

## PHOTOSWITCH Distance Measurement Sensor

Catalog Numbers 45DMS-B8LAT1-D4, 45DMS-B8LGT1-D5

<b>IMPORTANT</b> Save these instructions for future use.	
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### Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

Topic	Page
Updated Features list.	1
Updated the minimum distance between targets in Window Mode with a Positive Slope and Discrete Output Teach in Window Mode with a Negative Slope sections.	3
Updated <a href="#">Figure 4</a> .	3
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Added sections: <ul style="list-style-type: none"> <li>Invert Analog Output (45DMS-B8LGT1-D5 Only)</li> <li>Change Analog Output from Current to Voltage (45DMS-B8LGT1-D5 Only)</li> </ul>	4
Updated Factory Default Settings section.	5
Updated figures: <ul style="list-style-type: none"> <li><a href="#">Figure 7</a></li> <li><a href="#">Figure 8</a></li> <li><a href="#">Figure 12</a></li> </ul>	6
Updated Specifications table.	7

### Description

The PHOTOSWITCH® 45DMS distance measurement photoelectric sensor is a compact, time-of-flight sensor that is ideal for measurement applications in material handling and packaging environments. Background-suppression sensing modes are ideal for applications where highly reflective backgrounds must be ignored while helping to provide excellent reliability detection of targets within the specified range.

The distance measurement sensor also offers a background reflection (also known as foreground suppression) sensing mode that enables you to use the surface of a background (for example, a conveyor) as a reflector. The detection of a target occurs once an object blocks the visual path between the sensor and the background (for example, a conveyor).

### Features

- 5 m (16.4 ft) sensing range to 90% white and 3 m (9.8 ft) sensing range for 6% black target
- 1 mm (0.04 in.) resolution via IO-Link™ and 5 mm (0.2 in.) resolution with 4...20 mA or 0...10V analog output
- ±20 mm (0.79 in.) maximum linearity for distance measurement applications
- Eye Safe Class 1 Laser for ease of alignment and installation
- Distance measurement, background suppression, and background reflection sensing modes selectable using IO-Link
- Discrete only, 4...20 mA and 0...10 V on analog with adjustable range using the push buttons
- Enhanced sensor diagnostics when using IO-Link 1.1 point-to-point protocol helps customers minimize machine downtime and increase productivity
- Additional virtual output when using IO-Link
- IP67 and IP69K rated enclosures

[Table 1](#) provides indicator status in the RUN mode during sensor operation. The sensor is always in Run mode except when the teach sequence is in process.

**Table 1 - Operating Mode Indication**

Function	Status	Description
Q (discrete output)	OFF	Target not present
	Orange	Target present
Q <sub>A</sub> (analog output)	Green	<ul style="list-style-type: none"> <li>Solid: Target not present or analog output not active</li> <li>Flashing: IO-Link operation</li> </ul>
	Orange	Analog output active

## Sensor Configuration

The 45DMS sensor can be configured using the push button, remote teach, or IO-Link with the help of the status indicators on the sensor. The following sensor features can be configured:

- Teach sensing range: standard or precision teach
- Background suppression and background reflection (foreground suppression) sensing modes via IO-Link.
- Light Operate (L.O.) or Dark Operate (D.O.) output
- Auto PNP/NPN, dedicated NPN, or dedicated PNP
- Push button lock and unlock
- Change sensor output from 4...20 mA to 0...10V using IO-Link

**Table 2 - Factory Default Settings**

Description	45DMS-B8LAT1-D4 Settings	45DMS-B8LGT1-D5 Settings
Sensing range	5 m (16.4 ft) to 90% white 3 m (9.4 ft) to 6% black	Q <sub>A</sub> : 0.3...3 m (0.98...9.84 ft) Q: 0.3...3 m (0.98...9.84 ft)
Sensing mode	Background suppression (single point)	Background reflection (window)
Response time	2 ms	

## Teach Procedures for 45DMS-B8LAT1-D4

For standard teach background suppression, teach the sensitivity/sensing range is a two-step process:

- Teach the target (first condition)
- Teach the background (second condition)

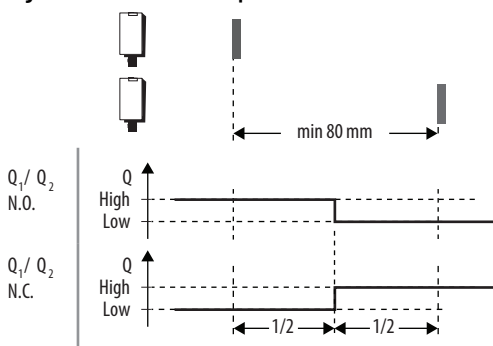
The switching threshold for output ON vs. OFF is set in between the two conditions.

**IMPORTANT** The minimum distance between first target and second target must be at least 80 mm (3.15 in.) of separation.

1. To teach the target (first condition), place the target at the desired distance. Press and hold the push button for 3 seconds until the orange and green status indicators start to flash intermittently. Release the button. The first condition has been taught.
2. To teach the background (second condition), remove the target. Press and release the button. The teach process is complete. The sensor is now configured to detect objects up to the maximum taught distance.

If the push button is not pressed within 30 seconds, the sensor exits the teach mode and returns to the run mode without learning the new setting.

**Figure 1 - Standard Teach Operation**



The sensor can also operate as a background reflection sensor when configured with IO-Link. See publication [45DMS-OR001](#) for more information on how to change the configuration on the sensor to operate from background suppression to background reflection mode.

## Precision Teach for Background Suppression

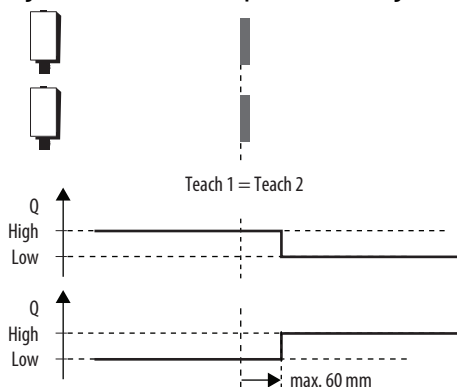
Teach the sensitivity/sensing range on the 45DMS sensor in a two-step process:

1. Teach the target (first condition): Place the target at the desired distance. Press and hold the push button for 3 seconds until the orange and green status indicators start to flash intermittently. Release the button. The first condition has been taught.
2. With the target still in the sensor field of view, press and release the push button. The teach process is complete. The sensor is now configured to detect objects up to the maximum taught distance with a maximum hysteresis of 60 mm (2.36 in.).

**IMPORTANT** The switching threshold for output ON vs. OFF is set with the smallest possible hysteresis be at least 60 mm (2.36 in.) of separation.

If the push button is not pressed within 30 seconds, the sensor exits teach mode and returns to run mode without learning the new setting.

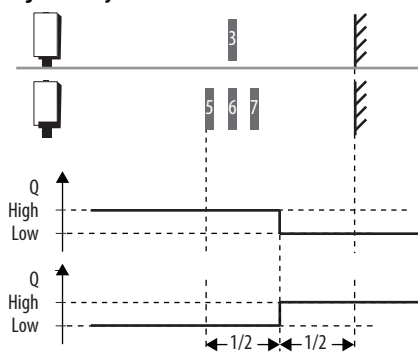
**Figure 2 - Precision Teach Operation for Background Suppression**



## Dynamic Teach (Run Process) - Background Suppression

Focus the sensor on the running process, press and hold the button for 3 seconds until the yellow status indicator starts to flash. The sensitivity is automatically taught in the next 30 seconds provided the sensor sees two cycles of target and no target. The switching threshold for output ON vs. OFF is set in between the two conditions.

**Figure 3 - Dynamic Teach-in**



## Teach Procedures for 45DMS-B8LGT1-D5

The sensor discrete and analog outputs can be programmed with the use of the following two dedicated push buttons on the 45DMS-B8LGT1-D5.

- Q: Configures the discrete output operation window of the sensor
- Q<sub>A</sub>: Configures the analog output to operate in either positive or negative slope

### Window Mode with a Positive Slope

To teach the desired operating window with a positive slope, you must follow a two-step process: teach the near distance to the face of the sensor (first condition) and teach far distance from the face of the sensor (second condition).

**IMPORTANT** The minimum distance between first target and second target must be at least 40 mm (1.57 in.) of separation.

### Teach Discrete Output (Q)

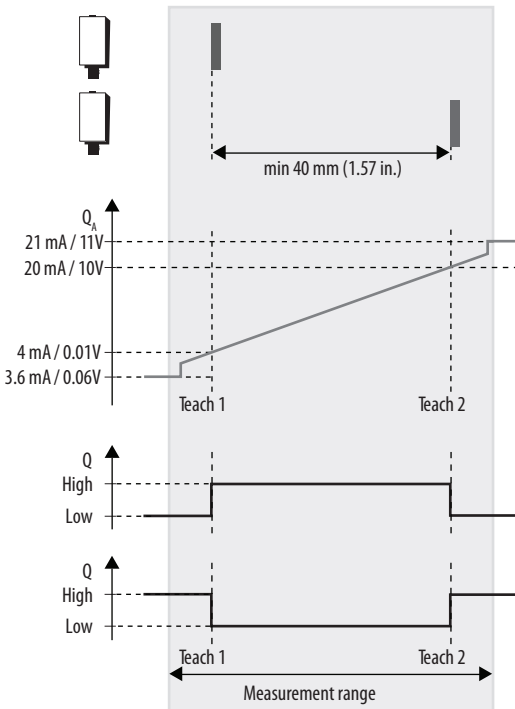
1. Teach near distance (first condition): Place the target at the desired near distance. Press and hold the Q button for 3 seconds until the orange and green status indicator start to flash intermittently. Release the Q button. The first condition has been taught.
2. Teach far distance (second condition): Place the target at the desired far distance. Press and release the Q button. The teach process is complete.

### Teach Analog Output (Q<sub>A</sub>)

1. Teach near distance (first condition): Place the target at the desired near distance. Press and hold the Q<sub>A</sub> button for 3 seconds until the orange and green status indicators start to flash intermittently. Release the Q<sub>A</sub> button. The first condition has been taught.
2. Teach far distance (second condition): Place the target at the desired far distance. Press and release the Q<sub>A</sub> button. The teach process is complete.

If the push button is not pressed within 30 seconds, the sensor exits teach mode and returns to run mode without learning the new setting.

Figure 4 - Discrete Output Teach for Window Mode and Positive Slope



The sensor can also operate as a background suppression sensor when the configuration is with IO-Link.

## Discrete Output Teach in Window Mode with a Negative Slope

To teach the desired operating window with a negative slope, you must follow a two-step process: teach the far distance to the face of the sensor (first condition) and teach the near distance from the face of the sensor (second condition).

**IMPORTANT** The minimum distance between first target and second target must be at least 40 mm (1.57 in.) of separation.

### Teach Discrete Output (Q)

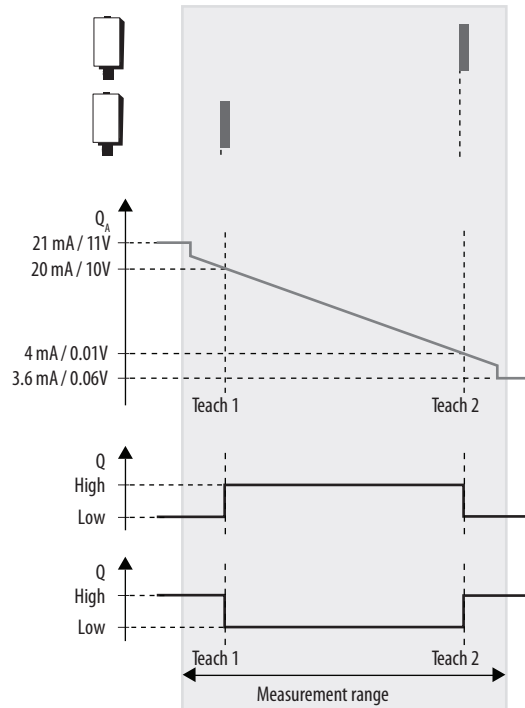
1. Teach far distance (first condition): Place the target at the desired far distance. Press and hold the Q button for 3 seconds until the orange and green status indicators start to flash intermittently. Release the Q button. The first condition has been taught.
2. Teach near distance (second condition): Place the target at the desired near distance. Press and release the Q button. The teach process is complete.

### Teach Analog Output (Q<sub>A</sub>)

1. Teach far distance (first condition): Place the target at the desired far distance. Press and hold the Q<sub>A</sub> button for 3 seconds until the orange and green status indicators start to flash intermittently. Release the Q<sub>A</sub> button. The first condition has been taught.
2. Teach near distance (second condition): Place the target at the desired near distance. Press and release the Q<sub>A</sub> button. The teach process is complete.

If the push button is not pressed within 30 seconds, the sensor exits teach mode and returns to run mode without learning the new setting.

Figure 5 - Discrete Output - Window Mode - Negative Slope



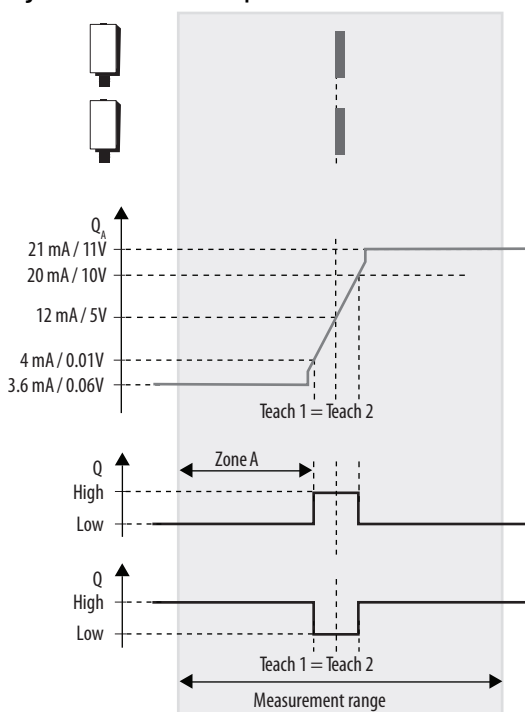
## Background-reflection Mode Precision Teach

The 45DMS sensor requires the equivalent of precision teach (which teaches the background twice) to achieve operation as a background reflection sensor. When operating in background reflection mode, the sensor detects the presence of a target when the optical path between the background and the sensor is interrupted. This sensing mode requires a minimum separation of at least 60 mm (2.35 in.).

1. Teach the target (first condition): Place the target at the desired distance. Press and hold the push button for 3 seconds until the orange and green status indicators start to flash intermittently. Release the button. The first condition has been taught.
2. With the target still in the field of view of the sensor, press and release the push button. The teach process is complete. The sensor is now configured to detect objects up to the maximum taught distance with a maximum hysteresis of 60 mm (2.35 in.).

If the push button is not pressed within 30 seconds, the sensor exits teach mode and returns to run mode without learning the new setting.

Figure 6 - Precision Teach Operation



## Teach the Sensor

Align the sensor to the background. Press and hold the button for 3 seconds until the orange and green status indicators start to flash intermittently. Release the button. Press the button again for less than 1 second. The sensor has been taught.

## Teach Light Operate (L.O.) or Dark Operate (D.O.)

The default setting of the output is light operate (L.O.). The L.O. setting means that output turns ON when the target is detected. If the application requires the output to turn OFF when the target is detected, change the setting to dark operate (D.O.).

### To Access the Teach Output Mode Settings

Press and hold the Q button for 10 seconds until the green status indicator starts to flash. Release the button. The orange status indicator shows the current setting:

- L.O.: Orange status indicator ON
- D.O.: Orange status indicator OFF

### To Change the Sensor Output Mode Setting

Press and release the button for less than 1 second within 10 seconds to toggle from L.O. to D.O., the selection indicated by the orange status indicator.

The sensor retains the setting per the last press of the button and returns to the run mode 10 seconds after the last button press.

## Invert Analog Output (45DMS-B8LGT1-D5 Only)

The default setting of the analog output  $Q_A$  is Positive Slope, which means that the analog value for the near distance starts at 4 mA/0.1V while the far distance ends at 20mA/10V. If the application requires a Negative Slope, the analog near distance starts at 20mA/10V while the analog far distance ends at 4 mA/0.1V

To invert the analog output, follow these steps:

1. Press and hold the  $Q_A$  button for 10 seconds until the green and orange status indicators start to flash asynchronously. Release the button.  
The orange status indicator shows the current setting:
  - Green status indicator flashing: Positive slope
  - Orange status indicator: Solid ON
2. To Invert the Analog Output, press and release the  $Q_A$  button for less than 1 second within 10 seconds to toggle from Positive Slope to Negative Slope, the selection indicated by the orange status indicator. The orange status indicator is OFF when negative slope is selected.
3. The sensor retains the setting per the last press of the button and returns to the run mode 10 seconds after the last button press.

## Change Analog Output from Current to Voltage (45DMS-B8LGT1-D5 Only)

The default setting of the analog output  $Q_A$  is analog current 4...20mA. If the application requires analog voltage, you can change the analog output to operate from 0...10V by following these steps:

1. Press and hold the  $Q_A$  button for 13 seconds until the green and orange status indicators start to flash simultaneously. Release the button.  
The orange status indicator shows the current setting:
  - Orange status indicator flashing: Current output
  - Green status indicator: OFF
2. To change the analog output to 0...10V, press and release the button for less than 1 second within 10 seconds to toggle from 4...20 mA to 0...10V, the selection indicated by the orange status indicator. The orange status indicator flashes green when analog voltage is selected.
3. The sensor retains the setting per the last press of the button and returns to the run mode 10 seconds after the last button press.

## Output Type Selection: Auto PNP/NPN, Dedicated NPN, Dedicated PNP

The default setting is Auto PNP/NPN. The sensor monitors the load connection and automatically configures for the proper operation, for example, PNP or NPN. If no load is connected, the sensor defaults to PNP.

The following applications are covered with dedicated PNP or dedicated NPN selection.

1. Parallel wiring of multiple sensor outputs: select dedicated PNP or dedicated NPN setting, as needed.
2. Select dedicated NPN if the load is connected to another power supply than the power used for the sensor.

Selection can be made as follows.

1. To access output type: Press and hold the Q push button for 12 seconds (until both status indicators start to flash synchronously). At the release of the button, the slow flash of the status indicators shows the current setting of the output type as follows:
  - Auto PNP/NPN: Both status indicators flash (synchronously)
  - Dedicated NPN: Green status indicator flashes
  - Dedicated PNP: Orange status indicator flashes
2. To change output type: To select desired type, press and release the push button within 10 seconds. Each press of the button cycles to the next output setting. The status indicators show the type that is selected. The sensor retains the setting per the last press of the button and returns to the run mode 10 seconds after the last button press.

## Push Button Lock/Unlock

The push button or remote teach (RT) can be used to stop unauthorized users from changing teach settings.

### Permanent Lock

The push button is permanently locked by connecting the white wire (pin 2) to -V. To unlock the push button, disconnect the white wire (pin 2) on the catalog number 45DMS-B8LAT1-D4 sensor or the gray wire (pin 5) on the catalog number 45DMS-B8LGT1-D5 sensor.

## Remote Teach (RT)

The sensor can be taught remotely via the gray wire (pin 5). Connection to -V acts the same as the button being pressed and no connection is the same as the button not being pressed. The sensor can be taught by following the same teach/timing sequence as used in the push button teach. For example:

1. Connect to the +V for more than 3 seconds to teach the target.
2. Disconnect from the +V.
3. Remove the target and connect to the -V for less than 1 second to teach the second condition. See [Teach the Sensor on page 4](#) for additional information.

All push button functions can be implemented via Remote Teach.

## Factory Default Settings

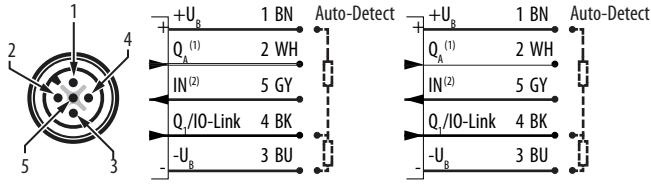
To reset the sensor configuration to the factory default settings, you must perform the following steps:

1. Remove power to the sensor by unplugging the cordset.
2. Press and hold any button (Q or Q<sub>A</sub>).
3. Plug in the cordset that provides power to the sensor. The green and orange status indicators flash simultaneously. Keep the Q or Q<sub>A</sub> button pressed for at least 10 seconds until both status indicators start to flash faster.
4. Release the Q or Q<sub>A</sub> push button. The sensor is now set with the factory default settings.

## Wiring Diagrams

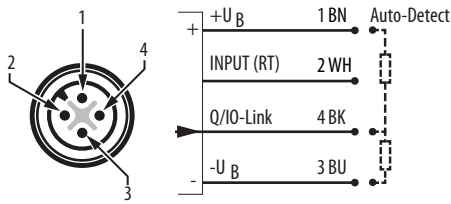
The quick-disconnect connector is shown [Figure 7](#). The pin numbers correspond to the male connectors on the sensor.

**Figure 7 - Integral M12 QD (5-pin) - Cat. No. 45DMS-B8LGT1-D5**

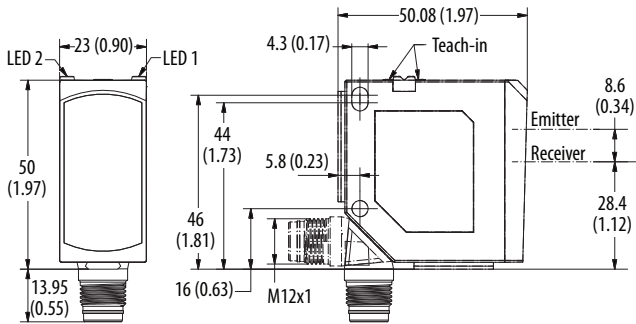


- (1) 4...20 mA or 0...10V
- (2) Remote teach

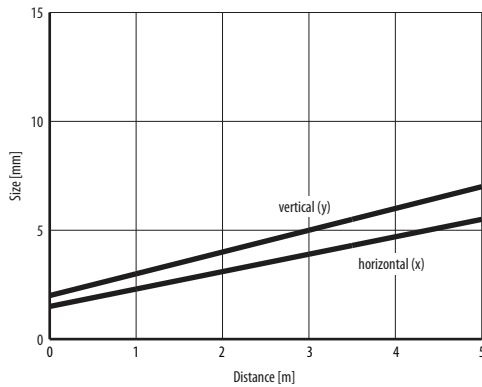
**Figure 8 - Integral M12 QD (4-pin) - Cat. No. 45DMS-B8LAT1-D4**



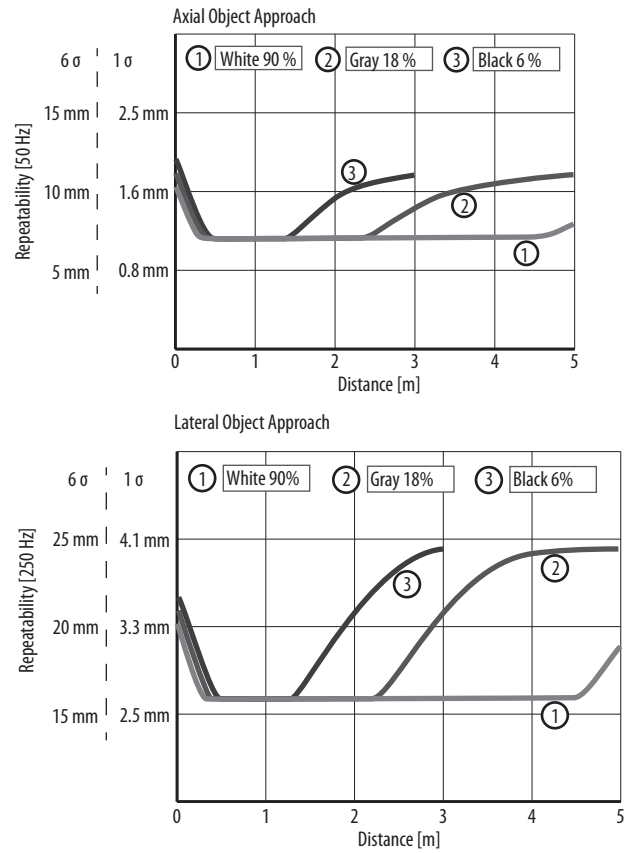
**Figure 9 - Approximate Dimensions [mm (in.)]**



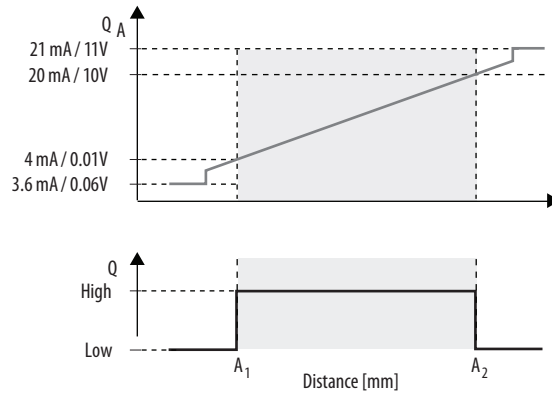
**Figure 10 - Light Spot Size Curve**



**Figure 11 - Sensor Repeatability Curve**



**Figure 12 - Characteristic Analog Curve**



## Specifications

<b>Attribute</b>	<b>45DMS-B8LAT1-D4, 45DMS-B8LGT1-D5</b>
Certifications	c-UL-us and CE marked for all applicable directives
Vibration	10...55 Hz, 1 mm (0.04 in.) amplitude, meets or exceeds IEC 60947-5-2
Shock	30 g with 1 m (3.28 ft), meets or exceeds IEC 60947-5-2
MTTF	<ul style="list-style-type: none"> <li>45DMS-B8LGT1-D5: 158 years</li> <li>45DMS-B8LAT1-D4: 187 years</li> </ul>
Warm-up time	20 min
<b>User Interface</b>	
Status indicators	<ul style="list-style-type: none"> <li>Q: Green Discrete Output</li> <li>Q<sub>A</sub>: Orange Output</li> </ul>
<b>Optical</b>	
Sensing range	<ul style="list-style-type: none"> <li>45DMS-B8LGT1-D5: 0.1...5 m (0.33...16.4 ft)</li> <li>45DMS-B8LAT1-D4: 0.06...5 m (0.33...16.4 ft)</li> </ul>
Resolution	<ul style="list-style-type: none"> <li>Analog: &lt;5 mm (0.2 in.)</li> <li>IO-Link: 1.2 mm (0.05 in.)</li> </ul>
Linearity	±20 mm (0.79 in.)
Repeatability	1.2 mm (0.05 in.)
Hysteresis	20 mm (0.79 in.)
Laser type (IEC 60825-1)	Class 1 Eye Safe Laser (wavelength: 655 nm; frequency: 62.5 kHz; pulse duration: 4 ns; limit value pulse: <1.56 W)
<b>Electrical</b>	
Adjustments	Teachable using push buttons or remote teach (5-pin models)
Voltage	18...30V DC
Current consumption, max	60 mA
Sensor protection	<ul style="list-style-type: none"> <li>Reverse polarity</li> <li>Short circuit</li> </ul>
<b>Discrete Output</b>	
Response time	2 ms for both Q and Q <sub>A</sub>
Output type	Auto PNP or NPN on power-up
Load current, max	100 mA
<b>Analog Output</b>	
Range	4...20 mA (default) or 0...10 V (configurable with IO-Link)
Update rate	2 ms
Load	<500 Ω (4...20 mA); more than 4k Ω (0...10 V)
Temperature drift	<1 mm (0.04 in.)/K
<b>IO-Link</b>	
Communications mode	COM2
Cycle time, min	2.7 ms
Process data bit length	24 bits (3 bytes)
Specifications	1.1
<b>Mechanical</b>	
Housing material	ABS
Lens material	PMMA
<b>Environmental</b>	
Enclosure type rating	IP67 and IP69K
Operating temperature	-40...+ 60 °C (-40...+140 °F)
Connection type	270° rotatable integral M12 QD

## Description of Laser Class

### Class I Laser Product

Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.



### Caution. Do not disassemble for repair.

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

## Rockwell Automation Support

Use these resources to access support information.

<b>Technical Support Center</b>	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	<a href="http://rok.auto/support">rok.auto/support</a>
<b>Knowledgebase</b>	Access Knowledgebase articles.	<a href="http://rok.auto/knowledgebase">rok.auto/knowledgebase</a>
<b>Local Technical Support Phone Numbers</b>	Locate the telephone number for your country.	<a href="http://rok.auto/phonesupport">rok.auto/phonesupport</a>
<b>Literature Library</b>	Find installation instructions, manuals, brochures, and technical data publications.	<a href="http://rok.auto/literature">rok.auto/literature</a>
<b>Product Compatibility and Download Center (PCDC)</b>	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	<a href="http://rok.auto/pcdc">rok.auto/pcdc</a>

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