PVD One-Piece Pick-to-Light Array

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

Patent pending

- 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') when used with retroreflective target; 400 mm (15.7") 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 x 15 mm deep (1.2" x 0.6")
- 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') 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

Models	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 (for example, **PVD100 W/30**).

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

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

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.

Overview

The PVD Series Parts Verification Sensor Pick-to-Light sensors are suited to many part assembly and bin picking (pick-to-light) applications. The job light system results in increased 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.

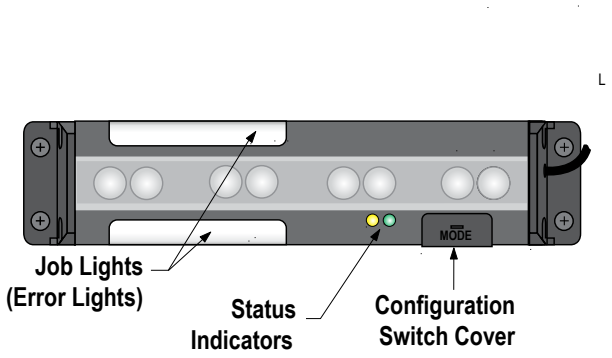


Figure 1. Sensor features

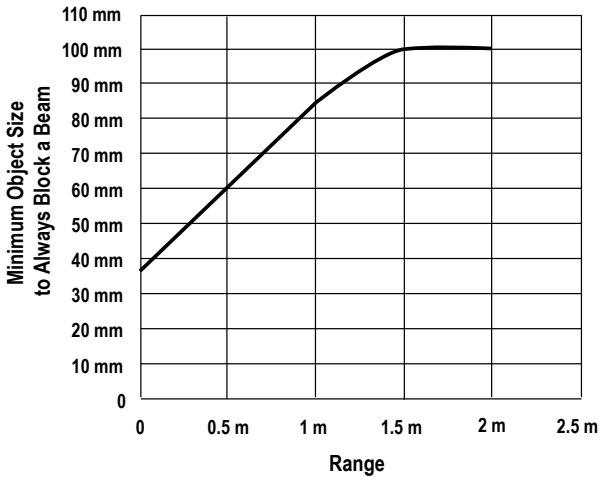


Figure 2. Minimum object detection size (retroreflective operation)

The PVD is an easy-to-use, one-component solid-state light screen, capable of functioning in either diffuse or retroreflective sensing mode. (Sensor range decreases when no retroreflector is installed.) 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.

The solid-state output interfaces to a system controller, which is pre-programmed for a specific sequence of tasks. Mounted in or near each bin in an assembler's work station, 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.

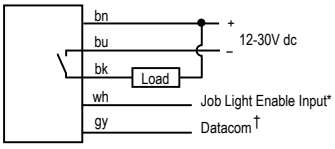
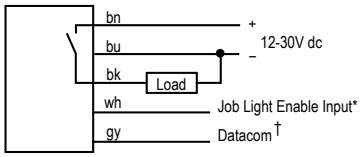
If multiple parts are to be removed from one bin, the job light may remain ON until the appropriate number of signals is returned to the controller. If an incorrect part is selected, the control system may be wired to signal an alarm for the assembler and/or a supervisor, or it may be programmed to interpret the action as a call for parts.

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, and Job light control input.

Wiring

All models feature integral 2 m (6.5 ft) long, 3.3 mm (0.13 inch) 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.

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

NPN (Sinking) Output	PNP (Sourcing) Output
	

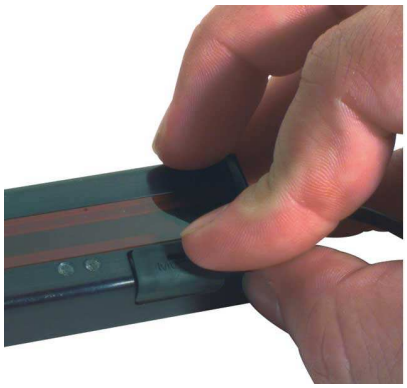
* See *Configuration* on page 2 for job light enable input requirements.

† For specialized applications requiring custom configuration options. See *Overview* on page 1 and contact your Banner representative for more information.

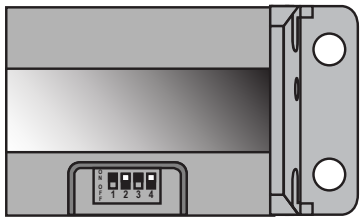
Configuration

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. When setting the DIP switches, use the supplied plastic screwdriver, to avoid damaging the switches or causing a short circuit.

The factory default setting is ON for all switches.

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		
	Switch	**Condition**
 Example Shown: Switch #1 OFF Switch #2 ON Switch #3 OFF Switch #4 ON **Figure 3. Configuration DIP switch setting positions**	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 of the emitter and receiver as follows: **PNP Output** ON = Job light ON for +10 to 30V dc (29k 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 input impedance)

Additional configuration options can be adjusted using specialized Banner software and 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

Status Indicators/Troubleshooting

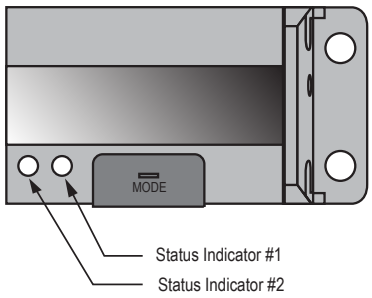


Figure 4. Status indicators

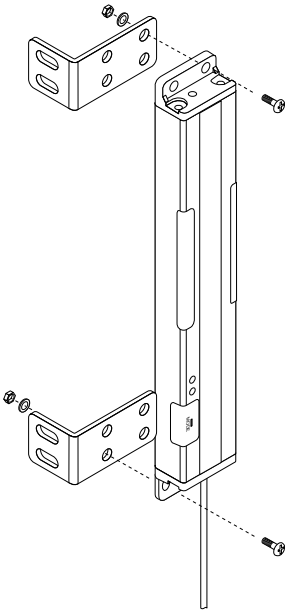
Indicator	Condition	Description
#1	Steady Yellow	Output is active (change Switch #2 to Light Operate to turn the yellow indicator ON when the system is clear)
	OFF	Output is inactive (change Switch #2 to Dark Operate to turn the yellow indicator ON when the system is blocked)
#2	Steady Green	Power is ON and system is OK
	OFF	Power is OFF
	Flashing Green 1x/sec	Blanking is enabled

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, with their cable ends pointing the same direction, and their tops and bottoms aligned.

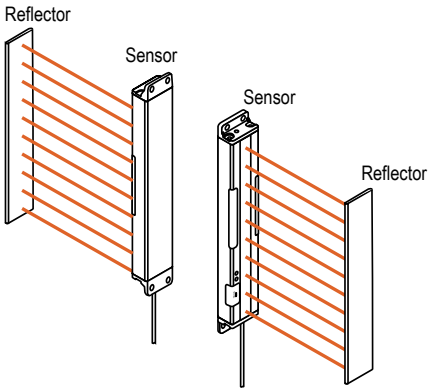
1. From a common point of reference, make measurements to locate the sensor and its reflector, if used, in the same plane with their midpoints directly opposite each other.
2. Mount the included brackets to the top and bottom of each sensor, as shown.
3. Mount the sensor in its brackets and the reflector, if used, being careful to position the sensosr'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.

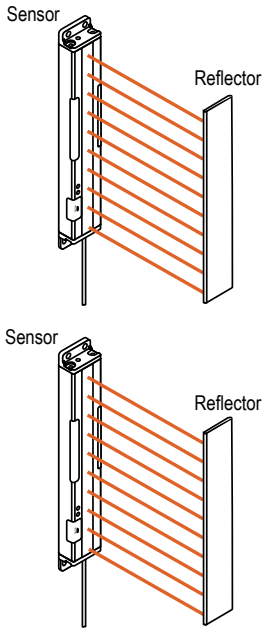


Installation

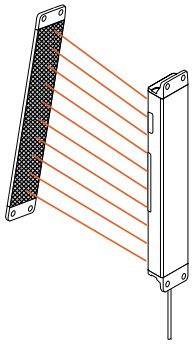
Multiple sensors located farther than the sensor's maximum range from one another are unlikely to cause crosstalk problems. However, when multiple sensors are mounted in a confined area, take care to avoid crosstalk between them. Alternate the relative position of adjacent sensors and/or reflectors.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

Examples of Appropriate Positions





Example of Incorrect Position



Specifications

Supply Voltage and Current
12 to 30V dc (10% max. ripple)
Less than 40 mA @ 24V dc and less than 70 mA @ 12V dc (exclusive of load)

Supply Protection and 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: 400mm (15.7") with 18% reflectivity gray card target

Sensing Height
111 mm (4.4") or 240 mm (9.4"), depending on model

Beam Spacing
28.6 mm (1.125")

Delay at Power-Up
Less than 1.0 second

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.

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

Construction

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'); Diffuse: 55 mm dia. at 400 mm range (2.16" at 15.7" range)

Output Configuration

User-selectable via DIP switch:

1 open-collector PNP (current sourcing) or 1 open-collector NPN (current sinking)

Output Rating

Max. load: 150 mA

OFF-state leakage current: less than 10 microamps

ON-state saturation voltage: NPN — less than 1V dc at 150 mA; PNP — less than 2V dc at 150 mA

Output Protection

Protected against false pulse on power-up and continuous overload or short circuit of output

Output Response Time

400 ms (includes standard 100 ms ON-delay and 100 ms OFF-delay)

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

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"). QD models require a mating cordset with either a 4-pin or 5-pin connector.

Environmental Rating

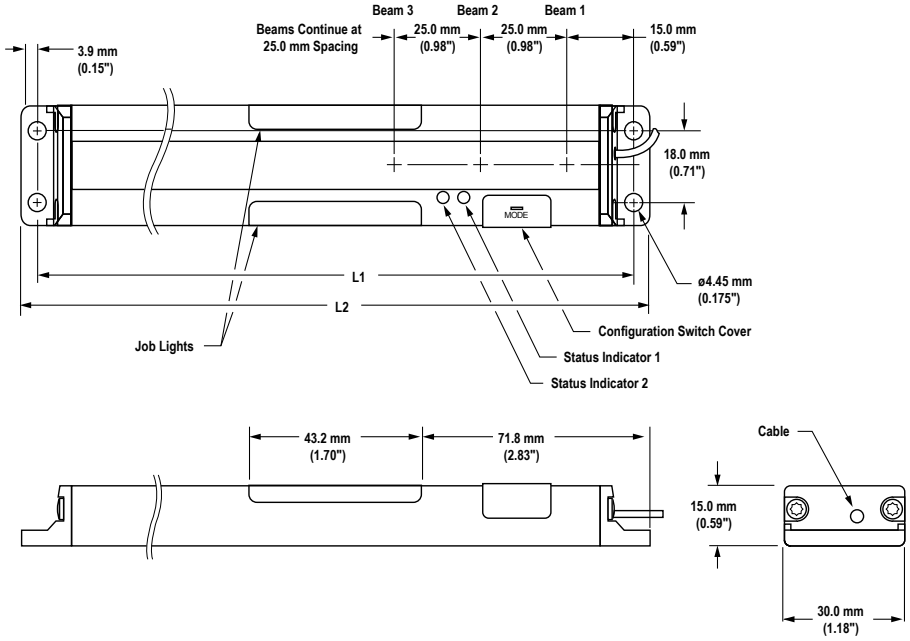
NEMA 2; IEC IP62

Operating Conditions

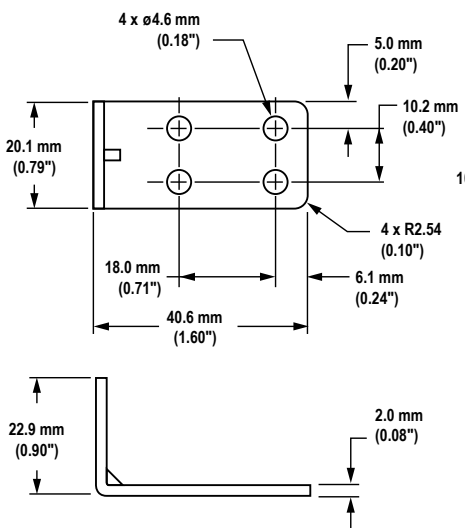
0° to +50°C (+32° to 122°F); 90% max. relative humidity @ 50°C (non-condensing)

Certifications

Dimensions



Standard Bracket (Included with PVD)



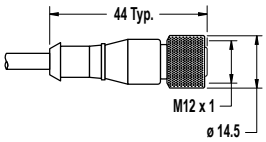
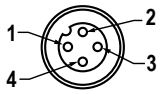
Hardware (kit part number 50532) Included with Each Sensor

Qty	Description
4	Stainless steel Phillips panhead machine screws (M4 x 0.7 x 12)
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" long)

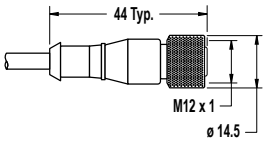
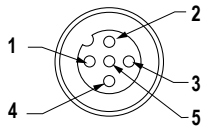
Accessories

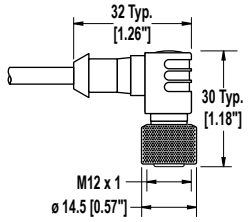
Cordsets

4-Pin Threaded M12/Euro-Style Cordsets

Model	Length	Style	Dimensions	Pinout
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

Model	Length	Style	Dimensions	Pinout
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)			
MQDC1-506RA	1.83 m (6 ft)	Right-Angle		
MQDC1-515RA	4.57 m (15 ft)			
MQDC1-530RA	9.14 m (30 ft)			

5-Pin Threaded M12/Euro-Style Cordsets				
Model	**Length**	**Style**	**Dimensions**	**Pinout**
				

Brackets

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.

SMBPVD100A
SMBPVD100AB
SMBPVD225A
SMBPVD225AB

- Heavy-duty protective brackets
- Set of 2 brackets
- Cold-rolled steel, zinc finish
- Models with suffix “AB” allow no access to PVD DIP switches

SMBPVA5C
SMBPVA10C

- Back-mounted bracket required for mounting to **SMBPVA7** or **SMBPVA8** brackets
- Also accommodates protective bracket **SMBPVD..A**
- Cold-rolled steel, zinc finish
- Accommodates multiple sensor sizes, back-to-back

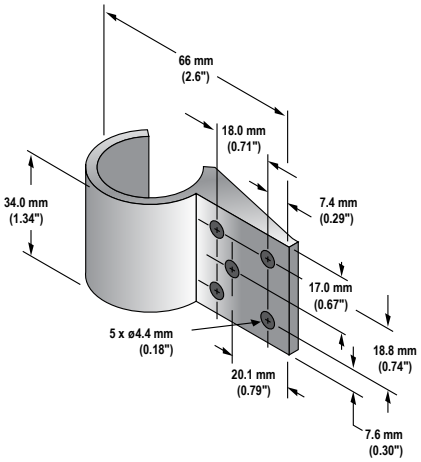
Shown with protective brackets of different sizes, mounted back-to-back

Models with DIP Switch Access Port	Models with No DIP Switch Access	For Use With	L
SMBPVD 100A	**SMBPVD 100AB**	PVD 100	140 mm (5.5")
SMBPVD 225A	**SMBPVD 225AB**	PVD 225	269 mm (10.6 ")

Length	Model SMBPVA5C	Model SMBPVA10C
Overall length	188.7 mm (7.43")	317.2 mm (12.49")

SMBPVA2

- Set of 4 molded brackets
- Brackets snap onto 28 mm pipe
- Request data sheet P/N 54752 for more information



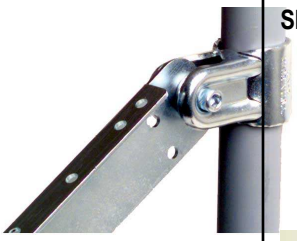
SMBPVA7

- 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

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°

Retroreflective Tape

There are two sets of tables - one divided by reflectivity factor, the other set are individual model numbers.

NOTE: For maximum adhesion of all tape products, surfaces must be clean.

Tape by Reflectivity Factor

Model	Reflectivity Factor	Maximum Temperature	Size
BRT-THG-3X3-10	0.7	+60°C (+140°F)	75 x 75 mm
BRT-THG-4X4-5	0.7	+60°C (+140°F)	100 x 100 mm
BRT-THG-8.5X11-2	0.7	+60°C (+140°F)	216 x 280 mm
BRT-THG-18X36	0.7	+60°C (+140°F)	457 x 914 mm
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

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
BRT-TVHG-2X2	0.8	+60°C (+140°F)	50 x 50 mm

Model	Reflectivity Factor	Maximum Temperature	Size
BRT-THT-100 [1]	0.07	+175°C (+347°F)	25 mm wide, 2.5 m (100 in) long

Model	Reflectivity Factor	Maximum Temperature	Size
BRT-TVHG-2X2 [2]	0.8	+60°C (+140°F)	50 x 50 mm
BRT-TVHG-8X10P† [3]	0.8	+60°C (+140°F)	203 x 254 mm

Tape by Model Number

Model	Reflectivity Factor	Maximum Temperature	Size
BRT-THG-3X3-10	0.7	+60°C (+140°F)	75 x 75 mm

Model	Reflectivity Factor	Maximum Temperature	Size
BRT-THG-4X4-5	0.7	+60°C (+140°F)	100 x 100 mm (package of 5)

Model	Reflectivity Factor	Maximum Temperature	Size
BRT-THG-8.5X11-2	0.7	+60°C (+140°F)	216 x 280 mm (package of 2)

[1] These targets are not recommended for polarized retroreflective sensors.
[2] These are sealed micro-prism style pieces and may not be cut.
[3] These targets are not recommended for polarized retroreflective sensors.

Model	Reflectivity Factor	Maximum Temperature	Size
BRT-THG-18X36	0.7	+60°C (+140°F)	457 x 914 mm (single sheet)

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

2 in retroreflective tape, 30.48 m (100 ft)

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

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

Model	Reflectivity Factor	Maximum Temperature	Size
BRT-THT-100	0.07	+175°C (+347°F)	25 mm wide, 2.5 m (100 in) long

These targets are not recommended for polarized retroreflective sensors.

BRT-TVHG

- Reflectivity factor: 0.8
- Max. Temperature: +60ºC (+140ºF)

Retroreflective tape is available in a variety of sizes and shapes; see your Banner Catalog for more information.
Not recommended for use with clear object detection sensors.

Model	Reflectivity Factor	Maximum Temperature	Size
BRT-TVHG-2X2	0.8	+60ºC (+140ºF)	50 x 50 mm

These are sealed micro-prism style pieces and may not be cut.

Model	Reflectivity Factor	Maximum Temperature	Size
BRT-TVHG-8X10P	0.8	+60°C (+140°F)	203 x 254 mm

These targets are not recommended for polarized retroreflective sensors.

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