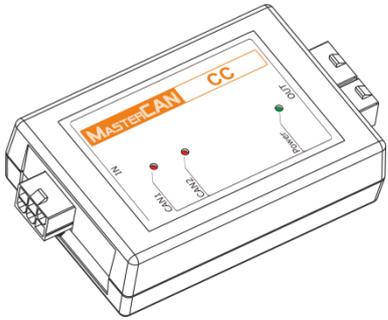
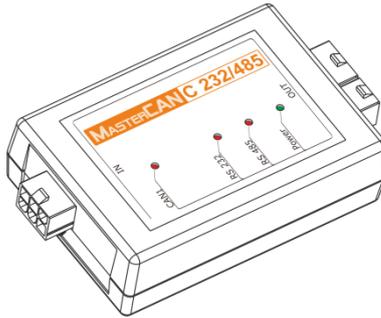


# MASTERCAN

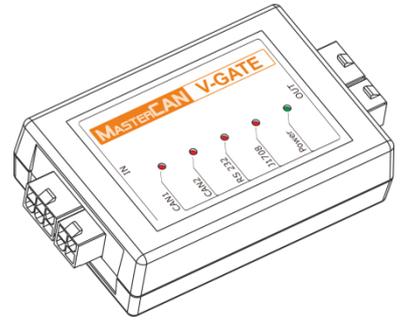
## VEHICLE DATA INTERFACES



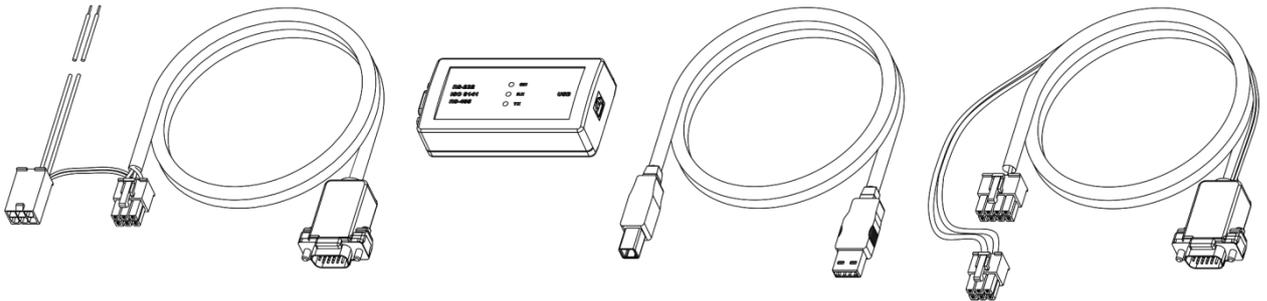
**MasterCAN CC**



**MasterCAN C 232/485**



**MasterCAN V-GATE**



**SK MasterCAN**

## OPERATION MANUAL (including Service MasterCAN software manual)

Version 4.0



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## Revision history

Version	Date	Editor	Description of changes
1.0	01.2013	OD	Basic version.
4.0	01.2017	OD	<ul style="list-style-type: none"><li>• New design of output connectors for all models of MasterCAN.</li><li>• MasterCAN scheme of connection to terminal changed.</li><li>• Delivery set of MasterCAN and SK MasterCAN changed.</li><li>• S6 SK service kit can now be used for MasterCAN configuration.</li><li>• MasterCAN connection to PC is changed and amended.</li><li>• MasterCAN V-gate connection parameters are clarified.</li><li>• MasterCAN data transfer protocol is amended.</li><li>• Terms and definitions are updated.</li></ul>

## Terms and Definitions

**S6** — is the vehicle onboard data bus developed by [JV Technoton](#) to enable integrating the GPS/GLONASS-based vehicle monitoring system into the vehicle electrical equipment. It comprises a set of cables, interfaces and protocols. Physically, it is based on CAN 2.0B (ISO 11898-1:2003) and K-Line (ISO 9141). S6 bus data exchange protocol complies with SAE J1939 International Standard.



To get more details on S6 telematics bus visit [http://s6.jv-technoton.com/en/Telematics\\_interface\\_S6\\_operation\\_manual](http://s6.jv-technoton.com/en/Telematics_interface_S6_operation_manual) contains guidelines and rules which refer to S6 cabling system, S6 SK service kit and service software for S6 Telematics Interface

**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** are data packets of vehicles' digital onboard interfaces (further on vehicles) that comply with the document FMS-Standard Interface Description (further on — FMS-Standard).



**FMS-Standard** is an open FMS Interface Standard developed by world leading truck manufacturers.

More detailed description of FMS messages is described in FMS-Standard Interface description document. Actual version of the document can be downloaded from the web site of developer <http://www.fms-standard.com>.

**Telematics** — special set of telematics messages developed by Technoton. Meets requirements of SAE J1939/71 standards. Telematics messages contain important operation parameters of vehicle.

**Onboard equipment** (OE) — Telematics System Elements, directly installed in vehicle.

**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 real-time and after trip vehicle monitoring and control. Main vehicle parameters monitored: route, fuel consumption, operation time, technical condition of vehicle, safety. Consists of OE, 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.

**Unit** — an element of Onboard Equipment of Vehicle, which is connected to Telematics Interface S6.

## Introduction

Recommendations and guidelines contained in this Operation Manual are related to MasterCAN Vehicle Data Interfaces (hereinafter [MasterCAN](#)) and SK MasterCAN service kit developed by [TECHNOTON JV](#), Minsk, BELARUS.

This document contains information on MasterCAN design, principle of operation, specifications as well as recommendations on its installation and operation. The document also defines SK MasterCAN connection and operation as well as manual on the included Service MasterCAN software (version 3.2 and newer).

**MASTERCAN** — is a tool for [Telematics systems](#) designed for safe and uninterrupted data gathering from onboard information buses of global leading [Vehicle](#) manufacturers.

SK MasterCAN provides communication between PC and MasterCAN units for their configuration.

### MasterCAN features:

- comply with national and European automobile standards;
- easy integration with vehicle Telematics systems;
- safe data integration from one or several onboard information buses to S6 [Telematics interface](#)  \*;
- simplifies setting-up of [Telematics terminal](#) by sifting unnecessary data
- simple input connection using [Crocodile](#) contactless readers   
and  ;
- automatic trip fuel consumption counter, incremented by hourly fuel consumption rate from onboard CANbus \*\*
- power supply from the vehicle onboard power supply system without any additional power supply units.

---

\* MasterCAN CC and MasterCAN V-GATE.

\*\* For MasterCAN CC firmware v.8 and higher and for MasterCAN C 232/485 and MasterCAN V-gate firmware v.7 and higher

MasterCAN modifications:

- [MasterCAN CC](#) for receiving data from onboard CAN interface, converting received data and sending created [FMS](#) and [Telematics](#) messages to CAN/S6 interface;
- [MasterCAN C 232/485](#) for receiving data from onboard CAN interface, converting received data and sending created messages to RS-232 and RS-485 interfaces;
- [MasterCAN V-GATE](#) for receiving data from onboard CAN and J1708 interfaces simultaneously, converting received data and sending created FMS and Telematics messages to CAN/S6 interface and messages to RS-232 interface.

[MasterCAN](#) modifications are designated in accordance with table 1.

Table 1 — MasterCAN modifications

<b>Vehicle Data Interface</b>		
<b>MASTERCAN X</b>		
<b>X</b> symbol standing for MasterCAN modifications	Input interface (Protocol)	Output Interface (Protocol)
<b>CC</b>	CAN (SAE J1939)	CAN/S6 (SAE J1939)
<b>C 232/485</b>	CAN (SAE J1939)	RS-232 and RS-485 (ASCII/Modbus/DUT-E COM)
<b>V-GATE</b>	CAN (SAE J1939) and J1708 (SAE J1587)	CAN/S6 (SAE J1939) and RS-232 (ASCII/Modbus/DUT-E COM)

To ensure proper operation, MasterCAN should be connected and configured by certified professionals who have successfully finished manufacturer's [technical training](#).

For MasterCAN configuration service kits SK MasterCAN and S6 SK can be used (purchased separately).



**ATTENTION:** The Manufacturer guarantees MasterCAN compliance with the requirements of technical regulations subject to the conditions of storage, transportation and operation set out in this Manual. Manufacturer reserves the right to modify MasterCAN 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 application area

**MASTERCAN** are designed for information Vehicle buses data processing and generation of information ready for use by Telematics systems.

**Application area of MasterCAN** - is used within [Telematics systems](#).

[MasterCAN](#) in combination with contactless readers CANCrocodile and 1708Crocodile can be used as convenient solution for data integration from onboard CANbuses and [1708buses](#) to Telematics system (see figure 1).

MasterCAN analyzes information from automotive information buses, filters out excess data and generates output messages containing tens of most important operation parameters of Vehicle (e.g. instant and trip fuel consumption, total fuel consumption, RPMs, fuel level, engine operation time, engine temperature, oil pressure and level).

MasterCAN output messages are received by [Telematics terminal](#) which collects, records, stores and transmits data to Server. Software on the Server processes, analyzes received data and generates reports containing data on fuel consumption and parameters of [Vehicle](#) operation.

MasterCAN in combination with Crocodile is also a convenient solution for data gathering from sensors and peripheral devices of one or several onboard CAN (J1708) buses and data transfer to [S6 Telematics interface](#). This allows to monitor various Vehicle operation parameters via just one CAN-port of Telematics terminal (see figure 2).

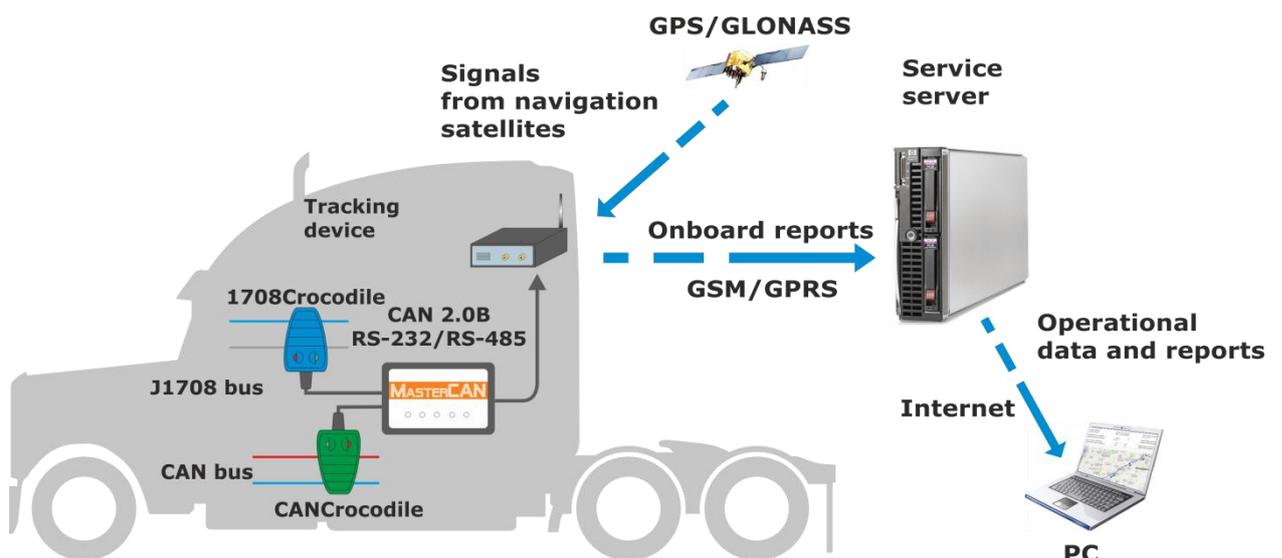


Figure 1 – On-board CAN and J1708 buses data integration in Telematics interface

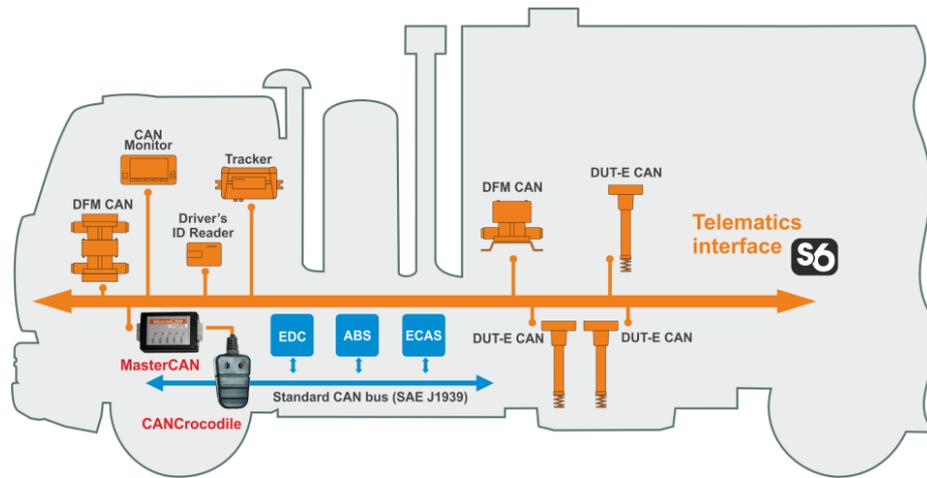


Figure 2 – On-board automotive CANbus data transmission to S6 Telematics interface

Reports based on [MasterCAN](#) data allow monitoring of instant [Vehicle](#) fuel consumption rate as well as fuel volume consumed during trip (see figure 3)



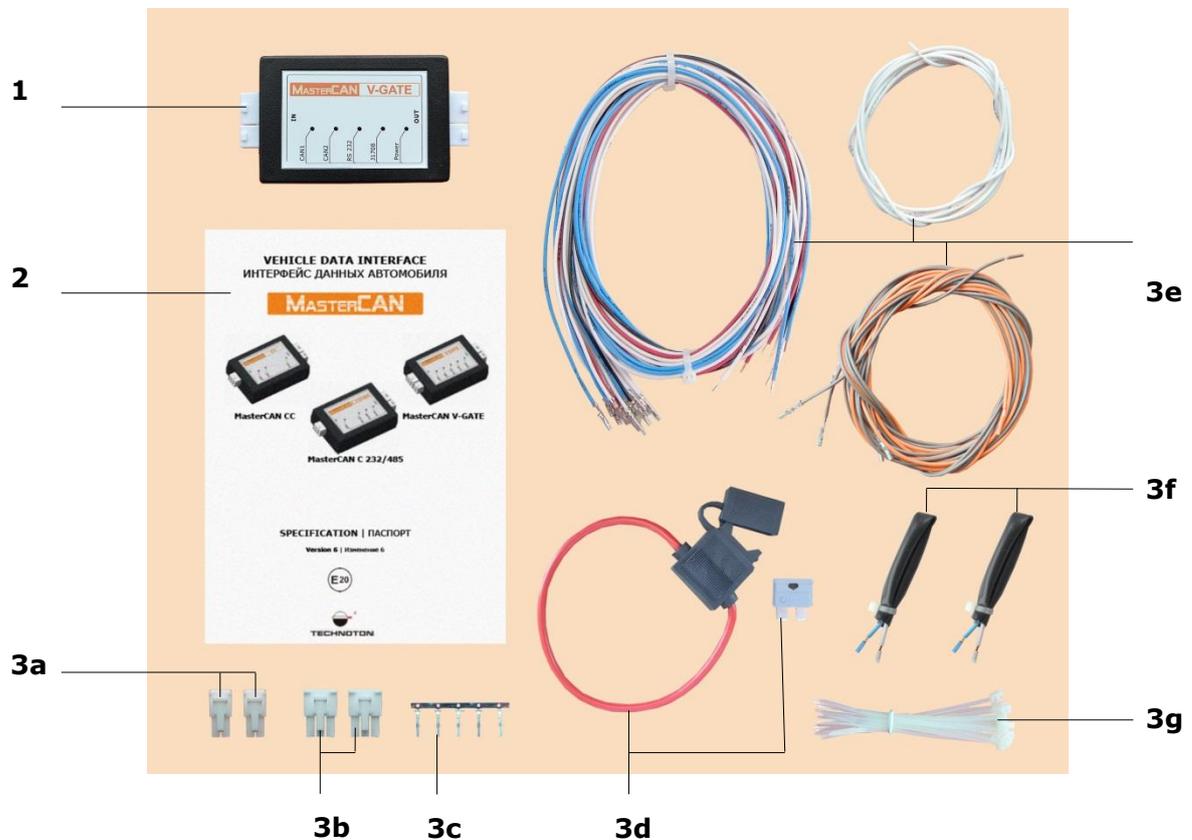
Report	12.1 Fuel report
Object	Mra 3522 NOK-S 7032
Report generation time	07.12.2016 11:10:34
Time interval starts	28.11.2016 00:00:00
Time interval ends	04.12.2016 23:59:59
Milage	99 km
Movement time	15:50:02
Fuel consumption of engine/CAN	282 lt
Average consumption of engine/CAN	281 lt/100 km

Data based on CANbus

Graph of instant fuel consumption based on CANbus data

Figure 3 – Automotive CANbus data monitoring through MasterCAN

## 1.2 Delivery set



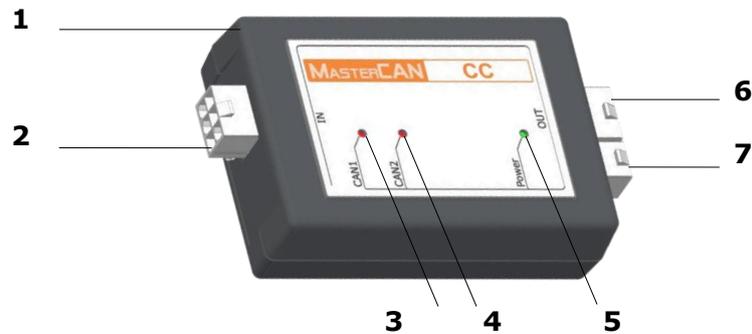
- |           |                                                  |            |
|-----------|--------------------------------------------------|------------|
| <b>1</b>  | MasterCAN vehicle data interface                 | - 1 pc.;   |
| <b>2</b>  | Specification with factory settings sheet        | - 1 pc.;   |
| <b>3</b>  | MasterCAN MK VDI mounting kit (1 pc.) including: |            |
| <b>a)</b> | molex connector, 4 pins                          | - 2 pcs.;  |
| <b>b)</b> | molex connector, 6 pins                          | - 2 pcs.;  |
| <b>c)</b> | contact pin                                      | - 5 pcs.;  |
| <b>d)</b> | fuse with holder (2 A)                           | - 1 pc.;   |
| <b>e)</b> | wire                                             | - 17 pcs.; |
| <b>f)</b> | S6 CW plug *                                     | - 2 pcs.;  |
| <b>g)</b> | cable tie                                        | - 20 pcs.  |

Figure 4 — MasterCAN delivery set

\* Includes embedded termination resistor 120 Ohm.

## 1.3 Exterior view and design

### 1.3.1 Exterior view and design MasterCAN CC



- 1** - casing;
- 2** - input **CAN** connector to connect to onboard CANbus;
- 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** - output **S6** connector for connection to [S6 Telematics interface](#);
- 7** - **RS232/485** connector \*;

*Figure 5 — MasterCAN CC exterior view and design*

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\* Not used for MasterCAN CC.

### 1.3.2 Exterior view and design MasterCAN C 232/485



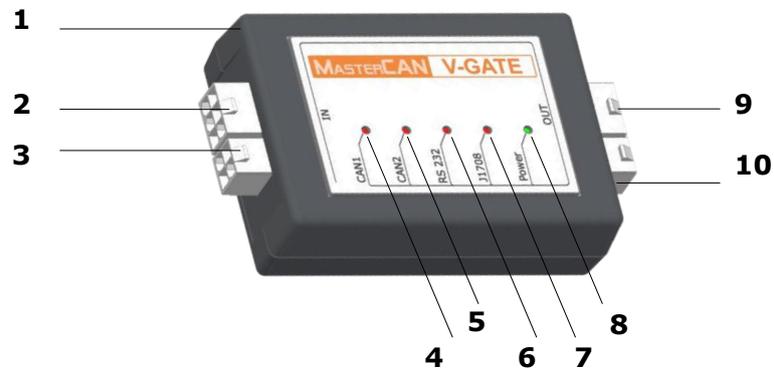
- 1** - casing;
- 2** - input **CAN** connector to connect to the onboard CANbus;
- 3** - red **CAN1** LED indicating data reception;
- 4** - red **RS232** LED indicating data transmission;
- 5** - red **RS485** LED indicating data transmission;
- 6** - green **Power** LED indicating power supply is turned on;
- 7** - output **S6** connector for connection to [S6 Telematics interface](#);
- 8** - output **RS232/485** connector for connection to RS-232/RS-485-ports of [Telematics terminal](#).

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

---

\* For power supplying and configuring MasterCAN C 232/485.

### 1.3.3 Exterior view and design MasterCAN V-GATE



- 1** - casing;
- 2** - input **CAN** connector to connect to the onboard CANbus;
- 3** - input **J1708** connector to connect to the onboard J1708 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** - output **S6** connector for connection to [S6 Telematics interface](#);
- 10** - output **RS232/485** connector for connection to RS-232-port of [Telematics terminal](#).

*Figure 7 — MasterCAN V-GATE exterior view and design*

## 1.4 Operation principle

[MasterCAN](#) automatically and continuously receives data from CAN onboard bus via J1939 protocol ([MasterCAN CC](#), [MasterCAN C 232/485](#) and [MasterCAN V-GATE](#) modifications), or from J1708 onboard bus via J1587 protocol (MasterCAN V-GATE modification). Additionally, MasterCAN V-GATE can receive data from CANbus and [J1708 bus](#) simultaneously.

MasterCAN analyzes received data and sorts out the most needed data on vehicle operation parameters, generates messages ([PGN](#)) and sends them to CAN/S6 output interface in accordance with [1.5.2-1.5.4](#).

Messages contained in signals of MasterCAN LED indicators during its operation are identified in accordance with their description in table 2.

Table 2 - Messages contained in signals of MasterCAN LED indicators

LED indicator		Description
Designation	Indicator status and light color	
<b>CAN1</b>		Data reception from CANbus is on
	No signal	No data reception from CANbus
<b>CAN2</b>		Outgoing messages transmission to CAN/S6 interface is on
	No signal	No outgoing messages are transmitted to CAN/S6 interface
<b>RS232</b>		Transmission of messages to RS-232 interface is on
	No signal	No messages are transmitted to RS- 232 interface
<b>RS485</b>		Transmission of messages to RS-485 interface is on
	No signal	No messages are transmitted to RS- 485 interface
<b>1708</b>		Transmission of data of J1708 bus is on
	No signal	No transmission of data of J1708 bus
<b>Power</b>		Power is on
	No signal	Power is off (or the supplied voltage value is less than minimally allowed)

## 1.5 Technical specifications

### 1.5.1 Main Performance Specifications

Table 3 — Basic performance specifications of MasterCAN

Specification, Unit of Measurement	Value
Supply voltage range, V	from 10 to 45
Current consumption at nominal voltage 12 V, mA, not more than	100
Current consumption at nominal voltage 24 V, mA, not more than	50
Ambient air temperature, °C	from -40 to +85
Level of casing protection	IP40
Dimensions, mm, not more than	see <a href="#">figure 8</a>
Weight, kg, not more than	0.15

## 1.5.2 MasterCAN CC input and output interfaces

**MasterCAN CC input interface** is used to receive data from the onboard CANbus. It's physically based on CAN 2.0B interface. Data reception is carried out automatically (default mode) or on request.

MasterCAN CC input interface signals comply with SAE J1939 international standard.

CAN/S6 **output interface** is used for transmission of useful information to [Telematics terminal](#). Data transmission protocol is based on SAE J1939 and correspond to [S6 Database](#) (see details at <http://s6.jv-technoton.com>).

MasterCAN CC sends [Telematics](#) and [FMS](#) messages to CAN/S6 interface (see table 4). Output messages can be selected through [Service MasterCAN software](#).

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>.

MasterCAN CC has unique not editable network address 122 which is used for device identification through input and output interfaces.

*Table 4 – Output messages of MasterCAN to CAN/S6 interface*

PGN	Short message description
<a href="#">Telematics</a>	
<a href="#">63233</a>	Message 1
<a href="#">63234</a>	Message 2
<a href="#">63235</a>	Message 3
<a href="#">63236</a>	Message 4
<a href="#">FMS</a>	
<a href="#">61440</a>	Electronic retarder controller 1
<a href="#">61443</a>	Electronic engine controller 2
<a href="#">61444</a>	Electronic engine controller 1
<a href="#">61445</a>	Electronic transmission controller 2
<a href="#">64777</a>	High resolution fuel consumption (liquid)
<a href="#">64932</a>	PTO drive engagement
<a href="#">64933</a>	Door control 2
<a href="#">64977</a>	FMS-standard interface identity/Capabilities
<a href="#">65102</a>	Door control 1
<a href="#">65110</a>	Aftertreatment 1 diesel exhaust fluid tank 1 information
<a href="#">65112</a>	Air suspension control 4
<a href="#">65131</a>	Driver's identification

Table 4 continued

<b>PGN</b>	<b>Short message description</b>
<a href="#">65132</a>	Tachograph
<a href="#">65136</a>	Combination vehicle weight
<a href="#">65198</a>	Air supply pressure
<a href="#">65216</a>	Service information
<a href="#">65217</a>	High resolution vehicle distance
<a href="#">65237</a>	Alternator information
<a href="#">65253</a>	Engine hours, revolutions
<a href="#">65254</a>	Time/Date
<a href="#">65257</a>	Fuel consumption (liquid)
<a href="#">65258</a>	Vehicle weight
<a href="#">65260</a>	Vehicle identification
<a href="#">65262</a>	Engine temperature 1
<a href="#">65265</a>	Cruise control/Vehicle speed 1
<a href="#">65266</a>	Fuel economy (liquid)
<a href="#">65269</a>	Ambient conditions
<a href="#">65276</a>	Dash display
<p>Notes</p> <p>1 The content of MasterCAN output messages depends on the data gathered from CANbus (<a href="#">J1708 bus</a>). This data may differ depending on make, model and year of the <a href="#">Vehicle</a> equipped.</p> <p>2 MasterCAN automatically increments trip fuel consumption counter, calculating it from "Hourly fuel consumption" (<a href="#">SPN 183</a>) and stores calculated values inside internal memory until powering off. Step of trip fuel consumption counter incrementation is 0.5 l. If standard <a href="#">PGN 65257</a>, which contains "Volume of fuel consumed in a trip" (<a href="#">SPN 182</a>) and/or "Fuel consumption by engine" (<a href="#">SPN 250</a>), is transmitted over a CANbus, this standard PGN will have higher priority and will be transmitted to the output of MasterCAN without any changes.</p>	

### 1.5.3 MasterCAN C 232/485 input and output interfaces

[MasterCAN C 232/485 input interface](#) is used to receive data from the onboard CANbus. It's physically based on CAN 2.0B interface. Data reception is carried out automatically (default mode) or on request.

MasterCAN C 232/485 input interface signals comply with SAE J1939 international standard.

MasterCAN 232/485 has unique not editable network address 124 which is used for device identification through input interface.

MasterCAN C 232/485 **output interface** is used for transmission of useful information to [Telematics terminal](#). It's physically based on RS-232 and RS-485 interfaces.

By default, MasterCAN C 232/485 transmits text messages per ASCII standard through RS-232 and RS-485 interfaces. Description of text messages transmission protocol can be found in [annex B](#).

[Service MasterCAN software](#) allows selecting "request-response" mode (operating on Modbus protocol, see [3.6.3](#)) for output text messages transmission. [Modbus](#) protocol allows transmission of wider set of Vehicle parameters (see [annex A](#)).

## 1.5.4 MasterCAN V-GATE input and output interfaces

### Input interfaces of [MasterCAN V-GATE](#):

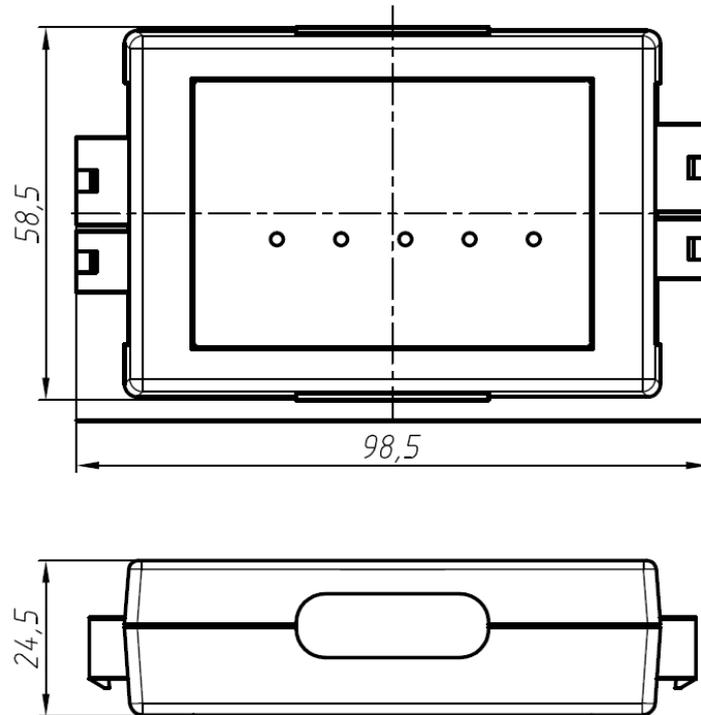
- CAN – for data reception from automotive CANbus. Physically based on CAN 2.0B interface. Data reception is carried out automatically (default mode) or on request. Input signals characteristics corresponds to SAE J1939 standard.
- J1708 — for data reception from automotive [J1708bus](#). Data reception is carried out automatically. Input signals characteristics corresponds to SAE J1587 standard.

### Output interfaces of MasterCAN V-GATE:

- CAN/S6 — for transmission of useful information to [Telematics terminal](#). Data transmission protocol is based on SAE J1939 and correspond to [S6 Database](#) (see details at <http://s6.jv-technoton.com>). MasterCAN V-GATE transmits [Telematics](#) and [FMS](#) messages to CAN/S6 interface similarly to MasterCAN CC (see [1.5.2](#)). Output messages can be selected through [Service MasterCAN software](#).
- RS-232 — for transmission of useful information to Telematics terminal. MasterCAN V-GATE transmits messages to RS-232 interface similarly to MasterCAN C 232/485 (see [1.5.3](#)).

MasterCAN V-GATE has unique not editable network address 125 which is used for device identification through input (CAN) and output (CAN/S6) interfaces.

## 1.6 Dimensions



*Figure 8 - MasterCAN overall dimensions*

## 2 MasterCAN connection

**ATTENTION:**



- 1)** Strictly follow safety rules of automobile repair works as well as local safety rules of the customer company when connecting [MasterCAN](#).
- 2)** Before connection it is recommended to carefully study through the electrical circuit diagram and the Operation Manual for the [Vehicle](#) where MasterCAN is mounted.
- 3)** Check the quality of the chassis ground of the vehicle. Resistance between any point of chassis and the “-” clamp of the battery should not exceed 1 Ohm.

### 2.1 Exterior inspection prior to starting works

It is required to conduct MasterCAN 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 Operational restrictions

To mount [MasterCAN](#), you need to select a dry location protected from aggressive impact of the environment.

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

A suitable place to mount MasterCAN DAC15 is inside driver's cabin.

## 2.3 Electrical connection

MasterCAN can be power supplied either from onboard [Vehicle](#) electric system or from tracking device. If connected to [S6 Telematics interface](#), MasterCAN is power supplied through S6 cabling system.

### IMPORTANTLY:



**1)** Before mounting and connecting [MasterCAN](#) switch off power supply of the [Vehicle](#) electrical circuits. To do this switch off the battery switch or release the terminals of the wires connected to the battery. To prevent equipment failure, turning power supply on is allowed only after electrical connection is finished.

**2)** It is recommended to use fuse (supplied within delivery set) when connecting MasterCAN power supply. Nominal fuse current is not more than 2 A (see figure 9 a).

**3)** When connecting MasterCAN to onboard power source it is necessary to connect feed "+" and chassis "-" wires to the same sockets where appropriate wires of telematics terminal (tracking device) or recording/display device is connected.

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.



Figure 9 — Accessories for MasterCAN connection



**ATTENTION:** To ensure correct data transfer through CAN 2.0B (J1939) communication link when connecting MasterCAN CC (MasterCAN V-GATE) to telematics terminal not equipped by terminating resistor, connect S6 CW plugs (see [1.2](#)) to ends of communication links between CAN LOW and CAN HIGH wire (see figure 10)

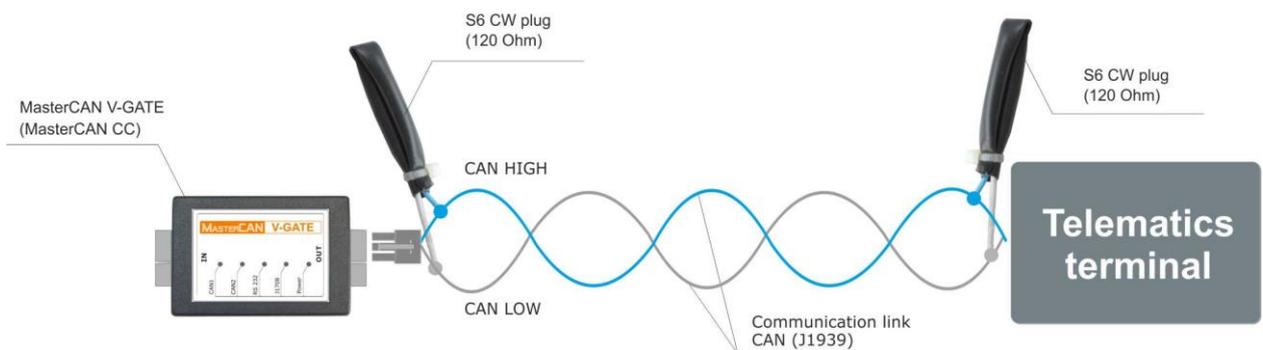


Figure 10 — Connecting MasterCAN CC (MasterCAN V-GATE) to telematics terminal not equipped by termination resistor

### 2.3.1 Using Crocodile contactless reader devices to connect MasterCAN input

Simple to operate, [TECHNOTON](#)-made [Crocodile](#) contactless readers are most suitable for reliable and safe connection of [MasterCAN](#) to CAN and [J1708](#) vehicle data buses. To connect MasterCAN, we recommend to use the following modifications of Crocodile:

-  — for contactless connection of any MasterCAN modification to CANbus and obtaining data from the bus without removing and/or damaging insulation layer of wires and with no electrical contact (see figure 11 a);
-  — for contactless connection of MasterCAN V-GATE to J1708 bus and obtaining data from the bus without removing and/or damaging insulation layer of wires and with no electrical contact (see figure 11 b).



a) CANCrocodile



b) 1708Crocodile

Figure 11 — Exterior view of contactless readers

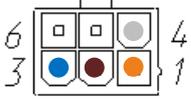
CANCrocodile and 1708Crocodile generate the output signal; the data contained in this signal coincides with the data readings of the connected bus.

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

Vehicle CANbus connection is made according to **CAN** connector pinout and color of the wires, as shown in table 5.

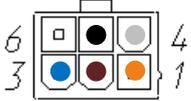
Table 5 – Connection of the input CAN connector

Connector Pinout	Connector Contact Number	Wire Marking	Wire Color	Circuit Designation	Signal Parameters
	1	VE	Orange	Power Supply Output "+"*	Analog, voltage from 0 to 45 V
	2	GND	Brown	Ground "-"	-
	3	CAN1.H	Blue	CAN HIGH	Digital, in accordance with SAE J1939 Standard
	4	CAN1.L	White	CAN LOW	

\* To provide power supply to [CANCrocodile](#).

Power supply wires and the tracking device of the vehicle tracking system are connected in accordance with designation of **S6** output connector pinout and color of wires, as shown in 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 from 0 to 45 V
	2	GND	Brown	Ground "-"	-
	3	CANH	Blue	CAN HIGH	Digital, CAN 2.0B, in accordance with SAE J1939 Standard
	4	CANL	White	CAN LOW	
	5	KLIN	Black	K-Line*	Digital, in accordance with ISO 14230 Standard

\* For adjustment and firmware update of MasterCAN.

An example of [MasterCAN CC](#) connection using [CANCrocodile](#) to receive data from the CAN onboard bus is provided in figure 12.

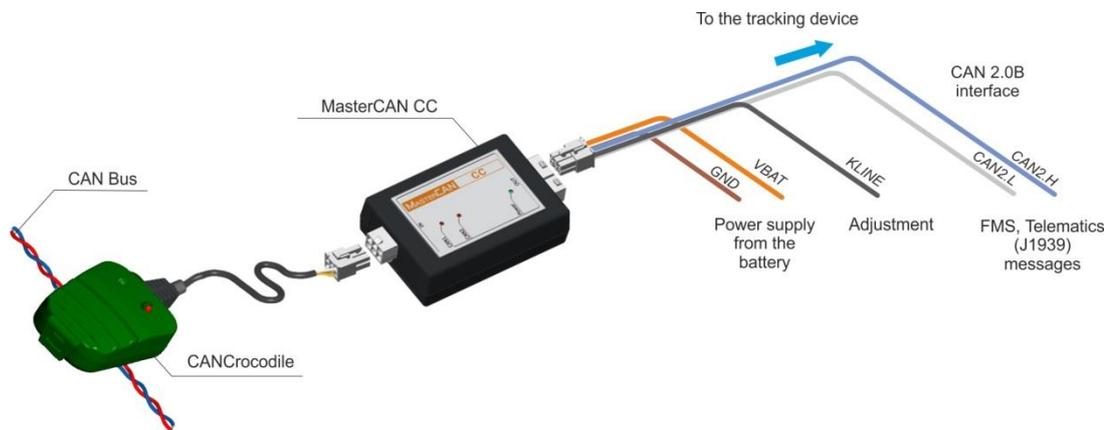


Figure 12 — Connection of MasterCAN CC to CAN bus

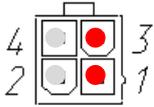
### 2.3.3 MasterCAN C 232/485 connection

Power supply wires is connected in accordance with designation of **S6** output connector pinout and color of wires, as shown in table 6.

Vehicle CANbus connection is made according to **CAN** connector pinout and color of the wires, as shown in table 5.

The tracking device of the vehicle tracking system is connected in accordance with designation of **RS232/485** output connector pinout and color of wires, as shown in table 7.

Table 7 – Connection of RS232/485 output connector

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

An example of [MasterCAN C 232/485](#) connection using [CANCrocodile](#) to receive data from the CAN onboard bus is provided in figure 13.

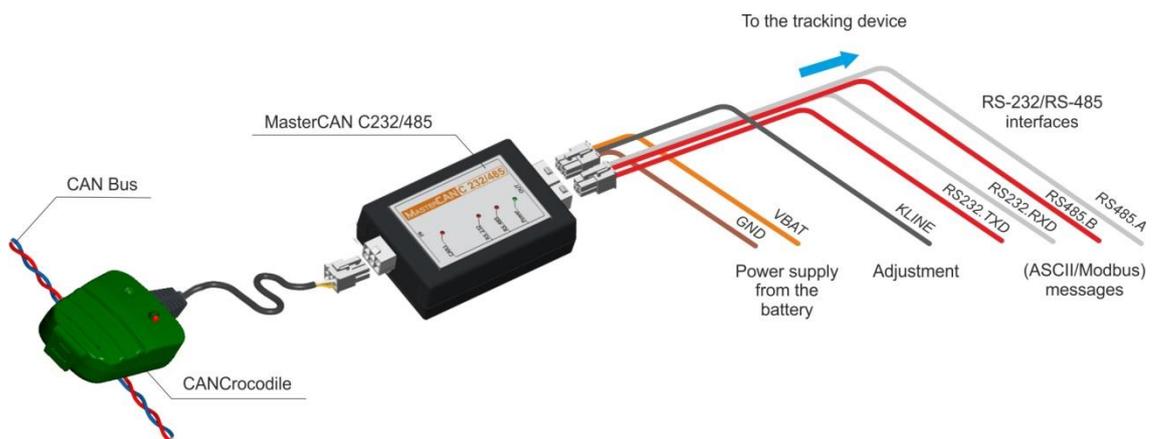


Figure 13 – Connection of MasterCAN C 232/485 to CAN bus

### 2.3.4 MasterCAN V-GATE connection

Power supply wires is connected in accordance with designation of **S6** output connector pinout and color of wires, as shown in table 6.

Vehicle CANbus connection is made according to **CAN** connector pinout and color of the wires, as shown in table 5.

Vehicle [J1708](#) bus connection is made according to **J1708** connector pinout and color of the wires, as shown in table 8.

Table 8 — Connection of the input J1708 connector

Connector Pinout	Connector Contact Number	Wire Marking	Wire Color	Circuit Designation	Signal Parameters
	1	J1708.A	White	J1708.A	Digital, in accordance with SAE J1587 Standard
	2	J1708.B	Blue	J1708.B	
	3	VE	Orange	Power Supply Output "+" *	Analog, voltage from 0 to 45 V
	4	GND	Brown	Ground "-"	

\* To provide power supply to [1708Crocodile](#).

The tracking device of the vehicle tracking system to CAN/S6 interface is connected in accordance with designation of **S6** output connector pinout and color of wires, as shown in table 6.

The tracking device of the vehicle tracking system to RS-232 interface is connected in accordance with designation of **RS232/485** output connector pinout and color of wires, as shown in table 7.

An example of [MasterCAN V-GATE](#) connection using [CANCrocodile](#) to receive data from the CAN onboard bus is provided in figure 14.

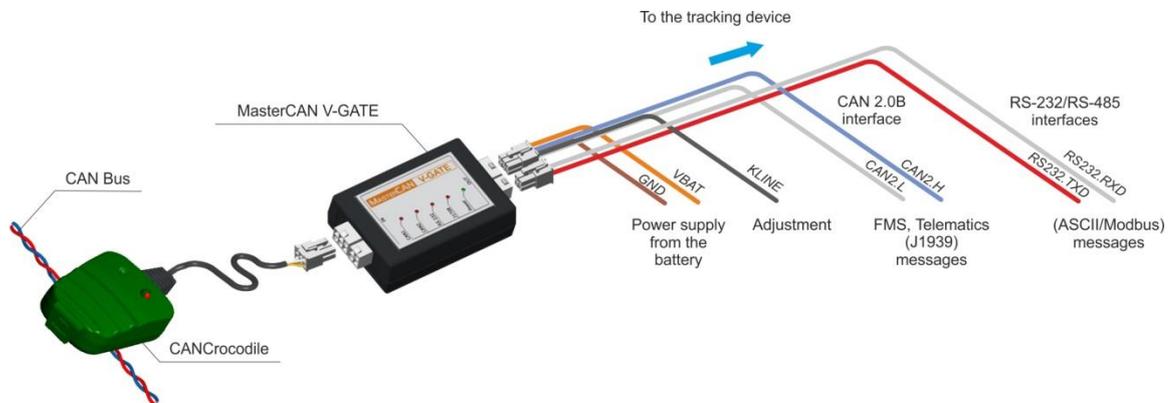


Figure 14 — Connection of MasterCAN V-GATE to CAN bus

An example of [MasterCAN V-GATE](#) connection using [1708Crocodile](#) to receive data from the [J1708](#) onboard bus is provided in figure 15.

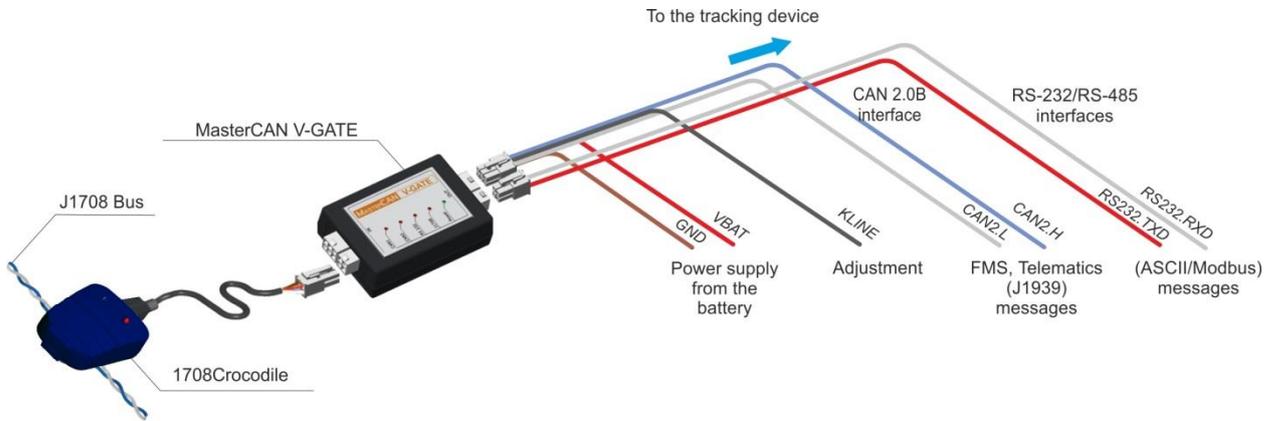


Figure 15 — Connection of MasterCAN V-GATE to J1708 bus

An example of MasterCAN V-GATE connection using [CANCrocodile](#) and [1708Crocodile](#) for simultaneous data reception from CAN and J1708 onboard buses is provided in figure 16.

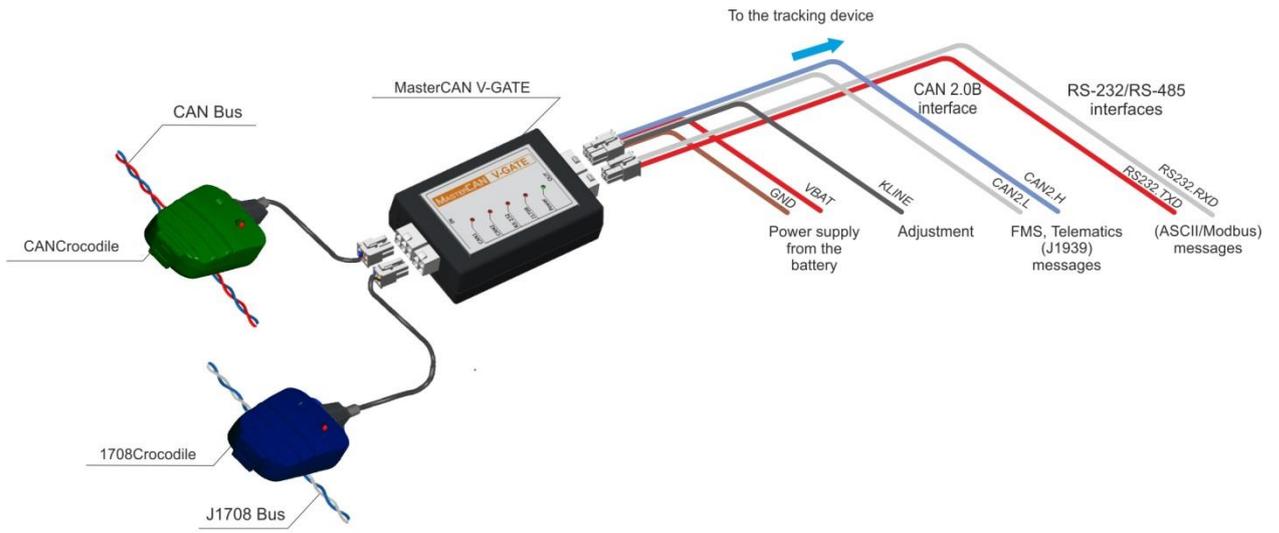


Figure 16 — Connection of MasterCAN V-GATE simultaneously to CAN and J1708 buses

## 2.4 Serviceability check

In case the connection is made correctly, [MasterCAN](#) starts its operation from the moment power is supplied to it (when the ignition is on). When the power supply is cut off (the ignition is off), MasterCAN switches off.

When MasterCAN is connected properly, readings of LED indicators on its casing should correspond to the readings in [table 3](#).

## 2.5 Using MasterCAN as a summator of DUT-E CAN fuel level sensors

To measure the total volume of fuel in several tanks, you may use [MasterCAN C 232/485](#) and [MasterCAN V-GATE](#) together with [DUT-E](#) CAN fuel level sensors.

The circuit diagram showing [MasterCAN](#) connection for summation of readings from two or more DUT-E CAN sensors also specifying types of cables that need to be ordered is provided in [annex C](#).

[S6](#) onboard bus enables to connect 8 DUT-E CAN sensors. You need to use decimal addresses from 101 to 108.

The calibration table of the fuel tank in which the volume of fuel is measured should be recorded into the internal memory of each DUT-E CAN sensor connected to S6 bus.

MasterCAN receives fuel volume readings from each DUT-E CAN fuel level sensor connected to S6 bus, sums them up and transmits the data on the total volume of fuel in the form of output messages, in accordance with [1.5.3](#) (for MasterCAN C 232/48) and in accordance with [1.5.4](#) (for MasterCAN V-GATE).

MasterCAN output messages when working as a summator for DUT-E CAN are sent according to [Modbus](#) protocol or [DUT-E COM protocol](#). Protocol selection is made with SK MasterCAN service kit (see [3.6.3](#)).

The current version of DUT-E COM protocol can be downloaded at: <http://www.jv-technoton.com/>.

## 3 MasterCAN configuration with the service kit

MasterCAN configuration for specific operation conditions is carried out via K-Line (ISO 14230) interface. For configuration, connect MasterCAN to PC using SK MasterCAN or S6 SK service kits.

Prior to start working with service kit, please, go to <http://www.jv-technoton.com> ([Software/Firmware](#) section), download and install [USB driver](#) and [Service MasterCAN software](#) (version 3.2. and higher).

Setup file has the following form: ServiceMasterCAN\_v\_X\_X\_Setup.exe, where X\_X — version of the Software.

[S6 Telematics interface operation manual](#) contains guidelines and rules which refer to S6 SK service kit.

### 3.1 SK MasterCAN application

**SK MasterCAN service kit is designed for data exchange between PC and MasterCAN units for configuration and setting up.**

Service MasterCAN functions:

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

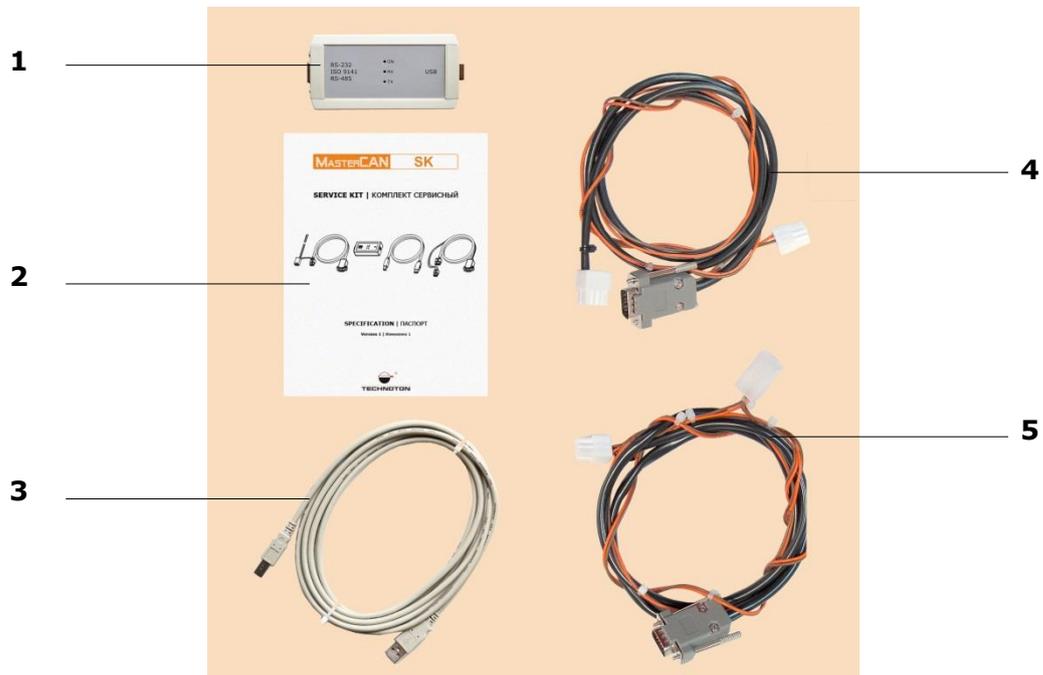
## 3.2 Hardware requirements

To run Service [MasterCAN](#) utility IBM-compatible PC is required (desktop or laptop):

- CPU - Intel or AMD with a minimum clock speed of 800 MHz;
- RAM - 256 MB (recommended 512 MB or more);
- USB port;
- operating system - Windows XP/Vista/7/8.

## 3.3 Service kit delivery set

### 3.3.1 Exterior view and delivery set



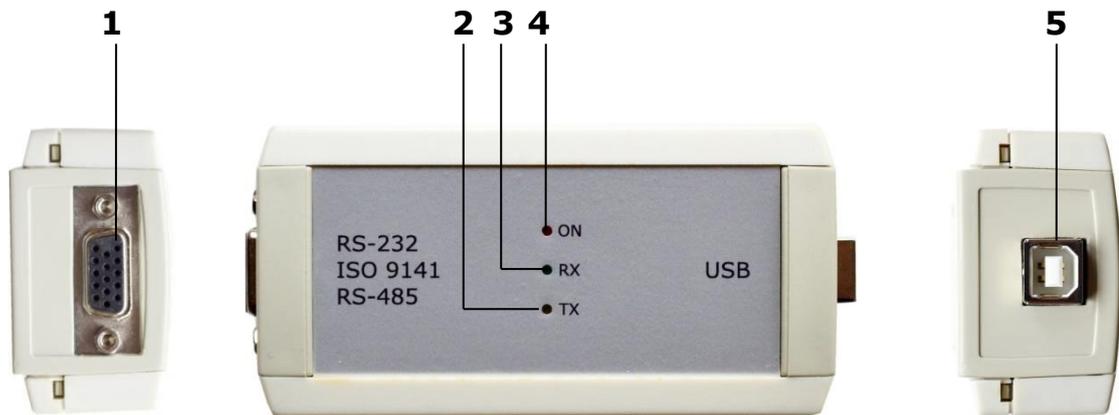
- 1** - universal service adapter;
- 2** - SK MasterCAN specification;
- 3** - USB A-B cable;
- 4** - service cable for [MasterCAN CC](#), [MasterCAN C 232/485](#) and [MasterCAN V-GATE](#);
- 5** - service cable for MasterCAN Diagnostic.

Figure 17 — SK MasterCAN delivery set

### 3.3.2 Universal service adapter

Universal service adapter (hereinafter adapter) is designed to transmit data between [MasterCAN](#) and PC.

See Figure 18 for adapter exterior view.

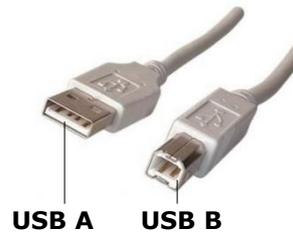


- 1** – RS-232/ISO 9141/RS-485 socket for MasterCAN connection;
- 2** – TX yellow LED indicator of data transmitted to MasterCAN;
- 3** – RX green LED indicator of data received from MasterCAN;
- 4** – ON red LED indicator of power supply;
- 5** – USB B port for PC connection.

*Figure 18 — Adapter exterior view*

### 3.3.3 USB A-B Cable

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

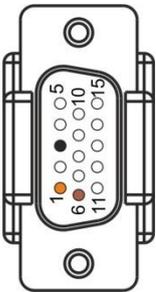
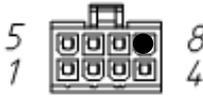


*Figure 19 — USB A-B cable connectors*

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

[MasterCAN CC](#), [MasterCAN C 232/485](#), [MasterCAN V-GATE](#) service cable is used to connect adapter to MasterCAN units with firmware version below 12.0.

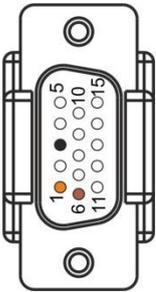
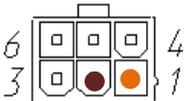
Table 12 —MasterCAN CC, MasterCAN C 232/485, MasterCAN V-GATE service cable pinout

View	Pin number	Wire		Signal		
		Marking	Color	Assignment	Type	
	1	VBAT		Orange	Power supply "+"	Analog, Voltage 0...32 V
	3	KLINE		Black	K-Line	Serial, ISO 9141 standard
	6	GND		Brown	Ground "-"	—
	8	KLINE		Black	K-Line	Serial, ISO 9141 standard
	1	VBAT		Orange	Power supply "+"	Analog, Voltage 0...32 V
	2	GND		Brown	Ground "-"	—

### 3.3.5 MasterCAN Diagnostic service cable

MasterCAN Diagnostic service cable is used to connect adapter to MasterCAN units with firmware version is above 12.0 or MasterCAN Diagnostic data interface\*.

Table 13 — MasterCAN Diagnostic service cable pinout

View	Pin number	Wire		Signal		
		Marking	Color	Assignment	Type	
	1	VBAT		Orange	Power supply "+"	Analog, Voltage 0...32 V
	3	KLINE		Black	K-Line	Serial, 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	Serial, ISO 9141 standard
	1	VBAT		Orange	Power supply "+"	Analog, Voltage 0...32 V
	2	GND		Brown	Ground "-"	—

\* MasterCAN Diagnostic is currently not produced.

## 3.4 Service kit connection

### 3.4.1 Exterior inspection prior to connection

It is necessary to conduct Service kit exterior inspection for the presence of the possible defects arisen during transportation, storage or careless use:

- 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 kit to the device mounted on [Vehicle](#):

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



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

### 3.4.3 Connecting MasterCAN to PC



**ATTENTION:** Power down the electrical system of the Vehicle prior to connecting MasterCAN to the PC\*. Use the battery switch or take off the battery contact terminals.

MasterCAN is connected to PC in the following sequence of steps:

**1)** Connect adapter to MasterCAN

If using SK MasterCAN – connect **S6** output connector of MasterCAN to RS-232/ ISO 9141/RS-485 connector of adapter using MasterCAN Diagnostic service cable (see figure 20).

If using S6 SK – adapter’s service cable connector is connected to **S6** output connector of MasterCAN using S6 SK Connector from delivery set. MasterCAN and adapter can be power supplied through any free connector of S6 SK Connector or through one of inputs of MasterCAN – **CAN** or **J1708** \*\* (see figure 21).

While configuring MasterCAN connected to [S6 Telematics interface](#), adapter’s service cable connector can be connected to any free connector of S6 cabling system. MasterCAN and adapter are now power supplied through S6 cabling system (see figure 22).

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

**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.

---

\* It can leave the power supply from onboard network turned on while configuring Units connected via [S6 Telematics interface](#).

\*\* 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.

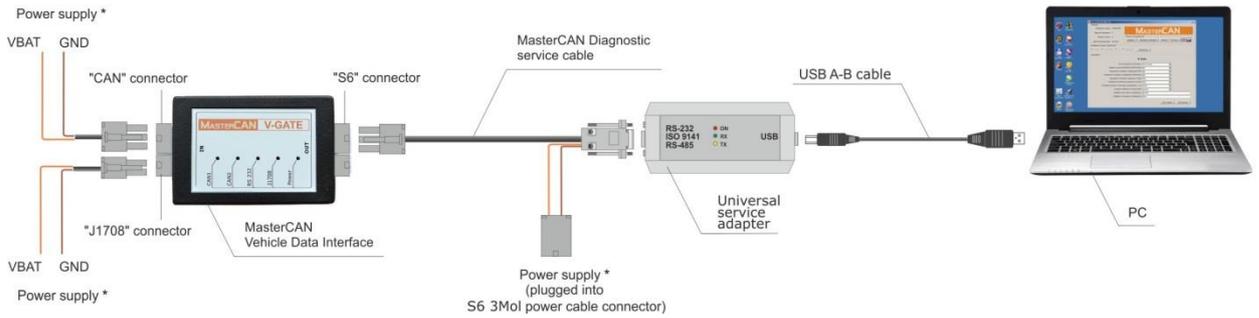


Figure 20 — MasterCAN to PC wiring scheme while using SK MasterCAN for configuration of MasterCAN

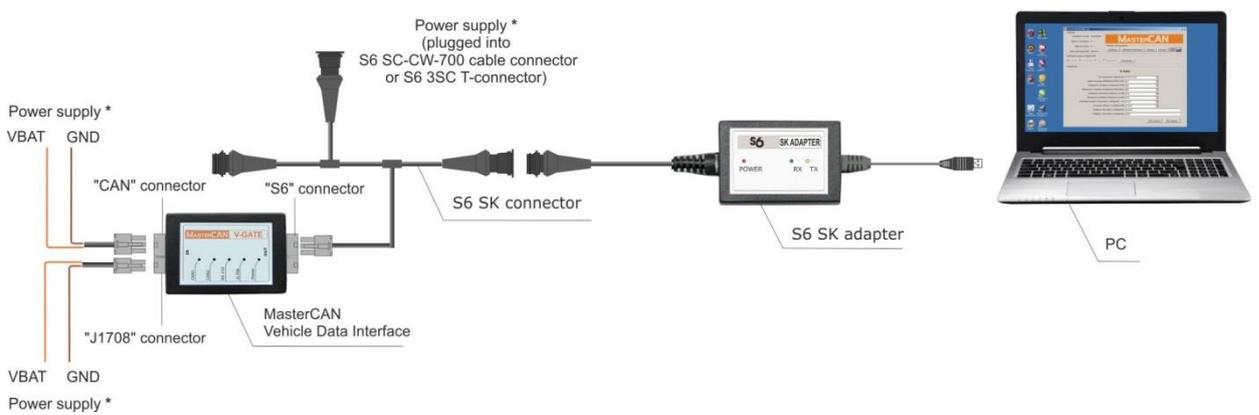


Figure 21 — MasterCAN to PC wiring scheme while using S6 SK for configuration of MasterCAN

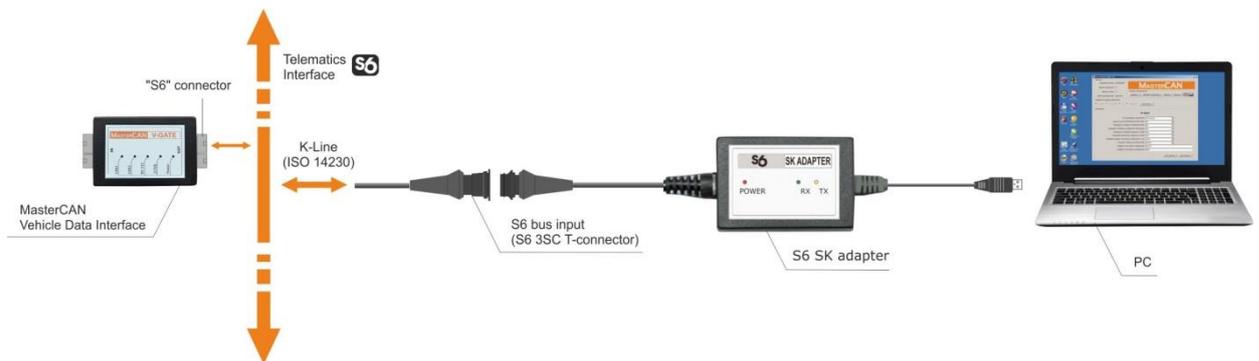


Figure 22 — MasterCAN to PC wiring scheme, while using S6 SK for configuration of MasterCAN within S6 Telematics

\* For power connection, any designated place can be chosen.

### 3.5 Operation check

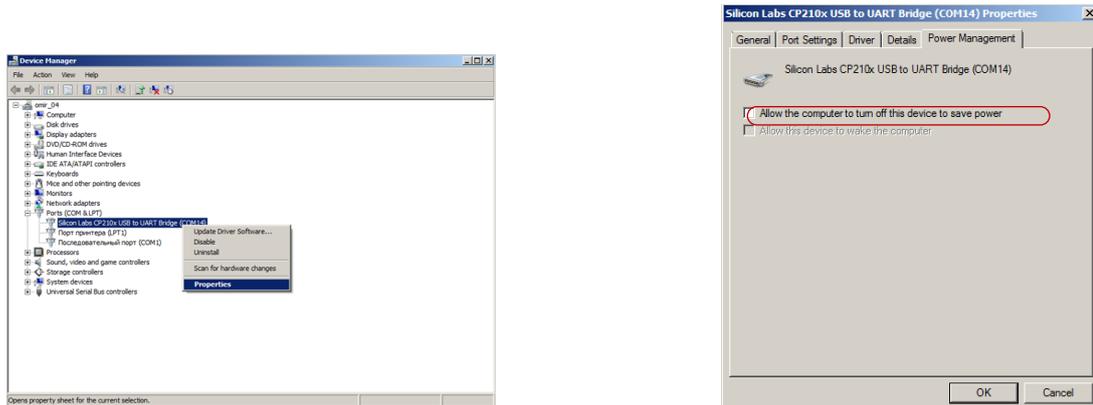
In case software installed and service kit connected properly Windows will automatically detect connected adapter and switches on virtual COM-port driver for it. Virtual COM-port is displayed in Windows Device manager (see figure 23 a).



**ATTENTION:** When working with Service MasterCAN utility:

- 1) It is recommended to use the same USB port of the PC for adapter connections.
- 2) Untick power save check box in virtual COM-port properties (see Figure 23 b).

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



a) selecting port properties

b) disabling power save option

Figure 23 — Virtual COM-port configuration in Device manager

Service kit 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 14.

Table 14 — 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	MasterCAN data is being received
		No signal		No data from MasterCAN
TX			Yellow	Data is being transmitted to MasterCAN
		No signal		No data to MasterCAN

### 3.6 Service MasterCAN software operation

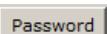
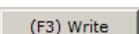
#### 3.6.1 User authorization



Service MasterCAN is launched with a  icon which is created during the installation process.

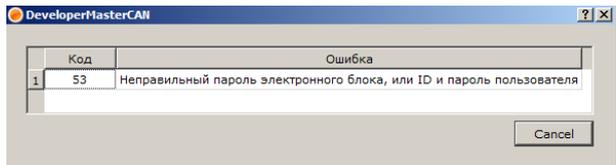
Select proper unit model and click  button at **Select MasterCAN Model** area to enable connection.

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



a) inserting current password



b) invalid password message



c) current password changing

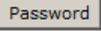
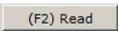
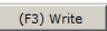
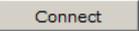
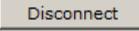
Figure 24 — User authorization

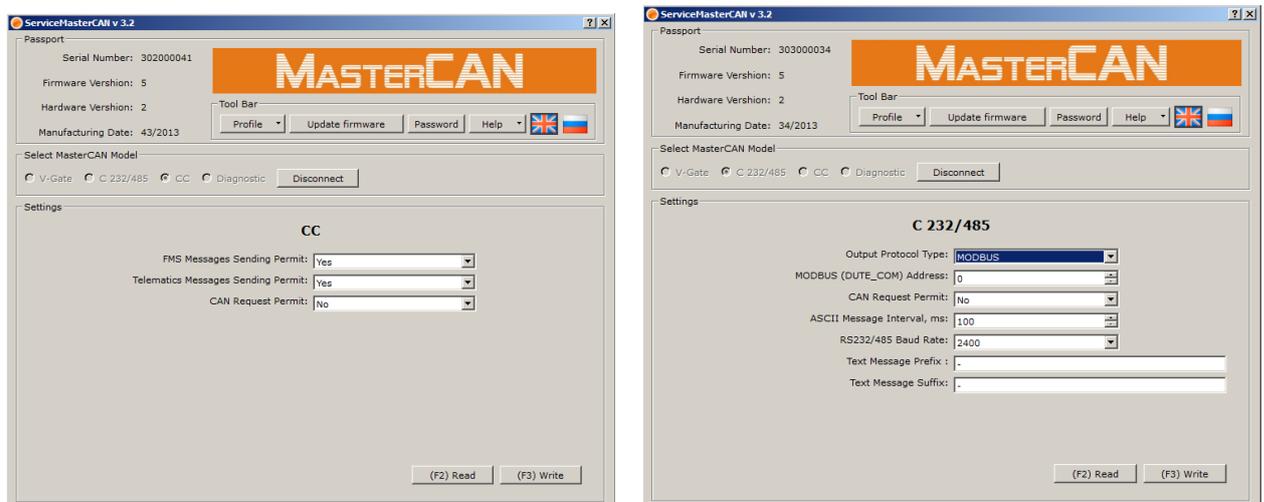
### 3.6.2 Working with MasterCAN profile

Service MasterCAN utility is used for working with MasterCAN **profile**.

Profile is a combination of specifications, parameters and configurations of MasterCAN [Unit](#).

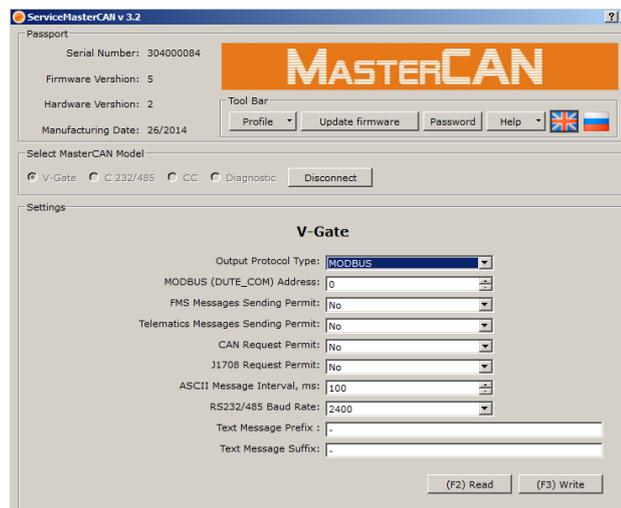
Since the authorization is successful utility will automatically load and display profile data at the **Passport** area: serial number, firmware version, hardware version, manufacturing date.

**Settings** area will get active as well as , , ,  buttons.  will change to  (see figure 25). LED indicators will send signals according to [table 14](#).



a) MasterCAN CC

b) MasterCAN C 232/485



c) MasterCAN V-GATE

Figure 25 — Service MasterCAN window after establishing connection with the Unit

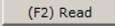
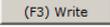
**Profile** menu (see figure 26) at **Tool Bar** area of Service MasterCAN provides possibility to work with profile in both [MasterCAN](#) connected mode and autonomous mode.

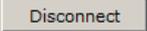


**ATTENTION:** The present manual describes Service MasterCAN operation mode with connected MasterCAN [Unit](#). Some functions and setting are not available in the autonomous mode.

**1) MasterCAN** connected mode allows modifying of current profile and saving it into MasterCAN memory or to the PC hard drive.

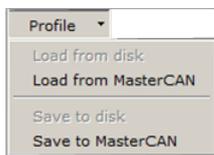
- to load profile of the connected MasterCAN select: **Profile** menu → Load from MasterCAN.
- to save profile to MasterCAN select: **Profile** menu → Save to MasterCAN.

To read current settings of the profile click  button. To store modified settings, click  button.

- to save profile on disk: click  button. 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 [3.6.1](#)) and then select **Profile** menu → Save to MasterCAN.

### 3.6.3 MasterCAN settings

**Settings** area (see figure 25) provides the following options:

**1) Output protocol type** for [MasterCAN C 232/485](#) or [MasterCAN V-GATE](#) according to [1.5.3](#), [1.5.4](#):

- [text \(ASCII\)](#);
- [MODBUS](#);
- [DUTE-COM](#).

**2) MODBUS (DUTE-COM) address** to set network address for MasterCAN C 232/485 or MasterCAN V-GATE when those are used as summators of DUT-E CAN fuel level sensors. By default MasterCAN network address is equal to two last serial number digits;

**3) FMS Messages Sending Permit** to enable/disable output of FMS messages by MasterCAN CC or MasterCAN V-GATE output interface (see [1.5.2](#), [1.5.4](#));

**4) Telematics Messages Sending Permit** to enable/disable output of Telematics messages by MasterCAN CC or MasterCAN V-GATE output interface (see [1.5.2](#), [1.5.4](#));

**5) CAN Request Permit** to enable/disable of sending requests into CANbus by input interface of MasterCAN CC, MasterCAN C 232/485 or MasterCAN V-GATE. Active Requests are used for gathering of the following information from automotive CANbus:

- [PGN 65216](#) – service information;
- [PGN 65253](#) - engine operation time, RPMs;
- [PGN 65257](#) - fuel (liquid) consumption.

#### **ATTENTION:**



- 1)** Active requests sent into CANbus can cause malfunctions of vehicle equipment.
- 2)** Active requests sending is only possible for direct bus connections of MasterCAN to CANbus. Requests cannot be sent when connecting with contactless [Crocodile](#) reader.

**6) J1708 Request Permit** — requests not transmitted to automotive J1708bus for current version of software.

**7) ASCII Message Interval, ms** used to set a time period for sending output messages from MasterCAN C 232/485 or MasterCAN V-GATE according to ASCII standard (see [1.5.3](#), [1.5.4](#) and [annex B](#)).

Interval can be set in range from 100 to 65535 ms (with 1 ms step). Default value is 100 ms.

**8) RS232/485 Baud Rate** to select baud rate for serial output interface of MasterCAN C 232/485 or MasterCAN V-GATE. Available rates: 2400; 4800; 9600; 19200; 38400; 57600; 115200 b/s. Default is 2400 b/s.

**9) Text Message Prefix** to determine a beginning of data packet for output messages of MasterCAN C 232/485 or MasterCAN V-GATE according to ASCII standard (see [1.5.3](#), [1.5.4](#) and [annex B](#)).

**10) Text Message Suffix** to determine an ending of data packet for output messages of MasterCAN C 232/485 or MasterCAN V-GATE according to ASCII standard (see [1.5.3](#), [1.5.4](#) and [annex B](#)).

### 3.6.4 MasterCAN firmware upgrade



**ATTENTION:** Firmware update of [MasterCAN](#) should be done **only** to apply upgrades recommended by [Manufacturer](#).

To upgrade the firmware:

**1)** Connect MasterCAN to PC with the help of service kit and establish connection session between MasterCAN and PC.



**IMPORTANTLY:** While updating firmware, voltage of MasterCAN power supply must not drop out of 10-45 V range.

**2)** Click  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  to run it.



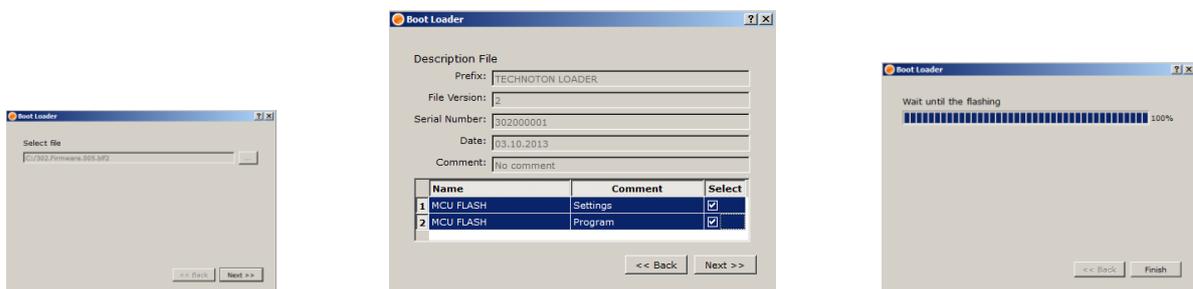
**ATTENTION:** Before starting firmware update process check the information attachment of the firmware file to make sure the file matches the type and hardware version of MasterCAN [Unit](#).

**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 MasterCAN inner firmware will be updated. Both options enabled by default.

Process of firmware uploading into MasterCAN memory can last for several minutes.

If you need to shut down the utility during the file uploading, click  button. For renewal of the process establish connection between MasterCAN and PC and click  button.

**5)** After the process is finished click  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 27 — MasterCAN firmware update steps



**WARNING:** To avoid MasterCAN failure, **do not:**

- to turn PC power off;
- to turn MasterCAN power off;
- to disconnect adapter from the PC
- to disconnect MasterCAN from the adapter;
- to run any resource-intensive applications at the PC.

In case of errors check the connection of cables and try firmware updating once again. If the second attempt also fails it is recommended to contact [Technoton](https://www.technoton.com) technical support team at [support@technoton.by](mailto:support@technoton.by).

## 4 Storage

[MasterCAN](#) is recommended to be stored in dry enclosed areas.

MasterCAN storage is allowed only in original packaging at temperature range from -50 to +40° C and relative humidity up to 98 % at 25° C.

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

MasterCAN shelf life must not exceed 6 months.

## 5 Transportation

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

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

Shipping containers with packed MasterCAN should be sealed.

## 6 Utilization/re-cycling

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

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

## Contacts

### Manufacturer



[JV Technoton](#)

[www.mastercan.com](http://www.mastercan.com)

**Tel/fax: +375 17 240-39-73**

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



### Technical support

**E-mail:** [support@technoton.by](mailto:support@technoton.by)



## Annex A

### Register map of Modbus output messages of MasterCAN

A list of registers of accessible [MasterCAN](#) output messages based on Modbus protocol is provided in Table A.1.

Table A.1 – List of registers of accessible MasterCAN output messages based on Modbus protocol

Register Address	Register Content	SPN (J1939)	PID (J1587)	Support Reading	Support Recording
1	Output Interface Exchange Rate (RS232, RS485): 1 – 4800 2 – 9600 3 – 19200 4 – 38400 5 – 57600 7 – 115200		No	+	+
2	Operation Mode 1 – Text output 2 – Request-response (MODBUS)		No	+	+
3	Output interval, s		No	+	+
4	SPN bit mask for output		No	+	+
5	Output bit of calculated fuel consumption value		No	+	+
6	Maximum fuel consumption value to obtain its calculated value, 0.1 l/h		No	+	+
21	Engine speed	<a href="#">190</a>	190	+	-
22	Actual engine - percent torque	<a href="#">513</a>	92	+	-
23	Engine fuel rate	<a href="#">183</a>	183	+	-
24	Engine instantaneous fuel economy	<a href="#">184</a>	184	+	-
25	Axle weight	<a href="#">582</a>	178	+	-
			179		
			180		
			181		
26	Wheel-based vehicle speed	<a href="#">84</a>	84	+	-
27	Fuel level 1	<a href="#">96</a>	96	+	-
28	Engine coolant temperature	<a href="#">110</a>	110	+	-
29	Engine oil pressure	<a href="#">100</a>	100	+	-
30	Ambient air temperature	<a href="#">171</a>	171	+	-
31	Cab interior temperature	<a href="#">170</a>	170	+	-
32	Engine oil level	<a href="#">98</a>	98	+	-

Table A.1 continued

Register Address	Register Content	SPN (J1939)	PID (J1587)	Support Reading	Support Recording
33	Engine coolant level	<a href="#">111</a>	111	+	-
34	Total vehicle distance (high word)	<a href="#">245</a>	245	+	-
35	Distance travelled (low word)	<a href="#">245</a>	245	+	-
36	Engine total fuel used (high word)	<a href="#">250</a>	250	+	-
37	Engine total fuel used (low word)	<a href="#">250</a>	250	+	-
38	Engine total hours of operation (high word)	<a href="#">247</a>	247	+	-
39	Engine total hours of operation (low word)	<a href="#">247</a>	247	+	-
40	Fuel used per hour, calculated value	No		+	-
41	Brake switch	<a href="#">597</a>	85	+	-
	Clutch switch	<a href="#">598</a>			
	Cruise control active	<a href="#">595</a>			
42	PTO governor state	<a href="#">976</a>	150	+	-
43	Accelerator pedal position 1	<a href="#">91</a>	91	+	-
44	Axle location	<a href="#">928</a>	No	+	-
45	Engine fuel temperature 1	<a href="#">174</a>	174	+	-
46	Reserve	No		+	-
47	Reserve	No		+	-
48	High resolution total vehicle distance (high word)	<a href="#">917</a>	No	+	-
49	High resolution total vehicle distance (low word)	<a href="#">917</a>	No	+	-
50	Service distance	<a href="#">914</a>	No	+	-
51	Driver 1 working state	<a href="#">1612</a>	No	+	-
	Driver 2 working state	<a href="#">1613</a>			
	Vehicle motion	<a href="#">1611</a>			
	Driver 1 time related states	<a href="#">1617</a>			
	Driver card, driver 1	<a href="#">1615</a>			
	Vehicle overspeed	<a href="#">1614</a>			

Table A.1 continued

Register Address	Register Content	SPN (J1939)	PID (J1587)	Support Reading	Support Recording
52	Driver 2 time related states	<a href="#">1618</a>	No	+	-
	Driver card, driver 2	<a href="#">1616</a>			
	System event	<a href="#">1622</a>			
	Handling information	<a href="#">1621</a>			
	Tachograph performance	<a href="#">1620</a>			
	Direction indicator	<a href="#">1619</a>			
53	Tachograph vehicle speed	<a href="#">1624</a>	214	+	-
54	At least one PTO engaged	<a href="#">3948</a>	No	+	-
55	High resolution engine total fuel used (high word)	<a href="#">5054</a>	No	+	-
56	High resolution engine total fuel used (low word)	<a href="#">5054</a>	No	+	-
57	Fuel tank level (left tank)	<a href="#">521023</a>	No	+	-
58	Fuel tank volume (left tank)	<a href="#">521024</a>	No	+	-
59	Tank fuel rate (left tank)	<a href="#">521025</a>	No	+	-
60	Engine fuel temperature 1 (left tank)	<a href="#">174</a>	No	+	-
61	Fuel tank level (right tank)	<a href="#">521023</a>	No	+	-
62	Fuel tank volume (right tank)	<a href="#">521024</a>	No	+	-
63	Tank fuel rate (right tank)	<a href="#">521025</a>	No	+	-
64	Engine fuel temperature 1 (right tank)	<a href="#">174</a>	No	+	-
65	Fuel tank level (tank 3)	<a href="#">521023</a>	No	+	-
66	Fuel tank volume (tank 3)	<a href="#">521024</a>	No	+	-
67	Tank fuel rate (tank 3)	<a href="#">521025</a>	No	+	-
68	Engine fuel temperature 1 (tank 3)	<a href="#">174</a>	No	+	-
69	Fuel tank level (auxiliary equipment fuel tank)	<a href="#">521023</a>	No	+	-

Table A.1 continued

Register Address	Register Content	SPN (J1939)	PID (J1587)	Support Reading	Support Recording
70	Fuel tank volume (auxiliary equipment fuel tank)	<a href="#">521024</a>	No	+	-
71	Tank fuel rate (auxiliary equipment fuel tank)	<a href="#">521025</a>	No	+	-
72	Engine fuel temperature 1 (auxiliary equipment fuel tank)	<a href="#">174</a>	No	+	-
73	Fuel tank level (trailer tank)	<a href="#">521023</a>	No	+	-
74	Fuel tank volume (trailer tank)	<a href="#">521024</a>	No	+	-
75	Tank fuel rate (trailer tank)	<a href="#">521025</a>	No	+	-
76	Engine fuel temperature 1 (trailer tank)	<a href="#">174</a>	No	+	-
77	Vehicle fuel volume	<a href="#">521193</a>	No	+	-
78	Engine trip fuel (high word)	<a href="#">182</a>	182	+	-
79	Engine trip fuel (low word)	<a href="#">182</a>	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 increments trip fuel consumption counter, calculating it from "Hourly fuel consumption" ([SPN 183](#)) and stores calculated values inside internal memory until powering off. Minimum step of trip fuel consumption counter incrementing is 0.5 L. If standard [PGN 65257](#), which contains "Volume of fuel consumed in a trip" ([SPN 182](#)) and/or "Fuel consumption by engine" ([SPN 250](#)), is transmitted over a CANbus, this standard PGN will have higher priority and will be transmitted to the output of MasterCAN without any changes.'

## Annex B MasterCAN C 232/485 and MasterCAN V-GATE text message protocol

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
<a href="#">84</a>	Wheel-Based Vehicle Speed	km/h	AAA
<a href="#">91</a>	Accelerator Pedal Position 1	%	AAB
<a href="#">92</a>	Engine Percent Load At Current Speed	%	AAC
<a href="#">96</a>	Fuel Level 1	%	AAD
<a href="#">98</a>	Engine Oil Level	%	AAE
<a href="#">100</a>	Engine Oil Pressure	kPa	AAF
<a href="#">110</a>	Engine Coolant Temperature	deg C	AAG
<a href="#">111</a>	Engine Coolant Level	%	AAH
<a href="#">170</a>	Cab Interior Temperature	deg C	AAI
<a href="#">171</a>	Ambient Air Temperature	deg C	AAJ
<a href="#">174</a>	Engine Fuel Temperature 1	deg C	AAK
<a href="#">183</a>	Engine Fuel Rate	L/h	AAL
<a href="#">184</a>	Engine Instantaneous Fuel Economy	km/L	AAM
<a href="#">190</a>	Engine speed	rpm	AAN

Table B.1 continued

SPN	Name	Measure	ID
<a href="#">237</a>	Vehicle Identification Number	-	AAO
<a href="#">245</a>	Total Vehicle Distance	km	AAP
<a href="#">247</a>	Engine Total Hours of Operation	hr	AAQ
<a href="#">250</a>	Engine Total Fuel Used	L	AAR
<a href="#">513</a>	Actual Engine - Percent Torque	%	AAS
<a href="#">582</a>	Axle Weight	kg	AAT
<a href="#">595</a>	Cruise Control Active	-	AAU
<a href="#">597</a>	Brake Switch	-	AAV
<a href="#">598</a>	Clutch Switch	-	AAW
<a href="#">914</a>	Service Distance	km	AAX
<a href="#">917</a>	High Resolution Total Vehicle Distance	km	AAZ
<a href="#">928</a>	Axle Location	-	ABA
<a href="#">976</a>	PTO Governor State	-	ABB
<a href="#">1611</a>	Vehicle motion	-	ABC
<a href="#">1612</a>	Driver 1 working state	-	ABD
<a href="#">1613</a>	Driver 2 working state	-	ABE
<a href="#">1614</a>	Vehicle Overspeed	-	ABF
<a href="#">1615</a>	Driver card, driver 1	-	ABG
<a href="#">1616</a>	Driver card, driver 2	-	ABH
<a href="#">1617</a>	Driver 1 Time Related States	-	ABI
<a href="#">1618</a>	Driver 2 Time Related States	-	ABJ
<a href="#">1619</a>	Direction indicator	-	ABK
<a href="#">1620</a>	Tachograph performance	-	ABL
<a href="#">1621</a>	Handling information	-	ABM
<a href="#">1622</a>	System event	-	ABN
<a href="#">1624</a>	Tachograph vehicle speed	km/h	ABO
<a href="#">1625</a>	Driver 1 identification	-	ABP
<a href="#">1626</a>	Driver 2 identification	-	ABQ
<a href="#">2804</a>	FMS-standard Diagnostics Supported	-	ABR
<a href="#">2805</a>	FMS-standard Requests Supported	-	ABS
<a href="#">2806</a>	FMS-standard SW-version supported	-	ABT
<a href="#">3948</a>	At least one PTO engaged	-	ABU
<a href="#">5054</a>	High Resolution Engine Total Fuel Used	L	ABV
<a href="#">521193</a>	Vehicle Fuel Volume	L	ABW
<a href="#">182</a>	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.

<b>space</b>	<b>Parameter</b>	<b>space</b>
	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 MasterCAN connection scheme to summarize several DUT-E CAN readings

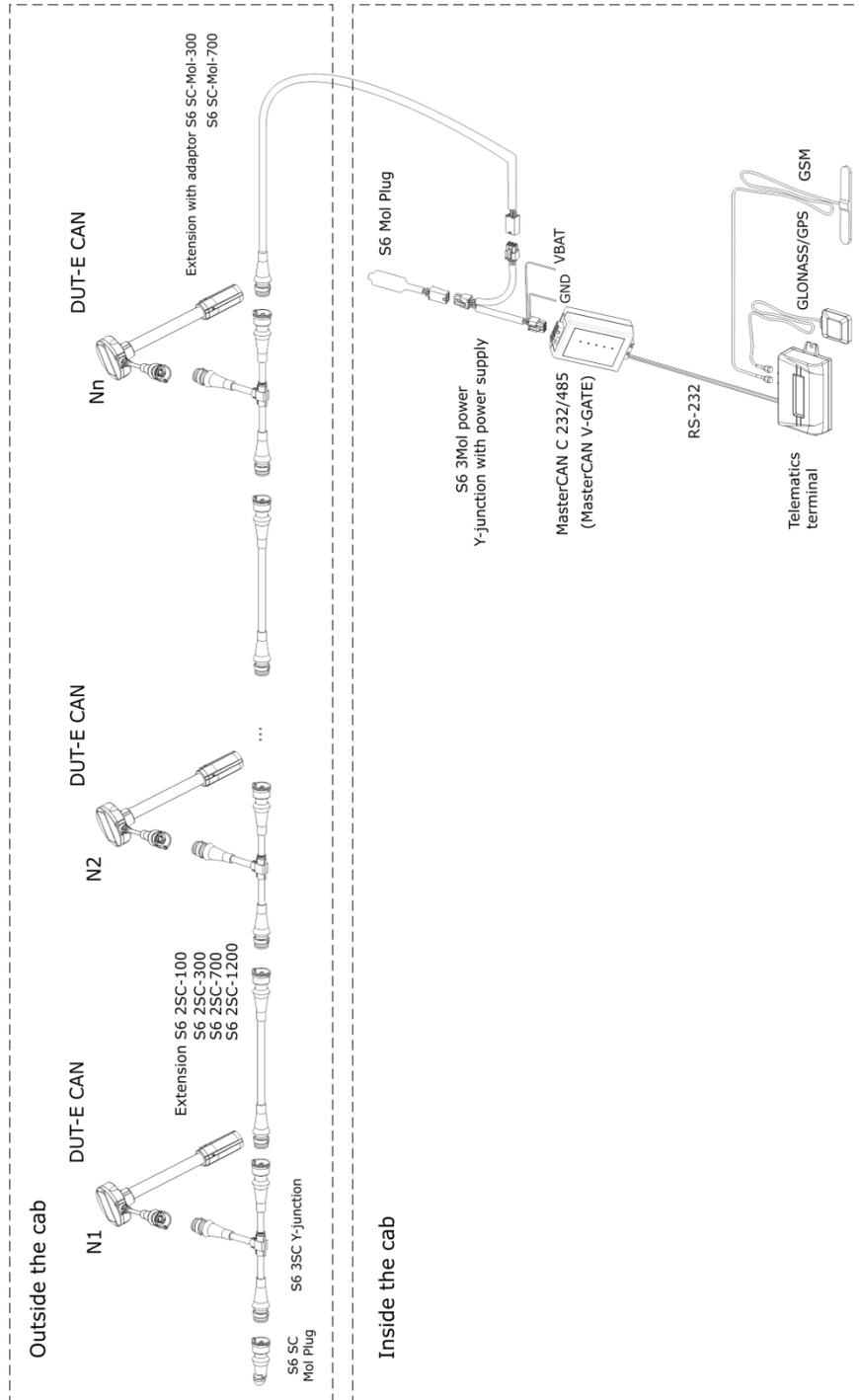


Figure C.1 —MasterCAN connection scheme to summarize several DUT-E CAN readings