Escort TD-150 BLE User Manual

by tech support

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Connecting a sensor to a smartphone

To configure any TD-150 BLE sensor, to calibrate it and to do the tank calibration, you need to use Escort Configurator app available on iOS and Android devices (hereinafter - the “**app**”).

Geolocation

Run the configurator. Be sure to give it access to your geolocation. Activate the Bluetooth and the geolocation of your smartphone (**Fig. 1**). The app must have access to the geolocation due to the requirements of the AppStore and GooglePlay (**Fig. 2**).

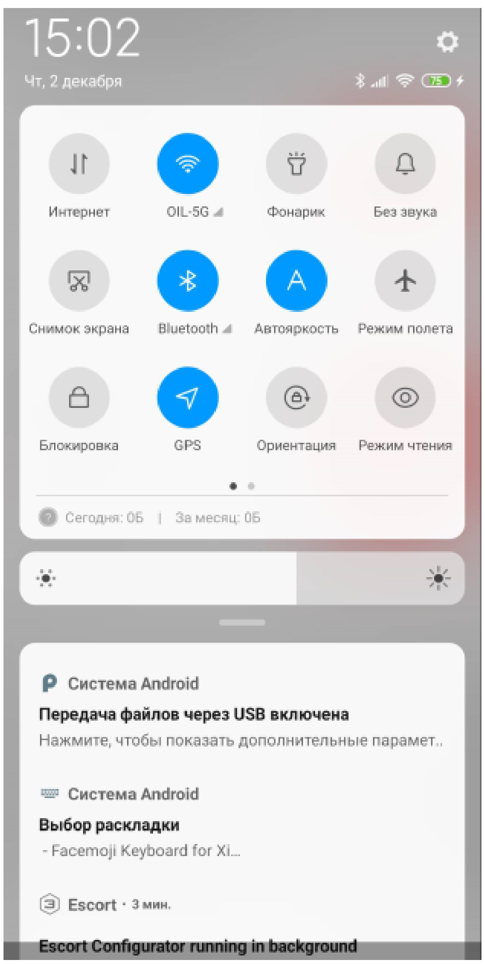


Fig. 1 GPS (geolocation) and Bluetooth activated

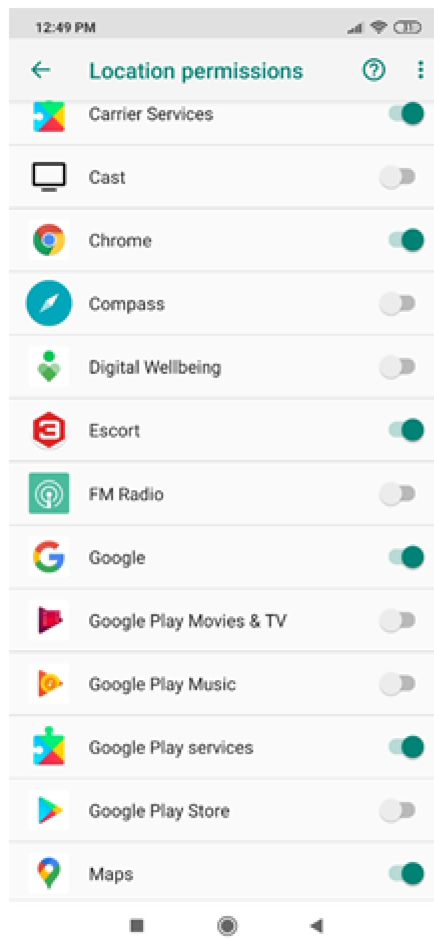


Fig. 2 Location permissions

Connecting sensor

First, power up the sensor by connecting its red (PWR) and black (GND) wires to a 12-36V power supply.

If you have C200M RS485-USB converter, you can connect the sensor to the Molex socket.

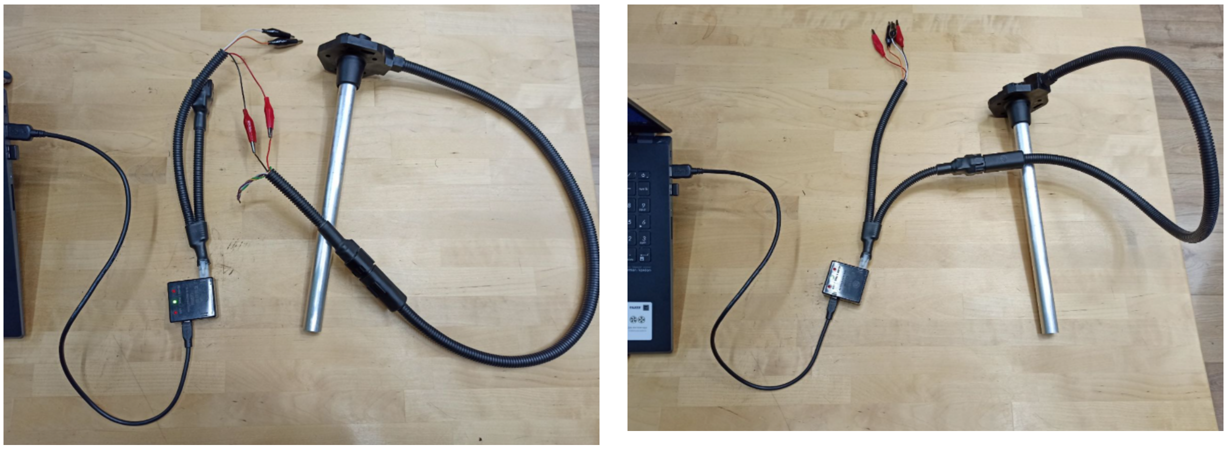


Fig. 3 Connecting the sensor to a power supply or C200M (via Molex)

Run the app on your Android or iOS device.

Tap on the **Sensor settings** button. Next, select **TD-150 BLE (TW)**.

Fig. 2 Sensor settings

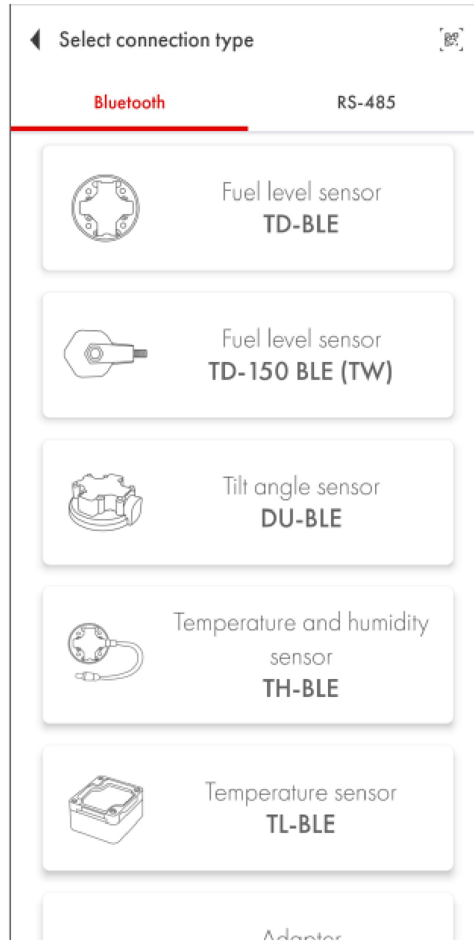


Fig. 3 Connection and sensor type

Search for a particular sensor by introducing the last 6 digits of its serial number, if necessary. The serial number can be found on the sensor's head.

Or simply find the sensor you need on the list and tap on the **Connect** button.

When using an Android device, you can also tap on the sensor itself to open the dropdown menu displaying the data received in the advertising mode.

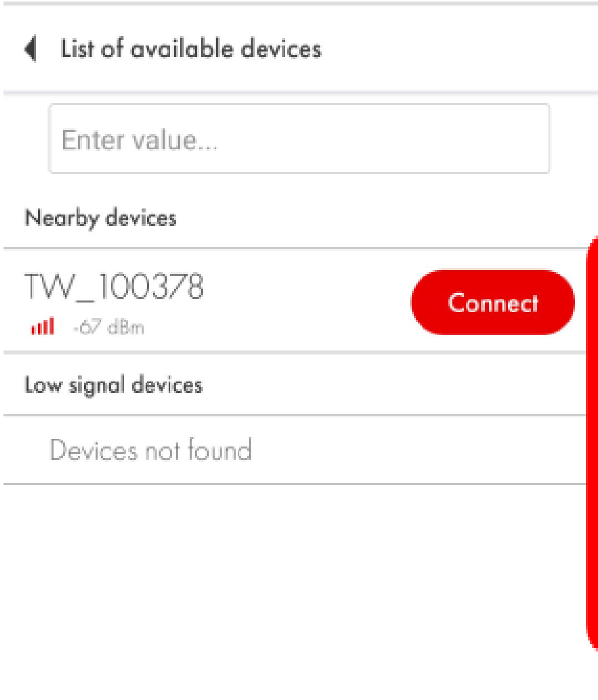


Fig. 4 Sensor search

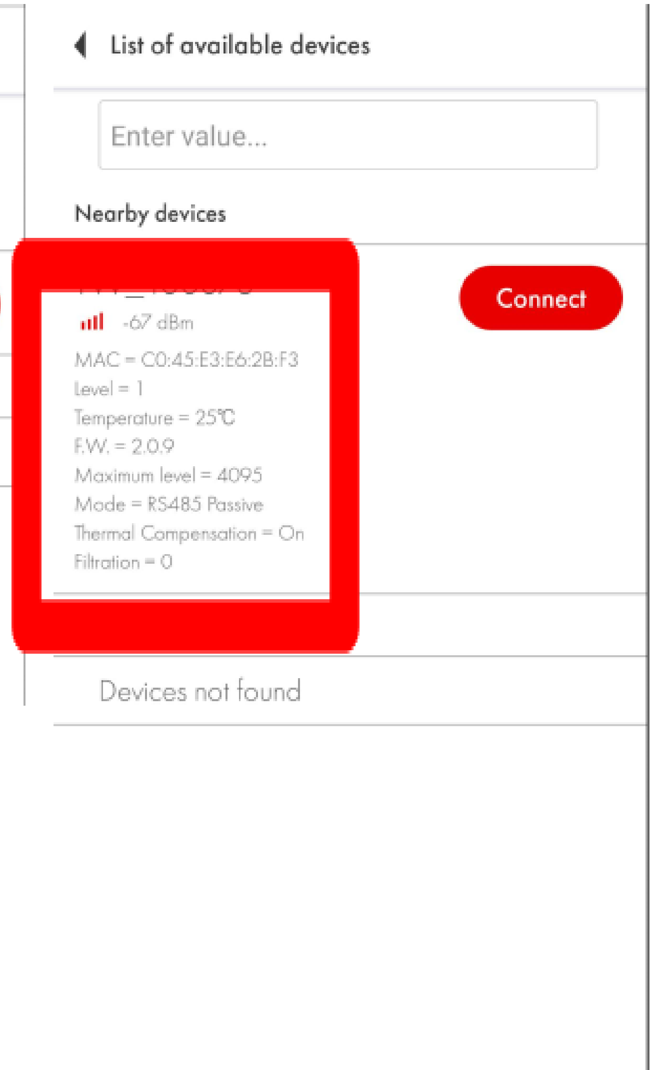


Fig. 5 Data received in Advertising mode

Sensor's password protection

Once you connect the sensor for the first time, the app will require that you to set up a password. Please, do so. Otherwise anyone with our app could change the settings of the sensor.

If the sensor already has a password, you will be required to enter the previously set password.

Sensor’s main parameters and readings

On the main screen of the sensor you can see the following parameters:

1) **RSSI** - Received Signal Strength Indicator that shows how well your smartphone receives the data from the sensor; this parameter is NOT transmitted by the sensor but is calculated by the device that receives the data from it;
2) **Serial number** of the sensor;
3) **Version of the firmware** (hereinafter - **FW**) installed on the sensor
4) The **temperature** measured by the sensor;
5) **Network address** used for the connection via the **RS-485** interface;
6) **Operating mode** of the sensor (based on what output is used to communicate with a GPS tracker/other external device)
7) Level of smoothing/filtration;
8) **MAC address** for pairing sensors with GPS tracker or other devices via Bluetooth (**IMPORTANT!** First check if the sensor is compatible with the devices of a particular manufacturer with the tech support of that manufacturer);
9) The **level** reading - fuel level reading as a value from 1 to 1023 or from 1 to 4095 range; this is not a reading in liters but more on that later;
10) **Approximate voltage** reading on the analog output (**IMPORTANT!** This is a very approximate voltage reading calculated based on the formula; we don’t recommend doing the tank calibration using these readings);
11) **Indicator** of level stability;

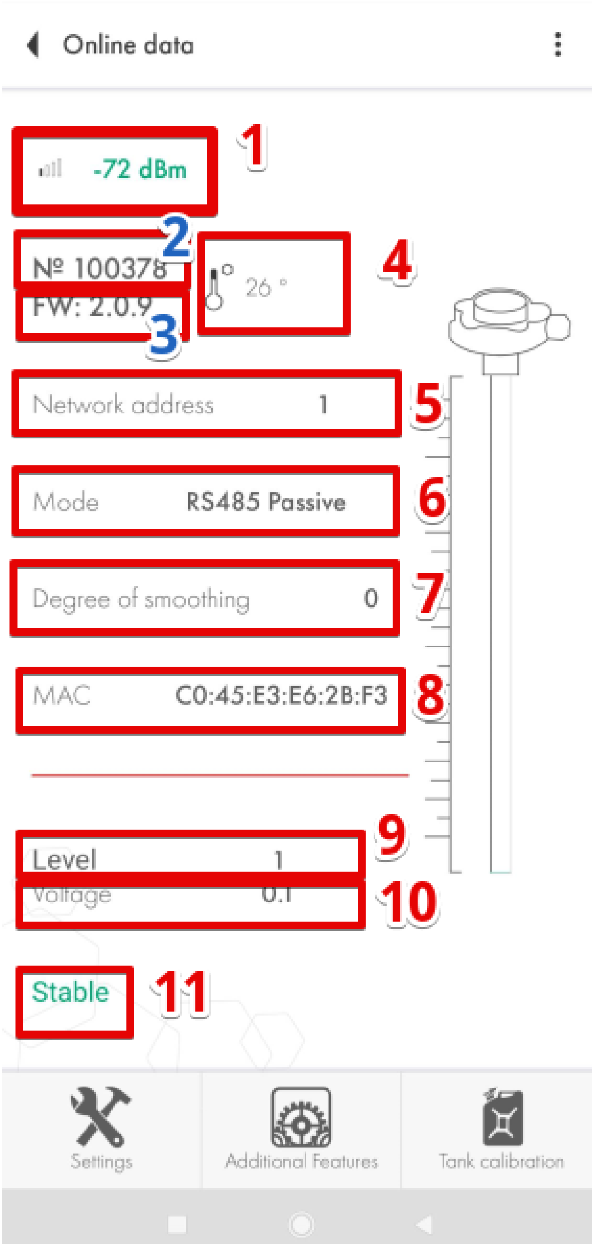


Fig. 6 Sensor's main screen (Android)

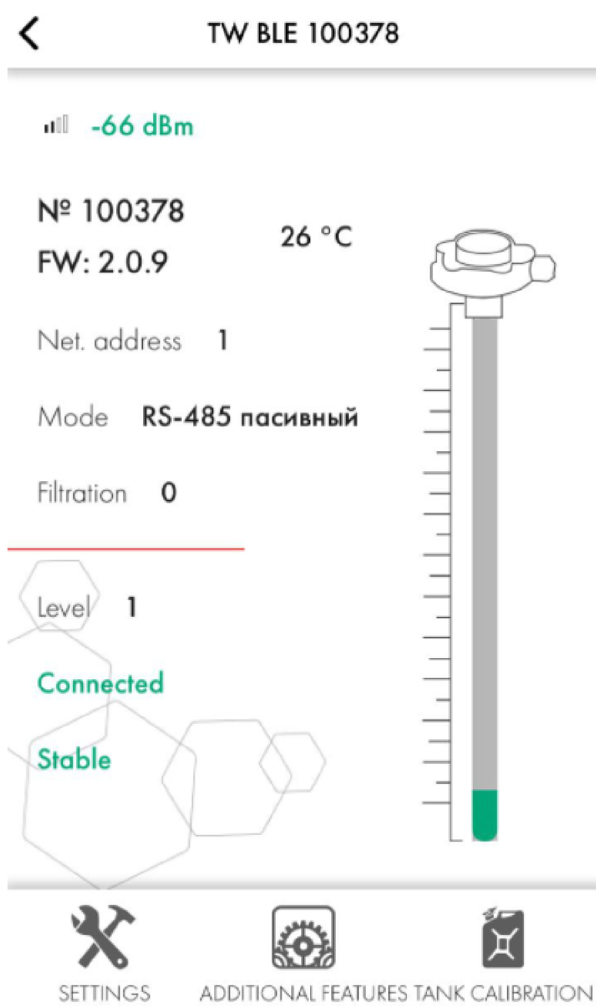


Fig. 7 Sensor's main screen (iOS)

Sensor calibration

CNT. What happens when you calibrate the sensor

After you cut or extend the tubes of the sensor, you need to recalibrate it, i.e. to set its new **Full** and **Empty** calibration values. You can do that in the **Settings** menu **(Fig. 8, 1)**.

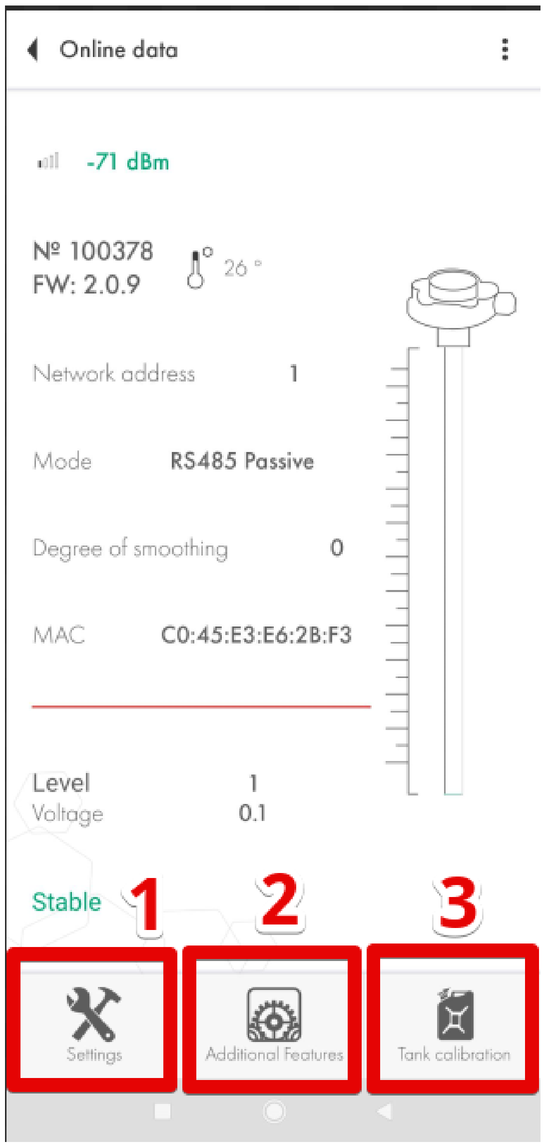


Fig. 8 Settings. Additional Features. Tank calibration

The sensor's "raw" readings - current level or CNT - change depending on how much fuel there is in the sensor's tubes.

The CNT is then compared with the Empty and Full values.

If the **tubes are empty** and "**CNT (Fig. 9, 1) ≈ Empty calibration value (Fig. 9, 2)**", the level is displayed as 1.

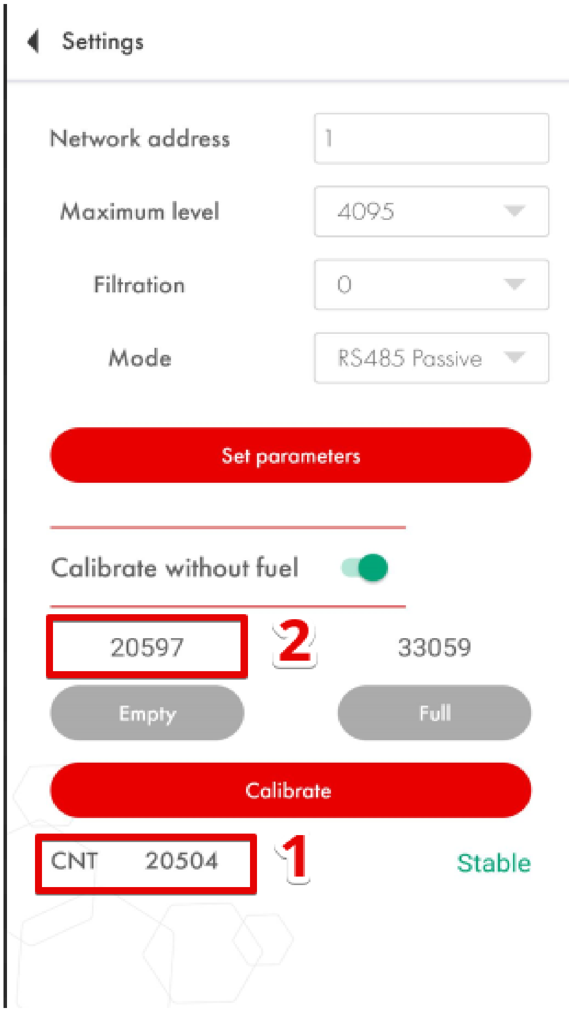


Fig. 9 CNT and Empty

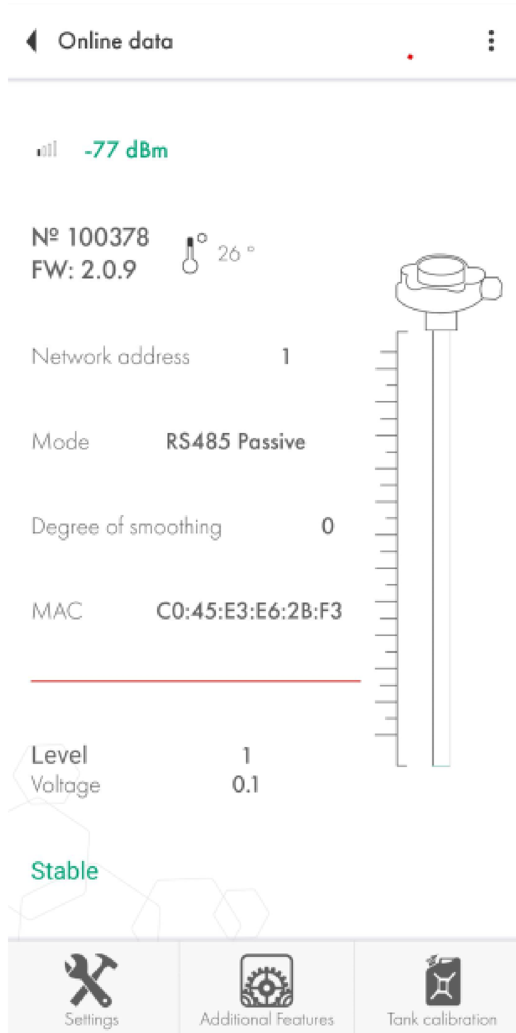


Fig. 10 Level reading when CNT ≈ Empty

If the tubes are full and "**CNT (Fig. 11, 1) ≈ Full calibration value (Fig. 11, 2)**", the level is displayed as 1023 or 4095.

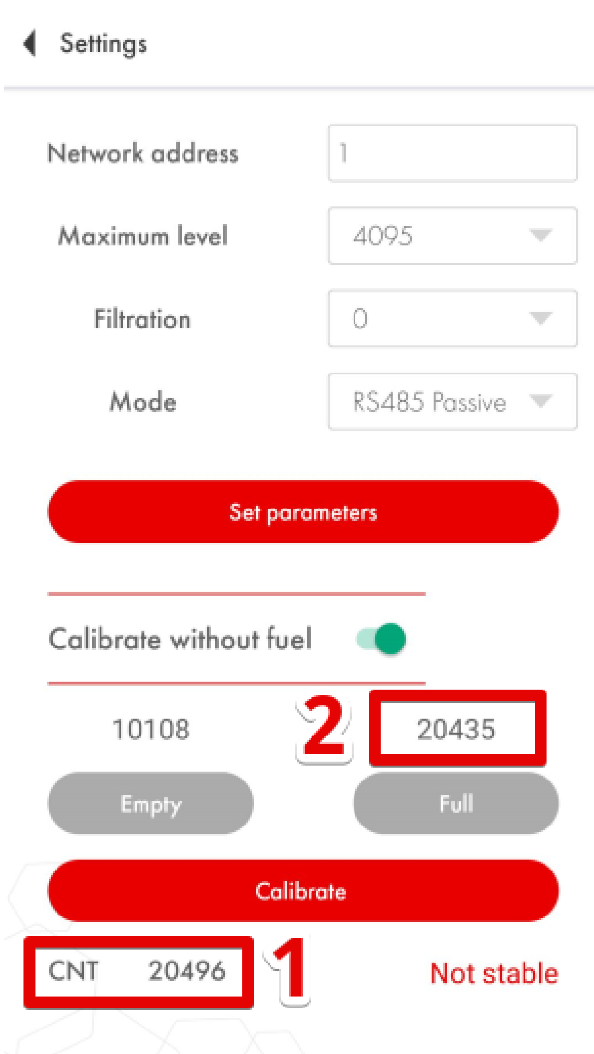


Fig. 11 CNT and Full

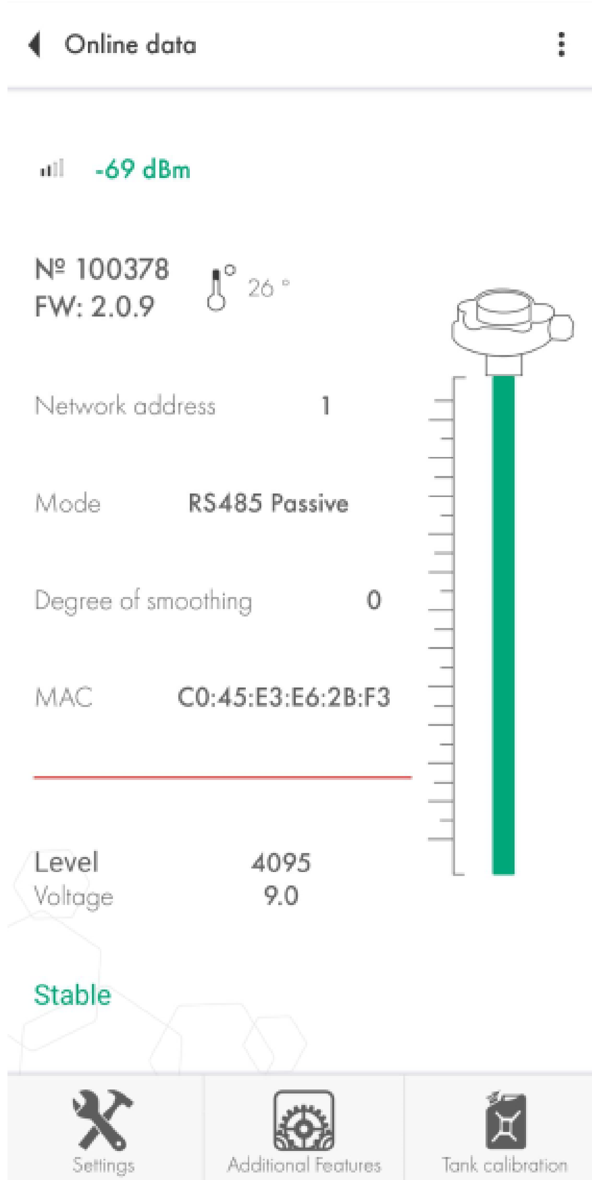


Fig. 12 Level reading when CNT ≈ Full

Therefore, the CNT must be increasing as the fuel fills the sensor's tubes. It has to be moving from the value close to the Empty calibration value towards the Full calibration value.

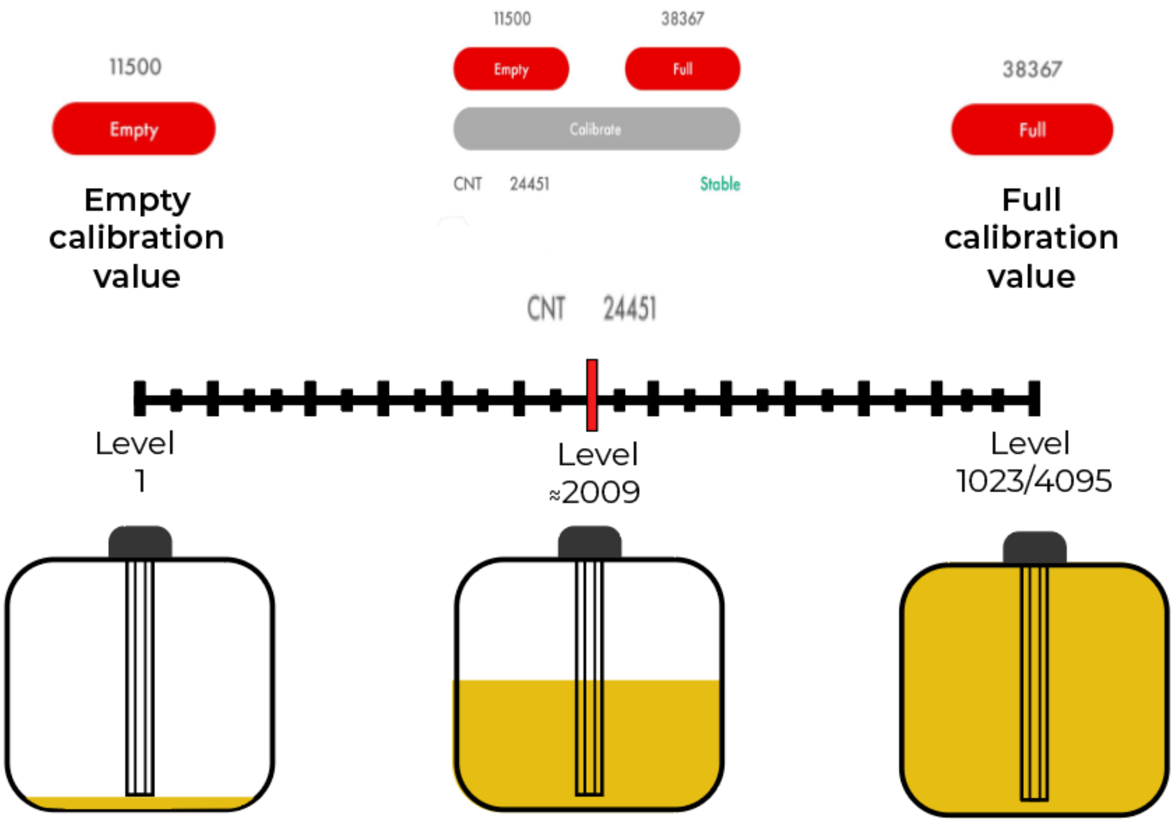


Fig. 13 CNT, level and physical fuel level

When you calibrate the sensor, the current CNT value is saved as either the Full calibration value (if you press the **Full** button) or as the Empty calibration value (if you press the **Empty** button).

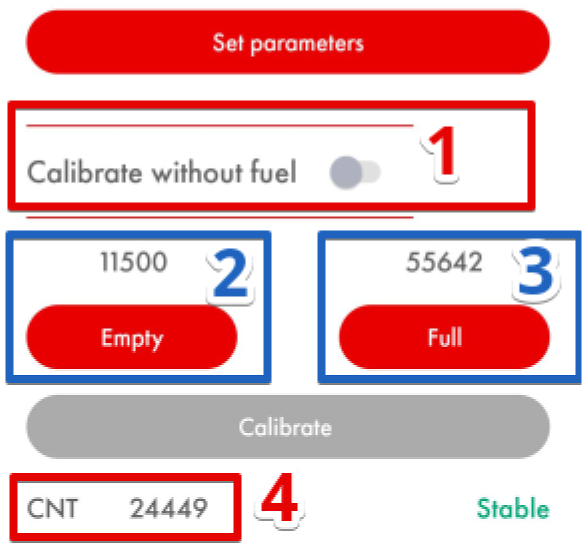


Fig. 14 CNT and Full **before** pressing Full

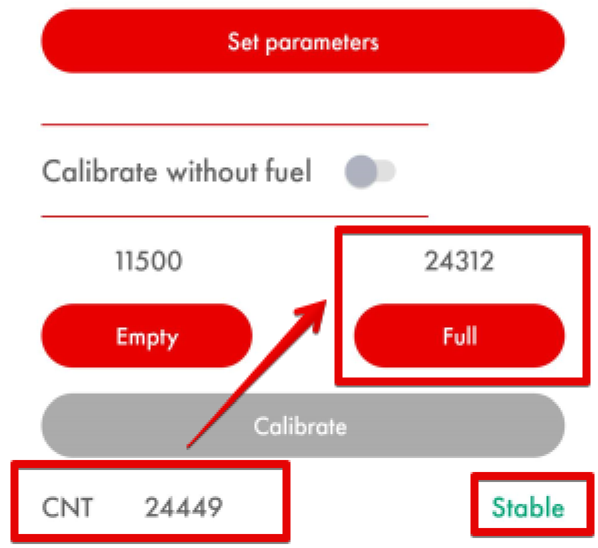


Fig. 15 CNT and Full **after** pressing Full

How to and why calibrate sensors?

Initially, the sensor is calibrated at its original length. **Once you change it by cutting or extending the tubes, you need to recalibrate it** i.e. to record the new CNT values that the sensor calculates when its tubes are either full or empty.

That is why you need to:

- Insert the centrator from the sensor’s kit into the tubes (**Fig. 16**)

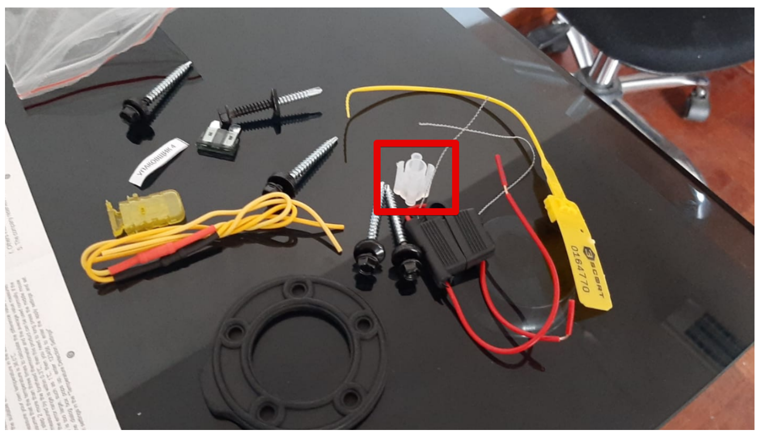


Fig. 16 Centrator/centralizer

- Fill the tubes with fuel by either covering the drainage hole with a piece of insulation tape and turning the device upside down (**Fig. 17**) or by putting the sensor into a recipient so that the fuel reaches the edge of its head (**Fig. 18**). The first way is better.

Fig. 17 Covering drainage hole, turning the sensor upside down and filling the tubes from a jerry can

Fig. 18 Filling the tubes by putting the sensor into fuel

- Switch off the **Calibration without fuel** tumbler (**Fig. 19**) and press the **Full** button (**Fig. 20**, **1**) when the level is **Stable** or the digit before the last two of the CNT value stops changing (**Fig. 20**, **2**)

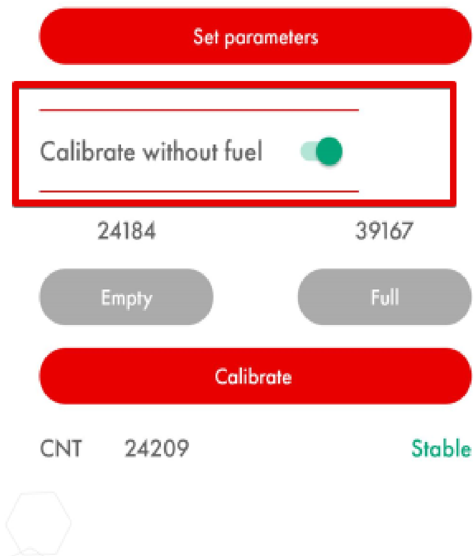


Fig. 19 Deactivate the Calibrate without fuel option

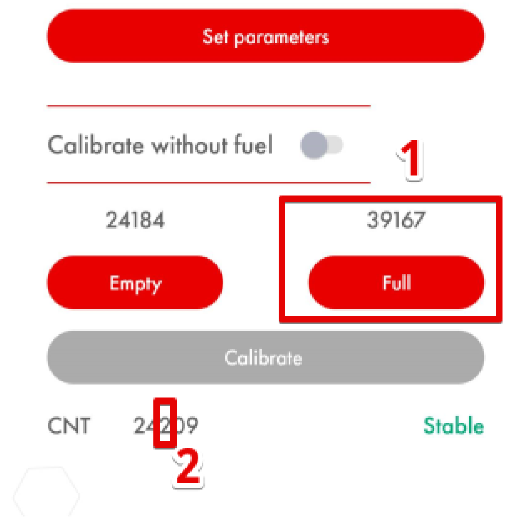


Fig. 20 Press **Full** when the level is stable

- Next, empty the tubes, wait for 2-3 minutes for the last drops of fuel to get out of the tubes and press **Empty**

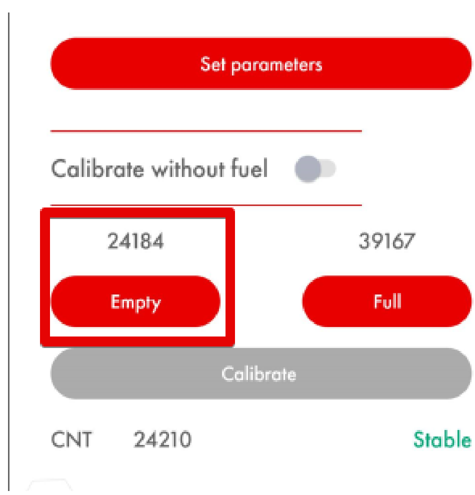


Fig. 21 Press **Empty** button when the tubes are empty

Calibration without fuel

Alternatively, you can calibrate the sensor without fuel.

In this case, make sure the sensor's tubes are empty and there is no fuel in its tubes. Leave the **Calibrate without fuel** tumbler active (green) and press **Calibrate**. The values above the Empty and Full buttons will change automatically. **Figures 22** and **23** show change in the calibration values.

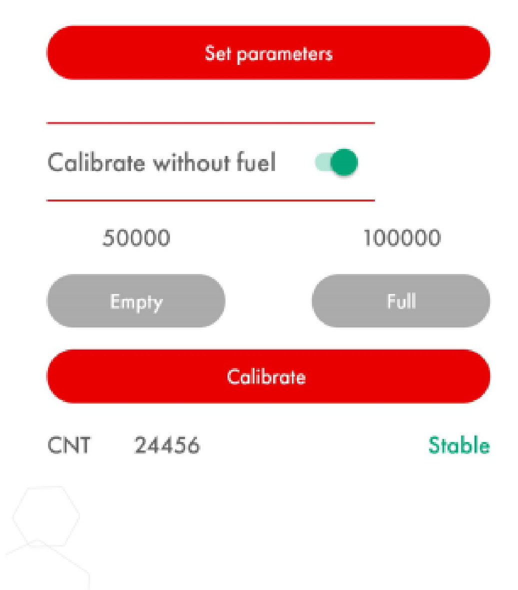


Fig. 22 Calibration values BEFORE calibration without fuel

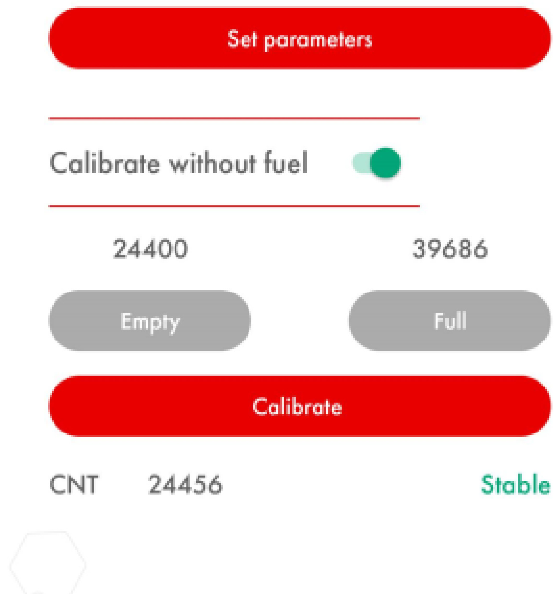


Fig. 23 Calibration values AFTER calibration without fuel

If you calibrate the sensor without fuel, the measurement range could change a little bit.

Originally there are two measurement ranges:

- From 1 to 1023
- From 1 to 4095

The sensor never transmits the value of 0. When it is empty, the level is shown as 1.

Sometimes when you calibrate a sensor without fuel, the range can change from 1...4095 one to the 36...3986 one, for example.

It is nothing to worry about if you do the tank calibration properly.

When and how to select the 1024 or 4096 range?

The **1…1023 measurement range** is generally recommended for the **sensors shorter than 500 mm**. The 1…4095 measurement range is recommended in all other cases.

To change the range, open the Settings menu and select one of the two ranges in the **Maximum level** dropdown menu (**Fig. 24**). Then be sure to tap on the **Set parameters** (or **Write parameters to device**) button (**Fig. 25**).

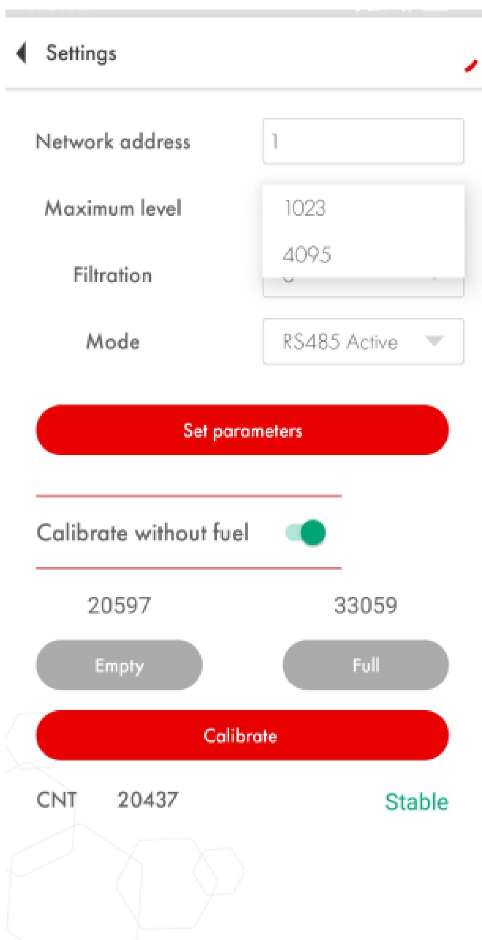


Fig. 24 Maximum level - select range

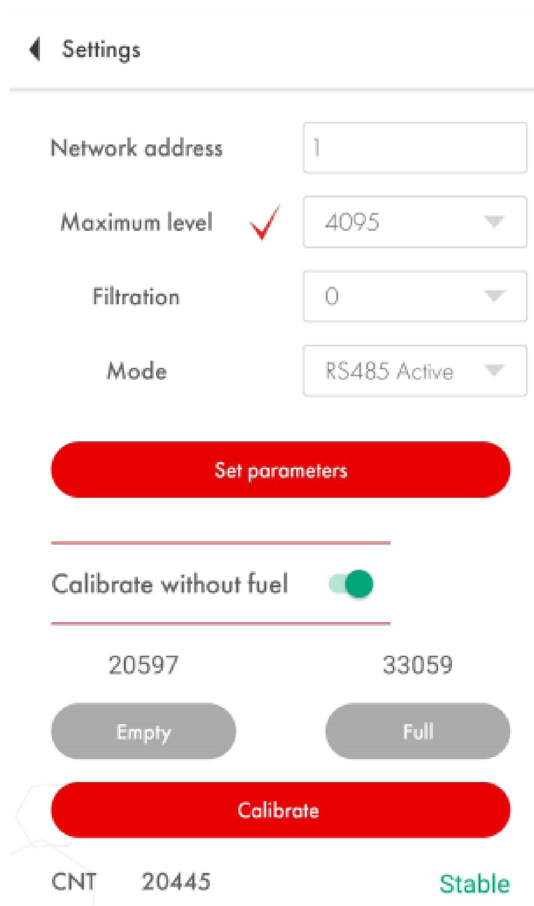


Fig. 25 Set parameters to apply the change and remove the red tick

How to check if the sensor is properly calibrated?

The Empty calibration value must be at least x1.4 lesser than the Full calibration value.

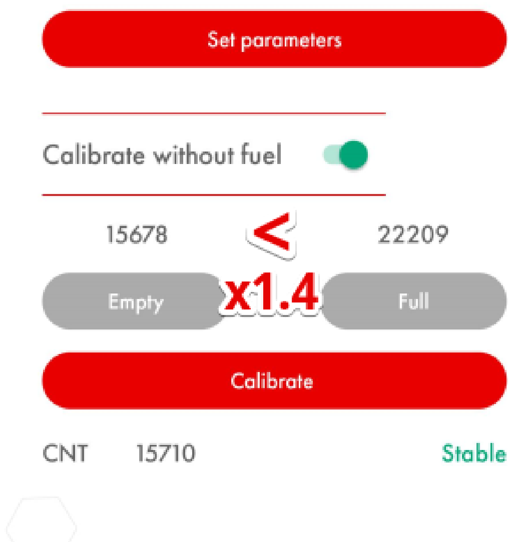


Fig. 26 Properly calibrated sensor
22 209 (Full) : 15 687 (Empty) ≈ 1.4

Operating modes

The TD-150 BLE have the following three operating modes:

- RS-485 Passive (the sensor transmits the data only after getting a request from a tracker/other compatible device)
- RS-485 Active (the sensor transmits the data every 2 seconds without any requests)
- Analog (empty tubes ≈ 0.2 V; full tubes ≈ 9 V)
- Frequency (empty tubes = 300 Hz are present on the orange wire; when tubes are full = 1323 or 4395 Hz are present on the orange wire);

ATTENTION! ANALOG MODE IS NOT DISPLAYED IN THE DROPDOWN LIST BECAUSE YOU DON'T NEED TO SELECT IT!
IT IS ACTIVE ALL THE TIME AND THE VOLTAGE WITHIN THE ≈ 0.2 ... 9 V RANGE IS ALWAYS PRESENT ON THE GREEN WIRE OF THE SENSOR!

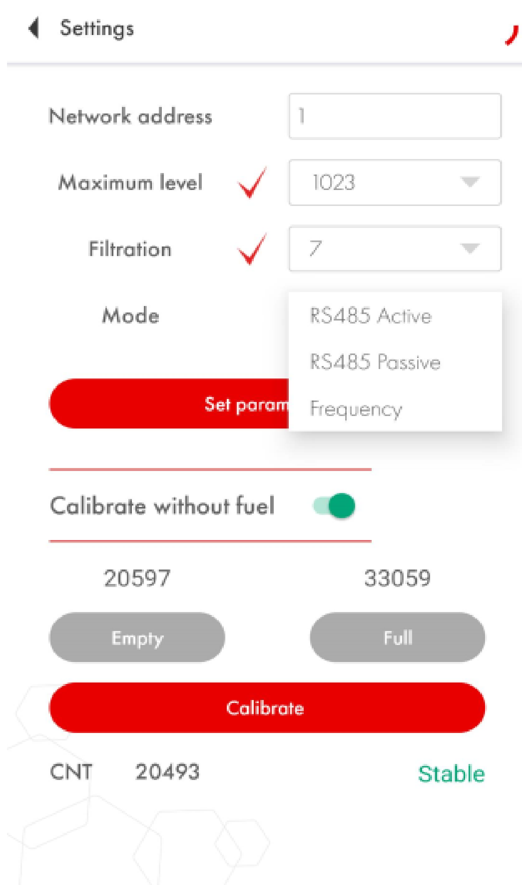


Fig. 27 Selecting Operating mode

Be sure to tap on the **Set parameters** button if you changed the Maximum level, Filtration or Mode.

RS-485 Network address

To connect several sensors to the same GPS tracker via the RS-485 interface, every sensor must be given a unique network address that serves as an ID used to distinguish one sensor from another.

That is why when you need to connect 2 or more sensors, you need to change the default network address in one or more of them from 1 to 2, 3, 4, etc. (depending on how many sensors are to be installed).

Type the network address you need in the Network address box (**Fig. 28**, **1**) and then press 'Set parameters' button to apply the change (**Fig. 28**, **2**).

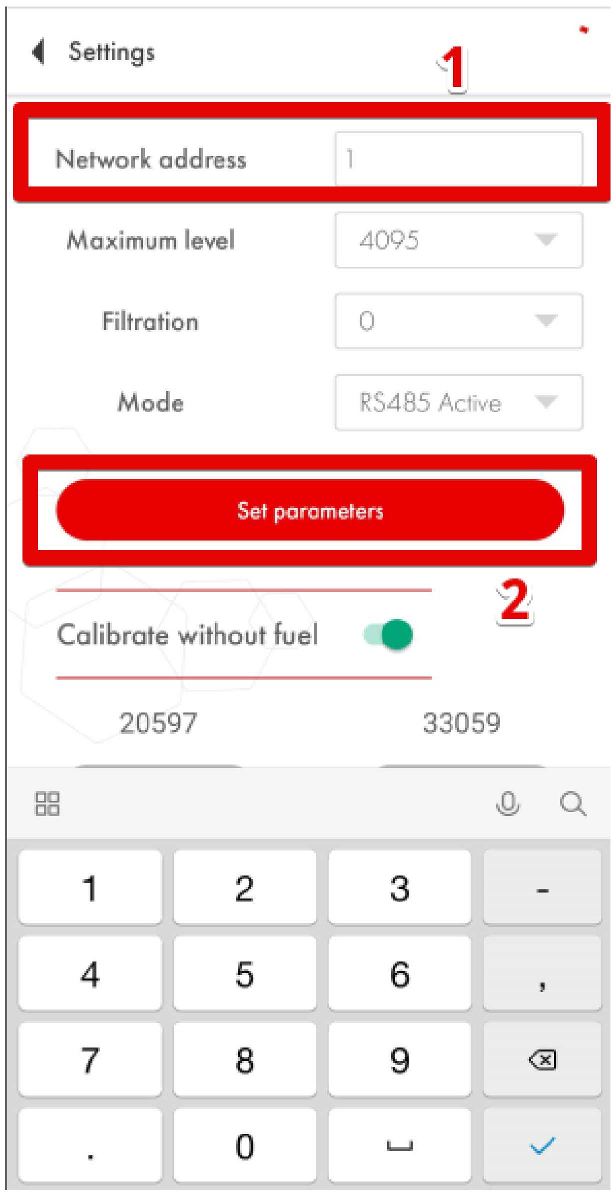


Fig. 28 Changing network address

Tank preparation

To prepare the tank, you need to:

- Empty the tank and clean any dirt from it if necessary
- **Remove any fuel vapors and fumes** (especially if it is a gasoline/petrol tank); to do so, you can boil some water in a separate recipient and administer the vapor from that recipient into the tank so it could "push" the fuel vapors and fumes out; be sure to keep the fire used to boil the water far enough from the fuel tank (**Fig. 29**)

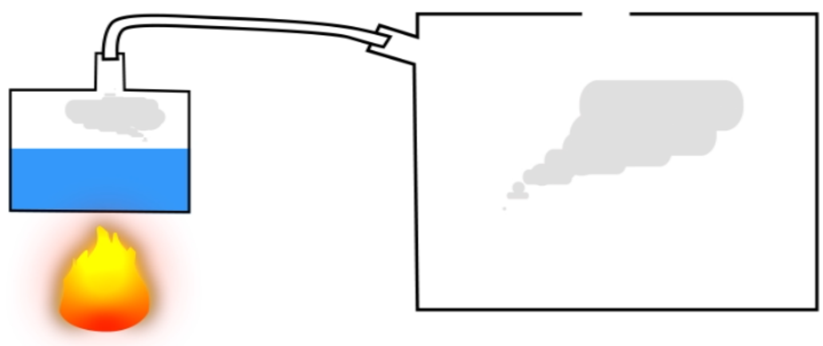


Fig. 29 Removing fuel vapors

- **Find the geometric center of the tank** (**Fig. 30**) and **drill a little hole** in it using a **ø3mm bit.** Then probe the space around it for any reinforcement plates/ribs or baffles inside the tank using a piece of wire (**Fig. 31**);

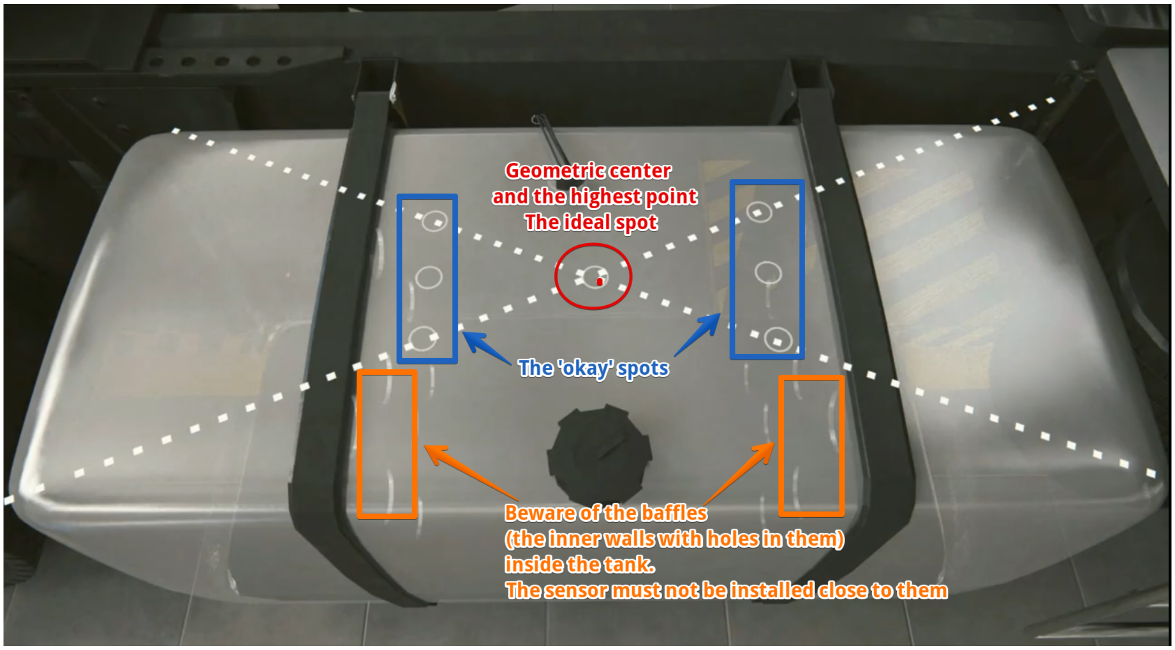


Fig. 30 Selecting the spot

Fig. 31 Drilling a hole to later probe for any obstacles inside with a piece of wire

- If the space around the selected spot is clear, **drill a bigger hole with a ø 30-35 mm bimetallic hole saw**; be sure to tilt the saw a little bit to prevent the cut piece from falling into the tank (**Fig. 32 and 33**). Use a magnet to collect metal shavings and keep them from falling into the tank.

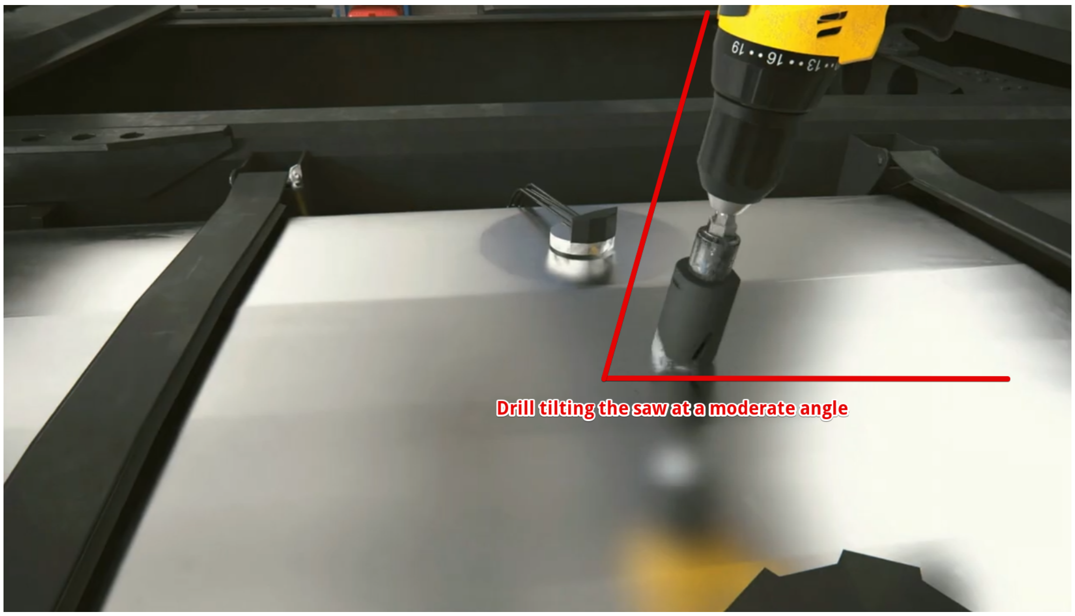


Fig. 32 Drilling a hole at an angle

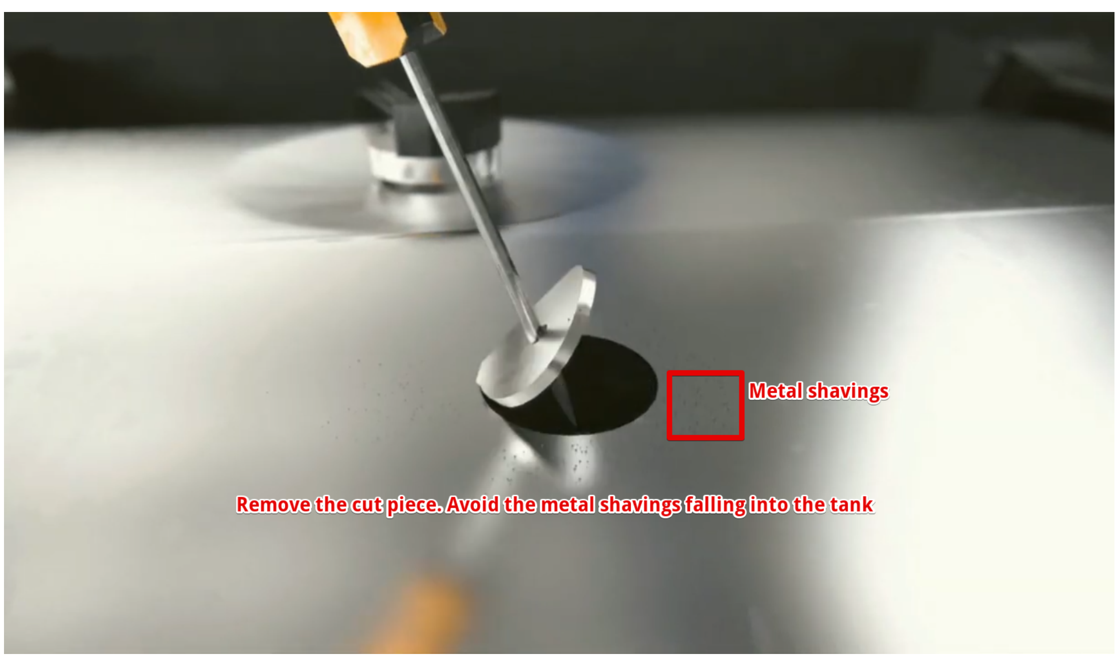


Fig. 33 Removing the cut piece

If the sensor cannot be installed in the geometric center of the tank, try to pick a spot as close to the geometric center as possible; that spot also must coincide with the point where the tank's height is at its maximum. This way you **minimize the magnitude of the oscillations** in the level readings caused by the fuel's sloshing during trips.

Why must the sensor be installed in the geometric center of the tank?

The highest point must be selected for the sensor to be able **to measure all the fuel** inside the tank **without any blind zones**.

The readings of the sensor installed in the center of the tank will be less affected by the fuel sloshing than the readings of the sensor installed close to one of the tank's walls.

If the sensor cannot be installed in the tank's center, consider installing two sensors - one at each end of the tank. Each sensor will compensate for the fuel surges and drops in the readings of another.

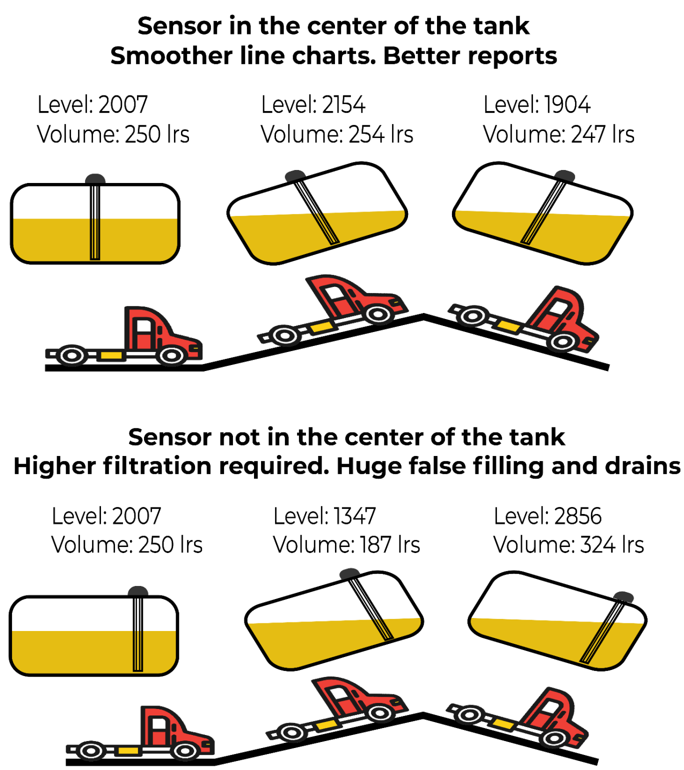


Fig. 34 Position of the sensor and fuel sloshing

Sensor adjustment

Before calibrating the sensor, you need to **adjust the length** of its measurement tubes according to the height of the tank by either cutting or extending them. **The length of the tubes** should be calculated based on the **following formula**:

L = H - 15 mm,

where **L is the length of the tubes** after they were cut or extended and **H is the height of the tank** at the installation spot.

ATTENTION!!! The minimum length of the tubes must not be less than 15 cm (150 mm). Otherwise the sensor will not work properly. The maximum length of the tubes can reach 6 m.

Fig. 35 Measuring the height of the tank

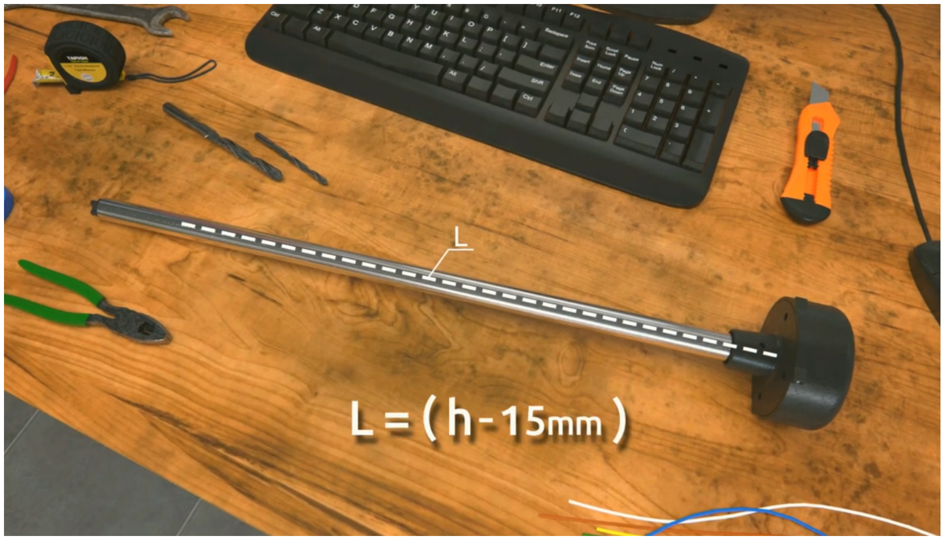


Fig. 36 Establishing the length of the tubes

To cut the tubes, use a metal hacksaw. Be careful while cutting them and avoid damaging the connection between the tubes and the sensor's circuit inside its head.

Fig. 37 Cutting the tubes

Do not let any metal shavings end up stuck inside the tubes: that could provoke a short circuit in the sensor and then you would need to blow the tubes with compressed air through the drainage holes under the

sensor's flange. Treat the cut with a piece of sandpaper to remove any irregularities and burrs.

To extend the tubes of the sensor, **use a collet coupling** and an extra piece of tubes.

Fig. 38 Collet coupling

The collet nuts (the gold-yellow ones shown on the **Figure 39**) connect the parts of the inner tube. Once inserted into the parts of the inner tubes and screwed onto the stud bolt, they don't have to touch but try to drive them as close to each other as possible without breaking the tubes (**Fig. 40**).

Fig. 39 Collet coupling. Inner coupling

The outer coupling cylinder and its nuts must be tightened up as hard as possible. The outer tubes of the sensor must touch each other.

Fig. 40 Collet coupling. Outer coupling

Fig. 41 Collet coupling fixed

Be sure to check out this video on our YouTube channel to see the coupling assembled in real time.

Tank calibration

Once the sensor's length is adjusted and it has been recalibrated, you need to install it in the tank.

Mount the sensor into the tank driving its tubes through the ø 30-35 mm hole you drilled previously. Make sure that the **gasket** is placed between the sensor's flange and the tank's top surface. Then screw in the self-tapping screws from the sensor's installation kit into the ø 3mm holes you drilled earlier.

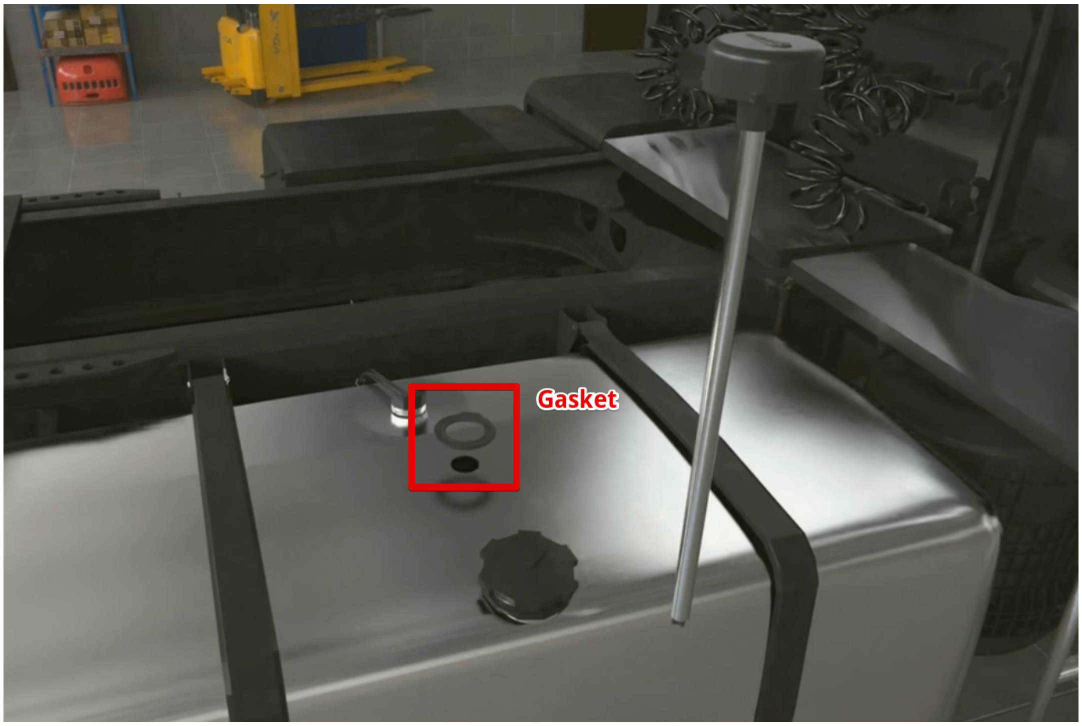


Fig. 42 Putting the sensor inside tank

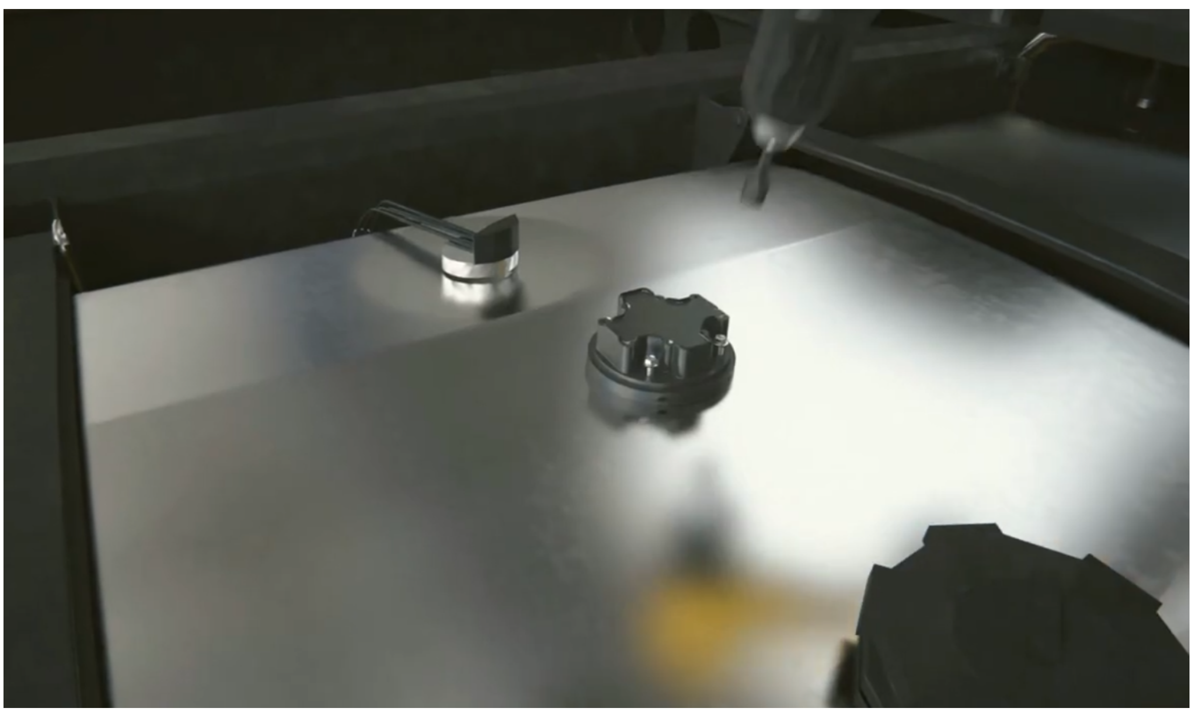


Fig. 43 Fixing the self-tapping screws

Begin the tank calibration. This procedure results in a level-to-liters or level-to-gallons **table** that enables your monitoring platform **to convert the**

level readings the sensor outputs **into liters/gallons** displayed in the reports you get from the platform.

To create such a table, you need to fill the tank step-by-step adding the fuel into the tank portion-by-portion and recording the level-to-liters(/gallons) correlation after each portion is added using the Tank calibration menu of the app.

Let's say that you need to do a tank calibration for a tank with a total capacity of 100 liters and do that in 10 portions equal to 10 liters each.

To do so, you need to connect the sensor and tap on the **Tank calibration** button (**Fig. 44, 3**). However, first, make sure that the **filtration is set to 0** in the **Settings** menu (**Fig. 45**). The filtration slows the level calculation down and can increase the time needed to complete the tank calibration.

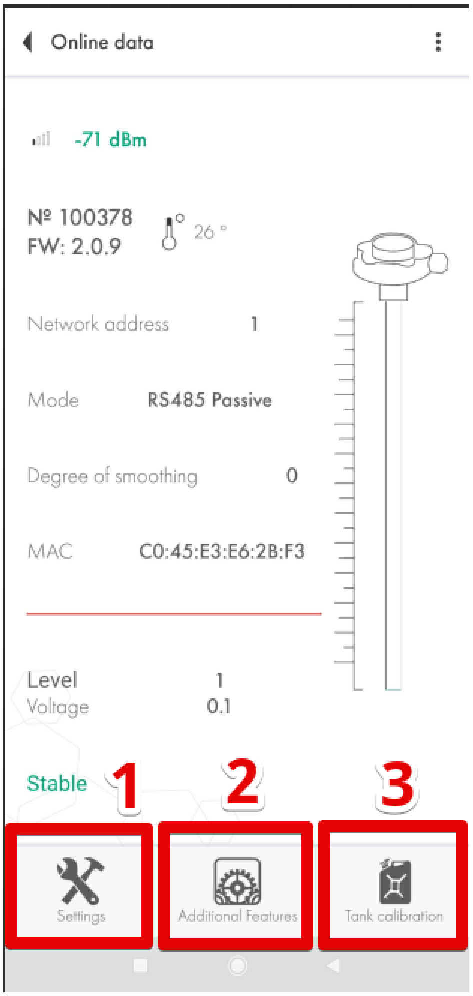


Fig. 44 Tank calibration menu

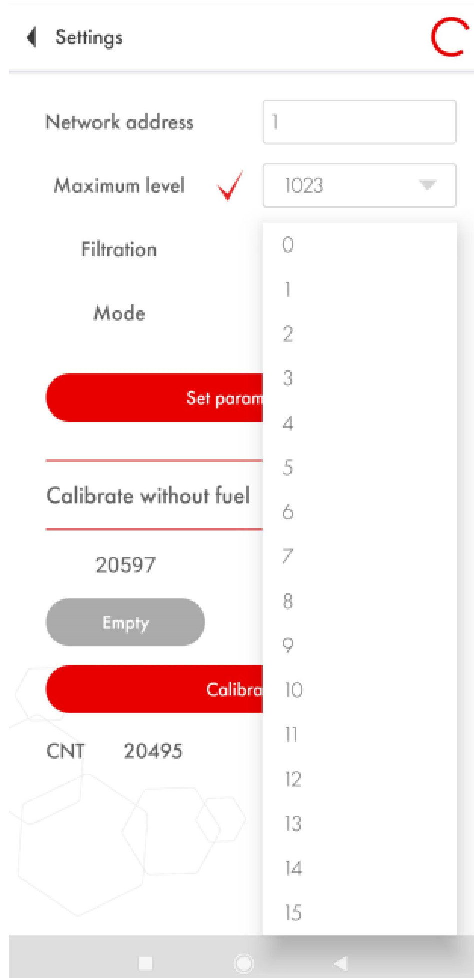


Fig. 45 Select 0 Filtration and press Set parameters (Write parameters to device)

Next, you can either **Start** creating a new table or select the file you might have already created and **Continue** working with it.

If you press Continue, then you will need to find the table on your Android device where you previously created/placed it. Select another folder via the main menu button (**Fig. 46, 1**) or via the dropdown menu (**Fig. 46, 2**). Find the table and tap on it (**Fig. 46, 3**)

Fig. 45 Start or Continue

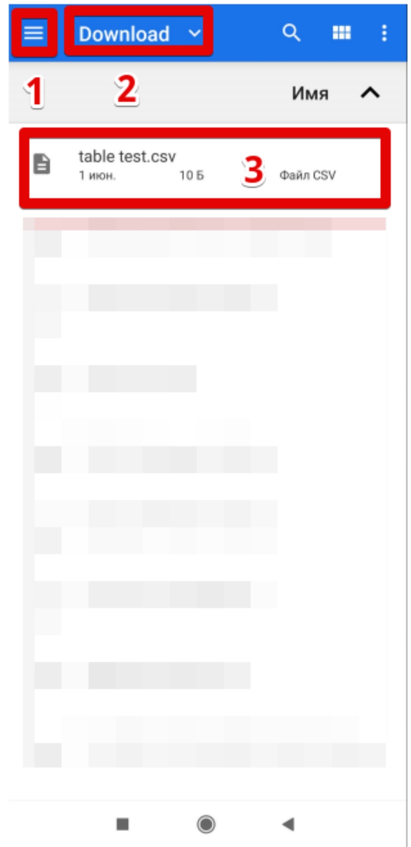


Fig. 46 Set parameters to apply the change and remove the red tick

If you press **Start**, then, once again, choose the folder in which the table will be saved (**Fig. 47**, 1, 2) and press the button to select it (**Fig. 47**, 3)

Fig. 47 Selecting folder and creating a new file

Then you can select either **Filling** or **Draining** method (**Fig. 48**, 1, 2). **The filling method is recommended because it tends to be more accurate**.

In case of the draining method you can never be 100% sure of what is the current volume of the fuel inside the tank (**Fig. 49**) and if the tank is 100% full.

Next, give the table's file a name (**Fig. 48**, **3**) and set the portion volume (**Fig. 48**, **4**).

ATTENTION! Portion volume is not the number of portions! It is the number of liters/gallons each portion will be equal to! In the example below the tank supposedly contains 100 liters and that volume can be divided into 10 portions of 10 liters. If the tank had a total capacity of 300 liters and the idea was to calibrate it in 10 portions, the Portion volume would have been set as 30 liters.

Once finished with all that, press **Continue** (**Fig. 48**, **5**).

Fig. 48 Select method. Table name. Portion volume

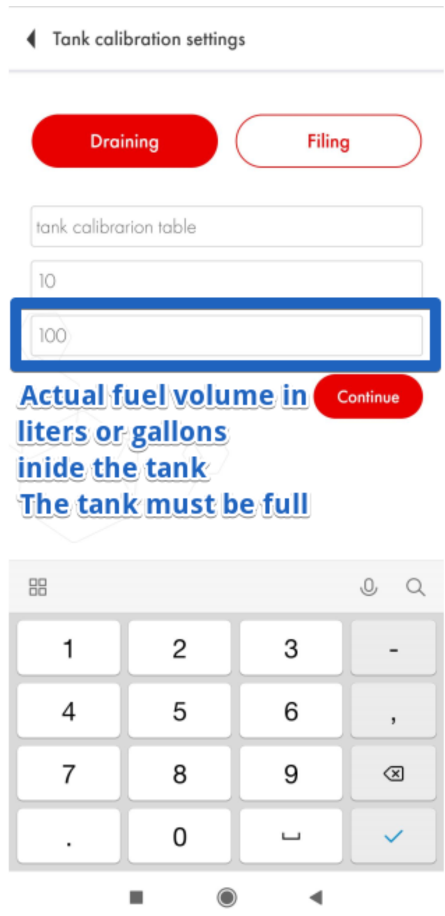


Fig. 49 Draining method. Actual volume of a full tank

Then you will see the table with the first row that reads 0 liters or gallons and level 1 (**Fig. 50**).

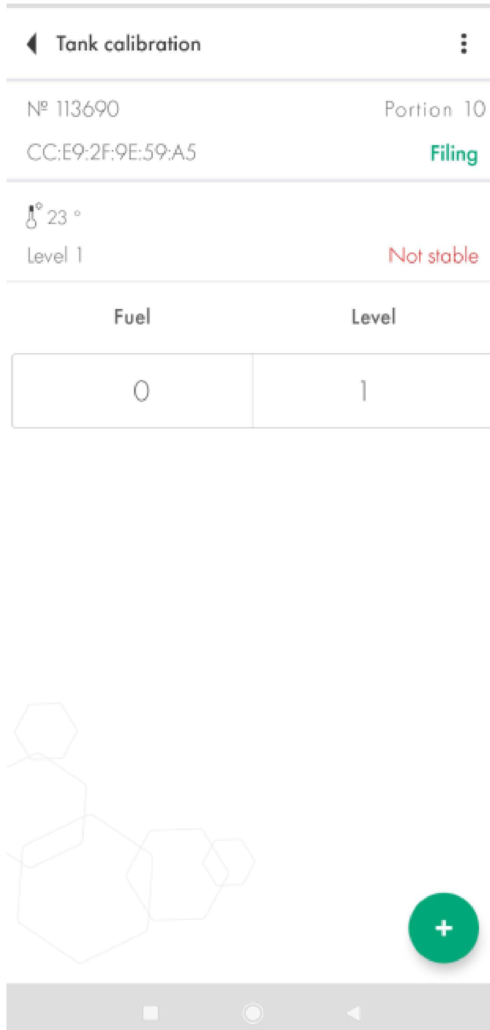


Fig. 50 First row. 0 liters/gallons and level 1

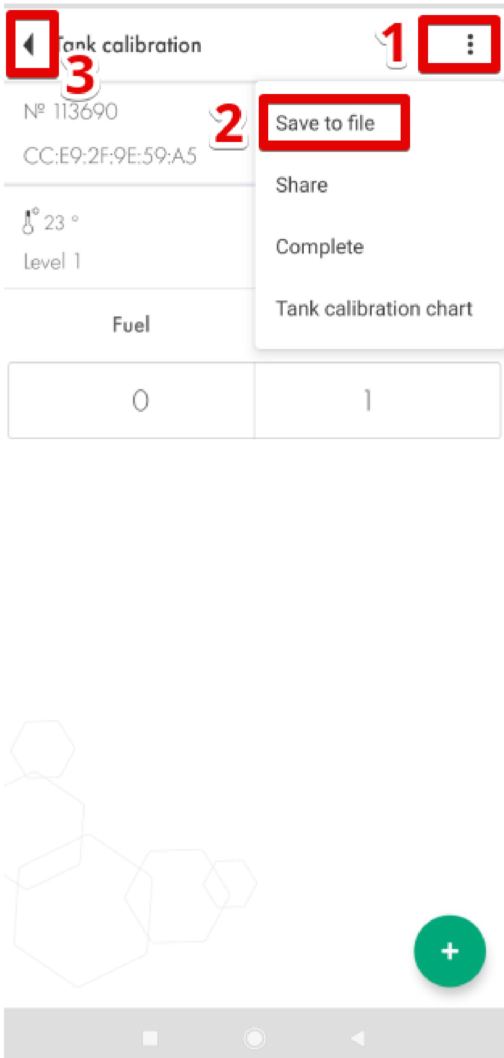


Fig. 51 Save table and leave

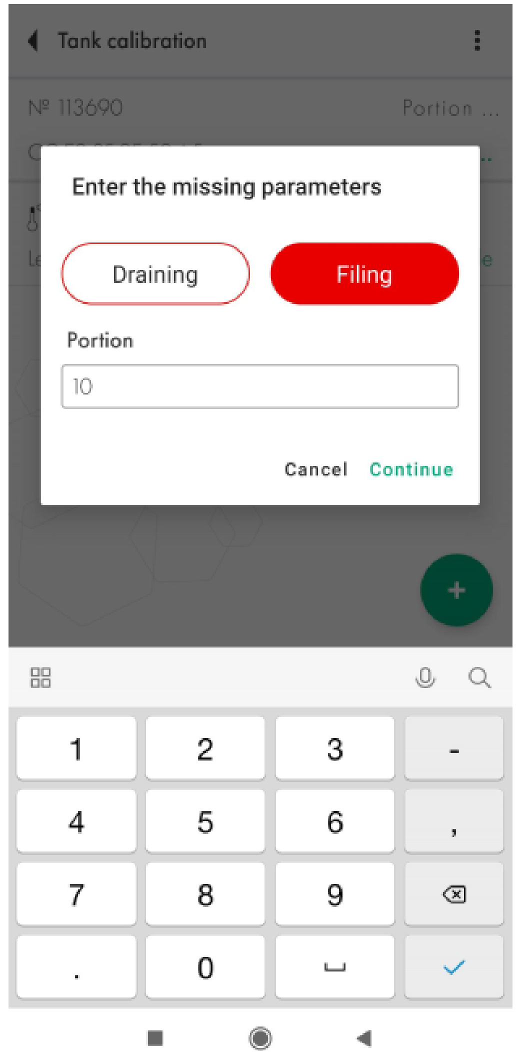


Fig. 52 Resuming tank calibration

In general, the table is saved automatically after you press the ✚ button.

Next, you need to add the first portion of the fuel into the tank (**Fig. 53**). Once the level has changed (**Fig. 54**, 3) and has been reported to be stable (**Fig. 54**, 4), tap on the ✚ button (**Fig. 54**, 1).

In this example the level (**Fig. 54**, 3) doesn't change because we did not have any fuel to do a real tank calibration when working on this manual. In your case, the level must change and its status must be Stable before you press the ✚ button.

The next row will appear (**Fig. 54**, 2). The **value in the Fuel column** will increase by the value you indicated in the **Portion** box when you created the table or changed it (**Fig. 54**, 3) last time.

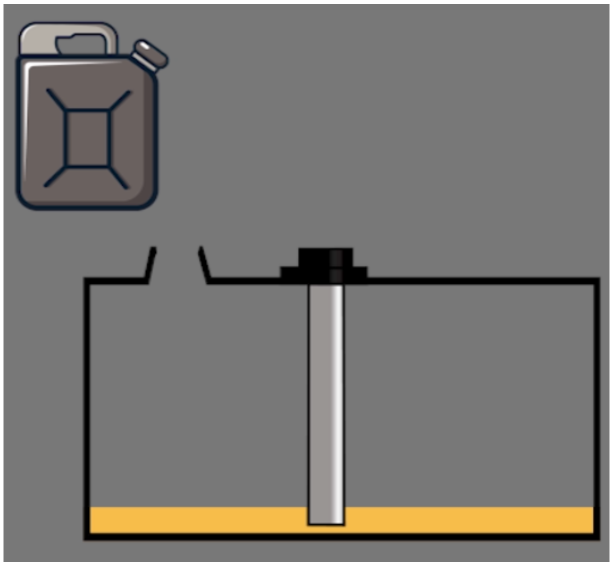


Fig. 53 Add the 1st portion into the tank

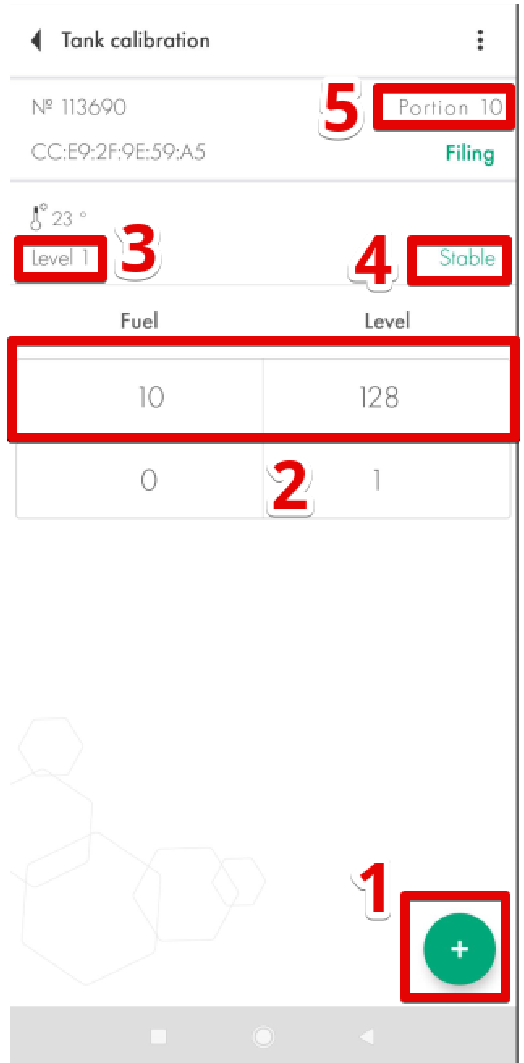


Fig. 54 Press **+** button and the new row will appear

You can also edit any row by pressing and holding it for a few seconds until a new dialogue window appears (**Fig. 55**). This way you can correct any mistakes that could have been made before.

If you press and hold it and then swipe to the left, the row will be deleted (**Fig. 56**).

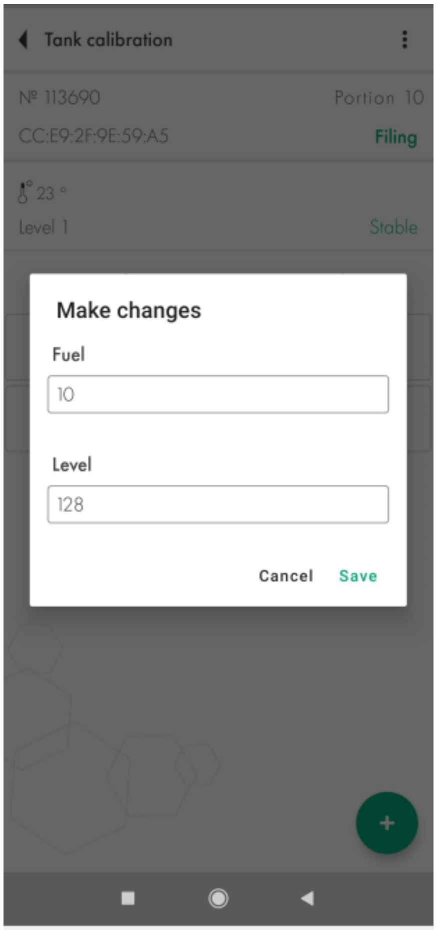


Fig. 55 Edit the row

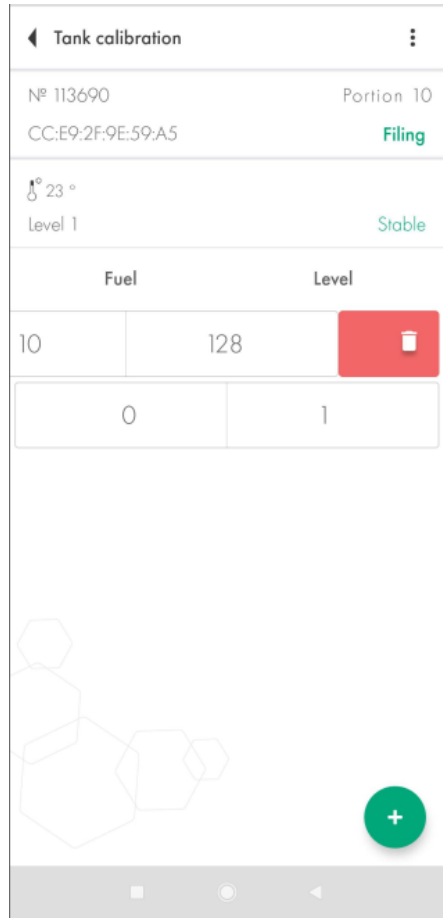


Fig. 56 Delete the row by pressing, holding and swiping to the left

Then you add another portion of the fuel into the tank (**Fig. 57**). Wait for the level to change and become **stable** and then press the + button again (**Fig. 58**). **Continue until the tank is full.**

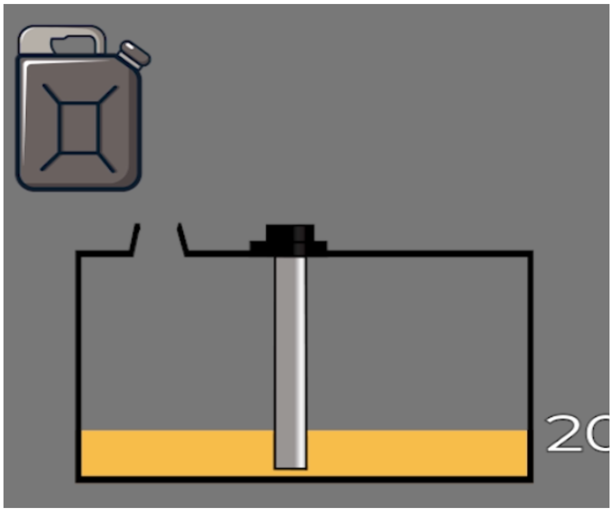


Fig. 57 Add the next portion into the tank

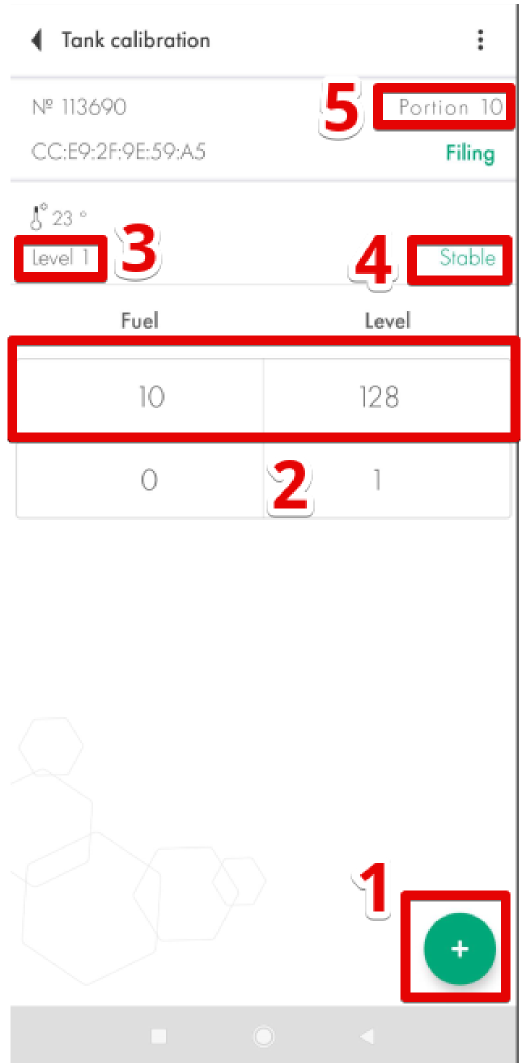


Fig. 58 Press **+** button and the new row will appear

What to do if the tank cannot be emptied completely?

If you cannot empty the tank completely, you need to somehow find out how many liters or gallons are already there in it. After that you can manually edit the table so it looked like the example below. Or simply edit the table file before uploading it onto the platform later.

Let's imagine that there are always 10 liters inside the tank that cannot be removed from there so when you put the sensor in the tank, it instantly shows the level 115 instead of 1.

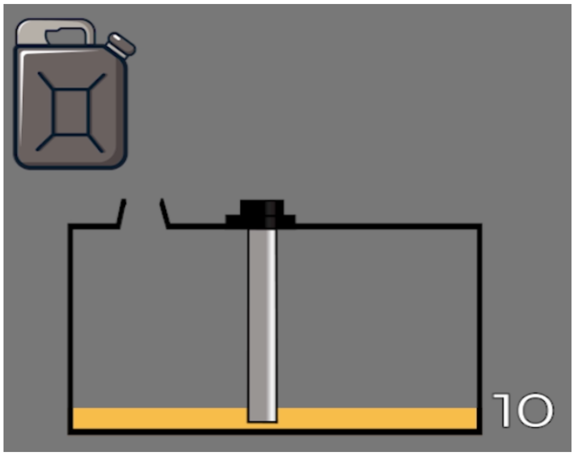


Fig. 59 Ten liters inside the tank that cannot be removed

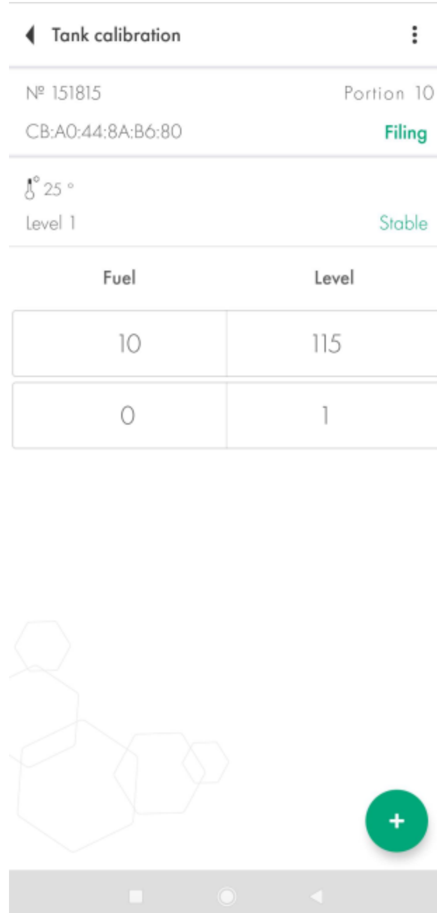


Fig. 60 The table

You add the first portion into the tank. The level must change from 115 to a different value. If the level value doesn't change, check the drainage holes of the sensor. They could be blocked by an insulation tape you left there after the calibration at full and empty or some surplus of the sealer got stuck in them.

If this happens, the air inside the tubes gets trapped and doesn't allow the fuel go up the tubes.

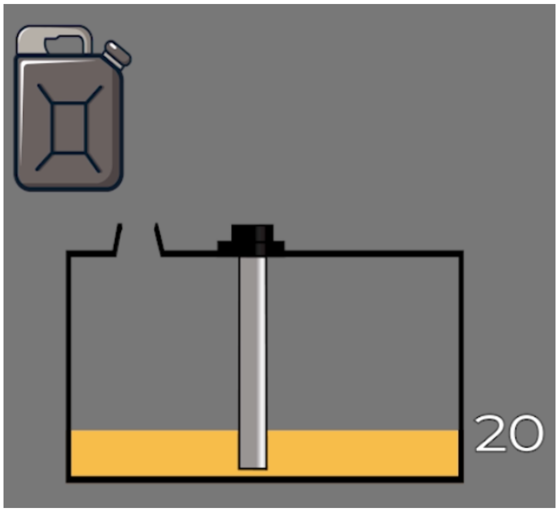


Fig. 61 Second portion is in

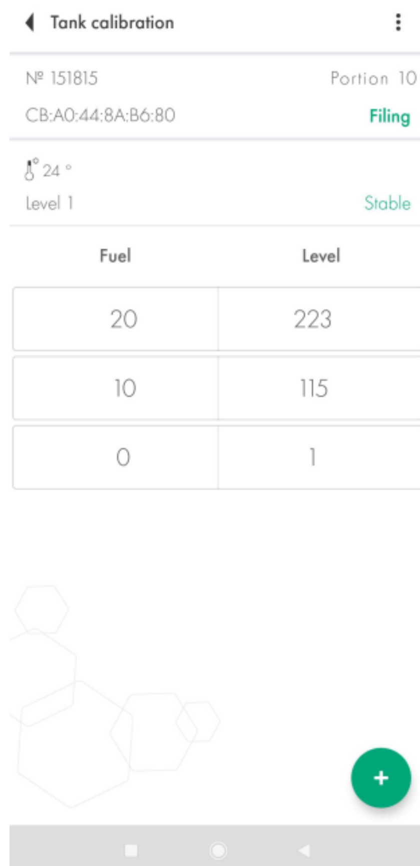


Fig. 62 The table with two portions

You continue like that until the tank is full.

Calibrating tanks with complex shapes

If there are some **curves** or other peculiarities in the tank's shape, be sure to **reduce the volume of portions** when the fuel level rises to that peculiarity of the tank. Once past that shape's peculiarity, switch back to the previous volume of portions.

Let's imagine that you do the tank calibration with portions of 10 liters just like before. The level gets to some peculiarity of the tank's shape.

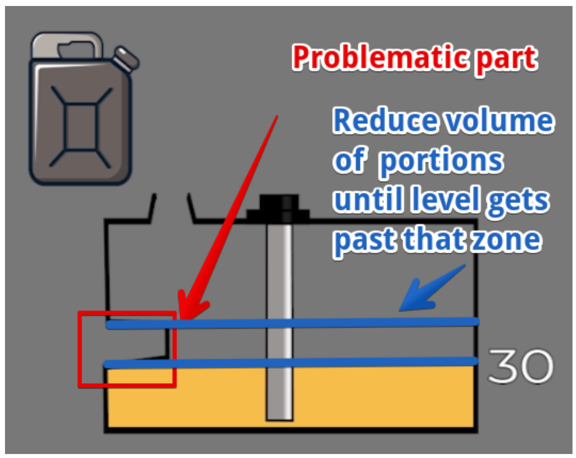


Fig. 63 Reducing portions' volume

You reduce the portions' volume from 10 to 5 liters. And keep adding the portions until the level is above the problematic part.

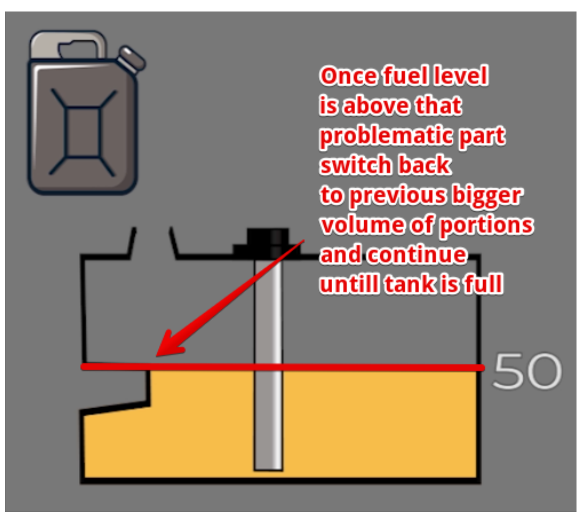


Fig. 64 Switching to previous portions' volume

When the level is above the problematic part, you can switch back to filling the tank with portions of 10 liters.

When the tank is full, you should have a tank calibration table that looks like the following example.

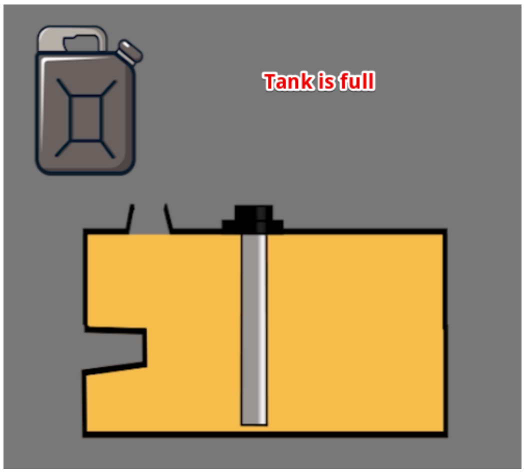


Fig. 65 Tank filled

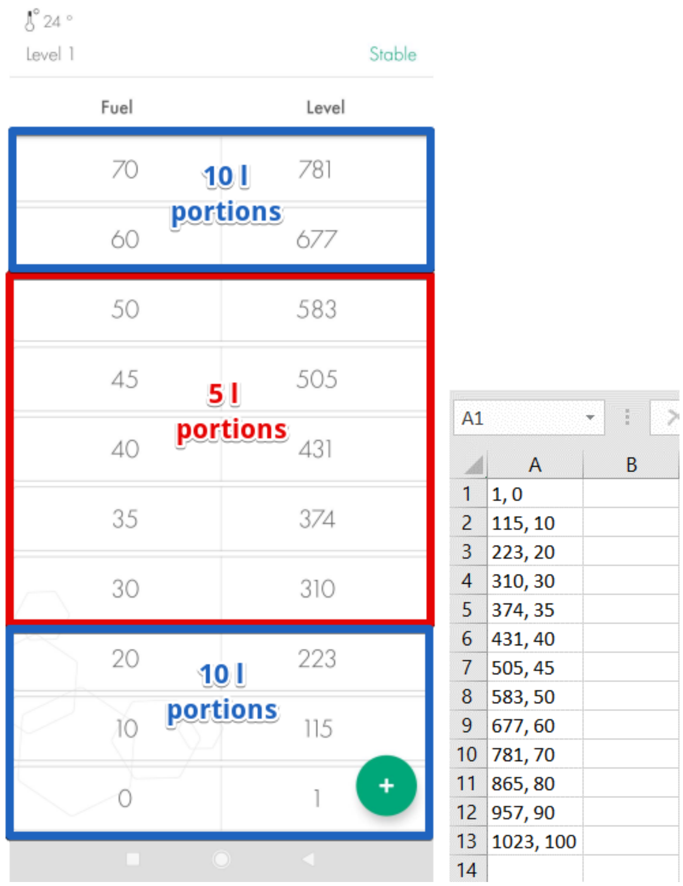


Fig. 66 Tank calibration table in the app and with all rows in a .csv file

What to do if the tank cannot be filled completely?

If in your case the level cannot reach 1023 or 4095 because you cannot fill the tank completely because of how it is shaped, don't worry about that. It is fine if your table ends up looking like the following example although the range from 1 to 1023 was selected.

E9

	A	B
1	1, 0	
2	115, 10	
3	223, 20	
4	310, 30	
5	374, 35	
6	431, 40	
7	505, 45	
8	583, 50	
9	677, 60	
10	781, 70	
11	865, 80	
12	957, 90	
13	989, 100	
14		

Fig. 67 Tank calibration table in a .csv file

How many portions to add?

The total number of the portions depends on the tank's total capacity. See the table with our recommendations below.

Table 1

Recommended number and volume of portions for tank calibration

Tank´s capacity in liters	Number of portions	Volume of each portion in liters (Tank´s capacity/Number of portions)
0-60	10-20	3-6
61-100	12-20	5
101-500	10-50	10
501-1000	20-50	20
More than 1000	In accordance with your capabilities. General rule: smaller volume of each portion and bigger number of portions = more precise data	

The general rule is: **the more portions – the more precise will be the data in the reports on the platform**.

Tank calibration in Analog/Frequency mode

When creating the tank calibration table for the sensor that is to be connected to a GPS tracker/other device via its analog (green wire) or frequency (orange wire) output, you need to connect the corresponding wire to the AIN or frequency input of the tracker and then to **create a tank calibration table based on the voltage/frequency readings displayed in the tracker's configurator**.

The AIN and frequency inputs of the tracker have a native resistance that will affect the final voltage or frequency readings transmitted by the tracker to your monitoring platform. To offset that, you need to take the values displayed in the tracker's telemetry. If it is impossible, better use the values in the messages on your platform. Otherwise it is possible that the precision of the data in your reports won't be as high as it should.

Filtration

After the tank calibration is over, select the level of Filtration (**Fig. 68**) in the **Settings** menu (**Fig 69**, **1**) and tap **Set parameters** (or Write parameters to device).

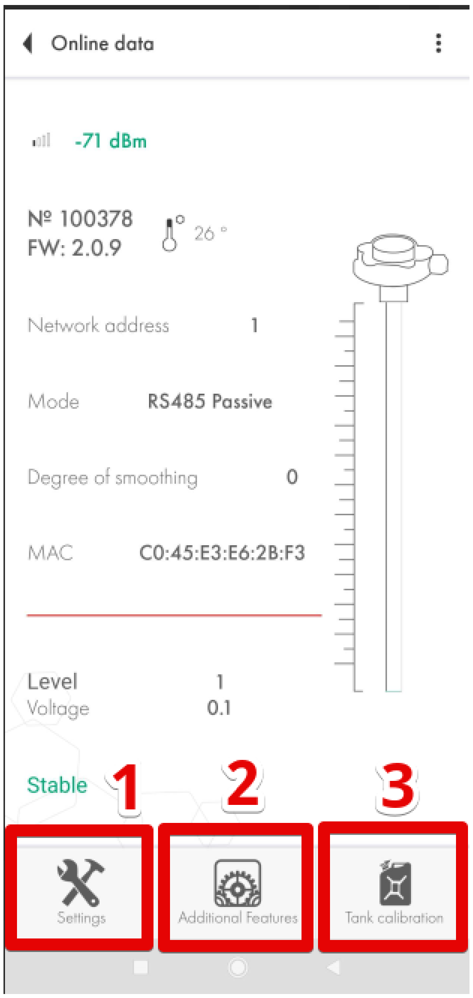


Fig. 68 Settings (**1**)

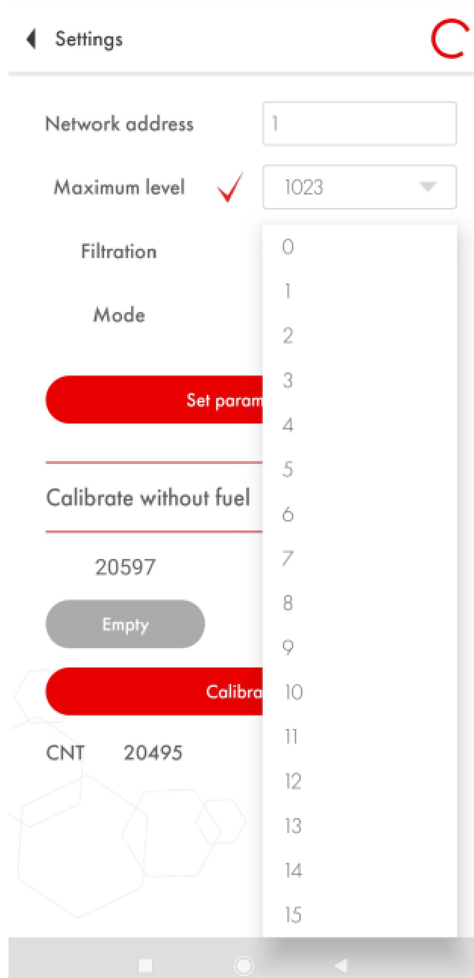


Fig. 69 Select Filtration and press Set parameters (Write parameters to device)

The following are our recommendations on what level of Filtration to choose for a particular type of vehicle:

Table 2

Filtration recommendations for wired FLS:

0-1	Stationary storage units and tanks
2-6	Trucks driving on good quality asphalt roads
7-12	Agricultural machinery (tractors, harvesters, etc.)
13-15	Heavy machinery units operating at querries, mines, open cuts and strips.

These are some general recommendations.

The general rules are:

- The shorter the sensor (<30cm) the higher must be the filtration level
- The closer the sensor is to one of the tank’s walls, the higher must be the filtration level
- The rougher is the terrain, the higher must be the filtration

The filtration reduces the magnitude of level fluctuations that happen because of the fuel’s sloshing during trips.

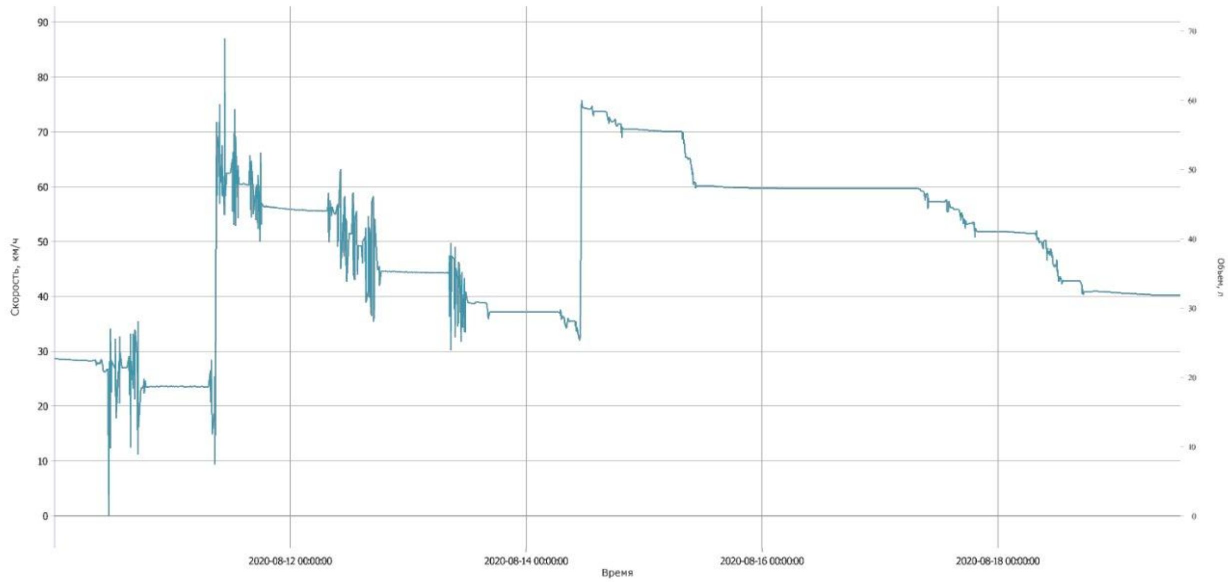


Fig. 70 Before and after switching the filtration on

Additional Features

In the Additional Features menu, you can set, change or delete the password (**Fig. 71**, **1**). To do so, enter the previously set password and press Enter. Then type down a new password and press Install.

ATTENTION! Do not change the position of the Disable Thermal Compensation tumbler (it must be gray) unless you have some other algorithm applied by the GPS tracker or other device the sensor is connected to or by the platform (Fig. 71, 2).

Do not activate the **Data encryption** option (**Fig. 71**, **3**) unless you are using a BLE-RS485 adapter/base or you have a confirmation given by the tracker's manufacturer that the tracker supports data encryption of Escort BLE sensors.

Setting Full and Empty calibration values manually

You can skip the sensor calibration by entering the calibration value of an equally long sensor manually (**Fig. 71**, **4**) and pressing the **Install** button (**Fig. 71**, **5**).

ATTENTION!!! Setting calibration values manually will likely increase the margin of error of the sensor! We do not recommend using this option!

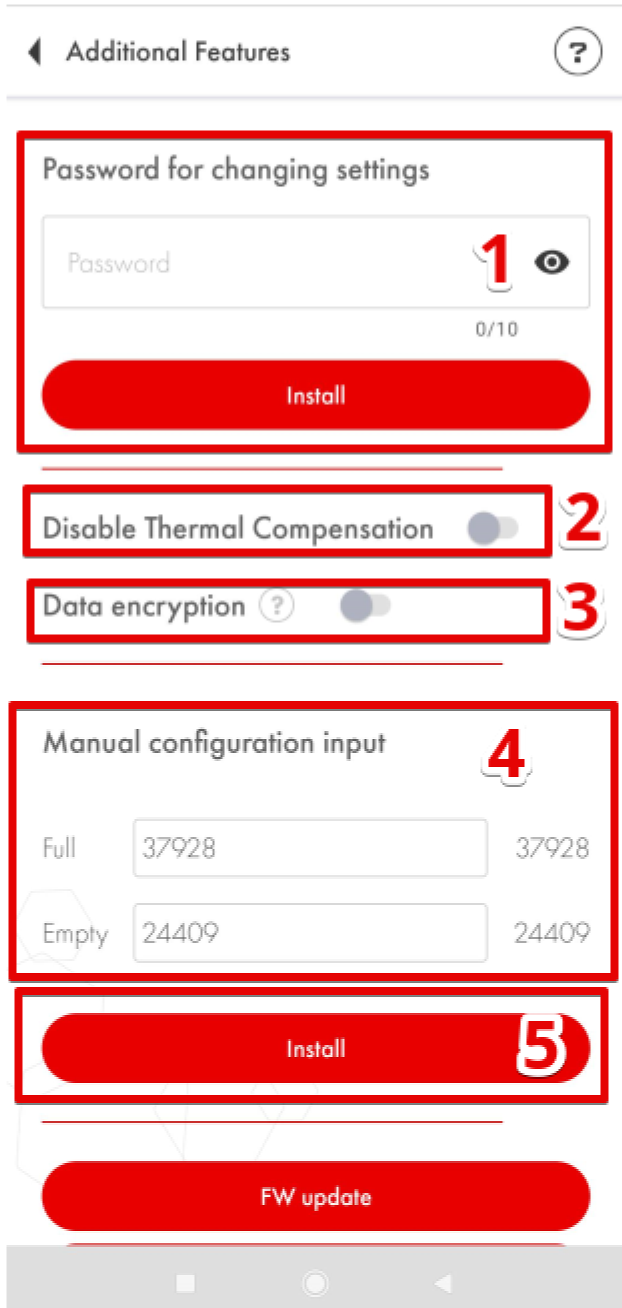


Fig. 71 Additional Features

Sensor diagnostics

If the sensor cannot be connected to a smartphone while some other sensor can, you need to check its power consumption and voltage readings measured on the line A and line B of the device's RS-485 port.

To check the power consumption of the sensor, select the **A ⎓** option on your multimeter/multitester. One of the probes of the multimeter must be connected to the **COM socket** and the other – to the **mA socket**.

Then the sensor's black wire must be connected to the GND of the power supply. One probe of the multimeter has to be connected to the red wire of the sensor and the other one to the PWR wire of the power supply.

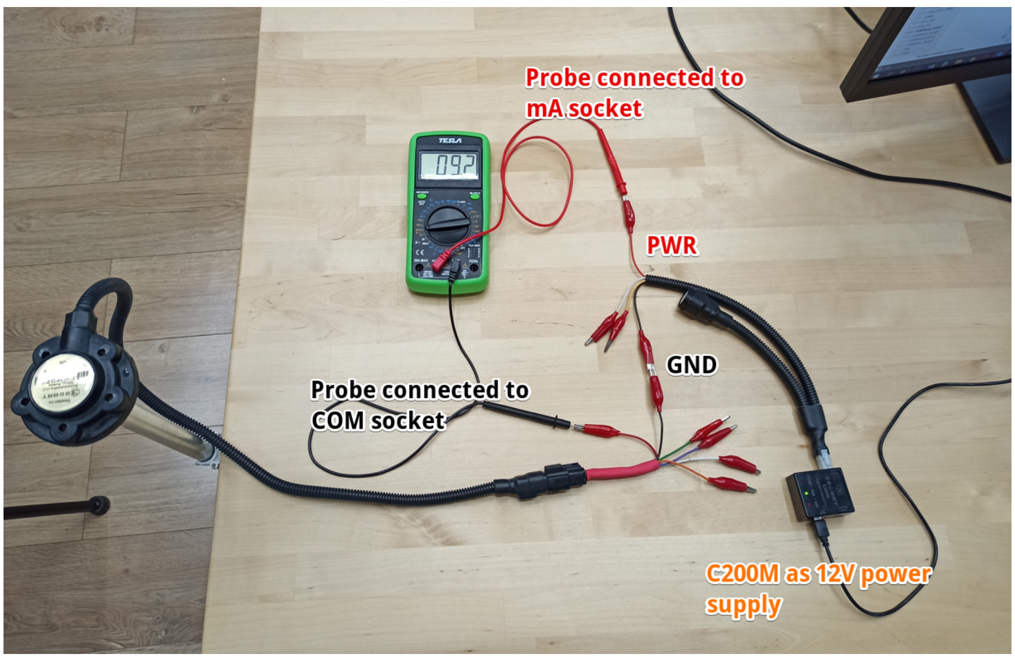


Fig. 72 Power consumption (amperage) check

Compare the reading you get with the normal values indicated in the table below. Take a photo or record a short video of the check.

To check if the line A and line B of the sensor are intact, connect one of the multimeter's probe (the one plugged into the multimeter's **COM** socket) between the black wire of the sensor and the GNR of the power supply. The other probe (the one plugged into the multimeter's V ⎓ socket) must be connected first to the line A (orange wire of the sensor) and then to the line B (white wire of the sensor). Power the sensor up.

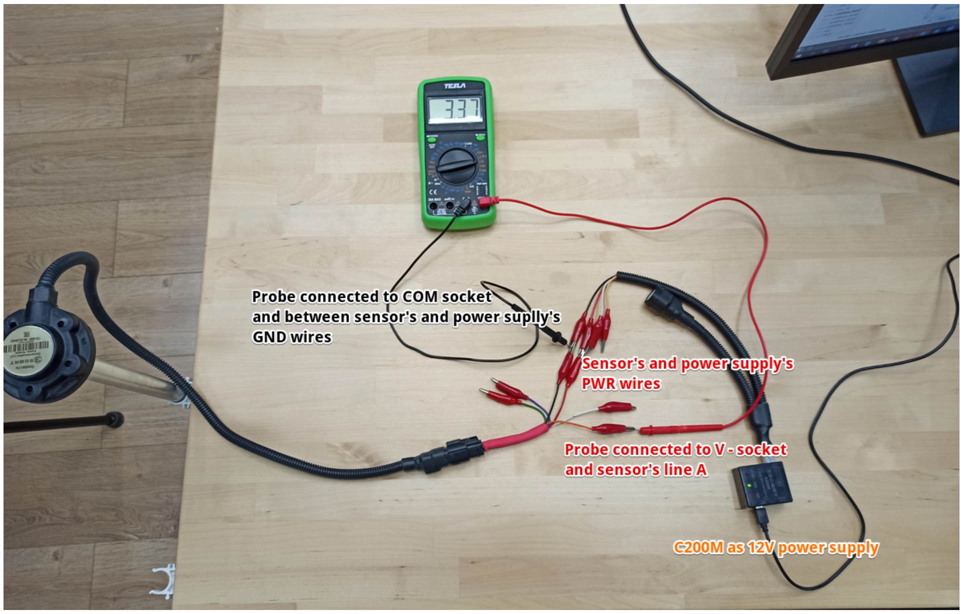


Fig. 73 Line A voltage check (relative to GND)

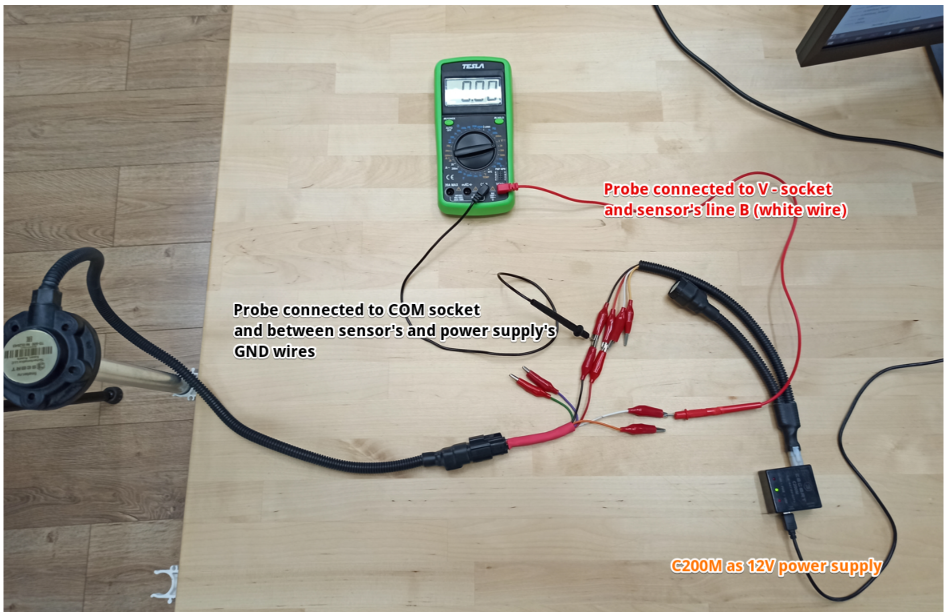


Fig. 74 Line B voltage check (relative to GND)

Compare the readings you get on both A and B lines with the normal values indicated in the table below.

Table 3

	Power Consumption	Line A Voltage	Line B Voltage
TD-150 BLE	≈20 mA	1-2 V	3.5-4 V

Common issues and how to resolve them

The level reading doesn't change

One of the possible reasons is that the sensor is not properly calibrated and its CNT is below the Empty calibration value. In such a case, recalibrate the sensor.

Also, if you calibrated the sensor with fuel, it is possible that the drainage hole of the sensor was left covered and the air trapped inside the tubes doesn't allow the fuel to go up the tubes.

Level 7000

Level 7000 is an error code for a short circuit. It means that there is some dirt, water, metal shaving or admixtures inside the sensor's tubes. All these can be highly conductive and the sensor is designed to work in an environment with low conductivity (such as fuel).

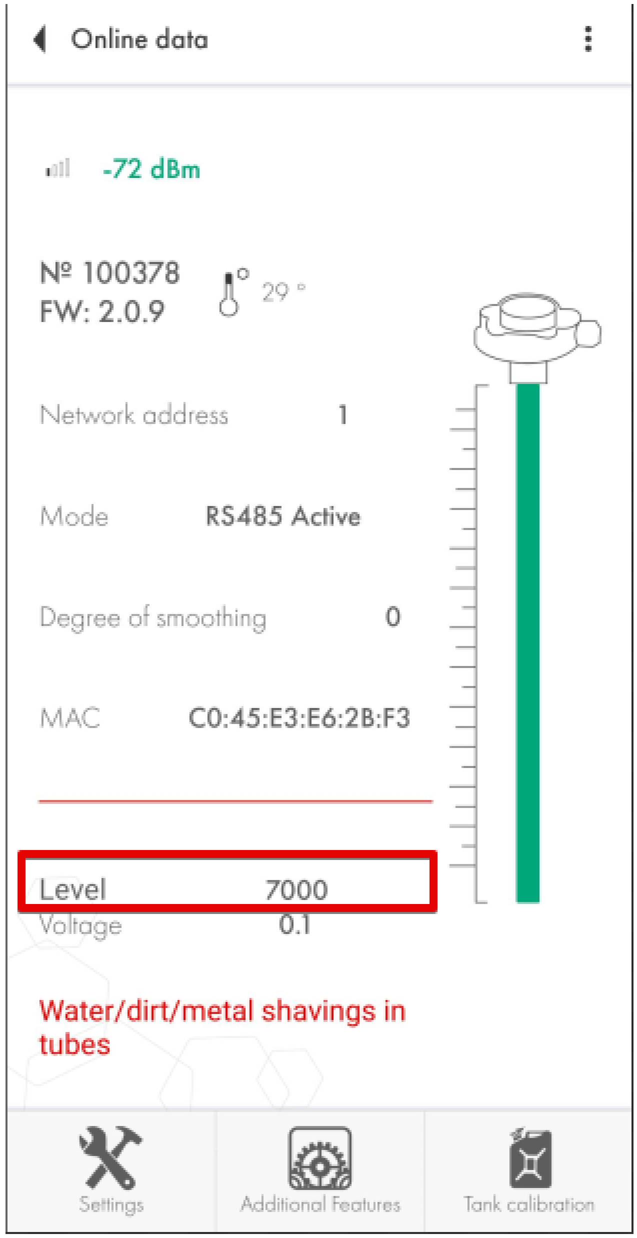


Fig. 72 Level 700

You need to clean the tubes of the sensor - preferably with compressed air blowing the sensor's tubes via the drainage hole. Clean the tank and replace the fuel if necessary.

Level 6500

This code stands for disconnection of the tubes. It could also occur after you cut the tubes so, first of all, try and recalibrate the sensor.

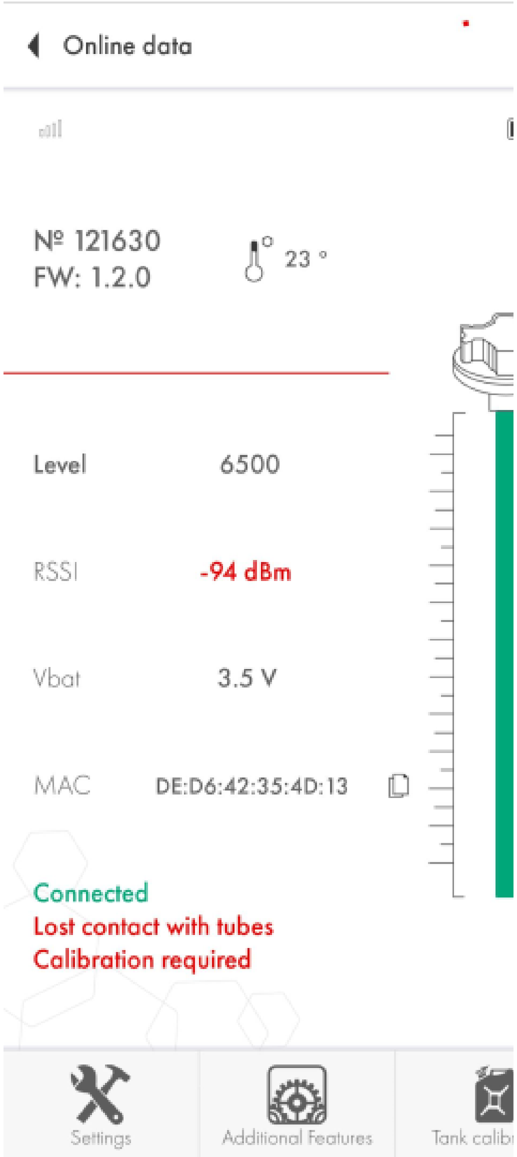


Fig. 73 Level 6500

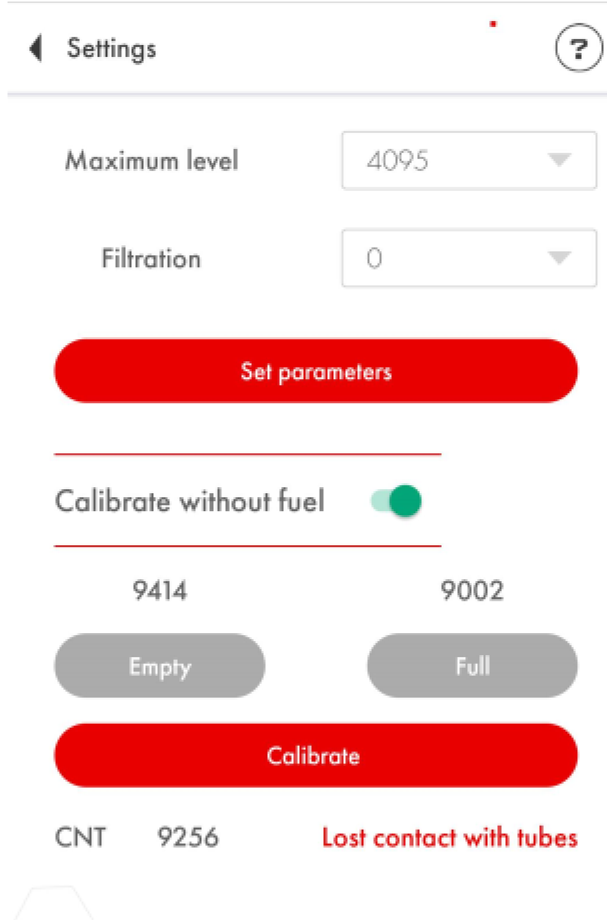


Fig. 74 CNT below 10 000

If it doesn't help, check the CNT. If it is below 10 000, then most likely the tubes are disconnected from the sensor's head indeed.

Take the picture of the sensor's head (the serial number must be clearly visible), its tubes (it must be clearly visible if there is any misalignment of the tubes) and the screenshot of the main screen of the sensor and of the Settings menu and send all those to us.

The sensor is not connecting or cannot be detected by the app

First of all, make sure that the sensor is not connected to any other smartphone. It can be connected to one smartphone at a time only.

Then make sure that you have the geolocation activated on your smartphone and the app has the access to it.

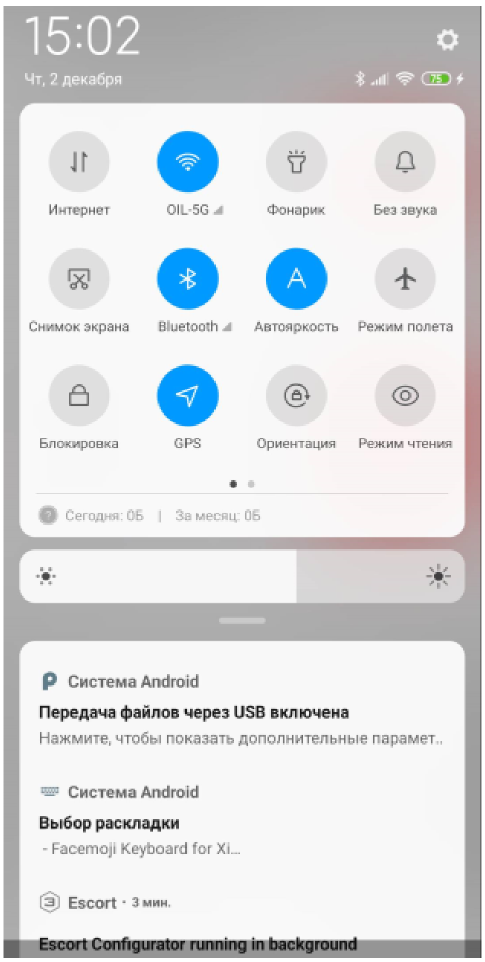


Fig. 75 GPS (geolocation) and Bluetooth activated

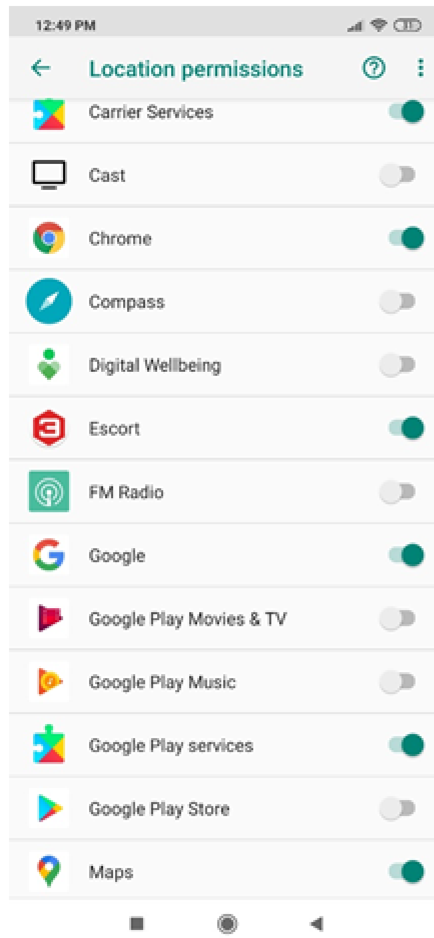


Fig. 76 Geolocation permissions

Check if the sensor can be detected in the nRF Connect app.

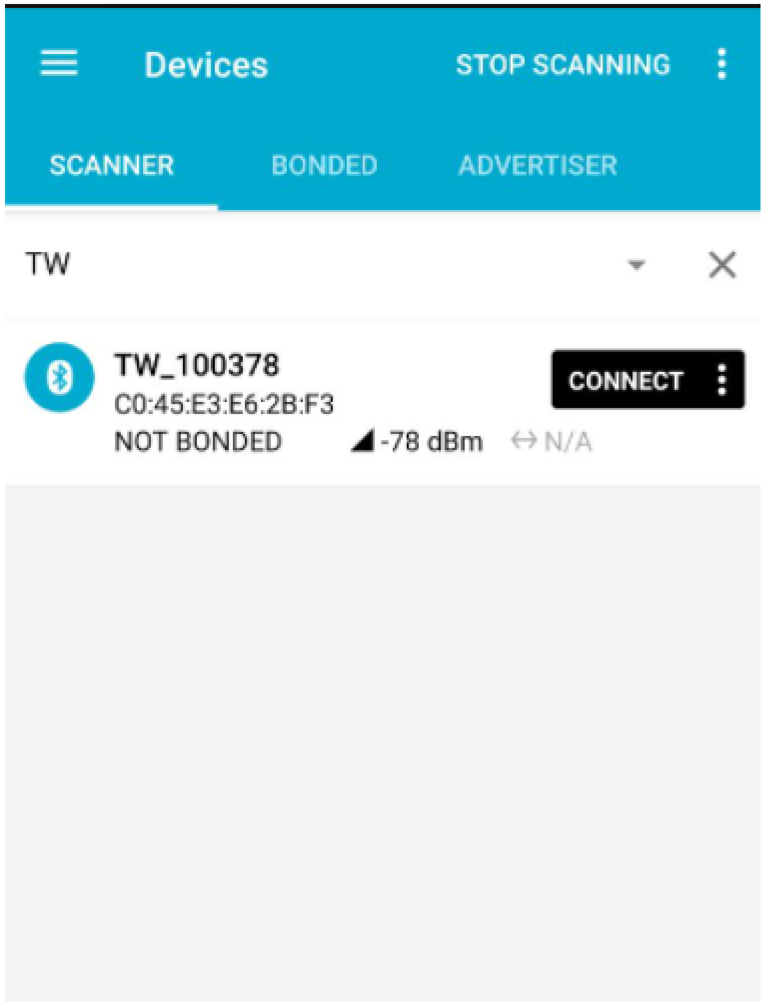


Fig. 77 nRF Connect app. Be sure to tap on the Scan button (top, right corner)

If it is detected but you cannot connect it by means of Escort Configurator app, check if any other sensor can be connected to the same smartphone.

If one sensor in particular doesn't appear on the list in the app, check if it is properly connected to a power supply. If it is, check the voltage and consumption of the sensor as indicated in the **Sensor diagnostics** paragraph of this Manual.

No data from sensor in the tracker's telemetry

If, for some reason, the sensor's data is not transmitted onto the tracker properly after you have properly configured everything, you need to check if there's any data exchange between the devices.

To do that, connect the sensor to the tracker via Rs485. Power both devices up.

Then take a Rs485-USB converter and connect it between the sensor and the tracker. Line A and line B of the converter must be connected with the line A and line B of the tracker and the sensor respectively

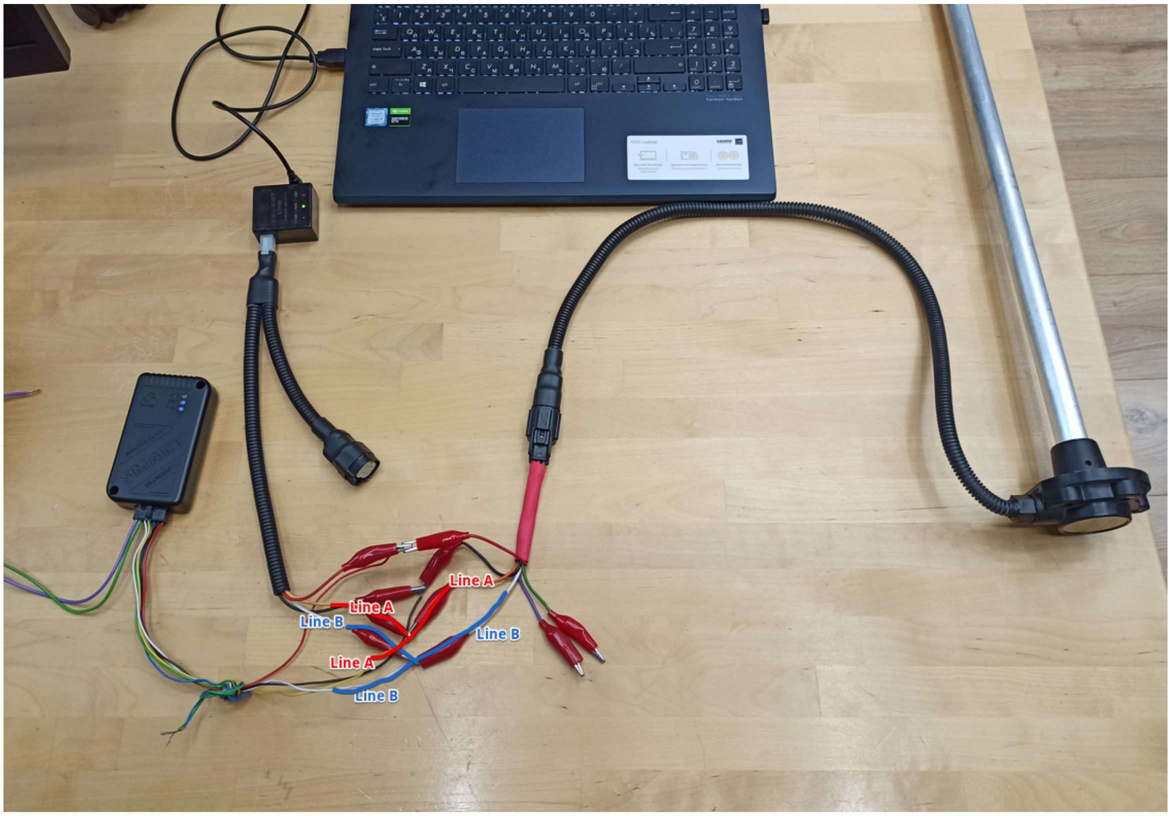


Fig. 78 Rs485 log recording wiring

Run the Terminal.exe program and configure the COM port as follows:

Baud rate – 19200, Parity – None, Stop-bits – 1, Handshaking – None.

Also check the HEX or ASCII box depending on what format the sensor's output will be transmitted in.

Once the converter is properly connected, select the COM port and click 'Connect'.

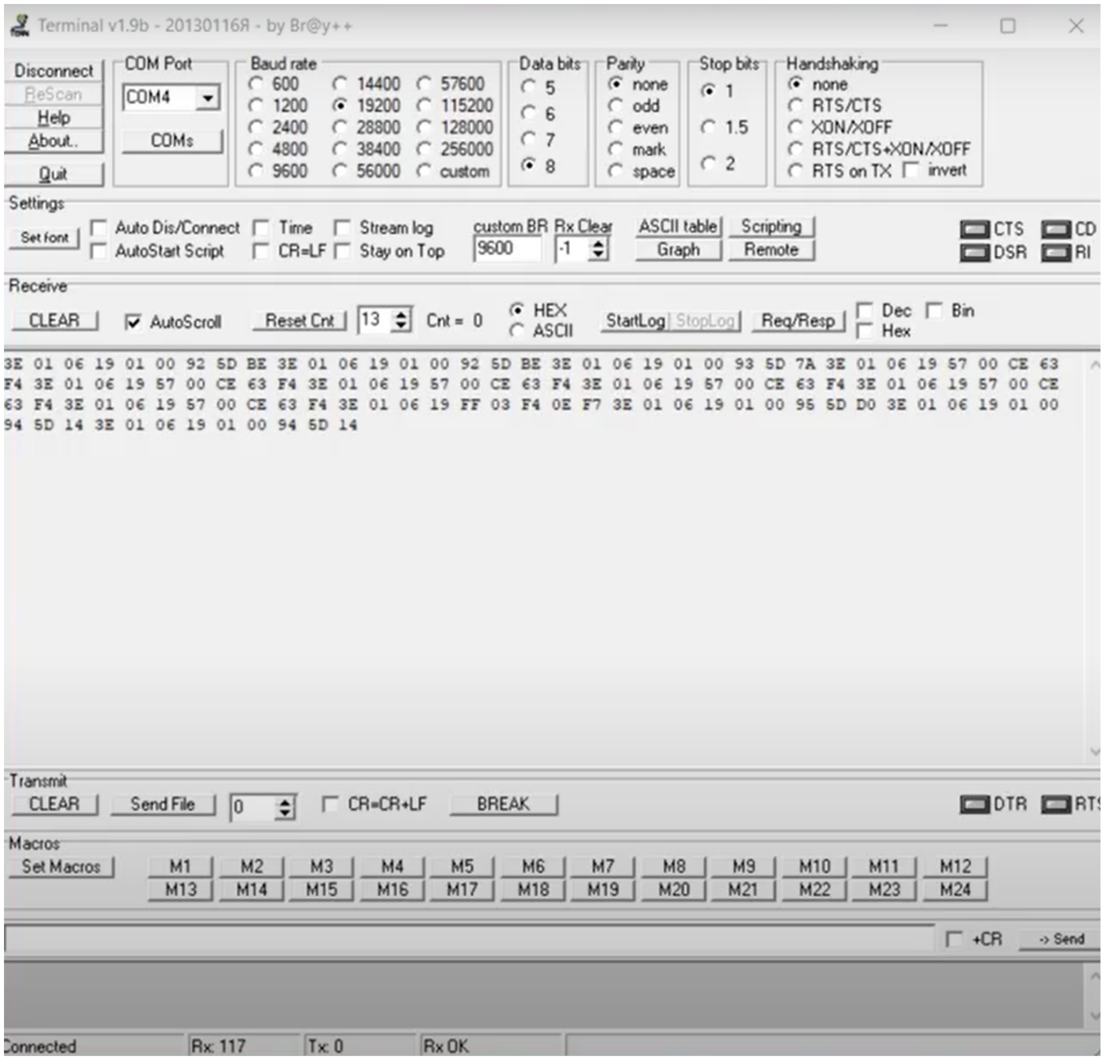


Fig. 79 Sensor responding to tracker via Rs485

If the tracker polls the sensor and the sensor responds, then everything is fine.

If there is no communication between the two devices, try to poll the sensor manually.

To do so, enter the request **31$01$06$6C** if the sensor's network address is 1 and click '**Send**'.

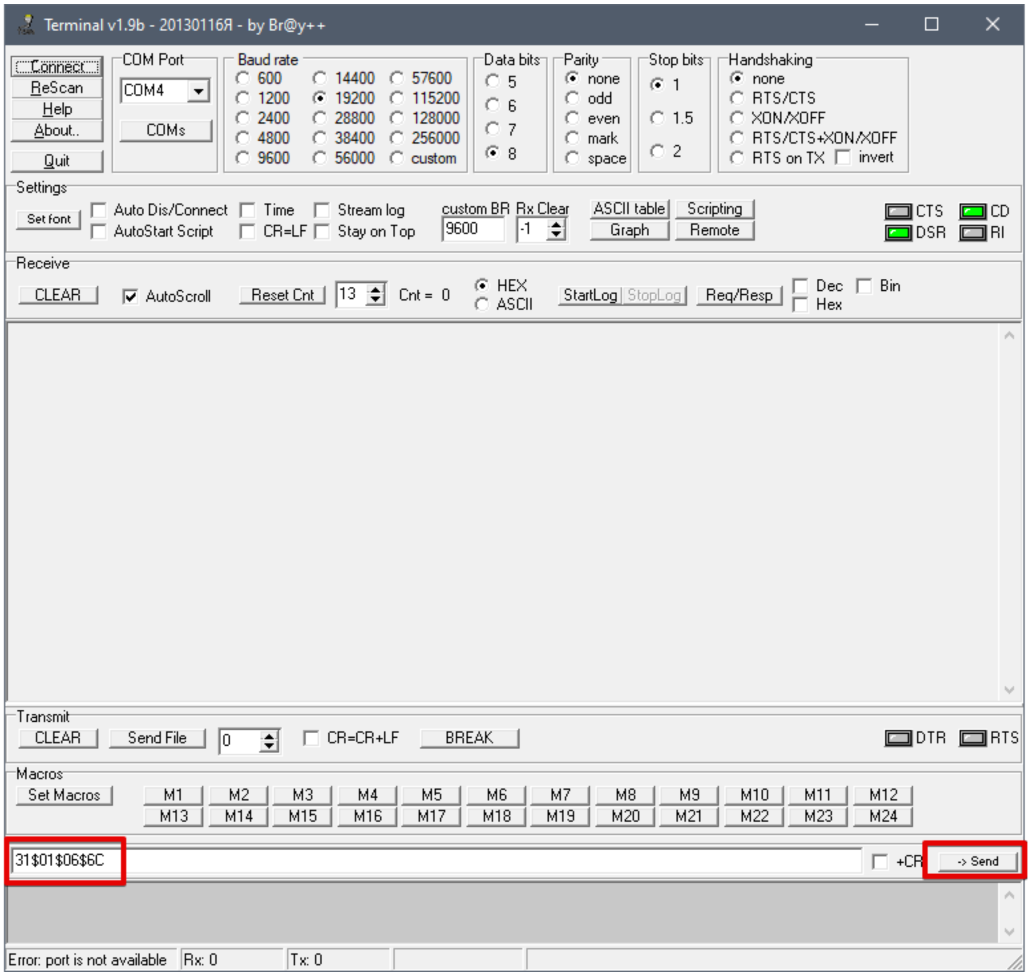


Fig. 80 Sending requests to sensor

The request's structure depends on the address of the sensor. If you change the address of the sensor to 255 for example, then the request will look like this:

31FF06$29

- where FF stands for 255 converted from DEC into HEX
- and 29 stands for the CRC calculated for this request in particular

To calculate the CRC, you can open the https://crccalc.com/ website and then enter the request without **$** signs, select HEX, click CRC-8/MAXIM and click Calc CRC-8.

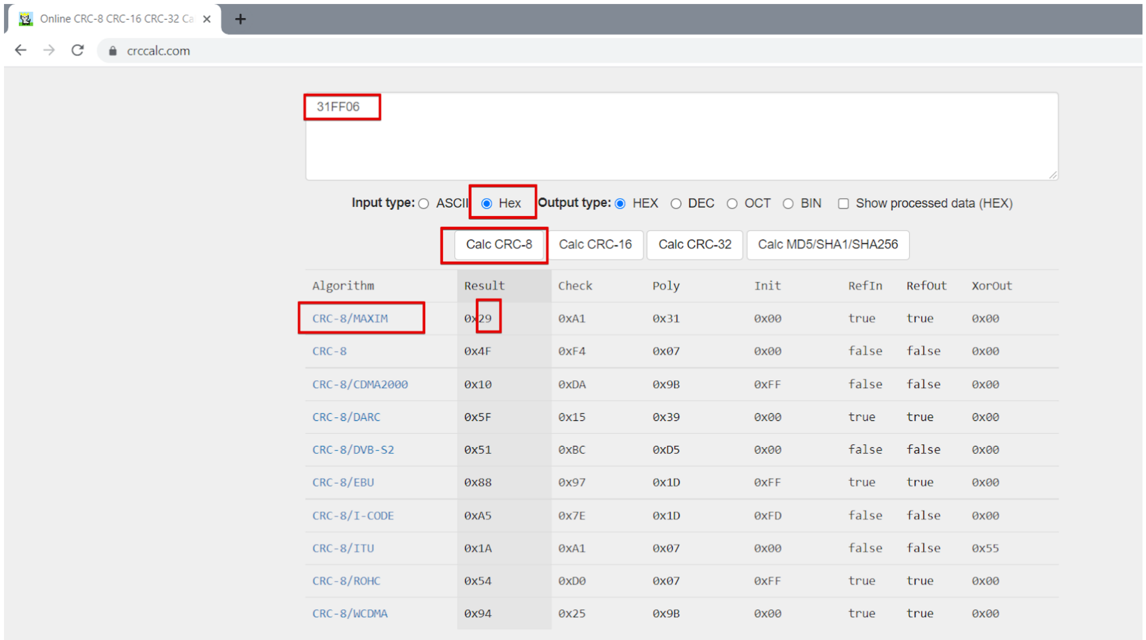


Fig. 81 CRC calculated for 255 network address

If the sensor doesn’t respond to the tracker but does respond to a request you send to it manually then you need to check the Rs485 port of the tracker.

If the sensor doesn’t respond at all, you need to run some basic diagnostics on it.

Sensor's FW Update

To update the FW of the sensor, open the **Additional Features** menu (**Fig. 82, 2**). Then tap on the FW update button (**Fig. 83**).

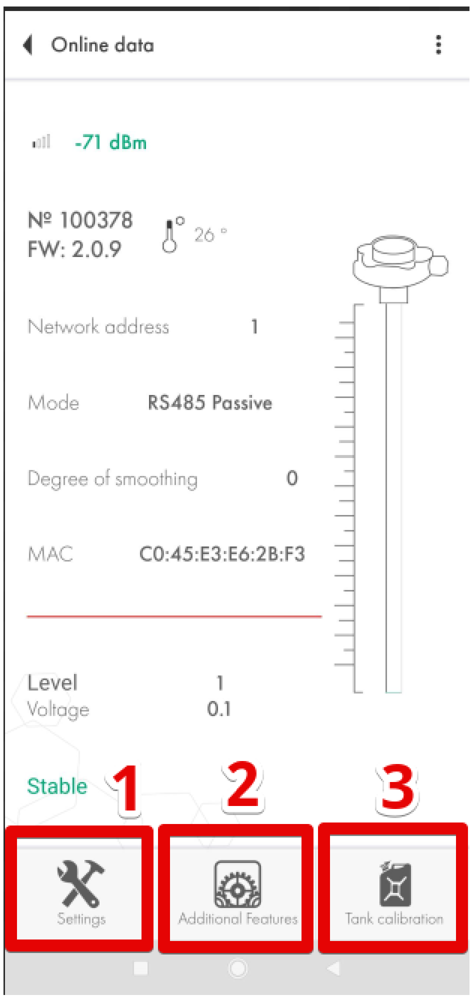


Fig. 82 Additional Features

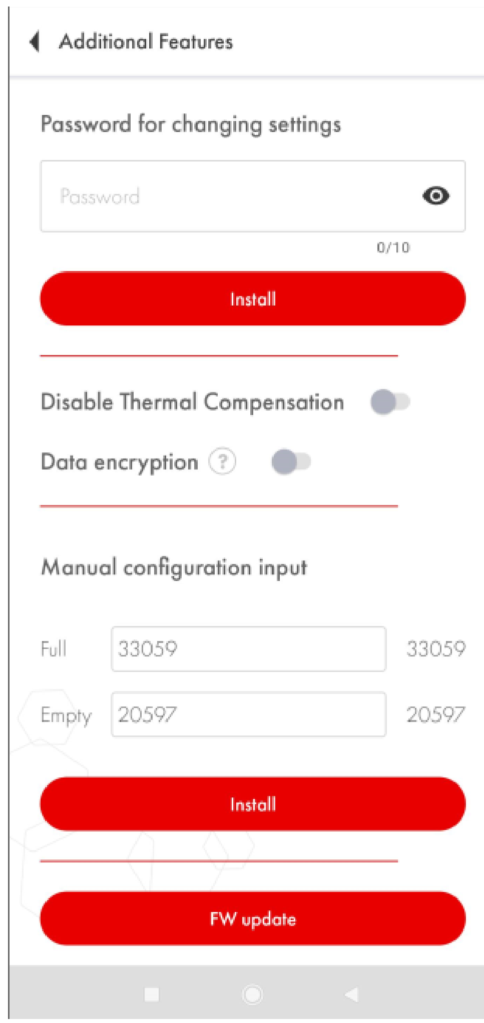
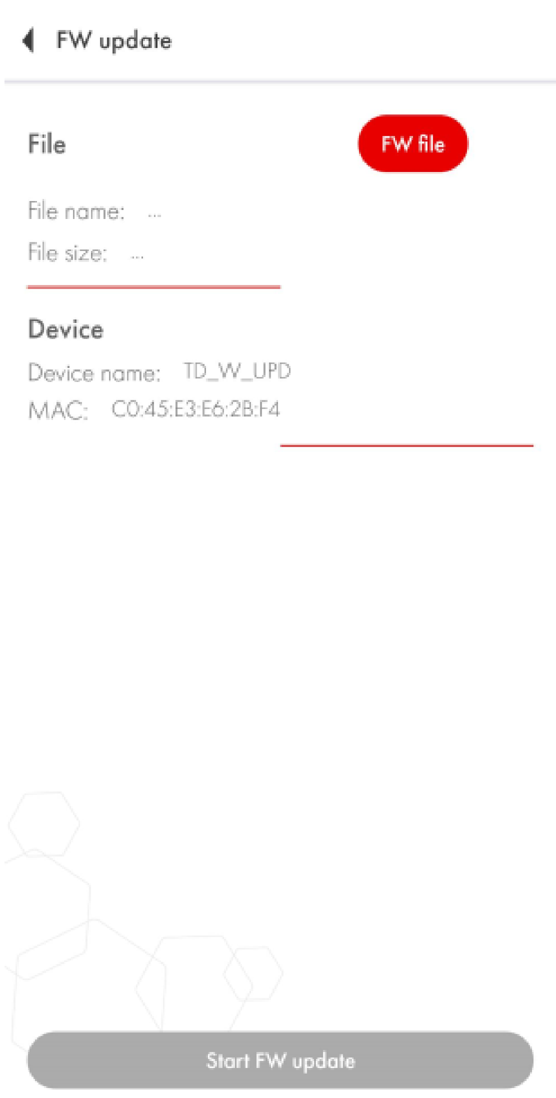


Fig. 83 FW Update

Next, press the **FW file** button (**Fig. 84**) and select the FW file (**Fig. 85**) on your smartphone (it must be downloaded onto your device beforehand).



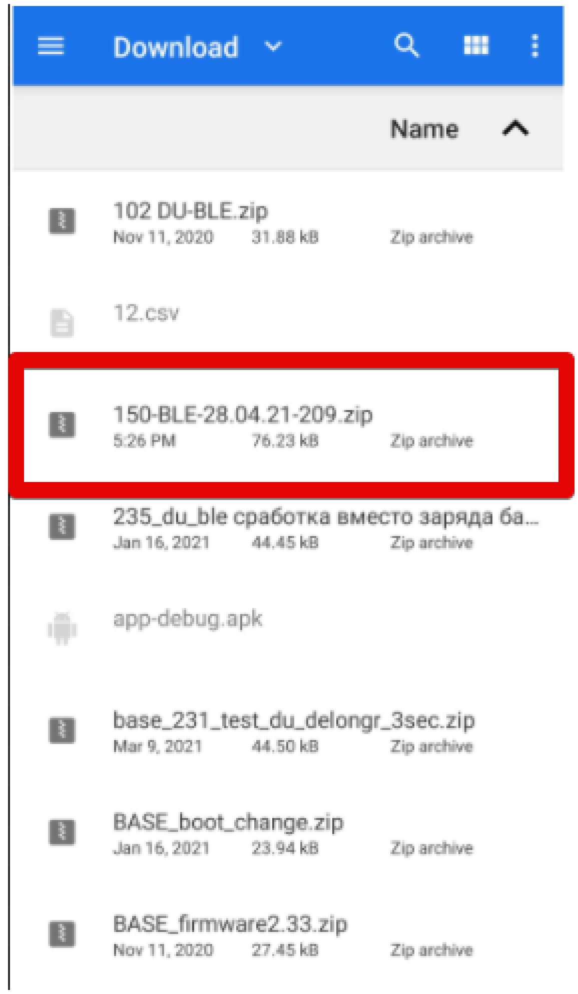


Fig. 84 Additional Features **Fig. 85** FW Update

Then press the **Start FW update** and wait for the progress bar to hit 100%. Then reconnect the sensor.

Sealing the sensor

To seal the sensor and prevent anyone from taking it out of the tank without you or your customer being aware of that, put the sensor's protecting cap over its head and then drive the plastic dowel (**Fig. 86, 1**) through the sealing orifice (**Fig. 86, 2**).

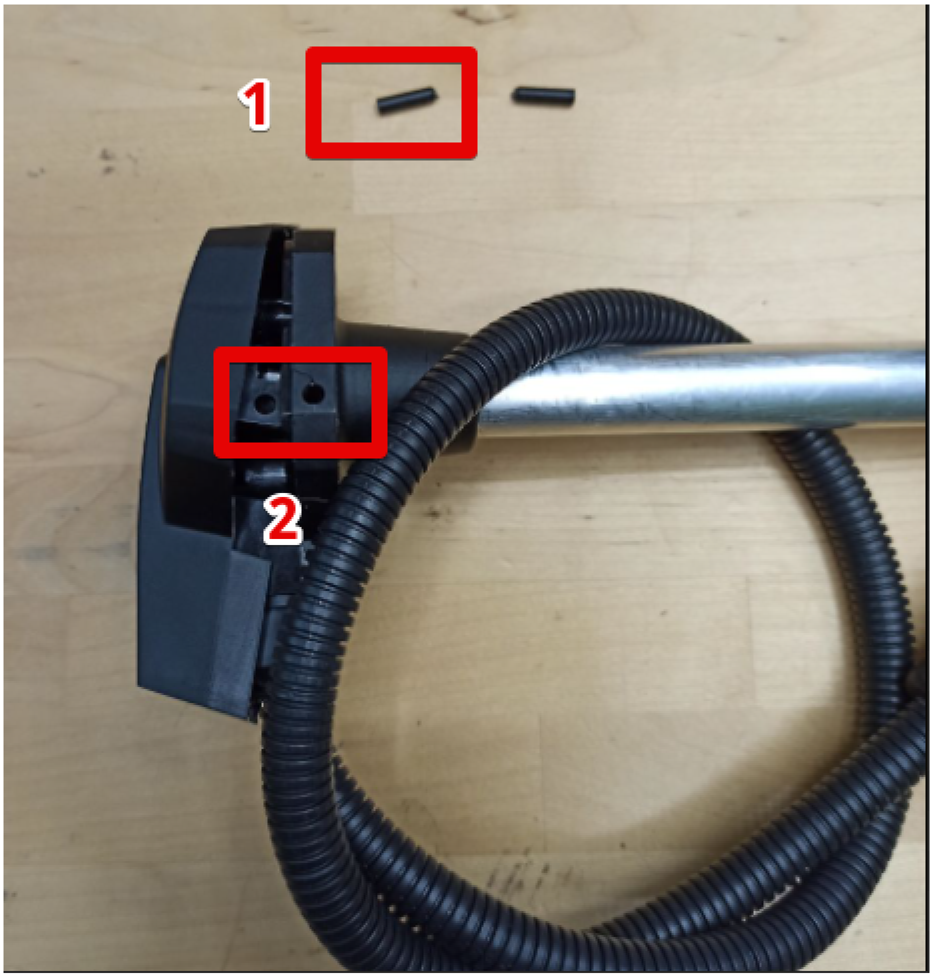


Fig. 86 Putting the protection case and aligning sealing orifices

Fig. 87 Push the dowel into the orifice

To seal the connection of the extension cable, drive the plastic seal through the special orifices and fasten the seal.

Sealing
sensor and extension cable

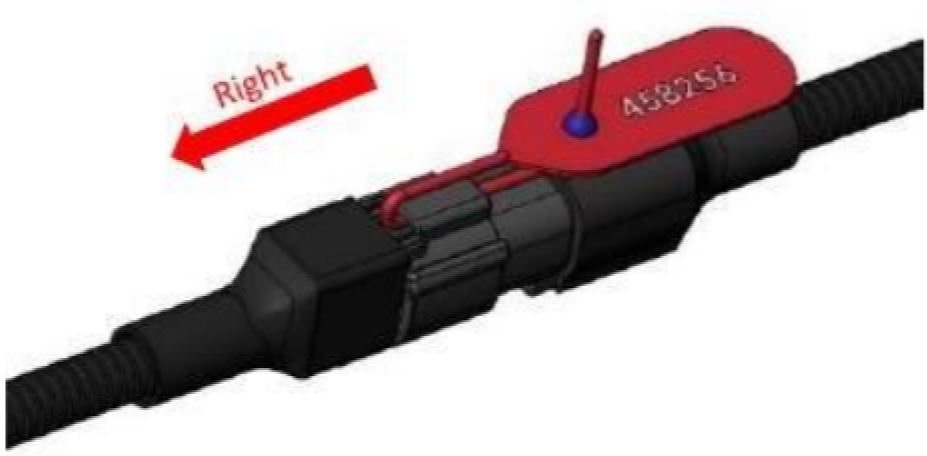
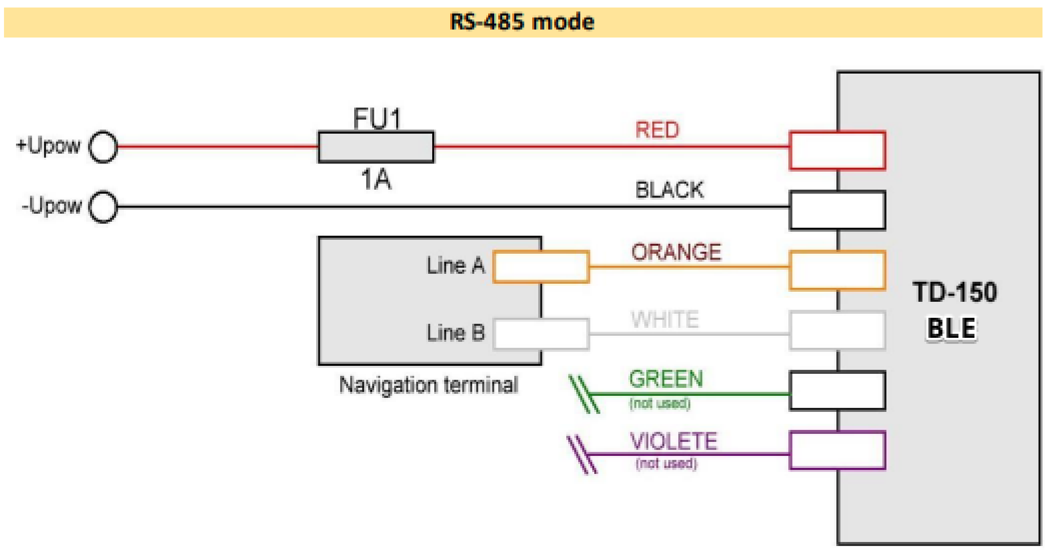
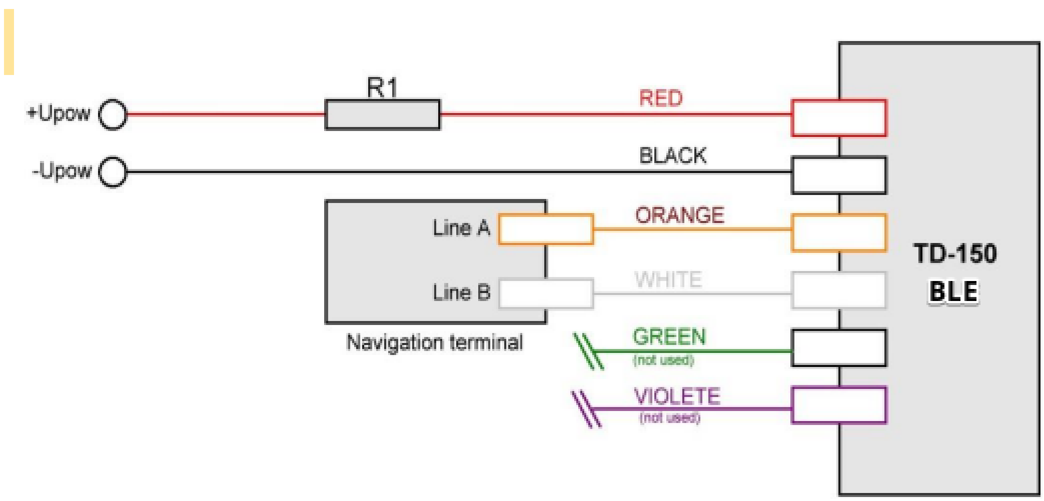


Fig. 88 Sealing cable connection point

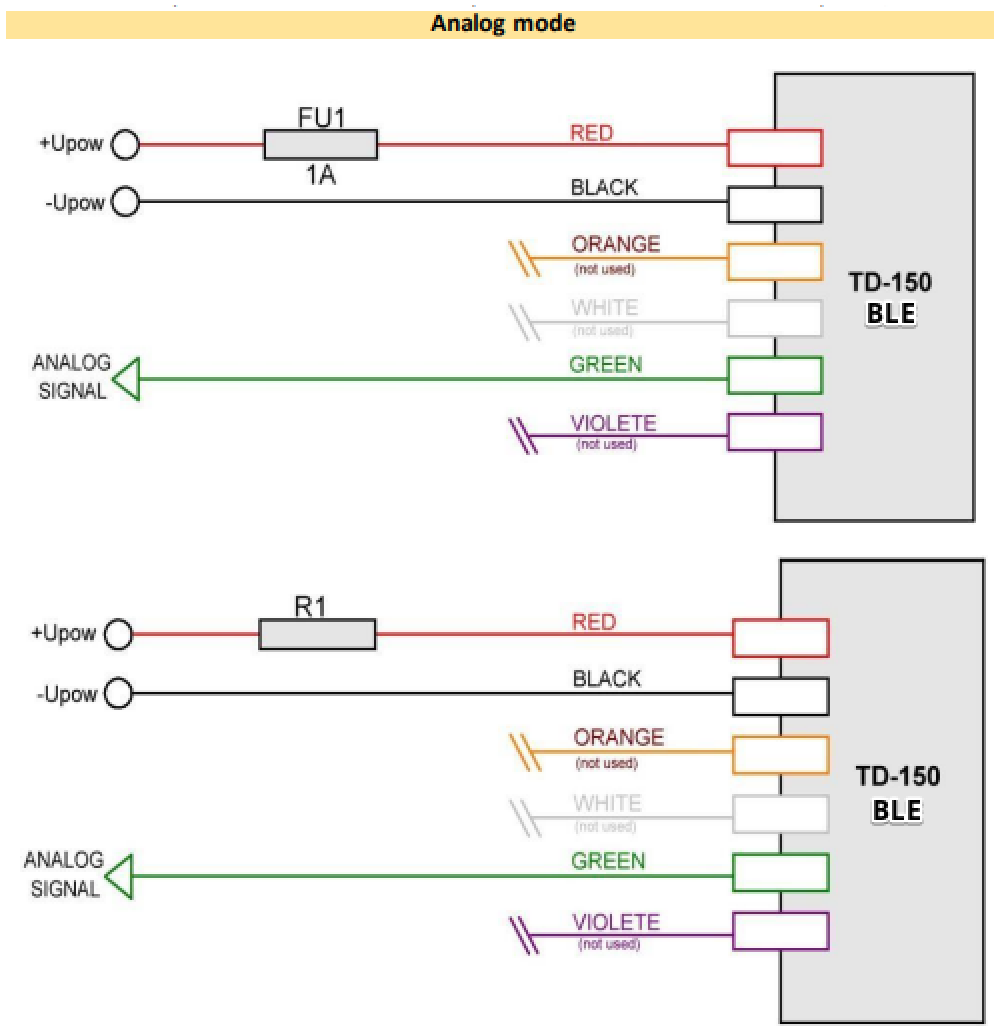
Wiring Diagrams

RS-485 Passive/Active mode

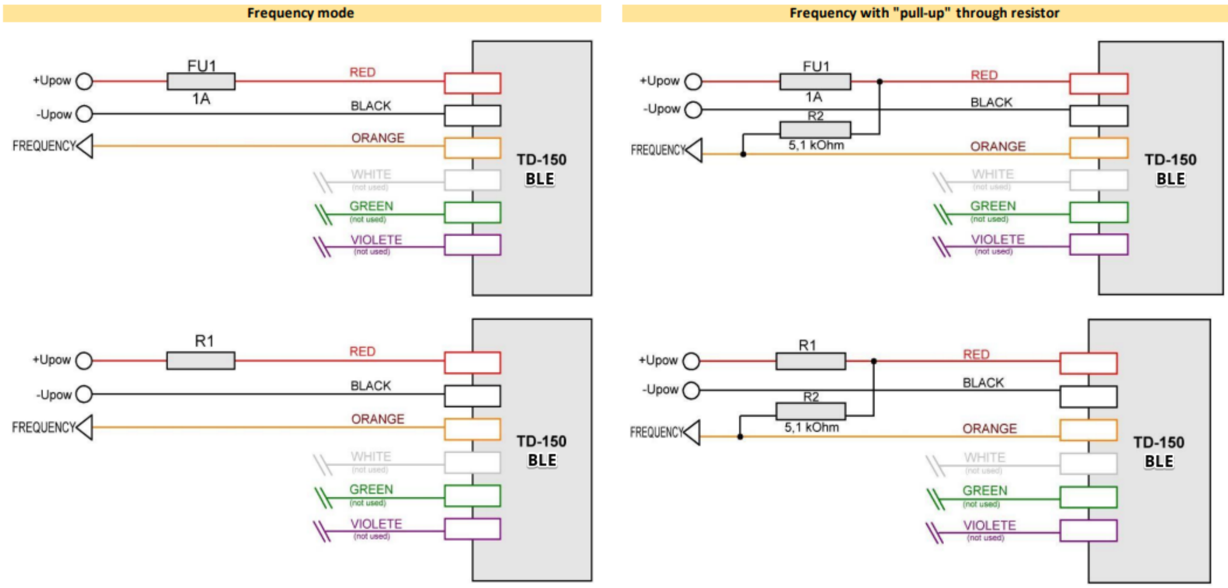




Analog mode


Analog mode
FU1
1A
+Upow
-Upow
RED
BLACK
ORANGE
(not used)
WHITE
(not used)
ANALOG
SIGNAL
GREEN
VIOLETE
(not used)
TD-150
BLE
R1
+Upow
-Upow
RED
BLACK
ORANGE
(not used)
WHITE
(not used)
ANALOG
SIGNAL
GREEN
VIOLETE
(not used)
TD-150
BLE

Frequency mode



Wiring with fuse (FU1) or resistance (R1)

The sensors are shipped with kits that contain 2 ballasts/resistances. Each of them can be installed instead of the fuse from kit (not along with it) in case it is necessary to comply with special anti-explosion safety requirements.

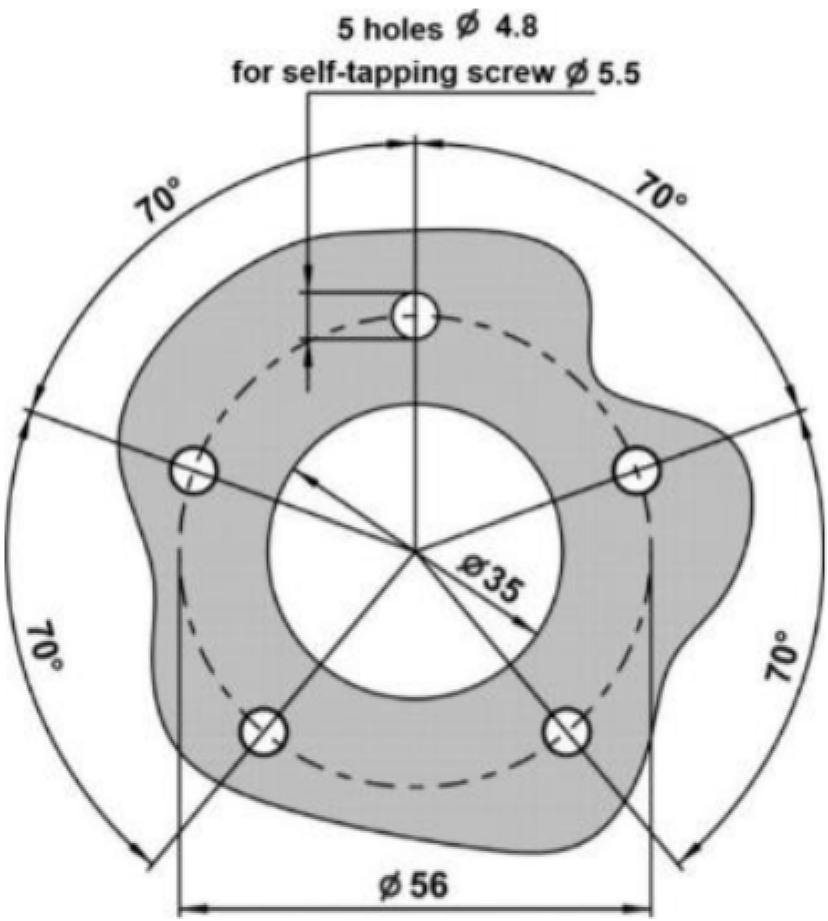
The black resistance must be used if the sensor is to be powered up by a 12 V power supply. The red one must be used if the 24-36 V power supply will be used.

The idea behind this is that, if there is a short circuit or a sudden voltage surge in the connection with the power supply, the resistance - installed outside the immediate danger zone - will burn and thus disrupt the chain before any sparks will have time to reach the sensor installed in the explosive zone and provoke an explosion.

Ballast 120 Ohm (Black)

Ballast 620 Ohm (Red)

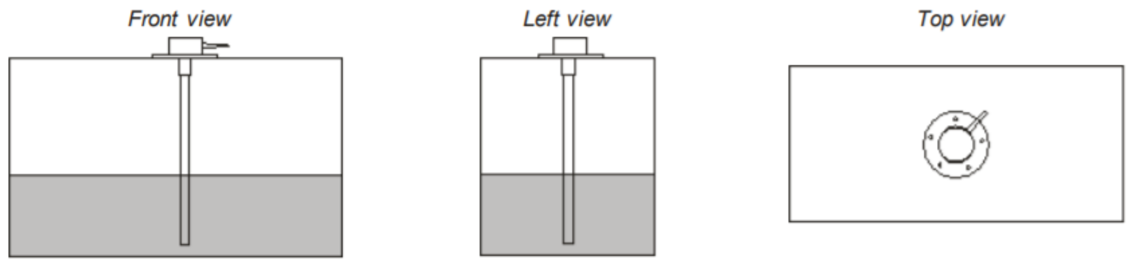
Sensor installation dimensions

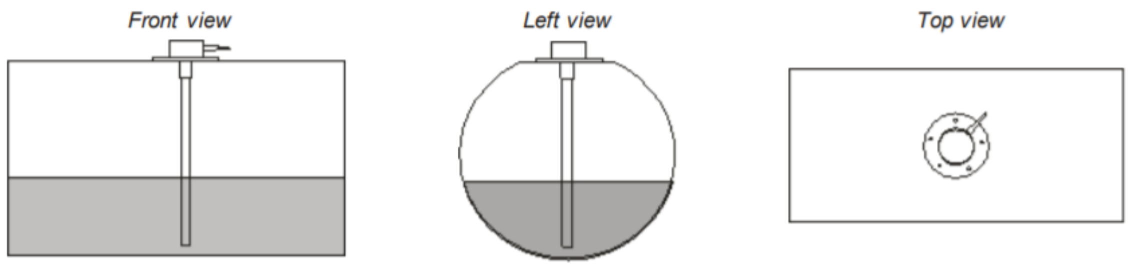


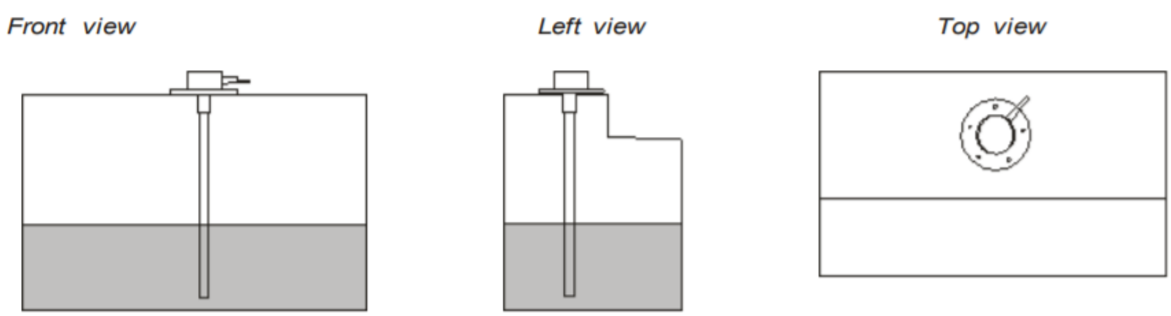
Installing sensors in regular and complex-shaped tanks

The basic principle for selecting the installation spot is the following:

- The sensor must be installed in the highest point of the tank;
- It must installed in the center of the tank or as close to is as possible;
- It must not be installed close (closer than 20 cm) to the tank's walls, baffles, reinforcement ribs/plates or any sensors installed by the manufacturer;







In some tanks, to achieve the best result, it is better to put two sensors in the same tank, placing them at opposite sides on the same diagonal line.