

FF Series IP69K-rated Photoelectric Sensors



FFR3-BN-1E

M18 (18 mm) stainless steel - DC

- 30 models - diffuse, polarized reflective, retro-reflective and through-beam
- 20 m maximum reading distance
- M12 quick disconnect (purchase cable separately)
- 316L stainless steel housing
- Supply voltage: 10 - 30 VDC
- LED light status indicators: yellow (output), green (teach-in function for some diffuse and reflective models)
- IP69K rated for food and beverage applications
- Complete protection against electrical damage
- M18 mounting hex nuts included



FF Series Photoelectric Sensor Selection Chart								
Part Number	Price	Sensing Range	Output State	Logic	Connection	Wiring	Characteristic Curves	
Diffuse								
FFR3-BN-1E	\$66.00	100 mm (3.9 in.)	N.O./N.C. complementary	NPN	M12 (12 mm) connector (purchase cable separately)	Diagram 1	Chart Set 1	
FFR3-BP-1E	\$66.00			PNP		Diagram 2	Chart Set 1	
FFR3-ON-1E	\$66.00		N.O./N.C. selectable	NPN		Diagram 3	Chart Set 1	
FFR3-OP-1E	\$66.00			PNP		Diagram 4	Chart Set 1	
FFI7-BN-1E	\$66.00	400 mm (15.7 in.)	N.O./N.C. complementary	NPN		Diagram 1	Chart Set 2	
FFI7-BP-1E	\$66.00			PNP		Diagram 2	Chart Set 2	
FFI7-ON-1E	\$66.00		N.O./N.C. selectable	NPN		Diagram 3	Chart Set 2	
FFI7-OP-1E	\$66.00			PNP		Diagram 4	Chart Set 2	
FFI8-BN-1E	\$68.00	800 mm (31.5 in.)	N.O./N.C. complementary	NPN		Diagram 1	Chart Set 3	
FFI8-BP-1E	\$68.00			PNP		Diagram 2	Chart Set 3	
FFI8-ON-1E	\$68.00		N.O./N.C. selectable	NPN		Diagram 3	Chart Set 3	
FFI8-OP-1E	\$68.00			PNP		Diagram 4	Chart Set 3	
Polarized retro-reflective*								
FFRP-BN-1E •	\$68.00	4 m (13.1 ft)	N.O./N.C. complementary	NPN	M12 (12 mm) connector (purchase cable separately)	Diagram 1	Chart Set 4	
FFRP-BP-1E •	\$68.00			PNP		Diagram 2	Chart Set 4	
FFRP-ON-1E •	\$68.00		N.O./N.C. selectable	NPN		Diagram 3	Chart Set 4	
FFRP-OP-1E •	\$68.00			PNP		Diagram 4	Chart Set 4	
FFRN-BN-1E	\$70.00		N.O./N.C. complementary	NPN		Diagram 1	Chart Set 4	
FFRN-BP-1E	\$70.00			PNP		Diagram 2	Chart Set 4	
FFRN-ON-1E	\$70.00		N.O./N.C. selectable	NPN		Diagram 3	Chart Set 4	
FFRN-OP-1E	\$70.00			PNP		Diagram 4	Chart Set 4	
Retro-reflective for transparent objects*								
FFRL-BN-1E	\$70.00	1 m (3.3 ft)	N.O./N.C. complementary	NPN	M12 (12 mm) connector (purchase cable separately)	Diagram 1	Chart Set 5	
FFRL-BP-1E	\$70.00			PNP		Diagram 2	Chart Set 5	
FFRL-ON-1E	\$70.00		N.O./N.C. selectable	NPN		Diagram 3	Chart Set 5	
FFRL-OP-1E	\$70.00			PNP		Diagram 4	Chart Set 5	
Through-beam**								
FFIZ-BN-1E •	Receiver	20 m (62.6 ft)	N.O./N.C. complementary	NPN	M12 (12 mm) connector (purchase cable separately)	Diagram 1	Chart Set 6	
FFIZ-BP-1E •	Receiver			PNP		Diagram 2	Chart Set 6	
FFIZ-ON-1E •	Receiver		N.O./N.C. selectable	NPN		Diagram 3	Chart Set 6	
FFIZ-OP-1E •	Receiver			PNP		Diagram 4	Chart Set 6	
FFIH-00-1E	Emitter		Receiver dependent	Receiver dependent			Diagram 5	Chart Set 6
FFIH-X0-1E†	Emitter							Diagram 6

NOTES:

† Check function

*Purchase reflectors separately.

**Purchase one receiver and one emitter for a complete set.

• Sensors without sensitivity adjustment

Switching Element Function		
	Thru-beam and Reflective Models	Diffuse Reflective Models
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

FF Series IP69K-rated Photoelectric Sensors

Wiring Diagrams

Diagram 1

NPN Output

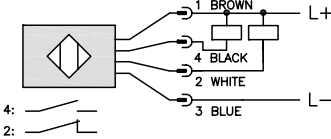


Diagram 2

PNP Output

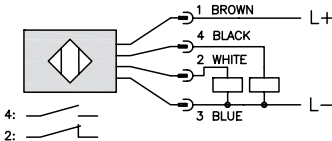


Diagram 3

NPN Output

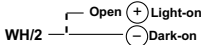
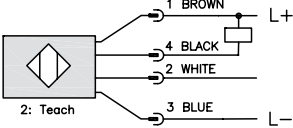
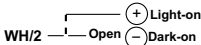
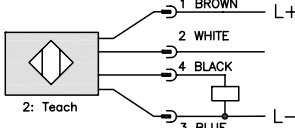


Diagram 4

PNP Output



Connector

M12 Connector

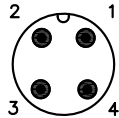


Diagram 5

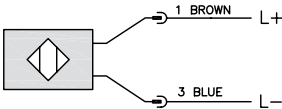
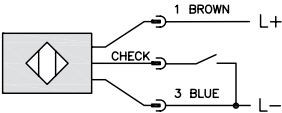


Diagram 6



2-meter Axial Cable version: check is black
M12 Connector: check is Pin 2 (white)

FF Series IP69K-rated Photoelectric Sensors

Characteristic curves

Chart Set 1 (Diffuse FFR3)

FFR3/**-1E

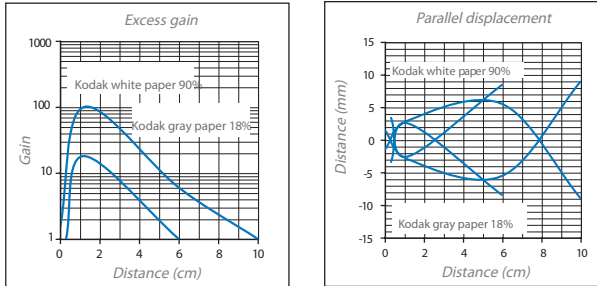


Chart Set 2 (Diffuse FF17)

FF17/**-1E

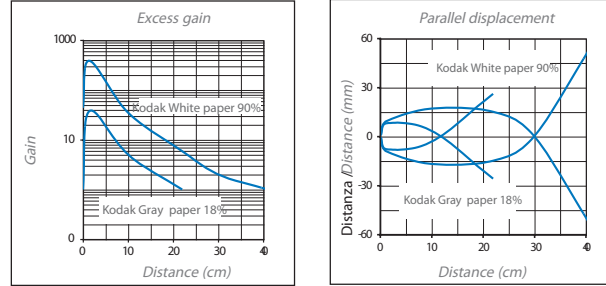


Chart Set 3 (Diffuse FF18)

FF18/**-1E

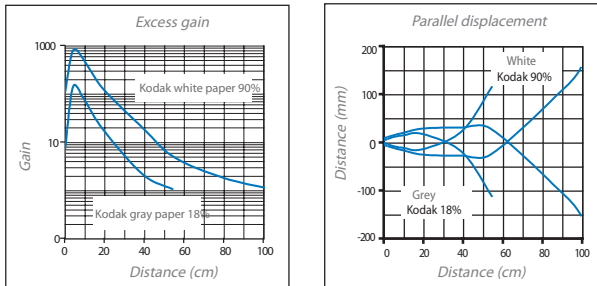


Chart Set 4 (Polarized retro-reflective)

FFRN/**-1E - FFRP/**-1E

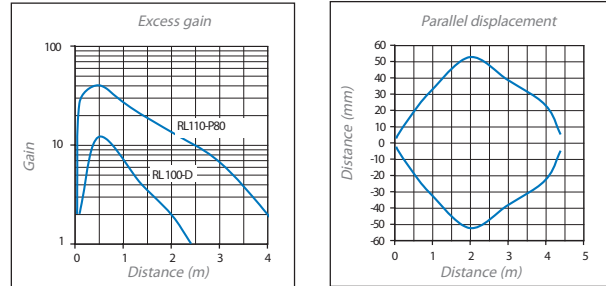


Chart Set 5 (Retro-reflective for transparent objects)

FFRL/**-1E

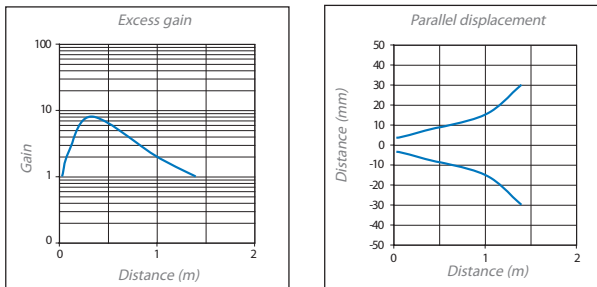
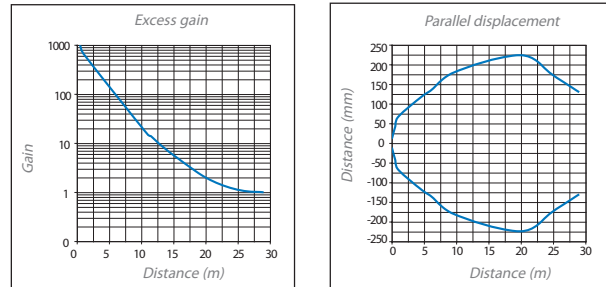


Chart Set 6 (Through-beam)

FFIH/**-1E + FFIZ/**-1E



FF Series IP69K-rated Photoelectric Sensors

FF Series 18 mm Photoelectric Sensors Specifications								
Type	Diffuse Reflective			Polarized Reflective			Through-beam ⁵	
Model Series	FFR3	FFI7	FFI8	FFRL	FFRN	FFRP	FFIZ	FFIH
Sensing Distance	100 mm ¹	400 mm ²	800 mm ³	1 m	4 m ⁴		20 m	
Light Spot Diameter	10 mm @ 100 mm	50 mm @ 400 mm	180 mm @ 800 mm	80 mm @ 1 m	200 mm @ 4 m		600 mm @ 20 m	
Emission	Red (660 nm)	Infrared (660 nm)	Infrared (880 nm)	Red (660 nm)			–	Infrared (880 nm)
Sensitivity	Teach					None		
Output Type	See individual parts on Selection Chart							
Operating Voltage	10-30VDC							
No-load Supply Current	≤30mA					≤25mA	40mA	
Operating (Load) Current	≤100mA							
Off-state (Leakage) Current	≤10µA at 30 VDC							
Voltage Drop	2V max at 100mA							
Switching Frequency	500 Hz					250 Hz	–	
Ripple	≤10%							
Time Delay Before Availability (tv)	200ms							
Short-Circuit Protection	Yes, switch auto-resets after load is removed							
Operating Temperature	-13°F to 176°F (-25°C to 80°C)							
Protection Degree (DIN 40050)	IEC IP68, IP69K							
LED Indicators- Switching Status	Green ON: teach function available Green OFF: teach function blocked Green Fast flashing: fine teach active Green Slow Flashing: teach in progress Yellow ON: Output state - Excess gain O models*; Light state - Excess gain B models*					Yellow: Output state - O models Light state - B models		Yellow: Supply on
Housing Material	316L stainless steel							
Lens Material	Poly methyl methacrylate (PMMA), FDA certified							
Exit Connector	Grilamid							
Shock/Vibration	See terminology section							
Tightening Torque	50 Nm (36.88 lb-ft)							
Weight	120g (4.23 oz)							
Connection	M12 plug							
Agency Approvals	CE, cULus file E187310, ECOLAB, RoHS, Johnson Diversey							

¹With 100x100mm white matte paper

²With 200x200mm white matte paper

³With 400x400mm white matte paper

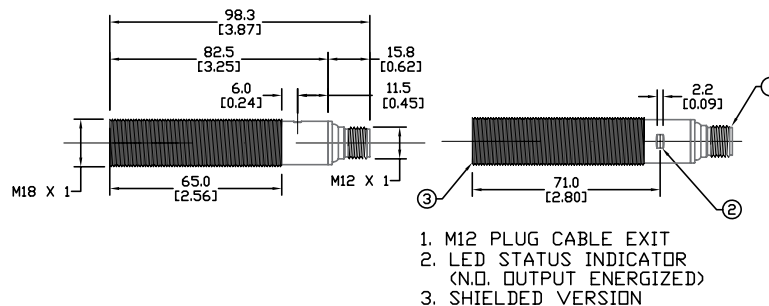
⁴With standard diameter 84mm RL110 reflector

⁵ An emitter and receiver pair must be ordered for a complete sensor set.

*Note: Yellow LED Fixed On: Excess Gain ≤2. Yellow LED Flashing: Excess Gain <2

Dimensions

mm(in)



Warning: These products are not safety sensors and are not suitable for use in personal safety applications.

Accessories for 18mm Sensors

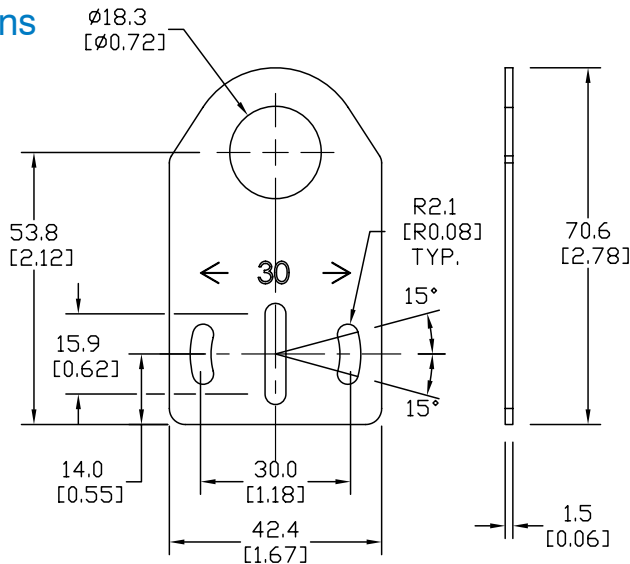
Axial Mounting Bracket

Axial mounting bracket for use with 18mm sensors. Has two mounting holes (use 4mm screws) and allows for rotation of an optical axis for right-beam-angle-adaptor sensors. Hexagonal nuts not included.

Accessories for 18mm Sensors			
Part Number	Price	Description	Weight [lb]
ST18A	\$1.25	Mounting bracket, axial, zinc-plated steel. For use with 18mm sensors. 1/pk.	0.06
ST18A7W	\$6.00	Mounting bracket, axial, 316L stainless steel. For use with 18mm sensors. 1/pk.	0.06

Dimensions

mm [inches]



ST18A

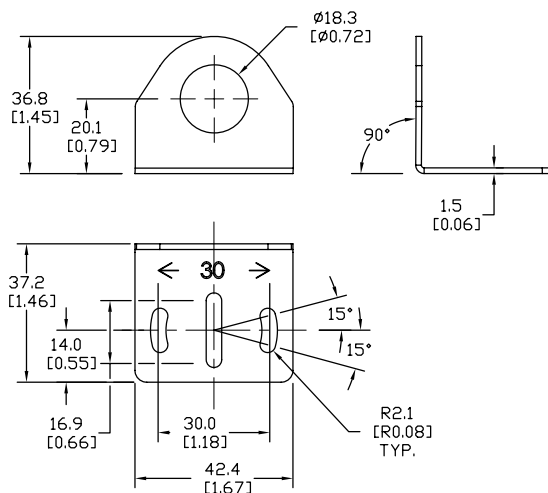
Right-angle Mounting Bracket

Right-angle mounting bracket for use with 18mm sensors. Has two mounting holes (use 4mm screws) and allows the rotation of an optical axis for axial sensors. Hexagonal nuts not included.

Accessories for 18mm Sensors			
Part Number	Price	Description	Weight [lb]
ST18C	\$1.25	Mounting bracket, right angle, zinc-plated steel. For use with 18mm sensors. 1/pk.	0.06
ST18C7W	\$6.00	Mounting bracket, right angle, 316L stainless steel. For use with 18mm sensors. 1/pk.	0.06

Dimensions

mm [inches]



ST18C

See our website: www.AutomationDirect.com for complete engineering drawings

Accessories for 18mm Sensors

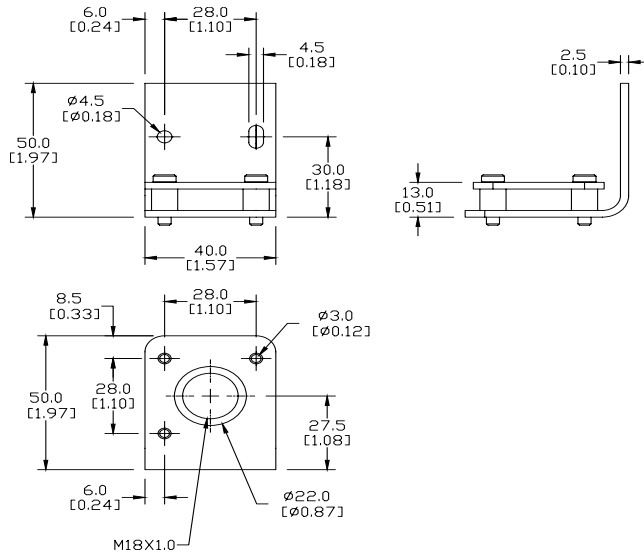
Right-angle Fine Tune Mounting Bracket

Mounting bracket, right-angle, fine tune vertical and horizontal adjustment, nickel-plated steel. For use with 18mm sensors. Allows for fine tuning vertical and horizontal placement.

Accessories for 18mm Sensors			
Part Number	Price	Description	Weight [lb]
OPT2036	\$30.00	Mounting bracket, right-angle, fine tune vertical and horizontal adjustment, nickel-plated steel. For use with 18mm sensors.	0.02

Dimensions

mm [inches]



OPT2036

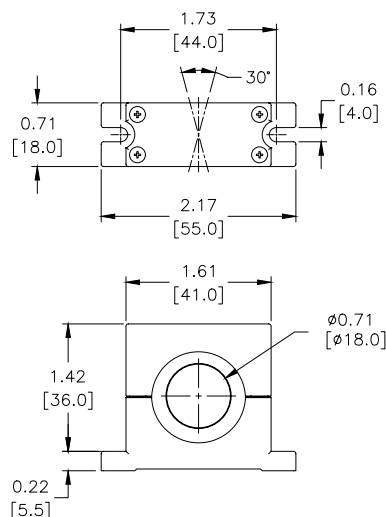
Swivel Mounting Bracket

Mounting bracket, ball swivel, plastic. For use with 18mm sensors. Has a ball-joint and set screws to adjust sensor orientation. Allows angular orientation up to 15 degrees (from center) in all directions for photoelectric sensors (Will not work with C18 series).

Accessories for 18mm Sensors			
Part Number	Price	Description	Weight [lb]
ST02	\$8.25	Mounting bracket, ball swivel, plastic. For use with 18mm sensors.	0.06

Dimensions

mm [inches]



ST02

See our website: www.AutomationDirect.com for complete engineering drawings

Accessories for 18mm Sensors

Right-angle Mounting Brackets

Mounting bracket, right-angle, fixed insertion stop adjustment, plastic. For use with 18mm sensors. Available with or without fixed insertion stop.

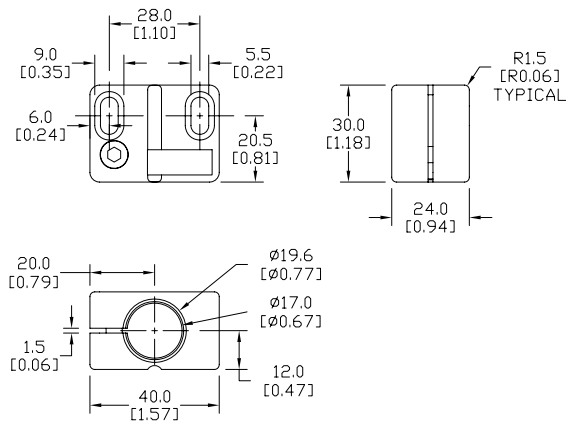
Accessories for 18mm Sensors				
Part Number	Price	Description	Weight [lb]	
OPT2104	\$8.00	Mounting bracket, right-angle, fixed insertion stop adjustment, plastic. For use with 18mm sensors.	0.06	
OPT2105	\$8.00	Mounting bracket, right-angle, plastic. For use with 18mm sensors.	0.06	



OPT2104, OPT2105

Dimensions

mm [inches]



Right-angle Swivel Mounting Systems

Mounting bracket, right-angle swivel, 360 degree vertical and horizontal adjustment, 12mm rod mount. For use with 18mm sensors. Available in all 304 stainless steel or with an aluminum head and a stainless steel mounting plate.

Accessories for 18mm Sensors					
Part Number	Price	Description	Mounting Head	Mounting Plate	Weight [lb]
OPT2116	\$9.00	Mounting bracket, right-angle swivel, 360 vertical and horizontal adjustment, aluminum, 12mm rod mount. For use with 18mm sensors.	Aluminum	304 Stainless Steel	0.15
OPT2117	\$16.00	Mounting bracket, right-angle swivel, 360 vertical and horizontal adjustment, 304 stainless steel, 12mm rod mount. For use with 18mm sensors.	304 Stainless Steel	304 Stainless Steel	0.28

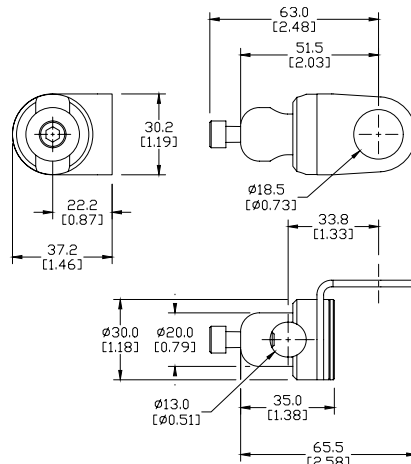
Note: 304 Stainless steel mounting rods sold separately: OPT2109 (200mm length), OPT2110 (300mm length), and OPT2111 (500mm length).



OPT2116, OPT2117

Dimensions

mm [inches]



See our website: www.AutomationDirect.com for complete engineering drawings

Mounting Rods

Mounting Rods

304 Stainless steel rods for mounting swivel brackets OPT2112 - OPT2127. Available in three lengths: 200mm, 300mm, and 500mm. 12mm diameter.

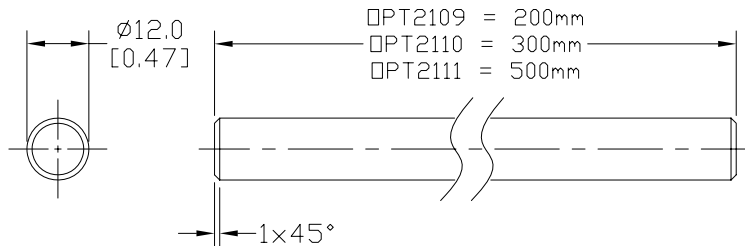
Mounting Rods for OPT2112-2127 Swivel Mounting Brackets			
Part Number	Price	Description	Weight [lb]
OPT2109	\$10.00	Mounting rod, 12mm diameter, 200mm length, 304 stainless steel.	0.41
OPT2110	\$12.00	Mounting rod, 12mm diameter, 300mm length, 304 stainless steel.	0.60
OPT2111	\$16.00	Mounting rod, 12mm diameter, 500mm length, 304 stainless steel.	0.98



OPT2109, OPT2110, OPT2111

Dimensions

mm [inches]



Right-angle Mounting Bracket

Mounting bracket, right-angle, nickel-plated brass. For use with 12mm mounting rods OPT2109, OPT2110 & OPT2111.

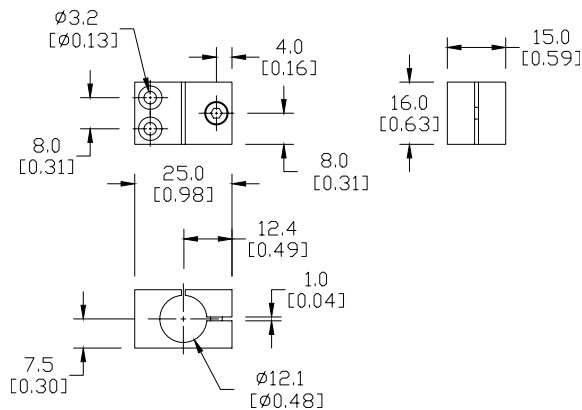
Accessories for 12mm Sensors			
Part Number	Price	Description	Weight [lb]
OPT2108	\$12.00	Mounting bracket, right-angle, nickel-plated brass. For use with 12mm mounting rods OPT2109, OPT2110 & OPT2111.	0.07



OPT2108

Dimensions

mm [inches]



See our website: www.AutomationDirect.com for complete engineering drawings

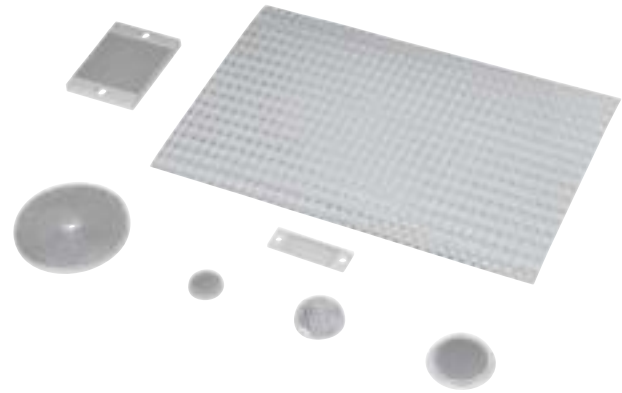
Reflectors

RL Series Reflectors for Polarized Reflective Photoelectric Sensors (All Models)

- Suitable for use with polarized light photoelectric sensors
- Shapes and sizes for most applications
- Miniature types for close mounting in multiple sensor installations
- Single hole, dual hole and self-adhesive mounting types available
- Single and 10-packs available

Installation Notes

- Keep the reflector surface clean to ensure peak detection performance. This is especially true when the maximum sensing range is being used. Clean using a damp cloth.
- When selecting a reflector, it is important to consider the ambient conditions it will be exposed to. Dusty or high humidity conditions may reduce the sensing range as much as 90%.
- Reflectors should be positioned at a 90° angle to the optical axis with a tolerance of ±15°.



Specifications							
Model	Price	Quantity	Dimensions	Degree of Protection	Mounting	Materials	
RL102	\$35.00	10 per pack	25mm [0.98 in]	IEC IP67	Customer-supplied adhesive or other mounting method required	Reflective face: PMMA Polymethylmethacrylate (acrylic) Base material: ABS (Acrylonitrile-butadiene-styren)	
RL102-1	\$3.75	1 per pack					
RL103	\$40.00	10 per pack	34.5 mm [1.36 in]				
RL103-1	\$4.25	1 per pack					
RL104	\$40.00	10 per pack	46mm [1.81 in]				
RL104-1	\$4.25	1 per pack					
RL105 *	\$35.00	10 per pack	90 x 40 mm [3.54 x 1.58 in]		Two 4.3 mm holes		
RL105-1 *	\$3.75	1 per pack					
RL105G *	\$35.00	10 per pack	95 x 38 mm [3.74 x 1.50 in]				
RL105G-1 *	\$3.75	1 per pack					
RL106G	\$40.00	10 per pack	182 x 42 mm [7.17 x 1.65 in]		Two 6mm holes		
RL106G-1	\$4.25	1 per pack					
RL110	\$18.00	10 per pack	84mm [3.31 in]		One 5mm hole		
RL110-1	\$2.00	1 per pack					
RL116	\$18.00	10 per pack	41 x 60 mm [3.54 x 2.36 in]		Two 3mm holes		
RL116-1	\$2.00	1 per pack					
RL100DA4	\$32.50	1 per pack	200 x 300 mm [7.87 x 11.81 in]		Self-adhesive		Paper (Acrylic tape with micro prism)
RL100DC4	\$10.00	1 per pack	50 x 300 mm [1.97 x 11.81 in]				
RL100DQ1	\$7.50	1 per pack	100 x 100 mm [3.94 x 3.94 in]				
RL111G	\$52.00	10 per pack	22.5 x 47 mm [0.89 x 21.85 in]		Two 3mm slots		Reflective face: PMMA Polymethylmethacrylate (acrylic) Base material: ABS (Acrylonitrile-butadiene-styren)
RL111G-1	\$6.00	1 per pack					
RL112G	\$40.00	10 per pack	19 x 73 mm [0.75 x 2.87 in]				
RL112G-1	\$4.25	1 per pack					
RL113G	\$46.00	10 per pack	51.4 x 60.3 mm [2.02 x 2.37 in]	Two 4mm slots			
RL113G-1	\$5.00	1 per pack					

Not recommended for applications involving moist air environments or water immersion.

* Note: RL105 and RL105-1 reflectors are being replaced by the RL105G and RL105G-1 models, and will no longer be available once our current stock is depleted.

The new reflectors function the same but the dimensions are slightly different. Compare the outside dimensions shown in this table and the dimensional drawings on the next page.

Reflectors

RL Series Reflectors for Polarized Reflective Laser Photoelectric Sensors (FALN series)

- Suitable for use with polarized light laser photoelectric sensors
- Sizes for most applications
- Miniature types for close mounting in multiple sensor installations
- Single and 5-packs available

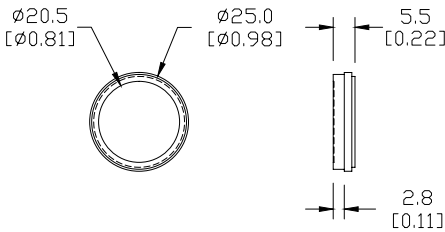
Specifications						
Model	RL201	RL201-1	RL203	RL203-1	RL204	RL204-1
Price	\$32.00	\$7.00	\$30.00	\$6.50	\$26.00	\$5.75
Quantity (per package)	5	1	5	1	5	1
Dimensions	60 x 82 mm 2.36 x 3.23 in		19 x 6mm 0.75 x 2.36 in		20mm x 32mm 0.80 in x 1.26 in	
Degree of Protection ¹	IEC IP67					
Mounting	Two 0.4 mm holes		Two 0.4 mm holes		Two 0.3 mm holes	
Materials	Acrylic/polycarbonate					

¹ Not recommended for applications involving moist air environments or water immersion.

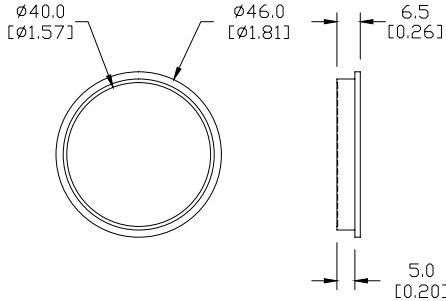
Dimensions

mm [inches]

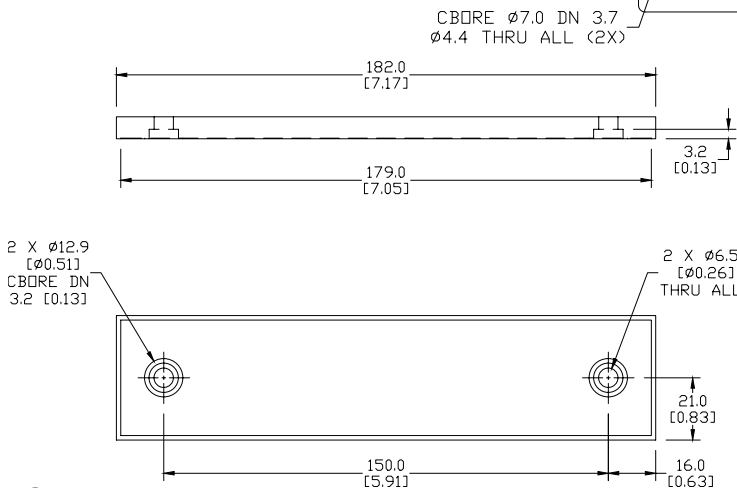
RL102/RL102-1



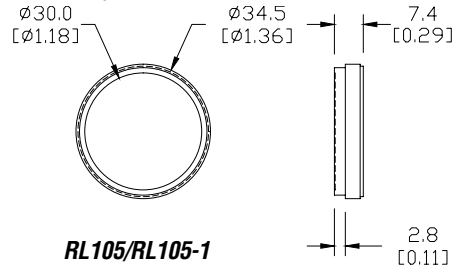
RL104/RL104-1



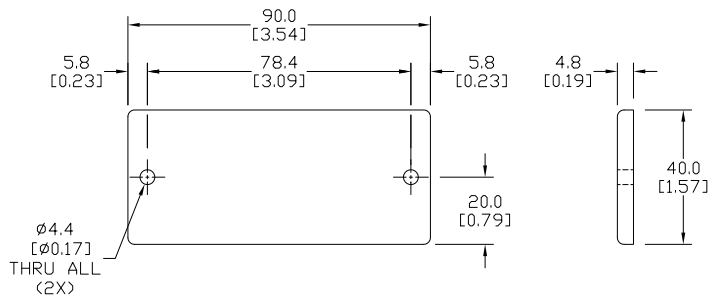
RL106G/RL106G-1



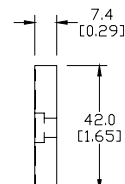
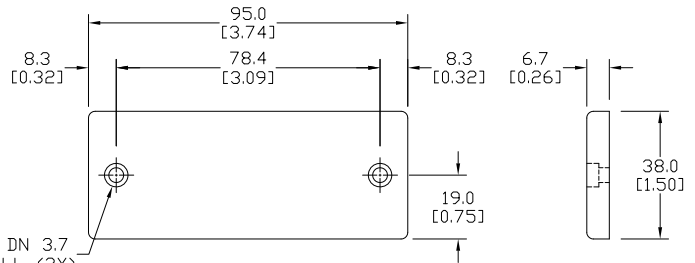
RL103/RL103-1



RL105/RL105-1



RL105G/RL105G-1



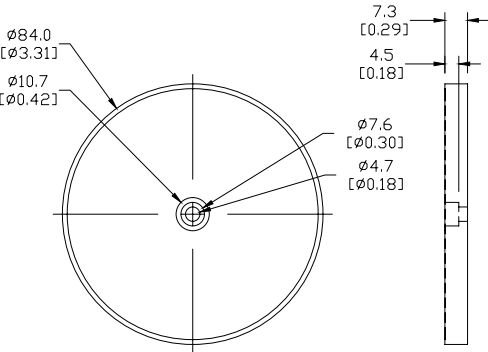
See our website: www.AutomationDirect.com for complete engineering drawings

Reflectors

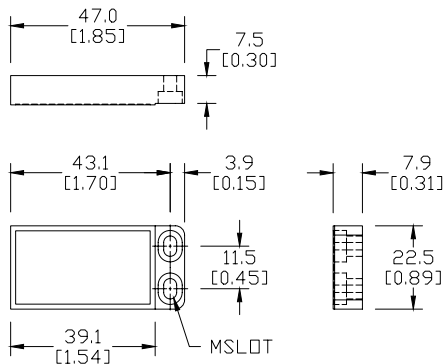
Dimensions

mm [inches]

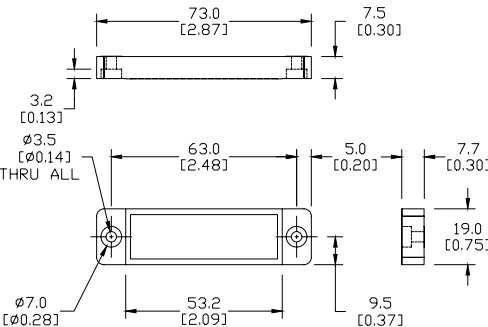
RL110/RL110-1



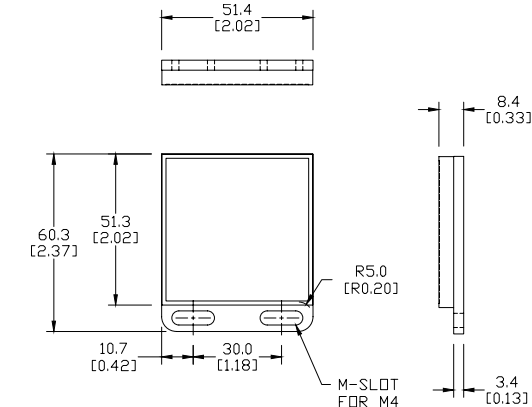
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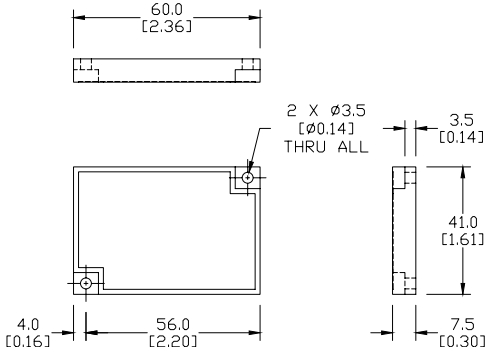
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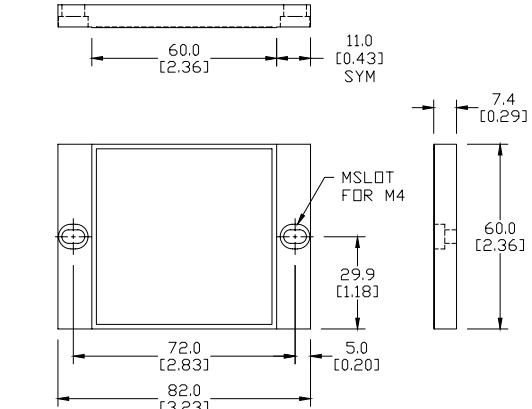
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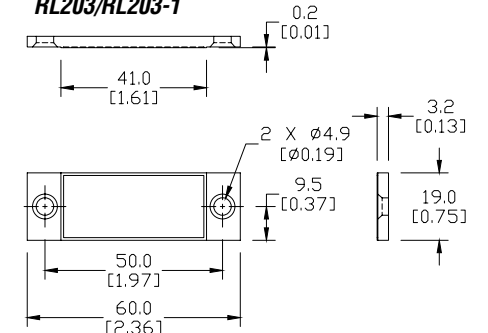
RL116/RL116-1



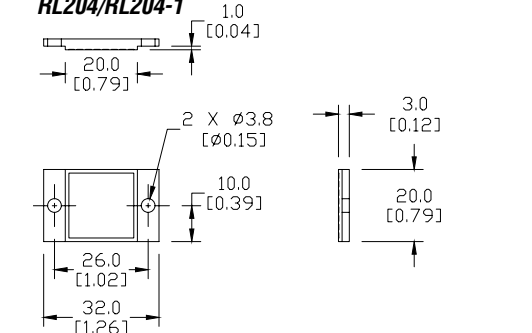
RL201/RL201-1



RL203/RL203-1



RL204/RL204-1



See our website: www.AutomationDirect.com for complete engineering drawings