BANNER®
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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') **Diffuse Mode:** up to 400 mm (15.7") All models may be used in either sensing mode.	100 mm (4") Long, 4 Beams	2 m (6.5') 5-wire cable, unterminated	12 to 30V dc	User-selectable NPN/PNP
PVD100Q			2 m (6.5') cable, terminated in a QD connector		
PVD225		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.

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

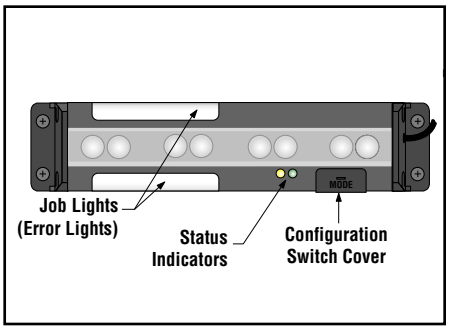

Figure 1. Sensor features

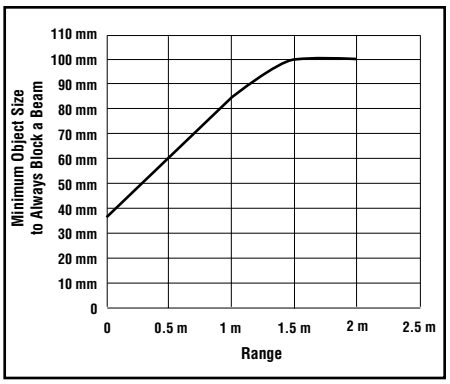

Figure 2. Minimum object detection size (retroreflective operation)

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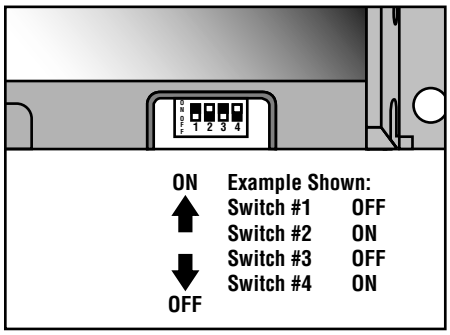

Figure 3. DIP-switch setting positions

Figure 4. DIP-switch cover removal

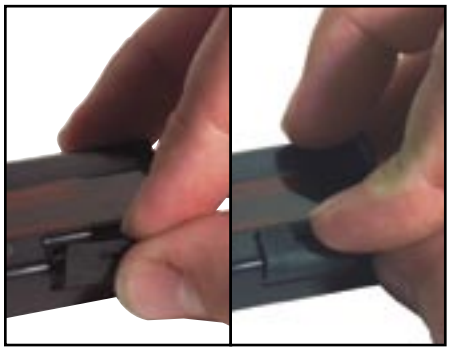

Figure 5. Align edge of cover, press back into place

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

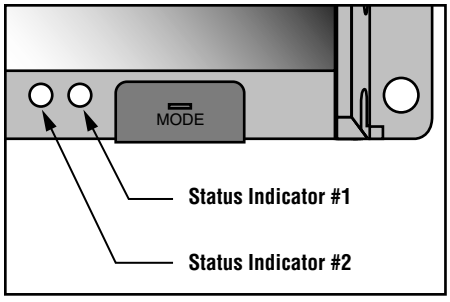

Figure 6. Sensor status indicators

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

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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.

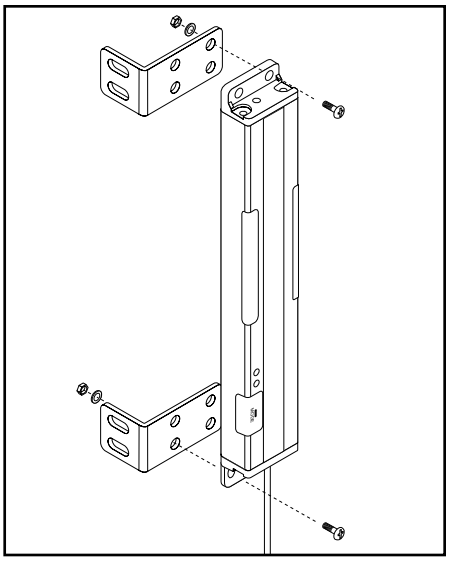

Figure 7. PVD mounting hardware

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.

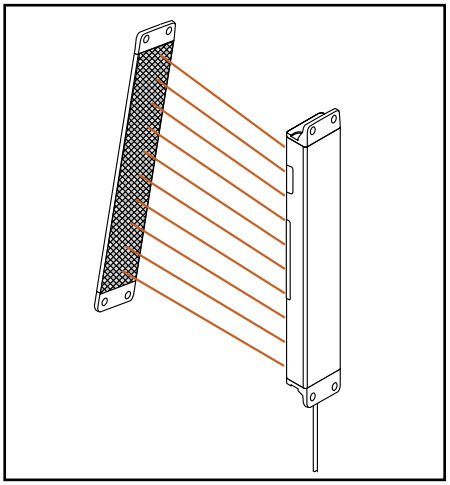

Figure 8. Improper orientation; sensor and opposite surface should be parallel

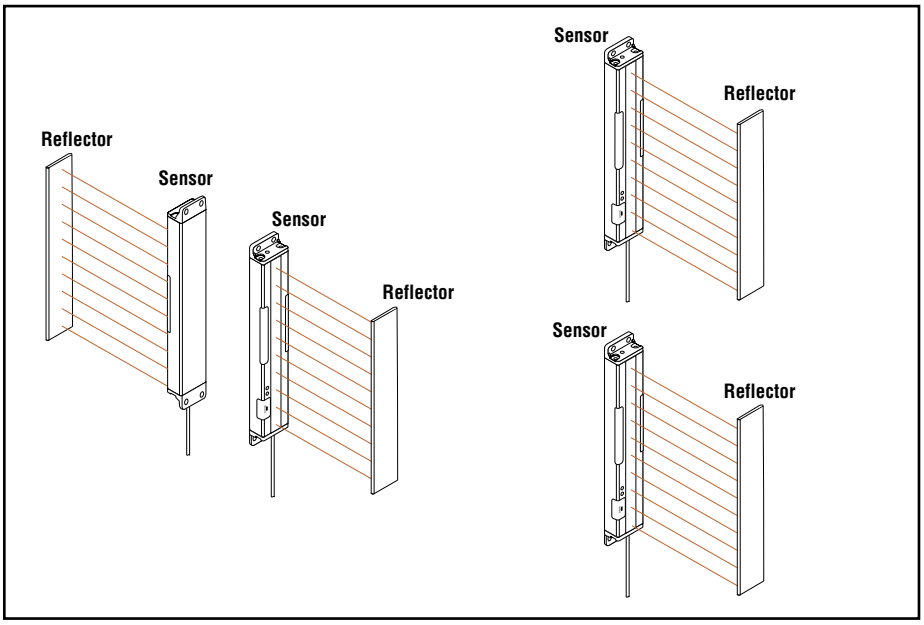

Figure 9. Position multiple sensors as shown to avoid crosstalk

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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. *PNP*† / NPN output 2. *Normally Open operation*† / Normally Closed 3. *Job light ON solid*† / Job light flashing 4. *Job light input high*† / 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	CE c UL US

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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)

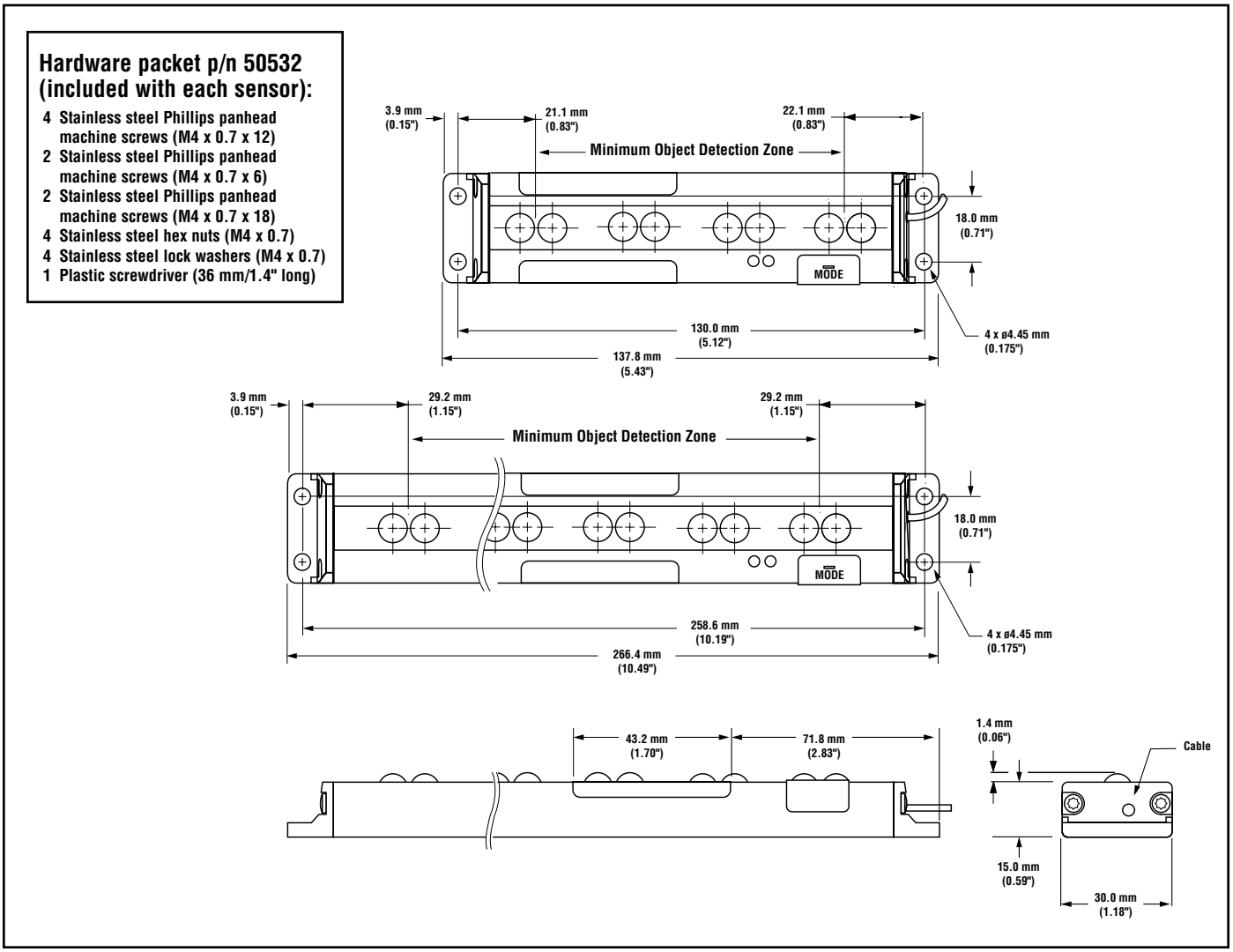


Figure 10. Sensor dimensions

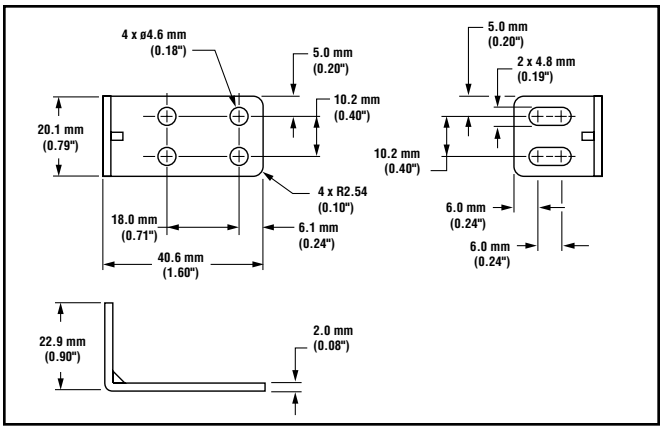
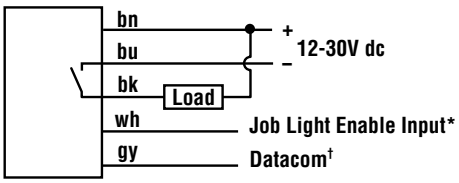


Figure 11. Bracket dimensions

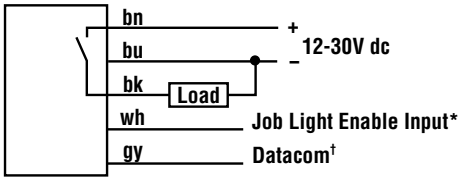
Hookups

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



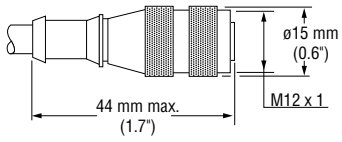
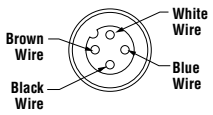
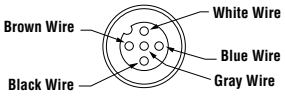
* See configuration information on page 3 for job light enable input requirements.

† 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** **MQDC-415** **MQDC-430**	2 m (6.5') 5 m (15') 9 m (30')		
5-Pin Straight	**MQDC1-506** **MQDC1-515** **MQDC1-530**	2 m (6.5') 5 m (15') 9 m (30')		

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PVD Bracket Selection Table

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**
SMBPVD100A(B) SMBPVD225A(B)	N.A.	**SMBPVD1 SMBPVA5(10) SMBPVA9 SMBPVA2**
SMBPVA5C SMBPVA10C	N.A.	**SMBPVD100A(B) SMBPVD225A(B) SMBPVA7 SMBPVA8**

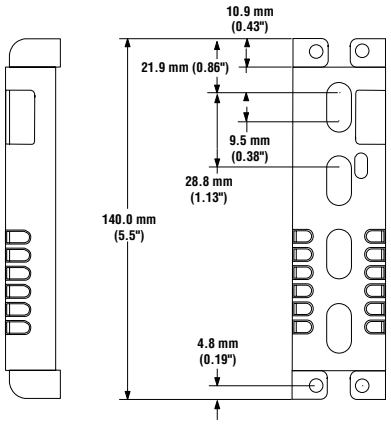
Bracket Model	Requires Use of Bracket Model(s)	May Be Used with Bracket Model(s)
SMBPVA9	N.A.	**SMBPVD100A(B) SMBPVD225A(B)**
SMBPVA2	N.A.	**SMBPVD100A(B) SMBPVD225A(B)**
SMBPVA7	**SMBPVA5C or SMBPVA10C**	**SMBPVD100A(B) SMBPVD225A(B)**
SMBPVA8	**SMBPVA5C or SMBPVA10C**	**SMBPVD100A(B) SMBPVD225A(B)**

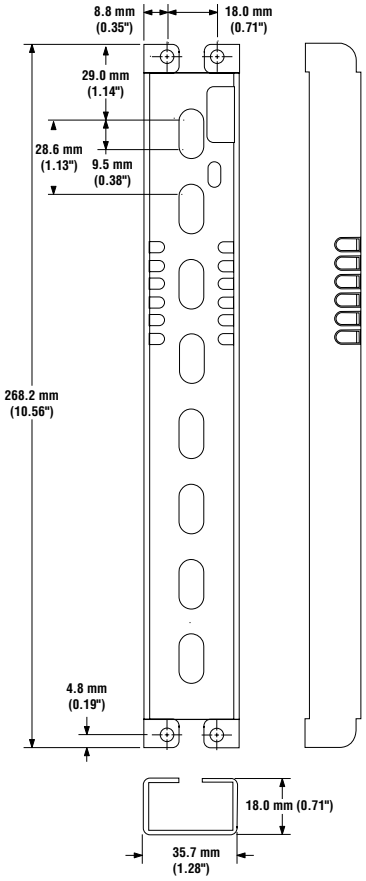
Accessory Mounting Brackets

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





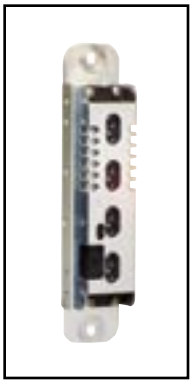
Model	DIP-Switch Access	Used with	Overall Length
SMBPVD100A	Yes	PVD100	140 mm (5.5")
SMBPVD100AB	No		
SMBPVD225A	Yes	PVD225	269 mm (10.6")
SMBPVD225AB	No		

Accessory Mounting Brackets, continued

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

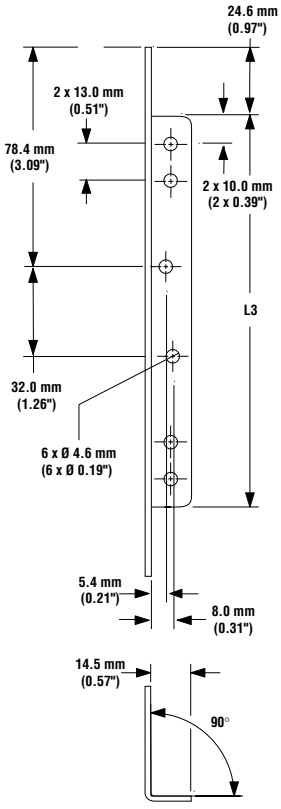
SMBPVA5C **SMBPVA10C**	• Back-mounted bracket required for mounting to SMBPVA7 or SMBPVA8 brackets • Cold-rolled steel, zinc finish

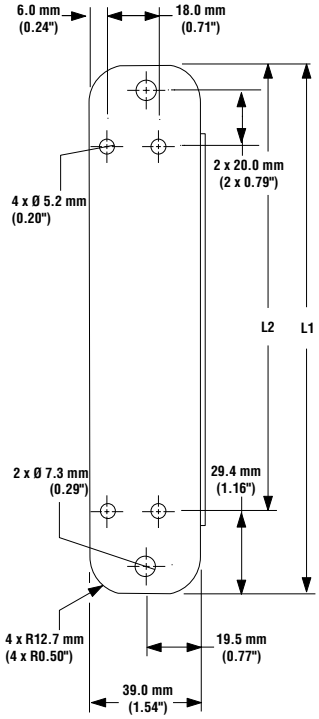
Length* (see drawing)	Model SMBPVA5C	Model SMBPVA10C
L1	188.7 mm (7.43")	317.2 mm (12.49")
L2	159.6 mm (5.12")	258.6 mm (10.18")
L3	139.5 mm (5.49")	268.0 mm (10.55")

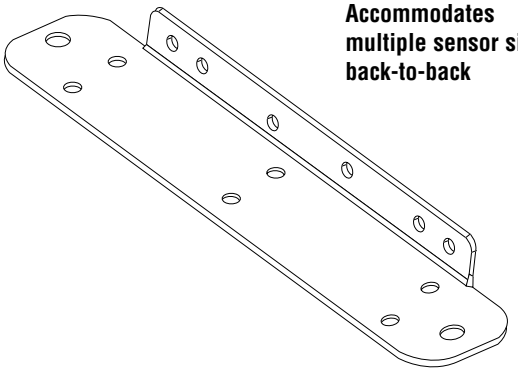


Shown with protective bracket SMBPVD100A

Accommodates multiple sensor sizes, back-to-back







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

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Accessory Mounting Brackets, continued

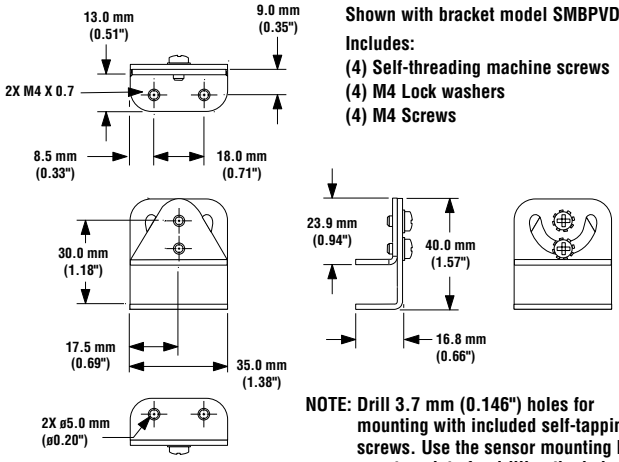
NOTE: Basic mounting brackets are included with PVD Sensor. See Figure 11, page 6.

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 ±90°

Shown with bracket model SMBPVD100A

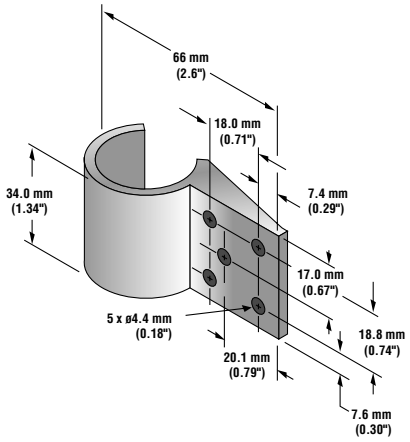
Includes:
(4) Self-threading machine screws
(4) M4 Lock washers
(4) M4 Screws



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

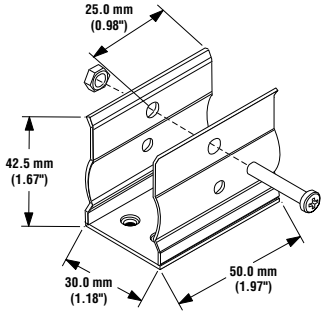
- Set of 4 molded brackets
- Brackets snap onto 28 mm (1 1/8") dia. pipe
- Request data sheet P/N 54752 for more information



SMBPVA7

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

Shown with bracket model SMBPVA5C

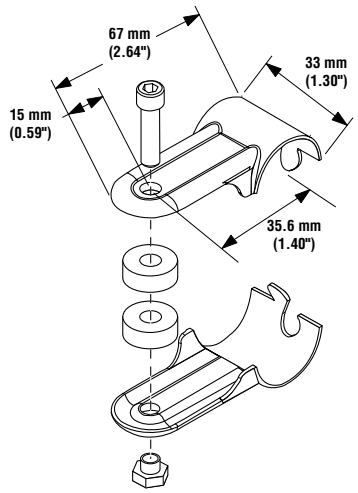


SMBPVA8

- Heavy-duty 2-part bracket mounts to 28 mm (1 1/8") dia. pipe
- Cold-rolled steel, zinc finish
- Requires use of SMBPVA5(10) for mounting

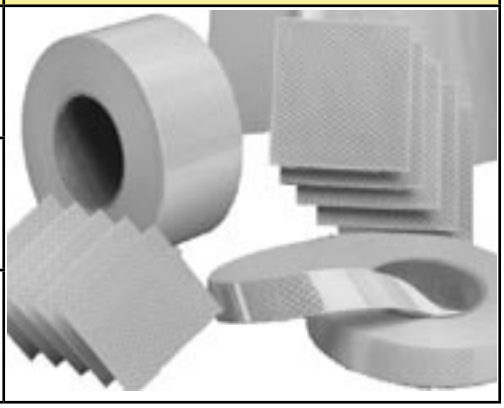
Shown with bracket model SMBPVA5C

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



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

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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.

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