FUEL LEVEL SENSOR

DUT-E S7

OPERATION MANUAL

Version 4.0

TECHNOTON
ADVANCED VEHICLE TELEMTATICS
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</tr>
</thead>
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<td>1.0</td>
<td>01.2019</td>
<td>OD</td>
<td>Basic version.</td>
</tr>
<tr>
<td>1.1</td>
<td>03.2019</td>
<td>OD</td>
<td>Added information about the certificate of explosion protection of sensor.</td>
</tr>
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</table>
| 2.0     | 08.2019  | OD     | - Information on the new mobile application — Fuel Tank 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     | Significant changes in the Fuel Tank Monitor mobile application are reflected:  
- 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. |
Structure of external links

DUT-E S7 fuel level sensor. Operation manual. Version 4.0
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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 implements Bluetooth 4.X Low Energy (BLE) as a communication channel.

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** fuel level sensor is 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 (USA), GLONASS (Russia), Galileo (EU), BeiDou (China).

**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.

**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. In 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 contained in this Operation Manual are related to DUT-E S7 fuel level sensor (further on — DUT-E S7), model code — 07 manufactured by JV Technoton, Minsk, Republic of Belarus.

Model code of DUT-E S7 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 — Finding out model code of DUT-E S7

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

DUT-E S7 key features:

- wireless transmission of data using S7 Technology via Bluetooth Low Energy channel simultaneously to many receiving devices (Android-based 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;
- 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.
DUT-E S7 has all the advantages of “classical” DUT-E fuel level sensor models:

- 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** 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 DUT-E S7 ordering.

![DUT-E S7 order identification codes](image)

**Figure 2 — DUT-E S7 order identification codes**

Example of DUT-E S7 ordering identification codes:

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

* Can be manufactured with any custom measuring probe length up to 1400 mm.
**Not included into the delivery set.
Introduction

To receive the sensor indications by means of S7 Technology with a smartphone/tablet based on Android 5.X and higher operating system (further on — Android device), Fuel Tank Monitor mobile application is used, its functionality enables the user to:

- Monitor current values of:
  - fuel level in the tank;
  - volume of fuel in the tank;
  - frequency of the sensor measuring generator;
  - temperature of fuel in the tank.
- Receive messages of recorded Events:
  - “Fuelling”/“Fuel discharge”;
  - “Low level of fuel in the tank”; 
  - “High/Low temperature of fuel in the tank”.
- Conduct the calibration of the measuring system and the fuel tank calibration.
- Enable/disable the feature of compensation of thermal expansion/compression of fuel in the tank.
- Define automatically the remaining distance of the route, depending on the average fuel consumption and the volume of fuel in the tank.
- Sum up indications of the fuel volume of the specified group of sensors.
- Define automatically the time left before the tank is filled during the fuelling operation.
- Monitor the received signal strength indicator (RSSI) and the time of the latest message reception from the sensor.
- Monitor the current mode of the sensor operation.
- Monitor the sensor malfunctions.
- Receive the sensor ID data (serial number, firmware version, MAC address of BLE-module).
- Record (log) current values of the measuring generator frequency, fuel temperature, fuel level in the tank.
- Select between the metric system and the USC, to display sensor indications.
- Conduct operations with the sensor profile.

The user may download the Fuel Tank Monitor application from Google Play (search request “Technoton”) and subscribe to it with 10 days free test period.

**ATTENTION:** It is strongly recommended to follow strictly the instructions of the present Manual when using, mounting or maintaining DUT-E S7.

The Manufacturer guarantees DUT-E S7 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 DUT-E S7 specifications that do not lead to a deterioration of the consumer qualities without prior customer notice.
1 General information and technical specifications of DUT-E S7

1.1 Purpose of use, operation principle and application area

**is used 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.

**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. Such a mode of operation enables the sensor to operate completely independently during no less than 5 years without using any external power sources; power is supplied only from the inbuilt battery. Data from DUT-E S7 can be received at a distance of up to 50 meters by unlimited number of various receiving devices (Telematics units, Android-smartphones/tablets etc.), which are equipped with Bluetooth 4.X module.

**Application areas:** DUT-E S7 may be applied both independently, and within the Telematics system (it may operate 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).
General information and technical specifications of DUT-E S7 / Purpose of use, operation principle and application area

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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.

Figure 4 — Application areas of DUT-E S7

a) example of fuel volume monitoring in Vehicles tanks

b) example of fuel volume monitoring in fixed tanks
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 5 — 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.
1.3 Design

Inside measuring “head” of sensor (1): electronic measuring unit, BLE module for wireless data transfer using S7 Technology and built-in battery (see figure 6).

Measuring part (2) 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).

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

Powered of DUT-E S7 only by the built-in battery. **DUT-E S7** can be used in the conditions of temperate and cold climate. For resistance to mechanical impact DUT-E S7 is shake and shockproof.

1.4.1 Main specifications

*Table 1 — DUT-E S7 main specifications*

<table>
<thead>
<tr>
<th>Parameter, measuring unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel level sensor operating principle</td>
<td>Capacitive</td>
</tr>
<tr>
<td>Sensor sensitivity to fuel level changes, mm</td>
<td>0.1</td>
</tr>
<tr>
<td>Relative measuring error (to the length of the measuring part), %, not more than</td>
<td>±1.0</td>
</tr>
<tr>
<td>Wireless data transfer interface</td>
<td>Bluetooth 4.1</td>
</tr>
<tr>
<td>Transmitter power (Tx Power), dBm</td>
<td>+4</td>
</tr>
<tr>
<td>Maximum distance between sensor and receiving device, m</td>
<td>20 (if mounted on a Vehicle or in indoor locations)</td>
</tr>
<tr>
<td></td>
<td>50 (when mounted within line-of-sight range)</td>
</tr>
<tr>
<td>Data transfer interval, s</td>
<td>5</td>
</tr>
<tr>
<td>Estimated lifetime of the sensor (battery life), years</td>
<td>5</td>
</tr>
<tr>
<td>Maximum cutting of the measuring probe</td>
<td>up to any length required</td>
</tr>
<tr>
<td>Maximum length extension of the measuring probe, mm, not more</td>
<td>3000*</td>
</tr>
<tr>
<td>Temperature range, °C</td>
<td>-30...+80</td>
</tr>
<tr>
<td>Ingress protection rating</td>
<td>IP55/57</td>
</tr>
<tr>
<td>Certificates of BLE module electromagnetic compatibility</td>
<td>CE</td>
</tr>
<tr>
<td></td>
<td>FCC and IC (see annex B),</td>
</tr>
<tr>
<td></td>
<td>TELEC</td>
</tr>
<tr>
<td></td>
<td>BQE</td>
</tr>
<tr>
<td>Explosion safety certificate</td>
<td>![Ex0ExiaIIA T4 X](Ex0ExiaIIA T4 X)</td>
</tr>
<tr>
<td></td>
<td>(see annex C)</td>
</tr>
<tr>
<td>Weight, kg, not more than</td>
<td>1.0 (at L=1000 mm)</td>
</tr>
<tr>
<td></td>
<td>0.9 (at L=700 mm)</td>
</tr>
<tr>
<td>Overall dimensions, mm, not more than</td>
<td>see figure 8</td>
</tr>
</tbody>
</table>

* In case you need the measuring probe of extended length up to 6000 mm, it can be manufactured upon order.
1.4.2 Data composition of DUT-E S7 output message

DUT-E S7 wireless fuel level sensor transmits data by means of S7 Technology, without integration with receiving devices 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 by DUT-E S7 is provided in figure 7.

<table>
<thead>
<tr>
<th>Service field (AD0)</th>
<th>Data field (AD1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(permanent values)</td>
<td>(variable values)</td>
</tr>
<tr>
<td>Data length (AD Length)</td>
<td>Data type (AD Type)</td>
</tr>
<tr>
<td>0x02</td>
<td>0x01</td>
</tr>
</tbody>
</table>

Figure 7 — Structure of data packet transmitted by DUT-E S7

The application layer of the output message protocol of DUT-E S7 conforms with S6 Database (see table 2)

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

<table>
<thead>
<tr>
<th>Field number</th>
<th>Length</th>
<th>Parameter</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Level Sensor. RAW Data</td>
<td>PGN 63277 (0xF72D)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4 bytes</td>
<td>SPN 521440</td>
<td>Frequency, Hz</td>
</tr>
<tr>
<td>2</td>
<td>1 byte</td>
<td>SPN 521457</td>
<td>Temperature, °C</td>
</tr>
<tr>
<td>3</td>
<td>2 bytes</td>
<td>SPN 5347*</td>
<td>Lateral acceleration extended range, m/s²</td>
</tr>
<tr>
<td>4</td>
<td>2 bytes</td>
<td>SPN 5348*</td>
<td>Longitudinal acceleration extended range, m/s²</td>
</tr>
<tr>
<td>5</td>
<td>2 bytes</td>
<td>SPN 5349*</td>
<td>Vertical acceleration extended range, m/s²</td>
</tr>
<tr>
<td>6</td>
<td>4 bytes</td>
<td>SPN 521488</td>
<td>Unit DTCs mask (see table 3)</td>
</tr>
<tr>
<td>8</td>
<td>6 bytes</td>
<td>-</td>
<td>Reserve</td>
</tr>
</tbody>
</table>

* In the process of preparation for introduction.

Table 3 — Numerical values of malfunction mask (DTCs Mask) of DUT-E S7

<table>
<thead>
<tr>
<th>Numerical value</th>
<th>Description of malfunction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fuel temperature. No data or incorrect data</td>
</tr>
<tr>
<td>64</td>
<td>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”</td>
</tr>
<tr>
<td>512</td>
<td>Defective measuring generator. Possible locking of the measuring module pipes</td>
</tr>
<tr>
<td>1024</td>
<td>Low battery charge (&lt;10 %)</td>
</tr>
<tr>
<td>2097152</td>
<td>Real time clock. Clocking is off</td>
</tr>
</tbody>
</table>
**SPN** values of the sensor output message may be calculated according to the formula (1) using attributes from table 4.

\[
\text{Parameter value} = \text{SPN Content} \cdot \text{Factor (Resolution)} + \text{Offset}
\]  

(1)

**Table 4 — Attributes for calculation of current values of DUT-E S7 parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Factor (Resolution)</th>
<th>Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPN 521440</td>
<td>0.001</td>
<td>0 Hz</td>
</tr>
<tr>
<td>SPN 521457</td>
<td>1</td>
<td>-50 °C</td>
</tr>
<tr>
<td>SPN 5347</td>
<td>0.01</td>
<td>-320 m/s²</td>
</tr>
<tr>
<td>SPN 5348</td>
<td>0.01</td>
<td>-320 m/s²</td>
</tr>
<tr>
<td>SPN 5349</td>
<td>0.01</td>
<td>-320 m/s²</td>
</tr>
</tbody>
</table>

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

\[
L_{\text{act}} = L_s \cdot F_1 \cdot (F_0/F_{\text{act}}-1)/(F_0-F_1), \text{ mm}
\]  

(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;

\(F_{\text{act}}\) – current value of the sensor measuring generator frequency, Hz.
1.4.3 Compatibility with receiving devices

**DUT-E S7** can be used with receiving device (Android smartphones/tablets, Telematics units, GPS tracker and other devices for data receiving, logging and displaying), which have Bluetooth 4.X and high.

Recommendations on wireless connection of DUT-E S7 to Telematics terminals can be obtained upon request at Technoton technical support service by e-mail: support@technoton.by.

**RECOMMENDATION:** The best compatibility with DUT-E S7 sensor during its operation using S7 Technology is provided by CANUp 27 Pro 3G/ CANUp 27 Pro Wi-Fi 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 8 — DUT-E S7 overall dimensions

* Nominal measuring probe length (700 mm/1000 mm).
2 DUT-E S7 installation

For **DUT-E S7** correct operation its mounting and configuration should be carried out by certified specialists who have passed corporate technical training.

⚠️ **ATTENTION:** Strictly follow safety rules of automobile repair works as well as local safety rules of the customer company when mounting sensor.

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 Mounting

Recommendations on installation, length shortening and extension, screen-filter installation, fastening and fixation of DUT-E S7 are identical to the respective recommendations for "wired" DUT-E sensors, described in DUT-E/DUT-E 2Bio/DUT-E GSM installation manual.
2.3 Wireless transfer of sensor indications to the Android device

For wireless monitoring of DUT-E S7 by means of S7 Technology, first, download the Fuel Tank Monitor application on your smartphone/tablet from Google Play (search request “Technoton”) and subscribe to it.

**IMPORTANT:**

1) To eliminate connection failures between the DUT-E S7 and the Android device, 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 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 Android device depends on the quality of the Bluetooth connection of the Android device. To assure the stable data transmission, it is recommended that this distance should not exceed 20 m.

2.3.1 BLE-module activation

**WARNING:** The transfer of DUT-E S7 indications to the Android device is possible only after activation of the sensor BLE-module.

DUT-E S7 has the following modes of operation determined by the status of its BLE-module:

- **“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.

- **“Manufacturing”** — in this mode, the BLE-module of DUT-E S7 is activated for data transmission only for the period of the sensor testing or checking its operability with Fuel Tank Monitor application. To activate this mode, you need to apply the magnetic key (see the delivery set) for 1 s to the cap of the sensor “head” (see figure 9 a). 4 h later or after another touching the sensor cap by the magnetic key, the BLE-module of DUT-E S7 again becomes inactive.

- **“Operating”** — this mode is enabled, when the sensor is mounted in the tank of a Vehicle or in a fixed tank. In this mode, the BLE-module is fully enabled, without the possibility to return to the inactive state. After that, DUT-E S7 is ready to transmit data by means of S7 Technology throughout its service life. To activate the “Operating” mode, you need to bridge the tubes of DUT-E S7 measuring probe with a small screwdriver and simultaneously apply the magnetic key to the cover of the sensor “head” for 1 s (see figure 9 b).
Apply the magnetic key to the cover of the sensor “head” for 1 s

**a) during the activation of the “Manufacturing” mode**

Bridge the tubes of the measuring probe

**b) during the activation of the “Operating” mode**

*Figure 9 — Activation of DUT-E S7 BLE-module*
2.3.2 Establishment of communication between the sensor and the Android device

**WARNING:** All settings made in the Fuel Tank Monitor application are not recorded into the sensor, but are only saved in the memory of the Android device in the profile file of a specific sensor (see 2.3.4).

Launch the Fuel Tank Monitor mobile application with icon from the main menu of the Android device.

From the moment of BLE-module activation (enabling “Operating”/”Manufacturing” mode) **DUT-E S7** is ready to operate in Fuel Tank Monitor.

Right after it is launched, the Fuel Tank Monitor will offer to allow enabling the Bluetooth of the Android device (see figure 10 a) and after the Bluetooth activation, the window **Searching** aimed at detection of active DUT-E S7 sensors is opened.

Each sensor detected is automatically entered into the list of accessible devices by the application (**Results** area), with displaying the following data (see figure 10 b):

- serial number (1);
- signal of the time the latest message was received (2);
- MAC-address of the BLE-module (3);
- presence/absence of the sensor active malfunctions (4);
- received signal strength indicator (RSSI) (5);
- frequency of the measurement generator (6);
- fuel temperature (7).

To select the required sensor from the list of accessible devices, press the line containing its serial number.
During DUT-E S7 operation, signals of indicator time of receiving last message from the sensor on the Android device should be displayed in Fuel Tank Monitor app (see table 5).

Table 5 – Values of signals of time indicator of receiving last message from DUT-E S7

<table>
<thead>
<tr>
<th>Signal type</th>
<th>Signal color</th>
<th>Signal values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Green</td>
<td>Less than 20 s passed after receiving last message from the sensor</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>(20…40) s passed after receiving last message from the sensor</td>
</tr>
<tr>
<td></td>
<td>Orange</td>
<td>(40…60) s passed after receiving last message from the sensor</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>More than 60 s passed after receiving last message from the sensor</td>
</tr>
</tbody>
</table>
2.3.3 Interface of Fuel Tank Monitor application

In the area **Information and settings** the current sensor indications and the application settings are displayed.

In the **Tools Panel** area there are the following elements for use during work with Fuel Tank Monitor application:

- icon to select operations with the sensor profile;
- description of the selected menu item;
- icon to open the **Navigation menu** (monitoring of sensor indications, configuration of notification of Events, calibration of the measuring system, tank calibration, diagnostics of malfunctions etc.) and the **Menu of settings** (selection of language of the interface and units of measurement, Help button and displaying information of the application).

When working with **DUT-E S7**, the Fuel Tank Monitor mobile app operates with data (PGN and SPN) from **S6 databases**.
2.3.4 Operations with the sensor Profile

The DUT-E S7 Profile is the collection of all settings of a specific sensor. The Profile menu serves to perform operations with DUT-E S7 profile. It is opened by pressing on the Tools panel (see 2.3.3).

The Profile menu contains the following options for operations (see figure 12):

- **Load from a file** — is used to load the profile saved in the memory of the Android device before. In the window where the file is to be loaded you need to find and select the profile file (DUT-E_S7_*_.prf);
- **Save to a file** — is used to save the changed settings of the profile in the Android device memory;
- **Load a default profile** — is used for loading a profile with standard settings.

![Figure 12 — View of Profile menu Fuel Tank Monitor mobile application](image)

**IMPORTANT**: All configuration changes made in Fuel Tank Monitor app are not stored in the sensor, but in memory of Android device. Configuration changes are saved in a file, placed in folder, where Fuel Tank Monitor is installed: \Fuel Tank Monitor\DUT-E_S7_*_.prf.

Note — If needed, you may save the sensor profile file with the file name which is different from the file name assigned by default. However, in this case, the Fuel Tank Monitor application will not be able to find automatically the required profile, when the communication with the sensor is established.

* DUT-E S7 serial number.
2.3.5 Calibration of the measuring system

The calibration of the measuring system is necessary for correct displaying of the fuel level measurement readings by a specific Android device.

**IMPORTANT:** In case of replacing old Android device, it is necessary to copy profile of particular sensor into memory of new Android device (see 2.3.4) or repeat the measuring system calibration operation.

In the process of the measuring system calibration, minimum and maximum possible levels of fuel measurement in tank are stored into the memory of Android device in Sensor calibration bar of the Fuel Tank Monitor application (Settings submenu, Sensor tab) (see figure 13).

![Figure 13 — Measuring system calibration with Fuel Tank Monitor application](image)

For the measuring system calibration make the following steps:

1) Select the desired sensor from the list of available devices (see 2.3.2).

2) Get the sensor out of the fuel tank and wait for (30...60) seconds so that all fuel run off the probe.

3) Measure sensor probe length L (mm) from ending of tubes to draining hole (see figure 14) and enter the measured value in Fuel Level Sensor Length After Cutting field (see figure 13).

![Figure 14 — Measuring probe length of DUT-E S7](image)
4) To calibrate minimum (lowest) point of level measurement, press button in **Sensor calibration** bar.  

**ATTENTION:** When the measuring system calibrating to minimum level, there should not be fuel residues on surface of tubes of probe.

5) Dip the probe’s tubes fully into the fuel. Wait for (10...20) seconds for sensor readings stabilization.

6) To calibrate maximum (highest) point of level measurement, press button in **Sensor calibration** bar.

7) Save the changes of the profile in the memory of the Android device.

8) Measuring system calibration is finished.

**IMPORTANT:** If frequency values of the sensor measuring generator for the maximum and minimum fuel levels are known, it is sufficient to enter these values in the fields **Frequency “Empty”** and **Frequency “Full”** of **Sensor calibration** bar respectively, instead of the calibration operation (see figure 13).
2.3.6 Calibration of fuel tank

Fuel Tank Monitor app recalculates the measured value of fuel level into the fuel volume in the tank according to the calibration table. To set up calibration table it is required to carry out calibration of fuel tank.

Calibration procedure is a sequence of fuel fillings by fixed portions from empty to full state of the fuel tank (see video Fuel level DUT-E installation).

**IMPORTANT:** To measure the volume of fuel portions it is necessary to use measuring reservoir with inaccuracy not more than 0.25 %.

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;
- 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.

Tank calibration table is stored in memory of **specific** Android device using Fuel Tank Monitor app (**Settings** submenu, **Tank** tab) (see figure 15).

![Figure 15 — Example of the tank calibration table generation using the Fuel Tank Monitor application](image)
**IMPORTANT:** In case of replacing old Android device, it is necessary to copy profile of particular sensor into memory of new Android device (see 2.3.4). Alternatively, fuel tank calibration should be repeated with new Android device.

Select **DUT-E S7** which is installed in a calibrated tank from the list of available devices (see 2.3.2).

The data is entered as a table of correspondence between measured fuel level value (Level, mm column) and fuel volume in the tank (Volume, l column).

- To add lines into the calibration table, press button. In the process of adding new batches of fuel into the tank with a measuring vessel, each time a new batch is added the current value of the fuel level in the tank will be displayed on the left side of this button, as well as the value of the measuring generator frequency that corresponds to it. Whenever the button is pressed, these values are automatically entered into the next line in Level, mm and Freq., Hz columns.

**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.

- New entries are automatically sorted from low to high fuel level value.

If you need to cancel all changes, press button. To delete the line, place the cursor into any of the cells and press button.

Button is used for deleting all entries of calibration table.

- As soon as the calibration is over, clicking button will allow saving the table as a *.ttr7 file in memory of Android device.

- To load previously saved table from file click button (for example, in case of replacement of fuel level sensor).

- As soon as the creation of the calibration table is completed, save the changes of the sensor profile in the Android device memory.

- Fuel tank calibration is finished.

**ATTENTION:**

1) The number of calibration table points is proportional to the measurement accuracy of fuel volume. The recommended number of calibration points is not less than 15. The maximum possible number of calibration points in Fuel Tank Monitor app is 60.

2) The maximum possible volume of the tank to be calibrated is **250000 l**.

3) In the process of entering the calibration points, it should be borne in mind that the Fuel Tank Monitor application displays data with **10 s** filtration time lag.

4) If needed (e.g. in case of a repeated calibration of the measuring system), you may manually correct the measuring generator frequency in points of the calibration table (column Freq., Hz). The fuel level values (column Level, mm) will be recalculated respectively.
**RECOMMENDATION:** Tank calibration using **DUT-E ATS-3 automatic calibration station** reduces the calibration error to ±0.5% of the tank volume and also reduces the labor input and the time needed for tank calibration by 2...3 times (see **DUT-E ATS-3 Operation Manual**).

Whenever you use DUT-E S7 within the **Telematics system**, the **Server** software calculates the volume of fuel in the **Vehicle** tank.

In order to transfer points of the generated calibration table from the Fuel Tank Monitor application to the **Telematics server** (e.g. **ORF 4** or **Wialon**), perform the following operations (see figure 16):

- In the settings of ORF 4 for the fuel level sensor (**New sensor** window of the service, **Calculation Table** tab) enter all values from **Frequency, Hz** column of the mobile application into **X** column, while the respective values from **Volume, l** column are to be entered into **Y** column.
- Press **Generate** button.
- Save changes.
- The configuration is completed.

*Figure 16 — Example of the tank calibration table transfer from the Fuel Tank Monitor application into ORF 4 Telematics service*
2.3.7 Adaptation of indications for specific conditions of exploitation

To adapt indications of the selected DUT-E S7 sensor (see 2.3.2) for specific conditions of operation, you may use the following features of the Fuel Tank Monitor application (see figure 17):

1) **Thermal correction** function (Settings, submenu, Sensor tab) is recommended to activate for automatic compensation of the fuel thermal expansion/contraction.

ATTENTION: Thermal expansion/contraction of the fuel caused by the temperature deviation, alters the volume of fuel in the tank. As consequence, the sensor transmits a significant increase or decrease of fuel level to Android device.

Automatic thermal compensation is disabled by default. To activate it, press button in the Temperature correction area and move the blue contact slider to the right in the window of settings that is opened. Insert the required coefficient value into the field Coefficient, %/°C. To turn off the thermal compensation, insert the coefficient value 0.0 or shift the blue slider to the left.

Thermal correction coefficient $K_{ther\_corr.}$ is determined by formula (3):

$$K_{ther\_corr.} = \left( -1 \right) \times \left( \frac{V_{max} - V_{min}}{T_{max} - T_{min}} \right) \cdot \frac{100}{V_{min}}$$

(3)

where $T_{min}$ and $T_{max}$ — respectively the minimum and the maximum measured values of fuel temperature in the tank during 24 hours;

$V_{min}$ and $V_{max}$ — measured values of fuel volume in the tank with minimum and maximum fuel temperature respectively.

IMPORTANT:
1) The values of $V_{min}$, $V_{max}$, $T_{min}$, $T_{max}$ determined by the DUT-E S7 readings.
2) When measuring values $V_{min}$, $V_{max}$, $T_{min}$, $T_{max}$ during 24 hours follow the requirements:
   - Vehicle is not moving with engine off.
   - Ambient temperature should correspond to normal operating conditions of the Vehicle.
   - Tank should be filled with fuel not less than 10 % of the total fuel volume.
   - There should be the same fuel volume in the tank (refueling or draining is not allowed).

2) The **Remaining distance of the route** function (Settings submenu, Sensor tab) is used to define automatically the remaining distance for this Vehicle, in accordance with the measured volume of fuel in the tank and the value of the average fuel consumption specified. To configure this function, specify the necessary value of the average fuel consumption in the Average consumption field.
3) Detection of Events function (Settings submenu, Events tab) is used for automatic recording of Events and the user notification of their occurrence. By default, this function is OFF for all Events. To detect Events, there are the following settings (see figure 18):

- To activate the detection of the "Discharging" Event, press in the Discharging line. Move the blue slider contact to the right in the settings window that opens. In the field Threshold, l/h enter the threshold value of the fuel consumption. In this value is exceeded, the application will display information of the respective Event.

- To activate the detection of the "Fuelling" Event, press in the Fuelling line. Move the blue slider contact to the right in the settings window that opens. In the field Threshold, l/h enter the threshold value of the fuel consumption. In case this value is exceeded, the application will display information of the respective Event. Note — The specified threshold value of the fuel consumption is also used in the function of automatic defining the time left before the tank is filled, during the fuelling operation. It should be noted that this feature is active in any position of the blue slider contact in the Fuelling line.

- To activate defining the low limit for the fuel left in the tank, press sign in the line Low fuel level. Move the blue slider contact to the right in the settings window that opens. In the field Threshold, I enter the value of the minimum volume of fuel in the tank below which the application will display information of the respective Event.

- To activate defining the minimal fuel temperature at which the engine can be started, press sign in Low temperature line. Move the blue slider contact to the right in the settings window that opens. In the field Threshold, °C enter the value of the minimum temperature of fuel in the tank, below which the application will display information of the respective Event.

- To activate defining the maximal fuel temperature at which the engine can be started, press sign in High temperature line. Move the blue slider contact to the right in the settings window that opens. In the field Threshold, °C enter the value of the maximum temperature of fuel in the tank above which the application will display information of the respective Event.

Figure 17 — Configuration of Thermal Correction and Remaining Distance functions in the Fuel Tank Monitor application
Information windows appearing on the Android device display in case of Events (see figure 19) are accompanied by sound and vibration signals*. For fuel tank “Fuelling”/“Discharging” Event the following information is displayed (see figure 19 a):
- data and time of the Event occurrence;
- volume of fill-up/drained fuel;
- fuel volume in the beginning and at the end of the Event.

For other Events, only the date and time of their occurrence as well as the current value of the Parameter, specified in Threshold field are displayed.

* With sound and vibration signals ON in the Android device which is being used.
The list of all Events recorded during work with DUT-E S7, before the working session with Fuel Tank Monitor application is completed, is displayed in the Indicator panel submenu (Events tab) (see figure 19 b). Data on the latest Event and of the number of recorded Events are displayed in the Indicator panel submenu (Data tab) (see figure 20 a).

Figure 19 — Display Events information in the Fuel Tank Monitor application

IMPORTANT: Enabling and correct operation of the feature of automatic identification of “Fuelling”/“Discharging” Events is possible only after the measuring system calibration (see 2.3.5) and entering the calibration table into the memory of the Android device being used (see 2.3.6).
2.3.8 Monitoring of indications using the Android device

**IMPORTANT:** Correct monitoring of indications with Fuel Tank Monitor application is possible only after the measuring system calibration (see 2.3.5) and entering the calibration table into the memory of the Android device being used (see 2.3.6).

For monitoring of indications, select the required sensor from the list of accessible devices in the Fuel Tank Monitor application (see 2.3.2) and open Data tab of (Indicator panel submenu) (see figure 20 a).

![Figure 20 — Monitoring of indications in the Fuel Tank Monitor application](image)

- a) example of displaying the current indication
- b) example of logging the current indication

With the Fuel Tank Monitor application, the user can monitor in real time on the display of the Android device:

1) **Current values of Parameters:**
   - fuel level in the tank;
   - fuel volume in the tank;
   - frequency of the sensor measuring generator;
   - fuel temperature in the tank;
   - remaining distance of the route, depending on the average fuel consumption and the volume of fuel in the tank;
   - time left before the tank is filled during fuelling.

2) **Recorded Events:**
   - “Fuelling”/“Discharging”;
   - “Low level of fuel in the tank”;
   - “High/Low temperature of fuel in the tank”.

3) **Presence/absence of the sensor active malfunctions.**

To carry out the indications analysis, you may enable (move the blue contact slider to the right, Log submenu) the registration (logging) of current values of the fuel temperature, frequency of the sensor measuring generator and the fuel level (see figure 20 b), with their recording in the log file (*.txt).
The maximum number of control points displayed — 200. The number of points recorded in the log file — not limited.

Whenever you tick the **Scroll** field, each added line of the Parameters will be displayed in the bottom portion of the table.

The recorded log files are automatically placed into the installation folder of the application, in the memory of the Android device (**\Fuel Tank Monitor\Log**). The log file name is generated automatically and contains the sensor serial number, the current date and time of starting the data recording.
2.3.9 Summation of indications

The function of summation of the fuel volume indications measured by a group of DUT-E S7 sensors (up to 10 pcs.) is configured in Settings submenu (Group tab).

You may add additional sensors (Slave sensors), to the main sensor (Master sensor) that will display the total value of the fuel volume; readings of additional sensors are to be summed up.

**IMPORTANT:** For correct monitoring of readings, you must comply with the following requirements:

1) The calibration data ("Empty" and "Full" frequencies) (see 2.3.5) and the calibration table of the respective tank (see 2.3.6) must be recorded into the profile of each sensor.

2) The sensors’ profiles files must be saved in the memory of the Android device which is used, in the installation folder of the Fuel Tank Monitor application.

3) The sensors’ profiles files are not recommended to save with the names different from names assigned by default. Because in such a case, the Fuel Tank Monitor application will not be able to find automatically the required profile, when the connection with the sensor is to be established.

Addition of accessible sensors to the group from Searching area is performed by pressing button located to the right of the serial number of the respective sensor (see figure 21 a).

By pressing button in the bottom portion of Multisensor group area, you may add a sensor with any serial number entered by the user.

Using button, you may delete any respective Slave sensor from the group. However, you cannot delete the Master sensor from the group.

The following data are displayed for each sensor from the group: serial number, current readings of the fuel volume, data on presence/absence of active malfunctions and the indicator of time of the latest message reception (see figure 21 b).

The total indication of the fuel volume measured by the created group of sensors is displayed in the Total field, in the upper right portion of Group tab.

**WARNINGS:**

1) In case "Empty" and "Full" calibration frequencies are not recorded in the profile of a sensor which is added to the group, its serial number is displayed in red color. During monitoring the total indications of the group of sensors the red-colored **No calibration** warning will be displayed for this sensor in Indicator panel submenu (Group tab).

2) In case there are active sensor malfunctions, (!) red warning sign is displayed near its serial number (see figure 21 b).

To sum up the readings of the created group of sensors during the next working session with the Fuel Tank Monitor application, you will have to save the changed profile of the Master sensor in the memory of the Android device which you use.
DUT-E S7 fuel level sensor. Operation manual. Version 4.0
© Technoton, 2021

Figure 21 — Example of summation of readings of several DUT-E S7 sensors in the Fuel Tank Monitor mobile application

**a) generation of a group of sensors for summation of readings**

**b) monitoring total indications of a group of sensors**
3 Sealing

It is required to seal the sensor with sealing cord and disposable plastic seal* to prevent fuel thefts or unauthorized interference into DUT-E S7 operation. Seals and cord are included into DUT-E S7 delivery set (see figure 22).

To seal the sensor put the sealing cord through the special holes of the mounting plate and DUT-E S7 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 22 — Sealed DUT-E S7

⚠️ **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 22.
4 Measurement accuracy check

4.1 Basic principles

DUT-E S7 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 DUT-E S7 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 DUT-E S7 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:** DUT-E S7 indications in the Fuel Tank Monitor application will be invalid if the measuring tubes are closed by conducting mud or water.

To monitor the quality of performance of the selected DUT-E S7, the **Self-diagnostics** submenu is used in the Fuel Tank Monitor application. All active sensor malfunctions (if any) that occurred during the session of work with this application (see figure 23 b), as well as their indicators (see table 6) are displayed in the **Malfunctions** area of this submenu. In case there are no active malfunctions, the appropriate message is displayed in the **Malfunctions** area (see figure 23 a).

You can also monitor the quality of the sensor performance:

1) **In the** Searching **window** (see 2.3.2) and in the Group **tab** (Indicator panel **submenu**) (see 2.3.9) where the **Self-diagnostics: Ok** message is displayed under the serial number of each sensor, in case no malfunctions are detected; if there are some malfunctions, **Self-diagnostics: (!) sign** is displayed.

2) **In the** Data **tab** (Indicator panel **submenu**) (see 2.3.8), where **ok** icon is displayed, in case no malfunctions are detected; in case of any malfunctions, **(!) icon** is displayed.

### Table 6 — Meaning of signals of active malfunctions indicator of DUT-E S7

<table>
<thead>
<tr>
<th>Signal type</th>
<th>Signal color</th>
<th>Signal values</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Red" /></td>
<td>Red</td>
<td>Active malfunction detected (see table 3)</td>
</tr>
<tr>
<td><img src="image" alt="Blue" /></td>
<td>Blue</td>
<td>Active malfunction eliminated</td>
</tr>
</tbody>
</table>

*a) without active malfunctions  b) there are active malfunctions*

**Figure 23 — Sensor Quality Control in the Fuel Tank Monitor application**
6 Maintenance

6.1 General instructions

DUT-E 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.

DUT-E S7 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 demounting.

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

Cut the sealing cord carefully.

Unfasten DUT-E S7 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) In case of repeated installation of DUT-E S7 — replace the old rubber gasket with a new one.
6.3 Examination

**DUT-E S7** is demounted conduct a visual examination to detect the following defects:
- visible damages of the sensor head body, measuring probe;
- backlash of measuring unit tubes relative to each other and/or the body;
- 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.
6.4 Cleaning

During DUT-E S7 operation mud or paraffin formation is possible on the surface of the measuring probe pipes. Pollution of the cavity between the pipes of the measuring probe can lead to significant increase of accuracy error.

**ATTENTION:** Mud coating inside the inner measuring tube does not affect DUT-E S7 normal operation. Examine the space between two tubes of measuring part and between measuring part and additional electrode for mud and paraffin.

To clean the tubes wash them with the clean 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:** Avoid fuel getting on DUT-E S7 head body, interface cable and its connector when washing the tubes.
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 24) 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 24 — Exterior view of DUT-E S7 Radiobox RS](image)

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 25).

![Figure 25 — Example of DUT-E S7 Radiobox RS employment in a transport Telematics system](image)

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 26 — 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 27 — DUT-E S7 Radiobox RS design
# 7.4 Technical specifications

## 7.4.1 Main specifications

<table>
<thead>
<tr>
<th>Parameter, measuring unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless data receive interface</td>
<td>Bluetooth 4.1</td>
</tr>
<tr>
<td>Output interface</td>
<td>RS-232/RS-485</td>
</tr>
<tr>
<td>Service interface</td>
<td>K-Line (ISO 14230)</td>
</tr>
<tr>
<td>Receiver sensitivity (Rx), dBm</td>
<td>-88</td>
</tr>
<tr>
<td>Maximum distance to sensor, m</td>
<td>20 (in case there are metal partitions in the mounting location) 50 (when mounted within line-of-sight range)</td>
</tr>
<tr>
<td>Power supply voltage range, V</td>
<td>9...45</td>
</tr>
<tr>
<td>Maximal current consumption at supply voltage 12/24 V, mA, not more than</td>
<td>80/60</td>
</tr>
<tr>
<td>Ambient operation temperature range, °C</td>
<td>-40...+85</td>
</tr>
<tr>
<td>Ingress protection rating</td>
<td>IP40</td>
</tr>
<tr>
<td>Certificates of BLE module electromagnetic compatibility</td>
<td>CE FCC and IC (see annex B), TELEC, BQE</td>
</tr>
<tr>
<td>Weight, kg, not more than</td>
<td>0.2</td>
</tr>
<tr>
<td>Overall dimensions, mm, not more than</td>
<td>see figure 28</td>
</tr>
</tbody>
</table>
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 **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

![Overall dimensions diagram]

*Figure 28 — 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 are 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 8 and figure 29).

**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 29 — Diagram of DUT-E S7 Radiobox RS electrical connection

Table 8 — Designation of wires in OUT wire bundle

<table>
<thead>
<tr>
<th>Connector Pinout</th>
<th>Connector Contact Number</th>
<th>Wire Marking</th>
<th>Wire Color*</th>
<th>Circuit Designation</th>
<th>Signal Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>S6 Mol</td>
<td>1</td>
<td>VBAT</td>
<td>Orange</td>
<td>Power “+”</td>
<td>Analog, voltage 9...45 V</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>GND</td>
<td>Brown</td>
<td>Ground “-“</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>KLIN</td>
<td>Black</td>
<td>K-Line</td>
<td>Digital, ISO 14230 Standard</td>
</tr>
<tr>
<td></td>
<td>TX</td>
<td>Blue</td>
<td></td>
<td>Data transmitted</td>
<td>Digital, RS-232 Standard</td>
</tr>
<tr>
<td></td>
<td>RX</td>
<td>White</td>
<td></td>
<td>Data received</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>Blue</td>
<td></td>
<td>Exchange of data</td>
<td>Digital, RS-485 Standard</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>White</td>
<td></td>
<td>Exchange of data</td>
<td></td>
</tr>
</tbody>
</table>

* 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 30).

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).
After the installation and starting of Service S6 DUT-E software, press the 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 31).

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 32):

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 values 2400; 4800; 9600; 19200; 38400; 57600; 115200 bit/s (19200 bit/s by default).

---

![Figure 32](image)

Figure 32 — 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 33 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 33 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 33 — 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 34).

![Figure 34 — Configuration of DUT-E S7 Radiobox RS for summarization of DUT-E S7 readings using S7 Technology](image)

**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 readings of the Android device, see 2.3.5). To enter the frequencies, tick the field Enter calibration parameters, press Save to Unit button and select Enter manually (see figure 35).

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 Save to file 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 readings of the Android device, see 2.3.6) or load them from the file (*.ttr).

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

![Figure 35— The procedure of editing manually calibration frequencies of DUT-E S7 wireless sensor](image)
8 Packaging

**DUT-E S7** delivery sets come in cardboard boxes of the following shape (see figure 36).

![Figure 36 — DUT-E S7 packaging](image)

Label sticker with information on the product name, serial number, firmware version, manufacture date, weight as well as Quality Control seal and QR code is stuck on two sides of the DUT-E S7 box (see figure 37).

![Figure 37 — DUT-E S7 packaging label](image)

Note — Label design and contents can be modified by the Manufacturer.
9 Storage

**DUT-E S7** is recommended to be stored in dry enclosed areas.

DUT-E S7 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 DUT-E S7 in the same room with substances that cause metal corrosion and/or contain aggressive impurities.

DUT-E S7 shelf life must not exceed 24 months.
10 Transportation

Transportation of DUT-E S7 is recommended in closed transport that provides protection for DUT-E S7 from mechanical damage and precipitation.

When transporting by air, DUT-E S7 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 DUT-E S7 sensors should be sealed.
11 Utilization/re-cycling

**DUT-E S7** does not contain precious metals in amount that should be recorded.

The inbuilt lithium-thionyl chloride battery of DUT-E S7 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

Tel/Fax: +375 17 240-39-73
https://www.jv-technoton.com/
marketing@technoton.by
support@technoton.by

Manufacturer

Zavod Flometr
Tel/fax: +375 1771 3-29-21
office@flowmeter.by
Annex A
Template of check test report

Report

Date: ______________________

<table>
<thead>
<tr>
<th>DUT-E S7 serial number</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle type, model, registration number</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drainage volume</th>
<th>According to calibrated container $V_M$, liters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>According to the indication on the display of the Android device $V_{Android}$, liters</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accuracy error</th>
<th>Absolute error $\Delta = V_{Android} - V_M$, liters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normalized to total tank volume $\delta = \frac{V_{Android} - V_M}{V_{total_volume}} \cdot 100%$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Refueling volume</th>
<th>According to calibrated container $V_M$, liters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>According to the indication on the display of the Android device $V_{Android}$, liters</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accuracy error</th>
<th>Absolute error $\Delta = V_{Android} - V_M$, liters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normalized to total tank volume $\delta = \frac{V_{Android} - V_M}{V_{total_volume}} \cdot 100%$</td>
</tr>
</tbody>
</table>

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: ____________________/__________________/

DUT-E S7 fuel level sensor. Operation manual. Version 4.0
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Annex B
Electromagnetic compatibility of BLE-module

BLE-module installed in **DUT-E_S7** and **DUT-E_S7 Radiobox RS** is certified and found to comply with:

- FCC Rules Part 15 (marking — Contains FCC ID: S9NSPBTLERF);
- IC Rules, RSS-210 (marking — Contains IC: 8976C-SPBTLERF).

**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.
Annex C

Explosion protection of DUT-E S7

1) **DUT-E S7** fuel level sensors (compliance certificate № EAЭC 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;

2) Ex marking od **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.
   Ex marking is placed on measuring “head” of the sensors as pictured on figure C.1.

   ![Ex marking](image)

   *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) S6 Technology.

D.1 Self-diagnostics FM

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

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

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Factory value</th>
<th>Unit of measure</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>S21120</td>
<td>Serial number</td>
<td>On the fact</td>
<td>No</td>
<td>Serial number is a set of numbers that is used for identification of specific Unit. Serial number of the Unit has the following format: AABBBC DDDDD, where: AA — code of model; 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.</td>
</tr>
<tr>
<td>S21345</td>
<td>Model</td>
<td>On the fact</td>
<td>No</td>
<td>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.</td>
</tr>
</tbody>
</table>
### Annex D SPN of DUT-E S7 Radiobox RS Functional modules / Self-diagnostics FM

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Factory value</th>
<th>Unit of measure</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521123</td>
<td>Line</td>
<td>DUT-E</td>
<td>No</td>
<td>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.</td>
</tr>
<tr>
<td>521344</td>
<td>Mark</td>
<td>TECHNOTON</td>
<td>No</td>
<td>Name of the Unit Manufacturer. SPN is not available for editing.</td>
</tr>
<tr>
<td>521121</td>
<td>Firmware version</td>
<td>On the fact</td>
<td>No</td>
<td>Version of built in Software of the Unit. SPN is not available for editing.</td>
</tr>
<tr>
<td>521125</td>
<td>Date of production</td>
<td>On the fact</td>
<td>No</td>
<td>Date (day, month, year) of the Unit production. SPN is not available for editing.</td>
</tr>
<tr>
<td>521188</td>
<td>Address at S6 (SA) bus</td>
<td>129</td>
<td>No</td>
<td>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.</td>
</tr>
</tbody>
</table>

#### Unit. Counters

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Factory value</th>
<th>Unit of measure</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521116</td>
<td>Unit working time</td>
<td>On the fact</td>
<td>s</td>
<td>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.</td>
</tr>
<tr>
<td>521118</td>
<td>Number of Unit restarts</td>
<td>On the fact</td>
<td>pcs.</td>
<td>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.</td>
</tr>
</tbody>
</table>

#### Unit. Passwords

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Factory value</th>
<th>Unit of measure</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521593/3.3</td>
<td>Password/3.3 Installer</td>
<td>1111</td>
<td>No</td>
<td>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.</td>
</tr>
</tbody>
</table>

Active DTC

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Factory value</th>
<th>Unit of measure</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521044</td>
<td>Malfunction code (SID)</td>
<td>On the fact</td>
<td>No</td>
<td>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 &quot;No malfunctions&quot;.</td>
</tr>
</tbody>
</table>

Bootloader information

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Factory value</th>
<th>Unit of measure</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521122</td>
<td>Bootloader Version</td>
<td>On the fact</td>
<td>No</td>
<td>Displays current version of the bootloader used for the correct start of service software, as well as when updating firmware of the Unit.</td>
</tr>
</tbody>
</table>
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.

![Calibration tab](image1)

![Calibration Table tab](image2)

![Settings tab](image3)

![Parameters tab](image4)

*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>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Factory value</th>
<th>Unit of measure</th>
<th>Range</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521440/22.0</td>
<td>Duty cycle/22.0 Empty</td>
<td>On the fact</td>
<td>%</td>
<td>0…4294970</td>
<td>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.</td>
</tr>
<tr>
<td>521440/22.1</td>
<td>Duty cycle/22.1 Full</td>
<td>On the fact</td>
<td>%</td>
<td>0…4294970</td>
<td>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.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Factory value</th>
<th>Unit of measure</th>
<th>Range</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521355</td>
<td>Number of elements per array</td>
<td>2</td>
<td>pcs.</td>
<td>1...60</td>
<td>Number of points of calibration table, created during the fuel tank normalization process. Recommended number of calibration points – no less than 15.</td>
</tr>
<tr>
<td>521023</td>
<td>Fuel level in the tank</td>
<td>On the fact</td>
<td>mm</td>
<td>0...6425.5</td>
<td>Values of fuel level in the tank corresponding with points of calibration table.</td>
</tr>
<tr>
<td>521024</td>
<td>Fuel volume in the tank</td>
<td>On the fact</td>
<td>l</td>
<td>0...6425.5</td>
<td>Values of fuel volume of the tank corresponding with points of calibration table.</td>
</tr>
</tbody>
</table>

#### Calibration table, Tank 1

**PGN 63036**

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Factory value</th>
<th>Unit of measure</th>
<th>Range</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521023/2.10</td>
<td>Fuel level/ 2.10 Filtering</td>
<td>On the fact</td>
<td>mm</td>
<td>0...6425.5</td>
<td>Displays the value of the fuel level in Vehicle tank filtered according to the preset time interval.</td>
</tr>
<tr>
<td>521024/2.10</td>
<td>Fuel volume in the tank/ 2.10 Filtering</td>
<td>On the fact</td>
<td>l</td>
<td>0...6425.5</td>
<td>Displays the value of the fuel volume in Vehicle tank filtered according to the preset time interval.</td>
</tr>
<tr>
<td>174</td>
<td>Fuel temperature 1</td>
<td>On the fact</td>
<td>°C</td>
<td>-40...210</td>
<td>This setting displays present value of fuel temperature in the vehicle’s tank.</td>
</tr>
</tbody>
</table>

#### Fuel level and volume of the tank

**PGN 62982**

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Factory value</th>
<th>Unit of measure</th>
<th>Range</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521433</td>
<td>Temperature correction coefficient</td>
<td>0.084</td>
<td>%/°C</td>
<td>-32...32</td>
<td>Field for entering temperature correction coefficient that provides temperature compensation of fuel expansion/compression inside of vehicle’s fuel tank.</td>
</tr>
<tr>
<td>521444</td>
<td>Filtering interval</td>
<td>60</td>
<td>s</td>
<td>0...64255</td>
<td>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.</td>
</tr>
<tr>
<td>521093</td>
<td>Length of the sensor after cutting</td>
<td>On the fact</td>
<td>mm</td>
<td>0...64255</td>
<td>Field for entering of sensor’s measuring length for what calibration table has been made before installation into the vehicle’s fuel tank.</td>
</tr>
<tr>
<td>521311</td>
<td>Temperature correction is On</td>
<td>Off</td>
<td>No</td>
<td>On/Off</td>
<td>Field for activation/ deactivation of temperature correction function that provides compensation of fuel expansion/compression inside of the Vehicle’s fuel tank.</td>
</tr>
</tbody>
</table>

### Obligatory settings, required for operation of the DUT-E S7 Radio Box RS together with the DUT-E S7 sensor.
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](image)

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

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Factory value</th>
<th>Unit of measure</th>
<th>Range</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521024/2.11</td>
<td>Fuel Tank Volume/2.11 Summary Value</td>
<td>0…6425.5</td>
<td>l</td>
<td>PGN 63152</td>
<td>Displays the value of total fuel volume in tanks, selected for summation.</td>
</tr>
<tr>
<td>521259/27.0</td>
<td>Fuel Level Sensor Summation Enable/27.0 DUT 1</td>
<td>Off</td>
<td>-</td>
<td>On/Off</td>
<td>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.</td>
</tr>
<tr>
<td>521259/27.1</td>
<td>Fuel Level Sensor Summation Enable/27.1 DUT 2</td>
<td>Off</td>
<td>-</td>
<td>On/Off</td>
<td>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.</td>
</tr>
</tbody>
</table>
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](image1)

![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](image2)
Table D.4 — Vehicle power supply FM. Displayed and/or editable SPN with the help of Service S6 DUT-E software

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Factory value</th>
<th>Unit of measure</th>
<th>Range</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521055</td>
<td>Vehicle Power Supply Voltage</td>
<td>On the fact</td>
<td>V</td>
<td>0...3212.75</td>
<td>Shows current value of ON voltage.</td>
</tr>
<tr>
<td>521055/2.9</td>
<td>Vehicle Power Supply Voltage/ 2.9 Average For 5 Minutes</td>
<td>On the fact</td>
<td>V</td>
<td>0...3212.75</td>
<td>Shows average value of ON voltage within previous 5 minutes.</td>
</tr>
<tr>
<td>521056</td>
<td>Vehicle Power Supply Status</td>
<td>On the fact</td>
<td>No</td>
<td>Off/ Low level/ Accumulator/ Starter/ Generator/ High level</td>
<td>Shows current mode of ON in accordance with user-defined borders of ON voltage levels of Vehicle (see figures D.4 and D.5).</td>
</tr>
<tr>
<td>521075</td>
<td>Vehicle Power Supply Presence</td>
<td>On the fact</td>
<td>No</td>
<td>On/Off</td>
<td>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).</td>
</tr>
</tbody>
</table>

Power supply borders

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Value</th>
<th>Unit of measure</th>
<th>Range</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521075</td>
<td>Nominal Battery Voltage</td>
<td>24</td>
<td>V</td>
<td>0...60</td>
<td>Field for entering a nominal value of accumulator voltage of Vehicle (U\text{nom}=12V/24V) (see figures D.4 and D.5).</td>
</tr>
<tr>
<td>521063</td>
<td>High Voltage Level</td>
<td>1.29</td>
<td>-</td>
<td>0...1.99</td>
<td>Field for entering value of high voltage level of onboard network (1.29\text{U}_{\text{nom}}) (see figures D.4 and D.5). Entered value of voltage is used as a threshold for recording &quot;Faulty ON&quot; Event.</td>
</tr>
<tr>
<td>521064</td>
<td>Generator Voltage Level</td>
<td>1.16</td>
<td>-</td>
<td>0...1.99</td>
<td>Field for entering voltage level of generator, i.e. when engine of Vehicle is running (1.16\text{U}_{\text{nom}}) (see figures D.4 and D.5).</td>
</tr>
<tr>
<td>521065</td>
<td>Engine Starter Voltage Level</td>
<td>0.91</td>
<td>-</td>
<td>0...1.99</td>
<td>Field for entering voltage level starter is running, i.e. when Vehicle’s engine is starting (0.91\text{U}_{\text{nom}}) (see figures D.4 and D.5).</td>
</tr>
<tr>
<td>521067</td>
<td>Low Voltage Level</td>
<td>0.75</td>
<td>-</td>
<td>0...1.99</td>
<td>Field for entering value of low voltage level of ON (0.75\text{U}_{\text{nom}}). Entered value of voltage is used as a threshold for recording &quot;Faulty ON&quot; Event. (see figures D.4 and D.5).</td>
</tr>
<tr>
<td>521068</td>
<td>Battery Off Level</td>
<td>0.20</td>
<td>-</td>
<td>0...1.99</td>
<td>Field for entering voltage level when ON switches off (0.20\text{U}_{\text{nom}}) (see figures D.4 and D.5).</td>
</tr>
<tr>
<td>521074</td>
<td>Engine Starter Continues Working Time Limit</td>
<td>30</td>
<td>s</td>
<td>5...30</td>
<td>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.</td>
</tr>
</tbody>
</table>

Vehicle power supply. Counts

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Value</th>
<th>Unit of measure</th>
<th>Range</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521173</td>
<td>Vehicle hours of operation on power supply</td>
<td>On the fact</td>
<td>s</td>
<td>0.4211080000</td>
<td>Counter of total operating time of Vehicle from onboard network since Unit installation to the Vehicle. User cannot reset the value of this Counter*.</td>
</tr>
<tr>
<td>521172</td>
<td>Vehicle hours of operation from battery</td>
<td>On the fact</td>
<td>s</td>
<td>0.4211080000</td>
<td>Counter of total operating time of Vehicle from accumulator since Unit installation to the Vehicle. User cannot reset the value of this Counter*.</td>
</tr>
<tr>
<td>521170</td>
<td>Starter hours of operation</td>
<td>On the fact</td>
<td>s</td>
<td>0.4211080000</td>
<td>Counter of total operating time of starter since Unit installation to the Vehicle. User cannot reset the value of this Counter*.</td>
</tr>
<tr>
<td>521171</td>
<td>Starter hours of operation</td>
<td>On the fact</td>
<td>s</td>
<td>0.4211080000</td>
<td>Counter of total operating time of Vehicle’s engine since Unit installation to the Vehicle. User cannot reset the value of this Counter*.</td>
</tr>
</tbody>
</table>

* 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](image)

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

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Factory value</th>
<th>Unit of measure</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521355</td>
<td>Array Elements Count</td>
<td>On the fact</td>
<td>pcs.</td>
<td>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.</td>
</tr>
<tr>
<td>521490</td>
<td>MAC Address</td>
<td>On the fact</td>
<td>No</td>
<td>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.</td>
</tr>
<tr>
<td>521178</td>
<td>Received Signal Strength Indicator (RSSI)</td>
<td>On the fact</td>
<td>dBm</td>
<td>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.</td>
</tr>
<tr>
<td>521084</td>
<td>Timeout</td>
<td>On the fact</td>
<td>s</td>
<td>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.</td>
</tr>
</tbody>
</table>

**Available Bluetooth Device List**

PGN 63279

<table>
<thead>
<tr>
<th>SPN</th>
<th>Name</th>
<th>Factory value</th>
<th>Unit of measure</th>
<th>Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>521355</td>
<td>Array Elements Count</td>
<td>On the fact</td>
<td>pcs.</td>
<td>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).</td>
</tr>
<tr>
<td>SPN</td>
<td>Name</td>
<td>Factory value</td>
<td>Unit of measure</td>
<td>Clarification</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------</td>
<td>---------------</td>
<td>-----------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>521188</td>
<td>S6 Address (SA)</td>
<td>No</td>
<td>No</td>
<td>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.</td>
</tr>
<tr>
<td>521490</td>
<td>MAC Address</td>
<td>On the fact</td>
<td>No</td>
<td>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.</td>
</tr>
</tbody>
</table>
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.


3) Choose firmware upgrade file (*.blf3) on PC disk or memory stick.

4) Press [Open] 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 [Stop] 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 S6 DUT-E 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@technoton.by.
Annex F

Videographic

1) Video clip DUT-E ATS-1 automatic tank calibration station.
Check out the link: [https://youtu.be/uFF1mG-iz6A](https://youtu.be/uFF1mG-iz6A)

2) Animation Wireless fuel level sensor DUT-E S7.
Check out the link: [https://youtu.be/MnbGXn9JX_g](https://youtu.be/MnbGXn9JX_g)

3) Animation DUT-E 2Bio fuel level sensor.
Check out the link: [https://www.youtube.com/watch?v=WR1556gaN7o](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](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=X0qUSF3dRWk](https://www.youtube.com/watch?v=X0qUSF3dRWk)

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](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](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/UCq7EF3DHrgI7fOWB2ynsR-A](https://www.youtube.com/channel/UCq7EF3DHrgI7fOWB2ynsR-A)