Level Sensor RD



Level Sensor RD SEN180 and SEN180-EA (Version 4.2)

This level sensor enables the contactless measurement of liquid levels in unpressurised containers. The sensor is integrated into a Wi-Fi network and allows direct access via a web browser. The measured values can also be transmitted by MQTT for easy integration into common smart home systems. Alternatively, the measured values can be accessed worldwide via remote access.

The maximum distance, or container height, is 40 m.

How it works

A radar sensor in the frequency range around 80 GHz is used to measure the distance between the sensor and the surface of the liquid.

The sensor continuously emits modulated high-frequency signals. These are reflected by the surface of the liquid and received again by the sensor.

From the difference between the transmitted and the received signal, the device calculates the distance between the sensor and the liquid surface.

Safety instructions

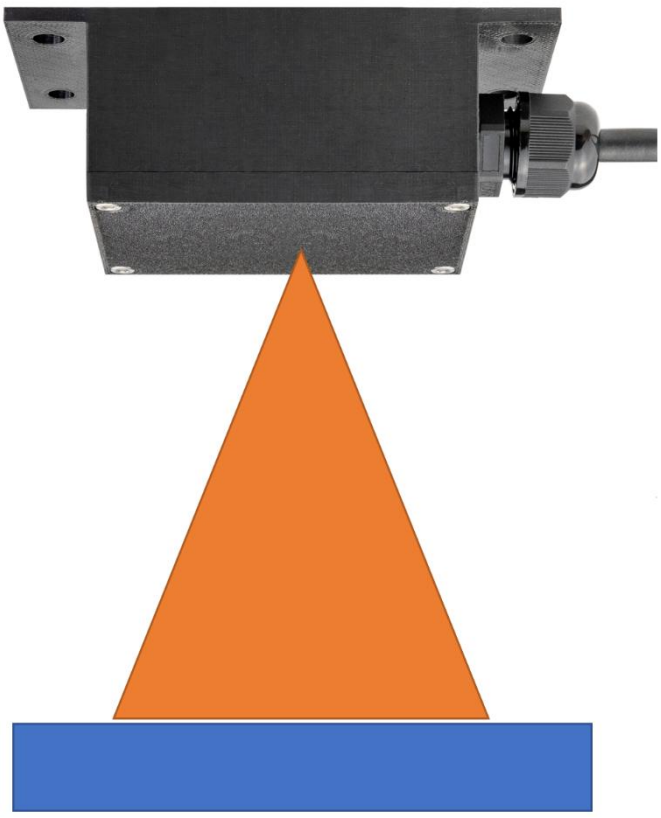
Please read these instructions carefully before commissioning the device.

- The device is intended solely for the purpose described in these instructions.
- The device is supplied ready to plug in and may be connected by the user to a properly installed socket outlet.
- The mains plug must be disconnected before cleaning or maintenance work.
- Do not use the device if the cable, the plug or the enclosure is damaged.
- The device must not be opened or modified.
- Use the device only in the environment specified in the technical data.
- The device must not be exposed to direct sunlight.
- Protect the plug and the socket outlet from moisture.
- The level sensor is not intended for use in tanks containing flammable liquids (e.g. heating oil, diesel or petrol).
- A minimum distance of 20 cm from persons must be maintained during operation.

Mounting the level sensor



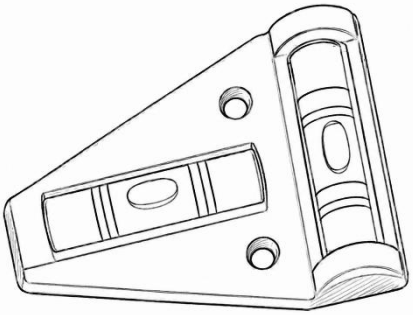
The level sensor is installed above the surface of the liquid. The minimum distance from the surface is 15 cm. The final distance is entered later during the configuration of the sensor. The sensor must be mounted so that it is aligned **securely and perpendicularly** to the surface. Make sure that the alignment is correct, ideally using a T-shaped spirit level (see figure below). A sensor that is **not level in the longitudinal and transverse direction** will deliver **no or incorrect measurement results**. The measuring range of the sensor should be obstructed by objects (e.g. pipes or hoses) as little as possible. The measuring range is determined by the cone of the radar waves. This cone becomes wider as the distance increases.



Mount the sensor as centrally as possible. Make sure that there is sufficient distance from the inner wall. Make sure that the sensor can never be immersed in the liquid. Also make sure that you have a sufficiently strong Wi-Fi connection at the installation site, or use the version with an external antenna (SEN180-EA) and mount it within the reception area. If you use the device with an external antenna connector, mount the antenna within the reception area and screw its plug onto the RP-SMA connector of the device.

Caution: Only connect the antenna when the device is disconnected from the mains.

Only antennas with the following specification may be used: 2400–2483.5 MHz, 50 Ω, VSWR ≤ 3.0, linear polarisation, maximum gain 3.5 dBi, RP-SMA connector.



T-shaped spirit level

In difficult installation situations it may be necessary to adapt the operation of the radar sensor to its surroundings. Further information on this can be found in the section “Radar Configuration”.

Connect the sensor to the mains supply (230V AC).

Integrating the sensor into your own Wi-Fi network

1: Preparations

Make sure that you know the network details of your Wi-Fi network, such as the network name (SSID) and the password.

2: Connecting to the access point

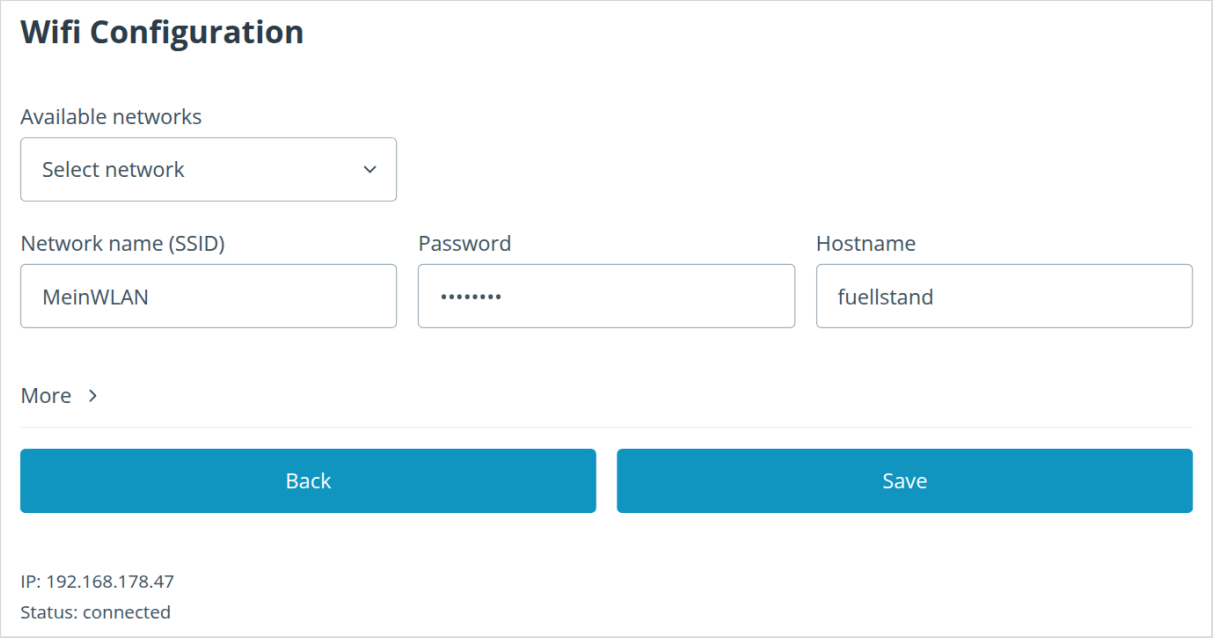
The level sensor provides its own access point, i.e. its own Wi-Fi network. Using your smartphone, tablet or computer, look in the Wi-Fi settings for the network with the name “LevelSensor-xxxxxx” and connect to it. The default password is “12345678”. The access point has the IP address 192.168.4.1.

3: Accessing the configuration interface

Open a web browser on the device that is connected to the level sensor. Enter the address “http://192.168.4.1/wifi” in the address bar to open the configuration interface of the sensor. If the configuration interface is not displayed, please make sure that you are connected to the access point and, on a smartphone or tablet, also deactivate the mobile data connection.

4: Wi-Fi settings

Now enter the network details of your Wi-Fi network. Select your network from the “Available networks” list. The name is then adopted under “Network name (SSID)”, or you enter it there yourself. Under “Password”, enter the password of your Wi-Fi network. Under “Hostname”, assign a suitable name for your level sensor (15 characters at most). You can leave all other fields under “More” at their default values. Make sure that you enter the correct information so that the connection can be established successfully. Save the settings with “Save” and wait a moment while the level sensor tries to establish a connection to your Wi-Fi network.



5: Checking the connection

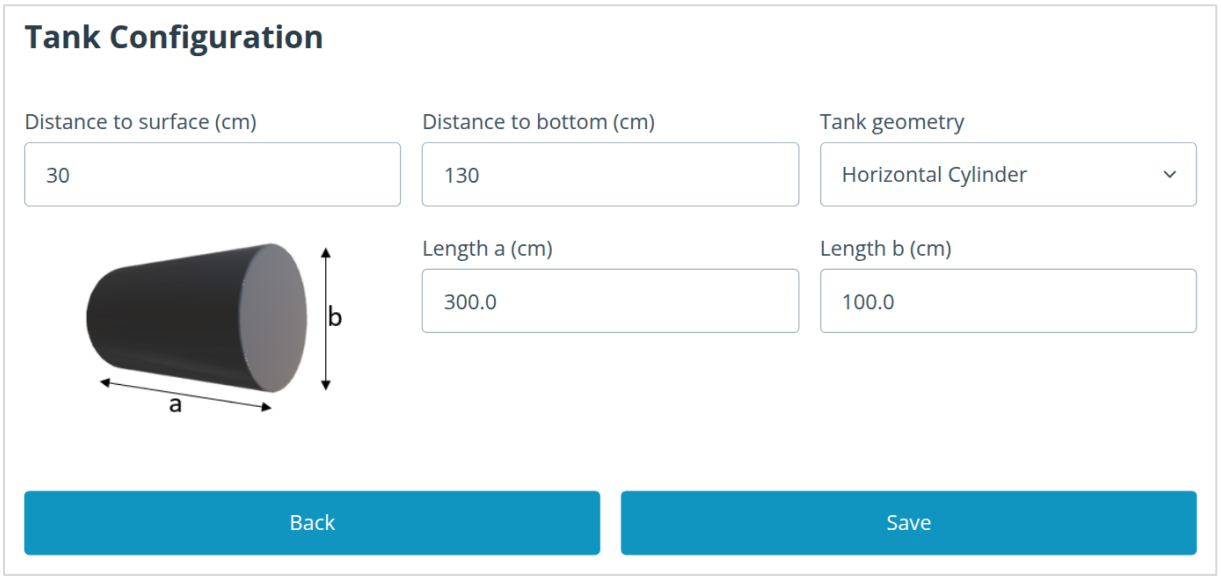
If the connection to your Wi-Fi network has been established successfully, the IP address of the level sensor and the status “connected” are shown at the bottom of the page. Alternatively, you will find the IP address of the level sensor in the configuration area of your router, or you can use a network scanner on your smartphone to search your Wi-Fi network for the name of the level sensor.

After the level sensor has established a connection to your Wi-Fi network, you can disconnect the device that you connected to the access point of the level sensor and connect it to your own Wi-Fi network. In the web browser you can now connect to the level sensor by entering the IP address. If your router supports name resolution, it is called up via the hostname http://*hostname* (name of the level sensor that you assigned in the previous step). If you use a FRITZ!Box, for example, call up “http://*hostname*.fritz.box”.

If the level sensor is available neither in your Wi-Fi network nor in access point mode, briefly disconnect it from the power supply and check the connection again.

Setting up the sensor

To obtain correct measured values, the position of the sensor in relation to the maximum and minimum level must be set under “Tank Config”. To do this, enter under “Distance to surface” the distance in cm from the surface of the liquid when the container is completely full. This must be at least 15 cm. Under “Distance to bottom”, enter the distance of the sensor in cm to the minimum level or to the bottom of the container. This must not exceed 4,000 cm.

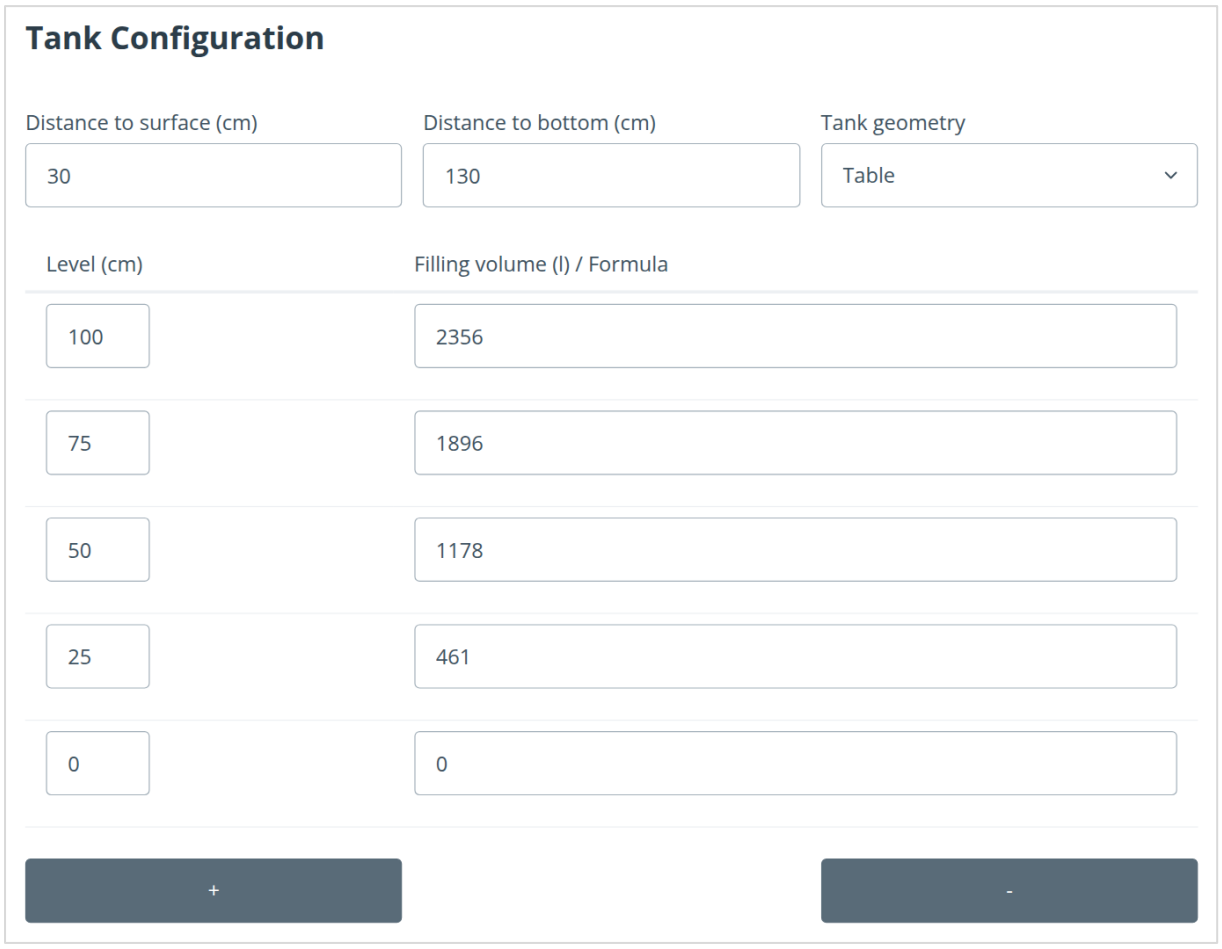


Calculating the tank contents in litres

In order to convert the level into litres, predefined shapes (cuboid, vertical cylinder, horizontal cylinder and sphere) can be selected under “Tank geometry”. Depending on the shape selected, the length a and, where applicable, b must be entered in cm. The meaning of a and, where applicable, b follows from the geometry of the tank and is shown graphically. For a horizontal cylinder, the length b must not be smaller than the usable height (distance to bottom minus distance to surface).

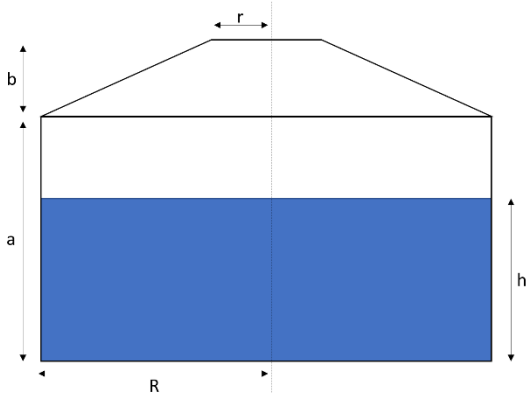
Alternatively, a capacity table can be used. In such a table, a corresponding filling volume in litres is assigned to each filling level. As a rule, you can obtain suitable tables from your tank manufacturer. The bottom row of the table always contains the contents of an empty tank, that is “0” for both “Level” and “Filling volume”. The top row always contains the maximum filling volume at the maximum filling level.

Rows can be added to or deleted from the table using “+” and “-”. The table is built up from bottom to top. The lowest filling volume is therefore at the bottom of the table. The filling levels must increase from bottom to top and must not exceed the usable height (distance to bottom minus distance to surface).



User-defined container shapes

If you can neither use one of the predefined shapes nor have a capacity table available, you can still use the table, because formulas for calculating the level can also be entered in the “Filling volume” column. The height within a geometric shape is available in the formula as the parameter “h”. This makes it possible to enter further geometric bodies and even composite shapes. Below is an example of a tank consisting of a vertical cylinder with a truncated cone on top:



The volume of the cylinder is calculated as follows

$$V = \pi * R^2 * a$$

The volume of the truncated cone is given by

$$V = \frac{1}{3} * \pi * b * (R^2 + R * r + r^2)$$

The volume of each partial body is calculated with its own height “h”, i.e. the heights of the shapes below it are subtracted from the measured height.

The configuration therefore consists of different geometries that are stacked from bottom to top:

The formula for the volume of the cylinder is:

$$V = \pi * R^2 * h$$

The volume of the truncated cone is calculated as follows. Note that the inner radius depends on the height “h”:

$$r_i = R - \frac{h}{b} * (R - r)$$

The volume is therefore:

$$V = \frac{1}{3} * \pi * h * \left[R^2 + R * \left(R - \frac{h}{b} * (R - r) \right) + \left(R - \frac{h}{b} * (R - r) \right)^2 \right]$$

In the table, enter your values for “a” and “a + b” in the first column. In the second column, enter the corresponding formulas and replace b, r and R with your values. To obtain a value in litres from cubic centimetres, each result must also be divided by 1,000.

Table: cylinder with truncated cone

Level (cm)	Filling volume (l) / Formula
a+b	=pi/3*h*(R**2+R*(R-h/b*(R-r))+(R-h/b*(R-r))**2)/1000
a	=pi*R**2*h/1000
0	0

The following mathematical functions are available (log() is the natural logarithm, the trigonometric functions work in radians):

Function	Notation
Basic arithmetic (plus, minus, times, divided by)	+ - * /
Brackets	( )
Exponentiation	**
Square root	sqrt()
Exponential function	exp()
Logarithm	log()
Sine and arcsine	sin() asin()
Cosine and arccosine	cos() acos()
Tangent and arctangent	tan() atan()
Absolute value	abs()
Pi (π)	pi

All settings only take effect once you press “Save”.

How often the measured values are updated (display, alert and MQTT) is set on the main page under “More”. This value may be between one second and 60 seconds. It is set with the “Update” slider. The sensor itself measures continuously, regardless of this setting.

In the browser, the value can be set quickly and precisely as follows:

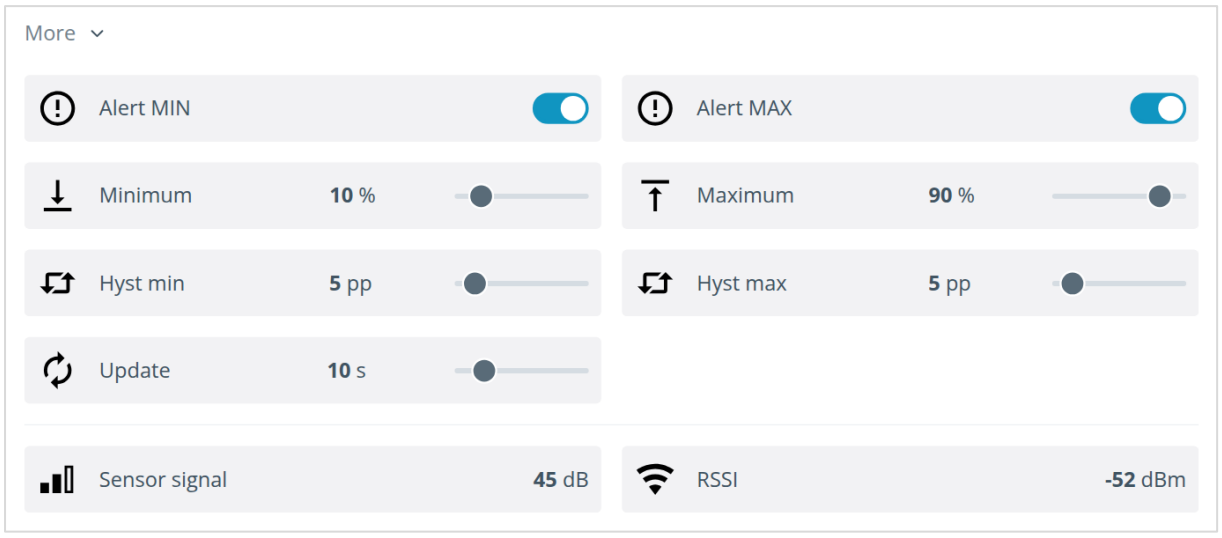
- Click the slider with the mouse button and keep it pressed
- Set the desired value roughly
- Fine-tune it with the left and right arrow keys

Min/max monitoring

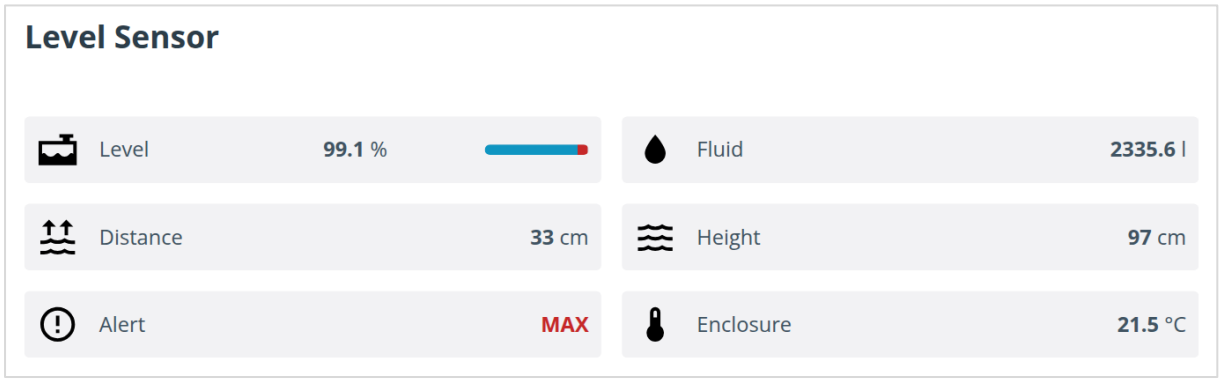
Setting a minimum and/or maximum value makes it possible to monitor containers for running empty or overflowing. If the minimum value is reached or undershot, or the maximum value is reached or exceeded, an alert is set. Clearing the alert can be controlled by defining a hysteresis (in percentage points). On the one hand, this keeps the alert signal stable in the event of frequent fluctuations; on the other hand, it makes it possible, for example, to control a pump for filling or pumping out up to a certain level. This is not an overfill prevention device within the meaning of WHG/AwSV.

You set the minimum, the maximum and the hysteresis (“Hyst min”, “Hyst max”) on the main page under “More” using the sliders. The minimum must be at least 2 percentage points below the maximum, and each hysteresis must be at least 2 percentage points smaller than the gap between the minimum and the maximum. The sliders do not allow invalid values.

Use the “Alert MIN” and “Alert MAX” switches to set whether an alert is raised at all at the minimum or at the maximum. An alert that is switched off is not shown.

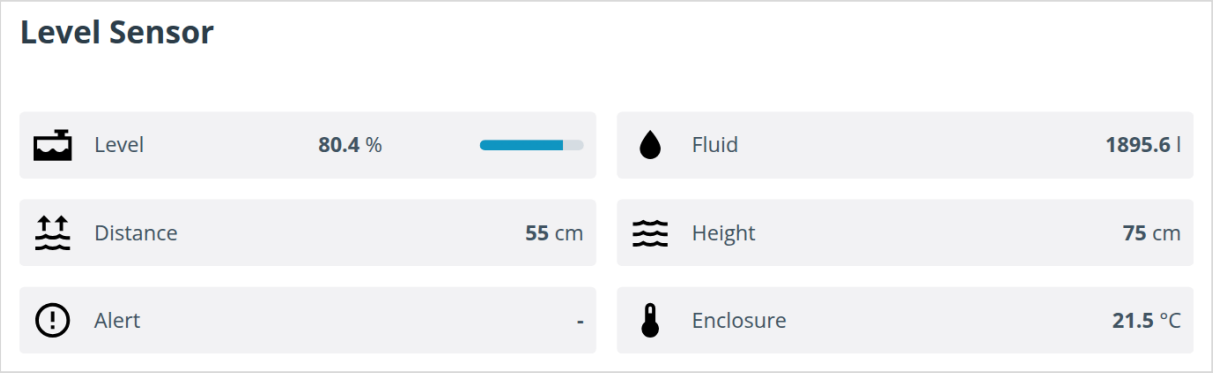


An active alert (“MIN” or “MAX”) is shown in red on the main page. In addition, the part of the level bar above the maximum turns red; when the minimum is reached, the entire bar does.



Measured values

The following measured values are provided:



- **Level**: relative level in %
- **Fluid**: filling volume in l
- **Distance**: distance from the sensor to the surface of the liquid in cm
- **Height**: absolute level in cm
- **Alert**: MIN or MAX
- **Enclosure**: temperature inside the enclosure in °C
- **Sensor signal**: The strength of the radar signal received by the sensor in dB (under “More”)
- **RSSI**: received signal strength of the Wi-Fi network in dBm (under “More”)

RSSI	Wi-Fi signal quality
> -50 dBm	Excellent
-50 to -60 dBm	Good
-60 to -70 dBm	Adequate
< -70 dBm	Weak

If the sensor does not receive any valid measured values, the message “Sensor issue!” appears on the main page. If the measured distance lies outside the distances set under “Tank Config”, “Measurement outside the range!” appears. If the sensor has not yet had a valid measured value since it was switched on or restarted, it shows “-” instead of the measured values.

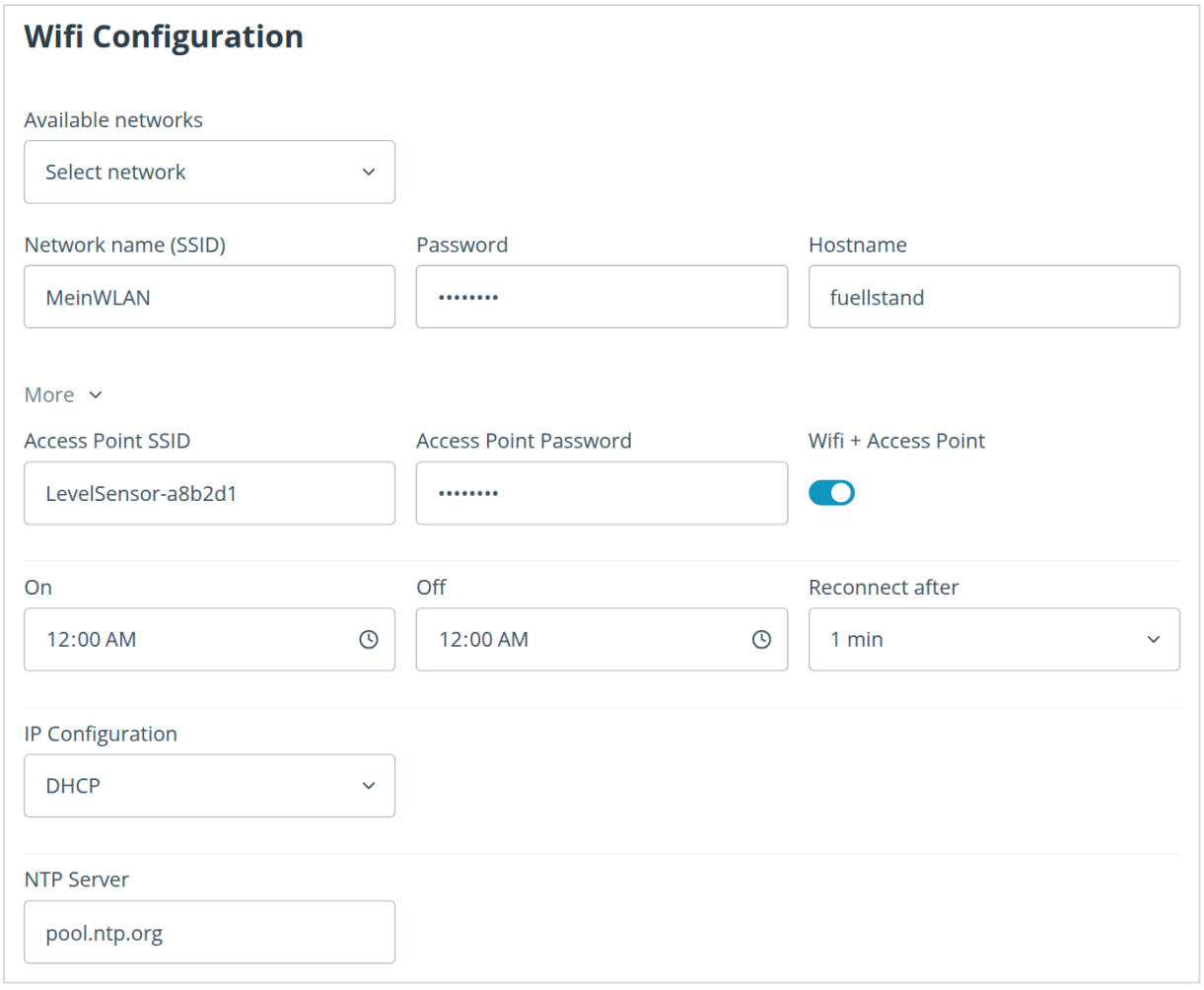
The sensor protects itself against overheating (e.g. due to direct sunlight). If the enclosure temperature reaches 65 °C, it switches itself off. It resumes operation as soon as the temperature falls below 55 °C. During this time it cannot be reached and reports neither measured values nor alerts. If it cannot measure the enclosure temperature several times in a row, it shows “-” instead of the temperature.

Wi-Fi Configuration

Besides the access details for your own Wi-Fi network and for the level sensor's access point, a time-controlled activation of the Wi-Fi can be configured under "More". To do so, enter the start and end time for switching the Wi-Fi on. For uninterrupted Wi-Fi operation, set the start and end time to the same value. If the Wi-Fi network is unavailable, the level sensor regularly tries to reconnect to the Wi-Fi network. The interval before the next connection attempt can also be set. The times are German local time (CET/CEST). Time control requires the sensor to have internet access and to have been able to obtain the time from the NTP server. Time control is suspended in power saving mode.

By default, integration into the network takes place via DHCP. However, it is also possible to assign a static IP address.

By default, the NTP server is set to "pool.ntp.org". If required, a different server can be entered.



If no Wi-Fi network is available, the level sensor sets up its own Wi-Fi network. Its name and its password can be configured. The IP address is always 192.168.4.1. With the "Wifi + Access Point" switch, the access point also remains reachable while a Wi-Fi connection exists. It is switched on when the device is delivered. The access point password must have at least 8 characters. We recommend changing it after setting up the device.

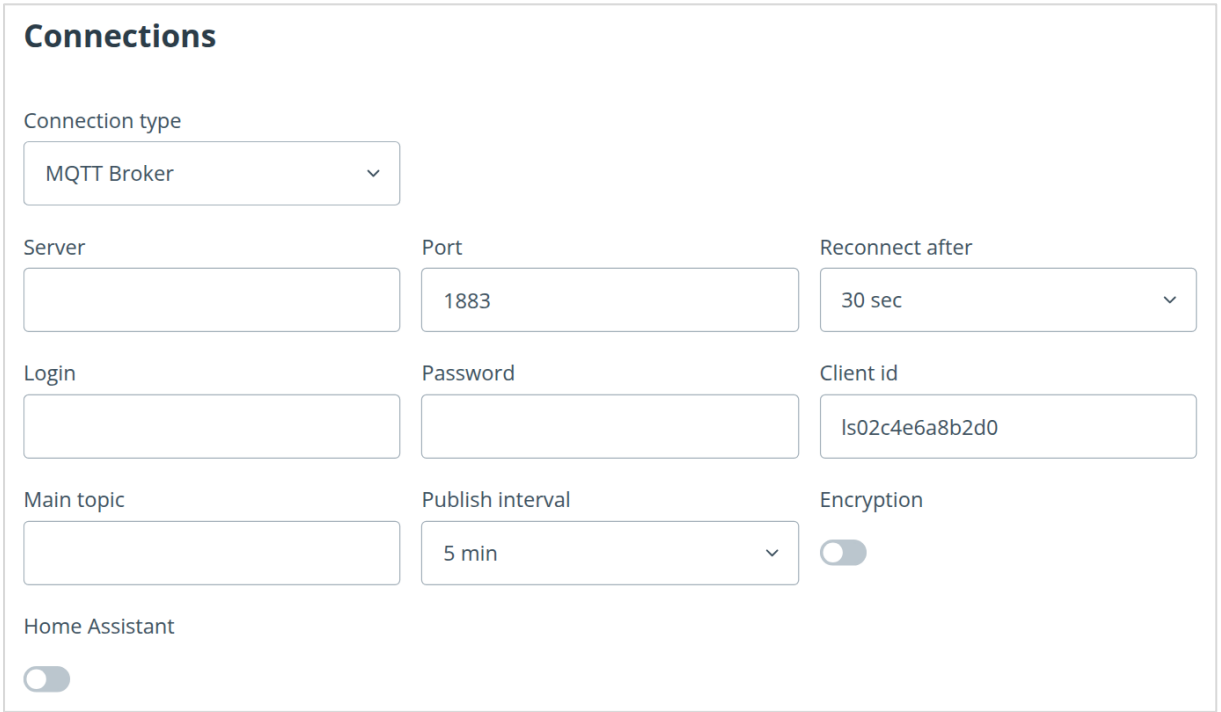
All settings only take effect once you press “Save”.

Connection via MQTT or Remote Access

The level sensor can be connected either to an MQTT broker for exchanging data or to Senvolon Remote Access. Remote access makes it possible to read the measured values on devices that are not connected to your Wi-Fi network but are connected to the internet.

MQTT Configuration

Under “Connections”, select the configuration of the “MQTT Broker”. Under “Server”, enter the name or the IP address of the MQTT broker and under “Port” its port (default: 1883). Under “Reconnect after” you define the time after which a new connection attempt is started. If the broker requires a login and a password, these must be entered here. The “Client id” identifies the level sensor as an MQTT client and must be unique for each client; it may only contain letters (no umlauts), digits and “_”.
The “Main topic” field defines the topic under which the sensor data is published. It must be filled in. Use only letters (no umlauts), digits and “_”; the MQTT characters “+”, “#” and “/” must not be used in the main topic.
The “Publish interval” defines the interval at which all measured, configuration and status values are sent to the broker in JSON format.
The “Encryption” switch makes the connection via SSL/TLS. In that case, enter the TLS port of your broker under “Port” (usually 8883).



If you tick “Home Assistant”, MQTT Discovery for Home Assistant is enabled. A level sensor connected to the broker is found and configured automatically by Home Assistant. Besides the

measured values, Home Assistant also creates the Minimum, the Maximum, the two hysteresis values, Update and the two distances, as well as the two alert switches, as adjustable values.

All settings only take effect once you press “Save”.

MQTT communication uses the Tasmota scheme:

- “tele/{Main topic}/STATE”: Sends the current status of the level sensor
- “tele/{Main topic}/LWT”: Availability of the level sensor
- “stat/{Main topic}/*VALUE*”: Transmits the state of a particular value
- “cmnd/{Main topic}/*VALUE*”: Sends a particular value to the level sensor

Example:

> “cmnd/{Main topic}/WIFI_ON” transmits a new time to the level sensor

If a measured value changes, the sensor sends it with the next refresh (“Update” slider) under “stat/{Main topic}/…”. The “Publish interval” applies to the complete status under “tele/{Main topic}/STATE”. Numerical values for commands are sent without a unit (e.g. “20”), times as HH:MM. The alert switches take “ON” and “OFF”. The sensor discards invalid values. For the distances, Minimum, Maximum, hysteresis, Update and the alert switches it then reports the valid value back under “stat/{Main topic}/…”. The distance to the surface must be smaller than the distance to the bottom. If both are to be changed, the order therefore matters: if both increase, send TOP2BOTTOM first; if both decrease, send TOP2SURFACE first.

Configuration values/commands

Value/command	Description
WIFI_ON	HH:MM – e.g. 6:00
WIFI_OFF	HH:MM – e.g. 22:00
MQTT_PUBLISH_INTERVAL	In seconds – e.g. 300 = 5 minutes
TOP2SURFACE	Distance to surface – e.g. 20 cm
TOP2BOTTOM	Distance to bottom – e.g. 200 cm
READ_INTERVAL	Refresh interval for the measured values – e.g. 5 s
UPDATE	Sends the current device status
MINI	Minimum – e.g. 10 %
MAXI	Maximum – e.g. 90 %
HYST_MIN	Hysteresis minimum – e.g. 30 pp
HYST_MAX	Hysteresis maximum – e.g. 70 pp
ALERT_MIN	Alert minimum – ON or OFF
ALERT_MAX	Alert maximum – ON or OFF
POWERSAVE	Switch off power saving mode – OFF, send with retain flag

Measured values

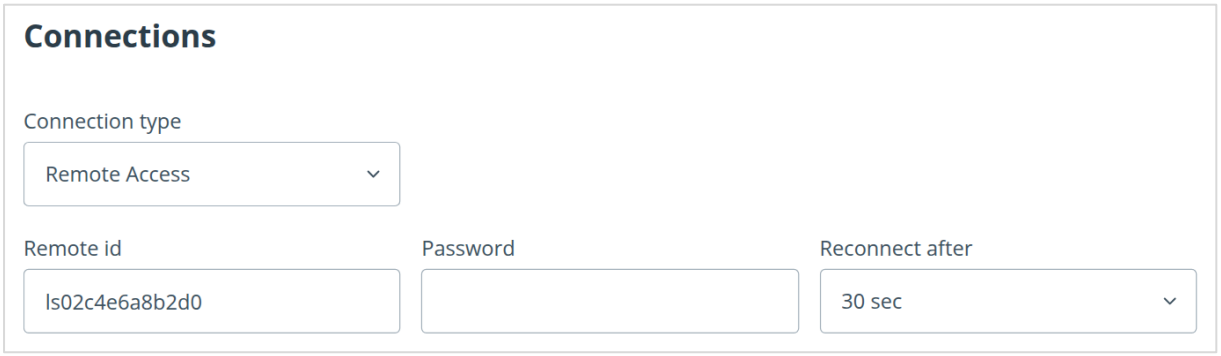
Value	Description
DISTANCE	Distance to surface – e.g. 25 cm
LEVEL	Absolute level – e.g. 120 cm
REL_LEVEL	Relative level – e.g. 85 %
FILLING	Filling volume in litres – e.g. 50 l
ALERT	Alert – MIN, MAX or empty
STRENGTH	Strength of the radar signal – e.g. 20 dB
TEMPERATURE	Enclosure temperature in °C – e.g. 20 °C

Status

Value	Description
IP	IP address – e.g. 192.168.178.47
SIGNAL	RSSI – e.g. -73 dBm
PROBLEM	Technical problem with the sensor – True/False
OUT_OF_RANGE	Measured values outside the configuration – True/False
LWT	Availability – e.g. Online
SLEEP	Seconds until wake-up (power saving mode)

Remote Access

Under “Connections”, select the configuration of “Remote Access”. It works worldwide via “remote.senvolon.de”. To log in you need, besides the “Remote id” shown, a password of at least eight characters that you define yourself. The “Remote id” always begins with a small “L”.



If remote access is unavailable, the level sensor regularly tries to reconnect. The interval before the next connection attempt can be set.

Web app on iOS

Log in at “remote.senvolon.de” in the browser (Safari). As soon as the page with the measured values is displayed, tap the share icon. It looks like a square with an arrow pointing upwards and is located at the bottom of the screen (on the iPhone) or in the top right-hand corner (on the iPad). Then scroll down in the share menu and select “Add to Home Screen”. After that, tap “Add” in the top right-hand corner and you have direct access to the sensor data in the form of an app. You can also enable push notifications in the event of an alert.

Web app on Android

Log in at “remote.senvolon.de” in the browser (Chrome). As soon as the page with the measured values is displayed, tap the menu icon (three vertical dots) in the top right-hand corner of the screen. Then scroll down in the menu and select “Add to Home screen”. After that, tap “Add” and you have direct access to the sensor data in the form of an app. You can also enable push notifications in the event of an alert.

System

Under “System” you can view various information about the operation of the level sensor. Besides the option to download the complete configuration in JSON format for backup purposes, the log file is also available. Logging can be switched on and off. If required, debug information can also be recorded in the log file. From a size of 100 KB onwards, the log file is automatically shortened by removing the oldest entries.

Keep the downloaded configuration confidential. It contains your access credentials.

Under “Sensor name” you adjust the name that is shown on the main page (and in Home Assistant).

Under “Language” you set the preferred user language (German, English or Spanish).

In order to obtain stable measured values, for example where the liquid surface is choppy, the measured values can be smoothed over a time window that you define. The “Moving median” is particularly suitable for eliminating outliers. The larger the time window, the smoother the values become. For this the sensor measures continuously, independently of the setting under “Update”. The “Window size” states over how many of the most recently measured values the median is formed. As a new value is produced about every second, with a “Window size” of 60 s the system considers, put simply, the readings of the last 60 seconds or so and forms the median from them.

Example: the level sensor returns the following values in succession:

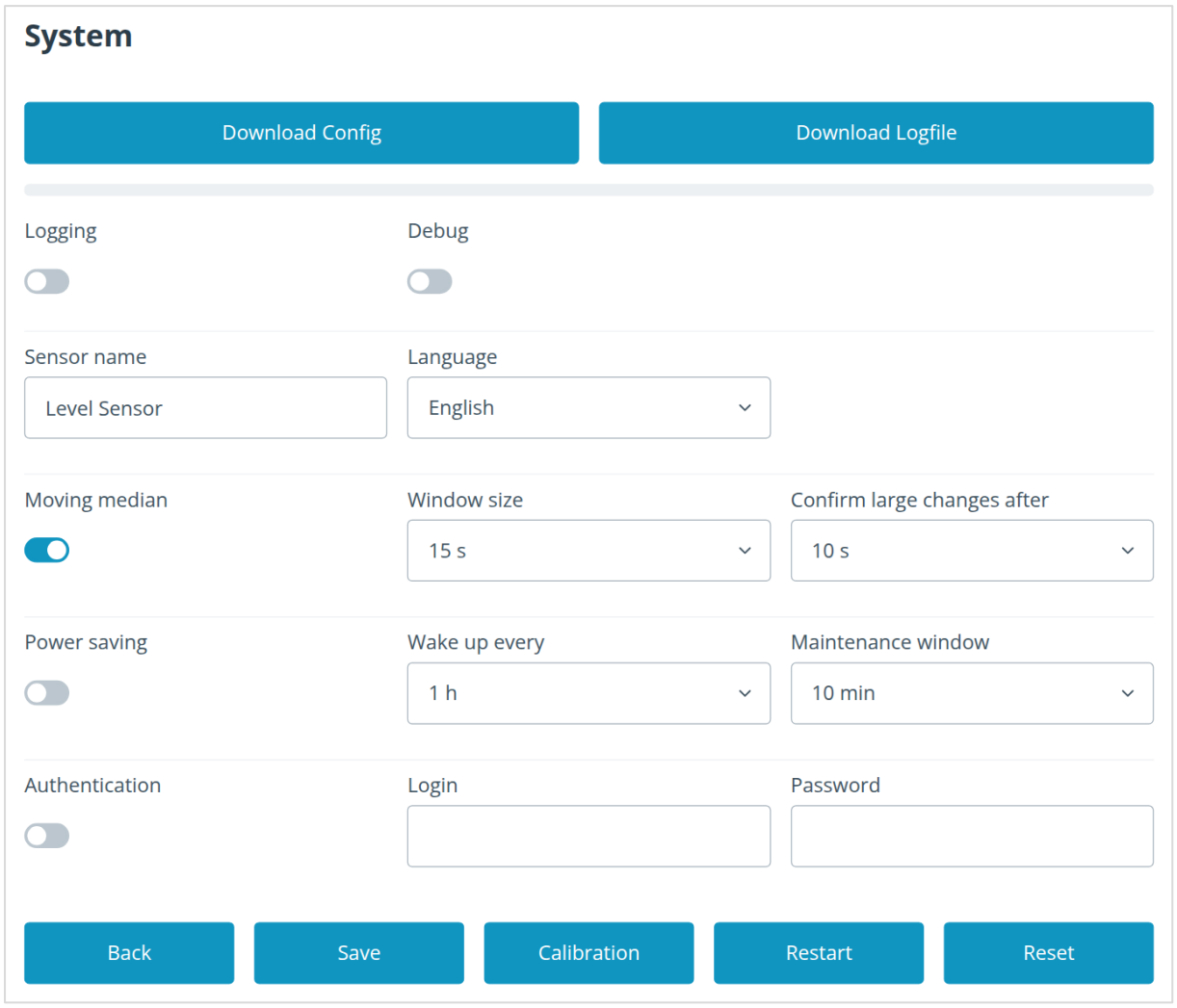
100 cm – 101 cm – 100 cm – 145 cm – 99 cm

The value 145 cm is obviously an outlier, caused for example by a wave or a reflection.

With a median window over these five measured values, the values are sorted by size:

99 – 100 – 100 – 101 – 145

The middle value is 100 cm. This is output as the smoothed measured value. The outlier of 145 cm therefore has no influence.



In addition, you can define the value “Confirm large changes after” in the sensor configuration. On delivery this value is set to 10 s. If the measured value changes abruptly by 10 cm or more, the new value must be measured stably for that length of time before the change is shown. Smaller jumps from 3 cm upwards are adopted after a few measurements. Short-term large jumps can be filtered out directly in this way.

The “Power saving” switch puts the sensor into an energy-saving deep sleep. It then wakes up only at fixed intervals, takes a measurement, sends the measured values to the MQTT broker or to remote access and then goes back to sleep. You choose the interval under “Wake up every” (1 to 24 hours). Power saving mode can only be switched on when the sensor is connected to your Wi-Fi network and to an MQTT broker or to remote access.

After power saving mode has been switched on and after every restart, the sensor stays awake for the time set under “Maintenance window” (5 to 60 minutes) and can be reached as usual. Every page request extends the maintenance window, including retrieving the measured values via HTTP. As long as the main page or the “Wifi”, “Connections” or “System” page is open, even in a background tab, the sensor does not go to sleep. So after setup, close all pages of the web interface and do not query the measured values via HTTP at regular intervals.

While it is asleep, the sensor cannot be reached either via your Wi-Fi network or via its access point. To wake it up, briefly disconnect it from the power supply. The maintenance window then starts again, during which you can switch power saving mode off.

Each time it wakes up, the sensor also evaluates the alerts for minimum and maximum that are switched on and reports them. If the level rises above or falls below a limit between two wake-ups, the sensor only notices this at the next wake-up. If it cannot connect when it wakes up, it goes back to sleep after one minute at the latest and tries again next time.

To protect against unauthorised access, authentication with login and password can be activated. Login and password may only contain letters (no umlauts), digits and the characters - . _ ~. The password must be at least 8 characters long.

“Restart” causes the system to restart.
“Reset” restores all settings to the factory state after a confirmation prompt and deletes the log file. The sensor is then accessible again via its access point, and the interface appears in English. On the “RADAR Configuration” page, the reset affects only the clutter filter, which is switched off. Search mode, sensitivity and transmit power keep their settings. Switch the clutter filter back on if required.

All settings only take effect once you press “Save”.

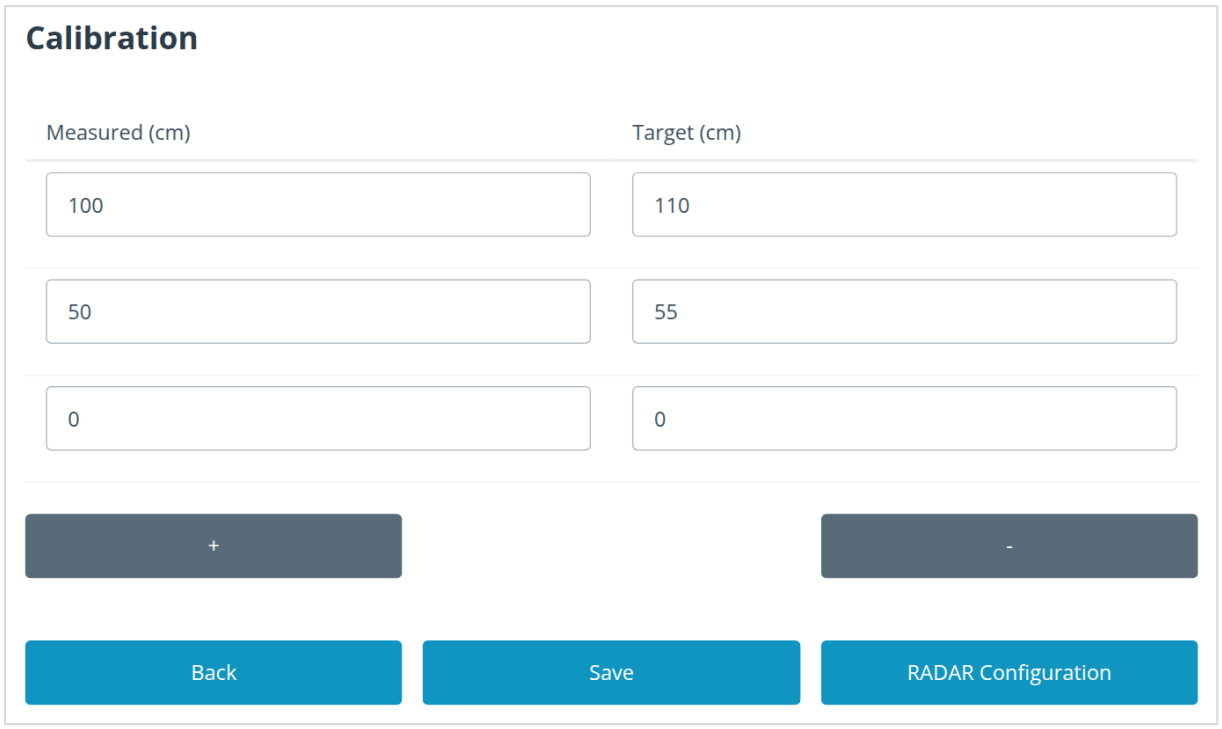
Calibration

With clear liquids such as water, or in special local conditions (sensor not installed exactly vertically), calibrating the sensor can be useful. The calibration is carried out using at least one measuring point. Any number of further measuring points is possible. You reach it under “System” via the “Calibration” button. In the table, enter the distance shown by the sensor under “Measured (cm)” and the actually measured distance under “Target (cm)”.

If the distance shown is already calibrated, reset the table to a single row with “0” and “0” before a new calibration and save it, otherwise the correction is applied twice.

If the table contains only one row, the sensor shifts all distances by the same difference. If you add further measuring points above the row “0”/“0”, it converts linearly between the points.

Begin the entries with the smallest distance.



Rows can be added to or deleted from the table using “+” and “-”. The table is built up from bottom to top. The lowest measured value is therefore at the bottom of the table.

Radar Configuration

If required (for example in the case of unreliable measurement results), the operation of the radar sensor can be adapted. The chart illustrates what the radar currently “sees” and helps to identify interference and to adjust and check the configuration. You reach the page under “System” and then “Calibration” via the “RADAR Configuration” button.

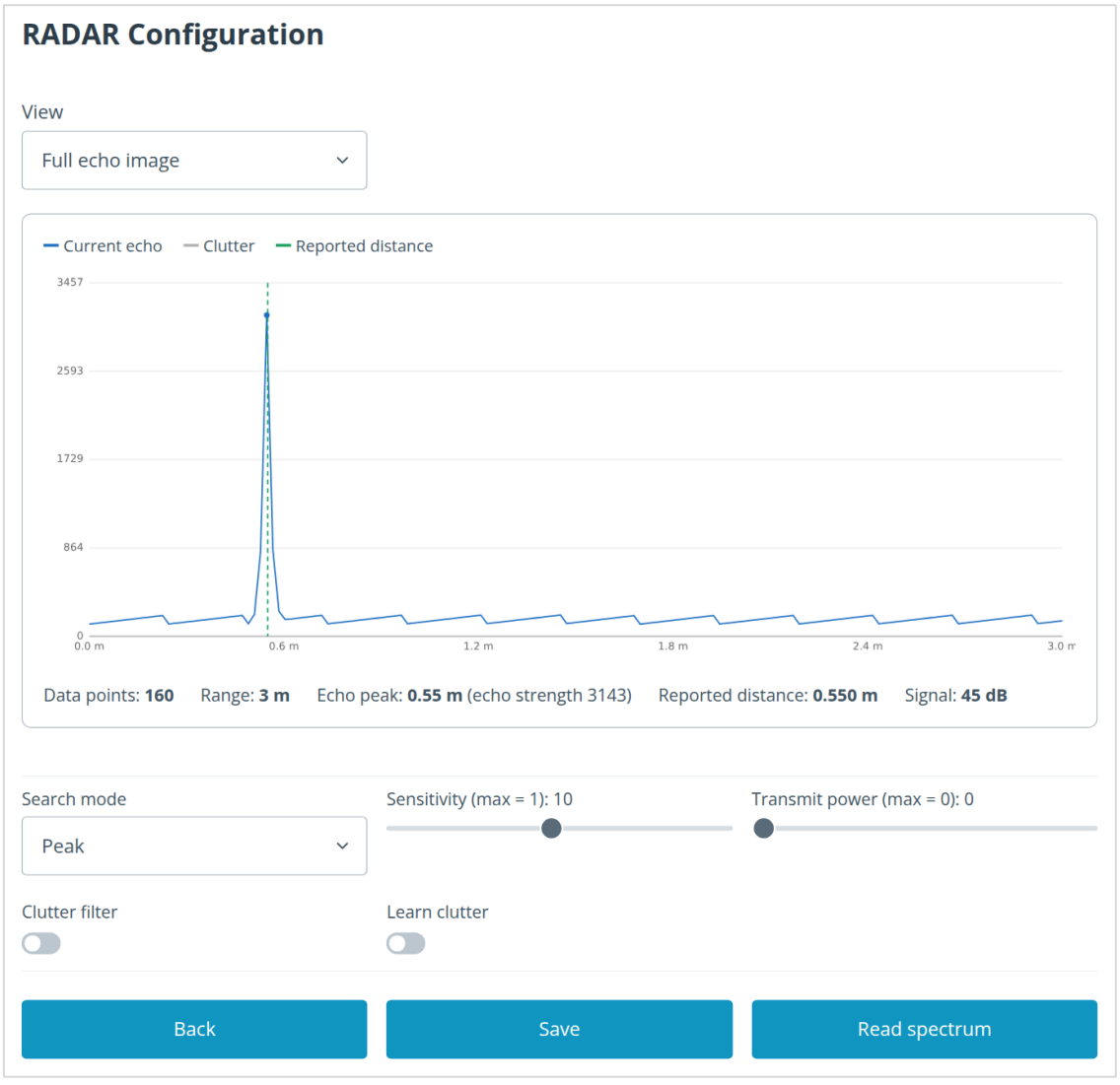
The chart shows the strength of the echoes over the distance:

The x-axis shows the distance from the sensor in metres. The y-axis represents the strength of the received echo as a relative value without a unit. The higher the deflection, the stronger the echo at that distance.

The selection field “View” lets you choose between two representations:

The full echo image shows the signal currently received (blue) together with the learned clutter (grey). The cleaned echo image shows only the signal with the fixed clutter removed.

The green dashed line marks the distance that the sensor currently reports as the target. The dot marks the strongest peak.



How clutter filtering works

The radar receives not only the echo of the target, e.g. of the water surface, but also reflections from objects that are permanently present. These are, for example, walls, brackets or internal fittings. These stationary echoes are the clutter.

With the “Learn clutter” function, the sensor takes a snapshot of these fixed echoes and stores it as the clutter image. If the “Clutter filter” is switched on, the sensor subtracts this clutter image from the current signal. Ideally, only the moving target (the water surface) remains. This makes the measurement considerably more robust.

The following aspects are important for a good result:

Learn the clutter image when the container is empty or the level is low, if at all possible.
As long as no suitable clutter image exists, leave the clutter filter switched off. A “contaminated” image degrades the measurement.

Typical procedure for setting up clutter filtering

1. Read the spectrum and check whether the target (the water surface) appears as a clear peak. If this is the case, no further steps are necessary. If further relevant peaks appear, it is worth setting up clutter filtering.
2. If possible, remove the target (empty the container or lower the level considerably).
3. Switch on “Learn clutter” and save. After learning, the clutter filter is active automatically.
4. Restore the target (fill the container) and check that the reported distance is measured stably and with a good signal (greater than 10 dB).

Further configuration options

The search mode determines which echo counts as the target:

- “Peak” reports the strongest echo. A good default setting when there is a clear, dominant target.
- “Threshold” reports the first echo that exceeds a detection threshold. Useful when it is not the strongest echo that counts, but the nearest one.

The sensitivity determines how well weak echoes are still detected:

- Smaller values make the sensor more sensitive: it also detects weak or more distant targets, but is more likely to pick up interference.
- Larger values make it less sensitive: weak signals are ignored, which is better in environments with a lot of interference.

Set a smaller value if the target is detected too weakly, and a larger one if clutter wrongly appears as the target.

The transmit power controls the transmission strength:

- Smaller values mean more power. Better for long distances or weakly reflecting targets.
- Larger values mean less power. Helpful when close, strongly reflecting targets overdrive the signal, and it reduces the radiated emission.

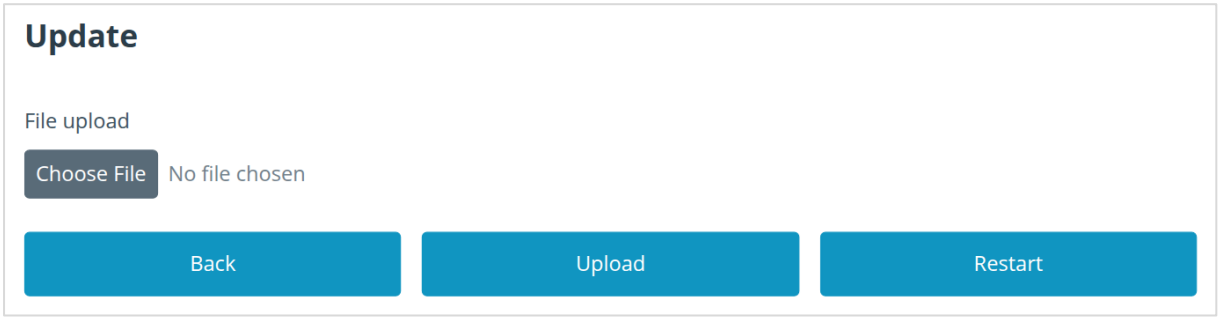
The clutter filter switches the clutter removal on or off.

The “Learn clutter” switch triggers a single re-learning of the fixed clutter image.

The “Read spectrum” button reloads the echo image at any time.

Update

The update function offers the possibility of updating the firmware. In addition, a saved configuration can be loaded. For this the file “config.json” of the level sensor has to be uploaded. To do so, select the file under “File upload” (depending on the browser via “Choose file” or “Browse…”) and then click on “Upload”. Wait until the main page appears again. A loaded configuration only takes effect after a “Restart”. Do not rename firmware files.



Retrieving the measured values via HTTP

By calling up “http://*hostname*/measurements” you receive the current measured values in JSON format. If authentication is activated, append the access credentials: “http://hostname/measurements?login=…&password=…”.

If something does not work

If you have problems with the Wi-Fi or MQTT connection, or if you would like to analyse how the sensor works, please activate logging under “System”. All relevant events and errors are then recorded. You obtain even more information if you activate the “Debug” option.

The most recent entries are shown directly. However, you can also download the log.

In normal operation you should deactivate both logging and the debugging function.

You can also contact our support team at **support@senvolon.de** for help.

Technical data

	SEN180	**SEN180-EA**
Power supply	230V AC	230V AC
Power consumption	1.0 W typ., 1.5 W max.	1.0 W typ., 1.5 W max.
Protection class	II	II
Antenna	internal, FPC, 1.16 dBi	external, RP-SMA, max. 3.5 dBi
Wi-Fi frequency range	2400-2483.5 MHz	2400-2483.5 MHz
Wi-Fi max. transmit power	20 dBm EIRP	20 dBm EIRP
Radar frequency range	77-81 GHz	77-81 GHz
Radar max. transmit power	20 dBm EIRP	20 dBm EIRP
Antenna beam angle	+/- 25°	+/- 25°
Measuring range	0.15-40 m	0.15-40 m
Resolution	1 mm	1 mm
Accuracy	+/- 5 mm	+/- 5 mm
Weight	115 g	115 g
Dimensions (WxHxD)	55x39x108 mm	55x39x108 mm
Temperature range	-20 - +40 ° C	-20 - +40 ° C
Degree of protection	IP 65	IP 65
Connection cable length	2 m	2 m

Contact

SENVOLON GmbH
Dolomitstr. 37
50226 Frechen

www.senvolon.de
Email: info@senvolon.de

Conformity

Hereby, SENVOLON GmbH declares that the radio equipment type SEN180 / SEN180-EA is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address: www.senvolon.de

Radio and radar information

The device contains a millimetre-wave radar for level measurement in the 80 GHz frequency range.

The radiated power is below the statutory limits for human exposure. When the device is used as intended, there is no health hazard.

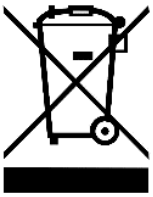
Make sure that the radar surface is not covered by metal, films or enclosure parts. Modifications to the device are not permitted and void the radio approval.

In addition, the device contains a radio module for Wi-Fi in the 2.4 GHz frequency range.

Details of the frequency bands and the maximum transmit power can be found in the “Technical data” section.

Disposal instructions

Disposal of waste electrical and electronic equipment (WEEE / ElektroG)



This device is marked with the symbol of the crossed-out wheeled bin.
It must not be disposed of with household waste.
Waste electrical and electronic equipment must be handed in separately from household waste at a collection or take-back point.

Data protection

If the device has stored personal data (e.g. network or user information), delete it before disposal.

Manufacturer information

Manufacturer: SENVOLON GmbH
WEEE Reg. No. DE: 93352512