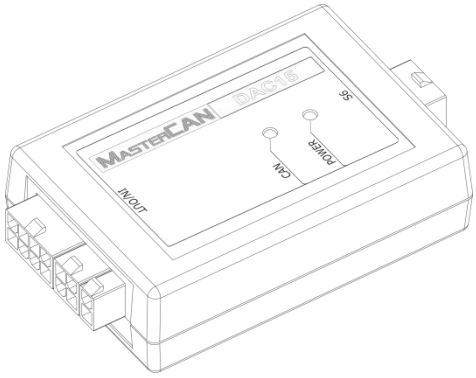
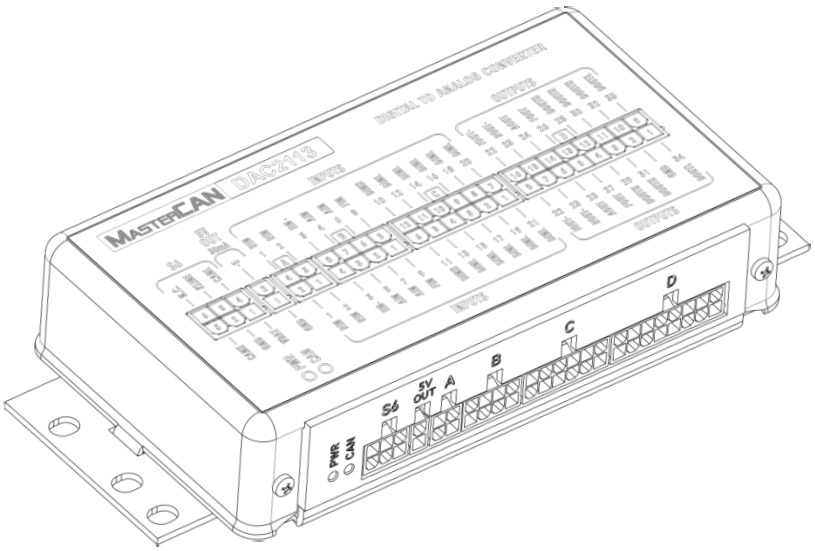
MASTERCAN DAC

J1939 I/O MODULES





MasterCAN DAC15 **MasterCAN DAC2113**

OPERATION MANUAL

Version 2.0

S6 IoT BURGER

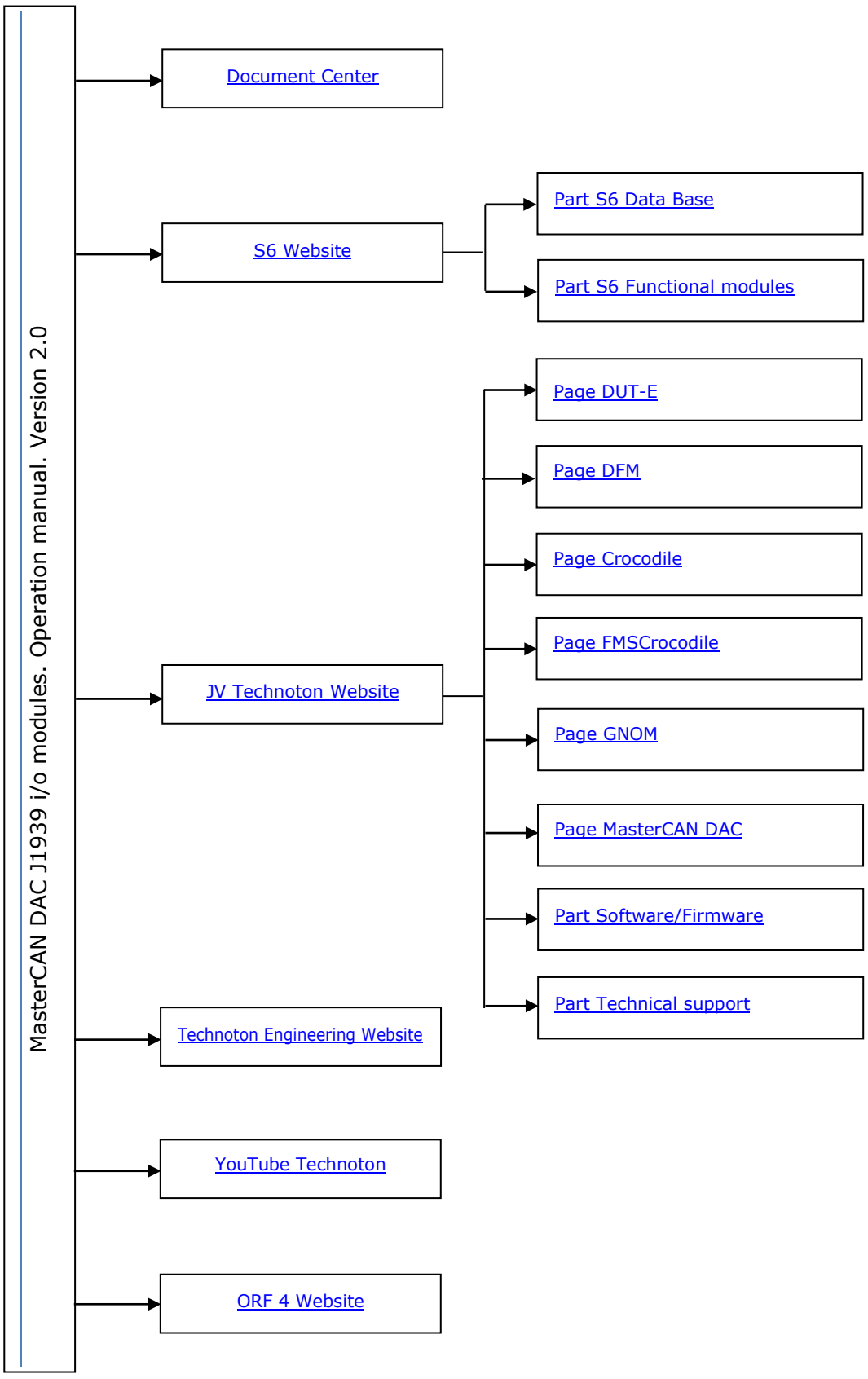
TECHNOTON

Contents

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 DAC15 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 DAC2113 J1939 i/o module is added. • Changes in MasterCAN DAC15 delivery set are reflected. • A new functional feature of MasterCAN DAC15 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.

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, GSM 2G/3G 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 J1939 i/o modules 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.

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).

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

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

Parameter — time-varying or space characteristic of the Vehicle (SPN value). For example, speed, fuel volume in the tank, hourly fuel consumption, coordinates. Parameter is usually displayed in the form of graph, or averaged data.

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

Telematics 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.

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.

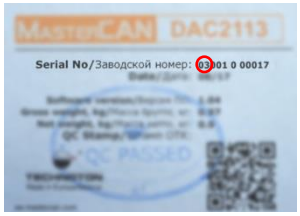
Vehicle an object controlled within Telematics system. Usually Vehicle means a truck, tractor or bus, sometimes a locomotive or river boat. From Telematics system point of view, stationary objects are also considered to be vehicles: diesel gensets, stationary tanks, boilers/burners.

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 guidelines contained in this Operation Manual are related to MasterCAN DAC J1939 i/o modules (hereinafter MasterCAN DAC), model code: **01** (for MasterCAN DAC15), **03** (for MasterCAN DAC2113), developed and manufactured by JV Technoton, Minsk, Belarus.
Model code of MasterCAN DAC is defined by first two digits of serial number, which is printed on nameplate placed in the lower part of back cover or printed on package label:



This document contains information on the design, principle of operation, specifications, recommendations on connection, configuration and operation of MasterCAN DAC.

MasterCAN DAC — tools within Telematics systems, used for:

1) Converting digital data (SPN) of automotive interface CAN j1939/S6 to analog inputs of Telematics terminal or dashboard.
2) Converting analog output signals of automotive sensors to CAN j1939/S6 ports of Telematics terminal.

Advantages of MasterCAN DAC:

- complies with European automotive industry standards;
- compliance with Units, Database and cabling system S6 Technology;
- IoT_Burger Technology provides internal data processing (Parameter filtration and normalization, Events logging, Counters recording) for easier server operation and data traffic saving;
- conversion of signals from standard and additional analog sensors into CAN j1939/S6 Telematics interface increases considerably the number of the Vehicle parameters which are monitored using the cost-effective terminal with one CAN input;
- connects safely to standard on-board CANbus through CANCrocodile contactless reader;
- integrates converted data of CAN j1939/S6 automotive bus to Telematics system when Terminal equipped by analog inputs is used;
- ensured compatibility with majority of Telematics terminals and dashboards through possibility of output signal setting and adjustment;
- power-supplied by on-board electrical system of Vehicle – does not require external power sources.

MasterCAN DAC equipmet includes the following models:

1) MasterCAN DAC15 — the converter of signals with base functionality for trucks and buses which has:

- CAN j1939/S6 configurable digital interface;
- One adjustable signal input for analog voltage/frequency;
- Five adjustable signal outputs:
  - analog voltage/frequency/pulse;
  - current;
  - discrete (2 pcs.);
  - resistive.

2) MasterCAN DAC2113 — the converter of signals with extended functionality for complex mobile and fixed installations (locomotives, track machines, river and sea vessels, farming equipment, municipal and special vehicles, industrial automation systems etc.) which has:

- CAN j1939/S6 adjustable digital interface;
- 21 adjustable signal inputs:
  - resistive (2 pcs.);
  - frequency (2 pcs.);
  - analog voltage (4 pcs.);
  - current;
  - discrete (12 pcs.);
- 13 adjustable signal outputs:
  - discrete (7 pcs.);
  - frequency (2 pcs.);
  - analog voltage (2 pcs.);
  - resistive;
  - current.
- 5 V output voltage for external devices power supply.

To ensure proper operation, MasterCAN DAC should be connected and configured by certified professionals who have successfully passed manufacturer's technical training.

For MasterCAN DAC configuration S6 SK service adapter (purchased separately) and Service S6 MasterCAN software (can be downloaded from https://www.jv-technoton.com, Software/Firmware) should be used.

ATTENTION: The Manufacturer guarantees MasterCAN DAC compliance with the requirements of technical regulations subject to the conditions of storage, transportation and operation set out in this Manual.
Manufacturer reserves the right to modify MasterCAN DAC specifications that do not lead to a deterioration of the consumer qualities without prior customer notice.

1 General information and technical specifications

1.1 Purpose of use and application area

MasterCAN DAC **is designed and used for:**

1) Converting digital data of CAN j1939/S6 Telematics interface or automotive CANbus to various types of analog signals (see figures 1 and 2).

2) Converting analog output signals of automotive sensors to digital data of CAN j1939/S6 Telematics interface (see figure 3).

Application area — MasterCAN DAC CAN-converters are employed as part of Telematics systems, in which equipment with CAN j1939/S6 digital interface is used alongside with analog On-board equipment.

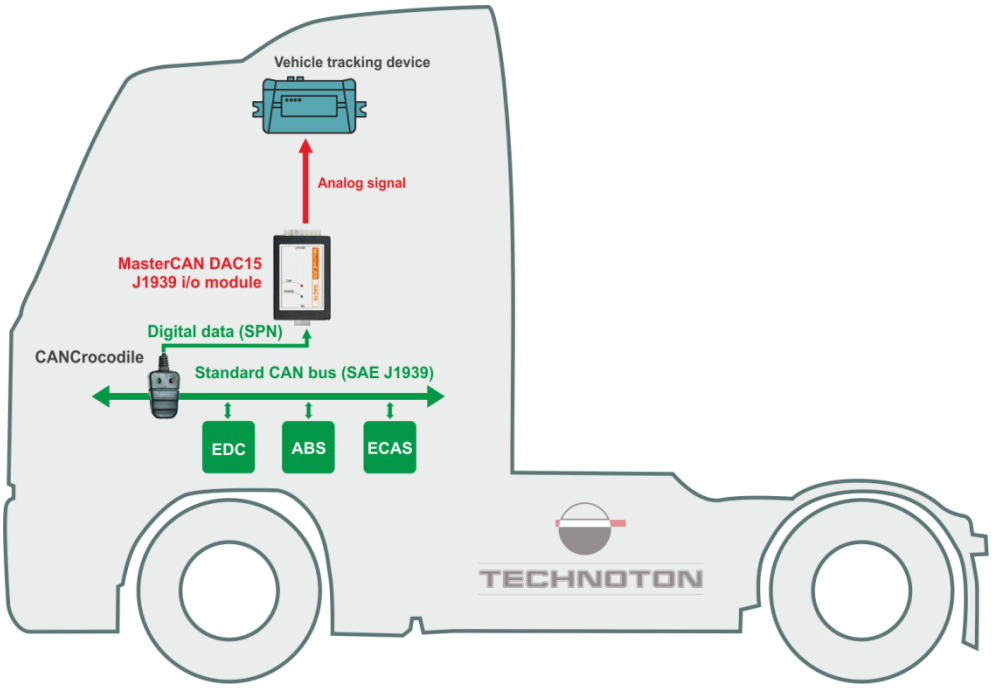


Figure 1 – Example of MasterCAN DAC15 employment for conversion of CAN-bus data into analog signals

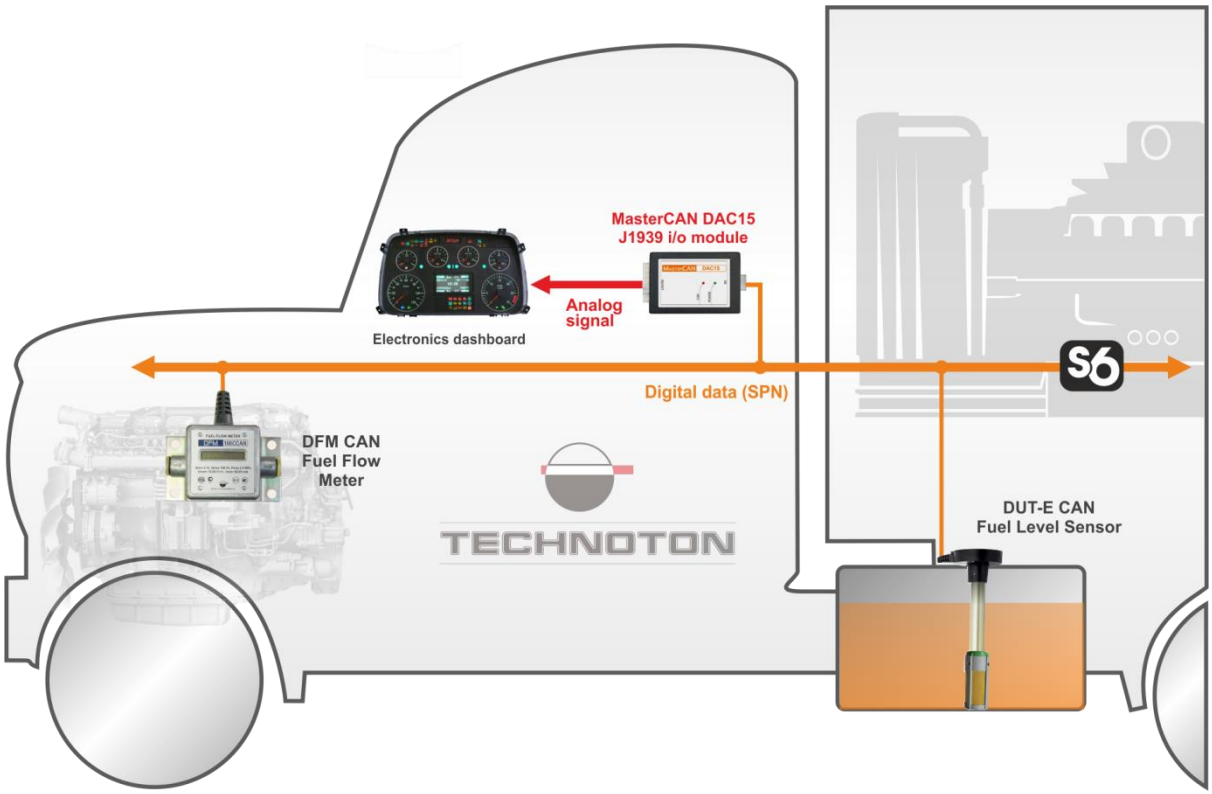


Figure 2 – Example of MasterCAN DAC15 employment for conversion of CAN j1939/S6 Telematics interface data into analog signals

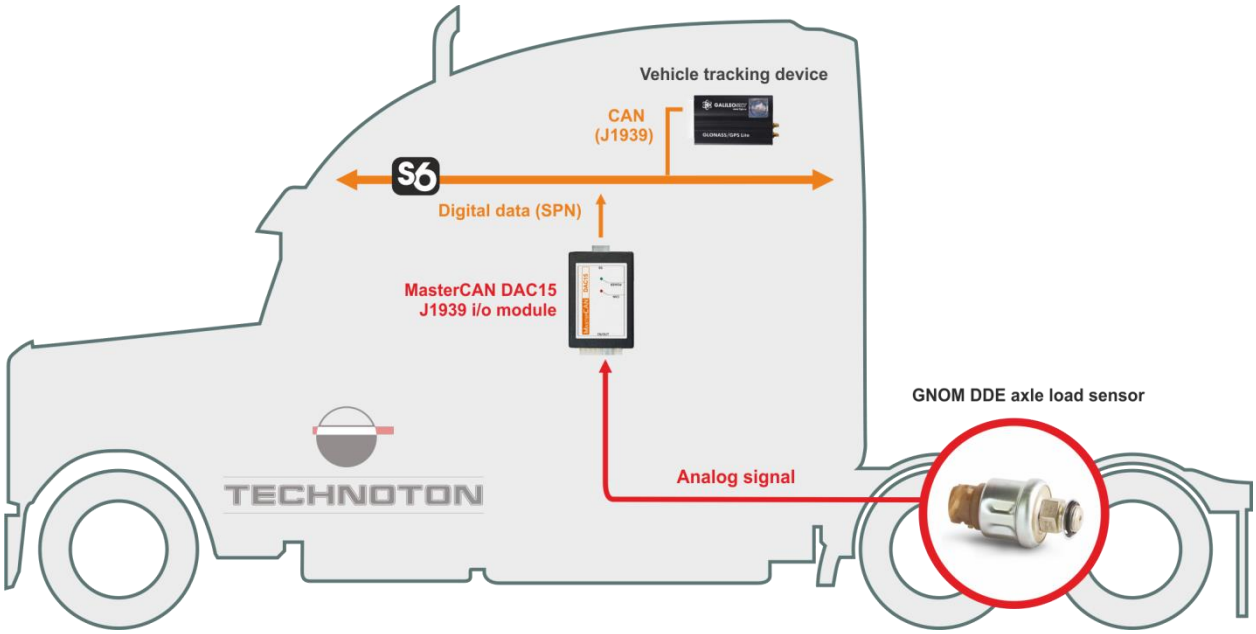


Figure 3 – Example of MasterCAN DAC15 employment for conversion of an analog signal into CAN j1939/S6 Telematics interface

1) MasterCAN DAC15 application

MasterCAN DAC15 CAN-converter in combination with CANCrocodile contactless reader is a ready-for-use solution for conversion of data from the vehicle CAN-bus into the Telematics system in which the Vehicle tracking device with analog inputs is used (see figure 1).
MasterCAN DAC15 together with DUT-E CAN fuel level sensor may be a solution for visual monitoring of the fuel volume in the Vehicle tank on the analog dashboard. (see figure 2).
MasterCAN DAC15 is convenient to use for conversion of an analog signal from GNOM axle level sensors into CAN j1939/S6 Telematics interface (see figure 3).

2) MasterCAN DAC2113 application

The availability of CAN j1939/S6 interface for MasterCAN DAC2113 enables to integrate the Vehicle operation parameters received after the conversion of signals from standard and additional analog sensors into the Telematics system using S6 Technology by means of the cost-effective terminal with one CAN-input. The employment of MasterCAN DAC2113 together with DFM CAN fuel flow meters (up to 8 pcs.) and DUT-E CAN fuel level sensors (up to 8 pcs.) is a convenient solution for comprehensive monitoring of fuel and performance parameters for complex mobile equipment and fixed installations (see figure 4).

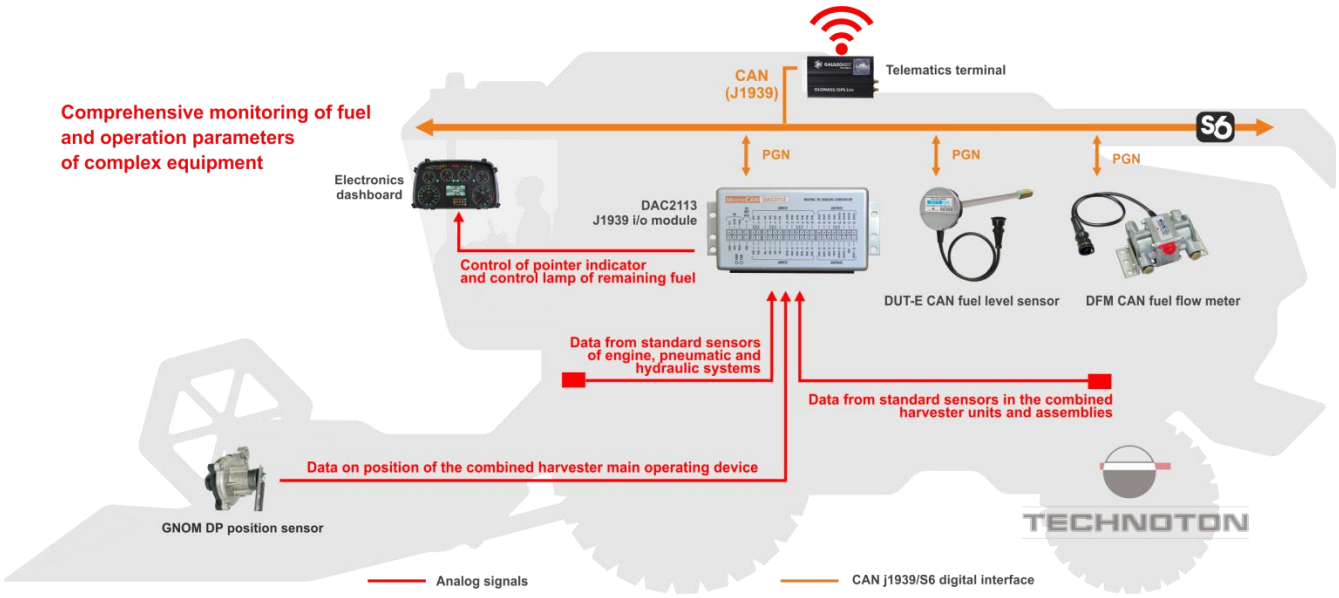
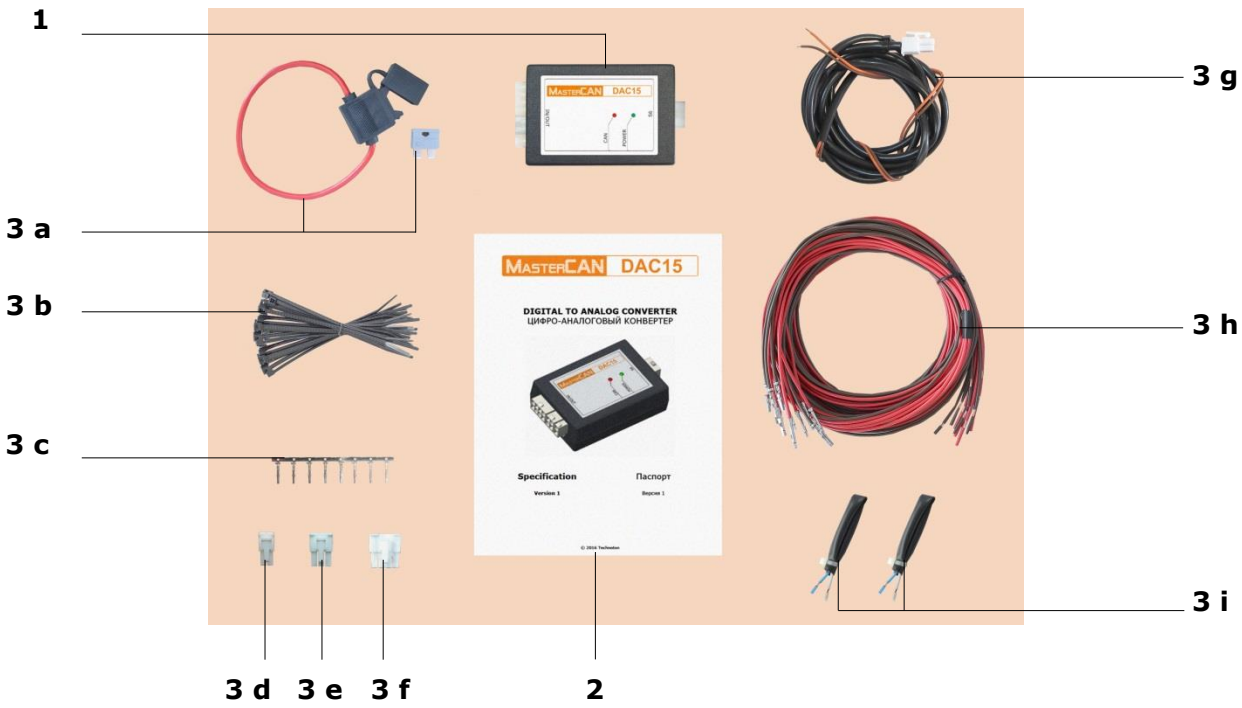


Figure 4 — Example of MasterCAN DAC2113 application in the monitoring system using CAN j1939/S6 to monitor fuel and operation parameters of complex equipment

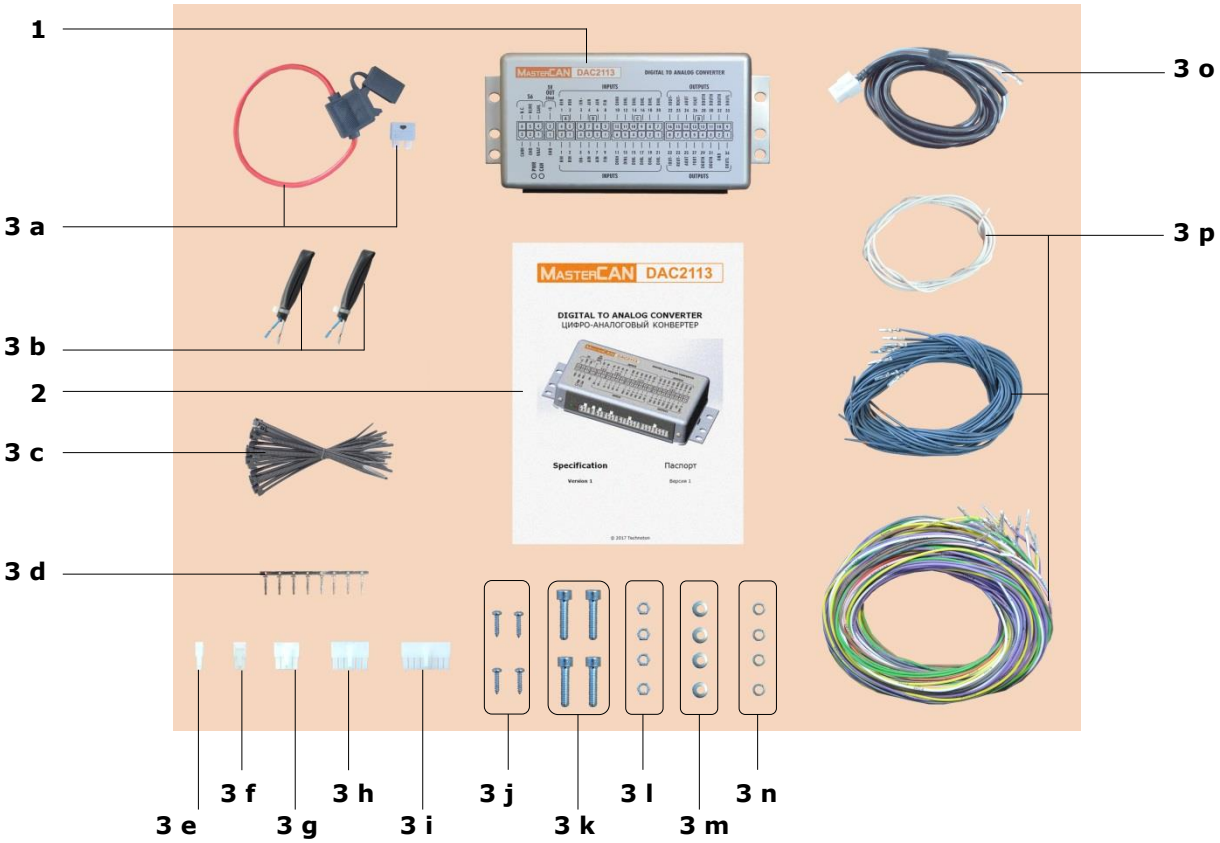
1.2 Delivery set



1	MasterCAN DAC15 J1939 i/o module	– 1 pc.;
2	Specification	– 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 5 — MasterCAN DAC15 delivery set

***** Contains the 120 Ohms inbuilt terminal resistor.



1	MasterCAN DAC2113 J1939 i/o module	– 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.

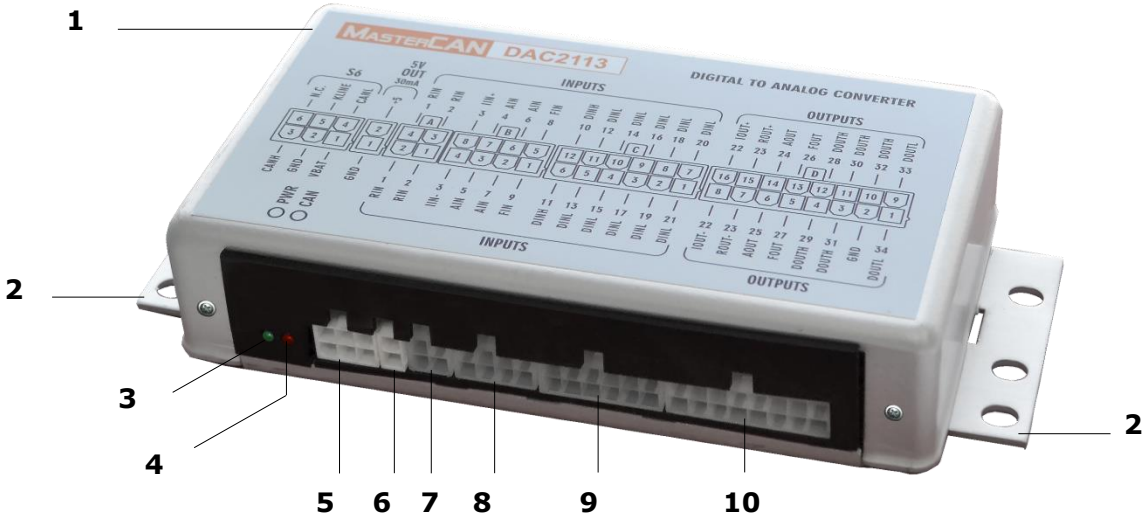
Figure 6 — MasterCAN 2113 delivery set

***** Contains the 120 Ohms 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 5 — MasterCAN DAC15 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 8 — MasterCAN DAC2113 exterior view and design

1.4 Principles and modes of operation

1) **Mode of digital to analog CAN-gateway**. After connection to CAN (J1939) onboard bus or to CAN j1939/S6 Telematics interface MasterCAN DAC, in accordance with its settings, receives digital data (PGN), sorts out parameters (SPN) containing current data on fuel consumption and the Vehicle operation parameters, converts SPN into analog signals, generates a physical signal in the selected output.

2) **Mode of collector/converter of analog signals**. When an analog signal is transmitted, MasterCAN DAC, in accordance with its settings, converts the signal received into digital data (SPN) which it transmits in generated messages (PGN) into CAN/S6 Telematics interface.

3) **Combined mode**. MasterCAN DAC can simultaneously operate in Digital-analog gateway and Analog signal collector-converter modes.

1.5 Technical specifications

1.5.1 Main specifications

Table 1 — MasterCAN DAC main specifications

Parameter, measurement units	Value	
	MasterCAN DAC15	**MasterCAN DAC2113**
Digital interface	CAN j1939/S6	
Power supply range, V	9…45	
Current consumption at 12/24 V, mA, not more than	100/50	
Ambient operation temperature range, °C	-40…+85	
Ingress protection rating	IP40	
Overall dimensions, mm, not more than	see figure 9	see figure 10
Weight, kg, not more than	0.08	0.32

1.5.2 CAN j1939/S6 digital interface specifications and protocols

Specifications of CAN j1939/S6 MasterCAN DAC digital interface correspond to S6 Technology. Data transfer protocols is based on SAE J1939 standard and meets its requirements.

Configuration of MasterCAN DAC connection options via S6 Technology, as well as selection of necessary PGN and SPN is performed via K-Line interface (ISO 14230) using Servicse S6 MasterCAN software (can be downloaded from https://www.jv-technoton.com, Software/Firmware).

MasterCAN DAC receives/transmits data automatically (default mode) or on request. Baudrate can be selected from the following values: 100; 125; 250; 500; 1000 kbit/s (default rate — 250 kbit /s).

After the connection using S6 Technology, unique network addresses (SA) should be specified for MasterCAN DAC15: 126 or 146 (126 by default), while for MasterCAN DAC2113: 127 or 147 (127 by default).

Detailed information regarding the architecture of CAN j1939/S6 Telematics interface is provided in its CAN j1939/S6 Operation manual.

1.5.3 Analog signals specifications

1) Analog signals of MasterCAN DAC15

Table 2 — Specifications of signals for MasterCAN DAC15 analog inputs

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

Table 3 — Specifications of signals for MasterCAN DAC15 analog outputs

Signal type, measurement units	Value
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.	
Notes 1 The load current of the analog output should not exceed 40 mA. 2 The maximum current of the descrete outputs should not exceed 0.3 A. 3 The maximum load impedance for the current output is calculated according to the formula: $R_{L\,max}$ =(U*$_{PS}$ - 5 V)/0.02 Ohms.	

2) Analog signals of MasterCAN DAC2113

Table 4 — Specifications of signals for MasterCAN DAC2113 analog inputs

Signal type, measurement units	Value
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*$_{PS}$
* U_{PS} – onboard circuit voltage.	

Table 5 — Specifications of signals for MasterCAN DAC2113 analog outputs

Signal type, measurement units	Value
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* $_{PS}$)	
* U_{PS} – onboard circuit voltage.	
Notes 1 The maximum current of the descrete outputs should not exceed 0.5 A. 2 The maximum output current of the analog voltage should not exceed 50 mA. 3 The maximum load impedance for the current output is calculated according to the formula $R_{L\,max}$ =(U*$_{PS}$ - 5 V)/0.02 Ohms.	

The selection of the required type of analog input/output signals and configuration of their values conversion into SPN is performed using Service S6 MasterCAN service software (the current version can be downloaded at https://www.jv-technoton.com, Software/Firmware).

1.5.4 Overall dimensions

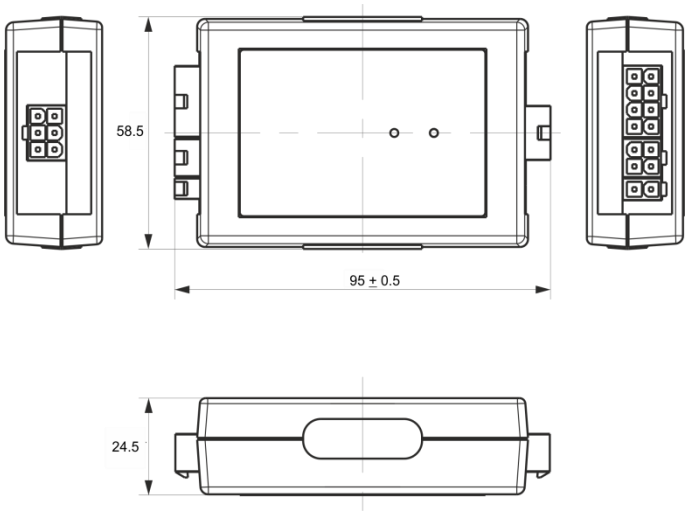


Figure 9 — MasterCAN DAC15 overall dimensions

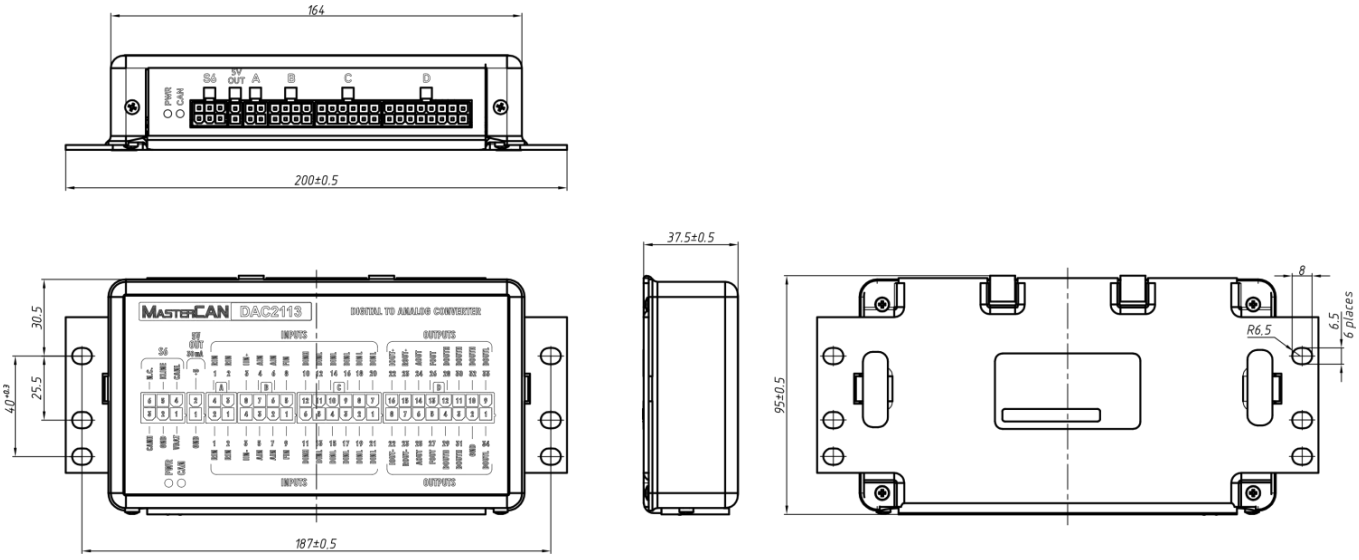


Figure 10 — MasterCAN DAC2113 overall dimensions

2 MasterCAN DAC connection

ATTENTION:

1) Strictly follow safety rules of automobile repair works as well as local safety rules of the customer company when connecting MasterCAN DAC.

2) Before connection it is recommended to carefully study through the electrical circuit diagram and the Operation manual for the vehicle wher MasterCAN DAC is mounted.

3) Check the quality of the chassis ground of the vehicle. Resistance between any point of chassis and the "-" clamp of the battery should not exceed 1 Ohm.

2.1 Exterior inspection prior to starting works

It is required to conduct MasterCAN DAC exterior inspection for the presence of the possible defects of body or connectors arisen during transportation, storage or careless use.
Contact the supplier if any defects are detected.

2.2 Operational restrictions

To mount MasterCAN DAC, you need to select a dry location protected from aggressive impact of the environment.

MasterCAN DAC should not be mounted near heating and cooling devices (e.g. the climate control system). We also do not recommend to install MasterCAN DAC close to the vehicle power electric circuits.

A suitable location to mount MasterCAN DAC is inside driver's cabin.

2.3 Power supply connection

IMPORTANT:

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

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

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

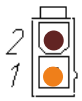
MasterCAN DAC is supplied with electrical power from on-board Vehicle power source. We recommend to purchase and use terminal clamps to connect the power supply cables (see figure 11).

Figure 11 — Terminals

1) Power supply for MasterCAN DAC15 is connected according to the designation of contacts of **POWER** connector and the colour of wires, in accordance with table 6.

During the operation of MasterCAN DAC15 using S6 Technology, its the power supply is provided through **S6** connector (see 2.4). In this case you don't need to connect power supply to **POWER** connector.

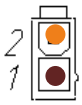
*Table 6 — Connection of **POWER** connector*

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 DAC2113 is connected using S6 Technology, in accordance with the designation of contacts of **S6** connector and the colour of wires, in accordance with table 8 (see 2.4).

3) 5 V OUT connector is used in MasterCAN DAC2113 for **external devices power supply.** It is connected in accordance with the designation of contacts and the colour of wires, according to table 7.

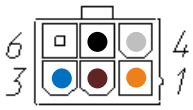
*Table 7 — Connection of **5 V OUT** connector*

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 "-"	—

2.4 Connection using S6 Technology

The connection of MasterCAN DAC using S6 Technology is performed in accordance with the designation of contacts of **S6** connector and the colour of wires of CAN j1939/S6 Telematics interface (see table 8).

*Table 8 — Connection of **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
* To provide power supply for CANCrocodile (only in case of CANCrocodile connection to MasterCAN DAC15) ** For MasterCAN DAC configuration and firmware update.					

ATTENTION:
1) To ensure correct data transmission via CAN (J1939) communication line in case of MasterCAN DAC connection to the Telematics terminal that has no inbuilt terminal resistor, **connect S6 CW plugs** (see Delivery set) at both ends of the communication line between CAN LOW and CAN HIGH wires (see figure 12).
2) In case of MasterCAN DAC2113 connection, you may enable the inbuilt terminal resistor in CAN j1939/S6 interface connection settings (see 3.1). In this case, you must connect S6 CW plug only at that end of the communication line which is connected to the terminal.

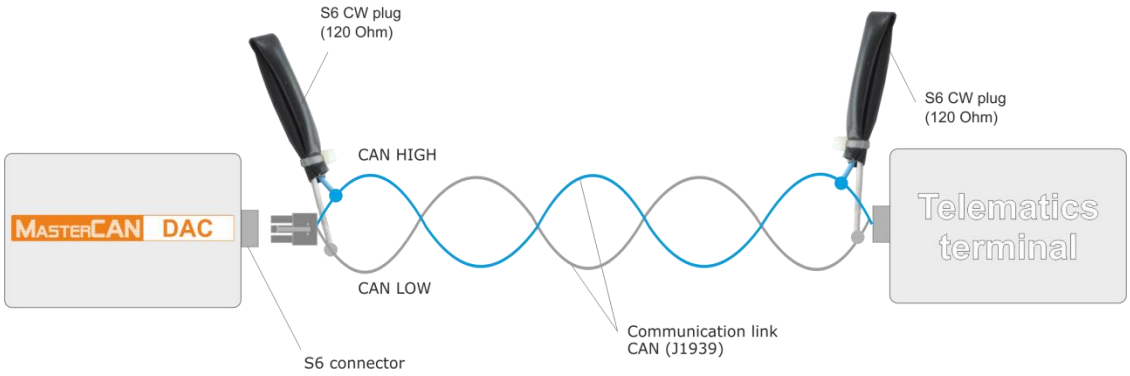
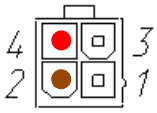


Figure 12 — Connection of MasterCAN DAC to the Telematics terminal that has no inbuilt terminal resistor

2.5 Connecting analog input

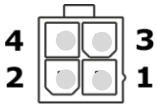
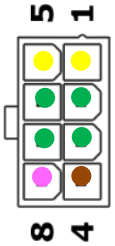
1) MasterCAN DAC15 analog input is connected to signal wires of analog voltage/frequency in compliance with the designation of contacts of **IN/OUT** connector and the colour of the wires (see table 9).

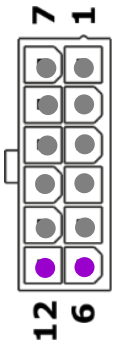
*Table 9 — Connection of MasterCAN DAC15 analog inputs (**IN/OUT** connector)*

Connector Pinout	Connector Contact Number	Wire Marking	Contact group	Wire Color	Circuit Designation	Signal Parameters
	4	AFin+	I1	Red	Analog/ frequency input	See 1.5.3 (table 2)
	2	AFin-		Brown		

2) MasterCAN DAC2113 analog inputs are connected to signal wires of analog voltage/frequency in compliance with the designation of contacts of **A/B/C** connectors and the colour of the wires (see table 10).

Table 10— Connection of MasterCAN DAC2113 analog inputs (A/B/C connectors)

Connector Pinout	Connector Contact Number	Wire Marking	Contact group	Wire Color	Circuit Designation	Signal Parameters
A 	A1	Rin1	2	White	Resistive input	See 1.5.3 (table 4)
	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	Contact group	Wire Color	Circuit Designation	Signal Parameters
C  	C1	DinL	21	Gray	Discrete input	See 1.5.3 (table 4)
	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			

We recommend to purchase and use connectors to connect MasterCAN DAC to the corresponding wires of the vehicle (see figure 13).

Figure 13 — Connectors

2.6 Connecting analog outputs

1) Analog outputs of MasterCAN DAC15 are connected to:

- Signal wires of analog voltage/frequency/pulse signal, in compliance with the colour of the wires and the designation of contacts of **IN/OUT** connector (see table 11);
- Current/discrete/resistive signal wires, in compliance with the colour of the wires and the designation of contacts of **OUT** connector (see table 12).

*Table 11 — Connection of MasterCAN DAC15 analog output (**IN/OUT** connector)*

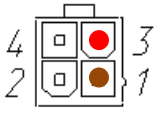
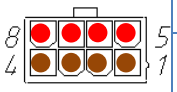
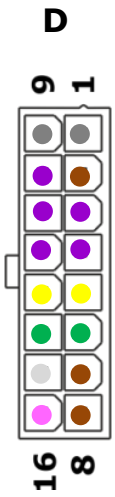
Connector Pinout	Connector Contact Number	Wire Marking	Contact group	Wire Color	Circuit Designation	Signal Parameters
	3	AFout+	O1	Red	Analog/ frequency output	See 1.5.3 (table 3)
	1	AFout-		Brown	Analog/ frequency/pulse output	

*Table 12 — Connection of MasterCAN DAC15 analog outputs (**OUT** connector)*

Connector Pinout	Connector Contact Number	Wire Marking	Contact group	Wire Color	Circuit Designation	Signal Parameters
	1	Iout-	O2	Brown	Current output	See 1.5.3 (table 3)
	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) MasterCAN DAC2113 analog outputs are connected to signal wires of analog voltage/frequency/current/discrete in compliance with the designation of contacts of **D** connector and the colour of the wires (see table 13).

*Table 13 — Connection of MasterCAN DAC2113 analog outputs (**D** connector)*

Connector Pinout	Connector Contact Number	Wire Marking	Contact group	Wire Color	Circuit Designation	Signal Parameters
	D1	DoutL	34	Gray	Discrete output	See 1.5.3 (table 5)
	D9	DoutL	33			
	D2	GND	—	Brown	Ground "-"	—
	D10	DoutH	32	Violet	Discrete output	See 1.5.3 (table 5)
	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		

2.7 Connection scheme examples

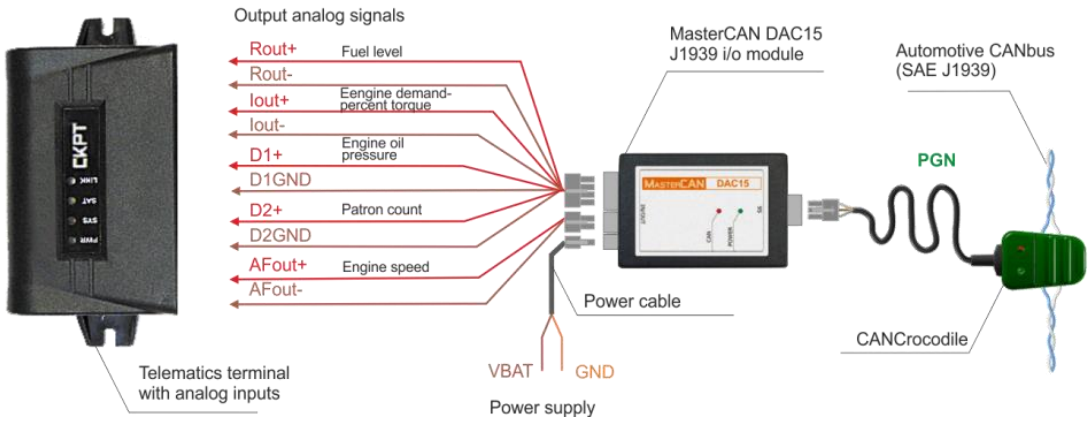


Figure 14 — Connecting MasterCAN DAC15 for CANbus data conversion to analog inputs of Telematics terminal

ATTENTION: We recommend to purchase and use CANCrocodile contactless reader to connect MasterCAN DAC15 to the vehicle CAN-bus (detailed information on specifications and instructions for connecting the above devices is available at https://www.jv-technoton.com/).

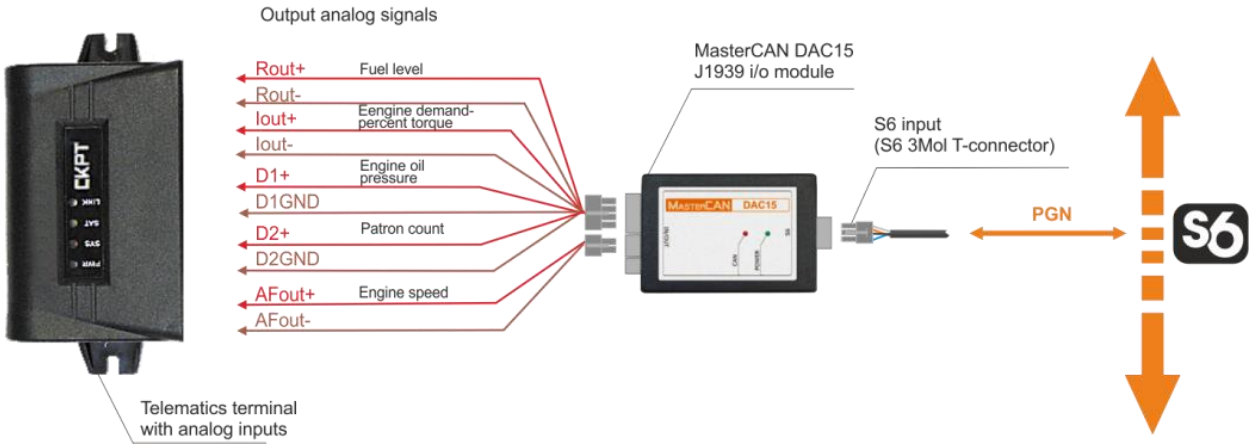


Figure 15 — Connecting MasterCAN DAC15 for CAN j1939/S6 Telematics interface data conversion to analog inputs of Telematics terminal

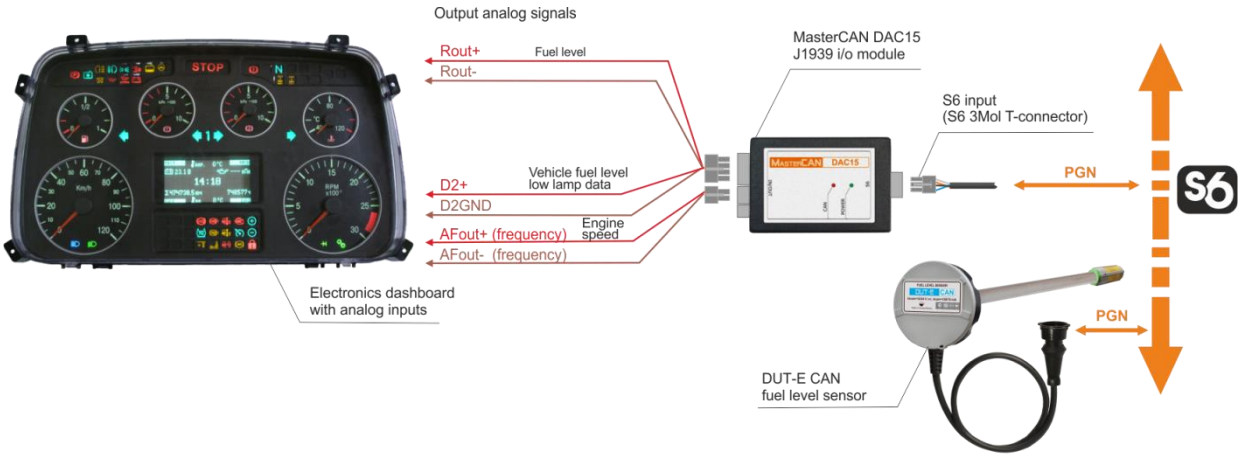


*Figure 16 — Connecting MasterCAN DAC15 for CAN j1939/S6 Telematics interface data and DUT-E CAN fuel level sensor data conversion to analog inputs of dashboard**

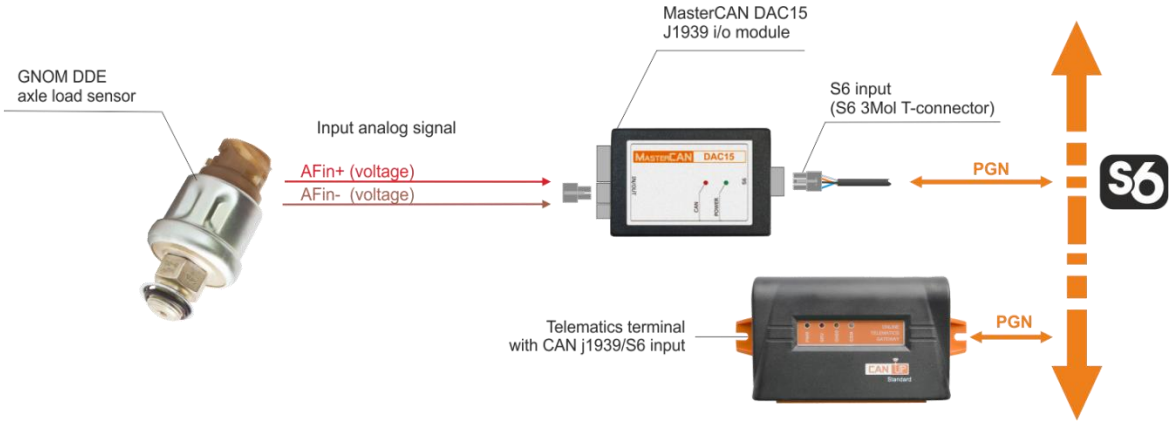


Figure 17 — Connection of MasterCAN DAC15 to convert the analog output signal of GNOM DDE axle load sensor into CAN/S6-input of the Telematics terminal

* MAZ 8099 electromechanical automobile dashboard is taken as an example, with the factory settings of MasterCAN DAC15 physical outputs set in accordance with table A.2. In case of additional adjustment of physical outputs, the data provided to the dashboard may be different.

It is allowed to connect dashboards of any models that have inputs which correspond to specifications of MasterCAN DAC15 output signals (see 1.5.3).

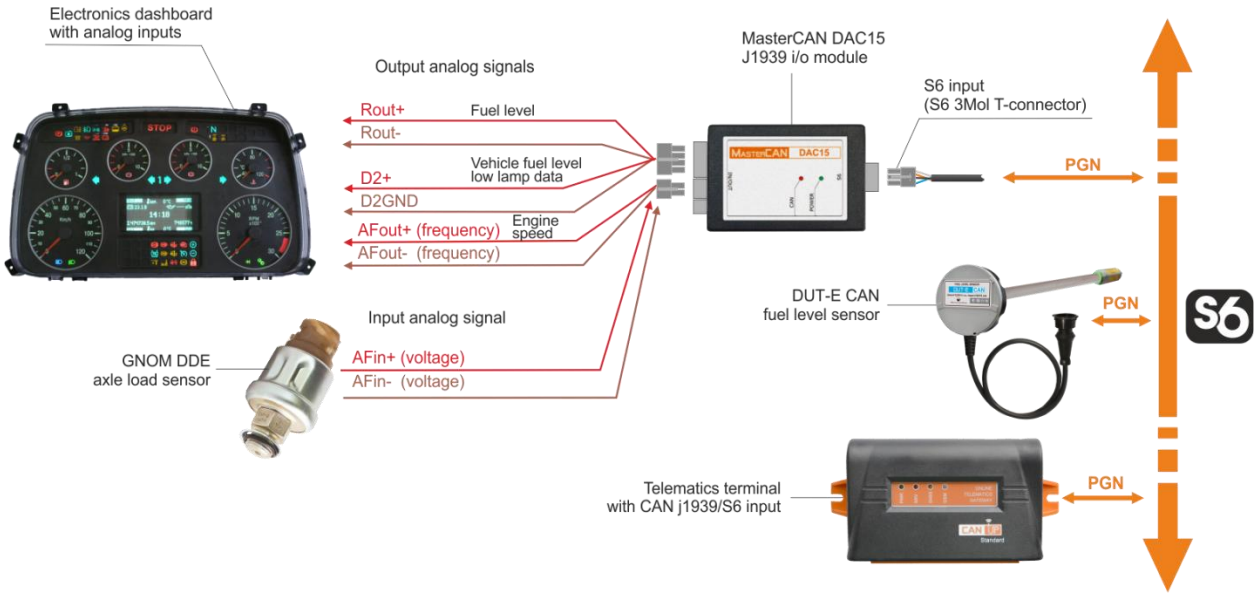


Figure 18 — Connection of MasterCAN DAC15 to convert:

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.

* MAZ 8099 electromechanical automobile dashboard is taken as an example, with the factory settings of MasterCAN DAC15 physical outputs set in accordance with table A.2. In case of additional adjustment of physical outputs, the data provided to the dashboard may be different.

It is allowed to connect dashboards of any models that have inputs which correspond to specifications of MasterCAN DAC15 output signals (see 1.5.3).

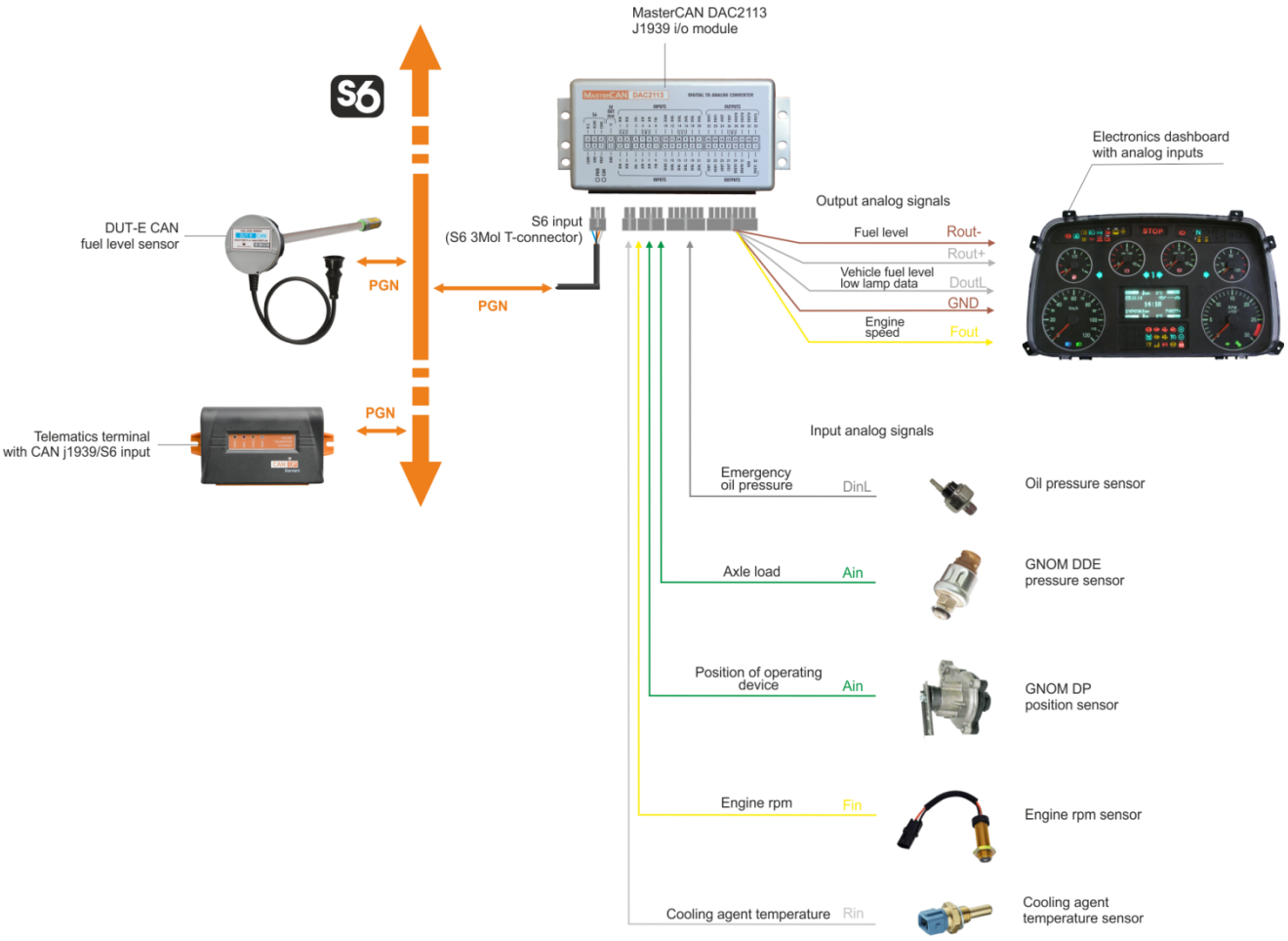


Figure 19 — Connection of MasterCAN DAC2113 to convert:

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.

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* MAZ 8099 electromechanical automobile dashboard is taken as an example, with the factory settings of MasterCAN DAC2113 physical outputs set in accordance with table A.2. In case of additional adjustment of physical outputs, the data provided to the dashboard may be different.

It is allowed to connect dashboards of any models that have inputs which correspond to specifications of MasterCAN DAC2113 output signals (see 1.5.3).

3 MasterCAN DAC configuration

MasterCAN DAC configuration to meet specific operational requirements is carried out via K-Line interface (ISO 14230).

To start configuration connect MasterCAN DAC to PC through S6 SK Service adapter (hereinafter — S6 SK).

To operate S6 SK it is necessary to download and install USB drivers and Service S6 MasterCAN software (please, visit https://www.jv-technoton.com, Software/Firmware section).

Description of S6 SK, scheme and sequence of MasterCAN DAC connection to PC, installation and description of software is described in CAN j1939/S6 Operation manual.

3.1 Configuration of connection via CAN j1939/S6 interface

To connect MasterCAN DAC via CAN j1939/S6 interface select **Interface** tab in Vertical menu of Software (see figure 20). Apply the following configurations:

1) From the drop-down menu of **CAN Protocol Type** select necessary data transmission protocol (by default – J1939 + S6)

2) In the field **SA Address (SA)** enter the inique ID address of the Unit which is part of CAN j1939/S6 Telematics interface. This address is also used during the Unit configuration using K-line interface. For MasterCAN DAC15 it is allowed to use the addresses 126 or 146 (126 by default), while for MasterCAN DAC2113 — 127 or 147 (127 by default).

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

4) From the dropdown list **Enable Termination Resistor*** select ON or OFF (OFF by default) of the inbuilt terminal resistor (120 Ohms) between the contacts CAN LOW and CAN HIGH of **S6** connector. ON or OFF (OFF by default). Enabling the terminal resistor ensures correct data transmission via CAN 2.0B (J1939) communication line in case of using a signal cable that has no terminal resistor at both ends, (e.g. S6 SC-Mol).

5) In the field **PGN Receive Timeout**, s** enter the maximum time (5 s by default) during which the absence of input PGN selected for conversion into analog signals is allowed. In case the receive timeout specified is exceeded, The Self-diagnostics FM will display an error message in CAN communication line.

***** There is no inbuilt terminal resistor in MasterCAN DAC15.

****** This setting is not supported for MasterCAN DAC2113.

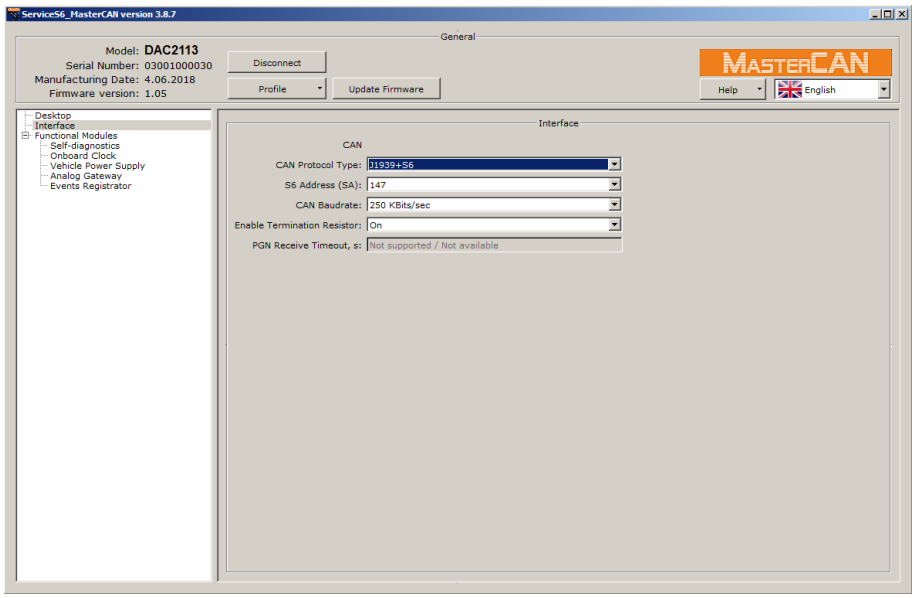

Figure 20 — Configuration of MasterCAN DAC connection parameters using CAN j1939/S6 interface

3.2 Functional modules configuration

When operating with Functional modules (FM) of MasterCAN DAC the software uses data of S6 Database (detailed description can be found and the web-pages of S6 Telematics interface).

For each SPN, prompt messages containing the range of data, discreteness, the unit of measurement are displayed in the software. Automatic control of correctness of values entered is provided in the fields for editing settings.

SPN list of Functional modules of MasterCAN DAC, which can be configured and/or seen in the software can be found annex A.

3.3 Serviceability check

In case the connection is made correctly, MasterCAN DAC starts its operation from the moment power is supplied to it. When the power supply is cut off, MasterCAN DAC switches off.

When MasterCAN DAC is connected properly, readings of LED indicators on its casing should correspond to the readings in table 14.

Table 14 – Description of MasterCAN DAC LEDs

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 DAC15 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 DAC15 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 21).

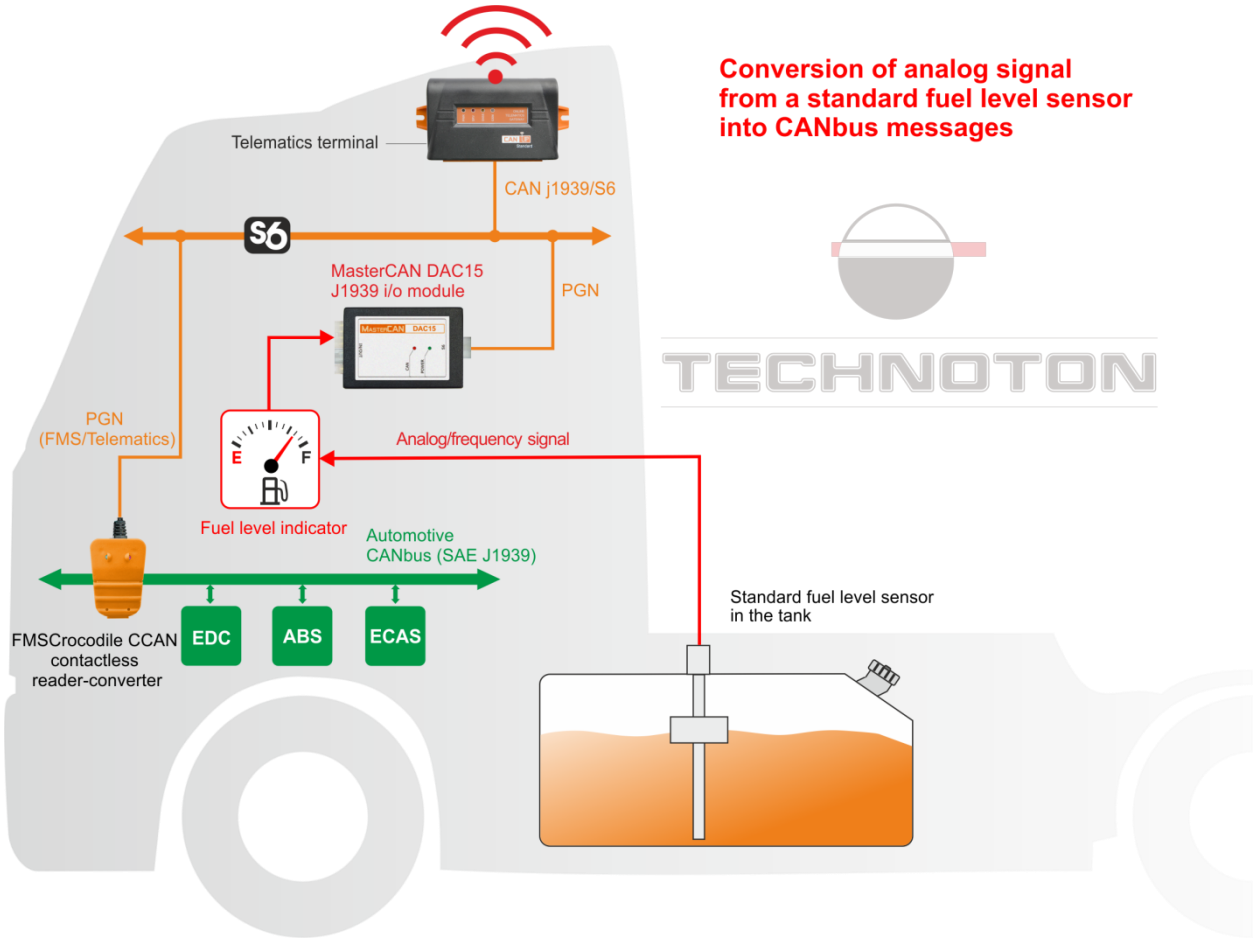

Figure 21 — Using MasterCAN DAC15 for conversion of an analog signal from the Vehicle standard fuel level sensor into CAN j1939/S6 Telematics interface

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 DAC15 to the Vehicle circuit (see 2.3);
- signal wires of a standard fuel level sensor to corresponding contacts of the analog input (connector **IN/OUT**, contacts group I1) MasterCAN DAC15 (see 2.5);
- CAN j1939/S6 digital interface (connector **S6**) of MasterCAN DAC15 to CAN j1939/S6 Telematics interface (see 2.5).

2) Using S6 SK service adapter connect MasterCAN DAC15 to the PC. Establish a communication session between the Unit and PC in Service S6 MasterCAN service software (see CAN j1939/S6 Operation manual).

3) Open FM Collector DAC15 in settings of Service S6 MasterCAN software for physical input (see annex A, table 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 (Level and Volume of Fuel in the Tank) that includes the parameter of fuel volume in the tank. From the dropdown list **SPN** select the parameter SPN 521024 (Volume of Fuel in the Tank, l);
- Save the calibration table of the Vehicle fuel tank in the MasterCAN DAC15 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 DAC15 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 delivery sets are supplied in carton boxes, as shown in figure 22.

a) MasterCAN DAC15 *b) MasterCAN DAC2113*

Figure 22 — Packaging

Label sticker with information containing product name, serial number, firmware version, manufacture date, weight and also Quality Control stamp and QR code is placed on two sides of the MasterCAN DAC15 box (see figure 23).

a) MasterCAN DAC15 *b) MasterCAN DAC2113*

Figure 23 — Packaging label

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

6 Storage

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

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

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

MasterCAN DAC shelf life must not exceed 12 months.

7 Transportation

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

When transporting by air, MasterCAN DAC 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 MasterCAN DAC should be sealed.

8 Utilization/re-cycling

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

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

Contacts

Manufacturer

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

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

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

E-mail: marketing@technoton.by

Technical support

E-mail: support@technoton.by

Annex A

SPN of MasterCAN DAC Functional modules

MasterCAN DAC operation in Digital-analog gateway mode and in Collector-converter of analog signal mode, Counters, Events registration, Parameters configuration and self-diagnostics is ensured by coordinated operation of its Functional modules (FM).
SPN format of MasterCAN DAC FM is in accordance with Database (DB) of Telematics interface CAN j1939/S6.

A.1 Self-diagnostics FM

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

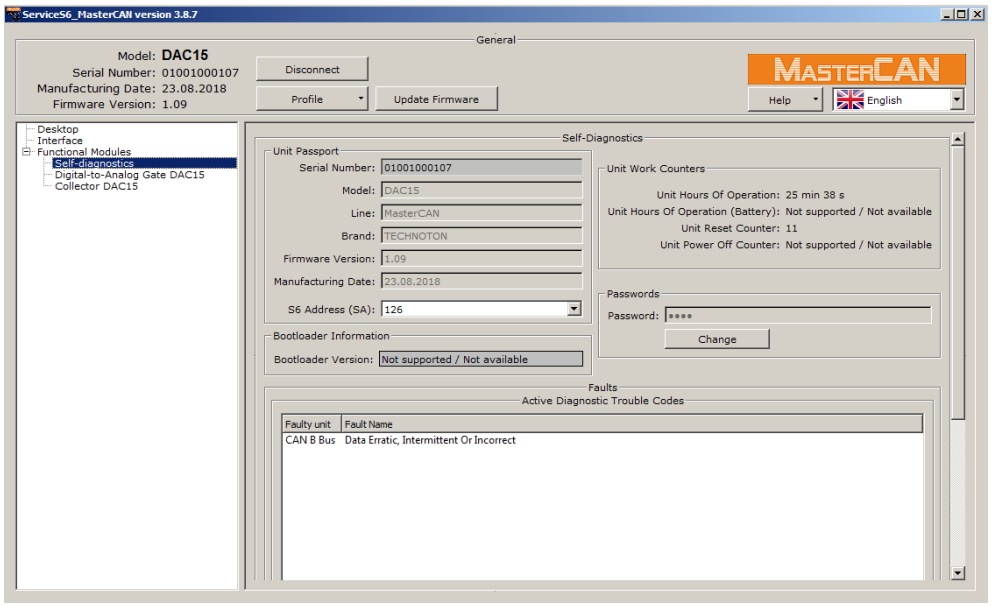

Figure A.1 — Window of settings of Self-diagnostics FM in Service S6 MasterCAN software

Table A.1 — Self-diagnostics FM.
SPNs, displayed and/or editable in 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 DAC15 has the following format: AABBB C DDDDD, where: AA – code of MasterCAN model; BBB – digits that reflect changes product changes; C – Manufacturer code; DDDDD – sequential number. Setting is not available for editing.
521345	Model	DAC15	No	Model – this is version of the product inside of MasterCAN product line. Each model has its own functional and constructive features. Setting is not available for editing.

SPN	Name	Factory value	Unit of measure	Clarification
521123	Line	MasterCAN	No	Name of the product line. The line represents a group of similar products – fuel flow meters 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 DAC15) and 127 or 147 (for MasterCAN DAC2113).
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 RSC only.
521118	Unit reset counter	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)	On the fact	No	List of current MasterCAN DAC15 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 DAC15 working performance. In case of lack of active malfunctions the following message is displayed "No malfunctions".
Previously active diagnostic trouble codes PGN 65227				
521044	Fault identifier (SID)	On the fact	No	List of saved MasterCAN DAC15 malfunctions are displayed at the settings field (in case of its presence — up to 20). For each saved malfunction is indicated following: - faulty nod; - malfunction name; - malfunction counter. This setting allows to monitor MasterCAN DAC15 working performance. In case of lack of saved 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 which is used for correct starting the service software, as well as during the Unit firmware update.

A.2 Digital-to-analog gate DAC15 FM

Digital-to-Analog Gate DAC15 FM* — is designed to receive digital data of PGN via CAN j1939/S6 Telematics interface, to convert SPN parameters into analog signals of different types (voltage, frequency, pulse, current, discrete, resistive) and transmit them to the respective Unit outputs.

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* This FM is created only for MasterCAN DAC15 model.

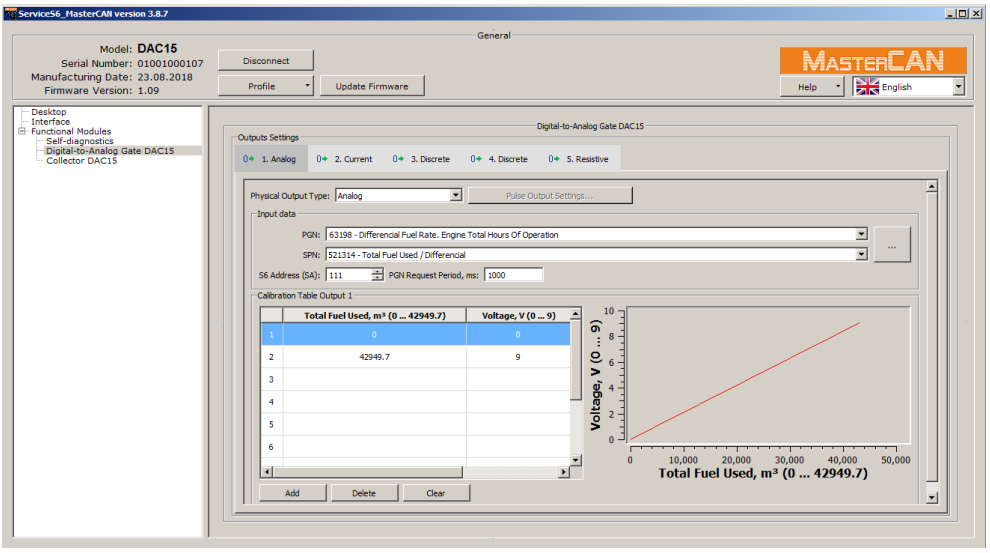

Figure A.2 — Window of settings of Digital-to-analog gate DAC15 FM in Service S6 MasterCAN software

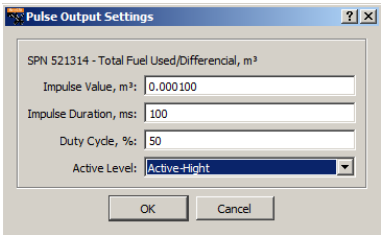

Figure A.3 — Pulse output settings

Table A.2 — Digital-to-analog gate DAC15 FM. SPNs, displayed and/or editable in Service S6 MasterCAN software

SPN	Name	Factory value*	Unit of measure	Data Range	Clarification
Outputs settings (PGN 63092) (contact group O1, see 2.6)					
521352	Output number	No	No	0…255	Choosing Unit's contact group O1 of analog/frequency physical output.
521150	PGN	61444 Electronic engine controller 1	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	190 Engine speed	No	0…524287	Selecting SPN which should be converted to analog/frequency signal from the group of parameters of specified PGN.

SPN	Name	Factory value*	Unit of measure	Data Range	Clarification
521188	S6 Address (SA)	0	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	1000	ms	0…4294970000	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 2.6)					
521430	Physical output type	Frequency	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	0; 3000 rpm	On the fact	0…4294970000	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	0; 1100 Hz	On the fact	0…4294970000	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…4294970000	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.
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 2.6)					
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…4294970000	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.

SPN	Name	Factory value*	Unit of measure	Data Range	Clarification
Calibration table output 2 (PGN 63094) (contact group O2, see 2.6)					
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…4294970000	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…4294970000	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 2.6)					
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…4294970000	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 3 (PGN 63095) (contact group O3, see 2.6)					
521430	Physical output type	Not supported	No	"0" – 0 V, "1"– voltage of vehicle power supply source (see 1.5.3)	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…4294970000	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…4294970000	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 2.6)					
521352	Output number	No	No	0…255	Choosing Unit's contact group O4 of discrete physical output.

SPN	Name	Factory value*	Unit of measure	Data Range	Clarification
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…4294970000	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 2.6)					
521430	Physical output type	Discrete	No	0 V — "0/1", 10 V — "1/0" or 0 V — "0/1", value — "1/0" of circuit voltage (see 1.5.3)	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…4294970000	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	«1»;«0»	On the fact	0…4294970000	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 O5, see 2.6)					
521352	Output number	No	No	0…255	Choosing Unit's contact group O5 of resistive physical output.
521150	PGN	65276 Dash display	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	96 Fuel level 1	No	0…524287	Selecting SPN which should be converted to resistive 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…4294970000	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 5 (PGN 63097) (contact group O5, see 2.6)					
521430	Physical output type	Resistive	Ohm	10…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	0; 25.20; 50.00; 75.20; 100.00 %	On the fact	0…4294970000	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	780; 560; 405; 285; 200 Ohm	On the fact	0…4294970000	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 those provided in this table.					

A.3 Collector DAC15 FM

Collector DAC15 FM* — designed to receive an analog signal, to convert it into digital values of SPN parameters and to transfer it into CAN j1939/S6 Telematics interface.

* This FM is created only for MasterCAN DAC15 model.

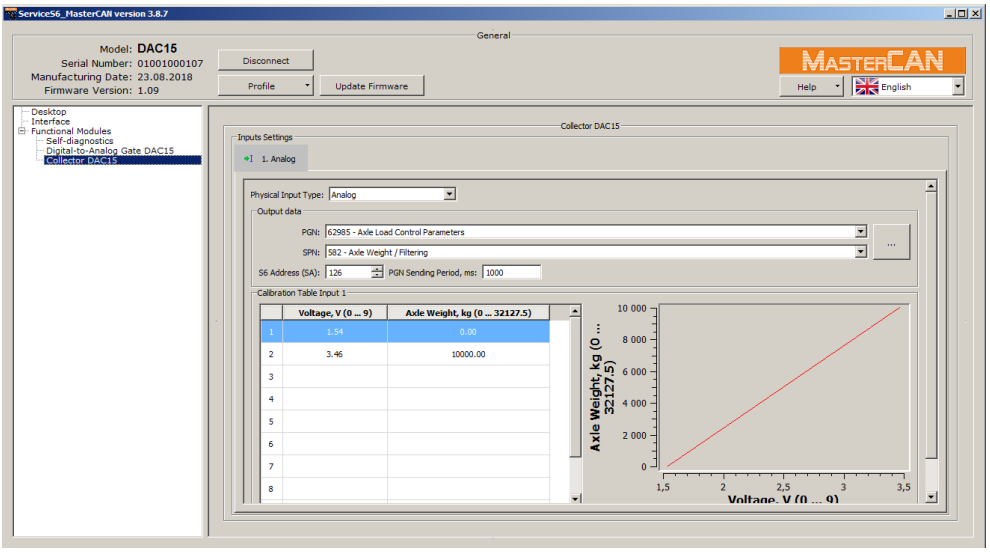

Figure A.4 — Window of settings of Collector DAC15 FM in Service S6 MasterCAN software

Table A.3 — Collector DAC15 FM.
SPNs, displayed and/or editable in Service S6 MasterCAN software

SPN	Name	Factory value*	Unit of measure	Data Range	Clarification
Input settings (PGN 63100) (contact group I1, see 2.5)					
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	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 DAC15 digital-analog converter) included in CAN j1939/S6 Telematics interface.
521362	PGN sending period	1000	ms	0…4294970000	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 2.5)					
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.

SPN	Name	Factory value*	Unit of measure	Data Range	Clarification
521366	Signal input value	1.54; 3.46 V	On the fact	0…4294970000	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…4294970000	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 those provided in this table.					

A.4 Onboard clock FM

Onboard Clock FM*— designed for generation of signals of time and its transmission to other Functional modules MasterCAN DAC2113.

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* This FM is created only for MasterCAN DAC2113 model.

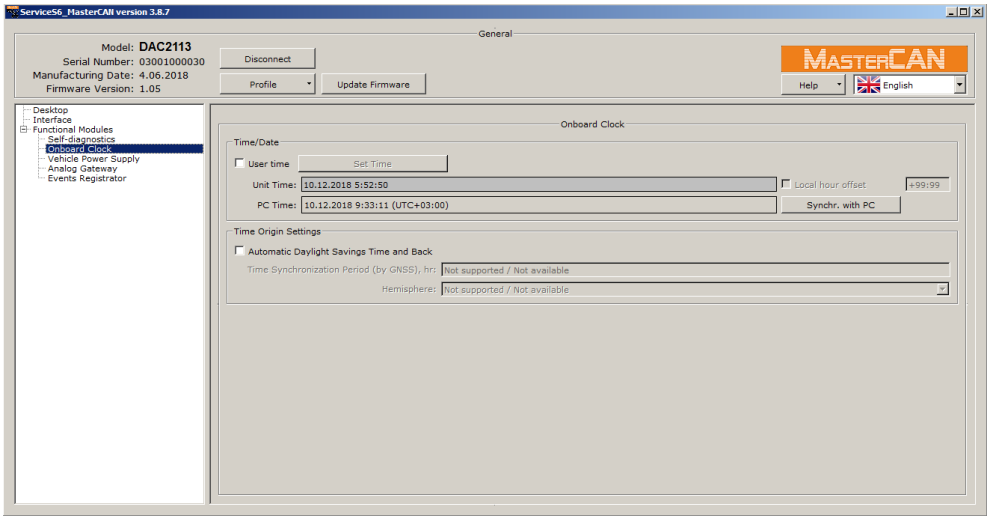

Figure A.5 — Window of settings of Onboard Clock FM in Service S6 MasterCAN software

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*. Used during Events registration.
960	Minutes	On the fact	min	0…250	Present time — minutes*. Used during Events registration.
961	Hours	On the fact	h	0…250	Present time — hours*. Used during Events registration.
963	Month	On the fact	month	0…250	Present date — month*. Used during Events registration.
962	Day	On the fact	d	0…62.5	Present date — day*. Used during Events registration.
964	Year	On the fact	year	1985…2235	Present date — year*. Used during Events registration.
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	Daylight saving time automatic adjustment ON/OFF.
* By default, time is set in UTC format (Coordinated Universal Time standard) and displayed according to local displacement. Present time is available for user for editing manually or synchronizing of date/time with computer clock.					

A.5 Vehicle power supply FM

Vehicle power supply FM*— is designed for monitoring of onboard power network voltage, current mode of power network, operation time of Vehicle in different power network modes, quantity of engine starts**, exceeding permissible time of continuous operation of starter**.

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* This FM is created only for MasterCAN DAC2113 model.
** Preparation for release.

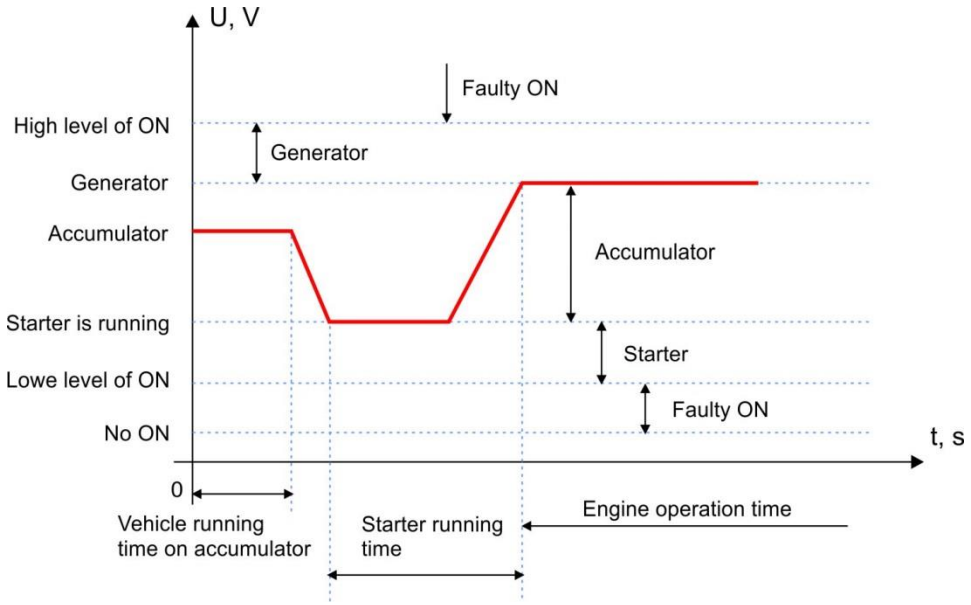

Figure A.6 — Operation modes on onboard network (ON) voltage level

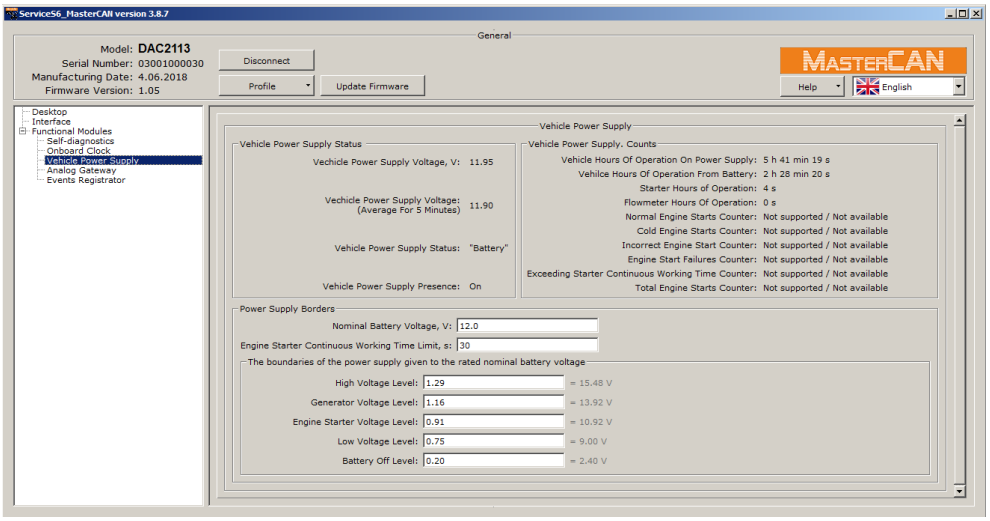

Figure A.7 — Window of settings of Vehicle power supply FM in Service S6 MasterCAN software

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.6 and A.7).
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.6 and A.7).
Power supply borders PGN 63067					
521075	Nominal Battery Voltage	24	V	0…60	Field for entering a nominal value of accumulator voltage of Vehicle (U_{nom}=12V/24V) (see figures A.6 and A.7).
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.6 and A.7). 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.6 and A.7).
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.6 and A.7).
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.6 and A.7).
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.6 and A.7).
521074	Engine Starter Continues 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.6 and A.7). Entered value is used as a threshold for recording "Exceeding permissible time of continuous operation of starter" Event.
Vehicle power supply. Counts PGN 62976					
521173	Vehicle hours of operation on power supply	On the fact	s	0…4211080000	Counter of total operating time of Vehicle from onboard network since sensor installation to the Vehicle. User cannot reset the value of this counter*.
521172	Vehicle hours of operation from battery	On the fact	s	0…4211080000	Counter of total operating time of Vehicle from accumulator since sensor installation to the Vehicle. User cannot reset the value of this counter*.
521170	Starter hours of operation	On the fact	s	0…4211080000	Counter of total operating time of starter since sensor installation to the Vehicle. User cannot reset the value of this counter*.
521171	Starter hours of operation	On the fact	s	0…4211080000	Counter of total operating time of Vehicle's engine since sensor installation to the Vehicle. User cannot reset the value of this counter*.
* Counter can be reset by the Manufacturer of RSC.					

A.6 Analog Gateway FM

Analog Gateway FM* is designed to convert signals of the Unit input/output channels, in compliance with the user settings:

- for input channels it receives analog signals, converts them into digital values of SPN parameters and and transfers them into CAN j1939/S6 Telematics interface;
- for output channels it receives digital PGN data via CAN j1939/S6 Telematics interface, converts SPN paramaters into analog signals of different types (voltage, frequency, current, discrete, resistive) and transfers them into the Unit respective physical outputs.

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* This FM is created only for MasterCAN DAC2113 model.

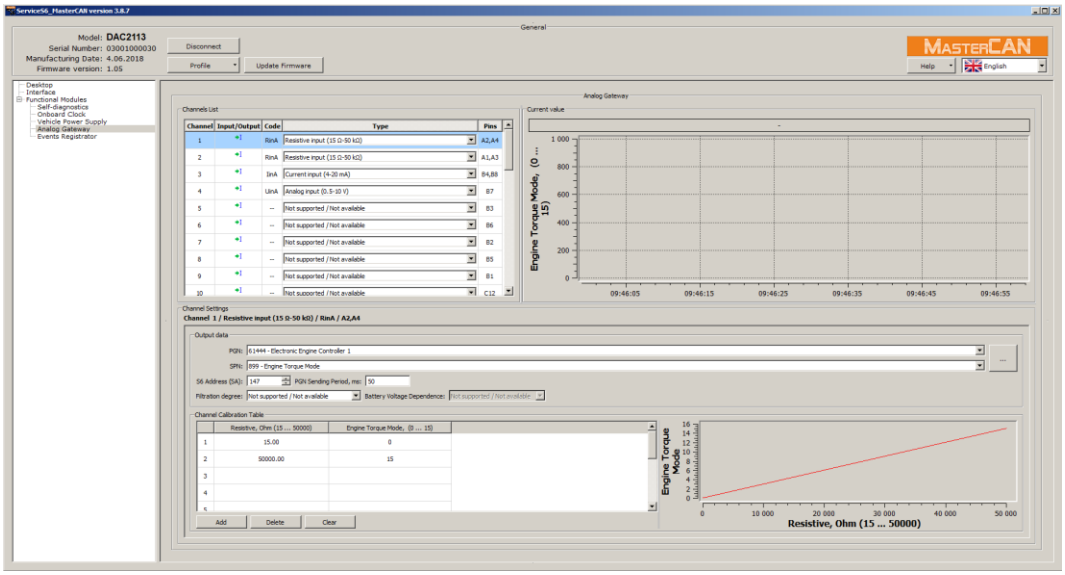


Figure A.8 — Window of settings of Analog Gateway FM in Service S6 MasterCAN software

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	pc.	0…34	Total number of adjustable channels for MasterCAN DAC2113. MasterCAN DAC2113 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 DAC2113 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 I→); - channels numbered from 22 to 34 are physical outputs (designated 0→). 2) Input/output connector and numbers of contacts for electrical connection.

SPN	Name	Factory value	Unit of measure	Range	Clarification
521372	Channels type	On the fact	On the fact	0…4294970000	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 DAC2113 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 2.5, tables 9 and 2.6, table 12).
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 2.5, tables 9 and 2.6, table 12).
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 2.5, tables 9 and 2.6, table 12).
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).
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 DAC2113, 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 DAC2113 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 DAC2113. 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 DAC2113 input analog signal on the voltage fluctuations in the Vehicle circuit. This setting is available only for input analog channels (UinA).

SPN	Name	Factory value	Unit of measure	Range	Clarification
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…4294970000	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.
521377	Signal value	On the fact	On the fact	0…4294970000	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 * — is designed to record up to 15 important recent Events and up to 15 information recent Events.

* This FM is created only for MasterCAN DAC2113 model.

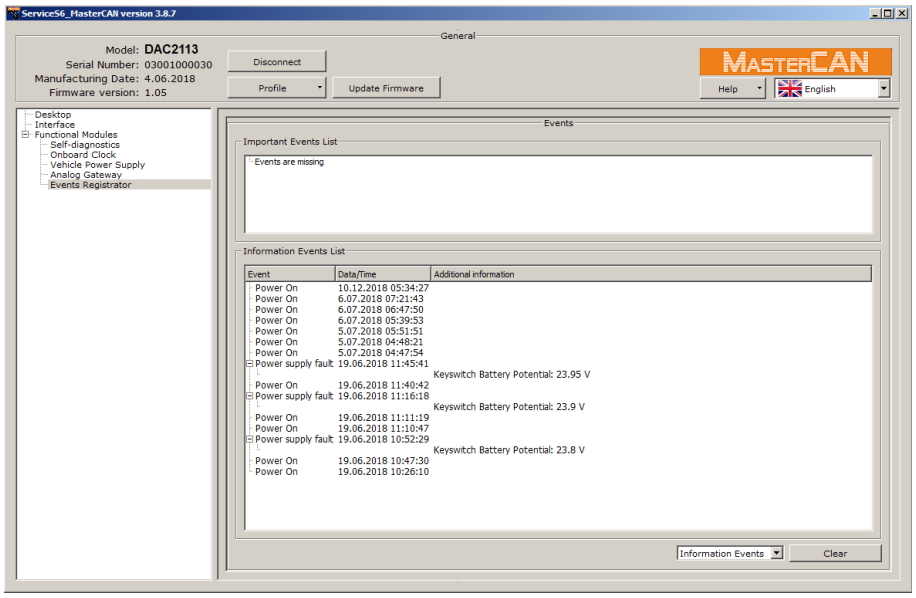


Figure A.9 — Window of settings of Events registrator FM in Service S6 MasterCAN software

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

SPN	Name	Factory value	Unit of measure	Clarification
List of important Events PGN 63055				
521166	SPN Events	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). For each Event, its designation, date/time of occurrence as well as additional information (if any) are specified. Events are displayed in chronological sequence starting from the most recent. As soon as the maximum possible number of the Events displayed is reached, new Events are recorded over the preceding ones, the earliest Events being deleted first.
List of informative Events PGN 63056				
521166	SPN Events	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. For each Event, its designation, date/time of occurrence as well as additional information (if any) are specified. Events are displayed in chronological sequence starting from the most recent. As soon as the maximum possible number of the Events displayed is reached, new Events are recorded over the preceding ones, the earliest Events being deleted first. The user may clear the list of informative Events.

Detailed description of SPN, composition and contents of FM MasterCAN DAC PGN are provided at https://www.jv-technoton.com/ (for access to S6 Database you need to get registered).

Annex B

Channels for configuration of MasterCAN DAC2113

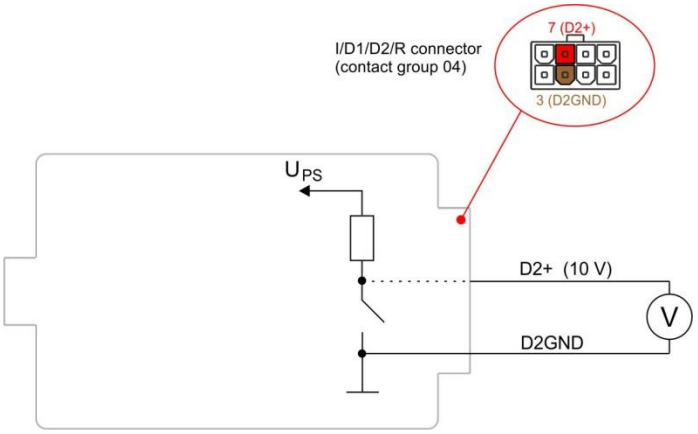
Channel Type	Mnemocode	Specifications
Discrete Input (<10 % U_{PS})	DLinA	Active level of input signal (0…10 % U_{PS})– logical zero, U_{max}=48 V, I≤0.12 mA
Discrete Input (>10 % U_{PS})	DHinA	Active level of input signal (10 % U_{PS} … U_{PS}) – logical one, R_{in} =110 kOhm, U_{max}=48 V
Current Input (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…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…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...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 DAC15

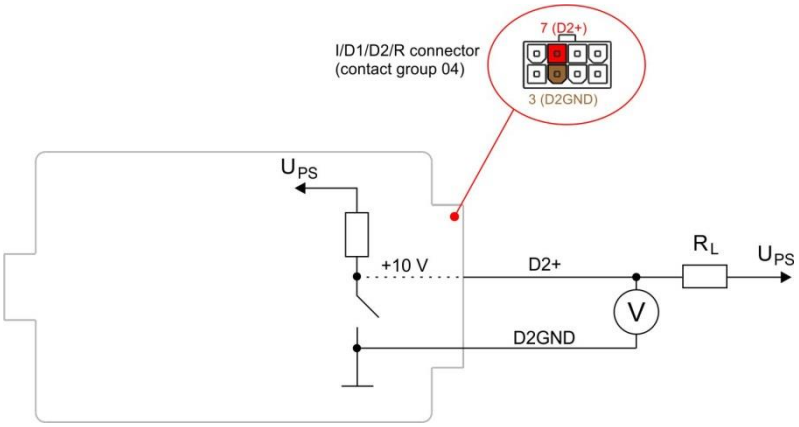
Discrete output D2+ is an inverted output. In case of using this output as signal output, the high voltage level is 10V (see figure C.1).

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