Fox AVL
Communication Protocol

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1. Table of Contents

2. Introduction

We would like to thank you for your interest in Geneko Fox AVL FoxLite AVL product.
This document is a description of communication protocol between Fox/FoxLite device and server to which data are sent, as well as a protocol for parameters remote change of Fox/FoxLite device.

3. Fox AVL device communication package formats

Fox AVL device sends data to remote server using **TCP** connection. Data are sent to server with **static IP** address through one of free **IP** ports (server addresses parameters and port(data port) can be configured by Fox AVL device menu). Socket connection time out by default is set to 0s, as soon as data are sent Fox device will close the connection. Connection time out can be configured to 60s.
Fox AVL device can send data in two predifined data formats:

- binary data protocol
- XML data protocol

4. Fox AVL Binary data protocol

Fox AVL Binary protocol is designed to decrese sending costs. Using binary protocol data load can be reduced up to 40%. 100 bytes in XML format can be translated to 40 bytes in bynary format. Applicable for device Fox AVL with firmware versions 2.0.8 and above.

Fox AVL bynary protocol format (FOX AVL not encrypted message)

bytes	***binary value***	***description***
0-1	0x5C 0x72	Start of massage
2	variable	Total number of bytes in message including start of message bytes
3	variable	Message type,
4-7	variable	Vehicle ID number, 4-MSB ... 7-LSB
8-9	variable	Message ID, 8-MSB 9-LSB
10	variable	Year & 0x7f [0-99], GPS valid flag & 0x80 [0 valid, 0x80 not valid]
11	variable	month
12	variable	day
13	variable	hour [24 hours encoding]
14	variable	minutes
15	variable	seconds
16-27	variable	GPS data, format MIN GPS data aaaabbbbccccddddeeeeffff MSB(aaaa) & 0x80 latitude northing 0-N, 1-S MSB(aaaa) & 0x7f latitude MSB [min] LSB(aaaa) latitude LSB [min] MSB(bbbb) latitude MSB [min/10000] 4 decimal places LSB(bbbb) latitude LSB [min/10000] 4 decimal places MSB(cccc) & 0x80 longitude easting 0-E, 1-S MSB(cccc) & 0x7f longitude MSB [min] LSB(cccc) longitude LSB [min] MSB(dddd) longitude MSB [min/10000] 4 decimal places LSB(dddd) longitude LSB [min/10000] 4 decimal places MSB(eeee) MSB speed [knots] [1 knot = 1 km/h * 250/463] LSB(eeee) MSB speed [knots] MSB(ffff) MSB direction [deg] LSB(ffff) MSB direction [deg]
28-var	variable	Reserved field, depends of message type and message ID, max length = 256-29
28 + reserved len		Checksum

4.1. Message Type - description

This field describes current message type. Reserved values are:
0x56 Fox/FoxLite not encrypted GPS data
0x5a Fox/FoxLite not encrypted parametar data

4.2. Fox AVL not encrypted GPS data – reserved field

Field Reserved is field with variable length consist of three subfields in this specific order: Cell Name, Vehicle Status and Event Data

Cell Name - format (1 byte Cell info length +[0-25] + Cell Name) max total 26 bytes
Vehicle Status - format (1 byte Status field length [0 or 16] + Status) max total 26 bytes
Event Data - format (1 byte Event Data field Length [0-64] + eventData) max total 65 bytes

Reserved field total max length 17+25+65 = 107 bytes.

4.3. Fox AVL vehicle status subfield description

Total length 16 bytes

bytes	***description***
0	Digital inputs states LSB (msb I7 I6 I5 I4 I3 I2 I1 I0 lsb) I0-Driver door status 0-opened, 1 closed I1-External presence sensor 1 Input, 0-activated, 1- not actevated I2-External presence sensor 2 Input, 0-activated, 1- not actevated I3-User defined digital input 2, 0-activated, 1- not actevated I4-Trunk door status, 0-opened, 1- closed I5-Hood door status, 0-opened, 1- closed I6-Panic taster, 0-activated, 1- not actevated I7-Unused, default 1
1	Digital inputs states MSB (msb I15 I14 I13 I12 I11 I10 I9 I8 lsb) I8-Contac Key, 0-off, 1-on I9-Digital armed signal, 0-activated, 1- not actevated I10-User defined digital input 1, 0-activated, 1- not actevated I11-Unused, default 1 I12-Unused, default 1 I13-Unused, default 1 I14-Unused, default 1 I15-Unused, default 1
2	Digital outputs states (msb O7 O6 O5 O4 O3 O2 O1 O0 lsb) O0-Head Lights O1-Output for activation external sensors O2-Central lock O3-Engine blocked O4-LED signalization O5-Alarm siren

bytes	*description*
	O6-Flashes O7-User defined output
3	User analog AD value MSB
4	User analog AD value LSB
5	RPM [rounds/min] value MSB
6	RPM [rounds/min] value LSB
7	FUEL [1%-100%], 0 - no fuel measuring
8	Engine Temperature MSB (for future use)
9	Engine Temperature LSB (for future use)
10	User defined AD input MSB (for future use)
11	User defined AD input LSB (for future use)
12	Future Use 1
13	Future Use 2
14	Future Use 3
15	Future Use 4

4.4. Fox AVL checksum field

Checksum byte calculation includes all message bytes except start of message bytes.
Checksum calculation algorithm is:
checksum byte = 256 - mod256(sum(all bytes without start of message bytes))
To test the correctness of message summarize all bytes including check sum byte and without start of message bytes. If result is 0, message is correct.

4.5. Fox AVL message ID field

This field describes GPS data message
message ID

Message ID	*Description*
0	Regular GPS data, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(16B) + event_data_len(1B) + event_data(4B or 6B) If 4B (MSB,...,LSB) total distance traveled [m] If 6B (MSB,...,LSB) total distance traveled [m] + (2B)max speed between two position, MSB-integer value of speed and LSB integer value of decimal fraction multiplied with 100
1	Over speed event, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
11	WDT start (Fox Start), reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(1B or 2B) reset code

Message ID	*Description*
17	Internal alarm armiran, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
18	RPM over limit event, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(2B) – (MSB, LSB RPM value)
19	Unathorized vehicle access, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
22	External alarm activated, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
24	Internal alarm disarmed, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
27	External power supply below limit event, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(2B) –(MSB,LSB power supply value [100mV])
29	Dallas key event, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(9B) - (iButton code 8B)
30	External alarm deactivated, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
31	Fuel data packet, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(64B) – (32*2B, 32 measured values of fuel, MSB1, LSB1,..., MSB32, LSB32)
45	GPS Receiver Error 24h without valid signal, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
46	Sim Card Connection Error, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
47	Beckup Battery Low Message, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
51	iButton Login Message, reserved - cell_info_len(1B) + cell_name(max16B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(9B) - (iButton code 8B)
52	iButton Logout Message, reserved - cell_info_len(1B) + cell_name(max16B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(9B) - (iButton code 8B)
80	Response on parameter change command , reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(nB) (list of parameters n bytes)
81 (depricated)	Parameters from group 1 has changed, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)

Message ID	*Description*
82 (depricated)	Parameters from group 2 has changed, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
83 (depricated)	Parameters from group 3 has changed, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
86	Remote reset of device, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
87 (depricated)	RTC has changed remotely, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
88	Firmware updated, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
89	GPS data on demand, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(16B) + event_data_len(1B) + event_data(0B)
90	Unknown remote command, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
91	Iregular remote command format, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
100	Response on parameter read command, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(nB) (list of parameters n bytes)
101	Response on debug command, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(nB) (list of parameters n bytes)
110	Response on remote iButton change, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(nB) (list of ibuttons, format n*m:0123456789ABCDEF...) n-number of message, m total number of message) max 15 ibuttons per message
1011/1012	Driver's door opened/closed, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
1021	Eksternal alarm sensor activated, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
1051/1052	Trunk opened/closed, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
1061/1062	Hood opened/closed, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
1071	Panik taster activated, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
1091/1092	Contakt key off/on, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
1122	Internal acceleration sensor event, reserved - cell_info_len(1B) + cell_name(max25B)

Message ID	*Description*
	+ status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
2010/2011	Digital output 1 (user defined output GPO) turned off/turned on, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
2020/2021	Digital output 2 (flash lights) turned off/turned on, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
2030/2031	Digital output 3 (alarm siren) turned off/turned on, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
2040/2041	Digital output 4 (LED signalization) turned off/turned on, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
2050/2051	Digital output 5 (engine block) turned off/turned on, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
2060/2061	Digital output 6 (central lock) turned off/turned on, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
2070/2071	Digital output 7 (output for external sensors activation) turned off/turned on, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)
2080/2081	Digital output 8 (head lights) turned off/turned on, reserved - cell_info_len(1B) + cell_name(max25B) + status_info_len(1B) + status(0B) + event_data_len(1B) + event_data(0B)

5. Fox AVL XML data protocol

Data sent from Fox device to server in the following format:

```
<fox>
<gps id="vehicle ID"
data="IdStatusa,Valid[V/A],Date,Time,Latitude,LatDirection,Longitude,
LonDirection,Speed,Course,GsmCellInfo,VehicleStatus,AdditionalDataOnStatus/>
</fox>
```

In upper format:

- tag ***id*** defines vehicle identification number,
- tag ***data*** is standard **NMEA** message received fromGPS receiver in modified format. Beside NMEA sequence it contains:
  - GSM station name,
  - Vehicle status,

- Data on time and date read from built-in device real time clock in format *ddmmyy* and *hhmmss* (in case data from GPS are valid, date and time are read from GPS receiver).

Note1: Invalid data on vehicle position will be sent to server too. The third window in GPS data structure speaks whether the position is accurate or not (V stands for invalid data, and A for valid ones). Server will decide how these data will be interpreted.
Note2: Time and date that are sent, represents UTM time and date (UTM time is the same or differs from GMT time for 1 hour depends is it winter or summer time)

Basic message ***VehicleStatus*** has the following format:

$I_0I_1I_2I_3I_4I_5I_6I_7I_8I_9I_{10}I_{11}I_{12}I_{13}I_{14}I_{15}$ VehicleAccumulatorVoltage*10 Uservoltage RPM FuelLevelPercentage XShockSensor YShockSensor $O_1O_2O_3O_4O_5O_6O_7O_8$

Where I_n [n=0, 1, 2,...,15] is device input states and O_n [n=1,2,...,8] device output states. States are expressed in values 0 (logical zero) and 1 (logical one).

I0 - Driver door status 0-opened, 1 closed
I1 - External presence sensor 1 Input, 0-activated, 1- not actevated
I2 - External presence sensor 2 Input, 0-activated, 1- not actevated
I3 - User defined digital input 2, 0-activated, 1- not actevated
I4 - Trunk door status, 0-opened, 1- closed
I5 - Hood door status, 0-opened, 1- closed
I6 - Panic taster, 0-activated, 1- not actevated
I7 - Unused, default 1
I8 - Contac Key, 0-off, 1-on
I9 - Digital armed signal, 0-activated, 1- not actevated
I10 - User defined digital input 1, 0-activated, 1- not actevated
I11 - Unused, default 1
I12 - Unused, default 1
I13 - Unused, default 1
I14 - Unused, default 1
I15 - Unused, default 1

O1 - Head Lights
O2 - Output for activation external sensors
O3 - Central lock
O4 - Engine blocked
O5 - LED signalization
O6 - Alarm siren
O7 - Flashes
O8 - User defined output

5.1. Example of three messages in a row

```
<fox>
<gps id="5" data="0,A,271006,130450,4448.9987,N,02028.2615,E,0,96,Palilula,,0" />
```

```
<gps id="5" data="11,A,271006,130454,4448.9987,N,02028.2615,E,0,96,Palilula,,1" />
<gps id="5" data="0,A,271006,130456,4448.9987,N,02028.2615,E,0,96,Palilula,,7" />
</fox>
```

List of events and statuses options

Event code	Event/status	Additional data
0	GPS Position	Total distance traveled and max vehicle speed from last GPS position
1	Speed > Speed MAX	
11	Start Of Built-in „Watch Dog" Timer	Two digits reset code
17	Alarm Armed	
18	RPM > RPM MAX	RPM [rounds/min]
19	Anauthorized Access To Vehicle, Alarm Activated	
22	External Alarm Activated	
24	Alarm Disarmed	
27	Vehicle Accumulator Low Level (Vehicle accumulator is below level defined in the menu)	Accumulator voltage [V*10]
29	Dallas Key (iButton)	Dallas key code 8*2 hex digits
30	External Alarm Deactivated	
31	Fuel Measure Values	32 numbers, separated with comma, representing fuel levels in past 131sec
45	GPS receiver error, 24 hours without valid GPS signal	
46	Sim Card Connection Error	
47	Beckup Battery Low Message	
51	iButton Login Message	Dallas key code 8*2 hex digits
52	iButton Logout Message	Dallas key code 8*2 hex digits
80	Response on parameter change command	List of changed parameters
81	Parameter Group 1 Changed (old par. change protocol)	
82	Parameter Group 2 Changed (old par. change protocol)	
83	Parameter Group 3 Changed (old par. change protocol)	
86	Device Reset	
87	RTC Value Changed	
88	Firmware Changed	
89	GPS and status data on demand	
90	Unknown Command	
91	Irregular Command Format	
100	Response on parameter read command	List of read parameters
101	Response on debug command	list of debug parameters
110	Response on remote iButton change	list of new iButtonsn*m:0123456789ABCDEF...; n-number of message, m total number of message) max 15 ibuttons per message
1011	Driver Door Opened	
1012	Driver Door Closed	
1021	External Sensor 1 Activated	
1051	Trunk Opened	
1052	Trunk Closed	
1061	Hood Opened	

1062	Hood Closed	
1071	Panic Taster Activated	
1091	Contact Key off	Total distance traveled and max vehicle speed from last contact on message
1092	Contact Key on	Total distance traveled
1122	Shock Sensor Activated	
2010	Actuator 1 (optional digital output) Deactivated	
2011	Actuator 1 (optional digital output) Activated	
2020	Actuator 2 (flash lights) Deactivated	
2021	Actuator 2 (flash lights) Activated	
2030	Actuator 3 (alarm siren) Deactivated	
2031	Actuator 3 (alarm siren) Activated	
2040	Actuator 4 (indicator LED) Deactivated	
2041	Actuator 4 (indicator LED) Activated	
2050	Actuator 5 (engine blocking) Deactivated	
2051	Actuator 5 (engine blocking) Activated	
2060	Actuator 6 (central lock) Deactivated	
2061	Actuator 6 (central lock) Activated	
2070	Actuator 7 (power for external sensors) Deactivated	
2071	Actuator 7 (power for external sensors) Activated	
2080	Actuator 8 (main vehicles lights) Deactivated	
2081	Actuator 8 (main vehicles lights) Activated	