

Operating instructions



Ultrasonic level indicator

SonarFox® UST 20

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1. About these operating instructions

These operating instructions describe the ultrasonic level meter UST-20 (also referred to as "product" in these operating instructions). These operating instructions are part of the product.

- You may only use the product if you have fully read and understood these operating instructions.
- Verify that these operating instructions are always accessible for any type of work performed on or with the product.
- Pass these operating instructions as well as all other product-related documents on to all owners of the product.
- If you feel that these operating instructions contain errors, inconsistencies, ambiguities or other issues, contact the manufacturer prior to using the product.

These operating instructions are protected by copyright and may only be used as provided for by the corresponding copyright legislation. We reserve the right to modifications.

The manufacturer shall not be liable in any form whatsoever for direct or consequential damage resulting from failure to observe these operating instructions or from failure to comply with directives, regulations and standards and any other statutory requirements applicable at the installation site of the product.

2. Information on safety

2.1. Safety messages and hazard categories

These operating instructions contain safety messages to alert you to potential hazards and risks. In addition to the instructions provided in these operating instructions, you must comply with all directives, standards and safety regulations applicable at the installation site of the product. Verify that you are familiar with all directives, standards and safety regulations and ensure compliance with them prior to using the product.

Safety messages in these operating instructions are highlighted with warning symbols and warning words. Depending on the severity of a hazard, the safety messages are classified according to different hazard categories.

DANGER

DANGER indicates a hazardous situation, which, if not avoided, will result in death or serious injury.

NOTICE

NOTICE indicates a hazardous situation, which, if not avoided, can result in equipment damage.

In addition, the following symbols are used in these operating instructions::



This is the general safety alert symbol. It alerts to injury hazards or equipment damage. Comply with all safety instructions in conjunction with this symbol to help avoid possible death, injury or equipment damage.



This symbol alerts to hazardous electrical voltage. If this symbol is used in a safety message, there is a hazard of electric shock.



This symbol alerts to general information.

2.2. Intended use

This product may be used for non-contact level measurement of liquid, mushy and pasty media in open or closed containers, tanks or silos.

Any use other than the application explicitly permitted in these operating instructions is not permitted and causes hazards.

Verify that the product is suitable for the application planned by you prior to using the product. In doing so, take into account at least the following:

- All directives, standards and safety regulations applicable at the installation site of the product
- All conditions and data specified for the product
- The conditions of the planned application

In addition, perform a risk assessment in view of the planned application, according to an approved risk assessment method, and implement the appropriate safety measures, based on the results of the risk assessment. Take into account the consequences of installing or integrating the product into a system or a plant.

When using the product, perform all work and all other activities in conjunction with the product in compliance with the conditions specified in the operating instructions and on the nameplate, as well as with all directives, standards and safety regulations applicable at the installation site of the product.

2.3. Predictable incorrect application

The product must never be used in the following cases and for the following purposes:

- Measurements of acoustically diffuse surfaces (foam, bulk material)
- Use as overflow prevention system according to WHG

2.4. Qualification of personnel

Only appropriately trained persons who are familiar with and understand the contents of these operating instructions and all other pertinent product documentation are authorized to mount, commission, maintain and decommission this product.

These persons must have sufficient technical training, knowledge and experience and be able to foresee and detect potential hazards that may be caused by using the product.

All persons working on and with the product must be fully familiar with all directives, standards and safety regulations that must be observed for performing such work.

2.5. Personal protective equipment

Always wear the required personal protective equipment. When performing work on and with the product, take into account that hazards may be present at the installation site which do not directly result from the product itself.

2.6. Modifications to the product

Only perform work on and with the product which is explicitly described in these operating instructions. Do not make any modifications to the product which are not described in these operating instructions.

3. Transport and storage

The product may be damaged as a result of improper transport or storage.

NOTICE

INCORRECT HANDLING

- Verify compliance with the specified ambient conditions during transport or storage of the product.
- Use the original packaging when transporting the product.
- Store the product in a clean and dry environment.
- Verify that the product is protected against shocks and impact during transport and storage.

Failure to follow these instructions can result in equipment damage.

Store the device in its original packaging in dry areas covered from weather conditions, with humidity of up to 85 % without effects of chemically active substances. The storage temperature range is -10 °C to +50 °C.

4. Product description

4.1. Measuring principle

The product is intended for non-contact measurement of level, distance and volume. The product works according to the echo transit time method.

Communication with the product is possible either via an integrated RS 485 interface (Modbus RTU) or via the HART protocol. This allows parameter data to be received, saved, changed and transferred back to the product.

Measurement of bulk material is limited.

4.2. Variants of Level Sensors

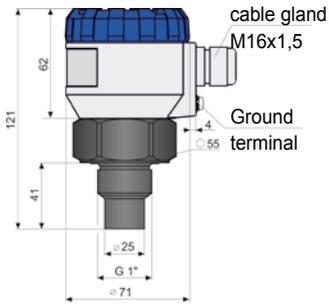
- **UST 20_-01** Measuring range 0.15 – 2 m, 120 kHz, plastic PP, mechanical connection with thread G1.
- **UST 20_-11** Measuring range 0.25 – 6 m,, 75 kHz, plastic PP, mechanical connection with thread G1½.
- **UST 20_-21** Measuring range 0.4 – 10 m, 50 kHz, plastic PP, mechanical connection with thread G2¼.
- **UST 20_-31** Measuring range 0.5 – 20 m, 30 kHz, aluminium alloy flange EN 1092-1 DN100 PN16.

The product is also produced in explosion-proof version:

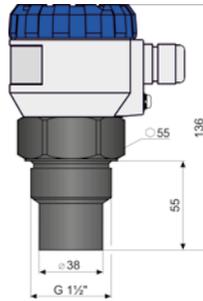
- **EX** – intrinsically safe explosion-proof version for or use in hazardous areas (gas and dust EX)

4.3. Dimensions

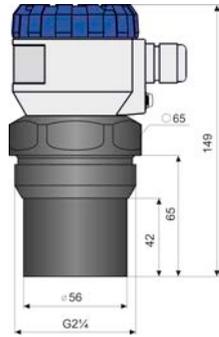
UST 20_-01



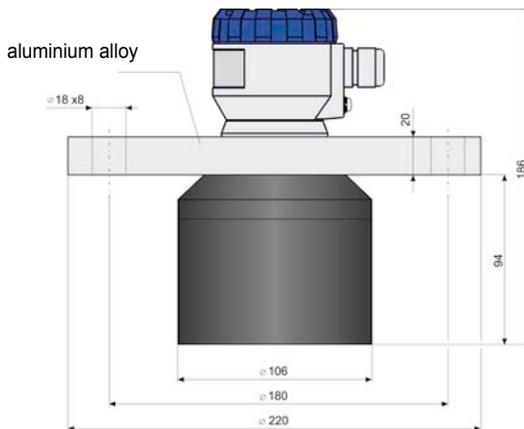
UST 20_-11



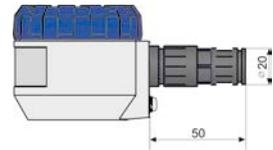
UST 20_-21



UST 20_-31

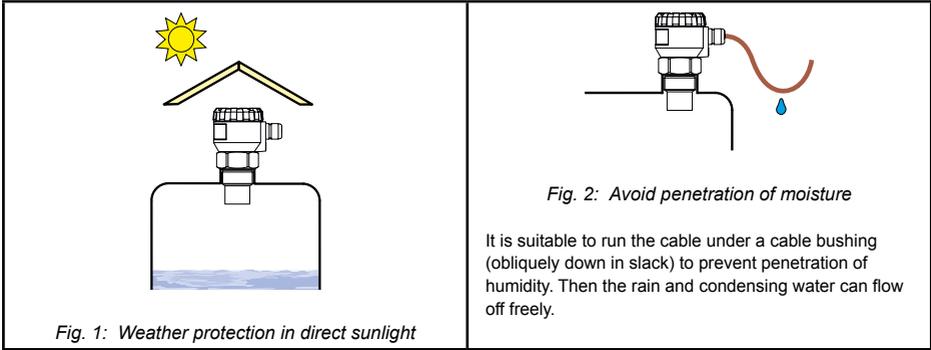


Variant UST 20 with protective conductor



5. Mounting

- ⇒ Verify that the product is protected from direct sunlight and other heat sources.
- ⇒ Verify that the product is protected from direct weather when installed outdoors.
- ⇒ Verify that the environmental conditions are observed.



5.1. Preparing mounting

The product is mounted in the container using a welding flange, fastening nut or flange. In the case of closed containers, the product must be installed in such a way that the sensor face cannot be flooded.

The sensor face of the product is the starting point for level measurement. The dead zone (see technical data) determines the minimum distance between the sensor face and the maximum filling level.

- ⇒ Verify that there are no fixtures, welds or similar within the beam angle.
- ⇒ Verify that the sensor face of the product is mounted perpendicular to the surface of the medium.
- ⇒ Verify that the product is attached to a bracket (e.g. mounting bracket) with open channels or collecting containers.

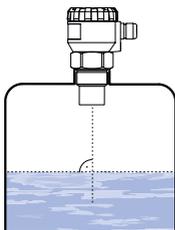
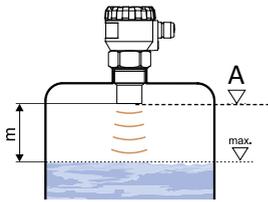


Fig. 3: Recommended installation in the tank

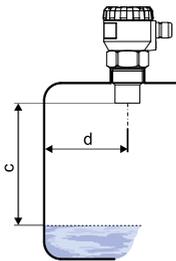
Mount the product in a way that the dead zone is not reached even when it is filled to the maximum. The product cannot measure in the area of the dead zone.

UST 20-01, -21	$d > 1/12 c$ (min. 200 mm)
UST 20-11	$d > 1/8 c$ (min. 200 mm)
UST 20-31	$d > 1/10 c$ (min. 200 mm)



m = Dead zone
 A = reference plane for the measurement

Fig. 4: Level meter dead zone



d = Distance from the tank wall
 c = Maximum reach of the level meter

Fig. 5: Distance from the tank wall

Installation in closed containers

When installing in closed containers, the sensor face must not be flooded. Use a pipe socket if the distance cannot be maintained in any other way.

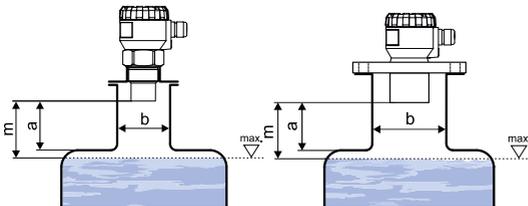


Fig. 6: Possible installation in the container

a = Height of pipe socket
 b = Wide pipe socket
 m = Dead zone (Incorrect measurement)

UST 20-01, -11	$a < 3b$ $b > 100 \text{ mm}$
UST 20-21	$a < 1,5b$ $b > 100 \text{ mm}$
UST 20-31	$a < 1,5b$ $b > 150 \text{ mm}$

Vessel installations

Vessel installations can cause strong false echoes that are superimposed over the useful echo signals (roughness on container walls, various partitions, agitator etc.) It is necessary to map false reflections by activating the mode "TEACHING".

In case of installed mixers, it is necessary to put the mixers to position under the level meter (direct the agitator paddle to the ultrasonic signal beam).

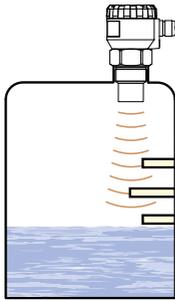


Fig. 7: False echoes of obstacles

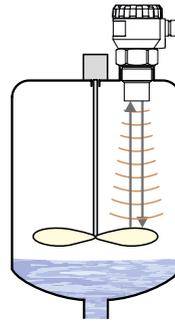
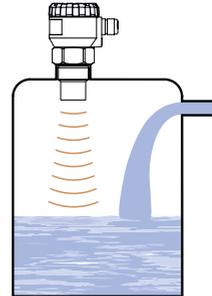
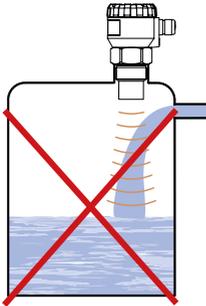


Fig. 8: False echoes of agitator paddle

Installation with inflowing medium

Do not install the level meter in or above the filling point.



Foam formation

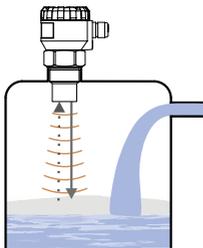


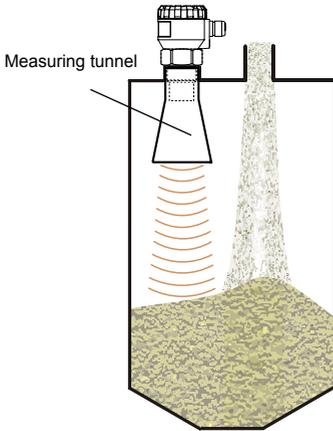
Fig. 9: Foam on the surface

During filling, mixing and other processes, foam can arise on the surface level of the measured liquid.

The foam considerably absorbs the ultrasonic signal which might cause malfunction of the level meter. For such cases, it is necessary to set up "SENSITIVITY" mode to "high" or contact the manufacturer if need.

In case of a thin layer of foam, it is also possible to use the directional horn for improving receipt of the reflected echo.

Installation in silo or storage reservoir

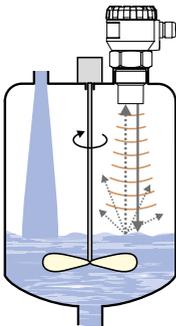


In case the level of bulk solids is measured, the measurement range is reduced. Due to absorption of acoustic waves by a bulk medium, shortening of the measuring range occurs by up to 50 % depending on the grain size.

We therefore recommend selecting a level meter with greater range than the maximum range of measuring the medium. It is also appropriate to use a directional horn, which reduces the shortening of the measuring range, because it better concentrates acoustic energy while preserving the same beam angle, and improves the sensitivity when receiving the reflected echo.

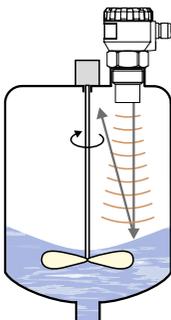
Fig. 10: Installation in silo or hopper

Installation on uneven and wavy surfaces



If the surface is slightly uneven or wavy (due to agitator or filling flow), there may be interfering reflections.

Fig. 11: Moderately stirred surface



The surface can be whirled up by the rotating blades of the agitator and this can lead to interfering reflections.

In the case of uneven surfaces, you must perform a false signal suppression.

Fig. 12: Intensely stirred surface

Installation in standpipe

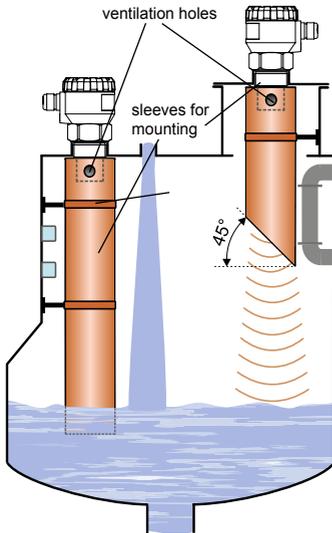


Fig. 13: Installation in standpipe

By using a standpipe, the effects of tank installations, foam formation and turbulence can be prevented.

The standpipe must be made of a material with a smooth inner surface. After installation, you must perform a false signal suppression using the "LEARN" menu item.

When using pipe sockets that protrude into the closed container, the stand pipe must end at a 45° angle (Fig. 13 right hand).

Measurement in the standpipe is not suitable for bulk solids that tend to adhere strongly.

6. Electrical connection



ELECTRIC SHOCK

- Verify that the degree of protection against electric shock (protection class, double insulation) is not reduced by the type of electrical installation.

Failure to follow these instructions will result in death or serious injury.



ELECTRIC SHOCK CAUSED BY LIVE PARTS

- Disconnect the mains voltage supply before performing the work and ensure that it cannot be switched on.
- Verify that no hazards can be caused by electrically conductive objects or media.
- Products in the Ex area must be earthed.

Failure to follow these instructions will result in death or serious injury.

The product is connected to the downstream device (evaluation device) with a standard two-core cable ($2 \times 0.5 \dots 0.75 \text{ mm}^2$) without shielding.

1. Use 2 pc. $2 \times 0,25 \text{ mm}^2$ (twisted double-circuit line, shielded) for versions with Modbus communication.

If the product is connected to the RS-485 line as a terminal device with Modbus communication, the installation of a terminating resistor 120Ω is recommended. Set the lever labeled 120Ω to the ON position. Terminating resistors are not connected for products that are connected to the RS-485 line as continuous devices.

Connect cable to the product

1. Unscrew the nut of the upper transparent lid.
2. Take the upper edge of the display module and take it out carefully by mild swinging up.
 - If you cannot grasp the module, you can use a small screwdriver. Insert it as far as the seam and use from several sides to slightly lift the module.
3. Loosen the cable gland and lead the cable through the cable gland under the display module.
4. Connect the phase to the + terminal and the neutral conductor to the - terminal.
5. In the case of shielded cables, connect the shield to the ground terminal.
6. Connect communication lines A and B of the RS-485 line (for version "M" - Modbus) to terminals A and B.
7. Tighten the terminals and the cable gland.
 - For tightening torque, see technical parameters.
8. Insert the display module back into the head so that the connector is properly connected.
9. Slide silicone seal on the thread of the level meter body.
10. Tighten the nut of the upper lid
11. Connect the cable to downstream devices

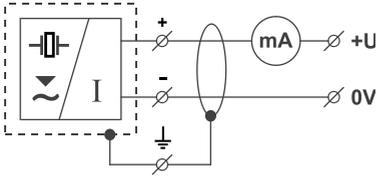
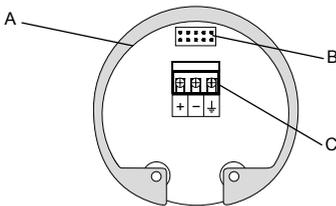


Fig. 14: Electrical connection 4-20 mA

- +U to terminal (+)
- 0V to terminal (-)
- Shield (only shielded cables) to terminal GND



In case of strong ambient electromagnetic interference, paralleling of conductors with power distribution, or for the distribution to distance over 30 m, we recommend using shielded cable.



Inside view of screw terminals

- A = Metal clip
- B = Display unit connector
- C = Terminal block

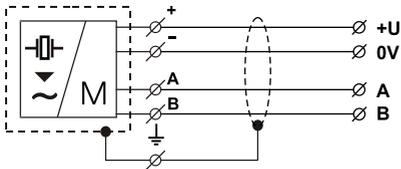
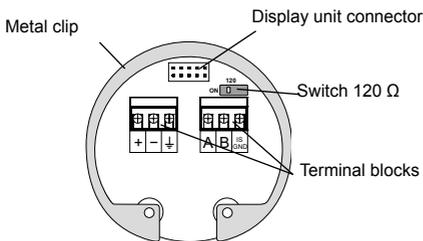


Fig. 15: Electrical connection Modbus

- +U to terminal (+)
- 0V to terminal (-)
- Shield (only shielded cables) to terminal GND
- Communication wires A and B of the line RS-485 (for version "M" - Modbus) are connected to the terminals A and B.

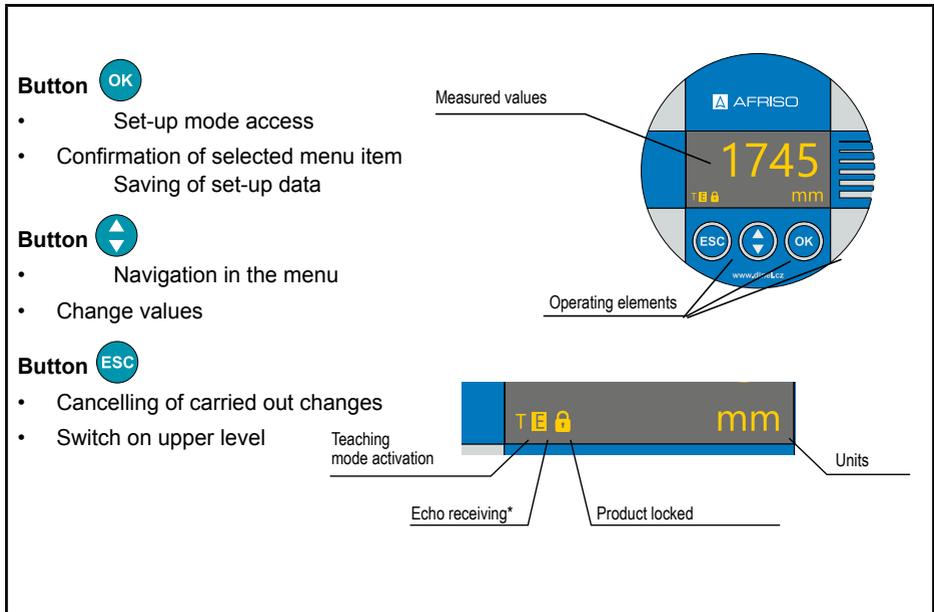


During electrical installation, measures must also be taken to reduce the effects of static electricity to a safe level.

The product must be installed in accordance with EN 60079-14 in potentially explosive atmospheres (Electrical installations for explosive gaseous atmospheres - Part 14).

7. Operating elements

Settings are performed using 3 buttons located on the display module.



* Slow flashing while the reflected signal (echo) is received from the measured level.

Display	Funktion
"NO ECHO"	Flashing – the product cannot receive an echo for a long period of time. Incorrect installation of the product
"DEAD ZONE"	Flashing – the measured level is within the dead zone or the sensor surface is contaminated.
"NO PASSWORD"	The product is protected against unauthorized setting. Enter password
Symbol "T" ¹⁾	Illuminates continuously – "LEARNING" mode is activated.
Symbol "E" ¹⁾	Flashing – correct reception of the reflected echo.
Symbol ¹⁾	Illuminates continuously – The product is protected against unauthorized setting. Enter password to unlock the product.

¹⁾ Icon is shown in the lower left corner of the display

8. Settings

The product is manually controlled using 3 buttons located on the removable display module.

The text "SAVED" at the bottom of the display indicates that the values have been saved. Values not confirmed by pressing button will not be saved! After 5 minutes of inactivity, the level meter automatically switches back to the measuring mode. If the password is activated, the level meter will also lock itself. Once it is locked, it is not possible to make any changes to the settings. When any editing is attempted, the display will show the text "NO PASSWORD". The unlocking procedure is described on page 23.

After connecting the supply voltage, the product display will show the manufacturer's logo and the text "Starting" (approx. 30 s). Then the menu switches to the measuring mode and the display shows the current measured value.



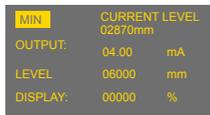
Basic settings

The basic setting is required after the product has been commissioned for the first time (Setting the measuring range, selecting the units or damping, sensitivity and teaching).

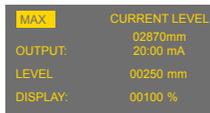


MIN LEVEL and MAX LEVEL

The minimum / maximum distance to the level is set here („LEVEL“ for currents 4 mA / 20 mA). Then the value can be assigned on the display under the menu item "DISPLAY". The units are set in the "UNITS" menu.



- **CURRENT:** currently measured distance to the level
- **OUTPUT:** Current 4 mA / 20 mA
- **LEVEL:** Definition OF MIN/MAX distance to the level
- **DISPLAY:** Value on the display



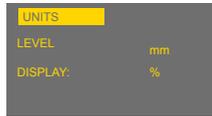
If the message "OUT OF LIMITS" appears in the lower part of the display when entering values, then the value entered in the "LEVEL" menu item is outside the measuring range. If the message "PAN TOO SMALL" appears, enter a larger range of min / max values, see chapter. "Specifications".

The decimal point position is fixed in the menu item "LEVEL" is fixed in the menu item "LEVEL" (based on the selected units). The position of the menu item "DISPLAY" is freely adjustable.

1. Press the OK button to open the "BASIC SETTINGS" menu.
2. Use the arrow buttons to select the "MIN LEVEL" or "MAX LEVEL" menu and press OK.
3. Press the OK button and the arrow buttons to set the distance for the defined current "LEVEL". The value is shown on the "DISPLAY" display.
4. Press the OK button to save the values.
5. Press the ESC button to exit the menu. The product switches back to the measurement mode.

UNITS

The product can display and calculate a large number of physical quantities. The setting is made in the "UNITS" menu.



LEVEL: Unit selection (mm, cm, m, in, ft)
DISPLAY: unit shown on the display
(%, mm, cm, m, in, ft, l, hl, m3, gal, bbl, mA)

1. Press the OK button to open the "BASIC SETTINGS" menu.
2. Use the arrow buttons to select the „UNIS“ and press OK.
3. Press the OK button and the arrow buttons to set the units.
4. Press the OK button to save the values.
5. Press the ESC button to exit the menu. The product switches back to the measurement mode.

DAMPING

Setting of the echo velocity during the measurement. The function suppresses unstable display with unsteady input of rapid or sudden level changes. (e.g surface turbulence). The subsequent reaction time depends on the exponential curve. The damping with a defined delay in seconds describes the period in which the exponential curve reaches 2/3 of its maximum value.



The damping time can be set in a range of 0 to 99 s.

1. Press the OK button to open the "BASIC SETTINGS" menu.
2. Use the arrow buttons to select the „DAMPING“ and press OK.
3. Press the OK button and the arrow buttons to set damping in seconds.
4. Press the OK button to save the values.
5. Press the ESC button to exit the menu. The product switches back to the measurement mode.

SENSITIVITY

Sensitivity level meter is defined in four steps:

- "LOW" – reduced sensitivity in case of environmental disturbances which impair the measurement.
- "MEDIUM" – medium sensitivity (suitable for most applications).
- "HIGH" – increased sensitivity for media that partially reduce the echo (foam).



You can set the sensitivity in four degrees:

LOW – MEDIUM – HIGH.

1. Press the OK button to open the "BASIC SETTINGS" menu.
2. Use the arrow buttons to select the „SENSITIVITY“ and press OK.

3. Press the OK button and the arrow buttons to set the sensitivity
4. Press the OK button to change from „SENSITIVITY“ to the sub menu USER. The arrow keys can be used to navigate between the sensitivity levels.
5. Press the OK button to save the values.
6. Press the ESC button to exit the menu. The product switches back to the measurement mode.

TEACHING

This operation mode is to false echo avoidance. Partition walls, agitators or other obstacles can influence the reflection. After activating this operating mode, false echoes are automatically recognized and masked out.



If there are no significant obstacles in the tank, this operating mode is not necessary.

1. Press the OK button to open the "BASIC SETTINGS" menu.
2. Use the arrow buttons to select the „TEACHING“ and press OK.
3. Press the OK button. The display shows the query whether the menu should be started.
4. Press the OK button to start the menu.

During the acquisition, the message "RUNNING" flashes on the display. When the false echo has been detected, the display shows the message "DONE".

5. Press the ESC button to exit the menu. The product switches back to the measurement mode.



The mode "TEACHING" will stop automatically after ca. 1000 measurements.

If during the scanning of the tank in the bottom of the display appears the dialog "press OK to stop" (see figure) the level meter already found no further obstacles and "TEACHING" mode may be terminated. If it is not terminated, the level meter is still ready for the possible presence of obstacles (e.g. paddles of the agitator).

Once it registers a further obstacle, the dialogue disappears and the obstacle is erased. This process may be repeated up to 1000 cycles. After this the "TEACHING" mode is automatically stopped.



Before starting the mode it is necessary to empty the tank as much as possible (preferably completely).

In case of installed agitator, it is necessary to position the agitator under the level meter (direct the agitator blade to the ultrasonic signal beam).

Note: If there are significant obstacles in the upper half of the tank, multiple false reflections can occur especially in closed tanks. In such cases it is necessary to reduce the level in the tank as much as possible to correctly mask these possible multiple false reflections.

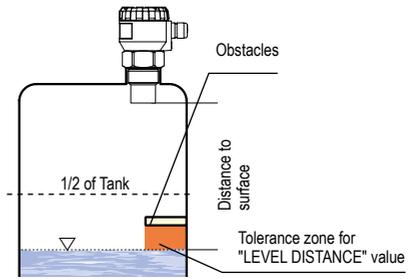
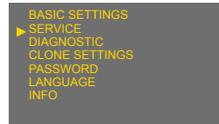


Fig. 16: Enter value „Set level distance

8.1. Service settings

The following points can be set or evaluated in the service setting:

- Length of the electrode
- Electrode type
- Change or shortening of the electrode
- Fault conditions of HART®, MODBUS communication
- Default setting
- Reset



MEDIUM TEMPERATURE

If for instance in the tank there is a difference of 10 °C between the temperature of the measured material (medium) and the temperature at the mounting site of the level meter (see the mode "DIAGNOSTICS), the measuring accuracy will be reduced by around 1 % of the set range. If this function is activated, this temperature difference can be compensated.

Inactive compensation (initial state), the word "NO" appears on the display.

See the "UNITS" menu for temperature unit selection (°C or °F).



After start of the zone temperature compensation mode it is necessary to set the temperature of the surface of the medium. The level meter then calculates the average value from the medium temperature and the temperature at the installation place of the level meter. With such an average temperature it counts in calculating of the velocity of acoustic waves propagation and for determination of the level position.

FAILURE MODE

Determines the current value at the output of the product in the event of an echo loss ("NO ECHO").



NO ECHO: Current in case of echo loss

DEAD ZONE: Dead zone current

The values can be set in three steps:
3.75 mA, 22 mA and LAST (last measured data).

HART

This menu item belongs to the menu of the product with the current output UST-20. HART®-Protocol setting (point to point, multidrop) and address for the multidrop mode. Up to 15 units can be connected to one two-wired cable in the multidrop mode.



In case of the address "00", the point to point mode is enabled. The range from "01" to "15" is reserved for addresses in the multidrop mode.

MODBUS

This menu item belongs to the menu of the product with the output Modbus UST 20. Modbus mode is intended for the settings of the level Modbus addresses, baud rate and parity settings.



ADDRESS: 1 to 247 (default 1) 4800, 9600, 19200 (default 9600)

FORMAT: 8N1, 8O1, 8E1, 8N2 (default 8N1)

FORMAT: — number of Stopbits:

└─ parity
N – non parity
O – odd parity
E – even parity
data: 8 – number of bits

FACTORY DEFAULT

To reset the initial values of the level meter set by the manufacturer, press the OK button (see the Factory default table).



After you press the OK button, "RUNNING" will be displayed for about 3 sec. After the initial values are set, "DONE" will be appear on the display.



RESET

Complete restart of the level meter. The same effect has also a short-time interruption of the supply voltage.



During the restart process, "RUNNING" will be displayed. Then the level meter will be automatically turned off and on.

8.2. Additional functions

Additional functions include modes to display temperature in the tank or to find out the actual flowing current in the loop. Besides, to lock modifications using a password and information about the level meter version. All of the functions are accessible from the main menu.

DIAGNOSTICS

It contains information about DISTANCE TO LEVEL, TEMPERATURE and CURRENT.

DISTANCE TO LEVEL: Shows the current distance value to the medium surface.

TEMPERATURE: Shows the actual temperature in the tank

CURRENT: Contains information about the actual current value in the loop.



The temperature is measured inside the tank where the level meter is installed.

If the temperature of the measured medium is different, we recommend you to carry out the temperature compensation "MEDIUM TEMPERATURE" because of accuracy. Then the displayed temperature is an average value from the temperature set in the "MEDIUM TEMPERATURE" and the current temperature measured by the sensor.

CLONE SETTINGS

This operating mode is for copying the configuration of the level meter (body) UST 20 into the display module (Display) PD 20 UST/PMG and back. The display module can then be removed from the level meter body and put into another level meter and make there the settings transfer (cloning).



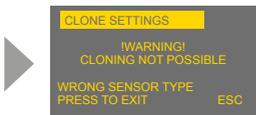
The "CLONE SETTINGS" mode transfers all data, excluding setting of the "Teaching" and HART®.



1. Press the OK button to open the "CLONING SETTINGS" menu.

Copying of the settings is done by selecting "SENSOR → DISPLAY MODULE". To transfer the settings from the display module to another level meter select the item DISPLAY MODULE → SENSOR.

2. Use the arrow buttons to select the operating mode and press OK.
 - During transmission the display shows "NOW CLONING".
 - After completing the process in the middle of the screen displays "DONE".
3. Press the ESC button to exit the menu:



Incompatible type. Transfer of the settings can be realized only with the same type of level meter and with the firmware version 2.0 and later.



The data set is not stored into the display module (DM-70). The transfer can not be done. It is necessary to repeat the procedure of the copying the settings in the mode "CLONE SETTINGS".

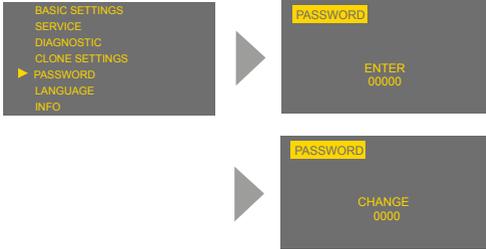
PASSWORD

Here the product can be blocked against unauthorized data processing. Once the password has been activated, the data can be viewed, but not edited. If you try to edit, the message "NO PASSWORD ENTERED" appears on the display.

The password can consist of any 5-digit numeric combination. The combination 00000 is reserved for deactivating the password.

1. Press the OK button to open the "PASSWORD" menu.
2. Use the arrow buttons to select the operating mode for entering the password "ENTER" or changing the password "CHANGE" and press OK.
 - When activated, both messages appear inversely.
3. Press the OK button again to confirm the selection.
 - The password change is only possible when the level meter is unlocked. Otherwise the message "NO PASSWORD ENTERED" appears.
4. Enter the Password.
 - The current entry for editing is shown inversely.

5. Press the OK button to move to the next position (clockwise direction).
6. Change the value with the arrow keys (0 ... 9).
7. Press the OK button to save the edited data.



Display of status information to confirm data:

- „YES“ – correctly edited password
- „NO“ – incorrectly edited password
- „OK“ – the password saved (only in case of "CHANGE")

The password is automatically hidden after it has been entered or changed ("00000" will appear).

To deactivate the password, edit the numerical combination "00000" in the mode "CHANGE".



If the password is lost, contact the manufacturer.



The level meter with activated password will be automatically locked after 5 minutes of inactivity or after 5 min. from switching to measuring mode. Locking of level meter is indicated in the lower left corner of the screen by the symbol .

LANGUAGE

Display menu – language setting.

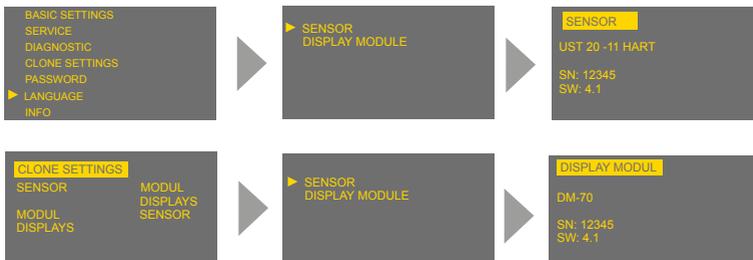


You can set following languages:

- ČESKY – ENGLISH – DEUTSCH

INFORMATION

Product information (type, serial number – SN and firmware version – SW).



9. HART® communication protocol

A universal communication interface for the communication of the peripheral devices with the product. Data communication takes place over the same line as the analog signal 4 ... 20 mA.

A HART communicator is required to set the level meter and record the measurement data, via which direct communication with the level meter can take place or which can be used to convey communication with a peripheral device.

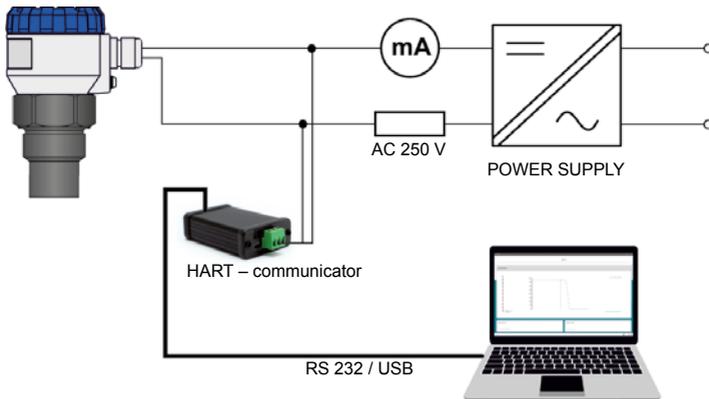


Fig. 17: Connection of peripheral devices with HART protocol

HART Specifications

The implemented HART protocol is revision no. 5.

It contains universal commands: 0, 1, 2, 3, 6, 11, 12, 13, 14, 15, 16, 17, 18, 19 and Standard commands (practice): 34, 35, 40, 42, 44, 49.

10. Modbus® protocol

A universal communication interface for the communication of the peripheral devices with the product. Data communication is via a serial line using the RS-485 standard and the Modbus RTU protocol. The list of the respective variables can be found in a separate appendix. The software application "Basic SCADA level", which is freely available on the website www.dinel.cz, can be used to set the level meter and record the measured data. The connection to the peripheral device can be made via converter URC-485.

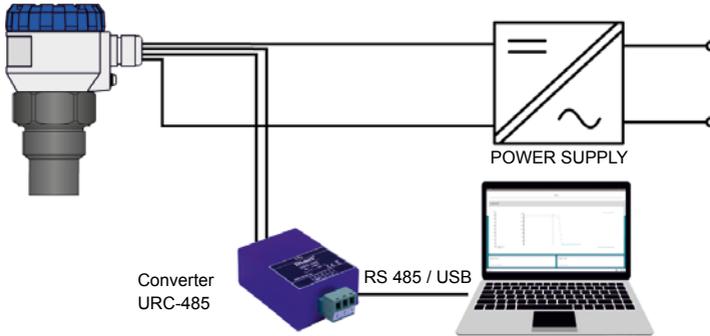


Fig. 18: Connection of peripheral devices with Modbus® protocol

11. Ordering data

1 Ultrasonic transmitter	
56220	SonarFox® UST 20
2 Probe type/measuring range/measuring frequency/process connection	
01	Measuring range 0.15–2 m, 120 kHz, PP G1B
11	Measuring range 0.25–6 m, 75 kHz, PP G1½B
21	Measuring range 0.4–10 m, 50 kHz, PP G2¼B
31	Measuring range 0.5–20 m, 30 kHz, aluminium alloy EN 1092-1 DN 100 PN 16
3 Display (required for programming)	
D	With local display, housing lid with window
O	Without local display, housing lid without window
4 Output signal/interface	
01	4–20 mA + HART / 2-wire / DC 18–36 V
02	RS-485 Modbus RTU
EX	4–20 mA (ia) + HART / 2-wire / DC 18–28 V Uj=30 V DC; Ii=132 mA; Pi=0.99 W; Ci=370 nF; Li=0.9 mH

Ordering codes examples	56220	11	D	01
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12. Accessories

Standard (scope of delivery)

- 1 x seal (for UST–20_–11, 21,31)
- free-to-download programme Basic Scada Level (for the Modbus version)

Optional – for an extra charge

- Fixing nuts G1 and G1½" and G2¼
- Horn adapter ST–G1 (for UST–20_–11) and ST–G1,5 (for UST–20_–21)
- for version Modbus convertor URC-485

13. Safety, Protections, Compatibility and Explosion safety

The Product is equipped with protection against electric shock on the electrode, reverse polarity, output current overload, short circuit and against current overload on output.

Protection against dangerous contact is secured by low safety voltage that complies with EN 33 2000- 4- 41. Electromagnetic Compatibility according to EN 55022/B, EN 61326/Z1 and EN 61000-4-2 to 6.

Explosion proof UST 20 ... EX is provided by conformity with standards: EN 60079-0:2013; EN 60079-11:2012 and EN 60079-26:2007. and examined by FTZÚ-AO 210 Ostrava - Radvanice certificate No.: FTZU 21 ATEX 0027X

Special conditions for safe use of variants UST 20..EX)

UST 20 ... EX are designed for connection to intrinsically safe circuits with galvanic isolation. If you use the device without galvanic isolation (Zener barriers) it is necessary to offset a potential between the sensor and the grounding point of the barriers.

For application in zone 0 the present explosive atmospheres - mixture of air with flammable gases, vapour or mists must comply: $0,8 \text{ bar} < p < 1,1 \text{ bar}$. The device must be installed in such a way, to prevent mechanical damage of sensor face. It is necessary carried out earthing by screw which is placed on head of level meter.

14. Maintenance

Maintenance of this equipment consists in verification of integrity of the level meter and of the supply cable. Depending on the character of the substance measured, we recommend to verify at least once per year the clarity of the ultrasound transducer emitting field and to clean it, respectively. In case any visible defects are discovered, the manufacturer or reseller of this equipment must be contacted immediately.

15. Returning the device

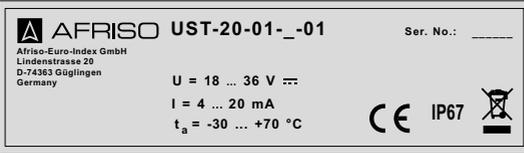
Get in touch with us before returning your product (service@afriso.de).

16. Warranty

See our terms and conditions at www.afriso.com or your purchase contract for information on warranty.

17. Indications on the nameplate

Labels for type UST 20-....._01



Temperature range according to type:

- 01 $t_a = -30 \dots 70 \text{ }^\circ\text{C}$
- 11 $t_a = -30 \dots 70 \text{ }^\circ\text{C}$
- 21 $t_a = -30 \dots 60 \text{ }^\circ\text{C}$
- 31 $t_a = -30 \dots 60 \text{ }^\circ\text{C}$

Manufacturer's label: AFRISO®

Internet: www.afriso.de

Level meter type: UST 20-.....

Serial number of the device: no.: _____ - (from left: year of manufacture, serial number)

Supply voltage: $U = 18 \dots 36 \text{ V} =$

Output current range: $I = 4 \dots 20 \text{ mA}$

Data communication: RS-485 (Modbus RTU)

Operating temperature range: $t_a = -30 \dots + \dots \text{ }^\circ\text{C}$ (according to type)

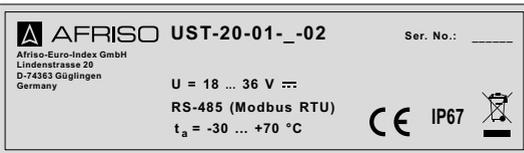
Protection class: IP 67

Compliance mark: **CE**

Labeling for the return of electric waste:

Country of origin: Made in Czech Republic

Labels for type UST 20-....._02



Temperature range according to type:

- 01 $t_a = -30 \dots 70 \text{ }^\circ\text{C}$
- 11 $t_a = -30 \dots 70 \text{ }^\circ\text{C}$
- 21 $t_a = -30 \dots 60 \text{ }^\circ\text{C}$
- 31 $t_a = -30 \dots 60 \text{ }^\circ\text{C}$

Manufacturer's label: AFRISO®

Internet: www.afriso.de

Level meter type: UST 20-.....

Serial number of the device: _____ - (from left: year of manufacture, serial number)

Supply voltage: $U = 18 \dots 36 \text{ V} =$

Output current range: $I = 4 \dots 20 \text{ mA}$

Data communication: RS-485 (Modbus RTU)

Operating temperature range: $t_a = -30 \dots + \dots \text{ }^\circ\text{C}$ (according to type)

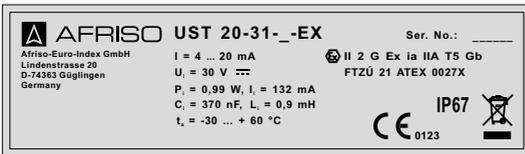
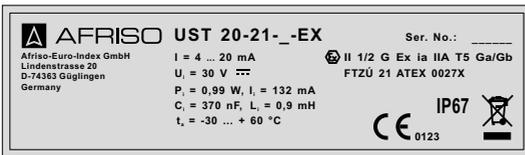
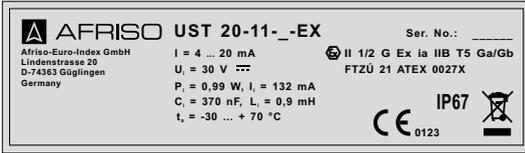
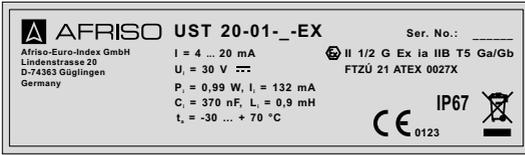
Protection class: IP 67

Compliance mark: **CE**

Labelling for the return of electric waste:

Country of origin: Made in Czech Republic

Labels for type UST 20-.....EX



Classification Ex version:

- 01 II 1/2G Ex ia IIB T5 Ga/Gb
- 11 II 1/2G Ex ia IIB T5 Ga/Gb
- 21 II 1/2G Ex ia IIA T5 Ga/Gb
- 31 II 2G Ex ia IIA T5 Gb

Temperature range according to type:

- 01 ta = -30 ... 70 °C
- 11 ta = -30 ... 70 °C
- 21 ta = -30 ... 60 °C
- 31 ta = -30 ... 60 °C

Manufacturer's label: AFRISO®

Internet: www.afriso.de

Level meter type: UST 20-.....

Serial number of the device: no.: xxxxx - (from left: year of manufacture, serial number)

Supply voltage: I=4 ... 20 mA

Max. internal values: U_i=30 V, I_i=132 mA; P_i=0,99 W; C_i=370 nF; L_i=0,9 mH

Operating temperature range:: t_a = -30 ... +__ °C (according to type)

Sign of explosion-proof system: Design: II_G Ex ia II_T5 _/_

EC-Type Examination Certificate number: FTZU 21 ATEX 0027X

Protection class: IP 67

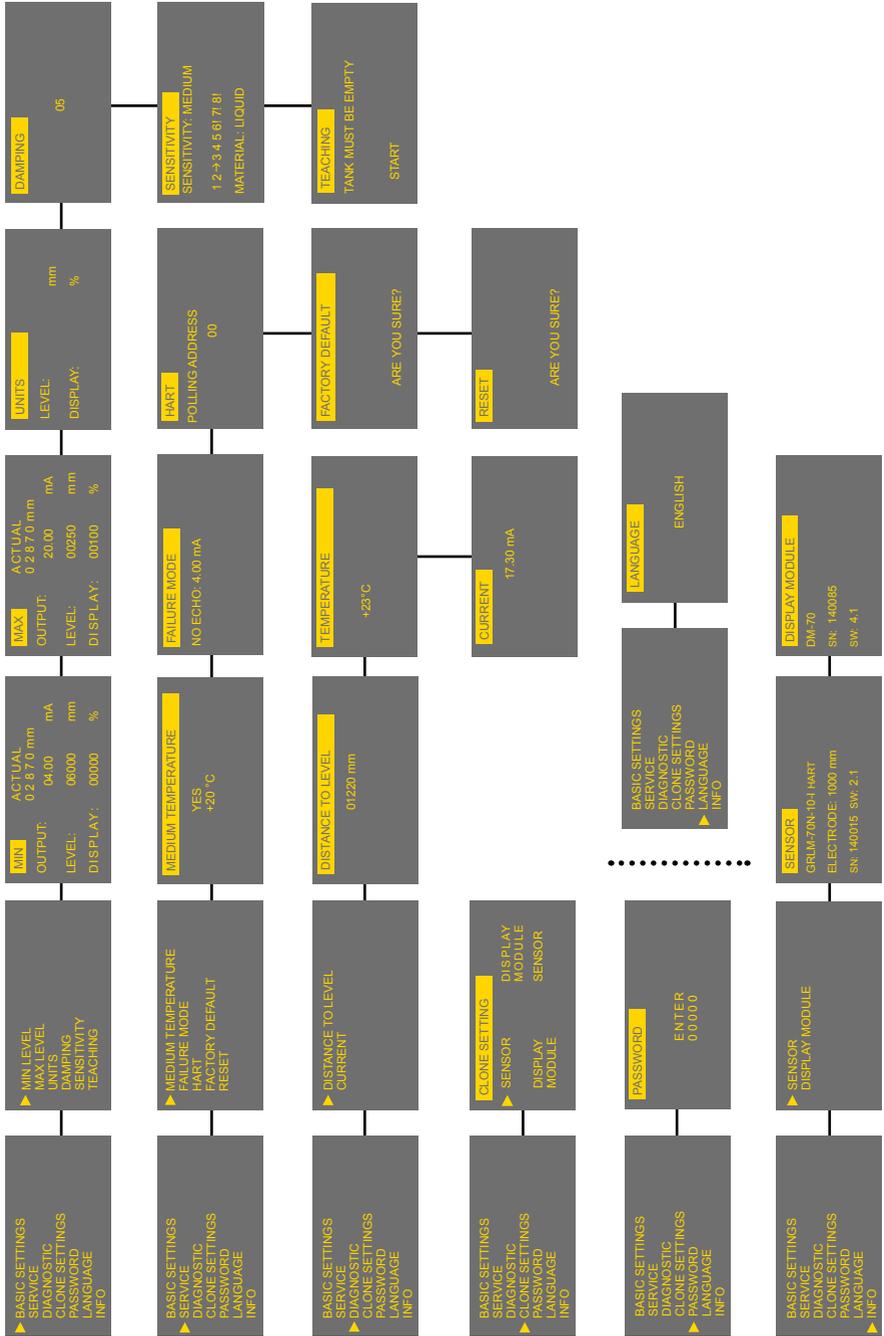
Compliance mark:

Notified Body and Identification number 0123

Labelling for the return of electric waste:

Country of origin: Made in Czech Republic

18. Menu structure



19. Technical specifications

Technical specifications – level meter		
Measurement range ¹⁾	UST 20_01 UST 20_11 UST 20_21 UST 20_31	0,15 ... 2 m 0,25 ... 6 m 0,4 ... 10 m 0,5 ... 20 m
Adjustable measuring range (SPAN)		min. 200 mm
Supply voltage	UST 20 UST 20_...EX	18 ... 36 V DC 18 ... 30 V DC
Output	UST 20_...01 UST 20_...02	4 ... 20 mA (limit values 3,9 ... 20,5 mA), HART® RS-485 with Modbus RTU
Power consumption	UST 20_...01 UST 20_...02	4 ... 20 mA / max. 22 mA max. 20 mA
Resolution	UST 20_01, 11 UST 20_21 UST 20_31	< 1 mm < 2 mm < 2,5 mm
Accuracy (within the total range)		0,15 %
Temperature error		max. 0,04 % / K
Operating frequency	UST 20_01 UST 20_11 UST 20_21 UST 20_31	120 kHz 75 kHz 50 kHz 30 kHz
Beam angle (-3 dB)	UST 20_01, 21 UST 20_11 UST 20_31	10° 14° 12°
Operating temperature range	UST 20_01, 11 UST 20_21, 31	-30 ... 70 °C -30 ... 60 °C
Short-time temperature stress resistance		+90 °C / 1 hour
Maxi. operating pressure (on sensor surface)		0,1 MPa
Sensitivity		3 steps (low – medium – high)
Damping		0 ... 99 s
Measuring period (depending on sensor type)		1 ... 4 s
Rise time		ca. 30 s
Additional technical data for Ex proof ²⁾ – limiting parameters		Ui=30V DC; li=132mA; Pi=0,99W; Ci=370nF; Li=0,9mH
Failure indication (echo loss, level in dead zone, internal failure) ³⁾		optional adjustable: 3,75 mA, 22 mA, last measurement value
Process connection	UST 20_01 UST 20_11 UST 20_21 UST 20_31	Screw connection G1 Screw connection G 1½ Screw connection G 2¼ Flange, aluminium alloy
Maximal resistance of current output load (U = 24 V DC)		R _{max} = 270 Ω ⁴⁾

1) In case the level of bulk-solid materials is measured, the measurement range is reduced.

2) Permissible pressure range in zone 0 (Version Xi): 80 ... 110 kPa.

3) Dead zone = Blind zone = Blocking distance

4) Including 250 Ω resistor in case of HART® connection.

Technical specifications – level meter

Protection class		IP67
Weight	UST 20_01	0,3 kg
	UST 20_11	0,4 kg
	UST 20_21	0,7 kg
	UST 20_31	3,1 kg

Technical specifications - Display module

Display type		Matrix OLED, LCD
Resolution		128 × 64 Pixel
Character height / Number of digits measured value		9 mm / 5 Digits
Display colour	OLED	Yellow
	LCD	Black with white background light
Buttons		Membrane switch panel
Operating temperature range	OLED	-30 ... 70 °C
	LCD	-20 ... 70 °C
WEight		46 g

Used materials

Sensor part	VARIants	Standard material *
Lid	All types	Aluminium alloy with surface coating
Glass	All types	Polycarbonate
Body	All types	Aluminium alloy with surface coating
Housing	All types	Plastic PP
Electroacoustic converter	All types	Plastic PVDF
Display module	UST 20_..._D (with display)	Plastic POM
Cable gland	All types	Plastic PA
Flange	UST 20_.	Aluminium alloy with surface coating

Factory default

	UST 20_01	UST 20_11	UST 20_21	UST 20_31
Min level ¹⁾	2.000	6.000	10.000	20.000
Max level ²⁾	150	250	400	500
Units	mm; %; °C	mm; %; °C	mm; %; °C	mm; %; °C
Damping	2	5	10	10
Sensitivity	Medium	Medium	Medium	Medium
Temperature medium	No	No	No	No
Error mode – no echo	3,75 mA	3,75 mA	3,75 mA	3,75 mA
Error mode – dead zone ³⁾	22 mA	22 mA	22 mA	22 mA
Pooling address (HART®)	00	00	00	00
Password	No password	No password	No password	No password

1) Distance to min. level

2) Distance to max. level

3) Dead zone = Blind zone = Blocking distance

Area classification (according to EN 60079-10 and EN 60079-14)

UST 20_01	Basic version for non-hazardous areas
UST 20_01_EX UST 20_11_EX	Intrinsically safe version for use in hazardous areas (explosive gas atmospheres or explosive atmospheres with vapours) Ⓢ II 1/2G Ex ia IIB T5 with intrinsically safe supply units, whole sensor zone 1, Front part of the unit zone 0
UST 20_21_EX	Intrinsically safe version for use in hazardous areas (flammable vapors or gases) Ⓢ II 1/2G Ex ia IIA T5 with intrinsically safe supply units, whole sensor zone 1, Front part of the unit zone 0
UST 20_31_EX	Intrinsically safe version for use in hazardous areas (flammable vapors or gases) Ⓢ II 2G Ex ia IIA T5 whole sensor zone 1

20. EU Declaration of Conformity



Technik für Umweltschutz

Messen. Regeln. Überwachen.

EU – Konformitätserklärung <i>EU-Declaration of Conformity / Déclaration EU de conformité</i> <i>Declaración de conformidad CE / Declaração de conformidade CE</i>			Formblatt FB 27 - 03
<p>Name und Anschrift des Herstellers: <u>AFRISO-EURO-INDEX GmbH, Lindenstr. 20, 74363 Güglingen</u> <i>Manufacturer / Fabricant / Fabricante / Nome e endereço do fabricante:</i></p> <p>Erzeugnis: <u>Ultraschalltransmitter SonarFox</u> <i>Product / Produit / Producto / Produto:</i></p> <p>Typenbezeichnung: <u>UST 20</u> <i>Type / Type / Tipo / Tipo:</i></p> <p>Betriebsdaten: <u>Versorgungsspannung DC 18 - 36 V</u> <i>Techn. Details:</i> <i>Caractéristiques / Características / Detalhes técnicos:</i></p> <p>Das bezeichnete Erzeugnis stimmt mit den Vorschriften folgender Europäischer Richtlinien überein: <i>The above mentioned product meets the requirements of the following European Directives</i> <i>Le produit mentionné est conforme aux prescriptions des Directives Européennes suivantes</i> <i>El producto indicado cumple con las prescripciones de las Directivas Europeas siguientes</i> <i>O produto indicado cumpre com as prescrições das seguintes Diretivas Europeias:</i></p> <p>Elektromagnetische Verträglichkeit (2014/30/EU) <i>Directive Electromagnetic Compatibility / Directive compatibilité électromagnétique / Directiva compatibilidad electromagnética / Diretiva sobre compatibilidade eletromagnética</i></p> <p><u>EN 61326-1; EN 55011 class B</u> <u>EN 61000-4-2 class A; EN 61000-4-3 class A; EN 61000-4-4 class B</u> <u>EN 61000-4-5 class A; EN 61000-4-6 class A;</u></p> <p>RoHS-Richtlinie (2011/65/EU) <i>RoHS Directive / Directive RoHS / Directiva RoHS / Diretiva RoHS</i></p> <p>Unterzeichner: <u>Dr. Späth, Geschäftsführer Technik</u> <i>Signed / Signataire / Firmante / Assinado por:</i> <i>Technical Director / Diretor Técnico</i></p> <p><u>3. 11. 2020</u> <i>Datum / Date / Fecha / Data</i></p> <p> <i>Unterschrift / Signature / Firma / Assinatura</i></p>			
Version: 3 / Index: 0	AFRISO-EURO-INDEX GmbH	D-74363 Güglingen	Seite: 1 von 1

000000 50004 05/13

EU - Konformitätserklärung

EU Declaration of Conformity / Déclaration EU de conformité /
Declaración de conformidad CE / Declaração de confirmação CE /
Deklaracja zgodności UE



Formblatt
FB 27 - 03

Name und Anschrift des Herstellers: AFRISO-EURO-INDEX GmbH, Lindenstraße 20, 74363 Güglingen
 Manufacturer / Fabricant / Fabricante / Nome e endereço do fabricante / Producent:

Erzeugnis: Ultraschalltransmitter SonarFox
 Product / Produit / Producto / Produto / Produkt:

Typenbezeichnung: UST 20 EX
 Type / Type / Tipo / Tipo / Typ:

Betriebsdaten: Versorgungsspannung DC 18 – 28 V;
Max. Input: U_i = 30 V; I_i = 132 mA; P_i = 0,99 W; C_i = 370 nF; L_i = 0,9 mH
 Techn. Details / Caractéristiques / Características / Detalhes técnicos / Dane techniczne:

Wir erklären in alleiniger Verantwortung, dass das bezeichnete Erzeugnis mit den Vorschriften folgender
 Europäischer Richtlinien übereinstimmt:

*We declare under our sole responsibility that the above mentioned product meets the requirements of the
 following European Directives:*

Le produit mentionné est conforme aux prescriptions des Directives Européennes suivantes:

El producto indicado cumple con las prescripciones de las Directivas Europeas siguientes:

O produto indicado cumpre com as prescrições das seguintes Diretivas Europeias:

Wymieniony wyżej produkt spełnia wymagania następujących Dyrektyw Europejskich:

Elektromagnetische Verträglichkeit (2014/30/EU)

*Directive Electromagnetic Compatibility / Directive compatibilité électromagnétique / Directiva compatibilidad
 electromagnética / Diretiva sobre compatibilidade eletromagnética / Dyrektywa kompatybilności elektromagnetycznej*

EN 61326-1; EN 55011 class B; EN 61000-4-2 class A; EN 61000-4-3 class A;
EN 61000-4-4 class B; EN 61000-4-5 class A; EN 61000-4-6 class A

Explosionsschutz-Richtlinie (2014/34/EU)

ATEX Directive / Directive ATEX / Directiva ATEX / Diretiva ATEX / Dyrektywa ATEX

EN IEC 60079-0:2018; EN 60079-11:2012

EU-Baumusterbescheinigung-Nr.: FTZÚ 21 ATEX 0027X

Benannte Stelle: FTZÚ (Physical-Technical Testing Institute), Pikartská 1337/7,
716 07 Ostrava-Radvanice, Czech Republic; Kennnummer NB 1026

RoHS-Richtlinie (2011/65/EU)

RoHS Directive / Directive RoHS / Directiva RoHS / Diretiva RoHS / Dyrektywa RoHS

EN IEC 63000:2018

Unterzeichner: Dr. Späth, Geschäftsführer Technik

Signed / Signataire / Firmante /

Technical Director / Diretor Técnico / Dyrektor Techniczny

Assinado por / Podpisal:

19. 4. 2021

Datum / Date / Fecha / Data



AFRISO

AFRISO-EURO-INDEX GmbH
 Lindenstraße 20 • 74363 Güglingen
 Tel.: +49 7143 502-0 • www.afriso.de

Unterschrift / Signature / Firma / Assinatura / Podpis

Version: 3 Index: 4

AFRISO-EURO-INDEX GmbH D-74363 Güglingen

Seite 1 von 1

21. EU-Type Examination Certificate



Physical-Technical Testing Institute
Ostrava - Radvanice



EU - Type Examination Certificate

- (1) **EU - Type Examination Certificate**
(2) **Equipment or Protective Systems Intended for Use
in Potentially Explosive Atmospheres
(Directive 2014/34/EU)**

(3) EU - Type Examination Certificate number:

FTZÚ 21 ATEX 0027X

- (4) Product: **Ultrasonic transmitter SonarFox® UST-20...Ex**
(5) Manufacturer: **Afriso-Euro-Index GmbH**
(6) Address: **Lindenstrasse 20, D-74363, Güglingen, Germany**
(7) This product and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.
(8) The Physical-Technical Testing Institute, Notified Body number 1026, in accordance with Articles 17 of Directive 2014/34/EU of the European Parliament and of the Council, dated 26.02.2014, certifies that this product has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential Report number:

21/0027 dated 31.03.2021

- (9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN IEC 60079-0:2018, EN 60079-11:2012
- (10) If the sign "X" is placed after the certificate number, it indicates that the product is subject to Specific Conditions of Use specified in the schedule to this certificate.
- (11) This certificate relates only to the design and construction of the specified product. Further requirements of the Directive apply to the manufacturing process and supply of this product. These are not covered by this certificate.
- (12) The marking of the product shall include the following:

 **II 1/2G Ex ia IIB T5 Ga/Gb** for UST 20-01-_-Ex and UST 20-11-_-
 **II 1/2G Ex ia IIA T5 Ga/Gb** for UST 20-21-_-Ex and UST 20-31-_-Ex
 **II 2G Ex ia IIA T5 Gb** for UST 20-31-_-Ex

This certificate is valid till: **30.06.2025**

Responsible person:


Dipl. Ing. Lukáš Martinák
Head of Certification Body



Date of issue: 31.03.2021

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Physical-Technical Testing Institute, s.p., Píkarťská 1337/7, 716 07 Ostrava - Radvanice, Czech Republic
tel.: +420 595 223 111, +420 604 203 525, e-mail: ftzu@ftzu.cz, www.ftzu.cz



Physical-Technical Testing Institute
Ostrava - Radvanice

(13)

Schedule

(14) **EU - Type Examination Certificate No. FTZÚ 21 ATEX 0027X**

(15) Description of Product:

The ultrasonic level meter type UST-20...Ex consist of electro-acoustic converter, measuring module display and adjusting modules. It is designed for screwing into vessel cover, so only electro-acoustic converter is installed in zone 0. Upper part (installed in zone 1) contains encapsulated measuring electronics and display and adjusting module. Output signal is current 4 – 20 mA with HART communication.

Device types UST 20-01-_-Ex and UST 20-11-_-Ex belong to apparatus subgroup IIB.

Device types UST 20-21-_-Ex and UST 20-31-_-Ex belong to apparatus subgroup IIA.

Device type UST 20-31-_-Ex is designed only for zone 1.

Maximum inputs parameters:

$U_i = 30 \text{ V}$
 $I_i = 132 \text{ mA}$
 $P_i = 0.99 \text{ W}$
 $C_i = 370 \text{ nF}$
 $L_i = 0.9 \text{ mH}$
 $T_{amb} = -30^\circ\text{C} \leq T_a \leq +70^\circ\text{C}$

(16) Report Number: 21/0027 dated 31.3.2021

(17) Specific Conditions of Use:

1. The device is designed for connection to the supply unit type IRU-420.
2. When the other approved supply unit is used, whose output parameters satisfy above mentioned output parameters, it is necessary to have a galvanic separation or, if supply unit without galvanic separation is used (Zener barriers), it is necessary to provide equalization between sensor and point of barrier earthing.
3. For application in zone 0 the present explosive atmosphere – mixture of air with flammable gases, vapour or mists must comply: $-20^\circ\text{C} \leq T_a \leq -60^\circ\text{C}$; $0.8 \text{ bar} \leq p \leq 1.1 \text{ bar}$.
4. The device must be installed in the way, which prevent mechanical damage of sensor face.
5. It is necessary to carried out earthing by screw which is placed on the head of level meter.

Responsible person:


Dipl. Ing. Lukáš Martinák
Head of Certification Body



Date of issue: 31.03.2021

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tel.: +420 595 223 111, +420 604 203 525, e-mail: ftzu@ftzu.cz, www.ftzu.cz



Physical-Technical Testing Institute
Ostrava - Radvanice

(13)

Schedule

(14) **EU - Type Examination Certificate No. FTZÚ 21 ATEX 0027X**

(18) Essential Health and Safety Requirements:

Compliance with the Essential Health and Safety Requirements is covered by standards mentioned in clause (9) of this certificate.

(19) Drawings and Documents:

Number	Revision	Sheets	Date	Description
01.2021.0	-	34	01.2021	User's guide
ULM-70-OD-04	-	1	01.02.2021	Drawing

Responsible person:


Dipl. Ing. Lukáš Martinák
Head of Certification Body



Date of issue: 31.03.2021

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