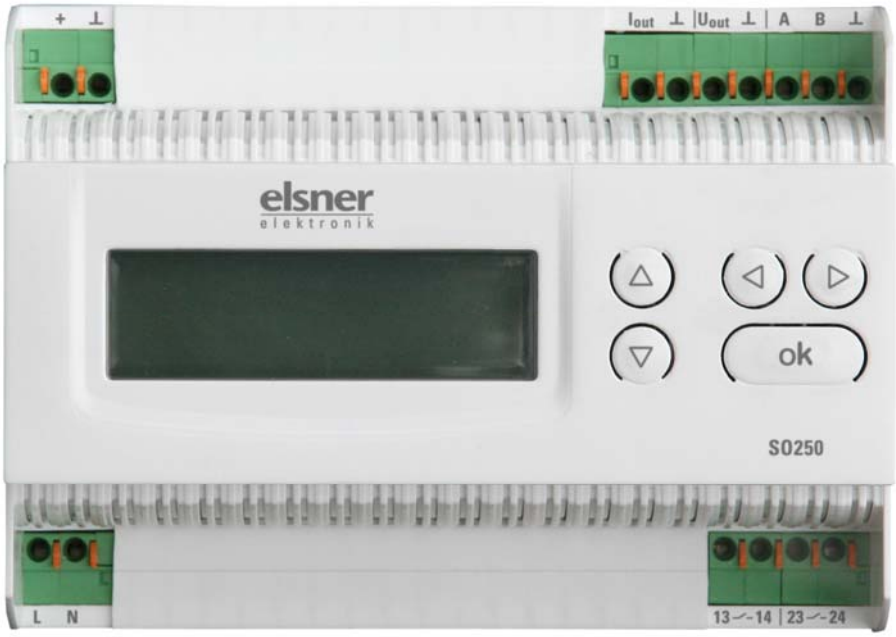
SO250-UI
Tank Sensor



Item number 70152

Technical specifications
and installation instructions

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The SO250-UI ultrasound sensor is used to detect the liquid content of tanks and for distance measurements. Besides applications in areas such as rainwater storage tanks or heating oil tanks, the sensor can also be used in fish tanks or fountains, as well as for monitoring the parking distances between heavy goods vehicles. Please follow the “Instructions for assembly and operation” on page 4.

The distance/content level can be directly read off the display of the output device. The integrated keyboard allows the tank geometry and data output to be input (Modbus interface, current output, voltage output and two relay switch outputs). Switching a relay can additionally trigger an acoustic alarm signal.

Functions:

- **Distance measurement**
- **Content measurement** in spherical, rectangular and cylindrical shaped tanks. Several tanks of the same type set up as a battery
- **Current output**
- **Voltage output**
- **2 relay switch outputs** for automatic filling/drainage and/or overfill/empty warnings, or for triggering fault warnings
- **Modbus interface** with configurable address, data transfer rate, parity checking

Technical specifications

Evaluation device

Housing:	Plastic
Colour:	White
Installation:	Series installation on DIN rail
Protection rating:	IP 20
Dimensions:	approx. 123 x 89 x 61 (W x H x D, mm), 7 width units
Weight:	approx. 360 g
Ambient temperature:	Operating -5…+45 °C, Storage -25…+70°C
Ambient air humidity:	max. 95% rH, avoid condensation
Operating voltage:	230 V AC / 50 Hz
Power consumption:	max. 4 W

The product conforms with the provisions of EU directives.

Housing:	Plastic
Colour:	Black
Protection category:	IP 52

Chemical resistance:	Water, heating oil
Dimensions:	Overall diameter approx. 60 mm, overall sensor head height approx. 45 mm, thread 1½ inches
Connector cable:	RG 58 coaxial cable with BNC plug 10 m length, can be extended to max. 40 m
Total weight:	approx. 400 g
Ambient temperature:	+0…+40 °C
Measurement range:	12…250 cm

Installation and commissioning

Installation, testing, operational start-up and troubleshooting should only be performed by an electrician.

DANGER!
Risk to life from live voltage (mains voltage)!
There are unprotected live components within the device.
- National legal regulations are to be followed.
- Ensure that all lines to be assembled are free of voltage and take precautions against accidental switching on.
- Do not use the device if it is damaged.
- Take the device or system out of service and secure it against unintentional use, if it can be assumed, that risk-free operation is no longer guaranteed.

The device is only to be used for its intended purpose. Any improper modification or failure to follow the operating instructions voids any and all warranty and guarantee claims.

After unpacking the device, check it immediately for possible mechanical damage. If it has been damaged in transport, inform the supplier immediately.
The device may only be used as a fixed-site installation; that means only when assembled and after conclusion of all installation and operational start-up tasks and only in the surroundings designated for it.

Elsner Elektronik is not liable for any changes in norms and standards which may occur after publication of these operating instructions.

Instructions for assembly and operation

Evaluation device:

Must only be installed and operated in dry, indoor spaces.
Avoid condensation.

Ultrasonic probe:

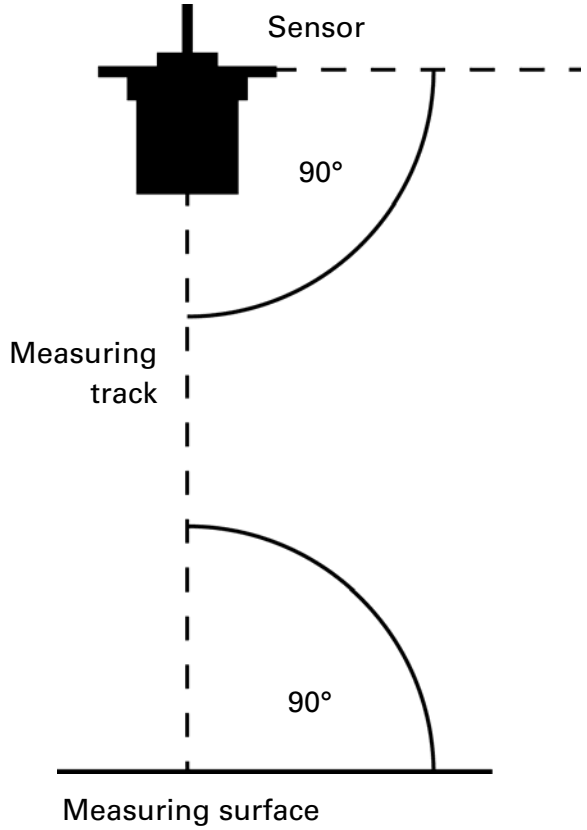
Do not cause any mechanical stress on the front part (rubber)!

The measuring head must be dry:
It must not be washed by liquids!
No condensation, no droplet formation!

The measuring track must be free:
No steam, fog, etc. between the sensor and the measuring surface.
Steam is formed e.g. when a warm fluid is poured into a tank.

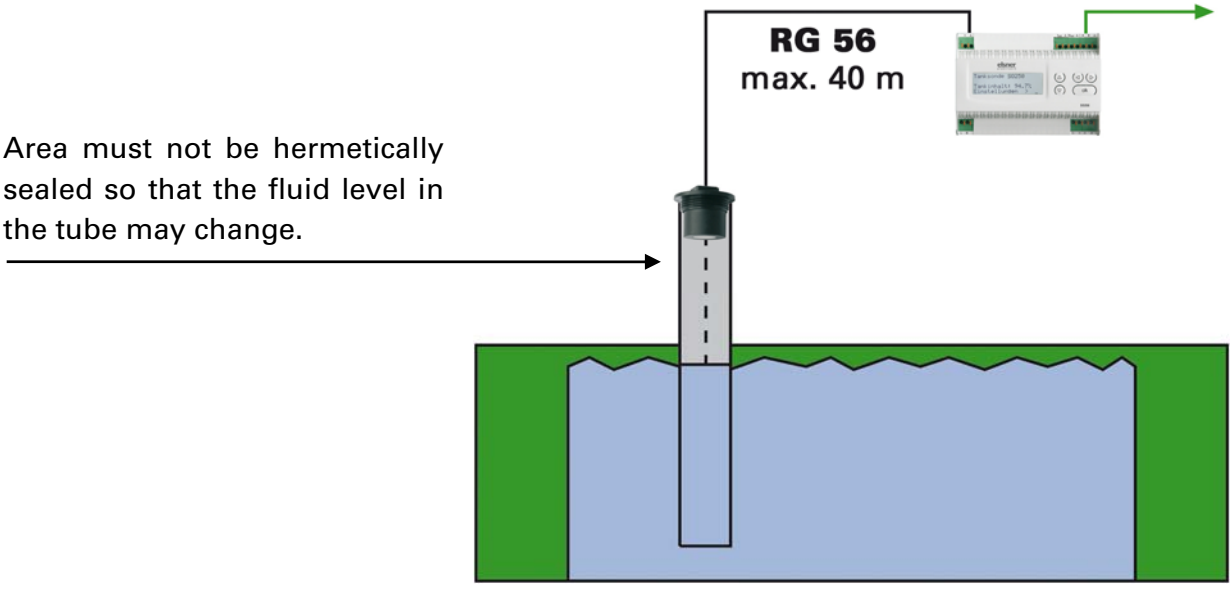
The measured surface must be still:
No waves, no vibrations!

The measuring track is aligned vertical to the sensor surface. The measuring track has to meet the measuring surface vertically, too.



To avoid wave formation in fluids, the measured area can be separated using a measuring tube (Ø at least 50 mm). Please note: the measuring area is only calm as long as the end of the tube is below the surface of the liquid.

Area must not be hermetically sealed so that the fluid level in the tube may change.

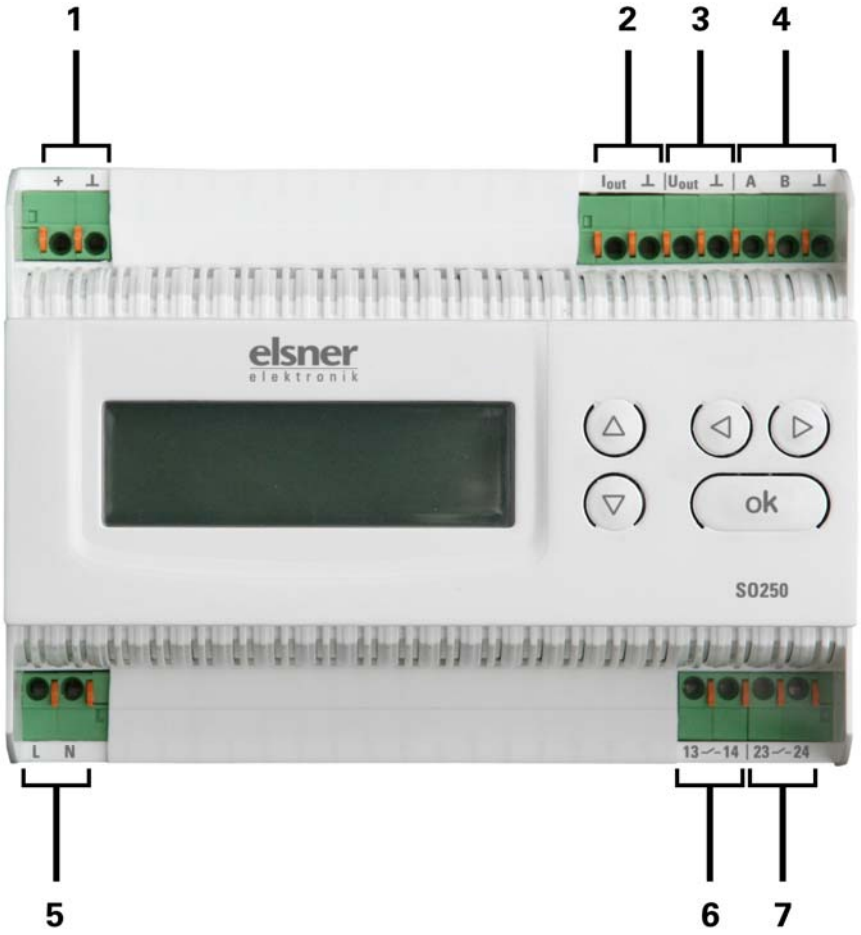


Loud surrounding noise (e.g. when filling metal tanks) may disrupt the measurement. Please contact us with any questions regarding the area of application or installation.

Connection

Ensure that the unit is correctly connected. Incorrect connection may lead to the destruction of the tank sensor or electronic equipment connected to it.

Casing



1 *measurement sensor connection, + / shield ⊥*
2 *Current output, I_{out} / ⊥*
3 *Voltage output, U_{out} / ⊥*
4 *Modbus interface, A / B / ⊥*
5 *Operating voltage input 230 V AC, L / N*
6 *Relay output 1 (NO contact), 13 / 14*
7 *Relay output 2 (NO contact), 23 / 24*

All connections are suitable for solid conductors up to 1.5 mm² or fine wire conductors

Modbus transmission protocol

Applicable protocol: Modbus RTU

SO 250-UI Modbus inquiry string from master

Byte no.	**Variable**		**Explanation**
0	Slave address	xx	
1	Command	04H	Read Input Registers
2	Start Address High Byte	xx	
3	Start Address Low Byte	xx	
4	Word Count High Byte	xx	
5	Word Count Low Byte	xx	
6	CRC High Byte	xx	
7	CRC Low Byte	xx	

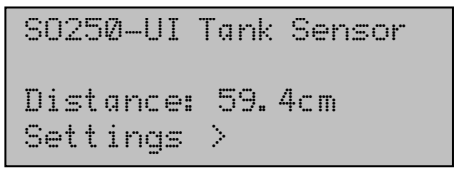
SO250-UI Modbus output string to master

Byte no.	Start Address	Variable		Explanation
0		Slave address	xx	
1		Command	04H	Read Input Registers
2		Byte Count	xx	Master requirement * 2
3	0	Measurement value	H	
4	1	Measurement value	L	0 … 100%
5	2	Relay 1	H	
6	3	Relay 1	L	1 = On, 2 = Off
7	4	Relay 2	H	
8	5	Relay 2	L	1 = On, 2 = Off
9	6	Error	H	
10	7	Error	L	0 = Measurement value ok, 1 = Error
11	CRC		H	
12	CRC		L	

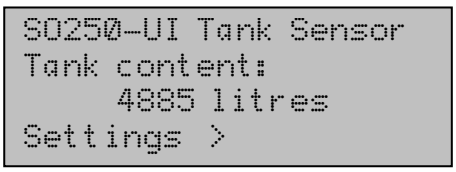
Operation

Display main menu

Main menu:



or



The display indicates the currently measured distance and/or tank content (depending on the setting). Where no measurement is possible, the message "No echo received!" appears.

The following settings can be applied using the keypad:

- Distance measurement
- Content measurement
- Interfaces (Modbus, current output, voltage output, relay)
- Acoustic signal

The display will dim after 60 seconds if no key is pressed during this time.

Key functions in display menu

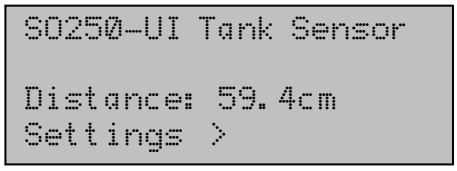
▷ key:	Confirms the selection, moves to the next step.
◁ key:	One step back.
▽ and △ keys:	Changes a setting (selects a setting or changes a value). The cursor (the blinking rectangle) indicates the selected menu item.
ok key:	Confirms the settings and returns to the device main menu.

Distance measurement

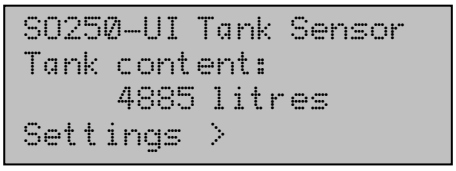
The SO250-UI Tank Sensor can detect distances. The following settings can be applied in the “Distance measurement” menu:

- Distance display unit
- Measurement time interval

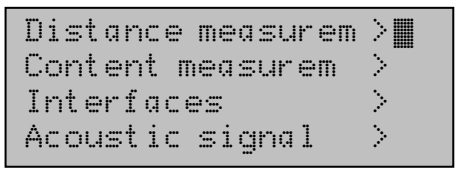
Main menu:



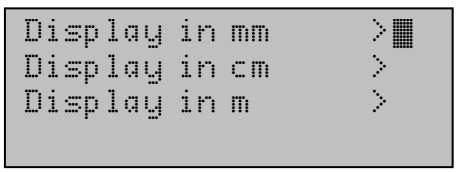
or



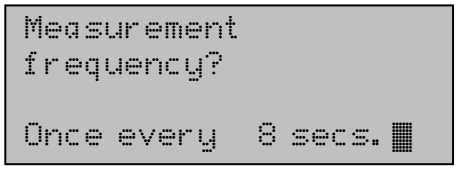
Press the ▷ key once to access the “Settings” area.



Move the cursor (the blinking rectangle on the right) to the ”Distance measurement” menu item using the ▽ and △ keys, and press the ▷ key.



Move the cursor to the desired setting using the ▽ or △ keys. You can display distances in millimetres (mm), centimetres (cm) or metres (m). Confirm your selection using the ▷ key.



Use the ▽ and △ keys to set the desired time interval for your measurements.

Settings options: From 1 s to 9 s in one-second increments, from 10 s to 50 s in ten-second increments, from 1 min to 120 min in 10-minute increments.

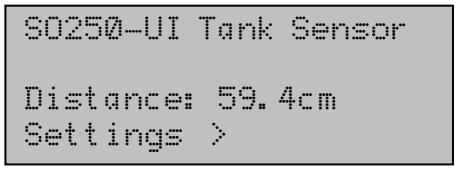
Confirm your selection using the ▷ key. You will automatically return to the basic settings.

Content measurement

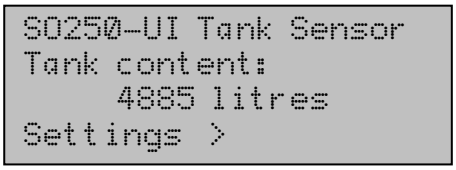
The SO250-UI Tank Sensor can measure a tank's liquid contents. Possible tank shapes include rectangular, spherical and upright or horizontal cylindrical tanks. Where two or more tanks of the same type are laid out in a battery, only one tank need be described to allow the SO250-UI to calculate the content based on the input number of tanks. The following settings can be applied in the “Content measurement” menu:

- Tank form
- Tank volume / capacity / filling height
- Sensor distance from liquid when tank is full
- Number of tanks in battery
- Content display unit
- Measurement time interval

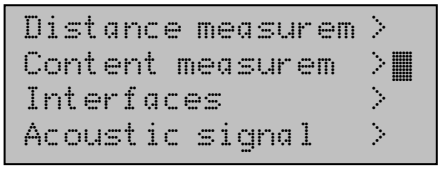
Main menu:



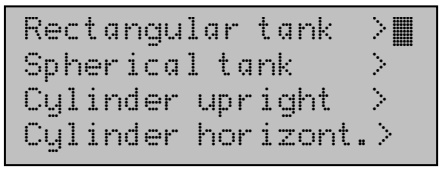
or



Press the ▷ key once to access the “Settings” area.



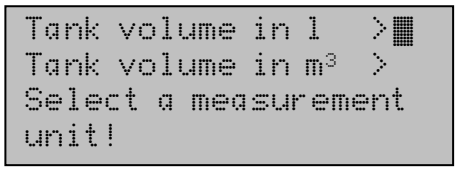
Move the cursor (the blinking rectangle on the right) to the "Content measurement" menu item using the ▽ and △ keys, and press the ▷ key.



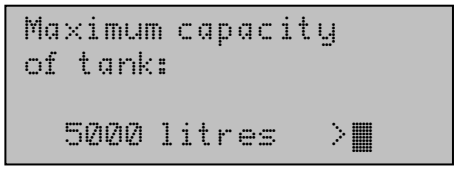
Move the cursor to the desired setting using the ▽ or △ keys. The SO250-UI can calculate the content of rectangular, spherical, and upright or horizontal cylindrical tanks.

Confirm your selection using the ▷ key and proceed as described for the respective tank form.

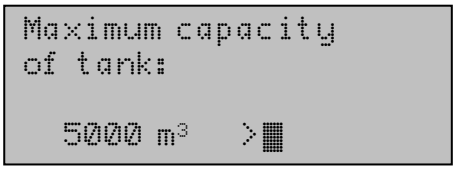
Rectangular tank



Move the cursor to the desired setting using the ▽ or △ keys. You can input the capacity of the tank in litres (l) or cubic meters (m³). Confirm your selection using the ▷ key.



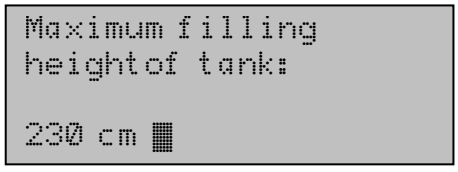
or



Use the ▽ and △ keys to select the maximum capacity of the tank (the number of tanks in use can be input at a later stage).

Settings options: *Litres*: 1 to 99 l in one-litre increments, 100 to 100,000 l in one hundred-litre increments. *Cubic meters*: 1 to 99 m³ in one-litre increments, 100 to 100,000 m³ in one hundred-cubic metre increments.

Confirm your selection using the ▷ key.



Use the ▽ and △ keys to select the maximum filling height of the tank (1 to 254 cm).

Confirm your selection using the ▷ key and proceed as described in “Settings for all tank shapes”.

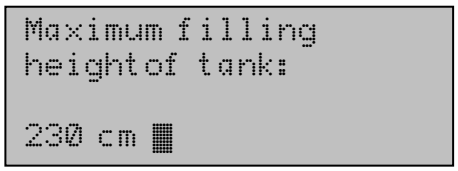
Spherical tank

Use the ▽ and △ keys to select the interior diameter of the tank (1 to 1,000 cm).

Confirm your selection using the ▷ key and proceed as described in “Settings for all tank shapes”.

Cylinder upright

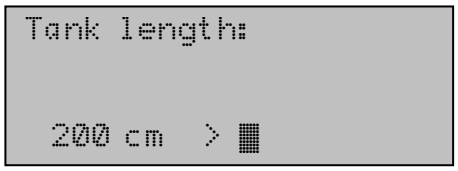
Use the ▽ and △ keys to select the interior diameter of the tank (1 to 1,000 cm). Confirm your selection using the ▷ key.



Use the ▽ and △ keys to select the maximum filling height of the tank (1 to 254 cm).

Confirm your selection using the ▷ key and proceed as described in “Settings for all tank shapes”.

Cylinder horizontal



Use the ▽ and △ keys to select the length of the tank.

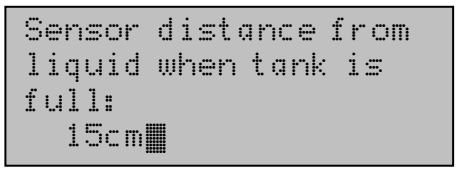
Settings options: 1 to 99 cm in one-centimetre increments, 100 to 100,000 cm in ten-centimetre increments.

Confirm your selection using the ▷ key.

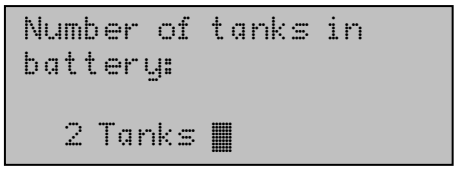
Use the ▽ and △ keys to select the interior diameter of the tank (1 to 1,000 cm).

Confirm your selection using the ▷ key and proceed as described in "Settings for all tank shapes".

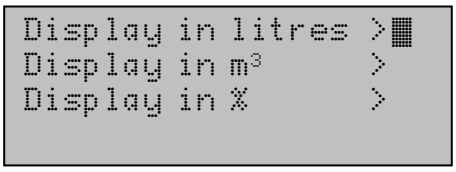
Settings for all tank shapes



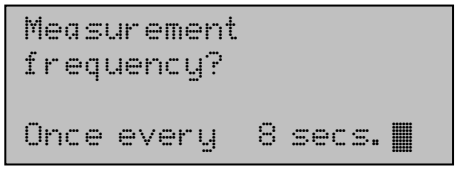
Use the ▽ and △ keys to select the distance of the sensor from the liquid when the tank is full (12 to 200 cm). Confirm your selection using the ▷ key.



Use the ▽ and △ keys to select how many of the described tanks are included in the battery (1 to 100 tanks). Confirm your selection using the ▷ key.



Move the cursor to the desired setting using the ▽ or △ keys. The SO250-UI can indicate the fluid content of the tank in litres (l) cubic meters (m^3) or percent (%). Confirm your selection using the ▷ key.



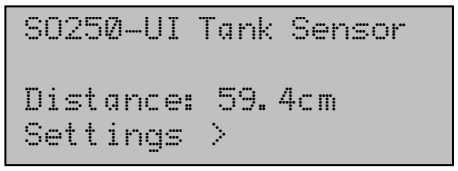
Use the ▽ and △ keys to set the desired time interval for your measurements.

Settings options: From 1 s to 9 s in one-second increments, from 10 s to 50 s in ten-second increments, from 1 min to 120 min in 10-minute increments.

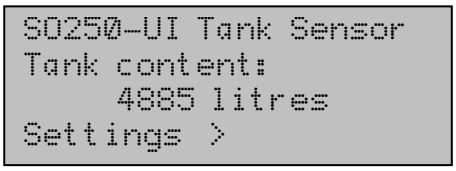
Confirm your selection using the ▷ key. You will automatically return to the main menu.

Interfaces

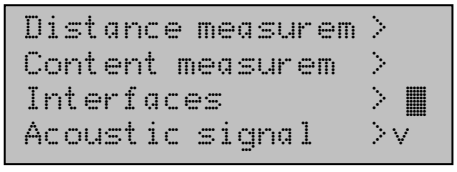
Main menu:



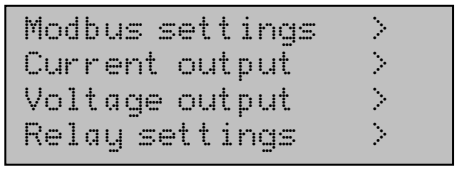
or



Press the ▷ key once to access the “Settings” area.



Move the cursor (the blinking rectangle on the right) to the “Interface” menu item using the ▽ and △ keys, and press the ▷ key.

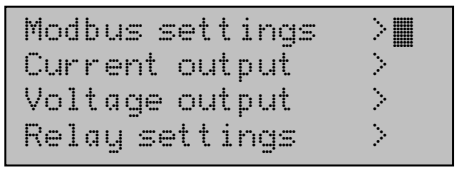


The selection menu for the different interfaces appears.

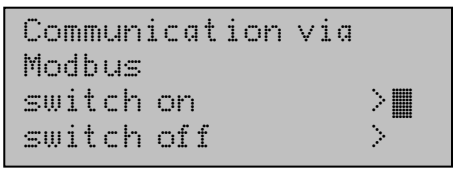
Modbus settings

The following settings can be applied to the Modbus interface:

- Modbus switch on/off settings
- Modbus address settings
- Data transmission rate settings
- Parity check settings

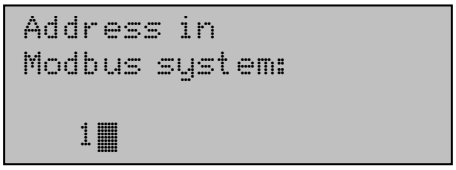


Move the cursor to the "Modbus settings" menu item using the ▽ or △ keys. Confirm your selection using the ▷ key.



Move the cursor to the desired setting using the ▽ or △ keys. Confirm your selection using the ▷ key.

Selecting “Switch off” returns the SO250-UI automatically to the basic settings. Selecting “Switch on” brings you to the next Setting step:



Use the ▽ and △ keys to change the address (1 to 247). Confirm your selection using the ▷ key.

Use the ▽ and △ keys to set the desired data transmission rate.

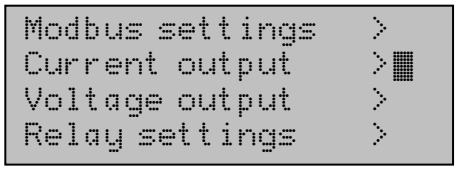
Settings options: 4.8 kbit/s • 9.6 kbit/s • 19.2 kbit/s • 38.4 kbit/s • 115 kbit/s.

Confirm your selection using the ▷ key.

Use the ▽ and △ keys to set the desired data parity check (even/odd parity). Confirm your selection using the ▷ key.

You will automatically return to the main menu.

Current output



Move the cursor to the "Current output" menu item using the ▽ or △ keys. Confirm your selection using the ▷ key

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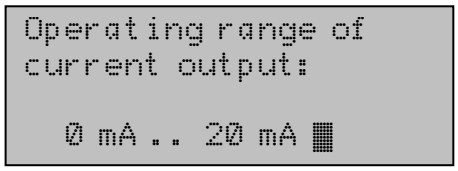


Use the ▽ and △ keys to set the operating range of the current output. Settings options: 0 mA ... 20 mA or 4 mA ... 20 mA.

Confirm your selection using the ▷ key. You will automatically return to the main menu.

Operating range 0...20 mA:

Distance measurement:	**Content measurement:**
0 mA → 12 cm	0 mA → 0% Tank content
20 mA → 250 cm	20 mA → 100% Tank content

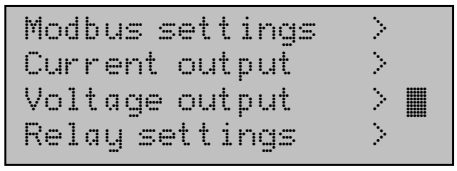
If "No echo received“: 0 mA.

Operating range 4...20 mA:

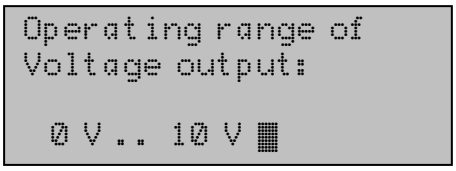
Distance measurement:	**Content measurement:**
4 mA → 12 cm	4 mA → 0% Tank content
20 mA → 250 cm	20 mA → 100% Tank content

If "No echo received“: 4 mA.

Voltage output



Move the cursor to the "Voltage output" menu item using the ▽ or △ keys. Confirm your selection using the ▷ key.



Use the ▽ and △ keys to set the operating range of the current output. Settings options: 0 V ... 5 V or 0 V ... 10 V.

Confirm your selection using the ▷ key. You will automatically return to the main menu.

Operating range 0...5 V:

Distance measurement:	**Content measurement:**
0 V → 12 cm	0 V → 0% Tank content
5 V → 250 cm	5 V → 100% Tank content

If "No echo received“: 0 V.

Operating range 0...10 V:

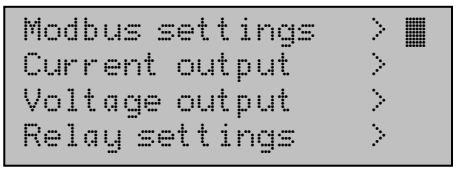
Distance measurement:	**Content measurement:**
0 V → 12 cm	0 V → 0% Tank content
10 V → 250 cm	10 V → 100% Tank content

If "No echo received“: 0 V.

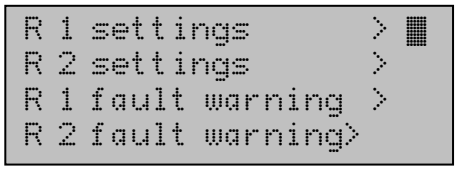
Relay settings

Both relay outputs can either be set to automatically monitor tank contents (filling/drainage, overfill/empty warnings), or the relays can be used to trigger a fault warning.

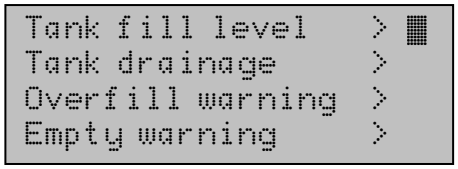
Whenever any value is set in the “Rel. 1/2 settings” menu item, the relevant relay operates as a control system for automatic monitoring. Whenever the “Rel. 1/2 fault warning” menu item is selected, only a fault warning is triggered.



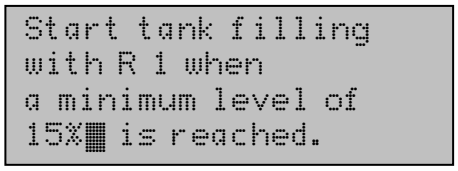
Setting relays 1 / 2:

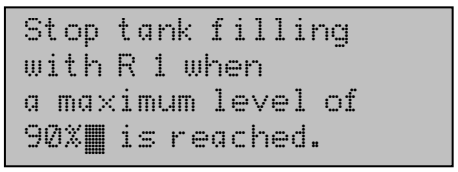


The settings options are the same for both relays. Confirm your selection using the ▷ key.

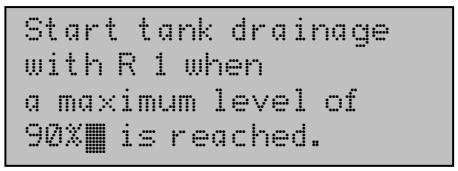


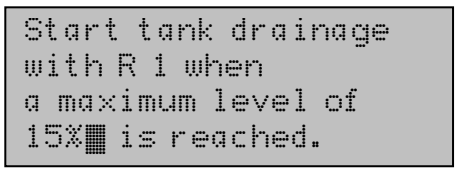
Tank fill level:





Tank drainage:

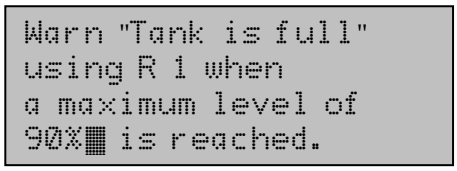




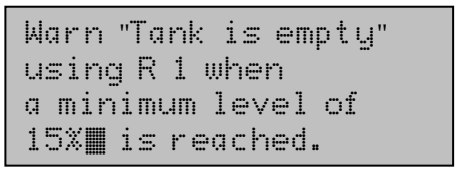
Use the ▽ and △ keys to set the minimum level (in %), at which tank drainage stops. Confirm your setting using the ▷ key. You will automatically return to the main menu.

Overfill warning:

Use the ▽ and △ keys to set the maximum level (in %) at which an overfill warning is triggered. Confirm your setting using the ▷ key. You will automatically return to the main menu.

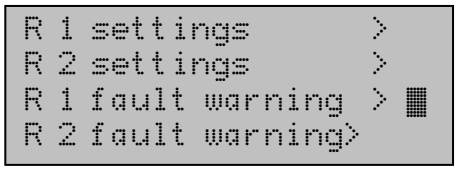


Empty warning:



Use the ▽ and △ keys to set the minimum level (in %) at which an empty warning is triggered. Confirm your setting using the ▷ key. You will automatically return to the main menu.

Fault warnings using relays 1 / 2:



To use the relays for fault warnings, move the cursor to the "Rel. 1 fault warning" and/or "Rel. 2 fault warning" menu items using the ▽ or △ keys.

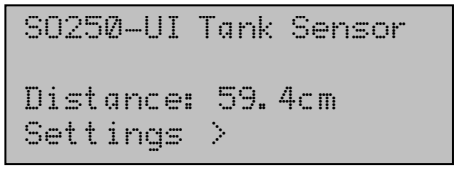
Confirm your selection using the ▷ key. You will automatically return to the main menu.

The selected relay will only close in the event of a fault, and no further settings are possible. To switch off the fault warning, select any of the relay functions in the "Rel. 1/2 settings" menu item.

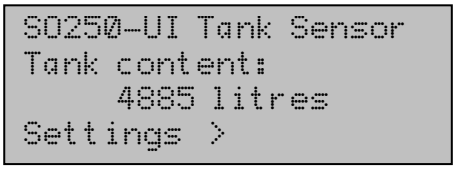
Acoustic signal

The SO250-UI Tank Sensor offers the possibility of triggering an acoustic warning whenever a set value for a relay is over- or under-run.

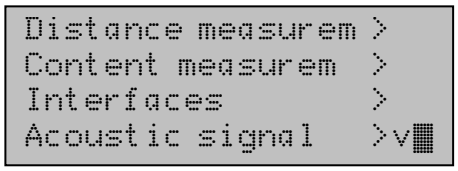
Main menu:



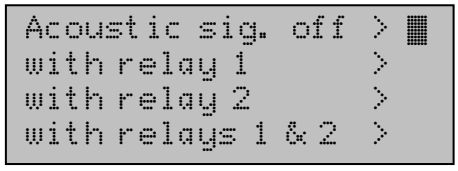
or



Press the ▷ key once to access the "Settings" area.



Move the cursor (the blinking rectangle on the right) to the "Acoustic signal" menu item using the ▽ and △ keys, and press the ▷ key.

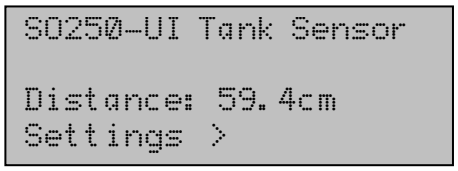


Move the cursor to the desired setting using the ▽ or △ keys. The SO250-UI can issue an acoustic signal when relays 1 and/or 2 is/are triggered, or when relays 1 or 2 is/are triggered.

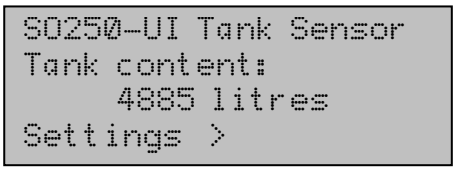
Confirm your selection using the ▷ key. You will automatically return to the main menu.

Language

Main menu:

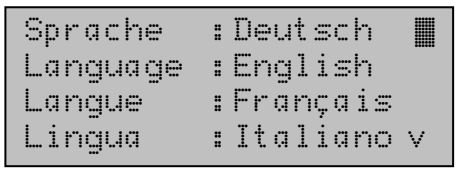


or



Press the ▷ key once to access the "Settings" area.

Move the cursor (the blinking rectangle on the right) to the "Language" menu item using the ▽ and △ keys, and press the ▷ key.



Move the cursor to the desired language using the ▽ or △ keys (German, English, French, Italian or Spanish).

Confirm your selection using the ▷ key. You will automatically return to the main menu.