OCTOGON

MANUAL

FUMA

ULTRASONIC LEVEL SENSOR

Operating manual



Document	Version	Date	Applies to
Operating manual	V00x	10/2026	FUMA, type 49-40, 49-160 and 49-350

Ultrasonic level sensor with 4 ... 20 mA and HART, 4-digit display, 3 buttons and two electronic limit value contacts.

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Contents

1 Information ... 2
1.1 Device ... 2
1.2 Use in accordance with the intended use ... 3
1.3 Knowledge required ... 3
2 Overview ... 3
3 Signs, abbreviations ... 3
4 Maintenance, accessories ... 3
5 Storage, disposal ... 3
6 Function ... 3
7 Safety instructions ... 4
8 Before mounting ... 4
9 Start-up, operation ... 5
9.1 Product label ... 5
9.2 Ultrasonic measuring principle ... 5
9.3 Mounting ... 5
9.4 Adjusting the display unit ... 6
9.5 Electrical connection ... 6
9.6 Connection of switching outputs ... 6
9.7 Function test ... 6
9.8 Error detection / fault current ... 6
10 Configuration ... 8
10.1 System operating principles ... 8
10.2 Main menu ... 9
10.3 Basic menu (bASE) ... 9
10.4 Display menu (diSP) ... 10
10.5 Switch point menu (SP) ... 11
10.6 Calibration menu (CAL) ... 12
10.7 System menu (SYS) ... 13
10.8 Menu tree overview ... 14
11 Troubleshooting ... 15
12 Technical data ... 16
12.1 Mechanics ... 17
12.2 Programmable features ... 17
12.3 Dimensions ... 17

1 Information

1.1 Device

Feature	Version
Device	ultrasonic level sensor with display, 4 ... 20 mA with HART, 3-wire
Ranges	type 49-40: 30 ... 400 mm; type 49-160: 80 ... 1600 mm; type 49-350: 300 ... 3500 mm
Limit contacts	2 × PNP or NPN, electronic (option)
Manufacturer type	MEUS

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.

1.2 Use in accordance with the intended use

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

1.3 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), „Storage, disposal“ (chap. 5), „Safety instructions“ (chap. 7) and „Start-up, operation“ (chap. 9). Read these chapters in any case.

3 Signs, abbreviations

Sign	Meaning
Warning!	Non-compliance can cause injuries to persons and/or can be a danger to life.
Attention!	Non-compliance can cause a faulty device operation or lead to property damage.
Information!	Non-compliance can have influence on device operation or cause unintentional device reactions.
U+	Positive supply connection
U–	Negative supply connection
SP1	Switching point 1
SP2	Switching point 2

4 Maintenance, accessories

Information – The ultrasonic sensors 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.

Information 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 sensor 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 Safety instructions

Warning – Select the ultrasonic 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 12 „Technical data“.
– 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

Information – 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 Start-up, operation

9.1 Product label

Field	Meaning	Field	Meaning
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

Symbol	Meaning
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

In the principle drawing the maximum level (distance M) corresponds to 4 mA / 100 %, the minimum level to 20 mA / 0 %.

Principle of the signal transit time

The sensor transmits ultrasonic pulses in the direction of the product surface. There the ultrasonic pulses are reflected back and received by the sensor. The sensor 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 (velocity of sound) × 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 echos cannot be evaluated due to the transient characteristics of the sensor.

9.3 Mounting

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.

Conditions for level measurements

- Do not mount the sensor in the middle of the tank. Advantageous is a distance between sensor and the tank wall of 1/6 of the tank diameter.
- Avoid measurements through the filling curtain.
- Things built in such as temperature sensors should not be within the emitting angle of the ultrasonic sensor. In particular symmetrical equipment such as heating coils or baffles can influence measurement.
- It is only allowed to use always one sensor in one tank as otherwise two signals may affect each other.

Mounting variants: with counter nut, with sleeve, with adaptor flange, with connecting piece, with mounting bracket.

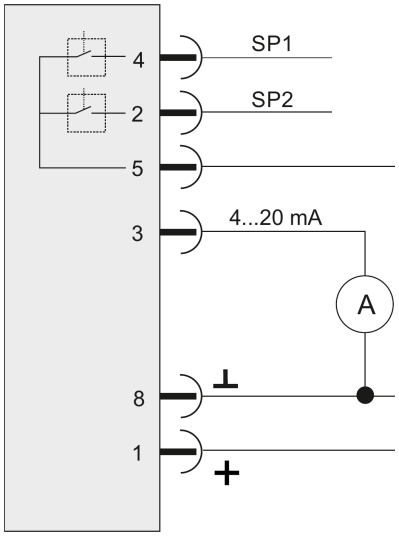
9.4 Adjusting the display unit

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

Attention – The ingress protection specified only applies 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.

Pin (M12x1, 8-pole)	Polarity	Function
3	+	4 ... 20 mA HART
8	–	4 ... 20 mA HART (common with supply)
2, 4, 5		electronic limit value contacts (4 = SP1, 2 = SP2, 5 = common)
1	+	Supply
8	ground	Supply



Example of electrical connection: supply 24 V DC at 1 (+) and 8 (ground), ammeter between 3 and 8, switching outputs at 4 and 2, common 5 at + of the supply.

9.6 Connection of switching outputs

The switching outputs are potential-free. They are electrically isolated from the current loop. 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.

Wiring	NPN (common on low side)	PNP (common on high side)
Two outputs are used	4 – RL1 – (+); 2 – RL2 – (+); 5 – (–)	4 – RL1 – (–); 2 – RL2 – (–); 5 – (+)
One output, load on high side	4 – RL – (+); 5 – (–)	4 – (–); 5 – RL – (+)
One output, load on low side	4 – (+); 5 – RL – (–)	4 – RL – (–); 5 – (+)

Shown for SP1 (pin 4); for SP2 pin 2 applies accordingly.

9.7 Function test

Information 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 11 „Troubleshooting“.

9.8 Error detection / fault 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 distance from 3.8 to 20.5 mA. If the measured distance 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 loss of voltage supply.

Measuring signal (% of range)	Current output
unter –1.25	3.6 mA
–1.25	3.8 mA
0	4.0 mA
100	20.0 mA
103.125	20.5 mA
above 103.125	21.0 mA

Values from the characteristic „output current and measured signal“.

10 Configuration

Description of handling and configuration of the display device. An overview of the menu tree is shown in section 10.8.

The 3 buttons on the display head operate by capacitive principle with no mechanical components: when pressing a button, there is no key drop. The buttons are reacting to the approach of a finger via sensing its electromagnetic field. Withdraw your finger at least 1 cm after pressing a button. This is useful for proper keypress detection.

The following description is for a device configuration using capacitive 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

10.1.2 Display mode / measured value indication

After powerup 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 10.4.4). As long as the center button is pressed the selected unit will be displayed. A single arrow button has no function in display mode.

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.

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 exited 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.

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, and 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.

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 the entry proceeds 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).

10.2 Main menu

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

10.3 Basic menu (bASE)

Display	Designation	Description
unit	Measuring unit	Setting the measuring unit (parameter list)
SLr	Set lower range	Setting the distance corresponding to 4 mA current signal
Sur	Set upper range	Setting the distance corresponding to 20 mA current signal
dAP	Set damping	Setting the damping for the measuring signal
Lo	Trailing pointer minimum (low)	Display and/or delete the minimum trailing pointer
Hi	Trailing pointer maximum (high)	Display and/or delete the maximum trailing pointer
-rEt-	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 units mm, cm, m, inch, feet, % of measuring range and mA; the last list item **-rEt-** returns to **unit**.

Example – changing the unit from cm to mm:

1. In display mode press both arrow buttons > 2 s and < 4 s: **bASE** appears.
2. Center button: menu item **unit**.
3. Center button: the current list item (cm) appears.
4. Up arrow: previous item (mm).
5. Center button: store selection, **Stor** appears, then **unit**.
6. Both arrow buttons > 1 s: **-rEt-**, then **-ESc-** – back in display mode.

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.

10.3.3 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 a fault current (see 9.8).

Display	Designation	Description
value	Value of min/max pointer	Value of the min/max pointer in the selected measuring unit
clr	Clear	Reset the stored pointer value
-rEt-	Return	Return to **Lo** or **Hi**

Example – resetting the minimum pointer:

1. In display mode press both arrow buttons > 2 s: **bASE**.
2. Center button: **unit**.
3. 4 × down arrow: item 5 **Lo**.
4. Center button: the minimum value is shown.
5. Down arrow: **clr**; center button: **---** (reset), then **Lo**.
6. Both arrow buttons > 1 s: **-ESc-** – back in display mode.

10.4 Display menu (diSP)

Display	Designation	Description
AddU	Add unit	Adds the unit to the measured value on the display or removes it
td	Display period for measured value (time data)	Setting between 0.5 ... 99.9 s possible
tu	Display period for unit (time unit)	Setting between 0.0 ... 99.9 s possible
rot	Rotate 180°	Rotate screen by 180° when the device is mounted upside down
dEcP	Decimal places	Setting the decimal places (0 ... 3 fixed decimal places or automatic)
-rEt-	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 the measured value) and **tu** (display period for unit) are hidden (see 10.4.2).

Display	Designation	Description
OFF	Off	The unit will be displayed alternately with measured value
on	On	Unit and measured value will be displayed simultaneously
-rEt-	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
0°	Standard (0°)	
180°	Upside down (180°)	Display rotated by 180° for upside down operation
-rEt-	Return	Return to **rot**

10.4.4 Decimal point setting (dEcP)

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

Display	Designation	Description
Auto	Automatic	The decimal point is set so that all digits are fully used
0000	No decimal place	
000.0	One decimal place	
00.00	Two decimal places	
0.000	Three decimal places	
-rEt-	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 **AddU** 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
SP 1	Switch point	Switch point in the selected measuring unit
rP 1	Reset point	Reset point in the selected unit
dS 1	Delay switch	Output delay at switch point
dr 1	Delay reset	Output delay at reset point
out 1	Output function	Configuring the output behaviour (normally open, normally closed, hysteresis / frame function)
...	Menu items for switch point 2	
-rEt-	Return	Return to **SP**

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 (**dS**) as well as the reset point (**dr**), 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
FH 1	Frame high	Upper frame limit in the selected measuring unit
FL 1	Frame low	Lower frame limit in the selected measuring unit
dS 1	Delay switch	Output delay when entering the frame
dr 1	Delay reset	Output delay when leaving the frame
out 1	Output function	Configuring the output behaviour (normally open, normally closed, hysteresis / frame function)
...	Menu items for switch point 2	
-rEt-	Return	Return to **SP**

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

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

Display	Designation	Description
Hno	Hysteresis, normally open	If the distance is above the switch point the switch is closed. At the lower range limit the switch is open.
Hnc	Hysteresis, normally closed	If the distance is above the switch point the switch is open. At the lower range limit the switch is closed.
Fno	Frame, normally open	Inside of the frame the switch is closed. At the lower range limit the switch is open.
Fnc	Frame, normally closed	Inside of the frame the switch is open. At the lower range limit the switch is closed.
-rEt-	Return	Return to **out 1** or **out 2**

10.6 Calibration menu (CAL)

Display	Designation	Description
tLr	Teach lower range	Adjust the lower range (4 mA) to the applied distance
tur	Teach upper range	Adjust the upper range (20 mA) to the applied distance
4mA	Adjust 4 mA	Adjust the current output at 4 mA
20mA	Adjust 20 mA	Adjust the current output at 20 mA
-rEt-	Return	Return to **CAL**

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 to the settings in section 10.3.2 has to be applied, e.g. by using an 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 section 10.3.2 the lower range value was set to 300 mm. For the modification the device is adjusted so that there is a distance of 300 mm up to the measuring plane. When the display reading is stable go to the menu item **tLr** (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
-rEt-	Return	Return to **tLr** or **tur**
YES	Yes	Adjust the lower or upper range value to the applied distance

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

It is possible to adjust the output current to eliminate tolerances and systematic 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 similarly.

Select the menu item **4mA** 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 is 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 **4mA**.

10.7 System menu (SYS)

Display	Designation	Description
LooP	Loop test	Setting a fixed current in order to test the current loop
inFo	Information	Indicating of hardware and software version, serial number
rES	Reset	Reset to factory settings
-rEt-	Return	Return to **SYS**

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 stops 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)

Display	Designation	Description
HW1 / **HW2**	Hardware version 1 / 2	
SW1 / **SW2**	Software version 1 / 2	
Sn 1 / **Sn 2**	Serial number 1 / 2	
-rEt-	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
-rEt-	Return	Return to **rES**
YES	Yes	Resetting the device to factory settings

10.8 Menu tree overview

Menu	Function
bASE	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
diSP	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)
SP	Configuring the switching outputs (when available)
SP 1 / FH 1	Switch point or upper frame limit of switching output 1
rP 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
CAL	Calibration menu
tLr	Adjusting the lower range value (4 mA) to the applied distance
tur	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
SYS	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

Warning – 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.

Information – 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	Check connectors and cable
No output signal	No/incorrect voltage supply or current spike	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	Clean sensor if necessary
Output signal unchanged after change in distance	Fitting position not suitable	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	Shield the device, shield the cables, remove the interference source
Signal span erratic/incorrect	Working temperature too high/too low	Ensure permissible temperatures as per the operating instructions

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 dismounted instruments before returning them in order to protect persons and the environment from any hazard caused by adherent remaining media.

12 Technical data

Item	Value
Input	
Signal	ultrasonic echo
Range type 49-40	30 ... 400 mm (minimum range: 30 mm)
Range type 49-160	80 ... 1600 mm (minimum range: 80 mm)
Range type 49-350	300 ... 3500 mm (minimum range: 300 mm)
Attention	Plastic as material option can cause deviations from the listed ranges.
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 49-40: < 0.3 %; type 49-160: < 0.5 %; type 49-350: < 0.5 %
Repeatability	type 49-40: ± 1 mm, ± 0.2 %; type 49-160: ± 2 mm, ± 0.2 %; type 49-350: ± 2 mm, ± 0.4 %
Temp. compensation	available
Response time t90	type 49-40: 100 ms; type 49-160: 130 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	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	2 × PNP or NPN (30 V DC, 200 mA); option: 2 × PNP or NPN (30 V DC, 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
Galvanical insulation	switching outputs are separated from measuring amplifier
Supply	
Voltage	24 V DC ± 10 %
Current consumption	< 70 mA (without limit value contacts)
Reverse battery protection	available (no function, no damage)
Environmental 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

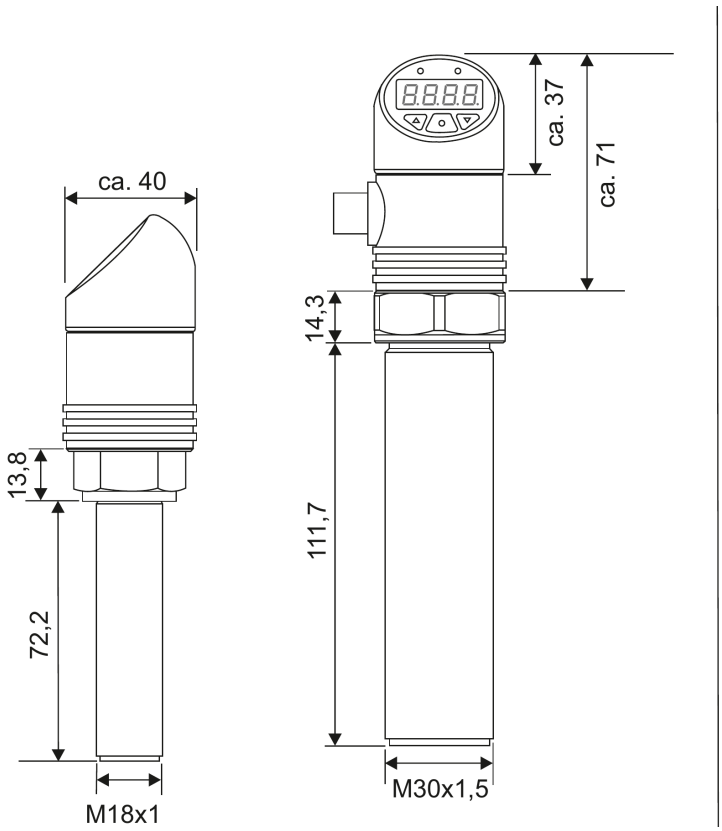
12.1 Mechanics

Item	Value
Process connection	type 49-40, type 49-160: M18x1; type 49-350: M30x1.5
Electrical connection	M12 male, 8-pole
Material process connection	standard: stainless steel 1.4571; option: PA6 / PVC / POM
Material casing	PBT GF30
Material head of display	polycarbonate (Makrolon)
Weight type 49-350	stainless steel approx. 240 g / synthetic approx. 180 g
Fitting position	any (avoid deposition on sound exit area)
System pressure	10 bar maximum
Ingress protection	electronics at least IP65; process connection IP67
PCB	potted by parts

12.2 Programmable features

Area	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

12.3 Dimensions



Dimensions in mm (from the data sheet). Left: type 49-40 and 49-160 with M18x1, right: type 49-350 with M30x1.5.