Quick Start Guide


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 [www.bannerengineering.com](http://www.bannerengineering.com). Search for p/n 181485 to view the Instruction 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**

![Sensor Features](image1)

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

**Display and Indicators**

![Display in Run Mode](image2)

- 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 on at a displayed value of 100 (excess gain of 1.0).

For models with a specified background suppression distance, ευτ 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 ευτ displays. For the background suppression models, the sensor’s output state when displaying ευτ can be controlled using the ευτ 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 ΞΞΞ 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.

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.

Sensor-to-Background Position

![Figure 5. Q3XBLD Contrast Detection versus Background Suppression](image)

<table>
<thead>
<tr>
<th>Model Number</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD50</td>
<td>50 mm</td>
<td>60 mm</td>
</tr>
<tr>
<td>LD100</td>
<td>100 mm</td>
<td>120 mm</td>
</tr>
<tr>
<td>LD150</td>
<td>150 mm</td>
<td>190 mm</td>
</tr>
<tr>
<td>LD200</td>
<td>200 mm</td>
<td>280 mm</td>
</tr>
</tbody>
</table>

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

10-30V dc

Input Wire

Load

Load

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:

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

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

When in **答え** mode, **ョ** 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 **邬** mode, hold ‾ and press ‼ four times. To enter **答え** mode, hold ‾ and press ‼ seven times. Holding ‾ and pressing ‼ four times unlocks the sensor from either lock mode and the sensor displays **邬**.

**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.

<table>
<thead>
<tr>
<th>Q3XTLBD Models</th>
<th>Q3XTLBD50 Models</th>
<th>Q3XTLBD100 Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Excess Gain for Standard Sensitivity](Figure 6)</td>
<td>![Excess Gain for Standard Sensitivity](Figure 7)</td>
<td>![Excess Gain for Standard Sensitivity](Figure 8)</td>
</tr>
</tbody>
</table>

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.
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.

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

**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

**Sensing Range**

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

**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
Q3X Laser Contrast Sensor

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
- 1 ms — 1 millisecond
- 5 ms — 5 milliseconds

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

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.

<table>
<thead>
<tr>
<th>Supply Wiring (AWG)</th>
<th>Required Overcurrent Protection (Amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>22</td>
<td>3.0</td>
</tr>
<tr>
<td>24</td>
<td>2.0</td>
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<tr>
<td>26</td>
<td>1.0</td>
</tr>
<tr>
<td>28</td>
<td>0.8</td>
</tr>
<tr>
<td>30</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Beam Spot Size

<table>
<thead>
<tr>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mm</td>
</tr>
<tr>
<td>50 mm</td>
</tr>
<tr>
<td>100 mm</td>
</tr>
<tr>
<td>150 mm</td>
</tr>
<tr>
<td>200 mm</td>
</tr>
<tr>
<td>300 mm</td>
</tr>
</tbody>
</table>

**Table 2: Models LD, LD100, LD150, LD200**

Table 2: Model LD50

<table>
<thead>
<tr>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mm</td>
</tr>
<tr>
<td>50 mm</td>
</tr>
</tbody>
</table>

Vibration
MIL-STD-202G, Method 201A (10 Hz to 60 Hz, 0.06 inch (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)

Certifications

UL Class 2 power
Figure 11. Setup Mode Menu Map
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