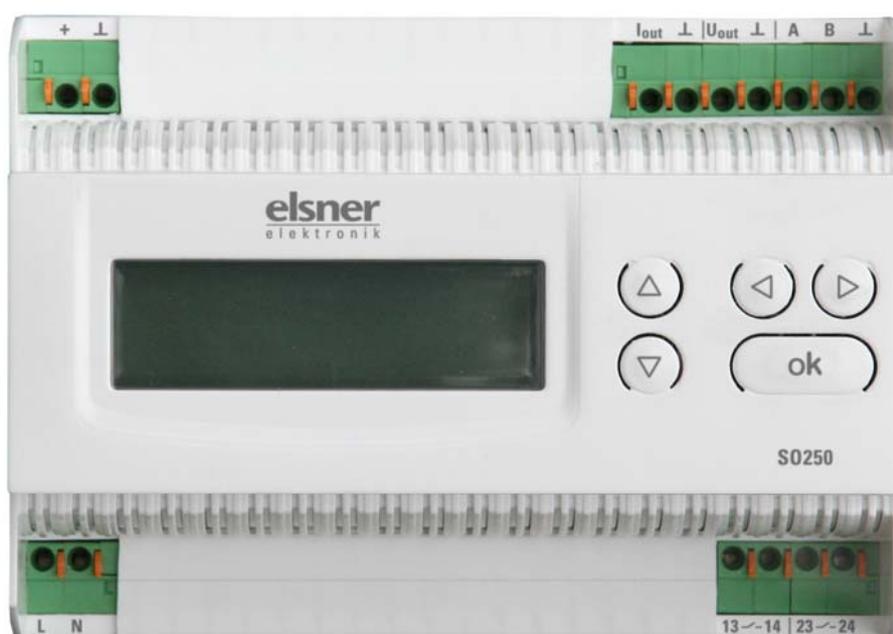


S0250-UI Tank Sensor



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.

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 overflow/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 following standards were used for assessing the product with regard to electromagnetic compatibility:

Electromagnetic emission:

EN 60730-1:2000 EMC Section (23, 26, H23, H26) (Threshold class: B)

EN 50090-2-2:1996-11 + A1:2002-01 (Threshold class: B)

EN 61000-6-3:2001 (Threshold class: B)

Immunity to interference:

EN 60730-1:2000 EMC Section (23, 26, H23, H26)

EN 50090-2-2:1996-11 + A1:2002-01
EN 61000-6-1:2004

The product was tested by an accredited EMC laboratory in accordance with the abovementioned standards.

Air-ultrasound sensor

Housing:	Plastic
Colour:	Black
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, 10 m length
Total weight:	approx. 400 g
Ambient temperature:	+0...+40 °C
Measurement range:	12...250 cm

Installation and commissioning

Warning, mains voltage!

VDE (German Association of Electricians) regulations are to be observed.



Installation, testing, commissioning and fault repair of the SO250-UI tank sensor may only be carried out by a qualified electrician. Shut off the voltage to all cables to be fitted and take safety precautions against unintended activation.

The tank sensor is intended exclusively for appropriate use. Any improper alteration or non-observance of the operating instructions will void any warranty or guarantee claim.

After unpacking, the unit shall be checked immediately for any possible mechanical damage. The supplier shall be immediately notified in the event of any transport damage.

The tank sensor must not be used if damaged.



If it is assumed that danger-free operation can no longer be guaranteed, the equipment shall be taken out of service and secured against unintended operation.

The tank sensor may only be operated as a fixed installation, meaning a built-in condition and following the completion of all installation and commissioning work, and only in the intended environment.

Elsner Elektronik shall not be liable for any changes to norms or standards after the publication of these operating instructions.

Connection

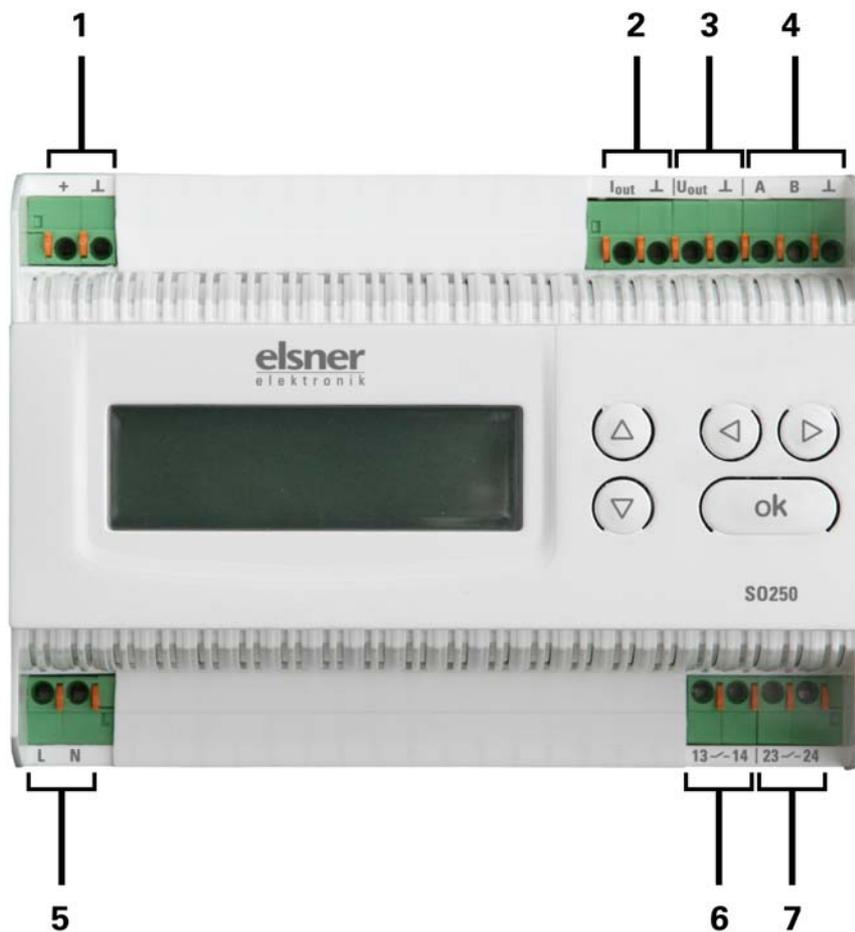
Ensure that the unit is correctly connected. Incorrect connection may lead to the destruction of the tank sensor or electronic equipment connected to it.

The evaluation unit must only be installed and used in dry, interior spaces. Avoid condensation.



The ultrasonic probe must not get washed around by liquid.

Casing



- 1 measurement sensor connection, + / shield \perp
- 2 Current output, I_{out} / \perp
- 3 Voltage output, U_{out} / \perp
- 4 Modbus interface, A / B / \perp
- 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	

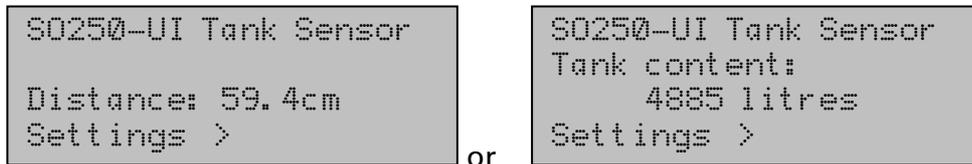
SO250-UI Modbus output string to master

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:



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

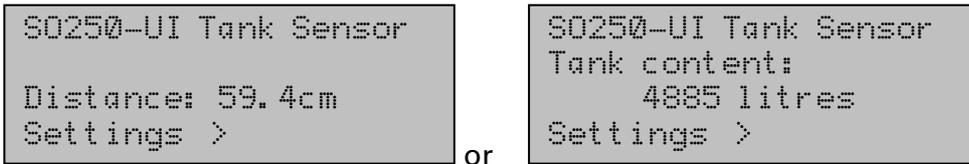
- ▷ key: Confirms the selection, moves to the next step.
- ◁ key: One step back.
- ▽ and △ keys: Changes a setting (selects a setting or changes a value). The cursor (the blinking rectangle) indicates the selected menu item.
- ok key: Confirms the settings and returns to the device main menu.

Distance measurement

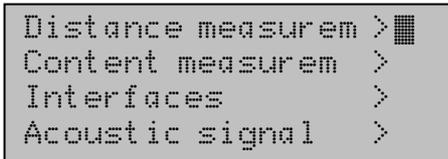
The SO250-UI Tank Sensor can detect distances. The following settings can be applied in the "Distance measurement" menu:

- Distance display unit
- Measurement time interval

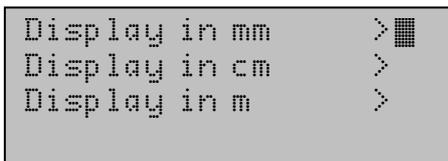
Main menu:



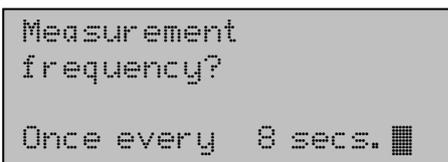
Press the \triangleright key once to access the “Settings” area.



Move the cursor (the blinking rectangle on the right) to the “Distance measurement” menu item using the ∇ and \triangle keys, and press the \triangleright key.



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



Use the ∇ and \triangle 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 \triangleright 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:

```
SO250-UI Tank Sensor
Distance: 59.4cm
Settings >
```

or

```
SO250-UI Tank Sensor
Tank content:
  4885 litres
Settings >
```

Press the \triangleright key once to access the "Settings" area.

```
Distance measurem >
Content measurem >
Interfaces >
Acoustic signal >
```

Move the cursor (the blinking rectangle on the right) to the "Content measurement" menu item using the ∇ and \triangle keys, and press the \triangleright key.

```
Rectangular tank >
Spherical tank >
Cylinder upright >
Cylinder horizont.>
```

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

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

Rectangular tank

```
Tank volume in l >
Tank volume in m³ >
Select a measurement
unit!
```

Move the cursor to the desired setting using the ∇ or \triangle keys. You can input the capacity of the tank in litres (l) or cubic meters (m^3). Confirm your selection using the \triangleright key.

```
Maximum capacity
of tank:
5000 litres >
```

or

```
Maximum capacity
of tank:
5000 m³ >
```

Use the ∇ and \triangle 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 m^3 in one-litre increments, 100 to 100,000 m^3 in one hundred-cubic metre increments.

Confirm your selection using the \triangleright key.

```
Maximum filling
height of tank:
230 cm █
```

Use the ∇ and \triangle keys to select the maximum filling height of the tank (1 to 254 cm).

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

Spherical tank

Interior diameter of tank:

200 cm █

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

Interior diameter of tank:

200 cm █

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

Maximum filling height of tank:

230 cm █

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

Tank length:

200 cm > █

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.

Interior diameter of tank:

200 cm █

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

```
Sensor distance from
liquid when tank is
full:
  15cm█
```

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.

```
Number of tanks in
battery:
  2 Tanks █
```

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.

```
Display in litres >█
Display in m³ >
Display in % >
```

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 (m³) or percent (%). Confirm your selection using the ▷ key.

```
Measurement
frequency?
Once every 8 secs. █
```

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:

```
SO250-UI Tank Sensor
Distance: 59.4cm
Settings >
```

or

```
SO250-UI Tank Sensor
Tank content:
  4885 litres
Settings >
```

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

```
Distance measurem >
Content measurem >
Interfaces > █
Acoustic signal >v
```

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

```
Modbus settings >
Current output >
Voltage output >
Relay settings >
```

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

```
Modbus settings > █
Current output >
Voltage output >
Relay settings >
```

Move the cursor to the "Modbus settings" menu item using the ∇ or \triangle keys. Confirm your selection using the \triangleright key.

```
Communication via
Modbus
switch on > █
switch off >
```

Move the cursor to the desired setting using the ∇ or \triangle keys. Confirm your selection using the \triangleright key.

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

```
Address in
Modbus system:

1 █
```

Use the ∇ and \triangle keys to change the address (1 to 247). Confirm your selection using the \triangleright key.

```
Data transmission
rate:

19.2 kbit/s █
```

Use the ∇ and \triangle 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 \triangleright key.

```
Parity check:

Even Parity █
```

Use the ∇ and \triangle keys to set the desired data parity check (even/odd parity). Confirm your selection using the \triangleright key.

You will automatically return to the main menu.

Current output

```
Modbus settings >
Current output > █
Voltage output >
Relay settings >
```

Move the cursor to the "Current output" menu item using the ∇ or \triangle keys. Confirm your selection using the \triangleright key.

```
Operating range of
current output:

0 mA .. 20 mA █
```

Use the ∇ and \triangle 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 \triangleright key. You will automatically return to the main menu.

Voltage output

```
Modbus settings >
Current output >
Voltage output > █
Relay settings >
```

Move the cursor to the "Voltage output" menu item using the ∇ or \triangle keys. Confirm your selection using the \triangleright key.

```
Operating range of
Voltage output:

0 V .. 10 V █
```

Use the ∇ and \triangle 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 \triangleright key. You will automatically return to the main menu.

Relay settings

Both relay outputs can either be set to automatically monitor tank contents (filling/drainage, overflow/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.

```
Modbus settings > █
Current output >
Voltage output >
Relay settings >
```

Move the cursor to the "Relay settings" menu item using the ∇ or \triangle keys. Confirm your selection using the \triangleright key.

Setting relays 1 / 2:

```
R 1 settings > █
R 2 settings >
R 1 fault warning >
R 2 fault warning>
```

To use the relay for automatic filling/drainage or for overflow/empty warnings, move the cursor to the "Rel. 1 settings" and/or "Rel. 2 settings" menu items using the ▾ or △ keys.

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

```
Tank fill level > █
Tank drainage >
Overflow warning >
Empty warning >
```

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

Tank fill level:

```
Start tank filling
with R 1 when
a minimum level of
15% █ is reached.
```

Use the ▾ and △ keys to set the minimum level (in %), at which tank filling starts. Confirm your setting using the ▷ key.

```
Stop tank filling
with R 1 when
a maximum level of
90% █ is reached.
```

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

Tank drainage:

```
Start tank drainage
with R 1 when
a maximum level of
90% █ is reached.
```

Use the ▾ and △ keys to set the maximum level (in %), at which tank drainage starts. Confirm your setting using the ▷ key.

```
Start tank drainage
with R 1 when
a maximum level of
15% █ is reached.
```

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.

Overflow warning:

```
Warn "Tank is full"
using R 1 when
a maximum level of
90% █ is reached.
```

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

Empty warning:

```
Warn "Tank is empty"
using R 1 when
a minimum level of
15% is reached.
```

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

Fault warnings using relays 1 / 2:

```
R 1 settings >
R 2 settings >
R 1 fault warning > █
R 2 fault warning>
```

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 \triangle keys.

Confirm your selection using the \triangleright 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:

```
SO250-UI Tank Sensor
Distance: 59.4cm
Settings >
```

or

```
SO250-UI Tank Sensor
Tank content:
4885 litres
Settings >
```

Press the \triangleright key once to access the "Settings" area.

```
Distance measurem >
Content measurem >
Interfaces >
Acoustic signal > ▣
```

Move the cursor (the blinking rectangle on the right) to the "Acoustic signal" menu item using the ∇ and \triangle keys, and press the \triangleright key.

```
Acoustic sig. off > █
with relay 1 >
with relay 2 >
with relays 1 & 2 >
```

Move the cursor to the desired setting using the ∇ or \triangle 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 \triangleright key. You will automatically return to the main menu.

Language

Main menu:

```
S0250-UI Tank Sensor
Distance: 59.4cm
Settings >
```

or

```
S0250-UI Tank Sensor
Tank content:
    4885 litres
Settings >
```

Press the \triangleright key once to access the "Settings" area.

```
Language > █
```

Move the cursor (the blinking rectangle on the right) to the "Language" menu item using the ∇ and \triangle keys, and press the \triangleright key.

```
Sprache   : Deutsch █
Language  : English
Langue    : Français
Lingua    : Italiano v
```

Move the cursor to the desired language using the ∇ or \triangle keys (German, English, French, Italian or Spanish).

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