

Polarized Sensor Array

Catalog Numbers 45PLA-P2LPT1-F4

IMPORTANT Save these instructions for future use.

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Description

Bulletin 45PLA is a self-contained polarized retroreflective sensor that is designed for reliable detection of irregularly shaped objects in material handling and packaging applications. The sensor provides a 69 mm (2.7 in.) wide area of detection to verify that any object within the field of view triggers the sensor output. This solution minimizes the need of having to install and configure multiple sensors to be able to cover a wider area of detection.

The embedded IO-Link 1.1 communications protocol offers access to additional features and prognostic information that helps operators optimize the sensor for their application needs.

Features

- Wide detection area of 69 mm (2.7 in.)
- 4.5 m (14.8 ft) maximum sensing range
- Smallest detectable object of 6 mm (0.24 in.)
- Highly visible 360° indicator light-emitter diodes (LEDs) helps achieve reliable operation and facilitates sensor troubleshooting
- Bin picking mode enables operators to change the LED operation to be controlled independently using the embedded IO-Link 1.1 communications protocol
- IO-Link configurable beam blanking feature allows operators to select the amount of beams that are needed to solve the application
- 2.5 ms maximum response time
- IP67 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 - Standard I/O Operating Mode Indication

LED Color	Status	Description
Green	OFF	Sensor power is OFF
	ON	Sensor power is ON and sensing gain is stable
	Flashing 6 Hz	Low < Margin < High
	Flashing 1.5 Hz	Short circuit protection indication for both outputs
Green/Orange (color semblance)	OFF	Output is OFF (only the green LED is ON)
	ON	Output is ON (both the green and red LEDs are ON)
Red	OFF	Sensor is operating normally
	ON	Sensor fault

Table 2 - I-O Link Operating Mode Indication

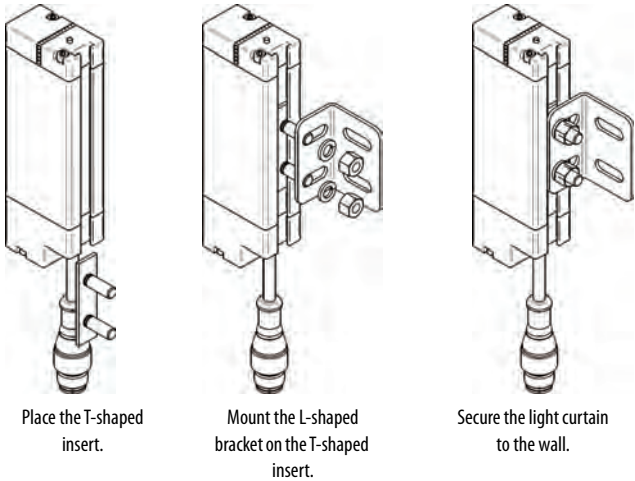
LED Color	Status	Description
Green	OFF	Sensor power is OFF
	ON	Sensor power is ON
	Flashing 1.5 Hz	IO-Link mode operating
Orange/Red	OFF	Output is OFF
	Flashing ON 1.5 Hz	Output is ON

See <https://ab.rockwellautomation.com/Sensors-Switches/Photoelectric-Sensors> for additional details about the operation of the Bulletin 45PLA Light Array in IO-Link mode.

Mounting the Sensor

Securely mount the sensor on a firm, stable surface, or support. An application, which is subject to excessive vibration or shifting, can cause intermittent operation.

Figure 1 - Securing 45PLA Light Curtain with the Mounting Kit (Cat. No. 60-BPLA-LS [included])



Wiring

The quick-disconnect connector is shown in Figure 2. The pin numbers correspond to the male connectors on the sensor.

Figure 2 - Pinouts and Output Configuration

4-pin Micro (M12)	Wiring								
	<table><tr><td>Brown (1)</td><td>+V</td></tr><tr><td>White (2)</td><td>PNP, NPN, or Input</td></tr><tr><td>Black (4)</td><td>PNP (IO-Link) or NPN</td></tr><tr><td>Blue (3)</td><td>-V</td></tr></table>	Brown (1)	+V	White (2)	PNP, NPN, or Input	Black (4)	PNP (IO-Link) or NPN	Blue (3)	-V
Brown (1)	+V								
White (2)	PNP, NPN, or Input								
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Blue (3)	-V								

Sensor Configuration

Bulletin 45PLA 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 using the push button:

- Teach operating sensing range
- Light and dark operate selection
- Alignment Mode
- PNP only or NPN only operation
- Push-button lock and unlock

Teach Procedure

To teach the sensor when operating in Standard I/O mode:

1. Align the sensor to the reflector. Confirm that the reflector is at least 200...300 mm (8...12 in.) away to be sure of reliable teach process.

2. Press the teach button for about three seconds until the red LED starts blinking. Release the push button.
3. Now the sensor operates with Standard sensitivity, the red LED continues to flash for 30 seconds, then the LEDs go to a standard indication.
4. Within 30 seconds, if you press the button for one second and then release it, the sensor alternates between green and red four times for about two seconds. This process indicates a successful Precision sensitivity Teach.
5. Place a target between the sensor and the reflector. This placement simulates an object passing through to verify proper setup. If the green LED is blinking after the teach process has been completed, it means that the teach process is marginal and the sensor has to be retaught.
6. If the reflector is out of alignment or not in the visible field when the learning process is started, the red LED light source starts to flash. A correct alignment is achieved when the green and red LED flash simultaneously (green for maximum and red for minimum intensity). With the reflector in alignment, press and hold the button for at least one second.
7. At this point, follow the instructions from point 3.

Upon start up of the teach procedure, if the procedure is not complete, the sensor returns to RUN mode after 30 seconds.

Lock and Unlock the Teach Button

Bulletin 45PLA push button can be locked or unlocked locally to prevent unauthorized or unintentional change of sensor settings.

To lock or unlock the button: Press and release the button three times within three seconds. Both LEDs flash synchronously or asynchronously for three seconds to indicate that the button is locked or unlocked, respectively.

To toggle the status: Press and release the button three times within three seconds.

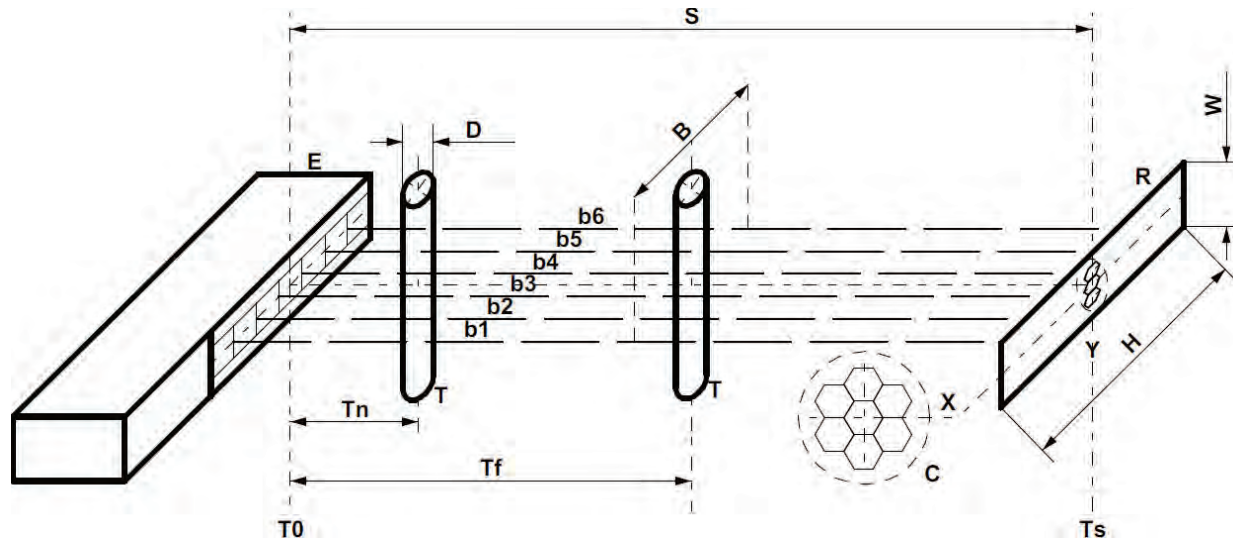
Light Operate or Dark Operate Selection

Bulletin 45PLA outputs can be configured to operate in Light Operate (L.O.) or Dark Operate (D.O.). L.O. means that the output turns ON when the light is received from the reflector. D.O. means that the sensor output is ON when the light is not being received from the reflector. Follow these steps to enter Light or Dark Operate Mode.

1. Press and hold the push button for at least six seconds until the green LED and the red LED flash asynchronously, then release.
2. When the red LED with the green LED flash at 50% duty cycle, it indicates that the Output is set to operate as L.O.). The red LED off while the green LED is flashing indicates that the sensor output is operating as Dark Operate.
3. Press and release the button within 10 seconds in order to toggle from L.O. to D.O., the selection indicated by the yellow LEDs. The sensor retains the setting per the last button depression and returns to the RUN mode 10 seconds after the last button is depressed.

Table 3 - Sensing Range with Specific Reflectors

Reflectors	ExG 1 m (3.28 ft)	ExG ≥ 1.5 m (4.92 ft)	ExG 1 m (3.28 ft)	Reflector Active Area [mm (in.)]	Reflector Size [mm (in.)]
92-135	0.15	0.2...4.5	5.5	36 x 136 (1.42 x 5.35)	42 x 182 (1.65 x 7.16)

Figure 3 - Identification of the Elements of an Application

Item	Description
E	Polarized reflex array sensor
R	Reflector, only the corner type is capable of handling polarized light
H	Length of the active surface of the reflector (dimensions that are optimized for best compromise range and resolution) 80 mm (3.15 in.)
W	Width of the active surface of the reflector (dimensions that are optimized for best compromise range and resolution) 20 mm (0.79 in.)
C	Best orientation of the reflective cells to obtain the minimum dark area (minimum S), optimum cell dimension: 4 mm (0.16 in.)
S	Distance between sensor and reflector (length of controlled area), from Smin (dark zone) to Smax (maximum range)
b1...b6	Pair of beams (emitted / reflected) determined by the array that is formed by four emitters and three receivers
B	Width of the controlled area (varies slightly according to dimension Tx) on average 60 mm (2.36 in.)
T	Test rod of D diameter, the minimum diameter that is intercepted with continuity is indicated as MDO
D	Diameter of the test rod
T0	Minimum distance (T sliding to the front of E), normally here MDO is worse than what you get between Tn and Tf.
Tn	Minimum distance assumed by T where you start to get the best MDO, in some cases Tn and Tf coincide
Tf	Distance assumed by T beyond which MDO is worse than what is obtained between Tn and Tf
Ts	The maximum distance taken by T (close the reflector surface) the MDO increases linearly between Tf and Ts

Figure 4 - Definition of the Minimum Detectable Object without Interruption Determined by the Distance of the Reflector and Position of the Same Object

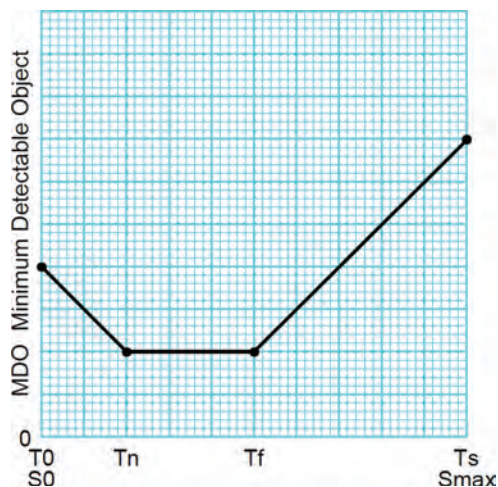


Figure 5 - Shape of the Characteristic Curve and Identification of Reference Points on the Graph

Range [m (ft)]	MDO @ Tx [mm (in.)]								
	Precision Teach				Standard Teach				
Smax	T0	Tn	Tf	Ts	T0	Tn	Tf	Ts	
0.1	0	0	100	100	0	0	100	100	Tx
	4	4	4	4	8	8	8	8	MDO
0.15	0	0	150	150	0	0	150	150	Tx
	3	3	3	3	7	7	7	7	MDO
0.2	0	0	200	200	0	0	200	200	Tx
	4	4	4	4	8	8	8	8	MDO
0.25	0	0	250	250	0	0	250	250	Tx
	4.5	4.5	4.5	4.5	10	10	10	10	MDO
0.5	0	250	250	500	0	0	100	500	Tx
	3.5	3	3	6	5	5	5	12	MDO
1	0	150	200	1000	0	0	100	1000	Tx
	3.5	3	3	4	5	5	5	14	MDO
1.5	0	200	600	1500	0	0	50	1500	Tx
	4	3	3	7	4.5	4.5	4.5	18	MDO
2	0	300	500	2000	0	150	250	2000	Tx
	4	2.5	2.5	7	6	4.5	4.5	18	MDO
2.5	0	400	700	2500	0	300	300	2500	Tx
	4.5	2.5	2.5	7	6	4.5	4.5	22	MTO
3	0	400	1500	3000	0	300	600	3000	Tx
	4.5	2.5	2.5	8	7	5	5	30	MDO
4	0	400	1500	4000	0	400	900	4000	Tx
	4.5	2.5	2.5	10	7	5	5	30	MDO
4.5	0	400	1500	4500	0	450	700	4500	Tx
	4.5	2.5	2.5	10	7	5	5	30	MDO

Between T0...Tn and Tf...Ts MDO varies in a quasi-linear way. Formulas can be used to obtain an approximate MDO value in these traits.

Formula for calculating an MDO for a Tx between Tf and Ts: $((MDO_{Ts} - MDO_{Tf}) / (Ts - Tf)) * (Tx - Tf) + MDO_{Tf}$

Formula for calculating an MDO for a Tx between T0 and Tn: $((MDO_{Tn} - MDO_{Tf}) / (Tn - Tf)) * (Tx - Tf) + MDO_{Tf}$

Change Output Type

The Bulletin 45PLA output can be configured to operate as PNP or NPN. Follow these steps to change this setting:

1. Press and hold the push button for at least 12 seconds. The green and red/orange LED starts flashing asynchronously at 6 Hz, then release.
2. When the LED flashes red, it indicates operation of pin-4 output as PNP. When the green LED flashes, it indicates the operation of the pin-4 output as NPN.
3. Press and release the button within 10 seconds in order to toggle from PNP to NPN. The sensor retains the settings per the last button depression and returns to the RUN mode ten seconds after the last button is depressed.

Alignment Mode

Bulletin 45PLA can be enabled to enter alignment mode. This mode aids operators to confirm that they have aligned the sensor to the reflector to be sure of maximum signal levels. To enter the sensor in alignment mode, follow these steps:

1. Press and release the button 2 times within 3 seconds. If no reflector is inside the sensor field of view, the green LED turns OFF.
2. Place the reflector inside the sensor field of view. Observe the green LED as it slowly gets brighter until the red LED is solid ON. If the sensor is in L.O. (or OFF if the sensor is in D.O.) and continue to search the maximum for the green LED.
3. After the reflector has been successfully aligned, the sensor RUNs correctly, but the sensor user Interface LEDs return to RUN mode after 120 seconds.
4. After a correct alignment, it is recommended that you perform a Teach to be sure you get the best performance.

Display Indications and Diagnostics

Table 4 - LED Status Indicators

Symbol	Description
	Indication of full light and steady
	Indication of low intensity or intermittently with fast periodic flashing
	Indication of slow continuous flashing
	Off

Table 5 - LED Indicators

Green		Red	
	No power supply or below 5V		Light state. No power supply
	Power supply below 16V. Emission LEDs failed.		Memory reading error.
	Alignment. Outputs in short circuit.		Alignment. Some optics in dark.
	Normal operation.		Many or all optics in the dark. Fault or outputs in short circuit.

Table 6 - Combined Indications

							
Green							
Red							
Status							
	Off or Low	Memory Error	Fault	Light	Dark	Alignment	Overload

Table 7 - Specifications

Attribute	Value
Certifications	c-UL-us and CE marked for all applicable directives
Vibration	Complies with IEC 60947-5-2
Shock	Complies with IEC 60947-5-2
Humidity	95% max
Ambient Light Immunity	Direct Illumination: 50,000 lux – Incandescent Lamp; Direct Illumination: 5K lux – Fluorescent Lamp
MTTF	84.87 years
MTTFd	16.97 years
User Interface	
Status Indicators	Red and Green LED
Adjustments	Push button
Operating Performance	
Sensing Range	0.2 ... 4.5 m (0.01 ... 0.18 in.) with 92-135 (included with sensor); 0 ... 5 (reflector dependent)
Smallest Detectable Object	6 mm (0.24 in.)
Light Source	Visible red 617 nm
Field of View	2.5°
Standard Teach Hysteresis	20%
Precision Teach Hysteresis	10%
Electrical	
Operating Voltage	12 ... 24V DC
Ripple	1.2V max
Current Consumption	100 mA max
Power On Delay	300 ms max
Sensor Protection	Reverse polarity and short circuit protection
Outputs	
Output Type	Pin 4: PNP or NPN; Pin 2: PNP, NPN or Input
Output Mode	Selectable Light Operate and Dark Operate
Response Time	2.5 ms max
Load Current	160 mA max
Inputs (Pin 2 Configured as Input)	
Low Level	0.8V max
Open Level	2.35V max
High Level	30V max
Integration Time	20 ms
IO-Link	
Communications Mode	COM3
Cycle Time	1.2 ms, min
Process data bit length	5 bytes (40 bits)
Specifications	1.1
Vendor ID	2 (0x02)
Device ID	301 (0x12D)
Mechanical	
Housing Material	Aluminum
Lens Material	PMMA
Cover Material	PC +TPE
Environmental	
Enclosure Rating	IP67
Operating Temperature	-10 ... +55 °C (14 ... 131 °F)
Storage Temperature	-25 ... +70 °C (-13 ... +158 °F)
Connections	4-pin M12 QD on 240 mm (9.45 in.) pigtail

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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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