

Proximity Sensors

Section 18



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Current Sensors

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Pressure Sensors

Section 23

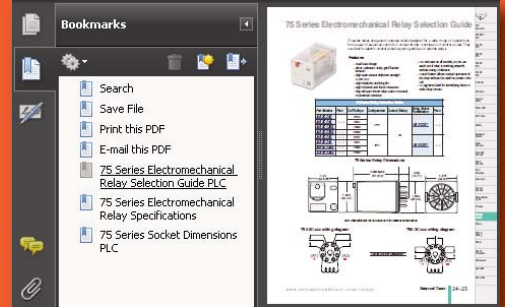


Temperature Sensors

Section 24



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- Use bookmarks to save, search, print or e-mail the catalog section
- Click on part #s to link directly to our online store for current pricing, specs, stocking information and more



Photoelectric Sensor Technologies Expand Applications



What type of photoelectric sensor is best for me?

There are many different styles of photoelectric sensors, but really only four basic technologies: through-beam, reflective, diffuse, and background suppression. The chart describes some advantages and disadvantages of each technology.

Type	Advantages	Disadvantages
Through-beam	<ul style="list-style-type: none"> • Most accurate • Longest sensing range • Very reliable 	<ul style="list-style-type: none"> • Must install at two points on system: emitter and receiver • Costly - must purchase both emitter and receiver
Reflective	<ul style="list-style-type: none"> • Cost less than through-beam • Only slightly less accurate than through-beam • Sensing range better than diffuse • Very reliable 	<ul style="list-style-type: none"> • Must install at two points on system: sensor and reflector • Slightly more costly than diffuse • Sensing range less than through-beam
Diffuse	<ul style="list-style-type: none"> • Only install at one point • Cost less than through-beam or reflective 	<ul style="list-style-type: none"> • Less accurate than through-beam or reflective • More setup time involved
Background Suppression	<ul style="list-style-type: none"> • Effective with reflective backgrounds 	<ul style="list-style-type: none"> • Cost more than diffuse, reflective or through-beam • Most setup time required

How do these sensors benefit me?

Everybody wants to know how a particular product will help them. With AUTOMATIONDIRECT photoelectric sensors, you benefit from:

- Approximately 2-to-1 list pricing compared to the competition. This allows OEM-like pricing on single item purchases.
- Rectangular formats that provide mounting holes directly into the sensor. This eliminates the need for mounting plates and allows for easier installation.
- Quick-disconnect cable versions available for all sensors. The Q/D sensors make for fast and easy replacement. Troubleshooting is also much faster with Q/D devices as the user need only unscrew the connector and change out the sensor. This eliminates the need for disconnecting wires and cutting wire ties, thus speeding up the replacement process with much less room for error.
- Electrical protection against short circuit, reverse polarity, and transient noise. Even if the sensor is initially wired wrong, or wired into a noisy environment, the sensor will still operate properly.
- 30-day, money-back guarantee. Nothing else needs to be said. If you are not satisfied with the performance of your sensor, just send it back.

The Most Popular Photoelectric Sensor Styles

The most popular and widely-accepted photoelectric sensor mounting shape in the U.S. market is the 18 mm round format. From a standard through-beam (plastic) sensor to a unique right-angle, background suppression diffuse sensor, AUTOMATIONDIRECT has a model to fit your needs.

- Metal or plastic housing
- Diffuse, polarized retroreflective, through-beam, and background suppression models
- Straight or unique right-angle optics
- 3-wire and 4-wire outputs
- NPN and PNP models
- Normally open and normally closed (light or dark operation) models

Also available are 5, 8 and 12 mm diameter models in various styles.



Rectangular styles for unique mounting needs

- The CX series offers a built-in LED that indicates when dirt is blocking the light emission. This feature ensures reliable operation and eliminates constant cleaning of the sensor. The CX series is also completely sealed with potting and has an IP65, watertight rating.
- The FE series offers universal voltages with a 3A relay output
- All sensors contain adjustment potentiometers and double-alignment LEDs. This simplifies installation and setup time and allows for customization to your specific application.

Quick-disconnect cables and accessories



Quick-disconnect cables, reflectors, mounting brackets and other accessories available include:

- Micro (12 mm) and pico (8 mm) Q/D sizes in 2 m, 5 m, and 7 m lengths
- Extension cables for quick-disconnect sensors
- LED sensor cables for signal confirmation
- Round and rectangular reflectors in many sizes
- Photoelectric shutters that focus your photoelectric sensor on small targets
- Right-angle adapters for special mounting applications

A photoelectric sensor must suit your application, and must also be easy to install, simple to set up, and operate flawlessly. AUTOMATIONDIRECT understands these needs and offers products that solve your application problems:

- **Unique right-angle mounting sensors.** Have you ever tried to install a right-angle sensor? Have you tried getting the mounting nut over the right-angle head of the sensor? It's not easy! We offer a right-angle sensor that a nut will fit directly over. Our competitors don't offer a product that's so easy to use. This technology will save you time and headaches during installation.
- **IP67 (washdown) rating.** All of our sensors are watertight and built to last. Since you won't have to swap sensors out constantly, you will ultimately save money.
- **Metal or plastic sensors.** Plastic sensors are great for corrosion resistance, while metal sensors are rugged and can absorb more punishment. We offer both.
- **Alignment LEDs.** With onboard indicators, our sensors simplify installation to save you time and money.

We are so confident of our sensors' quality, we offer a 30-day money-back guarantee if you don't like them.



Photoelectric Sensor Lineup



from
\$61.75

5 mm, C5 series

- Power: 10-30 VDC
- Embedded cable or M8 Q/D
- 3-wire, NPN or PNP output
- Fixed sensitivity



from
\$80.00
pair

8 mm, HE series thru-beam

- Power: 10-30 VDC
- Embedded cable or M8 Q/D
- 3-wire, NPN or PNP output,
- Fixed sensitivity



from
\$37.00

12 mm, DM series

- Power: 10-30 VDC
- Embedded cable or M12 Q/D
- 4-wire, NPN or PNP output, LO/DO selectable
- Teach auto calibration



from
\$31.00

18 mm non-metal, SS/MS/MV series

- Power: 10-30 VDC or 20-250VAC
- Embedded cable or M12 Q/D
- 4-wire, NPN or PNP output, LO/DO selectable, triac output
- Fixed sensitivity



from
\$33.50

18 mm metal, C18 series

- Power: 10-30 VDC
- Embedded cable or M12 Q/D
- 3 or 4-wire, NPN or PNP output
- Adjustable sensitivity
- Axial or right-angle optics



from
\$36.00

18 mm non-metal, FA series

- Power: 10-30 VDC
- Embedded cable or M12 Q/D
- 4-wire, NPN or PNP output, LO/DO selectable
- Laser or LED, fixed sensitivity



from
\$91.75

AC/DC rectangular, FG series

- Universal voltage, 12-240 VDC or 24-240 VAC
- Embedded cable
- 3A SPDT relay output
- Adjustable sensitivity



from
\$61.75

Mini DC Rectangular, FE Series

- Power: 10-30 VDC
- Embedded cable or M8 Q/D
- 3-wire, NPN or PNP output, LO/DO selectable
- Adjustable sensitivity



from
\$41.75

DC rectangular, CX series

- Embedded cable or M8 Q/D
- 3-wire, NPN or PNP output
- Adjustable sensitivity



from
\$52.50

DC rectangular, QX series

- Power: 10-30 VDC
- Embedded cable or M12 Q/D
- 4-wire, NPN/PNP selectable output
- Fixed sensitivity
- Axial or right-angle optics



from
\$68.00

DIN rail fiber amplifiers, DFT and DFP series

- Power: 10-30 VDC
- Embedded cable or M8 Q/D
- 4-wire, NPN or PNP output, LO/DO selectable



from
\$51.00

Cutler-Hammer Enhanced 50 Series

- Drop-in replacement for AB 9000 series
- Diffuse, retroreflective, through-beam and clear object detection



from
\$37.00

18 mm fiber amplifier, SSF series

- Power: 10-30 VDC
- Embedded cable or M12 Q/D
- 4-wire, NPN or PNP output, LO/DO selectable
- Teach auto calibration



from
\$25.00

Cutttable fibers, CF series

- 2.2 mm Ø Diameter
- 2m length, field cuttable
- Use with DFP/DFT/SSF series



from
\$164.75

Light screens, BX series

- Power: 12-24 VDC
- M12 Q/D
- 4-wire, NPN or PNP output, NO/NC selectable
- Screen measures 2 m x 70 mm
- 12 light beams, 5 mm resolution

Photoelectric Sensors Selection Guide

Company Information

Systems Overview

Programmable Controllers

Field I/O

Software

C-more & other HMI

Drives

Soft Starters

Motors & Gearbox

Steppers/Servos

Motor Controls

Proximity Sensors

Photo Sensors

Limit Switches

Encoders

Current Sensors

Pressure Sensors

Temperature Sensors

Pushbuttons/Lights

Process

Relays/Timers

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Terminal Blocks & Wiring

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Appendix

Product Index

Part # Index



Specification	FA Series LED DC	FA Series Laser DC	SS Series DC	MS Series DC
Description	18mm plastic, DC	18mm plastic, DC	18mm plastic, DC	18mm plastic with background suppression, DC
Sensing Distances	Diffuse models: 1m Reflective models: 3m Through-beam: 20m	Diffuse models: 300mm Reflective models: 20m Through-beam: 50m	Diffuse models: 100mm, 200mm, 400mm Reflective models: 2m Through-beam models: 8m	Diffuse Reflection Standard distance models: 50mm Extended distance models: 100mm
Output State	Complementary N.O / N.C.	Complementary N.O / N.C.	N.O. / N.C. selectable	N.O. / N.C. selectable
Logic Output	NPN / PNP	NPN / PNP	NPN / PNP	NPN / PNP selectable
Connection Type	Axial cable / M12 connector	Axial cable / M12 connector	Axial cable / M12 connector	Axial cable / M12 connector
Supply Voltage	10-30VDC	10-30VDC	10-30VDC	10-30VDC
Switching Frequency	250Hz	Diffuse and reflective models: 800Hz Through-beam models: 1kHz	Diffuse and reflective models: 250Hz Through-beam models 25Hz	80Hz
Rating	IEC IP67	IEC IP67	IEC IP67	IEC IP67
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Specification	FARS Series DC	MQ Series AC	MV Series AC	C5 Series DC	HE/HER Series DC
Description	18 mm diffuse with background suppression	18 mm diffuse with background suppression, 90° radial optic	18mm plastic, AC	5mm stainless steel, DC	8 mm Thru-Beam
Sensing Distances	30 to 130 mm	Standard distance models: 50mm Extended distance models: 100mm	Diffuse: 100mm, 200mm, 400mm Reflective: 3m Through-beam: 16m	Diffuse models: 50mm Through-beam models: 250mm	1000 mm / Ex. gain = 2
Output State	N.O./N.C. background suppression Light-on/Dark-on selectable Q/Qnot	N.O. / N.C. background suppression	N.O./ receiver dependent	N.O. / receiver dependent	N.O. / N.C.
Logic Output	NPN/PNP	Triac	Triac	NPN / PNP/ N.O. only	NPN / PNP
Connection Type	Axial cable M12 quick disconnect	M12 quick disconnect	Axial cable M12 connector	Axial cable M8 connector	Axial cable M8 quick disconnect
Supply Voltage	10-30VDC	20-253VAC	20-253VAC	10-30VDC	10-30VDC
Switching Frequency	1 kHz	25Hz	25Hz	250Hz	10kHz
Rating	IEC IP67	IEC IP67	IEC IP67	IEC IP67	IEC IP67
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Photoelectric Sensors Selection Guide



Specification	DM Series DC	C18 Series DC	FE Series DC	CX Series DC	QX Series DC
Description	12mm nickel-plated brass with Teach operating distance function, DC	18mm nickel-plated brass, DC	Mini-rectangular plastic, DC	Mini-rectangular plastic, DC	Rectangular plastic, DC
Sensing Distances	Diffuse models: 100mm, 300mm Reflective models: 2m Through-beam: 4m	Diffuse models: up to 600mm Diffuse models w/ background suppression: 10 to 120mm Reflective models: Up to 2m Through-beam models: up to 6m	Diffuse models: 800mm Reflective models: 4m Through-beam: 12m	Diffuse models: up to 600mm Diffuse models w/ background suppression: 15 to 150mm Reflective models: Up to 2m Through-beam models: Up to 6m	Diffuse models: 300mm Reflective models: 2.5m Through-beam models: 8m
Output State	Diffuse: N.O./ N.C. selectable Polarized reflective: N.O./ N.C. selectable Through-beam: N.O / N.C./ receiver dependent	Diffuse: N.O./ N.C. selectable Diffuse models w/ background suppression: N.O. Polarized reflective: N.O. Through-beam: N.O / N.C./ receiver dependent	Light-on/Dark-on selectable	N.O.	N.O./receiver dependent
Logic Output	NPN / PNP	NPN/PNP/receiver dependent	NPN / PNP	NPN / PNP	NPN/PNP selectable/receiver dependent
Connection Type	Axial cable / M12 connector	Axial cable/M12 connector	Axial cable / M8 connector	Axial cable / M8 connector	Axial cable / M12 connector
Supply Voltage	10-30VDC	10-36VDC	10-30VDC	10-36VDC	10.8-30VDC
Switching Frequency	Diffuse and reflective models: 400Hz Through-beam models: 250Hz	Diffuse models: 1 kHz Diffuse models w/ background suppression: 500Hz Reflective models: 1kHz Through-beam models: 1kHz	1kHz	Diffuse models: 1kHz Diffuse models w/ background suppression: 500Hz Reflective models: 1kHz Through-beam models: 1kHz	Diffuse and reflective models: 750Hz (Tr=0.5ms) Through-beam models: 500Hz (Tr=0.75ms)
Rating	IEC IP67	IEC IP67	IEC IP67	IEC IP65	IEC IP65
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Specification	FG Series AC/DC	CH Enhanced 50 Series
Description	Rectangular plastic, AC/DC	Fiberglass-reinforced plastic
Sensing Distances	Diffuse models: 550mm Reflective models: 9m Through-beam: 20m	Through-beam: 500 ft (152 m) Diffuse models: 10 ft. (3 m) Polarized reflex: 16 ft. (4.9 m) Clear /object detector: 45 in (1.2 m)
Output State	N.O./N.C.	Light-on/Dark-on selectable
Logic Output	SPDT 3A relay	Through-beam: NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3 A @ 120 VAC Diffuse: NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3 A @ 120 VAC Polarized reflex: NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3 A @ 120 VAC Clear object detector: NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3 A @ 120 VAC
Connection Type	Axial cable	Cable or mini/micro connection
Supply Voltage	12-240VDC / 24-240VAC	10 - 40 VDC, 12 - 240 VDC, 24 - 240 VAC
Switching Frequency	33Hz	various
Rating	IEC IP67	IEC IP67
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Photoelectric Sensors Selection Guide



Specification	DFT Series Fiber Amp	DFP Series Fiber Amp	SSF Series Fiber Amp
Description	Compact rectangular plastic fiber optic amplifier with Teach operating distance function, DC	Compact rectangular plastic fiber optic amplifier, DC	18mm plastic fiber optic amplifier, DC
Sensing Distances	See Optical Fiber Tables following the amplifier's specifications	See Optical Fiber Tables following the amplifier's specifications	See Optical Fiber Tables following the amplifier's specifications
Output State	Light-on / Dark-on selectable	Light-on / Dark-on selectable	Light-on / Dark-on selectable
Logic Output	NPN / PNP	NPN / PNP	NPN / PNP
Connection Type	Axial cable / M8 connector	Axial cable / M8 connector	Axial cable / M12 connector
Supply Voltage	10-30VDC	10-30VDC	10-30 VDC
Switching Frequency	1.5kHz	1.5kHz	800Hz
Rating	IEC IP64	IEC IP64	IEC IP67
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Specification	CF Series Optical Fibers	BX Series Light Screen
Description	Cutoffable diffuse reflection and through-beam fiber optic cables (2.2mm diameter)	Rectangular plastic high resolution area sensor, DC
Sensing Distances	Amplifier dependent. Refer to fiber optic tables for sensing distances.	Through-beam: 2m with 70mm height area
Output State	N/A	Selectable N.O / N.C.
Logic Output	N/A	NPN / PNP
Connection Type	N/A	M12 connector
Supply Voltage	N/A	12 - 24 VDC
Switching Frequency	N/A	N/A
Rating	IEC IP67	IEC IP67
Page	19-60	19-64

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- Field I/O
- Software
- C-more & other HMI
- Drives
- Soft Starters
- Motors & Gearbox
- Steppers/ Servos
- Motor Controls
- Proximity Sensors
- Photo Sensors**
- Limit Switches
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- Terminal Blocks & Wiring
- Power
- Circuit Protection
- Enclosures
- Tools
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FA Series LED Photoelectric Sensors



M18 (18 mm) plastic - DC

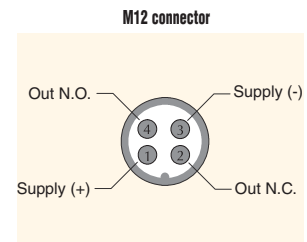
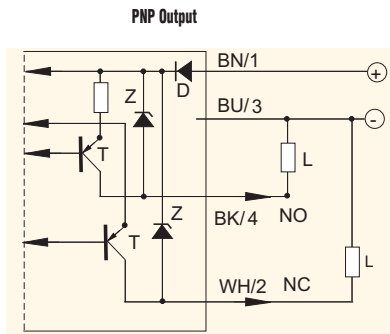
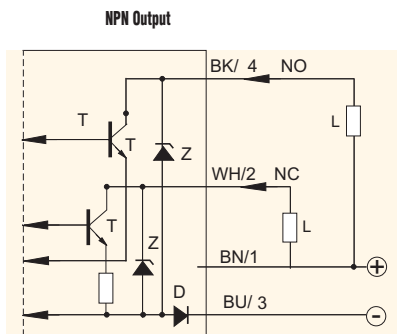
- 14 models available
- Diffuse, polarized reflective, and through-beam models with long sensing distances
- Plastic housing
- Axial cable or M12 quick-disconnect models
- NPN or PNP; Complementary N.O./N.C. outputs
- IP67 rated

FA Series Photoelectric Sensors Selection Chart									
Part Number	Price	Sensing Range	Output State	Logic	Connection	Dimensions	Characteristic Curves		
Diffuse									
FAI8-BN-0A	<--->	1m (39.37in)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Figure 1	Chart 1		
FAI8-BP-0A	<--->			PNP	2m (6.5) axial cable	Figure 1	Chart 1		
FAI8-BN-0E	<--->			NPN	M12 (12mm) connector	Figure 2	Chart 1		
FAI8-BP-0E	<--->			PNP	M12 (12mm) connector	Figure 2	Chart 1		
Polarized reflective*									
FARN-BN-0A	<--->	3m (118.11in)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Figure 1	Chart 2		
FARN-BP-0A	<--->			PNP	2m (6.5) axial cable	Figure 1	Chart 2		
FARN-BN-0E	<--->			NPN	M12 (12mm) connector	Figure 2	Chart 2		
FARN-BP-0E	<--->			PNP	M12 (12mm) connector	Figure 2	Chart 2		
Through-beam**									
FAID-BN-0A	Receiver <--->	20m (65.62ft)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Figure 1	Chart 3		
FAID-BP-0A	Receiver <--->			PNP	2m (6.5) axial cable	Figure 1	Chart 3		
FAID-BN-0E	Receiver <--->			NPN	M12 (12mm) connector	Figure 2	Chart 3		
FAID-BP-0E	Receiver <--->			PNP	M12 (12mm) connector	Figure 2	Chart 3		
FAIH-00-0A	Emitter <--->			Receiver dependent			2m (6.5) axial cable	Figure 1	Chart 3
FAIH-00-0E	Emitter <--->						M12 (12mm) connector	Figure 2	Chart 3

*Receivers include one round (84mm dia.) RL110 reflector. Purchase additional reflectors separately. See page 18-67.

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

Wiring diagrams



Note: N.O. = Signal ON when emitter is NOT sensing receiver.
N.C. = Signal ON when emitter is sensing receiver.

Cables and Accessories
Cables and accessories start on page 19-65

FA Series LED Photoelectric Sensors

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflection ³	Through-beam ⁴
Sensing Distance	1m ¹	3m ²	20m
Emission	Infrared (880nm)	Red (660nm)	Infrared (880nm)
Tolerance	+15%/-5%		
Sensitivity	Adjustable		
Differential Travel	≤10%		
Repeat Accuracy	5%		
Operating Voltage	10-30VDC		
Ripple	≤10%		
No-load Supply Current	≤30mA		≤25mA
Load Current	≤100mA		
Leakage Current	≤10μA		
Voltage Drop	2V max at 100mA		
Output Type	NPN or PNP - Complementary NO/NC		
Switching Frequency	250Hz		
(tv) Time Delay Before Availability	200ms		
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/+70°C (-13° to 158° F)		
Temperature Drift	10% Sr		
Interference to External Light	5000 lux (incandescent lamp), 10000 lux (sunlight)		
Protection Degree (DIN 40050)	IEC IP67		
LED Indicators	Yellow (output energized)		Receiver: Yellow (output energized) Emitter: Green (power ON)
Housing Material	PBT		
Lens Material	PC	PMMA	PC
Tightening Torque	40 N-m (29 lb-ft)		
Weight	100g (3.53 oz)		Emitter + Receiver 200g (7.05 oz)

¹ With 100x100mm white matte paper
² With standard diameter 84mm RL110 reflector. See page19-67.
³ Each sensor includes one 84mm round reflector (RL110). Purchase additional reflectors separately.
⁴ An emitter (FAIH) and receiver (FAID) pair must be ordered for a complete sensor set.

Dimensions

Figure 1

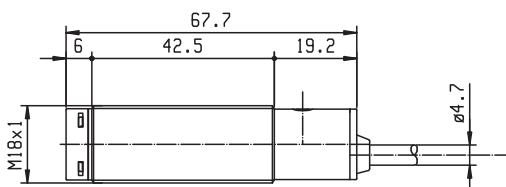
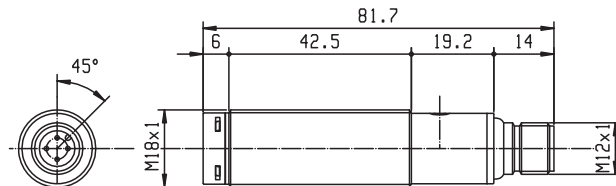


Figure 2



FA Series LED Photoelectric Sensors

Characteristic curves

Chart 1

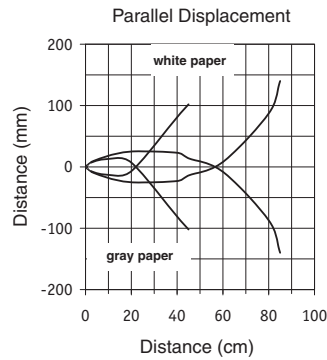
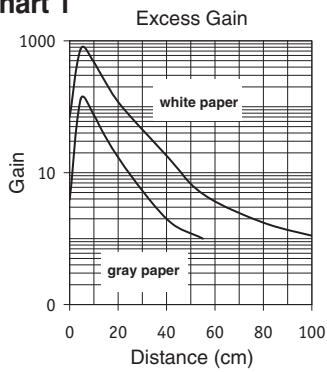


Chart 2

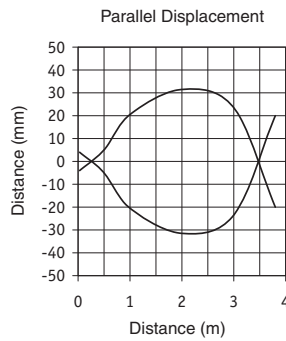
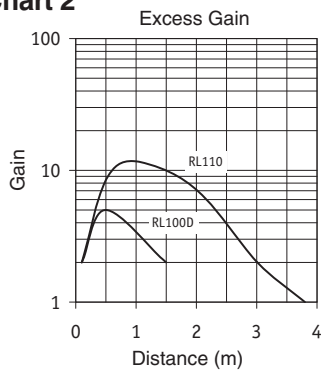
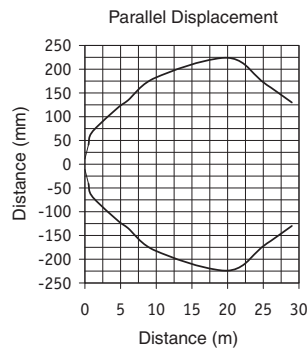
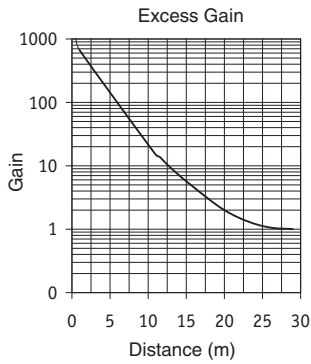


Chart 3



FA Series Laser Photoelectric Sensors



M18 (18 mm) plastic - DC

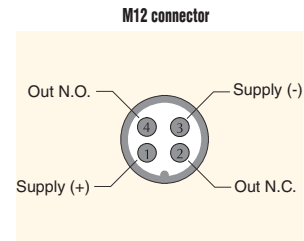
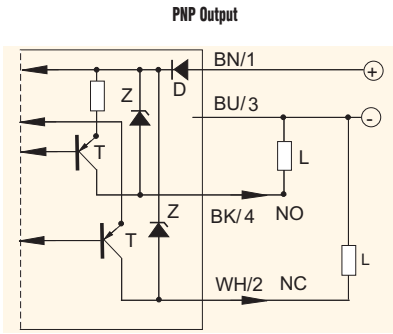
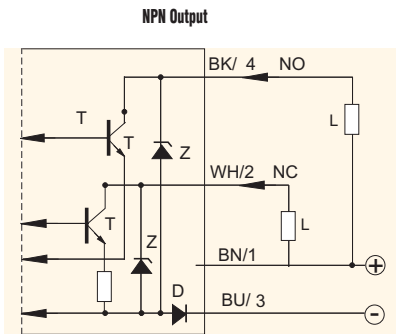
- 14 models available
- Diffuse, polarized reflective, and through-beam models with long sensing distances
- Plastic housing
- Axial cable or M12 quick-disconnect models
- NPN or PNP, complementary N.O./N.C. outputs
- IP67 rated

FA Series Photoelectric Sensors Selection Chart							
Part Number	Price	Sensing Range	Output State	Logic	Connection	Dimensions	Characteristic Curves
Diffuse							
FAL4-BN-0A	<--->	300mm (11.81in)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Figure 1	Chart 1
FAL4-BP-0A	<--->			PNP	2m (6.5) axial cable	Figure 1	Chart 1
FAL4-BN-0E	<--->			NPN	M12 (12mm) connector	Figure 2	Chart 1
FAL4-BP-0E	<--->			PNP	M12 (12mm) connector	Figure 2	Chart 1
Polarized reflective*							
FALN-BN-0A	<--->	20m (65.61ft) with RL110	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Figure 1	Chart 2
FALN-BP-0A	<--->			PNP	2m (6.5) axial cable	Figure 1	Chart 2
FALN-BN-0E	<--->	30m (98.43ft) with RL201		NPN	M12 (12mm) connector	Figure 2	Chart 2
FALN-BP-0E	<--->			PNP	M12 (12mm) connector	Figure 2	Chart 2
Through-beam**							
FALD-BN-0A	Receiver <--->	50m (164.04ft)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Figure 1	Chart 3
FALD-BP-0A	Receiver <--->			PNP	2m (6.5) axial cable	Figure 1	Chart 3
FALD-BN-0E	Receiver <--->			NPN	M12 (12mm) connector	Figure 2	Chart 3
FALD-BP-0E	Receiver <--->			PNP	M12 (12mm) connector	Figure 2	Chart 3
FALH-XO-0A	Emitter <--->			Receiver dependent	2m (6.5) axial cable	Figure 1	Chart 3
FALH-XO-0E	Emitter <--->			Receiver dependent	M12 (12mm) connector	Figure 2	Chart 3

*Receivers include one round (84mm dia.) RL110 reflector. Purchase additional reflectors separately. See page 18-67.
 **Purchase one receiver and one emitter for a complete set.

Cables and Accessories
 Cables and accessories start on page 19-65

Wiring diagrams



Note: N.O. = Signal ON when emitter is NOT sensing receiver.
 N.C. = Signal ON when emitter is sensing receiver.

- Company Information
- Systems Overview
- Programmable Controllers
- Field I/O
- Software
- C-more & other HMI
- Drives
- Soft Starters
- Motors & Gearbox
- Steppers/Servos
- Motor Controls
- Proximity Sensors
- Photo Sensors
- Limit Switches
- Encoders
- Current Sensors
- Pressure Sensors
- Temperature Sensors
- Pushbuttons/Lights
- Process
- Relays/Timers
- Comm.
- Terminal Blocks & Wiring
- Power
- Circuit Protection
- Enclosures
- Tools
- Pneumatics
- Appendix
- Product Index
- Part # Index

FA Series Laser Photoelectric Sensors

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflection ³	Through-beam ⁴
Sensing Distance	300mm ¹	20m with RL110 reflector ² 30m with RL201 reflector	50m
Emission	Visible red Class 1 Laser (650nm); see note below		
Minimum Detectable Object	0.1mm	0.7mm	10mm
Sensitivity	Adjustable		
Differential Travel	≤10%		
Repeat Accuracy	5%		
Operating Voltage	10-30VDC		
Ripple	≤10%		
No-load Supply Current	≤30mA	≤20mA	≤25mA
Load Current	≤100mA		
Leakage Current	≤10μA		
Voltage Drop	2V max at 100mA		
Output Type	NPN or PNP - Complementary NO/NC		
Switching Frequency	800Hz		1kHz
(tv) Time Delay Before Availability	200ms		
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	-15/+55°C (5° to 131° F)		
Temperature Drift	10% Sr		
Interference to External Light	3000 lux (incandescent lamp), 10000 lux (sunlight)		
Protection Degree (DIN 40050)	IEC IP67		
LED Indicators	Yellow (output energized) Green (power ON)		Receiver: Yellow (output energized) Emitter: Green (power ON)
Housing Material	PBT		
Lens Material	PC		
Tightening Torque	40 N-m (29 lb-ft.)		
Weight	200g (7.05 oz)		
¹ With 100x100mm white matte paper ² With standard Ø84mm RL110 reflector ³ Each sensor includes one reflector (RL110). Purchase additional reflectors separately. ⁴ An emitter (FALH) and receiver (FALD) pair must be ordered for a complete sensor set.			

IMPORTANT NOTE

Class 1 Laser Product

Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice Number 50, dated July 26, 2001.

Note: FA-L sensors are equipped with a visible red light laser diode and are classified as CLASS 1 LASER DEVICES. According to the CEIEN60825-1 norms, the class 1 laser devices are safe in operating conditions that can be reasonably foreseen. The FA-L sensors emit visible laser light impulses with a maximum peak power of 0.4 milliwatt. The laser output maximum power level is checked through a circuit that is always working, so it can detect any single failure. The FA-L Class 1 laser always emits a beam of intense and very concentrated light. The intentional and prolonged observation of this light can cause eye problems. As a result, it is advisable, where possible, to install the laser sensors so the beam cannot exceed the operating area. Avoid laser beam contact with eyes.

FA Series Laser Photoelectric Sensors

Dimensions

Figure 1

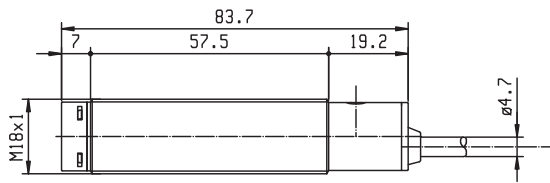
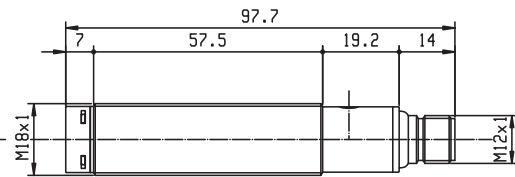


Figure 2



Characteristic curves

Chart 1

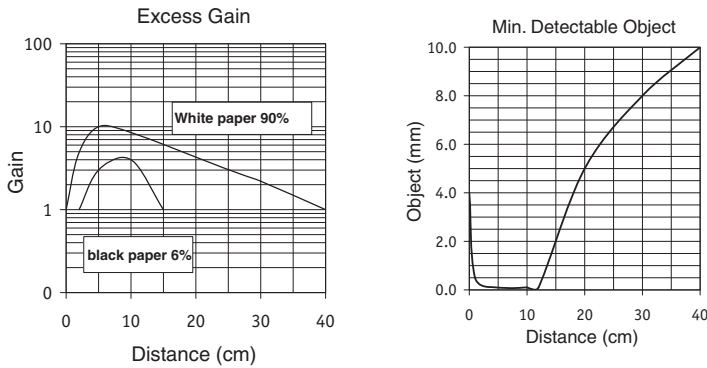


Chart 2

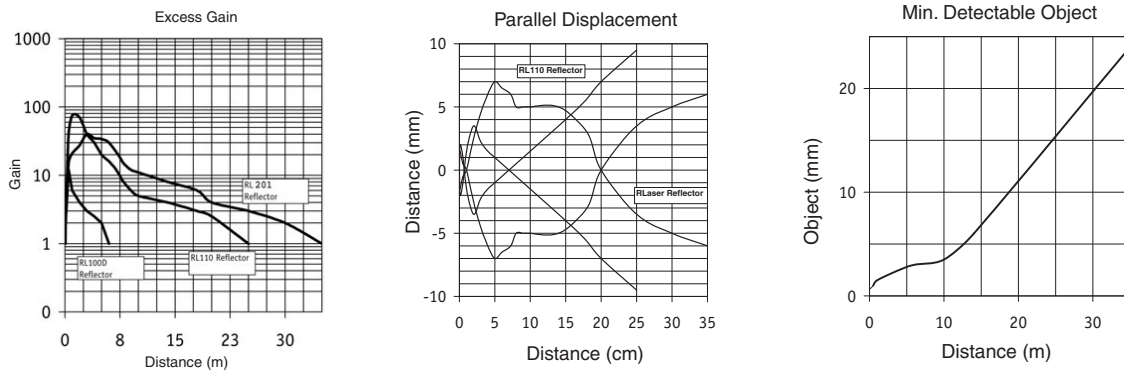
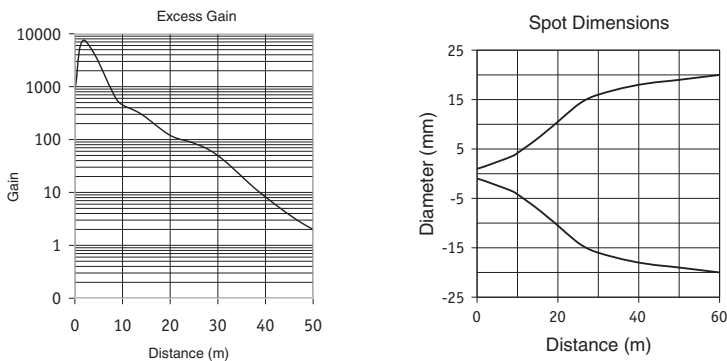


Chart 3



SS Series Photoelectric Sensors



M18 (18 mm) plastic- DC

- 22 models available
- Diffuse, polarized reflective, and through-beam models
- Plastic housing
- Axial cable or M12 quick-disconnect models
- N.O./N.C. selectable output
- IP67 rated

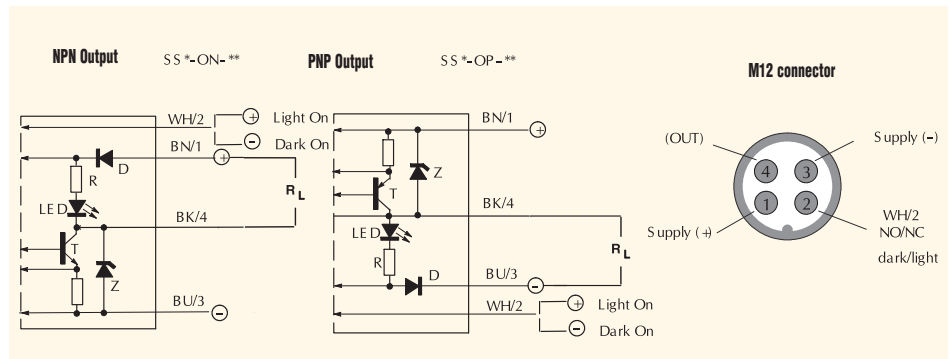
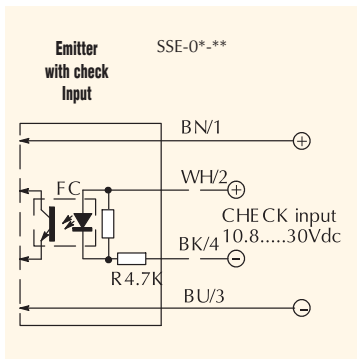
SS Series Photoelectric Sensor Selection Chart							
Part Number	Sensing Range	Output State*	Logic	Connection	Dimensions	Characteristic Curves	Price
Diffuse							
SS2-ON-4A	100mm (3.9 in.)	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Figure 1	Chart Set 1	<--->
SS2-OP-4A			PNP	2m (6.5') axial cable	Figure 1	Chart Set 1	<--->
SS2-ON-4E			NPN	M12 (12mm) connector	Figure 2	Chart Set 1	<--->
SS2-OP-4E			PNP	M12 (12mm) connector	Figure 2	Chart Set 1	<--->
SS5-ON-4A	200mm (7.9 in.)	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Figure 1	Chart Set 2	<--->
SS5-OP-4A			PNP	2m (6.5') axial cable	Figure 1	Chart Set 2	<--->
SS5-ON-4E			NPN	M12 (12mm) connector	Figure 2	Chart Set 2	<--->
SS5-OP-4E			PNP	M12 (12mm) connector	Figure 2	Chart Set 2	<--->
SS6-ON-4A	400mm (15.7 in.)	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Figure 1	Chart Set 3	<--->
SS6-OP-4A			PNP	2m (6.5') axial cable	Figure 1	Chart Set 3	<--->
SS6-ON-4E			NPN	M12 (12mm) connector	Figure 2	Chart Set 3	<--->
SS6-OP-4E			PNP	M12 (12mm) connector	Figure 2	Chart Set 3	<--->
Polarized reflective*							
SPP-ON-4A	2m (6.6 ft)	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Figure 1	Chart Set 4	<--->
SPP-OP-4A			PNP	2m (6.5') axial cable	Figure 1	Chart Set 4	<--->
SPP-ON-4E			NPN	M12 (12mm) connector	Figure 2	Chart Set 4	<--->
SPP-OP-4E			PNP	M12 (12mm) connector	Figure 2	Chart Set 4	<--->
Through-beam**							
SSR-ON-4A	Receiver	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Figure 1	Chart Set 5	<--->
SSR-OP-4A	Receiver		PNP	2m (6.5') axial cable	Figure 1	Chart Set 5	<--->
SSR-ON-4E	Receiver		NPN	M12 (12mm) connector	Figure 2	Chart Set 5	<--->
SSR-OP-4E	Receiver		PNP	M12 (12mm) connector	Figure 2	Chart Set 5	<--->
SSE-00-4A	Emitter	Receiver dependent	Receiver dependent	2m (6.5') axial cable	Figure 1	Chart Set 5	<--->
SSE-00-4E	Emitter		Receiver dependent	M12 (12mm) connector	Figure 2	Chart Set 5	<--->

*Receivers include one round (84mm dia.) RL110 reflector. Purchase additional reflectors separately. See page 18-67.

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

Cables and Accessories
Cables and accessories start on page 19-65

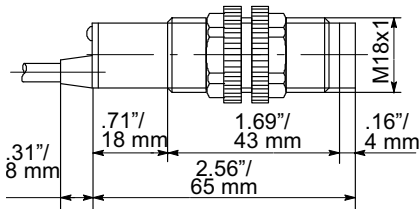
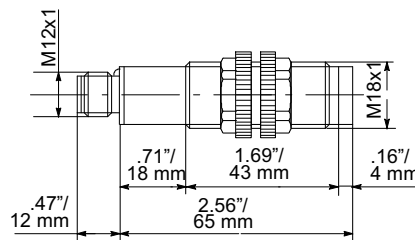
Wiring Diagrams



SS Series Photoelectric Sensors

Specifications	Diffuse Models			Reflective Models	Through-Beam Models
Type	Diffuse reflection			Polarized reflection ⁴	Through-beam ⁵
Sensing Distance	100mm ¹	200mm ¹	400mm ²	2m ³	8M
Minimal Detectable Objects					07.5mm
Emission	Infrared (880nm)			Red (660nm)	Infrared (880nm)
Tolerance	+15/-5%Sn	0/+20% Sn		See SR in glossary	N/A
Sensitivity					Fixed
Differential Travel					≤10%
Repeat Accuracy					5%
Operating Voltage					10-30VDC
Ripple					≤10%
No-load Supply Current	30mA			15mA (SSE), 20mA (SSR)	
Load Current					≤100mA
Leakage Current					≤10μA
Voltage Drop					≤1.2volt maximum at 100mA
Output Type					NPN or PNP/N.O./N.C. selectable
Switching Frequency	250Hz			25Hz	
(tv) Time Delay Before Availability					200ms
Input Voltage Transients Protection					Yes, as long as the transient peak does not exceed 30VDC
Input Power Polarity Reversal Protection					Yes
Output Power Short-Circuit Protection					Yes (switch autoresets after overload is removed)
Temperature Range					-25° to +70° C (-13° to 158° F)
Temperature Drift					≤10° Sr
Interference to External Light					3,000 lux (incandescent lamp) 10,000 lux (sunlight)
Protection Degree (DIN 40050)					IEC IP67
LED Indicators	Yellow (output energized)			Red (output energized)	
Housing Material					PBT (plastic housing), polycarbonate (cable exit)
Lens Material					PMMA
Weight	100g (3.53 oz)			200g (7.05oz)	
¹ With 100x100mm white matte paper ² With 200x200mm white matte paper ³ With standard Ø84mm RL110 reflector ⁴ Each sensor includes one 84mm round reflector (RL110). Purchase additional reflectors separately.					⁵ An emitter (SSE) and receiver (SSR) pair must be ordered for a complete sensor set.

Dimensions

Figure 1

Figure 2


Cables and Accessories

Cables and accessories start on page 19-65

Switching Element Function

	Reflective Models	Diffuse Reflective Models
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

SS Series Photoelectric Sensors

Characteristic curves

Chart Set 1

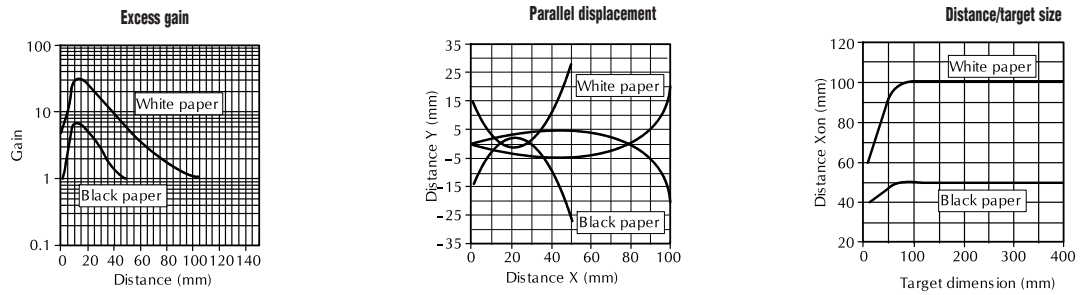


Chart Set 2

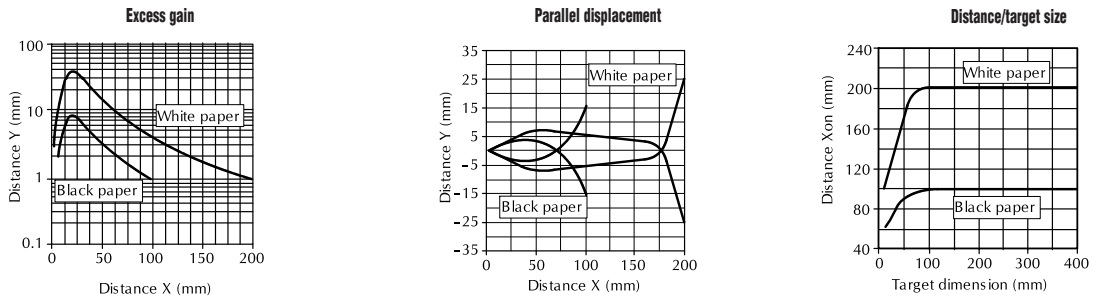


Chart Set 3

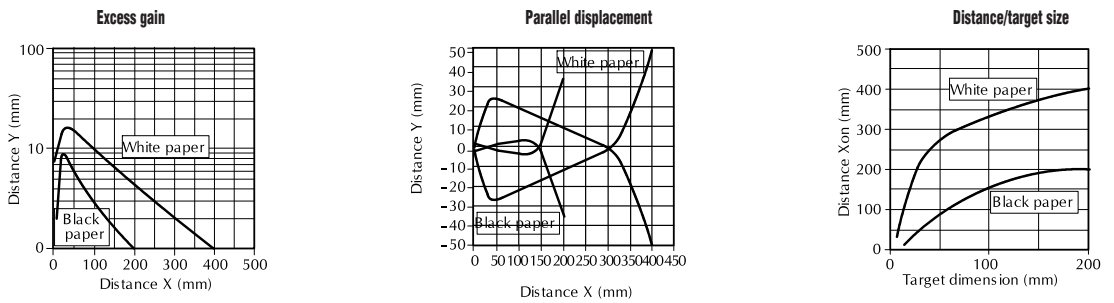


Chart Set 4

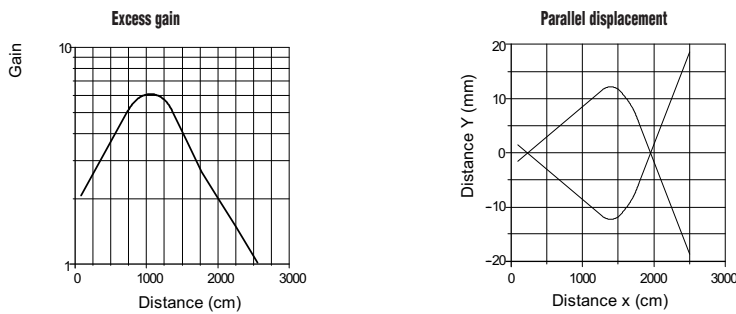
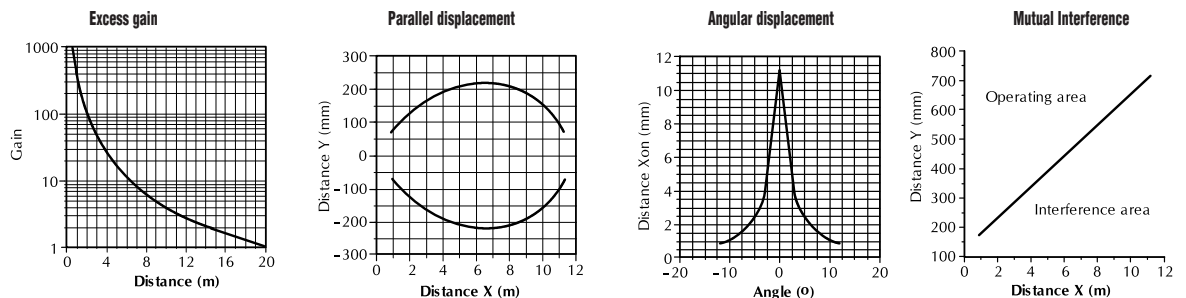


Chart Set 5



MS Series Photoelectric Sensors

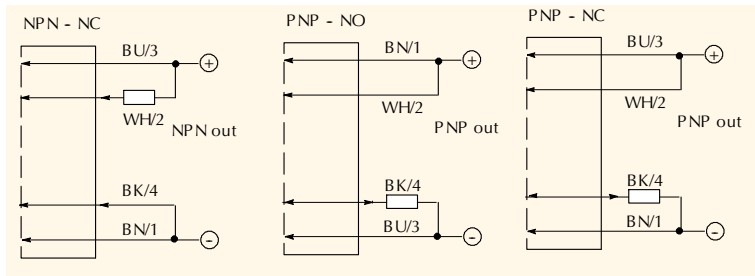
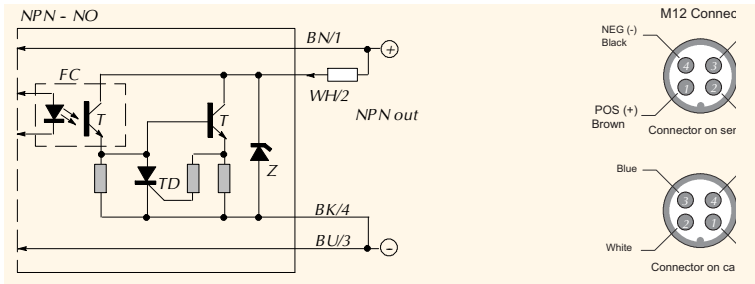
M18 (18 mm) plastic with background suppression - DC



- 4 models available
- Diffuse reflection with background suppression
- Plastic housing
- Axial cable or M12 quick-disconnect models
- NPN, PNP, N.O./N.C. selectable output
- IP67 rated

MS Series Photoelectric Selection Chart							
Part Number	Price	Sensing Range	Output State	Logic	Connection	Dimensions	Characteristic Curves
MS0-00-0A	<-->	50mm (1.97in)	N.O./N.C. selectable	NPN/PNP selectable	2m (6.5') axial cable	Figure 1	Chart 1
MS0-00-0E	<-->				M12 (12mm) connector	Figure 2	Chart 1
MS1-00-0A	<-->	100mm (3.94in)	N.O./N.C. selectable	NPN/PNP selectable	2m (6.5') axial cable	Figure 1	Chart 2
MS1-00-0E	<-->				M12 (12mm) connector	Figure 2	Chart 2

Wiring diagrams



Characteristic curves

Chart 1

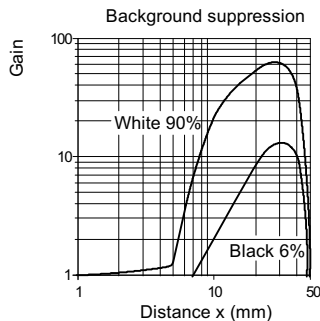
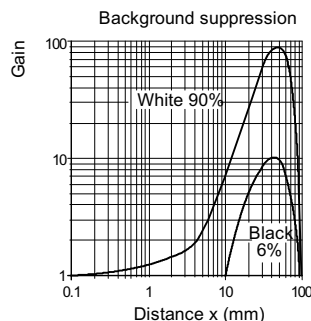


Chart 2



Cables and Accessories
Cables and accessories start on page 19-65

Dimensions

Figure 1

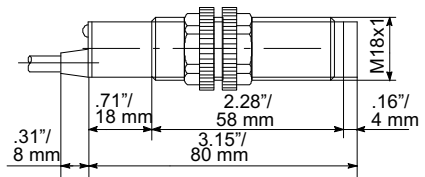
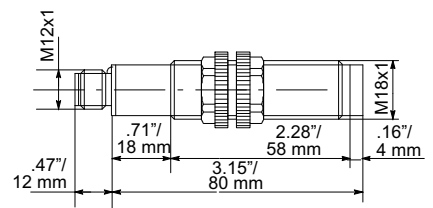


Figure 2



MS Series Photoelectric Sensors

Specifications	Standard Distance	Extended Distance
Type	Diffuse reflection with background suppression	
Sensing Distance	50mm ¹	100mm ¹
Emission	Infrared (880nm)	
Tolerance	0 to +10%Sn	
Differential Travel	≤5%	
Repeat Accuracy	5%	
Operating Voltage	10-30VDC	
Ripple	≤10%	
No-load Supply Current	40mA	
Load Current	≤100mA	
Leakage Current	≤10μA	
Voltage Drop	≤1.2volt maximum at 100mA	
Output Type	NPN/PNP selectable; N.O./N.C. selectable	
Switching Frequency	80Hz	
(tv) Time Delay Before Availability	200ms	
Input Voltage Transients Protection	Yes, as long as the transient peak does not exceed 30VDC	
Input Power Polarity Reversal Protection	No	
Output Power Short-Circuit Protection	Yes (switch autoresets after overload is removed)	
Temperature Range	-25° to +70° C (-13° to 158° F)	
Temperature Drift	5°	
Interference to External Light	3,000 lux (incandescent lamp) 10,000 lux (sunlight)	
Protection Degree (DIN 40050)	IEC IP67	
LED Indicators	Red (output energized)	
Housing Material	PBT (plastic housing), polycarbonate (cable exit)	
Lens Material	Plexiglass 7N	
Weight	150g (5.29 oz)	

¹ With 100x100mm white matte paper

FARS Series Photoelectric Sensors



M18 (18 mm) plastic - DC

The FARS series is a direct reflection diffuse sensor with adjustable background suppression. By using an embedded linear position sensor and a microprocessor, the FARS sensor has excellent capabilities in sensing targets of all shades of color, from a 90% reflective white target, all the way to a 6% reflective black target. The sensing distance can be adjusted between 30 mm and 130 mm using the lateral trimmer.

Features

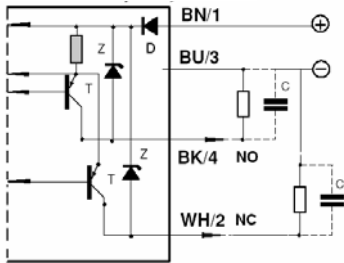
- 8 models, diffuse with background suppression
- 30/130 mm adjustable maximum reading distance
- Cable or M12 quick disconnect
- Plastic or metal housing
- Supply voltage: 10 - 30 VDC, output current: 100 mA
- LED light status indicator
- IP67 housing protection
- Complete protection against electrical damage

18mm diameter Diffuse Sensors Selection Chart

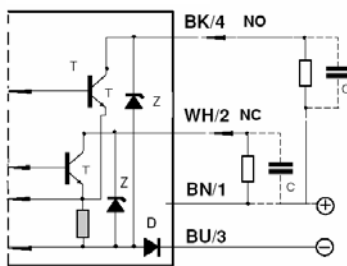
Part Number	Price	Voltage Range	Sensing Range	Switching Frequency	Sensing Beam	Thru-Beam Component	Output Type	Connection Type
FARS-BN-0A	<-->	10 - 30 VDC	30 -130 mm adjustable	1 kHz	Infrared	NO/NC background suppression	NPN NO + NC selectable	2 meter axial cable
FARS-BN-0E	<-->						NPN NO + NC selectable	M12 quick disconnect (purchase cable separately)
FARS-BP-0A	<-->						PNP NO + NC selectable	2 meter axial cable
FARS-BP-0E	<-->						PNP NO + NC selectable	M12 quick disconnect (purchase cable separately)
FARS-ON-0A	<-->					Light On/ Dark On background suppression	NPN LO/DO selectable	2 meter axial cable
FARS-ON-0E	<-->						NPN LO/DO selectable	M12 quick disconnect (purchase cable separately)
FARS-OP-0A	<-->						PNP LO/DO selectable	2 meter axial cable
FARS-OP-0E	<-->						PNP LO/DO selectable	M12 quick disconnect (purchase cable separately)

Wiring Diagrams

PNP Output

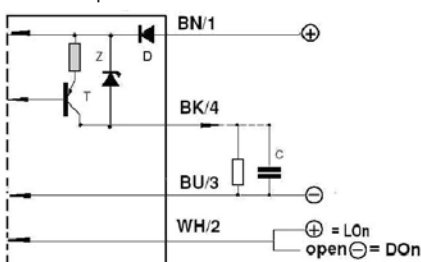


NPN Output

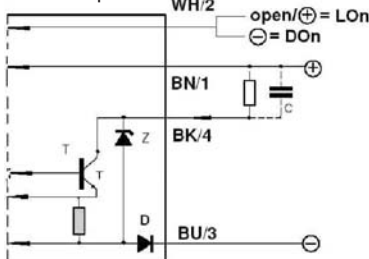


Light On - Dark On Selectable Outputs

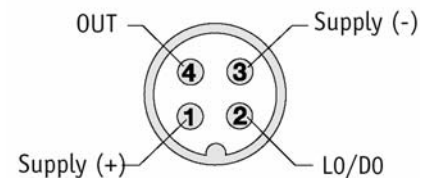
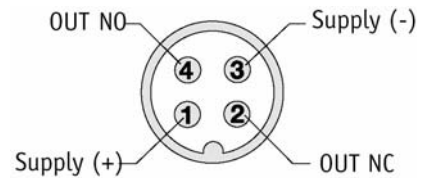
PNP Output



NPN Output



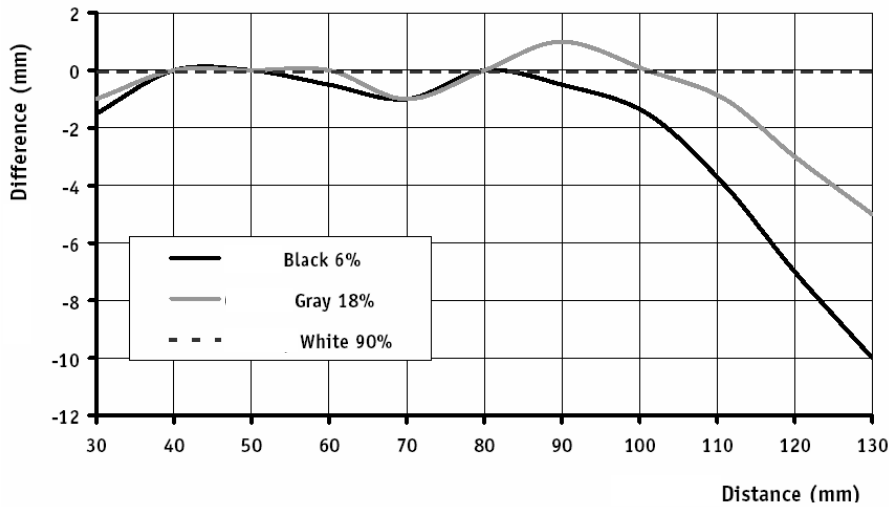
Connector Diagrams



NO	Light ON
NC	Dark ON

FARS Series Photoelectric Sensors

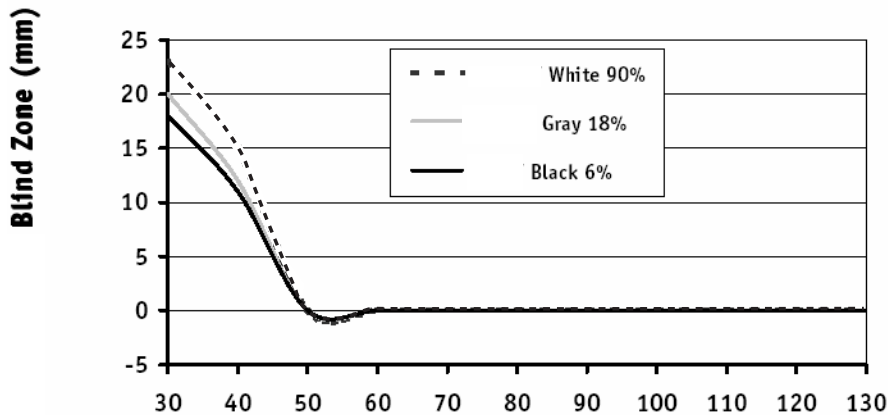
Black-White Differential Chart



Black-White Differential Graph

This graph shows the difference in distance between where the FARS series sensors detect a 90% reflective white card, versus a 6% reflective black card under the same conditions. As the adjoining graph illustrates, the FARS series sensors provide practically a zero millimeter difference between the white and black target at a setup distance of 80 mm, 3 mm difference at a setup distance of 100 mm and 10 mm for a setup distance of 130 mm.

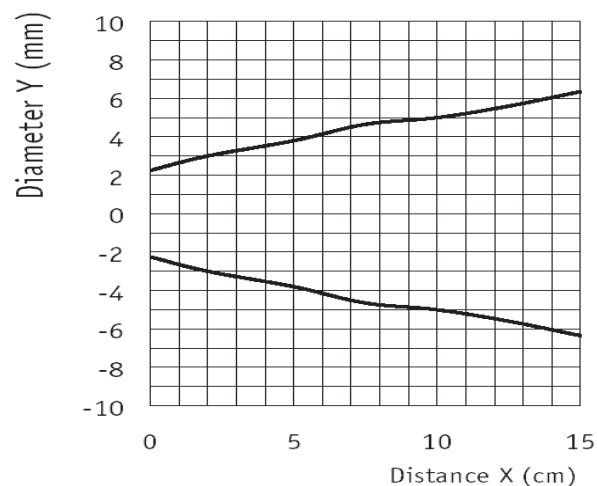
Blind zone chart



Blind Zone Graph

This graph shows the blind zone, which is where the FARS series sensors will not detect, depending on the setup distance. For setup sensing distance of 30 mm the FARS sensor will have a blind zone of 25 mm, so the effective sensing envelope is from 25 mm to 30 mm; but, as the setup sensing distance is increased, the blind zone decreases. The graph shows that from a setup sensing distance of 60 mm to 130 mm, the blind zone is zero millimeters.

Spot dimension chart

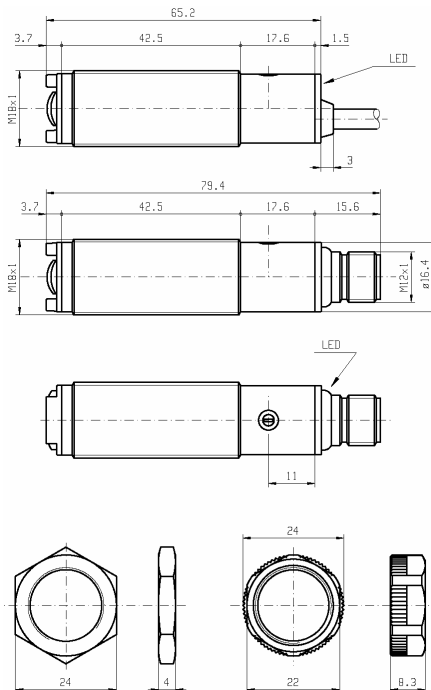


FARS Series Photoelectric Sensors

FARS Series Photoelectric Sensors Specifications	
Specifications	18 mm Diffuse with Background Suppression
Model Series	FARS
Input Voltage	10 - 30 VDC
Sensing Range	30 - 130 mm
Switching Frequency	1 kHz
Sensing Beam	Red Light (660 nm)
Output Types	NPN / PNP Q/Qnot L-on/D-on
Light/Dark Operation	switch selectable
Operating Temperature	13°F to 158°F (-25°C to +70°C)
Case Material	PBT
Lens Material	PMMA
Vibration	per IEC EN 60947-5-2
Shock	per IEC EN 60947-5-2
Protection	Output short circuit and overcurrent protection, reverse polarity protection
Enclosure Ratings	IP67
Agency Approvals	UL, CE
Output Load	100 mA
(tv) Time Delay Before Availability	200 ms
No Load Current Draw	25 mA
Leakage Current (max)	≤ 10 μA @ 30 VDC
Indicator LEDs	Yellow Output/Short Circuit Status

Cables and Accessories
Cables and accessories start on page 19-65

Dimensions (mm)



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

MQ Series Photoelectric Sensors

M18 (18 mm) plastic - AC



The MQ series is an AC diffuse photoelectric with a unique 90° optic package for mounting in space-limited applications. This series fits in a standard 18 mm mounting bracket or mounting hole, and is available in a choice of 20-250 VAC outputs in NO or NC configurations with an M12 disconnect. All MQ models include background suppression with maximum available sensing distances of 50 mm or 100 mm.

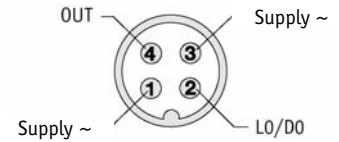
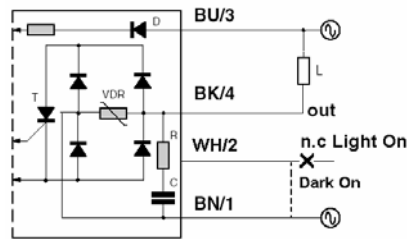
Features

- Diffuse with background suppression
- Models with 50 mm or 100 mm maximum reading distance
- M12 plug connection
- Plastic housing
- Supply voltage 20 - 253 VAC
- LED output status indicator
- Light - ON, Dark - ON selectable
- IP67 housing protection

18mm AC Photoelectric Reflection Sensors with Background Suppression Selection Chart

Part Number	Price	Voltage Range	Sensing Range	Switching Frequency	Sensing Beam	Thru-Beam Component	Output Type	Connection Type
MQ0-00-0E	<--->	20 - 253 VAC	50 mm	25 Hz	Infrared	NO/NC background suppression	TRIAC LO/DO selectable	M12 quick disconnect (purchase cable separately)
MQ1-00-0E	<--->		100 mm				TRIAC LO/DO selectable	M12 quick disconnect (purchase cable separately)

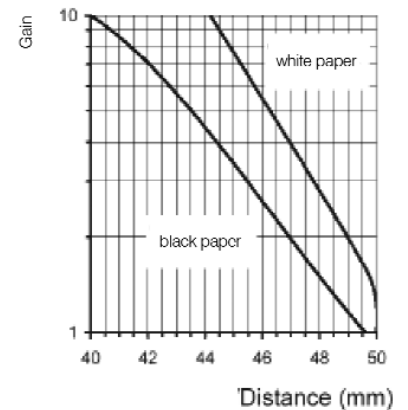
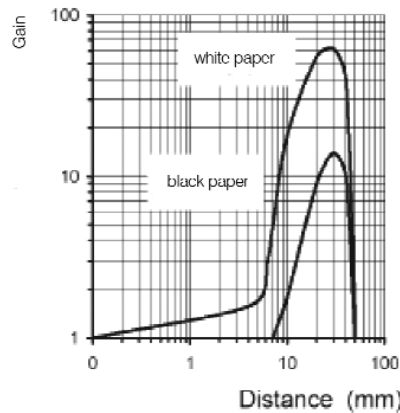
Wiring Diagram



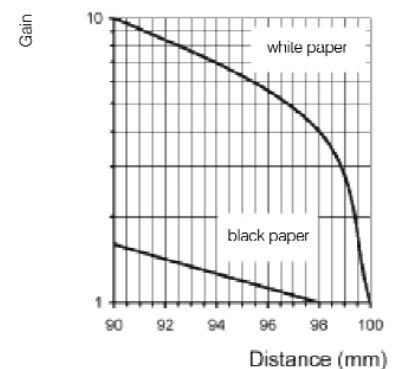
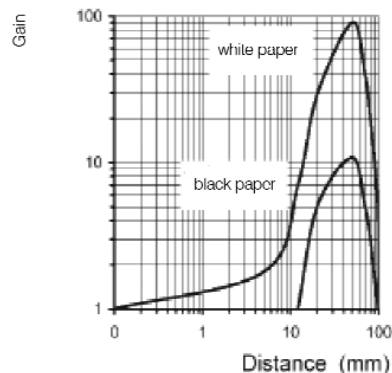
NO	Light ON
NC	Dark ON

Characteristic Curves

MQ0-00-0E



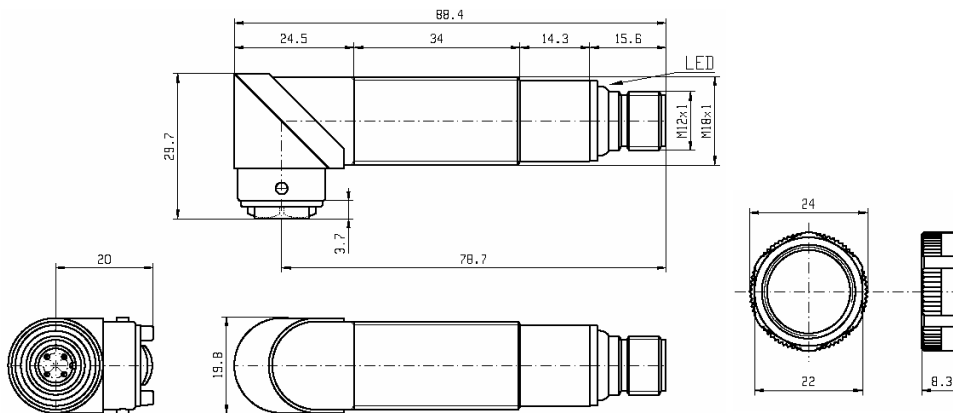
MQ1-00-0E



MQ Series Photoelectric Sensors

MQ Series Photoelectric Sensors Specifications	
Specifications	18 mm Diffuse with Background Suppression, 90° Radial Optic
Model Series	MQ0/MQ1
Input Voltage	20 - 253 VAC
Sensing Range	50 mm / 100 mm
Switching Frequency	25 Hz
Sensing Beam	Infrared (C880nm)
Output Types	TRIAC
Operating Temperature	13°F to 158°F (-25°C to +70°C)
Case Material	PBT
Lens Material	PMMA
Vibration	per IEC EN 60947-5-2
Shock	per IEC EN 60947-5-2
Protection	Output short circuit and overcurrent protection, reverse polarity protection
Enclosure Ratings	IP67
Agency Approvals	UL, CE
Output Load	5 ... 300 mA RMS
(tv) Time Delay Before Availability	200 ms
No Load Current Draw	40 mA
Leakage Current (max)	≤ 1.5 mA @ 250 VAC
Indicator LEDs	Yellow Output State

Dimensions (mm)



Cables and Accessories

Cables and accessories start on page 19-65

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

MV Series AC Powered Photoelectric Sensors

M18 (18 mm) plastic- AC



- 12 models available
- Diffuse, polarized reflective, and through-beam models
- Plastic housing
- Axial cable or M12 quick-disconnect models
- Operates on 20 to 253 VAC
- IP67 rated

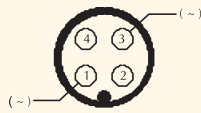
MV Series Photoelectric Selection Chart						
Part Number	Price	Sensing Range	Output State	Connection	Dimensions	Characteristic Curves
Diffuse						
MV2-A0-0A	<--->	100mm (3.9 in.)	N.O.	2m (6.5 ft) axial cable	Figure 1	Chart 1
MV2-A0-0E	<--->			M12 (12mm) connector	Figure 2	
MV4-A0-0A	<--->	200mm (7.9 in.)		2m (6.5 ft) axial cable	Figure 1	Chart 2
MV4-A0-0E	<--->			M12 (12mm) connector	Figure 2	
MV6-A0-0A	<--->	400mm (15.7 in.)		2m (6.5 ft) axial cable	Figure 1	Chart 3
MV6-A0-0E	<--->			M12 (12mm) connector	Figure 2	
Polarized reflective*						
MVP-A0-0A	<--->	3m (9.8 ft)	N.O	2m (6.5 ft) axial cable	Figure 1	Chart 4
MVP-A0-0E	<--->			M12 (12mm) connector	Figure 2	
Through-beam**						
MVE-00-0A	Emitter	16m (52.5 ft)	Receiver dependent	2m (6.5 ft) axial cable	Figure 1	Chart 5
MVE-00-0E	Emitter			M12 (12mm) connector	Figure 2	
MVR-A0-0A	Receiver		N.O.	2m (6.5 ft) axial cable	Figure 1	Chart 5
MVR-A0-0E	Receiver		N.O.	M12 (12mm) connector	Figure 2	

*Receivers include one round (84mm dia.) reflector.
Purchase additional reflectors separately.

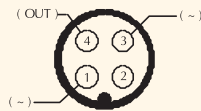
**Purchase one receiver and one emitter for a complete set.

Wiring diagrams

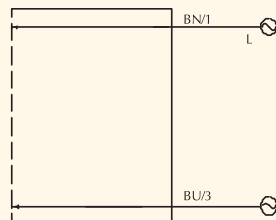
M12 Connectors



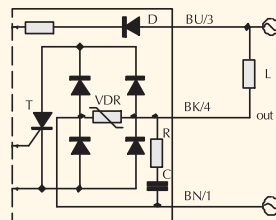
M12 connector on emitter



M12 connector



Emitter



AC Output

Cables and Accessories
Cables and accessories start on page 19-65

Dimensions (mm)

Figure 1

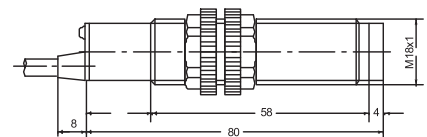
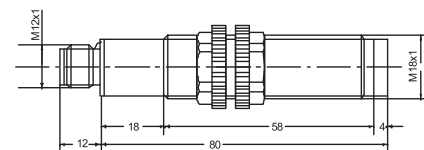


Figure 2



MV Series AC Powered Photoelectric Sensors

Company Information

Systems Overview

Programmable Controllers

Field I/O

Software

C-more & other HMI

Drives

Soft Starters

Motors & Gearbox

Steppers/ Servos

Motor Controls

Proximity Sensors

Photo Sensors

Limit Switches

Encoders

Current Sensors

Pressure Sensors

Temperature Sensors

Pushbuttons/ Lights

Process

Relays/ Timers

Comm.

Terminal Blocks & Wiring

Power

Circuit Protection

Enclosures

Tools

Pneumatics

Appendix

Product Index

Part # Index

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflective ⁴	Through-beam ⁵
Sensing Distance	MV2 models: 100mm ¹ MV4 models: 200mm ¹ MV6 models: 400mm ²	3m ³	16m
Minimal Detectable Objects	-	-	07.5mm
Emission	Infrared (880nm)	Red (660nm)	Infrared (880nm)
Tolerance	+15/ -5% Sn		N/A
Differential Travel	≤10%		
Repeat Accuracy	5%		
Operating Voltage	20-253VAC, 50/60Hz		
No-load Supply Current	30mA (rms)	Emitter: 30mA (rms) Receiver: 15mA (rms)	
Load Current	5-300mA (rms) (Ta=50°C)		
Leakage Current	1.5mA (rms) max. at 250VAC		
Voltage Drop	3V max. I _L =300mA		
Output Type	TRIAC		
Switching Frequency	25Hz		
(tv) Time Delay Before Availability	200 ms		
Input Voltage Transients Protection	Yes, as long as the transient peak does not exceed 253VAC		
Input Power Polarity Reversal Protection	Yes		
Output Power Short-Circuit Protection	Yes		
Temperature Range	-25° to +70°C (-13° to +158°F)		
Temperature Drift	10% Sr		
Interference to External Light	3000 lux (incandescent lamp), 10000 lux (sunlight)		
Protection Degree (DIN 40050)	IEC IP67		
LED Indicators	red (output energized)		
Housing Material	PBT (plastic housing), polycarbonate (cable exit)		
Lens Material	Plexiglas 7N		
Weight	35-100g	70-200g	

¹ With 100x100mm white matte paper

² With 200x200mm white matte paper

³ With standard Ø84mm RL110 reflector

⁴ Each sensor includes one 84mm round reflector (RL110). Purchase additional reflectors separately.

⁵ An emitter (SSE) and receiver (SSR) pair must be ordered for a complete sensor set.

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

MV Series AC Powered Photoelectric Sensors

Characteristic curves

Chart 1

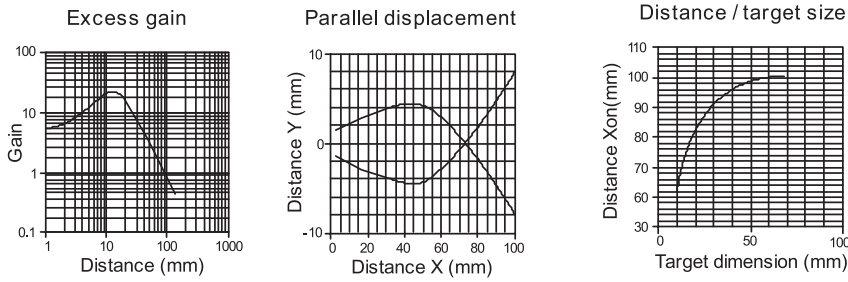


Chart 2

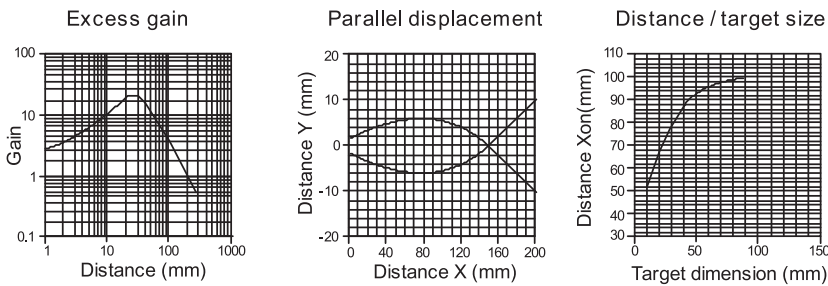


Chart 3

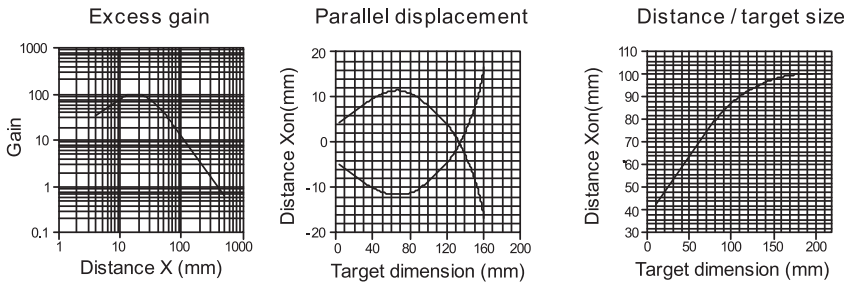


Chart 4

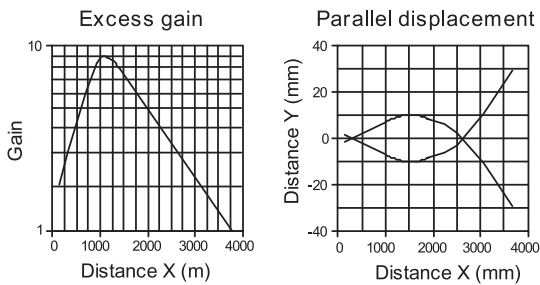
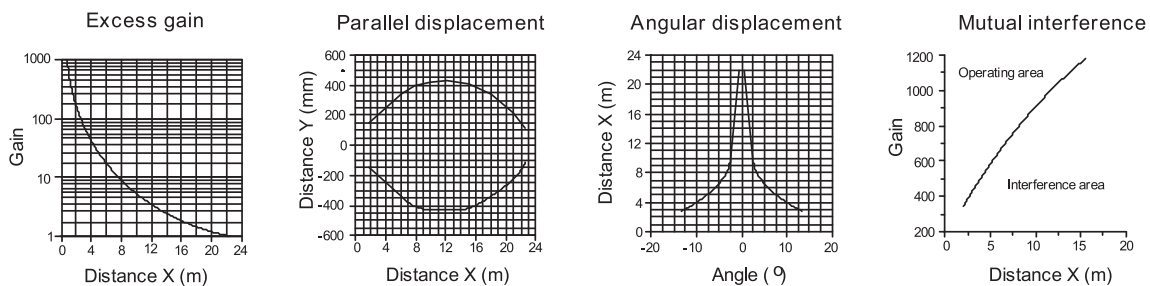


Chart 5



C5 Series Stainless Steel Photoelectric Sensors



M5 (5 mm) stainless steel - DC

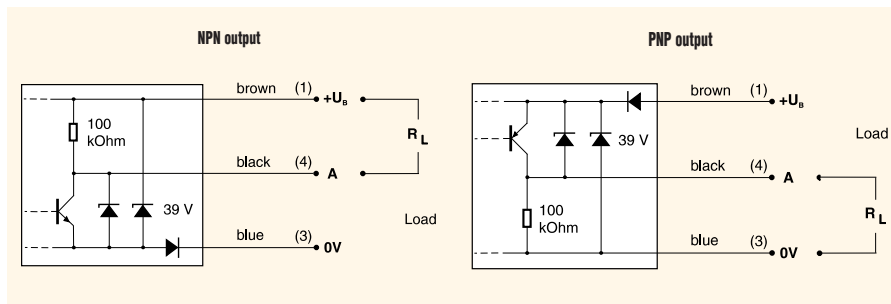
- 14 models available
- Diffuse and through-beam styles
- Long operating distances
- Compact stainless steel housing
- Scratch resistant and easy to clean glass lens
- Axial cable or M8 quick-disconnect models
- Complete overload protection
- IP67 rated

C5 Series M5 Photoelectric Sensors Selection Chart								
Part Number	Sensing Range	Output State	Logic	Connection	Wiring	Dimensions	Characteristic Curves	Price
Diffuse								
C5D-AN-1A	50mm (1.97in) ¹	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 1	<--->
C5D-AP-1A			PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 1	<--->
C5D-AN-1F			NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 1	<--->
C5D-AP-1F			PNP	M8 (8mm) connector	Diagram 1	Figure 2	Chart 1	<--->
C5D-AN-2A	10mm (0.40in)	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3	<--->
C5D-AP-2A			PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3	<--->
C5D-AN-3A	20mm (0.79in) ¹	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 4	<--->
C5D-AP-3A			PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 4	<--->
Through-beam*								
C5R-AN-1A	Receiver	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 2	<--->
C5R-AP-1A	Receiver		PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 2	<--->
C5R-AN-1F	Receiver		NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 2	<--->
C5R-AP-1F	Receiver		PNP	M8 (8mm) connector	Diagram 1	Figure 2	Chart 2	<--->
C5E-ON-1A	Emitter	Receiver dependent	Receiver dependent	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 2	<--->
C5E-ON-1F	Emitter			M8 (8mm) connector	Diagram 2	Figure 2	Chart 2	<--->

¹ With 100x100mm white matte paper

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

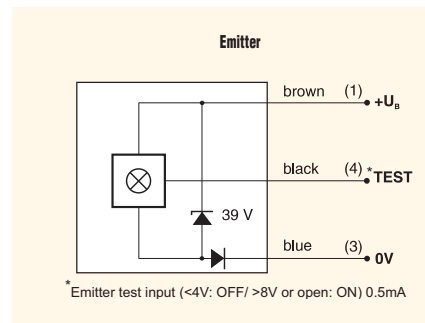
Diagram 1 Wiring diagrams



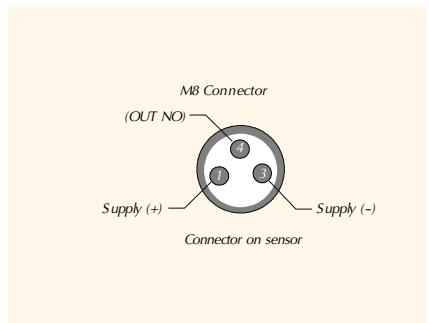
Cables and Accessories
Cables and accessories start on page 19-65

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

Diagram 2



Connector



- Company Information
- Systems Overview
- Programmable Controllers
- Field I/O
- Software
- C-more & other HMI
- Drives
- Soft Starters
- Motors & Gearbox
- Steppers/ Servos
- Motor Controls
- Proximity Sensors
- Photo Sensors
- Limit Switches
- Encoders
- Current Sensors
- Pressure Sensors
- Temperature Sensors
- Pushbuttons/ Lights
- Process
- Relays/ Timers
- Comm.
- Terminal Blocks & Wiring
- Power
- Circuit Protection
- Enclosures
- Tools
- Pneumatics
- Appendix
- Product Index
- Part # Index

C5 Series Stainless Steel Photoelectric Sensors

Specifications	Diffuse and Through-beam Models
Emission	Infrared (880nm)
Differential Travel	≤10%
Operating Voltage	10-30VDC
Ripple	≤20%
Current Draw	Emitter: 10mA Receiver: 5mA
Load Current	≤100mA
Leakage Current	≤10μA
Voltage Drop	≤2.0V
Output Type	NPN or PNP; N.O. only
Switching Frequency	250Hz
(tv) Time Delay Before Availability	20ms
Protection from Input Voltage Transients	Up to 30VDC
Input Power Polarity Reversal Protection	Yes
Output Power Short-Circuit Protection	Yes (switch autoresets after overload is removed)
Temperature Range	0° to +55° C (32° to 131° F)
Temperature Drift	≤3%
Interference to External Light	3,000 lux (incandescent lamp) 10,000 lux (sunlight)
Protection Degree (DIN 40050)	IEC IP67
Agency Approvals	UL file E328811
LED Indicators	Yellow (output energized), yellow flashing (excess light indication)
Housing Material	Stainless steel
Lens Material	Glass
Weight (cable/connector)	76g (2.68 oz)/18g (0.63 oz)

Dimensions (mm)

Figure 1

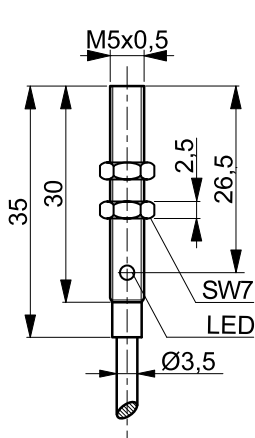
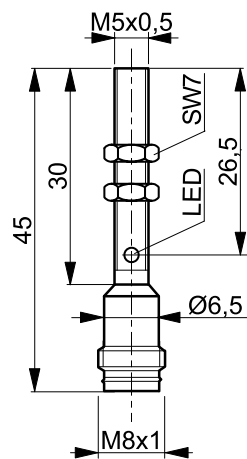


Figure 2



Characteristic curves

Chart 1

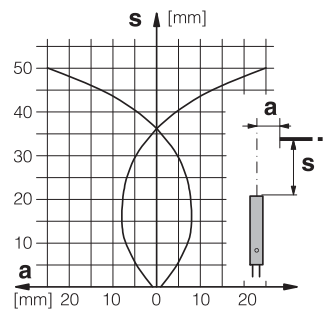


Chart 2

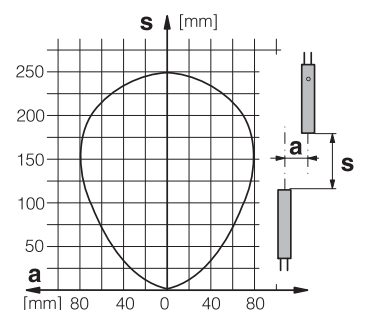


Chart 3

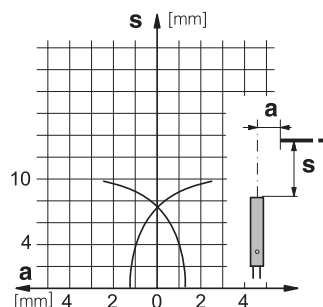
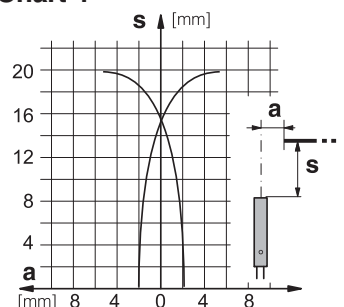


Chart 4



HE Series Photoelectric Sensors

M8 (8 mm) thru-beam series

M8 miniaturized HEE and HER series thru-beam sensors are available with NPN or PNP, and NO or NC outputs.

In the PNP models, the load is connected between the output (black wire) and the negative (blue wire).

In the NPN models, the load is connected between the output (black wire) and the positive (brown wire).

In the Normally Open models, the output is ON when the target is present (beam interrupted); in the Normally Closed models, the output is On when the target is absent (beam free).

Features

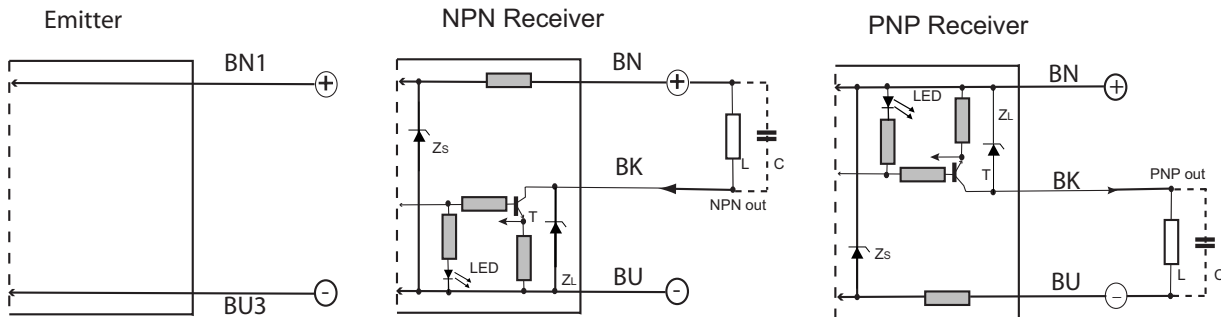
- M8 small dimension housing
- LED status indicator for all models
- Complete protection against electrical damage
- IP67 protection
- Strong stainless steel housing
- Fast switching frequency 10 kHz
- Sensing distance: 1 meter
- Supply voltage: 10 - 30 VDC
- NPN or PNP, NO or NC models



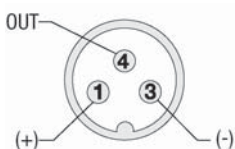
8mm diameter Thru-beam Photoelectric Sensors Selection Chart

Part Number	Price	Voltage Range	Sensing Range	Switching Frequency	Sensing Beam	Thru-Beam Component	Output Type	Connection Type
HEE-00-3A	<-->	10 - 30 VDC	3.28 ft. (1 m)	10 kHz	Infrared	Source/Emitter		1 meter cable
HER-AP-3A	<-->					Detector/Receiver	PNP NO	
HER-CP-3A	<-->					Detector/Receiver	PNP NC	
HER-AN-3A	<-->					Detector/Receiver	NPN NO	
HER-CN-3A	<-->					Detector/Receiver	NPN NC	
HEE-00-3F	<-->					Source/Emitter		
HER-AP-3F	<-->					Detector/Receiver	PNP NO	
HER-CP-3F	<-->					Detector/Receiver	PNP NC	
HER-AN-3F	<-->					Detector/Receiver	NPN NO	
HER-CN-3F	<-->					Detector/Receiver	NPN NC	

Wiring diagram



Connector diagram



Cables and Accessories

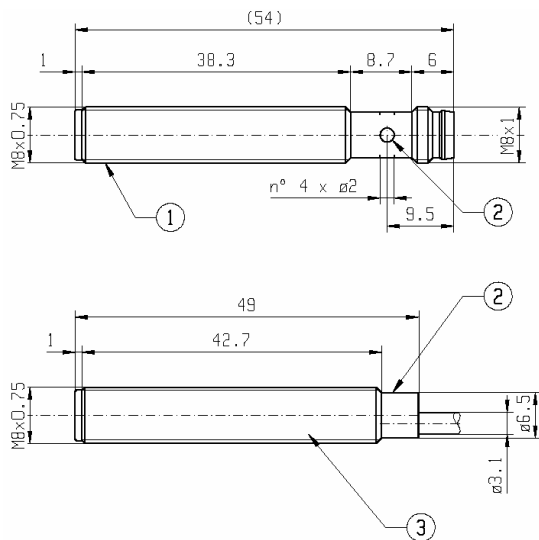
Cables and accessories start on page 19-65

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

HE Series Photoelectric Sensors

HEE/HER Series Photoelectric Sensors Specifications	
Specifications	8 mm Thru-Beam
Model Series	HEE/HER
Input Voltage	10 - 30 VDC
Sensing Range	1000 mm/Ex. Gain = 2
Switching Frequency	10 kHz
Sensing Beam	Infrared
Output Types	PNP/NPN NO/NC
Operating Temperature	13°F to 122°F (-25°C to +50°C)
Case Material	Stainless Steel
Lens Material	PMMA
Vibration	per IEC EN 60947-5-2
Shock	per IEC EN 60947-5-2
Protection	Output short circuit and overcurrent protection, reverse polarity protection
Enclosure Ratings	IP67
Agency Approvals	CE
Output Load	100 mA
(tv) Time Delay Before Availability	100 ms
No Load Current Draw	25 mA
Leakage Current (max)	<10 μ A @ 30 VDC
Indicator LEDs	Yellow Output State

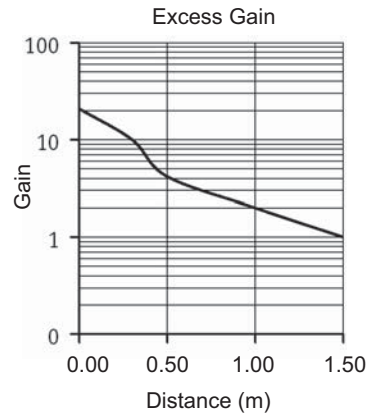
Dimensions (mm)



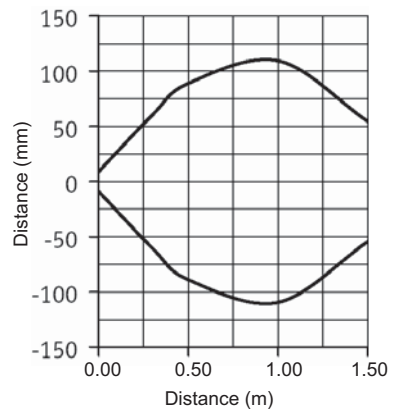
- ① M8 x 0.75 threaded cylindrical housing M8 connector exit
- ② Yellow LED (output state indicator HER - Supply Indicator HEE)
- ③ M8 x 0.75 threaded cylindrical housing cable exit

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

Characteristic curve chart



Spot dimension chart



DM Series Photoelectric Sensors

M12 (12 mm) metal with Teach function - DC



- 18 models available
- Metal housing
- Teach function available on diffuse and polarized reflective models
- Adjustable sensitivity on through-beam models
- Axial cable or M12 quick-disconnect models
- Multifunction LED status indicator
- Operates on 10-30 VDC
- IP67 rated

Cables and Accessories

Cables and accessories start on page 19-65

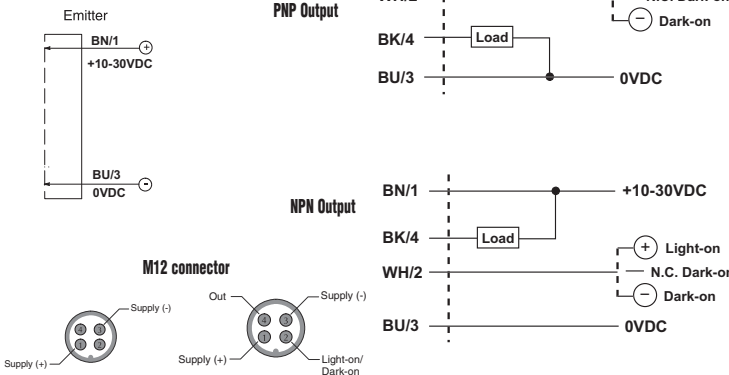
DM Series Photoelectric Sensors Selection Chart							
Part Number	Price	Sensing Range	Output State	Logic	Connection	Dimensions	Characteristic Curves
Diffuse							
DM3-ON-1A	<--->	Up to 100mm (3.9 in.)	Light on / Dark on Selectable	NPN	2m (6.5) axial cable	Figure 1	Chart 1
DM3-OP-1A	<--->			PNP	2m (6.5) axial cable	Figure 1	Chart 1
DM3-ON-1H	<--->			NPN	M12 (12mm) connector	Figure 2	Chart 1
DM3-OP-1H	<--->			PNP	M12 (12mm) connector	Figure 2	Chart 1
DM7-ON-1A	<--->	Up to 300mm (11.8 in.)	Light on / Dark on Selectable	NPN	2m (6.5) axial cable	Figure 1	Chart 2
DM7-OP-1A	<--->			PNP	2m (6.5) axial cable	Figure 1	Chart 2
DM7-ON-1H	<--->			NPN	M12 (12mm) connector	Figure 2	Chart 2
DM7-OP-1H	<--->			PNP	M12 (12mm) connector	Figure 2	Chart 2
Polarized reflective*							
DMP-ON-1A	<--->	Up to 2m (6.6 ft)	Light on / Dark on Selectable	NPN	2m (6.5) axial cable	Figure 1	Chart 3
DMP-OP-1A	<--->			PNP	2m (6.5) axial cable	Figure 1	Chart 3
DMP-ON-1H	<--->			NPN	M12 (12mm) connector	Figure 2	Chart 3
DMP-OP-1H	<--->			PNP	M12 (12mm) connector	Figure 2	Chart 3
Through-beam**							
DMR-ON-1A	Receiver <--->	Up to 4m (13.1 ft)	Light on / Dark on Selectable	NPN	2m (6.5) axial cable	Figure 1	Chart 4
DMR-OP-1A	Receiver <--->			PNP	2m (6.5) axial cable	Figure 1	Chart 4
DMR-ON-1H	Receiver <--->			NPN	M12 (12mm) connector	Figure 2	Chart 4
DMR-OP-1H	Receiver <--->			PNP	M12 (12mm) connector	Figure 2	Chart 4
DME-00-1A	Emitter <--->			Receiver dependent	2m (6.5) axial cable	Figure 1	Chart 4
DME-00-1H	Emitter <--->			Receiver dependent	M12 (12mm) connector	Figure 2	Chart 4

*Receivers include one round (84mm dia.) reflector. Purchase additional reflectors separately.

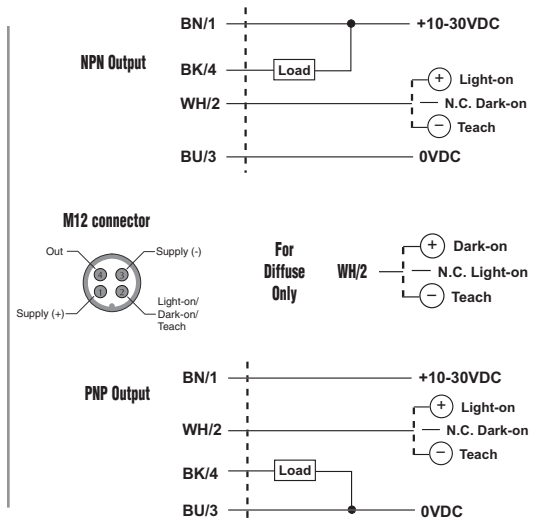
**Purchase one receiver and one emitter for a complete set.

Wiring diagrams

Through-beam models



Diffuse / polarized reflective models



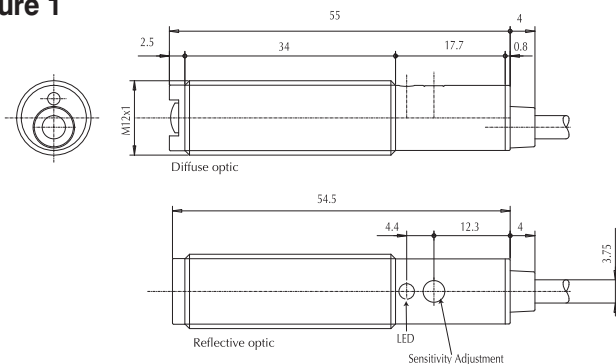
DM Series Photoelectric Sensors

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflection ⁴	Through-beam ⁵
Sensing Distance	DM3: 100mm ¹ DM7: 300mm ²	2m ³	4m
Emission	100mm: Infrared (880nm) 300mm: Red (660nm)	Infrared (880nm)	
Tolerance	+15%/-5%		
Sensitivity	Teach function (see product data sheet for details)		Potentiometer
Differential Travel	≤10%		≤20%
Repeat Accuracy	5%		
Operating Voltage	10-30VDC		
Ripple	≤10%		
No-load Supply Current	≤20mA		
Load Current	≤100mA		
Leakage Current	≤10μA		
Voltage Drop	2V max at 100mA		
Output Type	NPN or PNP - Light on / Dark on selectable		
Switching Frequency	400Hz		250Hz
(tv) Time Delay Before Availability	150ms		
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 to +70°C (-13° to 158°F)		
Temperature Drift	≤10% Sr		
Interference to External Light	3000 lux (incandescent lamp), 10000 lux (sunlight)		
Protection Degree (DIN 40050)	IEC IP67		
LED Indicators	Yellow		
Housing Material	Nickel-plated brass		
Lens Material	PMMA		
Weight	Axial cable models: 54g (1.9 oz) M12 connector models: 18g (0.63 oz)		

¹ With 100x100mm white matte paper
² With 200x200mm white matte paper
³ With standard Ø84mm RL110 reflector
⁴ Each sensor includes one 84mm round reflector (RL110). Purchase additional reflectors separately.
⁵ An emitter (DME) and receiver (DMR) pair must be ordered for a complete sensor set.

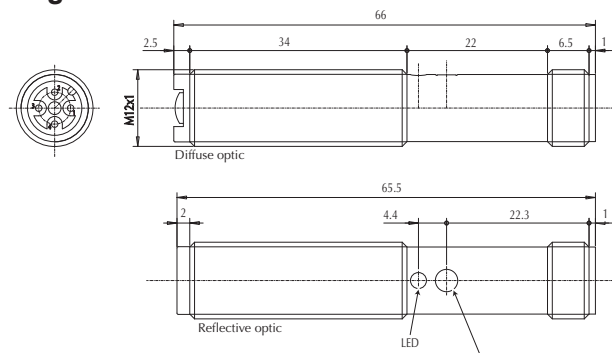
Dimensions (mm)

Figure 1



(Diffuse and Reflective only)

Figure 2



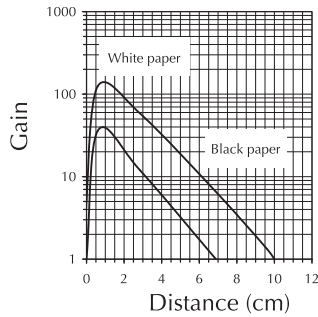
(Diffuse and Reflective only)

DM Series Photoelectric Sensors

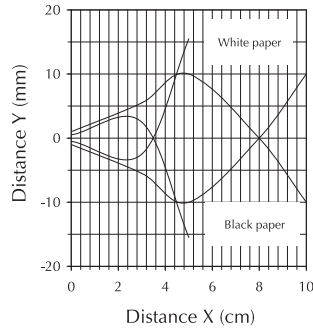
Characteristic curves

Chart 1

Excess Gain



Parallel displacement



Sensitivity adjustment

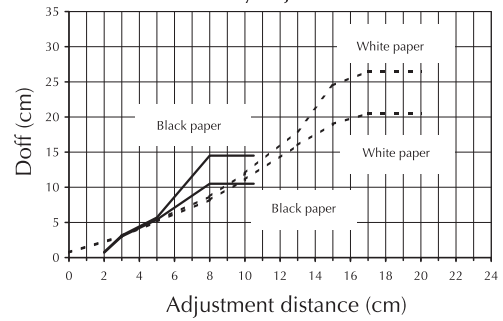
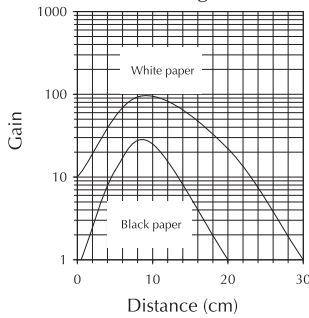
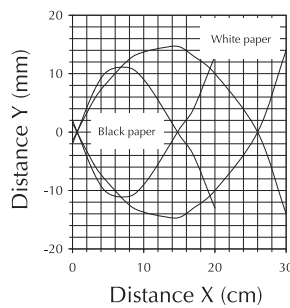


Chart 2

Excess gain



Parallel displacement



Sensitivity adjustment

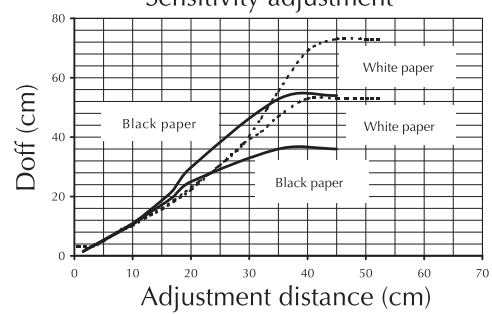
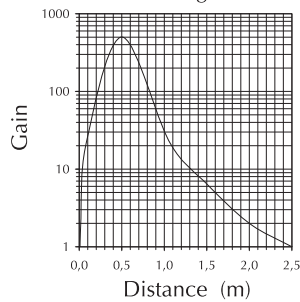
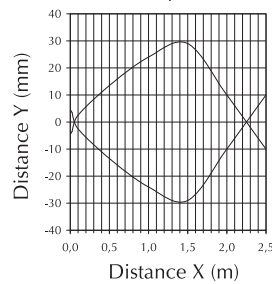


Chart 3

Excess gain



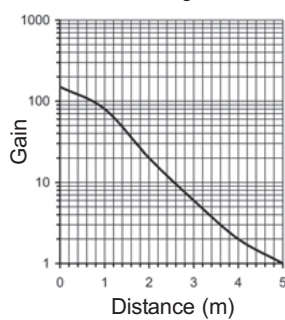
Parallel displacement



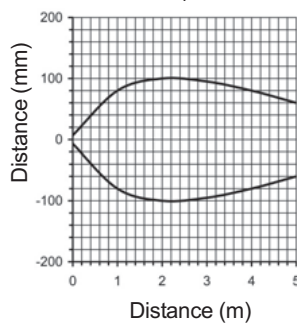
Warning: These products are not safety sensors and are not suitable for use in personal safety applications.

Chart 4

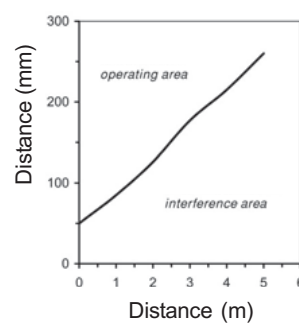
Excess gain



Parallel displacement



Mutual interference



C18 Series Photoelectric Sensors



M18 (18 mm) metal – DC

- 36 models available
- Diffuse, Polarized reflective, Through-beam, and Diffuse with background suppression models
- Long operating distances
- Scratch resistant and easy-to-clean glass lens
- Adjustable sensitivity (diffuse models only)
- Axial cable or 12 mm quick-disconnect models
- Complete overload protection
- IP67 rated

Cables and Accessories

Cables and accessories start on page 19-65

C18 Series Photoelectric Sensor Selection Chart

Part Number	Sensing Range	Output State	Optics	Logic	Connection	Wiring	Dimensions	Characteristic Curves	Price
Diffuse									
C18D-ON-1A	Up to 600mm (23.62 in)	1 N.O. and 1 N.C.	Axial	NPN	2m (6.5') axial cable	Diagram 3	Figure 1	Chart 5	<--->
C18D-OP-1A		1 N.O. and 1 N.C.	Axial	PNP	2m (6.5') axial cable	Diagram 4	Figure 1	Chart 5	<--->
C18D-ON-1E		1 N.O. and 1 N.C.	Axial	NPN	M12 (12mm) connector	Diagram 3	Figure 2	Chart 5	<--->
C18D-OP-1E		1 N.O. and 1 N.C.	Axial	PNP	M12 (12mm) connector	Diagram 4	Figure 2	Chart 5	<--->
C18D-ON-2A		1 N.O. and 1 N.C.	Right-angle	NPN	2m (6.5') axial cable	Diagram 3	Figure 3	Chart 6	<--->
C18D-OP-2A		1 N.O. and 1 N.C.	Right-angle	PNP	2m (6.5') axial cable	Diagram 4	Figure 3	Chart 6	<--->
C18D-ON-2E		1 N.O. and 1 N.C.	Right-angle	NPN	M12 (12mm) connector	Diagram 3	Figure 4	Chart 6	<--->
C18D-OP-2E		1 N.O. and 1 N.C.	Right-angle	PNP	M12 (12mm) connector	Diagram 4	Figure 4	Chart 6	<--->
Diffuse with background suppression									
C18B-AN-1A	10-120mm (0.39 to 4.72 in)	N.O.	Axial	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 1	<--->
C18B-AP-1A			Axial	PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 1	<--->
C18B-AN-1E			Axial	NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 1	<--->
C18B-AP-1E			Axial	PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart 1	<--->
C18B-AN-2A	10-120mm (0.39 to 4.72 in)	N.O.	Right-angle	NPN	2m (6.5') axial cable	Diagram 1	Figure 3	Chart 2	<--->
C18B-AP-2A			Right-angle	PNP	2m (6.5') axial cable	Diagram 2	Figure 3	Chart 2	<--->
C18B-AN-2E			Right-angle	NPN	M12 (12mm) connector	Diagram 1	Figure 4	Chart 2	<--->
C18B-AP-2E			Right-angle	PNP	M12 (12mm) connector	Diagram 2	Figure 4	Chart 2	<--->
Polarized reflective *Receivers include one round (84mm dia.) reflector. Purchase additional reflectors separately.									
C18P-AN-1A	Up to 2m (6.6 ft)	N.O.	Axial	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3	<--->
C18P-AP-1A			Axial	PNP	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 3	<--->
C18P-AN-1E			Axial	NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 3	<--->
C18P-AP-1E			Axial	PNP	M12 (12mm) connector	Diagram 2	Figure 2	Chart 3	<--->
C18P-AN-2A	Up to 2m (6.6 ft)	N.O.	Right-angle	NPN	2m (6.5') axial cable	Diagram 1	Figure 3	Chart 4	<--->
C18P-AP-2A			Right-angle	PNP	2m (6.5') axial cable	Diagram 2	Figure 3	Chart 4	<--->
C18P-AN-2E			Right-angle	NPN	M12 (12mm) connector	Diagram 1	Figure 4	Chart 4	<--->
C18P-AP-2E			Right-angle	PNP	M12 (12mm) connector	Diagram 2	Figure 4	Chart 4	<--->
Through-beam **Purchase one receiver and one emitter for a complete set.									
C18R-ON-1A	Up to 6m (19.7 ft)	1 N.O. and 1 N.C.	Axial	NPN	2m (6.5') axial cable	Diagram 3	Figure 1	Chart 7	<--->
C18R-OP-1A			Axial	PNP	2m (6.5') axial cable	Diagram 4	Figure 1	Chart 7	<--->
C18R-ON-1E			Axial	NPN	M12 (12mm) connector	Diagram 3	Figure 2	Chart 7	<--->
C18R-OP-1E			Axial	PNP	M12 (12mm) connector	Diagram 4	Figure 2	Chart 7	<--->
C18E-00-1A	Receiver dependent	Receiver dependent	Axial	Receiver dependent	2m (6.5') axial cable	Diagram 5	Figure 5	Chart 7	<--->
C18E-00-1E			Axial		M12 (12mm) connector	Diagram 5	Figure 6	Chart 7	<--->
C18R-ON-2A	Up to 6m (19.7 ft)	1 N.O. and 1 N.C.	Right-angle	NPN	2m (6.5') axial cable	Diagram 3	Figure 3	Chart 8	<--->
C18R-OP-2A			Right-angle	PNP	2m (6.5') axial cable	Diagram 4	Figure 3	Chart 8	<--->
C18R-ON-2E			Right-angle	NPN	M12 (12mm) connector	Diagram 3	Figure 4	Chart 8	<--->
C18R-OP-2E			Right-angle	PNP	M12 (12mm) connector	Diagram 4	Figure 4	Chart 8	<--->
C18E-00-2A	Receiver dependent	Receiver dependent	Right-angle	Receiver dependent	2m (6.5') axial cable	Diagram 5	Figure 7	Chart 8	<--->
C18E-00-2E			Right-angle		M12 (12mm) connector	Diagram 5	Figure 8	Chart 8	<--->

C18 Series Photoelectric Sensors

Specifications	Diffuse Models	Diffuse Models with Background Suppression	Reflective Models	Through-beam Models
Type	Diffuse reflection	Diffuse reflection with background suppression	Polarized reflection	Through-beam ¹
Sensing Distance	600 mm (23.62in) ²	10 to 120 mm (0.39 to 4.72 in) ³	2 m (6.6 ft)	6 m (19.7 ft)
Emission	LED red (660nm)	LED red (660nm)	LED red polarized (660 nm)	LED red (660nm)
Sensitivity	Adjustable one-turn pot.			—
Differential Travel	≤10%			
Operating Voltage	10-36 VDC			
Ripple	≤20%			
Power Consumption	20 mA	25 mA	15 mA	Receiver: 10 mA Emitter: 15 mA
Load Current	≤200 mA			
Leakage Current	≤10μ A			
Voltage Drop	≤2.0 V			
Output Type	NPN or PNP; 1 N.O. and 1 N.C.	NPN or PNP; N.O. only	NPN or PNP; N.O. only	NPN or PNP; 1 N.O. and 1 N.C.
Switching Frequency	1kHz	500Hz	1kHz	1kHz
(tv) Time Delay Before Availability	60ms	20ms	20ms	20ms
Input Voltage Transients Protection	Up to 36 VDC			
Input Power Polarity Reversal Protection	Yes			
Output Power Short-Circuit Protection	Yes (switch autoresets after overload is removed)			
Temperature Range	-25° to + 55°C (-13° to 131°F)			
Temperature Drift	0.5% per °C			
Interference to External Light	5,000 lux (incandescent lamp) 10,000 lux (sunlight)			
Protection Degree (DIN 40050)	IEC IP67			
Agency Approvals	UL file E328811			
LED Indicators	Yellow (output state, output energized), green (excess light indication). Emitter has no LED.			
Housing Material	Chrome-plated brass			
Lens Material	Glass			

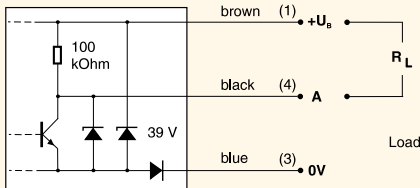
Notes: ¹ Through-beam sensors must be used in pairs consisting of one receiver and one emitter. ² With 200x200mm white matte paper. ³ With 100x100mm white matte paper.

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

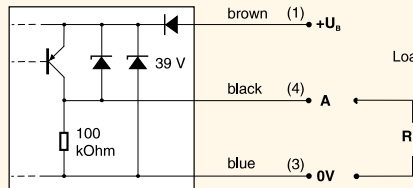
Wiring diagrams

Diagram 1

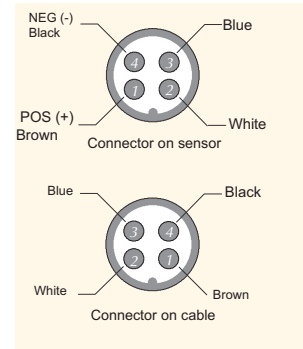
NPN Output


Diagram 2

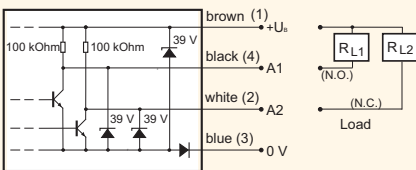
PNP Output



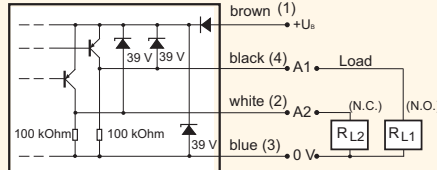
M12 Connector


Diagram 3

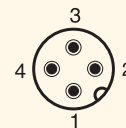
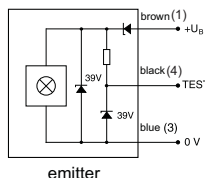
4-Wire NPN Output


Diagram 4

4-Wire PNP Output



4-Wire Pinouts


Diagram 5


C18 Series Photoelectric Sensors

Dimensions (mm)

Figure 1

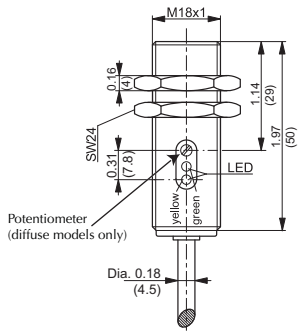


Figure 2

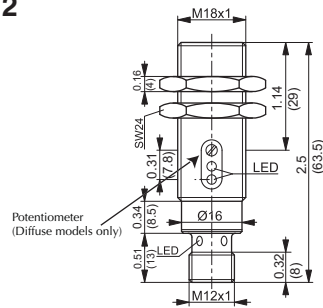


Figure 3

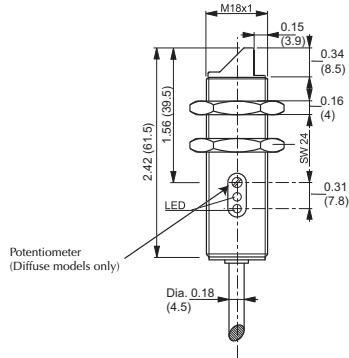


Figure 4

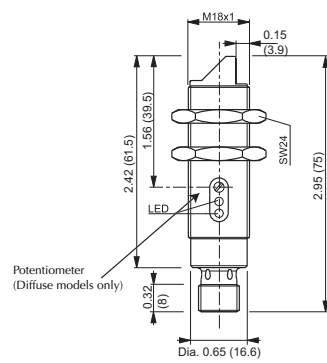


Figure 5

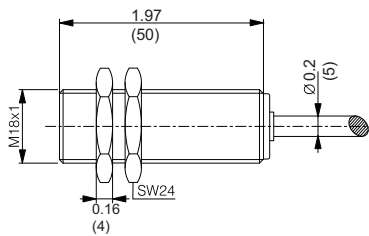


Figure 6

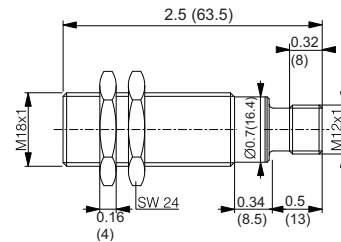


Figure 7

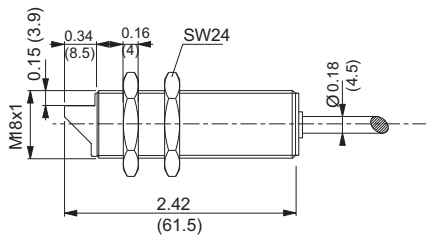
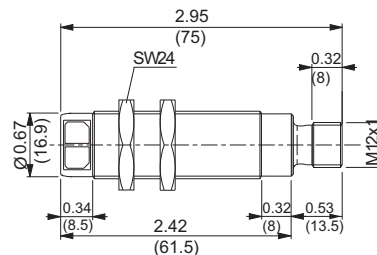


Figure 8



Note: Dimensions are in inches (millimeters).

C18 Series Photoelectric Sensors

Characteristic Curves

Chart 1

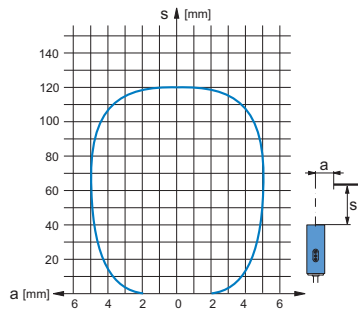


Chart 2

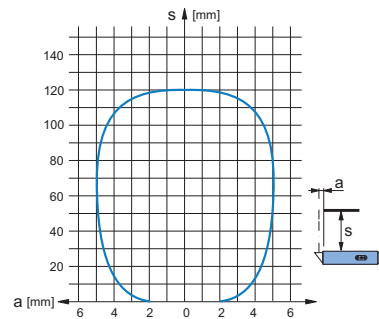


Chart 3

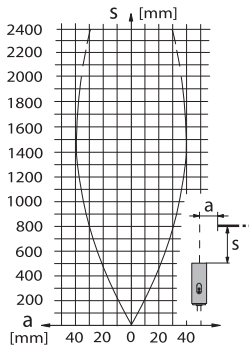


Chart 4

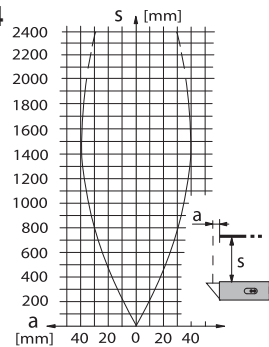


Chart 5

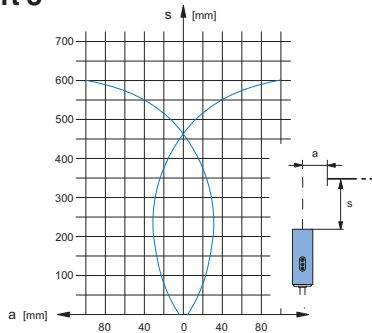


Chart 6

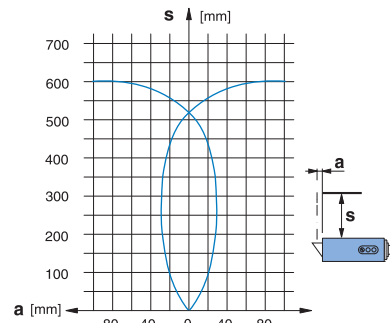


Chart 7

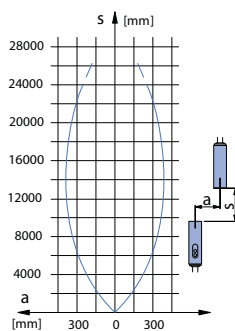
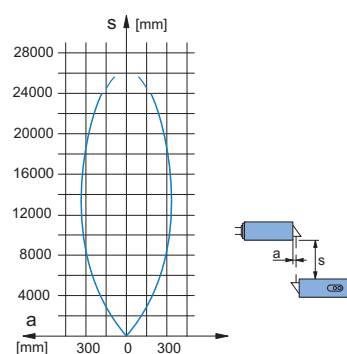


Chart 8



Company Information

Systems Overview

Programmable Controllers

Field I/O

Software

C-more & other HMI

Drives

Soft Starters

Motors & Gearbox

Steppers/ Servos

Motor Controls

Proximity Sensors

Photo Sensors

Limit Switches

Encoders

Current Sensors

Pressure Sensors

Temperature Sensors

Pushbuttons/ Lights

Process

Relays/ Timers

Comm.

Terminal Blocks & Wiring

Power

Circuit Protection

Enclosures

Tools

Pneumatics

Appendix

Product Index

Part # Index

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

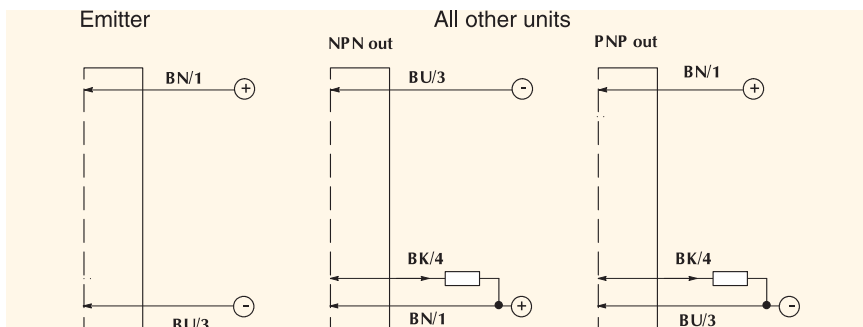
FE Series Photoelectric Sensors Selection Chart								
Part Number	Price	Sensing Range	Output State	Logic	Connection	Dimensions	Characteristic Curves	
Diffuse								
FER8-ON-OA	<--->	up to 800mm (31.49in)	Light-on/Dark-on Selectable	NPN	2m (6.5) axial cable	Figure 2	Chart 1	
FER8-OP-OA	<--->			PNP	2m (6.5) axial cable	Figure 2	Chart 1	
FER8-ON-OF	<--->			NPN	M8 (8mm) connector	Figure 1	Chart 1	
FER8-OP-OF	<--->			PNP	M8 (8mm) connector	Figure 1	Chart 1	
Polarized reflective*								
FERN-ON-OA	<--->	up to 4m (13.12ft) with RL110	Light-on/Dark-on Selectable	NPN	2m (6.5) axial cable	Figure 2	Chart 2	
FERN-OP-OA	<--->			PNP	2m (6.5) axial cable	Figure 2	Chart 2	
FERN-ON-OF	<--->	up to 1m (39.37in) with RL122	Light-on/Dark-on Selectable	NPN	M8 (8mm) connector	Figure 1	Chart 2	
FERN-OP-OF	<--->			PNP	M8 (8mm) connector	Figure 1	Chart 2	
Through-beam								
FERHD-ON-OA	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-OP-OA					PNP	2m (6.5) axial cable	Figure 2	Chart 3
FERHD-ON-OF					NPN	M8 (8mm) connector	Figure 1	Chart 3
FERHD-OP-OF					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.

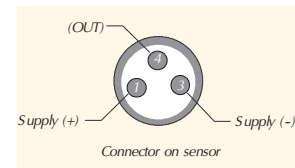
Cables and Accessories

Cables and accessories start on page 19-65

Wiring diagrams



M8 connector



Dimensions

Figure 1

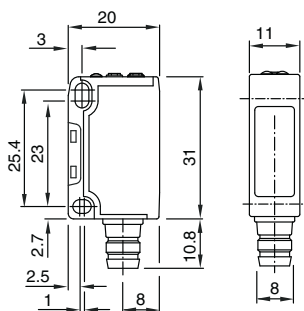
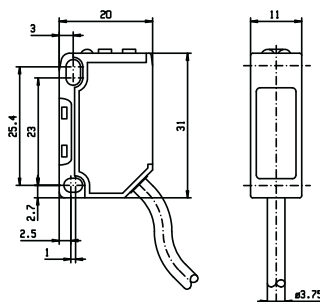
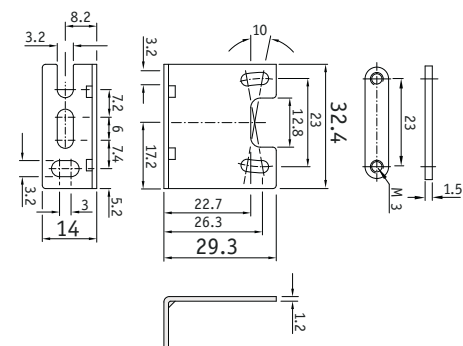


Figure 2



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 (visible)		
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

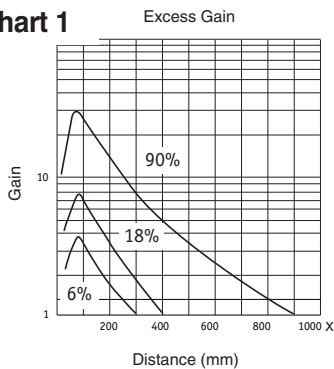


Chart 2

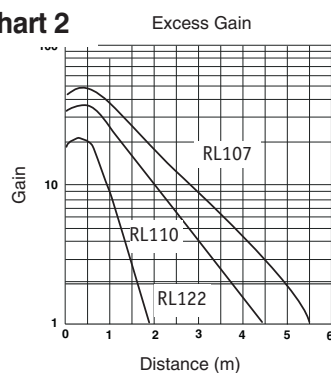
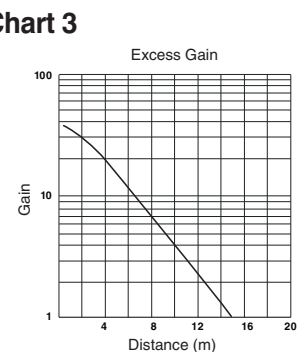


Chart 3



CX Series Photoelectric Sensors



Mini-rectangular plastic - DC

- 18 models available
- Long operating distances
- Adjustable sensitivity
- Scratch-resistant and easy to clean glass lens
- Axial cable or M8 quick-disconnect models
- Complete overload protection
- Mounting brackets are not needed
- IP65 rated

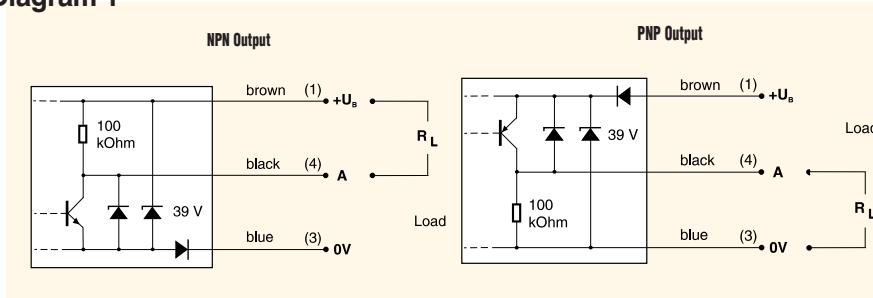
CX Series Mini-Rectangular Photoelectric Sensors Selection Chart									
Part Number	Sensing Range	Output State	Logic	Connection	Wiring	Dimensions	Characteristic Curves	Price	
Diffuse									
CX3-AN-1A	Up to 600mm (23.62in)	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 1	<--->	
CX3-AP-1A			PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 1	<--->	
CX3-AN-1F			NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 1	<--->	
CX3-AP-1F			PNP	M8 (8mm) connector	Diagram 1	Figure 2	Chart 1	<--->	
Diffuse with background suppression									
CX5-AN-1A	15-150mm (0.59 to 5.91in)	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 2	<--->	
CX5-AP-1A			PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 2	<--->	
CX5-AN-1F			NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 2	<--->	
CX5-AP-1F			PNP	M8 (8mm) connector	Diagram 1	Figure 2	Chart 2	<--->	
Polarized reflective*									
CXP-AN-1A	Up to 2m (6.6 ft)	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3	<--->	
CXP-AP-1A			PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3	<--->	
CXP-AN-1F			NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 3	<--->	
CXP-AP-1F			PNP	M8 (8mm) connector	Diagram 1	Figure 2	Chart 3	<--->	
Through-beam**									
CXR-AN-1A	Receiver	Up to 6m (19.7 ft)	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 4	<--->
CXR-AP-1A	Receiver			PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 4	<--->
CXR-AN-1F	Receiver			NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 4	<--->
CXR-AP-1F	Receiver			PNP	M8 (8mm) connector	Diagram 1	Figure 2	Chart 4	<--->
CXE-ON-1A	Emitter	Receiver dependent	Receiver dependent	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 4	<--->	
CXE-ON-1F	Emitter			M8 (8mm) connector	Diagram 2	Figure 2	Chart 4	<--->	

*Receivers include one round (84mm dia.) RL110 reflector. Purchase additional reflectors separately.

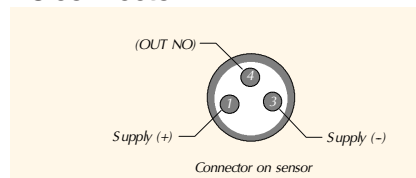
**Purchase one receiver and one emitter for a complete set.

Wiring diagrams

Diagram 1



M8 connector

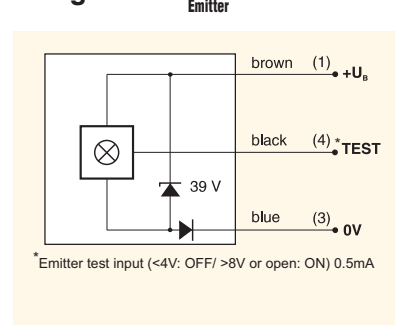


Warning: These products are not safety sensors and are not suitable for use in personal safety applications.

Cables and Accessories

Cables and accessories start on page 19-65

Diagram 2



CX Series Photoelectric Sensors

Company Information

Systems Overview

Programmable Controllers

Field I/O

Software

C-more & other HMI

Drives

Soft Starters

Motors & Gearbox

Steppers/ Servos

Motor Controls

Proximity Sensors

Photo Sensors

Limit Switches

Encoders

Current Sensors

Pressure Sensors

Temperature Sensors

Pushbuttons/ Lights

Process

Relays/ Timers

Comm.

Terminal Blocks & Wiring

Power

Circuit Protection

Enclosures

Tools

Pneumatics

Appendix

Product Index

Part # Index

Specifications	Diffuse Models	Diffuse Models with Background Suppression	Reflective Models	Through-beam Models
Type	Diffuse reflection	Diffuse reflection with background suppression	Polarized reflection	Through-beam
Sensing Distance	600mm ²	15 to 150mm ³	2m	6m
Emission	IR-LED (880nm)	LED red (660nm)	LED red polarized(660nm)	IR-LED (880nm)
Sensitivity	Adjustable one-turn pot.			
Differential Travel	≤10%			
Operating Voltage	10-36VDC			
Ripple	≤20%			
Power Consumption	15mA	25mA	15mA	15mA(R)/10mA(E)
Load Current	≤200mA			
Leakage Current	≤10µA			
Voltage Drop	≤2.0V			
Output Type	NPN or PNP; N.O. only			
Switching Frequency	1kHz	500Hz	1kHz	1kHz
(tv) Time Delay Before Availability	100ms			
Protection From Input Voltage Transients	Up to 36VDC			
Input Power Polarity Reversal Protection	Yes			
Output Power Short-Circuit Protection	Yes (switch autoresets after overload is removed)			
Temperature Range	-25° to +55°C (-13° to 131°F)			
Temperature Drift	≤3%			
Interference to External Light	5,000 lux (incandescent lamp) 10,000 lux (sunlight)			
Protection Degree (DIN 40050)	IEC IP65			
LED Indicators	Yellow (output state, output energized), green (excess light indication)			
Housing Material	PBT (Crastin)			
Lens Material	Glass			
Weight (cable/connector)	84g (2.96 oz)/49g (1.73 oz)			232g (8.40oz)/98g (3.46oz)

¹ Through-beam sensors must be used in pairs consisting of one receiver and one emitter ² With 200x200mm white matte paper, ³ With 100x100mm white matte paper

Dimensions (mm)

Figure 1

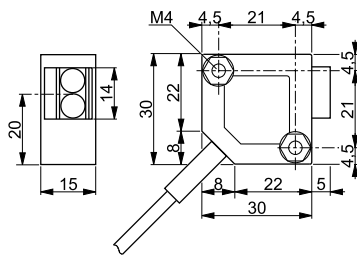
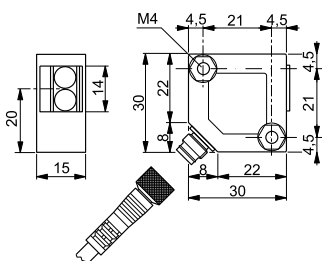


Figure 2



Characteristic curves

Chart 1

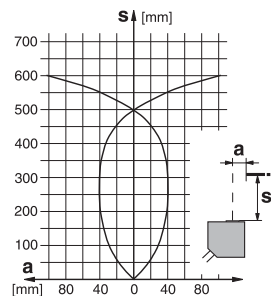


Chart 2

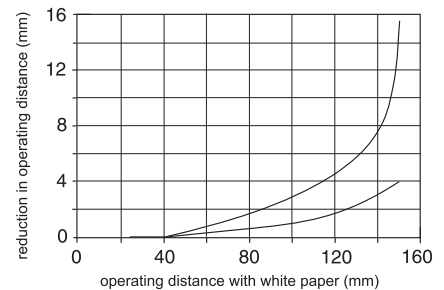


Chart 3

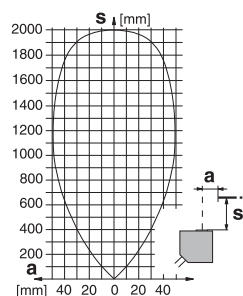
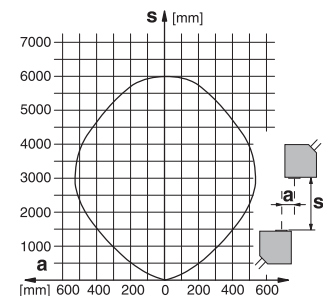


Chart 4



QX Series Photoelectric Sensors



Rectangular plastic - DC

- 16 models available, including diffuse, polarized reflective, and through-beam detection
- Axial or right-angle optics
- Fast response time
- NPN/PNP selectable output
- 2 LED indicators (threshold and signal margin)
- IP65 rated

QX Series Photoelectric Sensor Selection Chart											
Part Number	Sensing Range	Output State*	Optics	Logic	Connection	Wiring	Dimensions	Characteristic Curves	Price		
Diffuse											
QX3-A0-1A	300mm (11.81in)	N.O.	Axial	NPN/PNP selectable	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 1	<--->		
QX3-A0-1E			Axial		M12 (12mm) connector	Diagram 1	Figure 2	Chart 1	<--->		
QX3-A0-2A	300mm (11.81in)	N.O.	Right-angle		2m (6.5') axial cable	Diagram 1	Figure 3	Chart 1	<--->		
QX3-A0-2E			Right-angle		M12 (12mm) connector	Diagram 1	Figure 4	Chart 1	<--->		
Polarized reflective**											
QXP-A0-1A	2.5m (78.74in)	N.O.	Axial	NPN/PNP selectable	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 2	<--->		
QXP-A0-1E			Axial		M12 (12mm) connector	Diagram 1	Figure 2	Chart 2	<--->		
QXP-A0-2A	2.5m (78.74in)	N.O.	Right-angle		2m (6.5') axial cable	Diagram 1	Figure 3	Chart 2	<--->		
QXP-A0-2E			Right-angle		M12 (12mm) connector	Diagram 1	Figure 4	Chart 2	<--->		
Through-beam**											
QXR-A0-1A	Receiver	8m (26.25ft)	N.O.	NPN/PNP selectable	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3	<--->		
QXR-A0-1E					Receiver	M12 (12mm) connector	Diagram 1	Figure 2	Chart 3	<--->	
QXX-00-1A	Emitter		Receiver dependent		Axial	Receiver dependent	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 3	<--->
QXX-00-1E	Emitter				Axial	Receiver dependent	M12 (12mm) connector	Diagram 2	Figure 2	Chart 3	<--->
QXR-A0-2A	Receiver	8m (26.25ft)	N.O.	NPN/PNP selectable	2m (6.5') axial cable	Diagram 1	Figure 3	Chart 3	<--->		
QXR-A0-2E	Receiver				Right-angle	M12 (12mm) connector	Diagram 1	Figure 4	Chart 3	<--->	
QXX-00-2A	Emitter		Receiver dependent		Right-angle	Receiver dependent	2m (6.5') axial cable	Diagram 2	Figure 3	Chart 3	<--->
QXX-00-2E	Emitter				Right-angle	Receiver dependent	M12 (12mm) connector	Diagram 2	Figure 4	Chart 3	<--->

*Receivers include one round (84mm dia.) RL110 reflector. Purchase additional reflectors separately.

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

Cables and Accessories

Cables and accessories start on page 19-65

Wiring diagrams

Diagram 1

NPN/PNP output (All QX series outputs are NPN/PNP selectable) QX*-A0-**

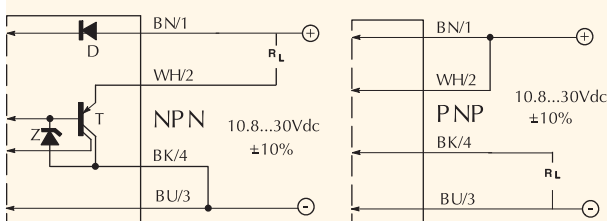
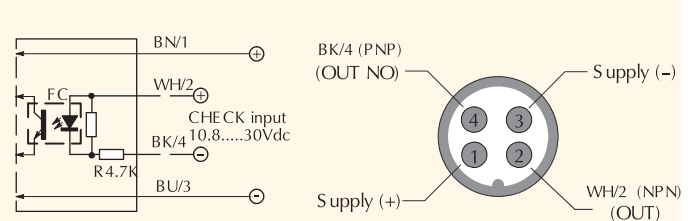


Diagram 2

Emitter with check QXX-00-** M12 connector



Check input test circuit (QXX models only): To test that the sensor is operating correctly, apply 10.8-30VDC across the WH/2 (+) and BK/4 (-) leads, which are decoupled from the power supply. In light state, light pulses are interrupted, which simulates the presence of a target and causes the output to switch. If switching does not occur, check for a fault in the system.

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

QX Series Photoelectric Sensors

Dimensions (in/mm)

(M3 x 0.5 screws included with sensor)

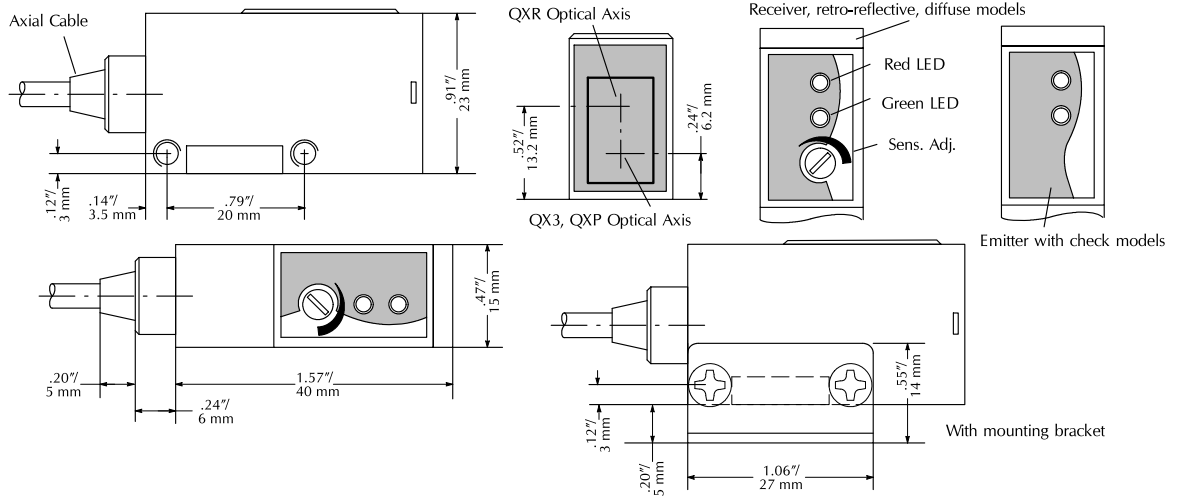


Figure 1

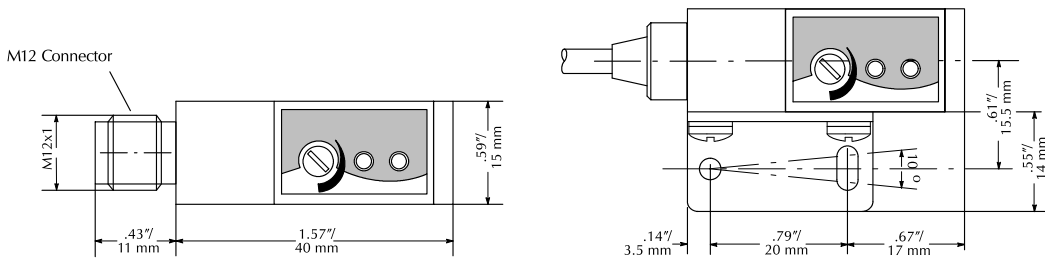


Figure 2

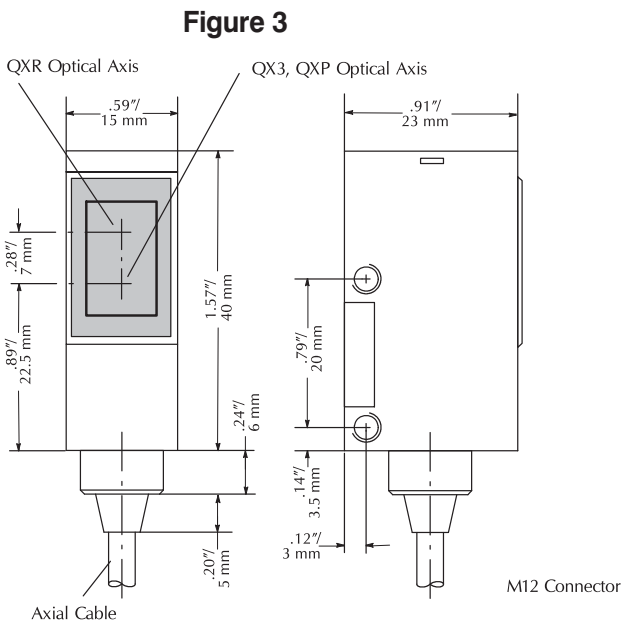


Figure 3

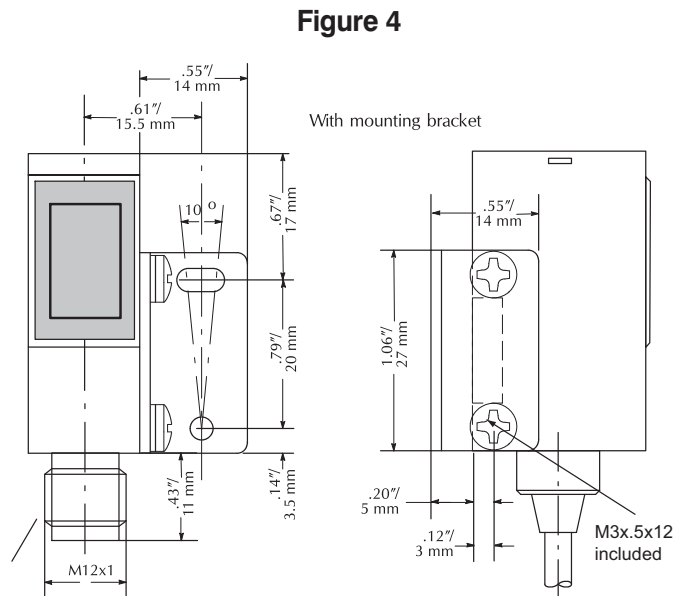
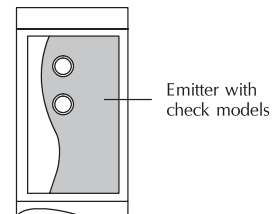
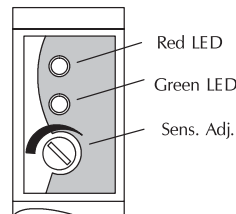
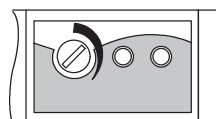


Figure 4



QX Series Photoelectric Sensors

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection ¹	Polarized reflection ²	Through-beam ³
Sensing Distance	300mm ⁴	2.5m ⁵	8m
Emission	infrared (880nm)	red (660nm)	
Minimum Detectable Object	-		2mm
Sensitivity	Adjustable one-turn pot.		
Tolerance	+15/-5% Sn		
Differential Travel	10%		
Repeat Accuracy	5%		
Operating Voltage	10.8-30VDC		
Ripple	10% max.		
No-load Supply Current	20mA	20mA (emitter), 5mA (receiver)	
Check Voltage	-	10.8-30VDC (QXX)	
Load Current	300mA		
Leakage Current	10µA max at 30VDC		
Voltage Drop	1.2volt maximum at 100mA		
Output Type	NPN/PNP selectable/N.O. only		
Switching Frequency	750Hz (Tr=0.5ms)	500Hz (Tr=0.75ms)	
(tv) Time Delay Before Availability	200 ms		
Protection From Input Voltage Transients	Yes, as long as the transient peak does not exceed 30VDC		
Protection From Input Power Polarity Reversal	Yes		
Output Power Short-Circuit Protection	Yes, (switch autoresets after overload is removed)		
Temperature Range	-25° to +70°C (-13° to 158°F)		
Interference to External Light	3,000 lux (incandescent lamp) 10,000 lux (sunlight)		
Protection Degree (DIN 40050)	IEC IP65		
LED Indicators	See Dimensions on previous page		
Housing Material	ABS (glass reinforced)		
Lens Material	Acrylic		
Weight	70g (2.47oz)		

¹Mounting bracket included ²Mounting bracket and Ø84mm round reflector included (RL110). Purchase additional reflectors separately.

³An emitter (QXX) and receiver (QXR) pair is needed for a complete sensor set.

⁴With 100X100mm white matte paper ⁵With standard Ø84mm reflector (RL110)

Characteristic curves

Chart 1

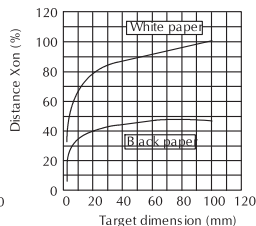
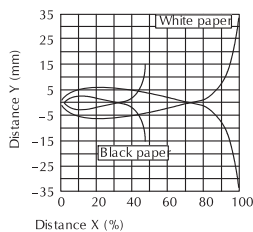
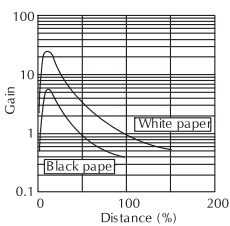


Chart 3

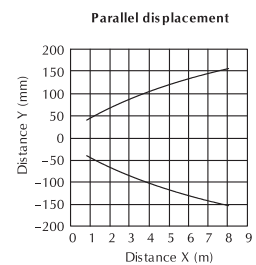
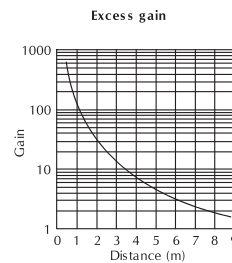
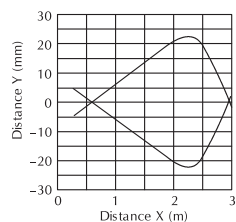
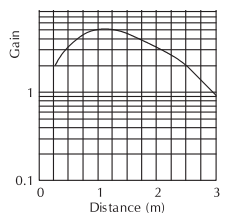
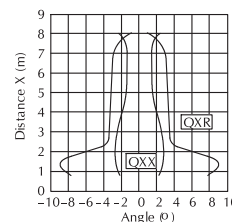


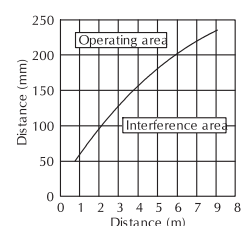
Chart 2



Angular displacement



Mutual interference



FG Series Photoelectric Sensors



Rectangular plastic - AC/DC

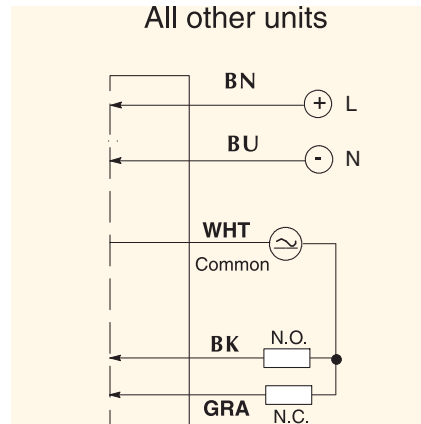
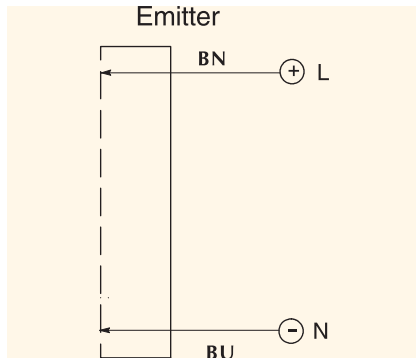
- Universal supply voltage: 12-240 VDC or 24-240 VAC
- Diffuse w/background suppression, polarized reflective, and through-beam models
- Plastic housing
- SPDT electrically isolated output
- Adjustable sensitivity
- IP67 rated

FG Series Photoelectric Sensors Selection Chart						
Part Number	Price	Sensing Range	Output	Connection	Dimensions	Characteristic Curves
Diffuse with background suppression						
FGRW-DT-0A	<--->	up to 550mm (21.65in)	SPDT Relay	2m (6.5) axial cable	Figure 1	Chart 1
Polarized reflective*						
FGRN-DT-0A	<--->	up to 9m (29.52ft)	SPDT Relay	2m (6.5) axial cable	Figure 2	Chart 2
Through-beam**						
FGRHD-DT-0A	<--->	up to 20m (65.62ft)	SPDT Relay	2m (6.5) axial cable	Figure 3	Chart 3

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

**Through-beam model consists of an emitter and receiver pair.

Wiring diagrams



Dimensions (mm)

Figure 1

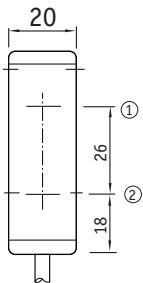


Figure 2

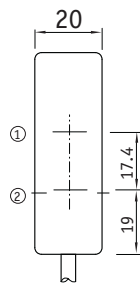
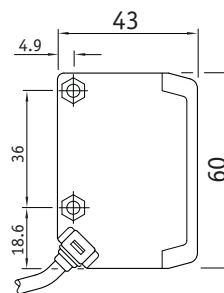
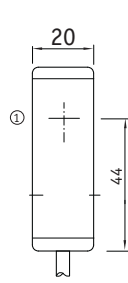


Figure 3



- 1) Emitter center of optical axis
- 2) Receiver center of optical axis

Enhanced 50 Series Photoelectric Sensors Selection Guide

Overview

The Enhanced 50 family of high performance photoelectric sensors offers outstanding features, flexibility and durability at an incredible price. Choose from a wide selection of Thru-beam, Polarized Reflex, Diffuse and even Clear

Object models all designed in a rugged, industry standard, rectangular package. Each model comes with a variety of input options for maximum flexibility across many voltage ratings. Cabling choices include built-in mini-connector, micro-connector, pigtail micro-connector or a 6 ft. integrated cable.

Other convenient features included are Dark-On/Light-On selectability and Gain adjustment, available on all models. Use the Selection Guide below to find the sensor model that best suits your requirements.



Enhanced 50 Photoelectric Sensors Specifications by Model Type

Specifications	Thru-Beam	Diffuse	Polarized Reflex	Clear Object Detector
Voltage Range	10 - 40 VDC 12 - 240 VDC 24 - 240 VAC	10 - 40 VDC 12 - 240 VDC 24 - 240 VAC	10 - 40 VDC 12 - 240 VDC 24 - 240 VAC	10 - 40 VDC 12 - 240 VDC 24 - 240 VAC
Sensing Range	500 ft. (152 m)	10 ft. (3 m)	16 ft. (4.9 m)	45 in. (1.2 m)
Optimum Power	0.1 to 250 ft. (0.03 to 77 m)	1 to 60 in. (25 to 1520 mm)	0.5 to 8 ft. (0.2 to 2.5 m)	1 to 24 in. (25 to 610 mm)
Sensing Beam	Infrared	Infrared	Visible Red	Visible Red
Output Types	NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3 A @ 120 VAC	NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3 A @ 120 VAC	NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3 A @ 120 VAC	NPN/PNP 250 mA, Solid-state relay 300 mA @ 240 VAC/VDC, SPDT EM relay 3 A @ 120 VAC

Enhanced 50 Photoelectric Sensors Specifications by Input Type

Specifications	AC/DC EM Relay Models	AC/DC Solid-State Relay Models	DC Only Models
Input Voltage	12 - 240 VDC 24 - 240 VAC	12 - 240 VDC 24 - 240 VAC	10 - 40 VDC
Light/Dark Operation	Switch selectable		
Operating Temperature	-13° to 131°F (-25° to 55°C)		
Humidity	95% relative humidity, non-condensing		
Case Material	Fiberglass reinforced plastic		
Lens Material	Acrylic		
Vibration	IEC 60947-5-2 part 7.4.2		
Shock	IEC 60947-5-2 part 7.4.1		
Protection	Output short circuit and overcurrent protection, reverse polarity protection		
Enclosure Ratings	IP67		
Agency Approvals	IEC IP67, cCSAus, UL508 (CSA File 224447)	IEC IP67, cCSAus, UL508 (CSA File 224447)	IEC IP67, cCSAus, UL508 (CSA File 224447)
Output Load	3A @ 120 VAC 3A @ 28 VAC 3A @ 240 VAC	300 mA @ 240 VAC/VDC	250 mA
Response Time	15 ms	2 ms	
No Load Current Draw	<30 mA		
Leakage Current (max.)	—	1 mA @ 240 VAC	<10 µA
Indicator LEDs	Thru-Beam Source All Others: Red: Power Green: Output Yellow: Power Red: Alignment		

EAT•N Enhanced 50 Series Photoelectric Sensors

Cutler-Hammer

Application Guide

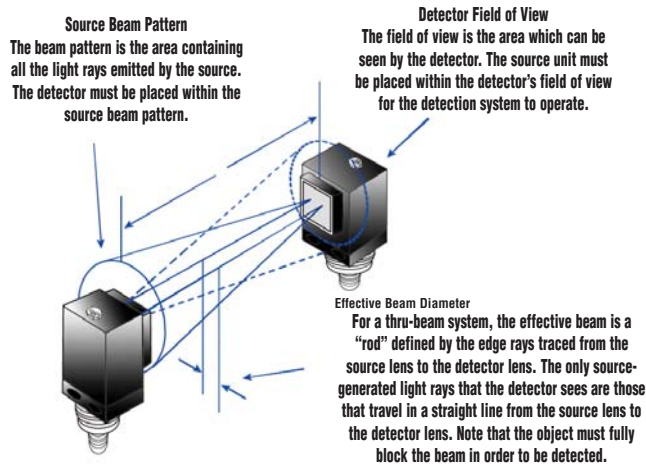
The Enhanced 50 Series Photoelectric Sensors are a great fit for applications such as material handling, packaging, wrapping and sortation.

This family of sensors, with its four basic models (Thru-beam, Polarized Reflex, Diffuse and Clear Object), meets the needs for almost any sensing requirement, including harsh environments with excessive dust or high temperature.

Follow the application guide below to choose the best sensor model for your application.

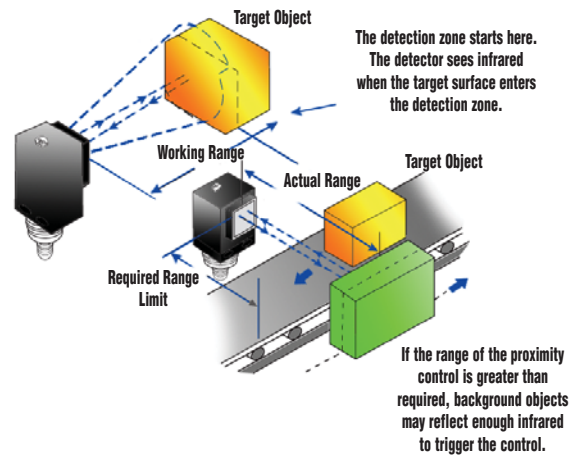
Thru-Beam

- Most accurate
- Longest sensing range
- Most reliable
- Must be installed in two points on system: emitter and receiver
- More costly



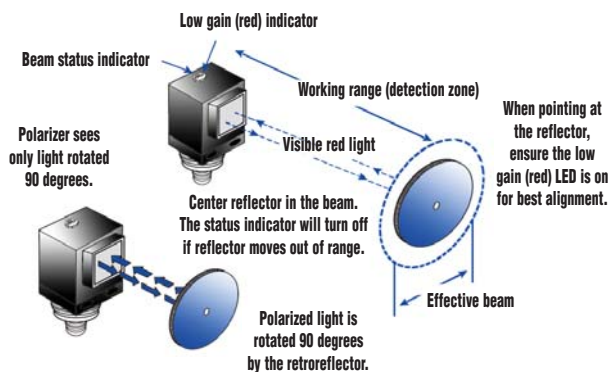
Diffuse

- Lower cost
- Install at one point
- Less accurate than Thru-Beam or Polarized Reflex
- More setup time involved



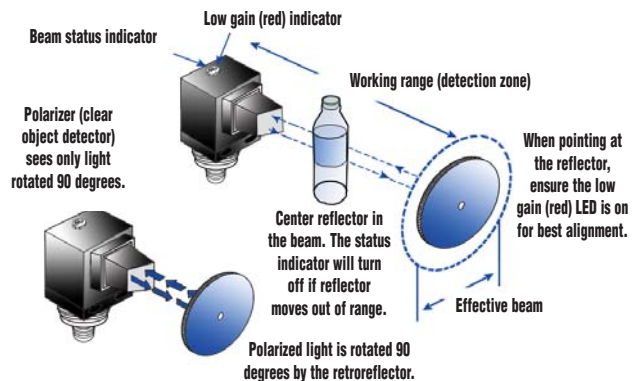
Polarized Reflex

- Lower cost than Thru-Beam
- Longer sensing range than Diffuse
- Very reliable
- Must be installed in two points on system: sensor and reflector



Clear Object Detector

- Most reliable for sensing transparent objects
- Must be installed in two points on system: sensor and reflector.
- Short sensing distance: 45 inches max.



Enhanced 50 Series Thru-beam Photoelectric Sensors

Cutler-Hammer

- Long sensing distances
- 13 models available
- Fiberglass-reinforced plastic housing
- Field of view: 2.4°
- Cable wires or mini/micro connector termination
- NPN/PNP, Solid-State Relay, or SPDT EM Relay outputs
- IP67 rated



1151E-6504 1251E-6504



1151E-6517 1251E-6517

Note: Cutler-Hammer parts available for sale to North America locations only.

Enhanced 50 Series Thru-beam Photoelectric Sensors Selection Chart

Part Number	Price	Voltage Range	Sensing Range	Optimum Range	Sensing Beam	Thru-Beam Component	Output Type	Connection Type	Cable Part Number				
1151E-6517	<--->	10 - 40 VDC	500 ft. (152 m)	0.1 to 250 ft. (0.03 to 77 m)	Infrared	Source/Emitter	N/A	6-foot cable (300V)	pre-wired 6 ft. (1.8 m)				
1251E-6517	<--->					Detector/Receiver	NPN/PNP 250 mA						
1151E-6547	<--->					Source/Emitter	N/A	4-pin Euro (Micro) DC connector	CSDS4A4CY2202 CSDS4A4CY2205				
1251E-6547	<--->					Detector/Receiver	NPN/PNP 250 mA						
1151E-6507	<--->					Source/Emitter	N/A	4-pin Mini connector	CSMS4A4CY1602 CSMS4A4CY1606				
1251E-6507	<--->					Detector/Receiver	NPN/PNP 250 mA						
1151E-6513	<--->					12 - 240 VDC 24 - 240 VAC	500 ft. (152 m)	0.1 to 250 ft. (0.03 to 77 m)	Infrared	Source/Emitter	N/A	6-foot cable (300V)	pre-wired 6 ft. (1.8 m)
1251E-6513	<--->									Detector/Receiver	Solid-state relay 300 mA @ 240 VAC/VDC		
1151E-6543	<--->									Source/Emitter	N/A	4-pin Micro AC connector	CSAS4F4CY2202 CSAS4F4CY2205
1251E-6543	<--->									Detector/Receiver	Solid-state relay 300 mA @ 240 VAC/VDC		
1151E-6504	<--->	Source/Emitter	N/A	4-pin Mini connector	CSMS4A4CY1602 CSMS4A4CY1606								
1251E-6503	<--->	Detector/Receiver	Solid-state relay 300 mA @ 240 VAC/VDC										
1251E-6504	<--->	Detector/Receiver	SPDT EM relay 3A @ 120 VAC	5-pin Mini connector	CSMS5A5CY1602 CSMS5A5CY1606								

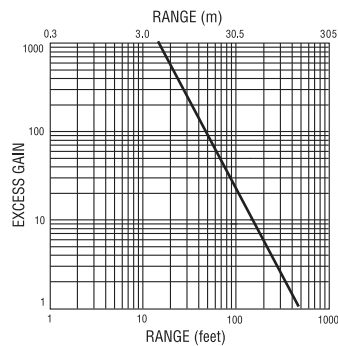
Note: Purchase one source and one detector for a complete set.

WIRING DIAGRAM (Pin numbers are for reference only. Rely on pin location when wiring.)

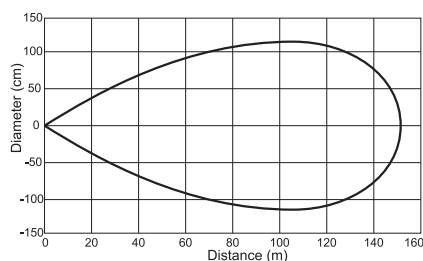
Operating Voltage	Models	Cable Models	Mini-Connector Models (Face View Male Shown)	Micro and Euro (Micro) Connector Models (Face View Male Shown)
10 - 40V DC	Thru-Beam Source /Emitter	BR (+) BK Test BU (-)	Test ① ④ ② ③	② ① ③ ④
	Thru-Beam Detector/Receiver	BR (+) WH Load BK Load BU (-)	PNP ① ④ ② ③ NPN Load Load	② ① Load (+) ③ ④ Load (-)
12 - 240V DC or 24 - 240V AC	Thru-Beam Source /Emitter	BR L1 (+) BU L2 (-)	① ④ ② ③ L1 (+)	③ ② L2 (-) ④ ① L1 (+)
	Thru-Beam Detector/Receiver	BR L1 (+) WH Isolated AC/DC Output BK Isolated AC/DC Output BU L2 (-)	Isolated AC/DC Output ① ④ Out Out ② ③ L2 (-) L1 (+)	Isolated AC/DC Output ③ ② L2 (-) ④ ① L1 (+)
12 - 240V DC or 24 - 240V AC	Thru-Beam Source /Emitter	BR L1 (+) BU L2 (-)	① ④ ② ③ L1 (+)	③ ② L2 (-) ④ ① L1 (+)
	Thru-Beam Detector/Receiver	BR L1 (+) BK Load - N.C. Out OR COM WH Load - N.C. Out BU L2 (-)	N.C. Out Load Load ① ⑤ ② ③ L2 (-) L1 (+) COM	① L1 (+) ② ⑤ N.C. ③ ④ N.C.

① Connect load to appropriate output for either sinking or sourcing operation.
② Connecting the test input to 0 VDC allows you to switch the light source off for troubleshooting while leaving the sensor under power.

Characteristic curve chart



Spot dimension chart



- Company Information
- Systems Overview
- Programmable Controllers
- Field I/O
- Software
- C-more & other HMI
- Drives
- Soft Starters
- Motors & Gearbox
- Steppers/ Servos
- Motor Controls
- Proximity Sensors
- Photo Sensors
- Limit Switches
- Encoders
- Current Sensors
- Pressure Sensors
- Temperature Sensors
- Pushbuttons/ Lights
- Process
- Relays/ Timers
- Comm.
- Terminal Blocks & Wiring
- Power
- Circuit Protection
- Enclosures
- Tools
- Pneumatics
- Appendix
- Product Index
- Part # Index

Enhanced 50 Series Diffuse Photoelectric Sensors



1351E-6547



1351E-6517

- 9 models available
- Fiberglass-reinforced plastic housing
- Field of view: 2.8°
- Cable wires or mini/micro connector termination
- NPN/PNP, Solid-State Relay, or SPDT EM Relay outputs
- IP67 rated



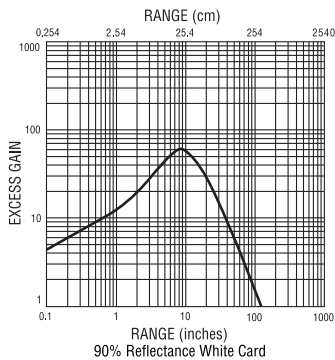
1351E-6534

Note: Cutler-Hammer parts available for sale to North America locations only.

Enhanced 50 Series Diffuse Photoelectric Sensors Selection Chart								
Part Number	Price	Voltage Range	Sensing Range*	Optimum Range*	Sensing Beam	Output Type	Connection Type	Cable Part Number
1351E-6517	<--->	10 - 40 VDC	10 ft. (3 m)	1 to 60 in. (25 to 1520 mm)	Infrared	NPN/PNP 250 mA	6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1351E-6547	<--->						4-pin Euro (Micro) DC connector	CSDS4A4CY2202 CSDS4A4CY2205
1351E-6507	<--->						4-pin Mini connector	CSMS4A4CY1602 CSMS4A4CY1606
1351E-6513	<--->	12 - 240 VDC 24 - 240 VAC	10 ft. (3 m)	1 to 60 in. (25 to 1520 mm)	Infrared	Solid-state relay 300 mA @ 240 VAC/VDC	6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1351E-6543	<--->						4-pin Micro AC connector	CSAS4F4CY2202 CSAS4F4CY2205
1351E-6503	<--->						4-pin Mini connector	CSMS4A4CY1602 CSMS4A4CY1606
1351E-6514	<--->						6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1351E-6534	<--->						5-pin Micro AC connector (7.5" pigtail)	CSAS5A5CY2202 CSAS5A5CY2205
1351E-6504	<--->					SPDT EM relay 3 A @ 120 VAC	5-pin Mini connector	CSMS5A5CY1602 CSMS5A5CY1606

*Note: Ranges based on 90% reflectance white card for diffuse reflective sensors.

Characteristic curve chart



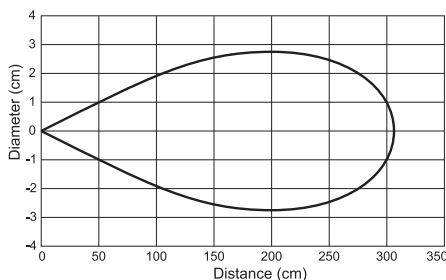
Wiring Diagrams

(Pin numbers are for reference only. Rely on pin location when wiring.)

Operating Voltage	Models	Cable Models	Mini-Connector Models (Face View Male Shown)	Micro and Euro (Micro) Connector Models (Face View Male Shown)
10-40 VDC	Diffuse			
12 - 240 VDC or 24 - 240 VAC	Diffuse Solid-State Relay			
12 - 240 VDC or 24 - 240 VAC	Diffuse SPDT EM Relay			

① Connect load to appropriate output for either sinking or sourcing operation.

Spot dimension chart



Cables and accessories

Cables and accessories start on page 19-65

Enhanced 50 Series Polarized Reflex Photoelectric Sensors



1451E-6503



1451E-6513

- 9 models available
- Fiberglass-reinforced plastic housing
- Field of view: 1.0°
- Cable wires or mini/micro connection termination
- NPN/PNP, Solid-State Relay, or SPDT EM Relay outputs
- IP67 rated

Note: Cutler-Hammer parts available for sale to North America locations only.



1451E-6543

Enhanced 50 Series Polarized Reflex Photoelectric Sensors Selection Chart								
Part Number	Price	Voltage Range	Sensing Range*	Optimum Range*	Sensing Beam	Output Type	Connection Type	Cable Part Number
1451E-6517	<--->	10 - 40 VDC	16 ft. (4.9 m)	0.5 to 8 ft. (0.2 to 2.5 m)	Visible Red	NPN/PNP 250 mA	6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1451E-6547	<--->						4-pin Euro (Micro) DC connector	CSDS4A4CY2202 CSDS4A4CY2205
1451E-6507	<--->						4-pin Mini connector	CSMS4A4CY1602 CSMS4A4CY1606
1451E-6513	<--->	12 - 240 VDC 24 - 240 VAC				Solid-state relay 300 mA @ 240 VAC/VDC	6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1451E-6543	<--->						4-pin Micro AC connector	CSAS4F4CY2202 CSAS4F4CY2205
1451E-6503	<--->						4-pin Mini connector	CSMS4A4CY1602 CSMS4A4CY1606
1451E-6514	<--->						6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1451E-6534	<--->						5-pin Micro AC connector (7.5" pigtail)	CSAS5A5CY2202 CSAS5A5CY2205
1451E-6504	<--->						5-pin Mini connector	CSMS5A5CY1602 CSMS5A5CY1606
						SPDT EM relay 3 A @ 120 VAC		

**Note: Ranges based on 3-inch retro-reflector for reflex sensors. Polarized sensors may not operate with reflective tape. Test tape selection before installation.*



Note: Polarized Reflex models include one 84 mm RL110 reflector. Purchase additional reflectors separately.

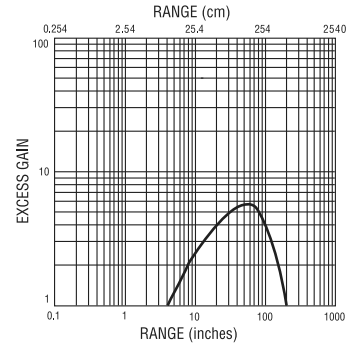
Wiring Diagrams

(Pin numbers are for reference only. Rely on pin location when wiring)

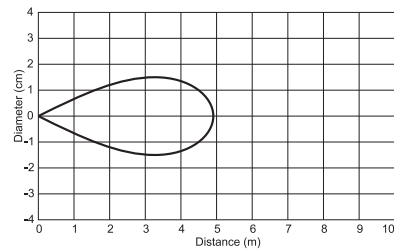
Operating Voltage	Models	Cable Models	Mini-Connector Models (Face View Male Shown)	Micro and Euro (Micro) Connector Models (Face View Male Shown)
10-40 VDC	Polarized Reflex			
12 - 240 VDC or 24 - 240 VAC	Polarized Reflex Solid-State Relay			
12 - 240 VDC or 24 - 240 VAC	Polarized Reflex SPDT EM Relay			

① Connect load to appropriate output for either sinking or sourcing operation.

Characteristic curve chart



Spot dimension chart



Cables and accessories
Cables and accessories start on page 19-65.

Enhanced 50 Series Clear Object Photoelectric Sensors



1452E-6547



1452E-6517

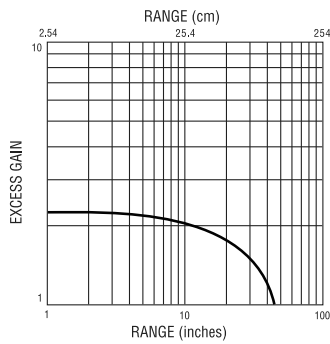
- 7 models available
- Fiberglass-reinforced plastic housing
- Field of view: 0.68°
- Cable wires or mini/micro connector termination
- NPN/PNP, Solid-State Relay, or SPDT EM Relay outputs
- IP67 rated

Note: Cutler-Hammer parts available for sale to North America locations only.

Enhanced 50 Series Clear Object Photoelectric Sensors Selection Chart

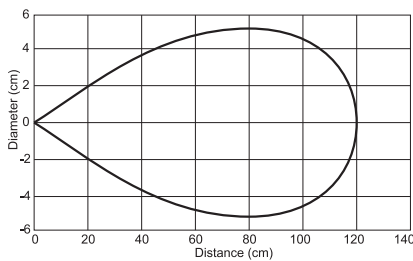
Part Number	Price	Voltage Range	Sensing Range	Optimum Range	Sensing Beam	Output Type	Connection Type	Cable Part Number
1452E-6517	<--->	10 - 40 VDC	45 in. (1.2 m)	1 to 24 in. (25 to 610 m m)	Visible Red	NPN/PNP 250 mA	6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1452E-6547	<--->						4-pin Euro (Micro) DC connector	CSDS4A4CY2202 CSDS4A4CY2205
1452E-6507	<--->						4-pin Mini connector	CSMS4A4CY1602 CSMS4A4CY1606
1452E-6513	<--->	12 - 240 VDC 24 - 240 VAC	45 in. (1.2 m)	1 to 24 in. (25 to 610 m m)	Visible Red	Solid-state relay 300 mA @ 240 VAC/VDC	6-foot cable (300V)	Pre-wired 6 ft. (1.8 m)
1452E-6543	<--->						4-pin Micro AC connector	CSAS4F4CY2202 CSAS4F4CY2205
1452E-6503	<--->						4-pin Mini connector	CSMS4A4CY1602 CSMS4A4CY1606
1452E-6504	<--->						5-pin Mini connector	CSMS5A5CY1602 CSMS5A5CY1606

Characteristic curve chart



Note: Clear Object models include one 84 mm RL110 reflector. Purchase additional reflectors separately.

Spot dimension chart



Wiring Diagrams

(Pin numbers are for reference only. Rely on pin location when wiring.)

Operating Voltage	Models	Cable Models	Mini-Connector Models (Face View Male Shown)	Micro and Euro (Micro) Connector Models (Face View Male Shown)
10-40 VDC	Clear Object			
12 - 240 VDC or 24 - 240 VAC	Clear Object Solid-State Relay			
12 - 240 VDC or 24 - 240 VAC	Clear Object SPDT EM Relay			

① Connect load to appropriate output for either sinking or sourcing operation.

Mounting brackets

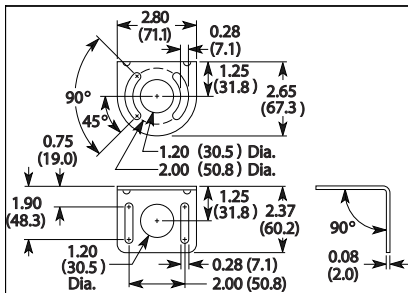
Short, tall or ball-swivel style of mounting brackets are available. All styles allow 360° rotation of the sensor.

Note: Cutler-Hammer parts available for sale to North America locations only.

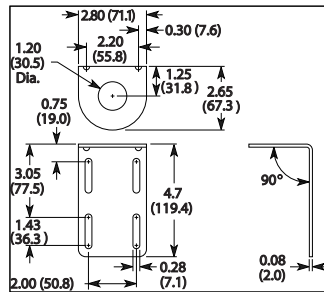
Enhanced 50 Series Accessories Selection Chart		
Part Number	Price	Description
6150E-6501	<--->	Short right angle metal mounting bracket. Allows full 360° rotation of sensor and up to 1.5" of vertical adjustment. Nickel plated.
6150E-6502	<--->	Tall right angle metal mounting bracket. Allows full 360° rotation of sensor, up to 1.5" of vertical adjustment in each slot, and 3.5" overall positioning adjustment
6150E-6503	<--->	Right angle plastic mounting bracket with ball swivel. Allows full 360° rotation of sensor. Ball swivel allows for ±30° sensor angle



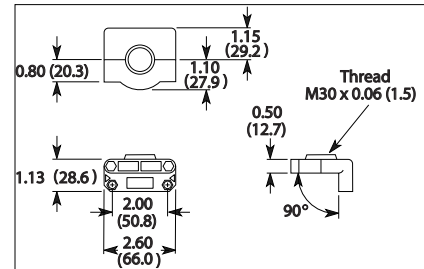
6150E-6501



6150E-6502



6150E-6503



Approximate dimensions in inches (millimeters)

RL series reflectors

- Suitable for use with polarized light photoelectric sensors
- 10 reflectors per package











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 of the environment. 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	RL110 ³
Price	<--->
% Sensing Range Using Enhanced 50 Series ¹	100%
Dimensions	Diameter: 84 mm
Degree of Protection ²	IEC IP67
Mounting	one 5 mm dia. hole
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. ³ All reflective sensors are shipped with an RL110 reflector.	



Enhanced 50 Series Photoelectric Sensors Connector Cables

Enhanced 50 Series Cables Selection Chart				
Part Number	Price	Description	Gauge	Pin-Out Diagram
CSDS4A4CY2202	<--->	DC Euro (Micro) connector cable for quick-disconnect photoelectric sensors, straight female, DC 4-pin/4-wire, PVC, 6 feet (2 meter) length	22	 1-Brown 2-White 3-Blue 4-Black
CSDS4A4CY2205	<--->	DC Euro (Micro) connector cable for quick-disconnect photoelectric sensors, straight female, DC 4-pin/4-wire, PVC, 16.4 feet (5 meter) length	22	 1-Red/Black 2-Red/White 3-Red 4-Green
CSAS4F4CY2202	<--->	AC Micro connector cable for quick-disconnect photoelectric sensors, straight female, AC 4-pin/4-wire, PVC, 6 feet (2 meter) length, 1/2" - 20 UNF thread	22	 1-Red/Black 2-Red/White 3-Red 4-Green
CSAS4F4CY2205	<--->	AC Micro connector cable for quick-disconnect photoelectric sensors, straight female, AC 4-pin/4-wire, PVC, 16.4 feet (5 meter) length, 1/2" - 20 UNF thread	22	 1-Red/Black 2-Red/White 3-Red 4-Green
CSAS5A5CY2202	<--->	AC Micro connector cable for quick-disconnect photoelectric sensors, straight female, AC 5-pin/5-wire, PVC, 6 feet (2 meter) length, 1/2" - 20 UNF thread	22	 1-Brown 2-Blue 3-Gray 4-Black 5-White
CSAS5A5CY2205	<--->	AC Micro connector cable for quick-disconnect photoelectric sensors, straight female, AC 5-pin/5-wire, PVC, 16.4 feet (5 meter) length, 1/2" - 20 UNF thread	22	 1-Brown 2-Blue 3-Gray 4-Black 5-White
CSMS4A4CY1602	<--->	Mini connector cable for quick-disconnect photoelectric sensors, straight female, 4-pin/4-wire, PVC, 6 feet (2 meter) length, 7/8" - 16 UN thread	16	 1-Black 2-Blue 3-Brown 4-White
CSMS4A4CY1606	<--->	Mini connector cable for quick-disconnect photoelectric sensors, straight female, 4-pin/4-wire, PVC, 19.69 feet (6 meter) length, 7/8" - 16 UN thread	16	 1-Black 2-Blue 3-Brown 4-White
CSMS5A5CY1602	<--->	Mini connector cable for quick-disconnect photoelectric sensors, straight female, 5-pin/5-wire, PVC, 6 feet (2 meter) length, 7/8" - 16 UN thread	16	 1-Black 2-Blue 3-Orange 4-Brown 5-White
CSMS5A5CY1606	<--->	Mini connector cable for quick-disconnect photoelectric sensors, straight female, 5-pin/5-wire, PVC, 19.69 feet (6 meter) length, 7/8" - 16 UN thread	16	 1-Black 2-Blue 3-Orange 4-Brown 5-White



CSDS4A4CY2205



CSAS4F4CY2205

Note: Cutler-Hammer parts available for sale to North America locations only.

Connector Cables Specifications		
	Micro Style	Mini Style
Jacket Material	PVC	PVC
Contact Material	Gold-plated copper alloy	Gold-plated brass
Coupling Nut Material	Zinc die cast epoxy-coat	Zinc die cast epoxy-coat
O-ring	Nitrile rubber	None
Cable	PVC insulation and jacket, stranded copper conductors	
Cable Strain Relief	35 pounds minimum	
Voltage Rating	320 V (24 VDC for LED plugs)	600 V
Current Rating	4A	4-pin: 10A 5-pin: 8 A
Contact Resistance	5 mΩ maximum	5 mΩ maximum
Isolation Resistance	1000 MΩ minimum	1000 MΩ minimum
Protection	IP67	NEMA 6P, IP68
Temperature Range	-25° to 90°C	-20° to 105°C
Cable Diameter (3/C = 3 Conductor)	22 AWG PVC: 4/C: 0.21 inch (5.3 mm) 5/C: 0.20 inch (5.1 mm)	16AWG PVC: 4/C: 0.42 inch (10.7 mm) 5/C: 0.50 inch (12.7 mm)
Bend Radius	Minimum recommended bend radius is 12X cable diameter	



CSAS5A5CY2202



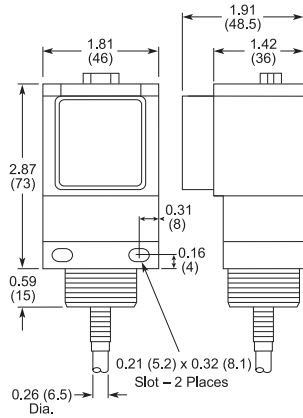
CSMS4A4CY1602



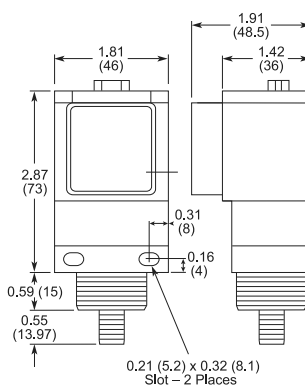
CSMS5A5CY1602

Sensors Dimensions (in/mm)

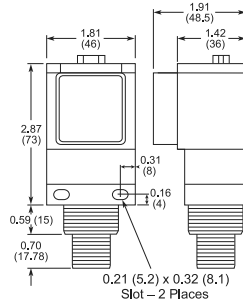
Cable and Pigtail Connector* Version



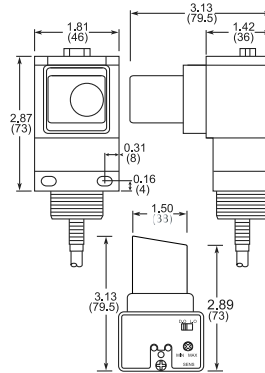
AC/DC Micro or Euro (Micro) Connector Versions



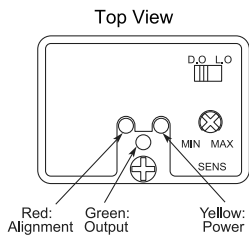
Mini Connector Versions



Clear Object Versions (Cable Version Shown)



* Pigtail length: 7.5" nominal

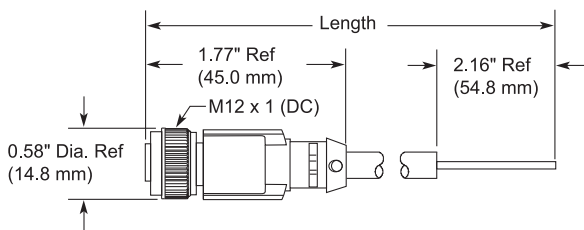


Approximate dimensions in inches (millimeters)

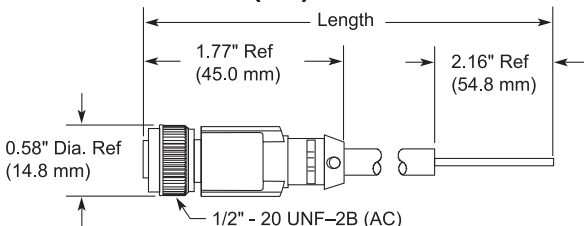
Connector Cables Dimensions (in/mm)

Micro Style Connector Cables

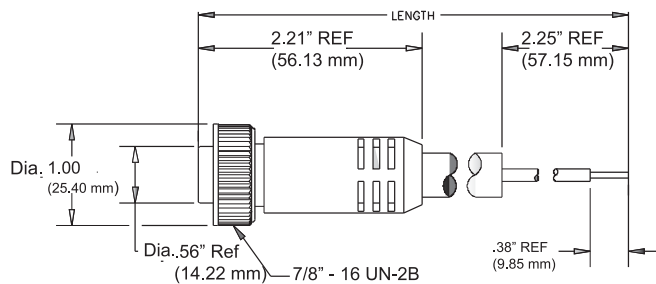
M12 x 1 (DC) connector cable



1/2" - 20 UNF-2B (AC) connector cable



Mini Style Connector Cables



AutomationDirect HQ and mega-warehouse, just north of Atlanta, GA USA



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We were originally founded as PLCDirect in 1994 and have grown from a tiny PLC company to one of the best value choices in the industry.

As the first industrial controls company to successfully use a telephone supported direct sales catalog for PLC products, we learned that "the way it's always been done" approach is not necessarily the most efficient way. So we worked smarter to develop in-house processes that maximized productivity to keep costs low. Then we passed those savings on to our customers.

In 1999, we changed our name to AutomationDirect.com, and brought that "pass along the value" philosophy online. We have been serving tens of thousands of satisfied customers ever since.

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2006 Control Design magazine
Readers' Choice Awards

2006 Design News magazine
Readers' Choice Awards

2005 Control Design magazine
Readers' Choice Awards

2005 Control magazine
Readers' Choice Award

2004 Control Engineering
Editors' Choice Award

2004 Control
Readers' Choice Awards

2004 Control Design
Readers' Choice Awards

2003 Control Engineering's
Editors' Choice Award

2003 Control Design
Readers' Choice Awards

2002 Control Design
Readers' Choice Awards



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DFT Series Fiber Photoelectric Amplifiers

Compact rectangular plastic DIN-rail mount with Teach function - DC



- 4 models available
- DIN-rail mounting
- Bargraph signal-strength indicator
- NPN or PNP, Light-on/Dark-on selectable outputs
- Red LED with visible spot
- IP64 rated

Cables and Accessories

Cables and accessories start on page 19-65

DFT Series Fiber Photoelectric Amplifier Selection Chart						
Part Number	Price	Sensing Range	Output State	Logic	Connection	Dimensions
DFT-AN-1A	<--->	Optical fiber dependent	Light On / Dark On selectable	NPN	2m (6.5') axial cable	Figure 1
DFT-AN-1F	<--->				M8 (8mm) connector	Figure 2
DFT-AP-1A	<--->			PNP	2m (6.5') axial cable	Figure 1
DFT-AP-1F	<--->				M8 (8mm) connector	Figure 2

Specifications		
	DFT-AN-1*	DFT-AP-1*
Sensing Distance	See Optical Fibers Table	
Sensitivity Setting	Dual Teach function	
Emission	red (680nm)	
Differential Travel	≤10%	
Operating Voltage	10-30VDC	
Ripple	≤20%	
No-load Supply Current	≤25mA	
Load Current	≤200mA	
Leakage Current	≤0.1mA	
Voltage Drop	2V maximum at 200mA	
Output Type	NPN	PNP
Output Function	Light On or Dark On Selectable	
On Delay	10-150ms set with Delay function	
Off Delay	10-150ms set with Stretch mode	
Switching Frequency	1.5kHz	
(tv) Time Delay Before Availability	80ms	
Input Voltage Transients Protection	≤30 VDC	
Input Power Polarity Reversal Protection	Yes	
Output Power Short-Circuit Protection	Yes (switch autoresets after overload is removed)	
Temperature Range	-25° to +55° C (-13° to 131° F)	
Temperature Drift	0.2% / °C	
Interference to External Light	5,000 lux (incandescent lamp) 10,000 lux (sunlight)	
Protection Degree	IP64	
Agency Approvals	UL file E328811	
LED Output Indicator	Yellow (output energized)	
Signal Strength Indicator	Yellow bargraph type	
Housing Material	PBT	
Lens Materials	Acrylic	
Weight (cable/connector)	68g (2.39oz) / 17g (0.60oz)	

Dimensions (mm)

Figure 1

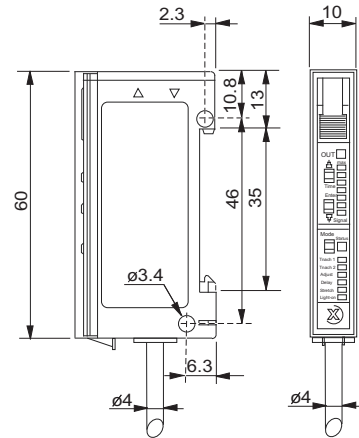
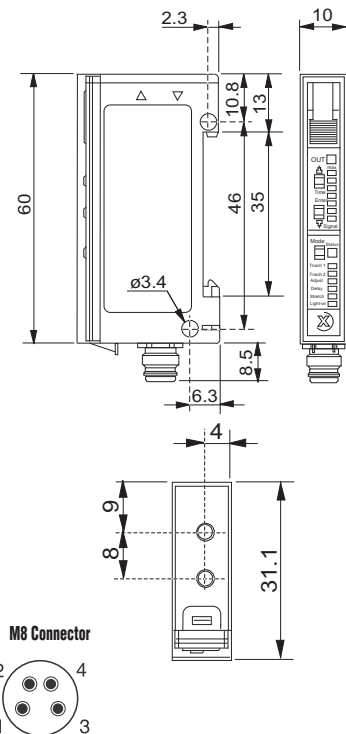
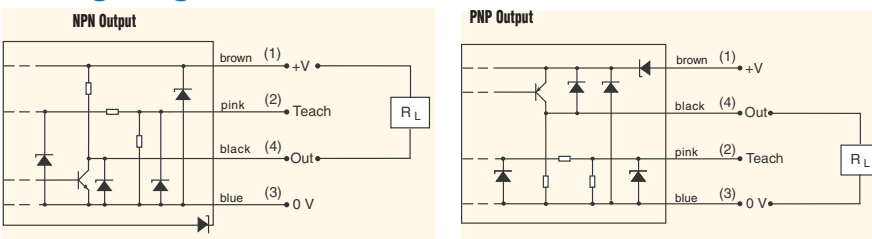


Figure 2



Wiring diagrams



DFP Series Fiber Photoelectric Amplifiers



Compact rectangular plastic DIN-rail mount- DC

- 4 models available
- DIN-rail mounting
- 12-turn potentiometer sensitivity setting with illuminated scale
- NPN or PNP, Light-on/Dark-on selectable outputs
- Red LED with visible spot
- IP64 rated

Cables and Accessories

Cables and accessories start on page 19-65

DFP Series Fiber Photoelectric Amplifier Selection Chart

Part Number	Price	Sensing Range	Output State	Logic	Connection	Dimensions
DFP-AN-1A	<--->	Optical fiber dependent	Light-on, Dark-on selectable	NPN	2m (6.5') axial cable	Figure 1
DFP-AN-1F	<--->				M8 (8mm) connector	Figure 2
DFP-AP-1A	<--->			PNP	2m (6.5') axial cable	Figure 1
DFP-AP-1F	<--->				M8 (8mm) connector	Figure 2

Specifications

	DFP-AN-1*	DFP-AP-1*
Sensing Distance	See Optical Fibers Table	
Sensitivity Setting	12-turn Potentiometer with illuminated scale	
Emission	red (680nm)	
Differential Travel	≤10%	
Operating Voltage	10-30VDC	
Ripple	≤20%	
No-load Supply Current	≤15mA	
Load Current	≤200mA	
Leakage Current	≤0.1mA	
Voltage Drop	2V maximum at 200mA	
Output Type	NPN	PNP
Output Function	Light On or Dark On Selectable	
Switching Frequency	1.5kHz	
(tv) Time Delay Before Availability	300ms	
Input Voltage Transients Protection	≤30 VDC	
Input Power Polarity Reversal Protection	Yes	
Output Power Short-Circuit Protection	Yes (switch autoresets after overload is removed)	
Temperature Range	-25° to +55°C (-13° to 131°F)	
Temperature Drift	0.2% / °C	
Interference to External Light	5,000 lux (incandescent lamp) 10,000 lux (sunlight)	
Protection Degree	IP64	
Agency Approvals	UL file E32881	
LED Output Indicator	Yellow (output energized)	
Excess Light Indicator	Green (On when less than 80% of the available operating sensing distance is used. Excess gain is desirable in most applications.)	
Housing Material	PBT	
Lens Materials	Acrylic	
Weight (cable/connector)	69g (2.44oz) / 18g (0.63oz)	

Dimensions (mm)

Figure 1

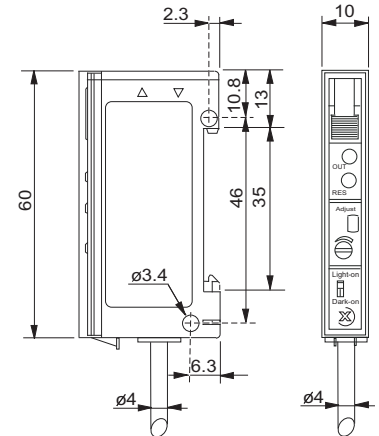
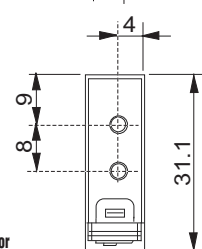
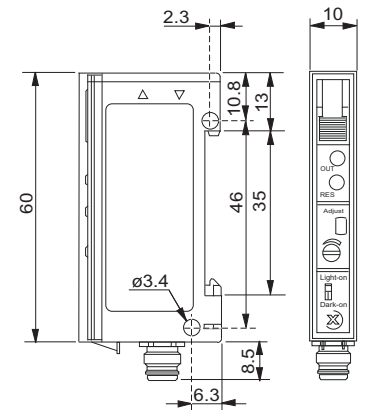
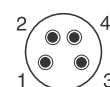


Figure 2

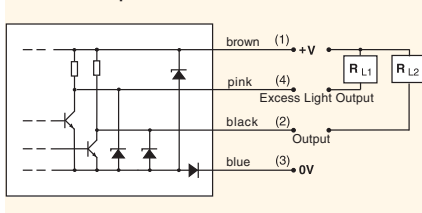


M8 Connector

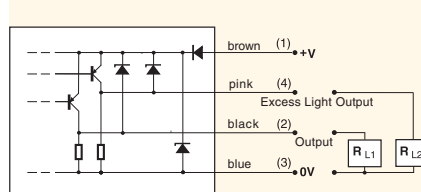


Wiring diagrams

NPN Output



PNP Output



SSF Series Fiber Photoelectric Amplifiers

M18 (18 mm) plastic with Teach function - DC



- 4 models available
- Sensitivity adjustment using Teach button
- NPN or PNP, Light-on/Dark-on selectable outputs
- Red LED with visible spot
- IP67 rated

Cables and Accessories

Cables and accessories start on page 19-65

SSF Series Fiber Photoelectric Amplifier Selection Chart							
Part Number	Price	Sensing Range	Output State	Logic	Connection	Wiring	Dimensions
SSF-ON-0A	<--->	Optical fiber dependent	Light-on, Dark-on selectable	NPN	2m (6.5') axial cable	Diagram 1	Figure 1
SSF-ON-0E	<--->				M12 (12mm) connector		Figure 2
SSF-OP-0A	<--->			PNP	2m (6.5') axial cable	Diagram 2	Figure 1
SSF-OP-0E	<--->				M12 (12mm) connector		Figure 2

Specifications		
	SSF-ON-0*	SSF-OP-0*
Sensing Distance	See Optical Fibers Table	
Sensitivity Setting	Teach button	
Emission	red LED	
Differential Travel	≤10%	
Operating Voltage	10-30VDC	
Ripple	≤10%	
No-load Supply Current	≤20mA	
Load Current	≤100mA	
Leakage Current	≤10µA	
Voltage Drop	2V maximum	
Output Type	NPN	PNP
Output Function	Light On or Dark On Selectable	
Switching Frequency	800Hz	
(tv) Time Delay Before Availability	150ms	
Input Voltage Transients Protection	≤30 VDC	
Input Power Polarity Reversal Protection	Yes	
Output Power Short-Circuit Protection	Yes (switch autoresets after overload is removed)	
Temperature Range	-25° to +70°C (-13° to 158°F)	
Temperature Drift	10% Sr	
Interference to External Light	3,000 lux (incandescent lamp) 10,000 lux (sunlight)	
Protection Degree	IP67	
LED Output Indicator	Yellow (output energized)	
Housing Material	PBT	
Lens Materials	Acrylic	
Tightening Torque	40 N-m (29l lb-ft.)	
Weight (cable/connector)	100g (3.53oz)	

Wiring diagrams

Diagram 1

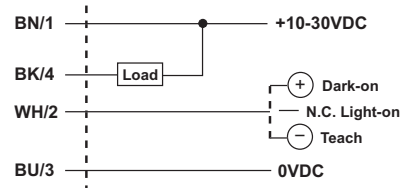
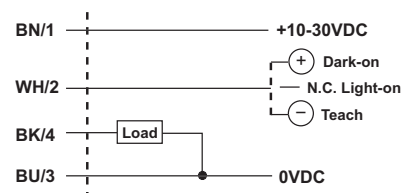
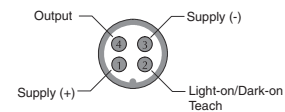


Diagram 2



Connector



Dimensions (mm)

Figure 1

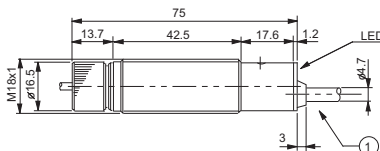
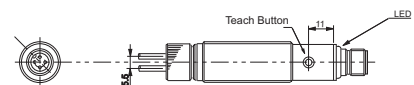
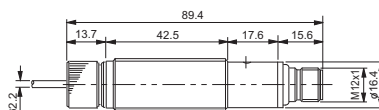


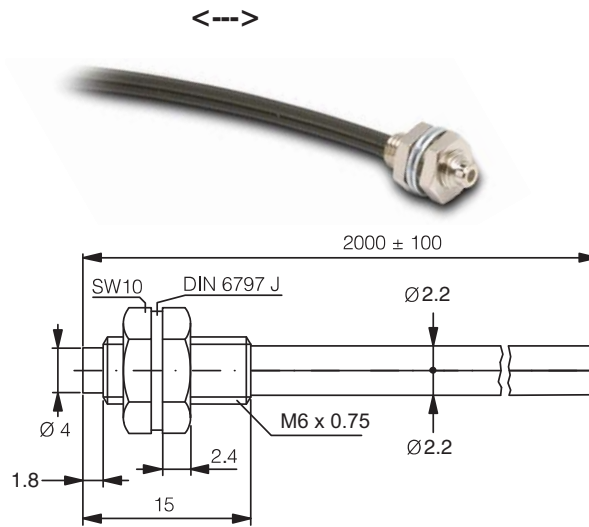
Figure 2



Cuttable Optical Fibers (2.2 mm Diameter)

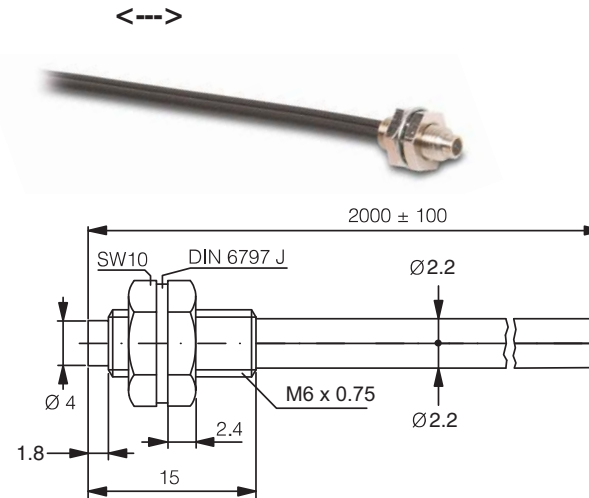
CF-DB1-20 diffuse reflection

Specifications	
Optical Fiber Core Ø	1 mm (0.039in)
Sensing Distance with DFT and DFP series	200 mm (7.87in)
Fiber Length (L)	2.0 m (78.74in)
Fiber Bending Radius	25 mm (0.98in)
Free Cut	Yes
Head Size	M6
Thread Pitch	0.75 mm
Protection Degree	IEC IP67
Agency Approvals	UL file 328811
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass



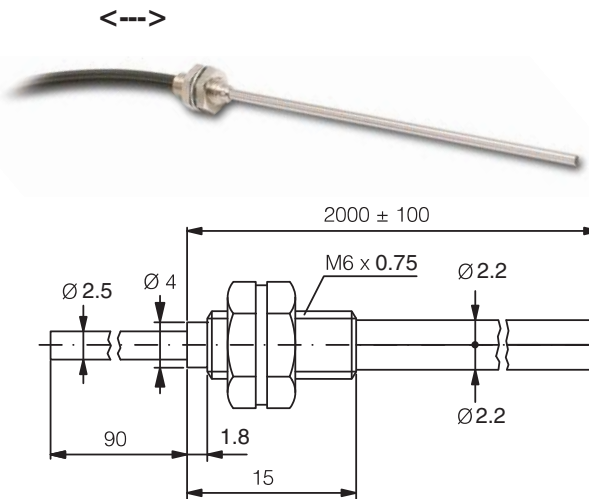
CF-DB2-20 diffuse reflection

Specifications	
Optical Fiber Core Ø	1.5 mm (0.06in)
Sensing Distance with DFT and DFP Series	260 mm (10.27in)
Fiber Length (L)	2.0 m (78.74in)
Fiber Bending Radius	40 mm (1.57in)
Free Cut	Yes
Head Size	M6
Thread Pitch	0.75 mm
Protection Degree	IEC IP67
Agency Approvals	UL file 328811
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass



CF-DB3-20 diffuse reflection

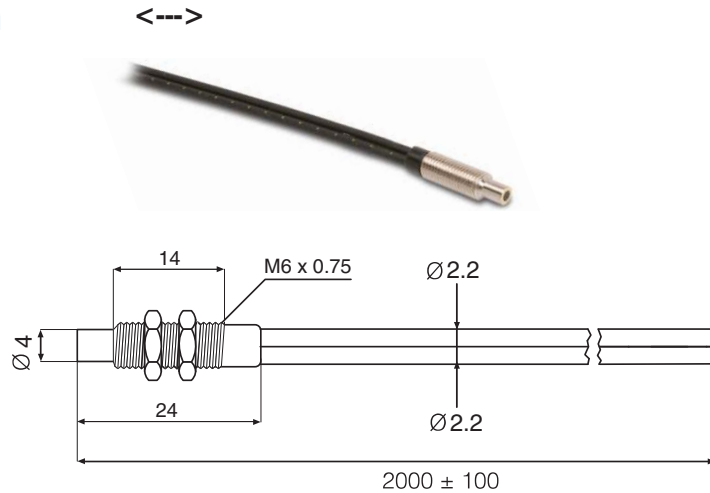
Specifications	
Optical Fiber Core Ø	1 mm (0.039in)
Sensing Distance with DFT and DFP Series	200 mm (7.87in)
Fiber Length (L)	2.0 m (78.74in)
Fiber Bending Radius	25 mm (0.98in)
Bendable light-outlet tube	Yes, 25 mm (0.98in) radius
Free Cut	Yes
Head Size	M6
Thread Pitch	0.75 mm
Protection Degree	IEC IP67
Agency Approvals	UL file 328811
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass



Cuttable Optical Fibers (2.2 mm Diameter)

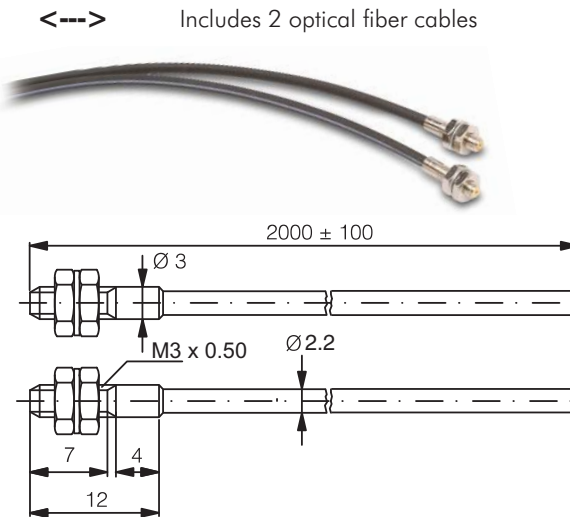
CF-CB1-20 diffuse reflection

Specifications	
Optical Fiber Core Ø	1 mm (0.039in)
Sensing Distance with SSF Series	50 mm (1.97in)
Fiber Length (L)	2.0 m (78.74in)
Fiber Bending Radius	25 mm (0.98in)
Free Cut	Yes
Head Size	M6
Thread Pitch	0.75 mm
Protection Degree	IEC IP67
Temperature Range	-40° to +70°C (-40° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass



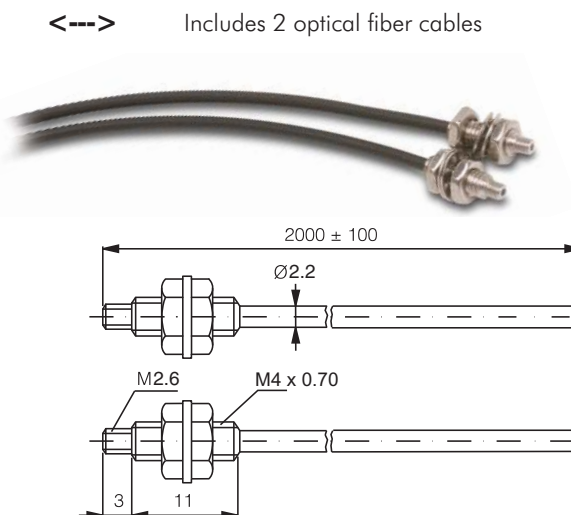
CF-TB1-20 through-beam

Specifications	
Optical Fiber Core Ø	0.5 mm (0.02in)
Sensing Distance with DFT and DFP Series	200 mm (7.87in)
Fiber Length (L)	2.0 m (78.74in) ea. piece
Fiber Bending Radius	25 mm (0.98in)
Free Cut	Yes
Head Size	M3
Thread Pitch	0.5 mm
Protection Degree	IEC IP67
Agency Approvals	UL file 328811
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass



CF-TB2-20 through-beam

Specifications	
Optical Fiber Core Ø	1 mm (0.039in)
Sensing Distance with DFT and DFP Series	700 mm (27.56in)
Fiber Length (L)	2.0 m (78.74in) ea. piece
Fiber Bending Radius	25 mm (0.98in)
Free Cut	Yes
Head Size	M4
Thread Pitch	0.7 mm
Protection Degree	IEC IP67
Agency Approvals	UL file E328811
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass

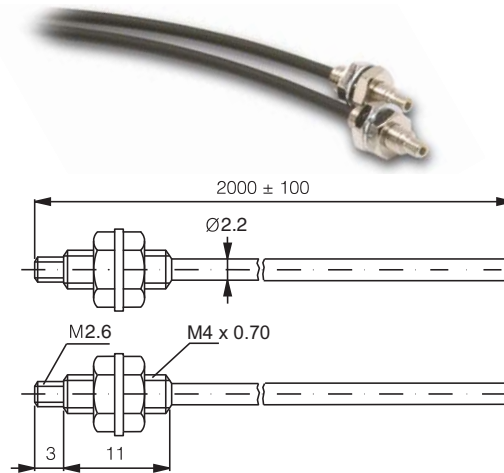


Cuttable Optical Fibers (2.2 mm Diameter)

CF-TB3-20 through-beam

Specifications	
Optical Fiber Core Ø	1.5 mm (0.06in)
Sensing Distance with DFT and DFP Series	900 mm (35.43in)
Fiber Length (L)	2.0 m (78.74in) ea. piece
Fiber Bending Radius	40 mm (1.57in)
Free Cut	Yes
Head Size	M4
Thread Pitch	0.7 mm
Protection Degree	IEC IP67
Agency Approvals	UL file E328811
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass

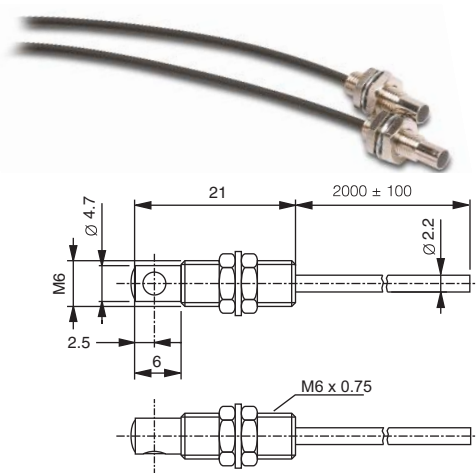
<---> Includes 2 optical fiber cables



CF-TB4-20 90° through-beam

Specifications	
Optical Fiber Core Ø	1.0 mm (0.039in)
Sensing Distance with DFT and DFP Series	1800 mm (70.87in)
Fiber Length (L)	2.0 m (78.74in) ea. piece
Fiber Bending Radius	25 mm (0.98in)
Free Cut	Yes
Head Size	M6
Thread Pitch	0.75 mm
Protection Degree	IEC IP67
Agency Approvals	UL file E328811
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass

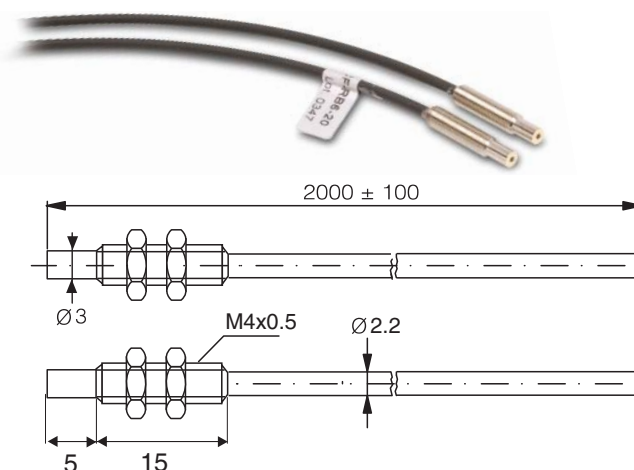
<---> Includes 2 optical fiber cables



CF-RB6-20 through beam

Specifications	
Optical Fiber Core Ø	1.0 mm (0.039in)
Sensing Distance with SSF Series	120 mm (4.72in)
Fiber Length (L)	2.0 m (78.74in) ea. piece
Fiber Bending Radius	25 mm (0.98in)
Free Cut	Yes
Head Size	M4
Thread Pitch	0.75 mm
Protection Degree	IEC IP67
Temperature Range	-40° to +70°C (-40° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass

<---> Includes 2 optical fiber cables



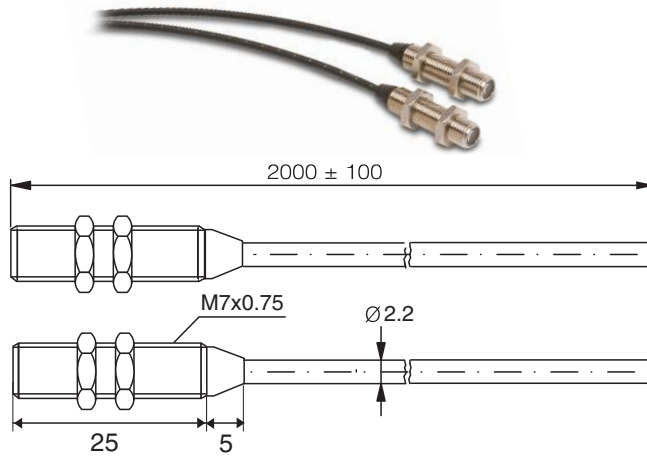
Cuttable Optical Fibers (2.2 mm Diameter)

CF-RBA-20 through-beam with lenses



Includes 2 optical fiber cables

Specifications	
Optical Fiber Core Ø	1.0 mm (0.039in)
Sensing Distance with SSF series	1200 mm (47.24in)
Fiber Length (L)	2.0 m (78.74in) ea. piece
Fiber Bending Radius	25 mm (0.98in)
Free Cut	Yes
Head Size	M7
Thread Pitch	0.75 mm
Protection Degree	IEC IP67
Temperature Range	-40° to +70°C (-40° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene
Head Materials	Nickel-plated brass



- Company Information
- Systems Overview
- Programmable Controllers
- Field I/O
- Software
- C-more & other HMI
- Drives
- Soft Starters
- Motors & Gearbox
- Steppers/Servos
- Motor Controls
- Proximity Sensors
- Photo Sensors**
- Limit Switches
- Encoders
- Current Sensors
- Pressure Sensors
- Temperature Sensors
- Pushbuttons/Lights
- Process
- Relays/Timers
- Comm.
- Terminal Blocks & Wiring
- Power
- Circuit Protection
- Enclosures
- Tools
- Pneumatics
- Appendix
- Product Index
- Part # Index

BX Series High Resolution Area Sensor



High resolution area sensor (light screen) - DC

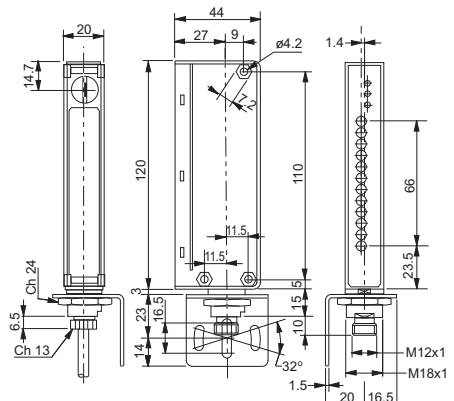
- 70 mm controlled area height
- Operating distance up to 2m
- Adjustable sensitivity
- NPN or PNP with NO/NC selectable output
- Emitter and receiver LED status indicators
- IP67 rated

Cables and Accessories
Cables and accessories start on page 19-65

BX80 Series Area Sensor Selection Chart							
Part Number	Price	Function	Sensing Range	Output State	Logic	Connection	Wiring
BX80B-1N-0H	<--->	Receiver	2m (78.74in)	N.O./N.C. selectable	NPN	M12 (12mm) connector	Figure 1
BX80B-1P-0H	<--->	Receiver			PNP		Figure 2
BX80S-10-0H	<--->	Emitter			Receiver dependent		Receiver dependent

Specifications	
Sensing Distance	2m
Controlled Area Height	70mm
Number of Light Beams / Beam Pitch	12 / 6mm apart at 4mm diameter
Angular Displacement	3° emitter - 6° receiver at Sn distance
Minimum Detectable Object	5mm
Minimum Operating Distance	300mm
Response Time	≤10ms
Emission	Infrared (880nm)
Tolerance	0-20% of the nominal sensing distance Sn
Differential Travel	≤15%
Repeat Accuracy	5%
Operating Voltage	12-24VDC
Ripple	≤10%
No-load Supply Current	Emitter: 100mA; Receiver: 50mA
Load Current	≤100mA
Leakage Current	≤10µA
Voltage Drop	1.2volt maximum at 100mA
Output Type	NPN or PNP; N.O./N.C.selectable
(tv) Time Delay Before Availability	500ms
Input Voltage Transients Protection	≤30 VDC
Input Power Polarity Reversal Protection	Yes
Output Power Short-Circuit Protection	Yes (switch autoresets after overload is removed)
Temperature Range	-25° to +50°C (-13° to 122°F)
Temperature Drift	10% Sr
Interference to External Light	1,500 lux (incandescent lamp) 4,500 lux (sunlight)
Protection Degree (DIN 40050)	IEC IP67
Emitter's LED Indicators	Green (power), Red (sync. alarm), Yellow (area occupied)
Receiver's LED Indicators	Green (power), Red (alignment alarm), Yellow (output energized)
Housing Material	PBT
Lens Material	PC
Tightening Torque	25 N-m (18.44 lb-ft) max.
Weight	300g (10.58oz)

Dimensions (mm)



Wiring diagrams

Figure 1

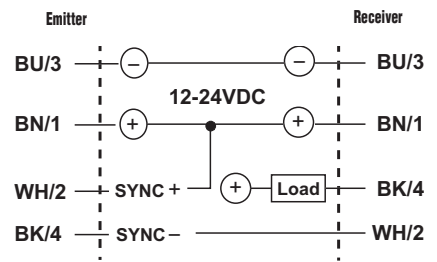
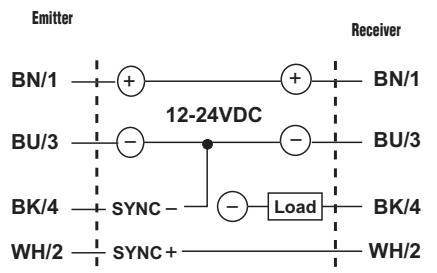
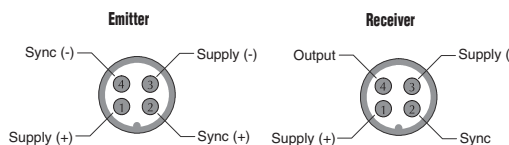


Figure 2



Connectors



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

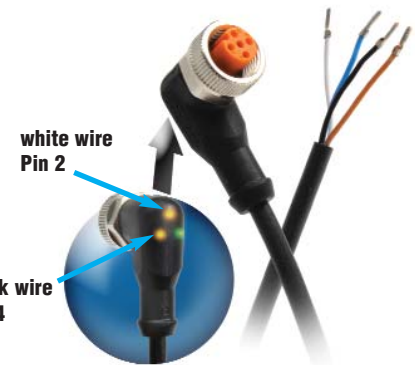
M8 Quick-Disconnect Cables (Pico, Nano)							
Part Number	Price	Length	Poles	Connector	LED	Jacket	Dimensions
M8 Quick-Disconnects							
CD08-0A-020-A1	<--->	2m (6.5ft.)	3	Axial	No	PVC	Figure 1
CD08-0A-020-C1	<--->	2m (6.5ft.)	3	Right-angle	No	PVC	Figure 2
CD08-0A-050-A1	<--->	5m (16.4ft.)	3	Axial	No	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

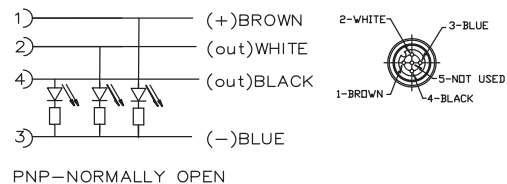
- Industry standard M12 right angle female plug with open leads
- These cables can be used with patch cables
- 2m, 5m and 10m cable lengths
- PUR (polyurethane) jacket for oily and direct sunlight applications
- IP67 / IP68 / IP69K, II rated
- LED indication for 10-36 VDC PNP sensors only



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



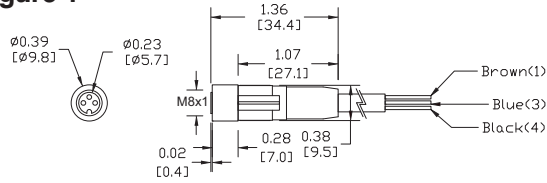
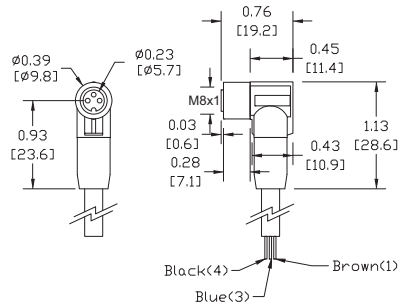
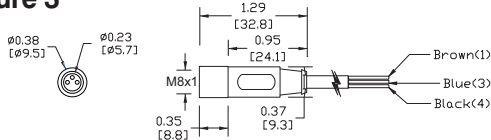
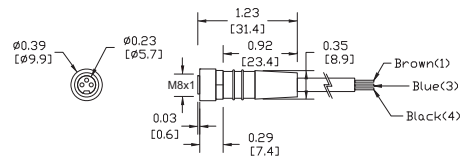
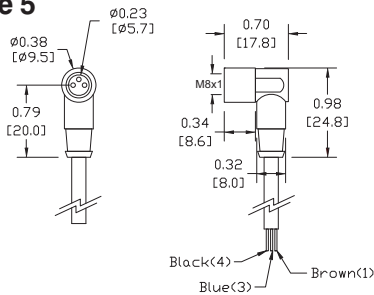
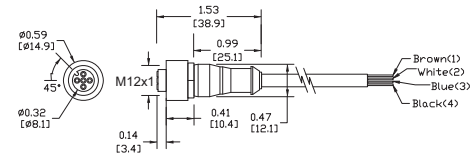
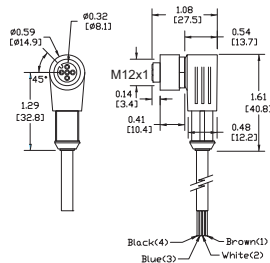
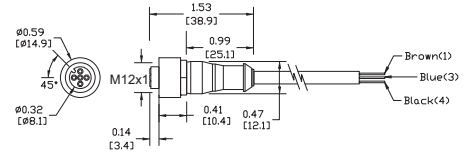
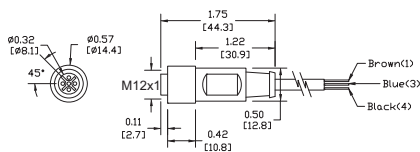
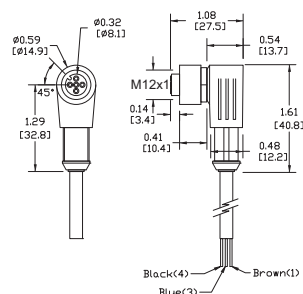
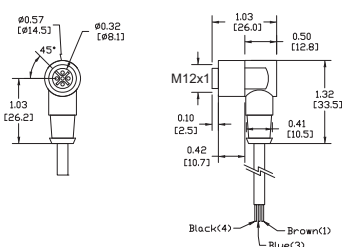
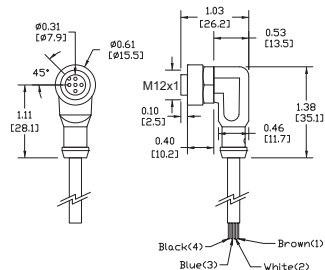
Sensors Accessories: Cables

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	>5 million
	Travel Speed	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	±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
<i>Note: Shown in UL file under Mini-series Female Cord Connectors using catalog number</i>	

Sensors Accessories: Cables

Dimensions (in/mm)

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

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

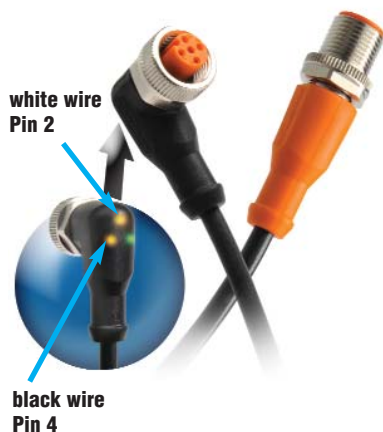
M12 Patch Cables with Quick-Disconnect on Each End (Euro, Micro DC-Single Key)						
Part Number	Price	Length	Poles	Connectors	Jacket	Dimensions
M12 Quick-disconnect Patch Cables						
CDP12-0B-010-AA	<-->	1m (3.28ft)	4	2 Axial. One male and one female connector	PVC	Figure 4
CDP12-0B-010-BB	<-->	1m (3.28ft)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

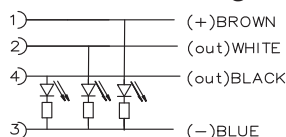
Available patch cables with LED include:

- 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



LED Models' Wiring



PNP-NORMALLY OPEN

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.**

Sensors Accessories: Cables

Company Information

Systems Overview

Programmable Controllers

Field I/O

Software

C-more & other HMI

Drives

Soft Starters

Motors & Gearbox

Steppers/ Servos

Motor Controls

Proximity Sensors

Photo Sensors

Limit Switches

Encoders

Current Sensors

Pressure Sensors

Temperature Sensors

Pushbuttons/ Lights

Process

Relays/ Timers

Comm.

Terminal Blocks & Wiring

Power

Circuit Protection

Enclosures

Tools

Pneumatics

Appendix

Product Index

Part # Index

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	50VAC/75VDC	10 to 36VDC
Max Current	4A	4A
	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)
Environmental		Halogen-free, Silicone-free
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

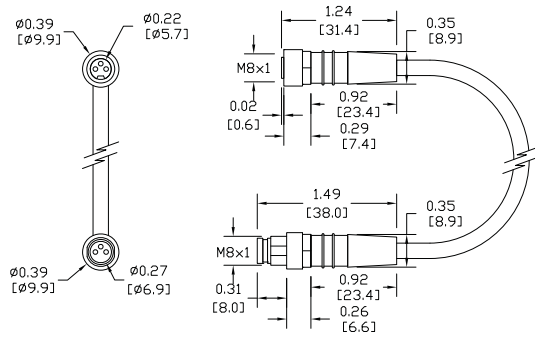


Figure 2

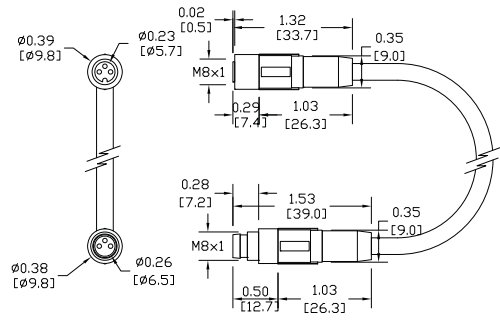


Figure 3

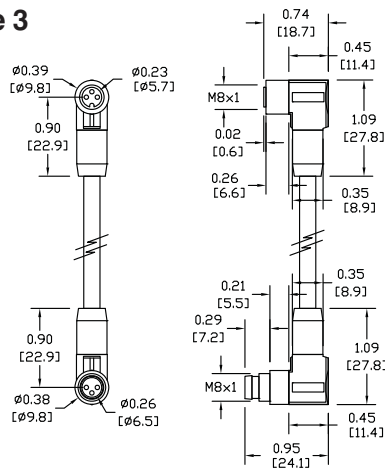


Figure 4

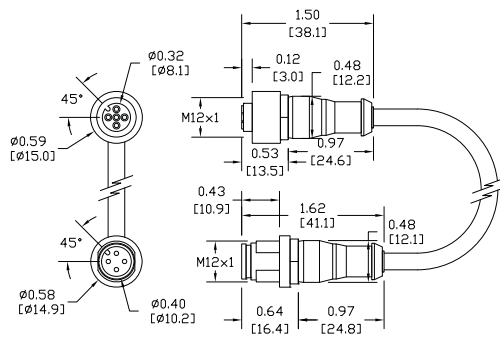


Figure 5

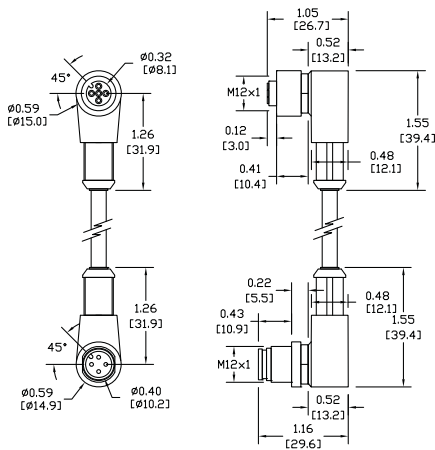
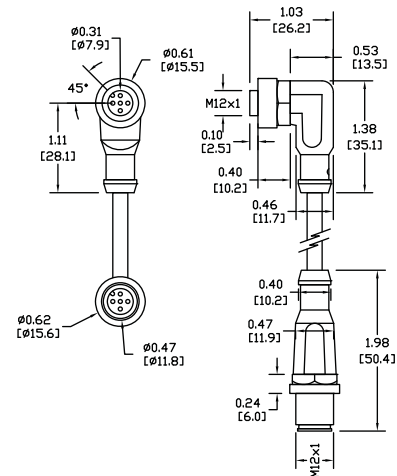


Figure 6



Photoelectric Sensors Accessories: Cables

Cables with quick-disconnect plugs for DFT/DFP Models

Do not use extension cables with the cable listed below. The physical pin configurations do not match.

Available cables include:

- Industry standard M8 screw-lock connectors
- Axial and right-angle connector models
- 2m, 5m and 10m cable lengths
- PVC (polyvinyl chloride) jacket for typical industrial applications
- IP68 rated

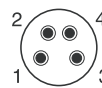


M8 Cables with Quick-Disconnect

Part Number	Price	Length	Poles	Connectors	Jacket	Dimensions
M8 Quick-Disconnects						
CD08-0G-020-A1	<-->	2m (6.56ft.)	4	Axial	PVC	Figure 1
CD08-0W-020-C1	<-->	2m (6.56ft.)	4	Right-angle	PVC	Figure 2
CD08-0G-050-A1	<-->	5m (16.4ft.)	4	Axial	PVC	Figure 1
CD08-0W-050-C1	<-->	5m (16.4ft.)	4	Right-angle	PVC	Figure 2
CD08-0G-100-A1	<-->	10m (32.8ft.)	4	Axial	PVC	Figure 1
CD08-0W-100-C1	<-->	10m (32.8ft.)	4	Right-angle	PVC	Figure 2

Use these cables if the sensor pin configuration looks like the connector pin-out below.

M8 Connector



Cable Specifications	M8
Length	2m (6.56ft.) 5m (16.4ft.) 10m (32.8ft.)
Nominal Voltage	30VAC/30VDC
Nominal Current	4A
Protection Degree	IEC IP67
Contact Body Material	ABS
Housing Material	PUR
Contacts Material	CuSn
Conductors Section	0.25mm ²
Ø Outer Cable	4.5mm
Temperature Range	-5° to +70°C (23° to 158°F)

Dimensions (mm)

Figure 1

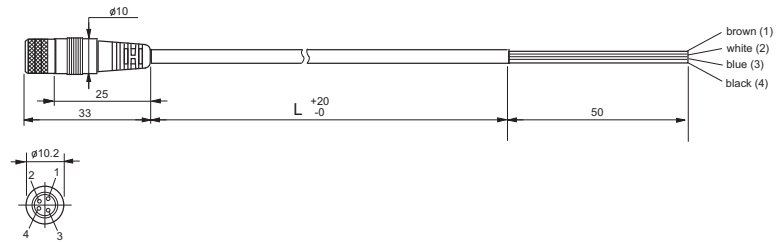
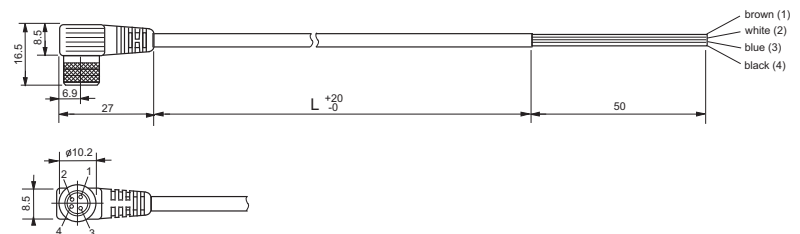


Figure 2

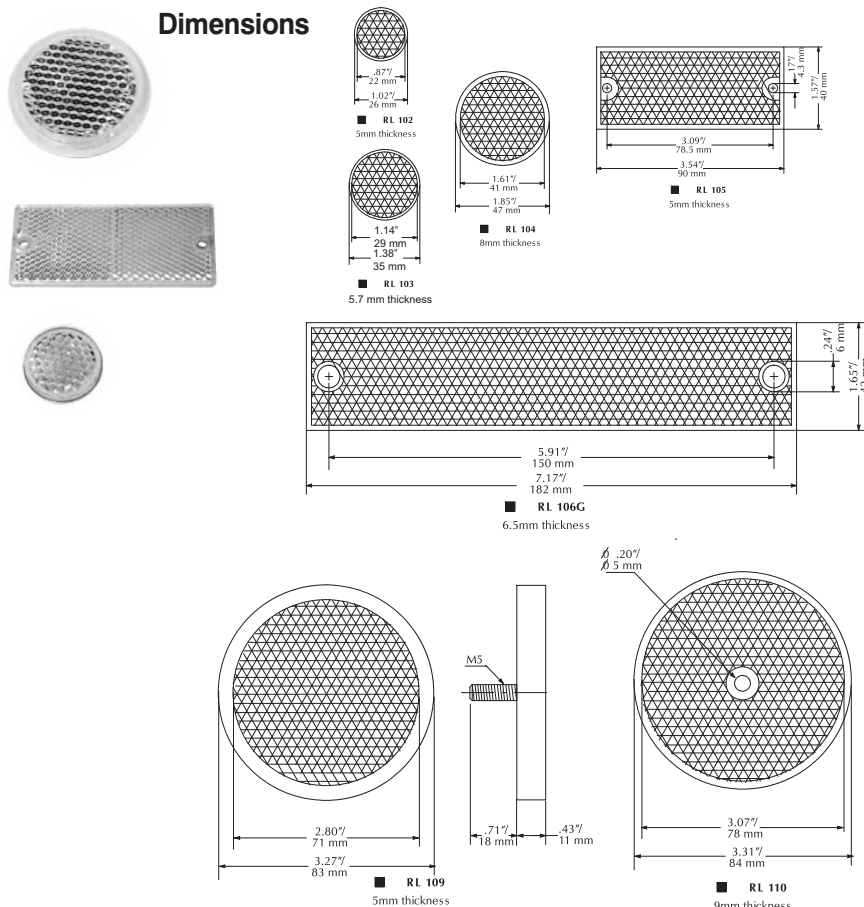


Accessories: Reflectors and Shutters

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	RL110³
Price (10 per pack)	<--->	<--->	<--->	<--->	<--->	<--->	<--->
% Sensing Range Using SSP¹	50%	40%	50%	50%	50%	50%	100%
% Sensing Range Using QXP¹	--	35%	60%	50%	45%	30%	100%
Dimensions	Ø26mm	Ø36mm	Ø47mm	90x40mm	182x42mm	Ø83mm	Ø84mm
Degree of Protection²	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.							

STOS1 through STOS8 shutters for M18 (18 mm) through-beam sensors (SSE / SSR)

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

Sensing Distance (when used with SSE / SSR Model Photoelectric switches)						
Model	STOS1	STOS2	STOS3	STOS4	STOS6	STOS8
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



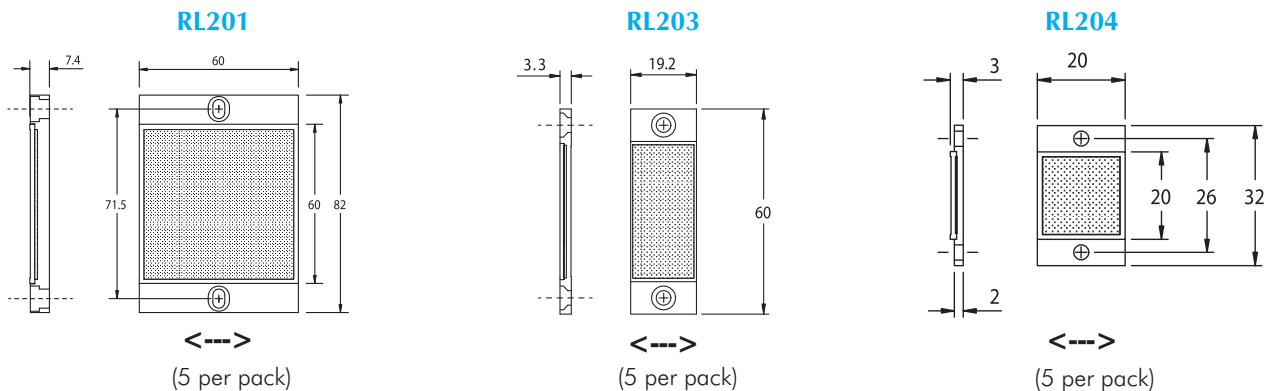
Accessories: Reflectors, Adapters & Mounting Brackets

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

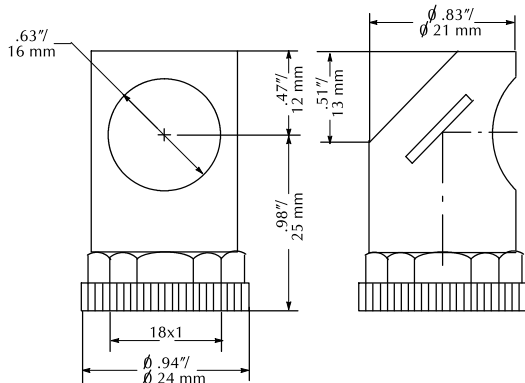
Specifications			
Model	RL201	RL203	RL204
Sensing Range Using FALN ¹	30m	7m	7m
Dimensions	60mm x 82mm	19mm x 60mm	20mm x 32mm
Mounting	two Ø4mm holes	two Ø6mm holes	two Ø3mm holes
Degree of Protection ²	IEC IP67		
Materials	Acrylic/polycarbonate		

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.



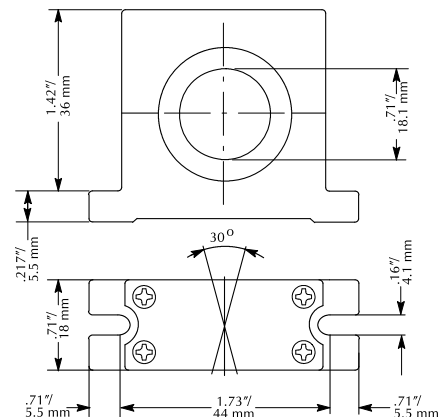
ST03 right-angle M18 (18 mm) beam adapter

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).




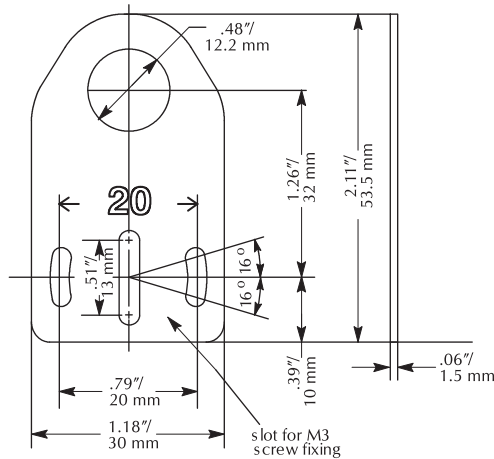
Accessories: Mounting Brackets

ST12A metal 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.





(1 per pack)

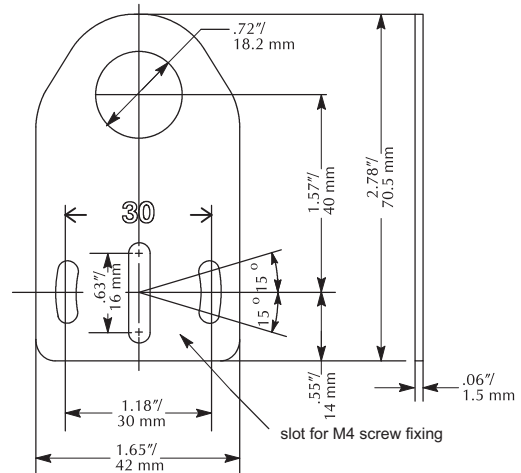


ST18A metal axial bracket

Metal 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-adapters sensors.





(1 per pack)

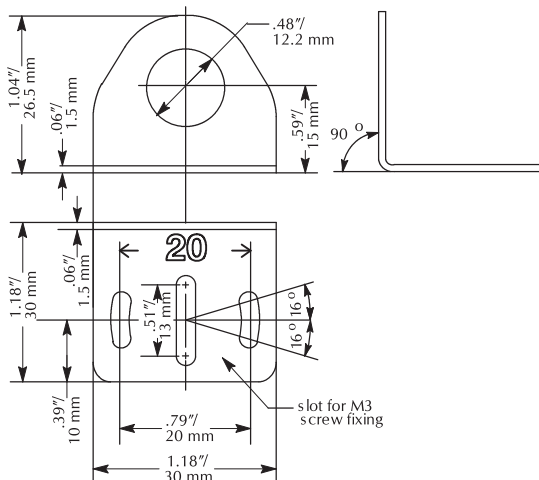


ST12C metal right-angle bracket

Metal 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.





(1 per pack)

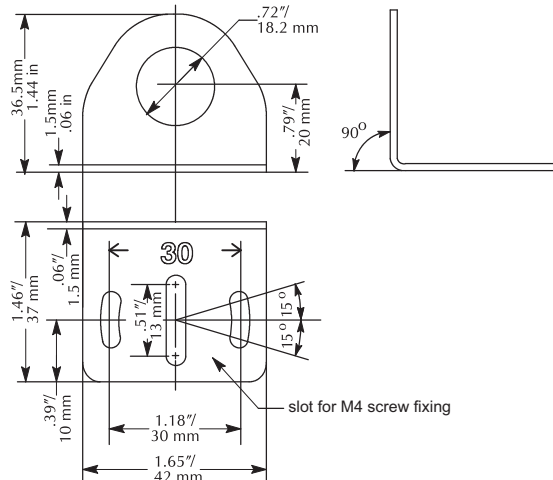


ST18C metal right-angle bracket

Metal 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.




(1 per pack)



Photoelectric Sensor Terminology

Background suppression

These sensors function in an identical manner to energetic diffuse sensors, but using the angle of incidence, rather than the amount of reflected light. For this reason, the operating distance depends only to a slight extent on the target's size, color, or surface nature. The target can therefore be accurately recognized even on a light background.

Break N.C. (normally closed)

This feature causes load current to flow when a target is not detected and not to flow when a target is detected.

Clearance

The photo sensors must not be mutually influenced. For this reason, a minimum distance a between sensors has to be provided. This distance depends strongly upon the model used and the actual sensitivity setting.

Correction factors

The specified operating distance s refers to exactly defined measuring conditions (see sensing distance in specifications tables). Other arrangements generally result in a reduction of the operating distance. When this occurs, a correction factor must be applied.

DC out:

A sensor with two power supply wires and two optically decoupled output terminals. Because of its decoupled static relay, it is capable of offering NPN, PNP, parallel and series configurations as well as interfacing with any input desired. The changeover (make-break) function allows switching from N.O. to N.C. and vice versa by simply reversing the polarity of the power supply leads, allowing complex logical functions.

Diffuse-reflection photo-sensor

With this type of device, the emitter and receiver form part of the same unit. The optical beams are either parallel or slightly converging. The presence of an

object in the optical field causes diffused reflection of the luminous beam. The receiver detects the reflection from the object itself. The reflective properties of the object are important. It is generally possible to reliably detect the presence of any object unless it is perfectly reflective or black. Clear objects with a reflective power of 90% are detected close to the rated operating distance. Dark objects with 18% reflectivity are detected at about half the normal operating distance.

Dual Teach function

Teach 1: With no target present, the operating distance is automatically adjusted to the available background in such a way that the background will not be detected. Thus, with respect to the target, maximum excess light is achieved.

Teach 2: The teach process takes place in two stages; the first on the target, the second on the background. The device subsequently sets the operating distance to an intermediate value. This provides the best results where there is little difference in signal strength between the target and the background. The **Adjust** mode can be used to manually tune the detection zone or to fine tune after using the either Teach function.

Excess light indication

The excess light indication circuit senses the excess radiation power that falls upon the light incidence surface and is processed by the light receiver. The excess light can decrease in time due to dirt, change in the reflection factor of the object, and aging of the emitter diode, so that reliable operation may no longer be guaranteed. Some of the units are therefore equipped with a second LED (green) which lights up when more than approximately 80% of the available operating distance is used. Given this situation in units without the second green LED, the yellow LED will flash. Models with an excessive light output make the excess light signal available to the user for further processing. Unreliable operating conditions may be checked by the control system.

Inductive-load Protection

Unless otherwise stated, DC sensors are fitted with an inductive-load (surge) protection which consists of a diode or Zener diode.

IR light

IR is the abbreviation for InfraRed. This refers to any electromagnetic radiation with a wavelength longer than that of normal visible light (wavelength range approx. 380 to 780 nm). Wavelengths of approx. 780 to 1500 nm are used. IR light cannot be used with plastic fibers due to their high attenuation in this range. Red light is used instead. Usual polarization filters do not work properly in the IR range, therefore red light is also used for reflex sensors.

Leakage current

The leakage current is the current that passes through the output transistor when it is blocked. This must be taken into account, especially in the case of parallel connection of several sensors.

Load resistance

From the selected supply voltage U_B and the specified maximum output current of the photoelectric sensor, the lowest permissible load resistance for trouble-free operation can be calculated. With a voltage of 24V and a specified maximum output current of 200 mA, the minimum load resistance is 120 Ohms; for 15V, the value is 75 Ohms ($R=V/I$). In this example, $120 \text{ Ohms} = 24V/.2A$.

Make-break or complementary function:

A switching element combination that contains one make function and one break function.

In order to establish a relationship between the two different modes, you must distinguish between type D sensors (light diffusion) and types R and T (light reflection or transmission):

Type	Dark operate	Light operate
Diffuse Reflective	N.C.	N.O.
Retroreflective	N.O.	N.C.
Through-beam	N.O.	N.C.

Photoelectric Sensor Terminology

Make N.O. (normally open)

Causes load current to flow when a target is detected and not to flow when a target is not detected.

Open collector

An output transistor is not internally connected to a pull-up or pull-down load in an open collector model. Therefore, it is possible to connect an external load supplied by an external voltage. If the output is not the open-collector type, it is possible for the load to be supplied by an external voltage using a blocking diode in series with the output. This solution increments the output voltage drop.

Optical fibers

An optical fiber consists of:

- A core through which the light is transmitted
- A lining that ensures reflection of the light and keeps it within the core
- A sheath that protects the actual fiber from the outside environment

The light travelling inside the fiber is reflected by the surface separating the core from the lining. This is because the refractive index of the core is greater than that of the lining. In order for a light ray to enter the fiber, it must reach the surface of the fiber with an angle of incidence lower than the critical angle limit, which is the angle beyond which the rays enter the lining and are scattered onto the protective covering.

Standard: OF Series, "uncuttable" fiber, with special connection for MSF amplifier.

Acceptance angle

The acceptance angle is the angle inside which a light ray is accepted by the fiber. It is also the angle with which the light is discharged from the fiber. This angle produces the size of the spot generated by a fiber photocell.

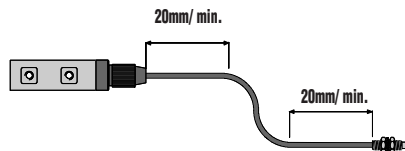
For plastic fibers, the opening angle is 60°; for glass fibers, it is 70°.

Attenuation

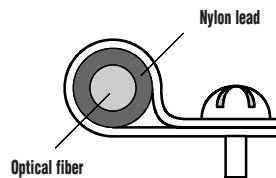
Attenuation is the reduction in signal power caused by the length of the fiber. This parameter must be considered if using fibers with length greater than the standard size.

Installation

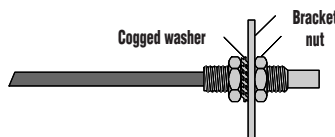
- Do not subject the fibers to a tractive force exceeding 3 kg.
- Keep the radius of curvature as wide as possible.
- Do not bend near the amplifier or termination.
- Secure the fibers using nylon fairleads or cable clamps to avoid causing pressure that could deform the fiber.
- Adjust the ring nut using the following maximum torque wrench settings:
 - M7: 4.5 Nm (39.83 lb-in)
 - M6: 1.2 Nm (10.62 lb-in)
 - M4: 0.8 Nm (7.08 lb-in)
 - M3: 0.8 Nm (7.08 lb-in)
- Set the smooth terminations of the optical fiber using a dowel following the maximum torque wrench settings:



- \varnothing (diameter) = 3 mm: 0.25 Nm (2.2 lb-in)



- \varnothing (diameter) > 3 mm: 0.5 Nm (4.43 lb-in)
- Insert the fiber in the amplifier:
- CF series: loosen the ring nuts on the fiber carriers, insert the two optical fibers in their special seats, push down in order to overcome the resistance of the internal O-ring, then tighten the ring nuts securely.



- OF Series: insert the special termination in the fiber-carrier seat of the MSF amplifier and tighten the ring nut securely.

Please note:

It is important that the minimum radius of curvature be followed to avoid performance loss or breakage of bendable fiber terminations:

- Plastic fiber with core diameter 0.5 mm: Rmin = 5 mm
- Plastic fiber with core diameter 1 mm: Rmin = 10 mm

Overvoltage protection

When an inductive load is switched off, the output voltage (when there is no protection circuit present) rises to such a high value that the output transistor may be destroyed. For this reason, our photo sensors feature a built-in Zener diode at the output, which limits the output voltage to a safe value (3-wire types). When connecting an inductive load with a current greater than 100 mA, and a switching frequency exceeding 10 Hz, the addition of a protective diode placed directly at the load terminal is recommended to limit the power loss of the built-in Zener diode.

Polarity reversal protection

All our photo sensors are protected against polarity reversal at all terminals. However, operation, is only possible if the sensor is connected the right way.

Protection degree

For information on how to define your IP Rating, see the APPENDIX section of this desk reference.

Polarized reflective photoelectric sensor

This is a variant of the reflective photo sensor. A polarizing filter is placed in the emitter's optical path. A polarizing filter in the receiver is oriented at a right angle to the filter in the emitter. This results in the elimination of reflections from surfaces other than the reflector. The light from the reflector possesses a component that is strongly polarized in a perpendicular direction to the incident light. It becomes the only recognizable reflected-light source.

Photoelectric Sensor Terminology

Reflective photoelectric sensor

The emitter and receiver form part of the same unit. The optical beams are parallel. The emitter's luminous beam hits a reflector and is redirected toward the receiver. Detection occurs when the path of the beam is interrupted by the presence of an opaque object. Operating distance mainly depends on the quality of the reflector used and on the optical-beam angle.

Shocks

In accordance with IEC 68-2-27:

- Pulse shape: half-sine
- Peak acceleration: 30g
- Pulse duration: 11ms
- Short circuit protection

All DC devices feature a built-in protection circuit against short-circuits and overloads. Short-circuits between the output and both power supply terminals do not damage the switch and may be applied permanently. The same applies for overloads. During a short-circuit condition, the LEDs do not operate.

Status indicators

The LED indicators can be classified according to color:

Continuous green: Power on

Continuous yellow: Output on

Continuous red: Fault — When there is only one LED, it is usually red and indicates the output state.

Switching element functions

Dark operate

Allows current to flow when the path of the light beam is blocked and will prevent flow when the path of the light beam is not blocked.

Light operate

Allows current to flow when the path of the light beam is not blocked and will prevent flow when the path of the light beam is blocked.

Tightening torque

Over-tightening of the nuts can mechanically damage the photoelectric sensor. The following tightening torques should therefore not be exceeded:

M5 x 1 1.5 Nm

M18 x 1 20 Nm

M30 x 1.5 40 Nm

Through-beam photoelectric sensor

Emitter and receiver are housed in two separate units and are installed one in front of the other. Detection occurs when the path of the beam is interrupted by the presence of an opaque object.

Types of output and load connections

3-wire NPN

There are two power wires and one output wire. The switching element is connected between the output wire and the negative terminal, and the load is connected between the output wire and the positive terminal. In the ON state, the current sinks from the load into the switching element.

3-wire PNP

There are two power wires and one output wire. The switching element is connected between the output wire and the positive terminal, and the load is connected between the output wire and the negative terminal. In the ON state, the current flows from the switching element into the load.

4-wire NPN or PNP

(Programmable output state)

There are two power wires, one N.O./N.C. selection input and one output wire. The output state is programmable, connecting the input wire to one of the power supply lines.

4-wire NPN or PNP

(Complementary outputs)

There are two power wires, one N.O. output and one N.C. output.

4-wire NPN and PNP

There are two power wires and the output type is wiring programmable. The NPN output is available by connecting the PNP terminal to the negative power supply line. The PNP output is available by connecting the NPN terminal to the positive power supply line.

2-wire AC

The two leads make up the switching element itself. In the ON state, with one terminal connected to the phase and the other to the load, current is drawn from the phase line and supplied to the load through the output terminal. The other load terminal is connected to the neutral line.

3-wire AC

These models have two power supply wires and one output. The switching element is connected between output terminal and phase line. In the ON state, current is drawn from the phase line and supplied to the load through the output terminal. The other load terminal is connected to the neutral line.

Vibration

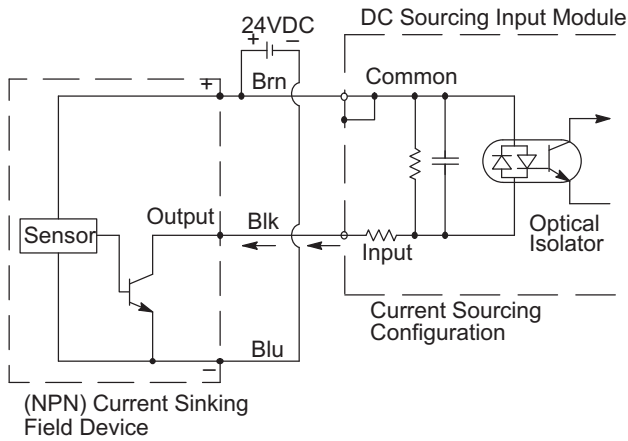
In accordance with IEC 68-2-6:

- Frequency Range: 10-55 Hz
- Amplitude: 1 mm
- Sweep cycle duration: 5 min.
- Duration of endurance at 55 Hz: 30 min. in each of the three axis directions

Photoelectric Sensor Terminology

Field Device Examples - 3 Wire Connections

NPN (Sinking)
Field Device Example



PNP (Sourcing)
Field Device Example

