NIKOLIN
FUEL CONTROL

Operating Manual

Fuel Level Sensor

2026

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1. Intended Use and Operating Principle

1.1 Intended Use

The fuel level sensor (FLS) measures non-conductive liquids: diesel, biodiesel, kerosene, and mineral oil.

Applications include operational fuel accounting in vehicle fuel tanks and at various stationary facilities, including diesel generator sets, boiler equipment, stationary tanks, etc.

Figure 1 - FLS appearance

The FLS is designed to be powered from a vehicle electrical system with a nominal voltage of 12/24 V. The sensors are available with the following output types: analog (A), frequency (F), RS232 interface (RS232), and RS485 interface (RS485). Depending on the length of the measuring section, sensors are available in lengths from 200 mm to 2,000 mm.

The FLS has a one-piece, complex-shaped housing made of glass-filled polyamide. The measuring element is installed through an opening in the bottom of the housing and prevents the electrodes from contacting each other.

A control board is installed inside the housing. The board is completely sealed with Efix polyurethane compound. All electrical connections on the printed circuit board are encapsulated, and no part extends beyond the compound fill.

1.2 Operating Principle

The FLS operates on the capacitive principle of fuel-level measurement. Its sensing element is a capacitor formed by two tubes (outer and inner) extending from the sensor housing. When immersed in fuel, the capacitor, which is connected to the reference oscillator circuit, changes its capacitance, thereby changing the circuit frequency. The microcontroller measures the frequency in the measuring circuit, processes the data (valid-range check, filtering, and temperature compensation), and outputs the resulting value according to the sensor type. If an error occurs during measurement, the microcontroller generates the corresponding error codes (see Section 6).

2. Technical Specifications

Parameter	Value			
Sensor type	**A**	**F**	**RS232**	**RS485**
Output signal type	analog	frequency	digital	
Output signal range	from 0 to 10 V	from 500 to 1,500 Hz	0 to 100% (of fill level)	
Level measurement range (depending on order), mm	0 to 200 (0 to 2,000)			
Limits of reduced error, %	±1,0			
Limits of reduced error at ambient temperatures from -40 °C to +85 °C, %	±3,0		±1,0	
Operating ambient temperature range, °C	-40 to +85			
DC supply voltage range, V	10.8 to 36.0			
Maximum current consumption, mA, max.	50			
Ambient relative humidity during operation, max.	95% at 40 °C			
Enclosure rating per GOST 14254 (external components)	IP67			
Continuous operating time, h, min.	24			
Service life before decommissioning, years	10			
Mean time to failure Tavg, h (failure: reduced error changes by more than ±1%)	≥15000			
Explosion protection:				
- marking	0Ex ma IIB T6 Ga			
- explosive atmosphere	IIB, T6			
- protection level	ma			

The FLS is also available in a reinforced version with a metal housing and additional sections for installation in large-volume tanks and equipment subject to increased strength requirements.

3. Scope of Supply

Item	Quantity
Fuel level sensor (FLS)	1 pc.
Connecting cable, 7 m	1 pc.
Installation kit	1 pc.
Packaging	1 pc.
Product passport*	
* One copy may be supplied per batch	

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4. Operating Rules

- The sensor shall be installed and operated by personnel who have read and understood this manual;
- Before installation, visually inspect the sensor. Do not use the sensor if any mechanical damage is found (cracks, chips, dents, etc.);
- Do not apply a supply voltage to the FLS other than that specified in this manual;
- The FLS contains no parts that may serve as an ignition source;
- When installing the sensor on a vehicle, special-purpose machine, or stationary storage facility, comply with the approved safety requirements applicable to the type of facility (for example, steam-cleaning a truck fuel tank before installing and connecting the sensor);
- Depending on the operating mode and intended use of the measuring device, additional components such as fuses may be used in the power and signal circuits. Install these components in the cab of the vehicle or other equipment. If installation in these locations is not possible, provide additional protection against external climatic effects (for example, sunlight and precipitation) and operational effects (for example, heat and moving parts). Install additional components at a safe distance from fuel and combustible fuel products, in non-hazardous areas;
- To protect the power circuit, use a fuse of the appropriate rating supplied with the sensor;
- After installing the sensor on a vehicle, it is recommended to seal all electrical connections;
- Make all connections with the sensor and the connected devices powered off.

5. Transportation and Storage

1. Before commissioning, store the FLS in its packaging in a storage facility at an ambient temperature from -50 °C to +40 °C and relative humidity up to 98%.

2. The FLS transportation conditions with respect to mechanical factors shall be medium (C) according to GOST 23170.

3. Transport the sensor at an ambient temperature from -50 °C to +40 °C and relative humidity not exceeding 98% at +25 °C.

6. Disposal

Titan fuel level sensors contain no harmful substances or components that pose a hazard to human health or the environment during or after operation, including during disposal. Plastics and non-ferrous metals shall be recycled.

7. Sensor Installation

7.1 Installation procedure:

4. Select the sensor installation location. Install the FLS as close as possible to the geometric center of the tank, avoiding contact with internal baffles, the fuel pickup, and the standard fuel level sensor. This minimizes the effect of fuel movement while driving or when parked on a slope. In irregularly shaped tanks, install the sensor at the deepest point. In large tanks (L = 2 x H), it is recommended to install two FLS units diagonally.

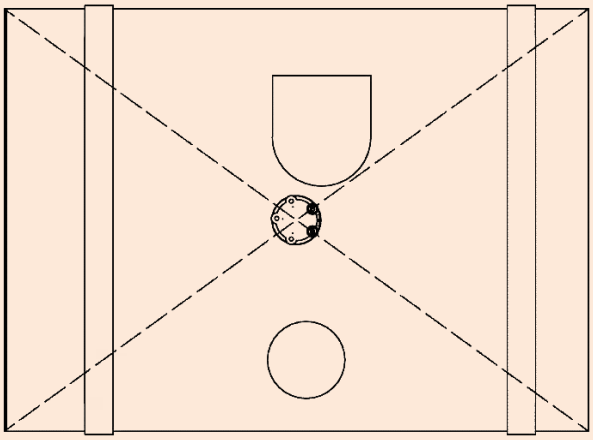


Figure 7.1 - Installing the FLS at the center of the tank

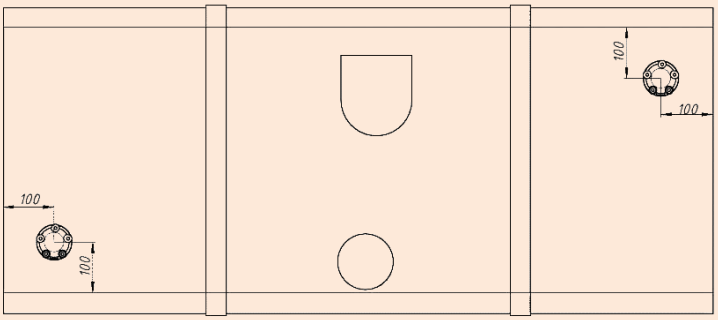


Figure 7.2 - Installing two FLS units at opposite ends of the tank

5. Drill a central hole 32-35 mm in diameter for sensor installation.

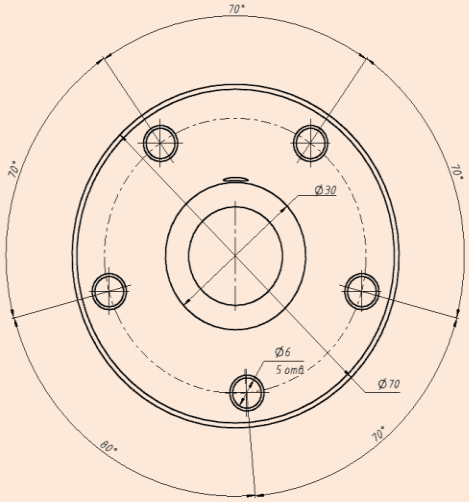


Figure 7.3 - Bottom view of the sensor head with dimensions

Caution! Before drilling, the fuel tank of a diesel-engine vehicle must be completely filled. The fuel tank of a gasoline-engine vehicle must first be steam-cleaned or completely filled with water.

6. Cut the sensor to the required length. To prevent water and dirt from entering the measuring section, cut the FLS 20 mm shorter than the tank height at the installation point.

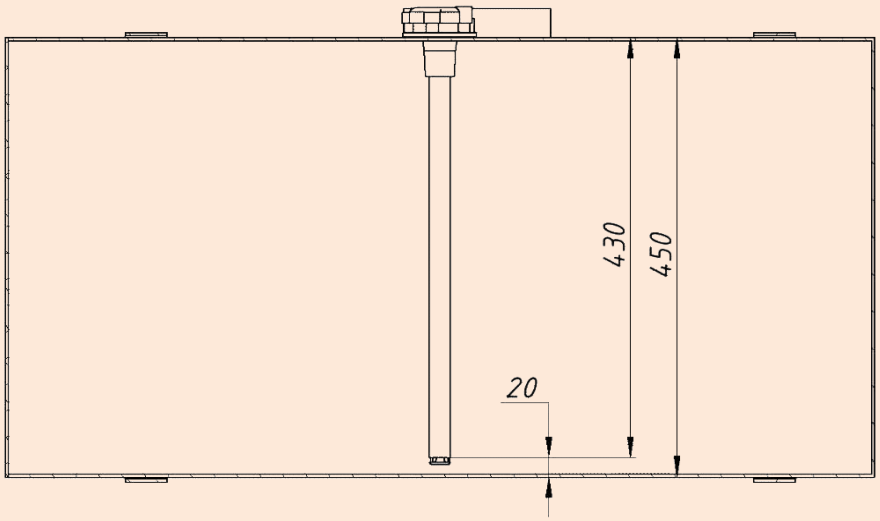


Figure 7.4 - Trimmed FLS installed on the fuel tank

7. Thoroughly remove all aluminum filings from between the tubes.

8. Insert the retainer supplied with the sensor into the ends of the tubes. This prevents the measuring-element tubes from shorting together and protects them from vibration damage during operation.

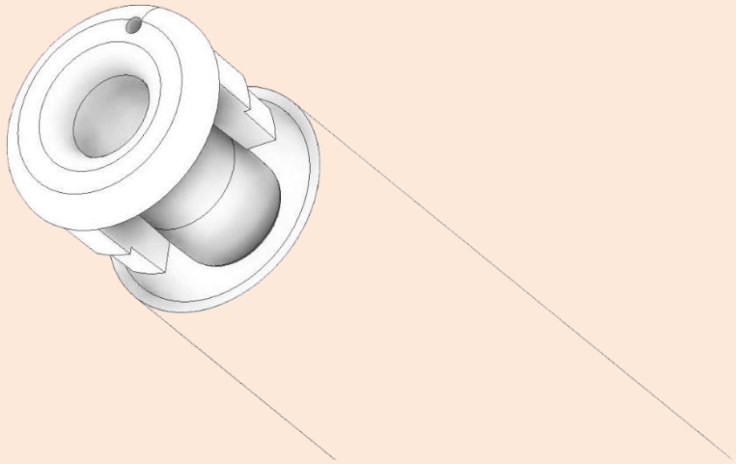
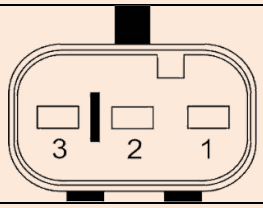
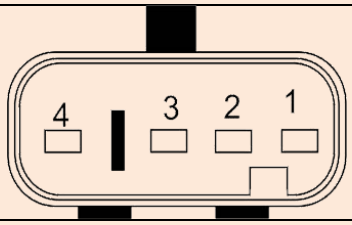


Figure 7.5 - Retainer

9. Calibrate and configure the FLS (see Section 6).
10. Route the extension cable for connecting the FLS. It is recommended to route the extension cable along the vehicle wiring harness to protect it from mechanical and thermal effects during operation.
11. Make the electrical connections according to the wiring diagram for the relevant sensor type.
12. Install the sensor in the central hole and secure it with self-tapping screws.
13. Connect the extension cable to the FLS.
14. Seal the FLS mounting and the extension-cable connector.

7.2 Connector Pin Assignment and Wire Colors

Connector type	Pin assignment	Extension-cable wire color
A / F		
	1 - FLS signal 2 - Power supply "-" 3 - Power supply "+"	Black Brown Blue
RS232 / RS485		
	1 - Power supply "-" 2 - Power supply "+" 3 - Line A / Rx 4 - Line B / Tx	Brown Blue Yellow Black

7.3 Wiring Diagrams

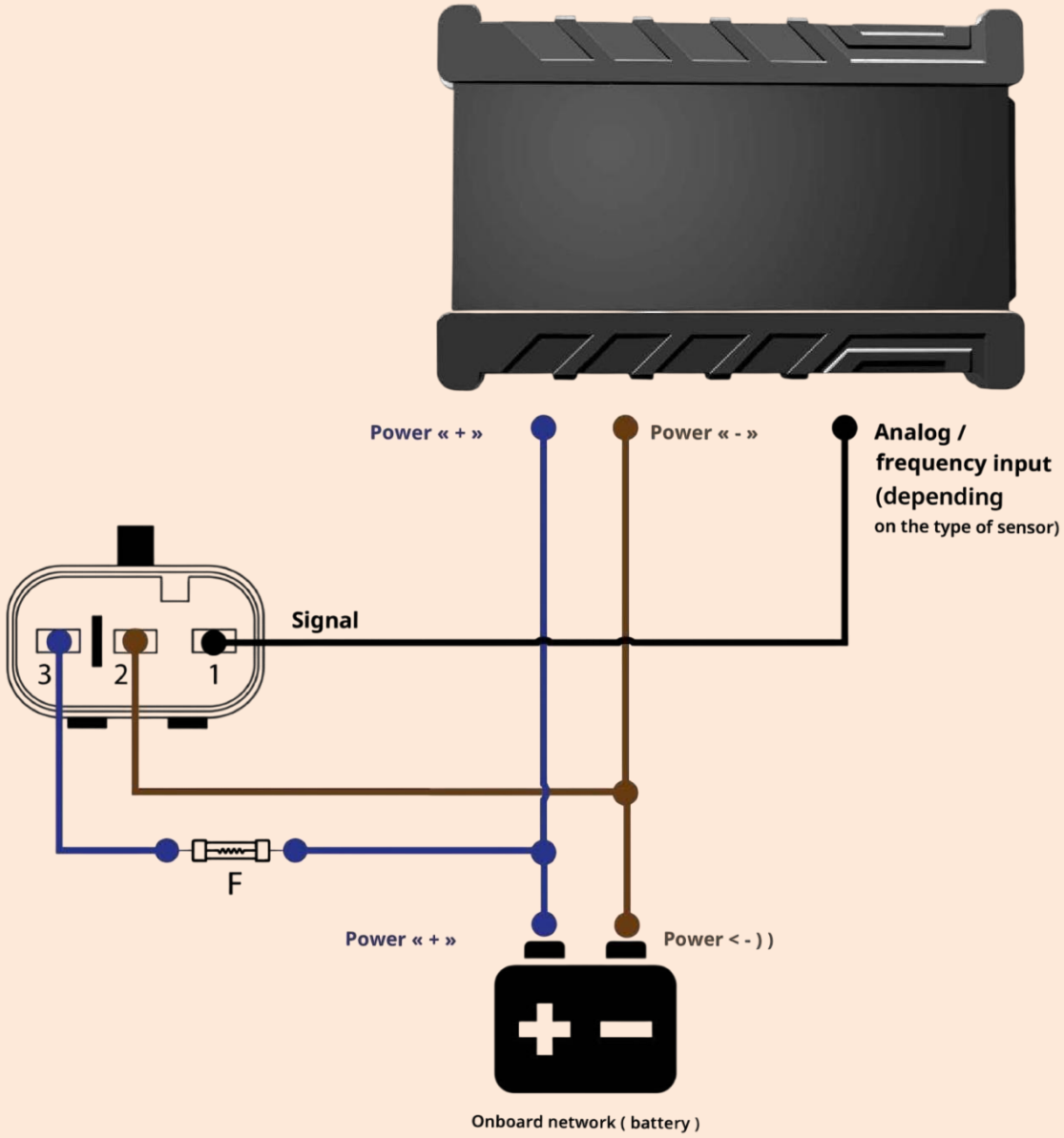


Figure 7.6 - Wiring diagram for an FLS with an analog or frequency output signal

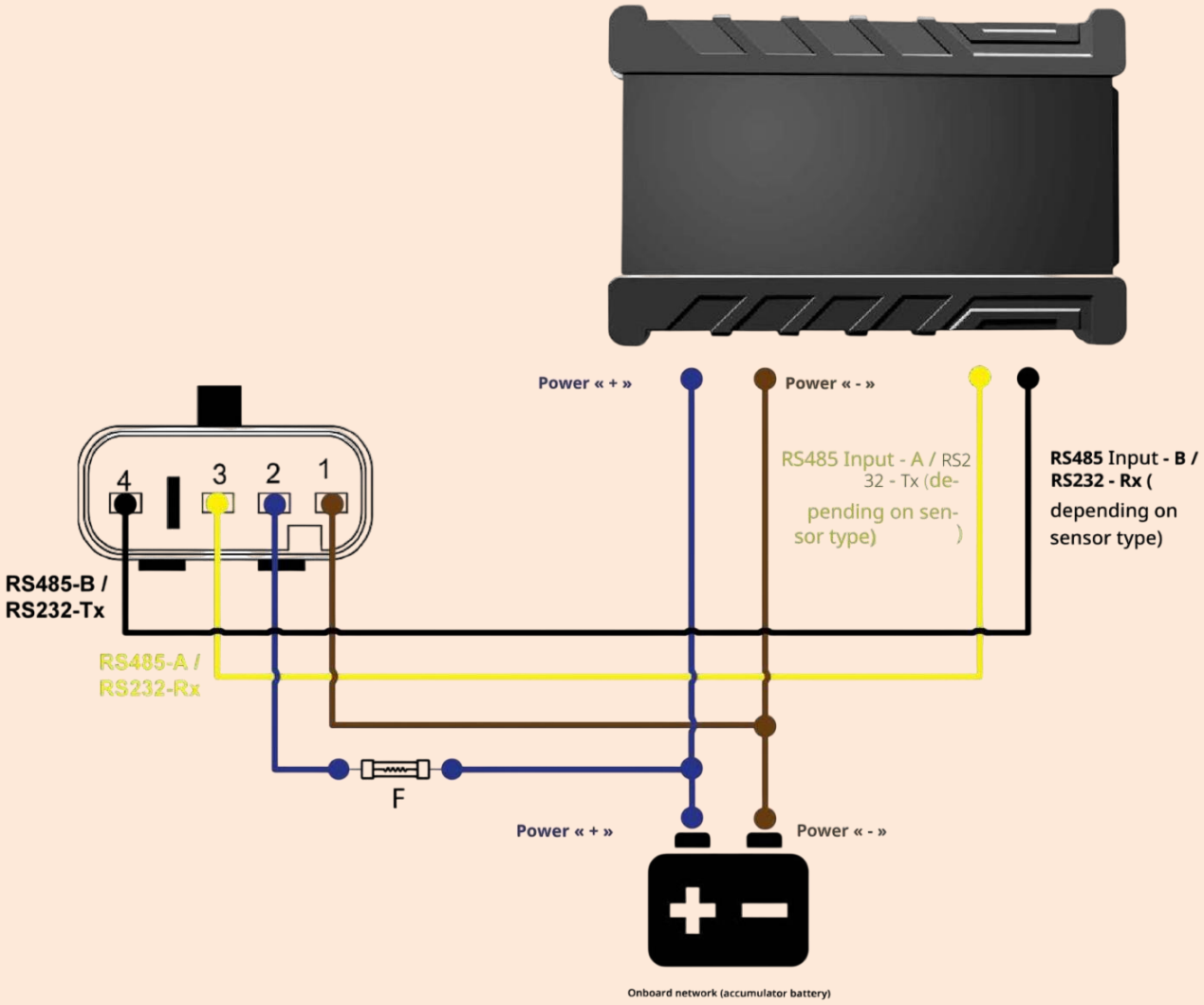


Figure 7.7 - Connecting an FLS with an RS485 or RS232 digital output

Install the fuse as close as possible to the positive power connection point to protect the vehicle wiring against a short circuit in the monitoring-system power lines.

WARNING! The sensor and terminal negative leads must be connected to the same grounding point!

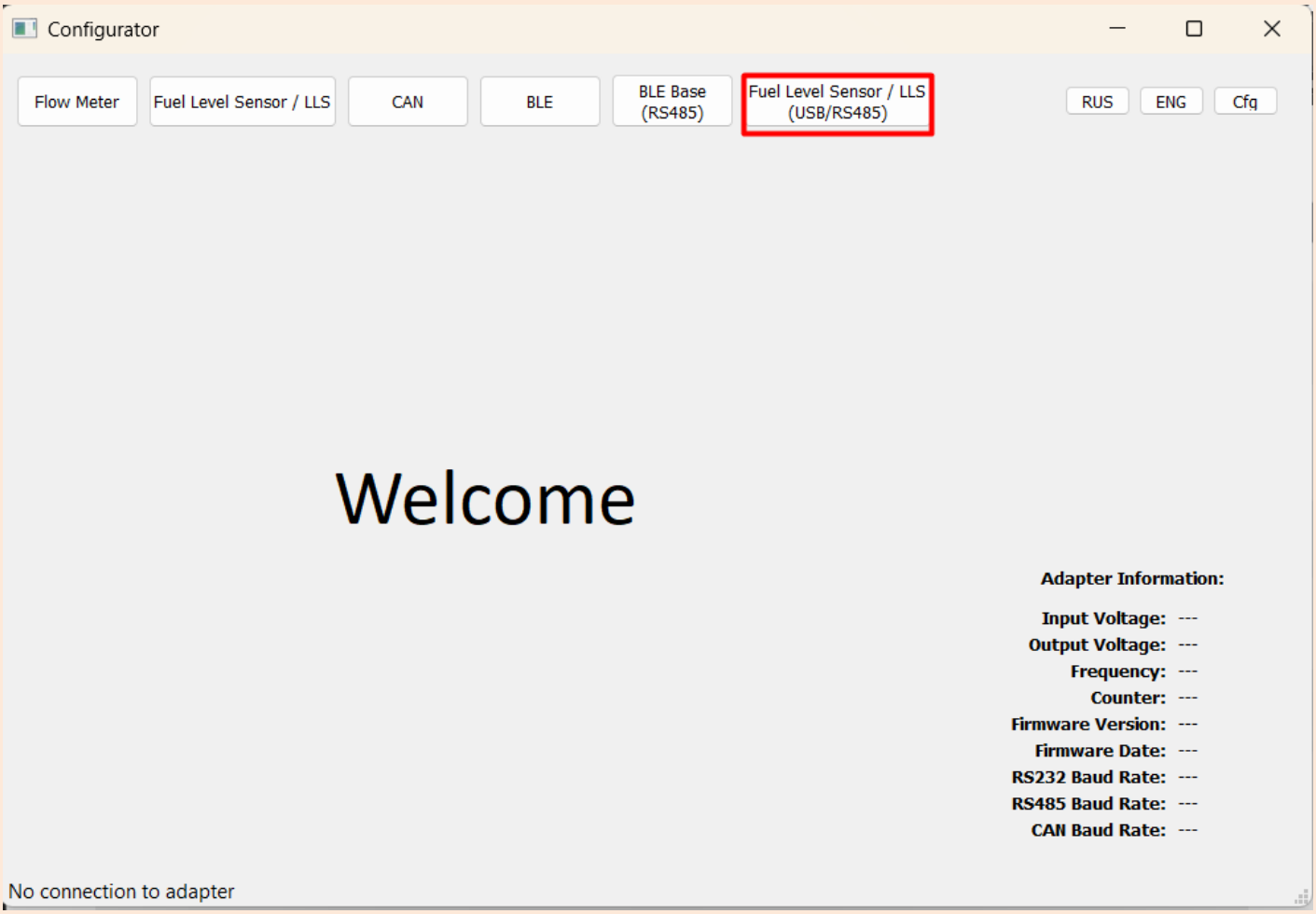


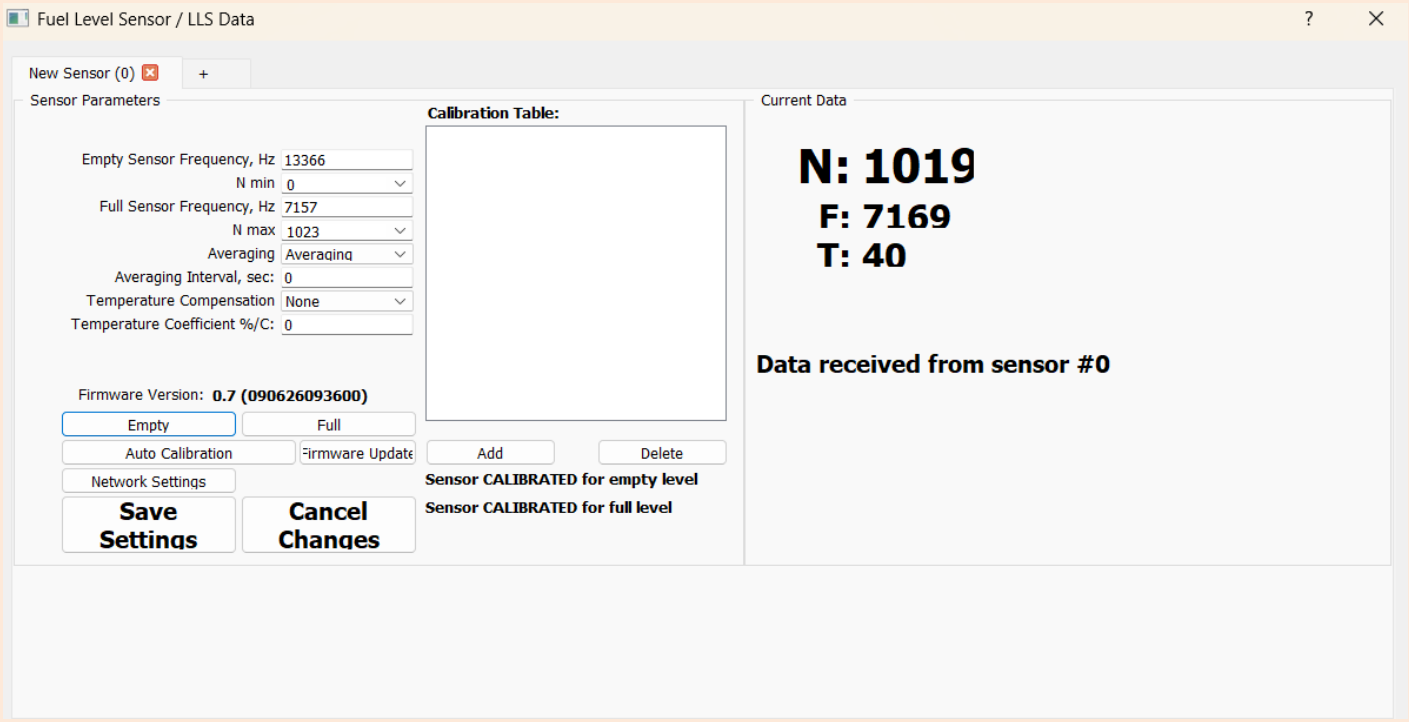
Figure 8.1 - Programmer appearance

Configuring the RS232 / RS485 FLS:

1. Connect the sensor to the PC using the programmer.

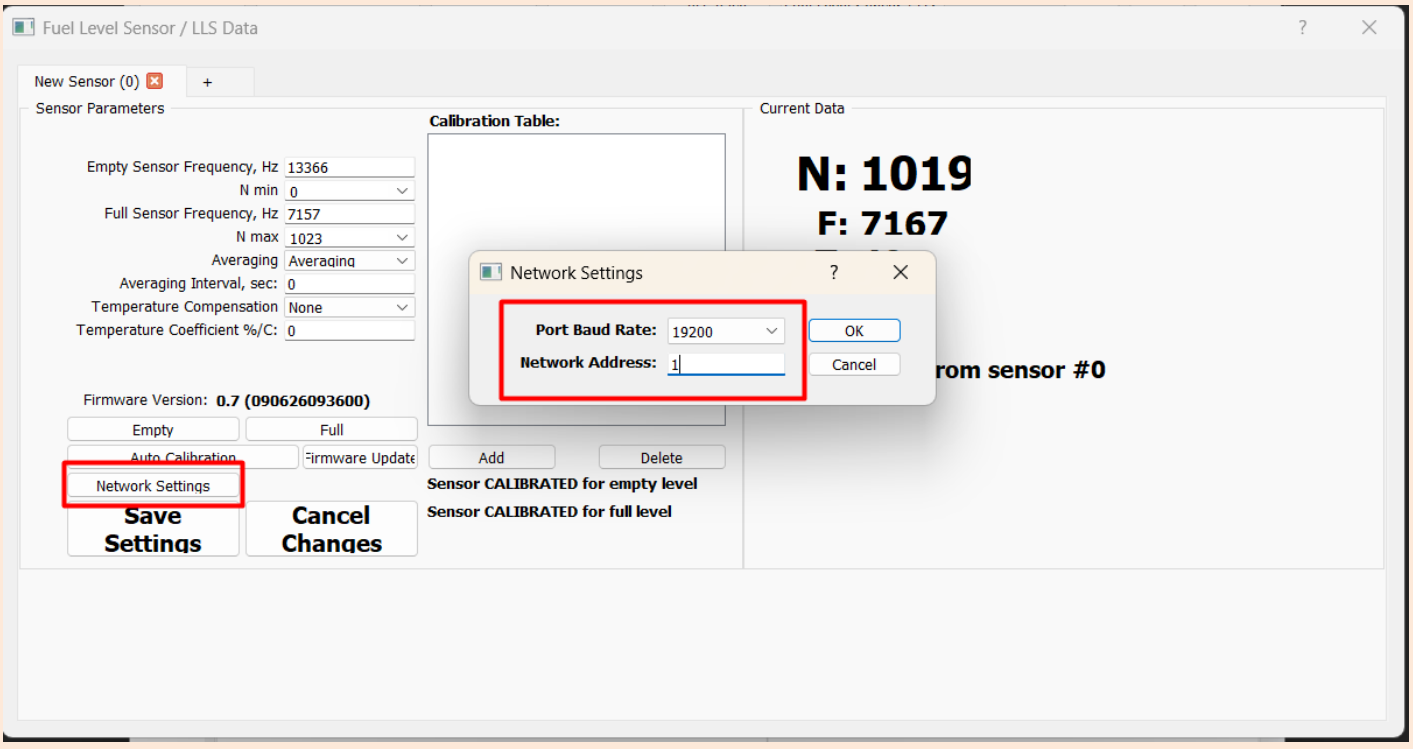
2. Start **rc_config_tool**. In the window that opens, select "FLS/LLS".

3. After selecting "FLS/LLS", make sure that communication with the sensor has been established. If the connection is successful, a new window will open showing the sensor settings, firmware version, and sensor connection status.



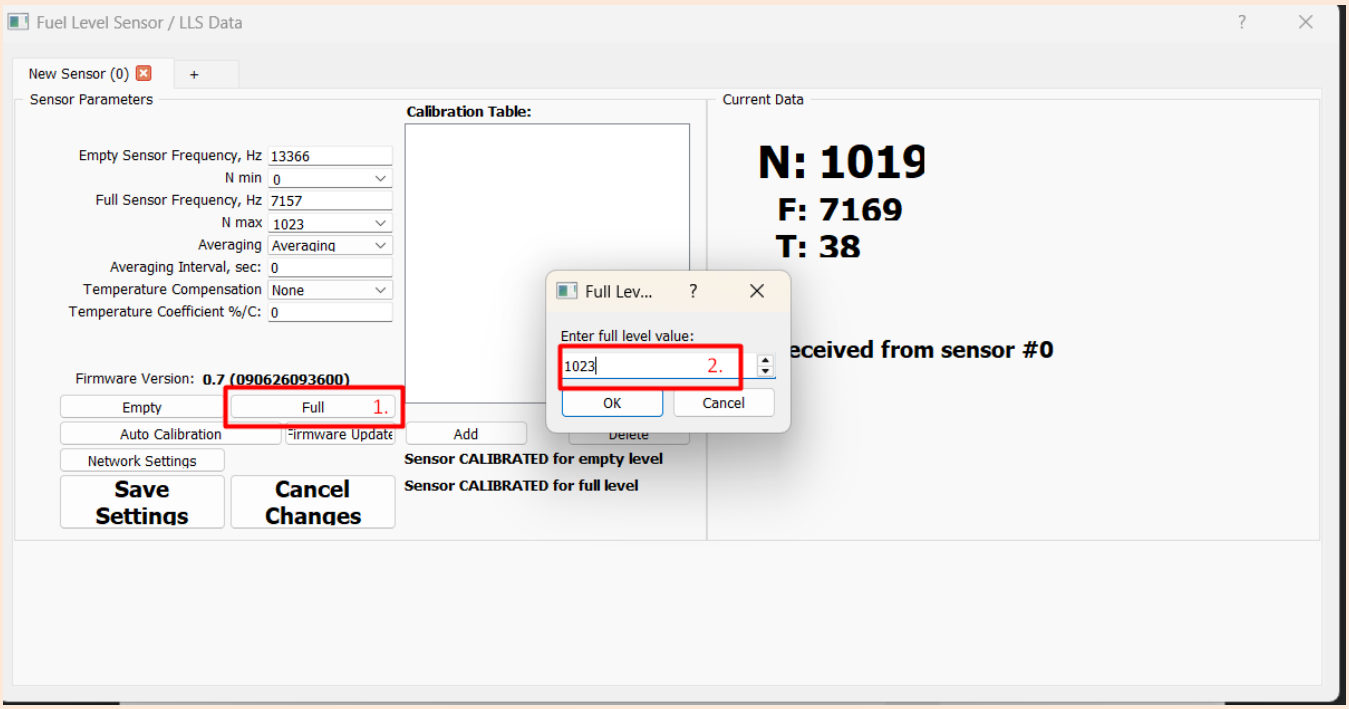
Changing the sensor address and communication rate:

To change the communication rate and sensor address, click "Network Settings". In the window that opens, change the "Port Rate" and "Network Address" as required.

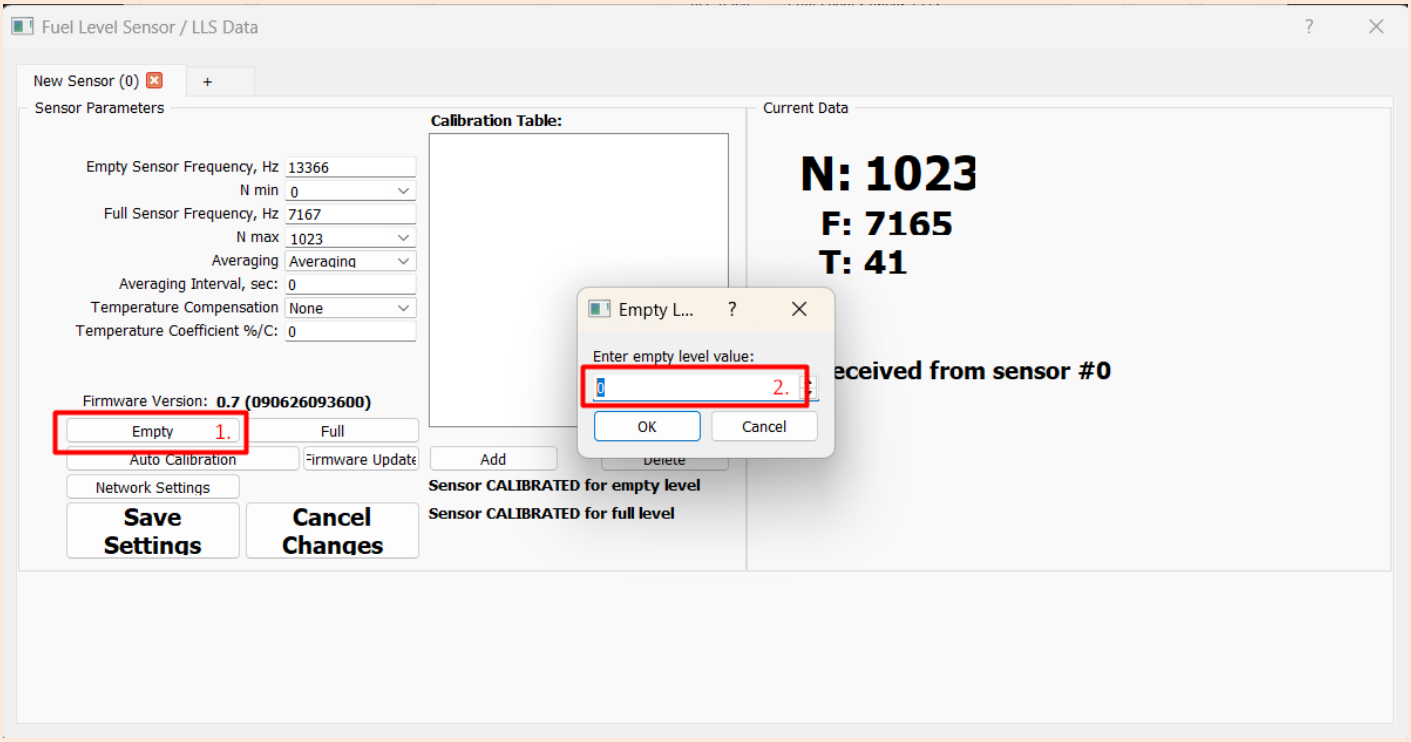


Sensor calibration:

1. Fully immerse the sensor in fuel.
2. Click "Full Tank" and enter the full-level value in the window that opens.



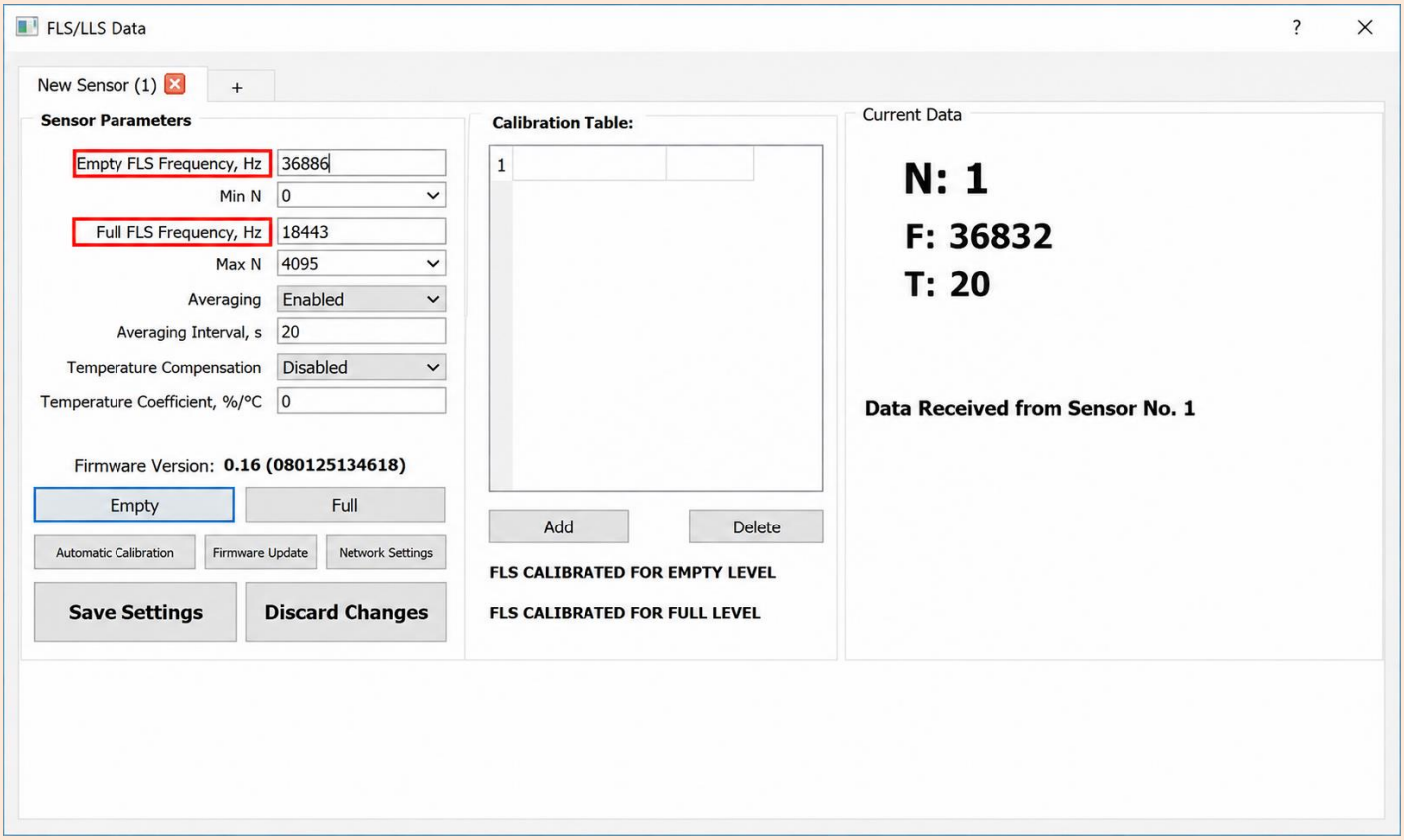
3. Remove the sensor from the fuel and allow it to dry for 2-3 minutes.
4. Click "Empty Tank" and enter the empty-level value in the window that opens.



If the frequencies of the dry sensor and the sensor fully immersed in fuel are known, they can be entered manually:

In the "Empty Tank Frequency, Hz" field, enter the frequency corresponding to an empty tank.

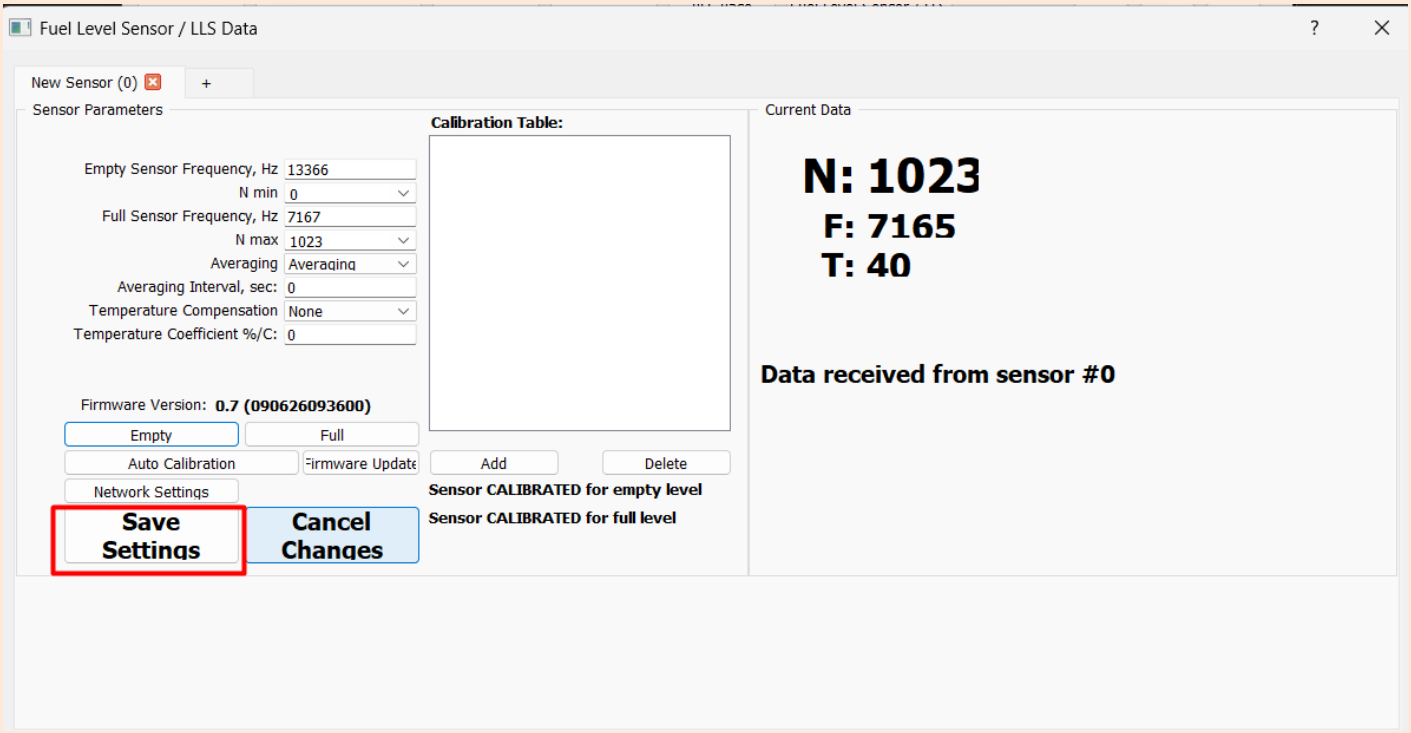
In the "Full Tank Frequency, Hz" field, enter the frequency corresponding to a full tank.



Setting the Averaging Interval.

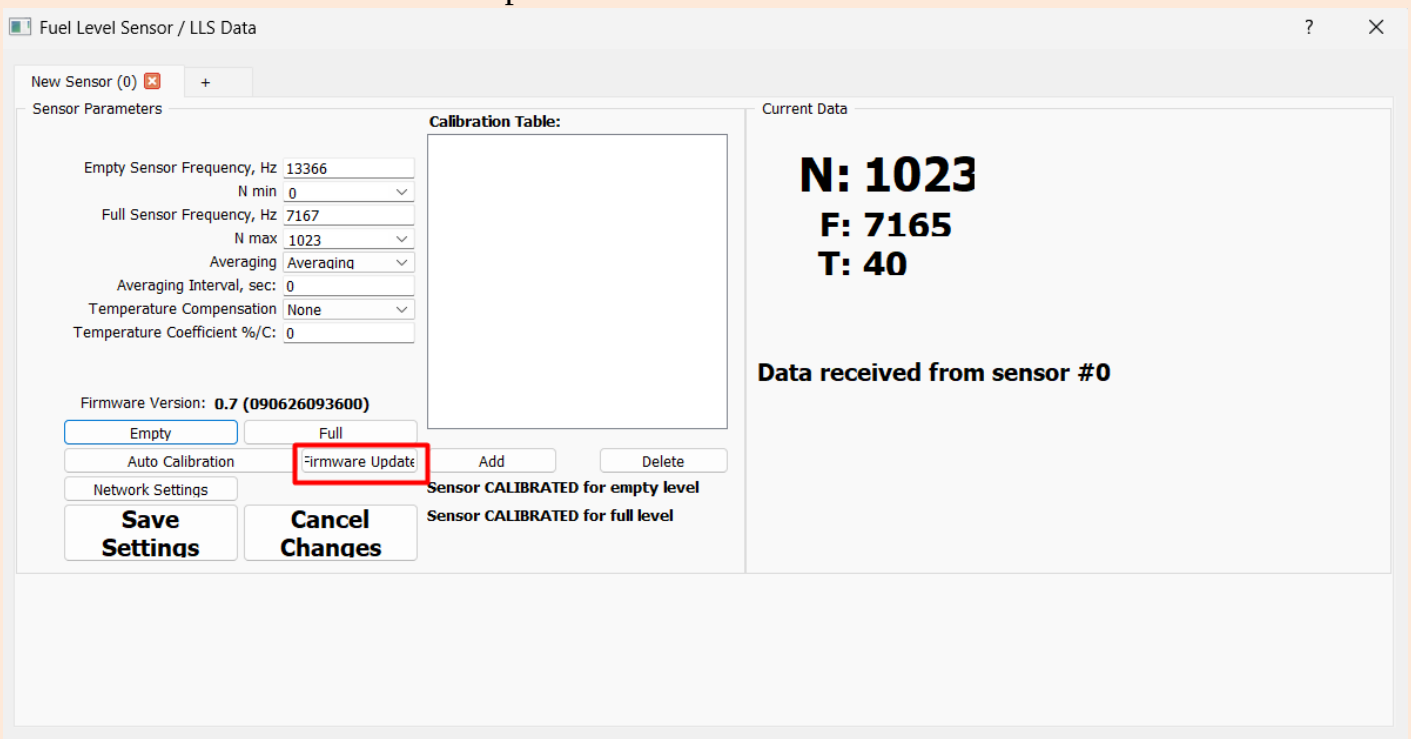
The averaging interval is the time period over which the measured frequency values of the measuring oscillator are averaged. To set the averaging interval, enter a value from 10 to 90 seconds in the "Averaging Interval, s" field.

After entering all parameters, click "Save Settings".



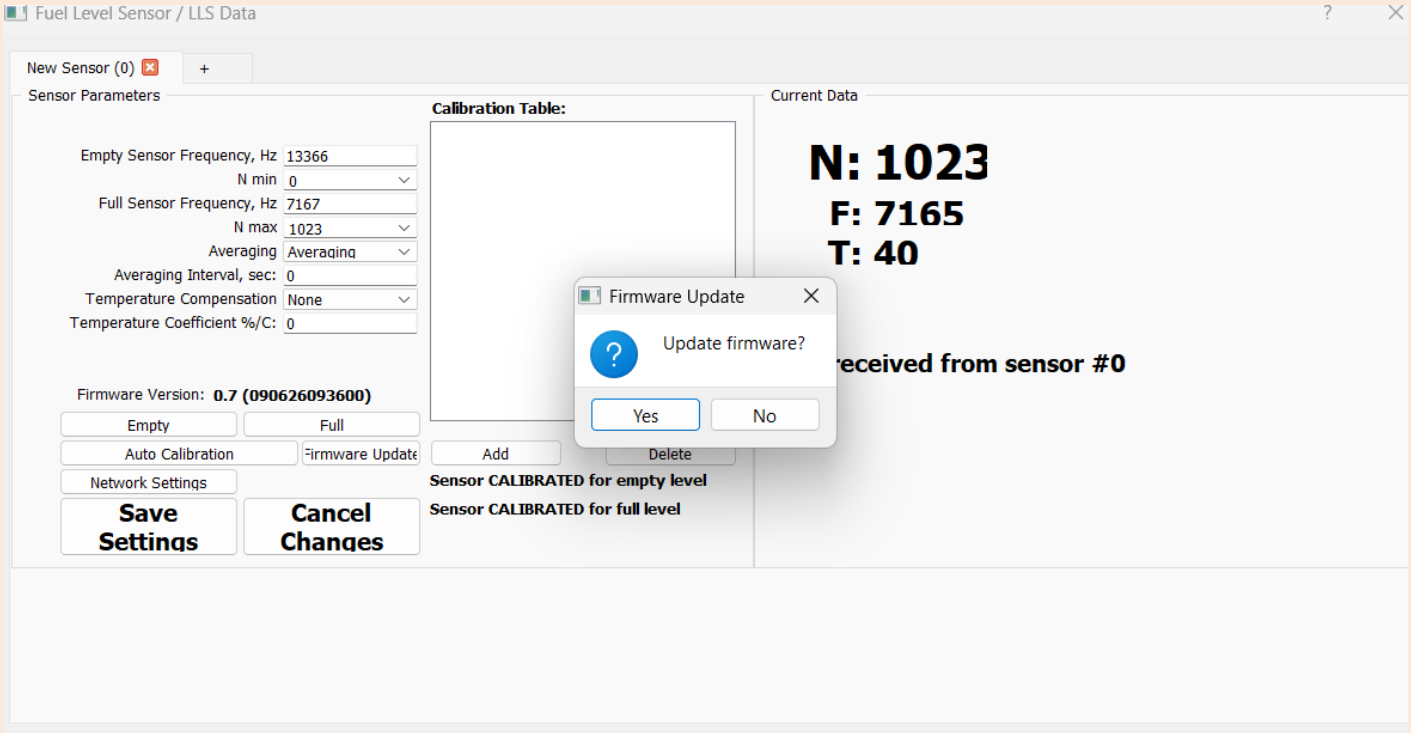
Updating the Sensor Firmware:

1. Select "Firmware Update".



2. In the window that opens, select the firmware file and click "Open".

3. Click "Yes" in the firmware update confirmation window.


Fuel Level Sensor / LLS Data
New Sensor (0)
+
Sensor Parameters
Empty Sensor Frequency, Hz 13366
N min 0
Full Sensor Frequency, Hz 7167
N max 1023
Averaging Averaging
Averaging Interval, sec: 0
Temperature Compensation None
Temperature Coefficient %/C: 0
Firmware Version: 0.7 (090626093600)
Empty
Full
Auto Calibration
Firmware Update
Network Settings
Save Settings
Cancel Changes
Calibration Table:
Add
Delete
Sensor CALIBRATED for empty level
Sensor CALIBRATED for full level
Firmware Update
Update firmware?
Yes
No
Current Data
N: 1023
F: 7165
T: 40
eceived from sensor #0