Allen-Bradley

PHOTOSWITCH Distance Measurement Sensor

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

IMPORTANT	Save these instructions for future use.

Description

The PHOTOSWITCH® 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 operators 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
- ± 30 mm (1.18 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
- IP69K rated enclosure

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_A (Analog Output)	Green	Solid: Target not present or analog output not active Blinking: IO-Link operation
	Orange	Analog output active

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Sensor Configuration

The Bulletin 45DMS 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 (a.k.a. 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_A: 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) and
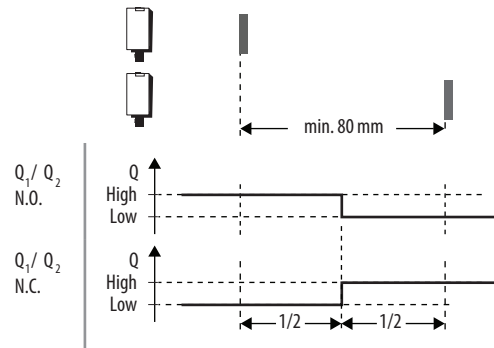- Teach the background (second condition).

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 three seconds until the orange and green indicators start blinking 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 via IO-Link. See the 45DMS IO-Link user manual for more information on how to change the configuration on the sensor to operate from background suppression to background reflection mode.
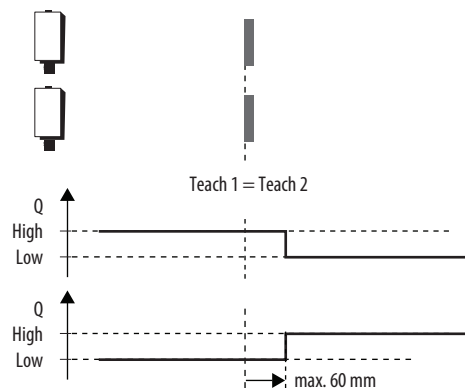
Precision Teach for Background Suppression

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 three seconds until the orange and green indicator start blinking 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.
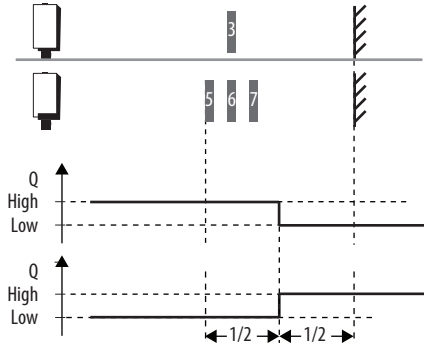
Figure 2 - Precision Teach Operation for Background Suppression

Dynamic Teach (Run Process) - Background Suppression

Focus the sensor on the running process, press and hold the button for three seconds until the yellow light-emitting diode (LED) starts flashing. 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 two dedicated push buttons on the 45DMS-B8LGT1-D5. These buttons are:

- Q – Configures the discrete output operation window of the sensor
- Q_A – 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, the operator 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 80 mm (3.15 in.) of separation.
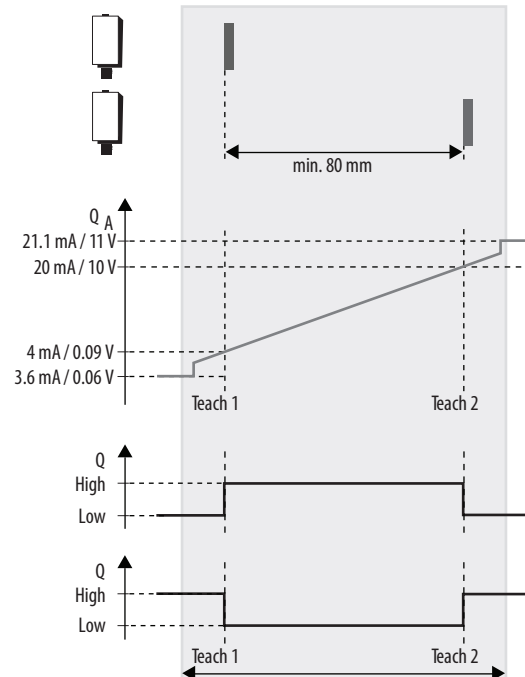
Teach Discrete Output (Q)

1. Teach near distance (first condition): Place the target at the desired near distance. Press and hold the Q button for three seconds until the orange and green indicator start blinking intermittently. Release the 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 button. The teach process is complete.

Teach Analog Output (Q_A)

1. Teach near distance (first condition): Place the target at the desired near distance. Press and hold the Q_A button for three seconds until the orange and green indicator start blinking intermittently. Release the 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 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 configurator is via IO-Link.

Discrete Output Teach in Window Mode with a Negative Slope

To teach the desired operating window with a negative slope, the operator 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 80 mm (3.15 in.) of separation.
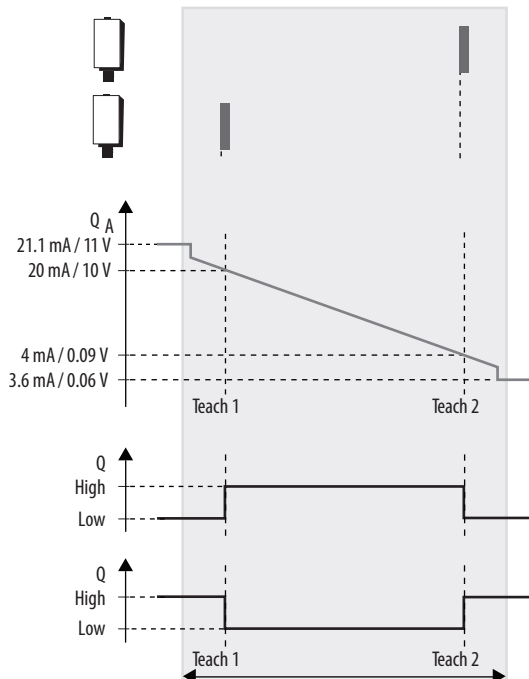
Teach Discrete Output (Q)

1. Teach far distance (first condition): Place the target at the desired far distance. Press and hold the Q button for three seconds until the orange and green indicator start blinking intermittently. Release the 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 button. The teach process is complete.

Teach Analog Output (Q$_A$)

1. Teach far distance (first condition): Place the target at the desired far distance. Press and hold the Q$_A$ button for three seconds until the orange and green indicator start blinking intermittently. Release the 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 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.

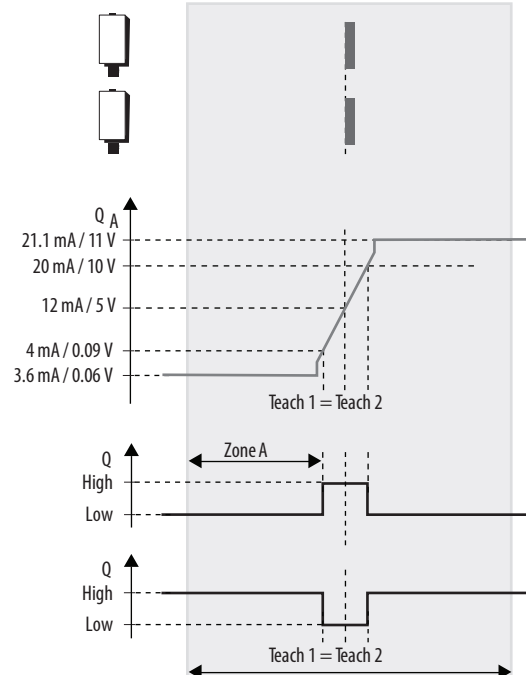**Figure 5 - Discrete Output – Window Mode – Negative Slope**

Background-reflection Mode Precision Teach

The 45DMS 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 three seconds until the orange and green indicator start blinking 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 three seconds until the orange and green indicator start blinking intermittently. Release the button. Press the button again for less than one 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 button for 10 seconds until the green indicator starts flashing. Release the button. The orange indicator shows the current setting:

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

The sensor retains the setting per the last button depression and returns to the run mode 10 seconds after the last button is depressed.

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 push button for 12 seconds (until both indicators start flashing synchronously). At the release of the button, the slow flashing of the indicator (or indicators) shows the current setting of the output type as follows:

    a. Auto PNP/NPN: Both indicators flashing (synchronously)

    b. Dedicated NPN: Green indicator flashing

    c. Dedicated PNP: Orange indicator flashing

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 indicators show the type that is selected. The sensor retains the setting per the last button depression and returns to the run mode 10 seconds after the last button is pressed.

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:

- Connect to the +V for more than three seconds to teach the "target,"

- Disconnect from the +V,

- Remove the target and connect to the -V for less than one second to teach the second condition. See 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, the operator has to perform the following steps:

1. Remove power to the unit by unplugging the cordset

2. Press the Q or Q_A buttons

3. With the Q or Q_A buttons pressed, plug in the cordset that provides power to the sensor. Keep the button pressed for at least 10 seconds until both LEDs on the unit blink simultaneously 3 times.

Wiring Diagrams

The quick-disconnect connector is shown . The pin numbers correspond to the male connectors on the sensor.

Figure 7 - Micro (M12) Male QD Pigtail/Male QD (5-pin)

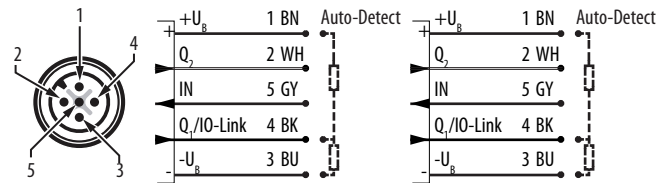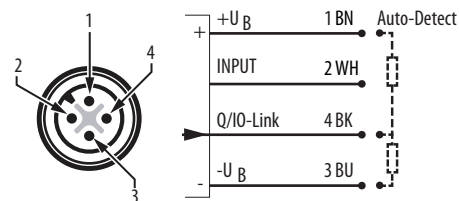**Figure 8 - Micro (M12) Male QD Pigtail/Male QD (4-pin)**

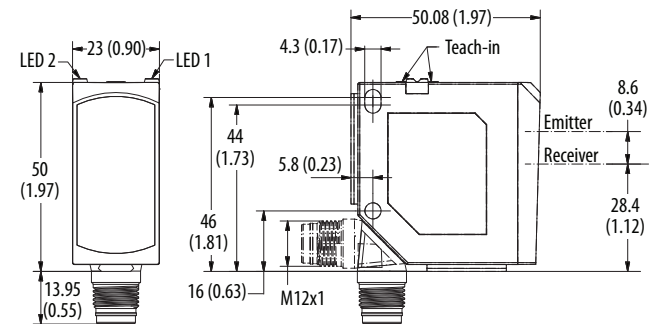**Figure 9 - Approximate Dimensions [mm (in.)]**
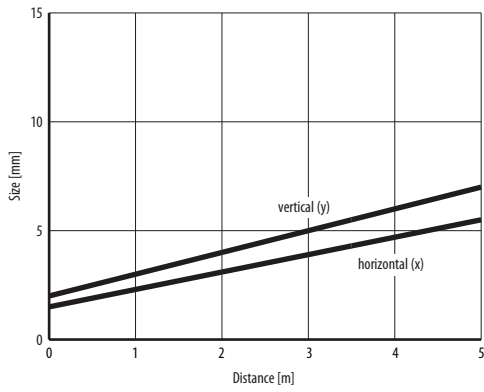
Figure 10 - Light Spot Size Curve

Figure 12 - Characteristic Analog Curve

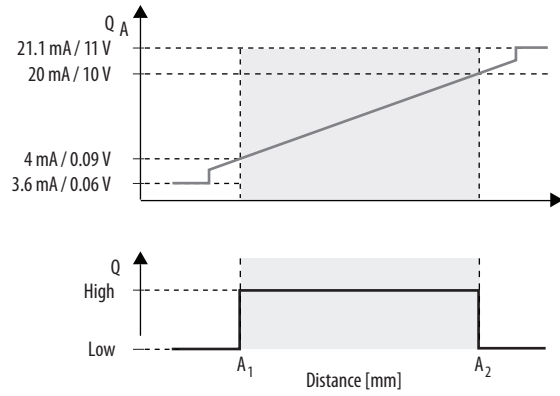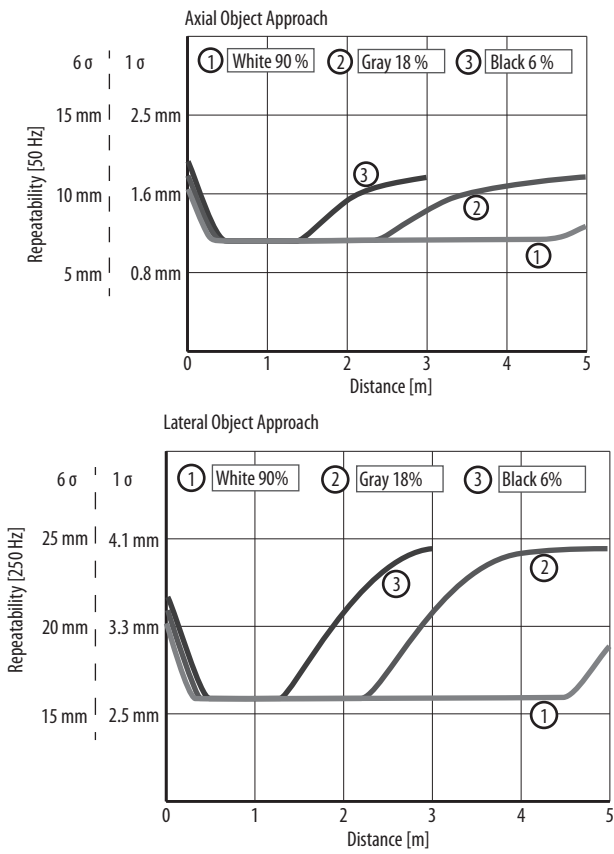**Figure 11 - Sensor Repeatability Curve**

Specifications

Attribute	45DMS-B8LAT1-D4, 45DMS-B8LGT1-D5
Certifications	c-UL-us and CE marked for all applicable directives
Vibration	10…55 Hz, 1 mm (0.04 in.) amplitude, meets or exceeds 60947-5-2
Shock	30 g with 1 m (3.28 ft), meets or exceeds IEC 60947-5-2
Warm-up time	20 min.
User Interface	
Status indicators	Q: Green Discrete Output; Q_A: Orange Output
Optical	
Sensing range	45DMS-B8LGT1-D5 – 0.1…5 m (0.33…16.4 ft) 45DMS-B8LAT1-D4 – 0.06…5 m (0.33…16.4 ft)
Resolution	Analog: Less than 5 mm (0.2 in.); IO-Link: 1.2 mm (0.05 in.)
Linearity	+/- 30 mm (1.18 in.)
Repeatability	1.2 mm (0.05 in.)
Hysteresis	20 mm (0.79 in.)
Laser type (IEC 60825-1)	Class 1 Eye Safe Laser
Electrical	
Adjustments	Teachable using push buttons or remote teach (5-pin models)
Voltage	18…30V DC
Current consumption	60 mA max.
Sensor protection	Reverse polarity and short circuit.
Discrete Output	
Response time	2 ms for both Q and Q_A
Output type	Auto PNP or NPN on power-up
Load current	100 mA max
Analog Output	
Range	4…20 mA (default) or 0…10 V (configurable using IO-Link)
Update rate	2 ms
Load	Less than 500 Ohms (4…20 mA); More than 4k Ohm (0…10 V)
Temperature drift	Less than 2 mm (0.08 in.)/K
IO-Link	
Communications mode	COM2
Cycle time	2.7 ms, min
Process data bit length	24 bits (3 bytes)
Specifications	1.1
Mechanical	
Housing material	ABS
Lens material	PMMA
Environmental	
Enclosure type rating	IP67 and IP69K rated enclosure
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 the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

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Waste Electrical and Electronic Equipment (WEEE)

At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental information on its website at
http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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