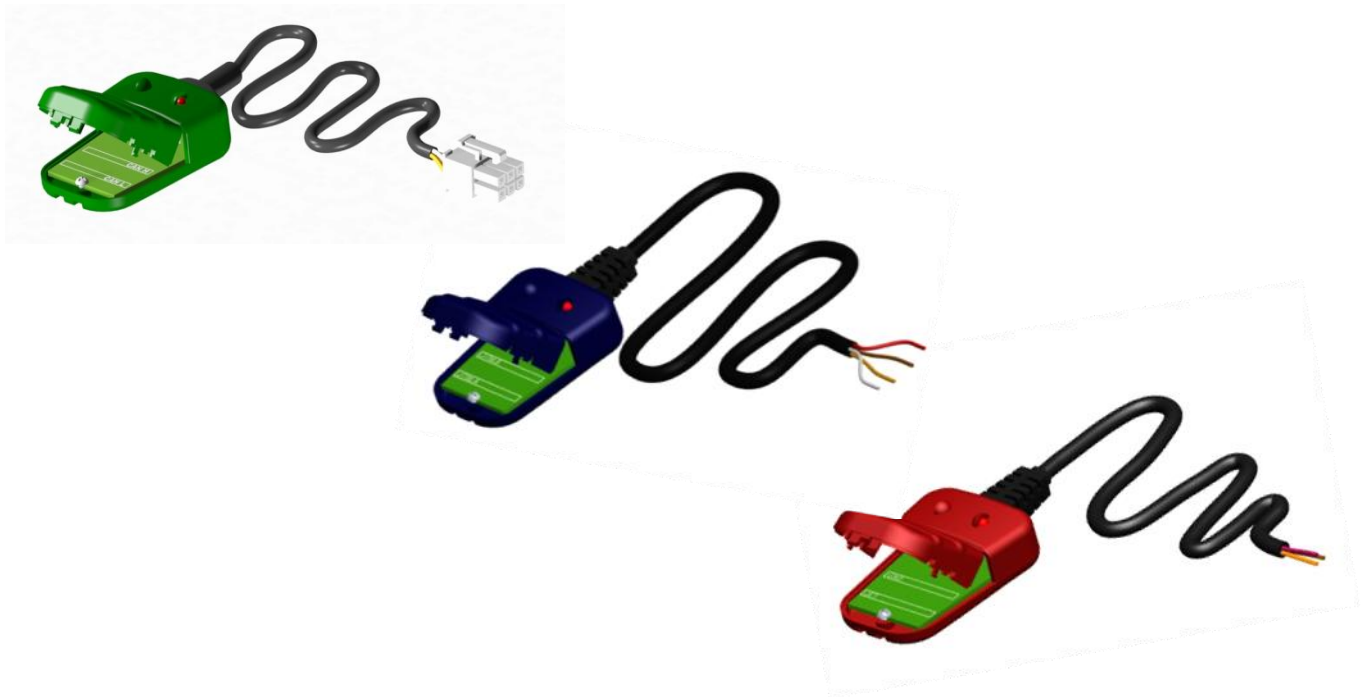


CONTACTLESS READER



OPERATION MANUAL

Ver. 1.1



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Terms and definitions

Tracker (tracking device) is a compulsory element of vehicle tracking system that collects, records and stores signals for regular and additional sensors installed on the vehicle, as well as receives satellite signals about location and speed of the vehicle and transmits data to the server of the vehicle tracking system.

CAN bus is a digital interface of bus type that corresponds to the international standard ISO 11898-1:2003. It is based on a currently wide-spread standard SAE J1939 that uses CAN bus of CAN 2.0 B standard as a channel layer. CAN bus is used for data transmitting and exchange of information between electronic units of modern vehicles.

Bus J1708 is a digital interface of bus type that corresponds to the international standard SAE J1708. Predecessor of the currently wide-used CAN bus. Bus J1708 is used for data transmitting and exchange of information between the motor controller and other electronic units on some modern vehicles. The upper layer protocol for the bus J1587 is a Protocol of SAE J1708 standard.

Introduction

Recommendations and regulations given in the operation manual are related to **contactless reader Crocodile** (hereinafter **Crocodile**), developed by JV Technoton, Minsk, Belarus. This document defines the procedure for installation and connection of **Crocodile**, as well as provides guidance/recommendations on the operation.

Crocodile has the following versions:

- **CANCrocodile** — for contactless connection of vehicle tracking devices to the CAN bus of vehicles and for data obtaining from the bus without interfering into the wires insulating sheathed and without electrical contact;
- **1708Crocodile** — for contactless connection of vehicle tracking devices to the J1708 bus of vehicles and for data obtaining from the bus without interfering into the wires insulating sheathed and without electrical contact;
- **NozzleCrocodile** — for contactless reading of control pulses of the engine injector and converting them into normalized pulses that number is proportional to the volume of consumed fuel. The obtained data are used in vehicle tracking systems for fuel consumption control of the vehicle.

Distinctive features of Crocodile:

- **contactless reading** that doesn't interfere into the integrity of wire insulation and doesn't have impact on the electronic and electrical equipment of the vehicle;
- **easy to install**;
- operation **without preliminary setup**;
- **powered by automobile on-board network**, i.e. you don't need to use additional devices (power supply units).

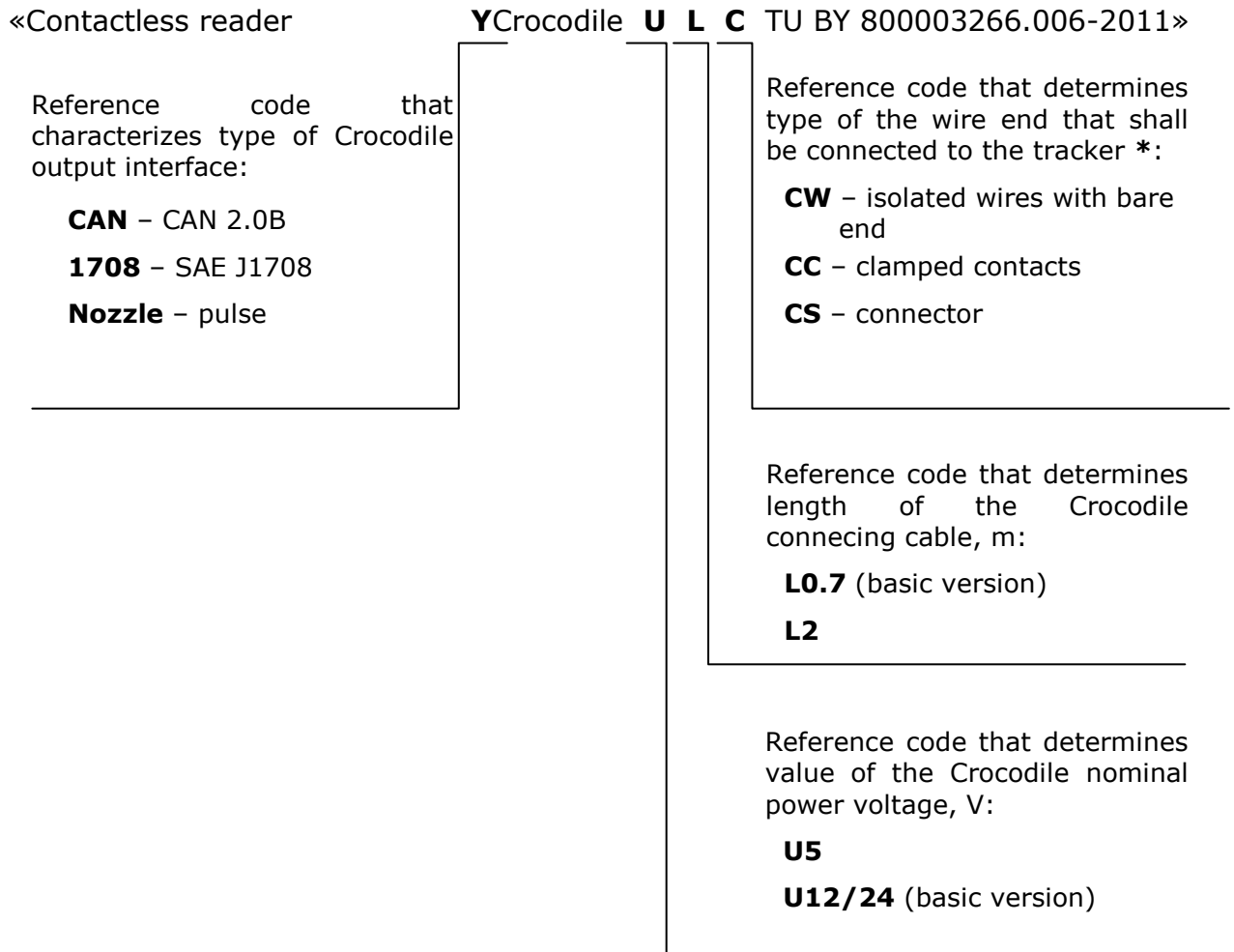
ATTENTION! By using **Crocodile**, it is necessary strictly to follow the manufacturer's recommendations mentioned in this manual.

The manual is for the professional users who are familiar with the rules for repair and mounting works on vehicles and who have professional knowledge in the field of electrical and electronic equipment of various vehicles.

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 that **Crocodile** corresponds to the requirements of technical regulations provide that rules for proper storage, transportation and maintenance as well as recommendations on operation given in this manual will be followed.

Reference code for Crocodile by its ordering and in documentation shall be written as follows:



* For **NozzleCrocodile** and **1708Crocodile** the reference code **CW** corresponds to the basic version.
For **CANCrocodile** the reference code **CS** corresponds to the basic version.

ATTENTION! During recording procedure, it is allowed not to specify the reference codes that correspond to basic version of **Crocodile**.

Examples of Crocodile recording while ordering:

«**Contactless reader CANCrocodile U5 L2 CC TU BY 800003266.006-2011**»,
(output interface — CAN 2.0B; nominal supply voltage — 5 V;
length of connecting cable — 2 m; end of connecting cable — clamped contacts);

«**Contactless reader NozzleCrocodile TU BY 800003266.006-2011**»,
(output interface — pulse; nominal supply voltage — 12/24 V;
length of connecting cable — 0.7 m; end of connecting cable — isolated wires with bare end).

1 Description and functioning

1.1 Purpose of use

Crocodile, depending on its version, is designed for:

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

Crocodile is used in GPS/GLONASS vehicle tracking systems where it serves as a device for information receipt about the fuel consumption, operating modes of the engine, sensor status, troubleshooting, etc. (See Fig. 1).

CANCrocodile and **1708Crocodile** are installed on all types of the vehicle equipped with CAN bus and J1708 bus respectively.

NozzleCrocodile is installed on the vehicles equipped with a petrol engine with electronically controlled nozzles in the fuel injection system.

CANCrocodile and **1708Crocodile** are compatible with all types of trackers that have an input for connection of CAN bus and bus J1708 respectively.

NozzleCrocodile is compatible with all types of trackers that have an input for connection of pulse fuel flow meter.

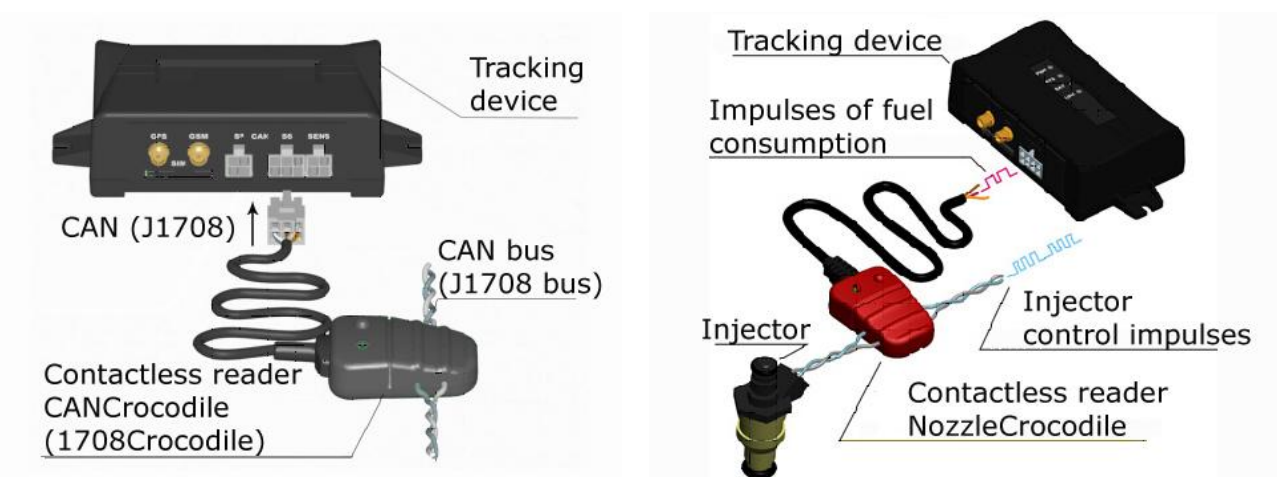


Fig. 1 — Information receipt about operating modes of the engine, sensors status, troubleshooting and fuel consumption by means of Crocodile

CANCrocodile and **1708Crocodile** generate the output signal with information package that matches the read-out data of the connected bus. **NozzleCrocodile** converts the read-out control pulses of the engine injector into normalized pulses that number is proportional to the volume of consumed fuel.

Crocodile output signal is received by tracking device that collects, records, stores and transfers the received signals to the vehicle tracking system server. Software installed on the server is processing and analyzing the 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 Fig. 1).

ATTENTION! The information package transmitted via CAN bus (J1708 bus) may differ depending on the producer, model and manufacture year of the vehicle. A complete list of transmitted digital parameters for a particular vehicle model shall be looked in the operational documentation of the vehicle manufacturer.

1.2 Technical characteristics

1.2.1 Main operational characteristics

Main operational characteristics of **Crocodile** are given in Table 1.

Table 1 — Main operational characteristics of Crocodile

Name of the factor, units of measurement	Crocodile version		
	CANCrocodile	1708Crocodile	NozzleCrocodile
Acceptable level of message losses,%, not more	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	100		30
Current consumption at supply voltage 24 V, mA, not more			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		
Operating ambient temperature, °C	From -40 to +85		
Dimensions, mm, not more	38.5x(50.0+L**) <x20.5< td=""> </x20.5<>		
Weight, kg, not more	0.1		
Compatibility	SAE J1939, CAN Open, DeviceNet, NMEA 2000	SAE J1587	—
* See Introduction			
** Length of Crocodile connecting cable, mm.			

1.2.2 CANCrocodile output interface

CANCrocodile output interface is CAN 2.0B, in accordance with international standard ISO 11898-1:2003.

1.2.3 1708Crocodile output interface

1708Crocodile output interface is J1708, in accordance with international standard SAE J1708.

1.2.4 Signal characteristics of NozzleCrocodile

Characteristics of **NozzleCrocodile** input and output signals are given in Tables 2 and 3 accordingly.

Table 2 – Characteristics of NozzleCrocodile input signal (read-out injector signal)

Name of the factor, units of measurement	Value
Signal type	pulse
Frequency, Hz, not more	100
Duty cycle, %	from 0 to 100
Amplitude, V	from 10 to 32

Table 3 – Characteristics of NozzleCrocodile output signal

Name of the factor, units of measurement	Value
Signal type	pulse
Frequency, Hz, not more	5
Amplitude, V	from 0 to U_{bn} *
* U_{bn} – on-board network	

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 in Fig. 2.

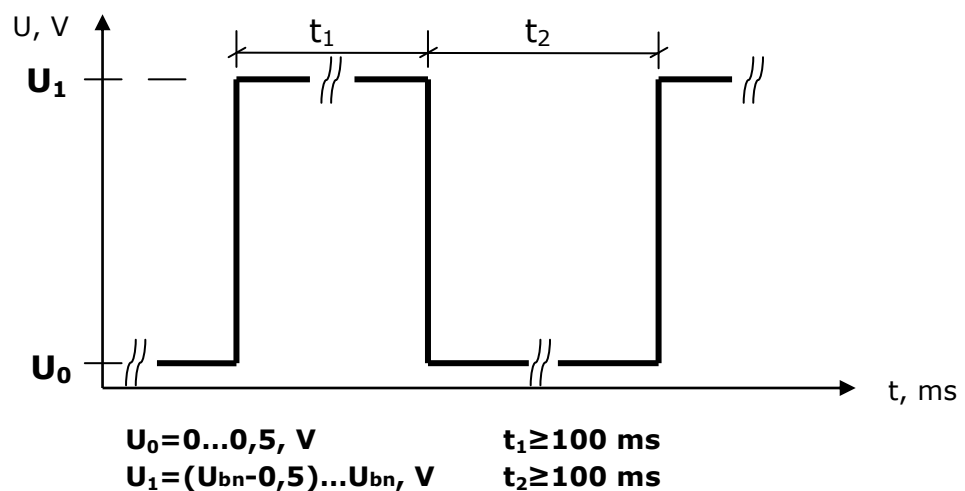
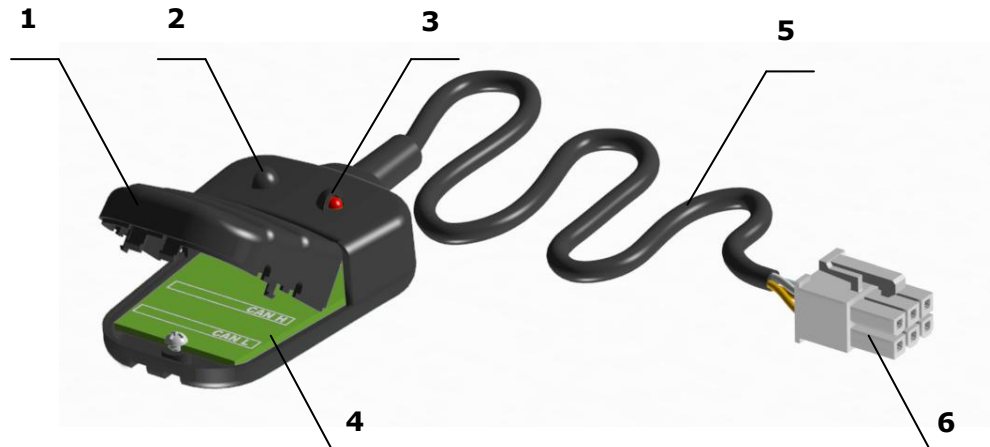


Fig. 2 – Type of NozzleCrocodile output signal

1.3 Unit structure and principle of operation

1.3.1 Unit structure

Crocodile unit structure is shown in Fig. 3.



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

* delivered for versions **CS** (See Introduction).

Fig. 3 – Crocodile unit structure

Signal values of **Crocodile** LED indicators are defined in accordance with Table 4.

Table 4 – Signal values of Crocodile LED indicators

LED indicator		Signal value		
Colour	Status	CANCrocodile	1708Crocodile	NozzleCrocodile
Green	Blinking	Messages receipt	Messages receipt	Pulses transmission
	off	No messages in CAN bus	No messages in bus J1708	No pulse transmission
Red	on	Power is on		
	off	No power (supply voltage is lower than normal)		

1.3.2 Dimensions

Dimensions of **Crocodile** are shown in Fig. 4.

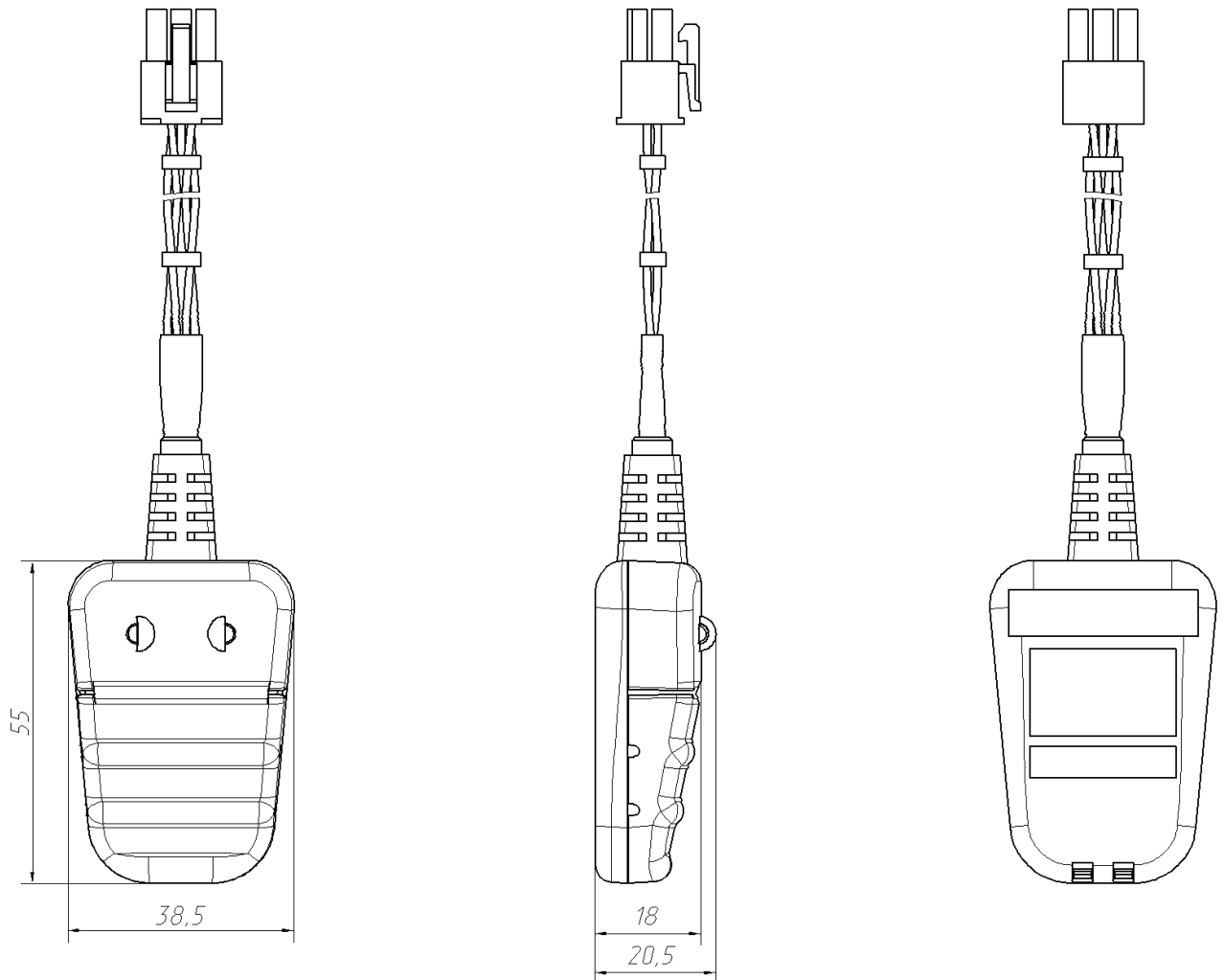


Fig. 4 – Dimensions of Crocodile

1.3.3 Connector scheme and wire assignment for the connecting cable

Assignment and marking of **CANCrocodile** wires correspond to Table 5.

Table 5 - Assignment and marking of the wires for CANCrocodile connecting cable

Marking of the wires	Colour	Assignment
CAN-high	Blue	CAN-high
CAN-low	White	CAN-low
POWER	Orange	Power «+»
GND	Brown	Ground «-»

Figure 5 shows **CANCrocodile** connector scheme for contact application:



- 1 - power «+»;
- 2 - ground «-»;
- 3 - CAN-high;
- 4 - CAN-low;
- 5, 6 - not used.

Fig. 5 — Connector scheme of CANCrocodile connecting cable (contact application)

Assignment and marking of **1708Crocodile** wires correspond to Table 6.

Table 6 - Assignment and marking of the wires for 1708Crocodile connecting cable

Marking of the wires	Colour	Assignment
J1708.A	White	J1708.A
J1708.B	Red	J1708.B
POWER	Orange	Power «+»
GND	Brown	Ground «-»

Assignment and marking of **NozzleCrocodile** wires correspond to Table 7.

Table 7 - Assignment and marking of the wires for NozzleCrocodile connecting cable

Marking of the wires	Colour	Assignment
VBAT	Orange	Power «+»
GND	Brown	Ground «-»
T701	Pink	Output signal

1.3.4 Principle of operation

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, troubleshooting of the vehicle.

NozzleCrocodile converts read-out engine nozzle control pulses into normalized pulses that number is proportional to the volume of consumed fuel.

1.4 Packing

Crocodile comes in a blister pack; its exterior view is shown in Fig. 6.



Fig. 6 — Exterior view of Crocodile packing

At the backside of the **Crocodile** blister packing the following information is given:

- main technical characteristics;
- brief guide for connection procedures;
- assignment of LED indicators;
- wire assignment of connection cable;
- warranty period.

Crocodile of version **L2** (see Introduction) are delivered in carton box.

2 Application

2.1 Connection

2.1.1 Exterior examination before connection

Before you start, you should make external check of Crocodile for any possible defects that occurred during transportation, storage or careless handling:

- visible damage of the housing, connecting cable and connector;
- damage of connector and isolated sheathed wires of connecting cable.

By discovering any defects, please, contact the product supplier.

2.1.2 Search of wires for CANCrocodile connection

ATTENTION! Before you start search of the wires to connect Crocodile, it is recommended that you carefully read the scheme of electrical equipment and operational documentation of the vehicle where Crocodile is going to be installed to.

Before you start **CANCrocodile** installation, you need to detect CAN bus and define CAN-H and CAN-L wires.

Primary diagnosis and defining of CAN bus functioning can be carried out with a volt-ohm meter by means of the following traditional methods:

- testing for line disconnections CAN-L and CAN-H;
- testing for short circuit and impedance (full impedance that depends on terminators and on input resistances of electronic units connected to the bus) between lines CAN-L and CAN-H;
- voltage level measurement on lines CAN-L and CAN-H in recessive (when ignition is off and the "ground" is on) and dominant status (when ignition is on and engine is started).

Impedance check shall be carried out when the on-board network is **completely off** ("**ground**" is off). Control impedance value shall be not more than **60 Ohms**.

CAN bus functioning check is carried out between twisted pair wires when the ignition is on, **the engine is running**, and **the accelerator pedal** is pushed and released. Control voltage value shall be **from 1.2 to 3.0 V**.

Detection of CAN-H and CAN-L wires is carried out in **recession** status (when the **battery main supply switch** (button "ground") is **off**, ignition is off) and in **dominant** status (when **ignition** is turned to "position 1", with and without engine running). Voltage values shall be as follows: **2.5 V (recession), 2 V (CAN-L), 3 V (CAN-H)**.

Signal oscilloscope patterns of CAN-H and CAN-L wires look like it is shown in Fig. 10.

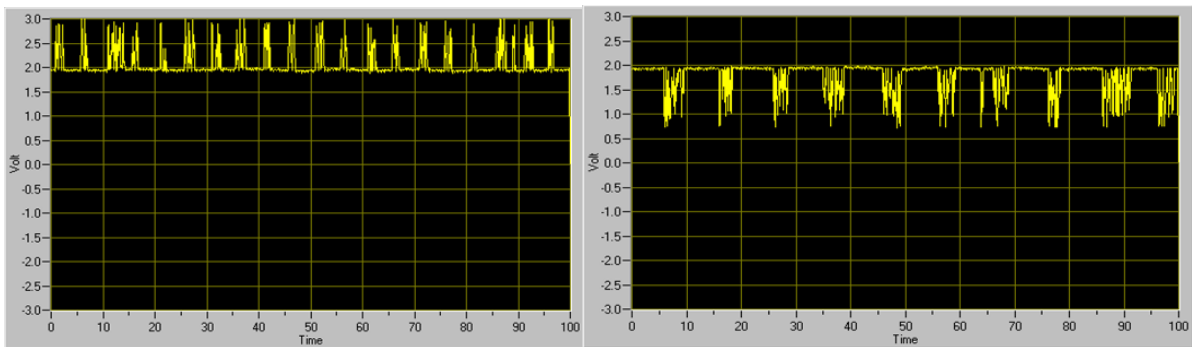


Fig. 10 — Signal oscilloscope patterns of the wires CAN-high (on the left) and CAN-low (on the right)

2.1.3 Search of wires for 1708Crocodile connection

Before you start **1708Crocodile** installation, you need to detect bus J1708 and detect J1708.A and J1708.B wires with help of oscilloscope.

Signal type of bus J1708 – differential, voltage amplitude on wires J1708.A and J1708.B varies in the range **from 0 to 5 V**.

2.1.4 Search of wires for NozzleCrocodile connection

NozzleCrocodile 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:

- connector of injector connection;
- 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 in Fig. 11.

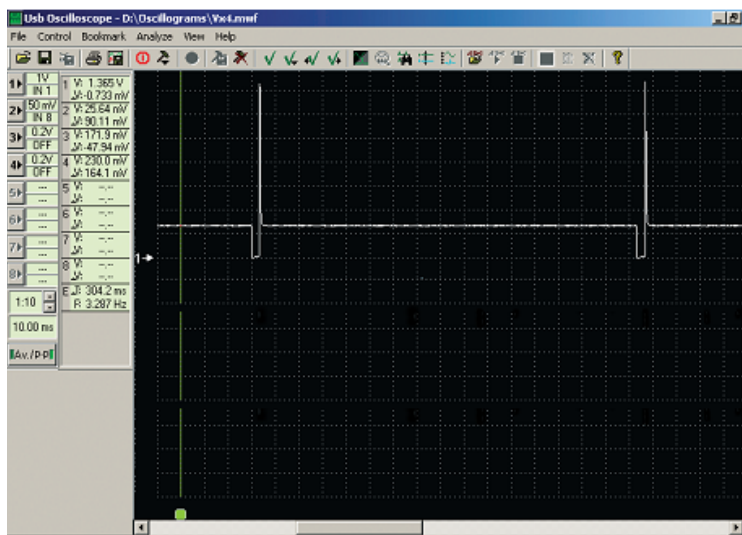


Fig. 11 — Oscilloscope patterns of control pulse signals of the petrol engine injector with electronically controlled fuel injection system

2.1.5 Operating limits

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.

2.1.6 Installation

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 connect **Crocodile**, fulfill the steps in accordance with Fig. 12.



Fig. 12 – Steps while Crocodile connection

1. Open the **Crocodile** housing with a screwdriver with a narrow spline and open it.
2. Lay the corresponding wires into the slots of the housing according to the applied marking.
3. Close the **Crocodile** housing until it clicks.

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

ATTENTION! If it is powered from the onboard network, you need to connect wires of **Crocodile** to the same points of onboard network where the corresponding wires of tracking device are connected to.

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

An example how to connect **Crocodile** to the automobile wire is shown in Fig. 13.

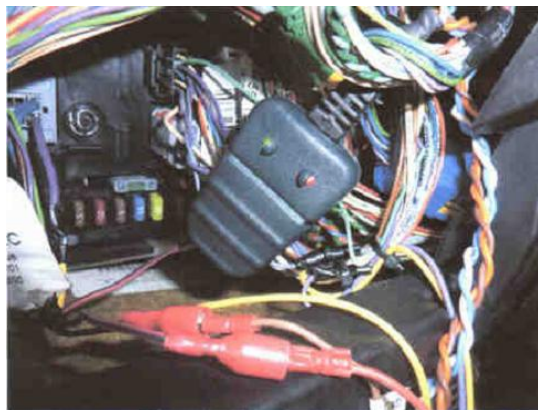


Fig. 13 – Connected Crocodile

2.1.7 Uninstallation

ATTENTION! Before you start **Crocodile** uninstallation, 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 the connector of **Crocodile** connecting cable (wire) from the tracking device. If **Crocodile** is powered from the onboard network, you need to disconnect **Crocodile** connecting cable from the onboard network connection points.
2. Open the Crocodile housing with a screwdriver with a narrow spline and open it.
3. Extract the vehicle wires out of the slots of **Crocodile** housing.

After uninstallation, the Crocodile can be used for new connections to wires of the vehicle.

2.2 Functioning check

If the connection was made 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 housing shall comply with Table 4.

ATTENTION! If injector wires are connected correctly in the **NozzleCrocodile**, then blinking frequency of the green LED indicator will increase with grow of the engine frequency rotations.

If an increase of the engine frequency rotations reduces blinking frequency of the green LED indicator, then you can make a conclusion that injector wires are connected wrong. In this case, it is necessary to reconnect NozzleCrocodile by switching the injector wires.

2.3 NozzleCrocodile calibration

Each output pulse of **NozzleCrocodile** corresponds to a certain volume of consumed fuel. Thus, **NozzleCrocodile** pulse value is 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 the **calibration factor C**, 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. Fuel the tank to full.
3. Consume **40-50%** of the fuel volume in standard driving conditions for the vehicle.
4. Fuel the tank to full (at the same fuel pump 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:

$$C = \frac{300 \cdot W}{V}$$

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

3 Storage

Crocodile can be stored in closed or dry areas with natural ventilation, without artificially regulated climate conditions, in unheated storages.

Crocodile storage is allowed only in original packaging at temperature range from -50 to +40° C and relative humidity up to 100% at 25° C.

Do not store **Crocodile** in the same room with substances that cause metal corrosion and contain aggressive impurities.

4 Transportation

Crocodile is transported in any closed transport that provides protection from mechanical damage and no access of precipitation.

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

5 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.

Contact information

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