

OPERATING PRINCIPLES FOR PHOTOELECTRIC SENSORS

These sensors use light sensitive elements to detect objects and are made up of an emitter (light source) and a receiver. Four types of photoelectric sensors are available.

Direct Reflection - emitter and receiver are housed together and use the light reflected directly off the object for detection. In the use of these photocells, it is important to bear in mind the color and the type of surface of the object. With opaque surfaces, the sensing distance is affected by the color of the object. Light colors correspond to the maximum distances and vice versa. In the case of shiny objects, the effect of the surface is more important than the color. The sensing distance in the technical data is related to matte white paper.

Reflection with Reflector - emitter and receiver are housed together and requires a reflector. An object is detected when it interrupts the light beam between the sensor and reflector. These photocells allow longer sensing distances, as the rays emitted are almost totally reflected towards the receiver.

Polarized Reflection with Reflector - similar to Reflection with Reflector, these photocells use an anti-reflex device. The use of such a device, which bases its functioning on a polarized band of light, offers considerable advantages and secure readings even when the object to be sensed has a very shiny surface. They are not in the technical data affected by random reflections.

Thru Beam - emitter and receiver are housed separately and detect an object when it interrupts the light beam between the emitter and receiver. These photocells allow for the longest distances.

Light On / Dark On Types Of Output: For the photocell, the same terminology as inductive and capacitive sensors is used: NO = normally open, NC = normally closed. This refers to the state of the unit in the absence of the product to be sensed. In the case of photocells, light on / dark on is used. In the case of the direct reflection types, NO is light on and NC is dark on. For the other types, NO is dark on and NC is light on.

Sensing Distance (Sn): The space in which it is possible to sense an object. In the case of direct reflection types, it is the maximum distance between the photocell and the object. In the case of reflector or barrier types, it is the distance between the unit and the reflector or between units.

Power Supply: The supply voltage range that sensor will operate at.

Power On Delay: This is the time lapse between providing power and the operation of the output. This is to avoid unwanted switching when the unit is powered.

Power Drain: The amount of current required to operate a sensor.

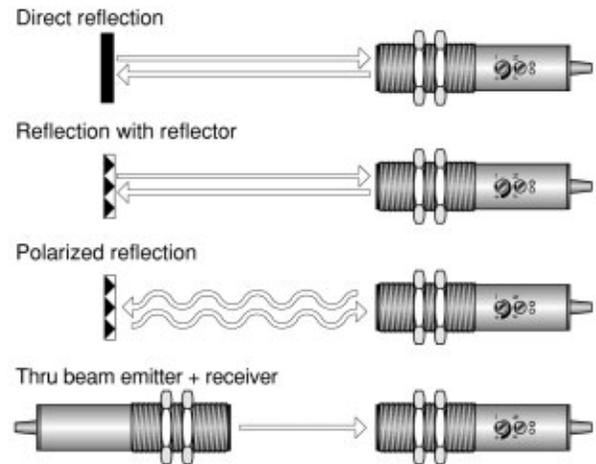
Voltage Drop: The voltage drop across a sensor when driving the maximum load.

Switching Current (Max): The amount of continuous current allowed to flow through the sensor without causing damage to the sensor. It is given as a maximum value.

Short Circuit Protection: Protection against damage to a sensor if the load becomes shorted.

Operating Frequency: The maximum number of on/off cycles that the device is capable of in one second. According to EN 50010.

Light Immunity: The maximum limit of an incandescent light or sunlight. Beyond this limit, the photocell may not work correctly due to interference on the receiver.



Photoelectric

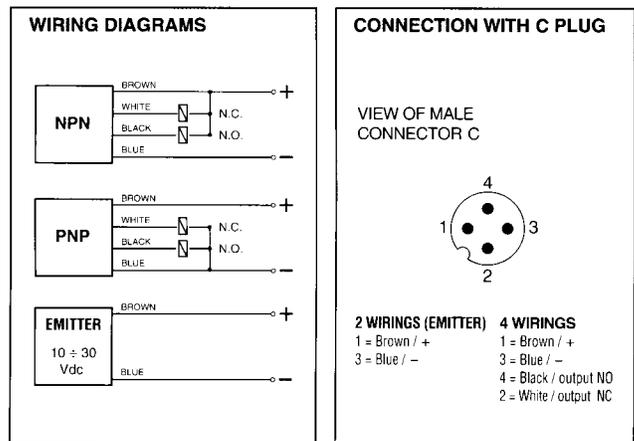
18 mm Plastic, DC

FEATURES:

- Low cost
- LED function indicators
- Short circuit & reverse polarity protection
- Pre-wired cable or connector models
- **CE** Compliant to the EMC directive
- Protection degree IP67: dust tight and protection from the effects of immersion

| | | MODEL | | | | |
|----------------------------------|-----|---|---------------------------|-------------------------------------|-----------------------|-------|
| Type | | Direct Reflection | Reflection with reflector | Polarized Reflection with reflector | Thru Beam | |
| | | | | | Receiver Emitter | |
| Cable, PVC, L= 2m | NPN | S4301 | S4320 | S4340 | S4368 | S4360 |
| | PNP | S4308 | S4328 | S4348 | S4376 | |
| Connector C | NPN | S4306 | S4326 | S4346 | S4374 | S4366 |
| | PNP | S4314 | S4334 | S4354 | S4382 | |
| Dimensions: mm 1 mm = .03937" | | <p>Optional 90° beam available upon request</p> | | | | |
| Operating Distance | | 10 cm* | 250 cm** | 100 cm** | 1500 cm | |
| External Diameter | | M18 x 1 | | | | |
| Light Source | | Infrared | | Red | Infrared | |
| Power Supply | | 10 – 30 Vdc | | | | |
| Power on Delay | | ≤ 50 mSec | | | ≤ 180 mSec | |
| Power Drain | | ≤ 20 mA | ≤ 30 mA | | ≤ 35 mA | |
| Voltage Drop (on state) | | ≤ 1.5 V | | | | |
| Switching Current (max) | | 200 mA | | | | |
| Short Circuit Protection | | Yes | | | | |
| Operating Frequency | | 200 Hz max | | | | |
| Light Immunity | | > 10,000 Lux | | | | |
| Case | | Plastic (black makrolon) | | | | |
| Protection Degree | | IP 67 | | | | |
| Operating Temperature | | Storage - 20 to +90 °C • Working - 20 to +50 °C | | | | |

* The operating distance is related to matt white paper dim. 10 x 10 cm. ** The operating distance is related to CT80 reflector.



18 mm Stainless Steel, DC

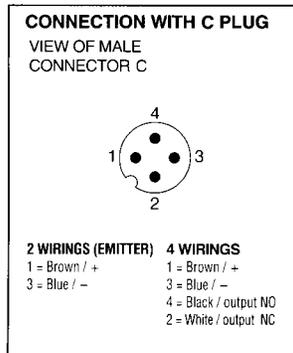
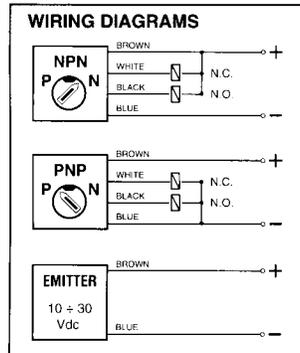
FEATURES:

- Stainless steel housing
- Programmable output NPN/PNP
- Sensitivity adjustment standard
- LED function indicators
- Short circuit & reverse polarity protection
- Pre-wired cable or connector models
- **CE** Compliant to the EMC directive
- Protection degree IP67: dust tight and protection from the effects of immersion

| Type | MODEL | | | | | |
|----------------------------------|---|---------------|---------------------------|-------------------------------------|----------------|---------|
| | Direct Reflection | | Reflection with reflector | Polarized Reflection with reflector | Thru Beam | |
| | Receiver | Emitter | | | Receiver | Emitter |
| Cable, PVC, L= 2m | S4050 | S4054 | S4060 | S4070 | S4082 | S4080 |
| Connector C | S4051 | S4055 | S4061 | S4071 | S4083 | S4081 |
| Dimensions: mm 1 mm = .03937" | | | | | | |
| Operating Distance | 20 cm* | 40 cm* | 250 cm** | 100 cm** | 1500 cm | |
| External Diameter | M18 x 1 | | | | | |
| Light Source | Infrared | | | Red | Infrared | |
| Programmable Output | NPN/PNP NO + NC | | | | | |
| Power Supply | 10 – 30 Vdc | | | | | |
| Power on Delay | ≤ 75 mSec | | | | | |
| Power Drain | ≤ 50 mA | | ≤ 20 mA | | ≤ 35 mA | |
| Voltage Drop (on state) | ≤ 3 V | | | | | |
| Switching Current (max) | 200 mA | | | | | |
| Short Circuit Protection | Yes | | | | | |
| Operating Frequency | 700 Hz max | | | | 250 Hz max | |
| Light Immunity | > 10,000 Lux | | | | | |
| Case | Stainless steel AISI 303 | | | | | |
| Protection Degree | IP 67 | | | | | |
| Operating Temperature | Storage - 20 to +90 °C • Working - 20 to +50 °C | | | | | |

* The operating distance is related to matt white paper dim. 10 x 10 cm. ** The operating distance is related to CT80 reflector.

WIRING:



INSTRUCTIONS FOR THE PROGRAMMING AND ADJUSTMENT
TRIMMER FOR THE SENSING RANGE ADJUSTMENT: The photocell is supplied with max sensing range with the trimmer totally rotated in the clockwise direction. The sensitivity reduces by rotating the trimmer in the counterclockwise direction.
SWITCH NPN/PNP: The photocell is supplied with the switch in P (PNP output). To change to NPN turn the switch to N in the counterclockwise direction.
WARNING! Do not carry out the switching when the photocell is powered.
GREEN LED - STABILITY INDICATOR: This LED is on when the level of the output signal and the alignment of the photoelectric sensors are in the optimum position. In the case, that the LED is off, this indicates that the lens is obscured. For the types with direct reflection, a possible alteration of the dimension or color may cause the LED to go off.
YELLOW LED - OPERATION INDICATOR: This LED is on when the object to be detected enters the sensing range of the photocell giving output signals.
NOTE! Program the photo cell to NPN or PNP function before applying power **NOTE!** It is recommended that the proper tool be used to rotate the trimmer and the switch to avoid damage

Photoelectric

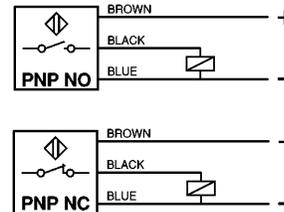
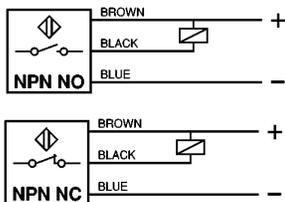
Fork Shape, DC

FEATURES:

- Metal case
- Short circuit & Reverse polarity protection
- Protection degree IP67: dust tight and protection from the effects of immersion
- LED function indicator & sensitivity adjustment
- Detects non-transparent and translucent materials
- 3.5, 5, 7.5 and 10 meter cable lengths available upon request

| | | MODEL |
|----------------------------------|---------|--|
| Output Function | NPN, NO | S4390 |
| | NPN, NC | S4391 |
| | PNP, NO | S4392 |
| | PNP, NC | S4393 |
| Dimensions: mm 1 mm = .03937" | | |
| Fork Gap | | 13 mm |
| Light Source | | Infrared |
| Power Supply | | 10-30 Vdc |
| Power on Delay | | ≤ 75 mSec |
| Max Switching Current | | 200 mA |
| Power Drain (@ 24Vdc) | | < 15 mA |
| Voltage Drop (sensor on) | | < 1.5 V (at 200 mA) |
| Short Circuit Protection | | Yes |
| Operating Frequency | | 500 Hz |
| Light Immunity | | Sun light 10,000 Lux – Incandescent lamp 3,000 Lux |
| Case | | Nickel-plated brass |
| Protection Degree | | IP 67 |
| Operating Temperature | | Storage: - 40 to +85 °C • Working - 25 to +50 °C |
| Output Connection | | Cable, L = 2 m |

WIRING:



18 mm Plastic, AC

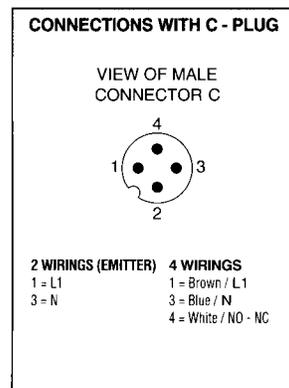
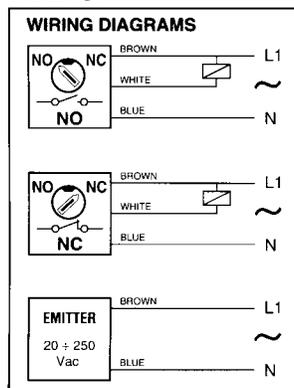
FEATURES:

- Plastic housing
- Programmable output NO/NC
- Sensitivity adjustment standard
- LED function indicator
- 20-250 VAC operating voltage
- Pre-wired cable or connector models
- **CE** Compliant to the EMC directive
- Protection degree IP67: dust tight and protection from the effects of immersion

| Type | MODEL | | | | | |
|----------------------------------|--|--------|---------------------------|-------------------------------------|----------|-------------------|
| | Direct Reflection | | Reflection with reflector | Polarized Reflection with reflector | Receiver | Thru Beam Emitter |
| Cable, PVC, L= 2m | S4240 | S4242 | S4250 | S4260 | S4272 | S4270 |
| Connector C | S4241 | S4243 | S4251 | S4261 | S4273 | S4271 |
| Dimensions: mm 1 mm = .03937" | | | | | | |
| Operating Distance | 20 cm* | 40 cm* | 250 cm** | 100 cm** | 1500 cm | |
| External Diameter | M18 x 1 | | | | | |
| Light Source | Infrared | | | Red | Infrared | |
| Programmable Output | NO or NC | | | | | |
| Power Supply | 20 - 250 Vac | | | | | |
| Power on Delay | ≤ 75 mSec | | | | | |
| Power Drain | ≤ 10 mA | | | | | |
| Voltage Drop (on state) | ≤ 1.5 V | | | | | |
| Switching Current (max) | 300 mA | | | | | |
| Short Circuit Protection | Yes | | | | | |
| Operating Frequency | 15 Hz max | | | | | |
| Light Immunity | > 10,000 Lux | | | | | |
| Case | Plastic, gray makrolon (upon request stainless steel AISI 303) | | | | | |
| Protection Degree | IP 67 | | | | | |
| Operating Temperature | Storage - 20 to +90 °C • Working - 20 to +50 °C | | | | | |

* The operating distance is related to matte white paper dim. 10 x 10 cm. ** The operating distance is related to CT80 reflector.

WIRING:



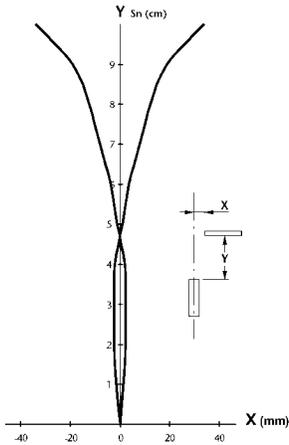
INSTRUCTIONS FOR THE PROGRAMMING AND ADJUSTMENT
TRIMMER FOR THE SENSING RANGE ADJUSTMENT: The photocell is supplied with max sensing range with the trimmer totally rotated in the clockwise direction. The sensitivity reduces by rotating the trimmer in the counterclockwise direction.
SWITCH NO/NC: The photocell is supplied with switch in NO position (in absence of the object to be detected the output is not activated). To change to NC (in absence of the object to be sensed the output is activated) turn the switch to NC in the counterclockwise direction.
LED FOR INDICATION OF OPERATION: This indicates the output of the photocell, in the absence of the object to be sensed. It is off with output NO and is on with output NC. This changes state when the object to be sensed enters into the sensing area of the photocell.

NOTE! Program the photo cell to NO or NC output function before applying power.
NOTE! It is recommended that the proper tool be used to rotate the trimmer and the switch to avoid damage.

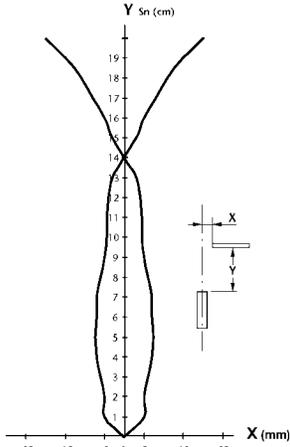
Photoelectric

CHARACTERISTIC CURVES

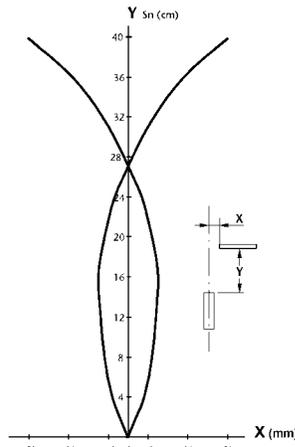
Direct Reflection, Sn 10 cm



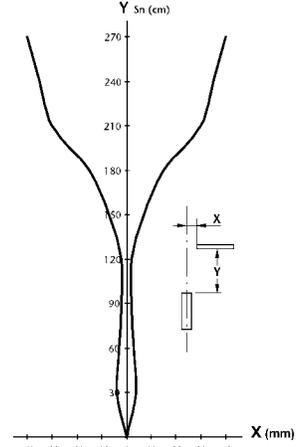
Direct Reflection, Sn 20 cm



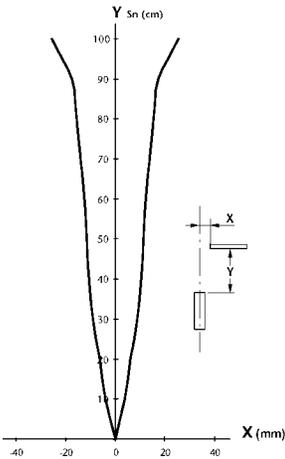
Direct Reflection, Sn 40 cm



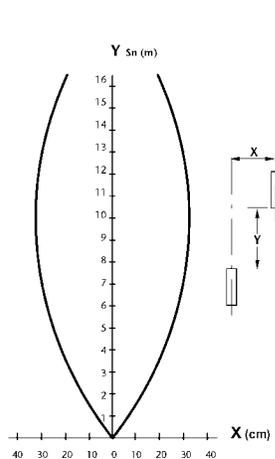
Reflection with reflector



Polarized Reflection with reflector

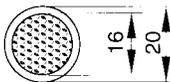


Thru Beam

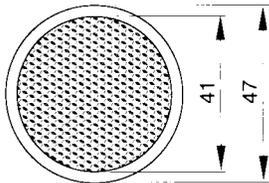


REFLECTORS

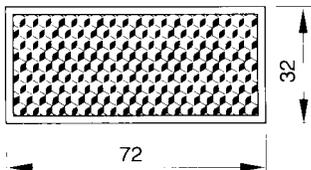
CT20
Thickness 5 mm



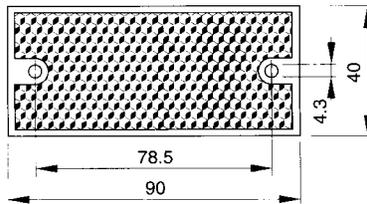
CT45
Thickness 8 mm



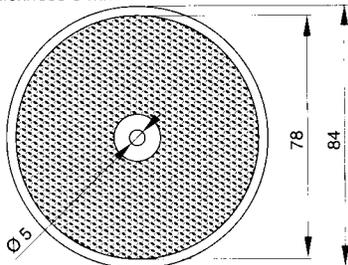
CTR1 ADHESIVE
Thickness 6 mm



CTR2
Thickness 5 mm



CT80
Thickness 8 mm



Relationship between reflector and operating distance

| Reflector | Operating distance as a percent of CT80 |
|--------------|---|
| S4220 - CT20 | 31% |
| S4224 - CT45 | 63% |
| S4226 - CTR1 | 70% |
| S4227 - CTR2 | 79% |
| S4225 - CT80 | 100% |