

Installation Instructions

45LMS Laser Measurement Sensor

IMPORTANT: SAVE THESE INSTRUCTIONS FOR FUTURE USE.

Description

The 45LMS family of long distance laser sensors is available in a variety of measuring ranges. The 8 m diffuse and 50 m retroreflective models use a Class 1 visible red laser and the 15 m diffuse models use a Class 2 visible red laser. The discrete and analog outputs can be easily set using the 5-step rotary switch and the push button. Potential applications include object position (analog output) and object detection (background suppression with discrete output).

This sensor utilizes the Time of Flight (ToF) principle and has a relatively small beam spot even at 15 m away. The sensor is completely self-contained and does not require any external control devices which add cost and require additional mounting space.

The 45LMS is easily set up by mounting the sensor such that the target is within the operating range of the sensor and teaching in the appropriate set-points required for the application. All sensors in this family have one discrete output with one analog output. The discrete output can be wired for either Light Operate (L.O.) or Dark Operate (D.O.) and the analog output is automatically scaled between the selected set-points with either a positive or negative slope.

The 45LMS is an excellent solution for long range detection and measurement applications including: distance measurement, verifying material position, stack level, thickness measurement, roll diameter, positioning fixtures, error proofing inspection, long standoff distance, level monitoring, crane crash protection and other difficult applications that exceed the capabilities of standard diffuse or background suppression photosensors.

Features

- Eye Safe Class 1 or Class 2 laser (by model)
- 8 m (26 ft.), 15 m (49 ft.) or 50 m (164 ft.) sensing range, dependent on model
- One discrete output (1 x NPN/PNP) and one analog output (1 x 4...20 mA)
- Easy setup of switch points or analog scaling using programming buttons
- IP65 enclosure
- Self-contained sensor

ATTENTION



This installation instruction should be read and understood before operating the sensor.

The 45LMS sensor should only be installed by qualified personnel.

The 45LMS is not a safety component as described by the EU machinery directives.

General Specifications

Certifications	UL, cULus, and CE marked for all applicable directives
Operation	
Sensing Beam	Class 1 laser, visible red 660 nm (for 8 m & 50 m models) Class 2 laser, visible red 660 nm (for 15 m model)
Spot Size	< 10 mm (0.39 in.) at a distance of 8 m (26 ft) at 20°C (68°F) < 15 mm (0.59 in.) at a distance of 15 m (49 ft) at 20°C (68°F) < 50 mm (2 in.) at a distance of 50 m (164 ft) at 20°C (68°F)
Sensing Distance	0.2...8 m (0.66...26.25 ft) diffuse 0.2...15 m (0.66...49.21 ft) diffuse 0.2...50 m (0.66...164.04 ft) retroreflective
Absolute Accuracy	± 25 mm (± 0.98 in.)
Repeatability	< 5 mm (0.20 in.)
Angle Deviation	± 2° max.
Reference Target	Kodak white (90%)
Temperature Influence	≤ 0.25 mm/K typ.
Electrical	
Operating Voltage	10...30V DC (18...30V DC when operating in IO-Link mode)
Current Consumption	≤70 mA @ 24V DC
Discrete Output Type	1 NPN/PNP output, short-circuit protected, reverse polarity protected
Discrete Output Rating	30V DC max. / 100 mA max.
Analog Output Type	1 analog output 4...20 mA, short-circuit/overload protected
Switching Frequency	50 Hz
Response Time	10 ms
Mechanical	
Housing Material	Plastic ABS
Optical Face Material	Plastic pane
Control Inputs	5-step rotary switch for operating modes selection Push button for set-point teach
LED Indicators	Green: Power Yellow: Output switching states Green/Yellow Flashing 2.5 Hz: Teach indication Green/Yellow Flashing 8.0 Hz: Teach error
Connection Type	4-Pin DC Micro (M12)
Supplied Accessories	None
Environmental	
Operating Environment	IP65
Vibration	10...55 Hz, 0.5 mm amplitude; 3 planes; meets or exceeds IEC 60068-2-6
Shock	30 g; 11 ms; 3 planes: meets or exceeds IEC 60068-2-27
Operating Temperature	-30...50°C (-22...122°F)
Storage Temperature	-30...70°C (-22...158°F)

Interface	
Interface type	IO-Link
Protocol	IO-Link V1.0
Cycle time	Min. 2.3 ms
Mode	COM 2 (38.4 kBaud)
Process data width	16 bit
SIO mode support	Yes

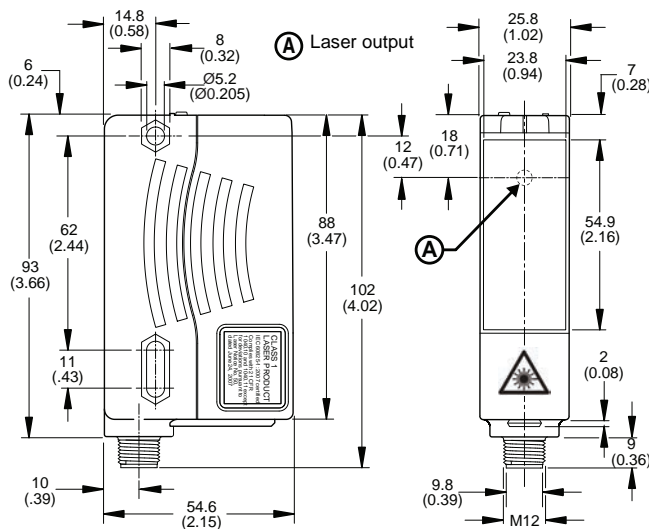


8 m & 50 m MODELS Laser Class 1
15 m MODELS Laser Class 2
DO NOT STARE INTO BEAM

The 8 m & 50 m models of the 45LMS are Class 1 laser products. A Class 1 laser is safe under all conditions of normal use. This means the maximum permissible exposure (MPE) is impossible to exceed.

The 15 m models of the 45LMS are Class 2 laser products. A Class 2 laser is not safe to stare at continuously; however, the blink reflex of the human eye will prevent eye damage, unless the person deliberately stares into the beam for an extended period of time.

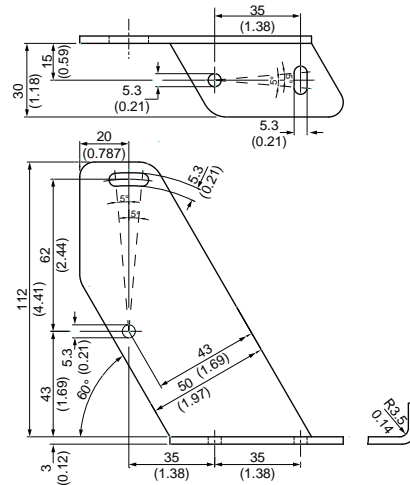
Dimensions [mm (in.)]



Mounting

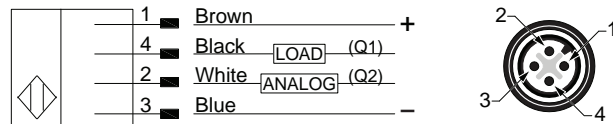
Securely mount the sensor on a firm, stable surface or support for reliable operation. A mounting subject to excessive vibration or shifting may cause intermittent operation. The 45LMS-BKT1 mounting bracket is available for installation convenience. Once securely mounted, the sensor can be wired per the wiring instructions in the next section.

45LMS-BKT1 mounting bracket [mm (in.)]



Wiring

NPN or PNP (Push-Pull)

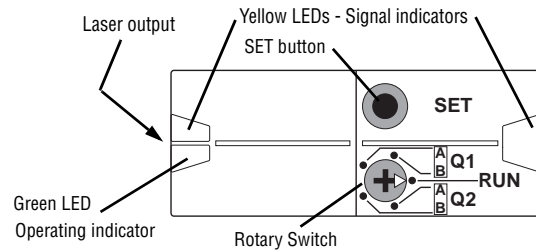


The 45LMS photoelectric sensor is available with a micro quick-disconnect for ease of installation and maintenance.

Rockwell Automation recommends the use of the 889 Series of cordsets and patchcords for quick-disconnect model sensors. All external wiring should conform to the National Electric Code and all applicable local codes.

The 45LMS features a Push-Pull discrete output. This means the outputs always drive either 24V or 0V and can therefore be wired like either an NPN or a PNP sensor.

Controls and indicators



Setting the sensor

The 45LMS is set up using the Rotary Switch and the SET button, and it displays feedback via the Yellow and Green LED indicators on the top of the sensor.

Upon completion of any set-point Teach, both LEDs flash simultaneously, followed by alternating flashing of the LEDs.

- A successful Teach is indicated by a slower alternating flashing (2.5 Hz).
- An unsuccessful Teach is indicated by a faster alternating flashing (8 Hz). After an unsuccessful Teach, the sensor continues to operate with the previous valid setting.

Set-points can be independently taught. For example, set-point Q1-B can be set/re-taught without changing set-point Q1-A.

By pressing the SET button for >5 s when Q1-A, Q1-B or Q2-A is selected with the Rotary Switch, the taught value for that set-point is deleted, leaving the sensor with no value for the set-point that was selected. When you delete Q2-A, the analog output changes to Zero Point mode (see “Zero Point (Positive Slope)” on page 4 for details). Note that the value for Q2-B cannot be deleted, it can only be overwritten.

When switching between discrete sensing modes, it is necessary to delete or teach the set-points for both Q1-A and Q1-B.

IMPORTANT

The remainder of these instructions refer to the 24V state as ON and the 0V state as OFF (PNP). If wired as NPN, the logic is inverted.

Setting the discrete output: Q1

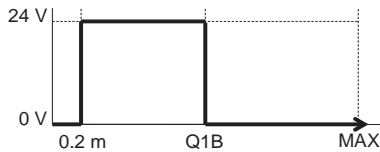
The discrete NPN/PNP output can be set as a switchpoint or switching window as described below.

These instructions were made with the assumption that the sensor is being used for Light Operate and that a PNP output is desired. If the required output is NPN, then refer to the rotary positions listed in the parentheses () throughout the Discrete Output instructions.

IMPORTANT

Please note that when you use the sensor for an NPN output, the Yellow LED will behave opposite to the sensor output. For example, when the NPN output is ON, the Yellow LED will be OFF.

Switch-point and closer



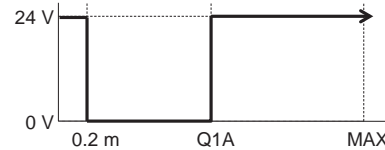
This is the most commonly used mode for object detection with background suppression. If using the sensor for this type of application set the Teach-point at the farthest distance from the sensor that the target will pass.

When using this mode, the sensor output will turn on if it detects an object between 200 mm (8 in.) from the sensor face and up to the Teach-point. For example, if the Teach-point is set at 2 m (6.6 ft), the output would turn on if the sensor detects an object anywhere between 200 mm and 2 m.

1. Place a target at the desired Teach-point, move the Rotary Switch to position Q1-B (Q1-A for NPN).
2. Press and hold the SET button until the Green and Yellow LEDs flash simultaneously¹.
3. If the Teach is successful, move the Rotary Switch to RUN.

¹ After the LEDs flash simultaneously, they flash alternately to indicate whether the Teach was successful:
 Successful: slower alternating flashing (2.5 Hz)
 Unsuccessful: faster alternating flashing (8 Hz).

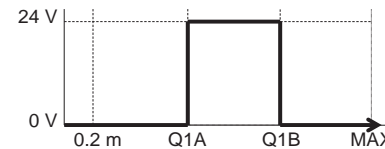
Switch-point and farther



In this mode, the sensor output will turn on if it detects an object at the Teach-point or at any distance farther than the Teach-point up to the maximum range of the sensor. For example, if the Teach-point is at 2 m, the output will turn on if the sensor detects an object anywhere from 2 m to the maximum range.

1. Place a target at the desired Teach-point, move the Rotary Switch to position Q1-A (Q1-B for NPN).
2. Press and hold the SET button until the Green and Yellow LEDs flash simultaneously¹.
3. If the Teach is successful, move the Rotary Switch to RUN.

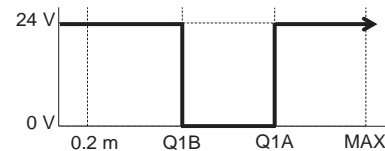
Switching window



When setting the sensor this way, the output will turn on when it detects an object within a window created between two Teach-points. For example, if the Teach-point for Q1-A is set at 2 m, and the Teach-point for Q1-B is set at 3 m, the sensor will turn the output on if it detects an object between 2 and 3 m.

1. Place a target at the closer (relative to the sensor) desired Teach-point, move the Rotary Switch to position Q1-A (Q1-B for NPN).
2. Press and hold the SET button until the Green and Yellow LEDs flash simultaneously¹.
3. Place a target at the farther (relative to the sensor) desired Teach-point, move the Rotary Switch to position Q1-B (Q1-A for NPN).
4. Press and hold the SET button until the Green and Yellow LEDs flash simultaneously¹.
5. If the Teach is successful, move the Rotary Switch to RUN.

Switching window (inverted)



When setting the sensor this way, the output will turn on when there is no object detected within the defined window created between 2 Teach-points. For example, if the Teach-point for Q1-B is set at 2 m, and the Teach-point for Q1-A is set at 3 m, the sensor will remain on as long as there is no object detected between 2 and 3 m.

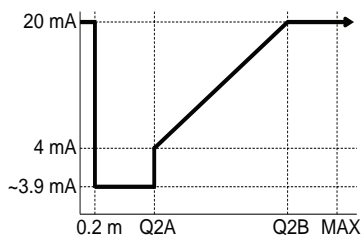
1. Place a target at the closer (relative to the sensor) desired Teach-point, and move the Rotary Switch to position Q1-B (Q1-A for NPN).
2. Press and hold the SET button until the Green and Yellow LEDs flash simultaneously¹.

- Place a target at the farther (relative to the sensor) desired Teach-point, move the Rotary Switch to position Q1-A (Q1-B for NPN).
- Press and hold the SET button until the Green and Yellow LEDs flash simultaneously¹.
- If the Teach is successful, move the Rotary Switch to RUN.

Setting the analog output: Q2

The 4...20 mA output can be defined as any range within 200 mm to the maximum range of the sensor, as either a rising or falling slope, as described below. The default analog output setting for Q2 is A = 200 mm (8 in.) and B = 5,000 mm (16 ft) for all sensor models. Minimum window for setting the analog span is 21 mm (0.83 in.)

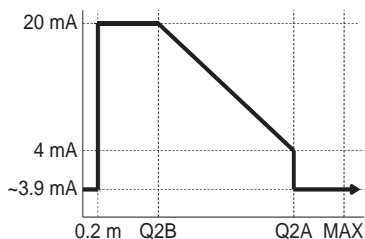
Positive Slope



In the Positive Slope mode (also called Rising Slope) a target positioned at the closer set-point results in an analog output of 4 mA while a target at the farther set-point results in an output of 20 mA, with the analog output scaled linearly in between. In this mode, the sensor will output 20 mA when the target is outside of the operating range, which is 0...200 mm (0...8 in.) and anything greater than the maximum sensing range.

- Place a target at the minimum Teach-point.
- Move the Rotary Switch to position Q2-A.
- Press and hold the SET button until the Green and Yellow LEDs flash simultaneously¹.
- Place a target at the maximum Teach-point.
- Move the Rotary Switch to position Q2-B.
- Press and hold the SET button until the Green and Yellow LEDs flash simultaneously¹.
- If the Teach is successful, move the Rotary Switch to RUN.

Negative Slope

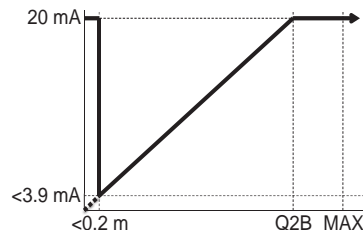


In the Negative Slope mode (also called Falling Slope) a target positioned at the farther set-point results in an analog output of 4 mA while a target at the closer set-point results in an output of

20 mA, with the analog output scaled linearly in between. In this mode, the sensor will output 3.9 mA when the target is outside of the operating range, which is 0...200 mm (0...8 in.) and anything greater than the maximum sensing range.

- Place a target at the maximum Teach-point, and move the Rotary Switch to position Q2-A.
- Press and hold the SET button until the Green and Yellow LEDs flash simultaneously¹.
- Place a target at the minimum Teach-point, move the Rotary Switch to position Q2-B.
- Press and hold the SET button until the Green and Yellow LEDs flash simultaneously¹.
- If the Teach is successful, move the Rotary Switch to RUN.

Zero Point (Positive Slope)



In the Zero Point (Positive Slope) mode a target positioned at the farther set-point (Q2-B) results in an analog output of 20 mA and the analog signal is scaled linearly between 0.0 mm and (Q2-B). This is useful for simplifying the scaling within the PLC or control device. For example, the following equation can be used:

$$D = (D_{Max} / I_{Max}) * I_i$$

where

D = Current distance of target

D_{Max} = set-point distance

I_{Max} = analog range (which is always 20 for the 45LMS)

I_i = current analog output from sensor.

However, even though the analog signal is scaled linearly from 0.0 mm to (Q2-B) it will still provide an analog output of 20 mA when the target is outside of the operating range, which is 0...200 mm (0...8 in.) and anything greater than the maximum sensing range. (This is due to the fact that the 45LMS cannot detect objects between 0...200 mm.)

- Place a target at the maximum Teach-point.
- Move the Rotary Switch to position Q2-B.
- Press and hold the SET button until the Green and Yellow LEDs flash simultaneously¹.
- Move the Rotary Switch to position Q2-A, and delete the set-point [factory default is 200 mm (8 in.)] by pressing and holding the SET button for >5 s. Successful completion is indicated by both LEDs turning off.
- If the Teach is successful, move the Rotary Switch to RUN.

¹ After the LEDs flash simultaneously, they flash alternately to indicate whether the Teach was successful:

Successful: slower alternating flashing (2.5 Hz)

Unsuccessful: faster alternating flashing (8 Hz).

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