PHOTOELECTRIC SENSORS

5mm, C5 series
- Power: 10-30 VDC
- Embedded cable or M8 Q/D
- 3 wire, NPN/PNP output
- Fixed sensitivity

12mm, DM series
- Power: 10-30 VDC
- Embedded cable or M12 Q/D
- 4 wire, NPN/PNP output, LO/DO selectable
- Teach auto calibration

18mm non-metal, SS/MS/MV series
- Power: 10-30 VDC or 20-250VAC
- Embedded cable or M12 Q/D
- 4 wire, NPN/PNP output, LO/DO selectable, triac output
- Fixed sensitivity

18mm metal, C18 series
- Power: 10-30 VDC
- Embedded cable or M12 Q/D
- 3 wire, NPN/PNP output
- Adjustable sensitivity

18mm right angle, C18 series
- Power: 10-30 VDC
- Embedded cable or M12 Q/D
- 3 wire, NPN/PNP output
- Adjustable sensitivity

18mm non-metal, FA series
- Power: 10-30 VDC
- Embedded cable or M12 Q/D
- 4 wire, NPN/PNP output, LO/DO selectable
- Laser or LED, fixed sensitivity

AC rectangular, FG series
- Universal voltage, 12-240 VAC/VDC
- Embedded cable
- 3A SPDT relay output
- Adjustable sensitivity

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

DC rectangular, CX series
- Power: 10-30VDC
- Embedded cable or M8 Q/D
- 3 wire, NPN/PNP output
- Adjustable sensitivity

DC rectangular, QX series
- Power: 10-30 VDC
- Embedded cable or M12 Q/D
- 4 wire, NPN/PNP output, LO/DO selectable
- Fixed sensitivity

Din rail fiber amplifier, DFP series
- Power: 10-30 VDC
- Embedded cable or M8 Q/D
- 3 wire, NPN/PNP output, LO/DO selectable via user interface
- Adjustable sensitivity via user interface

Din rail fiber amplifier, DFT series
- Power: 10-30 VDC
- Embedded cable or M8 Q/D
- 3 wire, NPN/PNP output, LO/DO selectable via user interface
- Teach auto calibration (2 levels)

18mm fiber amplifier, SSF series
- Power: 10-30 VDC
- Embedded cable or M12 Q/D
- 4 wire, NPN/PNP output, LO/DO selectable
- Teach auto calibration

Cuttable fibers, CF series
- 2.2mm ∅ Diameter
- Length 2 m, field cuttable
- Use with DFP/DFT/SSF series

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

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	· Most accurate · Longest sensing range · Very reliable	· Must install at two points on system: emitter and receiver · Costly - must purchase both emitter and receiver
Reflective	· Cost less than through-beam · Only slightly less accu rate than through-beam · Sensing range better than diffuse · Very reliable	· Must install at two points on system: sensor and reflector · Slightly more costly than diffuse · Sensing range less than through-beam
Diffuse	· Only install at one point · Cost less than through-beam or reflective	· Less accurate than through-beam or reflective · More setup time involved
Background Suppression	· Effective with reflective backgrounds	· 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. That is why AUTOMATIONDIRECT offers this sensor in many varieties, at a cost anyone can afford. 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 12 mm metal sensors in diffuse, through-beam and polarized reflective styles, and 5 mm diffuse and through-beam models.

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.

Rectangular Styles for Unique Mounting Needs

Ultimately, everything comes down to maximizing time and minimizing cost. We've developed our product offering with these issues in mind. Here's how our rectangular sensors can help you save time and money:

- 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.
- All sensors contain adjustment potentiometers and double-alignment LEDs. This simplifies installation and setup time and allows for customization to your specific application.
- The CX series is completely sealed with potting and has an IP65, watertight rating. This increases the life of the sensor and eliminates the concern for accidental contact that may destroy the sensor.
- The FG series offers universal voltages with a 3A relay output

Fiber Optic Sensors

DFT and DPT Series Amplifiers

- Less than 10 mm thick
- Accepts industry standard 2.2∅ mm fibers (CF series)
- Output on/off indicator
- Signal strength indicator
- Easy programming user interface
- Swiss made precision
- Dual level teach automatic calibration
- Remote trigger of teach function through digital input
- Fine adjustment to customize to most applications
- 10-30 VDC input
- Built-in, adjustable timer functions
- High switching frequency (1.5 kHz) can handle faster applications
- Sensing technology that has accuracy from 20 mm to 200 mm
- No blind zone makes it easier to design into application
- CE approved

SSF Series Amplifiers

- 18mm round style
- Teach automatic calibration
- 4-wire output, selectable light-on or dark-on
- IP67 rated

CF Series industry standard 2.2 mm∅ cuttable fibers

- Diffuse reflective or through-beam
- 50 mm to 1800 mm sensing distances
- M3, M4, M6 and M7 sensor head sizes
- Axial angle, 90 degree angle and axial with bendable light tube models
- Fiber core diameters of 0.5 mm, 1.0 mm and 1.5 mm
- IEC IP67

MSF Series Amplifiers

- 18 mm round amplifiers
- Plug and play fibers, no cutting required
- Diffuse or through-beam
- 4-wire, fully selectable NPN/PNP or NO/NC
- 4 mm, 6 mm, and 7 mm fiber heads
- IP67 (submersible) rating

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
- Round and rectangular reflectors in many sizes
- Photoelectric shutters that focus your photoelectric sensor on small targets
- Right-angle adapters for special mounting applications

CUSTOM DESIGNED SENSORS

Custom designed sensors for your challenging applications

AUTOMATIONDIRECT and Microdetectors (MD) have been partners in the sensor business for over 5 years. MD is located in Italy and has been in business for over 30 years. With high quality processes, including UL/CE design procedures, AUTOMATIONDIRECT and MD supply the North American market with industrial quality sensors at a very reasonable price. Based on this engineering quality and engineering design capabilities, MD and AUTOMATIONDIRECT are now offering the opportunity for customized products for your special application needs.

The MD Custom Design Service can add value to your products by implementing sensing technology ranging from optoelectronics to RFID.

MD is committed to providing the highest quality, craftsmanship and flexibility to provide exactly what you need.

Call 1-800-633-0405 to ask about custom-designed sensors.

Micro Detectors

MD has co-designed the following applications:

- Linear optical encoder
- Through-beam sensor for lift applications
- Tobacco sensor
- Moisture sensor for ceramic industry
- Bar code reader for domestic and household appliances field

Photoelectric Sensors Selection Guide




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: 2m Reflective models: 20m Through-beam: 50m	Diffuse models: 100mm, 200mm, 400mm Reflective models: 2m Through-beam models: 8m	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 Though-beam models 25Hz	80Hz
Rating	IEC IP67	IEC IP67	IEC IP67	IEC IP67
Page	17–10	17–13	17–16	17–19




Specification	MV Series AC	C5 Series DC	DM Series DC	C18 Series DC
Description	18mm plastic, AC	5mm stainless steel, DC	12mm nickel-plated brass with Teach operating distance function, DC	18mm nickel-plated brass, DC
Sensing Distances	Diffuse: 100mm, 200mm, 400mm Reflective: 3m Through-beam: 16m	Diffuse models: 50mm Through-beam models: 250mm	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: 2m Through-beam models: Up to 6m
Output State	N.O./ receiver dependent	N.O. / receiver dependent	Diffuse: N.O./ N.C. selectable Polarized reflective: N.O./ N.C. selectable Through-beam: N.O / N.C./ receiver dependent	N.O.
Logic Output	Triac	NPN / PNP/ N.O. only	NPN / PNP	NPN / PNP / receiver dependent
Connection Type	Axial cable / M12 connector	Axial cable/M8 connector	Axial cable / M12 connector	Axial cable/M12 connector
Supply Voltage	20-253VAC	10-30VDC	10-30VDC	10-36VDC
Switching Frequency	25Hz	250Hz	Diffuse and reflective models: 400Hz Though-beam models: 250Hz	Diffuse models:1kHz Diffuse models w/ background suppression: 500Hz Reflective models:1kHz Through-beam models: 1kHz
Rating	IEC IP67	IEC IP67	IEC IP67	IEC IP67
Page	17–21	17–24	17–26	17–29

PHOTOELECTRIC SENSORS SELECTION GUIDE




Specification	FE Series DC	CX Series DC	QX Series DC	FG Series AC/DC
Description	Mini-rectangular plastic, DC	Mini-rectangular plastic, DC	Rectangular plastic, DC	Rectangular plastic, AC/DC
Sensing Distances	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: 2m Through-beam models: 8m	Diffuse models: 550mm Reflective models: 9m Through-beam: 20m
Output State	Light-on / Dark-on selectable	N.O.	N.O./receiver dependent	SPDT 3A relay
Logic Output	NPN / PNP	NPN / PNP	NPN / PNP selectable / receiver dependent	-
Connection Type	Axial cable / M12 connector	Axial cable / M8 connector	Axial cable / M12 connector	Axial cable
Supply Voltage	10-30VDC	10-36VDC	10.8-30VDC	12-240VDC / 24-240VAC
Switching Frequency	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)	33Hz
Rating	IEC IP67	IEC IP65	IEC IP65	IEC IP67
Page	17–32	17–34	17–36	17–39




Specification	DFT Series Fiber Amp	DFP Series Fiber Amp	SSF Series Fiber Amp	MSF 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	18mm plastic fiber optic amplifier, DC (only the fibers below can be used with MSF series amplifiers)
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	OF-SC1 Diffuse reflective: 200mm OF-SR1 Through-beam: 40mm OF-SR2 Through-beam:400mm
Output State	Light-on / Dark-on selectable	Light-on / Dark-on selectable	Light-on / Dark-on selectable	N.O./N.C. selectable
Logic Output	NPN / PNP	NPN / PNP	NPN / PNP	NPN / PNP selectable
Connection Type	Axial cable / M8 connector	Axial cable / M8 connector	Axial cable / M12 connector	Axial cable / M12 connector
Supply Voltage	10-30VDC	10-30VDC	10-30VDC	10-30VDC
Switching Frequency	1.5kHz	1.5kHz	800Hz	500Hz
Rating	IEC IP64	IEC IP64	IEC IP67	IEC IP67
Page	17–41	17–42	17–43	17–48

Photoelectric Sensors Selection Guide

Specification	CF Series Optical Fibers	BX Series Light Screen
Description	Cuttable 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	Complementary N.O / N.C.
Logic Output	N/A	NPN / PNP
Connection Type	N/A	M12 connector
Supply Voltage	N/A	10-30VDC
Switching Frequency	N/A	-
Rating	IEC IP67	IEC IP67
Page	17–44	17–50

FA Series LED Photoelectric Sensors

M18 (18mm) 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		check	1m (39.37in)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Figure 1	Chart 1
FAI8-BP-0A		check			PNP	2m (6.5) axial cable	Figure 1	Chart 1
FAI8-BN-0E		check			NPN	M12 (12mm) connector	Figure 2	Chart 1
FAI8-BP-0E		check			PNP	M12 (12mm) connector	Figure 2	Chart 1
Polarized reflective*								
FARN-BN-0A		check	3m (118.11in)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Figure 1	Chart 2
FARN-BP-0A		check			PNP	2m (6.5) axial cable	Figure 1	Chart 2
FARN-BN-0E		check			NPN	M12 (12mm) connector	Figure 2	Chart 2
FARN-BP-0E		check			PNP	M12 (12mm) connector	Figure 2	Chart 2
Through-beam **								
FAID-BN-0A	Receiver	check	20m (65.62ft)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Figure 1	Chart 3
FAID-BP-0A	Receiver	check			PNP	2m (6.5) axial cable	Figure 1	Chart 3
FAID-BN-0E	Receiver	check			NPN	M12 (12mm) connector	Figure 2	Chart 3
FAID-BP-0E	Receiver	check			PNP	M12 (12mm) connector	Figure 2	Chart 3
FAIH-00-0A	Emitter	check			Receiver dependent	2m (6.5) axial cable	Figure 1	Chart 3
FAIH-00-0E	Emitter	check				M12 (12mm) connector	Figure 2	Chart 3

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

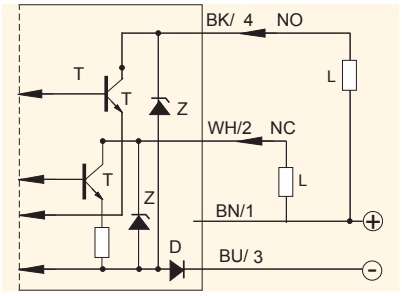
**Purchase one receiver and one emitter for a complete set.

Cables and Accessories

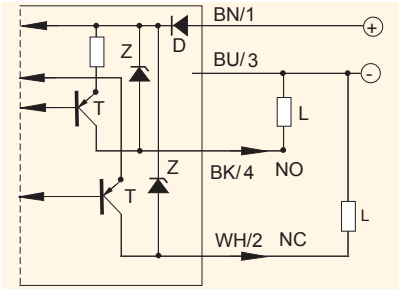
Cables and accessories can be found starting on page 17–51.

Wiring diagrams

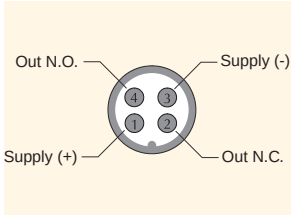
NPN Output



PNP Output



M12 connector



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	40Nm (29ft./lb.)		
Weight	100g (3.53 oz)		Emitter + Receiver 200g (7.05 oz)

[1] With 100x100mm white matte paper
[2] With standard Ø84mm RL110 reflector
[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

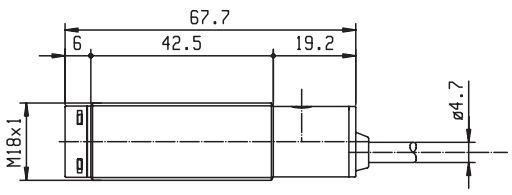
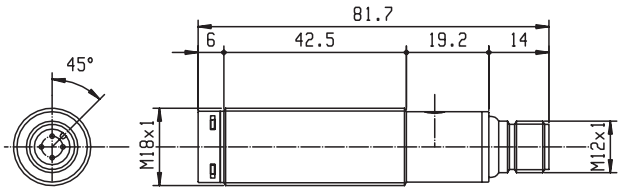


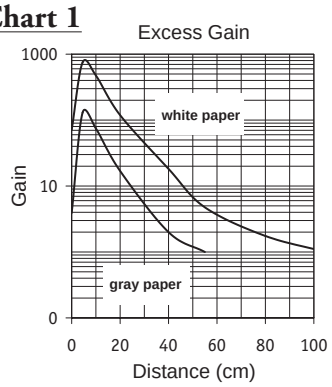
Figure 2



FA Series LED Photoelectric Sensors

Characteristic curves

Chart 1



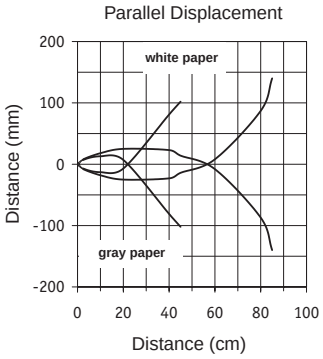
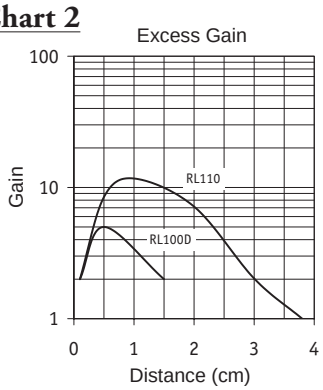


Chart 2



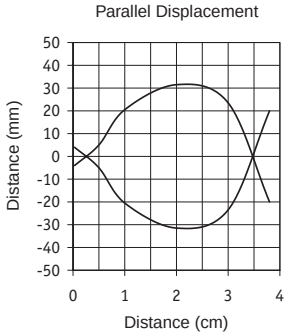
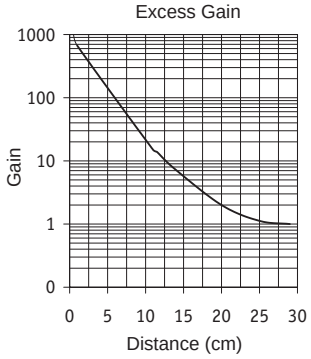
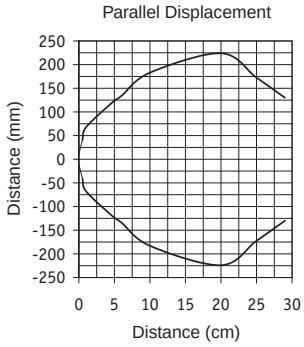


Chart 3





FA Series Laser Photoelectric Sensors

M18 (18mm) 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		check	2m (78.74in)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Figure 1	Chart 1
FAL4-BP-0A		check			PNP	2m (6.5) axial cable	Figure 1	Chart 1
FAL4-BN-0E		check			NPN	M12 (12mm) connector	Figure 2	Chart 1
FAL4-BP-0E		check			PNP	M12 (12mm) connector	Figure 2	Chart 1
Polarized reflective*								
FALN-BN-0A		check	20m (65.61ft) with RL110 30m (98.43ft) with RL201	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Figure 1	Chart 2
FALN-BP-0A		check			PNP	2m (6.5) axial cable	Figure 1	Chart 2
FALN-BN-0E		check			NPN	M12 (12mm) connector	Figure 2	Chart 2
FALN-BP-0E		check			PNP	M12 (12mm) connector	Figure 2	Chart 2
Through-beam**								
FALD-BN-0A	Receiver	check	50m (164.04ft)	Complementary N.O./N.C.	NPN	2m (6.5) axial cable	Figure 1	Chart 3
FALD-BP-0A	Receiver	check			PNP	2m (6.5) axial cable	Figure 1	Chart 3
FALD-BN-0E	Receiver	check			NPN	M12 (12mm) connector	Figure 2	Chart 3
FALD-BP-0E	Receiver	check			PNP	M12 (12mm) connector	Figure 2	Chart 3
FALH-X0-0A	Emitter	check			Receiver dependent	2m (6.5) axial cable	Figure 1	Chart 3
FALH-X0-0E	Emitter	check				M12 (12mm) connector	Figure 2	Chart 3

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

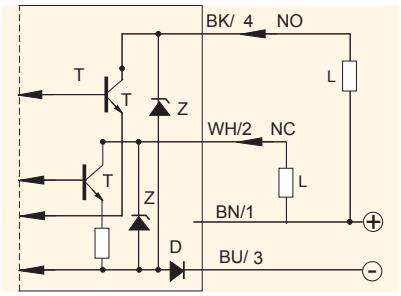
**Purchase one receiver and one emitter for a complete set.

Cables and Accessories

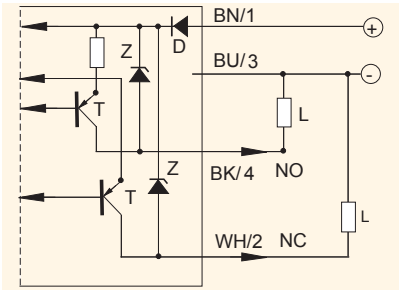
Cables and accessories can be found starting on page 17–51.

Wiring diagrams

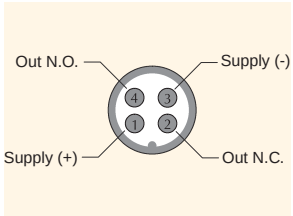
NPN Output



PNP Output



M12 connector



FA Series Laser Photoelectric Sensors

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflection[3]	Through-beam[4]
Sensing Distance	2m[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	40Nm(29ft./lb.)		
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.

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

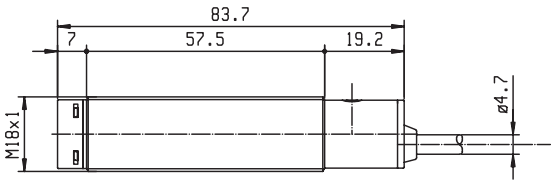
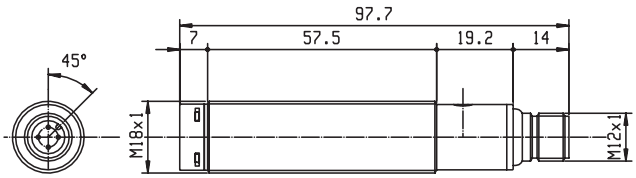
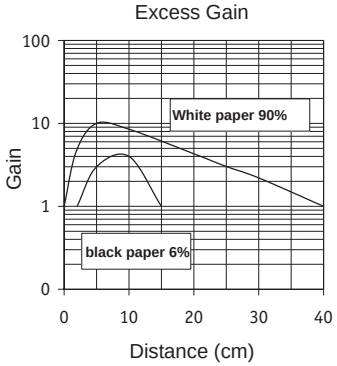


Figure 2



Characteristic curves

Chart 1



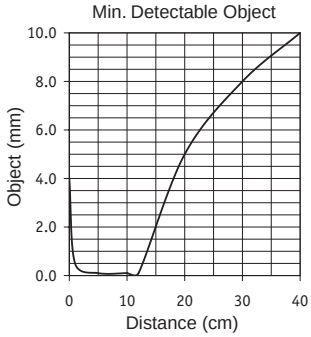
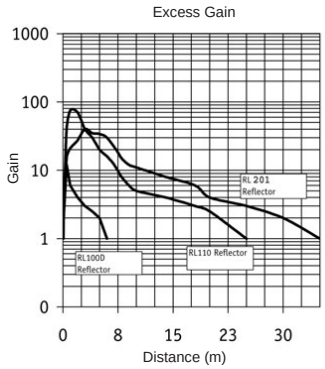
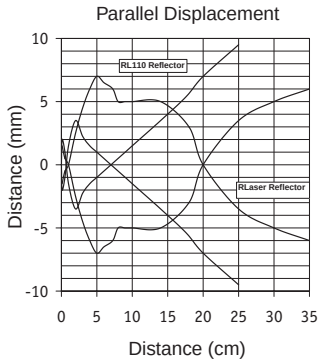


Chart 2





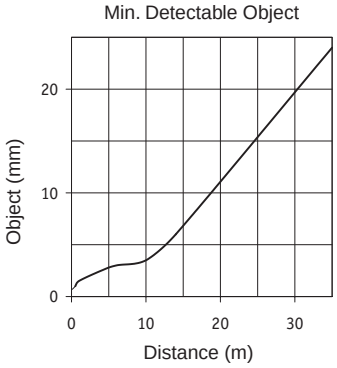
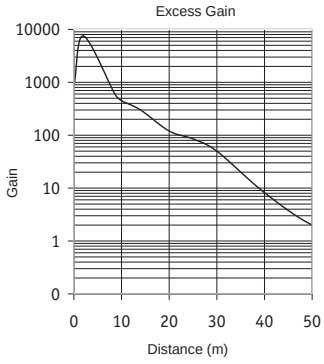
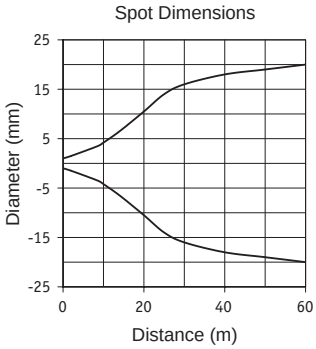


Chart 3





SS Series Photoelectric Sensors

M18 (18mm) 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

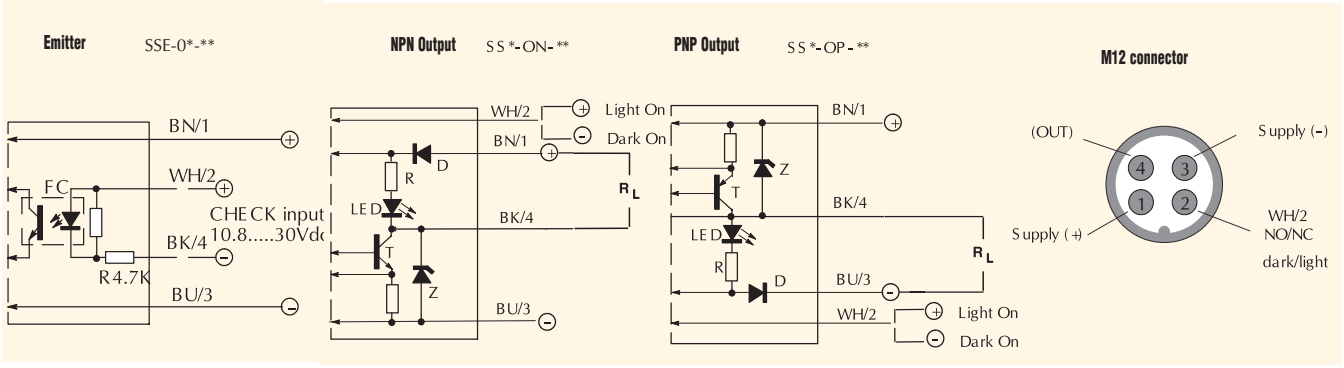
SS Series Photoelectric Sensor Selection Chart

Part Number		Sensing Range	Output State*	Logic	Connection	Dimensions	Characteristic Curves	Price
Diffuse								
SS2-0N-4A		100mm (3.9 in.)	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Figure 1	Chart Set 1	check
SS2-0P-4A				PNP	2m (6.5') axial cable	Figure 1	Chart Set 1	check
SS2-0N-4E				NPN	M12 (12mm) connector	Figure 2	Chart Set 1	check
SS2-0P-4E				PNP	M12 (12mm) connector	Figure 2	Chart Set 1	check
SS5-0N-4A		200mm (7.9 in.)	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Figure 1	Chart Set 2	check
SS5-0P-4A				PNP	2m (6.5') axial cable	Figure 1	Chart Set 2	check
SS5-0N-4E				NPN	M12 (12mm) connector	Figure 2	Chart Set 2	check
SS5-0P-4E				PNP	M12 (12mm) connector	Figure 2	Chart Set 2	check
SS6-0N-4A		400mm (15.7 in.)	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Figure 1	Chart Set 3	check
SS6-0P-4A				PNP	2m (6.5') axial cable	Figure 1	Chart Set 3	check
SS6-0N-4E				NPN	M12 (12mm) connector	Figure 2	Chart Set 3	check
SS6-0P-4E				PNP	M12 (12mm) connector	Figure 2	Chart Set 3	check
Polarized reflective								
SSP-0N-4A		2m (6.6 ft)	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Figure 1	Chart Set 4	check
SSP-0P-4A				PNP	2m (6.5') axial cable	Figure 1	Chart Set 4	check
SSP-0N-4E				NPN	M12 (12mm) connector	Figure 2	Chart Set 4	check
SSP-0P-4E				PNP	M12 (12mm) connector	Figure 2	Chart Set 4	check
Through-beam								
SSR-0N-4A	Receiver	8m (26.2 ft)	N.O./N.C. selectable	NPN	2m (6.5') axial cable	Figure 1	Chart Set 5	check
SSR-0P-4A	Receiver			PNP	2m (6.5') axial cable	Figure 1	Chart Set 5	check
SSR-0N-4E	Receiver			NPN	M12 (12mm) connector	Figure 2	Chart Set 5	check
SSR-0P-4E	Receiver			PNP	M12 (12mm) connector	Figure 2	Chart Set 5	check
SSE-00-4A	Emitter		Receiver dependent	Receiver dependent	2m (6.5') axial cable	Figure 1	Chart Set 5	check
SSE-00-4E	Emitter				M12 (12mm) connector	Figure 2	Chart Set 5	check

Cables and accessories

Cables and accessories can be found starting on page 17–51.

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

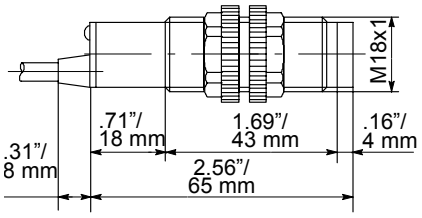
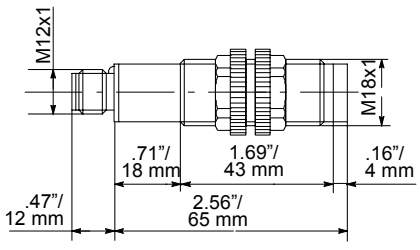


Figure 2

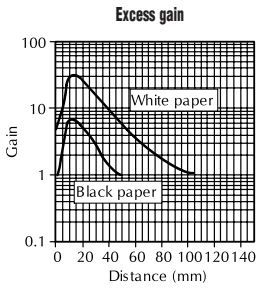


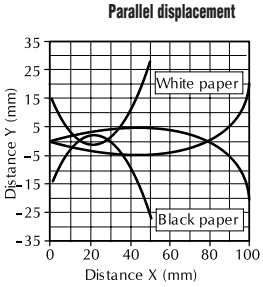
Switching Element Function		
	Retroreflective Models	*Diffuse Reflective Models*
Light on	N.C.	N.O.
Dark on	N.O.	N.C.

SS Series Photoelectric Sensors

Characteristic curves

Chart Set 1





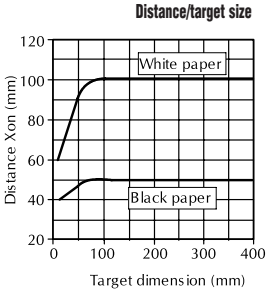
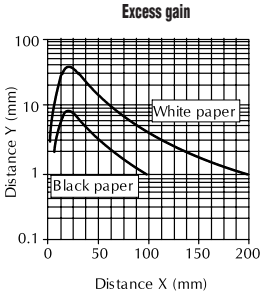
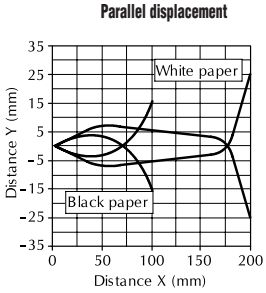


Chart Set 2





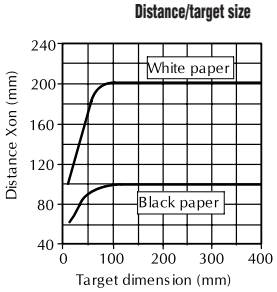
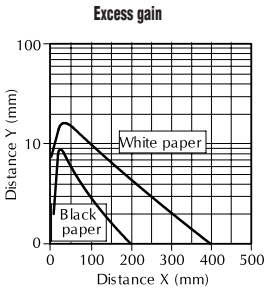
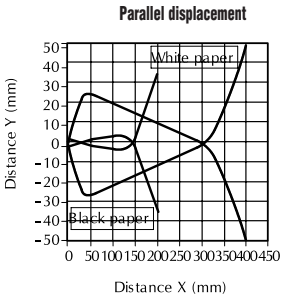


Chart Set 3





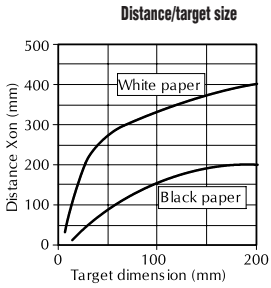
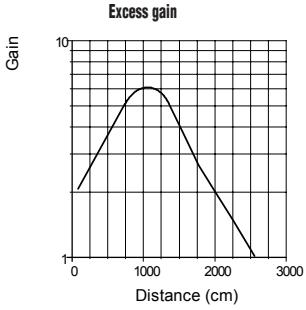


Chart Set 4



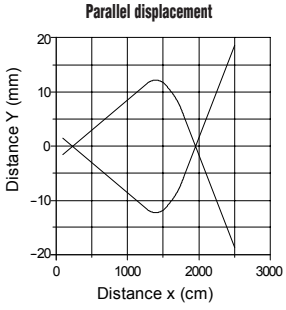
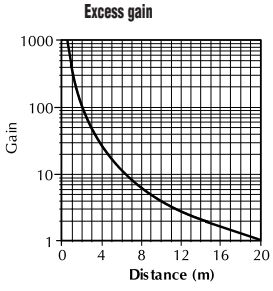
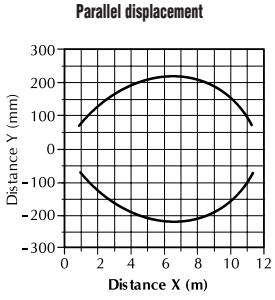
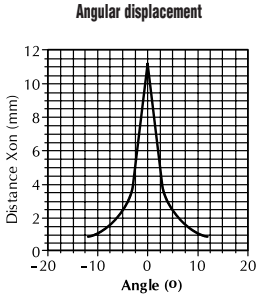
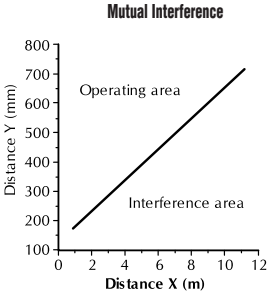


Chart Set 5









MS Series Photoelectric Sensors

M18 (18mm) 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

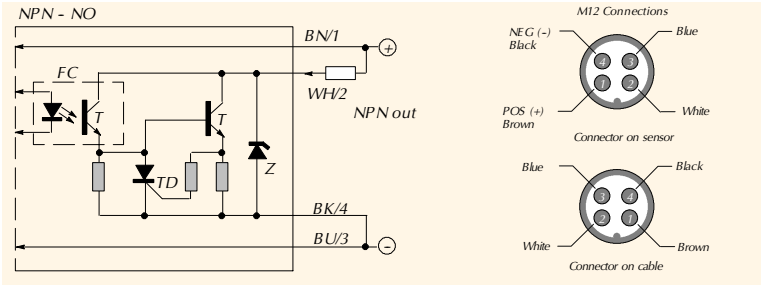
MS Series Photoelectric Selection Chart

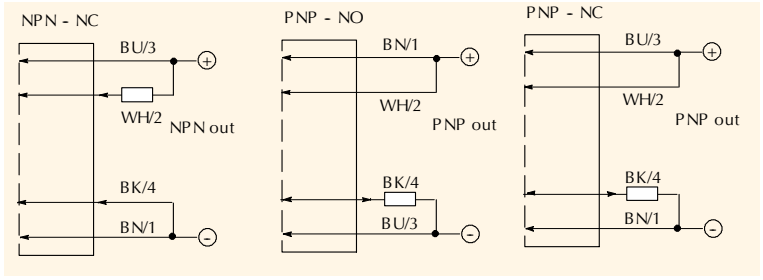
Part Number	Price	Sensing Range	Output State	Logic	Connection	Dimensions	Characteristic Curves
MS0-00-0A	check	50mm (1.97in)	N.O./N.C. selectable	NPN/PNP selectable	2m (6.5') axial cable	Figure 1	Chart 1
MS0-00-0E	check				M12 (12mm) connector	Figure 2	Chart 1
MS1-00-0A	check	100mm (3.94in)	N.O./N.C.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

Cables and Accessories

Cables and accessories can be found starting on page 17–51.

Wiring diagrams





Dimensions

Figure 1

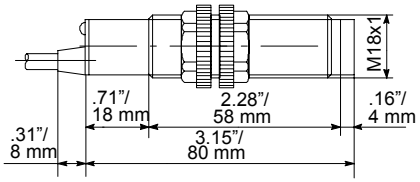
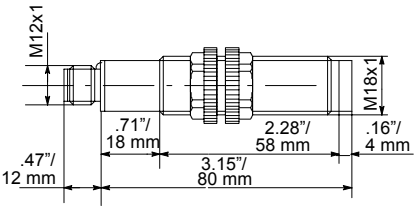


Figure 2



Characteristic curves

Chart 1

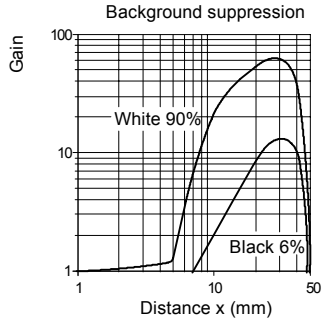
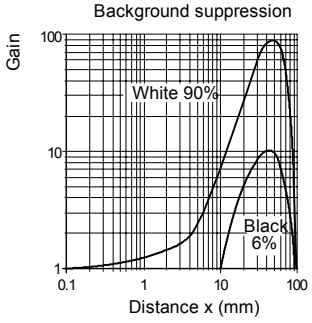


Chart 2



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

MV Series AC Powered Photoelectric Sensors

M18 (18mm) plastic- AC

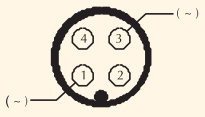
- 12 models available
- Diffuse, polarized reflective, and through-beam models
- Plastic housing
- Axial cable or M12 quick-disconnect models
- Operates on 20 to 253 VAC
- IP67 rated

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

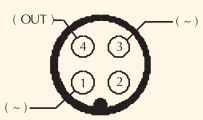
*Receivers include one round reflector (84mm dia.). Purchase additional reflectors separately.
**Purchase one receiver and one emitter for a complete set.

Wiring diagrams

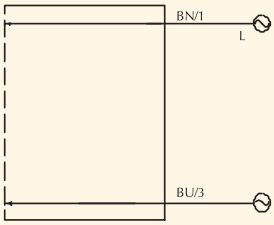
M12 Connectors



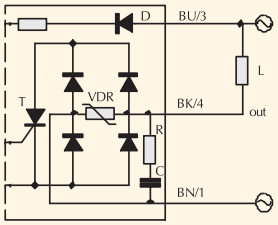
M12 connector on emitter



M12 connector



Emitter



AC Output

Cables and Accessories

Cables and accessories can be found starting on page 17–51.

Dimensions

Figure 1

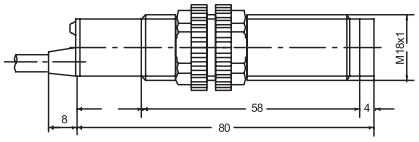
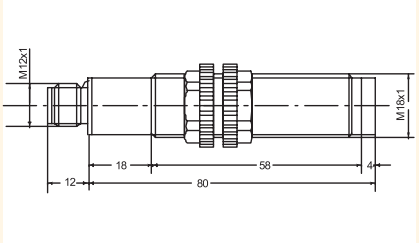


Figure 2



MV Series AC Powered Photoelectric Sensors

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Retroreflective[4]	Through-beam[5]
Sensing Distance	MV2 models: 100mm[1] MV4 models: 200mm[1,2] 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

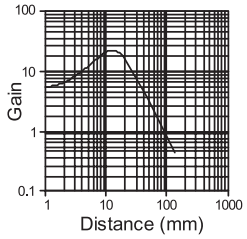
[1] With 100x100mm white matte paper
[2] With 200x200mm white matte paper
[3] With standard Ø84mm RL110 reflector
[4] Each sensor includes one 84mm round reflector (RL110). Purchase additional reflectors separately.
[5] An emitter (SSE) and receiver (SSR) pair must be ordered for a complete sensor set.

MV Series AC Powered Photoelectric Sensors

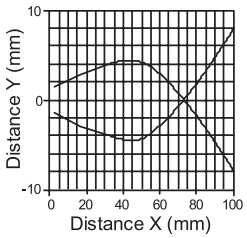
Characteristic curves

Chart 1

Excess gain



Parallel displacement



Distance / target size

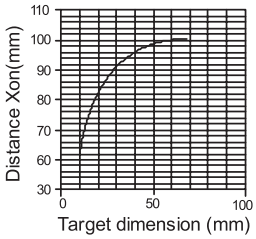
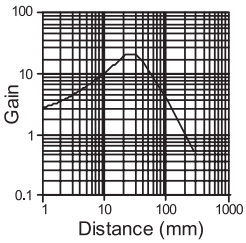
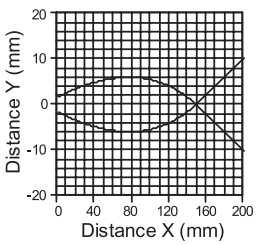


Chart 2

Excess gain



Parallel displacement



Distance / target size

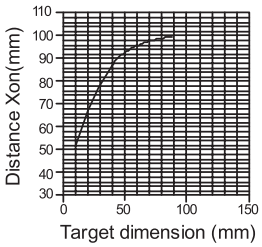
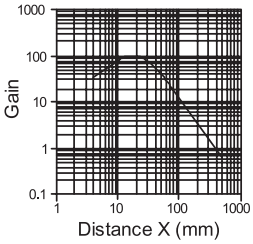
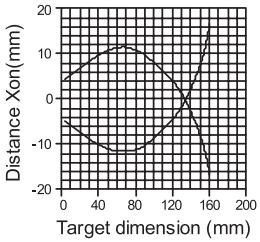


Chart 3

Excess gain



Parallel displacement



Distance / target size

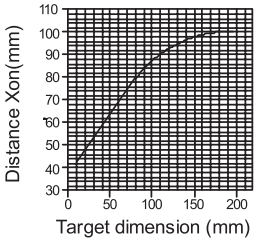
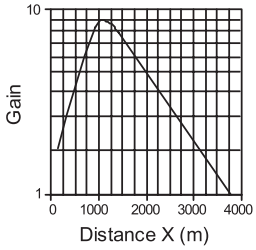


Chart 4

Excess gain



Parallel displacement

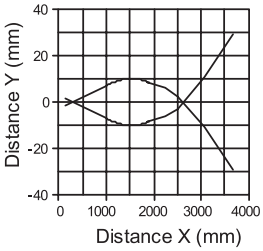
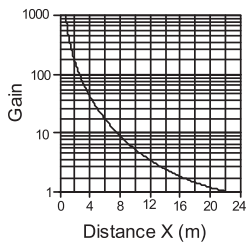
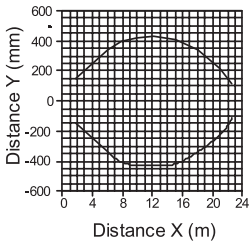


Chart 5

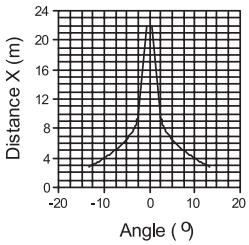
Excess gain



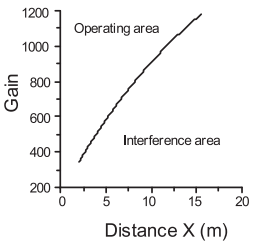
Parallel displacement



Angular displacement



Mutual interference



C5 Series Stainless Steel Photoelectric Sensors

M5 (5mm) 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	check
C5D-AP-1A				PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 1	check
5D-AN-1F				NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 1	check
C5D-AP-1F				PNP	M8 (8mm) connector	Diagram 1	Figure 2	Chart 1	check
C5D-AN-2A		10mm (0.40in)		NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3	check
C5D-AP-2A				PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3	check
C5D-AN-3A		20mm (0.79in)[1]		NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 4	check
C5D-AP-3A				PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 4	check
Through-beam									
C5R-AN-1A	Receiver	250mm (9.84in)	N.O.	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 2	check
C5R-AP-1A	Receiver			PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 2	check
C5R-AN-1F	Receiver			NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 2	check
C5R-AP-1F	Receiver			PNP	M8 (8mm) connector	Diagram 1	Figure 2	Chart 2	check
C5E-0N-1A	Emitter		Receiver dependent	Receiver dependent	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 2	check
C5E-0N-1F	Emitter				M8 (8mm) connector	Diagram 2	Figure 2	Chart 2	check

[1] With 100x100mm white matte paper

Wiring diagrams

Diagram 1

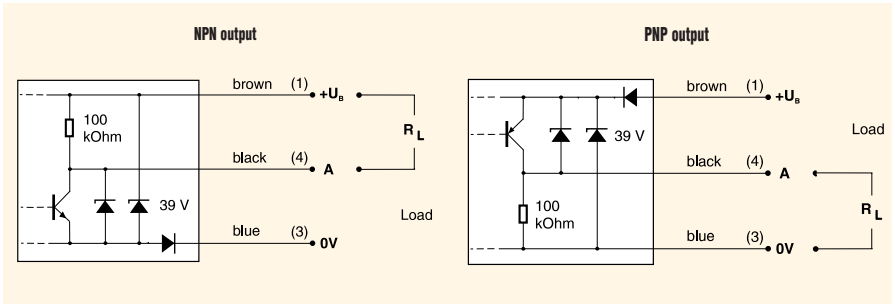
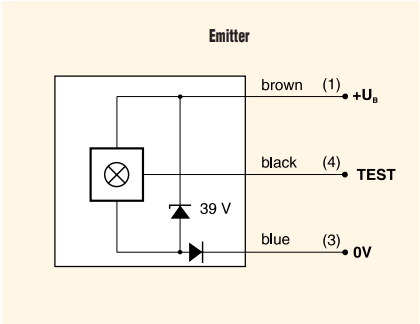
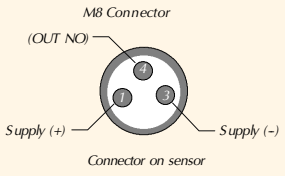


Diagram 2



Connector



Cables and Accessories

Cables and accessories can be found starting on page 17–51

C5 Series Stainless Steel Photoelectric Sensors

Specifications	Diffuse and Through-beam Models
Emission	Infrared (880nm)
Differential Travel	≤10%
Operating Voltage	10-30VDC
Ripple	≤20%
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 400050)	IEC IP67
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

Figure 1

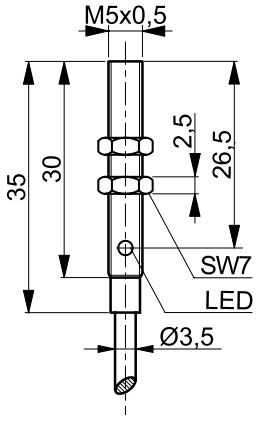
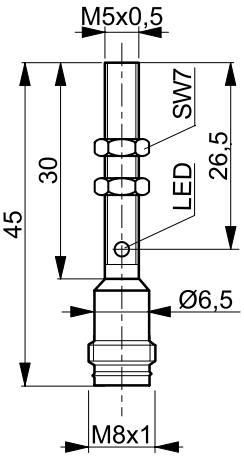


Figure 2



Characteristic curves

Chart 1

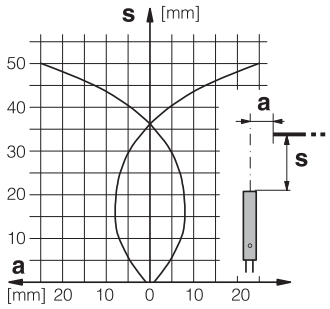


Chart 2

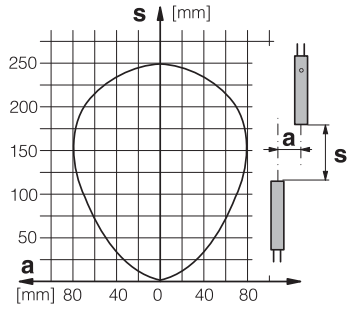


Chart 3

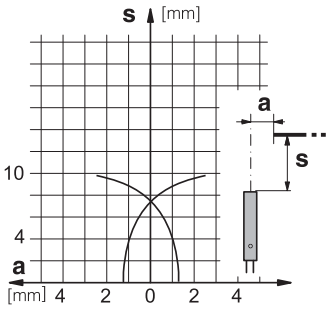
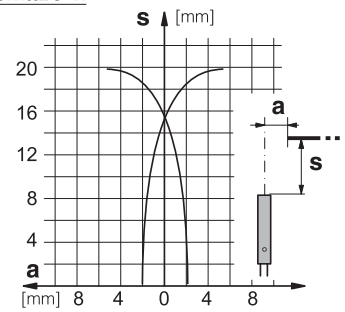


Chart 4



DM Series Photoelectric Sensors

M12 (12mm) 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 can be found starting on page 17–51.

DM Series Photoelectric Sensors Selection Chart

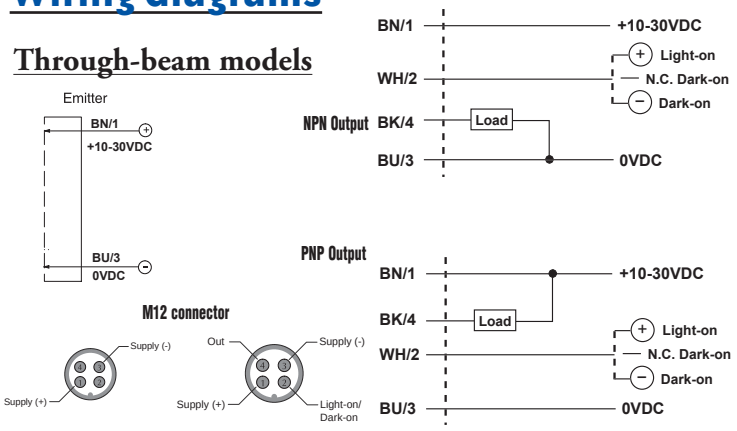
Part Number		Price	Sensing Range	Output State	Logic	Connection	Dimensions	Characteristic Curves
Diffuse								
DM3-0N-1A		check	Up to 100mm (3.9 in.)	Light on / Dark on Selectable	NPN	2m (6.5) axial cable	Figure 1	Chart 1
DM3-0P-1A		check			PNP	2m (6.5) axial cable	Figure 1	Chart 1
DM3-0N-1H		check			NPN	M12 (12mm) connector	Figure 2	Chart 1
DM3-0P-1H		check			PNP	M12 (12mm) connector	Figure 2	Chart 1
DM7-0N-1A		check	Up to 300mm (11.8 in.)	Light on / Dark on Selectable	NPN	2m (6.5) axial cable	Figure 1	Chart 2
DM7-0P-1A		check			PNP	2m (6.5) axial cable	Figure 1	Chart 2
DM7-0N-1H		check			NPN	M12 (12mm) connector	Figure 2	Chart 2
DM7-0P-1H		check			PNP	M12 (12mm) connector	Figure 2	Chart 2
Polarized reflective*								
DMP-0N-1A		check	Up to 2m (6.6 ft)	Light on / Dark on Selectable	NPN	2m (6.5) axial cable	Figure 1	Chart 3
DMP-0P-1A		check			PNP	2m (6.5) axial cable	Figure 1	Chart 3
DMP-0N-1H		check			NPN	M12 (12mm) connector	Figure 2	Chart 3
DMP-0P-1H		check			PNP	M12 (12mm) connector	Figure 2	Chart 3
Through-beam**								
DMR-0N-1A	Receiver	check	Up to 4m (13.1 ft)	Light on / Dark on Selectable	NPN	2m (6.5) axial cable	Figure 1	Chart 4
DMR-0P-1A	Receiver	check			PNP	2m (6.5) axial cable	Figure 1	Chart 4
DMR-0N-1H	Receiver	check			NPN	M12 (12mm) connector	Figure 2	Chart 4
DMR-0P-1H	Receiver	check			PNP	M12 (12mm) connector	Figure 2	Chart 4
DME-00-1A	Emitter	check			Receiver dependent	2m (6.5) axial cable	Figure 1	Chart 4
DME-00-1H	Emitter	check				M12 (12mm) connector	Figure 2	Chart 4

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

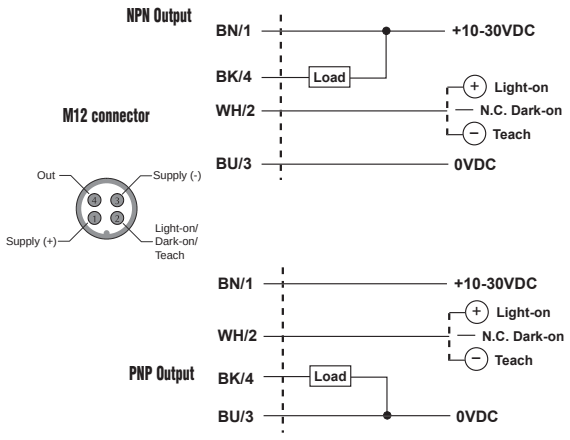
**Purchase one receiver and one emitter for a complete set.

Wiring diagrams

Through-beam models



Diffuse / polarized reflective models



Check input test circuit. 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.

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/+70°		
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

Figure 1

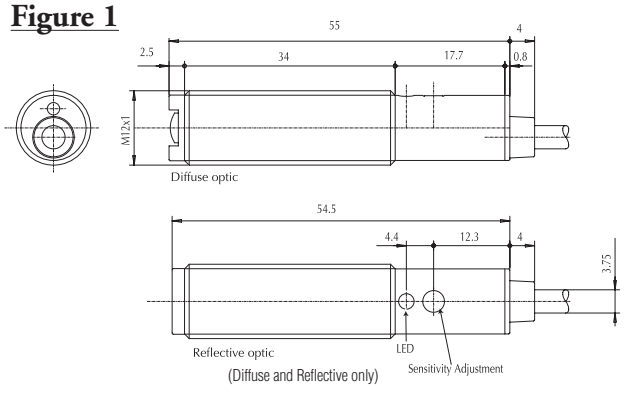
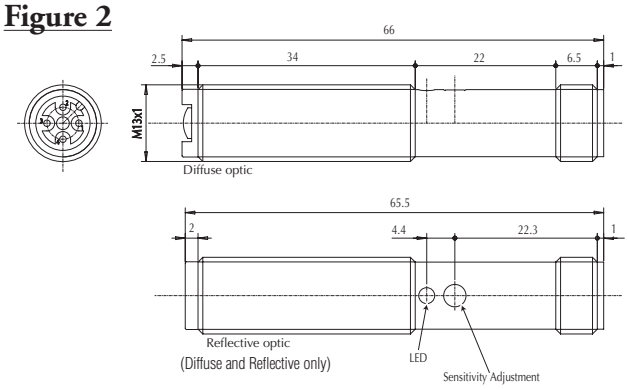


Figure 2

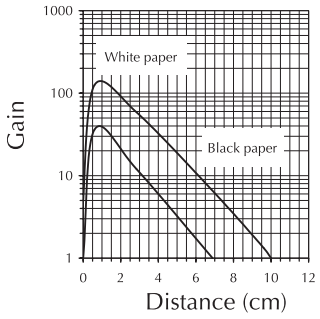


DM Series Photoelectric Sensors

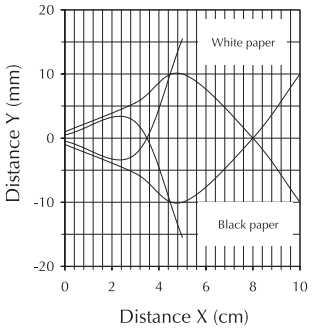
Characteristic curves

Chart 1

Excess Gain



Parallel displacement



Sensitivity adjustment

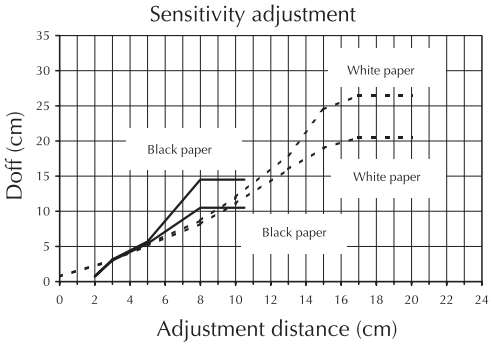
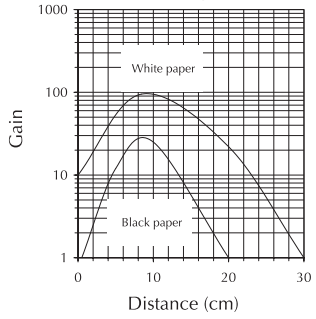
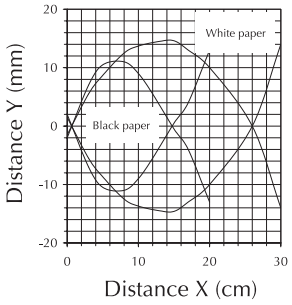


Chart 2

Excess gain



Parallel diplacement



Sensitivity adjustment

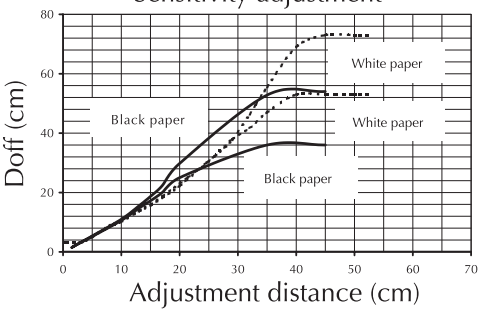
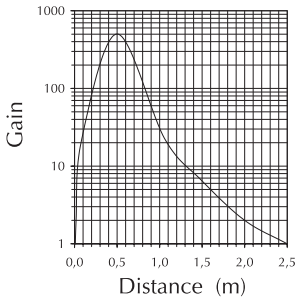
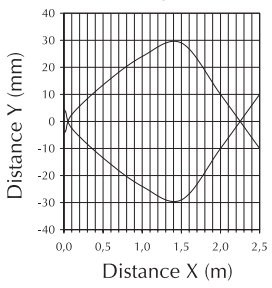


Chart 3

Excess gain



Parallel displacement



C18 Series Photoelectric Sensors

M18 (18mm) metal – DC

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

Cables and Accessories

Cables and accessories can be found starting on page 17–51.

C18 Series Photoelectric Sensor Selection Chart

Part Number		Sensing Range	Output State	Optics	Logic	Connection	Wiring	Dimensions	Characteristic Curves	Price
Diffuse										
C18D-AN-1A		Up to 600mm (23.62in)	N.O.	Axial	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 1	check
C18D-AP-1A				Axial	PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 1	check
C18D-AN-1E				Axial	NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 1	check
C18D-AP-1E				Axial	PNP	M12 (12mm) connector	Diagram 1	Figure 2	Chart 1	check
C18D-AN-2A		Up to 600mm (23.62in)	N.O.	Right-angle	NPN	2m (6.5') axial cable	Diagram 1	Figure 3	Chart 2	check
C18D-AP-2A				Right-angle	PNP	2m (6.5') axial cable	Diagram 1	Figure 3	Chart 2	check
C18D-AN-2E				Right-angle	NPN	M12 (12mm) connector	Diagram 1	Figure 4	Chart 2	check
C18D-AP-2E				Right-angle	PNP	M12 (12mm) connector	Diagram 1	Figure 4	Chart 2	check
Diffuse with background suppression										
C18B-AN-1A		10-120mm (0.39 to 4.72in)	N.O.	Axial	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3	check
C18B-AP-1A				Axial	PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3	check
C18B-AN-1E				Axial	NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 3	check
C18B-AP-1E				Axial	PNP	M12 (12mm) connector	Diagram 1	Figure 2	Chart 3	check
C18B-AN-2A		10-120mm (0.39 to 4.72in)	N.O.	Right-angle	NPN	2m (6.5') axial cable	Diagram 1	Figure 3	Chart 3	check
C18B-AP-2A				Right-angle	PNP	2m (6.5') axial cable	Diagram 1	Figure 3	Chart 3	check
C18B-AN-2E				Right-angle	NPN	M12 (12mm) connector	Diagram 1	Figure 4	Chart 3	check
C18B-AP-2E				Right-angle	PNP	M12 (12mm) connector	Diagram 1	Figure 4	Chart 3	check
Polarized reflective										
C18P-AN-1A		Up to 2m (6.6 ft)	N.O.	Axial	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 4	check
C18P-AP-1A				Axial	PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 4	check
C18P-AN-1E				Axial	NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 4	check
C18P-AP-1E				Axial	PNP	M12 (12mm) connector	Diagram 1	Figure 2	Chart 4	check
C18P-AN-2A		Up to 2m (6.6 ft)	N.O.	Right-angle	NPN	2m (6.5') axial cable	Diagram 1	Figure 3	Chart 5	check
C18P-AP-2A				Right-angle	PNP	2m (6.5') axial cable	Diagram 1	Figure 3	Chart 5	check
C18P-AN-2E				Right-angle	NPN	M12 (12mm) connector	Diagram 1	Figure 4	Chart 5	check
C18P-AP-2E				Right-angle	PNP	M12 (12mm) connector	Diagram 1	Figure 4	Chart 5	check
Through-beam										
C18R-AN-1A	Receiver	Up to 6m (19.7 ft)	N.O.	Axial	NPN	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 6	check
C18R-AP-1A	Receiver			Axial	PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 6	check
C18R-AN-1E	Receiver			Axial	NPN	M12 (12mm) connector	Diagram 1	Figure 2	Chart 6	check
C18R-AP-1E	Receiver			Axial	PNP	M12 (12mm) connector	Diagram 1	Figure 2	Chart 6	check
C18E-0N-1A	Emitter	Receiver dependent	Receiver dependent	Axial	Receiver dependent	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 6	check
C18E-0P-1E	Emitter			Axial		M12 (12mm) connector	Diagram 2	Figure 2	Chart 6	check
C18R-AN-2A	Receiver	Up to 6m (19.7 ft)	N.O.	Right-angle	NPN	2m (6.5') axial cable	Diagram 1	Figure 3	Chart 7	check
C18R-AP-2A	Receiver			Right-angle	PNP	2m (6.5') axial cable	Diagram 1	Figure 3	Chart 7	check
C18R-AN-2E	Receiver			Right-angle	NPN	M12 (12mm) connector	Diagram 1	Figure 4	Chart 7	check
C18R-AP-2E	Receiver			Right-angle	PNP	M12 (12mm) connector	Diagram 1	Figure 4	Chart 7	check
C18E-0N-2A	Emitter	Receiver dependent	Receiver dependent	Right-angle	Receiver dependent	2m (6.5') axial cable	Diagram 2	Figure 3	Chart 7	check
C18E-0P-2E	Emitter			Right-angle		M12 (12mm) connector	Diagram 2	Figure 4	Chart 7	check

C18 Series Photoelectric Sensors

Specifications	Diffuse Models	Diffuse Models with Background Suppression	Reflective Models	Through-beam Models[1]
Type	Diffuse reflection	Diffuse reflection with background suppression	Polarized reflection	Through-beam
Sensing Distance	600mm (23.62in)[2]	10 to 120mm (0.39 to 4.72in)[3]	2m (6.6 ft)	6m (19.7 ft)
Emission	LED red (660nm)	LED red (660nm)	LED red polarized (660nm)	LED red (660nm)
Differential Travel	≤10%			
Operating Voltage	10-36VDC			
Ripple	≤20%			
Power Consumption (axial/right-angle)	20mA/15mA	20mA/25mA	20mA/15mA	15mA/15mA
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	20ms			
Input Voltage Transients Protection	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 (-57° to 131° F)			
Temperature Drift	≤5%			
Interference to External Light	5,000 lux (incandescent lamp) 10,000 lux (sunlight)			
Protection Degree (DIN 40050)	IEC IP67			
LED Indicators	Yellow (output state, output energized), green (excess light indication)			
Housing Material	Nickel-plated brass			
Lens Material	Glass			
Weight (cable/connector)	115g (4.05 oz)/40g (1.41 oz)			

[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

Wiring diagrams

Diagram 1

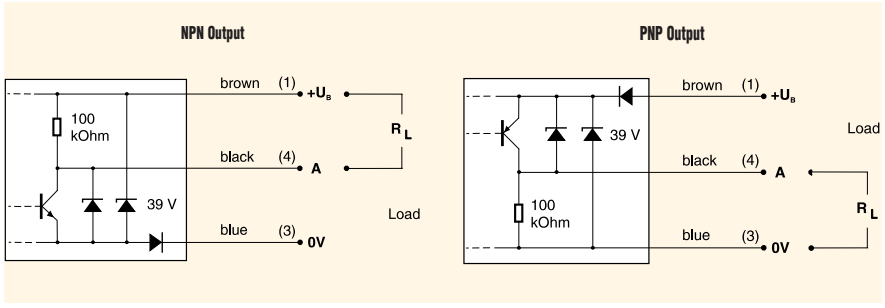
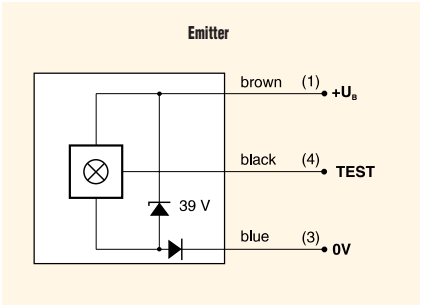
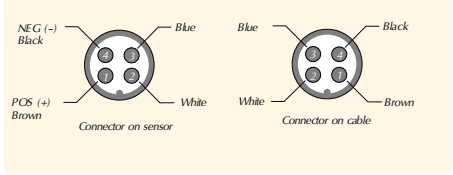


Diagram 2



M12 Connector



C18 Series Photoelectric Sensors

Dimensions

Figure 1

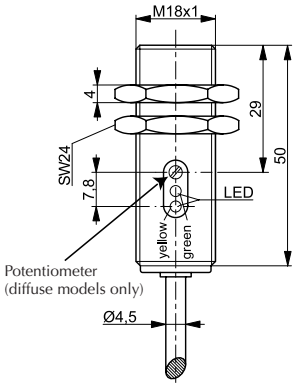


Figure 2

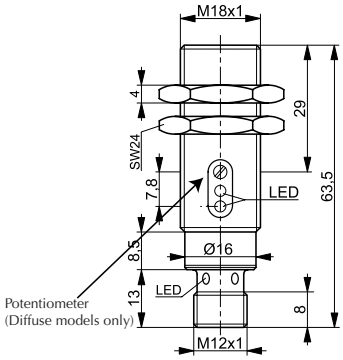


Figure 3

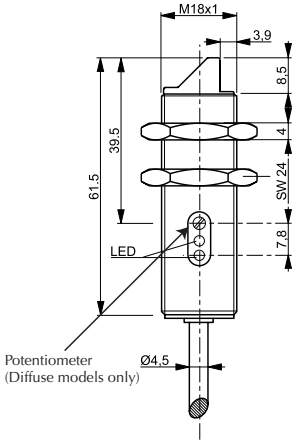
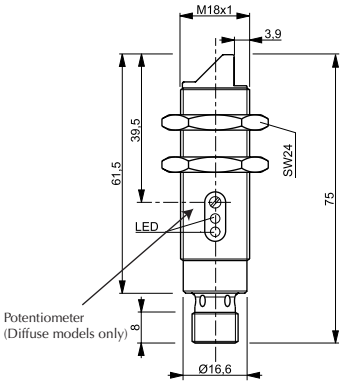


Figure 4



Characteristic Curves

Chart 1

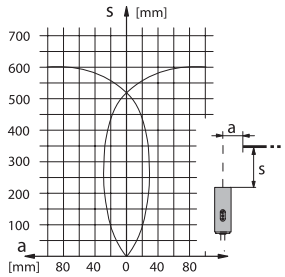


Chart 2

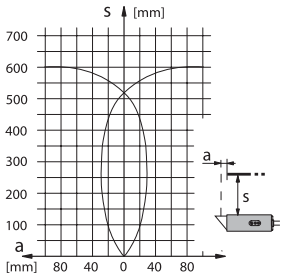


Chart 3

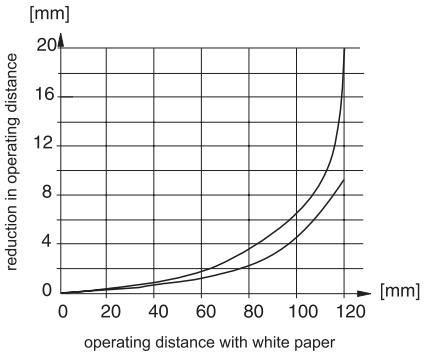


Chart 4

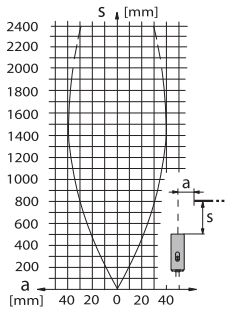


Chart 5

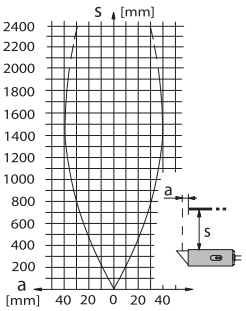


Chart 6

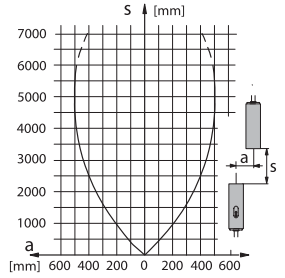
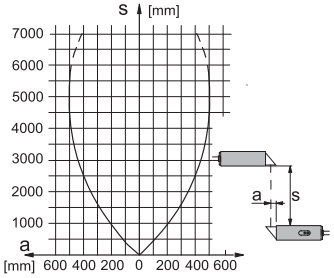


Chart 7



FE Series Photoelectric Sensors

Mini-rectangular plastic - DC

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

FE Series Photoelectric Sensors Selection Chart

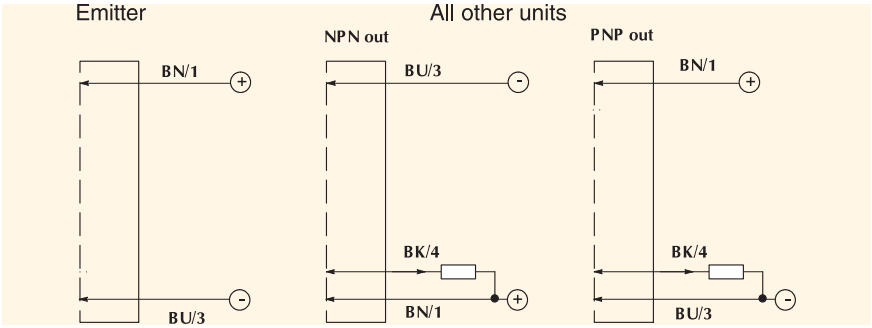
Part Number		Price	Sensing Range	Output State	Logic	Connection	Dimensions	Characteristic Curves
Diffuse								
FER8-0N-0A		check	800mm (31.49in)	Light-on/Dark-on Selectable	NPN	2m (6.5) axial cable	Figure 1	Chart 1
FER8-0P-0A		check			PNP	2m (6.5) axial cable	Figure 1	Chart 1
FER8-0N-0F		check			NPN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

*Receivers include one round reflector (84mm dia.) and one rectangular reflector (12mm x 54mm). Purchase additional reflectors separately.

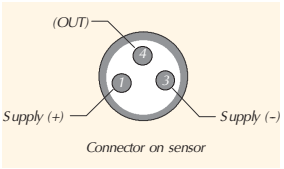
Cables and Accessories

Cables and accessories can be found starting on page 17–51.

Wiring diagrams



M8 connector



Dimensions

Figure 1

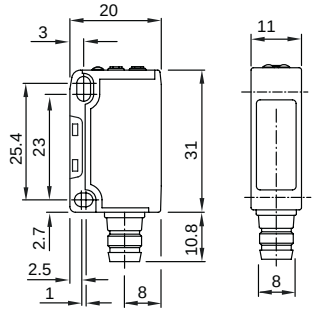
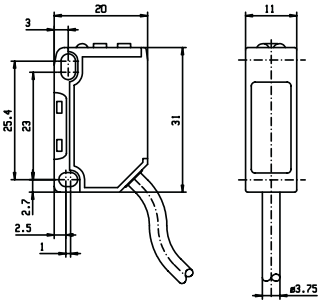
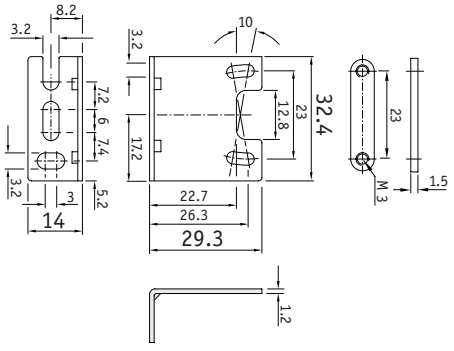


Figure 2



Horizontal mounting bracket supplied with each unit



FE Series Photoelectric Sensors

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

Characteristic curves

Chart 1

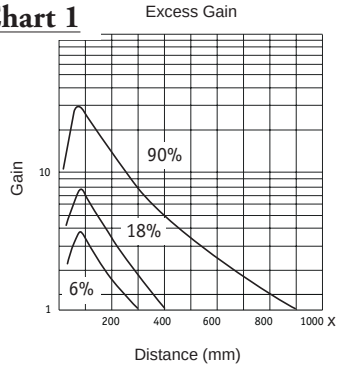


Chart 2

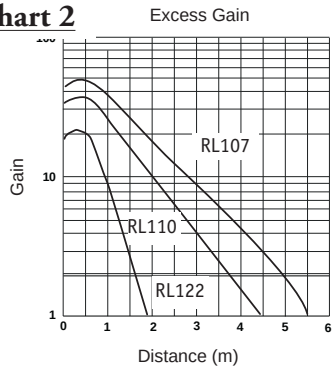
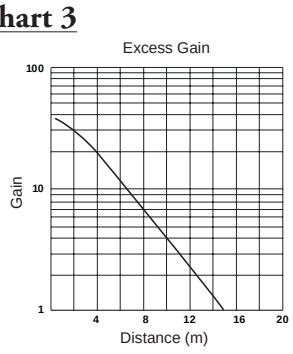


Chart 3



CX Series Photoelectric Sensors

Mini-rectangular plastic - DC

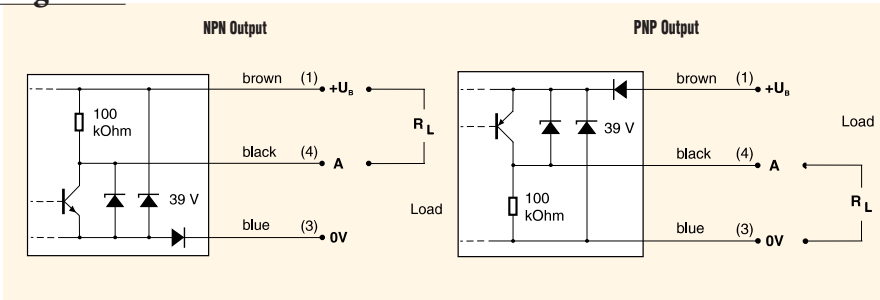
- 18 models available
- Long operating distances
- Adjustable sensitivity
- Scratch-resistant and easy to clean glass lens
- Axial cable or M8 quick-disconnect models
- Complete overload protection
- Mounting brackets are not needed
- IP65 rated

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	check
CX3-AP-1A				PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 1	check
CX3-AN-1F				NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 1	check
CX3-AP-1F				PNP	M8 (8mm) connector	Diagram 1	Figure 2	Chart 1	check
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	check
CX5-AP-1A				PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 2	check
CX5-AN-1F				NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 2	check
CX5-AP-1F				PNP	M8 (8mm) connector	Diagram 1	Figure 2	Chart 2	check
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	check
CXP-AP-1A				PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3	check
CXP-AN-1F				NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 3	check
CXP-AP-1F				PNP	M8 (8mm) connector	Diagram 1	Figure 2	Chart 3	check
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	check
CXR-AP-1A	Receiver			PNP	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 4	check
CXR-AN-1F	Receiver			NPN	M8 (8mm) connector	Diagram 1	Figure 2	Chart 4	check
CXR-AP-1F	Receiver			PNP	M8 (8mm) connector	Diagram 1	Figure 2	Chart 4	check
CXE-0N-1A	Emitter		Receiver dependent	Receiver dependent	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 4	check
CXE-0N-1F	Emitter				M8 (8mm) connector	Diagram 2	Figure 2	Chart 4	check

Wiring diagrams

Diagram 1



M8 connector

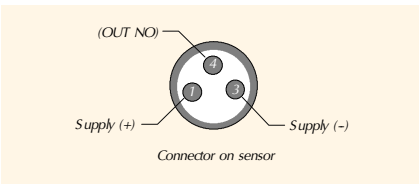
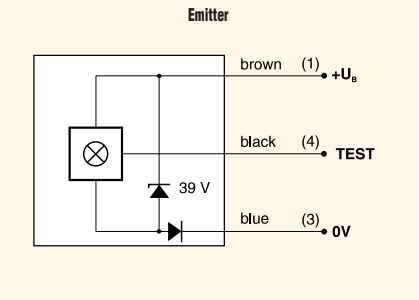


Diagram 2



Cables and Accessories

Cables and accessories can be found starting on page 17–51.

CX Series Photoelectric Sensors

Specifications	Diffuse Models	Diffuse Models with Background Suppression	Reflective Models	Through-beam Models[1]
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)
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 (-57° 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	PBTP (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

Figure 1

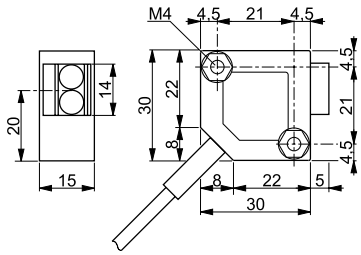
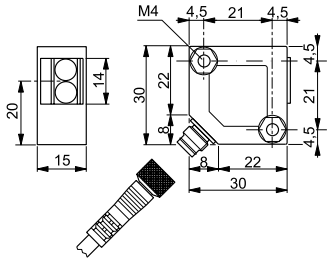


Figure 2



Characteristic curves

Chart 1

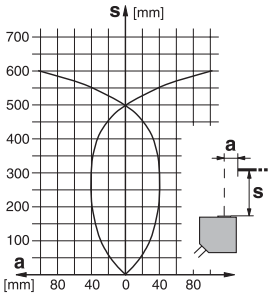


Chart 2

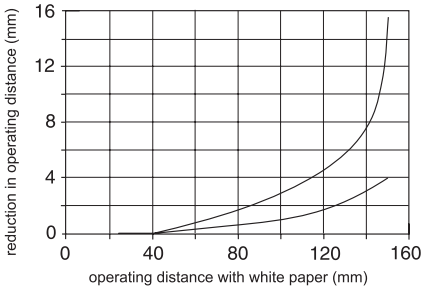


Chart 3

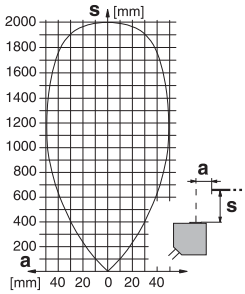
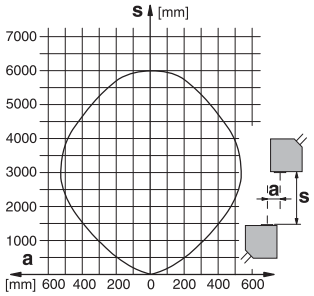


Chart 4



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	check
QX3-A0-1E				Axial		M12 (12mm) connector	Diagram 1	Figure 2	Chart 1	check
QX3-A0-2A		300mm (11.81in)	N.O.	Right-angle		2m (6.5') axial cable	Diagram 1	Figure 3	Chart 1	check
QX3-A0-2E				Right-angle		M12 (12mm) connector	Diagram 1	Figure 4	Chart 1	check
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	check
QXP-A0-1E				Axial		M12 (12mm) connector	Diagram 1	Figure 2	Chart 2	check
QXP-A0-2A		2.5m (78.74in)	N.O.	Right-angle		2m (6.5') axial cable	Diagram 1	Figure 3	Chart 2	check
QXP-A0-2E				Right-angle		M12 (12mm) connector	Diagram 1	Figure 4	Chart 2	check
Through-beam										
QXR-A0-1A	Receiver	8m (26.25ft)	N.O.	Axial	NPN/PNP selectable	2m (6.5') axial cable	Diagram 1	Figure 1	Chart 3	check
QXR-A0-1E	Receiver			Axial		M12 (12mm) connector	Diagram 1	Figure 2	Chart 3	check
QXX-00-1A	Emitter		Receiver dependent	Axial	Receiver dependent	2m (6.5') axial cable	Diagram 2	Figure 1	Chart 3	check
QXX-00-1E	Emitter			Axial		M12 (12mm) connector	Diagram 2	Figure 2	Chart 3	check
QXR-A0-2A	Receiver	8m (26.25ft)	N.O.	Right-angle	NPN/PNP selectable	2m (6.5') axial cable	Diagram 1	Figure 3	Chart 3	check
QXR-A0-2E	Receiver			Right-angle		M12 (12mm) connector	Diagram 1	Figure 4	Chart 3	check
QXX-00-2A	Emitter		Receiver dependent	Right-angle	Receiver dependent	2m (6.5') axial cable	Diagram 2	Figure 3	Chart 3	check
QXX-00-2E	Emitter			Right-angle		M12 (12mm) connector	Diagram 2	Figure 4	Chart 3	check

Wiring diagrams

Diagram 1

Emitter with check **QXX-00-****

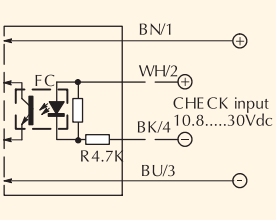
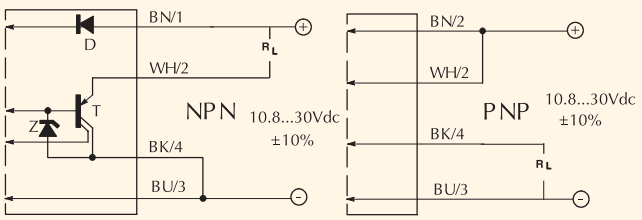
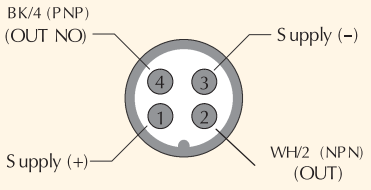


Diagram 2

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



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.

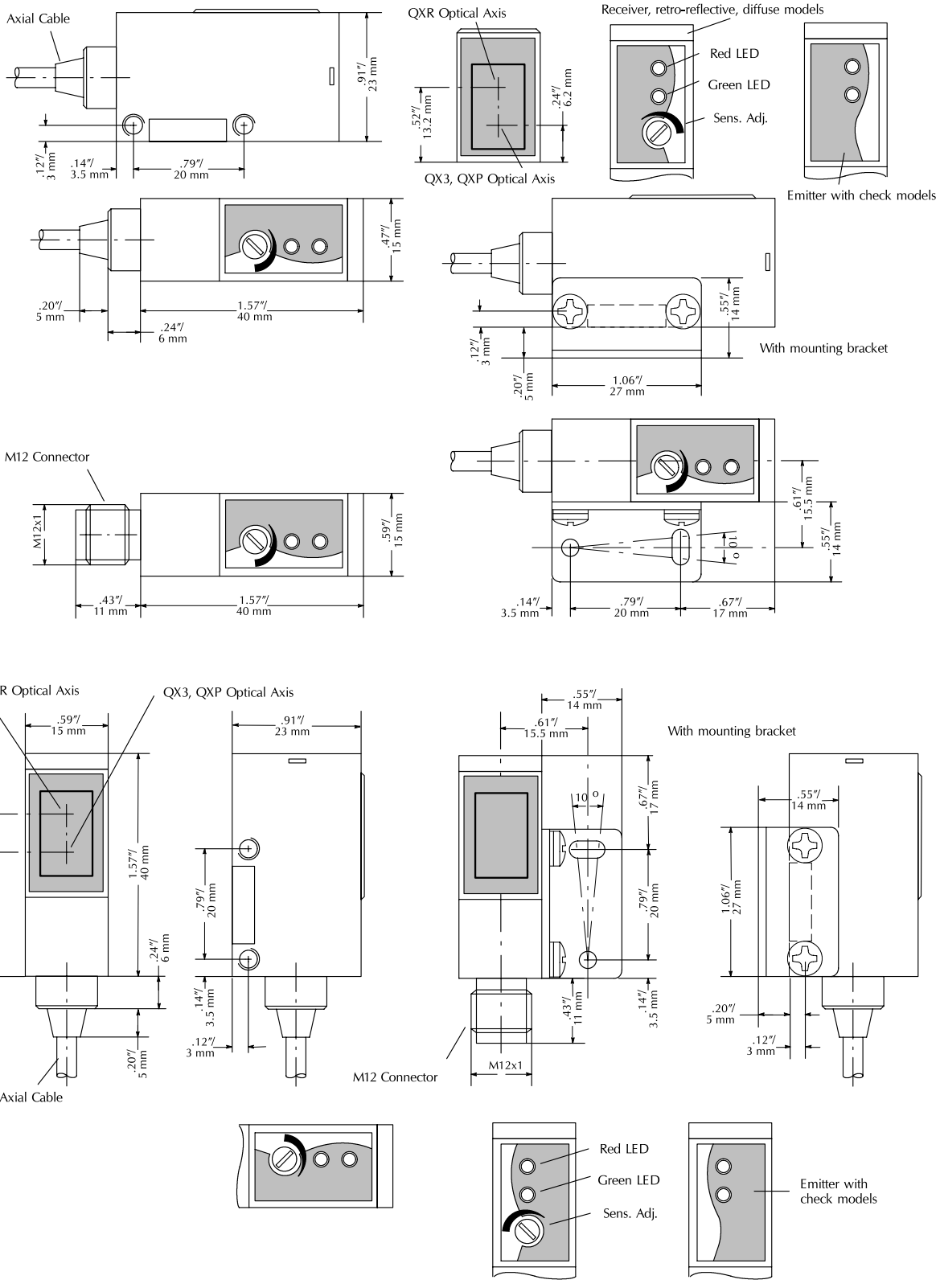
Cables and Accessories

Cables and accessories can be found on starting page 17–51.

QX Series Photoelectric Sensors

Dimensions

(M3 x 0.5 screws included with sensor)



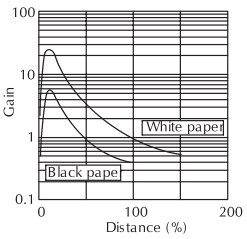
QX Series Photoelectric Sensors

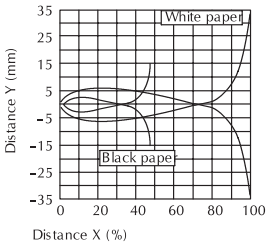
Specifications	Diffuse Models	Reflection Models	Through-Beam Models
Type	Diffuse reflection[1]	Polarized reflection[2]	Through-beam[3]
Sensing Distance	300mm[4]	2.5m[5]	8m
Emission	infrared (880nm)	red (660nm)	
Minimum Detectable Object	-		2mm
Sensitivity	Adjustable one-turn pot.		
Tolerance	+15/-5% Sn		
Differential Travel	10%		
Repeat Accuracy	5%		
Operating Voltage	10.8-30VDC		
Ripple	10% max.		
No-load Supply Current	20mA		20mA (em), 5mA (rec)
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)		

[1]Mounting bracket included [2]Mounting bracket and Ø84mm round reflector included (RL110). Purchase additional reflectors separately. [3]An emitter (QXX) and receiver (QXR) pair is needed for a complete sensor set.
[4]With 100X100mm white matte paper [5]With standard Ø84mm reflector (RL110)

Characteristic curves

Chart 1





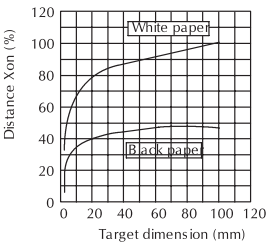
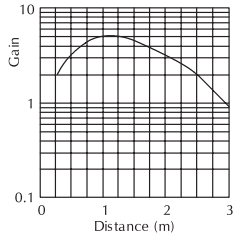


Chart 2



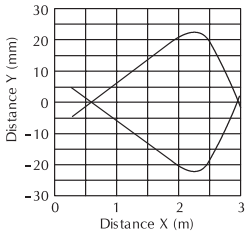
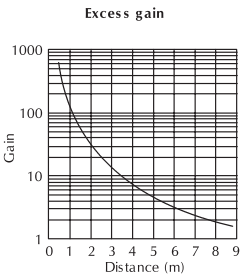
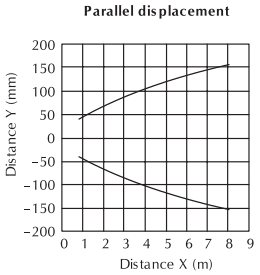
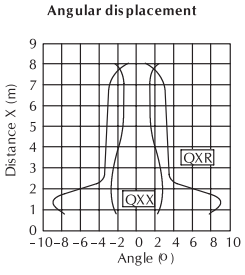
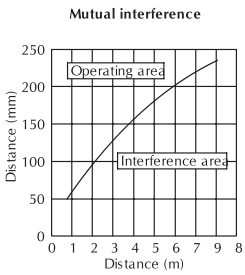


Chart 3









FG Series Photoelectric Sensors

Rectangular plastic - AC/DC

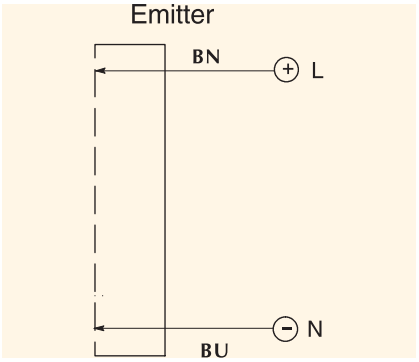
- Universal supply voltage: 12-240VDC or 24-240VAC
- Diffuse w/background suppression,polarized reflective, and through-beam models
- Plastic housing
- SPDT electrically isolated output
- Adjustable sensitivity
- IP67 rated

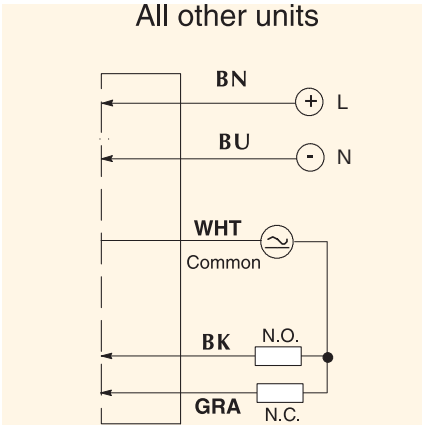
FG Series Photoelectric Sensors Selection Chart						
Part Number	***Price***	***Sensing Range***	***Output***	***Connection***	***Dimensions***	***Characteristic Curves***
Diffuse with background suppression						
FGRW-DT-0A	check	550mm (21.65in)	SPDT Relay	2m (6.5) axial cable	Figure 1	Chart 1
Polarized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

*Receivers include one reflector RL123 (51.6mm x 61.6mm).
Purchase additional reflectors separately.
**Through-beam model consists of an emitter and receiver pair.

Accessories
Accessories can be found starting on page 17–51.

Wiring diagrams





Dimensions

Figure 1

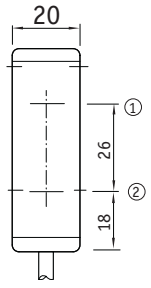


Figure 2

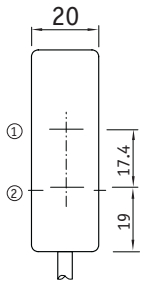
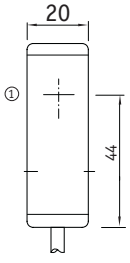
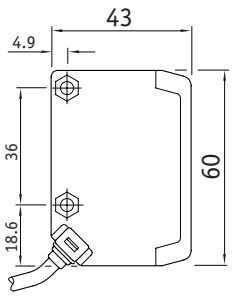


Figure 3





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

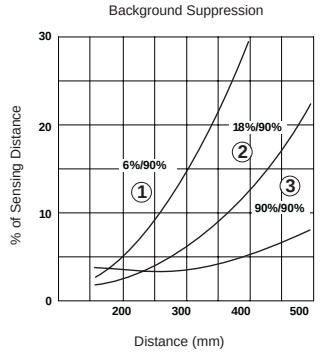
FG Series Photoelectric Sensors

Specifications	Diffuse Models	Reflective Models	Through-Beam Models
Type	Diffuse reflection	Polarized reflection[3]	Through-beam[4]
Sensing Distance	550mm[1]	9m[2]	20m
Emission	Red LED (visable)		
Blind Zone	10-35mm	10mm	-
Sensitivity	Adjustable		
Response Time	≤15ms		
Operating Voltage	12-240VDC or 24-240VAC		
No-load Supply Current	≤2VA		
Load Current	3A @ 240VAC/30VDC		
Output Type	SPDT relay electrically isolated		
Switching Frequency	33Hz		
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		
Housing Material	ABS		
Lens Material	PC		
Weight	160g (5.64oz)		Emitter/Receiver pair 290g(10.23oz)

[1] With 100x100mm white matte paper
[2] With standard RL123 reflector
[3] Each sensor includes one reflector (RL123). Purchase additional reflectors separately.
[4] Each through-beam part number consists of an emitter and receiver pair.

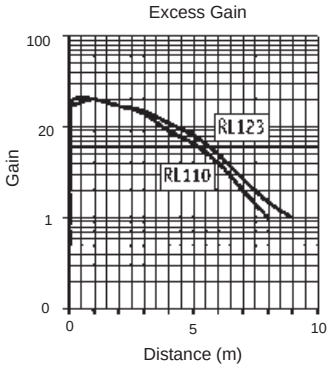
Characteristic curves

Chart 1



1) Sensing range on black with white background.
2) Sensing range on gray with white background.
3) Sensing range on white with white background.

Chart 2



RL123 reflector supplied with FRGN models

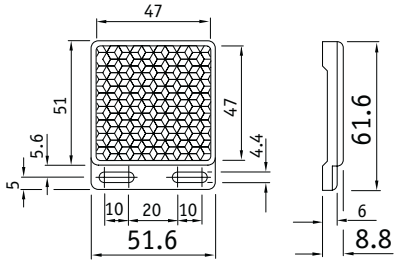
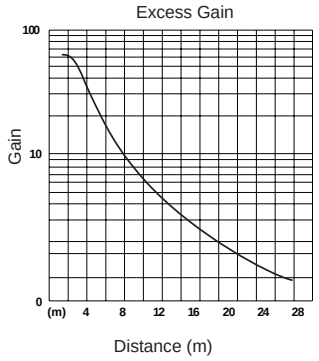
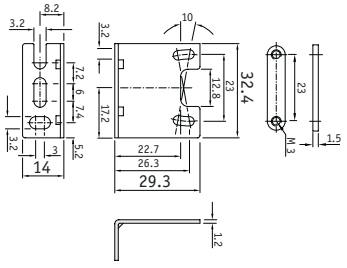


Chart 3



Horizontal mounting bracket supplied with each unit



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 can be found starting on page 17–53.

DFT Series Fiber Photoelectric Amplifier Selection Chart						
Part Number	Price	Sensing Range	Output State	Logic	Connection	Dimensions
DFT-AN-1A	check	Optical fiber dependent	Light On / Dark On selectable	NPN	2m (6.5') axial cable	Figure 1
DFT-AN-1F	check				M8 (8mm) connector	Figure 2
DFT-AP-1A	check			PNP	2m (6.5') axial cable	Figure 1
DFT-AP-1F	check				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 - Off Delay	10-150ms set withTeach Function	
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	
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

Figure 1

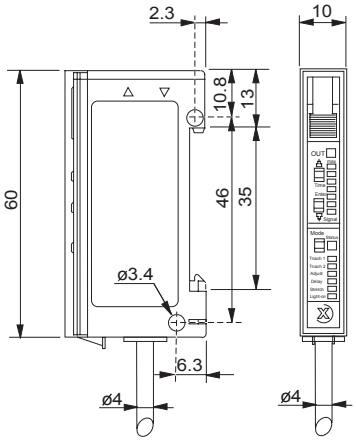
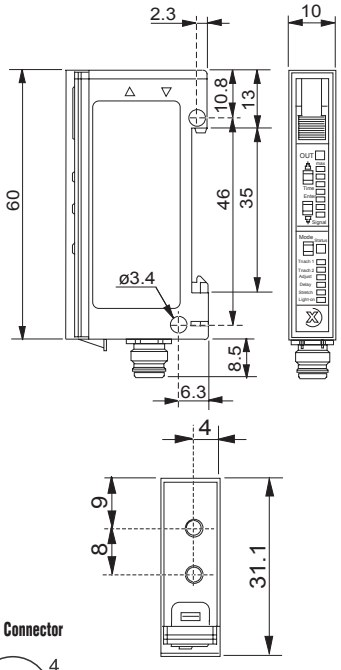
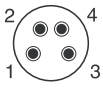


Figure 2

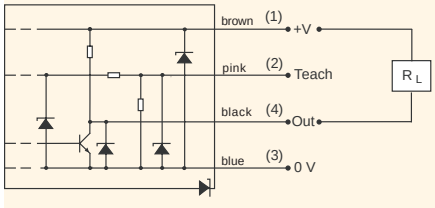


M8 Connector

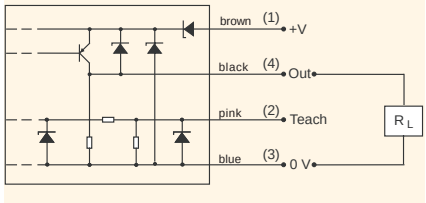


Wiring diagrams

NPN Output



PNP Output



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

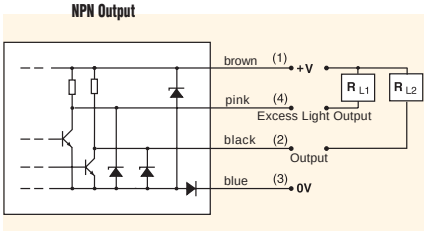
Cables and accessories can be found starting on page 17–53.

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

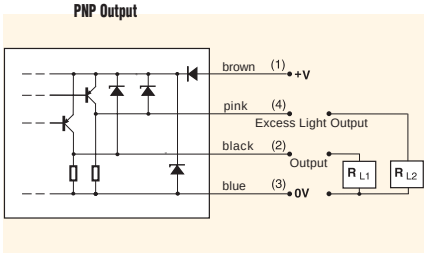
Specifications		
	*DFP-AN-1**	*DFP-AP-1**
Sensing Distance	See Optical Fibers Table	
Sensitivity Setting	12-turn Potentiometer with illuminated scale	
Emission	red (680nm)	
Differential Travel	≤10%	
Operating Voltage	10-30VDC	
Ripple	≤20%	
No-load Supply Current	≤15mA	
Load Current	≤200mA	
Leakage Current	≤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	
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)	

Wiring diagrams

NPN Output



PNP Output



Dimensions

Figure 1

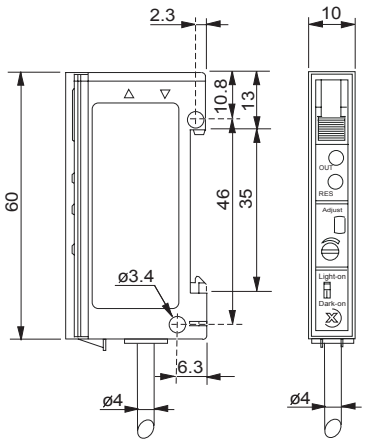
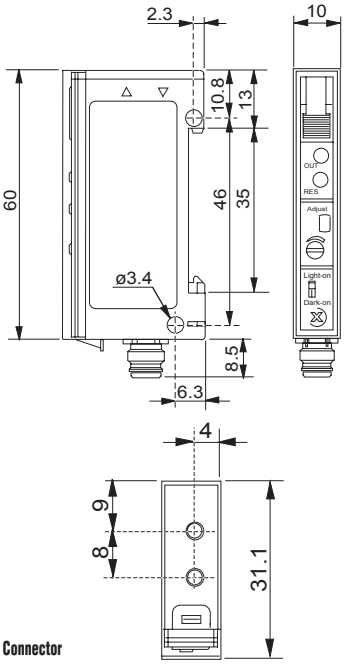
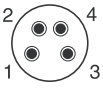


Figure 2



M8 Connector



SSF Series Fiber Photoelectric Amplifiers

M18 (18mm) 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 can be found starting on page 17–51.

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

Specifications		
	SSF-0N-0*	**SSF-0P-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	40Nm (29lb./ft.)	
Weight (cable/connector)	100g (3.53oz)	

Wiring diagrams

Diagram 1

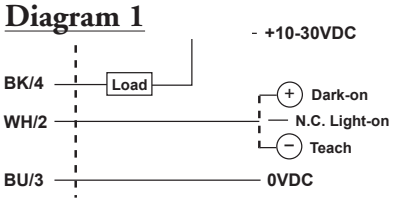
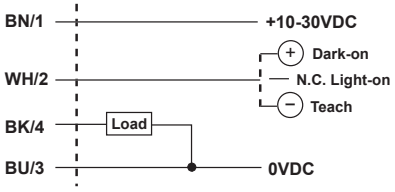
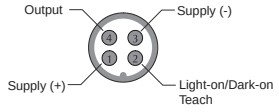


Diagram 2



Connector



Dimensions

Figure 1

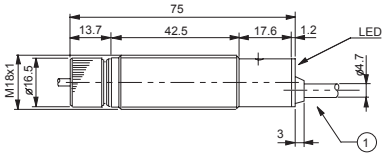
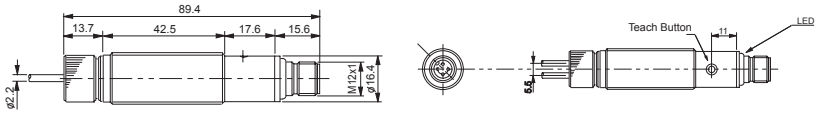


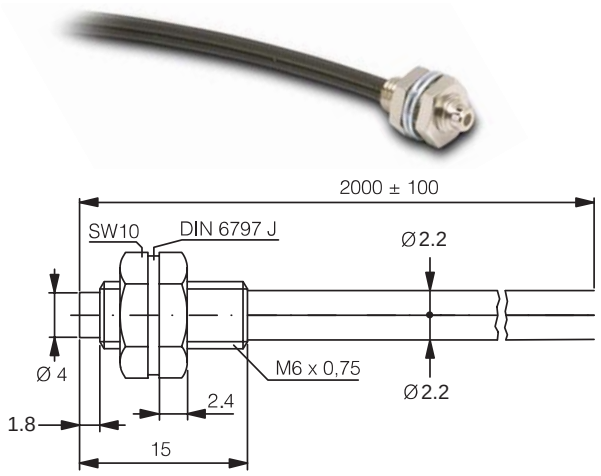
Figure 2



Cuttable Optical Fibers (2.2mm Diameter)

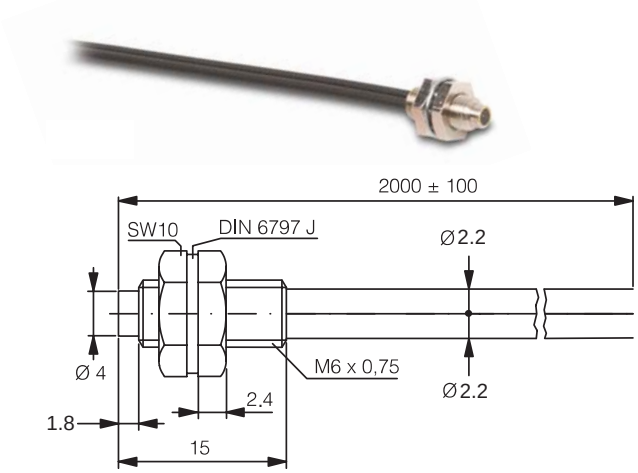
CF-DB1-20 diffuse reflection

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



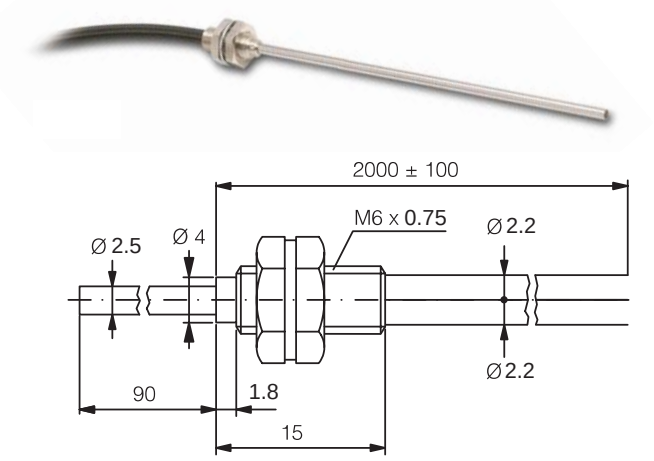
CF-DB2-20 diffuse reflection

Specifications	
Optical Fiber Core Ø	1.5mm (0.06in)
Sensing Distance	260mm (10.27in)
Fiber Length (L)	2.0m (78.74in)
Fiber Bending Radius	40mm (1.57in)
Free Cut	Yes
Head Size	M6
Protection Degree	IEC IP67
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

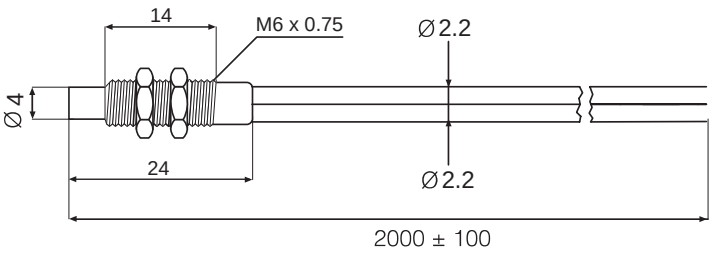
Specifications	
Optical Fiber Core Ø	1mm (0.039in)
Sensing Distance	200mm (7.87in)
Fiber Length (L)	2.0m (78.74in)
Fiber Bending Radius	25mm (0.98in)
Bendable light-outlet tube	Yes, 25mm (0.98in) radius
Free Cut	Yes
Head Size	M6
Protection Degree	IEC IP67
Temperature Range	-25° to +70°C (-13° to 158°F)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



Cuttable Optical Fibers (2.2mm Diameter)

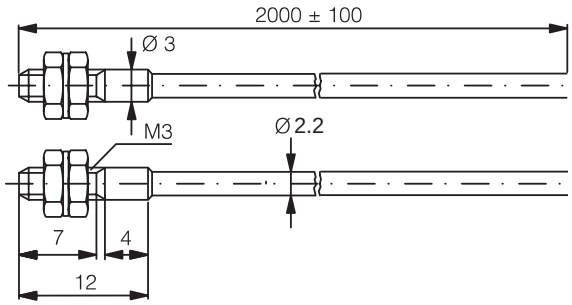
CF-CB1-20 diffuse reflection

Specifications	
Optical Fiber Core Ø	1mm (0.039in)
Sensing Distance	50mm (1.97in)
Fiber Length (L)	2.0m (78.74in)
Fiber Bending Radius	25mm (0.98in)
Free Cut	Yes
Head Size	M6
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



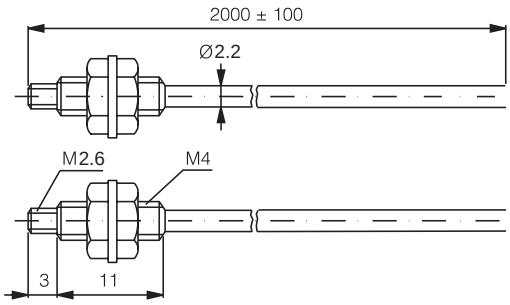
CF-TB1-20 through-beam

Specifications	
Optical Fiber Core Ø	0.5mm (0.02in)
Sensing Distance	200mm (7.87in)
Fiber Length (L)	2.0m (78.74in) ea. piece
Fiber Bending Radius	25mm (0.98in)
Free Cut	Yes
Head Size	M3
Protection Degree	IEC IP67
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

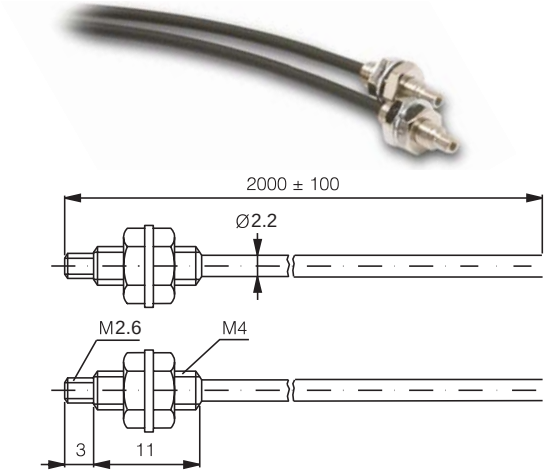
Specifications	
Optical Fiber Core Ø	1mm (0.039in)
Sensing Distance	700mm (27.56in)
Fiber Length (L)	2.0m (78.74in) ea. piece
Fiber Bending Radius	25mm (0.98in)
Free Cut	Yes
Head Size	M4
Protection Degree	IEC IP67
Temperature Range	-25° to +70°C (-13° to 158°F)
Fiber Materials	PMMA
Sleeve Materials	Polyethylene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



Cuttable Optical Fibers (2.2mm Diameter)

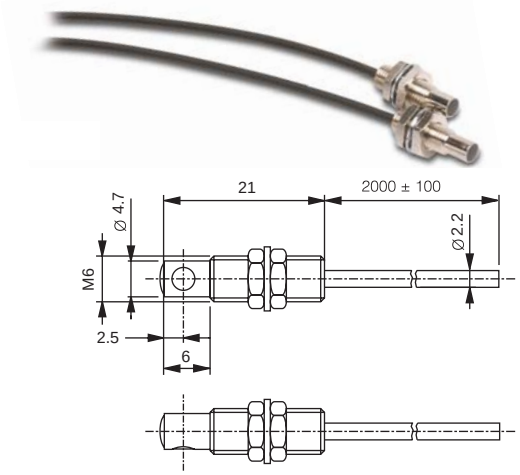
CF-TB3-20 through-beam

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



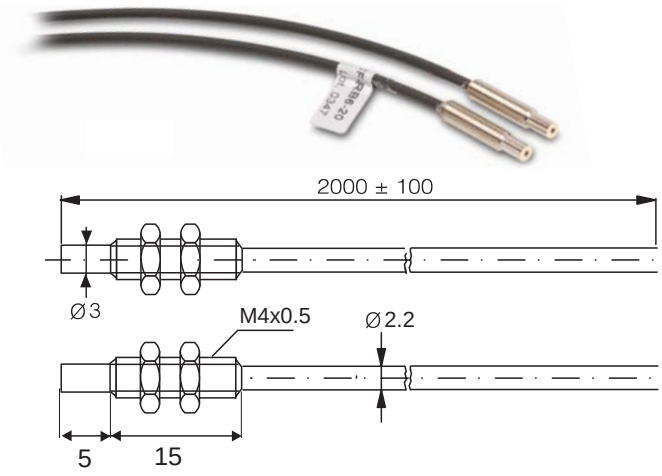
CF-TB4-20 90° through-beam

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



CF-RB6-20 through beam

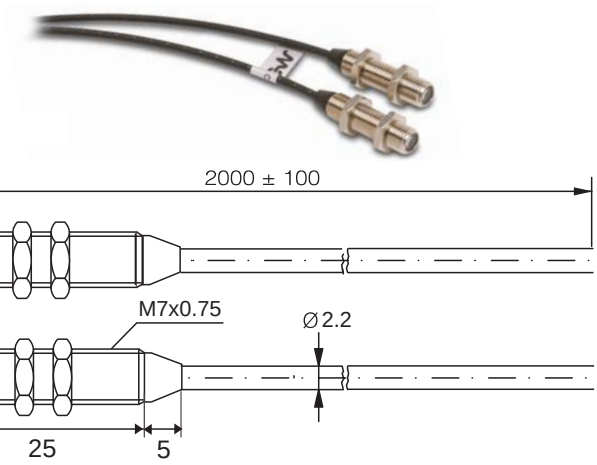
Specifications	
Optical Fiber Core Ø	1.0mm (0.039in)
Sensing Distance	120mm (4.72in)
Fiber Length (L)	2.0m (78.74in) ea. piece
Fiber Bending Radius	25mm (0.98in)
Free Cut	Yes
Head Size	M4
Protection Degree	IEC IP67
Temperature Range	-40° to +70°C (-40° to 158°F)
Fiber Materials	PMMA
Sleeve Materials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



Cuttable Optical Fibers (2.2mm Diameter)

CF-RBA-20 through-beam with lenses

Specifications	
Optical Fiber Core Ø	1.0mm (0.039in)
Sensing Distance	1200mm (47.24in)
Fiber Length (L)	2.0m (78.74in) ea. piece
Fiber Bending Radius	25mm (0.98in)
Free Cut	Yes
Head Size	M7
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



MSF Series Fiber Photoelectric Amplifiers

M18 (18mm) plastic - DC

- 2 models available
- Multifunctional output: NPN, PNP, N.O./N.C. selectable output
- Red light with visible spot
- LED status indicator
- IP67 rated

Cables and Accessories

Cables and accessories can be found starting on page 17–51.

MSF Series Fiber Photoelectric Amplifier Selection Chart						
Part Number	Price	Sensing Range	Output State	Logic	Connection	Dimensions
MSF-00-4A	check	Optical fiber dependent	N.O./N.C. selectable	NPN/PNP selectable	2m (6.5') axial cable	Figure 1
MSF-00-4E	check				M12 (12mm) connector	Figure 2

Specifications	
Model	MSF-00-4A and MSF-00-4E
Sensing Distance	See Optical Fibers Table on next page
Emission	red (660nm)
Tolerance	+15/-10% of the nominal sensing distance Sn
Differential Travel	≤10%
Repeat Accuracy	5%
Operating Voltage	10-30VDC
Ripple	≤10%
No-load Supply Current	25mA
Load Current	≤100mA
Leakage Current	≤10µA
Voltage Drop	1.2volt maximum at 100mA
Output Type	(NPN, PNP, N.O., N.C.)
Switching Frequency	500Hz
(tv) Time Delay Before Availability	200ms
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 (DIN 40050)	IEC IP67
LED Indicators	Red (output energized)
Housing Material	Polyamide (plastic), polycarbonate (cable exit)
Lens Materials	Acrylic
Weight	150g (5.29oz)

Dimensions

Figure 1

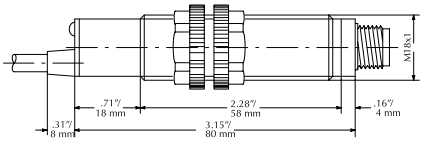
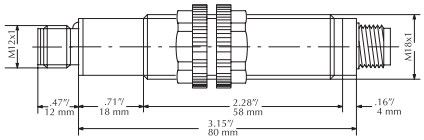
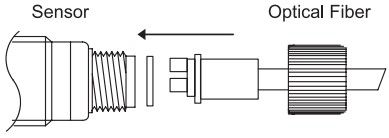
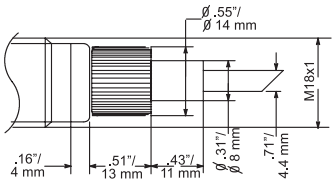


Figure 2

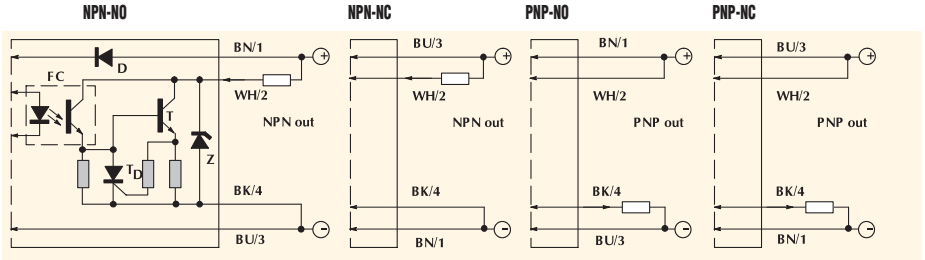


Optical fiber connection

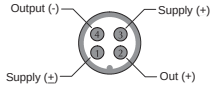




Wiring diagrams



M12 Connector



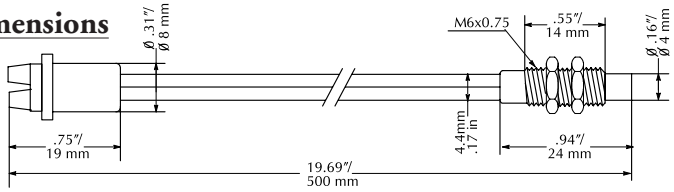
Fixed Length MSF Optical Fibers

Use these fibers only with MSF amplifiers

0F-SC1 diffuse reflection

Specifications	
Optical Fiber Core Ø	1mm (0.039in)
Distance (with MSF)	20mm (0.79in)
Fiber Length (L)	0.5m (19.69in)
Free Cut	No
Head Shape	M6
Protection Degree	IEC IP67
Temperature Range	-10° to +70°C (14° to 158°F)
Optical Fiber Materials	PE, PMMA
Head Materials	Nickel-plated brass

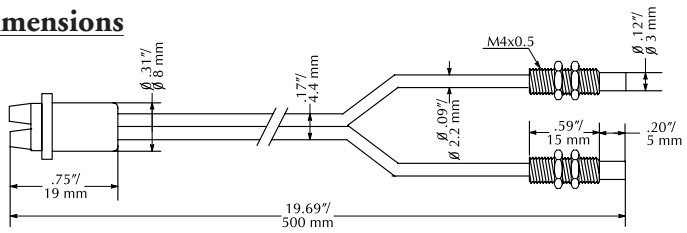
Dimensions



0F-SR1 through-beam

Specifications	
Optical Fiber Core Ø	1mm (0.039in)
Distance (with MSF)	40mm (1.57in)
Fiber Length (L)	0.5m (19.69in)
Free Cut	No
Head Shape	M4
Protection Degree	IEC IP67
Temperature Range	-10° to +70°C (14° to 158°F)

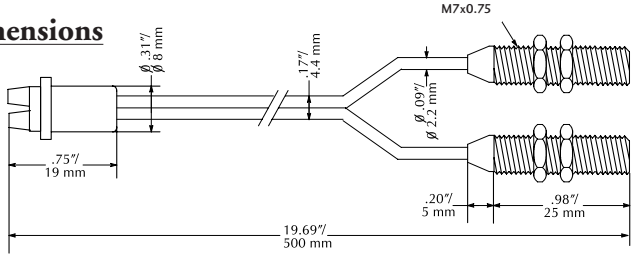
Dimensions



0F-SR2 through-beam

Specifications	
Optical Fiber Core Ø	1mm (0.039in)
Distance (with MSF)	400mm (15.7in)
Fiber Length (L)	0.5m (19.69in)
Free Cut	No
Head Shape	M7
Protection Degree	IEC IP67
Temperature Range	-10° to +70°C (14° to 158°F)
Optical Fiber Materials	PE, PMMA
Head Materials	Nickel-plated brass

Dimensions



Note: Part numbers begin with zero, not letter O

BX Series High Resolution Area Sensor

High resolution area sensor - DC

- 70mm 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

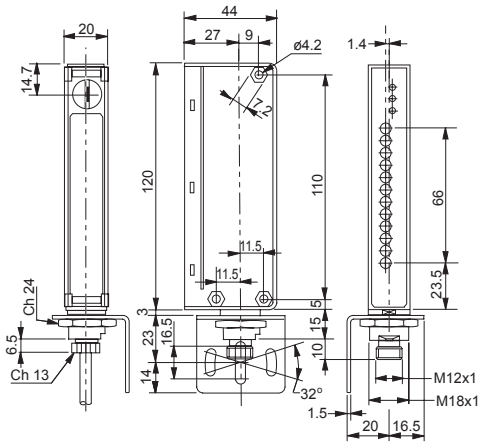
Cables and Accessories

Cables and accessories can be found starting on page 17–51

BX80 Series Area Sensor Selection Chart							
Part Number	**Price**	**Function**	**Sensing Range**	**Output State**	**Logic**	**Connection**	**Wiring**
BX80B-1N-0H	check	Receiver	2m (78.74in)	N.O./N.C. selectable	NPN	M12 (12mm) connector	Figure 1
BX80B-1P-0H	check	Receiver			PNP		Figure 2
BX80S-10-0H	check	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	25Nm max.
Weight	300g (10.58oz)

Dimensions



Wiring diagrams

Figure 1

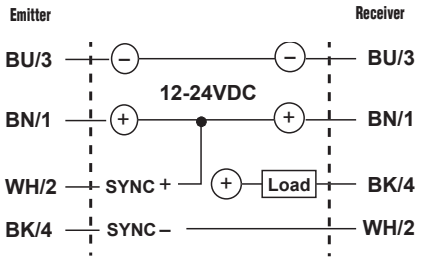
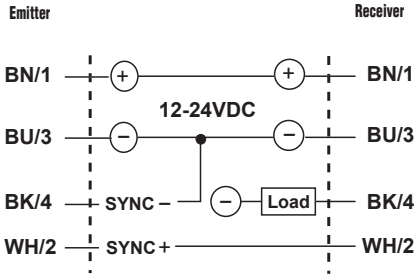
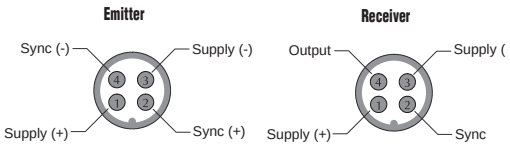


Figure 2



Connectors



Photoelectric Sensors Accessories: Cables

Cables with quick-disconnect plugs

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

M8 Quick-Disconnect Cables						
Part Number	**Price**	**Length**	**Poles**	**Connector**	**Jacket**	**Dimensions**
M8 Quick-Disconnects						
CD08-0A-020-A1	check	2m (6.5ft.)	3	Axial	PVC	Figure 1
CD08-0A-020-C1	check	2m (6.5ft.)	3	Right-angle	PVC	Figure 2
CD08-0A-050-A1	check	5m (16.4ft.)	3	Axial	PVC	Figure 3
CD08-0C-050-A1	check	5m (16.4ft.)	3	Axial	PUR	Figure 3
CD08-0A-050-C1	check	5m (16.4ft.)	3	Right-angle	PVC	Figure 4
CD08-0C-050-C1	check	5m (16.4ft.)	3	Right-angle	PUR	Figure 4
CD08-0A-070-A1	check	7m (23ft.)	3	Axial	PVC	Figure 1
CD08-0A-070-C1	check	7m (23ft.)	3	Right-angle	PVC	Figure 2

M12 Quick-Disconnect Cables						
Part Number	**Price**	**Length**	**Poles**	**Connector**	**Jacket**	**Dimensions**
M12 Quick-Disconnects						
CD12L-0B-020-A0	check	2m (6.5ft.)	4	Axial	PVC	Figure 5
CD12L-0B-020-C0	check	2m (6.5ft.)	4	Right-angle	PVC	Figure 6
CD12M-0B-050-A1*	check	5m (16.4ft.)	3	Axial	PVC	Figure 7
CD12M-0D-050-A1*	check	5m (16.4ft.)	3	Axial	PUR	Figure 7
CD12M-0B-050-C1*	check	5m (16.4ft.)	3	Right-angle	PVC	Figure 8
CD12M-0D-050-C1*	check	5m (16.4ft.)	3	Right-angle	PUR	Figure 8
CD12M-0B-070-A1	check	7m (23ft.)	4	Axial	PVC	Figure 5
CD12M-0B-070-C1	check	7m (23f.t)	4	Right-angle	PVC	Figure 5

*** Note: Do not use with: DM, FA, QX, SS, SSF, MS and MSF series photoelectric sensors. These sensors require 4 pole cables.**

Cable Specifications	M8		M12	
Length	2m (6.5ft.)/ 7m (23ft.)	5m (16.4ft.)	2m (6.5ft.)/ 7m (23ft.)	5m (16.4ft.)
Nominal Voltage	50VAC/75VDC	60VAC/75VDC	300VAC	60VAC/75VDC
Nominal Current	4A	1.5A	4A	1.5A
Protection Degree	IEC IP67		IEC IP67	
Contact Body Material	ABS	PUR	ABS	PUR
Housing Material	PUR		PUR	
Contacts Material	CuSn	CuZn	CuSn	CuZn
Conductors Section	0.34mm^2		0.34mm^2	
Ø Outer Cable	5mm		5mm	
Temperature Range	-25° to +70°C (-13° to 158°F)		-25° to +70°C (-13° to 158°F)	

Dimensions

Figure 1

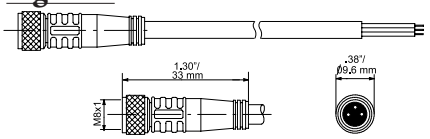


Figure 2

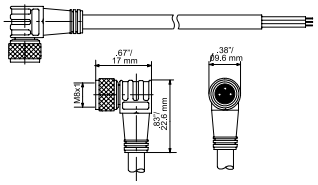


Figure 3

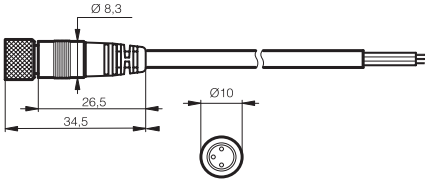


Figure 4

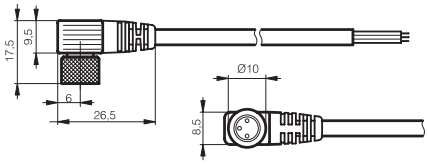


Figure 5

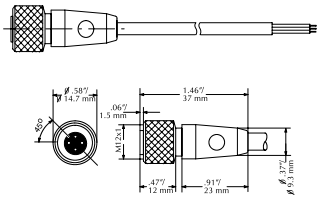


Figure 6

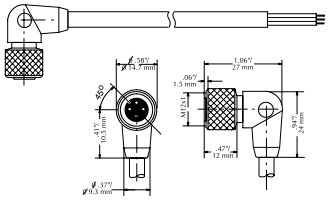


Figure 7

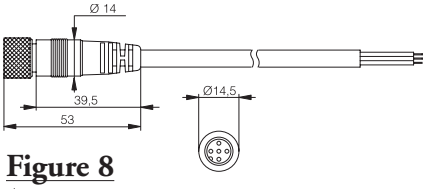
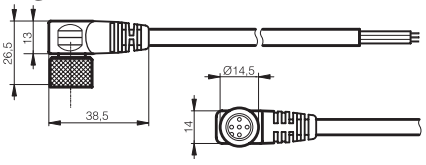


Figure 8



PHOTOELECTRIC SENSORS ACCESSORIES: EXTENSION CABLES

Extension cables with quick-disconnect plugs on each end

Available extension cables include:

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

M8 Extension Cables with Quick-Disconnect on each end						
Part Number	**Price**	**Length**	**Poles**	**Connectors**	**Jacket**	**Dimensions**
M8 Quick-Disconnect Extension Cables						
CDP08-0A-010-AA	check	1m (3.28ft.)	3	2 Axial	PVC	Figure 1
CDP08-0A-010-BB	check	1m (3.28ft.)	3	2 Right-angle	PVC	Figure 2
CDP08-0A-030-AA	check	3m (9.84ft.)	3	2 Axial	PVC	Figure 1
CDP08-0A-030-BB	check	3m (9.84ft.)	3	2 Right-angle	PVC	Figure 2

M12 Extension Cables with Quick-Disconnect on each end						
Part Number	**Price**	**Length**	**Poles**	**Connectors**	**Jacket**	**Dimensions**
M12 Quick-disconnect Extension Cables						
CDP12-0B-010-AA	check	1m (3.28ft.)	4	2 Axial	PVC	Figure 3
CDP12-0B-010-BB	check	1m (3.28ft.)	4	2 Right-angle	PVC	Figure 4
CDP12-0B-030-AA	check	3m (9.84ft.)	4	2 Axial	PVC	Figure 3
CDP12-0B-030-BB	check	3m (9.84ft.)	4	2 Right-angle	PVC	Figure 4

Cable Specifications	M8 / M12
Length	1m (3.28ft.)/ 3m (9.84ft.)
Nominal Voltage	50VAC/75VDC
Nominal Current	4A
Protection Degree	IEC IP67
Contact Body Material	ABS
Housing Material	PUR
Contacts Material	CuSn
Conductors Section	0.34mm^2
Ø Outer Cable	5mm
Temperature Range	-25° to +70°C (-13° to 158°F)

Dimensions

Figure 1

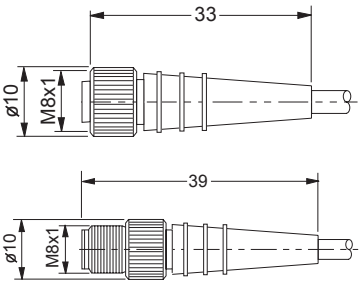


Figure 2

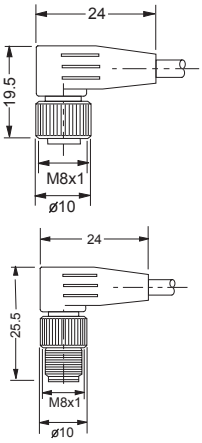


Figure 3

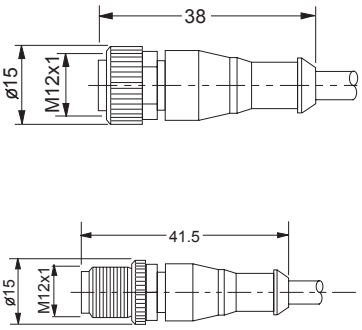
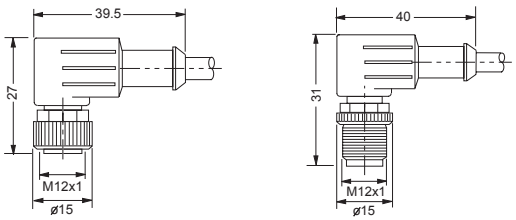


Figure 4



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	check	2m (6.56ft.)	4	Axial	PVC	Figure 1
CD08-0W-020-C1	check	2m (6.56ft.)	4	Right-angle	PVC	Figure 2
CD08-0G-050-A1	check	5m (16.4ft.)	4	Axial	PVC	Figure 1
CD08-0W-050-C1	check	5m (16.4ft.)	4	Right-angle	PVC	Figure 2
CD08-0G-100-A1	check	10m (32.8ft.)	4	Axial	PVC	Figure 1
CD08-0W-100-C1	check	10m (32.8ft.)	4	Right-angle	PVC	Figure 2

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

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

Figure 1

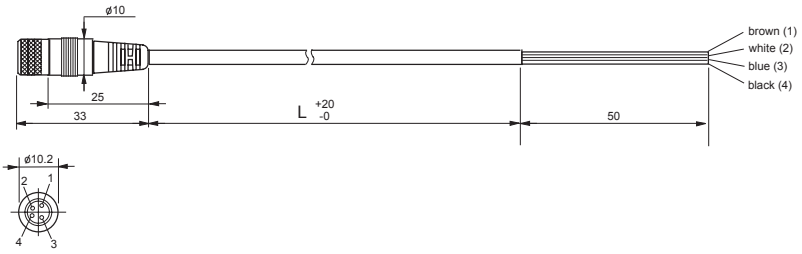
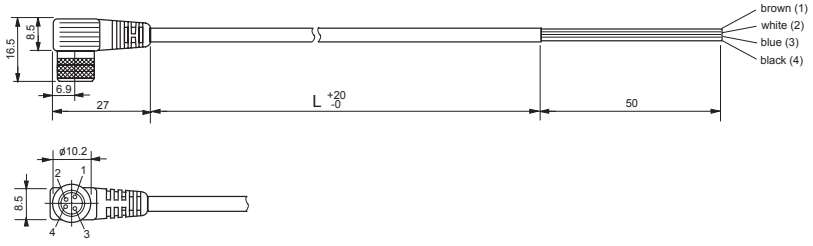


Figure 2

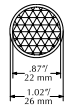


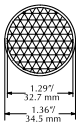
ACCESSORIES: REFLECTORS AND SHUTTERS

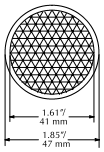
RL series reflectors for retroreflective photoelectric sensors (all models)

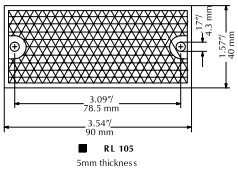
- Suitable for use with polarized light photoelectric sensors
- Shapes and sizes for most applications
- Miniature types for close mounting in multiple sensor installations
- Single hole, dual hole and stud mounting types available
- 10 reflectors per package

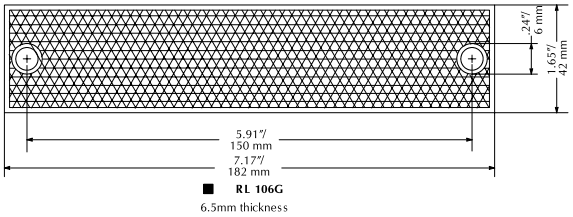
Dimensions

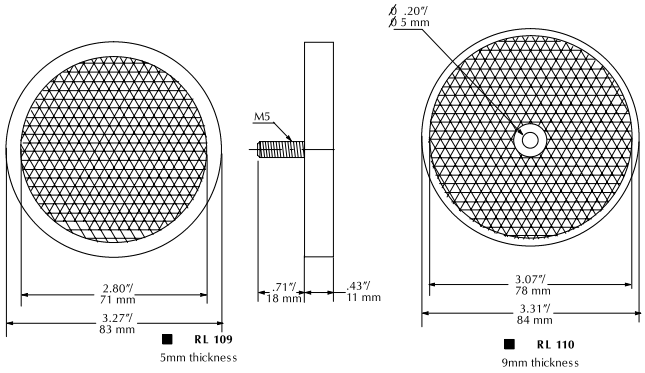












Installation notes

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

Specifications							
Model	**RL102**	**RL103**	**RL104**	**RL105**	**RL106G**	**RL109**	**RL110** [3]
Price	check	check	check	check	check	check	check
% Sensing Range Using SSP [1]	50%	40%	50%	50%	50%	50%	100%
% Sensing Range Using QXP [1]	--	35%	60%	50%	45%	30%	100%
Dimensions	Ø26mm	Ø36mm	Ø47mm	90x40mm	182x42mm	Ø83mm	Ø84mm
Degree of Protection [2]	IEC IP67						
Mounting	Customer-supplied adhesive or other mounting method required			two Ø4.3mm holes	two Ø6mm holes	one M5 stud	one Ø5mm hole
Materials	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.

ST0S1 through ST0S8 shutters for M18 (18mm) 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 screws onto the optical head of both the emitter and receiver. The table above shows the sensing distance and minimal detectable object

Sensing Distance (when used with SSE / SSR Model Photoelectric switches)						
Model	**ST0S1**	**ST0S2**	**ST0S3**	**ST0S4**	**ST0S6**	**ST0S8**
Price	check	check	check	check	check	check
Ø x shutter (mm)	1	2	3	4	6	8
Distance (m) **object (mm)**	/ /	/ /	1 1.5	1.5 2	3.5 3	6.5 4

Accessories: Reflectors, Adapters & Mounting Brackets

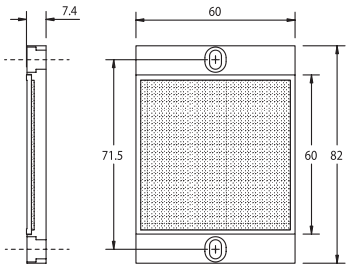
RL series reflectors for retroreflective Laser photoelectric sensors (FALN series)

- 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

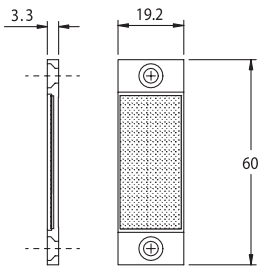
Specifications			
Model	**RL201**	**RL203**	**RL204**
Sensing Range Using FALN [1]	30m	7m	7m
Dimensions	60mm x 82mm	19mm x 60mm	20mm x 32mm
Mounting	two Ø4mm holes	two Ø6mm holes	two Ø3mm holes
Degree of Protection [2]	IEC IP67		
Materials	Acrylic/polycarbonate		

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.

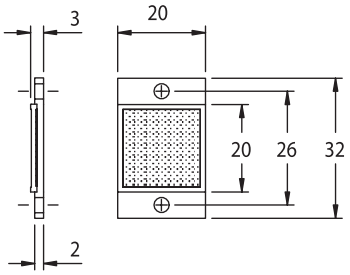
RL201



RL203



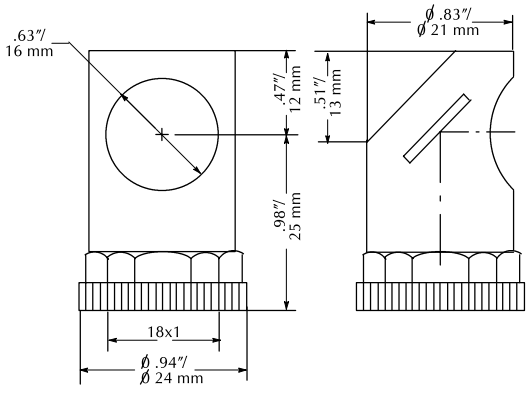
RL204



ST03 right-angle M18 (18mm) beam adapter

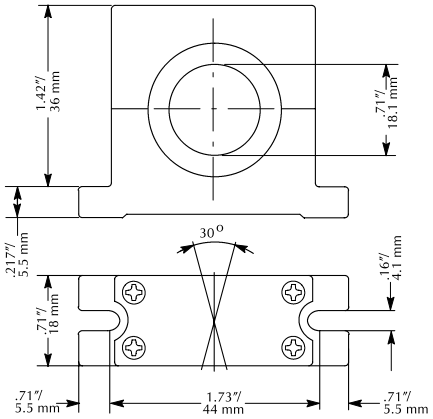
For use with M18 retroreflective and through-beam photoelectric switches (not for use with diffuse reflection sensors).

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 (18mm)

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).

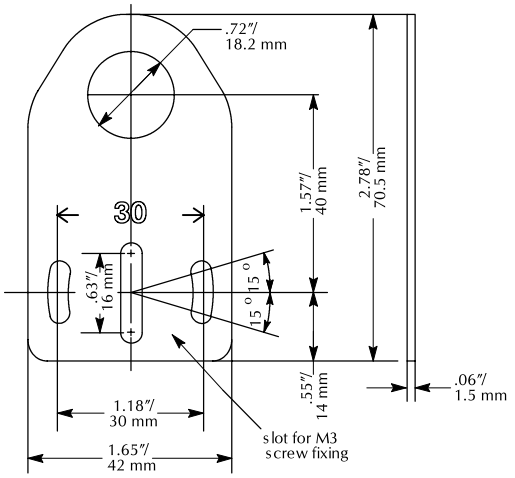


ACCESSORIES: MOUNTING BRACKETS

ST18A axial bracket

Metal mounting bracket for M18 (18mm) sensors. Has two mounting holes (use 4mm screws) and allows the rotation of an optical axis for right-beam-angle-adapter sensors. Includes hexagonal nuts to secure sensor.

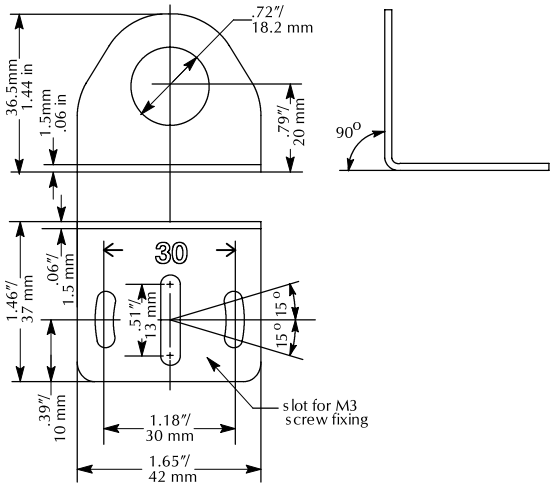
(10 pack)



ST18C metal right-angle bracket

Metal angular mounting bracket for M18 (18mm) sensors. Has two mounting holes (use 4mm screws) and allows the rotation of an optical axis for axial sensors. Includes hexagonal nuts to secure sensor.

(10 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 detected and not to flow when a target is not 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 Photosensor

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

Teach1: 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 UB 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 24 V and a specified maximum output current of 200 mA, the minimum load resistance is 120 Ohms; for 15 V, the value is 75 Ohms (R=V/I. In this example,120 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

PHOTOELECTRIC SENSOR TERMINOLOGY

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.

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.

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 recommend 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 retroreflective photoelectric sensor

This is a variant of the retroreflective 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.

Retroreflective 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

Photoelectric Sensor Terminology

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

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: 0F 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.

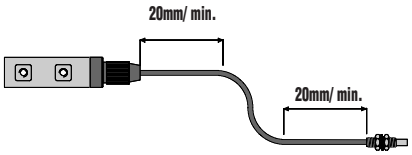
For plastic fibers, the opening angle is 60°; for glass fibers, it is 70°.

Attenuation

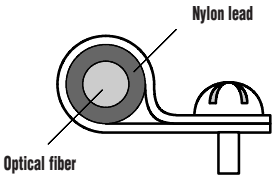
Attenuation is the reduction in signal power caused by the length of the fiber. This parameter must be considered if using fibers with length greater than the standard size.

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.

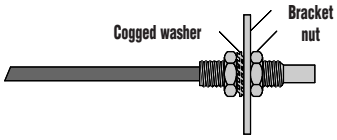


- Secure the fibers using nylon fairleads or cable clamps to avoid causing pressure that could deform the fiber.



- Adjust the ring nut using the following maximum torque wrench settings:

M7: 4.5 Nm (39.83 lb./inches)
M6: 1.2 Nm (10.62 lb./inches)
M4: 0.8 Nm (7.08 lb./inches)
M3: 0.8 Nm (7.08 lb./inches)



- Set the smooth terminations of the optical fiber using a dowel following the maximum torque wrench settings:

Ø = 3mm: 0.25 Nm (2.2 lb./inches)
Ø > 3mm: 0.5 Nm (4.43 lb./inches)

- 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.
0F Series: insert the special termination in the fiber-carrier seat of the MSF amplifier and tighten the ring nut securely.

Please note:

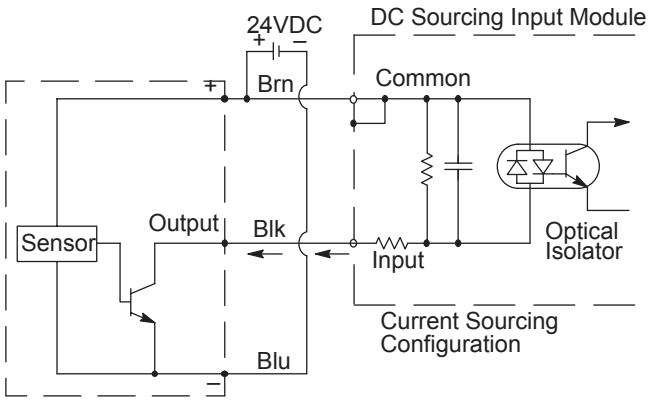
It is important that the minimum radius of curvature be followed to avoid performance loss or breakage of bendable fiber terminations:

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

PHOTOELECTRIC SENSOR TERMINOLOGY

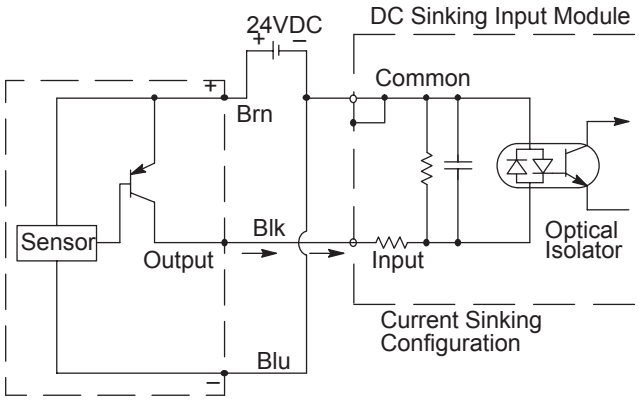
Field Device Examples - 3 Wire Connections

NPN (Sinking)
Field Device Example



(NPN) Current Sinking
Field Device

PNP (Sourcing)
Field Device Example



(PNP) Current Sourcing
Field Device