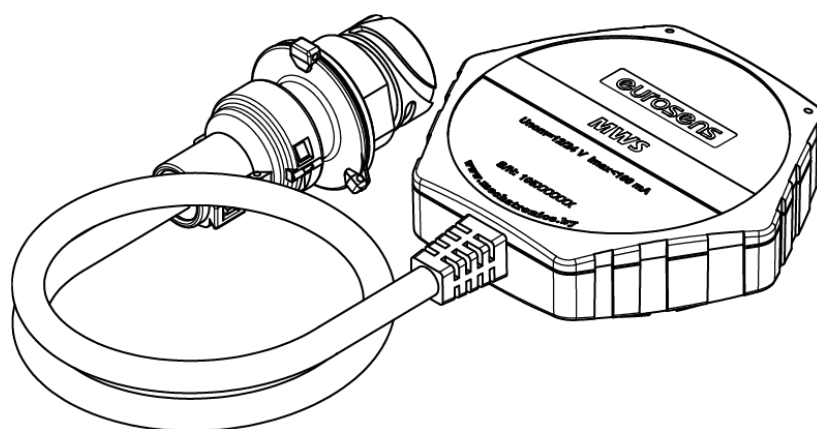


UNIVERSAL DISTANCE SENSOR

eurosens MWS 2



Operating Manual

1 Description and operation of eurosens MWS 2

1.1 Intended use

The eurosens MWS 2 universal distance sensor is used to measure the distance to an object or medium.

1.1.1 Typical applications

- Liquid level measurement in a tank.
- Measurement of bulk material height inside or outside a container.
- Measurement of distance to the ground or soil surface.
- Object presence detection.

1.1.2 Liquid level measurement in a tank

The sensor can be installed through an opening in the tank (Fig. 1) or bonded to the outer surface for non-invasive measurement (Fig. 2). An invasive installation is required for metal tanks. Non-invasive installation is possible on tanks made of dielectric materials (for example, plastic bulk containers for liquids), but the measurement result depends on the measured product and the tank wall thickness.



Fig. 1. Installation of eurosens MWS 2 through an opening in the tank

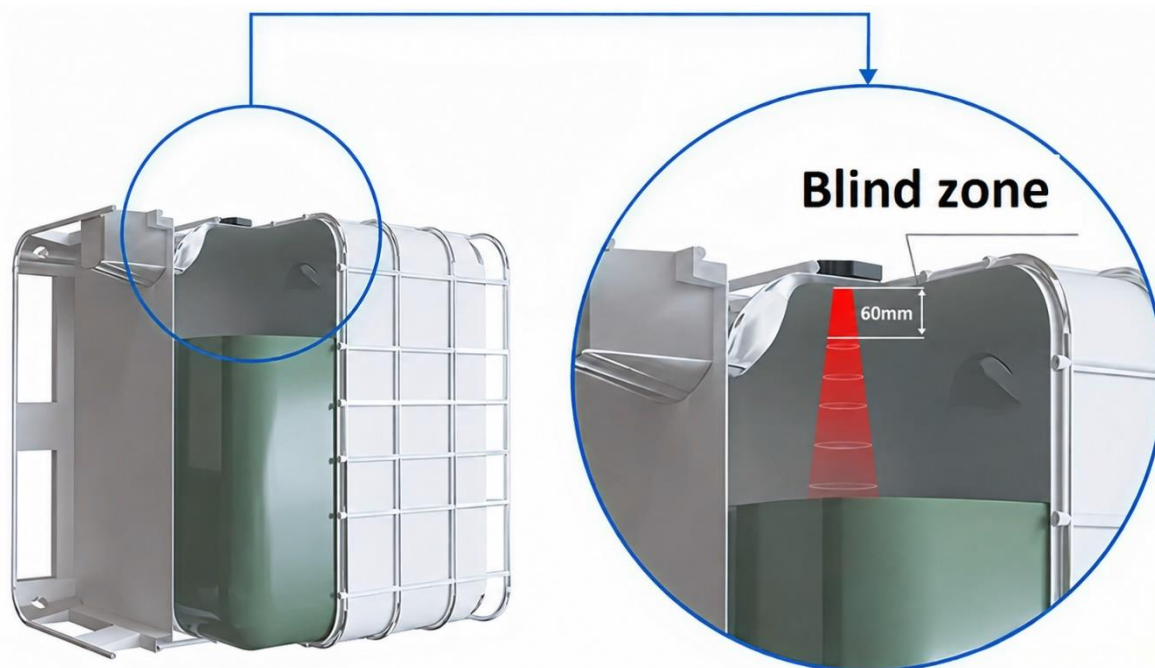


Fig. 2. Non-invasive installation of eurosens MWS 2 on the outside of the tank

1.1.3 Measurement of bulk material height inside or outside a container

The sensor can measure the height of bulk materials both inside and outside a container (Fig. 3).



Fig. 3. Bulk material measurement

1.1.4 Measurement of distance to the ground or soil surface

eurosens MWS 2 can be used in automatic position-control systems for special equipment where maintaining a specified distance to the ground is important.

1.1.5 Object presence detection

The sensor emits short microwave pulses toward the surface of the measured object. When a pulse reaches the surface, part of its energy is reflected back to the receiver, where it is processed by the sensor electronics. The time difference between the transmitted and reflected pulses is determined by the microprocessor and converted into distance. The product level in the tank is calculated from this distance (Fig. 4).

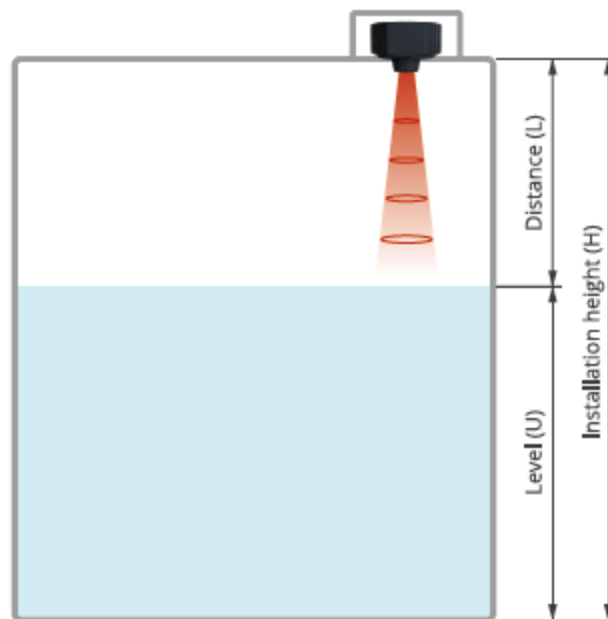


Fig. 4. Object presence detection

2 eurosens MWS 2 specifications

Table 1

Parameter	MWS 2
Supply voltage, V	10 - 50
Reverse-polarity protection	Yes
Measurement unavailable (dead zone)	60 mm from the lens
Measurement error	± 10 mm
Temperature range, °C	-40 - +85
Configuration interface	RS-485
Data interface	RS-485
Data transmission protocol	MODBUS, LLS
Ingress protection	IP 67



eurosens MWS 2 sensors have a "dead zone" in which measurement is inaccurate or impossible. The sensor should be installed (spacers may be used) so that the minimum distance from the lens to the maximum liquid level is not less than 60 mm.

3 Installing the eurosens MWS 2 sensor

3.1 Installation recommendations

- Select the sensor mounting location with the maximum distance to the measured object (empty tank).
- When installing the sensor, avoid objects or structures in the measurement zone that may interfere with propagation of the radio beam (pipes, fittings, cables, other sensors).
- Install the sensor so that the flow of liquids or bulk materials during loading/unloading DOES NOT enter the sensor measurement zone (Fig. 5).

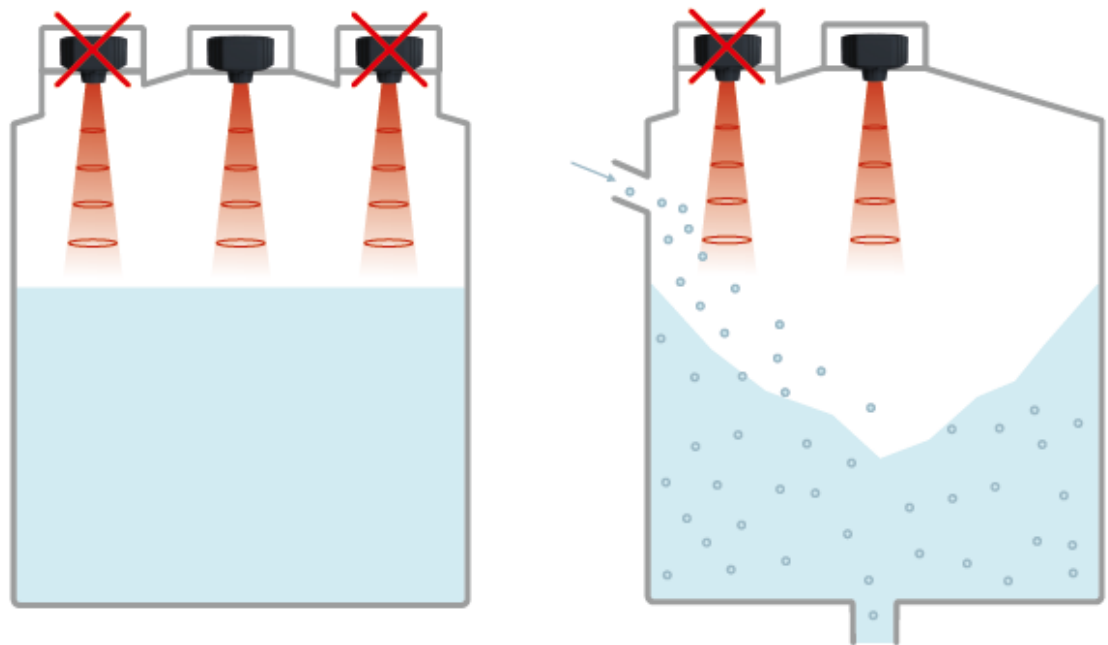


Fig. 5. Recommended sensor installation locations

- Aim the sensor at the lowest point of the container so that the product level can be measured over the full depth of the container.
- Install a sun shield above the sensor when it is installed outdoors.



The sensor may be installed at an angle.

The sensor can be installed in two ways:

- through an opening in the tank;
- bonding to the tank surface.

A bayonet mount included in the eurosens MWS 2 installation kit is used for mounting (Fig. 6).



Fig. 6. Installation kit

3.2 Installation through an opening in the tank

- 1) Drill a 38 mm diameter hole in the tank using a hole saw (Fig. 7).
- 2) Drill 5 holes for screws or self-tapping screws to match the holes in the bayonet plate.



Screws are recommended for tanks with a metal thickness of 3 mm or more (with threads tapped in the holes).

- 3) Install the flat rubber gasket from the installation kit between the tank and the bayonet plate.



If self-tapping screws are used, rotate the rubber gasket so that the screws DO NOT pass through the holes in the gasket.



Fig. 7. Opening for sensor installation

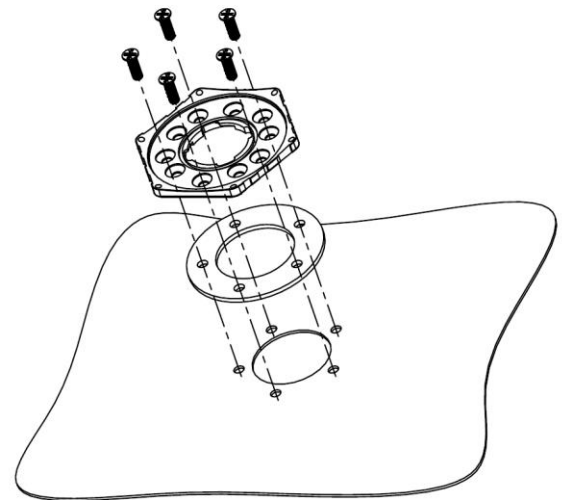


Fig. 8. Installing the bayonet plate

- 4) Install the bayonet plate using self-tapping screws or screws (Fig. 8).
- 5) Install the rubber O-ring in the groove of the bayonet plate.
- 6) Insert the sensor fully into the bayonet opening and turn it clockwise until it locks.



It is recommended to seal the sensor installation point.

4 Configuring eurosens MWS 2

Configurator MWS software and a service adapter (for example, [eurosens Destination 02](#)) are used to configure eurosens MWS 2.

4.1 Connection procedure

- 1) Download Configurator MWS from the eurosens MWS 2 product page and install it on your personal computer (PC).
- 2) Connect the service adapter to your PC.
- 3) Start the software. If an Internet connection is available and your Configurator version is outdated, the program will display a pop-up notification and offer to redirect you to cloud storage containing the new software version (Fig. 10).
- 4) Select the required COM port (Fig. 11).

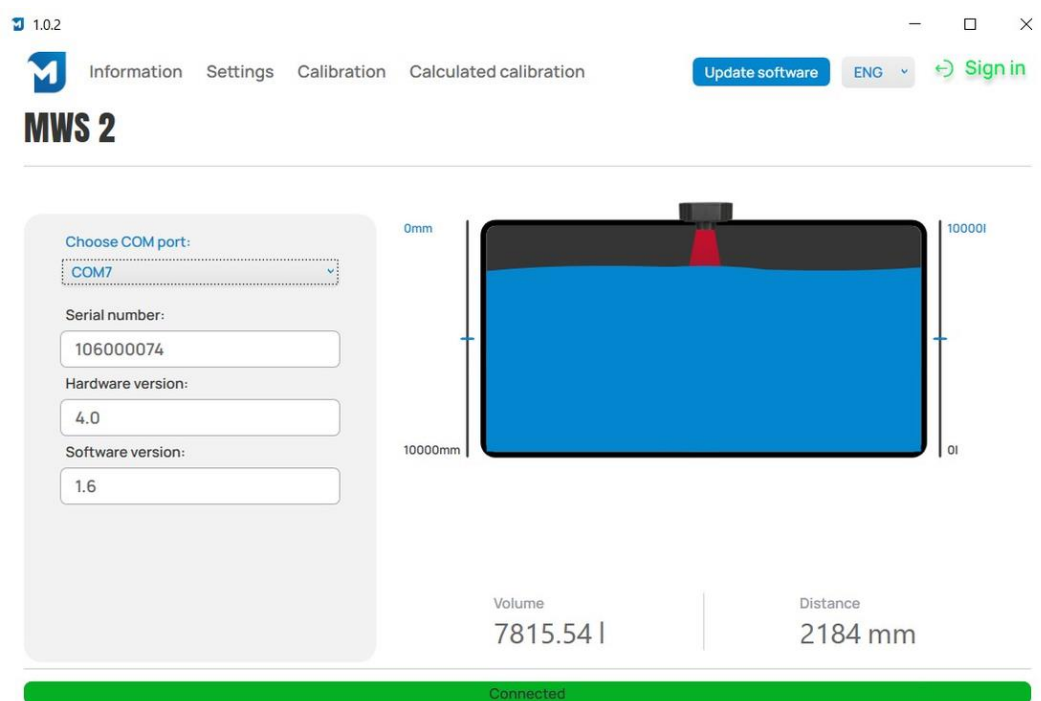


Fig. 9. Sensor operation menu

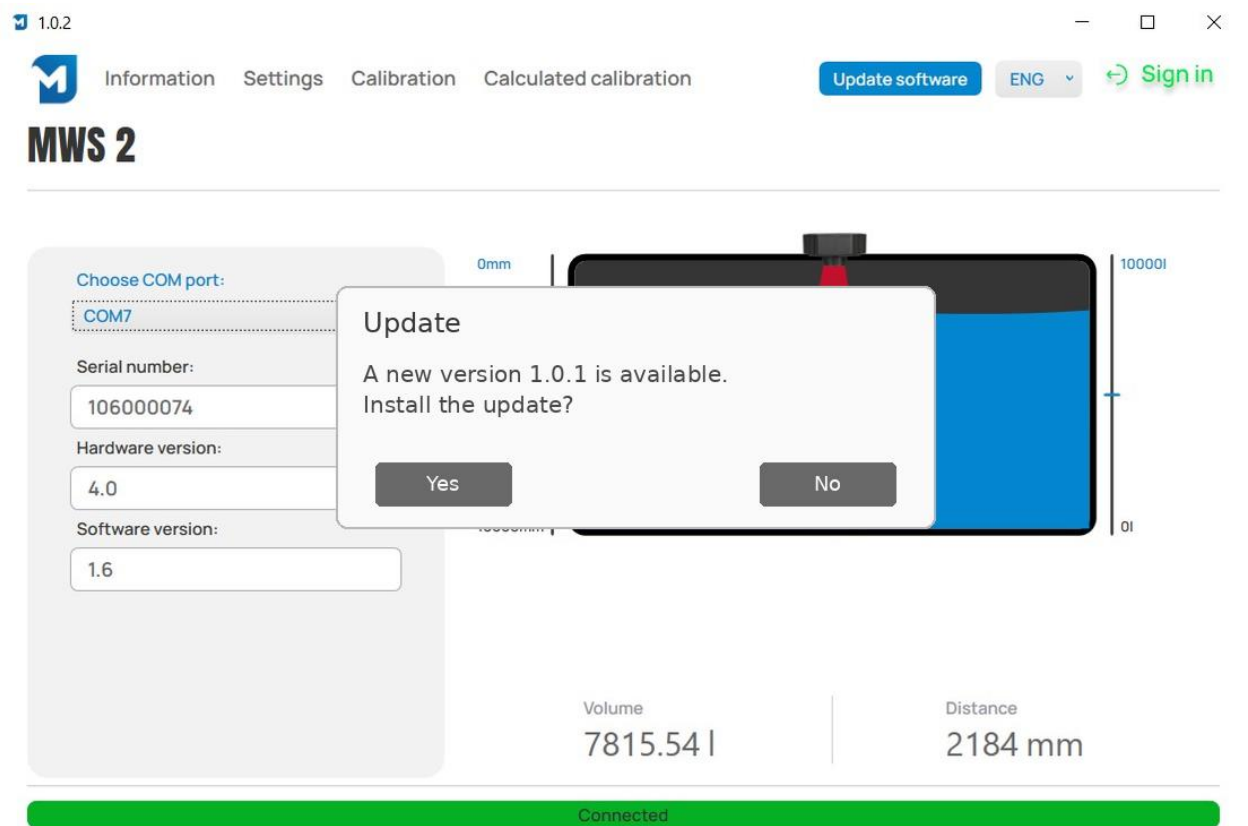


Fig. 10. Notification of a new software version

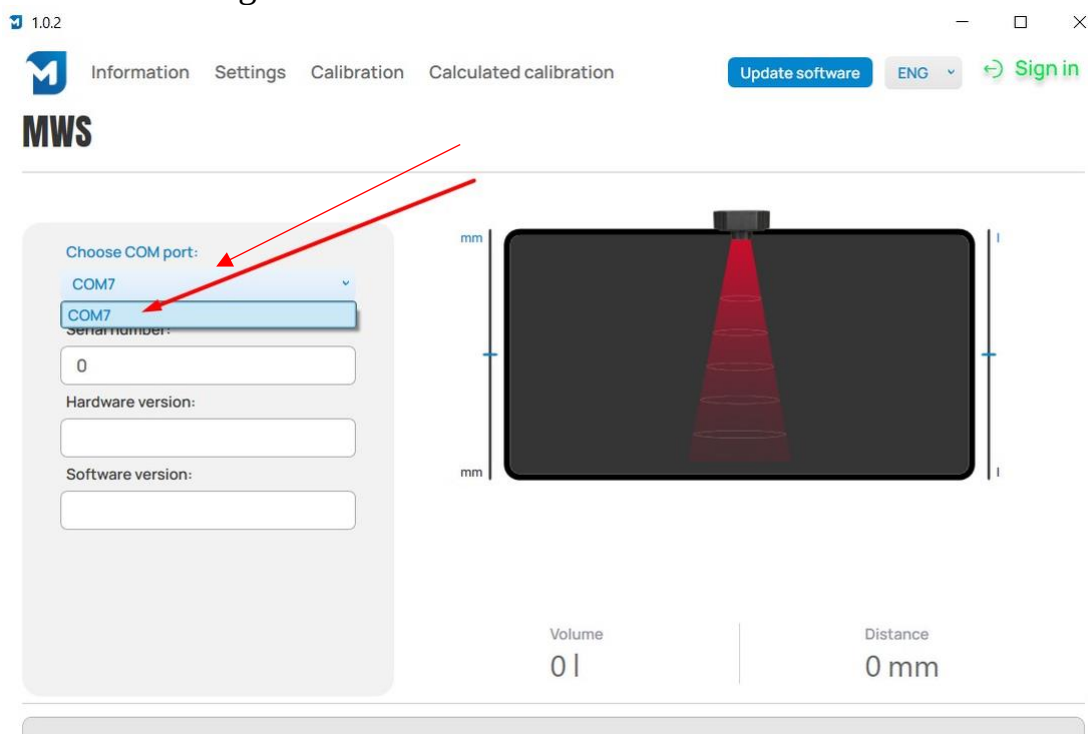


Fig. 11. Selecting the COM port

5) Connect the eurosens MWS 2 sensor to [eurosens Destination 02](#).

4.2 Working with the configuration software

4.2.1 Settings tab

The Settings window is shown in Fig. 12 and contains the following configurable parameters:

- **Sensor address** - the sensor address on the network;
- **Averaging** - the time interval over which measurement results are averaged;
- **Transmission speed** - the message transmission rate over the RS-485 interface. It can be set from 19200 to 115200;
- **Up line** (biasing) - provides a stable logic "1" state when there is no data exchange. Physical line A is pulled up to the interface supply, and line B is pulled down to the common wire;
- **Termination** - enables impedance matching of the RS-485 data bus. When this option is enabled, a 120 ohm termination resistor is connected to the data bus on the device side. Enable it only on the two end devices of the entire RS-485 bus.
- **Tank height** – the distance from the bottom of the container to the sensor lens. It is specified in meters; the parameter is set to the next whole number (+1). Example: for a measured distance of 2894 mm, set the parameter to 4 m.
- **Tank shape** - can be **regular** (rectangular/cubic) or rounded (**barrel-shaped**).
- **Surface shape** - can be flat (surface of the measured liquid) or indefinite (bulk or other materials).
- **Threshold sensitivity** - determines how weak a signal the sensor will accept as the liquid level. Closer to 0 means high sensitivity: the sensor responds even to a weak signal. Closer to 1 means low sensitivity: the sensor accepts only a strong, reliable signal. Decrease the value if the sensor does not detect the liquid. Increase the value if the sensor indicates a false level or responds to interference.
- **Signal quality threshold.**
A low value, for example -10...0, allows the sensor to accept even low-quality signals. Measurements are obtained more frequently but may be less stable. A medium value, for example 5...15, provides a balance between stability and sensitivity.
A high value, for example 20...30, means that the sensor accepts only very high-quality signals. Measurements become more reliable, but with weak reflection the level may not be detected.

Fig. 12. Settings window

4.2.2 "Calibration" tab

The "Calibration" tab (Fig. 13) is used when data must be transmitted as volume (liters) instead of distance values (mm).

Number	Value, mm	Volume, l
1	10000	0
2	0	10000

Fig. 13. Entering the calibration table

The sensor must also be calibrated on this tab. The sensor should be installed on the container, and the container must be empty. During sensor calibration, the minimum permissible distance from the lens to the surface must not exceed 300 mm. If this distance cannot be provided (a low tank), remove the sensor from the container, point it toward an area free of foreign objects, and click "Calibrate". The status must change from "Not calibrated" to "Calibrated".

Number	Value, mm	Volume, l
1	10000	0
2	0	10000

Current detector: 2188 Stable
Status: Calibrated
Portion in l: 10
Calibrate

Connected

Fig. 14. Sensor calibration.

Calibration (2-point and incremental)

For software-side calibration, it is sufficient to define two points on the Calibration tab: empty and full. In the "Volume" field, you can enter either the actual tank volume in liters or a value N (for example, 1-4095). For this operation, delete the existing records by selecting them and clicking "Remove the record". Install the sensor on an empty container, wait until the detector status is "Stable", enter 0 for empty in the "Portion" field (or N min), and click "Add a record" as shown in Fig. 15.1. Then fill the container and create the full value: enter the full container volume (or N max) in the "Portion" field and click "Add a record" as shown in Fig. 14.2.

The screenshot displays the eurosens MWS 2 software interface. At the top, there is a navigation bar with tabs: Information, Settings, Calibration, and Calculated calibration. To the right of the tabs are buttons for 'Update software', a language dropdown set to 'ENG', and a 'Sign in' button. Below the navigation bar, the title 'MWS 2' is followed by 'Read from file' and 'Save to file' buttons. On the far right, there is a 'Write to the sensor' button.

The main content area features a table with the following columns: Number, Value, mm, and Volume, l. The table contains one record with the number '1', a value of '3320', and a volume of '0'. Below the table are two buttons: 'Add a record' with a checkmark icon and 'Remove the record' with a red X icon. To the right of the table is a 'Current detector' panel. It displays '3320 Stable' in green, a status of 'Calibrated' in green, and a 'Portion in l:' field with the value '0'. Below this is a blue 'Calibrate' button.

Two red arrows are drawn on the interface: one points from the 'Add a record' button to the 'Value, mm' field of the first record, and the other points from the 'Volume, l' field of the first record to the 'Portion in l:' field in the 'Current detector' panel.

At the bottom of the interface, a green bar indicates the device is 'Connected'.

Fig. 14.1

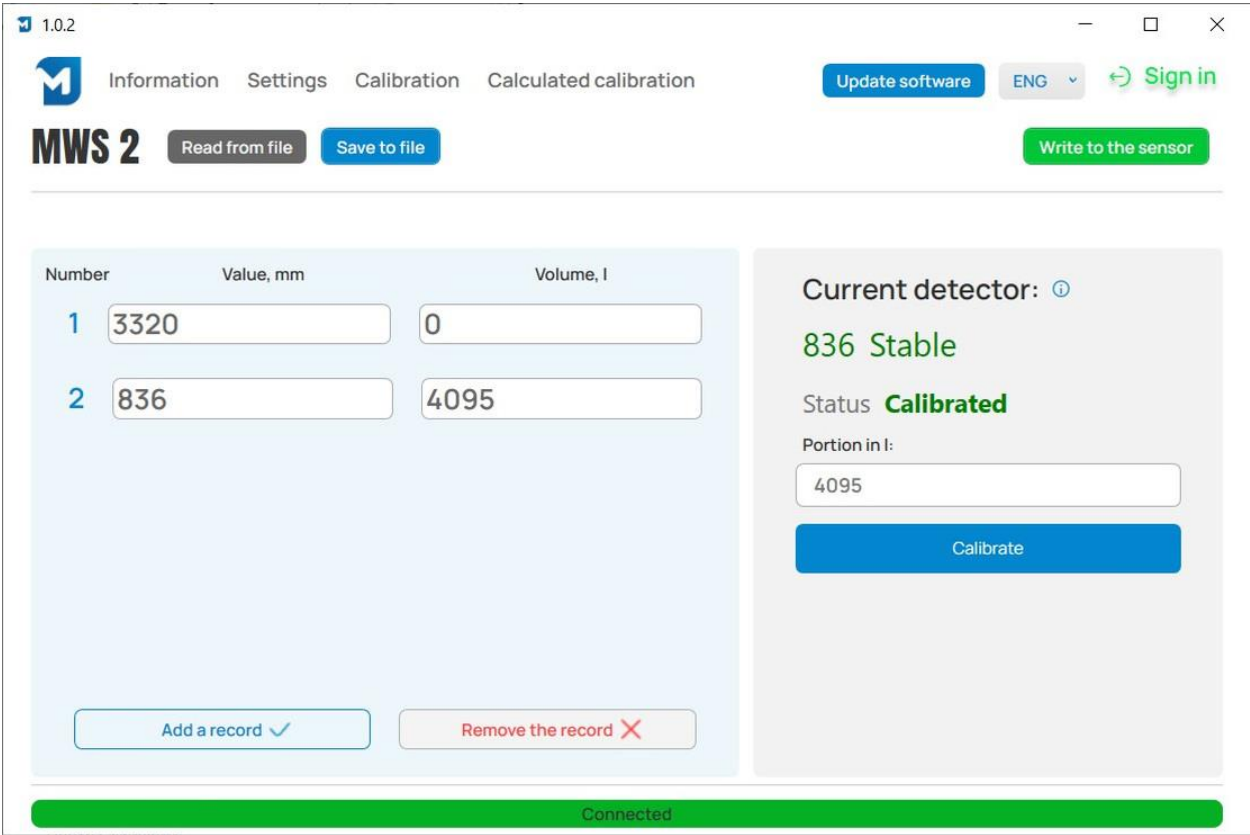


Fig. 14.2

For incremental calibration, the table-filling procedure is the same as for the "empty-full" method, with intermediate records added by entering values in the "Portion" field (Fig. 14.3).

The screenshot shows the MWS 2 software interface. At the top, there is a navigation bar with tabs: Information, Settings, Calibration, and Calculated calibration. The 'Calibration' tab is active. On the right side of the navigation bar, there are buttons for 'Update software', 'ENG' (language dropdown), and 'Sign in'. Below the navigation bar, there is a section for 'MWS 2' with buttons for 'Read from file' and 'Save to file'. On the right side of this section, there is a green button labeled 'Write to the sensor'. The main area of the interface is divided into two panels. The left panel contains a table with columns 'Number', 'Value, mm', and 'Volume, l'. The table has five rows of data. Below the table are two buttons: 'Add a record' (with a checkmark icon) and 'Remove the record' (with a red X icon). The right panel shows the 'Current detector' status. It displays '882 Stable' in green, 'Status Calibrated' in green, and 'Portion in l: 150' in a text box. Below this is a blue button labeled 'Calibrate'. At the bottom of the interface, there is a green bar with the text 'Connected'.

Number	Value, mm	Volume, l
1	3320	0
2	2370	150
3	1956	300
4	1769	450
5	882	600

Current detector: 882 Stable
Status **Calibrated**
Portion in l: 150
Calibrate

Connected

Fig. 14.3

After calibration, write the data to the sensor using the corresponding button. We also recommend saving the calibration file on the PC (Fig. 14.4).

This screenshot is similar to Fig. 14.3, but it highlights the 'Save to file' and 'Write to the sensor' buttons with red arrows. The 'Save to file' button is blue, and the 'Write to the sensor' button is green. The red arrows point from the text in the paragraph above to these two buttons.

Save to file Write to the sensor

Fig. 14.4

4.2.3 "Calculated calibration" tab

The "Calculated calibration" tab (Fig. 15) is used when calibration by filling/draining is not possible. For calculated calibration, enter the data according to the provided diagram (Fig. 16).

Fig. 15. "Calculated calibration" window

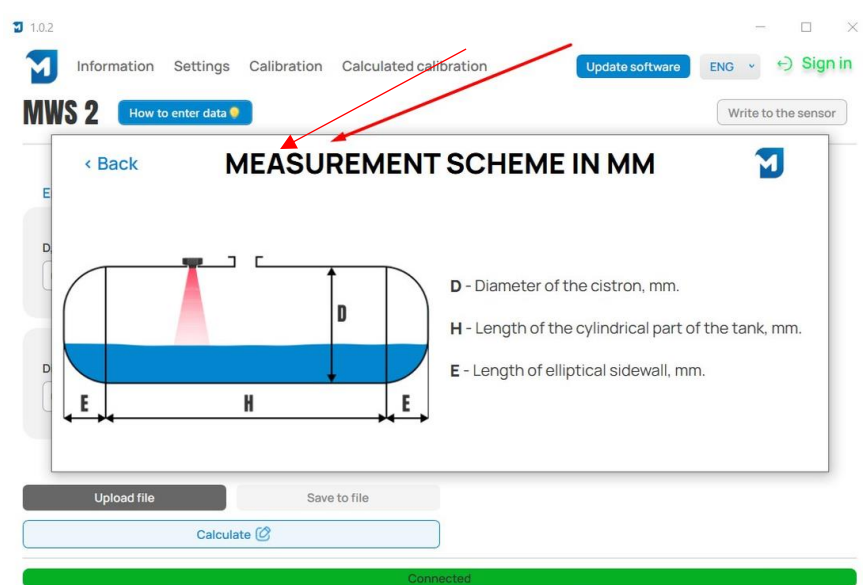


Fig. 16. Data entry diagram for the "Calculated calibration" window

Files in the "Calculated **calibration**" **window** can be used in three formats (Fig. 17): *.xls; *.xlsx; *.csv.

The screenshot shows the 'Calculated calibration' window of the MWS 2 software. The window has a top navigation bar with 'Information', 'Settings', 'Calibration', and 'Calculated calibration' tabs. Below the navigation bar, there's a 'Write to the sensor' button. The main area is titled 'Entry data' and contains three input fields for 'D, mm:', 'H, mm:', and 'E, mm:', each with a value of '0'. Below these is a larger input field for 'Distance from the sensor to the bottom of the tank, mm:' with a value of '0'. At the bottom, there are three buttons: 'Upload file', 'Save to file', and 'Calculate'. A red box highlights the 'Upload file' and 'Save to file' buttons, and a red arrow points to them from the right. The status bar at the bottom shows 'Connected'.

Fig. 17. Working with files in the "Calculated calibration" window

4.2.4 Software update

In the "**Software Update**" window, you can update the eurosens MWS 2 firmware when necessary. If Internet access is available and the installed firmware is not the latest version, the program will offer an automatic firmware update (Fig. 18). Without Internet access, the procedure can be performed manually (Fig. 19). This tab also allows you to restore the sensor to factory settings (Fig. 20).

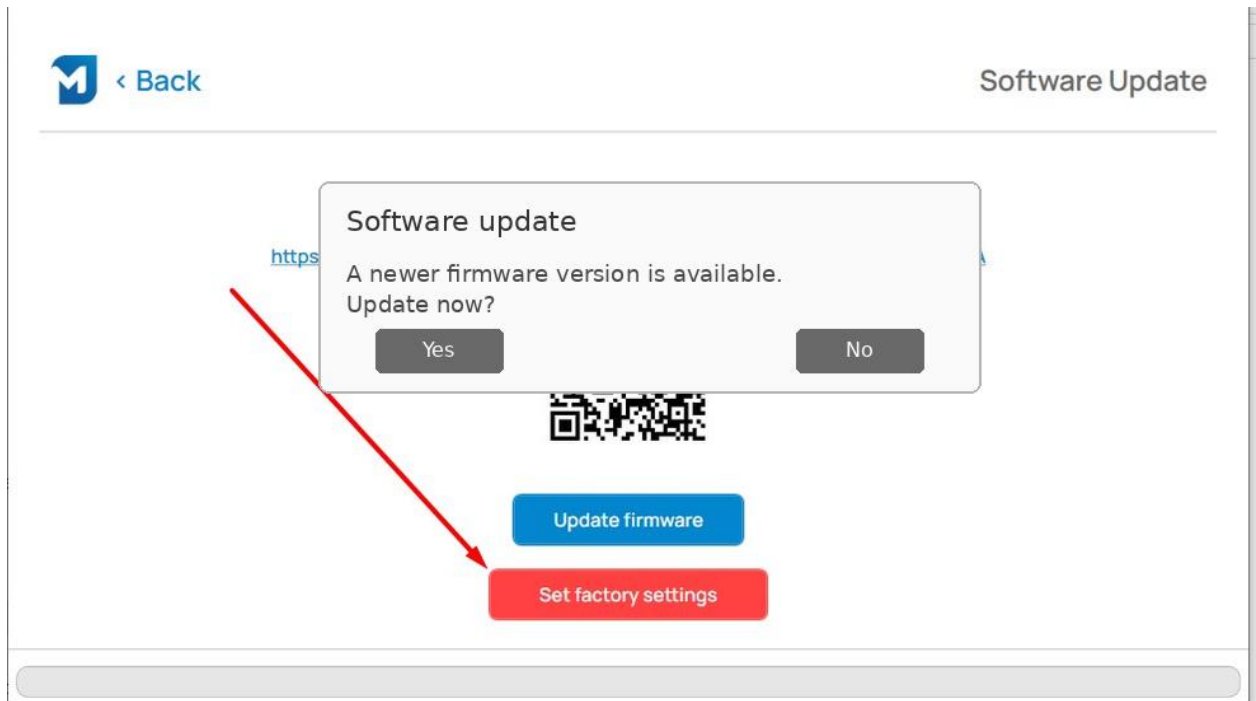


Fig. 18. Automatic software update prompt.

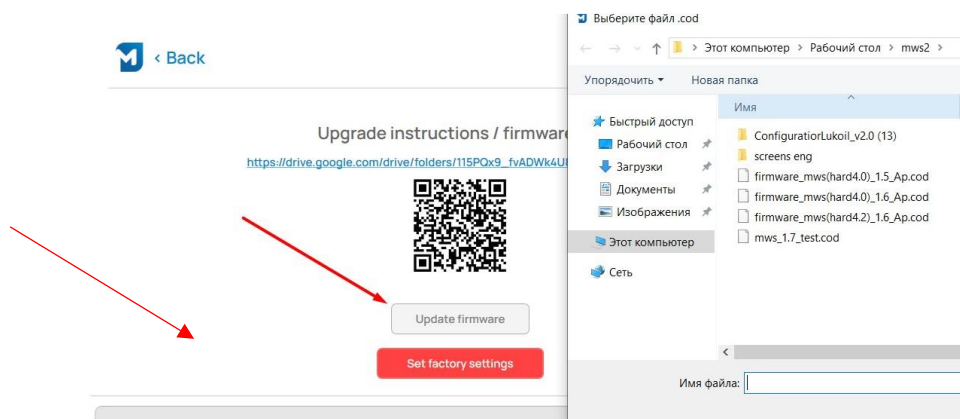


Fig. 19. Manual software update window

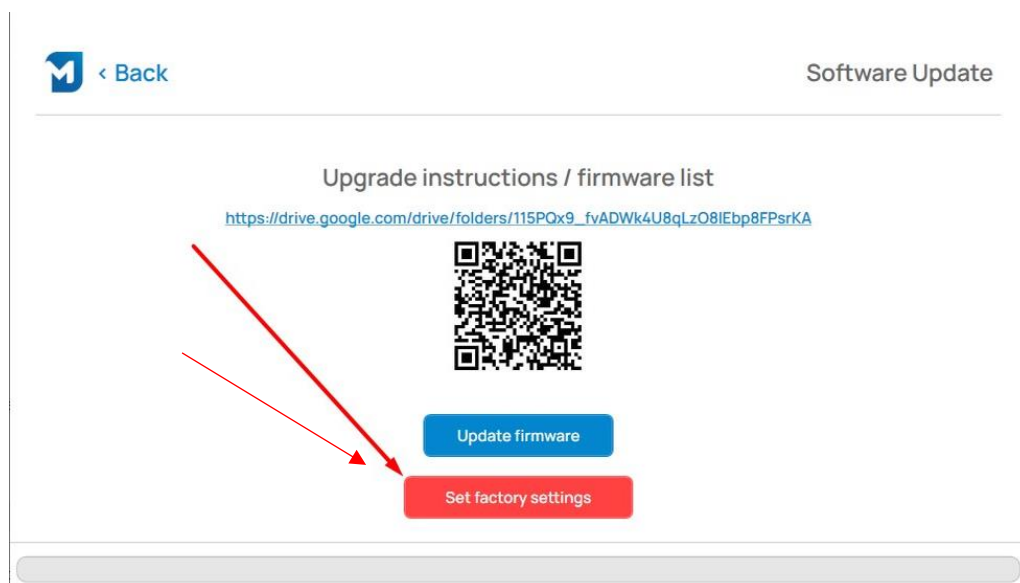


Fig. 20. Restoring the sensor to factory settings.

4.2.5 Synchronization with the mechatronics-service server software

In the **"Information"** window, you can sign in to the program (Fig. 21) using your credentials from <https://mechatronics-service.com>. Signing in is not required to use the program, but it allows settings data and sensor connection history to be saved automatically on the server.

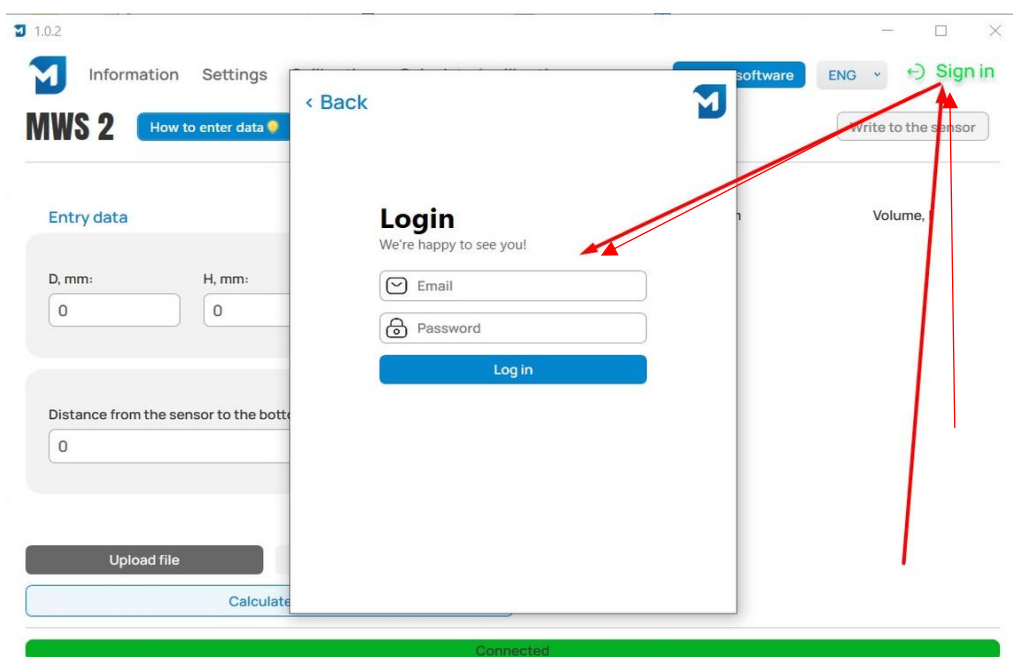


Fig. 21. Signing in to the program.

If sign-in is successful, the window will close and the sign-in button will change to "Sign out" (Fig. 22).

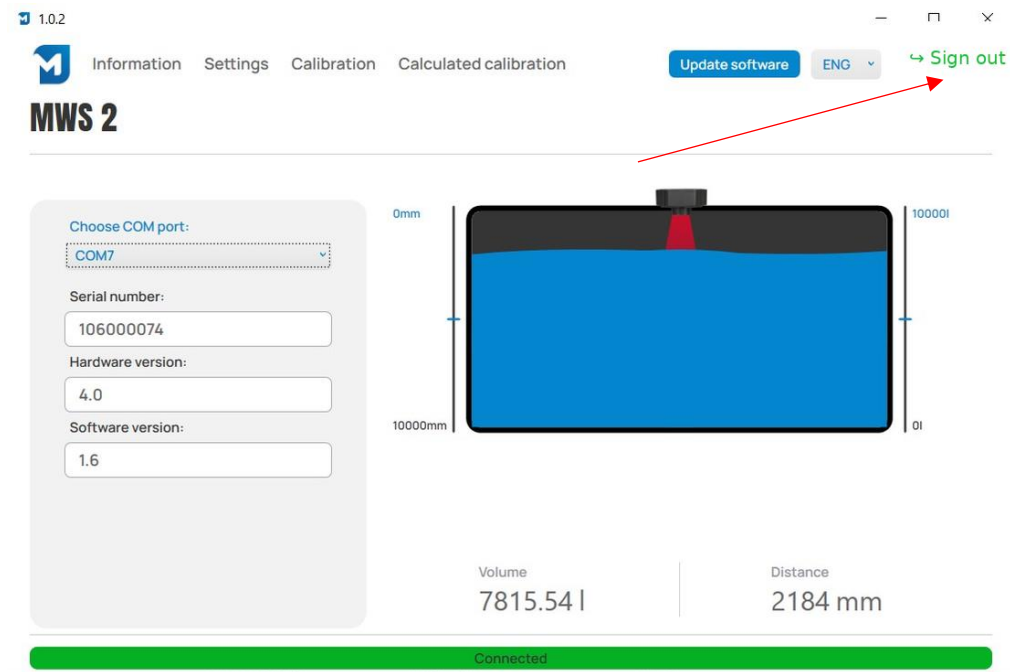


Fig. 22. Signed-in state.

5 Connection

eurosens MWS 2 is connected to the corresponding inputs of the monitoring/control device (for example, a vehicle monitoring terminal). The wire and connector pin assignments for eurosens MWS 2 (Fig. 23) are given in the product passport included in the package.

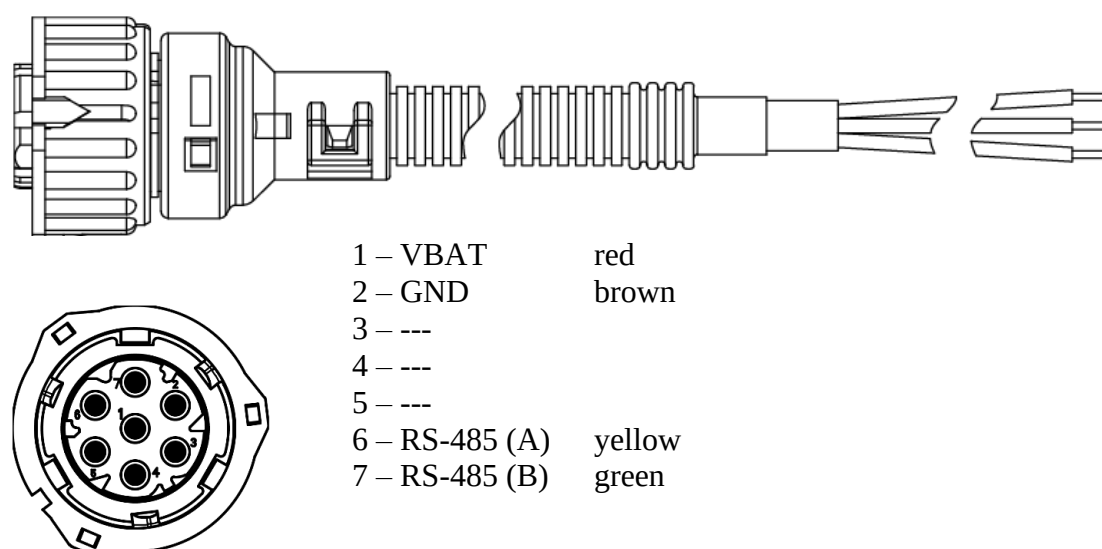


Fig. 23. Wire and connector pin assignments

Use special cables and splitters to connect eurosens MWS to a sensor network (Fig. 24).

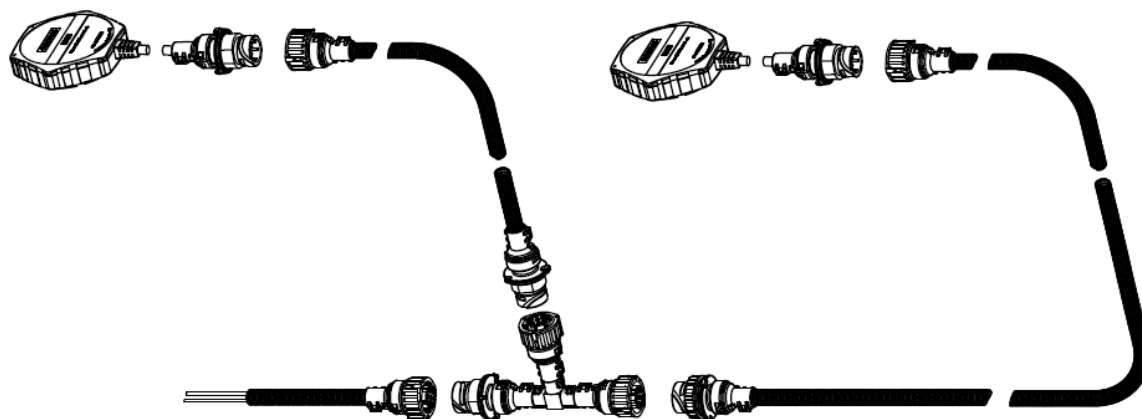


Fig. 24. Using T-Cable splitters

If eurosens MWS data must be displayed at the installation location, it is recommended to use [eurosens Display RS](#) or [eurosens Display CAN](#) (Fig. 25).

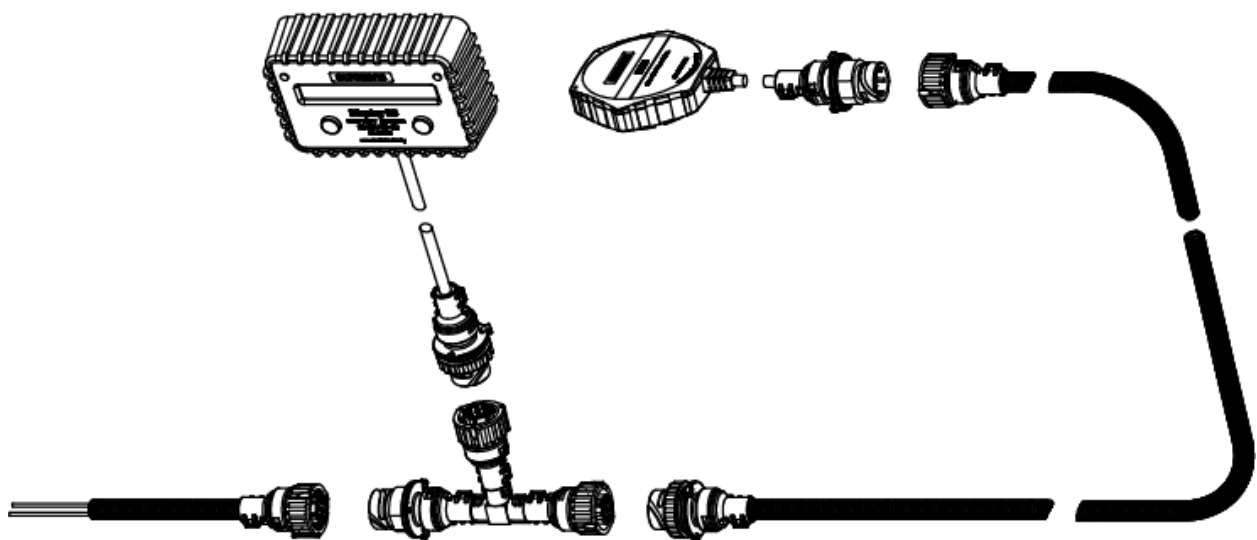


Fig. 25. Using the eurosens MWS 2 sensor with a display

6 Additional information

6.1 Storage

eurosens MWS should be stored in enclosed dry premises.

eurosens MWS may be stored only in the original packaging at temperatures from -50 to +40 °C and relative humidity up to 100% at +25 °C.

Do not store eurosens MWS in the same room with substances that cause metal corrosion and/or contain aggressive impurities.

The storage period for eurosens MWS must not exceed 24 months.

6.2 Transportation

eurosens MWS may be transported by any type of enclosed transport that protects the product from mechanical damage and prevents precipitation from reaching the packaging.

The atmosphere inside transport vehicles must not contain acidic, alkaline, or other aggressive contaminants.

Shipping containers with packaged eurosens MWS units must be sealed.

6.3 Disposal

eurosens MWS contains no harmful substances or components that pose a hazard to human health or the environment during operation, after the end of its service life, or during disposal.

eurosens MWS contains no precious metals in quantities subject to accounting.

6.4 Technical support

Tel.: +375 (25) 602-75-50

E-mail: support@mechatronics.by

6.5 Contacts

Mechatronics CJSC

222417, Vileyka, Republic of Belarus

Tel.: +375 (1771) 33011

Fax: +375 (1771) 24190

E-mail: office@mechatronics.by

www.eurosenstelematics.com

Appendix 1. LLS data transmission protocol

eurosens MWS 2 can transmit data via the RS-485 interface in accordance with the LLS protocol.

Table 1. LLS protocol data structure

Field No.	Field name	Length, bytes	Description
1	Prefix	1	This field marks the beginning of a message. Incoming messages must have the 31h prefix, and outgoing messages must be generated by the program with the 3Eh prefix.
2	Network address	1	The field contains: - for prefix 31h, the network address of the message recipient; - for prefix 3Eh, the network address of the message sender.
3	Operation code	1	The field contains: - for prefix 31h, the operation code that the program must execute; - for prefix 3Eh, the operation code to which the response is issued.
4	Data	Depends on operation code	The data composition and field format depend on the operation code.
5	Checksum	1	This field is used to verify data integrity.

Commands

0x06 - Single data read.

Single data read (command 06H)

The command is used to read the current data: volume and distance. Data is transmitted least significant byte first.

Table 2. Command 06h. Request

Offset, bytes	Length, bytes	Value	Description
0	1	31h	Prefix
+1	1	00h...FFh	Recipient network address
+2	1	06h	Operation code
+3	1	00h...FFh	Checksum

Table 3. Command 06h. Response

Offset, bytes	Length, bytes	Value	Description
0	1	3Eh	Prefix
+1	1	00h...FFh	Sender network address
+2	1	06h	Operation code
+3	1	00h...FFh	Status (see Table 5)
+4	2	0000h...FFFFh	Volume, l
+6	2	0000h...FFFFh	Distance, mm
+8	1	00h...FFh	Checksum

Appendix 2. Modbus data transmission protocol

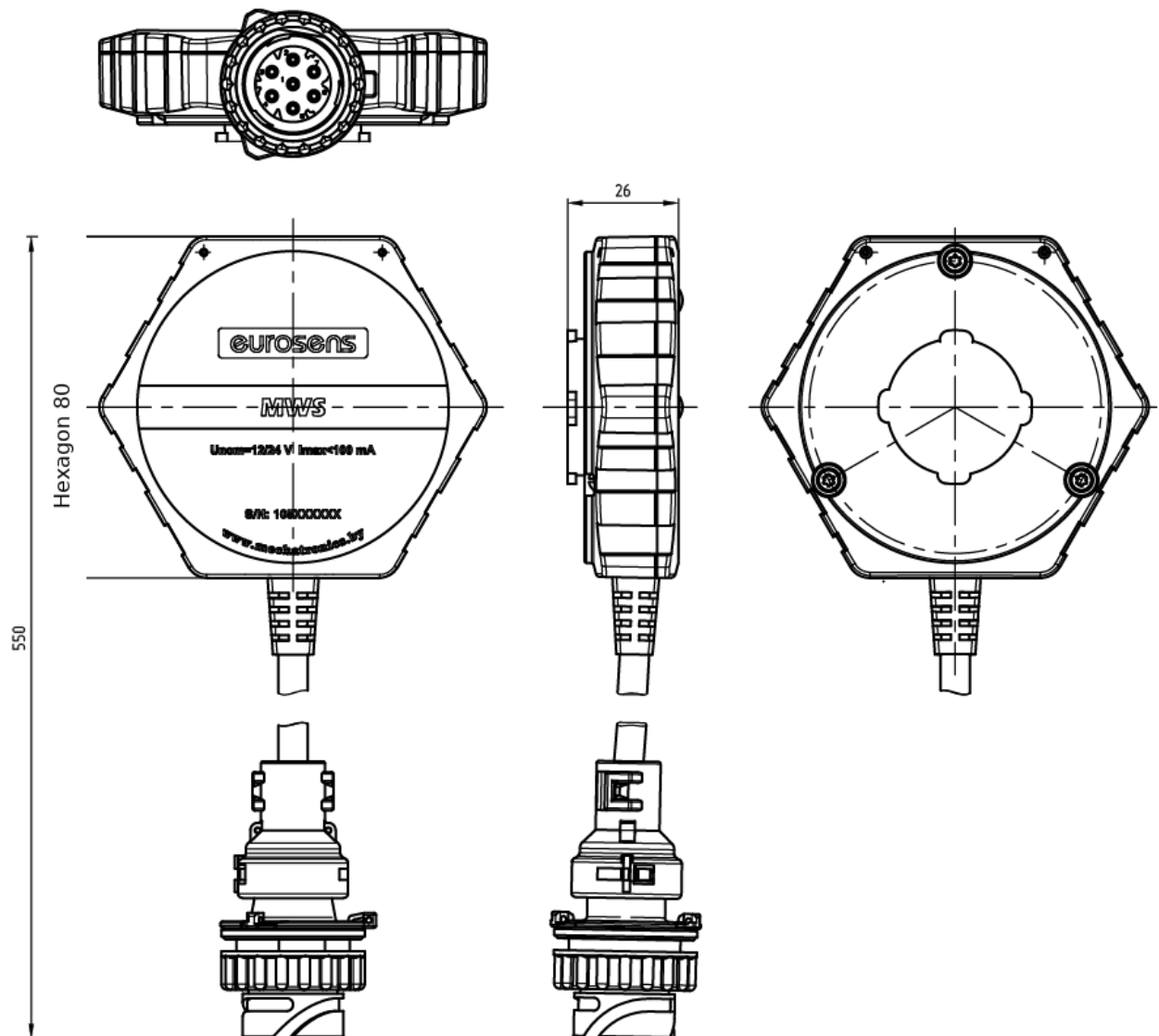
eurosens MWS 2 can transmit data via the RS-485 interface in accordance with the MODBUS protocol.

Table 4. Holding Registers - command **0x03/0x04**

Addressing byte-wise (1 byte)		Addressing two-byte (2 bytes)		Type	Description	Size
Address (10)	Address (16)	Address (10)	Address (16)			
0	0x00	0	0x00	Uint32_ t	Volume in 0.1 l	4 bytes
4	0x04	2	0x02	Uint16_ t	Distance, mm	2 bytes
6	0x06	3	0x03	Uint16_ t	Statuses	2 bytes

Description	Bit index
Stable and within operating range	0
Measurement obstruction	1
Dead zone	2
Outside operating range	3

Appendix 3. Dimensional drawing





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