ENGLISH

RS PRO IO-Link photoelectric sensor

2377276 and 2377277

Instruction manual

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1. Introduction

This manual is a reference guide for RS Components IO-Link photoelectric sensors 2377276 and 2377277. It describes how to install, setup and use the product for its intended use.

1.1. Description

RS Components photoelectric sensors are devices designed and manufactured in accordance with IEC international standards and are subject to the Low Voltage (2014/35/EU) and Electromagnetic Compatibility
(2014/30/EU) EC directives.

1.2. Validity of documentation

This manual is valid only for 2377276 and 2377277 photoelectric sensors with IO-Link and until new documentation is published.

1.3. Who should use this documentation

This instruction manual describes the function, operation and installation of the product for its intended use. This manual contains important information regarding installation and must be read and completely understoodby specialized personnel dealing with these photoelectric sensors.
We highly recommend that you read the manual carefully before installing the sensor. Save the manual for futureuse. The Installation manual is intended for qualified technical personnel.

1.4. Use of the product

These photoelectric diffuse reflective sensors are designed with Background Suppression, meaning it is detecting the object via triangulation. The reciver is a detector array that performs precise detection independentof the colour of the object and allows elimination of a background.
The received signal level can be read via the Process data in IO-Link mode.
The 2377276 and 2377277 sensors can operate with or without IO-Link communication. By means of an IO-Link master it is possible to operate and configure these devices.

1.5. Safety precautions

This sensor must not be used in applications where personal safety depends on the function of the sensor (The sensor is not designed according to the EU Machinery Directive).
Installation and use must be carried out by trained technical personnel with basic electrical installation knowledge. The installer is responsible for correct installation according to local safety regulations and must ensure that a defective sensor will not result in any hazard to people or equipment. If the sensor is defective, it must be replaced and secured against unauthorised use.

1.6. Other documents

It is possible to find the datasheet, the IODD file and the IO-Link parameter manual on the Internet at http://xxxxxxxxxxxxxxxxxxxx

1.7. Acronyms

I/O	Input/Output
PD	Process Data
PLC	Programmable Logic Controller
SIO	Standard Input Output
SP	Setpoints
IODD	I/O Device Description
IEC	International Electrotechnical Commission
NO	Normally Open contact
NC	Normally Closed contact
NPN	Pull load to ground
PNP	Pull load to V+
Push-Pull	Pull load to ground or V+
QoR	Quality of Run
QoT	Quality of Teach
UART	Universal Asynchronous Receiver-Transmitter
SO	Switching Output
SSC	Switching Signal Channel
DA	Dust alarm
AFO	Application function output
TA	Temperatur alarm
BGS	Background Suppression
FGS	Foreground Suppression

2. Product

2.1. Main features

IO-Link RS Components 4-wire DC photoelectric Background Suppression sensors, built to the highest quality standards, are available in Plastic (PBT) IP67 approved housing material.
They can operate in standard I/O mode (SIO), which is the default operation mode. When connected to an SCTL55 or an IO-Link master, they automatically switch to IO-Link mode and can be operated and easily configured remotely.
Thanks to their IO-Link interface, these devices are much more intelligent and feature many additional configuration options, such as the settable sensing distance and hysteresis, also timer functions of the output. Advanced functionalities such as the Logic function block and the possibility to convert one output into an external input makes the sensor highly flexible.
Application functions such as; Pattern recognition, Speed and Length monitoring, Divider function and Object and Gap detection are de-central functions dedicated to solve specific sensing tasks.

2.2. Type selection

Connection	Housing	Light type	Distance	Code
Plug	Plastic housing	Infrare	25 - 200 mm	**2377276**
Cable	Plastic housing	Infrare	25 - 200 mm	**2377277**

2.3. Operating modes

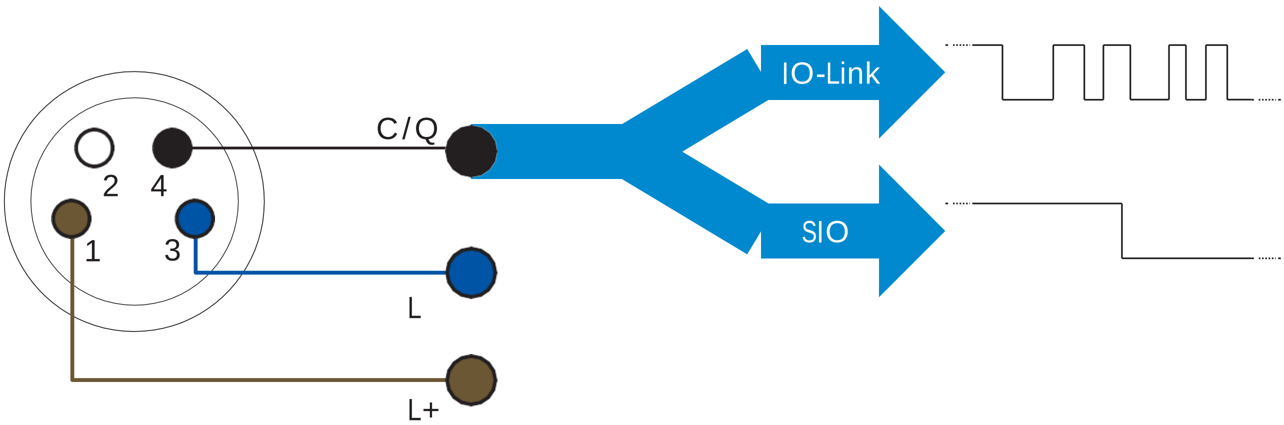
IO-Link photoelectric sensors are provided with two switching outputs (SO) and can operate in two differentmodes: SIO mode (standard I/O mode) or IO-Link mode (pin 4).

2.3.1. SIO mode

When the sensor operates in SIO mode (default), a SCTL55 or an O-Link master is not required. The device works as a standard photoelectric sensor, and it can be operated via a fieldbus device or a controller (e.g. a PLC) when connected to its PNP, NPN or push-pull digital inputs (standard I/O port). One of the greatest benefits of these photoelectric sensors is the possibility to configure them via a SCTL55 or an O-Link master and then, once disconnected from the master, they will keep the last parameter and configuration settings. In this way it is possible, for example, to configure the outputs of the sensor individually as a PNP, NPN or push-pull, or to add timer functions such as T-on and T-off delays or logic functions and thereby satisfy several application requirements with the same sensor.

2.3.2. IO-Link mode

IO-Link is a standardized IO technology that is recognized worldwide as an international standard (IEC 61131-9). It is today considered to be the “USB interface” for sensors and actuators in the industrial automation environment. When the sensor is connected to one IO-Link port, the SCTL55 or IO-Link master sends a wakeup request (wake up pulse) to the sensor, which automatically switches to IO-Link mode: point-to-point bidirectional communication then starts automatically between the master and the sensor.
IO-Link communication requires only standard 3-wire unshielded cable with a maximum length of 20



IO-Link communication takes place with a 24 V pulse modulation, standard UART protocol via the switching andcommunication cable (combined switching status and data channel C/Q) PIN 4 or black wire.
For instance, an M8 4-pin male connector has:

- Positive power supply: pin 1, brown
- Negative power supply: pin 3, blue
- Digital output 1: pin 4, black
- Digital output 2: pin 2, white

The transmission rate of 2377276 and 2377277 sensors is 38.4 kBaud (COM2).
Once connected to the IO-Link port, the master has remote access to all the parameters of the sensor and to advanced functionalities, allowing the settings and configuration to be changed during operation, and enabling diagnostic functions, such as temperature warnings, temperature alarms and process data.

Thanks to IO-Link it is possible to see the manufacturer information and part number (Service Data) of the device connected, starting from V1.1. Thanks to the data storage feature it is possible to

Access to internal parameters allows the user to see how the sensor is performing, for example by reading theinternal temperature.
Event Data allows the user to get diagnostic information such as an error, an alarm, a warning or a communicationproblem.
There are two different communication types between the sensor and the master and they are independent ofeach other:

- Cyclical for process data and value status – this data is exchanged cyclically.
- Acyclical for parameter configuration, identification data, diagnostic information and events(e.g. error messages or warnings) – this data can be exchanged on request

2.3.3. Process data

By default the process data shows the following parameters as active: 16 bit Analogue value, SwitchingOutput1 (SO1) and Switching Output 2 (SO2).
The following parameters are set as Inactive: SSC1, SSC2, TA, SC, DA1, DA2, AFO1.
However by changing the Process Data Configuration parameter, the user can decide to also enable the statusof the inactive parameters. This way several states can be observed in the sensor at the same time.
Process data can be configured. See 2.5.3. Process data configuration

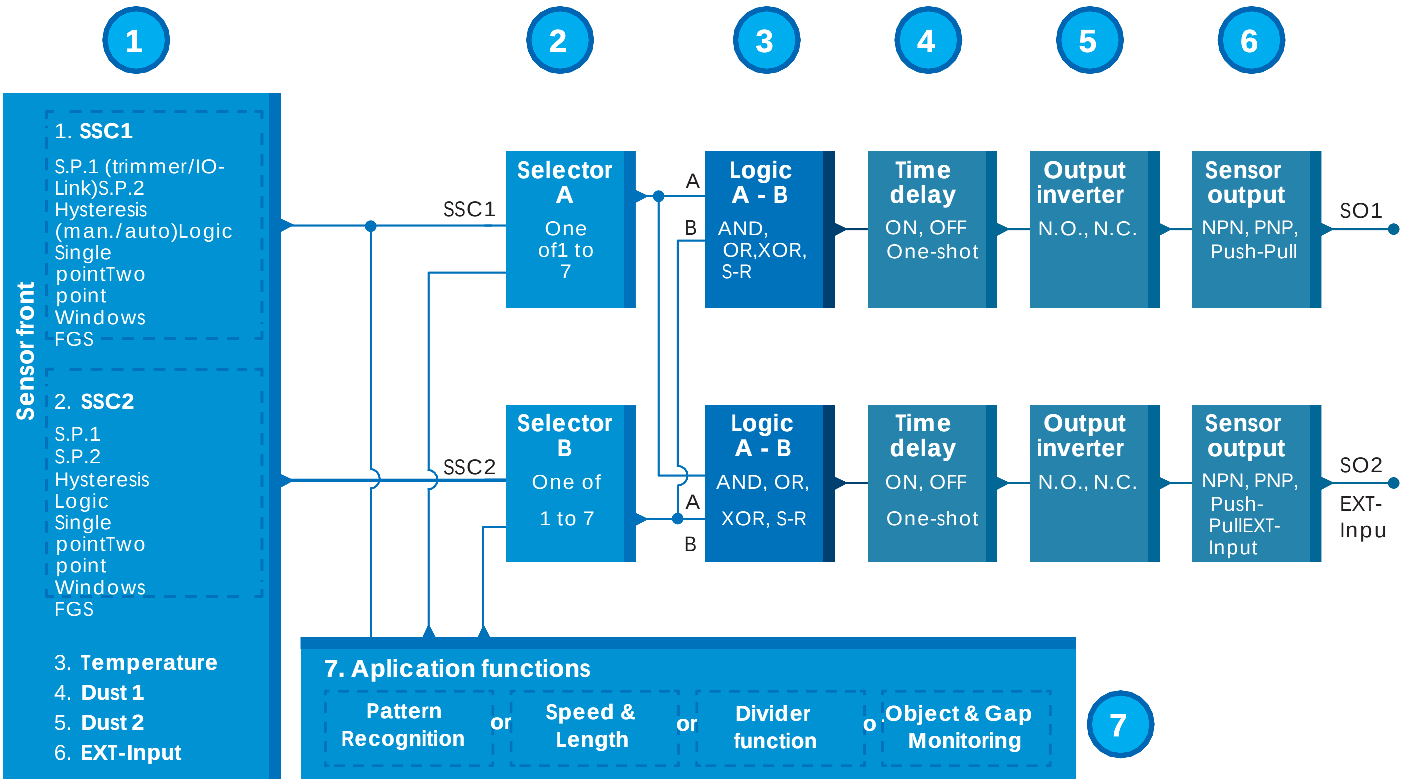
Byte 0	31	30	29	28	27	26	25	24
	MSB							
Byte 1	23	22	21	20	19	18	17	16
								LSB
Byte 2	15	14	13	12	11	10	9	8
			SC	**TA**	**DA2**	**DA1**	**SSC2**	**SSC1**
Byte 3	7	6	5	4	3	2	1	0
	AFO1						**SO2**	**SO1**

4 Bytes
Analogue value 16 … 31 (16

2.4. Output Parameters

Seven sensing functions and 4 application functions can be selected. These values can be independently adjusted and used as source for the Switching Output 1 or 2; in addition to those, an external input can be selected for SO2. After selecting one of these sources, it is possible to configure the output of the sensor with a SCTL55 or an IO-Link master, following the seven steps shown in the Switching Output setup below.

Once the sensor has been disconnected from the master, it will switch to the SIO mode and keep the last configuration setting



1

2.4.1. Sensor front

The Background Suppression sensor emits light towards a target and measure the position of the light reflected from the target. If the measured position value is equal to or less than a predefined position for the target, the sensor changes the output state. The measured sensing distance is almost independent of the target colour.

2.4.1.1. SSC (Switching Signal Channel)

For presence (or absence) detection of an object in front of the face of the sensor, the following settings are available: SSC1 or SSC2. Setpoints can be set from 20 ... 225 mm for PD30CTB.20..., 20 ... 275 mm forPD30CTBS25... and 20 ... 375 mm for the PD30CTBR35... sensor *.

* It is not recommended to use settings higher than maximum 200, 250 and 350 mm depending on the sensor type however under optimal conditions (ambient light environment and EMC noise etc.) the distance can be setat higher value.

2.4.1.2. Switchpoint mode:

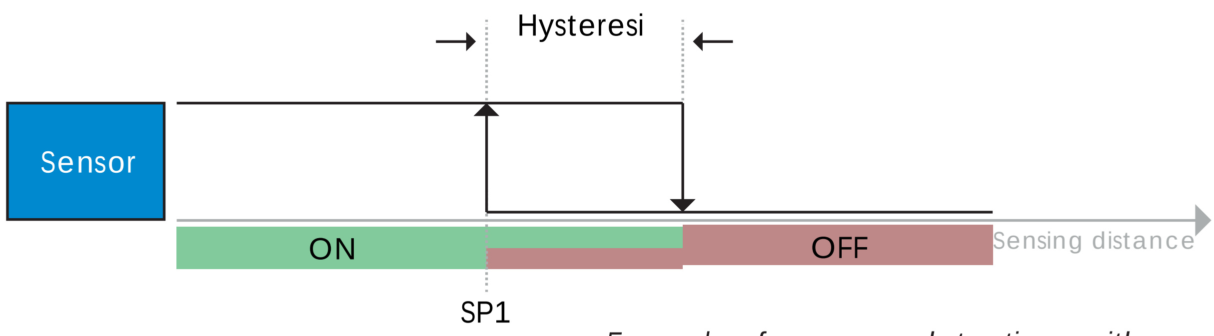
Each SSC channel can be set operate in 4 modes or be disabled. The Switchpoint mode setting can be used to create more advanced output behaviour. The following switchpoint modes can be selected for the switching behaviour of SSC1 and SSC2

Disabled

SSC1 or SSC2 can be disabled individually.

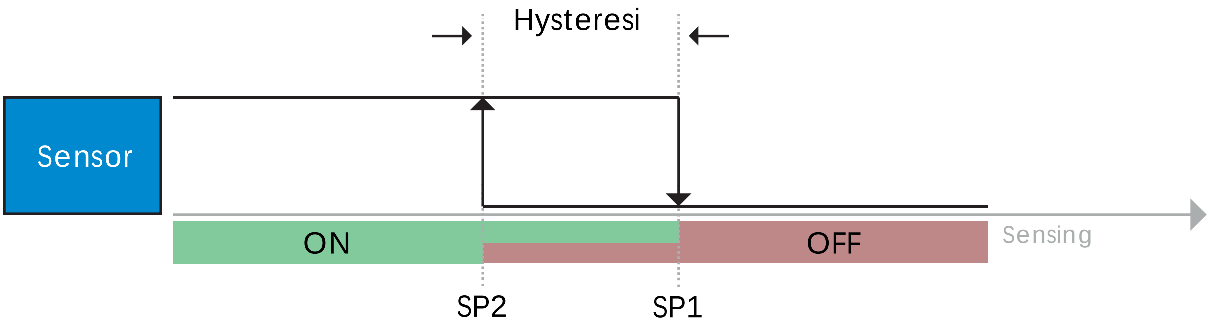
Single point mode

The switching information changes, when the distance passes the threshold defined in setpoint SP1, with rising or falling distances, taking into consideration the hysteresis settings stored in the sensor.



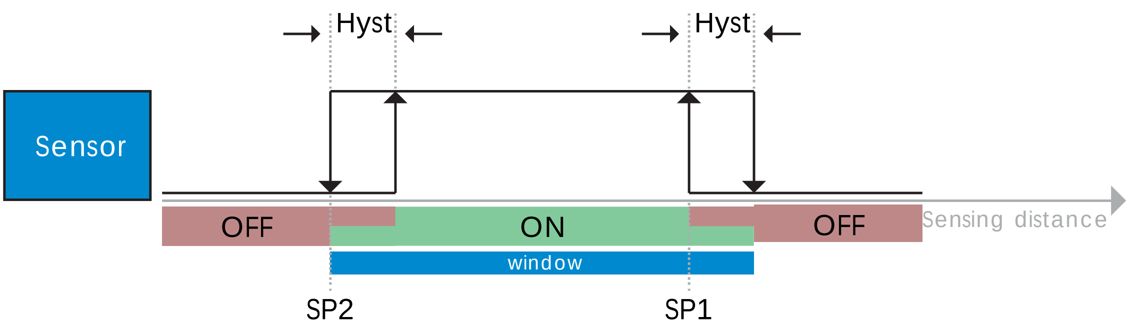
Example of presence detection - with non-

Two point mode
The switching information changes when the distance measured passes the threshold defined in setpoint SP1. This change occurs only with decreasing distance measured. The switching information also changes when the distance measured passes the threshold defined in setpoint SP2. This change occurs only with increasing distance measured. Hysteresis settings stored in the sensor are not applied in this case. The hysteresis results from the difference between SP1 and



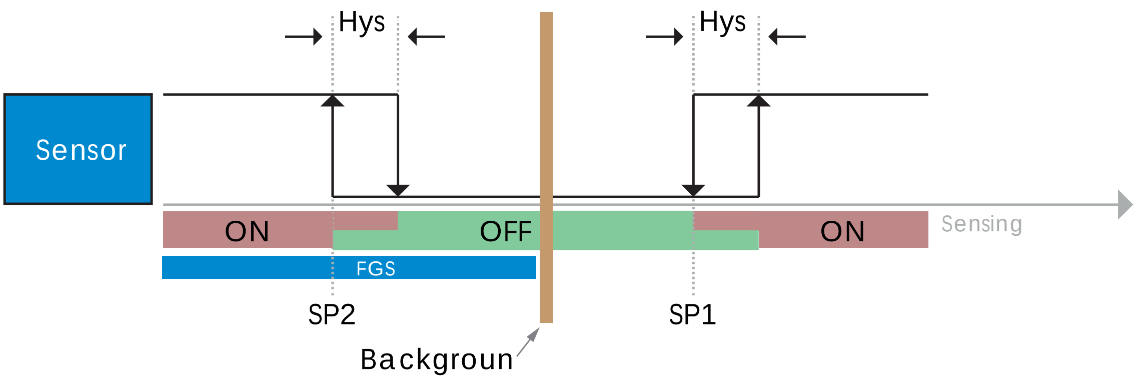
Example of presence detection - with non-

Window mode
The switching information changes, when the distance measured passes the thresholds defined in setpoint SP1 and setpoint SP2, with increasing or decreasing distance measured, taking into consideration the hysteresis settings stored in the sensor.



Example of presence detection - with non-

Foreground suppression Mode
In foreground suppression mode, the sensor is set to detect a background in a predefined distance. If the background is no longer detected in this predefined distance, e.g. because the reflected light from the background is blocked by an object, the sensor changes the



Example of presence detection - with non-

2.4.1.3. Hysteresis Settings

The hysteresis can be set automatically or manually for SSC1 and manually only for SSC2. The hysteresis isset in mm for SP1 and SP2.
Note: *When trimmer is selected, the default hysteresis is Automatic.*

Automatic hysteresis:

Automatic hysteresis will guarantee stable operation for most applications.
Hysteresis is calculated with reference to SP1/SP2 and the actual values can be read via parameter "SSC1Auto hysteresis", typically 14 mm for PD30CTB.20.., 17 mm for PD30CTBS25... and 24 mm for PD30CTBR35... for SP1 and SP2.

Manual hysteresis:

When manual hysteresis is selected the hysteresis can be changed between 2 ... 225 mm for PD30CTB.20...,2 ... 275 mm for PD30CTBS25 and 2 ... 375 mm for PD30CTBR...
For application that require a hysteresis other than the automatic, the hysteresis can be configured manually.This feature makes the sensor more versatile.
Note: *Special attention to the application must be considered when choosing a hysteresis lower than theautomatic hysteresis.*

2.4.1.4. Dust alarm 1 and Dust alarm 2

Minimum Excess Gain is used for dust alarm levels and is set as a common value for both SSC1 and SSC2. The dust alarm will be active after a preset time, if the measured Excess Gain value isbelow the Minimum Excess gain.
See 2.5.10 Excess Gain.

2.4.1.5. Temperature alarm (TA)

The sensor monitors constantly the internal temperature. Using the temperature alarm setting it is possible toget an alarm from the sensor if temperature thresholds are exceeded. See §2.5.5.
Two independent temperature alarm settings can be set. One for the maximum temperature alarm and onefor the minimum temperature alarm.
It is possible to read the temperature of the sensor via the acyclic IO-Link parameter data.
NOTE!
The temperature measured by the sensor will always be higher than the ambient temperature, due to internalheating.
The difference between ambient temperature and internal temperature is influenced by how the sensor isinstalled in the application.

2.4.1.6. External input

The output 2 (SO2) can be configured as an external input allowing external signals to be fed into thesensor, e.g. from a second sensor or from a PLC or directly from machine output.

2

2.4.2. Input selector

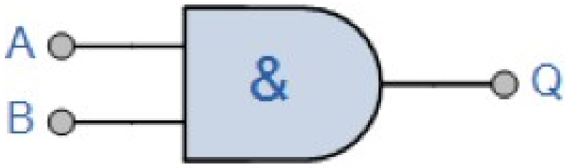
This function block allows the user to select any of the signals from the "sensor front" to the Channel A or B. Channels A and B: can select from SSC1, SSC2, Dust alarm 1, Dust alarm 2, Water drop alarm 1, Water dropalarm 2, Temperature alarm and External input.

3

2.4.3. Logic function block

In the logic function block a logic function can be added directly to the selected signals from the input selectorwithout using a PLC – making decentralised decisions possible.
The logic functions available are: AND, OR, XOR, SR-FF.

AND



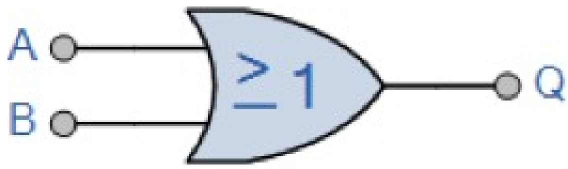
2-input AND Gate

A	B	Q
0	0	0
0	1	0
1	0	0
1	1	1

Boolean Expression **Q = A.B**

Read as A **AND** B gives Q

OR



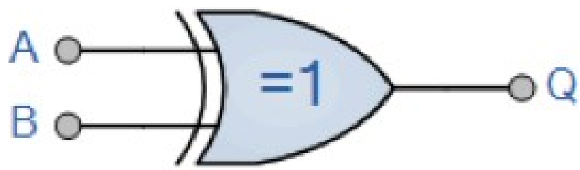
2-input OR Gate

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	1

Boolean Expression **Q = A + B**

Read as A **OR** B gives Q

XOR



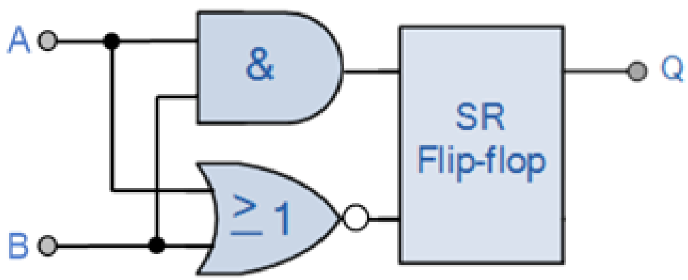
2-input XOR Gate

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	0

Boolean Expression **Q =** $A \oplus B$

A **OR** B but **NOT BOTH** gives Q

"Gated SR-FF" function
The function is designed to: e.g. start or stop signal for a buffer conveyor dependent on the fill status of theadjacent feeder or receiver conveyor using only two interconnected sensors.

Symbol	Truth table		
	A	B	Q
	0	0	0
	0	1	X
	1	0	X
	1	1	1

X – no changes to the

4

2.4.4. Timer (Can be set individually for Out1 and Out2)

The Timer allows the user to introduce different timer functions by editing the 3 timer parameters:

- Timer mode
- Timer scale

2.4.4.1. Timer mode

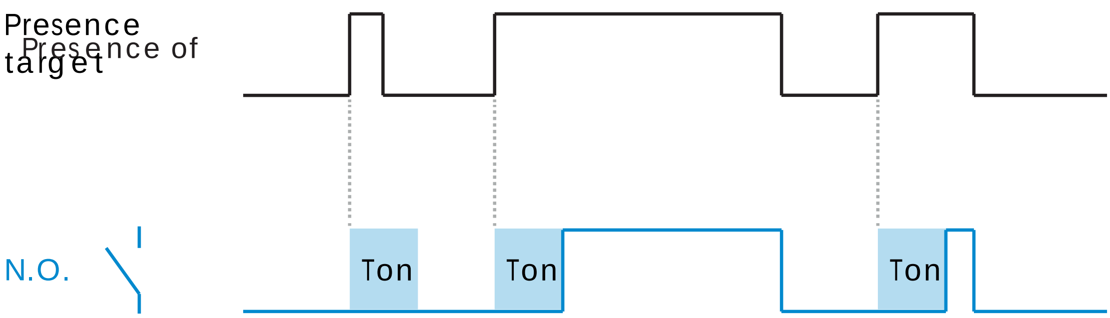
This selects which type of timer function is introduced on the Switching Output. Any one of the following ispossible:

2.4.4.1.1. Disabled

This option disables the timer function no matter how the timer scale and timer delay is set up.

2.4.4.1.2. Turn On delay (T-on)

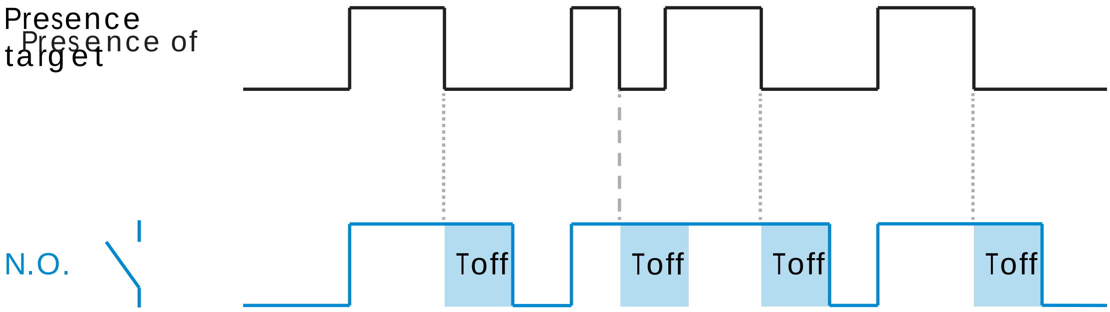
The activation of the switching output is generated after the actual sensor actuation as shown in the figurebelow.



Example with normally open

2.4.4.1.3. Turn Off delay (T-off)

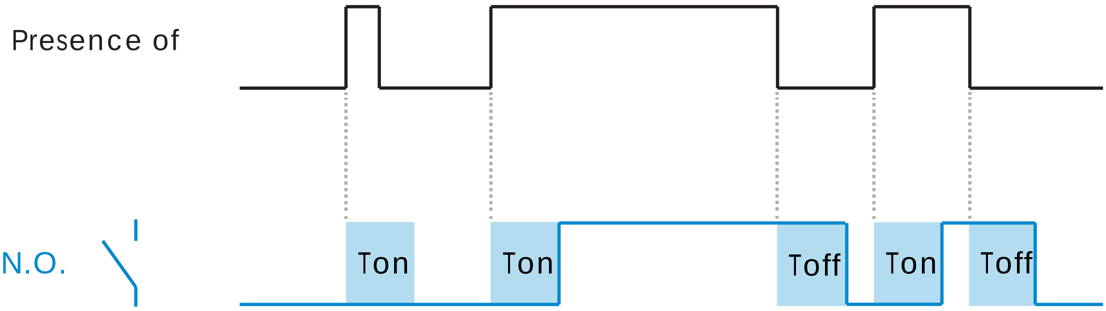
The deactivation of the switching output is delayed until after to the time of removal of the target in the frontof the sensor, as like shown in the figure below.



Example with normally open

2.4.4.1.4. Turn ON and Turn Off delay (T-on and T-off)

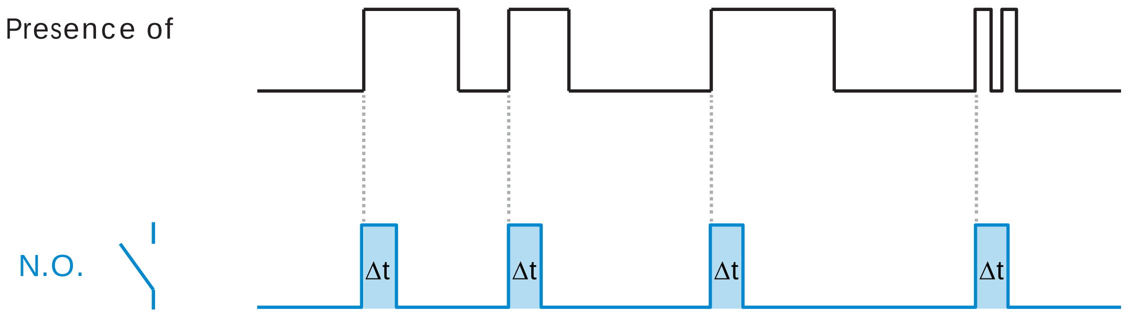
When selected, both the Ton and the Toff delays are applied to the generation of the



Example with normally open

2.4.4.1.5. One shot leading edge

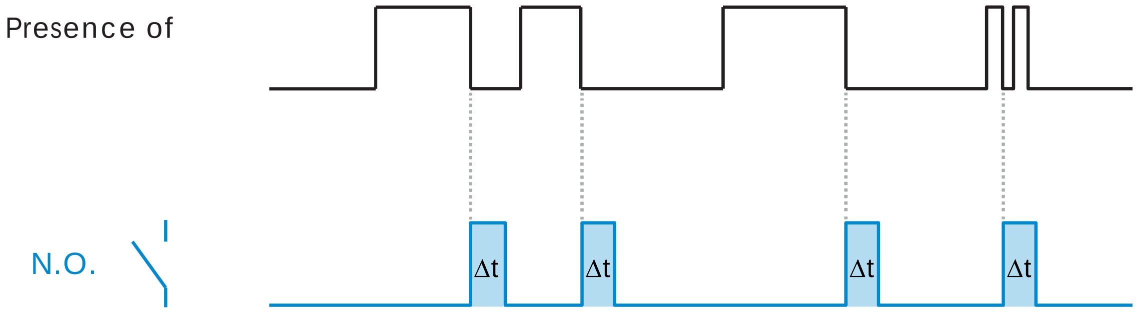
Each time a target is detected in front of the sensor the switching output generates a pulse of constantlength on the leading edge of the detection. This function is not retriggerable. See



Example with normally open

2.4.4.1.6. One shot trailing edge

Similar in function to the one shot leading edge mode, but in this mode the switching output is changed onthe trailing edge of the activation as shown in the figure below. This function is



Example with normally open

2.4.4.2. Timer scale

The parameter defines if the delay specified in the Timer delay should be in milliseconds, seconds

2.4.4.3. Timer Value

The parameter defines the actual duration of the delay. The delay can be set to any integer value between1 and 32 767.

5

2.4.5. Output Inverter

This function allows the user to invert the operation of the switching output between Normally Open andNormally Closed.

RECOMMENDED FUNCTION

The recommended function is found in the parameters under 64 (0x40) sub index 8 (0x08) for SO1 and 65 (0x41) sub index 8 (0x08) for SO2. It has no negative influence on the Logic functions or the timer functions ofthe sensor as it is added after those functions.

CAUTION!

The Switching logic function found under 61 (0x3D) sub index 1 (0x01) for SSC1 and 63 (0x3F) sub index1 (0x01) for SSC2 are not recommended for use as they will have a negative influence on the logic or timer functions. Using this function will turn an ON delay into an Off delay if it is added for the SSC1 and SSC2. It is only for the SO1 and SO2.

6

2.4.6. Output stage mode

In this function block the user can select if the switching outputs should operate as:SO1: Disabled, NPN, PNP or Push-Pull configuration.

SO2: Disabled, NPN, PNP, Push-Pull , External input (Active high/Pull-down), External input(Active low/pull up) or External Teach input.

7

2.4.7. Application functions

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

- Speed and Length.
- Pattern Recognition.
- Divider.
- Object and Gap Monitoring.

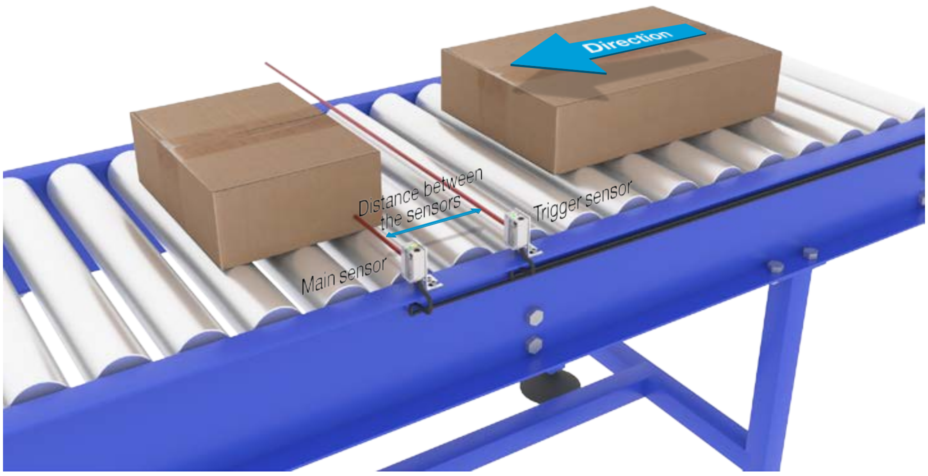
2.4.7.1. Speed and Length

This function is designed to monitor the length of an object as well as the speed of a conveyor belt by means of only two interconnected sensors. The actual value if the length in [mm] and the speed in [mm/s]are directly available on the IO-Link master.
Either the length or the speed can be set as process data.

2.4.7.1.1. Conditions

Two sensors are needed for this function: a Trigger sensor and a Main sensor.

2.4.7.1.2. Speed and Length – Setup procedure



Alignment of Trigger and Main

Sensor preparation

1) Mount two sensors at the conveyor with an individual distance of e.g. 100 mm
2) Connect the two sensors to an SCTL55 or IO-Link master
3) Upload the IODD files in the SCTL55 or IO-Link Master
4) Switch on the power to the sensors
5) Restore the sensors to factory settings using the SCTL55 or IO-Link master.
6) Align the two sensors so the light beams are parallel to each other and aimed at the target.
7) Adjust the sensitivity on the sensors to get a reliable detection on the object.
   (The yellow LED is ON, and the green LED is ON indicating stable ON and IO-Link Mode)

IO-Link parameter settings (see Data Range options in § 7.2.6.1.)

8) Trigger sensor: (The object passes the Trigger Sensor first)
   a) Select "Speed and Length" in the SCTL55 or IO-Link master; Menu "Parameter" ->

b) Select “Sensor role” -> “Trigger Sensor”
c) IO-Link Parameter Set-up is finished for the Trigger Sensor

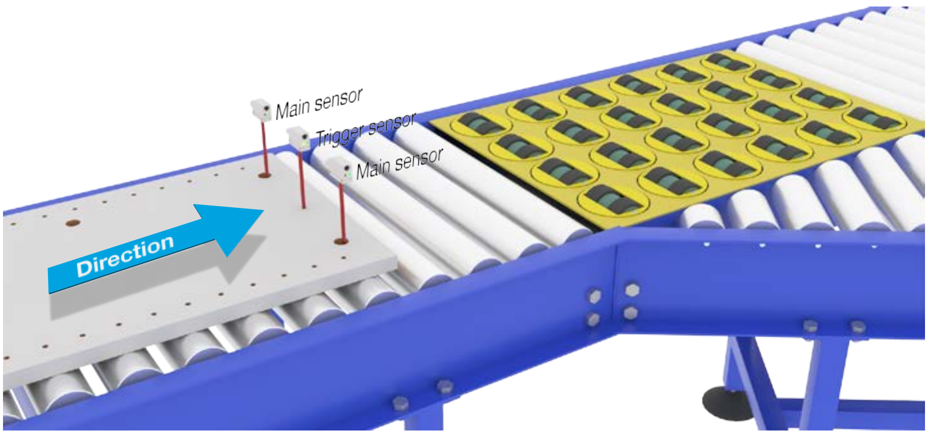
9) Main sensor: (calculates Speed and Length and makes data available
   a) Reset the sensor using “Restore factory Settings” (if already performed in point 5 then this can be skipped).
   b) Select “Speed and Length” in the SCTL55 or IO-Link master; Menu “Parameter” -> “ApplicationFunctions” Select “Sensor role” -> “Main Sensor”.
   c) Enter the distance in between the two sensors in [mm] in the menu “Speed and Length MeasurementMain Sensor” -> “Distance between sensors” Select “Object Length” or “Object Speed” if required in “Process Data” in the “Observation menu”under “Process data configuration” -> “Analogue value”
      i. Object Length will be shown in [mm]
      ii. Object Speed will be shown in [mm/s]
10) Connect sensor output Pin 2 of the Trigger Sensor to Input Pin 2 of the Main Sensor
11) The Speed and length function is now ready for use.

2.4.7.2. Pattern Recognition

The pattern recognition function is used to verify if a manufactured part has all the e.g. holes or taps asexpected and that the parts are made according to the specification.
A pattern of a part can be recorded into the sensor and the following parts then compared to the pre-recorded pattern.
If pattern match, the sensor will respond with a positive signal or command either as standalone operationor via an IO-Link master
The pattern can max. contain 20 edges eg. 10 holes or 10 taps.
If multiple pattern are to be detected then several Main sensors can be connected to a single Trigger sensor.

2.4.7.2.1. Conditions

Two sensors are needed for this function a Trigger Sensor and a Main Sensor, however several Mainsensors can be connected to the Trigger Sensor if more than one pattern must be examined simultaneously.



Alignment of Trigger and Main

Sensor preparation

1) Mount two sensors at the conveyor in line so the object will reach the two sensors at the same time.
2) Connect the two sensors to an SCTL55 or IO-Link master

4) Switch on the power to the sensors
5) Restore the sensors to factory settings using the SCTL55 or IO-Link master.
6) Align the two sensors so the light beams will be detecting the edge of the target at the same time.
7) The trigger sensor must be mounted in a position where it will continuously detect the object withoutany holes or taps.
8) The Main sensor must be mounted so it detects the taps or holes that contain the pattern to beexamined
9) Adjust the sensitivity on the sensors to get a reliable detection on the target.
   (The yellow LED are ON, and the green LED are ON indicating Stable ON and IO-Link Mode)

IO-Link parameter settings (see Data Range options in § 7.2.6.2.)

10) Trigger sensor:
    a) Select “Pattern Recognition” in the SCTL55 or IO-Link master; Menu “Parameter” -> “ApplicationFunctions”
    b) Select “Sensor role” -> “Trigger Sensor”
    c)IO-Link Parameter Set-up is finished for the Trigger Sensor
11) Main sensor:
    a) Select “Pattern Recognition” in the SCTL55 or IO-Link master; Menu “Parameter” -> “ApplicationFunctions”
    b) Select “Sensor role” -> “Main Sensor”.
    c)Enter the Timeout value used for maximum evaluation time between 1 ... 60 sec, in the menu“Pattern Recognition Setup” -> “Timeout” (default value is 60 sec.)
    d) Enter the Tolerance of the Pattern in ‰ (Parts per thousand), between 1 and 200 ‰ in the menu“Pattern Recognition Setup” -> “Tolerance”, default value is 50 ‰
12) Connect sensor output Pin 2 of the Trigger Sensor to Input Pin 2 of the Main Sensor(s)

Teach the Pattern

13) Activate the “Teach Pattern” command to start learning the pattern
14) Move the target at a steady speed passing fully by the two sensors
    NB! During the measurement variations in the conveyor speed may impact the result.
15) The sensor responds with:
    a) “Saved” in “Pattern Recognition Result” -> “Reference Pattern”
    b) “E.g. 12” in “Pattern Recognition Result” -> “Reference Pattern No Of Edges” (counts both theleading and trailing edges of the measurement targets).
    c)Each edge is saved in ms from the leading edge of the complete measurement target and can be found in the Observation menu. When compared to the reference pattern the edges are normalizedas a percentage value of the complete measurement target. This ensures that the pattern can be recognized at various constant speeds.
16) The Pattern can be saved as a project in the SCTL55 or IO-Link master and at a later point send backto the sensor in order to use this specific saved pattern as a reference pattern.
17) The Pattern Recognition function is now ready for use.
18) Move the target again at a steady speed passing fully by the two sensors
19) The Sensor responds with the text
    a) “E.g. 12” in “Pattern Recognition Result” -> “Number of Edges Last Pattern”
20) “Patterns Match” in “Pattern Recognition Result” -> “Pattern Recognition Status”

Standalone operation in SIO Mode

21) Disconnect the sensor from the SCTL55 or IO-Link master and connect the Pin 4 to your e.g. decentralTower light or good/bad conveyor belt
22) Once a valid pattern is detected the Pin 4 output responds with a 1 second pulse.

Multiple patterns

Multiple patterns can be detected simultaneously on the same target using only one Trigger

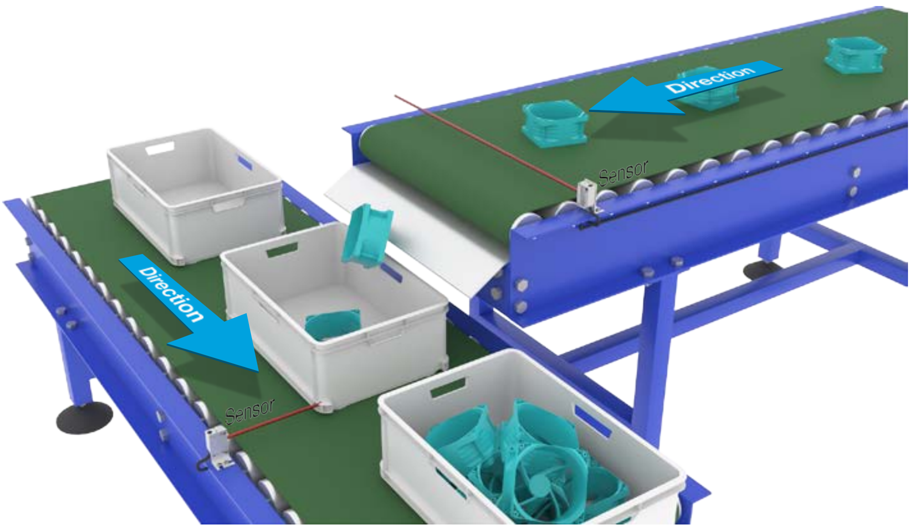
2.4.7.3. Divider function

This function allows e.g. the user to set up a number of counts to be performed before changing the output. By default, this value is set to 1 and each activation causes the output to change. When the value is set to a higher value e.g. 10 then the sensor will give output every 10th detection, the sensor will count at the trailing edge of the object. In the application example below the sensor shall change the output state after 8 products have been detected. The sensor output will indicate a "box full" and a new box is moved in front of the primary conveyor. The counter can be reset manually via the SO2, pre-configured as an external reset button.

2.4.7.3.1. Conditions

Only a single sensor is being used for this function.

2.4.7.3.2. Divider function – Setup procedure



Alignment of

Sensor preparation

1) Mount the sensors at the conveyor at a position where the trailing edge of the target is detected just before it drops into the box.
2) Connect the sensor to an SCTL55 or IO-Link master.
3) Upload the IODD file in the SCTL55 or IO-Link Master.
4) Switch on the power to the sensor.
5) Restore the sensor to factory settings using the SCTL55 or IO-Link master.
6) Align the sensor so the light beam will detect the target.
7) Adjust the sensitivity on the sensor to get a reliable detection on the target. (The yellow LED must light steady, and the green LED are ON indicating Stable ON and IO-Link Mode)

IO-Link parameter settings (see Data Range options in § 7.2.6.3.)

8) Select "Divider" in the SCTL55 or IO-Link master; Menu "Parameter" -> "Application Functions"
9) Enter the Counter value in the menu "Divider and Counter Setup" -> "Counter Limit" between 1 … 65 535(default value is 1)

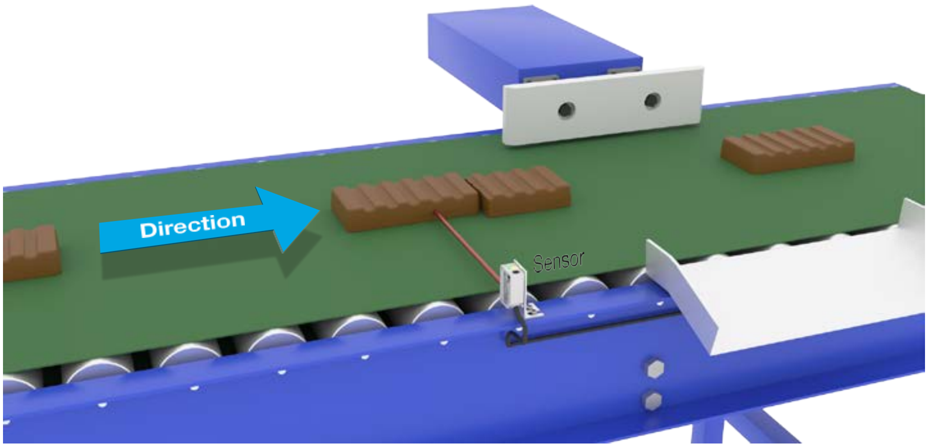
2.4.7.4. Object and Gap Monitoring

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. The stand alone sensor gives a signal if the size of the object is too small, the objects overlap each other or if the gap between two objects are too small for the following processes.

2.4.7.4.1. Conditions

Only a single sensor is being used for this function.

2.4.7.4.2. Object and Gap Monitoring – Setup procedure



Alignment of

Sensor preparation

1) Mount the sensor at the conveyor at the required position.
2) Connect the sensor to an SCTL55 or IO-Link master.
3) Upload the IODD file in the SCTL55 or IO-Link Master.
4) Switch on the power to the sensor.
5) Restore the sensor to factory settings using the SCTL55 or IO-Link master.
6) Align the sensor so the light beam is aimed at the target to be detected.
7) Adjust the sensitivity on the sensor to get a reliable detection on the target.
   (The yellow LED must light steady, and the green LED are ON indicating Stable ON and IO-Link Mode)

IO-Link parameter settings (see Data Range options in § 7.2.6.4)

8) Select "Object and Gap monitoring" in the SCTL55 or IO-Link master; Menu "Parameter" -> "ApplicationFunctions".
9) Object time:
   a)Enter the minimum time the target will be present in the menu "Object and Gap monitor" -> "Objectminimum time" between 10 … 60 000 ms (default value is 500) ms, e.g. 130 ms.
   As a help the Object time can be read from the "Object and Gap monitor" -> "Object time".
   b)Enter the maximum time the target will be present in the menu "Object and Gap monitor" -> "Object maximum time" between 10 … 60 000 ms (default value is 500) ms, e.g. 150 ms. As a help the Object time can be read from the "Object and Gap monitor" -> "Object time".
10) Gap time:

b) Enter the maximum time the Gap will be present in the menu “Object and Gap monitor” -> “Gapmaximum time” between 10 ... 60 000 ms (default value is 500) ms, e.g. 130 ms.
As a help the gap time can be read from the “Object and Gap monitor” -> “Gap time”.

11) The sensor is now ready to use.
12) The Parameter for Object length will toggle between: Measurement running and Inside limits, Timetoo long or, Time too short.
13) The Parameter for Gap length will toggle between: Measurement running and Inside limits, Time too longor, Time too short.

Standalone operation in SIO Mode

14) Disconnect the sensor from the SCTL55 or IO-Link master.
15) Output Pin 4 will activate of the object time is too long or too short.
16) Output Pin 2 will activate of the gap time is too long or too short.
NB! If the signals of both outputs are evaluated using a logical OR function, the output

2.5. Sensor Specific adjustable parameters

Besides the parameters directly related to output configuration, the sensor also have various internal parametersuseful for setup and diagnostics.

2.5.1. Selection of local or remote adjustment

It is possible to select how to set the sensing distance by either selecting the "Trimmer Input" or "Teach-by-wire" using the external input of the sensor, or to disable the trimmer input by selecting "IO-Link Adjustment" to makethe sensor tamperproof.

2.5.2. Trimmer data

Value between 20 ... 225 mm for PD30CTB.20..., 20 ... 275 mm for PD30CTBS25... and 20 ... 375 mm forPD30CTBR35...

2.5.3. Process data configuration

When the sensor is operated in IO-Link mode, the user has access to the cyclic Process Data Variable.

By default the process data shows the following parameters as active: 16 bit Analogue value, SwitchingOutput1 (SO1) and Switching Output 2 (SO2).

The following parameters are set as Inactive: SSC1, SSC2, DA1, DA2, TA, SC, AFO1.

However by changing the Process Data Configuration parameter, the user can decide to also enable the statusof the inactive parameters. This way several states can be observed in the sensor at the same time.

NB! If Application functions are selected more options for "Analogue Values" can be selected in the Observationtab.

2.5.4. Sensor Measurement Selection

The sensor has 3 sensor precision presets, which can be selected depending on the environment:

- Default precision (Filter scaler fixed to 1)
- High precision (Filter scaler fixed to 10 - slow)
- Customized (Filter scaler can be set from 1-255)

Precision can be adjusted via parameter "Filter scaler". See 2.6.9.

2.5.5. Temperature alarm threshold

The temperature at which the temperature alarm will activate can be changed for the maximum and minimum temperature. This means that the sensor will give an alarm if the maximum or minimum temperature is exceeded.The temperatures can be set between -50 °C to +150 °C. The default factory settings are, Low threshold -30
°C and high threshold +120 °C.

2.5.6. Safe limits

The Safe limits can be set for the sensor in % of the SP1 and SP2 and can be set individually for SSC1 andSSC2. It is used for calculating a Stable ON or Stable OFF signals.

- Dust alarm: If the Safe limits are exceeded then the dust alarm is activated, see also Dust alarm description

2.5.6.1. Stable ON

When the sensor detects a signal that are x % higher (set by Safe limits) than the value for which the outputswitches ON, then the sensor is stable ON.

2.5.6.2. Stable OFF

When the sensor detects a signal that are x % lower (set by Safe limits) than the value for which theoutputs switches Off, then the sensor is stable OFF.

2.5.7. Event configuration

Temperature events transmitted over the IO-Link interface are turned off by default in the sensor. If the user wants to get information about critical temperatures detected in the sensor application, this parameter allows the following 4 events to be enabled or disabled:

- Temperature fault event: the sensor detects temperature outside the specified operating range.
- Temperature over-run: the sensor detects temperatures higher than those set in the TemperatureAlarm threshold.
- Temperature under-run: the sensor detects temperatures lower than those set in the TemperatureAlarm threshold.
- Short circuit: the sensor detects if the sensor output is short-circuited.

2.5.8. Quality of run QoR

The Quality of run informs the user about the actual sensor performance, evaluating the following parameters:Maximum signal, Minimum signal, Hysteresis, SP and Safe Limits.
The value for QoR can vary from 0 … 255 %.
The QoR value is updated for every detection cycle.Examples of QoR is listed in the table below.

Quality of Run values	Explanation
> 150%	Excellent sensing conditions, the sensor is not expected to require mainte-nance in the near future.
100%	Good sensing conditions, the sensor performs as well as when the setpointswere taught or set-up manually with a safety margin of twice the standard hysteresis. • Long term reliability is expected under all environmental conditions.
50%	Average sensing conditions • Due to environmental conditions, the reliability of the measurement valuesis reduced and maintenance is required in order to improve the detection behavior. • If the environmental conditions remain stable, reliable detection can beexpected for the near future.
0%	Unreliable sensing conditions, sensor does not work correctly, immediatemaintenance required.

2.5.9. Quality of Teach QoT

The quality of Teach value lets the user know how well the actually the teach procedure was carried out,evaluating the relation between the following parameters: TP2, TP1, Hysteresis and Safe Limits.
The value for QoT can vary from 0 … 255 %.
The QoT value is updated after every Teach procedure Examples of QoT are listed in the table

Quality of Teach values	Explanation
> 150%	Excellent teach conditions, the sensor is not expected to require maintenancein the near future.
100%	Good teach conditions, the sensor has been taught with the safe limits set atstandard safe limits: • Long term reliability is expected under all environmental conditions. • Maintenance is not expected to be required.
50%	Average teach conditions. • The environmental conditions do not allow reliable detection for a longerperiod. Maintenance should be carried out in the near future. • If the environmental conditions remain stable, reliable
0%	Poor teach result. • Poor sensing conditions for reliable detection. (e.g. too small measuringmargin between the target and the surroundings).

2.5.10. Excess Gain

The Excess Gain value describe the ratio of the light received by the photoelectric sensor to the light requiredto operate the sensor.
The Excess gain value can be found in the Diagnostic tab of the SCTL55 or IO-Link master.

$$\text{Excess Gain} \quad \frac{\text{Light received by the}}{\text{Light required to switch the}}$$

2.5.11. Filter Scaler

This function can increase the immunity towards unstable targets and electromagnetic disturbances: Its value can be set from 1 to 255, the default factory setting is 1. The filter functions as a moving average. This means that a filter setting of 1 gives the maximum sensing frequency and a setting of 255 gives the minimum sensingfrequency.

2.5.12. Mutual interference

In an optimal installation the sensors must be installed so they do not interfere with each other, however in some cases that is not possible, so the mutual interference protection function can be used. Using this function will increase the immunity significantly however it will also have a negative impact on the sensing speed. When the filter is activated, the sensor analyses the received signals and try to filter out interfering pulses.

1. sensor mode: is to be used where the sensor is disturbed by a foreign sensor, strong flashlight or a strongmodulated light source e.g. LED lights.
   The response time is increased 5 times
2. sensor mode:is to be used if two identical sensors are interfering each other.The response time is increased 5 … 6 times
3. sensor mode:is to be used if three identical sensors are interfering each other.The response time is increased 5 … 7 times

2.5.13. LED indication

The LED indication can be configured in 3 different modes: Inactive, Active or Find my sensor.

Inactive: The LEDs are turned off at all times

Active: The LEDs follow the indication scheme in 5.1.

Find my sensor: The LEDs are flashing alternating with 2Hz with 50% duty cycle in order to easily locatethe sensor.

2.5.14. Hysteresis mode

See 2.4.1.3.Hysteresis

2.5.15. Auto hysteresis value

See 2.4.1.3.Hysteresis Settings

2.5.16. Cutoff distance

Range 20...250 mm

Measured distance beyond Cutoff distance, will be truncated to Cutoff distance.Cutoff distance value will also be used when an object

2.6. Teach procedure by use of SCTL55 or an IO-Link master

The setpoints can be set-up using a teach procedure, this ensures that the setpoints a set at an optimal valuetaking into consideration safe limits and hysteresis.

2.6.1. External Teach (Teach-by-wire)

NB! This function works in Single point Mode, and only for SP1 in SSC1.
The Teach by wire function must be selected first using the SCTL55 or an IO-link master:

a) Select "Teach in" in "Channel 2 (SO2)" -> "Channel 2 Setup.Stage Mode.
b) Select "Single point mode" in "Switching signal channel1" -> "SSC1 Configuration.Mode".
c) Select "Teach by wire" in "SSC1 Single Point" -> "Selection of local/remote adjustment".

Teach-by-wire procedure.

1) Place target in front of sensor.
2) Connect Teach wire input (Pin 2 white wire) to V+ (Pin 1 brown wire). Yellow led start to flash with 1Hz (10% on), indicating that Teach is running.
3) After 3-6 sec Teach window is open. Here flash pattern changes to 90% on. Release white wire.
4) If Teach is done successfully, yellow led makes 4 flash (2Hz, 50%).
5) The new teached setpoint can be found in "SSC1 Single Point" -> "Setpoint" -> " SSC1 Parameter.Set Point 1".If Teach fails or is suspended, sensor will exit Teach mode.

NB: *If white wire is released outside the Teach window, teach is suspended.*
If white wire is not released within 10 sec., teach is suspended (timeout indicated by a number of fast yellowflash (5Hz, 50%))

2.6.2. Teach from IO-Link Master or Smart configurator (SCTL55)

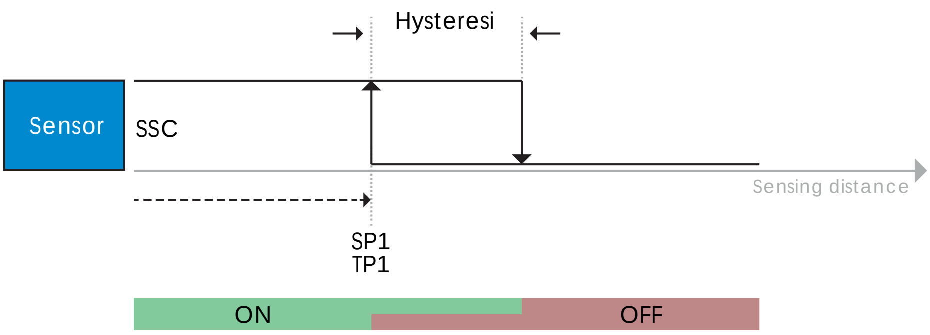
1. Select SSC1 or SSC2 configuration mode:
   SSC1: Select: "Single point", "Window" or "Two Point" in " Switching signal channel1" ->"SSC1 Configuration.Mode".
   NB! *If "Single point" is selected, then "IO-Link adjustment" must be chosen in "SSC1 Single Point" ->"Selection of local/remote adjustment"*
   SSC2: Select: "Single point", "Window" or "Two Point" in "Switching signal channel2" ->"SSC2 Configuration.Mode".
2. Select channel to be taught e.g. "Switching signal channel 1" or "Switching signal channel 2" in"Teach-in" -> "Teach-in,Select".

2.6.2.1. Single point mode procedure

1) Single value teach command sequence:

Single value teach command sequence.
(Buttons are found in: "Teach-in SSC1" or "Teach-in SSC2" -> "Teach in single value SSC1" or"Teach-in single value SSC2").

1. Place the target in front of the sensor.
2. Press "Teach SP1".
3. Teach-in result is shown in "Teach-in Result. -> Teach-in State" e.g. "SUCCESS".
4. QoT is shown in "Quality of Teach" e.g. 100%.



2) Dynamic teach command sequence

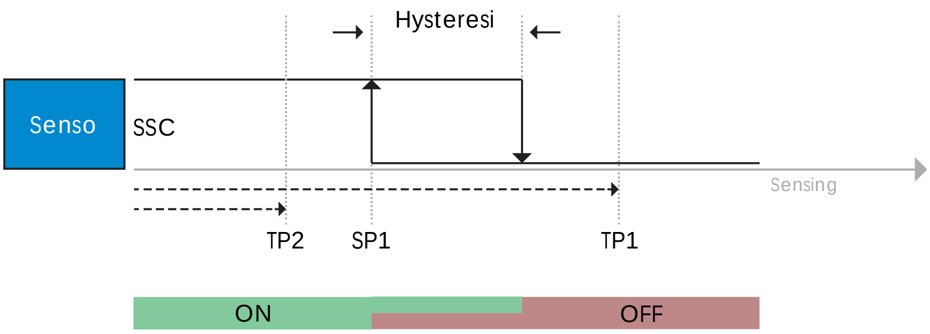
Dynamic teach for Single value teach command sequence
(Buttons are found in: “Teach-in SSC1” or “Teach-in SSC2” -> “Teach in dynamic SSC1” or“Teach-in dynamic SSC2”)

1. Press “Teach SP1 Start”.
2. Move the target in and out of the detecting zone, at slightly different positions, in front ofthe sensor.
3. Press “Teach SP1 Stop”
4. Teach-in result is shown in “Teach-in Result. -> Teach-in State” e.g . “SUCCESSS”
5. QoT is shown in “Quality of Teach” e.g. 150 %

3) Two value teach command sequence

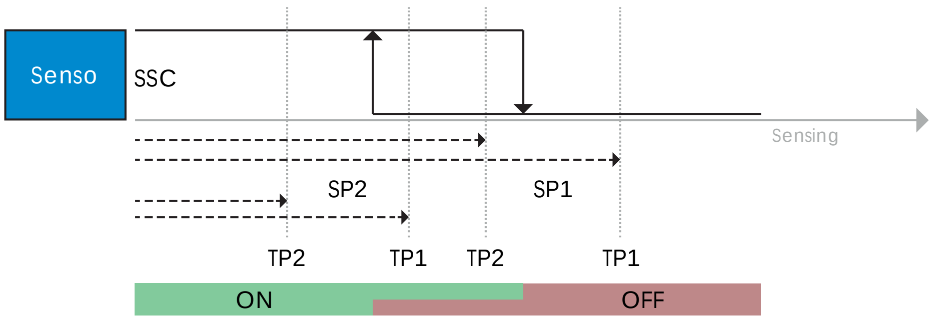
Two Value teach for SP1
(Buttons are found in: “Teach-in SSC1” or “Teach-in SSC2” -> “Teach-in Two value SSC1” or“Teach-in Two value SSC2”)

1. Move the target to the position for SP1 TP1
   A. Press “Teach SP1 TP1”
   B. “Teach-in Result.TeachPoint 1 of Set Point 1” = e.g. “OK”
   C. Teach-in Result.Teach-in state = e.g. “WAIT FOR COMMAND”
2. Move the target to the position for SP1 TP2
   A. Press “Teach SP1 TP2”.
   B. Teach-in Result.TeachPoint 2 of Set Point 1” = e.g. “OK”
   C. Teach-in Result. -> Teach-in State e.g . “SUCCESSS”
3. QoT is shown in “Quality of Teach” e.g. 150 %

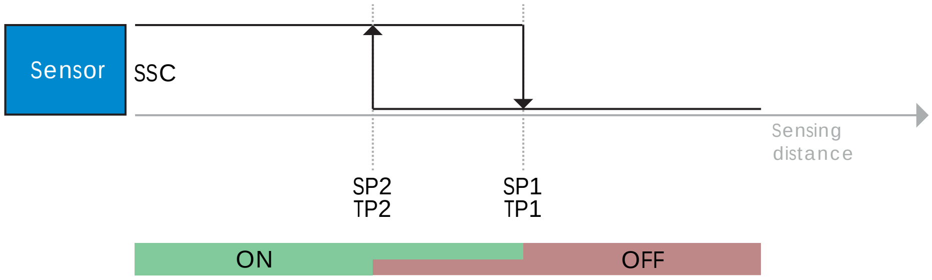


2.6.2.2. Two point mode procedure

1) **Two value teach command sequence:**
   Buttons are found in menu: "Teach-in SSC1" or "Teach in SSC2" -> "Teach-in Two value SSC1"or "Teach-in Two value SSC2"
   1. Move the target to the position for SP1 TP1
      A. Press "Teach SP1 TP1"
      B. "Teash-in Result.TeachPoint 1 of Set Point 1" = e.g. "OK"
      C. Teach-in Result.Teach-in state = e.g. "WAIT FOR COMMAND"
   2. Move the target to the position for SP1 TP2
      A. Press "Teach SP1 TP2"
      B. "Teash-in Result.TeachPoint 2 of Set Point 1" = e.g. "OK"
      C. Teach-in Result.Teach-in state = e.g. "WAIT FOR COMMAND"
   3. Move the target to the position for SP2 TP1
      A. Press "Teach SP2 TP1"
      B. "Teash-in Result.TeachPoint 1of Set Point 2" = e.g. "OK"
      C. Teach-in Result.Teach-in state = e.g. "WAIT FOR COMMAND"
   4. Move the target to the position for SP2 TP2
      A. Press "Teach SP2 TP2"
      B. "Teash-in Result.TeachPoint 2 of Set Point 2" = e.g. "OK"
      C. Teach-in Result.Teach-in state = e.g. "WAIT FOR COMMAND"
   5. Press Teach Apply
      A. Teach-in Result.Teach-in state = e.g. "Success"



2) **Dynamic teach command sequence:**
   Buttons are found in menu: "Teach-in Dynamic SSC1" or "Teach-in Dynamic SSC2" -> "Teach-in"
   1. Move the target to the position for SP1
      A. Press "Teach SP1 Start ".
      B. Teach-in Result.Teach-in state = e.g. "WAIT FOR COMMAND"
      C. Press "Teach SP1 Stop "
      D. Teach-in Result.Teach-in state = e.g. "WAIT FOR COMMAND"
   2. Move the target to the position for SP2
      A. Press "Teach SP2 Start ".
      B. Teach-in Result.Teach-in state = e.g. "WAIT FOR COMMAND"
      C. Press "Teach SP2 Stop "
      D. Teach-in Result.Teach-in state = e.g. "WAIT FOR COMMAND"
   3. Teach-in Result.Teach-in state = e.g. "SUCCESS"

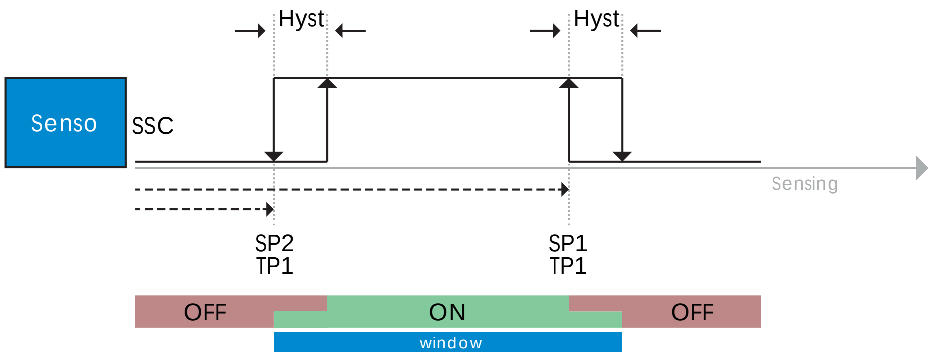


2.6.2.3. Windows mode procedure

1) Single value teach command sequence:

Buttons are found in menu: “Teach-in SSC1” or “Teach in SSC2” -> “Teach-in Single valueSSC1” or “Teach-in Single value SSC2”

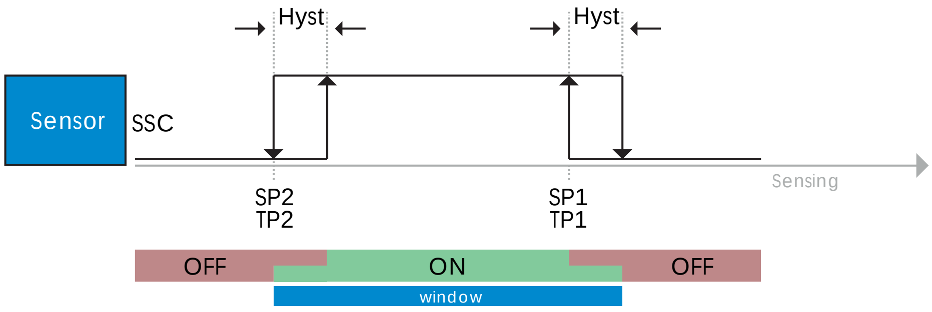
1. Move the target to the position for SP1
   - A. Press “Teach SP1”
   - B. Teach-in Result.Teach-in state = e.g. “WAIT FOR COMMAND”
2. Move the target to the position for SP2
   - A. Press “Teach SP2”
   - B. Teach-in Result.Teach-in state = e.g. “SUCCESS”
3. QoT is shown in “Quality of Teach” e.g. 255 %



2) Dynamic teach command sequence:

Buttons are found in menu: “Teach-in SSC1” or “Teach-in SSC2” -> “Teach in Dynamic SSC1”or “Teach in Dynamic SSC2”

1. Move the target to the position for SP1
   - A. Press “Teach SP1 Start”
   - B. Teach-in Result.Teach-in state = e.g. “WAIT FOR COMMAND”
   - C. Press “Teach SP1 Stop”
   - D. Teach-in Result.Teach-in state = e.g. “WAIT FOR COMMAND”
2. Move the target to the position for SP2
   - A. Press “Teach SP2 Start”
   - B. Teach-in Result.Teach-in state = e.g. “WAIT FOR COMMAND”
   - C. Press “Teach SP2 Stop”
   - D. Teach-in Result.Teach-in state = e.g. “SUCCESS”
3. QoT is shown in “Quality of Teach” e.g. 100 %



2.6.2.4. *Foreground suppression mode*

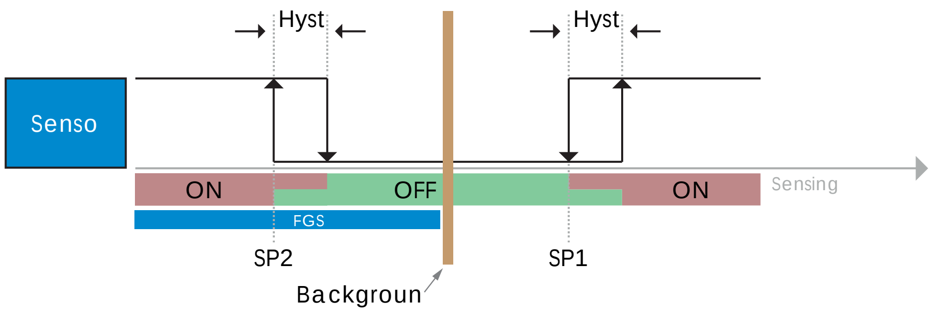
1) Single value teach command sequence:
The button is found in menu: "Teach-in SSC1" or "Teach-in SSC2" -> "Teach-in Single valueSSC1" or "Teach-in Single value SSC2" -> "Teach Background"

1. Aim the sensor at the Background
   A. Press "Teach Background"
   B. Teach-in Result.Teach-in state = e.g. "SUCCESS"
2. QoT is shown in -> "Quality of Teach" e.g. 144 %

2) Dynamic teach command sequence:
The button is found in menu: "Teach-in SSC1" or "Teach-in SSC2" -> "Teach in DynamicSSC1" or "Teach in Dynamic SSC2" -> "Teach Background"

1. Aim the sensor at the Background

A. Press "Teach Background start"
B. Teach-in Result.Teach-in state = e.g. "WAIT FOR COMMAND"
C. Press "Teach Background stop"
D. Teach-in Result.Teach-in state = e.g. "SUCCESS"



2.7. Diagnostic parameters

2.7.1. Operating hours

The sensor has a built-in counter that logs every hour in which the sensor has been operational. The actualnumber of operating hours can be read through the SCTL55 or an IO-Link master.

2.7.2. Number of power cycles [cycles]

The sensor has a built-in counter that logs every time the sensor has been powered-up. The value is saved every hour. The actual number of power cycles is recorded and can be read through the SCTL55 or anIO-Link master.

2.7.3. Maximum temperature – all time high [°C]

The sensor has a built-in function that logs the highest temperature that the sensor has been exposed to during its full operational lifetime. This parameter is updated once per hour and can be read through the SCTL55 or an IO-Link master.

2.7.4. Minimum temperature – all time low [°C]

The sensor has a built-in function that logs the lowest temperature that the sensor has been exposed to during its full operational lifetime. This parameter is updated once per hour and can be read through the SCTL55 or an IO-Link master.

2.7.5. Maximum temperature since last power-up [°C]

From this parameter the user can get information about what the maximum registered temperature has been since start-up. This value is not saved in the sensor, however it can be read through the SCTL55 or an IO-Link master.

2.7.6. Minimum temperature since last power-up [°C]

From this parameter the user can get information about what the minimum registered temperature has been since start-up. This value is not saved in the sensor, however it can be read through the SCTL55 or an IO-Link master.

2.7.7. Current temperature [°C]

From this parameter the user can get information about the current temperature of the sensor. The Temperaturecan be read through the SCTL55 or an IO-Link master.

2.7.8. Detection counter [cycles]

The sensor logs every time the SSC1 changes state. This parameter is updated once per hour and can be readthrough the SCTL55 or an IO-Link master.

2.7.9. Minutes above maximum temperature [min]

The sensor logs how many minutes the sensor has been operational above the maximum temperature. The maximum number of minutes to be recorded is 2 147 483 647. This parameter is updated once per hour andcan be read through the SCTL55 or an IO-Link master.

2.7.10. Minutes below minimum temperature [min]

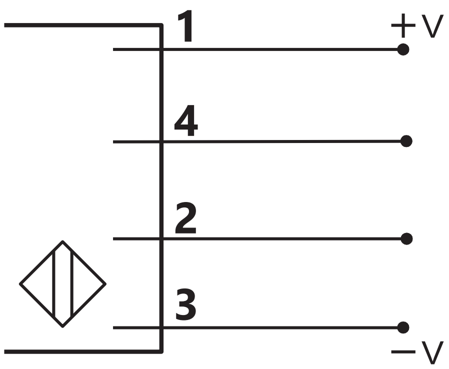
The sensor logs how many minutes the sensor has been operational below the minimum temperature. The maximum number of minutes to be recorded is 2 147 483 647. This parameter is updated once per hour andcan be read through the SCTL55 or an IO-Link master.

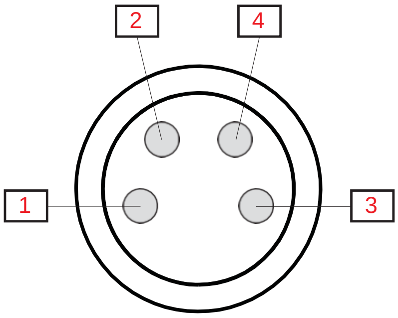
2.7.11. Download counter

The sensor logs how many times its parameters have been changed. The maximum number of changes to be recorded is 65 536. This parameter is updated once per hour and can be read through the SCTL55 or an IO-Link master.

NOTE!
The temperature measured by the sensor will always be higher than the ambient temperature, due to internal heating.
The difference between ambient temperature and internal temperature is influenced by how the sensor is installed in the application. If the sensor is installed in a metal bracket the difference will be lower than if the sensor is mounted in a plastic one.

3. Wiring diagrams





PIN	Color	Signal	Description
1	Brown	10 … 30 VDC	Sensor Supply
2	White	Load	Output 2 / SIO mode / External input / External Teach
3	Blue	GND	Ground
4	Black	Load	IO-Link /Output 1 /SIO mode

4. Commissioning

150 ms after the power supply is switched on, the sensor will be operational.
If it is connected to an IO-link master, no additional setting is needed and the IO-Link communication will startautomatically after the IO-Link master sends a wake-up request to the

5. Operation

5.1. User interface

2377276 and 2377277 sensors are equipped with one yellow and one green LED.

SIO and IO-Link mode			
Green LED	**Yellow LED**	**Power**	**Detection**
ON	OFF	ON	OFF (stable) SSC1
OFF	OFF	ON	OFF (Not stable) SSC1 or LEDs disabled
OFF	ON	ON	ON (Not stable) SSC1
ON	ON	ON	ON (stable) SSC1
OFF	OFF	OFF	Power not connected
-	Flashing 10 Hz 50% dutycycle	ON	Output short-circuit
-	Flashing 0.5…20 Hz 50% dutycycle	ON	Timer triggered indication
SIO mode only			
-	Flashing 1 Hz ON 100 ms OFF 900 ms	ON	External teach by wire. Only for single point mode
-	Flashing 1 Hz ON 900 ms OFF 100 ms	ON	Teach time window (3 - 6 sec)
-	Flashing 10 Hz ON 50 ms OFF 50 ms Flashing for 2	ON	Teach time out (12 sec)
-	Flashing 2 Hz ON 250 ms OFF 250 ms Flashing for 2	ON	Teach successful
IO-Link mode only			
Flashing 1 Hz ON 900 ms OFF 100 ms	OFF	ON	Sensor is in IO-Link mode and SSC1 is stable
Flashing 1 Hz ON 100 ms OFF 900 ms	ON	ON	Sensor is in IO-Link mode and SSC1 is not stable
Flashing 2 Hz 50%		ON	Find my sensor

6. IODD file and factory setting

6.1. IODD file of an IO-Link device

All features, device parameters and setting values of the sensor are collected in a file called I/O Device Description (IODD file). The IODD file is needed in order to establish communication between he SCTL55 or the IO-Link master and the sensor. Every supplier of an IO-Link device has to supply this file and make it available for download on their web site.
The IODD file includes:

- process and diagnostic data
- parameters description with the name, the allowed range, type of data and address (index andsub-index)
- communication properties, including the minimum cycle time of the device
- device identity, article number, picture of the device and Logo of the manufacturer

6.2. Factory settings

The Default factory settings are listed in appendix 7 under default values.

7. Appendix

7.1. Acronyms

IntegerT	Signed Integer
OctetStringT	Array of Octets
PDV	Process Data Variable
R/W	Read and Write
RO	Read Only
SO	Switching Output
SP	Set Point
TP	Teach Point
SSC	Switching Signal Channel
StringT	String of ASCII characters
TA	Temperature Alarm
UIntegerT	Unsigned Integer
WO	Write Only
SC	Short cicuit
DA	Dust alarm
AFO1	Application Function Output 1

7.2. IO-Link Device Parameters

7.2.1. Device Identification

Parameter Name	Index Dec (Hex)	Access	Default value	Data range	Data Type	Length
Vendor Name	16 (0x10)	R	RS Components	-	StringT	20 Byte
Vendor Text	17 (0x11)	R	www.xxxxxxxxxxxxx	-	StringT	34 Byte
Product Name	18 (0x12)	RO	(Sensor name)	-	StringT	20 Byte
Product ID	19 (0x13)	RO	(EAN code of product)	-	StringT	13 Byte
Product Text	20 (0x14)	RO	e.g.Photoelectric Sensor, Background Suppression, infrared Light Emitter, 200	-	StringT	30 Byte
Serial Number	21 (0x15)	RO	(Unique serial number)	-	StringT	13 Byte
Hardware Revision	22 (0x16)	R	e.g. V01.00	-	StringT	6
Firmware Revision	23 (0x17)	R	e.g. V01.00	-	StringT	6
Application Specific	24 (0x18)	R/W	***	Any string up to 32	StringT	max 32
Function Tag	25 (0x19)	R/W	***	Any string up to 32	StringT	max 32
Location Tag	26 (0x1A)	R/W	***	Any string up to 32	StringT	max 32
Process-DataInput	40 (0x28)	R	-	-	IntegerT	32

7.2.2. Observation

Parameter Name	Index Dec (Hex)	Access	Default value	Data range	Data Type	Length
Process data	70 (0x46)	R/W	-	-	-	-
Analogue value	1 (0x01)	R/W	1 = Normal	0 = Inactive 1 = Normal 2 = Object Length 3 = Object	RecordT	16 bit
Switching Output 1	2(0x02)	R/W	1 = Switching Output 1 Active	0 = Switching Output 1 Inactive	RecordT	16 bit
Switching Output 2	3 (0x03)	R/W	1 = Switching Output 2 Active	0 = Switching Output 2 Inactive	RecordT	16 bit
Switching Signal Channel 1	4 (0x04)	R/W	0 = SSC1 Inactive	0 = SSC1 Inactive 1	RecordT	16 bit
Switching Signal Channel 2	5 (0x05)	R/W	0 = SSC2 Inactive	0 = SSC2 Inactive 1	RecordT	16 bit
Dust alarm 1	6 (0x06)	R/W	0 = DA1 Inactive	0 = DA1 Inactive 1	RecordT	16 bit
Dust alarm 2	7 (0x07)	R/W	0 = DA2 Inactive	0 = DA2 Inactive 1	RecordT	16 bit
Temperature alarm	8 (0x08)	R/W	0 = TA Inactive	0 = TA Inactive	RecordT	16 bit
Short-circuit	9 (0x09)	R/W	0 = SC Inactive	0 = SC Inactive	RecordT	16 bit
Application Function Output 1	12 (0x12)	R/W	0 = AFO1 Inactive	0 = AFO1 Inactive 1	RecordT	16 bit

7.2.3. SSC parameters

Parameter Name	Index Dec (Hex)	Acce ss	Default value	Data range	Data Type	Length
Teach-In Select	58 (0x3A)	R W	1 = SSC1	0 = No Channel Selected 1 = SSC1 (Switching	UInteger T	8 bit
Teach-In Result	59 (0x3B)	-	-	-	-	-
Teach-in State	1 (0x01)	R O	0 = Idle	0 = Idle 1 =Success 4 = Wait for command 5 = Busy	RecordT	8 bit
TP1 (Teach Point 1) of SP1	2 (0x02)	R O	0 = Not OK	0 = Not OK 1 = OK	RecordT	8 bit
TP2 (Teach Point 2) of SP1	3 (0x03)	R O	0 = Not OK	0 = Not OK 1 = OK	RecordT	8 bit
TP1 (Teach Point 1) of SP2	4 (0x04)	R O	0 = Not OK	0 = Not OK 1 = OK	RecordT	8 bit
TP2 (Teach Point 2) of SP2	5 (0x05)	R O	0 = Not OK	0 = Not OK 1 = OK	RecordT	8 bit
SSC1 Parameter (Switching Signal	60 (0x3C)	-	-	-	-	-
Set point 1 (SP1)	1 (0x01)	R/W	20 mm	20 ... 225 mm	IntegerT	16
Set point 2 (SP2)	2 (0x02)	R/W	200 mm	20 ... 225 mm.	IntegerT	16
SSC1 Configuration	61 (0x3D)	-	-	-	-	-
Switching Logic	1 (0x01)	R/W	0 = High active	0 = High active 1 =	UInteger T	8 bit
Mode	2 (0x02)	R/W	1 = Single Point	0 = Deactivated 1 = Single Point 2 =	UInteger T	8 bit
Hysteresis	3 (0x03)	R/W	14 mm	20 ... 225 mm	UInteger	16
SSC2 Parameter (Switching Signal	62 (0x3E)	-	-	-	-	-
Set point 1 (SP1)	1 (0x01)	R/W	20 mm	20 ... 225 mm	IntegerT	16
Set point 2 (SP2)	2 (0x02)	R/W	200 mm	20 ... 225 mm	IntegerT	16
SSC2 Configuration	63 (0x3F)	-	-	-	-	-
Switching Logic	1 (0x01)	R/W	0 = High active	0 = High active 1 =	UInteger T	8 bit
Mode	2 (0x02)	R/W	1 = Single Point	0 = Deactivated 1 = Single Point 2 =	UInteger T	8 bit
Hysteresis	3 (0x03)	R/W	14 mm	20 ... 225 mm	UInteger	16

7.2.4. Output Parameters

Parameter Name	Index Dec	Acce	Default value	Data range	Data	Length
Channel 1 Setup	64 (0x40)	-	-	-	-	-
Stage Mode	1 (0x01)	R/W	1 = PNP output	0 = Disabled output1 = PNP output 2 = NPN output	UInteger T	8 bit
Input selector 1	2 (0x02)	R/W	1 = SSC 1	0 = Deactivated 1 = SSC 1 2 = SSC 2 3 = Dust Alarm 1 (DA1) 4 = Dust alarm 2 (DA2) 5 = Temperature Alarm (TA)6 = External logic	UInteger T	8 bit
Timer Mode	3 (0x03)	R/W	0 = Disabled timer	0 = Disabled timer1 = T-on delay 2 = T-off delay 3 = T-on/T-off delay	UInteger T	8 bit
Timer Scale	4 (0x04)	R/W	0 = Milliseconds	0 = Milliseconds 1 = Seconds 2 = Minutes	UInteger T	8 bit
Timer Value	5 (0x05)	R/W	0	0 … 32 767	IntegerT	16
Logic function	7 (0x07)	R/W	0 = Direct	0 = Direct 1 = AND 2 = OR 3 = XOR 4 = Set-reset Flip-Flop	UInteger T	8 bit
Output Inverter	8 (0x08)	R/W	0 = Not inverted	0 = Not inverted (Normally Open)1 =	UInteger	8 bit
Channel 2 Setup	65 (0x41)	-	-	-	-	-
Stage Mode	1 (0x01)	R/W	1 = PNP output	0 = Disabled output1 = PNP output 2 = NPN output3 = Push-Pull 4 = Digital logic input (Active high/Pull-down)	UInteger T	8 bit
Input selector 2	2 (0x02)	R/W	1 = SSC 1	0 = Deactivated 1 = SSC 1 2 = SSC 2 3 = Dust Alarm 1 (DA1) 4 = Dust alarm 2 (DA2) 5 = Temperature Alarm (TA)6 = External logic	UInteger T	8 bit
Timer Mode	3 (0x03)	R/W	0 = Disabled timer	0 = Disabled timer1 = T-on delay 2 = T-off delay 3 = T-on/T-off delay	UInteger T	8 bit
Timer Scale	4 (0x04)	R/W	0 = Milliseconds	0 = Milliseconds 1 = Seconds 2 = Minutes	UInteger T	8 bit
Timer Value	5 (0x05)	R/W	0	0 … 32 767	IntegerT	16
Logic function	7 (0x07)	R/W	0 = Direct	0 = Direct 1 = AND 2 = OR 3 = XOR 4 = Set-reset Flip-Flop	UInteger T	8 bit
Output Inverter	8 (0x08)	R/W	1 = Inverted (Normally	0 = Not inverted (Normally Open)1 =	UInteger	8 bit

7.2.5. Sensor specific adjustable parameters

Parameter Name	Index Dec (Hex)	Access	Default value	Data range	Data Type	Length
Selection of local/remote adjustment	68 (0x44)	R/W	1 = Trimmer input	0 = IO-Link adjust 1 = Trimmer	UInteger T	8 bit
SP1 Trimmer value	69 (0x45)	R	210 mm	23 ... 210 mm	UInteger	16
Sensor Filter pre-set	71 (0x47)	R/W	0 = Default precision	0 = Default precision1 = High	UInteger T	8 bit
Temperature Alarm	72 (0x48)	-	-	-	-	-
High Threshold	1 (0x01)	R/W	70°C	-30 … 70°C	IntegerT	16
Low Threshold	2 (0x02)	R/W	-20°C	-30 … 70°C	IntegerT	16
Safe limits	73 (0x49)	-	-	-	-	-
SSC 1 - Safe limit	1 (0x01)	R/W	5%	1 … 100%	IntegerT	8 bit
SSC 2 - Safe limit	2 (0x02)	R/W	5%	1 … 100%	IntegerT	8 bit
Filter scaler	77 (0x4D)	R/W	1	1 … 255	UInteger	8 bit
LED indication	78 (0x4E)	R/W	1 = LED indication Active	0 = LED indication Inactive1 = LED	UInteger T	8 bit
CutOff distance	79 (0x4F)	R/W	250 mm	20 ... 250 mm	UInteger	16
Hysteresis Mode	80 (0x50)	R/W	0 = Hysteresis set manually	0 = Hysteresis set manually	UInteger T	8 bit
SSC1 Auto hysteresis	81 (0x51)	-	-	-	-	-
AutoHysteresisValu	1 (0x01)	R	14 mm	20 ... 225 mm	UInteger	16
AutoHysteresisValu	2 (0x02)	R	14 mm	20 ... 225 mm	UInteger	16
Minimum Excess	82 (0x52)	-	-	-	-	-
Minimum Excess	1 (0x01)	R/W	1	1.00 ... 1 000.00	UInteger	32
Dust response time	2 (0x02)	R/W	2	1 ... 255	UInteger	8 bit
Dust reset time	3 (0x03)	R/W	2	1 ... 255	UInteger	8 bit
Mutual interference protection	84 (0x54)	R/W	0 = Off	0 = Off 1 = 1sensor mode 2 = 2sensor - sensor13 = 2sensor - sensor24 =	Uinteger	8 bit

7.2.6. Application Function

Parameter Name	Index Dec (Hex)	Access	Default value	Data range	Data Type	Length
Application Function Selector	88 (0x58)	RO	0 = No appliction function selected	0 = No appliction function selected 1 = Speed and Length 2 = Pattern Recognition 3	UIntegerT	8 bit

7.2.6.1. Speed and Length

Parameter Name	Index Dec (Hex)	Access	Default value	Data range	Data Type	Length
Setup	89 (0x59)	-	-	-	-	-
SensorMode	1 (0x01)	R/W	0 = No Role selected	0 = No Role selected 1 = Trigger	UIntegerT	8 bit
Distance between	2 (0x02)	R/W	100 mm	25 … 150 mm	UInteger	8 bit
Results	90 (0x5A)	-	-	-	-	-
Object Speed	1 (0x01)	R	-	0 … 2 000 mm/sec	UInteger	16
Object length	2 (0x02)	R	-	25 … 60 000 mm	UInteger	16
Status	3 (0x03)	RO	0 = IDLE	0 = IDLE 1 = Measurement Running 2 = Speed too High 3 = Timeout	UIntegerT	8 bit

7.2.6.2. Pattern Recognition

Parameter Name	Index Dec (Hex)	Access	Default value	Data range	Data Type	Length
Pattern Recognition	91 (0x5B)	-	-	-	-	-
TimeOut	1 (0x01)	R/W	60 sec	1 … 60 sec	UInteger	8 bit
Tolerance	2 (0x02)	R/W	50 ‰	1 … 200 ‰	UInteger	8 bit
Sensor Role	3 (0x03)	R/W	0 = No role selected	0 = No role selected 1 = Trigger	UIntegerT	8 bit
Pattern Recognition	92 (0x5C)	-	-	-	-	-
Reference pattern	1 (0x01)	RO	0 = Not Saved	0 = Not Saved 1	UIntegerT	8 bit
Reference pattern No of	2 (0x02)	RO	0	0 … 20	UIntegerT	8 bit
No of Edges Last	3 (0x03)	R	0	0 … 20	UInteger	8 bit
Pattern Recognition Status	4 (0x04)	RO	0 = IDLE	0 = IDLE 1 = Measurement running 2 = Pattern Match 3 = Timeout 4 = Too many	UIntegerT	8 bit

7.2.6.2. Pattern Recognition (cont)

Parameter Name	Index Dec (Hex)	Access	Default value	Data range	Data Type	Length
Observation Menu						
Pattern recognition	97 (0x61)	-	-	-	-	-
Timestamp 1 … 20	1 … 20 (0x01 …	R/W	0	Time stamp for each event [ms].	UInteger T	16 bit
Pattern Timestamp 1 … 20	21 … 40 (0x15 … 28)	R/W	0 = No Edge	0 = No Edge 1 = Positive Edge 2=	UInteger T	8 bit
Object Time	41 (0x29)	R/W	0 ms	0 … 65 535 ms	UInteger	16
Reference pattern	42 (0x2A)	R/W	0 = Not Saved	0 = Not Saved 1	UInteger T	8 bit
Reference pattern No of	43 (0x2B)	R/W	0	0 … 20	UInteger T	8 bit

7.2.6.3. Divider

Parameter Name	Index Dec (Hex)	Access	Default value	Data range	Data Type	Length
Divider and counter	93 (0x5D)	-	-	-	-	-
Counter limit	1 (0x01)	R/W	5	1 … 65 535	UInteger	16
Preset counter	2 (0x02)	R/W	0 -	0 … 65 535	UInteger	16
Result	94 (0x5E)	-	-	-	-	-
Counter value	1 (0x01)	R	-	0 … 65 535	UInteger	16

7.2.6.4. Object and Gap Monitoring

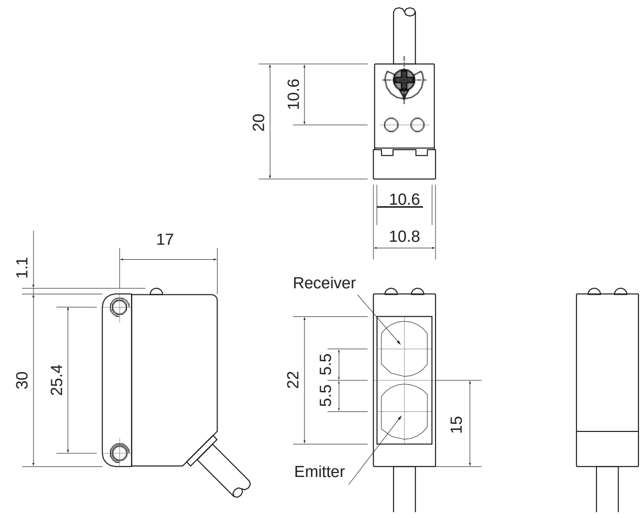
Parameter Name	Index Dec (Hex)	Access	Default value	Data range	Data Type	Length
Object and Gap Monitoring Setup	95 (0x5F)	-	-	-	-	-
Object minimum	1 (0x01)	R/W	500 ms	10 … 60 000 ms	UInteger	16
Object maximum	2 (0x02)	R/W	10 000	10 … 60 000 ms	UInteger	16
Gap minimum time	3 (0x03)	R/W	500 ms	10 … 60 000 ms	UInteger	16
Gap maximum	4 (0x04)	R/W	10 000	10 … 60 000 ms	UInteger	16
Object and Gap Monitoring Result	96 (0x60)	-	-	-	-	-
Object time	1 (0x01)	R	0 ms	0 … 60 000 ms	UInteger	16
Gap time	2 (0x02)	R	0 ms	0 … 60 000 ms	UInteger	16
Object status	3 (0x03)	RO	0 = Idle	0 = Idle 1 = Measurement running 2 = Inside limits	UInteger T	8 bit
Gap status	4 (0x04)	RO	0 = Idle	0 = Idle 1 = Measurement running 2 = Inside limits	UInteger T	8 bit

7.2.7. Diagnostic parameters

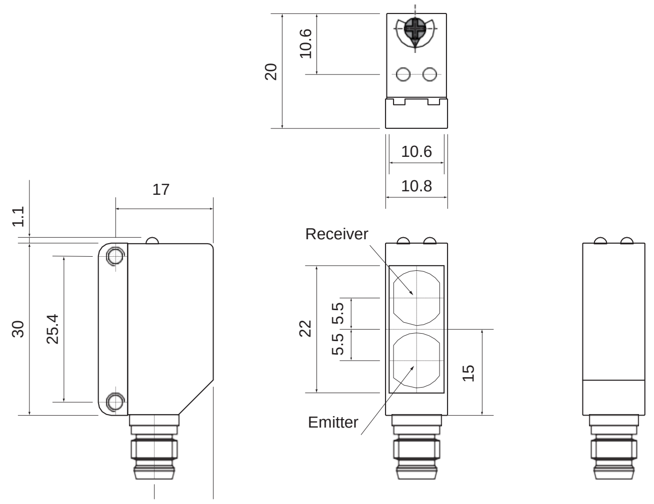
Parameter Name	Index Dec (Hex)	Acce ss	Default value	Data range	Data Type	Length
Sensor Diagnostics						
Frontend Failure	209 (0xD1)	R	0 = OK	0 = OK. 1 = Fail.	IntegerT	8 bit
EE_MemoryFailur e (during power	208 (0xD0)	-	-	-	-	-
Memory Failure	1 (0x01)	R	0 = OK	0 = OK. 1 = Fail.	IntegerT	8 bit
Temperature Diagnostics						
Maximum temperature	203 (0xCB)	R O	- °C	-50 … 150 [°C]	IntegerT	16 bit
Minimum temperature	204 (0xCC)	R O	- °C	-50 … 150 [°C]	IntegerT	16 bit
Maximum temperature	205 (0xCD)	R O	- °C	-50 … 150 [°C]	IntegerT	16 bit
Minimum temperature	206 (0xCE)	R O	- °C	-50 … 150 [°C]	IntegerT	16 bit
Current temperature	207 (0xCF)	R	- °C	-50 … 150 [°C]	IntegerT	16
Minutes above Maximum	211 (0xD3)	R O	0 min	0 … 2 147 483 647 [min]	IntegerT	32 bit
Minutes below Minimum	212 (0xD4)	R O	0 min	0 … 2 147 483 647 [min]	IntegerT	32 bit
Operating Diagnostics						
Operating Hours	201 (0xC9)	R	0 h	0 … 2 147 483 647 [h]	IntegerT	32
Number of Power	202 (0xCA)	R	0	0 … 2 147 483 647	IntegerT	32
Detection counter	210 (0xD2)	R	0	0 … 2 147 483 647	IntegerT	32
Maintenance event	213 (0xD5)	R	0	0 … 2 147 483 647	IntegerT	32
Download counter	214 (0xD6)	R	0	0 … 65 536	UInteger	16
Quality of Teach	75 (0x4B)	R	-	0 … 255	UInteger	8 bit
Quality of Run	76 (0x4C)	R	-	0 … 255	UInteger	8 bit
Excess Gain	83 (0x53)	R	-	1 … 255%	UInteger	8 bit
Error Count	32 (0x20)	R	0	0 … 65 535	UInteger	16
Device Status	36 (0x24)	R O	0 = Device is operating properly	0 = Device is operating properly1 = Maintenance required 2 = Out-of-specification	UInteger T	8 Bit
Detailed Device	37 (0x25)	-	-	-	-	-
Temperature fault	-	R	-	-	OctetStri	3
Temperature over-	-	R	-	-	OctetStri	3
Temperature	-	R	-	-	OctetStri	3
Short-circuit	-	R	-	-	OctetStri	3
Maintenance	-	R	-	-	OctetStri	3
Event Configuration						
Event Configuration	74 (0x4A)	-	-	-	-	-
Maintenance event (0x8C30)	1 (0x01)	R/W	0 = Maintanance event Inactive	0 = Maintenance event Inactive1 =	RecordT	16 bit
Temperature fault event	2 (0x02)	R/W	0 = Temperatur	0 = Temperature fault event Inactive1 =	RecordT	16 bit
Temperature over-run event	3 (0x03)	R/W	0 = Temperature over-run	0 = Temperature over-run event Inactive1 =	RecordT	16 bit
Temperature under-run event	4 (0x04)	R/W	0 = Temperature under-run	0 = Temperature under-run event Inactive1 =	RecordT	16 bit
Short circuit event (0x7710)	5 (0x05)	R/W	0 = Short circuit	0 = Short circuit event Inactive1 =	RecordT	16 bit

Dimensions

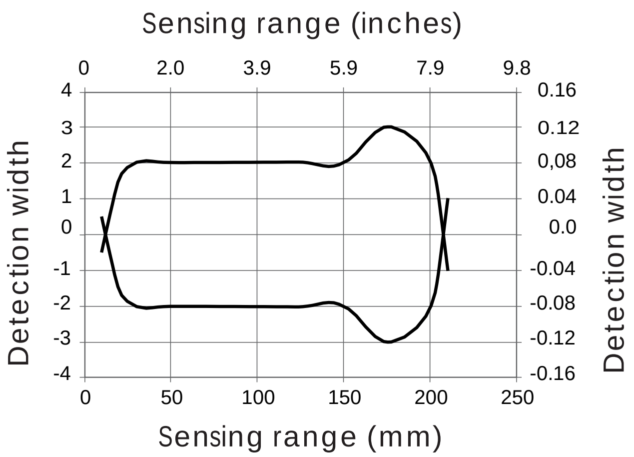
2377276

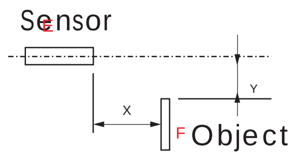


2377277

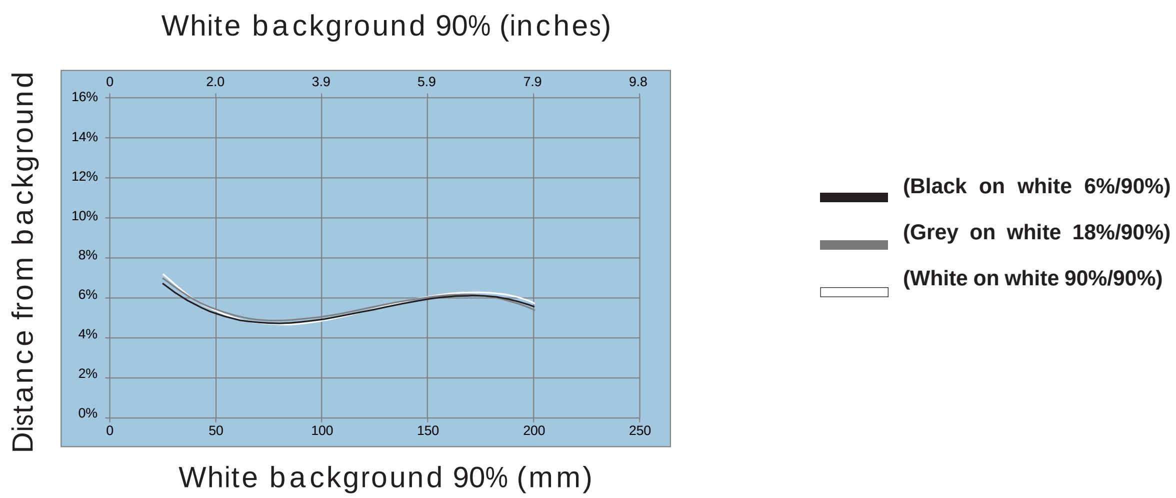


Detection diagram

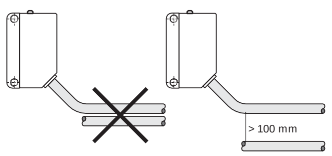
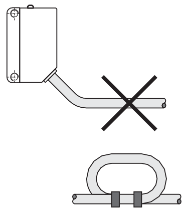
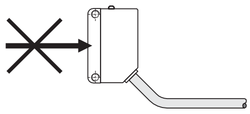
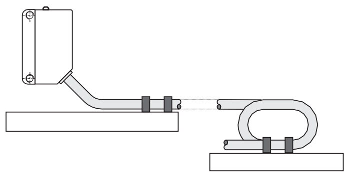




Sensing Condition



Installation Hints

			
To avoid interference from inductive voltage/ current peaks, separate the prox. switch power cables from any other power cables, e.g. motor, contactor or solenoid cables	*Relief of cable strain* The cable should not be pulled	*Protection of the sensing face* A proximity switch should not serve as mechanical stop	*Switch mounted on mobile carrier* Any repetitive flexing of the cable should be avoided

RS Components Ltd

Certified in accordance with ISO 9001