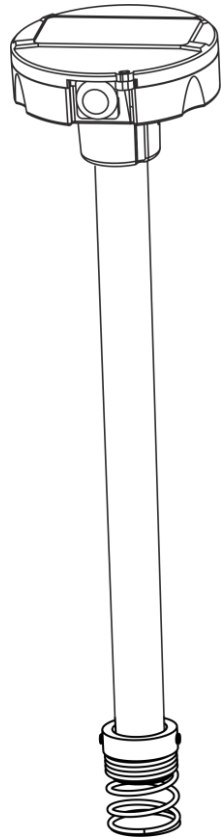
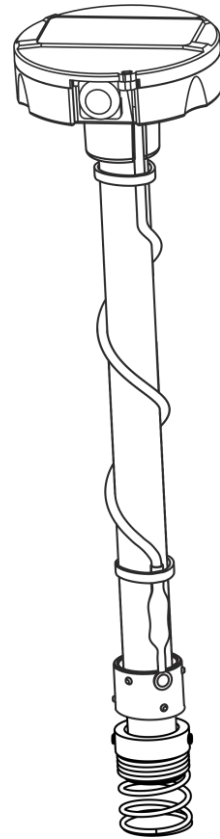




FUEL LEVEL SENSORS



DUT-E S7



DUT-E 2Bio S7

OPERATION MANUAL

Version 8.2



TECHNOTON

ADVANCED MACHINERY TELEMATICS

E28 10R – 06 2435

ERC Ex 0Ex ia IIA T4 X
EA9C RU C-BY.MK062.B.00195/19



Contents

Contents	2
Revision history	4
Structure of external links	6
Terms and Definitions	7
Introduction	9
1 General information and technical specifications	12
1.1 Purpose of use, operation principle and application area	12
1.1.1 DUT-E S7 fuel level sensors.....	12
1.1.2 DUT-E 2Bio S7 differential fuel level sensors.....	14
1.2 Exterior view and delivery set.....	16
1.3 Design.....	18
1.4 Technical specifications.....	20
1.4.1 Main specifications	20
1.4.2 Data composition in output messages of sensors.....	21
1.4.3 Compatibility with Terminals and receiving devices.....	24
1.4.4 Overall dimensions	25
2 Sensor installation	26
2.1 Exterior inspection prior to works start	26
2.2 General recommendations for sensor installation	27
2.2.1 Standard fuel sensor replacement	27
2.2.2 Installation into a special hole.....	28
2.2.3 Probe cutting according to tank depth.....	31
2.2.4 Extension of the measuring probe length	33
2.2.5 Mounting a screen filter and fixing the sensor	35
2.3 BLE-module activation	37
2.4 Measuring system calibration.....	40
3 Sealing	42
4 Measurement accuracy check	43
4.1 Basic principles.....	43
4.2 Check tests procedure	44
5 Malfunction diagnostics.....	45
6 Maintenance.....	46
6.1 General instructions	46
6.2 Demounting	47
6.3 Examination	48
6.4 Cleaning	49
7 DUT-E S7 Radiobox RS wireless interface.....	50
7.1 Purpose of use, operation principle, application area	50
7.2 Delivery set.....	51
7.3 Design.....	52
7.4 Technical specifications.....	53
7.4.1 Main specifications	53
7.4.2 Output interface specifications	54
7.4.3 Overall dimensions	55
7.5 Electrical connection.....	56

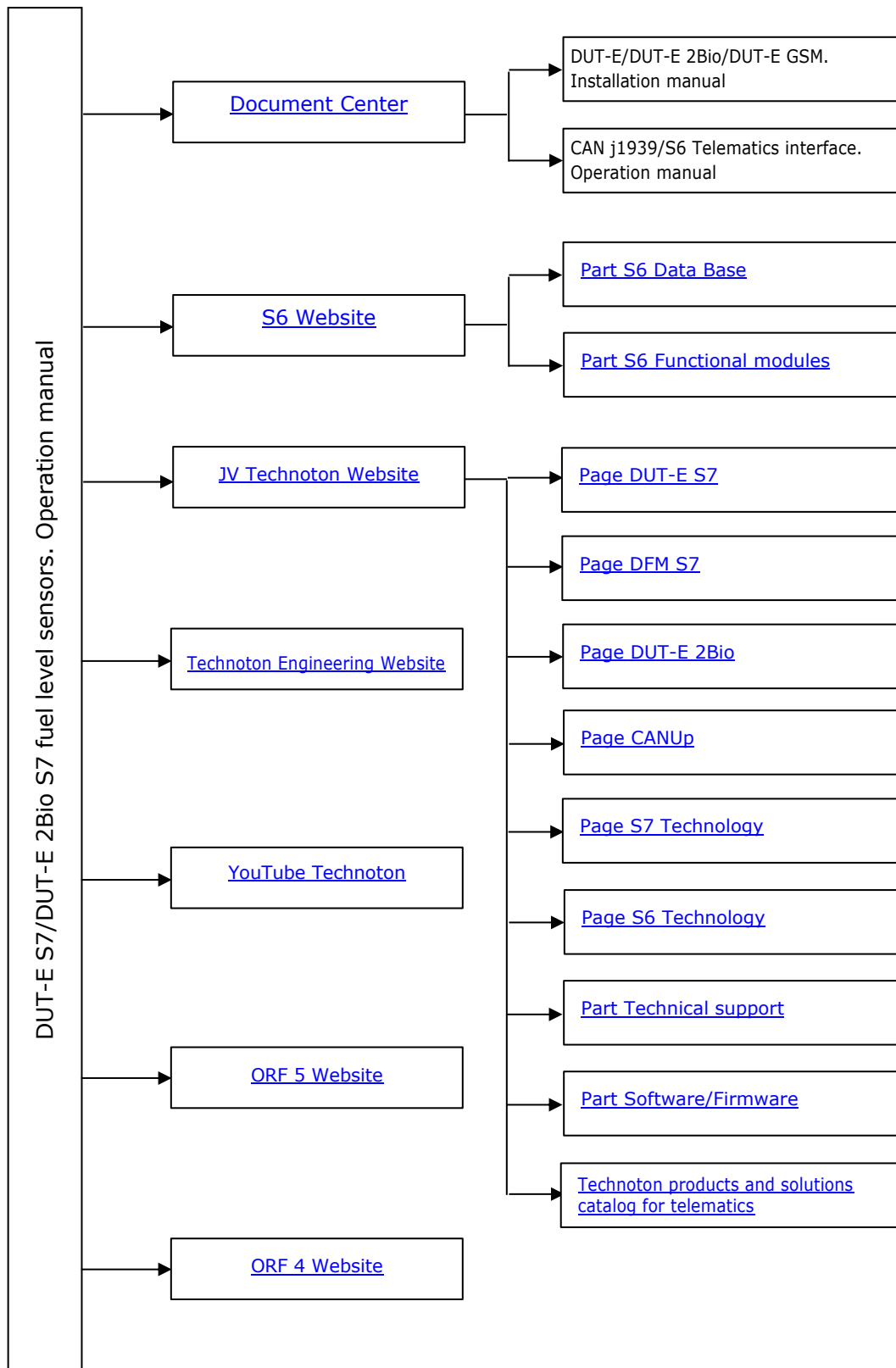
7.6 Configuration.....	58
7.6.1 Basic provisions	58
7.6.2 Connection parameters for RS-232/RS-485 interface	60
7.6.3 Establishment of communication with DUT-E S7 wireless sensors.....	61
7.6.4 Summarization of readings of DUT-E S7 wireless sensors.....	62
8 Accessories	64
8.1 MK DUT-E mounting kit	64
8.2 Additional accessories.....	65
9 Packaging	66
10 Storage	67
11 Transportation	68
12 Utilization/re-cycling.....	69
Contacts.....	70
Annex A Template of check test report	71
Annex B Electromagnetic compatibility	72
Annex C Explosion protection of DUT-E S7	73
Annex D SPN of DUT-E S7 Radiobox RS Functional modules.....	74
D.1 Self-diagnostics FM	74
D.2 Fuel Level Sensor FM	76
D.3 Fuel Level Control FM.....	78
D.4 Vehicle Power Supply FM	79
D.5 Base S7 FM.....	81
Annex E DUT-E S7 Radiobox RS firmware upgrade	83
Annex F Videography	84

Revision history

Version	Date	Editor	Description of changes
1.0	01.2019	OD	Basic version.
1.1	03.2019	OD	Added information about the certificate of explosion protection of sensor.
2.0	08.2019	OD	<ul style="list-style-type: none"> Information on the new mobile application — Fuel Tanks Monitor, which is designed for displaying the sensor indications using Android devices (instead of Service S7 DUT-E service mobile application) is added. DUT-E S7 technical specifications and the delivery set are updated.
3.0	01.2020	OD	Information on DUT-E S7 Radiobox RS wireless interface and its use together with DUT-E S7 wireless fuel level sensors is added.
4.0	02.2021	OD	<p>Significant changes in the Fuel Tanks Monitor mobile application are reflected:</p> <ul style="list-style-type: none"> - new interface design; - function of automatic defining the remaining distance of the route; - function of summation of the fuel volume indications of the specified group of sensors; - function of selection between metric/USC systems of units of measurement for data display; - function of automatic defining the time left before the tank is full during fuelling; - separate configuration of functions of the Events detection: "Fuelling", "Discharging" and others.
5.0	06.2022	OD	<ul style="list-style-type: none"> The description of the Fuel Tanks Monitor mobile application is deleted due to its inclusion into a separate user manual. Data composition in the sensor output messages is updated. Information is added on the "Service" mode of DUT-E S7 for the sensor firmware update using Fuel Tanks Monitor mobile application. Special Long modification of DUT-E S7 sensor is introduced for extension of its measuring probe up to 6000 mm. General recommendations on DUT-E S7 sensor mounting are introduced. Accessories for the sensors mounting and use are added. Certificates added.

Version	Date	Editor	Description of changes
6.0	02.2023	OD	<ul style="list-style-type: none"> • New sensor modification is introduced (Model code 13); its functionality enables to: <ul style="list-style-type: none"> - record the sensor Profile containing values of the calibration table points, values of the measuring probe length after cutting, values of "Empty"/ "Full" frequencies and values of the thermal correction coefficient into DUT-E S7 memory in "Service" mode; - transfer simultaneously readings of frequency (in Hz), fuel level (in mm) and fuel volume in the tank (in liters) using S7 Technology; - extend measuring probe length up to 6000 mm. • Sensor specifications are updated. • Data transfer protocol when using S7 Technology is updated. • National certificate of type approval of measuring instruments of the Republic of Belarus is added. • Locations for placing explosion protection and electromagnetic compatibility marking are indicated etc.
7.0	09.2023	OD	<ul style="list-style-type: none"> • National certificates of type approval of measuring instruments of the Republic of Kazakhstan and the Republic of Uzbekistan are added. • For DUT-E S7 sensor (Model code 13), the wireless data transfer module according to Bluetooth 5.2. standard is introduced. • Technical specifications are updated, general information on the Product is added etc.
8.0	04.2024	OD	<ul style="list-style-type: none"> • Modification of DUT-E 2Bio S7 wireless sensor with the third electrode, for automatic correction of readings while using different types of fuel is introduced. • Special DUT-E S7 Long modification of DUT-E S7 sensor is deleted. • Subscription payment for Fuel Tanks Monitor mobile application is cancelled etc.
8.1	05.2025	OD	<ul style="list-style-type: none"> • Support for the Fuel Tanks Monitor mobile application has been discontinued for iOS devices.
8.2	11.2025	OD	<ul style="list-style-type: none"> • Clarifications have been introduced regarding the sensors' autonomous operating time when powered by the built-in battery.

Structure of external links



Terms and Definitions

S7 — Technology designed for wireless collection of data from unattended sensors in systems of industrial and automobile Telematics. S7 Technology is recommended for use in facilities where wiring is impossible or hard to install.



S7 Technology uses Bluetooth Low Energy (BLE) wireless interface which operates according to Bluetooth 5.2 standard, as a communication channel for DUT-E S7 ([Model code 13](#)) and for DUT-E 2Bio S7; it also operates according to Bluetooth 4.1 standard for DUT-E S7 (Model code 07).

S7 Technology provides ultra-low power consumption and a long period of independent operation for smart sensors and other IoT devices.

On the application level, S7 Technology is fully compatible with [S6 Technology](#) which uses cabling.

Advantages of S7 Technology:

- Simple design of data transmission protocol;
- Low power consumption, a potential for fully independent operation of sensors for several years;
- Option of data collection by several data recipients at one time.

[DUT-E S7](#) and [DUT-E 2Bio S7](#) wireless fuel level sensors are designed based on S7 Technology.

S6 is the Technology of combining smart sensors and other IoT devices within one wire network for monitoring of complex stationary and mobile objects: vehicles, locomotives, smart homes, technological equipment etc. The Technology is based and expands SAE J1939 automotive standards.



Information on cabling system, service adapter and S6 software refer to [CAN j1939/S6 Operation manual](#).

PGN (Parameter Group Number) — is a combined group of S6 parameters, which has common name and number. Functional modules (FM) of the Unit can have input/output PGNs and setup PGNs.

SPN (Suspect Parameter Number) — informational unit of S6. Each SPN has determined name, number, extension, data type and numerical value. The following types of SPN exist: Parameters, Counters, Events. SPN can have a qualifier which allows qualification of parameter's value (e.g. – Onboard power supply limit/Minimum).

GNSS (Global Navigation Satellite System) — System for area positioning of an object through satellite signal processing. GNSS is composed of space, ground and user segments. Currently, there are several GNSSs: GPS, GLONASS, Galileo, BeiDou.

Model code — digits reflecting the Product modification. The Model code of a wireless fuel level sensor is identified by the 3^d or 4th digits of its serial number placed on the measuring probe and on the packing label. The functionality of a sensor differs depending on its Model code.

Onboard reports (the Reports) — information about vehicle which is returned to a user of Telematics system in accordance with inputted criteria. The Reports are generated by a terminal unit both periodically (Periodic reports) and on Event occurrence (Event report).

Parameter — time-varying or space characteristic of the Vehicle (SPN value). For example, speed, fuel volume in the tank, hourly fuel consumption, coordinates. Parameter is usually displayed in the form of graph, or averaged data.

Sensor profile (Profile) — a number of settings of a specific wireless fuel level sensor presented in the form of (*.prf7) file. The Profile file is created in the Fuel Tanks Monitor mobile application and is stored in the memory of the mobile device you are using. For DUT-E S7 (Model code 13) or DUT-E 2Bio S7, the Profile can be recorded into the sensor internal memory (see details in the document "[Fuel Tanks Monitor mobile application. User manual](#)").

Server (AVL Server) — hardware-software complex of Telematics service ORF 4 / ORF 5, used for processing and storage of Operational data, formation and transmission of Analytical reports through Internet by request of [ORF 4](#) / [ORF 5](#) users.

Event — a relatively rare and sudden change in SPN. For example, the sharp increase of volume in the tank is the Event "Fuelling". An Event may have one or more characteristics. Thus, the Event "Fuelling" has the following characteristics: "volume of fuel at the beginning of the fueling", "volume of fuel at the end of the fueling", "volume of the fueling" and so on. As soon as an Event is detected, the Terminal registers the time of the Event which is subsequently specified in the Report of the Event. The Event is always linked to the time and the location where it was detected.

Counter — cumulative numerical characteristic of Parameter. Counter is displayed by a single number and over time its value is increasing. Examples of counters: fuel consumption, trip, engine hours counter etc.

Telematics terminal (Tracking device, Telematics unit) is a unit of Telematics system used for reading the signals of Vehicle standard and additional sensors, getting location data and transmitting the data to the Server.

Telematics system — complex solution for vehicle monitoring in real time and trip analysis. The main monitored characteristics of the vehicle: Route, Fuel consumption, Working time, technical integrity, Safety. It includes On-board report, Communication channels, Telematics service ORF 4 / ORF 5.

Vehicle is an object controlled by the Vehicle Tracking System. This is generally a truck, a bus or a tractor, sometimes a locomotive, a ship, a utility vehicle. From the point of view of Vehicle Tracking System, static equipment such as diesel generators, heating boilers, burners, and so on are considered vehicles.

Function module (FM) unit-embedded component of hardware and software combination, executing a group of special functions. Uses input/output PGNs and settings PGNs.

Unit is an element of Vehicle on-board equipment compatible with S6 bus, which uses [S6 Technology](#) or [S7 Technology](#).

Introduction

Recommendations and guidelines set out in this Operation Manual are related to **wireless fuel level sensors: DUT-E S7**, Model codes **07** and **13** (further on — [DUT-E S7](#)) and **DUT-E 2Bio S7**, Model code **12** (further on — [DUT-E 2Bio S7](#)), manufactured by [Technoton](#) company.

[Model code](#) is identified by third and fourth digits of its serial number engraved at its measuring probe or printed on its packing label (see figure 1).

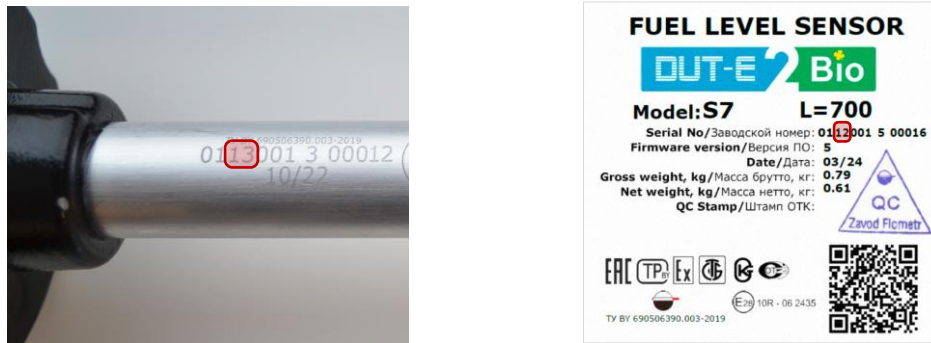




Figure 1 — Identification of the model code

This document contains information on the design, principle of operation, specifications, recommendations for operation of DUT-E S7.

Types of wireless fuel level sensors:

DUT-E  — **wireless sensors, used within [Telematics systems](#) or autonomously for accurate level measurement of fuel and other non-conductive liquids in tanks of vehicles and tractors / stationary tanks.**

DUT-E  **Bio** — **differential sensors with the third (additional) measuring electrode which are used within [Telematics systems](#) or independently for accurate measurement of fuel level in tanks of vehicles and tractors / stationary tanks, irrespective of type or chemical composition of fuel.**

Particularities of wireless sensors:

- wireless transmission of data using [S7 Technology](#) via **Bluetooth Low Energy** channel simultaneously to many receiving devices (smartphones/tablets, the [Telematics terminal](#), the display in the driver's cabin);
- operation in the "advertising" mode (BLE-radio) — continuous transmission of measurement results, with no need of integration with receiving devices;
- full-scale compatibility with receiving devices according to Bluetooth 4.X / 5.X¹ wireless interface standards;
- automatic generation and direct transfer of ready indications of fuel level and volume in the tank by the sensor, in accordance with the tank calibration table recorded into the sensor internal memory¹;
- unique function of automatic readings correction, when replacing one type of fuel with another (diesel/biodiesel/kerosene/mineral oil) ensures stable measurement accuracy without the tank re-calibration²;
- Adjustable function of automatic identification of type of fuel in the tank where the sensor is mounted³;
- Accurate measurement of the current fuel temperature using a special thermal sensor mounted on the additional electrode²;

¹ Valid only for DUT-E S7 (Model code 13) and DUT-E 2Bio S7 sensors.

² Valid only for DUT-E 2Bio S7 sensors.

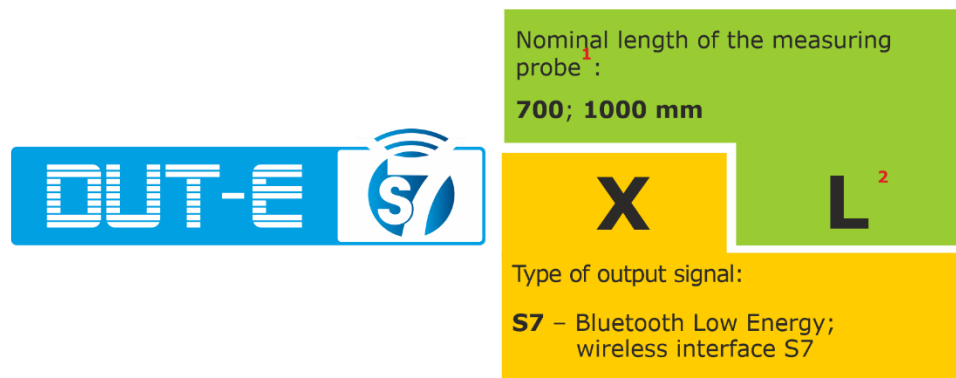
³ The function is applicable only to DUT-E 2Bio S7 and can be employed using the Fuel Tanks Monitor mobile application and also by means of appropriate external devices or the [Server](#).

- ultra-low power consumption provides completely independent sensor operation during up to 5 years from the inbuilt battery, without the external power supply;
- availability of [Explosion protection certificate](#) — safe sensor operation in explosion-dangerous environments;
- no signal cable– quick installation without a need of electrical connection;
- no signal cable — explosive and fire safety of the sensor is ensured without using additional modules of explosion protection;
- no signal cable – increase resistance to sabotage;
- function of digital self-diagnostics for sensor quality control;
- automatic compensation of ambient temperatures effect on the electronic sensor module.

Wireless sensors also have the full set advantages inherent to “classic” DUT-E:

- shortening/extending length of measuring probe;
- full set of mounting accessories and connection cable included;
- ergonomic bayonet mount allows to save installation time;
- bottom spring for better mounting rigidity;
- screen filter (purchased separately) for secure protection from water and mud;
- sealing possibility to avoid unauthorized intrusion and tampering;
- ergonomic grooves in body allow comfortable grip of sensor’s “head” when fastening it in bayonet mounting plate;
- high-quality [technical support](#) and [documentation](#);
- conformity with European and national automotive standards.

See figure 2 for identification codes for wireless sensors ordering.



¹ Can be manufactured with any custom measuring probe length up to 1400 mm (in case you order less than 200 pcs. of the same length during the quarter of a year, the price is 20% higher).

² For DUT-E 2Bio S7, in case L > 1400 mm or the cable length of the 3d electrode >1700 mm, the price is 10% higher + cost of [additional KDC sections](#).

Note — The cost of the extended warranty for the sensors: 3^d year + 5 % is added to the price, 4th year + 10% is added to the price.

Figure 2 — Designation of DUT-E S7/DUT-E 2Bio S7 sensors for ordering

Examples of specifying wireless sensors, when placing an order:

"Fuel level sensor DUT-E S7 L = 1000 mm"
(wireless S7 interface, measuring probe length 1000 mm).

"Fuel level sensor DUT-E 2Bio S7 L = 700 mm"
(wireless S7 interface, measuring probe length 700 mm).

IMPORTANT: When ordering DUT-E S7 models, you should bear in mind that their functionality differs, depending on the sensor [Model code](#) (see [figure 1](#)). Therefore, when ordering a sensor, we recommend to get information from your supplier on Model codes of the sensors (07 or 13) that are currently available.

For instance, the functionality of DUT-E S7 (Model code 13) has the following additional advantages:



- transfer of data according to Bluetooth 5.X standard;
- option for the measuring probe extension up to 6000 mm;
- transfer of ready data on fuel level (in mm) and fuel volume in the tank (in liters) via BLE channel, alongside with frequency readings (in Hz);
- option for recording the sensor [Profile](#) into its internal memory in the "Service" mode; the Profile would contain the tank calibration table, the value of the measuring probe length after its cutting, values of "Empty"/"Full" frequencies and the value of the thermal correction coefficient.

For displaying wireless fuel level sensors' readings on the screen of a smartphone/tablet by means of [S7 Technology](#) (Android platform), the **Fuel Tanks Monitor** free mobile application is used.

This application also serves for the sensors firmware update; in case you are using DUT-E S7 (Model code 13) / DUT-E 2Bio — for recording its [Profile](#) into the sensor "[Fuel Tanks Monitor mobile application. User manual](#)").

You can install the application from Google Play (search request "Technoton").



ATTENTION: It is strongly recommended to follow strictly the instructions of the present Manual when using, mounting or maintaining wireless fuel level sensors.

[The Manufacturer](#) guarantees wireless fuel level sensors compliance with the requirements of technical regulations subject to the conditions of storage, transportation and operation set out in this Manual.



ATTENTION: Manufacturer reserves the right to modify wireless fuel level sensors specifications that do not lead to a deterioration of the consumer qualities without prior customer notice.

1 General information and technical specifications

1.1 Purpose of use, operation principle and application area

1.1.1 DUT-E S7 fuel level sensors

- DUT-E S7** are designed for:
- accurate level and volume (remaining) measurement in fuel tanks of vehicles and stationary units (see figure 3);
 - measurement of current fuel temperature in the tank;
 - wireless transfer of data using [S7 Technology](#).



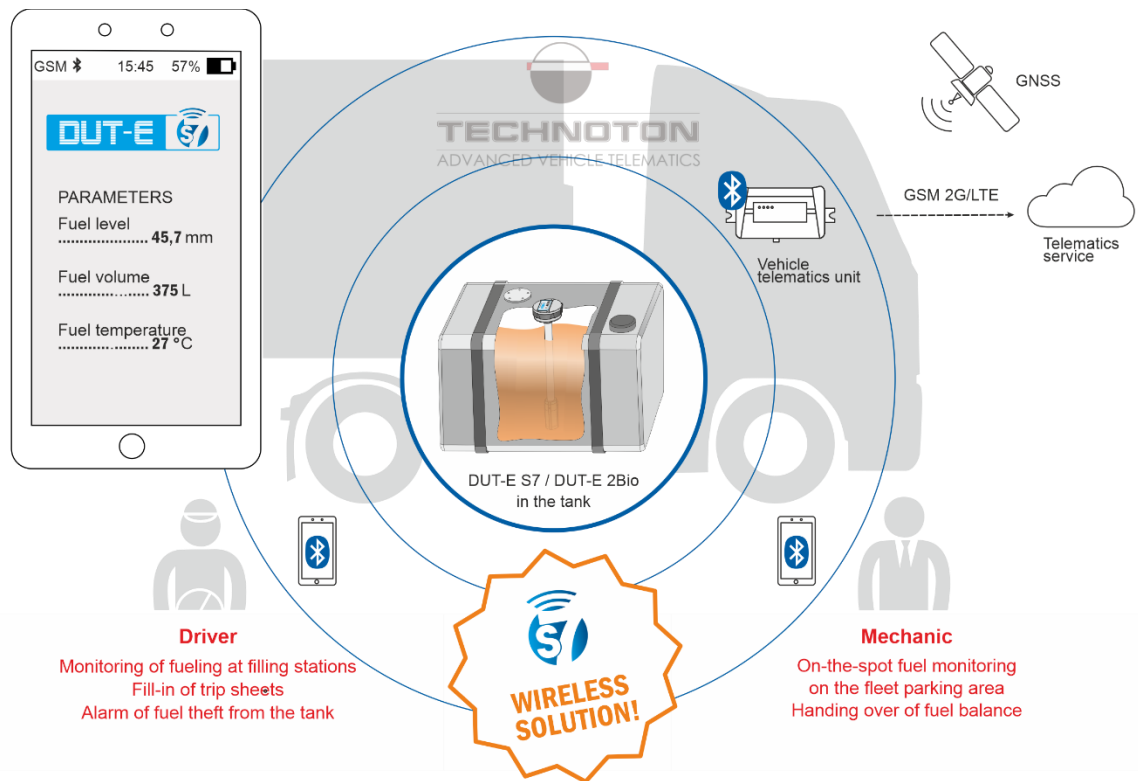
Figure 3 — Purpose of DUT-E S7

Operating principle: [DUT-E S7](#) has an inbuilt Bluetooth low energy module (BLE-module) which, due to a special data transmission algorithm, enables the sensor operation with ultra-low power consumption. The BLE-module transmitter switches on automatically once in 5 s to transmit the current indications. This operating mode enables the sensor to function completely autonomously for up to 5 years, without using any external power sources, powered solely by the built-in battery.

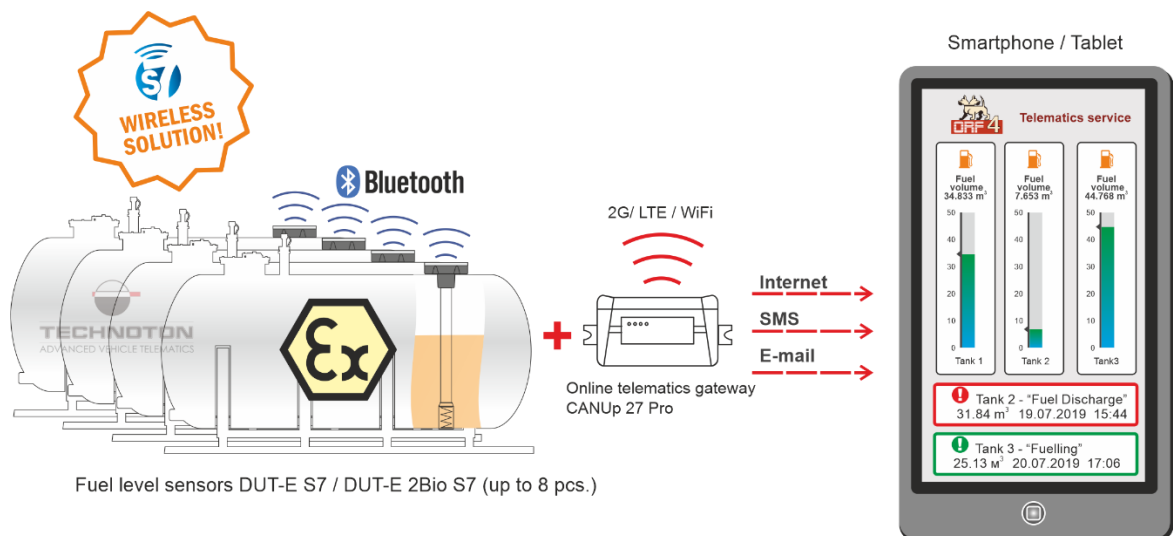
Data from DUT-E S7 can be received via the BLE channel at a distance of up to 50 meters by unlimited number of various receiving devices ([Telematics units](#), smartphones/tablets etc.).

Application areas: DUT-E S7 may be applied both independently, and within the [Telematics system](#) (including without using services of a [Server](#)) for wireless monitoring the fuel volume:

- 1) In fuel tank of any [Vehicle](#) (see figure 4 a).
- 2) In fixed tanks (employed in oil products storage facilities, boiler equipment, diesel generators sets etc.) (see figure 4 b).



a) wireless monitoring fuel volume in tanks of Vehicles



b) wireless monitoring fuel volume in fixed tanks

Figure 4 — Examples of areas of application of DUT-E S7 / DUT-E 2Bio

Due to the availability of the inbuilt BLE-module in [DUT-E S7](#), up to 8 wireless fuel level sensors can operate using [S7 Technology](#) together with [CANUp 27 Pro](#) Telematics gateway; this enables to monitor in real time:

- accurate current value of fuel level and fuel volume in tank;
- accurate volume of fuel fill-ups and drains;
- fuel temperature;
- sensor specification data (passport);
- sensor malfunctions.

1.1.2 DUT-E 2Bio S7 differential fuel level sensors

DUT-E 2Bio are designed for:

- accurate fuel level and volume measurement in tanks of vehicles and tractors, as well as in fixed tanks which, from time to time, are filled with different types of fuel (see figure 5);
- automatic compensation of changes in fuel dielectric permittivity, whenever one type of fuel used is replaced with another or in case the fuel quality is changed;
- automatic detection of fuel type change;
- automatic identification of the fuel type used*;
- accurate measurement of the temperature of fuel in the tank;
- wireless transfer of readings by means of [S7 Technology](#).

* This feature can be employed using the Fuel Tanks Monitor mobile application, as well as by means of corresponding external devices or the [Server](#).



Figure 5 — Purpose of DUT-E 2Bio S7

Different types of diesel fuel (mineral summer/winter fuel, biodiesel) or the same type of fuel but with additives, or diesel fuel that is used in different regions (for example, Russian Federation and countries of European Union) have different dielectric constant. When fuel is changed from one type to another, for example, from diesel fuel to biodiesel, difference in fuel readings of standard capacitive fuel level sensor can be more than 40 %. In such cases, to provide high accuracy of fuel volume measurement in the tank, it is necessary to renew long calibration procedure of the tank.

Operating principle:

The principle of wireless data transfer by [DUT-E 2Bio S7](#) differential sensor is similar to that of [DUT-E S7](#) model (see [1.1.1](#)).

But as differs from a regular DUT-E S7, DUT-E 2Bio S7 differential sensor has the third (additional) electrode (see [1.3](#)), to provide the feature of **automatic correction of readings, in case the fuel dielectric permittivity is changed.**

In case dielectric properties of fuel change during the next fuelling of the [Vehicle](#), the **differential mechanism** of measurement readings correction is automatically activated, in accordance with the difference of values of coefficients of the fuel dielectric permittivity – between the initial coefficient (at which the sensor calibration was carried out) and the coefficient of fuel the tank is currently filled with.

Example: When fuel is changed from diesel to biodiesel standard fuel level sensor shows significantly higher fuel volume in the tank (up to 30 %) (see figure 6 a). Fuel level sensor DUT-E 2Bio S7 shows real fuel volume in the tank even if the fuel in the tank is changed from diesel to biodiesel (see figure 6 b).

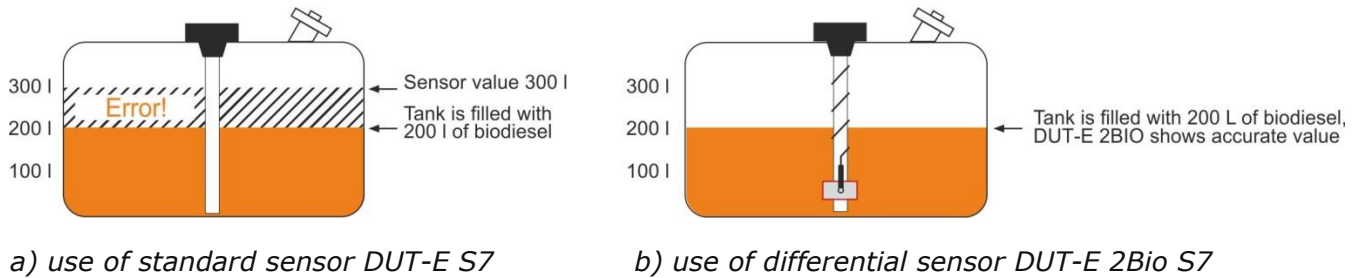


Figure 6 – Illustration of specifics of fuel volume measurement in tank of Vehicle when switching from regular diesel to biodiesel



IMPORTANT: Function of automatic correction of fuel dielectric constant allows to control fuel level in the tank with higher accuracy regardless the type of fuel (see figure 7). **Procedure of fuel tank re-calibration is not required with DUT-E 2Bio S7!**

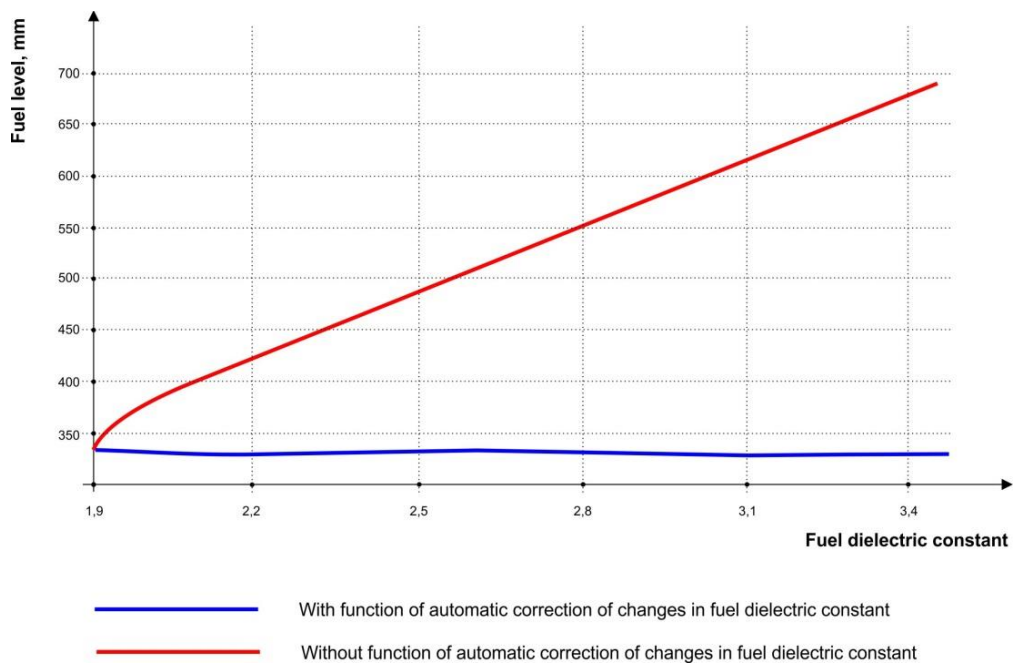
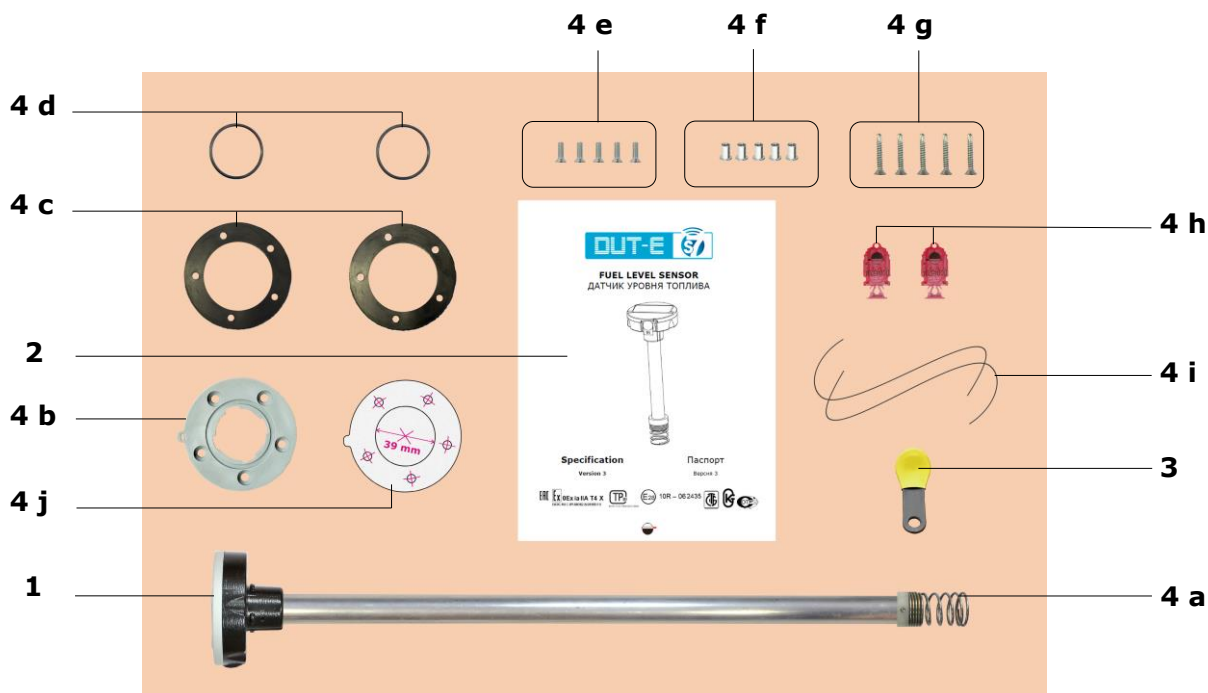


Figure 7 – Example of data comparison of corrected and uncorrected fuel levels

Application areas:

[DUT-E 2Bio S7](#) sensors are used for monitoring fuel in mobile / fixed assets (see [figure 4](#)) as additional sensors of [Telematics systems](#) or independently, in case different types of fuel are used from time to time on the same facility.

1.2 Exterior view and delivery set

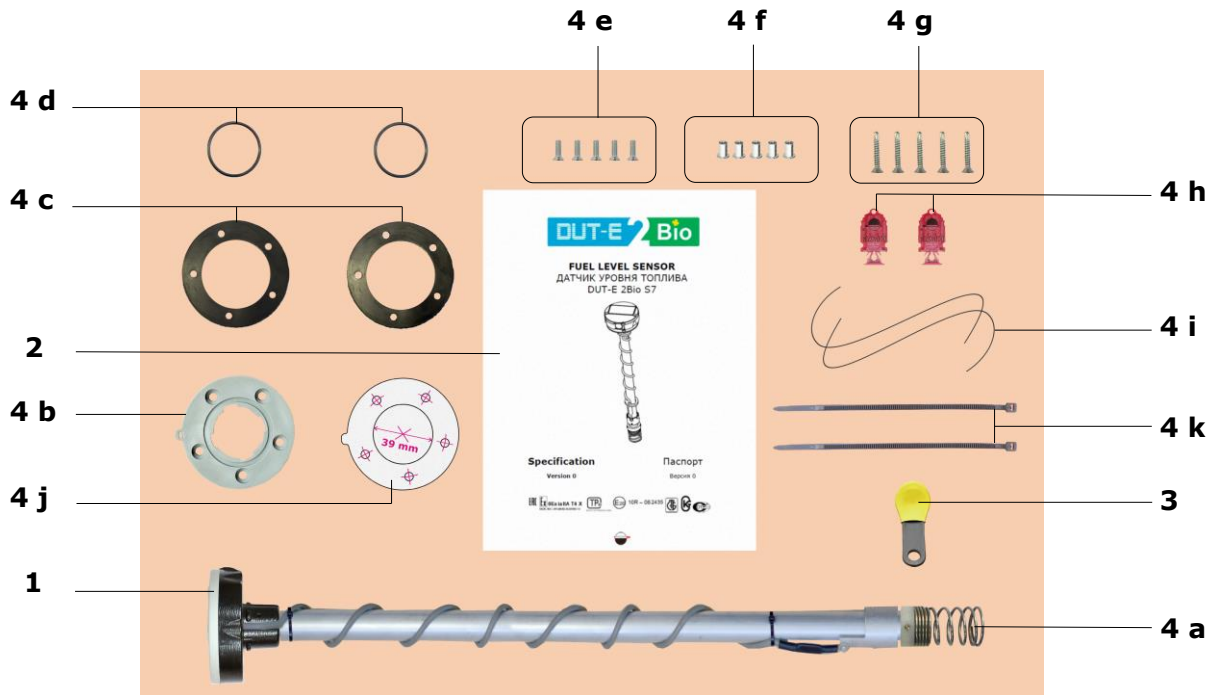


- | | | |
|----------|--|------------|
| 1 | DUT-E S7 fuel level sensor | - 1 pc.; |
| 2 | Specification | - 1 pc.; |
| 3 | Magnetic key | - 1 pc.; |
| 4 | Mounting kit (1 pc.) including: | |
| | a) bottom stop | - 1 pc.; |
| | b) plastic mounting plate | - 1 pc.; |
| | c) rubber gasket | - 2 pcs.*; |
| | d) sealing rubber ring | - 2 pcs.*; |
| | e) bolt | - 5 pcs.; |
| | f) threaded rivet | - 5 pcs.; |
| | g) self-tapping screw | - 5 pcs.; |
| | h) plastic seal** | - 2 pcs.*; |
| | i) sealing cord | - 2 pcs.; |
| | j) pattern of mounting holes location | - 1 pc. |

Figure 8 — DUT-E S7 delivery set

* 1 pc. is for initial DUT-E S7 mounting and 1 pc. as a spare part.
The delivery set may include just 1 gasket of 4 mm.

** Exterior of seal can be different.



- | | | |
|-----------|---|------------|
| 1 | DUT-E 2Bio S7 fuel level sensor | - 1 pc.; |
| 2 | Specification | - 1 pc.; |
| 3 | Magnetic key | - 1 pc.; |
| 4 | Mounting kit (1 pc.) including: | |
| a) | bottom stop | - 1 pc.; |
| b) | plastic mounting plate | - 1 pc.; |
| c) | rubber gasket | - 2 pcs.*; |
| d) | sealing rubber ring | - 2 pcs.*; |
| e) | bolt | - 5 pcs.; |
| f) | threaded rivet | - 5 pcs.; |
| g) | self-tapping screw | - 5 pcs.; |
| h) | plastic seal** | - 2 pcs.*; |
| i) | sealing cord | - 2 pcs.; |
| j) | pattern of mounting holes location | - 1 pc.; |
| k) | cable tie | - 2 pc. |

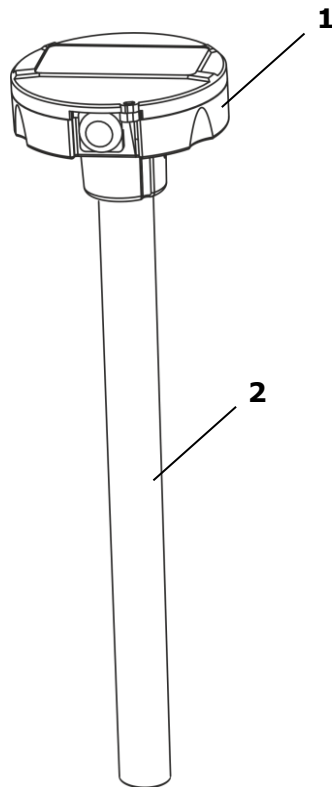
Figure 9 — DUT-E 2Bio S7 delivery set

* 1 pc. is for initial DUT-E 2Bio S7 mounting and 1 pc. as a spare part.

The delivery set may include just 1 gasket of 4 mm.

** Exterior of seal can be different.

1.3 Design



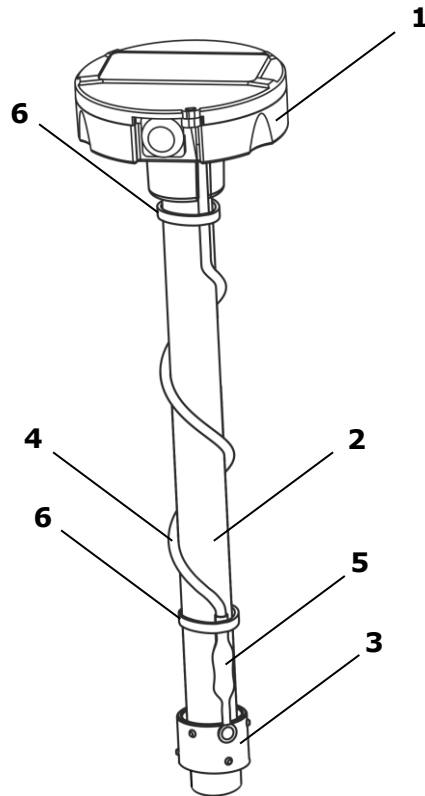
- 1 - measuring "head" inside which there is the sensor electronic measuring module, the BLE-module for wireless data transfer by means of [S7 Technology](#) and the battery for independent power supply;
- 2 - measuring probe of the sensor which is composed of two coaxial tubes that form condenser coating.

Figure 10 – Design of [DUT-E S7](#) wireless sensor



WARNING: Capacitive principle ensures highest accuracy of liquid measurement when the liquid has **constant dielectric permeability coefficient**. Otherwise, additional inaccuracy of measurement may appear.

In case you use different types of fuel in the same tank from time to time, we recommend to mount [DUT-E 2Bio S7](#) differential sensor.



- 1 - measuring "head" inside which there is the sensor electronic measuring module, the BLE-module for wireless data transfer by means of [S7 Technology](#) and the battery for independent power supply;
- 2 - measuring part of the sensor composed of two coaxial tubes that form condensate coating. Changes of sensor electrical capacity depend on the diving depth of measuring probe into fuel (dielectric liquid according to its properties);
- 3 - additional electrode for function of automatic fuel correction in real time (when chemical composition or type of fuel is changed).
Additional electrode should always be immersed in fuel and its upper edge should be 9...10 cm from the end of main measuring probe.
- 4 - cable of additional electrode for connection with electrical sensor module;
- 5 - temperature sensor for precision measurement of current fuel temperature;
- 6 - cable ties for fixing the cable of additional electrode.

Figure 11 — Design of [DUT-E 2Bio S7](#) wireless sensor

1.4 Technical specifications


[DUT-E S7](#) / [DUT-E 2Bio S7](#) sensors are powered only from the inbuilt battery.

The sensors can be employed in moderate and cold climatic conditions.

As for resistance to mechanical impact, the sensors are vibration-proof and shock-proof.

1.4.1 Main specifications

Table 1 — Basic specifications of wireless fuel level sensors

Parameter, measuring unit	Value	
	DUT-E S7 (Model code 13) and DUT-E 2Bio S7	DUT-E S7 (Model code 07)
Fuel level sensor operating principle	Capacitive	
Working fluids	Diesel/biodiesel fuel, kerosine, petrol, mineral oil	
Sensor sensitivity to fuel level changes, mm	0.1	
Relative measuring error (to the length of the measuring part), %, not more than	±1.0	
Wireless data transfer interface	Bluetooth 5.2	Bluetooth 4.1
Transmitter power (Tx Power), dBm	+8	+4
Receiver sensitivity (Rx Sensitivity), dBm	-97	-88
Maximum distance between sensor and receiving device, m	20 (when mounting on a Vehicle and inside buildings) 50 (when mounted within line-of-sight range)	
Data transfer interval, s	5	
Sensor autonomous operating time from the built-in battery, years	up to 5*	
Maximum cutting of the measuring probe	to any the length required	
Maximum length extension of the measuring probe , mm, not more	6000	3000
Temperature range, °C	-30...+80	
Ingress protection rating	IP55/IP57	
Resistance to external vertical mechanical pressure on the cap of the sensor "head", kg, no more than	1500	
Certificates of electromagnetic compatibility	see annex B	
Explosion safety certificate	 EA3C RU C-BY.MHO62.B.00195/19 (see annex C)	
Weight, kg, not more than	1.0 (at L=1000 mm) 0.9 (at L=700 mm)	
Overall dimensions, mm, not more than	see figure 13	
* At a constant ambient temperature of +20 °C. Under real operating conditions, when the temperature fluctuates, the sensor's autonomous operating time may be reduced, but it is guaranteed to be at least 2 years. ** X character indicates that during mounting and operation of sensors you need to take measures, to prevent sparks in case of shocks or friction.		

1.4.2 Data composition in output messages of sensors

[DUT-E S7](#) / [DUT-E 2Bio S7](#) wireless fuel level sensors transmit data by means of [S7 Technology](#), without integration with the receiving device and without acknowledgement of data reception. The data in the form of Advertising packets are transmitted automatically with 5 s periodicity in the continuous data transfer mode. The structure of the data packet transmitted is provided in figure 12.

Service field (AD0) (permanent values)			Data field (AD1) (variable values)					
Data length (AD Length)	Data type (AD Type)	Data (Data)	Data length (AD Length)	Data type (AD Type)	Company identifier (Company ID)	Unit firmware version (Soft Ver)	PGN number (PGN)	PGN data (PGN Data)
(1 byte)	(1 byte)	(1 byte)	(1 byte)	(1 byte)	(2 bytes)	(1 byte)	(2 bytes)	(0...21 bytes)
0x02	0x01	0x06	0xFF	0xFF	0x0972 ¹ 0xFFFF ²	0xFF	0xFFFF	...

¹ Only for DUT-E S7 (Model code 13) and DUT-E 2Bio S7.

² Only for DUT-E S7 (Model code 07) with firmware version lower than 13.0.

Figure 12 — Composition of a data packet transmitted by the sensors

The application level of the protocol of the sensors' output messages conforms with [S6 Database](#) (see table 2).

To display readings of wireless sensors on the screen of a smartphone/tablet, you can use the **Fuel Tanks Monitor** mobile application (see details in the document "[Fuel Tanks Monitor mobile application. User manual](#)").

Table 2 — Data composition of DUT-E S7 output messages

Field number	Length	Parameter	Name
1) Fuel Level Sensor. Raw Data PGN 63277 (0xF72D)			
1	4 bytes	SPN 521440	Frequency (Duty Cycle)
5	1 byte	SPN 521457	Temperature
6	4 bytes	SPN 521773	Third Electrode Frequency ³
10	2 bytes	SPN 521774	Fuel Permittivity Relative ³
12	4 bytes	SPN 521488	Unit DTCs Mask (see table 3)
16	2 bytes	SPN 521023	Fuel Tank Level ²
18	4 bytes	SPN 521728	Fuel Tank Volume ²
2) MAC Address PGN 63558 (0xF846) ¹			
1	6 bytes	SPN 521490	MAC Address
¹ Valid for all wireless sensors except DUT-E S7 (Model code 07) with the version of firmware lower than 24.0. ² Valid only for sensors DUT-E S7 (Model code 13) and DUT-E 2Bio S7. ³ Valid only for sensors DUT-E 2Bio S7. For DUT-E 2Bio S7, the ON/OFF status of the fuel type correction function which is set in the sensor profile affects the correctness of these readings.			



IMPORTANT: DUT-E S7 sensors (Model code 13) and DUT-E 2Bio S7 sensors can independently generate and transfer ready indications of fuel level ([SPN 521023](#)) and fuel volume ([SPN 521728](#)) in the tank. For their correctness, you need to record in advance the sensor [Profile](#) into the sensor internal memory using the Fuel Tanks Monitor application; the Profile should contain:

- sensor measuring probe length;
- values of "Empty"/ "Full" calibration frequencies of the measuring generator for the minimum and maximum fuel levels;
- values of points of the tank calibration table.

In case DUT-E 2Bio S7 is mounted into a tank in which different types of fuel are used from time to time, the fuel type correction function must be enabled in its Profile; also, values of "Empty"/ "Full" calibration frequencies for the third electrode must be set in its Profile.

Table 3 – Numerical values of the sensors' malfunctions mask

Numerical value	Description of malfunction
1	Fuel temperature. No data or incorrect data
64	Current frequency of sensor's measuring generator is higher by more than 100 Hz, compared to the stored value obtained during the calibration of the sensor's "minimum"
256	Calibration error
512	Defective measuring generator. Possible locking of the measuring module pipes
1024	Low battery charge (<10 %)
2097152	Real time clock. Clocking is off
16777216	Device operates in "Manufacturing" mode*
8388608	Malfunction of 3d electrode measuring generator**
<p>* This value is not a sign of the sensor malfunction; it only shows that its BLE-module operates in "Manufacturing" mode (see 2.3).</p> <p>** Valid only for sensors DUT-E 2Bio S7.</p>	

[SPN](#) values of the sensor output message may be calculated according to the formula (1) using attributes from table 4.

$$\text{Parameter value} = \text{SPN Content} \cdot \text{Factor (Resolution)} + \text{Offset} \quad (1)$$

Table 4 – Attributes for calculation of the current Parameters values

Parameter	Factor (Resolution)	Offset
SPN 521440	0.001	0 Hz
SPN 521457	1	-50 °C
SPN 521023*	0.1	0 mm
SPN 521728*	0.1	0 l
SPN 521773**	0.001	0 Hz
SPN 521774**	0.001	0

* Valid only for sensors DUT-E S7 (Model code 13) and DUT-E 2Bio S7.
 ** Valid only for sensors DUT-E 2Bio S7.

The fuel level value (L_{act}) may be calculated according to the formula (2):

$$L_{act} = L_s \cdot F_1 \cdot (F_0 / F_{act} - 1) / (F_0 - F_1), \text{ mm} \quad (2)$$

where L_s – length of the sensor measuring probe after cutting, mm;

F_0 – frequency of the dry sensor measuring generator, Hz;

F_1 – measuring generator frequency of the sensor fully plunged into the fuel, Hz;

F_{act} – current value of the sensor measuring generator frequency, Hz.

1.4.3 Compatibility with Terminals and receiving devices

[DUT-E S7](#) / [DUT-E 2Bio S7](#) wireless fuel level sensors may be used together with Terminals and receiving devices (Android smartphones, tablets, other tracking devices) using Bluetooth version 4.X and higher standards of wireless interface.

[Technoton](#) regularly conducts tests for compatibility and joint accuracy of sensors with different models of Terminals (Vehicle tracking devices).

<https://www.jv-technoton.com/> web-page contain a [table](#) with up-to-date list of Compatibility declarations of Technoton products and Telematic units of various manufacturers.

Recommendations on connecting and setting up the equipment can be obtained from [Technical support](#) of Technoton by e-mail support@jv-technoton.com.



RECOMMENDATION: The best compatibility with wireless sensors during its operation using [S7 Technology](#) is provided by [CANUp 27 Pro](#) Telematics gateway. The procedure for connection of wireless [Units](#) to the Gateway please, see in [CANUp 27 Operation Manual](#).

1.4.4 Overall dimensions

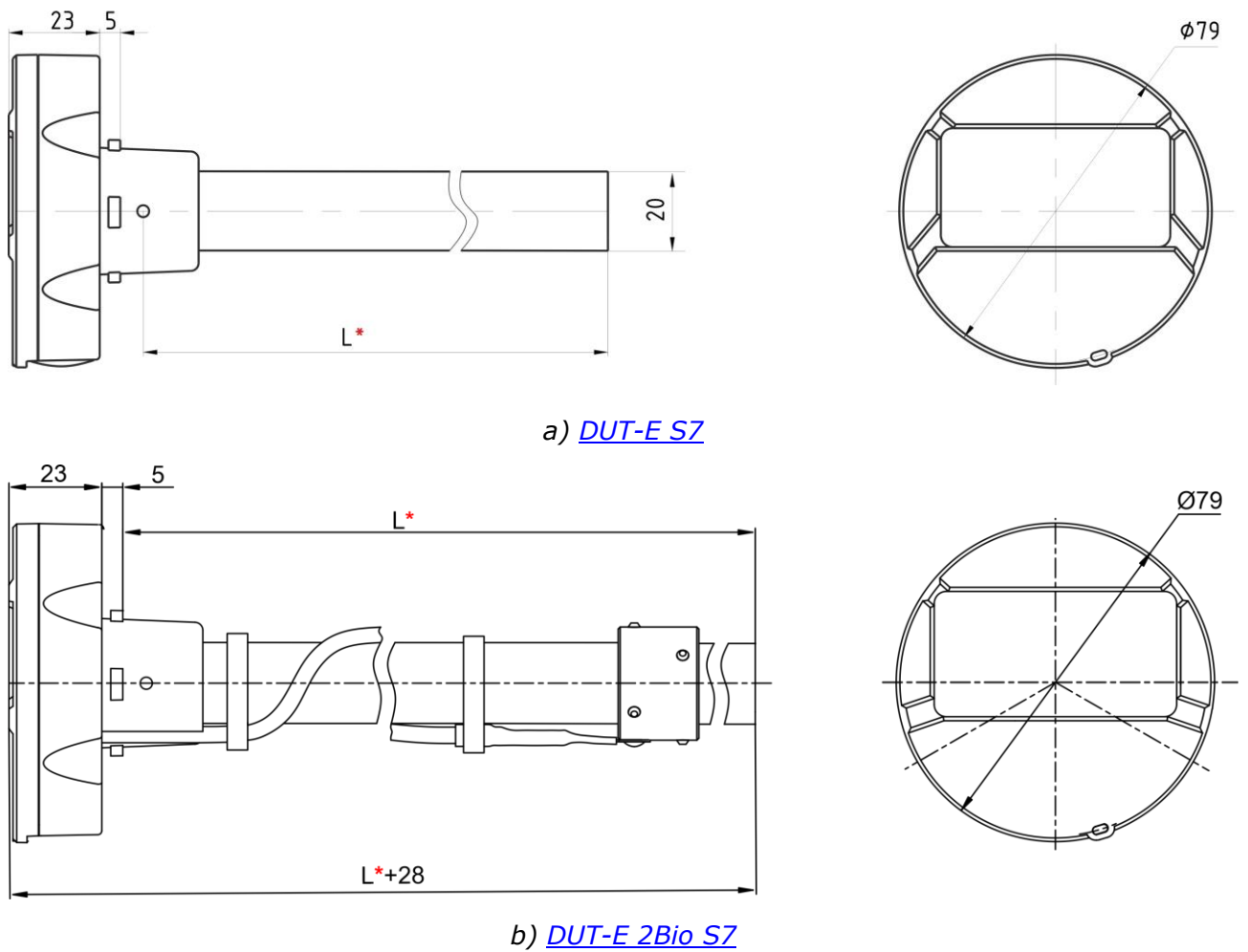


Figure 13 — Overall dimensions

* Nominal measuring probe length (700 or 1000 mm).

2 Sensor installation

To ensure correct operation of [DUT-E S7](#) / [DUT-E 2Bio S7](#) wireless fuel level sensors, their mounting must be carried out by certified specialists who have passed [corporate technical training](#).



ATTENTION: During sensor mounting you are to follow general health and safety rules for repairing vehicles and tractors, as well as health and safety rules established at a particular company.

In this chapter, general recommendations regarding sensor mounting are provided. Detailed recommendations regarding sensor mounting are similar to appropriate recommendations for cable-connected fuel level sensors which are provided [in Installation instructions for DUT-E/DUT-E 2Bio/DUT-E GSM/DUT-E S7](#).

For mounting sensor, we recommend to have the following tools and accessories:

- Small tools: (box wrench kits, drive sockets, screwdrivers, pliers, jab saw or angle grinder with a cutoff disk, rivet spinner).
- Drill (screw driving machine) with a set of drill bits for metal.
- Hollow drill set, d=38 mm.
- 10...20 l verified measuring reservoir for fuel.
- In case the tank volume is more than 200 l, the availability of a filling station with a counter or [DUT-E ATS automatic calibration station](#) is preferable.
- Calibration pipe with one end sealed, its length being no less than the height of the tank to be equipped.
- Silicone sealing compound.
- Rags.
- Diesel fuel; full tank for each [Vehicle](#).
- Spare tank for fuel of volume equal to that of the given fuel tank.
- Mobile device (Android tablet or smartphone), with Fuel Tanks Monitor application installed.



RECOMMENDATION: Tank calibration using DUT-E ATS automatic calibration station eliminates the impact of human factor on the calibration accuracy and reduces the calibration error down to ± 0.5 % of the tank volume, it also reduces by 2...3 times labor costs and time for the tank calibration (see [DUT-E ATS operation manual](#)).

2.1 Exterior inspection prior to works start

It is necessary to conduct DUT-E S7 exterior inspection for the presence of the possible defects arisen during transportation, storage or careless use.

Contact the product supplier if there any defects.

2.2 General recommendations for sensor installation

2.2.1 Standard fuel sensor replacement

[DUT-E S7](#) / [DUT-E 2Bio S7](#) can be mounted either into the flange of factory mounted float sensor* or into a specially drilled hole of the fuel tank.



ATTENTION: If the standard fuel sensor is not located in the geometrical center of the tank, it is not recommended to replace it with DUT-E S7 or DUT-E 2Bio S7. Sensor installation far from the geometrical center of the tank will lead to significant fluctuations in fuel level readings.

Dismount the standard sensor and clean the mounting area before sensor mounting.

M5x16 bolts can be used for installation; they are included into the [delivery set](#). Bolt or screw heads must be completely sunk in the mounting plate (see figure 14).



Figure 14 — Mounting plate screwed to the tank

Preorder correspondent mounting plate to replace the standard sensor with **SAE 5 bolt** bores layout.



RECOMMENDATION: For a further easier sealing of sensor pass the sealing cord through the sealing hole of the plate **prior** to fastening the plate to the tank!

* Study carefully the layout of the mounting bores for a factory mounted fuel sensor and compare it with the drawing of bores for a mounting plate.

2.2.2 Installation into a special hole

IMPORTANT:



- 1) Before drilling a bore in a fuel tank, the tank must be emptied, dismantled (if necessary) and dried or filled with water.
- 2) Before drilling, make sure that there are no bulkheads that interfere sensor installation.
- 3) Eliminate contact of measuring probe with the bar of the standard float fuel sensor.

Sequence of operations during mounting:

- 1) Determine installation location. **Geometrical center of the fuel tank** is recommended (see figure 15). This will reduce measurement errors caused by fuel level deviation during driving.

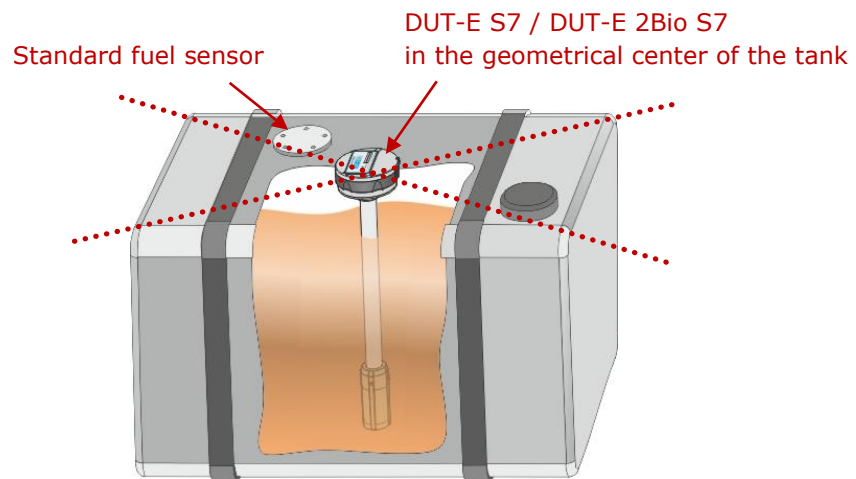


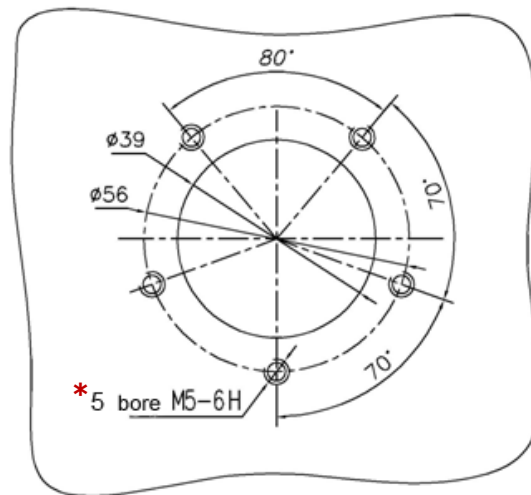
Figure 15 — Recommended location for a sensor installation

- 2) Stick hole placement template from [delivery set](#) to the top of the tank and drill holes accordingly (see figure 16).

We recommend to drill a hole for the sensor mounting plate with a hollow drill set **38 mm** in diameter.



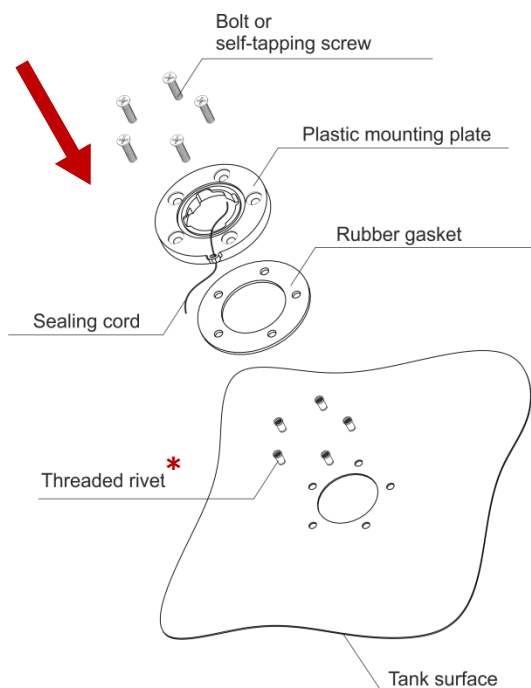
BE CAREFUL: The mounting plate can be installed only in one position on the bores prepared! Before marking and drilling, examine the place where you plan to fix the mounting plate because sealing holes should be accessible.



* While installing fastening plate with threaded rivets, make $d=7\text{ mm}$ holes for rivets.

Figure 16 — Bores layout for sensor mounting plate fastening

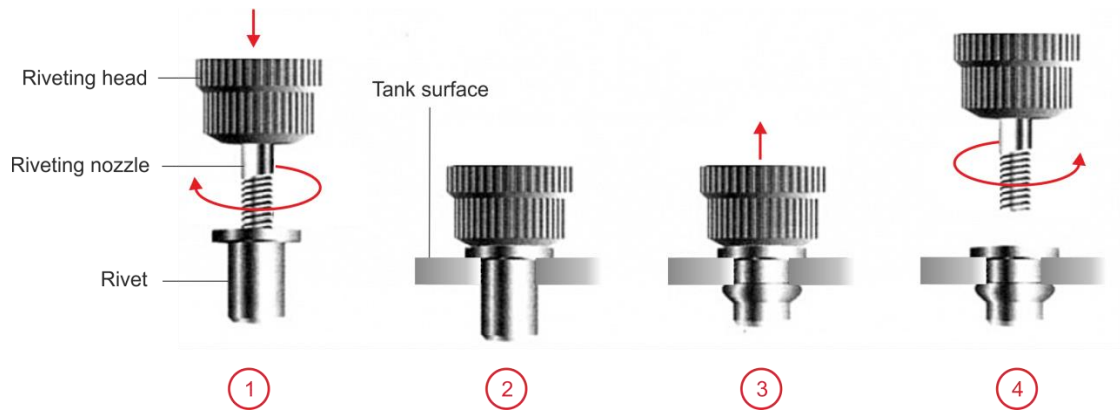
3) Put rubber gasket and fastening plate over prepared holes, fix them with screws and threaded rivets of with self-tapping screws from [MK DUT-E](#) mounting kit (see figure 17).



* Recommend for installation of sensor in fuel tank with thin walls (**less than 2 mm**).

Figure 17 — Mounting plate fastening

When using threaded rivets, they should be mounted using riveter and according to figure 18.



a) threaded rivets procedure of installation



b) installed fastening plate view of from inside of tank

Figure 18 — Threaded rivets usage for sensor installation



ATTENTION: When fixing the mounting plate to the tank, make sure that the bolt or screw heads are not skewed and completely sunk in the plate in order to provide **electrical isolation** between the tank and [DUT-E S7](#) / [DUT-E 2Bio S7](#).

2.2.3 Probe cutting according to tank depth



ATTENTION: It is allowed to cut the measuring probe of [DUT-E S7](#) / [DUT-E 2Bio S7](#) to any needed length.

Sequence of operations for cutting the sensor measuring probe:

1) Measure the depth of the tank from mounting plate to the bottom.



IMPORTANT: It is **required to leave a 20...30 mm gap** between the edge of the measuring probe and the tank bottom to:

- provide at least **10 mm** operation area for bottom spring stopper (if the bottom spring is fixed in full loading position the bayonet mounting plate can get damaged);
- avoid the short circuit of the measuring probe tubes with conductive mud or water at the tank bottom.

2) Cut the sensor measuring probe with a metal hacksaw so that the cut would be 25 mm from the tank bottom. Trim the cut edges carefully and wash the tubes with fuel (see figure 19).

Particularities regarding cutting the DUT-E 2Bio S7 sensor measuring probe:

- Before cutting, cut the lower cable tie fixing the additional electrode cable. Slide additional electrode to the measuring "head" of the sensor to avoid damaging the additional electrode cable while cutting the sensor.
- After cutting, wind evenly the cable of the additional electrode on the tubes of the sensor measuring probe and fix it with a new cable tie from the [delivery set](#) (see figure 20).



Figure 19 — Measuring probe cutting and flushing the cut with fuel

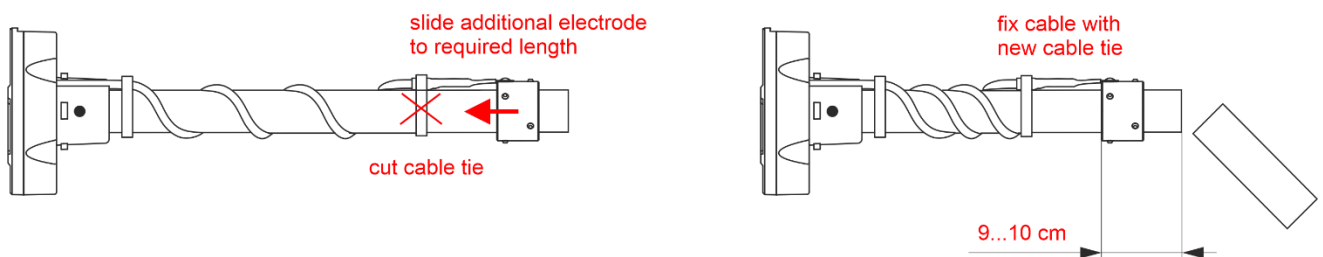


Figure 20 — Particularities of cutting the DUT-E 2Bio S7 sensor measuring probe

3) In case you use the Fuel Tanks Monitor application, after cutting the measuring probe, for correct displaying fuel level indications, **you must conduct the measuring system calibration** in the mobile device you are using.



IMPORTANT: In order to receive correct measurement results with [DUT-E 2Bio S7](#) and for correct operation of the automatic fuel correction in conditions of a specific fuel tank, **by all means conduct the calibration procedure of the sensor additional electrode!** This procedure allows to eliminate the influence of the casing and the tank baffle plates on the frequency of DUT-E 2Bio S7 measuring generator.

After cutting DUT-E S7 (Model code 13) or DUT-E 2Bio S7, save the [Sensor profile](#) with the help of Fuel Tanks Monitor application in the memory of the mobile device you are using. You can also record the Profile into the sensor internal memory (see the document "[Fuel Tanks Monitor mobile application. User manual](#)").



WARNING: Correct monitoring readings of fuel level and volume in the tank is possible without recording the profile into the internal memory of sensor by using Fuel Tanks Monitor application **only** on a specific mobile device containing the profile of this sensor.

The sensor Profile must contain:

- measuring probe length;
- "Empty"/ "Full" calibration frequencies of the measuring generator for the minimum and maximum fuel levels, respectively;
- points of the tank calibration table.
- enabled function of fuel type correction and "Empty"/ "Full" calibration frequencies for the third electrode (applicable only for DUT-E 2Bio S7, in case of using different types of fuel from time to time).

2.2.4 Extension of the measuring probe length

The sensor length is extended by means of attachment of [additional sections of DUT-E](#) to its measuring probe (see figure 21 and [DUT-E Length extension with KDC](#) video).

Length extension option significantly decreases expenses on storage and transportation.

Model range of additional sections includes: **KDC 250**, **KDC 500** and **KDC 1000** (lengths of 250, 500 and 1000 mm respectively).

For DUT-E S7 (Model code 13) sensors, length extension up to **6000 mm** is allowed.

For DUT-E S7 (Model code 07) sensors, length extension up to **3000 mm** is allowed.

Particularities of length extension for DUT-E 2Bio S7 sensor:

The maximally allowed measuring probe length extension for **standard modifications** of DUT-E 2Bio S7 limited by the additional electrode cable length is calculated according to the formula (1):

$$L_{\max} = 1,7 \cdot L \quad (1)$$

where **L** – nominal length of the sensor measuring probe (see [figure 13 b](#)).

To increase the length of sensor take off additional electrode together with its cable from the measuring probe. After fixing the additional sections place additional electrode to the end of measuring probe and equally wrap the cable around the tubes.



IMPORTANT: For correct operation of the function of automatic fuel type correction, the distance from the upper edge of the additional electrode to the cut of the extended measuring probe of DUT-E 2Bio S7 must be **no more than 10 cm**.

If necessary, additional sections can be cut to the necessary length. While cutting them, you should be guided by recommendations set out in [2.2.3](#).

In case you fix additional sections, the force moment of tightening the threaded connection of the internal tube must be **10 N/m**, and that of the external tube must be **40 N/m**.



a) external view of KDC additional section

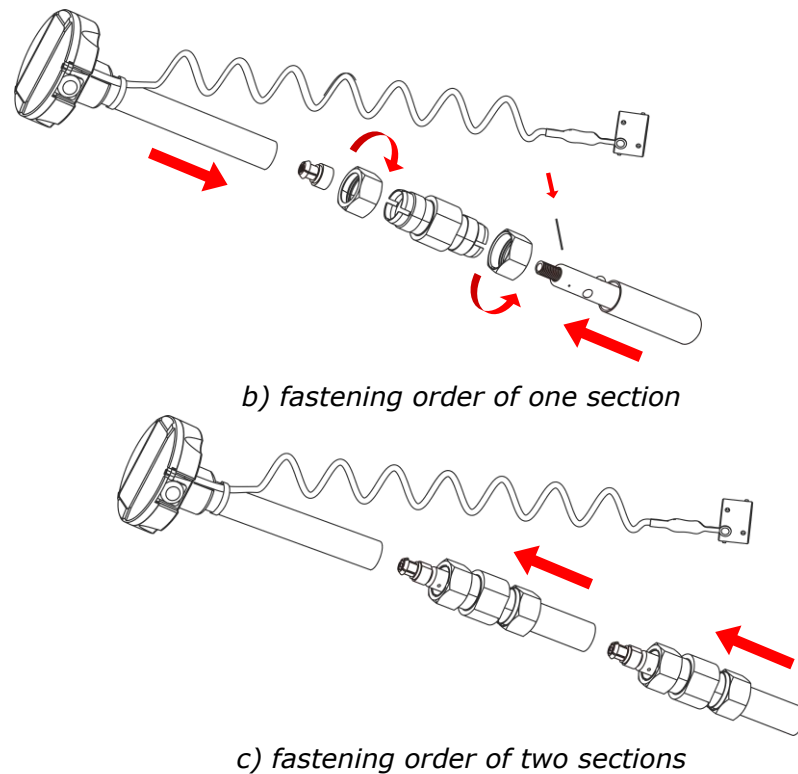


Figure 21 — Extension of sensor length using additional sections
(DUT-E 2Bio S7 is taken as an example)

When using the Fuel Tanks Monitor application, after the sensor length extension, **you are to conduct the measuring system calibration** on the mobile device you are using, for correct displaying fuel level readings.



IMPORTANT: In order to receive correct measurement results with [DUT-E 2Bio S7](#) and for correct operation of the automatic fuel correction in conditions of a specific fuel tank, **by all means conduct the calibration procedure of the sensor additional electrode!** This procedure allows to eliminate the influence of the casing and the tank baffle plates on the frequency of DUT-E 2Bio S7 measuring generator.

After length extension of DUT-E S7 (Model code 13) or DUT-E 2Bio S7, save the [Sensor profile](#) in the memory of the mobile device you are using with the help of the Fuel Tanks Monitor application. You can also record the Profile into the sensor internal memory (see the document "[Fuel Tanks Monitor mobile application. User manual](#)").



WARNING: Correct monitoring readings of fuel level and volume in the tank is possible without recording the profile into the internal memory of sensor by using Fuel Tanks Monitor application **only** on a specific mobile device containing the profile of this sensor.

The sensor Profile must contain:

- measuring probe length;
- "Empty"/ "Full" calibration frequencies of the measuring generator for the minimum and maximum fuel levels, respectively;
- points of the tank calibration table.
- enabled function of fuel type correction and "Empty"/ "Full" calibration frequencies for the third electrode (applicable only for DUT-E 2Bio S7, in case of using different types of fuel from time to time).

2.2.5 Mounting a screen filter and fixing the sensor

Before fixing the sensor, put on **the screen filter** at the end of the sensor measuring probe (purchased separately) (see figure 22 a). It is aimed at protection of the measuring probe electrodes from water and mud. Using the screen filter allows to enhance considerably the sensor service life (see the video [Screen filter of a fuel level sensor](#)).

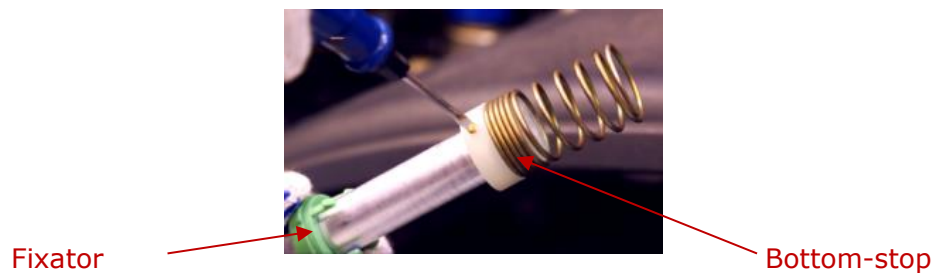
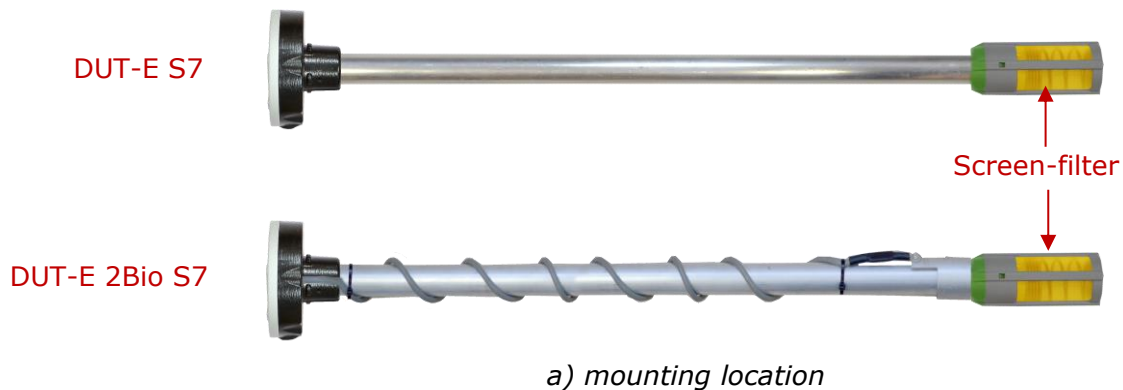
Screen filter mounting order:

1) Put the fixing element on the measuring probe (see figure 22 b).

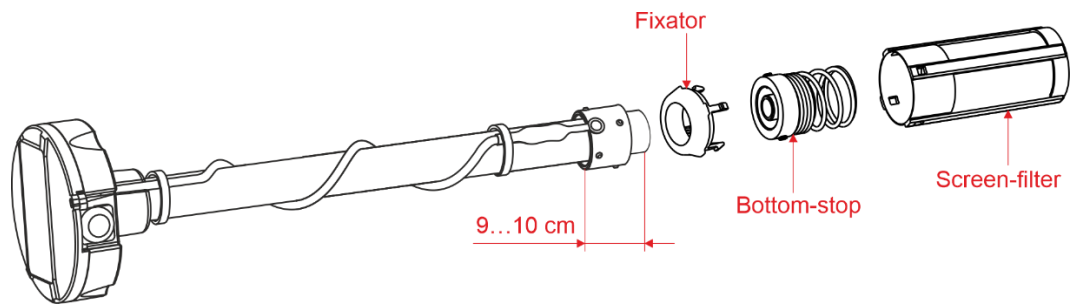
Note — In case you are using DUT-E 2Bio S7, first, move the additional electrode 9...10 cm from the cut on the measuring probe (see figure 22 c).

2) Mount the bottom stop and tighten it with two screws on the sides, using a screw driver.

3) Put the screen filter over the bottom stop and fix it with locks of the fixing element.



b) mounting order



c) mounting for DUT-E 2Bio S7

Figure 22 — Mounting a screen filter



ATTENTION: Screen filter cannot be used without installed bottom spring stop.

To fix the sensor, place the sealing ring into the groove of the mounting plate and put the sensor measuring probe, with the screen filter mounted, down into the hole. Then, press the sensor "head" and fix it by turning it clockwise (see figure 23).



RECOMMENDATION: Put some oil or fuel on the sealing ring of the mounting plate, to prevent its deformation during fixing the sensor.

The sensor mounting should be carried out in such a way that sealing holes in the mounting plate and those in the sensor casing would match after its fixing.

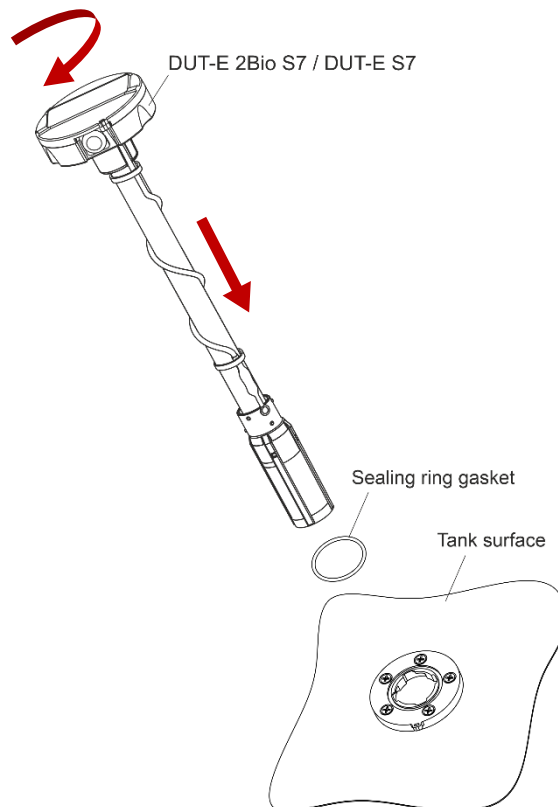


Figure 23 — Procedures for fixing the sensor

2.3 BLE-module activation



ATTENTION: Wireless data transfer to receiving devices by [DUT-E S7](#) / [DUT-E 2Bio S7](#) by means of [S7 Technology](#) ([Telematics terminal](#), smartphone/tablet, data display etc.) is possible **only after enabling** the sensor **BLE-module**.

To display readings of a wireless fuel level sensor on the screen of a smartphone/tablet using S7 Technology and to update the sensor firmware, the **Fuel Tanks Monitor** mobile application is used.

In case you use DUT-E S7 (Model code 13) or DUT-E 2Bio S7, you can record the [Profile](#) containing calibration frequencies and the tank calibration table into the sensor. This enables you to receive ready data of fuel level ([SPN 521023](#)) and fuel volume ([SPN 521728](#)) in the tank directly from the sensor (see the document "[Fuel Tanks Monitor Mobile application. User manual](#)").

You can install the Fuel Tanks Monitor application from the applications store Google Play (search request "Technoton").



WARNINGS:

1) To eliminate connection failures between the DUT-E S7 and the smartphone/tablet, you need to make sure that there are no sources of electromagnetic interference near your working place (radio telephones, video signal transmission units and other wireless devices operating within 2.4 or 5.0 GHz frequency bands, as well as running electric motors, powerful transformers and switching equipment, welding equipment, high-voltage lines etc.).

2) The maximum allowed distance between the DUT-E S7 and the smartphone/tablet depends on the quality of the Bluetooth connection of the mobile device. To assure the stable data transmission, it is recommended that this distance should not exceed 20 m.

Depending on the status of its BLE-module activation, DUT-E S7 / DUT-E 2Bio S7 sensor can be in the following modes:

1) "Storage" — the sensor is in this mode from the moment it is manufactured. The BLE-module of DUT-E S7 is disabled, no data transmission at all.

2) Manufacturing" — in this mode the BLE-module of DUT-E S7 is activated for data transfer only for the period of the sensor testing or checking its operability with Fuel Tanks Monitor application.

To activate this mode, you need to apply the magnetic key from the [delivery set](#) for **1...2 s** to the place indicated on the cap of the sensor "head" (see figure 24 a). After **4 h** or after another touching the indicated place for **1...2 s** by the magnetic key, the BLE-module of DUT-E S7 will switch back to "Storage" mode.

3) "Operating" — this mode is enabled right before mounting the sensor in the [Vehicle](#) tank or in a fixed tank. In "Operating" mode, the BLE-module is fully enabled, without the possibility to switch it back to the inactive state. After that, the sensor is ready to transfer data by means of S7 Technology throughout its service life.

To activate "Operating" mode from "Storage" mode, you need to bridge the tubes of DUT-E S7 measuring probe with a small screwdriver and **simultaneously** apply the magnetic key for **1...2 s** to the indicated place on the cap of the sensor "head" (see figure 24 b).

4) "Service" – this mode serves to update the inbuilt firmware of sensors and to record the [Sensor profile](#) (saved before in the mobile device memory) into the internal memory of DUT-E S7 (model code 13) or DUT-E 2Bio S7.

Note – Detailed description of operations performed in "Service" mode is provided in the document "[Fuel Tanks Monitor mobile application. User manual](#)".

- To switch over sensor into "Service" mode from "Storage" mode, you need to apply the magnetic key for **1...2 s** to place indicated on the cap of the sensor "head". The "Service" mode is enabled only for **20 s** during which you must establish communication between the sensor and the mobile device using Fuel Tanks Monitor application, for further firmware update. If during 20 s after sensor is switched into "Service" mode the communication with the mobile device is not established, the sensor will automatically switch back into "Manufacturing" mode.
- To switch over sensor into "Service" mode from "Operating" mode, you need to bridge the tubes of the measuring probe with a small screwdriver and simultaneously apply the magnetic key for **1...2 s** to the indicated place on the cap of the sensor "head". The "Service" mode is enabled only for **20 s** during which you must establish communication between the sensor and the mobile device using Fuel Tanks Monitor application, for further firmware update. If during 20 s after sensor is switched into the "Service" mode the communication with the mobile device is not established, the sensor will automatically switch back into "Operating" mode.

WARNINGS:

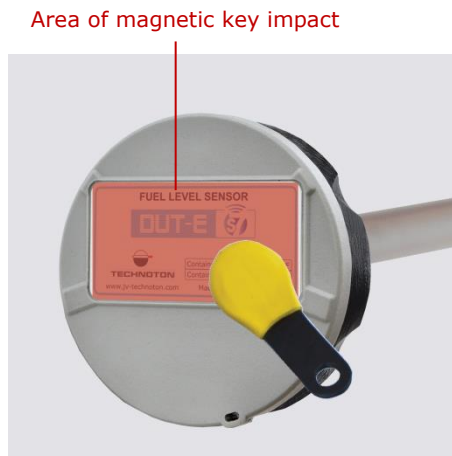
1) Firmware update in "Service" mode is allowed for all sensors except DUT-E S7 ([Model code](#) 07) with the version of firmware lower than **18.0**.

2) Firmware update is conducted **only** with the aim of the sensor improvements recommended by the [Manufacturer](#).



3) You should take note that after the firmware update, DUT-E S7 (Model code 07) **always switches over into "Storage" mode**, irrespective of the initial mode in which it was before the firmware update. After the firmware update, DUT-E S7 sensors (model code 13) and DUT-E 2Bio S7 **remain in the initial mode** (i.e. the mode in which they were before the firmware update).

4) Recording the Profile into the sensor internal memory in "Service" mode is allowed only for DUT-E S7 (Model code 13). Before doing that, you are to enter calibration data, the tank calibration table and, if necessary, the thermal correction coefficient into the Profile. After that, the Profile must be saved in the memory of the mobile device used.



Apply the magnetic key to the cover of the sensor "head" for 1...2 s

a) to switch from "Storage" mode into "Manufacturing"/"Service" mode



Bridge the tubes of the measuring probe

+

Area of magnetic key impact



Apply the magnetic key to the cover of the sensor "head" for 1...2 s

b) to switch from "Manufacturing" mode into "Operating"/"Service" mode

Figure 24 — Activation of DUT-E S7 BLE-module

2.4 Measuring system calibration



IMPORTANT: The obligatory condition for correctness of indications of [DUT-E S7](#) / [DUT-E 2Bio S7](#) wireless fuel level sensor is the procedure of **the measuring system calibration which is conducted before its use!**

The aim of the measuring system calibration is to create the calibration table for a specific tank in which the wireless fuel level sensor is mounted.

The calibration table determines the dependence of the fuel volume value on the sensor output frequency ([SPN 521440](#)) (see [1.4.2](#)) which corresponds to the measured fuel level.

Values of the calibration table points are then recorded into the respective settings of the [Terminal](#) and/or [Server](#) (e.g. — [ORF 4](#) / [ORF 5](#)). Further on, the calibration table is used by the [Telematics system](#) for automatic calculation of the current fuel volume in the [Vehicle](#) tank.

The calibration procedure consists of a sequence of the tank fill-ups with fixed portions of fuel within the range from the empty to the full state.



IMPORTANT: When measuring the volume of fuel portions added to the tank, use a measuring reservoir with an error not more than 0.25 %.

For your convenience while creating the calibration table (no less than 15 points are recommended, 60 points at a maximum), install and use the Fuel Tanks Monitor free application on your mobile device. The application automatically performs plotting of the calibration table; it allows to record the calibration table into the file and monitor the sensor readings on the display of a smartphone/tablet.

You can study the detailed description of the measuring system calibration procedure which is conducted with the help of Fuel Tanks Monitor application in the document "[Fuel Tanks Monitor mobile application. User manual](#)"

To make fuel tank calibration correctly, where the sensor is installed, it is required to follow the procedure:

- the Vehicle should not be loaded and stand on the flat horizontal surface;
- fuel tank should be empty;
- the vehicle wheels must be of standard size (replacement by wheels of non-standard type and size after the calibration procedure is conducted results in decreasing measurements accuracy or another calibration is needed);
- the tire pressure should match with the prescribed for this Vehicle;
- the vehicle should not move, ignition off, engine off;
- pause between fuel fillings by portions into the tank should be not less than 60 seconds.



RECOMMENDATION: After the sensor mounting in the tank, the end of its measuring probe is located at a distance of 20...30 mm from the tank bottom. Some 10...30 l of the remaining fuel which is not consumed is usually left in this dead zone which is not accessible for monitoring. While creating the calibration table, we recommend to enter for its first point (level of 0.0 mm) the value of the fuel volume which is equal to the volume of not consumed fuel remaining in the tank.

When using DUT-E S7 (Model code 13) or DUT-E 2Bio S7, in case you need to transfer ready fuel level readings ([SPN 521023](#)) and fuel level in the tank ([SPN 521728](#)) directly from the sensor to the [Terminal](#), first, save the [Sensor profile](#) in the memory of the mobile device used with the help of Fuel Tanks Monitor application.

Then, after you switch into the "Service" mode, record the Profile saved in your mobile device into the sensor internal memory.

The sensor Profile must contain:

- measuring probe length;
- "Empty"/ "Full" calibration frequencies of the measuring generator for the minimum and maximum fuel levels, respectively;
- points of the tank calibration table;
- enabled function of fuel type correction and "Empty"/ "Full" calibration frequencies for the third electrode (applicable only for DUT-E 2Bio S7, in case of using different types of fuel from time to time).



IMPORTANT: In order to receive correct measurement results with [DUT-E 2Bio S7](#) and for correct operation of the automatic fuel correction in conditions of a specific fuel tank, **by all means conduct the calibration procedure of the sensor additional electrode!** This procedure allows to eliminate the influence of the casing and the tank baffle plates on the frequency of DUT-E 2Bio S7 measuring generator.

For monitoring readings of wireless fuel level sensors on the screen of a smartphone/tablet using the Fuel Tanks Monitor application, Profiles of corresponding sensors must be recorded into the memory of the mobile device used.

In case of using [DUT-E S7](#) (Model code 13), you may choose the data source for displaying readings of fuel level and fuel volume in the tank — either from data calculated by the application, or from data received directly from the sensor.

For [DUT-E 2Bio S7](#) , when displaying fuel level and fuel volume readings in the application, only data received directly from the sensor are used.



RECOMMENDATION: Tank calibration using [DUT-E ATS automatic calibration station](#) reduces the calibration error to $\pm 0,5$ % of the tank volume; it also reduces by 2...3 times labor costs and time for the tank calibration (see [DUT-E ATS operation manual](#)).

3 Sealing

To prevent unauthorized interference into the operation of the mounted [DUT-E S7](#) / [DUT-E 2Bio S7](#), it is necessary to seal the sensor with a sealing cord and a disposable plastic seal* included into [delivery set](#) (see figure 25).

To seal the sensor put the sealing cord through the special holes of the mounting plate and sensor body. Then put the ends of the cord through the holes in the center of the plastic seal body. Latching the seal will lock the cord. Seal removal will be impossible without its damaging.



Figure 25 — Sealed sensor



WARNING: Sealing rope should not touch the fuel tank body!

* Design of the seal supplied within the delivery set can differ from the one displayed in figure 25.

4 Measurement accuracy check

4.1 Basic principles

Accuracy check test is conducted to determine the reduced and absolute error of fuel volume measurement on the particular vehicle fuel tank.

The procedure of sensor accuracy check requires filling/draining of the fuel tank and comparing sensor data with the actual amounts of filling/draining.

Fuel drain is carried with manual or mechanical pump.

Calibrated measuring containers must be used to determine the exact amount of drained/refilled fuel.



ATTENTION: The amount of any fuel filling/draining during the accuracy test should not be less than 20 % of total tank capacity.

4.2 Check tests procedure

Check tests should be carried out in the following order:

- 1)** Drain a fixed volume of fuel.
- 2)** Determine the exact amount of drained fuel with the calibrated measuring container.
- 3)** Record the data into the Check test report.
- 4)** Wait for the fuel getting still in the tank (for stable sensor readings).
- 5)** Refuel the tank with the previously drained fuel.
- 6)** Record the data into the Check test report.
- 7)** When analyzing accuracy errors, "Drain" and "Refill" [Parameters](#) are estimated as a percentage relative to the total tank capacity.

See [annex A](#) for check test report template and error calculation formula.

5 Malfunction diagnostics



WARNING: Readings of [DUT-E S7](#) / [DUT-E 2Bio S7](#) would not be correct in case of short circuit of the sensor measuring probe tubes due to electrically conductive mud or water.

It is convenient to monitor the quality of service of sensor with the help of Fuel Tanks Monitor application. During the session of work with the application, names and indicators of all sensor active malfunctions (if any) are displayed on the screen of a smartphone/tablet.

In case there are no active sensor malfunctions, the appropriate message is displayed (see details in the document "[Fuel Tanks Monitor mobile application. User manual](#)").

6 Maintenance

6.1 General instructions

[DUT-E S7](#) / [DUT-E 2Bio S7](#) visual inspection and operation check is recommended at least once per year.



IMPORTANT: We recommend to check annually the correctness of the measuring system calibration for minimum and maximum levels of fuel in the tank (provided that the tank has not lost its shape and was not replaced). In case of incorrect indication, repeat the measuring system calibration. Re-calibration of the fuel tank of Vehicle in this case is not required.

Sensors repair works are carried out only by certified **Regional Service Centers** ([RSC](#)). Full list of RSC can be found at <https://www.jv-technoton.com/>.

6.2 Demounting

Clean the tank surface nearby the mounting location before [DUT-E S7](#) / [DUT-E 2Bio S7](#) demounting.

Prepare a clean napkin to clean the fuel from the sensor probe.

Cut the sealing cord carefully.

Unfasten sensor by turning its body counterclockwise.

Mount the fuel tank plug (be ordered separately) for protection from any possible clogging through mounting opening.

Remove screen-filter and bottom stop from the end of measuring tubes.

ATTENTION:



1) Screen-filter dismantling should be done carefully to avoid breaking latches of fixator.

2) During DUT-E 2Bio S7 demounting, don't pull the cable of the additional electrode. If so, you may damage the cable and/or the measuring module.

3) In case of repeated installation of sensor — replace the old rubber gasket with a new one.

6.3 Examination

[DUT-E S7](#) / [DUT-E 2Bio S7](#) is demounted conduct a visual examination to detect the following defects:

- visible damages of the sensor head body, measuring probe;
- cables of the additional electrode and temperature sensor*;
- backlash of measuring unit tubes relative to each other and/or the body;
- incorrect positioning of the additional electrode in relation to the cut of the measuring probe (see [figure 20](#))*;
- presence of mud or paraffin between the tubes of the measuring probe;
- damage of the plastic mounting plate and traces of fuel leaks through the rubber gasket of the mounting plate.

Contact [RSC](#) or [Manufacturer](#) if the defects detected.

* Valid only for DUT-E 2Bio S7.

6.4 Cleaning

During the sensor operation, mud or paraffin residue can accumulate on the surface of the measuring probe tubes and of the additional electrode*. Dirt in the cavity between the tubes of the measuring probe can lead to significant increase of accuracy error.



ATTENTION: Mud residue accumulated inside the central tube of the measuring probe does not affect the sensor operability and error of measurements. You should control the cleanness of the cavity between the two tubes of the measuring probe, as well as between the measuring probe and the additional electrode*.

You should clean the tubes of the measuring probe and the additional electrode* from dirt by washing them in the fuel. If there is paraffin in the cavity between the tubes, it is necessary to slightly warm the measuring part with a heat gun to remove it.

It is also recommended to wash the [screen filter](#) as well.



ATTENTION: While washing the tubes of the measuring probe, the additional electrode and the screen filter, take care not to let the fuel splash on the sensor casing.

* The additional electrode is applicable only to DUT-E 2Bio S7.

7 DUT-E S7 Radiobox RS wireless interface

7.1 Purpose of use, operation principle, application area

DUT-E S7 Radiobox RS wireless interface (further on — [DUT-E S7 Radiobox RS](#)) (see figure 26) is designed for:

- reception of data from DUT-E S7 wireless sensors (up to 2 pcs.) by means of [S7 Technology](#) and their conversion into RS-232/RS-485 interface (protocol Modbus RTU/ [DUT-E COM](#));
- totalization of fuel volume indications in two fuel tanks (storage tanks) in which [DUT-E S7](#) sensors are installed.



Figure 26 — Exterior view of DUT-E S7 Radiobox RS

Application area: DUT-E S7 Radiobox RS may be used together with DUT-E S7 wireless sensors as part of [Telematics systems](#) based on the [Telematics terminal](#) (of any manufacturer) that has RS-232/RS-485 input (see figure 27).

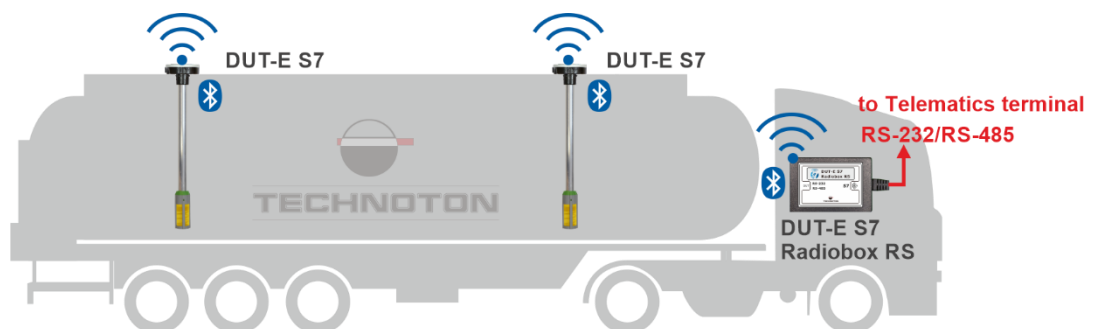
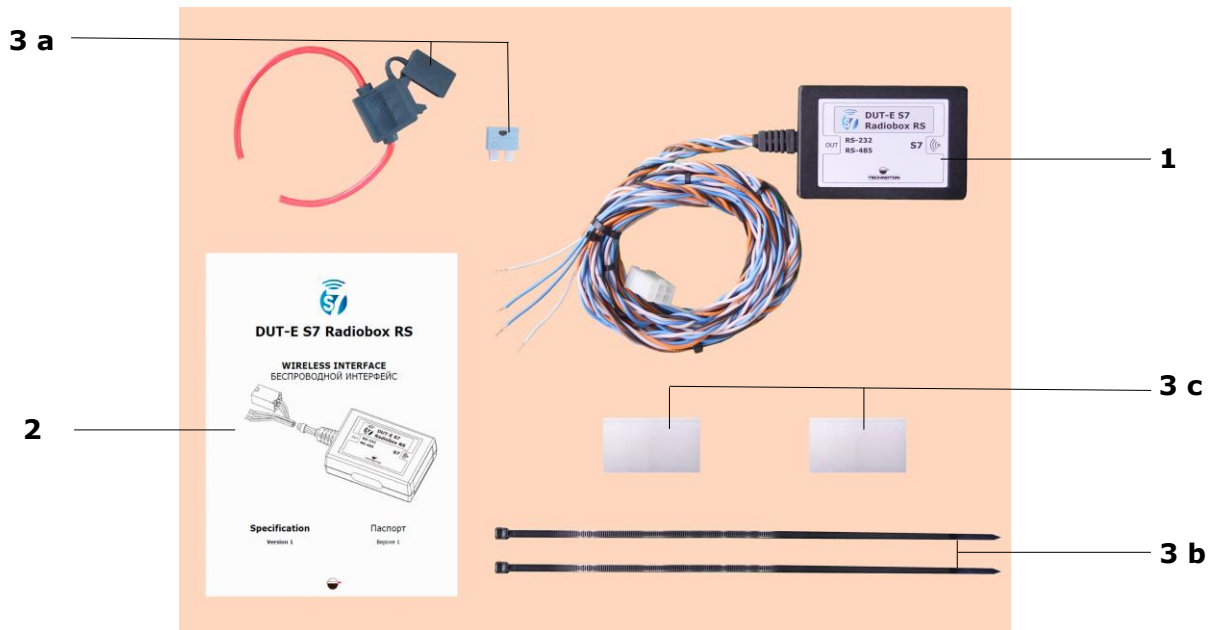


Figure 27 — Example of DUT-E S7 Radiobox RS employment in a transport Telematics system

Operating principle: DUT-E S7 Radiobox RS has an inbuilt BLE-module which receives signals in the continuous mode from wireless fuel level DUT-E S7 sensors (up to 2 pcs.) by means of S7 Technology, at a distance of up to 50 m. In accordance with user settings, the DUT-E S7 Radiobox RS automatically processes signals received and converts them into ready data for RS-232/RS-485 interface.

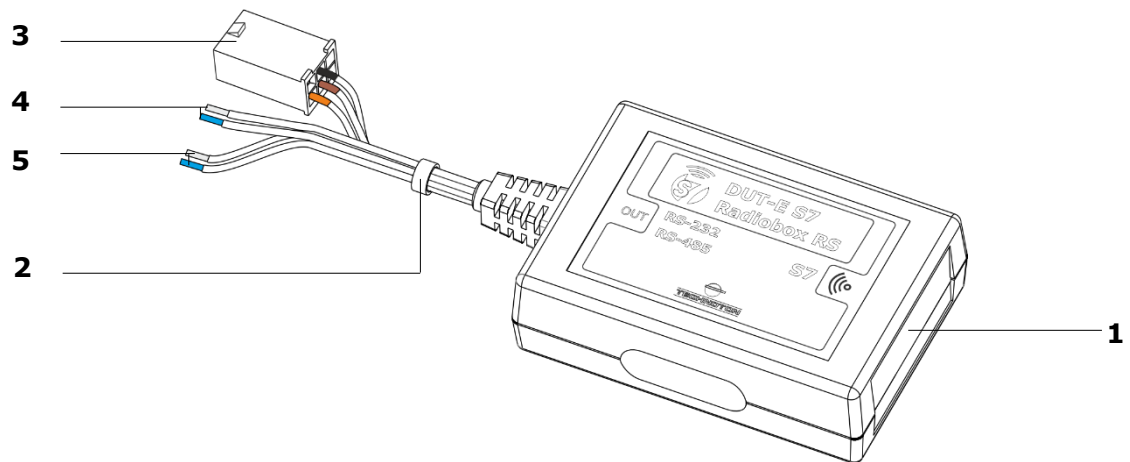
7.2 Delivery set



- | | | |
|----------|---|-----------|
| 1 | DUT-E S7 Radiobox RS wireless interface | - 1 pc.; |
| 2 | Specification | - 1 pc.; |
| 3 | Mounting kit (1 pc.) including: | |
| | a) fuse with holder (2 A) | - 1 pc.; |
| | b) cable tie | - 2 pcs.; |
| | c) self-adhesive clasp (5 cm) | - 2 pcs. |

Figure 28 — DUT-E S7 Radiobox RS delivery set

7.3 Design



- 1 – casing inside which there is the BLE-module designed to receive data from DUT-E S7 by means of [S7 Technology](#), the electronic unit for processing the data and the non-volatile memory to save user settings;
- 2 – wire bundle **OUT** designed for operational connection and service connection;
- 3 – **S6 Mol** service connector (**KLINE** wire (black) for configuration, **VBAT** (orange) and **GND** (brown) wires for power supply connection);
- 4 – **TX** (blue) and **RX** (white) wires for connection to the [Telematics terminal](#) via RS-232 interface;
- 5 – **B** (blue) and **A** (white) wires for connection to the Telematics terminal via RS-485 interface.

Figure 29 — [DUT-E S7 Radiobox RS](#) design

7.4 Technical specifications

7.4.1 Main specifications

Table 5 – [DUT-E S7 Radiobox RS](#) main specifications

Parameter, measuring unit	Value
Wireless data receive interface	Bluetooth 4.1
Output interface	RS-232/RS-485
Service interface	K-Line (ISO 14230)
Receiver sensitivity (Rx), dBm	-88
Maximum distance to sensor, m	20 (in case there are metal partitions in the mounting location) 50 (when mounted within line-of-sight range)
Power supply voltage range, V	9...45
Maximal current consumption at supply voltage 12/24 V, mA, not more than	80/60
Ambient operation temperature range, °C	-40...+85
Ingress protection rating	IP40
Certificates of BLE module electromagnetic compatibility	CE FCC and IC (see annex B), TELEC BQE
Weight, kg, not more than	0.2
Overall dimensions, mm, not more than	see figure 30

7.4.2 Output interface specifications

[DUT-E S7 Radiobox RS](#) output interface meets RS-232 and RS-485 standards.

No more than one DUT-E S7 Radiobox RS can be connected to the [Telematics terminal](#) via RS-232/RS-485 interface.

DUT-E S7 Radiobox RS supports the transmission of data:

- according to Modbus RTU protocol, in the “request-response” mode (see [DUT-E 2Bio fuel level sensors Operation manual](#), annex D).
- According to [DUT-E COM Protocol](#) (extended LLS) in the “request-response” modes and automatic deliverance (ASCII/ASCII EXT/HEX).

In accordance with DUT-E COM protocol, the data may be transmitted in the form of:

- dimensionless units, from 0 to 1000 (0 – empty tank, 1000 – full tank);
- fuel level in the tank, mm;
- volume of fuel, l;
- volume of fuel related to the full tank, %.

Besides the data on the fuel level in the tank, DUT-E S7 Radiobox RS transmit data on the current fuel temperature.

The selection of the required data transmission mode and the user configuration of parameters of RS-232/RS-485 digital interface are conducted using Service S6 DUT-E service software version not earlier than 5.11 (see [7.6.2](#)).

Using the service software, you can configure the summarization of fuel volume indications for two DUT-E S7 wireless sensors operating together with DUT-E S7 Radiobox RS (see [7.6.4](#)). Values of unique network addresses (SA) — 129 for DUT-E S7 Radiobox RS and 101 or 102 for DUT-E S7 are automatically set by the service software and are not accessible for editing by the user.

7.4.3 Overall dimensions

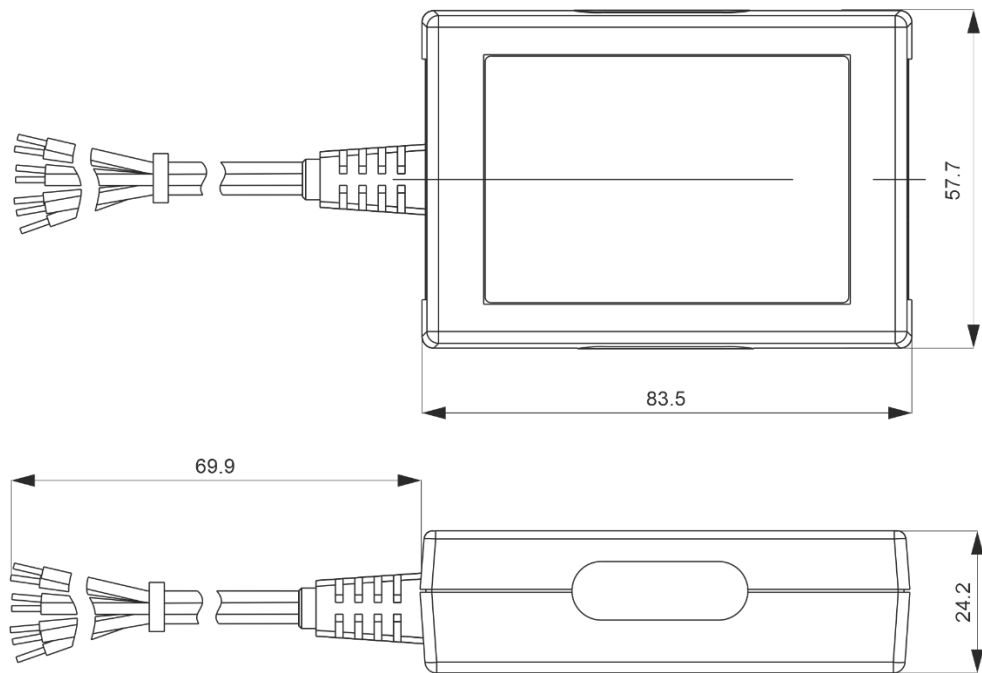


Figure 30 — [DUT-E S7 Radiobox RS](#) overall dimensions

7.5 Electrical connection

ATTENTION:



- 1) When mounting [DUT-E S7 Radiobox RS](#), strictly follow safety rules of car repair works as well as local safety rules of the customer's company.
- 2) Before starting DUT-E S7 Radiobox RS connection operations, study carefully the electric equipment diagram and the operation documentation of the [Vehicle](#) (facility) to be equipped.

It is required to conduct DUT-E S7 Radiobox RS exterior inspection for the presence of the possible defects arisen during transportation, storage or careless use. Contact the product supplier if there any defects.

IMPORTANT: DUT-E S7 Radiobox RS should not be mounted near heating and cooling devices (e.g. the climate control system). Also, it is not recommended to mount DUT-E S7 Radiobox RS close to the vehicle electrical circuits.



You need to make sure that there are no sources of electromagnetic interference near mounting place (radio telephones, video signal transmission units and other wireless devices operating within 2.4 or 5.0 GHz frequency bands).

DUT-E S7 Radiobox RS installation should be done in a dry location protected from aggressive impact of the environment. A suitable location to mount DUT-E S7 Radiobox RS is inside driver's cabin.

For uninterrupted data transmission in conditions of the Vehicle, it is recommended that the distance between DUT-E S7 Radiobox RS and DUT-E S7 sensors should not exceed 20 m.

To fix DUT-E S7 Radiobox RS, make use of the self-adhesive clasps that are contained in the [delivery set](#).

DUT-E S7 Radiobox RS is powered from the external source (e.g. Vehicle onboard circuit). The power supply, service and output interfaces of DUT-E S7 Radiobox RS are to be connected, in accordance with the designation of wires of **OUT** wire bundle (see table 6 and figure 31).

IMPORTANT:



- 1) Before mounting and connecting DUT-E S7 Radiobox RS switch off power supply of the Vehicle electrical circuits. To do this switch off the battery switch or release the terminals of the wires connected to the battery. To eliminate the electric equipment damaging, the accumulator battery is allowed to be switched on only after the completion of the electric equipment connection.
- 2) Prior to electrical connection of the sensor pay special attention to checking Vehicle chassis ground. Resistance between any point of vehicle chassis and "-" terminal of the battery or between terminals of the chassis ground switch should not exceed 1 Ohm.
- 3) When connecting DUT-E S7 Radiobox RS to onboard electrical network of Vehicle, use fuse (2 A) from delivery set in accordance to scheme of connection.

We recommend to purchase and use connectors for connecting **OUT** wire bundle to the respective wires of the Vehicle onboard circuit.

DUT-E S7 Radiobox RS starts operating from the moment the power supply is ON; it is switched off, as soon as the power supply (onboard circuit) is OFF.

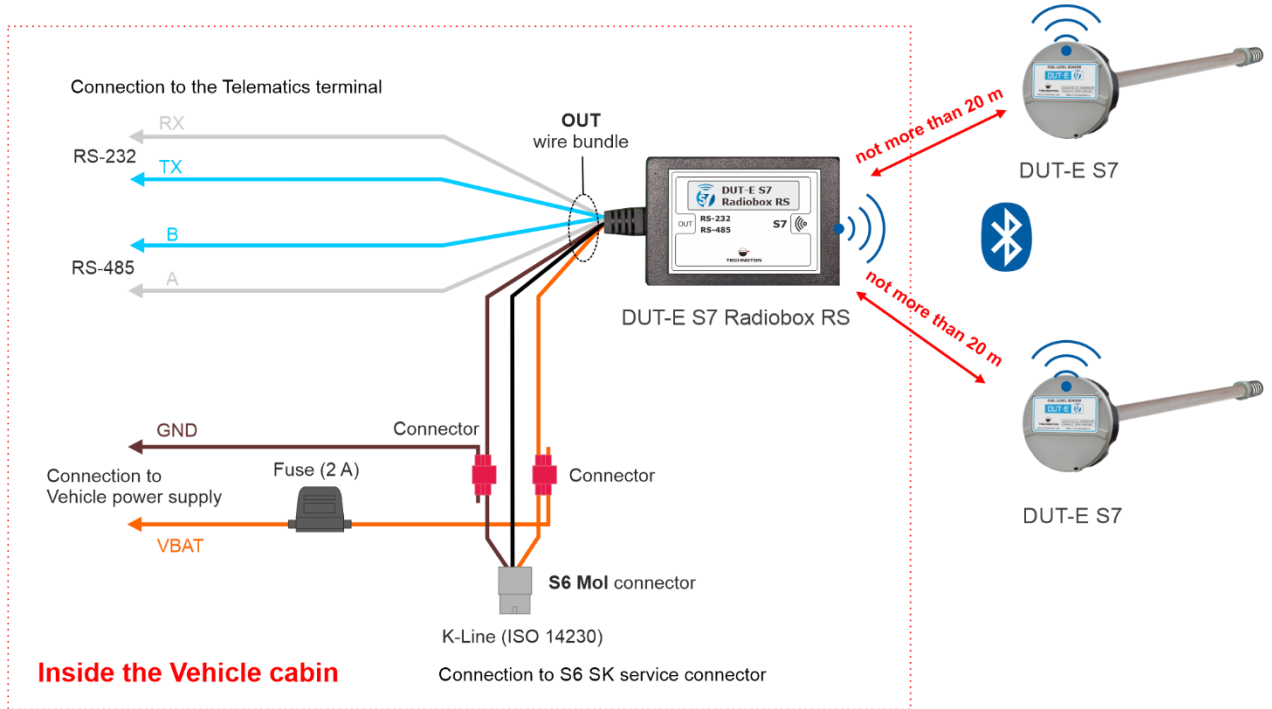
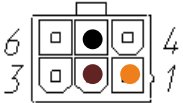


Figure 31 — Diagram of DUT-E S7 Radiobox RS electrical connection

Table 6 — Designation of wires in **OUT** wire bundle

Connector Pinout	Connector Contact Number	Wire Marking	Wire Color*	Circuit Designation	Signal Parameters
	1	VBAT	Orange	Power "+"	Analog, voltage 9...45 V
	2	GND	Brown	Ground "-"	—
	5	KLIN	Black	K-Line	Digital, ISO 14230 Standard
—		TX	Blue	Data transmitted	Digital, RS-232 Standard
		RX	White	Data received	
		B	Blue	Exchange of data	Digital, RS-485 Standard
		A	White	Exchange of data	

* [Manufacturer](#) reserves the right to modify wire colors, that is why pay attention to its marking.

7.6 Configuration

7.6.1 Basic provisions

[DUT-E S7 Radiobox RS](#) and profiles of DUT-E S7 wireless sensors operating together with it are configured by means of K-Line interface (ISO 14230) using [S6 SK](#) service adapter which is to be purchased separately.

For configuration of DUT-E S7 Radiobox RS it is required to connect to PC with S6 SK service adapter (see figure 32).

Recommendations regarding DUT-E S7 Radiobox RS connection to the PC are similar to the respective recommendations for [DUT-E 2Bio](#) sensors (see [DUT-E 2Bio fuel level sensor operation manual](#), paragraph 2.5.1).

S6 SK description can be found in [CAN j1939/S6 Telematics interface operation manual](#).



ATTENTION: To avoid any communication faults between DUT-E S7 Radiobox RS and PC make sure there are no sources of electromagnetic interference close to the workplace (running electric motors, welding equipment, high-power transformers, power lines, etc.).

Before starting with service adapter, it is necessary to download software from <https://www.jv-technoton.com/> (section [Software/Firmware](#)) and install it to PC:

- USB driver;
- Service S6 DUT-E software (version from 5.11 and higher).

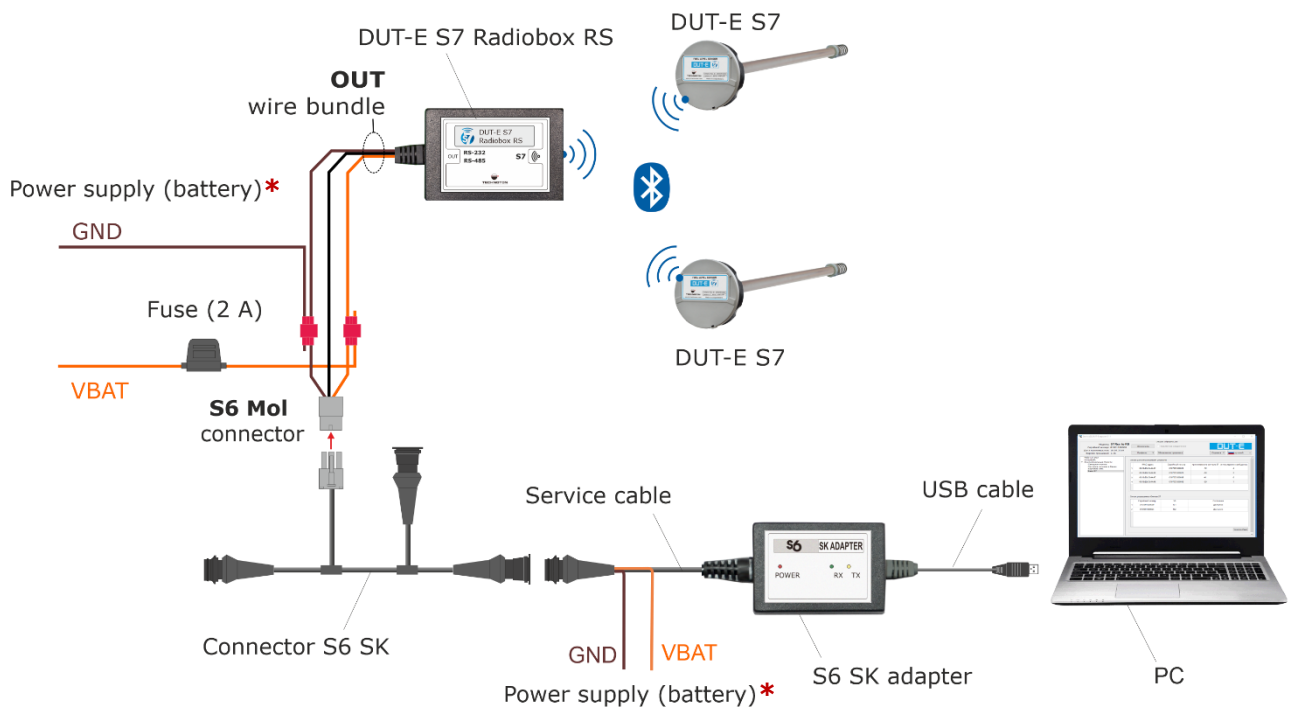
Note — Installation file of software has the view as: ServiceS6_DUT-E_X_X_Setup.exe. X_X corresponds to the version of software.



ATTENTION: For work with Service S6 DUT-E software, you need a separate PC (desktop or laptop) on which **only** [Technoton](#) service [software](#) that meets the following minimal requirements is installed:

- Windows 7/10 operating system of X32/X64 bit depth;
- CPU — Intel Core i3, dual-core, 2.0 GHz;
- RAM — 4 Gb;
- availability of USB 2.0 port;
- display resolution 1366x768.

Service S6 DUT-E software description see in [DUT-E 2Bio fuel level sensor operation manual](#) (paragraphs 2.5.2 – 2.5.4).



* For connecting power supply (battery) you can choose any of marked places.

Figure 32 — Scheme of [DUT-E S7 Radiobox RS](#) connection to PC

After the installation and starting of Service S6 DUT-E software, press button in the upper portion of the software window, to establish a communication session between DUT-E S7 Radiobox RS and the PC. The software will search for devices connected to the PC and will display the **Connection** window containing the list of Units accessible for connection. Besides DUT-E S7 Radiobox RS, accessible DUT-E S7 wireless sensors (up to 2 pcs.) may be displayed in the list. The profile of each of these sensors can be loaded separately and configured for operation together with DUT-E S7 Radiobox RS (see figure 33).

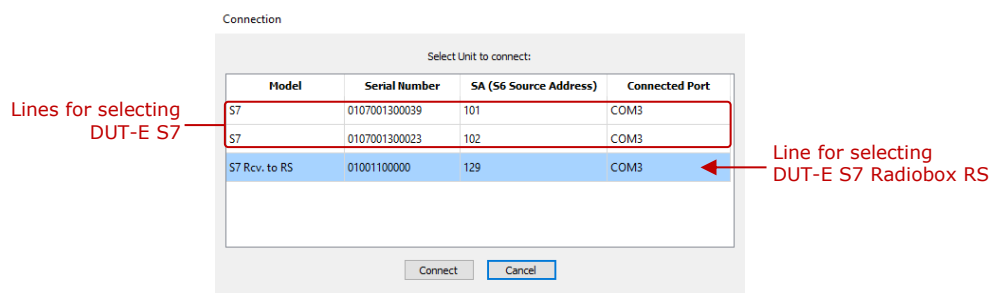


Figure 33 — Selection of [Units](#) for connection to the PC

See [annex D](#) for DUT-E S7 Radiobox RS and profiles of DUT-E S7 sensors settings, displayed and/or made by Service S6 DUT-E software.

7.6.2 Connection parameters for RS-232/RS-485 interface

To connect [DUT-E S7 Radiobox RS](#) to [Telematics terminal](#), you should configure parameters of the RS-232/RS-485 in the **Interface** submenu Service S6 DUT-E software (see figure 34):

1) Select the data transfer protocol from the dropdown list **Output Protocol Type: Modbus** or **DUT-E COM** (DUT-E COM by default).

For DUT-E COM areas for additional settings are available:

a) in the field **RS Settings** you can select:

- Mode of the sensor outgoing messages transmission from the dropdown list **Data Sending Mode:**
 - **On Request** — automatic data transfer is off; only data transfer upon the terminal demand is on (mode by default);
 - **Auto HEX** — hexadecimal format of the automatic data output;
 - **Auto ASCII** — text format of the automatic data output;
 - **Auto ASCII EXT** — extended text format of the automatic data output. In case it is used, fields of additional parameters are available for editing:
 - **Text Message Prefix** and **Text Message Suffix** which respectively establish the beginning and the end of the transmitted data in the text format (32 characters at a maximum).
- In the field **Sending Interval, s** you can set the value of the time interval for which the sensor transmits data to the connected tracking device. The time interval values for the messages output may vary from 1 to 255 s (increment size 1 s). 1 s is set by default.

b) In the field **DUT-E COM Setting Mode** you can select from the drop-down list **Output Parametr Type Measure:**

- **y.e.** — fuel level in the tank in dimensionless units (0...1000 d.u.);
- **mm** — level of fuel in the tank (mm), step 0.1 mm;
- **Litres** — volume of fuel in the tank (l), step 0.1 l (parameter by default);
- **%** — volume of fuel in the tank (%), step 0.4 %.

2) Select the **RS232/485 Baud Rate** from the following range of fixed values: **2400; 4800; 9600; 19200; 38400; 57600; 11520 bit/s (19200 bit/s by default)**.

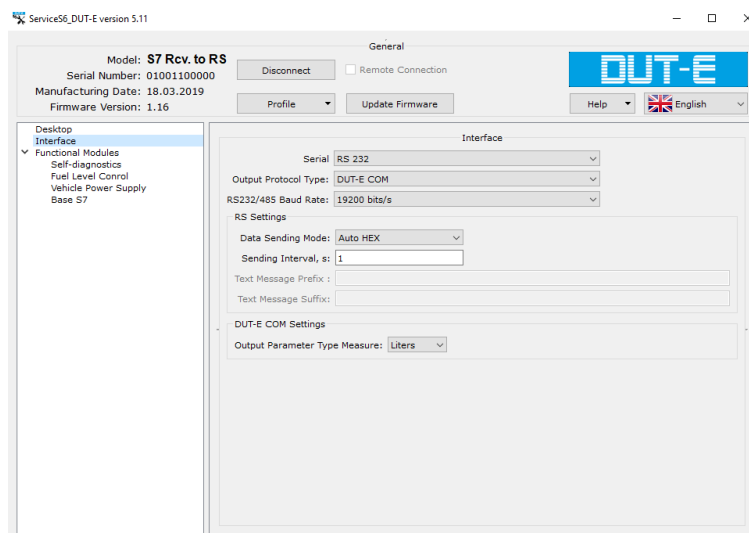


Figure 34 — Configuration of DUT-E S7 Radiobox RS connection parameters via RS-232/RS-485 interface

7.6.3 Establishment of communication with DUT-E S7 wireless sensors

Service S6 DUT-E software enables to configure the connection of [DUT-E S7 Radiobox RS](#) with [DUT-E S7](#) wireless fuel level sensors (up to 2 pcs.) by means of [S7 Technology](#).

To establish a connection with DUT-E S7 and to receive data from it, you need to perform the following actions:

1) In the submenu of **Base S7 FM** (see [D.5](#)) select the required sensor, in accordance with its serial number, from the **Available Bluetooth Device List**. The above-mentioned list contains MAC addresses of sensors (up to 15) that are currently visible (accessible) for the BLE-module of DUT-E S7 Radiobox RS.

2) Copy the selected sensor by drag-and-drop to the **Allowed Units S7 List** (see figure 35 a). During the operation using S7 Technology each sensor is automatically assigned the ordinal number of its network address: 101 and 102, for its identification.

In the appearing window **Add Unit** its serial number and network address are displayed for the sensor added (see figure 35 b).

For each sensor added to the **Allowed Units S7 List** the possibility of operation using S7 Technology is determined, in accordance with its accessibility status (**Enable/Disable**).

WARNINGS:

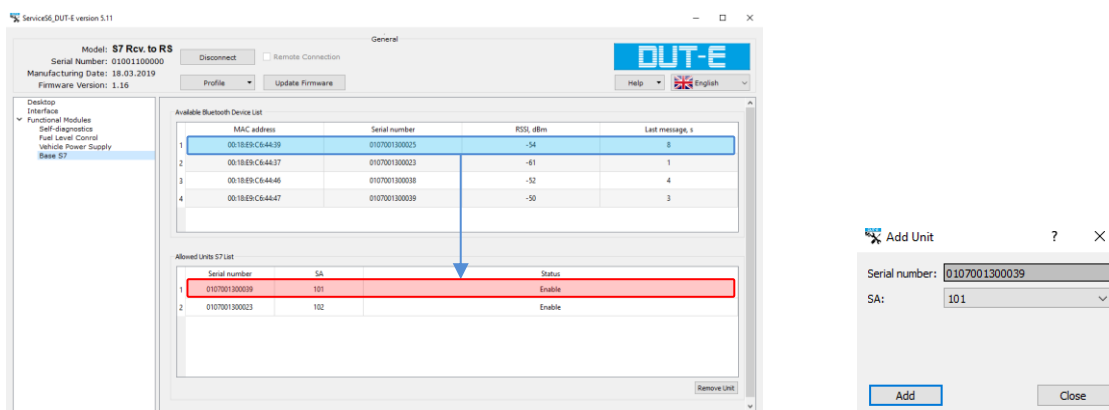


1) After adding the sensor into the **Allowed Units S7 List**, you must save the modified profile of DUT-E S7 Radiobox RS in the Unit. Then, after switching off DUT-E S7 Radiobox RS, you may establish a connection directly with the added sensor and configure its profile.

2) You may add two DUT-E S7 wireless sensors at a maximum into the **Allowed Units S7 List**.

3) In case DUT-E S7 sensor is deleted from the **Allowed Units S7 List**, its settings are not deleted, but are stored in the non-volatile memory of DUT-E S7 Radiobox RS.

4) In case the sensor from the **Allowed Units S7 List** is replaced by another one, you need to re-configure the profile for the sensor added.



a) addition of a sensor for connection by means of S7 Technology

b) displaying the network address and the serial number of the sensor added

Figure 35 — Configuration of DUT-E S7 Radiobox RS for operation with DUT-E S7 wireless sensors by means of S7 Technology

7.6.4 Summarization of readings of DUT-E S7 wireless sensors

Using [S7 Technology](#), [DUT-E S7 Radiobox RS](#) can summarize volume readings of the two tanks in which [DUT-E S7](#) wireless fuel level sensors are installed.

For summarization of DUT-E S7 sensors readings, load the profile of DUT-E S7 Radiobox RS into the Service S6 DUT-E software; tick the fields **Tank 1** and **Tank 2** in the settings of the submenu **Fuel Level Control FM** (see [D.3](#)) and save the profile in the Unit.

The current value of the total volume of fuel in the selected tanks must be displayed in the line **Summary Value. Fuel Tank Volume, l** (see figure 36).

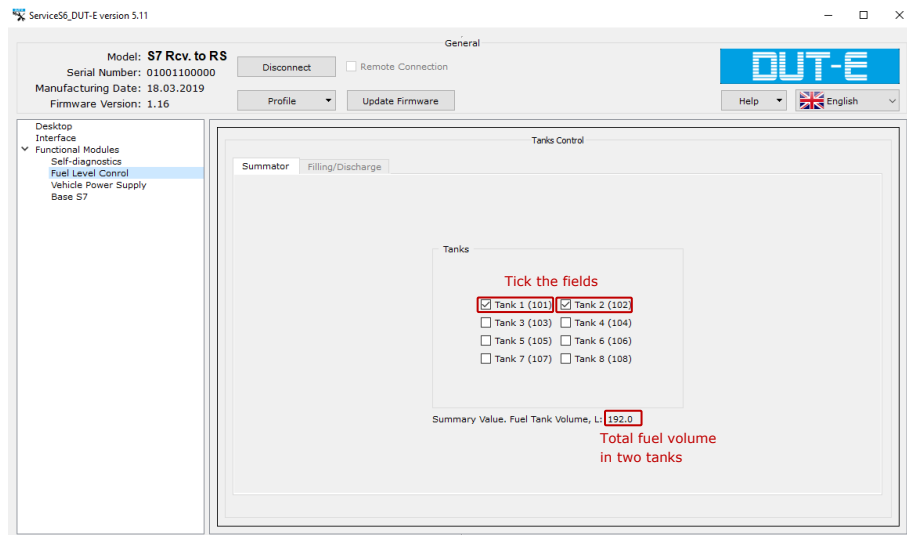


Figure 36 — Configuration of DUT-E S7 Radiobox RS for summarization of DUT-E S7 readings using S7 Technology



IMPORTANT: For correct summarization of fuel volume readings, the profile of each of the DUT-E S7 sensors operating together with DUT-E S7 Radiobox RS must contain the calibration parameters (“Empty” and “Full” frequencies), as well as the calibration table of the respective tank.

The procedures of calibration and creation of calibration tables are carried out using Service S6 DUT-E software similar to the respective procedures for [cable-connected DUT-E sensors](#).

You can manually enter values of the calibration frequencies “Empty” and “Full” into the memory of DUT-E S7 Radiobox RS in the submenu of the **Fuel level sensor FM (Calibration tab)** (see [D.2](#)) (e.g. using indications in the Fuel Tanks Monitor application, see the [User manual](#)). To enter the frequencies, tick the field **Enter calibration parameters**, press button and select **Enter manually** (see figure 37).

You can also enter values of the calibration frequencies “Empty” and “Full” for the sensors profiles into the memory of DUT-E S7 Radiobox RS by loading a special file **DUT-E_*.cal** (* — serial number of the respective sensor) generated in advance (using button). In order to load the file, press button and choose **Load from file**.

In case the calibration table for the corresponding fuel tank is available, you can manually enter values of calibration points into the memory of DUT-E S7 Radiobox RS in the submenu of the **FM Fuel level sensor** (see [D.2](#)) (**Calibration Table** tab) (e.g. using indications in the Fuel Tanks Monitor application, see the [User manual](#)) or load them from the file (***.ttr**).

Save the modified profiles of the DUT-E S7 sensors.

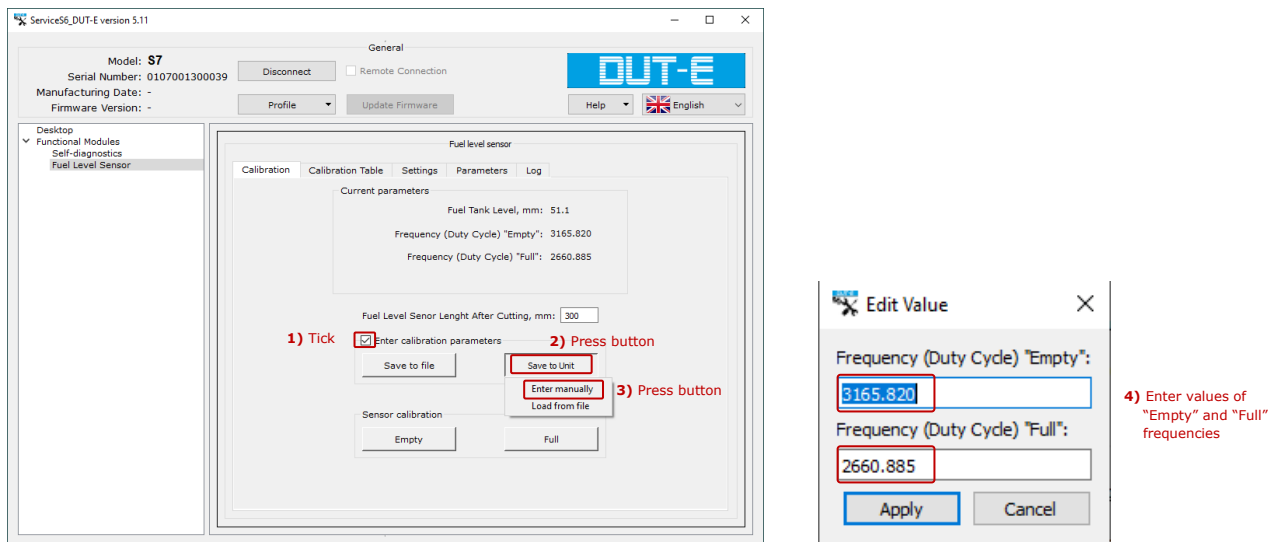


Figure 37— The procedure of editing manually calibration frequencies of DUT-E S7 wireless sensor

8 Accessories

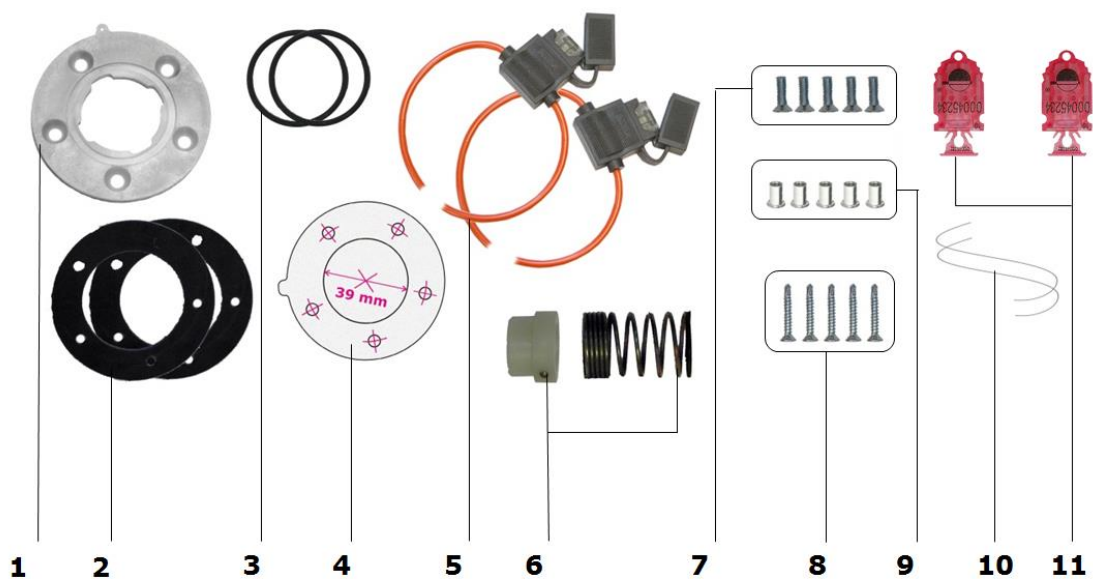
[Technoton](#) offers **high quality accessories** for mounting, connection and operation of [DUT-E S7](#) / [DUT-E 2Bio S7](#) sensors.

8.1 MK DUT-E mounting kit

DUT-E mounting kit (hereinafter [MK DUT-E](#)) is used for sensor mounting into the fuel tank of vehicle or stationary tank. MK DUT-E is included into sensor delivery set. Extra mounting kits can be ordered separately if required. Sensor is mounted quickly and accurately with MK DUT-E.

See figure 38 for MK DUT-E components.

Mounting plate with SAE 5 bolt standard bore position can be preordered.



1	- plastic mounting plate	- 1 pc.;
2	- rubber gasket	- 2 pcs.*;
3	- sealing rubber ring	- 2 pcs.*;
4	- hole placement template	- 1 pc.;
5	- fuse with holder (2 A)	- 2 pcs.;
6	- bottom stop	- 1 pc.;
7	- bolt	- 5 pcs.;
8	- self-tapping screw	- 5 pcs.;
9	- threaded rivet	- 5 pcs.;
10	- sealing cord	- 2 pcs.;
11	- plastic seal	- 2 pcs.**

Figure 38 — MK DUT-E mounting kit



* 1 pc. – used for DUT-E installation and 1 pc. is a spare part.
Could be complemented with 4 mm thick gasket.

** Exterior of seal can be different.

8.2 Additional accessories

Additional accessories may be required for [DUT-E S7](#) / [DUT-E 2Bio S7](#) mounting on a [Vehicle](#) (see table 7).

Table 7 – Additional accessories for sensors

View	Name	Description	Application
	Filter DUT-E	Screen filter	For protecting electrodes (tubes) against water and mud in tanks' bottom
	FTP DUT-E	Fuel tank plug	Bayonet plug for temporary sensor replacement
	Plug	Plug for sensor mounting hole	To plug fuel tank opening
	Gasket	Rubber gasket 2 mm	Rubber gasket under mounting plate
	DUT-E WP-11	Adaptor plate with 4 holes	To mount the sensor in the tank in the place for the Omnicomm sensor
	SAE 5 bolt	Mounting plate	Mounting plate with SAE 5 bolt standard bore position
	DUT-E FP CT	Mounting plate for barrel-shaped tanks	Mounting plate for sensors installation on barrel-shaped fuel tanks
	DUT-E TAM-d105	Mounting plate	Special duralumin mounting plate for 6 screws
	DUT-E WP-10	Wedge-shaped fastening plate	Fastening plate for sensors installation on fuel tanks with inclined surface (10-degree angle)
	DUT-E WP-12	Mounting plate with a hidden fixing element	Mounting plate with a fixing element for protection from theft and vandalism
	DUT-E Bracket	Protective bracket	Bracket to protect the sensor from theft and vandalism

9 Packaging

[DUT-E S7](#) / [DUT-E 2Bio S7](#) delivery sets come in cardboard boxes of the following shape (see figure 39).



a) DUT-E S7

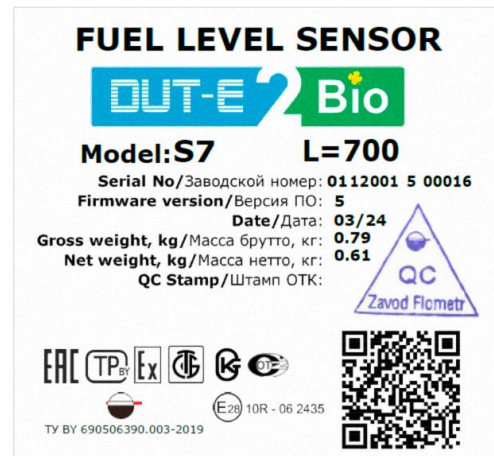
b) DUT-E 2Bio S7

Figure 39 — Examples of the sensors packing

Label sticker containing information on the product name, nominal measuring probe length, serial number, inbuilt software version, manufacturing date, weight, certificates, technical conditions, as well as Quality Control seal, bar code and QR code is stuck on both sides of DUT-E S7 box (see figure 40).



a) DUT-E S7



b) DUT-E 2Bio S7

Figure 40 — Examples of labels on the sensors packing

Note — Label design and contents can be modified by the [Manufacturer](#).

10 Storage

[DUT-E S7](#) / [DUT-E 2Bio S7](#) is recommended to be stored in dry enclosed areas.

Sensors storage is allowed only in original packaging at temperature range from +10 to +30 °C and relative humidity from 45 to 75 % at 25 °C.

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

Sensors shelf life must not exceed 24 months.

11 Transportation

Transportation of [DUT-E S7](#) / [DUT-E 2Bio S7](#) is recommended in closed transport that provides protection for sensors from mechanical damage and precipitation.

When transporting by air, sensors must be stored in heated pressurized compartments.

Air environment in transportation compartments should not contain acid, alkaline and other aggressive impurities.

Shipping containers with packed sensors should be sealed.

12 Utilization/re-cycling

[DUT-E S7](#) / [DUT-E 2Bio S7](#) does not contain precious metals in amount that should be recorded.

The inbuilt lithium-thionyl chloride battery of sensors contains harmful substances and components that are hazardous to human health and environment.

Battery must not be disposed of together with general domestic waste.

The Buyer is responsible for the disposal of battery by means of its delivery to the hazardous waste collecting center; this will ensure safety for human health and environment.

[Technoton](#) bears no responsibility for any non-compliance with the above disposal and recycling requirements for battery.

Contacts

Distribution, technical support and service



sales@jv-technoton.com

support@jv-technoton.com



Annex A

Template of check test report

Report

Date: _____

Sensor serial number	
Vehicle type, model, registration number	

Drainage volume	According to measuring reservoir V_M , liters	
	According to the indication on the display of the mobile device V_{mobile} , liters	
Accuracy error	Absolute error $\Delta = V_{mobile} - V_M$, liters	
	Normalized to total tank volume $\delta = \frac{V_{mobile} - V_M}{V_{total\ volume}} \cdot 100, \%$	

Refueling volume	According to measuring reservoir V_M , liters	
	According to the indication on the display of the mobile device V_{mobile} , liters	
Accuracy error	Absolute error $\Delta = V_{mobile} - V_M$, liters	
	Normalized to total tank volume $\delta = \frac{V_{mobile} - V_M}{V_{total\ volume}} \cdot 100, \%$	

Resume:

The results of drain measurement **match/do not match** specifications.

The results of refueling measurement **match/do not match** specifications.

Comments: _____

representative of the CUSTOMER: _____/_____

representative of the CONTRACTOR: _____/_____

Annex B

Electromagnetic compatibility

- 1) [DUT-E S7](#) sensor has E-mark Certificate of Production Conformity with “Uniform Provisions concerning the approval of vehicles with regard to electromagnetic compatibility, in accordance with UN/ECE Regulation No 10”.
- 2) BLE-module which is part of DUT-E S7 sensor and [DUT-E S7 Radiobox RS](#) wireless interface is certified and found to comply with:
 - FCC Rules Part 15 (contains FCC ID identifier: S9NSPBTLERF);
 - IC Rules, RSS-210 (contains IC identifier: 8976C-SPBTLERF).

Locations in which electromagnetic compatibility marking is placed on DUT-E S7 sensor are shown in figure B.1.



WARNING: Any changes or modifications of BLE-module, which are not approved by the [party](#) responsible for compliance with FCC and IC certificates, may deprive the user of the sensor of the right to operate it.

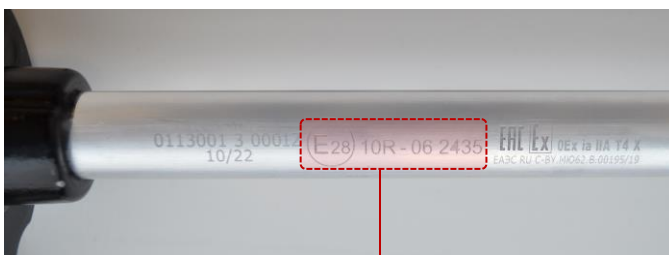
1) BLE-module complies with the restrictions for Class B digital device in accordance with Part 15 of the FCC Rules and RSS-210 of the IC Rules.

These restrictions are used for providing protection from harmful interference when operating in residential premises. BLE-module generates and can transmit/receive radio frequency energy. If it is not installed and is not used in accordance with the instructions, it may cause harmful interference to radio communication. There is no guarantee that interference will not occur in a particular installation. If BLE-module creates harmful interference to the reception of radio or television signals, what can be determined by turning BLE-module on and off, it is recommend for a user to try to eliminate the interference in one or more of the following ways:

- change the direction or location of the receiving antenna;
- increase the distance between the equipment and the receiver;
- plug the equipment into an outlet on a circuit different from that to which receiver is connected;
- contact the dealer or an experienced radio / television technician for a help.

2) BLE-module complies with the restrictions for Class A digital device in accordance with Part 15 of the FCC Rules and RSS-210 of the IC Rules.

These restrictions are designed to provide reasonable protection against harmful interference when the BLE-module is operated in a commercial environment. BLE-module generates and can transmit / receive radio frequency energy. If it is not installed and is not used in accordance with the instructions, it may cause harmful interference to radio communication. Operation of BLE-module in a residential area may cause harmful interference in which case the user will be required to correct the interference at his own expense.



Laser marking of conformity with E-mark Certificate



Marking of FCC and IC identifiers

Figure B.1 – Locations in which electromagnetic compatibility marking is placed on DUT-E S7

Annex C

Explosion protection of DUT-E S7

1) **DUT-E S7** fuel level sensors ([compliance certificate](#) No. EA3C RU C-BY.MIO62.B.00195/19 valid from 01.03.2019 to 29.02.2024) comply with requirement of explosion protection according to the following standards:

- TR of ECU 012/2011 – Technical Regulation of Eurasian Customs Union (“On the safety of equipment for operation in explosive environments”);
- GOST 31610.0-2012 – Electrical equipment for explosive gas environments. Part 0. General requirements;
- GOST 31610.11-2012 – Electrical equipment for explosive gas environments. Part 11. Spark-safe electrical circuit “i”.

2) Ex marking of DUT-E S7: **0Ex ia IIA T4 X**

Where **X** means, that when installing and operating the sensor, special actions should be carried out to avoid occurrence of sparks caused by hits and frictions.

Explosion protection marking is placed on the external tube of the sensor measuring probe using laser engraving technology, in accordance with figure C.1.



Figure C.1 – Placing of Ex mark on DUT-E S7

3) DUT-E S7 application area in hazardous locations of classes 0, 1 and 2 according to IEC 60079-10-1:2006 (GOST IEC 60079-10-1-2011), categories of explosive IIA mixtures according to IEC 60079-20-1:2010 (GOST R MEK 60079-20-1-2011), according to Ex marking of equipment, IEC 60079-14:2007 (GOST IEC 60079-14-2011) and other regulatory documents governing the use of electrical equipment in potentially hazardous locations.

4) Technical specifications of DUT-E S7 linked to explosion protection:

- ambient temperature: -30...+80 °C;
- ingress protection from external impacts: IP 55/IP57;
- nominal voltage of built-in battery: 3.6 V;
- capacity of built-in battery: 2100 mAh.

Annex D

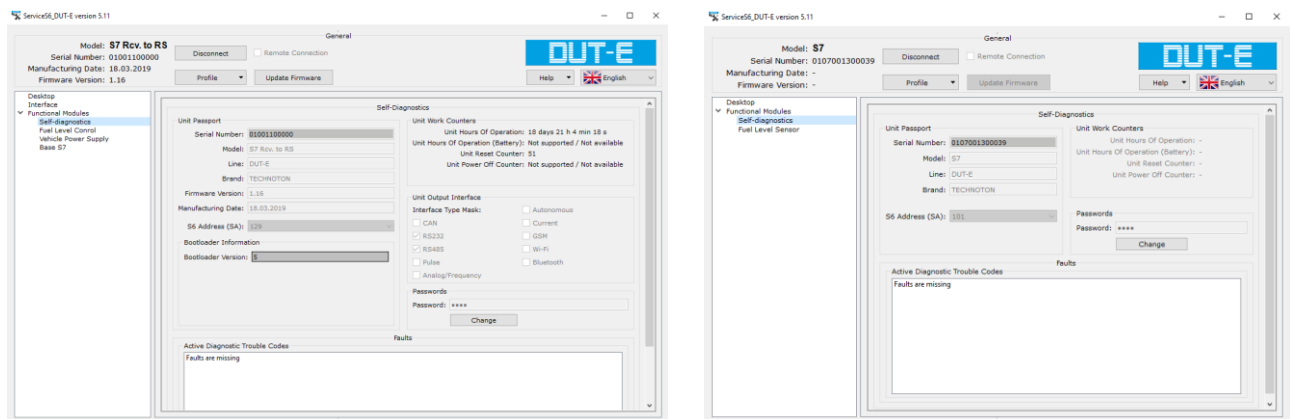
SPN of DUT-E S7 Radiobox RS Functional modules

Reception and processing readings of [DUT-E S7](#) wireless sensors, transmission of ready data into RS-232/RS-485 digital interface, self-diagnostics, configuration of [Parameters](#), maintenance of [Counters](#) are assured by the well-concerted operation of [Functional modules](#) (FM) of [DUT-E S7 Radiobox RS](#).

Parameter form ([SPN](#)) of FM DUT-E S7 Radiobox RS matches with [Data base](#) (DB).

D.1 Self-diagnostics FM

[Self-diagnostics FM](#) — designed for user authorization, identification of the [Unit](#) passport data, operation time recording and also active malfunctions.



a) for DUT-E S7 Radiobox RS

b) for DUT-E S7

Figure D.1 — Example of the window of settings of FM Self-diagnostics in Service S6 DUT-E software

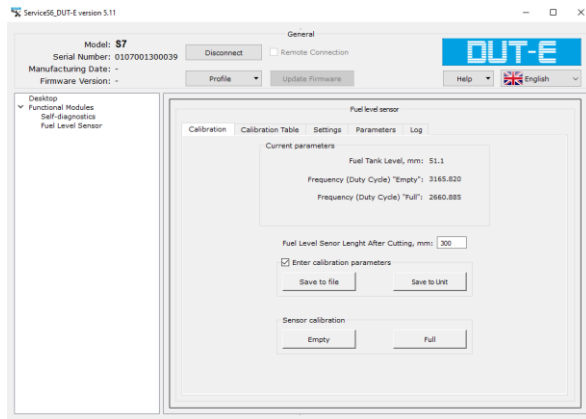
Table D.1 — Self-diagnostics FM. Displayed and/or editable SPN with the help of Service S6 DUT-E software

SPN	Name	Factory value	Unit of measure	Clarification
Unit passport PGN 62995				
521120	Serial number	On the fact	No	Serial number is a set of numbers that is used for identification of specific Unit. Serial number of the Unit has the following format: AABBB C DDDDD, where: AA – code of model inside of DUT-E product line; BBB – digits that reflect changes product changes; C – Manufacturer code; DDDDD – sequential number. Setting is not available for editing. SPN is not available for editing.
521345	Model	On the fact	No	Model – this is version of the Unit inside of DUT-E product line. Each model has its own functional and constructive features. For instance, a particular feature of DUT-E S7 Radiobox RS is the conversion of data received by means of S7 Technology from DUT-E S7 wireless sensors into RS-232/RS-485 digital interface. SPN is not available for editing.

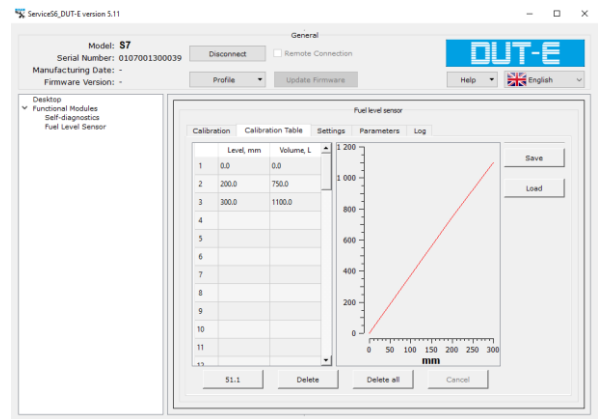
SPN	Name	Factory value	Unit of measure	Clarification
521123	Line	DUT-E	No	Name of the product line. The line represents a group of similar products – fuel level sensors produced under general trademark DUT-E . SPN is not available for editing.
521344	Brand	TECHNOTON	No	Name of the Unit Manufacturer. SPN is not available for editing.
521121	Firmware Version	On the fact	No	Version of built in Software of the Unit . SPN is not available for editing.
521125	Manufacturing Date	On the fact	No	Date (day, month, year) of the Unit production. SPN is not available for editing.
521188	S6 address (SA)	129 (for DUT-E S7 Radiobox RS) 101/102 (for DUT-E S7)	No	Network address of the Unit. Values of unique network addresses are automatically set by the service software and are not accessible for editing by the user.
Unit work Counters PGN 62994				
521116	Unit Hours Of Operation	On the fact	s	Counter of summarized working time of the Unit since its production moment. The user cannot reset the value of this counter. It can be reset by the Manufacturer or RSC only.
521118	Unit reset Counter	On the fact	pcs.	Counter of Unit's processor restarts at a time when the power is On or there is an impact of conducted interferences of the vehicle's on-board network. Restarts accounting is carried out since production date of the Unit. The user cannot reset the value of this counter. It can be reset by the Manufacturer or RSC only.
Passwords PGN 63017				
521593/3.3	Password/3.3 Installer	1111	No	Password is entered for user authorization while establishing connection session between DUT-E S7 Radiobox RS and service Software for configuring the Unit. Password is a specific combination of four digits. By default, used: Login – 0, password – 1111. User can change password of the Unit. After entering and confirming the new password is recorded into internal memory of the Unit.
Active diagnostic trouble codes PGN 65226				
521044	Fault identifier (SID+FMI)	On the fact	No	List of current Unit malfunctions are displayed at the settings field (in case of its presence – up to 10). For each active malfunction is indicated following: - faulty nod; - malfunction name. This setting allows to monitor Unit working performance. In case of lack of active malfunctions, the following message is displayed "No malfunctions".
Bootloader Information PGN 63009				
521122	Bootloader Version	On the fact	No	Displays current version of the bootloader used for the correct start of service software, as well as when updating firmware of the Unit.

D.2 Fuel Level Sensor FM

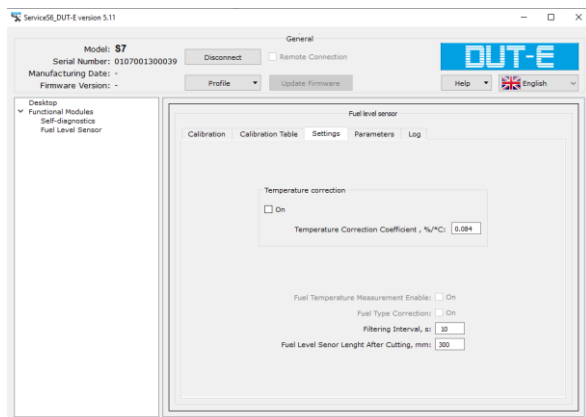
Fuel Level Sensor FM — is designed for measurement of current values of fuel level, volume and temperature in the **Vehicle** fuel tank, for entering calibration parameters, for generation of the fuel tank calibration table, filtration and thermal correction of the measurement readings.



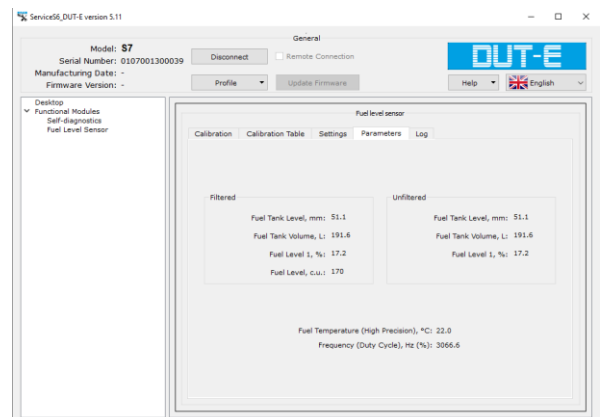
a) **Calibration** tab



b) **Calibration Table** tab



c) **Settings** tab



d) **Parameters** tab

Figure D.2 — Example of the window of settings of the Fuel Level Sensor FM in Service S6 DUT-E software for the profile of DUT-E S7 wireless sensor operating together with DUT-E S7 Radiobox RS

Table D.2 — Fuel Level Sensor FM. Displayed and/or editable SPN with the help of Service S6 DUT-E software

SPN	Name	Factory value	Unit of measure	Range	Clarification
Calibration Settings PGN 63076					
521440/22.0	Frequency (Duty Cycle)/ 22.0 Empty	On the fact	%	0...4294967	This setting displays duty cycle of signal of measuring generator DUT-E S7 for empty fuel tank. Based on this value we can estimate if the sensor has been calibrated correctly to minimum fuel level.
521440/22.1	Frequency (Duty Cycle)/ 22.1 Full	On the fact	%	0...4294967	This setting displays duty cycle of signal of measuring generator DUT-E S7 for full fuel tank. Based on this value we can estimate if the sensor has been calibrated correctly to maximum fuel level.

SPN	Name	Factory value	Unit of measure	Range	Clarification
Calibration Table. Fuel Tank 1 PGN 63036					
521355	Array Elements Count	2	pcs.	1...60	Number of points of calibration table, created during the fuel tank normalization process. Recommended number of calibration points – no less than 15.
521023	Fuel Tank Level	On the fact	mm	0...6425.5	Values of fuel level in the tank corresponding with points of calibration table.
521024	Fuel Tank Volume	On the fact	l	0...6425.5	Values of fuel volume of the tank corresponding with points of calibration table.
Filtered Fuel Level/Volume in Tank PGN 62982					
521023/2.10	Fuel Tank Level/ 2.10 Filtering	On the fact	mm	0...6425.5	Displays the value of the fuel level in Vehicle tank filtered according to the preset time interval.
521024/2.10	Fuel Tank Volume/ 2.10 Filtering	On the fact	l	0...6425.5	Displays the value of the fuel volume in Vehicle tank filtered according to the preset time interval.
174	Engine Fuel Temperature 1	On the fact	°C	-40...210	This setting displays present value of fuel temperature in the vehicle's tank.
Dash Display PGN 65276					
96	Fuel Level 1	On the fact	%	0...100	This setting displays value (in %) of present fuel level in the tank in relation to the level of full Vehicle's tank.
FM Fuel Level Sensor Settings PGN 63029					
521433	Temperature Correction Coefficient	0.084	%/°C	-32...32	Field for entering temperature correction coefficient that provides temperature compensation of fuel expansion/compression inside of vehicle's fuel tank.
521444	Filtering Interval	60	s	0...64255	Field for entering time interval value during which DUT-E S7 Radiobox RS calculates smoothed fuel level of vehicle's fuel tank before transmitting out coming data to the Server .
521093	Fuel Level Sensor Length After Cutting	On the fact	mm	0...64255	Field for entering of sensor's measuring length for what calibration table has been made before installation into the vehicle's fuel tank.
521311	Temperature Correction Enable	Off	No	On/Off	Field for activation/ deactivation of temperature correction function that provides compensation of fuel expansion/compression inside of the Vehicle's fuel tank.
■ – Obligatory settings, required for operation of the DUT-E S7 Radio Box RS together with the DUT-E S7 sensors.					

D.3 Fuel Level Control FM

[Fuel Level Control FM](#) — is designed to receive data on the measured total fuel volume of the [Vehicle](#) two tanks via RS-232/RS-485 interface.

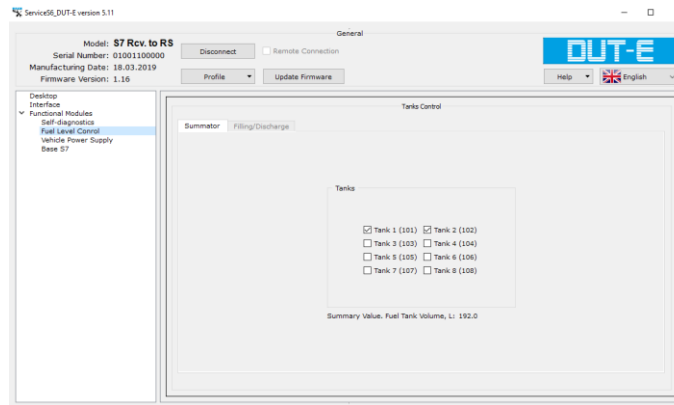


Figure D.3 — Example of the window of settings of Fuel Level Control FM in Service S6 DUT-E software for DUT-E S7 Radiobox RS

Table D.3 — Fuel Level Control FM. Displayed and/or editable SPN with the help of Service S6 DUT-E software

SPN	Name	Factory value	Unit of measure	Range	Clarification
Total Fuel Volume In Tanks PGN 63152					
521024/2.11	Fuel Tank Volume/ 2.11 Summary Value	On the fact	l	0...6425.5	Displays the value of total fuel volume in tanks, selected for summation.
Summation Settings DUT PGN 63149					
521259/27.0	Fuel Level Sensor Summation Enable/ 27.0 DUT 1	Off	-	On/Off	A field for turning on / off summation of fuel volume measured by the fuel level sensor (network address 101), which is set in Tank 1 of the Vehicle.
521259/27.1	Fuel Level Sensor Summation Enable/ 27.1 DUT 2	Off	-	On/Off	A field for turning on / off summation of fuel volume measured by the fuel level sensor (network address 102), which is set in Tank 2 of the Vehicle.

D.4 Vehicle Power Supply FM

[Vehicle Power Supply FM](#) — is designed for monitoring of onboard power network voltage, current mode of power network, operation time of Vehicle in different power network modes, quantity of engine starts*, exceeding permissible time of continuous operation of starter*.

* Preparation for release.

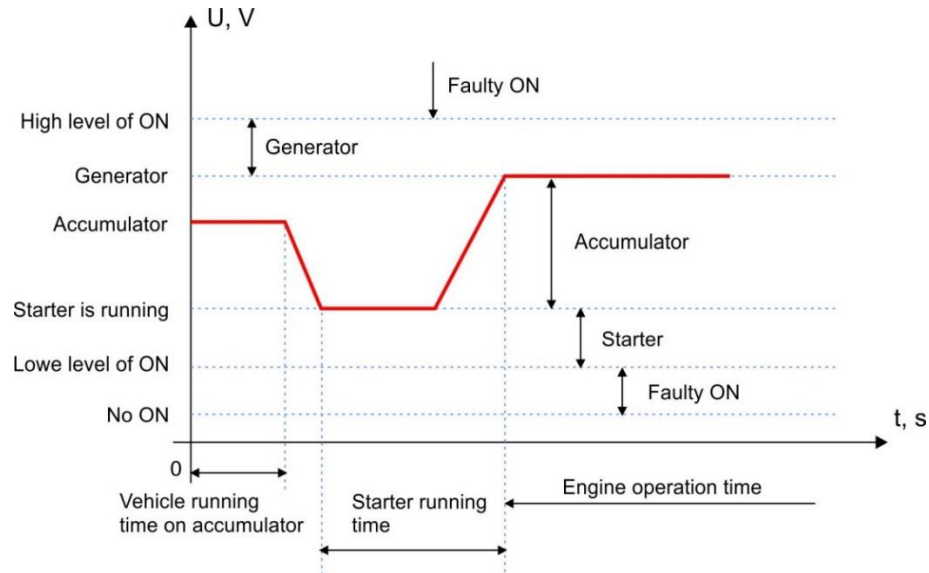


Figure D.4 — Operation modes on onboard network (ON) voltage level

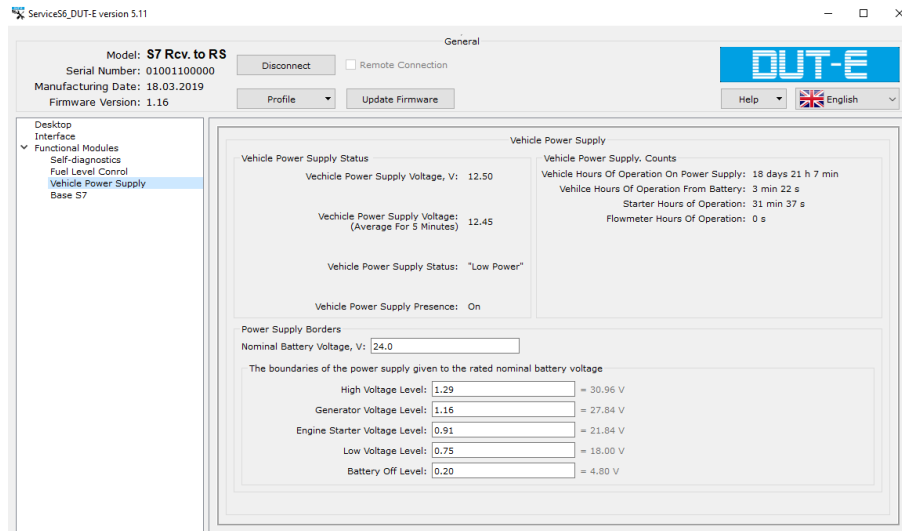


Figure D.5 — Example of the window of settings of Vehicle Power Supply FM in Service S6 DUT-E software for DUT-E S7 Radiobox RS

Table D.4 — Vehicle Power Supply FM. Displayed and/or editable SPN with the help of Service S6 DUT-E software

SPN	Name	Factory value	Unit of measure	Range	Clarification
Vehicle Power Supply Status PGN 63089					
521055	Vehicle Power Supply Voltage	On the fact	V	0...3212.75	Shows current value of ON voltage.
521055/2.9	Vehicle Power Supply Voltage/ 2.9 Average For 5 Minutes	On the fact	V	0...3212.75	Shows average value of ON voltage within previous 5 minutes.
521056	Vehicle Power Supply Status	On the fact	No	Off/ Lowe level/ Accumulator/ Starter/ Generator/ High level	Shows current mode of ON in accordance with user-defined borders of ON voltage levels of Vehicle (see figures D.4 and D.5).
521076	Vehicle Power Supply Presence	On the fact	No	On/Off	Displays the current state of the board (On/Off) in accordance with the user-set voltage level of the TC system trip (see figures D.4 and D.5).
Power Supply Boundaries PGN 63067					
521075	Nominal Battery Voltage	24	V	0...60	Field for entering a nominal value of accumulator voltage of Vehicle ($U_{nom}=12V/24V$) (see figures D.4 and D.5).
521063	High Voltage Level	1.29	-	0...1.99	Field for entering value of high voltage level of onboard network ($1.29 \cdot U_{nom}$) (see figures D.4 and D.5). Entered value of voltage is used as a threshold for recording "Faulty ON" Event .
521064	Generator Voltage Level	1.10	-	0...1.99	Field for entering value of voltage level of generator, i.e. when engine of Vehicle is running ($1.10 \cdot U_{nom}$) (see figures D.4 and D.5).
521065	Engine Starter Voltage Level	0.91	-	0...1.99	Field for entering value of voltage level starter is running, i.i when Vehicle's engine is starting ($0.91 \cdot U_{nom}$) (see figures D.4 and D.5).
521067	Low Voltage Level	0.75	-	0...1.99	Field for entering value of low voltage level of ON ($0.75 \cdot U_{nom}$). Entered value of voltage is used as a threshold for recording "Faulty ON" Event . (see figures D.4 and D.5).
521068	Battery Off Level	0.20	-	0...1.99	Field for entering value of voltage level when ON switches off ($0.20 \cdot U_{nom}$). (see figures D.4 and D.5).
521074	Engine Starter Continuous Working Time Limit	30	s	5...30	Field for entering value of starter's permissible time of continuous operation, above which the starter may fail (see figures D.4 and D.5). Entered value is used as a threshold for recording "Exceeding permissible time of continuous operation of starter" Event .
Power Supply Voltage. Counters PGN 62976					
521173	Hours Of Operation On Power Supply	On the fact	s	0..4211081215	Counter of total operating time of Vehicle from onboard network since Unit installation to the Vehicle. User cannot reset the value of this Counter*.
521172	Hours Of Operation From Battery	On the fact	s	0..4211081215	Counter of total operating time of Vehicle from accumulator since Unit installation to the Vehicle. User cannot reset the value of this Counter*.
521170	Starter Hours Of Operation	On the fact	s	0..4211081215	Counter of total operating time of starter since Unit installation to the Vehicle. User cannot reset the value of this Counter*.
521171	Flowmeter Hours Of Operation	On the fact	s	0..4211081215	Counter of total operating time of Vehicle's engine since Unit installation to the Vehicle. User cannot reset the value of this Counter*.
* Counter can be reset by the Manufacturer of RSC .					

D.5 Base S7 FM

Base S7 FM — is designed for reception of messages ([PGN](#)) from wireless [Units](#) by means of [S7 Technology](#).

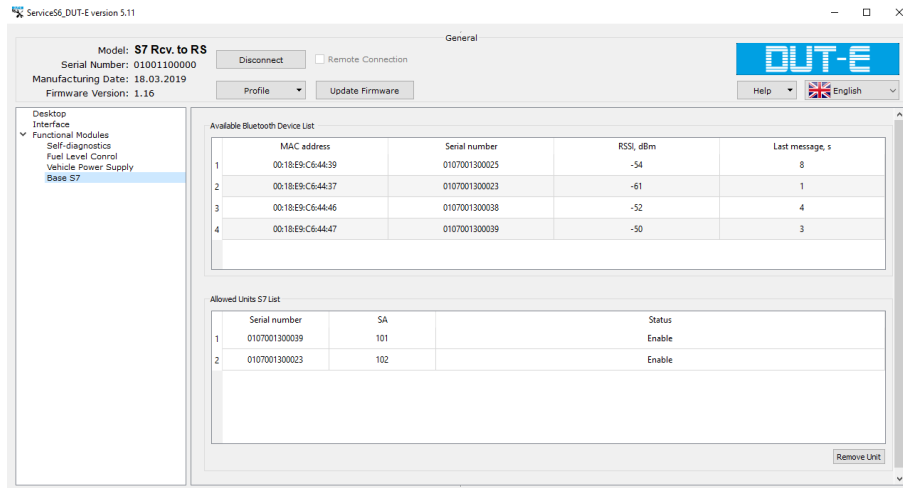


Figure D.6 — Example of the window of settings of Base S7 in Service S6 DUT-E software for DUT-E S7 Radiobox RS

Table D.5 — Base S7. Displayed and/or editable SPN with the help of Service S6 DUT-E software

SPN	Name	Factory value	Unit of measure	Clarification
Available Bluetooth Device List PGN 63279				
521355	Array Elements Count	On the fact	pcs.	The number of MAC addresses of wireless Units (DUT-E S7 fuel level sensors) which are visible (accessible) at a current moment for BLE-module of DUT-E S7 Radiobox RS . The maximum number of elements in the list — 15. The list is not accessible for editing.
521490	MAC Address	On the fact	No	The setting displays the unique identifier (MAC address) of BLE-module of the wireless Unit. Using MAC address, the software generates a serial number of a specific Unit and also identifies its accessibility status for operation based on S7 Technology. The data are not accessible for editing.
521178	Received Signal Strength Indicator (RSSI)	On the fact	dBm	The setting displays the current level of the signal power (by the logarithmic scale) received from the wireless Unit. The displayed range: from -125..0 dBm. The data are not accessible for editing.
521084	Timeout	On the fact	s	The setting displays the length of the time interval after reception of the latest message from the wireless Unit. The data are not accessible for editing.
Allowed Units S7 List PGN 63270				
521355	Array Elements Count	On the fact	pcs.	Number of MAC addresses of wireless Units (DUT-E S7 fuel level sensors) selected by the user, in order to establish communication with DUT-E S7 Radiobox RS using S7 Technology . The maximum number of elements in the list — 2. The user has access to editing the list (addition/deletion of Units).

SPN	Name	Factory value	Unit of measure	Clarification
521188	S6 Address (SA)	No	No	Network address of DUT-E S7 selected by the user to establish communication with DUT-E S7 Radiobox RS using S7 Technology. The network address is used to identify the Units during the work using S7 Technology. The value of the network address (101 or 102) is automatically assigned to DUT-E S7 fuel level sensor by its ordinal number. Network addresses of DUT-E S7 cannot be modified by the user.
521490	MAC Address	On the fact	No	Sensor MAC address itself of DUT-E S7 sensor selected by the user for connection by means of S7 Technology is not displayed in the list of authorized Units. However, based on MAC address, the software generates the serial number of a specific Unit and also identifies its accessibility status for work using S7 Technology . The data are not accessible for editing.

Annex E

DUT-E S7 Radiobox RS firmware upgrade



WARNING: [DUT-E S7 Radiobox RS](#) firmware update should be carried out **only** for implementing improvements, recommended by the [Manufacturer](#).

To upgrade firmware the following actions should be made:

- 1) Connect DUT-E S7 Radiobox RS to the PC using [S6 SK](#) service adapter



WARNING: When re-uploading firmware, power supply voltage of DUT-E S7 Radiobox RS should not drop out of 9...45 V range.

- 2) After authorization press button in Service S6 DUT-E software.

- 3) Choose firmware upgrade file (***.bif3**) on PC disk or memory stick.

- 4) Press button, that will start firmware file downloading into DUT-E S7 Radiobox RS memory.

After firmware file integrity and compatibility check by Service S6 DUT-E software window of firmware uploading into DUT-E S7 Radiobox RS memory will appear. In case of any errors the software will send warning message.

To cancel firmware upgrade it is needed to press button.



ATTENTION: Before the end of the update process and automatic Service S6 DUT-E software reset it is **forbidden**:

- power down the PC;
- power down the DUT-E S7 Radiobox RS;
- disconnect DUT-E S7 Radiobox RS from the adapter and adapter from the PC;
- run any resource-intensive applications on the PC.

Service S6 DUT-E software will display appropriate message and automatically will disconnect DUT-E S7 Radiobox RS from PC in case the update is successful. DUT-E S7 Radiobox RS is ready for further operation. Service software will display a new firmware version with the next connection session between PC and DUT-E S7 Radiobox RS.

If the DUT-E S7 Radiobox RS firmware update has been completed incorrectly and the current version of the inbuilt software has been damaged, the firmware update procedure has to be repeated. In this case, the inbuilt firmware loader is activated which enables to recover DUT-E S7 Radiobox RS operability. If the repeated attempt fails, we recommend to consult [Technoton technical support](#) service by e-mail support@jv-technoton.com.

Annex F

Videography

1) Video clip DUT-E ATS-1 automatic tank calibration station.

Check out the link:  <https://youtu.be/uFF1mG-iz6A>

2) Animation Wireless fuel level sensor DUT-E S7.

Check out the link:  https://youtu.be/MnbGXn9JX_g

3) Animation DUT-E 2Bio fuel level sensor.

Check out the link:  <https://www.youtube.com/watch?v=WR1556gaN7o>

4) Animation DUT-E GSM fuel level sensor.

Check out the link:  <https://www.youtube.com/watch?v=ixBaKMzKtG8>

5) Video clip DUT-E 485 fuel level sensor installation.

Check out the link:  <https://www.youtube.com/watch?v=X0gUSF3dRWk>

6) Video clip Length extension of measurement part DUT-E Using measuring sections KDC

Check out the link:  https://www.youtube.com/watch?v=dWuY_JJfhFw

7) Video clip Filter Screen of DUT-E fuel level sensor

Check out the link:  <https://www.youtube.com/watch?v=B5dcYxGfSqQ>

8) Other [Technoton](#) videos are on the YouTube channel which is regularly updated:

 <https://www.youtube.com/channel/UCq7EF3DHrgl7fOWB2ynsR-A>