

# Installation Instructions

## Bulletin 45BPD Analog Laser Sensor



**IMPORTANT: SAVE THESE INSTRUCTIONS  
FOR FUTURE USE.**

### Description

The 45BPD analog output sensor is a Class 2 visible red laser sensor that provides sensing with both an analog and discrete output. It is set up using the Teach-In buttons and LED indicators on the top of the sensor.

This sensor utilizes the triangulation principle for precise measurement and the visible red beam spot is useful for alignment in small part detection and measurement applications. The sensor is completely self contained in an IP 67 enclosure and does not require any external control devices which add cost and require additional mounting space.

The 45BPD can be 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. The sensor can be set with both a discrete PNP output and a 4...20 mA analog output. The discrete output can be set for normally open (N.O.) or normally closed (N.C.) operation and the analog output is automatically scaled between the taught set points with either a positive or negative slope.

The 45BPD is an excellent solution for several noncontact measurement applications including: distance measurement, part profiling, thickness measurement, error proofing, inspection, verifying material position, hole depth, warpage, and positioning.

### Features

- Noncontact measurement
- Visible red Class 2 laser
- Analog and discrete outputs
- Scalable analog output (4...20 mA)
- Configurable discrete output (N.O./N.C.)
- IP 67 enclosure
- 270° rotatable connector
- Set point adjustment via pushbuttons
- Self-contained sensor
- Laser-disable control
- Teach-in lock out
- Averaging and speed mode

## Specifications

<b>Sensing Beam</b>	Visible red Class 2 laser, 650 nm
<b>Sensing Range</b>	45BPD-8LTB1-D5: 30...100 mm 45BPD-8LTB2-D5: 80...300 mm
<b>Measuring Range</b>	70 mm and 220 mm
<b>Spot Size</b> 30/100 mm model 80/300 mm model	1.5 x 3 mm/1.5 x 3.25 mm 1.5 x 3.5 mm/2.0 x 4.5 mm
<b>Linearity</b>	<0.25% of measuring range
<b>Resolution</b>	<0.1% of measuring range
<b>Temperature Drift</b>	<0.02%/°C
<b>Supply Voltage</b>	18...30V DC
<b>Current Consumption</b>	≤40 mA @ 24V DC
<b>Circuitry Protection</b>	Short circuit, overload, false pulse, transient noise, reverse polarity protection
<b>Output Type</b>	Discrete: PNP (N.O./N.C.); Analog: Current 4...20 mA
<b>Output Rating</b>	100 mA max. for discrete output, 500Ω max. impedance for analog
<b>Response Time</b>	Speed Mode: 0.4 ms (applicable with synchronously switched laser and target)
<b>Control Input</b>	Laser disable; Teach-in lock; free running
<b>Housing Material</b>	Plastic—ABS
<b>Lens Material</b>	PMMA
<b>LED Indicators</b>	See Figure 3
<b>Connection Type</b>	5-pin DC micro, 270° rotatable
<b>Accessories</b>	Cordsets, mounting brackets
<b>Operating Environment</b>	IP 67
<b>Vibration</b>	10...55 Hz, 1.5 mm amplitude; 3 planes; meets or exceeds IEC 60947-5-2
<b>Shock</b>	30 g; 11 ms; meets or exceeds 60947-5-2
<b>Operating Temperature—C (F)</b>	-10...+60° (14...140°)
<b>Approvals</b>	UL, cULus and CE marked for all applicable directives

The Installation Instructions should be read and understood before operating the sensor.

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

The 45BPD is not a safety component as described by EU machine directives.



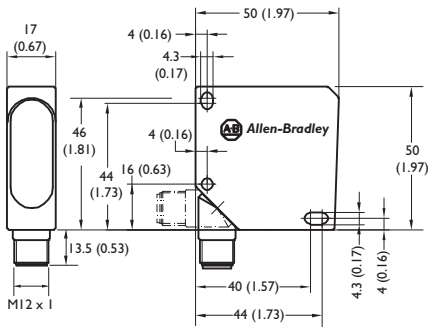
<b>Laser Light</b> Do not stare into beam class 2 laser product
EN60825-1, 03/97, $\lambda=630\dots680$ nm pulsed - mode operation

The 45BPD is a Class 2 laser product. There is a natural eye aversion when looking into the laser beam. Do not look directly into the laser beam or suppress the reflex to close your eyes.

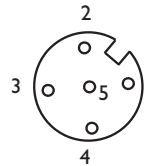
The 45BPD should be mounted such that it is not directed at people (head height) and the beam path is terminated at the end of its functional path.

The laser safety label on the 45BPD sensor should be visible after installation. A second label has been provided in the event that the attached label is covered due to the installation.

### Dimensions—mm (inches)



### Wiring Diagram



The control input (pin 5) can be used to disable the laser by connecting it to the +DC power supply (18...30V DC). The laser is shut down and both the discrete and analog outputs will retain their state. The control input (pin 5) can also be used to prevent setting changes to the sensor (lock out the Teach-in buttons) by connecting it to 0V DC. The sensor can be operated in the free-run mode by not connecting the control input (pin 5).

### Sensor Alignment

Position the 45BPD sensor so that the distance from the object to the sensor will be within the sensing range of the sensor.

The sensor should be mounted at an angle of approximately 5° for very reflective targets as shown in Figure 1.

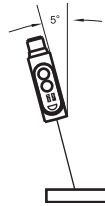


Figure 1

The sensor should be mounted perpendicular to the direction of travel for targets which have steps, border lines, and round targets (see Figure 2).

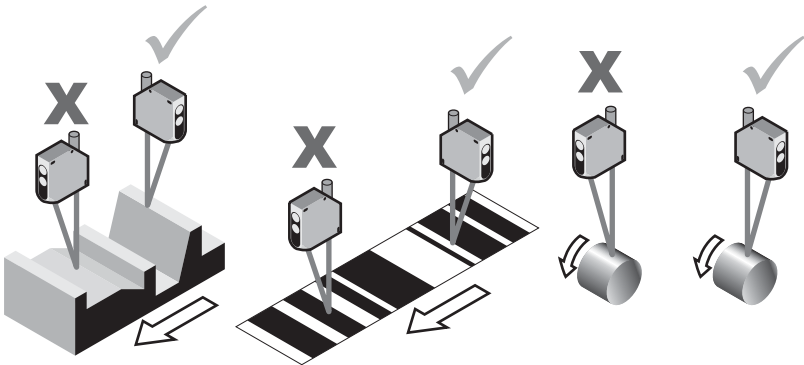


Figure 2

The sensor will provide more precision when the spot size is not larger than the feature that is being measured (see Figure 3).

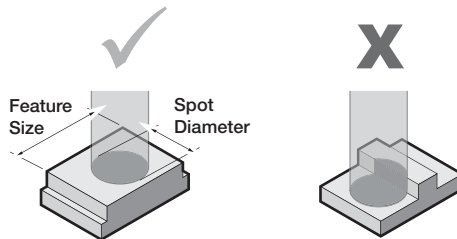


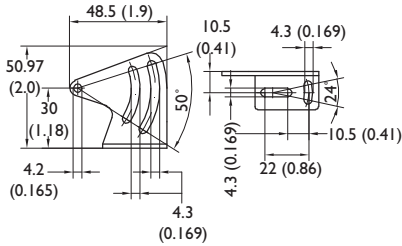
Figure 3

## Mounting

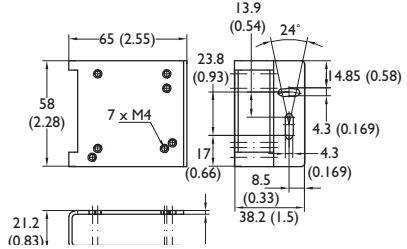
Securely mount the sensor on a firm, stable surface or support for reliable operation. A mounting which is subjected to excessive vibration or shifting may cause intermittent operation. The following mounting brackets are available for installation convenience and sensor protection. Once securely mounted, the sensor can be wired per the attached wiring diagrams.

### Mounting Bracket Dimensions—mm (in)

#### 45BPD-BKT1



#### 45BPD-BKT2



## Wiring

The 45BPD photoelectric sensor is available with a micro quick-disconnect for ease of installation and maintenance. The connector can be rotated up to 270° to accommodate the installation of the sensor and its associated wiring. 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 45BPD sensor is ready to operate with factory settings after applying power.

### Possible Settings and Operating Modes

- Set a switching point
- Set a switching window
- Scale the analog output between two setpoints (positive or negative slope)
- Set the operating mode to either Speed mode or Averaging mode
- Set the switch type (N.O. or N.C.)
- Reset the sensor to the factory settings
- Laser disable control (requires electrical connection)
- Hold the measured value (requires electrical connection)
- Teach-In button lockout (requires electrical connection)

## LED Indicators (Sensor in Operation)

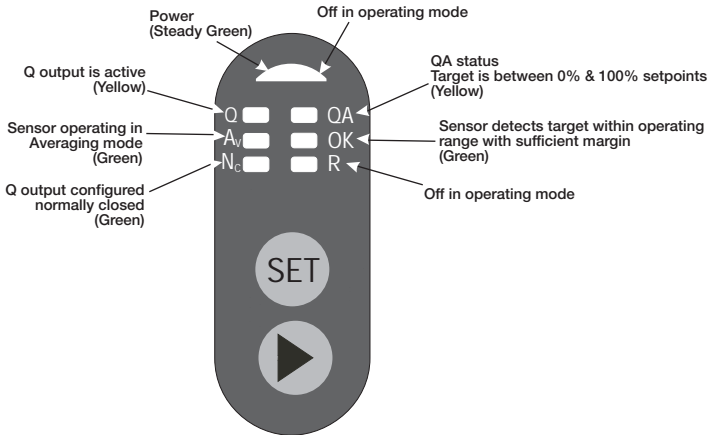


Figure 4

### Factory Settings

- Switching Output Q: The switching output is active when the target is in the operating range.
- Switching Output Q is configured for normally open operation.
- Analog Output (4...20 mA)  $Q_A$ : 4 mA at the end of operating range; 20 mA at the beginning of operating range
- Operating mode is set to the Speed mode

## LED Indicators (Teach-in Mode)

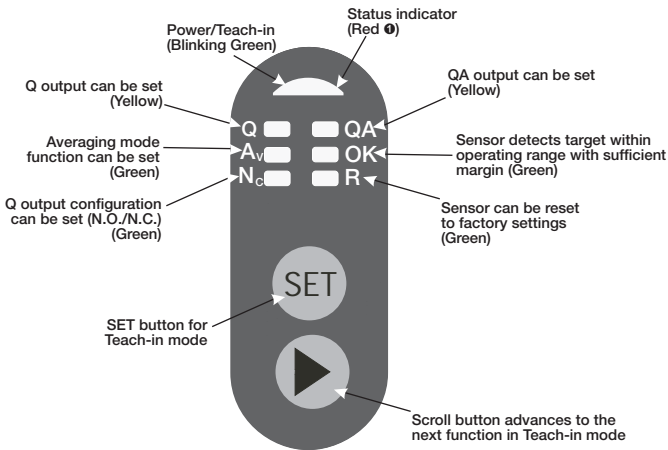


Figure 5

1 The status indicator LED can be steady or blinking depending on the Teach-In setting.

## Setting the Sensor

The 45BPD is set up using the pushbuttons (SET and ►) and the LED indicators on the top of the sensor.

To begin the Teach-In process, press the SET and ► buttons simultaneously for 3 seconds. The Power/Teach-In LED will begin to blink when the sensor is in the Teach-In mode.

Scrolling through the Teach-In functions is done using the ► button and is indicated as shown in Figure 5. There are five possible settings (Q, QA, Av, Nc, R). To skip over a function and not change a setting, press the ► button to advance to the next desired function. After the last function is reached the menu is started again from the first function.

To teach the selected function indicated by the teach-in LEDs, press the SET button.

### Step 1—Setting the Discrete Output Q

The discrete output can be set with either a switchpoint or switching window as described.

#### Switchpoint

Press the ► button until the “Q” LED turns on indicating that this function can be set.

Position the target at the desired switchpoint.

Press the SET button and the status indicator LED will begin to blink. This sets the switchpoint.

Press the ► button to advance to the next setting or press the SET and ► buttons simultaneously for 1 second to exit the Teach-In process.

#### Switching Window

Press the ► button until the “Q” LED turns on indicating that this function can be set.

Position the target at the first limit for the switching window.

Press the SET button and the status indicator LED will begin to blink. This sets the first limit.

Position the target at the second limit for the switching window.

Press the SET button and the status indicator LED will turn on as long as SET is pressed to confirm. This sets the second limit.

Press the ► button to advance to the next setting or press the SET and ► buttons simultaneously for 1 second to exit the Teach-In process.

**Note:** If the target is in the same position when setting both limits of the switching window, a minimum switching window of 1% of the operating range will be set around the teach point.

## Step 2—Scaling the Analog Output $Q_A$

Press the ► button until the “ $Q_A$ ” LED turns ON indicating that this function can be set.

Position the target at the desired 0% point (4mA).

Press the SET button and the status indicator LED will begin to blink. This sets the 0% setpoint.

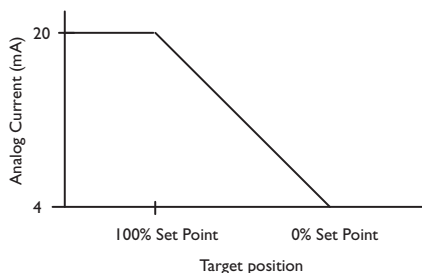
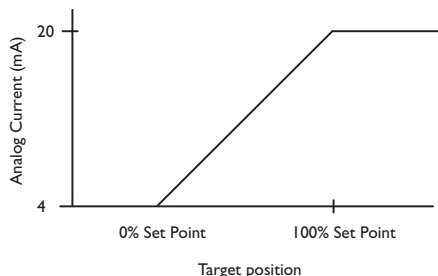
Position the target at the desired 100% point (20mA).

Press the SET button and the status indicator LED will turn on as long as SET is pressed to confirm.

This sets the 100% setpoint.

Press the ► button to advance to the next setting or press the SET and ► and buttons simultaneously for 1 second to exit the Teach-In process.

## Analog Output



**Note:** If the distance between the 0% and 100% setpoints is less than 5% of the overall operating range, then the analog output will be automatically scaled to 5% of the operating range and the middle is placed between the 0% and 100% setpoints.

## Step 3—Setting the Averaging Mode/ Speed Mode

Press the ► button until the “Av” LED turns on indicating that this function can be set.

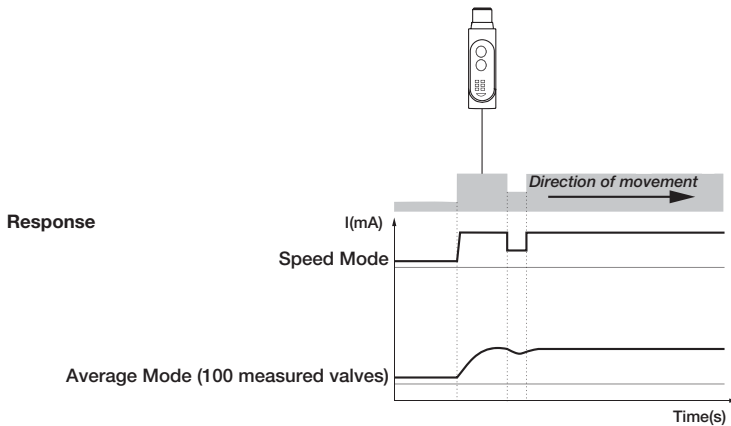
This function can be set to either Averaging mode or Speed mode by pressing the SET button.

The status indicator LED will turn on when the Averaging mode is active, the status indicator LED will turn off when operating in the Speed mode.

Press the ► button to advance to the next setting or press the SET and ► and buttons simultaneously for 1 second to exit the Teach-In process.

**Note:** The averaging mode should be used when detecting rough surfaces. The speed mode should be used when the shortest response time and maximum switching frequency is required.





### Step 4—Discrete Output Configuration (N.O. / N.C.)

Press the ► button until the “Nc” LED turns on indicating that this function can be set.

This function can be set to either Normally Open mode or Normally Closed mode by pressing the SET button. The status indicator LED will turn on when the output is in the normally closed mode, the status indicator LED will turn off when the output is in the normally open mode.

Press the ► button to advance to the next setting or press the SET and ► and buttons simultaneously for 1 second to exit the Teach-In process.

### Step 5—Factory Reset

Press the ► button until the “R” LED turns ON indicating that this function can be set.

The sensor can be reset to the factory settings by pressing the SET button.


The status indicator LED will turn on as long as the SET button is depressed to confirm the sensor has been reset.

Press the ► button to advance to the next setting or press the SET and ► and buttons simultaneously for 1 second to exit the Teach-In process.

### Exit the Teach-In Menu

After the desired functions are set, press SET and ► simultaneously for approximately 1 second to save the settings and exit the Teach-In mode. The sensor will begin normal operation based on these Teach-In settings.

## Accessories

Description	Cat. No.	
2m (6.5ft) Micro QD Cordset	<b>889D-F5AC-2</b>	
Mounting Bracket	<b>45BPD-BKT I</b>	—
Protective Mounting Bracket	<b>45BPD-BKT2</b>	—

## Micron Conversions

$$1 \mu\text{m} = 0.001 \text{ mm}$$

$$1 \mu\text{m} = 0.000039 \text{ inches}$$

$$25.4 \mu\text{m} = 0.001 \text{ inches (one thousandth)}$$

$$20 \mu\text{m} = 0.00079 \text{ inches (0.79 thousandths)}$$

## Application Notes

1. The sensor should be powered for approximately 5 minutes for maximum precision.
2. The sensor is ready to operate after a delay ( $\leq 300$  ms).
3. The precision of the sensor is dependent on the combined errors of linearity, resolution and temperature drift.



**Publication 75009-266-01(A)**  
**[068-13806]**  
**March 2006**