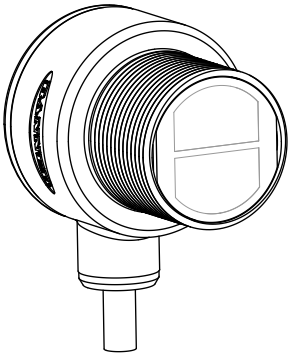
T30 Series NAMUR Fixed-Field Sensors

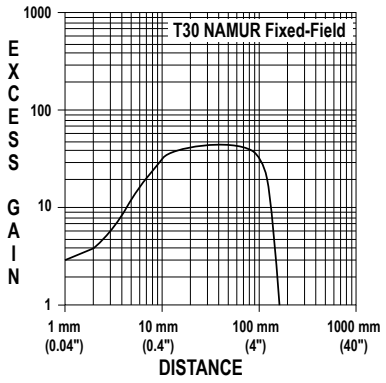
For Intrinsically Safe Operation in Hazardous Areas



- Intrinsically safe sensors 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 rated 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 30V dc; constant current output

WARNING: Not To Be Used for Personnel Protection
Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does NOT include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

Models

Models	Far-Limit Cutoff	LED	Supply Voltage	Excess Gain	
T30AD9FF150 (2 m cable)	150 mm (5.9 in)	Infrared 880 nm	5 to 30V dc		Performance is based on the use of a 90% reflectance white test card. **Using 18% gray test card:** cut-off distance is 95% of the value shown. **Using 6% black test card:** cutoff distance is 90% of the value shown.
T30AD9FF150Q (4-pin Euro-style QD fitting)					

Fixed-Field Mode Overview

T30 Series 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 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.

Fixed-Field Sensing – Theory of Operation

The T30FF NAMUR 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. Fixed-Field Concept* on page 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 model T30FF sensors is fixed at 200, 400 or 600 millimeters (7.9 in, 16.7 in, or 23.6 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 page 2).

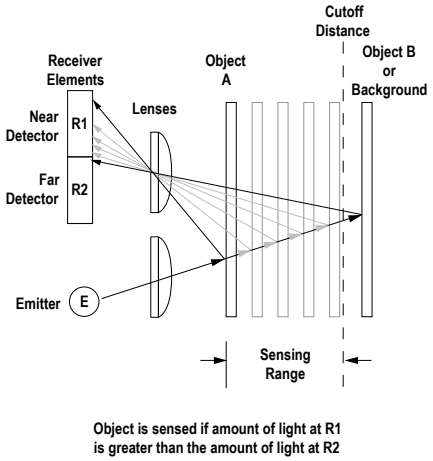


Figure 1. Fixed-Field Concept

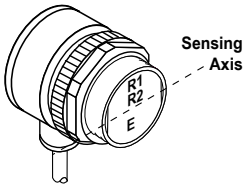


Figure 2. Fixed-Field Sensing Axis

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. Fixed-Field Sensing Axis* on page 2. The sensing axis becomes important in certain situations, such as those illustrated in *Figure 5. Object Beyond Cutoff - Problem* on page 3 and *Figure 6. Object Beyond Cutoff - Solution* on page 3.

Sensor Setup

Sensing Reliability

For highest sensitivity, position the target object 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 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 to the near detector (R1) than to the far detector (R2). The result is a false ON condition (*Figure 3. Reflective Background - Problem* on page 2). 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 (*Figure 4. Reflective Background - Solution* on page 2). 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. Object Beyond Cutoff - Problem* on page 3), 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. The problem is easily remedied by rotating the sensor 90° (*Figure 6. Object Beyond Cutoff - Solution* on page 3). The object then reflects the R1 and R2 fields equally, resulting in no false triggering. A better solution, if possible, may be to reposition the object or the sensor.

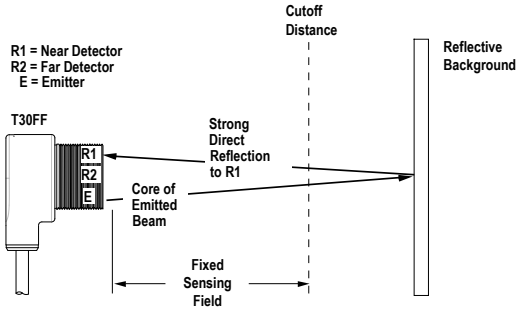


Figure 3. Reflective Background - Problem

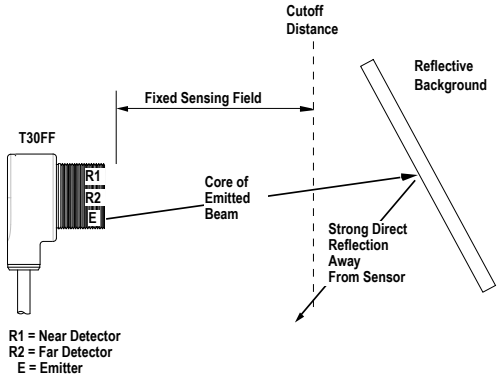
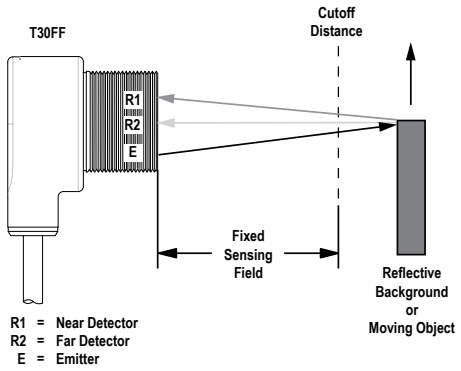
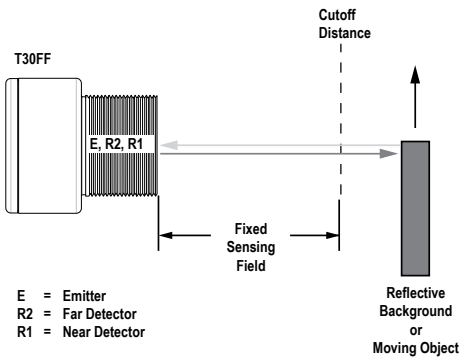


Figure 4. Reflective Background - Solution



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

Figure 5. Object Beyond Cutoff - Problem



A reflective background object in this position or moving across the sensor face in this axis will be ignored.

Figure 6. Object Beyond Cutoff - Solution

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); thus 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 30V dc (provided by the amplifier to which the sensor is connected)

Output
Constant current output; ≤1.2 mA in the dark condition and ≥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.

Construction
Yellow PBT enclosure, PBT rear cover. Acrylic lens. M30xl,5 threaded lens housing with two mounting nuts supplied. Meets 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 Euro-style quick-disconnect (QD) fitting, depending on model. QD cable must be purchased separately.

Operating Conditions
Temperature: −40 °C to +70 °C (−40 °F to +158 °F)

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).

Design Standards

ATEX (European)
EN 60079-0, EN 60079-11, EN 60079-26

Canadian
CAN/CSA C22.2 No. 0-M91, No. 142-M1987, No.157-92, No. 1010.1, E60079-0, E60079-11

United States
FM Class 3600, 3610, and 3810, ANSI/ISA 61010-1 (82.02.01), ANSI/ISA 60079-0, 60079-11, and 60079-26

Approvals

ATEX (European)
II 1 G Ex ia IIC T6 Ta = -40 °C to 70 °C - 13321; Entity FM12ATEX0094X
Entity Parameters: V_{Max} = 30 V, I_{Max} = 35 mA, C_i = 0, L_i = 0

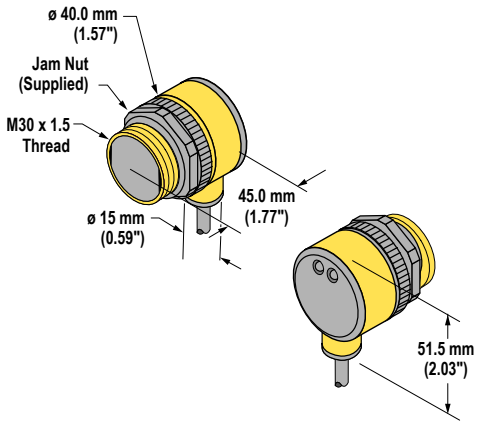
Canada
Intrinsically safe for Class I, II and III, Division 1, Groups A, B, C, D, E, F and G T6 Ta = -40 °C to 70 °C - 13321; Entity
Intrinsically safe for Class I, Zone 0 Ex ia Group IIC T5 Ta = -40 °C to 70 °C
Entity Parameters: V_{Max} = 30 V, I_{Max} = 350 mA, C_i = 0, L_i = 0

United States
Intrinsically safe for Class I,II and III, Division 1, Groups A, B, C, D, E, F and G T6 Ta = -40 °C to 70 °C - 13321; Entity
Intrinsically safe for Class I, Zone 0 AEx ia Group IIC T5 Ta = -40 °C to 70 °C
Entity Parameters: V_{Max} = 15 V dc, I_{Max} = 35 mA, Pi = 0.131 W, C_i = 0.3 µF, L_i = 0 mH.

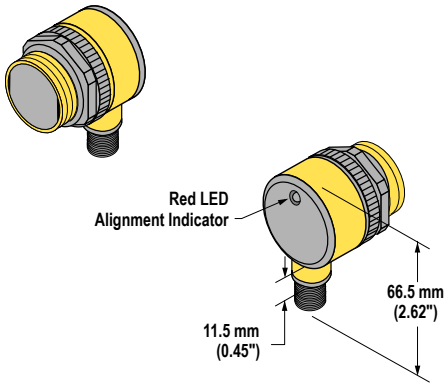
Certifications

Dimensions

Cabled Models

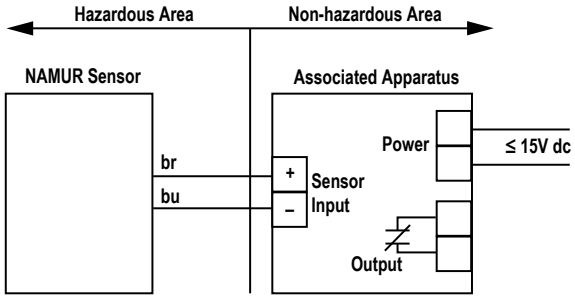


QD Models

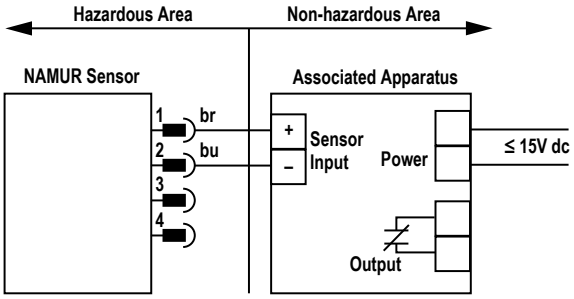


Hookups

Cabled Models



Quick-Disconnect Models



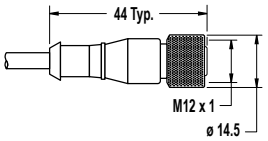
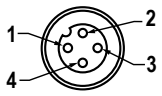
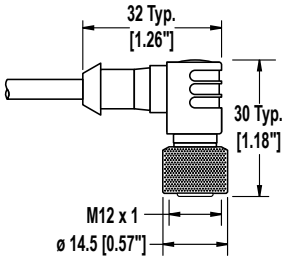
Entity Parameters

Associated Apparatus	Sensor Apparatus
Voc ≤ 15V dc	Vmax = 30V dc
Isc ≤ 35 mA	Imax = 35 mA
Ca ≥ *C (cable) + Ci	Ci = 0
La ≥ *L (cable) + Li	Li = 0
	Pi = 131
*C (cable) = 60 pF/ft	*L (cable) = 0.2 uH/ft

Important: Hazardous Area Application
Associated apparatus may include amplifiers and barriers to monitor apparatus supply current which is the apparatus output signal. Associated apparatus must limit both supply voltage current in the even of failures.

Accessories

Cordsets

4-Pin Threaded M12/Euro-Style Cordsets (for use with NAMUR sensors)				
Model	**Length**	**Style**	**Dimensions**	**Pinout**
MQD9-406	1.83 m (6 ft)	Straight		
MQD9-415	4.57 m (15 ft)			
MQD9-430	9.14 m (30 ft)			
MQD9-406RA	1.83 m (6 ft)	Right-Angle		1 = Brown 2 = Blue
MQD9-415RA	4.57 m (15 ft)			
MQD9-430RA	9.14 m (30 ft)			

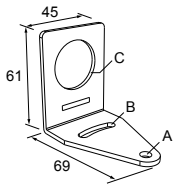
Brackets

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

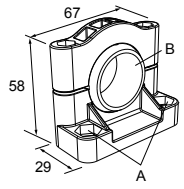
- Right-angle bracket with curved slot for versatile orientation
- Clearance for M6 (¼ in) hardware
- Mounting hole for 30 mm sensor
- 12-ga. stainless steel



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

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