



T30 AC-Voltage Series Sensor Product Manual

Original Instructions

p/n: 121523 Rev. D

31-Oct-25

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Chapter 1 Features

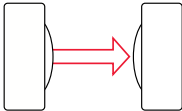
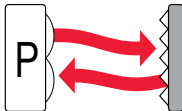
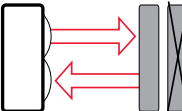


- Featuring EZ-BEAM® technology, specially designed optics and electronics provide reliable sensing without adjustments
- “T” style PBT polyester housing with 30 mm threaded lens in opposed, retroreflective, or fixed-field modes
- Completely epoxy-encapsulated providing superior durability, even in harsh sensing environments, rated to IP69K per ISO 20653
- Innovative dual-indicator system takes the guesswork out of sensor performance monitoring
- 20 V AC to 250 V AC (3-wire); 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

Sensing Mode	Model	Output	Range	LED
 OPPOSED	T303E	-	60 m (200 ft)	Infrared, 950 nm
	T30AW3R	LO		
	T30RW3R	DO		
 POLAR RETRO	T30AW3LP	LO	6 m (20 ft)	Visible red, 680 nm
	T30RW3LP	DO		
 FIXED-FIELD	T30AW3FF200	LO	200 mm (8 in) cutoff	Infrared, 880 nm
	T30RW3FF200	DO		
	T30AW3FF400	LO	400 mm (16 in) cutoff	
	T30RW3FF400	DO		
	T30AW3FF600	LO	600 mm (24 in) cutoff	
	T30RW3FF600	DO		

Standard 2 m (6.5 ft) cable models are listed.

- To order the 9 m (30 ft) cable model: add suffix “W/30” (for example, T303E W/30).
- To order the 4-pin Micro-style integral QD model: add suffix “Q1” (for example, T303EQ1).
- A model with a QD connector requires a mating cable; see ["Cordsets" on page 10](#).

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Chapter 2 Fixed-Field Mode Overview

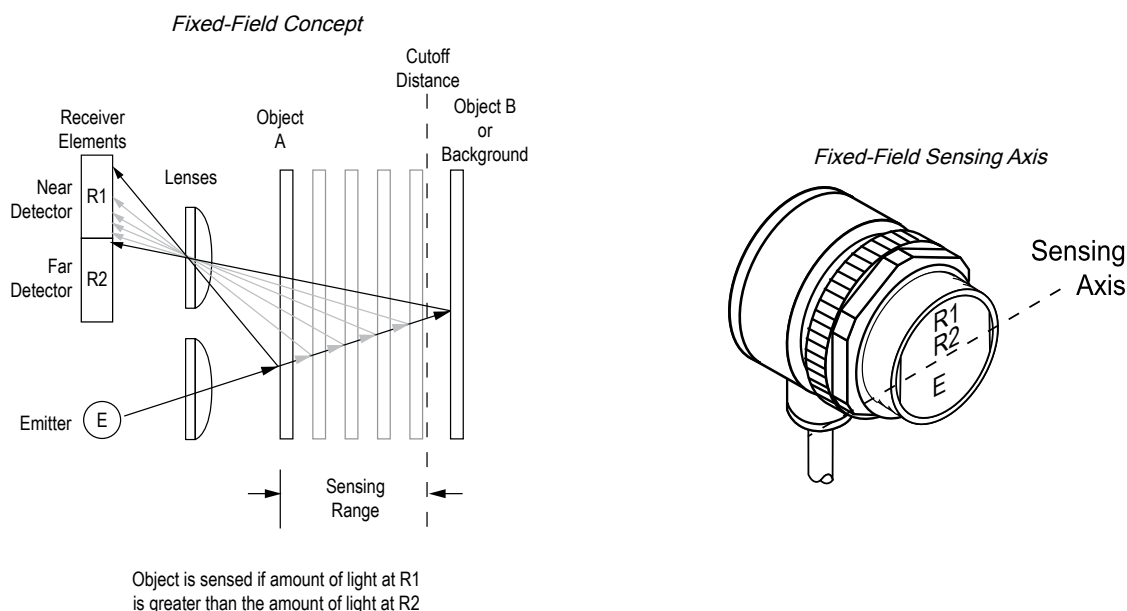
T30 self-contained fixed-field sensors are small, powerful, infrared diffuse mode sensors with far-limit cutoff (a type of background suppression). Their high excess gain and fixed-field technology allow the detection of objects of low reflectivity while ignoring background surfaces.

The cutoff distance is fixed. Backgrounds and background objects must always be placed beyond the cutoff distance.

Fixed-Field Sensing Theory of Operation

The T30 Fixed-Field 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: Fixed-Field Concept" on page 4](#). 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 T30 is fixed at 200, 400, or 600 mm (7.9, 16.7, 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 5](#)).



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: Fixed-Field Sensing Axis" on page 4](#).

The sensing axis becomes important in certain situations, such as when the object is beyond the cutoff distance as shown in ["Background Reflectivity and Placement" on page 5](#).

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Chapter 3 Sensor Setup

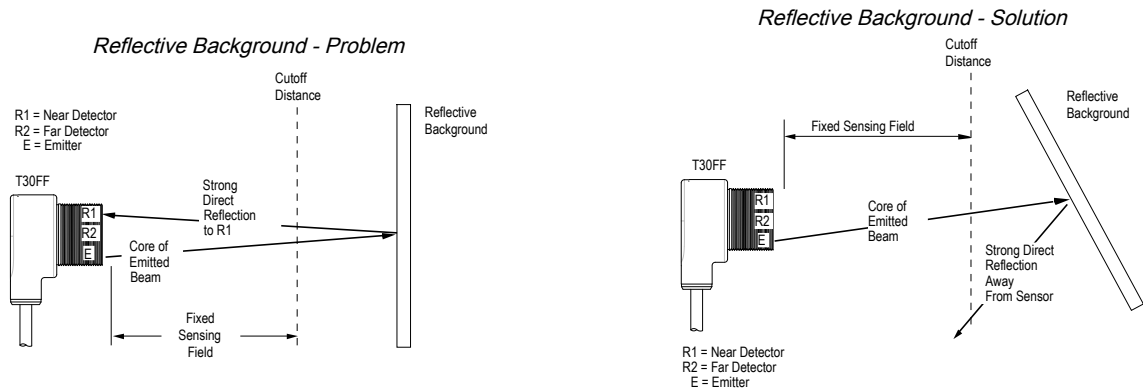
Sensing Reliability

For the 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 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.

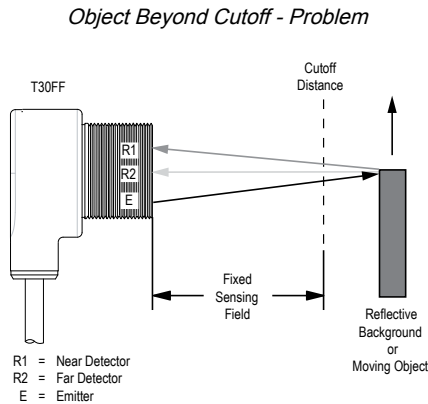
Background Reflectivity and Placement

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: Reflective Background - Problem" on page 5). 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: Reflective Background - Solution" on page 5). Position the background as far beyond the cutoff distance as possible.

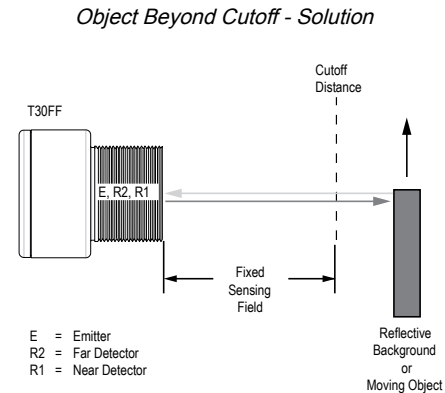
An object beyond the cutoff distance, either stationary (and when positioned as shown in "Figure: Object Beyond Cutoff - Problem" on page 6), or moving past the face of the sensor in a direction perpendicular to the sensing axis, may cause unwanted triggering of the sensor if more light is reflected to the near detector than to the far detector. Correct the problem by rotating the sensor 90° ("Figure: Object Beyond Cutoff - Solution" on page 6). 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.



Continued from page 5



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



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

Color Sensitivity

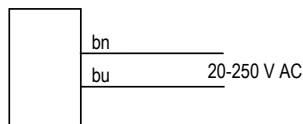
The effects of object reflectivity on cutoff distance, though small, may be important for some applications. It is expected that at any given cutoff setting, the actual cutoff distance for lower reflectance targets is slightly shorter than for higher reflectance targets. This behavior is known as color 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 190 mm (7.5 in) for the 200 mm (8 in) cutoff model, for example; and 190 mm represents the cutoff for this sensor and target.

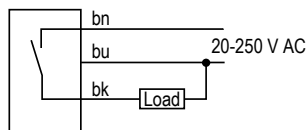
These excess gain curves were generated using a white test card of 90% reflectance. Objects with reflectivity of less than 90% reflect less light back to the sensor and thus require proportionately more excess gain to be sensed with the same reliability as more reflective objects. When sensing an object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

Wiring Diagrams

Cabled emitters



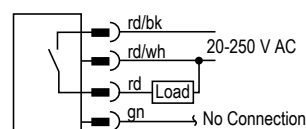
All other cabled models



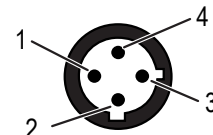
4-pin 1/2 in-20UNF (1/2-in Dual Key) quick disconnect emitters



All other 4-pin 1/2 in-20UNF (1/2-in Dual Key) quick disconnect models



4-pin 1/2 in-20UNF (1/2-in Dual Key) male pinout



Key:

- 1 - Red/black
- 2 - Red/white
- 3 - Red
- 4 - Green

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Chapter 4 Specifications

Supply Voltage and Current

20 V AC to 250 V AC (50 Hz to 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

Output Protection Circuitry

Protected against false pulse on power-up

Output Configuration

SPST solid-state AC switch; three-wire hookup; light operate or dark operate, depending on model

Light Operate: Output conducts when 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 ms, non-repetitive

OFF-state leakage current: < 100 mA

ON-state saturation voltage: 3 V at 300 mA AC; 2 V at 15 mA AC

Output Response

Time Opposed mode: 16 ms ON, 8 ms OFF

Other models: 16 ms ON and OFF

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

Repeatability

Opposed mode: 2 ms

Other models: 4 ms

Repeatability and response are independent of signal strength

Indicators

Two LEDs (Green and Amber)

Green ON steady: power to sensor is ON

Amber ON steady: sensor sees light

Amber flashing: excess gain marginal (1 to 1.5 times) in light condition

Construction

PBT polyester housing; polycarbonate (opposed-mode) or acrylic lens

Environmental Rating

Leakproof design rated IP69K per ISO 20653

Connections

2 m (6.5 ft) integral PVC-jacketed cable, or Integral 4-pin 1/2 in. 20UNF quick-disconnect connector

Operating Conditions

Temperature: -40 °C to +70 °C (-40 °F to +158 °F)

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

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



Banner Engineering BV
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.

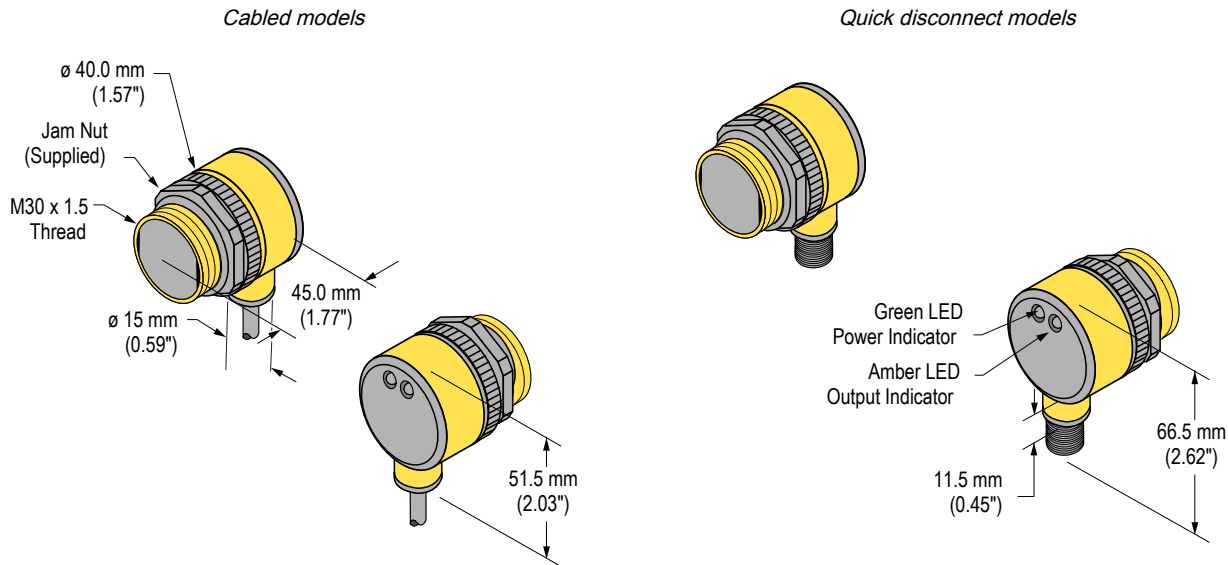
Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.

Supply wiring leads < 24 AWG shall not be spliced.

For additional product support, go to www.bannerengineering.com.

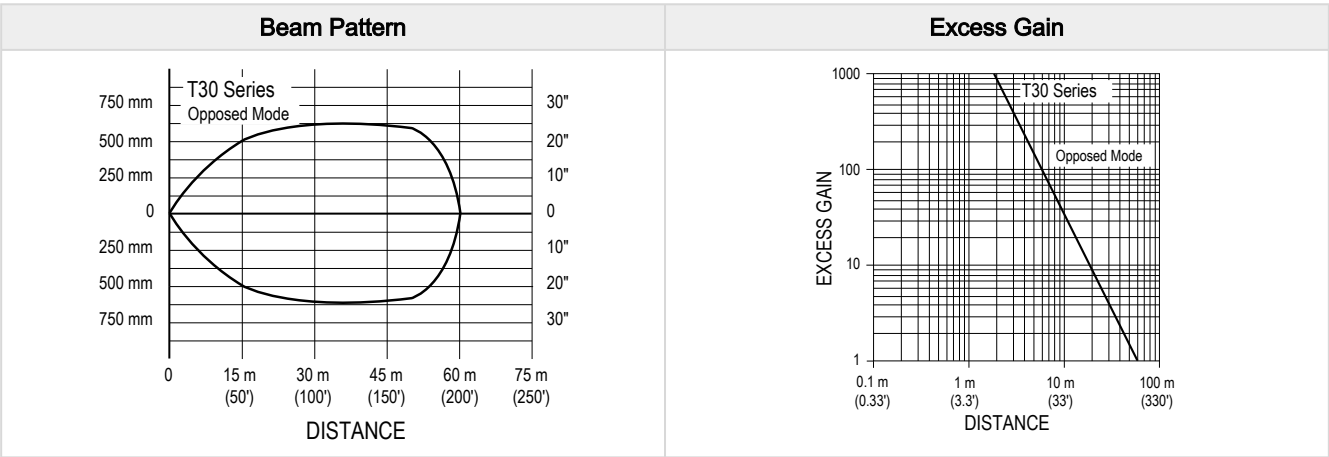
Supply Wiring (AWG)	Required Overcurrent Protection (A)	Supply Wiring (AWG)	Required Overcurrent Protection (A)
20	5.0	26	1.0
22	3.0	28	0.8
24	2.0	30	0.5

Dimensions

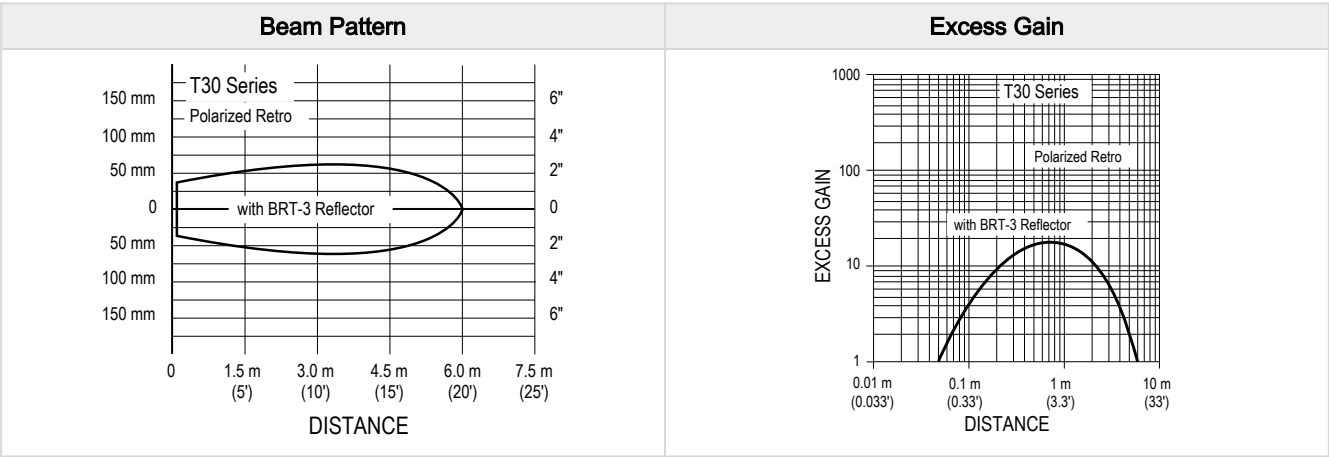


Performance Curves

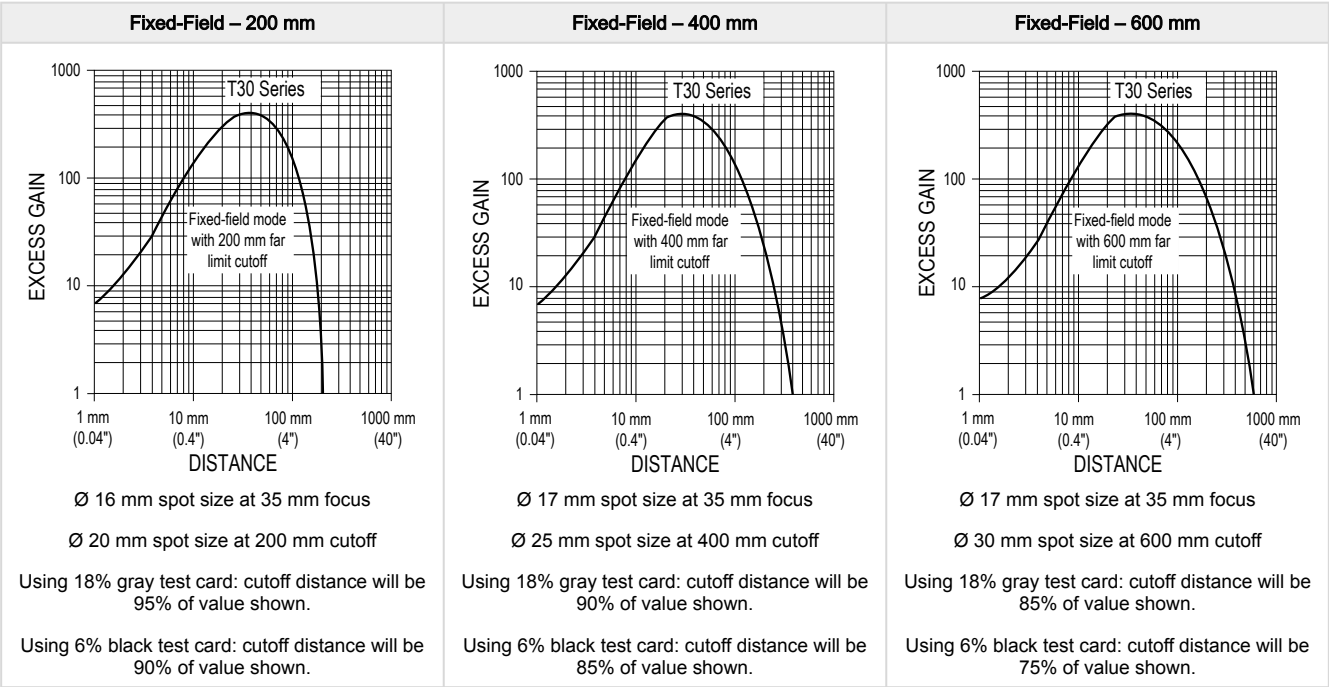
Opposed Mode Sensors



Polarized Retro Mode Sensors⁽¹⁾



Fixed-Field Mode Sensor Excess Gain⁽²⁾



⁽¹⁾ Performance based on use of a model BRT-3 retroreflector (3-inch diameter). Actual sensing range may be more or less than specified, depending on the efficiency and reflective area of the retroreflector used.

⁽²⁾ Performance based on use of a 90% reflectance white test card. Focus and spot sizes are typical.

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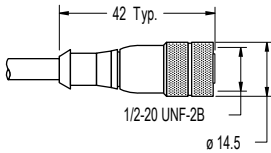
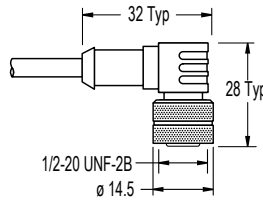
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Accessories

Cordsets

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

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)				

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Chapter 6 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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