



Operating instructions
Evaluation unit for monitoring analogue standard
signals
DL3003

GB

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1 Preliminary note

You will find instructions, technical data, approvals and further information using the QR code on the unit / packaging or at documentation.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.
-  Information
Supplementary note

1.2 Warnings

Warnings indicate the possibility of personal injury and damage to property. This enables safe product handling. Warnings are graded as follows:



WARNING

Warning of serious personal injury

- ▷ If the warning is not observed, fatal and serious injuries are possible.



CAUTION

Warning of minor to moderate personal injury

- ▷ If the warning is not observed, minor to moderate injuries are possible.

ATTENTION

Warning of damage to property

- ▷ If the warning is not observed, damage to property is possible.

1.3 Safety symbol on the device



Safety symbol on the device:

- Adhere to the operating instructions for the safe operation of the unit.

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, programming, configuration, operation and maintenance of the product must be carried out by personnel qualified and authorised for the respective activity.
- Protect units and cables against damage.
- Replace damaged units, otherwise the technical data and safety will be impaired.
- Observe applicable documents.

3 Intended use

The device is a configurable analogue threshold relay for evaluating physical values derived from analogue standard signals.

The device has two analogue inputs and two independent channels for evaluation.

The setting possibilities of the various parameters ensure that the function of the device is variable within a great range of values and can thus be adapted to the individual application.

- Outputs (relays) for direct control of contactors, smaller drives, valves, etc.
- In the control cabinet in an industrial environment (indoors) as a permanently installed device with supply from SELV/PELV according to the technical data.

Operation by trained, authorised specialist personnel due to protection class IP20.

Application examples:

- limit value monitoring of flow, pressure, temperature or level
- monitoring of the difference between inflow and return flow
- monitoring of differential pressure



The device is not suited for environments with particular requirements on mechanical stability (e.g. shock/vibration).

► Observe the operating conditions (→ Technical data at www.ifm.com).

Monitoring of two independent signals

The analogue current signals at both inputs can be scaled, displayed and monitored separately.

Any numerical value can be assigned to the start and end values of the analogue signal (corresponding to the measuring range of the sensor, e.g. 4...20 mA = 0...25 bar).

The teach function enables the assignment of an actual signal value to a switch point and the assignment of the process value to the analogue output.

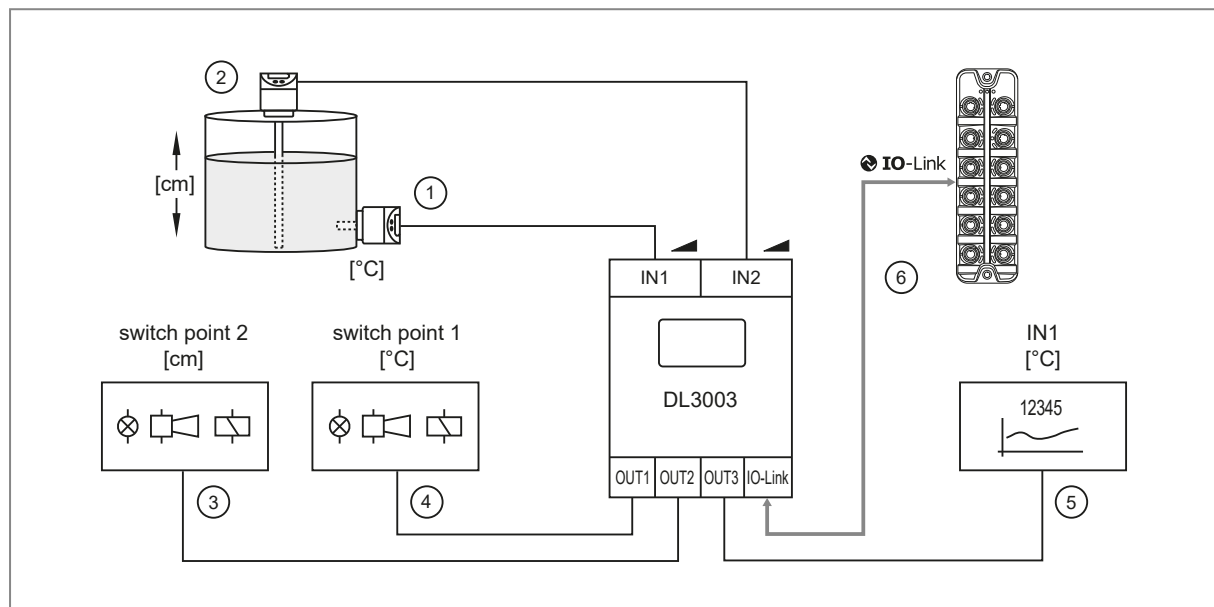


Fig. 1: Limit value monitoring of 2 independent, different process values (here e.g. temperature [°C] and level [cm])

- 1: Temperature sensor [°C]
- 2: Level sensor [cm]
- 3: Switching output 2, here limit value 2 for level [cm]
- 4: Switching output 1, here limit value 1 for temperature [°C]
- 5: Analogue output for display, evaluation or recording of IN1, here [°C]
- 6: IO-Link for digital transmission of measured values

Monitoring the difference between or the sum of two signals

The device can calculate the difference between or the total of the two input signals ($IN1-IN2$, $IN1+IN2$).

The differential or total value can be displayed, evaluated, compared with the set limit values, and provided as an analogue signal.

The outputs switch according to the set parameter values and functions.

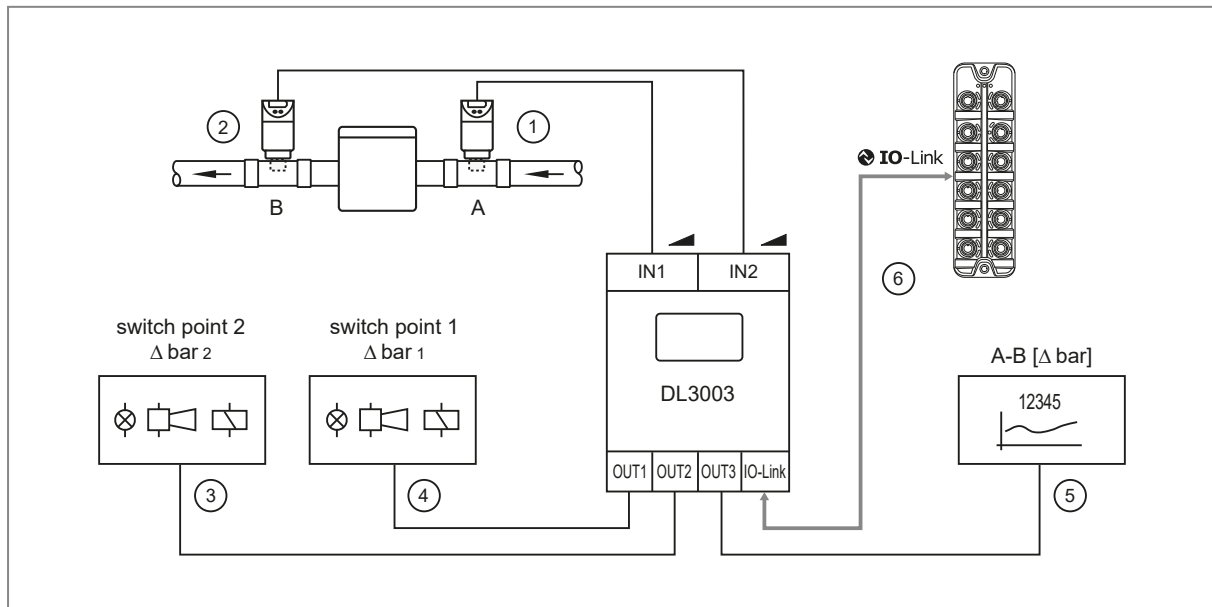


Fig. 2: Limit and differential monitoring of 2 physically identical process values by means of the signal combination A-B (here e.g. pressure [bar])

- 1: Pressure sensor A
- 2: Pressure sensor B
- 3: Switching output 2, here limit value 2 for pressure difference [Δbar2]
- 4: Switching output 1, here limit value 1 for pressure difference [Δbar1]
- 5: Analogue output for display, evaluation or recording, here A-B [Δbar]
- 6: IO-Link for digital transmission of measured values

4 Function

The device monitors and offsets two analogue signals in two measurement data channels (MDC). The monitoring result is output on the display, via two switching outputs, an analogue output and IO-Link process data.

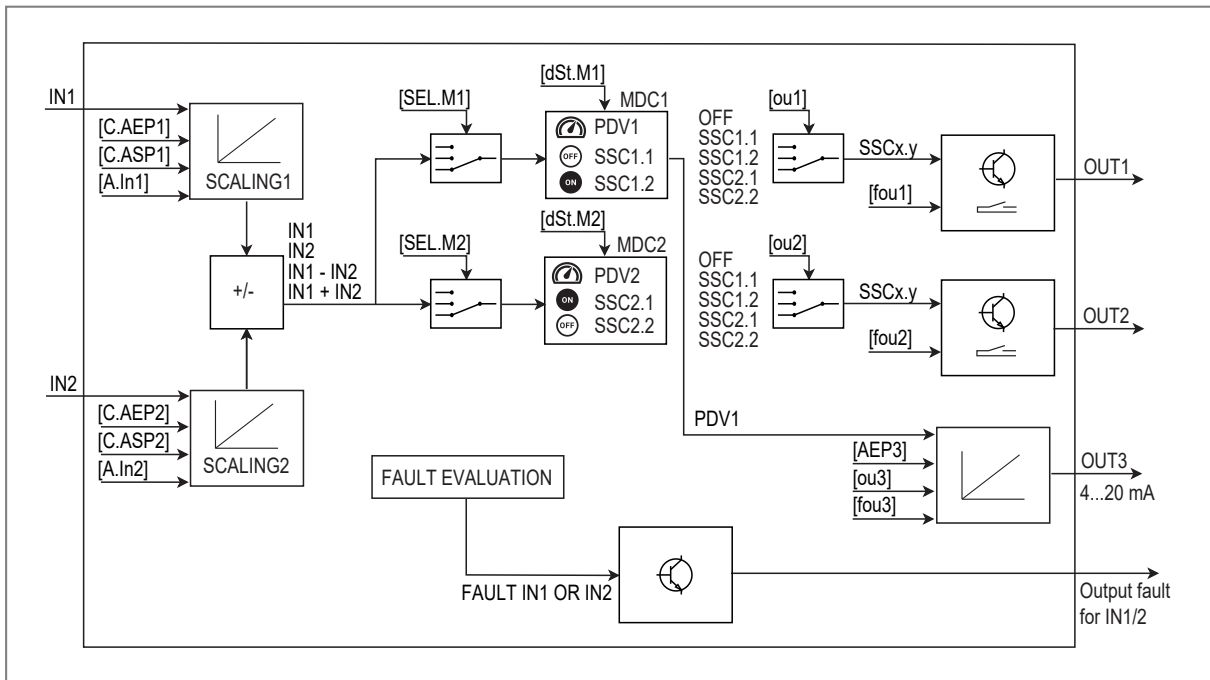


Fig. 3: Block diagram

The parameters of the device can be set locally via the display and the device keys. In addition, the device can be configured via IO-Link.

4.1 Supply types

The following supply types are available (→ [Electrical connection](#) 11):

- DC operation with supply from IO-Link master and IO-Link operation
 - DC operation without IO-Link
 - AC operation without IO-Link
- Voltage ranges → Technical data at www.ifm.com

4.2 Application as an IO-Link device

4.2.1 General information

The unit has an IO-Link communication interface which requires an IO-Link capable module (IO-Link master).

The IO-Link interface allows direct access to the process and diagnostic data and enables setting of the parameters of the unit during operation.

You will find further information about IO-Link and all the necessary information about the required IO-Link hardware and software at:

www.io-link.ifm

4.2.2 IO Device Description (IODD)

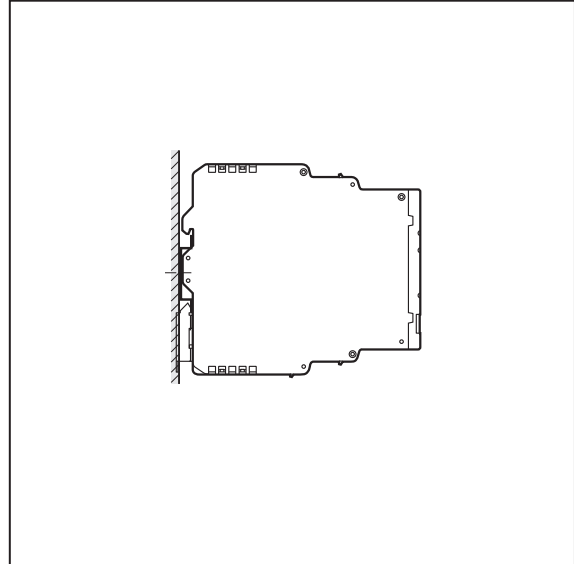
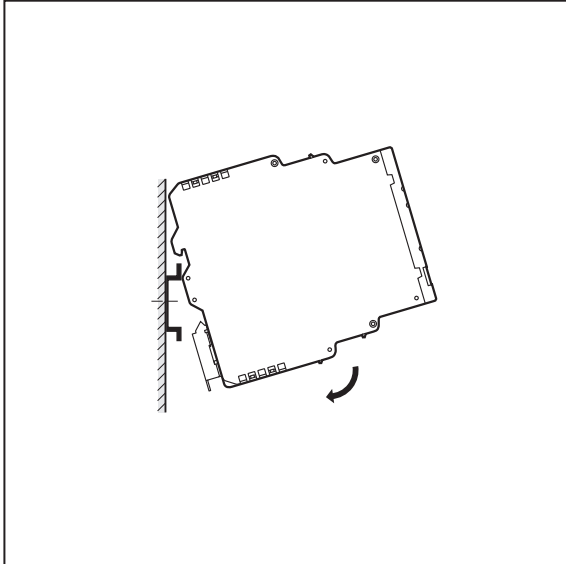
You will find the IODDs required for configuration of the IO-Link device as well as detailed information about the process data structure, diagnostic information and parameter addresses at documentation.ifm.com

5 Installation

- ▶ Disconnect power.

To ensure correct operation, install the device in a housing that can only be opened using a tool or in a locked control cabinet (both protection rating IP 54 or higher) as an enclosure in accordance with EN61010-1.

- ▶ Install the device vertically on a 35 mm DIN rail.



- ▶ Leave enough space (≥ 50 mm) between the device and the top and bottom of the control cabinet to enable air circulation and to avoid excessive heating.

ATTENTION

If units are mounted side by side, inadmissible heating may occur between the units.

- ▷ Malfunction / damage is possible.
- ▶ Take into account the internal heating of all devices when mounting different devices side by side and observe the environmental conditions for each device.

6 Electrical connection

6.1 Overview

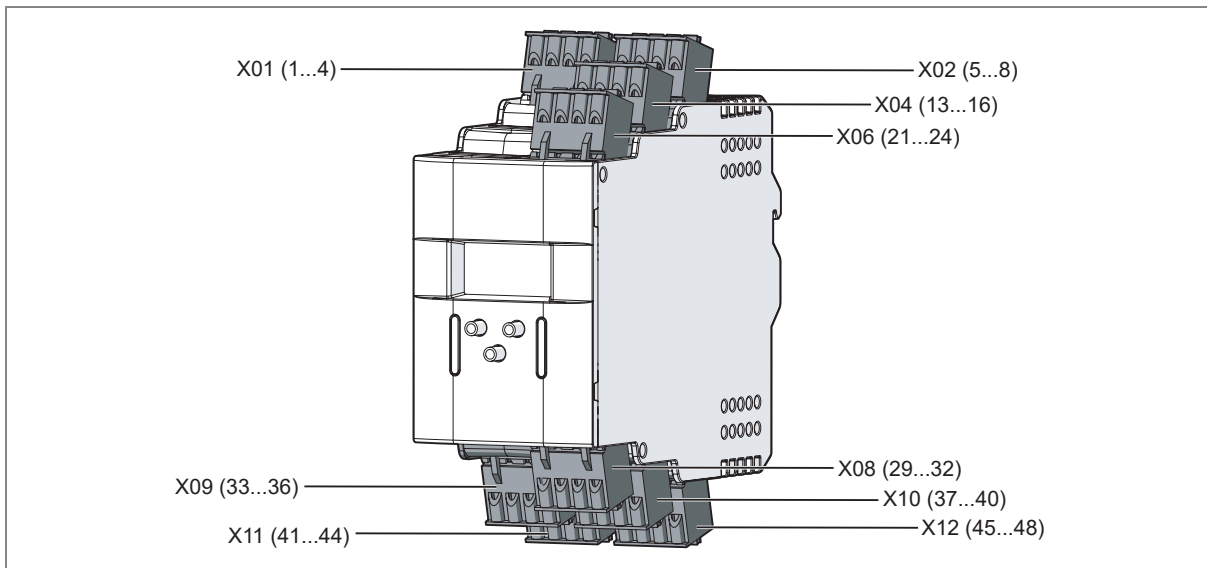


Fig. 4: Terminal overview

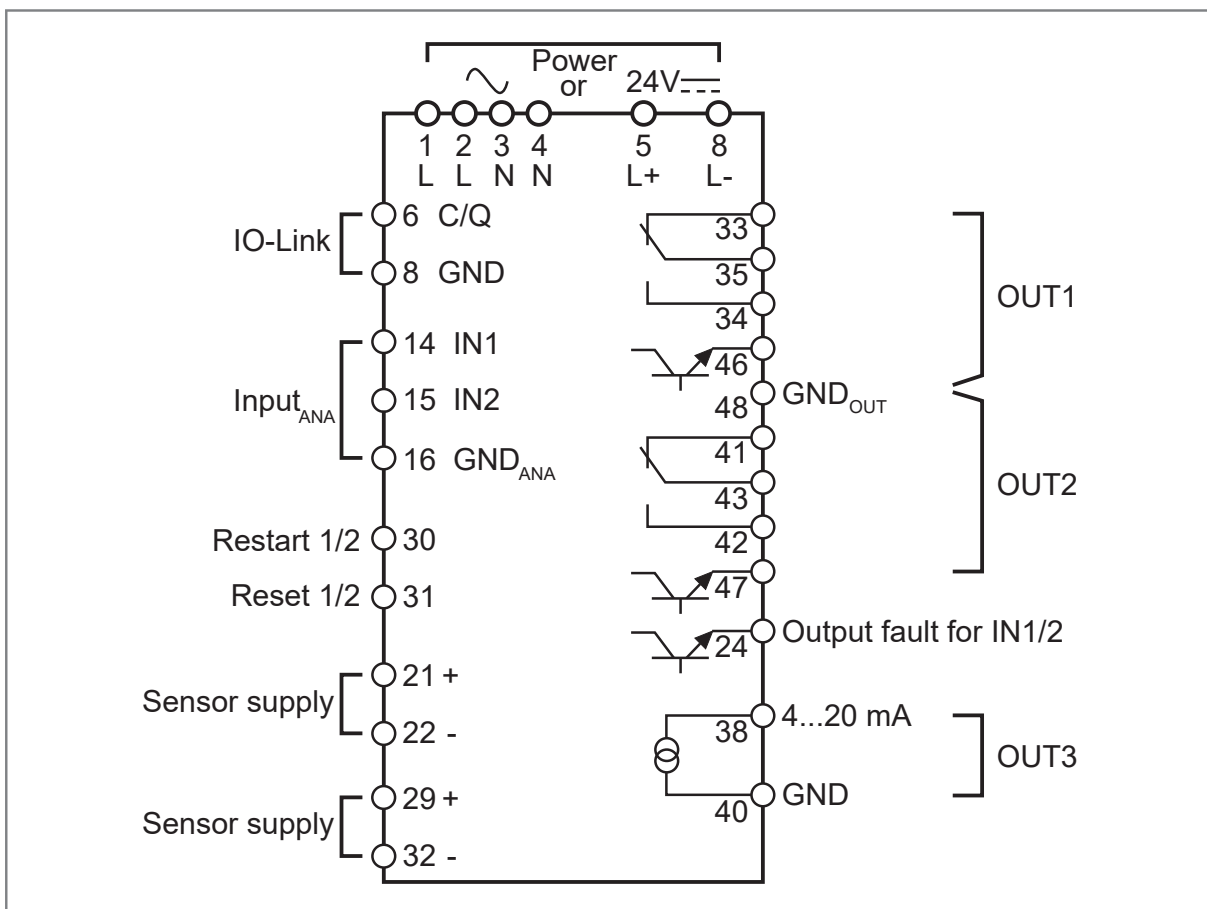


Fig. 5: Wiring



All GND are internally interconnected.

► Only use GND_{ANA} as GND for the analogue signal sources.



Terminals 1 and 2 are internally interconnected.
Terminals 3 and 4 are internally interconnected.

6.2 General wiring information



The unit must be connected by a qualified electrician.

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



WARNING

Use of unconnected terminals

- ▷ Electric shock possible.
- ▶ Do not use unconnected terminals (n.c.) which are not shown in the drawing as support point terminals.
- ▷ Protection guaranteed.

- ▶ Observe the notes on IO-Link wiring.

Accessible surfaces of the device are insulated from the circuits with basic insulation according to IEC 61010-1 (mains circuit of overvoltage category II up to 300 V nominal mains voltage).

This does not apply to connection areas and cooling openings (IP20).

The AC voltage supply and the relay circuits OUT1 and OUT2 are insulated from the DC voltage supply and from each other with reinforced insulation according to IEC 61010-1 (mains circuit of overvoltage category II up to 300 V nominal mains voltage).

The external wiring has to be carried out in a way that ensures the required separation from other circuits.

6.3 Notes on wiring

Maximum length of the connection cables:

- without IO-Link communication 30 m at each terminal
- for IO-Link communication 20 m

6.4 Pluggable cage clamps

All connections that can interact with the mains voltage are located on the left-hand side of the device and are specially coded (red coding on the pluggable cage clamps) so that they cannot be accidentally connected on the right-hand side.

6.5 Voltage supply (power)

- ▶ Voltage supply see type label.
- ▶ Connect the device only to one of the possible voltage connections, i.e. either to terminals 1-2, 3-4 (AC) or to terminals 5/8 (24 V DC).
- ▶ Lay all supply and signal cables separately. Use a screened cable if required in the application.



When the device is switched on, the signal level for the inactive switching state is briefly present at the outputs (high for "low active", low for "high active").

6.5.1 AC voltage supply

The device features an internal power supply that powers both the device and the connected sensors. The current required by the connected sensors must not exceed the available sensor supply.

There are two terminals each for L and N. The second terminal can be used to supply other devices with AC voltage. These terminals are bridged in the device, so unplugging will interrupt the supply to other devices.



The maximum current rating of the bridged terminals 1-2, 3-4 is 8 A.



WARNING

No internal protection of the bridged terminals 1-2, 3-4

▷ Risk of fire / electric shock due to overload / short circuit

▶ The system architect must provide external protection/limitation to 8 A in accordance with the applicable regulations

▷ Protection guaranteed

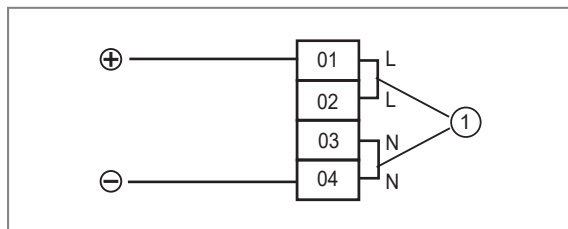


Fig. 6: Connection example AC supply

1: Internal bridge

If the device is operated on an AC supply, the extra-low voltage provided for the sensor supply meets the SELV criteria according to EN 61010.



If the device is operated on an AC supply, it can take up to 18 seconds for the device to start.

6.5.2 DC voltage supply without IO-Link

▶ The SELV / PELV criteria must be observed for DC voltage supply.



An electrical separation between the device supply and the sensor supply only exists with AC voltage supply.

The device can be operated on an existing 24 V DC supply.

▶ Take the current consumption into account.

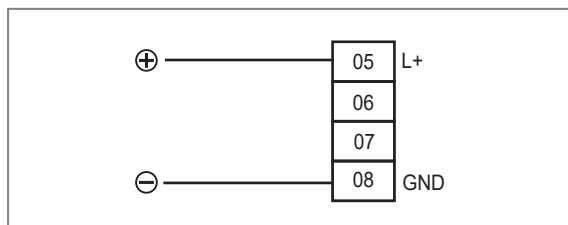


Fig. 7: Connection to 24 V DC supply

6.5.3 IO-Link operation



In IO-Link operation, the voltage must be supplied by the IO-Link master via terminals 5 and 8. No additional voltage supply may be connected.

The device is an IO-Link device. Connect it to an IO-Link master port for data transmission, parameter setting and voltage supply.

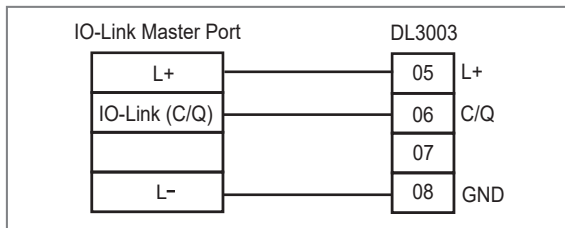


Fig. 8: Connection example IO-Link operation

6.6 Inputs



If the device is operated on an AC supply, a maximum sensor supply of 150 mA is available in total at terminals 21 and 29 (with DC supply: 200 mA).



If the device is operated on a DC supply, the sensor supply at terminals 21 and 29 is up to 2 V lower than the DC supply voltage.

6.6.1 Connection of 4...20 mA sensors and transmitters (IN1, IN2)

Supply via DL3003

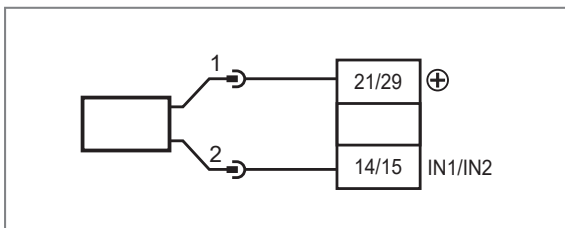


Fig. 9: Connection example 2 wires

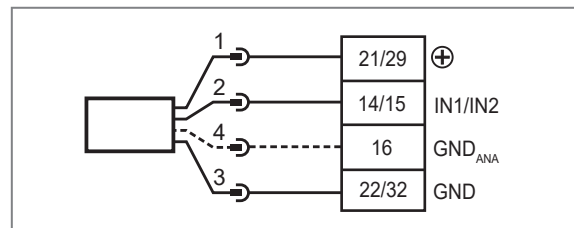


Fig. 10: Connection example 3 or 4 wires

External power supply

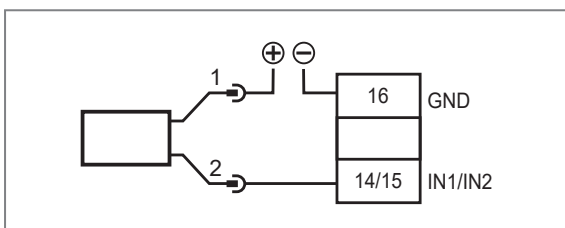


Fig. 11: Connection example 2 wires

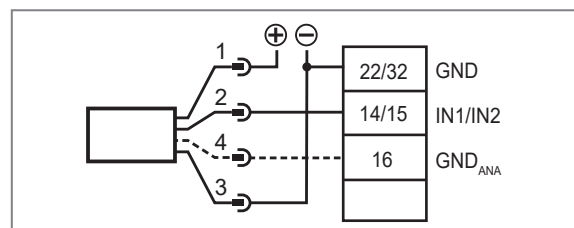


Fig. 12: Connection example 3 or 4 wires



Observe the wiring instructions of the connected devices.



Maximum permissible current 24 mA.

6.6.2 Connection of 0...10 V sensors

Supply via DL3003

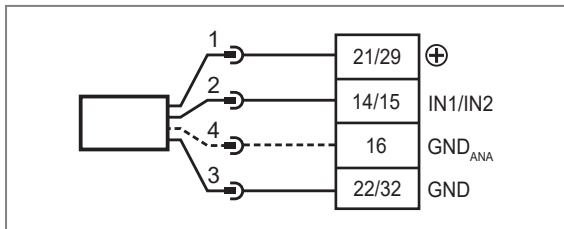


Fig. 13: Connection example 3 or 4 wires

External power supply

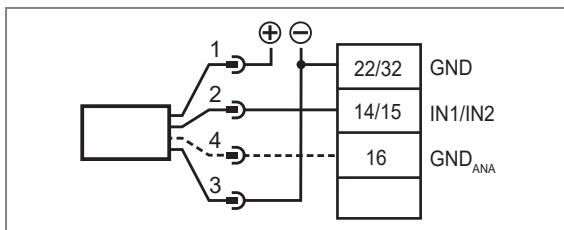


Fig. 14: Connection example 3 or 4 wires



Observe the wiring instructions of the connected devices.



Maximum voltage 12 V.

6.6.3 Control of the restart and reset inputs

Restart and reset inputs are digital PNP inputs designed to IEC61131-2 type 3. Voltage above 11 V is recognised as high, voltage below 5 V as low.

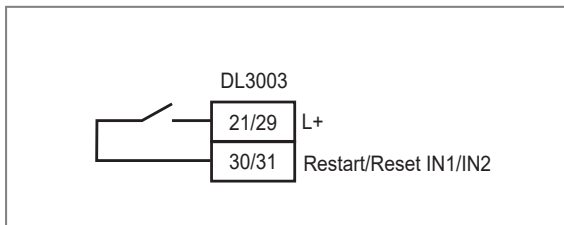


Fig. 15: Connection example: connect a mechanical switch

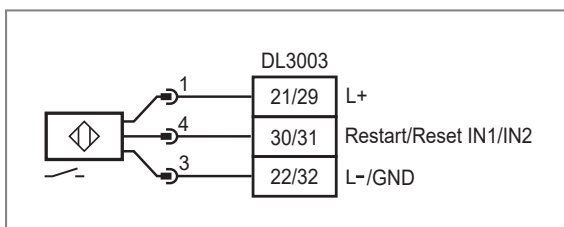


Fig. 16: Connection example: connect a digital sensor

6.7 Outputs

6.7.1 Relay outputs (OUT1/OUT2)



WARNING

No internal protection of the relay outputs

- ▷ Risk of fire / electric shock due to overload / short circuit
- ▶ The system architect must provide external protection/limitation to 6 A in accordance with the applicable regulations
- ▷ Protection guaranteed

- ▶ To prevent excessive wear and to comply with the EMC standards, interference suppression of the contacts is required for switching inductive loads.



WARNING

Connection of different AC phase conductors to the AC power supply and relays OUT1 and OUT2

- ▷ Electric shock possible
- ▶ For AC voltage supply, connect relay OUT1 and relay OUT2 to the same phase conductor.
- ▷ Protection guaranteed



If the relay outputs are used for switching very small currents (e.g. PLC inputs), considerable contact resistance can arise. In this case use the transistor outputs for DC.

6.7.2 Transistor outputs (OUT1/OUT2/Fault)

The transistor outputs are used to transmit the switching signal to other systems. They switch 24 V DC PNP without bouncing.



The transistor outputs are only intended for resistive loads. Do not connect any inductive loads.

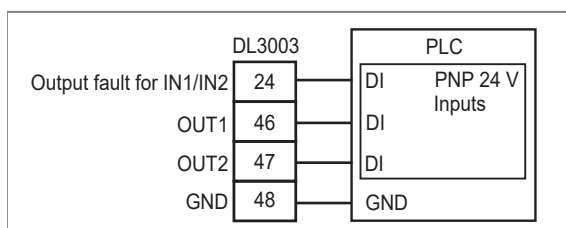


Fig. 17: Connection example: transistor outputs

6.7.3 Analogue output (OUT3)

The analogue output provides an analogue signal that is proportional to the PDV in MDC1. (Parameter setting: [Output configuration \(analogue / digital\)](#) (→ [24](#)) and [Analogue output](#) (→ [25](#))). The max. possible resistance of the connected load can only be operated if the device is supplied via an AC voltage supply or a DC voltage supply of at least 24 V. If the supply voltage falls below 24 V, the maximum resistance for the connected load is 300 ohm.

7 Operating and display elements

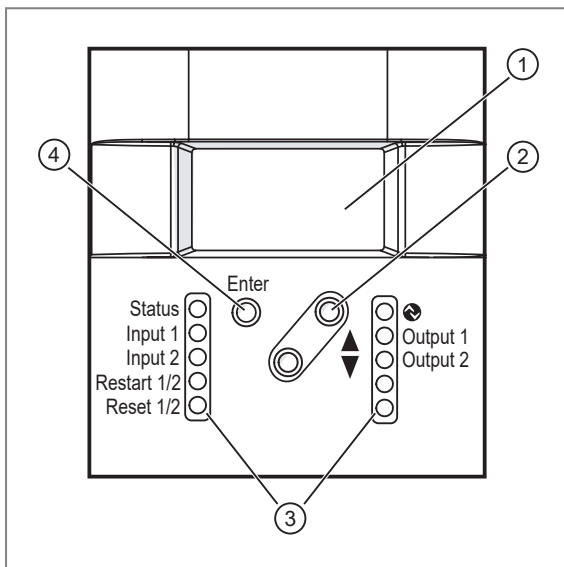


Fig. 18: Operating and display elements

- 1: Display
- 2: Up [▲] and down [▼] arrow buttons
 - Select a parameter.
 - Change a parameter (hold button pressed).
 - Change the displayed value in operating mode.
 - Lock / Unlock (buttons pressed simultaneously > 10 s).
- 3: LEDs
- 4: Enter button [●]
 - Change from the operating mode to the main menu.
 - Change to the parameter setting mode.
 - Apply the set parameter value.

7.1 Display

7.1.1 Screensaver / standby mode

In order to maintain a constant screen brightness throughout the lifetime of the device, the OLED display turns itself off after 30 seconds without user interaction.

Press any button to switch the display on again. This first button operation during screensaver mode will only activate the display; the original function of the button will be ignored for this one button operation.



Even if no values and units are visible, the device continues its monitoring function on the basis of the set parameters and switches the relay and transistor outputs accordingly.

7.2 Display in operating mode

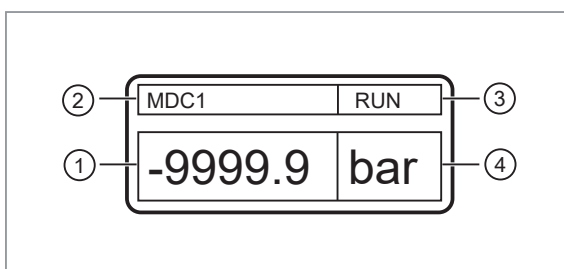
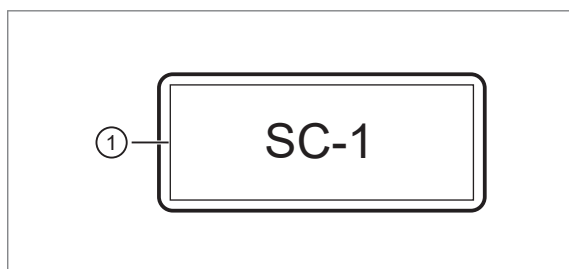


Fig. 19: Display in operating mode

- 1: Indication of the current measured value or output value
 - [MDC1] + [ScAL.M1] [Basic settings \(→ 23\)](#)
 - [MDC2] + [ScAL.M2] [Basic settings \(→ 23\)](#)
 - [OUT3]
 - No Data - currently no measured value
- 2: Indication of the selected channel:
 - [MDC1]
 - [MDC2]
 - [OUT3]
- 3: Indication of the current mode:
 - [RUN] in operating mode
 - [Menu] in parameter setting mode
- 4: Indication of the unit of measurement:
 - [c.uni1] [Basic settings \(→ 23\)](#)
 - [c.uni2] [Basic settings \(→ 23\)](#)
 - [mA] (if displaying output current at OUT3)

7.3 Display of error messages



1: Display of error messages

Fig. 20: Display of error messages

If an event such as a short circuit at output 1 is triggered, it will be displayed instead of the process data.

What the different events mean is described under [Troubleshooting](#) (→ [34](#)).

7.4 LEDs

LED	Function	Colour	State	Description
Status	Status	Green	Off	Device switched off.
			On	Device ready for operation.
			Double flashing	IO-Link localisation.
		Red	On	Device hardware fault.
			Flashing	Malfunction due to external factors → IO-Link events or display.
Input 1	Analogue input 1	Yellow	Off	- Value below or above measuring range. - Probe not available.
			On	Analogue signal in the measuring range.
			Double flashing	IO-Link localisation.
Input 2	Analogue input 2	Yellow	Off	- Value below or above measuring range. - Probe not available.
			On	Analogue signal in the measuring range.
			Double flashing	IO-Link localisation.
Restart 1/2	Restart input 1/2	Yellow	Off	Input inactive.
			On	Input active or input pulses ≥ 50 Hz.
			Flashing	Input pulses < 50 Hz.
			Double flashing	IO-Link localisation.
Reset 1/2	Reset input 1/2	Yellow	Off	Input inactive.
			On	Input active or input pulses ≥ 50 Hz.
			Flashing	Input pulses < 50 Hz.
			Double flashing	IO-Link localisation.
	IO-Link	Green	Off	No IO-Link communication.
			On	IO-Link communication.
			Double flashing	IO-Link localisation.
Output 1	Digital output 1	Yellow	Off	Output inactive.
			On	Output active.
			Flashing with 4 Hz	Short circuit.
			Double flashing	IO-Link localisation.
Output 2	Digital output 2	Yellow	Off	Output inactive.

LED	Function	Colour	State	Description
Output 2	Digital output 2	Yellow	On	Output active.
			Flashing with 4 Hz	Short circuit.
			Double flashing	IO-Link localisation.

Error signals and diagnostics under [Troubleshooting](#) (→ [34](#)).

8 Menu

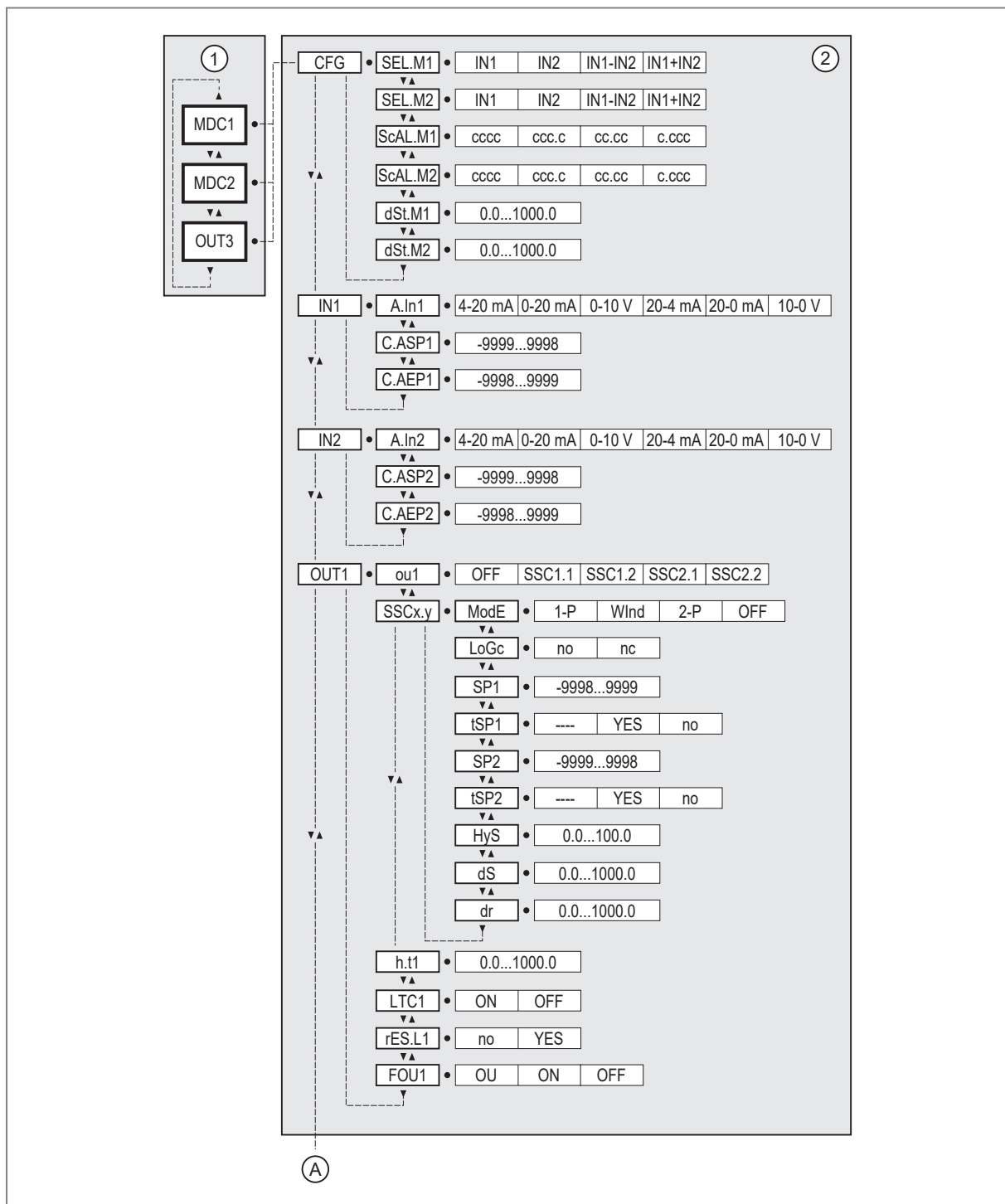


Fig. 21: Parameter setting mode part 1

- 1: Operating mode
- 2: Parameter setting mode
- A: Continuation of parameter setting mode

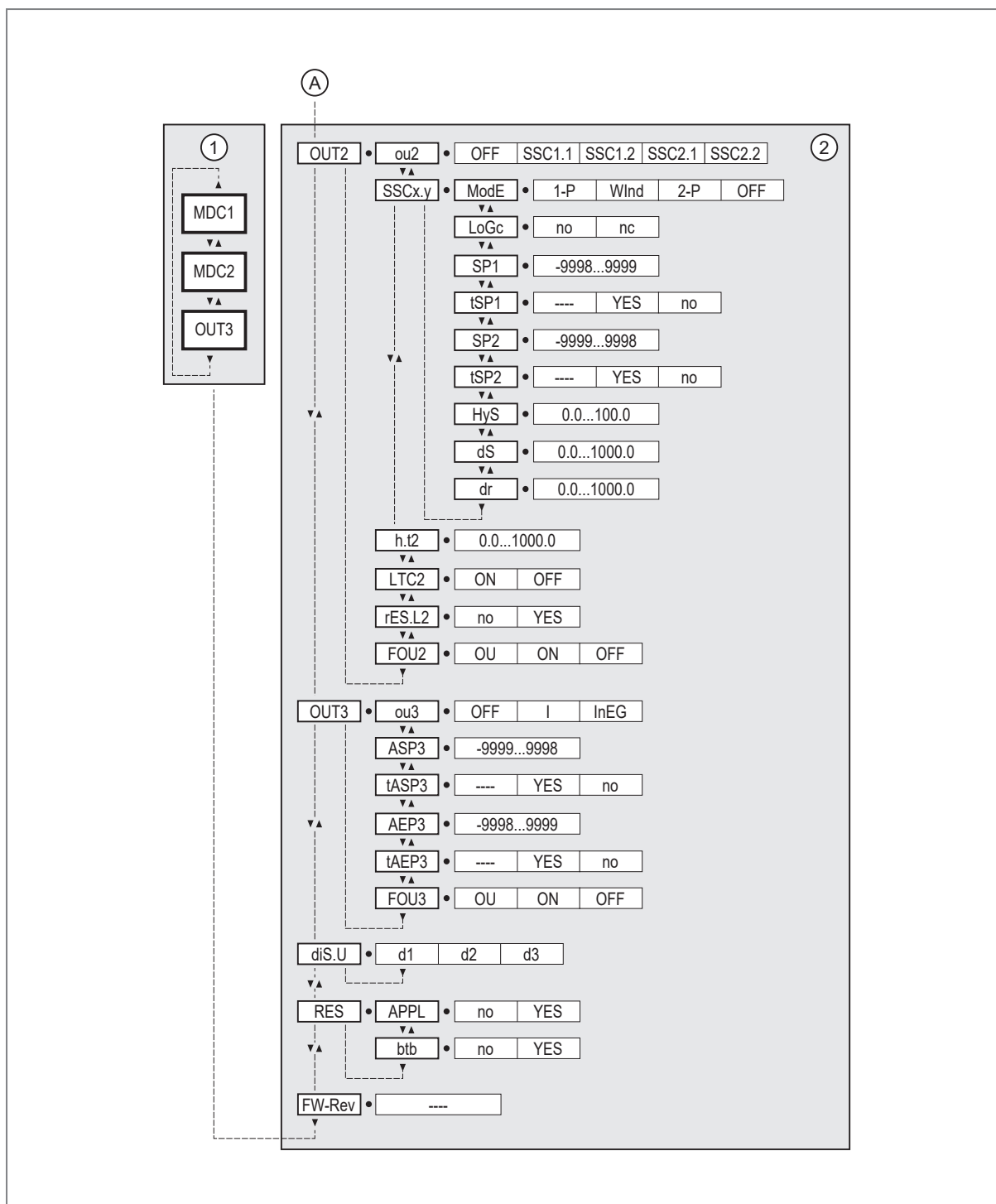


Fig. 22: Parameter setting mode part 2

A: Continuation of parameter setting mode

1: Operating mode

2: Parameter setting mode

---: Indicates a non configurable value (current measured value or firmware version)

9 Parameter setting

Parameter setting can be carried out via the IO-Link interface or via the operating elements on the unit.

Access via an IO-Link tool has a higher priority than parameter setting via the menu.



Parameter cloning and parameter setting backup is possible with an IO-Link tool.



Some parameters can only be set via the IO-Link interface.



During parameter setting the unit remains in the operating mode. It continues its monitoring functions with the existing parameters until the parameter setting has been completed.

9.1 Parameter setting via the device keys

Each parameter setting consists of 6 steps:

Step		Key
1	Change from operating mode to parameter setting mode.	[•]
2	Select the required parameter [ou1], [SP1]...	[▲] or [▼]
3	Change to the parameter setting mode of the parameter.	[•]
4	Select or change the parameter value. Wait until it stops flashing.	[▲] or [▼]
5	Acknowledge the set parameter value.	[•]
6	Return to the operating mode.	[▲] and [▼]

9.2 Notes on programming

9.2.1 Timeout

If no button is pressed for 30 s during parameter setting, the unit returns to the operating mode with the unchanged value.

9.2.2 Locking / unlocking

The device can be locked electronically to prevent unauthorised setting. Set parameter values and settings can be displayed but not changed.

Local locking:

- Make sure that the device is in normal operating mode.
- Press [▲] + [▼] simultaneously for 10 s.
- ▷ [Loc] is displayed.
- ▷ The device is locked.
- ▷ [Loc] is briefly displayed if you try to change parameter values.

The parameter values can still be changed via IO-Link.

To unlock the device:

- Press [▲] + [▼] simultaneously for 10 s.
- ▷ [uLoc] is displayed.

On delivery the device is not locked.



If [C.Loc] is displayed when an attempt is made to modify a parameter value via the keys, parameter setting via IO-Link is active (temporary locking).



If [S.Loc] is displayed, the device is permanently locked via software. This locking can only be removed using an IO-Link parameter setting software.

9.3 Parameter overview

9.3.1 Basic settings

	Menu	Description
[C.uni#]	-	Customer-specific unit with max. 4 characters. This unit is assigned to the corresponding MDC and shown on the display.
[SEL.M#]	[SEL.M#]	Selection of the source for the corresponding MDC. Only MDC1 can be provided via the analogue output.
[IN1]	[IN1]	Process data value at input 1, is assigned to MDC#.
[IN2]	[IN2]	Process data value at input 2, is assigned to MDC#.
[IN1+IN2]	[IN1+IN2]	The sum of the process data values at input 1 and input 2 is assigned to MDC#.
[IN1-IN2]	[IN1-IN2]	The difference between the process data values at input 1 and input 2 is assigned to MDC#.
[dST.M#]	[dST.M#]	Start-up delay time that affects the corresponding MDC.
[ScAL.M#]	[ScAL.M#]	Sets the decimal place in the display for the corresponding MDC. IO-Link transmission and parameter values are not affected. Example: selection of c.ccc on display 12.345
[cccc]	[cccc]	Value without decimal place.
[ccc.c]	[ccc.c]	Value with 1 decimal place.
[cc.cc]	[cc.cc]	Value with 2 decimal places.
[c.ccc]	[c.ccc]	Value with 3 decimal places.

= [1, 2] = number of the MDC (measurement data channel)



When changing [SEL.M#], the signal level for the inactive switching state is briefly present at the outputs (high for "low active", low for "high active").

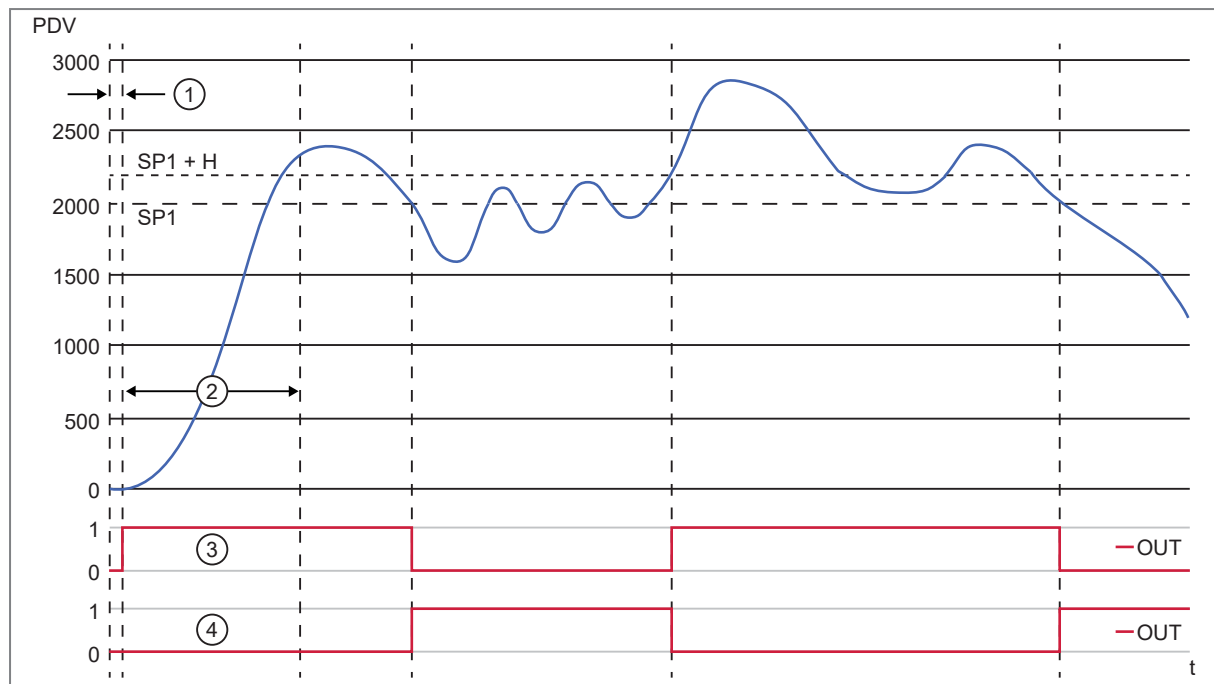


Fig. 23: Function diagram start-up delay

- | | |
|------------------------|--------------------|
| 1: Power-on delay time | 2: Start-up delay |
| 3: Normally open | 4: Normally closed |

The start-up delay dSt suppresses the output signal during the set time.

The start-up delay is active from the rising edge of the input signal. The input signal can come from one of the 3 following signal sources. The dSt time runs from the falling edge. The dSt time also runs automatically after power-on of the device if no signal is present at the following signal sources.

Signal sources:

- restart input (Restart 1/2) refers to both MDCs,
- restart bits in PDO (one bit per MDC available),
- CSC bits in PDO (one bit per MDC available).

9.3.2 Output configuration (analogue / digital)

Menu	Menu	Description
[ou#]	[ou#]	Signal source for the corresponding digital output.
[SSC1.1]	[SSC1.1]	Switching channel 1 of MDC1.
[SSC1.2]	[SSC1.2]	Switching channel 2 of MDC1.
[SSC2.1]	[SSC2.1]	Switching channel 1 of MDC2.
[SSC2.2]	[SSC2.2]	Switching channel 2 of MDC2.
[ou3]	[ou3]	Configure analogue output.
[I]	[I]	4...20 mA current output (start point 4 mA, end point 20 mA).
[InEG]	[InEG]	20...4 mA current output (start point 20 mA, end point 4 mA).
[FOU#]	[FOU#]	Defines the response of the outputs in case of a fault.
[OU]	[OU]	In case of a fault, the output follows the normal operation according to the settings.
[On]	[ON]	In case of a fault, the output is set to high.
[OFF]	[OFF]	In case of a fault, the output is set to low.
[FOU3]	[FOU3]	Defines the response of [ou3] in case of a fault.

☹	Menu	Description
[OU]	[OU]	In case of a fault, the output follows the normal operation according to the settings.
[On]	[ON]	The output provides 21.1 mA in case of a fault.
[OFF]	[OFF]	The output provides 3.5 mA in case of a fault.

= [1, 2] = number of the output

9.3.3 Digital outputs

☹	Menu	Description
[h.t#]	[h.t#]	Hold time of the active switching state at OUT#.
[LTC#]	[LTC#]	Latch of the active switching signal at OUT#.
[ON]	[ON]	If the switching condition is met, the output is permanently kept in the active switching state. It must be reset manually via the assigned physical digital input (Reset 1/2), IO-Link ([Reset Latch1] / [Reset Latch2]) or the menu ([rES.L1] / [rES.L2]).
[OFF]	[OFF]	The output is automatically reset to the inactive switching state if the switching condition is no longer met.

= [1, 2] = number of the output

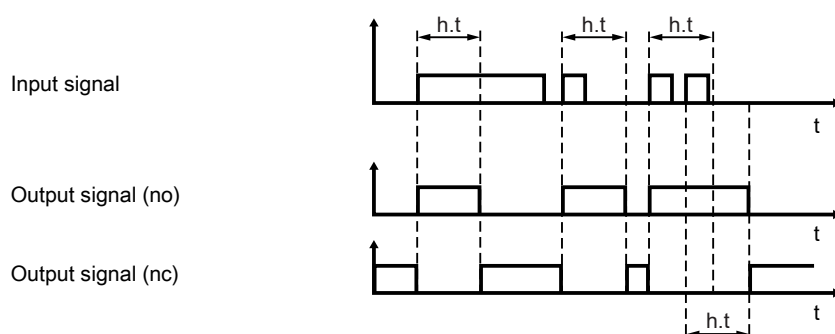


Fig. 24: Function diagram for the hold time h.t#

9.3.4 Analogue output

☹	Menu	Description
[ASP3]	[ASP3]	Analogue start point. This value refers to the start point of the configuration of analogue output [ou3].
[AEP3]	[AEP3]	Analogue end point. This value refers to the end point of the configuration of analogue output [ou3].

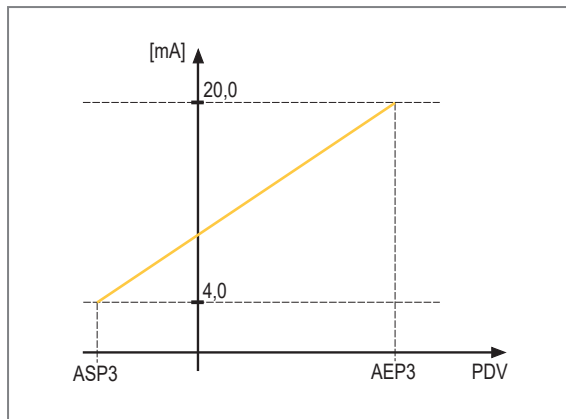


Fig. 25: Non-negated output, [ou3] = I

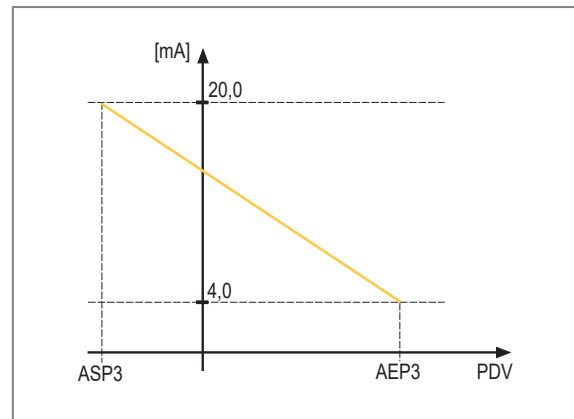


Fig. 26: Negated output, [ou3] = InEG



The source is always MDC 1.

9.3.5 Analogue input

☹	Menu	Description
[A.In#]	[A.In#]	Configuration of the analogue input.
[4-20 mA]	[4-20 mA]	Measuring range: start point 4 mA, end point 20 mA.
[0-20 mA]	[0-20 mA]	Measuring range: start point 0 mA, end point 20 mA.
[0-10 V]	[0-10 V]	Measuring range: starting point 0 V, end point 10 V.
[20-4 mA]	[20-4 mA]	Measuring range: start point 20 mA, end point 4 mA.
[20-0 mA]	[20-0 mA]	Measuring range: start point 20 mA, end point 0 mA.
[10-0 V]	[10-0 V]	Measuring range: start point 10 V, end point 0 V.
[C.ASP#]	[C.ASP#]	Customer-specific analogue start point. PDV when reaching the start point of the analogue input [A.In#].
[C.AEP#]	[C.AEP#]	Customer-specific analogue end point. PDV when reaching the end point of the analogue input [A.In#].

= [1, 2] number of the input

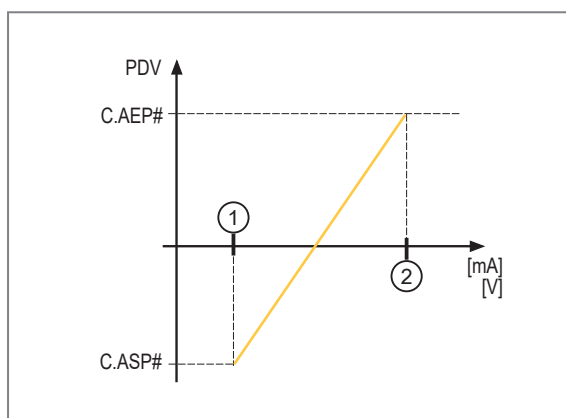


Fig. 27: Non-negated input, [A.IN#] = 4-20 mA, 0-20 mA, 0-10 V

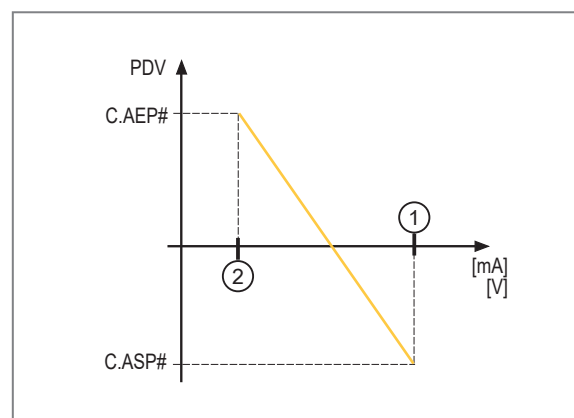


Fig. 28: Negated input, [A.IN#] = 20-4 mA, 20-0 mA, 10-0 V

1: Start of the measuring range

2: End of the measuring range



If the input configuration is changed, the signal level for the inactive switching state is briefly present at the outputs (high for “low active”, low for “high active”).

9.3.6 Configuration of the switching outputs

The device provides digital switching signals via switching signal channels (SSC = Switching Signal Channel).

The device has 2 digital switching signal channels SSCx.1 and SSCx.2 for each process value:



Explanation of the numbering of the switching signal channels SSCx.y:
x = process value; y = switching signal channel

The switching channels can be analysed via the IO-Link interface and the hardware outputs.

The parameters for each switching signal channel can be set individually.

The switch point mode, switch points and the switch point logic are set when the switching signal channel parameters are set.

Switch-point mode [SSCx.y] → [ModE]

You can choose between the following switch point modes according to the IO-Link smart sensor profile – Function Class “Object Detection”:

- [Deactivated]
- [Single Point Mode]
- [Two Point Mode]
- [Window Mode]

The switching signal channel changes to the active state depending on the process data value (PDV).

The active state is above the switch point in [Single Point Mode] and [Two Point Mode] and within the window section in [Window Mode].

Switch-point logic [SSCx.y] → [LoGc]

By setting the switch point logic [High active] or [Low active], you can specify which value the switching signal channel has in the active state:

- [High active]: The switching signal channel is “high” in the active state (= ON = normally open = 1)
- [Low active]: The switching signal channel is “low” in the active state (= OFF = normally closed = 0)

The following figures show the status of the switching signal channels depending on the switch point mode, switch point logic and process data value (PDV).

Deactivated

If the [Deactivated] switch point mode is set for a switching signal channel, then the switching signal channel will permanently have the following value regardless of the process value:

- For switch point logic [High active]: permanently “low”.
- For switch point logic [Low active]: permanently “high”.

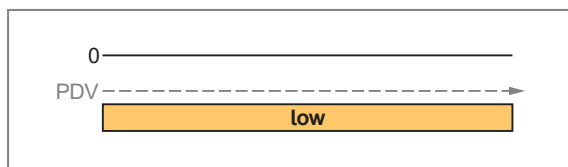


Fig. 29: [Deactivated] / [High active]

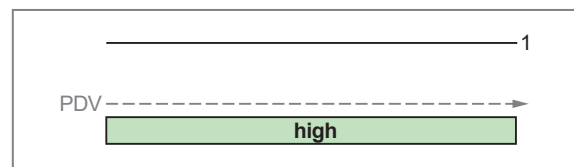


Fig. 30: [Deactivated] / [Low active]

Single Point Mode

Only one switch point (SP1) is manually set or taught.

The reset point (SP1-H) results from the switch point and the set hysteresis.

When teaching, the switch point is set below the taught process value (TP1) by the hysteresis.

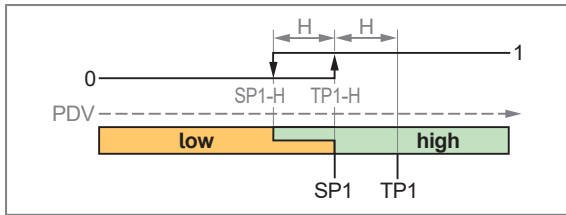


Fig. 31: [Single Point Mode] / [High active]

H: Hysteresis
 SP1: Switch point
 TP1: Teach point
 TP1-H: Switch point during teach (= SP1)
 SP1-H: Reset point

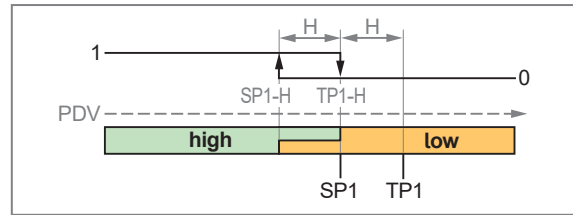


Fig. 32: [Single Point Mode] / [Low active]

H: Hysteresis
 SP1: Switch point
 TP1: Teach point
 TP1-H: Switch point during teach (= SP1)
 SP1-H: Reset point

Two Point Mode

One switch point SP1 and one switch point SP2 are manually set or taught.

SP1 must be greater than SP2. Thus, switch point 2 is always the reset point.

When teaching, the switch point is set directly to the taught process value. The following applies:
 [Teach SP1] sets SP1, [Teach SP2] sets SP2.

The hysteresis will be ignored in Two Point Mode.

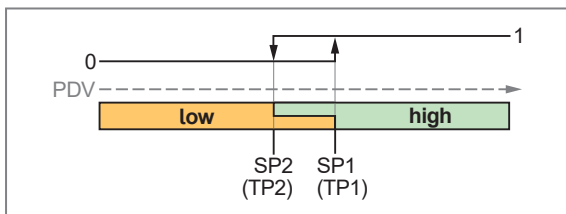


Fig. 33: [Two Point Mode] / [High active]

SP1: Switch point 1
 SP2: Switch point 2
 TP1: Teach point 1 (= SP1)
 TP2: Teach point 2 (= SP2)

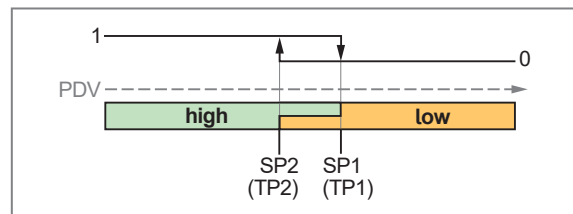


Fig. 34: [Two Point Mode] / [Low active]

SP1: Switch point 1
 SP2: Switch point 2
 TP1: Teach point 1 (= SP1)
 TP2: Teach point 2 (= SP2)

Window mode

Two switch points (SP1) and (SP2) are manually set or taught.

The two switch points define a window area.

SP1 must be greater than SP2. Thus, switch point 2 is always the reset point.

When teaching, the switch point is set directly to the taught process value. The following applies:
 [Teach SP1] sets SP1, [Teach SP2] sets SP2.

When the process data value enters the window area, the status of the switching signal channel changes immediately when the switch points are exceeded/not reached.

If the process data value leaves the window area, the status of the switching signal channel changes when the switch point plus hysteresis (SP1+H or SP2-H) is exceeded/not reached.

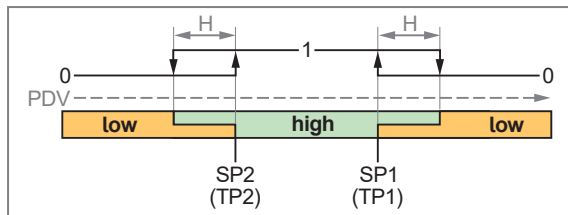


Fig. 35: [Window Mode] / [High active]

H: Hysteresis
 SP1: Switch point 1
 SP2: Switch point 2
 TP1: Teach point 1 (= SP1)
 TP2: Teach point 2 (= SP2)

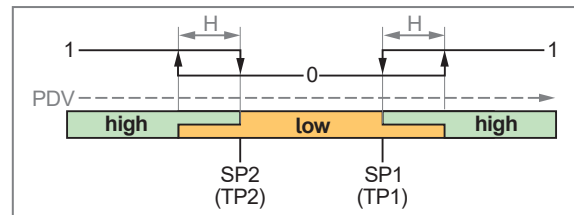


Fig. 36: [Window Mode] / [Low active]

H: Hysteresis
 SP1: Switch point 1
 SP2: Switch point 2
 TP1: Teach point 1 (= SP1)
 TP2: Teach point 2 (= SP2)

Switching the switching channels on and off can be delayed with the [dS] switching delay and [dr] switch-off delay parameters.

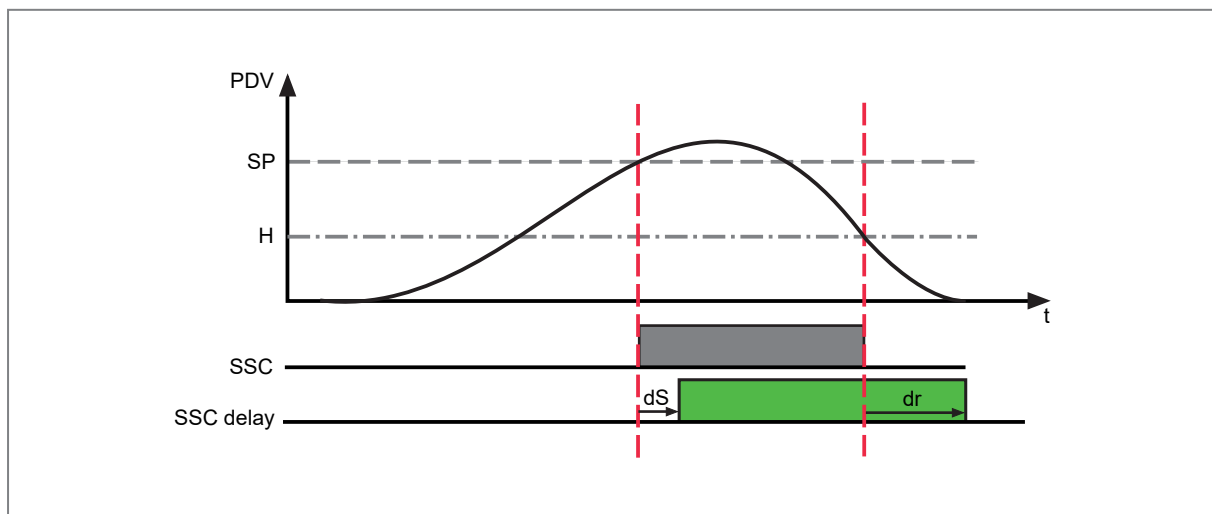


Fig. 37: Example of a switching delay in single point mode with quantity detection

	Menu	Description
[SSCx.y Config.Mode]	[ModE]	Sets the switch-point mode of the SSC channel.
[Deactivated]	[OFF]	No use of switch points (SSC always "inactive").
[Single point]	[1-P]	Use of switch point SP1 for switching with hysteresis for resetting (see 9.6.3 Single point).
[Window]	[WInd]	Window function using SP1, SP2 and the hysteresis at both switch points (see 9.6.3 Window mode)
[Two point]	[2-P]	Use of switch point SP1 for switching and SP2 for resetting (see 9.6.3 Two point)
[SSCx.y Config.Logic]	[LoGc]	Sets the switch-point logic.
[High active]	[no]	When active, "high" is provided at the output.
[Low active]	[nc]	When active, "low" is provided at the output.
[SSCx.y Config.Hyst]	[HyS]	Sets the hysteresis for switch points SP1 and SP2.
[SSCx.y Param.SP1]	[SP1]	Threshold for the upper / highest switch point.
[SSCx.y Param.SP2]	[SP2]	Threshold for the lower / smaller switch point.
[SSCx.y Delay.ds]	[dS]	Delay of the SSC bit / output when switching from inactive to active.
[SSCx.y Delay.dr]	[dr]	Delay of the SSC bit / output when switching from active to inactive.

x.y = [1, 2]. [1, 2] = [Number of the PDV].[Number of the switching channel]

9.3.7 Display settings

	Menu	Description
[diS.U]	[diS.U]	Refresh rate of the device display.
[d1]	[d1]	Fast refresh rate.
[d2]	[d2]	Medium refresh rate.
[d3]	[d3]	Slow refresh rate.
[Loc]	-	This lock prevents the settings from being changed via the local operating elements on the device. [Loc] can be reset on the device. See also Locking / unlocking (→ □ 22).
[Loc]	-	Local control element is locked. The device settings cannot be changed via the local control element.
[uLoc]	-	Local control element is unlocked. The device settings can be changed via the local control element.
[Device access locks.local parameterization]	-	This lock prevents the settings from being changed via the local operating elements on the device. [S.Loc] cannot be reset on the device. See also Locking / unlocking (→ □ 22).
[Locked]	-	Local control element is locked. The device settings cannot be changed via the local control element.
[Unlocked]	-	Local control element is unlocked. The device settings can be changed via the local control element.

9.3.8 Diagnostics

	Menu	Description
[Operating hours]	-	Only counts full operating hours. Operating times of less than one full hour are not saved. Counter values are saved permanently.
[Internal temperature]	-	Reads the data from the internal temperature sensor of the microcontroller.

9.3.9 Identification

	Menu	Description
[Application-Specific Tag]	-	Customer-specific application description, max. 32 ASCII characters long.
[Function Tag]	-	Customer-specific application description, max. 32 ASCII characters long.
[Location Tag]	-	Customer-specific application description, max. 32 ASCII characters long.
[Product URI]	-	Represents a unique instance identification according to DIN-SPEC 91406, max. 100 characters. The value is device-dependent and cannot be changed.

9.4 System commands

	Menu	Description
[Teach SP1] [Teach SP2]	[tSP1] [tSP2]	Adopts the current process data value for SP1 or SP2 of the selected SSC. See Configuration of the switching outputs (→ □ 27)

	Menu	Description
[Teach ASP3]	[tASP3]	Adopts the current process data value for ASP3 as the start point for the analogue signal. See Analogue output (→ □ 25)
[Teach AEP3]	[tAEP3]	Adopts the current process data value for AEP3 as the end point for the analogue signal. See Analogue output (→ □ 25)
[Back-to-box]	[btb]	Reset to factory settings. The following is reset: • All changed application-specific parameters and teaches. • All writeable device identification parameters such as Application Specific Tag, Function Tag or Location Tag. • Diagnostic parameters, status parameters, events. After the back-to-box reset, the device suspends communication until the voltage is interrupted. It is still possible to switch the outputs. The IO-Link data storage is not triggered.
[Reset application]	[APPL]	Reset of the parameter settings. The following is reset: • All changed application-specific parameters and teaches. If IO-Link data storage is activated, this triggers a parameter update in the master. The parameters configured in the master will be written to the device again. An application reset may therefore be ineffective.
[Locator Start]	-	The visual indicators of the device are switched to the localisation display pattern, making it easier to spot a device in an application.
[Locator Stop]	-	The localisation display pattern is stopped. The visual indicators of the device show the device-specific operating states again.
[Reset Latch1] [Reset Latch2]	[rES.L1] [rES.L2]	Resets the latch LTC of the respective output.

9.5 Parameter setting example

Below is a parameter setting example for switching the fuel supply from two different tanks.

Application: A multi-fuel generator is supplied from a vegetable oil tank and a diesel tank. Vegetable oil should preferably be used. If the vegetable oil tank is empty, the system switches to diesel tank supply. In order to estimate the remaining operating time, the combined level of the two tanks must also be determined. The levels in the tanks are determined using distance sensors. Measuring range of the distance sensors: 80...1200 mm

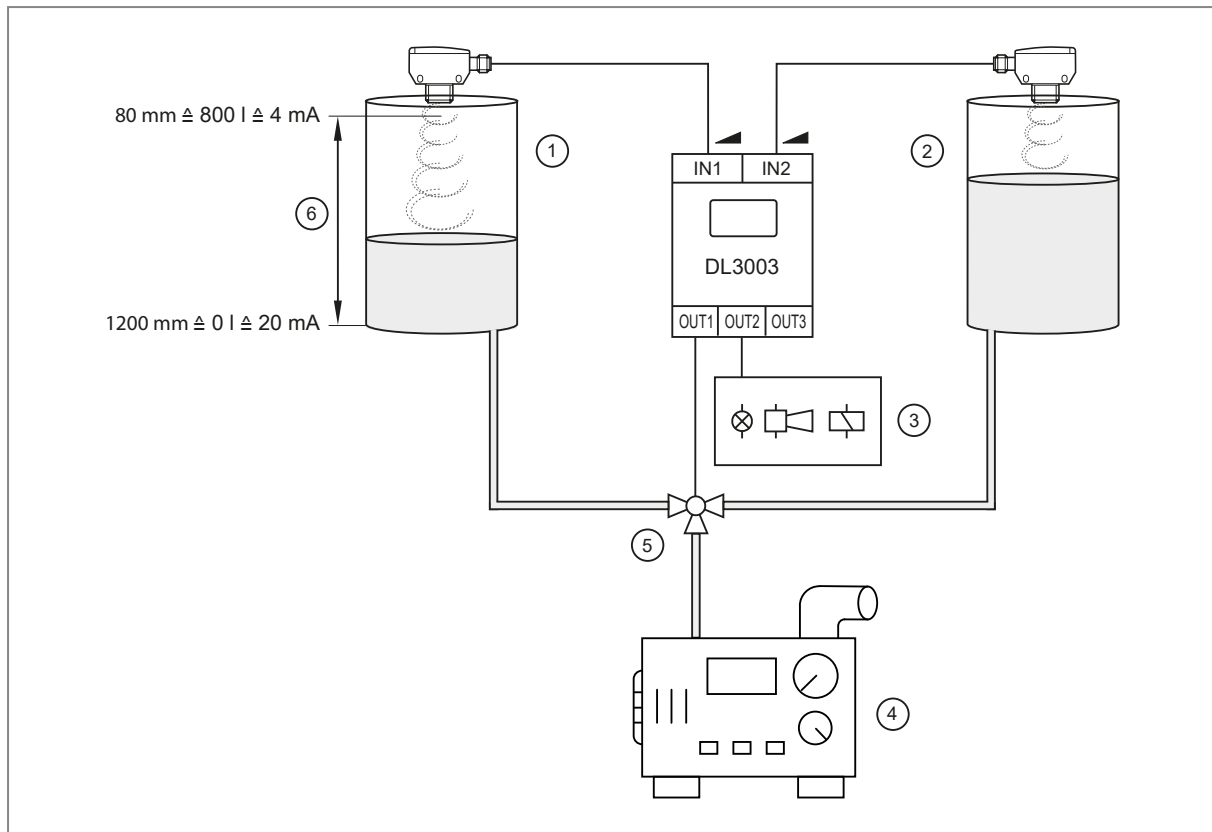


Fig. 38: Switching the fuel supply from 2 different tanks

- | | |
|----------------------------|----------------------------------|
| 1: Tank with vegetable oil | 2: Tank with diesel |
| 3: Signal transmitter | 4: Multi-fuel generator |
| 5: Changeover valve | 6: Measuring range of the sensor |

Example configuration:

Parameter		Value	Description
[CFG]	[SEL.M1]	[IN1]	Distance from the sensor to the vegetable oil in [MDC1]
	[SEL.M2]	[IN1+IN2]	Both distances added in [MDC2]
	[ScAL.M1]	[ccc.c]	One decimal place on the display
	[ScAL.M2]	[ccc.c]	One decimal place on the display
Vegetable oil:			
[IN1]	[A.In1]	[20-4 mA]	Inverts the measuring range to convert distance to level
	[C.ASP1]	0	Value in the device with a sensor signal of 20 mA (in this case 0.0 litres)
	[C.AEP1]	8000	Value in the device with a sensor signal of 4 mA (in this case 800.0 litres)
Diesel:			
[IN2]	[A.In2]	[20-4 mA]	Inverts the measuring range to convert distance to level
	[C.ASP2]	0	Value in the device with a sensor signal of 20 mA (in this case 0.0 litres)
	[C.AEP2]	8000	Value in the device with a sensor signal of 4 mA (in this case 800.0 litres)
Switch to diesel:			
[OUT1]	[ou1]	[SSC1.1]	Due to [SEL.M1] the level of the vegetable oil is in [MDC1]. If it falls below the threshold value, OUT1 switches to diesel.
	[SSC1.1]	[ModE]	[1-P] Single point mode. Switch when value falls below threshold.
		[LoGc]	[nc] Switch when value falls below threshold (not when it is exceeded).
		[SP1]	50 Switch to diesel if the level is below 4 litres (5 litres - 1 litre, hysteresis). Note: Due to [ScAL] the comma is not visible here nor in the process data or parameters.

Parameter			Value	Description
[OUT1]	[SSC1.1]	[HyS]	20	Hysteresis = 20% of SP1. → Switch to diesel when the level is below 4 litres. Switch back when the level is above 5 litres. (This prevents undesired switching due to wave movements of the fuel).
	[FOU1]		[ON]	Switch to diesel in case of a fault (e.g. sensor signal out of valid range).
				Total level warning:
[OUT2]	[ou2]		[SSC2.1]	The total level is in [MDC2] due to [SEL.M2]. If it falls below the threshold value, OUT2 switches to diesel.
	[SSC2.1]	[ModE]	[2-P]	Two point mode: switch point and reset point.
		[LoGc]	[nc]	Switch when value falls below threshold (not when it is exceeded).
		[SP1]	1500	Activate warning signal if total level falls below 150 litres.
		[SP2]	1550	Deactivate warning signal if total level exceeds 155 litres.
	[FOU2]		[ON]	Activate warning signal in case of a fault (e.g. sensor signal out of valid range).

The total level in litres is displayed in operating mode if [MDC2] is selected.

The vegetable oil level can be output in 1/10 litres via IO-Link ([MDC1], [PDV1]).

The total level can be read in 1/10 litres via IO-Link ([MDC2], [PDV2]).

10 Troubleshooting

Display	LED / process data bit	Error	Troubleshooting
[SC-1]	Status: red (flashes at 1 Hz) OUT1: yellow (flashes at 4 Hz)	Short circuit / overload at digital output 1.	Remove short circuit / overload at digital output OUT1.
[SC-2]	Status: red (flashes at 1 Hz) OUT2: yellow (flashes at 4 Hz)	Short circuit / overload at digital output 2.	Remove short circuit / overload at digital output OUT2.
[SC-Fault]	Status: red (flashes at 1 Hz)	Short circuit / overload at transistor output.	Remove short circuit / overload at transistor output [Output fault for IN1/2].
[SC-SS]	Status: red (flashes at 1 Hz)	Short circuit / overload at sensor supply.	Remove short circuit / overload at sensor supply +.
[nPrb]	Status: red (flashes at 1 Hz) IN1: OFF Fault In1: high	No probe at analogue input 1.	Check probe.
	Status: red (flashes at 1 Hz) IN2: OFF Fault In2: high	No probe at analogue input 2.	Check probe.
	Status: red (flashes at 1 Hz) Fault OUT3: high	No load on analogue output.	Check load and parameter setting [ou3].
[OL]	Status: red (flashes at 1 Hz) IN1: OFF Fault In1: high	Measured value at analogue input 1 above measuring range.	Check input signal.
	Status: red (flashes at 1 Hz) IN2: OFF Fault In2: high	Measured value at analogue input 2 above measuring range.	Check input signal.
[UL]	Status: red (flashes at 1 Hz) IN1: OFF Fault In1: high	Measured value at analogue input 1 below measuring range.	Check input signal.
	Status: red (flashes at 1 Hz) IN2: OFF Fault In2: high	Measured value at analogue input 2 below measuring range.	Check input signal.
[Warn]	Status: red (flashes at 1 Hz)	Load for analogue output too high.	Check load.
[PARA]	Status: red (flashes at 1 Hz)	Invalid parameter set.	Check parameter settings.
[Err]	Status: red (flashes at 1 Hz) OUT1: OFF OUT2: OFF	Device temperature too high.	Reduce device temperature.
	Status: red (flashes at 1 Hz)		
	Status: red	Device faulty.	Replace the device.
	Status: OFF	Supply voltage too low.	Check/correct supply voltage.
	IN1: double flashing IN2: double flashing Restart: double flashing Reset: double flashing IOL: double flashing OUT1: double flashing OUT2: double flashing	Locator Start activated.	Deactivate locator.
[Loc]		Parameter setting via pushbuttons disabled.	Unlock pushbuttons: Locking / unlocking (→ p 22)
[C.Loc]		Parameter setting via pushbuttons locked due to active IO-Link parameter setting.	Wait until parameter setting via IO-Link is finished.
[S.Loc]		Parameter setting via pushbuttons disabled by software.	Unlocking only possible via IO-Link interface/IO-Link parameter setting software.



LEDs or process data bits that are not listed can exhibit any behaviour.

11 Maintenance, repair and disposal

11.1 Maintenance

The unit is maintenance-free.

11.2 Cleaning the housing surface

- ▶ Disconnect the device from the voltage supply.
- ▶ Clean the device from dirt using a soft, chemically untreated and dry micro-fibre cloth.

11.3 Repair

- ▶ The device must only be repaired by the manufacturer. Observe the safety instructions (→ 2 Safety instructions).

11.4 Disposal

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