

PVD Series Parts Verification Sensor

Diffuse or retroreflective sensor for error proofing of bin-picking operations



Patent pending



Features

- One-component system is easy to mount and even easier to use. Automatically operates in either diffuse or retroreflective mode, depending on the application.
- Automatic setup and adjustment; wide beam pattern provides easy alignment.
- Range is up to 2 m (6.5') when used with retroreflective target; 400 mm (15.7") when used in diffuse mode.
- Large green job lights on either side of the metal housing can be remotely controlled to initiate user action with a solid or a blinking light. Job lights turn red to indicate bin-picking errors.
- Compact package size; only 30 mm wide x 15 mm deep (1.2" x 0.6"). Available in 2 lengths: 100 mm or 225 mm (4" or 9") to fit existing parts bin sizes and configurations.
- Easy DIP-switch adjustments: PNP/NPN output, normally open/normally closed operation, solid/flashing job light, and gate polarity for job light activation.
- Two LEDs indicate power ON and output ON.
- Choose 2 m (6.5') unterminated cable or 2 m (6.5') cable with 5-pin Euro-style quick-disconnect connector.
- Heavy-duty protective brackets available.
- 12-30V dc operation.



Visible Red, 630 nm

Models

| Model Number | Range | Array | Cable* | Supply Voltage | Output |
|----------------|--|---------------------------------|---|----------------|----------------------------|
| PVD100 | Retroreflective Mode: up to 2 m (6.5') | 100 mm (4") Long, 4 Beams | 2 m (6.5') 5-wire cable, unterminated | 12 to 30V dc | User-selectable NPN/PNP |
| PVD100Q | Diffuse Mode: up to 400 mm (15.7") | | 2 m (6.5') cable, terminated in a QD connector | | |
| PVD225 | All models may be used in either sensing mode. | 225 mm (9") Long, 8 Beams | 2 m (6.5') 5-wire cable, unterminated | | |
| PVD225Q | | | 2 m (6.5') cable, terminated in a QD connector | | |

*9 m (30') cables are available by adding suffix "W/30" to the model number of any cabled sensor (e.g., **PVD100 W/30**).

150 mm (6") cable terminated in a QD connector available by adding "W/6IN" to model number of any terminated sensor (e.g., **PVD100Q W/6IN**).

A model with a QD connector requires a mating cable; see page 7.



WARNING . . . Not To Be Used for Personnel Protection

Never use these products as sensing devices for personnel protection. Doing so could lead to serious injury or death.

These sensors do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition. Consult your current Banner Safety Products catalog for safety products which meet OSHA, ANSI and IEC standards for personnel protection.

PVD Series Parts Verification Sensor

Overview

The PVD is a one-component, easy-to-use light screen suited to many part assembly, pick-to-light, and error-proofing applications. The PVD self-contained, solid-state emitter/receiver array is capable of functioning in either diffuse or retroreflective sensing mode. No configuration is required for this selection. If a retroreflective target is installed opposite the sensor, it will function in retroreflective mode. If not, it will function in diffuse mode. The sensor's ongoing self-adjustment feature requires no user adjustment; the sensor adapts to the sensing conditions after 15 seconds when blocked. Sensor range is decreased when no retroreflector is installed.

The DIP-switch-selectable PNP/NPN output easily interfaces to a system controller, which is pre-programmed by a supervisor for a specific sequence of tasks. Mounted with its visible red beams stretching across each parts bin, the PVD signals the assembler via its large green job lights:

- Which bins contain items to be picked in a given operation; and
- In what order they should be picked.

As the assembler reaches into each bin, the system senses if the correct part has been taken, then signals the next bin in the sequence. If the assembler reaches into a bin out of sequence, the PVD turns on its output to signal the system controller and turns on its red job light to signal the assembler that an incorrect pick has occurred.

Using the PVD system increases task efficiency, due to simplified job training, increased quality control (no skipped components), and reduced rework and inspections. The PVD speeds the resumption of work after breaks and other distractions, and it is ideal for multilingual workplaces where communication may be an issue.

Standard configuration options are selected by means of a bank of four DIP switches behind a press-on black rubber cover (see page 3). DIP switch options include:

- PNP or NPN output
- Normally Open or Normally Closed operation
- Steady or flashing job light
- Job light control input

Using specialized Banner software, additional configuration options can be adjusted. These options are programmed via the gray Datacom wire. Consult the factory or your Banner sales representative for more information. These additional options include:

- Operating frequency
- Channel blanking
- Automatic update rates
- ON and OFF delays
- Customized job light configurations

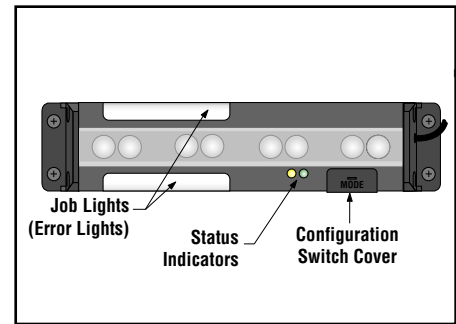


Figure 1. Sensor features

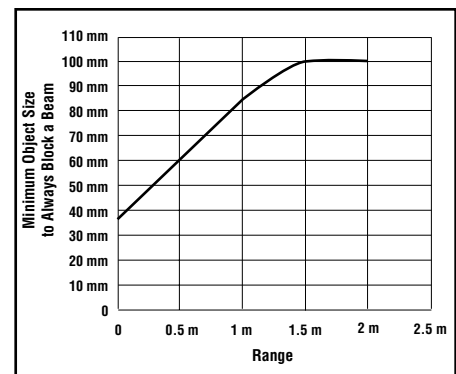


Figure 2. Minimum object detection size (retroreflective operation)

PVD Series Parts Verification Sensor

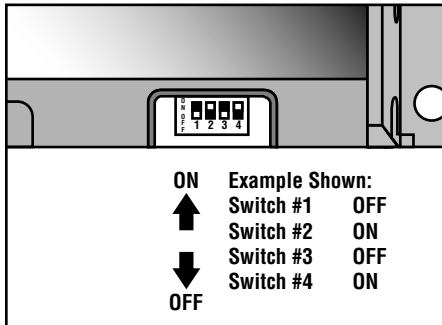


Figure 3. DIP-switch setting positions



Figure 4. DIP-switch cover removal

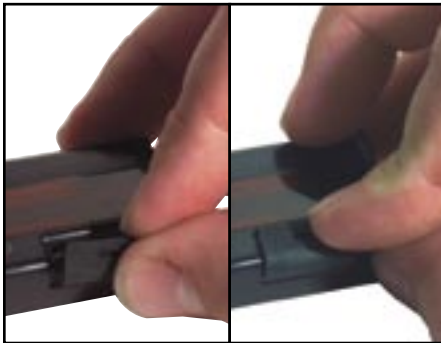


Figure 5. Align edge of cover, press back into place

Configuration

To configure the PVD, set the DIP switches as shown below, using the supplied little plastic screwdriver to avoid damaging the switches or causing a short circuit. The switches determine 4 status operating modes:

Switch 1: ON – PNP output
OFF – NPN output

Switch 2: ON – Normally Open
OFF – Normally Closed

Switch 3: ON – Job light steady
OFF – Job light flashes

Switch 4: Job light control input: connect the white wire as follows:

PNP Output

ON – Job light ON for +10 to 30V dc (29k Ω input impedance)
OFF – Job light ON for 0 to 1.5V dc/open circuit

NPN Output

ON – Job light ON for +10 to 30V dc/open circuit
OFF – Job light ON for 0 to 1.5V dc (10k Ω input impedance)

The factory default setting is ON for all switches.

Accessing the DIP Switches

To remove the switch cover, insert a fingernail or small screwdriver into the slot (see Figure 4); apply gentle pressure, angling away from the sensor lens. The cover will remain tethered to the sensor housing.

To replace the switch cover, align one edge of the cover with the edge of the sensor housing opening, then press the front corners into place (Figure 5).

Status Indicators/Troubleshooting

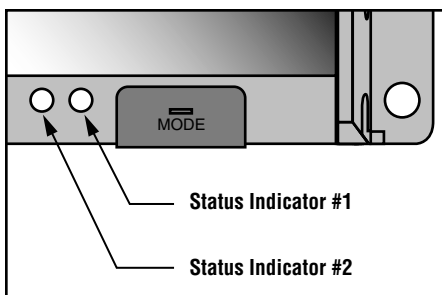


Figure 6. Sensor status indicators

| Status Indicator #1 | Notes |
|---------------------|--|
| Steady Yellow | Output is active (Changing Switch #2 to N.C. will turn the yellow indicator ON when the system is clear) |
| OFF | Output is inactive (Changing Switch #2 to N.O. will turn the yellow indicator ON when the system is blocked) |
| Status Indicator #2 | Notes |
| Steady Green | Power is ON and system is OK |
| Flashing Green | Blanking is enabled |
| OFF | Power is OFF |

PVD Series Parts Verification Sensor

Mounting

Banner PVD sensors are small, lightweight, and easy to handle during mounting. The wide beam pattern of these sensors simplifies their alignment. M4 stainless steel fasteners and two stainless steel brackets are included with each sensor.

The sensor must be mounted parallel to the opposing surface (bin wall or retroreflector) in the same plane. From a common point of reference, make measurements to locate the centers of the sensor and the retroreflector. Mount the brackets to the top and bottom of sensor, as shown in Figure 7 and attach to mounting surface. Attach retroreflector, if used.

Measure from one or more reference planes (for example, the building floor) to the centers of the sensor and retroreflector to verify their mechanical alignment. (If they are mounted exactly vertical or horizontal, a carpenter's level may be helpful. A straightedge or a string extended between the sensor and the opposing bin wall may also be helpful.) Make any necessary final mechanical adjustments, and hand-tighten the bracket hardware. After the electrical hookup is complete, check for beam alignment.

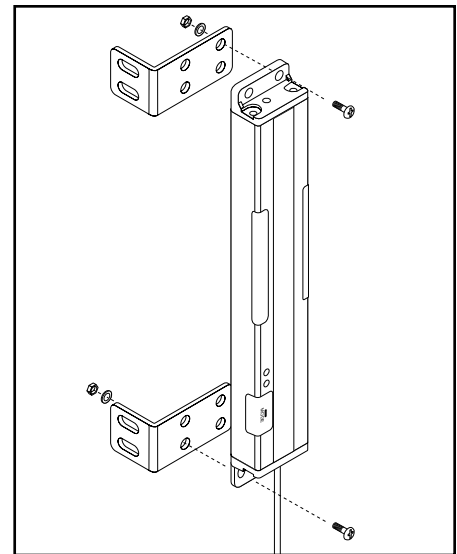


Figure 7. PVD mounting hardware

Installation Notes

When multiple sensors are mounted in a confined area, care must be taken to avoid crosstalk between them. There are several ways to avoid crosstalk:

- Position the sensors and retroreflectors (or bin walls) as shown in Figure 9.
- The effective maximum sensor range is approximately 2 m (6.5'), so sensors located farther than that from one another are unlikely to cause crosstalk problems.

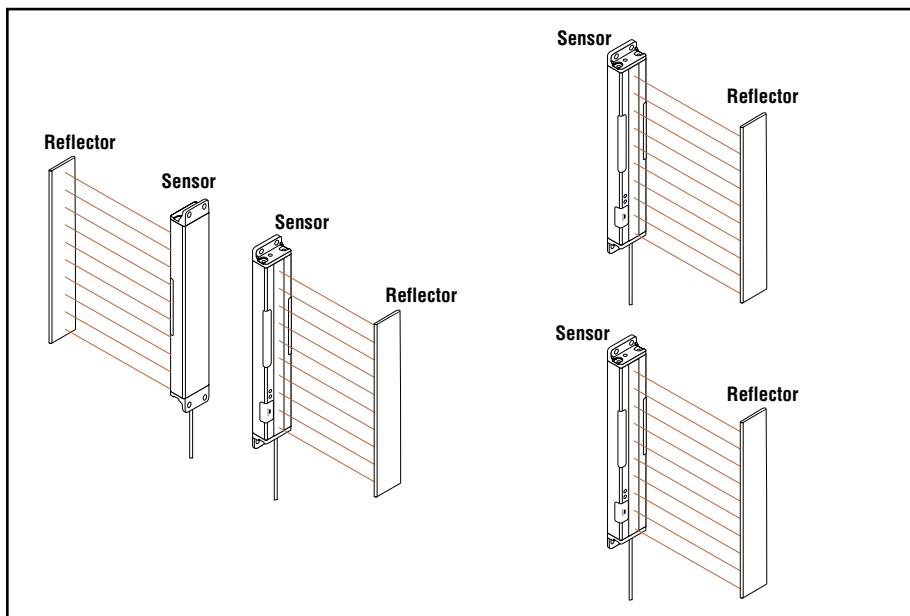


Figure 9. Position multiple sensors as shown to avoid crosstalk

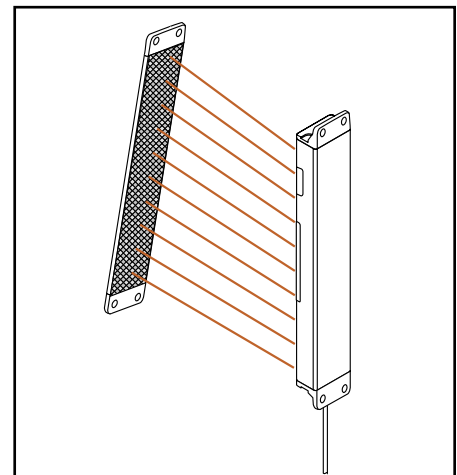



Figure 8. Improper orientation; sensor and opposite surface should be parallel

PVD Series Parts Verification Sensor

Specifications

| | |
|------------------------------------|---|
| Supply Voltage and Current | Input Voltage: 12 to 30V dc (10% maximum ripple @ 10% duty cycle) Input Current: less than 40 mA @ 24V dc and less than 70 mA @ 12V dc (exclusive of load) |
| Supply Protection Circuitry | Protected against reverse polarity and transient over-voltage |
| Sensing Beam | 630 nm visible red |
| Sensing Range | Retroreflective applications: 2 m (6.5'), using 25 mm (1") wide retroreflective tape Diffuse applications: 400 mm (15.7"), with 18% reflectivity gray card target |
| Sensing Height | 4-channel models: 111 mm (4.4") 8-channel models: 240 mm (9.4") |
| Beam Spacing | 28.6 mm (1.125") |
| Sensing Resolution | Retroreflective: 51 mm at 406 mm range, 100 mm at 2 m (2.0" dia. at 16" range, 3.9" at 6.5') See Figure 2. Diffuse: 55 mm dia. at 400 mm range (2.16" at 15.7" range) See Figure 10 for Minimum Object Detection Zone. |
| Output Configuration | User-selectable via DIP switch: 1 open-collector PNP (current sourcing) or 1 open-collector NPN (current sinking) |
| Output Rating | 150 mA maximum Off-state leakage current: less than 10 microamps On-state saturation voltage: NPN: less than 1.0V dc at 150 mA PNP: less than 2.0V dc at 150 mA |
| Output Protection Circuitry | Protected against false pulse at power-up and short circuit of outputs |
| Output Response Time | 400 ms (Includes standard 100 ms ON-delay and 100 ms OFF-delay) |
| Delay at Power-Up | Less than 1.0 second |
| Status Indicators | See Figure 1 and page 3. Green LED: Power ON/OFF Yellow LED: Output ON/OFF Job Light: (Diffused Green LED) Turned ON and OFF by applying an external signal to the Job input (white wire; see page 7). The job lights will be active high or active low, depending on user selection of DIP switch 4. Error Light: (Diffused Red LED) Turned ON and OFF by detection of an output event when job light is not ON. |
| Adjustments | 4 DIP switches, located behind access panel († denotes default setting): 1. <i>PNP</i> [†] / NPN output 2. <i>Normally Open operation</i> [†] / Normally Closed 3. <i>Job light ON solid</i> [†] / Job light flashing 4. <i>Job light input high</i> [†] / Job light input low |
| Construction | Black painted aluminum housing; acrylic lenses; thermoplastic polyester end caps; thermoplastic elastomer programming switch cover; stainless steel mounting brackets and hardware |
| Environmental Rating | NEMA 2; IEC IP62 |
| Connections | 5-conductor PVC-jacketed 2 m (6.5') cable which is either unterminated or terminated with a 5-pin Euro-style quick-disconnect connector, depending on model. Cable diameter is 3.3 mm (0.13"). |
| Operating Conditions | Temperature: 0° to +50°C (+32° to 122°F) Relative Humidity: 90% relative humidity @ 50°C (non-condensing) |
| Certifications |  |

PVD Series Parts Verification Sensor

Dimensions

Hardware packet p/n 50532 (included with each sensor):

- 4 Stainless steel Phillips panhead machine screws (M4 x 0.7 x 12)
- 2 Stainless steel Phillips panhead machine screws (M4 x 0.7 x 6)
- 2 Stainless steel Phillips panhead machine screws (M4 x 0.7 x 18)
- 4 Stainless steel hex nuts (M4 x 0.7)
- 4 Stainless steel lock washers (M4 x 0.7)
- 1 Plastic screwdriver (36 mm/1.4" long)

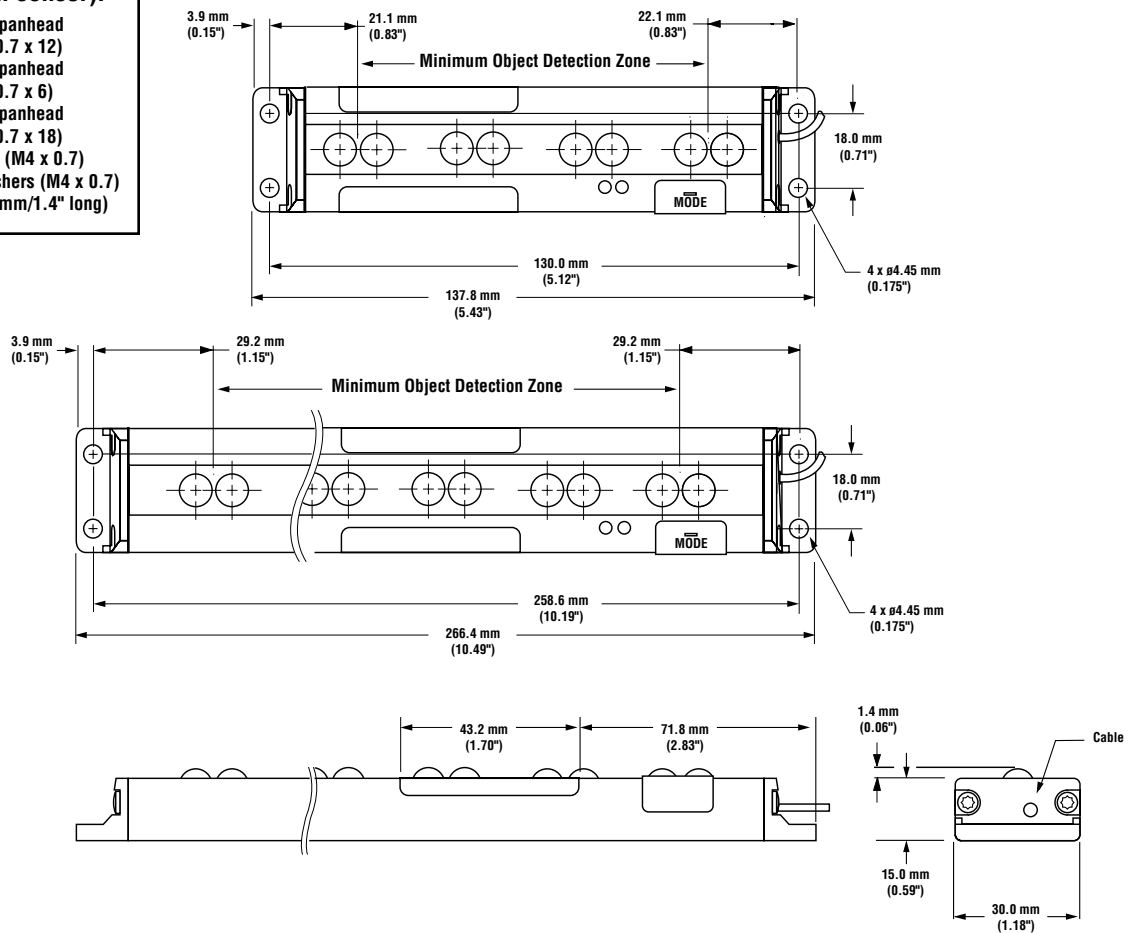


Figure 10. Sensor dimensions

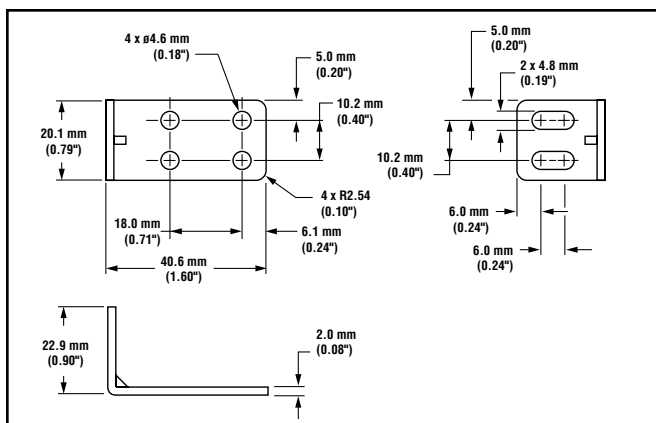


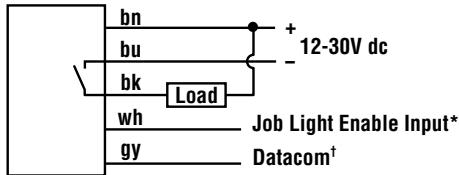
Figure 11. Bracket dimensions

PVD Series Parts Verification Sensor

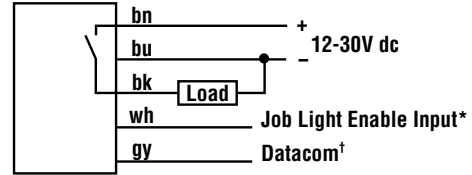
Hookups

All models feature integral 2 m (6.5') long, 3.3 mm (0.13") dia. PVC-jacketed cables. Models whose model numbers end in "Q" are terminated with quick-disconnect (QD) Euro-style 5-pin connectors; other models have unterminated ends. Optional mating QD cables shown below. Either 4-pin or 5-pin QD cables may be used; the center pin of a 5-pin cable is unused in normal operation.

NPN (Sinking) Output



PNP (Sourcing) Output



* See configuration information on page 3 for job light enable input requirements.

† For specialized applications requiring custom configuration options. See page 2 and contact your Banner representative for more information.

Accessories

Euro-Style Quick-Disconnect Cables

Cable: PVC jacket, polyurethane connector body, nickel-plated brass coupling nut
Conductors: 22 or 20 AWG high-flex stranded, PVC insulation, gold-plated contacts
Temperature: -40° to +90°C (-40° to +194°F)
Voltage Rating: 250V ac/300V dc

| Style | Model | Length | Dimensions | Pinout | |
|-------------------|------------------|------------|------------|--------|--|
| 4-Pin Straight | MQDC-406 | 2 m (6.5') | | | |
| | MQDC-415 | 5 m (15') | | | |
| | MQDC-430 | 9 m (30') | | | |
| 5-Pin Straight | MQDC1-506 | 2 m (6.5') | | | |
| | MQDC1-515 | 5 m (15') | | | |
| | MQDC1-530 | 9 m (30') | | | |

PVD Series Parts Verification Sensor

PVD Bracket Selection Table

| Bracket Model | Requires Use of Bracket Model(s) | May Be Used with Bracket Model(s) | Bracket Model | Requires Use of Bracket Model(s) | May Be Used with Bracket Model(s) |
|---------------------------------------|----------------------------------|--|---------------|----------------------------------|-----------------------------------|
| SMBPVD1 (included with PVD System) | N.A. | SMBPVD100A(B) SMBPVD225A(B) SMBPVA2 | SMBPVA9 | N.A. | SMBPVD100A(B) SMBPVD225A(B) |
| SMBPVD100A(B) SMBPVD225A(B) | N.A. | SMBPVD1 SMBPVA5(10) SMBPVA9 SMBPVA2 | SMBPVA2 | N.A. | SMBPVD100A(B) SMBPVD225A(B) |
| SMBPVA5C SMBPVA10C | N.A. | SMBPVD100A(B) SMBPVD225A(B) SMBPVA7 SMBPVA8 | SMBPVA7 | SMBPVA5C or SMBPVA10C | SMBPVD100A(B) SMBPVD225A(B) |
| | | | SMBPVA8 | SMBPVA5C or SMBPVA10C | SMBPVD100A(B) SMBPVD225A(B) |

Accessory Mounting Brackets

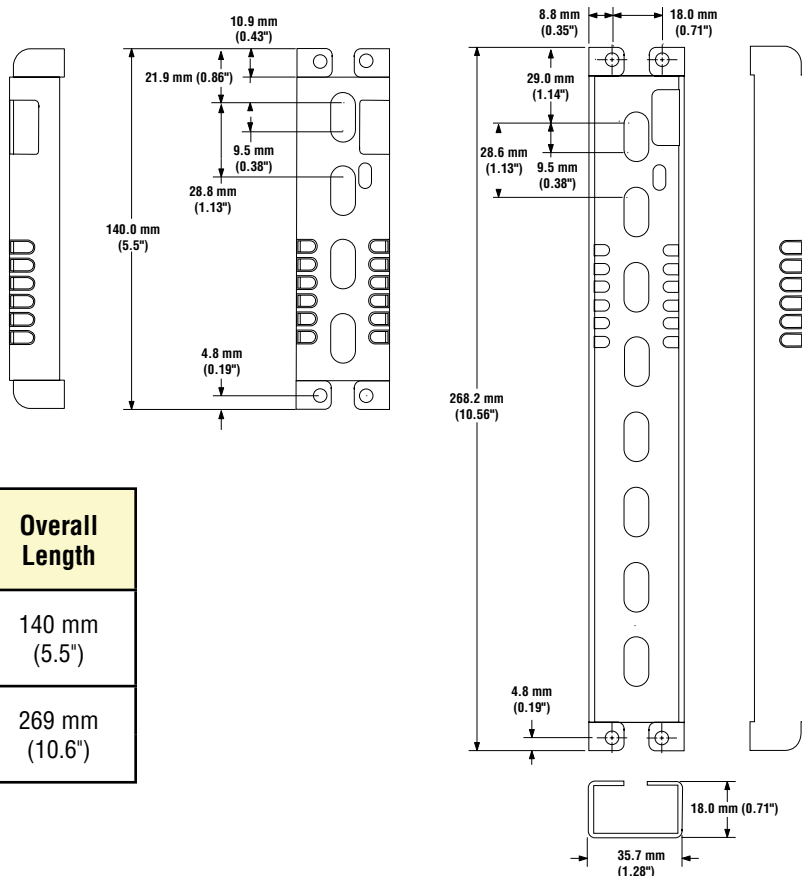
NOTE: Basic mounting brackets are included with PVD Sensor. See Figure 11, page 6.

SMBPVD100A
SMBPVD100AB
SMBPVD225A
SMBPVD225AB

- Heavy-duty protective brackets
- Cold-rolled steel, zinc finish
- May be used with SMBPVA5(10) for mounting to SMBPVA7 or SMBPVA8 brackets



Model
SMBPVD100A
shown



| Model | DIP-Switch Access | Used with | Overall Length |
|-------------|-------------------|-----------|-------------------|
| SMBPVD100A | Yes | PVD100 | 140 mm (5.5") |
| SMBPVD100AB | No | | |
| SMBPVD225A | Yes | PVD225 | 269 mm (10.6") |
| SMBPVD225AB | No | | |

PVD Series Parts Verification Sensor

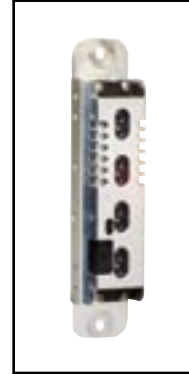
Accessory Mounting Brackets, continued

NOTE: Basic mounting brackets are included with PVD Sensor. See Figure 11, page 6.

SMBPVA5C
SMBPVA10C

- Back-mounted bracket required for mounting to SMBPVA7 or SMBPVA8 brackets
- Cold-rolled steel, zinc finish

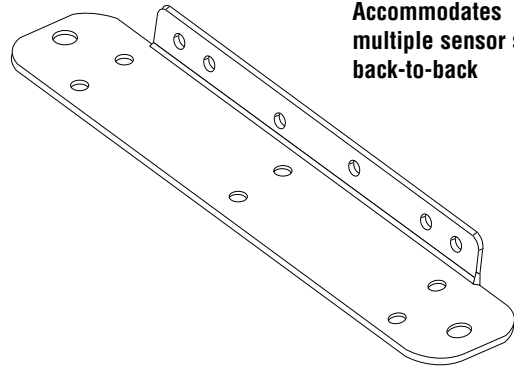
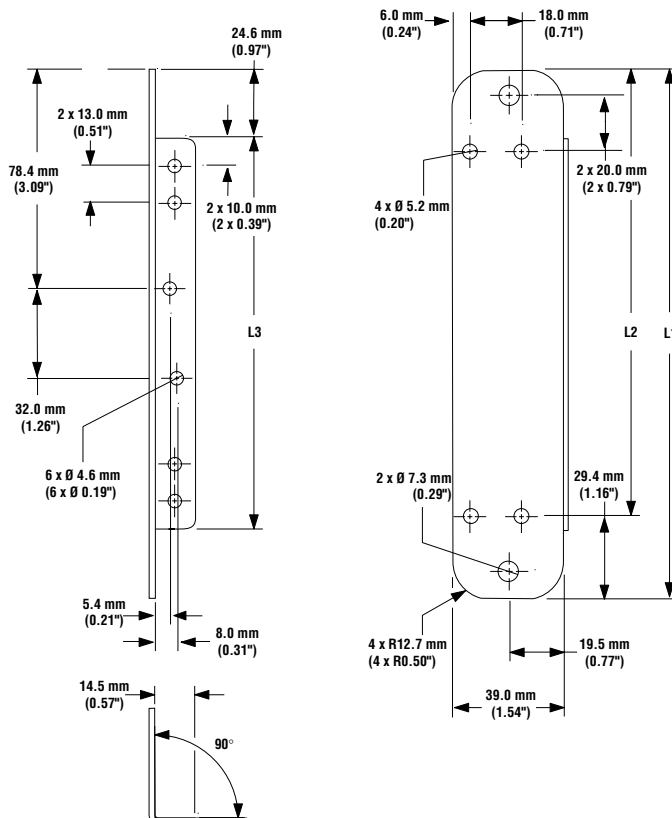
| Length* (see drawing) | Model SMBPVA5C | Model SMBPVA10C |
|--------------------------|-------------------|--------------------|
| L1 | 188.7 mm (7.43") | 317.2 mm (12.49") |
| L2 | 159.6 mm (5.12") | 258.6 mm (10.18") |
| L3 | 139.5 mm (5.49") | 268.0 mm (10.55") |



Shown with
protective bracket
SMBPVD100A



Accommodates
multiple sensor sizes,
back-to-back



*NOTE: Bracket sizes are also available to accommodate all sizes of PVA sensors.

PVD Series Parts Verification Sensor

Accessory Mounting Brackets, continued

NOTE: Basic mounting brackets are included with PVD Sensor. See Figure 11, page 6.

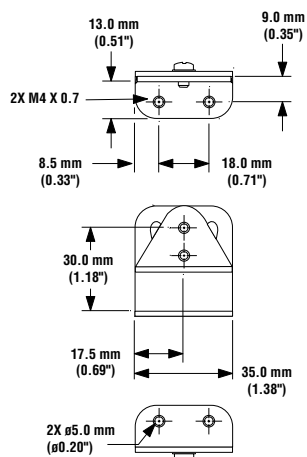
SMBPVA9

- Pair of 2-piece swivel brackets
- Mount directly to sensor or to SMBPVD100(225) protective brackets
- Designed for mounting sensor to "look down" or at an angle $\pm 90^\circ$



Shown with bracket model SMBPVD100A

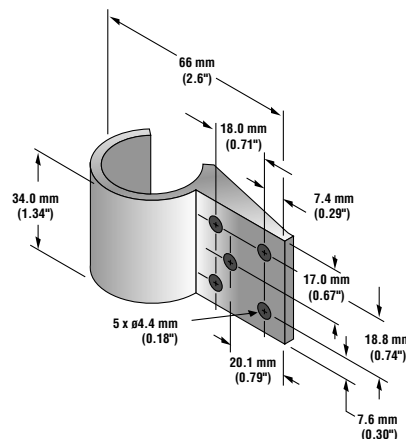
- Includes:
- (4) Self-threading machine screws
 - (4) M4 Lock washers
 - (4) M4 Screws



NOTE: Drill 3.7 mm (0.146") holes for mounting with included self-tapping screws. Use the sensor mounting holes as a template for drilling the holes.

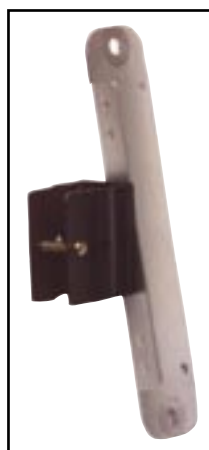
SMBPVA2

- Set of 4 molded brackets
- Brackets snap onto 28 mm (1¹/₈") dia. pipe
- Request data sheet P/N 54752 for more information

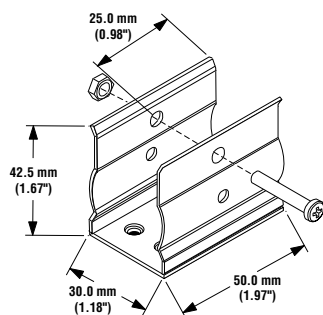


SMBPVA7

- 1-piece bracket for mounting to 28 mm (1¹/₈") dia. pipe
- Black-painted steel
- Requires use of SMBPVA5(10) for mounting



Shown with bracket model SMBPVA5C



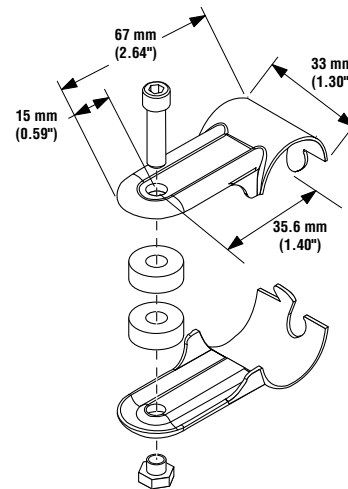
SMBPVA8

- Heavy-duty 2-part bracket mounts to 28 mm (1¹/₈") dia. pipe
- Cold-rolled steel, zinc finish
- Requires use of SMBPVA5(10) for mounting

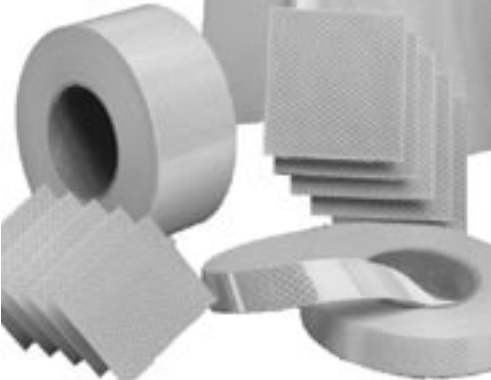


Shown with bracket model SMBPVA5C

- Includes:
- (1) 1/4-20 bolt
 - (1) 1/4-20 nut
 - (2) bushings



PVD Series Parts Verification Sensor

| Retroreflective Tape | | | | | |
|---|---------------------|---------------------|--------------------|------------------------|---|
| NOTE: For maximum adhesion of all tape products, surfaces must be clean | | | | | |
| Model | Reflectivity Factor | Maximum Temperature | Size | Unit | |
| BRT-THG-1-100 | 0.7 | 60°C (140°F) | 25 mm (1") wide | 2.5 m (100") length |  |
| BRT-THG-2-100 | 0.7 | 60°C (140°F) | 50 mm (2") wide | 2.5 m (100") length | |
| BRT-THG-3-100 | 0.7 | 60°C (140°F) | 75 mm (3") wide | 2.5 m (100") length | |

PVD Series Parts Verification Sensor



more sensors, more solutions

WARRANTY: Banner Engineering Corp. warrants its products to be free from defects for one year. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture found to be defective at the time it is returned to the factory during the warranty period. This warranty does not cover damage or liability for the improper application of Banner products. This warranty is in lieu of any other warranty either expressed or implied.