

# QS30 Standard DC Voltage Series Sensor Product Manual

Original Instructions
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ПРОМЭЛЕКТРОНИКА/ sales@prom-elec.com

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# Chapter 1 Features

*Compact, self-contained photoelectric sensors in universal-style housing*



- Advanced one-piece photoelectric sensors with exceptional long-range optical performance
- Compact housing with mounting versatility, via its popular 30 mm threaded barrel or side-mount holes
- 10 V DC to 30 V DC operation with bipolar discrete outputs, NPN and PNP
- Selectable Light or Dark Operate, depending on wiring
- Tough ABS/polycarbonate blend housing is rated to IEC IP67; NEMA 6
- Easy-to-see sensor status indicators: two status LEDs visible from 360°; extra-large Output indicator on back of sensor housing (except emitters) visible from long distance
- Opposed, retroreflective, polarized retroreflective, diffuse and fixed-field (200 mm, 400 mm, or 600 mm cutoff) models available
- Retroreflective, polarized retroreflective, and diffuse models have potentiometer on back of housing for easy sensor range adjustment
- Choose 2 m integral cable or M12 integral QD models

**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 | Sensing Mode | Beam | Range [1] | Output |
|---|---|---|---|---|
| **QS30E** (emitter) | Opposed | 875 nm Infrared | 60 m (200 ft) | N/A |
| **QS30R** (receiver) | | Effective Beam: 18 mm (0.7 in) | | Bipolar NPN/PNP |
| **QS30LP** | Polarized Retroreflective | 630 nm Visible Red | 8 m (26 ft) | |
| **QS30LV** | Retroreflective | | 12 m (40 ft) | |
| **QS30D** | Diffuse | 940 nm Infrared | 1 m (3.3 ft) | |
| **QS30FF200** | Fixed Field | 680 nm Visible Red | 200 mm (8 in) | |
| **QS30FF400** | | | 400 mm (16 in) | |
| **QS30FF600** | | | 600 mm (24 in) | |

Only standard 2 m (6.5 ft) cabled models are listed.

- To order the 9 m (30 ft) integral cable model, add suffix “W/30” to the model number (for example, QS30E W/30).
- To order the 5-pin integral M12 quick disconnect (QD), add suffix “Q” (for example, QS30EQ).

[1] Polarized Retroreflective and Retroreflective ranges are specified using a model BRT-84 retroreflector.


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# Specifications

**Supply Voltage**

10 V DC to 30 V DC (10% max. ripple) at less than 40 mA, exclusive of load

Protected against reverse polarity and transient voltages

**Output Response**

Opposed Mode: 5 milliseconds ON and OFF

All others: 2 milliseconds

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

**Repeatability**

Opposed Mode: not applicable

All others: 500 microseconds

**Cutoff Point Tolerance**

Fixed-Field only: ± 5% of nominal cutoff distance

**Construction and Mounting**

ABS housing, rated IEC IP67; NEMA 6; Acrylic lens cover

3 mm mounting hardware included

**Connections**

2 m (6.5 ft) unterminated 5-wire PVC-jacketed cable; 9 m (30 ft) unterminated 5-wire PVC-jacketed cable ; or Integral 5-pin M12 male quick-disconnect connector

**Application Tip for the QS30LV Model**

For best sensing reliability, targets should be a minimum of 0.5m from the sensor

**Output Configuration**

Bipolar: One current sourcing and one current sinking

Rating: 100 mA maximum each output at 25 °C

Off-state leakage current:

NPN: less than 50 µA
PNP: less than 40 µA

ON-state saturation voltage:

NPN: less than 3 V at 100 mA
PNP: less than 3 V at 100 mA

Protected against false pulse on power-up and continuous overload or short circuit of outputs

**Adjustments**

Selectable Light/Dark Operate is achieved via the gray wire.

Opposed, Retroreflective, and Polarized Retroreflective models:

Light Operate - Low (0 V to 3 V)*
Dark Operate - High (open or 5 V to 30 V)*

Diffuse and Fixed-Field models:

Light Operate - High (open or 5 V to 30 V)*
Dark Operate - Low (0 V to 3 V)*

Diffuse, Retroreflective, and Polarized Retroreflective mode models (only):

Single-turn Sensitivity (Gain) adjustment potentiometer

* Input impedance 10 kΩ

**Indicators**

2 LEDs on sensor top:

Green on: Power on

Green flashing: Output overloaded (except receivers)

Amber on: Light sensed

Amber flashing: Marginal excess gain (1–1.5× excess gain)

Large oval LED on sensor back (except emitters): Yellow on indicates the output is conducting

**Operating Conditions**

–20 °C to +70 °C (–4 °F to +158 °F)

95% 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 maximum acceleration) requirements. Also meets IEC 60947-5-2 (Shock: 30G 11 ms duration, half sine wave) requirements.

**Certifications**

Banner Engineering BV
Park Lane, Culliganlaan 2F bus 3
1831 Diegem, BELGIUM

**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 |

# Performance Curves

For the diffuse models, the performance is based on using a 90% reflectance white test card.


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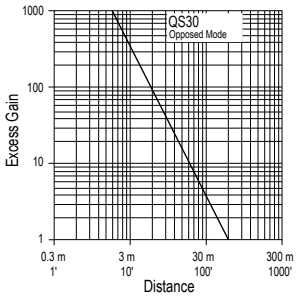
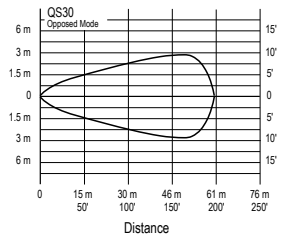
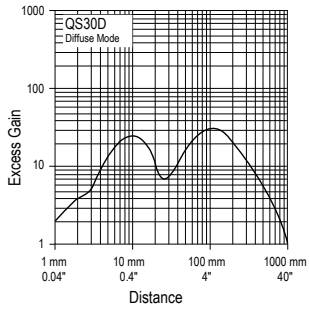
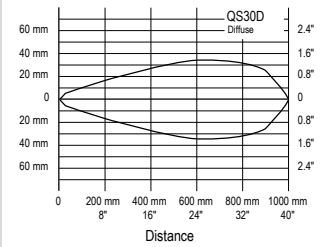
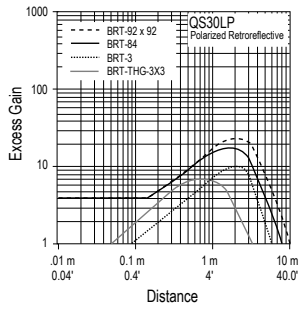
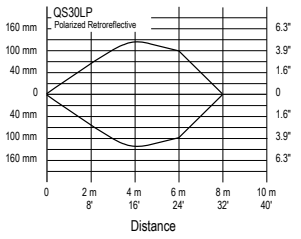
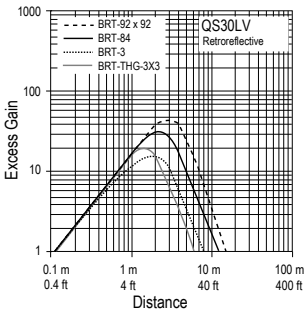
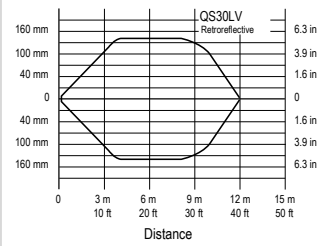
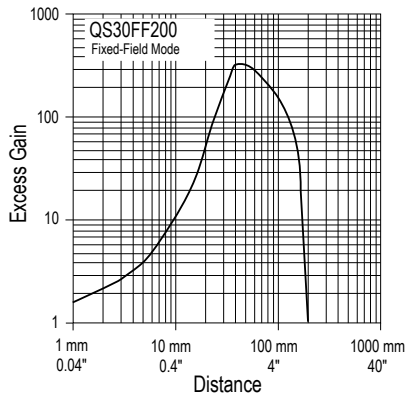
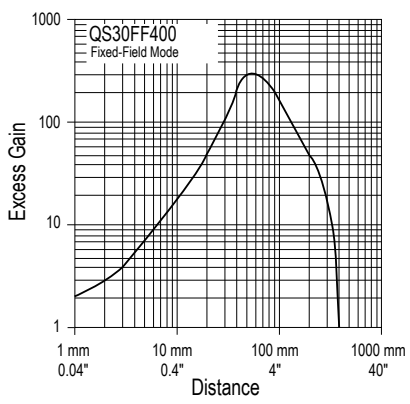
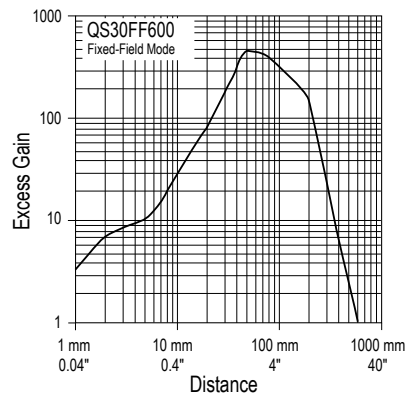
| Opposed Mode | | Diffuse Mode | |
|---|---|---|---|
| **Excess Gain** | **Beam Pattern** | **Excess Gain** | **Beam Pattern** |
|  |  |  |  |

For the polarized retroreflective and retroreflective models, the performance is based on using the specified retroreflector.

| Polarized Retroreflective | | Retroreflective | |
|---|---|---|---|
| **Excess Gain** | **Beam Pattern** | **Excess Gain** | **Beam Pattern** |
|  |  |  |  |

Fixed field performance is based on using a 90% reflectance white test card.

| Fixed Field | | |
|---|---|---|
| **200 mm** | **400 mm** | **600 mm** |
|  |  |  |
| ø 10 mm spot size at 160 mm focus<br>ø 7 mm spot size at 200 mm cutoff<br>Using 18% gray test card: performance will be 95% of values shown.<br>Using 6% black test card: performance will be 90% of values shown. | ø 10 mm spot size at 160 mm focus<br>ø 10 mm spot size at 400 mm cutoff<br>Using 18% gray test card: performance will be 90% of values shown.<br>Using 6% black test card: performance will be 85% of values shown. | ø 10 mm spot size at 160 mm focus<br>ø 15 mm spot size at 600 mm cutoff<br>Using 18% gray test card: performance will be 85% of values shown.<br>Using 6% black test card: performance will be 75% of values shown. |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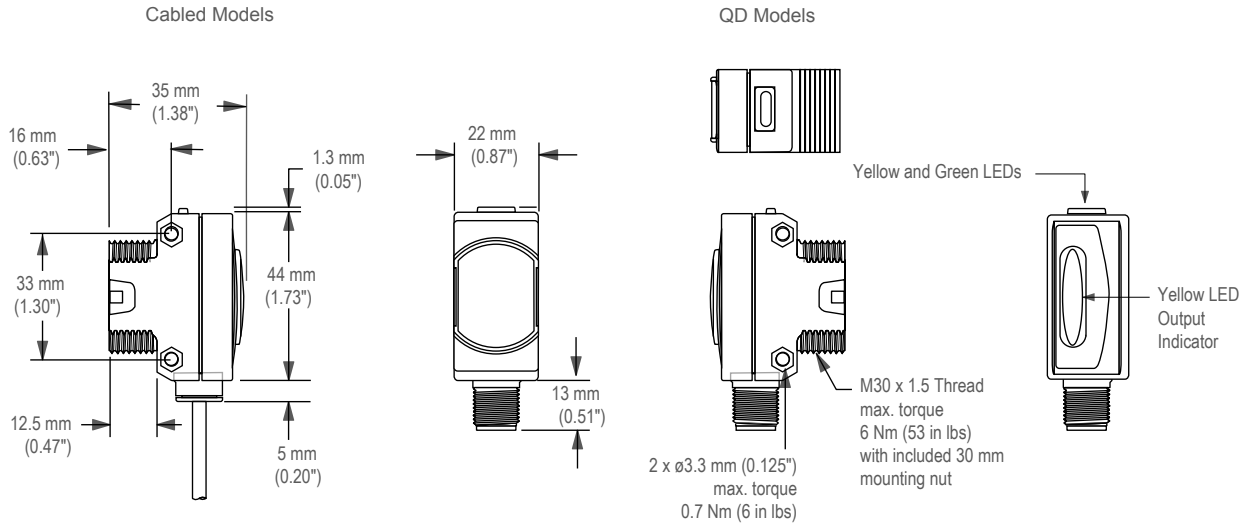
# Dimensions




All measurements are listed in millimeters [inches], unless noted otherwise. The measurements provided are subject to change.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# Chapter 2 Installation

## Fixed-Field Mode Overview

QS30 self-contained fixed-field sensors are small, powerful, visible red 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.

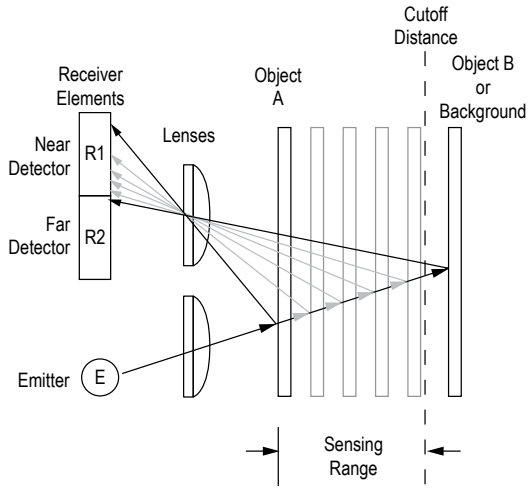
The cutoff distance is fixed. Backgrounds and background objects must always be placed beyond the cutoff distance.

### Fixed-Field Sensing Theory of Operation

The WORLD-BEAM QS30 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 7. 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.

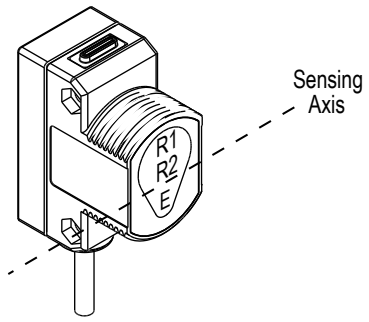
The cutoff distance for the QS30 is fixed at 200 mm, 400 mm, or 600 mm (8 in, 16 in, or 24 in). Objects lying beyond the cutoff distance are usually ignored, even if they are highly reflective. However, under certain conditions, it is possible to falsely detect a background object (see "Background Reflectivity and Placement" on page 9).

*Fixed-Field Concept*




Object is sensed if amount of light at R1 is greater than the amount of light at R2

*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: Fixed-Field Sensing Axis" on page 7.

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 9.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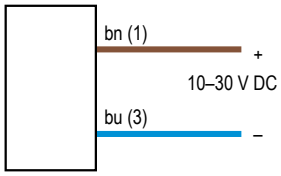
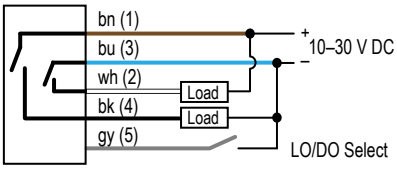
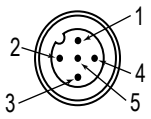
# Wiring

Cabled wiring diagrams are shown. Quick disconnect wiring diagrams are functionally identical.

| Cabled Emitters | Other Cabled Models | 5-Pin Male M12 Quick Disconnect |
|---|---|---|
|  |  |  |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# Chapter 3 Configuring a Sensor

## Sensing Reliability

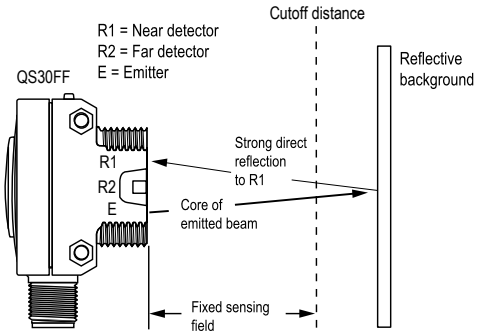
For the highest sensitivity, position the target for sensing at or near the point of maximum excess gain. Refer to the Performance Curves for the excess gain. Sensing at or near this distance makes maximum use of each sensor's available sensing power. The background must be placed beyond the cutoff distance. Note that the reflectivity of the background surface also may affect the cutoff distance. Following these guidelines improves sensing reliability.

## Background Reflectivity and Placement

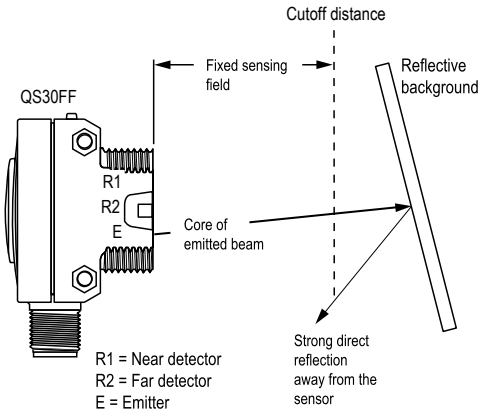
Avoid mirror-like backgrounds that produce specular reflections. A false sensor response occurs if a background surface reflects the sensor's light more to the near detector (R1) than to the far detector (R2). The result is a false ON condition ("Figure: Reflective Background - Problem" on page 9). Correct 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 9). 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 10), 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 10). 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.

*Reflective Background - Problem*




*Reflective Background - Solution*




Continued on page 10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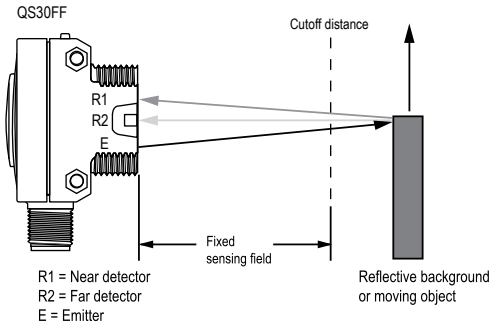
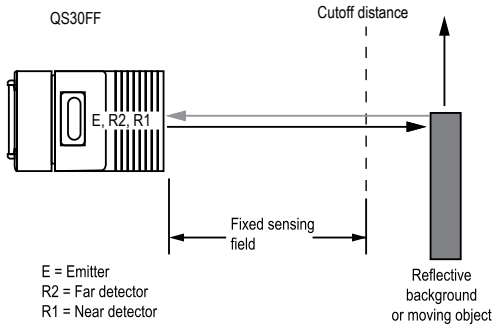
Continued from page 9

*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.

*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 190 mm (7.5 in) cutoff model, for example; and 190 mm (7.5 in) 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.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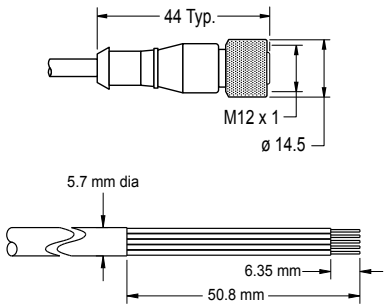
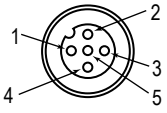
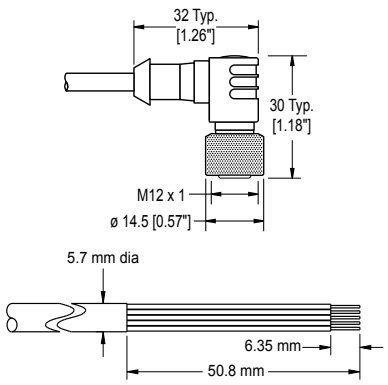
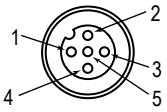
# Chapter 4 Accessories

## Quick-Disconnect Cordsets

| 5-pin Single-Ended M12 Female Cordsets | | | | |
|---|---|---|---|---|
| **Model** | **Length** | **Dimensions (mm)** | **Pinout (Female)** | |
| **BC-M12F5-22-1** | 1 m (3.28 ft) |  |  | 1 = Brown<br>2 = White<br>3 = Blue<br>4 = Black<br>5 = Gray |
| **BC-M12F5-22-2** | 2 m (6.56 ft) | | | |
| **BC-M12F5-22-5** | 5 m (16.4 ft) | | | |
| **BC-M12F5-22-8** | 8 m (26.25 ft) | | | |
| **BC-M12F5-22-10** | 10 m (30.81 ft) | | | |
| **BC-M12F5-22-15** | 15 m (49.2 ft) | | | |

| 5-pin Single-Ended M12 Female Right-Angle Cordsets | | | | |
|---|---|---|---|---|
| **Model** | **Length** | **Dimensions (mm)** | **Pinout (Female)** | |
| **BC-M12F5A-22-1** | 1 m (3.28 ft) |  |  | 1 = Brown<br>2 = White<br>3 = Blue<br>4 = Black<br>5 = Gray |
| **BC-M12F5A-22-2** | 2 m (6.56 ft) | | | |
| **BC-M12F5A-22-5** | 5 m (16.4 ft) | | | |
| **BC-M12F5A-22-8** | 8 m (26.25 ft) | | | |
| **BC-M12F5A-22-10** | 10 m (30.81 ft) | | | |
| **BC-M12F5A-22-15** | 15 m (49.2 ft) | | | |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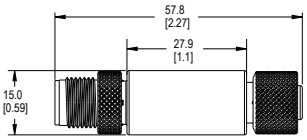
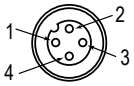
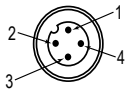
# Sensor Status Indicators

| S15L Series In-Line Sensor Status Indicator | | | | | | |
|---|---|---|---|---|---|---|
| **Model** | **Input Type** | **LED Color** | **Dimensions** | **Female** | **Male** | **Wiring** |
| **S15LGYPQ** | PNP | Power ON = Green<br>Input Active = Yellow |  |  |  | 1 = Brown, 10 to 30 V DC<br>2 = White<br>3 = Blue, DC common<br>4 = Black, Sensor Input |
| **S15LGYNQ** | NPN | | | | | |

# Brackets for the QS30 Standard DC Sensor

**SMBQS30L**

- Right-angle bracket for cable sensor models
- Clearance for M4 (#8) hardware
- ± 12° tilt adjustment
- 14-gauge stainless steel

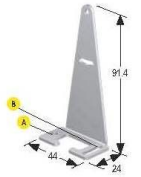
**Hole center spacing:** A to B=35.0
**Hole size:** A=ø 4.3, B=ø 4.25×16.3




**SMBQS30LT**

- Tall right-angle bracket for QD models
- ± 8° tilt adjustment
- 14-gauge stainless steel

**Hole center spacing:** A to B=35.0
**Hole size:** A=ø 4.3, B=ø 4.25×16.3




**SMBQS30Y**

- Heavy-duty die-cast bracket
- M18 vertical mount option
- ± 8° tilt adjustment with cabled units
- Includes nuts and lock washer

**Hole size:** A=ø 15.3




**SMBQS30YL**

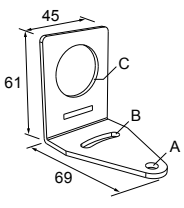
- Heavy-duty die-cast bracket designed for industrial protection
- M18 vertical mount option
- Replaceable window
- Includes nuts and lock washer

**Hole size:** A=ø 15.3

**SMB30A**

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

**Hole center spacing:** A to B=40
**Hole size:** A=ø 6.3, B= 27.1 × 6.3, C=ø 30.5





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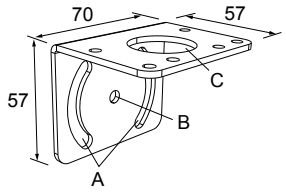
**SMB30MM**

- 12-gauge stainless steel bracket with curved mounting slots for versatile orientation
- Clearance for M6 (¼ in) hardware
- Mounting hole for 30 mm sensor

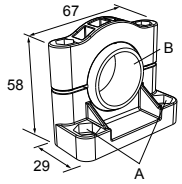
**Hole center spacing:** A = 51, A to B = 25.4
**Hole size:** A = 42.6 × 7, B = ø 6.4, C = ø 30.1




**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

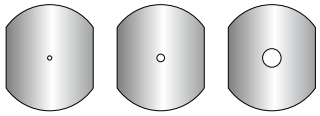


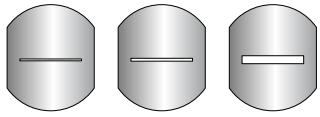

All measurements are listed in millimeters [inches], unless noted otherwise. The measurements provided are subject to change.

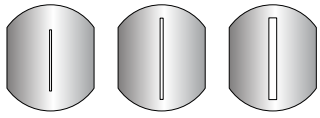
# QS30 Apertures

Opposed-mode QS30 sensors may be fitted with apertures to narrow or shape the sensor's effective beam to more closely match the size or profile of the objects being sensed. A common example is the use of "line" (or "slot") type apertures to sense thread.

**NOTE:** The use of apertures reduces the sensing range.

| Model | Aperture Description | Pieces | |
|---|---|---|---|
| APQS30-040 | 1 mm (0.04 in) diameter, circular | 6 |  |
| APQS30-100 | 2.5 mm (0.10 in) diameter, circular | 6 | |
| APQS30-200 | 5 mm (0.20 in) diameter, circular | 6 | |

| Model | Aperture Description | Pieces | |
|---|---|---|---|
| APQS30-040H | 1 × 12 mm (0.04 in × 0.47 in), horizontal slot | 6 |  |
| APQS30-100H | 2.5 × 12 mm (0.10 in × 0.47 in), horizontal slot | 6 | |
| APQS30-200H | 5 × 12 mm (0.20 in × 0.47 in), horizontal slot | 6 | |

| Model | Aperture Description | Pieces | |
|---|---|---|---|
| APQS30-040V | 1 × 17 mm (0.04 in x 0.67 in), vertical slot | 6 |  |
| APQS30-100V | 2.5 × 17 mm (0.10 in × 0.67 in), vertical slot | 6 | |
| APQS30-200V | 5 × 17 mm (0.20 in × 0.67 in), vertical slot | 6 | |
| APQS30-DVHX2 | Kit containing two of each aperture above | 18 | |
| APQS30-DVH | Kit containing one each of aperture models: APQS30-040, APQS30-040H, APQS30-040V | 18 | |

### Reduced Range for QS30E and QS30R Pair with Apertures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| Aperture Model | Maximum Range | |
|---|---|---|
| | Aperture on Both Emitter and Receiver | Aperture on Receiver Only |
| APQS30-040 | 0.5 m (1.5 ft) | 4.1 m (13.5 ft) |
| APQS30-100 | 2.4 m (8 ft) | 14.3 m (47 ft) |
| APQS30-200 | 11.6 m (38 ft) | 23.5 m (77 ft) |
| APQS30-040H | 7 m (23 ft) | 16.8 m (23 ft) |
| APQS30-100H | 16.5 m (54 ft) | 24.7 m (54 ft) |
| APQS30-200H | 28.7 m (94 ft) | 36.6 m (94 ft) |
| APQS30-040V | 7 m (23 ft) | 16.8 m (23 ft) |
| APQS30-100V | 16.5 m (54 ft) | 24.7 m (54 ft) |
| APQS30-200V | 28.7 m (94 ft) | 36.6 m (94 ft) |

**Example:** The QS30E/QS30R sensor pair is used with apertures APQS30-040. Using the circular aperture on only the receiver, the range reduces to 4.1 m (13.5 ft). When the APQS30-040 aperture is installed on both the receiver and emitter, the sensor range reduces to 0.5 m (1.5 ft).

# Retroreflective Targets

Banner offers a wide selection of high-quality retroreflective targets. See www.bannerengineering.com for complete information.

**NOTE:** Polarized sensors require corner cube-type retroreflective targets. Non-polarized sensors may use any retroreflective target.




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# Chapter 5 Banner Engineering Corp Limited Warranty

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