

OMNICOMM

Omnicom LLS-Ex 5 Fuel Level Sensor and BIS-MX Spark protection unit

User Manual

Omnicom Configurator 6

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Omnicom LLS-Ex 5 Fuel Level Sensor and BIS-MX Spark protection unit

General Information

This User Manual is designed for Omnicomm LLS-Ex 5 fuel level sensor and BIS-MX Spark protection unit.

Omnicom LLS-Ex 5 sensor

Omnicom LLS-Ex 5 fuel level sensors are designed to measure fuel level in tanks of vehicles and stationary fuel storages.

Fuel level sensors also measure the temperature. RS-485 or RS-232 interfaces are used to exchange information with the device.

The Omnicomm LLS-Ex 5 fuel level sensor is installed on special types of equipment or on stationary fuel tanks and storages, which require equipment explosion protection and have the "0ExialBT6GaX" explosion protection label.

The sensor calibration is adjusted automatically when fuel composition or properties change.

The types of fuel in which the sensor can operate: gasoline, summer fuel and winter diesel fuel and other liquid light petroleum products.

Different versions of Omnicomm LLS-Ex 5 are available depending on the length of the measuring probe: 700 mm, 1000 mm, 1500 mm, 2000 mm, 2500 mm, 3000 mm. Any measuring probe longer than 3000 mm is composite.

The Omnicomm LLS-Ex 5 fuel level sensor is installed together with the BIS-MX spark protection unit manufactured by Omnicomm.

BIS-MX Spark protection unit

BIS-MX spark protection unit on voltage regulation tubes is designed to protect intrinsically safe circuits when exposed to a voltage of up to 250 V.

BIS-MX is designed to be located outside of the hazardous area.

BIS-MX is designed for installation in electrical circuits connecting Omnicomm LLS-Ex 5

General Information

fuel level sensor, located in a hazardous area, and an external device, located in an explosion-proof area, and limits the values of voltage and current to intrinsically safe.

BIS-MX must always be grounded when in use.

BIS-MX is part of the connected electrical equipment; it executes the “intrinsically safe electrical circuit” type of explosion protection - i, the “extra explosion-proof” level of explosion protection - a, and IIB category, carries the [Exia] IIB explosion-proof marking.

BIS-MX is a passive device.

Technical Specifications

Omnicom LLS-Ex 5 sensors

Parameter	Value
Level measurement range depending on the version, mm	0...700, 1000, 1500, 2000, 2500, 3000, 4000, 5000, 6000
REF-channel length, mm	- for sensors of 700, 1000 mm length - 200 - for sensors of 1500 mm length - 700 - for sensors of 2000, 2500 mm length - 1000 - for sensors of 3000 mm length - 1500 - for sensors of 4000 mm length - 2000 - for sensors of 5000 mm length - 2500 - for sensors of 6000 mm length - 3000
Limit of the allowed main reduced error of level, %	$\pm 0,5$ (when working with fuel for which the calibration have been performed, or upon filling up the tanker full in case of changing fuel type)
Interface for measured values output	RS-232, RS-485
Programmable interface transmission rate, bit/s	1200, 2400, 4800, 7200, 9600, 14 400, 19 200, 38 400, 57 600*, 115 200*
Measured values output protocol (protocol auto- detection)	LLS, Modbus
Power supply voltage, V	5,1

Technical Specifications

Parameter	Value
Power consumption, not more than, W	0,4
Current consumption, not more than, mA	40
Body protection rating	IP69k
Electric strength of galvanic insulation, not less than, V	7000
Terms of Use:	
Ambient temperature, °C	From -40 to +80
Extreme temperatures, °C	From -60 to +85
Maximum humidity, %	100
Digital code range corresponding to the maximum level measurement value	1...4095
Digital code range corresponding to the minimum level measurement value	0...4095
Temperature measuring range, °C	From -40 to +80
Measurement time period, sec	1

Technical Specifications

Parameter	Value
Automatic data output interval, sec	From 1 to 255
Operating mode	Continuous
Overall dimensions, cm	87.3 x 83.5 x (21 + measuring probe length)
Weight, not more than, kg	2
Average service life before sensor failure, not less than, hours	100 000
Average service life, years	12
** In addition to LLS-Ex 5 sensors when connected via RS-232 interface using 20 meter KTZ cable	

BIS-MX Spark protection unit

Parameter	Value
Power supply voltage, V	8 - 50
Maximum input voltage U_m , V	250
Open-circuit voltage U_0 , V	2 x 5.1

Electrical Parameters of Intrinsic Safety

Parameter	Value
Short-circuit current I_0 , A	2 x 0.13
Maximum external capacitance C_0 , μF	2 x 15
Maximum external inductance L_0 , mH	2 x 1.0
Operating temperature range, $^{\circ}\text{C}$	From -60 to +80
Body protection rating	IP69k
Overall dimensions (without cables), mm	138 x 115 x 56
Weight, not more than, kg	0.9
Average service life, years	12

Electrical Parameters of Intrinsic Safety

Omnicom LLS-Ex 5 sensor

Parameter name	Value
Maximum input voltage, U_i , V	5.5
Maximum input current, I_i , A	0.06
Maximum internal capacity, C_i , μF	10

Special conditions for safe operation of Omnicomm LLS-Ex 5

Parameter name	Value
Maximum internal inductance L_i , mH	0.5

Special conditions for safe operation of Omnicomm LLS-Ex 5

In order to avoid ignition from frictional sparks (which appear from friction or collision), it is recommended to install at places which restrict access to the exterior parts of the fuel sensor. It is necessary to protect the sensors body from accidental shocks or friction.

It is recommended to use a protective seal cover.

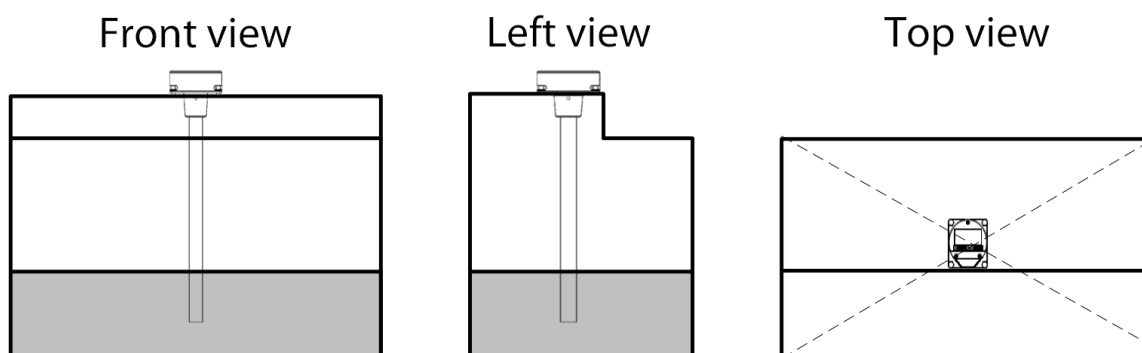
It is not recommended to use a sensor with the damaged paint coating.

Preparation

Fuel Tank Preparation

1. Select the location for Omnicomm LLS-Ex 5 sensor installation subject to the following requirements:

- Installation location should be as close as possible to the geometric center and placed at the deepest level of the tank:

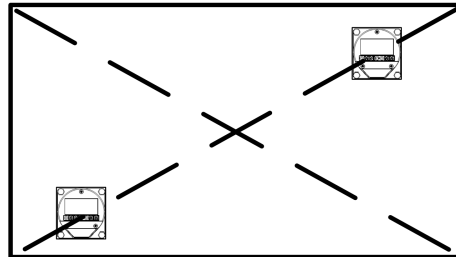


- When installed, the sensor should not be in contact with reinforcement ribs and auxiliary equipment inside the tank

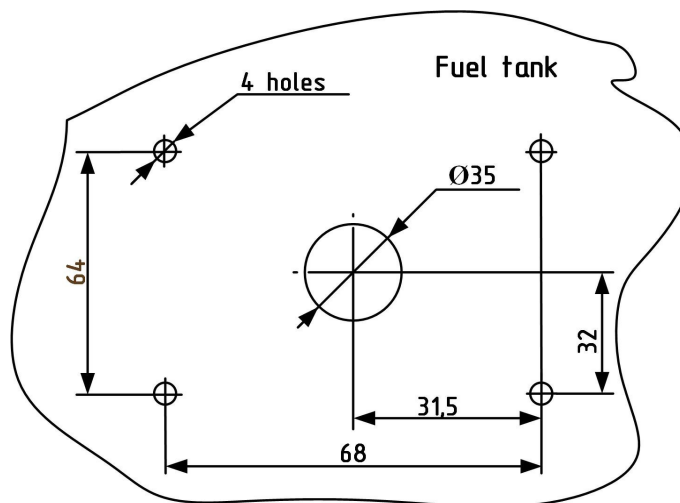
Special conditions for safe operation of Omnicomm LLS-Ex 5

- Installation of two sensors in one fuel tank allows for significant reduction of the fuel level dependence on the vehicle inclination angle:

Top view



2. Steam out the tank to ensure compliance with the safety rules
3. Drill out the central bore by bimetal core drill $\varnothing 35$ mm
4. Drill out four mounting holes according to the diagram:



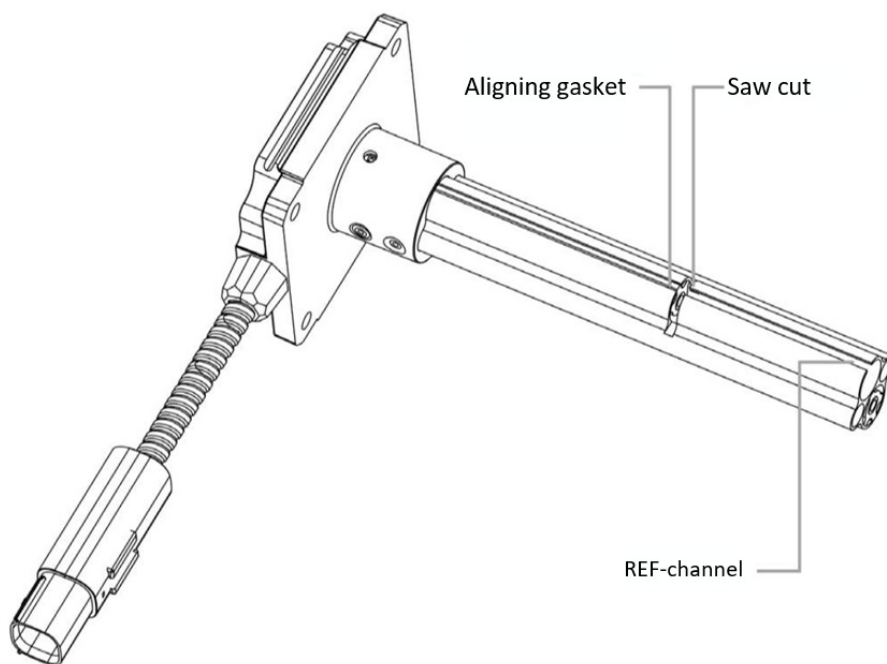
The mounting hole diameter depends on the tank material:

- $\varnothing 4$ mm – for metal tanks with wall thickness over 3 mm (cut M5 thread)
- $\varnothing 7$ mm – for plastic and metal tanks with wall thickness up to 3 mm (for rivets)
- $\varnothing 4$ mm – for plastic tanks with wall thickness over 3 mm

Sensor Preparation

1. Cut the sensor measuring probe according to the following recommendations:

- The length of the sensor measuring part should be 20mm less than the depth of the tank.
- The REF channel must be at least 100 mm shorter than the measuring part of the sensor. If the difference is less than 100 mm, trim the REF channel according to the figure:



2. Install the central partition into the sensor measuring part at the depth of 1 cm.

Cut the REF channel (only if the length of the REF channel and the measuring part is less than 100 mm):

1. Install the central partition in the REF channel in close proximity to the cut point.
2. Cut with a cutting wheel (max. 125 mm in diameter)
3. Remove a section of the REF channel rod

The REF channel rod is shorter than the main measuring rod and is located on the right when looking at the sensor body on the connector side.

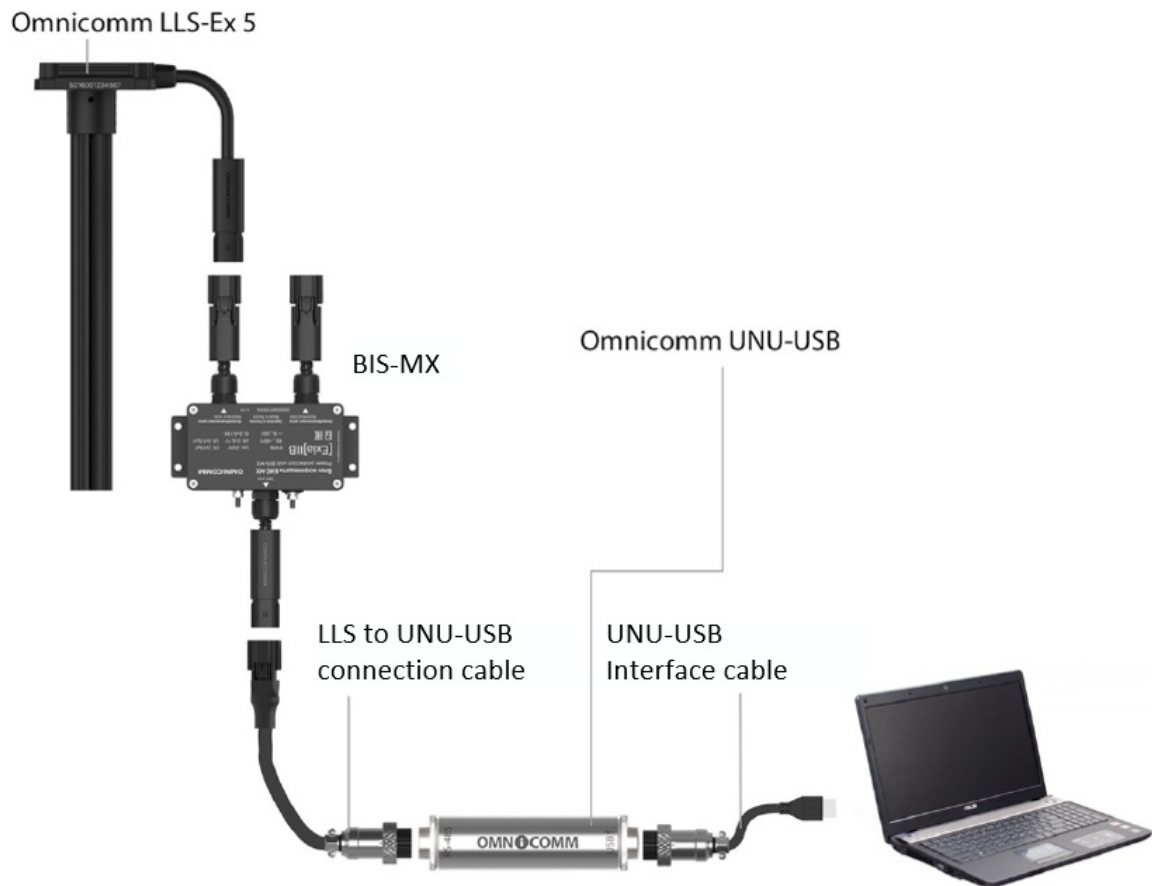
Setting

Setting

Firmware update is only done via RS-485 interface connection.

Connect the sensor to a PC.

Omnicom LLS-Ex 5 sensors are connected according to the schemes:



Run the Omnicomm Configurator program on your PC.

Setting

Omnicom Configurator (PC):



Fuel level is displayed without regard for filtration.

Setting

“Full/Empty” Calibration

During Full-Empty calibration and subsequent calibration of the fuel tank using one type of fuel, it is recommended to turn on “Auto-adjustment” (see [Sensor Settings](#)). Perform the automatic adjustment and save the settings in the fuel level sensor.

1. Fill the measuring container with fuel
2. Immerse the Omnicomm LLS-Ex 5 sensor in the fuel to the full length of the measuring probe
3. Wait for the green “Stabilized” indicator to appear.
Press “Full” to set the value corresponding to a full tank
4. Take the Omnicomm LLS-Ex 5 sensor out of the container and allow the fuel to flow down the measuring piece for 1 minute. Press “Empty” to set the value corresponding to an empty tank
5. Press the “Record into device” button

Omnicom LLS-Ex 5 Sensor Settings

“Automatic adjustment” - turn on for automatic adjustment of measurements in case of a change in the permittivity of the fuel. Upon activation of auto-tuning, changes of level caused by thermal expansion of the fuel will be displayed, i.e. the level will be shown considering the current temperature. The setting is only available after sensor calibration.

To adjust automatically Omnicomm LLS 5 sensor calibration values, full fuelling of the tank is required when operating the vehicle. When the tank is to be fully fueled, the max length of the measuring part that does not emerge into the fuel shall not exceed 10 cm from the sensor's flange. When operating a vehicle with insufficient fuel level in the tank, auto-tuning cannot be performed.

“Network address” (1 to 254) – set the network address for the Omnicomm LLS fuel level sensor. When several sensors are connected to one external device, they should have unique network addresses.

“Min level” (0 to 4095) – select the minimum reading for the Omnicomm LLS-Ex 5 fuel level sensor. Default value – 0.

“Max level” (1 to 4095) – select the maximum reading for the Omnicomm LLS-Ex 5 fuel level sensor. Default value – 4095.

“Filtering” – set the output signal filtration parameters:

- **“No”** – no filtering is applied, only isolated strong drifts are excluded.
- **“Minimum”** – the data interval for filtering is approximately 15 seconds. Used for city roads
- **“Medium”** – the data interval for filtering is approximately 30 seconds. Used for vehicles operating at regular road conditions
- **“Maximum”** – the data interval for filtering is approximately 5 minutes. Used when vehicles operate at severe road conditions and is not a recommended setting as it may cause delays in fuel readings after a refueling/draining operation

“Baud rate” – select the rate for data exchange with external devices. Default value – 19,200 bit/s.

“Automatic data output” – select:

- **“Disabled”** – no independent data output (without request) is performed
- **“Enabled”** – independent binary data output

Installation and Connection

- "Data output interval" (1 to 255 seconds) – set the automatic data output interval

The automatic data output mode can be used only when not more than one Omnicomm LLS 5 sensor is connected to one interface and using exclusively the LLS protocol.

"Compensate for thermal expansion of fuel" - Check the checkbox to disable the fuel level change due to temperature change when the automatic adjustment is on.

- "Compensation algorithm threshold" - set the difference of the sensor reading by which the fuel level is allowed to change due to the temperature change without compensation. Default value – 200.

"Modbus function" - select the Modbus protocol function. The default value: 3. Possible values:

- "3" - holding register reading
- "4" - input register reading

Fuel level sensor detects the protocol automatically - LLS or Modbus - and responds in the protocol of the request

"Level" - the address of the register with fuel level is specified, default value: 40001. Possible values:

- If "Modbus function" = 3, the allowed register value range is 40001-49999
- If "Modbus function" = 4, the allowed register value range is 30001-39999

"Temperature" - the address of the register with sensor temperature is specified, default value: 40002. Possible values:

- If "Modbus function" = 3, the allowed register value range is 40001-49999,
- If "Modbus function" = 4, the allowed register value range is 30001-39999

Installation and Connection

When installing the fuel level sensor onto the plastic fuel tank it is important to provide a secure electrical connection between the sensor's body and the frame of the vehicle. If this condition isn't met, it can lead to sensor malfunction caused by static electricity.

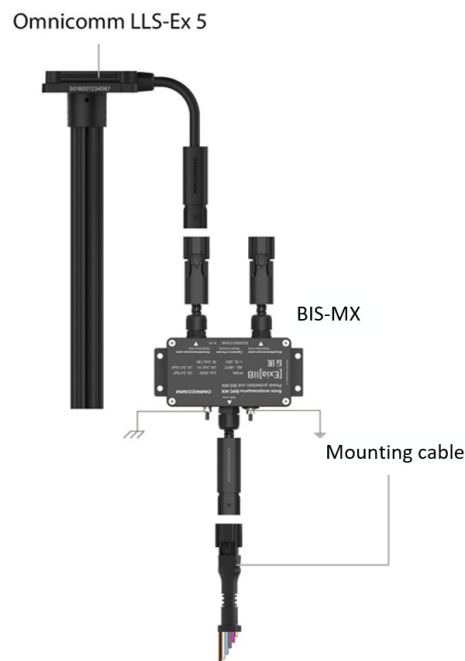
Installation and Connection

For installation onto cylindrical fuel tanks with the diameter 420...710 mm follow the instructions in the section [Fuel level sensor installation recommendations for cylindrical fuel tanks](#).

1. Put the vendor furnished mounting point gasket on the Omnicomm LLS-Ex 5 sensor measuring probe
2. Put the Omnicomm LLS-Ex 5 sensor into the tank and fix it:
 - when securing with bolts, first put on a spacer and a spring washer
 - when securing to a plastic tanks with a wall thickness over 3 mm, use vendor furnished self-tapping screws

3. Connect the Omnicomm LLS sensors to an external device:

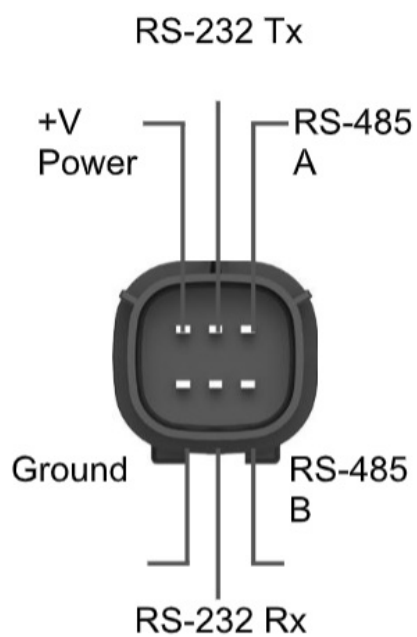
Omnicomm LLS-Ex 5 according to the scheme:



4. Connect the device and the BIS-MX unit using a KTZ-MX cable (where y is the length of the cable, e.g. KTZ-10MX) manufactured by Omnicomm. The use of other mounting cables, as well as the extension or reduction of the standard cables, is forbidden.

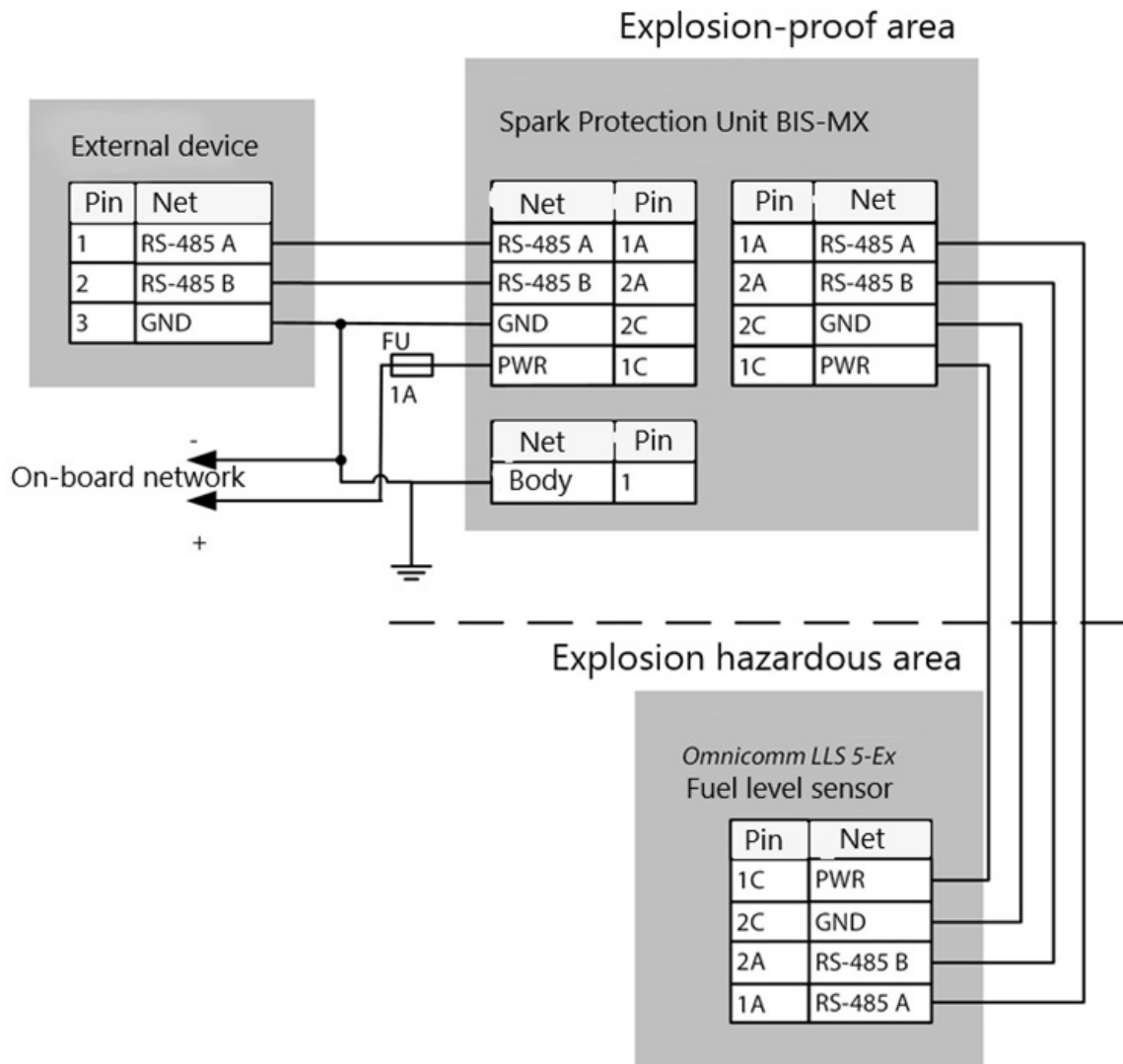
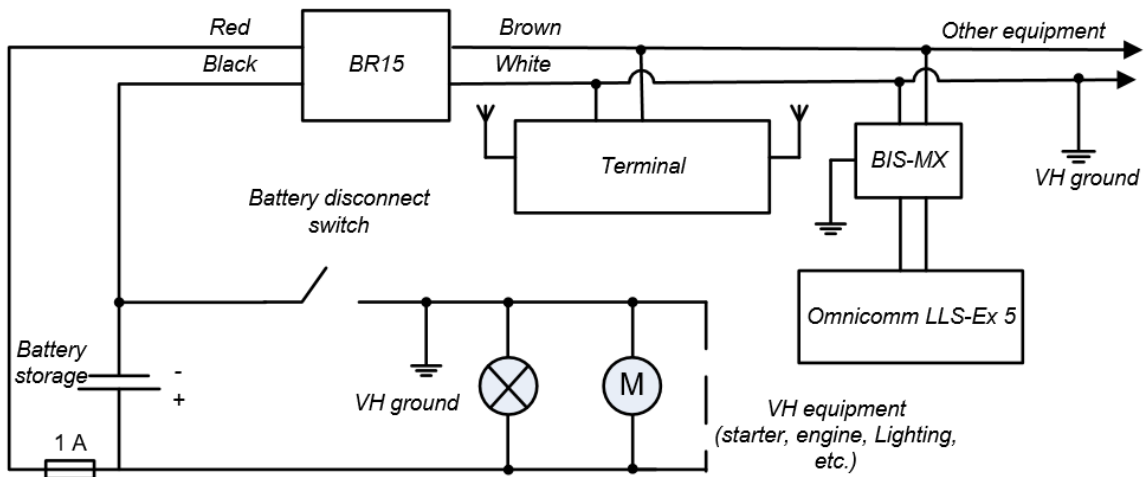
Pinout of the sensor connector:

Installation and Connection



Name of the signal	Color of the wire
RS-485 A	Orange-white
RS-485 B	Blue-white
RS-232 Tx	Pink
RS-232 Rx	Gray
+V Power	Brown
Ground	White

Installation and Connection



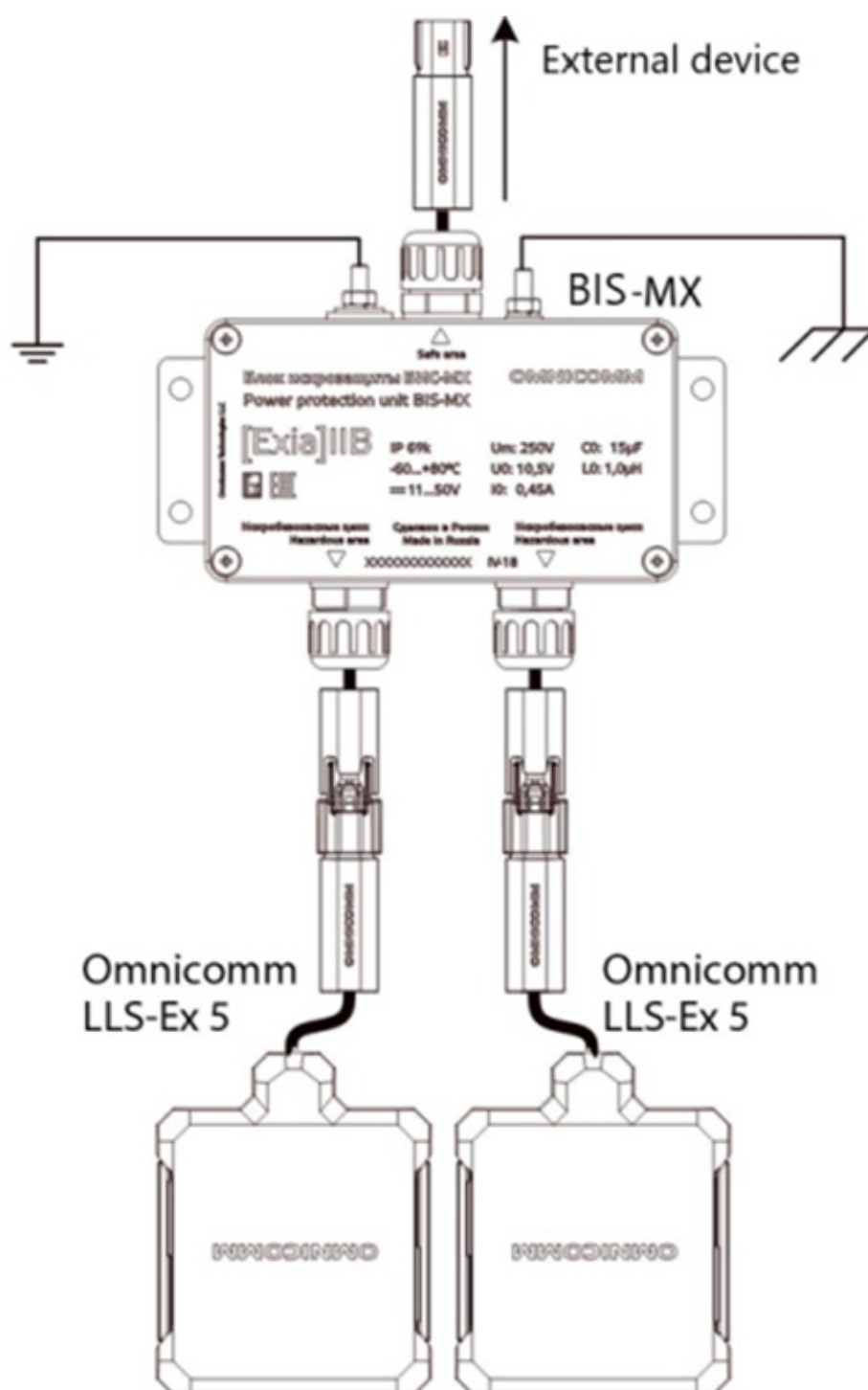
Installation and Connection

Connecting the Omnicomm LLS-Ex 5 fuel level sensor to an external device using BIS-MX

BIS-MX can connect up to two LLS-Ex 5 fuel level sensors to an external device. If only one sensor is connected, put a cover on the empty connector.

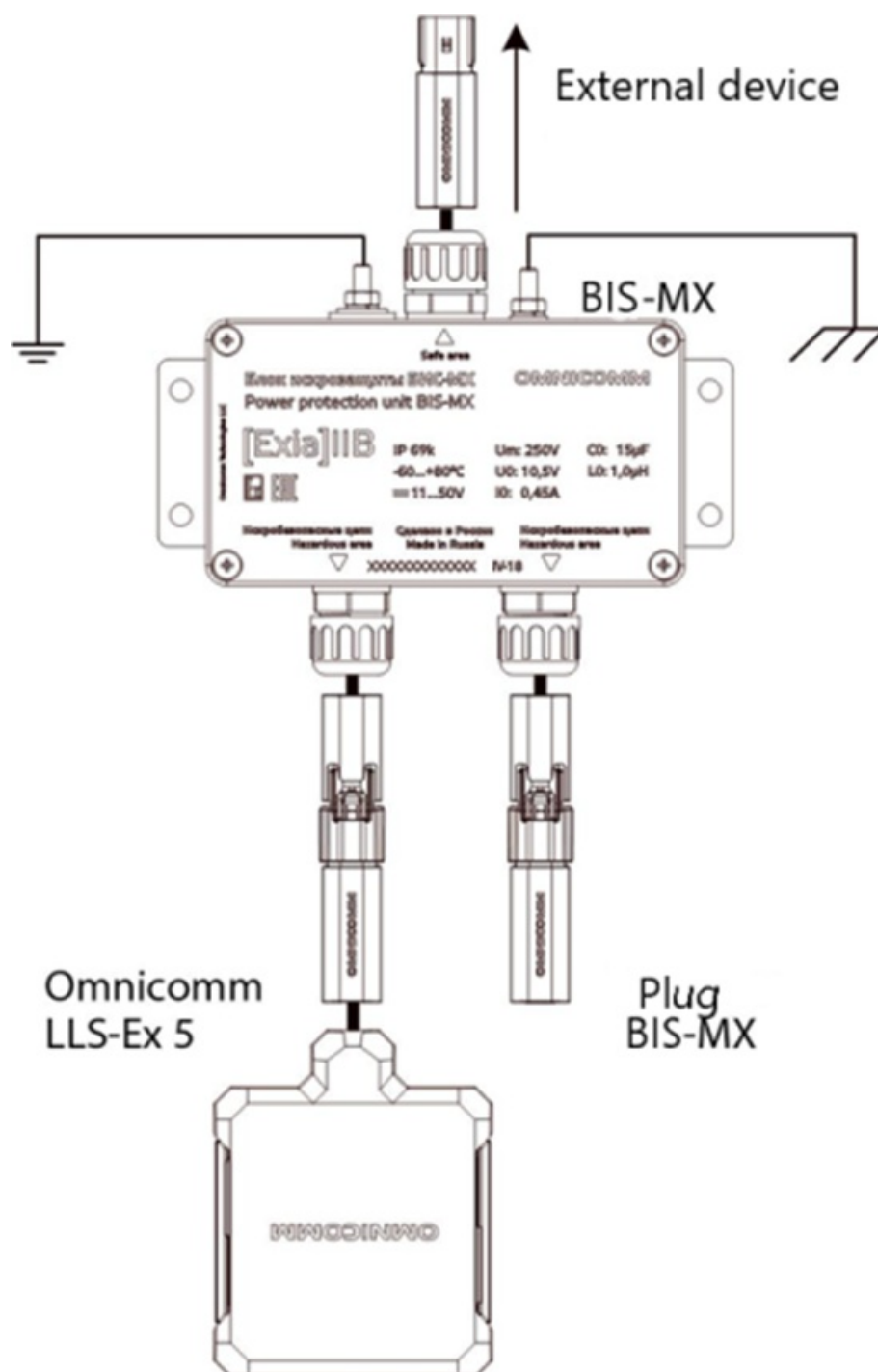
Connect two Omnicomm LLS-Ex 5 fuel level sensors as shown in the diagram:

Installation and Connection



Connect one Omnicomm LLS-Ex 5 fuel level sensor as shown in the figure:

Calibration



Calibration

Calibration of the fuel tank is necessary to verify the conformity of the digital code issued by the Omnicomm LLS-Ex 5 sensor's digital code and the fuel volume in a particular fuel tank.

Calibration

Calibration of the fuel tank is the fuel tank refueling up – from empty to full, following a certain refueling step, and recording the Omnicomm LLS sensor's readings in the calibration table. It is recommended to carry out at least 20 steps. It is possible to calibrate the tank by draining it.

A container may be calibrated by draining.

Calibration of a container with several Omnicomm LLS 5 sensors will be similar to the calibration with one sensor. Before the calibration process, add the necessary quantity of sensors and specify the network addresses. All sensors are calibrated at one time.

Connect several sensors to PC using a KTZ splitter.

Calibration of the tank with one Omnicomm LLS 5 sensor:

1. Empty the fuel tank
2. Connect the sensor to PC according to the diagram in the [Setting](#) section
3. Run Omnicomm Configurator. Select "Calibration".

Omnicomm Configurator (PC):

Liters	Sensor No. 7 N = 2287 stable
150	3800
130	3650
110	3112
90	2822
70	2555
50	800
30	600
10	520

By draining

Step: 20

Tank volume: 150

ADD A SENSOR [F7]

ADD ROW [Enter]

DELETE ROW [Del]

CONTINUE

Service

Calibration table export

Calibration table import

Calibration table chart

Clear the table

Start / continue / finish calibration

If the sensor reading column is not displayed, press the "Add sensor" button. Select the type of sensor. Specify the network address set in the sensor during setting.

Calibration

4. Set the flow interval in liters

If the fuel tank geometry is non-linear and/or has widenings or narrowings, for better accuracy, it is recommended to follow the lower calibration step by using lower-dosage (higher-resolution) measuring containers.

5. Press the "Start/continue calibration" button

6. Fill in the fuel volume equal to the flow interval

Refuel using a measuring container or under control of a fluid flowmeter with the preset interval. The container must have the metrological calibration test certificate.

7. Press "Add line"

The refueling volume equal to the predefined flow interval will be displayed in the "Liters" column.

The value equal to the refueling volume will be displayed in the "Sensor" column.

8. Press "Add line"

9. Repeat items 6, 7 and 8 according to the number of control points. The minimum recommended number of control points - 20. Use the "F2" key to export a calibration table with more than 65534 liters of fuel volume.

10. Press the "Finish calibration" button

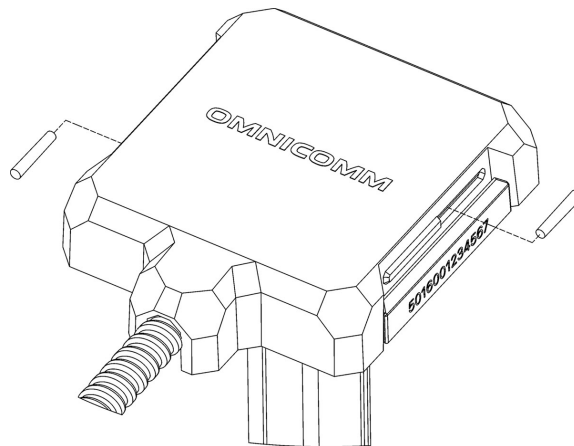
11. Save the calibration table in a calibration file (.ctb), Omnicomm Online (.xml) file, in the Terminal or Indicator, by pressing the "Export" button

When performing the calibration table export to the Omnicomm Online (.xml) file, the "Export" window will open. Specify the Omnicomm LLS sensor number to display in Omnicomm Online.

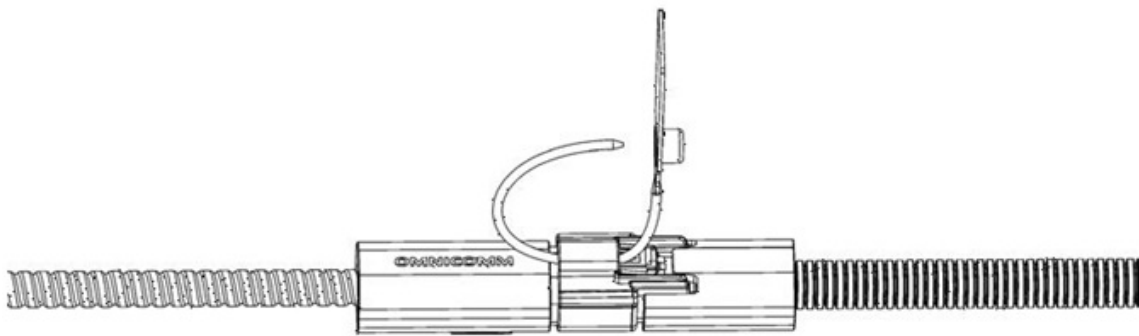
Sealing

Sealing

- Place the casing-seal on the body of the sensor
- Place the pins with the smaller diameter into the grooves of the casing-seal facing the protrusion of the casing and push them in as far as possible



- Connect the Omnicomm LLS-Ex 5 connector to the mounting cable until their typical clicking position
- Run the flexible piece of the seal through the connectors
- Run the flexible piece of the seal through the hole in the seal body



- Tighten up the connection
- Cut off the protruding part of the flexible part of the seal

Remote Configuration and Firmware Update

When connecting the Omnicomm LLS 5 and LLS-Ex 5 fuel level gauges to the Omnicomm 3.0, 3.1 and 3.2 terminals with the firmware version of FW310 or higher, it is possible to update the firmware and sensor settings via the remote configuration server.

A detailed description of configuration and update of the Omnicomm LLS 5 and LLS-Ex 5 sensors firmware is contained in the terminal operating manual.

Recommendations for the Assembly of the Fuel Sensors from 3 to 6 meters in length

1. Take the fuel level sensor and the extension of the measuring part from the package
2. Determine the appropriate length of the fuel and cut the excess of the measuring part

The measuring probe extension must be cut only from the threadless side.



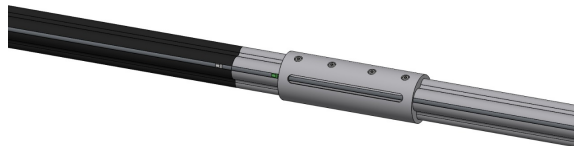
3. Connect them by screwing completely the central rod of the fuel sensor and the extension of the measuring part



Remote Configuration and Firmware Update



4. Move the profile (tube) of the extension of the measuring part until it is levels with the profile of the sensor



5. Cut the zip-ties which hold the coupling and locate the coupling symmetrical to the joints of the sensor and the extension of the measuring part

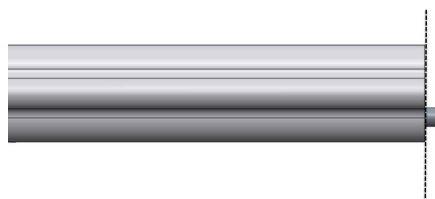


6. Screw in 8 screws to fixate the coupling in the following order: 4 screws on one side bottomed out, then tighten the 4 screws on the other side.

7. Check the electrical contact between the extension and the measuring part. Locate the probes of the multimeter in the gap of the reference channel on each side of the coupling. In the way that the probes will touch the inside of the tubing.

8. If necessary cut the excess of the rod until it is levels with the tube.

Fuel Level Sensor Installation Recommendations for Cylindrical Fuel Tanks

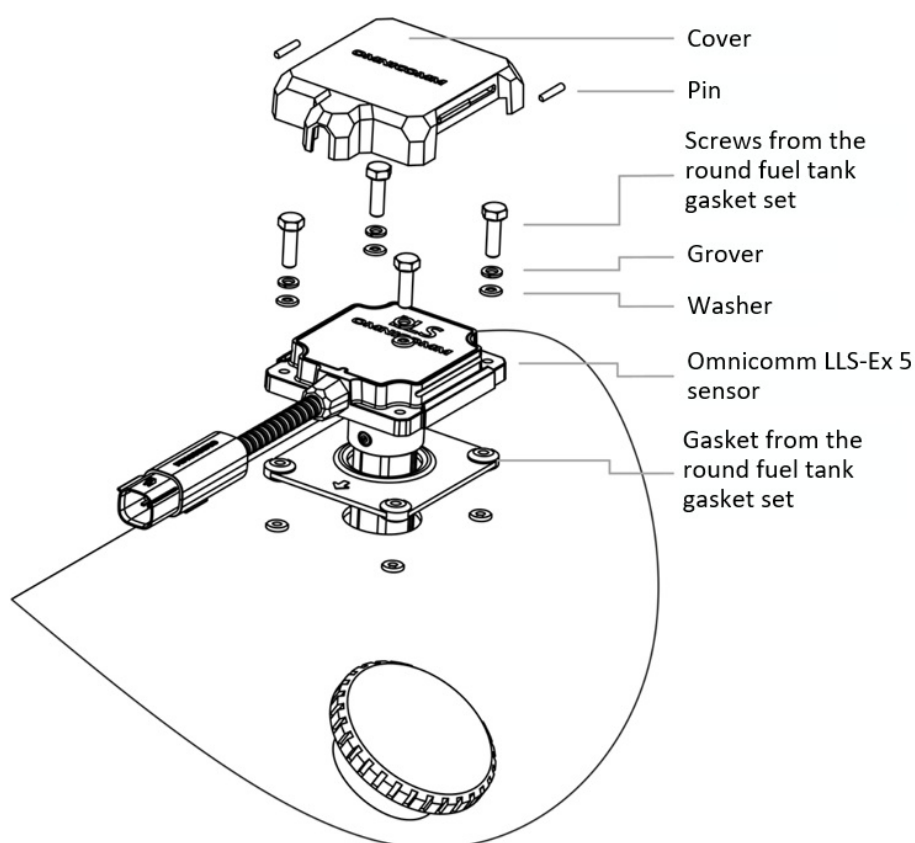


Fuel Level Sensor Installation Recommendations for Cylindrical Fuel Tanks

When installing the fuel sensor onto cylindrical fuel tanks with the diameter 420...710 mm it is necessary to purchase a set of gaskets for round fuel tanks.

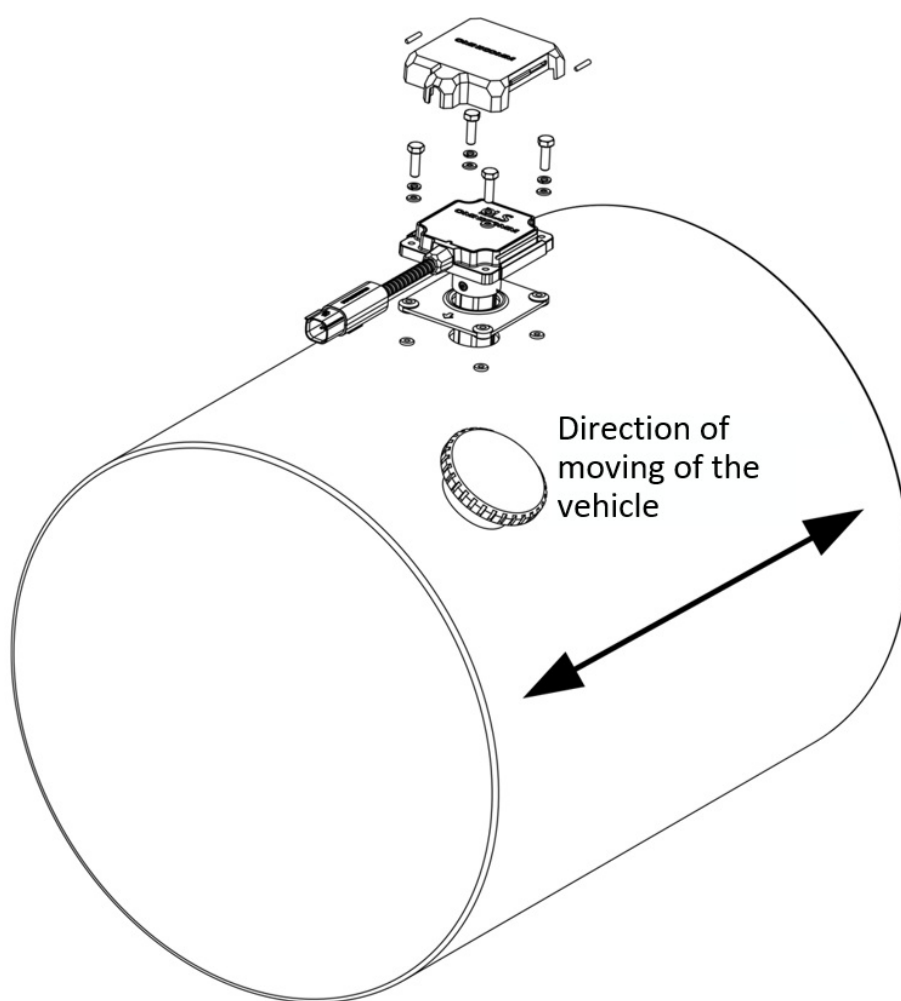
Replace the gaskets and the bolts provided with the LLS-Ex 5 with gaskets and screws for the round fuel tank.

The installation sequence of Omnicomm LLS-Ex 5 fuel level sensors:



The sensor's cable should align with the direction of the vehicle or shall be located on the long side of the fuel tank.

Fuel Level Sensor Installation Recommendations for Cylindrical Fuel Tanks



Appendix. List of equipment for Omnicomm LLS-Ex 5 fuel level sensors and BIS-MX Spark protection unit installation

Appendix. List of equipment for Omnicomm LLS-Ex 5 fuel level sensors and BIS-MX Spark protection unit installation

Omnicomm LLS-Ex 5 sensor

No.	Name	Quantity, pcs
1	Fuel Level Sensor	1
2	Casing-seal	1
3	Assembly parts kit	1
4	Mounting cable	1 (*In case of warranty replacement, no cable is provided in the supply set.)
5	Gloves	1
6	Passport	1

Assembly parts kit:

No.	Name	Quantity, pcs
1	Gasket	1
2	Closed-end M5 rivet nut	4

Appendix. List of equipment for Omnicomm LLS-Ex 5 fuel level sensors and BIS-MX Spark protection unit installation

No.	Name	Quantity, pcs
3	Pin	2
4	Bolt M5 x 20	4
5	Washer 5.3 mm	4
6	Lock washer 5.1 mm	1
7	Self-tapping roofing screws 4.8 x 29	4
8	Blade fuse 1A	1
9	Fuse holder	1
10	Coupling sleeve	4
11	Centering retainer wall	1
12	Seal tie	1

BIS-MX Spark protection unit

BIS-MX spark protection unit on voltage regulation tubes:

No.	Name	Quantity, pcs
1	BIS-MX unit	1
2	BIS-MX cover	1

Appendix. List of equipment for Omnicomm LLS-Ex 5 fuel level sensors and BIS-MX Spark protection unit installation

No.	Name	Quantity, pcs
3	Assembly parts kit	1
4	Passport	1

Assembly parts kit:

No.	Name	Quantity, pcs
1	Ground cable	1
2	Mounting cable (7m corrugated tube)	1
3	Bolt M4 x 16 DIN 933	5
4	Flat washer 4.3 mm DIN 125	6
5	Lock washer 4.1 mm DIN 127	6
6	Nut M4 DIN 934	6
7	Fuse 1A	1
8	Fuse holder	1
9	Coupling piece	4

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