TechnoКом

GLONASS GPS

DOCUMENT VERSION 16.7

GSM

Wi Fi

GSM & Wi Fi

AutoGRAPH

VEHICLE AND PERSONAL TRACKING SYSTEM

USER MANUAL

SMS

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Introduction

This User Manual applies to AutoGRAPH on-board vehicle tracking controller (hereafter - tracker) of hardware revision 3.0 produced by TechnoKom Ltd[1]. It contains installation and connection procedures of this device, as well as its function and control. This Manual constitutes the Operating Rules to be observed to ensure successful operation of the controller and its compliance warranty provisions.

The Manual is intended for specialists who are aware of maintenance and installation principles typical for motor vehicles and are proficient in using the electronic and electrical equipment of various vehicles.
To ensure the best performance of the AutoGRAPH controller, they should be installed and set up only by qualified specialists.

For proper operation of the AutoGRAPH controller, a user should be aware of operating principles of the vehicle tracking system as a whole, as well as understand functions of its individual components. Therefore, it is highly recommended to study the fundamentals of operation of GPS navigation, GSM and Wi-Fi communication, peculiarities of short message service (SMS), GPRS and the Internet before starting.

Some functions of AutoGRAPH controllers depend on capacities and configuration of the existing mobile network operator (MNO). Furthermore, some functions may be disabled by the operator, or their operating range may be limited due to the settings of the network. To check availability of a certain function, contact your mobile network operator.

All information on functions, functional capabilities and other specifications related to AutoGRAPH on-board vehicle tracking controllers, as well as all information contained in this User Manual is based on current data (at time of writing) and is deemed to be valid as of the date of publication. TechnoKom reserves the right to modify the information or specifications without prior notice or commitment.

[1] Detailed information on modification of the AutoGRAPH on-board controller of hardware revision 3.0 is given in the section "Modifications of the AutoGRAPH controller".

Version history

This table provides a summary of the document revision

Version	Description	Data
16.1	Initial version of the document	02/2016
16.7	Added the section “Eco Driving”	07/2016

Related documentation

Given below is a list of the documentation related to AutoGRAPH on-board controller.

• **Configuration and setup. AG.GSMConf software.** This document covers detailed instruction related to AutoGRAPH on-board controller configuration using the AG.GSMConf software.

• **Control SMS and server commands of AutoGRAPH controller**. This document contains description of the commands format intended to control and configure AutoGRAPH on-board controller remotely via data server or by means of SMS.

Modifications of AutoGRAPH controller

The table contains the list of available modifications of AutoGRAPH on-board controller and an initial serial number of each modifications.

Modification	Initial serial number
AutoGRAPH-GSM	0362000
AutoGRAPH-GSM+	1365000
AutoGRAPH-WiFi	3002000
AutoGRAPH-GSM+WiFi	

Safe Operation Recommendations

This section contains important information for effective and safe operation. Please read the information below before using AutoGRAPH on-board vehicle tracking controllers.

Performance Characteristics

AutoGRAPH on-board vehicle tracking controllers of some modifications operate using a GSM/GPRS module and function as a low power receiver and transmitter. When the device is ON, it receives and transmits electromagnetic energy in the radiofrequency range. Operating band of the device ranges from 850 MHz to 1,990 MHz; the device uses digital modulation techniques.
When the device is in operation, a call service system controls the strength of sent-out RF signal.

Exposure to Electromagnetic Fields

The design of the AutoGRAPH-GSM on-board vehicle-tracking controller complies with the following standards, which specify the safe levels of exposure to radiofrequency electromagnetic fields:
• EN 55022: 2010+AC:2011 / Class B Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement.
• EN 55024:2010 Information technology equipment. Immunity characteristics. Limit and methods of measurement.
• EN 61000-3-2:2006+A1:2009+A2:2009/ -3:2008 Electromagnetic compatibility (EMC) Limits.
• EN 61000-6-3:2007+A1:2011 Electromagnetic compatibility (EMC) Generic standards.
• EN 301 489-1 Electromagnetic compatibility and radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standards for radio equipments and services.

Antennas

Use only original supplied antennas. Antennas that have been modified may damage the device or cause violations of statutory rules and regulations.
DO NOT touch the GSM antenna of the device while it is in operation. This can impair communication quality and give rise to an undesired increase in radiated power.
DO NOT touch the GPS antenna of the device while it is in operation. This can impair the quality of reception and result in inaccurate positioning.
DO NOT use a device with a defective antenna. If there are any defects in antenna or antenna cable, replace the antenna or consult your local dealer as soon as possible.

Electromagnetic Interference and Compatibility

Almost any electronic device is subjected to electromagnetic interference unless it is adequately shielded, has proper construction or is compatible with devices operating in another frequency band.

Prohibition on Use of Mobile Communication Devices

If you come across a signage or a notice, which prohibits the use of mobile communication devices, turn off your tracker. This is required to avoid electromagnetic interference with equipment sensitive to electromagnetic fields often used in hospitals, health care institutions or petrol stations.

General Information on Safe Use

Explosion Hazard Zones

SWITCH OFF the device when entering the explosion hazard zone. Explosion hazard zones include: fuel stations, box girder decks on sea vessels, facilities or plants for handling and storage of fuels or chemicals, areas with chemicals or solid particles such as grains, dust or metal powder in atmosphere; and any other locations where it is usually required to shut off a vehicle's engine. Explosion hazard areas are often (yet not always) expressly marked.

Blasting Areas

In order to avoid interference with blasting operations, SWITCH OFF the device in blasting areas or in any locations marked with «Two-way radio-communication is prohibited» signage. Observe the signage instructions and rules.

Vehicle

Observe the rules on using hand-held devices when driving.

- Use hands-free devices when driving.
- Stop to make or take a call.

Medical Devices

Cardiac Pacemakers

Medical Device Manufacturers Association advises to use mobile communication devices at distances greater than 15 cm from cardiac pacemaker so as to prevent the failure of the latter. These recommendations conform to the studies carried out by independent medical laboratories and Research Centre for Wireless Technologies.

Hearing Devices

Sometimes, use of mobile communication devices may cause troubles for wearers of certain hearing devices. In this case, consult the manufacturer of your hearing device to select another model.

Other Medical Devices

For other personal medical devices, contact your physician or device manufacturer to find out whether your device is adequately shielded from electromagnetic interference generated by mobile communication devices.

Product Overview

The AutoGRAPH on-board vehicle tracking controller is an electronic recorder which tracks all movements of a vehicle by recording the time and the route in the form of geographic coordinates received from the satellites of global navigation system GPS (NAVSTAR) or GLONASS.
In addition to coordinates, the device records a number of other parameters: speed, direction of movement, event counters, etc., as well as the states of digital inputs of the controller, external sensors and data buses.

Collected data is transferred to the dedicated data server where it becomes available via the Internet for further analysis and processing by dispatch software. Depending on the controller modification the data can be transferred by a GSM 850/900/1800/1900 mobile network operator by means of General Packet Radio Service (GPRS) or via Wi-Fi network of the standard IEEE 802.11 b/g/n.

Furthermore, controllers of the modification AutoGRAPH-GSM+WiFi support data transmission both by GSM/GPRS network and via Wi-Fi. This allows the controller to be able to transfer data even when one of the data transmission channels is unavailable, e.g. when the controller is installed on a machinery operating in area with poor GSM signal coverage. In this case, data from the controller can be transferred via Wi-Fi, e.g. to a laptop with the appropriate data collection software for further transmission to AutoGRAPH dispatch software.

Additionally, it is available to read data from the controller via USB.

AutoGRAPH on-board controller of all available modifications may be used in any types of vehicles.

For AutoGRAPH controllers equipped with only GSM modem, data transfer is possible only when GSM mobile network operator, which supports General Packet Radio Service (GPRS), is available.

Technical Specifications

Description	GSM	GSM+	GSM+WiFi	WiFi
GNSS Receiver				
Supported GNSS	GLONASS + GPS / GALILEO / Beidou			
GNSS receiver	uBlox MAX-M8Q			
Channels	72			
A-GPS service	Yes			
Differential GPS (D-GPS)	Yes			
Antenna (GPS/GLONASS)	External (SMA)			
Communication (GSM and Wi-Fi)				
GSM/GPRS	GSM (GPRS/SMS) 850 / 900 / 1800 / 1900			---
3G UMTS[1]	Yes			---
Wi-Fi	---		Wi-Fi (802.11 b/g/n)	
SIM card holders	2			---
Supported Wi-Fi encryption protocols	---		WEP, WPA, WPA2 Personal	
Output Wi-Fi power	---		17.0 dBm	
Wi-Fi module sensitivity	---		-94.7 dBm	
Antenna (GSM/Wi-Fi)[2]	External (SMA)			
General				
Bluetooth Smart	Yes			
Connection to PC	USB 2.0			
Internal FLASH memory, records	up to 270.000			
Additional memory	MicroSD	eMMC		
Additional memory capacity, GB	32	4		
Built-in accelerometer / motion sensor	Yes			
Digital inputs, total number	6			
High-impedance digital inputs, total number	---	1		
Configurable inputs (analogue/digital), total number	2			
Digital outputs, total number	2			
RPM input	---	1		
RPM input frequency measuring range, Hz	---	0.01...10 000		
RPM input frequency measuring accuracy, %	----	0.01		

Description	GSM	GSM+	GSM+WiFi	WiFi
1-Wire	1			
RS-232	1			
RS-485 (TIA / EIA-485-A)	2			
CAN (SAE J1939 / FMS)	1	2		
Audio interface (GSM) / loudspeaker amplifier	No	Yes		No
Battery charger	No	Yes		
Battery charging time, h	---	30		
Rated backup battery voltage, V	12/24	12		
Type of external backup battery[3]	Lead-acid			
Operating voltage, V	10...60			
Power consumption at 12 VDC: - recording state, mA - data transferring state, mA	 70 300	 80 320		 80 300
Time to first start[4], sec	26			
Protective case (IP54)	Optional			
Operating temperature, °C	-40...+85			
Dimensions, mm: - standard case - protective case	 138 x 67 x 27 138 x 92 x 27			
Weight, kg: - standard case - protective case	 110 150			
Average life time, years	10			

[1] Optional.

[2] A type of supplied antenna depends on the AutoGRAPH controller modification. Detailed information is given in the section "Scope of supply".

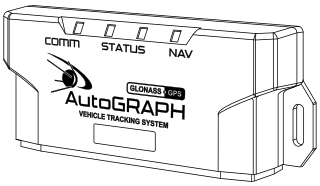
[3] Not supplied.

[4] With nominal navigation signals level -130dBm.

Scope of supply

№	Description	GSM	GSM+	GSM+WiFi	WiFi
1	AutoGRAPH on-board controller	✔	✔	✔	✔
2	Power supply cable (primary)	✔	✔	✔	✔
3	4/6-pin CAN / 1-Wire / Output 2 / Inputs 3-4 cable	✔ *	✔	✔	✔
4	6-pin CAN / RS-485 / Inputs 7-8 cable	✔ *	✔	✔	✔
5	4/6-pin RS-232 / RS-485 / RPM / Input 9 cable	✔ *	✔	✔	✔
6	Loudspeaker communication connection kit	---	✔	✔	✔
7	1A fuse with a holder	✔	✔	✔	✔
8	GPS/GLONASS antenna	✔	✔	✔	✔
9a	GSM antenna	✔	✔	---	---
9b	GSM/Wi-Fi antenna	---	---	✔	---
9c	Wi-Fi antenna	---	---	---	✔
10	Warranty certificate	✔	✔	✔	✔

* on request.



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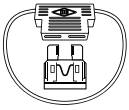

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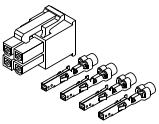

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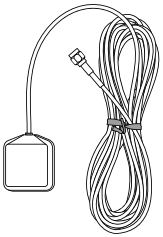

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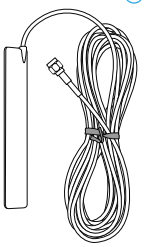

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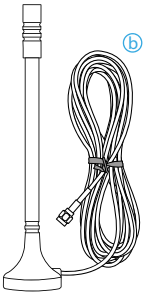

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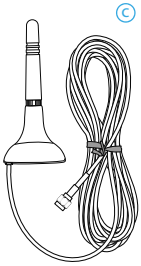

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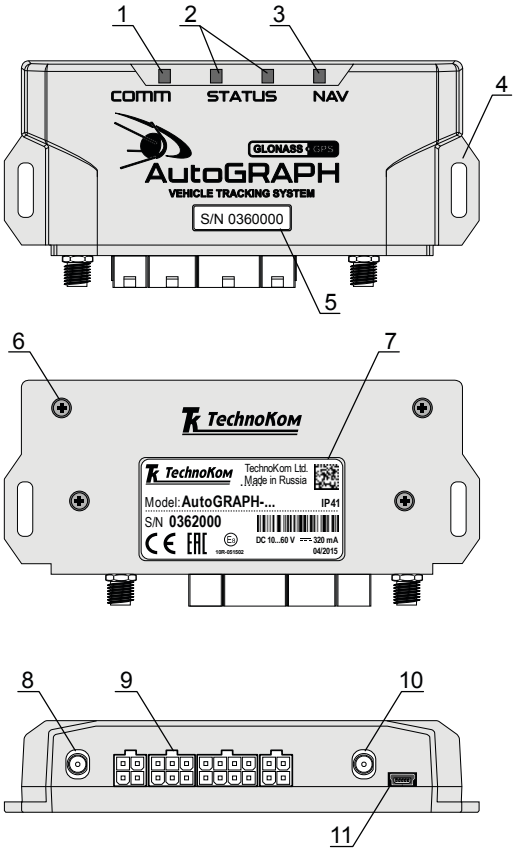
Components of AutoGRAPH Controller (standard case)

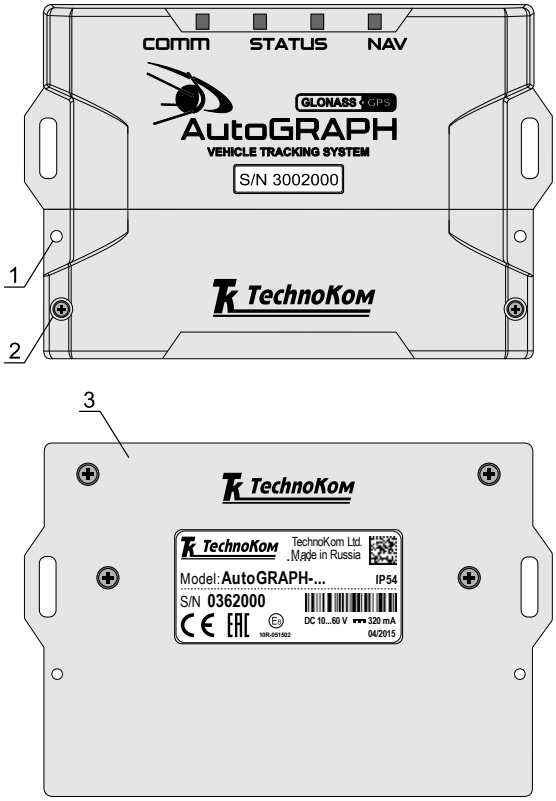


1. **COMM LED.**
2. **STATUS LEDs.**
3. **NAVIGATION LED.**
4. **Mounting bracket.**
5. **Label with serial number.**
6. **Fastening screw of a back cover (x4).**
7. **Manufacturer's label.**
8. **GSM / GSM/Wi-Fi / Wi-Fi antenna connector.**
9. **Interface connectors.[1]**
10. **GPS/GLONASS antenna connector.**
11. **Mini USB connector.**

[1] For more detailed information on assignment of interface connectors see «Interface Connectors» section of this User Manual.

Components of AutoGRAPH Controller (protective case)

Optionally AutoGRAPH on-board controller may be supplied in a protective case providing high ingress protection rate and sealing option.



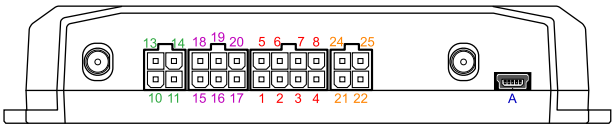
1. **Sealing hole (x2).**
2. **Fastening screw of a protective cover (x2)**
3. **Back protective cover.**

Interface Connectors

Set of interface connectors may vary depending on the AutoGRAPH controller functionality.

Variant 1

Variant 1 of the interface connectors is applicable for AutoGRAPH-GSM controllers.



Power supply connector

№	Colour of a wire in a cable	Assignment
1	Red (long)	+ Vin
2	Black	-Vin
3	Yellow	Digital input 1 (active low)
4	Green	Analogue input 1 (0…10 V) / Digital input 5 (active high)
5	Red (short)	+ Backup supply voltage
6	Gray	Open collector output 1 (0.5 A)
7	White	Digital input 2 (active low)
8	Brown	Analogue input 2 (0…24 V) / Digital input 6 (active high)

4-pin 1-Wire / Output 2 / Inputs 3-4 connector

№	Colour of a wire in a cable	Assignment
10	Blue	Digital input 3 (active low)
11	Orange	Open collector output 2 (0.5 A)
13	Blue with a white stripe	Digital input 4 (active low)
14	Pink	1-Wire

6-pin CAN / RS-485 / Inputs 7-8 connector

№	Colour of a wire in a cable	Assignment
15	Green with a white stripe	CAN (H)
16	Black with a white stripe	Digital input 7 (active high)
17	Brown with a white stripe	1: RS-485 (B)
18	Yellow with a white stripe	CAN (L)
19	Red with a white stripe	Digital input 8 (active high)
20	Orange with a white stripe	1: RS-485 (A)

4-pin RS-232 / RS-485 connector

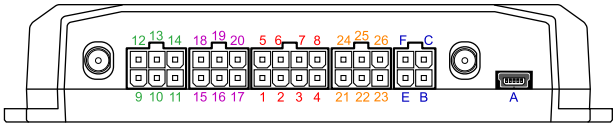
№	Colour of a wire in a cable	Assignment
21	Brown with a blue stripe	RS-232 TxD
22	Brown with a white stripe	2: RS-485 (B)
24	Orange with a green stripe	RS-232 RxD
25	Orange with a white stripe	2: RS-485 (A)

USB connector

ID	Assignment
A	Mini USB connector (programming / data reading / GPS mouse)

Variant 2

Variant 2 of the interface connectors is applicable for AutoGRAPH-GSM+, AutoGRAPH-GSM+WiFi and AutoGRAPH-WiFi controllers. The GS-3 interface connector is not available in AutoGRAPH-WiFi controller once it is not equipped with GSM modem providing voice communication.



Power supply connector

№	Colour of a wire in a cable	Assignment
1	Red (long)	+ Vin
2	Black	-Vin
3	Yellow	Digital input 1 (active low)
4	Green	Analogue input 1 (0…10 V) / Digital input 5 (active high)
5	Red (short)	+ Backup rechargeable battery
6	Gray	Open collector output 1 (0.5 A)
7	White	Digital input 2 (active low)
8	Brown	Analogue input 2 (0…24 V) / Digital input 6 (active high)

6-pin CAN / 1-Wire / Output 2 / Inputs 3-4 connector

№	Colour of a wire in a cable	Assignment
9	Green with a white stripe	CAN2 (H)
10	Blue	Digital input 3 (active low)
11	Orange	Open collector output 2 (0.5 A)
12	Yellow with a white stripe	CAN2 (L)
13	Blue with a white stripe	Digital input 4 (active low)
14	Pink	1-Wire

6-pin CAN / RS-485 / Inputs 7-8 connector

№	Colour of a wire in a cable	Assignment
15	Green with a white stripe	CAN (H)
16	Black with a white stripe	Digital input 7 (active high)
17	Brown with a white stripe	1: RS-485 (B)
18	Yellow with a white stripe	CAN (L)
19	Red with a white stripe	Digital input 8 (active high)
20	Orange with a white stripe	1: RS-485 (A)

6-pin RS-232 / RS-485 / RPM / Input 9 connector

№	Colour of a wire in a cable	Assignment
21	Brown with a blue stripe	RS-232 TxD
22	Brown with a white stripe	2: RS-485 (B)
23	Yellow with a grey stripe	RPM input
24	Orange with a green stripe	RS-232 RxD
25	Orange with a white stripe	2: RS-485 (A)
26	Pink	Digital input 9 (high-impedance)

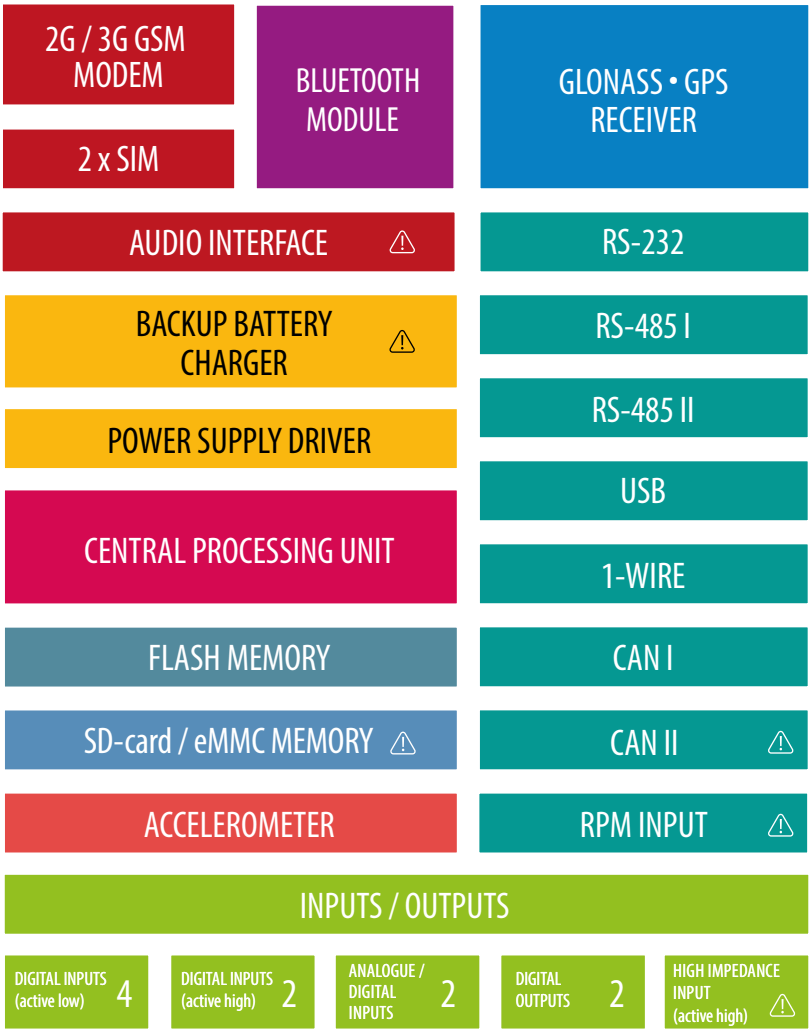
USB connector / GS-3 audio connector

ID	Assignment
A	Mini-USB connector (programming / data reading / GPS mouse)
B	+ Microphone signal input
C	+ Loudspeaker signal output (1.5 W amplifier)
E	- Microphone signal input
F	- Loudspeaker signal output (1.5 W amplifier)

Structure Diagram of AutoGRAPH Controller

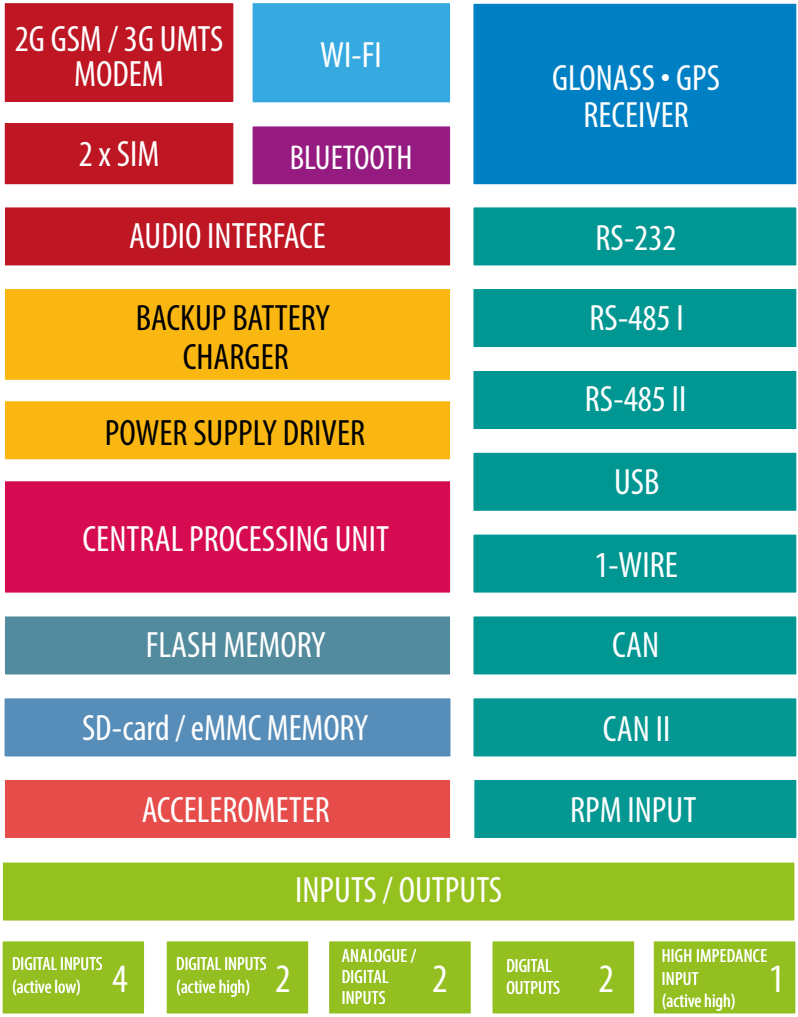
This section provides functional diagrams for different modifications of AutoGRAPH controller.

AutoGRAPH-GSM / AutoGRAPH-GSM+ controllers

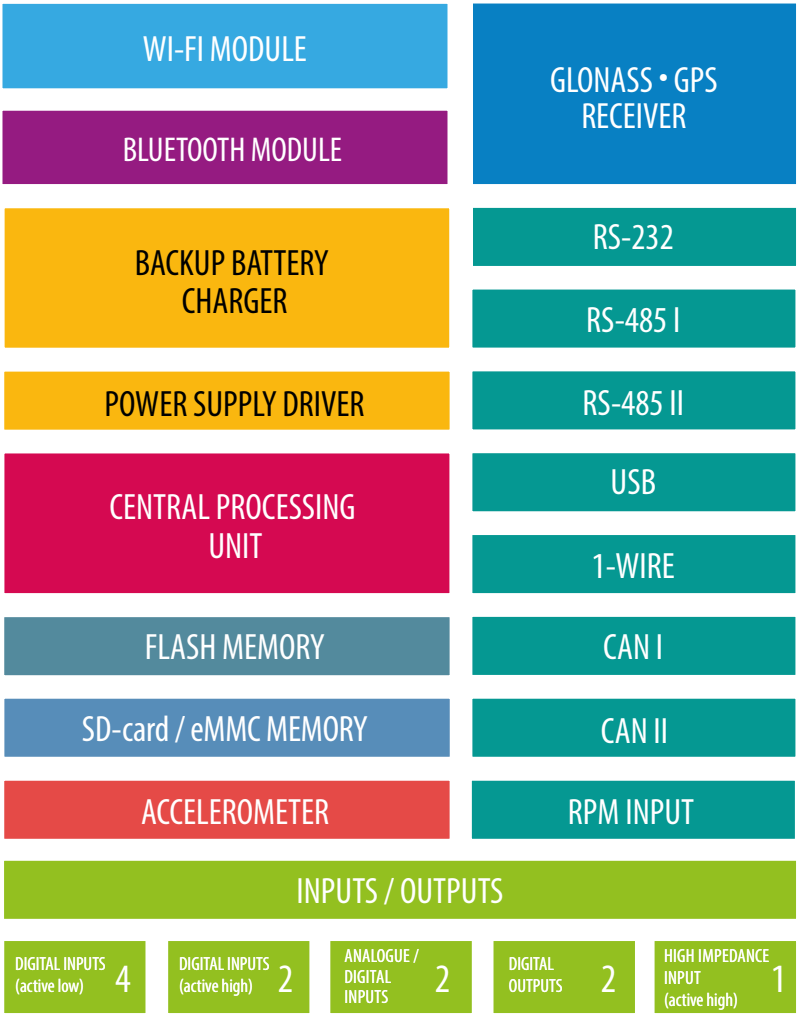


⚠ – the unit is available only in AutoGRAPH-GSM+ controllers. Furthermore, AutoGRAPH-GSM+ controllers are not equipped with a holder for SD-card, but equipped with internal eMMC memory.

AutoGRAPH-GSM+WiFi controllers



AutoGRAPH-WiFi controllers



Given below is description of structure diagram for different modifications of AutoGRAPH on-board controller. Some functional modules can be unavailable in some modifications. Detailed technical characteristics of AutoGRAPH controller modifications are given in the section “Technical specifications”.

2G / 3G GSM modem

The GSM modem is intended to provide a connection between the controller and the GSM mobile network. The GSM signal is received and transmitted via an external GSM antenna. The controller is equipped with a SIM card to be identified by the GSM network and to be able to access the services provided by the mobile network operator. The GSM modem performs several functions:

- Enables the device to access the GSM network and to be identified by the network using the SIM card.
- Enables data exchange (including transmission of track points) between the AutoGRAPH controller and the server via TCP/IP through the Internet by means of General Packet Radio Service (GPRS).
- Enables exchange of data and control SMS messages and USSD requests (for example, for subscriber’s personal account monitoring).

Optionally trackers can be equipped with 3G modem providing high rate of data transmission.

Wi-Fi module

Wi-Fi modem is intended to connect the AutoGRAPH controller with WLAN access point. The Wi-Fi signal is received and transmitted via an external Wi-Fi antenna.
The WiFi modem provides following functions:

- Access to Wi-Fi network and the device identification by the wireless network.
- Data exchange (including track points transmission) between the AutoGRAPH controller and the server via TCP/IP through the Internet.
- Data exchange between the AutoGRAPH controller and a PC with Dispatch software via TCP/IP. This scheme is commonly used for data collection from AutoGRAPH controllers installed on vehicles which operate in hard-to reach areas, e.g. wood lot, deposits, pipeline laying areas, and etc. Generally data is collected by a laptop or a mobile computer, e.g. by a superviser when visiting such areas. Moreover, period of the data collection can range from several days to several weeks.

Bluetooth module

Bluetooth module supporting low energy technology Bluetooth Smart and integrated in AutoGRAPH tracker is a 2.4 GHz radio unit with a built-in controller intended for wireless connection of external devices and sensors to the tracker.
All connected devices must be Bluetooth Smart compatible.
Current version of AutoGRAPH tracker firmware supports connection of up to 8 TKLS fuel level sensors via Bluetooth.

GLONASS/GPS receiver

The GNSS module is designed using a highly sensitive receiver based on high performance u-blox M8 engine. It receives coded signals by means of external active GPS/GLONASS antenna from the satellites of the Global Positioning System (NAVSTAR) and GLONASS, and uses its internal computer to determine the geographical coordinates of the receiver position, the exact time, speed and direction of movement. Received data is transferred via NMEA protocol from the GNSS module output to the central processing unit for further processing.
The u-blox MAX-M8 supports concurrent reception of two GNSS systems and, as a result, the information being received is highly accurate and available even in the case of very poor visibility of satellites.

CPU

The central processing unit is the core of AutoGRAPH controller, which unites all of the system components together and ensures their interaction in accordance with the program stored in the device. The processing unit is a high-speed single-chip microcomputer able to perform computations of at a speed and accuracy level that is sufficient to meet various navigation and service challenges. The custom firmware, developed by TechnoKom specialists, enables the CPU to receive data from the different modules of the system, to perform logical and mathematical processing of the data and to control the modules as appropriate. It should be noted that the functional capability of the controller firmware is being constantly enhanced and extended so as to provide users with new and improved features and options.

Non-Volatile FLASH Memory Module / Additional Memory

The Non-Volatile FLASH memory module serves as a black box storage device to store the collected data. The FLASH memory module is designed to store up to 270,000 records for up to 10 years – even when the device is powered off. The FLASH memory module in AutoGRAPH tracker is designed to use the ring buffer principle, which means that new records will be written over the oldest records first, ensuring that the most recent data is always available.
AutoGRAPH controller is equipped with additional memory to store log-files and photos from cameras connected to the controller. The AutoGRAPH-GSM controller uses an external micro SD card to store additional data, the AutoGRAPH-GSM+, AutoGRAPH-WiFi and AutoGRAPH-GSM+WiFi controllers are equipped with eMMC memory.

Power Supply Driver

The power supply driver with protection circuits generates all of the necessary supply voltages for controller components. The primary power supply input ensures operation at vehicle system voltage of 10-60 V, which makes it possible to use the controller on the majority of vehicles without employing any additional voltage regulation.
Furthermore, the power supply driver protects the controller against polarity reversal, voltage overload, interference, etc. A resettable fuse is installed in the supply circuit of the printed circuit board in order to provide extra protection.

Long-term exposure of the controller to the maximum values of the supply circuit may cause irreparable damage to the protection circuits due to overheating or disruption. This may lead to failure of the device. DO NOT exceed the maximum values stated. Operating voltage range and maximum supply voltage values are specified in Technical Specifications section.

Inputs / Outputs

The I/O block is designed for monitor and measure parameters of external equipment and devices, as well as for control various actuators and warning devices.
The I/O block is divided into three sections:

Digital inputs

These inputs have two states: «1» and «0» , and are able to show a change of input state, count pulses and measure frequency.
The controller has the four active low inputs and 2 active high inputs.
In addition, analogue inputs of the controller can operate as digital inputs with the configurable switching threshold.
Logic of the discrete inputs operation is shown in the table below:

Physical state of the input	Logic state of	
	active low input	active high input
High (connected to supply voltage)	1	1
Open-Circuit	1	0
Low (connected to ground)	0	0

Note that logic states of the two inputs differ in open-circuit state (see the table above). This must be taken into account when making connections.

Operation modes of the discrete inputs are fully programmable for each input and include:

• **Normal input**. In this mode, the digital inputs are monitored. When the input state changes, the time and location data is stored into the device memory. Normal mode is useful for recording the time of different sensors' activation and for monitoring the performance of equipment and mechanisms, such as an alarm button, oil pressure sensor, ignition system, passenger presence sensor, security alarm triggering, opening of doors, limit switches of various special-purpose and construction machinery mechanisms, etc. This mode also enables the device to perform unscheduled transmission of data to the server via GPRS upon input state changes, as well as to send an SMS message to the specified phone number.

• **Storage counter.** This mode is intended to track the input switching states and to count various events. This may include counting of pulses from fuel-flow pulse output sensor (of DRT-5 or VZO type), passenger count, speed sensor, tipper body lift sensor, etc. In storage counter mode, the number of pulses from each sensor is stored in memory. The location data is not stored.

• **Periodic counter.** This mode is intended for counting of pulses within one minute. Periodic counter mode is used for taking the readings of sensors, which transmit measured values in pulse bursts in amounts proportional to the measured value. This mode is used, for example, for fuel level, temperature and engine speed sensors with pulse outputs. This mode does not involve recording of a track point into the storage memory when the input state changes.

• **Frequency**. This mode is intended for sensors with frequency outputs. The device is capable of measuring frequencies of 0 – 2,500 Hz. Frequency measurement mode is used, for example, for fuel level sensors with frequency outputs, engine and shaft speed sensors, proximity sensors etc.

Analogue inputs

Analogue inputs are designed to measure the signal level generated by analogue sensors and can be used to measure fuel level in a tank, temperature, pressure and other properties. The AutoGRAPH controller is equipped with two 10-bit analogue inputs, which are fully configurable. Each analogue input of the controller can be set up to record data when the level of the analogue signal changes by a specified value.

The measuring range of the first analogue input is 0 to 10 V or 0 to 1023 ADC stages.

The measuring range of the second analogue input is 0 to 24 V (but not more than supply voltage level of the controller) or 0 to 1023 ADC stages.

The analogue input also enables connection of TKLS fuel level sensor to AutoGRAPH tracker using Frequency-to-Analogue Converter[1].

Furthermore, the analogue inputs of the controller can be set up to operate as active high digital inputs with a configurable switching threshold. When an analogue input operates as a digital one, the controller simultaneously records both analogue data and corresponding logical state. This allows analogue inputs to be used to measure an analogue value and detect a threshold crossing (for example, critical pressure level, temperature or fuel level etc.).

High-impedance inputs

High-impedance input is intended to connect various voltage output devices to AutoGRAPH tracker. AutoGRAPH-GSM+, AutoGRAPH-WiFi and AutoGRAPH-GSM+WiFi trackers are equipped with one digital high-impedance active high input.

The high-impedance input has following logical states:

- «1» – if the input voltage is higher than 7 V;
- «0» – if the input voltage is lower than 3 V.

If the input is in logical 0, it is considered to be disconnected.

Digital outputs

Digital outputs are intended to control any external actuators and turn on warning devices. The controller has two programmable, open collector, discrete outputs. The outputs are controlled by an SMS command and can be set up to send a pulse of a specified length or to switch to specified state. Advanced users can send control commands via the data server. In simple case, the discrete output can be used to warn about speeding, an entrance or exit of the geofenced area, etc.

[1] Frequency-to-Analogue Converter is an electronic device produced by TechnoKom. The Converter is not supplied with AutoGRAPH tracker. To purchase the product, contact the manufacture.

Accelerometer

AutoGRAPH controller is equipped with 3-axis digital accelerometer with wide range of full scales from ±2g to ±16g intended to detect motion, determine the tracker's orientation, measure vibration level, etc. The tracker can be set up to send a notification to a preset phone number or data to a preset server, when detecting the acceleration exceeding a preset threshold.

USB Port

The USB port embedded into controller is intended to:

- configure and check the performance of the controller by means of the configuration program – AG.GSMConf;
- read data from the device so as to deliver them to the AutoGRAPH Dispatch Software (AutoGRAPH 5 PRO);
- update processor microcode (firmware) of the device;
- use the controller in the «GPS mouse» mode.

When using the device as a GPS mouse, the tracker, which is connected to the USB port of a PC, laptop or PDA with a data cable via virtual serial port (COM port), transmits the location data in RMC format through the NMEA protocol once per second. This enables the users to locate the object equipped with AutoGRAPH tracker using software such as OziExplorer, Google Earth Plus/Pro, 2GIS for PC 3.0, Garmin, Navitel and many others. For details please refer to «Using the GPS mouse» document.

RS-485 (TIA/EIA-485-A)

RS-485 (TIA / EIA-485-A) is a data transfer standard for data transmission via a two-wire serial channel. This bus serves to simultaneously connect different devices and sensors compatible with the controller's firmware by two wires.

The controller is equipped with two RS-485 buses. Additional RS-485-2 Bus is designed for photo cameras connection and connection of external devices enabled by the device configuration. Simultaneously up to 16 cameras can be connected to RS-485-2 Bus.

AutoGRAPH tracker supports connection of up to 8 fuel level sensor supporting LLS or MODBUS protocol, as well as TKLS sensors produced by TechnoKom. These sensors must be connected to RS-485-1 bus. Also RS-485-1 bus of AutoGRAPH tracker supports connection of different Technokom and third-party devices intended to extend the device functionality: external GLONASS/GPS receiver, AutoGRAPH-INFO informational display, various MODBUS sensors, AGFC fuel dispensing controller, AutoGRAPH-CardReaders, and etc.

1-Wire Bus

1-Wire, designed by Dallas Semiconductor Corporation, is a simple and convenient bus typically used to communicate with small devices and sensors such as digital thermometers, iButton keys, card readers, and other devices equipped with 1-Wire bus and compatible with the controller's firmware.

RS-232 (EIA/TIA-232-E)

RS-232 is a communication standard for serial communication between two devices: AutoGRAPH controller and any external device compatible with the controller's firmware.
AutoGRAPH controller supports interaction with the external GPS/GLONASS receiver via NMEA 0183 standard, the CAN-LOG module and the tachograph Continental VDO DTCO 3283 via RS-232. Also the tracker supports transmission of coordinate data to any external device via RS-232 in NMEA 0183 format.

CAN (SAE J1939/FMS)

The CAN bus is an industrial network standard primarily designed for interconnection of various actuators and sensors in a single network. It is used in the automotive industry as a management and control line. The CAN interface of the controller may be connected to the CAN bus of a vehicle and is intended for use with SAE J1939 / FMS standard protocol. This standard is widely used in vehicles of well-known truck manufacturers, such as SCANIA, MAN, VOLVO, DAF, IVEKO, RENAULT, MERCEDES (DaimlerChrysler), KAMAZ and MAZ trucks of latest models etc.
Advanced users can set up the tracker to receive data in any CAN protocol using the AG.GSMConf program.

Use of the two-wire CAN bus enables quick connection and allows access to a great number of parameters directly from the sensors of vehicles.
Using the CAN bus, the following information would become available: vehicle speed, cruise control status, accelerator pedal position, brakes and clutch switch statuses, fuel consumption, fuel level in tanks (up to 6 sensors), engine speed, service distance, engine hours, engine coolant temperature, oil and fuel temperatures, total vehicle distance and vehicle distance per day and axle weight. Furthermore, it enables monitoring of some custom parameters not covered by SAE J1939 / FMS standard.
AutoGRAPH-GSM controller is equipped with one CAN bus, controllers AutoGRAPH-GSM+, AutoGRAPH-WiFi+GSM, AutoGRAPH-WiFi are equipped with two CAN buses. The second bus is intended to only receive data from vehicle CAN bus and can not be used for interaction with an external device.

RPM input ⚠

To control revolution of different actuating mechanisms of a vehicle, some modifications of AutoGRAPH trackers are equipped with a digital RPM input intended to measure an average rotation frequency of the monitoring unit.
The frequency is averaged for an interval selectable within the range from 1 to 240 s. Input frequency ranges from 0,01 to 10 000 Hz (from 0,6 to 600 000 rotations per a minute (rpm)). The input provides measurement with an accuracy of up to 0,01%, but not accurate then 0,01 Hz (0,6 rpm)
The readings of the RPM input can be used in AutoGRAPH 5 dispatch software to calculate total revolution of a vehicle engine for required interval, control ready-mix trucks operation, filter operation time of different mechanism at the base of RPM readings, and etc.

⚠ – Functionality available only in extended modifications of AutoGRAPH controllers. See detailed information in the section "Technical Specifications".

Battery charger ⚠

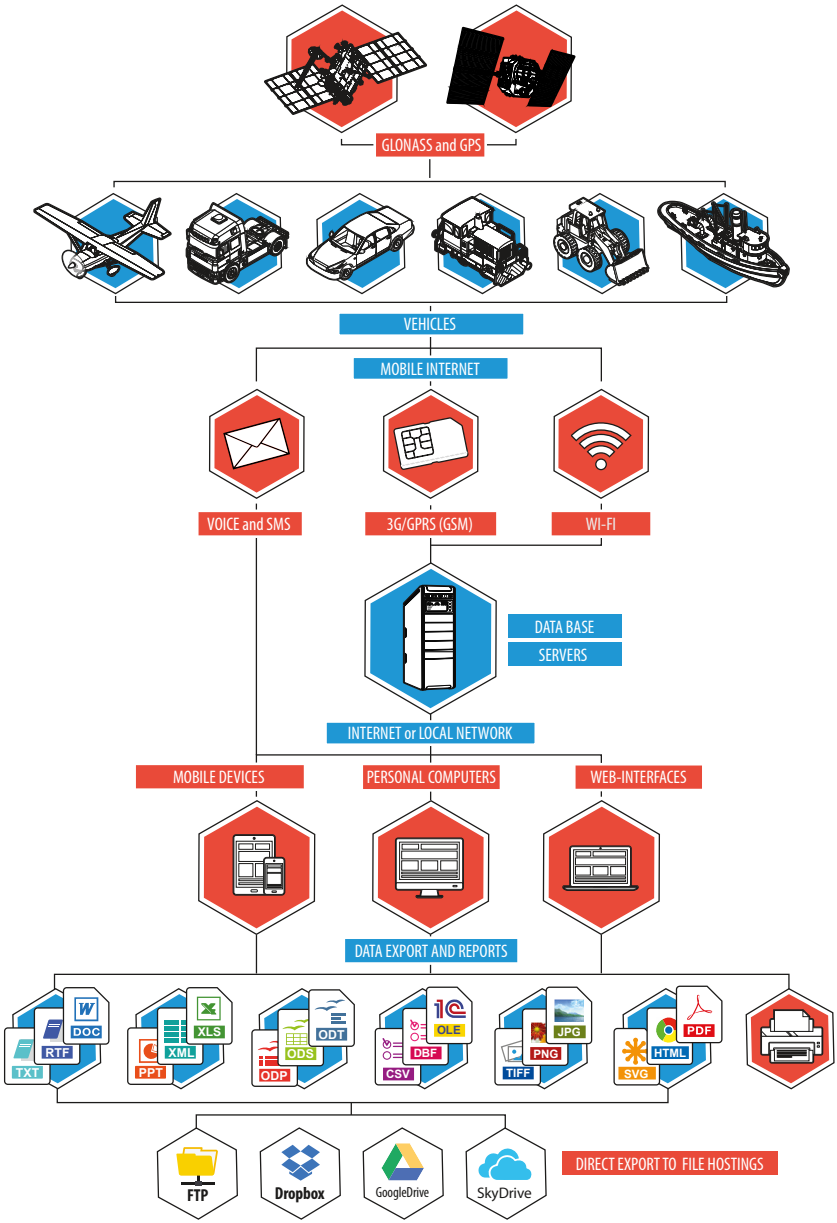
AutoGRAPH controller has a built-in charger to charge an external backup battery. When the controller is powered by the vehicle power system, the power supply driver turns on the charger. The controller sends a notification to a preset phone number when the backup battery voltage falls below the threshold.

Audio Interface (with loudspeaker amplifier) ⚠

The audio interface provides voice communication between vehicle driver and a dispatcher via GSM and available only for controllers AutoGRAPH-GSM+ and AutoGRAPH-GSM+WiFi, which are equipped with GSM modem.
The audio interface of AutoGRAPH controller consists of a loudspeaker and a microphone. A built-in amplifier provides required gain of input signal, then transmits it to loudspeaker. The speaker outputs and microphone inputs are arranged on the 4-pin Voice connector.
The audio interface is allows as to receive incoming calls as call two phone numbers saved in the tracker's memory. Answering and making a call are performed by means of the button on the loudspeaker. Furthermore, AutoGRAPH controller automatically answers calls coming from numbers those have masks specified in the tracker.
Audio interface options can be set up by means of remote command (via server or SMS) and using the AG.GSMConf software.

⚠ – Functionality available only in extended modifications of AutoGRAPH controllers. See detailed information in the section "Technical Specifications".

Brief Description of Vehicle Tracking System Operation



AutoGRAPH controllers, installed on vehicle, constantly receive coded signals from Global Positioning System (NAVSTAR) and GLONASS satellites. These signals are used to determine exact coordinates of the vehicle location.

The coordinates are written to the non-volatile memory of the AutoGRAPH controller either on a regular basis or adaptively. Furthermore, the storage memory records and stores the statuses of various sensors connected to the tracker or data buses, and other parameters required by the software.

Either on a regular basis or upon occurrence of a preset event, the collected data is transferred to the dedicated AutoGRAPH server. Depending on AutoGRAPH tracker modification, the data is transferred via the Internet using General Packet Radio Service (GPRS) supported by a GSM mobile network operator or via Wi-Fi 802.11 b/g/n network if the tracker is in the area of the approved network coverage. Furthermore, AutoGRAPH-GSM+WiFi controller supports data transmission via both Wi-Fi and GSM/GPRS networks. A possibility for data transmission allows to reduce GPRS traffic and provides permanent communication with AutoGRAPH controller even when GSM network is not available.

The server is a computer running Microsoft Windows Server with an Internet connection and reliable data storage device. The server is responsible for receiving data from AutoGRAPH controllers, storing the data and transmission upon request to the dispatcher stations. Depending on a version of AutoGRAPH server, access to data is provided either according to key files or by a user login and password. In the latter case each user has an access to the specified list of AutoGRAPH controllers.

Dispatcher workstations are personal computers or laptops with the AutoGRAPH 5 dispatch software installed that has either Internet access or server connection via LAN. An Internet connection and computer with the Dispatch Software will enable users to obtain data from anywhere in the world. Easy deployment of the Dispatch Software without the need to install third-party database support enables users to immediately create new dispatcher workstations with any PC running MS Windows 2000/XP/Vista/7/8. The number of workstations is unlimited. Dispatch Software is completely free of charge and the latest version may be downloaded from the official website of TechnoKom: http://www.tk-chel.ru.

The AutoGRAPH 5 Dispatch Software is delivered in two versions: a desktop version for MS Windows platforms (AutoGRAPH 5 PRO) and WEB one (AutoGRAPH 5 WEB) for access to data using an Internet browser. WEB version ready without an installation and requires only Internet connection to access the data.

Upon the user's request or on a regular basis the dispatcher workstation connects with the server to update data on. Access to the data is provided according the personal login and password. The received data is stored in a local folder on the dispatcher workstation that enables processing of the data without being connected to the server. Furthermore, to reduce the web traffic, the dispatching network may be organized in such a way as to send any missing data through the Internet to only one workstation, while all other users may use these downloaded data via LAN by retrieving them from the local data folder of the workstation. The users may use this data to track the vehicles on a map, browse through various parameters, events and readings of various sensors. In addition, it is possible to generate various types of reports and charts both for each particular vehicle and in groups.

To interact with various external applications and handlers (including 1C), AutoGRAPH Software incorporates OLE server application (COM server) which enables data exchange between AutoGRAPH Software and the programs written in the majority of existing programming languages which support OLE-enabled data exchange, as well as programs and systems based on their own embedded

programming language (1C Enterprise, MS Office, various databases, etc.).
Furthermore, there is an option to upload all tracking data and reports in the form of MS Excel, DBF and CSV files. The reporting module of the Dispatch Software allows users not only to generate a large number of reports with fully customized layout, data and charts to be presented, but also to save them in many different formats to enable further processing, sending or presentation: PDF, Open Office ODS, Open Office ODT, MS Excel (OLE), MS Excel (XML), XML, RTF, HTML, TEXT, CSV, BMP, JPEG, TIFF, GIF.
Also there is a possibility to generate reports according to a schedule.

Control SMS commands and preset events enables sending of vehicle location coordinates and various notification messages to an ordinary cell phone of GSM standard by means of SMS messages. Furthermore, SMS commands can be used to configure AutoGRAPH tracker directly from a cell phone or a PDA.

Audio interfaces of AutoGRAPH trackers[1] allows a dispatcher to communicate with a vehicle's driver by a call on a phone number of the tracker SIM card. For back call, the driver can call one of two phone numbers stored on of the tracker's memory. To do the call, it is necessary to press and hold a button on a hands free for 1,5 sec. This will send a call to the first preset number. If the number is not available or not responding, the tracker will try to call the second preset number.

It should be noted that this brief description covers just one of the simple operation schemes of the vehicle tracking system based on AutoGRAPH controllers hardware and software. The device has a range of customizations available to tailor the product to the users' needs.

To obtain detailed information on the implementation of particular features for customization of the monitoring system in accordance with your needs, please contact your regional authorized representative of TechnoKom and the manufacturer's technical support service.

[1] Audio interface is available only in AutoGRAPH-GSM+ and AutoGRAPH-GSM+WiFi controllers.

Connection of AutoGRAPH controller

This section covers connection procedures of AutoGRAPH controllers:

- Installation of a SIM card
- Installation of a microSD card
- Connection of a GPS/GLONASS antenna
- Connection of a GSM / GSM/Wi-Fi / Wi-Fi antenna
- Connection of main power supply
- Connection of backup power supply
- Connection of digital inputs
- Connection of analogue inputs
- Connection of outputs
- Connection of 1-Wire bus
- Connection of RS-485 (TIA/EIA-485-A) bus
- Connection of RS-232 (EIA/TIA-232-E) bus
- Connection of CAN (SAE J1939/FMS) bus
- Connection of RPM input[1]
- Connection of audio interface[2]
- Connection of backup battery[1]

To make the tracker ready for the simplest operation scheme it would be sufficient just to install a SIM card, GPS/GLONASS and GSM antennas, and to connect the tracker to power supply source. However, the hardware and software of AutoGRAPH controllers include an extensive range of features and capabilities, which allow for easy configuration, customization and adaptation of the system to the needs of a user.

Application of digital and analogue inputs, outputs and data buses enables permanent monitoring of various parameters (for example, fuel consumption and fuel level), as well as to monitor operating conditions and performance of external equipment and devices and to promptly respond to various events (for example, to the pushing of an alarm button). The output of the controller enables the device to control various actuators and warning devices. An external backup battery enables the controller to operate even when the main power fails. All of these features allow the creation of diverse variants of the system able to perform monitoring of a great number of parameters and to respond to various events.

The following sections focus on basic connection diagrams of various interfaces, inputs and outputs of AutoGRAPH controllers.
Depending on modification, set of interface connectors of AutoGRAPH tracker may vary, that's why all connection diagrams in following sections are given for the most extended modification of the tracker – AutoGRAPH-GSM+ and AutoGRAPH-GSM+WiFi. Provided that functional assignment of interface connectors of all controllers is observed, the diagrams are also applicable to other modifications of AutoGRAPH controller.

[1] The section is intended for AutoGRAPH-GSM+, AutoGRAPH-WiFi and AutoGRAPH-GSM+WiFi controllers.

[1] The section is intended for AutoGRAPH-GSM+ and AutoGRAPH-GSM+WiFi controllers.

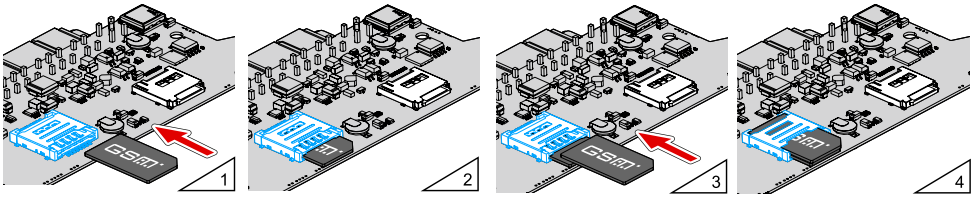
Installation of SIM Card

The AutoGRAPH controller is equipped with a dual SIM holder. In order for the controller to log in GSM network, it is necessary to install at least one SIM card in the controller. This is required for the tracker to be able to transfer data to a server by means of GPRS.

SIM card installation is required only for those AutoGRAPH controllers which are equipped with an internal GSM modem. These are AutoGRAPH-GSM, AutoGRAPH-GSM+ and AutoGRAPH-GSM+WiFi controller.
AutoGRAPH controllers without an internal GSM modem transfer data via Wi-Fi network.

To insert SIM cards:

- Unscrew the four fastening screws and remove the back cover of the tracker.
- Insert a SIM card in the lower retaining slot of the SIM card holder with the card's contacts facing the PCB (see fig.1). Be sure that the card's keying matches the key on the PCB (see fig.2).
- If necessary, insert a second SIM card in the upper retaining slot of the SIM card holder with the card's contacts facing the PCB (see fig.3). Be sure that the SIM card is inserted into the retaining slot with its cut angle facing the edge of the printed circuit board (see fig.4).
- When the SIM cards are connected place the back cover back and tighten the four fastening screws.



The SIM card installed in the lower retaining slot of the SIM card holder is the main card. When switched on, the AutoGRAPH-GSM controller will operate with this SIM card. The SIM card installed in the upper retaining slot of the SIM card holder is the backup card. The tracker will switch to the backup SIM card when the main card is unavailable (disabled, damaged or not inserted).
For proper operation it is quite sufficient to insert the main SIM card into the tracker. But the backup card provides the appropriate operation of the controller even if the main SIM card is damaged. Due to this the controller will stay connected and be able to transfer data full time.

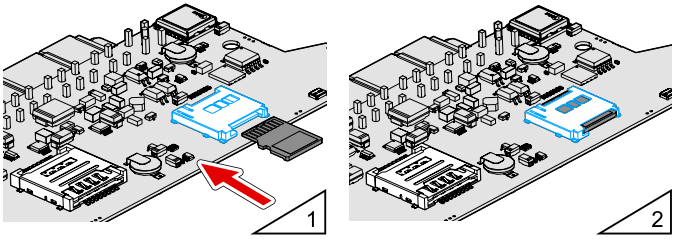
Do a test of a new SIM card in a cell phone before you install it into the controller. This ensures that GPRS / SMS / USSD services are enabled and operate properly, the PIN code matches the code preset in the controller (in order to prevent locking), and a personal account associated with the SIM card has the sufficient balance for successful operation of the services.

Installation of MicroSD Card

The AutoGRAPH-GSM controller is equipped with a slot for microSD card located on the upper side of the PCB. The microSD card is used to store photos from cameras connected to the tracker and logs of operation. The tracker supports installation of microSD cards with maximum capacity of 32GB.
AutoGRAPH controllers of other modifications are equipped with internal eMMC memory to store photos and operation logs.

To insert microSD card:

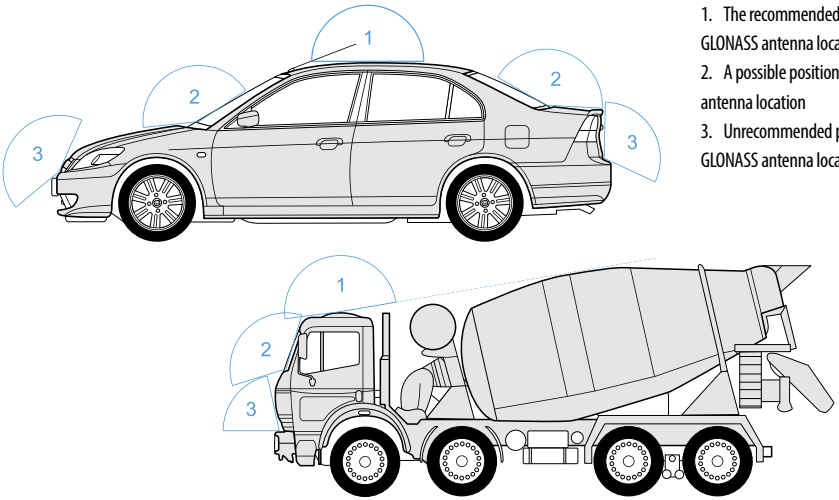
- Unscrew the four fastening screws and remove the back cover of the tracker.
- Insert a microSD card in the slot with the card's contacts facing the PCB (see fig.1).
- When the microSD card is inserted, place the back cover back and tighten the four fastening screws.



To remove the microSD card, gently push the card's external edge and release it. Then remove the card.

Connection of GPS/GLONASS Antenna

The controller is supplied with magnetic mounted waterproof, active GPS/GLONASS antenna. The GPS/GLONASS antenna is connected to the connector in the lower-right part of the AutoGRAPH-GSM controller.
The position of the GPS/GLONASS antenna is critical to goof performance of the GPS receiver, therefore it is highly recommended to plan the antenna's position on a vehicle before installation.
The antenna should be located in an open area, which shall ensure free GPS signal transmission; its active surface should face the sky and be parallel to the celestial sphere. Possible variants are illustrated in the picture below:



1. The recommended position for GPS/GLONASS antenna location
2. A possible position for GPS/GLONASS antenna location
3. Unrecommended position for GPS/GLONASS antenna location

NOTE

When locating the antenna make allowance for the length of its cable. When laying the cable, avoid sharp edges. Cable bend radius should be at least 10 cable diameters (about 3…5 cm).
Do not fix antenna before you make settings and configure your system, it is highly recommended to determine its final position and install only when you are absolutely sure that the system is configured and operates properly.

IMPORTANT

Do not splice or cut the antenna cable.

Connection of GSM and Wi-Fi Antennas

Depending on a modification of AutoGRAPH controller, it can be supplied with following antenna:

- Flat GSM antenna with an adhesive coating for it to be stuck to the window. GSM antenna is supplied with AutoGRAPH-GSM and AutoGRAPH-GSM+ controllers.
- Whip GSM/Wi-Fi antenna with a magnetic base. The combined GSM/Wi-Fi antenna intended to receive both GSM and Wi-Fi signals is supplied with AutoGRAPH-GSM+WiFi controller.
- Whip Wi-Fi antenna with a magnetic base. This antenna is supplied with AutoGRAPH-WiFi controllers.

These antennas must be connected to the connector in the lower-left part of the controller.
The position of the antenna is critical to good performance of the GSM and Wi-Fi communication; therefore it is highly recommended to plan the antenna's position on a vehicle before installation.
The antenna should be located in an open area, which shall ensure free GSM signal transmission.

Before attaching the antenna with an adhesive coating, wipe the window surface with the cloth supplied with the antenna. If the antenna is supplied without a cloth, clean the window surface with any cloth damped with alcohol-based liquid before sticking the antenna.

When locating the antenna make allowance for the length of its cable. When laying the cable, avoid sharp edges. Cable bend radius should be at least 10 cable diameters (about 3-5 cm).
Do not fix antenna before you make settings and configure your system, it is highly recommended to determine its final position and install only when you are absolutely sure that the system is configured and operates properly.

Do not splice or cut the antenna cable.

In order to avoid cross-talk effects place the GSM and GPS/GLONASS antennas at least 50 cm away from each other.

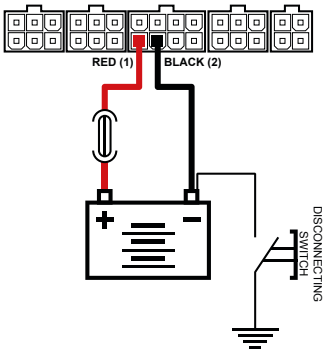
Power Supply Connection

AutoGRAPH controller is connected to the power supply source using the interface cable supplied with the device. The device is supplied with a fuse intended to provide a short circuit protection of power supply. The fuse holder is installed on a wire ring, which should be cut before operation.

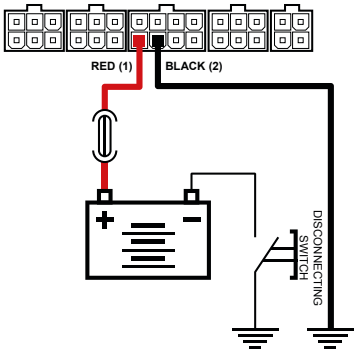
When making connections, pay special attention to the safety rules stipulated by the regulations for motor vehicle repair procedures. All connections should be properly isolated and securely connected. If the wire is too short, it can be spliced with a wire of at least 0.5 mm^2 cross section (20 AWG or thicker).

The power supply input of the controller is rated for the vehicle system operating voltage of 10-60 V DC.

Power can be fed to the controller either before or after the vehicle's battery disconnect switch (see diagram).



Power connection before the vehicle battery disconnecting switch



Power connection after the vehicle battery disconnecting switch

If power is connected before the vehicle battery disconnect switch, the controller shall always be ON, therefore, it is highly recommended to use adaptive position recording for this case so as to minimize an amount of data to be transferred, as well as to reduce GPRS and web traffic.

The fuse should be placed as close as possible to the point where the AutoGRAPH-GSM is connected to the vehicle power system.

Backup Power Supply Connection

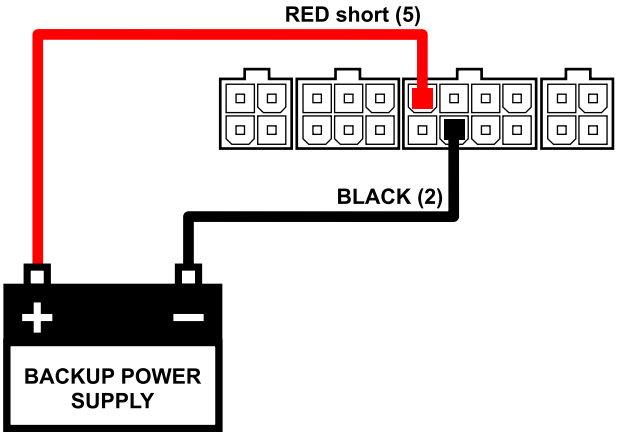
To avoid the tracker turning off, when the main power supply shuts down, the power supply driver supports connection of a backup power supply.

Switching between the main power supply and the backup power supply is performed automatically. If the main power supply turns off, the tracker switches to the backup power supply. As soon as the main power supply is restored, the controller will switch back to the main power supply.

The tracker can be setup to send a low voltage notification via SMS to a preset telephone number, if the backup supply voltage falls below 11 V.

It should be note, that AutoGRAPH-GSM is not equipped with the battery charger. All other modifications of AutoGRAPH controller have a built-in charger to charge connected back up battery.

Backup Power Connection Diagram:



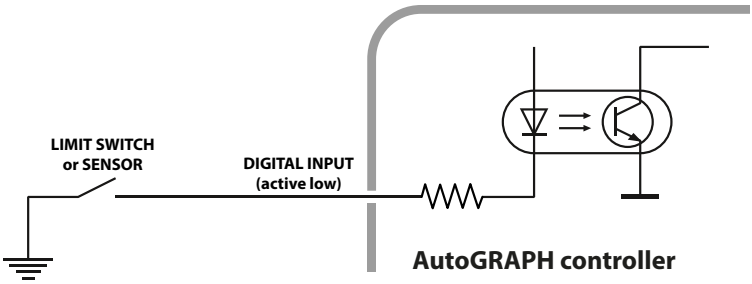
Connection of Digital Inputs 1...4 (active low)

AutoGRAPH controllers has four active low digital inputs: two inputs – on power supply connector (pin 3, pin 7), two inputs – on 4/6-pin CAN / 1-Wire / Output 2 / Inputs 3-4 connector (pin 10, pin 13).
Active low digital input has two states:
logical «1», when the input is connected to the supply voltage or open-circuit.
logical «0», when the input connected to the ground. This state is considered to be active.

The input is able to show change of the input state, count pulses and measure frequency and is intended to connect various dry contact sensors to the tracker. Ensure that the sensors are in good order and able to maintain reliable operation. The manufacturer shall not bear any responsibility for incorrect state recording of these sensors (chatter, loss of contact and etc.).

Internal Connection Diagram of Active Low Digital Input

Internal connection diagram of the active low digital input is shown in the picture below:



IMPORTANT

It should be noted that all voltage levels of active low digital inputs under 5 V shall be considered to be logical '0', while all voltage levels above 6 V shall be considered to be logical «1» . If the input is disconnected it shall denote logical «1» .

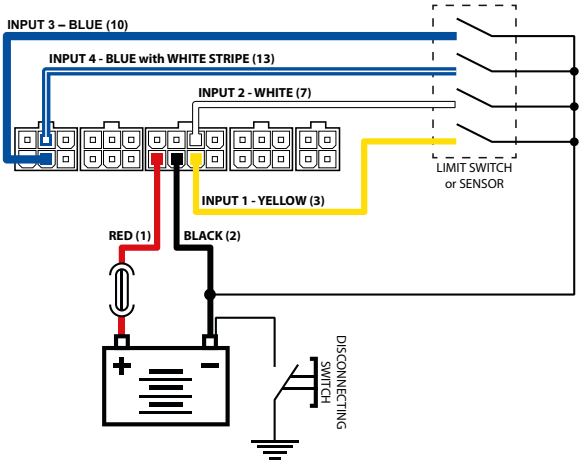
NOTE

It is convenient to connect the active low digital input to an emergency oil pressure relief sensor to control the engine performance. In this case, the AutoGRAPH dispatch software shall enable metering of engine hours and application of various filters related to the engine's operating time. For example, «Skip the coordinates» filter when the engine is shut down reduces traffic and filters coordinate drift at stops when the engine is not running.

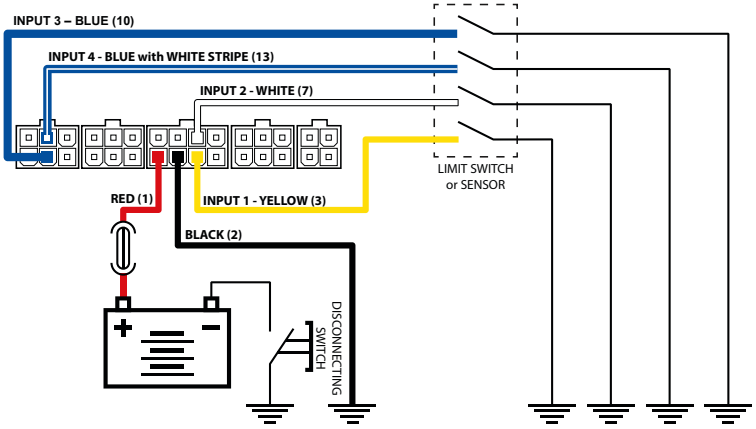
External Connection Diagram of Active Low Digital Input

The external connection diagram for the active low digital input can vary depending on the position of the vehicle battery disconnecting switch in the circuit (see Power Supply Connection diagrams).
This is due to the fact that when the sensors are connected to the vehicle body (“after vehicle battery disconnecting switch” option), and the disconnecting switch opens; the tracker will not be able to record sensor states on the digital input 1 correctly.

Connection Diagram for Active Low Digital Input «Before Disconnecting Switch» Option:



Connection Diagram for Active Low Digital Input «After Disconnecting Switch» Option:



Connection Diagram for Active Low Digital Input Inductive Load Circuit:

Sometimes, it is necessary to integrate the controller's digital input into a circuit with an inductive load, such as a relay winding, solenoid valve or any other device that has an inductance coil.
When an inductive load is being disconnected, stored current must be dissipated, this causes a self-induced electromotive force of inversed polarity (back EMF) that may damage the controller.
To prevent this, use one of the following protection options if an inductive load is being applied to the controller:

1. **Protective diode** (fig. 1) – to be installed in parallel to the inductive load. In this case, forward current of the protective diode (I_{fw}) should be at least 1.5 • $I_{holding,\ coil}$. If the coil holding current is unknown or uncertain, use the option with safety relay protection.
2. **Safety relay** (fig. 2) – to be installed in parallel to the inductive load. In this case, the safety relay contacts are used for closing the controller's input on ground.

Fig 1

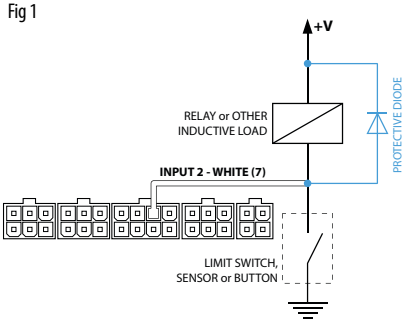
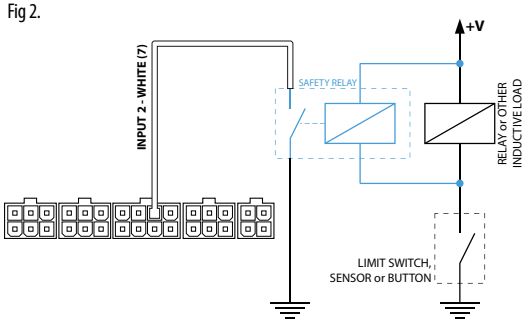


Fig 2.



NOTE

You may use following protective diodes: KD212, KD116-1 or similar.

NOTE

Use may use safety relays designed for switching of direct current circuits with voltage rating compatible with the vehicle system voltage. For example, relays of 901.3747 type manufactured by AVAR, AO, (www.ellink.ru/co/avar) for a vehicle system voltage of 24 V.

Connection of Digital Inputs 7...8 (active high)

AutoGRAPH controllers have two active high digital inputs, arranged on 6-pin CAN/ RS-485 / Inputs 7-8 connector (pin 16, pin 19).
Active high digital input has two states:

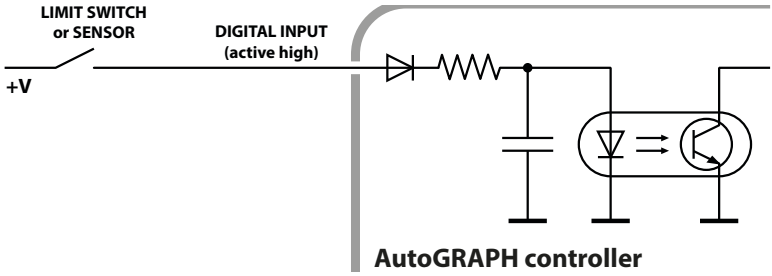
logical «1», when the input is powered by supply voltage. This state is considered to be active.

logical «0», when the input is connected to the ground or open-circuit.

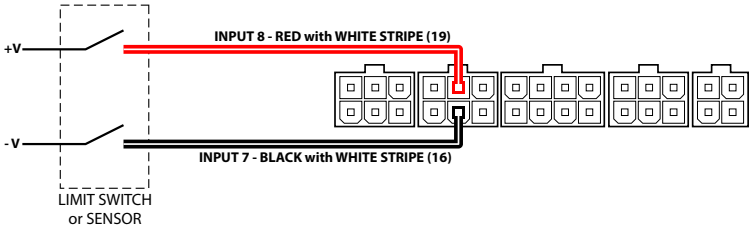
The input is able to show change of the input state, count pulses and measure frequency and is intended to connect various dry contact sensors. Ensure that the sensors are in good order and able to maintain reliable operation. The manufacturer shall not bear any responsibility for incorrect state recording of these sensors (chatter, loss of contact and etc.).

It should be noted that all voltage levels of active high digital inputs under 5 V will be considered to be logical zero ('ground'), while all voltage levels above 6 V shall be considered to be logical «1» (active). If the input is open-circuit it shall denote logical «0» .

Internal Connection Diagram of Active High Digital Input



External Connection Diagram of Active High Input



Connection Diagram for Active High Digital Input Inductive Load Circuit:

Sometimes, it is necessary to integrate the controller's digital input into a circuit with an inductive load such as a relay winding, solenoid valve or any other device, which has inductance coil.
When an inductive load is being disconnected, stored current must be dissipated, this causes a self-induced electromotive force of inversed polarity (back EMF) that may damage the controller.
To prevent such breakdown, use one of the following protection options, if an inductive load is being applied to the tracker:

1. **Protective diode** (fig. 1) – to be installed in parallel to the inductive load. In this case, forward current of the protective diode (I_{fw}) should be at least 1.5 • $I_{holding, coil}$. If the coil holding current is unknown or uncertain, use the option with safety relay protection.
2. **Safety relay** (fig. 2) – to be installed in parallel to inductive load. In this case, the safety relay contacts are used for closing the controller's input on supply voltage.

Fig 1.

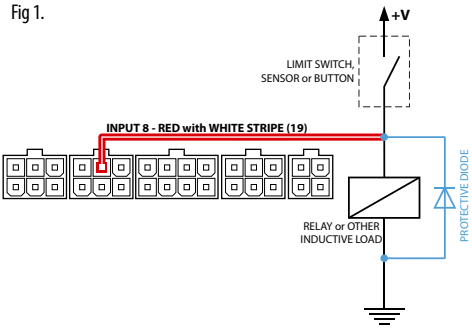
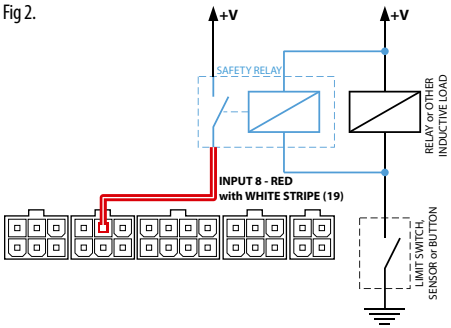


Fig 2.



NOTE

You may use following protective diodes: KD212, KD116-1 or similar.

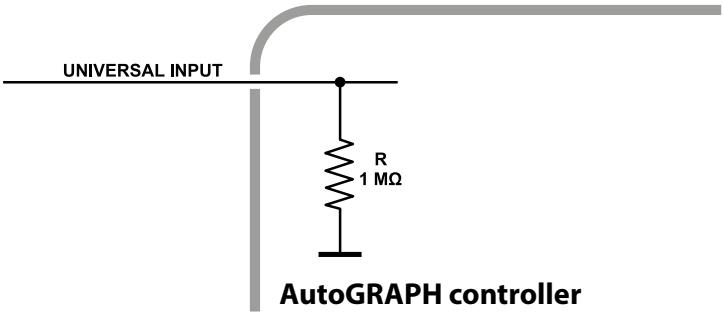
NOTE

Use may use safety relays designed for switching of direct current circuits with voltage rating compatible with the vehicle system voltage. For example, relays of 901.3747 type manufactured by AVAR, AO, (www.ellink.ru/co/avar) for a vehicle system voltage of 24 V.

Connection of High-impedance Digital Input

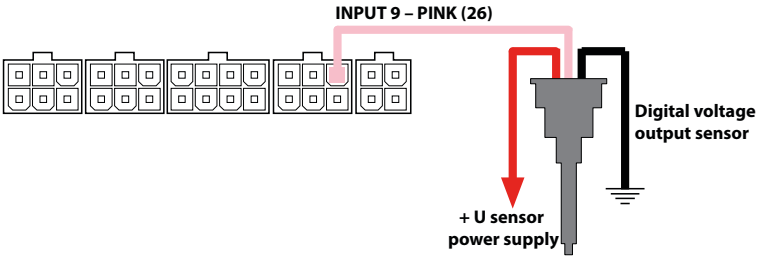
AutoGRAPH-GSM+, AutoGRAPH-GSM+WiFi and AutoGRAPH-WiFi controllers have one high-impedance active high input (pin 26 on the 6-pin RS-232 / RS-485 / RPM / Input 9 interface connector).
High-impedance digital input is intended to connect a device with a voltage output to the tracker.
The high-impedance input has two states:
logical “1” – when input voltage is greater than 7 V;
logical “0” – when input voltage is lower than 3 V.
If the high-impedance input is open-circuit it shall denote logical “0”.

Internal Diagram of High-impedance Input:



The input resistance of the high-impedance input is 1 mega-ohm (1MΩ).
The cut-off frequency of the input low-pass filter is 5,000 Hz.

External Connection Diagram of High-impedance Input:



Connection of Analogue Inputs

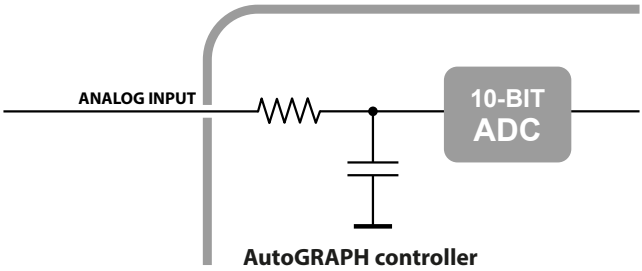
AutoGRAPH controller has two 10-bit analogue inputs: pin 4 and pin 8 on the power supply connector. The analogue inputs allow measurement of voltage levels from devices with an analogue voltage output, i.e. signals from an analogue fuel level sensor.
The measuring range of the first analogue input (pin 4) is 0 to 10 V which is converted to a figure between 0-1023.
The measuring range of the second analogue input (pin 8) is 0 to 24 V (but not more than supply voltage) which is converted to a figure between 0-1023.
The input resistance of the analogue inputs is 1 mega-ohm (1MΩ).
The analogue readings are smoothed using the moving average method with a configurable averaging window.
The cut-off frequency of the input low-pass filter is 1600 Hz.

The analogue inputs of the controller can be used as active high digital inputs with a configurable switching threshold: analogue input 1 can be set up as digital input 5; analogue input 2 can be set up as digital input 6. The operational properties of the analogue inputs can be specified using the AG.GSMConf configuration program or remotely using the control SMS commands.
When the analogue input is used as a digital input, it is considered to be open-circuit in the case of a logical «0» and a voltage below 6 V. In digital mode, the input operates both as digital input and as analogue input. Along with the current logical state, voltage level on the input is measured and recorded into the FLASH memory at the specified intervals.

The maximum frequency of the impulse signal on an analogue input in Pulse Counter mode is 500 Hz.

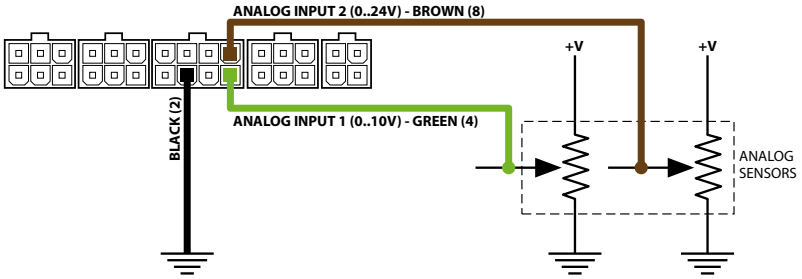
Connection Diagrams of analogue inputs in digital mode is given in «Connection of Digital Inputs 7..8 (active high)» section.

Internal Functional Diagram of Analogue Inputs:



It is highly recommended to connect analogue inputs to –Vin line, if the inputs are not used.

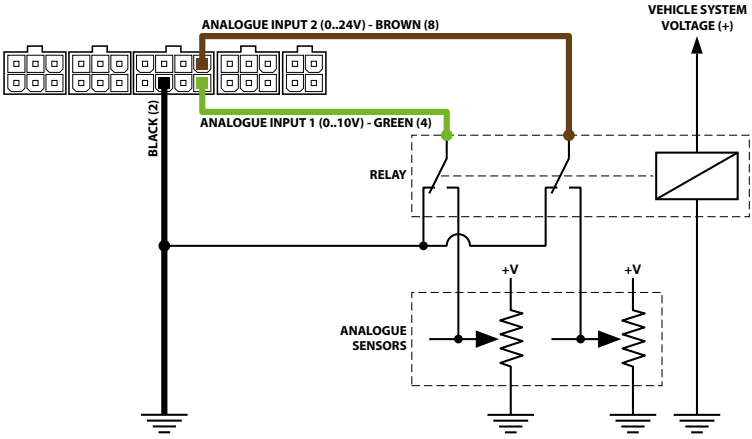
External Connection Diagram of Analogue Inputs:



IMPORTANT

Most analogue sensors are connected to the –Vin line of the vehicle power system. So, if the –Vin line is disconnected (e.g., by a disconnecting switch), the state of the analogue input will be undefined and analogue readings will not be considered to be valid. Therefore, if the tracker is connected to the vehicle power system via a disconnecting switch, it is highly recommended to connect the analogue sensors via a relay.

Connection diagram of analogue input protected from -Vin line disconnecting:



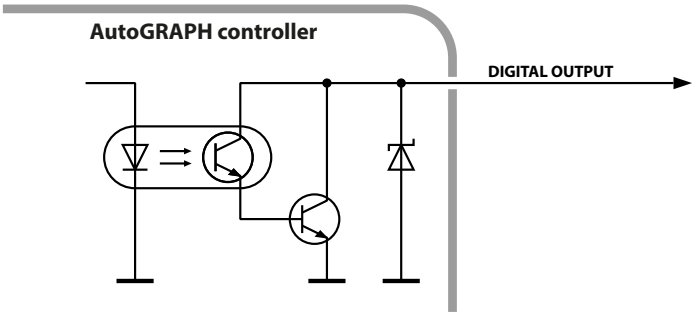
NOTE

It is recommended to use a relay intended to switch dc circuits and with operating voltage equal to voltage of vehicle power system. For example, 901.3747 relay, designed by AVAR Corp. (www.ellink.ru/co/avar) for 24 V vehicle network.

Connection of Outputs

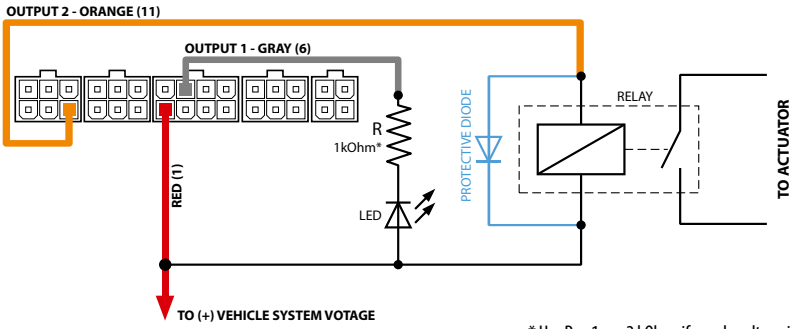
The AutoGRAPH tracker has two open collector digital outputs: the first output is arranged on the power supply interface connector (pin 6), the second one is arranged on the 4/6-pin CAN / 1-Wire / Output 2 / Inputs 3-4 connector (pin 11).
The outputs are intended to control various external actuators, as well as to activate warning devices
Minimum recommended load current is 10 mA.
Maximum load current should not exceed 500 mA.

Internal Diagram of Outputs



External Connection Diagram of Digital Outputs:

The following is an example of a LED and relay connected to the controller output. To avoid damage of the controller output due to back EMF, induced from disconnecting an inductive load, connect a protective diode in parallel to the relay. To select a correct diode make sure that direct current of this protective diode is at least 1.5 times greater than the relay holding current.



* Use R = 1 . . . 2 kOhm, if supply voltage is 24 V.
Use R = 500 Ом . . . 1 kOhm, if supply voltage is 12 V.

Bluetooth connection

AutoGRAPH on-board controllers of a hardware version 3.0 are equipped with Bluetooth module which allows to connect external devices to the tracker wirelessly. All connected devices and sensors must be Bluetooth Smart compatible.
Current version of AutoGRAPH trackers supports wireless connection of TKLS fuel level sensors of TechnoKom production.

To connect TKLS fuel level sensors to AutoGRAPH controller via Bluetooth, the controller firmware must be AGEX-12.12 or higher and firmware of TKLS sensors must be TKLS-01.38 or higher.

Before connection, it is necessary to set up Bluetooth options – specify addresses of connected TKLS sensors and set up data recording period for those sensors.

Detailed instruction for configuration of Bluetooth module of AutoGRAPH trackers is given in the document "Configuration and Setup. AG.GSMConf software".

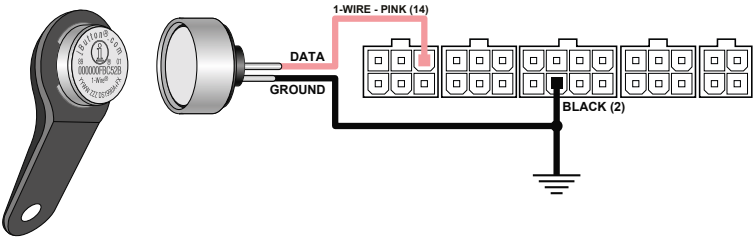
To connect TKLS sensor to AutoGRAPH controller via Bluetooth, follow the next steps:

- set all connected sensors up;
- set Bluetooth options of AutoGRAPH tracker up;
- mount TKLS sensor in a tank following the instructions given in User manual for the sensor, then connect power supply to the sensor;
- connect power supply to AutoGRAPh controller. After turning on and initializing all modules, AutoGRAPH controller will start searching for available sensors via Bluetooth. Then it will automatically connect to devices which have been found, if their are compatible with the trackers firmware;
- after that the controller will record readings of connected sensors in internal memory with the specified recording period and transfer collected reading to data server along with other data. Data is transferred to server with a regular period of by a preset event.

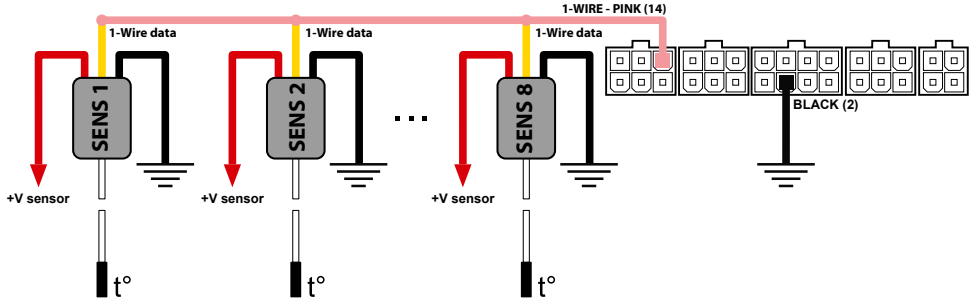
1-Wire Bus

AutoGRAPH controller are equipped with a 1-Wire bus intended to connect touch memory iButton reader and up to 8 temperature sensors, designed by TechnoKom Ltd. or DS18B20 thermometers. Furthermore, proximity card readers compatible with the iButton protocol can be connected to the controller via the 1-Wire bus. This provides supervising drivers and identification of other staff using individual cards and keys.

Connection Diagram of Touch Memory iButton readers:



Connection of Temperature Sensors Designed by TechnoKom Ltd.:



For detailed information on operation and configuration of the controller for interaction with the touch memory iButton reader and the temperature sensors via 1-Wire bus see the document «Configuration and Setup. AG.GSMConf software».

RS-232 (EIA / TIA-232-E) Bus

AutoGRAPH controller is equipped with an RS-232 (EIA/TIA-232-E) bus.
RS-232 is a bi-directional serial data transmission interface between a transceiver and peripheral devices. The main advantages of the RS-232 interface are reliability and flexibility of implementation.

Current version of AutoGRAPH controller supports connection of following devices via RS-232 bus:

1. NMEA 0183 coordinates output – intended to send coordinate data in NMEA 0183 protocol to any external device connected to the tracker via RS-232, e.g. AutoGRAPH-NAVIGATOR display. This mode is set by default.

2. CAN-LOG (or CAN-LOG 2) – intended to receive data from CAN-LOG 2 device. The CAN-LOG 2 is intended for connecting to the vehicle CAN Bus, scanning data and transferring it to another device connected to the CAN-LOG via RS-232. The CAN-LOG 2 supports many CAN protocols. Connected to the controller the CAN-LOG is capable of reading data from the CAN bus and transferring it to the controller, even if the CAN protocol is not known in advance. The data from the CAN-LOG 2 is transferred in text format.

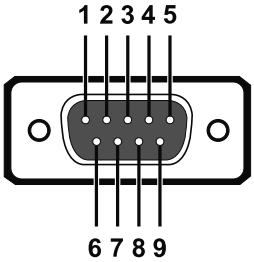
3. External GPS / GLONASS receiver with NMEA 0183 standard – intended to receive coordinates from a high-precision receiver in NMEA 0183 protocol.

4. APC (automotive passenger counting) output to RS-232 interface – intended to transfer data from APC systems IRMA MATRIX and IRMA BASIC to external device via RS-232.

5. VDO RS232 – intended to receive .ddd-files from tachograph Continental VDO DTCO 3283 and then transfer this data to server.

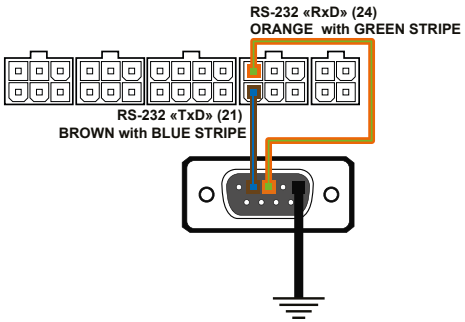
Before connecting any device to the tracker, the required mode of RS-232 interface must be selected in the controller. The customer can set this using the GSMConf configuration program or control commands via SMS or the server.

RS-232 Serial Connector Pin Assignment (DE-9):



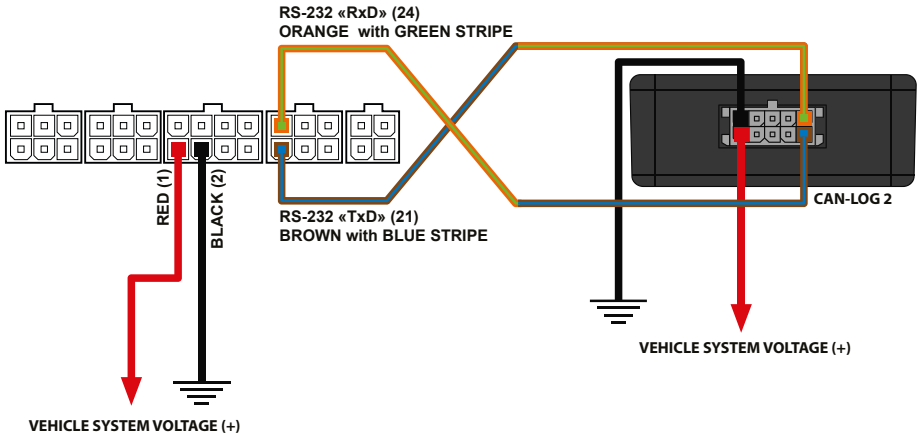
1	DCD	Not used
2	RxD	Receive Data
3	TxD	Transmit Data
4	DTR	Not used
5	GND	System Ground
6	DSR	Not used
7	RTS	Not used
8	CTS	Not used
9	RI	Not used

RS-232 (EIA/TIA-232-E) Connection Diagram:



Connection of CAN-LOG 2 to the controller Designed by TechnoKom Ltd.:

The following is an example of connection the CAN-LOG 2 module to the tracker. This device is powered by P145_20 controllers, designed by Farvater Ltd.



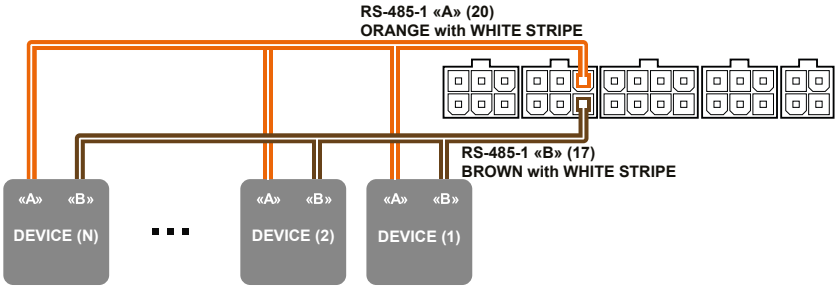
RS-485 (TIA / EIA-485-A)

AutoGRAPH controller is equipped with two RS-485 (TIA/EIA-485-A) interfaces.

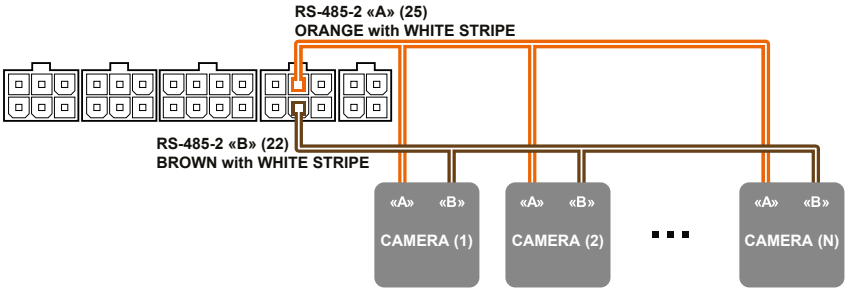
RS-485 is one of the most commonly used industrial standards of communication. A network based on an RS-485 interface consists of transceivers connected with twisted pair wires. All devices are connected to one twisted pair in the same manner: non-inverting outputs (A) to one wire and inverting outputs (B) to another wire.
The controller allows up to 16 devices to be connected simultaneously to one RS-485 bus. There are many sensors, interfaces and expansion modules that are compatible with the tracker's firmware. Amongst such devices are: fuel level sensors (up to 8 sensors simultaneously), passenger traffic metering system, input expander, display for messaging with a vehicle driver, AutoGRAPH-CR device, temperature sensors which support MODBUS protocol, etc.
The additional RS-485-2 bus is intended for photo cameras connection and connection of external device, enabled by the device configuration. The current version of the device firmware supports ridership data transmission via RS-485-2 bus.
Interaction with photo cameras is supported by controllers equipped with additional memory. AutoGRAPH controller stores photos in an external microSD card.

General Block Diagram of Connection of External Devices to RS-485 Bus:

RS-485-1



RS-485-2



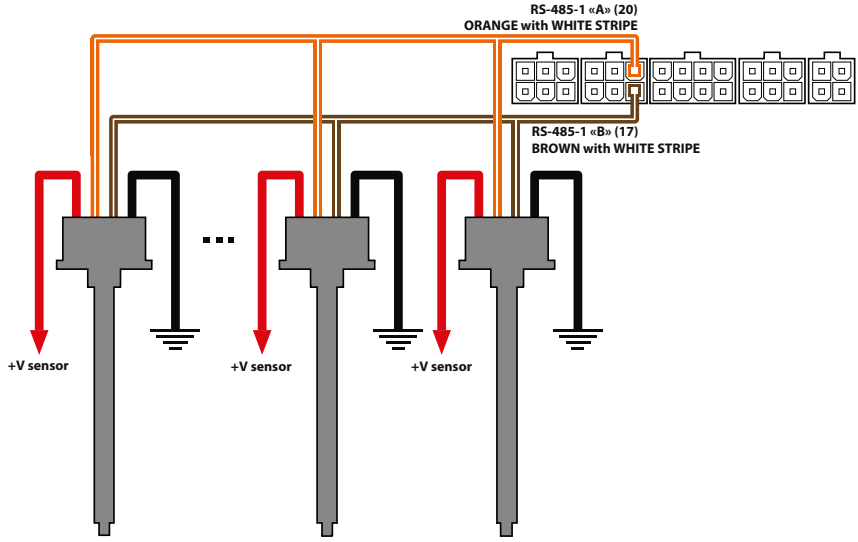
IMPORTANT

Be careful not to cross the «A» and «B» wires, otherwise the device connected to the tracker may operate incorrectly.

Connection of Fuel Level Sensors to RS-485 Bus

At the present time AutoGRAPH on-board controller supports connection of TKLS fuel level sensors produced by TechnoKom Ltd. and other sensors supporting LLS and Modbus protocols via RS-485.
There is AGHIP (AutoGRAPH Hardware Interface Protocol) protocol intended for AutoGRAPH controller to operate with AutoGRAPH peripherals as well as TKLS fuel level sensors. Enabled in TKLS sensors, this protocol allows reception of additional data along with fuel level, e.g. sensor's error codes, an inclination angle of a fuel tank (vehicle) and etc.
Also LLS and Modbus protocols can be used to receive data from TKLS sensors.

Given below is a connection diagram of TKLS fuel level sensor to RS-485-1 bus of AutoGRAPH controller. This diagram is applicable for third-party fuel level sensors connecting to the controller via RS-485 bus.



IMPORTANT

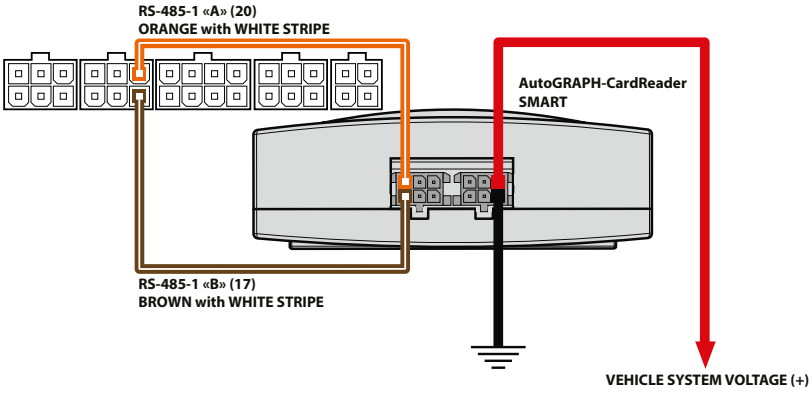
Before making any connections study the manuals for fuel level sensors supplied by the sensor manufacturers. Pay attention to the supply voltage range of the sensors and peculiarities of their configuration. Some sensors require external supply voltage stabilization. If you have any doubts on making connections or configuration, consult the representative of the sensor manufacturer or your regional TechnoKom dealer.

RS-485 Bus of the controller has to be customized to interact with fuel level sensors. It can be performed by means of the AG.GSMConf configuration program and control commands via the data server or a SMS.

TKLS fuel level sensor conforms to European regulatory documents, requirements and standards. Technical characteristics and full list of certificates and licences of the TKLS sensor, see on official web site www.tkls.eu.

Connection of AutoGRAPH-CardReader-SMART to RS-485 Bus

The AutoGRAPH-CardReader-SMART is designed to read RFID and SIM cards. The ID (identification number) of inserted card is transmitted to AutoGRAPH controller via RS-485 bus. Up to 250 IDs can be stored in the flash memory of the AutoGRAPH-CardReader-SMART. Each card can customize outputs of the card reader when connecting.



For more information on connection and configuration of the tracker for operation with the AutoGRAPH-CardReader-SMART via RS-485 bus see document «User Manual. AutoGRAPH-CardReader-SMART».

CAN Bus (SAE J1939 / FMS)

Depending on modification, AutoGRAPH controllers are equipped with one or two CAN buses:
- AutoGRAPH-GSM controller is equipped with one CAN bus (CAN 1).
- Controllers AutoGRAPH-GSM+, AutoGRAPH-GSM+WiFi and AutoGRAPH-WiFi are equipped with two CAN buses (CAN1 and CAN2)

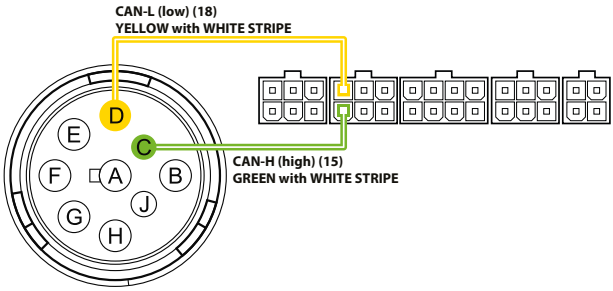
CAN1 bus is arranged on 6-pin CAN / RS-485 / Inputs 7-8 connector: pin 15 and pin 18.
CAN1 bus is arranged on 6-pin CAN / 1-Wire / Output 2 / Inputs 3-4 connector: pin 9 and pin 12.

CAN Bus (SAE J1939 / FMS) allows to connect the tracker to vehicle CAN bus and read different data on vehicle operation. By default, the tracker supports SAE J1939 / FMS protocol of CAN. However, advanced users can specify any other known protocol in the tracker and operate with it. CAN Bus of the tracker can be configured using the GSMConf program or remotely by means of control commands.

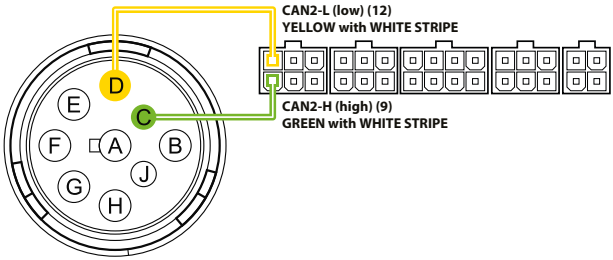
Additional CAN bus (CAN2) is intended only to receive data and can not be used for communication with an external device.

Connection to CAN Bus (SAE J1939 / FMS)

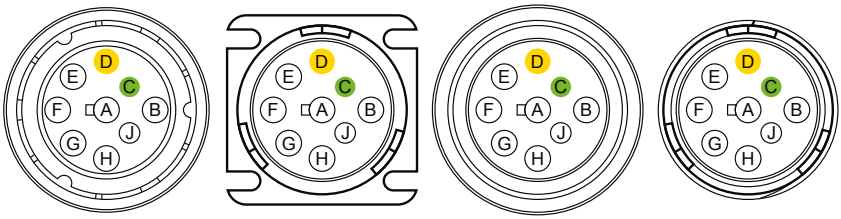
Connection diagram of CAN Bus 1



Connection diagram of CAN Bus 2



Typical Vehicle Connectors of SAE J1939-13 Standard



Pin	Assignment (SAE J1939-13)
A	Battery (–)
B	(+) Unswitched - with Unconditioned 10 A fuse
C	**SAE J1939 CAN-H (high)**
D	**SAE J1939 CAN-L (low)**
E	CAN-SHIELD (for SAE J1939-11) or No Connection (for ISO 11783-2)
F	SAE J1708 (+)
G	SAE J1708 (–)
H	Proprietary OEM Use or Implement Bus CAN-H
J	Proprietary OEM Use or Implement Bus CAN-L

RPM Input

AutoGRAPH-GSM+, AutoGRAPH-GSM+WiFi and AutoGRAPH-WiFi controllers are equipped with one RPM input: pin 23 on the 6-pin RS-232 / RS-485 / RPM / Input 9 connector
The RPM input of the controller is intended to measure a rotating frequency of different actuating mechanisms.

Input frequency ranges from 0,01...10 000 Hz (0,6...600 000 rpm).
Accuracy of frequency measuring – 0,01% (but not accurate than 0,01 Hz (0,6 rpm)).

AutoGRAPH controller is able to measure and record RPM readings, as well as monitor a threshold value of RPM readings enabling preset actions in case of the threshold crossing. It can be extra data transmission to server, SMS or call to specified number, and an extra record of RPM readings.
RPM readings can be recorded with a regular period or in adaptive basis providing that data is recorded if RPM level changes more than the Maximum level of changing per a unit of time.
To record RPM data in required units, there is a coefficient multiplying reading by before recording in the tracker memory.

You can configure RPM threshold and the conversion coefficient in the AG.GSMConf software intended to set up operation parameters of AutoGRAPH on-board controllers. Detailed information is given in document "Configuration and setup. AG.GSMConf software".

Given below is an example of measuring the rotating frequency of a crank shaft. This requires that the RPM input is connected to a phase winding of the generator (usually denoted by "W") or an output of AC voltage with a frequency proportional to rotating frequency of the actuating mechanism.
Following formula is used to recalculate frequency value on the RPM input to a number of revolutions:

$$n=\frac{60 \cdot f}{p \cdot i}$$

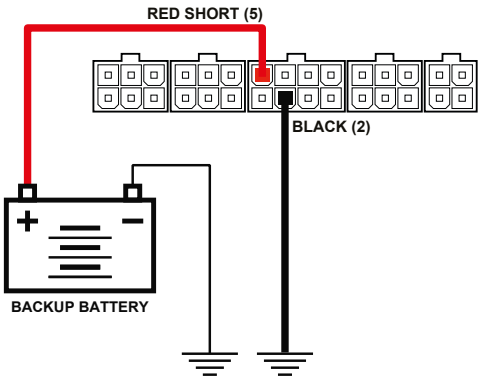
where
n – a number of engine revolutions;
f – frequency of voltage on RPM input;
p – a number of pairs of poles (e.g. p=6 for the most of vehicle produced in Russia);
i – gear ratio;

This formula can be used only when the RPM input of AutoGRAPH tracker is connected to a phase winding of the generator. Because the conversion coefficient depends on how the RPM input is connected to rotating mechanism.

Connection of Backup Battery

To avoid the AutoGRAPH controller turning off, if the main power supply shuts down, the power supply driver supports connection of a rechargeable backup battery.
As a backup battery, the tracker uses a lead/acid rechargeable battery of 12 V and 1.2 to 2 Ah capacity.
AutoGRAPH-GSM+, AutoGRAPH-GSM+WiFi and AutoGRAPH-WiFi controllers have a built-in charger to charge the backup battery. The charger turns on automatically and limits the charging current to 75 mA.
If the backup battery voltage drops below 11 V, the tracker will send a low battery notification to specified number by SMS.
Switching between the main power supply and the backup power supply is performed automatically. If the main power supply turns off, the tracker switches to the backup power supply. As soon as the main power supply is restored, the controller will switch back to the main power supply.

Connection Diagram of backup battery



The manufacturer recommends using small package lead/acid DT12012 or BPL2-12 batteries and another battery with capacity not more than 2Ah as a backup power supply. Example of lead/acid battery is given on figure on the right.

IMPORTANT

It takes about 30 hours to charge fully discharged 2 Amh capacity battery. So the presented diagram is not applicable in case of frequently shutdowns of main power supply.

Audio Interface

AutoGRAPH-GSM+ and AutoGRAPH-GSM+WiFi controllers are equipped with an audio interface that provides two-way communication between a driver and a dispatcher. The audio interface consists of an input for connecting a microphone, an output for connecting a loudspeaker and an input for connecting an Answer/Call button. The audio interface is arranged on the additional 4-pin audio interface connector.

In order to be able to receive an incoming call and to make a dialled call, a GS-3 type loudspeaker with built-in Answer/Call button and designed by TechnoKom Ltd should be connected to the controller. The loudspeaker with should be connected to the 4-pin audio connector.
AutoGRAPH tracker is equipped with an audio amplifier providing output power of 1.5 W at the load of 8 Ohm.

Audio interface allows the tracker both to calll two preset phone numbers and receive incoming calls from any numbers.

Receive an incoming voice call

An incoming call is indicated by producing a ringtone on the loudspeaker.
To answer the call, press and hold Answer/Call button on the loudspeaker for 1-2 seconds.
A second press on Answer/Call button ends the call.

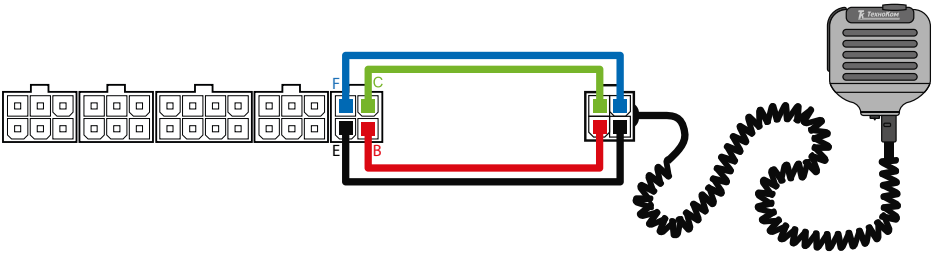
Make a call to preset number

To make a dialled call, press and hold Answer/Call button on the loudspeaker for 1-2 seconds. The tracker starts to dial to the first telephone number, stored in the controllers memory. If the first number is not available, the controller will dial the second preset number. The tracker will try to call all preset numbers in order, until one of the numbers answers the call. If no calls are answered, the tracker will loop back to the first number and continue the dialling process until a call is answered.
A second press on the button ends the call.

Digital input 1 of the controller can be used for indicating an incoming call using an LED, or a sound device, connected to this input.
Call indication on digital input 1 should be set up using the GSMConf program or a control command.
The tracker can be set up to answer the call automatically or by pressing the Answer/Call button on the loudspeaker.
The tracker automatically answers the calls from telephone numbers, that the auto answer is enabled for in the tracker' settings.
To answer calls from other telephone numbers, press the Answer/Call button.

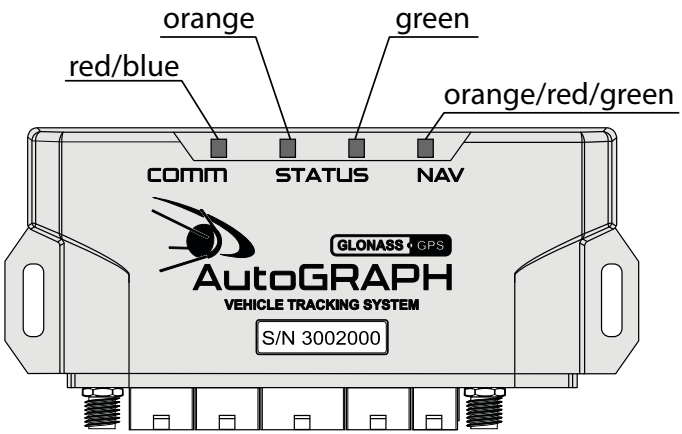
A press on Answer/Call button must be 1-2 seconds long. A short press won't be processed.

Connection Diagram of GS-3 type loudspeaker:



The GS-3 loudspeaker is equipped with micro-jack type connector for connecting a hands-free kit. If the hands-free kit is connected to the loudspeaker, press the answer button on the hands-free kit to answer an incoming call.

Indication of Operation



The AutoGRAPH tracker has four LEDs arranged on the front side of the case and intended to indicate the tracker operation:

- **COMM LED (red/blue)** indicates operation of GSM modem and Wi-Fi module.
- **STATUS STATUS1 (orange)** – indicates state of data transmission.
- **STATUS LED2 (green)** – indicates a state of position acquisition.
- **NAV LED (red/green/orange)** – indicates a mode of GPS/GLONASS receiver. If the mode «GLONASS only» is set, the LED flashes red. If the mode «GPS (NAVSTAR) only» is set, it flashes green. And if combined GPS/GLONASS mode is set, it flashes orange.

The COMM LED of AutoGRAPH controllers equipped only with GSM modem will flash only orange. Likewise, the COMM LED of AutoGRAPH controllers equipped only with Wi-Fi module will flash only blue. Both colour of the COMM LED are used only in AutoGRAPH-GSM+WiFi equipped with both Wi-Fi module and GSM modem.

Before turning on AutoGRAPH tracker:

- Connect GPS / GLONASS and GSM antennas to the tracker.
- Power the tracker up.
- Wait until the tracker acquires the position and connects to a GSM. In normal mode, the COMM LED flashes red every 3 seconds, STATUS LED1 is constantly ON, NAV LED flashes once a second. The NAV LED flashing colour depends on GPS / GLONASS receiver mode.
- Starting time takes approximately 26 seconds. If the tracker does not start for a long time, verify compliance with the operating conditions.

Indication of GPS / GLONASS Module Operation:

- **When powering up** both STATUS LED2 and NAV LED light up and go out after one second.
- **Upon normal operation**, the NAV LED flashes once a second. The STATUS LED2 is constantly green after positioning of the vehicle and goes out upon loss of signal from satellites.

Indication of GSM Module Operation[1]:

- **Searching for GSM network** – the COMM LED flashes red once a second.
- **Transferring data to a server** – the STATUS LED1 is constantly ON.
- **Error of data transmission** – the STATUS LED1 flashes twice a second.
- **Connecting to GPRS** – the STATUS LED1 flashes once per two seconds.
- **Normal connection to GSM network** – the COMM LED flashes red once every three seconds.
- **Switching off or fault of GSM modem** – the COMM LED does not flash orange.

Indication of Wi-Fi[2] operation:

- **Searching for Wi-Fi network** – the COMM LED is constantly blue.
- **Transferring data via Wi-Fi network** – the COMM LED flashes blue frequently.
- **Switching off or fault of Wi-Fi module** – the COMM LED does not flash blue.

Error Indication:

The NAV LED and the STATUS LED2 can be used for indication of the tracker's errors. When an error is detected, the NAV LED lights up in red, the STATUS LED2 flashes green several times, after that the NAV LED goes out. Number of flashings of the STATUS LED2 determines an error code.

[1] For AutoGRAPH controllers equipped with GSM modem.

[2] For AutoGRAPH controllers equipped with Wi-Fi modem.

Number of flashing	Description of error
1	GSM turning on failure. Ensure, that SIM card is not damaged and correct PIN is entered
2	FLASH memory failure
3	GSM modem power supply circuit is damaged
4	Tracker firmware is damaged
5	FLASH memory failure. Memory is protected
6	FLASH memory failure. Memory is protected
7	SIM PUK is required
8	SIM is not inserted
9	Failure of Wi-Fi module
10	Failure of operative memory

Operation with PC:

- **Memory cleaning** – the NAV LED lights constantly red.
- **Data reading** – the STATUS LED2 is constantly ON.
- **Writing the settings** – the NAV LED frequently flashes red.

You must take into account the specific operation of bi-colour COMM LED in AutoGRAPH trackers equipped with both Wi-Fi module and GSM modem, because in case of simultaneous indication of these modules the COMM LED can flash a colour which is the mix of both LED colours.

Eco Driving

AutoGRAPH on-board controllers support monitor of driving style according to data from the internal accelerometer.
The driving style is monitored by estimating several parameters of acceleration and comparing them with specified threshold.

Sharp accelerations, braking and turns increase fuel consumption in effect of excessive engine rpm and produce an additional impact on the vehicle braking and clutch systems increasing their wear. Also such style of driving causes crash situations on roads. Eco driving mode allows you to analyse how accurate a driver uses a vehicle and generate different report on driving styles if driver in AutoGRAPH Dispatch Software.

How to start Eco driving mode:

• set all required acceleration thresholds in AutoGRAPH tracker using AG.GSMConf program or remote configuration command;
• mount AutoGRAPH tracker on a vehicle and securely fasten it. To avoid incorrect data about the driving style, it is recommended to mount the tracker closer to the center line of the vehicle;
• turn on AutoGRAPH tracker. Then the calibration will start. The calibration takes 15 minutes and is initiated after the motion start. During the calibration the tracker does not record the acceleration state. The calibration is performed only on the move and is required only after update of the tracker firmware. Periodically the tracker checks the calibration data and initiates new calibration procedure if it is necessary.

Drivers Installation

This section covers the procedure of installing the drivers of the AutoGRAPH controller for Microsoft Windows 7 OS.

When connecting the tracker to a PC for the first time, the system will automatically download the device drivers from Windows Update server if the Internet connection is available. If automatic download of drivers is not available, it is recommended to install AutoGRAPH drivers manually.

The AutoGRAPH controller drivers required for Windows 2000, XP, Server 2003, Vista, 7, 8, Server 2003, Server 2008 (x86 and x64) are free of charge and can be downloaded from the official website of TechnoKom: http://www.tk-nav.ru

To install the tracker drivers onto Microsoft Windows 7 OS:

1. Connect the tracker to your PC using the USB cable. The system will automatically search for new equipment (Fig.1). For proper operation, it is necessary to install drivers for both devices: AutoGRAPH and AutoGRAPH CDC device.

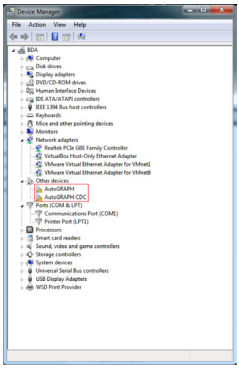


Fig.1.

2. Download the archived drivers folder from the official website of TechnoKom - AGUSBDriver.zip and extract files to a temporary directory on a hard drive.

3. Launch the driver update wizard and select «Browse my computer for driver software» to search for drivers manually (Fig.2).

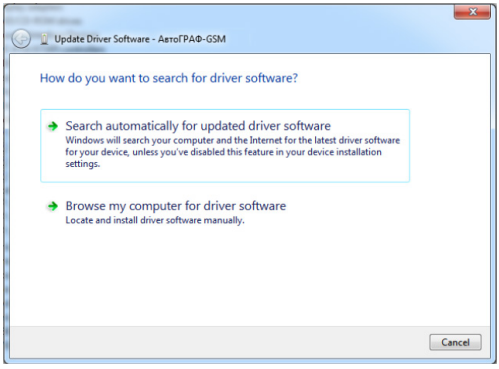


Fig.2.

4. Browse to the location where the drivers are saved (Fig.3).
5. Install the driver. When the driver is installed the system will automatically identify connected device (Fig.4).

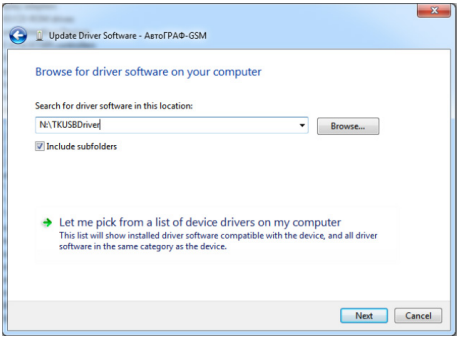


Fig.3.

Fig.4.

6. Drivers for the AutoGRAPH tracker are successfully installed. The device is ready to operate with troubleshooting utilities, dispatch software and other applications (Fig.5).

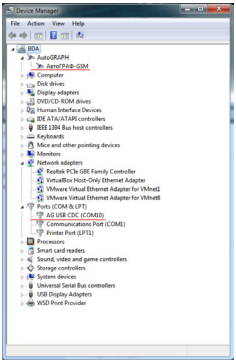


Fig.5.

Connection to PC

Some cases may require connection of the AutoGRAPH controller to a personal computer (PC) or a laptop. A PC connection may be required for:

- configuration and checking of the performance of the tracker by means of the configuration program – AG.GSMConf;
- using the tracker in the «GPS mouse» mode;
- reading the data from the tracker storage memory and writing the data directly to the AutoGRAPH dispatch software.

To connect the tracker to a PC:

- Disconnect the tracker from the vehicle power supply.
- Disconnect the antennas and remove the device from the vehicle.
- Connect the tracker to your PC using a USB cable.
- If the drivers are installed, the system automatically identifies the controller. If the drivers are not installed, install them following the steps specified in the «Installing the drivers» section.
- The tracker is now ready to operate with the applications.

For detailed information on configuration the tracker using the AG.GSMConf program see document «Configuration and setup. AG.GSMConf Software».

For more information on reading data from the tracker using the AutoGRAPH 5 PRO Dispatch Software see «AutoGRAPH 5 PRO Software. User Manual» document.

Conformity certificates

AutoGRAPH-GSM / AutoGRAPH-GSM+

ELEKTROTECHNICKÝ ZKUŠEBNÍ ÚSTAV

ELECTROTECHNICAL TESTING INSTITUTE - CZECH REPUBLIC
ELEKTROTECHNISCHE PRÜFANSTALT - TSCHECHISCHE REPUBLIK
INSTITUT ELECTROTECHNIQUE D'ESSAIS - RÉPUBLIQUE TCHÈQUE
ЭЛЕКТРОТЕХНИЧЕСКИЙ ИСПЫТАТЕЛЬНЫЙ ИНСТИТУТ - ЧЕШСКАЯ РЕСПУБЛИКА

Pod Lisem 129, 171 02 Praha 8 - Troja

CERTIFICATE

No.: 1150139

Product: AUTOGRAPH

Type: GSM

Rating: IP54, IP4X

Ordering firm: TechnoKom Ltd.
ul. Brat'jev Kaširinych 65 Čeljabinsk, Russian Federation

Manufacturer: TechnoKom Ltd.
ul. Brat'jev Kaširinych 65 Čeljabinsk, Russian Federation

Trade mark:

The test results are stated in the test-report No.: 405695-01/01 of: 12.02.2015

A sample of the product was found to be in conformity with:
EN 61373:2010, cat. 1, rate B, EN 60529:1991+A2:2013

The validity of the certificate is limited to: 31.3.2018

3.3.2015

Prague

Miroslav Sedláček
Head of Certification Body

elektrotechnický zkušební ústav ezú Pod Lisem 129, 171 02 Praha 8 -1-

Stamp

405695-01

Ministerstvo dopravy - Česká republika
Ministry of Transport - Czech Republic
Nábřeží L. Svobody 12/1222, 110 15 Praha 1- CZ

E8

OSVĚDČENÍ o:[1/] **COMMUNICATION** concerning: [1/]

UDĚLENÍ HOMOLOGACE	**APPROVAL GRANTED**
~~ROZŠÍŘENÍ HOMOLOGACE~~	~~APPROVAL EXTENDED~~
~~ODMÍTNUTÍ HOMOLOGACE~~	~~APPROVAL REFUSED~~
~~ODEJMUTÍ HOMOLOGACE~~	~~APPROVAL WITHDRAWN~~
~~UKONČENÍ VÝROBY~~	~~PRODUCTION DEFINITIVELY DISCONTINUED~~

~~typu vozidla~~/dílu/~~samostatného technického celku~~ [1/] z hlediska Předpisu č. 10
of a ~~type of vehicle~~/component/~~separate technical unit~~ [1/]
with regard to Regulation No. 10

Homologace č.: / Approval No.: **10R-05 1502**

Rozšíření č.: / Extension No.: **N/A**

1.	Značka (obchodní název výrobce): / Make (trade name of manufacturer):	**TechnoKom**
2.	Typ a obchodní značení: / Type and general commercial description(s):	**AutoGRAPH-GSM** **AutoGRAPH-GSM +** **Vehicle tracking system**
3.	Způsob označení typu, je-li uvedeno na ~~vozidle/dílu~~/samostatném technickém celku [1/]: / Means of identification of type, if marked on the ~~vehicle/component~~/separate technical unit [1/]:	**Typový štítek laserový tisk** **Laser printed type label**
3.1.	Umístění označení: / Location of that marking:	**Trvanlivě připevněn na krytu výrobku** **Durably fixed on housing of appliance**
4.	Kategorie vozidla: / Category of vehicle:	**Nepoužito** **Not applicable**
5.	Název a adresa výrobce: / Name and address of manufacturer:	**TechnoKom Ltd.** **ul. Braťjev Kaširinych 65, Čeljabinsk, Rusko** **TechnoKom Ltd.** **Bratiev Kashirinych 65, Chelyabinsk,** **Russian Federation**

Ministry of Transport and Communications UNECE Approval Authority E8 Type approvals of wheeled vehicles, equipment and parts B Czech Republic

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