

Technical Glossary

A

Absorption:

When a light beam passes through a medium, radiant energy (or a portion thereof) is converted into another form of energy, e.g. heat. This process is known as absorption.

Adjustable Range:

The range within which, for example, a sensor's -> switching point can be adjusted with the switching distance adjuster (-> blind spot).

Adjuster:

-> potentiometer

Ambient Light:

Light from sources other than the light source integrated into the transmitter, e.g. sunlight or interior lighting fixtures (-> max. allowable extraneous light).

Analog Output:

The output at which the sensor's measurement results are read out either as an analog voltage (e.g. 0 to 10 V) or an analog current (e.g. 4 to 20 mA).

Analog Rise Time:

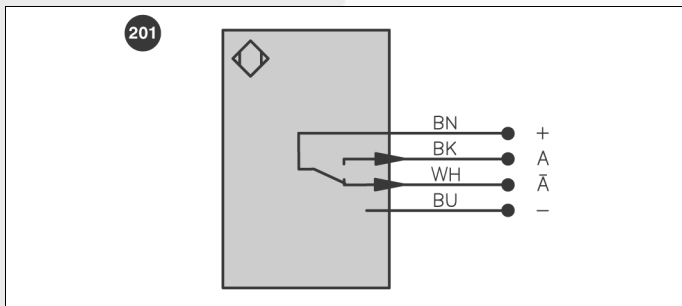
The time during which output voltage may climb from 10 to 90%.

Anti-Inductive Protection:

Protection against induced voltage and current.

Antivalent Sensor:

A sensor with two switching outputs, one normally closed (dark switching) and one normally open (light switching).



Aperture:

A mechanical component positioned in front of the sensor's transmitter or receiver by means of which the diameter of the light beam can be changed.

B

Background Suppression, Electromechanical:

The receiver is mechanically aligned with an external adjusting screw such that only reflected light from the desired working range strikes the receiving diode.

Background Suppression, Electronic:

Light reflected by the object strikes a certain point at the receiver, e.g. a -> PSD or a CMOS image sensor. Reflected light is electronically evaluated at this particular point.

Background Suppression:

A mode of operation for certain diffuse reflex photoelectric sensors. The angle is measured between transmitted and reflected light in accordance with the principle of optical triangulation. Light is reflected at different angles from the background and the object to be recognized, because they are at different distances from the receiver. Thus only the sensor's distance to the object is decisive as regards the switching point. After the sensor has been aligned to the object to be detected, objects which are located behind the selected working range are optically suppressed.

Barrier Principle:

Contactless recognition of objects with the help of a -> through-beam operation or a -> retro-reflective light barrier

Baud Rate:

Data transmission speed of the utilized -> interface

Beam Divergence:

Beam Divergence: Opening angle of a laser beam, specified in mrad (1 mrad = 0.057°).

Blind Spot:

A range between the sensor's lens and the beginning of its working range, within which correct functioning of the sensor cannot be assured.

Block Discharge:

All goods within a defined range of the conveyor system are released simultaneously for further transport.

C

Cascadable:

Several devices can be interconnected allowing for increased functionality through combination.

CE Mark:

Represents the manufacturer's declaration that any product bearing such a mark is in compliance with applicable European standards and directives. The CE mark is neither a seal of quality nor a mark of conformity, but rather serves to facilitate free commercial trade within the EU.

Chopped Light:

Light with varying degrees of radiant power.

Clear Glass Recognition:

A characteristic demonstrated by through-beam sensors and retro-reflective light barriers, which can be so accurately set that clear glass and transparent sheet materials can be reliably detected.

Connection:

The type of connector used to connect sensors to supply power. Sensors are equipped with a plug, or with a cable which is permanently connected to the device (standard cable length is 2 meters).

Contamination Output:

An output which reads out a signal indicating that a sensor is operating in the -> unreliable range.

Continuous Light:

Light which demonstrates constant radiant power (e.g. sunlight).

Contrast Markings:

-> Print Marks

Contrast:

The difference in the grey-scale values of two objects.

Correction Factor:

The detection range of a sensor depends upon the material and the surface characteristics of the object to be scanned. The correction factor defines the various scanning widths for different materials with reference to a standard material.

Current Consumption:

The own consumption of current required by a sensor with outputs that are not switched.

Cut-Off Frequency:

This term is used in connection with analog sensors. As opposed to the static signal, the amplitude of the -> analog output is reduced by 3 dB (a factor of 0.7) at the cut-off frequency.

D**Dark Switching (normally closed, NC):**

A sensor output mode of operation. The output is activated when the receiver is not illuminated by light from the transmitter.

Degree of Protection:

The specified degree of protection indicates whether or not the device is protected against contact, penetration by solid particles of a specified size and moisture (in accordance with IEC 529 / DIN 40 050).

IP 20: Protection against penetration by solid particles with diameters larger than 12 mm. No special protection against penetration by water.

IP 40: Protection against penetration by solid particles with diameters larger than 1 mm. No special protection against penetration by water.

IP 54: Protection against dust deposits, full contact protection, protection against splash-water from all directions.

IP 65: Full contact protection for voltage conducting components, protection against penetration by dust, protection against water jet streams.

IP 67: Full contact protection for voltage conducting components, protection against penetration by dust, protection against submersion in water under specified conditions: at a depth of 1 metre for a duration of 30 minutes

IP 69K: Full contact protection for voltage conducting components, protection against penetration by dust, protection against water high pressure / steam jet cleaning (80-100 bar, 80°C).

The degree of protection depends upon the utilised plug for devices with plug connectors.

Differential Measurement:

Evaluation of measured values provided by two sensors (e.g. evaluation with the AW01 analysis module).

Diffuse Reflex Sensor:

A mode of operation for photoelectric sensors. The transmitter and the receiver are integrated into a single housing. The beam emitted from the transmitter is reflected diffusely by the surface of the object to be recognized. A portion of this light is captured by the receiver, and is processed as a switching signal by the analysis electronics integrated into the sensor.

Digital Resolution:

The number of digital graduations into which an analog quantity can be converted. The greater the digital resolution, the more accurately the analog quantity can be digitally evaluated.

Divergence:

After light is emitted from the sensor it branches off (i.e. diverges) at a specific -> opening angle.

E**End-to-End Array:**

Several sensors, arranged one after the other, which are all operated simultaneously. The sensors may not be permitted to interfere with one another, and a minimal clearance from one to the next must therefore be maintained. The size of this clearance depends primarily upon the sensor type and the selected operating sensitivity.

Error Output:

An output which is activated when the sensor is functioning within an unreliable range, for example as a result of contamination, incorrect alignment, ageing or a faulty operating status.

Exposure Time:

Time during which a light sensitive material is exposed to light.

External Teach Input:

An input at which sensor functions can be adjusted by applying an electrical signal.

F**Fiber Bundle Diameter:**

The diameter of a fiber bundle used in glass fiber-optic cables for transmitters and receivers.

Focal Distance:

The distance from the centre of the lens to the point at which axially parallel light beams converge after refraction through a lens.

Focus Distance:

The distance between the sensor and the focal point.

Focus:

The point at which a concentrated light beam demonstrates its smallest diameter.

Frequency:

Number of events per second (-> switching frequency)

Full Encapsulation:

The sensor's electronic components are fully encapsulated in casting resin. This results in improved resistance to impact, vibration and water.

G**Glass Fibre Optic Cable:**

A cable consisting of a bundle of glass fibers. Each individual glass fiber conducts light from the light source to the other end of the fiber by means of total reflection.

Gloss:

Relationship between -> reflection and -> remission. Glossy objects demonstrate little remission and high reflectivity.

Grey Tones:

Technically detectable brightness levels ranging from black to white. For example, the ZKA100 line sensor is capable of recognising 256 grey tones.

I**Illumination Intensity:**

The entire light beam which strikes a surface is expressed in terms of illumination intensity. The utilized unit of measure is 1 lux = 1 lm/m² (lumens divided by square meters).

Impact Resistance:

Mechanical resistance to pulse-shaped acceleration (impacts).

Incident Light:

Light which emanates from a defined light source and illuminates the object.

Infrared Light:

Invisible light with a wavelength of greater than 790nm.

Input Resistance:

The internal resistance of an input

Input:

An electrical connection at a sensor or an electrical device to which an electrical signal can be applied, thus causing the device to react.

Interface:

Serial or parallel output, e.g. RS 232 or RS 485

L**Laser Light:**

Monochrome light with in-phase wave arrangement. Laser diodes have a small emitting surface. It is thus possible to focus light accurately with a lens. Slightly divergent light beams with highly concentrated energy can be generated. The Laser sensors are classified after EN60825-1:1994 + A11:2001.

Laser Safety Class 2:

Laser Safety Class	Class 2
Danger Classification	Minimal power, eye protection is generally assured by the eyelid reflex.
Use of a plug connector for remote controlled safety interlocks	Not required
Key switch	Not required
Beam stop or beam attenuator	Not required
Additional warning signs at entrances, safety covers etc.	Not required
Identification of the beam emission aperture	Not required
Bundle of rays terminated at its end	*
Bundle of rays as short as possible, and enclosed if feasible (e.g. in pipe)	Not required
Eye protection	Not required
Laser safety inspector	Not required
Avoid inadvertent specular reflection	Not required
Protective clothing	Not required
User training	Not required

Laser Safety Class 3R:

Laser Safety Class	Class 3R
Danger Classification	Looking directly into the light beam may be hazardous
Use of a plug connector for remote controlled safety interlocks	Not required
Key switch	Not required
Beam stop or beam attenuator	Not required
Additional warning signs at entrances, safety covers etc.	Not required
Identification of the beam emission aperture	Required
Bundle of rays terminated at its end	Not required if wavelength is within a range of 400...700 nm *
Bundle of rays as short as possible, and enclosed if feasible (e.g. in pipe)	Not required if wavelength is within a range of 400...700 nm *
Eye protection	Not required if wavelength is within a range of 400...700 nm *
Laser safety inspector	Not required if wavelength is within a range of 400...7000 nm *
Avoid inadvertent specular reflection	Required
Protective clothing	Not required
User training	Required for operating and service personnel

* Termination of the bundle of rays is not required by the standard, but is nevertheless advisable. Open beam paths should be positioned above or below eye-level, in as far as this is practical. The table is intended to provide an overview only. The currently valid laser equipment safety standard is binding.

Laser Sensor:

An photoelectric sensor which makes use of laser light.

Lateral Approach:

The object is moved perpendicular to the optical axis within the receiving range.

Law of Reflection:

If a light beam strikes the boundary surface of two media it is cast back in part or in its entirety, and the angle of incidence and the angle of emergence are identical.

LED (light emitting diode):

LEDs are semiconductor light sources.

Light Pulse:

Time limited light emission

Light Switching (normally open, NO):

A sensor output mode of operation. The output is activated when the receiver is illuminated by light from the transmitter.

Light, Invisible:

e.g. -> infrared light

Light, Visible:

Radiation within the range of the electromagnetic spectrum which is visible to the human eye. This range includes wavelengths from 380 nm (violet) to 780 nm (red).

Linearity:

Data sheet specification indicating maximum possible output voltage deviation from an ideal straight line for analog sensors, expressed in mV or %.

Load Current, Max.:

-> max. output current

Luminescence:

The conversion of UV light (365 to 380 nm) into visible light (> 400 nm).

Luminescent Substance:

Materials which reflect visible light within a wavelength range of 420 to 750 nm when irradiated with UV light. Luminescent substances can be applied to almost anything (e.g. labels and cartons), and can be added to many substances such as ink, oil and grease.

Luminous Intensity:

Unit of measure: candela. Defined as lumens divided by steradian.

Lux:

Unit of measure for -> illumination intensity

M

Max. Allowable Extraneous Light:

Correct functioning of light sensors and light barriers may be impaired by sources of extraneous light. The maximum allowable illumination intensity at which correct functioning of the device can be assured is generally specified in product data sheets as maximum allowable extraneous light expressed in lux.

Max. Operating Pressure:

The maximum air pressure at which a device can be operated in an error-free fashion.

Max. Output Current:

The maximum current value for which the outputs are rated. If this current value is exceeded, even only briefly, short-circuit protection is triggered. Incandescent lamps and capacitors may result in intermittently exceeded maximum output current.

Measuring Distance:

The distance between the front edge of the distance measuring system and the middle of the -> measuring range. Analog output voltage has a value of 5 V as long as the object to be scanned is located at this distance from the sensor.

Measuring Range:

The range within which analog output voltage demonstrates a proportional relationship to the distance between the sensor and the object. Analog voltage does not provide us with a usable value outside of this range.

Minimum Operating Current:

-> current consumption

N

Nominal Switching Distance, S_n :

A characteristic used for categorizing sensors. This characteristic does not take manufacturing tolerances, deviation or external influences such as temperature or voltage into consideration (-> switching point).

Normally Closed Function (NC, dark switching for optical sensors):

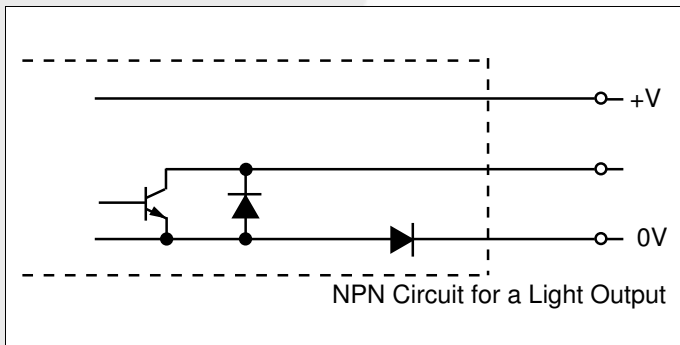
The output is activated as soon as an object reaches the switching point. In the case of through-beam sensors, the output is deactivated as soon as the light beam is interrupted.

Normally Open function (NO, light switching for optical sensors):

The output is deactivated as soon as an object reaches the switching point. In the case of through-beam sensors, the output is activated as soon as the light beam is interrupted.

NPN Output:

A load or an analysis module is connected between the plus pole (incoming supply) and the output. When the sensor is switched, the output is connected to the minus pole via an electronic switch. NPN outputs may be equipped with a -> pull-up resistor.



O

Object:

The entity to be recognized by the sensor is called the object.

Off-Delay:

An adjustable -> release delay.

On-Delay:

An adjustable -> response time.

Opening Angle:

The angle at which light is emitted from the sensor's transmitter, or the angle which is scanned by the receiver.

Optical Fiber Curtain:

The optical fibers of a -> glass fiber-optic cable are arranged next to each other such that their ends form a line. The light emitting ends thus create a line of light.

Output Function:

-> normally closed, -> normally open, -> analog output, -> interface

Output Resistance:

The internal resistance of an output

Output:

An electrical connection at the sensor to which a load or an analysis module is connected. The actual function of the sensor is made available by means of electrical connection to the output (-> NPN output, -> PNP output, -> push-pull output, -> analog output, -> interface).

Overload Protection:

The output of a sensor is deemed overload-proof if it is capable of withstanding all current values ranging from nominal load current to short-circuit current without sustaining any permanent damage.

P

Parallel Connection:

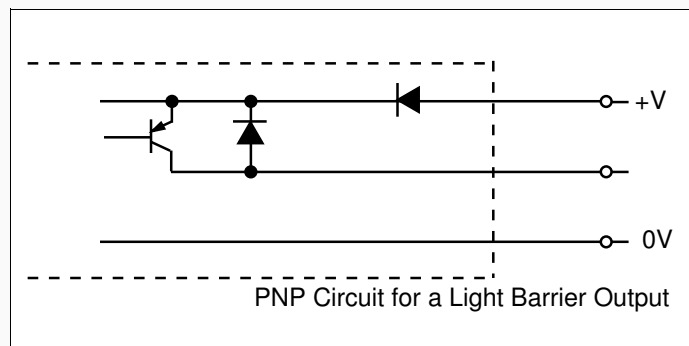
The outputs of sensors with identical output stages (NPN or PNP only) are connected to each other. The control monitors the outputs and reacts as soon as any of the sensors generates a signal. The circuit thus utilizes OR logic.

Plastic Fibre-Optic Cable:

A cable consisting of a plastic fiber. The fiber conducts light from the light source to the other end of the fiber by means of total reflection.

PNP Output:

A load or an analysis module is connected between the minus pole (incoming supply) and the output. When the sensor is switched, the output is connected to the plus pole via an electronic switch. PNP outputs may be equipped with a -> pull-down resistor.

**Polarisation Filter:**

A filter which only allows light within a single plane of oscillation to pass.

Polarised Light:

Light which is limited to a single plane of oscillation.

Potentiometer:

A mechanical component with a variable resistance value. Potentiometers can be used to adjust sensor functions such as detection ranges.

Power Supply Indicator:

An -> LED display which indicates that -> supply voltage is present.

Print Marks:

Color markings or grey profiles printed on packaging materials. These can be recognized photoelectrically, and can be caused to trigger control commands at an interconnected machine.

Protected Against Polarity Reversal:

A sensor is protected against polarity reversal if its terminals can be connected at random without destroying the sensor.

Protective Insulation:

Double insulation which protects users of electrical equipment against dangerous voltages.

Protocol:

A transmission specification in accordance with which data are transferred from one interface to another.

PSD:

A semiconductor component which generates two sub-currents in photoelectric sensors. The sub-currents depend upon the position at which light reflected from an object strikes the PSD.

Pull-Down Resistor:

A resistor which is integrated into the output of a sensor. As long as the sensor has not been switched, the output is connected to the minus pole via this resistor.

Pull-Up Resistor:

A resistor which is integrated into the output of a sensor. As long as the sensor has not been switched, the output is connected to the plus pole via this resistor.

Pulse Duty Factor:

Relationship of pulse duration to cycle duration

Pulsed Light:

A cyclical series of -> light pulses

PUR Cabel:

A cabel made of polyurethane. These cabels are resistant to oils and fuels as well as abrasion and weather, are highly flexible - even at low temperatures - and have a high tearing strength. They are notch-ductile and impact resistant.

Push-Pull Output:

Works like an electronic switch, which switches the output alternately to the plus pole or the minus pole.

PVC Cabel:

A cabel made of polyvinyl chloride.

R

Range:

The mechanically exploitable distance between the transmitter and the receiver (in the case of -> retro-reflective light barriers the distance between the sensor and the -> reflector)

Ranging Sensor:

A sensor which measures distance from the sensor to an object. Results are read out via an analog or a digital output.

Rated Frequency:

Specified frequency for mains supply power (e.g. 50 Hz or 60 Hz.)

Rated Insulation Voltage:

Maximum allowable voltage between housing and terminals

Receiver:

The part of the sensor to which the light beam is transmitted.

Red Light:

Visible light having a wavelength within a range of 630 to 780 nm

Reference Reflector:

A reflector to which the sensor's range is referenced. Other reflectors result in other ranges (see also range table, retro-reflective light barrier / reflector).

Reflection:

The casting back of light which occurs at the boundary surface of two media in accordance with the -> law of reflection. Reflective objects demonstrate low remission and high gloss.

Reflector Sheet:

A reflector in the form of a flexible sheet, which is usually self-adhesive

Reflector:

An optical fixture. If light strikes a reflector, it is cast back by means of -> retro-reflection. As a rule, reflectors are -> triple mirrors.

Relay Output:

A floating mechanical output for connecting machines or controls.

Release Delay:

-> response time

Remission (diffuse reflection):

The reflection of light beams in all directions from non-specular surfaces.

Repeat Accuracy:

The difference between two switching distance measurements performed under identical conditions within a specified period of time is known as repetition accuracy, and is expressed as a percentage of nominal switching distance.

Reproducibility:

-> repeat accuracy

Residual Current:

Current which flows via the load at the deactivated output in the idle state.

Resolution:

Specifies the smallest movement of the object within the working range which can be detected by the sensor.

Response Time:

Delay time required by the sensor in order to forward data to the output concerning an event which has occurred within the sensor's working range.

Retro-Reflection:

-> Reflector sheets as well as -> triple mirrors reflect light back to the light source, as opposed to normal mirrors to which the law of reflection applies: angle of incidence = angle of emergence.

Retro-Reflective Light Barrier:

The transmitter and the receiver are integrated into a single housing. Light emitted by the transmitter strikes a reflector by means of which it is reflected. If the light beam is interrupted by an object, the output is switched.

RS-232:

-> Interface

S**Scanning Mode Operation:**

Contactless object recognition with the help of a -> diffuse reflex sensor.

Scanning Range:

Specifies the distance between the transmitter and the object at which the sensor is switched for diffuse reflex sensors.

Series Connection:

A method of electrically connecting sensors to one another. The output of one sensor is connected to the power supply terminals of the next sensor. As soon as the output of the upstream sensor is activated, it provides the downstream sensor with supply power in the form of an output voltage. This type of sensor connection corresponds to AND logic.

Short-Circuit Protection:

In accordance with VDE 0160, the output of a sensor is designated short-circuit proof if it is capable of continuously withstanding short-circuited load current or a short-circuit to ground at the output without sustaining any damage, and if it is once again ready for operation without any switching operations after the short-circuit has been eliminated.

Single-Lens Optics:

In the case of single-lens optics, the sensor is equipped with only one lens which is used by the transmitter as well as the receiver.

Smallest Recognizable Part:

The smallest object which can be optoelectronically recognized.

Spectral Sensitivity:

Specifies the sensitivity of, for example, photo-electronic converters with reference to radiation wavelength.

Spot:

The area of the object which is illuminated by the light beam of the transmitter.

Standard Target, Optical:

The target (calibrating plate) for a certain sensor which defines nominal switching distance.

Starting Pulse Suppression:

During power-up, the sensor's output status is undefined. Devices with starting pulse suppression are equipped with a circuit which briefly disables the output during power-up, until specified operating conditions have been achieved.

Supply Voltage:

A voltage range within which reliable operation is assured. This voltage range may not be exceeded or fallen short of. Even if the specified range is exceeded only intermittently, the sensor may be destroyed.

Switching Current:

-> max. output current

Switching Frequency:

Defines the maximum possible number of switching cycles per second, when the distance between the objects to be scanned is of the same size as the individual objects themselves, i.e. with a -> pulse duty factor of 1:2.

Switching Hysteresis:

The difference between the making point and the breaking point

Switching Point Drift:

-> temperature drift

Switching Point:

The distance at which the sensor is switched

Switching Sensitivity:

Sensitivity of a gloss sensor to the degree of gloss demonstrated by the object. Can be set within a range of matte to high-gloss.

Switching Status Display:

Optical display which indicates the sensor's switching status, usually a yellow LED.

Switching threshold:

The triggering limit at which switching occurs.

T**Target:**

-> Standard target (calibration plate)

Teach-In mode:

NT = normal Teach-In

This standard operating mode is used to calculate a switching point which allows for optimized functional reserves.

MT = minimal Teach-In

This operating mode is used to select a switching point which assures adequate functional reserves for the recognition of, for example, clear glass and sheet products.

HT = background Teach-In

Teach-In is performed while the sensor spot is aligned to the background. The switching distance is then automatically set to a distance which is slightly less than the clearance between the sensor and the background. The sensor is thus activated whenever an object is located between the background and the sensor.

VT = foreground Teach-In

Teach-In is performed while the sensor spot is aligned to the object. The switching distance is then automatically set to a distance which is slightly greater than the clearance between the sensor and the object. The sensor is thus activated for all objects whose distance to the sensor is equal to or less than the distance to the object used for the Teach-In procedure.

ZT = two-point Teach-In

One Teach-In procedure is used to teach in the object, and another to teach in, for example, the background. Using both measured values acquired and saved in this way, the sensor calculates the switching point such that it lies between the two Teach-In points.

FT = window Teach-In

The distance to an object, or its brightness, is taught during the Teach-In process. The sensor establishes switching thresholds both above and below the Teach-In point. The difference between the two switching points is referred to as a window, and can be changed in steps. The sensor is activated when an object is positioned within the window, and is deactivated if the object is outside of the window.

DT = dynamic Teach-In

The sensor is switched to recording mode operation, allowing for automatic Teach-In. Measured values are recorded in this operating mode. After the recording mode has been exited, a switching point which lies between the minimum and maximum measured values is calculated.

TP = key potentiometer

Allows for manual adjustment of the switching point through the use of plus and minus keys.

Teach-In:

A function by means of which the sensor is caused to automatically calculate and save future settings based upon momentarily acquired values by pressing a button or applying a control signal.

Temperature Drift:

Switching point variation which results from a change in ambient temperature.

Temperature Range:

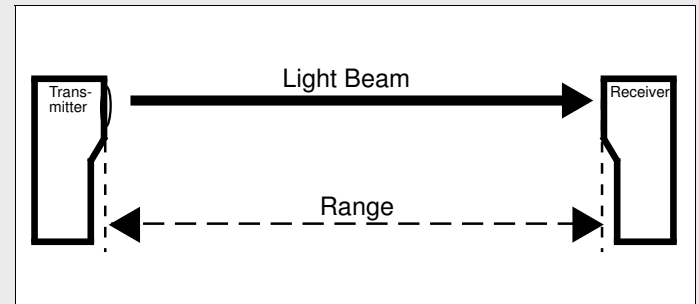
Specifies the range of ambient temperatures within which the sensor may be operated.

Through-Beam Operating Mode:

Optoelectronic process for object recognition. The object is between the light source, i.e. the transmitter, and the sensor's receiver. Transmitted light is thus influenced by the object. The degree and type of influence is evaluated by the receiver.

Through-Beam Operation:

A mode of operation for photoelectric sensors. The transmitter and the receiver are enclosed in two separate housings. The transmitter and the receiver are mounted such that the light beam emitted by the transmitter strikes the lens at the receiver. If the light beam is interrupted, the output is switched accordingly.

**Time Delay:**

Off-delay -> on-delay

Total Reflection:

Light is totally reflected at boundary surfaces consisting of one more, and one less optically dense material.

Transmission Speed:

-> baud rate

Transmission:

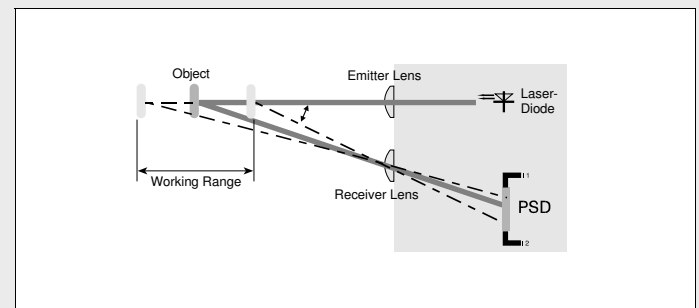
The passage of radiation through a medium

Transmitter:

The part of the sensor which transmits the light beam

Triangulation:

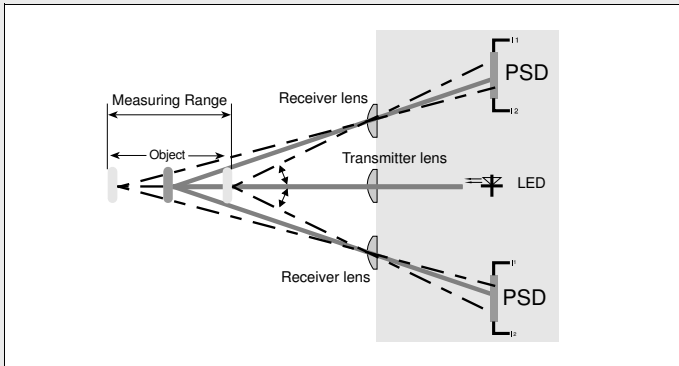
A measuring method by means of which the distance to an object is calculated based upon angular relationships (-> background suppression).

**Trigger Mode Operation:**

A switching operation or a measurement is triggered by applying an edge to the trigger input (i.e. by changing the electrical signal from negative to positive or vice versa).

Triple Beam Correction:

Double -> triangulation (see also Background Suppression).



Triple Mirror:

Consists of three mirrors which are arranged at right angles to one another. A beam of light which strikes this tetrahedron of mirrors is turned exactly 180°, and thus emerges from the triple mirror in precisely the opposite direction it arrived. The mirror has an acceptance angle of $\pm 15^\circ$, i.e. reversal of the direction travelled by the beam is independent of mirror inclination (-> reflector).

U

Unreliable Range:

The switching range within which the sensor is not reliably switched. Unreliable switching may result from a lack of reflectivity as regards the object, incorrect sensor mounting, contamination or impairment of the sensor's optical components. Impairment of this type is indicated by means of a signal from the -> contamination output for devices equipped with contamination warning.

V

Vibration Resistance:

see DIN 60947, section 742

Voltage Drop:

Voltage which is present at the activated output.

W

Window Width:

Tolerance width for the three colors red, green and blue used with color sensors for the recognition of colors (a small window width results in high resolution color recognition).

Working Distance:

The distance between the sensor and the object. Working distance must lie within the sensor's -> working range - otherwise the sensor cannot function.

Working Range:

The range of distance within which the object to be recognized must be situated in order for the sensor to function correctly under specified temperature and voltage conditions.