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Automation Components

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LD30 - IO-Link smart photoelectric laser sensors

Sensors

LD30 series
IO-Link smart photoelectric laser sensors

The LD30.PBR... IO-Link smart laser sensors are highly flexible multifunction laser sensors in a compact housing.
The LD30.PBR... IO-Link smart laser sensors offer: Selectable Background or Foreground suppression, with a sensing distance of 100, 300 or 600 mm. The sensors have a focused visible red laser beam of Ø 1mm and are of Laser class 1, capable of detecting small objects on long distances or close to a background.
The LD30.PBR... IO-Link smart laser sensors have besides numerous IO-Link options also 5 unique application functions: Dual Detection, Speed and length, Pattern recognition, Divider and Object and gap monitoring.
The LD30.PBR... IO-Link smart laser sensors are available in two housing styles, an AISI316L stainless steel version with IP69K and ECOLAB approvals designed for use in harsh or hygienic environments and an ABS plastic version with IP 67 approval.

Universal, smart and easy

Data availability down to the field level
Using IO-Link, the sensors can deliver their data directly into the control system very efficiently.

Device identification
Each IO-Link sensor has an IODD (IO Device Description), which describes the sensor, its capabilities and parameters, process data, diagnosis data and user interface configuration. Furthermore, each sensor is equipped with an internal ID.

Automatic parameter settings
Initial setup of a new sensor is smooth and easy using previously stored parameters. Once a sensor has been replaced, the IO-Link master simply transmits parameters stored from the old sensor.

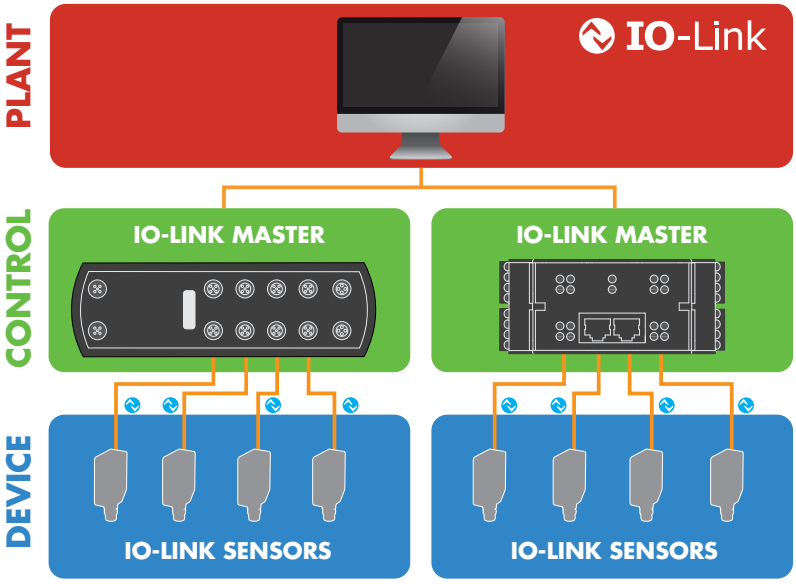
Centralized configuration and data management
IO-Link enables fast configuration and dynamic change of the sensor parameters on the fly, which considerably reduces downtime in case of product changeover and increases flexibility and diversity of the installation.

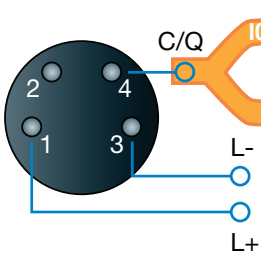
Universal, smart and easy

Simplified installation
An IO-Link system requires just standard, unshielded 3-wire cables, and a standardized uniform interface for sensors and actuators drastically reduces the complexity of the installation process. In addition, the automated parameter reassignment simplifies sensor replacement in case of defects and prevents incorrect settings. The IO-Link-enabled sensor acts as a standard sensor when installed in a non-IO-Link system, so the same sensor can be stocked for both standard I/O (SIO) applications and IO-Link applications.

Simplified configuration with the Handheld IO-Link SCTL55 smart configurator
By using the Handheld IO-Link SCTL55 smart configurator from Carlo Gavazzi it is very smart and easy to configure your IO-Link sensor. When the SCTL55 smart configurator has automatically downloaded the sensors IODD file you are ready to configure.

IO-Link





Pin	Signal	Remarks
1	L+	24 V
2	OUT	Sensor dependent
3	L-	Ground
4	C/Q	Communication/ switching signal

What is IO-Link?

IO-Link is a universal, open communication standard protocol that allows IO-Link-enabled devices to exchange, collect and analyze data and convert it into actionable information.
IO-Link is recognized worldwide as an international standard (IEC 61131-9), and it is today considered as the "USB interface" for sensors and actuators in the industrial automation environment.

Plug and play

When the IO-Link sensor is connected to an IO-Link port, the IO-Link master sends a wake-up request to the sensor, which automatically switches to IO-Link mode, and a point-to-point bidirectional communication automatically starts between the master and the sensor.

Operating modes

The IO-Link-capable sensor can operate in two different modes; SIO mode (standard I/O) or IO-Link mode.

- SIO mode: the sensor works as a traditional sensor, and pin 4 acts as an ordinary digital output. SIO mode ensures backwards compatibility with standard sensor systems.
- IO-Link mode: exchange of data between sensor and IO-Link master takes place, and pin 4 is used for the transmission of IO-Link-related data.

LD30 series
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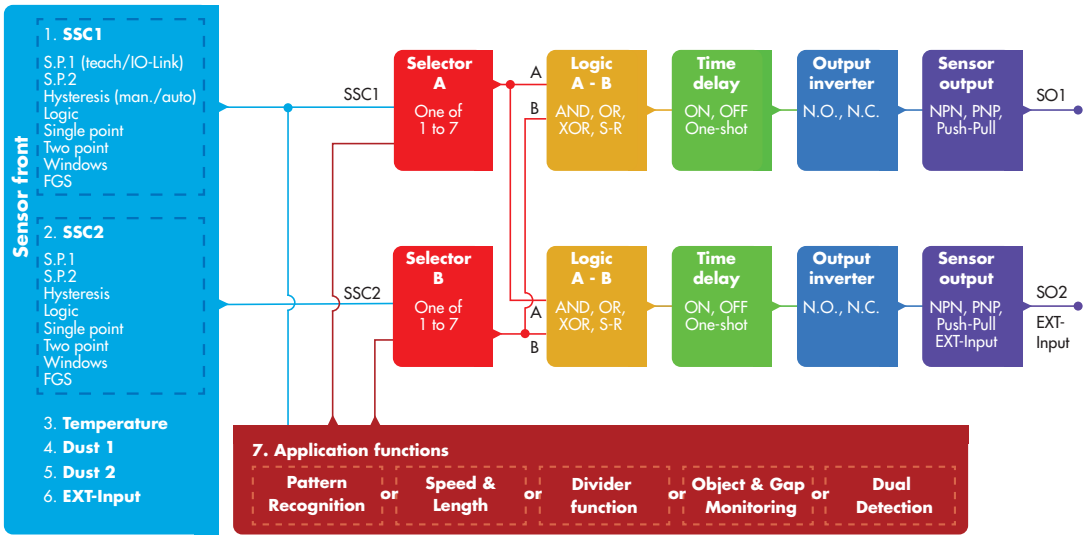
IO-Link functions

Highly flexible sensors

IO-Link provides the first globally standardized interface for communication with the sensor. Once you have connected the sensor to the IO-Link port, you can access a multitude of configuration parameters and advanced functionalities. This way, the sensor can be tailored to meet your individual needs and requirements at a given time. The settings can also be stored in a master and can always be changed if the need occurs, or they can be smoothly transferred to a new sensor in case of sensor replacement.



Sensor front

Foreground Suppression (FGS)

A Foreground Suppression sensor (FGS) needs a background as reference target. If the sensor does not recognize the background, an object must be present.

Background Suppression (BGS)

A Background suppression sensor (BGS) prevents an object beyond the set distance to be detected.

Dual Detection (DD)

A Dual Detection sensor works as a Foreground Suppression sensor combined with a Diffuse Reflective sensor. This sensing principle evaluates both the position change as well as the light intensity of the received light.

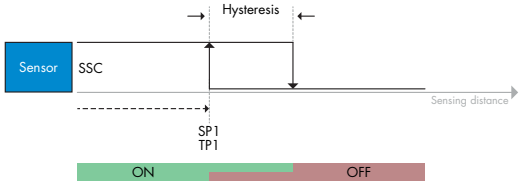
SSC1and SCC2 (Switching Signal Channel)

Detection modes

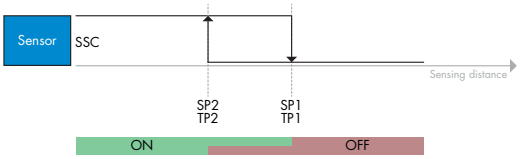
Each SSC channel can be set and operate in 4 detection modes or be disabled. The switch point mode setting can be used to create more advanced output behavior. The following switch point modes can be selected for the switching behavior of SSC1 and SSC2.

Single-point mode, two-point mode, windows mode and Foreground suppression Mode (only BGS).

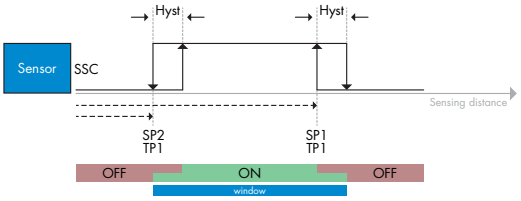
Single point mode



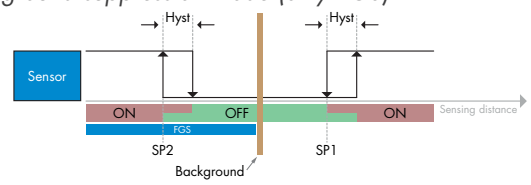
Two point mode



Windows mode



Foreground suppression mode (only BGS)



Hysteresis Settings

The hysteresis can be set automatically or manually for SSC1 and manually only for SSC2. The hysteresis is set as a distance in mm of the set value chosen for SP1 and SP2.

Manual hysteresis

When manual hysteresis is selected, the hysteresis can be changed between 1.00 … max. distance in mm.

IO-Link functions

Standard automatic hysteresis
Automatic hysteresis will guarantee stable operation for most applications.

Fine automatic hysteresis
With fine automatic hysteresis the hysteresis is set at minimum value and thus optimized for detection close to a background.

Temperature alarm
The sensor can be configured to give an alarm if the temperature exceeds or drops below a preset value (Tmax or Tmin).

Dust alarm 1 and Dust alarm 2
The sensor can be configured to give an alarm even with a slightly buildup of dust.

Water drop alarm 1 and Water drop alarm 2
The sensor can be configured to give an alarm even with a slightly buildup of water drops.

External input
The output 2 (SO2) can be configured as an external input allowing external signals to be fed into the sensor.

Predictive maintenance

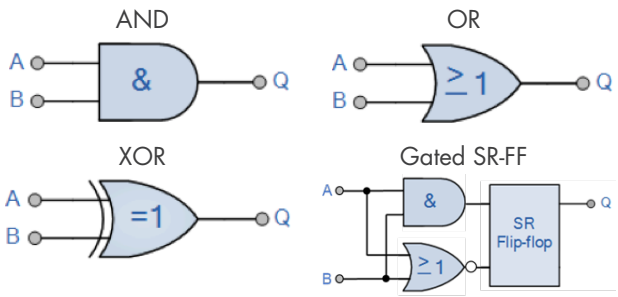
QoR (Quality of Run) from 0 to 255%
QoT (Quality of Teach) from 0 to 255%
Operation hours, hourly data saved in sensor internal memory.
Operating cycles for SSC1, sensor logs SSC1 detections.
Power cycles, number of ON/OFF switching's of the sensor.
Dust alarm, variable safe limits from 0 ... 100%.
Temperature alarm, separate setpoints for high and low temperature alarm settings.

Selector

This function block allows the user to select any of the signals from the "sensor front" to the Channel A or B.
Channels A and B: can select from SSC1, SSC2, Temperature alarm, Dust alarm 1, Dust alarm 2 and External input.

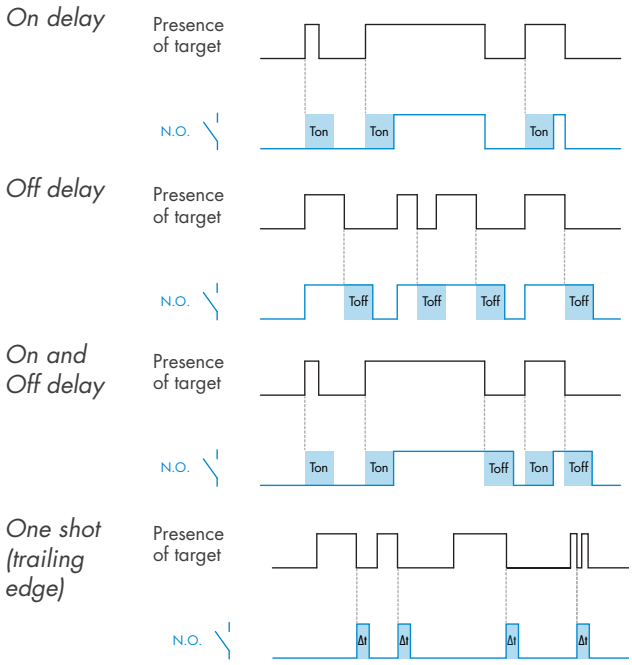
Logic

In the logic function block the selected signals from the input selector can be added a logic function directly without using a PLC – making decentral decisions possible.
The logic functions available are: AND, OR, XOR and Gated SR-FF.



Time delay

It is possible to activate different timer functions: ON delay, OFF delay, ON and OFF delay or one shot (leading edge or trailing edge).



Output inverter

The output can be configured to normally open or normally closed.

Sensor output

The I/O terminals can be configured as: NPN, PNP, push-pull or external input (only output 2).

Outputs/inputs
The sensor has two I/O terminals SO1 and SO2.

Application functions

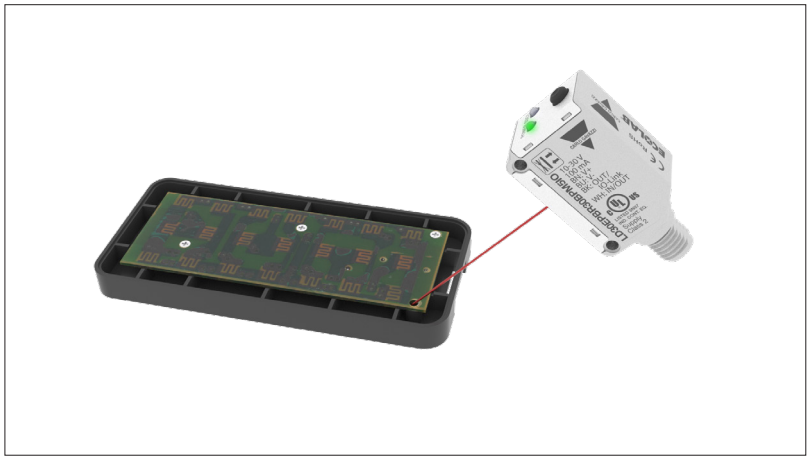
5 unique application functions can be selected via IO-Link only.

- Dual Detection.
- Pattern Recognition.
- Speed and Length.
- Divider function.
- Object and Gap Monitoring.

IO-Link smart photoelectric laser sensors

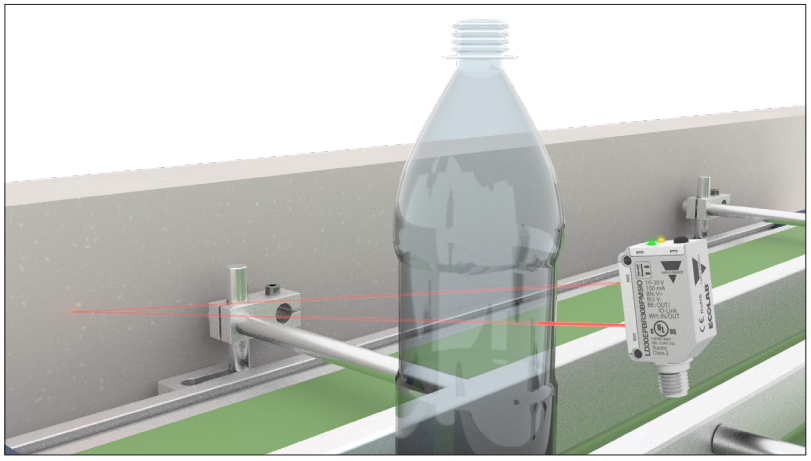
Applications

Quality inspection of missing part



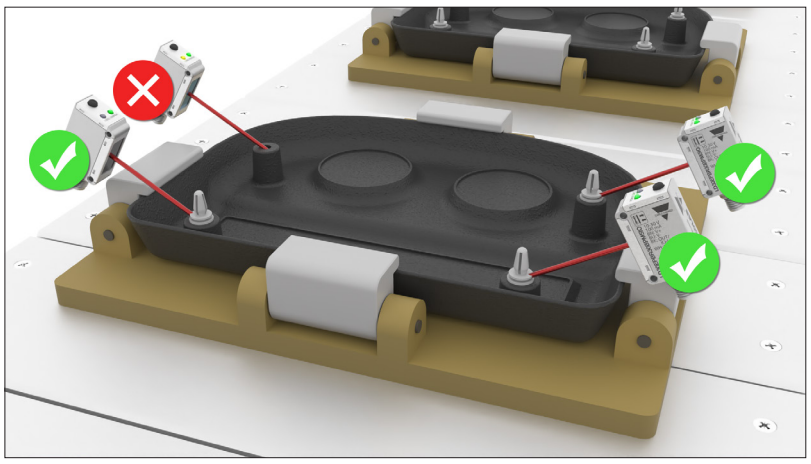
The 1 mm, visible, round, red laser spot is aimed at the background surface with the small screw missing, and the sensor taught in Dual Detection mode to recognize the background. If the screw has been correctly mounted, it will block the sensor from seeing the background, and the small screw will be detected.

Transparent bottle detection



The 1 mm, visible, round, red laser spot is aimed at the background surface and taught in Dual Detection mode. The reflected distance and light intensity of the background is saved in the sensor as a reference. A change in the position or intensity of the reflected light caused by the presence of a bottle, will be detected by the sensor as an object (bottle).

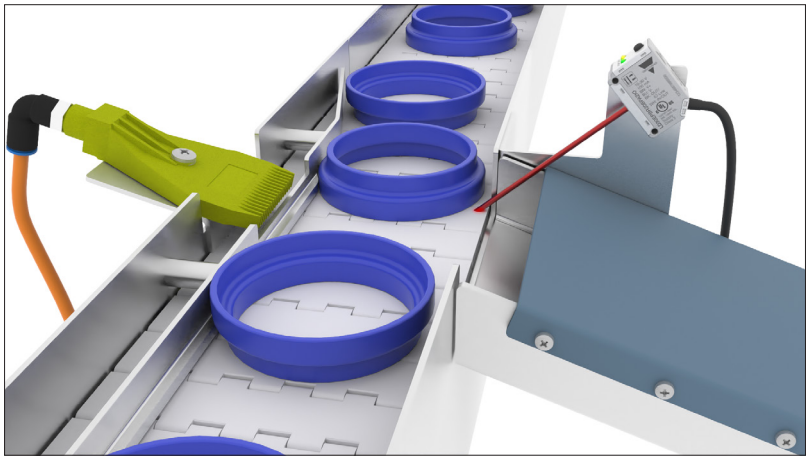
Detection of missing parts during quality inspection



The small 1 mm visible round red laser spots are aligned on the background surface with the clips missing and taught in foreground suppression mode to recognize the background itself. If the clips are correctly mounted, they will prevent the sensor from seeing the background and thus the clips are detected.

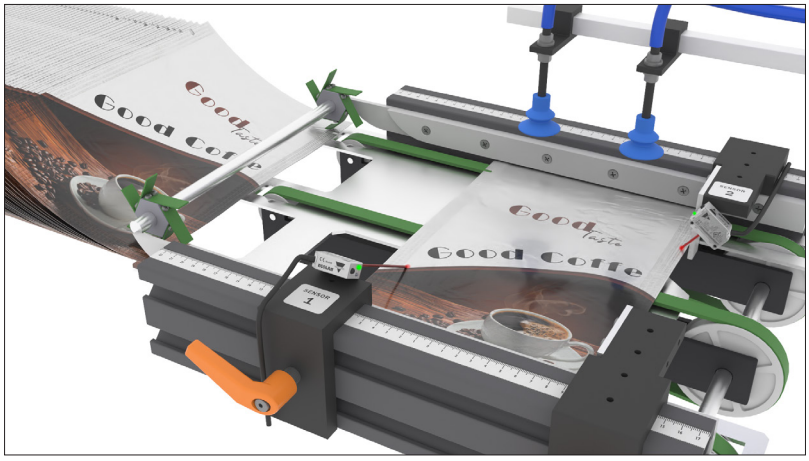
Applications

Bowl feeder system for sorting out parts with incorrect orientation



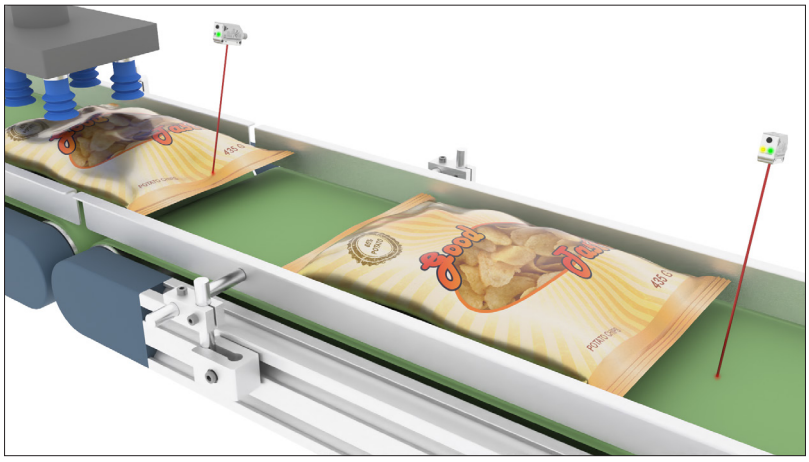
The small 1 mm visible round red laser spot is aligned on the white conveying belt and taught in foreground suppression mode to recognize the belt. If a part is turned upside down and hence its larger diameter lying directly on the belt is blocking the sensor from seeing the belt, the blow nozzle is triggered and sends the part back into the vibratory bowl.

Pouch feeder for horizontal packaging lines



The small 1 mm round laser spots are easy to align so the setting of the guides can be adjusted correctly. The sensors have been taught in foreground suppression mode to detect a background below the conveyor, allowing reliable detection of pouches, regardless of whether all laser light is reflected away from the sensor or absorbed by a dead black pouch.

Case packaging machine with buffer conveyor



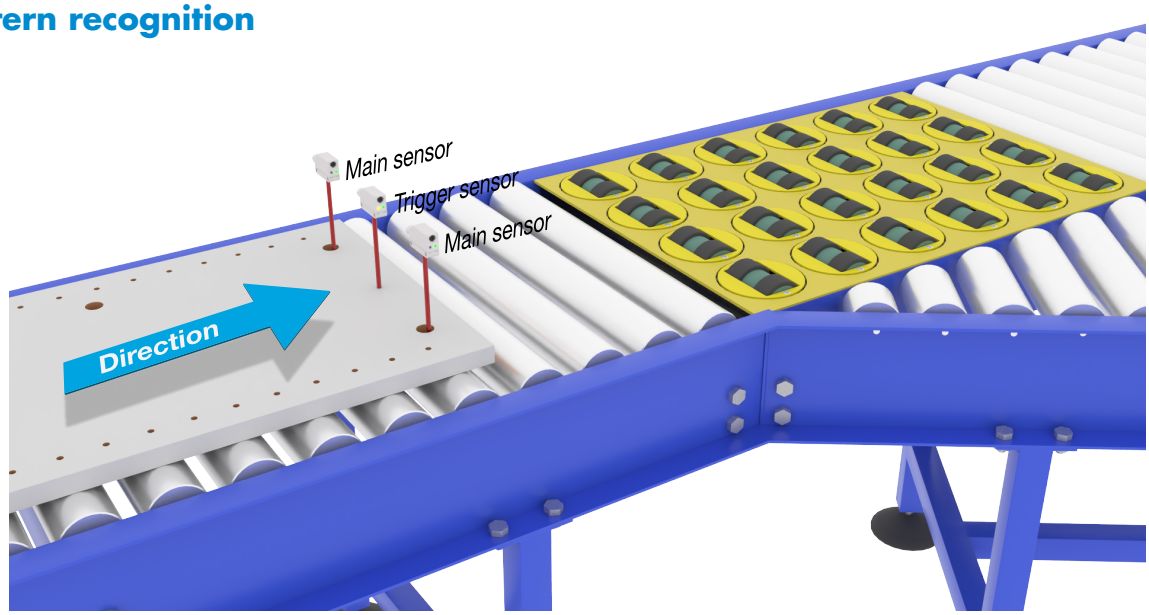
The small 1 mm round laser spot is highly visible so the sensor is easy to align. The sensors can be set in foreground suppression mode to teach the green conveying belt, either with a single teach or using the dynamic teach function to compensate for movement of the belt. The sensor will expect to see the conveying belt. If any object blocks its view to the belt, it will either reflect the light away from the sensor or it will absorb all the light from the sensor. In both cases it is detected as an object.

LD30 series
IO-Link smart photoelectric laser sensors

Application functions

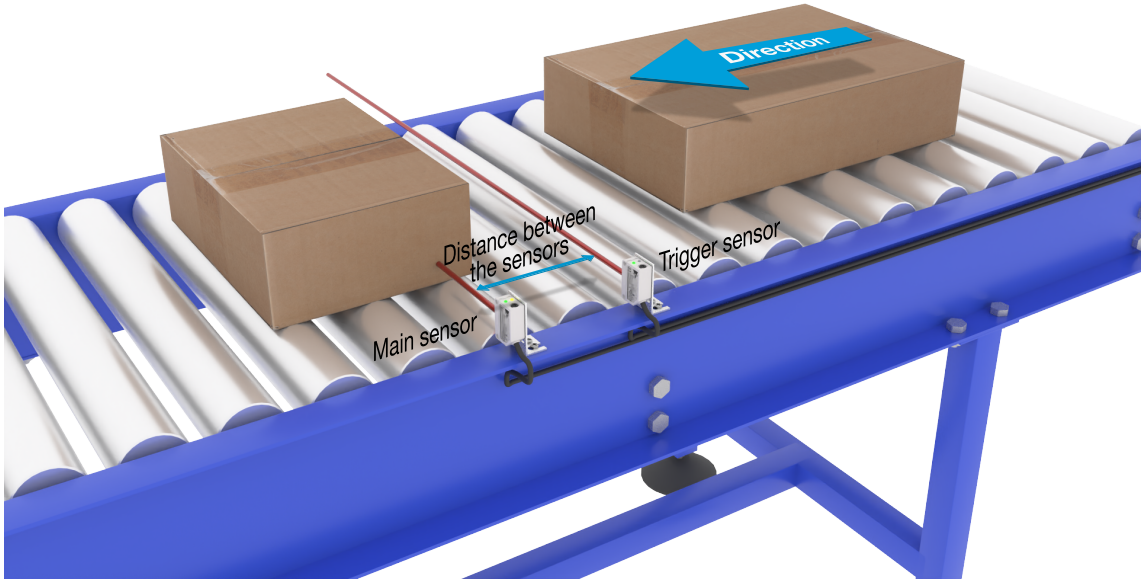
Optimized design for applications like automatic conveyor systems or packaging machinery, the LD30 IO-Link smart laser sensors provides five new unique predefined and selectable application functions: Dual Detection, Speed and length, Pattern recognition, Divider function and Object and gap monitoring. These embedded functions help the customer with additional data, decentralized controls, very important to optimize the production process, and simplification of the machine control system layout.

Pattern recognition



The pattern recognition function is used to verify if a manufactured part has all the e.g. holes or taps as expected and that the parts are made according to the specification.

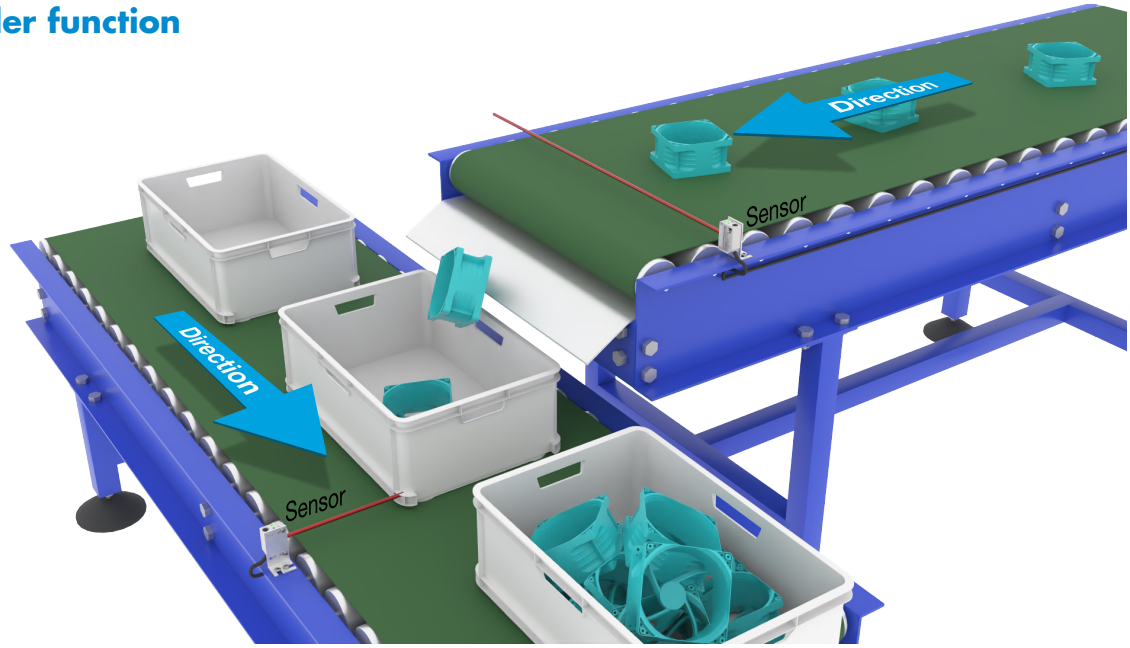
Speed and Length



Monitor the speed and length of an object on a conveyor for e.g. sorting on size.
With this unique function it is possible to monitor the speed and length of an object on a conveyou for e.g. sorting on size.

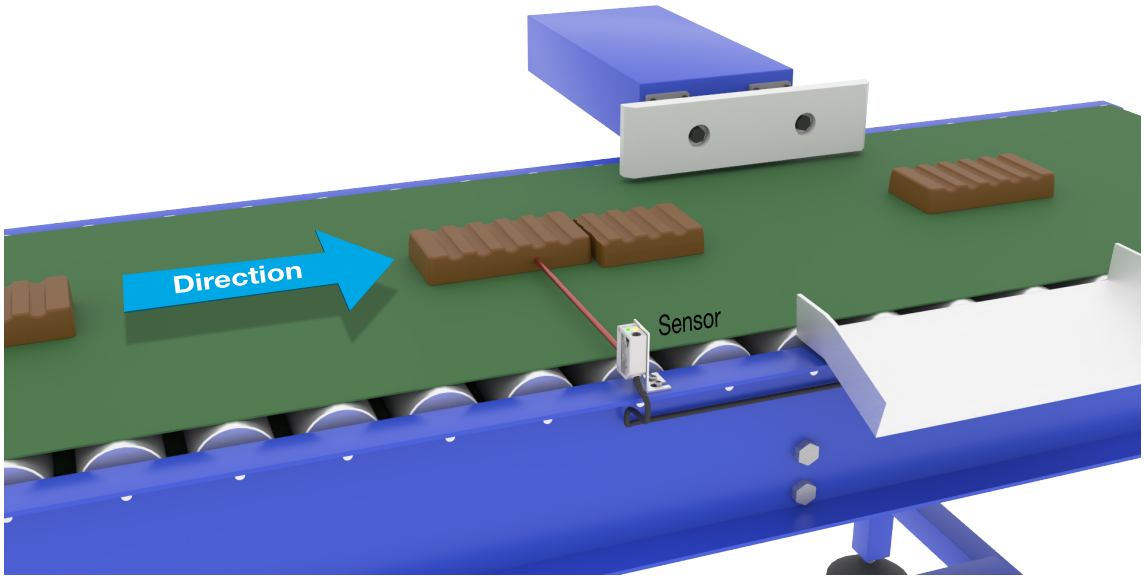
Application functions

Divider function



A decentral counting function that gives a signal when a preset count level is reached e.g. when a certain items are packed in a carton box it ask for a new box.

Object and Gap monitoring



This function is designed to monitor that the length of an objects and the gap between the following object on a conveyor belt are within certain limits.

LD30 series
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BGS vs FGS

Background Suppression

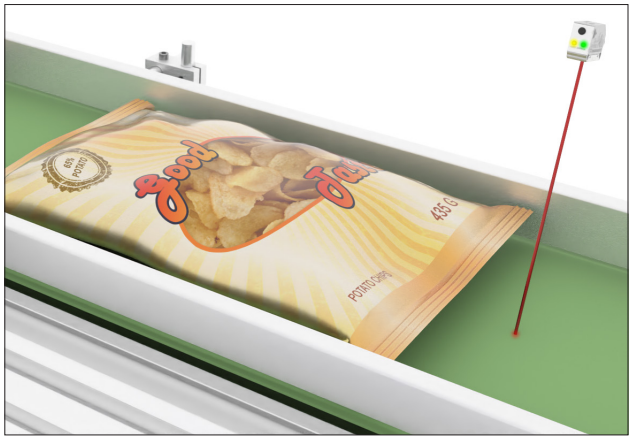
A Background suppression sensor (BGS) prevents an object beyond the set distance from being detected. Objects within the set distance are detected at their position and with the signal strength of the received light.
The detection capabilities of the sensor are almost independent of the colour of the object as it uses the position of the reflected light for detection. Dead black objects or shiny objects that reflects the laser light away from the sensor will not be detected.
A BGS sensor does not need a physical background to operate.

Foreground Suppression

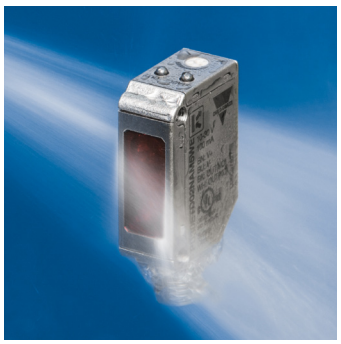
A Foreground Suppression sensor (FGS) needs a background as reference target. If the sensor does not recognize the background, an object must be present, that either;

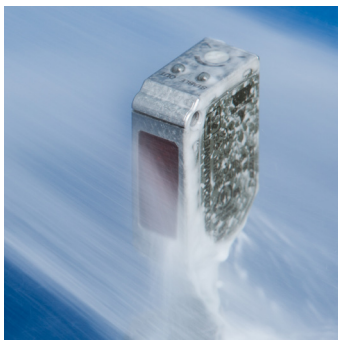
- Sends the laser light back to the sensor, however the detected distance is shorter than the set distance for the background.
- Absorbs the laser light so no light is reflected to the sensor e.g. dead black objects.
- Deflects the laser light so no light is received by the sensor e.g. highly reflective objects.

In case reflected light from highly reflective objects is detected briefly due to object movements, an ON timer can be added to keep the output steady.
A FGS sensor needs a physical background to operate.



The advantages of the LD30 series in stainless steel





Highest degree of protection

The IP69K rating is for applications where high pressure and high temperature wash-down is used to sanitize equipment.

The LD30 Stainless steel housing withstands high-pressure cleaning processes with chemicals, and the sensor's object detection is continuous and reliable even in the harshest conditions. Certified by Ecolab.

LD30 photoelectric IO-Link laser Background suppression types

Housing	Plastic (ABS)		Stainless steel (AISI316L)	
Connection	Plug	Cable	Plug	Cable
Sensing distance 20.0...125.0 mm	**LD30CPBR10BPM5IO**	**LD30CPBR10BPA2IO**	**LD30EPBR10BPM5IO**	**LD30EPBR10BPA2IO**
Sensing distance 20.0...325.0 mm	**LD30CPBR30BPM5IO**	**LD30CPBR30BPA2IO**	**LD30EPBR30BPM5IO**	**LD30EPBR30BPA2IO**
Sensing distance 20.0...625.0 mm	**LD30CPBR60BPM5IO**	**LD30CPBR60BPA2IO**	**LD30EPBR60BPM5IO**	**LD30EPBR60BPA2IO**
Rated operating distance (S_n)	LD30xPBR10: ≤ 100.0 mm; LD30xPBR30: ≤ 300.0 mm; LD30xPBR60: ≤ 600.0 mm			
IO-Link	Transmission type: COM2 (38.4 k Baud), Revision: 1.1, SDCI standard: IEC 61131-9, Profiles: Smart sensor (Process Data Variable; Device Identification), SIO mode: Yes, Required master port type: A, Min. process cycle time [ms]: 5			
Selectable function output 1	NPN, PNP or Push-Pull			
Selectable function output 2	NPN, PNP, Push-Pull, External input or External teach			
Diagnostic	Operation hours, Power cycles, Detection cycles max. and min. Temperatures, Short-circuit, No of Parameter change.			
Logic functions	AND, OR, X-OR, Gated SR-FF			
Timer functions	ON Delay. OFF delay, ON+OFF delay and One shot			
Sensitivity control	Teach-button, Teach by wire or by IO-Link			
Rated operational voltage (U_B)	10 to 30 V DC (ripple included)			
No load supply current (I_o)	≤ 30 mA @ U_B min, ≤ 15 mA @ U_B max			
Minimum operational current (I_m)	> 0.5 mA			
Off-State current (I_r)	≤ 50 µA			
Voltage drop, digital (U_d)	≤ 1.0 V DC @ 100 mA DC			
Capacitive load	100 nF @ 100 mA, 24 VDC			
Frequency of operating cycles (f)	Up to 1000 Hz depending on sensor type and settings			
Response time t_{ON} or t_{OFF}	Down to 0.5 ms depending on sensor type and settings			
Power on delay (t_v)	≤ 150 ms			
Hysteresis (adjustable by IO-Link)	Manual: LD30xPBR10: 1.0 ... 125.0 mm; LD30xPBR30: 1.0 ... 325.0 mm; LD30xPBR60: 1.0 ... 625.0 mm Factory settings: LD30xPBR10: 7 mm; LD30xPBR30: 20 mm; LD30xPBR60: 40 mm			
Led indications	Yellow LED steady: Output ON and signal stability. Yellow LED flashing: Output short-circuit, timer indication and teach. Green LED steady: Power ON and signal stability. Green LED flashing: IO-Link mode. Yellow LED and green LED flashing: Find my sensor			
Sensor protection	Short circuit (A), reverse polarity (B) and transients (C)			
Electrostatic discharge	Contact discharge: ±4 kV. Air discharge: ±8 kV (IEC 61000-4-2; EN60947-1)			
Electrical fast transients/burst	±2kV/5kHz (IEC 61000-4-4; EN60947-1)			
Surge	1kV (with 500 Ω)			
Wire conducted disturbances	10 Vrms (IEC 61000-4-6; EN60947-1)			
Power - frequency magnetic fields	30 A/m, 38 µ tesla (IEC 61000-4-8)			
Radiated RF electromagnetic fields	10 V/m (IEC 61000-4-3)			
Vibration	10 to 150 Hz, 1 mm/15G in X,Y and Z direction (EN 60068-2-6)			
Shock	30G /11 mS. 6 positive and 6 negative in X,Y and Z direction (EN 60068-2-27)			
Drop test	2 times from 1m, 100 times from 0,5m (EN 60068-2-31)			
Degree of protection	IP67 (IEC60539; EN60947-1)		IP67, IP68, IP69K (IEC60539; EN60947-1; DIN40050-9)	
NEMA type	1 (NEMA 250)		1, 2, 4, 4X, 5, 6, 6P (NEMA 250)	
Ambient temperature	Operating: -25 to +50°C (-13 to +122°F). Storage: -40 to +70°C (-40 to +158°F)			
CE marking	According to EN 60947-5-2			
Approvals	cULus (UL508)		cULus (UL508), ECOLAB	
Overvoltage category	III (IEC60664; EN 60947-1)			
Pollution degree	3 (EN60947-1)			
$MTTF_d$	LD30CPBR10: 129.2 years @ 40°C (104°F), LD30CPBR30/60: 133.5 years @ 40°C (104°F)			
Material	Body: ABS. Front glass: PMMA, red. Teach-button: FKM, black.		Body: Stainless steel, AISI316L. Front glass: PPSU, red. Teach-button: FKM, black.	
Cable	PCV, black, 2 m, 4 x 0.14 mm², Ø=3.3 mm			
Connector	M8, 4-pin, male			
Dimensions	Cable and Plug: 10.8 x 30 x 20 mm		Cable and Plug: 11 x 31.5 x 21 mm	
Weight incl. packaging	Cable version ≤ 50 g, Plug version ≤ 20 g		Cable version ≤ 100 g, Plug version ≤ 65 g	
Accessories, additional	Connectors: CO..54NF-... -series. Mounting brackets: APD30-MB1 or APD30-MB2		Connectors: CO..54NF-..W -series. Mounting brackets: APD30-MB1 or APD30-MB2	
Further informaion	www.gavazziautomation.com			

*) Stainless Steel sensors

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