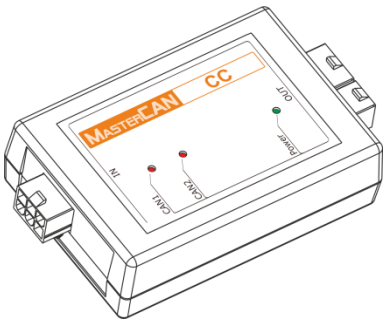
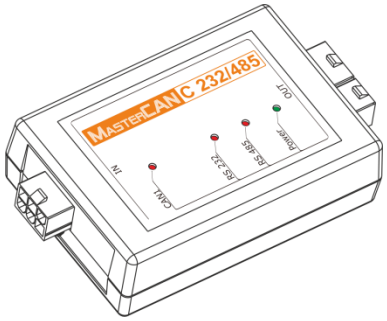
MASTERCAN

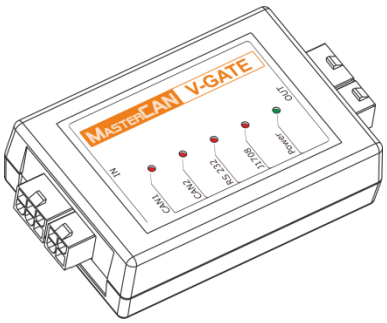
DATA CONVERTERS



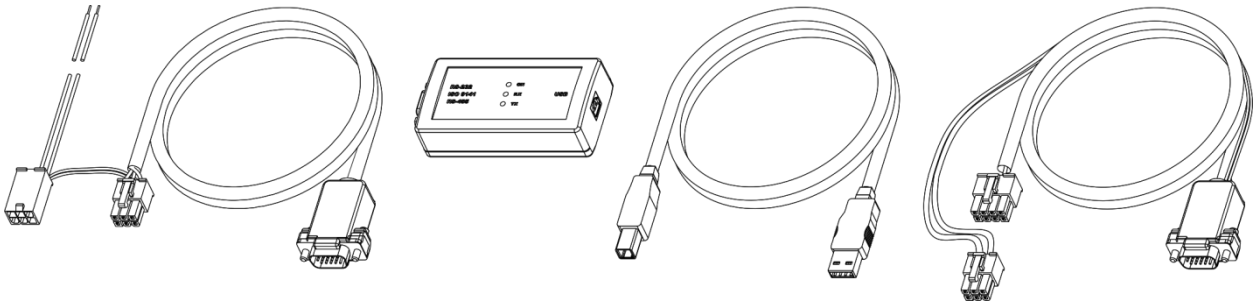
MasterCAN CC



MasterCAN C 232/485



MasterCAN V-GATE



SK MasterCAN service adapter

OPERATION MANUAL

(includes Service MasterCAN software manual)

Version 5.0

S6

TECHNOTON

ADVANCED MACHINERY TELEMATICS

E28 10 R - 05 2192

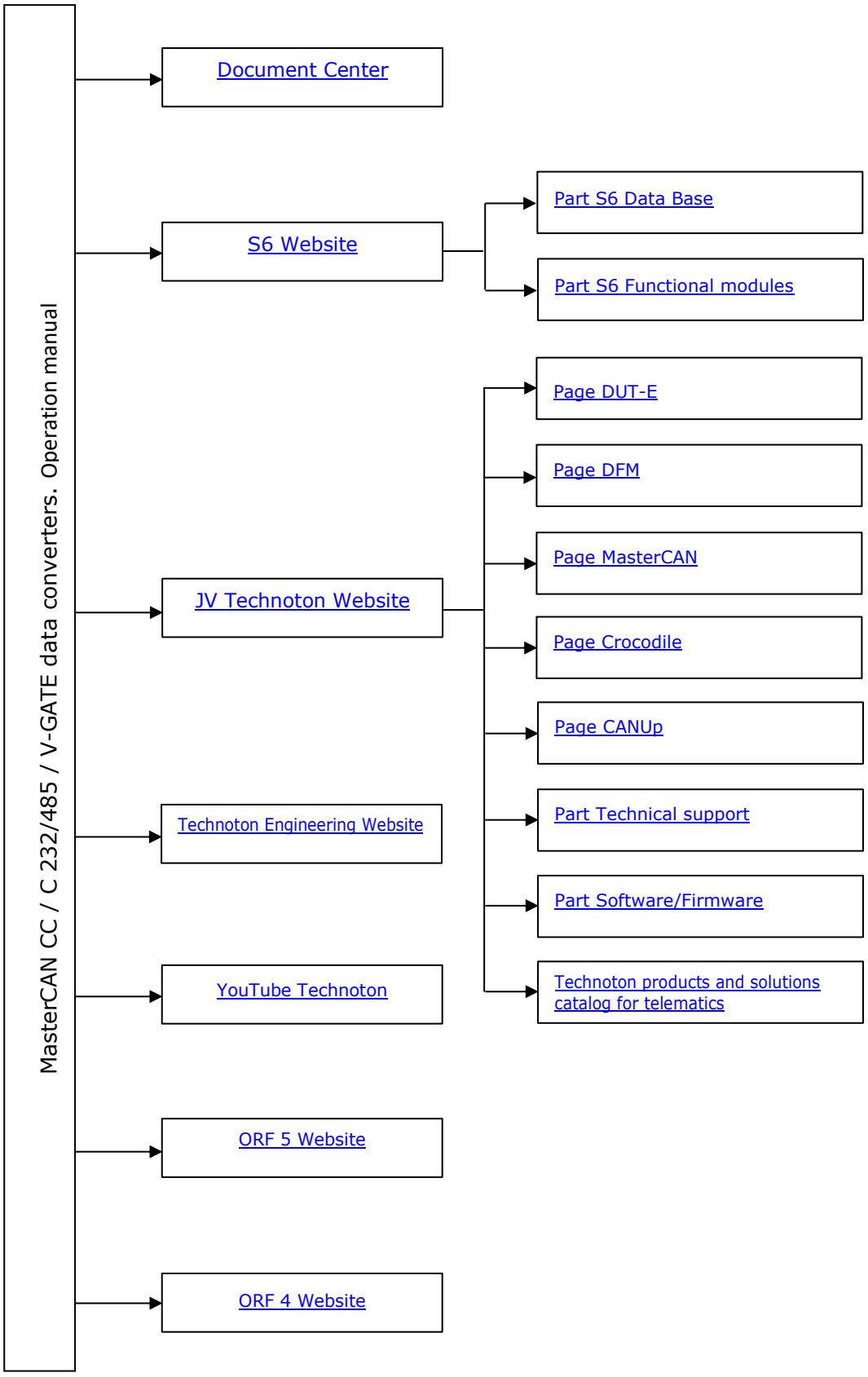
EAC

Content

Revision history

Version	Date	Editor	Description of changes
1.0	01.2013	OD	Basic version.
4.0	01.2017	OD	• New design of output connectors for all models of MasterCAN. • MasterCAN scheme of connection to terminal changed. • Delivery set of MasterCAN and SK MasterCAN changed. • S6 SK service kit can now be used for MasterCAN configuration. • MasterCAN connection to PC is changed and amended. • MasterCAN V-gate connection parameters are clarified. • MasterCAN data transfer protocol is amended. • Terms and definitions are updated.
5.0	08.2021	OD	• New product names are introduced (MasterCAN CC/ C 232/485 / V-GATE data converters, SK MasterCAN service adapter). • Information on the products is updated, as well as the products terminology. • Model codes of the converters are added. • Data composition in the converters output messages via CAN j1939/S6 interface is updated. • Valid certificates added: - E-mark — Uniform provisions concerning the official approval of vehicles with regard to electromagnetic compatibility, in accordance with Regulation No 10 UN/ECE. - Declaration of Compliance TR CU 020/2011 "Electromagnetic Compatibility of Technical Products". • Minimum requirements to the PC for work with Service MasterCAN software are specified. • Diagrams of the converters connection to the PC using S6 SK service adapter are updated. • Example of the converter connection diagram for summation of DUT-E CAN sensors readings via RS-232 interface is updated. • Structure of external links is added, videography etc.

Structure of external links



Terms and Definitions

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.

Data converters MasterCAN CC / C 232/485 / V-GATE are designed on the basis of S6 Technology.

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).

j1708 is a digital bus-type interface. Bus j1708 is used in some modern vehicles to transmit and exchange data between the engine controller and other electronic devices. The level of data presentation complies with SAE j1587 International Standard.

FMS — special set of PGN containing basic parameters from onboard data buses of trucks. It corresponds to FMS-Standard Interface description standard which is the standard of leading world producers of trucks.

Telematics — special set of Telematics PGN developed by Technoton which accumulates basic data on the vehicle performance. It meets requirements of SAE j1939/71 standard.

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.

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)..

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

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.

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.

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.

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

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

Telematics terminal (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.

Vehicle an object controlled within Telematics system. Usually Vehicle means a truck, tractor or bus, sometimes a locomotive or river boat. From Telematics 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 on-board equipment compatible with S6 bus, which uses S6 Technology.

Introduction

Recommendations and rules set out in this Operation Manual are related to **MasterCAN CC / C 232/485 / V-GATE** data converters (further on — converters), models codes: **123** (for MasterCAN CC), **124** (for MasterCAN C 232/485), **125** (for MasterCAN V-GATE) and to **SK MasterCAN service adapter** (further on — SK MasterCAN), manufactured by JV Technoton, Minsk, Republic of Belarus.

The converter model code is identified by the first three digits of its serial number printed on nameplate on the bottom part of its casing or printed on package label:

This document contains information on the design, operation principle, specifications, instructions on connection, configuration and use of the converters.

MasterCAN **data converters are tools for converting data of CAN data buses (SAE j1939/71), j1708 (SAE j1587) and generating ready-to-use data for the** Telematics system**.**

SK MasterCAN service adapter serves for data exchange between the converter and the personal computer (further on — PC).

Distinguishing features of the converters:

- Versatility – employment in Telematics systems of GPS/GLONASS monitoring transport and industrial automation (IIoT).
- Secure uniting data from one or several onboard data buses into CAN j1939/S6 Telematics interface*.
- Simple connection and secure reading data from CAN and j1708 buses using Crocodile contactless readers**.
- Simple, intuitive configuration using service software.
- Simplifying the Terminal or Server configuration by filtering out unnecessary CAN-messages.
- Automatic counter of fuel consumption for the trip; its indications increase according to data of fuel consumption per hour received from the onboard CAN-bus***.
- Automatic adjustment to the input baudrate of CAN-bus (100…1000) kbit/s and conversion to the output baudrate of CAN-bus – 250 kbit/s.
- Simple mounting, full set of mounting components in the mounting kit.
- Power is supplied from the onboard circuit without any use of additional power units.
- Compliance with automobile standards of EEU and EU countries.
- High-quality technical support and documentation.

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* Valid for MasterCAN CC and MasterCAN V-GATE.

** Optional.

***Only for MasterCAN CC with the version of firmware not lower than v.8.0; while for MasterCAN C 232/485 and MasterCAN V-GATE with the version of firmware not lower than v.7.0.

The data converters are presented by the following models:

MASTERCAN CC — are used for filtering out FMS messages from the onboard CAN bus (SAE j1939/71), transferring them and the generated special Telematics messages into CAN j1939/S6 Telematics interface.

MASTERCAN C 232/485 — are used for converting FMS messages from the onboard CAN bus (SAE j1939/71) into RS-232 and RS-485 interfaces (ASCII / Modbus RTU / DUT-E COM).

MASTERCAN V-GATE — are used for data conversion from CAN (SAE j1939/71) and j1708 (SAE j1587) onboard buses, transfer of FMS messages and the generated special Telematics messages into CAN j1939/S6 Telematics interface, as well as for transfer of messages into RS-232 interface (ASCII / Modbus RTU / DUT-E COM).

Models of MasterCAN data converters are designated in accordance with table 1 1.

Table 1 — Input and output interfaces (protocols) of the converters models

MASTERCAN X **data converter**			
X symbol standing for model	**CC**	**C 232/485**	**V-GATE**
Input interface (protocol)			
CAN (SAE j1939/71)	■	■	■
j1708 (SAE j1587)			■
Output interface (protocol)			
CAN (j1939/S6)	■		■
RS-232 (Modbus RTU)		■	■
RS-232 (ASCII / DUT-E COM (extended LLS))		■	■
RS-485 (Modbus RTU)		■	
RS-485 (ASCII / DUT-E COM (extended LLS))		■	

To ensure the converters correct operation, their connection and configuration must be carried out by certified personnel that have undergone training at the Manufacturer company.

SK MasterCAN or S6 SK service adapters (purchased separately) as well as Service MasterCAN software (versions from 3.2 and higher) may be used to configure the converters. The software may be downloaded at: https://www.jv-technoton.com/, section Software/Firmware.

⚠ **ATTENTION:** It is strongly recommended to follow strictly the instructions of the present Manual when using, mounting or maintaining converter.

The Manufacturer guarantees converter 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 converter specifications that do not lead to a deterioration of the consumer qualities without prior customer notice.

1 General information and technical specifications

1.1 Purpose of use, operation principle and application area

MasterCAN CC / C 232/485 / V-GATE data converters **are designed for integration of standard and additional** Onboard equipment **with different interfaces into a single** Telematics system **and simplifying the configuration of** Terminal **or** Server **by filtering out unnecessary CAN-messages.**

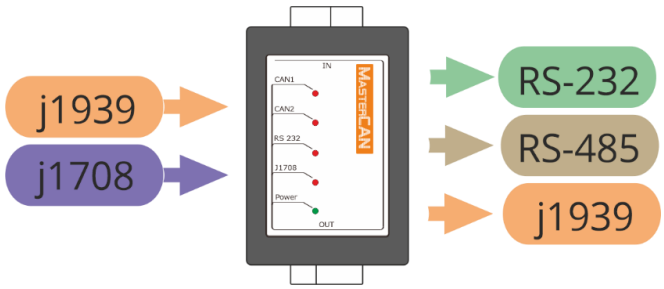


Figure 1 — Purpose of data converters

Operation principle: Depending on the model (see table 1), the converter automatically receives data from the onboard CAN-bus (SAE j1939/71) and/or j1708 onboard bus (SAE j1587) in the non-stop mode. The converter analyzes the data received singling out important Telematics data on the Vehicle operation. The converter transfers the filtered FMS-messages and the generated special Telematics messages into CAN j1939/S6 Telematics interface, converts them into messages of RS-232 / RS-485 interfaces.

Area of application: Transport and industrial Telematics systems.

Functions of the data converters in Telematics systems:

1) Vehicle data interface. The converter scans the CAN-bus, selects FMS-messages contained in it and transfers them to the monitoring Terminal. Filtering FMS-messages allows to reduce the load on the Terminal input, optimize the volume of data transferred to the Server, and, as a result, to simplify the configuration of the entire Telematics system. Besides, the converter generates special Telematics messages containing the most important Parameters, from the point of view of transport Telematics, (instant fuel consumption, fuel consumption for the trip, total fuel consumption, engine rpm, fuel level in the tank, operation time, engine temperature, pressure and level of oil etc.).

2) Simultaneous reception of data from CAN and j1708 buses in equipment produced by Volvo, Renault, John Deere, US-produced trucks and so on. In combination with CANCrocodile and 1708Crocodile contactless readers, the converter receives data from CAN onboard buses (SAE j1939/71) and j1708 (SAE j1587), filters FMS-messages, generates special Telematics messages and transfers them to CAN j1939/S6 Telematics interface (see figure 2).

3) Conversion of CAN-messages into RS-232 or RS-485. The converter converts messages received via CAN and j1708 buses into HEX format, text format or according to Modbus RTU protocol and transfers them via RS-232 or RS-485 interfaces. This is convenient in case CAN-input to connect the bus is missing in GPS/GLONASS monitoring Terminal or in any other receiving device, but where there is serial RS-232 or RS-485 interface.

4) Uniting data from two CAN-buses. Simultaneous reading and transmitting messages from two CAN-buses (SAE j1939) to one CAN-input of the Terminal may result in the conflict of network addresses of these devices. The Terminal would receive values of the same Parameter from ECU (electronic control units) of different buses not connected between themselves that would have the same addresses (SA). That would result in incorrect indications. The data converter transfers FMS-messages not changing their source address, while specifying its own network address for Telematics messages.

5) Counter of fuel consumption from the moment the engine is started. "Total consumption of fuel" Parameter is often missing in the standard CAN-bus (SAE j1939/71), however, needed for monitoring fuel consumption by the engine. The converter automatically calculates the total fuel consumption for the trip (from the moment the engine was last started) using the Parameter "Hourly fuel consumption" (SPN 183) and transfers the Counter indication to the Terminal (see figure 3).

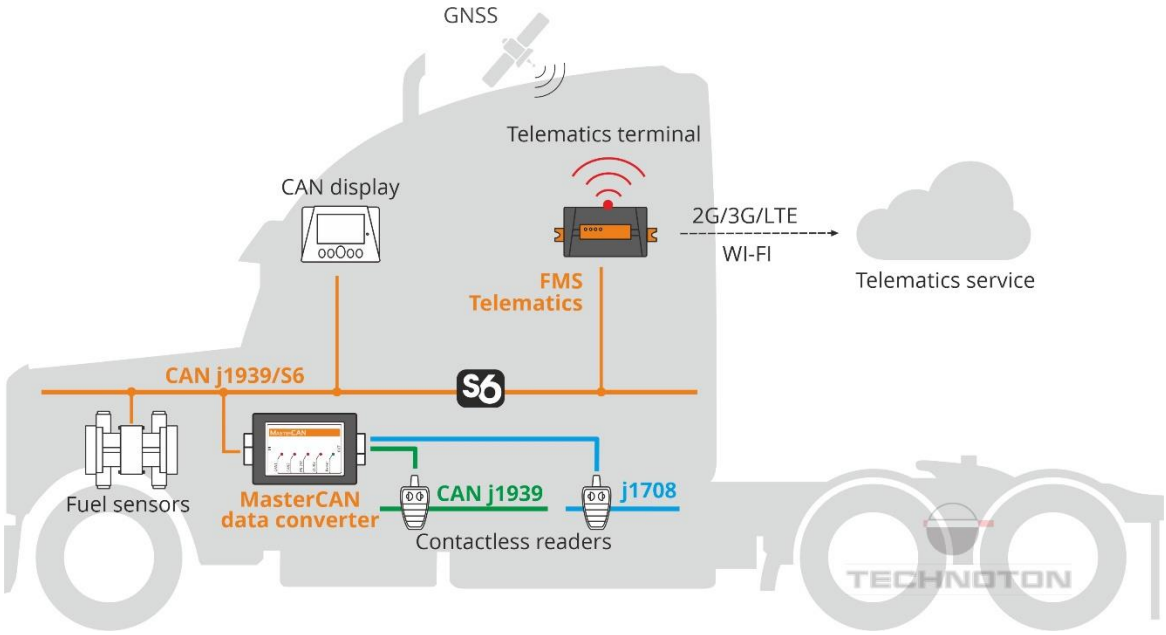


Figure 1 — On-board CAN and j1708 buses data integration in Telematics interface

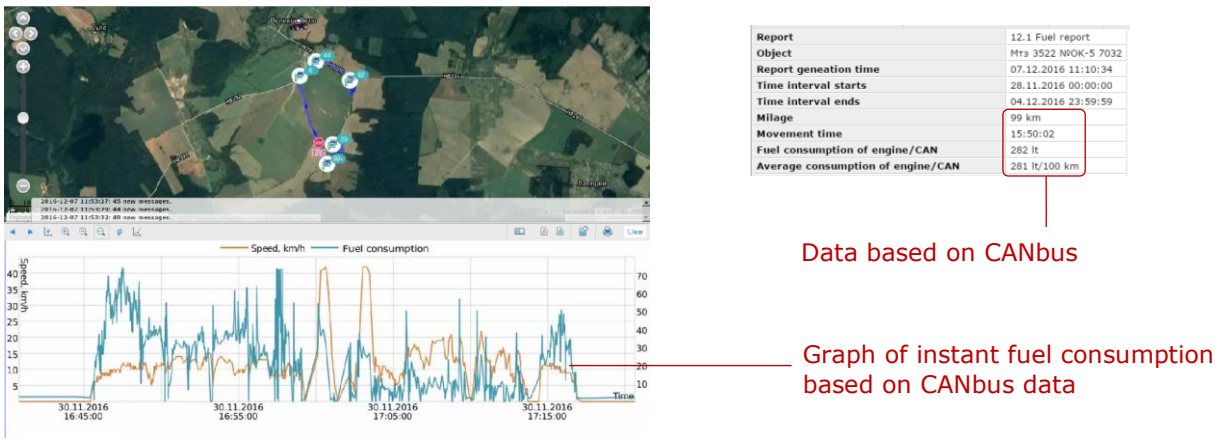
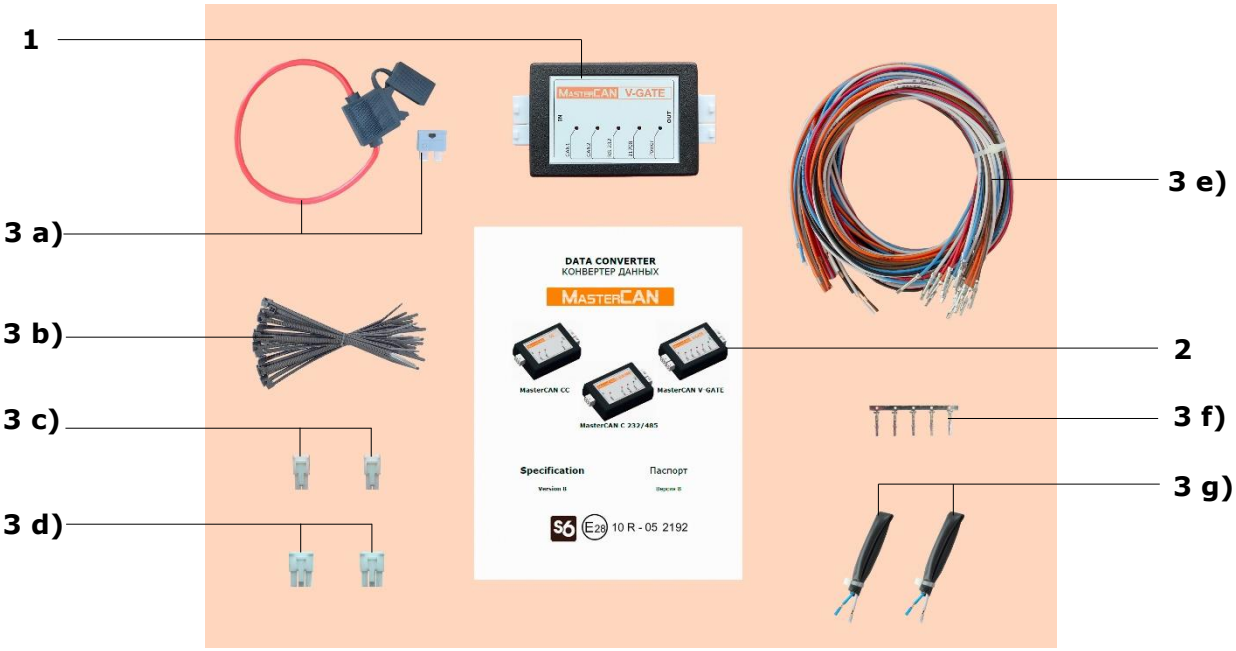


Figure 3 — Example of data received from the onboard CAN-bus using MasterCAN converter and displayed in ORF-4 Telematics service

1.2 Delivery set



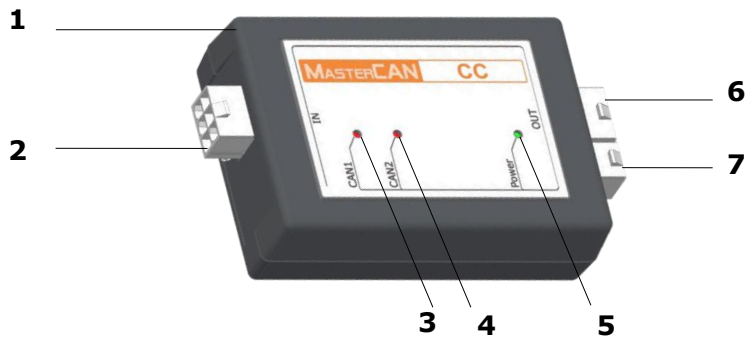
1	Data converter*	– 1 pc.;
2	Passport including the list of factory settings	– 1 pc.;
3	MK VDI mounting kit (1 pc.) including:	
	a) fuse with holder 2 A (3 A)	- 1 pc.;
	b) cable tie	- 20 pcs.;
	c) Molex 4 pin connector	- 2 pcs.;
	d) Molex 6 pin connector	- 2 pcs.;
	e) wire	- 17 pcs.;
	f) contact pin	- 5 pcs.;
	g) S6 CW plug**	- 2 pcs.

Figure 4 — The delivery sets of data converter

* Delivery sets for models MasterCAN CC / C 232/485 / V-GATE are identical.
**Contains the inbuilt terminal resistor 120 Ohms.

1.3 Exterior view and design

1.3.1 Exterior view and design MasterCAN CC



1 - converter casing;

2 - input **CAN** connector to connect to the onboard CAN-bus;

3 - red **CAN1** LED indicating data reception;

4 - red **CAN2** LED indicating data transmission;

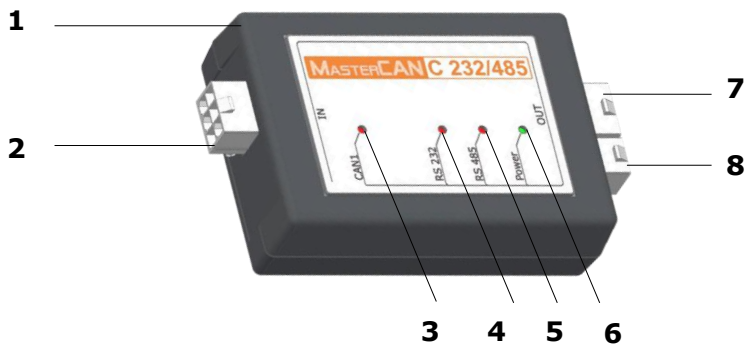
5 - green **Power** LED indicating power supply is turned on;

6 - **S6** output connector to connect to CAN j1939/S6 Telematics interface;

7 - spare connector not used in MasterCAN CC.

Figure 5 — MasterCAN CC exterior view and design

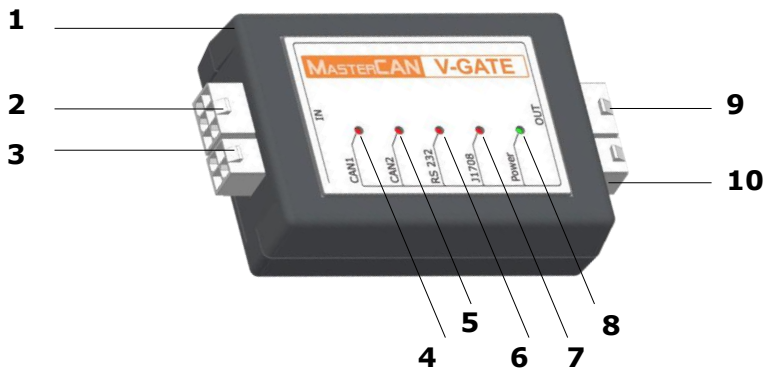
1.3.2 Exterior view and design MasterCAN C 232/485



1 - converter casing;
2 - input **CAN** connector to connect to the onboard CAN-bus;
3 - red **CAN1** LED indicating data reception;
4 - red **RS232** LED indicating data transmission;
5 - red **RS485** LED indicating data transmission;
6 - green **Power** LED indicating power supply is turned on;
7 - **S6** connector for power supply and configuration of MasterCAN C 232/485;
8 - **RS** output connector to connect to the external device by means of RS-232/RS-485 interfaces.

Figure 6 — MasterCAN C 232/485 exterior view and design

1.3.3 Exterior view and design MasterCAN V-GATE



1 - converter casing;

2 - input **CAN** connector to connect to the onboard CAN-bus;

3 - **j1708** input connector to connect to j1708 onboard bus;

4 - red **CAN1** LED indicating data reception;

5 - red **CAN2** LED indicating data transmission;

6 - red **RS232** LED indicating data transmission;

7 - red **j1708** LED indicating data reception;

8 - green **Power** LED indicating power supply is turned on;

9 - **S6** output connector to connect to CAN j1939/S6 Telematics interface;

10 - **RS** connector to connect to the external device by means of RS-232 interface.

Figure 7 — MasterCAN V-GATE exterior view and design

1.4 Technical specifications

1.4.1 Main Performance Specifications

Table 2 — Basic performance specifications of the converters

Specification, Unit of Measurement	Value
Supply voltage range, V	10…45
Maximum used current at power supply voltage 12/24 V, mA, not more than	100/50
Ambient air temperature, °C	-40…+85
Level of casing protection	IP40
Dimensions, mm, not more than	see figure 8
Weight, kg, not more than	0.2

1.4.2 Input and output interfaces of MasterCAN CC

CAN input interface (see 1.3.1) is used for data reception from the onboard CAN-bus. It is physically designed based on CAN 2.0B interface. Data can be received automatically or upon request. The data transfer protocol for input messages meets SAE j1939/71 standard.

CAN j1939/S6 output interface (see 1.3.1) is used for transfer of ready data to the Telematics terminal. Its specifications correspond to S6 Technology. The application level of the data transfer protocol is designed based on SAE j1939 standard and corresponds to S6 database (see details at http://s6.jv-technoton.com/, you need to get registered for work with BD S6).

MasterCAN CC transfers special Telematics messages to CAN j1939/S6 output interface (solution designed by Technoton) (see table 3) and FMS-messages (see table 4). Output messages are selected using Service MasterCAN service software (see 3.5.3). The current version of this software can be downloaded at https://jv-technoton.com/, section Software/Firmware.

Detailed description of FMS-messages is contained in the document "FMS-Standard Interface Description". The current version of this document can be downloaded at the developing company website at: http://www.fms-standard.com.

For its identification in CAN input interface and CAN j1939/S6 output interface, MasterCAN CC converter has a fixed unique network address — 122.

Table 3 — Data composition in output Telematics messages of MasterCAN data converters

Field number	Length	Parameter	Description	Rules of output
Message 1 PGN 63233 (0xF701)				1000 ms
1	2 bytes	SPN 190	Engine speed	
3	2 bytes	SPN 183	Engine Fuel Rate	
5	1 byte	SPN 110	Engine Coolant Temperature	
6	1 byte	SPN 100	Engine Oil Pressure	
7	1 byte	SPN 513	Actual Engine - Percent Torque	
8	1 byte	SPN 111	Engine Coolant Level	
Message 2 PGN 63234 (0xF702)				1000 ms
1	2 bytes	SPN 184	Engine Instantaneous Fuel Economy	
3	1 byte	SPN 98	Engine Oil Level	
4	2 bytes	SPN 171	Ambient Air Temperature	
6	1 byte	SPN 96	Fuel Level 1	
Message 3 PGN 63235 (0xF703)				1000 ms
1	4 bytes	SPN 250	Engine Total Fuel Used	
5	4 bytes	SPN 247	Engine Total Hours of Operation	

Table 4 — List of output FMS-messages of MasterCAN data converters

PGN	Description
61440 (0xF000)	Electronic Retarder Controller 1
61443 (0xF003)	Electronic Engine Controller 2
61444 (0xF004)	Electronic Engine Controller 1
61445 (0xF005)	Electronic Transmission Controller 2
64777 (0xFD09)	High Resolution Fuel Consumption (Liquid)
64932 (0xFDA4)	PTO Drive Engagement
64933 (0xFDA5)	Door Control 2
64977 (0xFDD1)	FMS-standard Interface Identity/Capabilities
65102 (0xFE4E)	Door Control 1
65110 (0xFE56)	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Information
65112 (0xFE58)	Air Suspension Control 4
65131 (0xFE6B)	Driver's Identification
65132 (0xFE6C)	Tachograph
65136 (0xFE70)	Combination Vehicle Weight
65198 (0xFEAE)	Air Supply Pressure
65216 (0xFEC0)	Service Information
65217 (0xFEC1)	High Resolution Vehicle Distance
65237 (0xFED5)	Alternator Information
65253 (0xFEE5)	Engine Hours, Revolutions
65254 (0xFEE6)	Time/Date
65257 (0xFEE9)	Fuel Consumption (Liquid)
65258 (0xFEEA)	Vehicle Weight
65260 (0xFEEC)	Vehicle Identification
65262 (0xFEEE)	Engine Temperature 1
65265 (0xFEF1)	Cruise Control/Vehicle Speed 1
65266 (0xFEF2)	Fuel Economy (Liquid)
65269 (0xFEF5)	Ambient Conditions
65276 (0xFEFC)	Dash Display

Notes

1 The composition of output PGN depends on the content of data received from the onboard CAN-bus. These data may differ depending on the producer, model and year of the Vehicle manufacturing .

2 MasterCAN automatically updates the Counter of fuel consumption for the trip and stores it in its internal memory, until the power supply is off, calculating it according to the Parameter "Hourly fuel consumption" (SPN 183). The minimum increment of the fuel consumption counter update for the trip — 0.5 l.

In case there is a standard PGN 65257 in the onboard CAN-bus, its parameters "Fuel volume consumed for the trip" (SPN 182) and/or "Fuel consumption by the engine" (SPN 250) are also transferred to the output CAN j1939/S6 interface.

The value of fuel consumption for the trip of SPN 182 calculated by the converter is always transferred in PGN 65257 from MasterCAN address, irrespective of the availability of a similar PGN in a standard CAN-bus.

1.4.3 Input and output interfaces of MasterCAN C 232/485

CAN input interface (see 1.3.2) is used for data reception from the onboard CAN-bus. It is physically designed based on CAN 2.0B interface. Data can be received automatically or upon request. The data transfer protocol for input messages meets SAE j1939/71 standard.

For its identification by the CAN input interface, MasterCAN 232/485 converter has a fixed unique network address — 124.

RS output interface (see 1.3.2) is used to transfer ready data to the Telematics terminal. It is physically designed based on the standards of serial interfaces RS-232 and RS-485.

By default, MasterCAN C 232/485 transfers output text messages into RS-232 and RS-485 interfaces in the automatic data transfer mode, in accordance with ASCII standard. The description of text messages transfer protocol is provided in annex B.

Using Service MasterCAN service software, you may change the text mode of data transfer into request/response mode, in accordance with Modbus RTU protocol (see 3.5.3). Modbus RTU protocol enables to transfer a wide range of the Vehicle parameters, in accordance with the list of registers provided in annex A.

In case of using the converter as a summator of readings of DUT-E CAN sensors (see 4), output messages are transferred in the request/response mode, in accordance with DUT-E COM protocol (extended LLS).

1.4.4 MasterCAN V-GATE input and output interfaces

Input interfaces (see 1.3.3):

- **CAN** – is used for data reception from the onboard CAN-bus. It is physically designed based on CAN 2.0B interface. Data can be received automatically or upon request. The data transfer protocol for input messages meets SAE j1939/71 standard.
- **j1708** — is used for data reception from the onboard j1708 bus. Data are received automatically. The data transfer protocol for input messages meets SAE j1587 standard.

Output interfaces (see 1.3.3):

- **CAN j1939/S6** — is used for transfer of ready data to the Telematics terminal. Its specifications correspond to S6 Technology. The application level of the data transfer protocol is designed based on SAE j1939 standard and corresponds to S6 database (see details at http://s6.jv-technoton.com/, you need to get registered for work with BD S6).

  MasterCAN V-GATE transfers special Telematics messages to CAN j1939/S6 output interface (solution designed by Technoton) (see table 3) and FMS-messages (see table 4). Output messages are selected using Service MasterCAN service software (see 3.5.3). The current version of this software can be downloaded at https://jv-technoton.com/, section Software/Firmware.
- **RS** — is used to transfer ready data to the Telematics terminal. It is physically designed based on RS-232 serial interface.

  By default, MasterCAN V-GATE transfers output text messages into RS-232 interface in the automatic data transfer mode, in accordance with ASCII standard. The description of text messages transfer protocol is provided in annex B.

  Using Service MasterCAN service software, you may change the text mode of data transfer into request/response mode, in accordance with Modbus RTU protocol (see 3.5.3). Modbus RTU protocol enables to transfer a wide range of the Vehicle parameters, in accordance with the list of registers provided in annex A.

  In case of using the converter as a summator of readings of DUT-E CAN sensors (see 4), output messages are transferred in the request/response mode, in accordance with DUT-E COM protocol (extended LLS).

For its identification by the CAN input interface, MasterCAN V-GATE converter has a fixed unique network address — 125.

1.5 Overall dimensions

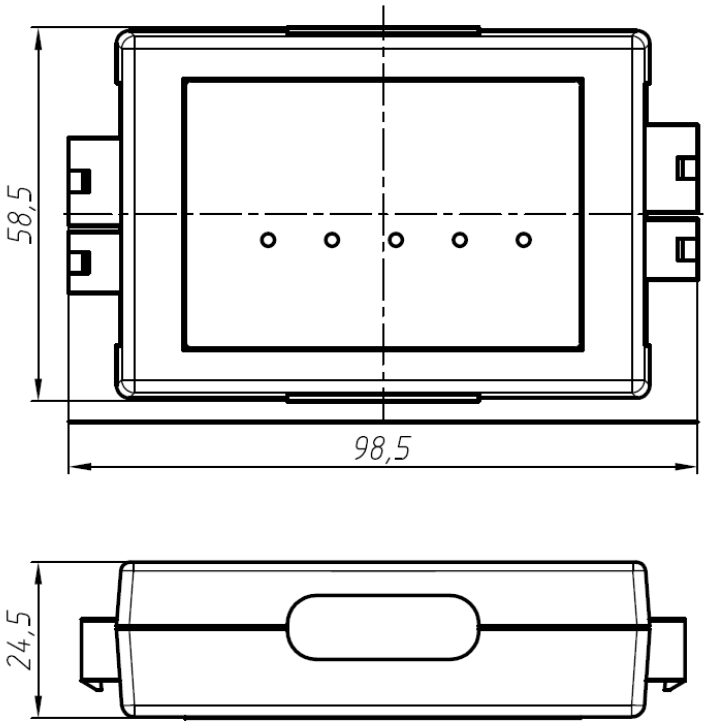


Figure 8 — Dimensions of the data converters

2 Mounting the converters

ATTENTION:
1) When mounting data converter, strictly follow safety rules of car repair works as well as local safety rules of the customer' company.
2) Before connection it is recommended to carefully study through the electrical circuit diagram and the Operation manual for the machinery unit where converter is mounted.
3) Pay special attention to check the proper Vehicle chassis earth grounding. The impedance between any point of the Vehicle chassis and "-" terminal of the battery or between the terminals of the chassis grounding switch should not exceed 1 Ohm.

To ensure proper operation of converter, it should be mounted, electrically connected and configured by specialist, who finished official technical training and was certified for that.

2.1 Exterior inspection prior to starting works

It is required to conduct converter exterior inspection for the presence of the possible defects of body or connectors arisen during transportation, storage or careless use.

Contact the supplier if any defects are detected.

2.2 Operating limitations

Data converter installation should be done in a dry location protected from aggressive impact of the environment.

Data converter should not be mounted near heating and cooling devices (e.g. the climate control system). Also, it is not recommended to mount converter close to the power electrical circuits.

A suitable location to mount converter on Vehicle is inside driver's cabin. During installation, you need to make sure that under the automobile hood the converter housing and its wires are located at least 30 cm far from engine rotating parts and surfaces.

2.3 Electrical connection

For power supply, the data converter must be connected to the external power source (e.g. to the Vehicle onboard circuit). In case the converter operates within the network of Units using S6 Technology, power is supplied through S6 cable system.

IMPORTANT:

1) Before you start electric connection operations, de-energize electric circuits for power supply of the unit to be equipped. When you mount the converter on the Vehicle, switch off the battery or remove the contact terminals from the battery.

2) When you connect the converter power supply to the Vehicle onboard circuit, we recommend to fix a fuse (2 A) from the delivery set into the power supply circuit (see figure 9 a).

3) The wires power "+" and chassis "-" must be connected in the same points of the power supply circuit to which the respective wires of the terminal (tracking device) are connected.

For electric connection of the converter, use **MK VDI mounting kit** from the converter delivery set (see 1.2). To connect MasterCAN power supply wires, it is recommended to use terminals (see figure 9 b), while connecting signal wires, it is recommended to use connectors as shown at figure 9 c.

a) fuse with holder *b) terminals* *c) connectors*

Figure 9 — Accessories for MasterCAN connection

ATTENTION: In case you connect MasterCAN CC / V-GATE to the terminal that has no inbuilt terminal resistor, connect S6 CW plugs (see the delivery set) at the ends of the communication line between CAN LOW and CAN HIGH wires (see figure 10). Switching on the terminal resistor **is the obligatory condition** for correct data transfer via CAN 2.0B communication line (SAE j1939).

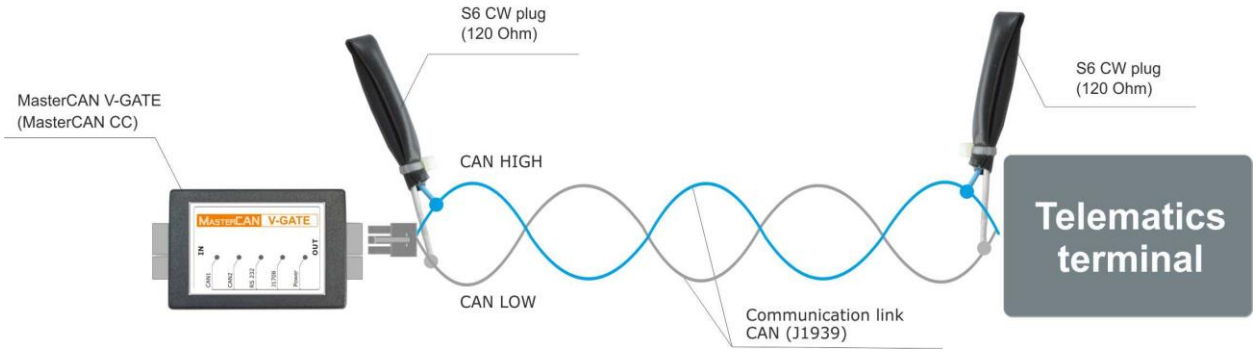


Figure 10 — Connection of MasterCAN CC / V-GATE converter to the Telematics terminal that has no inbuilt terminal resistor

2.3.1 Using Crocodile contactless reader devices to safe connect MasterCAN data converters

Simple to operate, TECHNOTON-made Crocodile contactless readers are most suitable for reliable and safe connection of MasterCAN data converters to CAN and j1708 vehicle data buses. To connect MasterCAN, we recommend to use the following modifications of Crocodile:

- CANCROCODILE — for contactless connection of MasterCAN CC / C 232/485 / V-GATE to the onboard CAN-bus, for reading data and generating the output signal whose data composition coincides with data of the connected bus (see figure 11 a);
- 1708CROCODILE — for contactless connection of MasterCAN V-GATE to the onboard j1708 bus , for reading data and generating the output signal whose data composition coincides with data of the connected bus (see figure 11 b).

a) CANCrocodile *b) 1708Crocodile*

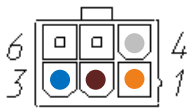
Figure 11 — Exterior view of contactless readers

Detailed information on specification and instructions for connection the above devices are available in Contactless readers Crocodile. Operation manual.

2.3.2 MasterCAN CC connection

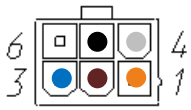
MasterCAN CC is connected to the onboard CAN-bus, in compliance with the designation of contacts of **CAN** input connector, the color and marking of wires, according to table 5.

*Table 5 — Connection of **CAN** input connector*

Connector Pinout	Connector Contact Number	Wire Marking	Wire Color	Circuit Designation	Signal Parameters
	1	VE	Orange	Power Supply Output "+"*	Analog, voltage 0…45 V
	2	GND	Brown	Ground "-"	–
	3	CAN1.H	Blue	CAN HIGH	Digital, SAE j1939 Standard
	4	CAN1.L	White	CAN LOW	
* Transit power supply for CANCrocodile contactless reader for secure converter connection to CAN-bus wires.					

Connection of power supply for MasterCAN CC and connection by means of S6 Technology to the monitoring Terminal are carried out in accordance with the designation of contacts of **S6** output connector, the color and marking of wires, according to table 6.

*Table 6 — Connection of **S6** output connector*

Connector Pinout	Connector Contact Number	Wire Marking	Wire Color	Circuit Designation	Signal Parameters
	1	VBAT	Orange	Power Supply Output "+"	Analog, voltage 0…45 V
	2	GND	Brown	Ground "-"	–
	3	CANH	Blue	CAN HIGH	Digital, CAN 2.0B, SAE j1939 Standard
	4	CANL	White	CAN LOW	
	5	KLIN	Black	K-Line*	Digital, ISO 14230 Standard
* Service interface for configuration and firmware update of MasterCAN data converter.					

Example of secure MasterCAN CC connection to the onboard CAN-bus to receive Telematics data using CANCrocodile is provided in figure 12.

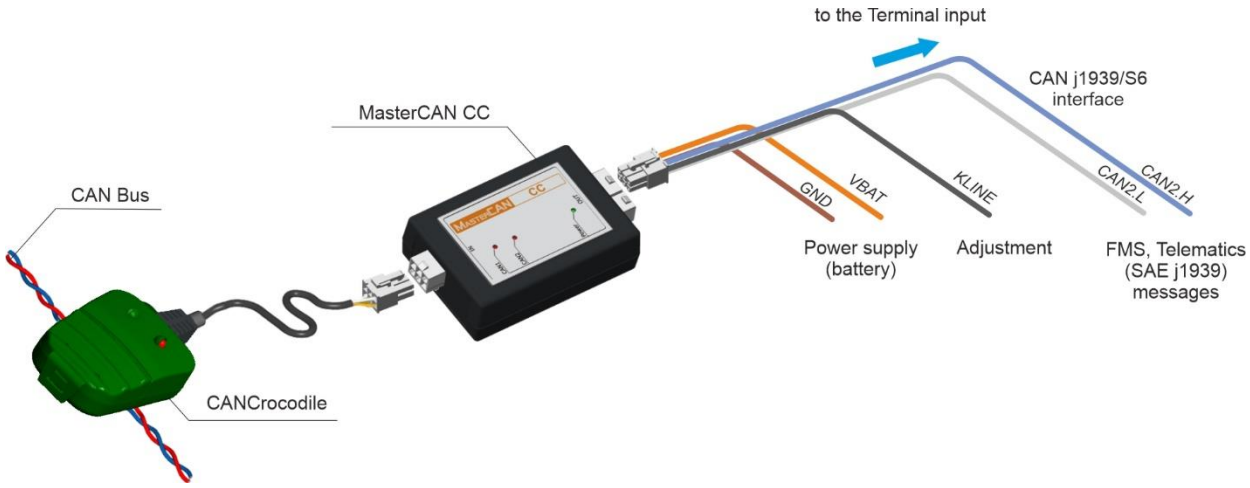


Figure 12 — MasterCAN CC connection both to CAN bus using CANCrocodile contactless reader

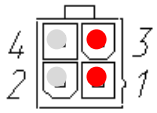
2.3.3 MasterCAN C 232/485 connection

Power supply for MasterCAN C 232/485 is connected in accordance with the designation of contacts of **S6** connector, the color and marking of wires, according to table 6.

MasterCAN C 232/485 is connected to the onboard CAN-bus in compliance with the designation of contacts of **CAN** input connector, the color and marking of wires, according to table 5.

MasterCAN C 232/485 is connected to the monitoring Terminal in accordance with the designation of contacts of **RS** output connector, the color and marking of wires, according to table 7.

*Table 7 — Connection of **RS** output connector*

Connector Pinout	Connector Contact Number	Wire Marking	Wire Color	Circuit Designation	Signal Parameters
	1	RS485.B	Red	Data reception/ transmission	Digital, RS-485 Standard
	2	RS485.A	White		
	3	RS232.TXD	Red	Transmitted data	Digital, RS-232 Standard
	4	RS232.RXD	White	Received data	

Example of secure MasterCAN C 232/485 connection to the onboard CAN-bus to receive Telematics data using CANCrocodile is provided in figure 13.

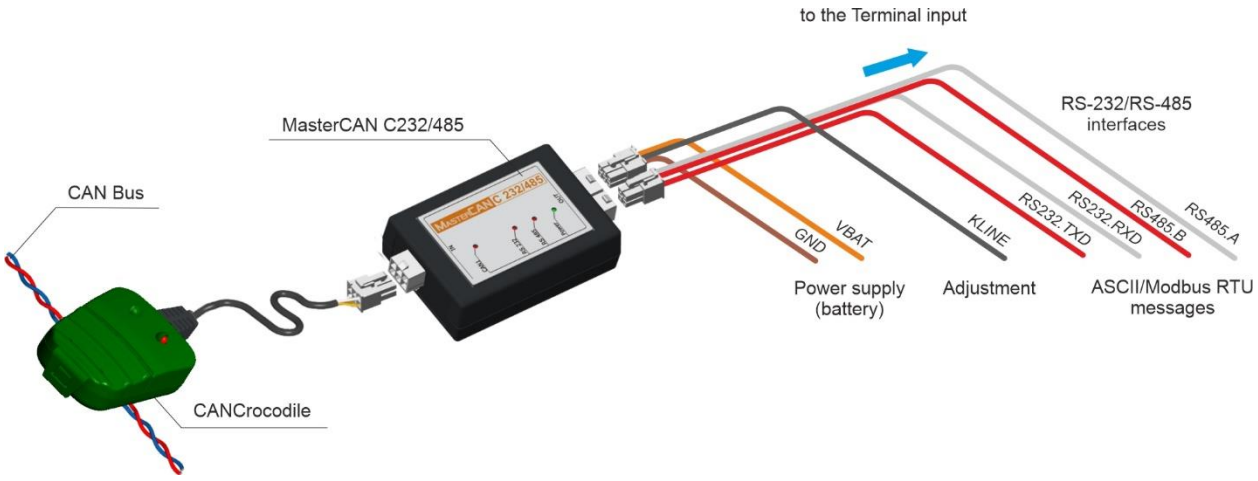


Figure 13 — MasterCAN C 232/485 connection both to CAN bus using CANCrocodile contactless reader

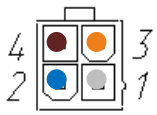
2.3.4 MasterCAN V-GATE connection

Power supply for MasterCAN V-GATE is connected in accordance with the designation of contacts of **S6** connector, the color and marking of wires, according to table 6.

MasterCAN V-GATE is connected to the onboard CAN-bus in compliance with the designation of contacts of **CAN** input connector, the color and marking of wires, according to table 5.

MasterCAN V-GATE is connected to the onboard j1708 bus in compliance with the designation of contacts of **j1708** input connector, the color and marking of wires, according to table 8.

*Table 8 — Connection of **j1708** input connector*

Connector Pinout	Connector Contact Number	Wire Marking	Wire Color	Circuit Designation	Signal Parameters
	1	j1708.A	White	j1708.A	Digital, SAE j1587 Standard
	2	j1708.B	Blue	j1708.B	
	3	VE	Orange	Power Supply Output "+" *	Analog, voltage 0…45 V
	4	GND	Brown	Ground "-"	—
* Transit power supply for 1708Crocodile contactless reader for secure converter connection to j1708 bus wires.					

Connection for MasterCAN V-GATE by means of S6 Technology to the monitoring Terminal is carried out in accordance with the designation of contacts of **S6** output connector, the color and marking of wires, according to table 6.

Connection to the Terminal by means of RS-232 interface is carried out in accordance with the designation of contacts of **RS** output connector, the color and marking of wires, according to table 7.

Example of secure MasterCAN V-GATE connection to the onboard CAN-bus to receive Telematics data using CANCrocodile is provided in figure 14.

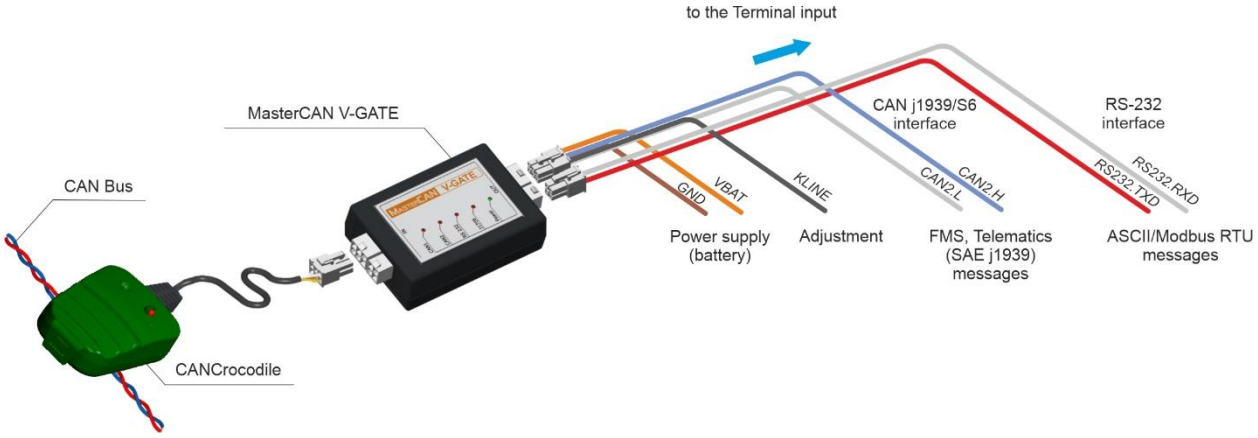


Figure 14 — MasterCAN V-GATE connection both to CAN bus using CANCrocodile contactless reader

Example of secure MasterCAN V-GATE connection to the j1708 onboard bus to receive Telematics data using 1708Crocodile is provided in figure 15.

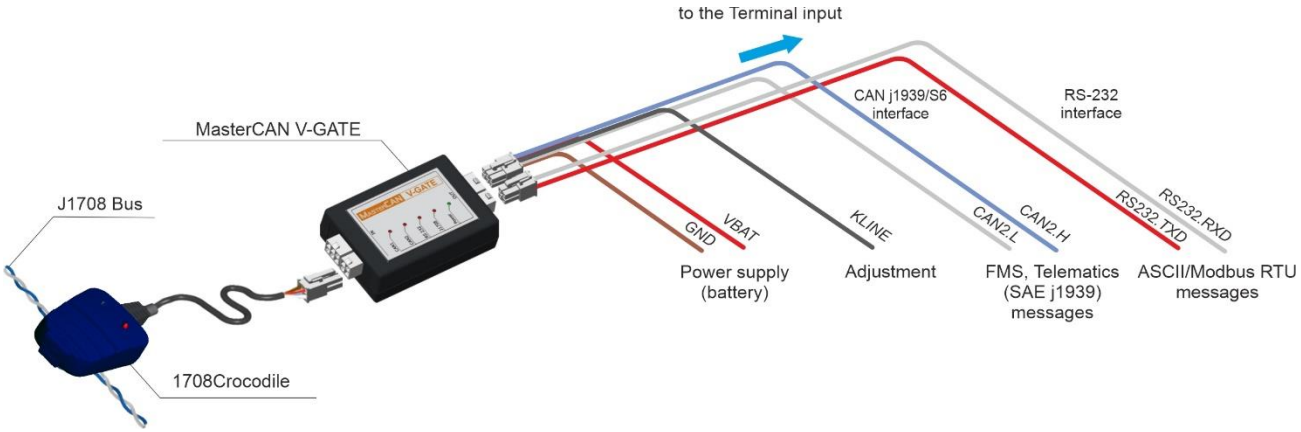


Figure 15 — MasterCAN V-GATE connection both to j1708 bus using 1708Crocodile contactless reader

Example of secure MasterCAN V-GATE connection to CAN and j1708 onboard buses at the same time for reception of Telematics data is provided in figure 16.

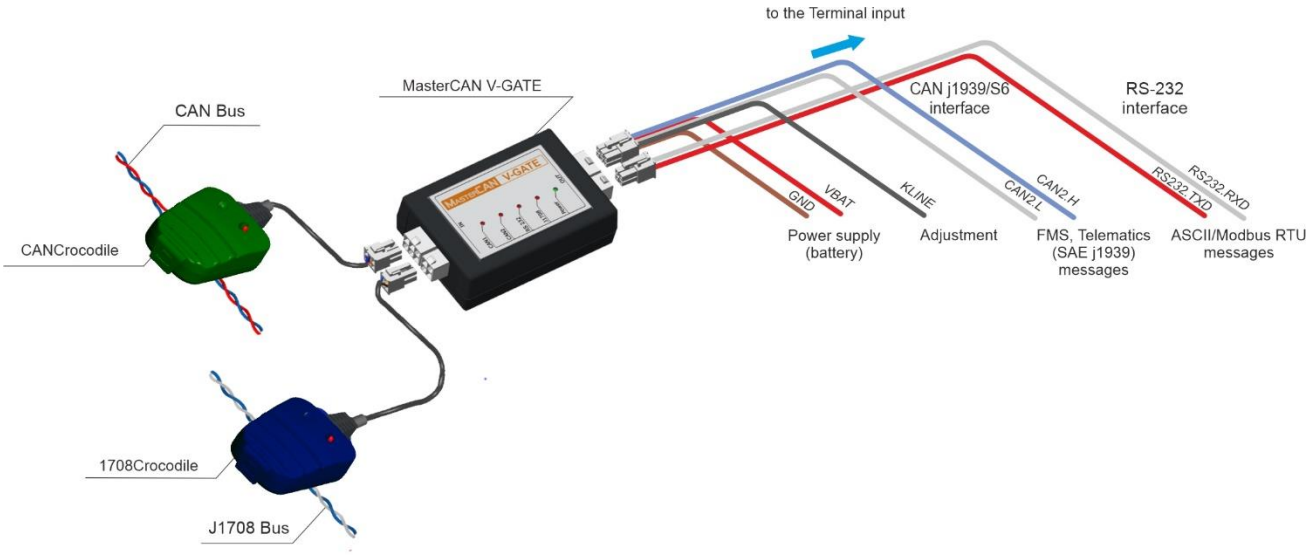


Figure 16 — MasterCAN V-GATE connection both to CAN and j1708 buses at the same time using CANCrocodile and 1708Crocodile contactless readers

3 Configuration of converters using the service adapter

Configuration of the converters to meet specific operational requirements is carried out by means of K-Line (ISO 14230) service interface using SK MasterCAN service adapter purchased separately. You may also use S6 SK service adapter for configuration of the converters.

Description of S6 SK can be found in CAN j1939/S6 Telematics interface. Operation manual.

Before you start your work with the service adapter, you are to download at https://www.jv-technoton.com/ (section Software/Firmware) and install on the PC the current version of the special software (further on — software):

- USB driver;
- Service MasterCAN (version 3.2 and higher).

Note — Setup file has the following form: ServiceMasterCAN_v_X_X_Setup.exe, where X_X — version of the Software.

3.1 SK MasterCAN purpose of use

SK MasterCAN service adapter is designed for data exchange between the PC and the converter during its configuration.

Service MasterCAN software functions:

- viewing and modifying converter settings;
- saving converter configuration profile to PC;
- uploading previously saved profiles to converter;
- converter firmware updating.

3.2 Hardware requirements

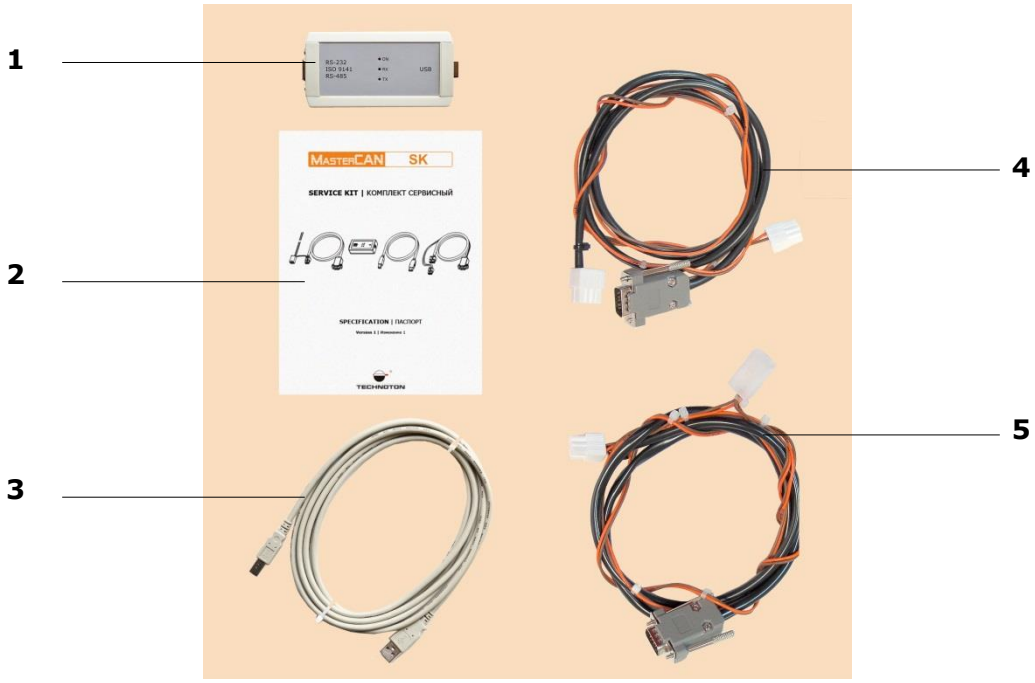
For work with Service MasterCAN software you'll need a separate PC (desktop or laptop) on which **only** Technoton service software is installed. The PC should meet the following minimum requirements:

- Windows XP/Vista/7/8/8.1/10 operating system of X32/X64 bit depth;
- CPU — Intel Core i3, dual-core, 2.0 GHz;
- RAM — 4 Gb;
- availability of USB 2.0 port;
- display resolution 1366x768.

ATTENTION: Work with the service adapter is possible only after you install the USB driver on the PC.

3.3 Composition of the service adapter

3.3.1 Exterior view and delivery set

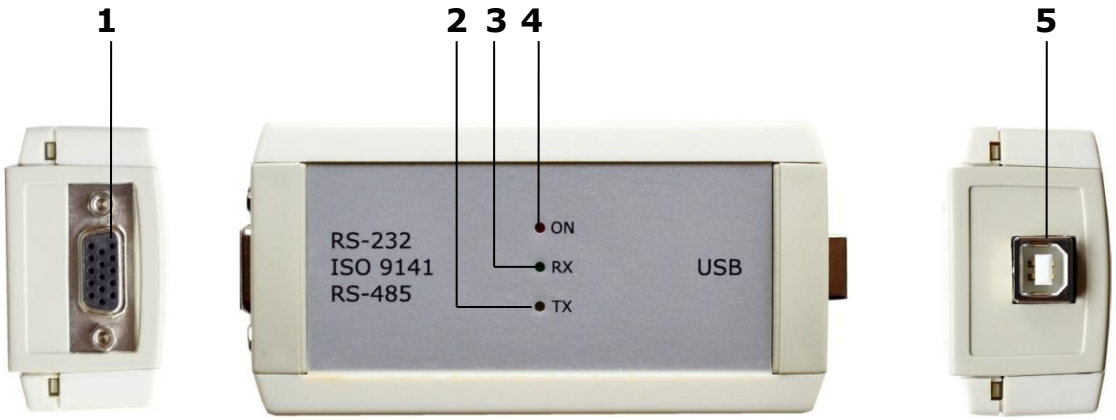


1 - universal service adapter;
2 - SK MasterCAN specification;
3 - USB A-B cable;
4 - service cable for MasterCAN CC, MasterCAN C 232/485 and MasterCAN V-GATE;
5 - service cable for MasterCAN Diagnostic.

Figure 17 — SK MasterCAN delivery set

3.3.2 Universal service adapter

The universal service adapter (further on — adapter) is designed for data exchange between the converter and the PC.



1 – RS-232/ISO 9141/RS-485 socket for converter connection;

2 – TX yellow LED indicator of data transmitted to converter;

3 – RX green LED indicator of data received from converter;

4 – ON red LED indicator of power supply;

5 – USB B port for PC connection.

Figure 18 — External view of the universal service adapter

3.3.3 USB A-B Cable

USB A-B cable is used for connection of PC and adapter.

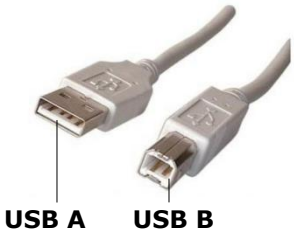
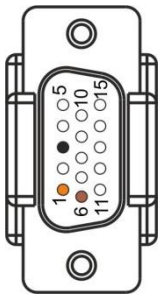


Figure 19 — USB A-B cable connectors

3.3.4 MasterCAN CC, MasterCAN C 232/485, MasterCAN V-GATE service cable

The service cable for MasterCAN CC, MasterCAN C 232/485, MasterCAN V-GATE is designed to connect the adapter to the converters with the version of firmware lower than 12.0.

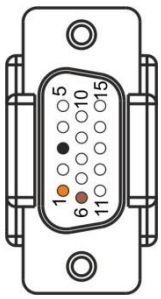
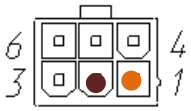
Table 9 — Designation of contacts of connectors in MasterCAN CC, MasterCAN C 232/485, MasterCAN V-GATE service cable

View	Pin No	Wire			Signal	
		Marking	Color		Assignment	Type
	1	VBAT		Orange	Power supply "+"	Analog, Voltage 0…32 V
	3	KLINE		Black	K-Line	Digital, ISO 9141 Standard
	6	GND		Brown	Ground "-"	—
	8	KLINE		Black	K-Line	Digital, ISO 9141 Standard
	1	VBAT		Orange	Power supply "+"	Analog, Voltage 0…32 V
	2	GND		Brown	Ground "-"	—

3.3.5 MasterCAN Diagnostic service cable

The service cable MasterCAN Diagnostic is designed to connect the adapter to converters with the version of firmware from 12.0 and higher or to the diagnostics gate MasterCAN Diagnostic*.

Table 10 — Designation of contacts of connectors in MasterCAN Diagnostic service cable

View	Pin No	Wire			Signal	
		Marking	Color		Assignment	Type
	1	VBAT		Orange	Power supply "+"	Analog, Voltage 0…32 V
	3	KLINE		Black	K-Line	Digital, ISO 9141 Standard
	6	GND		Brown	Ground "-"	-
	1	VBAT		Orange	Power supply "+"	Analog, Voltage 0…32 V
	2	GND		Brown	Ground "-"	—
	5	KLINE		Black	K-Line	Digital, ISO 9141 Standard
	1	VBAT		Orange	Power supply "+"	Analog, Voltage 0…32 V
	2	GND		Brown	Ground "-"	—

* Currently, MasterCAN Diagnostic is not produced.

3.4 Service adapter connection

3.4.1 Exterior inspection prior to connection

Before the first connection of the service adapter, you are to conduct its external examination to reveal any damages caused during its shipment, storage, or careless handling:

- visible damages of the adapter body and connectors;
- connector and insulation damages of cables.

Contact the supplier if any defects detected.

3.4.2 Operation restrictions

Avoid the following when connecting service adapter to converter, installed on 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.

ATTENTION: To avoid any service adapter faults in communication between PC and converter make sure there are no sources of electromagnetic enterference close to the workplace (running electric motors, welding equipment, high-power transformers, power lines, etc.).

3.4.3 Converter connection to the PC

ATTENTION: Prior to connecting converter to a PC, it is necessary to turn off electrical circuits of the machinery unit (Vehicle)*. To do this, use the battery switch or remove the battery terminals.

Connection of the converters for their configuration is conducted in accordance with diagrams provided in figures 20…22.

You are to perform connection operations following the sequence below:

1) Connect the adapter to the converter.

When using SK MasterCAN adapter

Connect **S6** output connector of the converter to **RS-232/ISO 9141/RS-485** connector of the adapter using MasterCAN Diagnosic service cable (see figure 20).

When using S6 SK adapter

Plug the connector of the adapter service cable to **S6** output connector of the converter through S6 SK connector. Power supply for the converter and adapter may be connected through power supply wires of the adapter service cable or through any other free jack of S6 SK connector or through one of the input connectors of the converter — **CAN** or **j1708****(see figure 21).

During the configuration of the converter operating within the network of Units by means of S6 Technology, the connector of the adapter service cable may be connected into the break in S6 cable system using S6 SK connector (e.g. instead of any S6 3SC T-connector). In this case, power is supplied to the converter and adapter through S6 cable system (see figure 22).

2) Connect the adapter using USB A-B cable (when using SK MasterCAN) or USB cable (when using S6 SK) to a free USB-port of your PC***.

3) Connect power supply wires to Vehicle onboard power network or power supply unit.

4) Switch power on (battery).

After adapter is connected to PC, red LED (indicating power supply is turned on) will light up (**ON** for SK MasterCAN adapter and **POWER** for S6 SK adapter). If LED does not light up, please make sure USB connector is properly connected to the corresponding port of PC.

---

* When configuring converter connected by S6 Technology, power supply of onboard network (battery) can be turned on.

** If MasterCAN V-GATE configuring.

*** Adapter can also be connected to USB-port of your PC after turning Vehicle's electrical system ON and starting the software.

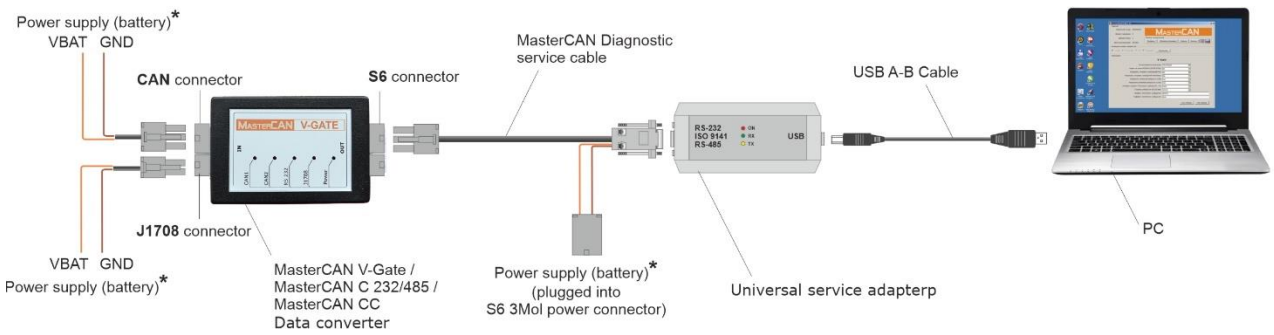


Figure 20 — MasterCAN to PC wiring scheme while using SK MasterCAN for configuration of MasterCAN

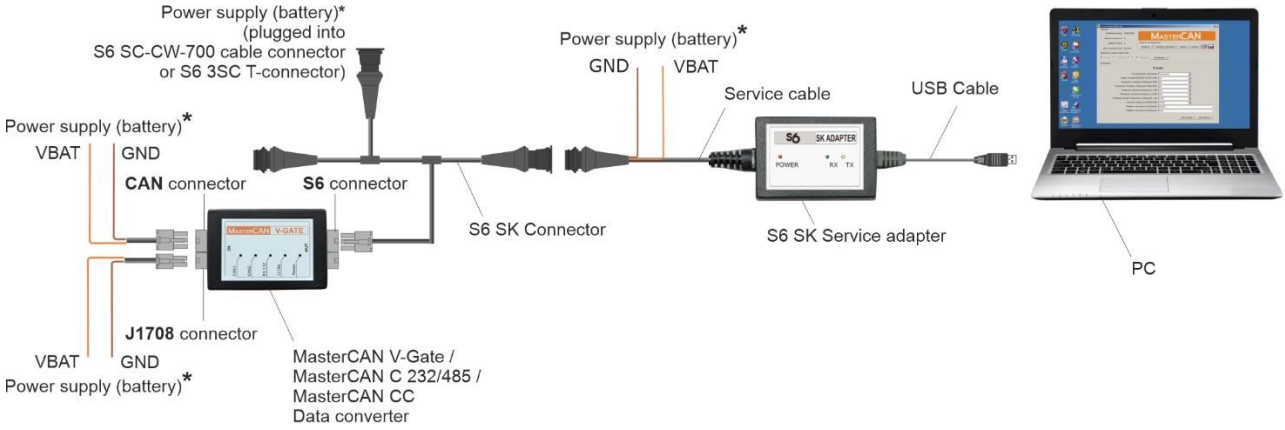


Figure 21 — MasterCAN to PC wiring scheme while using S6 SK for configuration of MasterCAN

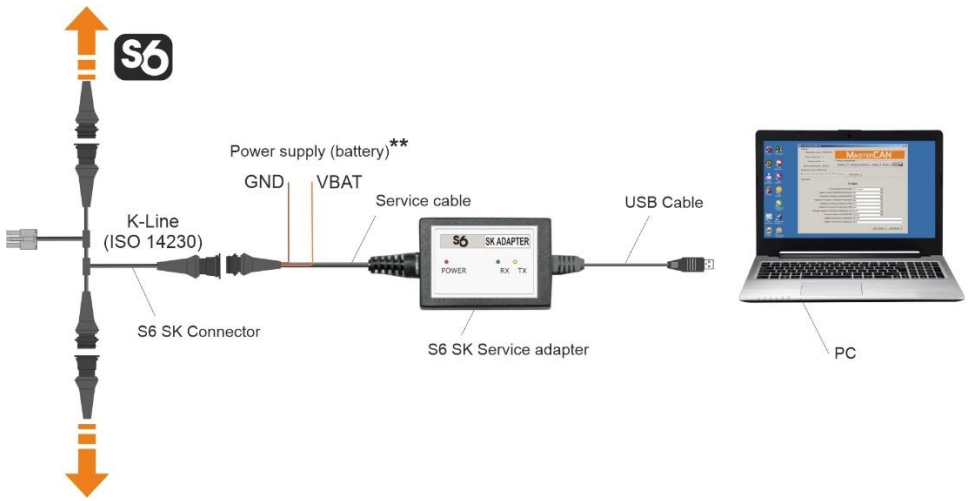


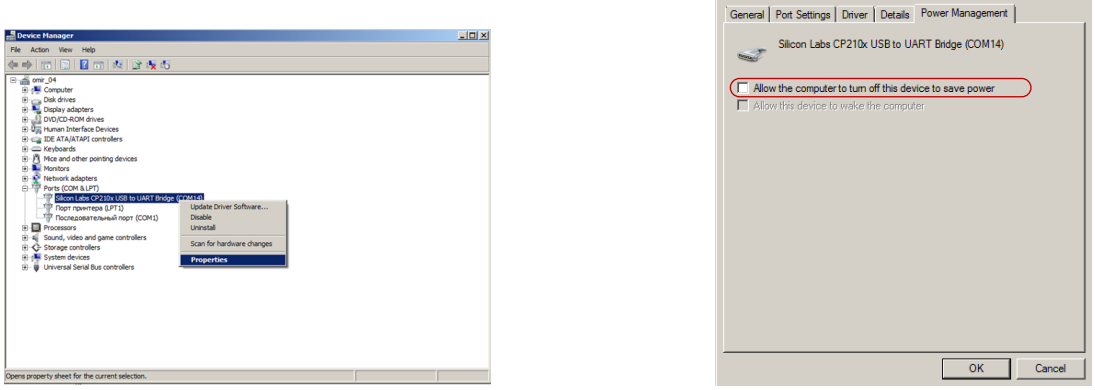
Figure 22 — MasterCAN to PC wiring scheme, while using S6 SK for configuration of MasterCAN via S6 Technology

* 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 23 a).

ATTENTION: It is recommended to untick power save check box for Service MasterCAN in the virtual COM-port properties for energy safety purpose (see figure 23 b).

SK MasterCAN is ready for work since been powered on (from vehicle power supply or external power sully unit).



a) selecting port properties *b) disabling power save option*

Figure 23 — Virtual COM-port configuration in Device manager

Service adapter is ready for operation straight after power supply connection. Check for a description of blinking LED-indicators placed on the top of the adapter in table 11.

Table 11 — Description of adapter's LEDs

LED Indicator				Signal description
Designation		Status	Light color	
for S6 SK adapter	for SK MasterCAN adapter			
POWER	**ON**		Red	Power supply is on
		No signal		Power supply is off (or voltage is less than minimum required)
RX			Green	Converter data is being received
		No signal		No data from converter
TX			Yellow	Data is being transmitted to converter
		No signal		No data to converter

3.5 Service MasterCAN software operation

3.5.1 User authorization

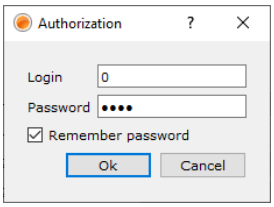
Service MasterCAN software is launched with a 

icon which is created during the installation process.

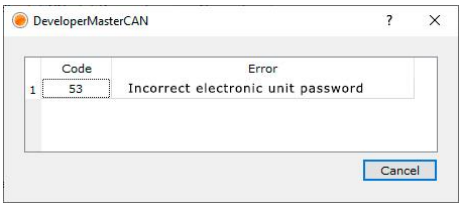
Select proper unit model and click Connect button at **Select MasterCAN Model** area to enable connection.

Authorization window will appear (see figure 24 a). Insert login and password (default login is **0**, password **2000**). Tick **Remember password** check box to save login data.

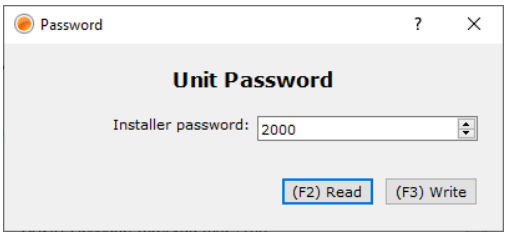
Click Password button at **Tool Bar** area to change your password. Insert four-digit password and click (F3) Write button (see Figure 24 c).



a) inserting current password



b) invalid password message



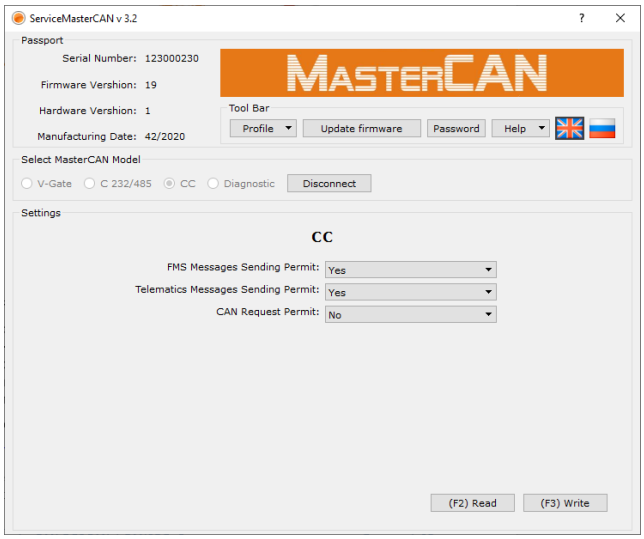
c) current password changing

Figure 24 — User authorization

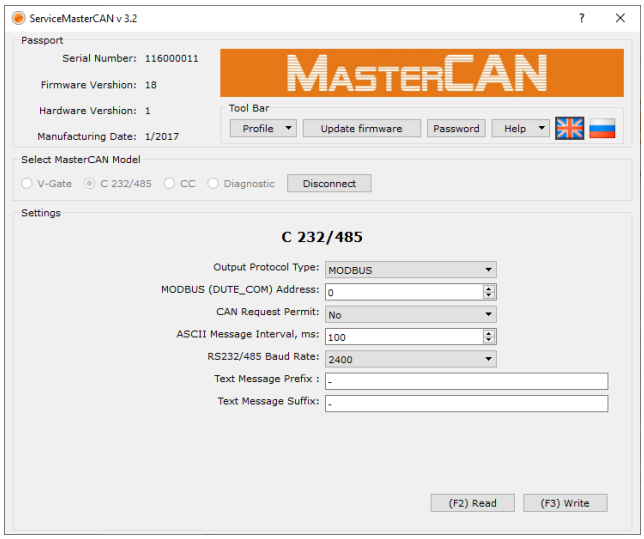
3.5.2 Operations with profile of converter

Service MasterCAN software is used for working with converter **profile**. Profile is a combination of specifications, parameters and configurations of MasterCAN Unit.

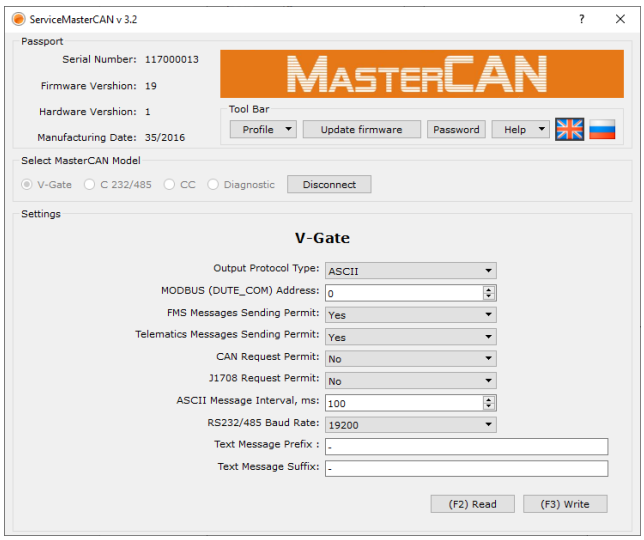
Since the authorization is successful utility will automatically load and display profile data at the **Passport** area: serial number, firmware version, hardware version, manufacturing date. **Settings** area will get active as well as Update firmware, Password, (F2) Read, (F3) Write buttons. Connect will change to Disconnect (see figure 25). LED indicators will send signals according to table 11.



a) for MasterCAN CC



b) for MasterCAN C 232/485



c) for MasterCAN V-GATE

Figure 25 — Window of the converter settings in Service MasterCAN software

Profile menu (see figure 26) at **Tool Bar** area of Service MasterCAN provides possibility to work with profile in both converter connected mode and autonomous mode.

ATTENTION: The present manual describes Service MasterCAN operation mode with connected MasterCAN Unit. Some functions and setting are not available in the autonomous mode.

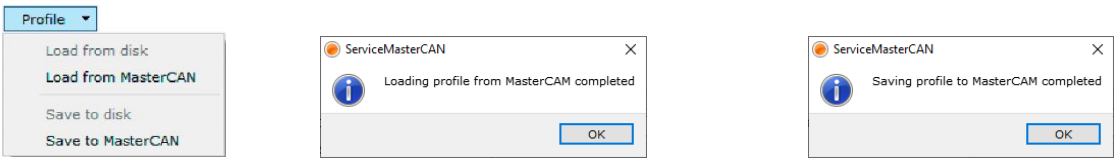
1) When using the software with the converter connected, you may edit the current profile, with its subsequent saving in the converter memory or on the PC hard disc.

- To load the profile of the connected converter, select **Profile** menu ➔ **Load from MasterCAN**.
- To save the profile in the converter memory, select **Profile** menu ➔ **Save to MasterCAN**.

To read current settings of the profile click (F2) Read button. To store modified settings, click (F3) Write button.

- To save profile on disk: click Disconnect button (**Select MasterCAN Model** area). The file saving location dialog window will appear. Insert filename. Saved profile can be used for configuration of other same model MasterCAN units.

ATTENTION: MasterCAN profile has ***.ptf** file extension.



a) selection menu options *b) profile load message* *c) profile save message*

Figure 26 — Working with Profile menu

2) When working in autonomous mode loading of previously saved profile (**Profile** menu ➔ **Load from disk**) and its modifying is possible.

- To save profile to disk select: **Profile** menu ➔ **Save to disk**.
  Select file location and insert filename. Saved profile can be used for configuration of other same model MasterCAN units.
- To save profile loaded from disk to MasterCAN: establish connection between unit (of proper model) and PC (see 3.5.1) and then select **Profile** menu ➔ **Save to MasterCAN**.

3.5.3 Converter settings

Settings area (see figure 25) enables the user to change the following converter settings:

1) Output Protocol Type — to select the necessary protocol of output messages transfer for MasterCAN C 232/485 / V-GATE converters, via RS-232/RS-485 serial output interface (see 1.4.3, 1.4.4):

- **ASCII** — Data transfer in the automatic mode, in accordance with ASCII text protocol. See the description of the text messages transfer protocol in annex B.
- **MODBUS** — Data transfer in the request/response mode, in accordance with Modbus RTU protocol. See the list of output messages registers that are accessible according to Modbus RTU protocol in annex A.
- **DUT-E COM** — Data transfer in the request/response mode, in accordance with DUT-E COM (extended LLC) protocol. This protocol is selected, in case the converter is used as a summator of DUT-E CAN sensors (see 4).

2) MODBUS (DUT-E COM) Address — to specify the unique network address of MasterCAN C 232/485 / V-GATE converters during their use as summators of DUT-E CAN fuel level sensors. The converter network address may be specified from the range **0...255**. By default, the network address consists of two last digits of the converter serial number.

3) FMS Messages Sending Permit — to enable/disable the transfer of FMS-messages into CAN j1939/S6 output interface of MasterCAN CC / V-GATE converters (see 1.4.2).

4) Telematics Messages Sending Permit — to enable/disable the transfer of Telematics messages into CAN j1939/S6 output interface of MasterCAN CC / V-GATE converters (see 1.4.2).

5) CAN Request Permit — to enable/disable the transfer of active requests to CAN onboard bus through CAN interface of MasterCAN CC / C 232/485 / V-GATE converters. Active requests are sent to collect data which are contained in the following FMS-messages:

- PGN 65216 — Service Information.
- PGN 65253 — Engine Hours, Revolutions
- PGN 65257 — Fuel Consumption (Liquid).

WARNINGS:
1) Active requests to the vehicle CAN bus may cause the Vehicle onboard equipment malfunctions.
2) Transfer of active requests is possible only in case of the converter contact connection to CAN onboard bus. In case of the converter secure connection by means of CANCrocodile reader, active requests to CAN-bus must be disabled.

6) J1708 Request Permit — transfer of active requests to j1708 bus is not provided for in the current software version.

7) ASCII Message Interval, ms — to specify the interval of transfer of data packets of output messages into RS-232/RS-485 output serial interface of MasterCAN C 232/485 / V-GATE converters, according to ASCII text protocol (see annex B).
The interval for text messages transfer may be selected from the range of values **100...65535 ms**, with the increment 1 ms (by default — **100 ms**).

8) RS232/485 Baud Rate — to select baudrate via RS-232/RS-485 output serial interface of MasterCAN C 232/485 / V-GATE converters.
Baudrate can be selected from the following range of fixed values: **2400**; **4800**; **9600**; **19200**; **38400**; **57600**; **115200 bit/s** (by default — **19200 bit/s**).

9) Text Message Prefix — special word up to 21 characters long entered by the user (e.g. **Prefix[**). Serves to identify the beginning of the data packet in output text messages of MasterCAN C 232/485 / V-GATE converters, in accordance with ASCII standard, which are transferred to the serial RS-232/RS-485 interface (see annex B).

10) Text Message Suffix — special word up to 21 characters long entered by the user (e.g. **Postfix[**). Serves to identify the end of the data packet in output text messages of MasterCAN C 232/485 / V-GATE converters, in accordance with ASCII standard, which are transferred to the serial RS-232/RS-485 interface (see annex B).

3.6 Function test

In case the data converter configuration and connection have been performed correctly, the equipment operation starts from the moment the power supply is on. Whenever the power supply is disconnected, the converter operation stops.

During the converter operation, lights of LED indicators located on its front panel can be seen (see table 12). Also, the converter must transfer converted data into the respective output interface.

Table 12 – Designation of signals of the converters LED indicators

LED Indicator			Signal description
Marking	**Status**	**Light color**	
CAN1		Red	Data reception from onboard CAN-bus
	No signal		No data reception from onboard CAN-bus
CAN2		Red	Transfer of output messages into CAN j1939/S6 Telematics interface in progress
	No signal		No transfer of output messages into CAN j1939/S6 Telematics interface
RS232		Red	Transfer of output messages into RS-232 interface is in progress
	No signal		No transfer of output messages into RS-232 interface
RS485		Red	Transfer of output messages into RS-485 interface is in progress
	No signal		No transfer of output messages into RS-485 interface
1708		Red	Data reception from onboard j1708 bus
	No signal		No data reception from onboard j1708 bus
Power		Green	Power supply is on
	No signal		Power supply is off (or voltage is less than minimum required)

4 Using the converters for summation of readings of DUT-E CAN fuel level sensors via RS-232 interface

To measure the total fuel volume in several tanks, you may use MasterCAN C 232/485 /V-GATE converters together with DUT-E CAN fuel level sensors.

ATTENTION: S6 Technology enables to summarize fuel volume indications of **up to 8 pcs.** of DUT-E CAN sensors. For each of the sensors, you are to specify the unique network address within the range 101…108. The calibration table of the respective fuel tank must be recorded in advance into the internal memory of each DUT-E CAN (see the document DUT-E Fuel level sensors. Operation manual).

An example of the converter connection diagram for summation of readings of two or more sensors via RS-232 interface, including the specification of S6 cable system components that need to be ordered is provided in figure 27.

MasterCAN receives fuel volume readings from each of DUT-E CAN fuel level sensors connected to S6 bus, summarizes them and transfers data of the total volume of fuel to RS-232 serial interface.

During the converter operation as a summator of DUT-E CAN sensors, output messages are transferred according to Modbus RTU or DUT-E COM protocols. The required protocol for output messages transfer is selected during the converter configuration using Service MasterCAN software (see 3.5.3).

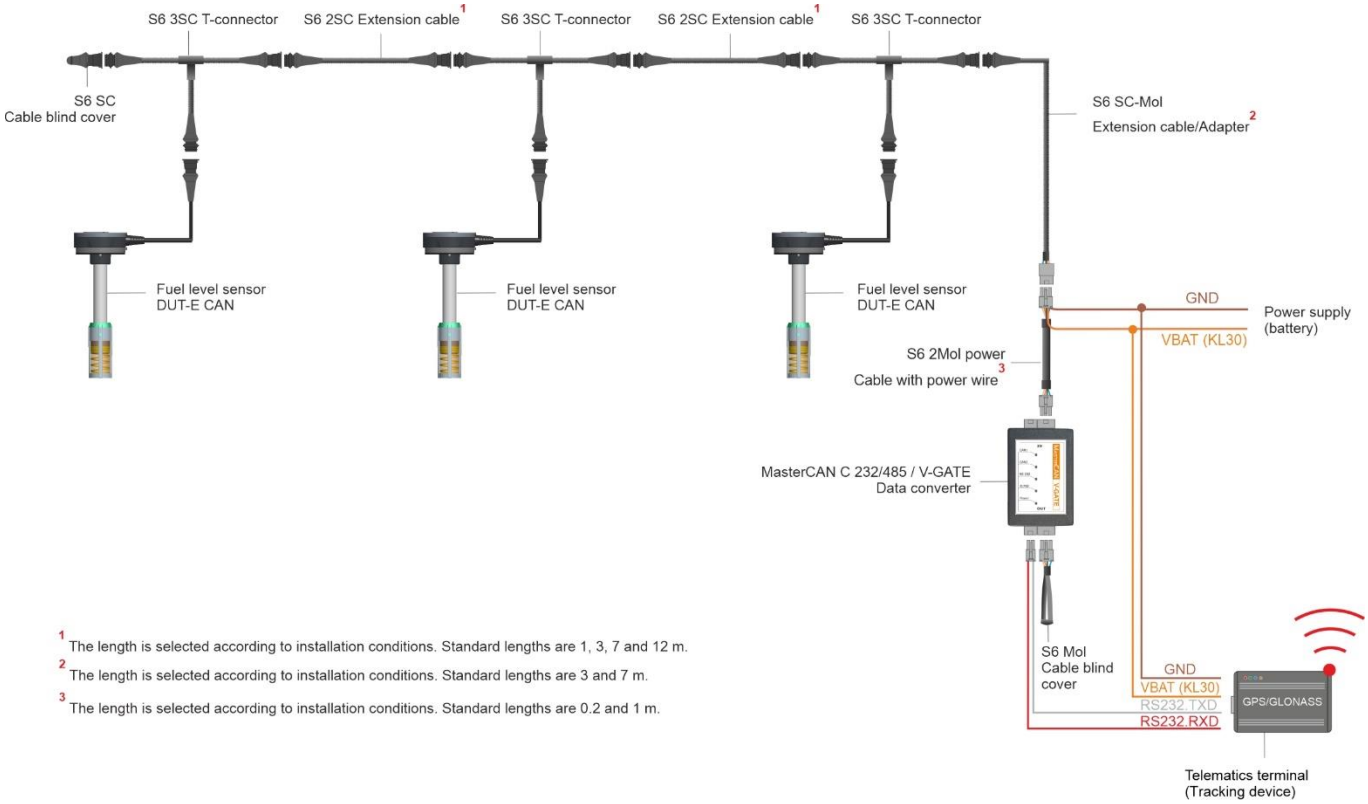


Figure 27 — Example of the connection diagram for several for DUT-E CAN connection to the converter for summation of fuel volume readings by means of RS-232 interface

5 Packaging

Delivery sets of data converters are shipped in carton boxes; their view is presented in figure 28.

Figure 28 — Package of data converters

Labels containing information on the product name, its serial number, date of manufacturing, version of the inbuilt software, weight, Technologies, certificates, QC department stamp and QR code are fixed on the converters' packages (see figure 29).

Figure 29 — Label on the package of data converters

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

6 Storage

Data converters are recommended to be stored in locked, dry premises.

Data converter 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 data converter in the same room with substances that cause metal corrosion and/or contain aggressive impurities.

Data converter shelf life must not exceed 24 months.

7 Transportation

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

When transporting by air, data converter 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 data converter should be sealed.

8 Utilization/re-cycling

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

Data converter does not contain precious metals in amount that should be recorded.

Contacts

Manufacturer

Tel/Fax: +375 17 240-39-73

https://www.jv-technoton.com/

http://s6.jv-technoton.com/

E-mail: marketing@technoton.by

Technical support

E-mail: support@technoton.by

Annex A
List of 16-bit registers of MasterCAN C 232/485 and MasterCAN V-GATE converters output messages which are accessible according to Modbus RTU protocol

Table A.1 — List of 16-bit registers of MasterCAN C 232/485 and MasterCAN V-GATE converters output messages which are accessible according to Modbus RTU protocol

Register Address	Register Content	SPN (j1939)	PID (j1587)	Support Reading	Support Recording
0	Output Interface Exchange Rate (RS-232/RS-485): 1 – 4800 2 – 9600 3 – 19200 4 – 38400 5 – 57600 7 – 115200	No		+	+
1	Operation Mode 1 – Text output 2 – Request-response (MODBUS RTU)	No		+	+
2	Output interval, ms	No		+	+
21	Engine speed	190	190	+	-
22	Actual engine - percent torque	513	92	+	-
23	Engine fuel rate	183	183	+	-
24	Engine instantaneous fuel economy	184	184	+	-
25	Axle weight	582	178 179 180 181	+	-
26	Wheel-based vehicle speed	84	84	+	-
27	Fuel level 1	96	96	+	-
28	Engine coolant temperature	110	110	+	-
29	Engine oil pressure	100	100	+	-
30	Ambient air temperature	171	171	+	-
31	Cab interior temperature	170	170	+	-
32	Engine oil level	98	98	+	-
33	Engine coolant level	111	111	+	-
34	Total vehicle distance (high word)	245	245	+	-
35	Distance travelled (low word)	245	245	+	-
36	Engine total fuel used (high word)	250	250	+	-
37	Engine total fuel used (low word)	250	250	+	-

Register Address	Register Content	SPN (j1939)	PID (j1587)	Support Reading	Support Recording
38	Engine total hours of operation (high word)	247	247	+	-
39	Engine total hours of operation (low word)	247	247	+	-
40	Fuel used per hour, calculated value	No		+	-
41	Brake switch	597	85	+	-
	Clutch switch	598			
	Cruise control active	595			
42	PTO governor state	976	150	+	-
43	Accelerator pedal position 1	91	91	+	-
44	Axle location	928	No	+	-
45	Engine fuel temperature 1	174	174	+	-
46	Reserve	No		+	-
47	Reserve	No		+	-
48	High resolution total vehicle distance (high word)	917	No	+	-
49	High resolution total vehicle distance (low word)	917	No	+	-
50	Service distance	914	No	+	-
51	Driver 1 working state	1612	No	+	-
	Driver 2 working state	1613			
	Vehicle motion	1611			
	Driver 1 time related states	1617			
	Driver card, driver 1	1615			
	Vehicle overspeed	1614			
52	Driver 2 time related states	1618	No	+	-
	Driver card, driver 2	1616			
	System event	1622			
	Handling information	1621			
	Tachograph performance	1620			
	Direction indicator	1619			
53	Tachograph vehicle speed	1624	214	+	-
54	At least one PTO engaged	3948	No	+	-
55	High resolution engine total fuel used (high word)	5054	No	+	-
56	High resolution engine total fuel used (low word)	5054	No	+	-
57	Fuel tank level (left tank)	521023	No	+	-
58	Fuel tank volume (left tank)	521024	No	+	-
59	Tank fuel rate (left tank)	521025	No	+	-
60	Engine fuel temperature 1 (left tank)	174	No	+	-
61	Fuel tank level (right tank)	521023	No	+	-
62	Fuel tank volume (right tank)	521024	No	+	-
63	Tank fuel rate (right tank)	521025	No	+	-
64	Engine fuel temperature 1 (right tank)	174	No	+	-
65	Fuel tank level (tank 3)	521023	No	+	-
66	Fuel tank volume (tank 3)	521024	No	+	-
67	Tank fuel rate (tank 3)	521025	No	+	-

Register Address	Register Content	SPN (j1939)	PID (j1587)	Support Reading	Support Recording
68	Engine fuel temperature 1 (tank 3)	174	No	+	-
69	Fuel tank level (auxiliary equipment fuel tank)	521023	No	+	-
70	Fuel tank volume (auxiliary equipment fuel tank)	521024	No	+	-
71	Tank fuel rate (auxiliary equipment fuel tank)	521025	No	+	-
72	Engine fuel temperature 1 (auxiliary equipment fuel tank)	174	No	+	-
73	Fuel tank level (trailer tank)	521023	No	+	-
74	Fuel tank volume (trailer tank)	521024	No	+	-
75	Tank fuel rate (trailer tank)	521025	No	+	-
76	Engine fuel temperature 1 (trailer tank)	174	No	+	-
77	Vehicle fuel volume	521193	No	+	-
78	Engine trip fuel (high word)	182	182	+	-
79	Engine trip fuel (low word)	182	182	+	-

Notes

1 The content of MasterCAN output messages depends on the data received by CANbus (j1708 bus). This data may differ depending on the manufacturer, the model and the year of the Vehicle manufacturing.

2 MasterCAN automatically updates the Counter of fuel consumption for the trip and stores it in its internal memory, until the power supply is off, calculating it according to the Parameter "Hourly fuel consumption" (SPN 183). The minimum increment of the fuel consumption counter update for the trip — 0.5 l.
In case there is a standard PGN 65257 in the onboard CAN-bus, its parameters "Fuel volume consumed for the trip" (SPN 182) and/or "Fuel consumption by the engine" (SPN 250) are also transferred to the output CAN j1939/S6 interface.

Annex B
ASCII text protocol for data transfer of MasterCAN C 232/485 and MasterCAN V-GATE converters

This protocol describes output data format of MasterCAN messages sent in text mode.
Physical level complies with RS-232 and RS-485 standards.
Output data is sent in ASCII with a configured interval.

1) Format of output data packet. MasterCAN output data packet (see figure B.1) consists of:

- prefix – ASCII string which defines the beginning of the packet;
- protocol version — ASCII string "VER.XXX", XXX stands for version number;
- data — parameters separated with space symbol;
- suffix — ASCII string which defines the ending of the packet;
- new line symbol — "\n".

prefix	space	protocol version	space	parameter	space	parameter	space	suffix	new line
$GATE		VER.001		AAA72.5		AAN1200		END	\r\n

Figure B.1 — MasterCAN data packet structure

Parameter consists of ID and numeric value (SPN).
See table B.1 for SPN and correspondent ID list.

Table B.1 — SPN and ID list

SPN	Name	Measure	ID
84	Wheel-Based Vehicle Speed	km/h	AAA
91	Accelerator Pedal Position 1	%	AAB
92	Engine Percent Load At Current Speed	%	AAC
96	Fuel Level 1	%	AAD
98	Engine Oil Level	%	AAE
100	Engine Oil Pressure	kPa	AAF
110	Engine Coolant Temperature	deg C	AAG
111	Engine Coolant Level	%	AAH
170	Cab Interior Temperature	deg C	AAI
171	Ambient Air Temperature	deg C	AAJ
174	Engine Fuel Temperature 1	deg C	AAK
183	Engine Fuel Rate	L/h	AAL
184	Engine Instantaneous Fuel Economy	km/L	AAM
190	Engine speed	rpm	AAN
237	Vehicle Identification Number	-	AAO
245	Total Vehicle Distance	km	AAP
247	Engine Total Hours of Operation	hr	AAQ
250	Engine Total Fuel Used	L	AAR
513	Actual Engine - Percent Torque	%	AAS
582	Axle Weight	kg	AAT
595	Cruise Control Active	-	AAU
597	Brake Switch	-	AAV

SPN	Name	Measure	ID
598	Clutch Switch	-	AAW
914	Service Distance	km	AAX
917	High Resolution Total Vehicle Distance	km	AAY
928	Axle Location	-	ABA
976	PTO Governor State	-	ABB
1611	Vehicle motion	-	ABC
1612	Driver 1 working state	-	ABD
1613	Driver 2 working state	-	ABE
1614	Vehicle Overspeed	-	ABF
1615	Driver card, driver 1	-	ABG
1616	Driver card, driver 2	-	ABH
1617	Driver 1 Time Related States	-	ABI
1618	Driver 2 Time Related States	-	ABJ
1619	Direction indicator	-	ABK
1620	Tachograph performance	-	ABL
1621	Handling information	-	ABM
1622	System event	-	ABN
1624	Tachograph vehicle speed	km/h	ABO
1625	Driver 1 identification	-	ABP
1626	Driver 2 identification	-	ABQ
2804	FMS-standard Diagnostics Supported	-	ABR
2805	FMS-standard Requests Supported	-	ABS
2806	FMS-standard SW-version sup-ported	-	ABT
3948	At least one PTO engaged	-	ABU
5054	High Resolution Engine Total Fuel Used	L	ABV
521193	Vehicle Fuel Volume	L	ABW
182	Engine Trip Fuel	L	ABX

2) Format of diagnostic output message. MasterCAN diagnostic output message is transmitted as parameter (see figure B.2) and consists of:

- ID – DM1 (active malfunctions), DM2 (saved malfunctions);
- SA – address of diagnosed unit;
- separator – ASCII symbol "*" which separates error codes, ID and unit address (SA);
- error code – consists of SPN and FMI separated with "/" ASCII symbol.

space	Parameter	space
	DM1*0*521/4*520198/2	

a) diagnostic message instance

Parameter										
ID	separator	SA	separator	SPN		FMI	separator	SPN		FMI
DM1	*	0	*	521	/	4	*	520198	/	2

b) diagnostic message parameter

Figure B.2 — Diagnostic message parameter parsing

3) Data output rate. See table B.2 for MasterCAN data output rate options.

Table B.2 — Dependence between baud rate, time interval and maximum packet size (bytes)

Interval, ms	**Baud rate, bit/s**				
	2400	**9600**	**19200**	**57600**	**115200**
500	120	480	960	2880	5760
1000	240	960	1920	5760	11520
5000	1200	4800	9600	28800	57600

Annex C
Converters firmware upgrade

WARNING: Data converter firmware update should be carried out **only** for implementing improvements, recommended by the Manufacturer.

To upgrade converter firmware the following actions should be made:

1) Connect converter to PC with the help of service adapter.

ATTENTION: When re-uploading firmware, power supply voltage of converter should not drop out of 10…45 V range.

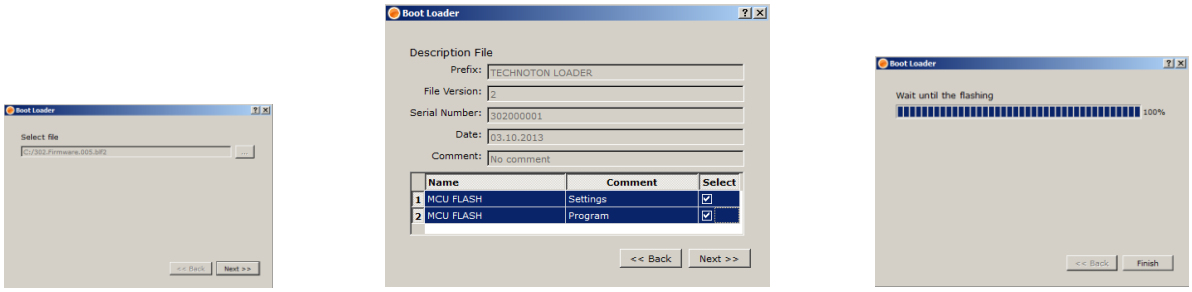
2) Click [Update firmware] button at **Tool Bar** area to launch a firmware update procedure.

3) Click [...] button at **Boot Loader** window to select a firmware file **(*.blf2)** from the disk. Click [Next >>] to run it.

ATTENTION: Study the firmware file summary note and make sure it corresponds to the converter model whose firmware is to be updated.

4) Next window will display description of the firmware file and update options table. Selecting only **Settings** check box will lead to update of settings to default factory values. Selecting only **Program** only converter inner firmware will be updated. Both options enabled by default.
Process of firmware uploading into converter memory can last for several minutes.
If you need to shut down the utility during the file uploading, click [Stop] button. For renewal of the process establish connection between converter and PC and click [Update firmware] button.

5) After the process is finished click [Finish] button. In case of successful update the **Passport** area will display a new version of the firmware. MasterCAN is ready for further work.



a) file opening *b) file description* *c) update finish*

Figure C.1 — Converter firmware update steps

ATTENTION: Before the end of the update process and automatic Service MasterCAN software reset it is **forbidden**:

1) Power down the PC.
2) Power down the converter.
3) Disconnect converter from the adapter and adapter from the PC.
4) Run any resource-intensive applications on the PC.

In case the converter firmware update has been completed incorrectly and the current version of the inbuilt software is damaged, the procedure of the firmware update has to be repeated. In this case, the inbuilt firmware loader is activated which allows to recover the converter operability. If a repeated attempt fails, we recommend to consult Technoton technical support service by e-mail support@technoton.by.

Annex D
Videography

Useful videos by Technoton are presented on the regularly updated YouTube page at:

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