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Q4X Stainless Steel Laser Sensor for Clear Object Detection Quick Start Guide

Product Description

Class 1 laser CMOS sensor with a discrete (PNP or NPN) output. Patent pending.

This guide is designed to help you set up and install the Q4X Sensor. For complete information on programming, performance, troubleshooting, dimensions, and accessories, please refer to the Product Manual at www.bannerengineering.com. Search for part number 181483 to view the Product Manual. Use of this document assumes familiarity with pertinent industry standards and practices.

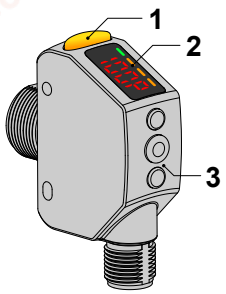
For illustration purposes, the threaded barrel model Q4X images are used throughout this document.

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.

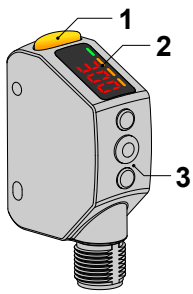
Features

Sensor Features—Threaded Barrel Models



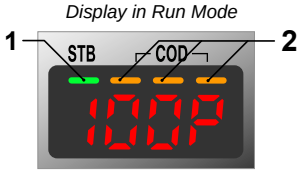
1. Output Indicator (Amber)
2. Display
3. Buttons

Sensor Features—Flush Mount Models



Display and Indicators

Display in Run Mode



The display is a 4-digit, 7-segment LED. The main screen is the Run Mode screen, which shows the percentage matched to the taught reference surface. A display value of 999P indicates the sensor has not been taught.

1. Stability Indicator (STB = Green)
2. Active TEACH Indicators
   - COD = Intensity and distance windows for clear object detection

Output Indicator

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

Active TEACH Indicators (COD)

- COD all on = Intensity and distance windows for clear object detection enabled

Stability Indicator (STB)

- On—Stable signal within the specified sensing range
- Flashing—Marginal signal, the target is outside the limits of the specified sensing range, or a multiple peak condition exists
- Off—No target detected within the specified sensing range

Original Instructions
24-Jul-25

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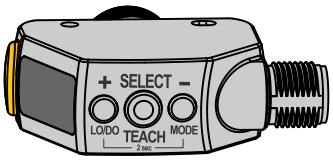
187731
p/n: 187731 Rev. E

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Buttons

Use the sensor buttons **(SELECT)(TEACH)**, **(+)(LO/DO)**, and **(-)(MODE)** to program the sensor.

Buttons



(SELECT)(TEACH)

- Press to select menu items in Setup mode
- Press and hold for longer than 2 seconds to start the Clear Object Detection TEACH mode

(-)(MODE)

- Press to navigate the sensor menu in Setup mode
- Press to change setting values; press and hold to decrease numeric values
- Press and hold for longer than 2 seconds to enter Setup mode

(+)(LO/DO)

- Press to navigate the sensor menu in Setup mode
- Press to change setting values; press and hold to increase numeric values
- Press and hold for longer than 2 seconds to switch between light operate (LO) and dark operate (DO)

NOTE: When navigating the menu, the menu items loop.

Installation

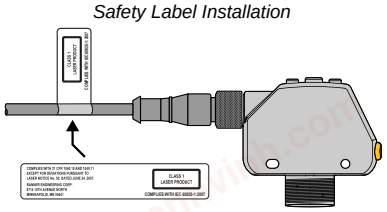
Install the Safety Label

The safety label must be installed on Q4X 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 Q4X cable, as shown.
3. Press the two halves of the label together.

Safety Label Installation



Sensor Orientation and Mounting Considerations for Transparent and Clear Object Detection

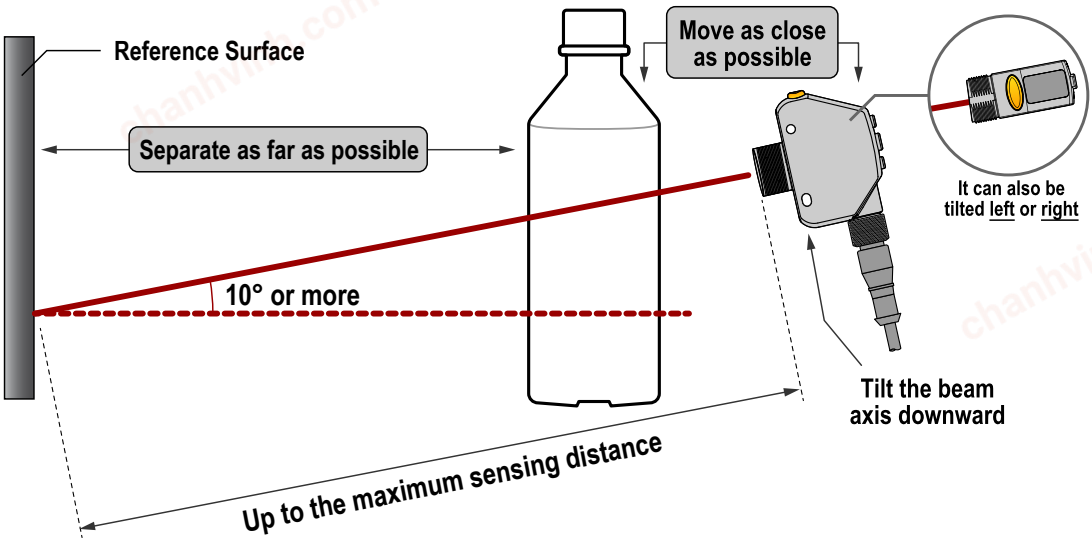
Optimize the reliable detection of transparent and clear objects by applying these principals when selecting your reference surface, positioning your sensor relative to the reference surface, and presenting your target. The robust detection capabilities of the Q4X will allow successful detection even under non-ideal conditions in many cases.

1. Select a reference surface with these characteristics where possible:
   - Matte or diffuse surface finish
   - Fixed surface with no vibration
   - Dry surface with no build-up of oil, water, or dust
2. Position the reference surface between 50 and 300 mm (threaded barrel models) or 60 mm and 310 mm (flush mount models).
3. Position the target to be detected as close to the sensor as possible, and as far away from the reference surface as possible.
4. Angle the sensing beam relative to the target and relative to the reference surface 10 degrees or more.

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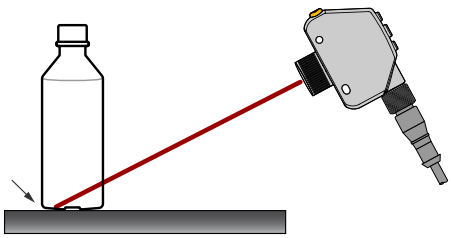
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Mounting considerations

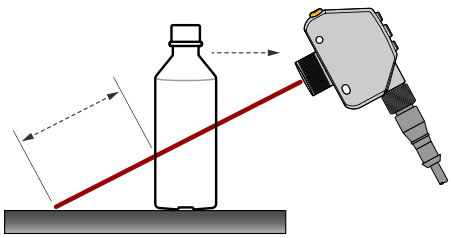


Common problems and solutions for detecting clear objects

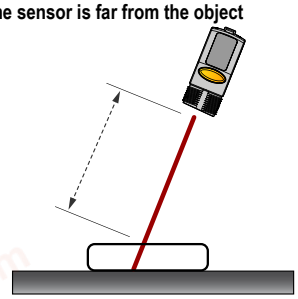
PROBLEM:
The object is close to the reference surface



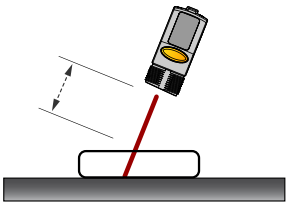
SOLUTION:
Move the target closer to the sensor



PROBLEM:
The sensor is far from the object



SOLUTION:
Move the sensor closer to the target



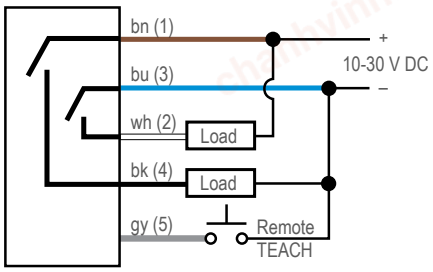
Mount the Device

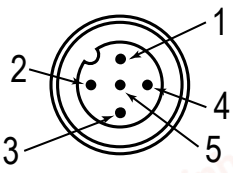
1. If a bracket is needed, mount the device onto the bracket.
2. Mount the device (or the device and the bracket) to the machine or equipment at the desired location. Do not tighten the mounting screws at this time.
3. Check the device alignment.
4. Tighten the mounting screws to secure the device (or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

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Wiring Diagram —Threaded Barrel Models





Key

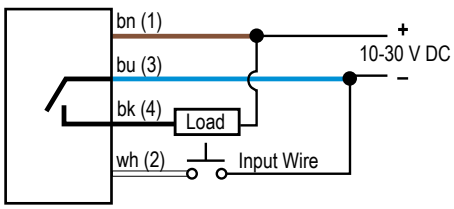
1 = Brown
2 = White
3 = Blue
4 = Black
5 = Gray

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

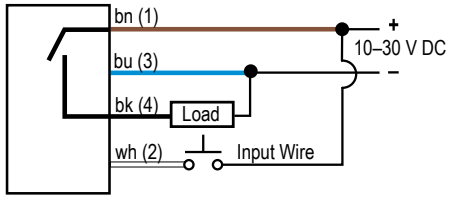
NOTE: The input wire function is user-selectable; see the Instruction Manual for details. The default for the input wire function is off (disabled).

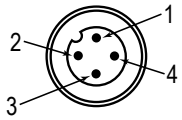
Wiring Diagram—Flush Mount Models

NPN Models



PNP Models





Key

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

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).

Clean Sensor with Compressed Air and Water

Handle the sensor with care during installation and operation. Sensor windows soiled by fingerprints, dust, water, oil, etc. 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 only water and a lint-free cloth. Do not use any other chemicals for cleaning.

Sensor Programming

Program the sensor using the buttons on the sensor or the remote input (limited programming options).

In addition to programming the sensor, use the remote input to disable the buttons for security, preventing unauthorized or accidental programming changes. See the Instruction Manual, p/n 181483 for more information.

Setup Mode

Access Setup mode and the sensor menu from Run mode by pressing and holding **MODE** for longer than 2 seconds. Use ⊕ and ⊖ to navigate through the menu. Press **SELECT** to select a menu option and access the submenus. Use ⊕ and ⊖ to navigate through the

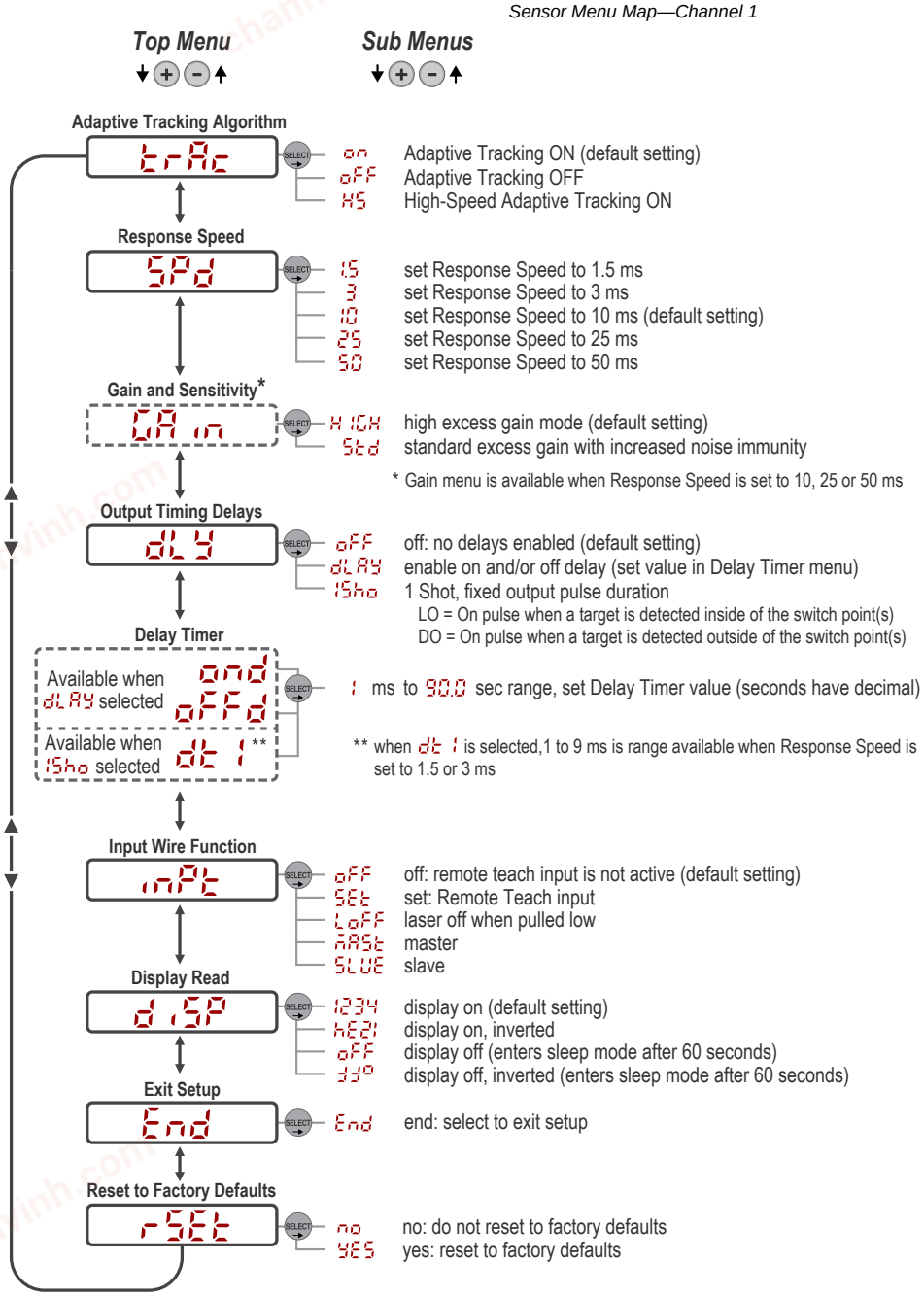
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submenus. Press **SELECT** to select a submenu option and return to the top menu, or press and hold **SELECT** for longer than 2 seconds to select a submenu option and return immediately to Run mode.

To exit Setup mode and return to Run mode, navigate to End and press **SELECT**.

Sensor Menu Map—Channel 1



Basic TEACH Instructions

Use the following instructions to teach the Q4X sensor.

1. Align the sensor to a stable reference surface.
2. Rigidly mount the sensor in this alignment.
3. Press and hold **TEACH** for longer than 2 seconds to start the TEACH mode.
4. Press **TEACH** to teach the reference surface. The reference surface is taught, the currently selected switch point value is displayed, and the sensor returns to run mode.

The Q4X sensor records the distance to the reference surface and the amount of laser light returned by the reference surface. The output is switched when an object passing between the sensor and the reference surface changes the perceived distance or amount of returned light.

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The Q4X is able to detect the very small changes caused by transparent and clear objects. Typical reference surfaces are metal machine frame, conveyor side rail, or mounted plastic targets. Please contact Banner Engineering if you require assistance setting up a stable reference surface in your application.

The Q4X sensor can be taught non-ideal reference surfaces, such as surfaces outside of the sensor range or very dark surfaces. Teaching non-ideal reference surfaces may enable applications other than transparent or clear object detection, but best results for transparent or clear object detection require a stable reference surface as described above in "Sensor Orientation and Mounting Considerations for Transparent and Clear Object Detection" on page 2.

Manual Adjustments

Manually adjust the sensor switch point using the + and - buttons.

1. From Run mode, press either + or - one time. The current switch point value flashes slowly.
2. Press + to move the switch point up or - to move the switch point down. After 1 second of inactivity, the new switch point value flashes rapidly, the new setting is accepted, and the sensor returns to Run mode.

After the TEACH process is completed, the taught reference point, a combination of the measured distance and returned signal intensity from the reference target, is recorded by the sensor. Use the push buttons to manually adjust the switch point. Manual adjustment changes the sensitivity of the thresholds around the taught reference point but does not move the taught reference point. Press + to increase the sensitivity and press - to decrease the sensitivity. After re-positioning the sensor or changing the reference target, re-teach the sensor.

The display shows the current match percentage relative to the taught reference point. The switch point defines the sensitivity; the output switches when the current match percentage crosses the switch point.

Your specific application may require some adjustment of the switch point, but these values are recommended starting switch points for common applications.

Switch point (%)	Typical Applications
75 (default)	Default, recommended for PET bottles and Trays
88	Recommended for thin films
50	Recommended for tinted brown, tinted green, or water-filled containers

Light Operate/Dark Operate

The default output configuration is light operate. To switch between light operate and dark operate, use the following instructions:

1. Press and hold **LO/DO** for longer than 2 seconds. The current selection displays.
2. Press **LO/DO** again. The new selection flashes slowly.
3. Press **SELECT** to change the output configuration and return to Run mode.

> **NOTE:** If neither **SELECT** nor **LO/DO** are pressed after step 2, the new selection flashes slowly for a few seconds, then flashes quickly and the sensor automatically changes the output configuration and returns to Run mode.

Locking and Unlocking the Sensor Buttons

Use the lock and unlock feature to prevent unauthorized or accidental programming changes.

Three settings are available:

- uLoc —The sensor is unlocked and all settings can be modified (default).
- Loc —The sensor is locked and no changes can be made.
- 0Loc —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 the **(SELECT)(TEACH)** button is pressed. The switch point displays when **(+)(LO/DO)** or **(-)(MODE)** are pressed, but **Loc** displays if the buttons are pressed and held.

When in **0Loc** mode, **Loc** displays when **(+)(LO/DO)** or **(-)(MODE)** are pressed and held. To access the manual adjust options, briefly press and release **(+)(LO/DO)** or **(-)(MODE)**. To enter TEACH mode, press the **(SELECT)(TEACH)** button and hold for longer than 2 seconds.

To enter **Loc** mode, hold **+** and press **-** four times. To enter **0Loc** mode, hold **+** and press **-** seven times. Holding **+** and pressing **-** four times unlocks the sensor from either lock mode and the sensor displays **uLoc**.

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Q4X Specifications

Sensing Beam
Visible red Class 1 laser, 655 nm

Supply Voltage (Vcc)
10 V DC to 30 V DC

Power and Current Consumption, exclusive of load
< 675 mW

Sensing Range
25 mm to 300 mm (0.98 in to 11.81 in)

Output Configuration
Bipolar (1 PNP and 1 NPN) output

Output Rating
100 mA total maximum (protected against continuous overload and short circuit)
Off-state leakage current: < 5 µA at 30 V DC
PNP On-state saturation voltage: < 1.5 V DC at 100 mA load
NPN On-state saturation voltage: < 1.0 V DC at 100 mA load

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

Supply Protection Circuitry
Protected against reverse polarity and transient overvoltages

Delay at Power Up
< 750 ms

Maximum Torque
Side mounting: 1 N·m (9 in·lbs)
Nose mounting: 20 N·m (177 in·lbs)

Ambient Light Immunity
> 5,000 lux at 300 mm

Connector
Integral 5-pin M12 male quick-disconnect connector

Construction
Housing: 316 L stainless steel
Lens cover: PMMA acrylic
Lightpipe and display window: polysulfone

Response Speed
User selectable:

- 1.5 —1.5 milliseconds
- 3 —3 milliseconds
- 10 —10 milliseconds
- 25 —25 milliseconds
- 50 —50 milliseconds

Chemical Compatibility
Compatible with commonly used acidic or caustic cleaning and disinfecting chemicals used in equipment cleaning and sanitation. ECOLAB® certified.
Compatible with typical cutting fluids and lubricating fluids used in machining centers

Application Note
For optimum performance, allow 10 minutes for the sensor to warm up

Environmental Rating
IP67 per IEC60529
IP68 per IEC60529
IP69K per ISO 20653
IP rating is dependent on proper cordset installation.

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

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

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.

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

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

Turck Banner LTD Blenheim House
Blenheim Court
Wickford, Essex SS11 8YT
GREAT BRITAIN

Industrial Control Equipment 3TJJ

Class 2 power; UL Environmental Rating: Type 1

ECOLAB chemical compatibility certified

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HIGH *Threaded Barrel Models Excess Gain (* Std *Excess Gain[1])*

Response Speed (ms)	Excess Gain—90% White Card	
	at 25 mm	at 300 mm
1.5	200	20
3	200	20
10	1000 (500)	100 (50)
25	2500 (1000)	250 (100)
50	5000 (2500)	500 (250)

HIGH *Flush Mount Models Excess Gain (* Std *Excess Gain[2])*

Response Speed (ms)	Excess Gain—90% White Card	
	at 35 mm	at 310 mm
1.5	200	20
3	200	20
10	1000 (500)	100 (50)
25	2500 (1000)	250 (100)
50	5000 (2500)	500 (250)

Class 1 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.





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.

Class 1 lasers are lasers that are safe 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.

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.

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(1)
- Std *excess gain available in 10 ms, 25 ms, and 50 ms response speeds only*
- Std *excess gain provides increased noise immunity*

(2)
- Std *excess gain available in 10 ms, 25 ms, and 50 ms response speeds only*
- Std *excess gain provides increased noise immunity*

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Models with a Range of ≤ 510 mm

Class 1 Laser Characteristics

Output power ≤ 510 mm Models: < 0.20 mW; > 510 mm Models: < 0.39 mW
Laser wavelength: 655 nm
Pulse duration: 7 µs to 2 ms

Models with a Range of > 510 mm

Class 1 Laser Characteristics

Output power: < 0.39 mW
Laser wavelength: 655 nm
Pulse duration: 7 µs to 2 ms

FCC Part 15 Class B for Unintentional Radiators

(Part 15.105(b)) This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

(Part 15.21) Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Industry Canada ICES-003(B)

This device complies with CAN ICES-3 (B)/NMB-3(B). Operation is subject to the following two conditions: 1) This device may not cause harmful interference; and 2) This device must accept any interference received, including interference that may cause undesired operation.

Cet appareil est conforme à la norme NMB-3(B). Le fonctionnement est soumis aux deux conditions suivantes : (1) ce dispositif ne peut pas occasionner d'interférences, et (2) il doit tolérer toute interférence, y compris celles susceptibles de provoquer un fonctionnement non souhaité du dispositif.

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