# FM Series Photoelectric Sensors

## Harsh Duty Rectangular


- 27 harsh duty, washdown models available
- Rectangular photoelectric sensor (photo eye)
- 316L stainless steel housing
- Diffuse, diffuse with background suppression, polarized retroreflective and through-beam models
- 3-wire NPN or PNP
- Through-beam models consist of emitter and receiver pair (sold separately)
- 2m output cable, M8, or M12 quick-disconnect Purchase cable separately
- Reflectors and mounting brackets available
- IP69K for food and beverage applications

### FM Series Photoelectric Sensors (Diffuse) Selection Chart

| Part Number | Price | Sensing Range | Emission Type | Logic | Connection | Wiring | Dimensions | Characteristic Curves |
|---|---|---|---|---|---|---|---|---|
| FMR6-0P-0A | $51.00 | 5 – 500 mm [0.197 – 19.68 in] | Visible Red 633 nm | PNP | 2m [6.5 ft] cable (pigtail) | Diagram 1 | Figure 1 | 3 |
| FMR6-0P-0E | $53.00 | | | PNP | 0.3 m cable with M12 quick-disconnect connector | Diagram 3 | Figure 1 | |
| FMR6-0P-0F | $51.00 | | | PNP | 4-pin M8 quick-disconnect | Diagram 3 | Figure 2 | |
| FMR6-0N-0A | $51.00 | | | NPN | 2m [6.5 ft] cable | Diagram 2 | Figure 1 | |
| FMR6-0N-0E | $53.00 | | | NPN | 0.3 m cable with M12 quick-disconnect connector | Diagram 4 | Figure 1 | |
| FMR6-0N-0F | $51.00 | | | NPN | 4-pin M8 quick-disconnect | Diagram 4 | Figure 2 | |

**Note: Brackets sold separately.**

### FM Series Photoelectric Sensors (Diffuse with Background Suppression) Selection Chart

| Part Number | Price | Sensing Range | Emission Type | Logic | Connection | Wiring | Dimensions | Characteristic Curves |
|---|---|---|---|---|---|---|---|---|
| FMRS-0P-0A | $69.00 | 2 – 200 mm [0.079 – 7.87 in] | Visible Red 633 nm | PNP | 2m [6.5 ft] cable | Diagram 1 | Figure 1 | 4 |
| FMRS-0P-0E | $71.00 | | | PNP | 0.3 m cable with M12 quick-disconnect connector | Diagram 3 | Figure 1 | |
| FMRS-0P-0F | $69.00 | | | PNP | 4-pin M8 quick-disconnect | Diagram 3 | Figure 2 | |
| FMRS-0N-0A | $69.00 | | | NPN | 2m [6.5 ft] cable | Diagram 2 | Figure 1 | |
| FMRS-0N-0E | $71.00 | | | NPN | 0.3 m cable with M12 quick-disconnect connector | Diagram 4 | Figure 1 | |
| FMRS-0N-0F | $69.00 | | | NPN | 4-pin M8 quick-disconnect | Diagram 4 | Figure 2 | |

**Note: Brackets sold separately.**

### FM Series Photoelectric Sensors (Polarized Retroreflective) Selection Chart

| Part Number | Price | Sensing Range | Emission Type | Logic | Connection | Wiring | Dimensions | Characteristic Curves |
|---|---|---|---|---|---|---|---|---|
| FMRP-0P-0A | $60.00 | 0.05 – 5 m [0.16 – 16.40 ft] | Visible Red 633 nm | PNP | 2m [6.5 ft] cable | Diagram 1 | Figure 1 | 2 |
| FMRP-0P-0E | $62.00 | | | PNP | 0.3 m cable with M12 quick-disconnect connector | Diagram 3 | Figure 1 | |
| FMRP-0P-0F | $60.00 | | | PNP | 4-pin M8 quick-disconnect | Diagram 3 | Figure 2 | |
| FMRP-0N-0A | $60.00 | | | NPN | 2m [6.5 ft] cable | Diagram 2 | Figure 1 | |
| FMRP-0N-0E | $62.00 | | | NPN | 0.3 m cable with M12 quick-disconnect connector | Diagram 4 | Figure 1 | |
| FMRP-0N-0F | $60.00 | | | NPN | 4-pin M8 quick-disconnect | Diagram 4 | Figure 2 | |

**Note: Reflectors and brackets sold separately.**

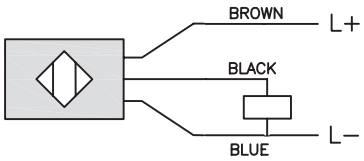
# FM Series Photoelectric Sensors

| FM Series Photoelectric Sensors (Through-beam) Selection Chart | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Part Number* | *Price* | *Sensing Range* | *Emission Type* | *Logic* | *Connection* | *Wiring* | *Dimensions* | *Characteristic Curves* |
| ***Emitters*** | | | | | | | | |
| ***FMRE-00-0A*** | $40.00 | Up to 10m [32.81 ft] | Visible Red 633 nm | – | 2m [6.5 ft] cable | Diagram 5 | Figure 1 | – |
| ***FMRE-00-0E*** | $45.00 | | | – | 0.3 m cable with M12 quick-disconnect connector | Diagram 6 | Figure 1 | – |
| ***FMRE-00-0F*** | $40.00 | | | – | 4-pin M8 quick-disconnect | Diagram 6 | Figure 2 | – |
| ***Receivers*** | | | | | | | | |
| ***FMRR-0P-0A*** | $49.00 | Up to 10m [32.81 ft] | – | PNP | 2m [6.5 ft] cable | Diagram 1 | Figure 1 | 1 |
| ***FMRR-0P-0E*** | $51.00 | | | PNP | 0.3 m cable with M12 quick-disconnect connector | Diagram 3 | Figure 1 | |
| ***FMRR-0P-0F*** | $49.00 | | | PNP | 4-pin M8 quick-disconnect | Diagram 3 | Figure 2 | |
| ***FMRR-0N-0A*** | $49.00 | | | NPN | 2m [6.5 ft] cable | Diagram 2 | Figure 1 | |
| ***FMRR-0N-0E*** | $51.00 | | | NPN | 0.3 m cable with M12 quick-disconnect connector | Diagram 4 | Figure 1 | |
| ***FMRR-0N-0F*** | $49.00 | | | NPN | 4-pin M8 quick-disconnect | Diagram 4 | Figure 2 | |

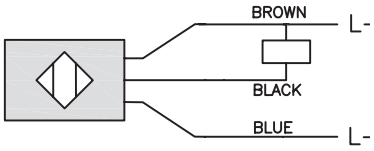
**Note: Brackets sold separately.**

## Wiring Diagrams

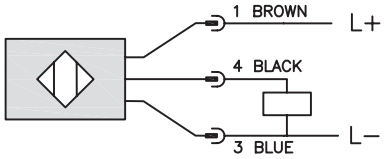
### Diagram 1



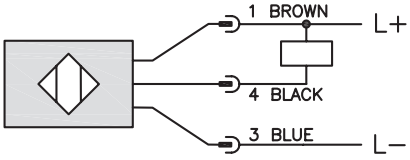

### Diagram 2



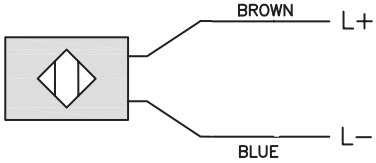

### Diagram 3



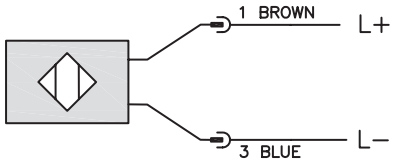

### Diagram 4



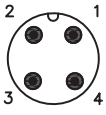

### Diagram 5



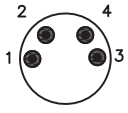

### Diagram 6




**Connector**
**M12 Connector***




**Connector**
**M8 Connector***




* Displaying sensor end.

Cable Assembly Wiring Colors:

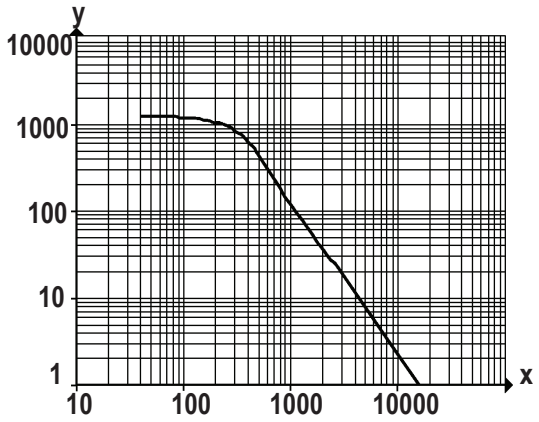
- Pin 1 - Brown
- Pin 2 - White
- Pin 3 - Blue
- Pin 4 - Black

***Note: wiring colors are based on AutomationDirect 4-pole cable assemblies.***

# FM Series Photoelectric Sensors

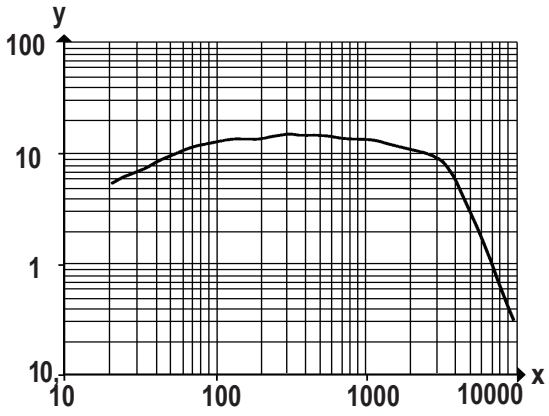
## Characteristic Curves

### Curve 1 (Through-beam)



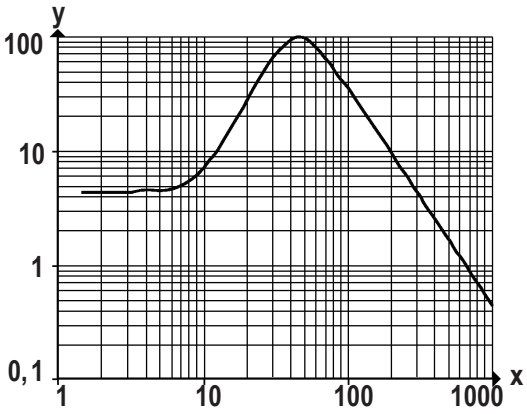

*Excess gain graphs*
*x: distance [mm]*
*y: excess gain factor*

### Curve 2 (Polarized Retroreflective)



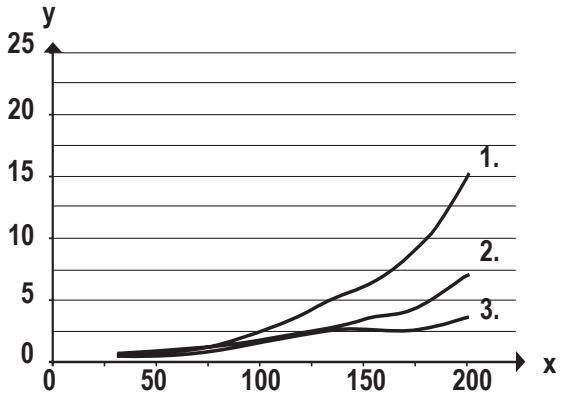

*Excess gain graphs*
*x: distance [mm]*
*y: excess gain factor*

### Curve 3 (Diffuse)




*Excess gain graphs*
*x: distance [mm]*
*y: excess gain factor*

### Curve 4 (Diffuse with Background Suppression)




*c: background*
*x: distance sensor/object*
*y: min. distance object/background*

*Values in [mm]*
*1 = object black (6% remission), background white (90% remission)*
*2 = object gray (18% remission), background white (90% remission)*
*3 = object white (90% remission), background white (90% remission)*

# FM Series Photoelectric Sensors

| FM Series Photoelectric Sensors Specifications | | | | |
|---|---|---|---|---|
| ***Type*** | ***Diffuse*** | ***Background suppression*** | ***Polarized Retroreflective*** | ***Through-beam*** |
| ***Sensing Distance*** | Refer to Photoelectric Sensors Selection Guide (FM Series DC) | | | |
| ***Light Spot Diameter*** | Refer to Characteristic Curves | | | |
| ***Emission*** | Refer to FM Series Photoelectric Sensors Selection Charts | | | |
| ***Sensitivity*** | Adjustable | | | |
| ***Output State*** | Light-on or Dark-on | | | |
| ***Operating Voltage*** | 10 – 30 VDC | | | |
| ***No Load Supply Current*** | 16mA | 22mA | 12mA | 7mA |
| ***Operating (Load) Current*** | ≤ 100mA | | | |
| ***Off-state (Leakage) Current*** | – | | | |
| ***Voltage Drop*** | < 2.5 V | | | |
| ***Switching Frequency*** | 1 kHz | | | |
| ***Ripple*** | – | | | |
| ***Time Delay Before Availability (tv)*** | Minimal | | | |
| ***Short-Circuit Protection*** | Yes (non-latching) | | | |
| ***Operating Temperature*** | -25 to 80ºC [-13 to 176ºF] | | | |
| ***Thermal Drift*** | – | | | |
| ***Protection Degree (DIN 40050)*** | IP65 IP67 IP68 IP69K | | | |
| ***LED Indicators - Light On/Dark On*** | Green (Power); Yellow (Output Status) | | | |
| ***LED Indicators - Excess Gain*** | – | | | |
| ***Housing Material*** | 316L Stainless Steel | | | |
| ***Lens Material*** | Polymethyl methacrylate (PMMA) | | | |
| ***Shock/Vibration*** | See Photoelectric Sensor section | | | |
| ***Tightening Torque*** | – | | | |
| ***Weight*** | M8 quick-disconnect: 0.037 kg [1.31 oz] 0.3 m cable with M12 quick-disconnect connector: 0.053 kg [1.87 oz] 2-meter Cable: 0.084 kg [2.96 oz] | M8 quick-disconnect: 0.036 kg [1.27oz] 0.3 m cable with M12 quick-disconnect connector: 0.053 kg [1.87 oz] 2-meter Cable: 0.083 kg [2.93 oz] | M8 quick-disconnect: 0.037 kg [1.31 oz] 0.3 m cable with M12 quick-disconnect connector: 0.053 kg [1.87 oz] 2-meter Cable: 0.083 kg [2.93 oz] | M8 quick-disconnect: 0.036 kg [1.27oz] 0.3 m cable with M12 quick-disconnect connector: 0.053 kg [1.87 oz] 2-meter Cable: 0.084 kg [2.96 oz] |
| ***Connectors*** | Refer to FM Series Photoelectric Sensors Selection Charts | | | |
| ***Accessories*** | Reflectors and mounting brackets available | | | |
| ***Agency Approvals**** | UL # E328811 | | | |

*** To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.**

# FM Series Photoelectric Sensors

## Dimensions

inches [mm]

**Figure 1**

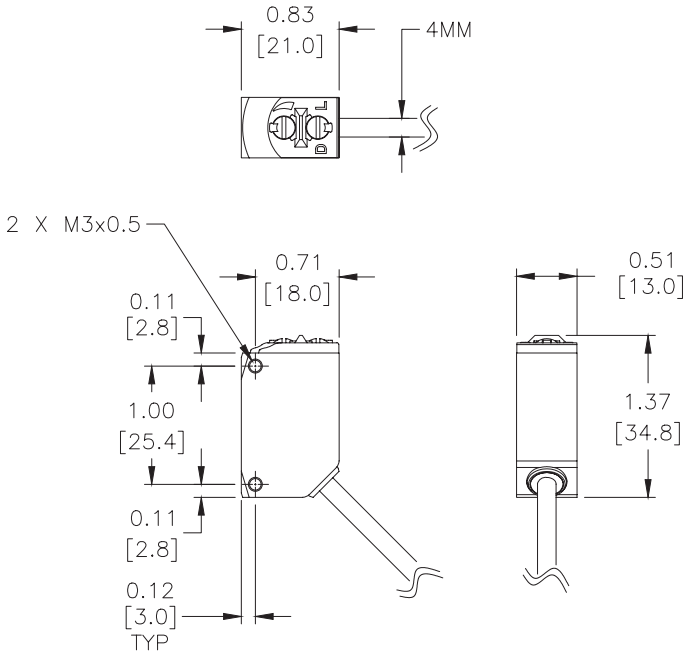
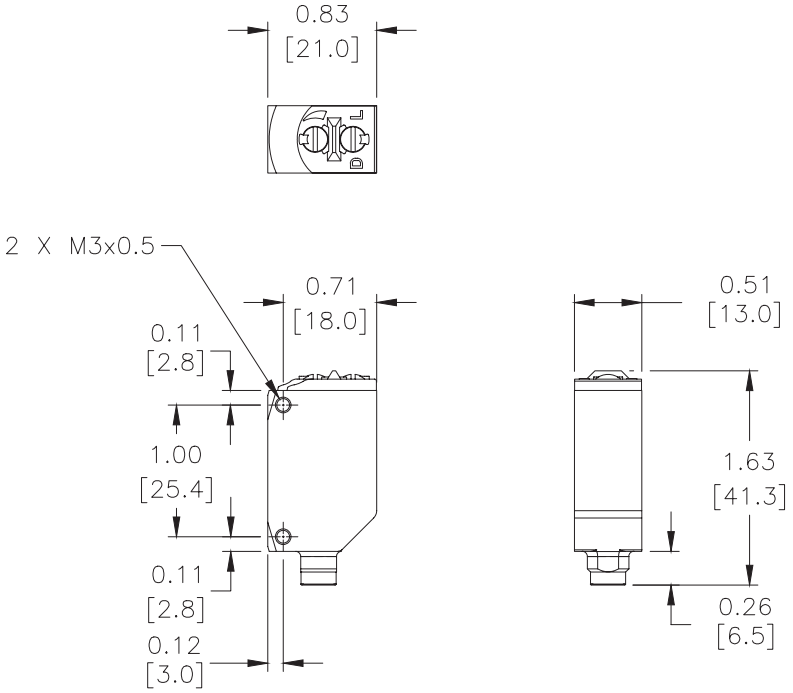
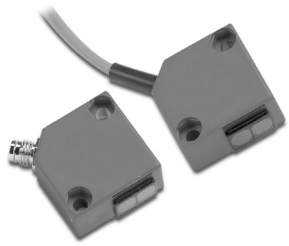



**Figure 2**



# 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

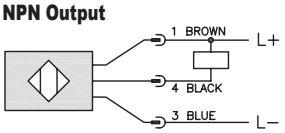

**CX Series Mini-Rectangular Photoelectric Sensors Selection Chart**

| Part Number | | Price | Sensing Range | Output State | Logic | Connection | Wiring | Dimensions | Characteristic Curves |
|---|---|---|---|---|---|---|---|---|---|
| ***Diffuse*** | | | | | | | | | |
| CX3-AN-1A | | $63.00 | Up to 600mm [23.62 in] | N.O. | NPN | 2m [6.5 ft] axial cable | Diagram 1 | Figure 1 | Chart 1 |
| CX3-AP-1A | | $63.00 | | | PNP | 2m [6.5 ft] axial cable | Diagram 2 | Figure 1 | Chart 1 |
| CX3-AN-1F | | $63.00 | | | NPN | M8 [8mm] connector | Diagram 1 | Figure 2 | Chart 1 |
| CX3-AP-1F | | $63.00 | | | PNP | M8 [8mm] connector | Diagram 2 | Figure 2 | Chart 1 |
| ***Diffuse with background suppression*** | | | | | | | | | |
| CX5-AN-1A | | $86.00 | 15-150mm [0.59 to 5.91 in] | N.O. | NPN | 2m [6.5 ft] axial cable | Diagram 1 | Figure 1 | Chart 2 |
| CX5-AP-1A | | $86.00 | | | PNP | 2m [6.5 ft] axial cable | Diagram 2 | Figure 1 | Chart 2 |
| CX5-AN-1F | | $86.00 | | | NPN | M8 [8mm] connector | Diagram 1 | Figure 2 | Chart 2 |
| CX5-AP-1F | | $86.00 | | | PNP | M8 [8mm] connector | Diagram 2 | Figure 2 | Chart 2 |
| ***Polarized reflective**** | | | | | | | | | |
| CXP-AN-1A | | $66.00 | Up to 2m [6.6 ft] | N.O. | NPN | 2m [6.5 ft] axial cable | Diagram 1 | Figure 1 | Chart 3 |
| CXP-AP-1A | | $66.00 | | | PNP | 2m [6.5 ft] axial cable | Diagram 2 | Figure 1 | Chart 3 |
| CXP-AN-1F | | $66.00 | | | NPN | M8 [8mm] connector | Diagram 1 | Figure 2 | Chart 3 |
| CXP-AP-1F | | $66.00 | | | PNP | M8 [8mm] connector | Diagram 2 | Figure 2 | Chart 3 |
| ***Through-beam*** | | | | | | | | | |
| CXR-AP-1A | Receiver | $63.00 | Up to 6m [19.7 ft] | N.O. | PNP | 2m [6.5 ft] axial cable | Diagram 2 | Figure 1 | Chart 4 |
| CXR-AP-1F | Receiver | $63.00 | | | PNP | M8 [8mm] connector | Diagram 2 | Figure 2 | Chart 4 |
| CXE-0N-1A | Emitter | $40.50 | | Receiver dependent | Receiver dependent | 2m [6.5 ft] axial cable | Diagram 3 | Figure 1 | Chart 4 |
| CXE-0N-1F | Emitter | $40.50 | | | | M8 [8mm] connector | Diagram 3 | Figure 2 | Chart 4 |

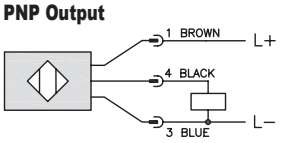
*Purchase reflectors separately.
**Purchase one receiver and one emitter for a complete set.

## Wiring Diagrams

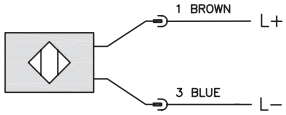
### Diagram 1
**NPN Output**




### Diagram 2
**PNP Output**

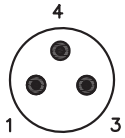



### Diagram 3
**Emitter**




*Emitter test input (<4V: OFF / >8V or open: ON) 0.5mA*

### Connector
**M8 connector**




**Switching Element Function**

| | Through-beam and Reflective Models | Diffuse Reflective Models |
|---|---|---|
| ***Light-on*** | N.C. | N.O. |
| ***Dark-on*** | N.O. | N.C. |

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

# CX Series Photoelectric Sensors

| CX Series Photoelectric Sensors Specifications | | | | |
|---|---|---|---|---|
| ***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*** | 600mm² | 15 to 150mm³ | 2m | 6m |
| ***Light Spot Diameter*** | See charts | | | |
| ***Emission*** | IR-LED [880nm] | LED red [660nm] | LED red polarized [660nm] | IR-LED [880nm] |
| ***Sensitivity*** | Adjustable 12-turn pot. | | | |
| ***Output Type*** | NPN or PNP; N.O. only | | | |
| ***Operating Voltage*** | 10-36 VDC | | | |
| ***No Load Supply Current*** | 15mA | 25mA | 15mA | 15mA (R) / 10mA (E) |
| ***Operating (Load) Current*** | ≤ 200mA | | | |
| ***Off-state (Leakage) Current*** | ≤ 10µA | | | |
| ***Voltage Drop*** | ≤ 2.0V | | | |
| ***Switching Frequency*** | 1kHz | 500Hz | 1kHz | 1kHz |
| ***Ripple*** | ≤ 20% | | | |
| ***Time Delay Before Availability (tv)*** | 100ms | | | |
| ***Short-Circuit Protection*** | Yes (switch auto-resets after overload is removed) | | | |
| ***Operating Temperature*** | -25 to 55°C [-13 to 131°F] | | | |
| ***Protection Degree (DIN 40050)*** | IEC IP65 | | | |
| ***LED Indicators - Switching Status*** | Yellow (output state, output energized), green (excess light indication) | | | |
| ***Housing Material*** | PBTP (Crastin) | | | |
| ***Lens Material*** | Glass | | | |
| ***Shock/Vibration*** | See terminology section | | | |
| ***Tightening Torque*** | N/A | | | |
| ***Weight (cable/connector)*** | 84g [2.96 oz] / 49g [1.73 oz] | | | 232g [8.40oz] / 98g [3.46oz] |
| ***Connectors*** | 2m [6.5 ft] axial cable; M8 [8mm] connector | | | |
| ***Agency Approvals*** | cULus E32881 | | | |

**[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**
**To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page.**

## Dimensions

(mm)

**Figure 1**

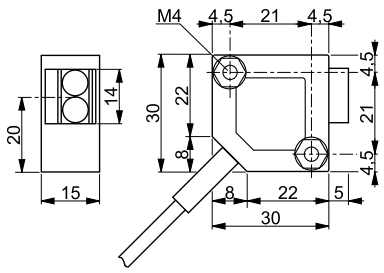
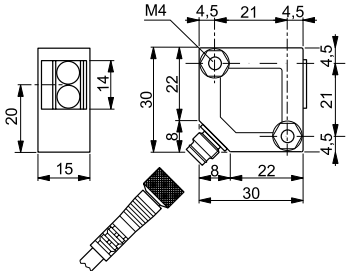



**Figure 2**




## Characteristic curves

**Chart 1 (Diffuse)**

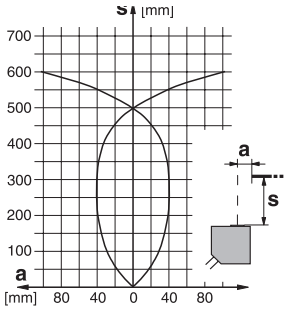



**Chart 2 (Diffuse with background suppression)**

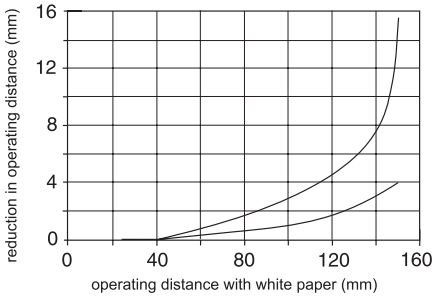



**Chart 3 (Polarized reflective)**

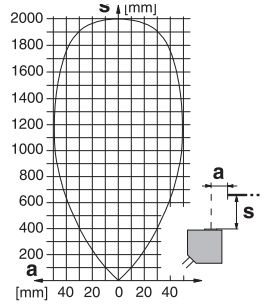
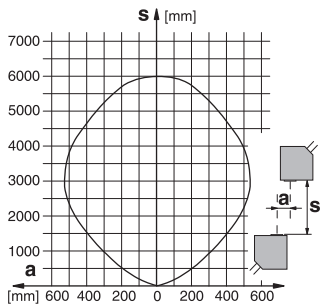



**Chart 4 (Through-beam)**



# OPT Short Range (CMOS) Series Photoelectric Sensors

OPT2001

## 50 x 50mm rectangular plastic - DC

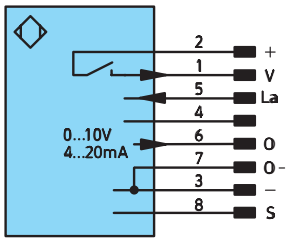
- Diffuse (Reflex) laser distance measurement sensors with CMOS technology
- Analog and switching outputs available
- Measured value independent of material, color, and brightness
- Class 1 and 2 lasers available (safety label included with Class 2 lasers)
- High resolution down to 8µm - (analog scalable down to 5mm range)
- High speed response times down to 660µs
- M12 quick-disconnect; purchase cable separately
- Mounting hardware included


**OPT Series Photoelectric Sensors Selection Chart**

| Part Number | Price | Sensing Range | Laser Class | Measurement Rate | Resolution | Output State | Logic | Connection | Wiring | Drawing Link | Characteristic Curves |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Diffuse (Reflex)* | | | | | | | | | | | |
| OPT2001 | $778.00 | 30-80mm [1.18-3.15 in] | 2 | 1500/s [660 µs] | < 8µm | Analog 4-20mA or 0-10V | — | 8-pin M12 quick-disconnect | Diagram 1 | PDF | See Characteristic Curve |
| OPT2002 | $778.00 | | 1 | 1000/s [1000 µs] | | | — | | | PDF | |
| OPT2003 | $778.00 | 40-160mm [1.57-6.30 in] | 2 | 1500/s [660 µs] | < 20µm | | — | | | PDF | |
| OPT2004 | $778.00 | | 1 | 1000/s [1000 µs] | | | — | | | PDF | |
| OPT2005 | $778.00 | 50-350mm [1.97-13.80 in] | 2 | 800/s [1250 µs] | < 50µm | | — | | | PDF | |
| OPT2006 | $778.00 | | 1 | 500/s [2000 µs] | | | — | | | PDF | |
| OPT2007 | $390.00 | 0 - 660 mm [0 - 25.98 in] working range 60-660 mm [2.36 - 25.98 in] adjustable range | 1 | 100 Hz switching | Hysteresis <1 % of range | Selectable [N.O.,N.C.] | 5-wire, configurable as PNP, NPN, or Push-Pull | 5-pin M12 quick-disconnect | Diagram 2 | PDF | — |

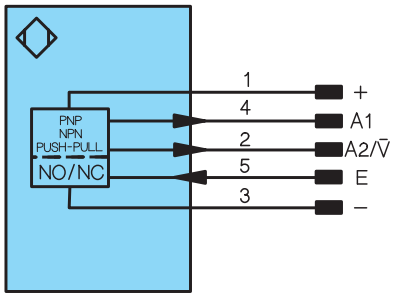
## Wiring Diagrams

### Diagram 1




| | |
|---|---|
| + | Supply Voltage "+" |
| V | Contamination/Error output (NO) |
| O | Analog output |
| O– | Ground for the analog output |
| – | Supply Voltage "0 V" |
| S | Shielding |
| La | Emitted Light disengageable |

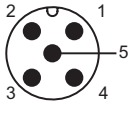
### Diagram 2



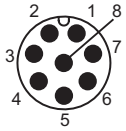

| | |
|---|---|
| + | Supply Voltage "+" |
| – | Supply Voltage "0 V" |
| A1/A2 | Switching output (NO) |
| V̄ | Contamination Warning/ Error Output (NC) |
| E | Input (Teach Input, Emitted light can be switched off) |

### Connectors

**5-Pin M12 connector**




**8-Pin M12 connector**

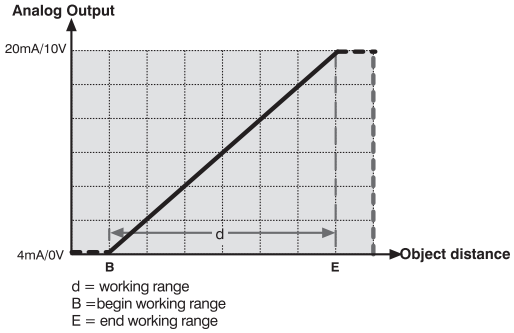



*Note: Class 2 power source required*

# OPT Short Range (CMOS) Series Photoelectric Sensors

| Specifications | OPT2001 | OPT2002 | OPT2003 | OPT2004 | OPT2005 | OPT2006 | OPT2007 |
|---|---|---|---|---|---|---|---|
| Type | Diffuse Reflex | | | | | | |
| Sensing Distance | 30-80 mm [1.18-3.15 in] | 30-80 mm [1.18-3.15 in] | 40-160 mm [1.57- 6.30 in] | 40-160 mm [1.57- 6.30 in] | 50-350 mm [1.97-13.78 in] | 50-350 mm [1.97-13.78 in] | 60-660 mm [2.36-25.98 in] |
| Light Spot Diameter (at maximum range) | 1 x 2 mm [0.04 x 0.08 in] | 0.7 x 1.4 mm [0.03 x 0.06 in] | 1 x 2.5 mm [0.04 x 0.10 in] | 0.9 x 1.8 mm [0.04 x 0.07 in] | 1.5 x 4 mm [0.06 x 0.16 in] | 1.4 x 3.1 mm [0.06 x 0.12 in] | 2.0 x 5.5 mm [0.08 x 0.22 in] |
| Emission | Class 2 Red laser 660Nm | Class 1 Red laser 660Nm | Class 2 Red laser 660Nm | Class 1 Red laser 660Nm | Class 2 Red laser 660Nm | Class 1 Red laser 660Nm | Class 1 Red laser 655Nm |
| Sensitivity | Adjustable via Teach | | | | | | |
| Output Type | 0-10 VDC or 4-20mA: PNP error output | | | | | | Complementary N.O./N.C. [Light-on, Dark-on] PNP or NPN |
| Current Output Max Load | 500Ω | | | | | | NA |
| Voltage Output Min Load | 10 KΩ | | | | | | NA |
| Operating Voltage | 18-30 VDC | | | | | | 10-30 VDC |
| No Load Supply Current | < 80mA @ 24VDC | | | | | | <50mA @ 2VDC |
| Operating (Load) Current | max 200mA | | | | | | |
| Off-state (Leakage) Current | negligible | | | | | | |
| Voltage Drop | < 2.5V | | | | | | <1.5V |
| Measurement Rate/ Resolution | 1500/s [660µs] @ 12µm 600/s [1660µs] @ 8µm | 1000/s [1000µs] @ 12µm 500/s [2000µs] @ 8µm | 1500/s [660µs] @ 30µm 600/s [1660µs] @ 20µm | 1000/s [1000µs] @ 30µm 500/s [2000µs] @ 20µm | 800/s [1250µs] @ 80µm 400/s [2500µs] @ 50µm | 500/s [2000µs] @ 80µm 250/s [4000µs] @ 50µm | NA |
| Switching Frequency | 1.5 kHz | 1.0 kHz | 1.5 kHz | 1.0 kHz | 800Hz | 500Hz | 100Hz |
| Linearity | 0.1% | | | | 0.15% | | NA |
| Time Delay Before Availability (tv) | NA | | | | | | |
| Short-Circuit Protection | Yes | | | | | | |
| Operating Temperature | -25 to 50°C [-13 to 122°F] | | | | | | -25 to 60°C [-13 to 140°F] |
| Protection Degree (DIN 40050) | IEC IP67 | | | | | | IEC IP68 |
| LED Indicators - Switching Status | Yellow | | | | | | |
| LED Indicators - Power | Green | | | | | | |
| Housing Material | Polycarbonate | | | | | | |
| Lens Material | Polymethyl methacrylate (PMMA) | | | | | | |
| Shock/Vibration | See terminology section. | | | | | | |
| Tightening Torque | 0.5 N·m (mounting screws) | | | | | | |
| Weight (lbs) (cable/connector) | 0.2 | | | | | | |
| Connectors | M12 quick-disconnect | | | | | | |
| Agency Approvals | CE, cULUS, E189727, RoHs | | | | | | |

## Characteristic Curves




d = working range
B = begin working range
E = end working range

***IMPORTANT NOTE***
The Laser Classification Systems for the standards IEC (EN) 60825-1 defines the following safety classes:

***Class 1***
This class is eye-safe under all operating conditions.

***Class 2***
These are visible lasers. This class is safe for accidental viewing under all operating conditions. However, it may not be safe for a person who deliberately stares into the laser beam for longer than 0.25 seconds, by overcoming their natural aversion response to the very bright light.

# OPT Series Transit Time Photoelectric Sensors

## Rectangular Plastic Distance Sensors

OPT2010, OPT2015, OPT2019

- Diffuse and Retro-reflective (Transit time) laser distance measurement sensors
- Analog and switching outputs available
- Measured value independent of material, color, and brightness
- Class 1 and 2 lasers available (safety label included with Class 2 lasers)
- M12 and M8 quick-disconnect and pigtail versions; purchase cable separately
- Mounting hardware included


### OPT Series Photoelectric Sensors Selection Chart

| Part Number | Price | Working Range m [ft] | Laser Class | Function | Measurement Rate | Resolution | Output State | Connection | Wiring Diagram | Dims [mm] | Drawing Link |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Diffuse (Transit Time)*** | | | | | | | | | | | |
| **OPT2010** | $306.00 | 0 - 3 [0 - 9.84] | 1 | Switching | 1kHz | Hysteresis < 15mm | Complementary (N.O./N.C.) PNP | 5-pin M12 quick-disconnect | 1 | 50 x 50 x 20 | PDF |
| **OPT2011** | $384.00 | 0.05 - 3.05 [0.16 - 10.01] | | Measuring / Switching | 500/s [2ms] | 1mm [0.04 in] | Analog 4-20 mA or 0-10 VDC | 4-pin M12 quick-disconnect | 2 | | PDF |
| **OPT2012** | $407.00 | 0.2 - 6.2 [0.66 - 20.34] | | | 1-100/s [10ms] | 1-12 mm [0.04 - 0.47 in] | Switching PNP/NPN (N.O./N.C.) | | 3 | 55 x 81 x 30 | PDF |
| **OPT2013** | $701.00 | 0.1 - 10.1 [0.33 - 33.14] | 2 | | | | | 8-pin M12 quick-disconnect | 4 | | PDF |
| **OPT2014** | $423.00 | | | | | | | 4-pin M12 quick-disconnect | 3 | | PDF |
| **OPT2016** | $317.00 | 0 - 1 [0 - 3.28] | 1 | Switching | 1kHz | Hysteresis < 20mm | Complementary (N.O./N.C.) PNP | 4-pin M8 quick-disconnect | 5 | 22 x 32 x 12 | PDF |
| **OPT2017** | $317.00 | | | | | | | 4-pin M12 quick-disconnect, 200mm [7.87 in] cable | | | PDF |
| **OPT2018** | $317.00 | | | | | | | 4-pin M8 quick-disconnect, 200mm [7.87 in] cable | | | PDF |
| **OPT2019** | $317.00 | | | | | | | Pigtail, 2m [6.5 ft] cable | | | PDF |
| **OPT2170** | $259.00 | 0 - 3 [0 - 9.84] | 1 | | 500HZ | Hysteresis < 15mm | 2 mutually independent switching PNP | 5-pin M12 quick-disconnect | 6 | 50 x 50 x 20 | PDF |
| **OPT2171** | $259.00 | | | | | | 2 mutually independent switching NPN | | 6 | | PDF |
| **OPT2172** | $207.00 | 0 - 1 [0 - 3.28] | | | | Hysteresis < 20mm | 2 mutually independent switching PNP | 4-pin M8 quick-disconnect | 7 | 22 x 32 x 12 | PDF |
| **OPT2173** | $207.00 | | | | | | | 4-pin M8 quick-disconnect, 200mm [7.87 in] cable | | | PDF |
| **OPT2174** | $207.00 | | | | | | | | | | PDF |
| ***Retro-Reflective (Transit Time)*** | | | | | | | | | | | |
| **OPT2015*** | $807.00 | 0.2 - 100.2 [0.66 - 328.74] | 1 | Measuring/ Switching | 1-100/s [10ms] | 4-20 mm [0.16 - 0.79 in] | Analog 4-20 mA or 0-10 VDC Switching PNP/NPN (N.O./N.C.) | 8-pin M12 quick-disconnect | 4 | 55 x 81 x 30 | PDF |

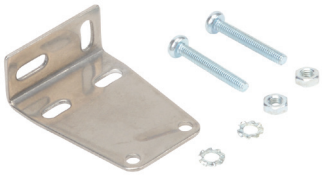
***Requires purchase of OPT2030 reflector (see Accessories). <50m sensing distance requires 1 reflector. 50-100m sensing distance requires 4 reflectors.**

# Accessories for QM and FM Series Photoelectric Sensors

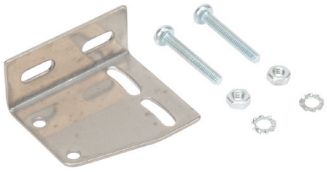
## Right-angle Mounting Brackets

Mounting bracket, right-angle vertical, 304 stainless steel. For use with QM & FM series photoelectric sensors. Mounting hardware included.

| Accessories for QM and FM Series Photoelectric Sensors | | | | |
|---|---|---|---|---|
| ***Part Number*** | ***Price*** | ***Description*** | ***Drawing Link*** | ***Weight [lb]*** |
| ***ST101*** | $3.00 | Micro Detectors mounting bracket, right-angle vertical, 304 stainless steel. For use with QM & FM series photoelectric sensors. Mounting hardware included. | PDF | 0.04 |
| ***ST102*** | $3.00 | Micro Detectors mounting bracket, right-angle horizontal, 304 stainless steel. For use with QM & FM series photoelectric sensors. Mounting hardware included. | PDF | 0.05 |
| ***ST104*** | $4.50 | Micro Detectors mounting bracket, protective horizontal, 304 stainless steel. For use with prewired QM & FM series photoelectric sensors only. Mounting hardware included. | PDF | 0.05 |



ST101



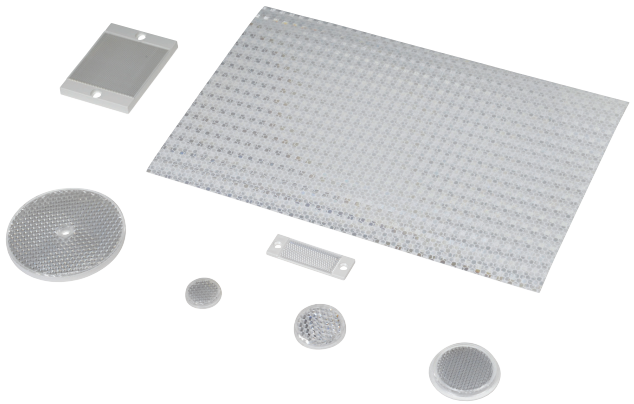
ST102

ST104

# Reflectors

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

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



## Installation Notes

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

**Reflector Specifications**

| Part number | Price | Drawing Link | Quantity | Dimensions mm [in] | Degree of Protection | Mounting | Materials |
|---|---|---|---|---|---|---|---|
| RL102 | $38.00 | PDF | 10 | 25 [0.98] | IEC IP67 | Customer-supplied adhesive or other mounting method required | Reflective face: PMMA Polymethylmethacrylate (acrylic)<br>Base material: ABS (Acrylonitrile-butadiene-styren) |
| RL102-1 | $4.25 | | 1 | | | | |
| RL103 | $42.50 | PDF | 10 | 34.5 [1.36] | | | |
| RL103-1 | $4.75 | | 1 | | | | |
| RL104 | $42.50 | PDF | 10 | 46 [1.81] | | | |
| RL104-1 | $4.75 | | 1 | | | | |
| RL105G | $38.00 | PDF | 10 | 95 x 38 [3.74 x 1.50] | | Two 4.3 mm holes | |
| RL105G-1 | $4.25 | | 1 | | | | |
| RL106G | $42.50 | PDF | 10 | 182 x 42 [7.17 x 1.65] | | Two 6mm holes | |
| RL106G-1 | $4.75 | | 1 | | | | |
| RL110 | $19.00 | PDF | 10 | 84 [3.31] | | One 5mm hole | |
| RL110-1 | $2.00 | | 1 | | | | |
| RL116 | $19.00 | PDF | 10 | 41 x 60 [3.54 x 2.36] | | Two 3mm holes | |
| RL116-1 | $2.00 | | 1 | | | | |
| RL100DA4 | $38.50 | NA | 1 | 200 x 300 [7.87 x 11.81] | | Self-adhesive | Paper (Acrylic tape with micro prism) |
| RL100DC4 | $12.00 | NA | 1 | 50 x 300 [1.97 x 11.81] | | | |
| RL100DQ1 | $8.75 | NA | 1 | 100 x 100 [3.94 x 3.94] | | | |
| RL111G | $60.00 | PDF | 10 | 22.5 x 47 [0.89 x 1.85] | | Two 3mm slots | Reflective face: PMMA Polymethylmethacrylate (acrylic)<br>Base material: ABS (Acrylonitrile-butadiene-styren) |
| RL111G-1 | $7.25 | | 1 | | | | |
| RL112G | $44.00 | PDF | 10 | 19 x 73 [0.75 x 2.87] | | | |
| RL112G-1 | $4.75 | | 1 | | | | |
| RL113G | $53.00 | PDF | 10 | 51.4 x 60.3 [2.02 x 2.37] | | Two 4mm slots | |
| RL113G-1 | $6.00 | | 1 | | | | |

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

# Reflectors

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

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

| Specifications | | | | | | |
|---|---|---|---|---|---|---|
| ***Part Number*** | ***RL201*** | ***RL201-1*** | ***RL203*** | ***RL203-1*** | ***RL204*** | ***RL204-1*** |
| ***Price*** | $38.00 | $8.25 | $35.50 | $7.75 | $30.00 | $6.75 |
| ***Quantity*** | 5 | 1 | 5 | 1 | 5 | 1 |
| ***Drawing Link*** | PDF | | PDF | | PDF | |
| ***Dimensions*** | 60 x 82 mm<br>2.36 x 3.23 in | | 19 x 6mm<br>0.75 x 2.36 in | | 20mm x 32mm<br>0.80 in x 1.26 in | |
| ***Degree of Protection*** [1] | IEC IP67 | | | | | |
| ***Mounting*** | Two 0.4 mm holes | | Two 0.4 mm holes | | Two 0.3 mm holes | |
| ***Materials*** | Acrylic/polycarbonate | | | | | |

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