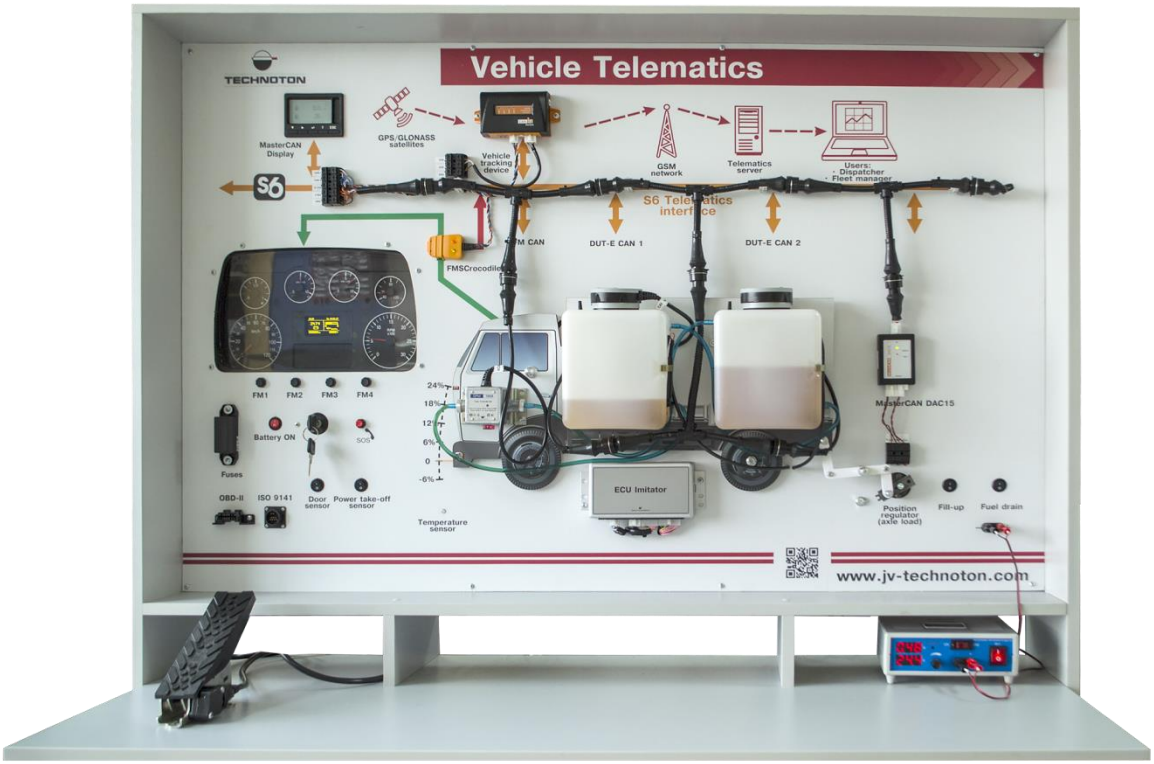
TECHNOTON

EDUCATIONAL TRAINER



Vehicle Telematics

OPERATION MANUAL

Version 2.0

Contents

Terms and Definitions

ORF 4 — is the Telematics service by JV Technoton developed 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.

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

Information on cabling system, service adapter and S6 software refer to CAN j1939/S6 Operation manual.

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

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

FMS — Data packets of onboard vehicle data buses which comply with the document "FMS-Standard Interface description" (FMS-Standard). FMS-Standard is the open standard of the FMS interface designed by the world leading truck producers.

A detailed description of FMS messages is contained in the document "FMS-Standard Interface description" (FMS-Standard). The current version of the document can be downloaded at the developing company site http://www.fms-standard.com.

OBD-II (On-board diagnostics) — the international standard of vehicle on-board diagnostics. CAN and K-Line buses are used in the OBD-II to transmit data. Depending on the vehicle manufacturer OBD-II employs protocols ISO 9141-2, ISO 14230 KWP 2000, SAE J1850 VPW/PWM, ISO 15765-4 CAN.

OBD-II Standard provides access to parameters and codes of malfunctions of engine and transmission control systems, enables to monitor the onboard computer data and carry out diagnostics of the Vehicle onboard set of electronic control modules.

Telematics — a set of telematic PGN developed by Technoton which accumulate basic data on the vehicle performance. Meets requirements of SAE J1939/71 standard.

Analytical report — report generated in ORF 4 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.

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).

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.

Post-trip Analysis — Vehicle operation analysis based on Analytical reports for the specified time period.

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

Event — relatively rare and sudden change in SPN. For example, the attempt to falsify values of "Instant fuel consumption" counter by applying electromagnetic field to fuel flow meter will be recognized as "Interference" Event. An Event can have one or several characteristics. "Interference" Event has the following: date/time and duration of interference. When the Event occurs, a terminal unit registers the time of occurrence, which is later mentioned in a report on the event. Thus, the Event is always attached to exact time and place of occurrence.

Counter — cumulative numerical characteristics of Parameter. Counter is represented by a number, which can only grow in time. Examples of Counters: fuel consumption, engine operation time, total distance and other.

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

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

Vehicle an object controlled within Telematic system. Usually Vehicle means a truck, tractor or bus, sometimes a locomotive or river boat. From Telematic system point of view, stationary objects are also considered to be vehicles: diesel gensets, stationary tanks, boilers/burners.

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

Unit is an element of vehicle onboard equipment compatible with S6 bus, which uses S6 Technology.

As applied to this document, this term indicates:

- DFM CAN fuel flow meter;
- DUT-E CAN fuel level sensors;
- FMSCrocodile CCAN contactless reader-converter;
- MasterCAN DAC15 J1939 i/o module;
- MasterCAN Display 61 display;
- CANUp 27 online telematics gateway.

Introduction

Recommendations and rules set forth in this Operation Manual are applied to the Educational Trainer Vehicle Telematics (further on Trainer) developed by JV Technoton, city of Minsk, Republic of Belarus.

This document contains general information on the purpose, design and characteristics of the Educational Trainer, outlines the procedure for its dedicated use.

ATTENTION: The work with the Trainer does not require any special qualification. The personnel who are instructed on health and safety rules for handling electrical equipment as well as health and safety rules established at the customer company are allowed to use the Educational Trainer.

The Manufacturer guarantees Trainer compliance with the requirements of technical regulations subject to the conditions of storage, transportation and operation set out in this Manual.

ATTENTION: It is strongly recommended to follow strictly the instructions of the present Manual when using Trainer.

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

1 General information and technical specifications

1.1 Purpose of use and area of application

The Vehicle Telematics Trainer is designed for functional simulation of the vehicle and Telematics system operation (see figure 1):

1) In the process of educational research activities of students, Master of Science students, postgraduate students (Training students of "Land Transportation" fields of study).

2) In the process of training telematics sensors and terminals installer personnel, telematics software developers, dispatch operators of transportation companies, other personnel working in the field of fleet satellite monitoring.

3) In the process of testing Onboard equipment and the Server of telematics services by producers and integrators of Telematics systems.

4) During the demonstration of the Vehicle telematics system functional performance at exhibitions of telematics equipment and workshops, in show rooms etc.

Area of application: the Trainer may be employed:

- in the process of education at automobile transportation higher educational establishments, colleges, technical schools, in the process of training and refresher training of personnel etc.;
- at exhibitions of telematics equipment and workshops;
- during testing of telematics equipment and related software.

Figure 1 — Purpose of the Vehicle telematics Trainer

The Trainer stand simulates operation of standard and additional vehicle Onboard equipment connected to CAN j1939/S6 Telematics interface and ensures real-time monitoring over 100 telematics Parameters, including:

- Vehicle location;
- Total volume of fuel and the volume of fuel separately in each of the two tanks;
- Presence of water in the fuel;
- Events "Refueling" and "Drain from the fuel tank";
- Hourly (instant) fuel consumption;
- Fuel consumption — total consumption and fuel consumption in various modes of engine operation ("Idle", "Optimal", "Overload");
- Time of engine operation — total time and time in various modes of engine operation ("Idle", "Optimal", "Overload");
- Events "Fuel Flow Meter Tampering" and "Interference into Flow Meter Operation";
- Engine rpm;
- Oil pressure and temperature;
- Cooling agent temperature;
- Air temperature outside the Vehicle;
- Onboard circuit voltage;
- Ignition key position;
- Axles load;
- Door opening;
- Event "Pressing SOS Emergency Button";
- Onboard equipment malfunctions.

The power supply and setup of Units comprising the Trainer as well as digital data transmission (PGN) are performed using CAN j1939/S6 Telematics interface cable system.

The monitoring of Parameters, Counters and Events in real time or for the selected time interval is performed in ORF 4 Telematics service through the Internet browser without using any special software, using any PC, tablet or smarphone.

During the Trainer operation current values of certain Parameters are presented on MasterCAN Display 61 displays and on the dashboard.

During the connection of CAN MasterCAN Tool Lite imitator/analyzer to CAN j1939/S6 Telematics interface all current data (PGN) transmitted using SAE J1939 protocol are displayed in the MasterCAN Tool software with their detailization into individual parameters (SPN).

During the connection of SK DUT-E service adapter to CAN j1939/S6 Telematics interface current Parameters, Counters and Events of DFM CAN fuel flow meter and DUT-E CAN fuel level sensors (which are components of the Trainer) can be viewed on the PC screen using the respective software (Service S6 DUT-E or Service S6 DFM).

1.2 Delivery set

Table 1 — Delivery set of Vehicle Telematics Trainer

Name	Quantity
Vehicle Telematics Trainer assembly	1 pc.
DC power supply source	1 pc.
Ignition key	2 pcs.
Accelerator pedal	1 pc.
Measuring liquid for the tank simulator	2 l
SK DUT-E Service Adapter	1 pc.
MasterCAN Tool Lite CAN bus Imitator/Analyzer	1 pc.
Specification	1 pc.

1.3 Trainer design

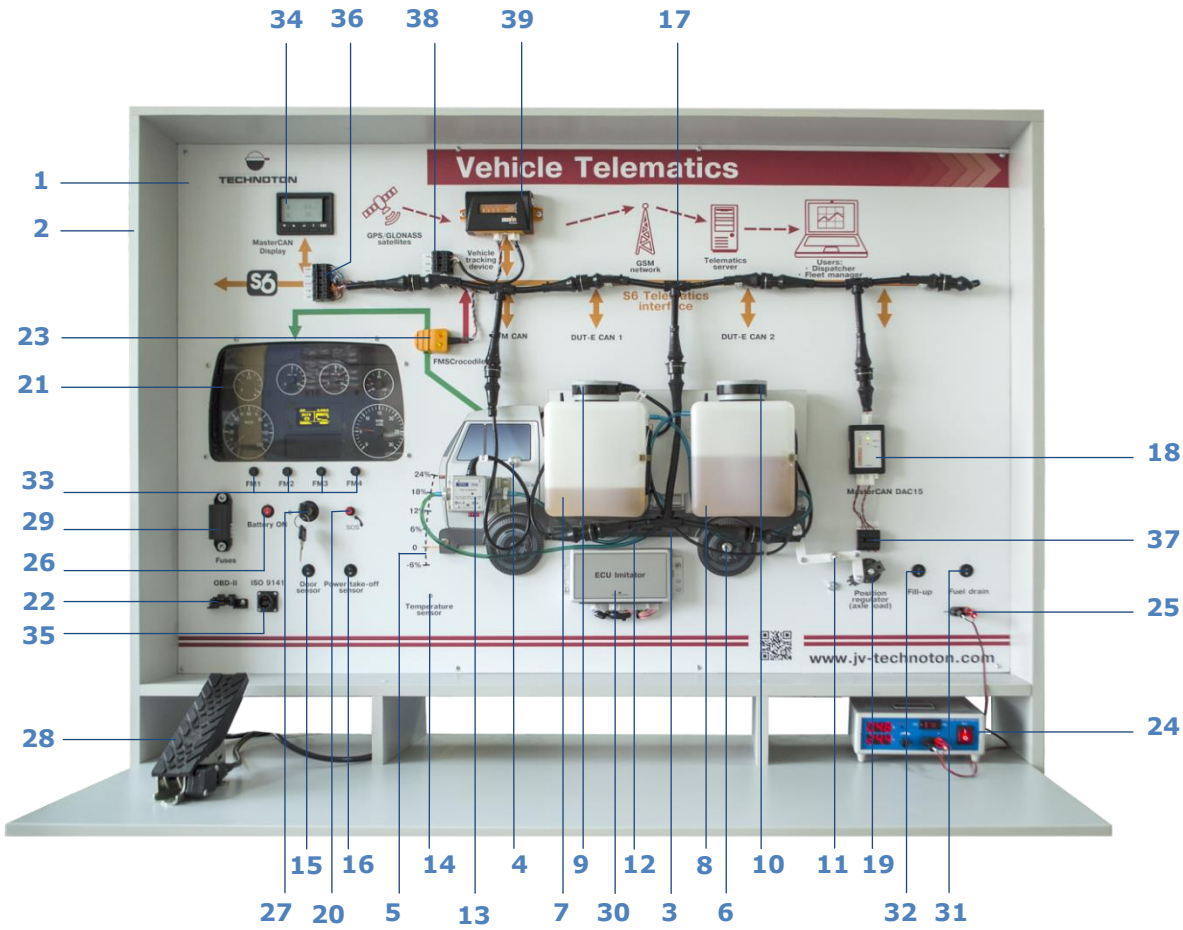


Figure 2 — Design of Vehicle Telematics Trainer

The Trainer equipment (components of Telematics system, S6 cable system, controls, tracking devices etc.) are located on the plastic base **(1)** which is fixed on the wooden frame with a panel **(2)**.

Power is supplied for the Trainer from the 24 V DC external power source **(24)**, the corresponding wires from the power source are connected to power supply terminals **(25)**.

"Battery ON" button **(26)** is used to simulate the Battery main switch.
The turn of the ignition key in the ignition lock simulates starting/switching off the engine and the vehicle onboard circuit **(27)**.

The electronic accelerator pedal **(28)** is used to simulate the fuel supply control.

The electronic module "ECU imitator" **(30)** is designed to simulate the running engine. It generates and transmits to CAN j1939/S6 Telematics interface the current parameters of oil pressure and temperature, temperature of the cooling agent, engine rpm etc.

In the centre of the Trainer stand there is a movable profile/imitator of a vehicle **(3)** on which two transparent fuel tank imitators filled with measuring liquid **(7, 8)** are mounted. DUT-E CAN fuel level sensors **(9, 10)** are mounted inside each of the imitator tanks. Each imitator tank is equipped with an electric pump and flexible transparent fuel supply pipelines **(12)** through which the fuel imitating liquid is pumped during the simulation of the running engine and during the "Drain from the fuel tank"/"Refueling" Events. To simulate the Event Drain from the fuel tank, the button "Fuel drain" **(31)** is used, while the "Fill-up" button is used to imitate the Refueling Event **(32)**.

DFM CAN **(13)** fuel flow meter is mounted in the crosscut section of the fuel supply pipeline, between the two fuel tank imitators. Output interfaces of the two DUT-E CAN sensors and DFM CAN fuel flow meter are connected to the cable system **(17)** of CAN j1939/S6 Telematics interface (see table 2).

To connect to CAN j1939/S6 Telematics interface in order to monitor data or to view the equipment malfunctions codes, the diagnostics connector ISO 9141 **(35)** may be used (see table 4).

Using the J1939 i/o module (digital-analog converter) MasterCAN DAC15 **(18)** the output signals of sensors: GNOM DP, of the ambient air temperature **(14)**, of the door opening **(15)**, of switching on the power take-off PTO **(16)** and SOS emergency button **(20)** are converted into CAN j1939/S6 Telematics interface.

The movable vehicle imitator profile is connected to the lever of GNOM DP axle load sensor **(19)** through a system of pull-rods **(11)**. Using the setting and fixing handle **(4)** the movable profile can be vertically shifted at a given angle of elevation from the point of fixing **(6)** which matches the Vehicle rear axle. This imitates the Vehicle moving on the road with a gradient from – 6 % to +24 % **(5)** which results in the liquid level fluctuation in the fuel tanks imitators and triggers the axle load sensor lever.

The Trainer stand contains a standard Vehicle CAN bus. The data from CAN bus are displayed on the dashboard **(21)** and on OBD-II diagnostics connector **(22)** (see table 3). FMSCrocodile CCAN Contactless Reader/Converter **(23)** is used to integrate data from CAN Vehicle bus (messages FMS and Telematics) into CAN j1939/S6 Telematics interface.

Data from CAN Vehicle bus (engine rpm, cooling agent temperature, pressure in the first and second air braking circuits, malfunction sensors of vehicle systems etc.) and DUT-E CAN 1 sensor readings are visually monitored from dashboard. FM1, FM2, FM3, FM4 buttons **(33)** are used to adjust the dashboard. The designation of the dashboard controls and warning indicators is provided in the Operation manual.

Besides, data received from measurements of DFM CAN fuel flow meter and the two DUT-E CAN fuel level sensors which are transmitted via CAN j1939/S6 Telematics interface are presented on MasterCAN Display 61 **(34)**. MasterCAN Display 61 automatically selects Parameters (SPN) from PGN which contain current data on the fuel consumption and Vehicle performance. Numerical values of SPN are presented on the LCD display in the form of information screens selected by the user.

The fuse block **(29)** (see table 8) is designed to protect electric circuits and the Trainer stand from short circuit and overloads.

The terminal block "S6" **(36)** (see table 5) serves to connect the wires of CAN j1939/S6 Telematics interface cable system.

The "Vehicle tracking device" terminal block **(38)** (see table 6) serves to connect the Telematics terminal***** to the wires of CAN j1939/S6 Telematics interface cable system. In case of using CANUp 27 online telematics gateway it is connected with Molex connector **(39)**.

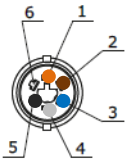
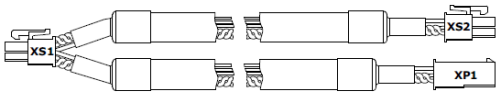
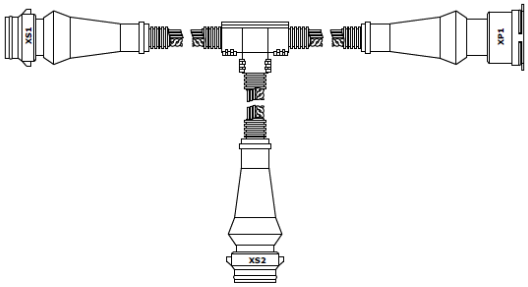
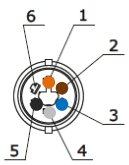
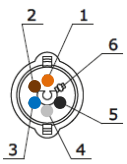
To monitor the output signal of GNOM DP sensor, axle load sensor, the "Axles Load Sensor" terminal block **(37)** (see table 7) is used.

Data from Onboard equipment alongside with data from CAN vehicle bus are received via S6 Telematics interface by the Terminal which collects, records, stores and transfers the received data to the Server. ORF 4 Telematics service processes and analyzes the received data and generates Analytical reports for the selected time interval.

***** We recommend to use CANUp 27 online telematics gateway

1.4 Connection elements of the Trainer stand

Table 2 — Elements of S6 cable system

Name and external view	Design
S6 SC-Mol **Extension cable/Adapter** 	 XS1  XS1, XP1 Pin / Circuit 1 VBAT 2 GND 3 CANH 4 CANL 5 KLIN 6 - XP1 
S6 3Mol **T-connector** 	 XS1, XS2  XS1, XS2, XP1 Pin / Circuit 1 VBAT 2 GND 3 CANH 4 CANL 5 KLIN 6 - XP1 
S6 3SC **T-connector** 	 XS1,XS2  XS1, XS2, XP1 Pin / Circuit 1 VBAT 2 GND 3 CANH 4 CANL 5 KLIN 6 - XP1 

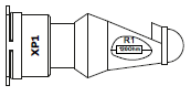
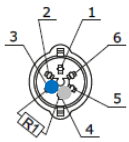
Name and external view	Design
S6 SC **Cable blind cover** 	 **XP1** Pin / Circuit 1 - 2 - 3 CANH 4 CANL 5 - 6 - **XP1**  Designed to generate electric impedance of CAN j1939/S6 Telematics interface, in compliance with SAE J1939 Standard requirements. It has S6 CS connector with the 120 Ohms inbuilt terminal resistor between CANH and CANL contacts.
Specification of wires of S6 cabling system: ● VBAT (KL30) — "+" power supply voltage (Battery) (9…45) V; ● GND — ground "-"; ● CANH — CAN HIGH signal of CAN 2.0B interface(SAE J1939); ● CANL — CAN LOW signal of CAN 2.0B interface(SAE J1939); ● KLIN — K-Line signal K-Line of interface (ISO 14230).	

Table 3 — Pinout of OBD-II diagnostics connector

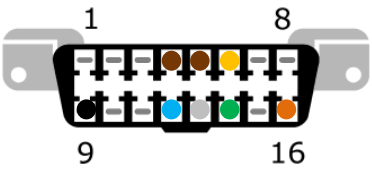
Type	Contact number	Designation	Name
 1 8 9 16	1	**-**	**-**
	2	-	-
	3	-	-
	4	GND	Ground “-”
	5	GND	Chassis ground of signal
	6	CANH	CAN-High (SAE J1939)
	7	-	-
	8	-	-
	9	KLIN (S6)	K-Line (ISO 14230)
	10	-	-
	11	-	-
	12	CANH (S6)	CAN- High (S6)
	13	CANL (S6)	CAN-Low (S6)
	14	CANL	CAN-Low (SAE J1939)
	15	-	-
	16	VBAT	Power supply “+”

Table 4 — Pinout of ISO 9141 diagnostics connector

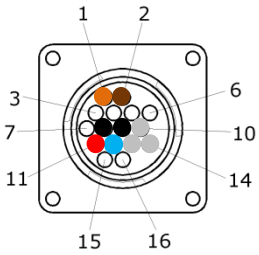
Type	Contact number	Designation	Name
	1	VBAT	Power supply “+”
	2	GND	Ground “-”
	3	-	-
	4	-	-
	5	-	-
	6	-	-
	7	-	-
	8	KLine	K-Line (ISO 9141)
	9	KLIN (S6)	K-Line (ISO 14230)
	10	LLine	L-Line (ISO 9141)
	11	232TX	Data transmitted (RS-232)
	12	CANH (S6)	CAN-High (S6)
	13	CANL (S6)	CAN-Low (S6)
	14	232RX	Data received (RS-232)
	15	-	-
	16	-	-

Table 5 — Pinout of "S6" terminal block

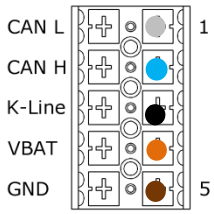
Type	Contact number	Designation	Name
	1	CANL	CAN-Low (S6)
	2	CANH	CAN-High (S6)
	3	KLIN	K-Line (ISO 14230)
	4	VBAT	Power supply “+”
	5	GND	Ground “-”

Table 6 — Pinout of "Vehicle tracking device" terminal block

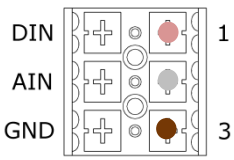
Type	Contact number	Designation	Name
	1	DIN	Discrete signal (pressing SOS emergency button)
	2	AIN	Analog signal (output signal of GNOM DP axles load sensor)
	3	GND	Ground “-”

Table 7 — Pinout of the "Axles Load" terminal block

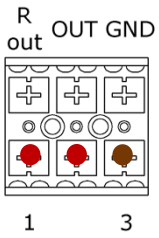
Type	Contact number	Designation	Name
	1	ROUT	Resistive signal (converted signal from DUT-E CAN fuel level sensor)
	2	OUT	Analog signal (output signal of GNOM DP axles load sensor)
	3	GND	Ground "-"

Table 8 — Fuse block

Type	Indication of Position	Rated Current for Triggering Fuse	Power Supply circuits protected
	FU1	3 A	Battery switch
	FU 2		CAN j1939/S6 Telematics interface
	FU 3		Ignition lock
	FU 4		Electric pumps for the fuel tanks imitators

1.5 Technical specifications

1.5.1 Main specifications

Table 9 — Main specifications

Parameter, measuring unit	Value
CAN j1939/S6 digital interface	CAN 2.0B (SAE J1939)
K-Line digital interface	ISO 9141
Rated power supply voltage, V	24
Power consumption, Wt, no more than	50
Time of readiness for operation, m, no more than	1 *
Time of continuous operation, h, no more than	16 **
Temperature range, °C	from +15 to +30
Average service life, years, no more than	10
Weight, kg, not more than	90
Overall dimensions, mm, not more than	see figure 3
* Time of readiness for reception of GNSS signals after the power is on. ** No less than 4 three-hour working sessions of continuous operation with technical breaks.	

1.5.2 Data transmitted from Units

Transmission of data by Units comprising the Trainer set is performed via CAN j1939/S6 Telematic interface.

The Units interface characreristics correspond to S6 specification. The Units data exchange protocol via CAN interface complies with J1939 Standard requirements and S6 Database.

The format of the data transferred corresponds to S6 database. The database of PGN and SPN used in S6 is presented at http://s6.jv-technoton.com/

The functioning of S6 Units, monitoring their operability, maintenance of Counters, recording of Events and setup of Parameters are ensured by the well-concerted operation of Functional Modules (FM). FM designation, a description of their settings, input/output parameters (SPN) are provided in the FM section of the company site http://s6.jv-technoton.com, as well as in operation manuals of the respective Units from the set of Units presented at the Trainer (see the section Products Documentation at https://www.jv-technoton.com).

Each Unit of the Trainer set must have a unique network address (SA) (see table 10), to identify it in CAN j1939/S6 Telematics interface.

Addresses of various types of Units may be chosen from the authorized range **81…163**.

WARNING: To avoid interference with CAN-bus operation, it is **strictly forbidden** to choose network addresses for Units from the ranges **0…80** and **164…255**

The Units transmit/receive data in the automatic mode (basic mode) or upon request. The rate of data exchange may be selected from the range of values: 100; 125; 250; 500; 1000 kbit/s.

The setup of the Trainer Units is conducted via K-Line interface (ISO 9141) using the service software, in compliance with S6 service protocol. The Units setup procedures are described in the operation manuals of the respective Units. The current versions of the software may be downloaded at https://www.jv-technoton.com, section Software/Firmware).

Table 10 — Authorized network addresses of Units comprising the Trainer set

Units S6		Quantity,	Authorized Network Addresses (SA)
Type	Model		
Online telematics gateway	CANUp 27	1	100
Fuel flow meter	DFM CAN	1	111…118
Fuel level sensor	DUT-E CAN	2	101…108
J1939 i/o module	MasterCAN DAC15	1	126, 146
Contactless reader-converter	FMSCrocodile CCAN	1	122
Display	MasterCAN Display 61	1	109, 110

Information on cabling system, service adapter and S6 software refer to CAN j1939/S6 Operation manual.

1.5.3 Overall dimensions

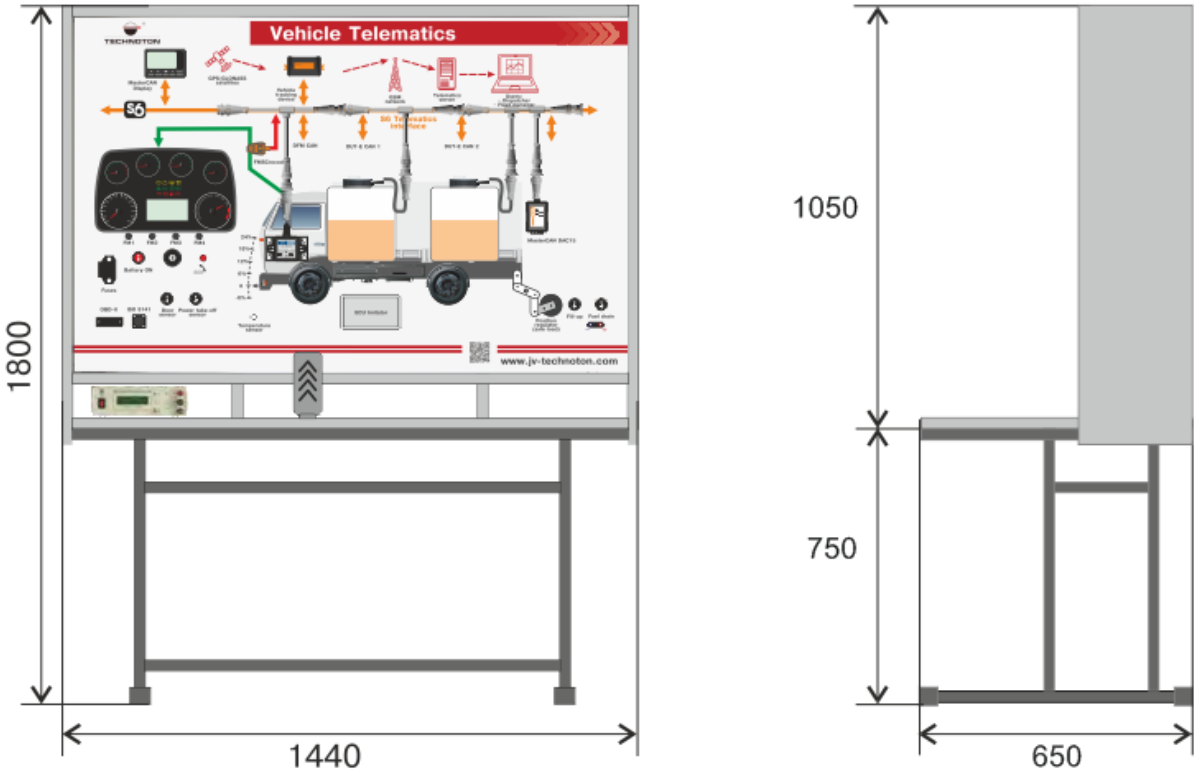


Figure 3 — Overall dimensions

2 Preparation for Work

ATTENTION: Strictly follow safety rules of automobile repair works as well as local safety rules of the customer company when working with Trainer.

To ensure the Trainer correct operation, we recommend to conduct its setup by certified personnel that has undergone training at the company.

IMPORTANT: To ensure the Trainer correct operation, you need to:
1) Ensure the maximum firmament view at the stand installation location for the best reception of the navigation data by the Terminal. It is recommended to install the Trainer at a distance no more than 3 m from the windows. The glasses of the windows must be radiotransparent.
2) Eliminate any electromagnetic interference in the vicinity of the Trainer (running electric motors, powerful transformers and switching equipment, welding equipment and so on).

Preparation for work with the Trainer includes the following operations:

1) Exterior inspection prior to works start

It is necessary to conduct the Trainer 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) Service Software installation on PC

To work with ORF 4 Telematics Service and the Units service software included into the Trainer set, you need the IBM-compatible PC (desktop or laptop) that meets the following requirements:

- CPU - Intel or AMD with a minimum clock speed of 2500 MHz;
- RAM - at least 3 GB;
- USB port;
- Screen resolution not less than 800x600;
- Operating system (X32/X64) - Windows XP/Vista/7/8/8.1/10.
- Special service software should be installed on PC:
  1) USB driver creating virtual COM port for USB-UART CP2102 converter;
  2) Service S6 utility for Unit configuration:
     - Service S6 DFM (for configuration of DFM CAN);
     - Service DUT-E (for configuration of DUT-E CAN);
     - Service CANUp (for configuration of CANUp 27);
     - Service S6 MasterCAN (for configuration of MasterCAN DAC15);
     - MasterCAN Tool Software and STM32 Virtual COM Port Drive (for configuration of MasterCAN Tool).

Please, download the USB driver and Service S6 software from https://www.jv-technoton.com/ website (Software/Firmware section) and install it to your PC.

3) Purchase and installation of SIM-card. Internet connection setup

SIM-card is not included into the Trainer delivery set and is to be purchased separately from the mobile communication operator company. Before you start working with the Trainer, install the SIM-card into the Terminal. Enter the setup data of the GPRS-modem Internet connection of the Terminal. in the service software of the Terminal.

ATTENTION:
1) During your work with the Terminal please, follow the instructions provided in its the operation documentation.
2) We recommend to use a SIM-card with PIN-code protection removed which supports only the feature of data transmission by GPRS, as well as reception/transmission of SMS messages.
2) To receive GPRS settings, you need to apply to service centre of the mobile communication operator whose SIM-card is installed in the Terminal.

4) Receiving access authorization to ORF 4 Telematics Service

To enter and use Telematics service, the user must have a unique login and password as well as certain access rights enabling him to view ORF 4 elements and operate them.

To receive access rights, please, apply to ORF 4 Administrator at the Technoton technical support service by E-mail support@technoton.by. Enter the received Server connection settings into the Terminal service software.

3 Dedicated Use

In order to start your work with the Trainer, switch on the external power source and press the button **Battery ON** located in the left bottom portion of the stand. All the Trainer equipment is operational from the moment the power supply is on. MasterCAN Display 61 switches on 10 s after the power supply is on. The display of dashboard switches on after the ignition key is turned to the **ON** position. The Trainer is ready for use 1 minute after it is switched on.

The Trainer enables to simulate the following telematics parameters:

1) Event "Refueling" (SPN 521200) indicates rapid increase of the fuel volume in the tank. Date/Time of the Event, the filled volume of the fuel and the fuel volume in the tank at the moment of the beginning/end of the Event are indicated in the Parameters of the Event.

To simulate the "Refueling" Event, set the ignition key to the **OFF** position or set it to the **ON** position without activating the starter and push the **Fill-up** button to position **I**.

The electric pump switches on and pumps the liquid from the imitation fuel tank with DUT-E CAN sensor 2 to the imitation tank with DUT-E CAN sensor 1. You can observe the increase of the fuel volume in the imitator tank:

- on the fuel level pointer indicator of the dashboard;
- on the LCD display MasterCAN Display 61;
- on the PC screen in Service S6 DUT-E software (Fuel Level Sensor submenu) during the connection of the service adapter to CAN j1939/S6 Telematics interface;
- on the window of ORF 4 Telematics service (the Refueling Event message, a change in the diagram of the fuel level in the tank, in accordance with figure 4).

2) "Drain from the fuel tank" Event (SPN 521201) indicates the rapid decrease of the fuel volume in the tank. Date/Time of the Event, the discharged volume of the fuel and the fuel volume in the tank at the moment of the beginning/end of the Event are indicated in the Parameters of the Event.

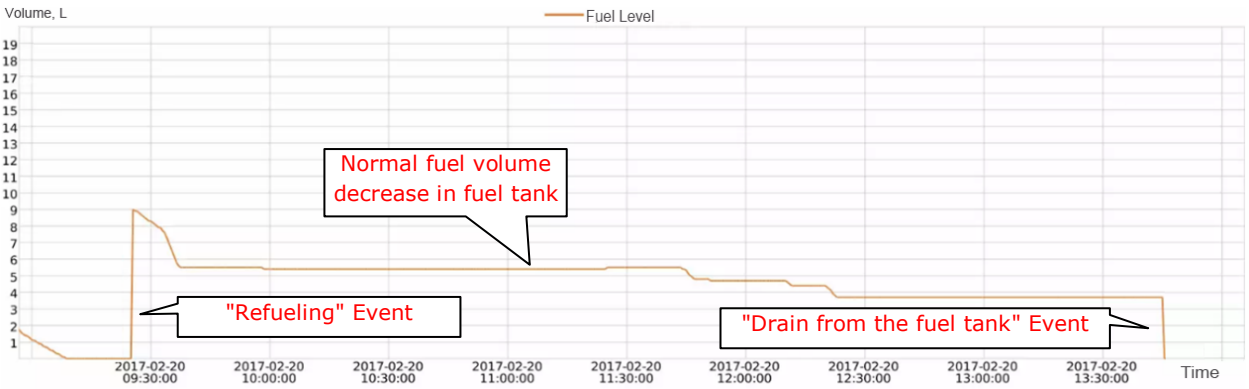
To simulate the "Drain from the fuel tank" Event, set the ignition key to the **OFF** position or set it to the **ON** position without activating the starter and push the **Fuel drain** button to position **I**.

The electric pump switches on and pumps the liquid from the imitation fuel Tank 1 with DUT-E CAN sensor to the imitation tank 2 with DUT-E CAN sensor. You can observe the decrease of the fuel volume in the imitator tank:

- on the fuel level pointer indicator of the dashboard;
- on the LCD display MasterCAN Display 61;
- on the PC screen in Service S6 DUT-E software (Fuel Level Sensor submenu) during the connection of the service adapter to CAN j1939/S6 Telematics interface;
- on the window of ORF 4 Telematics service (the "Drain from the fuel tank" Event message, a change in the diagram of the fuel level in the tank, in accordance with figure 4).

Event time	Time received	Event text	Location	Count
2017-02-20 08:54:43	2017-02-20 09:06:55	Stend TT_001: 2017-02-20 08:54:43 Fuel theft of '2.50 l' detecting near Partizanski Ave, Minsk.	Partizanski Ave, Minsk	1
2017-02-20 09:08:43	2017-02-20 09:25:18	Stend TT_001: 2017-02-20 09:08:43 Fuel theft of '2.20 l' detecting near Partizanski Ave, Minsk.	Partizanski Ave, Minsk	1
2017-02-20 09:29:59	2017-02-20 09:47:17	Stend TT_001: 2017-02-20 09:29:59 Fuel filling of '5.80 l' detecting near Partizanski Ave, Minsk. Final level '5.80 l'.	Partizanski Ave, Minsk	1

a) examples of messages on the "Refueling"/"Drain from the fuel tank" Events



b) example of the fuel level diagram analysis

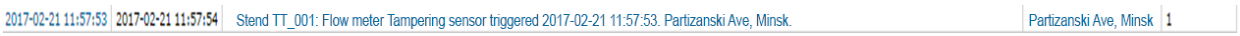
Figure 4 — Monitoring the fuel level in the tank based on data received from DUT-E via ORF 4

3) The "Tampering" Event (SPN 521216) is used to record incidents of unauthorized impact of external factors on DFM fuel flow meter which hamper its correct operation. This Event is an evidence of attempts to fake the fuel consumption Counter (e.g. by purging air through the flow meter measuring chamber). The Date/Time of the Event and the Volume of the fuel readings cheat are indicated in the Parameters of the Event.

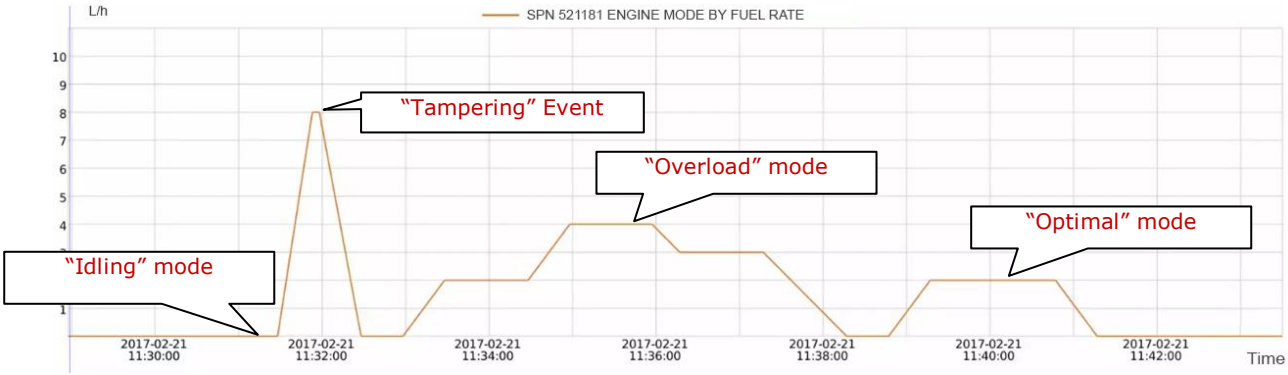
To simulate the "Tampering" Event, set the ignition key to the **OFF** position or to the **ON** position without activating the starter and set the **Fuel drain** button to position **I**.

The electric pump switches on the pump which will pump the liquid from the imitation fuel Tank 1 with DUT-E CAN sensor into the imitation Tank 2 with DUT-E CAN sensor through DFM CAN flow meter. You can observe the value of the fuel consumption rapid increase:

- on the PC screen in Service S6 DFM software (FM Flow Meter – field Counters and window Diagrams) during the connection of the service adapter to CAN j1939/S6 Telematics interface;
- on the LCD display MasterCAN Display 61;
- on the PC screen in MasterCAN Tool software (Monitor S6 tab) during the connection of MasterCAN Tool Lite to CAN j1939/S6 Telematics interface;
- on the window of ORF 4 Telematics service ("Tampering" Event message, a sharp increase of instant fuel consumption on the diagram of the engine modes of operation indicating fuel consumption, in accordance with figure 5).



a) example of the "Tampering" Event message



b) example of the engine modes of operation analysis in terms of fuel consumption

Figure 5 — Monitoring fuel consumption with ORF 4

4) Fuel consumption in the "Idle" fuel consumption mode (SPN 521392/9.0) — less than 10 % from the maximum hourly fuel consumption.

To simulate fuel consumption in the "Idle" mode, set the angle of shifting of the movable profile at 0 %, set the ignition key to **ON** position with the starter on, set the accelerator pedal to the position so that the readings of the tachometer (located at the dashboard) should not exceed 1000 rpm.

5) Fuel consumption in the modes of operation:

- "Optimal" (SPN 521392/9.1) — from 10 to 75 % from the maximum hourly fuel consumption;

To simulate fuel consumption in the "Optimal" mode, set the angle of shifting of the movable profile at 18 %, set the ignition key to ON position with the starter on, set the accelerator pedal to the position so that the readings of the tachometer (located at the dashboard) should not exceed the range 1000 – 3000 rpm.

- "Overload" (SPN 521392/9.2) — from 75 to 100 % from the maximum hourly fuel consumption.

To simulate fuel consumption in the "Overload" mode, set the angle of shifting of the movable profile at 24 %, set the ignition key to ON position with the starter on, set the accelerator pedal to the position so that the readings of the tachometer (located at the dashboard) should exceed the range of 3000 rpm.

You can observe the simulation of the vehicle operation in the "Idle", "Optimal" and "Overload" engine modes of operation:

- on the PC screen in Service S6 DFM software (FM Flow Meter – field Counters and window Diagrams) during the connection of the service adapter to CAN j1939/S6 Telematics interface;
- on the speed pointer indicator and the tachometer of the dashboard;
- on the LCD display MasterCAN Display 61;
- on the PC screen in MasterCAN Tool software (Monitor S6 tab) during the connection of MasterCAN Tool Lite to CAN j1939/S6 Telematics interface.
- on the window of ORF 4 Telematics service (see on figure 6 the example of the hourly fuel consumption diagrams for different modes of the engine operation).

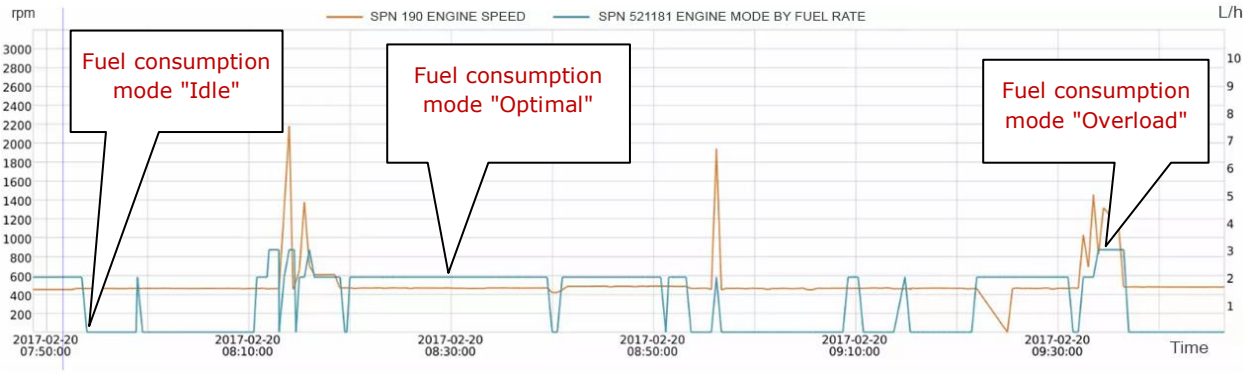


Figure 6 — Monitoring the fuel consumption by the Vehicle in different modes of fuel consumption

6) The Event "Interference with the flow meter operation" (SPN 521217) is used to record incidents of unauthorized impact of external factors on DFM fuel flow meter which hamper its correct operation. This Event is an evidence of attempts of impact the fuel flow meter with magnetic field in order to fake the readings of the hourly fuel consumption.
Date/Time of the Event and the Period of Interference are indicated in the Parameters of the Event.
To simulate the Event "Interference with the flow meter operation", set the ignition key to any position and apply the permanent magnet to the DFM CAN fuel flow meter cover.
The fact of impact on the flow meter operation with a magnet can be observed:

- on the PC screen in Service S6 DFM software (FM Flow Meter – the message Interference in the left upper portion of the window and the time of interference in the Counters field) during the connection of the service adapter to CAN j1939/S6 Telematics interface;
- on the PC screen in MasterCAN Tool software (Monitor S6 tab) during the connection of MasterCAN Tool Lite to CAN j1939/S6 Telematic interface;
- on the window of ORF 4 Telematics service ("Interference" Event message, in accordance with figure 7).

Figure 7 — Examples of ORF 4 messages of the "Interference with the Flow Meter Operation" Event

7) "Load" (SPN 521208), "Unload" (SPN 521209) and "Overload" (SPN 521210) Events are employed to monitor the facts of the Vehicle loading, unloading and overloading, respectively.

Date/Time of the Event, the load weight and the axle load at the beginning and at the end of the Event are indicated in "Load"/"Unload" ("Detachment") Parameters of the Event.

Date/Time of the Event and the axle load are indicated in the «Overload» Event Parameters.

To simulate "Load"/"Unload" ("Detachment")/"Overload" Events, set the ignition key to the ON position with the starter on.

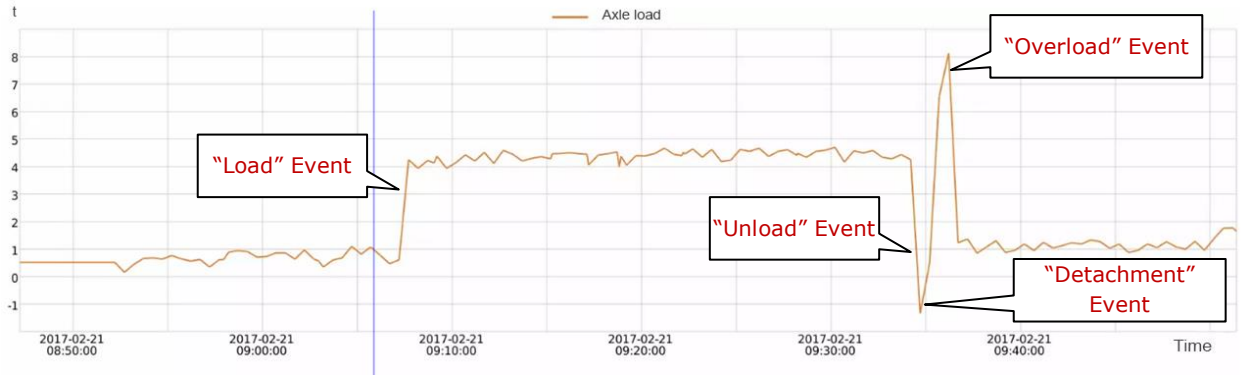
Set the following values of the angle shifting of the movable imitator profile:

- for the "Load" Event: +18 %;
- for the "Unload" Event ("Detachment" — semitrailer detachment from the tractive vehicle): -6 %;
- for the "Overload" Event: +24 %.

The facts of the Vehicle loading, unloading and overloading can be observed on the window of ORF 4 Telematics service (see the diagram of the Vehicle axle load and the "Overload" Event message in figure 8).

a) example of the "Overload" Event message

b) example of the "Detachment" Event message



c) example of the axle load diagram

Figure 8 — Monitoring axle load with ORF 4

8) The Event "SOS button pressed" (SPN 521226) is used to monitor facts of pressing SOS emergency button.
Date/Time of the Event, the longitude and latitude are indicated in the Parameters of the Event.
To simulate the Event "SOS button pressed", set the ignition key to any position. You must press SOS emergency button and hold it 2…3 s.
You may observe the fact of pressing SOS emergency button in the window of ORF 4 Telematics service (see the example of the emergency message in figure 9).

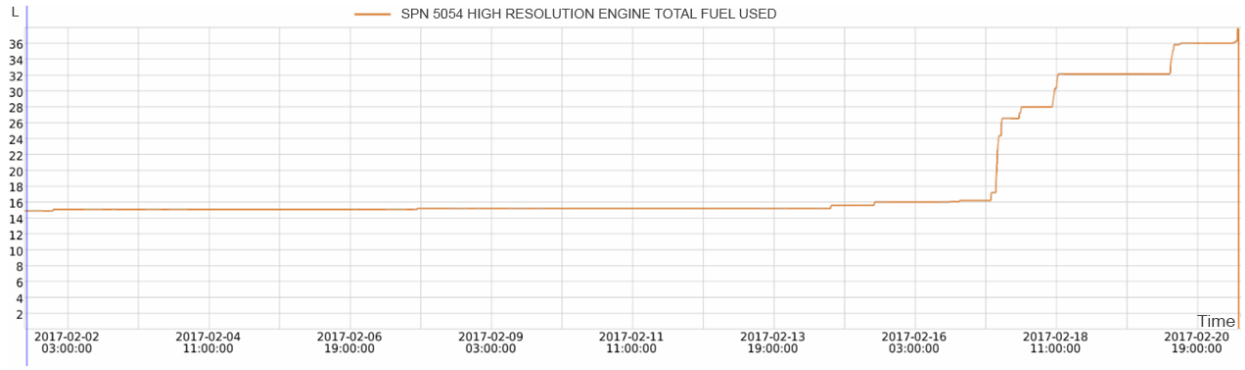
Figure 9 — Example of ORF 4 message of pressing the Emergency button

9) The ORF 4 Statistics Report serves to view the summary data of the monitored Telematics parameters (see figure 10).

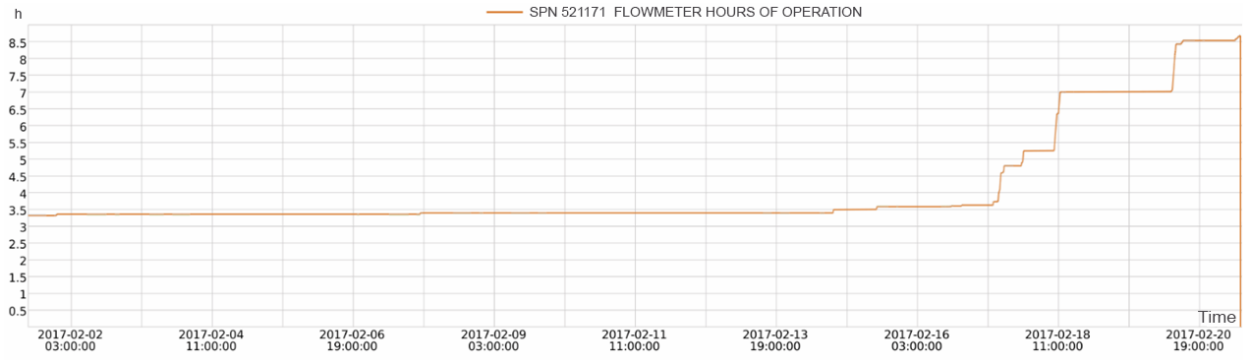
Report	Stend TT_001
Unit	Stend TT_001
Report execution time	2018-07-24 10:30:14
Interval beginning	2017-02-01 00:00:00
Interval end	2018-07-24 23:59:59
Mileage in trips	269 km
Consumed by DFM	91 lt
Avg consumption by DFM in l/h	4.93 lt/h
Avg consumption by DFM	33.44 lt/100 km
Initial fuel level	73 lt
Final fuel level	89 lt
Total filled	231 lt
Total fillings	7
Total fuel stolen	89 lt
Total thefts	5
Average speed in trips	498
Max speed in trips	2187
Engine hours	1:00:26

Figure 10 — Example of ORF 4 Statistics Report

10) The total fuel consumption, high resolution (SPN 5054) and the engine operation period (SPN 521171) may be also viewed in the form of diagrams (see figure 11).



a) example of the total fuel consumption, high resolution



b) example of the diagram of the engine operation time

Figure 11 — Examples of ORF 4 graphic reports

4 Packaging

The Trainer set is delivered in the plywood box. Gross weight — no more than 100 kg.

Label sticker with information on the product name, serial number, manufacture date, weight as well as Quality Control seal and QR code is stuck on the Trainer set box.

5 Storage

The Trainer stand may be stored in closed and other premises with natural ventilation, without any climatization, in warehouses that are not heated.

The Trainer stand 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 Trainer stand in the same room with substances that cause metal corrosion and/or contain aggressive impurities.

6 Transportation

Transportation of Trainer stand is recommended in closed transport that provides protection from mechanical damage and precipitation.

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

7 Utilization/re-cycling

The Trainer stand does not contain harmful substances and ingredients that are dangerous to human health and environment during and after the end of life and recycling.

The Trainer stand does not contain precious metals in amount that should be recorded.

Contacts

Manufacturer

TECHNOTON

9001:2015
certified quality

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