WORLD-BEAM® QS30 Series Sensor (DC Voltage)

Datasheet

To view or download the latest technical information about this product, including specifications, dimensions, accessories, and wiring, see *www.bannerengineering.com*. Search for Instruction Manual p/n *119165*.

WARNING: Not To Be Used for Personnel Protection

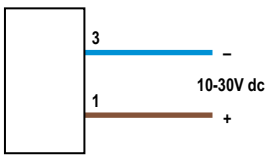
Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized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

Models

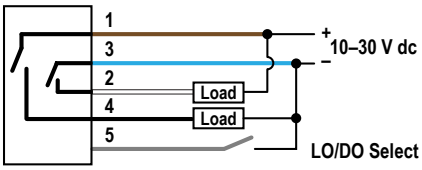
Model [1]	Sensing Mode	Beam	Range [2]	Output
QS30E (emitter)	Opposed	875 nm Infrared	60 m (200 ft)	N/A
QS30R (receiver)		Effective Beam: 18 mm (0.7 in)		Bipolar NPN/PNP
QS30LP	Polarized Retroreflective	630 nm Visible Red	8 m (26 ft)	
QS30LV	Retroreflective		12 m (40 ft)	
QS30D	Diffuse	940 nm Infrared	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)	

Wiring Diagrams

Cabled Emitters



Other Cabled Models



Key

1. Brown
2. White
3. Blue
4. Black
5. Gray

Cabled wiring diagrams are shown. Quick disconnect (QD) wiring diagrams are functionally identical.

[1] 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/Euro-style quick disconnect (QD), add suffix "Q" (for example, QS30EQ).

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

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

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 200 µA
PNP: less than 10 µA
ON-state saturation voltage:
NPN: less than 1.6 V at 100 mA
PNP: less than 2.0 V at 100 mA
Protected against false pulse on power-up and continuous overload or short circuit of outputs

Indicators
2 LEDs on sensor top:

	Green	Yellow
On	Power on	Light sensed
Flashing	Output overloaded (except receivers)	Marginal excess gain (1–1.5× excess gain)

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

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 cable; 9 m (30 ft) unterminated 5-wire PVC cable ; or Integral 5-pin M12/Euro-style male quick disconnect (QD)

Application Tip for the QS30LV Model
For best sensing reliability, targets should be a minimum of 0.5m from the sensor

Adjustments
Selectable Light/Dark Operate is achieved via the gray wire.
Opposed, Retroreflective, and Polarized Retroreflective models:
Light Operate - Low (0 to 3 V)*
Dark Operate - High (open or 5 to 30 V)*
Diffuse and Fixed-Field models:
Light Operate - High (open or 5 to 30 V)*
Dark Operate - Low (0 to 3 V)*
Diffuse, Retroreflective, and Polarized Retroreflective mode models (only):
Single-turn Sensitivity (Gain) adjustment potentiometer
* Input impedance 10 kΩ

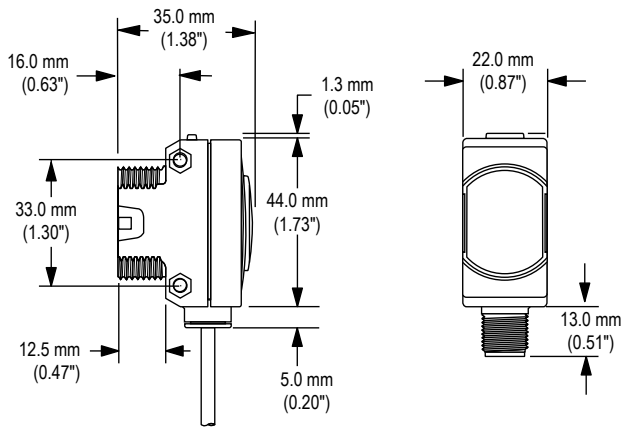
Operating Conditions
–20 °C to +70 °C (–4 °F to +158 °F)
95% at +50 °C maximum relative humidity (non-condensing)

Vibration and Mechanical Shock
All models meet Mil Std. 202F requirements. Method 201A (vibration: 10 Hz to 60 Hz max., double amplitude 0.06 inch, maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G 11 ms duration, half sine wave.

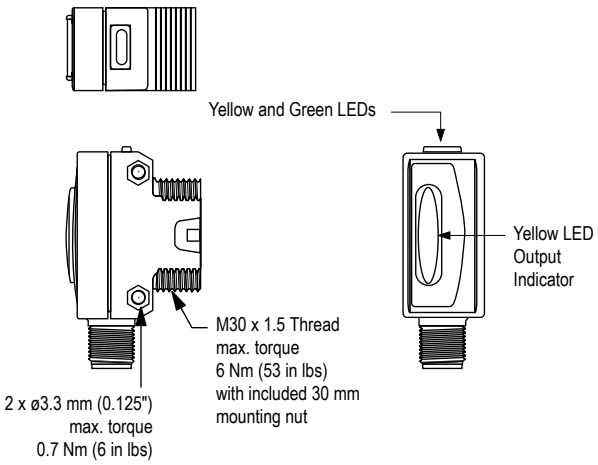
Certifications
Pending

Dimensions

Cabled Models



QD Models



All measurements are listed in millimeters [inches], unless noted otherwise.

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BANNER®
more sensors, more solutions

WORLD-BEAM QS30 LLP and LLPC

Datasheet

Polarized Retroreflective Laser Sensors

- Visible class 1 laser with small, effective beam size
- Excellent optical performance throughout sensing range, even close up
- Easy push-button SET options: Maximum Excess Gain or Low-Contrast SET, depending on model, plus Manual Adjust
- Easy-to-read operating status indicators, with 8-segment bar graph display
- Bipolar discrete outputs, PNP and NPN
- Selectable 30 millisecond OFF-delay
- Models available with 2 m or 9 m (6.5 ft or 30 ft) cable or integral quick-disconnect
- Tough ABS housing rated IEC IP67; NEMA 6
- Compact housing, mounting versatility – popular 30 mm threaded nose or side-mount

Excellent for applications where high sensing power and small beam size are important. Operates over sensing ranges typically accomplished only by conventional opposed-mode photoelectrics; uses a special filter to polarize the emitted light, filtering out unwanted reflections from shiny objects.

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

Model	Range and Use	Spot Size at Focus	Cable [1]	Supply	Output Type
QS30LLP	0.2 m to 18 m (0.67 ft to 60 ft) Maximum Excess Gain SET for Long-Range Applications	Approx. 4 mm at 10 m (0.16 in at 33 ft)	2 m (6.5 ft) 5-wire Cable	10 V dc to 30 V dc	Bipolar NPN / PNP
QS30LLPQ			Integral 5-pin Euro-style QD		
QS30LLPC	0.2 m to 18 m (0.67 ft to 60 ft) Low-Contrast SET for Small Object Detection		2 m (6.5 ft) 5-wire Cable		
QS30LLPCQ			Integral 5-pin Euro-style QD		

Overview

QS30LLP and QS30LLPC Series sensors are easy-to-use, high-performance laser sensors whose many configuration options make them suitable for demanding applications. Each sensor features two identically configured outputs, one each NPN and PNP.

The compact housing has a large, easy-to-see bar graph display plus bright LEDs for easy configuration and status monitoring during operation. The sensor can be side-mounted, using integral mounting holes, or front-mounted, via the 30 mm threaded barrel.

MODEL QS30LLP(Q) is configured using the Maximum Excess Gain SET procedure. It is useful for long-range applications and high variations in contrast, such as beam-break applications where the target objects are larger than the beam. See *Maximum Excess Gain SET - Model QS30LLP* on page 4 for more information.

[1] To order the 9 m (30 ft) cable models, add the suffix “W/30” to the model number of any cabled sensor (for example, QS30LLP W/30). A model with a QD connector requires a mating cable.

MODEL QS30LLPC(Q) is configured using the Low-Contrast SET procedure. It is useful for small object detection and other applications with small variations in contrast, such as yarn- or thread-break applications. See *Low-Contrast SET - Model QS30LLPC* on page 5 for more information.

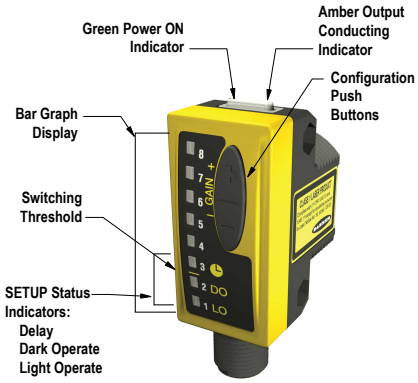


Figure 1. Model QS30LLP Features

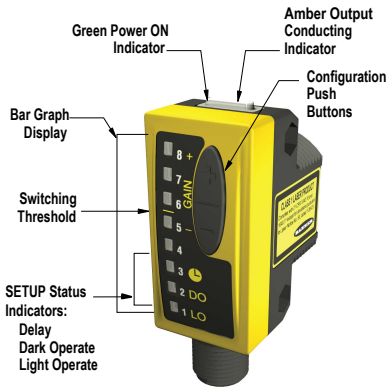


Figure 2. Model QS30LLPC Features

Description of Laser Classes

Class 1 Lasers

Class 1 lasers are lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

Reference IEC 60825-1:2001, Section 8.2.

CAUTION: Do Not Disassemble for Repair

This device contains no user-serviceable components. Do not attempt to disassemble for repair. Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. A defective unit must be returned to the manufacturer.

For Safe Laser Use (Class 1 or Class 2):

- Do not stare at the laser.
- Do not point the laser at a person's eye.
- Mount open laser beam paths either above or below eye level, where practical.
- Terminate the beam emitted by the laser product at the end of its useful path.

Device Setup

Installation Notes

Conventional retroreflective photoelectric sensors are extremely easy to align. Beam angles are wide, and retro targets are forgiving to the light beam's angle of incidence. The beam of this laser sensor is very narrow, compared with the beam of most retro sensors. As Figure 6 indicates, the effect of angular misalignment can be dramatic. Alignment is critical because the beam may miss the retroreflective target unless the target is large.

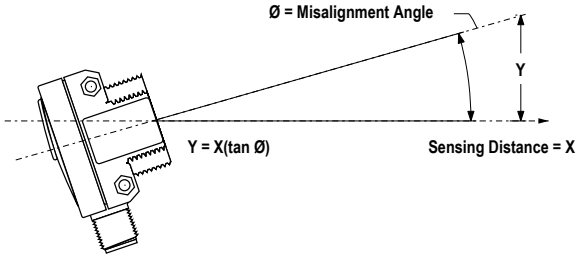


Figure 3. Beam Displacement per degree of misalignment

Sensor-to-Target Distance (X)	Beam Displacement (Y) for 1º of Misalignment
1.5 m (5 ft)	25 mm (1 in)
3 m (10 ft)	50 mm (2 in)
6 m (20 ft)	100 mm (4 in)
15 m (50 ft)	250 mm (10 in)
30 m (100 ft)	500 mm (20 in)

For example, with one BRT-51X51BM mounted at a distance of 6 m (20 ft) from the sensor, one degree of angular misalignment will cause the center of the laser beam to miss the center of the target by 100 mm (4 in).

Alignment Tip

When using a small retroreflective target at medium or long range, it is often useful to temporarily attach (or suspend) a strip of retroreflective tape (for example, BRT-TVHG-2X2) along a line that intersects the actual target. The visible red laser beam is easily seen in normal room lighting on such tape. Sight along the beam toward the target (from behind the sensor). Move the sensor to scan the laser beam back and forth across the retro tape strip. Use the tape strip to guide the beam onto the target.

Consider using sensor mounting bracket model SMB30SC (see *Brackets* on page 11). This swivel bracket can simplify multiple-axis alignment. Alignment is complete when the visible image is centered on the retro target. The perpendicularity of the laser beam to the face of the retro target is forgiving, just as it is with a conventional retroreflective sensor.

Effective Beam Size

Unlike conventional retroreflective sensors, the retroreflective laser has the ability to sense relatively small profiles. Figure 7 indicates the diameter of the smallest opaque rod which will reliably break the laser beam at several sensor-to-object distances using sensor model QS30LLP(Q). These minimum object sizes were measured with the sensor aligned to a BRT-51X51BM reflector and the gain set to maximum using the Max Excess Gain SET. This sensor is typically recommended for long-range applications of relatively small targets that will completely break the beam.

Sensor-to-Object Distance (X)	Minimum Object Detection Size
0.3 m (1 ft)	2.5 mm (0.10 in)
1.5 m (5 ft)	5.0 mm (0.20 in)
3 m (10 ft)	7.0 mm (0.28 in)
18 m (59 ft)	13 mm (0.52 in)

Figure 4. Minimum object detection size vs. distance from sensor, model QS30LLP(Q)

Smaller objects can be detected by using model QS30LLPC(Q), adjusting the sensor gain down using the Manual Adjust, or performing a Low-Contrast SET of the reflector. Objects as small as 2.0 mm can be reliably detected after performing the Low-Contrast SET at ranges up to 6 m (18 ft). This sensor is typically recommended for shorter-range applications detecting very small targets that may break only a portion of the beam.

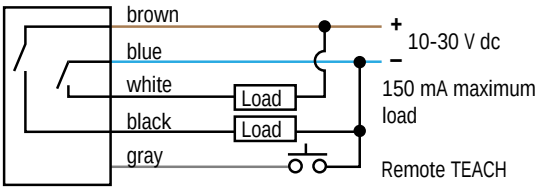
Note that the shape of the beam is elliptical. The minimum object sizes listed assume passage of the rod across the major diameter of the ellipse (worst case). It may be possible to detect objects smaller than the sizes listed if the direction in which the objects pass through the beam can be controlled.

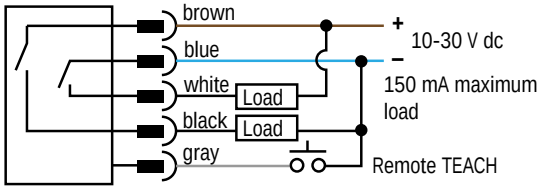
Retroreflector Recommendations

- BRT-51X51BM recommended for beam-block applications up to 18 m range.
- BRT-TVHG-2X2 recommended for applications up to 2 m range. (This retroreflector is an adhesive-backed sealed tape with micro-prism geometry.)

Wiring Diagrams

Cabled Models	QD Models





Note: The pink wire is not used.

Sensor Configuration

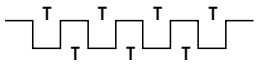
Configure the sensor using the SET and SETUP modes. After SET mode has defined the sensing parameters, use SETUP mode to add an OFF-delay or change the light/dark operate status. Use Manual Adjust to fine-tune the thresholds. Use the two push buttons, "+" and "-", to access and set sensing parameters. The remote wire also may be used for some procedures.

Remote Configuration

Use the Remote Configuration function to set the sensor threshold remotely or to disable the push buttons for security. Connect the gray wire of the sensor to ground (0 V dc), with a remote programming switch connected between them. Pulse the remote line according to the diagrams in the programming procedures. The length of the individual programming pulses is equal to the value T: 0.04 seconds ≤ T ≤ 0.8 seconds.

Push Button Disable

In addition to its programming function, Remote Programming may be used to disable the push buttons for security. Disabling the push buttons prevents undesired tampering with the programming settings. Connect the gray wire of the sensor as described and four-pulse to enable or disable the push buttons.



Maximum Excess Gain SET - Model QS30LLP

- Sets the sensor for maximum excess gain without allowing false proxing. Provides maximum contrast between any reflector and a blocked condition and is stable even in dirty environments.
- Useful for long-range applications and high variations in contrast, such as beam-break applications where the target objects are larger than the beam.

Sensor can be aimed at an object or the reflector during SET process to obtain the same result. All conditions darker than the switchpoint condition result in ON output (Dark Operate). Output ON and OFF conditions can be reversed by changing Light/Dark Operate in SETUP mode (factory setting: Dark Operate).

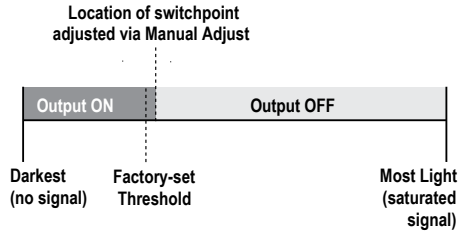


Figure 5. Maximum Excess Gain SET (Dark Operate shown)

Manual Adjust – Maximum Excess Gain SET

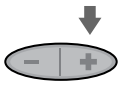
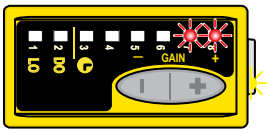
During RUN mode, adjusts switchpoint up or down via "+" or "–" push buttons.

- Each push button "click" adjusts the switchpoint up by approximately 0.5X excess gain or down by the same increments.
- The lighted bar graph LEDs move to reflect the increase or decrease of excess gain relative to the switchpoint.
- LEDs #7 and 8 flash when maximum gain is achieved; LEDs #1 and 2 flash when minimum gain is achieved.

When the received signal is at any level greater than 6X excess gain, the first "–" (minus) click to reduce excess gain reduces it to the 6X level. Subsequent "–" clicks result in decreased values as shown in *Specifications* on page 8 (approximately 2 clicks per LED change). To return to maximum excess gain, either press "+" repeatedly until LEDs #7 and 8 flash, or hold the "+" button for longer than 2 seconds. For example, in an application that results in 20X excess

gain, pressing "–" once lowers the gain to 6X, exhibited by LED #8 ON. Pressing it twice more results in approximately 5X excess gain, exhibited by LED #7 ON. Holding the "+" button for 2 seconds results in a return to maximum gain (20X), exhibited by LEDs #7 and 8 flashing.

Set the Switchpoint

Method	Action	Result
Push Button	Press and hold "+" > 2 seconds 	Green Power LED: OFF Amber Output LED: ON Bar graph: #7 & 8 flashing • Sensor returns to RUN mode with new settings • Use Manual Adjust to increase or decrease sensor excess gain 
Remote Input[2]	Single-pulse the remote input. 	

Low-Contrast SET - Model QS30LLPC

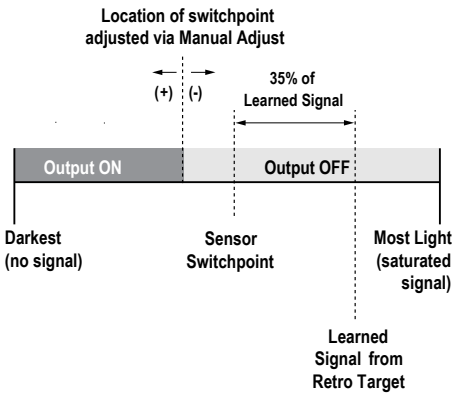


Figure 6. Low-Contrast SET (Dark Operate shown)

- Sets a switchpoint at 35 percent below the signal from the retroreflector.
- Useful for small object detection and other applications with small variations in contrast, such as yarn- or thread-break applications.
- Sensor must be aimed at the reflector during the SET process. All conditions darker than the switchpoint condition result in ON output (Dark Operate). Output ON and OFF conditions can be reversed by changing Light/Dark Operate in SETUP mode (factory setting: Dark Operate).

Manual Adjust – Low-Contrast SET

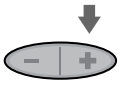
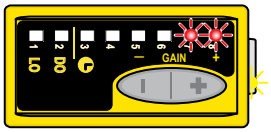
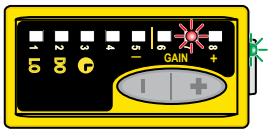
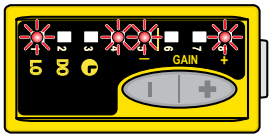
During RUN mode, adjusts switchpoint up or down via "+" or "–" push buttons.

- Each push button "click" adjusts the switchpoint up by 5 percent of the signal from the reflector or down by the same increments.
- The lighted bar graph LEDs move to reflect the increase or decrease in excess gain.
- LEDs #7 and 8 flash when maximum gain is achieved; LEDs #1 and 2 flash when minimum gain is achieved.

If the target object does not cause the output to change state, press the "–" button to decrease the gain, making the sensor more sensitive to small signal changes.

[2] 0.04 seconds ≤ T ≤ 0.8 seconds

Set Switchpoint

Method	Action	Result
Push Button	a. Align sensor to the reflector. b. Press and hold "+" > 2 seconds. 	Green Power LED: OFF Amber Output LED: ON  Switchpoint Accepted Bar graph: #7 and 8 flash for 2 sec Amber Power LED: OFF Green Power LED: ON Bar graph: Appropriate LED ON • Sensor returns to RUN mode with new settings • Use Manual Adjust to increase or decrease sensor sensitivity
Remote Input[3]	a. Align sensor to the reflector. b. Single-pulse remote line. 	 Switchpoint Not Accepted Bar graph: #1, 4, 5, and 8 flash for 2 sec Green Power LED: ON • Sensor returns to RUN mode without saving (maintains previous settings) 

SETUP Mode

SETUP mode is accomplished via the sensor's two push buttons. It is used to change sensor output response for:

- Light or Dark Operate
- 30-millisecond pulse stretcher (OFF-delay), if required.

The status LEDs, active only during SETUP mode, indicate the output response configuration when the sensor will be in RUN mode.

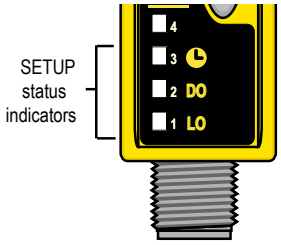
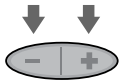
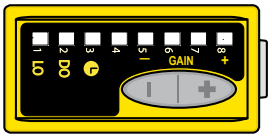


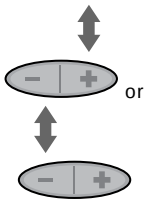
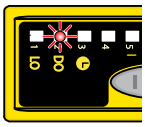
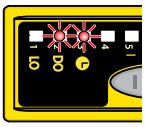
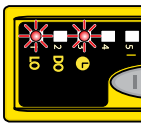
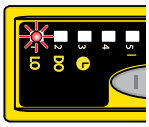
Figure 7. SETUP Mode

1. Access SETUP Mode.

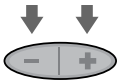
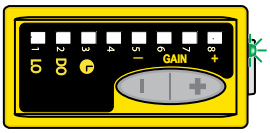
[3] 0.04 seconds ≤ T ≤ 0.8 seconds

Method	Action	Result
Push Button[4]	Press and hold both push buttons > 2 seconds 	Green Power LED turns OFF 

2. Select SETUP Options.

Method	Action	Result	
Push Button	Click either push button to toggle through the four possible setting combinations.  or	DO, No Delay 	DO 30 ms Delay 
		LO, 30 ms Delay 	LO, No Delay 

3. Return to RUN Mode.

Method	Action	Result
Push Button	Press and hold both push buttons > 2 seconds. 	Green Power LED turns ON 

[4] 0.04 seconds ≤ T ≤ 0.8 seconds

Specifications

Supply Voltage and Current
10 V dc to 30 V dc (10% maximum ripple at 10% duty cycle) at 35 mA maximum current, exclusive of load

Sensing Beam
Visible red LED, 650 nm

Laser Classification
Class 1

Beam Size at Aperture
Approximately 3 mm

Supply Protection Circuitry
Protected against reverse polarity, overvoltage, and transient voltages

Delay at Power-Up
1 second maximum; outputs do not conduct during this time

Output Configuration
Solid-state bipolar (SPDT): 1 current sourcing (PNP) and 1 current sinking (NPN)

Output Rating
150 mA maximum load
Off-state leakage current: < 10 µA at 30 V dc
ON-state saturation voltage:

NPN: less than 1.0 V at 150 mA load
PNP: less than 2.0 V at 150 mA load

Output Protection Circuitry
Protected against output short-circuit, continuous overload, transient overvoltages, and false pulse on power-up

Output Response
500 microseconds

Repeatability
70 microseconds

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 (Amps)
20	5.0
22	3.0
24	2.0
26	1.0
28	0.8
30	0.5

Adjustments
2 push buttons and remote wire

Easy push-button configuration
Manually adjust (+/-) thresholds (push buttons only)
LO/DO and OFF-delay configuration options
Push-buttons lockout (from remote wire only)

Factory Defaults:

No Delay
Dark Operate
Push buttons enabled

Indicators
Green LED: Power ON
Amber LED: Output conducting
8-Segment Red Bar Graph
SETUP mode:

LED 3 (clock): Flashes Red when delay is selected
LED 2 (DO): Flashes Red when Dark Operate is selected
LED 1 (LO): Flashes Red when Light Operate is selected

RUN mode: Signal Strength (excess gain), relative to switchpoint

Model QS30LLP	Model QS30LLPC
LED 8: >6X	LED 8: >2X
LED 7: 5-6X	LED 7: 1.5-2X
LED 6: 4-5X	LED 6: 1-1.5X
LED 5: 3-4X	LED 5: 0.8X
LED 4: 2-3X	LED 4: 0.6X
LED 3: 1-2X	LED 3: 0.4X
LED 2: 0.5-1X	LED 2: 0.2X
LED 1: 0-0.5X	LED 1: 0X

Sensor calibration failure: Alternating even-numbered and odd-numbered LEDs flash

Construction
ABS housing, acrylic lens cover

Environmental Rating
IEC IP67; NEMA 6

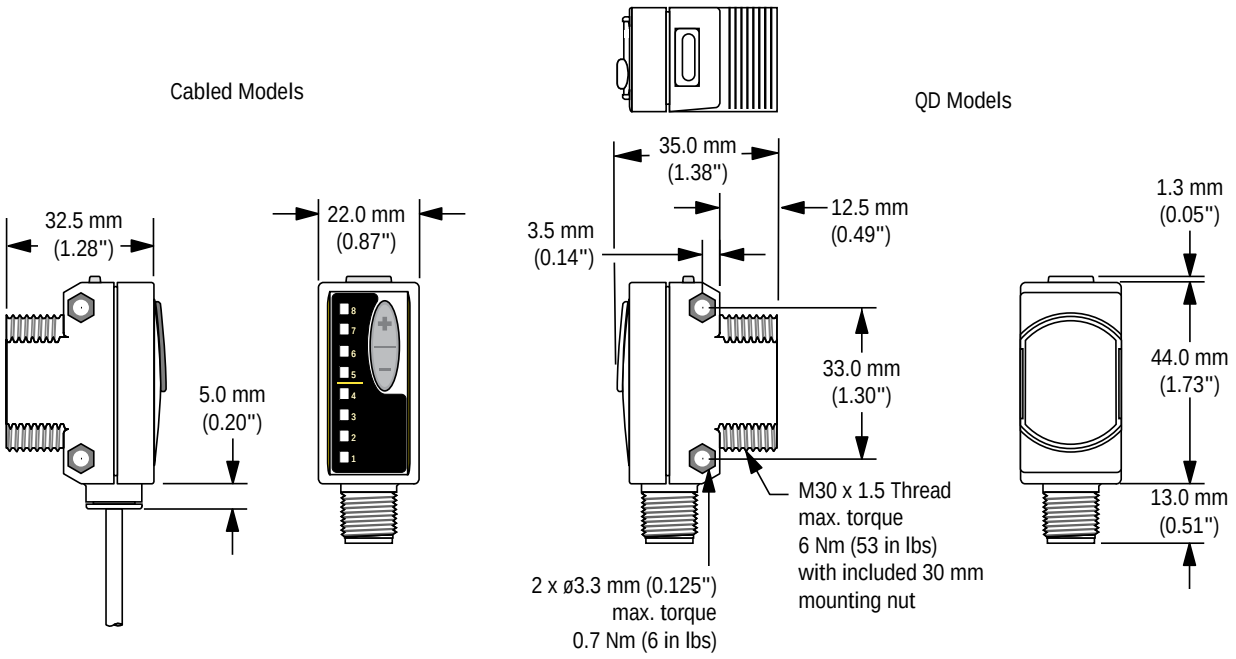
Connections
5-conductor 2 m (6.5 ft) PVC cable, 9 m (30 ft) PVC cable, or 5-pin integral M12/Euro-style male quick-disconnect fitting

Operating Conditions
–10 °C to +50 °C (+14 °F to +122 °F)
95% at +50 °C maximum relative humidity (non-condensing)

Vibration and Mechanical Shock
All models meet Mil Std. 202F requirements. Method 201A (vibration: 10 Hz to 60 Hz max., double amplitude 0.06 inch, maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G 11 ms duration, half sine wave.

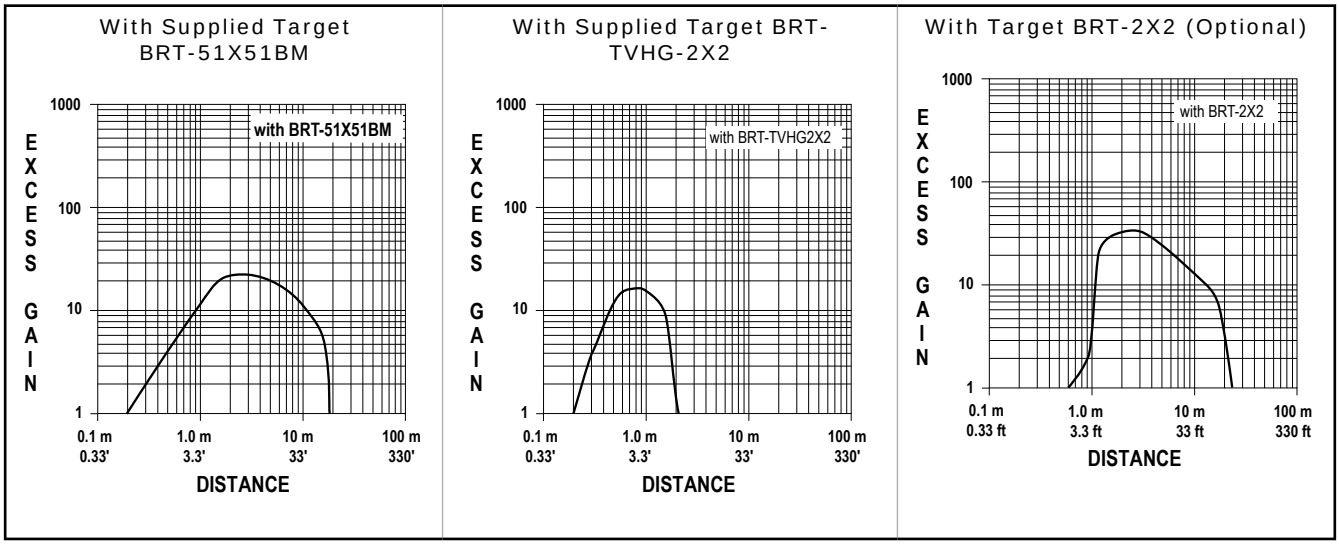
Certifications

Dimensions



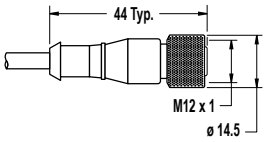
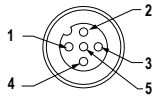
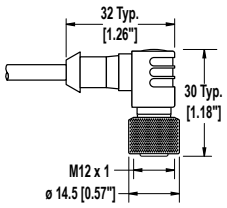
Hardware Included: (2) M3 × 0.5 × 28 stainless steel machine screws, nuts, and washers

Excess Gain



Accessories

Quick-Disconnect Cables

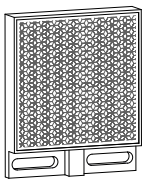
5-Pin Threaded M12/Euro-Style Cordsets—Single Ended				
Model	Length	Style	Dimensions	Pinout (Female)
MQDC1-501.5	0.50 m (1.5 ft)	Straight		 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
MQDC1-506	1.83 m (6 ft)			
MQDC1-515	4.57 m (15 ft)			
MQDC1-530	9.14 m (30 ft)			
MQDC1-506RA	1.83 m (6 ft)	Right-Angle		
MQDC1-515RA	4.57 m (15 ft)			
MQDC1-530RA	9.14 m (30 ft)			

Retroreflective Targets

NOTE: Polarized sensors require corner cube type retroreflective targets only.

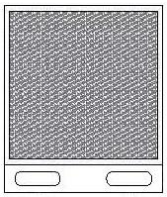
BRT-2X2

- Square, acrylic target
- Reflectivity factor: 1.0
- Max. temperature: +50 °C (+122 ºF)
- Optional brackets are available
- Approximate size: 51 mm × 51 mm



BRT-51X51BM

- Square, acrylic target
- Reflectivity Factor: 1.5
- Temperature: −20 °C to +50 °C (−4 °F to +122 °F)
- Micro-prism geometry
- Optional brackets are available
- Approximate size: 51 mm × 51 mm



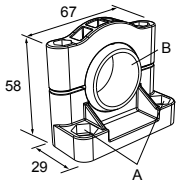
Retroreflective Tape

Model	Reflectivity Factor	Maximum Temperature	Size
BRT-TVHG-2X2	0.8	+60 °C (+140 °F)	50 × 50 mm

Brackets

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

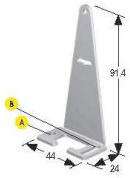
SMBQS30L

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

Hole center spacing: A to B=35.0
Hole size: A=ø 4.3, B=ø 4.25x16.3

SMBQS30LT

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



Hole center spacing: A to B=35.0
Hole size: A=ø 4.3, B=ø 4.25x16.3

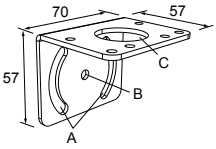
SMBQS30Y

- 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

SMB30MM

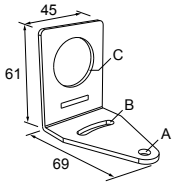
- 12-ga. stainless steel bracket with curved mounting slots for versatile orientation
- Clearance for M6 (¼ in) hardware
- Mounting hole for 30 mm sensor



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

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

All measurements are listed in millimeters, unless noted otherwise.

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WORLD-BEAM QS30EDV Expert Diffuse-Mode Sensor

Datasheet

Expert™ Diffuse-Mode Sensor with a Visible Red Beam

- Easy-to-set automatic Expert-style Static and Dynamic TEACH options, multiple Single-Point Set options, plus manual adjustment for fine tuning
- Smart power-control algorithm to maximize performance in low-contrast applications
- Normal mode provides 1.8 ms sensing response with improved crosstalk avoidance routine (for two sensors) and improved fluorescent light immunity
- Selectable high-speed (HS) mode option for 300-microsecond response (crosstalk avoidance and fluorescent light immunity disabled)
- Easy push-button Dark Operate/Light Operate select, output OFF-delay, and operating speed setup
- Powerful, highly collimated visible red sensing beam
- Easy-to-read operating status indicators, with 8-segment bar graph display
- Bipolar discrete outputs, PNP and NPN
- Selectable 30-millisecond OFF-delay
- Compact housing, mounting versatility – via popular 30 mm threaded barrel or side-mount
- Tough ABS housing is rated IEC IP67; NEMA 6
- Models available with 2 m or 9 m (6.5 ft or 30 ft) cable or integral quick-disconnect

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 [1]	Range	Cable	Supply Voltage	Output Type
QS30EDV	High-Speed Mode: 1,100 mm (43 inches Normal Mode: 1,400 mm (55 inches)	2 m (6.5 ft) unterminated 5-wire cable	10 to 30 V dc	Bipolar NPN/PNP
QS30EDVQ		Integral 5-pin M12/Euro-style male quick disconnect (QD)		

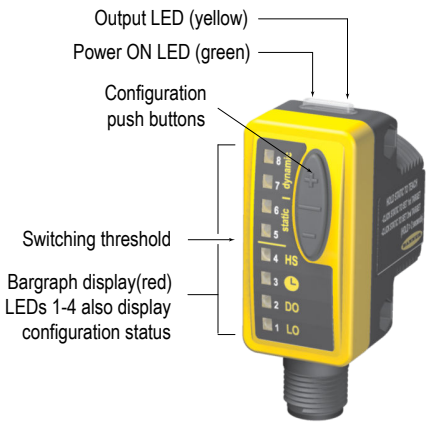
[1] Standard 2 m (6.5 ft) cable models are listed. To order the 9 m (30 ft) cable model, add suffix "W/30" (QS30EDV W/30). A model with a QD connector requires a mating cable; see *Accessories* on page 10.

Overview

The QS30EDV is an easy-to-use diffuse-mode sensor. It provides high-performance sensing in low-contrast applications. Its visible red beam provides easy sensor alignment. The sensor offers multiple configuration options, in addition to manual fine adjustment, remote programming, and security lockout options.

The sensor features bipolar outputs, one each NPN and PNP.

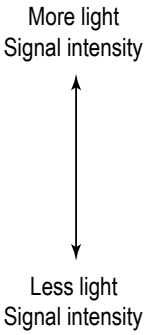
The sensor's compact housing has a large, easy-to-see bar graph display plus bright LEDs for easy configuration and status monitoring during operation. LEDs 1 through 4 of the bar graph display also show configuration status during setup. The sensor can be side-mounted, using its integral mounting holes, or front-mounted, via its 30 mm threaded barrel.



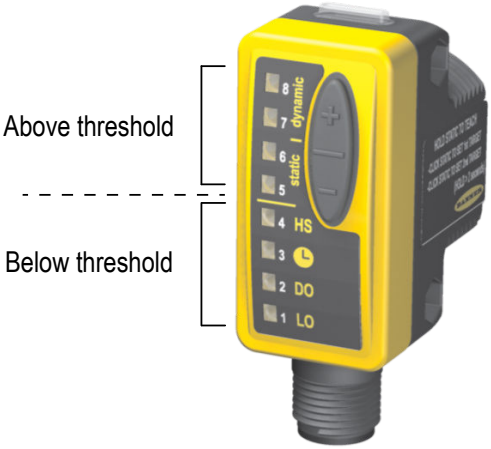
Bar Graph Indicator Functions

Run Mode. The lighted bar graph segment represents relative distance from the cutoff point. Its behavior depends on whether a sensing window or a sensing threshold is taught.

Sensing Window

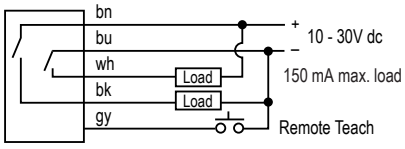


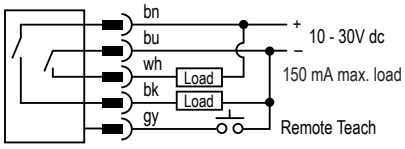
Switching Threshold



Wiring

Cabled Models	QD Models





Sensor Configuration

Configure the sensor configuration by using the TEACH or Set options, plus Setup mode.

After TEACH or Set have defined the sensing parameters, use the Setup mode to enable the delay, to change the Light Operate/Dark Operate status, or to select the high-speed response option (HS).

Use the Manual Adjust to fine-tune the thresholds. Two push buttons, Dynamic (+) and Static (-), or the remote wire, may be used to access and set the parameters.

Sensor configuration options include:

- Two-Point Static TEACH: a single switching threshold, determined by two taught conditions.
- Dynamic (on-the-fly) TEACH: a single switching threshold, determined by multiple sampled conditions.
- Window Set: a sensing window, centered on a single sensing condition.
- Light Set and Dark Set: a single switching threshold, offset from a single sensing condition.

Remote Configuration

The remote function can be used to configure the sensor remotely or to disable the push button for security. Connect the gray wire of the sensor to ground (0 V dc), with a remote programming switch connected between them. Pulse the remote line according to the diagrams in the configuration procedures. The length of the individual programming pulses is equal to the value T where: 0.04 seconds ≤ “T” ≤ 0.8 seconds

Returning to Run Mode

Configuration modes each may be exited either after the 60-second time-out or by exiting the process in one of the two following ways:

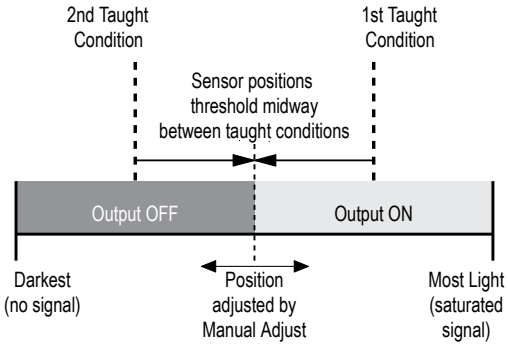
- In static TEACH or SET modes, press and hold the Static (-) button (or hold the remote line) for 2 seconds. The sensor returns to Run mode without saving any new settings.
- In SETUP mode, press and hold both the Static (-) and Dynamic (+) buttons (or hold the remote line) for 2 seconds. The sensor returns to Run mode and saves the current setting.

Two-Point Static TEACH (Threshold)

- Sets a single switching threshold (switching point)
- Threshold position is adjustable using “+” and “-” buttons (Manual Adjust).
- Recommended for applications where two conditions can be presented by the user.

Two-Point TEACH is the traditional configuration method. The sensor locates a single switchpoint at the optimal location between the two taught conditions, with the Output ON condition on one side, and the Output OFF condition on the other.

The first condition taught is the ON condition. The Output ON and OFF conditions can be reversed by changing Light/Dark Operate status in *Setup Mode*.



Using Manual Adjust with Two-Point TEACH moves the switching threshold position. The lighted LED on the bar graph moves to exhibit the received signal, relative to the threshold.

Bargraph LED (Following TEACH)	Relative Signal Difference/Recommendation
6 to 8	Excellent: Very stable operation.
4 to 5	Good: Minor variables will not affect sensing reliability.
2 to 3	Low: Minor sensing variables may affect sensing reliability.
1	Unreliable: Consider an alternate sensing scheme.

For the button or the remote wire, a button click or pulse is: 0.04 seconds ≤ T ≤ 0.8 seconds.

1. Access TEACH Mode.

Method	Action	Result
Push Button	Press and hold Static (-) button for more than 2 seconds.	Power LED: OFF Output LED: ON Bar graph: #5 and 6 alternately flash
Remote Input	No action required; sensor is ready for 1st TEACH condition.	

2. TEACH the Output ON condition.

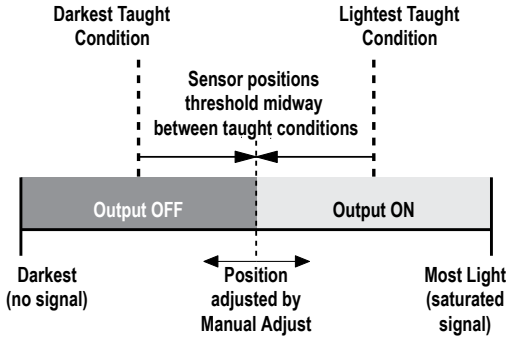
Method	Action	Result
Push Button	Present Output ON condition and click the Static (-) button.	Power LED: OFF Output LED: Flash, then OFF Bar graph: #5 and 6 alternately flash
Remote Input	Present Output ON condition and single-pulse the remote line.	

3. TEACH the Output OFF condition.

Method	Action	Result
Push Button	Present Output OFF condition and click the Static (-) button.	TEACH Accepted Power LED: ON Bar graph: One LED flashes to show relative contrast (good signal difference shown; see table above) Sensor returns to RUN mode
Remote Input	Present Output OFF condition and single-pulse the remote line.	TEACH Unacceptable Power LED: OFF Bar graph: #1, 3 and 5, 7 alternately flash to show failure Sensor returns to "TEACH Output ON Condition"

Dynamic TEACH and Adaptive Thresholds

- Teach on-the-fly
- Sets a single switching threshold (switching point)
- Threshold position is adjustable using "+" and "-" buttons (Manual Adjust)
- Recommended for applications where a machine or process may not be stopped for teaching.



Dynamic TEACH is a variation of two-point TEACH. It programs the sensor during actual machine run conditions, taking multiple samples of the light and dark conditions and automatically setting the threshold at the optimum level.

Dynamic TEACH activates the sensor's adaptive threshold system, which continuously tracks minimum and maximum signal levels, and automatically maintains centering of the threshold between the light and dark conditions. The adaptive threshold system remains in effect during Run mode. The adaptive routine saves to non-volatile memory at least once per hour.

When Dynamic TEACH mode is used, the output ON state (Light or Dark Operate) will remain as it was last programmed. To change the output ON state, use Setup Mode.

The sensing threshold may be adjusted (fine-tuned) whenever the sensor is in RUN mode by clicking the "+" and "-" buttons. However, when a manual adjustment is made, the adaptive threshold system is disabled (cancelled).

Bar Graph LED (Following TEACH)	Relative Signal Difference/Recommendation
6 to 8	Excellent: Very stable operation.
4 to 5	Good: Minor variables will not affect sensing reliability.
2 to 3	Low: Minor sensing variables may affect sensing reliability.
1	Unreliable: Consider an alternate sensing scheme.

1. Access Dynamic TEACH mode.

Method	Action	Result
Push Button	Press and hold the Dynamic (+) button for more than 2 seconds.	Power LED: OFF Output LED: OFF Bargraph: #7 and 8 alternately flash
Remote Input	Hold the remote line low (to ground) for more than 2 seconds.	

2. TEACH the sensing conditions.

Method	Action	Result
Push Button	Continue to hold the button (+) and present the Output ON and OFF conditions.	Power LED: OFF Output LED: OFF Bargraph: #7 and 8 alternately flash
Remote Input	Continue to hold the remote line low (to ground) and present the Output ON and OFF conditions.	

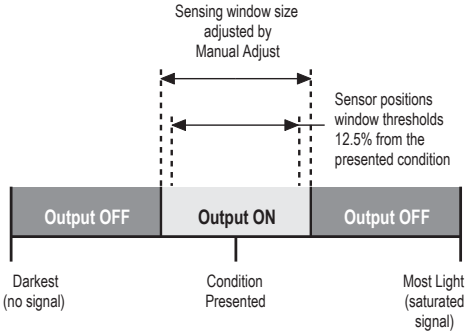
3. Return to Run mode.

Method	Action	Result
Push Button	Release the push button (+).	TEACH Accepted Power LED: ON Bargraph: One LED flashes to show relative contrast (good signal difference shown; see table above) Sensor returns to RUN mode with new settings
Remote Input	Release the remote line/switch.	TEACH Unacceptable Power LED: OFF Bargraph: #1, 3 and 5, 7 alternately flash to show failure Sensor returns to RUN mode without changing settings

Single-Point Window Set

- Sets a single ON condition that extends 12.5% above and below the taught condition.
- All other conditions (lighter or darker) result in OFF output
- Sensing window size (sensitivity) is adjustable using the "+" and "-" buttons (Manual Adjust)
- Recommended for applications where the target to be sensed may not always appear in the same place, or when other signals may appear.

Single-Point Set designates a sensing window, by setting two switching thresholds at 12.5% above and below the presented condition. The Output ON condition is inside the window, and the Output OFF conditions are outside the window when Light Operate is selected. Output ON and OFF conditions can be reversed by changing Light/Dark Operate status in Setup mode.



For the button or the remote wire, a button click or pulse is: 0.04 seconds ≤ T ≤ 0.8 seconds.

Using Manual Adjust with Single-Point Window Set expands or contracts the size of the window. The lighted LEDs on the light bar separate to a greater or lesser extent to exhibit the relative sensing window size.

1. Access Set Mode.

Method	Action	Result
Push Button	Press and hold the Static (-) button for more than 2 seconds.	Power LED: OFF Output LED: ON (Push Button) Output LED: OFF (Remote) Bar graph: #5 and 6 alternately flash
Remote Input	Single-pulse the remote line.	

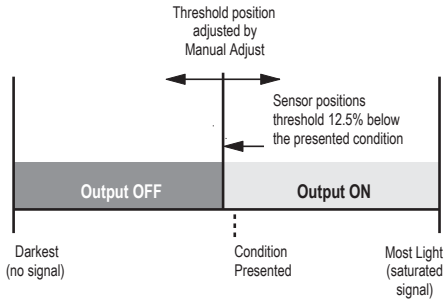
2. Set the sensing condition.

Method	Action	Result
Push Button	Present the sensing condition and double-click the Static (-) button.	Threshold Conditions Accepted Power LED: ON Bar graph: 2 indicators flash together to show the threshold conditions are accepted Sensor returns to RUN mode with new settings
Remote Input	Present the sensing condition and double-pulse the remote line.	Threshold Conditions Unacceptable Power LED: OFF Bar graph: #1, 3 and 5, 7 alternately flash to show failure Sensor returns to "SET Sensing Condition"

Single-Point Light Set

- Sets a threshold 12.5% below the taught condition.
- Any condition darker than the threshold condition causes the output to change state.
- Threshold position is adjustable using the "+" and "-" buttons (Manual Adjust).
- Recommended for applications where only one condition is known, for example a stable light background with varying darker targets.

A single sensing condition is presented, and the sensor positions a threshold 12.5% below the presented condition. When a condition darker than the threshold is sensed, the output either turns ON or OFF, depending on the Light/Dark Operate setting (see *Setup Mode* on page 7).



For the button or the remote wire, a button click or pulse is: 0.04 seconds ≤ T ≤ 0.8 seconds.

In Light Operate mode, Light Set teaches the Output ON condition. In Dark Operate mode, Light Set teaches the Output OFF condition.

1. Access Set mode.

Method	Action	Result
Push Button	Press and hold the Static (-) button for more than 2 seconds.	Power LED: OFF Output LED: ON (Push Button) Output LED: OFF (Remote) Bar graph: #5 and 6 alternately flash
Remote Input	Single-pulse the remote line.	

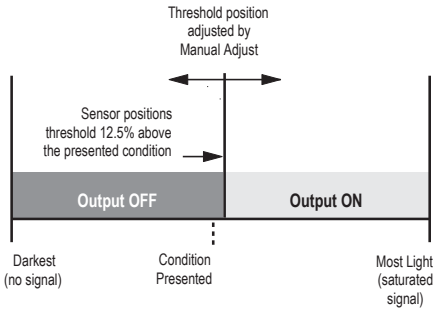
2. Set the sensing condition.

Method	Action	Result
Push Button	Present the sensing condition and click the Static (-) button four times.	Threshold Condition Accepted Power LED: ON Bar graph: Indicators #5–8 flash together to show that the threshold condition is accepted Sensor returns to RUN mode with new settings Threshold Condition Unacceptable Power LED: OFF Bar graph: #1, 3 and 5, 7 alternately flash to show failure Sensor returns to "SET Sensing Condition"
Remote Input	Present the sensing condition and four-pulse the remote line.	

Single-Point Dark Set

- Sets a threshold 12.5% above the taught condition.
- Any condition lighter than the threshold condition causes the output to change state.
- Threshold position is adjustable using the "+" and "-" buttons (Manual Adjust).
- Recommended for applications where only one condition is known, for example a stable dark background with varying lighter targets.

A single sensing condition is presented, and the sensor positions a threshold 12.5% above the taught condition. When a condition lighter than the threshold is sensed, the output either turns ON or OFF, depending on the Light/Dark Operate setting (see *Setup Mode* on page 7).



For the button or the remote wire, a button click or pulse is: 0.04 seconds ≤ T ≤ 0.8 seconds.

In Light Operate mode, Dark Set teaches the Output OFF condition. In Dark Operate mode, Dark Set teaches the Output ON condition.

1. Access Set mode.

Method	Action	Result
Push Button	Press and hold the Static (-) button for more than 2 seconds.	Power LED: OFF Output LED: ON (Push Button) Output LED: OFF (Remote) Bar graph: #5 and 6 alternately flash
Remote Input	Single-pulse the remote line.	

2. Set the sensing condition.

Method	Action	Result
Push Button	Present the sensing condition and click the Static (-) button five times.	Threshold Condition Accepted Power LED: ON Bar graph: Indicators #1–4 flash together to show that the threshold condition is accepted Sensor returns to Run mode with new settings Threshold Condition Unacceptable Power LED: OFF Bar graph: #1, 3 and 5, 7 alternately flash to show failure Sensor returns to “Set Sensing Condition”
Remote Input	Present the sensing condition and five-pulse the remote line.	

Setup Mode

Setup mode is used to change sensor output response for:

- Light or Dark operate
- 30-millisecond pulse stretcher (OFF delay), if required.
- 300 µs high-speed response

If Setup mode programming is interrupted and remains inactive for 60 seconds, the sensor returns to Run mode with the most recent settings (e.g., exits and saves current selection). Setup mode operates in the “background” while the outputs are active; changes are updated instantly.

For the button or the remote wire, a button click or pulse is: 0.04 seconds ≤ T ≤ 0.8 seconds.

1. Access Setup mode.

Method	Action	Result
Push Button	Press and hold both buttons (+ and -) for more than 2 seconds.	Green Power LED turns OFF Output LED remains active Status indicators (bar graph #1–4) flash current setup
Remote Input	Double-pulse the remote line.	

2. Select the sensing conditions.

Method	Action	Result
Push Button	Click either button (+ or -) until the LEDs show the desired settings.	Sensor rotates through eight setting combinations, in the following order: 1. Normal Speed - No Delay - LO* 2. Normal Speed - No Delay - DO 3. Normal Speed - Delay - LO 4. Normal Speed - Delay - DO 5. High Speed - No Delay - LO 6. High Speed - No Delay - DO 7. High Speed - Delay - LO 8. High Speed - Delay - DO * Factory default setting
Remote Input	Pulse the remote line until the LEDs show the desired settings. NOTE: Double-pulsing the remote line causes the setting to “back up” one step.	

3. Return to Run mode.

Method	Action	Result
Push Button	Press and hold both buttons (+ and -) for more than 2 seconds.	Green Power LED turns ON
Remote Input	Hold the remote line low for more than 2 seconds.	Sensor returns to RUN mode with new settings

Manual Adjust

Manual Adjust is used during Run mode and is accomplished using the push buttons only. Its behavior depends on whether a switching threshold or a sensing window is used.

Switching Threshold:

- Fine-tunes sensing sensitivity
- Press “+” to increase; press “-” to decrease

Sensing Window:

- Adjusts sensing window size (tolerance) for the single-point target condition
- Press “+” to increase; press “-” to decrease

The lighted bar graph LEDs move to reflect the increase or decrease.

Enabling or Disabling the Push Button

In addition to its programming function, the remote line may be used to disable the push buttons for security. Disabling the push buttons prevents undesired tampering with the sensor configuration settings.

1. Connect the sensor’s gray wire.
2. Four-pulse the remote line to enable or disable the push button.
   The sensor toggles between enable and disable settings and returns to RUN mode.

Specifications

Sensing Beam
660 nm visible red

Power
Supply voltage: 10 V dc to 30 V dc (10% maximum ripple) at 25 mA max current, exclusive of load
Supply protection circuitry: Protected against reverse polarity, over voltage, and transient voltages
Delay at power-up: 250 ms; outputs do not conduct during this time

Adjustments
2 push buttons and remote wire
Easy push-button configuration; manually adjust (+/–) cutoff (push buttons only); Light Operate/Dark Operate and OFF-delay configuration options (push buttons only); Push-button lockout (from remote wire only)

Indicators
8-segment red bar graph: distance relative to cutoff point
Green LED: Power ON
Yellow LED: Output conducting

Connections
5-conductor 2 m (6.5 ft) PVC cable, 9 m (30 ft) PVC cable, or 5-pin integral Euro-style quick-disconnect fitting

Output Configuration
Bipolar: 1 current sourcing (PNP) and 1 current sinking (NPN)

Output Ratings
150 mA maximum load (derate ~ 1 mA/°C above 25 °C)
OFF-state leakage current: < 50 µA at 30 V dc
ON-state saturation voltage (NPN): < 200 mV at 10 mA; < 1 V at 150 mA
ON-state saturation voltage (PNP): < 1.25 V at 10 mA; < 2 V at 150 mA

Output Protection
Protected against output short-circuit, continuous overload, transient over-voltages, and false pulse on power up

Output Response Time
High-Speed Mode: 300 microseconds
Normal Mode: 1.8 ms

Repeatability
High-Speed Mode: 100 microseconds
Normal Mode: 150 microseconds

Construction
ABS plastic housing; acrylic lens cover

Rating

IEC IP67, NEMA 6

Operating Conditions

−10 °C to +55 °C (+14 °F to +131 °F)

95% at +55 °C maximum relative humidity (non-condensing)

Vibration and Mechanical Shock

All models meet Mil Std. 202F requirements. Method 201A (vibration: 10 Hz to 60 Hz max., double amplitude 0.06 inch, maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G 11 ms duration, half sine wave.

Certifications

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 (Amps)
20	5.0
22	3.0
24	2.0
26	1.0
28	0.8
30	0.5

Performance Curves

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

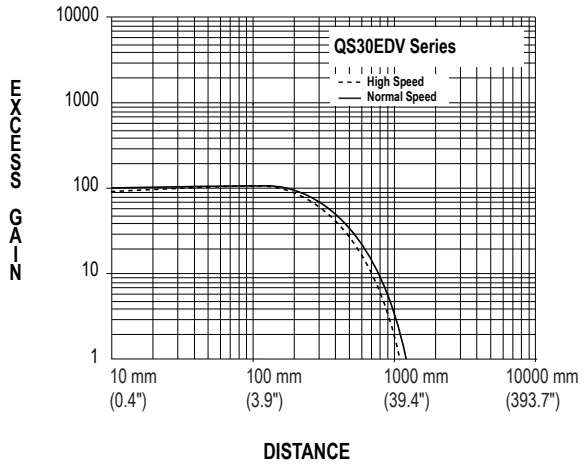


Figure 1. Excess Gain Curve

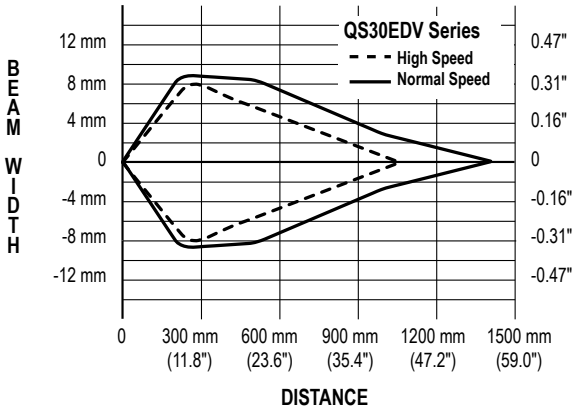
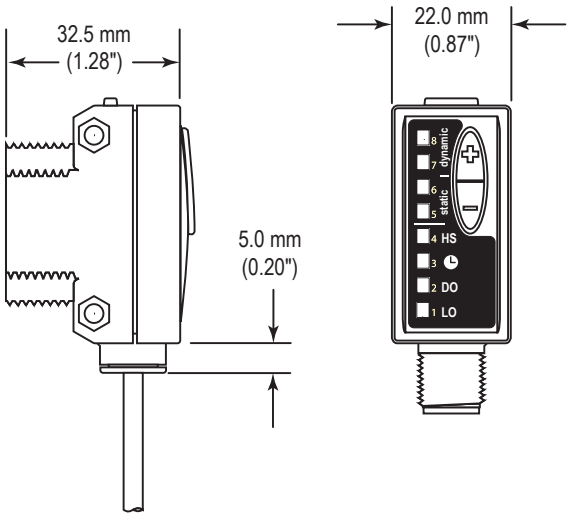
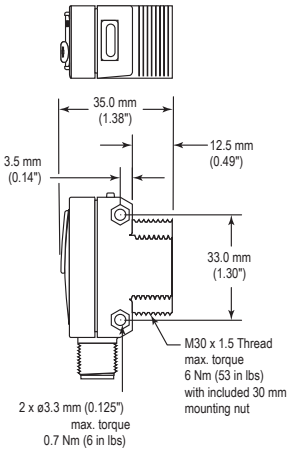


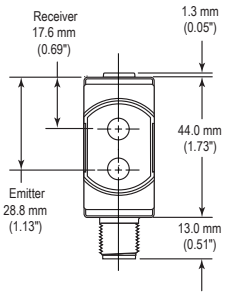
Figure 2. Beam Pattern

Dimensions

Cabled Models	QD Models

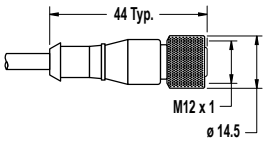
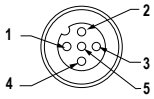
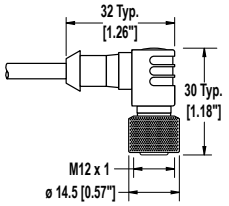






Hardware included: (10) M3 x 0.5 x 28 stainless steel machine screws, nuts and washers

Accessories

5-Pin Threaded M12/Euro-Style Cordsets—Single Ended				
Model	Length	Style	Dimensions	Pinout (Female)
MQDC1-501.5	0.50 m (1.5 ft)	Straight		 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
MQDC1-506	1.83 m (6 ft)			
MQDC1-515	4.57 m (15 ft)			
MQDC1-530	9.14 m (30 ft)			
MQDC1-506RA	1.83 m (6 ft)	Right-Angle		
MQDC1-515RA	4.57 m (15 ft)			
MQDC1-530RA	9.14 m (30 ft)			

Brackets

SMBQS30L

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

Hole center spacing: A to B=35.0
Hole size: A=ø 4.3, B=ø 4.25x16.3

SMBQS30LT

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

Hole center spacing: A to B=35.0
Hole size: A=ø 4.3, B=ø 4.25x16.3

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

Other compatible mounting brackets include: SMB30MM, SMB30SC, and SMB30A

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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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