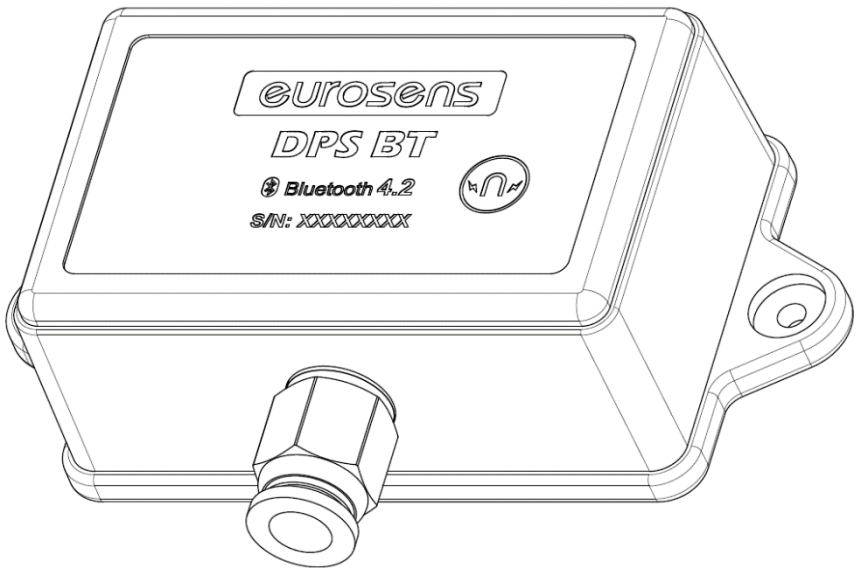
v 2.01

AXLE LOAD SENSOR

eurosens DPS BT



MECHATRONICS

User manual

CONTENTS

1 GENERAL INFORMATION

1.1 APPLICATION

The autonomous wireless pressure sensor eurosens DPS BT (fig. 1.1) (hereinafter referred to as the Sensor) is designed to measure pressure in pneumatic systems. It can be installed on vehicles with air suspension. Compatible with car gps trackers. Data can be received by trackers via Bluetooth interface. If the GPS tracker lacks a Bluetooth interface, the sensors can be used together with the Eurosens BT-COM receiver. The receiver can receive data from multiple transmitters (up to 10) and transmit the received information via RS485 interface (LLS, Modbus).

fig. 1.1. eurosens DPS BT

1.2 OPERATION

Air pressure causes deformation of the sensor membrane, on which the strain gauges are located. The strain gauge bridge resistance is measured by the electrical circuitry of the sensor and converted into an electronic signal proportional to air pressure. The signal is further processed by the microprocessor: the signal is converted into air pressure and axle load in kilograms according to the programmed calibration table. The axle load value, air pressure, battery charge and other parameters are transmitted via Bluetooth Low Energy wireless interface using the transmission protocol (see "Appendix 1").

1.3 DELIVERY SET

eurosens DPS BT delivery set includes:

- eurosens DPS BT axle load sensor;
- magnet key;
- specification.

Ordered separately:

- eurosens cable;
- mounting kit (fig. 1.2).

fig. 1.2. eurosens DPS mounting kit

The mounting kit includes the following items:

- a piece of pneumatic tube with an external diameter of 8 mm;
- a quick-change pneumatic connector;
- 2 plastic ties to secure the sensor.

The mounting kit and the connecting input of the sensor are designed for pneumatic tubes with an external diameter of 8 mm. If the vehicle has pneumatic tubes of a different diameter, it is necessary to use adapter fittings. You can order Ø10mm and Ø12mm fittings in Mechatronics (fig. 1.3).

fig. 1.3. Fittings-adapters for 10 and 12mm pneumatic lines.

2 SENSOR SPECIFICATION

Table 2.1. Specification of eurosens DPS BT.

Parameter, measurement unit	Value
Connectable external diameter of pneumatic tube, mm	8
Pressure, MPa	0-0,8
Measurement error, %	≤ 2,5
Protection class	IP67
Wireless connectivity range (in direct line of sight)	Up to 200 meters
Ambient operating temperature, °C	-40 – +85
Output interface	BLE 4.2, advertising packets (see Appendix I)

3 SENSOR INSTALLATION

Axle load sensor eurosens DPS can be installed either into the standard pneumatic line of a vehicle or free port of spring element.

Specify what type of installation you are going to use during order, because mouting kits are different

3.1 INSTALLATION INTO PNEUMATIC LINE

1) Identify the pneumatic lines leading to pneumatic elements of the left and right sides of a vehicle. They can be either directly connected to each other (in this case, it is enough to install one sensor), or be independent (in fig. 3.1).
2) Release the pressure from pneumatic system.
3) Carefully cut the pneumatic tube leading to the pneumatic element (fig. 3.2).

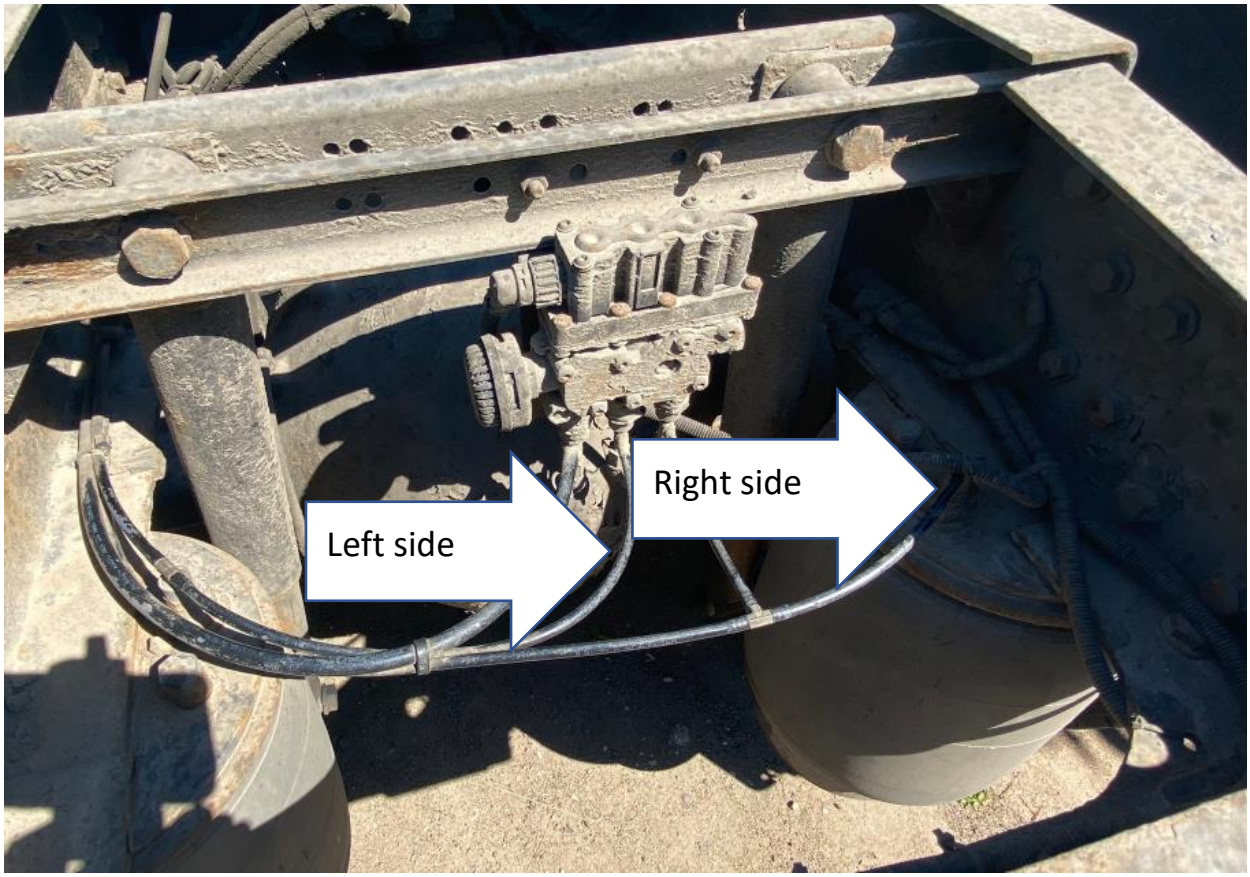


fig. 3.1. Pneumatic lines of left and right sides of truck

fig. 3.2. Cutting pneumatic line

4) Install a piece of the pneumatic tube from the mounting kit into a pneumatic connector (fig. 3.3).

To fix the tube in the pneumatic connector insert it into the connector until it stops and check the fixation by trying to pull it out.

fig. 3.3. Installing pneumatic tube into connector

5) Connect the cut pneumatic line to the pneumatic connector in the same way (fig. 3.4).
6) Connect the sensor to the electrical cable, lay the cable to the connection point with the monitoring terminal and/or on-board display and fix it with plastic ties (fig. 3.5) (not included in the delivery set).

fig. 3.4. Connection of pneumatic line finished

fig. 3.5. Cable fixing

7) Fix the sensor with plastic ties.

3.2 INSTALLATION INTO AIR SPRING

If the pneumatic element has a threaded plug, the sensor can be connected directly to it, without tapping into the standard (OEM) pneumatic lines (see Fig. 3.6).

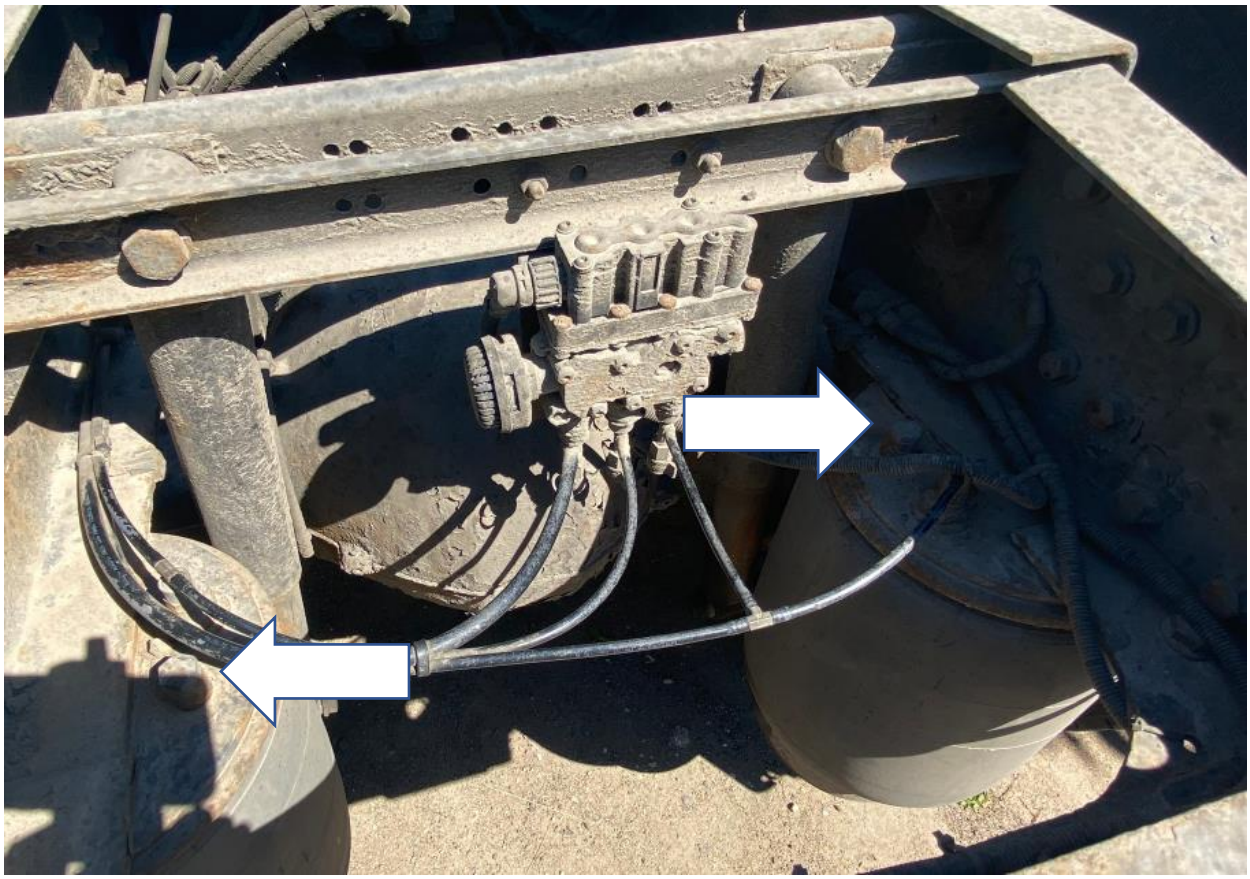


Fig. 3.6. Threaded plugs in air spring elements

To do this, order the alternative mounting kit with index -01 (Difference mounting 01-1 assembly, or Difference mounting 01-1 BT assembly—for the DPS BT wireless sensor) — see Fig. 3.7.

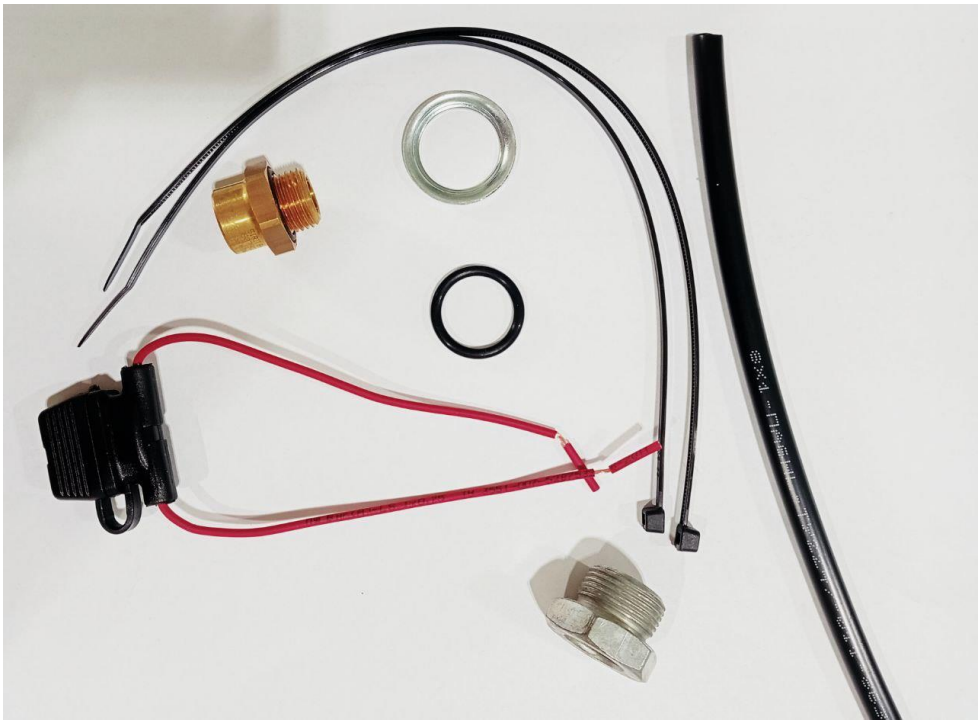


Fig. 3.7. Mounting kit Difference mounting 01-1

Installation is carried out in accordance with Fig. 3.8.

Fig. 3.8. Connecting the sensor to the pneumatic element in place of the plug.

4 CONFIGURATION SOFTWARE "CONFIGURATOR DOMINATOR BT"

For the configurator to work properly, a smartphone should meet the following technical requirements:

- Android 9.0 version or above;
- Bluetooth version 4.2 or above.

4.1 SOFTWARE INSTALLATION

1. Download and install the application "Configurator Dominator BT" from Play Market (fig. 4.1).

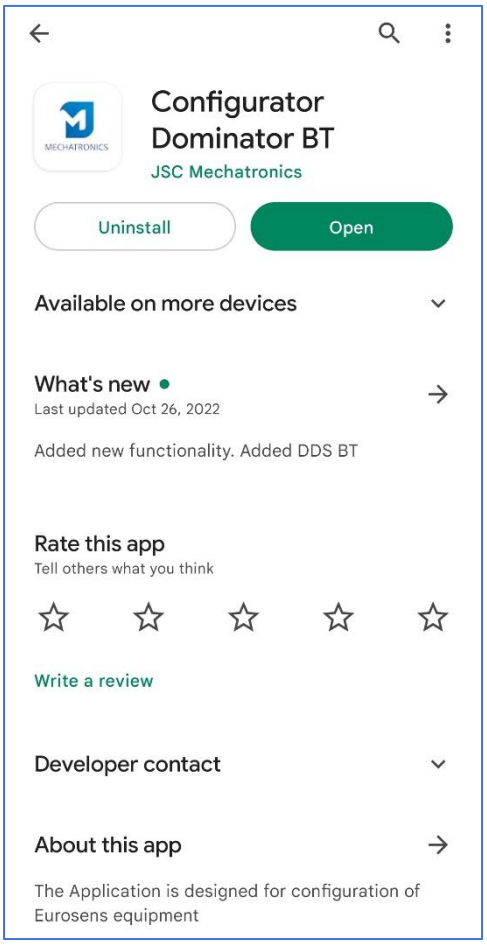


fig. 4.1. Configurator Dominator BT

2. While installing the app:
   - provide all the required permissions (fig. 4.2);

- enable Bluetooth access;
- enable geolocation services;
- follow the app instructions;

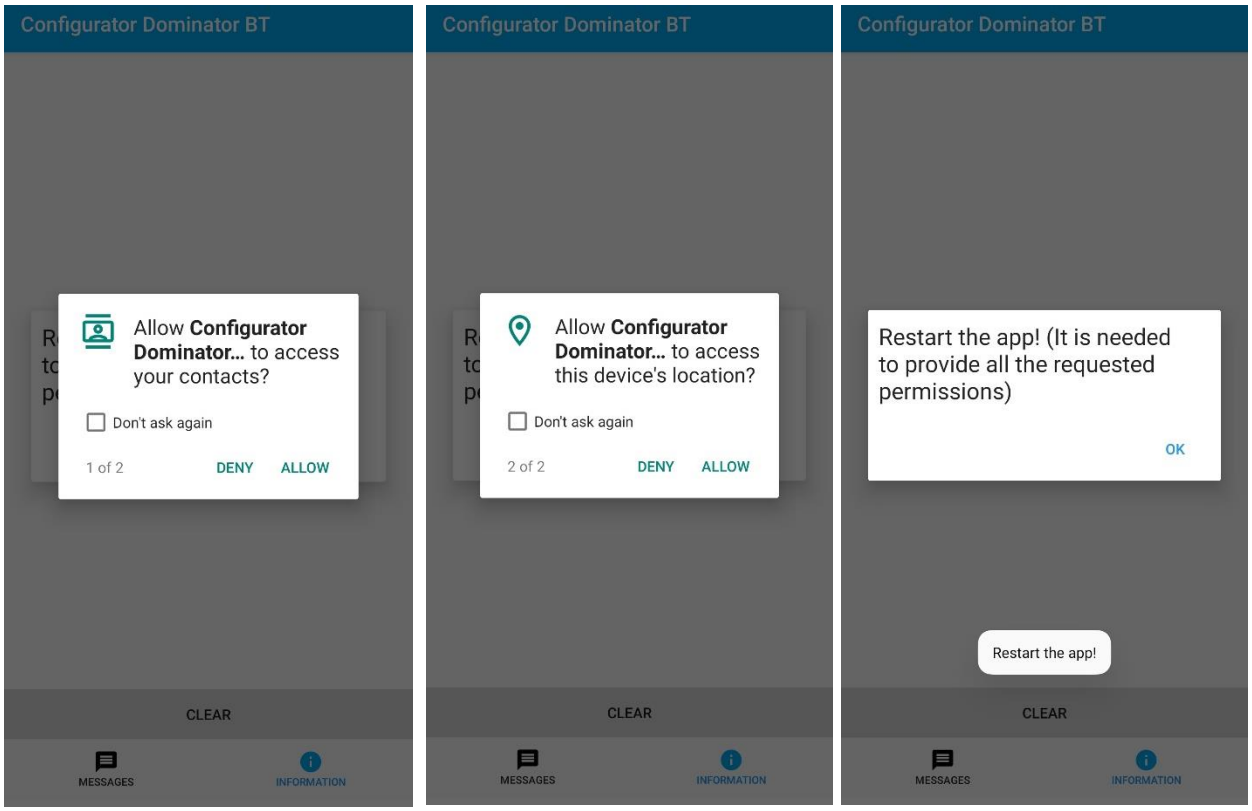


fig. 4.2. App permissions

4.2 REGISTRATION OF THE APP

To work with the application, you need to register it (get permission). For this you need access to the Internet.

There are several ways to get permission to work with the application:

1) Send a request to the Mechatronics.

After downloading and installing the application, a form to register the application will appear on the screen (Fig. 4.3). Fill in all fields of the form except for the “Administrator Code” field and click the “OK” button.

It is not recommended to delete “Configurator Dominator BT” or “Mechatronics” account in your phone as it will lead to the loss of registration data. You will need to repeat the registration process.

All software updates must be installed over the earlier version of “Configurator Dominator BT”.

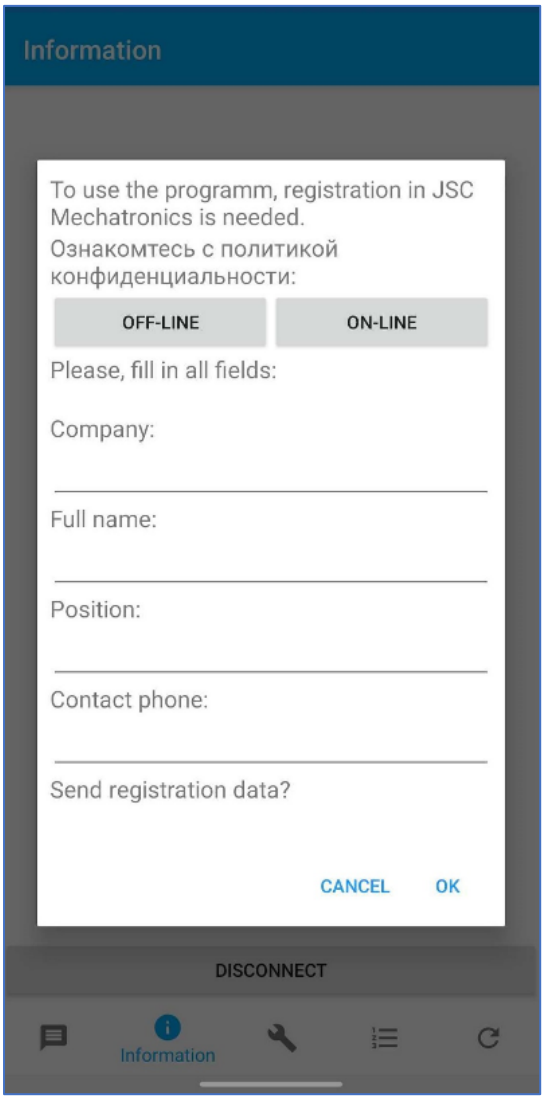


fig. 4.3. Registration form

Your account will be added to the list of authorized accounts after data verification.

1. Restart the app after you complete the registration process.

The app needs Internet connection (during the registration process and to check permissions after the app is restarted).

Further on, the Configurator can work offline.

2) Authorization of new user by admin of your company using service "Mechatronics-service.com"

This option is possible if the administrator of your company is registered on the this service and the company has been created.

Information about working with the service "Mechatronics-service.com" you can find in the user manual for this service.

Contact your administrator who has registered on the server and find out the administrator code. This code must be entered in the "Administrator code" field in the registration form (Fig. 4.4)

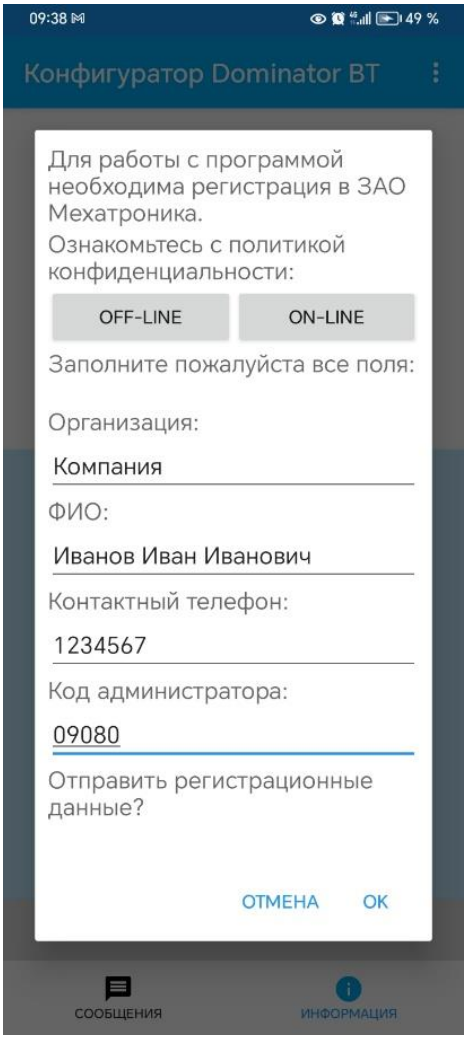


fig. 4.4. Registration form with company code

In this case, the request will be sent on “Mechatronics-service.com” to the administrator of your company. He will be able to grant you authorization without the involvement of Mechatronics technical support.

5 SENSOR CONFIGURATION AND CALIBRATION

5.1 “CONFIGURATOR DOMINATOR BT” SETUP

1. After app installation and registration:
   - check app permissions;
   - make sure that Bluetooth module and geolocation services are enabled.
2. Run the app. Device search will start automatically.
3. Go to the tab “**Messages**” for a quick data monitoring. The tab displays the current data from the sensors sent via Bluetooth Low Energy connection. The device search shows the list of sensors and compatible devices found within the Bluetooth visibility range such as DDS BT, Dominator BT, BT-COM, Dottrack, Degree BT.
4. Tap the button **“Clear”** to clear the list and restart the search (fig. 5.1).

The “filter” button allows you to set the filter of message reception by signal level. When you press it, a dialog box with filter settings appears (Fig. 5.2).

- Use the slider to set the signal level (RSSI), above which messages will be received.
- You can select the types of sensors displayed in the messages. To enable or disable the display of a particular type of sensor, check or uncheck the corresponding box next to its name.
- Below is the “Serial number” field where you can enter the serial number or part of it (messages from sensors containing this number will be displayed).

For convenient control of the displayed parameters, you can add the required device to your favorites.

When you click on the device in the list, a dialog box will appear with a proposal to add it to favorites (Fig. 3.3) and click “Add to favorites”.

fig. 5.1. Tab “Messages”

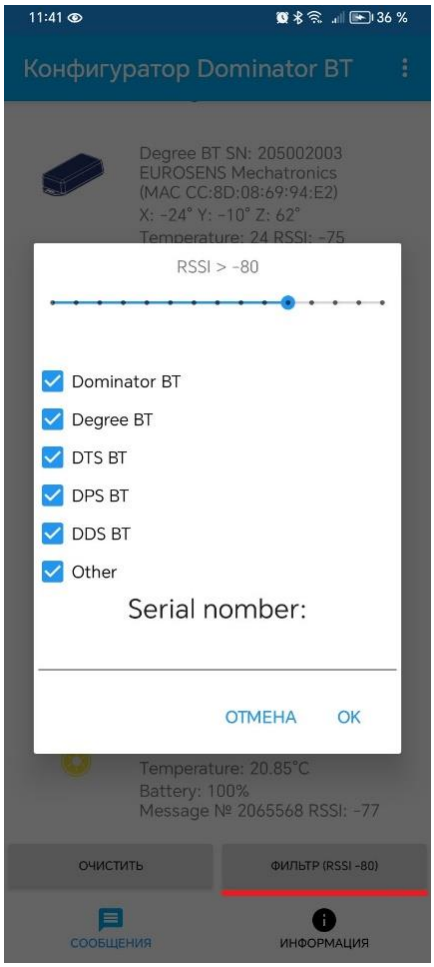


fig. 5.2. Filter sensors by RSSI level

5.2 SENSOR ACTIVATION

To connect to the sensor eurosens DDS BT:

1. Go to the tab “**Information**” (fig. 5.1).
2. Activate the sensor with a **magnetic key** (supplied in the delivery set). Hold it to the icon of magnet on sensor’s case for 2-3 seconds (fig. 5.2) until the sensor appears in the tab “**Information**”.

fig. 5.2. Sensor activation

3. The activated sensor connects to a smartphone within 30 sec. To connect the sensor, tap the sensor icon. The connected sensor works in a setting mode until you close the app or tap the button “**Disconnect**”.

- After 3 and more unsuccessful connection attempts (you put the magnetic key to the sensor but do not connect), the next attempt is available in 10 minutes.
- If unsuccessful connection attempts and false connections continue, the sensor blocks the possibility to connect for 1 hour.
- If there are no false connection attempts within 24 hours, the sensor deactivates the lock mode.

4. The tab **“Information”** appears after sensor connection. The tab has the following information about the sensor: current sensor values, manufacturer, model, MAC-address, serial number, firmware version, battery level, manufacture date, temperature (fig. 5.3).

fig. 5.3. Tab “Information”

Do not click the button **"Switch to firmware update mode"** unless you plan the firmware update.

Leaving the sensor in the firmware mode can lead to a rapid discharge of the battery

5.3 TAB “SETTINGS”

To configure the sensor, go to the tab “**Settings”** (fig. 5.4).

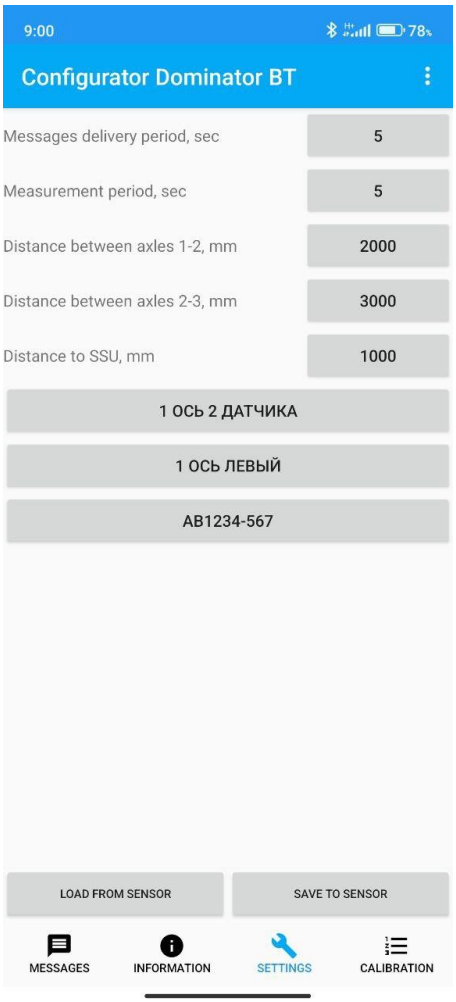


fig. 5.4. Tab “Settings”

The following sensor parameters are set in the tab:

- Messages delivery period, sec.;

- Measurement period, sec.;

The tab contains some information parameters important for a monitoring system (do not affect sensor operation):

- Distance between axles 1 – 2, mm;
- Distance between axles 2 – 3, mm;
- Distance to SSU (a fifth-wheel coupling), mm;
- System description with the sensor installed (fig. 5.5);
- Description of the sensor installation spot (fig. 5.6);
- Identification number (of a truck or a trailer where the sensor is installed): 10 characters, including Latin characters, numbers and some special characters («/», «-»).

After setting up the required parameters, click “**Save to sensor**”.

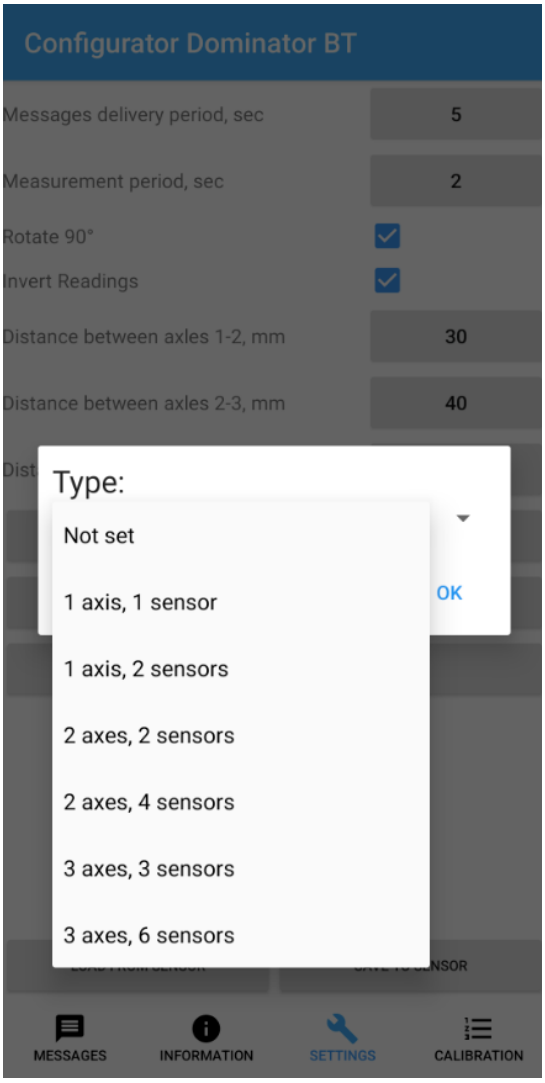


fig. 5.5. Sensor parameters

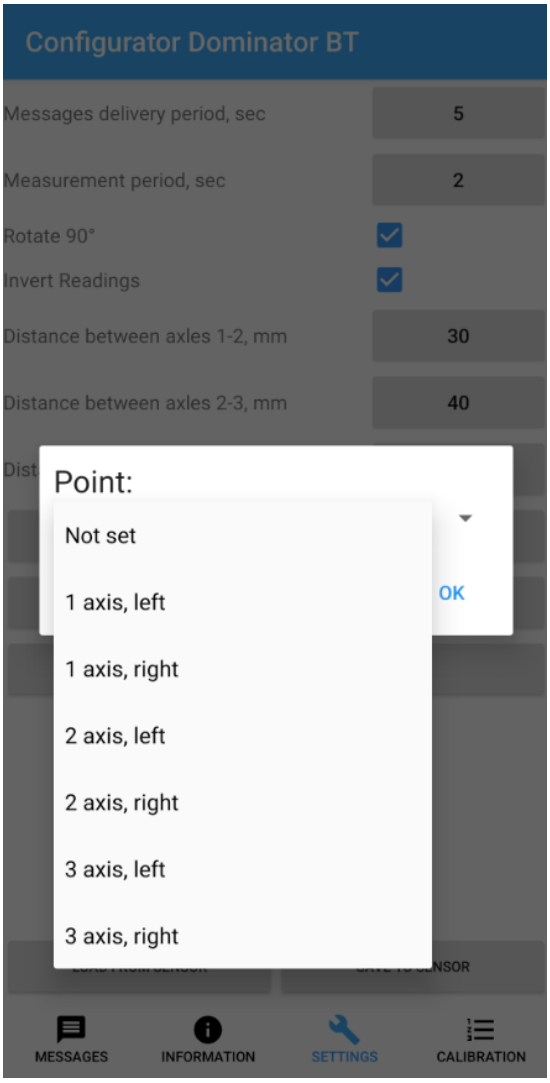


fig. 5.6. Sensor installation spot

5.4 TAB "CALIBRATION"

The tab **"Calibration"** contains the calibration table with its tools (fig. 5.7). The calibration table should contain sensor values for the loaded and unloaded axle. It is possible to add intermediate values to increase load readings accuracy.

fig. 5.7. Tab "Calibration"

The first column shows detector values. The second column shows axle load or cargo weight.

It is possible to change detector values manually. The rows highlighted in blue are included in the table. The rows highlighted in red is not included yet.

Tap the row to make it available for editing. Now the values of detector and axle load (cargo weight) may be changed.

Press «+» to add a row or «-» to delete it.

5.5 CALIBRATION METHODS

Sensor calibration process relates sensor output signal to vehicle real axle load (cargo weight). To calibrate the sensor, you need to create a calibration table with the minimal (empty vehicle) and maximal (fully loaded) axle load values.

E.g., the sensor shows 1200 value for the unloaded axle. Then, the vehicle is loaded and weighed with truck scales. The received sensor values are put into the table. Look at the example in fig. 5.7. A fully loaded vehicle has 9500 kg axle load that corresponds to 2463 sensor value in the last row. Optionally, you can add several more rows with partial loads to increase the accuracy of sensor readings. Based on the table values, the output signal determines cargo weight.

In the example in fig. 5.8, the axle load of an empty vehicle is 2500 kg, while the sensor value is 1545. After the vehicle is loaded, the sensor value is 2450 and the axle load is 8500 kg.

While measuring vehicle axle load, null value is a must. In this case, the detector value is set below the value of the unloaded axle. The example in fig. 5.8 has 1200 detector value as a null value.

There are two calibration methods:

- **Loading a weighted cargo:** then the calibration table has vehicle cargo weight and output sensor values correspond to cargo weight.
- **Axial vehicle weighing**: the calibration table has the axle load and, consequently, the output sensor values correspond to the axle load.

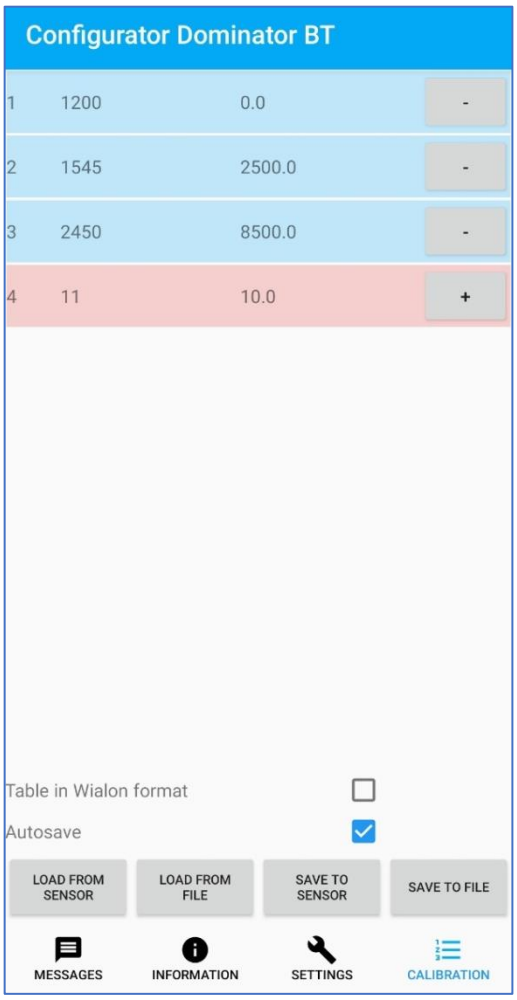


fig. 5.8. Axle load

To get correct axle load (cargo weight) data, the calibration table must have at least two rows: the first row with the sensor values for an empty vehicle and the second row with the values for a fully loaded vehicle.

Pay attention that the column "**Load, kg**" may have different meanings:

- Vehicle cargo weight (if the vehicle has only one axle load sensor installed and the cargo weight is measured by this sensor);
- Axle load measured with truck scales (platform scales or portable scales).

6 ADDITIONAL INFORMATION

6.1 STORAGE

It is recommended to store axle load sensors eurosens DPS BT in dry enclosed areas.

eurosens DPS BT must be stored in its original packaging at temperature range from -50°C to +40°C and relative humidity up to 100% at +25°C.

Do not store eurosens DPS BT with substances that cause metal corrosion and/or containing aggressive impurities.

The storage period of eurosens DPS BT should not exceed 24 months.

6.2 TRANSPORTATION

eurosens DPS BT must be transported in compartments that protect packages from mechanical damage and precipitation.

Air environment in transportation compartments must not contain acidic, alkaline and other corrosive impurities.

Shipping containers with eurosens DPS BT must be sealed.

6.3 DISPOSAL

eurosens DPS BT does not contain any substances or components that could be hazardous to health and the environment during and after the service life and disposal.

eurosens DPS BT does not contain any precious metals in the amount mandatory for accounting.

6.4 TECHNICAL SUPPORT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6.5 CONTACTS

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E-mail: office@mechatronics.by
eurosenstelematics.com/en

APPENDIX I. DATA TRANSFER PROTOCOL OF eurosens DPS BT

Field name	Specification	Example	Offset, byte.	Length, bytes.
40-bit Unique Identifier (UID)	constant	0x51B0724C60	7	5
Serial number		0x0D4AB5F2 (dec 223000050)	12	4
Message number	Message Overwrite Count	0x0003E6AA (dec 255658)	16	4
Status*	status flags	0x00 (dec 0)	20	1
Pressure, kPa. (0.1 kPa/ bit)	Current pressure. Resolution 0,1 kPa per bit.	0x0000 (dec 0, vol 0,0 kPa)	21	2
Weight, kg. (1 kg/ bit)	The current load. Resolution 1 kg per bit.	0x004E (dec 78, vol 78 kg)	23	2
Load (1% / bit)	The current load. Resolution 1% per bit.	0x27 (dec 39, vol 39 %)	25	1
Parameter number**	Cycling from 1 to 8	0x08	26	1
Parameter**	Meaning depends from parameter rumber	0x0201	27	2
Temperature, ° C. (1 ° C / bit)	The current temperature. Resolution 1 ° C per bit. Offset -40.	0x40 (dec 64, t +24 °C)	29	1
Battery charge (1% / bit)	The current battery charge. Resolution 1% per bit.	0x64 (dec 100)	30	1

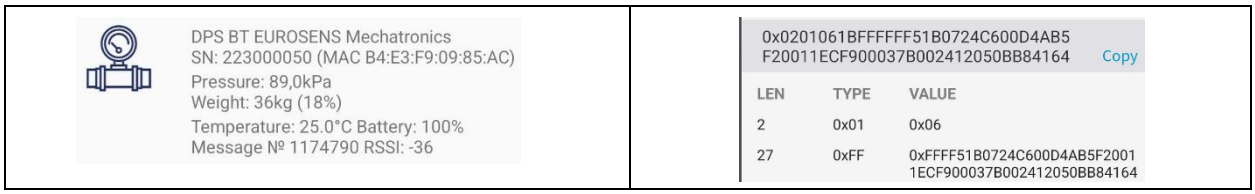
***) Bit position meaning**

Description	Bit number
Sensor locked	0
reserve	1 - 7

**)

Parameter number	Parameter
0	Chassis identifier (10 bytes), bytes 0-1
1	Chassis identifier (10 bytes), bytes 2-3
2	Chassis identifier (10 bytes), bytes 4-5
3	Chassis identifier (10 bytes), bytes 6-7
4	Chassis identifier (10 bytes), bytes 8-9
5	Distance between axles 1 and 2, mm
6	Distance between axles 2 and 3, mm
7	Distance for fifth wheel coupling, mm
8	Byte 0 – configuration type, 1 byte – installation place

Example:



APPENDIX II. DIMENSIONS

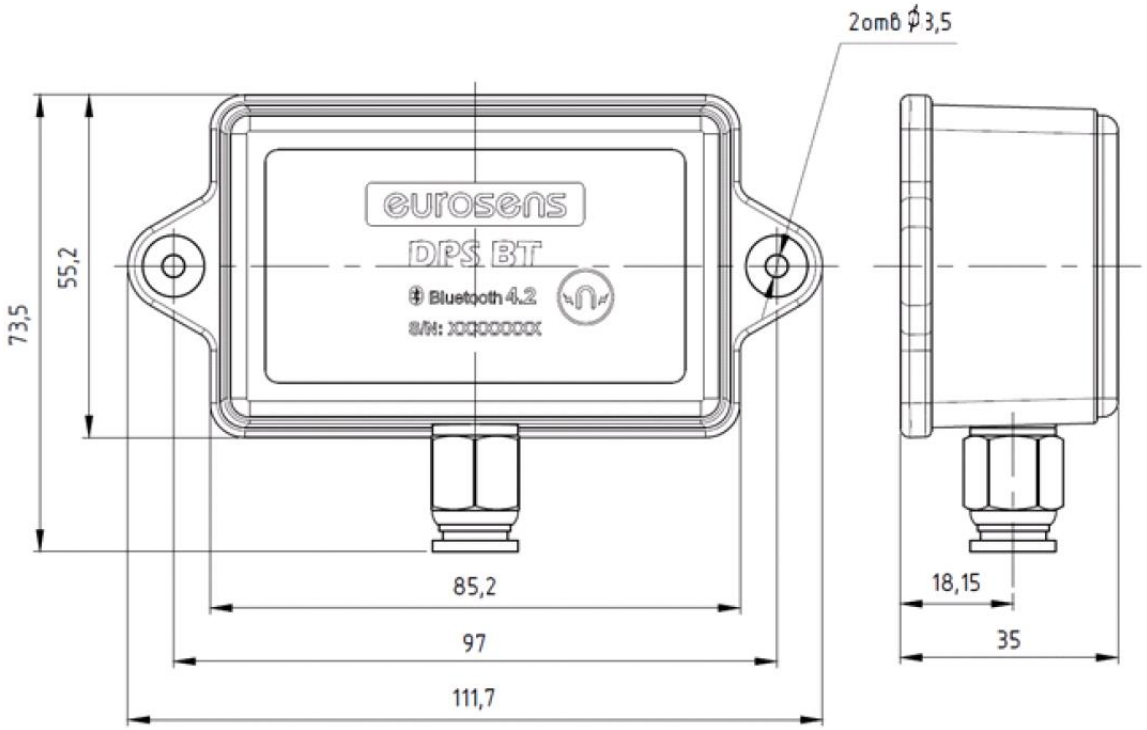


fig. II-1. eurosens DPS dimension