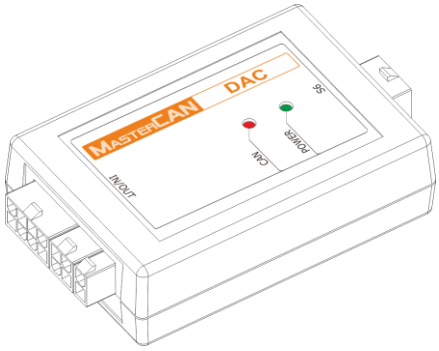
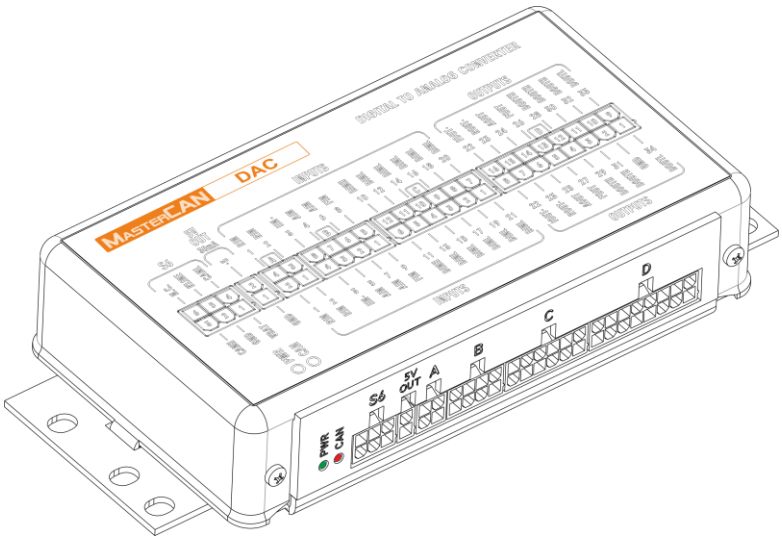
MasterCAN DAC

DIGITAL TO ANALOG CONVERTERS





MasterCAN DAC 15 **MasterCAN DAC 2113**

OPERATION MANUAL

Version 3.0

S6 IoT BURGER

TECHNOTON
ADVANCED MACHINERY TELEMATICS

E28 10 R - 05 2193 EAC

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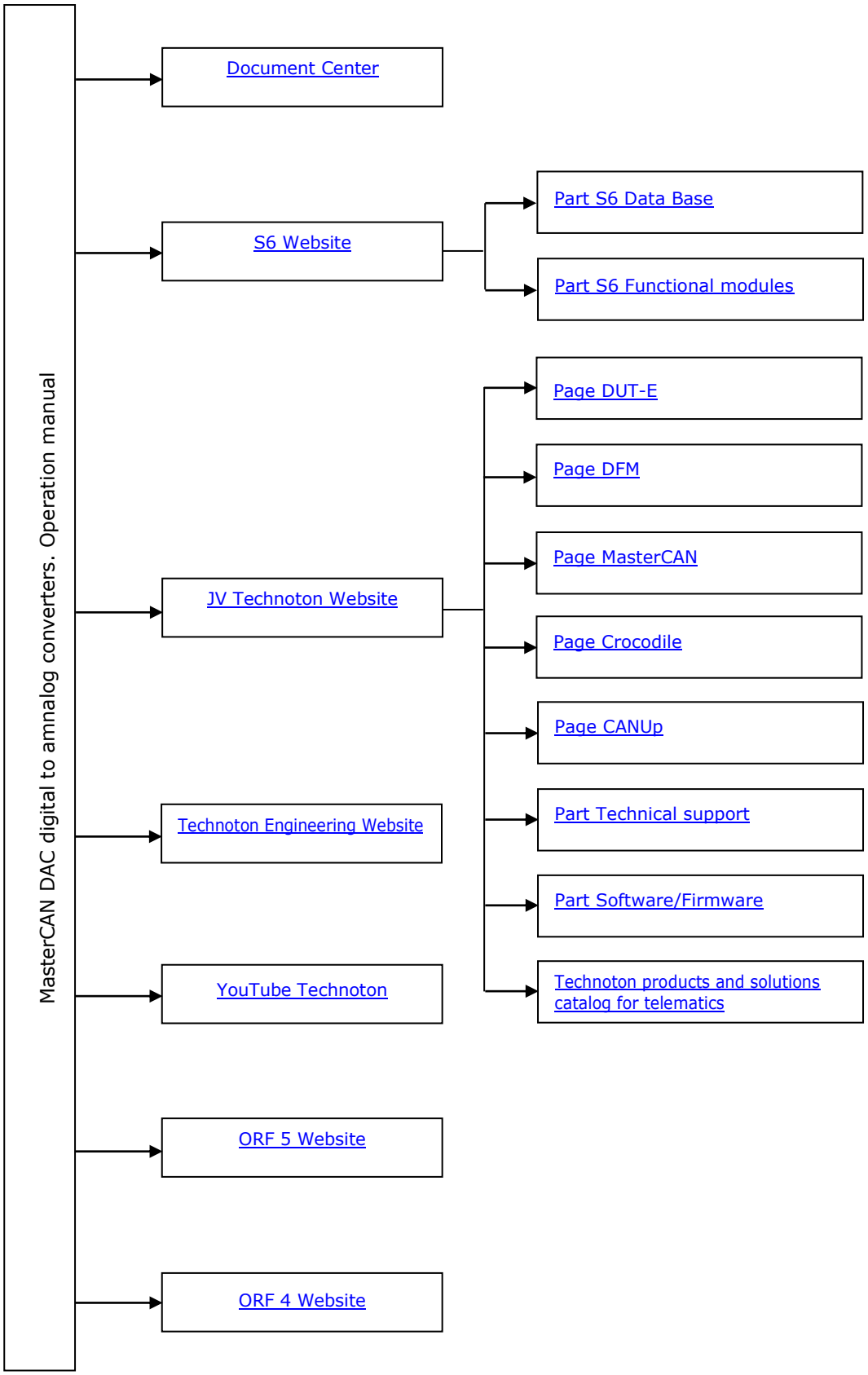
Revision history

Version	Date	Editor	Description of changes
1.0	08.2016	OD	Basic version.
1.1	05.2017	OD	The information added: • using MasterCAN DAC 15 as converter of analog/frequency signal of a Vehicle standard fuel level sensor into messages of CAN-bus; • load current of analog inputs/outputs; • maximum load impedance of the analog output; • connection diagrams for D2+ discrete output.
2.0	12.2018	OD	• The new model of MasterCAN DAC 2113 j1939 is added. • Changes in MasterCAN DAC 15 delivery set are reflected. • A new functional feature of MasterCAN DAC 15 added (conversion of SPN into pulse signal). • The document terminology is updated (S6 Technology and IoT Burger Technology). • The structure of the document external links is added.
3.0	11.2023	OD	• Technical specifications of the converters are updated. • Inormation on the product is updated and added. • Information on the converters application for automatic control of analog devices is added. • Schemes and procedure for the converters' connection to the PC using the service adapter, description of work with service software and methods of firmware update with the help of service software are introduced. • Settings of the converters' Functional modules are updated using Service S6 MasterCAN software (versions from 3.32 and higher). • Certificates are added: - E-mark — Uniform provisions concerning the official approval of vehicles with regard to electromagnetic compatibility, in accordance with Regulation No 10 of the United Nations and others. - Declaration of Compliance with requirements of Technical Regulation of the Customs Union TR 020/2011 "Electromagnetic compatibility of technical products" and others.

Structure of external links



Terms and Definitions

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

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

The technology provides for the availability of several measurement channels in any device including pre-set analytical treatment (filtration, linearization, thermal compensation) and the controlled error of measurement.
Devices created using IoT Burger may be united to form a wire-connected or wireless connection network. Data may be transmitted to the telematics server, to popular IoT platforms, by SMS, E-mail, to social networks.
At present, 2G/3G/LTE/NB-IoT/Wi-Fi/BLE data transmission standards are used in devices with IoT Burger. The reports transmitted contain data on instant and average values of Parameters, Counters, Events. The flexible system of Reports setup enables the user to select the optimal ratio of the data completeness and the volume of traffic.
MasterCAN DAC digital to analog converters are designed using IoT Burger Technology.

S6 is the Technology of combining smart sensors and other IoT devices within one wire network for monitoring of complex stationary and mobile objects: vehicles, locomotives, smart homes, technological equipment etc. The Technology is based and expands SAE j1939 automotive standards.
Information on cabling system, service adapter and S6 software refer to CAN j1939/S6 Operation manual.
MasterCAN DAC digital to analog converters are designed using 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).

ISObus – is a communication protocol used in farming machinery which complies with ISO 11783 standard and is based on SAE j1939 (which includes CANbus). ISOBUS bus contains Parameters of farming machinery operation and besides "classical" Parameters (total fuel consumption, engine rpm, cooling agent temperature), it also includes settings and Parameters of attached equipment (plough, sowing machine, mowing machine, cultivator, winnowing machine, spraying machine etc.).

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).

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

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

Parameter — Monitored object characteristic changing with time or space. For example, speed, fuel volume in the tank, hourly fuel consumption, coordinates. Parameter is usually displayed in the form of graph, or averaged data.

Server (AVL Server) — hardware-software complex of Telematics service ORF 4 / ORF 5, used for processing and storage of Operational data, formation and transmission of Analytical reports through Internet by request of ORF 4 / ORF 5, users.

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

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

Vehicle 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.

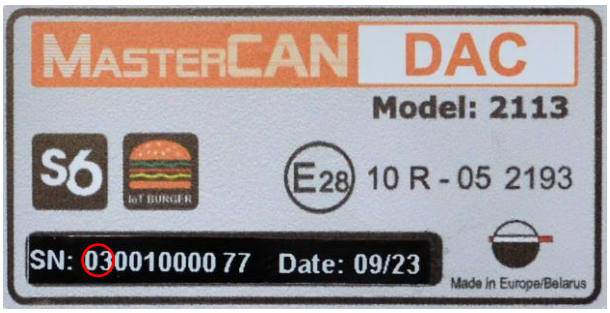
Function module (FM) unit-embedded component of hardware and software combination, executing a group of special functions. Uses input/output PGNs and settings PGNs.

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 DAC digital to analog converters** (further on — MasterCAN DAC), model code: **01** (for MasterCAN DAC 15), **03** (for MasterCAN DAC 2113), manufactured by Technoton.

MasterCAN DAC model code is identified by the first two digits of its serial number printed on the nameplate on the bottom part of its casing or on the package label:



The manual contains information on design, operation principle, specifications and instructions on connection, configuration and use of converter.

MasterCAN DAC — **intellectual converters of digital and analog signals which are used in Telematics systems for monitoring mobile and stationary objects for conversion of:**

1) Analog signals into digital data (PGN) of CAN bus (SAE j1939).

2) Digital data (SPN) of CAN bus (SAE j1939) into analog signals / frequency / pulse / current / discrete / resistive.

Particular features of the MasterCAN DAC converter:

- simultaneous operation in the combined mode of conversion "digital to analog" and "analog to digital" modes;
- support of the vehicle standard CAN-bus data transfer protocols (SAE j1939/71, FMS), CAN j1939/S6 Telematics interface, ISObus farming equipment bus;
- free choice of any input/output SPN from the united Database (10,000+ pcs.) of unified Parameters of equipment operation;
- automatic processing of CAN messages (PGN) and search for required SPN according to specified settings;
- integration of analog signals from standard and additional sensors into CAN j1939/S6 digital Telematics interface — convenient monitoring using the inexpensive terminal with a single CAN-input;
- integration of digital data from CAN j1939/S6 Telematics interface into the Telematics system based on the Terminal with analog inputs;
- compliance with S6 Technology — full-scale compatibility with Units, Database and S6 cable system;
- design based on IoT Burger Technology — receiving ready data for the Telematics system without using any additional devices;
- flexible configuration of output signals parameters, compatibility with the majority of models of Telematics terminals and dashboards available on the market;
- automatic measurement of the current value of input analog signals;

- reading data via CAN interface in the modes: active (“demand/response” and hidden (“sniffer mode”);
- adjustable Baudrate via CAN interface;
- simple and secure connection to wires of CAN bus using CANCrocodile / CANCrocodile Mini contactless readers;
- displaying SPN names in Russian or English during configuration;
- simple mounting, full set of mounting components in the mounting kit;
- protection from short circuit and incorrect connection of power supply wires;
- power is supplied from 12 V / 24 V onboard circuit — no need for using additional power units;
- high quality technical support and documentation;
- compliance with automobile standards of EU and EAEU countries.

MasterCAN DAC is presented by the following models:

1) MasterCAN DAC 15 — signals converter with basic functionality for trucks and buses.

2) MasterCAN DAC 2113 — signals converter with extended functionality for industrial automation systems and monitoring systems for complicated mobile objects (locomotives, track machines, river and sea vessels, special vehicles, farming equipment and municipal vehicles etc.).

Table 1 — Configurable inputs and outputs of MasterCAN DAC converters

Signal type	Signal specification*	Converter model			
		MasterCAN DAC 15		MasterCAN DAC 2113	
		Inputs, pcs.	Outputs, pcs.	Inputs, pcs.	Outputs, pcs.
CAN j1939/S6 digital interface	CAN 2.0 (SAE j1939/71, S6, FMS, ISObus protocols)	1	1	1	1
Analog voltage	0.5...9.0 V	1	1	4**	2**
Frequency	0.01...10 kHz	1	1	2	2
Pulse	0.5...9.0 V/40...250 ms	-	1	-	-
Resistive	0.015...50 kOhm	-	1	2	1
Current	4...20 mA	-	1	1	1
Discrete	low/high level	-	2	12	7

* See detailed specifications of CAN j1939/S6 interface in 1.4.2; see analog signals specifications in 1.4.3.
** Voltage value 0.5...10 V.
Combined voltage/frequency input.
Combined voltage/frequency/pulse output.

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

For converter configuration using cable connection to the PC you should use S6 SK service adapter (to be purchased separately) and the Service S6 MasterCAN service software (version from 3.32 and higher) (the software current version can 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, application area, operation principle

MasterCAN DAC **are designed for (see figure 1):**

1) Conversion of digital data of CAN j1939/S6 Telematics interface or of CAN bus into analog signals of various types.

2) Digitalization of output signals from analog sensors into data of CAN j1939/S6 Telematics interface.

Areas of application:

MasterCAN DAC converters are applied within Telematics systems for the following purposes:

- Conversion of signals from analog sensors, limit switches, signal lamps or relays sent to the digital CAN input (SAE j1939) of the Telematics terminal, dashboard, control panel, display (see figure 2).
- Transfer of converted data from CAN-bus (SAE j1939) or from Units of CAN j1939/S6 Telematics interface to the analog display, dashboard and/or Telematics terminal with analog inputs.
- Automation of analog devices control (relays, signal lamps, sound signal devices etc.) by means of CAN messages from the Terminal or other devices (see figure 3).

Figure 1 — Application of MasterCAN DAC digital to analog converters

Operation principle:

1) In the mode of **digital to analog CAN gateway** (when MasterCAN DAC is connected to the onboard CAN-bus (SAE j1939) or to CAN j1939/S6 Telematics interface), the converter, in accordance with its settings, receives digital data (PGN), and automatically singles out specified SPN containing current data on fuel consumption and the asset performance characteristics. The converter converts SPN into analog signals, generates the corresponding physical signal in the selected output (see figure 2).
2) In the mode of **collector/converter of analog signals** (when the analog signal is sent), MasterCAN DAC, in accordance with its settings, converts the signal received into digital data (SPN) which it transfers in created messages (PGN) into CAN j1939/S6 Telematics interface.
3) In the **combined mode** MasterCAN DAC simultaneously operates both as digital to analog gateway, and collector/converter of analog signals.

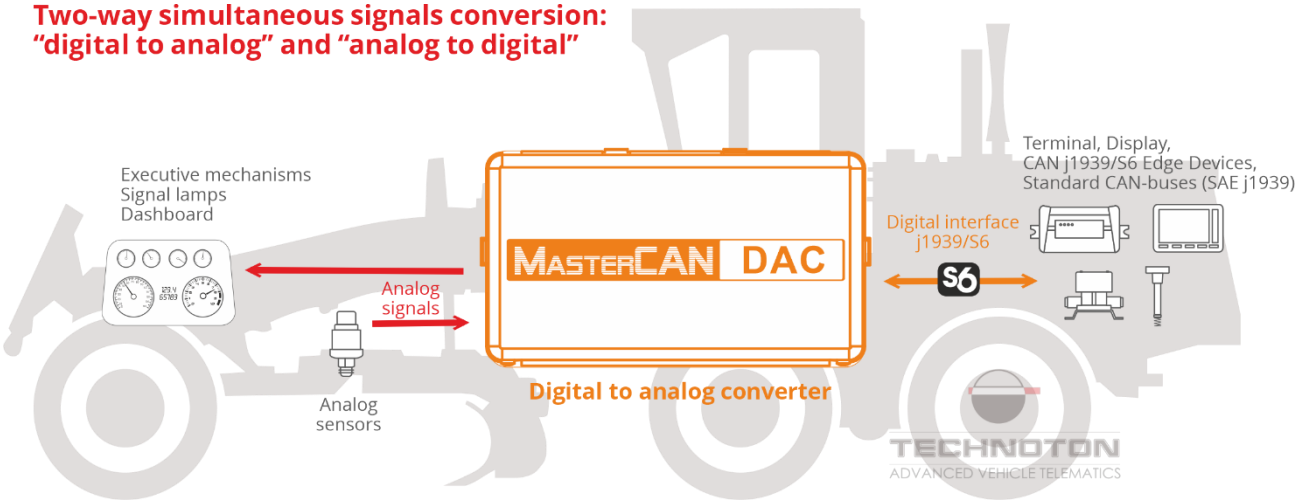


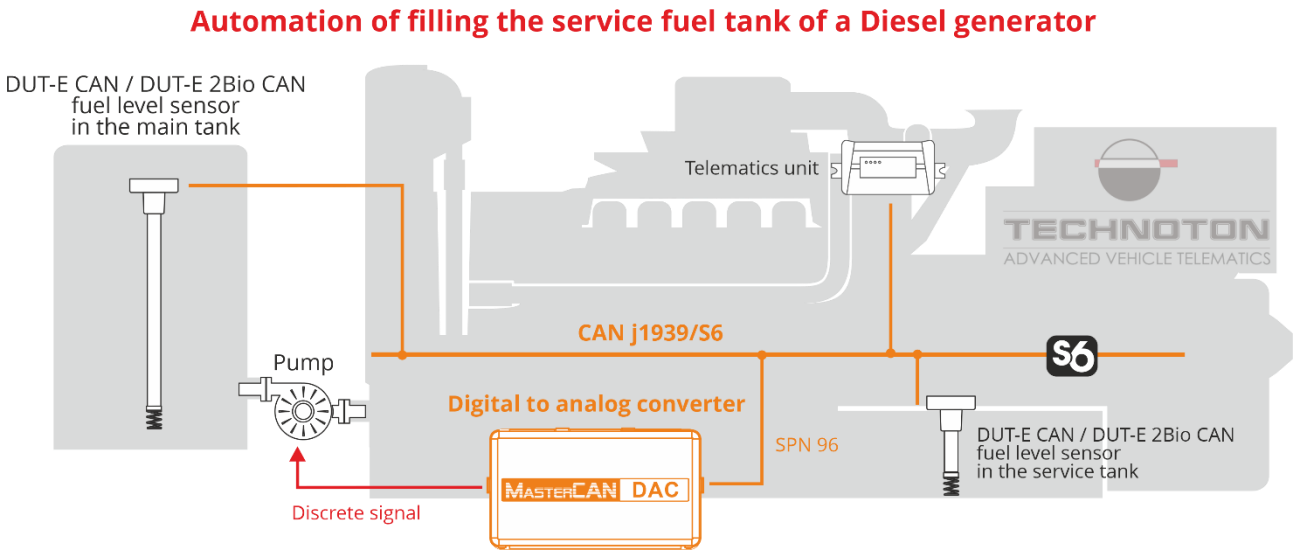
Figure 2 — Example of MasterCAN DAC application on the mobile asset for conversion of data from CAN-buses, CAN j1939/S6 Telematics interface and analog signals

MasterCAN DAC are convenient for use as an inexpensive intellectual tool for automatic control of analog devices (see figure 3):

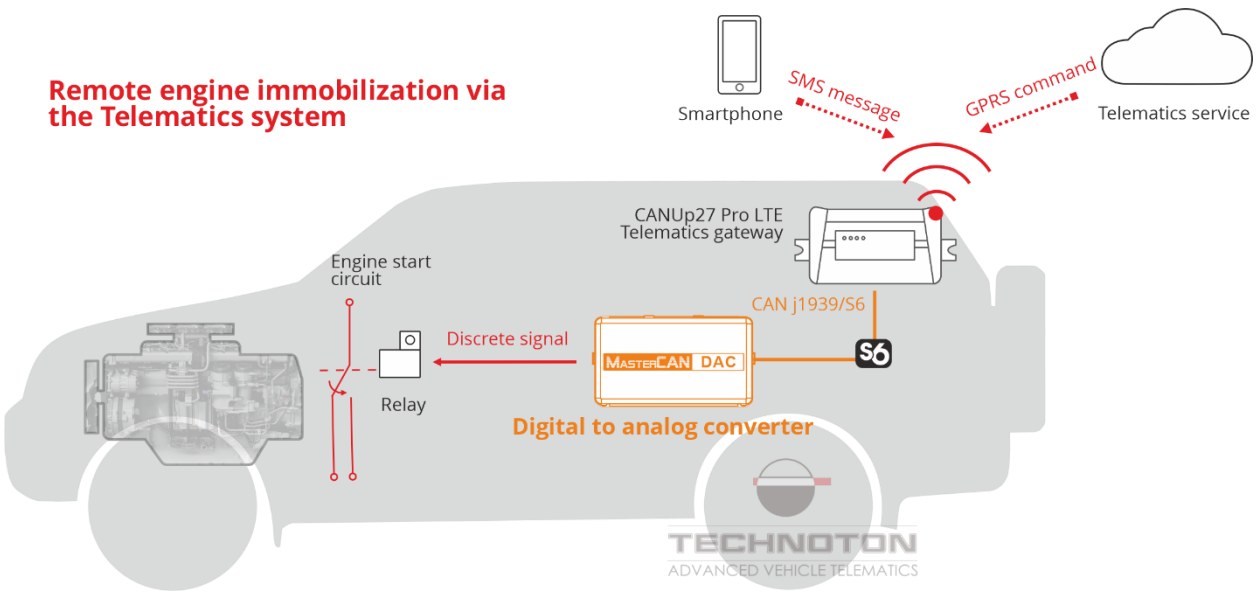
- **In the control system of uninterrupted fuel supply** to the Diesel generator feed tank, the converter receives and analyzes current readings of fuel level in the main tank (SPN 96) by means of S6 Technology which are measured by DUT-E CAN / DUT-E 2Bio CAN fuel level sensor. The wire from the converter discrete output is connected to the circuit that controls switching on/off the fuel pump feeding fuel from the auxiliary tank to the main tank. If the fuel level in the main tank goes down to 10 %, the converter produces a discrete signal which automatically closes contacts of the pump control electromagnetic relay. The pump switches on and pumps fuel from the auxiliary tank into the main tank. As soon as 80 % level in the main tank is reached, the relay contacts are automatically opened and the pump switches off.

⚠ **RECOMMENDATION:** As a ready solution for automatic fuel supply control from the auxiliary tank to the main consumer tank, you may also use the device **fuel supply automation unit** DUT-E SAU 12/24. This Unit is created on the basis of MasterCAN DAC 15 converter, in which a special profile of settings is recorded (see details in DUT-E SAU 12/24 operation manual).

- **In the vehicle engine immobilizer system**, following the controlling CAN message from CANUp 27 Pro LTE Telematics gateway, the converter generates the output discrete signal automatically opening contacts of the electromagnetic relay in the circuit controlling the engine start or of the fuel supply system. CAN message is generated by the gateway, as soon as the respective GPRS command is received from ORF 4 / ORF 5 Telematics service or a special SMS message is received from up to 3 authorized telephone numbers (see the document Subtask "Remote engine blocking system". Connection and configuration instructions).



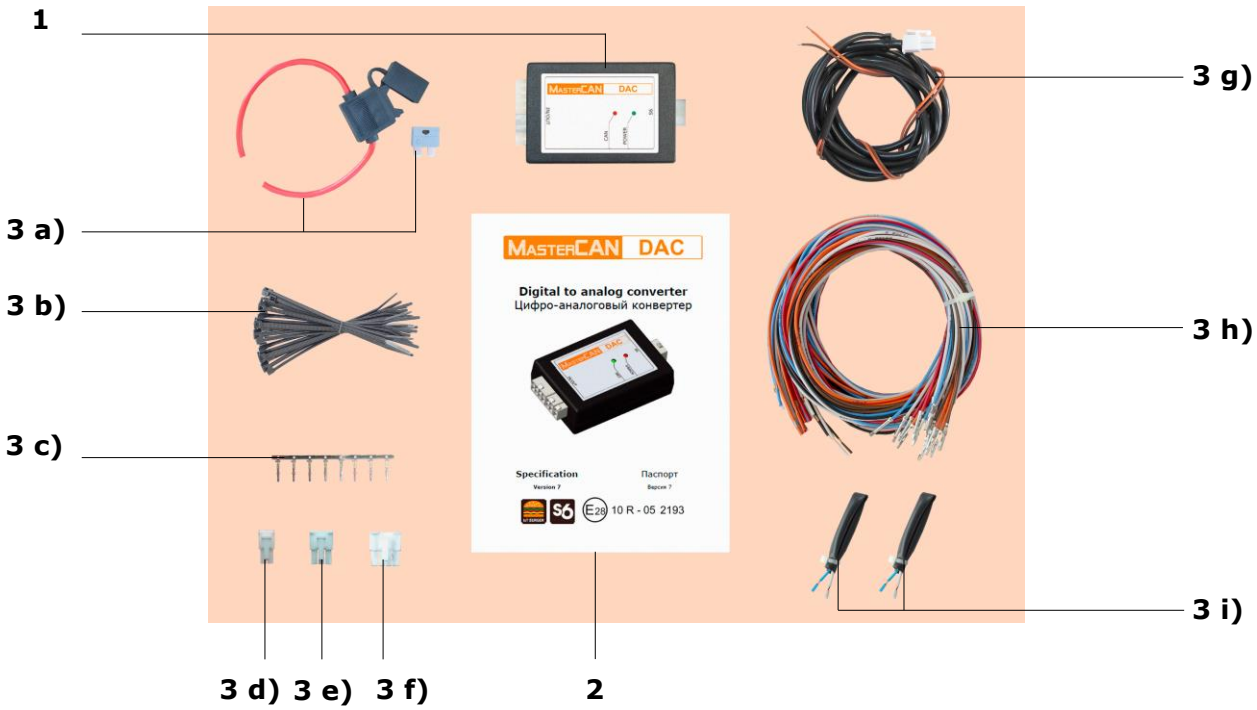
a) system of uninterrupted fuel supply control



b) remote control of engine start/stop

Figure 3 — Examples of MasterCAN DAC application for automation of controlling analog devices

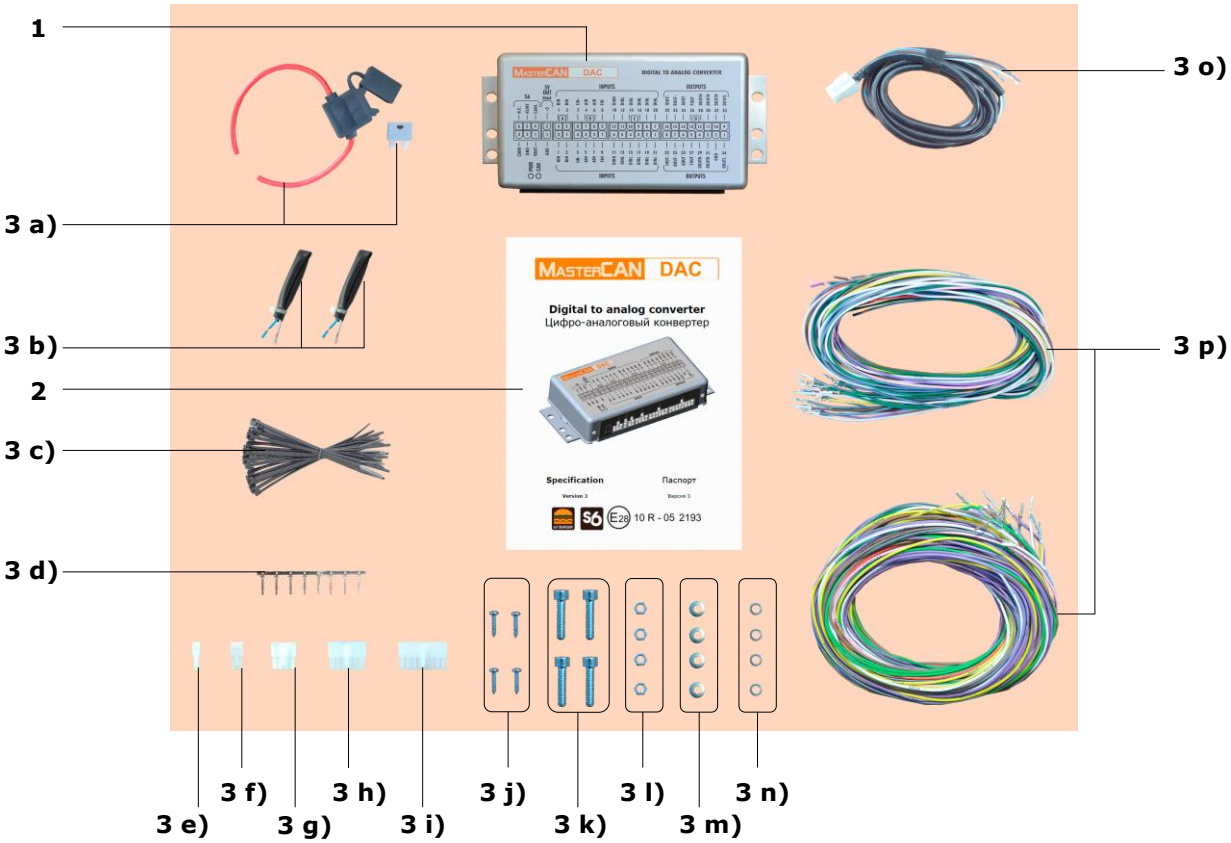
1.2 Delivery set



1	MasterCAN DAC 15 digital to analog converter	– 1 pc.;
2	Passport with a list of factory settings	– 1 pc.;
3	Mounting kit (1 pc.) including:	
a)	fuse with holder 2 A (3 A)	- 1 pc.;
b)	cable tie	- 20 pcs.;
c)	contact pin	- 8 pcs.;
d)	molex 4 pin connector	- 1 pc.;
e)	molex 6 pin connector	- 1 pc.;
f)	molex 8 pin connector	- 1 pc.;
g)	power cable	- 1 pc.;
h)	wire	- 17 pcs.;
i)	S6 CW plug*	- 2 pcs.

Figure 4 — MasterCAN DAC 15 delivery set

* Contains the 120 Ohm inbuilt terminal resistor.



1	MasterCAN DAC 2113 j1939 digital to analog converter	– 1 pc.;
2	Specification	– 1 pc.;
3	Mounting kit (1 pc.) including:	
a)	fuse with holder 2 A (3 A)	- 1 pc.;
b)	S6 CW plug*	- 2 pcs.;
c)	cable tie	- 25 pcs.;
d)	contact pin	- 8 pcs.;
e)	molex 2 pin connector	- 1 pc.;
f)	molex 4 pin connector	- 1 pc.;
g)	molex 8 pin connector	- 1 pc.;
h)	molex 12 pin connector	- 1 pc.;
i)	molex 16 pin connector	- 1 pc.;
j)	self-tapping screw 6.3x25	- 4 pcs.;
k)	screw M6x25	- 4 pcs.;
l)	nut M6	- 4 pcs.;
m)	washer 6	- 4 pcs.;
n)	lock washer 6.65	- 4 pcs.;
o)	S6 cable	- 1 pc.;
p)	wire	- 42 pcs.

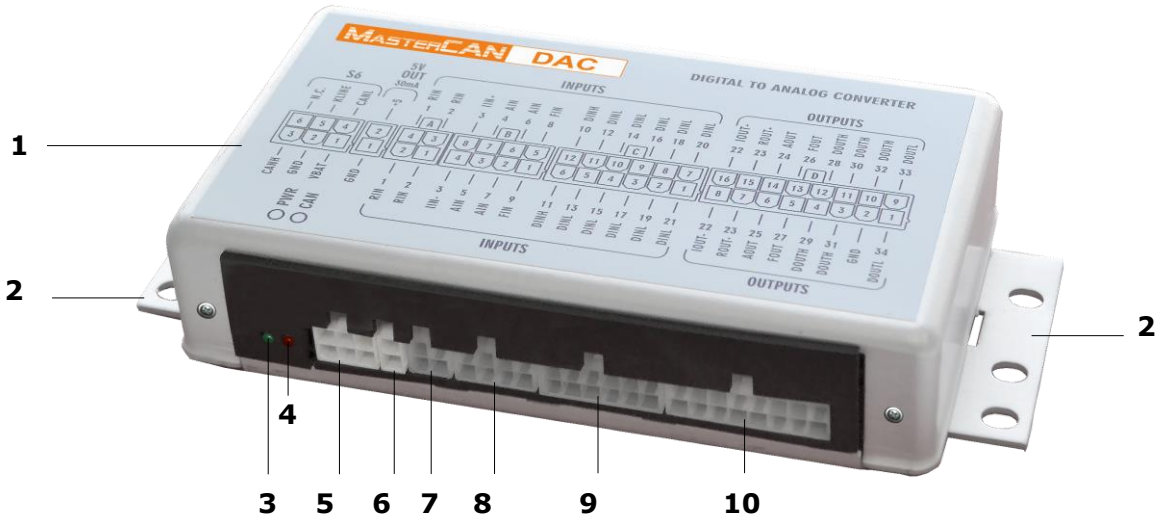
Figure 5 — MasterCAN DAC 2113 delivery set

* Contains the 120 Ohm inbuilt terminal resistor.

1.3 Exterior view and structure

1 – casing;
2 – **OUT** connector (current/discrete 1/discrete 2/resistive outputs);
3 – **IN/OUT** connector (analog voltage input/frequency and analog voltage output/frequency/pulse);
4 – **POWER** connector (Vehicle onboard circuit connection);
5 – **S6** connector (connection using CAN j1939/S6 interface);
6 – red **CAN** LED indicator for data transmission via CAN j1939/S6 interface;
7 – green **POWER** LED indicator to indicate the power supply in the onboard circuit.

Figure 6 — MasterCAN DAC 15 exterior view and design



1 – casing;
2 – mounting bracket;
3 – green **PWR** LED indicator;
4 – red **CAN** LED indicator;
5 – **S6** connector (connection via CAN j1939/S6 interface);
6 – **5 V OUT** connector (power supply connection (5 V, 30 mA) for external devices);
7 – **A** connector (resistive outputs (2 pcs.));
8 – **B** connector (frequency (2 pcs.)/analog voltage (4 pcs.)/ current (1 pc.) inputs);
9 – **C** connector (discrete inputs (12 pcs.));
10 – **D** connector (discrete (7 pcs.)/frequency (2 pcs.)/current (1 pc.)/ resistive (1 pc.)/analog voltage (2 pcs.) outputs).

Figure 7 — MasterCAN DAC 2113 exterior view and design

1.4 Technical specifications

1.4.1 Main specifications

Table 2 — MasterCAN DAC main specifications

Parameter, measurement units	Value	
	MasterCAN DAC 15	**MasterCAN DAC 2113**
Configurable digital interface	CAN j1939/S6	
Configurable analog inputs/outputs	see 1.4.3	
Service interface	K-Line (ISO 14230)	
Voltage range of external power supply, V	9…45	
Maximal current consumption at supply voltage 12 V, mA, not more than	500	
Maximal current consumption at supply voltage 24 V, mA, not more than	250	
Temperature range, °C	-40…+85	
Level of sealing protection from dust and moisture	IP40	
Overall dimensions, mm, not more than	see figure 8	see figure 9
Weight, kg, not more than	0.08	0.32

1.4.2 CAN j1939/S6 digital interface specifications

Characteristics of CAN j1939/S6 digital interface of MasterCAN DAC converters comply with S6 Technology. The application level of the data transfer protocol is based on SAE j1939 standard and complies with S6 Database (see details at http://s6.jv-technoton.com/; you need to get registered for work with BD S6).

MasterCAN DAC connection parameters by means of S6 Technology are configured and PGN / SPN are selected using K-Line (ISO 14230) service interface with the help of Service S6 MasterCAN software (versions from 3.32 and higher). The software current version can be downloaded at https://jv-technoton.com/, section Software/Firmware.

MasterCAN DAC receives/transfers data automatically or upon request. Baudrate can be selected from the range of fixed values: 100; 125; 250; 500; 1000 kbit/s (by default — 250 kbit/s).

In case you connect by means of S6 Technology, unique network addresses (SA) must be specified for MasterCAN DAC 15: 126 or 146 (by default — 126), while for MasterCAN DAC 2113 — 127 or 147 (by default — 127).

IMPORTANT: **The obligatory condition** for correct data transfer between MasterCAN DAC and Units via CAN j1939/S6 interface is the availability of two **120 Ohm** terminal resistors at both ends of CAN 2.0B (SAE j1939) communication line between CAN LOW and CAN HIGH wires (see figure 10).

1.4.3 Analog signals specifications

1) Analog signals of MasterCAN DAC 15

Table 3 — Specifications of signals for MasterCAN DAC 15 ***analog input***

Signal type, measurement units	Value
Analog voltage, V	0.5…9
Frequency, kHz	0.01…10
Remark — The input impedance of the analog input is at least 150 kOhm.	

Table 4 — Specifications of signals for MasterCAN DAC 15 ***analog outputs***

Signal type, measurement units	Value
Analog voltage, V	0.5…9
Frequency, kHz	0.01…10
Pulse, Amplitude, V Duration, ms	 0.5...9 40...250
Current, mA	4…20
Discrete, V (upper branch (supplied U*$_{PS}$))	level 0 — 0 level 1 — U*$_{PS}$
Discrete, V (inverse, lower branch (supplied GND), see annex B)	level 0 — 10 (without connecting the load) level 1 — 0
Resistive, kOhm	0.015…50
* U_{PS} – onboard circuit voltage.	
Remarks 1 Maximum load current for the analog output — no more than 40 mA. 2 Maximum current for the discrete outputs — no more than 0.3 A. 3 Maximum load impedance for the current output: $R_{L\,max}$ =(U*$_{PS}$ - 5 V)/0.02 Ohm.	

2) Analog signals of MasterCAN DAC 2113

Table 5 — Specifications of signals for MasterCAN DAC 2113 ***analog inputs***

Signal type, measurement units	Value
Analog voltage, V	0.5…10
Frequency, kHz (active level "low" (0…10 % U*PS))	0.01…10
Frequency, kHz (active level "high" (10 % U*PS… U*PS))	
Resistive, kOhm	0.015…50
Current, mA	4…20
Discrete, V (active level "low")	level 0 — 0…10 % U*PS
Discrete, V (active level "high")	level 1 — 10 % U*PS…U*PS
* UPS – onboard circuit voltage.	
Remarks 1 Input impedance of the analog input — no less than 140 kOhm. 2 Input impedance of the current input — no less than 158±4 Ohm. 3 Input current of the discrete input at "low" active level — no more than 0.12 mA. 4 Input impedance of the discrete input at "high" active level — 110 kOhm.	

Table 6 — Specifications of signals for MasterCAN DAC 2113 ***analog outputs***

Signal type, measurement units	Value
Analog voltage, V	0.5…10
Current, mA	4…20
Resistive, kOhm	0.015…50
Discrete, V (upper branch (supplied U*PS))	level 0 — <5 %U*PS level 1 — >80 %U*PS
Discrete, V (inverse, lower branch (supplied GND)	level 0 — <5 %U*PS level 1 — >80 %U*PS
Frequency, kHz (amplitude 3.3 V)	0.01…10
Frequency, kHz (amplitude 5 V)	
Frequency, kHz (amplitude 8 V)	
Frequency, kHz (amplitude U*PS)	
* UPS – onboard circuit voltage.	
Remarks 1 Maximum current for the discrete outputs — no more than 0.5 A. 2 Maximum output current of the analog voltage — no more than 50 mA. 3 Maximum absorbed power of the resistive output — 2 W. 4 Maximum load impedance for the current output: $R_{L\,max}$ =(U*PS - 5 V)/0.02 Ohm.	

The necessary type of analog input/output signals is selected and conversion of their values into SPN is configured with the help of Service S6 MasterCAN service software (the current version can be downloaded at https://www.jv-technoton.com/, section Software/Firmware).

1.4.4 Overall dimensions

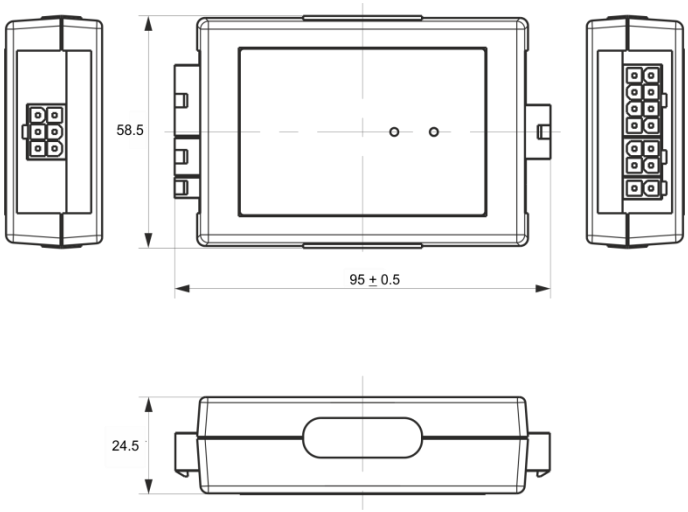


Figure 8 — MasterCAN DAC 15 overall dimensions

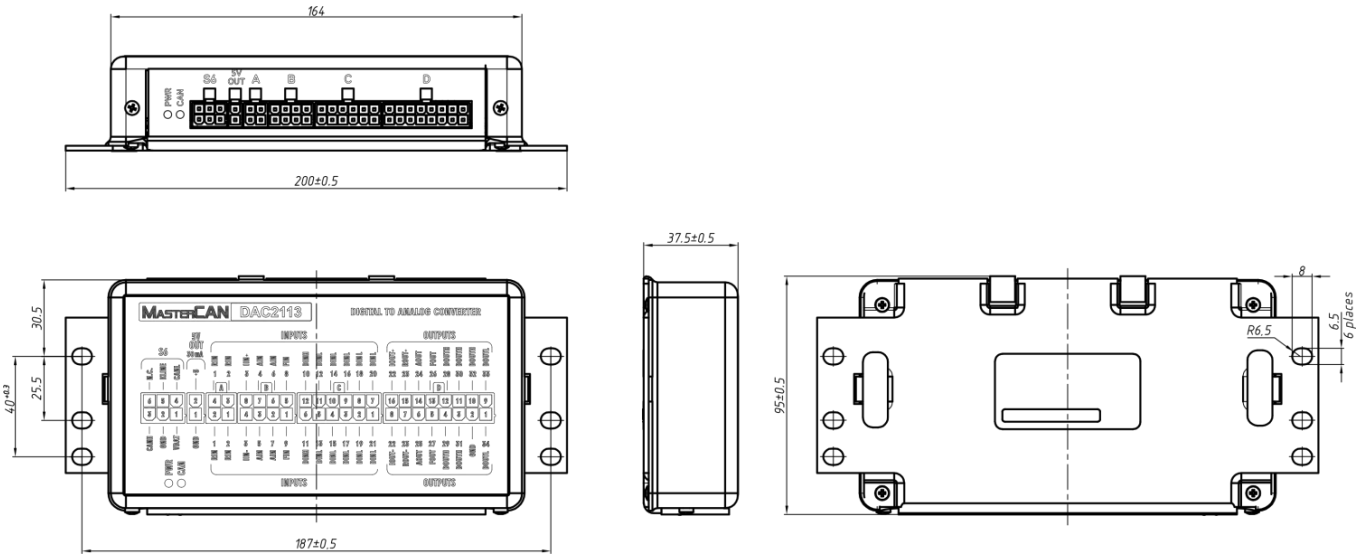


Figure 9 — MasterCAN DAC 2113 overall dimensions

2 Mounting the converter

ATTENTION:
1) When mounting MasterCAN DAC 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.

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

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

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.

The most suitable location to mount the converter on the Vehicle is the driver's cabin. In case of mounting it in the underhood space, you need to make sure that the converter casing and its wires are located at least 30 cm away from the engine rotating parts and surfaces.

2.3 Electrical connection

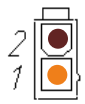
2.3.1 Power supply connection

For its power supply, MasterCAN DAC converter is connected to the external power source (e.g. from the 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 mounting and connecting converter switch off power supply electrical circuits of the equipped object. To do this switch off the battery switch or release the terminals of the wires connected to the battery.
2) It is recommended to use **fuse** (supplied within delivery set) when connecting converter to power supply. Nominal fuse current is 2 A (3 A).
3) When connecting converter to onboard power source it is necessary to connect feed "+" and chassis "-" wires to the same sockets where appropriate wires of tracker are connected.
4) Before starting electrical connection of the converter special attention must be paid to the quality of the chassis ground. Resistance between any point of the chassis and the negative clamp of the power supply (battery) must not exceed **1 Ohm**.

1) Power supply for MasterCAN DAC 15 is connected using the **power cable** from the delivery set (see figure 4), in accordance with the designation of contacts of **POWER** connector, color and marking of wires, in accordance with table 7.
During work with MasterCAN DAC 15 using S6 Technology, power is supplied through **S6** connector (see 2.3.2). In this case you don't need to connect power supply to **POWER** connector.

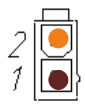
*Table 7 — Connecting wires to **POWER** connector*

Connector Pinout	Connector Contact Number	Wire Marking	Wire Color	Circuit Designation	Signal Parameters
	2	GND	Brown	Ground "-"	—
	1	VBAT	Orange	Power "+"	Analog, voltage 9…45 V

2) Power supply for MasterCAN DAC 2113 is connected by means of S6 Technology, in accordance with the designation of contacts of **S6** connector, color and marking of wires, according to table 9 (see 2.3.2).

3) For **power supply of external devices**, **5 V OUT** connector is used in MasterCAN DAC 2113; it is connected by using Molex 2 pin connector and wires from the delivery set (see figure 5), in accordance with the designation of contacts, color and marking of wires, according to table 8.

*Table 8 — Connecting wires to **5 V OUT** connector*

Connector Pinout	Connector Contact Number	Wire Marking	Wire Color	Circuit Designation	Signal Parameters
	2	VBAT	Orange	Output voltage	Analog,voltage 5 V, 30 mA
	1	GND	Brown	Ground "-"	—

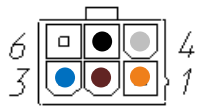
2.3.2 Connection using S6 Technology

Connection of power source, as well as Units, to the converter by means of S6 Technology is performed in accordance with the designation of contacts of **S6** connector, color and marking of wires, according to table 9.

Also, **S6** connector is used for the converter configuration with the help of S6 SK service adapter. During configuration of the converter which operates using S6 Technology, S6 SK adapter can be attached to any free connector of S6 cable system.

For connection of MasterCAN DAC 15, Molex 2 pin connector and wires from the delivery set (see figure 4) are used; for connection of MasterCAN DAC 2113 — **S6 cable** from the delivery set is used (see figure 5).

*Table 9 — Connecting wires to **S6** connector*

Connector Pinout	Connector Contact Number	Wire Marking	Wire Color	Circuit Designation	Signal Parameters
	1	VBAT	Orange	Power "+"*	Analog, voltage 9…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
	6	—	—	Reserve	—

* To provide power supply for CANCrocodile / CANCrocodile Mini (only in case of the contactless reader connection to MasterCAN DAC 15).
** Service interface for configuration and firmware update of MasterCAN DAC converter.

IMPORTANT:
1) The presence of 120 Ohms terminal resistors between the wires CAN LOW and CAN HIGH wires at the ends of CAN 2.0B (SAE j1939) communication line **is the obligatory condition** for correct data transfer. In case of converter connection to the to external device that has no inbuilt terminal resistor, connect S6 CW plugs (see delivery set and figure 10).
2) During mounting MasterCAN DAC 2113 you may enable the inbuilt terminal resistor in the connection settings by using CAN j1939/S6 interface (see 3.6). In this case, you need to connect S6 CW plug only at the end of the communication line which is connected to the Terminal.

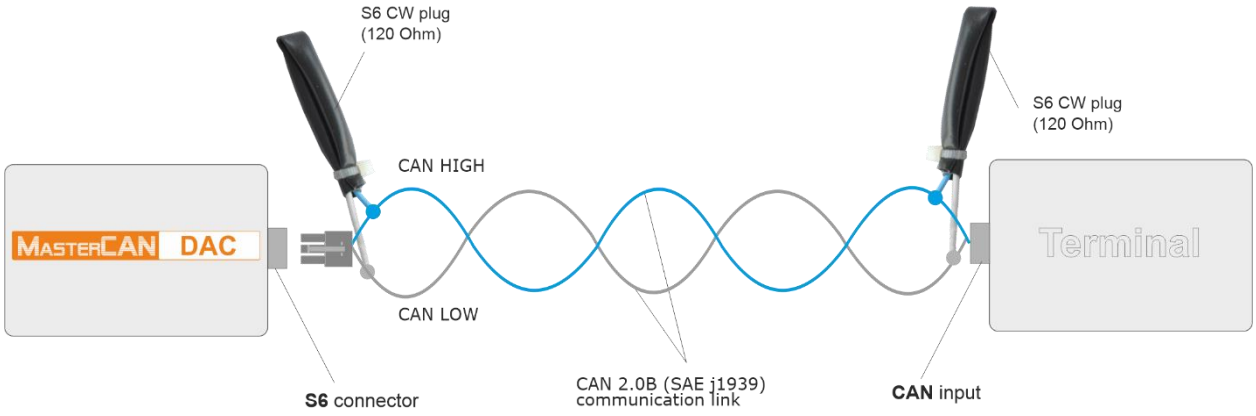


Figure 10 — Connection of converter by means of S6 Technology to the external device that has no inbuilt terminal resistor

We recommend to purchase and use **connectors** for the MasterCAN DAC 15 converter connection to the respective signal wires (see figure 11).

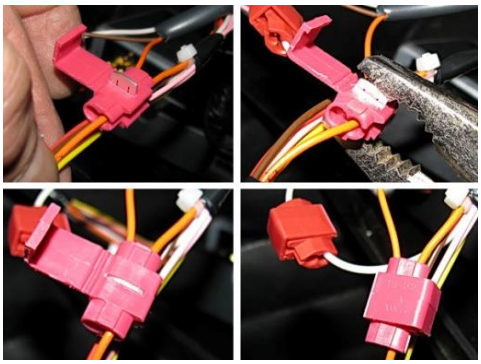
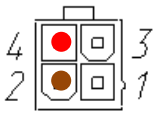


Figure 11 — Connecting signal wires to the converter using connectors

2.3.3 Connecting analog inputs

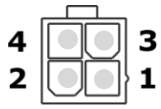
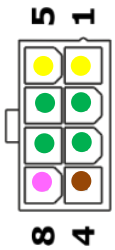
1) The analog input of MasterCAN DAC 15 is connected to the respective signal wires using Molex 4 pin connector and wires from the delivery set (see figure 4), in accordance with the designation of contacts of **IN/OUT** connector, color and marking of wires (see table 10).

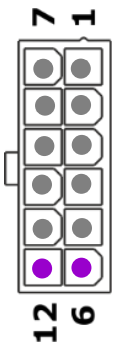
*Table 10— Connection of wires to the connector of MasterCAN DAC 15 analog input (**IN/OUT** connector)*

Connector Pinout	Connector Contact Number	Wire Marking	Contact group	Wire Color	Circuit Designation	Signal Parameters
	4	AFin+	I1	Red	Analog/ frequency input	see 1.4.3 (table 3)
	2	AFin-		Brown		

2) The analog inputs of MasterCAN DAC 2113 are connected to the respective signal wires using Molex 4 pin / Molex 8 pin / Molex 12 pin connectors and wires from the delivery set (see figure 5), in accordance with the designation of contacts of **A/B/C** connectors, color and marking of wires (see table 11).

*Table 11— Connection of wires to connectors of MasterCAN DAC 2113 analog inputs (**A/B/C** connectors)*

Connector Pinout	Connector Contact Number	Wire Marking	Number channel for configuration	Wire Color	Circuit Designation	Signal Parameters
A 	A1	Rin1	2	White	Resistive input	see 1.4.3 (table 5)
	A3	Rin1				
	A2	Rin2	1			
	A4	Rin2				
B 	B1	Fin	9	Yellow	Frequency input	
	B5	Fin	8			
	B2	Ain	7	Green	Analog input	
	B6	Ain	6			
	B3	Ain	5			
	B7	Ain	4			
	B4	Iin-	3	Brown	Current input	
	B8	Iin+		Pink		

Connector Pinout	Connector Contact Number	Wire Marking	Number channel for configuration	Wire Color	Circuit Designation	Signal Parameters
C  	C1	DinL	21	Gray	Discrete input	see 1.4.3 (table 5)
	C7	DinL	20			
	C2	DinL	19			
	C8	DinL	18			
	C3	DinL	17			
	C9	DinL	19			
	C4	DinL	15			
	C10	DinL	14			
	C5	DinL	13			
	C11	DinL	12			
	C6	DinH	11	Violet		
	C12	DinH	10			

2.3.4 Connecting analog outputs

1) Analog outputs of MasterCAN DAC 15 are connected to:

- signal wires of analog voltage/frequency/pulse signal with Molex 4 pin connector and wires from the delivery set (see figure 4), in accordance with the designation of contacts of **IN/OUT** connector, color and marking of wires (see table 12).
- the respective current/discrete/resistive/signal wires with Molex 8 pin connector and wires from the delivery set (see figure 4), in accordance with the designation of contacts of **OUT** connector, color and marking of wires (see table 13).

*Table 12— Connection of wires to **IN/OUT** connector (analog output of MasterCAN DAC 15)*

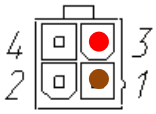
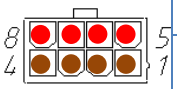
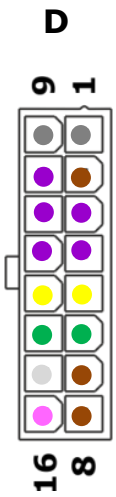
Connector Pinout	Connector Contact Number	Wire Marking	Contact group	Wire Color	Circuit Designation	Signal Parameters
	3	AFout+	O1	Red	Analog/ frequency output	see 1.4.3 (table 4)
	1	AFout-		Brown	Analog/ frequency/pulse output	

*Table 13 — Connection of wires to **OUT** connector (analog output of MasterCAN DAC 15)*

Connector Pinout	Connector Contact Number	Wire Marking	Contact group	Wire Color	Circuit Designation	Signal Parameters
	1	Iout-	O2	Brown	Current output	see 1.4.3 (table 4)
	5	Iout+		Red		
	2	D1GND	O3	Brown	Discrete output	
	6	D1+		Red		
	3	D2GND	O4	Brown	Discrete output	
	7	D2+		Red		
	4	Rout-	O5	Brown	Resistive output	
	8	Rout+		Red		

2) The analog outputs of MasterCAN DAC 2113 are connected to signal wires of analog voltage/frequency/current/resistive/discrete signals using Molex 16 pin connector and wires from the delivery set (see figure 5), in accordance with the designation of contacts of **D** connector, color and marking of wires (see table 14).

*Table 14— Connection of wires to the analog outputs connector of MasterCAN DAC 2113 (**D** connector)*

Connector Pinout	Connector Contact Number	Wire Marking	Number channel for configuration	Wire Color	Circuit Designation	Signal Parameters
	D1	DoutL	34	Gray	Discrete output	see 1.4.3 (table 6)
	D9	DoutL	33			
	D2	GND	—	Brown	Ground "-"	—
	D10	DoutH	32	Violet	Discrete output	see 1.4.3 (table 6)
	D3	DoutH	31			
	D11	DoutH	30			
	D4	DoutH	29			
	D12	DoutH	28			
	D5	Fout	27	Yellow	Frequency output	
	D13	Fout	26			
	D6	Aout	25	Green	Analog output	
	D14	Aout	24			
	D7	Rout-	23	Brown	Resistive output	
	D15	Rout+		White		
	D8	Iout-	22	Brown	Current output	
	D16	Iout+		Pink		

2.4 Connection schemes examples

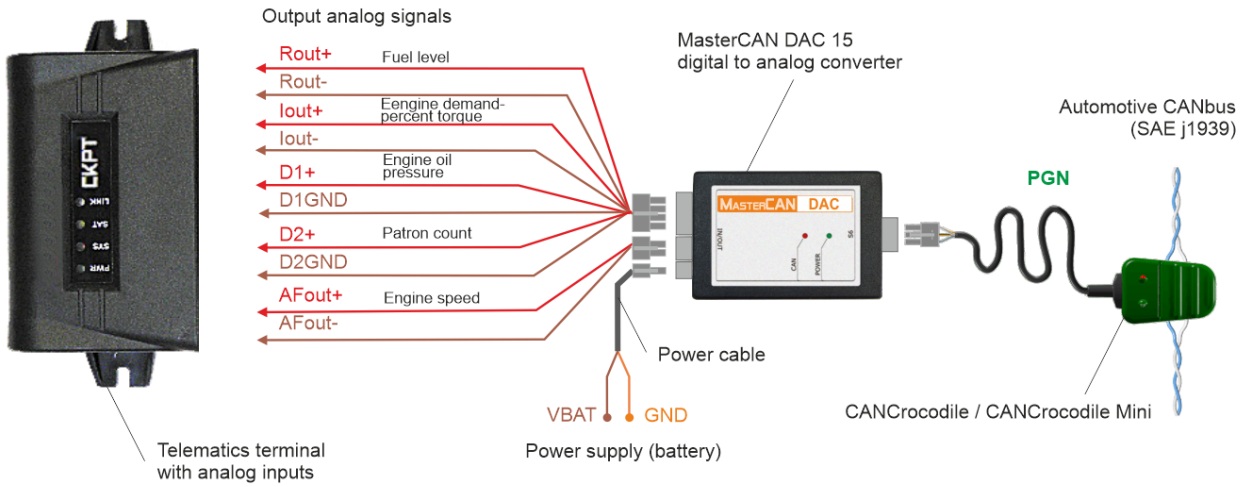


Figure 12 — Connecting MasterCAN DAC 15 for CANbus data conversion to analog inputs of Telematics terminal

ATTENTION: We recommend to purchase and use CANCrocodile / CANCrocodile Mini contactless reader to connect MasterCAN DAC 15 to the Vehicle CAN-bus (for detailed information, see the Crocodile contactless readers operation manual).

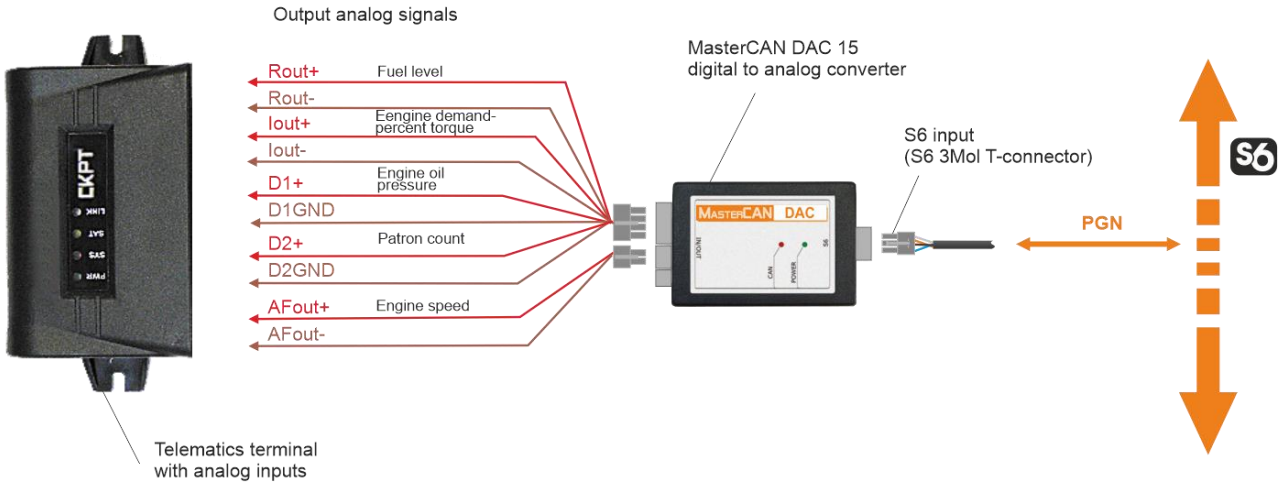


Figure 13 — Connecting MasterCAN DAC 15 for CAN j1939/S6 Telematics interface data conversion to analog inputs of Telematics terminal

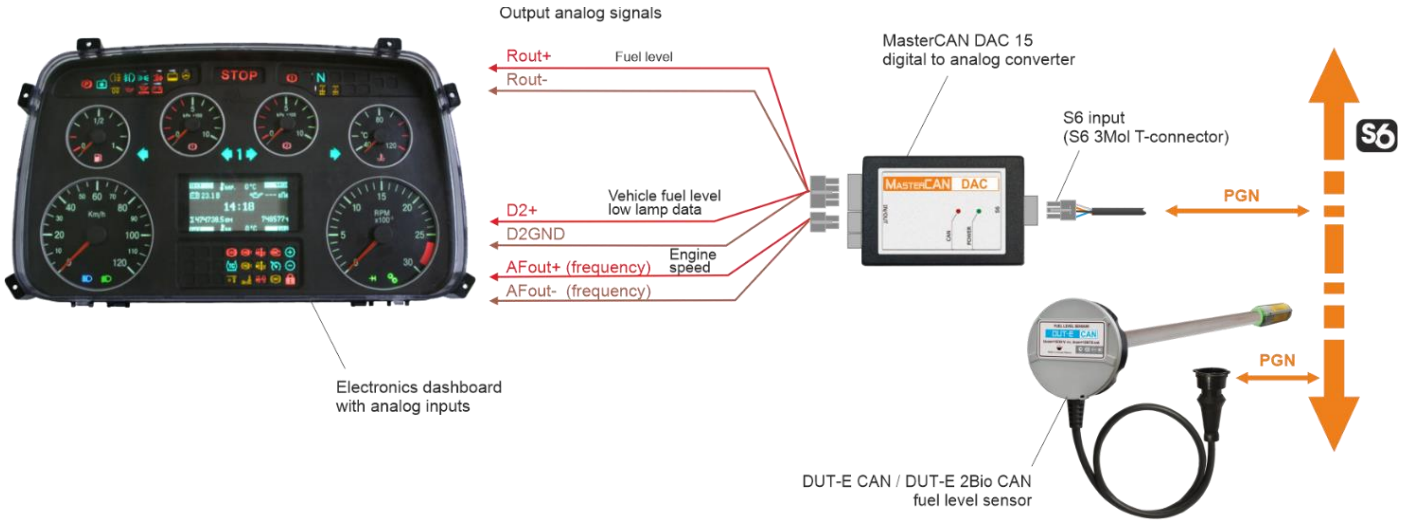


*Figure 14 — Connecting MasterCAN DAC 15 for CAN j1939/S6 Telematics interface data and DUT-E CAN fuel level sensor data conversion to analog inputs of dashboard**

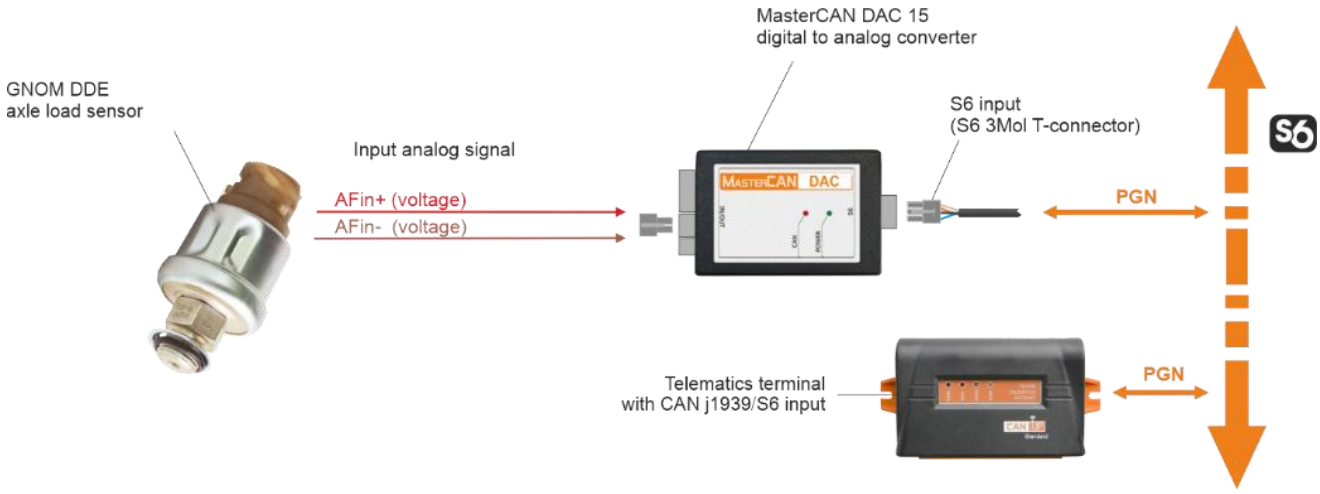


Figure 15 — Connection of MasterCAN DAC 15 to convert the analog output signal of GNOM DDE axle load sensor into CAN/S6-input of the Telematics terminal

* Connection of any models of dashboards is allowed; they should only have inputs corresponding to specifications of MasterCAN DAC 15 output signals (see 1.4.3).

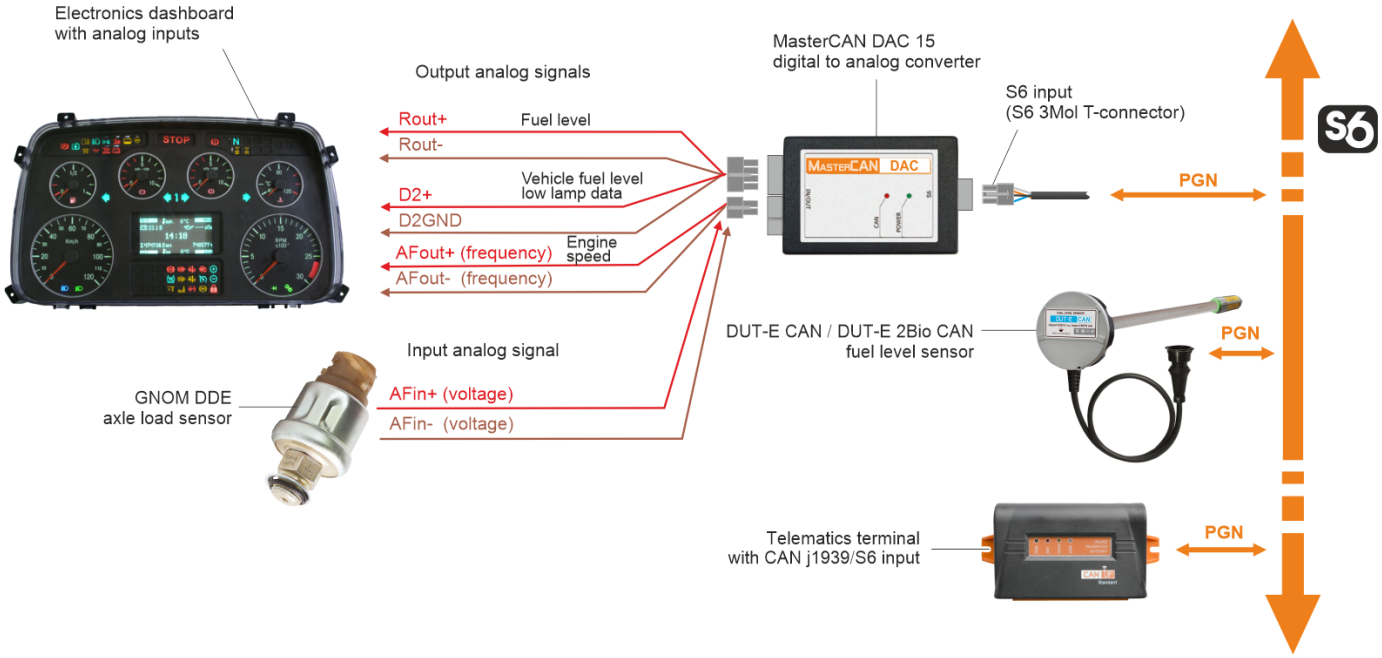


Figure 16 — Connection of MasterCAN DAC 15 to convert:

*1) data of CAN j1939/S6 Telematics interface and DUT-E CAN fuel level sensor into analog inputs of the dashboard**

2) the analog signal of GNOM DDE axle load sensor into CAN j1939/S6-input of the Telematics terminal

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* Connection of any models of dashboards is allowed; they should only have inputs corresponding to specifications of MasterCAN DAC 15 output signals (see 1.4.3).

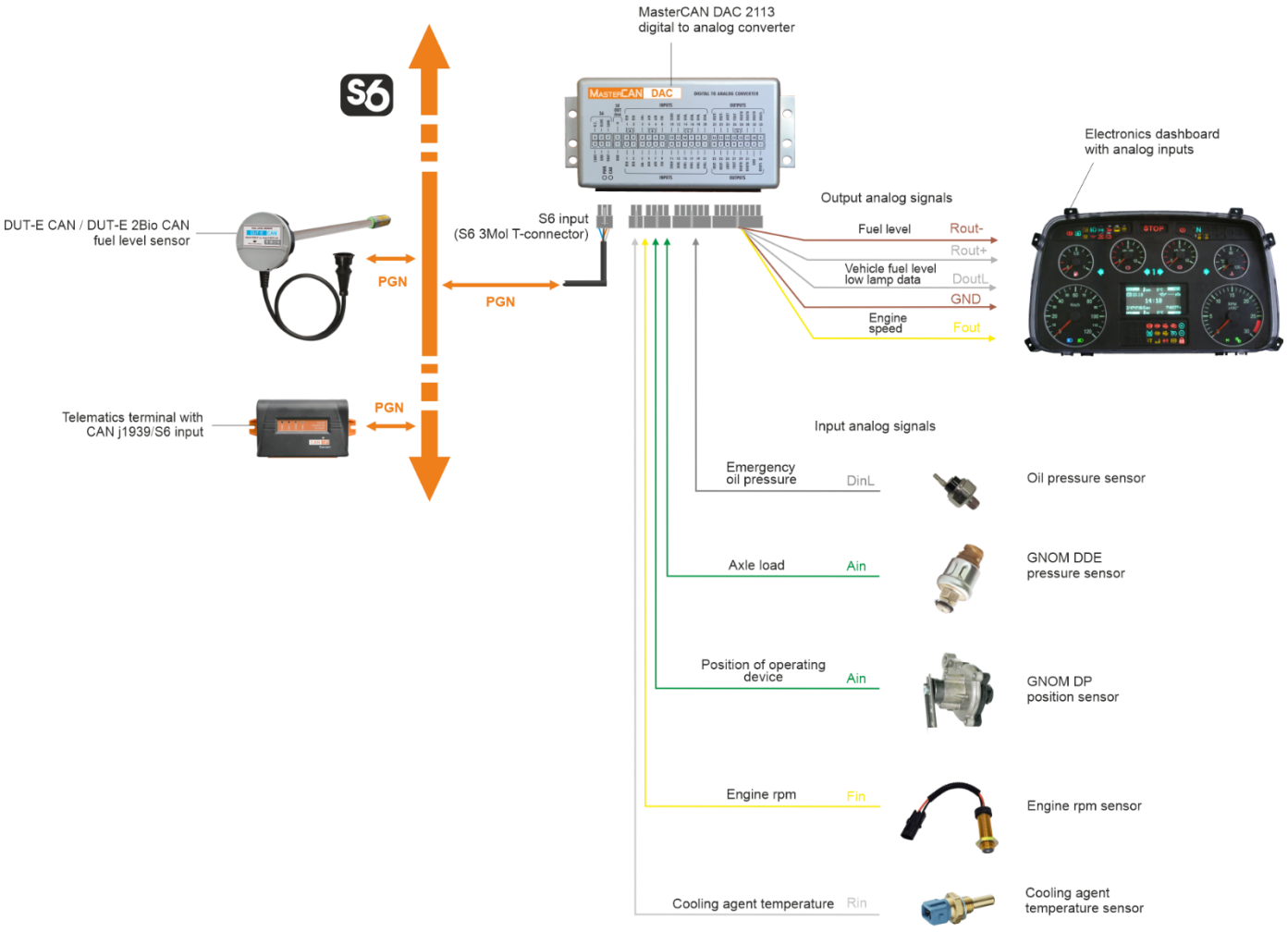


Figure 17 — Connection of MasterCAN DAC 2113 to convert:

*1) data of CAN/S6 Telematics interface and DUT-E CAN fuel level sensor into analog inputs of the dashboard**

2) the analog signal from standard and additional sensors into CAN/S6-input of the Telematics terminal

* Connection of any models of dashboards is allowed; they should only have inputs corresponding to specifications of MasterCAN DAC 2113 output signals (see 1.4.3).

3 Converter configuration

3.1 Basic provisions

MasterCAN DAC converters are configured by means of K-Line (ISO 14230) service interface using S6 SK service adapter purchased separately. To configure the converter, you need to connect it to the personal computer (PC).

ATTENTION: To avoid any communication disruption in the communication line between the converter and the PC, you need to make sure there are no sources of electromagnetic interference close to the location where the converter is being configured (running electric motors, high-power transformers and switching equipment, welding equipment, high voltage lines, etc.).

Before connecting converter to PC via service adapter, please download special software from http://www.jv-technoton.com/ (section Software/Firmware) and install it to your PC:

- USB driver;
- Service S6 MasterCAN (version 3.32 and higher).

Note — Installation file of software has the view as: ServiceS6_MasterCAN_X_X_Setup.exe. X_X corresponds to the version of software.

ATTENTION: For work with Service S6 MasterCAN software, you need a separate PC (desktop or laptop) on which **only** Technoton service software that meets the following minimal requirements is installed:
- Windows 7/10 operating system of X32/X64 bit depth;
- CPU — Intel Core i3, dual-core, 2.0 GHz;
- RAM — 4 Gb;
- availability of USB 2.0 port;
- display resolution 1366x768.

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

Settings of Functional modules of MasterCAN DAC converters displayed and/or edited using Service S6 MasterCAN software are provided in annex A.

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

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

Avoid the following when connecting service adapter to 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.

The converters are connected to the PC for their configuration, in accordance with connection diagrams, provided in figure 18. You need to perform the following operations in the following sequence:

1) Connect the adapter to the converter. For this purpose, connect the adapter service cable connector through S6 SK connector to **S6** socket of the converter.

The converter and adapter can be powered through one of the free S6 SK connectors, through the converter **S6** connector or by power supply wires of the adapter service cable (see figures 18 a, b).

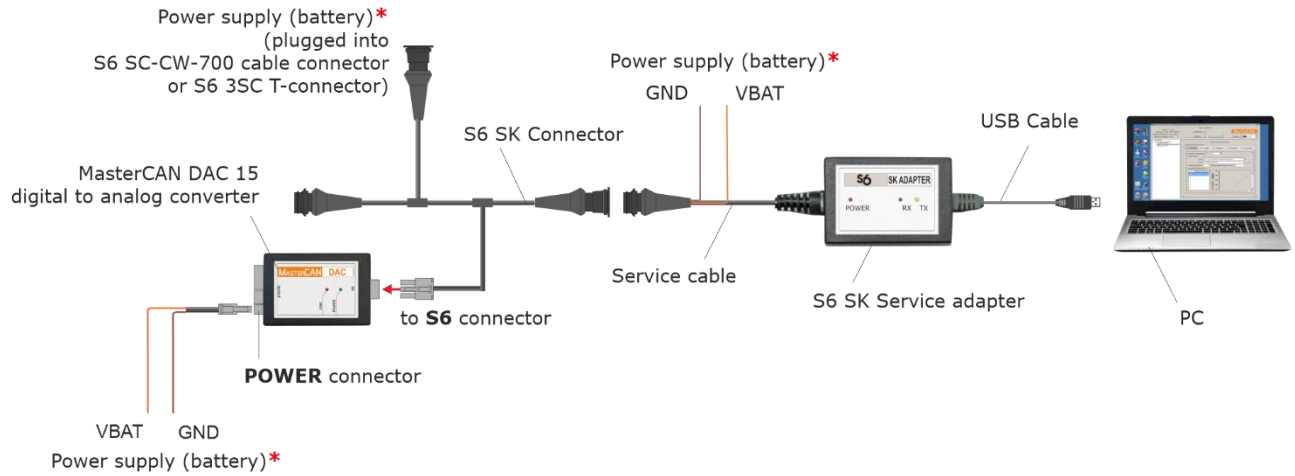
Note — During configuration of MasterCAN DAC15 it is allowed to connect power supply through **POWER** connector of the converter.

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 18 c).

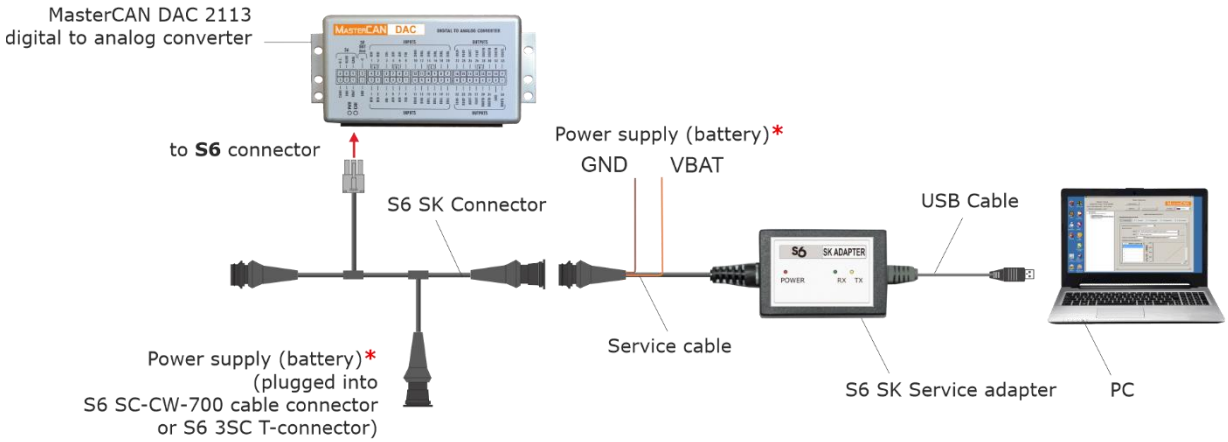
2) Connect the adapter with USB cable to a free USB-port of your PC.
Note — Adapter can also be connected to USB-port of your PC after turning electrical system ON and starting the software.

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

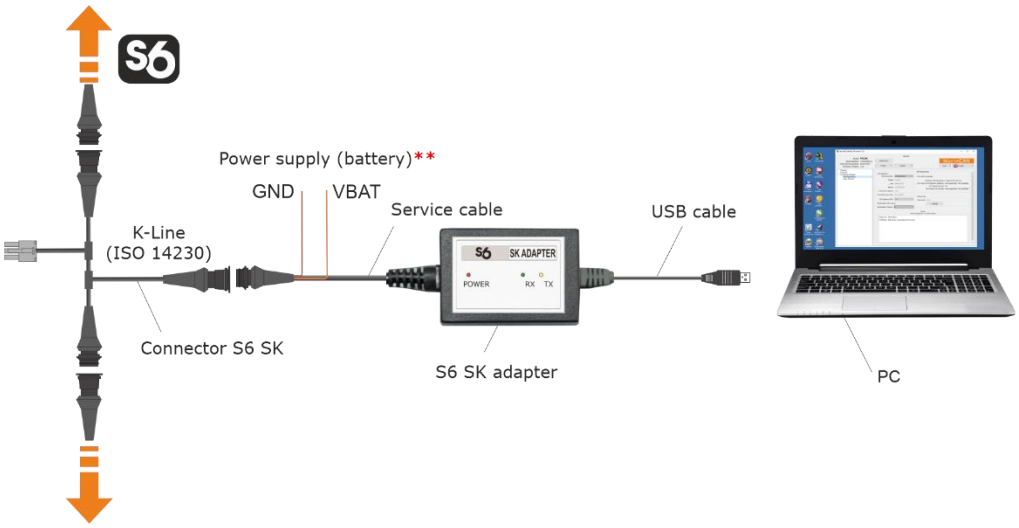
4) Switch power on (battery).



*a) connection of MasterCAN DAC 15 by means of S6 SK through **S6** connector*



*b) connection of MasterCAN DAC 2113 by means of S6 SK through **S6** connector*



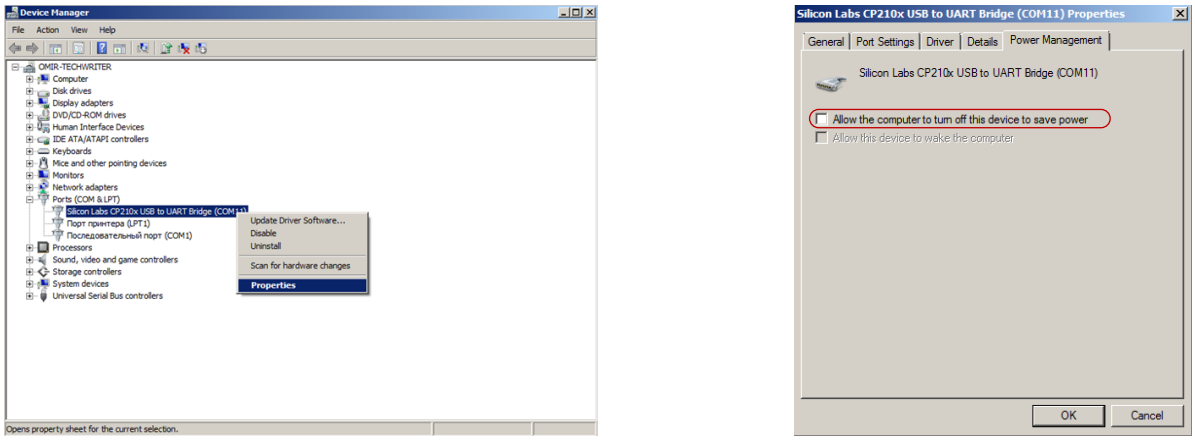
c) connection of MasterCAN DAC by means of S6 SK via S6 Technology

Figure 18 — Schemes of converters connection to PC

* For connecting power supply (battery) you can choose any of marked places.
** No need to connect. Power supply (battery) is carried out though S6 cabling system.

Windows automatically detects adapter connected to PC's USB port as USB device and enables virtual COM port driver for it. The virtual COM port will be displayed in the list of ports of Windows Device manager (see figure 19).

ATTENTION: It is recommended to untick power save check box for Service S6 MasterCAN in the virtual COM-port properties for energy safety purpose (see figure 19 b).



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

Figure 19 — 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 15.

Table 15 – Description of service adapter's LEDs

LED Indicator			Signal description
Marking	**Status**	**Light color**	
POWER		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

3.3 Interface of software

Service S6 MasterCAN software is launched with desktop shortcut created during installation. Software interface consists of **Horizontal menu**, **Vertical menu, Unit ID area** and **Information and Configuration area** (see figure 20).

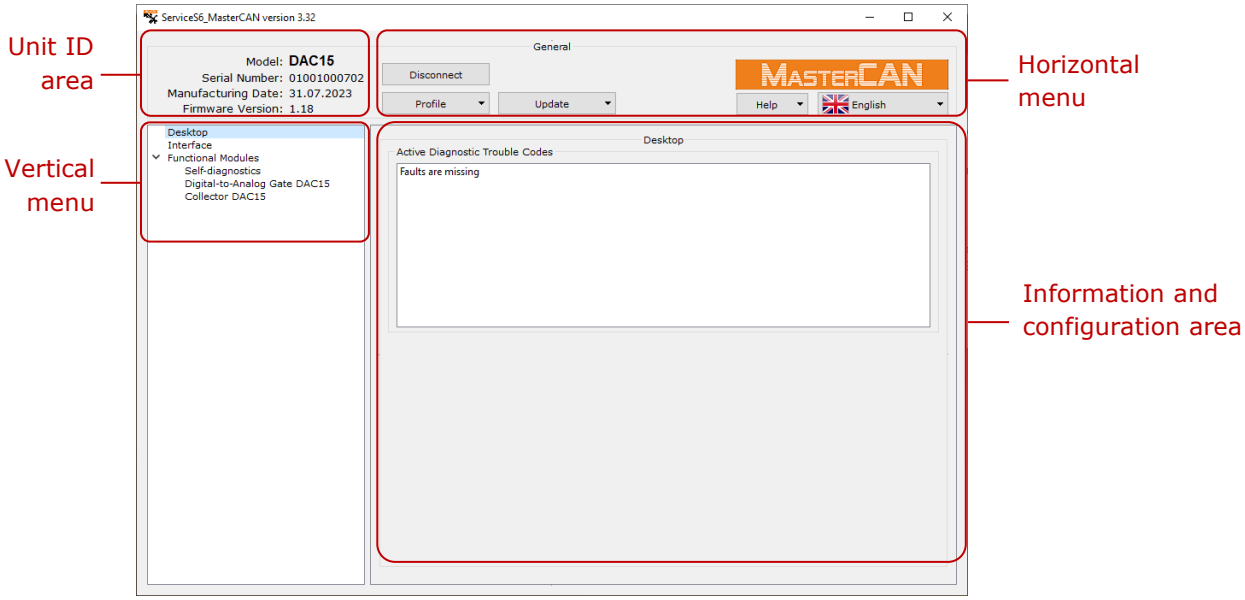


Figure 20 — Interface of Service S6 MasterCAN software

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

Unit ID area provides information about the model, serial number, manufacturing date and firmware version of the connected converter.

Horizontal menu provides the following:

- connection/disconnection of the converter;
- profile options (loading profile, saving profile, printing profile);
- updating firmware of the converter;
- S6 Database update in the service software (in case the PC has the Internet access);
- selection of interface language;
- viewing help file and information about the utility.

Vertical menu is used for selection of Function modules of converter. Its current parameters and configuration are displayed in **Configuration and Information area**. Function modules of Service S6 MasterCAN software are based on PGN and SPN messages from **S6 Database** (see annex A).

The detailed description of S6 Database can be found in the web-page http://s6.jv-technoton.com/ part Data base.

Information and Configuration area displays names (PGN) and parameters (SPN) of the messages. For each SPN, a prompt containing its specifications is displayed: data range, discreteness, unit of measurement etc. Automatic control of correctness of entered data is provided in the fields for settings editing. Appropriate prompts appear, whenever you place the cursor into the field containing the value to be edited.

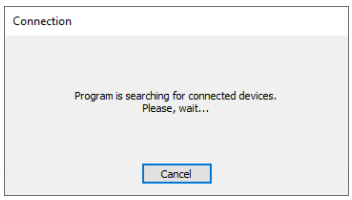
For automatic update of S6 Database in Service S6 MasterCAN software via Internet, press DB S6 button in the dropdown menu Update.

3.4 Authorization

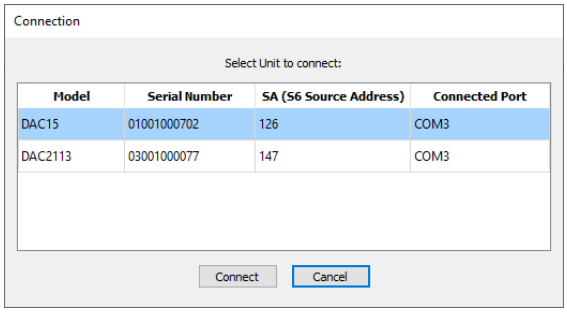
To enable connection between converter and PC, click the button Connect in **Horizontal menu**. Service S6 MasterCAN software will search for the connected Units (see figure 21 a).

When connecting the service adapter by means of S6 Technology to the network comprising several Units, select the Unit which will be used during your work with the software from the list in the window **Connection** of Unit and press Connect button (see figure 21 b).

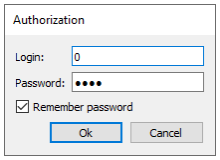
Enter Login and Password of the Unit into the appropriate fields of **Autorization** window. The default **Login** is 0. The default **Password** is 1111. To save a new Password (to avoid entering the password again during connection next time), tick **Remember Password** (see figure 21 c).



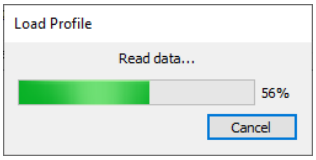
a) search for the connected Unit to PC



b) selecting one of several Units connected to S6 bus



c) user authorization



d) Unit's profile loading

Figure 21 — Enable connection between the converter and PC

To recover the password (in case it is lost) you need to place the cursor into the **Login** or the **Password** field of the window **Authorization** and press **Ctrl+F10** key combination. Service S6 MasterCAN software will display a code to recover the current password of the Unit (see figure 22). This message is being sent to Technoton technical department by e-mail support@technoton.by together with password recovery request.

Requirements for converter password request:

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

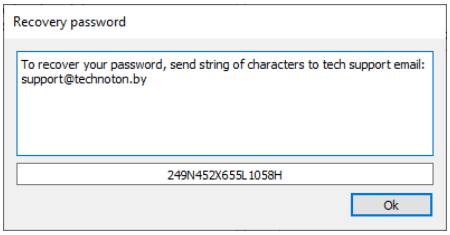


Figure 22 — Generating password recovery code

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

If Authorization is made successfully, then **Desktop** will appear automatically when you run the software (see figure 20). **Desktop** contains configuration and current parameters of Function modules of the connected converter (see annex A).

3.5 Operations with profile of converter

MasterCAN DAC converter **profile** is set of PGN (passport and diagnostic data, settings of Function modules).

It is possible to manage the profiles in both the converter connected and autonomous mode. The button Profile with drop down menu is used to choose the options (see figure 23). Profile can be stored as a file to PC hard drive or loaded into the memory of the Unit. It can be printed as well.

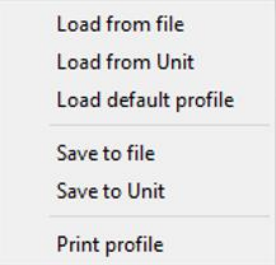


Figure 23 — View of Profile menu

1) Load profile. The following options of profile loading are available in Service S6 MasterCAN software:

- Load from file — for loading of previously saved profile from the hard drive or removable disk. In the loading window you need to find on the hard disc and select the profile file for the required converter model (**MasterCAN_DAC15_*.prf / MasterCAN_DAC2113_*.prf**).
- Load from Unit — is used for loading profile from the connected converter.
- Load default profile — is used for loading profile with default factory settings. With this profile, it is possible to study utility operation without real converter connection. By default, depending on the converter model, the Profile is saved in the file **MasterCAN_DAC15_default.prf** or **MasterCAN_DAC2113_default.prf**, in the folder of installation file ServiceS6_MasterCAN.exe.

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

2) Saving profile. Service S6 MasterCAN software has following profile saving options:

- Save to file — for saving profile to the hard drive or removable disk. This option is available only for profile loaded from file or Unit.
  In the window that opens, select the location on the disc and assign the Profile file name to the file, in accordance with the template (**MasterCAN_DAC15_*.prf / MasterCAN_DAC2113_*.prf**).
- Save to unit — is used for saving modified settings into profile of the connected Unit. It is available only during the time when there an active connection between PC and converter.

***** Any name specified by the user. The prefixes **MasterCAN_DAC15_** / **MasterCAN_DAC2113_** and **.prf** extension are inserted automatically in the file name.

If the modified settings were not saved into Unit and Disconnect button was pressed or Service S6 MasterCAN software is being closed there will appear a notification on profile settings saving. Pressing Yes will save all the unsaved parameters and converter settings.

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

RECOMMENDATION: It is recommended to attach the hardcopy of the profile to converter specification to log the history of the settings and configurations.

3.6 Configuration of connection by means of CAN j1939/S6 interface

To connect MasterCAN DAC converter via CAN j1939/S6 interface to Units by means of S6 Technology or to the onboard CAN-bus, select **Interface** heading in the **Vertical menu** of the software (see figure 24) and enable the following settings:

1) In the field **CAN Protocol Type** (SPN 521530) **J1939+S6** data transfer protocol is specified.

2) From the dropdown list **S6 Address(SA)** (SPN 521188), select the unique converter network address for its identification within CAN interface. The selected address will be also used during the converter configuration via K-Line (ISO 14230) service interface. For MasterCAN DAC 15, you are authorized to choose from the fixed addresses **126** and **146** (by default — **126**), while for MasterCAN DAC 2113 — from **127** and **147** (by default — **127**).

3) From the dropdown list **CAN Baudrate** (SPN 521531) select the required baudrate from the following range of fixed values: **100**; **125**; **250**; **500**; **1000 kbit/s** (by default — **250 kbit/s**).

4) From the dropdown list **CAN Mode*** select the required mode of data reception in CAN j1939/S6 interface:

- **Active (CAN Requests Enable)** — the converter generates active requests to Units connected by means of S6 Technology. PGN which, by default, are missing in the bus, but are provided upon request.
  Note — It should be noted that in case the converter is connected to the standard CAN-bus via CAN j1939/S6 interface, active requests may cause malfunctions of the onboard equipment operation.
- **Silent (Sniffer)** — the converter is not identified by other Units by its network address. Data are received in sniffer mode.

5) Through **Enable Termination Resistor**** drop-down list (SPN 521533), turn on or off (by default — **Off**) built-in terminating resistor (120 Ohm) between the CAN LOW and CAN HIGH pins of **S6** socket. Enabling the terminal resistor is the necessary condition for correct data transfer via CAN 2.0B (SAE j1939) communication line, whenever a signal cable with no terminal resistors at its ends is used (e.g. — S6 SC-Mol).

6) In the field **PGN Receive Timeout, s*** (SPN 521532) enter the maximum time (by default — **5 s**) during which no incoming PGN selected for conversion into analog signals are allowed. In case the specified waiting time is exceeded, the Self-diagnostics FM will produce an error message in CAN communication line.

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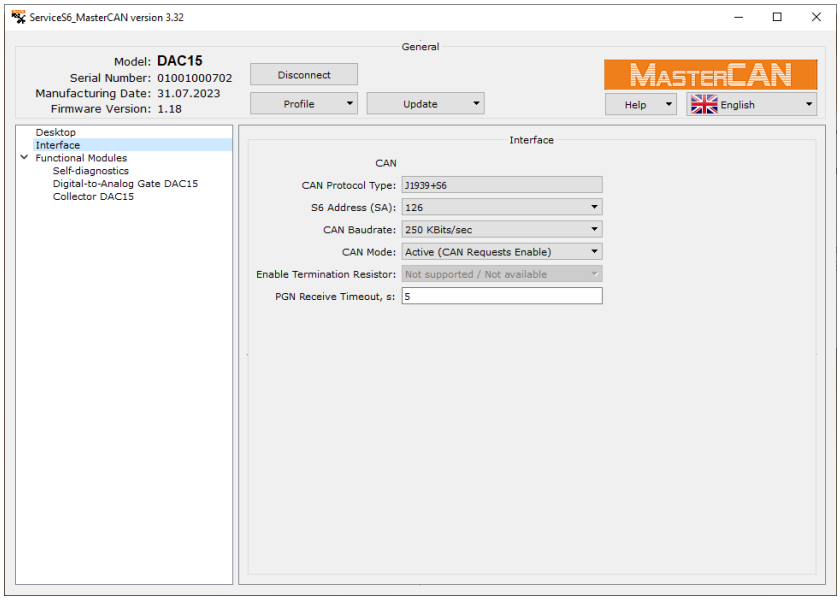
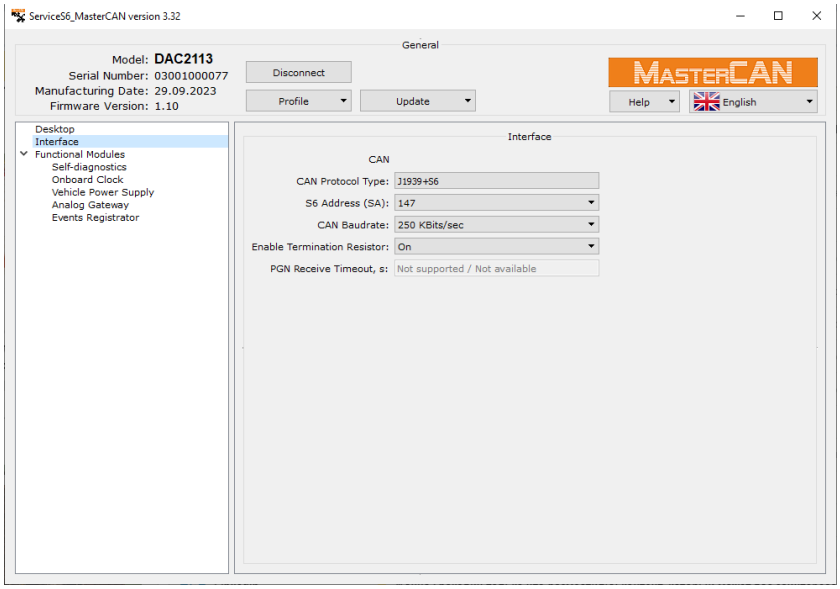
* For MasterCAN DAC 2113 this setting is not supported.

** In MasterCAN DAC 15 the inbuilt terminal resistor is missing.



a) for MasterCAN DAC 15



b) for MasterCAN DAC 2113

Figure 24 — Settings of the converters' connection parameters via CAN j1939/S6 interface

3.7 Configuration of signals conversion

To configure the converter analog inputs/outputs means to select the required type of signal (voltage/pulse/discrete/resistive) and set the limit values for its variations range. If needed (e.g. while measuring the fuel volume in the tank or axles load), you may create the calibration table and record it into the converter memory (up to 10 calibration points).

To configure CAN j1939/S6 digital interface means to select the required input data (SPN) from S6 Database for conversion into a selected analog signal or to select output messages (PGN) for conversion from the analog signal. Besides, the network address of the data source Unit and the period of time for reading data are set.

MasterCAN DAC 15 is configured for conversion of data from CAN j1939/S6 digital interface into analog signals by using the submenu of Digital-to-Analog Gate DAC15 FM (see A.2).

MasterCAN DAC 15 is configured for conversion of the analog signal into data of CAN j1939/S6 digital interface by using the submenu of the Collector DAC15 FM (see A.3).

MasterCAN DAC 2113 is configured for conversion of analog signals of the converter analog inputs signals into data of CAN j1939/S6 digital interface and for conversion of CAN j1939/S6 interface data into analog signals of the converter outputs by using the submenu of the Analog Gateway FM (see A.6).

Settings of Functional modules of MasterCAN DAC converters displayed and/or edited using the service software are provided in annex A.

3.8 Function test

If the MasterCAN DAC converter configuration and connection have been performed correctly, the device operation starts from the moment the power is on. When the power supply is off, the converter operation stops.

During the converter operation you should observe signals from its LED indicators (see table 16). Also, the converter should transfer the respective converted digital data and/or analog signals.

Table 16 – Designation of signals of the MasterCAN DAC converter LED indicators

LED indicator			**Signal description**
Marking	**Status**	**Light color**	
POWER		Green	Power supply is on
	No signal		Power supply is off (or voltage is less than minimum required)
CAN		Red	1) Transmit request to receive PGN (in digital-analog gateway mode) 2) Transmit PGN as response to request (in analog signal collector-converter mode)
			Connection error
	No signal		Normal functioning of connected CAN j1939/S6 interface

4 Analog signal converter of the Vehicle standard fuel level sensor

In some modern Vehicles equipped with CAN bus standard fuel level sensors with analog or frequency output signals are used. These signals are sent to the fuel level indicator. CAN-buses of such vehicles do not contain data on the fuel level in the tank which to a great extent limits the Telematics system potential for monitoring fuel consumption accrording to SAE j1939 protocol.

MasterCAN DAC 15 converter may be used as an intellectual tool to convert the analog/frequency output signal of a standard fuel level sensor into digital data (SPN) of CAN-bus and transmit it to CAN j1939/S6 Telematics interface.

MasterCAN DAC 15 in combination with FMSCrocodile contactless reader-converter is a convenient solution enabling to monitor the maximum possible volume of useful data on the Vehicle performance using the only CAN input of the terminal without using expensive additional equipment (e.g. fuel level sensors and fuel flow meters) (see figure 25).

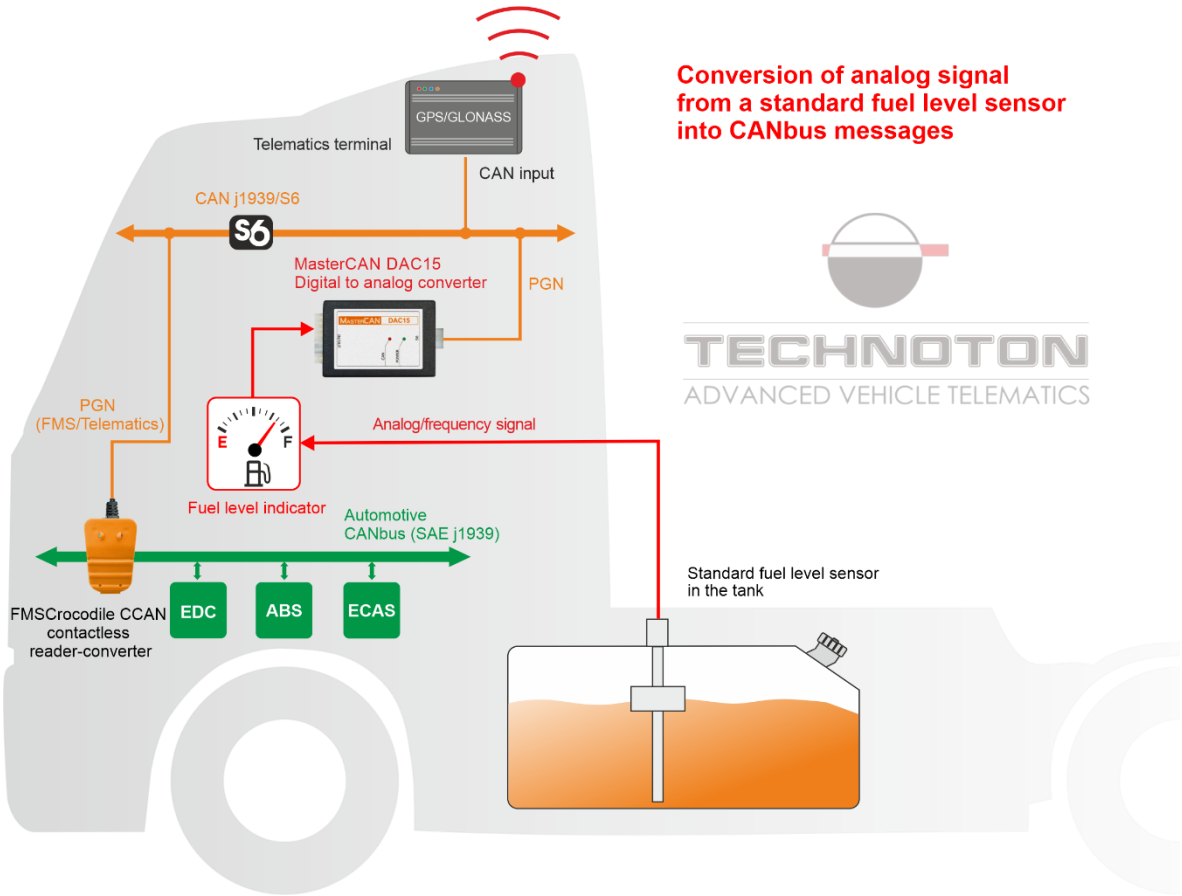


Figure 25 — Using MasterCAN DAC 15 for conversion of an analog signal from the Vehicle standard fuel level sensor into CAN j1939/S6 Telematics interface

To configure the converter of analog/frequency signal of a standard fuel level sensor into CAN-bus messages, perform the following actions:

1) Connect:

- power supply for MasterCAN DAC 15 to the Vehicle circuit (see 2.3.1);
- signal wires of a standard fuel level sensor to corresponding contacts of the analog input (connector **IN/OUT**, contacts group I1) MasterCAN DAC 15 (see 2.3.3);
- CAN j1939/S6 digital interface (connector **S6**) of MasterCAN DAC 15 to CAN j1939/S6 Telematics interface (see 2.3.2).

2) Using S6 SK service adapter connect MasterCAN DAC 15 to the PC. Establish a communication session between the Unit and PC in Service S6 MasterCAN service software (see 3.4).

3) Open **Collector DAC15 FM** submenu in settings of Service S6 MasterCAN software for physical input (see A.3):

- from the dropdown list **Physical Input Type** select the required type of signal (analog or frequency) that corresponds to the type of the output signal of the fuel level sensor;
- In the area **Output Data** from the dropdown list **PGN** select the output message of CAN-bus PGN 62982 (Filtered Fuel Level/Volume in Tank) that includes the parameter of fuel volume in the tank. From the dropdown list **SPN** select the parameter SPN 521024 (Fuel Tank Volume);
- Save the calibration table of the Vehicle fuel tank in the MasterCAN DAC 15 internal non-volatile memory (i.e. table of the analog/frequency signal correspondance of a standard fuel level sensor to the output SPN value). MasterCAN DAC 15 converts the current values of the analog/frequency signal, in accordance with points of the calibration table (maximum 10 points) of a standard fuel level sensor, into SPN.

IMPORTANT: The calibration table is created in the course of the **obligatory procedure of the fuel tank calibration** which consists of a succession of fill-up with fixed portions of fuel starting from the empty tank till the full state of the fuel tank. To measure the volume of fuel portions, it is necessary to use a measuring reservoir with inaccuracy not more than 0.25 %.
In the process of creating the calibration table in order to measure voltage/frequency values of the output signal of the fuel level sensor, use the verified multimeter/ frequency meter.

To perform the fuel tank calibration correctly, you should comply with the following requirements:

- the vehicle should not be loaded and stand on the flat horizontal surface;
- fuel tank should be empty;
- the vehicle wheels must be of standard size;
- the tire pressure should match with the prescribed for this vehicle;
- the vehicle should not move, ignition off, engine off;
- pause between fuel fillings by portions into the tank should be not less than 60 sec.

WARNING: In case the output signal of the standard fuel level sensor is sensitive to the impact of voltage fluctuations in the Vehicle circuit, enter the correcting coefficients to correct the fuel volume indication. The correcting coefficients are defined experimentally for each specific Vehicle.

5 Packaging

MasterCAN DAC converters delivery sets come in cardboard boxes of the following shape (figure 26).

a) MasterCAN DAC 15 *b) MasterCAN DAC 2113*

Figure 26 — Packaging MasterCAN DAC converter

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 27).

a) MasterCAN DAC 15 *b) MasterCAN DAC 2113*

Figure 27 — MasterCAN DAC converter packaging label

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

6 Storage

MasterCAN DAC converter is recommended to be stored in dry closed places.

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

Converter shelf life must not exceed 24 months.

7 Transportation

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

When transporting by air, 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 converter should be sealed.

8 Utilization/re-cycling

MasterCAN DAC 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.

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

Contacts

Manufacturer

Tel: +375 17 240-39-73

E-mail: sales@jv-technoton.com

Technical support

E-mail: support@jv-technoton.com

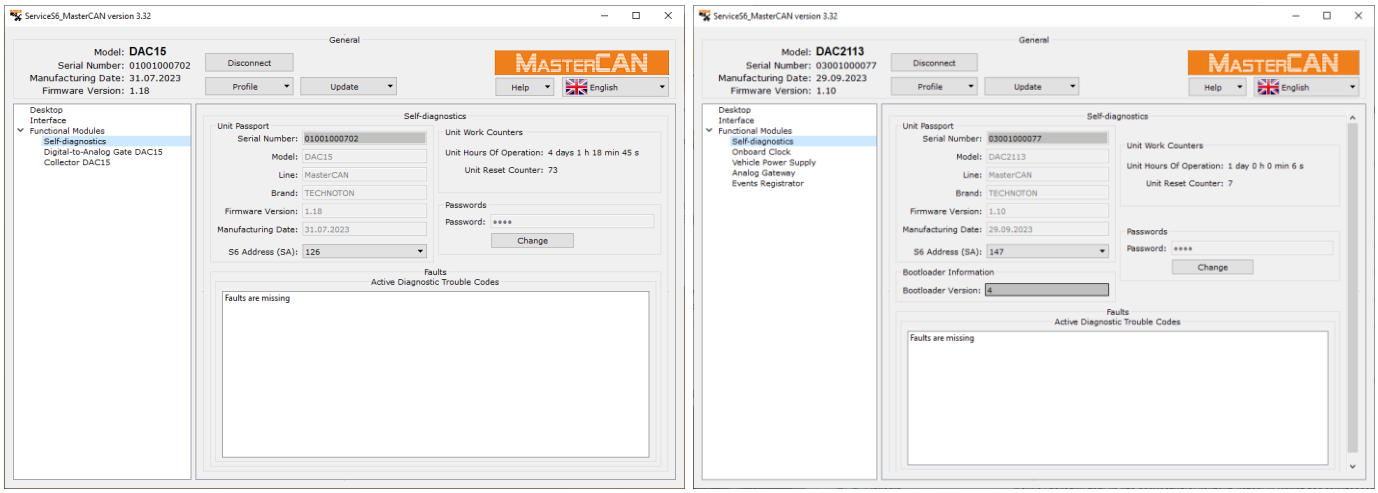
Annex A
SPN of MasterCAN DAC converters Functional modules

Conversion of signals, self-diagnostics, maintenance of Counters, configuration of Parameters are ensured by the coordinated operation of Functional modules (FM) of MasterCAN DAC converter.

The format of parameters (SPN) of FM MasterCAN DAC converter corresponds to S6 Database (S6 DB).

A.1 Self-diagnostics FM

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



a) for MasterCAN DAC 15 *b) for MasterCAN DAC 2113*

Figure A.1 — Example of the window of settings of Self-diagnostics FM in software Service S6 MasterCAN

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

SPN	Name	Factory value	Unit of measure	Clarification
Unit passport PGN 62995				
521120	Serial number	On the fact	No	Serial number is a set of numbers that is used for identification of specific Unit. Serial number MasterCAN DAC has the following format: AABBB C DDDDD, where: AA – code of converter model; BBB – digits that reflect changes product changes; C – Manufacturer code; DDDDD – sequential number. Setting is not available for editing.

SPN	Name	Factory value	Unit of measure	Clarification
521345	Model	On the fact	No	Model – this is version of the product inside of MasterCAN product line. Each model (MasterCAN DAC 15 or MasterCAN DAC 2113) has its own functional and constructive features. Setting is not available for editing.
521123	Line	MasterCAN	No	Name of the product line. The line represents a group of similar products – produced under general trademark MasterCAN. Setting is not available for editing.
521344	Brand	TECHNOTON	No	Name of MasterCAN DAC Manufacturer. Setting is not available for editing.
521121	Firmware version	On the fact	No	Version of built in Software MasterCAN DAC. Setting is not available for editing.
521125	Manufacturing date	On the fact	No	Date (day, month, year) of MasterCAN DAC production. Setting is not available for editing.
521188	S6 address (SA)	On the fact	No	Network MasterCAN DAC address at CAN j1939/S6 Telematics interface. Network address value can be selected by user in range: - 126 or 146 (for MasterCAN DAC 15); - 127 or 147 (for MasterCAN DAC 2113).
Unit Work Counters PGN 62994				
521116	Unit Hours Of Operation	On the fact	s	Counter of summarized working time of the MasterCAN DAC since its production moment. The user can not reset the value of this counter. It can be reset by the Manufacturer or Regional Service Center only.
521118	Number Of Unit Restarts	On the fact	pc.	Counter of MasterCAN DAC's processor restarts at a time when the power is On or there is an impact of conducted interferences of the vehicle's on-board network. Restarts accounting is carried out since production date of the MasterCAN DAC. The user can not reset the value of this counter. It can be reset by the Manufacturer or RSC only.
Passwords PGN 63017				
521593/3.3	Password/ 3.3 Installer	1111	No	Password is entered for user authorization while establishing connection session between MasterCAN DAC and service Software. Password is a specific combination of four digits. By default used: Login – 0, password – 1111. User can change password of the MasterCAN DAC. After entering and confirming the new password is recorded into internal memory of the MasterCAN DAC.
Active diagnostic trouble codes PGN 65226				
521044	Fault identifier (SID+FMI)	On the fact	No	List of current MasterCAN DAC malfunctions are displayed at the settings field (in case of its presence — up to 10). For each active malfunction is indicated following: - faulty nod; - malfunction name. This setting allows to monitor MasterCAN DAC working performance. In case of lack of active malfunctions the following message is displayed "No malfunctions".
Bootloader information* PGN 63009				
521122	Bootloader Version	On the fact	No	Displays the current version of the loader used for correct starting the inbuilt Unit software (firmware), as well as for the Unit firmware update.
* Valid only for MasterCAN DAC 2113 model.				

A.2 Digital-to-Analog Gate DAC15 FM

Digital-to-Analog Gate DAC15 FM* — is designed to receive digital messages (PGN) via CAN j1939/S6 interface, convert data (SPN) into selected analog signals (voltage, pulse, current, discrete/resistive) and transfer them into corresponding outputs.

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* This FM is valid only for MasterCAN DAC 15 model.

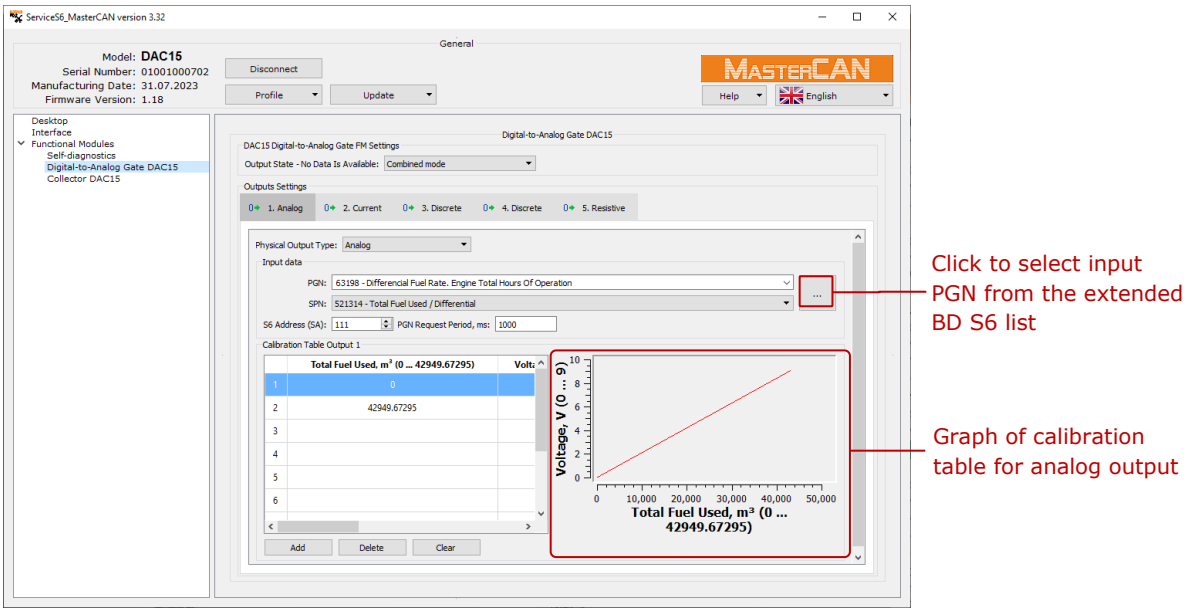

Figure A.2 — Example of the window of settings of Digital-to-Analog Gate DAC15 FM (for the analog output) in software Service S6 MasterCAN

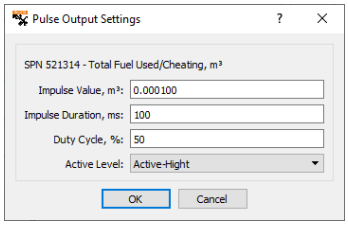

Figure A.3 —Example of the window for configuration of the pulse output

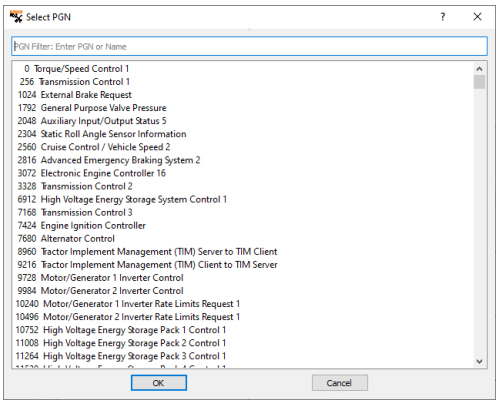

Figure A.4 — Example of the window for choosing input PGN

Table A.2 — Digital-to-Analog Gate DAC15 FM. Displayed and/or editable SPN with the help of Service S6 MasterCAN software

SPN	Name	Factory value*	Unit of measure	Data Range	Clarification
DAC15 Digital-to-Analog Gate FM Settings PGN 63552					
521761	Output State - No Data Is Available	2	No	0…3	Selecting status at the outputs, in case no incoming data (PGN) are received via CAN j1939/S6 interface: 0 — Output signal corresponds to the value of the first point in the calibration table. 1 — Output signal corresponds to the value of the last point of the calibration table. 2 — Combined mode — output signal changes from low to high value.
Outputs Settings PGN 63092 (contact group O1, see 2.3.4)					
521352	Output Number	No	No	0…255	Choosing Unit's contact group O1 of analog/frequency physical output.
521150	PGN	63198 Differencial Fuel Rate. Engine Total Hours Of Operation	No	0…65535	Specifying input data of PGN, from which SPN parameter should be chosen for analog/frequency signal conversion. PGN can be selected in Software from the priority list containing the most important Vehicle parameters or from extended list of S6 database.
1214	SPN	521314 Total Fuel Used	No	0…524287	Selecting SPN which should be converted to analog/frequency signal from the group of parameters of specified PGN.
521188	S6 Address (SA)	111	No	0…255	Specifying network address of Unit from which selected PGN is received. If SA is 255, selected PGN will be received from any Unit of CAN j1939/S6 Telematics interface (CAN bus).
521361	PGN Request Period	0	ms	0…4294967295	Specifying period for requesting PGN from CAN j1939/S6 Telematics interface (CAN bus). If PGN is sent automatically, period is not needed, select 0 ms.
Calibration Table Output 1 PGN 63093 (contact group O1, see 2.3.4)					
521430	Physical Output Type	Not supported	V (for analog/pulse) Hz (for frequency)	10…50 (for analog/pulse) 10…10000 (for frequency)	Selecting necessary type of physical output of signal – analog/ frequency/pulse. User can also turn off the output. In this case settings of the output will not be available for configuration.
521347	SPN Value	No	On the fact	0…4294967295	Specifying values of converted parameters of SPN for calibration table points. By default, the table contains two points corresponding to extreme values of range where SPN is changing. Maximum quantity of calibration points is 10. Software depicts a chart of output analog signal dependence on SPN values in correspondence with calibration table.
521348	Signal Output Value	No	On the fact	0…4294967295	Specifying voltage or frequency values for calibration table of output, resulted from conversion of corresponding SPN parameters values. By default, the table contains two points corresponding to extreme values of range where SPN is changing. Maximum quantity of calibration points is 10. Software depicts a chart of output analog signal dependence on SPN values in correspondence with calibration table.
Pulse Output Settings PGN 63210					
521274	Impulse Value	0.000100	m^3	0…4294967295	The volume of fuel that has passed the flow meter chamber and which corresponds to one its output pulse is specified. The pulse value is specified in the flow meter operation documentation.
521275	Impulse Duration	100	ms	0…64255	The value of the of the output pulse duration of the flow meter is specified. The pulse value is specified in the flow meter operation documentation.

SPN	Name	Factory value*	Unit of measure	Data Range	Clarification
521436	Duty Cycle	50	%	0…125	The output signal relative pulse duration value (i.e. ratio of the pulse-repetition interval to the pulse duration) of the flow meter is specified.
521276	Active Level	High	No	High/Low	Active level of output pulses based on which the flow meter calculates fuel consumption is selected.
Outputs Settings PGN 63092 (contact group O2, see see 2.3.4)					
521352	Output Number	No	No	0…255	Choosing Unit's contact group O2 of current physical output.
521150	PGN	No	No	0…65535	Specifying input data of PGN, from which SPN parameter should be chosen for current signal conversion. PGN can be selected in Software from the priority list containing the most important Vehicle parameters or from extended list of S6 database.
1214	SPN	No	No	0…524287	Selecting SPN which should be converted to current signal from the group of parameters of specified PGN.
521188	S6 Address (SA)	No	No	0…255	Specifying network address of Unit from which selected PGN is received. If SA is 255, selected PGN will be received from any Unit of CAN j1939/S6 Telematics interface (CAN bus).
521361	PGN Request Period	No	ms	0…4294967295	Specifying period for requesting PGN from CAN j1939/S6 Telematics interface (CAN bus). If PGN is sent automatically, period is not needed, select 0 ms.
Calibration Table Output 2 PGN 63094 (contact group O2, see 2.3.4)					
521430	Physical Output Type	Not supported	mA	4…20	Selecting type of physical output of signal – current. User can also turn off the output. In this case settings of the output will not be available for configuration.
521347	SPN Value	No	On the fact	0…4294967295	Specifying values of converted parameters of SPN for calibration table points. By default, the table contains two points corresponding to extreme values of range where SPN is changing. Maximum quantity of calibration points is 10. Software depicts a chart of output current signal dependence on SPN values in correspondence with calibration table.
521348	Signal Output Value	No	On the fact	0…4294967295	Specifying current value for calibration table of output, resulted from conversion of corresponding SPN parameters values. By default, the table contains two points corresponding to extreme values of range where SPN is changing. Maximum quantity of calibration points is 10. Software depicts a chart of output current signal dependence on SPN values in correspondence with calibration table.
Outputs Settings PGN 63092 (contact group O3, see 2.3.4)					
521352	Output Number	No	No	0…255	Choosing Unit's contact group O3 of discrete physical output.
521150	PGN	No	No	0…65535	Specifying input data of PGN, from which SPN parameter should be chosen for discrete signal conversion. PGN can be selected in Software from the priority list containing the most important Vehicle parameters or from extended list of S6 database.
1214	SPN	No	No	0…524287	Selecting SPN which should be converted to discrete signal from the group of parameters of specified PGN.
521188	S6 Address (SA)	No	No	0…255	Specifying network address of Unit from which selected PGN is received. If SA is 255, selected PGN will be received from any Unit of CAN j1939/S6 Telematics interface (CAN bus).
521361	PGN Request Period	No	ms	0…4294967295	Specifying period for requesting PGN from CAN j1939/S6 Telematics interface (CAN bus). If PGN is sent automatically, no request is required, select a period of 0 ms.

SPN	Name	Factory value*	Unit of measure	Data Range	Clarification
Calibration Table Output 3 PGN 63095 (contact group O3, see 2.3.4)					
521430	Physical Output Type	Not supported	No	"0" – 0 V, "1"– voltage of vehicle power supply source	Selecting type of physical output of signal – discrete. User can also turn off the output. In this case settings of the output will not be available for configuration.
521347	SPN Value	No	On the fact	0…4294967295	Specifying "0" and "1" values of discrete signal for points of calibration table of output resulted from conversion of corresponding values of SPN parameters. By default, the table contains "0" and "1" points corresponding to extreme values of range where SPN is changing. Software depicts a chart of output discrete signal dependence on SPN values in correspondence with calibration table.
521348	Signal Output Value	No	On the fact	0…4294967295	Specifying discrete value for calibration table of output, resulted from conversion of corresponding SPN parameters values. By default, the table contains two points corresponding to extreme values of range where SPN is changing ("0" and "1"). Software depicts a chart of output discrete signal dependence on SPN values in correspondence with calibration table.
Outputs Settings PGN 63092 (contact group O4, see 2.3.4)					
521352	Output Number	No	No	0…255	Choosing Unit's contact group O4 of discrete physical output.
521150	PGN	65276 Dash Display	No	0…65535	Specifying input data of PGN, from which SPN parameter should be chosen for discrete signal conversion. PGN can be selected in Software from the priority list containing the most important Vehicle parameters or from extended list of S6 database.
1214	SPN	96 Fuel Level 1	No	0…524287	Selecting SPN which should be converted to discrete signal from the group of parameters of specified PGN.
521188	S6 Address (SA)	101	No	0…255	Specifying network address of Unit from which selected PGN is received. If SA is 255, selected PGN will be received from any Unit of CAN j1939/S6 Telematics interface (CAN bus).
521361	PGN Request Period	0	ms	0…4294967295	Specifying period for requesting PGN from CAN j1939/S6 Telematics interface (CAN bus). If PGN is sent automatically, no request is required, select a period of 0 ms.
Calibration Table Output 4 PGN 63096 (contact group O4, see 2.3.4)					
521430	Physical Output Type	Discrete	No	"0" – 0 V, "1"– voltage of vehicle power supply source	Selecting type of physical output of signal – discrete. User can also turn off the output. In this case settings of the output will not be available for configuration.
521347	SPN Value	0; 12 %	On the fact	0…4294967295	Specifying "0" and "1" values of discrete signal for points of calibration table of output resulted from conversion of corresponding values of SPN parameters. By default, the table contains "0" and "1" points corresponding to extreme values of range where SPN is changing. Software depicts a chart of output discrete signal dependence on SPN values in correspondence with calibration table.
521348	Signal Output Value	"0";"1"	On the fact	0…4294967295	Specifying discrete value for calibration table of output, resulted from conversion of corresponding SPN parameters values. By default, the table contains two points corresponding to extreme values of range where SPN is changing ("0" and "1"). Software depicts a chart of output discrete signal dependence on SPN values in correspondence with calibration table.

SPN	Name	Factory value*	Unit of measure	Data Range	Clarification
Outputs Settings PGN 63092 (contact group O5, see 2.3.4)					
521352	Output Number	No	No	0…255	Choosing Unit's contact group O5 of resistive physical output.
521150	PGN	No	No	0…65535	Specifying input data of PGN, from which SPN parameter should be chosen for resistive signal conversion. PGN can be selected in Software from the priority list containing the most important Vehicle parameters or from extended list of S6 database.
1214	SPN	No	No	0…524287	Selecting SPN which should be converted to resistive signal from the group of parameters of specified PGN.
521188	S6 Address (SA)	No	No	0…255	Specifying network address of Unit from which selected PGN is received. If SA is 255, selected PGN will be received from any Unit of CAN j1939/S6 Telematics interface (CAN bus).
521361	PGN Request Period	No	ms	0…4294967295	Specifying period for requesting PGN from CAN j1939/S6 Telematics interface (CAN bus). If PGN is sent automatically, no request is required, select a period of 0 ms.
Calibration Table Output 5 PGN 63097 (contact group O5, see 2.3.4)					
521430	Physical Output Type	Not supported	Ohm	15…50000	Selecting type of physical output of signal – resistive. User can also turn off the output. In this case settings of the output will not be available for configuration.
521347	SPN Value	No	On the fact	0…4294967295	Specifying values of converted parameters of SPN for calibration table points. By default, the table contains two points corresponding to extreme values of range where SPN is changing. Maximum quantity of calibration points is 10. Software depicts a chart of output resistive signal dependence on SPN values in correspondence with calibration table.
521348	Signal Output Value	No	On the fact	0…4294967295	Specifying resistive value for calibration table of output, resulted from conversion of corresponding SPN parameters values. By default, the table contains two points corresponding to extreme values of range where SPN is changing. Maximum quantity of calibration points is 10. Software depicts a chart of output resistive signal dependence on SPN values in correspondence with calibration table.
* Factory values may differ from values presented here.					

A.3 Collector DAC15 FM

Collector DAC15 FM* — is designed to receive the analog signal, its conversion into digital values of SPN parameters and their transfer into CAN j1939/S6 Telematics interface.

* This FM is valid only for MasterCAN DAC 15 model.

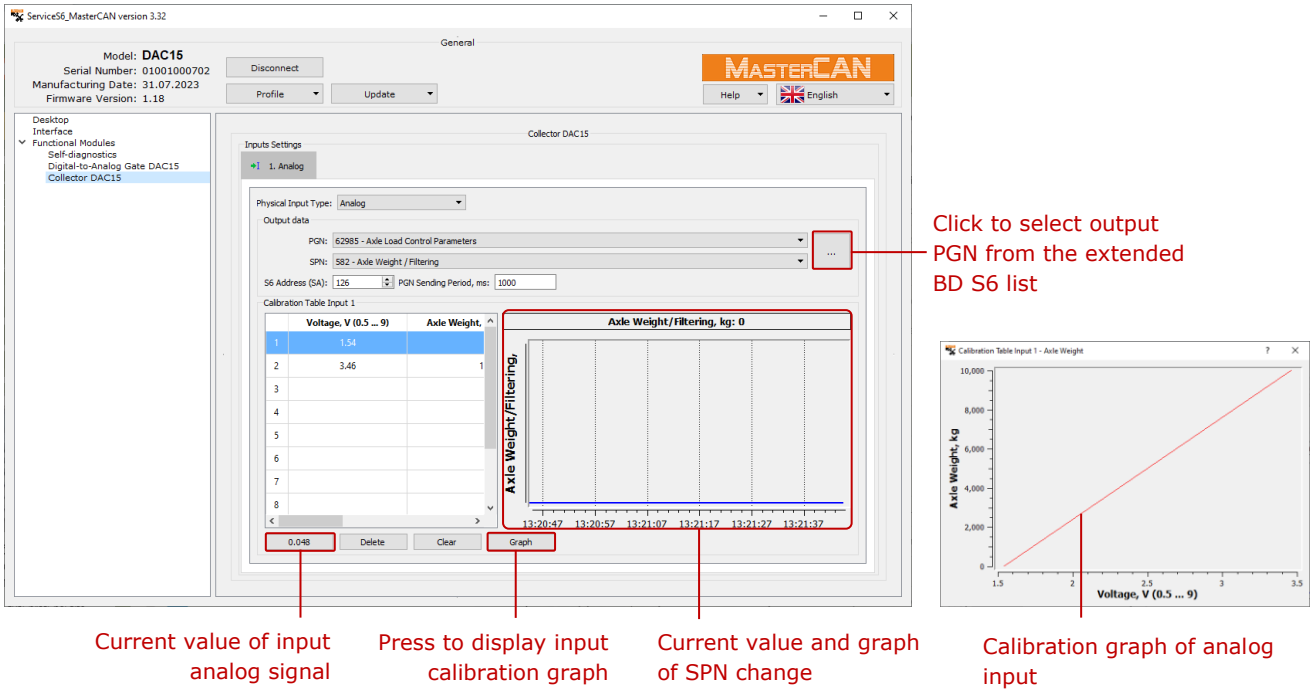

Figure A.5 — Example of the window of settings of Collector DAC15 FM (for the analog input) in software Service S6 MasterCAN

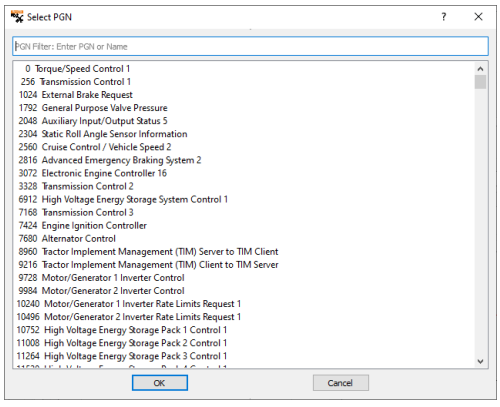

Figure A.6 — Example of the window for choosing output PGN

Table A.3 — Collector DAC15 FM. Displayed and/or editable SPN with the help of Service S6 MasterCAN software

SPN	Name	Factory value*	Unit of measure	Data Range	Clarification
Input Settings PGN 63100 (contact group I1, see 2.3.3)					
521364	Input Number	No	No	0…255	Choosing Unit's contact group I1 of resistive physical input.
521150	PGN	62985 Axle Load Control Parameters	No	0…65535	Specifying output PGN which should include SPN converted from analog or frequency signal. PGN can be selected in Software from the priority list containing the most important Vehicle parameters or from extended list of S6 database.
1214	SPN	582 Axle weight/ Rear Axle	No	0…524287	Selecting SPN, which should be converted from analog or frequency signal.
521188	S6 Address (SA)	126	No	0…255	Specifying SA network address of Unit (MasterCAN DAC 15 digital-analog converter) included in CAN j1939/S6 Telematics interface.
521362	PGN Sending Period	1000	ms	0…4294967295	Specifying time period (ms) of composed PGN transmission to CAN j1939/S6 Telematics interface. For PGN transmitted on request, time period 0ms should be selected.
Calibration Table Input 1 PGN 63101 (contact group I1, see 2.3.3					
521365	Physical Input Type	Analog	V (for analog) Hz (for frequency)	10…50 (for analog) 10…10000 (for frequency)	Selecting necessary type of physical intput of signal – analog or frequency. User can also turn off the output. In this case settings of the output will not be available for configuration.
521366	Signal Input Value	1.54; 3.46 V	On the fact	0…4294967295	Specifying values of analog or frequency input signal for point of calibration table. By default, the table contains two points corresponding to extreme values of range where SPN is changing. Maximum quantity of calibration points is 10. Software depicts the chart of converted parameters of SPN values dependence on values of input signal in correspondence with calibration table.
521347	SPN Value	0; 10000 kg	On the fact	0…4294967295	Specifying values of converted SPN for points of calibration table. By default, the table contains two points corresponding to extreme values of range where SPN is changing. Maximum quantity of calibration points is 10. Software depicts a chart of output analog signal dependence on SPN values in correspondence with calibration table.
* Factory values may differ from values presented here.					

A.4 Onboard Clock FM

Onboard clock FM*— designed for generation of signals of time and its transmission to other Functional modules of converter.

* This FM is valid only for MasterCAN DAC 2113 model.

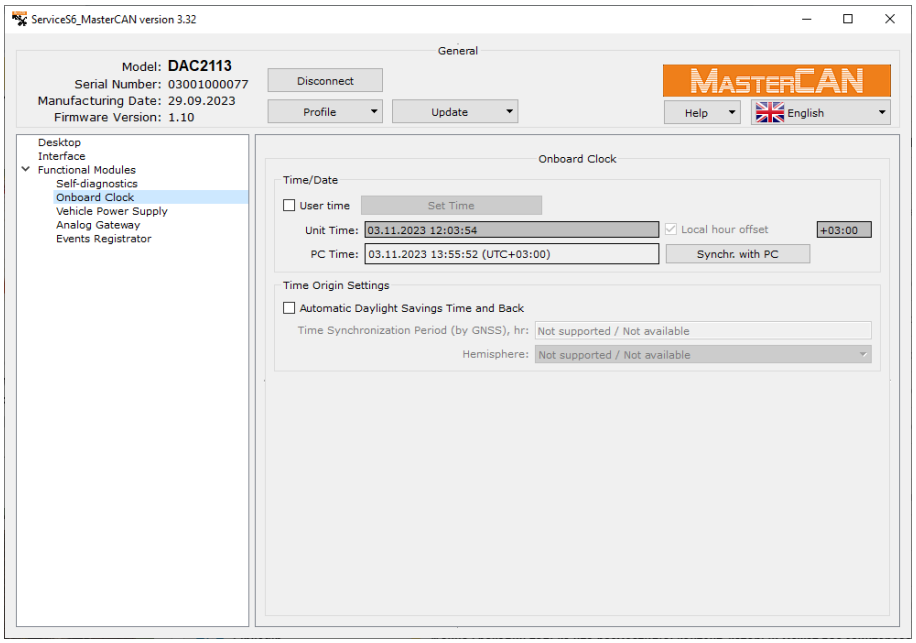

Figure A.7 — Example of the window of settings of Onboard Clock in software Service S6 MasterCAN

Table A.4 — Onboard Clock FM. SPNs, displayed and/or editable in Service S6 MasterCAN software

SPN	Name	Factory value	Unit of measure	Range	Clarification
Time/Date PGN 65254					
959	Seconds	On the fact	s	0…62.5	Present time — seconds.
960	Minutes	On the fact	Min	0…250	Present time — minutes.
961	Hours	On the fact	h	0…250	Present time — hours.
963	Month	On the fact	month	0…250	Present date — month.
962	Day	On the fact	d	0…62.5	Present date — day.
964	Year	On the fact	year	1985…2235	Present date — year.
1601	Local minute offset	0	min	0…59	Time displacement (in minutes) in relation to Coordinated Universal Time that matches with local time (Time zone). It is activated and available for editing when configuring present time manually and when synchronizing time with PC
1602	Local hour offset	+3	h	-24…+24	Time displacement (in hours) in relation to Coordinated Universal Time that matches with local time (Time zone). It is activated and available for editing when configuring present time manually and when synchronizing time with PC
Time Origin Settings PGN 63011					
521350	Automatic Daylight Savings Time and Back	Off	No	On/Off	Enabling/disabling of automatic present time switching to winter/summer.

Used during Events registration. Present time is available for user for editing manually or synchronizing of date/time with computer clock. By default, time is set in UTC format (Coordinated Universal Time standard) and displayed according to local displacement.

A.5 Vehicle Power Supply FM

Vehicle Power Supply FM*— is designed for monitoring: the onboard circuit operational status and its voltage, current onboard circuit mode, fuel consumer (Vehicle) operation time in different modes of the onboard circuit operation, starter operation time, allowed time for uninterrupted period of the the starter operation**.

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* This FM is valid only for MasterCAN DAC 2113 model.

** In the process of preparation for introduction.

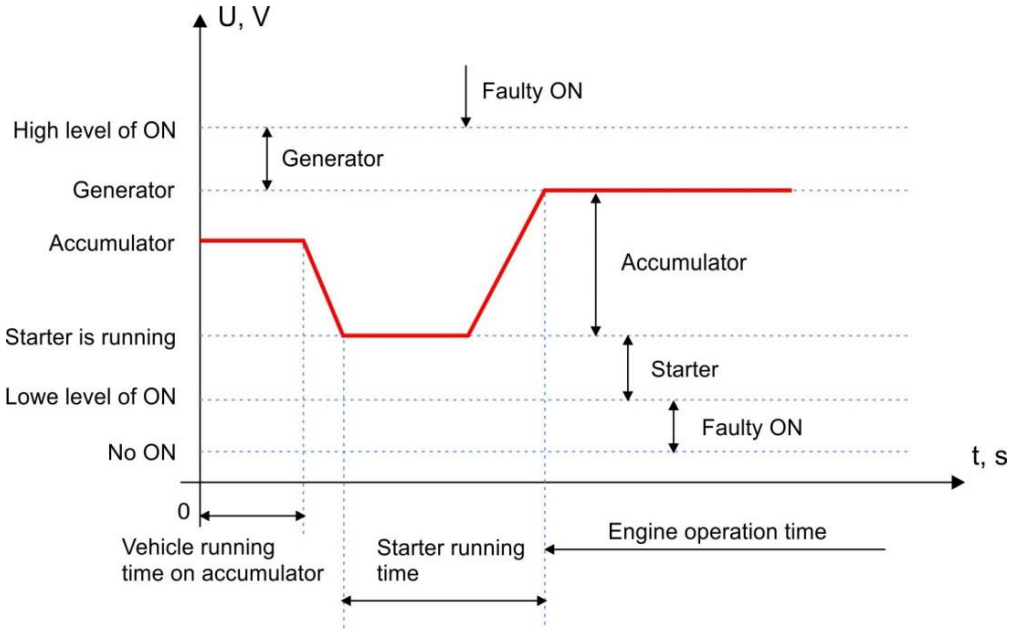

Figure A.8 — Operation modes on onboard network (ON) voltage level

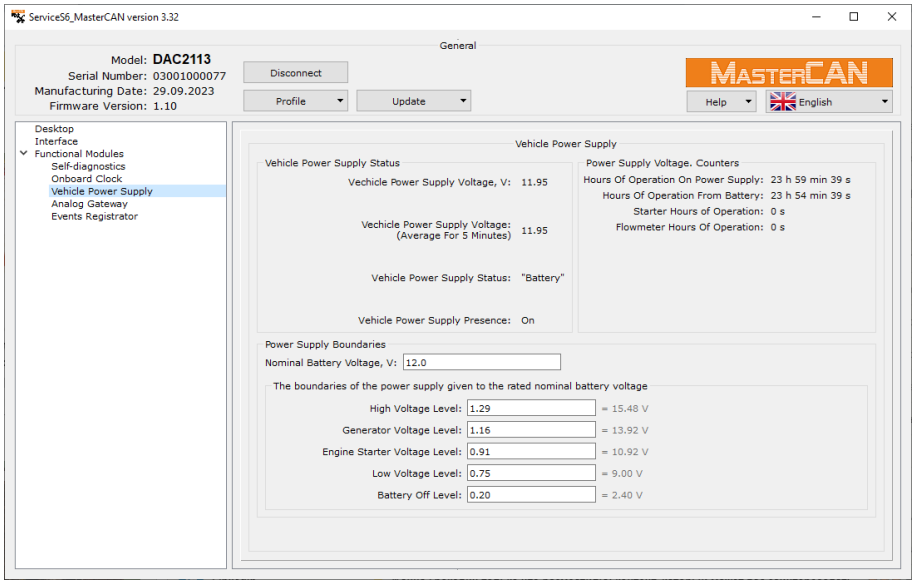

Figure A.9 — Example of the window of settings of Vehicle Power Supply FM in Service S6 MasterCAN software

Table A.5 — Vehicle power supply FM.
SPNs, displayed and/or editable in Service S6 MasterCAN software

SPN	Name	Factory value	Unit of measure	Range	Clarification
Vehicle Power Supply Status PGN 63089					
521055	Vehicle Power Supply Voltage	On the fact	V	0…3212.75	Shows current value of ON voltage.
521055/2.9	Vehicle Power Supply Voltage/ 2.9 Average For 5 Minutes	On the fact	V	0…3212.75	Shows average value of ON voltage within previous 5 minutes.
521056	Vehicle Power Supply Status	On the fact	No	Off/ Lowe level/ Accumulator/ Starter/ Generator/ High level	Shows current mode of ON in accordance with user-defined borders of ON voltage levels of Vehicle (see figures A.8 and A.9).
521076	Vehicle Power Supply Presence	On the fact	No	On/Off	Displays the current state of the board (On/Off) in accordance with the user-set voltage level of the system trip (see figures A.8 and A.9).
Power Supply Boundaries PGN 63067					
521075	Nominal Battery Voltage	12	V	0…60	Field for entering a nominal value of accumulator voltage of Vehicle (U_{nom}=12V/24V) (see figures A.8 and A.9).
521063	High Voltage Level	1.29	-	0…1.99	Field for entering value of high voltage level of onboard network (1.29•U_{nom}) (see figures A.8 and A.9). Entered value of voltage is used as a threshold for recording "Faulty ON" Event.
521064	Generator Voltage Level	1.16	-	0…1.99	Field for entering value of voltage level of generator, i.e. when engine of Vehicle is running (1.16•U_{nom}) (see figures A.8 and A.9).
521065	Engine Starter Voltage Level	0.91	-	0…1.99	Field for entering value of voltage level starter is running, i.i when Vehicle's engine is starting (0.91•U_{nom}) (see figures A.8 and A.9).
521067	Low Voltage Level	0.75	-	0…1.99	Field for entering value of low voltage level of ON (0.75•U_{nom}). Entered value of voltage is used as a threshold for recording "Faulty ON" Event (see figures A.8 and A.9).
521068	Battery Off Level	0.20	-	0…1.99	Field for entering value of voltage level when ON switches off (0.20•U_{nom}) (see figures A.8 and A.9).
521074*	Engine Starter Continuous Working Time Limit	30	s	5…30	Field for entering value of starter's permissible time of continuous operation, above which the starter may fail (see figures A.8 and A.9). Entered value is used as a threshold for recording "Exceeding permissible time of continuous operation of starter" Event.
Power Supply Voltage. Counters PGN 62976					
521173	Hours Of Operation On Power Supply	On the fact	s	0…4211081215	Counter of total time of Unit operation from onboard circuit from the moment it was mounted on the object**.
521172	Hours Of Operation From Battery	On the fact	s	0…4211081215	Counter of total time of Unit operation from the battery from the moment it was mounted on the object**.
521170	Starter Hours of Operation	On the fact	s	0…4211081215	Counter of total time of starter operation from the moment the Unit was mounted on the object**.
521171	Flowmeter Hours Of Operation	On the fact	s	0…4211081215	Counter of total time of engine (fuel consumer) operation from the moment the Unit was mounted on the object**.

* In the process of preparation for introduction.
** User don't can himself reset the Counter. Counter can be reset by the Manufacturer or Regional Service Center only.

A.6 Analog Gateway FM

Analog Gateway FM* is designed for conversion of signals of the Unit inputs/outputs, in accordance with user settings:

- for inputs: analog signals are received, converted into digital data (SPN) and transferred to CAN j1939/S6 Telematics interface;
- for outputs: digital data (PGN), are received via CAN j1939/S6 Telematics service, SPN are converted into various types of analog signals (voltage, frequency, current, discrete, resistive) and transferred to the respective physical outputs of the Unit.

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* This FM is valid only for MasterCAN DAC 2113 model.

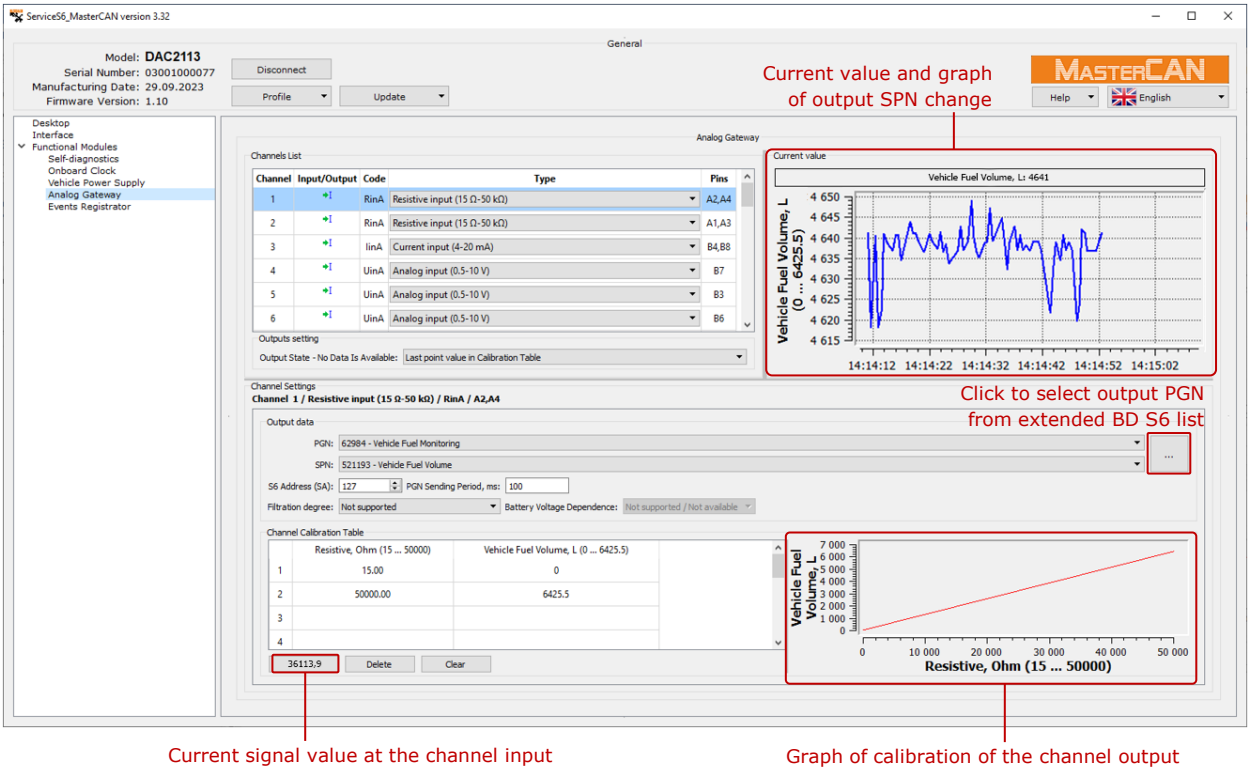


Figure A.10 — Example of the window of settings of Analog Gateway FM in software Service S6 MasterCAN

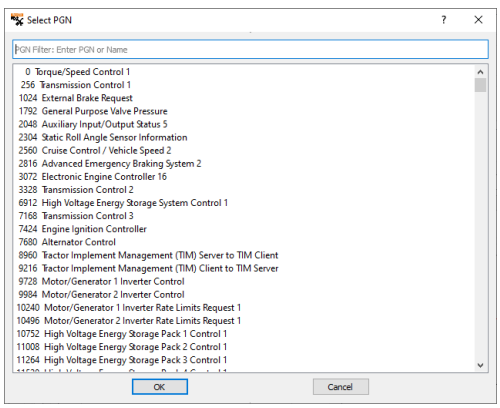


Figure A.11 — Example of the window for choosing input/output PGN

Table A.6 — Analog Gateway FM.
SPNs, displayed and/or editable in Service S6 MasterCAN software

SPN	Name	Factory value	Unit of measure	Range	Clarification
Channels List PGN 63175					
521355	Array Elements Count	No	pcs.	0…34	Total number of adjustable channels for MasterCAN DAC 2113. MasterCAN DAC 2113 has 34 channels altogether (of them 21 input channels, 13 output channels.)
521371	Channel Number	No	No	1…34	Select the number of the MasterCAN DAC 2113 channel which is to be configured from the list of channels of the Unit. Each channel number has its specifications: 1) channel physical design ("input/output"): - channels numbered from 1 to 21 are physical inputs (designated); - channels numbered from 22 to 34 are physical outputs (designated). 2) Input/output connector and numbers of contacts for electrical connection.
521372	Channels Type	On the fact	On the fact	0…4294967295	Select the type of channel corresponding to the physical value of the signal which being converted, from the dropdown list. In case you need to to disable the channel, select "Not supported". Depending on the channel type selected, the service software automatically assigns it a designation - the mnemonic code which consists of letter characters: 1) Channel physical type - DL – discrete, active level – "0"; - DH – discrete, active level – "1"; - I – current; - R – resistive; - F – frequency; - U – voltage. 2) Channel physical design - in – input; - out –output. 3) Sequence number of channels (A or B) of the same physical type. The mnemonic codes of MasterCAN DAC 2113 are provided in annex B.
521373	Connector Name	On the fact	No	A/B/C/D	Letter designation of the Unit connector for electrical connection to the channel which is being configured (see 2.3.3, tables 11 and 2.3.4, table 14).
521374	Pin 1	On the fact	No	0…255	Designation of the Unit contact number connector for connection to the channel which is being configured (see 2.3.3, tables 11 and 2.3.4, table 14).
521375	Pin 2	On the fact	No	0…255	Designation of the contact second number (in case two contacts are used for the channel) connector for connection to the Unit channel which is being configured (see 2.3.3, tables 11 and 2.3.4, table 14).
DAC15 Digital-to-Analog Gate FM Settings (Outputs Settings) PGN 63552					
521761	Output State - No Data Is Available	2	No	0…3	Selecting status at the outputs, in case no incoming data (PGN) are received via CAN j1939/S6 interface: 0 — Output signal corresponds to the value of the first point in the calibration table. 1 — Output signal corresponds to the value of the last point of the calibration table. 2 — Combined mode — output signal changes from low to high value.
Channel Settings PGN 63176					
521371	Channel Number	No	No	1…34	The number of the Unit channel which is being configured is displayed (see PGN 63175).
521376	Channel Type	On the fact	On the fact	0…255	The current type of the Unit channel which is being configured is displayed (see PGN 63175).

SPN	Name	Factory value	Unit of measure	Range	Clarification
521150	PGN	On the fact	On the fact	0…65535	During the configuration of input channels the output PGN comprising SPN parameter which is converted from the input analog signal is entered. For correct operation of MasterCAN DAC 2113, it is not recommended to assign different SPN from one PGN to different inputs of the Unit. During the configuration of the output channels the input data (PGN) is entered from which the SPN parameter is to be selected for its conversion into the analog signal. PGN may be selected in the service software from the priority list containing the Vehicle most important parameters or from the extended list of S6 Database.
1214	SPN	On the fact	On the fact	0…524287	During the configuration of input channels SPN which is to be converted from the analog signal is selected. During the configuration of output channels SPN is selected from the group of parameters of the PGN specified which is to be converted to the analog signal.
521188	S6 address (SA)	147	No	0…255	During the configuration of input channels MasterCAN DAC 2113 network address (127 or 147) should be entered. During the configuration of output channels the network address of the Unit from which the selected PGN is transmitted should be selected. If the network address is 255, the selected PGN will be received from any of S6 Units (of CAN-bus).
521378	Filtration degree	Not supported	No	Low/ Middle/ High/ Not supported	This setting enables to define the required average time interval for values of the input analog signal of MasterCAN DAC 2113. This setting is available only for input channels.
521379	Battery Voltage Dependence	Not supported	No	On/Off	This setting enables to exclude any dependence of MasterCAN DAC 2113 input analog signal on the voltage fluctuations in the Vehicle circuit. This setting is available only for input analog channels (UinA).
Channel Calibration Table PGN 63177					
521371	Channel Number	No	No	1…34	The number of the Unit channel which is configured is displayed (see PGN 63175).
521355	Array Elements Count	2	pc.	1…10	The number of points of the calibration table created during the channel configuration. The maximum number of calibration points – no less than 15.
521347	SPN Value	On the fact	On the fact	0…4294967295	During the configuration of the input channels values of the converted parameter (SPN) are entered for points of the input calibration table. By default, the table contains two points corresponding to the limit values of the SPN range of changing values. You may enter 10 calibration points at a maximum. The software displays the diagram of dependence of the converted SPN parameter values on values of the input signal, in accordance with the calibration table. During the configuration of the output channels values of SPN parameter which is being converted are entered for points of the output calibration table. By default, the table contains two points corresponding to the limit values of SPN range of changing values. You may enter 10 calibration points at a maximum. The software displays the diagram of dependence of the output analog signal on SPN values, in accordance with the calibration table.

SPN	Name	Factory value	Unit of measure	Range	Clarification
521377	Signal Value	On the fact	On the fact	0…4294967295	During the configuration of the input channels values of the input analog signal are entered to create points of the input calibration table. By default, the table contains two points corresponding to the limit values of the SPN range of changing values. You may enter 10 calibration points at a maximum. The software displays the diagram of dependence of the converted SPN parameter on values of the input analog signal, in accordance with the calibration table. During the configuration of the output channels values of the output analog signal are entered to create points of the output calibration table. They are obtained from the conversion of corresponding values of SPN parameter. By default, the table contains two points of the analog signal values corresponding to the limit values of the SPN range of changing values. You may enter 10 calibration points at a maximum. The software displays the diagram of dependence of the output signal on SPN values, in accordance with the calibration table.

A.7 Events Registrator FM

Events Registrator FM* — designed for registration of 15 important and 15 informative latest Events.

* This FM is valid only for MasterCAN DAC 2113 model.

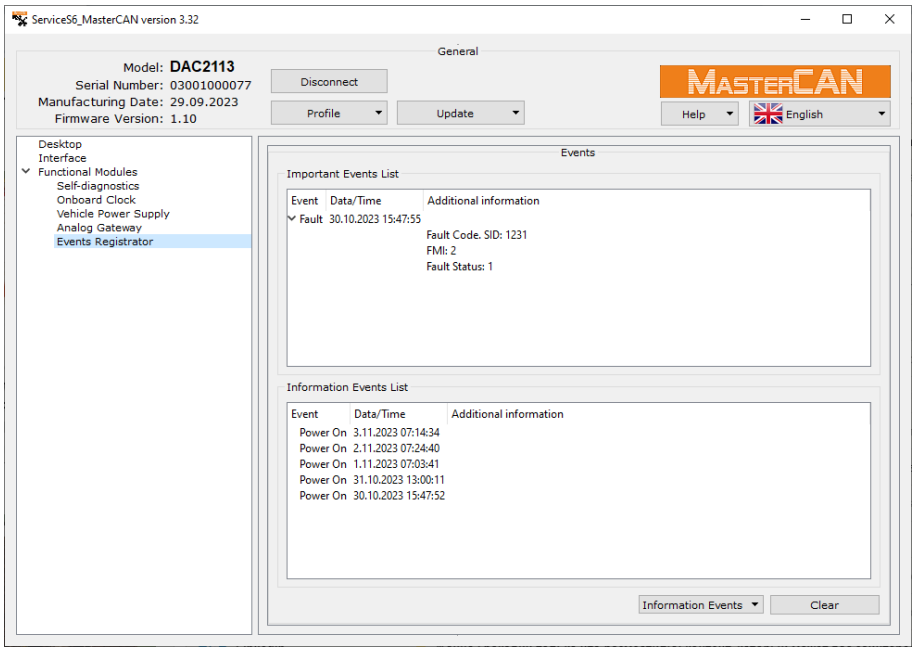


Figure A.12 — Example of the window of settings of Events Registrator FM in software Service S6 MasterCAN

Table A.7 — Events Registrator FM. SPNs, displayed and/or editable in Service S6 MasterCAN software

SPN	Name	Factory value	Unit of measure	Clarification
Important Events List PGN 63055				
521166	Event SPN	No	No	Displays the list of important Events (up to 15 Events). Such Events as, for example, malfunction of the onboard circuit are considered important (including the specification of voltage value).
Information Events List PGN 63056				
521166	Event SPN	No	No	A list of information Events is displayed (up to 15 Events). Such Events as, for example, the Unit power supply ON and OFF are considered information Events.
Notes 1 For each Event, are specified: designation, date/time of occurrence, as well as additional information (if any). 2 Events are displayed in their chronological sequence, starting from the latest. As soon as the maximum possible number of Events is reached, new Events overwrite the earliest deleted Events. 3 A user can clear the list of information Events, but cannot clear the list of important Events.				

Detailed parameters description (SPN), structure and content of messages (PGN) of FM MasterCAN DAC converter are placed at the following web site https://s6.jv-technoton.com/ (to access S6 DB registration is required).

Annex B
Channels for configuration of MasterCAN DAC 2113

Table B.1 — Channels for configuration of MasterCAN DAC 2113

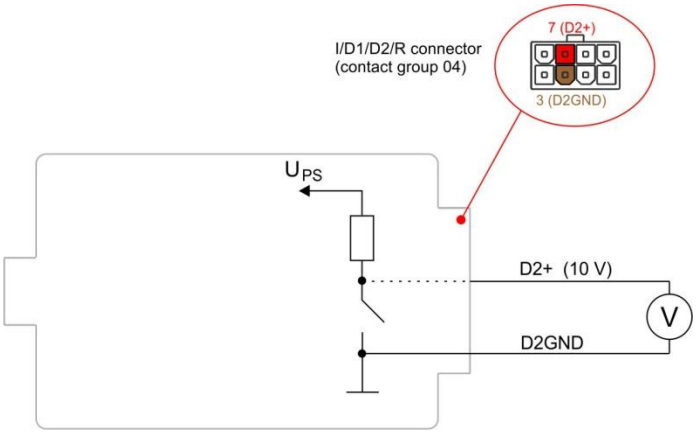
Channel Type	Mnemocode	Specifications
Discrete Input (<10 % U_{PS})	DLinA	Active level of input signal (0…10 % U_{PS})– logical zero, U_{max}=48 V, I≤0.12 mA
Discrete Input (>10 % U_{PS})	DHinA	Active level of input signal (10 % U_{PS} … U_{PS}) – logical one, R_{in} =110 kOhm, U_{max}=48 V
Current Input (4…20 mA)	IinA	Working range (4…20) mA, conversion error no more than 3 %, I_{max}=120 mA, R_{in}=158±4 kOhm, U_{max}=48 V
Analog Input (0.5…10 V)	UinA	Working range (0.5 … 10) V, conversion error no more than 3 %, R_{in}=140 kOhm, U_{max}=48 V
Resistive Input (15 Ohm…50 kOhm)	RinA	Working range (15 Ohm … 50 kOhm), conversion error no more than 3 %, power of impact no more than 0.05 Wt, U_{out_max}=5 V
Frequency Input (10 Hz…10 kHz), active level "Low"	FinA	Working range (10 Hz … 10 kHz), conversion error no more than 5 %, active level "Low" (0…10 % U_{PS}), I≤0.1 mA, U_{max}=48 V
Frequency Input (10 Hz…10 kHz) active level "High"	FinB	Working range (10 Hz … 10 kHz), conversion error no more than 5 %, active level "High" (10 % U_{PS} … U_{PS}), R_{in}≥6.6 kOhm, I≤0.1 mA, U_{max}=48 V
Discrete Output of upper branch (active U_{PS}, max.current 0.5 A)	DHoutA	Switching U_{PS} to output, pull-down resistor (10 kOhm), high level: (0.8…1) U_{PS} (one) when "1" is supplied, low level (0…0.05) U_{PS} when "0" is supplied, I_{out}≤0.5 A
Discrete Output of lower branch (active GND, max.current 0.5 A)	DLoutA	Switching GND to output, pull-up resistor (10 kOhm), high level: (0.8…1) U_{PS} (one) when "0" is supplied, low level (0…0.05) U_{PS} when "1" is supplied, I_{out}≤0.5 A, U_{max_load}=48 V
Current Output (4…20 mA)	IoutA	Output current (load on GND), working range (4…20) mA, Working range R_{load_max}=1.5 kOhm, U_{max}=40 V

Channel Type	Mnemocode	Specifications
Analog Output (0.5…10 V)	UoutA	Working range (0.5…10) V, conversion error no more than 2 %, I_{out}≤50 mA, U_{max}=12 V
Resistive Output (15 Ohm…50 kOhm)	RoutA	Working range (15 Ohm…50 kOhm) related to GND, conversion error no more than 5 %, P_{max}=2 Wt
Frequency Output (10 Hz…10 kHz, 3.3 V)	FoutA	Working range (10 Hz…10 kHz), conversion error no more than 5 %, amplitude 3.3 V, R_{out}=3.3 kOhm
Frequency Output (10 Hz …10 kHz, 5 V)	FoutB	Working range (10 Hz…10 kHz), conversion error no more than 5 %, amplitude 5 V, R_{out}=3.3 kOhm
Frequency Output (10 Hz …10 kHz, 8 V)	FoutC	Working range (10 Hz…10 kHz), conversion error no more than 5 %, amplitude adjustable 8 V, R_{out}=3.3 kOhm
Frequency Output (10 Hz...10 kHz, U_{PS})	FoutD	Working range (10 Hz…10 kHz), conversion error no more than 5 %, amplitude (0.8…1) U_{PS}, R_{out}=3.3 kOhm

Annex C
Connection diagrams for discrete output D2+ of MasterCAN DAC 15

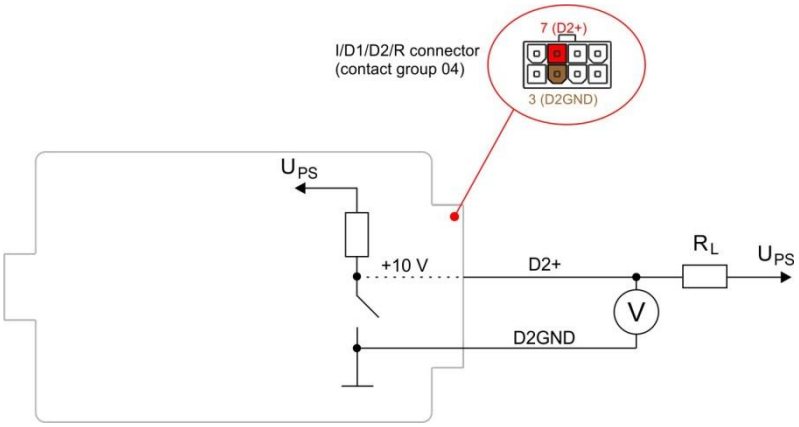
Discrete output D2+ is an inverted output. In case of using this output as signal output, the high voltage level is 10V (see figure C.1).

In case of connection of active load to descrete output D2+, the high voltage level is equal to U_{PS} (see figure C.2).



U_{PS} — Vehicle onboard circuit;
High level 10 V (0 or 1);
Low level 0 V (0 or 1).

Figure C.1 — Connection diagram of D2+ discrete output used as signal output



R_L — active load;
U_{PS} — Vehicle onboard circuit voltage;
High level U_{PS} (0 or 1);
Low level 0 V (0 or 1).

Figure C.2 — Connection diagram of D2+ discrete output connection to active load

Annex D
Converter firmware upgrade

WARNING: MasterCAN DAC 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 the converter to the PC by means of S6 SK service adapter (see 3.2).

ATTENTION: When re-uploading firmware, power supply voltage of converter should not drop out of 9…45 V range.

2) After the authorization (see 3.4), press Unit firmware button in Update dropdown menu of Service S6 MasterCAN software.

3) Choose the firmware file **(*.blf3)**, of the appropriate converter model on the PC disc or on removable media.

4) Press Open button, that will start firmware file downloading into converter memory.

After firmware file integrity and compatibility check by Service S6 MasterCAN software window of firmware uploading into converter memory will appear. In case of any errors the Software will send warning message. To cancel firmware upgrade it is needed to press Stop button.

ATTENTION: Before the end of the update process and automatic Service S6 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.

Service S6 MasterCAN software will display appropriate message and automatically will disconnect converter from PC in case the update is successful. Converter is ready for further operation. Software will display a new firmware version with the next connection session between PC and converter.

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

Annex E
Videography

Useful Technoton videos are on the YouTube channel which is regularly updated:


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