PVD Series Parts Verification Sensor

Datasheet

Diffuse or Retroreflective Sensor for Error Proofing of Bin-Picking Operations



- One-component system, 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 up to 2 m (6.5 ft) when used with retroreflective target; 400 mm (15.7 in) when used in diffuse mode
- Large job lights on either side of the metal housing can be remotely controlled to initiate user action with a solid or a blinking green light; job lights turn red to indicate bin-picking errors
- Compact package size; only 30 mm wide × 15 mm deep (1.2 in × 0.6 in)
- Available in 2 lengths 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 ft) unterminated cable or 2 m (6.5 ft) cable with 5-pin Euro-style quick-disconnect connector
- Heavy-duty protective brackets available
- 12 V dc to 30 V dc operation

WARNING: Not To Be Used for Personnel Protection

Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

Models

Models [1]	Range	Array	Sensing Beam	Supply Voltage	Output
PVD100	Retroreflective Mode: up to 2 m (6.5 ft) Diffuse Mode: up to 400 mm (15.7 in) All models may be used in either sensing mode.	100 mm (4 in) long, 4 beams	Visible red, 630 nm	12 V to 30 V dc	User-selectable NPN/PNP
PVD100Q					
PVD225		225 mm (9 in) long, 8 beams			
PVD225Q					

Overview

The PVD Series Parts Verification Sensor is a one-component, easy-to-use light screen suited to many part assembly, bin picking (pick-to-light), and error-proofing applications. The PVD increases task efficiency due to simplified job training, increased quality control (no skipped components), and reduced rework and inspections. It speeds the resumption of work after breaks and other distractions, and is ideal for multilingual workplaces where communication is an issue.

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 decreases when no retroreflector is installed.

The DIP-switch-selectable PNP/NPN output interfaces to a system controller, which is pre-programmed for a specific sequence of tasks. Mounted with its visible red beams stretching across each parts bin, the sensor job light signals the assembler which bins contain items to be picked in a given operation and in what order they should be picked.

As the assembler takes a part in sequence and breaks the beam, the sensor senses that the part was removed and it sends an output signal to the controller. The controller then verifies if the correct part was taken and may respond by turning that job light OFF, activating the job light of 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.

Standard configuration options are selected by means of a bank of four DIP switches behind a press-on black rubber cover. DIP switch options include: PNP or NPN output, Normally Open or Normally Closed operation, steady or flashing job light, and job light control input.

[1]
- To order the 9 m (30 ft) cable model, add the suffix "W/30" to the cabled model number. For example, PVD100 W/30.
- To order the 150 mm (6 in) cable model with a quick disconnect, add the suffix "W/6IN" to the cabled model number. For example, PVD100Q W/6IN.
- Models with a quick disconnect require a mating cordset.

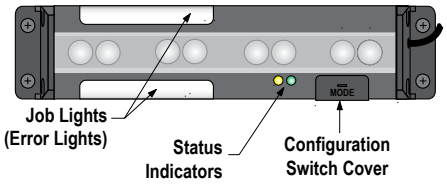


Figure 1. Sensor features

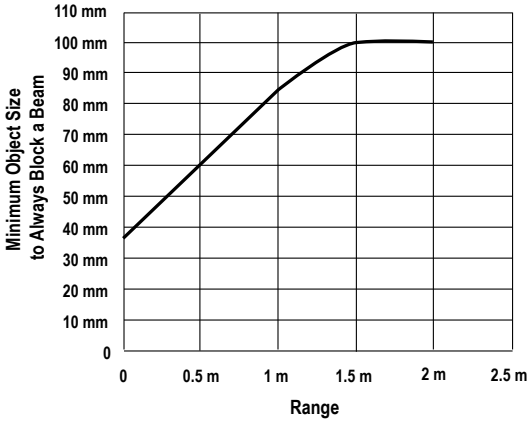


Figure 2. Minimum object detection size (retroreflective operation)

Installation

Multiple sensors located farther than the sensor's maximum range from one another are unlikely to cause crosstalk problems. However, when multiple sensors are mounted in a confined area, take care to avoid crosstalk between them. Alternate the relative position of adjacent sensors and/or reflectors. Sensors positioned above or below one another should not create crosstalk difficulties. Mount the sensor and reflector parallel.

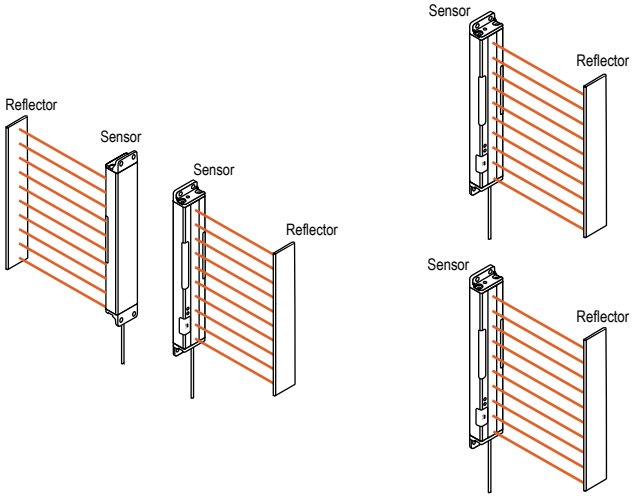


Figure 3. Examples of Appropriate Positions

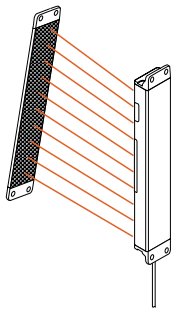


Figure 4. Example of Incorrect Position

Mounting

The wide beam pattern of PVD sensors simplifies their alignment. M4 stainless steel fasteners and two stainless steel brackets are included with each sensor.

Mount the sensor and its reflector, if used, parallel to one another in the same plane, and their tops and bottoms aligned.

1. From a common point of reference, make measurements to locate the sensor and its reflector, if used, in the same plane with their midpoints directly opposite each other.
2. Mount the included brackets to the top and bottom of each sensor, as shown.
3. Mount the sensor in its brackets and the reflector, if used, being careful to position the sensor's red lenses directly facing the reflector.
4. Measure from one or more reference planes (for example, the building or bin floor) to the same point(s) on the emitter and receiver to verify their mechanical alignment. (If the sensors/reflectors are mounted exactly vertical or horizontal, a carpenter's level may be helpful. A straightedge or a string extended between the sensor and the bin wall may also be helpful.)
5. Also check "by eye" for line-of-sight alignment.
6. Make any necessary final mechanical adjustments, and hand-tighten the bracket hardware.
7. After the electrical hookup is complete, check for beam alignment. If necessary, re-align the emitter and receiver at that time.

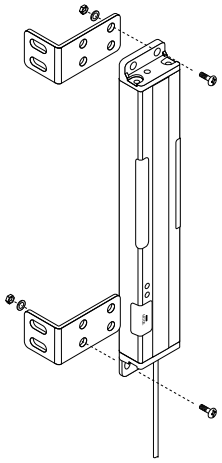


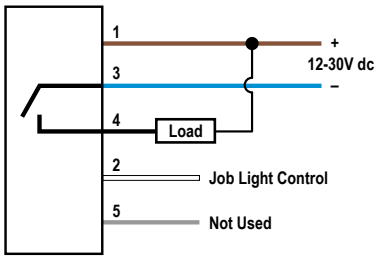
Figure 5. PVD Mounting Hardware

Wiring

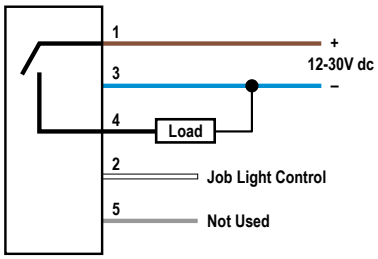
All models feature integral 2 m (6.5 ft) long, 3.3 mm (0.13 inch) diameter PVC-jacketed cables. Models whose model numbers end in "Q" are terminated with quick-disconnect (QD) Euro-style 5-pin connectors; other models have unterminated ends. Optional mating QD cables are available. Either 4-pin or 5-pin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

Wiring is functionally identical for cabled and quick-disconnect models.

NPN (Sinking) Output



PNP (Sourcing) Output



Key

1 = Brown
2 = White
3 = Blue
4 = Black
5 = Gray

See *Configuration* on page 3 for job light control input requirements.

Configuration

To configure the PVD, set the DIP switches as shown, using the supplied plastic screwdriver to avoid damaging the switches or causing a short circuit.

Cover Removal	Cover Replacement	
		

Cover Removal	Cover Replacement
Insert a fingernail or small screwdriver into the slot; 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.

The switches determine four status operating modes:

PVD Configuration DIP Switch Settings

The factory default setting is ON for all switches

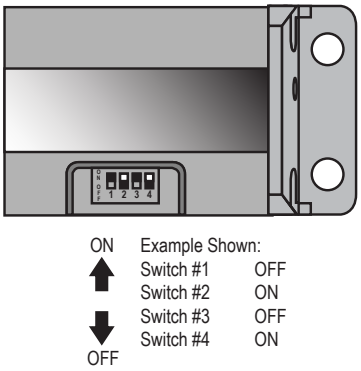
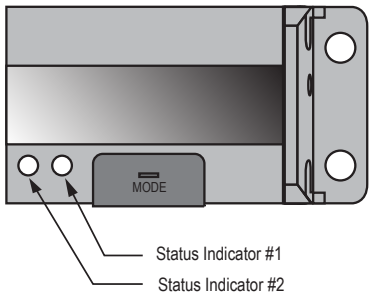


Figure 6. Configuration DIP switch setting positions

Switch	Condition
1	ON = PNP output OFF = NPN output
2	ON = Normally Open OFF = Normally Closed
3	ON = Job light steady OFF = Job light flashes
4	Job light control input: Connect the white wire as follows: PNP Output ON = Job light ON for +10 to 30V dc (29kΩ 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 (10kΩ input impedance)

Status Indicators/Troubleshooting

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

Specifications

Supply Voltage and Current
Input Voltage: 12 V dc to 30 V dc (10% maximum ripple at 10% duty cycle)
Input Current: less than 88 mA at 12 V dc, less than 75 mA at 24 V dc and less than 72 mA at 30 V dc (exclusive of load)

Supply Protection Circuitry
Protected against reverse polarity and transient overvoltages

Sensing Beam
Visible red, 630 nm

Sensing Range
Retroreflective applications: 2 m (6.5 ft) using 25 mm (1 in) wide retroreflective tape
Diffuse applications: 400 mm (15.7 in) with 18% reflectivity gray card target

Sensing Height
4-channel models: 111 mm (4.4 in)
8-channel models: 240 mm (9.4 in)

Beam Spacing
28.6 mm (1.125 in)

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 V dc at 150 mA; PNP — less than 2 V dc at 150 mA

Required Overcurrent Protection

WARNING: Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

Overcurrent protection is required to be provided by end product application per the supplied table.
Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.
Supply wiring leads < 24 AWG shall not be spliced.
For additional product support, go to *http://www.bannerengineering.com*.

Supply Wiring (AWG)	Required Overcurrent Protection (Amps)
20	5.0
22	3.0
24	2.0
26	1.0
28	0.8
30	0.5

Output Protection
Protected against false pulse on 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

Sensing Resolution
See *Dimensions* on page 6 for Minimum Object Detection Zone
Retroreflective: 51 mm at 406 mm range, 100 mm at 2 m (2.0 in dia. at 16 in range, 3.9 in at 6.5 ft); see *Figure 2* on page 2
Diffuse: 55 mm dia. at 400 mm range (2.16 in at 15.7 in range)

Indicators
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). The job lights will be active high or active low, depending on DIP switch 4 selection.
Error Light (Diffused Red LED): Turned ON and OFF by detection of an output event when job light is not ON.

Indicator Light Lumens

Light Function	Color	Typical Wavelength	Typical Intensity (lm)
Job Light	Green	525 nm	12
Error Light	Red	625 nm	2.5

Adjustments
4 DIP switches, located behind access panel (default setting is ON position)

Construction
Black painted aluminum housing; acrylic lenses; thermoplastic polyester end caps; thermoplastic elastomer programming switch cover; stainless steel mounting brackets and hardware

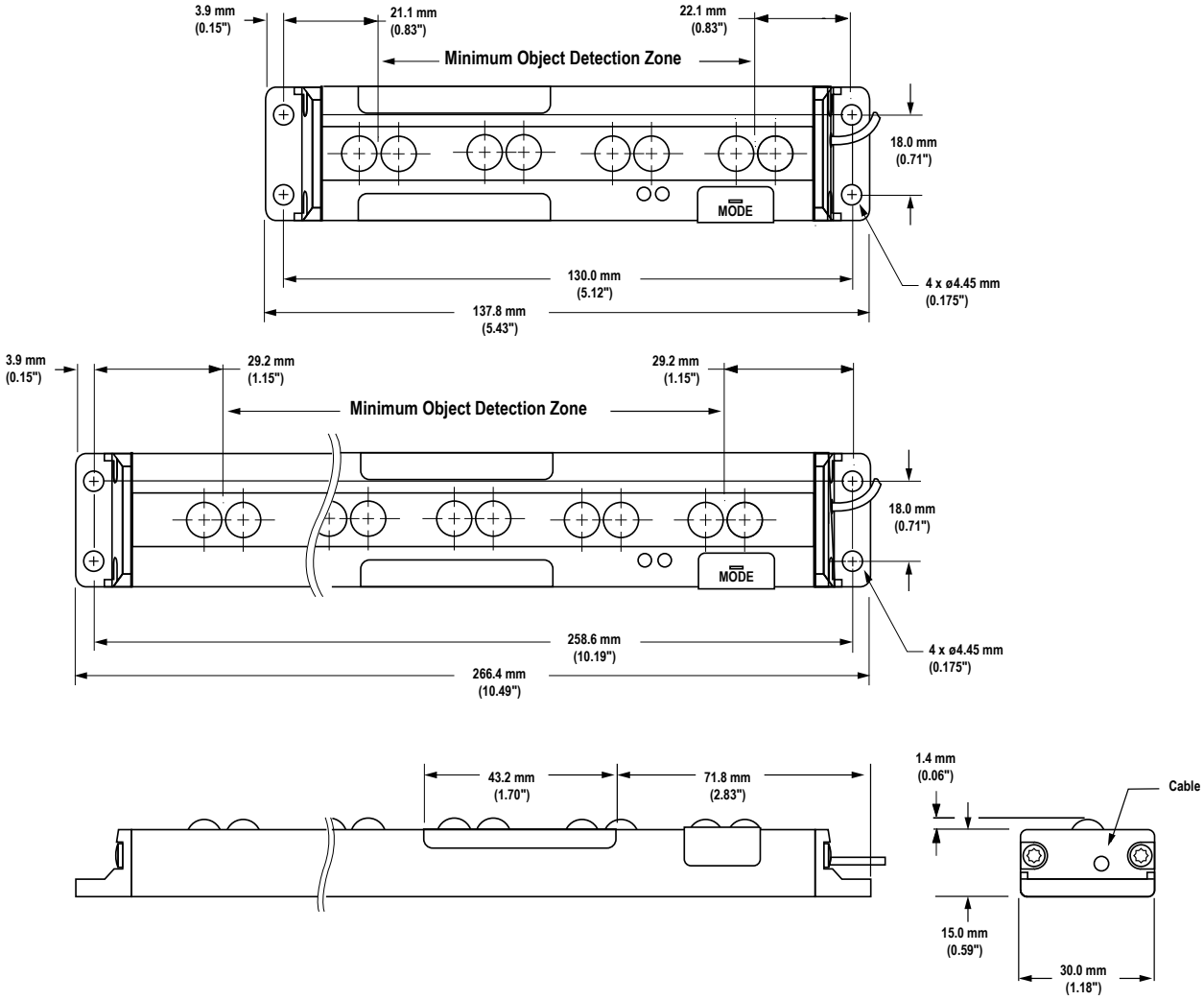
Connections
5-conductor PVC-jacketed 2 m (6.5 ft) cable which is either unterminated or terminated with a 5-pin Euro-style quick-disconnect connector, depending on model. Cable diameter is 3.3 mm (0.13 in).

Environmental Rating
NEMA 2; IEC IEC IP62

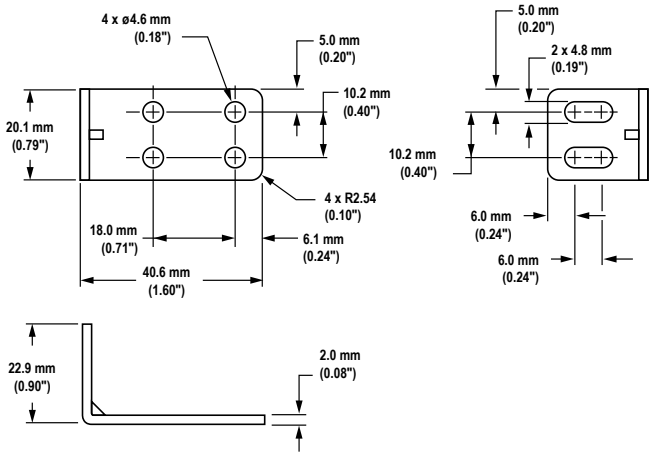
Operating Conditions
Temperature: 0 °C to +50 °C (+32 °F to +122 °F)
Humidity: 90% at +50 °C maximum relative humidity (non-condensing)

Certifications

Dimensions



SMBPVA1 Standard Bracket (2 Included with PVD)

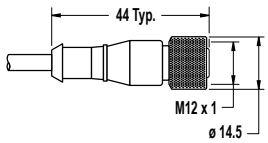
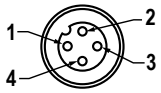


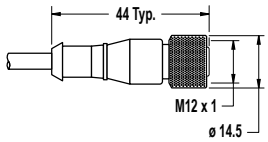
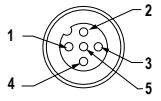
Hardware Included with Each Sensor (kit part number 50532)

Qty	Description
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 (3.6 cm/1.4 in long)

Accessories

Cordsets

4-Pin Threaded M12/Euro-Style Cordsets				
Model	Length	Style	Dimensions	Pinout (Female)
MQDC-406	1.83 m (6 ft)	Straight		 1 = Brown 2 = White 3 = Blue 4 = Black
MQDC-415	4.57 m (15 ft)			
MQDC-430	9.14 m (30 ft)			
MQDC-450	15.2 m (50 ft)			

5-Pin Threaded M12/Euro-Style Cordsets—Single Ended				
Model	Length	Style	Dimensions	Pinout (Female)
MQDC1-501.5	0.50 m (1.5 ft)	Straight		 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
MQDC1-506	1.83 m (6 ft)			
MQDC1-515	4.57 m (15 ft)			
MQDC1-530	9.14 m (30 ft)			

Brackets

All measurements are listed in millimeters, unless noted otherwise.

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)

NOTE: Standard mounting brackets are included with each PVD System. The following brackets are in addition to the standard brackets.

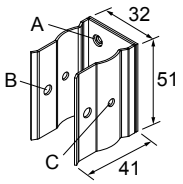
SMBPVA2

- Set of 4 molded brackets
- Snaps onto standard 28 mm (1.1 in) diameter pipe
- 2 required per sensor



SMBPVA7

- One-piece bracket for mounting to 28 mm (1.1 in) diameter pipe
- Black-painted steel
- Requires SMBPVA..C for mounting at an angle ±90°

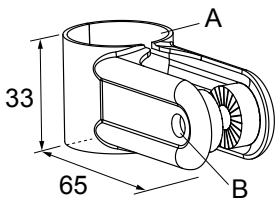


A = M4 x 0.5, B = ø 5.2, C = ø 4.2

SMBPVA8

- Heavy-duty 2-part bracket mounts to 28 mm (1.1 in) diameter pipe
- Cold-rolled steel with zinc finish
- Requires SMBPVA..C for mounting

A=ø 30.5, B=ø 7.1



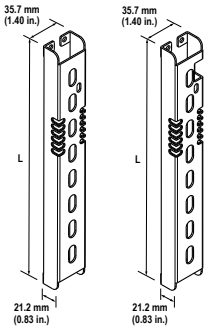
SMBPVA9

- Pair of two-piece swivel brackets
- Mount directly to sensor or to PVD or PVA protective brackets
- Designed for mounting sensor to "look down"



SMBPVD..A & SMBPVD..AB

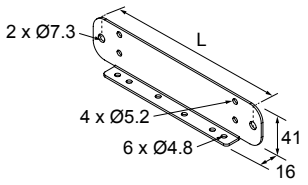
- Heavy-duty protection brackets
- Some models include DIP-switch access port
- Cold-rolled steel with zinc finish
- May be used with SMBPVA..C for mounting to SMBPVA7 or SMBPVA8 brackets



Models with DIP Switch Access Port	Models with No DIP Switch Access	L
SMBPVD100A	SMBPVD100AB	140 mm (5.5 in)
SMBPVD225A	SMBPVD225AB	269 mm (10.6 in)

SMBPV..C

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



Model	L
SMBPVA5C	170.0 mm
SMBPVA10C	298.5 mm

Retroreflective Tape

Model	Reflectivity Factor	Maximum Temperature	Size
BRT-THG-1-100	0.7	+60 °C (+140 °F)	25 mm (1 in) wide, 2.5 m (100 in) long
BRT-THG-2-100	0.7	+60 °C (+140 °F)	50 mm (2 in) wide, 2.5 m (100 in) long
BRT-THG-3-100	0.7	+60 °C (+140 °F)	75 mm (3 in) wide, 2.5 m (100 in) long

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