GB

Operating instructions

Inductive sensors with IO-Link and 2 switching outputs

11456696 / 00 05 / 2022

Contents

1 Preliminary note

You will find instructions, technical data, approvals and further information using the QR code on the unit / packaging or at www.ifm.com.

1.1 Symbols used

✓	Requirement
▶	Instructions
▷	Reaction, result
[...]	Designation of keys, buttons or indications
→	Cross-reference
!	Important note Non-compliance may result in malfunction or interference.
i	Information Supplementary note

2 Safety instructions

- The unit described is a subcomponent for integration into a system.
  - The system architect is responsible for the safety of the system.
  - The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Intended use).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.

3 Intended use

The unit detects metal without contact and signals this by means of a switching signal.

In addition, the unit provides a linearised distance value with a resolution of 12 bits via the IO-Link interface.

4 Function

The sensor has 2 outputs, OUT1 and OUT2, of which OUT2 can be used as a digital input. This offers the following functionalities, for example, depending on the application:

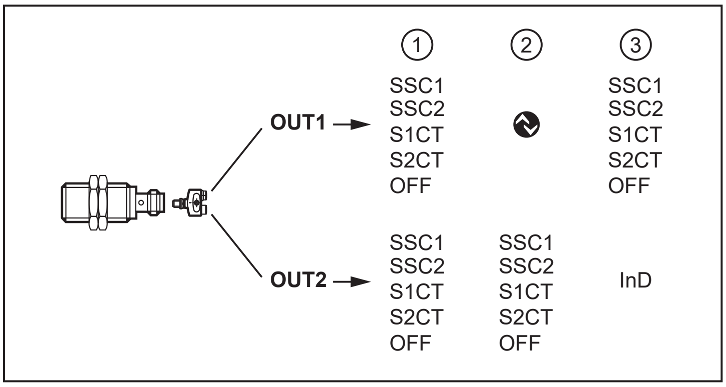


Fig. 1: function

1. OUT1 and OUT2 are both used as switching outputs.
2. OUT1 is used as an IO-Link interface and OUT2 as a switching output.
3. OUT1 is used as a switching output and OUT2 as a digital input for an external signal. See Input configuration (→ 🗋 12).

Both outputs can also be deactivated.

The switching signal channels SSC1 and SSC2 as well as the counters S1CT and S2CT can be set separately.
Using the parameter setting software, the switching signal channels and counters can be freely assigned to the outputs OUT1 and OUT2.

4.1 Switching function with switch point

A switching signal can be provided for process value monitoring. OUTx will change its switching status according to the parameter settings as a function of the distance to the object.

You can choose between the following switch point modes according to the IO-Link smart sensor profile:

- Single point mode
- Two point mode
- Window mode

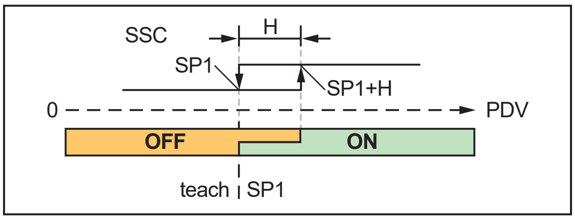
Term	Explanation
H	Hysteresis, can be set via the parameter [HY]
High active	Switch-point logic: switching output is switched on object detection = NO (normally open)
Low active	Switch-point logic: switching output is not switched on object detection = NC (normally closed)
PDV (Process data variable)	Process data value
SP	Switch point (SP1 must be greater than SP2)
SSC (Switching Signal Channel)	Switching signal channel
SSC1	Switching signal channel 1 (output signal, either via OUT1 or OUT2)
SSC2	Switching signal channel 2 (output signal, either via OUT1 or OUT2)
Single point mode	Single switch point mode
Two point mode	Two switch point mode

Term	Explanation
Window mode	Window mode

Tab. 1: definition of terms

Single point mode

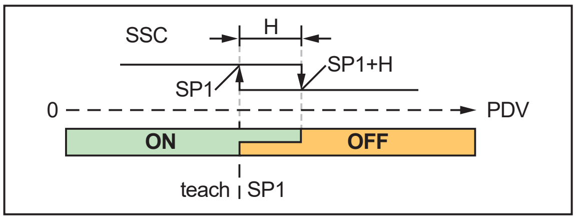
Only one switch point (SP1) is manually set or taught. The switch-off point results from the switch point and the set hysteresis (H).



Single point mode – low active

SP1+H: switch-on point

SP1: switch-off point



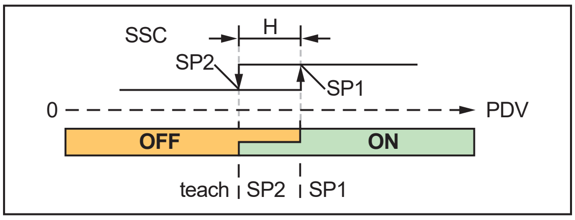
Single point mode – high active

SP1: switch-on point

SP1+H: switch-off point

Two point mode

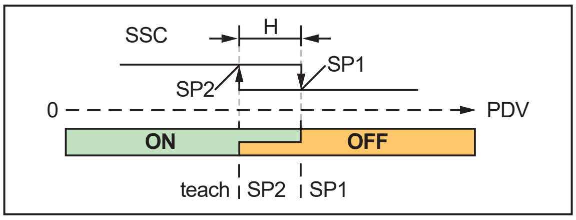
A switch point (SP1) and a switch-off point (SP2) are manually set or taught.



Two point mode – low active

SP2: switch-off point

SP1: switch-on point



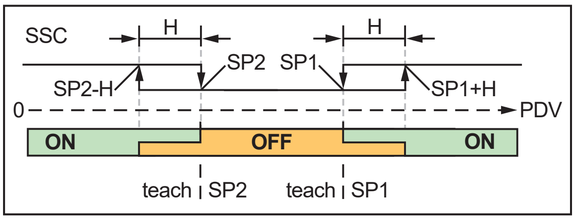
Single point mode – high active

SP1: switch-off point

SP2: switch-on point

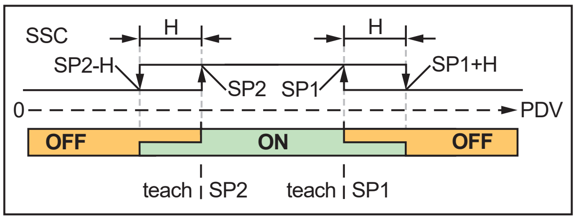
Window mode

Two switch points (SP1) and (SP2) are manually set or taught. The two switch points delimit a window area.



Window mode – low active

- The output switches off (low active) within the switching limits SP1 and SP2.
- The output switches on (high active) when the process value leaves the window area and the set hysteresis is exceeded: SP1+H or SP2-H.



Window mode – high active

- The output switches on (high active) within the switching limits SP1 and SP2.
- The output switches off (low active) when the process value leaves the window area and the set hysteresis is exceeded: SP1+H or SP2-H.

See also: Configure switching outputs (→ 🗋 14).

4.2 Switching function with counter

The unit saves the number of switching cycles at both switching signal channels SSC1 and SSC2 using the switching cycles counters S1CT and S2CT.

The counter value can be read via the IO-Link interface.

The counter saves the switching cycles every 5 minutes. Switching cycles since the last save operation are lost in case of a voltage interruption.

When a set switching cycle threshold is reached, the switching status changes, and when the IO-Link interface is used, a data bit is set. The status change is valid for a defined hold time.

See also: Configure counters (→ 🗋 16).

The counter can be reset via an IO-Link command or a trigger edge at the digital input, or it is reset automatically when the switching cycle threshold is reached.

See also: Reset counters (→ 🗋 17).

5 Installation

5.1 Information on flush and non-flush mounting in metal

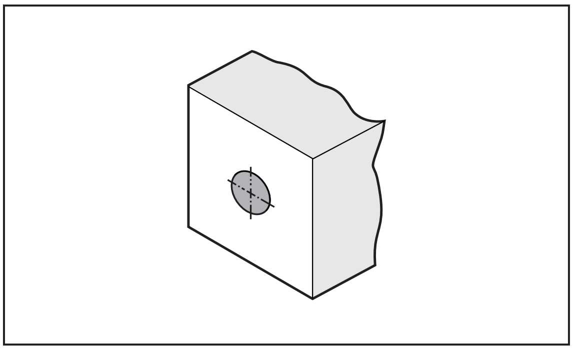


Fig. 2: cylindrical design, flush

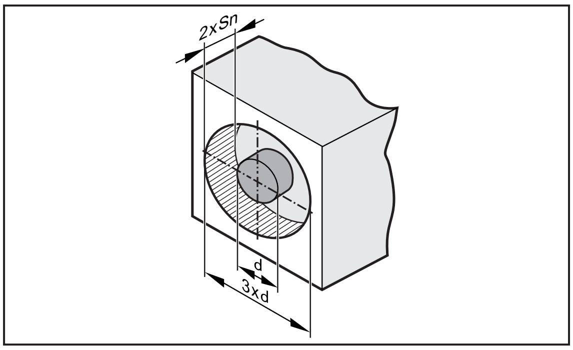


Fig. 3: cylindrical design, non-flush

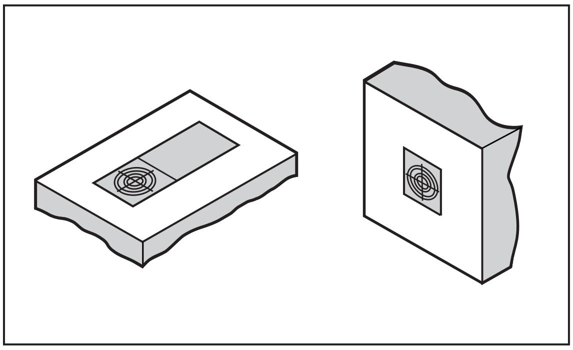


Fig. 4: rectangular design, flush

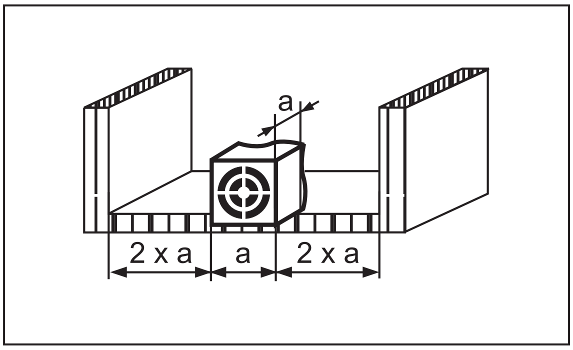


Fig. 5: rectangular design, non-flush

5.2 Minimum distance when installing units of the same type

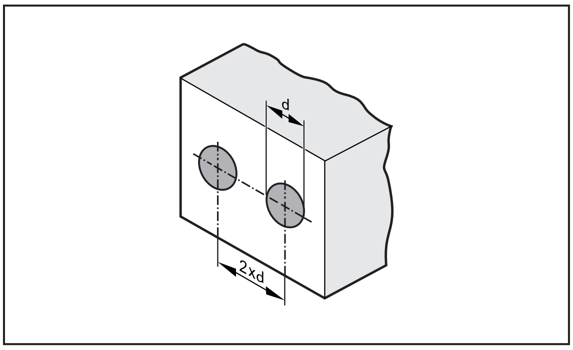


Fig. 6: distance, flush

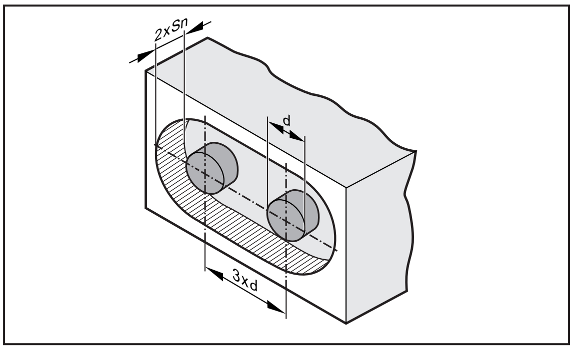


Fig. 7: distance, non-flush

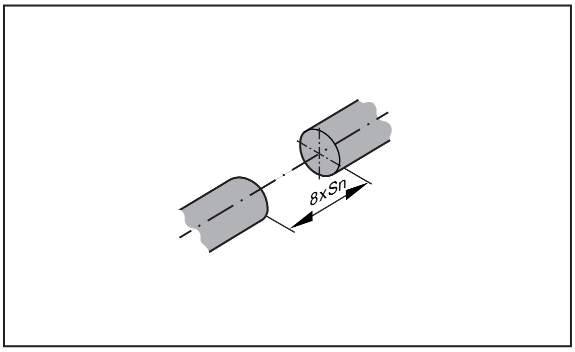


Fig. 8: distance, frontal

The minimum distance between units may only be disregarded for units with different oscillator frequencies or different sensing principles.

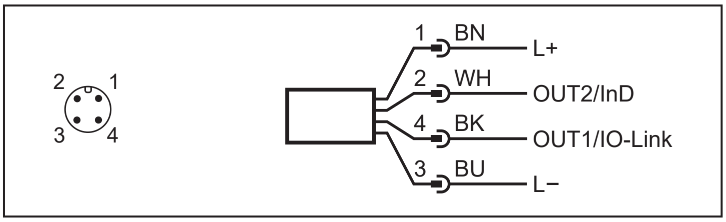
6 Electrical connection

The unit must be connected by a qualified electrician.

▶ Observe the national and international regulations for the installation of electrical equipment.

▶ Disconnect power.

▶ Connect the unit as follows:



BK: black
BU: blue
BN: brown
WH: white

Pin	Connection
1	L+
3	L-
4	• Switching output OUT1 • IO-Link • OFF
2	• Switching output OUT2 • Can be set to digital input • OFF

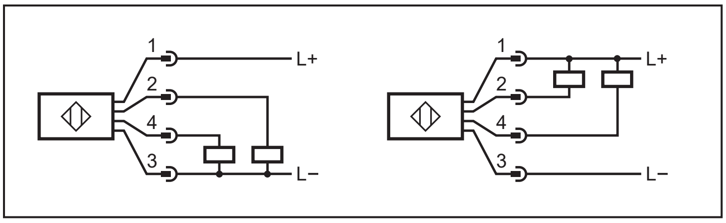


Fig. 9: example connection PNP/NPN

7 Parameter setting

The parameters are set via the IO-Link interface on pin 4 using the parameter setting software.

In addition, when using pin 2 as a digital input, the following settings can also be triggered via an input signal:

- switch point teach
- reset of switching cycles counters
- optical localisation of the sensor via a flashing LED
- configure switching signal channel for OUT1 / switch-point logic

See also: Input configuration (→ 🗋 12).

Parameters can be set before installation or during operation.

If you change parameters during operation, this will influence the function of the plant.

▶ Ensure that there will be no malfunctions in your plant.

During parameter setting the unit remains in the operating mode. It continues to monitor with the existing parameter until the parameter setting has been completed.

Requirements for parameter setting via the IO-Link interface:

✓ A suitable parameter setting software, e.g. ifm moneo|configure

✓ The Input Output Device Description (IODD) for the device, see documentation.ifm.com

✓ One IO-Link master

▶ Connect the IO-Link master to a parameter setting software.

▶ Set the port of the master to the IO-Link operating mode.

▶ Connect the device to a free port of the IO-Link master.

▷ The unit switches to IO-Link mode.

▶ Change parameter settings in the software.

▶ Write parameter settings to the unit.

Notes on parameter setting → Manual of the parameter setting software

7.1 Input configuration

The digital input enables the sensor to be controlled without an IO-Link master.

OUT2 is set as a digital input via the parameter setting software. The input signal can be provided through a trigger edge (e.g. pushbutton) or a static high/low signal (e.g. switch). The input signal changes the current function and operating principle of the sensor.

Via the input configuration, the conditions for the input signal and the sensor function to be triggered can be set using the parameters [DIn2] and [DIF2].

Selectable values:

Pulse through trigger edge:

[DIn2]	[DIF2]	Sensor function	
+EDG: rising trigger edge -EDG: falling trigger edge	D_IN_DEFAULT_IDLE	Factory setting: no function	
	D_IN_BLINK_TOGGLE	Optical localisation	
	D_IN_TEACH_SP1	Teach switch point 1	For the taught switch point, the set switch point mode, switch-point logic and hystere-sis values apply.
	D_IN_TEACH_SP2	Teach switch point 2	
	D_IN_RESET_CNT_ALL	Reset switching cycles counters 1 and 2	
	D_IN_RE-SET_CNT_SSC1	Reset switching cycles counter 1	
	D_IN_RE-SET_CNT_SSC2	Reset switching cycles counter 2	

Pulse through static signal:

[DIn2]	[DIF2]	Sensor function	
LEVL: static signal (0: low; 1: high)	D_IN_DEFAULT_IDLE	Factory setting: no function	
	D_IN_OU1_HI_SSC1_LO_SSC2	Configuration of the switching channel selection of OUT1:	
		Input signal (OUT2):	[ou1]:
		high	SSC1
		low	SSC2
	D_IN_SSC1_HI_CLOS-ER_LO_OPENER	Configuration of the switch-point logic of SSC1:	
		Input signal (OUT2):	[SSC1 Config. Logic]:
		high	high active (NO)
		low	low active (NC)
	D_IN_SSC2_HI_CLOS-ER_LO_OPENER	Configuration of the switch-point logic of SSC2:	
		Input signal (OUT2):	[SSC2 Config. Logic]:
		high	high active (NO)
		low	low active (NC)

7.1.1 Configure digital input

▶ Call up [Parameters] > [Output Configuration].

▶ Select [ou2] and set digital input: [In.D].

▶ Select [Parameters] > [Digital input 2].

▶ Select [DIn2] and configure input signal: [+EDG], [-EDG], [LEVL].

▶ Select [DIF2] and set the sensor function.

7.2 Output configuration

The following functions can be selected for the switching outputs OUT1 and OUT2:

- Switching function with switch point
- Switching function with counter
- Output switched off.
  The output signal at OUT1 and OUT2 can be deactivated. The output then goes to high impedance. Communication via the IO-Link interface on OUT1 remains active.

7.2.1 Configure switching outputs

See also: Switching function with switch point (→ 🗋 6).

The switching signal channels SSC1 and SSC2 can be freely assigned to the switching outputs OUT1 and OUT2.

The following parameters can be set for both switching signal channels:

Parameter	Explanation
Switch point mode [SSC1 Config. Mode] [SSC2 Config. Mode]	• Single point • Two point • Window
Switch-point logic [SSC1 Config. Logic] [SSC2 Config. Logic]	• High active: switching output is switched on object detection = NO (normally open) • Low active: switching output is not switched on object detection = NC (normally closed)
Hysteresis [SSC1 Config. Hyst] [SSC2 Config. Hyst]	• Single point mode: The switch-off point results from the set hysteresis. • Two point mode: no function • Window mode: The hysteresis setting affects the set switching limits. The hysteresis is set in % of the switch point.
Switch point [SSC1 Param. SP1] [SSC1 Param. SP2] [SSC2 Param. SP1] [SSC2 Param. SP2]	• SP1 (single point mode / two point mode / window mode) • SP2 (two point mode / window mode)
Switch-on delay [SSC1 Switch-On delay] [SSC2 Switch-On delay]	Adjustable switch-on delay time of the output in ms
Switch-off delay [SSC1 Switch-Off delay] [SSC2 Switch-Off delay]	Adjustable switch-off delay time of the output in ms

Tab. 2: switching channel setting options

Parameter setting:

▶ Call up [Parameters] > [Output Configuration].

▶ Select [ou1] and set the switching signal channel: [SSC1] or [SSC2].

▶ Select [ou2] and set the switching signal channel: [SSC1] or [SSC2].

▶ Call up [Parameters] > [Digital Output x].

▶ Select [SSCx Config. Mode] and set the switch point mode for the switching signal channel SSCx.

▶ Select [SSCx Config. Logic] and set the switch-point logic for the switching signal channel SSCx.

▶ Select [SSCx Config. Hyst] and set the hysteresis for the switching signal channel SSCx.

▶ Select [SSCx Switch-On delay] and set the switch-on delay for the switching signal channel SSCx.

▶ Select [SSCx Switch-Off delay] and set the switch-off delay for the switching signal channel SSCx.

▶ Configure the switch point: Switch point (→ 🗋 14).

7.2.1.1 Switch point

The switch point can be permanently set or taught via IO-Link or it can be taught via an external input signal.

The unit performs a check for all the setting types mentioned to ensure that the following criteria are met:

- SP1 ≤ 3800
- SP1+H ≤ 4066

- SP2 ≥ 388 and SP2 ≤ SP1-H_{min}

(H_{min} = minimum hysteresis = 3% of the set switch point)

If the criteria are not met, the current parameter settings are retained.

Set switch point via IO-Link

✓ The switch point mode, the switch-point logic and the hysteresis are set.

▶ Select [Parameters] > [Digital output x].

▶ Select [SSCx Param. SP1] and set switch point 1 for the switching signal channel SSCx.

Additionally for two point mode and window mode: Select [SSCx Param. SP2] and set switch point 2 for the switching signal channel SSCx.

▶ Select [SSCx Param.SP2] and set switch point 2 for the switching signal channel SSCx.

SP1 should be as high as possible in order to be able to set SP2 and H in as wide a range as possible.

Teach switch point via IO-Link

✓ The switch point mode, the switch-point logic and the hysteresis are set.

▶ Place object in position 1 in front of the sensor.

▶ Select [Parameters] > [Teach].

▶ Select [TI Select] and determine switching signal channel: [SSC1] or [SSC2].

▶ Save parameter set.

▶ Execute command: [Teach SP1].

▷ Switch point SP1 for SSCx is set.

Additionally for two point mode and window mode: Select [SSCx Param. SP2] and set switch point 2 for the switching signal channel SSCx.

▶ Place object in position 2 in front of the sensor.

▶ Execute command: [Teach SP2].

▷ Switch point SP2 for SSCx is set.

Teach switch point via input signal

✓ The switch point mode, the switch-point logic and the hysteresis are set.

✓ The digital input is configured with the following setting: [D_IN_TEACH_SP1]. (→ Configure digital input 🗋 13)

▶ Place object in position 1 in front of the sensor.

▶ Select [Parameters] > [Teach].

▶ Select [TI Select] and determine switching signal channel: [SSC1] or [SSC2].

▶ Trigger input signal.

▷ Switch point SP1 for SSCx is set.

Additionally for two point mode and window mode: Select [SSCx Param. SP2] and set switch point 2 for the switching signal channel SSCx.

✓ The digital input is configured with the following setting: [D_IN_TEACH_SP2].

▶ Place object in position 2 in front of the sensor.

▶ Trigger input signal.

▷ Switch point SP2 for SSCx is set.

7.2.2 Configure counters

See also: Switching function with counter (→ 8).

The counters S1CT and S2CT can be freely assigned to the outputs OUT1 and OUT2.

The following parameters can be set for both counters:

<table>
<tr><th>Parameter</th><th colspan="2">Explanation</th></tr>
<tr><td>SSC-EnhCtr_HoldTime. SSC1
SSC-EnhCtr_HoldTime. SSC2</td><td colspan="2">Hold time: duration of the changed switching status when reaching the switching cycle threshold in milliseconds.
Requirement: SSC-EnhCtr_AutoReload.SSCx = On.</td></tr>
<tr><td>SSC-EnhCtr_AutoReload. SSC1
SSC-EnhCtr_AutoReload. SSC2</td><td colspan="2">Counter reset:
• OFF: The output switches when the switching cycle threshold is reached. The counter continues counting until it is reset: See (→ Reset counters 17).
• On: The output switches when the switching cycle threshold is reached. The switching status remains active for the set hold time (→ SSC-EnhCrt_HoldTime.SSCx). Afterwards, the switching output and the counter are reset. The counter starts again at 0.</td></tr>
<tr><td rowspan="5">SSC-EnhCtr_CountCondition. SSC1
SSC-EnhCtr_CountCondition. SSC2</td><td colspan="2">Count condition:</td></tr>
<tr><td>Rising:</td><td>The counter only adds up switching cycles when changing from low to high (0 → 1).</td></tr>
<tr><td>Falling:</td><td>The counter only adds up switching cycles when changing from high to low (1 → 0).</td></tr>
<tr><td>Both:</td><td>The counter adds up the switching cycles on both edges.</td></tr>
<tr><td colspan="2">▶ Observe switching logic, see (→ Configure switching outputs 14).</td></tr>
<tr><td>SSC EnhCtr Threshold. SSC1
SSC EnhCtr Threshold. SSC2</td><td colspan="2">Switching cycle threshold: Number of switching cycles at counter SxCT at which a switching signal is triggered.</td></tr>
</table>

Tab. 3: counter setting options

Parameter setting:

- ▶ Call up [Parameters] > [Output Configuration].
- ▶ Select [ou1] and set counter: [S1CT] or [S2CT].
- ▶ Select [ou2] and set counter: [S1CT] or [S2CT].
- ▶ Select [Parameters] > [Counter configuration].
- ▶ Select [SSC-EnhCtr_HoldTime. SSCx] and set hold time.
- ▶ Select [SSC-EnhCtr_AutoReload. SSCx] and set counter reset.
- ▶ Select [SSC-EnhCtr_CountCondition. SSCx] and set count condition.
- ▶ Select [SSC EnhCtr Threshold. SSCx] and set switching cycle threshold.

7.2.3 Switch off output

- ▶ Call up [Parameters] > [Output Configuration].
- ▶ Select [oux] and set [OFF].

7.2.4 Configure output polarity

- ▶ Call up [Parameters] > [Output Configuration].
- ▶ Select [P-n] and set [PnP] or [nPn].

7.2.5 Damping

- ▶ Call up [Parameters] > [Damping].
- ▶ Select [dAP] and set a damping time in ms.

ℹ The damping time affects both outputs and the IO-Link transmission.

7.3 Read counter values

- ▶ Select [Parameters] > [Counter configuration].
- ▶ Select [SSC-EnhCtr.SSC1] and read the current counter value for SSC1.
- ▶ Select [SSC-EnhCtr.SSC2] and read the current counter value for SSC2.

7.4 Reset counters

7.4.1 Reset counters via IO-Link

Reset both counters:

- ▶ Select [Parameters] > [Counter configuration].
- ▶ Execute command: [Reset counter to zero].
- ▷ Both switching cycles counters are set to 0.

Reset counters individually:

- ▶ Select [Parameters] > [Setup].
- ▶ Execute command: [Reset SSC1 Counter].
- ▷ The switching cycles counter SSC1 is set to 0.
- ▶ Execute command: [Reset SSC2 Counter].
- ▷ The switching cycles counter SSC2 is set to 0.

7.4.2 Reset counters via input signal

- ✓ The digital input is configured with the following setting: [D_IN_RESET_xxx]. (→ Configure digital input 🗋 13)
- ▶ Trigger input signal.
- ▷ Counter is reset:
- Both counters when setting: [D_IN_RESET_ALL]
- Switching cycles counter SSC1 when setting: [D_IN_RESET_SSC1]
- Switching cycles counter SSC2 when setting: [D_IN_RESET_SSC2]

7.5 Device reset

The unit can be reset to factory settings.

ℹ We recommend documenting your own settings in the chapter Factory setting before carrying out a reset.

- ▶ Select [Parameters] > [Setup].
- ▶ Execute command: [Restore Factory Settings].
- ▷ The unit carries out a reboot.

7.6 Diagnosis

7.6.1 Operating hours counter

The operating hours since the first set-up are stored by the unit.

The current value can be read via the IO-Link interface.

▶ Select [Parameters] > [Diagnosis].

▶ Select [Operating hours] and read value.

7.6.2 Internal temperature

The sensor measures the internal temperature.

The current value can be read via the IO-Link interface.

▶ Select [Parameters] > [Diagnosis] > [Temperature].

▶ Select [Internal temperature] and read value.

7.7 Identification

7.7.1 Device information

Unalterable device information is stored on the unit. This includes:

- Product name
- Product family
- Manufacturer
- Manufacturer ID
- Device ID
- Serial number
- Hardware / firmware revision
- Description

In addition, further freely definable tags with a maximum length of 32 characters can be assigned to the unit via the IO-Link interface using suitable parameter setting software. This includes:

- application-specific tag
- function tag
- location tag

Read/edit device information:

▶ Select [Identification].

▶ Read device information or edit editable parameters.

7.7.2 Optical localisation

The sensor can be located remotely in the system via the IO-Link interface.

When using the command, the switching status LED flashes.

7.7.2.1 Optical localisation via IO-Link

▶ Select [Identification].

▶ Execute command: [Flash On].

▶ To end the flashing process: Execute command: [Flash Off].

7.7.2.2 Optical localisation via input signal

✓ The digital input is configured with the following setting: [D_IN_BLINK_TOGGLE]. (→ Configure digital input 🗋 13)

▶ Trigger input signal.

8 Maintenance, repair and disposal

The operation of the unit is maintenance-free.

Only the manufacturer is allowed to repair the unit.

- ▶ After use dispose of the device in an environmentally friendly way in accordance with the applicable national regulations.

9 Factory setting

	Parameter	Factory setting	User setting
	ou1	SSC1	
	ou2	SSC2	
	P-n	PnP	
	dAP	0 ms	
SSC1	SSC1 Param. SP1	3800	
	SSC1 Param. SP2	388	
	SSC1 Config. Logic	High active	
	SSC1 Config. Mode	Single point	
	SSC1 Config. Hyst	7%	
	SSC1 Switch-On delay	0 ms	
	SSC1 Switch-Off delay	0 ms	
SSC2	SSC2 Param. SP1	3800	
	SSC2 Param. SP2	388	
	SSC2 Config. Logic	Low active	
	SSC2 Config. Mode	Single point	
	SSC2 Config. Hyst	7%	
	SSC2 Switch-On delay	0 ms	
	SSC2 Switch-Off delay	0 ms	
S1CT	SSC-EnhCtr_HoldTime. SSC1	100 ms	
	SSC-EnhCtr_AutoReload. SSC1	On	
	SSC-EnhCtr_CountCondition. SSC1	Rising	
	SSC EnhCtr Threshold. SSC1	100	
S2CT	SSC-EnhCtr_HoldTime. SSC2	100 ms	
	SSC-EnhCtr_AutoReload. SSC2	On	
	SSC-EnhCtr_CountCondition. SSC2	Falling	
	SSC EnhCtr Threshold. SSC2	100	