FE Series Photoelectric Sensors



Mini-rectangular plastic - DC

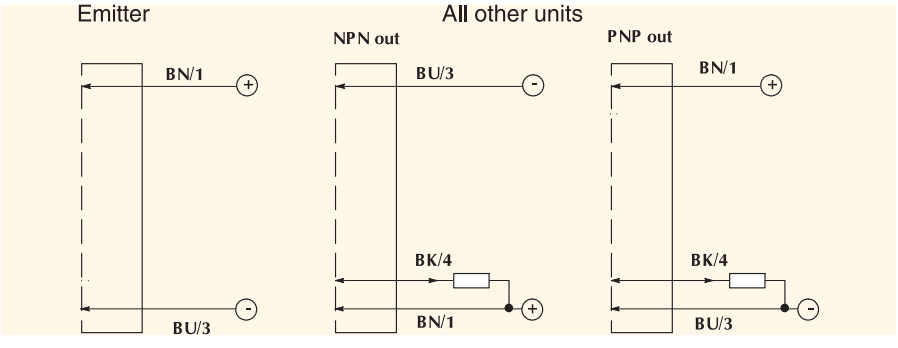
- 12 models available
- Diffuse, polarized reflective, and through-beam models
- Adjustable sensitivity
- Axial cable or M8 quick-disconnect models
- NPN or PNP, Light-on/Dark-on selectable output
- IP67 rated

FE Series Photoelectric Sensors Selection Chart

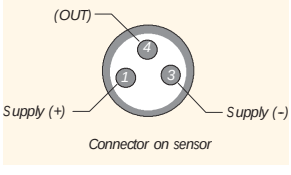
Part Number		Price	Sensing Range	Output State	Logic	Connection	Dimensions	Characteristic Curves
Diffuse								
FER8-0N-0A		<--->	up to 800mm (31.49in)	Light-on/Dark-on Selectable	NPN	2m (6.5) axial cable	Figure 2	Chart 1
FER8-0P-0A		<--->			PNP	2m (6.5) axial cable	Figure 2	Chart 1
FER8-0N-0F		<--->			NPN	M8 (8mm) connector	Figure 1	Chart 1
FER8-0P-0F		<--->			PNP	M8 (8mm) connector	Figure 1	Chart 1
Polarized reflective*								
FERN-0N-0A		<--->	up to 4m (13.12ft) with RL110 up to 1m (39.37in) with RL122	Light-on/Dark-on Selectable	NPN	2m (6.5) axial cable	Figure 2	Chart 2
FERN-0P-0A		<--->			PNP	2m (6.5) axial cable	Figure 2	Chart 2
FERN-0N-0F		<--->			NPN	M8 (8mm) connector	Figure 1	Chart 2
FERN-0P-0F		<--->			PNP	M8 (8mm) connector	Figure 1	Chart 2
Through-beam								
FERHD-0N-0A	Each part number consists of an emitter and receiver pair	<--->	up to 12m (39.37ft)	Light-on/Dark-on Selectable	NPN	2m (6.5) axial cable	Figure 2	Chart 3
FERHD-0P-0A		<--->			PNP	2m (6.5) axial cable	Figure 2	Chart 3
FERHD-0N-0F		<--->			NPN	M8 (8mm) connector	Figure 1	Chart 3
FERHD-0P-0F		<--->			PNP	M8 (8mm) connector	Figure 1	Chart 3

Note: Polarized reflective sensors include one round reflector (84mm dia.) and one rectangular reflector (12mm x 54mm). Purchase additional reflectors separately.

Wiring diagrams



M8 connector



Dimensions

Figure 1

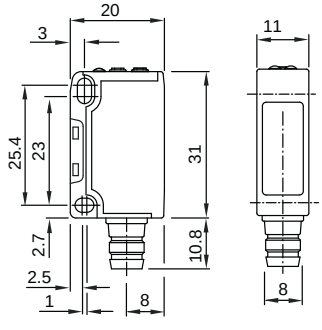
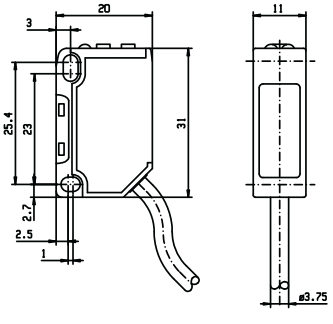
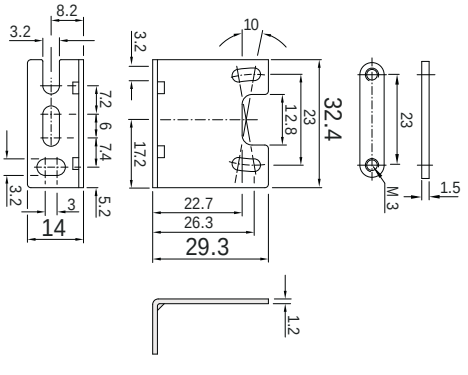


Figure 2



Horizontal mounting bracket supplied with each unit



FE Series Photoelectric Sensors

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflection[3]	Through-beam[4]
Sensing Distance	800mm[1]	4m with RL110 1m with RL122[2]	20m
Emission	Red LED (visable)		
Blind Zone	-	10mm	-
Sensitivity	Adjustable		
Differential Travel	≤20%	-	
Response Time	≤5ms		
Operating Voltage	10-30VDC		
Ripple	≤10%		
No-load Supply Current	≤30mA		Emitter: ≤15mA; Receiver: ≤20mA
Load Current	≤100mA		
Leakage Current			
Voltage Drop	1.8V max at 100mA		
Output Type	NPN or PNP - Light-on/Dark-on Rotary Switch		
Switching Frequency	1kHz		
(tv) Time Delay Before Availability	100ms		
Input Voltage Transients Protection	Yes, as long as the transient peak does not reach 30VDC		
Input Power Polarity Reversal Protection	Yes		
Output Power Short-Circuit Protection	Yes, switch autoresets after load is removed		
Temperature Range	-25/+55°C (-13° to 131° F)		
Temperature Drift	15% Sr		
Interference to External Light	3000 lux (incandescent lamp), 10000 lux (sunlight)		
Protection Degree (DIN 40050)	IP67		
Agency Approvals	UL file E328811		
LED Indicators	Yellow (output energized)		
Housing Material	PBT		
Lens Material	PC		
Tightening Torque	40 N-m (29 lb-ft)		
Weight (cable/connector)	53g (1.87oz) / 9g (0.32oz)		

[1] With 100x100mm white matte paper

[2] With Ø84mm RL110 reflector or 12 x 54mm RL122 reflector.

[3] Each sensor includes one 84mm round reflector (RL110) and one 12 x 54mm rectangular reflector. Purchase additional reflectors separately.

[4] Each through-beam part number consists of an emitter and receiver pair.

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

Characteristic curves

Chart 1

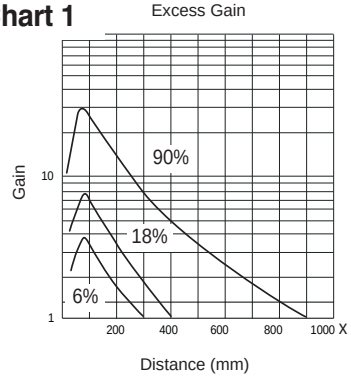


Chart 2

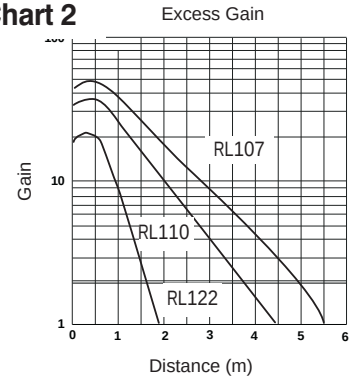
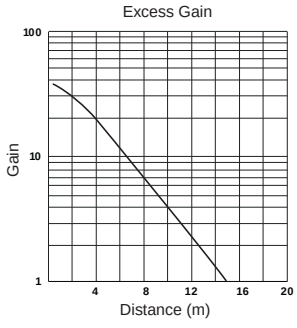


Chart 3



Sensors Accessories: Cables

Cables with quick-disconnect plugs

- Industry standard axial and right-angle M8/M12 screw-lock connectors with open leads. The cables listed can be used with patch cables
- 2m, 5m, 7m and 10m cable lengths
- PVC (polyvinyl chloride) jacket for typical industrial applications
- PUR (polyurethane) jacket for oily and direct sunlight applications
- IP67 rated



CD08-0A-020-A1 and -C1 shown



CD08-0A-050-A1 and -C1 shown



CD12L-0B-020-A0 and -C0 shown



CD12M-0B-050-C1 and -A1 shown

M8 Quick-Disconnect Cables (Pico, Nano)

Part Number	Price	Length	Poles	Connector	LED	Jacket	Dimensions
M8 Quick-Disconnects							
CD08-0A-020-A1	<--->	2m (6.5ft.)	3	Axial	No	PVC	Figure 1
CD08-0A-020-C1	<--->	2m (6.5ft.)	3	Right-angle	No	PVC	Figure 2
CD08-0A-050-A1	<--->	5m (16.4ft.)	3	Axial	No	PVC	Figure 4
CD08-0C-050-A1	<--->	5m (16.4ft.)	3	Axial	No	PUR	Figure 3
CD08-0A-050-C1	<--->	5m (16.4ft.)	3	Right-angle	No	PVC	Figure 5
CD08-0C-050-C1	<--->	5m (16.4ft.)	3	Right-angle	No	PUR	Figure 5
CD08-0A-070-A1	<--->	7m (23ft.)	3	Axial	No	PVC	Figure 1
CD08-0A-070-C1	<--->	7m (23ft.)	3	Right-angle	No	PVC	Figure 2

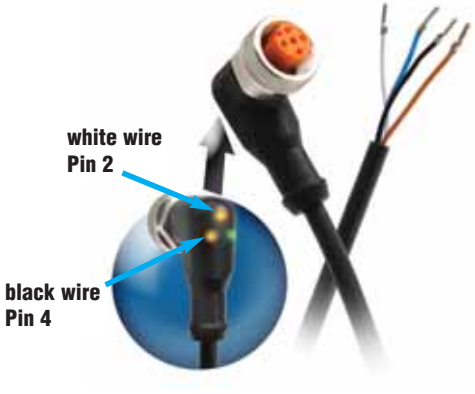
M12 Quick-Disconnect Cables (Euro, Micro DC-Single Key)

Part Number	Price	Length	Poles	Connector	LED	Jacket	Dimensions
M12 Quick-Disconnects							
CD12L-0B-020-A0	<--->	2m (6.5ft)	4	Axial	No	PVC	Figure 6
CD12L-0B-020-C0	<--->	2m (6.5ft)	4	Right-angle	No	PVC	Figure 7
CD12M-0B-050-A1*	<--->	5m (16.4ft)	3	Axial	No	PVC	Figure 8
CD12M-0D-050-A1*	<--->	5m (16.4ft)	3	Axial	No	PUR	Figure 9
CD12M-0B-050-C1*	<--->	5m (16.4ft)	3	Right-angle	No	PVC	Figure 10
CD12M-0D-050-C1*	<--->	5m (16.4ft)	3	Right-angle	No	PUR	Figure 11
CD12M-0B-070-A1	<--->	7m (23ft)	4	Axial	No	PVC	Figure 6
CD12M-0B-070-C1	<--->	7m (23ft)	4	Right-angle	No	PVC	Figure 7

** Note: Do not use with: DM, FA, QX, SS, SSF, SU, TU, VM, VK, MV, MS or MSF series sensors. These sensors require 4-pole cables.*

Cables with LED and quick-disconnect plugs

- Industry standard M12 right angle female plug with open leads
- These cables can be used with patch cables
- 2m, 5m and 10m cable lengths
- PUR (polyurethane) jacket for oily and direct sunlight applications
- IP67 /IP68 / IP69K, II rated
- LED indication for 10 -36 VDC PNP sensors only

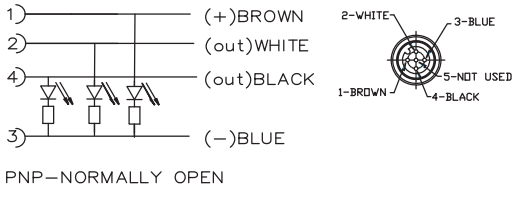


M12 Quick-Disconnect Cables with LED Indicator (Euro, Micro DC-Single Key)

Part Number	Price	Length	Poles	Connector	LED	Jacket	Dimensions
M12 Quick-Disconnects							
EVC178*	<--->	2m (6.5ft)	4	Right-angle	Yes	PUR	Figure 12
EVC179*	<--->	5m (16.4ft)	4	Right-angle	Yes	PUR	Figure 12
EVC180*	<--->	10m (32.8ft)	4	Right-angle	Yes	PUR	Figure 12

**Note: LED for 10 to 36 VDC PNP only.*
Do not use when white wire (Pin 2) is used for selection of a sensor function.

LED Models' Wiring



Sensors Accessories: Cables

Cable Specifications						
Specification		**M8**		**M12**		**M12 with LED**
Length		2m (6.5ft) / 7m (23ft)	5m (16.4ft)	2m (6.5ft) / 7m (23ft)	5m (16.4ft)	2m (6.5 ft) / 5m (16.4ft) / 10m (32.8ft)
Nominal Voltage		50VAC/75VDC	60VAC/DC	300VAC	250VAC/DC	10 to 36VDC
Max Current		4A		4A		4A
LED Current Loading		N/A	N/A	N/A	N/A	**10V input** Brown wire LED: 1.7mA White and/or Black LED: 0.9mA **36V input** Brown wire LED: 7.3mA White and/or Black LED: 4.7mA
Protection Degree		IP67	IP65 / IP68 / IP69K	IP67	PVC: IP68 PUR: IP68 / IP69K	IP67 / IP68 / IP69K
Material Nut		brass; nickel plated		brass; nickel plated		brass; nickel plated
Jacket Material		PVC	PVC:CD08-0A-xxx. PUR:CD08-0C-xxx	PVC	PVC:CD12M-0B-xxx. PUR:CD12M-0D-xxx	PUR
Housing Material		PUR		PUR		PUR
Contacts Material		Copper-Tin Alloy (CuSn) -gold plated		Copper-Tin Alloy (CuSn) -gold plated		Gold plated brass
Tightening Torque		0.5 Nm	≤ 0.4 Nm	0.5 Nm	≤ 0.4 Nm	0.6 to 1.5 Nm
Conductors Cross Section (AWG)		0.25mm^2 (24 AWG)	0.25mm^2 (24 AWG)	0.25mm^2 (24 AWG)	0.34mm^2 (22 AWG)	4 x 0.34mm^2 (4 x 22 AWG)
Ø Outer Cable		5mm	PVC: 4 mm PUR: 4 mm	5mm	PVC: 4.2 mm PUR: 4.3 mm	5mm
Temperature Range		-25° to +80°C (-13° to 176°F)	-25° to 90°C (-13° to 194°F)	-25° to +80°C (-13° to 176°F)	PVC: -30° to 70°C (-22° to 158°F) PUR: -50° to 90°C (-58° to 194°F)	-25° to +90°C (-13° to 194°F)
Environmental		N/A	Halogen free, Silicone free	N/A	Halogen free, Silicone free	Halogen free, Silicone free
Function Display Power LED		N/A	N/A	N/A	N/A	Green
Switching Status LED		N/A	N/A	N/A	N/A	2 x Yellow
Drag Chain (Roller Cable Tray) Suitability	**Bending Radius**	min. 10 x cable diameter				
	Bending Cycles	N/A	N/A	N/A	N/A	>5 million
	Travel Speed	N/A	N/A	N/A	N/A	Max. 3.3 m/s for a horizontal travel length of 5 meters and max. acceleration of 5 m/s^2
	Torsional Strain	N/A	N/A	N/A	N/A	±180°/m
Agency Approvals		RoHS				UL File E191684, RoHS

UL Reference	
Part Number	**Mini-Series Female Cord Connectors Series M12, UL Catalog Number**
EVC178	ADOAH043MSS0002H04
EVC179	ADOAH043MSS0005H04
EVC180	ADOAH043MSS0010H04
Note: Shown in UL file under Mini-series Female Cord Connectors using catalog number	

Sensors Accessories: Cables

Dimensions (in/mm)

Figure 1

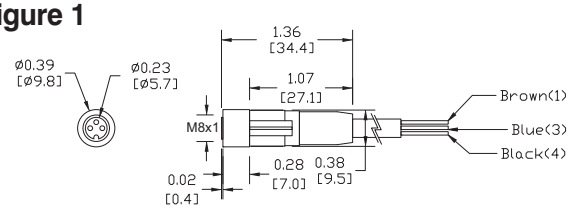


Figure 2

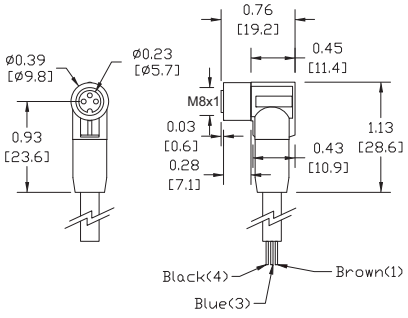


Figure 3

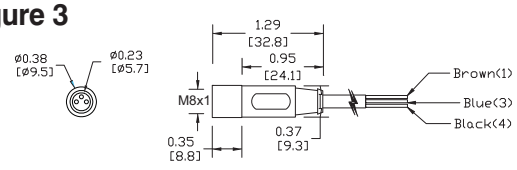


Figure 4

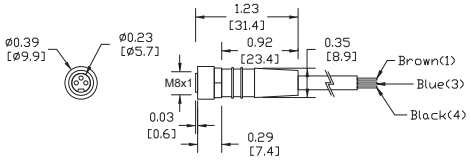


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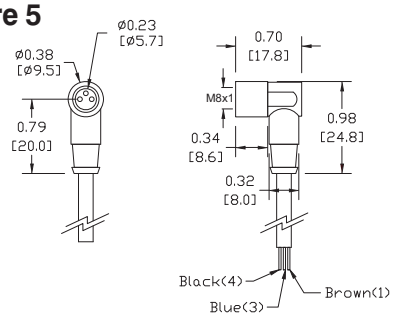


Figure 6

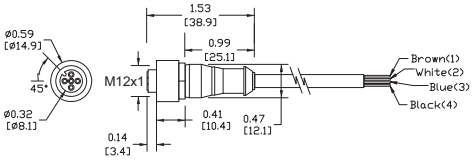


Figure 7

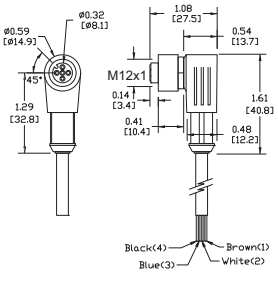


Figure 8

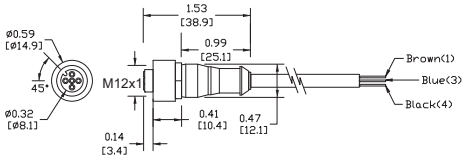


Figure 9

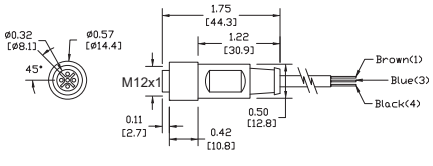


Figure 10

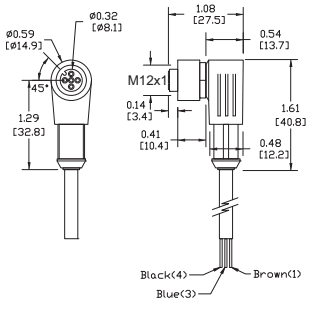


Figure 11

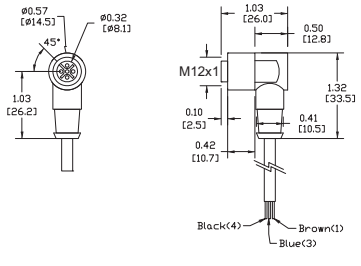
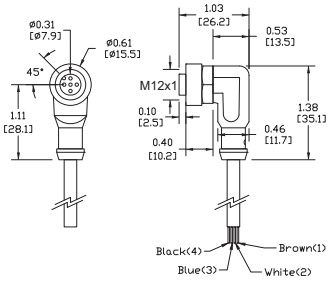


Figure 12



Sensors Accessories: Cables

Patch cables with quick-disconnect plugs on each end

Available patch cables include:

- Industry standard M8 and M12 screw-lock connectors
- One male and one female connector
- Axial and right-angle connector models
- 1m and 3m cable lengths
- PVC (polyvinyl chloride)jacket for typical industrial applications
- IP67 rated



M8 Patch Cables with Quick-Disconnect on Each End (Pico, Nano)						
Part Number	**Price**	**Length**	**Poles**	**Connectors**	**Jacket**	**Dimensions**
M8 Quick-Disconnect Patch Cables						
CDP08-0A-010-AA	<--->	1m (3.28ft)	3	2 Axial. One male and one female connector	PVC	Figure 1
CDP08-0A-010-BB	<--->	1m (3.28ft)	3	2 Right-angle. One male and one female connector	PVC	Figure 3
CDP08-0A-030-AA	<--->	3m (9.84ft)	3	2 Axial. One male and one female connector	PVC	Figure 2
CDP08-0A-030-BB	<--->	3m (9.84ft)	3	2 Right-angle. One male and one female connector	PVC	Figure 3

M12 Patch Cables with Quick-Disconnect on Each End (Euro, Micro DC-Single Key)						
Part Number	**Price**	**Length**	**Poles**	**Connectors**	**Jacket**	**Dimensions**
M12 Quick-disconnect Patch Cables						
CDP12-0B-010-AA	<--->	1m (3.28ft.)	4	2 Axial. One male and one female connector	PVC	Figure 4
CDP12-0B-010-BB	<--->	1m (3.28ft.)	4	2 Right-angle. One male and one female connector	PVC	Figure 5
CDP12-0B-030-AA	<--->	3m (9.84ft.)	4	2 Axial. One male and one female connector	PVC	Figure 4
CDP12-0B-030-BB	<--->	3m (9.84ft.)	4	2 Right-angle. One male and one female connector	PVC	Figure 5

Patch Cables with LED

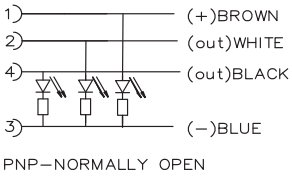
Available patch cables with LED include:

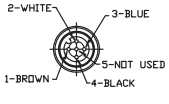
- Right-angle M12 female plug with LED indication on one end and axial male plug on the other end
- 0.3m, 0.6m, 1m, 2m, 5m, and 10m cable lengths
- PUR (polyurethane) jacket for oily and direct sunlight applications
- IP67 /IP68 / IP69K, II rated
- LED indication for 10 -36 VDC PNP sensors only



M12 Patch Cables with LED Indicator (Euro, Micro DC-Single Key)							
Part Number	**Price**	**Length**	**Poles**	**Connectors**	**LED**	**Jacket**	**Dimensions**
M12 Patch Cables							
EVC322*	<--->	0.3m (0.98ft)	4	Right-angle female, axial male	Yes	PUR	Figure 6
EVC323*	<--->	0.6m (1.97ft)	4	Right-angle female, axial male	Yes	PUR	Figure 6
EVC324*	<--->	1m (3.28ft)	4	Right-angle female, axial male	Yes	PUR	Figure 6
EVC325*	<--->	2m (6.5ft)	4	Right-angle female, axial male	Yes	PUR	Figure 6
EVC326*	<--->	5m (16.4ft)	4	Right-angle female, axial male	Yes	PUR	Figure 6
EVC327*	<--->	10m (32.8ft)	4	Right-angle female, axial male	Yes	PUR	Figure 6
Note: LED for 10 to 36 VDC PNP only. ***Do not use when white wire (Pin 2) is used for selection of a sensor function.***							

LED Models' Wiring





Sensors Accessories: Cables

Cable Specifications				
Specification		**M8**	**M12**	**M12 with LED**
Length		1m (3.28ft.) / 3m (9.84ft.)		0.3m (0.98ft) / 0.6m (1.97ft) / 1m (3.28ft) 2m (6.5ft) / 5m (16.4ft) / 10m (32.8ft)
Nominal Voltage		60 VAC/DC	250 VAC/DC	10 to 36VDC
Max Current		4A		4A
LED Current Consumption		N/A		**10V input** Brown wire LED: 1.7mA White and/or Black LED: 0.9mA **36V input** Brown wire LED: 7.3mA White and/or Black LED: 4.7mA
Protection Degree		IEC IP67		IEC IP67/IP68/IP69K
Material Nut		Brass: nickel plated		Brass: nickel plated
Jacket Material		PVC		PUR
Housing Material		PUR		Connector: Orange PUR, Socket: Black PUR
Contacts Material		Copper-tin(CuSn)=Brass		Brass; gold plated
Conductors Cross Section (AWG)		0.34mm^2		0.34mm^2 (22 AWG)
Tightening Torque		0.5 Nm		**Plug:** 0.6 to 1.5 Nm (take into account the maximum value of the counterpart) **Socket:** 0.6 to 1.5 Nm
Ø Outer Cable		5mm		5mm
Temperature Range		-25° to +70°C (-13° to 158°F)		-25° to +90°C (-13° to 194°F)
Function Display LED		N/A		Green
Switching Status LED		N/A		2 x Yellow
Drag Chain (Roller Cable Tray) Suitability	**Bending Radius**	min. 10 x cable diameter		
	Bending Cycles	>5 million		
	Travel Speed	N/A		Max. 3.3 m/s for a horizontal travel length of 5 m and max. acceleration of 5 m/s^2
	Torsional Strain	N/A		±180°/m
Agency Approvals		RoHS		UL File E191684, RoHS

UL Reference	
Part Number	**Cable Assemblies Series M12, UL Catalog Number**
EVC322	VDOAH043MSS00.3H04STGH040MSS
EVC323	VDOAH043MSS00.6H04STGH040MSS
EVC324	VDOAH043MSS0001H04STGH040MSS
EVC325	VDOAH043MSS0002H04STGH040MSS
EVC326	VDOAH043MSS0005H04STGH040MSS
EVC327	VDOAH043MSS0010H04STGH040MSS
Note: Shown in UL file under Cable Assemblies using catalog number	

Sensors Accessories: Cables

Dimensions (in/mm)

Figure 1

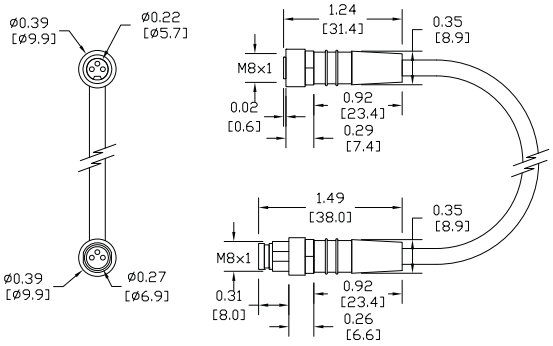


Figure 2

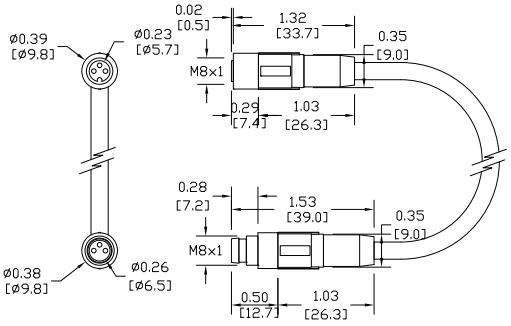


Figure 3

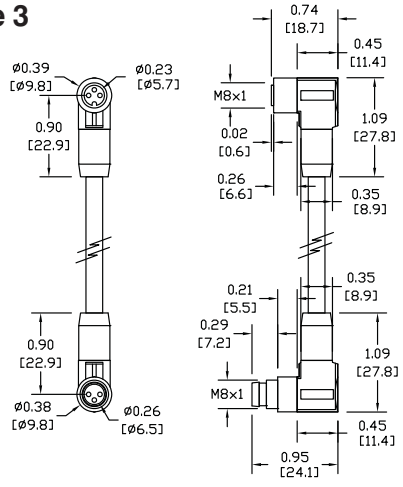


Figure 4

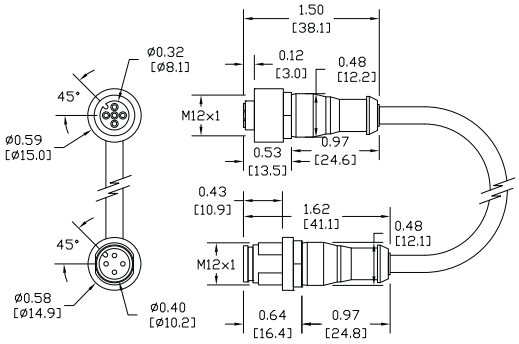


Figure 5

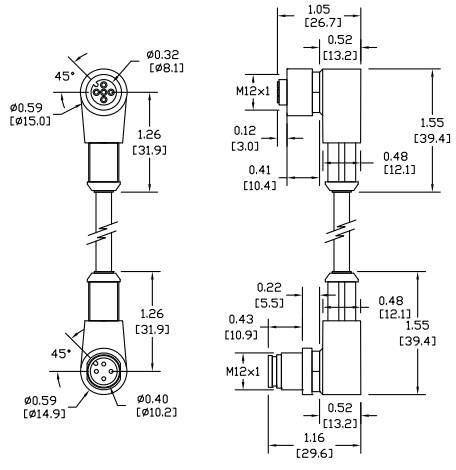
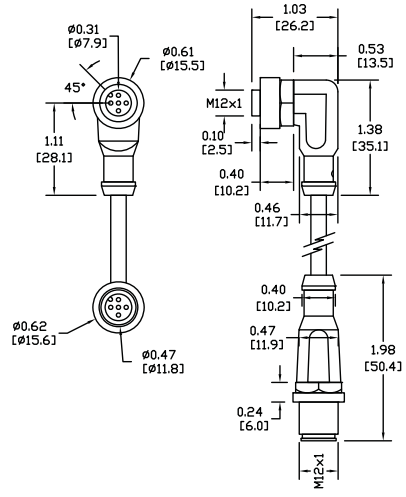


Figure 6



Accessories: Reflectors and Shutters

RL series reflectors for polarized reflective photoelectric sensors (all models)

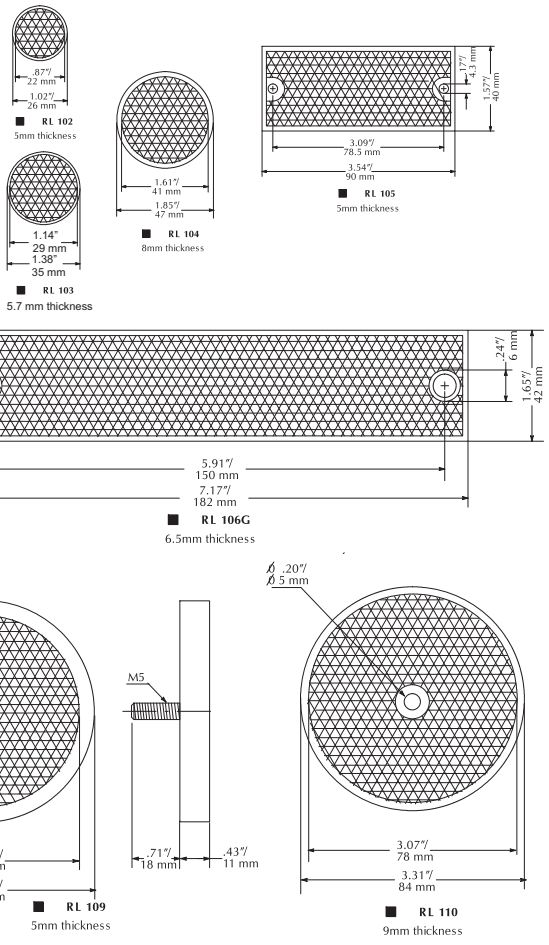
- Suitable for use with polarized light photoelectric sensors
- Shapes and sizes for most applications
- Miniature types for close mounting in multiple sensor installations
- Single hole, dual hole and stud mounting types available
- 10 reflectors per package







Dimensions



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	***RL102***	***RL103***	***RL104***	***RL105***	***RL106G***	***RL109***	***RL110*** [3]
Price (10 per pack)	<--->	<--->	<--->	<--->	<--->	<--->	<--->
% Sensing Range Using SSP [1]	50%	40%	50%	50%	50%	50%	100%
% Sensing Range Using QXP [1]	--	35%	60%	50%	45%	30%	100%
Dimensions	Ø26mm	Ø36mm	Ø47mm	90x40mm	182x42mm	Ø83mm	Ø84mm
Degree of Protection [2]	IEC IP67						
Mounting	Customer-supplied adhesive or other mounting method required			two Ø4.3mm holes	two Ø6mm holes	one M5 stud	one Ø5mm hole
Materials	Reflective face: PMMA Polymethylmethacrylate (acrylic); base material: ABS (Acrylonitrile-butadiene-styren)						

1 Refer to individual catalog pages for detailed explanations of these photoelectric sensors.
2 Not recommended for applications involving moist air environments or water immersion.
3 All reflective sensors are shipped with an RL110 reflector.

ST0S1 through ST0S8 shutters for M18 (18 mm) through-beam sensors (SSE / SSR)



- Reduces the emitted beam, allowing the detection of small targets

Sensing Distance (when used with SSE / SSR Model Photoelectric switches)						
Model	***ST0S1***	***ST0S2***	***ST0S3***	***ST0S4***	***ST0S6***	***ST0S8***
Pieces Per Pack	1	1	1	1	1	1
Price	<--->	<--->	Discontinued	<--->	<--->	<--->
Ø x shutter (mm)	1	2	3	4	6	8
Distance (m)	N/A	N/A	1	1.5	3.5	6.5
object (mm)	N/A	N/A	1.5	2	3	4

- Shutter consists of a threaded ring-nut, a protective lens, an O-ring and an aperture, which can screw onto the optical head of either the emitter or receiver. The table above shows the sensing distance and minimal detectable object.

Accessories: Reflectors, Adapters & Mounting Brackets

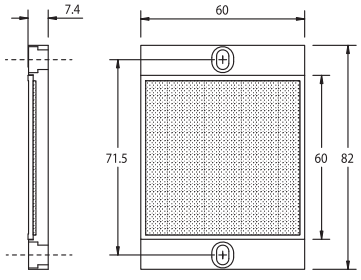
RL series reflectors for polarized reflective Laser photoelectric sensors (FALN series)

- Suitable for use with polarized light Laser photoelectric sensors
- Sizes for most applications
- Miniature types for close mounting in multiple sensor installations
- 5 reflectors per package

Specifications			
Model	***RL201***	***RL203***	***RL204***
Sensing Range Using FALN [1]	30m	7m	7m
Dimensions	60mm x 82mm	19mm x 60mm	20mm x 32mm
Mounting	two Ø4mm holes	two Ø5mm holes	two Ø3mm holes
Degree of Protection [2]	IEC IP67		
Materials	Acrylic/polycarbonate		

1 Refer to individual catalog pages for detailed explanations of these photoelectric sensors.
2 Not recommended for applications involving moist air environments or water immersion.
Note: All reflective sensors are shipped with an RL110 reflector. Purchase additional reflectors separately.

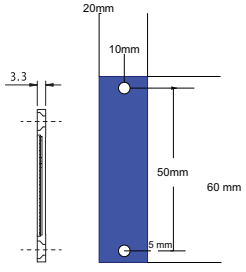
RL201



<--->

(5 per pack)

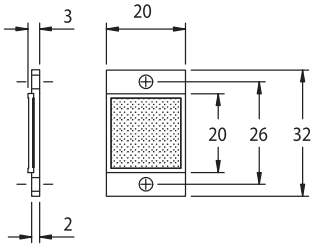
RL203



<--->

(5 per pack)

RL204



<--->

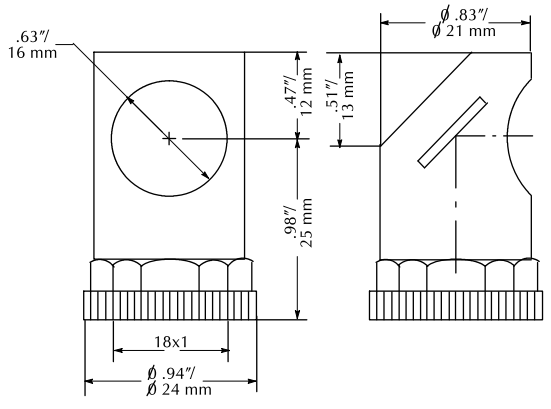
(5 per pack)

ST03 right-angle M18 (18 mm) beam adapter



For use with M18 retroreflective and through-beam photoelectric switches (not for use with diffuse reflection sensors). Allows 90° light detection using an internal mirror set at 45° to the optical axis. Sensitivity loss is about 20-30%.

<--->

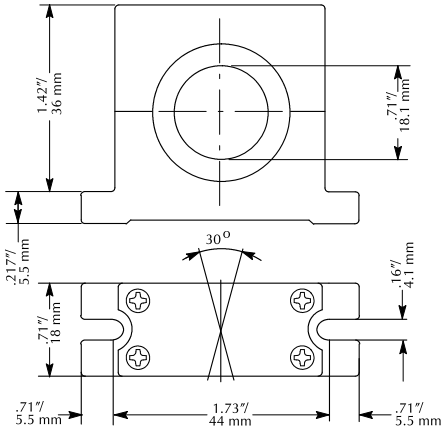


ST02 plastic swivel bracket M18 (18 mm)



Plastic mounting bracket for use with M18 photoelectric switches. Has a ball-joint and set screws to adjust sensor orientation. Allows orientation in all directions for retroreflective and through-beam sensors. (Will not work with C18 series).

<--->



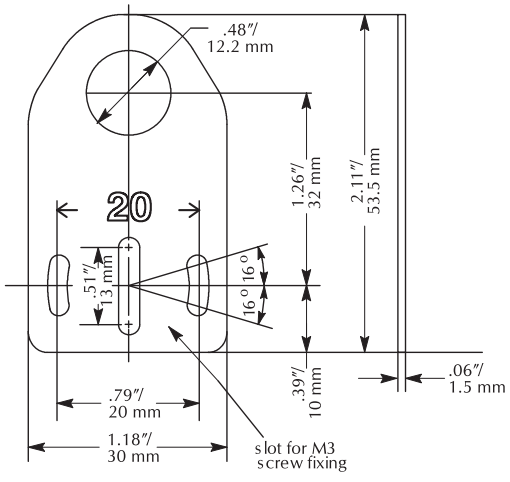
Accessories: Mounting Brackets

ST12A axial bracket

For mounting M12 (12 mm) sensors. Has two mounting holes (use 3 mm screws) and allows the rotation of an optical axis for right-beam angle adapter sensors.



Brackets		
Part Number	**Price**	**Description**
ST12A	<--->	Metal axial bracket for 12 mm sensors, 1/pk
ST12A7W	<--->	316L stainless steel axial bracket for 12 mm sensors, 1/pk

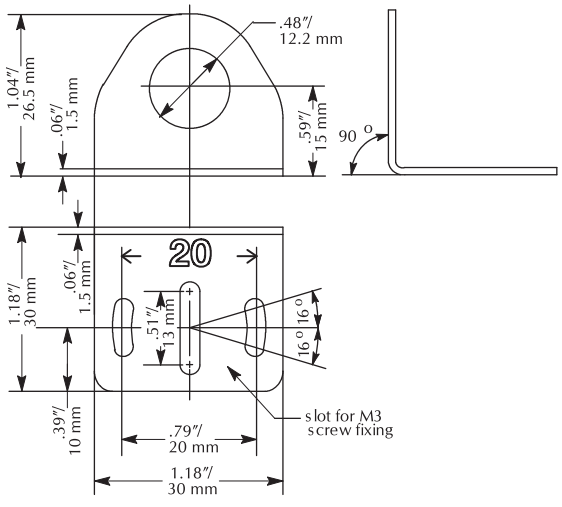


ST12C right-angle bracket

Angular mounting bracket for use with M12 (12 mm) sensors. Has two mounting holes (use 3 mm screws) and allows the rotation of an optical axis for axial sensors.



Brackets		
Part Number	**Price**	**Description**
ST12C	<--->	Metal right angle bracket for 12 mm sensors, 1/pk
ST12C7W	<--->	316L stainless steel right angle bracket for 12 mm sensors, 1/pk

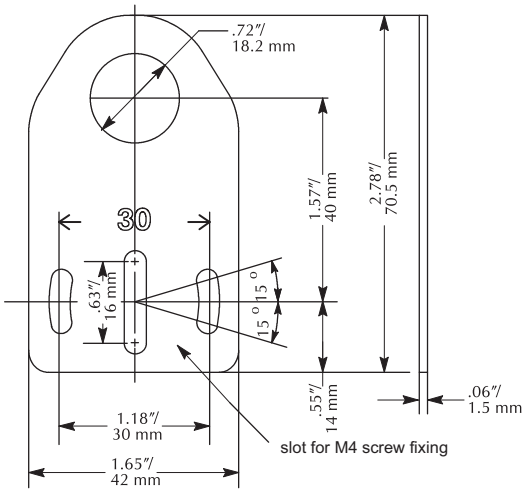


ST18A axial bracket

Mounting bracket for M18 (18mm) sensors. Has two mounting holes (use 4 mm screws) and allows the rotation of an optical axis for right-beam angle adapter sensors.



Brackets		
Part Number	**Price**	**Description**
ST18A	<--->	Metal axial bracket for 18 mm sensors, 1/pk
ST18A7W	<--->	316L stainless steel axial bracket for 18 mm sensors, 1/pk



ST18C right-angle bracket

Angular mounting bracket for M18 (18 mm) sensors. Has two mounting holes (use 4 mm screws) and allows the rotation of an optical axis for axial sensors.



Brackets		
Part Number	**Price**	**Description**
ST18C	<--->	Metal right angle bracket for 18 mm sensors, 1/pk
ST18C7W	<--->	316L stainless steel right angle bracket for 18 mm sensors, 1/pk

