Q3X Laser Contrast Sensor

Quick Start Guide

Laser Expert™ diffuse sensor with bipolar (1 PNP & 1 NPN) output. Patent pending.

This guide is designed to help you set up and install the Q3X Sensor. For complete information on programming, performance, troubleshooting, dimensions, and accessories, please refer to the Instruction Manual at *http://www.bannerengineering.com*. Search for p/n 181485 to view the manual. Use of this document assumes familiarity with pertinent industry standards and practices.

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.

Features

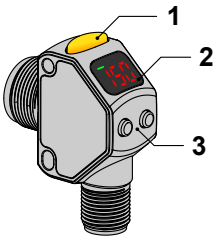


Figure 1. Sensor Features

1. Output Indicator (Amber)
2. Display
3. Buttons

Display and Indicators

Figure 2. Display in Run Mode

1. Stability Indicator (STB = Green)
2. Active TEACH Indicators
   - DYN = Dynamic TEACH selected (Amber)
   - WND = Symmetric window thresholds are active (Amber)

In Run mode, the 3-digit, 7-segment display provides real time information about signal strength for all models and target position for models with a fixed background suppression distance. The numeric value of 0 to 990 represent the amount of the received light divided by the threshold, and represents the excess gain of the sensing event expressed as a percentage of the switch point. This value is called normalized signal strength (NSS). A NSS display range of 999 indicates a saturated received light signal, meaning that low contrast detection is not possible.

In single threshold teach modes (Two-Point Static, Dynamic, Light Set, or Dark Set), the output switches at a displayed value of 100 (excess gain of 1.0).

For models with a specified background suppression distance, CUt indicates that a target is present at a distance beyond the background suppression distance and is being suppressed. In Light Operate mode, the output switches off when CUt displays. For the LD50 models, the sensor's output state when displaying CUt can be controlled using the CtO menu. By default, the sensor treats a target in the background as a dark signal and honors the LO/DO selection.

A displayed value of - - - indicates no light received or a loss of signal.

In Window Set teach mode, the value 100 represents the taught signal strength. The displayed value is the percentage of the received light divided by the taught signal strength. The output switches at displayed values above and below 100 as determined by the user-selected window offset percentage.

Output Indicator

- On—Outputs conducting (closed)
- Off—Outputs not conducting (open)

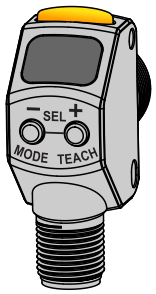
Stability Indicator (STB)

- On—Stable light signal received
- Flashing—Light intensity is within the switching threshold hysteresis band
- Off—No light signal received

Active TEACH Indicators (DYN and WND)

- DYN and WND off—Two-Point Static , Light Set, or Dark Set TEACH mode selected (Two-Point Static TEACH is the default).
- DYN and/or WND flashing—The sensor is in TEACH mode.
- DYN on—Dynamic TEACH mode selected
- WND on—Symmetric Window thresholds are active. The switch points are above and below 100 by the offset percentage

Buttons



Use the sensor buttons (-)(MODE) and (+)(TEACH) to program the sensor. See *Sensor Programming* on page 4 for programming instructions.

(-)(MODE)

- Decrease gain: press and release (-)(MODE), then press and hold (-)(MODE) to rapidly decrease gain
- Enter Setup mode: press and hold (-)(MODE) for longer than 2 seconds
- Navigate the sensor menu: press (-)(MODE)
- Change setting values: press and hold (-)(MODE) to decrease numeric values

(+)(TEACH)

- Increase gain: press and release (+)(TEACH), then press and hold (+)(TEACH) to rapidly increase gain
- Start the currently selected TEACH mode: press and hold (+)(TEACH) for longer than 2 seconds (Two-Point Static TEACH is the default)
- Navigate the sensor menu: press (+)(TEACH)
- Change setting values: press and hold (+)(TEACH) to increase numeric values

(-)(MODE) and (+)(TEACH)

- Select menu items in Setup mode: press (-)(MODE) and (+)(TEACH) simultaneously
- Select and save a parameter and return to Run mode: press (-)(MODE) and (+)(TEACH) simultaneously for longer than 2 seconds

When navigating the menu systems, the menu items loop.

Laser Description and Safety Information

CAUTION: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. Do not attempt to disassemble this sensor for repair. A defective unit must be returned to the manufacturer.

Laser wavelength: 655 nm
Output: < 0.42 mW
Pulse Duration: 5 µs

Installation

Install the Safety Label

The safety label must be installed on Q3X sensors that are used in the United States.

NOTE: Position the label on the cable in a location that has minimal chemical exposure.

1. Remove the protective cover from the adhesive on the label.
2. Wrap the label around the Q3X cable, as shown.
3. Press the two halves of the label together.

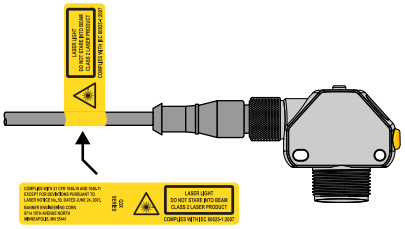


Figure 3. Safety Label Installation

Sensor Orientation

Correct sensor-to-target orientation is important to ensure proper sensing. To ensure reliable detection, orient the sensor as shown in relation to the target to be detected.

For models with background suppression, make sure the intended target is inside of the contrast sensing range and that any background objects are positioned beyond the background suppression distance.

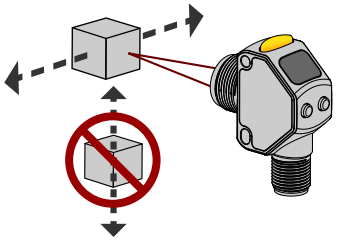
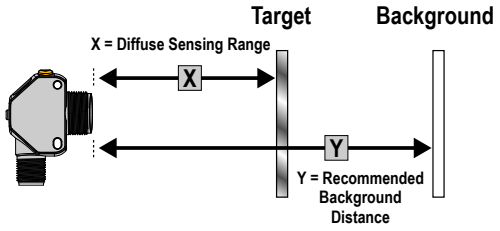


Figure 4. Optimal Orientation of Target to Sensor

Sensor-to-Background Position



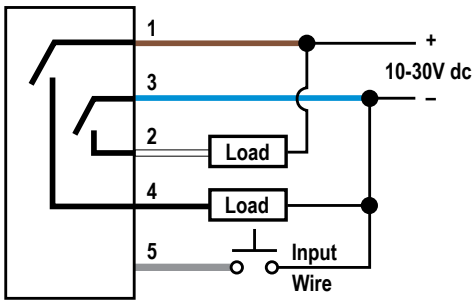
Model Number	X	Y
LD50	50 mm (1.97 in)	60 mm (2.36 in)
LD100	100 mm (3.94 in)	120 mm (4.72 in)
LD150	150 mm (5.91 in)	190 mm (7.48 in)
LD200	200 mm (7.87 in)	280 mm (11.02 in)

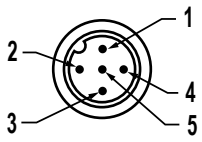
Figure 5. Q3XBLD Contrast Detection versus Background Suppression

Sensor Mounting

1. If a bracket is needed, mount the sensor onto the bracket.
2. Mount the sensor (or the sensor and the bracket) to the machine or equipment at the desired location. Do not tighten at this time.
3. Check the sensor alignment.
4. Tighten the screws to secure the sensor (or the sensor and the bracket) in the aligned position.

Wiring Diagram





Key

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

NOTE: Open lead wires must be connected to a terminal block.

NOTE: The input wire function is user-selectable; see the Instruction Manual for details. The default for the input wire function is off (disabled).

Cleaning and Maintenance

Handle the sensor with care during installation and operation. Sensor windows soiled by fingerprints, dust, water, oil, etc. may create stray light that may degrade the peak performance of the sensor. Blow the window clear using filtered, compressed air, then clean as necessary using 70% isopropyl alcohol and cotton swabs or water and a soft cloth.

Sensor Programming

Program the sensor using the buttons on the sensor or the input wire (limited programming options; see the Instruction Manual for details).

In addition to programming the sensor, use the input wire to disable the buttons for security, preventing unauthorized or accidental programming changes. See the Instruction Manual for more information.

Setup Mode

1. Access Setup mode from Run mode by pressing and holding MODE for longer than 2 seconds.
2. Use (-) or (+) to navigate through the top menu.

3. Select the desired submenu by pressing (-) and (+) simultaneously.
4. Press (-) or (+) to view the available options in the submenu.
5. Select a submenu option.
   - Press (-) and (+) simultaneously to select and save a submenu option and return to the top menu.
   - Press (-) and (+) simultaneously for longer than 2 seconds to select and save a submenu option and return to Run mode.

NOTE: The current submenu selection is solid, all other selections flash.

To exit Setup mode from the top menu and return to Run mode, navigate to End and press (-) and (+) simultaneously, or press and hold (-) and (+) simultaneously for longer than 2 seconds to return to Run mode from anywhere in the top menu.

Basic TEACH Instructions

Use the following instructions to teach the Q3X sensor. The instructions provided on the sensor display vary depending on the type of TEACH mode selected. Two-point TEACH is the default TEACH mode.

1. Press and hold TEACH for longer than 2 seconds to start the selected TEACH mode.
2. Present the target.
3. Press TEACH to teach the target. The target is taught and the sensor waits for the second target, if required by the selected TEACH mode, or returns to Run mode.

   Complete steps 4 and 5 only if prompted by the sensor for the selected TEACH mode:
4. Present the second target.
5. Press TEACH to teach the target. The target is taught and the sensor returns to Run mode.

See the Instruction Manual for detailed instructions and other available TEACH modes.

Manual Adjustments

Manually increase or decrease gain using (-) or (+).

1. From Run mode, press either (-) or (+) one time. The current signal strength value flashes slowly.
2. Press (-) to decrease the sensor's gain or (+) to increase the sensor's gain, or press and hold (-) or (+) to rapidly decrease or increase gain. After 1 second, the normalized signal strength flashes rapidly, the new setting is accepted, and the sensor returns to Run mode.

Locking and Unlocking the Sensor Buttons

Use the lock and unlock feature to prevent unauthorized or accidental programming changes. There are three different settings available:

- ULC —The sensor is unlocked and all settings can be modified (default).
- Loc —The sensor is locked and no changes can be made.
- OLC —The switch point value can be changed by teaching or manual adjustment, but no sensor settings can be changed through the menu.

When in Loc mode, Loc displays when (-)(MODE) or (+)(TEACH) are pressed.

When in OLC mode, Loc displays when (-)(MODE) is pressed and held. To access the manual adjust options, briefly press and release (-)(MODE) or (+)(TEACH). To enter TEACH mode, press the (+)(TEACH) button and hold for longer than 2 seconds.

To enter Loc mode, hold (+) and press (-) four times. To enter OLC mode, hold (+) and press (-) seven times. Holding (+) and pressing (-) four times unlocks the sensor from either lock mode and the sensor displays ULC.

Performance Curves

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

NOTE: For high sensitivity, the excess gain increases by a factor of 1.5. For low sensitivity, the excess gain decreases by a factor of 0.75

Q3XTBLD Models

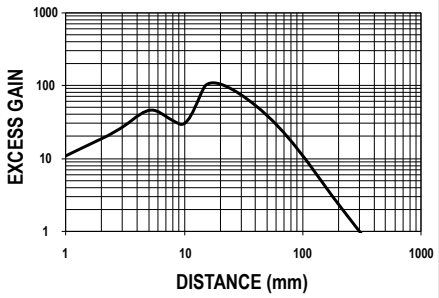


Figure 6. Excess Gain for Standard Sensitivity

Q3XTBLD50 Models

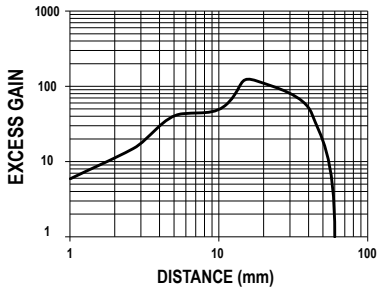


Figure 7. Excess Gain for Standard Sensitivity

Q3XTBLD100 Models

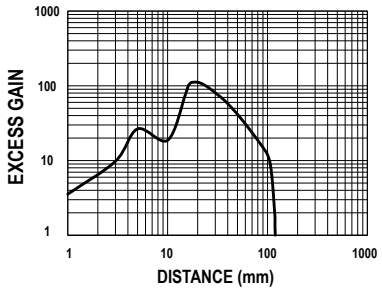


Figure 8. Excess Gain for Standard Sensitivity

For LD50 and LD100 models, the sensing cut-off distance of a 6% reflective black card will be 95% of the sensing cut-off distance of a 90% reflective white card.

Q3XTBLD150 Models

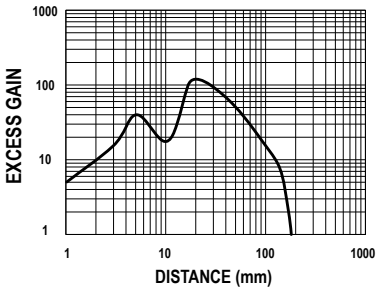


Figure 9. Excess Gain for Standard Sensitivity

For 150 mm models, the sensing cut-off distance for a 6% reflective black card will be 65% of the sensing cut-off distance of a 90% reflective white card.

Q3XTBLD200 Models

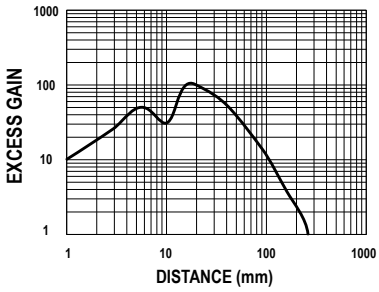


Figure 10. Excess Gain for Standard Sensitivity

For 200 mm models, the sensing cut-off distance for a 6% reflective black card will be 50% of the sensing cut-off distance of a 90% reflective white card.

Specifications

Sensing Beam
Visible red Class 2 laser, 655 nm

Supply Voltage (Vcc)
10 to 30 V dc

Power and Current, exclusive of load
Supply Power: < 675 mW
Current consumption: < 28 mA at 24 V dc

Supply Protection Circuitry
Protected against reverse polarity and transient overvoltages

Repeatability
60 µs

Delay at Power Up
1 s

Sensing Range

Table 1: Sensing Range

Model	Contrast Sensing Range	Background Suppression Distance
Q3XTBLD-Q8	0 to 300 mm (11.81 in)	Not Applicable
Q3XTBLD50-Q8	0 to 50 mm (1.97 in)	60 mm (2.36 in)
Q3XTBLD100-Q8	0 to 100 mm (3.94 in)	120 mm (4.72 in)
Q3XTBLD150-Q8	0 to 150 mm (5.91 in)	190 mm (7.48 in)
Q3XTBLD200-Q8	0 to 200 mm (7.87 in)	280 mm (11.02 in)

Maximum Torque
Side mounting: 1 N·m (9 in·lbs)
Nose mounting: 10 N·m (88 in·lbs)

Connector
5-pin M12 Euro-Style Integral Connector

Construction
Housing: Nickel-plated zinc die-cast
Side cover: Nickel-plated aluminum
Lens cover: Scratch-resistant PMMA acrylic
Lightpipes and display window: Polysulfone
Adjustment buttons: 316 stainless steel

Input Wire
Allowable Input Voltage Range: 0 to Vcc
Active Low (internal weak pullup—sinking current): Low State < 2.0 V at 1 mA max.

Output Configuration
Bipolar (1 PNP & 1 NPN) output

Output Rating
Discrete Output: 100 mA maximum (protected against continuous overload and short circuit)
Off-state Leakage Current: < 10 µA
NPN On-state saturation voltage: < 200 mV at 10 mA and < 1.0 V at 100 mA
PNP On-state saturation voltage: < 1 V at 10 mA and < 2.0 V at 100 mA

Ambient Light Immunity
> 5000 lux

Response Speed
User selectable:

- 250 —250 microseconds
- 1ms —1 millisecond
- 5ms —5 milliseconds

Beam Spot Size

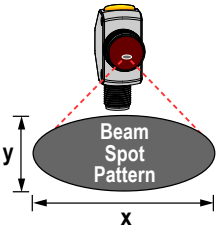


Table 2: Models LD, LD100, LD150, LD200

	Distance					
	20 mm	50 mm	100 mm	150 mm	200 mm	300 mm
X	5.9 mm	5.6 mm	5.1 mm	4.6 mm	4.1 mm	3.0 mm
Y	2.3 mm	2.1 mm	1.9 mm	1.6 mm	1.5 mm	1.2 mm

Table 3: Model LD50

	Distance	
	20 mm	50 mm
X	4.8 mm	3.4 mm
Y	2.0 mm	1.4 mm

Operating Conditions
Temperature: –10 °C to +50 °C (+14 °F to +122 °F)
Humidity: 35% to 95% relative humidity

Environmental Rating
IEC IP67 per IEC60529
IEC IP68 per IEC60529
IEC IP69K per DIN40050-9

Vibration
MIL-STD-202G, Method 201A (10 to 60 Hz, 0.06 in (1.52 mm) double amplitude, 2 hours each along X, Y and Z axes), with sensor operating

Shock
MIL-STD-202G, Method 213B, Condition I (100G 6x along X, Y and Z axes, 18 total shocks), with sensor operating

Storage Temperature
–25 °C to +75 °C (–13 °F to +167 °F)

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 *http://www.bannerengineering.com*.

Supply Wiring	Required Overcurrent Protection
20	5.0 Amps
22	3.0 Amps
24	2.0 Amps
26	1.0 Amps
28	0.8 Amps
30	0.5 Amps

Certifications

Industrial Control Equipment 3TJJ

Class 2 power

Sensor Menu Map

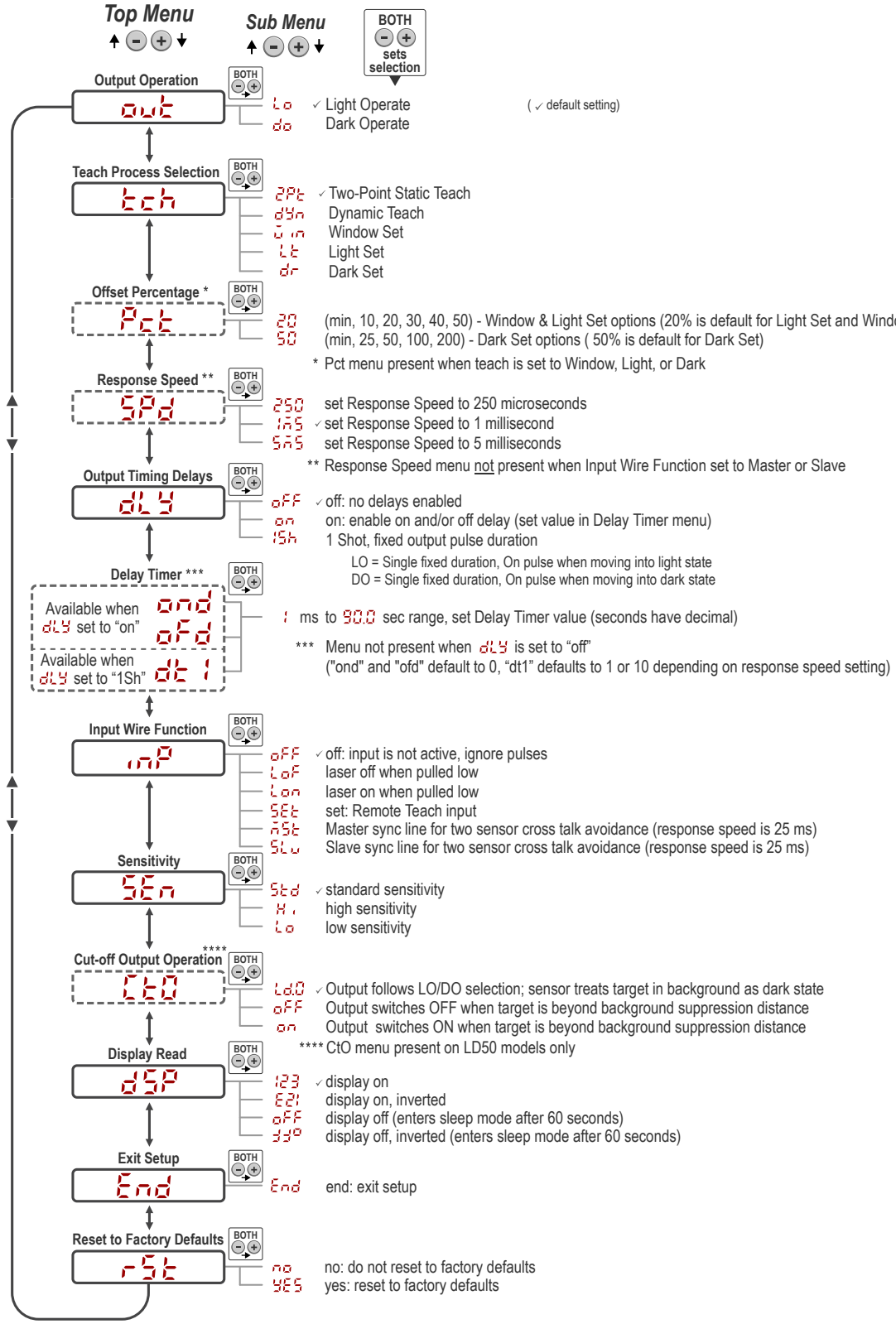


Figure 11. Setup Mode Menu Map

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