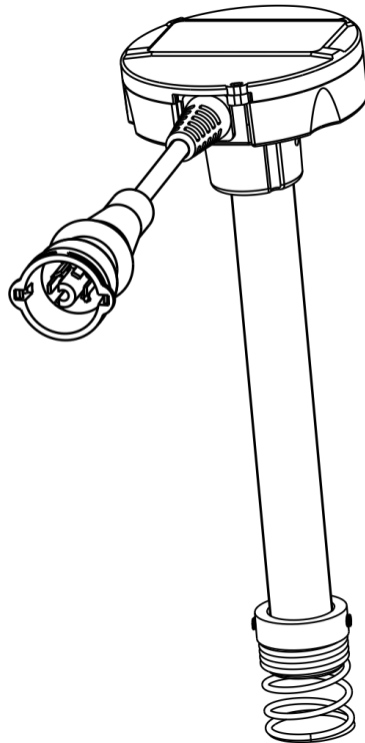




## FUEL LEVEL SENSORS



### DUT-E GSM

## OPERATION MANUAL

Version 6.0



**TECHNOTON**  
ADVANCED MACHINERY TELEMATICS

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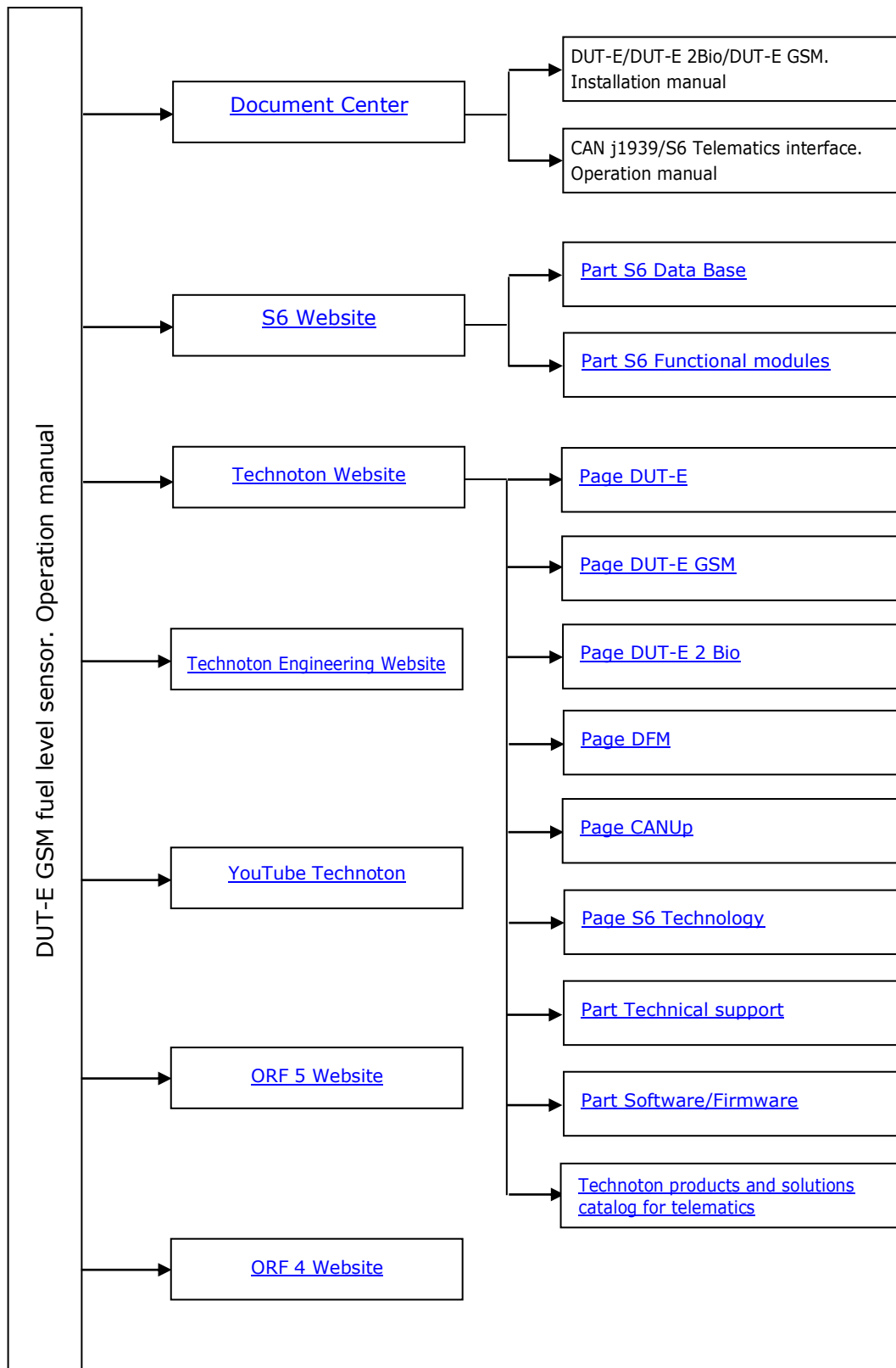
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## Revision history

Version	Date	Editor	Description of changes
1.0	05.2016	OD	Basic version.
2.0	07.2017	OD	<p><u>Added:</u></p> <ul style="list-style-type: none"> <li>• sensor operation <ul style="list-style-type: none"> <li>- via digital CAN/S6 interface;</li> <li>- via 3G technology;</li> <li>- via GSM-850/GSM-1900 standard;</li> </ul> </li> <li>• sensor integration into S6 telematics interface for signal summation of several DUT-E CAN;</li> <li>• recommended signal cable models;</li> <li>• operation with updated Service S6 software;</li> <li>• diagram and procedure of sensor connection to PC for configuration within S6 telematics interface;</li> <li>• procedure of establishing a remote connection with sensor;</li> <li>• sending Reports via e-mail;</li> <li>• sending Reports via SMS;</li> <li>• configuring connection parameters via CAN/S6;</li> <li>• configuration of data summarization;</li> <li>• function of automatic detection of Filling/Draining Events and fuel type correction;</li> <li>• example of connection scheme to S6 cabling system.</li> </ul> <p><u>Changed:</u></p> <ul style="list-style-type: none"> <li>• added new standard probe's lengths;</li> <li>• fuel sensor delivery set;</li> <li>• probe cutting and extending recommendations;</li> <li>• electrical connection sequence to Vehicle;</li> <li>• list of sensor's functional modules;</li> <li>• list of displayed/configurable SPNs;</li> <li>• list and content of Onboard reports of sensor;</li> <li>• creation and configuration order of Onboard reports;</li> <li>• protocol of remote sensor configuration via SMS;</li> <li>• firmware update procedure;</li> <li>• recommendations on sensor maintenance.</li> </ul>
3.0	12.2017	OD	<ul style="list-style-type: none"> <li>• The procedure for wireless sensor configuration using S6 BT Adapter service adapter is established; diagrams of the sensor connection to the Android device via Bluetooth are added.</li> <li>• Sensor configuration by means of the Android device using Service S6 DUT-E (Android) service mobile application is described.</li> <li>• The document terminology is updated (S6 Technology and IoT Burger Technology).</li> <li>• The structure of the document external links is added.</li> <li>• Diagrams of the sensor connection to the PC using S6 SK service adapter are added.</li> <li>• New SPN of the sensor Functional modules are added.</li> <li>• The example of the sensor connection by means of S6 Technology for summarization of indications of several DUT-E CAN is updated.</li> </ul>

Version	Date	Editor	Description of changes
4.0	11.2019	OD	<ul style="list-style-type: none"> <li>Data composition for DUT-E GSM output messages that are transmitted via CAN j1939/S6 interface is provided.</li> <li>Changes in the sensor delivery set are taken into account.</li> <li>E28 Certificate of E-mark International Standard, as well as detailed information on the sensor electromagnetic compatibility are added.</li> <li>Descriptions of Accelerometer FM and Small Report Registrator FM are added.</li> <li>Sensor technical specifications are updated.</li> <li>A description of configuration of the feature of automatic identification of the Events "Fuelling"/"Fuel discharge" is added.</li> <li>Settings of the sensor Functional modules for updated versions of Service S6 DUT-E (version 5.4) service software and Service S6 DUT-E (Android) (version 2.26) service mobile application are updated.</li> <li>Information on DUT-E GSM model codes is provided.</li> <li>Minimal requirements for the PC used for work with Service S6 DUT-E service software are added.</li> <li>The document terminology is updated (CAN j1939/S6 Telematics interface).</li> </ul>
5.0	12.2022	OD	<ul style="list-style-type: none"> <li>List of sensor output messages via CAN j1939/S6 interface is updated, malfunctions codes are added.</li> <li>Updated: <ul style="list-style-type: none"> <li>option for all sensor Functional modules configuration using Service S6 DUT-E (Android) service mobile application (version 3.00.05);</li> <li>sensor settings for Service S6 DUT-E service software (version 6.03).</li> </ul> </li> <li>Procedure for sensor remote configuration via TCP channel and remote firmware update by means of SMS- and GPRS- commands is added.</li> <li>Basic information on the Product is added.</li> <li>Recommendations regarding the creation of a calibration table for a tank of greater than 6553 l capacity are added.</li> <li>The formula for calculation of thermal correction coefficient is updated.</li> <li>Updated: example of the sensor connection diagram using S6 Technology for summation of readings of several DUT-E CAN, sensor connection diagrams to the PC and to the Android device using service adapters etc.</li> </ul>
6.0	01.2024	OD	<ul style="list-style-type: none"> <li>Sensor modifications with LTE mobile communication technology are introduced — DUT-E GSM LTE E (for countries of EMEA region) and DUT-E GSM LTE G (worldwide).</li> <li>DUT-E GSM 3G sensor modification is deleted.</li> <li>Information on the product is added.</li> <li>List of GSM frequencies supported by the sensors is introduced.</li> <li>Sensor settings configured with the help of Service S6 DUT-E service software (version 6.07) and Service S6 DUT-E (Android) mobile application (version 3.01.01) are updated.</li> <li>National certificates of type approval of means of measurement of the Republic of Kazakhstan and Republic of Uzbekistan are added.</li> </ul>

## Structure of external links



## Terms and Definitions

**IoT Burger** is the Technology of creating smart sensors and complex telematics IIoT devices operating in real time with built-in analytic features (further on – IoT Burger). The basis of IoT Burger is the software/hardware core, a set of ready-to-use universal Functional Modules, the database of standardized IoT parameters.



Particular features of IoT Burger:

- inbuilt analytic features for maximum treatment of signals within the device itself;
- a possibility to design devices with extremely low power consumption;
- doesn't require programming in the majority of applications, flexible setup;
- using inexpensive industrially manufactured equipment parts;
- measurement and treatment of "quick" processes which is impossible to implement using cloud technologies;
- an option of ready Reports delivery to the user avoiding server platforms;
- the inbuilt system of data authenticity assurance (self-diagnostics, authorization, impact control).

The technology provides for the availability of several measurement channels in any device including pre-set analytical treatment (filtration, linearization, thermal compensation) and the controlled error of measurement.

Devices created using IoT Burger may be united to form a wire-connected or wireless connection network. Data may be transmitted to the telematics server, to popular IoT platforms, by SMS, E-mail, to social networks.

At present, 2G/3G/LTE/NB-IoT/Wi-Fi/BLE data transmission standards are used in devices with IoT Burger. The reports transmitted contain data on instant and average values of Parameters, Counters, Events. The flexible system of Reports setup enables the user to select the optimal ratio of the data completeness and the volume of traffic.

[DUT-E GSM](#) fuel level sensors are designed based on IoT Burger 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](#).

DUT-E GSM fuel level sensors are designed based on S6 Technology.

**ISObus** – is a communication protocol used in farming machinery which complies with ISO 11783 standard and is based on SAE j1939.

ISObus bus contains Parameters of farming machinery operation and besides "classical" Parameters (total fuel consumption, engine rpm, cooling agent temperature), it also includes Parameters of attached equipment (plough, sowing machine, mowing machine, cultivator, winnowing machine, spraying machine etc.).

Over 7000 Parameters (SPN) of farming machinery operation complying with ISObus protocol are included into [S6 Database](#).

**ORF 4 / ORF 5**— is the by Technoton telematic service designed for receiving and processing Onboard reports via Internet, displaying Operational Data overlapped on area maps, information storage in database and Analytical reports generation upon user's request.

**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).

**Analytical report** — report generated in ORF 4 / ORF 5 on Vehicle or group of Vehicles operation for chosen time period (usually a day, week or month). Can be composed of numbers, tables, charts, mapped route of vehicle, diagrams.

**Complicated machine** — a vehicle or a fixed object that have one or several engines, fuel tanks and a great number of standard and additional sensors. The particularity of complicated machines' Telematics is determined by a broad set of onboard equipment with different interfaces and by the need to integrate standard data buses and analog devices into a single monitoring system.

**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.

**Edge Computing** — is a computing method allowing data procession in the device itself (data collection location). During Edge Computing access to data is provided via Internet.

Edge Computing ensures maximum data processing rate and communication capacity, no delays and instant response to received data.

**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 fuelling", "volume of fuel at the end of the fuelling", "volume of the fuelling" 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.

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

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

**Model code** — digits reflecting the product modification. For DUT-E GSM sensors, the model code is identified by the 1<sup>st</sup> and 2<sup>nd</sup> digits of its serial number printed on the sensor measuring probe, on the interface cable sticker or on its packing label.

**Onboard equipment** (OE) — Telematics system elements, directly installed in Vehicle.

**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).

**Operational data** — information about location and operation of the vehicle, transmitted by DUT-E GSM to the Server in real time, it includes coordinates, speed, direction of movement and fuel volume in the tank. Operational data is updated by ORF 4 / ORF 5 upon receipt of more recent information.

**Online monitoring** (Instant monitoring) — remote monitoring of location and vehicle operation in real time, the accumulation of information and preparation of Analytical reports by requests of [ORF 4](#) / [ORF 5](#) user.

**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.

**Route** — coordinates, speed and direction of vehicle movement. It matches with the route of the vehicle on the road. The map is displayed in the form of lines. Vehicle direction is displayed in the form of arrows.

**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.

**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.

During the use of DUT-E GSM fuel level sensor within the Telematics system the Terminal is not required.

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

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

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

## Introduction

Recommendations and rules set out in this Operation manual apply to **DUT-E GSM fuel level sensors** (further on — [DUT-E GSM](#)), **Model codes**: **45** (for DUT-E GSM 2G), **46** (for DUT-E GSM LTE E) and **47** (for DUT-E GSM LTE G) manufactured by [Technoton](#) company.

DUT-E GSM Model code is identified by the first two digits of its serial number printed on the sensor measuring probe, on the interface cable sticker or on its packing label:



The manual contains information on design, operation principle, specifications and instructions on installation, use and maintenance of DUT-E GSM. Besides, this document defines the procedure for wire-connected and wireless connection configuration of sensors.

**DUT-E GSM** – is an intellectual sensor within [Telematic systems](#) combining features of a [capacitive fuel level sensor](#) and of an onboard online [Terminal](#) in one device. It serves for accurate measurement of fuel level in tanks of vehicles and tractors, in fixed tanks and for [Instant monitoring](#) of Performance parameters of [Complicated machines](#).

DUT-E GSM key features:

- Inbuilt GSM modem enables the sensor itself to transfer [Operational data](#) on the fuel level, volume and temperature in tanks, voltage and modes of the onboard circuit operation etc. to the Internet via the mobile network without using any additional devices.
- Inbuilt [GNSS](#) receiver enables the sensor itself to monitor the [Vehicle](#) precise location, speed and direction of movement without the use of additional devices.
- [IoT Burger](#) Technology provides full-scale internal data processing (filtering and normalization of [Parameters](#), identification of [Events](#), maintenance of [Counters](#)) “onboard” the sensor, without the use of additional devices; it simplifies the Server operation and economizes traffic.
- Application of [Edge computing](#) method allows the sensor to scan and sort out automatically 10000+ unified equipment operation Parameters:
  - 7000+ Parameters of [CAN j1939/S6 Telematics interface](#) and [ISObus](#) bus of farming equipment;
  - 3000+ Parameters of a standard vehicle CAN-bus (SAE j1939/71)<sup>1</sup>.
- Event-based model of ready [Onboard reports](#) generation (up to 20 pcs., each containing up to 10 [Parameters](#) / [Counters](#)), flexible adaptation to any type of mobile or stationary equipment.

- Conformity with [S6 Technology](#) — 100 % compatibility with the [Database](#) of standardized Parameters, [Units](#) and S6 cable system, simultaneous connection of up to 40 additional sensors and other Technoton-made devices via CAN j1939/S6 interface.
- Inbuilt feature of automatic identification of the Events “Fuelling”/ “Fuel discharge”, with data validation using the accelerometer (identification of movement, tank pitch angle), to enhance the accuracy of Events recording.
- Summation of readings from up to 8 fuel level sensors connected in single network by S6 Technology<sup>2</sup>.
- Option of remote configuration, firmware update and the sensor operation control by means of SMS-commands or using a GPRS-command<sup>3</sup> via TCP channel directly from a remote PC/smartphone/tablet.
- Unique self-diagnostics function allows real-time monitoring of performance of the device.
- Sending [Reports](#) on [Events](#) directly to users without using [Telematics server](#) — by E-mail or SMS.
- Wireless configuration by means of Android devices via Bluetooth using [S6 BT Adapter](#).
- Saving mounting time — mounting one device instead of two.

[DUT-E GSM](#) has all the advantages of “classical” DUT-E fuel level sensor models:

- Measuring probe length reduction to required tank depth.
- Measuring probe length extension up to 6000 mm with [additional sections](#).
- Adjustable temperature correction for automatic measurement correction based on ambient temperature.
- Built-in voltage stabilizer – output signal does not depend on vehicle power supply voltage.
- Bottom spring for better mounting rigidity.
- Screen filter<sup>4</sup> for secure protection from water and mud.
- Full set of mounting accessories and connection cable included.
- Reverse polarity and short circuit protection of any output to vehicle electrical system and chassis.
- Ergonomic bayonet lock simplifies mounting the sensor in the tank; special holes for the sensor “head” provide convenient gripping during its fixing.
- Sealing possibility to avoid unauthorized intrusion and tampering.
- Rich experience accumulated during the period of its use, high-quality [technical support](#) and [documentation](#).
- Conformity with European and national automotive standards.

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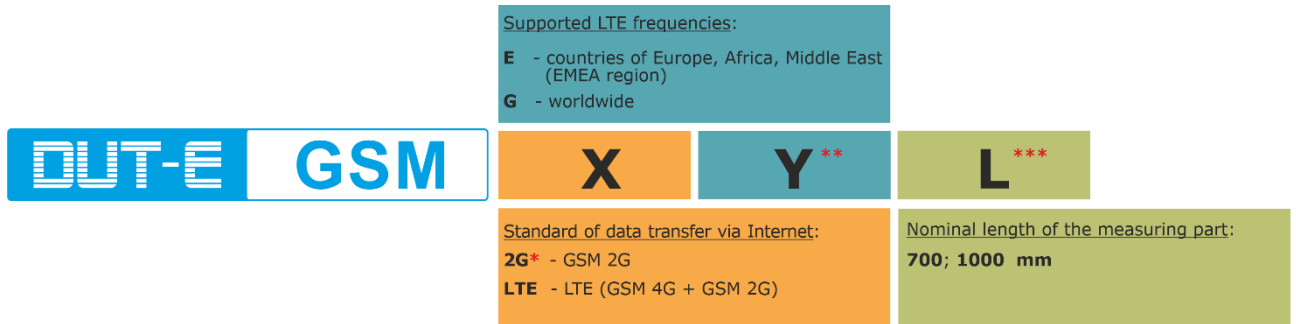
<sup>1</sup> Scanning data of CAN and ISObus buses is possible only in case DUT-E GSM sensor operates together with [CANCrocodile](#) contactless reader.

<sup>2</sup> S6 Technology allows to use DUT-E GSM to summarize data together from [DUT-E CAN](#) and [DUT-E 2Bio CAN](#) sensors.

<sup>3</sup> Except DUT-E GSM 2G with the version of firmware lower than 6.15.

<sup>4</sup> To be purchased separately.

See figure 1 for identification codes for DUT-E GSM ordering.



- \* By default, you may not specify 2G.
- \*\* You should specify **Y** indication only for LTE standard.
- \*\*\* Any length up to 1400 mm can be manufactured upon special order (in case the order is less than 200 pcs. per one quarter, the price is 10% higher).

Figure 1 — DUT-E GSM order identification codes

#### Examples of DUT-E GSM ordering identification codes:

"Fuel level sensor DUT-E GSM L=1000 mm"

(Standard of data transfer via Internet: 2G; nominal length of the measuring part: 1000 mm).


"Fuel level sensor DUT-E GSM LTE E L=700 mm"

(LTE data transfer standard, version for EMEA region, nominal length of the measuring part: 700 mm).

"Fuel level sensor DUT-E GSM LTE G L=1000 mm"

(LTE data transfer standard, global worldwide version, nominal length of the measuring part: 1000 mm).

For [DUT-E GSM](#) configuration using cable connection to the PC you should use [S6 SK](#) service adapter (to be purchased separately) and the Service S6 DUT-E service software (the software current version can be downloaded at <https://jv-technoton.com/>, Section [Software/Firmware](#)).

For wireless configuration of DUT-E GSM using an Android device you should use [S6 BT Adapter](#) service adapter (to be purchased separately) and the Service S6 DUT-E (Android) service software (the software current version can be downloaded at ).



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

[The Manufacturer](#) guarantees DUT-E GSM 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 GSM 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 GSM

## 1.1 Purpose of use and areas of application

**DUT-E GSM** is designed for:

- accurate measuring level of liquid fuel and other non-conductive liquids in tanks of vehicles and stationary tanks;
- monitoring [Vehicle](#) location according to [GNSS](#) signals;
- automatic identification of "Fuelling"/ "Fuel discharge" [Events](#);
- reception and summation of readings of up to 7 pcs. of [DUT-E CAN](#) / [DUT-E 2Bio CAN](#) fuel level sensors operating together;
- reception and processing of data from [Units](#) by means of [S6 Technology](#);
- reception and processing of data from CAN (SAE j1939) or [ISObus\\*](#) standard buses;
- monitoring the onboard circuit voltage and modes of operation;
- generation and transfer of [Onboard reports](#) to the [Vehicle](#) monitoring [Server](#);
- sending Reports on Events directly to the user by e-mail or in the form of SMS messages without using services of the Server.

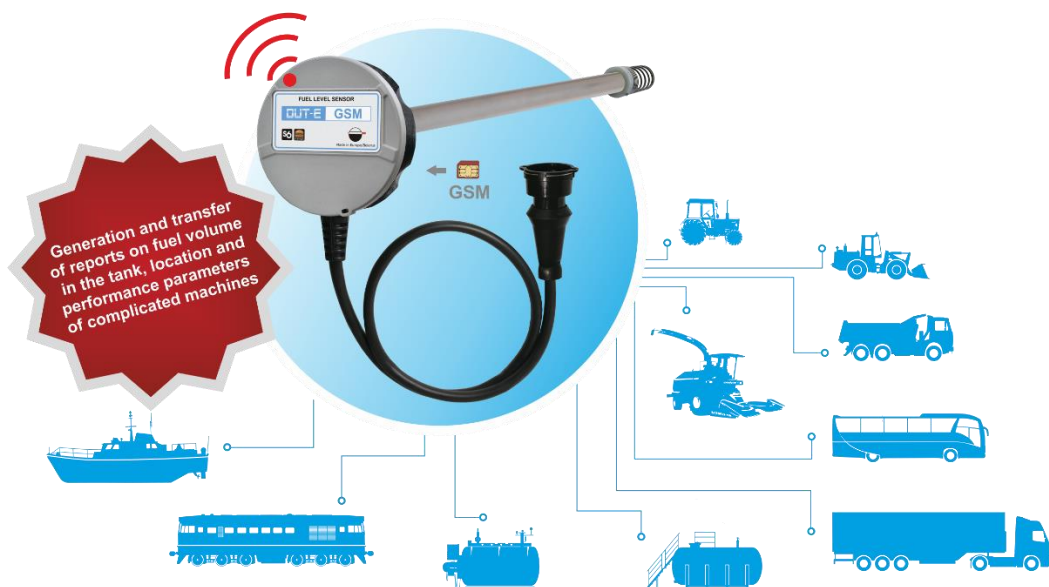


Figure 2 — DUT-E GSM purpose of use

Employment of DUT-E GSM provides the following advantages:

- **Two in one.** Saving time for mounting and configuration. The concept of "sensor/Terminal incompatibility" is irrelevant.
- **Flexible system of Reports generation.** Reception of ready Reports without the need to create templates at the Server for each separate vehicle.
- **Remote diagnostics and configuration.** No need to examine the vehicle/object on site. Saving labor and time of the engineering personnel.
- **Operation based on S6 Technology.** More sensors and equipment can be added by connecting it using a single cable system. Compatibility is ensured and time is saved for equipment selection and connection.

\* Only during DUT-E GSM operation together with [CANCrocodile](#) contactless reader.

**Areas of application:**

1) **DUT-E GSM** can be used within the **Telematics system** for monitoring the route and fuel of mobile equipment.



Figure 3 — Example of DUT-E GSM operation as part of the Telematic system

DUT-E GSM is mounted into the fuel tank of **Vehicle**. The sensor measures fuel tank level and determines unit location, movement speed and direction through GNSS signals (see figure 3).

DUT-E GSM records and processes the data for further transmission to the telematics **Server**. Server software processes and analyzes the received data to generate **Analytical reports** for a selected period of time (see figure 4).

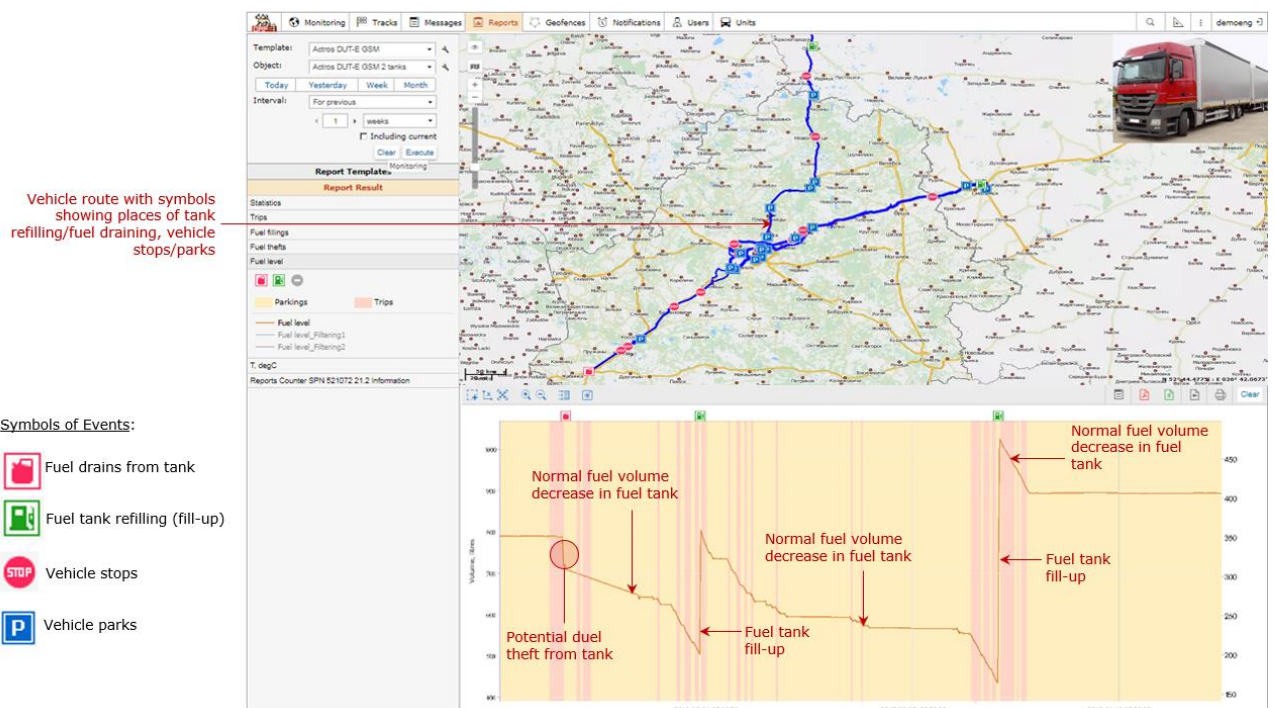
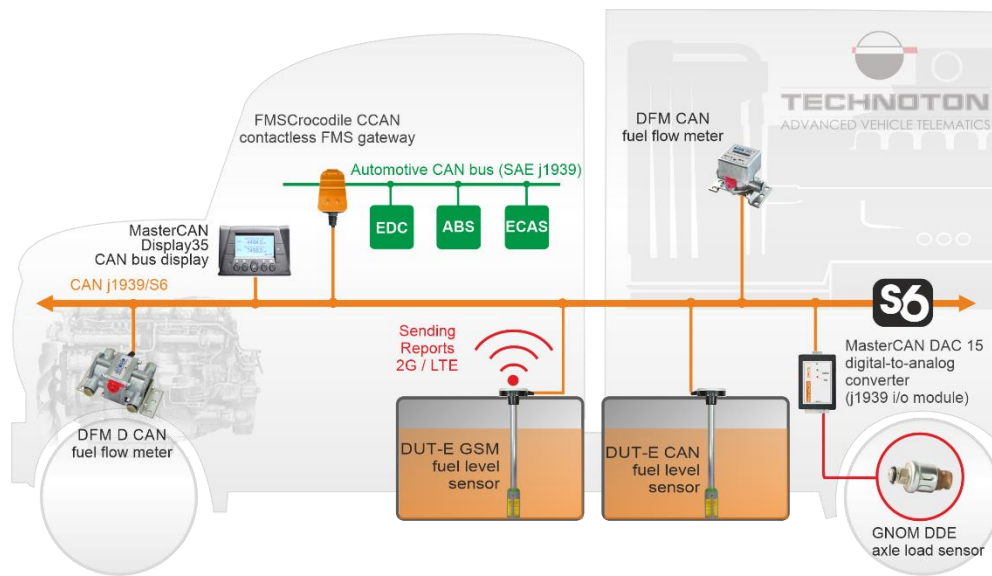


Figure 4 — Example of a Report on changing the volume of fuel in the tank and the route of the Vehicle movement, based on data received from DUT-E GSM

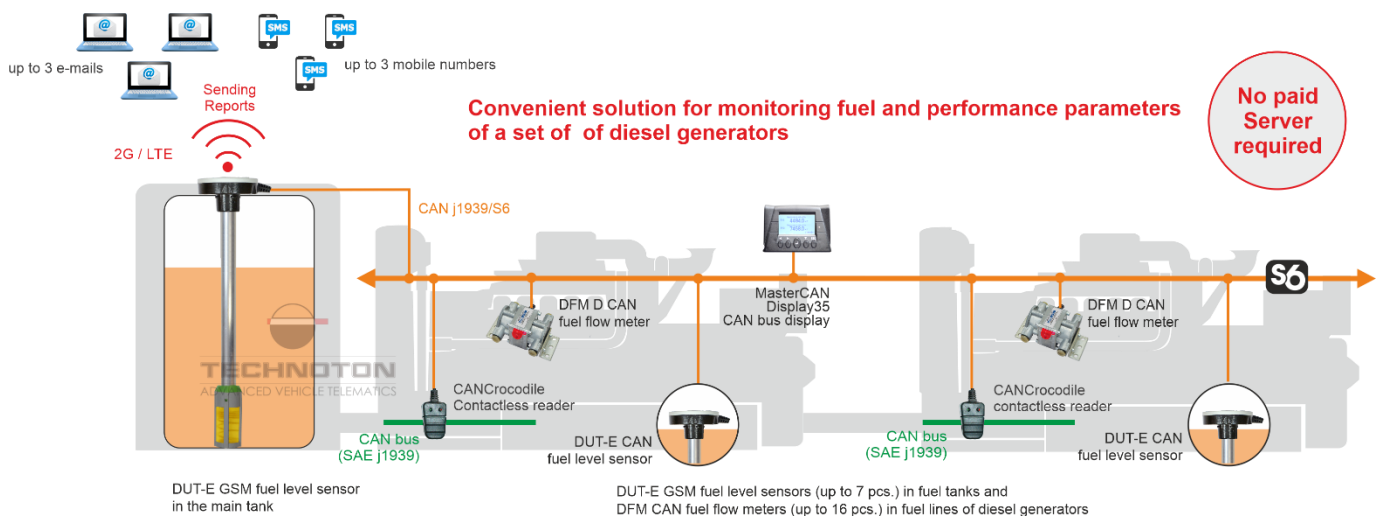
**2) DUT-E GSM is convenient to use for monitoring fuel and operation Parameters of complicated mobile machines or fixed objects by means of S6 Technology including monitoring without using services of a Server.**

The availability of CAN j1939/S6 interface enables DUT-E GSM to receive data by means of S6 Technology from DUT-E CAN / DUT-E 2 Bio CAN fuel level sensors (up to 7 pcs.), DFM CAN / DFM Marine CAN fuel flow meters (up to 16 pcs.), FMSCrocodile CCAN contactless readers/converters and from other standard and additional equipment (see figure 5).

This is a convenient solution for monitoring, for instance, fuel and performance Parameters of diesel generator units; it does not require the use of a Server and payment for its services. DUT-E GSM automatically sends ready Reports by E-mail directly to the user (up to 3 E-mail addresses) or in the form of SMS-messages (up to 4 telephone numbers).



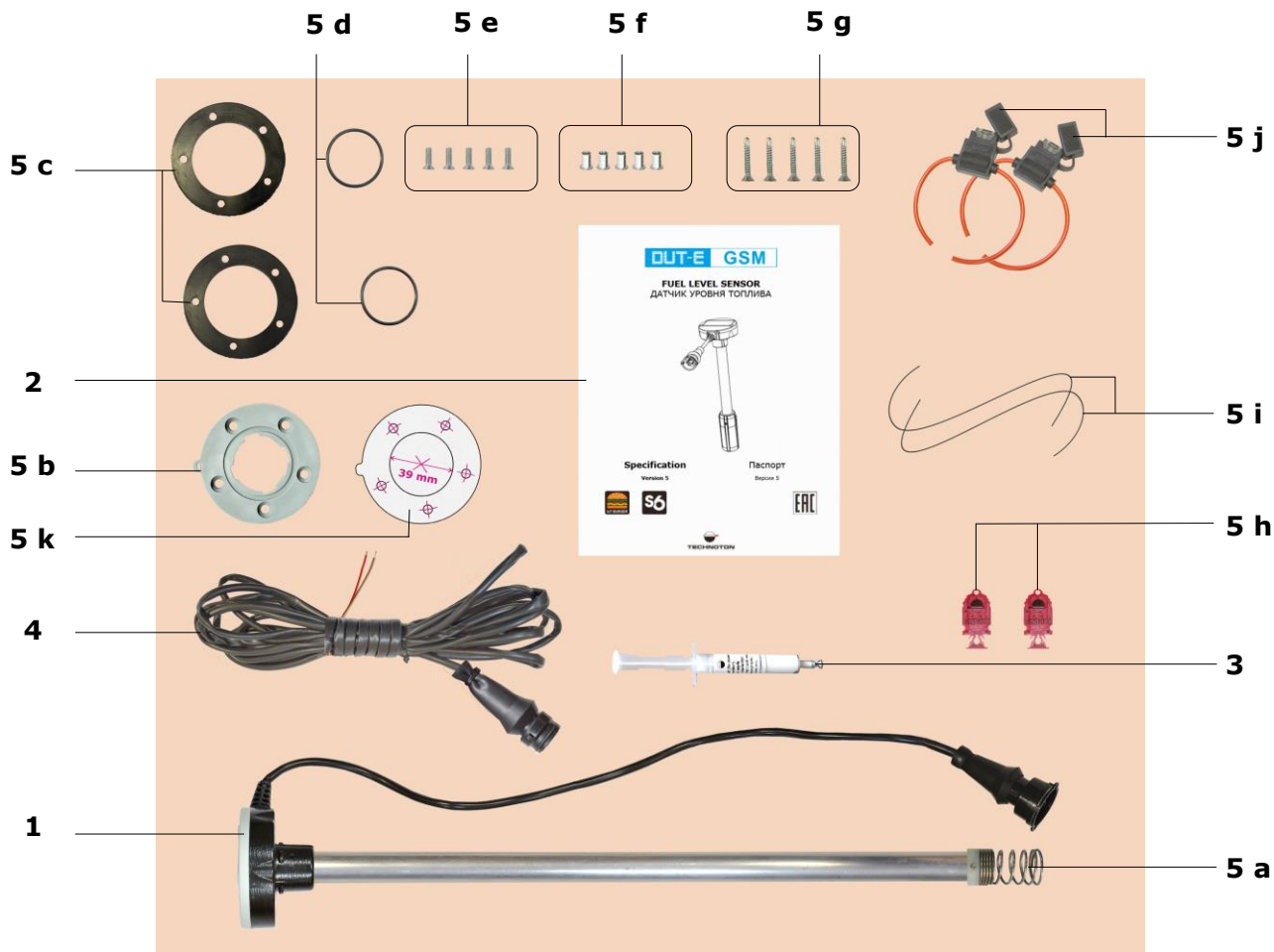
a) at a complex mobile object



b) at a complex fixed facility

Figure 5 — Examples of DUT-E GSM operation using S6 Technology

## 1.2 Exterior view and delivery set



- |          |   |             |
|----------|---|-------------|
| <b>1</b> | <b>DUT-E GSM</b> fuel level sensor        | - 1 pc.;    |
| <b>2</b> | Specification with factory settings sheet | - 1 pc.;    |
| <b>3</b> | Syringe with sealant for SIM holder       | - 1 pc.;    |
| <b>4</b> | Power cable (7.5 m)                       | - 1 pc.;    |
| <b>5</b> | Mounting kit (1 pc.) including:           |             |
|          | <b>a)</b> bottom stop                     | - 1 pc.;    |
|          | <b>b)</b> plastic mounting plate          | - 1 pc.;    |
|          | <b>c)</b> rubber gasket                   | - 2 pcs.*;  |
|          | <b>d)</b> sealing rubber ring             | - 2 pcs.*;  |
|          | <b>e)</b> bolt M5x16                      | - 5 pcs.;   |
|          | <b>f)</b> threaded rivet M5x13            | - 5 pcs.;   |
|          | <b>g)</b> self-tapping screw 3.9x25       | - 5 pcs.;   |
|          | <b>h)</b> plastic seal                    | - 2 pcs.**; |
|          | <b>i)</b> sealing cord                    | - 2 pcs.;   |
|          | <b>j)</b> fuse with holder (2 A)          | - 2 pcs.;   |
|          | <b>k)</b> hole placement template         | - 1 pc.     |

Figure 6 — DUT-E GSM delivery set

\* 1 pc. is for initial DUT-E GSM 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 and operation principle

[DUT-E GSM](#) fuel level sensor (see figure 7) consists of a measuring probe (**1**), measuring "head" (**2**), interface cable (**3**) with connector for electrical connection (**4**).

Inside the measuring "head" there are: the electronic module of the fuel level sensor, [GNSS](#) receiver with an antenna, GSM modem with an antenna and the SIM card holder to insert the Micro-SIM card.

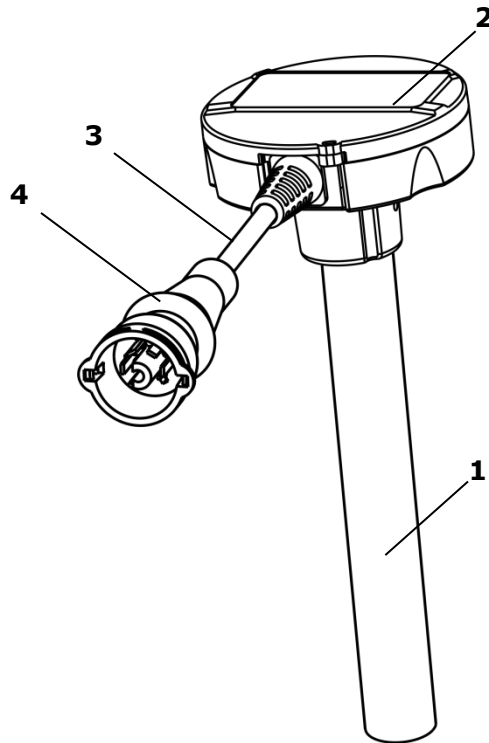


Figure 7 – DUT-E GSM design

DUT-E GSM operation principle is based on condenser capacitance measurement, where measuring probe pipes are used as capacitor plates. Electric capacitance changes depending on measuring probe immersion depth in the fuel which is dielectric liquid. The sensor analyzes current value of electric capacitance and then generates an appropriate output signal.



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

DUT-E GSM fuel level sensors can calculate current fuel amount independently in accordance with calibration table recorded in the sensor internal memory with service adapter (see [2.9](#)).

According to [GNSS](#) signals, DUT-E GSM defines the location, speed and direction of the Vehicle movement. Values of [Parameters](#) are recorded and stored in the sensor internal non-volatile memory.

DUT-E GSM generates [Onboard reports](#) data packets and sends them via GPRS to telematics [Server](#) within a configured time period or on particular event registration. Server software processes and analyzes the received data to generate analytical reports for a selected period of time. Tracking system users having an Internet connection can browse the reports.



**RECOMMENDATION:** [ORF 4](#) / [ORF 5](#) Telematics service provides the best accuracy of reports on movement tracking and fuel consumption monitoring.

[ORF 4](#) / [ORF 5](#) [Analytical reports](#) contain detailed data required for effective monitoring of vehicles and drivers' operation: operation time, time and location of parking, fuel consumption, refueling and fuel drains/thefts, movement route, speed and other parameters.

To enhance the accuracy of measurements, DUT-E GSM has features of automatic correction of the output signal — filtration by time, thermal correction (see [2.10](#)) and thermal compensation (see figure 8)

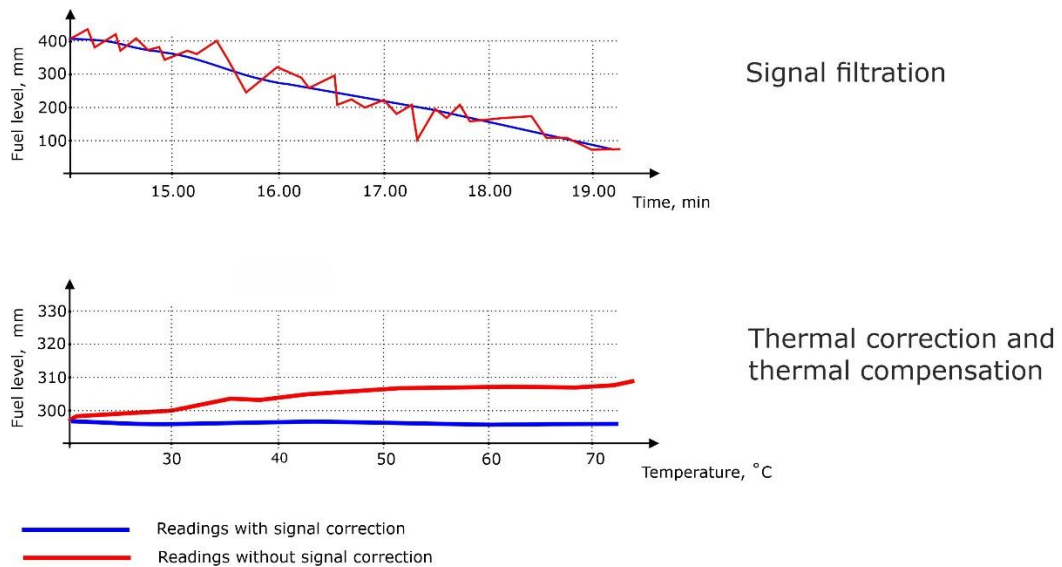


Figure 8 — Application of features of DUT-E GSM automatic correction of output signal

## 1.4 Technical specifications

[DUT-E GSM](#) can be used in the conditions of temperate and cold climate. For resistance to mechanical impact DUT-E GSM is shake- and shockproof.

### 1.4.1 Main specifications

Table 1 — DUT-E GSM main specifications

Parameter, measuring unit	Value
Supported GSM frequency bands, MHz	see <a href="#">table 2</a>
Data transmission channels	
Adjustable digital interface	<a href="#">CAN j1939/S6</a>
Communication protocol	<a href="#">Wialon IPS v 2.0</a>
Service interface	K-Line (ISO 14230)
Working fluid	diesel fuel**
Fuel level sensor operating principle	capacitive
Relative measuring error (to the length of the measuring part), %, not more than	±1.0
Sensor sensitivity to fuel level changes, mm	0.1
Voltage range of external power supply, V	10..45
Maximal current consumption at supply voltage 12/24 V, mA, not more than	200/100
Average current consumption at supply voltage 12/24V, mA, not more than	150/75
Time of readiness to receive GNSS signals, after the power supply is on, s, no more than	10
Reports number that can be stored in buffer memory (factory settings of reports), not less than	50 000
Maximum trimming of the measuring probe	to any length*
Maximum length increase, mm, not more than	6000*
Temperature range, °C	-40...+85
Level of sealing protection from dust and moisture	IP55/IP57
Electromagnetic compatibility	see <a href="#">annex H</a>
Weight, kg, not more than	0.6 (at L=1000 mm) 0.5 (at L=700 mm)
Overall dimensions, mm, not more than	see <a href="#">figure 9</a>

\* After cutting/length extension of the measuring probe the sensor calibration is obligatory (see [2.8](#)).

\*\* The sensor is allowed to operate using other types of fuel. However, it should be taken into consideration that while using the sensor in the explosive environment, the sensor must be electrically connected through the external power and spark protection unit (purchased separately), to meet the requirements regarding the spark-proof electric circuit. The spark-proof circuit must meet the following parameters:

- maximum input voltage — 10 V;
- maximum input current — 200 mA;
- maximum internal capacity — 15.0 µF;
- maximum inherent inductance — 1.188 mHn.

Table 2 — GSM frequency ranges supported by DUT-E GSM sensors


<b>Model</b>	<b>Data transfer channel</b>	<b>Frequency ranges (Bands)</b>	<b>Region of application*</b>
DUT-E GSM 2G	2G	GSM 850/900/1800/1900 MHz	Europe, Asia, USA, Canada, Latin America, Africa
DUT-E GSM LTE E	2G	GSM 900/1800 MHz	Europe, Middle East, Africa (EMEA region)
	4G	B1/B3/B5/B7/B8/B20/B28	
DUT-E GSM LTE G	2G	GSM 850/900/1800/1900 MHz	Worldwide
	4G	B1/B2/B3/B4/B5/B7/B8/B12/B13/B18/B19/B20/B25/B26/B28/B38/B39/B40/B41/B66	
<p>* Designations of regions. We recommend to consult in advance the mobile network operator within which DUT-E GSM would operate on the issue of GSM working frequency ranges.</p>			

## 1.4.2 Data transfer protocol to Server

[DUT-E GSM](#) sends Onboard reports to the telematics [Server](#) (AVL server) in form of data packets using communication protocol [Wialon IPS v.2.0](#).

DUT-E GSM [Onboard reports](#) format is specified in [annex B](#).

Remark — DUT-E GSM can send Reports directly to the user, without using the services of the Server, by e-mail (up to 3 e-mail addresses) or in the form of SMS messages (up to 3 telephone numbers).

[2.14](#) contains the procedure for Reports configuration using Service S6 DUT-E service software; (its current version can be downloaded at: <https://www.jv-technoton.com/>, section [Software/Firmware](#)) or using Service S6 DUT-E (Android) service mobile application (its current version can be installed from ).

### 1.4.3 CAN j1939/S6 digital interface specifications and protocol

Specifications of CAN j1939/S6 [DUT-E GSM](#) digital interface correspond to [S6 Technology](#). The data transfer protocol is based on SAE j1939 standard and meets its requirements. The composition of DUT-E GSM output data transmitted via CAN j1939/S6 interface is provided in table 3.

User configuration of external devices connection via CAN j1939/S6 interface is conducted using K-Line (ISO 14230) service interface with the help of Service S6 DUT-E software or Service S6 DUT-E (Android) mobile interface (see [2.11](#)).

Data are transferred automatically and upon request. Baudrate can be selected from a number of fixed values: 100; 125; 250; 500; 1000 kbit/s (by default — 250 kbit/s).

Up to 15 pcs. of fuel level sensors with CAN j1939/S6 interface ([DUT-E CAN](#) and/or [DUT-E 2Bio CAN](#)) can operate simultaneously in one network together with DUT-E GSM by means of S6 Technology. For each connected sensor you are to specify a unique network address (SA) from the following ranges: basic — 101...108 (by default — 101) and additional — 91...98\*.

S6 Technology enables DUT-E GSM to receive simultaneously readings from 7 pcs. DUT-E CAN and/or DUT-E 2Bio CAN sensors. For each sensor a unique network address (SA) should be specified from the range 101...108.



**IMPORTANT: The obligatory condition** for correct data transfer from DUT-E GSM via CAN j1939/S6 is the availability of two **120 Ohms** terminal resistors at both ends of CAN 2.0B (SAE j1939) communication line, between CAN LOW and CAN HIGH wires.

\* For DUT-E GSM you can choose addresses **only** from the main range.

Table 3 — Data composition in DUT-E GSM outgoing messages, that are transmitted via SAE j1939 protocol

Field number	Length	Parameter	Description	Rules of output
Output data <a href="#">Self-diagnostics FM</a> (version 10)				
Unit Work Counters <a href="#">PGN 62994</a> (0xF612)				On request
1	4 bytes	<a href="#">SPN 521116</a>	Unit Hours Of Operation	
5	4 bytes	<a href="#">SPN 521116</a> /16.1	Unit Hours Of Operation. Battery	
9	4 bytes	<a href="#">SPN 521118</a>	Unit Reset Counter	
13	4 bytes	<a href="#">SPN 521119</a>	Unit Power Off Counter	
Unit DTCs <a href="#">PGN 63169</a> (0xF6C1)				On request
1	4 bytes	<a href="#">SPN 521488</a>	Unit DTCs Mask	
Unit. Restart Counters <a href="#">PGN 63280</a> (0xF730)				On request
1	4 bytes	<a href="#">SPN 521118</a> /30.0	Unit Reset Counter. Software	
5	4 bytes	<a href="#">SPN 521118</a> /30.1	Unit Reset Counter. Hardware	
Active Diagnostic Trouble Codes <a href="#">PGN 65226</a> (0xFECA)				1000 ms
3	3 bytes	<a href="#">SPN 521044</a>	Fault Identifier (SID+FMI) (see <a href="#">table 4</a> )	
6.1	7 bits	<a href="#">SPN 1216</a>	Occurrence Count	
6.8	1 bit	<a href="#">SPN 1706</a>	SPN Conversion Method	

Field number	Length	Parameter	Description	Rules of output
Previously Active Diagnostic Trouble Codes <a href="#">PGN 65227</a> (0xFECB)				On request
3	3 bytes	<a href="#">SPN 521044</a>	Fault Identifier (SID+FMI) (see <a href="#">table 4</a> )	
6.1	7 bits	<a href="#">SPN 1216</a>	Occurrence Count	
6.8	1 bit	<a href="#">SPN 1706</a>	SPN Conversion Method	
Unit Passport <a href="#">PGN 62995</a> (0xF613)				On request
1	16 bytes	<a href="#">SPN 521123</a>	Line	
17	16 bytes	<a href="#">SPN 521344</a>	Brand	
33	16 bytes	<a href="#">SPN 521345</a>	Model	
49	16 bytes	<a href="#">SPN 521120</a>	Serial Number	
65	8 bytes	<a href="#">SPN 521121</a>	Firmware Version	
73	4 bytes	<a href="#">SPN 521125</a>	Manufacturing Date	
77	1 byte	<a href="#">SPN 521188</a>	S6 Address (SA)	
Output data <a href="#">Onboard Clock FM</a> (version 4)				
Time/Date <a href="#">PGN 65254</a> (0xFEE6)				On request
1	1 byte	<a href="#">SPN 959</a>	Seconds	
2	1 byte	<a href="#">SPN 960</a>	Minutes	
3	1 byte	<a href="#">SPN 961</a>	Hours	
4	1 byte	<a href="#">SPN 963</a>	Month	
5	1 byte	<a href="#">SPN 962</a>	Day	
6	1 byte	<a href="#">SPN 964</a>	Year	
7	1 byte	<a href="#">SPN 1601</a>	Time Displacement In Minutes	
8	1 byte	<a href="#">SPN 1602</a>	Time Displacement In Hours	
Output data <a href="#">Vehicle Power Supply FM</a> (version 3)				
Power Supply Voltage. Counters <a href="#">PGN 62976</a> (0xF600)				On request
1	4 bytes	<a href="#">SPN 521170</a>	Starter Hours of Operation	
5	4 bytes	<a href="#">SPN 521171</a>	Flowmeter Hours Of Operation	
9	4 bytes	<a href="#">SPN 521173</a>	Hours Of Operation On Power Supply	
13	4 bytes	<a href="#">SPN 521172</a>	Hours Of Operation From Battery	
Vehicle Voltage <a href="#">PGN 62987</a> (0xF60B)				1000 ms
1	2 bytes	<a href="#">SPN 158</a>	Key Switch Battery Potential	
3.1	2 bits	<a href="#">SPN 521049</a>	Ignition Key State	
4	4 bytes	<a href="#">SPN 521053</a>	Ignition ON Time	
Vehicle Power Supply Status <a href="#">PGN 63089</a> (0xF671)				1000 ms
1	2 bytes	<a href="#">SPN 521055</a>	Vehicle Power Supply Voltage	
3	2 bytes	<a href="#">SPN 521055</a> /2.9	Vehicle Power Supply Voltage. Average For 5 Minutes	
5.1	3 bits	<a href="#">SPN 521056</a>	Vehicle Power Supply Status	
5.4	2 bits	<a href="#">SPN 521076</a>	Vehicle Power Supply Presence	
5.6	2 bits	<a href="#">SPN 521049</a> /16.2	Ignition Key State. Ignition switch terminal 15	
Output data <a href="#">Fuel Level Sensor FM</a> (version 5)				
Filtered Fuel Level/Volume in Tank <a href="#">PGN 62982</a> (0xF606)				1000 ms
1	2 bytes	<a href="#">SPN 521023</a> /2.10	Fuel Tank Level. Filtering	
3	2 bytes	<a href="#">SPN 521024</a> /2.10	Fuel Tank Volume. Filtering	

Field number	Length	Parameter	Description	Rules of output
5	2 bytes	<a href="#">SPN 521025</a>	Tank Fuel Rate	
7	1 byte	<a href="#">SPN 174</a>	Engine Fuel Temperature 1	
Fuel Level <a href="#">PGN 63156</a> (0xF6B4)				On request
1	2 bytes	<a href="#">SPN 521448</a>	Fuel Level	
Dash Display <a href="#">PGN 65276</a> (0xFEFC)				1000 ms
2	1 byte	<a href="#">SPN 96</a>	Fuel Level 1	
7	1 byte	<a href="#">SPN 38</a>	Fuel Level 2	
Output data <a href="#">Fuel Level Control FM</a> (version 1)				
Total Fuel Volume In Tanks <a href="#">PGN 63152</a> (0xF6B0)				1000 ms
1	2 bytes	<a href="#">SPN 521024/2.11</a>	Fuel Tank Volume. Summary Value	
3	1 byte	<a href="#">SPN 96/2.11</a>	Fuel Level 1. Summary Value	
4	2 bytes	<a href="#">SPN 521033</a>	Tank Volume	
Output data <a href="#">GNSS FM</a> (version 4)				
Vehicle Position <a href="#">PGN 65267</a> (0xFEf3)				100 ms
1	4 bytes	<a href="#">SPN 584</a>	Latitude	
5	4 bytes	<a href="#">SPN 585</a>	Longitude	
Navigation Module Identification <a href="#">PGN 63244</a> (0xF70C)				On request
1	48 bytes	<a href="#">SPN 521282</a>	Software Version	
Vehicle Direction/Speed <a href="#">PGN 65256</a> (0xFEE8)				100 ms
1	2 bytes	<a href="#">SPN 165</a>	Compass Bearing	
3	2 bytes	<a href="#">SPN 517</a>	Navigation-Based Vehicle Speed	
5	2 bytes	<a href="#">SPN 583</a>	Pitch	
7	2 bytes	<a href="#">SPN 580</a>	Altitude	
GNSS. Parameters <a href="#">PGN 62998</a> (0xF616)				On request
1	4 bytes	<a href="#">SPN 521155</a>	UTC Time by GNSS	
5	4 bytes	<a href="#">SPN 584</a>	Latitude	
9	4 bytes	<a href="#">SPN 585</a>	Longitude	
13	2 bytes	<a href="#">SPN 521090</a>	Horizontal Dilution Of Precision (HDOP)	
15	2 bytes	<a href="#">SPN 165</a>	Compass Bearing	
17	2 bytes	<a href="#">SPN 580</a>	Altitude	
19	2 bytes	<a href="#">SPN 517</a>	Navigation-Based Vehicle Speed	
21	2 bytes	<a href="#">SPN 517/2.1</a>	Navigation-Based Vehicle Speed. Mean	
23.1	2 bits	<a href="#">SPN 521134</a>	GNSS Receiver Status	
23.3	2 bits	<a href="#">SPN 521135</a>	GNSS Antenna Status	
24	1 byte	<a href="#">SPN 521128</a>	Satellites Quantity	
GNSS Time <a href="#">PGN 62997</a> (0xF615)				On request
1	1 byte	<a href="#">SPN 959</a>	Seconds	
2	1 byte	<a href="#">SPN 960</a>	Minutes	
3	1 byte	<a href="#">SPN 961</a>	Hours	
4	1 byte	<a href="#">SPN 963</a>	Month	
5	1 byte	<a href="#">SPN 962</a>	Day	
6	1 byte	<a href="#">SPN 964</a>	Year	

Field number	Length	Parameter	Description	Rules of output
7	1 byte	<a href="#">SPN 1601</a>	Time Displacement In Minutes	
8	1 byte	<a href="#">SPN 1602</a>	Time Displacement In Hours	
GNSS. Counters <a href="#">PGN 62996</a> (0xF614)				1000 ms
1	4 bytes	<a href="#">SPN 521126</a>	Distance by GNSS	
5	4 bytes	<a href="#">SPN 521127</a>	Movement Time by GNSS	
Output data <a href="#">Reports Generator FM</a> (version 8)				
Report <a href="#">PGN 63088</a> (0xF670)				On request
1	1 byte	<a href="#">SPN 521070</a>	Report Id	
2.1	2 bits	<a href="#">SPN 521071</a>	Priority	
3	2 bytes	<a href="#">SPN 521356</a>	Data Size	
5	4 bytes	<a href="#">SPN 521299</a>	Report Generation Date/Time	
9	4 bytes	<a href="#">SPN 584</a>	Latitude	
13	4 bytes	<a href="#">SPN 585</a>	Longitude	
17	2 bytes	<a href="#">SPN 517</a>	Navigation-Based Vehicle Speed	
19	2 bytes	<a href="#">SPN 165</a>	Compass Bearing	
21	2 bytes	<a href="#">SPN 580</a>	Altitude	
23	1 byte	<a href="#">SPN 521128</a>	Satellites Quantity	
24	2 bytes	<a href="#">SPN 521090</a>	Horizontal Dilution Of Precision (HDOP)	
26	1728 bytes	<a href="#">SPN 521357</a>	Data	
Output data <a href="#">Simple Reports Registrator FM</a> (version 1)				
Reports Registrator Status <a href="#">PGN 63079</a> (0xF667)				On request
1	4 bytes	<a href="#">SPN 521072/21.0</a>	Reports Counter. Emergency	
5	4 bytes	<a href="#">SPN 521072/21.1</a>	Reports Counter. Important	
9	4 bytes	<a href="#">SPN 521072/21.2</a>	Reports Counter. Information	
Output data <a href="#">Communicator FM</a> (version 4)				
Sent e-mail Counter <a href="#">PGN 63147</a> (0xF6AB)				On request
1	4 bytes	<a href="#">SPN 521240</a>	E-mail Sent Counter	
5	4 bytes	<a href="#">SPN 521241</a>	E-mail Sending Error Counter	
Authentication AVL Server <a href="#">PGN 63099</a> (0xF67B)				On request
1.1	2 bits	<a href="#">SPN 521175</a>	AVL Authentication Status	
2	4 bytes	<a href="#">SPN 521176</a>	AVL Authentication Counter	
6	4 bytes	<a href="#">SPN 521177</a>	AVL Authentication Failures Counter	
Modem State <a href="#">PGN 63007</a> (0xF61F)				On request
1.1	2 bits	<a href="#">SPN 521130</a>	Modem Power Status	
1.3	2 bits	<a href="#">SPN 521131</a>	Modem Registration Status	
1.5	2 bits	<a href="#">SPN 521132</a>	Modem Internet Connection Status	
1.7	2 bits	<a href="#">SPN 521133</a>	AVL Connection Status	
2	4 bytes	<a href="#">SPN 521140</a>	AVL Sent Messages Counter	
6	4 bytes	<a href="#">SPN 521141</a>	Internet Connections Counter	
10	4 bytes	<a href="#">SPN 521142</a>	Internet Connection Failures Counter	
14	4 bytes	<a href="#">SPN 521143</a>	Internet Disconnections Counter	

Field number	Length	Parameter	Description	Rules of output
18	4 bytes	<a href="#">SPN 521144</a>	AVL Connection Counter	
22	4 bytes	<a href="#">SPN 521145</a>	AVL Connection Failures Counter	
26	4 bytes	<a href="#">SPN 521146</a>	AVL Disconnection Counter	
30	4 bytes	<a href="#">SPN 521147</a>	Sent SMS Counter	
34	4 bytes	<a href="#">SPN 521148</a>	Errors Sending SMS Counter	
38	4 bytes	<a href="#">SPN 521149</a>	Modem Reset Counter	
42	1 byte	<a href="#">SPN 521178</a>	Received Signal Strength Indicator (RSSI)	
Output data <a href="#">Accelerometer FM</a> (version 3)				
Acceleration Sensor <a href="#">PGN 61485</a> (0xF02D)				100 ms
1	2 bytes	<a href="#">SPN 5347</a>	Lateral Acceleration Extended Range	
3	2 bytes	<a href="#">SPN 5348</a>	Longitudinal Acceleration Extended Range	
5	2 bytes	<a href="#">SPN 5349</a>	Vertical Acceleration Extended Range	
7.1	2 bits	<a href="#">SPN 5350</a>	Lateral Acceleration Extended Range Figure of Merit	
7.3	2 bits	<a href="#">SPN 5351</a>	Longitudinal Acceleration Extended Range Figure of Merit	
7.5	2 bits	<a href="#">SPN 5352</a>	Vertical Acceleration Extended Range Figure of Merit	
7.7	2 bits	<a href="#">SPN 5353</a>	Support Variable Transmission Repetition Rate for Acceleration Sensor	
Accelerometer <a href="#">PGN 63155</a> (0xF6B3)				On request
1	2 bytes	<a href="#">SPN 5347</a>	Lateral Acceleration Extended Range	
3	2 bytes	<a href="#">SPN 5348</a>	Longitudinal Acceleration Extended Range	
5	2 bytes	<a href="#">SPN 5349</a>	Vertical Acceleration Extended Range	
7	2 bytes	<a href="#">SPN 5347/2.3</a>	Lateral Acceleration Extended Range	
9	2 bytes	<a href="#">SPN 5348/2.3</a>	Longitudinal Acceleration Extended Range	
11	2 bytes	<a href="#">SPN 5349/2.3</a>	Vertical Acceleration Extended Range	
13.1	2 bits	<a href="#">SPN 5350</a>	Lateral Acceleration Extended Range Figure of Merit	
13.3	2 bits	<a href="#">SPN 5351</a>	Longitudinal Acceleration Extended Range Figure of Merit	
13.5	2 bits	<a href="#">SPN 5352</a>	Vertical Acceleration Extended Range Figure of Merit	
13.7	2 bits	<a href="#">SPN 1611</a>	Vehicle motion	
14	2 bytes	<a href="#">SPN 521384</a>	Acceleration Module	
Slope Sensor Information <a href="#">PGN 61459</a> (0xF013)				100 ms
1	2 bytes	<a href="#">SPN 3318</a>	Pitch Angle	
3	2 bytes	<a href="#">SPN 3319</a>	Roll Angle	
5	2 bytes	<a href="#">SPN 3322</a>	Pitch Rate	
7.1	2 bits	<a href="#">SPN 3323</a>	Pitch Angle Figure of Merit	
7.3	2 bits	<a href="#">SPN 3324</a>	Roll Angle Figure of Merit	
7.5	2 bits	<a href="#">SPN 3325</a>	Pitch Rate Figure of Merit	
7.7	2 bits	<a href="#">SPN 3326</a>	Pitch and Roll Compensated	
8	1 byte	<a href="#">SPN 3327</a>	Roll and Pitch Measurement Latency	
Output data <a href="#">Events Registrator FM</a> (version 2)				
Information Events List <a href="#">PGN 63056</a> (0xF650)				On request
1	4 bytes	<a href="#">SPN 521166</a>	Event SPN	
5	1728 bytes	<a href="#">SPN 521357</a>	Data	

Field number	Length	Parameter	Description	Rules of output
Important Events List <a href="#">PGN 63055</a> (0xF64F)				On request
1	4 bytes	<a href="#">SPN 521166</a>	Event SPN	
5	1728 bytes	<a href="#">SPN 521357</a>	Data	
"Fuelling" Event <a href="#">SPN 521200</a>				On the fact, but not less than 600 s
1	4 bytes	<a href="#">SPN 521300</a>	Event Date/Time	
2	4 bytes	<a href="#">SPN 584</a>	Latitude	
3	4 bytes	<a href="#">SPN 585</a>	Longitude	
4	2 bytes	<a href="#">SPN 521301</a>	Filled Fuel Volume	
5	2 bytes	<a href="#">SPN 521024/17.0</a>	Fuel Tank Volume. At the Event start	
6	2 bytes	<a href="#">SPN 521024/17.1</a>	Fuel Tank Volume. At the Event end	
"Fuel Discharge" Event <a href="#">SPN 521201</a>				On the fact, but not less than 600 s
1	4 bytes	<a href="#">SPN 521300</a>	Event Date/Time	
2	4 bytes	<a href="#">SPN 584</a>	Latitude	
3	4 bytes	<a href="#">SPN 585</a>	Longitude	
4	2 bytes	<a href="#">SPN 521302</a>	Discharged Fuel Volume	
5	2 bytes	<a href="#">SPN 521024/17.0</a>	Fuel Tank Volume. At the Event start	
6	2 bytes	<a href="#">SPN 521024/17.1</a>	Fuel Tank Volume. At the Event end	
"Fault Detection" Event <a href="#">SPN 521748</a>				On the fact, but not less than 10 s
1	4 bytes	<a href="#">SPN 521300</a>	Event Date/Time	
2	1 byte	<a href="#">SPN 521188</a>	S6 Address (SA)	
3	4 bytes	<a href="#">SPN 521104</a>	Fault Code. SID (see <a href="#">table 4</a> )	
4	1 byte	<a href="#">SPN 521048</a>	FMI (see <a href="#">table 4</a> )	

Table 4 — Malfunction codes of DUT-E GSM sensor

Numerical designation of malfunction code		Description of malfunction code	Service
SID	FMI		
841	7	Global Positioning System (GPS). Mechanical System Not Responding Or Out Of Adjustment	
1231	2	CAN-bus. Data Erratic, Intermittent Or Incorrect	
2851	2	Communications Service Personal Identification Number (PIN Code). Data Erratic, Intermittent Or Incorrect	
2852	2	SIM card. Data Erratic, Intermittent Or Incorrect	
2854	7	Communications Carrier. Mechanical System Not Responding Or Out Of Adjustment	
520192	25	Analog to digital converter (ADC). Starting error	
523000	4	Fuel Level Sensor. Measuring Generator Fault. Measuring Tube Shorting	Wash measuring tube of the sensor in the fuel. Clear debris from fuel tank
523000	22	Fuel Level Sensor. Measuring Generator Fault. Third Electrode. Measuring Tube Shorting	
523000	14...21	Fuel Level Sensor. No response from Slave sensor with the respective network address (SA) from 101...108 range during the summation of readings	
523000	0	Fuel Level Sensor. Measuring Generator Frequency Above Minimum Calibration Value More Than 100 Hz	Check actual length of the measuring part value and (or) recalibrate the sensor
523000	12	Fuel Level Sensor. Calibration Minimum And Maximum Frequencies Difference Less Than 5 Hz	Check actual length of the measuring part value and (or) recalibrate the sensor
523000	13	Fuel Level Sensor. Calibration Error	Check actual length of the measuring part value and (or) recalibrate the sensor
523001	24	Real-time Clock. Clocking Off	
523004	1	Accumulator. Low battery (<10%)	
523006	2	External Flash Memory. Data Erratic, Intermittent Or Incorrect	
523007	2	FRAM. Data Erratic, Intermittent Or Incorrect	
523042	7	Accelerometer. Mechanical System Not Responding Or Out Of Adjustment	

### 1.4.4 Overall dimensions

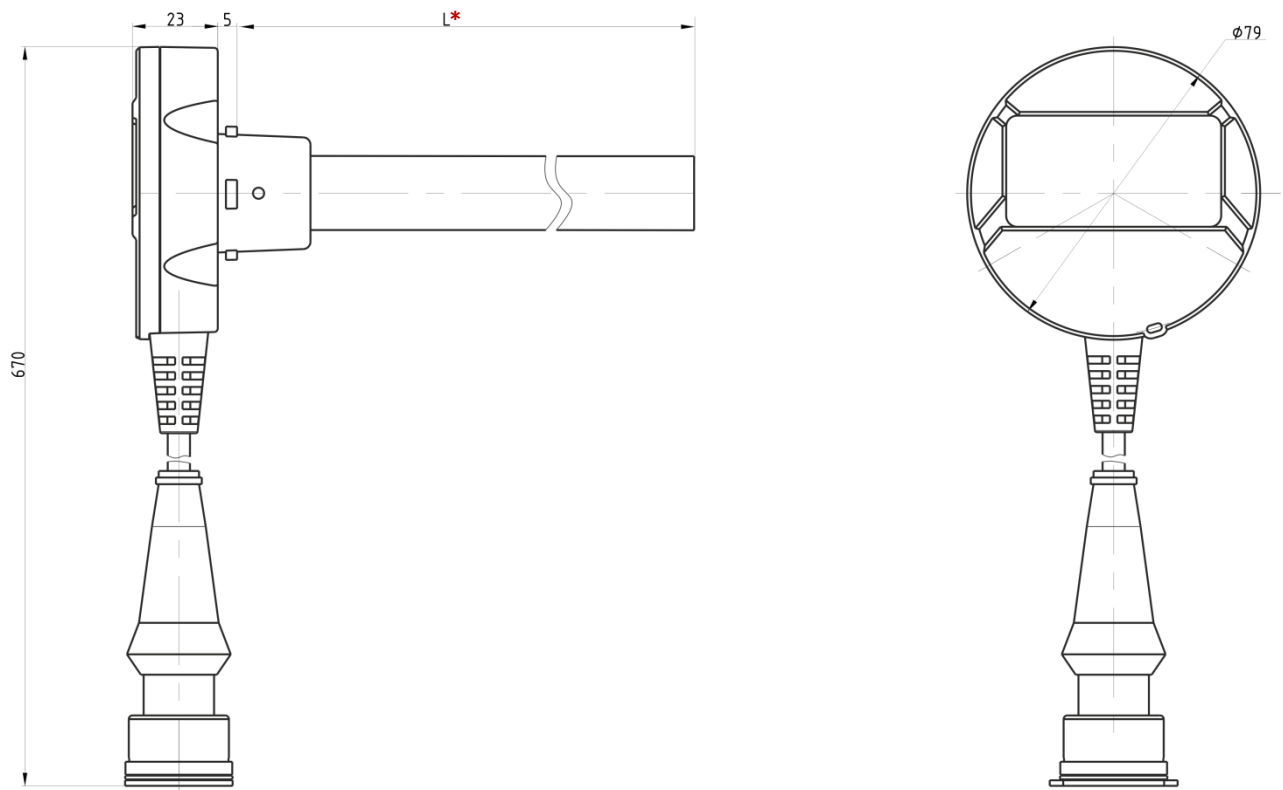


Figure 9 — Overall dimensions [DUT-E GSM](#)

\* Nominal measuring probe length: 700 mm / 1000 mm.

## 2 DUT-E GSM installation

For [DUT-E GSM](#) 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.

This chapter provides general recommendations on mounting DUT-E GSM sensor. Please, see detailed recommendations on DUT-E GSM mounting in [DUT-E/DUT-E 2Bio/DUT-E GSM/DUT-E S7 installation manual](#).

The following tools and accessories are recommended to have for DUT-E GSM mounting:

- Small tools: (box wrench kits, drive sockets, screwdrivers, pliers, jab saw or angle grinder with a cutoff disk, rivet spinner).
- Drill (screw driving machine) with a set of drill bits for metal.
- Hollow drill set, d=38 mm.
- Verified measuring reservoir for fuel (10...20 l volume).
- If the tank volume is greater than 200 l, the fuel filling station with a counter or [DUT-E ATS automatic calibration station](#) are desirable.
- Calibration pipe with one end sealed, its length being no less than the height of the tank to be equipped.
- Silicone sealing compound.
- Rags.
- Diesel fuel; full tank for each Vehicle.
- Spare tank for fuel of volume equal to that of the given fuel tank;
- In case of configuration using the cable system — [S6 SK](#) service adapter and PC with the installed [Service S6 DUT-E](#) service software.  
In case of wireless configuration — [S6 BT Adapter](#) service adapter and the Android device with the installed Service S6 DUT-E (Android) service mobile application;



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

### 2.1 Exterior inspection prior to works start

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

Contact the product supplier if there any defects.

## 2.2 General recommendations for sensor installation

### 2.2.1 Inserting SIM card into the sensor

#### ATTENTION:



**1)** Micro-SIM card is not a part of delivery set and should be purchased from a local GSM operator. Its installation into the sensor should be made by the installer **prior** to DUT-E GSM mounting into the fuel tank.

**2)** It is recommended to use Micro-SIM card with GPRS/SMS function only and disable PIN protection of the SIM card.

To install micro-SIM card in [DUT-E GSM](#) (see figure 10 and "[DUT-E GSM Sim-Card Installation](#)" video):

- 1)** Unscrew three screws in the bottom part of measurement head of sensor and remove the cover.
- 2)** Slide SIM-holder to "open" position and open it.
- 3)** Insert Micro-SIM card into the slot, contacts facing down. Close SIM-holder and slide it to "close" position.

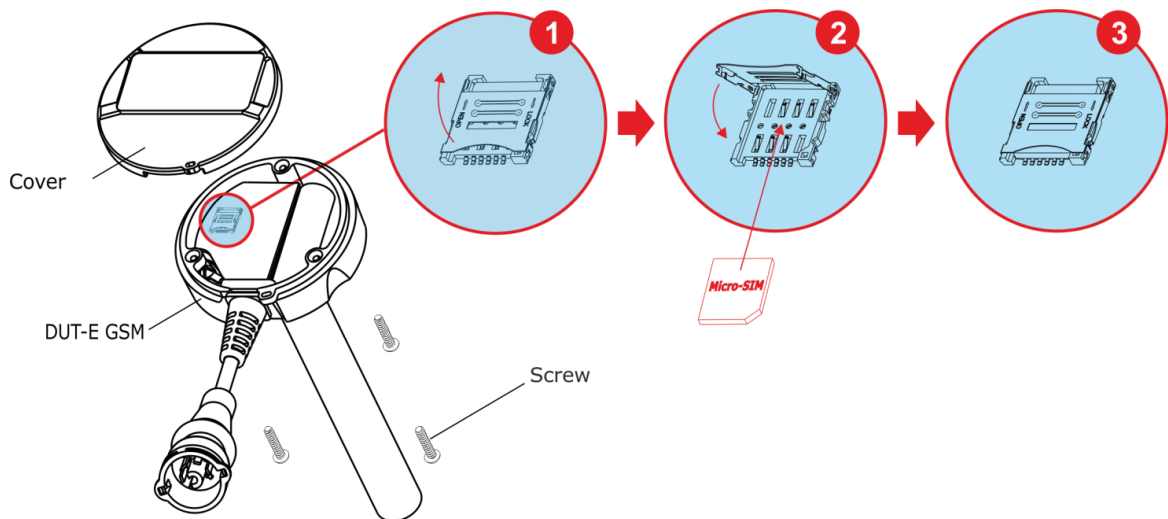


Figure 10 — Micro-SIM cards installation procedure

- 4)** Using S6 SK service adapter connect the sensor to the PC (see [2.3.1](#)) or using S6 BT Adapter connect the sensor to the Android device (see [2.4.1](#)). According to the **modem status Parameters** ([PGN\\_63007](#)) in the **Communicator FM** submenu (see [D.9](#)), make sure that GPRS-modem is connected to the Internet. Disconnect the sensor from the PC or the Android device.
- 5)** Evenly cover the area inside the frame of the SIM-holder with a 1...2 mm layer of sealant from the syringe (see the [delivery set](#)).
- 6)** Put back the cover of measuring head of sensor and fix it with screws.



#### WARNING: Do not use acid sealant!

Only neutral sealants can be used. Full curing of the sealant occurs within **24 hours**.

## 2.2.2 Standard fuel sensor replacement



**IMPORTANT:** When you mount [DUT-E GSM](#) in the fuel tank, you should take into consideration that [GNSS](#) antenna is located inside the sensor measuring “head”. Therefore, in order to provide unobstructed reception of signals from GNSS, you need to ensure the **maximum firmament view** in DUT-E GSM mounting location.

DUT-E GSM can be mounted either into the flange of factory mounted float sensor\* or into a specially drilled hole of the fuel tank.



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

Dismount the standard sensor and clean the mounting area before DUT-E GSM mounting.

M5x16 bolts can be used for installation; they are included into the [delivery set](#). Bolt or screw heads must be completely sunk in the mounting plate (see figure 11).



*Figure 11 — Mounting plate screwed to the tank*

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



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

---

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

### 2.2.3 Installation into a special hole

**IMPORTANT:**



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

Sequence of operations during mounting DUT-E GSM:

- 1) Determine installation location. **Geometrical center of the fuel tank** is recommended (see figure 12). This will reduce measurement errors caused by fuel level deviation during driving.

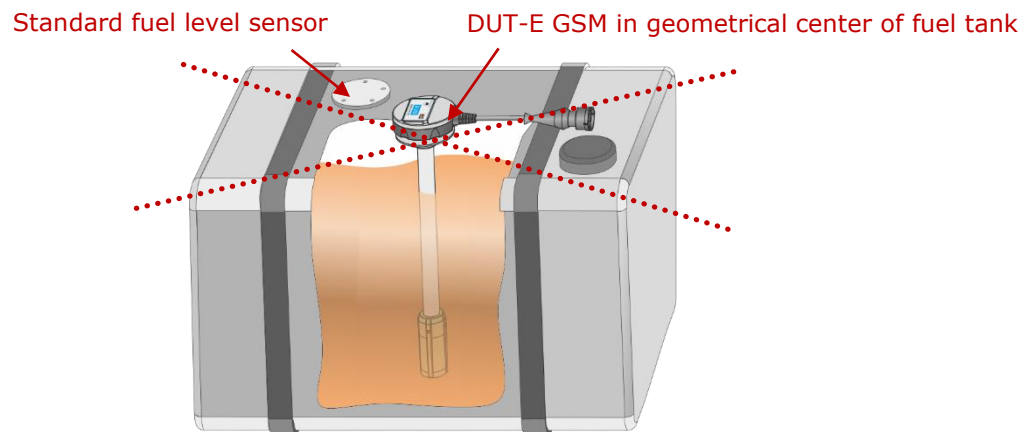


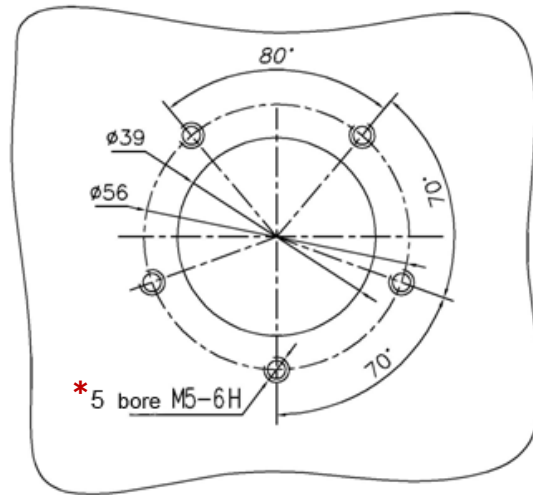
Figure 12 — Recommended location for a DUT-E GSM installation

- 2) Stick hole placement template from DUT-E GSM [delivery set](#) to the top of the tank and drill holes accordingly (see figure 13).

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



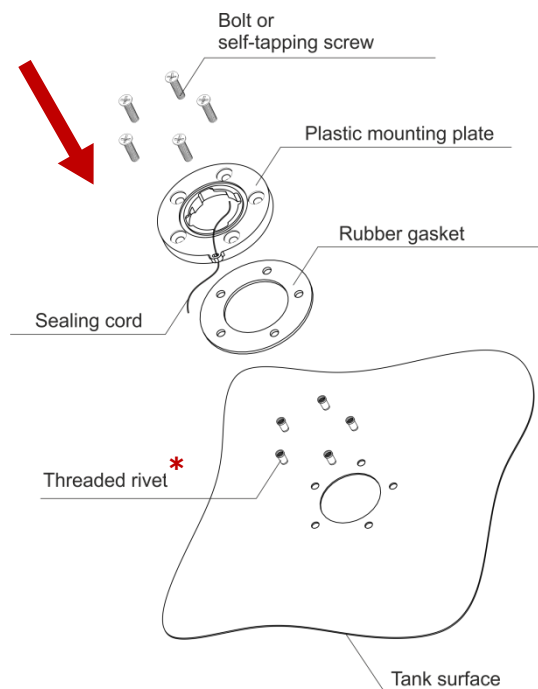
**BE CAREFUL:** The mounting plate can be installed only in one position on the bores prepared! Before marking and drilling, examine the place where you plan to fix the mounting plate because sealing holes should be accessible.



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

Figure 13 — Bores layout for sensor mounting plate fastening

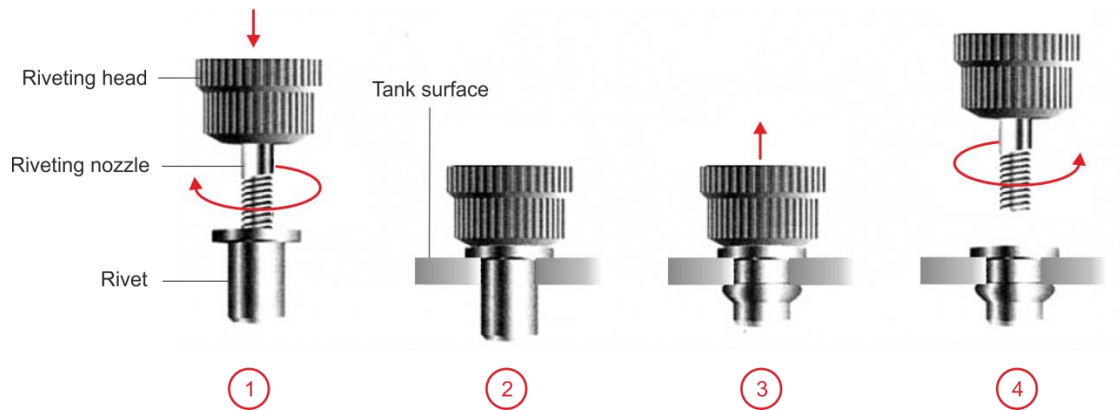
**3)** Put rubber gasket and fastening plate over prepared holes, fix them with screws and threaded rivets of with self-tapping screws from [MK DUT-E](#) mounting kit (see figure 14).



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

Figure 14 — Mounting plate fastening

When using threaded rivets, they should be mounted using riveter and according to figure 15.



a) threaded rivets procedure of installation



b) installed fastening plate view of from inside of tank

Figure 15 — Threaded rivets usage for sensor installation



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

## 2.2.4 Probe cutting according to tank depth



**ATTENTION:** It is allowed to cut the measuring probe of [DUT-E GSM](#) to any length needed.

Sequence of operations during cutting the measuring probe of DUT-E GSM:

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



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

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

2) Cut off DUT-E GSM probe so that the edge of the probe is in 25 mm above the bottom of the tank.



Figure 16 – DUT-E GSM measuring probe cutting and flushing the cut with fuel



**RECOMMENDATION:** Cut DUT-E GSM probe with a metal hacksaw. Carefully clean the edge and wash the tubes with clean fuel (see figure 16).

3) After cutting DUT-E GSM, the sensor calibration is obligatory (see [2.8](#)).

## 2.2.5 Length extension



**ATTENTION:** It is allowed to extend the length of [DUT-E GSM](#) up to **6000 mm**.

Length extension option significantly decreases expenses on storage and transportation. The sensor length is extended by means of attachment of [additional sections of DUT-E](#) to its measuring probe (see figure 17 and [DUT-E Length extension with KDC](#) video).

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

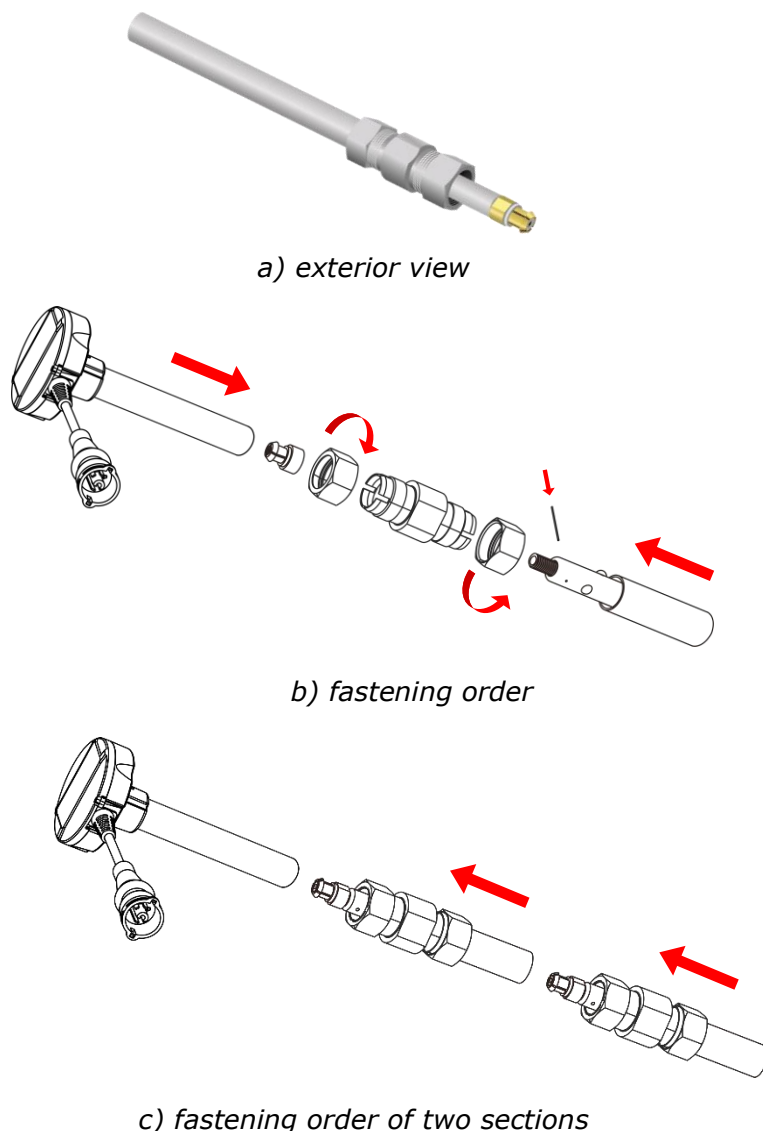


Figure 17 — Additional section DUT-E

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

Additional sections can be cut to necessary size. Follow instructions of clause [2.2.4](#) when cutting the sections.

After length extension of DUT-E GSM, the sensor calibration is obligatory (see [2.8](#)).

## 2.2.6 Mounting a screen filter and fixing the sensor

Before fixing [DUT-E GSM](#), put the **screen filter** (purchased separately) at the end of the sensor measuring probe (see figure 18 a); it serves to protect the measuring probe electrodes from water and dirt. Using the screen filter allows to increase considerably the sensor non-failure service life (see the video [Screen filter of a fuel level sensor](#)).

The screen filter is fixed in accordance with sequence of operations shown in figure 18 b. First, a fixing element is put on the measuring probe. Then, the bottom stop is mounted and fixed with two screws on the side. The screen filter is put over the bottom stop and fixed with locks of the fixing element.

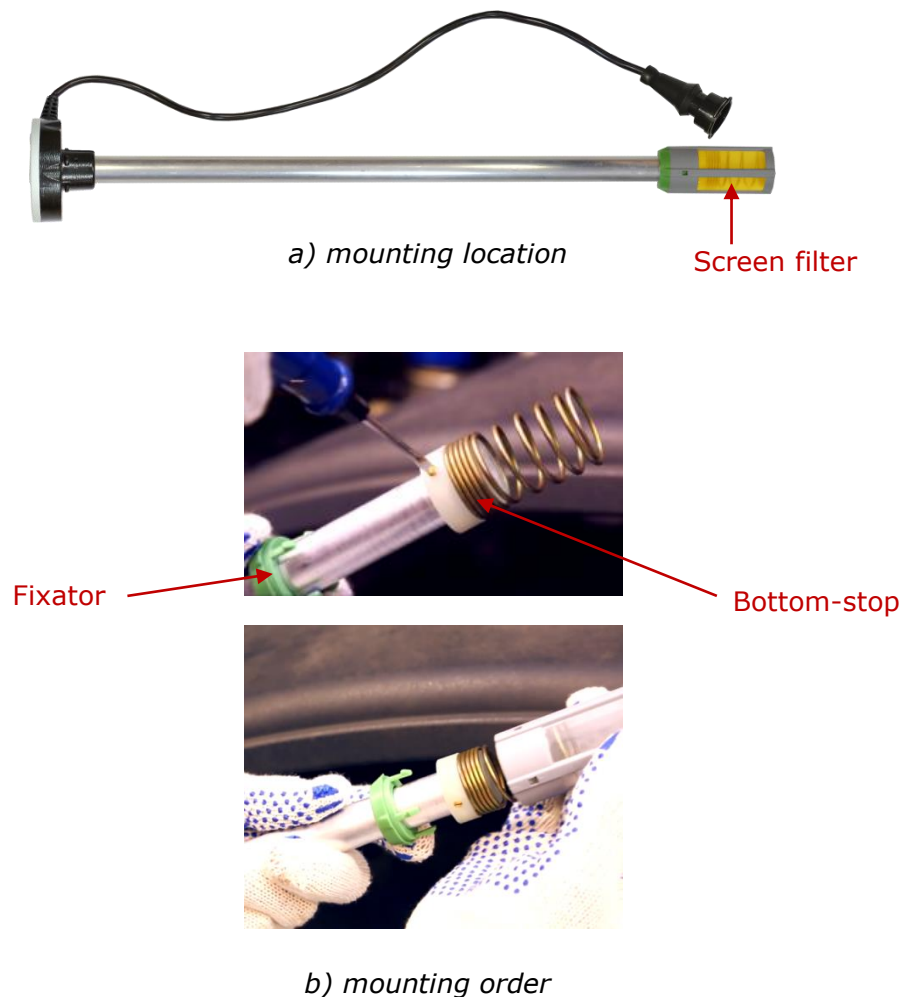


Figure 18 – Mounting a screen filter



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

To fix [DUT-E GSM](#) place the sealing ring into the groove of the mounting plate and put the sensor measuring probe, with the screen filter mounted, down into the hole. Then, press the sensor "head" and fix it by turning it clockwise (see figure 19).



**RECOMMENDATION:** It is recommended to put some oil or fuel on the sealing ring of the mounting plate to prevent its deformation during DUT-E GSM mounting.

The mounting should be carried out so that both sensor and mounting plate sealing holes would match one another after locking the DUT-E GSM.

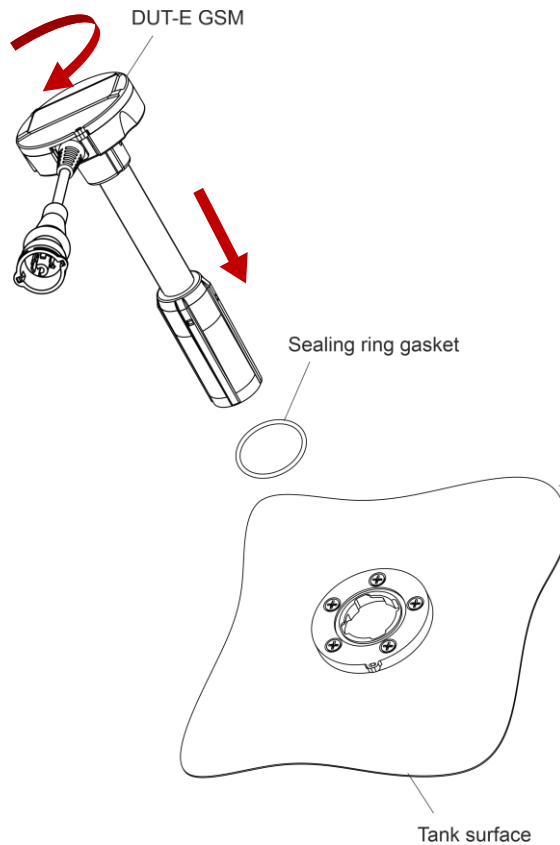


Figure 19 – DUT-E GSM mounting order

## 2.3 Sensor configuration by means of cable connection to the PC

[DUT-E GSM](#) setup is conducted via K-Line interface (ISO 14230) using [S6 SK](#) service adapter which is to be purchased separately. To conduct the setup, connect the sensor to the personal computer (further on PC) using the service adapter.



**ATTENTION:** To avoid any service adapter faults in communication between PC and DUT-E GSM 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://jv-technoton.com/> (Section [Software/Firmware](#)) and install it to PC:

- USB driver;
- Service S6 DUT-E software.

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](#) meeting the following minimal requirements is installed:

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

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

See [annex D](#) for DUT-E GSM settings, displayed and/or made by Service S6 software.

Service S6 DUT-E software allows to conduct remote configuration (see [2.6](#)) and firmware update (see [annex E](#)) of DUT-E GSM by means of connection to the sensor via Internet.

### 2.3.1 Connecting sensor to PC



**ATTENTION:** Prior to connecting DUT-E GSM to a PC, it is necessary to turn off electrical circuits of the [Vehicle](#)\*. To do this, use the battery switch or remove the battery terminals.

Before starting to use service adapter, have a closer look on its elements to detect defects which can occur while service adapter was transported, stored or handled carelessly.

Avoid the following when connecting service adapter to DUT-E GSM, mounted into the tank of the Vehicle:

- ingress of fuel and lubricants and moisture to the contact pins of adapter slots or connectors of service cables;
- potential damage of the adapter and cables by the rotating and heating elements of the engine.

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\* When configuring DUT-E GSM installed on Vehicle. When configuring sensors connected by [S6 Technology](#), power supply of onboard network (battery) can be turned on.

**DUT-E GSM** is connected to PC according to the connection schemes (see figure 20) in the following order:

**1) Connect the adapter to sensor:**

- The connector of the service adapter is to be connected to the sensor interface cable connector by means of the plug connector which is contained in the S6 SK supplied accessories kit (see figure 20 a).

Note — During DUT-E GSM configuration you need to provide power supply for the sensor and the adapter from the battery or from a power source. Power is supplied through one of the free input connectors of the connector or via power supply wires of the adapter service cable.

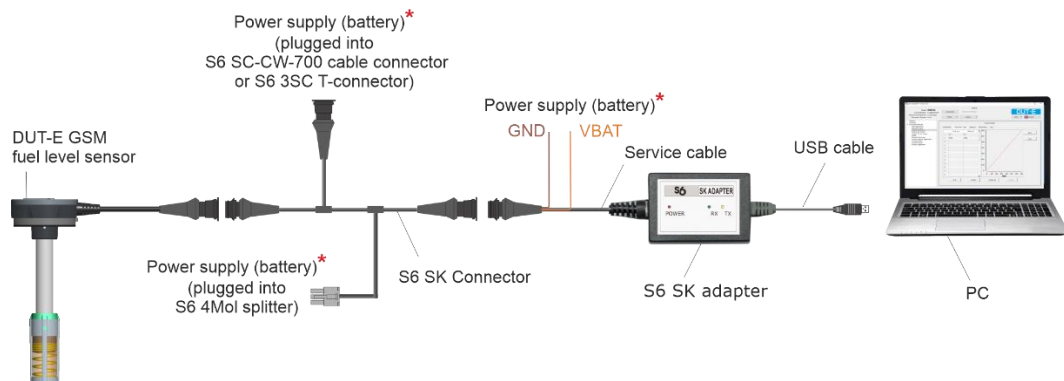
- During the configuration of DUT-E GSM which operates within the network of [Units](#) based on [S6 Technology](#) we recommend to plug the connector of the adapter service cable into the break in S6 cable system using S6 SK connector instead of any S6 3SC T-connector. In this case, power for the Unit and adapter is supplied through S6 cable system (see figure 20 b).

**2) Plug the adapter to USB port of PC with the USB cable.**

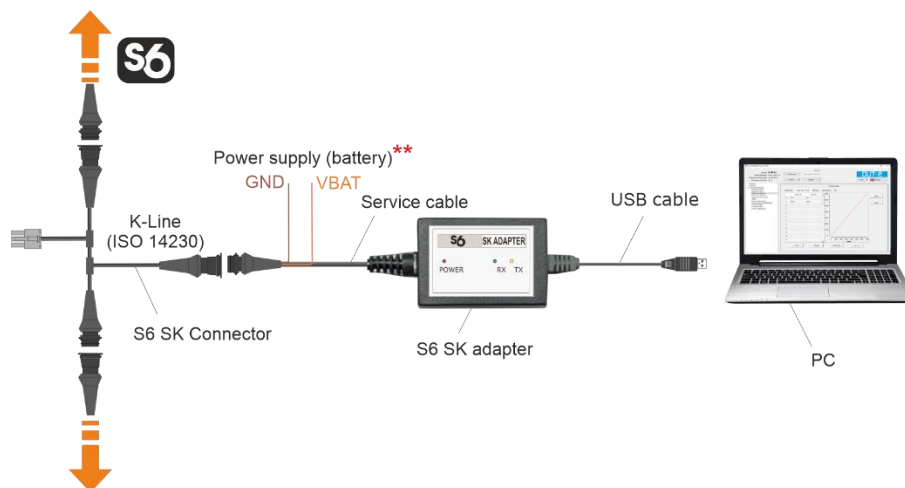
Note – it is allowed to connect adapter to USB-port of your PC after turning on power supply of sensor and running Service S6 DUT-E software.

**3) Connect power supply and ground wires to vehicle electrical system or battery.**

**4) Power on the vehicle (battery).**



a) connecting sensor using S6 SK



b) connecting sensor using S6 SK via S6 Technology

Figure 20 — Schemes of DUT-E GSM connection to PC

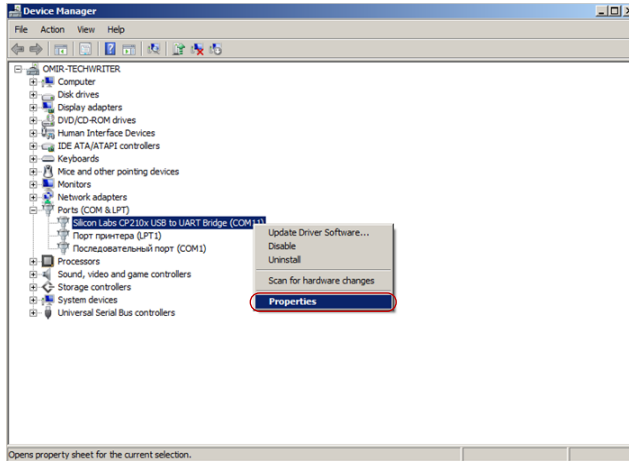
\* For connecting power supply (battery) you can choose any of marked places.

\*\* No need to connect. Power supply (battery) is carried out though S6 cabling system.

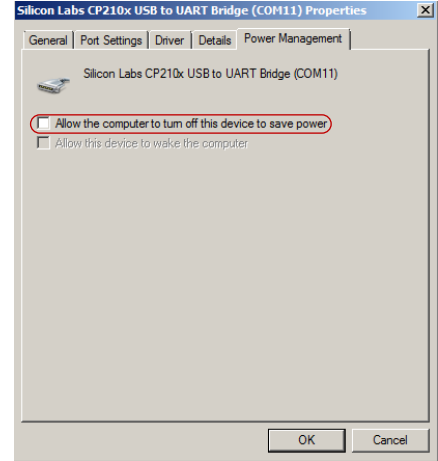
Windows automatically detects adapter connected to PC’s USB port as USB device and enables virtual COM port driver for it. The virtual COM port will be displayed in the list of ports of Windows Device manager (see figure 21).



**ATTENTION:** It is recommended to untick power save check box for Service S6 DUT-E in the virtual COM-port properties for energy safety purpose (see figure 21 b).



a) selecting port properties






b) disabling power save option


Figure 21 — Setting up a virtual COM-port in the Device Manager

Service adapter is ready to use since the power is on. See table 5 for signal description of LED indicators located on the adapter.

Table 5 – S6 SK adapter LED signals description

LED Indicator			Signal description
Marking	Status	Light color	
<b>POWER</b>		Red	Power supply is on
	No signal		Power supply is off (or voltage is less than minimum required)
<b>RX</b>		Green	DUT-E GSM data is being received
	No signal		No data from DUT-E GSM
<b>TX</b>		Yellow	Data is being transmitted to DUT-E GSM
	No signal		No data to DUT-E GSM

## 2.3.2 Interface of Service S6 DUT-E software

Service S6 DUT-E software is launched with  desktop shortcut created during installation. Software interface consists of **Horizontal menu**, **Vertical menu**, **Sensor ID area** and **Information and Configuration area** (see figure 22)

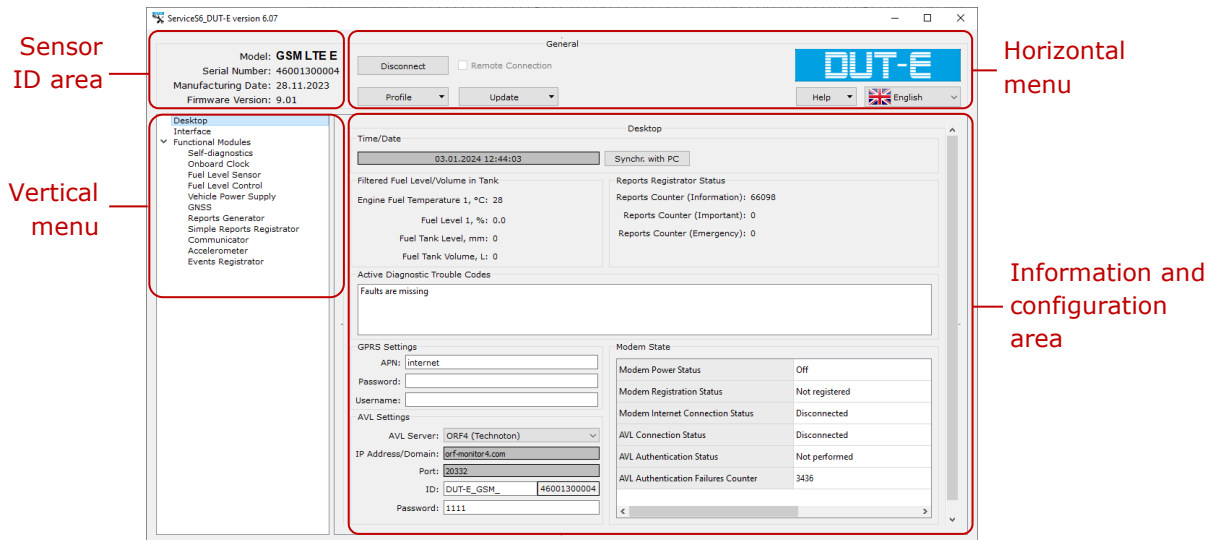


Figure 22 — Interface of Service S6 DUT-E



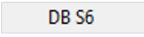
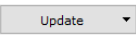
**ATTENTION:** At lower screen resolutions (less than 1024x768) Service S6 DUT-E window is automatically set to full screen. In this case scroll bars are used to display unseen areas.

**Sensor ID area** provides information about the model, serial number, manufacturing date and firmware version of the connected sensor.

**Horizontal menu** provides the following:

- sensor is connected/disconnected;
- profile options (loading, saving and printing profile);
- firmware update;
- remote connection to Unit;
- update of S6 Database in the service software (in case the PC has access to the Internet);
- selection of interface language;
- help and information about the manufacturer.

**Vertical menu** is used for selection of [Function modules](#) of [DUT-E GSM](#). Its current parameters and configuration are displayed in **Configuration and Information area**. Function modules of Service S6 DUT-E software are based on [PGN](#) and [SPN](#) messages from **S6 Database** (see [annex D](#)).

To update S6 Database in Service S6 DUT-E software, press  button in  dropdown menu. S6 Database (further on — BD S6) can be found at <https://s6.jv-technoton.com/>, section [S6 Database](#).

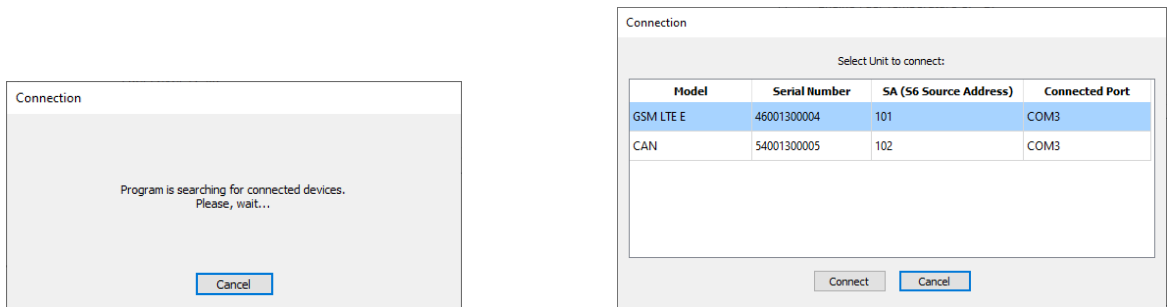
**Information and Configuration** area displays names (PGN) and parameters (SPN) of the messages. Each SPN holds the following: data range, discretion, measuring units.

### 2.3.3 Authorization

To enable connection between [DUT-E GSM](#) and PC, click the button **Connect** in **Horizontal menu**. Service S6 DUT-E software will search for the connected sensors (see figure 23 a).

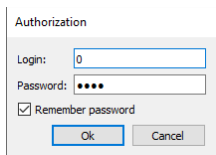
When you connect Service adapter via [S6 Technology](#), which contains more than one [Unit](#), in the **Connection** window from the list choose the unit, that will be used with software and click the button **Connect** (see figure 23 b).

Enter Login and Password of the Unit into the appropriate fields of **Authorization** window. The default Login is **0**. The default password is **1111**. To save a new Password (to avoid entering the password again during connection next time), tick **Remember Password** (see figure 23 c).

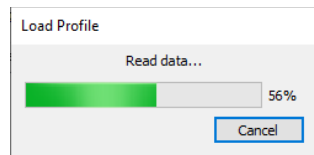


a) search for the connected sensors to PC

b) selection of one of the Units connected to the bus S6 to work with software



c) user authorization



d) Unit's profile loading

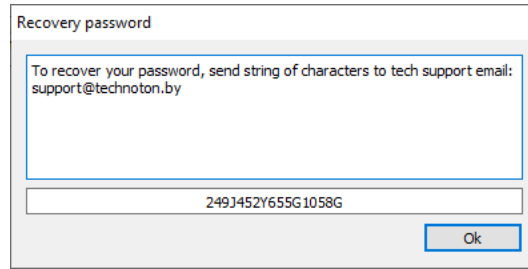
Figure 23 — Enable connection between the sensor and PC

To recover the password (in case it is lost), you need to place the cursor into the **Login** or the **Password** field of the window **Authorisation** and press **Ctrl+F10** key combination.

Service S6 DUT-E Software will display a code to recover the current password of the Unit (see figure 24). This message is being sent to [Technoton technical department](mailto:support@jv-technoton.com) by e-mail [support@jv-technoton.com](mailto:support@jv-technoton.com) Together with password recovery request.

Requirements for DUT-E GSM password request:

- scan copy of the request signed and sealed by the official representative of the company the sensor been purchased by should be attached;
- request should contain serial number and manufacturer date of the sensor;
- email should contain full name and contact e-mail of a person who should receive the recovered password.



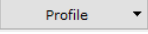
*Figure 24 — Generating password recovery code*

In case of incorrect Login and Password or incorrect connection to PC the warning error message will appear.

If Authorization is made successfully, then **Desktop** will appear automatically when you run the software (see figure 22). **Desktop** contains configuration and current parameters of [Function modules](#) of the connected sensor [DUT-E GSM](#) (see [annex D](#)).

### 2.3.4 Operations with the sensor profile

Sensor **profile** is set of [PGN](#) (passport data, [Counters](#) and settings of [Function modules](#) of [DUT-E GSM](#)).

It is possible to manage the profiles in both the sensor DUT-E GSM connected and autonomous mode. The button  with drop down menu is used to choose the options (see figure 25). Profile can be stored as a file to PC hard drive or loaded into the memory of the sensor. It can be printed as well.

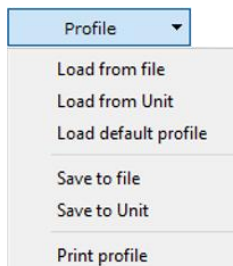
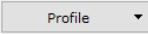


Figure 25 — View of Profile menu

Menu  is divided into the following sections:

**1) Load profile.** The following options of profile loading are available in Service S6 DUT-E software:

- [Load from file](#) — for loading of previously saved DUT-E GSM profile from the hard drive or removable disk. It is required to find and choose profile file in the appeared Open window (**DUT-E\_GSM\_\*.prf**).
- [Load from Unit](#) — is used for loading profile from the connected sensor DUT-E GSM.
- [Load default profile](#) — is used for loading profile with default factory settings. With this profile, it is possible to study utility operation without real DUT-E GSM connection.

By default, the profiles are recorded in the files **DUT-E\_GSM\_CAN\_2\_default.prf** (for DUT-E GSM 2G) and **DUT-E\_GSM\_LTE\_default.prf** (for DUT-E GSM LTE) which are stored on the PC disk in one folder together with the software start-up file ServiceS6\_DUT-E.exe.



**ATTENTION:** In autonomous mode only default profile or previously saved profile is available for loading.

**2) Saving profile.** Service S6 DUT-E has following profile saving options:

- [Save to file](#) — for saving profile to the hard drive or removable disk. This option is available only for profile loaded from file or [Unit](#). Select the location and give the name to file according to format **DUT-E\_GSM\_\*.prf**. Insert the name instead of \*. Prefix **DUT-E\_GSM\_** and format **.prf** will be inserted automatically.
- [Save to unit](#) — is used for saving modified settings into profile of the connected sensor. It is available only during the time when there an active connection between PC and DUT-E GSM.

If the modified settings were not saved into Unit and  button was pressed or Service S6 DUT-E is being closed there will appear a notification on profile settings saving. Pressing  will save all the unsaved parameters and settings [DUT-E GSM](#).

**3) Print Profile.** Profile file can be saved on a PC disk in **.pdf** format for later printing or viewing on the display. File name automatically generates DUT-E GSM serial number and date when file was created.



**RECOMMENDATION:** It is recommended to attach the hardcopy of the profile to DUT-E GSM specification to log the history of the settings and configurations.

## 2.4 Wireless configuration of sensor using Android devices


Wireless setup of [DUT-E GSM](#) is conducted by means of its connection via Bluetooth to the smartphone/tablet based on the Android operating system (further on Android device) using [S6 BT Adapter](#) which is to be purchased separately.

### ATTENTION:



**1)** To eliminate connection failures between the Unit 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 5.0 GHz frequency bands, as well as running electric motors, powerful transformers and switching equipment, welding equipment, high-voltage lines etc.).

**2)** The maximum allowed distance between the S6 BT Adapter 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 10 m.

Before using S6 BT Adapter, please, download Service S6 DUT-E (Android) service mobile application (further on S6 application) to the Android device from  (search request "Technoton").

A description of S6 BT Adapter and the installation procedure for S6 application are provided in the [CAN j1939/S6 Telematics Interface Operation Manual CAN j1939/S6](#).

Please, see in [annex D](#) configurations of DUT-E GSM that may be displayed and/or edited using S6 application.

Service S6 DUT-E (Android) application allows to conduct remote configuration (see [2.6](#)) and firmware update (see [annex E](#)) of DUT-E GSM by means of connection to the sensor via Internet.

### 2.4.1 Wireless connection of the sensor to the Android device



**ATTENTION:** Prior to connecting DUT-E GSM to the Android device, it is necessary to turn off electrical circuits of the [Vehicle\\*](#). To do this, use the battery switch or remove the battery terminals.

Before starting to use service adapter, have a closer look on its elements to detect defects which can occur while service adapter was transported, stored or handled carelessly.

Avoid the following when connecting service adapter to DUT-E GSM, mounted into the tank of the Vehicle:

- ingress of fuel and lubricants and moisture to the contact pins of adapter slots or connectors of service cables;
- potential damage of the adapter and cables by the rotating and heating elements of the engine.

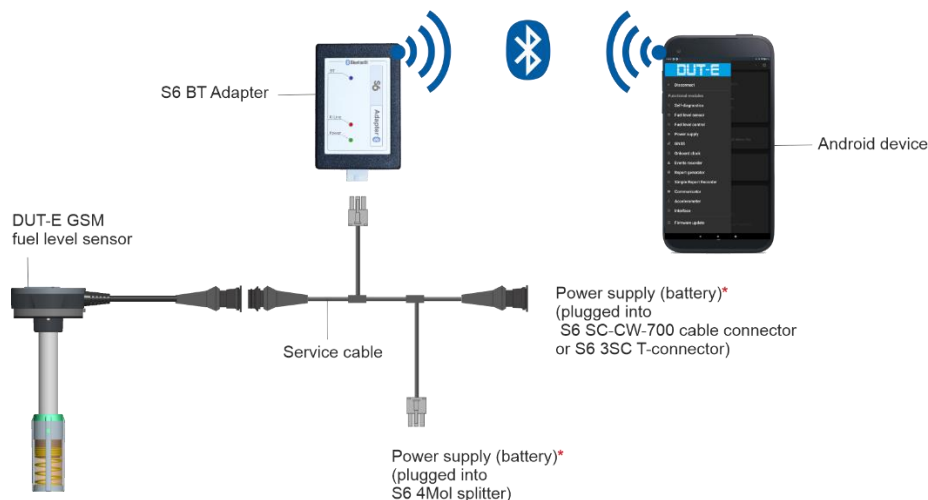
---

\* When configuring DUT-E GSM installed on Vehicle. When configuring sensors connected by [S6 Technology](#), power supply of onboard network (battery) can be turned on.

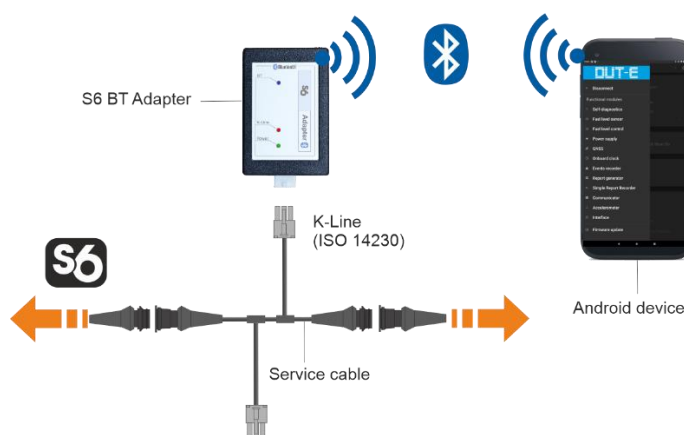
The procedure for [DUT-E GSM](#) wireless connection to the Android device (see figure 26) is as follows:

- 1) Connect the corresponding connector of the service cable to the connector of **S6** adapter.
- 2) Connect the adapter to DUT-E GSM:
  - The service cable connector is input to the interface cable connector of the sensor.  
Note — During the wireless configuration of DUT-E GSM you need to provide power supply for the sensor and the adapter either from the accumulator battery or from the power source. Power supply is provided through any of the free connectors of the service cable (see figure 26 a).
  - During wireless configuration of DUT-E GSM operating within the network of [Units](#), according to [S6 Technology](#), the service cable may be connected to the break in S6 cable system, instead of any S6 3SC T-connector. In this case, the sensor and adapter are powered through S6 cable system (see figure 26 b).
- 3) Connect power supply and ground wires to Vehicle electrical system or battery.
- 4) Power on the vehicle (battery).

After the power supply is on, the green LED indicator **POWER** is lit. You will also see a blue blinking light of the **BT** LED indicator which means that [S6 BT Adapter](#) is available for connection with Android devices via the Bluetooth channel.



a) connecting sensor using S6 BT Adapter




b) connecting sensor using S6 BT Adapter via S6 Technology

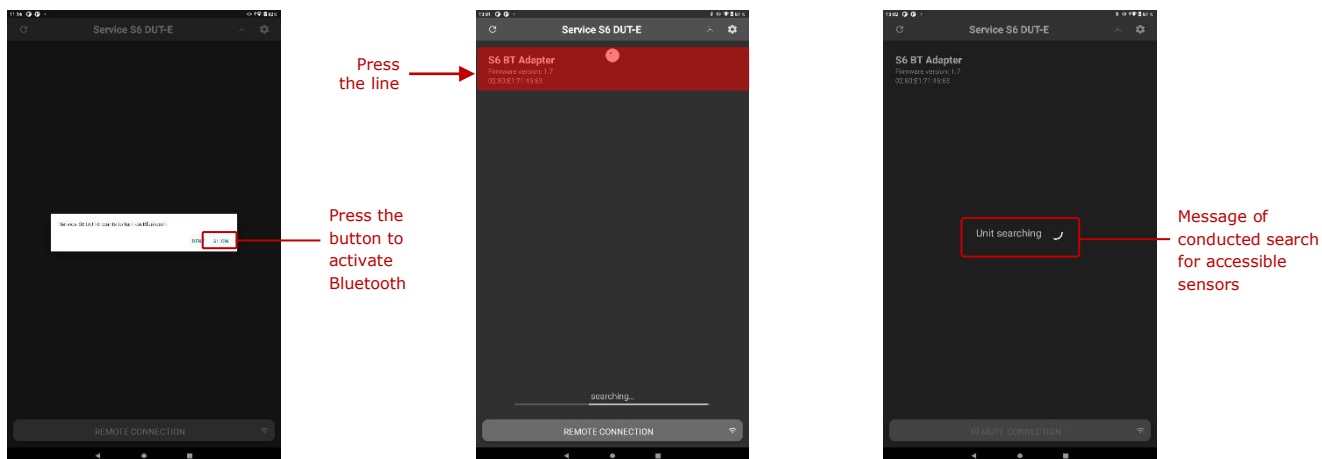
Figure 26 — Schemes of wireless connection of DUT GSM to Android-based device

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



Start S6 application from the main menu of the Android device with  icon which is created in the process of its installation.

**S6 BT Adapter** is ready for operation from the moment the power supply is on. If the S6 BT Adapter is connected correctly, after its initiation S6 application will offer to allow the activation of Bluetooth. After Bluetooth activation, the adapter which is accessible for wireless connection will be displayed on the screen of the Android device; its firmware version and MAC address will also be displayed. Press the line **S6 BT Adapter**, to establish its connection with the Android device (see figure 27).








- a) offer to allow Bluetooth connection
- b) adapter selection from the list of accessible devices
- c) detection of accessible Units with the help of the adapter

Figure 27 — Example of establishing a wireless connection between DUT-E GSM and Android device

During the operation of S6 BT Adapter signals of LED indicators should comply with those indicated in table 6.

Table 6 – S6 BT Adapter LED-indicators’ signal description

LED Indicator			Signal description
Marking	Status	Light color	
POWER		Green	Power supply is on
	No signal		Power off or power supply voltage is too low
K-Line		Red	Receiving data via K-Line interface
	No signal		Data are not received over K-Line interface
BT		Blue	S6 BT Adapter is initialized, but no connection with Andorid-based device (indicator is blinking each 1 s)
			Connection with S6 BT Adapter is established (blinking each 0.5 s)
			S6 BT Adapter is sending data over Bluetooth (blinking each 0.25 s)
	No signal		S6 BT Adapter is not initialized

## 2.4.2 Interface of S6 application

The interface of S6 application consists of **Information and Configuration Area** and **Tools Panel** (see figure 28).

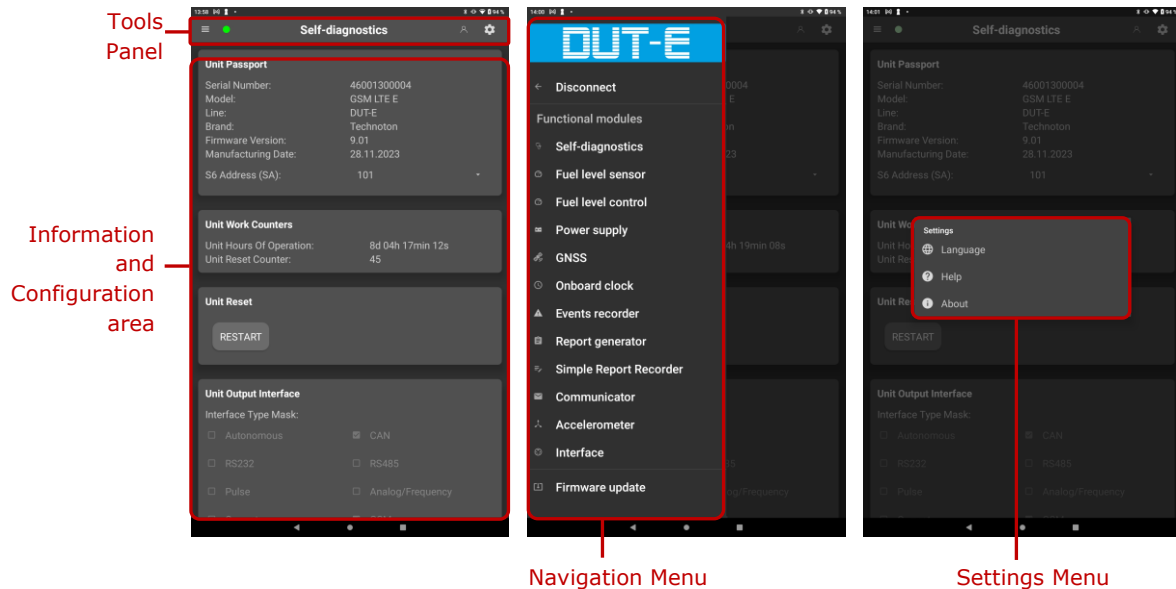
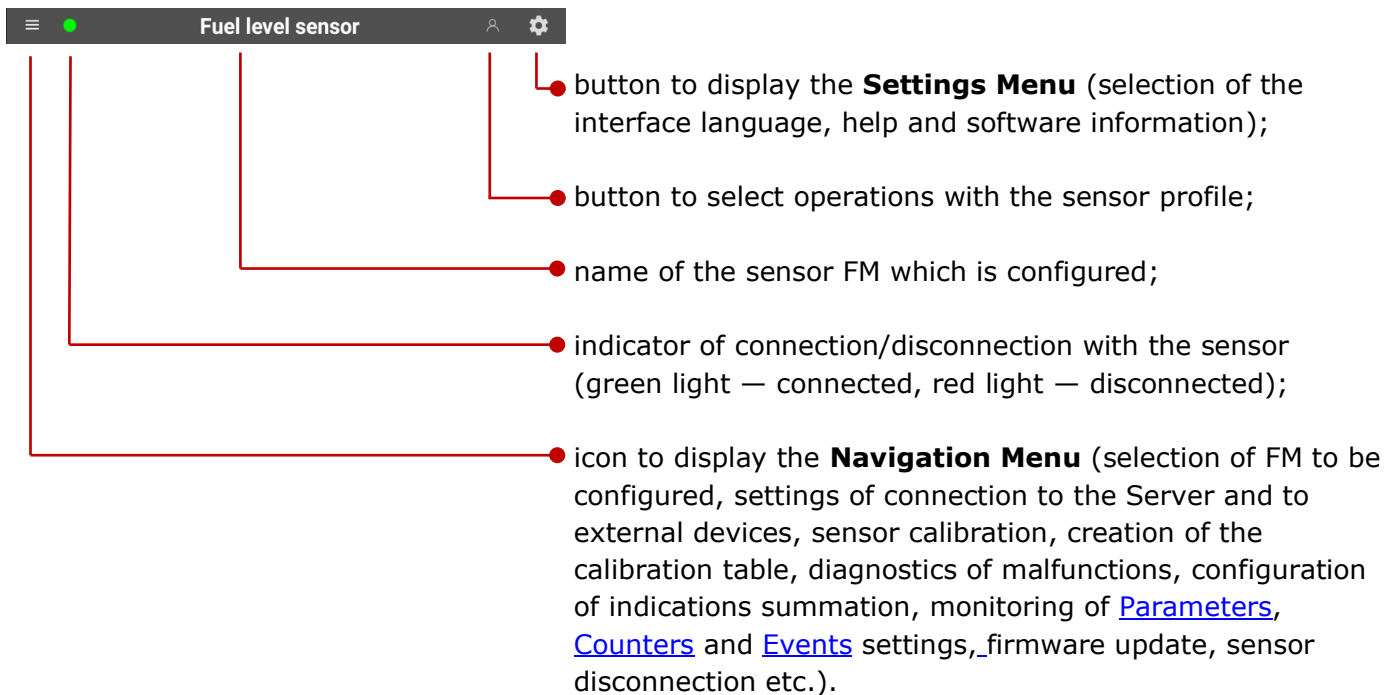


Figure 28 — Interface of Service S6 DUT-E service mobile application

In the **Information and Configuration** area current parameters and settings of the sensor [Functional modules](#) (FM) are displayed.

In the **Tools Panel** area there are the following elements for use during work with S6 application:



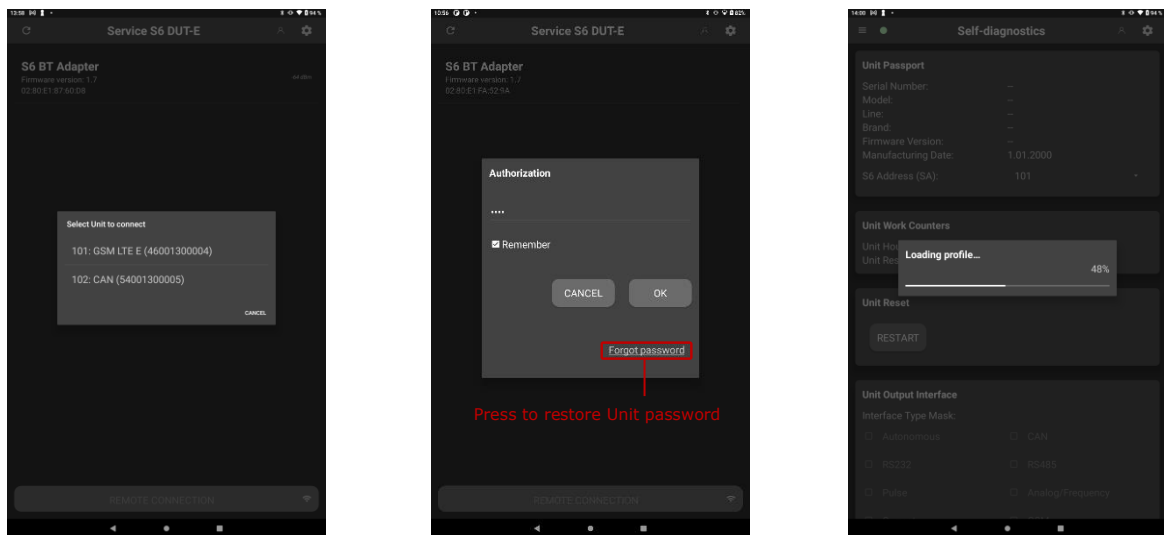
During its work with the FM [DUT-E GSM](#), the application employs data ([PGN](#) and [SPN](#)) from [S6 Database](#). The list of FM with SPN which are displayed and/or edited in the area **Information and settings** is provided in [annex D](#).

### 2.4.3 Authorization

To establish a session of wireless connection between [DUT-E GSM](#) and the Android device, establish connection with **S6 BT Adapter**. The application will automatically detect accessible sensors (see [figure 27](#)).

While connecting [S6 BT Adapter](#) to the network consisting of several [Units](#) using [S6 Technology](#), select the sensor required for use in the S6 application from the list displayed (see [figure 29 a](#)).

Enter the Unit password into the appropriate boxes of the **Authorisation** window. The password by default is **1111**. To save the password entered (to exclude its entering manually another time during the next session of work with the sensor), checkmark the box **Remember Password** (see [figure 29 b](#)).



a) select the required Unit for work with the application

b) user authorization

c) Unit's profile loading

Figure 29 — Establishing a wireless communication session between DUT-E GSM and the Android device

In case of incorrect entering the password or incorrect connection to the Android device, an error message will appear.

If the user authorisation has been conducted successfully, the loading of the of the connected DUT-E GSM profile will start.

To restore the Unit password (in case it is lost), press the link **Forgot password**.

S6 application will provide a code to restore the password (see figure 30). This message is being sent to [Technoton technical department](#) by e-mail [support@jv-technoton.com](mailto:support@jv-technoton.com) together with password recovery request.

Requirements for password recovery request:

- scan copy of the request signed and sealed by the official representative of the company the sensor been purchased by should be attached;
- request should contain serial number of the sensor;
- email should contain full name and contact e-mail of a person who should receive the recovered password.

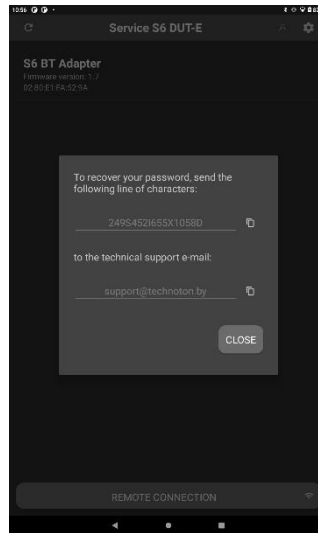


Figure 30 — Generated recovery code window

## 2.4.4 Operations with the sensor profile







Sensor **profile** is set of [PGN](#) (passport data, [Counters](#) and settings of [Function modules](#) of DUT-E GSM).



**ATTENTION:** Any operations with the [DUT-E GSM](#) profile in the S6 service mobile application are possible only during a wireless connection session between the sensor and the Android device. If there is a need to edit the profile in the off-line mode, connect DUT-E GSM to the PC using S6 SK and proceed in accordance with [2.3.4](#).

To perform any operations with the DUT-E GSM profile, the menu **Profile** is used which is opened by pressing  button on the **Tools Panel** (see figure 31).

The **Profile** menu contains the following options for operations with the DUT-E GSM profile:

-  **Load from 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\_GSM\_\*.prf**).
-  **Save to file** — is used to save the changed settings of the profile in the Android device memory;
-  **Load from Unit** — is used to load the profile from the sensor connected to the Android device;
-  **Save to Unit** — is used to save the changed settings of the profile in the memory of the connected sensor.
-  **Load default profile** — is used to load the profile with standard factory settings. By default, the profile is recorded in the files **DUT-E\_GSM\_CAN\_2\_default.prf** (for DUT-E GSM 2G) and **DUT-E\_GSM\_LTE\_default.prf** (for DUT-E GSM LTE) which are stored in the memory of the Android device.
-  **Print profile** — is used for the profile printout in pdf file.

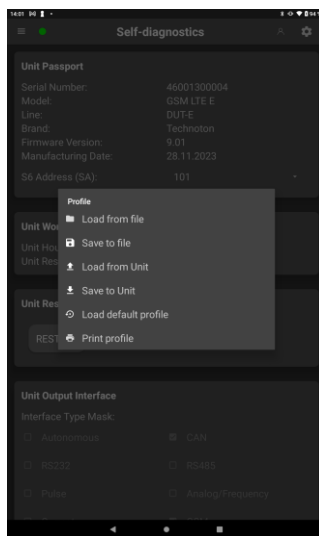


Figure 31 — View of Profile menu

## 2.5 Connection to ORF 4 Telematics service

For work with [ORF 4](#) / [ORF 5](#) Telematics service, [DUT-E GSM](#) is connected in the settings of **Communicator FM** submenu (see [D.9](#)), after the communication session between the sensor and the PC is started (see [2.3.3](#)) (in case it is configured using Service S6 DUT-E software) or between the sensor and the Android device (see [2.4.3](#)) (in case it is configured using Service S6 DUT-E (Android) application).



**RECOMMENDATION:** To establish quick connection with the [Telematics server](#), you may use the document [DUT-E GSM fuel level sensors. Quick Start Guide to configuration of connection to ORF Server](#).

To connect a [Unit](#) to ORF 4 / ORF 5 Telematics interface, you are to perform the following operations:

### 1) Connect the Unit to the Internet:

- in case of using SIM card with PIN code protection, first, you have to unlock it (enter PIN code and remove the checkmark in the appropriate field) ([PGN 63059](#));
- enter Internet connection settings of the Unit GPRS modem (APN of mobile communication operator) ([PGN 63020](#));
- taking note of GPRS modem indications parameters make sure the modem is connected to Internet ([PGN 63007](#)).



**ATTENTION:** For obtaining APN settings, contact service center of SIM-card provider.

### 2) Enter settings for DUT-E GSM connection with [AVL Server](#) ([PGN 63068](#)).



**IMPORTANT:** Data inserted into the fields of prefix (ID) should match with data inserted into the fields "Unique ID", they are entered during registration in the Telematics service (see [ORF 4 Telematics service. User manual](#)).

### 3) Check DUT-E GSM authentication settings on the Server ([PGN 63099](#)) to be sure that the Unit authentication is made successfully and there is connection with the Server.



**ATTENTION:** If connection problems occur, contact [Technoton technical support service](#) by e-mail [support@jv-technoton.com](mailto:support@jv-technoton.com).

### 4) In configuration of **GNSS FM** submenu according to the settings of [GNSS](#) (see [D.6](#)), check that built-in navigation receiver of DUT-E GSM is working properly and receives data from satellite navigation ([PGN 62998](#)).



**ATTENTION:** For good reception of navigation data it is necessary to **maximize the view of the sky** at the place where the DUT-E GSM is being tested.

## 2.6 Remote connection to sensor

If needed, Service S6 DUT-E software or Service S6 DUT-E (Android) application enable you to conduct remote configuration or firmware update of [DUT-E GSM](#) by connecting to the sensor via Internet.

### IMPORTANT:




- 1) For remote work with DUT-E GSM, the PC / Android device must have:
  - open network port for external connections;
  - static IP address on the Internet (provided by your Internet Service Provider).
- 2) For uninterrupted operation of the inbuilt DUT-E GSM communication module during remote configuration, you need to provide the following conditions:
  - sensor supply voltage within its limits — range (10...45) V;
  - Internet connection with the remote sensor must be stable.

1) To connect the PC or Android device to a remote DUT-E GSM by means of GSM-connection, you are to perform the following operations:

- When using Service S6 DUT-E software: In **Horizontal menu** of the software tick **Remote connection** field and press  button (see [figure 22](#)).

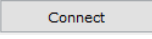
After a window containing Units with which remote connection is possible is displayed, **Connection settings** window appears (see figure 32 a). Enter the network port number into the appropriate field of this window for external connection.

When using Service S6 DUT-E (Android) application: After the application is started, press  button (see [figure 27](#)).


In the appearing window **Remote connection parameters** (see figure 32 a) enter the network port number and the IP address of the mobile device, network address and the [Unit](#) password into the appropriate fields.

- Send the **special SMS message** to the sensor SIM-card mobile number; it will initiate the Internet connection for remote connection to DUT-E GSM (see figure 32 b).

2) To connect the PC or Android device to a remote DUT-E GSM by means of **CSRV** GPRS-command via TCP channel, perform the following operations:

- Connect DUT-E GSM to [ORF 4 Telematics service](#) according to [2.5](#).
- In ORF 4 open **Additional menu** for the respective object. In **Commands** tab (**Unit Properties** window) specify settings of **CSRV** GPRS-command for remote connection to DUT-E GSM via TCP channel using Service S6 DUT-E software or Service S6 DUT-E (Android) application (see figure 32 c). The layout of **CSRV** GPRS-command fields is identical to that of SMS-command provided in [annex C](#).
- When using Service S6 DUT-E software — in **Horizontal menu** of the software tick **Remote connection** field and press  button (see [figure 22](#)).

After a window containing Units with which remote connection is possible is displayed, **Connection settings** window appears (see figure 32 a). Enter the network port number into the appropriate field of this window for external connection.

When using Service S6 DUT-E (Android) application — after the application is started, press  button (see [figure 27](#)).

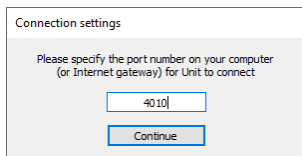
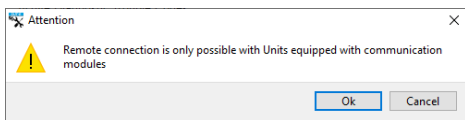
In the appearing window **Remote connection parameters** (see figure 32 a) enter the network port number and the IP address of the mobile device, network address and the [Unit](#) password into the appropriate fields.

- After the window for sending a **special SMS-message** to the SIM-card mobile number appears (see figure 32 b), open **Additional menu** for the respective object in [ORF 4 Telematics service](#). From the window **Execute a command**, execute **CSRV** GPRS-command (see figure 32 c). This command initiates the Internet connection for connecting to DUT-E GSM.

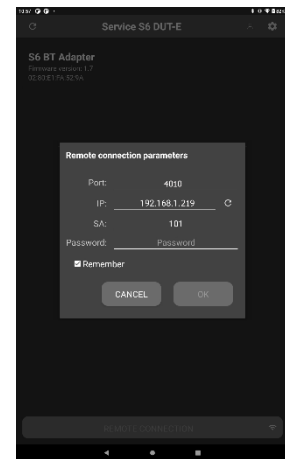


**IMPORTANT:** Before you send the command, you must make sure that DUT-E GSM is connected to ORF 4 Telematics service (the green indicator **Object connected** is on) and is transmitting data to the [Server](#) (see figure 32 d).

The maximum waiting time for remote connection to a [Unit](#) after sending SMS or GPRS-command **CSRV** is **30 min**. If no connection is established during that time, the message of the waiting period end is displayed. In this case, you are to try again to establish the remote connection with DUT-E GSM.

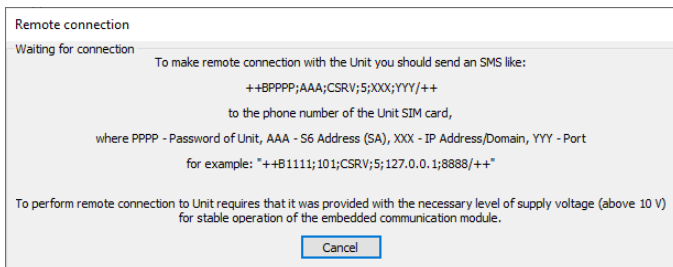


*in Service S6 DUT-E software*

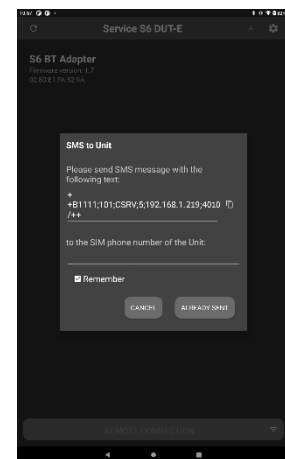


*in Service S6 DUT-E (Android) app*

*a) remote connection configuration*

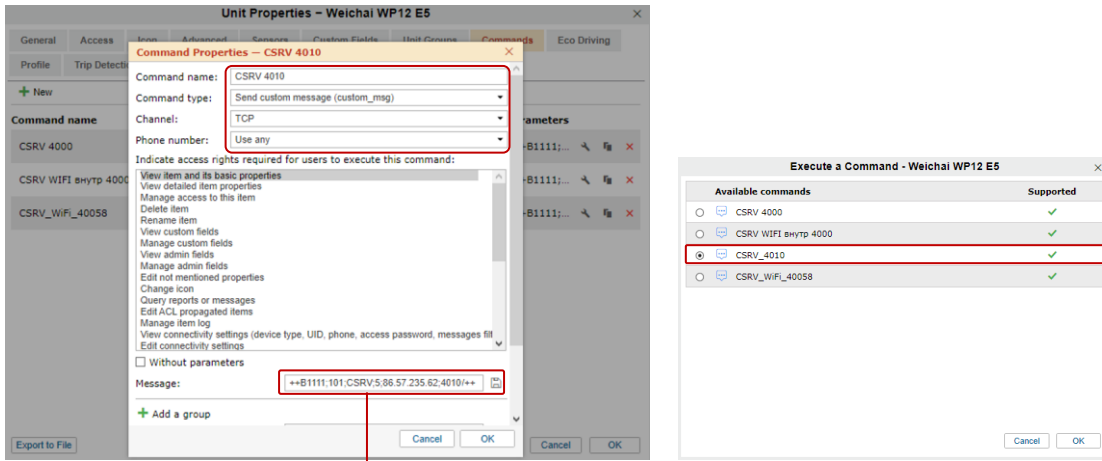


*in Service S6 DUT-E software*



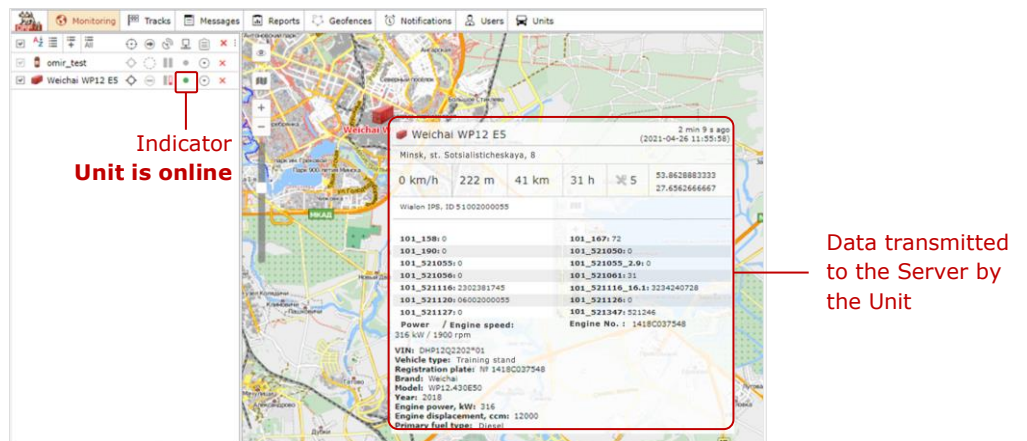
*in Service S6 DUT-E (Android) app*

*b) window with a special SMS for remote connection to a Unit*



Example of GPRS-command **CSRV**

c) windows in ORF 4 for configuration of properties and execution of CSRV GPRS-command for remote connection to a Unit



d) checking Unit connection to ORF 4 Telematics service, before sending a CSRV GPRS-command

Figure 32 — Example of establishing remote connection with DUT-E GSM

## 2.7 Electrical connection



### ATTENTION:

- 1) To ensure proper operation of [DUT-E GSM](#), it should be electrically connected by specialist, who finished [official technical training](#) and was certified for that.
- 2) When installing DUT-E GSM it is obligatory to follow safety rules on carrying out repair works applicable to the machinery being equipped.

DUT-E GSM is powered from the Vehicle onboard circuit.

To connect the sensor power supply, use **the power cable (7.5 m)** (see the [delivery set](#)), in accordance with the pinout provided in figure 33 and designation of the connectors' contacts specified in table 7.

To connect DUT-E GSM to [Units](#) using [S6 Technology](#), we recommend to purchase and use **signal cables** (see [annex F](#)).

### IMPORTANT



- 1) Before mounting and connecting DUT-E GSM 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.
- 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 GSM to onboard electrical network of Vehicle, use **fuses** from delivery set in accordance to scheme of connection (see figure 34). Nominal fuse current is not more than 2 A.
- 4) **Quick splice connectors** (ordered separately) are recommended for electrical connection of signal cable wires (see figure 35).
- 5) It is **strongly recommended** to lay signal cable together with standard electrical vehicle wiring with mandatory cable ties fixing of every 50 cm, at a positive ambient temperature (see figure 36).






a) DUT-E GSM interface cable

b) power cable

Figure 33 – Connector pinout

Table 7 – DUT-E GSM interface cable/power cable connectors assignment

Pin number	Wire marking	Wire color*		Assignment
1	VBAT	Orange		Power supply "+"
2	GND	Brown		Ground "-"
3**	CANH	Blue		CAN-High (SAE j1939)
4**	CANL	White		CAN-Low (SAE j1939)
5**	KLIN	Black		K-Line (ISO 14230)

\* [Manufacturer](#) reserves the right to modify wire colors, that is why pay attention to its marking.  
 \*\* It is missing in the power cable.

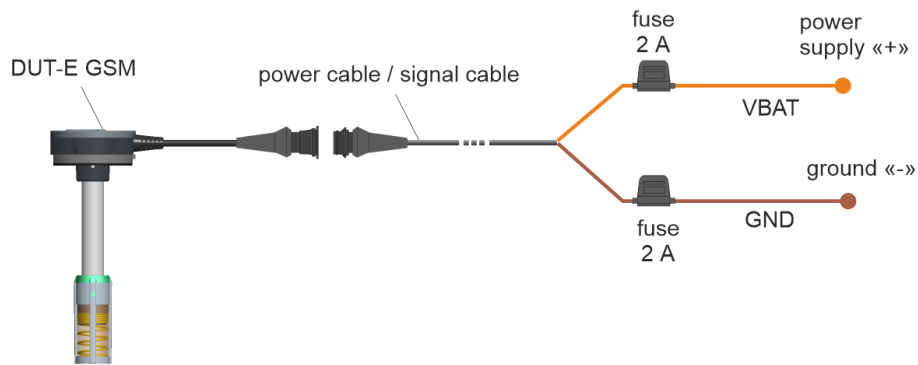


Figure 34 – DUT-E GSM to onboard electrical network scheme of connection

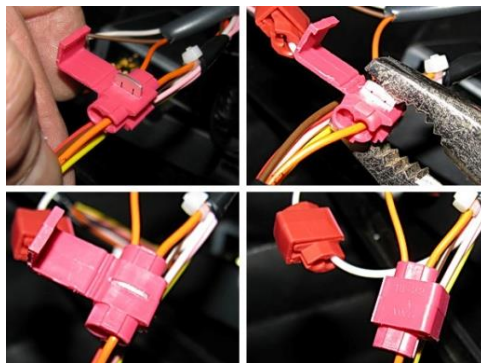
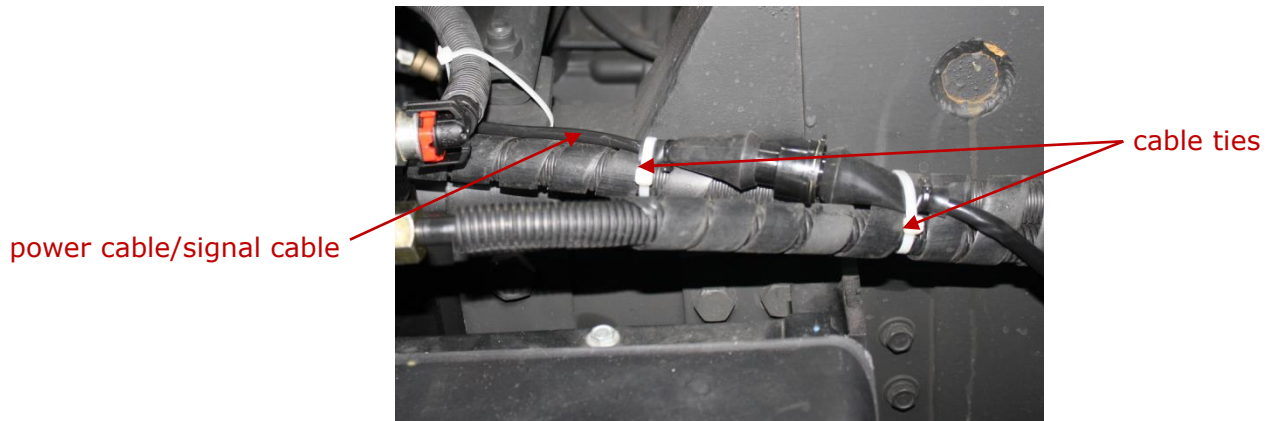


Figure 35 – Using connectors to connect wires of signal cable



**WARNING:** When connecting DUT-E GSM to [Units](#) by means of [S6 Technology](#), **120 Ohms** resistors **between** CAN LOW and CAN HIGH wires at the ends of CAN 2.0B (SAE j1939) communication line **is the obligatory condition** for correct data transfer.



*Figure 36 — Laying DUT-E GSM power cable/signal cable*



**IMPORTANT:** DUT-E GSM body is electrically connected to Ground “-” (brown wire of the connection cable). Electrical isolation between the DUT-E GSM body and the fuel tank is provided by the mounting plate made of dielectric plastic material.

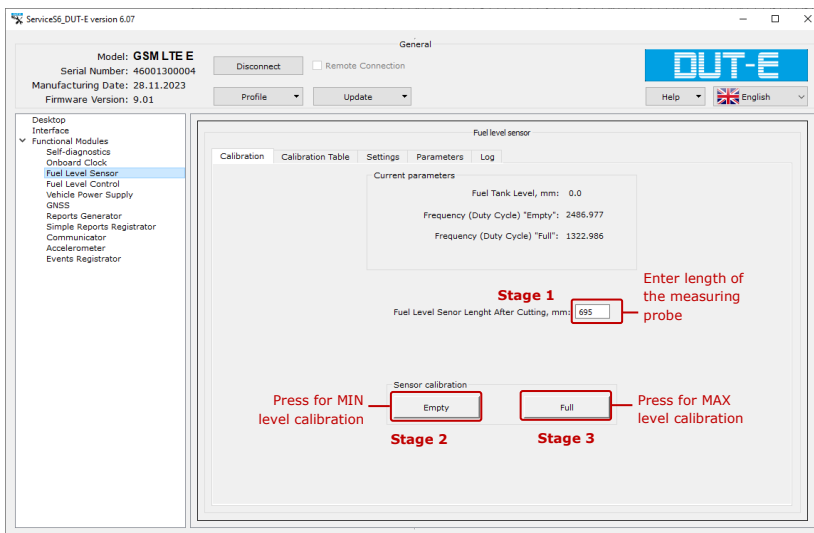
## 2.8 Sensor calibration



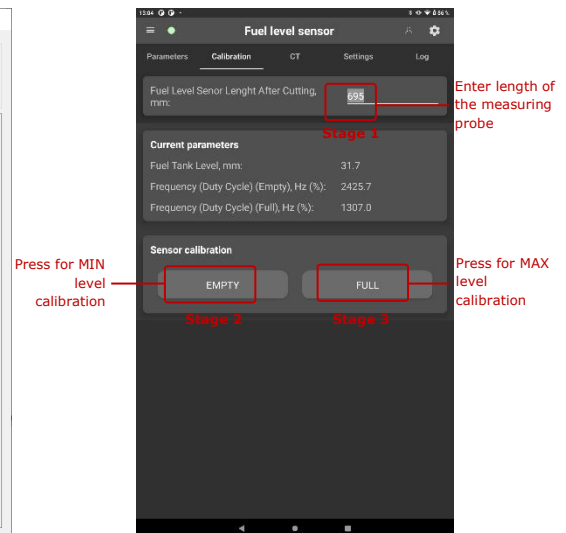
**IMPORTANT:**

- 1) Before installing [DUT-E GSM](#) in the tank, sensor calibration for the specific fuel type is required!
- 2) Recalibration of the sensor is necessary **after cutting/extending** its measuring part.

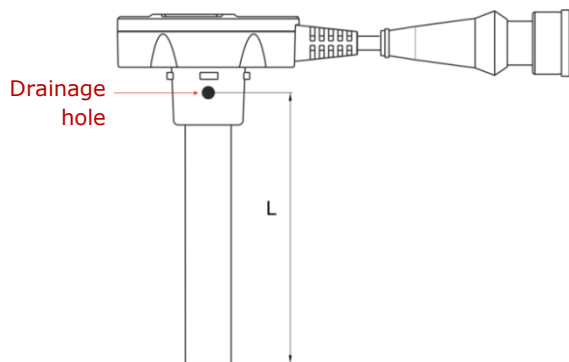
**Calibration** is required for correct operation of DUT-E GSM. In the process of calibration the minimal and maximal levels of the fuel measurement in the [Vehicle](#) tank are recorded into the memory of the sensor using Service S6 DUT-E service software or Service S6 DUT-E (Android) mobile application (**Fuel Level Sensor FM** submenu, tab **Calibration** (see [D.3](#))) (see figure 37).



a) in Service S6 DUT-E software



b) in Service S6 DUT-E (Android) app



c) measuring probe length of sensor

Figure 37 — DUT-E GSM sensor calibration

For [DUT-E GSM](#) calibration make the following steps:

**1)** While using Service S6 DUT-E software, connect the sensor to the PC using S6 SK service adapter (see [2.3.1](#)) and establish a communication session between DUT-E GSM and PC (see [2.3.3](#)).

In case of wireless sensor setting using Service S6 DUT-E (Android) application, connect DUT-E GSM to the Android device using S6 BT Adapter (see [2.4.1](#)). Establish the sensor connection with the Android device sensor via the Bluetooth channel (see [2.4.3](#)).

**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 37 c) and enter the measured value in **Fuel Level Sensor Length After Cutting, mm** field (**Fuel level sensor FM** submenu, **Calibration** or **Settings** tabs (see [D.3](#))).

**4)** To calibrate minimum (lowest) point of level measurement, press **Empty** button.



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

**5)** Dip the probe's tubes with the additional electrode fully into the fuel. Wait for (3...5) seconds for sensor readings stabilization.

**6)** To calibrate maximum (highest) point of level measurement, press **Full** button.

**7)** Calibration is finished. Save profile to sensor's memory.

## 2.9 Fuel tank calibration table

DUT-E GSM recalculates the measured value of fuel level into the fuel volume in the tank according to the calibration table. To create it, you need to conduct **the calibration procedure for a specific fuel tank** in which the sensor is mounted.

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 %.

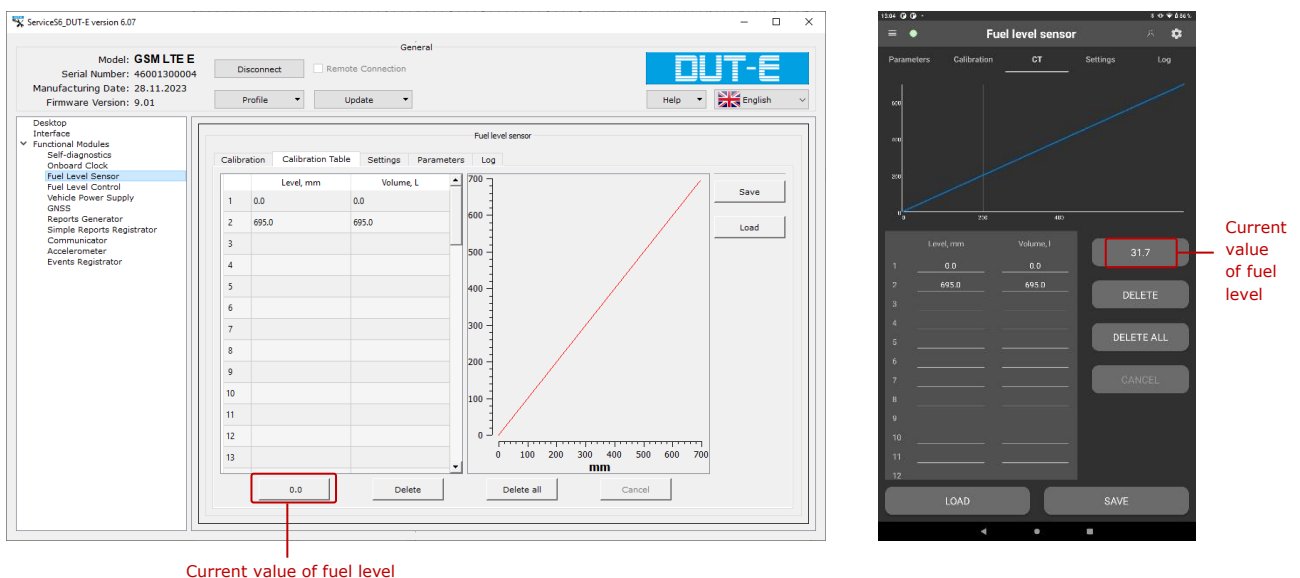
To make fuel tank calibration correctly, where the sensor is installed, it is required to follow the procedure:

- vehicle being equipped should not be loaded and should be parked on even horizontal surface;
- fuel tank should be empty;
- vehicle's tires should be of standard size and type for this model (replacement of standard wheels by wheels of non-standard type and size after the calibration procedure is performed results in decreasing accuracy of measurement or another calibration is needed);
- pressure in tires should be within allowed range for this model;
- vehicle should not move, ignition is turned on, engine not running;
- between to consequent tank refilling operations, please, wait at least 60 seconds.



**RECOMMENDATION:** Tank calibration using [DUT-E ATS automatic calibration station](#) reduces the calibration error down to  $\pm 0,5$  % of the tank volume; labor input and time needed for the tank calibration are reduced by 2...3 times (see [DUT-E ATS Operation manual](#)).

Calibration table is saved to internal memory of DUT-E GSM using Service S6 DUT-E software or Service S6 DUT-E (Android) mobile app (**Fuel level sensor FM** submenu, **Calibration Table** or **CT** tab (see [D.3](#))) (see figure 38).



a) in Service S6 DUT-E software

b) in Service S6 DUT-E (Android) app

Figure 38 — Making fuel tank calibration table

To record the calibration table using Service S6 DUT-E service software, connect the sensor to the PC using S6 SK service adapter (see [2.3.1](#)) and establish a communication session between DUT-E GSM and PC (see [2.3.3](#)).

In case of wireless sensor configuration using Service S6 DUT-E (Android) application, connect DUT-E GSM to the Android device using S6 BT Adapter (see [2.4.1](#)). Establish a connection between the sensor and the Android device via the Bluetooth channel (see [2.4.3](#)).

The data is entered as a table of correspondence between measured fuel level value (**Fuel level (mm) field**) and fuel volume in the tank (**Volume (L) field**).

- Click **0.0** button to insert a new entry into the table. When refilling with new portion of fuel, every time this button will show the current value of fuel level in the tank (see figure 38). When clicking on this button, the value is automatically entered into the next field of the table **Level, mm**.



**RECOMMENDATION:** When creating the calibration table, we recommend to enter for its first point (0.0 mm level) the value of fuel volume which is equal to the fuel volume not used which is remaining in the tank. Because the end of the mounted sensor measuring probe is located 20...30 cm from the tank bottom, there are normally 10...30 l of fuel not used in the dead zone beyond the limit of monitoring.

- New entries are automatically sorted from low to high fuel level value. To delete an entry highlight it and click **Delete** button. Button **Delete all** is used for deleting all entries of calibration table.
- Clicking **Save** button will allow saving the table as a \*.ttr file to PC disk or in the memory of the Android device.
- To load previously saved table from file click **Load** (for example, in case of replacement of fuel level sensor).
- Save profile to sensor's memory.



**ATTENTION:**

**1)** The number of calibration 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 sensor is **60**.

**2)** The maximum possible fuel volume value that can be entered into the calibration table is limited by the value of **6553 l**.

**3)** When creating the calibration table for the tank of **6553 l** capacity and higher, we recommend **to divide by 10** fuel volume values in each calibration point. Each of these values has **to be multiplied by 10** respectively at the [Server](#) for their correct displaying (see detailed recommendations in [annex I](#)).

## 2.10 Adaptation of sensor to specific conditions of operation

Adaptation of [DUT-E GSM](#) to specific conditions of operation is conducted using Service S6 DUT-E software or Service S6 DUT-E (Android) mobile application (**Fuel level sensor FM** submenu, tab **Settings** (see [D.3](#))) (see figure 39).

While using Service S6 DUT-E software, connect the sensor to the PC using S6 SK service adapter (see [2.3.1](#)) and establish a communication session between DUT-E GSM and PC (see [2.3.3](#)).

In case of wireless sensor setting using Service S6 DUT-E (Android) application, connect DUT-E GSM to the Android device using S6 BT Adapter (see [2.4.1](#)). Establish the sensor connection with the Android device sensor via the Bluetooth channel (see [2.4.3](#)).

There are the following settings for different conditions of the sensor operation:

**1) Function Thermal correction** compensate the thermal expansion/contraction of the fuel.



**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 the tracking device.

Automatic thermal compensation is disabled by default. To enable it, tick the checkbox **On** in **Temperature correction** tab, then insert the required coefficient value into the field **Temperature correction Coefficient, %/°C**. To turn off the thermal compensation insert the coefficient value **0.0**, or untick the checkbox **On**.

Thermal correction coefficient  $K_{\text{ther.corr.}}$  is defined, **when the feature of thermal correction is disabled**, according to formula (1):

$$K_{\text{ther.corr.}} = (-1) \cdot \frac{(V_{T_{\text{max}}} - V_{T_{\text{min}}}) \cdot 100}{(T_{\text{max}} - T_{\text{min}}) \cdot V_{T_{\text{min}}}} \quad (1)$$

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

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

### IMPORTANT:

- 1)** It is recommended to determine values  $V_{T_{\text{min}}}$ ,  $V_{T_{\text{max}}}$ ,  $T_{\text{min}}$ ,  $T_{\text{max}}$  by data on [Server](#).
- 2)** When measuring values  $V_{T_{\text{min}}}$ ,  $V_{T_{\text{max}}}$ ,  $T_{\text{min}}$ ,  $T_{\text{max}}$  during 24 hours follow the requirements:



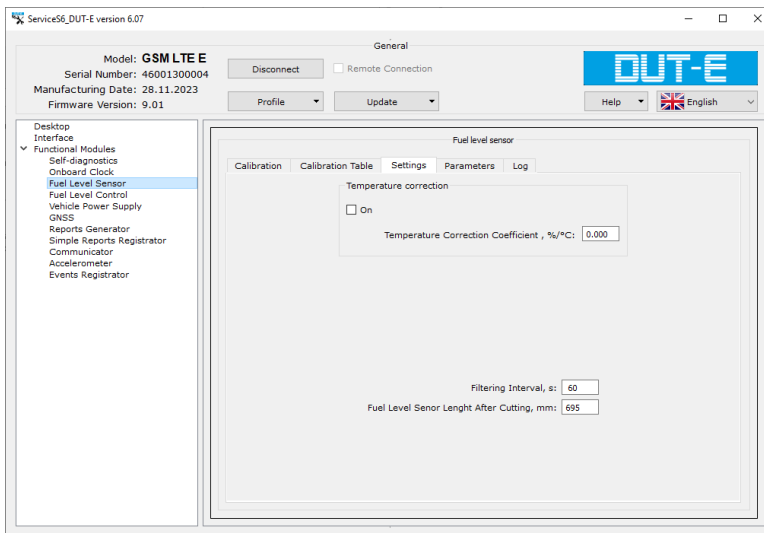
- thermal correction feature must be off in the sensor which is being configured;
- Vehicle is not moving with engine off.
- Ambient temperature should correspond to normal operating conditions of the [Vehicle](#).
- Tank should be filled with fuel not less than 10 % of the total fuel volume.
- There should be the same fuel volume in the tank (refueling or draining is not allowed).

**2)** In the field **Filtering Interval, s** it is possible to set up time interval, preceding the data transmission, when fuel level value is smoothed during this interval. Parameter value range (by default it is 60 sec) is 0...300 with 1 s step.

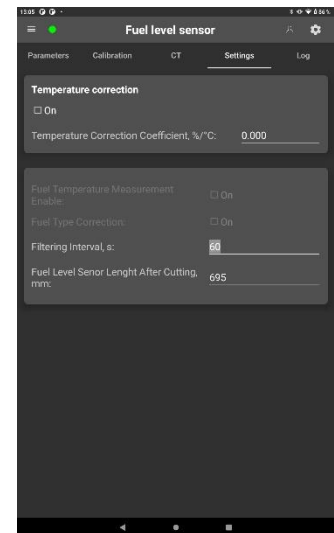


**ATTENTION:** Filtered information of fuel level in the tank transmitted by DUT-E GSM to Server is not instantaneous value. It is averaged value during some time interval. Filtration is important for DUT-E GSM mounted on vehicles operated on hilly surfaces (because of intense fluctuation of fuel level).

Save profile to sensor's memory.



a) in Service S6 DUT-E software



b) in Service S6 DUT-E (Android) app

Figure 39 — Configurations for specific operation conditions

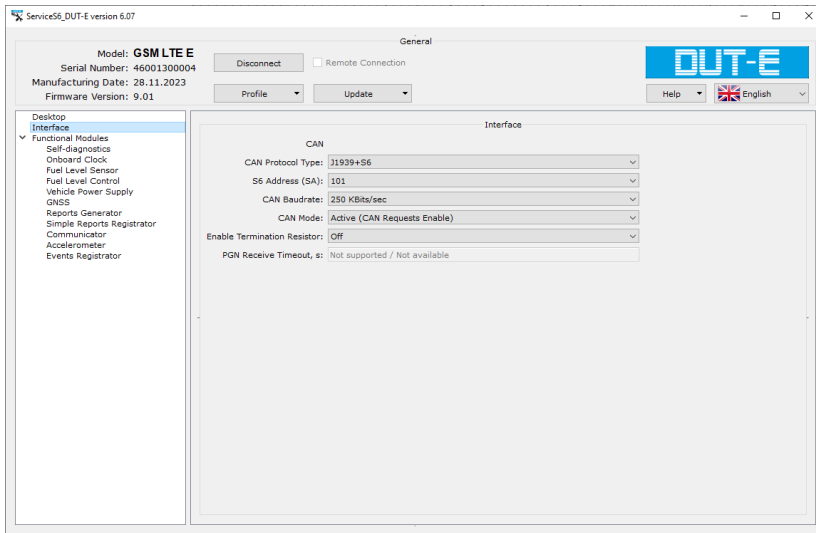
## 2.11 Connection parameters for CAN j1939/S6 interface

To connect [DUT-E GSM](#) to external device by [S6 Technology](#) it is necessary to enter parameters of CAN j1939/S6 interface in submenu **Interface** in Service S6 DUT-E software or Service S6 DUT-E (Android) mobile application (see figure 40):

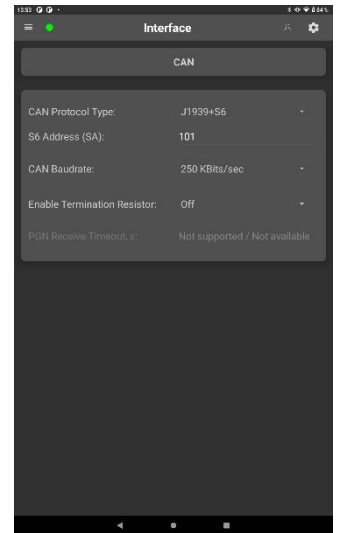
- 1) From **CAN Protocol Type** ([SPN 521530](#)) drop-down list, select **J1939+S6** data transfer protocol.
- 2) To identify the sensor within a network of several [Units](#) connected using S6 Technology, enter the unique DUT-E network address in the field **S6 Address (SA)** ([SPN 521188](#)) from the range of fixed values: **101; 102; 103; 104; 105; 106; 107; 108** (by default – **101**).  
Note — You can also change the DUT-E network address using Service S6 DUT-E (Android) application (see the settings of **Self-diagnostics FM** submenu (see [D.1](#))).
- 3) From the dropdown list **CAN Baudrate** ([SPN 521531](#)) select Baudrate for CAN j1939/S6 interface from the range of fixed values: **100; 125; 250; 500; 1000 kbit/s** (by default – **250 kbit/s**).
- 4) From the dropdown list **CAN Mode\*** select the required mode of data reception in CAN j1939/S6 interface:
  - **Active (CAN Requests Enable)** — DUT-E GSM generates active requests to Units connected by means of S6 Technology. The active requests are needed to receive [PGN](#) which, by default, are missing in the bus, but are provided upon request.  
Note — You should bear in mind that in case of connecting DUT-E GSM with CAN j1939/S6 interface to a standard [Vehicle](#) CAN-bus, active requests may cause failures of the Vehicle onboard equipment operation.
  - **Passive (CAN Requests Disable)** — DUT-E GSM does not generate active requests to Units connected with S6 Technology. In this mode DUT-E GSM is identified by its network address by other Units and receives data from them in the automatic mode.
  - **Silent (Sniffer)** — DUT-E GSM is not identified by its network address by other Units. The data are received in the sniffer mode.
- 5) From the dropdown list **Enable Termination Resistor** ([SPN 521533](#)) select ON or OFF (OFF by default) of the inbuilt terminal resistor (120 Ohm) between the contacts CAN LOW and CAN HIGH interface cable of DUT-E GSM. Mounting a terminal resistor **is the obligatory condition** for correct data transfer via CAN 2.0B communication line (SAE j1939), in case of using a signal cable that has no terminal resistors at its ends (e.g. S6 SC-Mol cable).

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\* This setting is not provided for in Service S6 DUT-E (Android) application.



a) in Service S6 DUT-E software



b) in Service S6 DUT-E (Android) app

Figure 40 — Configuration of the sensor connection parameters via CAN j1939/S6 interface

## 2.12 Summation of data

For summarization of indications, [DUT-E GSM](#) can operate using [S6 Technology](#) together with other models of fuel level sensors that have CAN j1939/S6 interface ([DUT-E 2Bio CAN](#) and (or) [DUT-E CAN](#)). The maximum number of sensors connected to DUT-E GSM — 7 pcs. in any combination of their types. Each of the sensors connected by means of S6 Technology needs to be assigned a unique network address within the range from 101 to 108 (see [2.11](#)).

An example of a connection diagram by means of S6 Technology for DUT-E GSM and DUT-E CAN sensors for summarization of the fuel volume in several tanks, with specification of cables that need to be ordered is provided in [annex G](#) (more examples of connection diagrams see in the [Operation manual for CAN j1939/S6 Telematics interface](#)).



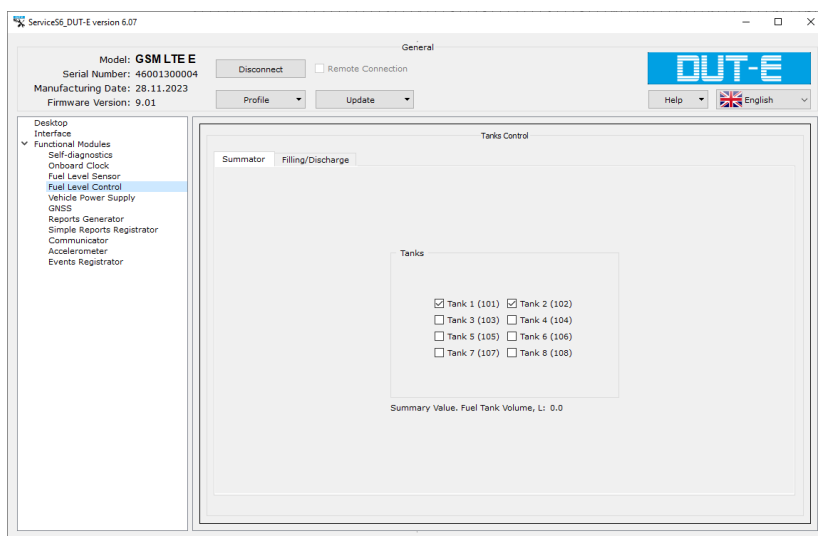
**IMPORTANT:** It is necessary to save calibration table of the corresponding fuel tank in the internal memory of each of the sensor in advance.

The summarization of values of fuel volume in tanks is set using Service S6 DUT-E software or Service S6 DUT-E (Android) application (**Fuel Level Control FM** submenu, **Summator** tab (see [D.4](#))) (see figure 41).

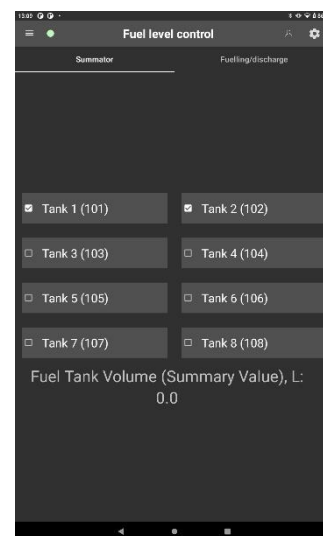
While using Service S6 DUT-E software, connect the sensor to the PC using S6 SK service adapter (see [2.3.1](#)) and establish a communication session between DUT-E GSM and PC (see [2.3.3](#)).

In case of wireless sensor setting using Service S6 DUT-E (Android) application, connect DUT-E GSM to the Android device using S6 BT Adapter (see [2.4.1](#)). Establish the sensor connection with the Android device sensor via the Bluetooth channel (see [2.4.3](#)).

In settings of the sensor which will provide the summerizing signal (Master sensor) you need to tick fields of all sensors whose indications you need to summarize (Slave sensors). After saving the Master sensor profile, the current summary fuel volume value in the selected tanks will be displayed in the **Summary Value. Fuel Tank Volume, L** line.



a) in Service S6 DUT-E software



b) in Service S6 DUT-E (Android) app

Figure 41 — Configuration of the fuel volume summation in several tanks

## 2.13 Automatic identification of "Fuelling"/"Fuel discharge" Events

In [DUT-E GSM](#) sensor with the firmware version from 6.12 and higher the **adjustable feature of automatic identification of "Fuelling"/"Fuel discharge" Events** is implemented. The sensor configuration so as to identify the above Events is possible only using Service S6 DUT-E software (versions from 5.4 and higher) or Service S6 DUT-E (Android) mobile application (versions from 2.26 and higher) (**Fuel Level Control FM** submenu, **Fuelling/Discharge** tab (see [D.4](#))) (see figure 42).

**IMPORTANT:** You need to perform the **preliminary operations:**

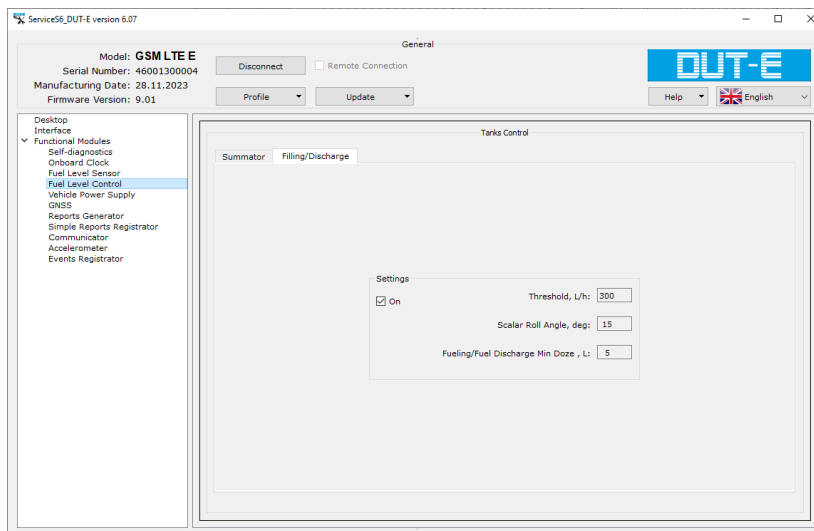
**1)** Mount DUT-E GSM in a particular fuel tank for which you'll have to determine the Events of fuel discharge and fuelling further on.

**2)** Record the calibration table of the respective fuel tank into internal memory of DUT-E GSM.

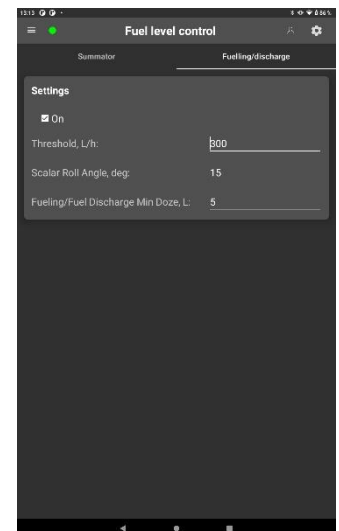


**3)** Conduct the calibration procedure of the inbuilt accelerometer of DUT-E GSM (**Accelerometer FM** submenu (see [D.10](#))). The following conditions should be met for its correct execution:

- The Vehicle to be equipped should be unloaded and must stand on a flat horizontal site with its engine stopped.
- The Vehicle wheels must be of a standard type and size;
- The pressure in the tires must correspond to the value established for this Vehicle.



a) in Service S6 DUT-E software



b) in Service S6 DUT-E (Android) app

Figure 42 — Configuration of DUT-E GSM for automatic identification of the Events "Fuelling"/"Fuel discharge"

The sequence of operations during the sensor configuration is as follows:

**1)** While using Service S6 DUT-E software, connect the sensor to the PC using S6 SK service adapter (see [2.3.1](#)) and establish a communication session between DUT-E GSM and PC (see [2.3.3](#)).

In case of wireless sensor setting using Service S6 DUT-E (Android) application, connect DUT-E GSM to the Android device using S6 BT Adapter (see [2.4.1](#)). Establish the sensor connection with the Android device sensor via the Bluetooth channel (see [2.4.3](#)).

**2)** Activate the feature of automatic identification of Fuelling/Fuel discharge. For this purpose, tick the field **On** ([SPN 521031](#)) in the **Settings** space (**Fuelling/Discharge** tab).

**3)** In **Settings** space set three threshold values of nominal parameters based on which DUT-E GSM will automatically identify Fuellings/Fuel discharges further on:

- **Threshold, l/h** ([SPN 521030](#)) — field to enter values of the maximum possible fuel consumption by the engine which is equipped.

The exceeding of this set value is the criterion to determine Fuel discharge.

- **Scalar Roll Angle, deg** ([SPN 521426](#)) — field to enter the maximum possible roll angle of the Vehicle which is being equipped, in specific conditions of operation. Fuellings/Fuel discharges will be identified only in conditions of roll angles less than the set value. For roll angles exceeding the set value, the identification of Fuellings/Fuel discharges will be ignored.

The non-exceeding of the set value of the roll angle is the criterion for identification of Fuelling/Fuel discharge.

- **Fuelling/Fuel Discharge Min Doze, l** ([SPN 521423](#)) — field to enter the minimum value of the fuel volume which is selected depending on the fuel tank volume of the Vehicle which is being equipped (e.g. for tanks of small volume the lower value of the minimum amount is specified).

The exceeding of this set value is the criterion to determine Fuelling/Fuel discharge.

Note — It should be noted that in case of selection of a too low value of the minimum dose, the shaking of fuel in the tank may be identified as a fake Fuelling/Fuel discharge Event, while selecting of a too high value of the minimum dose may result in a loss of data of Events.

#### **IMPORTANT:**

**1)** Threshold values of nominal parameters **are determined experimentally**, in the process of service of the Vehicle which is being equipped.

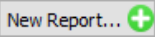



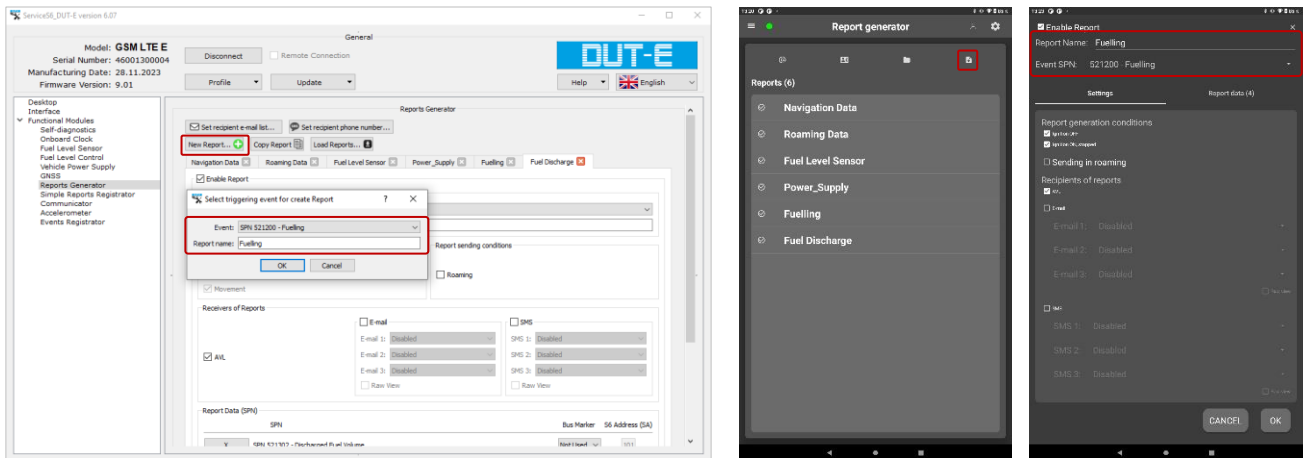
**2)** The sensor registers the "Fuelling"/"Fuel discharge" [Events](#) only in case all the three above-mentioned criteria are met.

**3)** During the summarization of indications of several sensors by means of [S6 Technology](#) automatic identification of "Fuelling"/"Fuel discharge" Events is conducted based on the total volume of fuel.

## 2.14 Creating and customizing Reports

The submenu of **Reports Generator FM\*** (see [D.7](#)) in Service S6 DUT-E software or in Service S6 DUT-E (Android) mobile application serves for work with [DUT-E GSM Onboard reports](#) and allows to create and configure **up to 20 pcs.** of different Reports.



To create a new Onboard report, press  button in the **Reports generator FM** submenu (when using the software) or  icon (when using the application). In the opening window select from the dropdown list the required [SPN](#) of the [Event](#) for which the Report has to be generated and enter the Report name (see figure 43).




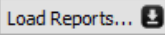

a) in Service S6 DUT-E software

b) in Service S6 DUT-E (Android) app



Figure 43 — Example of selecting the Event "Fuelling" for the Report generation

For quick creation of a Report based on an earlier created Report, select the required Report in **Reports generator FM** submenu and press  button (when using the software) or  icon (when using the application). Then, enter a new name for the copied Report into the appropriate field.

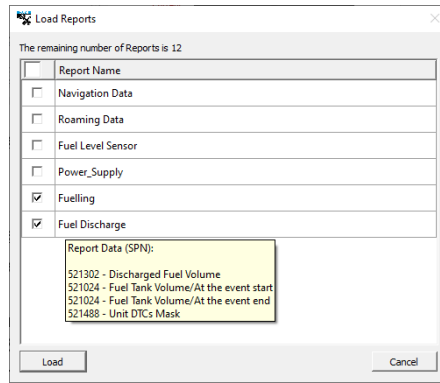
In case Service S6 DUT-E (Android) application is used, press the appropriate  icon for editing the Report's name or its settings (see figure 44 b).

In order to load Onboard reports from the earlier saved [Unit](#) profile, press  button in **Reports generator FM** submenu (when using the software) or  icon (when using the application) and select the required file (\*.prf) from the PC/Android device memory. In the opening window, tick the names of the Reports that need to be included.

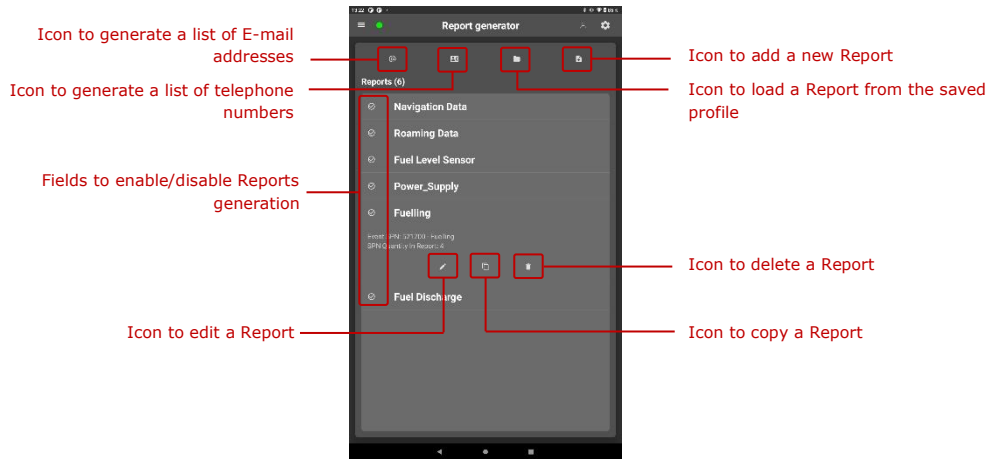
In case of using Service S6 DUT-E software, whenever a line in any of the Reports is highlighted, a prompt containing data ([SPN](#)) is displayed. Also, there is a prompt in the upper portion of the window telling how many Reports can be selected up to their maximum number (see figure 44 a).

Created Reports are displayed in **Reports generator FM** submenu in the form of tabs; each of them has identical settings for generating and sending a Report to the [Server](#). To delete a Report, there is  button (when using the software) (see figure 45 a) or  icon (when using the application) (see figure 44 b).

\* Methods of creating Reports in Service S6 DUT-E software and Service S6 DUT-E (Android) mobile application are identical.

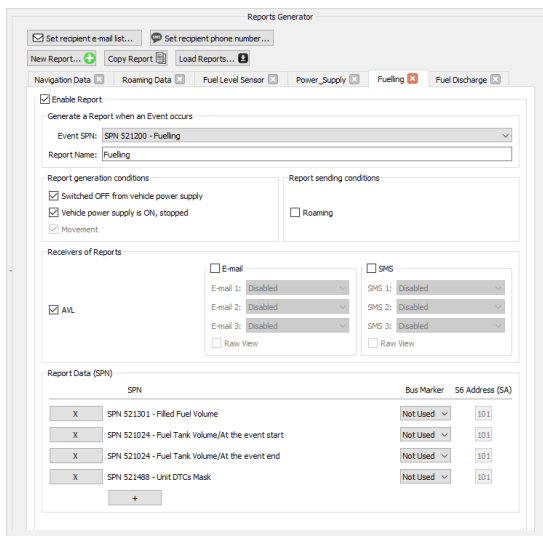


a) in Service S6 DUT-E software

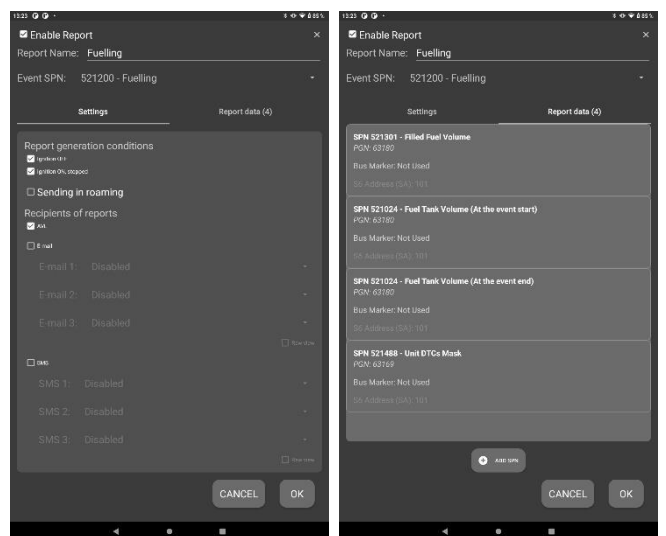


b) in Service S6 DUT-E (Android) app

Figure 44 — Examples of Reports loaded from the Unit profile



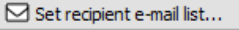

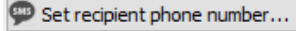

a) in Service S6 DUT-E software



b) in Service S6 DUT-E (Android) app



Figure 45 — Example of a tab with settings of the Report "Fuel discharge"

There are the following settings for [Reports](#):


- **Enable Report** ([SPN 521151](#)) field is used to enable or disable generation of selected Report;
- **Event SPN** ([SPN 521166](#)) drop-down list corresponding to [S6 Database](#). From this list, you can select the Event, which generates the Report when occurs;
- **Report Name** ([SPN 521250](#)) field, where you should enter name of the Report to identify it. Use letters of Latin alphabet only (to exclude conversion of encodings during sending Reports by e-mail or via SMS) when entering the name of Report.
- You may specify conditions for a Report generation in the appropriate fields, depending on the status of connection/disconnection to the onboard circuit, the Vehicle movement or on being in the roaming mode.
  - **Switched OFF from Vehicle power supply** ([SPN 521151/12.3](#));
  - **Vehicle power supply is ON, stopped** ([SPN 521151/12.4](#));
  - **Movement** — this setting is permanently ON;
  - **Roaming** ([SPN 521151/11.1](#)) — you may enable or disable sending the Report in the Roaming mode.
- In the appropriate fields, you may specify options for a Report sending:
  - in **AVL** field ([SPN 521154/25.0](#)) you may enable or disable the Report sending by means of GPRS;
  - **E-mail** — for sending [Report](#) by e-mail to selected addresses from pre-formed list of e-mail addresses of recipients.  button serves to generate the list of E-mail addresses (when using the software) or  icon (when using the application). A list can contain no more than three e-mail addresses of recipients. Each address must contain no more than 64 characters.
  - **SMS** - for sending Report as an SMS message to mobile phone numbers from the generated list of recipient numbers.  button serves to generate the list of telephone numbers (when using the software) or  icon (when using the application). The list can contain no more than three phone numbers of recipients, recorded in international format (maximum 13 digits).  
Note — In case any changes are made in lists of e-mail addresses or telephone numbers of Reports receivers, settings of Reports in which these receivers are specified will change automatically.




**RECOMMENDATION:** Do not choose to send by e-mail and/or via SMS the Reports, which are generated more than once per hour.

- In **Report Data (SPN)** area, you can select data, which will be used for Report generation (see figure 45). You can select up to 10 SPNs for one Report. In case you are using Service S6 DUT-E software,  button serves to add data, while  button against the respective SPN serves to delete data.

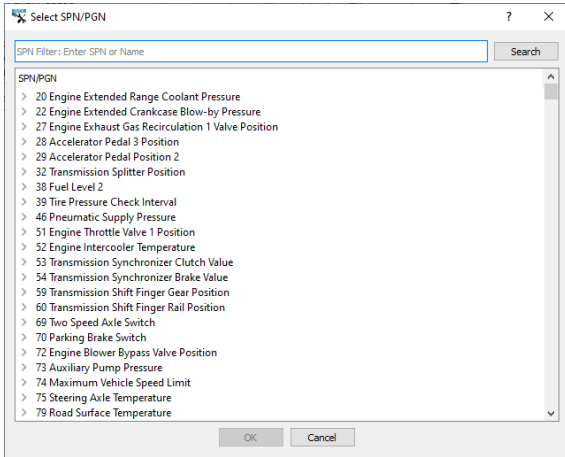
For each SPN, enter network address of [Unit](#) from which the SPN is received via [S6 Technology](#) and bus marker **S6**.

To add a specific SPN to Report, you can search it by number or name using search bar. Select [PGN](#) where the required [SPN](#) is contained and confirm the selection by pressing  button. For several SPNs which has the same ID number and are contained in one PGN, you can find a qualifier in a tooltip by hovering a cursor over the SPN (see figure 46 a).

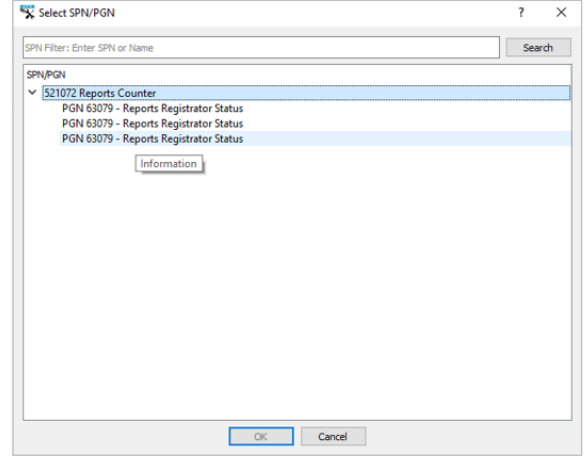
In case you are using Service S6 DUT-E (Android) application,  button serves to add data. To delete/make changes in the SPN, to select the bus marker and to specify the source Unit network address, the dropdown menu is used; it is appearing when you touch the respective SPN (see figure 46 b).



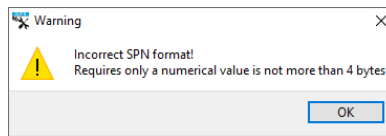
**WARNING:** For [DUT-E GSM](#) it is allowed to select only SPN with digital value no longer than 4 bytes that may be added to the Report. In case any SPN beyond these limitations is selected, the appropriate warning is displayed (see figure 46 a).



a list of SPNs in S6 Database

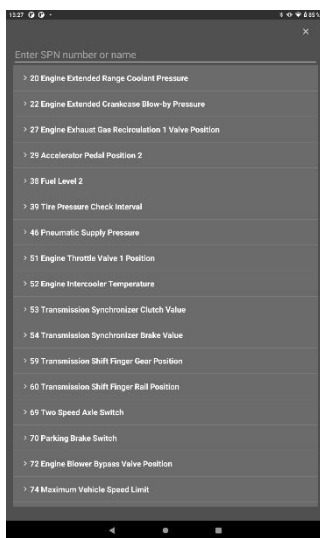


an example of displaying qualifier of SPNs with the same names

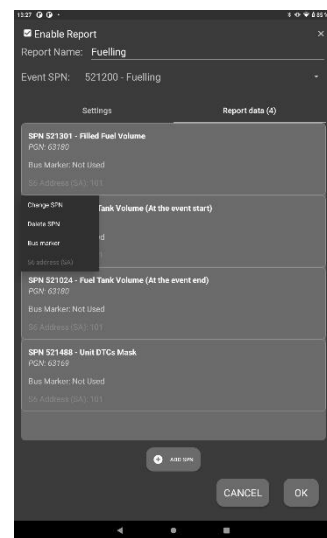


example of a message of wrong SPN format selected

a) in Service S6 DUT-E software



a list of SPNs in S6 Database



example of a dropdown menu of SPN

b) in Service S6 DUT-E (Android) app

Figure 46 – Adding data to the Report

## 2.15 Function test

To verify functioning it is required:

- 1) Register the [Vehicle](#) or fixed facility on which DUT-E GSM is mounted in [ORF 4](#) / [ORF 5](#) Telematics service (see the document [DUT-E GSM fuel level sensors. Quick Start Guide to configuration of connection to ORF server](#)).
- 2) Verify the correctness of data transfer to the [Server](#) (see figure 47).

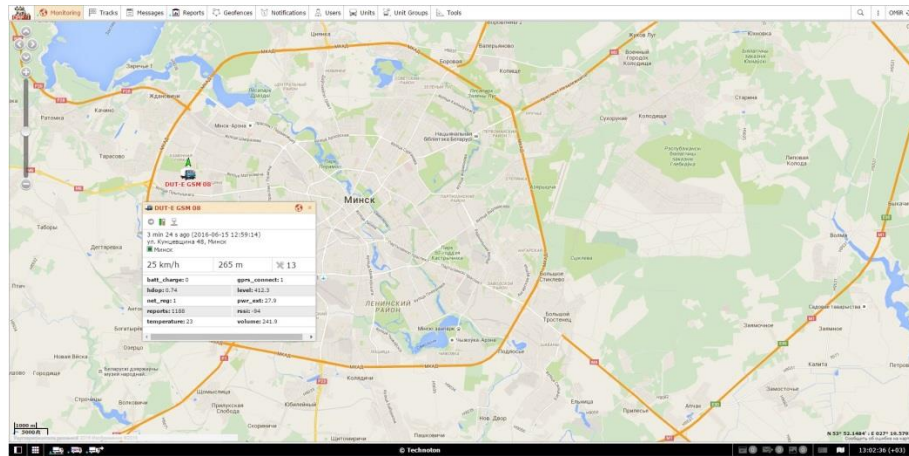


Figure 47 — Example of how the Vehicle (with DUT-E GSM installed) is displayed in ORF 4 monitoring service

## 3 Measurement accuracy check

### 3.1 Basic principles

[DUT-E GSM](#) 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 GSM 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.

## 3.2 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 GSM](#) 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.

## 4 Diagnostics and troubleshooting

[DUT-E GSM](#) operability is tested using Service S6 DUT-E software or Service S6 DUT-E (Android) application (see the **Self-diagnostics FM** submenu ([D.1](#))) by means of the sensor connection to the PC with a cable (see [2.3](#)) or, respectively, by means of the sensor wireless connection to the Android device via Bluetooth (see [2.4](#)).

In case of any malfunction first of all examine condition of [Vehicle](#) power supply system and power supply pins condition of the DUT-E GSM connector.

**WARNING:**



- 1)** Severe contact corrosion of chassis ground connection switch or its malfunction can seriously affect DUT-E GSM output signal.
- 2)** DUT-E GSM readings will be invalid if the measuring tubes are closed by conducting mud or water.

## 5 Maintenance

### 5.1 General instructions

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



**IMPORTANT:** It is recommended to check sensor's calibration for minimum and maximum fuel levels in the tank (provided that the tank has not lost its shape and was not replaced). In case of incorrect readings, recalibrate the sensor according to [2.8](#). Re-calibration of the fuel tank of Vehicle in this case is not required.

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

## 5.2 Demounting

Clean the tank surface nearby the mounting location before [DUT-E GSM](#) demounting.

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

Cut the sealing cord carefully, with no damage to connection cable.

Disconnect DUT-E GSM cable connector.

Unfasten DUT-E GSM 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)** To avoid any cable/PCB damage do not pull the interface cable when demounting DUT-E GSM.
- 2)** Screen-filter dismantling should be done carefully to avoid breaking latches of fixator.
- 3)** In case of repeated installation of DUT-E GSM – replace the old rubber gasket with a new one.

## 5.3 Examination

Since [DUT-E GSM](#) is demounted conduct a visual examination to detect the following defects:

- visible damages of the sensor head body, measuring probe, interface cable, cable;
- 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](#) (see [5.1](#)) or [Manufacturer](#) if the defects detected.

## 5.4 Cleaning

During [DUT-E GSM](#) 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 GSM normal operation. Examine the space between the tubes 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 GSM head body, interface cable and its connector when washing the tubes.

## 6 Packaging

[DUT-E GSM](#) delivery sets come in cardboard boxes of the following shape (see figure 48).



Figure 48 — DUT-E GSM packaging

Label sticker with information on the product name, certificates, serial number, firmware version, manufacture date, implemented technologies, certificates, weight as well as Quality Control seal and QR code is stuck on two sides of the DUT-E GSM box (see figure 49).

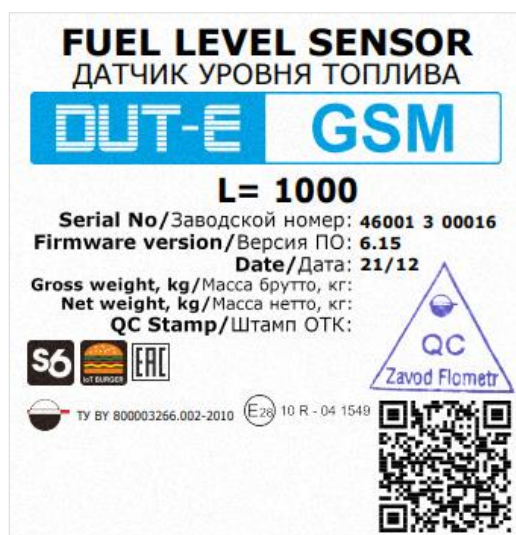


Figure 49 — DUT-E GSM packaging label

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

## 7 Storage

[DUT-E GSM](#) is recommended to be stored in dry enclosed areas.

DUT-E GSM storage is allowed only in original packaging at temperature range from -50 to +40 °C and relative humidity up to 100 % at 25 °C.

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

DUT-E GSM shelf life must not exceed 24 months.

## 8 Transportation

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

When transporting by air, DUT-E GSM 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 GSM sensors should be sealed.

## 9 Utilization/re-cycling

[DUT-E GSM](#) does not contain harmful substances and ingredients that are dangerous to human health and environment during and after the end of life and recycling.

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

## Contacts

### Distribution, technical support and service



[sales@jv-technoton.com](mailto:sales@jv-technoton.com)

[support@jv-technoton.com](mailto:support@jv-technoton.com)



## Annex A

### Template of check test report

#### Report

Date: \_\_\_\_\_

DUT-E GSM model and serial number	
Vehicle type, model, registration number	
Tracking/displaying device model and serial number	

<b>Drainage volume</b>	According to calibrated container $V_M$ , liters	
	According to tracking device $V_{\text{track}}$ , liters	
<b>Accuracy error</b>	Absolute error $\Delta = V_{\text{track}} - V_M$ , liters	
	Normalized to total tank volume $\delta = \frac{V_{\text{track}} - V_M}{V_{\text{total\_volume}}} \cdot 100\%$	

<b>Refueling volume</b>	According to calibrated container $V_M$ , liters	
	According to tracking device $V_{\text{track}}$ , liters	
<b>Accuracy error</b>	Absolute error $\Delta = V_{\text{track}} - V_M$ , liters	
	Normalized to total tank volume $\delta = \frac{V_{\text{track}} - V_M}{V_{\text{total\_volume}}} \cdot 100\%$	

#### Resume:

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

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

Comments: \_\_\_\_\_

representative of the CUSTOMER: \_\_\_\_\_/\_\_\_\_\_

representative of the CONTRACTOR: \_\_\_\_\_/\_\_\_\_\_

## Annex B

### List and contents of DUT-E GSM On-board reports

- 1) Packet of loin for authorization: **#L#protocol\_version;id;password;crc16\r\n**

Field name	Transmitted data
protocol_version	Wialon protocol version. Field should contain the value 2.0
id	Unique sensor ID with serial number
password	Unit password
crc16	Control sum
;	Separator

- 2) On-board report:

**#D#date;time;lat1;lat2;lon1;lon2;speed;course;height;sats;hdop;inputs;outputs;adc;ibutton;params;crc16\r\n**

Field name	Transmitted data
<b>date</b>	<a href="#">SPN 962</a> , <a href="#">SPN 963</a> , <a href="#">SPN 964</a> Date in format DDMMYY, in UTC, if nothing, NA is transmitted.
<b>time</b>	<a href="#">SPN 959</a> , <a href="#">SPN 960</a> , <a href="#">SPN 961</a> Time in format HHMMSS, in UTC, if nothing, NA is transmitted.
<b>lat1, lat2</b>	<a href="#">SPN 584</a> Latitude (5544.6025;N), if nothing, NA is transmitted; NA.
<b>lon1, lon2</b>	<a href="#">SPN 585</a> Longitude (03739.6834;E), if nothing, NA is transmitted.
<b>speed</b>	<a href="#">SPN 517</a> Speed, integer, km/h, if nothing, NA is transmitted.
<b>course</b>	<a href="#">SPN 165</a> Course, integer, degrees, if nothing, NA is transmitted.
<b>height</b>	<a href="#">SPN 580</a> Height, integer, in meters, if nothing, NA is transmitted.
<b>sats</b>	<a href="#">SPN 521128</a> The number of satellites, integer, if nothing, NA is transmitted.
<b>hdop</b>	<a href="#">SPN 521090</a> Reduced precision, fractional number, if nothing, NA is transmitted.
<b>inputs</b>	NA
<b>outputs</b>	NA
<b>adc</b>	NA
<b>ibutton</b>	NA
<b>params</b>	The field contains the transmitted data in accordance with <a href="#">S6 Database</a> . Data is presented in the form X:Y:Z, where X is the parameter number ( <a href="#">SPN</a> ) and SA; Y is the data type; Z is the parameter value.

## Annex C

# SMS commands for DUT-E GSM remote configuration

Format of SMS-commands: **++PVX;Y;Z;V;DDD...DDDD/++**

Table C.1 — Fields SMS-commands

Field SMS-commands	Purpose	Notes
<b>++</b>	Beginning of the command.	—
<b>PV</b>	Version of SMS format structure.	One symbol (meaning of symbol — B).
<b>X</b>	Password of sensor.	Numbers, not less than 4.
<b>Y</b>	SA sensor identification.	Numbers, not less than 4.
<b>Z</b>	Command.	Symbols (0,1,2...Z), not less than 4.
<b>V</b>	Time to execute the command.	Minutes, not less than 4.
<b>DDD...DDDD</b>	Field of the command.	Text or number, max 50 symbols.
<b>/++</b>	End of the command.	—
Notes 1 All symbols — Latin. 2 All numbers — decimal of symbol format. 3 Separator — semicolon ( <b>;</b> ). 4 Command for set up (entry) of field configuration begins from letter <b>S</b> . 5 Command for reading field of configuration begins from letter <b>R</b> .		

Table C.2 — List of SMS-commands

Command	Purpose	Field of the command (DDD...DDDD)	Notes
<b>LDFW</b>	Load firmware.	see <a href="#">table C.3</a>	—
<b>RDID</b>	Get serial number and firmware version.	—	Returns serial number of sensors and its firmware version. Example command: ++B1111;101;RDID;5;/++
<b>RAPN</b>	Get configurations of connection to mobile operator.	—	Example command: ++B1111;101;RAPN;5;/++ Example of sensor response: DUT-E GSM S/N:123456789 APN=internet Login=123 Pass=123
<b>SAPN</b>	Save configurations of connection to mobile operator.	APN access point, login, password.	Example command: ++B1111;101;SAPN;5;internet;123;123;/++ Command value consists of the name of the access point (APN) of mobile operator, login and password for connection
<b>RAVL</b>	Get AVL server configurations.	—	Example of sensor response: DUT-E GSM S/N:123456789 IP=orf-monitor4.com Port=1234 IP_prefix=DUT-E-GSM Password=1234
<b>SAVL</b>	Save AVL server configurations.	IP address/domain, port, user ID, password.	Example command: ++B1111;101;SAVL;5;orf-monitor4.com;20332;;;/++ Parameters in command field may be missing, in this case the current settings are used. Port - no more than 5 digits, ID - no more than 13 symbols, Password - no more than 16 symbols
<b>RLOC</b>	Return serial number and coordinates of sensor: latitude and longitude, hyperlink to googlemaps.	—	The command returns serial number and coordinates of sensor: latitude and longitude, hyperlink to googlemaps Example of sensor response: DUT-E GSM S/N:123456789 Lat:53.860008 Lon:27.686987 Link on map: <a href="http://maps.google.com/?q=53.860008,27.686987">http://maps.google.com/?q=53.860008,27.686987</a>

Command	Purpose	Field of the command (DDD...DDDD)	Notes
<b>RSTM</b>	Restart modem.	—	Example command: ++B1111;101;RSTM;5;/++
<b>CSRV</b>	Remote connection and control of the sensor via service software.	IP address, port of PC, where service software is running, and Internet connection is established.	Example command: ++B1111;101;CSRV;5; 127.0.0.1;1234/++

Table C.3 — Fields of SMS-command **LDFW**

Required fields		Examples
<file_name>	File name and letter case should be the same as on the server.	dut_e_fw_1_0.blf3
<ftp_pass>	Password for access to ftp-server.	1234
Optional fields		Examples
<ftp_addr>	Ftp-server address.	ns1.orf-monitor.com
<ftp_port>	Port for connection to ftp-server.	21
<ftp_connection_mode>	Connection mode 0 – active; 1 – passive.	1
<ftp_login>	Login for access to ftp-server.	anonymous
<p>Notes</p> <p>1 For firmware files, create a folder named “firmware” in the root directory of the server.</p> <p>2 If you need to specify any of the optional fields, all the preceding fields must also be specified. Missing fields are automatically filled with the corresponding settings saved in the sensor.</p> <p>Example command: ++B1111;101;LDFW;5;file.blf3;PSW/++ (file.blf3 – Firmware file, PSW – password for access to ftp-server).</p>		

## Annex D

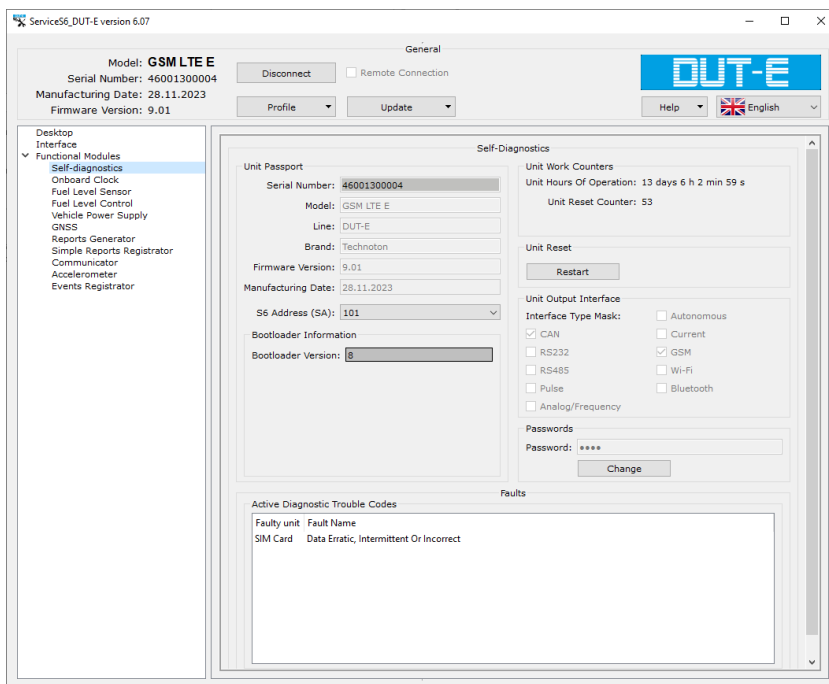
# SPN of DUT-E GSM Functional modules

The reception of data on the fuel level and volume, on the [Vehicle](#) location, the maintenance of [Counters](#), the registration of [Events](#), the configuration of [Parameters](#) and self-diagnostics, their processing and transmission to the [Server](#) are ensured by the well-concerted operation of [Functional modules](#) (FM) of DUT-E GSM.

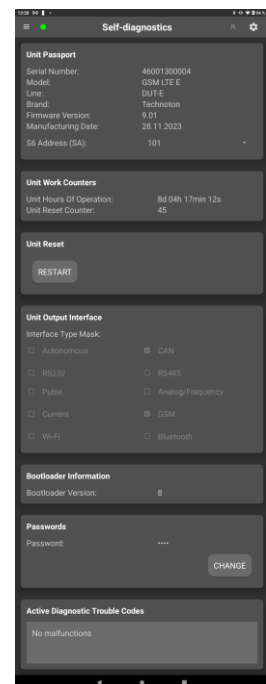
The format of parameters ([SPN](#)) of FM DUT-E GSM corresponds to [S6 Database](#) (DB).

### D.1 Self-diagnostics FM

[Self-diagnostics FM](#) — is designed for user authorization, identification of [DUT-E GSM](#) passport data, accounting of the operation period and active malfunctions, as well as for the [Unit](#) reset by using software.



a) in Service S6 DUT-E software



b) in Service S6 DUT-E (Android) app

Figure D.1 — Example of the window of settings of Self-diagnostics FM

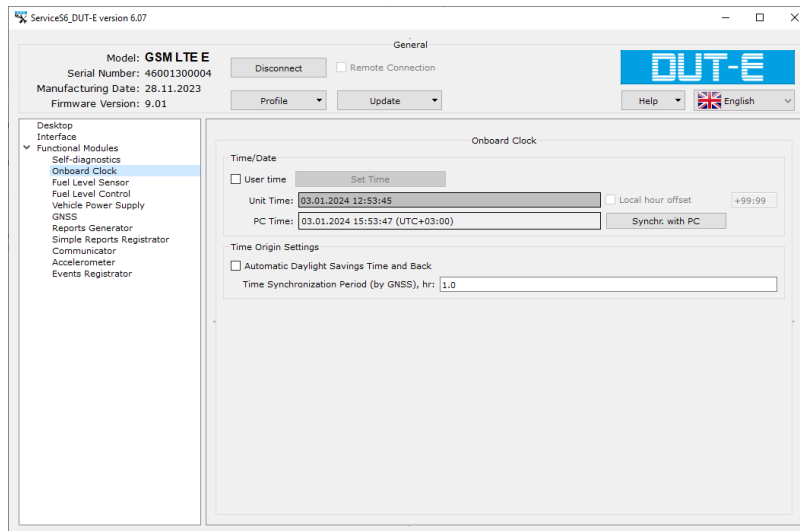
Table D.1 – Self-diagnostics FM. Displayed and/or editable SPN with the help of Service S6 DUT-E software or Service S6 DUT-E (Android) app

SPN	Name	Factory value	Unit of measure	Clarification
Unit passport <a href="#">PGN 62995</a>				
<a href="#">521120</a>	Serial number	On the fact	No	Serial number is a set of numbers that is used for identification of specific sensor. Serial number DUT-E GSM has the following format: AABBB C DDDDD, where: AA – code of DUT-E GSM model; BBB – digits that reflect changes product changes; C – Manufacturer code; DDDDD – sequential number. Setting is not available for editing.
<a href="#">521345</a>	Model	On the fact	No	Model – this is version of the sensor inside of DUT-E product line. Each model has its own functional and constructive features. Particularity of DUT-E GSM – transfer of <a href="#">Onboard reports</a> according to GSM standard by the sensor itself, without the use of additional devices. Setting is not available for editing.
<a href="#">521123</a>	Line	DUT-E	No	Name of the product line. The line represents a group of similar products – fuel level sensors produced under general trademark <a href="#">DUT-E</a> . Setting is not available for editing.
<a href="#">521344</a>	Mark	TECHNOTON	No	Name of sensor Manufacturer. Setting is not available for editing.
<a href="#">521121</a>	Firmware Version	On the fact	No	Version of built in Software DUT-E GSM. Setting is not available for editing.
<a href="#">521125</a>	Date Of Production	On the fact	No	Date (day, month, year) of sensor production. Setting is not available for editing.
<a href="#">521188</a>	Address at S6 (SA) Bus	101	No	Network address sensor which is connected via <a href="#">S6 Technology</a> . Network address value can be selected by user in range: 101...108.
Unit Work Counters <a href="#">PGN 62994</a>				
<a href="#">521116</a>	Unit Hours Of Operation	On the fact	s	Counter of summarized working time of the sensor since its production moment. The user cannot reset the value of this counter. It can be reset by the <a href="#">Manufacturer</a> or <a href="#">RSC</a> only.
<a href="#">521118</a>	Number Of Unit Restarts	On the fact	No	Counter of sensor'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 sensor. The user cannot reset the value of this counter. It can be reset by the Manufacturer or RSC only.
Passwords <a href="#">PGN 63017</a>				
<a href="#">521593/3.3</a>	Password/ 3.3 Installer	1111	No	Password is entered for user authorization while establishing connection session between DUT-E GSM and service Software for configuring the sensor. Password is a specific combination of four digits. By default, used: Login – 0, password – 1111. User can change password of the sensor. After entering and confirming the new password is recorded into internal memory of the sensor.

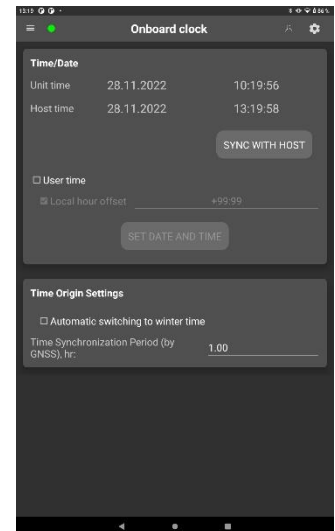
SPN	Name	Factory value	Unit of measure	Clarification
Active diagnostic trouble codes <a href="#">PGN 65226</a>				
<a href="#">521044</a>	Fault identifier (SID+FMI)	On the fact	No	List of current sensor malfunctions are displayed at the settings field (in case of its presence — up to 10). For each active malfunction is indicated following: - faulty nod; - malfunction name. This setting allows to monitor DUT-E GSM working performance. In case of lack of active malfunctions, the following message is displayed "No malfunctions".
Unit Reset <a href="#">PGN 63206</a>				
<a href="#">521272</a>	Reset Enable	No	No	Button for <a href="#">Unit</a> restart (reset) using software, i.e restart without disconnection from external power source.
Bootloader information <a href="#">PGN 63009</a>				
<a href="#">521122</a>	Bootloader Version	On the fact	No	Displays the current version of the loader used for correct starting the inbuilt Unit software (firmware), as well as for the Unit firmware update.

## D.2 Onboard clock FM

[Onboard Clock FM](#) — designed for generation of signals of time and its transmission to other Functional modules [DUT-E GSM](#).



a) in Service S6 DUT-E software



b) in Service S6 DUT-E (Android) app

Figure D.2 — Example of the window of settings of Onboard clock FM

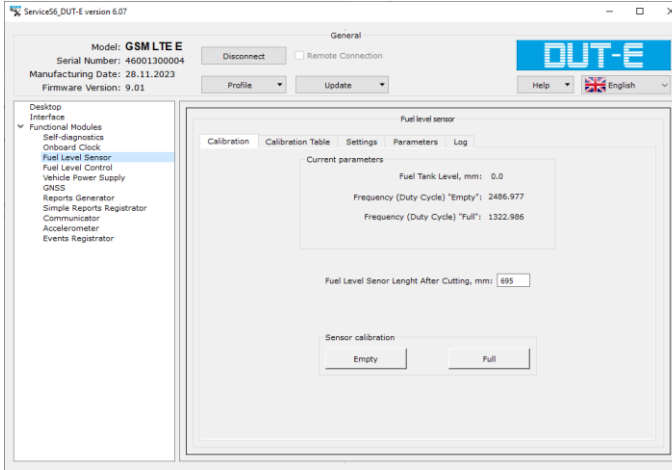
Table D.2 — Onboard clock FM. Displayed and/or editable SPN with the help of Service S6 DUT-E software or Service S6 DUT-E (Android) app

SPN	Name	Factory value	Unit of measure	Range	Clarification
Time/Date <a href="#">PGN 65254</a>					
<a href="#">959</a>	Seconds	On the fact	s	0...62.5	Present time — seconds*.
<a href="#">960</a>	Minutes	On the fact	Min	0...250	Present time — minutes*.
<a href="#">961</a>	Hours	On the fact	h	0...250	Present time — hours*.
<a href="#">963</a>	Month	On the fact	month	0...250	Present date — month*.
<a href="#">962</a>	Day	On the fact	d	0...62.5	Present date — day*.
<a href="#">964</a>	Year	On the fact	year	1985...2235	Present date — year*.
<a href="#">1601</a>	Local minute offset	0	min	0...59	Time displacement (in minutes) in relation to Coordinated Universal Time that matches with local time (Time zone). Enabled and accessible for editing, in case the current time is set manually and is synchronized with the PC or with the Android device.
<a href="#">1602</a>	Local hour offset	+3	h	-24...+24	Time displacement (in hours) in relation to Coordinated Universal Time that matches with local time (Time zone). Enabled and accessible for editing, in case the current time is set manually and in case it is synchronized with the PC or the Android device.
Time Origin Settings <a href="#">PGN 63011</a>					
<a href="#">521350</a>	Automatic Daylight Savings Time and Back	Off	No	On/Off	Enabling/disabling of automatic present time switching to winter/summer.
<a href="#">521353</a>	Time Synchronization Period (by GNSS)	1.0	h	0...210554000	Time interval value (in hours), after which there is an automatic present time adjustment performed according to <a href="#">GNSS</a> signals. This setting is available for editing by user. Automatic time adjustment with GNSS signals is not carried out when the value is 0 h.
* By default, time is set in UTC format (Coordinated Universal Time standard) and displayed according to local displacement. Used during <a href="#">Events</a> registration. The current time is accessible for the user for editing manually or by means of synchronization of date/time with the PC or Android device clock.					

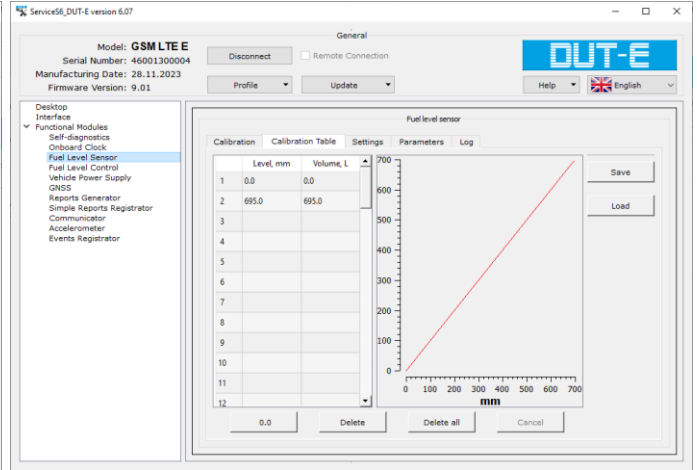
## D.3 Fuel level sensor FM

**Fuel Level Sensor FM** – designed for:

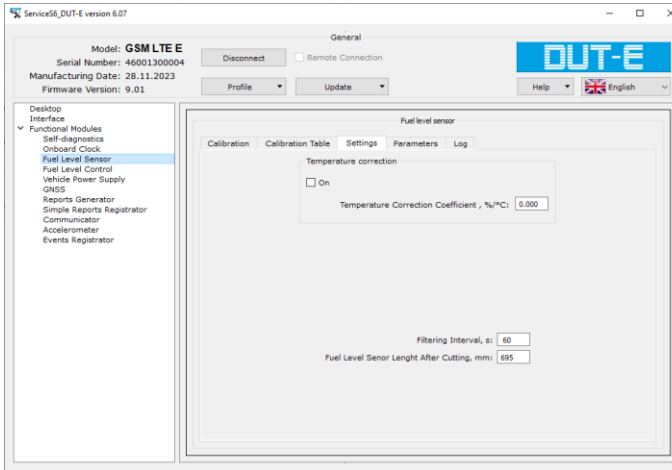
- measuring of present values of level, volume and temperature of fuel inside of **Vehicle**'s fuel tank;
- sensor calibration;
- creating calibration table of the fuel tank;
- filtering and temperature compensating of measuring results.



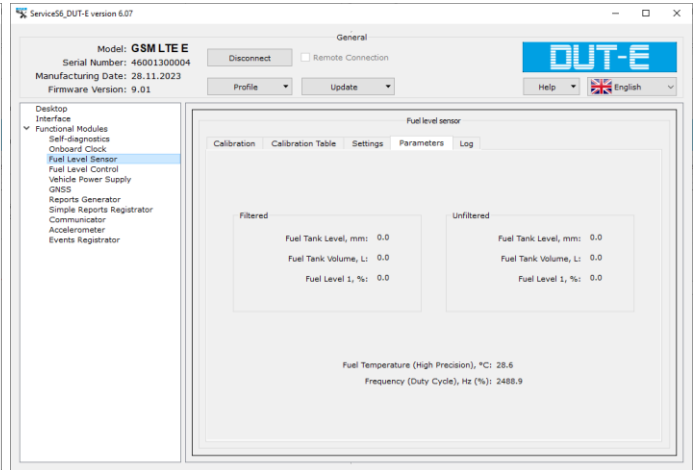
**Calibration tab**



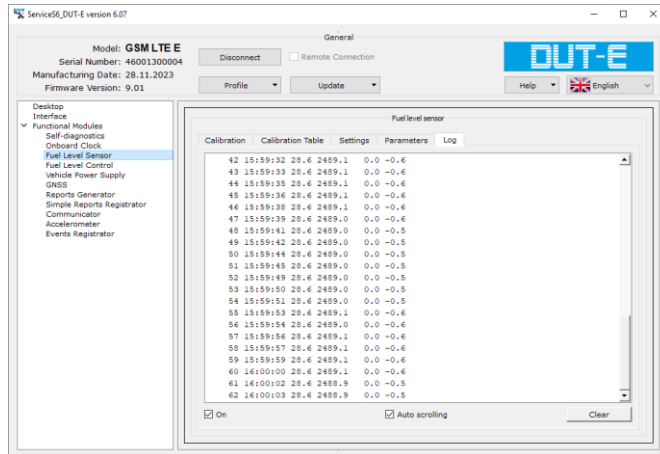
**Calibration Table tab**



**Settings tab**

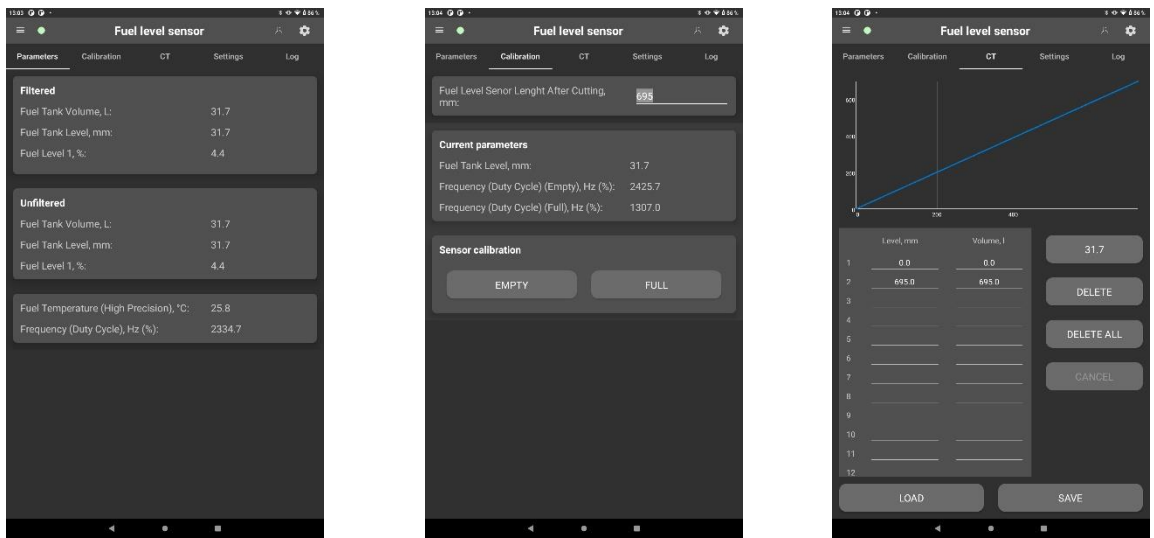


**Parameters tab**



**Log tab**

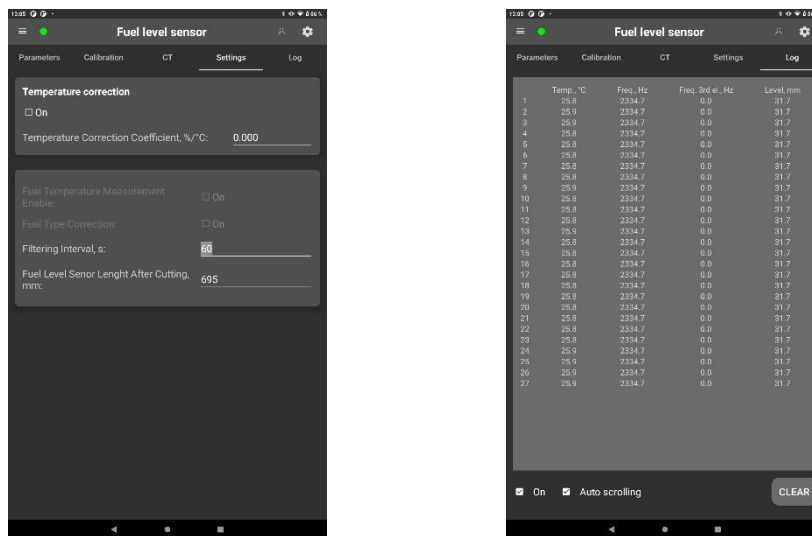
a) in Service S6 DUT-E software



**Parameters tab**

**Calibration tab**

**CT tab**



**Settings tab**

**Log tab**

b) in Service S6 DUT-E (Android) app

Figure D.3 — Example of the window of settings of Fuel level sensor FM

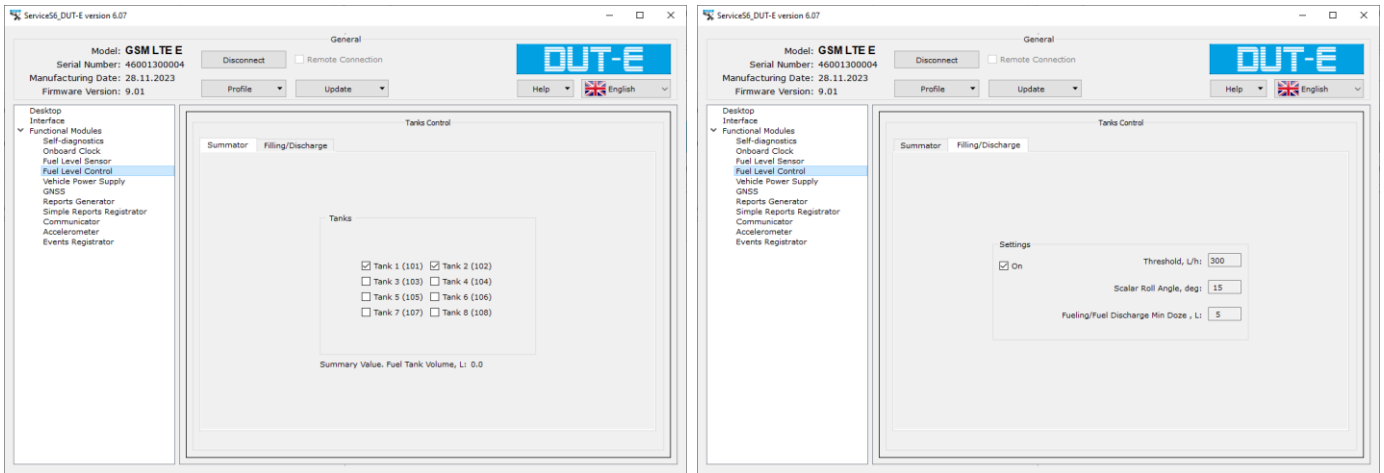
Table D.3 — Fuel level sensor FM. Displayed and/or editable SPN with the help of Service S6 DUT-E software or Service S6 DUT-E (Android) app

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

SPN	Name	Factory value	Unit of measure	Range	Clarification
Calibration Table. Fuel Tank 1 <a href="#">PGN 63036</a>					
<a href="#">521355</a>	Array Elements Count	2	pcs.	1...60	Number of points of calibration table, created during the fuel tank normalization process. The maximum possible number of calibration points – 60 pcs. Recommended number of calibration points – no less than 15 pcs.
<a href="#">521023</a>	Fuel Tank Level	On the fact	mm	0...6425.5	Values of fuel level in the tank corresponding with points of calibration table.
<a href="#">521024</a>	Fuel Tank Volume	On the fact	l	0...6425.5	Values of fuel volume of the tank corresponding with points of calibration table.
Filtered Fuel Level/Volume in Tank <a href="#">PGN 62982</a>					
<a href="#">521023/2.10</a>	Fuel Tank Level/ 2.10 Filtering	On the fact	mm	0...6425.5	Displays the value of the fuel level in Vehicle tank filtered according to the preset time interval.
<a href="#">521024/2.10</a>	Fuel Tank Volume/ 2.10 Filtering	On the fact	l	0...6425.5	Displays the value of the fuel volume in <a href="#">Vehicle</a> tank filtered according to the preset time interval.
<a href="#">174</a>	Engine Fuel Temperature 1	On the fact	°C	-40...210	This setting displays present value of fuel temperature in the vehicle's tank.
Dash Display <a href="#">PGN 65276</a>					
<a href="#">96</a>	Fuel Level 1	On the fact	%	0...100	This setting displays value (in %) of present fuel level in the tank in relation to the level of full vehicle's tank.
FM Fuel Level Sensor Settings <a href="#">PGN 63029</a>					
<a href="#">521433</a>	Temperature Correction Coefficient	0	%/°C	-32...32	Field for entering temperature correction coefficient that provides temperature compensation of fuel expansion/compression inside of vehicle's fuel tank.
<a href="#">521444</a>	Filtering Interval	60	s	0...64255	Field for entering time interval value during which DUT-E GSM calculates smoothed fuel level of vehicle's fuel tank before transmitting out coming data to the <a href="#">Server</a> .
<a href="#">521093</a>	Fuel Level Sensor Length After Cutting	On the fact	mm	0...64255	Field for entering of sensor's measuring length for what calibration table has been made before installation into the vehicle's fuel tank.
<a href="#">521311</a>	Temperature Correction Enable	Off	No	On/Off	Field for activation/ deactivation of temperature correction function that provides compensation of fuel expansion/compression inside of the vehicle's fuel tank.
Pulse-width Modulation Duty Cycle <a href="#">PGN 63489</a>					
<a href="#">521442</a>	Fuel Temperature (High Precision)	On the fact	°C	-273...1734.97	This setting displays present value measured with high precision temperature of fuel inside of vehicle's tank.
■ — Essential settings, required for DUT-E GSM performance.					

## D.4 Fuel level control FM

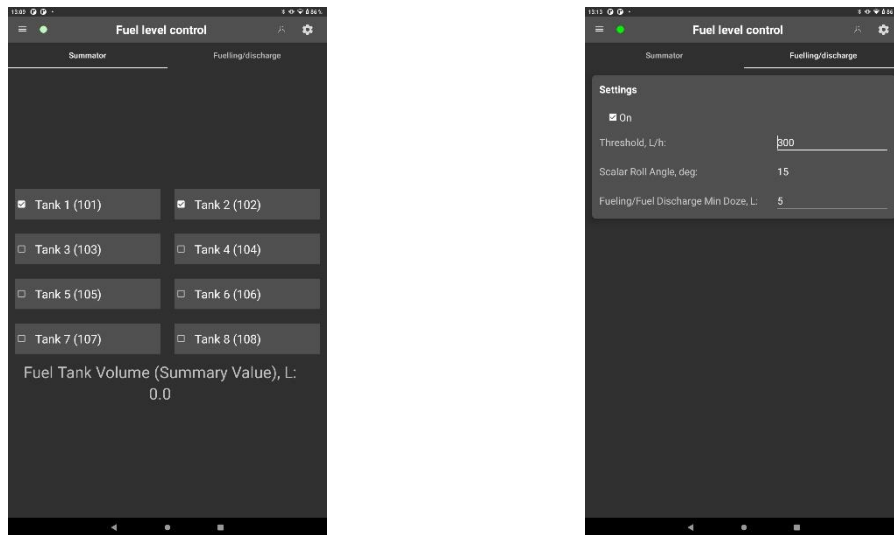
**Fuel Level Control FM** — is designed to receive data on measured total fuel volume in two or more tanks of the Vehicle via [CAN j1939/S6 interface](#); also for configuration and automatic identification of “Fuelling” / “Fuel discharge” [Events](#).



**Summator tab**

**Filling/Discharge tab**

a) in Service S6 DUT-E software



**Summator tab**

**Filling/Discharge tab**

b) in Service S6 DUT-E (Android) app

Figure D.4 — Example of the window of settings of Fuel level control FM

Table D.4 — Fuel level control FM. Displayed and/or editable SPN with the help of Service S6 DUT-E software or Service S6 DUT-E (Android) app

SPN	Name	Factory value	Unit of measure	Range	Clarification
Total Fuel Volume In Tanks <a href="#">PGN 63152</a>					
<a href="#">521024/2.11</a>	Fuel Tank Volume/ 2.11 Summary Value	On the fact	l	0...6425.5	Displays the value of total fuel volume in tanks, selected for summation.
Summation Settings DUT <a href="#">PGN 63149</a>					
<a href="#">521259/27.0</a>	Fuel Level Sensor Summation Enable/ 27.0 DUT 1	Off	-	On/Off	A field for turning on / off summation of fuel volume measured by the fuel level sensor (network address 101), which is set in Tank 1 of the <a href="#">Vehicle</a> .
<a href="#">521259/27.1</a>	Fuel Level Sensor Summation Enable/ 27.1 DUT 2	Off	-	On/Off	A field for turning on / off summation of fuel volume measured by the fuel level sensor (network address 102), which is set in Tank 2 of the Vehicle.
<a href="#">521259/27.2</a>	Fuel Level Sensor Summation Enable/ 27.2 DUT 3	Off	-	On/Off	A field for turning on / off summation of fuel volume measured by the fuel level sensor (network address 103), which is set in Tank 3 of the Vehicle.
<a href="#">521259/27.3</a>	Fuel Level Sensor Summation Enable/ 27.3 DUT 4	Off	-	On/Off	A field for turning on / off summation of fuel volume measured by the fuel level sensor (network address 104), which is set in Tank 4 of the Vehicle.
<a href="#">521259/27.4</a>	Fuel Level Sensor Summation Enable/ 27.4 DUT 5	Off	-	On/Off	A field for turning on / off summation of fuel volume measured by the fuel level sensor (network address 105), which is set in Tank 5 of the Vehicle.
<a href="#">521259/27.5</a>	Fuel Level Sensor Summation Enable/ 27.5 DUT 6	Off	-	On/Off	A field for turning on / off summation of fuel volume measured by the fuel level sensor (network address 106), which is set in Tank 6 of the Vehicle.
<a href="#">521259/27.6</a>	Fuel Level Sensor Summation Enable/ 27.6 DUT 7	Off	-	On/Off	A field for turning on / off summation of fuel volume measured by the fuel level sensor (network address 107), which is set in Tank 7 of the Vehicle.
<a href="#">521259/27.7</a>	Fuel Level Sensor Summation Enable/ 27.7 DUT 8	Off	-	On/Off	A field for turning on / off summation of fuel volume measured by the fuel level sensor (network address 108), which is set in Tank 8 of the Vehicle.
Fuelling/Fuel Discharge* <a href="#">PGN 63268</a>					
<a href="#">521423</a>	Fuelling/ Fuel Discharge Min Doze	5	l	0...6425.5	Field to enter the minimum value of the fuel volume which is selected depending on the volume of the fuel tank of the Vehicle which is equipped (e.g. for tanks of small volume, a lower value of the minimal amount is specified). The exceeding of this set value is the criterion to determine Fuelling/Fuel discharge.
<a href="#">521426</a>	Scalar Roll Angle	15	degrees	0...360	Field to enter the maximum possible banking angle of the Vehicle is being equipped, in specific conditions of operation. Fuellings/Fuel discharges will be identified only in conditions of roll angles less than the set value. For roll angles exceeding the set value, the identification of Fuelings/Fuel discharges will be ignored. The non-exceeding of the set value of the roll angle is the criterion for identification of Fuelling/Fuel discharge.

SPN	Name	Factory value	Unit of measure	Range	Clarification
Fueling/Discharging Settings* <a href="#">PGN 63103</a>					
<a href="#">521031</a>	Fueling/ Discharging Detect	Off	-	On/Off	Field to enable/disable the feature of automatic identification of Fuellings/Fuel discharges.
<a href="#">521030</a>	Threshold	300	l/h	0...3212.75	Field to enter the maximum possible fuel consumption by the engine of the Vehicle which is equipped. The exceeding of this set value is the criterion to determine Fuel discharge.
* For DUT-E GSM with the firmware version from 6.12 and higher, (Service S6 DUT-E software, version 5.4 and higher) or for the mobile application Service S6 DUT-E (Android), version from 2.26 and higher.					

## D.5 Vehicle Power Supply FM

**Vehicle Power Supply FM** — is designed for monitoring: the availability of the onboard circuit and its voltage, current onboard circuit mode, time of **Vehicle** operation in different onboard circuit modes of operation, time of starter operation, allowed time for starter uninterrupted operation\*.

\* In preparation for introduction.

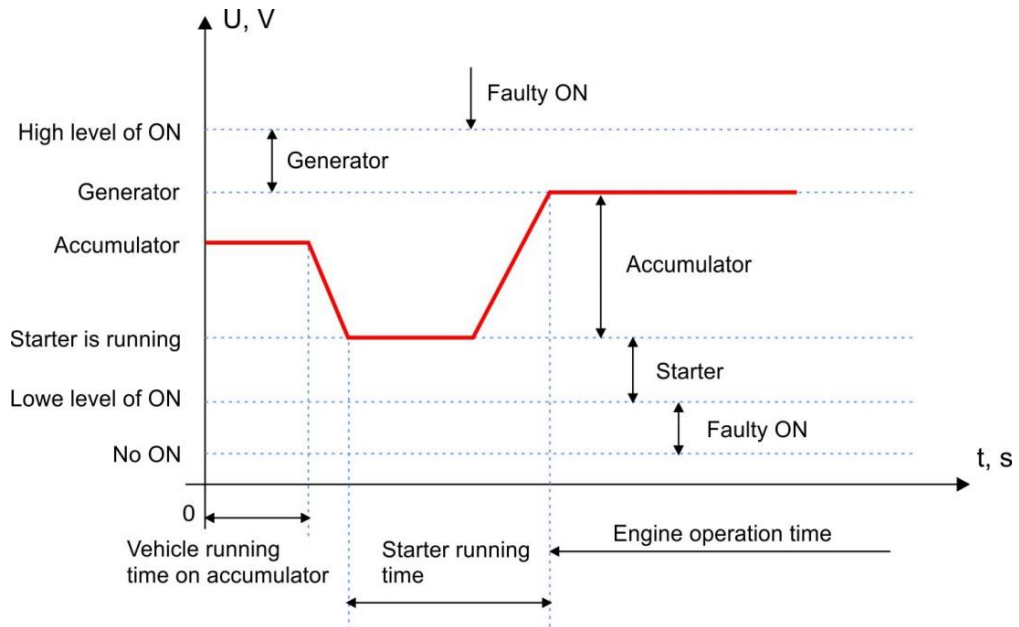
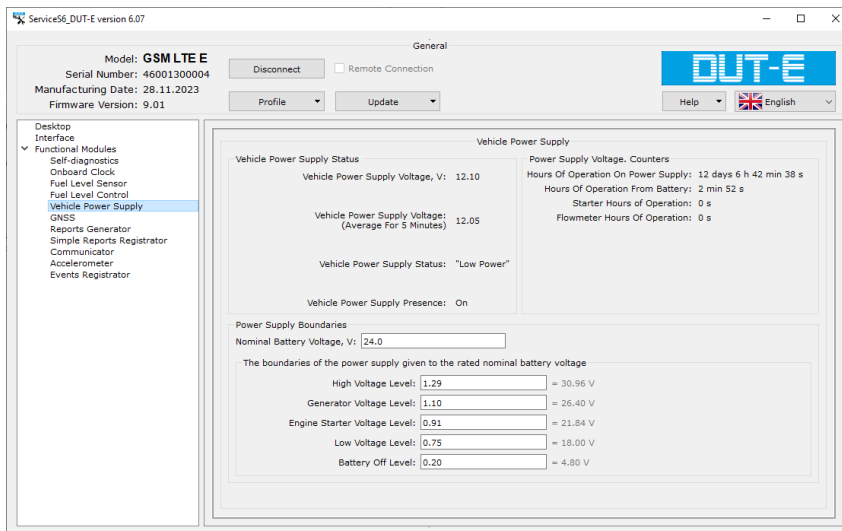
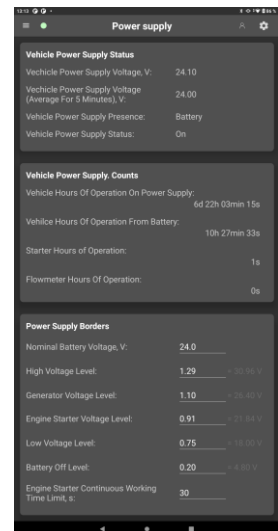


Figure D.5 — Operation modes on onboard network (ON) voltage level



a) in Service S6 DUT-E software



b) in Service S6 DUT-E (Android) app

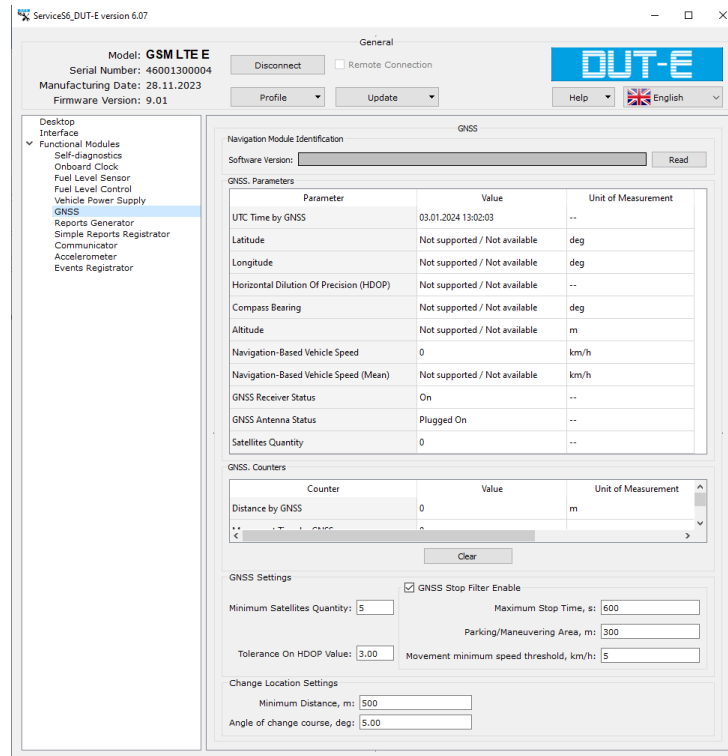
Figure D.6 — Example of the window of settings of Vehicle power supply FM

Table D.5 — Vehicle power supply FM. Displayed and/or editable SPN with the help of Service S6 DUT-E software or Service S6 DUT-E (Android) app

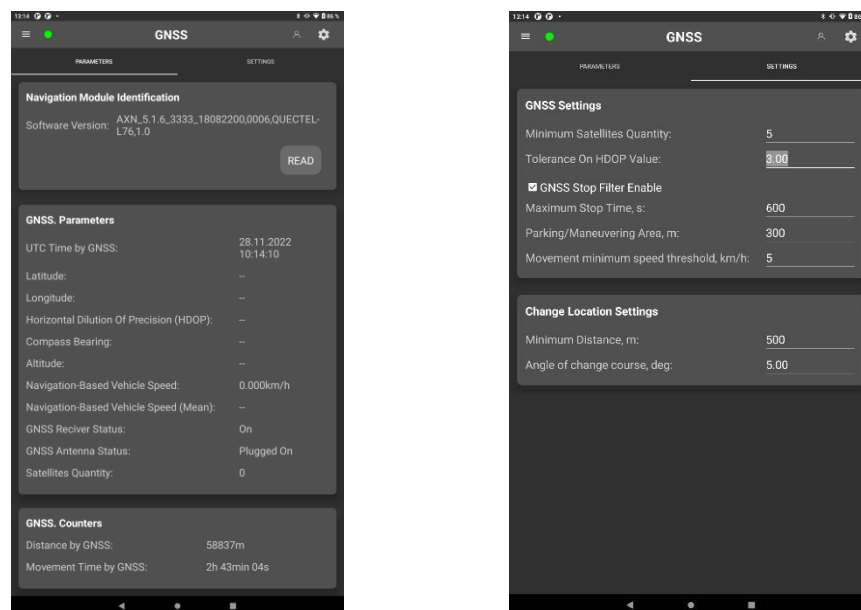
SPN	Name	Factory value	Unit of measure	Range	Clarification
Vehicle Power Supply Status <a href="#">PGN 63089</a>					
<a href="#">521055</a>	Vehicle Power Supply Voltage	On the fact	V	0...3212.75	Shows current value of ON voltage.
<a href="#">521055/2.9</a>	Vehicle Power Supply Voltage/ 2.9 Average For 5 Minutes	On the fact	V	0...3212.75	Shows average value of ON voltage within previous 5 minutes.
<a href="#">521056</a>	Vehicle Power Supply Status	On the fact	No	Off/ Lowe level/ Accumulator/ Starter/ Generator/ High level	Shows current mode of ON in accordance with user-defined borders of ON voltage levels of Vehicle (see figures D.5 and D.6).
<a href="#">521076</a>	Vehicle Power Supply Presence	On the fact	No	On/Off	Displays the current state of the board (On/Off) in accordance with the user-set voltage level of the TC system trip (see figures D.5 and D.6).
Power Supply Boundaries <a href="#">PGN 63067</a>					
<a href="#">521075</a>	Nominal Battery Voltage	24	V	0...60	Field for entering a nominal value of accumulator voltage of Vehicle ( $U_{nom}=12V/24V$ ) (see figures D.5 and D.6).
<a href="#">521063</a>	High Voltage Level	1.29	-	0...1.99	Field for entering value of high voltage level of onboard network ( $1.29 \cdot U_{nom}$ ) (see figures D.5 and D.6). Entered value of voltage is used as a threshold for recording "Faulty ON" Event.
<a href="#">521064</a>	Generator Voltage Level	1.10	-	0...1.99	Field for entering value of voltage level of generator, i.e. when engine of Vehicle is running ( $1.10 \cdot U_{nom}$ ) (see figures D.5 and D.6).
<a href="#">521065</a>	Engine Starter Voltage Level	0.91	-	0...1.99	Field for entering value of voltage level starter is running, i.i when Vehicle's engine is starting ( $0.91 \cdot U_{nom}$ ) (see figures D.5 and D.6).
<a href="#">521067</a>	Low Voltage Level	0.75	-	0...1.99	Field for entering value of low voltage level of ON ( $0.75 \cdot U_{nom}$ ). Entered value of voltage is used as a threshold for recording "Faulty ON" Event. (see figures D.5 and D.6).
<a href="#">521068</a>	Battery Off Level	0.20	-	0...1.99	Field for entering value of voltage level when ON switches off ( $0.20 \cdot U_{nom}$ ). (see figures D.5 and D.6).
<a href="#">521074*</a>	Engine Starter Continuous Working Time Limit	30	s	5...30	Field for entering value of starter's permissible time of continuous operation, above which the starter may fail (see figures D.5 and D.6). Entered value is used as a threshold for recording "Exceeding permissible time of continuous operation of starter" Event.
Power Supply Voltage. Counters <a href="#">PGN 62976</a>					
<a href="#">521173</a>	Hours Of Operation On Power Supply	On the fact	s	0..4211081215	Counter of total operating time of Vehicle from onboard network since sensor installation to the Vehicle**.
<a href="#">521172</a>	Hours Of Operation From Battery	On the fact	s	0..4211081215	Counter of total operating time of Vehicle from accumulator since sensor installation to the Vehicle**.
<a href="#">521170</a>	Starter Hours Of Operation	On the fact	s	0..4211081215	Counter of total operating time of starter since sensor installation to the Vehicle**.
<a href="#">521171</a>	Flowmeter Hours Of Operation	On the fact	s	0..4211081215	Counter of total operating time of Vehicle's engine since sensor installation to the Vehicle**.
* In preparation for introduction.					
** The user cannot reset the <a href="#">Counter</a> by himself. Counter can be reset by the <a href="#">Manufacturer</a> of <a href="#">RSC</a> .					

## D.6 GNSS FM

**GNSS FM** — receives and process signals from **GNSS**, calculates parameters received from navigation receiver (coordinates of location, speed and direction of the movement of the **Vehicle**).



a) in Service S6 DUT-E software



b) in Service S6 DUT-E (Android) app

Figure D.7 — Example of the window of settings of GNSS FM

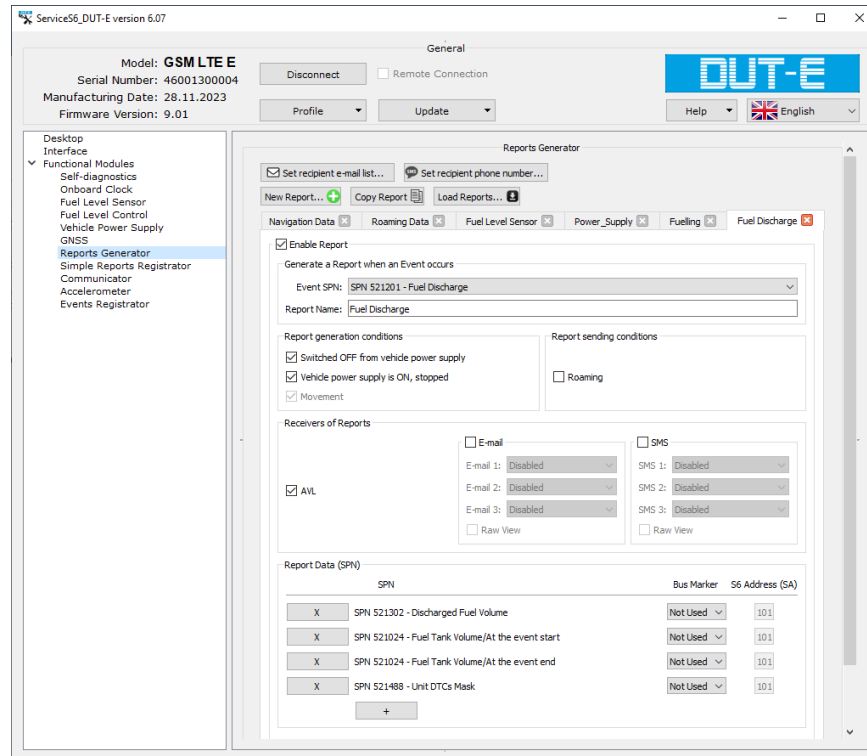
Table D.6 — GNSS FM. Displayed and/or editable SPN  
with the help of Service S6 DUT-E software or Service S6 DUT-E (Android) app

SPN	Name	Factory value	Unit of measure	Range	Clarification
Navigation Module Identification <a href="#">PGN 63244</a>					
<a href="#">521282</a>	Software Version	On the fact	No	No	The firmware version of the inbuilt GNSS-module of DUT-E GSM is displayed.
GNSS. Parameters <a href="#">PGN 62998</a>					
<a href="#">521155</a>	UTC Time by GNSS	On the fact	s	0...4211081215*	This setting displays present time in UTC format, defined according to <a href="#">GNSS</a> data.
<a href="#">584</a>	Latitude	On the fact	Degree	-210...211.101*	This setting displays geographical coordinates of latitude of present location of the vehicle, defined according to GNSS data.
<a href="#">585</a>	Longitude	On the fact	Degree	-210...211.101*	This setting displays geographical coordinates of longitude of present location of the vehicle, defined according to GNSS data.
<a href="#">521090</a>	Horizontal Dilution Of Precision (HDOP)	On the fact	No	0...642.55*	This setting displays present value of HDOP – coefficient that characterizes accuracy of the current location defining of the object in the horizontal plane. HDOP value can vary in range from 1 (maximum accuracy) to 50 (minimum accuracy).
<a href="#">165</a>	Compass Bearing	On the fact	Degree	0...501.99*	This setting displays present movement direction of the vehicle, defined according to GNSS data.
<a href="#">580</a>	Altitude	On the fact	m	2500...5531.88*	This setting displays height of present vehicle location above the sea level, defined according to GNSS data.
<a href="#">517</a>	Navigation-Based Vehicle Speed	On the fact	km/h	0...250.996*	This setting displays present vehicle speed, defined according to GNSS data.
<a href="#">521134</a>	GNSS Receiver Status	On the fact	No	On/Error	This setting displays status of serviceability of built-in navigation receiver DUT-E GSM.
<a href="#">521135</a>	GNSS Antenna Status	On the fact	No	Connected	This setting displays connection** status of built-in navigation antenna DUT-E GSM.
<a href="#">521128</a>	Satellites Quantity	On the fact	pcs.	0...250*	This setting displays present number of visible navigation satellites.
GNSS. Counters <a href="#">PGN 62996</a>					
<a href="#">521126</a>	Distance By GNSS	On the fact	m	0...4211081215	Shows value of total travel distance of <a href="#">Vehicle</a> since Unit installation to the Vehicle. User can reset the value of this Counter***.
<a href="#">521127</a>	Movement Time By GNSS	On the fact	s	0...4211081215	Shows value of total travel time of Vehicle since <a href="#">Unit</a> installation to the Vehicle. User can reset the value of this <a href="#">Counter</a> ***.
GNSS Settings <a href="#">PGN 63058</a>					
<a href="#">521097</a>	Tolerance On HDOP Value	3.00	No	0...642.55	Field for entering of allowable maximum value of HDOP, below which coordinates and movement vehicle's speed are considered to be reliable.
<a href="#">521098</a>	Minimum Satellites Quantity	5	pcs.	0...255	Field for entering of minimum number of visible navigation satellites, above which coordinates and movement vehicle's speed are considered to be reliable.
<a href="#">521101</a>	GNSS Stop Filter Enable	On	No	On/Off	Field to switch ON/OFF the feature of automatic identification of the Vehicle parking mode according to parameters entered.
<a href="#">521102</a>	Maximum Stop Time	600	s	0...64255	Field for entering the threshold time value which, in case it is exceeded, identifies the parking mode, if the Vehicle is immobile and the coordinates of the Vehicle location do not change.

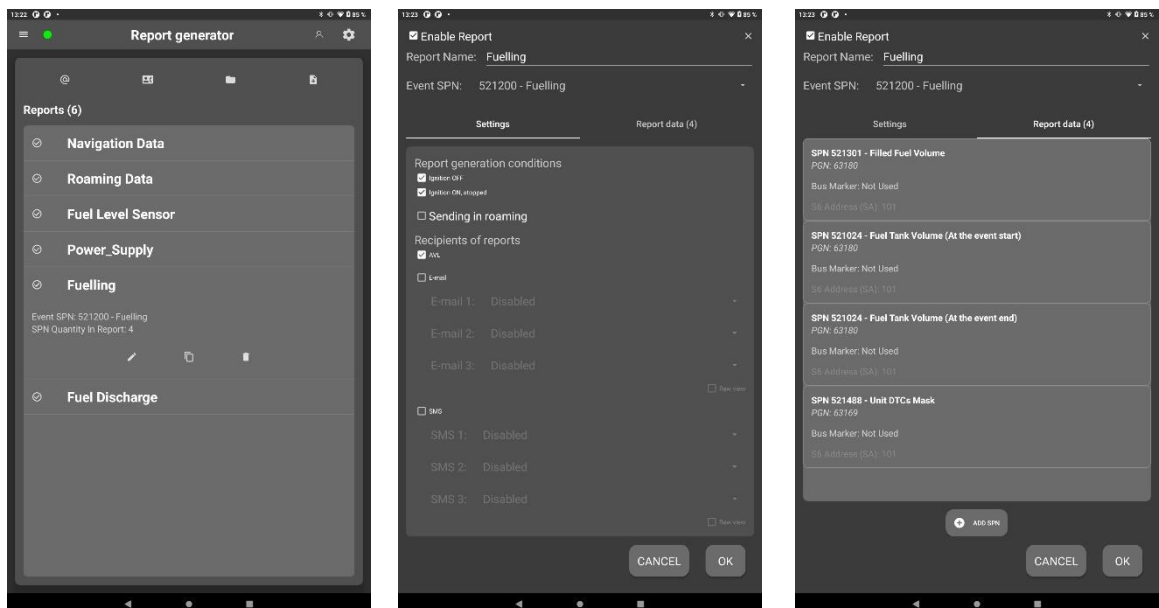
SPN	Name	Factory value	Unit of measure	Range	Clarification
<a href="#">521103</a>	Parking/ Maneuvering Area	300	m	-2500...5531.88	Field for entering the threshold value of the distance which, in case it is exceeded, if the Vehicle is immobile, results in changing the coordinates of the Vehicle location.
<a href="#">521266</a>	Movement Minimum Speed Threshold, km/h	5	km/h	0...63	Field for entering the threshold value of speed below which the Vehicle is considered immobile.
Change Location Settings <a href="#">PGN 63105</a>					
<a href="#">521078</a>	Minimum Distance	500	m	0...4294967295	Field for entering minimum distance between points on the straight section of Vehicle's movement for sending the <a href="#">Report</a> .
<a href="#">521079</a>	Angle Of Change Course	5.00	Degree	0...360	Field for entering Vehicle's course change angle, which if exceeded triggers Report sending.
<p>* When poor quality reception of navigation data or mismatch of GNSS coordinates reliability and <a href="#">Vehicle</a> movement speed, the following message displays "Not supported/ not available".</p> <p>** Status "Connected" is always displayed for <a href="#">GNSS</a> antenna.</p> <p>*** Valid only for Service S6 DUT-E software, version from 6.03 and higher.</p>					

## D.7 Reports Generator FM

[Reports Generator FM](#) — designed for [Onboard Reports](#) formation in accordance with defined configurations and sending through [Communicator FM](#).



a) in Service S6 DUT-E software



b) in Service S6 DUT-E (Android) app

Figure D.8 — Example of the window of settings of Reports Generator FM

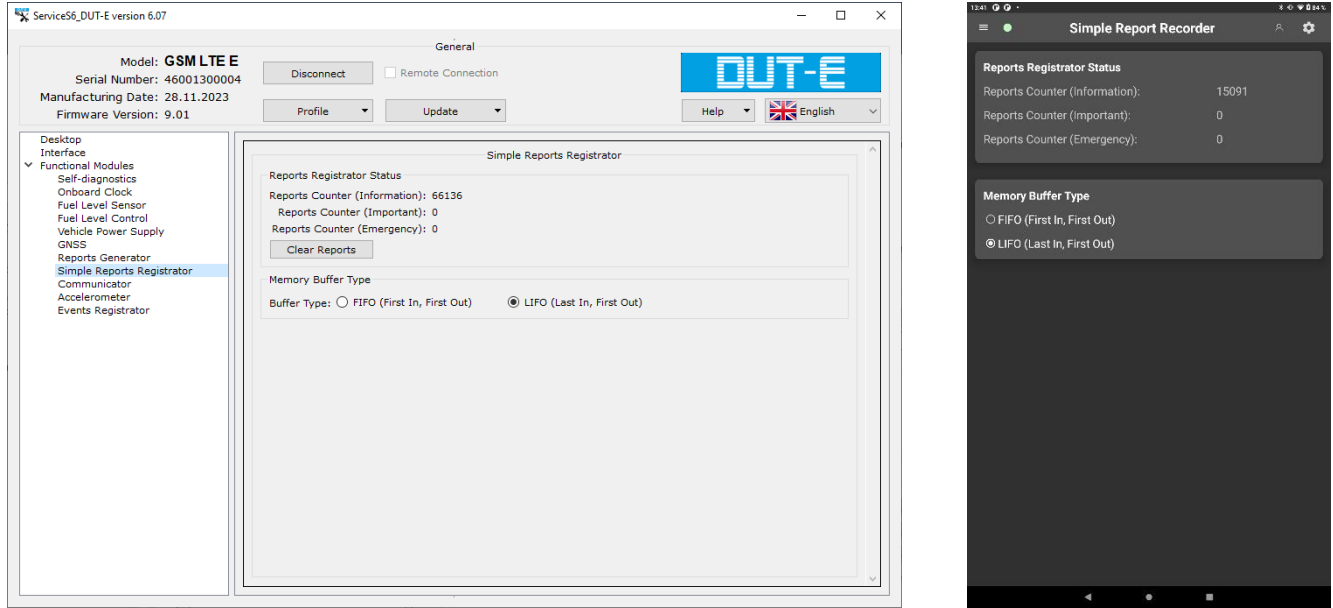
**Table D.7 — Reports Generator FM. Displayed and/or editable SPN with the help of Service S6 DUT-E software or Service S6 DUT-E (Android) app**

SPN	Name	Factory value	Unit of measure	Range	Clarification
E-Mail List <a href="#">PGN 63122</a>					
<a href="#">521355</a>	Array Elements Count	No	pcs.	0...3	Number of e-mail addresses in the list of recipients for sending <a href="#">Report</a> by e-mail.
<a href="#">521242</a>	E-Mail Address	No	No	No	Address of Report recipient. The address should not contain more than 64 characters.
Phone Numbers List <a href="#">PGN 63124</a>					
<a href="#">521355</a>	Array Elements Count	No	pcs.	0...3	Number of phone numbers in the list of recipients for sending Report to mobile phone numbers.
<a href="#">521020</a>	Phone Number	No	No	No	Report recipient's phone number. Number should be specified in international format (13 digits maximum).
Emergency Events List <a href="#">PGN 63051</a> Important Events List <a href="#">PGN 63055</a>			Information Events List <a href="#">PGN 63056</a> Operation Events List <a href="#">PGN 63146</a>		
<a href="#">521166</a>	Event SPN	No	No	0...4294967295	Drop-down list for selecting the Event, in the event of which the report should be generated.
Report 1 Generate Attributes <a href="#">PGN 63125</a> Report 2 Generate Attributes <a href="#">PGN 63126</a> Report 3 Generate Attributes <a href="#">PGN 63127</a> Report 4 Generate Attributes <a href="#">PGN 63128</a> Report 5 Generate Attributes <a href="#">PGN 63129</a> Report 6 Generate Attributes <a href="#">PGN 63130</a> Report 7 Generate Attributes <a href="#">PGN 63131</a> Report 8 Generate Attributes <a href="#">PGN 63132</a> Report 9 Generate Attributes <a href="#">PGN 63133</a> Report 10 Generate Attributes <a href="#">PGN 63134</a>			Report 11 Generate Attributes <a href="#">PGN 63135</a> Report 12 Generate Attributes <a href="#">PGN 63136</a> Report 13 Generate Attributes <a href="#">PGN 63137</a> Report 14 Generate Attributes <a href="#">PGN 63138</a> Report 15 Generate Attributes <a href="#">PGN 63139</a> Report 16 Generate Attributes <a href="#">PGN 63140</a> Report 17 Generate Attributes <a href="#">PGN 63141</a> Report 18 Generate Attributes <a href="#">PGN 63142</a> Report 19 Generate Attributes <a href="#">PGN 63143</a> Report 20 Generate Attributes <a href="#">PGN 63144</a>		
<a href="#">521151</a>	Enable Report	On	No	On/Off	Field for enabling or disabling Report formation.
<a href="#">521250</a>	Report Name	No	No	No	Field for entering Report's name for identifying. To enter the name, use only Latin characters.
<a href="#">521151</a> /12.3	Enable Report/ 12.3 Switched OFF from vehicle power supply	On	No	On/Off	Field for enabling or disabling Report formation when Vehicle's power supply is turned off.
<a href="#">521151</a> /12.4	Enable Report/ 12.4 Vehicle power supply is ON, stopped	On	No	On/Off	Field for enabling or disabling Report formation when Vehicle's power supply is turned on, but Vehicle is not moving.
<a href="#">521151</a> /11.1	Enable Report/ 11.1 Roaming	Off	No	On/Off	Field for enabling or disabling Report formation in roaming mode.
<a href="#">521154</a> /25.0	Send Report/ 25.0 AVL	On	No	On/Off	Field for enabling or disabling sending Report to Server.
<a href="#">521154</a> /25.1	Send Report/ 25.1 E-mail	Off	No	On/Off	Field for enabling or disabling sending Report by e-mail.
<a href="#">521151</a> /25.2	E-mail Id/ 25.2 E-mail 1	Disabled	No	No	Drop-down list for ticking or unticking E-mail address of the first recipient of Report by email.
<a href="#">521151</a> /25.3	E-mail Id/ 25.3 E-mail 2	Disabled	No	No	Drop-down list for ticking or unticking E-mail address of the second recipient of Report by email.
<a href="#">521151</a> /25.4	E-mail Id/ 25.4 E-mail 3	Disabled	No	No	Drop-down list for ticking or unticking E-mail address of the third recipient of Report by email.
<a href="#">521154</a> /25.5	Send Report/ 25.5 SMS	Off	No	On/Off	Drop-down list for enabling or disabling sending Report via SMS.
<a href="#">521252</a> /25.6	SMS Id/ 25.6 SMS 1	Disabled	No	No	Drop-down list for ticking or unticking telephone number of the first recipient of Report by SMS.
<a href="#">521252</a> /25.7	SMS Id/ 25.7 SMS 2	Disabled	No	No	Drop-down list for ticking or unticking telephone number of the second recipient of Report by SMS.
<a href="#">521252</a> /25.8	SMS Id/ 25.8 SMS 3	Disabled	No	No	Drop-down list for ticking or unticking telephone number of the third recipient of Report by SMS.
<a href="#">521253</a>	SPN Quantity in Report	No	pcs.	0...10	Quantity of SPNs, which can be added when forming Content of Report.

SPN	Name	Factory value	Unit of measure	Range	Clarification
<a href="#">521347</a>	SPN Value	No	On the fact	0...4294967295	Value of SPN, which is added to Content of Report. SPNs that have numerical value and length of no more than 4 bytes can be added to the Report.
<a href="#">521367</a>	Specifier. Group	No	On the fact	0...255	Specifying value of <a href="#">SPN</a> which is added to the Report content.
<a href="#">521368</a>	Specifier. Value	No	On the fact	0...255	Specifier of SPN, which is added in Content of <a href="#">Report</a> .
<a href="#">521150</a>	PGN	No	On the fact	0...65535	PGN, which contains SPN, added to Content of Report.
<a href="#">521254</a>	Bus Marker	Not used	No	No	Specifying bus, from which the Unit via CAN-interface gets SPN, added to the contents of the Report: - S6 - for getting SPN from S6 telematics interface; - Not used - getting SPN is not required.
<a href="#">521188</a>	S6 Address (SA)	101	No	0...255	CAN bus network address of device, which is the source of SPN added to content of Report.

## D.8 Simple Reports Registrator FM

[Simple Reports Registrator FM](#) — registers [Reports](#) according to sections, corresponding to importance of Reports and the priority of its processing.



a) in Service S6 DUT-E software

b) in Service S6 DUT-E (Android) app

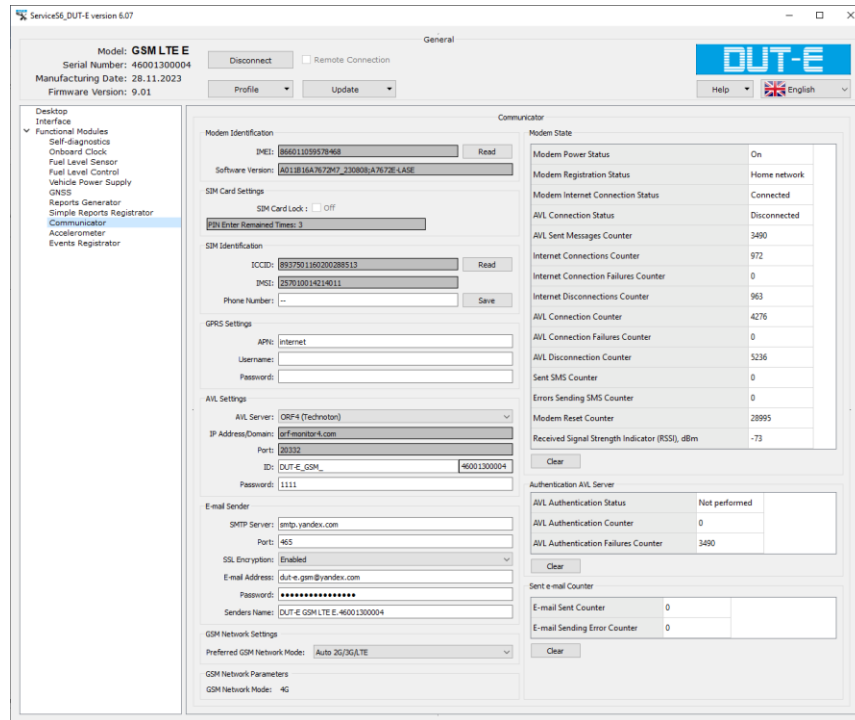
Figure D.9 — Example of the window of settings of Simple Reports Registrator FM

Table D.8 — Simple Reports Registrator FM. Displayed and/or editable SPN with the help of Service S6 DUT-E software or Service S6 DUT-E (Android) app

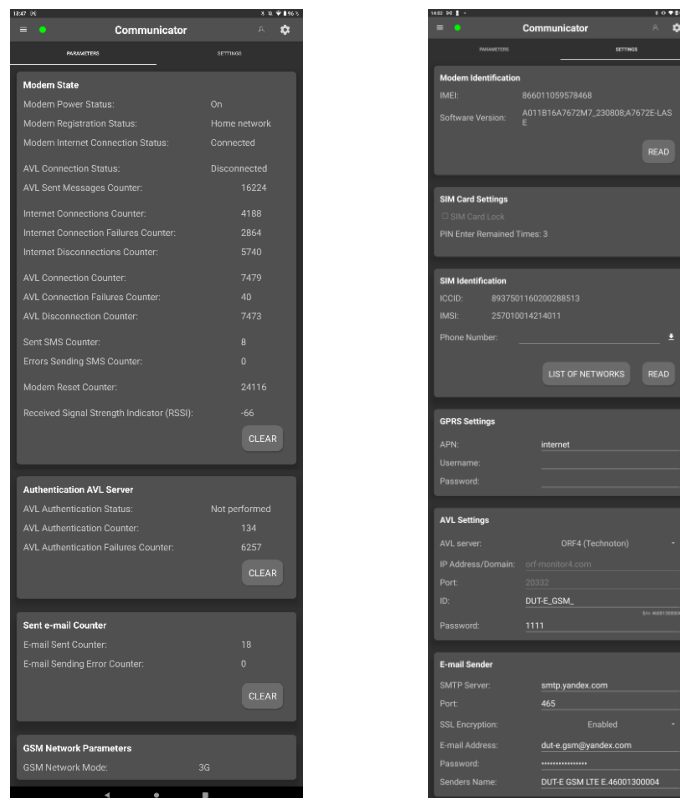
SPN	Name	Factory value	Unit of measure	Clarification
Reports Registrator Status <a href="#">PGN 63079</a>				
<a href="#">521072/21.0</a>	Reports Counter/21.0 Emergency	On the fact	No	Displays current number of registered Reports on emergency Events (for example - "Alarm").
<a href="#">521072/21.1</a>	Reports Counter/21.1 Important	On the fact	No	Displays current number of registered Reports on important Events (for example - "Drain", "Refueling").
<a href="#">521072/21.2</a>	Reports Counter/21.2 Information	On the fact	No	Displays current number of registered Reports on informational Events (for example - "Ignition On/Off", "Satellites detected/lost", "GPRS is available/not available").
Memory Buffer Type <a href="#">PGN 63102</a>				
<a href="#">521489</a>	Buffer Type	LIFO	No	Fields for selecting priority type for sending Reports, accumulated in internal memory while Vehicle was outside of network operator's coverage, to the Server: - FIFO (First In, First Out) – sending accumulated Reports in chronological sequence (i.e. starting from oldest Reports). - LIFO (Last In, First out) – sending accumulated Reports in opposite chronology (i.e. starting from newest Reports).

## D.9 Communicator FM

**Communicator FM** — designed for transmitting of generated [Onboard reports](#) DUT-E GSM to the Server/E-mail/SMS, configuration settings of parameters responsible for connection to Internet, AVL Server.



a) in Service S6 DUT-E software



b) in Service S6 DUT-E (Android) app

Figure D.10 — Example of the window of settings of Communicator FM

**Table D.9 — Communicator FM. Displayed and/or editable SPN with the help of Service S6 DUT-E software or Service S6 DUT-E (Android) app**

SPN	Name	Factory value	Unit of measure	Clarification
Modem Identification <a href="#">PGN 63237</a>				
<a href="#">521281</a>	IMEI	On the fact	No	The International Mobile Equipment Identity is displayed in the cellular communication operator network for the <a href="#">Unit</a> inbuilt modem. The International Mobile Equipment Identity is a unique number consisting of 15 digits in the decimal form in which the last digit is a check-sum digit according to Luhn algorithm, in accordance with ISO/IEC 7812. The data are not available for editing.
<a href="#">521282</a>	Software Version	On the fact	No	The firmware version for the inbuilt 3G Unit modem is displayed. The data are not available for editing.
SIM Card Settings <a href="#">PGN 63059</a>				
<a href="#">521625</a>	PIN	On the fact	No	PIN-code is a specific sequence of four digits for each SIM-card. Field for entering of PIN-code is displayed while using SIM-card that is password protected.
<a href="#">521628</a>	PIN Enter Remained Times	On the fact	No	Counter of remaining number of attempts for PIN-code entering of protected SIM-card while not correct PIN-code is entered. The user cannot reset this Counter.
<a href="#">521627</a>	SIM Card Lock	On the fact	No	SIM-card is locked automatically while PIN-code is entered incorrectly. To unlock the SIM-card enter its present correct PIN-code and turn locking off.
GPRS Settings <a href="#">PGN 63020</a>				
<a href="#">521619</a>	APN	internet	No	It is necessary to enter access point address of GSM provider (APN) for connecting <a href="#">Unit</a> to the Internet. Access point address can be obtained from GSM service provider which SIM-card is installed into the Unit.
<a href="#">521620</a> /13.0	Username/ 13.0 GPRS	No	No	It is necessary to enter access point user name for Unit authorization while connecting to the Internet. User name can be obtained from GSM service provider which SIM-card is installed into the Unit.
<a href="#">521621</a> /13.0	Password/ 13.0 GPRS	No	No	It is necessary to enter access point user password for Unit authorization while connecting to the Internet. User password can be obtained from GSM service provider which SIM-card is installed into the Unit.
AVL Settings <a href="#">PGN 63068</a>				
<a href="#">521622</a> /13.2	IP Address/ Domain/ 13.2 Automatic Vehicle Location	orf-monitor4.com	No	It is necessary to enter IP- or URL- address of <a href="#">AVL Server</a> that DUT-E GSM is establishing connection with for transmitting <a href="#">Onboard reports</a> .
<a href="#">521623</a> /13.2	Port/13.2 Automatic Vehicle Location	20332	No	It is necessary to enter opened port number of AVL Server that will be used for communicating with DUT-E GSM.
<a href="#">521080</a> /13.2	ID/13.2 Automatic Vehicle Location	DUT-E_GSM_XXXXXXXXXX (XXXXXXXXXX – serial number, automatically generated)	No	It is necessary to enter prefix for DUT-E GSM identification at AVL Server. Fields of entered prefix have to match with the settings of "Unique ID" field while registering vehicle at <a href="#">ORF4 Telematics Server</a> (see <a href="#">User manual</a> ).
<a href="#">521621</a> /13.2	Password/13.2 Automatic Vehicle Location	1111	No	It is necessary to enter password for DUT-E GSM authentication at the AVL server.

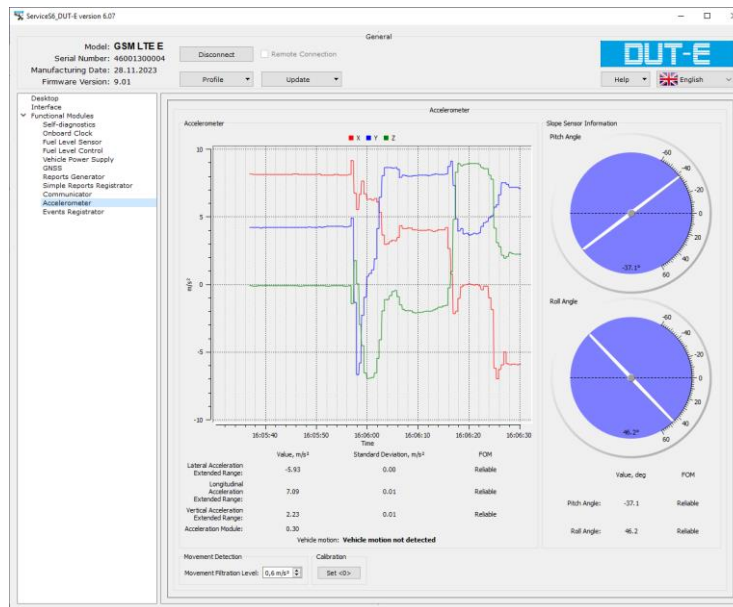
SPN	Name	Factory value	Unit of measure	Clarification
E-Mail Sender <a href="#">PGN 63145</a>				
<a href="#">521618</a>	SMTP Server	smtp.yandex.com	No	Field to enter the address of SMTP Server. It is allowed to use no more than 32 characters (Roman letters, dots). SMTP Server is the network protocol of e-mail transmission (Simple Mail Transfer Protocol) in TCP/IP networks. The main functions of SMTP Server: - checkup of correctness of settings and authorization for Unit to send a Report; - sending a Report to the specified address by the Unit. If the delivery is impossible, the Server transmits to the sender a sending error message.
<a href="#">521623</a> /13.3	Port/ 13.3 SMTP Server	465	No	Field to enter SMTP-port number to retransmit Reports from the Unit. It is allowed to use no more than 5 digits. Port 465 is used to send letters encoded in accordance with SSL protocol. This connection is better protected than the usual TCP/IP.
<a href="#">521617</a> /13.3	SSL Encryption/ 13.3 SMTP Server	Enabled	No	From the dropdown list you may enable or disable encoding Reports according to the level of SSL (Secure Sockets Layer). SSL encoding is the cryptographic protocol used for enhanced security data transmission by E-mail.
<a href="#">521242</a>	E-mail Address	dut-e.gsm@yandex.com	No	Field to enter the address of mailbox from which the Unit will send Reports to E-mail addresses of users. It is allowed to use no more than 64 characters (Roman letters, digits, dots).
<a href="#">521621</a>	Password	On the fact	No	Field to enter password to the Unit E-mail mailbox. It is allowed to use no more than 16 characters (only Roman letters, digits and special characters).
<a href="#">521616</a>	Senders Name	On the fact	No	Field to enter the name of the Unit from which Reports are to be sent by E-mail. The maximum length of address – 48 characters. It is allowed to use only Roman letters, digits, dots, as well as the following characters: dash, dot, underlining and space.  By default: DUT-E_GSM_XXXXXXXXXXXX, Where XXXXXXXXXXXX – serial Unit number. The data are entered automatically, but accessible for editing.
Modem Status <a href="#">PGN 63007</a>				
<a href="#">521130</a>	Modem Power Status	On the fact	No	This setting displays present GPRS modem power status (On/Off).
<a href="#">521131</a>	Modem Registration Status	On the fact	No	This setting displays present GPRS modem registration status in GSM network (No network/Home network/Roaming).
<a href="#">521132</a>	Modem Internet Connection Status	On the fact	No	This setting displays present GPRS modem connection status to the Internet (Connected/Disabled).
<a href="#">521133</a>	AVL Connection Status	On the fact	No	This setting displays present status of GPRS modem connection to AVL server (Connected/Disabled).
<a href="#">521140</a>	AVL Sent Messages Counter	On the fact	pcs.	Counter of Onboard Reports transmitted by modem to AVL server address via GPRS channel*.
<a href="#">521141</a>	Internet Connections Counter	On the fact	pcs.	Counter of successful GPRS modem connections to the Internet*.
<a href="#">521142</a>	Internet Connection Failures Counter	On the fact	pcs.	Counter of GPRS modem connection errors to the Internet*.
<a href="#">521143</a>	Internet Disconnections Counter	On the fact	pcs.	Counter of GPRS modem disconnections from the Internet*.
<a href="#">521144</a>	AVL Connection Counter	On the fact	pcs.	Counter of GPRS modem connections to AVL <a href="#">Server</a> *.

SPN	Name	Factory value	Unit of measure	Clarification
<a href="#">521145</a>	AVL Connection Failures Counter	On the fact	pcs.	Counter of GPRS modem connection errors to AVL Server*.
<a href="#">521146</a>	AVL Disconnection Counter	On the fact	pcs.	Counter of GPRS modem disconnections from AVL Server*.
<a href="#">521147</a>	Sent SMS Counter	On the fact	pcs.	Counter of sent SMS commands for remote configuration of DUT-E GSM*.
<a href="#">521148</a>	Errors Sending SMS Counter	On the fact	pcs.	Counter of sent SMS command errors for remote configuration of DUT-E GSM*.
<a href="#">521149</a>	Modem Reset Counter	On the fact	pcs.	Counter of automatic GPRS modem resets while GPRS modem has operation errors*.
<a href="#">521178</a>	Received Signal Strength Indication (RSSI)	On the fact	dBm	This setting displays present level of signal strength (on a logarithmic scale) received by GPRS modem receiver. Produced range: from -52 to -115 dBm.
Authentication AVL Server <a href="#">PGN 63099</a>				
<a href="#">521175</a>	AVL Authentication Status	On the fact	No	This setting displays present authentication status (originality check) of DUT-E GSM at AVL Server (Completed/Not completed).
<a href="#">521176</a>	AVL Authentication Counter	On the fact	pcs.	Counter of successful authentications of DUT-E GSM at AVL Server*.
<a href="#">521177</a>	AVL Authentication Failures Counter	On the fact	pcs.	Counter of authentication errors of DUT-E GSM at AVL server*.
Sent E-Mail Counter <a href="#">PGN 63147</a>				
<a href="#">521240</a>	E-Mail Sent Counter	On the fact	pcs.	Counter of number of Reports sent by e-mail*.
<a href="#">521241</a>	E-Mail Sending Error Counter	On the fact	pcs.	Counter of number of failed Report by e-mail sending attempts*.
GSM Network Settings <a href="#">PGN 63179</a>				
<a href="#">521335</a>	Preferred GSM Network Mode	Auto 2G/3G/LTE	No	From the dropdown list, you may select the cellular communication standard for the inbuilt GSM modem of the sensor: - Auto 2G/3G/LTE — automatic switching between GSM 2G / GSM 4G networks; - Only 2G — operation only within GSM 2G networks; - Only LTE (NB-IoT) — operation only within GSM 4G networks. In the majority of cases, when the Unit operates in the local network, we recommend to use "Auto 2G/3G/LTE" mode. However, in some cases, activation of "Only 2G" mode may improve the operation of the Unit inbuilt modem. E.g., if the Vehicle is outside the area covered by 4G network, enabling "Only 2G" mode allows to save the charge, in case the Unit is powered from the inbuilt accumulator.
GSM Network Parameters <a href="#">PGN 63178</a>				
<a href="#">521334</a>	GSM Network Mode	On the fact	No	The setting displays the cellular communication standard which is currently used by the Unit inbuilt GSM modem: 2G or 3G. This parameter is relevant only for DUT-E GSM 3G.
* User can reset values of all Counters <a href="#">PGN 63007</a> , <a href="#">PGN 63099</a> and (or) <a href="#">PGN 63147</a> if it is necessary.				
■ — Obligatory settings of <a href="#">DUT-E GSM</a> which are needed for its Internet connection and <a href="#">Reports</a> transfer to the Server.				

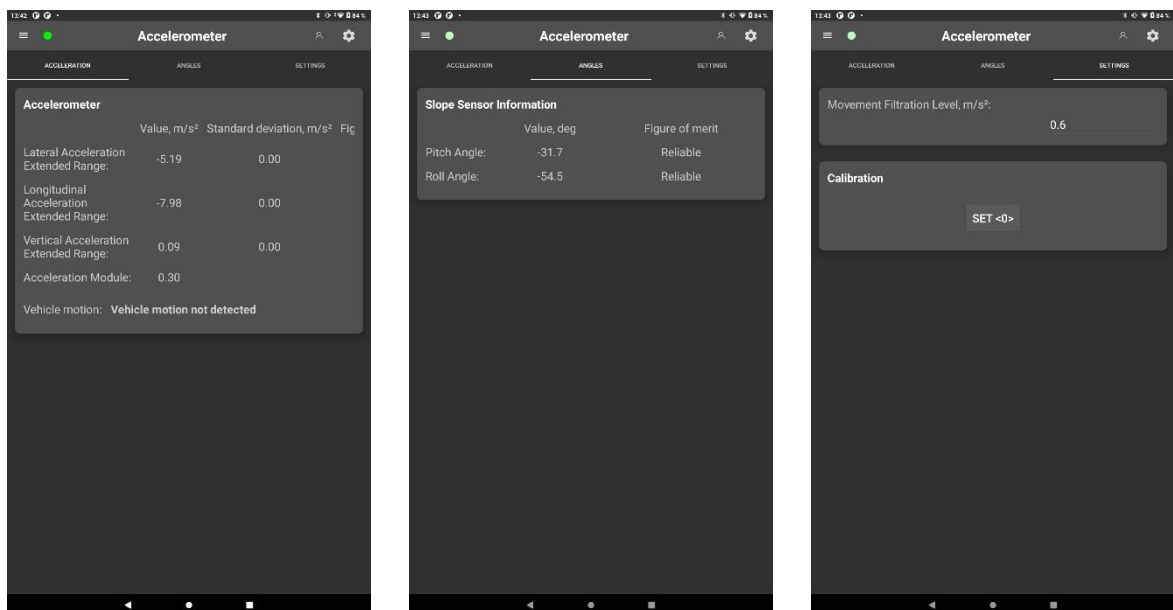
## D.10 Accelerometer FM

**Accelerometer FM** — is designed to identify current values of the Vehicle linear accelerations in three rectangular axes of Cartesian coordinate system and to calculate root-meansquare values of these accelerations, to identify the Vehicle movement and its banking angles.

**After DUT-E GSM mounting on the Vehicle you need to calibrate the inbuilt accelerometer, i.e. to specify zero values of pitch angle and banking angle by pressing **Set <0>** button!**



a) in Service S6 DUT-E software



b) in Service S6 DUT-E (Android) app

Figure D.11 — Example of the window of settings of Accelerometer FM

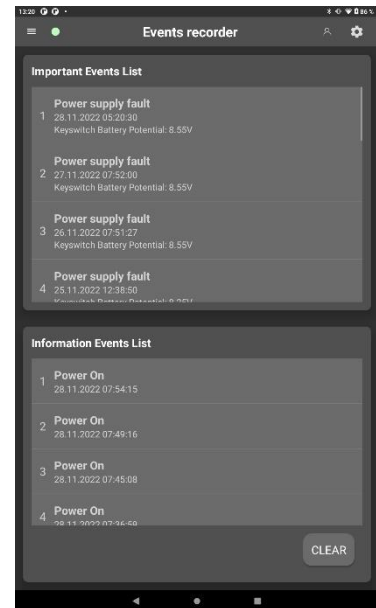
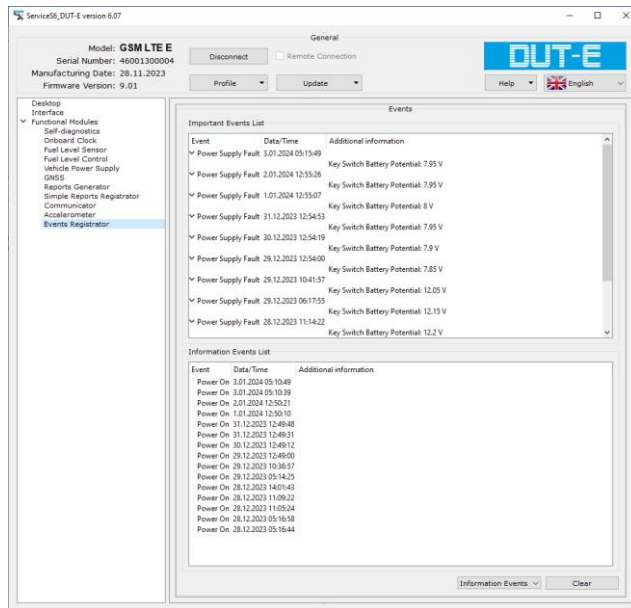
Table D.10 — Accelerometer FM. Displayed and/or editable SPN  
with the help of Service S6 DUT-E software or Service S6 DUT-E (Android) app

SPN	Name	Factory value	Unit of measure	Range	Clarification
Accelerometer <a href="#">PGN 63155</a>					
<a href="#">5347</a>	Lateral Acceleration Extended Range	On the fact	m/s <sup>2</sup>	-320...322.55	Current value of the Vehicle transverse linear acceleration is displayed (along Y axis of the Cartesian coordinate system) and the diagram of its changing with time.
<a href="#">5347/2.3</a>	Lateral Acceleration Extended Range / 2.3 Standard Deviation	On the fact	m/s <sup>2</sup>	-320...322.55	Value of the Vehicle mean-square deviation calculated based on the current data of the Vehicle transverse linear acceleration is displayed. You can estimate the reliability of the measured values of the Vehicle transverse linear acceleration by the value of mean-square deviation.
<a href="#">5350</a>	Lateral Acceleration Extended Range Figure of Merit	On the fact	No	Reliable/ Unreliable	Estimate of reliability of the measured values of the Vehicle transverse linear acceleration is displayed. If the transverse linear acceleration is less than 5 m/s <sup>2</sup> , the acceleration data are reliable, while in case the transverse linear acceleration is more than 5 m/s <sup>2</sup> , the data are unreliable.
<a href="#">5348</a>	Longitudinal Acceleration Extended Range	On the fact	m/s <sup>2</sup>	-320...322.55	Current value of the Vehicle longitudinal axis linear acceleration is displayed (along X axis of the Cartesian coordinate system) and the diagram of its changing with time.
<a href="#">5348/2.3</a>	Longitudinal Acceleration Extended Range / 2.3 Standard Deviation	On the fact	m/s <sup>2</sup>	-320...322.55	Value of the Vehicle mean-square deviation calculated based on the current data of the Vehicle longitudinal linear acceleration is displayed. You can estimate the reliability of the measured values the Vehicle longitudinal linear acceleration by the value of mean-square deviation.
<a href="#">5351</a>	Longitudinal Acceleration Extended Range Figure of Merit	On the fact	No	Reliable/ Unreliable	Estimate of reliability of measured values of the Vehicle longitudinal linear acceleration is displayed. If the longitudinal linear acceleration is less than 5 m/s <sup>2</sup> , the acceleration data are reliable, while in case of longitudinal linear acceleration more than 5 m/s <sup>2</sup> , the acceleration data are unreliable.
<a href="#">5349</a>	Vertical Acceleration Extended Range	On the fact	m/s <sup>2</sup>	-320...322.55	Current mean value of the Vehicle vertical linear acceleration is displayed (along Z axis of the Cartesian coordinate system) and the diagram of its changing with time.
<a href="#">5349/2.3</a>	Vertical Acceleration Extended Range / 2.3 Standard Deviation	On the fact	m/s <sup>2</sup>	-320...322.55	Value of the Vehicle mean-square deviation calculated based on the current data of the Vehicle vertical linear acceleration is displayed. You can estimate the reliability of the measured values the Vehicle vertical linear acceleration by the value of mean-square deviation.
<a href="#">5352</a>	Vertical Acceleration Extended Range Figure of Merit	On the fact	No	Reliable/ Unreliable	Estimate of reliability of measured values of the Vehicle vertical linear acceleration is displayed. If the vertical linear acceleration is less than 5 m/s <sup>2</sup> , the acceleration data are reliable, while in case of vertical linear acceleration more than 5 m/s <sup>2</sup> , the acceleration data are unreliable.
<a href="#">521384</a>	Acceleration Module	On the fact	m/s <sup>2</sup>	-320...322.55	Automatically calculated total value of the Vehicle linear acceleration in three axes of coordinates (X, Y, Z) is displayed; this value is equal to square root of the sum of squares of the Vehicle linear accelerations in each axis. If this value exceeds the specified level of the Movement Filtering ( <a href="#">SPN 521341</a> ), the Unit automatically identifies the Vehicle current status in relation to the Vehicle movement.
<a href="#">1611</a>	Vehicle motion	On the fact	No	Vehicle motion not detected/ Vehicle motion detected	Vehicle current status in relation to the Vehicle movement is displayed (the Vehicle is moving/not moving).

SPN	Name	Factory value	Unit of measure	Range	Clarification
Movement Detection <a href="#">PGN 63247</a>					
<a href="#">521341</a>	Movement Filtration Level	0.3	m/s <sup>2</sup>	-12.5...12.5	Field in which the user may specify threshold value of acceleration with which the value of the sum of the Vehicle linear accelerations in the three coordinates axes (X, Y, Z) must be compared. According to the results of the comparison, the Unit automatically identifies the Vehicle current status in relation to movement.
Slope Sensor Information <a href="#">PGN 61459</a>					
<a href="#">3318</a>	Pitch Angle	On the fact	deg	-64...64.51	Displays the current value of the grade angle in relation to the transverse axis of coordinates (Y axis).
<a href="#">3319</a>	Roll Angle	On the fact	deg	-64...64.51	Displays the current value of the grade angle in relation to the longitudinal axis of coordinates (X axis).
<a href="#">3323</a>	Pitch Angle Figure Of Merit	On the fact	No	Reliable/ Unreliable	Estimate of reliability of measurement of the Vehicle banking angle. If the value of the pitch angle is less than 60°, its value is considered reliable.
<a href="#">3324</a>	Roll Angle Figure Of Merit	On the fact	No	Reliable/ Unreliable	Estimate of reliability of measurement of the Vehicle banking angle. If the value of the banking angle is less than 60°, its value is considered reliable.

## D.11 Events Registrator FM

[Events Registrator FM](#) — designed for registration of 15 important and 15 informative latest Events.



a) in Service S6 DUT-E software

b) in Service S6 DUT-E (Android) app

Figure D.12 — Example of the window of settings of Events Registrator FM

Table D.11 — Events Registrator FM. Displayed and/or editable SPN with the help of Service S6 DUT-E software or Service S6 DUT-E (Android) app

SPN	Name	Factory value	Unit of measure	Clarification
Important Events List <a href="#">PGN 63055</a>				
<a href="#">521166</a>	Event SPN	No	No	Displayed list of an important Events (up to 15)*. Important Events are such as e.g. failed onboard circuit (with voltage specified). User cannot erase list of important Events.
Information Events List <a href="#">PGN 63056</a>				
<a href="#">521166</a>	Event SPN	No	No	Displayed list of informative Events (up to 15)*. Information Events are such as e.g. switching on/off the Unit power supply, appearing/absence of <a href="#">GNSS</a> , appearing/absence of GPRS. User can erase list of informative Events.
<p>* For each Event the following data are specified: designation, date/time of occurrence, as well as additional information (if any). Events are displayed in chronological sequence, starting from the most recent. As soon as the maximum number of Events displayed is reached, new Events overwrite the earliest Events. The user cannot clear the list of important Events</p>				

Detailed parameters description (SPN), structure and content of messages (PGN) of [FM DUT-E GSM](#) are placed at the following web site <http://s6.jv-technoton.com/> (to access [S6 DB](#) registration is required).

## Annex E

# DUT-E GSM firmware upgrade



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

To upgrade firmware the following actions should be made:

**1)** In case you use Service S6 DUT-E software, connect the sensor to the PC using [S6 SK](#) service adapter (see [2.3.1](#)) and establish a communication session between DUT-E GSM and PC (see [2.3.3](#)).

In case you use Service S6 DUT-E (Android), connect the sensor to the Android device using [S6 BT Adapter](#) service adapter (see [2.4.1](#)). Establish a connection between the sensor and the Android device via the Bluetooth channel (see [2.4.3](#)).



**WARNING:** When re-uploading firmware, power supply voltage of DUT-E GSM should not drop out of 10...45 V range.

**2)** Start the firmware update procedure.

**3)** Select the firmware file (**\*.bif3**) on the PC disc or in the memory of the Android device.

**4)** Start loading the firmware file into the DUT-E GSM memory.

After firmware file integrity and compatibility check by Service S6 DUT-E software or Service S6 DUT-E (Android) mobile app window of firmware uploading into DUT-E GSM 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.



**WARNING:** To avoid DUT-E GSM failure, before the end of the firmware upgrade process **is forbidden**:

- to switch off PC (in case you use Service S6 DUT-E software) or the Android device (in case you use Service S6 DUT-E (Android));
- to switch off the power supply for the [Unit](#);
- to disconnect the Unit from the service adapter and the adapter from the PC or the Android device;
- to connect to the Unit using S6 SK service adapter (cable) and S6 BT Adapter service adapter (wireless) at one time;
- Run any resource-intensive applications on the PC (in case you use Service S6 DUT-E software).

After the successful completion of the firmware update procedure, the appropriate message will appear. DUT-E GSM is ready for further operation. During the next communication session between the sensor and the PC or the Android device the new firmware version will be displayed in the software or in the mobile application, respectively.



**ATTENTION:** For remote sensor firmware update\*, you must send one of the following commands to it (see [2.6](#)):

**1) LDFW** SMS-command (see [annex C](#)).

**2) LDFW** GPRS-command. The layout of **LDFW** GPRS-command fields is identical to that of SMS-command provided in [annex C](#).

The procedure for sending **LDFW** GPRS-command is similar to that of **CSRV** GPRS-command provided in [2.6](#).


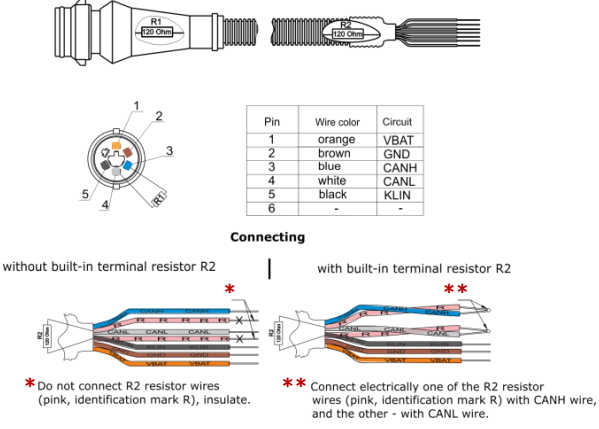

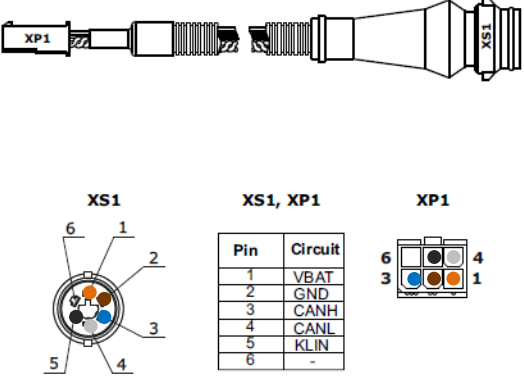
If the DUT-E GSM firmware update has been completed incorrectly and the current version of the inbuilt software has been damaged, the firmware update procedure has to be repeated. In this case, the inbuilt firmware loader is activated which enables to recover DUT-E GSM operability. If the repeated attempt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

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\* Except DUT-E GSM 2G with the version of firmware lower than 6.15.

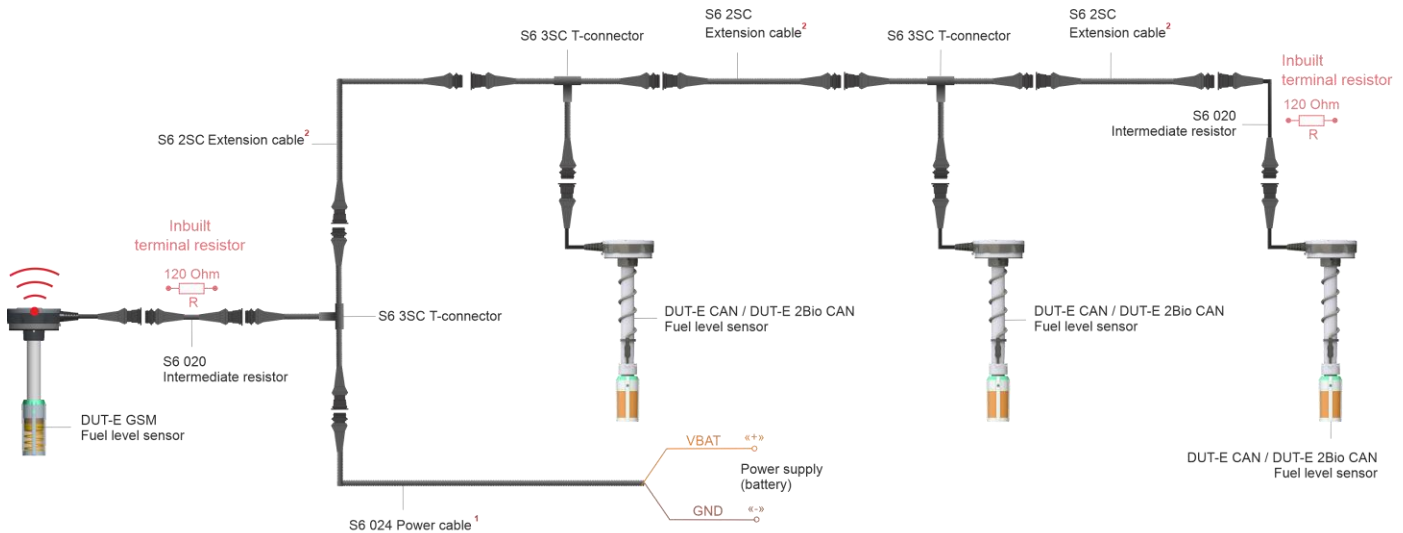
## Annex F Signal cables

Table F.1 — DUT-E GSM signal cables

Name and exterior	Design	Purpose of use and description																					
<p><b>S6 SC-CW-700 Cable</b></p> 	 <p><b>Pin</b></p> <table border="1" data-bbox="837 719 1018 831"> <thead> <tr> <th>Pin</th> <th>Wire color</th> <th>Circuit</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>orange</td> <td>VBAT</td> </tr> <tr> <td>2</td> <td>brown</td> <td>GND</td> </tr> <tr> <td>3</td> <td>blue</td> <td>CANH</td> </tr> <tr> <td>4</td> <td>white</td> <td>CANL</td> </tr> <tr> <td>5</td> <td>black</td> <td>KLIN</td> </tr> <tr> <td>6</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p><b>Connecting</b></p> <p>without built-in terminal resistor R2   with built-in terminal resistor R2</p> <p>* Do not connect R2 resistor wires (pink, identification mark R), insulate.</p> <p>** Connect electrically one of the R2 resistor wires (pink, identification mark R) with CANH wire, and the other - with CANL wire.</p>	Pin	Wire color	Circuit	1	orange	VBAT	2	brown	GND	3	blue	CANH	4	white	CANL	5	black	KLIN	6	-	-	<p>Designed to connect Units with S6 SC connector and CAN j1939/S6 interface (e.g. <a href="#">DUT-E GSM</a> fuel level sensors and so on) to tracking devices and to external power supply. Length 7 m. Includes two built-in terminating resistors (120 Ohm) between CANH and CANL wires.</p>
Pin	Wire color	Circuit																					
1	orange	VBAT																					
2	brown	GND																					
3	blue	CANH																					
4	white	CANL																					
5	black	KLIN																					
6	-	-																					
<p><b>S6 SC-Mol-300 S6 SC-Mol-700 Extension cable adapter</b></p> 	 <p><b>XS1</b></p> <p><b>XS1, XP1</b></p> <table border="1" data-bbox="837 1424 965 1559"> <thead> <tr> <th>Pin</th> <th>Circuit</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>VBAT</td> </tr> <tr> <td>2</td> <td>GND</td> </tr> <tr> <td>3</td> <td>CANH</td> </tr> <tr> <td>4</td> <td>CANL</td> </tr> <tr> <td>5</td> <td>KLIN</td> </tr> <tr> <td>6</td> <td>-</td> </tr> </tbody> </table> <p><b>XP1</b></p>	Pin	Circuit	1	VBAT	2	GND	3	CANH	4	CANL	5	KLIN	6	-	<p>Designed to connect the section of S6 cable system outside the cabin (S6 CS connector) and its section inside the cabin with Molex connector. Versions with cable length of 3 m and 7 m available.</p>							
Pin	Circuit																						
1	VBAT																						
2	GND																						
3	CANH																						
4	CANL																						
5	KLIN																						
6	-																						

## Annex G

### Example of a connection diagram by means of S6 Technology for DUT-E GSM and DUT-E CAN / DUT-E 2Bio CAN sensors for summarization of the fuel volume in several tanks



<sup>1</sup> Cable is included into DUT-E GSM delivery set. Length: 7.5 m.  
<sup>2</sup> The length is selected according to installation conditions. Standard lengths are 1, 3, 7 and 12 m.

Note — The above diagram can be used for connection of other [Units](#) with [CAN\\_j1939/S6 interface](#) (e.g. [DFM CAN](#), [DFM Marine CAN](#), [DFM Industrial CAN](#)) fuel flow meters instead of [DUT-E CAN](#) / [DUT-E 2Bio](#) sensors, in order to receive data from them.

Figure G.1 — Connecting several DUT-E CAN / DUT-E 2Bio CAN sensors to DUT-E GSM for summarizing data through S6 Technology

## Annex H

### Electromagnetic compatibility specifications

Table H.1 — Protection of power circuits of DUT-E GSM against conductive, capacitive and inductive interference as described in ISO 7637-2:2002

Test pulse	Test level	Us tested level, V for supply voltage	
		12 V	24 V
1	IV	-100	-600
2a	IV	+50	+50
2b	IV	+10	+20
3a	IV	-150	-200
3b	IV	+100	+200
4	IV	-7	-16
5	III	+65	+123

Table H.2 — Protection of signal circuits of DUT-E GSM against conductive, capacitive and inductive interference as described in ISO 7637-3:2002

Test pulse	Test level	Us tested level, V for supply voltage	
		12 V	24 V
Pulse "a" of short duration	IV	-60	-80
Pulse "b" of short duration	IV	+40	+80
Positive pulse of long duration (DCC)	IV	+30	+45
Negative pulse of long duration (DCC)	IV	-30	-45
Positive pulse of long duration (ICC)	IV	+6	+10
Negative pulse of long duration (ICC)	IV	-6	-10

Table H.3— DUT-E GSM own radio interference field strength as per UNECE Regulation No.10 (Revision 4)

Tested bandwidth, MHz	Quasi-peak value of field strength of radio interference, dB $\mu$ V/m		Average value of field strength of radio interference, dB $\mu$ V/m	
	Horizontal polarization	Vertical polarization	Horizontal polarization	Vertical polarization
30...34	27	25	20	20
34...45	23	21	16	18
45...60	18	18	13	14
60...75	17	16	10	9
75...100	11	13	7	8
100...130	12	14	7	9
130...170	22	16	18	12
170...225	24	18	18	13
225...300	32	24	27	11
300...400	19	21	13	14
400...525	22	24	16	15
525...700	24	27	23	23
700...850	34	32	25	27
850...1000	35	33	27	26

## Annex I

### Method of recording the calibration table for tanks of great capacity

For calibration of tanks (fixed tanks) of 6553.5 l capacity and higher, you need to change digit capacity of fuel volume values in all points of the calibration (column **Volume, l**).

The actual position of the decimal divider of the whole and fractional parts is ignored in volume values.

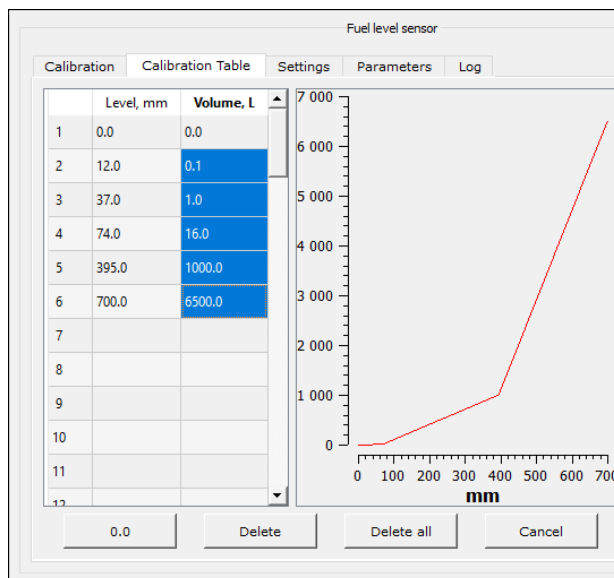
The discreteness of volume measurement in calibration points is changed from 0.1 liter to 1.0 liter.

The maximum possible volume value in the calibration table — 6553.5 l.

After the transfer of fuel volume data to the [Server](#) or to the tracking device, you don't have to multiply the value by 0.1 coefficient.



**WARNING:** For calibration of a tank (fixed tank) of greater than 6553.5 l capacity, you need to send fuel level values to the Server **in millimeters**. It is sufficient to create the calibration table only at the Server. No need to record the calibration table into the sensor memory.



Actual fuel volume values	Modified fuel volume values for recording into the calibration table
0 liter	0.0
1 liter	0.1
10 liters	1.0
160 liters	16.0
10000 liters	1000.0
65000 liters	6500.0

Figure I.1 — Example of recording of fuel volume values with changed discreteness into the calibration table with the help of Service S6 DUT-E software

## Annex J Videography

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

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

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

Check out the link:  [https://youtu.be/MnbGXn9JX\\_g](https://youtu.be/MnbGXn9JX_g)

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

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

**4) Animation DUT-E GSM fuel level sensor.**

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

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

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

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

Check out the link:  [https://www.youtube.com/watch?v=dWuY\\_JJfhFw](https://www.youtube.com/watch?v=dWuY_JJfhFw)

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

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

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

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