



## ModulSensor Level

Type MSLUD




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## ● 1 For information

Read these operating instructions without fail before installing and starting the sensor. Keep the operating instructions in a place that is accessible to all users at any time. The following installation and operating instructions have been compiled with great care but it is not feasible to take all possible applications into consideration. These installation and operation instructions should meet the needs of most pressure measurement applications. If questions remain regarding a specific application, please contact the supplier of the device.

With special models please note specifications in the delivery note.

If the serial number gets illegible (e. g. by mechanical damage), the retraceability of the instrument is not possible any more. The sensors, described in this operating manual, are carefully designed and manufactured using state-of-the-art technology. Every component undergoes strict quality inspection in all stages of manufacture.

### Use the products in accordance with the intended use

Use the ultrasonic sensor to transform the distance into an electrical signal.

### Knowledge required

Install and start the sensor only if you are familiar with the relevant regulations and directives of your country and if you have the qualification required. You have to be acquainted with the rules and regulations on measurement and control technology and electric circuits, since this ultrasonic sensor is “electrical equipment” as defined by EN 50178. Depending on the operation conditions of your application you have to have the corresponding knowledge, e.g. of aggressive media.

## ● 2 Overview

The most important information on the product and for your safety you can get in chapters “Signs, abbreviations” (Chap. 3) and “Storage, disposal” (Chap. 5), “For your safety” (Chap. 7) and “Starting, operation” (Chap. 9).

**Read these chapters in any case.**

## ● 3 Signs, abbreviations



Warning

### Warning!

A non-observance can cause injuries to persons and/or can be a dangerous to life.



### Attention!

A non-observance can cause a faulty operation of the device or lead to demolition of the device.



### Information!

A non-observance can have influence on the operation of the device or cause unintentional reactions of the device.

U+:	Positive supply connection
U-:	Negative supply connection
SP1:	Switching point 1
SP2:	Switching point 2

## ● 4 Maintenance, accessories



The ultrasonic sensors MSLUD are maintenance-free.  
Have repairs performed by the manufacturer only.  
For necessary accessories please contact your supplier.

## ● 5 Storage, disposal



Warning

When storing or disposing the ultrasonic sensor, take precautions with regard to remaining media in removed ultrasonic sensors. It's recommended to clean the transmitter properly and carefully.



### Disposal

Dispose instrument components and packaging materials in accordance with the respective waste treatment and disposal regulations of the region or country to which the sensor is supplied

## ● 6 Function

The MSLUD has a sound exit opening which receives also the reflected sound waves. The transit time of this signal is a quantity for the distance to the measuring point. By means of the electronics with the power supply fed to the sensor, the measured transit time is converted to an electrical standard signal. This electric signal changes in proportion to the distance and can be evaluated correspondingly.

## ● 7 For your safety



Warning

Select the ultrasonic pressure sensor with regard to scale range, performance and specific measurement conditions prior to installing and starting the instrument.

Observe the relevant national regulations (e. g. standards) and observe the applicable standards and directives for special applications (e. g. with dangerous media such as acetylene, flammable gases or liquids and toxic gases or liquids and with refrigeration plants or compressors).

**If you do not observe the appropriate regulation, serious injuries and/or damage can occur!**

- Observe the ambient and working conditions outlined in chapter "Technical data" (pages 23, 24).
- Observe the technical data for the use of the ultrasonic sensor in connection with aggressive / corrosive media and for the avoidance of mechanical hazards.
- Ensure that the ultrasonic sensor is only operated in accordance with the provisions i. e. as described in the following instructions.
- Do not carry out changes or interferences with the ultrasonic sensor which are not described in these operating instructions.
- Remove the ultrasonic sensor from service and mark it to prevent it from being used again accidentally, if it becomes damaged or unsafe for operation.
- **Take precautions with regard to remaining media in removed ultrasonic sensors. Remaining media may be hazardous or toxic!**
- Have repairs performed by the manufacturer only.
- Open circuit before removing connector / cover

## ● 8 Before mounting

Check if a completely assembled ultrasonic sensor is supplied.



Inspect the ultrasonic sensor for possible damage during transportation. Should there be any obvious damage, inform the transport company and supplier without delay.

Keep the packaging, as it offers optimal protection during transportation.

Ensure that the mounting thread and the connection contacts will not be damaged.

## 9 Starting, operation (continued)

### 9.1 Product label (example)

Logo	OX 0-2-1-1-2-1-0	
Contact	SN : 774.04/10-4.0-001	Art.Nr.: 1500-00422
LRL : 300 mm	OUT : 4...20 mA HART	U+: 3
URL : 3000 mm	SUP. : 24 VDC	U+: 1 U-: 8
SP : 1xPNP	Date : 44/10	Made in Germany

OX... : Product code

Art.Nr.: Part number

LRL : Lower range limit

SN : Serial number

URL : Upper range limit

Date : Date of QC

U+ : Supply +

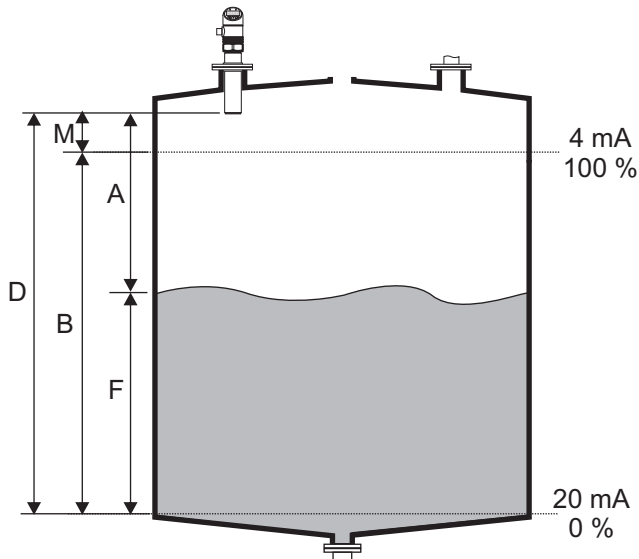
SP : Limit contact

U- : Supply -

OUT : Loop signal

SUP. : Range of voltage

### 9.2 Ultrasonic measuring principle



A: Distance from sensor membrane to product surface

F: Level

B: Measuring range (full distance)

M: Minimum distance from sensor membrane to maximum level

D: Empty distance

Principle of the signal transit time:

The sensor of the MSLUD transmits ultrasonic pulses in the direction of the product surface. There the ultrasonic pulses are reflected back and received by the sensor. The MSLUD measures the time (t) between pulse transmission and reception. By means of the velocity of sound the distance between the sensor membrane and the product surface is calculated.

$$A = c \text{ (velocity of sound)} \times t/2$$

The empty distance (D) is known, so that the level can be calculated.

$$F = D - A$$

A possible change in the velocity of sound, which is caused by a temperature change, is compensated by an integrated temperature sensor.

Minimum distance M: in this range the sensor cannot carry out distance measurements, because the level echoes cannot be evaluated due to the transient characteristics of the sensor.

### 9.3 Mechanical connection

Tools: wrench flats 36 (M30x1.5) / wrench flats 27 (M18x1)

Screw in or unscrew the instrument only via the flats using a suitable tool and the prescribed torque. The appropriate torque depends on the dimension of the sensor tube and the materials used (form/material).

Do not use the case as working surface for screwing in or unscrewing the instrument.

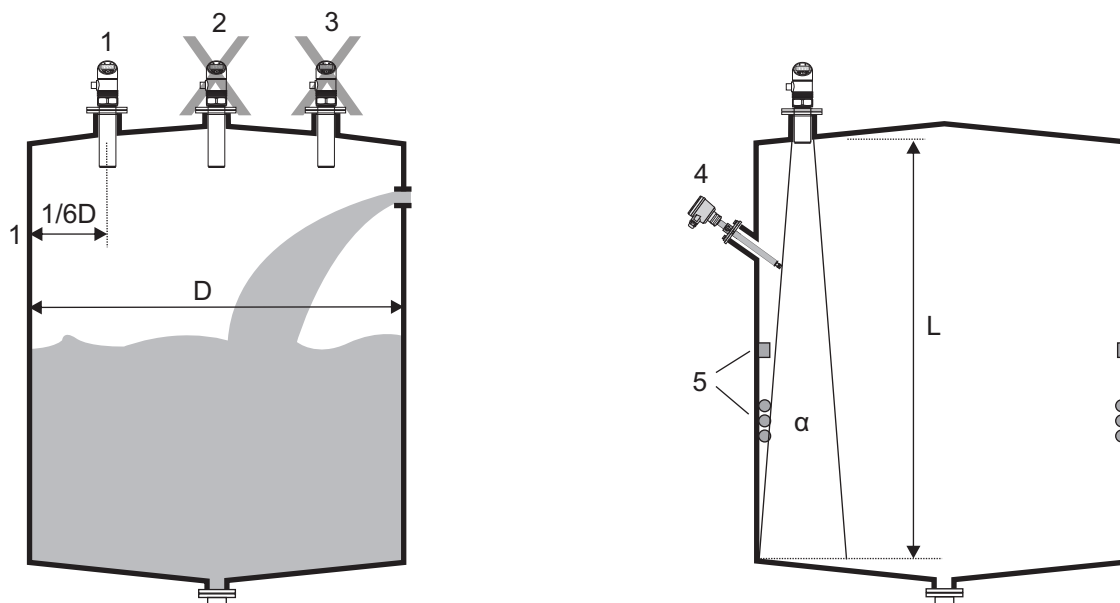
When screwing the device in, ensure that the threads are not jammed.

If necessary observe information about tapped holes and welding sockets.

More details about mounting see next page

## 9 Starting, operation (continued)

### Example: Conditions for level measurements



D = Tank diameter

L = max. coverage

$\alpha$  = Emitting angle of the sensor

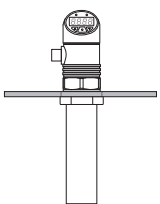
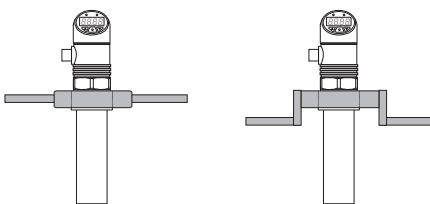
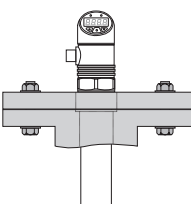
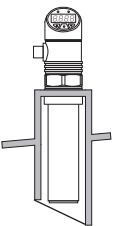
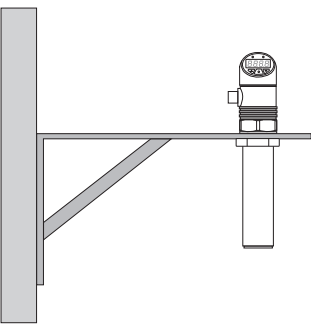
Do not mount the sensor in the middle of the tank (2). Advantageous is a distance between sensor and the tank wall of 1/6 of the tank diameter (1).

Avoid measurements through the filling curtain (3).

Things built in such as temperature sensors should not be within the emitting angle of the ultrasonic sensor (4). In particular symmetrical equipment such as heating coils or baffles (5) can influence measurement.

It is only allowed to use always one sensor in one tank as otherwise two signals may affect each other.

### Example: Mounting variants

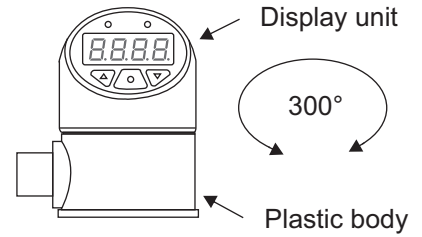
<p>Mounting with counter nut</p> 	<p>Mounting with sleeve</p> 	<p>Mounting with adaptor flange</p> 
<p>Mounting with connecting piece</p> 	<p>Mounting with mounting bracket</p> 	

● 9 Starting, operation (continued)

9.4 Adjusting the display unit

It is possible to turn the display unit approx. 300° to optimize the reading. To do so, hold the plastic body with one hand and turn the display unit with the other hand into the wanted position.

The turning angle is limited by an internal limit stop. Do not try to force the display beyond that point. It might be destroyed.



9.5 Electrical connection

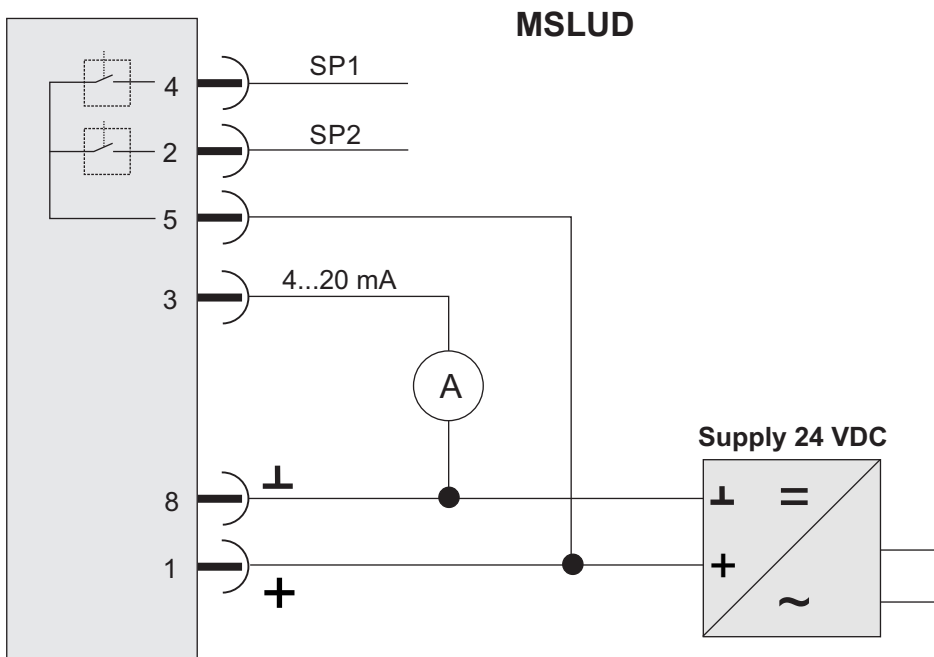


The ingress protection specified only apply while the sensor is connected with the female connectors that provide the corresponding ingress protection.

Route the cable without applying a force or turning moment to the device.

Assignment plug M12x1, 8-pole				
<p>4...20 mA HART</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">+</div> <div style="text-align: center;">-</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">3</div> <div style="border: 1px solid black; padding: 2px 5px;">8</div> </div>	<p>Electronic limit value contacts</p>	<p>Supply</p> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;">+</div> <div style="text-align: center;">-</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">8</div> </div>		

Example of electrical connection



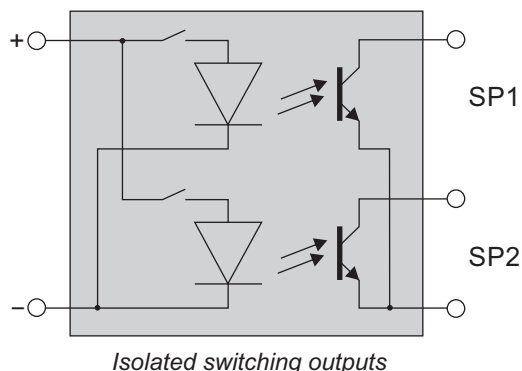
● 9 Starting, operation (continued)

9.6 Connecting the switching outputs

The switching outputs are potential-free. They are electrically isolated from the current loop (see right).

In case of using only one switching point it is possible to connect the load on both sides of the contact, e.g. NPN-style: load connected to high or low side (see below).

Use an appropriate recovery diode if you want to switch inductive loads.



Switching outputs with common on low side (NPN)		
Two outputs are used	One output is used, load on high	One output is used, load on low side

Switching outputs with common on high side (PNP)		
Two outputs are used	One output is used, load on high	One output is used, load on low side



## ● 9 Starting, operation (continued)

### 9.7 Functional test

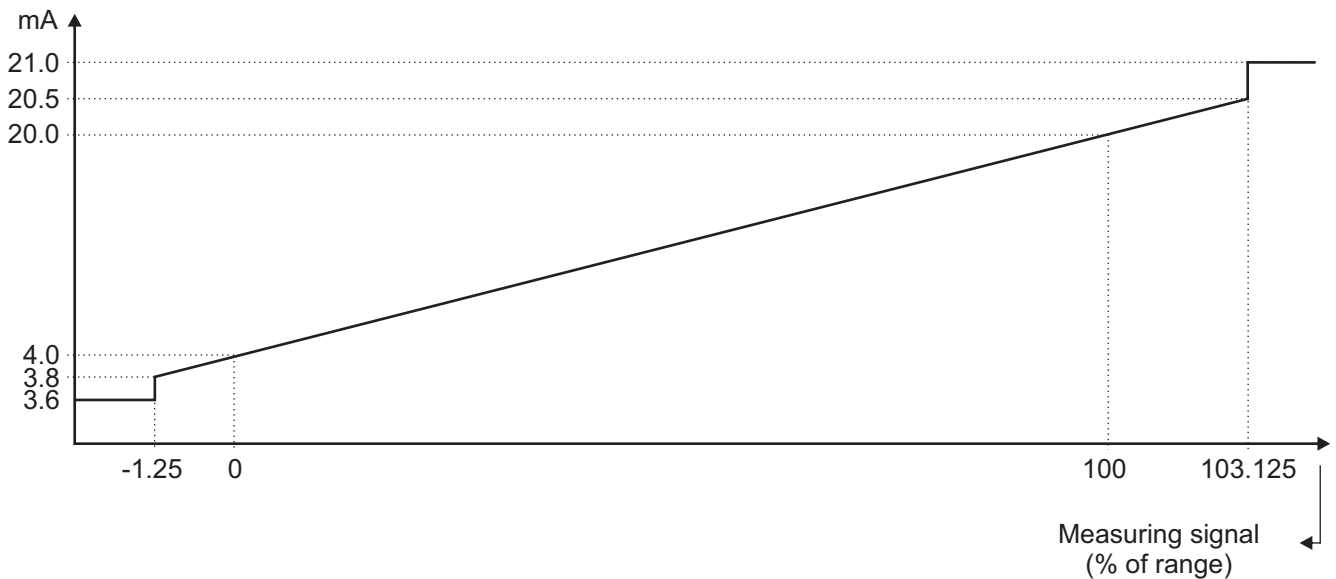
- The output signal must be proportional to the distance. If not, this might point to a wrong fitting position or configuration. In that case refer to chapter "Troubleshooting" (page 22).

### 9.8 Error detection / Error current

When using the maximum measuring range (LRL...URL) the output current is limited to 4...20 mA. The devices with 3-wire systems can use the error detection only when the used measuring range is smaller than the maximum measuring range. Example: maximum measuring range: 300...3500 mm (LRL...URL), used measuring range (turn-down): 450...3350 mm (LRV...URV). The device then detects wire break and short circuit (sensor element <> measuring amplifier) as well as distances outside of the measuring range and indicates this with an error current in the current loop circuit.

Then the current output is proportional to the pressure from 3.8 to 20.5 mA. If the measured pressure would result in a current below 3.8 mA the current output is set to 3.6 mA (also for a wire short circuit). If the current would exceed 20.5 mA, the current output is set to 21 mA (also for wire break).

If the device is equipped with switching outputs, these will be disabled if an error is detected for more than 10 seconds. This ensures that the switches are in a safe state, comparable to the of voltage supply.



Output current and measured signal

**10 Handling and Configuration**

Description of handling and configuration of the device with the three buttons on the head of display.

An overview of the menu tree is shown on page 21





The 3 buttons on the display head are working capacitive (no mechanical components), so there is no movement when pressing a button. The buttons are sensing the presence of a finger. Withdraw a finger at least 1 cm after pressing a button. This is useful for a proper detection of a key press.

The following description is for the configuration with the three buttons. The configuration via HART communication modem is described in a separate manual.

**10.1 System operating principles**

**10.1.1 System feedback to operator when buttons are pressed**

The LEDs for switching output are used to give a feedback to operator when buttons are pressed. This does not affect the switching outputs themselves. When no button is pressed the LEDs are showing the state of switching outputs.

Button		Feedback
	Arrow button down (left)	Left LED is flashing
	Arrow button up (right)	Right LED is flashing
	Both arrow buttons simultaneously	Both LEDs are flashing
	Center button	Both LEDs are flashing rapidly

*Feedback of the buttons*

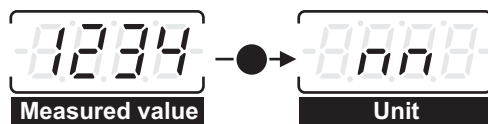
**10.1.2 Display mode / Measured value indication**

After power up the device starts in display mode. The current measured value is displayed or is displayed alternately with the unit (see 10.4.1).

The displayed value is flashing when the measured value is greater than the maximal presentable value. This can be caused by a fixed decimal point (see 10.4.3).

As long as the center button is pressed the selected unit will be displayed.

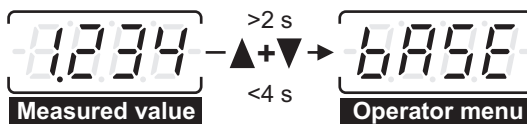
A single arrow button has no function in display mode.



*Indication of unit*

**10.1.3 Activating the configuration mode**

When pressing both arrow keys simultaneously for at least 2 s the configuration mode is entered. The first entry of the operator menu appears on the display (bASE). If both buttons are not released within 4 s the device switches back to display mode, showing the current measured value again.



*Activating the configuration mode*

## ● 10 Handling and configuration (continued)

### 10.1.4 Configuration mode / Operator menu

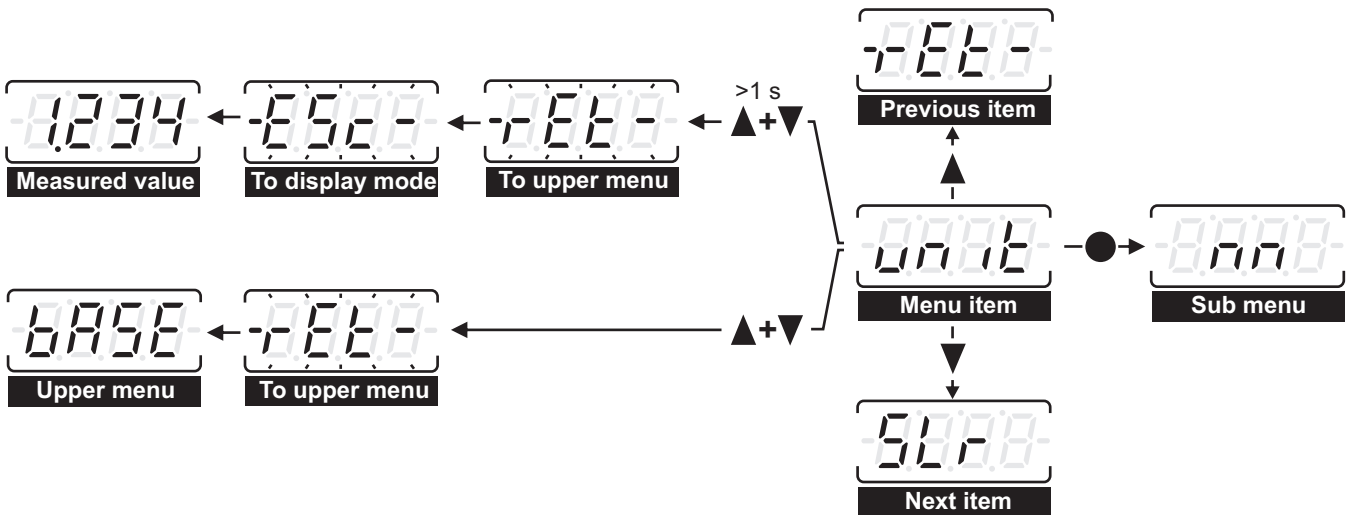
The configuration mode always starts with the first item of the main menu (bASE). Within the menu you navigate with the arrow buttons. The center button selects a menu item respectively enters a submenu. Menu items which just show a value (e.g. maximum pointer) can be exit to the next upper menu item with the center button.

Every menu has the item „rEt-“ (return) which allows you to go back to the next upper menu. In the main menu it goes back to the display mode.

At the end of a menu (typically „rEt-“) you return to the first menu item when pressing the down arrow button again. Similarly, you jump to the end of the menu when pressing the up arrow in the first menu item.

In each menu item it is possible to return to the next upper menu by pressing both arrow buttons simultaneously. The feedback is a flashing „rEt-“. When doing this for more than 1 s, the device returns to display mode with the feedback of a flashing „ESc-“ (escape).

If no button is pressed for 5 minutes in the configuration mode, the device automatically switches back to the display mode.



Configuration mode: Example operator menu

### 10.1.5 Setting values

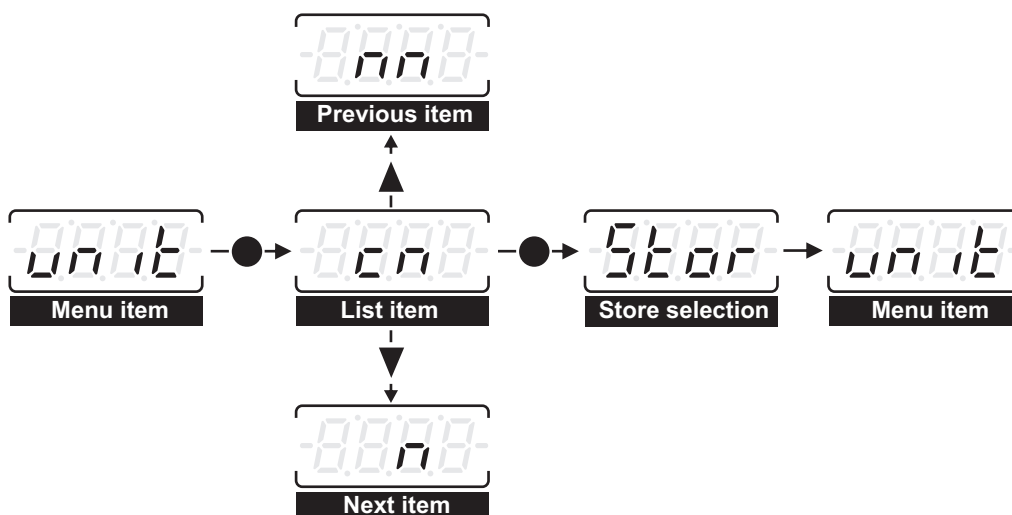
There are 2 types of values that can be altered:

- values which can be selected from a predefined parameter list
- numerical values

#### Selecting a value from a list

Parameter lists are used for example for the units. Within the list you navigate with the arrow buttons. With the center button a selected value is stored, confirmed with indicating „Stor“. After that the device is in the next upper menu.

The list can be left by pressing both arrow buttons simultaneously to the next upper menu without changing the present value.



Configuration mode: Example to select a value from a list

## 10 Handling and configuration (continued)

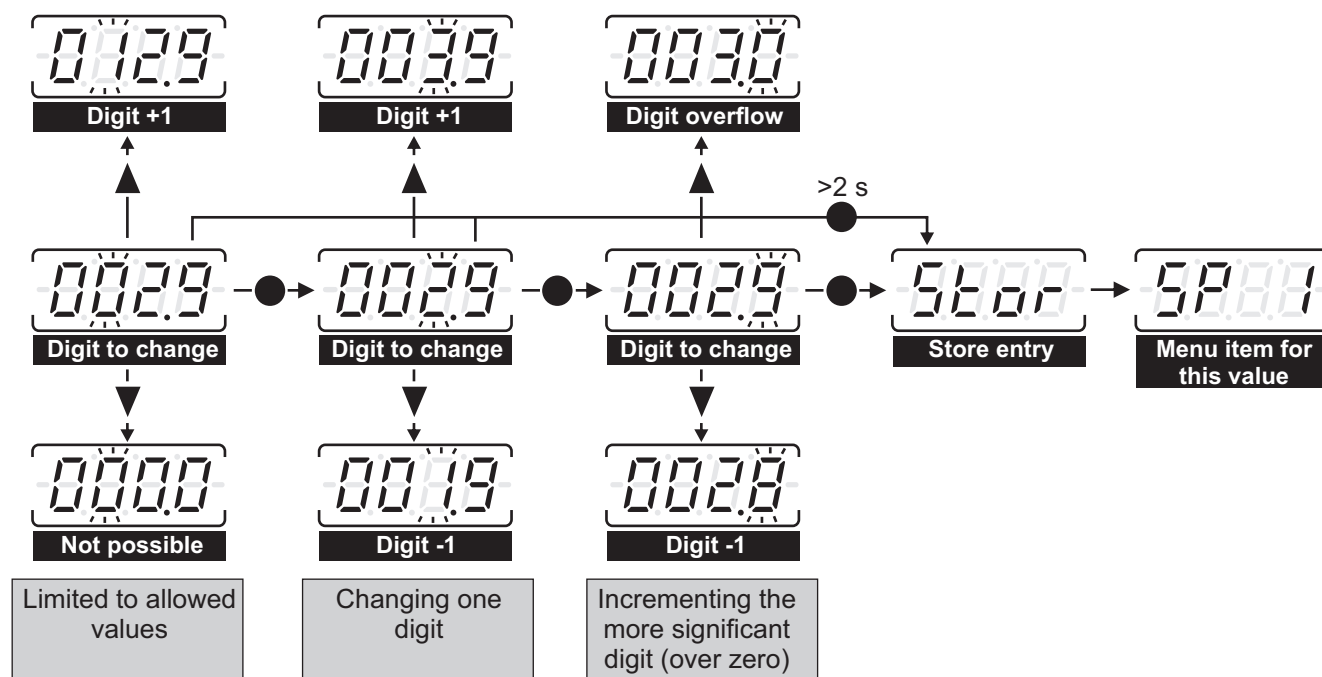
### Setting a numerical value

Numerical values are entered digit by digit. The selected digit flashes and is incremented with the up arrow button and decremented with the down arrow button. The more significant digit will also be incremented or decremented when stepping over zero. If a change of the active digit would exceed the allowable value (e.g. the lower or upper range limit) the allowable value will be shown. With the opposite arrow button you can return to the previous value.

The selected digit is confirmed with the center button and proceed to the next digit. You can cancel the value entry at any time by pressing both arrow buttons simultaneously. The device will then switch back to the corresponding menu entry. The partially edited value will not be saved.

When the right-most digit is selected, the center button confirms the whole value. "Stor" appears on the display to confirm that the value has been stored and the device switches back to the menu item for the value.

You can store a partially edited value at any digit position by holding the center button until "Stor" appears on the display (approx. 2 s).



Button functions for entering numerical values (Example)

### 10.2 Main menu

The main menu has the following functions

Display	Designation	Description
	Basic functions	Setting of unit, lower and upper range value, minimum and maximum pointer
	Display functions	All settings relating to the display
	Switch point settings	Configuration of the switching outputs (option)
	Calibration functions	Teaching lower and upper ranges, calibrating the current output
	System data	Reset to factory settings, loop test, Displaying of: hardware version, software version, serial number
	Return	Return to display mode

## ● 10 Handling and configuration (continued)

### 10.3 Basic menu (bASE)

The basic menu has the following functions

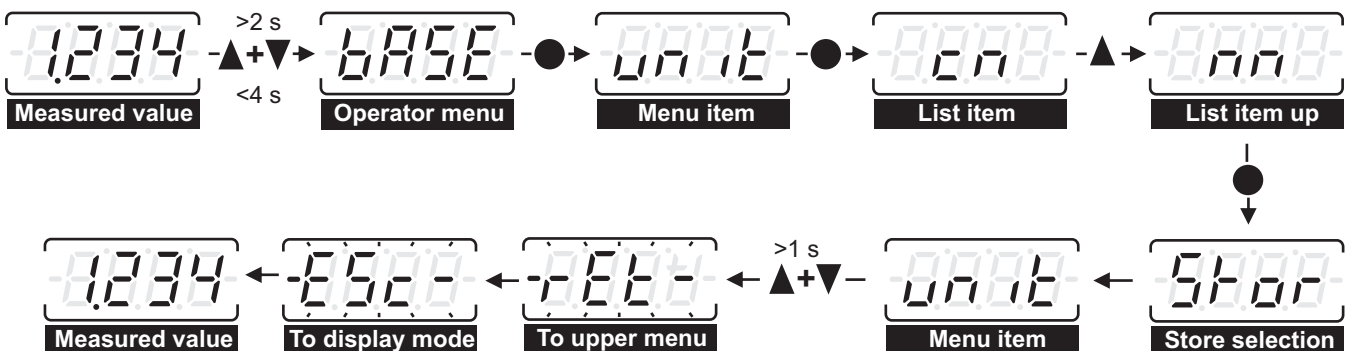
Display	Designation	Description
	Measuring unit	Setting the measuring unit (parameter list)
	Set lower range	Setting the distance corresponding to 4 mA current signal
	Set upper range	Setting the distance corresponding to 20 mA current signal
	Set damping	Setting the damping for the measuring signal
	Trailing pointer minimum (low)	Display and/or delete the minimum trailing pointer
	Trailing pointer maximum (high)	Display and/or delete the maximum trailing pointer
	Return	Return to main menu

#### 10.3.1 Setting the measuring unit (unit)

A selected unit applies to data entries (e.g. switching points) and to the displaying of numerical values (e.g. the trailing pointers). Possible are the following units:

Display	Unit	Display	Unit
	mm		Feet
	cm		% of measuring range
	m		mA
	Inch		Return to „Unit“

Example for the needed steps for changing the unit from cm to mm:



Steps to change the unit

● 10 Handling and configuration (continued)

10.3.2 Setting lower and upper ranges (SLr / Sur)

It is possible to set the lower range (SLr) and the upper range (Sur) value as needed within the allowed distance range of the device (lower and upper range limit), which is also known as „turn down“. The minimum span is about 10% of the maximum range (see technical data) . Make sure that there are no settings outside the permitted distance range.

Select the desired menu item and then enter the distance which has to correspond to 4 mA (SLr) or 20 mA (Sur) loop current. This will not affect the calibration of the transmitter and the current output.

A changing of the measuring range will delete the trailing pointers automatically.

This function is only available with the units mm, cm, m, inch, feet.

Note: Although the switch points are set in the chosen unit, they are saved as a percentage of the range. Therefore the absolute switch point distance will change with every new setting of the range. So it is always necessary to check the settings of the switch points after the setting of new range values.

10.3.4 Setting the damping (dAP)

The damping of the distance can be set in intervals of 0.1 s. Damping is disabled with the setting 0.0 s. The default setting is 0.1 s.

The damping impacts current output and switch points equally.

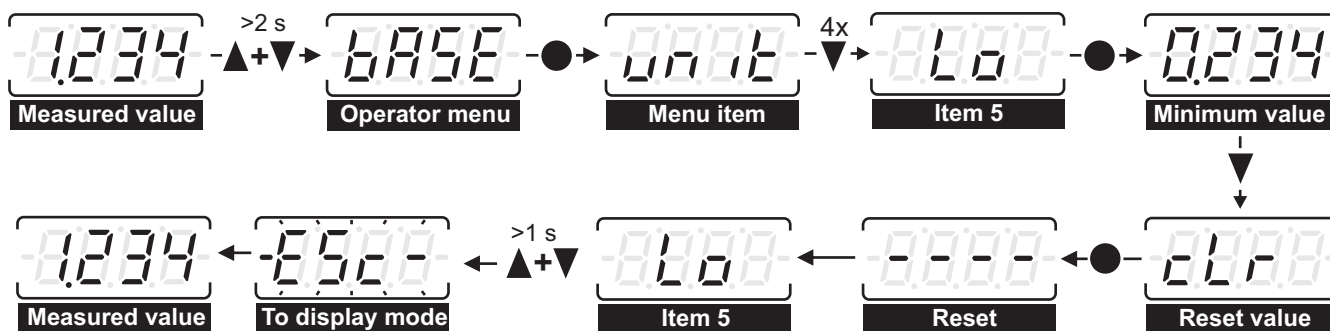
10.3.4 Trailing pointers (Lo / Hi)

The trailing pointers for minimum and maximum values can be displayed or reset. A reset is confirmed with „----“ on the display.

The trailing pointer shows „Er.Lo“ respectively „Er.Hi“ if the current output has been set to an error current (see 9.10).

Display	Designation	Description
	Value of min/max pointer	Value of the min/max pointer in the selected measuring unit
	Clear	Reset the stored pointer value
	Return	Return to „Lo“ or „Hi“

The steps to reset the minimum pointer are shown below.



Steps to reset the minimum pointer

## ● 10 Handling and configuration (continued)

### 10.4 Display menu (diSP)

The display menu has the following functions

Display	Designation	Description
	Add unit	Adds the unit to the measured value on the display or removes it
	Display period for measured value (time data)	Setting between 0.5...99.9 s possible
	Display period for unit (time unit)	Setting between 0.0...99.9 s possible
	Rotate 180°	Rotate screen by 180° when the device is mounted upside down
	Decimal places	Setting the decimal places (0...3 fixed decimal places or automatic)
	Return	Return to „diSP“

#### 10.4.1 Display option for measuring unit (AddU)

You can set the display to show distance and unit simultaneously. When „on“ is selected, the menu items „td“ (display period for pressure and „tu“ (display period for unit) are hidden (see 10.4.2).

Display	Designation	Description
	Off	The unit will be displayed alternately with measured value
	On	Unit and measured value will be displayed simultaneously
	Return	Return to „AddU“

#### 10.4.2 Display period for measured value/unit (td / tu)

The unit can be shown either by pressing the center button in display mode or alternately with the measured value. The display periods of measured value and unit can be configured independently of one another.

Setting the period for the unit to 0.0, only the measured value will be displayed.

#### 10.4.3 Rotating the display by 180° (rot)

In case of mounting the device upside down, the 7-segment display and buttons can be rotated by 180° so that reading and operating are possible as is usual.

Display	Designation	Description
	Standard (0°)	
	Upside down (180°)	Display rotated by 180° for upside down operation
	Return	Return to „rot“

## ● 10 Handling and configuration (continued)

### 10.4.4 Decimal point setting (dEcP)

Possible is a fixed or an automatic positioning of the decimal point.

Display	Designation	Description
	Automatic	The decimal point is set so that all digits are fully used
	No decimal place	
	One decimal place	
	Two decimal places	
	Three decimal places	
	Return	Return to „dEcP“

Please note that when the decimal point is fixed the measured value may not be displayed if there are insufficient digits left of the decimal point. In this case the maximum number that can be shown on the display will appear flashing, e.g. "99.99", when two decimal places are set for a measured value of 110 cm.

If the "Add unit" function is enabled (see 10.4.1), the parameter list will be modified to reflect the available options for displaying measured value and unit simultaneously.

### 10.5 Switch point menu (SP)

The menu has items for the settings of the two switch points. The output behaviour can be a hysteresis or a frame function where the menu items are different. The switching delays can be defined independently from the output function.

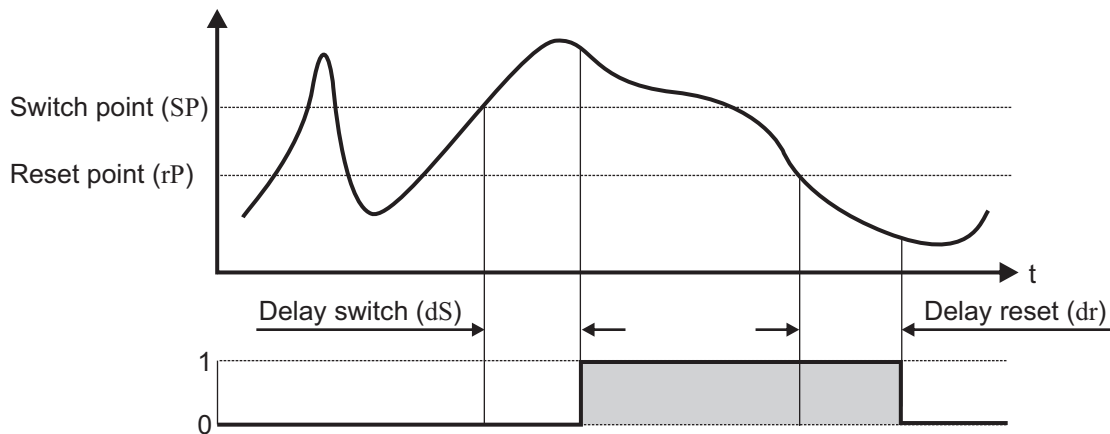
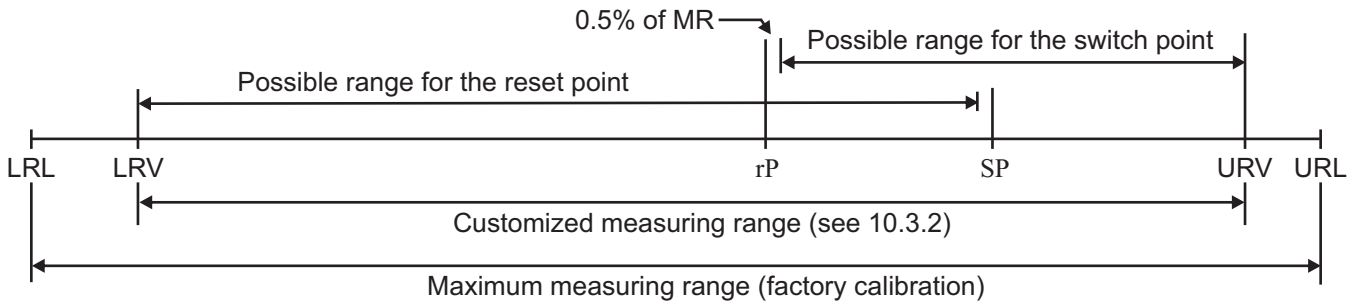
Display	Designation	Description
	Switch point	Switch point in the selected measuring unit
	Reset point	Reset point in the selected unit
	Delay switch	Output delay at switch point
	Delay reset	Output delay at reset point
	Output function	Configuring the output behaviour (normally open, normally close, hysteresis / frame function)
Menu items for switch point 2		
	Return	Return to „SP“



## ● 10 Handling and configuration (continued)

The switch point (SP) must be between the upper range value (URV) and the reset point. The reset point (rP) must be between the lower range value (LRV) and the switch point. The minimum hysteresis (difference between switch point and reset point) is 0.5% of the measuring range (MR) which is configured under 10.3.2.

It is possible to define a delay for the switch point as well as the reset point, e.g. to avoid that short error signals trigger the switch.








When the frame function is used, the menu items for switch point and reset point are replaced by the upper and lower frame limits. The minimum difference of the frame limits is 0.5% of the measuring range (MR) which is configured under 10.3.2.

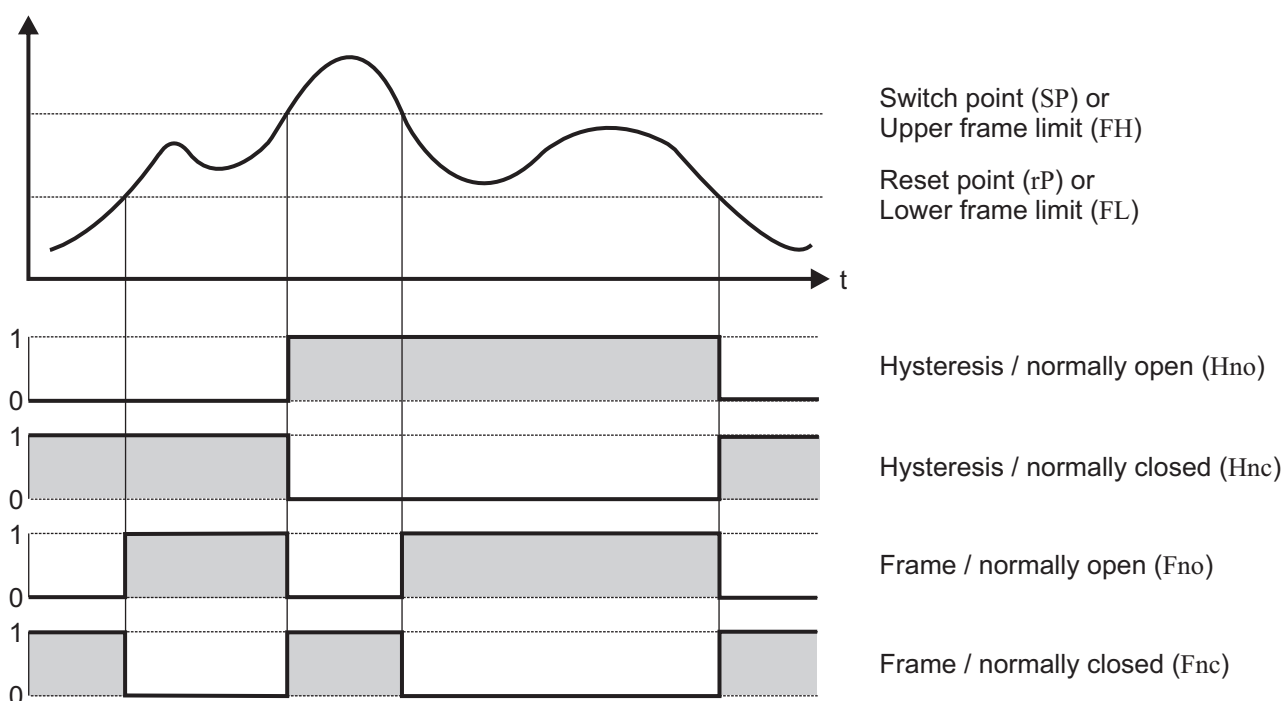
Display	Designation	Description
	Frame high	Upper frame limit in the selected measuring unit
	Frame low	Lower frame limit in the selected measuring unit
	Delay switch	Output delay when entering the frame
	Delay reset	Output delay when leaving the frame
	Output function	Configuring the output behaviour (normally open, normally close, hysteresis / frame function)
Menu items for switch point 2		
	Return	Return to „SP“

## ● 10 Handling and configuration (continued)

### 10.5.1 Configuring the output function (out 1 / 2)






Possible are hysteresis or frame functions and the output as normally open or closed contacts.

Display	Designation	Description
	Hysteresis, normally open	If the distance is above the switch point the switch is closed. At the lower range limit the switch is open.
	Hysteresis, normally closed	If the distance is above the switch point the switch is open. At the lower range limit the switch is closed.
	Frame, normally open	Inside of the frame the switch is closed. At the lower range limit the switch is open.
	Frame, normally closed	Inside of the frame the switch is open. At the lower range limit the switch is closed.
	Return	Return to „out 1" or „out 2"



### 10.6 Calibration menu (CAL)

The calibration menu has the following functions

Display	Designation	Description
	Teach lower range	Adjust the lower range (4 mA) to the applied distance
	Teach upper range	Adjust the upper range (20 mA) to the applied distance
	Adjust 4 mA	Adjust the current output at 4 mA
	Adjust 20 mA	Adjust the current output at 20 mA
	Return	Return to „CAL"

## ● 10 Handling and configuration (continued)

### 10.6.1 Adjusting lower and upper range (tLr / tur)

It is possible to adjust the output current for the lower range value (LRV) and the upper range value (URV) under the menu items „tLr“ and „tur“ to a certain distance value.

For the adjustment a stable distance according the settings in chapter 10.3.2 has to be applied, e.g. by using a adjuster. Then enter the calibration menu and select „tLr“ respectively „tur“. When entering the menu the entry points to „rEt“. To confirm the applied distance go to „YES“ with one of the arrow buttons and press the center button. After this final confirmation the applied distance will be matched to the lower or upper range value.

Example: In chapter 10.3.2 the lower range value was set to 300 mm. For the modification the device is adjusted that there is a distance of 300 mm up to the measuring plane. When the display reading is stable go to the menu item „Teach Lower Range“ and confirm with „YES“. From now on the transmitter will regard the actual sensor element reading as 300 mm. The internal calculation of the distance value out of the measured value will be adapted accordingly.

When confirming with the center button „donE“ appears on the display which confirms that the device has acknowledged the change. Then the device switches back to the initial menu item („tLr“ or „tur“).

Display	Designation	Description
	Return	Return to „tLr“ or „tur“
	Yes	Adjust the lower or upper range value to the applied distance

### 10.6.2 Adjusting the current output (4 mA / 20 mA)

It is possible to adjust the output current to eliminate tolerances and systemic deviations in the output driver or subsequent devices in the current loop.

Below are the steps for the lower current limit (4 mA). The adjusting of the upper current limit (20 mA) is done similar.

Select the menu item „4 mA“ and the device sets the output current to 4 mA. The display shows „04.00“. Now check the reading on the remote measuring instrument. If it deviates from 4 mA, enter this value in the device.

Example: The remote instrument shows 4.02 mA due to tolerances in the current loop. Enter then „04.02“ at the device.

If the value is confirmed the device will adjust the current output so that the remote instrument now will show 4.00 mA. The device will hold the 4 mA current output for 3 seconds so that it's possible to check the reading of the remote instrument. During this time the display will show „Stor“. After that period the device will calculate the current output depending on the measured distance and switch back to the menu item „4 mA“.

## 10.7 System menu (SYS)

The system menu has the following functions

Display	Designation	Description
	Loop test	Setting a fixed current in order to test the current loop
	Information	Indicating of hardware and software version, serial number
	Reset	Reset to factory settings
	Return	Return to „SYS“

## ● 10 Handling and configuration (continued)








### 10.7.1 Loop test (LoOP)

The device can be used to test the current loop. For this the current output can be set to any value between 3.6...21 mA. When an entry is confirmed, the transmitter sets the output current to the selected value and displays this value flashing. The flashing shows that the displayed value is not a valid measurement.

Note: In this mode the device will not return to the display mode after 5 minutes but continue the test until the operator will stop it by pressing the center button or both arrow buttons. The device returns to the menu item „LoOP“ and the output current returns to the value which is corresponding to the measured distance.

### 10.7.2 Information (inFo)

The information menu has the following functions



Display	Designation	Display	Designation
	Hardware version 1 (HW1)		Software version 2 (SW2)
	Hardware version 2 (HW2)		Serial number 1 (Sn 1)
	Software version 1 (SW1)		Serial number 2 (Sn 2)
	Return	Return to „InFo“	

Due to the limited number of alphanumerical segments on the display the values for these items are split.

### 10.7.3 Reset to factory settings (rES)

It is possible to reset the device to the configuration as delivered with the menu item „Reset“ (rES). When entering the menu the entry points to „rEt“. To confirm the reset go to „YES“ with one of the arrow buttons and press the center button. After this final confirmation all parameters will be changed to the settings as delivered.

When confirming with the center button „donE“ appears on the display which confirms that the device has been reset to factory settings. Then the device switches back to the initial menu item („rES“).

Display	Designation	Description
	Return	Return to „rES“
	Yes	Resetting the device to factory settings

## ● 10 Handling and configuration (continued)

### 10.8 Overview of the menu tree

<b>BASE</b>		Menu with basic functions
	unit	Setting the measuring unit (mm, cm, m, inch, feet, %, mA)
	SLr	Setting the distance (LRV) that corresponds to 4 mA output signal (only for mm, cm, m, inch, feet)
	Sur	Setting the distance (URV) that corresponds to 20 mA output signal (only for mm, cm, m, inch, feet)
	dAP	Setting the damping for the distance signal
	Lo	Display and/or delete the minimum trailing pointer
	Hi	Display and/or delete the maximum trailing pointer
<b>DISP</b>		All settings relating to the display
	AddU	Enable or disable displaying unit and distance simultaneously
	td	Setting the display period for the measured value (only when „AddU“ is disabled)
	tu	Setting the display period for the unit (only when „AddU“ is disabled)
	rot	Display direction (0° = standard, 180° = turned)
	decP	Display the decimal places (0...3 fixed decimal places or automatically)
<b>SP</b>		Configuring the switching outputs (when available)
	SP 1 FH 1	Switch point or upper frame limit of switching output 1
	SP 1 FL 1	Reset point or lower frame limit of switching output 1
	ds 1	Output delay at the switch point of switching output 1
	dr 1	Output delay at the reset point of switching output 1
	out 1	Output functions of switching output 1 (Hno, Hnc, Fno, Fnc)
		Menu items for switch point 2
<b>CAL</b>		Calibration menu
	ELr	Adjusting the lower range value (4 mA) to the applied distance
	EUR	Adjusting the upper range value (20 mA) to the applied distance
	4mA	Adjusting the current output at 4 mA
	20mA	Adjusting the current output at 20 mA
<b>SYS</b>		System functions
	Loop	Setting a fixed current for test of the loop
	info	Versions of hardware and software, serial number
	res	Reset to factory settings

## ● 11 Troubleshooting



- Open connections only after the system is without pressure.
- Take precautions with regard to remaining media on removed ultrasonic sensors. Remaining media may be hazardous or toxic .
- Remove the distance sensor from service and mark it to prevent it from being used again accidentally, if it becomes damaged or unsafe for operation.
- Have repairs performed by the manufacturer only.



- Do not use any pointed or hard objects for cleaning to prevent damage to the sound exit area.
- Verify in advance if the right voltage supply and the right type of wiring has been chosen.

Failure	Possible cause	Procedure
No output signal	Cable break No/incorrect voltage supply or current spike	Check connectors and cable Adjust voltage supply to correspond with the operating instructions
No/false output signal	Incorrectly wired	Follow pin assignment (see product label / operating instructions)
Output signal unchanged after change in distance	Sound exit area unclean Fitting position not suitable	Clean sensor if necessary Choose better fitting position
Measured value jumps sporadically on higher levels	Rough surface (agitator in operation, filling, emptying)	Increase time of filter (damping) Choose other fitting position
Measured value jumps downwards when filling or emptying	Rough surface	As possible do not use a center fitting position Possibly use an ultrasonic guide pipe
Device shows maximum distance respectively maximum output signal	Echo loss	Choose other fitting position  Align the sensor parallel to the product surface (important for bulk solids)
Signal span erratic/incorrect	Electromagnetic interference source in the vicinity e. g. inverter drive Working temperature too high/	Shield the device, shield the cables, remove the interference source Ensure permissible temperatures as

Note: In case of unjustified reclamation an additional charge is possible.

Make sure that after the setting the unit is working properly. In case the error continues to exist send the instrument for reparation (or replace the unit).

Returned goods: Purge / clean dismantled instruments before returning them in order to protect persons and the environment from any hazard caused by adherent remaining media.

## ● 12 Technical data

Input			
Signal:	Ultrasonic echo		
Ranges:	Type 49-200: 200...2000 mm (minimum range: 200 mm) Type 49-350: 300...3500 mm (minimum range: 300 mm)		
Emitting angle:	8°		
Output			
Current signal:	4...20 mA with superimposed communication signal HART, 3-wire system		
Current range:	3.8...20.5 mA		
Signal on error:	3.6 mA (sensor short circuit, underflow) 21 mA (sensor break, sensor open circuit, overflow)		
Performance			
Ultrasonic sensor:	Linearity deviation:	Type 49-200: <0.3% Type 49-350: <0.5%	
	Repeatability:	Type 49-200: ±2 mm, ±0.2% Type 49-350: ±2 mm, ±0.4%	
	Temperature compensation:	available	
	Response time t90:	Type 49-200: 250 ms Type 49-350: 700 ms	
	Reference temperature:	25 °C	
	Measuring amplifier:	Accuracy:	0.3% of range
		Resolution:	16 Bit
		Filter setting:	0...99 s
		Transmission behaviour:	linear with distance
		Measuring rate:	10 measurements / s
Adjustment:	Adjustment:	keys on display / via software (HART communication)	
	Turn-on delay time:	<5 s	
	Indicator / limit values:	Resolution: -9999...9999 digit Error of measurement: ±0.2% of range, ±1 digit Temperature drift: 100 ppm/K	
Indication			
Display:	7 segment, 8.5 mm, red, 4 digits, representation mirror-inverted 180° possible		
Head of display:	rotatable approx. 330°		
Memory:	minimum / maximum values		
Indication:	- measuring value                      - unit of measurement   - control menu		
Decimal point:	automatically or manually, dependent on measuring range / unit		
Limit contacts			
Electronically:	2x PNP or NPN (30 VDC, 200 mA) Option: 2x PNP or NPN (30 VDC, 1000 mA)		
Indication:	1 LED red for each limit value		
Voltage across:	<1 V		
Settings:	with 3 keys (TouchM-Technology)		
Setting range:	switch point and hysteresis: any value within measuring range		
Switching delay:	0.0...999.9 s		
Failsafe function:	adjustable		
Galvanic insulation:	switching outputs are separated from measuring amplifier		
Supply			
Voltage:	24 VDC ±10%		
Current consumption:	<70 mA (without limit value contacts)		
Reverse battery protection:	available (no function, no damage)		
Ambient conditions			
Temperature:	Operating range:	-15...+70 °C	
	Sensing head:	-15...+70 °C	
	Storing:	-15...+70 °C	
Water, water vapour:	50 °C maximum at Sensing head		

## ● 12 Technical data (continued)

### Mechanics

Dimensions:	see page 4	
Process connection:	M18x1, M30x1.5	
Electrical connection:	M12 male, 8-pole	
Material:	Process connection:	Standard: stainless steel 1.4571
		Option: PA6 / PVC / POM
Weight:	Body:	PBT GF30
	Head of display:	Polycarbonate (makrolon)
	Type 49-350: stainless steel:	ca. 240 g / synthetic: ca. 180 g
	Type 49-200: stainless steel:	ca. ??? g / synthetic: ca. ??? g
Fitting position:	any (avoid deposition on sound exit area)	
System pressure:	10 bar maximum	
Protection of device:	Ingress protection:	Electronics at least IP 65
		Process connection IP 67
	PCB:	potted by parts

### Programmable features

Measuring amplifier:	Measuring range start (LRV) / Measuring range end (URV) / Adjustment, simulation of output current / Filter function / Linear output signal / HART address / 2-point calibration
Display:	range of indication / time of indication / decimal point / units / stabilisation of zero point / locking of programming / calibration points / TAG number
Limit value contacts:	limit value 1 and 2 / hysteresis 1 and 2 / delay times 1 and 2
Features, operation:	according VDMA 24574-1 up to 24574-4











Sensors and Measuring Instruments




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