

45DMS Distance Measurement — IO-Link Reference

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

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Description

This quick reference includes IO-Link parameters that are offered in our distance measurement sensor (catalog numbers 45DMS-B8LAT1-D4 and 45DMS-B8LGT1-D5). These parameters can be accessed from any IO-Link 1.1 compliant master.

IO-Link Features

- Sensor heartbeat feature helps to improve reliability operation by indicating to the PLC if a sensor has lost connectivity due to failure or faulty wiring.
- Change from Background Suppression to Background Reflection sensing modes for added application flexibility.
- Measured Distance in millimeters minimizes the need to translate the measured data to user readable units.
- Averaging Filter function stabilizes the signal to provide a more constant measurement in the application.
- Signal Strength indicates the reflectivity level of the target that's being measured.
- Virtual output available only using IO-Link, enables operators to control additional parameters of the application without the need of an additional sensor.
- Counter, Timers and Monitoring Frequency parameters enable operators to add ON delay, OFF delay on the output behavior.
- Two Process Data Maps enable operators to use the continuous parameters best suited for the application.
- Ability to change the 4...20 mA to 0...10V DC on the analog output model.

Communication Parameters

Specifications	45DMS-B8LAT1-D4, 45DMS-B8LGT1-D5
IO-Link Revision	V1.1
Process Data In Length	24 bits (3 bytes)
Process Data Out Length	Not available
Communication Mode	COM 2 (38.4 kbps)
Minimum Cycle Time	2.7 ms
Vendor ID	2 (0x02)
Device ID	228: 45DMS-B8LAT1-D4 230: 45DMS-B8LGT1-D5
SIO mode	Supported
Data storage	Supported

Process Data In (Continuous Data)

Process Data In is transmitted cyclically to the IO-Link master from the IO-Link device.

The Bulletin 45DMS distance measurement sensor Process Data is 24 bits and includes the measurement distance, the signal strength, and the state of the sensors outputs. This information is sent to the IO-Link master every 2.7 ms.

Table 1 - Process Data Map 0 — Distance, Signal Quality

Byte 0								Byte 1								Byte 2							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
MSB D7	D6	D5	D4	D3	D2	D1	LSB D0	MSB D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	LSB D0
Signal quality 0 ... 100 %								Distance in mm - adjustable															

Table 2 - Process Data Map 1 — Triggered1, Triggered2, SignalQualityScore, Distance, SignalQuality

Byte 0								Byte 1								Byte 2							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
MSB D7	D6	D5	D4	D3	D2	D1	LSB D0	MSB D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	LSB D0	SignalQualityScore	Triggered2	Triggered1
Signal Quality 0 ... 100%								Distance in mm – non-adjustable															
Signal Quality Score - adjustable via index 196(0xC4)																							
Triggered 2 – Virtual sensor output																							
Triggered 1 – Operates the same as the discrete output in SIO mode.																							

Table 3 - Identification Tab

Index(Dec/Hex)	Access	Data	Length	Sub-Index	Description	Information
16 / 0x10	Read Only	String	64 bytes		Vendor Name	Allen-Bradley
18 / 0x12	Read Only	String	64 bytes		Product Name	45DMS-B8LAT1-D4/ 45DMS-B8LGT1-D5
20 / 0x14	Read Only	String	64 bytes		Product Text	Distance Measurement Sensor
19 / 0x13	Read Only	String	64 bytes		Product ID	PN-485482/ PN-485484
21 / 0x15	Read Only	String	64 bytes		Serial Number	1837-000016
User Specific Information						
24/0x18	Read/Write	String	32 bytes		Application Specific Tag	45DMS
Revision Information						
22 / 0x16	Read Only	String	32 bytes		Hardware Revision	1.0
23 / 0x17	Read Only	String	32 bytes		Firmware Revision	1.0

Parameter Definitions:

Signal Quality: Display the current signal value reflected from the target under the current measurement

Table 4 - Observation Tab

Index(Dec/Hex)	Access	Data	Length	Sub-Index	Description	Range	Default Value
Device Monitoring							
207 / 0xCF	Read Only	UInteger	8 bits		Signal Quality	0 – 100 %	N/A

Parameter Definitions

Signal Quality Value: This parameter reflects the strength of the return signal reflected from the target. The range for this value is between 0...100%. Darker targets will reflect a value closer to 0 while highly reflective targets will reflect a number closer to 100%.

Distance: Displays the measured distance in mm. This parameter operates differently in Process Data Map 0 and Process Data Map 1.

- **Process Data Map 0:** The measured distance can be modified using asynchronous parameters. For example, teaching the offset value or changing the averaging filter value to improve the distance measurement.
- **Process Data Map 1:** The measured distance cannot be modified using asynchronous parameters. None of the asynchronous parameters will modify the measured distance of the sensor.

Signal Quality Score: This parameter can be used to indicate if the signal strength is higher or lower than a defined threshold in index 196 (0xC4). This parameter helps operators detect a reflectivity of a target that may affect the measurement or impact the detection.

Triggered 1: This parameter performs the same operation as the discrete output when operating in IO-Link.

Triggered 2: This parameter is a virtual output that can be enabled to provide another discrete detection point. The operation of this output is disabled by default.

Process Data Out (Continuous Data)

Not applicable.

Parameter Data (Asynchronous Data)

These parameters can be read from and/or written to an IO-Link device. Unlike Process Data In, which is transmitted from the IO-Link device to the IO-Link master cyclically, these parameters are read or written on-request with the use of message instructions.

Parameter Definitions

Vendor Name: Provides the vendor name of the product.

Product Name: Displays the product catalog number

Product Text: Provides a brief description of the sensor

Product ID: Provides the ordering part number of the sensor

Serial Number: Displays the serial number of the unit following the YYWW-NNNNNN format. YY refers to the year the unit was manufactured while WW refers to the week. NNNNNN refers to the individual unit manufactured that week.

Application Specific Tag: This parameter allows operators to assign a value to describe the sensor in the application. For example, “roll level sensor.” When used in the RA AOP, this value shall not be empty as it could cause a loss in communications.

Hardware Revision: Defines the hardware revision of the sensor.

Firmware Revision: Defines the firmware revision of the sensor.

Static Teach Parameter Definitions

This section captures the static teach procedure of Bulletin 45DMS. The steps below show you how to teach the sensor.

1. Place the target in front of the sensor and send the command to “Static Teach – Show Target” (index: 67). Note that the Teach Channel Status, index 59 will change state once the process has been initiated.
2. Show the background where the target will be present and then send the command “Static Teach – Show Background” (index: 68).
3. To complete the static teach procedure you must send the “Teach Apply” (index: 64) command.

To cancel the procedure you can send the “Teach Cancel” (index: 79) command at any point.

Precision Teach Parameter Definitions

This section captures the precision teach procedure of Bulletin 45DMS. The steps below show you how to teach the sensor.

1. Place the target in front of the sensor and send the command to “Precision Teach – Show Target” (index: 65). Notice that the Teach Channel Status, index 59 will change state once the process has been initiated.
2. To complete the precision teach procedure you must send the “Teach Apply” (index: 64) command.

To cancel the procedure, you can send the “Teach Cancel” (index: 79) command at any point after the teach procedure has been initiated.

Dynamic Teach Parameter Definitions

This section captures the dynamic teach procedure of Bulletin 45DMS. The steps below show you how to teach the sensor.

1. With the sensor looking at the running process send the “Dynamic Teach-Start” (index: 71). Notice that the Teach Channel Status, index 59 will change state once the process has been initiated.
2. With the sensor field of view continuing to be focused on the running process, send the command “Dynamic Teach-Stop” (index: 72).
3. To complete the static teach procedure you must send the “Teach Apply” (index: 64) command.

To cancel the procedure you can send the “Teach Cancel” (index: 79) command at any point.

Table 5 - Parameter Tab

Index(Dec/Hex)	Access	Data Type	Length	Sub-Index		Description	Range Values	Default Value
Teach-In Operation								
Static Teach								
2 / 0x02	Write Only	UInteger	8 bit			Static Teach – Show Target	67 / 0x43	
2 / 0x02	Write Only	UInteger	8 bit			Static Teach – Show Background	68 / 0x44	
Precision Teach								
2 / 0x02	Write Only	UInteger	8 bit			Precision Teach – Show Target	65 / x041	
Dynamic Teach								
2 / 0x02	Write Only	UInteger	8 bit			Dynamic Teach – Start	71 / 0x47	
2 / 0x02	Write Only	UInteger	8 bit			Dynamic Teach – Stop	72 / 0x48	
Teach (Static, Precision, Dynamic)								
58 / 0x3a	Read /Write	UInteger	8 bit			Teach Channel	0 or 1 : Triggered1 2 : Triggered 2	Triggered1
2 / 0x02	Write Only	UInteger	8 bit			Teach Apply	64 / 0x40	
2 / 0x02	Write Only	UInteger	8 bit			Teach Cancel	79 / 0x4F	
59 / 0x3b	Read Only	UInteger	8 bit	1		Teach Status	See Definition	
Operation Configuration								
Triggered 1								
60 / 0x3c	Read/Write	UInteger	16 bit	1		Triggered1.Switchpoint 1	45DMS-B8LAT1-D4: 60...5000 45DMS-B8LGT1-D5: 100...5000	3000
	Read/Write	UInteger	16 bit	2		Triggered1.Switchpoint 2	60...5000	3100
213 / 0xD5	Read/Write	UInteger	8 bit	1		Type	0 - NPN 1 - PNP 2 - Auto PNP/NPN	2 - Auto PNP/NPN.
61 / 0x3d	Read/Write	UInteger	8 bit	1		Polarity	0 – Not Inverted 1 – Inverted	0 – Not Inverted
	Read/Write	UInteger	8 bit	2		Mode	0 - Disabled 1 – Hysteresis 2 – Window 3 – Adjustable Hysteresis	1 – Hysteresis
208 / 0xD0	Read/Write	UInteger	16 bit	1		Counter	0...65535 ms	0
				2		On Delay	0...65535 ms	0
				3		Off Delay	0...65535 ms	0
				4		One Shot	0...65535 ms	0
				5		Frequency Monitor	0...50 hertz	0
Triggered 2 (Virtual)								
62 / 0x3E	Read/Write	UInteger	16 bit	1		Triggered2.Switchpoint 1	45DMS-B8LAT1-D4: 60...5000 45DMS-B8LGT1-D5: 100...5000	3000
	Read/Write	UInteger	16 bit	2		Triggered2.Switchpoint 2	45DMS-B8LAT1-D4: 60...5000 45DMS-B8LGT1-D5: 100...5000	3100
63 / 0x3F	Read/Write	UInteger	8 bit	1		Polarity	Not Inverted Inverted	Not Inverted
	Read/Write	UInteger	8 bit	2		Mode	0 – Disabled 1 – Background Suppression 2 – Background Reflection 3 – Adjustable Hysteresis	0 – Disabled
209 / 0xD1	Read/Write	UInteger	16 bit	1		Counter	0...65535 ms	0
				2		On Delay	0...65535 ms	0
				3		Off Delay	0...65535 ms	0
				4		One Shot	0...65535 ms	0
				5		Frequency Monitor	0...50 Hz	0

Index(Dec/Hex)	Access	Data Type	Length	Sub-Index		Description	Range Values	Default Value
Analog (only available on Cat. No. 45DMS-B5LGT1-D5)								
194/0xC2	Read/Write	UInteger	8 bit	1		Signal Type	0...0...10V DC	
	Read/Write	UInteger	16 bit	2		Start Measurement Range	100...5000	300 mm
	Read/Write	UInteger	16 bit	3		End Measurement Range	100...5000	3000 mm
Sensor Configuration								
185 / 0xC3	Read / Write	UInteger	8 bit			Measurement Mode	0 – Negative Slope 1 – Positive Slope	1 – Positive Slope
189 / 0xBD	Read / Write	UInteger	8 bit			Averaging Filter	0 - 10	0 - Disabled
193 / 0xC1	Read / Write	Integer	16 bit			Offset	-5000 ... 5000 mm	0
2 / 0x02	Write Only	UInteger	8 bit			Teach Offset	224 / 0xE0	
196 / 0xC4	Read/Write	UInteger	8 bit			Signal Quality Level	10...90	10
221 / 0xDD	Read/Write	UInteger	16 bit			Pin 2 Input	0 – Pin 2 Input Disabled 1 – Pin 2 Input Enabled	1 – Pin 2 Input Enabled
Data Mapping Configuration								
202 / 0xCA	Read/Write	UInteger	8 bit			Process Data Mapping	0 – Process Data 0 1 – Process Data 1	0 – Process Data 0

Teach Channel Parameter Definitions

This parameter selects the desired teach channel where the static, precision, or dynamic teach procedures will be implemented. This can either be Triggered1 or Triggered 2.

The Triggered1 section captures the values that control the behavior of Triggered1 Output.

Triggered1.Switchpoint 1 defines the first set point value for Triggered1. This parameter can accept values between 60 and 5000 and is expressed in mm. The default value for this parameter is 3000.

Triggered1.Switchpoint 2 defines the second set point value for Triggered1. This parameter can accept values between 60 and 5000 and is expressed in mm. The default value for this parameter is 3100.

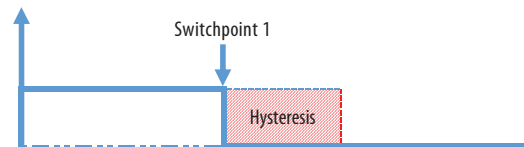
The Type defines the desired output type for Triggered 1. The available options for this parameter are Auto PNP/NPN, NPN only or PNP only.

The Polarity defines the desired polarity for Triggered 1. This value can either be Light Operate or Dark Operate. Light Operate means that the output will turn ON when the target is within the expected set points. Dark Operate means that the output will turn OFF when the target is within the expected set points.

The Mode defines the desired output mode for Triggered 1. These modes can be background suppression (hysteresis), background reflection, and adjustable hysteresis. The follow text defines each one of this modes.

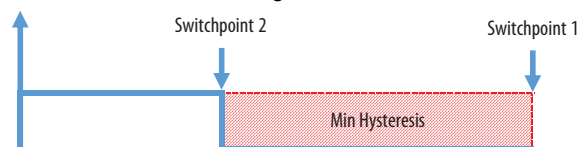
- The Background Suppression (Hysteresis) mode uses the value of switch point 1 to determine when the output will be ON or OFF depending on the Polarity setting. For this setting, the sensor will only detect objects between the minimum distance and the set point distance. Any higher reflectivity objects will be ignored beyond this point. For example, if the value for Switch point 1 is set at 1000 mm (1 m) any object beyond this distance will be ignored.

Figure 1 - Hysteresis Mode — Background Suppression



- The Background Reflection (Window) mode uses the values of switch point 1 and switch point 2 to determine when the output will be ON or OFF depending on the polarity settings. Only objects between switch point 1 and switch point 2 will be detected while objects outside of these distances will be ignored. In principle, this is how background reflection operates. In background reflection, any object that's different from the taught window that's part of the background will be a valid detection. For example, if the value for Switch point 1 is 2000 and the value for Switch Point 2 is 2500, the output will only be ON while the target is within these distances. In background reflection applications, the separation in distance between switch point 1 and switch point 2 is kept to a minimum so that any object that's above this value is detected. Switch point one must always be lower than switch point 2 to prevent an error or communications loss in the Add-on-profile.

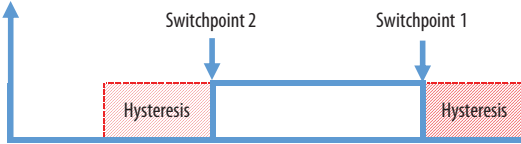
Figure 2 - Window Mode — Background Reflection



The Adjustable Hysteresis mode uses the values of switch point 1 and switch point 2 when the output will be ON or OFF depending on the polarity settings. In this mode, the output of the sensor will be ON until the distance of the object has reached switch point 2 and it will turn OFF once the object falls down to the switch point 1 distance. The output will turn back ON again once the distance has fallen below the Switch point 1 value. For example, if the switch point 1 distance is

200 mm (7.87 in.) and the switch point 2 distance is 400 mm (15.75 in.), the sensor output will be ON from the face of the sensor until it goes slightly above 400 mm, the output will turn OFF once the distance value falls below the 200 mm.

Figure 3 - Adjustable Hysteresis Mode



The Counter defines the desired amount of counts for the discrete output to turn ON. For example, if the counter value is set to three, the output will turn ON after the third detection has occurred.

The On Delay defines the desired delay for the output to turn ON once a target has been detected. For example, if the ON Delay value is 5000 ms (5 seconds), the sensor output will turn ON after 5 seconds have passed.

The Off Delay defines the desired delay for the output to turn OFF once a target has left the detection area. For example, if the OFF Delay value is 5000 ms (5 seconds), the sensor output will turn ON immediately and then it will turn OFF after 5 seconds have passed.

The One Shot defines the width of the pulse of the output. For example, if the One Shot value is set to 5000 ms (5 seconds), the output will turn ON immediately after the target has been detected and remain on for 5 seconds. This value can not be reset when a new target is detected. And if a target is detected while the pulse is active, it won't extend the output pulse.

The Frequency Monitor parameter confirms that the targets are detected and operating at the desired frequency. The output will turn ON when the time between detection of objects is detected and the operating frequency matches within 10% of the target value.

The Measurement Mode parameter enables operators to invert the measurement from Positive slope to Negative Slope. This parameter affects the behavior of the distance measured as part of Process Data 0. See publication [45DMS-IN001](#) for more information about the behavior of the positive slope when compared to the negative slope. The default value for this parameter is to operate as a positive slope.

The Averaging Filter parameter allows operators to average multiple measurements inside of the sensor with the goal of providing a more stable measurement. This parameter only affects the distance measured that's part of the Process Data 0 parameter. Operators can choose between 10...100 measurements to average the measured signal. The higher the measurement the more stable the measured output. This averaging operation does not affect the response time of Bulletin 45DMS distance measurement sensor. The default value for this parameter is disabled.

The Offset parameter allows operators to define an offset from the current measured value. This parameter only affects the distance measured that's part of the Process Data 0 parameter. Operators can choose between -5000...+5000 as an offset. By changing this parameter, operators can have more control of the application by implementing an offset that helps maintain linearity and performance of the sensor as well as filter out external conditions such as high reflectivity. The default value for this parameter is zero.

The Teach Offset parameter allows operators to teach the desired offset based on their application settings instead of manually entering it. This parameter only affects the distance measured that's part of the Process Data 0 parameter.

Signal Quality Level: This parameter allows operators to control when the SignalQualityScore bit that's part of the process data one will be enabled or disabled. This parameter accepts values from 10...90% and can help operators understand the level of reflectivity that may be acceptable or could affect your application.

The pin two Input parameter allows operators to enable or disable the pin two Input available on catalog number 45DMS-B8LAT1-D4. This function may be desired when connecting the sensor in devices such as an ArmorBlock® IO module where a voltage present on pin two may cause the sensor to enter Teach mode.

The Process Data Mapping parameter enables operators to change the current process data map that has been defined for sensor operation. Within the Add-on-profile, this parameter is disabled and defined as read only. However, this parameter can be freely accessed via explicit messaging to change the process data mapping of the devices.

Table 6 - Diagnosis Tab

Index(Dec/Hex)	Access	Data Type	Length	Sub-Index		Description	Range	Default Value
Device Access Locks								
12 / 0x0C	Read/Write	UInteger	16 bit			Device Access Locks. Data Storage	0 or 1	0x00
						Device Access Locks. User Interface	0 or 1	0x00
Service Function								
2 / 0x02	Write Only	UInteger	8 bit			Device Reset	128/0x80	
			8 bit			Restore Factory Settings	130/0x82	
			8 bit			Location Indication	175/0xAF	
			8 bit			Emitter OFF	160 / 0xA0	
			8 bit			Emitter ON	161 / 0xA1	
Operation Information								
88 / 0x58	Read Only	UInteger	8 bit	1		Operating Hours- Since Inception		See definition
			8 bit	2		Detection Counter – Since Inception		
Internal Temperature								
82 / 0x52	Read Only	Integer	8 bit	1		Actual – Since Power Up		See Definition
			8 bit	2		Maximum – Since Power Up		
			8 bit	3		Minimum – Since Power Up		
			8 bit	4		Maximum – Since Inception		
			8 bit	5		Minimum – Since Inception		
83 / 0x53	Read/Write	Integer	8 bit	1		Maximum Temperature Limit	-40...+100	80 °C (176 °F)
			8 bit	2		Minimum Temperature Limit	-40...+100	-20 °C (-4 °F)

Parameter Definitions

Device Access Locks — Captures the available device access locks for the Bulletin 45DMS distance measurement sensor.

DeviceAccessLocks.DataStorage — Enables or disables the Device Data Storage.

DeviceAccessLocks.User Interface — Enables or disables the local push button to prevent undesired teach on the sensors.

Device Reset — Allows operators to reset the sensor. This operation is similar to conducting a power cycle on the sensor.

Restore Factory Settings — Allows operators to restore the sensor's factory default settings.

Location Indication — Allows operators to set the local User Interface on the 45DMS to perform the location indication function. If this command is only sent once in a period of one second, the Indicator will remain ON for up to 60 seconds. If this command is sent twice in less than one second, the sensor will permanently until the operator sends the command 3 times in less than one second to stop the intermittent location indication flashing.

Emitter OFF — Enables operators to turn OFF the Class 1 Laser Light Source. This may be a desirable feature in some applications where the operators may want to disable the light source due to concerns with the light source.

Emitter ON — Enables operators to turn ON the Class 1 Laser Light Source.

Operating Hours – Since Inception — Displays the amount of hours that the sensor has been continuously in operation. This parameter is valuable as it can serve as a diagnostic parameter for troubleshooting applications in the event of repeated failures.

Detection Counter – Since Inception — Displays the amount of targets that have been detected since the sensor has been in operation.

Internal Temperature — Displays the internal temperature information available in the sensor. These parameters do not reflect the ambient temperature, however, it can be used to infer if the environment in the application is getting either too cold or too hot. This information could be used for application troubleshooting purposes.

Actual - Since Power Up — Reflects the current temperature inside of the microprocessor die of the sensor.

Maximum - Since Power Up — Reflects the maximum temperature inside of the microprocessor die of the sensor since the last power up.

Minimum - Since Power Up — Reflects the minimum temperature inside of the microprocessor die of the sensor since the last power up.

Maximum - Since Inception — Reflects the maximum temperature inside of the microprocessor die of the sensor since inception.

Minimum - Since Inception — Reflects the minimum temperature inside of the microprocessor die of the sensor since inception.

Maximum – Temperature Limit — Reflects the maximum temperature limit before enabling a high temperature event.

Minimum – Temperature Limit — Reflects the maximum temperature limit before enabling a low temperature event.

Table 7 - Events

Event(Dec/Hex)	Value	Event Type	Description	Range
20480 / 0x5000	4	Error	Hardware Fault	
20497 / 0x5011	4	Error	Non-volatile memory loss	
65425 / 0xFF91	0	Notice	Data storage – upload request	
16384 / 0x4000	0	Error	Temperature Fault	
16928/0x4220	1		Temperature below minimum	
16912 / 0x4210	1		Temperature above maximum	

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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