circ}\text{C}$ - 41685; Entity I / 0 / AEx ia / IIC / T6 / Ga Ta = $-40^{\circ}\text{C}$ to $70^{\circ}\text{C}$ - 41685; Entity Entity Parameters: $V_{\text{Max}} = 30$ V dc, $I_{\text{Max}} = 35$ mA, $C_i = 0$ $\mu\text{F}$ , $L_i = 0$ mH
IECEX	Ex ia IIC T6 Ga Ta = $-40^{\circ}\text{C}$ to $+70^{\circ}\text{C}$ - 41685; Entity Entity Parameters: $U_i = 30$ V dc, $I_i = 35$ mA, $C_i = 0$ $\mu\text{F}$ , $L_i = 0$ mH.



## Performance



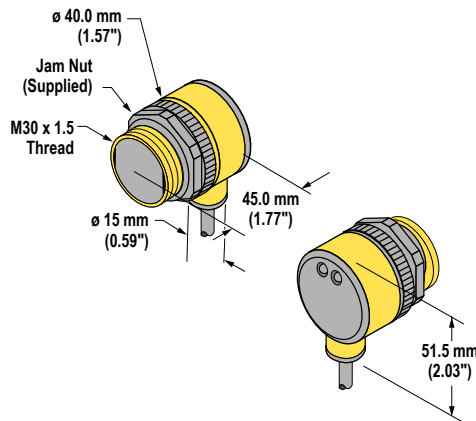
Performance is based on the use of a 90% reflectance white test card.

**Using 18% gray test card:** cutoff distance is 95% of the value shown.

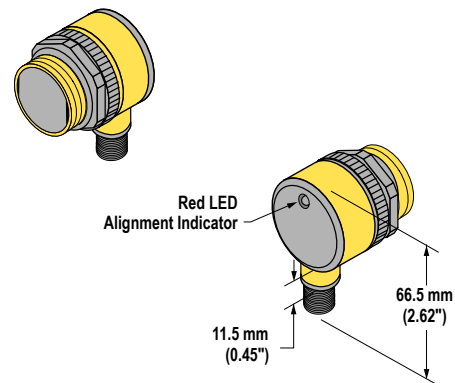
**Using 6% black test card:** cutoff distance is 90% of the value shown.

## Dimensions

### Cabled Models

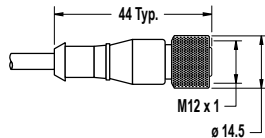
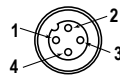
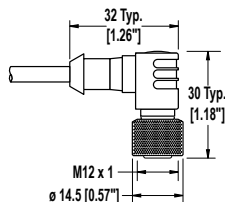
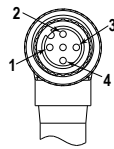


### QD Models



## Accessories

### Cordsets

4-Pin Threaded M12 Cordsets (for use with NAMUR sensors)—Single Ended					
Model	Length	Style	Dimensions	Pinout (Female)	
MQD9-406	2 m (6.56 ft)	Straight			1 = Brown 2 = Blue
MQD9-415	5 m (16.4 ft)				
MQD9-430	9 m (29.5 ft)				
MQD9-406RA	2 m (6.56 ft)	Right-Angle			
MQD9-415RA	5 m (16.4 ft)				
MQD9-430RA	9 m (29.5 ft)				

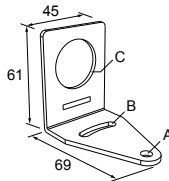
### Brackets

T30 Series sensors may also be mounted in a 30 mm clearance hole up to 15 mm (0.6 in) deep, using the supplied jam nut(s).

All measurements are in mm

#### SMB30A

- Right-angle bracket with curved slot for versatile orientation
- Clearance for M6 (¼ in) hardware
- Mounting hole for 30 mm sensor
- 12-ga. stainless steel

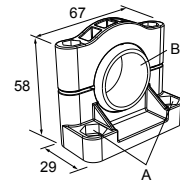


**Hole center spacing:** A to B=40

**Hole size:** A=ø 6.3, B= 27.1 x 6.3, C=ø 30.5

#### SMB30SC

- Swivel bracket with 30 mm mounting hole for sensor
- Black reinforced thermoplastic polyester
- Stainless steel mounting and swivel locking hardware included



**Hole center spacing:** A=ø 50.8

**Hole size:** A=ø 7.0, B=ø 30.0

## Repairs and Translations

Obtain assistance with product repairs by contacting your local Banner Engineering Corp distributor or by calling Banner directly at (763) 544-3164. Access literature translated into your native language on the Banner website at [www.bannerengineering.com](http://www.bannerengineering.com) or contact Banner directly at (763) 544-3164.

Para reparaciones de productos, por favor contacte a su distribuidor local de Banner Engineering o llame a Banner directamente al (763) 544-3164. Vea la literatura traducida en su idioma en el sitio web Banner en [www.bannerengineering.com](http://www.bannerengineering.com) o comuníquese con Banner directamente al (763) 544-3164.

Pour vous aider lors de la réparation de produits, contactez votre distributeur Banner local ou appelez directement Banner au (763) 544-3164. La documentation traduite dans votre langue est disponible sur le site internet de Banner [www.bannerengineering.com](http://www.bannerengineering.com) ou contactez directement Banner au (763) 544-3164.

## 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.

**THIS LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED (INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), AND WHETHER ARISING UNDER COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.**

This Warranty is exclusive and limited to repair or, at the discretion of Banner Engineering Corp., replacement. **IN NO EVENT SHALL BANNER ENGINEERING CORP. BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR ANY EXTRA COSTS, EXPENSES, LOSSES, LOSS OF PROFITS, OR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT OR FROM THE USE OR INABILITY TO USE THE PRODUCT, WHETHER ARISING IN CONTRACT OR WARRANTY, STATUTE, TORT, STRICT LIABILITY, NEGLIGENCE, OR OTHERWISE.**

Banner Engineering Corp. reserves the right to change, modify or improve the design of the product without assuming any obligations or liabilities relating to any product previously manufactured by Banner Engineering Corp. Any misuse, abuse, or improper application or installation of this product or use of the product for personal protection applications when the product is identified as not intended for such purposes will void the product warranty. Any modifications to this product without prior express approval by Banner Engineering Corp will void the product warranties. All specifications published in this document are subject to change; Banner reserves the right to modify product specifications or update documentation at any time. Specifications and product information in English supersede that which is provided in any other language. For the most recent version of any documentation, refer to:

[www.bannerengineering.com](http://www.bannerengineering.com).

For patent information, see [www.bannerengineering.com/patents](http://www.bannerengineering.com/patents).



more sensors, more solutions