

## Product Description

Laser Expert™ diffuse sensor with bipolar (one PNP and one NPN) output.

This guide is designed to help you set up and install the Q3X Laser Contrast Sensor. For complete information on programming, performance, troubleshooting, dimensions, and accessories, please refer to the Product Manual at [www.bannerengineering.com](http://www.bannerengineering.com). Search for part number 181485 to view the Product Manual. Use of this document assumes familiarity with pertinent industry standards and practices.

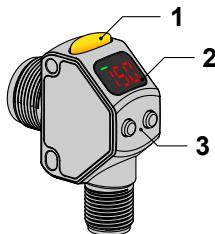
### WARNING:



- Do not use this device for personnel protection
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

## Features

Sensor Features



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

## Display and Indicators



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, 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 displays. For the background suppression models, the sensor's output state when displaying can be controlled using the 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)

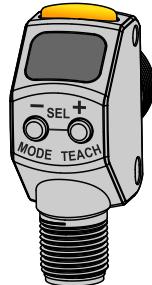
#### Stability Indicator (STB)

- 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 5](#) 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.

## Class 2 Laser Description and Safety Information



**Laser light. Do not stare into the beam.**

Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 56, dated May 8, 2019.

**CLASS 2  
LASER PRODUCT**

#### CAUTION:

- **Never stare directly into the sensor lens.**
- Laser light can damage your eyes.
- Avoid placing any mirror-like object in the beam. Never use a mirror as a retroreflective target.



#### CAUTION:

- **Return defective units to the manufacturer.**
- 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.

**CAUTION:**

- Ne regardez jamais directement la lentille du capteur.
- La lumière laser peut endommager la vision.
- Évitez de placer un objet réfléchissant (de type miroir) dans la trajectoire du faisceau. N'utilisez jamais de miroir comme cible rétro-réfléchissante.

**CAUTION:**

- Tout dispositif défectueux doit être renvoyé au fabricant.
- L'utilisation de commandes, de réglages ou de procédures autres que celles décrites dans le présent document peut entraîner une exposition dangereuse aux radiations.
- N'essayez pas de démonter ce capteur pour le réparer. Tout dispositif défectueux doit être renvoyé au fabricant.



Class 2 lasers are lasers that emit visible radiation in the wavelength range from 400 nm to 700 nm, where eye protection is normally afforded by aversion responses, including the blink reflex. This reaction may be expected to provide adequate protection under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

Complies with IEC 60825-1:2014 and EN 60825-1:2014+A11:2021.

**Class 2 Laser Safety Notes.** Low-power lasers are, by definition, incapable of causing eye injury within the duration of a blink (aversion response) of 0.25 seconds. They also must emit only visible wavelengths (400 nm to 700 nm). Therefore, an ocular hazard may exist only if individuals overcome their natural aversion to bright light and stare directly into the laser beam.

**For safe laser use:**

- 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.

**IMPORTANT:** This laser device is not bore-sighted.

**Class 2 Laser Characteristics**

Output power: < 0.42 mW

Laser wavelength: 655 nm

Pulse duration: 5  $\mu$ s

## Installation

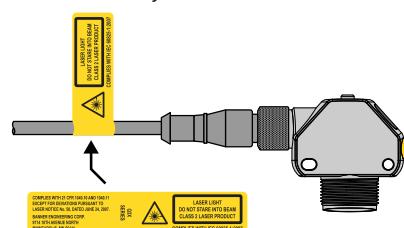
### Install the Safety Label

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

#### Safety Label Installation

**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.

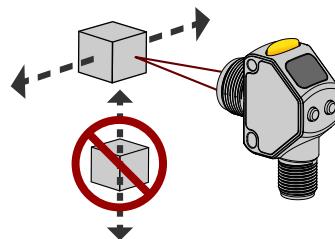


## Sensor Orientation

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.

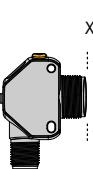
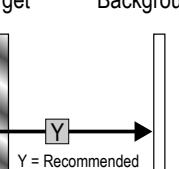
For models with background suppression, make sure the intended target is inside of the contrast sensing range and that any background objects are positioned beyond the background suppression distance.

Optimal Orientation of Target to Sensor



## Sensor-to-Background Position

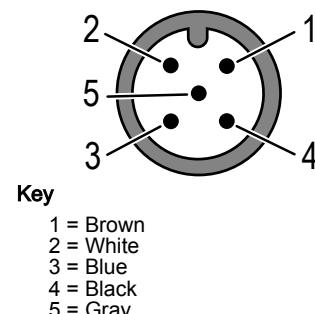
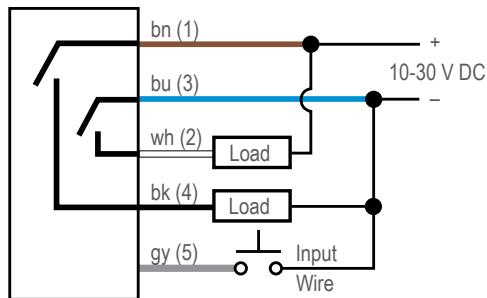
Q3XBLD Contrast Detection versus Background Suppression

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

## Mount the Device

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

## Wiring Diagram



**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).

# 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  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:

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

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

When in  mode,  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**.

## Specifications

### Sensing Beam

Visible red Class 2 laser, 655 nm

### Supply Voltage (Vcc)

10 V DC 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  $\mu$ s

### 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 Integral Connector

### 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  $\mu$ A

**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
- **155**—1 millisecond
- **555**—5 milliseconds

### Operating Conditions

**Temperature:** -10 °C to +50 °C (+14 °F to +122 °F)

**Humidity:** 35% to 95% relative humidity

### Environmental Rating

IP67 per IEC60529

IP68 per IEC60529

IP69K per ISO 20653 per DIN40050-9

### Sensing Range

#### Sensing Range

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

### Construction

**Housing:** Nickel-plated zinc die-cast

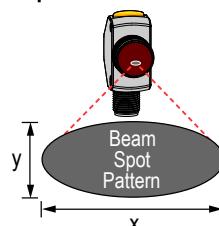
**Side cover:** Nickel-plated aluminum

**Lens cover:** Scratch-resistant PMMA acrylic

**Lightpipes and display window:** Polysulfone

**Adjustment buttons:** 316 stainless steel

### Beam Spot Size



*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

*Model LD50*

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

### Vibration

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

### Shock

MIL-STD-202G, Method 213B, Condition I (100G 6x along X, Y, and Z axes, 18 shocks), with device 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 [www.bannerengineering.com](http://www.bannerengineering.com).

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

## Certifications

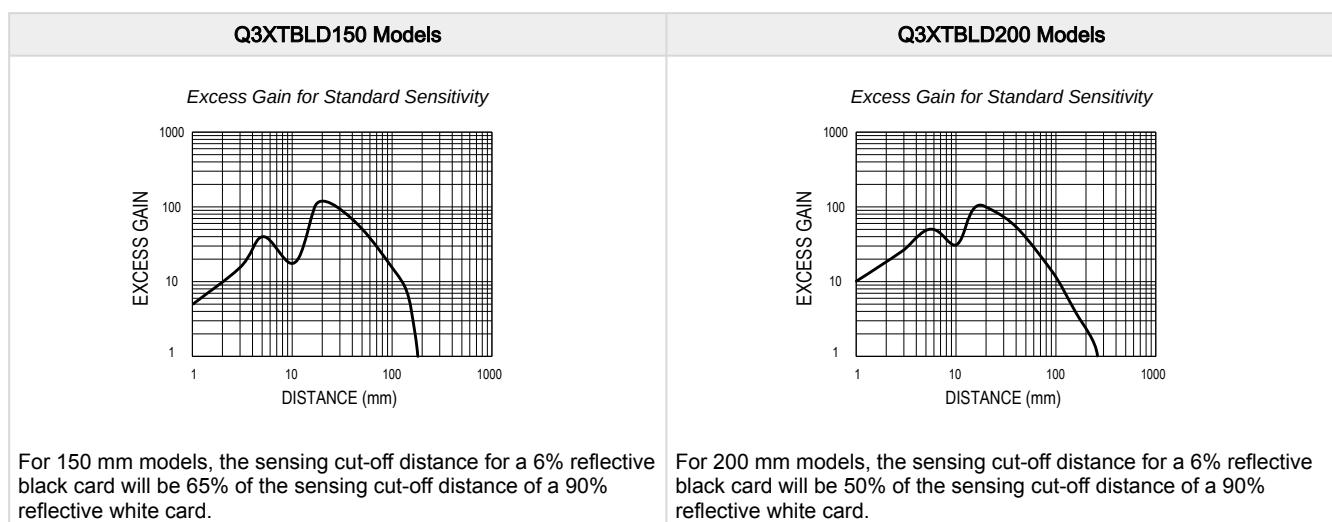
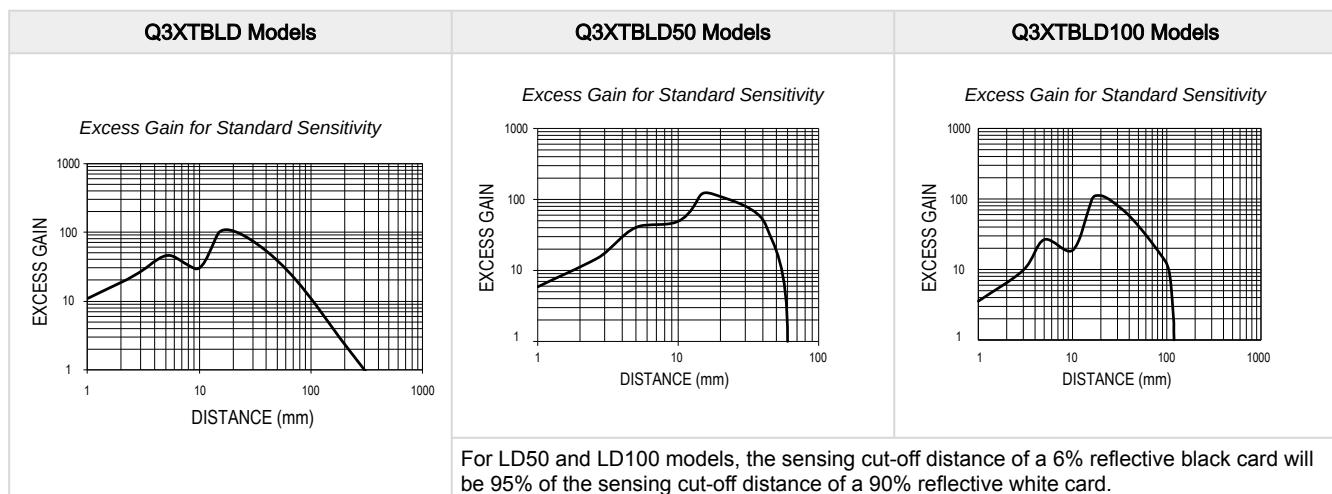


Industrial Control Equipment  
3TJU Class 2 power

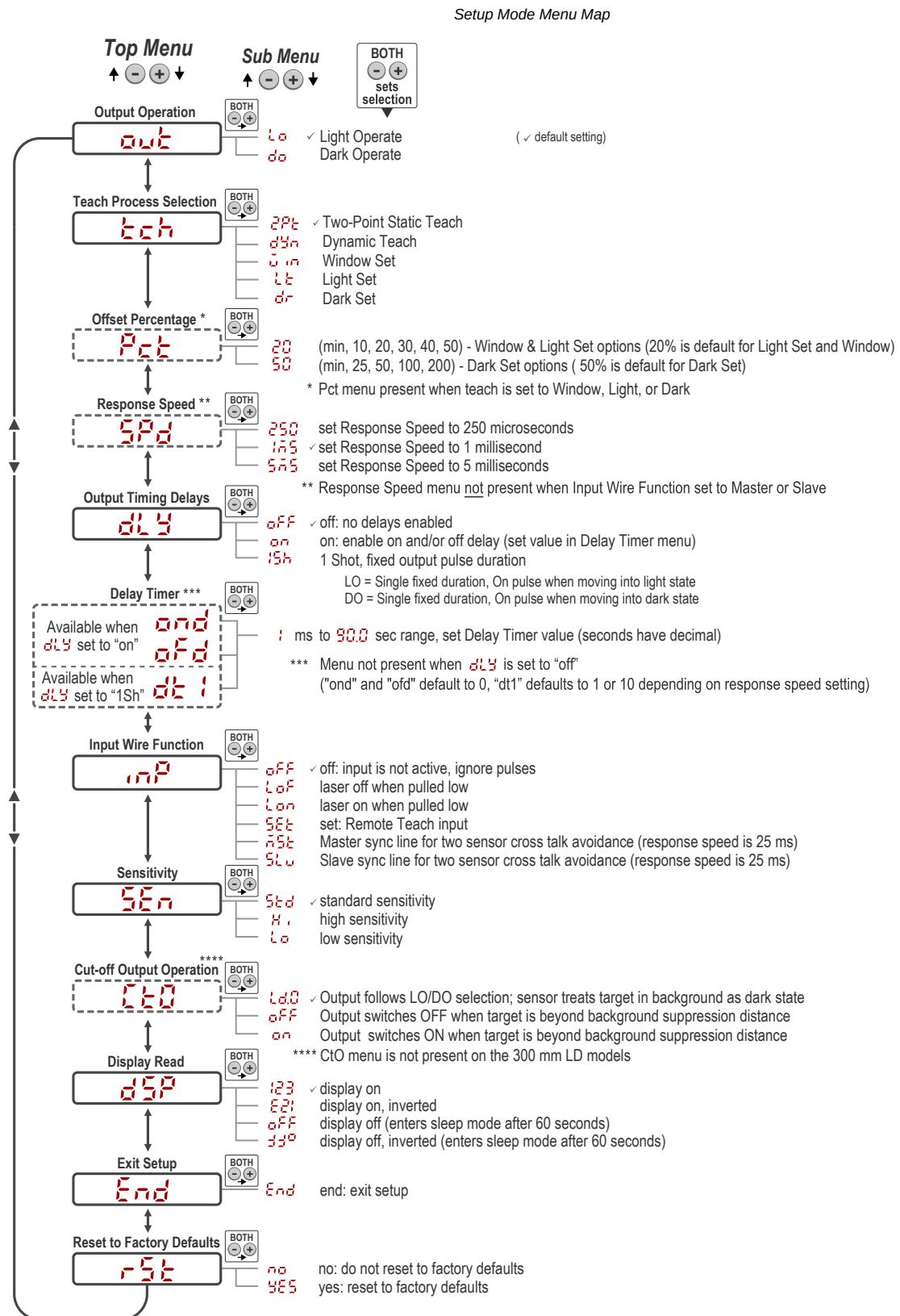
## Performance Curves

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



## Sensor Menu Map



# Banner Engineering Corp Limited Warranty

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For patent information, see [www.bannerengineering.com/patents](http://www.bannerengineering.com/patents).