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SONATAX sc

User manual

12/2022, Edition 4

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Section 1 Specifications

Specifications are subject to change without notice.

The product has only the approvals listed and the registrations, certificates and declarations officially provided with the product. The usage of this product in an application for which it is not permitted is not approved by the manufacturer.

General	
Measurement method	Ultrasonic measurement (750–1250 kHz)
Measuring range	0.2 m–12 m (0.7 ft–40 ft) sludge level
Resolution	0.03 m (0.1 ft) sludge level
Accuracy	0.1 m (0.33 ft)
Response time	10–1800 s (adjustable)
calibration	One time on commissioning
Environmental conditions	
Ambient temperature	> 0–50 °C (> 0–122 °F)
Temperature compensation	Automatic
Flow speed	Max. 3 m/s
Pressure range	≤ 0.3 bar or ≤ 3 m (≤ 43.55 psi or ≤ 10 ft)
Sensor specifications	
Dimensions	130 mm × 185 mm (5 in. × 7.3 in.) (H × Ø)
Earth	Approximately 3.5 kg (123.5 oz) (without struts)
Maintenance requirements	< 1 hour/month, typically
Cable length	10 m (33 ft), maximum 100 m (330 ft) with extension cable
Power consumption	12 V, 2.4 W, (200 mA)
Protection type	IP68 (≤ 1 bar (14.5 psi))
Compliance	CE, TÜV GS, UL/CSA
Warranty	2 years
Materials	
Probe body	Stainless steel 1.4581
Base plate and wiper	POM
Wiper magnet casting compound	Epoxy resin
Wiper rubber	Silicone rubber
Housing seals	NBR (acrylonitrile butadiene rubber)
Light guide seal	Polyurethane
Light guide	LEXAN polycarbonate
Sensor connection cable (fixed connection)	1 cable pair AWG 22 / 12 VDC twisted, 1 cable pair AWG 24 / data twisted, common cable shield, Semoflex (PUR)

Sensor connection plug (fixed connection)	Type M12, protection type IP67
Cable gland	Stainless steel 1.4571
Cable gland insert	TPE-V
Cable gland O-ring	NBR, silicone

In no event will the manufacturer be liable for damages resulting from any improper use of product or failure to comply with the instructions in the manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

2.1 Safety information

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is soley responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

2.1.1 Use of hazard information

DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

Notice

Indicates a situation that, if not avoided, could result in damage to the instrument. Information that requires special emphasis.

2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

2.2 General sensor information

The SONATAX sc is intended for the measurement of sludge levels in water. Use in other media without test of the materials (refer to Section 1 Specifications on page 3) or consultation with the manufacturer is regarded as explicitly not in accordance with requirements.

Any use other than use in accordance with requirements defined in the user manual leads to the loss of the warranty claims and can lead to personal injury and property damage, for which the manufacturer assumes no liability.

2.2.1 Property rights note

Parts of the device software are based on the work of the Independent JPEG Group.

2.2.2 Usage areas

The SONATAX sc can be used anywhere that the solid/liquid separation layer must be monitored.
For example in the area of final sedimentation or in sludge treatment (thickeners).

2.3 Device overview

Figure 1 shows the device components of the SONATAX sc.

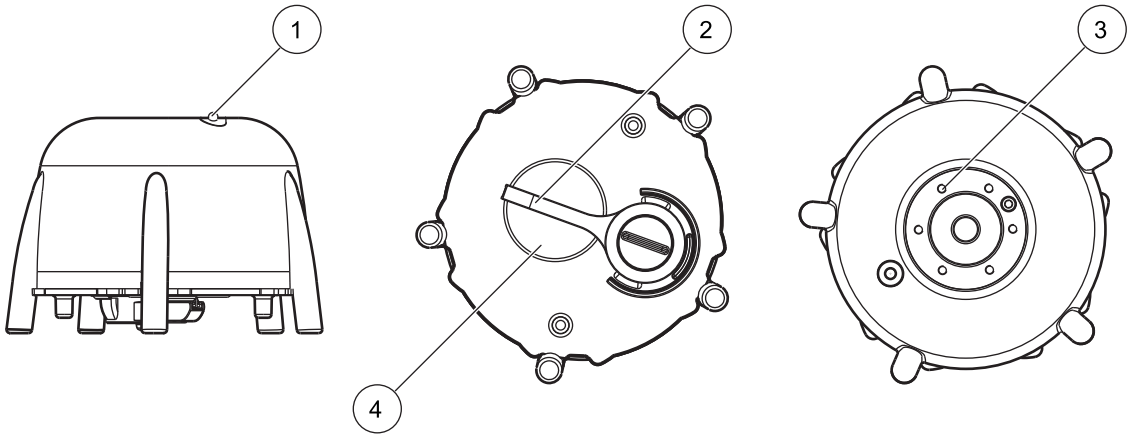


Figure 1 Device overview

1	Operating state LED (refer to Section 6.1)	**3**	Mount for the tank edge attachment
2	Wiper	**4**	Sensor head

2.4 Functional principle

In a tank where solid materials in water (or another fluid) can settle to the bottom, there is a boundary between the settled solids and the clear phase above. The distance from the water surface to the bottom is the sludge level. The sludge height is the distance from the tank floor.

More precisely, the sludge level (or the sludge height) indicates the place in a tank where (viewed from the water surface) the solid content first exceeds a defined limit. This limit value depends on the application. It will, for example, be higher in a pre-thickener of a wastewater treatment plant than in its final sedimentation, where the overlying fluid should be clear water.

The SONATAX sc measures the sludge level via an echo signal (refer to Figure 2) of an ultrasonic pulse. This echo signal is shown in the probe menu SENSOR SETUP > TEST / MAINT > SIGNALS in the echo list (refer to ECHO LIST on page 26). The depth and the echo strength are specified at the ultrasonic transducer in digits (1 digit approximately 1 µV).

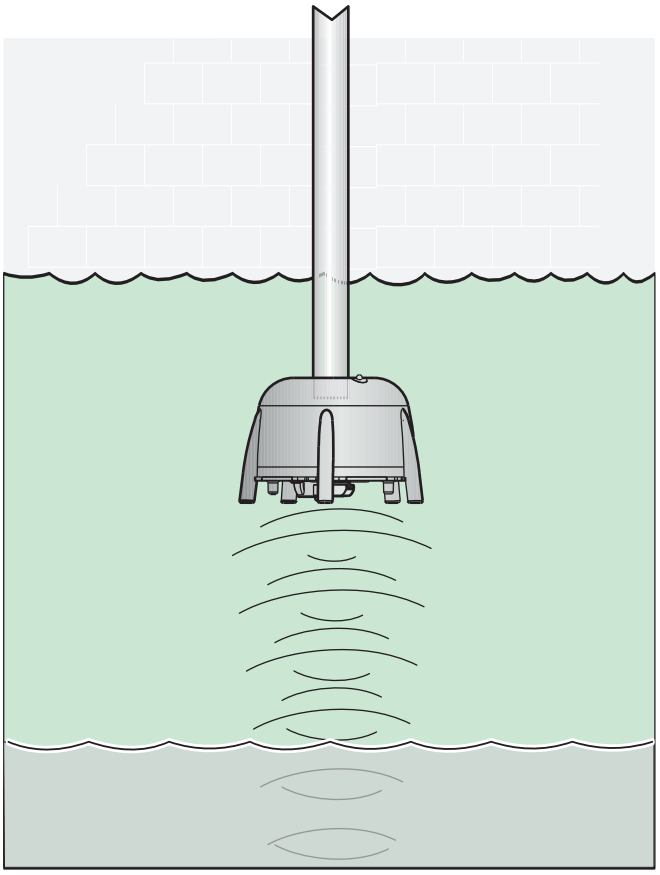


Figure 2 Functional principle

Echos from layers that are further away are quieter (weaker) than those which are closer. The SONATAX sc compensates for this attenuation. The result is indicated on the SONATAX sc as a profile. The data is found in the probe menu SENSOR SETUP > TEST / MAINT > SIGNALS in the profile list (refer to PROFILE LIST on page 26) ((2) Figure 3). The graphic display (for example sc1000) shows the profile in the measurement operation as a graphic ((1) Figure 3).

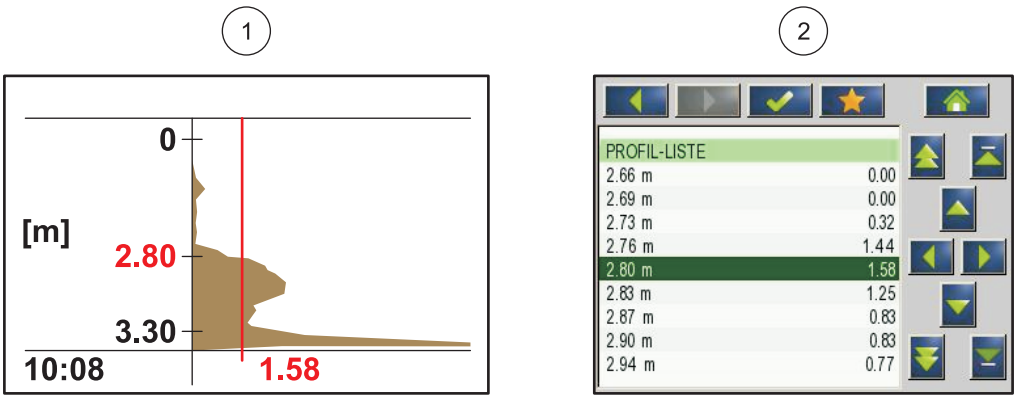


Figure 3 Profile as graphic and list

The example shows a typical profile curve of a sludge level measurement. The Y axis in this graphic reaches from the floor (which can be set in the probe menu SENSOR SETUP > CALIBRATE > TANK DEPTH on page 24) up to the water surface. The profile strength is given on the X axis. The profile increases at a sludge level. If the solid content below the sludge level remains constant, the profile strength decreases again due to the absorption of the ultrasound in the sludge. At the very bottom, the echo of the floor is normally detected.

The vertical line represents the threshold. The sludge level is detected by the SONATAX sc at the point at which the profile exceeds this threshold for the first time viewed from above (analogous to the abovementioned definition of the sludge level). In the graphic, the detected sludge level is identified by a mark on the Y axis.

The threshold is set automatically on the SONATAX sc (setting: THRESHOLD AUTO = xy % in the probe menu SENSOR SETUP > CALIBRATE > ADV.SETTINGS > THRESHOLD AUTO on page 24). The automatic threshold function searches for the maximum in the detected profile. Through an exact setting of the tank depth, a faulty measurement due to the echo of the floor is ruled out.

The background is that the echo signal of the floor in most tanks is the strongest in the profile. With a correct setting of the tank depth, the floor signal is not considered by the automatic threshold function during the determination of the sludge level.

For more information on the correct determination of the tank depth, refer to section Section 3.4.1 on page 13.

DANGER

The installation described in this section of the user manual should only be performed by qualified and specialized personnel. The sensor is not suitable for installation in hazardous areas.

The SONATAX sc can be used with an sc100, sc200 or with an sc1000 controller. Installation instructions are found in the handbook of the controller.

3.1 Unpack sensor

The SONATAX sc is supplied with the following components:

- Sensor
- User manual
- Wiper blades set (5 pieces)

If one of the parts is missing or damaged, please contact the manufacturer or dealer.

3.1.1 Handling of the immersed probe

The immersed probe contains a sensitive ultrasound transducer. Make sure that this is subjected to no hard mechanical impacts. Do not install the probe hanging on the cable. Make sure before the insertion of the probe into the medium that all functions run undisrupted through a check of the system. Check the probe carefully for external damage.

3.2 Connect sensor to an sc controller

3.2.1 Connect sensor with quick connection

The sensor cable is very easy to connect to the controller using a quick connection (Figure 4). Keep the protective cap of the connection socket in case you remove the sensor later and must seal the socket. For longer sensor cable lengths, optional extension cables are available.

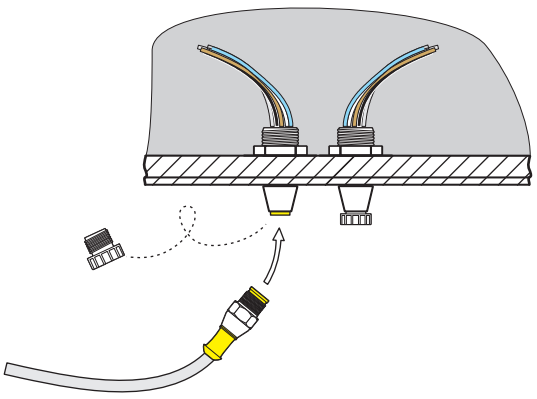


Figure 4 Connect sensor with quick connection

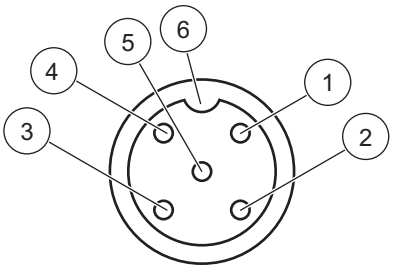


Figure 5 Pin assignment of the quick connection

Number	Assignment	Wire color
1	+12 V=	Brown
2	Earth	Black
3	Data (+)	Blue
4	Data (–)	White
5	Shield	Shield (gray wire for existing quick connection)
6	Insulator notch	

3.3 Function test

Directly after the connection of the sensor to the controller, perform a function check.

1. Connect the controller to the mains power.
2. If the controller does not recognize the new sensor, go to the SCAN SENSORS menu (refer to the user manual of the controller).
3. Confirm any prompt and wait until the new sensor is found.

If the new sensor is found, the controller switches to the measurement operation.

A wipe process is triggered and the device switches to the measurement operation. If no other messages appear, the sensor is functional.

Note: *Measurements in air lead to no measurement values. The error message SENSOR MEASURE is shown. This does not show a malfunction.*

3.4 Install sensor

The SONATAX sc is intended for installation with a tank edge attachment. For more information, refer to the installation instructions of the tank edge attachment.

Note: *Do not begin with the installation of the tank edge attachment before the installation location is determined (refer to Section 3.4.1).*

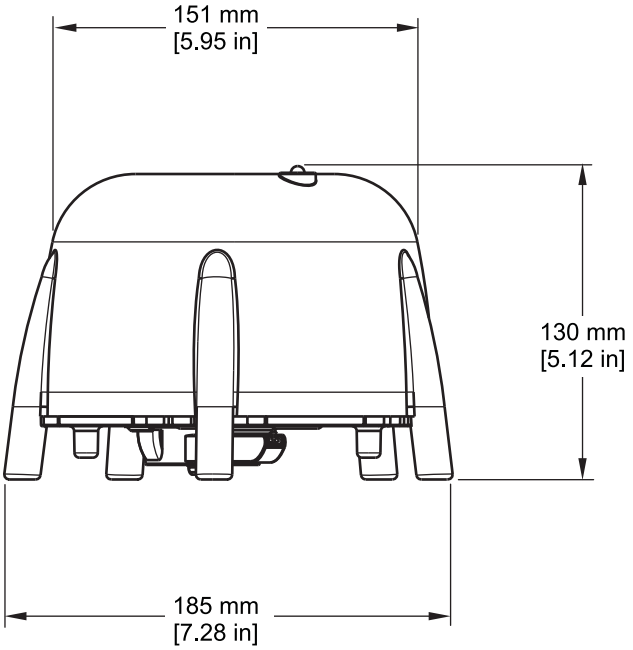


Figure 6 SONATAX sc scale drawing

3.4.1 Select the measurement location and pre-set the device

In the determination of the sludge level over the duration of an ultrasonic echo, the entire space between the probe on the water surface and the tank bottom is required for the measurement. As solid bodies in this area disrupt the measurements, special attention is required in the selection of the measurement location. In the following, it is explained how the suitability of a possible measurement location can be tested. The tank depth should be known here.

A suitable measurement location must be found depending on tank type. The graphics that follow show typical examples for a round tank and a rectangular tank. The point (1) in Figure 7 and Figure 8 is a suitable measurement location.

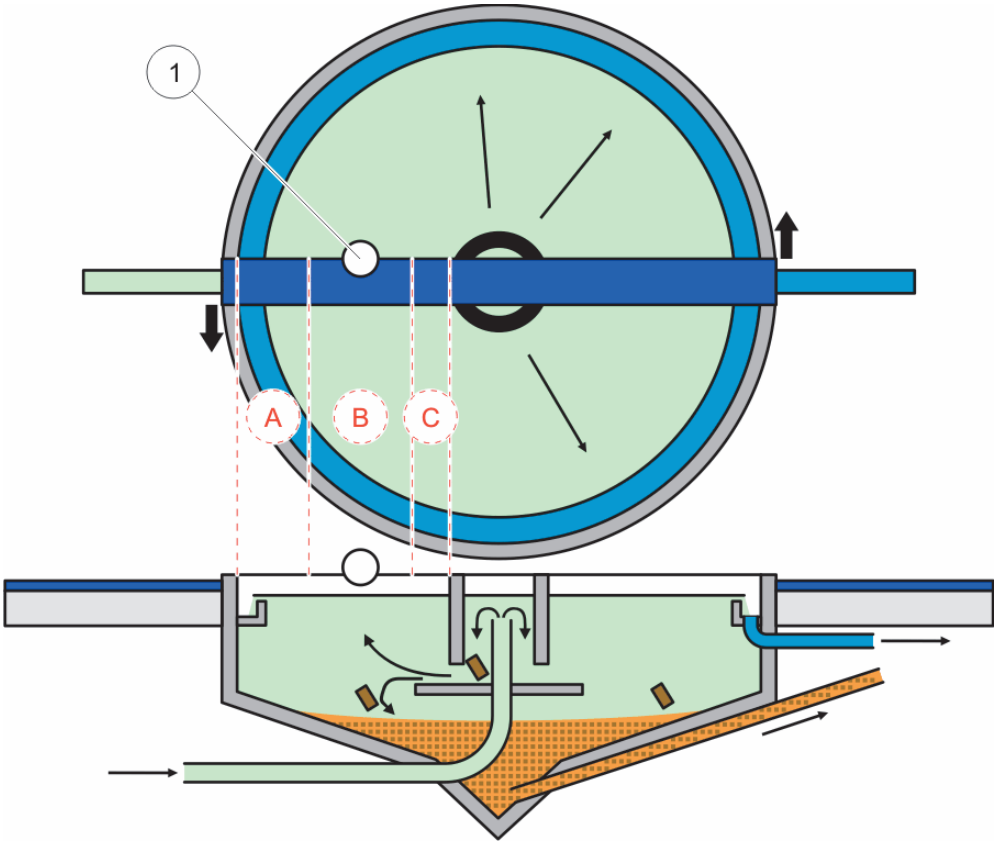


Figure 7 Round tank graphic

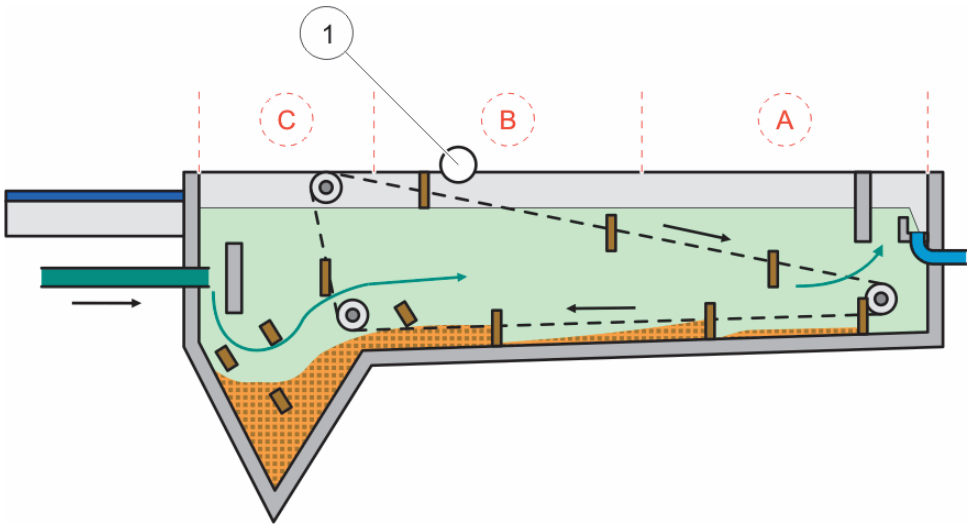


Figure 8 Rectangular tank graphic

At a suitable measurement location, there should be:

- Sufficient sludge present for the measurement, and
- A calm, clear phase above the sludge level

In the examples shown, area (A) shows only very little or no sludge, while in the area (C) above the sludge layer, sludge clouds may disrupt the measurement. The measurement points (A) and (C) are not suitable for the installation. Suitable measurement points can be found in between.

Note: *Installation note: For round tanks with a rotating scraper bridge, install the probe in the direction of rotation on the back of the bridge (Figure 7).*

3.4.1.1 Determine the distance to the tank edge

If the SONATAX sc is installed on the tank edge (i.e. not on a scraper bridge), make sure there is sufficient distance from the SONATAX sc to the tank edge.

This distance is dependent on the depth of the tank.
Use this formula to find a guideline value for this distance:

0.20 m + (0.05 x tank depth in meters) = distance to tank edge

This value can vary depending on composition of the tank. How a possible installation location can be checked for its suitability is described in Section 3.4.1.2 Determine measurement location.

3.4.1.2 Determine measurement location

1. Connect the probe to the sc controller and carefully immerse the probe in the water (approximately 20 cm (7.9 in.)) on the probe cable at the selected measurement location.

2. Select the probe menu SENSOR SETUP > CALIBRATE and do a measurement in the REFLEXLIST menu item.

After a few seconds, the reflex list is shown (refer to REFLEXLIST on page 24). This list usually contains the tank floor as the strongest signal.

If strong reflections between the water surface and the tank floor are present (for example due to pipes, plates etc.), another measurement location must be selected. Sometimes it is sufficient to move the probe by a few centimeters.

In the example (Table 1), there are two disruptive reflexes at a depth of 0.87 m and 2.15 m, and the tank floor is at a depth of 3.30 m.

Table 1 Reflex list

Meters	Intensity
0.87	25 %
2.15	2 %
3.30	100 %

At an ideal measurement location, no disruptive reflections should occur above the floor in the reflex list after multiple measurements (Table 2).

Table 2 Reflex list

Meters	Intensity
3.30	100 %

If no measurement location without disruptive reflexes can be found, select the probe menu SENSOR SETUP > CALIBRATE and trigger a measurement in the PROFILE LIST menu item.

- If there are increased values at the depth of the disruptive reflexes in the PROFILE LIST which influence the measurement value, another measurement location must be selected. Sometimes it is sufficient to move the probe by a few centimeters (refer to Figure 9, right).
- If the reflections do not disrupt the measurement value, this can be a suitable measurement location (refer to Figure 9, left).

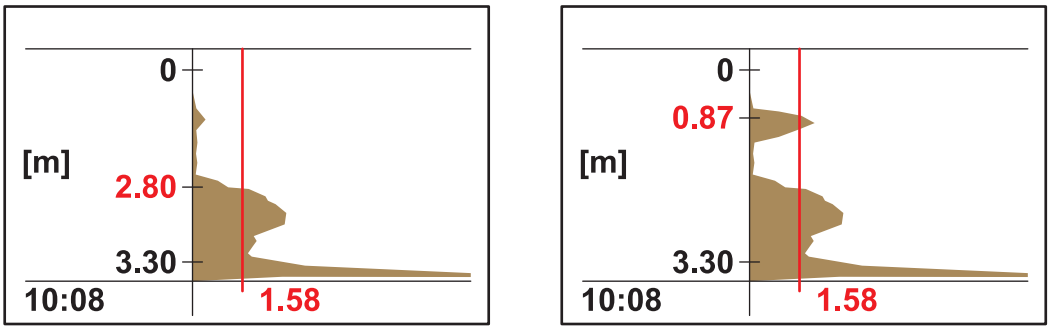


Figure 9 Determine measurement location

3. Then assemble the tank edge attachment there and install the probe.

Note: *The probe should be installed approximately 20 cm (7.9 in.) deep at the installation location (somewhat more than the entire probe head) to make sure that it remains immersed during the entire measurement operation.*

4. In the CALIBRATE probe menu, enter the actual plunger depth (Item A, Figure 10) in the PLUNGERDEPTH menu item.

5. Trigger after approximately 2 minutes another measurement of the reflex list (to adjust the temperature sensor to the water temperature) (also refer to REFLEXLIST on page 24).

6. In the CALIBRATE probe menu, enter the recorded value of the tank depth (Item C, Figure 10) in the TANK DEPTH menu item.

Important note: *The shown value of the tank depth is calculated from information shown:*
Tank depth C = plunger depth A + measured distance to floor B

This calculation is performed internally and leads to incorrect results if the plunger depth is entered incorrectly.

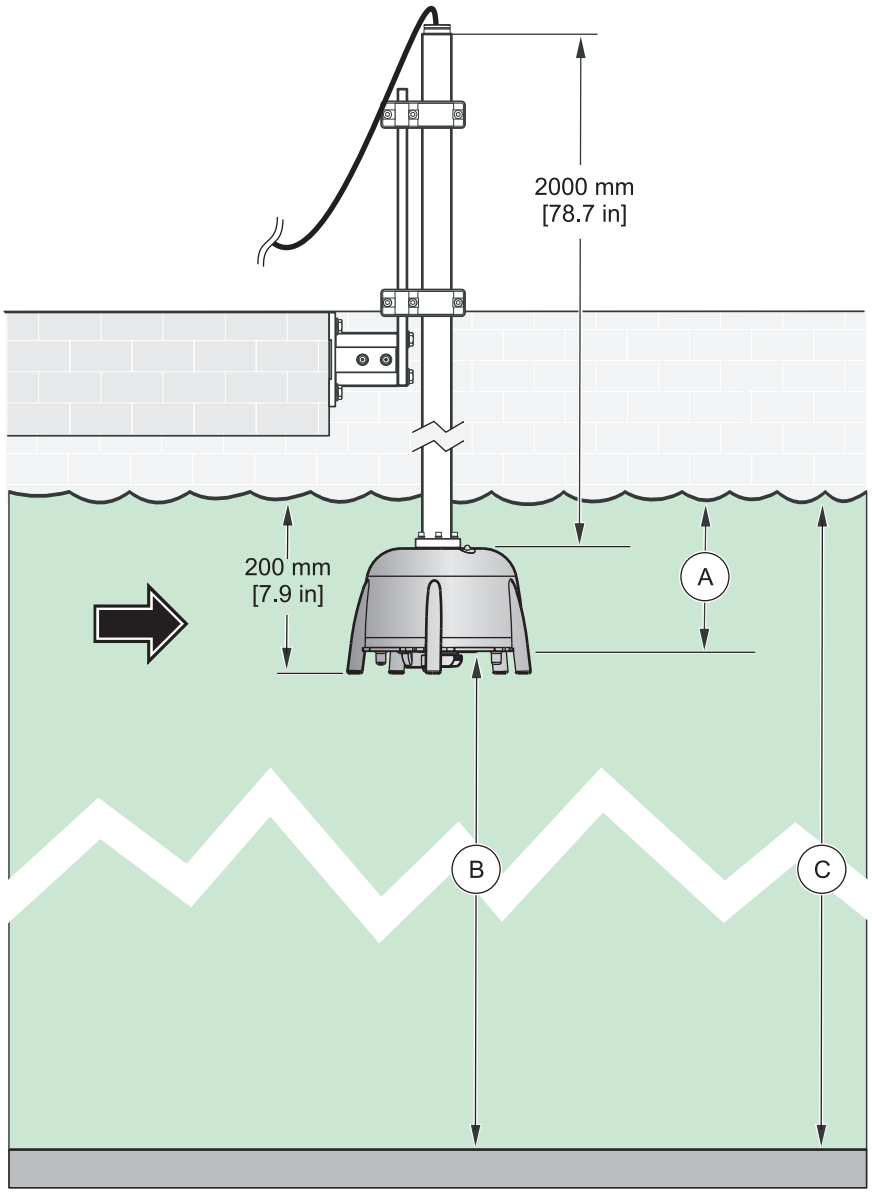


Figure 10 Plunger depth–tank depth

Note: *Should the reflex list not contain the tank depth (possible when there is a lot of sludge above the floor), the tank depth must be determined in another way (e.g. measuring).*

Important note: *The value entered in the TANK DEPTH menu item must in no case be larger than the actual tank depth. This could lead to incorrect measurement values.*

In the determination of a suitable measurement location, the optionally available SLUDGE DOCTOR diagnostic software can be helpful (refer to 7.2 Accessories on page 31). The software enables

the representation and saving of all graphic profiles of the SONATAX sc in a defined time interval (5 minutes–2 hours).

The software also shows and saves all important measurement and configuration parameters, such as the reflex list, measurement values, limit values and all advanced settings, such as response time, frequency, amplitude, angle and temperature.

Take further information from the ***SLUDGE DOCTOR user manual DOC013.98.90411***.

3.4.2 Installation of the sensor

Note: *Take further information on the installation from the installation instructions.*

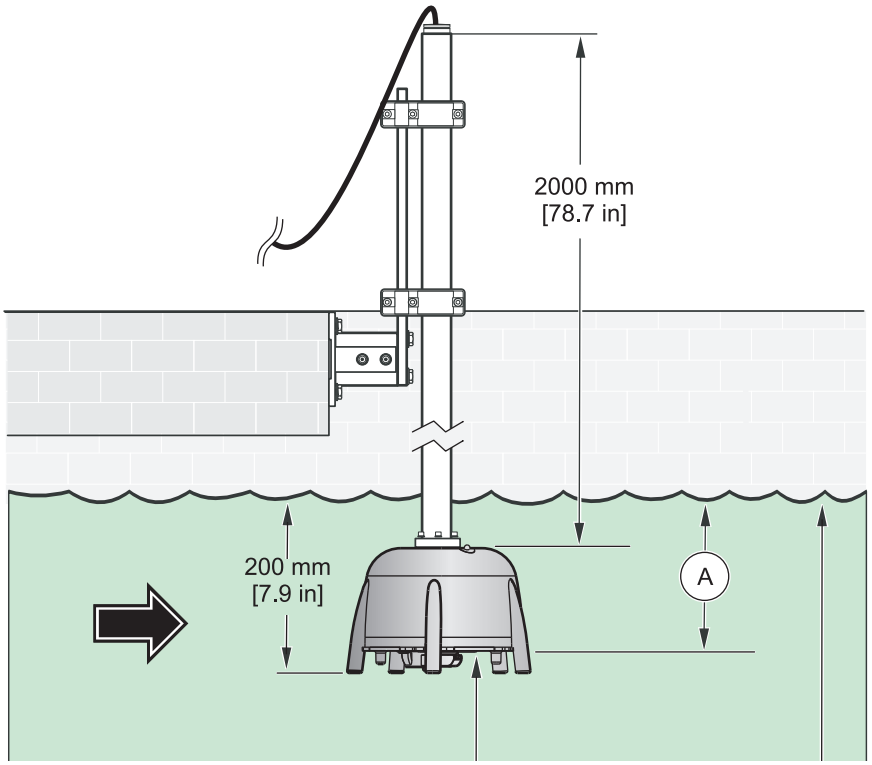


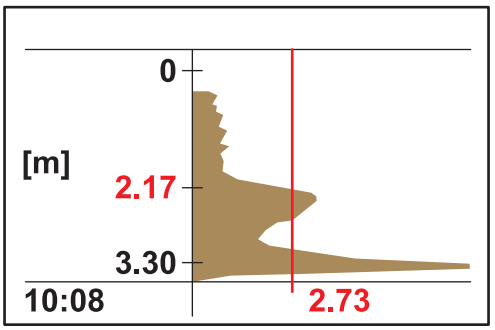
Figure 11 Installation of the sensor

3.5 Advanced settings

In the SENSOR SETUP > CALIBRATE > ADV. SETTINGS menu, special probe parameters can be found.

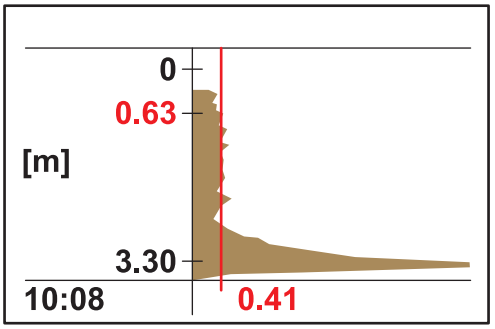
The default settings of these parameters are selected so that no correction is required in most applications. In exceptional cases, these parameters must be adapted depending on the application.

The examples that follow show typical sludge profiles.



Example 1: Pre-thickener with clear separation layer, but sporadically empty.

The image shows a thickener with a clear profile. The signals above the sludge level caused by turbid water do not disrupt the measurement.

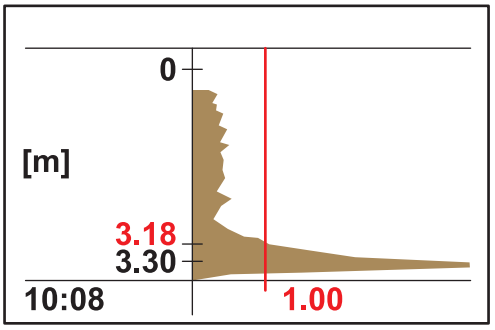


The same thickener is empty in this image. The threshold now adjusts itself automatically to the signals of the turbid water. The recorded measurement value at 0.63 m is incorrect.

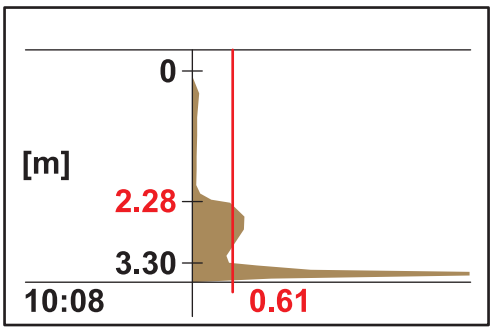
Recommended measure:

Increase the adjustment of the ADV. SETTINGS > LL THRESH. AUTO setting from 0.3 to 1.0.

Note: *LL THRESH. AUTO gives the smallest possible value that the threshold can accept.*

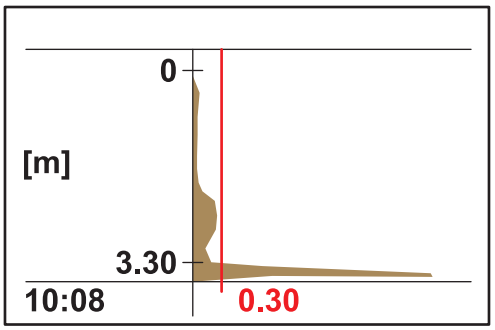


The image shows the empty thickener after the adjustment. The result 3.18 m is correct.

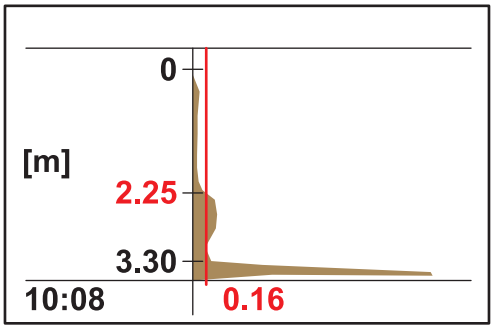


Example 2: Application with clear separation layer, but weak signal.

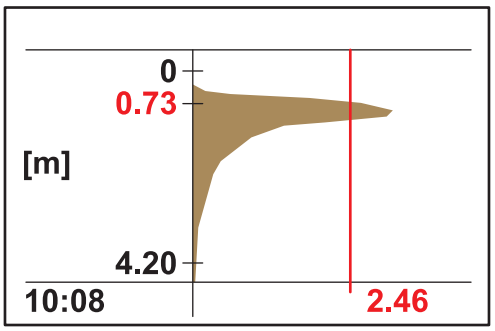
Very low to absolutely no interference signals through turbid water above the separation layer. Strength of the echo 0.61 is above the LL THRESH. AUTO (pre-setting 0.3) and leads to correct measurement value 2.28 m.



Very low to absolutely no interference signals through turbid water above the separation layer. Strength of the maximum echo <0.3. Instead of the correct measurement value, only the tank floor is found.

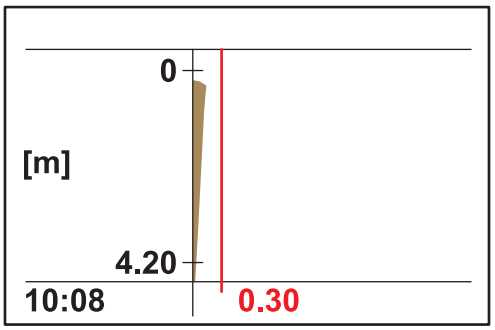


Increase the adjustment of the ADV. SETTINGS > LL THRESH. AUTO setting from 0.3 to 0.1. The threshold 0.16 finds the correct measurement value 2.25 m.

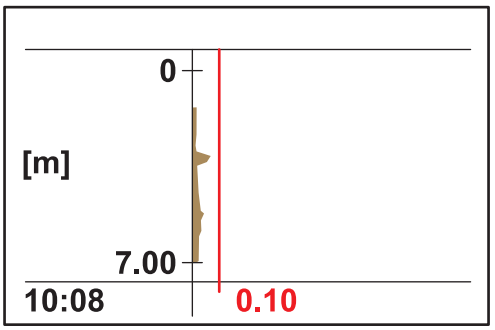


Example 3: Thickener or other application with very high sludge concentration up to just under the water surface; echo is absorbed in the uppermost sludge layer:

In this application, the floor signal is no longer detected due to the high absorption of the ultrasonic signal. The shown measurement value 0.73 is correct. No adjustment of the ADV. SETTINGS necessary.

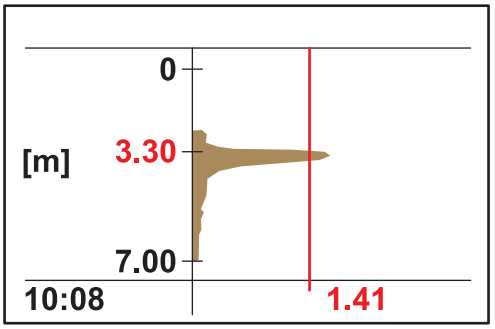


If the sludge increases so far that the sludge level is above the measurement range (the measurement range begins from 0.2 m beneath the sensor), it can occur that no sludge level is detected (SENSOR MEASURE error message). In this case, the application must be checked.



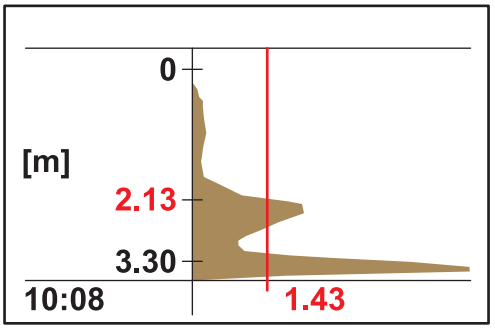
Example 4: Application with large tank depth and clear separation layer, but high absorption of the ultrasound by turbid materials above the separation layer.

Absorption is so high that no sludge level is detected at a plunger depth of 0.2 m and LL THRESH. AUTO 0.1 (SENSOR MEASURE error message).



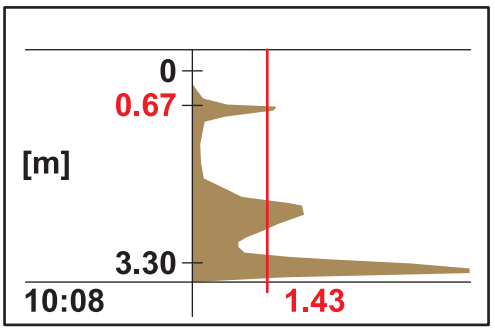
After adjustment of the plunger depth SENSOR SETUP > CALIBRATE > PLUNGERDEPTH to 3 m, the sludge level can be precisely determined at 3.30. The strength of the echo 1.41 shows that there is a clear separation layer.

Note: *After adjustment of the plunger depth, the setting of the tank floor must be checked (SENSOR SETUP > CALIBRATE > TANK DEPTH)*

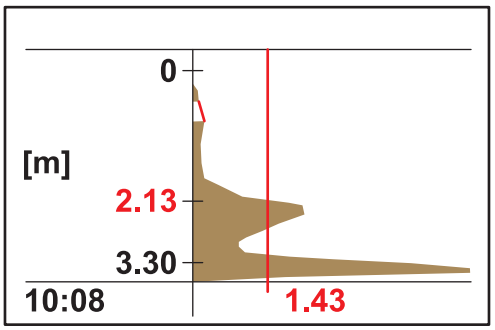


Example 5: Application with clear separation layer, but interference signal above the separation layer (for example skimmer).

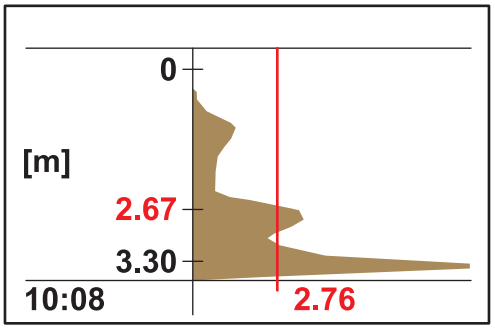
Ideal profile, correct measurement value.



The same measurement point with sporadic interference of the echo in a 0.67 m tank depth. The measurement value is incorrect.



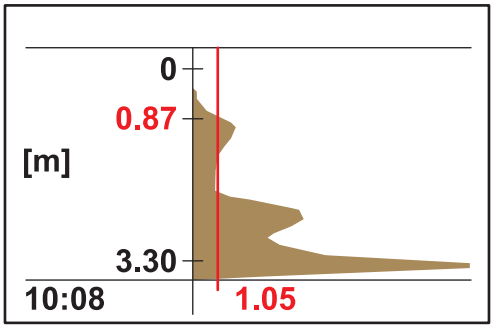
Fade out this disruption in SENSOR SETUP > CALIBRATE > ADV. SETTINGS > FADE-OUT in the range of 0.5–0.8 m. The sensor now ignores all signals in this range and finds the correct measurement value at 2.13 m.



Example 6: Application with clear separation layer and a sludge cloud above the separation layer.

In this application, the separation layer should be measured, the sludge cloud should be ignored (for example pre-thickener).

No change of the default setting. The automatic threshold detects the separation layer; the echo of the sludge cloud is lower than the echo of the sludge cloud.



The image shows the same profile as before, but with another threshold and measurement value.

In this application, the sludge cloud should be measured as an early warning system (for example sludge drift in the final clarification tank).

Change of the automatic threshold SENSOR SETUP > CALIBRATE > ADV. SETTINGS > THRESHOLD AUTO to 25 %. The automatic threshold detects the sludge cloud.

The optionally available SLUDGE DOCTOR diagnostic software can be helpful for the setting of the special probe parameters (refer to 7.2 Accessories on page 31). The software enables the representation and saving of all graphic profiles of the SONATAX sc in a defined time interval (5 minutes–2 hours).

The software also shows and saves all important measurement and configuration parameters, such as the reflex list, measurement values, limit values and all advanced settings, such as response time, frequency, amplitude, angle and temperature.

Take further information from the ***SLUDGE DOCTOR user manual DOC013.98.90411***.

Section 4 Operation

4.1 Use of the sc controller

Before using the sensor with an sc controller, make yourself familiar with the operating method of the controller. Learn to navigate through the menu and to use the menu functions. Further information is found in the user manual of the controller.

4.2 Sensor data logging

The sc controller provides one data log and one event log for each sensor. The data log stores the measurement data at selectable intervals. The event log stores a large number of events that occur on the devices, such as configuration changes, alarms and warnings etc. The data log and the event log can be read out in CSV format. Refer to the controller user manual for more information about the log download.

4.3 Sensor setup

During initial sensor setup, select the parameter that corresponds to the applicable instrument.

4.3.1 Change of the sensor name

When a sensor is installed for the first time, the serial number is shown as the measurement location (or sensor name). The measurement location can be changed as follows:

1. From the main menu, select SENSOR SETUP and confirm the selection.
2. If more than one sensor is connected, mark the required sensor and confirm the selection.
3. Select CONFIGURE and confirm the selection.
4. Select EDITED NAME and edit the name. Return to the Sensor Setup menu with confirm or cancel.

4.4 SENSOR STATUS menu

Select the SONATAX sc (if several sensors are connected)

SONATAX sc	
ERRORS	Lists error messages; refer to 6.2 Error messages on page 29
WARNINGS	Lists warnings; refer to 6.3 Warnings on page 30

4.5 SENSOR SETUP menu

Select the SONATAX sc (if several sensors are connected)

WIPE			
CALIBRATE			
	PLUNGERDEPTH		Plunger depth of the probe underside (refer to 3.4.1.2 Determine measurement location on page 15). Configurable: 0.1 m to 3 m (0.3 ft to 9.8 ft)
	REFLEXLIST		Shows the reflex list. A new measurement can be triggered. A list is shown of all detected solid bodies that have clearly reflected the ultrasonic impulse. The measurement depth is shown in m or ft and the strength of the reflected signal in %, relative to the strongest signal in the list. This list mostly contains the tank floor. If strong reflections between the water surface and the tank floor are present (for example due to pipes, plates etc.), it should be checked whether another installation location offers better conditions.
	TANK DEPTH		Entry of the floor depth (refer to 3.4.1.2 Determine measurement location on page 15). Configurable: 1.00 m to 12 m (3.3 ft to 39.4 ft)
	PROFILE LIST		A profile is calculated from the ultrasound echo and shown for the corresponding depths respectively as profile strength. The profile is similar in its curve with the TS profile of the tank. At an average solid content, the values are in the order of 1. A new measurement can be triggered (refer to Figure 3 on page 8).
	ADV. SETTINGS		
		FACTOR	Correction factor for the speed of sound. Configurable: 0.3 to 3.0, default setting 1.0 A change of the default factor is only required if the local speed of sound in the fluid deviates from the speed of sound in water: Factor (fluid) = speed of sound (fluid) / speed of sound (water) ***Note:*** *For applications in water, the factor should remain at 1.0.*
		THRESHOLD AUTO	With the automatic threshold function, the system constantly adapts the environmental conditions and automatically changes the sensitivity in order to guarantee maximum accuracy. Recommendation: 75% Configurable: 1-95%
		LL THRESH. AUTO	LL THRESH. AUTO gives the smallest possible value that the threshold can accept. Configurable: 0.1 to 1.0, recommendation 0.3
		FADE-OUT	If fixed installations or other influences interfere at certain tank depths, then this range can be faded out —·it is then completely ignored. Configurable: ON, OFF
		BEGIN	Upper limit of the range that should be faded out. Only active when FADE-OUT = ON.
		END	Lower limit of the range that should be faded out. Only active when FADE-OUT = ON.
		SET DEFAULTS	Reset to factory configuration for all probe-specific parameters. This occurs only after a security prompt.

4.5 SENSOR SETUP menu (Continued)

Select the SONATAX sc (if several sensors are connected)

KONFIGURIEREN (CONFIGURE)		
	EDIT NAME	Freely editable (up to 16 characters) Factory setting: device number
	PARAMETER	The measurement result can be shown as the sludge level (as the distance of the sludge from the water surface) or as the sludge height (as the distance from the tank floor). To calculate the sludge height, the tank depth specified in the TANK DEPTH menu item is used. (Sludge height = tank depth – sludge level) Configurable: sludge level, sludge height
	MEAS UNITS	Dimension of the measurement result. Configurable: meters, feet
	CLEAN. INTERVAL	Wipe interval, Recommendation: 15 minutes Configurable: 1 minute to 1 hour
	RESPONSE TIME	Damping of the measurement value. In the case of high measurement value fluctuations, a high damping of for example 300 seconds is recommended. Configurable: 10 to 1800 seconds
	LOGGER INTERVAL	The interval for the internal data log. Configurable: 1, 2, 3, 4, 5, 6, 10, 15, 30 minutes
	SET DEFAULTS	Reset to factory configuration for all menu items listed above. This occurs only after a security prompt.
TEST / MAINT		
	PROBE INFO	
	SENSOR NAME	Display of the device name.
	EDIT NAME	Display of the freely selectable measurement location (factory setting: device number).
	SERIAL NUMBER.	Device number
	MODEL NUMBER	Item no. of the sensor.
	HARDWARE-VERS	Production status of main circuit board
	SOFTWARE-VERS	Sensor software version
	COUNTER	
	WIPER COUNTER	Backward counter for wiping processes of the wiper profile. After expiration of the counter, a warning message is shown. In the case of a wiper change, the counter should be reset again.
	TOTAL TIME	Operating hours counter
	MOTOR	Forward counter for wiping processes.
	TEST / MAINT	Date of the last performed maintenance.
	REPLACE PROFILE	For the wiper profile change, the wiper arm moves to a central position. In this position, the wiper arm can then be removed and installed without problems.

4.5 SENSOR SETUP menu (Continued)

Select the SONATAX sc (if several sensors are connected)

TEST / MAINT		
	SIGNALS	
	MOIST	Indicator as to whether water is in the probe.
	TEMPERATURE	Temperature of the surrounding water in °C or F°.
	SENSOR ANGLE	Deviation of the probe axis from the perpendicular in degrees.
	ECHO LIST	The received echo signal in digits (units of the AD converter) is shown at the corresponding measurement depths in a list. The first element at 0 meters shows the strength of the transmission pulse. A new measurement can be started.
	PROFILE LIST	A profile is calculated from the ultrasound echo and shown for the corresponding depths respectively as profile strength. The profile is similar in its curve with the TS profile of the tank. At an average solid content, the values are in the order of 1. A new measurement can be started. (See Figure 3 on page 8)
	REFLEXLIST	Shows the reflex list. A new measurement can be triggered. Refer to REFLEXLIST on page 24
	FREQUENCY	The resonance frequency of the ultrasound transducer is shown.
	AMPL DIAG	The resonance voltage of the ultrasound transducer is shown.
	THRESHOLD	To determine the sludge level, a profile is first calculated from the ultrasonic echo. This roughly returns the solid content depending on the tank depth. The sludge level is assigned to the tank depth where the profile exceeds the threshold for the first time.
	SHOW AMPL.	On activation, the resonance profile of the ultrasound transducer is shown instead of the sludge profile (PROFILE LIST) as a graphic in the measurement window (only valid with sc1000). The resonance profile can be switched ON and OFF. After switch-off, the sludge profile (PROFILE LIST) is shown on the measurement window again.

DANGER

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

No components that can be serviced by the user are in the inside of the probe. Opening of the probe by the user leads to the loss of the manufacturer guarantee and may cause malfunctions.

The cleanliness of the ultrasound transducer is crucial for the accuracy of the measurement results.

The installed wiper is able to remove all impurities under normal circumstances and if the selection of the wiper interval is not too large (30 minutes).

If the regular check of the probe head and of the wiper (monthly) indicates dirt, wear of the wiper rubber or a defect, then either the probe head must be cleaned, or the wiper profile and/or the defective part must be exchanged.

5.1 Maintenance tasks

Take the maintenance intervals from Table 3.

Table 3 Maintenance schedule

Time interval	Action
Monthly	Visual inspection, if necessary, clean
Annually, at the latest after 20,000 wipe cycles	Change wiper rubber

5.2 Wiper change

CAUTION

Obey the locally applicable accident prevention regulations. Wear protective gloves where necessary during the change of the wiper rubber.

1. Go to SENSOR SETUP > TEST / MAINT > REPLACE PROFILE.

   The wiper arm (refer to item 3 in Figure 12) moves for the wiper change into a central position.

2. Remove the guide screw (refer to item 2 in Figure 12) and take off the wiper arm.

3. Pull the wiper profile (refer to item 1 in Figure 12) forward out of the wiper arm.

4. Slide a new wiper profile with the bevel at the front into the guide.

5. Install the wiper arm again and tighten the guide screw again by hand.

Note: *Only tighten the screw hand-tight until the safety lugs have audibly engaged 2–3 times.*

6. Select OK and the wiper arm automatically moves back to the initial position.

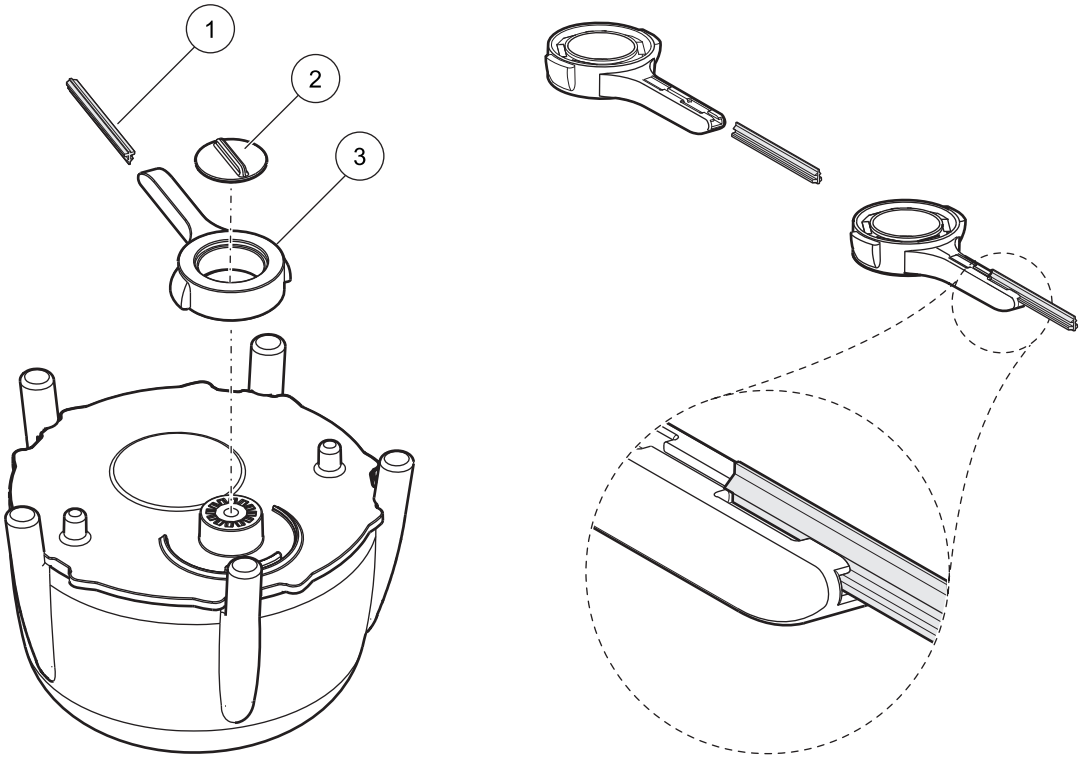


Figure 12 Wiper unit

1	Wiper profile	**3**	Wiper arm
2	Guide screw		

5.3 Cleaning tasks

Use water and a suitable brush to remove heavy contamination on the probe or on the strut as necessary.

Clean the ultrasound transducer carefully with water and a lint-free cloth.

Section 6 Troubleshooting

6.1 Operating state LED

The sensor is equipped on the top side with an LED that provides information on the operating state.

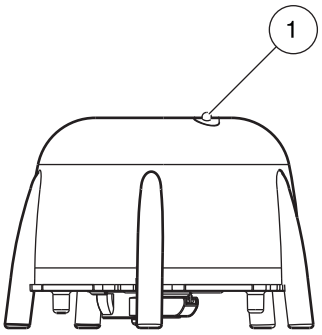


Figure 13 Operating state LED

1	Operating state LED

Table 4 Sensor status

Green LED	No errors or warnings
Green/red flashing LED	Probe in operation, probe position deviates strongly from the perpendicular, the measurement value is retained, there is no error
Red LED	Error
LED off	No device function

6.2 Error messages

In the case of an error, an error message is shown on the controller. Find error messages and notes on the resolution of the errors in Table 5.

Table 5 Error messages

Error message	Reason	Resolution
SENSOR MEASURE	The PROFILE LIST and graphic on the sc1000 is less than the programmed value for LL THRESH.AUTO. over the entire tank depth, or the ultrasound transducer is contaminated or not immersed.	Check device data, also the plunger depth, floor depth and advanced settings, check installation and remove contamination.
POS. UNKNOWN	The wiper position is not detected. The wiper is in the central position (after a wiper change).	Start a wiping process
	Defective light barrier plate	Call service
	Application with particles that block the wiper.	Cleaning of the ultrasound transducer and of the wiper system.
AMPL DIAG	Internal error	Call service
MOIST	Moisture value > 10	Call service
SENSOR ANGLE	The probe is more than 20° from perpendicular and for longer than 180 seconds.	Check installation
	Incorrectly calibrated position sensor	Call service
SYSTEM ERROR	Faulty RAM	Call service

6.3 Warnings

In the case of a warning, a warning message is shown on the controller. Find warnings and notes on the resolution of the warning in Table 6.

Table 6 Warnings

Warning message	Reason	Resolution
REPLACE PROFILE	The counter for the wiper profile has expired	Change wiper profile

6.4 SLUDGE DOCTOR, (diagnostic software for SONATAX sc)

SLUDGE DOCTOR is an optionally available diagnostic software for the SONATAX sc probe in connection with the controllers sc100, sc200 or sc1000. The software enables the representation and saving of all graphic profiles of the SONATAX sc in a defined time interval (5 minutes–2 hours).

The software also shows and saves all important measurement and configuration parameters, such as the reflex list, measurement values, limit values and all advanced settings, such as response time, frequency, amplitude, angle and temperature.

Take further information from the ***SLUDGE DOCTOR user manual DOC013.98.90411***.

Section 7 Replacement parts and accessories

7.1 Replacement parts

Description	Number	Order number
1 set of replacement wiper blades out of silicone for SONATAX/SONATAX sc probes (5 pieces)	1	LZX328
Wiper arm	1	LZY344
Guide screw (for stopping the wiper arm)	1	LZY345
User manual (xx=language code)	1	DOC023.xx.00117

7.2 Accessories

Description	Order number
Pivot attachment set, 0.35 m (1.15 ft)	LZX414.00.72000
Pivot attachment set, 1 m (3.3 ft)	LZX414.00.71000
Rail assembly attachment set	LZX414.00.73000
Tank edge attachment set	LZX414.00.70000
Scraper bridge attachment set	LZX414.00.74000
SONATAX sc chain stay	LZX914.99.11300
SLUDGE DOCTOR, diagnostic software without interface cable	LZY801.99.00000
SLUDGE DOCTOR, diagnostic software with sc200 interface cable	LZY801.99.00010
SLUDGE DOCTOR, diagnostic software with sc1000 interface cable	LZY801.99.00020

Appendix A Modbus register

Table 7 Sensor Modbus register

Tag name	Register #	Data type	Length	R/W	Description
SLUDGELEVEL m	40001	Float	2	R	Measured sludge level in m
SLUDGELEVEL ft	40003	Float	2	R	Measured sludge level in ft
SLUDGEHEIGHT m	40005	Float	2	R	Measured sludge height in m
SLUDGEHEIGHT ft	40007	Float	2	R	Measured sludge height in ft
PLUNGERDEPTH m	40009	Float	2	R/W	Plunger depth in m
PLUNGERDEPTH ft	40011	Float	2	R/W	Plunger depth in ft
BOTTOM m	40013	Float	2	R/W	Tank depth in m
BOTTOM ft	40015	Float	2	R/W	Tank depth in ft
SET PARAMETER	40017	Unsigned integer	1	R/W	Type of measurement: sludge level, sludge height
MEAS UNITS	40018	Unsigned integer	1	R/W	Dimension set: meters, feet
FACTOR	40019	Float	2	R/W	Correction factor for the measured value: 0.9–1.1
WIPE	40021	Unsigned integer	1	R/W	Wiper status
ERROR	40022	String	8	R	Error shown
EDITED NAME	40022	String	8	R/W	Name of the measuring location
CLEAN. INTERVAL	40030	Unsigned integer	1	R/W	Wiper interval
RESPONSE TIME	40031	Unsigned integer	1	R/W	Response time: 10–1800 seconds
FADE-OUT	40032	Unsigned integer	1	R/W	Blanking: ON/OFF
BEGIN m	40033	Float	2	R/W	Blanking start in m
BEGIN ft	40035	Float	2	R/W	Blanking start in ft
END m	40037	Float	2	R/W	Blanking end in m
END ft	40039	Float	2	R/W	Blanking end in ft
LOGGER INTERVAL	40041	Unsigned integer	1	R/W	Logger interval
THRESHOLD AUTO	40042	Unsigned integer	1	R/W	Automatic threshold function: ON/OFF
THRESHOLD	40043	Float	2	R/W	Threshold value (manual): 0.1–50
WINDOW	40045	Unsigned integer	1	R/W	Window
PROFILE COUNTER	40046	Unsigned integer	1	R/W	Wiper profile counter
SERIAL NUMBER	40047	String	6	R	Serial number
TEST / MAINT	40053	Time2	2	R/W	Date of the last maintenance
PROGRAM	40055	Float	2	R	Application version
BOOTPROG.	40057	Float	2	R	Boot loader version
STRUCTURE	40059	Unsigned integer	1	R	Structure driver version
FIRMWARE	40060	Unsigned integer	1	R	Firmware driver version
CONTENT	40061	Unsigned integer	1	R	Register driver version
FormatMinSL m	40062	Float	2	R	Lower sludge level limit in m
FormatMaxSL m	40064	Float	2	R	Upper sludge level limit in m
FormatMinSL ft	40066	Float	2	R	Lower sludge level limit in ft
FormatMaxSL ft	40068	Float	2	R	Upper sludge level limit in ft
FormatMinSH m	40070	Float	2	R	Lower sludge height limit in m
FormatMaxSH m	40072	Float	2	R	Upper sludge height limit in m
FormatMinSH ft	40074	Float	2	R	Lower sludge height limit in ft
FormatMaxSH ft	40076	Float	2	R	Upper sludge height limit in ft
MOIST	40078	Unsigned integer	1	R	Moisture signal

Table 7 Sensor Modbus register

Tag name	Register #	Data type	Length	R/W	Description
TEMPERATURE	40079	Integer	1	R	Temperature signal in °C
SENSOR ANGLE	40080	Unsigned integer	1	R	Probe position signal in degrees
FREQUENCY	40081	Integer	1	R	Resonance frequency signal in hertz
AMPL DIAG	40082	Integer	1	R	Resonance voltage signal in volts

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