CARLO GAVAZZI

IO-Link ultrasonic sensor

UAxxASDxxAPM1IO

Instruction manual

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1. Introduction

This manual is a reference guide for Carlo Gavazzi IO-Link ultrasonic sensors UAxxASDxxAPMIO. It describes how to install, setup and use the product for its intended use.

1.1. Description

Carlo Gavazzi ultrasonic 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.

Please do not hesitate to make any suggestions for improving this document.

1.2. Validity of documentation

This manual is valid only for UAxxASDxxAPMIO ultrasonic sensors with IO-Link and until new documentation is published. This user manual describes the function, operation and installation of the product for its intended use.

1.3. Who should use this documentation

This manual contains important information regarding installation and must be read and completely understood by specialized personnel dealing with these ultrasonic sensors.
We highly recommend that you read the manual carefully before installing the sensor. Save the manual for future use.

1.4. Use of the product

These ultrasonic sensors are diffuse reflective sensors, with a reflex mode, where the switching occurs when the target is obscured or absent. The sensor can also indicate the actual distance in mm via analog output or the process data in IO-Link mode.
The UAxxASDxxAPMIO sensors can operate with or without IO-Link communication. It is possible to operate and configure these devices by means of an IO-Link master or Smart Configurator SCTL55.

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 data-sheet, the IODD file and the IO-Link parameter manual on the Internet at http://gavazziautomation.com. IODD files are also available at https://ioddfinder.io-link.com.

1.7. Acronyms

I/O	Input/Output
PD	Process Data
PLC	Programmable Logic Controller
SIO	Standard Input Output
SP	Setpoint
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+
UART	Universal Asynchronous Receiver-Transmitter
SO	Switching Output
BDC	Binary Data Channel

2. Product

2.1. Main features

IO-Link Carlo Gavazzi 4-wire DC ultrasonic sensors, built to the highest quality standards, are available in robust nickel-plated brass housing.
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 sensors have additional configuration options, such as the settable sensing distance and hysteresis, as well as timer functions on the output.
The slope of the analog output can be configured as rising or falling, and it can operate in a master/slave setup where up to 10 sensors work synchronously or multiplexed. These additional features result in a highly flexible sensor.

2.2. Identification number

Code	Option	Description
U	**-**	Ultrasonic Sensor
A	**-**	Cylindrical housing
□	**12** **18** **30**	Housing diameter in mm
A	**-**	Nickel-plated brass housing
S	**-**	Short housing
D	**-**	Diffuse reflective
□	**02**	Rated operating distance: 200 mm
	04	Rated operating distance: 400 mm
	08	Rated operating distance: 800 mm
	15	Rated operating distance: 1500 mm
	30	Rated operating distance: 3000 mm
	60	Rated operating distance: 6000 mm
A	**-**	Analog output
P	**-**	Switching output: Push-pull, NPN, PNP, 150 mA, NO/NC
M1	**-**	M12, 4-pole connector
IO	**-**	IO-Link version

Additional characters may be used for customized versions.

2.3. Operating modes

The sensor has two outputs: One analog (pin2) and one digital (pin4), that can operate in two different modes: SIO mode (standard I/O mode) or IO-Link mode.

2.3.1. Analog output

Pin 2 can be set up for 3 different types of analog output:

- 0 - 10V rising or falling
- 4 - 20 mA rising or falling
- 0 - 20 mA rising or falling (requires configuration via IO-Link)

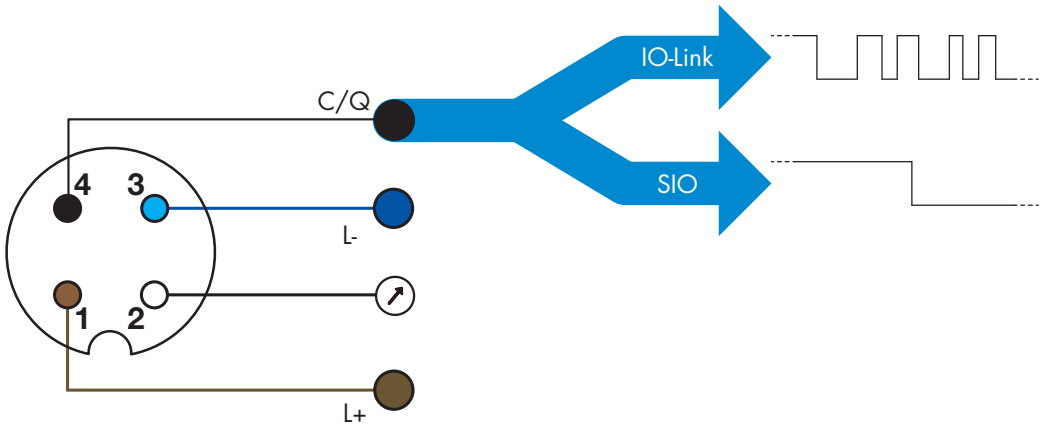
The rise or fall of the slope depends on the Teach sequence used.

2.3.2. SIO mode

When the sensor operates in SIO mode (default), a SCTL55 or an IO-Link master is not required. The device works as a standard ultrasonic 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 ultrasonic sensors is the option to configure them via a SCTL55 or an IO-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 and thereby satisfy several application requirements with the same sensor.

2.3.3. 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 a standard 3-wire unshielded cable with a maximum length of 20 m. In IO-Link mode, only 3 of the 4 wires are used for communication. However, if the sensor is in SIO mode, then a shielded cable is preferable to ensure maximum signal stability for the analog output.



IO-Link communication takes place with a 24 V pulse modulation, standard UART protocol via the switching and communication cable (combined switching status and data channel C/Q) PIN 4 or black wire.
For instance, an M12 4-pin male connector has:

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

The transmission rate of UAxxASDxxAPM1IO 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 readings 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. Due to the data storage feature it is possible to replace the device and automatically have all the information stored in the old device transferred into the replacement unit.
Access to internal parameters allows the user to see how the sensor is performing, for example by reading the internal temperature.
Event Data allows the user to get diagnostic information such as an error, an alarm, a warning or a communication problem.
There are two different communication types between the sensor and the master and they are independent of each other:

- Cyclical for process data and value status – this data is exchanged cyclically.
- Acyclical for parameter configuration, identification data and diagnostic information – only exchanged on request.

2.3.4. Process data

By default the process data shows the following parameters as active: 12 bit Analog value and 1 bit Switching Output1 (SO1).

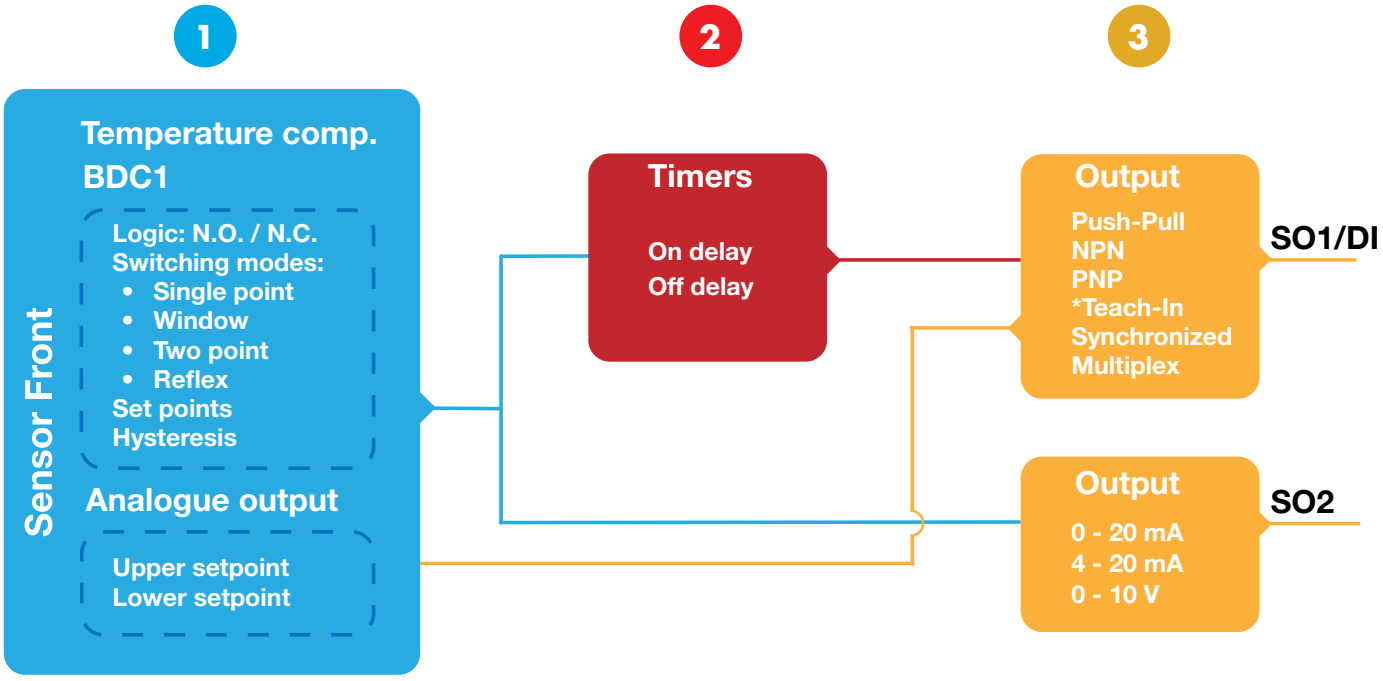
However by changing the Process Data Configuration parameter, the user can decide to also enable the status of the inactive parameters. This way several states can be observed in the sensor at the same time.
Process data can be configured. See 2.5.3. Process data configuration.

Byte 0	15	14	13	12	11	10	9	8
	MSB							
Byte 1	7	6	5	4	3	2	1	0
				LSB				**SO1**

2 Bytes
Analog value 4 … 15 (12 BIT)

2.4. Output Parameters

The sensor can be set to one out of three operating modes. These modes can be independently adjusted and affect the operation of the Switching Output 1 or 2. After selecting one of these modes, it is possible to configure the output of the sensor with a SCTL55 or an IO-Link master, following the three steps shown in the Switching Output setup below.
If the sensor is disconnected from the master, it will switch to the SIO mode and keep the last configuration setting.



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2.4.1. Sensor front

The sensor emits ultrasound towards a target and measures the travel time of the sound that reflects off the target and returns to the sensor. If the measured time is equal to or less than a predefined distance for the target, the sensor changes the output state. The measured sensing distance is more reliable for a hard surface rather than a damping one, and requires an environment without flying debris as it would cause false readings.

2.4.1.1. BDC1 (Binary Data Channel)

For presence (or absence) detection of an object in front of the face of the sensor, the following settings are available:

- UA12ASD02APM1IO: 20 - 200 mm
- UA12ASD04APM1IO: 40 - 400 mm
- UA18ASD08APM1IO: 80 - 800 mm
- UA18ASD15APM1IO: 150 - 1500 mm
- UA30ASD30APM1IO: 300 - 3000 mm
- UA30ASD60APM1IO: 600 - 6000 mm

2.4.1.2. Blind zone

The blind zone is a translation of the time from the end of a pulse until the sensor front stops undulating into mm:

- UA12ASD02APM1IO: 20 mm
- UA12ASD04APM1IO: 40 mm
- UA18ASD08APM1IO: 80 mm
- UA18ASD15APM1IO: 150 mm
- UA30ASD30APM1IO: 300 mm
- UA30ASD60APM1IO: 600 mm

2.4.1.3. Switching modes

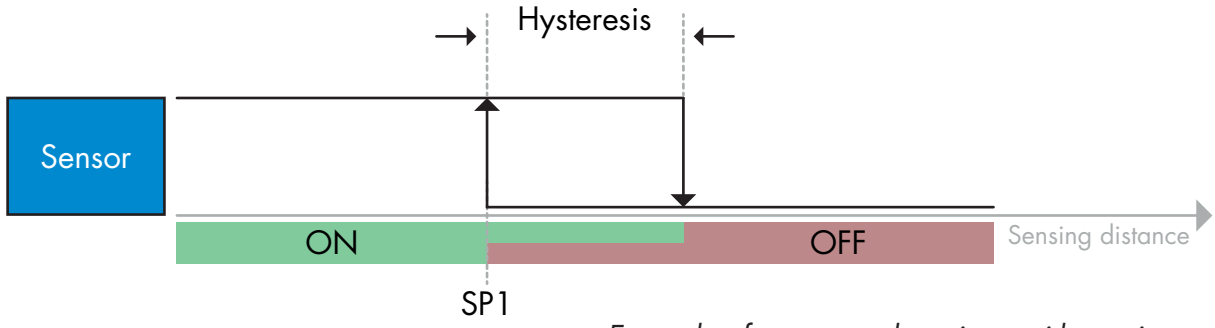
The digital channel can be set to operate in 4 modes or be disabled. The switching mode setting is used to create more advanced output behaviour. The following switching modes can be selected for the switching behaviour of BDC1 (Pin4).

Deactivated

BDC1 can be disabled.

Single point mode

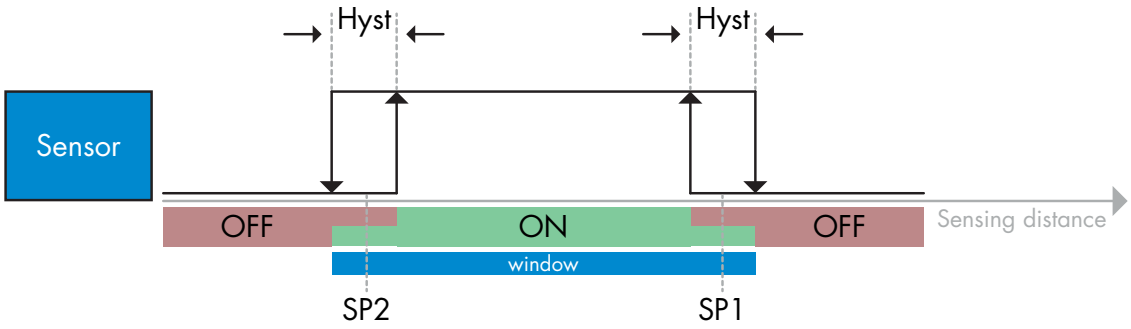
The switching information changes, when the distance passes the threshold defined in setpoint SP1, with rising or falling distances, taking into consideration the hysteresis settings stored in the sensor.



Example of presence detection - with non-inverted logic

Window mode

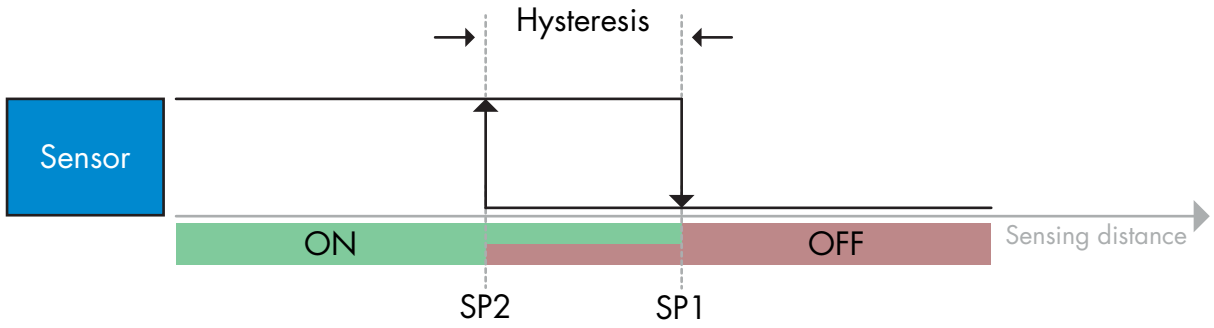
The switching information changes, when the distance measured passes the thresholds defined in setpoint SP1 and setpoint SP2, with increasing or decreasing distance measured, taking into consideration the hysteresis settings stored in the sensor.



Example of presence detection - with non-inverted logic

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 SP2. This mode can for instance be used in emptying/ filling applications.



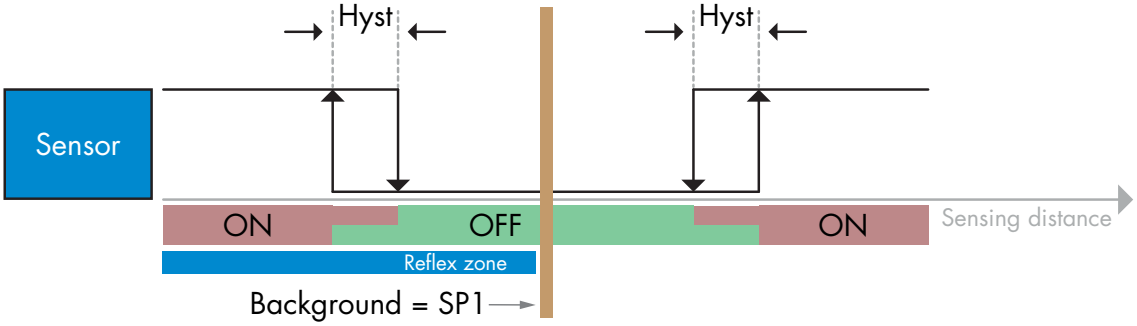
Example of presence detection - with non-inverted logic

Reflex mode

In reflex mode, the sensor needs a physical background as reference target to operate. If the sensor does not detect the background, then an object must be present, that either;

- Reflects the sound back to the sensor, however the measured distance is shorter than the distance set for the background.
- Absorbs the sound so nothing is reflected to the sensor e.g. very deadening surfaces.
- Deflects the sound at an angle so nothing is received by the sensor e.g. very smooth or tilted objects.

In case reflected sound from smooth and hard objects is detected briefly due to object movements, an ON timer can be added to keep the output steady.



Example of presence detection - with non-inverted logic

2.4.1.4. Hysteresis Settings

The hysteresis can be set via IO-Link and is always in mm. The factory setting is 2 mm.

The hysteresis can be set between 2 ... 20 mm for the digital output channel. See switching mode drawing for the distribution of the hysteresis.

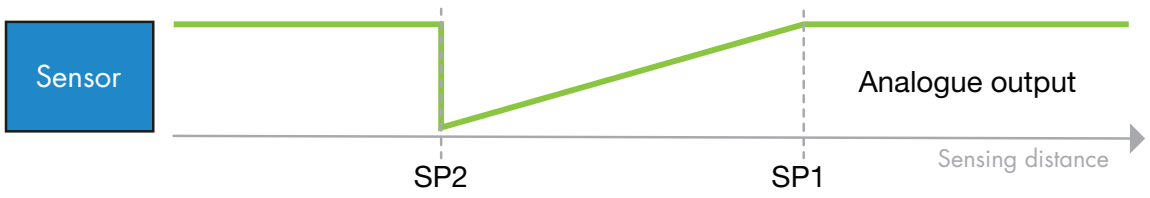
2.4.1.5. Switching logic (Output Inverter)

This function allows the user to invert the operation of the switching output between Normally Open and Normally Closed. This requires IO-Link.

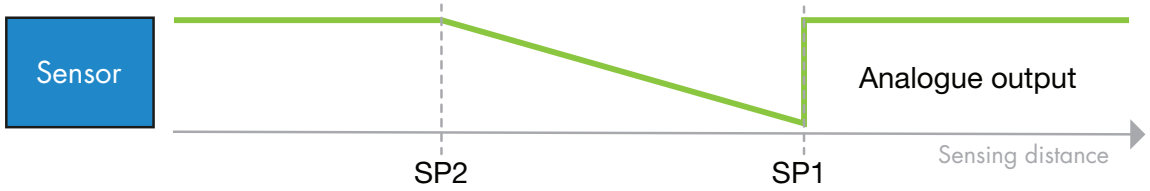
2.4.1.6. Analog settings (Pin2)

The analog output can be set up to have either a rising or a falling slope. The direction of the slope is defined by the teaching order of the two setpoints SP1 and SP2. SP1 defines the palcement of the lowest output, SP2 defines the placement of the highest output. Within these setpoints, the output current or voltage of the sensor is scaled according to the distance to the target.

If SP1 is closer to the sensor, and SP2 further away, the result is a rising slope.



On the other hand, if SP2 is located closer to the sensor than SP1, then the result is a falling slope.



2.4.2. Timer

The Timer allows the user to introduce different timer functions by editing these timer parameters in IO-Link mode:

- Timer mode
- Timer value

The timers are always measured in ms.

2.4.2.1. Timer mode

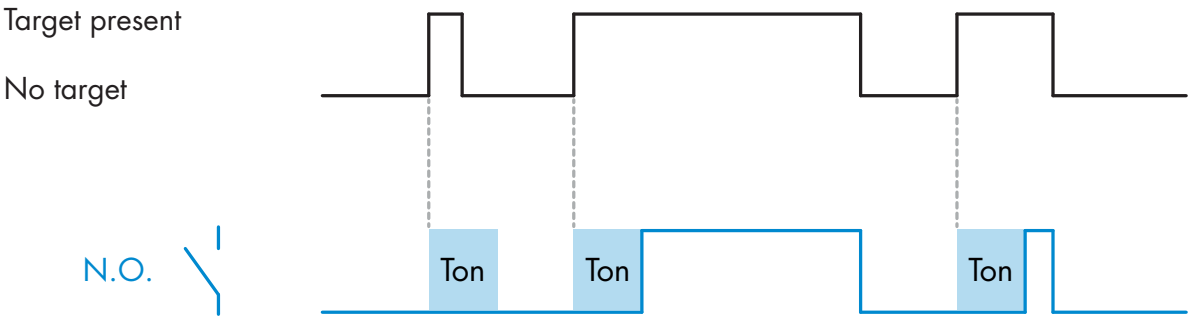
This selects which type of timer function is introduced on the switching output. Either of the following settings is possible:

2.4.2.1.1. Disabled

This option disables the timer function no matter which delay is set up.

2.4.2.1.2. Turn On delay (T-on)

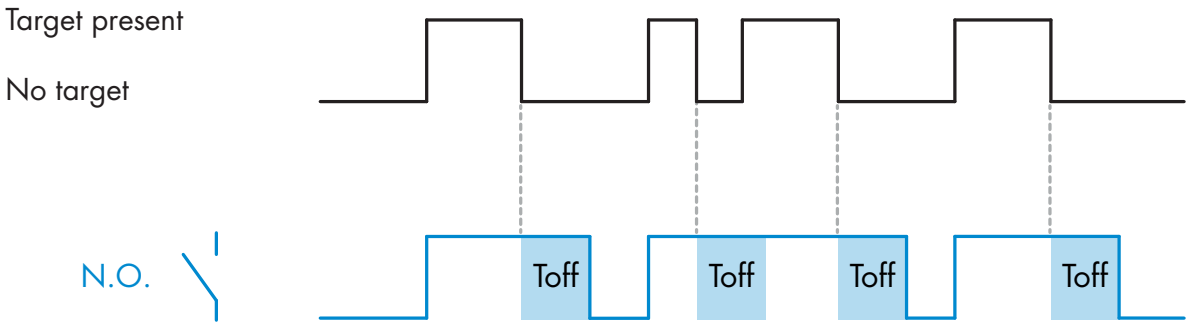
The activation of the switching output is generated after the actual sensor actuation as shown in the figure below.



Example with normally open output

2.4.2.1.3. Turn Off delay (T-off)

The deactivation of the switching output is delayed for a time after the target has moved out of sensing range, like shown in the figure below.



Example with normally open output

2.4.2.2. Timer Value

The parameter defines the duration of the delay. The delay can be set to any integer value between 1 and 10 000 ms.

2.4.3. Output stage mode

In this function block the user can select if the switching outputs should operate as:

SO1: NPN, PNP or Push-Pull configuration, or external communication for Teach-by-wire or synchronous/ multiplex operation.

SO2: 4 - 20 mA, 0 - 10 V or 0 - 20 mA analog output.

2.4.3.1. Digital output options

The digital channel has several options:

- External teach/Teach-by-wire: The factory setting for the digital channel is external teach /Teach-by-wire (see 2.6).
- Synchronous or Multiplex modes are used to set up a series of sensors
- Output mode with the following options: PNP, NPN or Push-Pull.

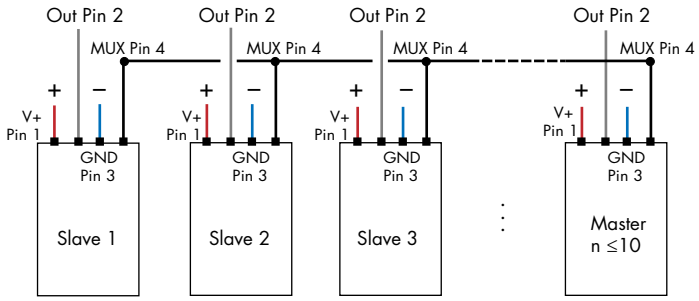
2.4.3.1.1. Mutual interference protection

In an optimal installation the sensors must be installed to avoid mutual interference, however, in some applications this is not possible, in which case the synchronous or multiplex function can be used.

2.4.3.1.2. Synchronous mode

In synchronous mode the sensors pulse simultaneously. This is useful when monitoring a larger area, or when several sensors are placed closely together to monitor the same surface. Synchronous mode has a faster response time than multiplex mode. Up to 10 identical sensors can be used for this function.

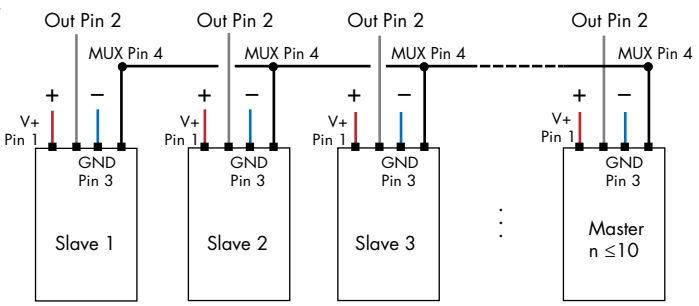
Synchronous mode requires each sensor to be assigned a role as either master or slave and to be assigned a number in the network. The master sensor must have the highest number. It is configured via IO-Link.



2.4.3.1.3. Multiplex mode

In multiplex mode the sensors pulse sequentially (only one sensor is active at a time). This prevents mutual interference and allows the sensors to be mounted facing each other. In multiplex mode each sensor must complete the cycle of pulse and reception before the next sensor pulses. This setup eliminates the risk of interference from other sensors however the response time is slower. Up to 10 identical sensors can be used for this function.

Multiplex mode requires each sensor to be assigned a role as either master or slave and to be assigned a number in the network. The master sensor must have the highest number, and it is the last to pulse. It is configured via IO-Link.



2.4.3.1.4. PNP, NPN, Push-Pull

The output of SO1 can be configured to NPN, PNP or Push-pull as required by the application. Connect to an IO-Link master to select one of these output types. When the selected option is saved to the sensor, the following switching modes may subsequently be selected and saved to the sensor: Single point, Two point, Window or Reflex mode.

2.4.3.2. Analog output options

SO2 has 3 different analog output options where the output current or voltage is scaled according to the distance to the target. The output options are:

- 4 - 20 mA
- 0 - 10 V (Requires IO-Link)
- 0 - 20 mA (Requires IO-Link)

The External Teach / Teach-by-wire allows for switching between the 4 - 20 mA and 0 - 10 V outputs. The 0 - 20 mA output can only be selected via IO-Link.

2.5. Sensor Specific adjustable parameters

Besides the parameters directly related to output configuration, the sensor also has various internal parameters useful 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 "External Teach" using the external input of the sensor, or to disable the teach function by selecting either one of the other options for SO1, making the sensor tamper proof.

2.5.2. Teach-in range

Value between

- UA12ASD02APM1IO: 20 - 200 mm
- UA12ASD04APM1IO: 40 - 400 mm
- UA18ASD08APM1IO: 80 - 800 mm
- UA18ASD15APM1IO: 150 - 1500 mm
- UA30ASD30APM1IO: 300 - 3000 mm
- UA30ASD60APM1IO: 600 - 6000 mm

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: 12 bit Analog value, 1 bit Switching Output1 (SO1).

2.5.4. Hysteresis

See 2.4.1.3.Hysteresis Settings

2.5.5. Temperature compensation

Temperature compensation ensures optimal measuring stability, no matter if the sensor has just been turned on, or has been operating for several hours in a warm environment.

However, if the sensor is exposed to fast temperature changes, it will need time to acclimate to the new temperature conditions, and will only then show exact distance measurement.

2.6. SIO teach procedure (External teach) of analog output

Out of the box, the sensor is set up to work in SIO mode, with Pin4 set to Teach-In (Teach-by-wire) for the analog output on Pin2.

Please refer to 5.1 for LED indication explanations.

In order to start the teach process in SIO mode, connect Pin4 (black wire) to + (Pin1, Brown wire). The duration of the connection defines which of the two Teach options is activated: SIO teach slope or change analog output type

2.6.1. SIO teach slope for the analog output

The following procedure sets up the output slope for the analog output. Prepare the installation by mounting the sensor and preparing the target placements for the lowest output (SP1) and highest output (SP2).

1. Install sensor in the application
2. Place target where you want SP1 to be located (SP1= lowest output, see 2.4.1.5.)
3. Connect wires (black and brown) for less than 2 seconds
4. Green LED on, yellow LED flashes at 1Hz to indicate SP1 is saved, teach process ongoing
5. Within 20 seconds, move target to SP2 (SP2 = highest output, see see 2.4.1.5.)
6. Connect wires (black and brown) less than 2 seconds to save SP2
7. Yellow LED flashes two times to indicate successful teach procedure

The output is scaled according to the distance within the setpoint range.

2.6.2. Change analog output type

SIO mode allows for toggling between the two outputs types 4 - 20 mA or 0 - 10 V. Factory setting is 4 - 20 mA

1. Connect wires (black and brown) for > 6 seconds
2. Yellow LED flashes two times to indicate successful teach procedure

Please note: The 0 - 20 mA output setting requires a connection to an IO-Link master or a SCTL55 to set up.

2.6.3. Teach procedure not successful - 4 flashes

Four flashes during or after the teach sequence indicate a failed teach. This is either because one of the setpoints is outside the sensing range, or the teach sequence was not completed within the 20 seconds, resulting in a time-out.

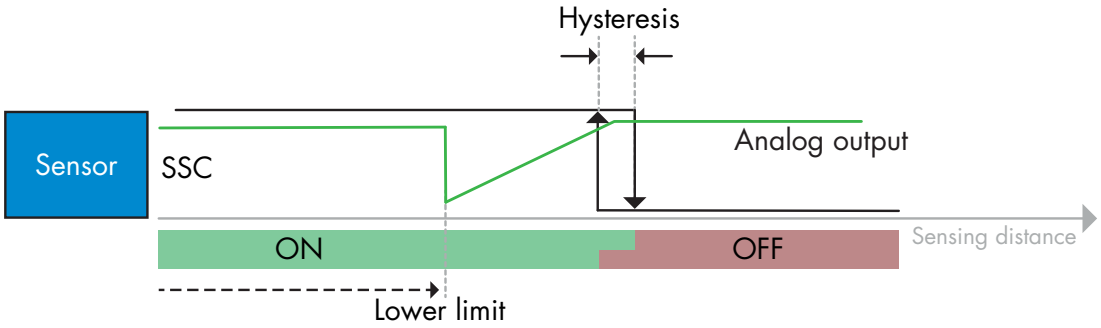
If a setpoint is outside the sensing range, the sensor will save the maximum range in the setpoint until a new teach process has been completed.

2.7. Set up guides for SCTL55 smart configurator

The setpoints of the sensor can be set-up using an IO-Link master or a SCTL55 smart configurator. The following describes the procedures using a smart configurator.

When using the Smart Configurator you can either enter the setpoints directly into data fields, or you can use the autoteach functions described in the following sections. Manual entry fields have gray backgrounds and a +-sign to show that the setpoint distance is set manually. A lightning bolt symbol indicates an automatic function.

2.7.1. Single Value auto-teach for analog output



The two buttons for the single value auto-teach command are found in the "Parameters" menu.
The following procedure defines the placement of the output slope.
Please note, that the LEDs will flash to indicate IO-Link connection throughout the procedure.

The LowerLimit setpoint defines the lowest point of a slope. The highest point of the slope is defined by the UpperLimit.

Start by preparing the installation for the sensor, and readying the target placements.

1. Connect the sensor to the Smart configurator
2. Launch the Configuration app
3. Go to the 'Parameters' menu
4. Place the target in front of the sensor at the position for the lower limit (the lowest output)
5. Scroll down to the heading: "Single Value Teach Analogoutput"
6. Press “Set Analog Output Lower Limit”
7. Scroll to the top of the Parameters menu
8. "Main Functions (Pin2)" -> "Ll Lower Limit" will show the distance to the target
9. Place target at the position of the upper limit
10. Press "Set Analog Output Upper Limit"
11. Scroll to the top of the "Parameters" menu
12. In "Main Functions (Pin2)" -> "Ul Upper Limit" will show the distance to the target
13. The procedure is complete

Please note, that the sensor will detect the target in the entire sensing range even though the slope is set to a narrower interval.

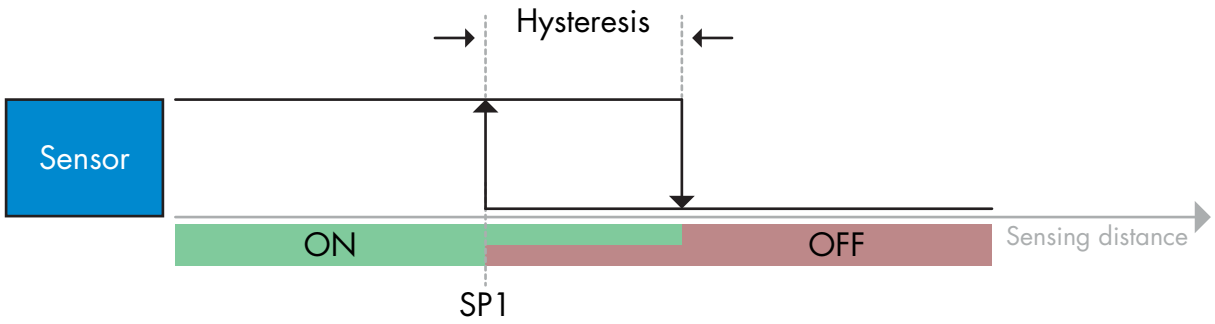
Please note, that the angle of the slope is dependent on the target placements when the limits are taught. If the lower limit is placed closer to the sensor than the upper limit, the result will be a rising slope. If the lower limit is placed further away from the sensor than the upper limit, then the result will be a falling slope.

2.7.2. Change output type of analog output

When using the SCTL55 smart configurator there are 3 options for the output current/voltage of the analog channel.

1. Connect the sensor to the smart configurator
2. Launch the Configuration app
3. Go to the 'Parameters' menu
4. In the heading: 'Main functions (Pin2)' -> 'O2 Output 2 (Pin2)' select the output type for the application:
   4 to 20mA
   0 to 20mA
   0 to 10V
5. Write the changes to the sensor

2.7.3. Single point mode single value teach procedure digital output



This teach-procedure affects the output of Pin4, and it saves one value for setpoint 1(SP1). The button is found in the Parameters menu: 'Setpoint 1 Single Value Teach'. Prepare the installation by mounting the sensor and preparing the target placement.

1. Connect the sensor to the Smart configurator
2. Launch the Configuration app
3. Go to the 'Parameters' menu
4. In the heading 'Main functions (Pin4)' -> 'O1 Output 1 (Pin4)' select switching output of Pin4: NPN, PNP or Push-Pull
5. A new selection becomes available: 'MO mode'. Select switching mode: Single point (see 2.4.1.3. for details)
6. Write changes to the sensor
7. Place target at required distance from sensor for SP1
8. Scroll down to the heading 'Single Value Teach'
9. Press the 'Setpoint 1 Single value teach' button
10. The distance to the target is saved in '1s (1) (Setpoint 1)'.

During the process, the sensor LEDs will flash to indicate IO-link connection.

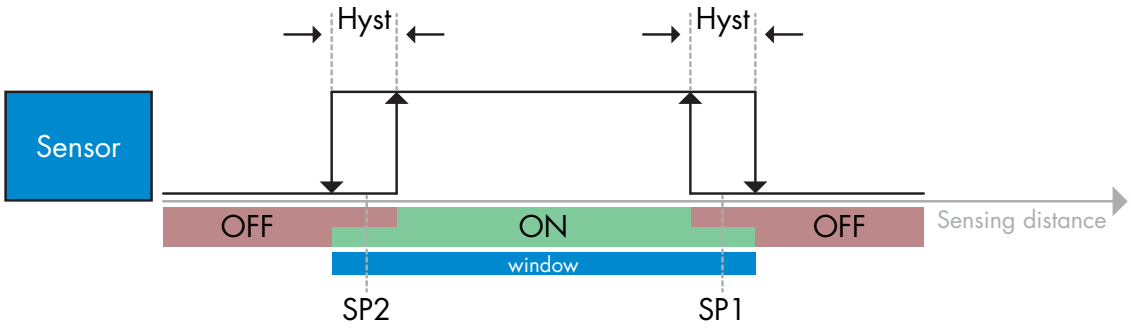
2.7.3.1. Single point mode dynamic teach procedure (Autoteach)

This teach procedure affects the output of Pin4. The sensor takes two measurements for each setpoint: When the procedure is started and stopped. The average of those measurements is saved in the respective setpoints mentioned below. Prepare the installation by mounting the sensor and preparing the target placements

1. Connect the sensor to the Smart configurator
2. Launch the Configuration app
3. Go to the 'Parameters' menu
4. In the heading 'Main functions (Pin4)' -> 'O1 Output 1 (Pin4)' select the switching output of Pin4: NPN, PNP or Push-Pull
5. A new selection becomes available: 'MO mode'. Select the switching mode : Single point (see 2.4.1.3. for details)
6. Write changes to the sensor
7. Place the target at the required distance for SP1
8. Press the 'Setpoint 1 Dynamic Teach **Start**' button
9. The message 'Sending' is shown on the screen
10. Press the 'Setpoint 1 Dynamic Teach **Stop**' button
11. The message 'Sending' is shown on the screen
12. The average distance of the target during the teaching time is saved in "1s (1) (Setpoint 1)'

During this procedure the sensor LEDs will flash to indicate IO-link connection.

2.7.4. Window mode single value teach procedure



This teach procedure affects the output of Pin4. It saves one value for each of SP1 and SP2 as required by the switching mode. The buttons are found in the Parameters menu: "Setpoint 1 Single Value Teach" and 'Setpoint 2 Single Value Teach'. Prepare the installation by mounting the sensor and preparing the target placements.

1. Connect the sensor to the Smart configurator
2. Launch the Configuration app
3. Go to the 'Parameters' menu
4. In the heading 'Main functions (Pin4)' -> 'O1 Output 1 (Pin4)'. Select switching output of Pin4: NPN, PNP or Push-Pull
5. A new selection becomes available: 'MO mode'. Select switching mode: Window mode (see 2.4.1.3. for details)
6. Write changes to the sensor
7. Place target at required distance from sensor for SP1
8. Press the 'Setpoint 1 Single value teach' button
9. The distance to the target is saved in '1s (1) (Setpoint 1)'
10. Place target at required distance from sensor for SP2
11. Press the 'Setpoint 2 Single value teach' button
12. The distance to the target is saved in '2s (2) (Setpoint 2)'

During the process, the sensor LEDs will flash to indicate IO-link connection.

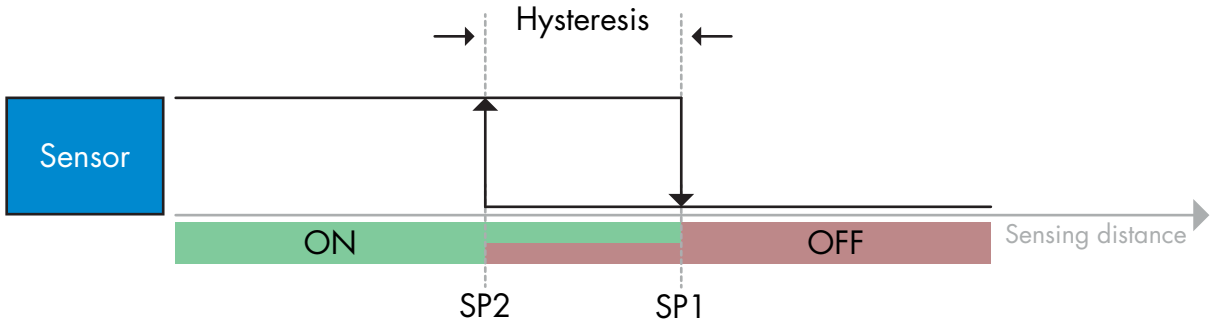
2.7.4.1. Window mode dynamic teach procedure (Autoteach)

This teach-procedure affects the output of Pin4. The sensor takes two measurements for each setpoint: When the procedure is started and stopped. The average of those measurements is saved in the respective setpoints mentioned below. Prepare the installation by mounting the sensor and preparing the target placements

1. Connect the sensor to the Smart configurator
2. Launch the Configuration app
3. Go to the 'Parameters' menu
4. In the heading 'Main functions (Pin4)' -> 'O1 Output 1 (Pin4)' select switching output of Pin4: NPN, PNP or Push-Pull
5. A new selection becomes available: 'MO mode'. Select the switching mode: Window mode (see 2.4.1.3. for details)
6. Write changes to the sensor
7. Place target at required distance from sensor for SP1
8. Press the 'Setpoint 1 Dynamic Teach **Start**' button
9. The message "Sending" is shown on the screen
10. Press the 'Setpoint 1 Dynamic Teach **Stop**' button
11. The message 'Sending' is shown on the screen
12. The average distance to the target during the teach time is saved in '1s (1) (Setpoint 1)'
13. Move target to second position for SP2
14. Press the 'Setpoint 2 Dynamic Teach **Start**' button
15. The message 'Sending' is shown on the screen
16. Press the 'Setpoint 2 Dynamic Teach **Stop**' button
17. The message 'Sending is shown on the screen
18. The average distance to the target during the teach time is saved in "2s (2) (Setpoint 2)'

During the process, the sensor LEDs will flash to indicate IO-link connection.

2.7.5. Two point mode single value teach procedure



This teach procedure affects the output of Pin4. It saves one value for each of SP1 and SP2 as required by the switching mode: Two point mode. The buttons are found in the Parameters menu: "Setpoint 1 Single Value Teach" and "Setpoint 2 Single Value Teach". Prepare the installation by mounting the sensor and preparing the target placements.

1. Connect the sensor to the Smart configurator
2. Launch the Configuration app
3. Go to the 'Parameters' menu
4. In the heading 'Main functions (Pin4)' -> 'O1 Output 1 (Pin4)'. Select switching output of Pin4: NPN, PNP or Push-Pull

5. A new selection becomes available: 'MO mode'. Select switching mode: Two point mode (see 2.4.1.3. for details)
6. Write changes to the sensor
7. Place target at required distance from sensor for SP1
8. Press the 'Setpoint 1 Single value teach' button
9. The distance to the target is saved in '1s (1) (Setpoint 1)'
10. Place target at required distance from sensor for SP2
11. Press the 'Setpoint 2 Single value teach button
12. The distance to the target is saved in '2s (2) (Setpoint 2)'

During the process, the sensor LEDs will flash to indicate IO-link connection.

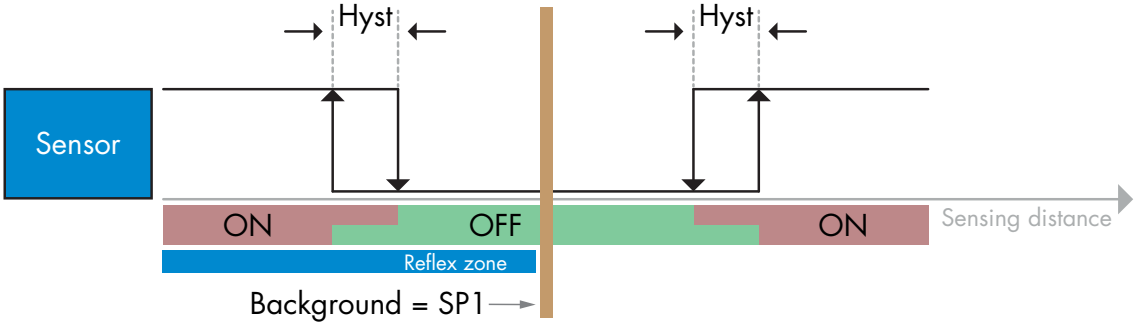
2.7.5.1. Two point mode dynamic teach procedure (Autoteach)

This teach-procedure affects the output of Pin4. The sensor takes two measurements for each setpoint: When the procedure is started and stopped. The average of those measurements is saved in the respective setpoints mentioned below. Prepare the installation by mounting the sensor and preparing the target placements

1. Connect the sensor to the Smart configurator
2. Launch the Configuration app
3. Go to the 'Parameters' menu
4. In the heading 'Main functions (Pin4)' -> 'O1 Output 1 (Pin4)' Select switching output of Pin4: NPN, PNP or Push-Pull
5. A new selection becomes available: 'MO mode'. Select the switching mode: Two point mode (see 2.4.1.3. for details)
6. Write changes to the sensor
7. Place target at required distance from sensor for SP1
8. Press the 'Setpoint 1 Dynamic Teach **Start**' button
9. The message 'Sending' is shown on the screen
10. Press the 'Setpoint 1 Dynamic Teach **Stop**' button
11. The message 'Sending' is shown on the screen
12. The average distance to the target during the teach time is saved in '1s (1) (Setpoint 1)'
13. Move target to second position for SP2
14. Press the 'Setpoint 2 Dynamic Teach **Start**' button
15. The message 'Sending' is shown on the screen
16. Press the 'Setpoint 2 Dynamic Teach **Stop**' button
17. The message 'Sending' is shown on the screen
18. The average distance to the target during the teach time is saved in '2s (2) (Setpoint 2)'

During the process, the sensor LEDs will flash to indicate IO-link connection.

2.7.6. Reflex mode single value teach procedure



This teach-procedure affects the output of Pin4. This teach procedure saves one value for SP1 as required by the switching mode. The button is found in the Parameters menu: "Setpoint 1 Single Value Teach". Prepare the installation by mounting the sensor and preparing the background placement.

1. Connect the sensor to the Smart configurator
2. Launch the Configuration app
3. Go to the 'Parameters' menu
4. In the heading 'Main functions (Pin4)' -> 'O1 Output 1 (Pin4). Select switching output of Pin4: NPN, PNP or Push-Pull
5. A new selection becomes available: 'MO mode'. Select switching mode: Reflex mode (see 2.4.1.3. for details)
6. Write changes to the sensor
7. Place background at required distance from sensor for SP1
8. Press the 'Setpoint 1 Single value teach' button
9. The distance to the target is saved in '1s (1) (Setpoint 1)'

During this procedure the sensor LEDs will flash to indicate IO-link connection.

Please note: Reflex mode will only work if the single value teach is done on SP1. If SP2 is taught by accident, then SP1 is automatically placed at the edge of the blind zone, and the sensor will not detect anything.

2.7.6.1. Reflex mode dynamic teach procedure (Autoteach)

This teach-procedure affects the output of Pin4. The sensor takes two measurements for the setpoint: When the procedure is started and stopped. The average of those measurements is saved in the setpoint mentioned below. Prepare the installation by mounting the sensor and preparing the target placement

1. Connect the sensor to the Smart configurator
2. Launch the Configuration app
3. Go to the 'Parameters' menu
4. In the heading 'Main functions (Pin4)' -> 'O1 Output 1 (Pin4)' Select the switching output of Pin4: NPN, PNP or Push-Pull
5. A new selection becomes available: 'MO mode'. Select the switching mode : Reflex mode (see 2.4.1.3. for details)
6. Write changes to the sensor
7. Place the target at the required distance for SP1
8. Press the 'Setpoint 1 Dynamic Teach **Start**' button
9. The message 'Sending' is shown on the screen
10. Press the 'Setpoint 1 Dynamic Teach **Stop**' button
11. The message 'Sending' is shown on the screen
12. The average distance to the target during the teach time is saved in '1s (1) (Setpoint 1)'

During this procedure the sensor LEDs will flash to indicate IO-link connection.

2.8. Diagnostic parameters

2.8.1. Switch counter
The sensor has a built-in counter that logs every time the output switches after power on or reset. The number of switching operations can be read through the SCTL55 or an IO-Link master and is not saved in the sensor during power off.

2.8.2. Temperature internal [°C]
From this parameter the user can get information about the current sensor temperature. The temperature can be read through the SCTL55 or an IO-Link master.

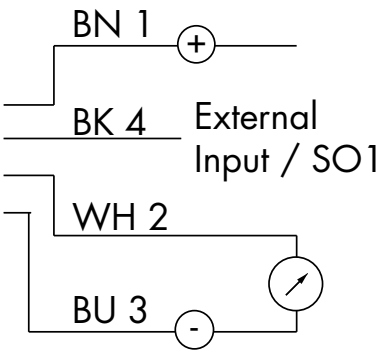
2.8.3. Maximum temperature [°C]
From this parameter the user can get information about what the maximum registered temperature has been since start-up. This value is not saved in the sensor, however it can be read through the SCTL55 or an IO-Link master.

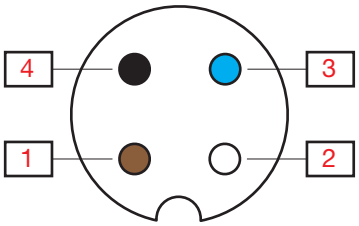
2.8.4. Operating hours
The sensor has a built-in counter that logs the number of hours the sensor has been operational, and saves the number in the sensor. The number of operating hours can be read through the SCTL55 or an IO-Link master.

2.8.5. Number of power on [cycles]
The sensor has a built-in counter that logs every time the sensor powers up. The number of power cycles is recorded 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	Analog	Analog output
3	Blue	GND	Ground
4	Black	Digital	IO-Link, Digital output/input, SIO mode, External Teach

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 start automatically after the IO-Link master sends a wake-up request to the sensor.

5. Operation

5.1. User interface of UAxxASDxxAPM1IO

UAxxASDxxAPM1IO sensors are equipped with one yellow/green LED.

SIO and IO-Link mode			
Green LED	**Yellow LED**	**Power**	**Detection**
ON	OFF	ON	OFF BDC1
ON	ON	ON	ON BDC1
OFF	OFF	OFF	Power not connected
IO-Link mode only			
Flashing 1 Hz ON 900 ms OFF 100 ms	-	ON	Sensor is in IO-Link mode

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 the SCTL55 or the IO-Link master and the sensor.

An IODD file is available on IODD Finder as well as on the Carlo Gavazzi Website:
http://gavazziautomation.com

6.2. Factory settings

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

7. Appendix

7.1. Acronyms

IntegerT	Signed Integer
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
UIntegerT	Unsigned Integer
WO	Write Only
SC	Short circuit

7.2. IO-Link Device Parameters for UAxxASDxxAPM1 IO-Link

7.2.1. Device Identification

Parameter Name	Index Dec (Hex)	Access	Default value	Data range	Data Type	Length
Vendor Name	16 (0x10)	RO	Carlo Gavazzi	-	StringT	20 Byte
Vendor Text	17 (0x11)	RO	www.gavazziautomation.com	-	StringT	34 Byte
Product Name	18 (0x12)	RO		-	StringT	20 Byte
Product ID	19 (0x13)	RO		-	StringT	13 Byte
Product Text	20 (0x14)	RO		-	StringT	30 Byte
Firmware Revision	23 (0x17)	RO		-	StringT	6 Byte
Application Specific Tag	24 (0x18)	R/W	***	Any string up to 32 characters	StringT	max 32 Byte

7.2.2. BDC parameters

Parameter Name	Index Dec (Hex)	Access	Default value	Data range	Data Type	Length
Set points	60 (0x3C)	-	-	-	-	-
(1) (BDC1, Q1)	1 (0x01)	R/W	UA12ASD02APM1IO: 20 mm UA12ASD04APM1IO: 40 mm UA18ASD08APM1IO: 80 mm UA18ASD15APM1IO: 150 mm UA30ASD30APM1IO: 300 mm UA30ASD60APM1IO: 600 mm	UA12ASD02APM1IO: 20 - 200 mm UA12ASD04APM1IO: 40 - 400 mm UA18ASD08APM1IO: 80 - 800 mm UA18ASD15APM1IO: 150 - 1500 mm UA30ASD30APM1IO: 300 - 3000mm UA30ASD60APM1IO: 600 - 6000 mm	UIntegerT	16 bit
(2) (BDC1, Q1)	2 (0x02)	R/W	UA12ASD02APM1IO: 200 mm UA12ASD04APM1IO: 400 mm UA18ASD08APM1IO: 800 mm UA18ASD15APM1IO: 1500 mm UA30ASD30APM1IO: 3000mm UA30ASD60APM1IO: 6000 mm	UA12ASD02APM1IO: 20 - 200 mm UA12ASD04APM1IO: 40 - 400 mm UA18ASD08APM1IO: 80 - 800 mm UA18ASD15APM1IO: 150 - 1500 mm UA30ASD30APM1IO: 300 - 3000mm UA30ASD60APM1IO: 600 - 6000 mm	UIntegerT	16 bit
Switchpoint BDC1	61 (0x3D)	-	-	-	-	-
Logic	1 (0x01)	R/W	-	0 = N.O. 1 = N.C.	UIntegerT	8 bit
Mode	2 (0x02)	R/W	-	0 = Deactivated 1 = Single Point 2 = Window 3 = Two Point 4 = Reflex	UIntegerT	8 bit
Hysteresis	3 (0x03)	R/W	UA12ASD02APM1IO: 2 mm UA12ASD04APM1IO: 2 mm UA18ASD08APM1IO: 2 mm UA18ASD15APM1IO: 6 mm UA30ASD30APM1IO: 5 mm UA30ASD60APM1IO: 5 mm	UA12ASD02APM1IO: 2 - 20 mm UA12ASD04APM1IO: 2 - 20 mm UA18ASD08APM1IO: 2 - 20 mm UA18ASD15APM1IO: 6 - 20 mm UA30ASD30APM1IO: 5 - 50 mm UA30ASD60APM1IO: 5 - 50 mm	UIntegerT	16 bit

7.2.3. Output Parameters

Parameter Name	Index Dec (Hex)	Access	Default value	Data range	Data Type	Length
Multi I/O (Pin4)	70 (0x46)	R/W	3 = Teach-in Analog Output	0 = Push-Pull 1 = NPN 2 = PNP 3 = Teach-in Analog output 4= Synchronisation 5= Multiplex	UIntegerT	8 bit
On-delay switching output	66 (0x42)	R/W	0 ms	0 ... 10 000 ms	UIntegerT	16 bit
Off-delay switching output	67 (0x43)	R/W	0 ms	0 ... 10 000 ms	UIntegerT	16 bit
Multi I/O (Pin2) Analog output	71 (0x47)	R/W	2 = 4 ... 20 mA	0 = Disabled 1 = 0 ... 20 mA 2 = 4 .. 20 mA 3 = 0 ... 10 V	UIntegerT	8 bit
Analog Range	72 (0x48)	R/W			RecordT	
Lower limit	1 (0x01)	R/W	UA12ASD02APM1IO: 20 mm UA12ASD04APM1IO: 40 mm UA18ASD08APM1IO: 80 mm UA18ASD15APM1IO: 150 mm UA30ASD30APM1IO: 300 mm UA30ASD60APM1IO: 600 mm	UA12ASD02APM1IO: 20 - 200 mm UA12ASD04APM1IO: 40 - 400 mm UA18ASD08APM1IO: 80 - 800 mm UA18ASD15APM1IO: 150 - 1500 mm UA30ASD30APM1IO: 300 - 3000mm UA30ASD60APM1IO: 600 - 6000 mm	UIntegerT	16 bit
Upper limit	2 (0x02)	R/W	UA12ASD02APM1IO: 200 mm UA12ASD04APM1IO: 400 mm UA18ASD08APM1IO: 800 mm UA18ASD15APM1IO: 1500 mm UA30ASD30APM1IO: 3000mm UA30ASD60APM1IO: 6000 mm	UA12ASD02APM1IO: 20 - 200 mm UA12ASD04APM1IO: 40 - 400 mm UA18ASD08APM1IO: 80 - 800 mm UA18ASD15APM1IO: 150 - 1500 mm UA30ASD30APM1IO: 300 - 3000mm UA30ASD60APM1IO: 600 - 6000 mm	UIntegerT	16 bit
Network	88(0x58)	R/W			RecordT	
Role in network	1 (0x01)	R/W	0	0 = Master 1 = Slave	UIntegerT	8 bit
Device No. (Master is highest No.)	2 (0x02)	R/W	5	0 ... 10	UIntegerT	8 bit

7.2.4. Sensor specific adjustable parameters

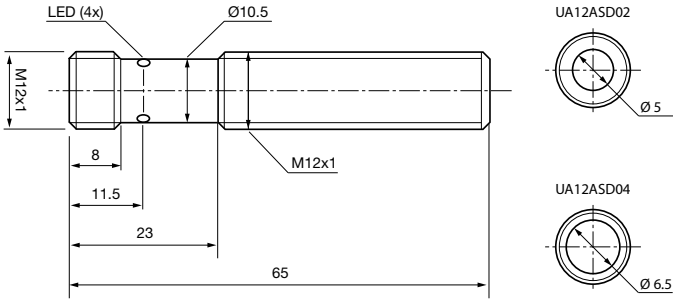
Parameter Name	Index Dec (Hex)	Access	Default value	Data range	Data Type	Length
Temperature compensation	74 (0x4A)	R/W	0	0 = Off 1 = On	UIntegerT	8 bit

7.2.5. Diagnostic parameters

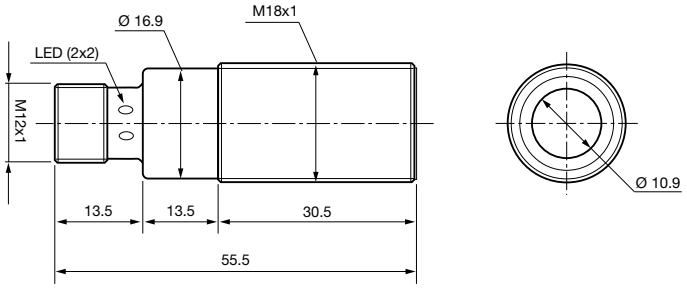
Parameter Name	Index Dec (Hex)	Access	Default value	Data range	Data Type	Length
Sensor Diagnostics						
Temperature Diagnostics						
Maximum temperature – All time high	96 (0x60)	RO	- °C	-	IntegerT	16 bit
Temperature Internal	86 (0x86)	RO	- °C	-	IntegerT	16 bit
Operating Diagnostics						
Operating Hours	93 (0x5D)	RO	-	-	UIntegerT	32 bit
Number of Power ON	94 (0x5E)	RO	-	-	IntegerT	32 bit
Error Count	32 (0x20)	RO	-	-	UIntegerT	16 Bit
Device Status	36 (0x24)	RO	-	0 = Device is operating properly 1 = Maintenance required 2 = Out-of-specification 3 = Functional-Check 4 = Failure	UIntegerT	8 Bit

8. Dimensions

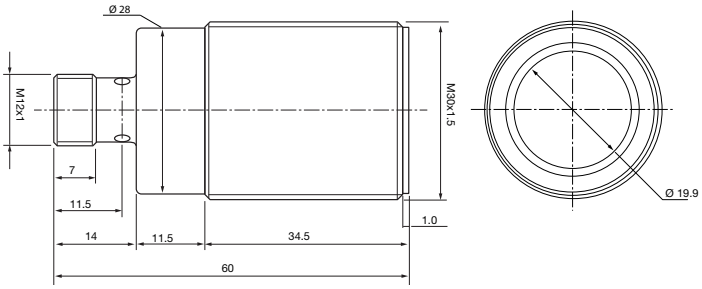
UA12ASDxxAPM1IO



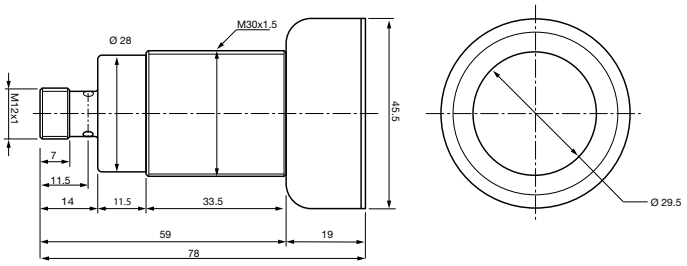
UA18ASDxxAPM1IO



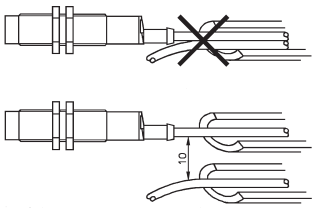
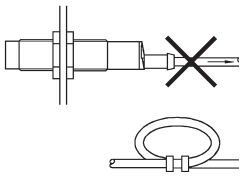
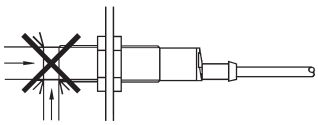
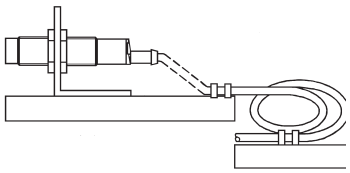
UA30ASD30APM1IO



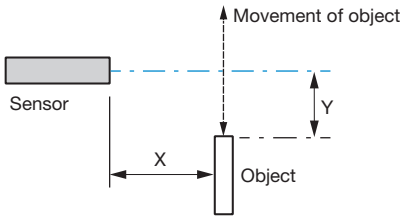
UA30ASD60APM1IO



9. 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

10. Detection diagram



UA12ASD04APM1IO

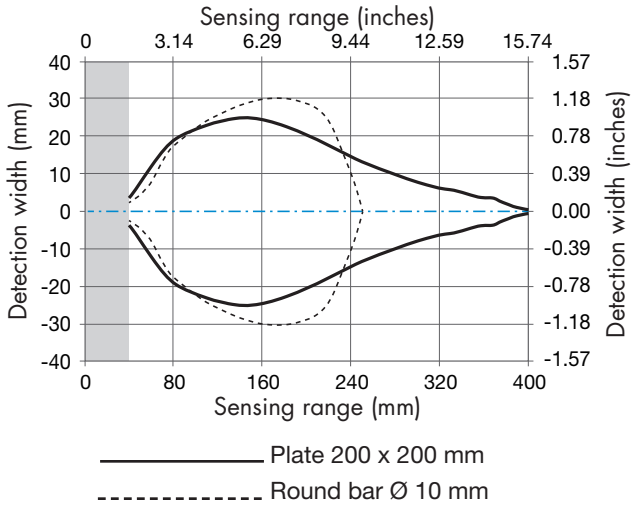


Plate 200 x 200 mm
Round bar Ø 10 mm

UA12ASD02APM1IO

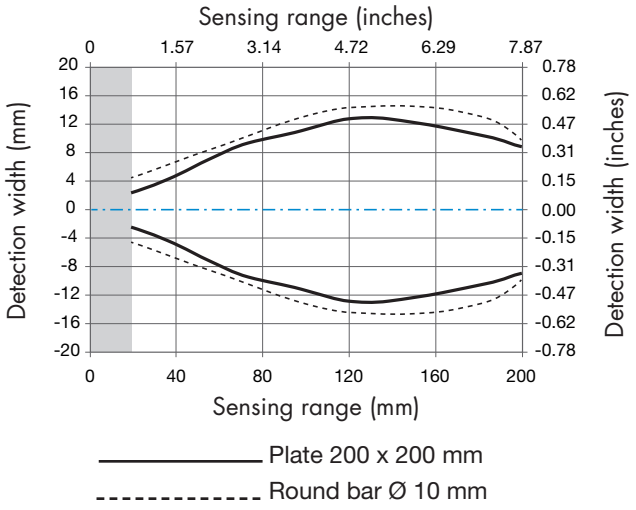


Plate 200 x 200 mm
Round bar Ø 10 mm

UA18ASD15APM1IO

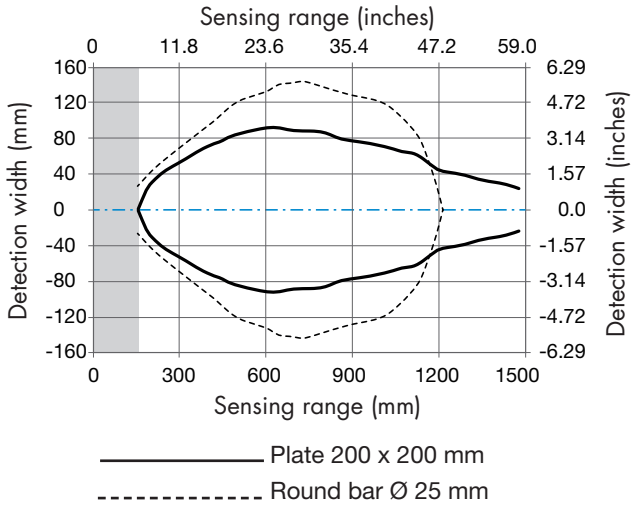


Plate 200 x 200 mm
Round bar Ø 25 mm

UA18ASD08APM1IO

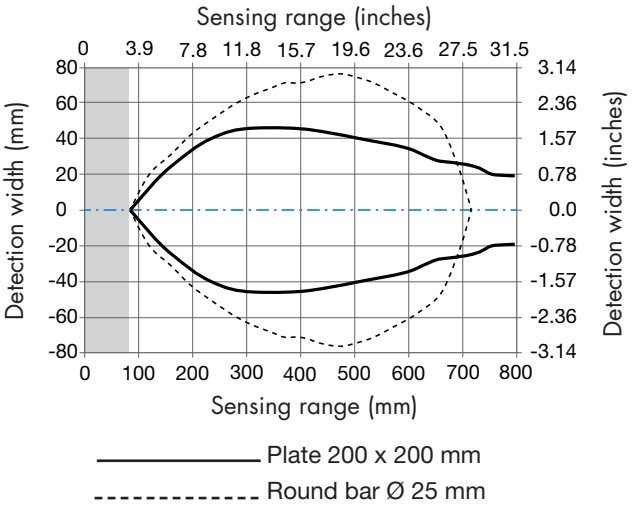


Plate 200 x 200 mm
Round bar Ø 25 mm

UA30ASD60APM1IO

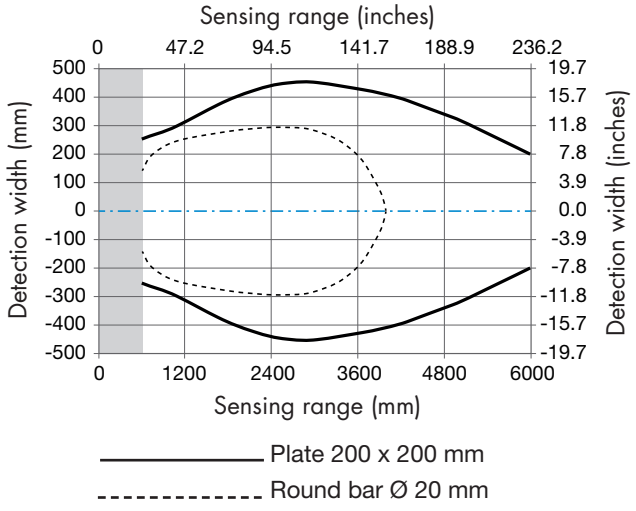


Plate 200 x 200 mm
Round bar Ø 20 mm

UA30ASD30APM1IO

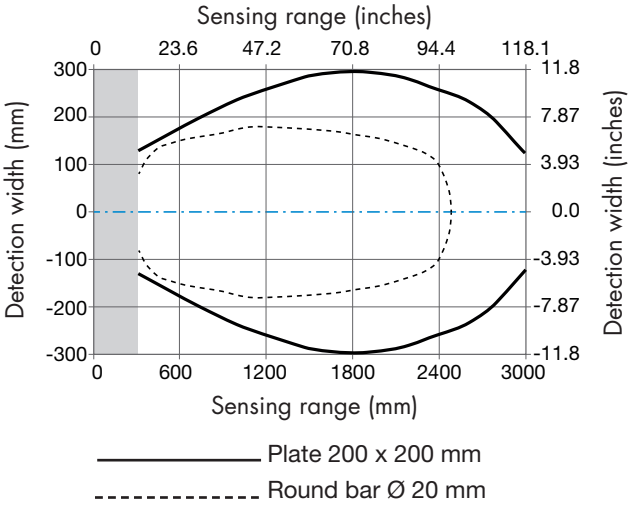


Plate 200 x 200 mm
Round bar Ø 20 mm

CARLO GAVAZZI

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Certified in accordance with ISO 9001

MAN UAxxASDxxAPM1 IO-Link ENG rev.00 - 03.2025