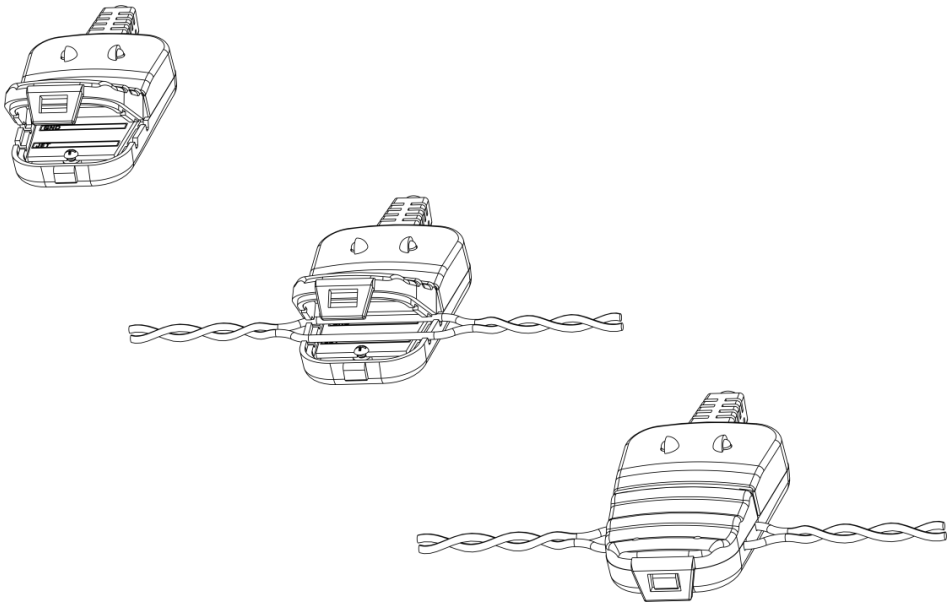
CONTACTLESS READERS



CAN ROCODILE®

NOZZLE ROCODILE®

FMS ROCODILE® CCAN

1708 ROCODILE®

NOZZLE ROCODILE® BM

OPERATION MANUAL

Version 3.0

TECHNOTON®

Content

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Updated information in comparison to version 2.0

- Contactless readers Crocodile product line was extended by a new model – contactless reader-converter FMSCrocodile CCAN;
- New case design for all Crocodile models;
- Changes in delivery set of Crocodile;
- Sealing process of Crocodile's case is described;
- Coordinated operation of CANCrocodile and FSMCrocodile CCAN with digital to analog converter MasterCAN DAC15 is described.

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Terms and Definitions

S6 — is the vehicle onboard data bus developed by JV Technoton to enable integrating the GPS/GLONASS-based vehicle monitoring system into the vehicle electrical equipment. It comprises a set of cables, interfaces and protocols. Physically, it is implemented on the basis of CAN 2.0B (ISO 11898-1:2003) and K-Line (ISO 9141). S6 bus data exchange protocol complies with SAE J1939 International Standard.
To get more details on S6 telematics bus visit http://s6.jv-technoton.com/en/
Telematics interface S6 operation manual contains guidelines and rules which refer to S6 cabling system, S6 SK service kit and service software for S6 Telematics Interface

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

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

J1708 is a digital bus-type interface. Bus J1708 is used in some modern vehicles to transmit and exchange data between the engine controller and other electronic devices. The level of data presentation complies with SAE J1587 International Standard.

FMS are data packets of vehicles' digital onboard interfaces (further on vehicles) that comply with the document FMS-Standard Interface Description (further on — FMS-Standard).
FMS-Standard is an open FMS Interface Standard developed by world leading truck manufacturers.
More detailed description of FMS messages are described in FMS-Standard Interface description document. Actual version of the document can be downloaded from the web site of developer http://www.fms-standard.com.

Telematics — special set of telematics messages developed by Technoton. Meets requirements of SAE J1939/71 standards. Teleamtics messages contain important operation parameters of vehicle.
Onboard equipment (OE) — Telematics System Elements, directly installed in vehicle.

Tracking device is a unit of Telematics System used for reading the signals of Vehicle standard and additional sensors, getting location data and transmitting the data to the Server.
Telematics system — complex solution for real-time and after trip vehicle monitoring and control. Main vehicle parameters monitored: route, fuel consumption, operation time, technical condition of vehicle, safety. Consists of OE, Communication channels, Telematics service ORF 4.

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

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

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Introduction

Recommendations and guidelines contained in this Operation Manual are related to contactless readers CANCrocodile/1708Crocodile/NozzleCrocodile/Nozzle BMCrocodile and contactless reader-converter FMSCrocodile CCAN (hereinafter Crocodile) developed by TECHNOTON JV, Minsk, BELARUS.

This document contains information on Crocodile design, principle of operation, specifications as well as recommendations on its installation, connection and exploitation.

— is toos for Telematics systems which allows to read vehicle's operation data without interfering into the integrity of vehicle's electronics systems.

Distinctive features of Crocodile:

- comply with national and European automobile standards;
- contactless data obtaining through wires insulation without interfering into its integrity;
- doesn't have an impact on the electronic and electrical equipment of the vehicle;
- safe data integration from one or several informational vehicle buses to Telematics Interface;
- simplifies setting-up of telematics terminal by sifting unnecessary data*;
- automatic counter of trip fuel consumption, incremental on hourly consumption data from CANbus*;
- used for petrol and LPG (liquid pressured gas) consumption monitoring on a light commercial vehicles **;
- light indication of operation modes;
- powered from vehicle's onboard power supply – does not require an additional equipment (power supply unit);
- protected against reverse polarity;
- easy to install and operate;
- setting-up is not needed.

* FMSCrocodile CCAN.
** NozzleCrocodile/Nozzle BMCrocodile.

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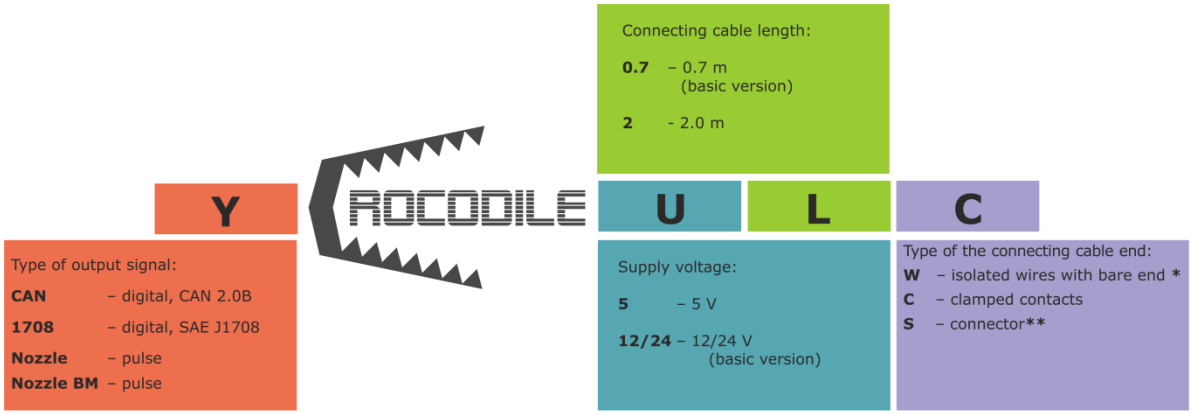
Contactless readers modifications:

- CANCrocodile® — designed for secure vehicle's operation data obtaining from onboard CAN bus;
- 1708Crocodile® — designed for secure vehicle's operation data obtaining from onboard J1708 bus;
- NozzleCrocodile® — designed for monitoring of actual petrol and LPG (liquid pressured gas) engine fuel consumption. Fuel consumption information is based on injector (nozzle) impulses of the engine equiped with electronically controlled injectors.
- NozzleCrocodile® BM — designed for monitoring of actual petrol and LPG (liquid pressured gas) engine fuel consumption of TOYOTA engines. Fuel consumption information is based on injector (nozzle) impulses of the engine equiped with electronically controlled injectors.

See Figures 1 and 2 for identification codes for Crocodile ordering:



* Basic version of NozzleCrocodile, Nozzle BMCrocodile and 1708Crocodile.

** Basic version of CANCrocodile.

Figure 1 — CANCrocodile/1708Crocodile/NozzleCrocodile/Nozzle BMCrocodile order identification codes

Contactless reader-converter modification:

- FMSCrocodile CCAN — for safe gathering of data from Vehicle's CANbus and processing information on fuel consumption and basic operation parameters of Vehicle for Telematics system.

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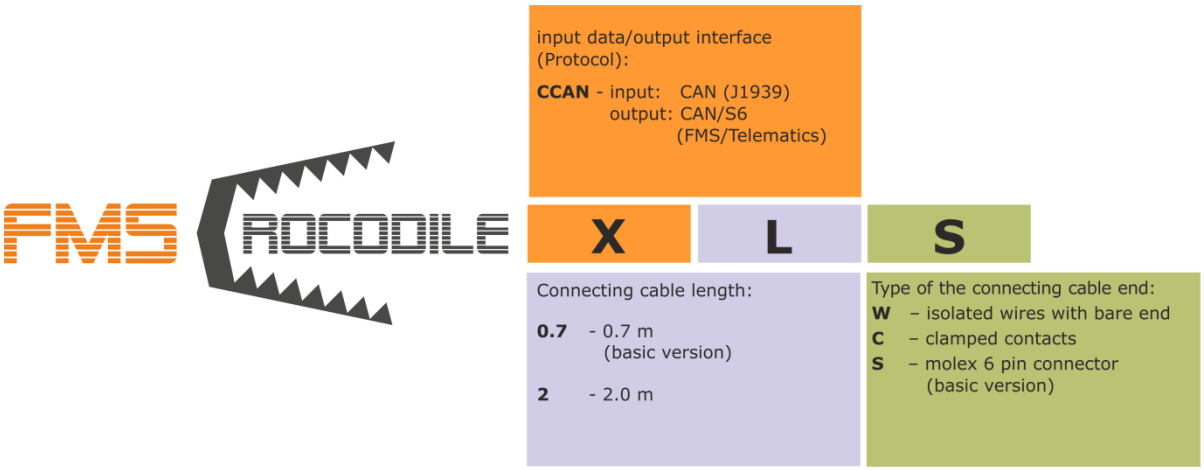

Figure 2 — FMSCrocodile CCAN order identification codes

ATTENTION: While making an order, it is allowed not to specify the identification codes that correspond to basic version of Crocodile.

Examples of Crocodile ordering identification codes:

"Contacless reader CANCrocodile U5 L2 C",
(output interface — CAN 2.0B; nominal supply voltage — 5 V;
length of connecting cable — 2 m; end of connecting cable — clamped contacts);

"Contacless reader NozzleCrocodile",
(output interface — impulse; nominal supply voltage — 12/24 V;
length of connecting cable — 0.7 m; end of connecting cable — isolated wires with bare end).

«Contactless reader-converter FMSCrocodile CCAN 2 S»,
(input data — CAN (SAE J1939), output interface — CAN/S6 (FMS/Telematics);
length of connecting cable — 2 m; end of connecting cable — molex 6 pin connector).

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

To ensure the proper functioning of Crocodile, certified professionals who are trained by the manufacturer should carry out its installation and setup.

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

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1 General information and technical specifications

1.1 Purpose of use and application area

1) Contactless readers, depending on its version, are designed for:

- Contactless data reading from CAN bus and generating the output signal with information package that matches data of the connected bus (CANCrocodile);
- contactless reading from J1708 bus and generating the output signal with information package that matches data of the connected bus (1708Crocodile);
- Contactless reading of the engine/ LPG nozzle control impulses and converting them into normalized impulses that number is proportional to the volume of consumed fuel (NozzleCrocodile).
- Contactless reading of TOYOTA engine nozzle control impulses and converting them into normalized impulses that number is proportional to the volume of consumed fuel (Nozzle BMCrocodile).

2) Contactless reader-converter FMSCrocodile CCAN is designed for Contactless data reading from CAN bus, signal processing, transformation and transmission of ready for use information: FMS messages and Telematics messages

Application area of Crocodile — is used in Telematics systems where it serves as a device for information receipt about the fuel consumption, operating modes of the engine, sensor status, malfunctioning of the vehicle.

CANCrocodile/ FMSCrocodile CCAN and 1708Crocodile are installed on all types of the vehicle equipped with CAN bus and J1708 bus respectively (see figure 3).

NozzleCrocodile and Nozzle BMCrocodile are installed on the vehicles equipped with a petrol/LPG engine with electronically controlled nozzles in the fuel injection system (see figure 4).

FMSCrocodile CCAN is a ready-made solution for safe data gathering from vehicle CANbus and information transmission to S6 Telematics interface. That allows monitoring of vast amount of Vehicle operation parameters over single CAN-port of telematics terminal (see figure 5).

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Crocodile output signal is received by tracking device that collects, records, stores and transfers received signals to the vehicle tracking system server. Software installed on the server is processing and analyzing received data and then making reports that contain information on fuel consumption, operating modes of the engine, sensors status and troubleshooting of the vehicle (see figures 6 and 7).

CANCrocodile/FMSCrocodile and 1708Crocodile are compatible with all types of trackers that have an input for connection of CAN bus and bus J1708 respectively. NozzleCrocodile and Nozzle BMCrocodile are compatible with all types of trackers that have an input for connection of pulse fuel flow meter.

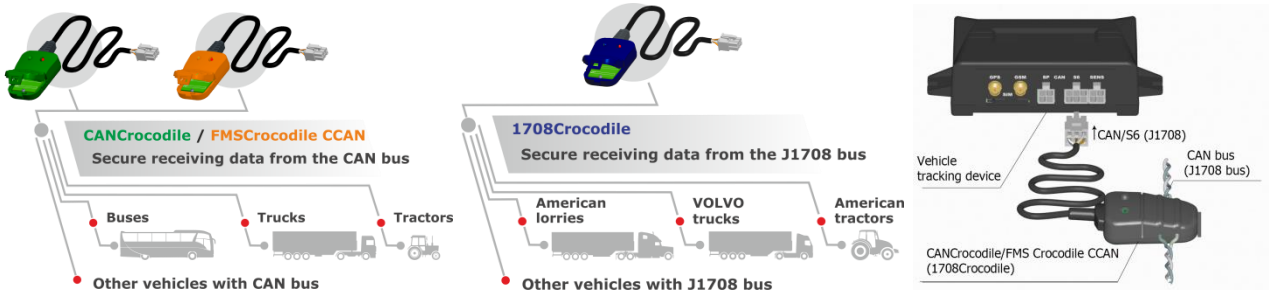

Figure 3 — Secure data obtaining use of CANCrocodile/FMSCrocodile CCAN and 1708Crocodile

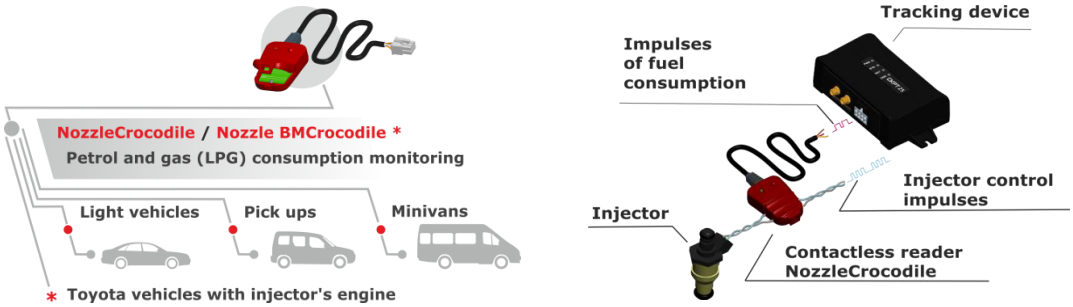

Figure 4 — Secure data obtaining use of NozzleCrocodile/Nozzle BMCrocodile

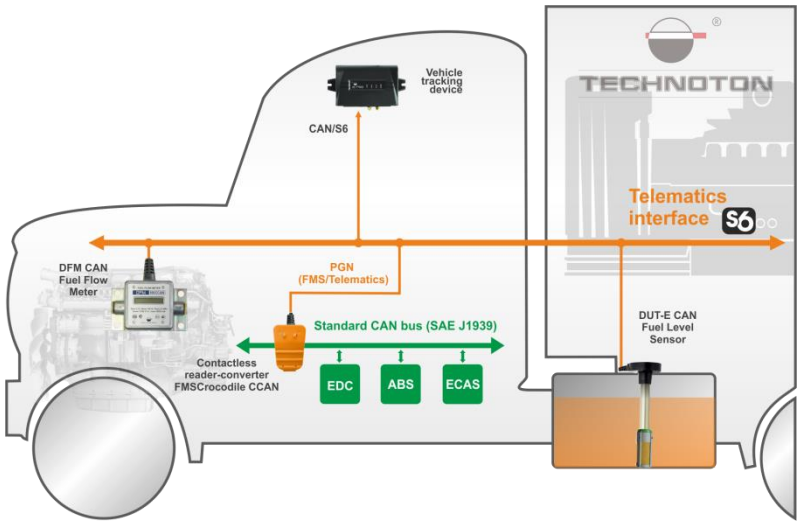

Figure 5 — Secure integration of standard onboard bus CAN and S6 Telematics interface use of FMSCrocodile CCAN

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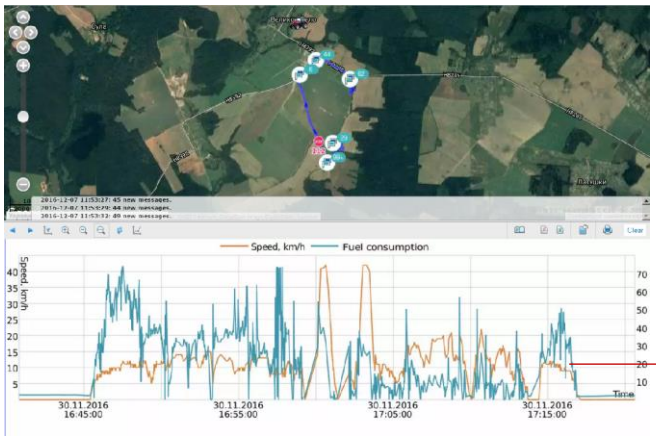

Report	12.1 Fuel report
Object	Мтз 3522 NROK-5 7032
Report geneation time	07.12.2016 11:10:34
Time interval starts	28.11.2016 00:00:00
Time interval ends	04.12.2016 23:59:59
Milage	99 km
Movement time	15:50:02
Fuel consumption of engine/CAN	282 lt
Average consumption of engine/CAN	281 lt/100 km

Data based on CAN bus

Graph of instant fuel consumption based on CAN bus data

Figure 6 — Example of report generated in ORF 4 sofware, based on the FMSCrocodile CCAN data

Graph of instant LPG consumption generated based on injector control impulses

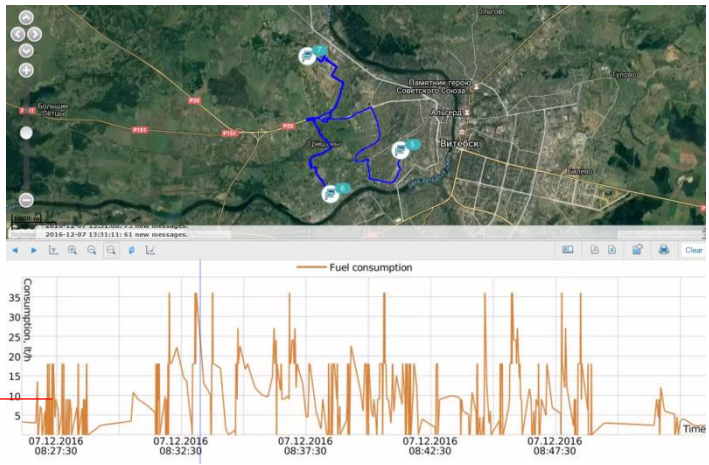

Figure 7 — Example of report generated in ORF 4 sofware, based on the NozzleCrocodile data

ATTENTION: The information package transmitted via CAN bus (J1708 bus) may differ depending on the producer, model and manufacture year of the Vehicle

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1.2 Delivery set

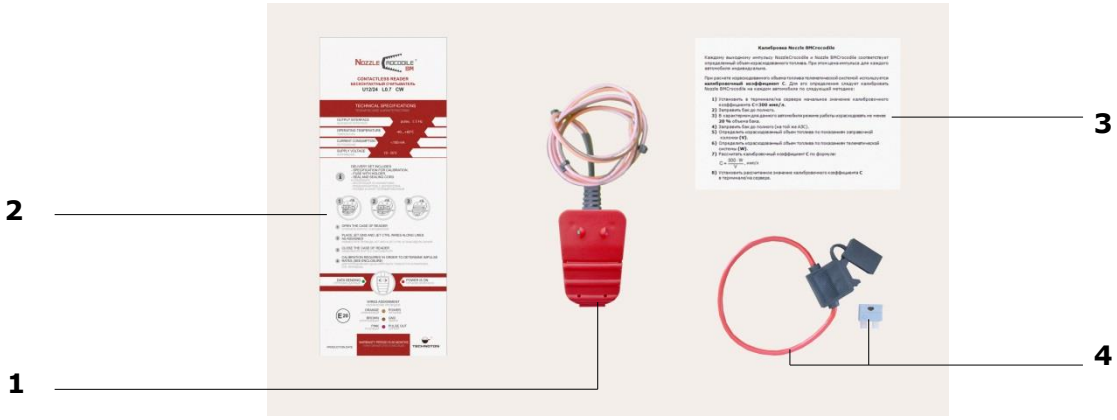
1 Contactless reader – 1 pc.;

2 Blister pack insert with main technical specifications and brief operation manual of Crocodile – 1 pc.;

3 Sealing cord – 1 pc.;

4 Plastic seal – 1 pc.

Figure 8 — CANCrocodile/1708Crocodile/FMSCrocodile CCAN delivery set



1 Contactless reader – 1 pc.;

2 Blister pack insert with main technical specifications and brief operation manual of Crocodile – 1 pc.;

3 Specification for calibration – 1 pc.;

4 Fuse with holder (2 A) – 1 pc.

Figure 9 — NozzleCrocodile/Nozzle BMCrocodile delivery set

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1.3 Technical specifications

1.3.1 Main exploitation specifications

Table 1 —Crocodile main exploitation specifications

Parameter, unit of measurement	**Crocodile modifications**			
	CANCrocodile	**1708Crocodile**	**NozzleCrocodile, Nozzle BMCrocodile**	**FMSCrocodile CCAN**
Acceptable level of message losses,%, not more	1		—	1
Nominal supply voltage for versions **U5***, V	5			—
Nominal supply voltage for versions **U12/24***, V	12 or 24			
Current consumption at supply voltage 5 V, mA, not more	200		100	—
Current consumption at supply voltage 12 V, mA, not more	30		30	40
Current consumption at supply voltage 24 V, mA, not more	15		20	20
Supply voltage range (at nominal supply voltage 5 V), V	from 4,5 to 5,5			—
Supply voltage range (at nominal supply voltage 12/24 V), V	from 10 to 50			from 10 to 45
Operating ambient temperature, °C	- 40…+ 85			
Ingress Protection Rating	IP30			
Overall dimensions, mm, not more	See figure 10			
Weight, kg, not more	0,1			
Compatibility	SAE J1939, CAN Open, DeviceNet, NMEA 2000	SAE J1587	—	SAE J1939
* See figure 1				

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1.3.2 Overall dimensions

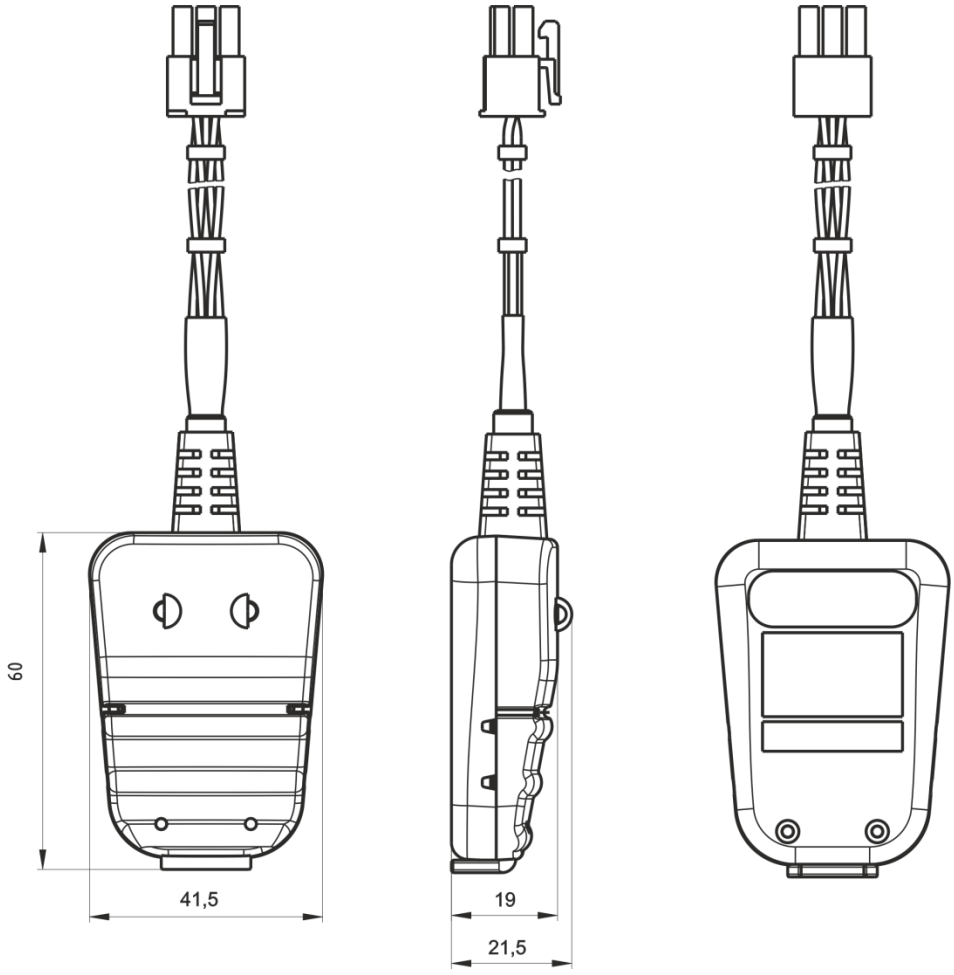

Figure 10 — Crocodile dimensions

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1.3.3 Output interface of CANCrocodile

CANCrocodile output interface — CAN 2.0B, according to international standard SAE J1939.

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1.3.4 Output interface of 1708Crocodile

1708Crocodile output interface— J1708, according to international standard SAE J1587.

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1.3.5 Output signal specifications of NozzleCrocodile and Nozzle BMCrocodile

NozzleCrocodile and Nozzle BMCrocodile output signal specifications presented at table 2.

Table 2 — Output signal specifications of NozzleCrocodile and Nozzle BMCrocodile

Parameter, unit of measurement	Value
Type of signal	Impulse
Frequency, Hz, no more then	10
Amplitude, V	from 0 to U_{ov}*
* U_{ov} – onboard voltage	

NozzleCrocodile output signal is voltage pulses which amplitude varies from 0 V up to the value of the on-board network voltage. Every pulse of **NozzleCrocodile** output signal is formed as a result of consumption of a certain fuel amount. Type of **NozzleCrocodile** output signal is shown at Figure 11.

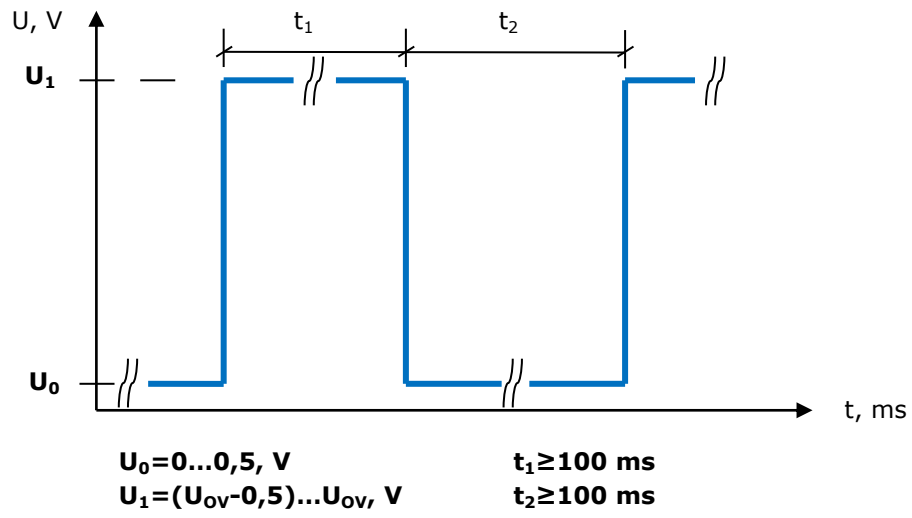

Figure 11 — NozzleCrocodile and Nozzle BMCrocodile output signal type

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1.3.6 Output interface of FMSCrocodile CCAN

FMSCrocodile CCAN output interface — CAN/S6. Physically, it is implemented on the basis of CAN 2.0B (SAE J1939) interface.

Data transfer protocol of FMSCrocodile CCAN meets requirements of SAE J1939 standard and S6 Database (see http://s6.jv-technoton.com).

FMSCrocodile CCAN sends FMS and Telematics messages to CAN/S6 interface (see table 3).

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

Table 3 — Output messages of FMSCrocodile CCAN

PGN	Short message description
Telematics	
63233	Message 1
63234	Message 2
63235	Message 3
63236	Message 4
FMS	
61440	Electronic retarder controller 1
61443	Electronic engine controller 2
61444	Electronic engine controller 1
61445	Electronic transmission controller 2
64777	High resolution fuel consumption (liquid)
64932	PTO drive engagement
64933	Door control 2
64977	FMS-standard interface identity/Capabilities
65102	Door control 1
65110	Aftertreatment 1 diesel exhaust fluid tank 1 information
65112	Air suspension control 4
65131	Driver's identification
65132	Tachograph
65136	Combination vehicle weight
65198	Air supply pressure
65216	Service information
65217	High resolution vehicle distance
65237	Alternator information

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Table 3 continued

PGN	Short message description
65253	Engine hours, revolutions
65254	Time/Date
65257	Fuel consumption (liquid)
65258	Vehicle weight
65260	Vehicle identification
65262	Engine temperature 1
65265	Cruise control/Vehicle speed 1
65266	Fuel economy (liquid)
65269	Ambient conditions
65276	Dash display

Notes

1 The content of FMSCrocodile CCAN output messages depends on the data received by CAN bus (J1708 bus). This data may differ depending on the manufacturer, the model and the year of the Vehicle manufacturing.

2 FMSCrocodile CCAN automatically increments trip fuel consumption counter, calculating it from "Hourly fuel consumption" (SPN 183) and stores calculated values inside internal memory until powering off. Minimum step of trip fuel consumption counter incrementing is 0.5 L. If standard PGN 65257, which contains "Volume of fuel consumed in a trip" (SPN 182) and/or "Fuel consumption by engine" (SPN 250), is transmitted over a CANbus, this standard PGN will have higher priority and will be transmitted to the output of FMSCrocodile CCAN without any changes.

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1.3.7 Compatibility of Crocodile with terminals

Technoton regularly conducts tests for compatibility and joint accuracy of Crocodile with different tracking devices of popular brands. Table 4 shows tracking devices models compatible with Crocodile providing accuracy error of joint fuel consumption measurement of not more than **±1 %.**

Table 4 — Compatible vehicle tracking devices

№	Tracking device			Analytical software	Crocodile model
	Brand	Model	Modification		
1	СКРТ	СКРТ	31	ORF-MONITOR	NozzleCrocodile
2			25		
3			45		
4	GALILEOSKY	GALILEOSKY	GPS	Wialon	NozzleCrocodile
5			GLONASS		
6	АвтоГРАФ	Autograf	GSM (GLONASS)	Autograf Software	NozzleCrocodile
7			GSM+		CANCrocodile*
8	TELTONIKA	Teltonika	FM4200	Wialon Hosting	Nozzle BMCrocodile**
9			FM5300		NozzleCrocodile
10	mapOn	MapOn	GBOX6	web server mapOn	NozzleCrocodile
11	LOCARUS	Locarus	702X	LocarusInformer	NozzleCrocodile
12			702R		
13			702S		
14			702X		CANCrocodile*
15	BCE BALTIC CAR EQUIPMENT	BCE	Fm Light	Wialon	NozzleCrocodile
16	ritm	VOYAGER	2	RITM-PCN	NozzleCrocodile
17	simbiotecha	Simbiotecha	GATE-FM 200	Server software monitoring "GPS vehicle tracking and fuel consumption monitoring" www.tracking.lt	NozzleCrocodile
18	NAVISET	Naviset	GT-10	server GPS-Trace Orange	NozzleCrocodile
19	EcoTelematics Group	NaviFleet	ET100	NaviFleet	NozzleCrocodile

* Terminal process the signal correctly.
** Accuracy error of joint fuel consumption measurement of not more than ± 2 %.

Relevant information on the compatibility of specific models of tracking devices and Crocodiles and recommendations for their connection and setup can be found at http://www.jv-technoton.com/.

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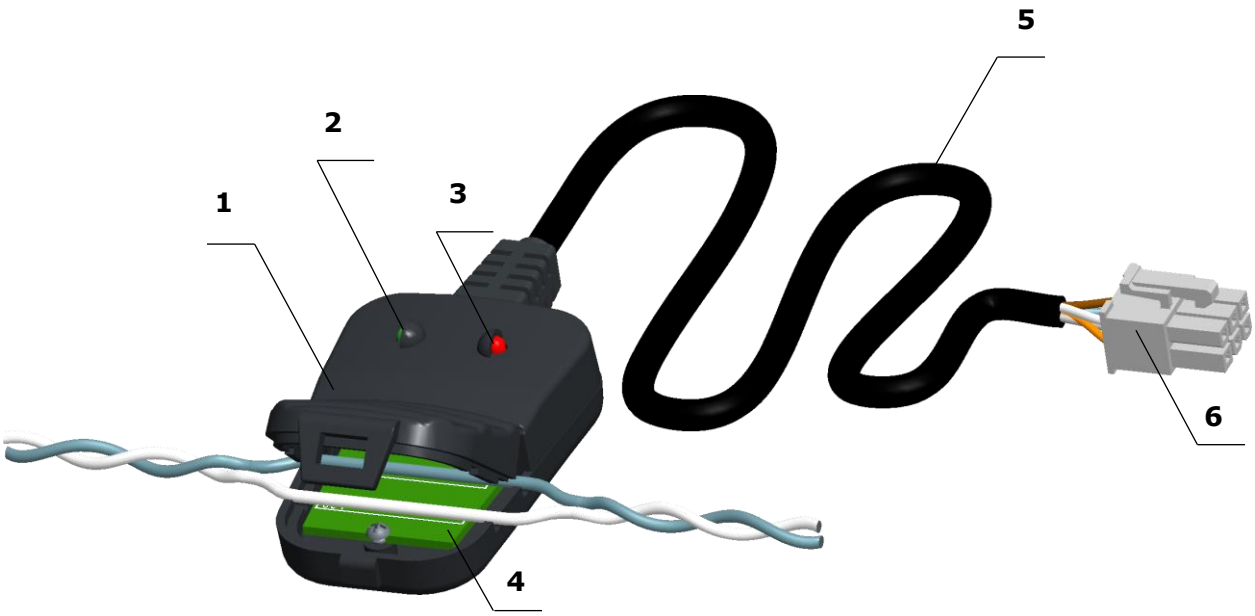
1.4 Unit structure and operation principle of Crocodile



1 – body;
2 – data LED indicator (green);
3 – power LED indicator (red);
4 - electronic board;
5 - connecting cable;
6 - connector* for power supply and the receiving device (tracker).

Figure 11 — Crocodile structure

The principle of Crocodile operation is based on reading the electromagnetic field that is formed around the wires during the signal passing.

CANCrocodile and 1708Crocodile form the digital output signal that has data package identical to the signal of the connected bus (CAN or J1708 respectively). This signal can contain information about operating modes of the engine, fuel consumption, sensor status, malfunctioning of the vehicle.

NozzleCrocodile and Nozzle BMCrocodile convert read-out engine nozzle control pulses into normalized pulses that number is proportional to the volume of consumed fuel. Nozzle BMCrocodile has a noise filtering function. Noise is common for nozzle control pulses of TOYOTA engines.

FMSCrocodile CCAN reads data from on-board CANbus over J1939 protocol, analyses gathered data, sorts out the information on Vehicle operation parameters, transforms information and transmits data packages (PGN) to output interface (see 1.3.6).

Signal values of Crocodile LED indicators are defined according to table 5.

***** delivered for versions **S** (see figure 1).

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Table 5 – Signal values of Crocodile LED indicators

LED indicator		Signal value		
Colour	**Status**	**CANCrocodile, FMSCrocodile CCAN**	**1708Crocodile**	**NozzleCrocodile Nozzle BMCrocodile**
Green		Messages receipt from CAN bus	Messages receipt from J1708 bus	Pulses transmission
	Off	No messages in CAN bus	No messages in J1708 bus	No pulse transmission
Red		Power is on		
	Off	No power (supply voltage is lower than normal)		

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2 Connection of Crocodile

ATTENTION: Strictly follow safety rules of automobile repair works as well as local safety rules of the customer company when mounting Crocodile.
Before Crocodile installation it is recommended to study carefully the electrical circuit diagram and the Operating Manual of the vehicle on which Crocodile is mounted.

2.1 Exterior inspection prior to connection

It is required to conduct Crocodile 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 detected.

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2.2 Recommendations for search of CAN bus wires

To connect CANCrocodile / FMSCrocodile CCAN to CAN onboard bus, you must find and identify wires CAN-H (CAN HIGH) and CAN-L (CAN LOW).

Physically, CAN bus most often is a twisted (stranded) pair of wires (30 windings per running meter) with splitters to connect electronic control units (further on – ECU) that have terminating resistors of 120 Ohms nominal impedance located at the ends of the bus. The resistors may be mounted separately or may be integrated into the ECU. As a rule, there is no SHLD wire.

Example: DEUTSCH company manufactures CAN buses made of special three-conductor cable (CAN-H, CAN-L, and signal GND) with 7 to 12 mm external coating diameter, special splitters, and terminating elements – terminating resistors designed to match wave impedance during the transmission of messages in the bus and to suppress interference (see figure 12).

Figure 12 — Elements of the CAN bus produced by DEUTSCH company

There may be from one to six and more CAN buses on the vehicle of EURO-3 Environmental Standard. They may be defined as M-CAN, T-CAN, I-CAN, H-CAN, A-CAN, EBS-CAN etc.
The following three CAN buses are of interest for fuel consumption monitoring: T-CAN, M-CAN, and I-CAN (seldom).

T-CAN and M-CAN may have the following features:

- Availability of OBD II connector for diagnostics (see figure 13);
- the color and cross-section of stranded pairs of wires;
- connection of stranded pairs of wires to contacts at OBD II and ECU connectors.

Example: If there is an OBD II diagnostics connector on the vehicle and a pair of stranded wires of orange color one of which has a black band, and the other has a brown one, and this pair of stranded wires matches the OBD II diagnostics connector, so this may be the CAN bus you are looking for. In this case, the orange wire with the black band is CAN-H, while the wire with the brown band is CAN-L.

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Figure 13 — Examples of OBD II diagnostics connector

Contacts of the ABS/ASR ECU system corresponding to CAN bus are identified according to figure 14.

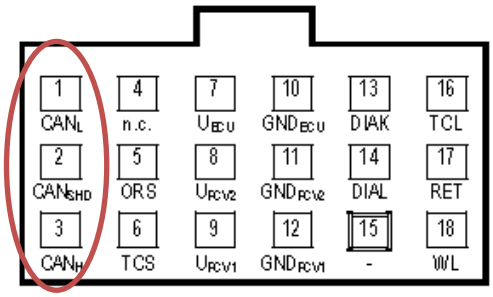

Figure 14 — Identification of CAN bus in the ABS/ASR ECU connector ABS/ASR ECU

WARNING: Features of CAN bus may be different for different vehicle manufacturers. Besides, those features may be different for the same manufacturer depending on the particular design features of the vehicle and its configuration (the engine, fuel supply system, the link between the engine EDC and the throttle pedal, availability or absence of the electronic dashboard, digital tachograph, etc).

Initial diagnostics and assessment of CAN bus serviceability may be carried out using a multimeter by means of the following traditional methods:

- continuity test of CAN-L and CAN-H wires;
- short circuit and impedance check (full impedance depending on the terminating resistors and input impedance of ECUs connected to the bus) between CAN-L and CAN-H wires;
- measurement of voltages in CAN-L and CAN-H wires in the recessive mode (the ignition is off, the battery disconnect switch is on) and in the dominant mode (the ignition is on and engine has been started).

The impedance check should be carried out with the whole onboard circuit off (the battery disconnect switch is off). The control impedance value must be no more than 60 Ohms.

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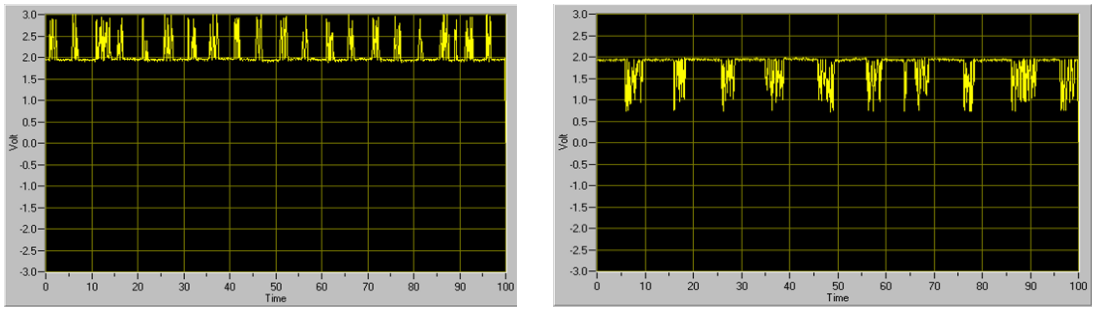
The serviceability check of CAN bus is carried out with the ignition and engine on, by pressing and releasing the throttle pedal between the wires of the stranded pair of wires. The control voltage value must be from 1.2 to 3.0 V.

CAN-H and CAN-L can be identified according to the following voltage values:

- recession mode — about 2.5 V (on both CAN-L and CAN-H);
- dominant mode — less than 2.5 V (on CAN-L) and more than 2.5 V (on CAN-H).

Example of oscilloscope pictures of signals from CAN-high and CAN-low are presented at figure 15.



a) CAN-H *b) CAN-L*

Figure 15 — Oscilloscope pictures of signals from CAN-high and CAN-low

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2.3 Recommendations for search of J1708 bus wires

To connect 1708Crocodile to J1708 onboard bus, we need to use the oscilloscope to identify J1708.A and J1708.B wires.

The signal of J1708 bus is a differential-mode signal, the voltage amplitude at J1708.A and J1708.B wires varies from 0 to 5 V.

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2.4 Recommendations for search of nozzle's control wire

NozzleCrocodile / Nozzle BMCrocodile is recommended to install on the nozzle control wire of the first engine cylinder.

Detection of nozzle control wire is carried out by means of oscilloscope. However, various vehicles have their own unique features for connection of the oscilloscope signal gauge that depending on wire access can be connected to:

- injector connection input;
- injector control unit;
- wire harness of the injector.

Oscilloscope patterns of control pulse signals of the petrol engine injector with electronically controlled fuel injection system look like it is shown at Figure 13.

a) single pulse *b) idle mode*

Figure 16 — Oscilloscope pictures of nozzle control signals (pulses)

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2.5 Exploitation restrictions

In order to install the Crocodile, you need to choose dry area protected from aggressive environmental influences.

It is not allowed to install Crocodile near heating or cooling elements (e.g.: climate-control systems). Also, it is not recommended to install Crocodile close to the automobile power circuits. A driver cabin will be the best place for the installation.

During installation, you need to make sure that under the automobile hood the Crocodile housing and its cable are located at least 10 cm far from engine rotating parts and surfaces.

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2.6 Electrical connection

Crocodile can be powered from the automobile vehicle's onboard network or from the tracking device.

ATTENTION:

1) Before starting Crocodile installation, it is needed to disconnect electrical circuit of the vehicle. To do this, we shall use the battery disconnect switch or remove contact terminals from it.

2) It is recommended to use fuses when connecting Crocodile power supply (see figure 17 a). Nominal fuse current is not more than 2 A.

3) Crocodile power supply "+" and Ground "-" wires should be connected to the same points of vehicle electric circuit as correspondent wires of the tracking device.

4) Prior to electrical connection of the Crocodile pay special attention to Checking vehicle chassis ground. Resistance between any point of vehicle chassis and "-" terminal of the battery or between terminals of the chassis ground switch should not exceed 1 Ohm.

To connect Crocodile power supply wires, it is recommended to use terminals (see figure 17 b), while connecting signal wires, it is recommended to use connectors as shown at figure 17 c.

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

Figure 17 — Terminal and connector accessories for Crocodile connection

CANCrocodile and FMSCrocodile CCAN electrical connection is made according to pin-out (applicable for **S** version) of the connector and interface cable wires assignment (see table 6).

Table 6 — CANCrocodile and FMSCrocodile CCAN cable wires assignment

Connector Pinout	Pin number	Wire			Signal	
		Marking	Color		Circuit designation	Signal parameters
	1	VBAT	Orange		Power Supply "+"	Analog, voltage from 10 to 50 V
	2	GND	Brown		Ground "-"	—
	3	CANH	Blue		CAN HIGH	Digital, in accordance with SAE J1939 Standard
	4	CANL	White		CAN LOW	

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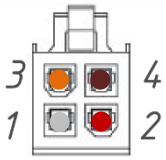
1708Crocodile electrical connection is made according to pin-out (applicable for **S** version) of the connector and interface cable wires assignment (see table 7).

Table 7 - 1708Crocodile cable wires assignment

Connector Pinout	Pin number	Wire			Signal	
		Marking	Color		Circuit designation	Signal parameters
	1	J1708.A	White		J1708.A	Digital, in accordance with international SAE J1587 standard
	2	J1708.B	Red		J1708.B	
	3	VBAT	Orange		Power Supply "+"	Analog, voltage from 10 to 50 V
	4	GND	Brown		Ground "-"	—

NozzleCrocodile and Nozzle BMCrocodile electrical connection is made according interface cable wires assignment (see table 8).

Table 8 – NozzleCrocodile and Nozzle BMCrocodile cable wires assignment

Wire			Signal	
Marking	Color		Circuit designation	Signal parameters
VBAT	Orange		Power Supply "+"	Analog, voltage from 10 to 50 V
GND	Brown		Ground "-"	—
T701	Pink		Output signal	Pulse (See 1.3.5)

After power-on of Crocodile, please switch on the battery (ignition).

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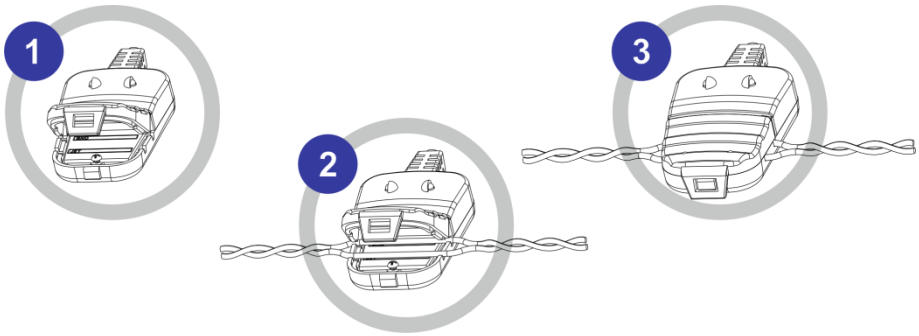
2.7 Contactless connection to the vehicle wires

To connect Crocodile, fulfill the steps in accordance with figure 18.



1 — open Crocodile cover.

2 — lay the corresponding wires into the slots of the Crocodile body according to the marking indicated on electronic board.

3 — close Crocodile body until you hear a click.

Figure 18 — Steps for Crocodile connection

ATTENTION: To reduce sensitivity of Nozzle BMCrocodile against conducted interference its recommended to use **Ivashkevich** connection **method.** The idea of the method is to use Ground "-" wire of interface cable instead of GND JET at coresponding slots of Nozzle BMCrocodile. As a rule Ivashkevich's method ensures more stable reading of nozzle control pulses at any engine speed.

Examples of Crocodile connection on a vehicle are presented at figure 19.

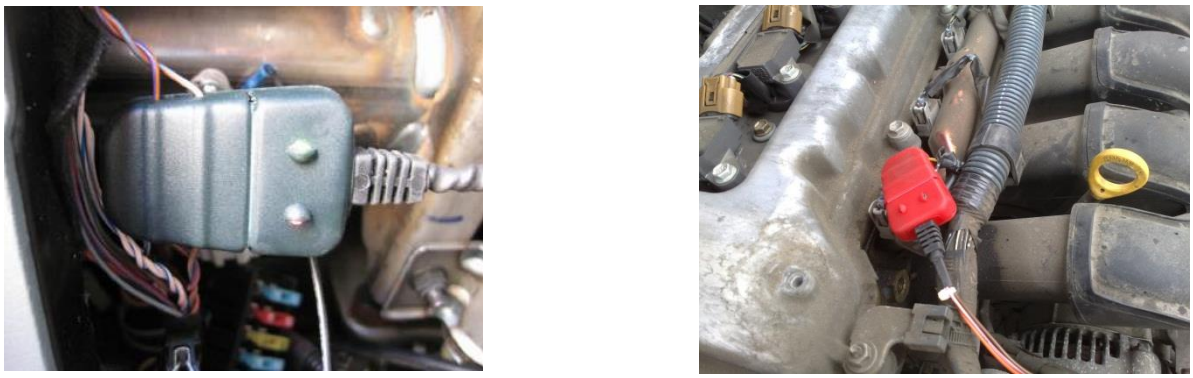


Figure 19 — Examples of Crocodile connection

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2.8 Sealing

To prevent unauthorized access to Crocodile, secure its case by using sealing rope and seal from delivery set (except NozzleCrocodile and NozzleCrocodile BM) (see figure 20).

Sealing should be done when Crocodile's case is opened. Put the rope through special holes in the case and through two holes placed in the center of the seal. Close Crocodile's case and click the seal. After clicking the seal, the rope will be permanently fixed making Crocodile's case opening not possible without damaging seal.

Figure 20 — Seal Crocodile *****

***** The seal may look different from the one shown on figure 20

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3 Functioning check

If the connection is done correctly, the Crocodile starts its operation as soon as it is powered on (ignition is on). When you disconnect the power supply (turn off the ignition), Crocodile will be switched off.

If Crocodile connection is made correctly, signal values of red and green LED indicators located on Crocodile body shall comply with table 5.

ATTENTION: When injector wires are connected with Nozzle Crocodile or Nozzle BMCrocodile correctly, the blinking frequency of the green LED indicator is increasing while speed of the engine is increasing.
If blinking frequency of the green LED indicator is not changing, you should check nozzle's wires connection and might need to swap it.

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4 NozzleCrocodile and Nozzle BMCrocodile calibration

Each output pulse of NozzleCrocodile and Nozzle BMCrocodile corresponds to a certain volume of consumed fuel. Thus, NozzleCrocodile and Nozzle BMCrocodile pulse values are individual for each vehicle.

To calculate the volume of consumed fuel, a calibration factor **C** is used in the telematics system. In order to define **calibration factor C** for NozzleCrocodile and Nozzle BMCrocodile, the following procedure should be applied to each vehicle:

1) Set the initial value of the calibration factor **C=300 imp/l** at the terminal or server.

2) Fill the tank to the full.

3) Consume **20%** of the fuel tank volume at a standard driving conditions of the vehicle.

4) Fill the tank to full (at the same petrol station)

5) Estimate the volume of consumed fuel according to the indications of the fuel pump dispenser **(V)**.

6) Estimate the volume of consumed fuel according to the telematics system indications **(W)**.

7) Calculate the calibration factor **C** using the following formula:

$$C = \frac{300 \cdot W}{V}, \text{ impulses/liter}$$

8) Set the calculated calibration factor **C** at the terminal or server.

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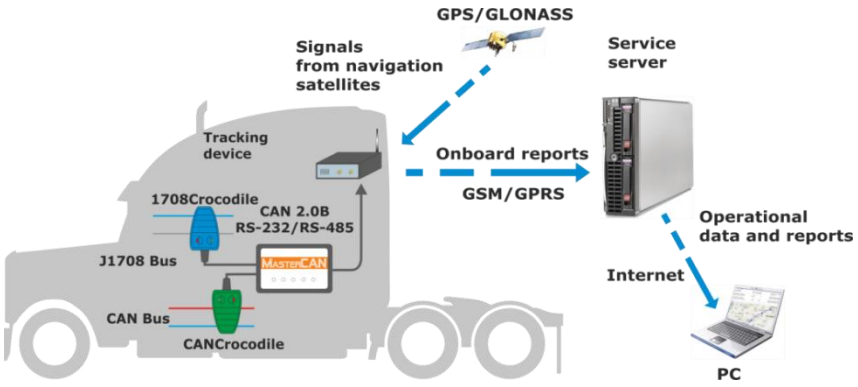
5 Integration of on-board data buses CAN and J1708 into Telematics systems

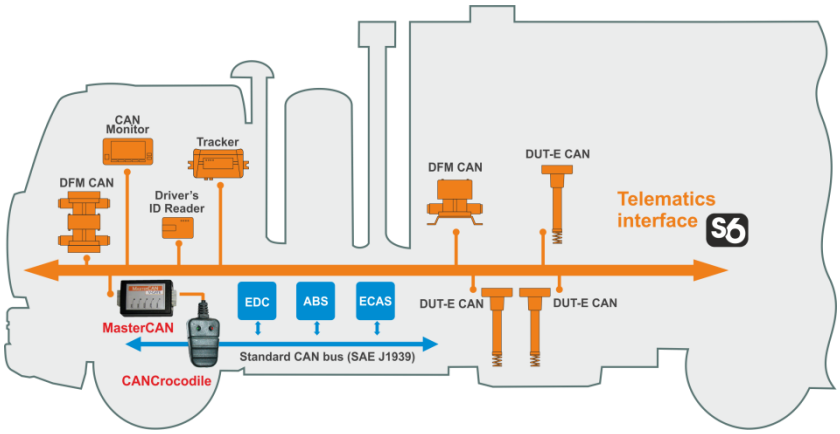
CANCrocodile and 1708Crocodile are used together with vehicle data interfaces MASTERCAN as a turn-key solution for integration of onboard data buses CAN and J1708 with transport telematics system (see figure 21 a).

MasterCAN is filtering data of onboard vehicle's buses read by Crocodile, is erasing not useful information and generating messages that contains the most valuable vehicle's operation parameters for telematics system.

Besides that, joint usage of MasterCAN and Crocodile is convenient to use for data collecting of sensors and peripheral equipment of one or several standard onboard buses CAN (J1708) and transmitting information to S6 Telematics interface (see figure 21 b).



a) Integration of onboard data buses CAN and J1708 with transport telematics system



b) Integration of standard onboard bus CAN and S6 Telematics interface

Figure 21 — Contactless readers Crocodile in combination with vehicle data interfaces MasterCAN

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MasterCAN modifications:

- MasterCAN CC for reception of data from CAN 2.0B and FMS onboard interfaces, data conversion and sending the created FMS messages and Telematics messages to CAN 2.0B interface;
- MasterCAN C 232/485 for reception of data from CAN 2.0B and FMS onboard interfaces, data conversion and sending the created messages into RS-232 and RS-485 interfaces;
- MasterCAN V-GATE for reception of data from CAN 2.0B, FMS and J1708, onboard interfaces, data conversion and sending the created FMS-messages and Telematics messages into CAN 2.0B interface and messages into RS-232 interface.

Table 9 — MasterCAN modifications input/ output interfaces (protocols)

MasterCAN modifications	Input interface (protocol)	Output Interface (Protocol)
	CAN (SAE J1939)	CAN 2.0B (SAE J1939)
	CAN (SAE J1939)	RS-232 and RS-485 (ASCII/Modbus/DUT-E COM)
	CAN (SAE J1939) and J1708 (SAE J1587)	CAN 2.0B (SAE J1939) and RS-232 (ASCII/Modbus/DUT-E COM)

Template schemes of connection of tracking device with CANCrocodile (1708Crocodile) and MasterCAN for secure data obtaining from onboard data buses CAN (J1708) are presented at Annex A.

Content of output messages, set up order and other useful information about MasterCAN is presented in MasterCAN operation manual.

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6 Usage of FMSCrocodile CCAN and CANCrocodile combined with digital to analog converter MasterCAN DAC15

CANCrocodile / FMSCrocodile CCAN combined with MasterCAN DAC15 digital to analog converter can be used as an out-of-the-box solution for integration of vehicle CAN bus essential data into vehicle Telematics system through analog inputs of the tracking device (see figure 22).

This solution is used within Telematics systems, where analog On-board equipment is used along with digital CAN/S6 equipment.

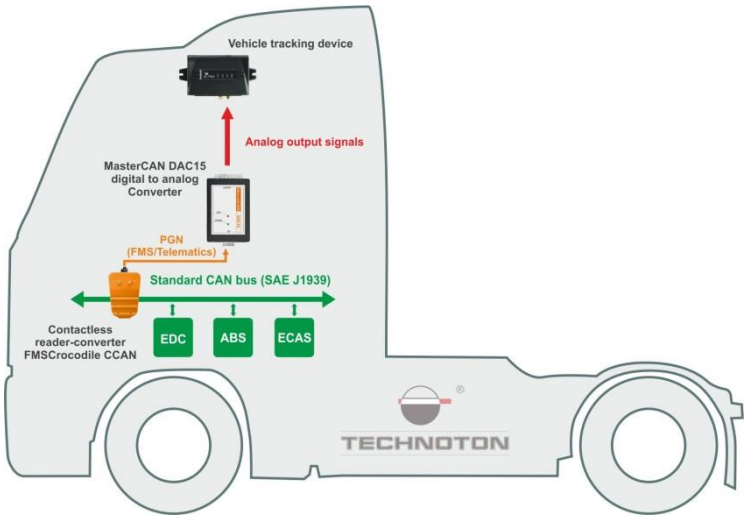

Figure 22 – Converting CANbus data to analog signals

MasterCAN DAC15 is equipped with:

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

MasterCAN DAC15 digital output interface specifications correspond to specifications of S6 Telematics interface. S6 bus data exchange protocol complies with SAE J1939 International Standard.

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Table 10 — Analog signals specification

Signal type, measurement units	Value
Analog input	
Voltage, V	0.5…9
Frequency, kHz	0.01…10
Analog outputs	
Voltage, V	0.5…9
Frequency, kHz	0.01…10
Current, mA	4…20
Discrete 1, V	0 (level 0) U_{PS} (level 1)*
Discrete 2, V	0 (level 0) 10 (level 1)
Resistive, kOhm	0.015…50
* U_{PS} – voltage of vehicle power supply source.	

Necessary input/output analog signal type selection and signal adjustment is carried out through Service S6 MasterCAN software (you can download software at http://www.jv-technoton.com/, in Software/Firmware section).

MasterCAN DAC15 converting digital data (SPN) of automotive interface CAN/S6 to analog inputs of telematics terminal or dashboard and (or) analog output signals of automotive sensors to CAN/S6 ports of telematics terminal.

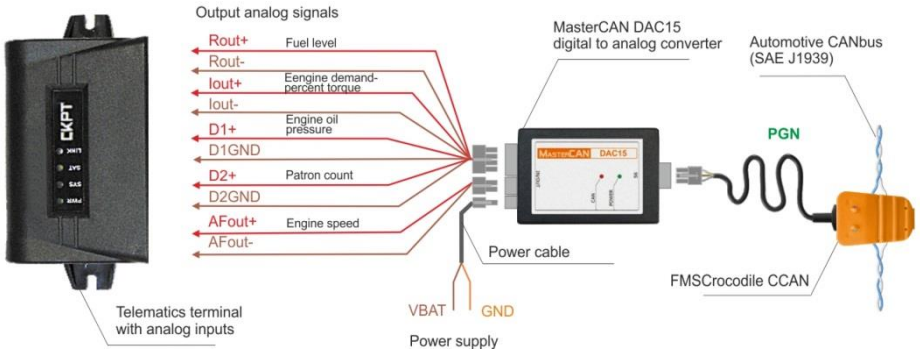

Figure 23 — Example connecting FMSCrocodile CCAN for CANbus data conversion to analog inputs of telematics terminal

Detailed information useful information about MasterCAN DAC15 is presented in Operation manual.

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7 Use of DFM i fuel consumption indicator

NozzleCrocodile and Nozzle BMCrocodile are conveniently used with DFM i **fuel consumption indicator** for registering and displaying information about petrol/LPG fuel consumption (see figure 24). DFM i is developed by JV Technoton.

Figure 24 — DFM i fuel consumption indicator

DFM i can be installed in the cabin or other place of the vehicle, convenient for visual checking of parameters.

Table 11 — Main technical specifications of DFM i

Parameter, measuring unit	**Value**
Registering consumption range, l/h	from 0.5 to 1000
Output signal	pulse
Calibration factor, ml/pulse	configurable, from 0.1 to 50.0
Input impedance, k Ohm, no less then	50
Operation temperature range, °C	from - 20 to + 60
Dimensions (without cable), mm, no more then	75x60x30
Weight, kg, no more then	0.3

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DFM i fuel consumption indicator and NozzleCrocodile / Nozzle BMCrocodile connection scheme is presented at figure 25.

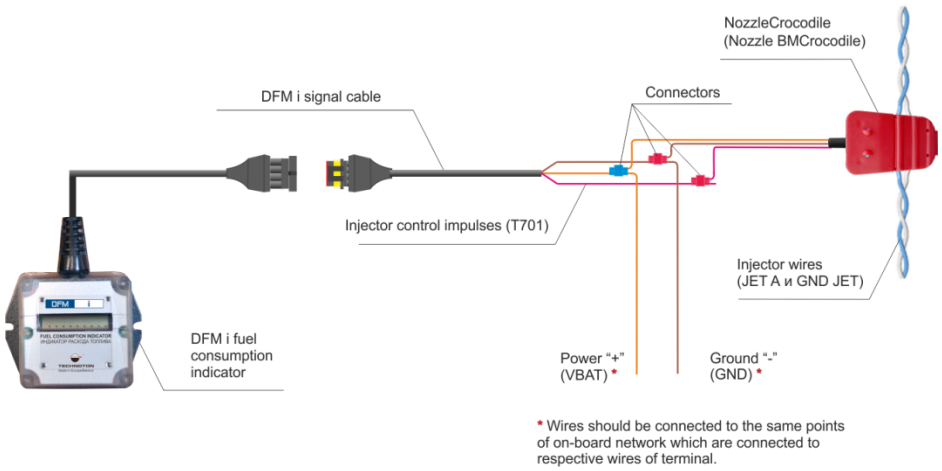

Figure 25 — Connection scheme of DFM i fuel consumption indicator and NozzleCrocodile / Nozzle BMCrocodile

Detailed technical specifications of DFM i fuel consumption indicator, its set up order and wiring connection, as well as data displaying on a screen is presented in DFM Operation manual

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8 Disconnection of Crocodile

ATTENTION: Before you start Crocodile installation, you need to disconnect electrical circuit of the vehicle. To do this, you shall use the battery disconnect switch or remove contact terminals from it.

To switch off the Crocodile, you need to fulfill the following steps:

1) Disconnect Crocodile connecting cable (wire) from the tracking device. If Crocodile is powered from the onboard power supply, you need to disconnect Crocodile power ("+" and "-" wires) from the onboard power supply.
2) Unlock the latch of Crocodile cover.
3) Take the vehicle wires out of the slots of Crocodile.

After dismounting, you can use Crocodile on another vehicle.

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9 Packing

Crocodile is delivered in a blister pack*, shown at Figure 26.

Figure 26 — Crocodile blister pack front and back views

Back side of Crocodile blister pack has following information:

- general information and technical specifications;
- brief connection instructions;
- assignment of LED indicators;
- assignment of interface cable wires;
- warranty period.

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* Crocodile **L2** modification (See Figure 1) is delivered in a carton box..

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10 Storage

Crocodile is recommended to be stored in dry enclosed areas or other premises with natural ventilation, without simulated climatic conditions and unheated warehouses.

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

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11 Transportation

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

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

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12 Utilization/re-cycling

Crocodile does not contain harmful substances and ingredients that are dangerous to human health and environment during and after the end of life and recycling.
Crocodile does not contain precious metals in amount that should be recorded.

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Contacts

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E-mail: info@jv-technoton.com

Technical support

E-mail: support@technoton.by

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Annex A
Template schemes of safe tracking device connection to the vehicle’s data buses CAN (J1708)

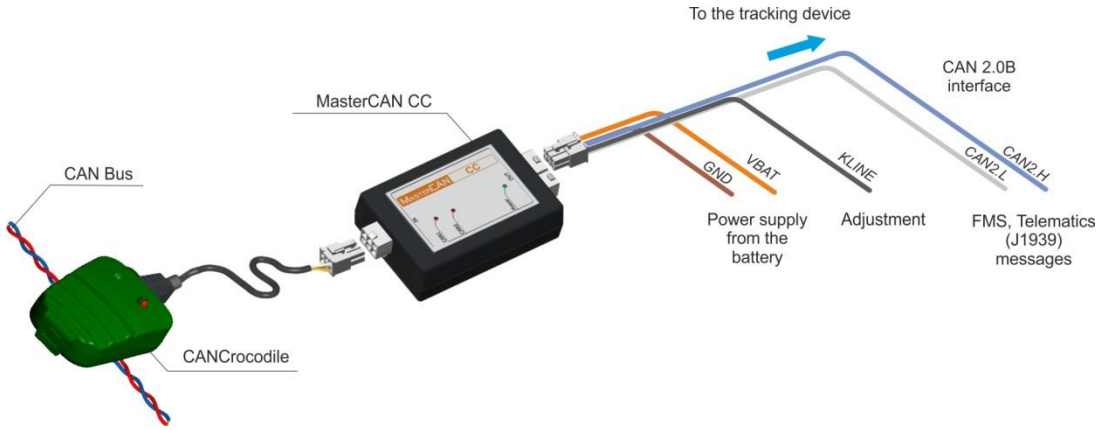

Figure A.1 — Telematics data obtaining from onboard CAN bus via CAN 2.0B interface

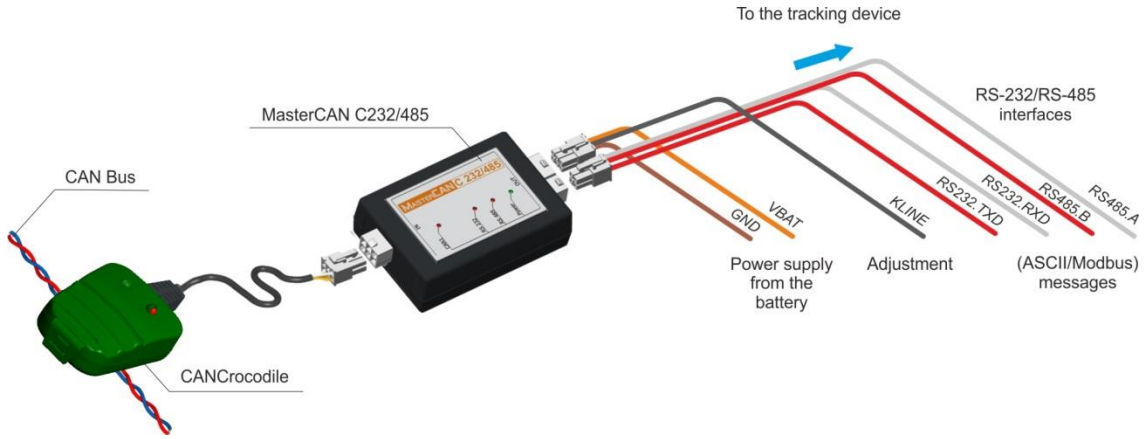

Figure A.2 — Telematics data obtaining from onboard CAN bus via RS-232/RS-485 interface

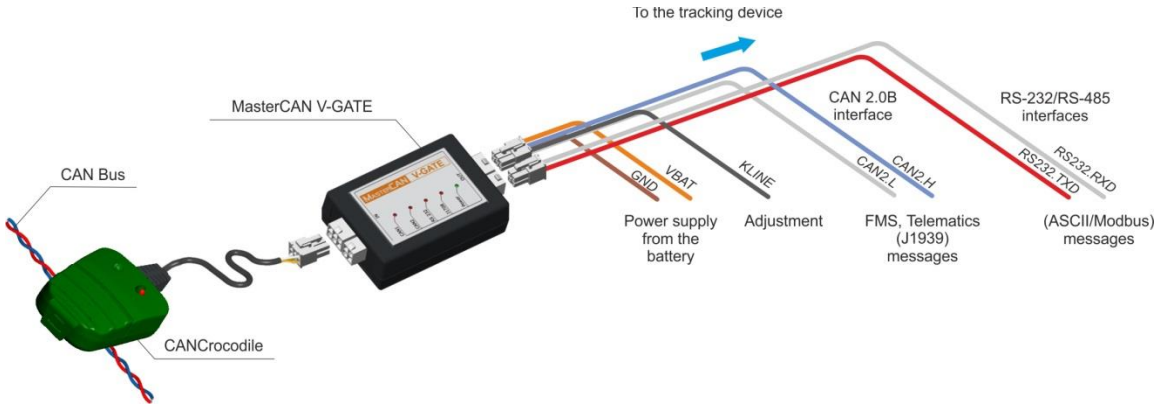

Figure A.3 — Telematics data obtaining from onboard CAN bus via CAN 2.0B and RS-232 interface

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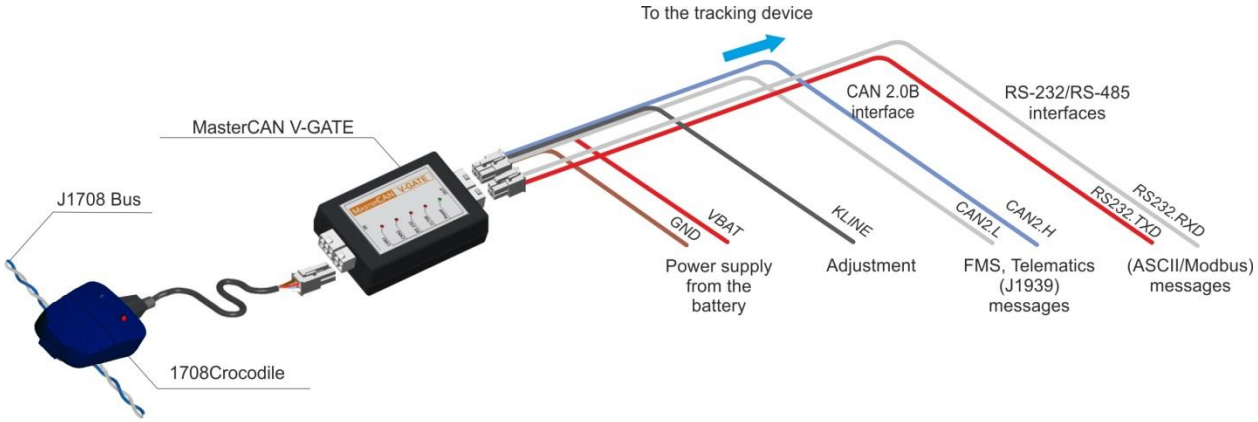

Figure A.4 — Telematics data obtaining from onboard J1708 bus via CAN 2.0B and RS-232 interface

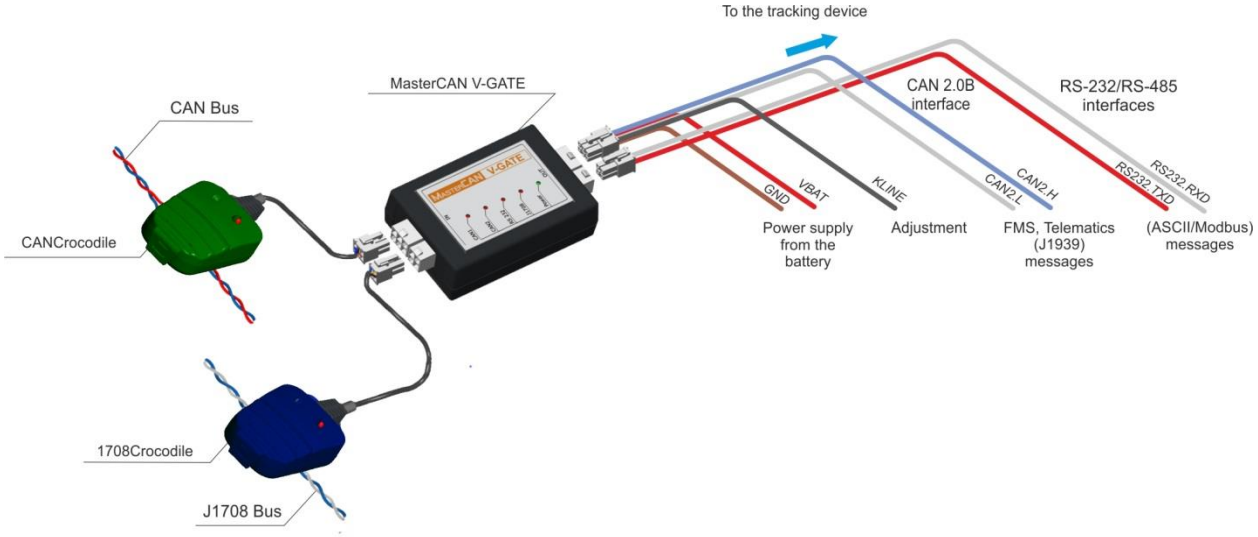

Figure A.5 — Telematics data obtaining from onboard CAN and J1708 buses via CAN 2.0B and RS-232 interfaces

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