FMB630 Protocols

V0.05

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1. FMB630 DATA PROTOCOL

1.1 AVL data packet

Below table represents AVL data packet structure.

4 zeroes	Data field length	Codec ID	Number of Data 1	AVL Data	Number of Data 2	CRC-16
4 Bytes	*4 Bytes*	*1 Byte*	*1 Byte*	*30- 147 Bytes*	*1 Byte*	*4 bytes*

Number of data – number of encoded data (number of records).
In FMB630 codec ID is constant 08.
Data field length is the length of bytes [codec id, number of data 2].
Number of data 1 should always be equal to number of data 2 byte.
CRC-16 is 4 bytes, but first two are zeroes and last two are CRC-16 calculated for [codec id, number of data 2]
Minimum AVL packet size is 45 bytes (all IO elements disabled).
Maximum AVL packet size for one record is 268 bytes

1.2 AVL Data

Timestamp	Priority	GPS Element	IO Element
8 Bytes	*1 Byte*	*15 Bytes*	*6-123*

Timestamp – difference, in milliseconds, between the current time and midnight, January 1, 1970 UTC.

1.3 Priority

0	Low
1	High
2	Panic

1.4 GPS Element

Longitude	Latitude	Altitude	Angle	Satellites	Speed
4 Bytes	*4 Bytes*	*2 Bytes*	*2 Bytes*	*1 Byte*	*2 Bytes*

X	Longitude[1]
Y	Latitude[1]
Altitude	In meters above sea level[1]
Angle	In degrees, 0 is north, increasing clock-wise [1]
Satellites	Number of visible satellites[1]
Speed	Speed in km/h. 0x0000 if GPS data is invalid[1]

Longitude and latitude are integer values built from degrees, minutes, seconds and milliseconds by formula.

$$\left(d + \frac{m}{60} + \frac{s}{3600} + \frac{ms}{3600000}\right) * p$$

d	Degrees
m	Minutes
s	Seconds
ms	Milliseconds
p	Precision (10000000)

If longitude is in west or latitude in south, multiply result by –1. To determine if the coordinate is negative, convert it to binary format and check the very first bit. If it is 0, coordinate is positive, if it is 1, coordinate is negative.

Example:

Received value: 20 9c ca 80
Converted to BIN: 00100000 10011100 11001010 10000000 first bit is 0, which means coordinate is positive
Convered to DEC: 547146368
For more information see two's compliment arithmetics.

1.5 IO element

Event IO ID	N of **Total** IO	N1 of **One Byte** IO	**1'st** IO ID	**1'st** IO Value	…	**N1'th** IO ID	**N1'th** IO Value	N2 of **Two Bytes**	**1'st** IO ID	**1'st** IO Value	…	**N2'th** IO ID	**N2'th** IO Value	N4 of **Four Bytes**	**1'st** IO ID	**1'st** IO Value	…	**N4'th** IO ID	**N4'th** IO Value	N8 of **Eight Bytes**	**1'st** IO ID	**1'st** IO Value	…	**N8'th** IO ID	**N8'th** IO Value
1 Byte	*1 Byte*	*1 Byte*	*1 Byte*	*1 Byte*		*1 Byte*	*1 Byte*	*1 Byte*	*1 Byte*	*2 Bytes*		*1 Byte*	*2 Bytes*	*1 Byte*	*1 Byte*	*4 Bytes*		*1 Byte*	*4 Bytes*	*1 Byte*	*1 Byte*	*8 Bytes*		*1 Byte*	*8 Bytes*

Event IO ID – if data is acquired on event – this field defines which IO property has changed and generated an event. If data cause is not event – the value is 0.

[1] If record is without valid coordinates – (there were no GPS fix in the moment of data acquisition) – Longitude, Latitude and Altitude values are last valid fix, and Angle, Satellites and Speed are 0.

N total number of properties coming with record (N=N1+N2+N4+N8)
N1 number of properties, which length is 1 byte
N2 number of properties, which length is 2 bytes
N4 number of properties, which length is 4 bytes
N8 number of properties, which length is 8 bytes

Permanent I/O elements (are always sent (with every record) to server if enabled)			
Property ID in AVL packet	Property Name	Bytes	Description
1	Digital Input Status 1	1	Logic: 0 / 1
2	Digital Input Status 2	1	Logic: 0 / 1
3	Digital Input Status 3	1	Logic: 0 / 1
4	Digital Input Status 4	1	Logic: 0 / 1
179	Digital Output 1	1	Logic: 0 / 1
180	Digital Output 2	1	Logic: 0 / 1
50	Digital Output 3	1	Logic: 0 / 1
51	Digital Output 4	1	Logic: 0 / 1
9	Analog Input 1	2	Voltage: mV, 0 – 30 V
10	Analog Input 2	2	Voltage: mV, 0 – 30 V
11	Analog Input 3	2	Voltage: mV, 0 – 30 V * Depents on HW Version
21	GSM signal level	1	Value in scale 1 – 5
22	Actual profile	1	Value in scale 1 – 4
24	Speedometer	2	Value in km/h, 0 – xxx km/h
66	External Power Voltage	2	Voltage: mV, 0 – 30 V
67	Internal Battery Voltage	2	Voltage: mV
68	Internal Battery Current	2	Voltage: mA
70	PCB Temperature	2	10 * Degrees (°C)
71	GNSS status	1	0-off/ 1-no antenna (only when using NAVYS)/ 2- no fix/ 3-got fix/ 4-sleep/ 5-over current
72	Dallas Temperature 1	2	10 * Degrees (°C), -55 - +115, if 3000 – Dallas error
62	Dallas Temperature ID1	8	ID of Dallas Temperature Sensor 1
73	Dallas Temperature 2	2	10 * Degrees (°C), -55 - +115, if 3000 – Dallas error
63	Dallas Temperature ID2	8	ID of Dallas Temperature Sensor 2
74	Dallas Temperature 3	2	10 * Degrees (°C), -55 - +115, if 3000 – Dallas error
64	Dallas Temperature ID3		ID of Dallas Temperature Sensor 3
75	Dallas Temperature 4	2	10 * Degrees (°C), -55 - +115, if 3000 – Dallas error
65	Dallas Temperature ID4		ID of Dallas Temperature Sensor 3
5	Dallas Temperature 5	2	10 * Degrees (°C), -55 - +115, if 3000 – Dallas error
6	Dallas Temperature ID5	8	ID of Dallas Temperature Sensor 5
7	Dallas Temperature 6	2	10 * Degrees (°C), -55 - +115, if 3000 – Dallas error
8	Dallas Temperature ID6	8	ID of Dallas Temperature Sensor 6
76	Fuel Counter	4	Difference of generated impulses on two signal lines
240	Movement Sensor	1	Logic: 0 / 1
239	Ignition	1	Logic: 0 / 1
78	iButton ID	8	iButton ID number
178	Network Type	1	0 – 3 G; 1 – 2G * Available since 00.00.54
208	Acceleration	1	In mG /10. Acceleration change on X axis * Available since 00.00.54

Permanent I/O elements (are always sent (with every record) to server if enabled)			
Property ID in AVL packet	Property Name	Bytes	Description
209	Deceleration	1	In mG /10. Acceleration change on X axis * Available since 00.00.54
181	GPS PDOP	2	Probability * 10; 0-500
182	GPS HDOP	2	Probability * 10; 0-500
199	Odometer	4	Distance between two records: m
200	Deep Sleep	1	0 – not deep sleep mode, 1 – deep sleep mode
205	Cell ID	4	Base station ID. Valid CID ranges are from 0 to 65535 on GSM and CDMA networks and from 0 to 268435455 on UMTS and LTE networks.
206	Area Code	2	Location Area code (LAC), it depends on GSM operator. It provides unique number which assigned to a set of base GSM stations. Max value: 65536
240	Movement	1	0 – not moving, 1 – moving.
241	Current Operator Code	4	Currently used GSM Operator code
201	Fuel level meter 1	2	Fuel level, measured by LLS sensor on COM1/COM or RS485, in kvants or liters.
202	Fuel temperature 1	1	Fuel temperature, measured by LLS sensor on COM1/COM2 or RS485, in degrees Celsius.
203	Fuel level meter 2	2	Fuel level, measured by LLS sensor on COM1/COM2 or RS485, in kvants or liters.
204	Fuel temperature 2	1	Fuel temperature, measured by LLS sensor on COM1/COM2 or RS485, in degrees Celsius.
210	Fuel level meter 3	2	Fuel level, measured by LLS sensor on RS485, in kvants or liters.
211	Fuel temperature 3	1	Fuel temperature, measured by LLS sensor on RS485 interface
212	Fuel level meter 4	2	Fuel level, measured by LLS sensor on RS485, in kvants or liters.
213	Fuel temperature 4	1	Fuel temperature, measured by LLS sensor on RS485 interface
214	Fuel level meter 5	2	Fuel level, measured by LLS sensor on RS485, in kvants or liters.
215	Fuel temperature 5	1	Fuel temperature, measured by LLS sensor on RS485 interface
207	RFID ID	8	Read RFID value, depending on RFID mode, values can be: for RFID mode in hexadecimal format, RFID M7 mode in decimal format.

There are 21 IO elements of 1 byte size.

Also 22 IO elements of 2 byte size.

Also 3 IO elements of 4 byte size.

And 8 IO elements of 8 byte size.

Property ID in AVL packet	Property Name	Bytes	Description
AUTOCAN			
79	Brake switch	1	0 – pedal released; 1 – pedal depressed

Property ID in AVL packet	Property Name	Bytes	Description
80	Wheel based speed	4	0-65536 (km/h)*
81	Cruise control active	1	0 = switched off ; 1 = switched on
82	Slutch switch	1	0 = pedal released; 1 = pedal depressed
83	PTO state	1	0 = off/disabled; 1 = Set; 2 = not available
84	Accelerator pedal position 1	4	0-102 (%)*
85	Engine Percent Load At Current Speed	1	0-125 (%)*
86	Engine total fuel used	4	0 – 2105540607,5 (Liters)*
87	Fuel level 1 X	4	1-102 (%)*
88	Engine speed X	4	0 – 8031,875 (rpm)*
89-103	Axle weight	4	32766 (kg)*
104	Engine total hours of Operation X	4	0 – 214748364 (Hours)*
105-108	vehicle identification number X	Max 24	Max 24 ASCII bytes
109	SW-version supported X	4	4 ASCII bytes (Version format – ab.cd)
110	Diagnostics supported X	1	0 = diagnostics is not supported; 1 = diagnostics is supported; 2 = reserved; 3 = don´t care
111	Requests supported X	1	0 = request is not supported; 1= request is supported; 2 = reserved; 3 = don´t care;
112	High resolution total vehicle distance X	4	0 - 21055406 km*
113	Service distance	4	-160 635 – 167040 km*
114	Vehicle motion X	1	0 – Motion Not Detected; 1 – Motion Detected
115	driver 2 working state X	1	0 – Rest; 1 – Driver Available; 2 – Work; 3 – Drive; 4 – Error; 5 – not available;
116	driver 1 working state X	1	0 – Rest; 1 – Driver Available; 2 – Work; 3 – Drive; 4 – Error; 5 – not available;
117	Vehicle overspeed	1	0 – No Overspeed; 1 – Overspeed
118	Driver 1 time rel. states	1	0 – Normal; 1 – 15min bef. 4,5h; 2 – 4,5h reached; 3 – 15min bef. 9h; 4 – 9h reached; 5 – 15min bef. 16h; 6 – 16h reached; 7 – Error; 8 – not available;
119	Driver 2 time rel. states	1	0 – Normal; 1 – 15min bef. 4,5h; 2 – 4,5h reached; 3 – 15min bef. 9h; 4 – 9h reached; 5 – 15min bef. 16h; 6 – 16h reached; 7 – Error; 8 – not available;
120	Driver 1 card X	1	0 – Card Not Present; 1 – Card Present;
121	Driver 2 card X	1	0 – Card Not Present; 1 – Card Present
122	Direction indicator	1	0 – Forward; 1 – Reverse;
123	Tachograph performance X	1	0 – No Handling Information; 1 – Handling Information
125	System event X	1	0 – No Tacho Event; 1 – Tacho Event
126	Tachograph vehicle speed X	2	[0 – 65000] – Tacho Vehicle Speed km/h*
127	engine coolant temperature X	1	[-40 – 210] oC– Engine Cooilant Temperature*

Property ID in AVL packet	Property Name	Bytes	Description
128	Ambient Air Temperature X	2	[-273 – 1770]oC – Ambient Air Temperature*
129-131	Driver 1 Identification	32	24 ASCII Bytes per Driver ID
132-134	Driver 2 Identification X	32	24 ASCII Bytes per Driver ID
135	Fuel rate X	4	[0 – 3212,75] litres/h*
136	Instantaneous Fuel Economy X	4	[0 – 125.5 km/litre]*
137	At least one PTO engaged	1	0 – No PTO Drive is Engaged; 1 – At least one PTO drive is engaged; 2 – Error; 3 – not available;
138	High resolution engine total fuel used	4	[0 - 4211081,215] litres*
145	Manual CAN1 0	Varying[2]	ID Specific data
146	Manual CAN1 1	Varying[2]	ID Specific data
147	Manual CAN1 2	Varying[2]	ID Specific data
148	Manual CAN1 3	Varying[2]	ID Specific data
149	Manual CAN1 4	Varying[2]	ID Specific data
150	Manual CAN1 5	Varying[2]	ID Specific data
151	Manual CAN1 6	Varying[2]	ID Specific data
152	Manual CAN1 7	Varying[2]	ID Specific data
153	Manual CAN1 8	Varying[2]	ID Specific data
154	Manual CAN1 9	Varying[2]	ID Specific data
216	Manual CAN2 0	Varying[2]	ID Specific data
217	Manual CAN2 1	Varying[2]	ID Specific data
218	Manual CAN2 2	Varying[2]	ID Specific data
219	Manual CAN2 3	Varying[2]	ID Specific data
220	Manual CAN2 4	Varying[2]	ID Specific data
221	Manual CAN2 5	Varying[2]	ID Specific data
222	Manual CAN2 6	Varying[2]	ID Specific data
223	Manual CAN2 7	Varying[2]	ID Specific data
224	Manual CAN2 8	Varying[2]	ID Specific data
225	Manual CAN2 9	Varying[2]	ID Specific data
155	Geofence zone 01	1	Event: 0 – target left zone, 1 – target entered zone
156	Geofence zone 02	1	Event: 0 – target left zone, 1 – target entered zone
157	Geofence zone 03	1	Event: 0 – target left zone, 1 – target entered zone
158	Geofence zone 04	1	Event: 0 – target left zone, 1 – target entered zone
159	Geofence zone 05	1	Event: 0 – target left zone, 1 – target entered zone
160	Geofence zone 06	1	Event: 0 – target left zone, 1 – target entered zone
161	Geofence zone 07	1	Event: 0 – target left zone, 1 – target entered zone
162	Geofence zone 08	1	Event: 0 – target left zone, 1 – target entered zone
163	Geofence zone 09	1	Event: 0 – target left zone, 1 – target entered zone
164	Geofence zone 10	1	Event: 0 – target left zone, 1 – target entered zone
165	Geofence zone 11	1	Event: 0 – target left zone, 1 – target entered zone
166	Geofence zone 12	1	Event: 0 – target left zone, 1 – target entered zone

[2] CAN property length can vary depending on filter settings. Data can be sent as 1, 2, 4 or 8 byte property.

Property ID in AVL packet	Property Name	Bytes	Description
167	Geofence zone 13	1	Event: 0 – target left zone, 1 – target entered zone
168	Geofence zone 14	1	Event: 0 – target left zone, 1 – target entered zone
169	Geofence zone 15	1	Event: 0 – target left zone, 1 – target entered zone
170	Geofence zone 16	1	Event: 0 – target left zone, 1 – target entered zone
171	Geofence zone 17	1	Event: 0 – target left zone, 1 – target entered zone
172	Geofence zone 18	1	Event: 0 – target left zone, 1 – target entered zone
173	Geofence zone 19	1	Event: 0 – target left zone, 1 – target entered zone
174	Geofence zone 20	1	Event: 0 – target left zone, 1 – target entered zone
175	Auto Geofence	1	Event: 0 – target left zone, 1 – target entered zone
249	Jamming	1	1 – jamming start, 0 – jamming stop
250	Trip	1	1 – trip start, 0 – trip stop
251	Immobilizer	1	1 – iButton connected
252	Authorized driving	1	1 – authorized iButton connected
253	ECO driving type	1	1 – harsh acceleration, 2 – harsh braking, 3 - harsh cornering
254	ECO driving value	1	Depending on eco driving type: if harsh acceleration, braking and cornering – g*10 m/s^2
255	Over Speeding	1	At over speeding start km/h, at over speeding end km/h
242	Data limit reached	1	Send When GPRS data limit was reached
243	Excessive Idling	1	Send When Idling with Ignition ON 1- Idling; 0 – Idling End
LV-CAN200			
30	LVCAN Speed	1	Value in km/h
31	LVCAN Acc Pedal	1	Value in persentages, %
33	LVCAN Fuel Consumed	4	Value in liters, L
34	LVCAN Fuel Level (liters)	2	Value in liters, L
35	LVCAN Engine RPM	2	Value in rounds per minute, rpm
36	LVCAN Total Mileage	4	Value in meters, m
37	LVCAN Fule Level (percent)	1	Value in percentages, %
12	LVCAN Program Number	4	LVCAN Program Number
Kline data			
183	Drive recognize	1	0 – vehicle not in motion, 1 – vehicle in motion
184	Driver 1 working state	1	0 – resting 1 – driver available 2 – work 3 – drive 6 – error 7 – not available
185	Driver 2 working state	1	
186	Overspeed	1	1 – overspeeding, 0 – not overspeeding
187	Driver 1 card	1	0 – card not present, 1 – card present
188	Driver 2 card	1	

Property ID in AVL packet	Property Name	Bytes	Description
189	Driver 1 time rel state	1	0 – normal 1 – 15 min before 4.5h 2 – 4.5h reached 3 – 15 min before 9h 4 – 9 h reached 5 – 15 min before 16h 6 – 16h reached 14 – error 15 – not available
190	Driver 2 time rel state	1	
191	Speed	2	Km/h
192	Odometer	4	Total vehicle distance
193	Distance of current journey	4	Current journey distance
194	Timestamp	4	Timestamp of received information packet
195	Driver 1 ID MSB	8	Most significant 8 Bytes of driver 1 ID
196	Driver 1 ID LSB	8	Least significant 8 bytes of driver 1 ID
197	Driver 2 ID MSB	8	Most significant 8 Bytes of driver 2 ID
198	Driver 2 ID LSB	8	Least significant 8 bytes of driver 2 ID
13	LVCAN ModuleID	8	Module ID
AllCAN-300			
14	LVCAN Engine Work Time	4	Engine work time in minutes
15	LVCAN Engine Work Time (counted)	4	Total Engine work time in minutes
16	LVCAN Total Mileage (counted)	4	Total Vehicle Mileage, m
17	LVCAN Fuel Consumed (counted)	4	Total Fuel Consumed,liters * 10
18	LVCAN Fuel Rate	2	Fuel Rate, liters *10
19	LVCAN AdBlue Level (percent)	1	AdBlue, %
20	LVCAN AdBlue Level (liters)	2	AdBlue level, L
23	LVCAN Engine Load	1	Engine load, %
25	LVCAN Engine Temperature	2	Engine Temperature, 10 * Degrees (°C),
26	LVCAN Axle 1 Load	2	Axle 1 load, kg
27	LVCAN Axle 2 Load	2	Axle 2 load, kg
28	LVCAN Axle 3 Load	2	Axle 3 load, kg
29	LVCAN Axle 4 Load	2	Axle 4 load, kg
32	LVCAN Axle 5 Load	2	Axle 5 load, kg
38	LVCAN Control State Flags	4	Control state flags
39	LVCAN Agricultural Machinery Flags	8	Agricultural machinery flags
40	LVCAN Harvesting Time	4	Harvesting Time, minutes

Property ID in AVL packet	Property Name	Bytes	Description
41	LVCAN Area of Harvest	4	Area of Harvest, m^2
42	LVCAN Mowing Efficiency	4	Mowing efficiency, (m^2)/h
43	LVCAN Grain Mown Volume	4	Mown Volume, kg
44	LVCAN Grain Moisture	2	Grain Moisture in proc, %
45	LVCAN Harvesting Drum RPM	2	Harvesting Drum RPM, RPM
46	LVCAN Gap Under Harvesting Drum	1	Gap Under Harvesting Drum, mm
47	LVCAN Security State Flags	8	Security State Flag
48	LVCAN Tacho Total Vehicle Distance	4	Tacho Total Vehicle Distance, m
49	LVCAN Trip Distance	4	Trip Distance, m
52	LVCAN Tacho Vehicle Speed	2	Tacho Vehicle Speed, km/h
53	LVCAN Tacho Driver Card Presence	1	Tacho Driver Card Presence
54	LVCAN Driver1 States	1	Driver1 States
55	LVCAN Driver2 States	1	Driver2 States
56	LVCAN Driver1 Continuous Driving Time	2	Driver1 Continuous Driving Time, minutes
57	LVCAN Driver2 Continuous Driving Time	2	Driver2 Continuous Driving Time, minutes
58	LVCAN Driver1 Cumulative Break Time	2	Driver1 Cumulative Break Time, minutes
59	LVCAN Driver2 Cumulative Break Time	2	Driver2 Cumulative Break Time, minutes
60	LVCAN Driver1 Duration Of Selected Activity	2	Driver1 Duration Of Selected Activity, minutes
61	LVCAN Driver2 Duration Of Selected Activity	2	Driver2 Duration Of Selected Activity, minutes
69	LVCAN Driver1 Cumulative Driving Time	2	Driver1 Cumulative Driving Time, minutes
77	LVCAN Driver2 Cumulative Driving Time	2	Driver2 Cumulative Driving Time, minutes
106	LVCAN Driver1 ID High	8	Driver1 ID High
107	LVCAN Driver1 ID Low	8	Driver1 ID Low

Property ID in AVL packet	Property Name	Bytes	Description
108	LVCAN Driver2 ID High	8	Driver2 ID High
140	LVCAN Driver2 ID Low	8	Driver2 ID Low
141	LVCAN Battery Temperature	2	10* Degrees, (°C)
142	LVCAN Battery Level (percent)	1	Value in percentages, %
143	LVCAN Door Status	2	Door status value: Min – 0, Max – 16128 Door status is represented as bitmask converted to decimal value. Possible values: 0 – all doors closed, 0x100 (256) – front left door is opened, 0x200 (512) – front right door is opened, 0x400 (1024) – rear left door is opened, 0x800 (2048) – rear right door is opened, 0x1000 (4096) – hood is opened, 0x2000 (8192) – trunk is opened, 0x3F00 (16128) – all doors are opened, or combinations of values
176	LVCAN DTC Errors	1	DTC errors count
226	LVCAN CNG Status	1	0 – engine not on CNG 1 – engine not on CNG
227	LVCAN CNG Used	4	CNG used Value in kg * 10
228	LVCAN CNG Level	2	CNG level in percentages, % * 10
Thermoking			
256	IBOX Fuel Level	1	reflects the ratio of the volume of fuel remaining to the total volume of the primary fuel storage container resolution: 0.5 %
257	IBOX Battery Voltage	2	battery voltage in Volts (V) resolution: 0.05 V
258	IBOX Total Electric Hours	4	reflects the accumulated time of operation of the unit when running under electric power. resolution: 0.05 h
259	IBOX Total Vehicle Hours	4	This value represents the time a unit is „ON“ but not necessarily having the engine running. The unit could be ON and the engine OFF in the case of a Shutdown Alarm or when the unit is in „Null“ or „Idle“ mode. resolution: 0.05 h
260	IBOX Total Engine Hours	4	This PID reflects the accumulated time of operation of the engine. resolution: 0.05 h

Property ID in AVL packet	Property Name	Bytes	Description
261	IBOX Zone 1 Alarm Type*	1	0 – no alarm 1 – level 0 alarm (log-stored/routine maintenance requered) 2 – level 1 alarm (low fuel) 3 – level 2 alarm (maintenance past due) 4 – level 3 alarm (reserved for future use) 5 – level 4 alarm (reserved for future use) 6 – level 5 alarm (reserved for future use) 7 – level 6 alarm (reserved for future use) 8 – level 7 alarm (check / immediate required) 9 – level 8 alarm (reserved for future use) 10 – level 9 alarm (reserved for future use) 11 – level 10 alarm (reserved for future use) 12 – level 11 alarm (reserved for future use) 13 – level 12 alarm (reserved for future use) 14 – level 13 alarm (reserved for future use) 15 – level 14 alarm (shutdown or catasthropic system failure)
262	IBOX Zone 1 Alarm Code	1	manufacturer specific code of value 0 to 255
263	IBOX Zone 1 Return Air Temperature 1	2	zone1 return Air #1 Temperature in celsius *10 MIN: -1838.2 °C MAX: 1802.6 °C
264	IBOX Zone 1 Supply Air Temperature 1	2	zone1 supply #1 Temperature in celsius * 10 MIN: -1838.2 °C MAX: 1802.6 °C
265	IBOX Zone 1 Temperature Setpoint	2	zone1 temperature Setpoint in celsius * 10 MIN: -1838.2 °C MAX: 1802.6 °C
266	IBOX Zone 1 Evaporator Coil Temperature	2	zone1 evaporator Coil Temperature in celsius * 10 MIN: -1838.2 °C MAX: 1802.6 °C
267	IBOX Zone 1 Return Air Temperature 2	2	zone1 return Air #2 Temperature in celsius *10 MIN: -1838.2 °C MAX: 1802.6 °C
268	IBOX Zone 1 Supply Air Temperature 2	2	zone1 supply #2 Temperature in celsius * 10 MIN: -1838.2 °C MAX: 1802.6 °C
269	IBOX Zone 1 Operating mode**	1	0 – power off or unknown 1 – cooling 2 – heating 3 – defrost 4 – null 5 – pretrip 6/7 – manufacturer specific Received data needs to be masked as E0 >> 5 to get described operating mode.

Property ID in AVL packet	Property Name	Bytes	Description
270	IBOX Zone 2 Alarm Type*	1	0 – no alarm 1 – level 0 alarm (log-stored/routine maintenance requered) 2 – level 1 alarm (low fuel) 3 – level 2 alarm (maintenance past due) 4 – level 3 alarm (reserved for future use) 5 – level 4 alarm (reserved for future use) 6 – level 5 alarm (reserved for future use) 7 – level 6 alarm (reserved for future use) 8 – level 7 alarm (check / immediate required) 9 – level 8 alarm (reserved for future use) 10 – level 9 alarm (reserved for future use) 11 – level 10 alarm (reserved for future use) 12 – level 11 alarm (reserved for future use) 13 – level 12 alarm (reserved for future use) 14 – level 13 alarm (reserved for future use) 15 – level 14 alarm (shutdown or catasthropic system failure)
271	IBOX Zone 2 Alarm Code	1	manufacturer specific code of value 0 to 255
272	IBOX Zone 2 Return Air Temperature 1	2	zone2 return Air #1 Temperature in celsius *10 MIN: -1838.2 °C MAX: 1802.6 °C
273	IBOX Zone 2 Supply Air Temperature 1	2	zone2 supply #1 Temperature in celsius * 10 MIN: -1838.2 °C MAX: 1802.6 °C
274	IBOX Zone 2 Temperature Setpoint	2	zone2 temperature Setpoint in celsius * 10 MIN: -1838.2 °C MAX: 1802.6 °C
275	IBOX Zone 2 Evaporator Coil Temperature	2	zone2 evaporator Coil Temperature in celsius * 10 MIN: -1838.2 °C MAX: 1802.6 °C
276	IBOX Zone 2 Return Air Temperature 2	2	zone2 return Air #2 Temperature in celsius *10 MIN: -1838.2 °C MAX: 1802.6 °C
277	IBOX Zone 2 Supply Air Temperature 2	2	zone2 supply #2 Temperature in celsius * 10 MIN: -1838.2 °C MAX: 1802.6 °C
278	IBOX Zone 2 Operating Mode**	1	0 – power off or unknown 1 – cooling 2 – heating 3 – defrost 4 – null 5 – pretrip 6/7 – manufacturer specific Received data needs to be masked as E0 >> 5 to get described operating mode.

Property ID in AVL packet	Property Name	Bytes	Description
279	IBOX Zone 3 Alarm Type*	1	0 – no alarm 1 – level 0 alarm (log-stored/routine maintenance requered) 2 – level 1 alarm (low fuel) 3 – level 2 alarm (maintenance past due) 4 – level 3 alarm (reserved for future use) 5 – level 4 alarm (reserved for future use) 6 – level 5 alarm (reserved for future use) 7 – level 6 alarm (reserved for future use) 8 – level 7 alarm (check / immediate required) 9 – level 8 alarm (reserved for future use) 10 – level 9 alarm (reserved for future use) 11 – level 10 alarm (reserved for future use) 12 – level 11 alarm (reserved for future use) 13 – level 12 alarm (reserved for future use) 14 – level 13 alarm (reserved for future use) 15 – level 14 alarm (shutdown or catasthropic system failure)
280	IBOX Zone 3 Alarm Code	1	manufacturer specific code of value 0 to 255
281	IBOX Zone 3 Return Air Temperature 1	2	zone3 return Air #1 Temperature in celsius *10 MIN: -1838.2 °C MAX: 1802.6 °C
282	IBOX Zone 3 Supply Air Temperature 1	2	zone3 supply #1 Temperature in celsius * 10 MIN: -1838.2 °C MAX: 1802.6 °C
283	IBOX Zone 3 Temperature Setpoint	2	zone3 temperature Setpoint in celsius * 10 MIN: -1838.2 °C MAX: 1802.6 °C
284	IBOX Zone 3 Evaporator Coil Temperature	2	zone3 evaporator Coil Temperature in celsius * 10 MIN: -1838.2 °C MAX: 1802.6 °C
285	IBOX Zone 3 Return Air Temperature 2	2	zone3 return Air #2 Temperature in celsius *10 MIN: -1838.2 °C MAX: 1802.6 °C
286	IBOX Zone 3 Supply Air Temperature 2	2	zone3 supply #2 Temperature in celsius * 10 MIN: -1838.2 °C MAX: 1802.6 °C
287	IBOX Zone 3 Operating Mode**	1	0 – power off or unknown 1 – cooling 2 – heating 3 – defrost 4 – null 5 – pretrip 6/7 – manufacturer specific Received data needs to be masked as E0 >> 5 to get described operating mode.
Thermoking			

Property ID in AVL packet	Property Name	Bytes	Description
288	MOBILEYE sound type	1	0 – silent 1 – left line departure warning 2 – rigth line departure warning 3 – headway warning 4 – traffic sign recognition (if enabled via EyeWatch) 5 – urban forward collision warning 6 - forward collision warning/pedestrian collision warning
289	MOBILEYE peds in DZ	1	0 – no warning 1 – pedestrians in danger zone warning
290	MOBILEYE peds FCW	1	0 – no warning 1 – pedestrians in forward collsion warning
291	MOBILEYE time indicator	1	0 – day indicated 1 – dusk indicated 2 – nigth is indicated
292	MOBILEYE error valid	1	0 – no error 1 – error code is valid
293	MOBILEYE error code	1	error code as in mobileye user manual. Code is valid if error valid bit is set
294	MOBILEYE zero speed	1	0 – hos vehicle moving 1 – host vehicle is stopped
295	MOBILEYE headway valid	1	0 – then close in path vehicle is not detected 1 – then close in path vehicle detected
296	MOBILEYE headway measurement	1	headway measurement in seconds * 10
297	MOBILEYE LDW off	1	0 – lane departure warning are enabled 1 – lane depatture warnings are disabled due to low speed or configuration
298	MOBILEYE left LDW on	1	0 – no left line departure warning 1 – left line depatrure warning event
299	MOBILEYE right LDW on	1	0 – no right line departure warning 1 – right line depatrure warning event
300	MOBILEYE maintenance	1	indicator of internal error. (mobileye manual)
301	MOBILEYE failsafe	1	0 – no failsafe modes 1 – indicates one of the internal failsafe modes (blur image, saturated image, low sun, partial bloking, partial transparent)
302	MOBILEYE FCW on	1	1 – forward collision warning will be on for the entire warning length
303	MOBILEYE TSR enabled	1	0 – trafic sign recognition OFF 1 – trafic sign recognition ON
304	MOBILEYE headway wrn. repeat	1	1 – indicates that headway repeatable feature is ON

Property ID in AVL packet	Property Name	Bytes	Description
305	MOBILEYE headway wrn. level	1	Headway warning level: 0 - then no vehicle detected 1 – then close in path vehicle present with headway which is bigger than headway config 2 – then close in path vehicle present with headway which is smaller or equal than headway config or then headway is less than 0,6
306	MOBILEYE TSR wrn. level	1	indicates if current vehicle speed is bigger than recognized traffic sign 0 – vehicle speed < road speed 1 – vehicle speed > road speed + [0-5] kmh 2 – vehicle speed > road speed + [5-10] kmh 3 – vehicle speed > road speed + [10-15] kmh 4 – vehicle speed > road speed + [15-20] kmh 5 – vehicle speed > road speed + [20-25] kmh 6 – vehicle speed > road speed + [25-30] kmh 7 – vehicle speed > road speed + [30+] kmh
307	MOBILEYE tamper alert	1	0 – no tamper alert 1 – tamper alert It will be active if there is no vehicle or lane detection for duration of 10 minutes.
308	MOBILEYE high beam	1	0 – high beam off 1 – high beam on
309	MOBILEYE low beam	1	0 – low beam off 1 – low beam on
310	MOBILEYE wipers	1	0 – wipers off 1 – wipers on
311	MOBILEYE right signal	1	0 – right turn signal is off 1 – right turn signal is on
312	MOBILEYE left signal	1	0 – left turn signal is off 1 – left turn signal is on
313	MOBILEYE brake signal	1	0 – brake signal is off 1 – brake signal is on
314	MOBILEYE wipers available	1	0 – wipers data not available 1 – wipers data available
315	MOBILEYE low beam available	1	0 – low beam data available 1 – low beam data available
316	MOBILEYE high beam available	1	0 – high beam data not available 1 – high beam data available
317	MOBILEYE speed available	1	0 – speed data not available 1 – speed data available
318	MOBILEYE speed	1	speed value 0-255 km/h
319	MOBILEYE TSR1	8	RAW traffic sign recognition data as described in mobileye manual
320	MOBILEYE TSR2	8	RAW traffic sign recognition data as described in mobileye manual
321	MOBILEYE TSR3	8	RAW traffic sign recognition data as described in mobileye manual

Property ID in AVL packet	Property Name	Bytes	Description
322	MOBILEYE TSR4	8	RAW traffic sign recognition data as described in mobileye manual
323	MOBILEYE TSR5	8	RAW traffic sign recognition data as described in mobileye manual
324	MOBILEYE TSR6	8	RAW traffic sign recognition data as described in mobileye manual
325	MOBILEYE TSR7	8	RAW traffic sign recognition data as described in mobileye manual
326	MOBILEYE TSR VO	8	RAW vision only decision data as described in mobileye manual

1.6 Codec 8 Example

```
Received data:
00000000 0000008c 08 01 0000013feb55ff74 00 0f0ea850 209a6900 0094 0000 12 0000 01 1e 0
9 01 00 02 00 03 00 04 00 16 01 47 03 f0 00 15 04 c8 00 0c 09 00 73 0a 00 46 0b 00 50 13 00 46 43 06 d7 44 00
00 b5 00 0b b6 00 07 42 2e 9f 18 00 00 cd 03 86 ce 00 01 07 c7 00 00 00 00 f1 00 00 60 1a 46 00 00 01 34 48 0
0 00 0b b8 49 00 00 00 bb 84 a0 00 00 bb 84 c0 00 00 00 00 02 4e 00 00 00 00 00 00 00 00 cf 00 00 00 00 00 00 0
0 00 01 00 00 3f ca
In total 152 Bytes.

00000000 4 zeroes, 4 bytes
0000008c data length, 4 bytes
08 - Codec ID
    01- Number of Data (1 record)

        1'st record data

            0000013feb55ff74 - Timestamp in milliseconds (1374042849140)
            GMT: Wed, 17 Jul 2013 06:34:09 GMT
            00 - Priority

            GPS Element

            0f0ea850        - Longitude 252618832 = 25,2618832° N
            209a6900        - Latitude 546990336 = 54,6990336 ° E
            0094            - Altitude 148 meters
            0000            - Angle 214°
            12              - 12 Visible sattelites
            0000            - 0 km/h speed

            IO Element

            00 - IO element ID of Event generated (in this case when 00 -
            data generated not on event)
            1e - 30 IO elements in record (total)
```

09 – 9 IO elements, which length is 1 Byte

01	– IO element ID = 01
00	– IO element's value = 0
02	– IO element ID = 02
00	– IO element's value = 0
03	– IO element ID = 03
00	– IO element's value = 0
04	– IO element ID = 04
00	– IO element's value = 0
16	– IO element ID = 22 (dec)
01	– IO element's value = 1
47	– IO element ID = 71 (dec)
03	– IO element's value = 3
F0	– IO element ID = 240 (dec)
00	– IO element's value = 0
15	– IO element ID = 21 (dec)
04	– IO element's value = 0
C8	– IO element ID = 200 (dec)
00	– IO element's value = 0

0C – 12 IO elements, which value length is 2 Bytes

09	– IO element ID = 9 (dec)
0073	– IO element's value
0a	– IO element ID = 10 (dec)
0046	– IO element's value
0b	– IO element ID = 11 (dec)
0050	– IO element's value
13	– IO element ID = 19 (dec)
0046	– IO element's value
43	– IO element ID = 67 (dec)
06d7	– IO element's value
44	– IO element ID = 68 (dec)
0000	– IO element's value
B5	– IO element ID = 181 (dec)
000b	– IO element's value
B6	– IO element ID = 182 (dec)
0007	– IO element's value
42	– IO element ID = 66 (dec)
2e9f	– IO element's value
18	– IO element ID = 24 (dec)
0000	– IO element's value
cd	– IO element ID = 205 (dec)
0386	– IO element's value
CE	– IO element ID = 206 (dec)
0001	– IO element's value

07 – 7 IO elements, which value length is 4 Bytes

C7	– IO element ID = 199 (dec)
00000000	– IO element's value
f1	– IO element ID = 241 (dec)

```
0000601a     - IO element's value
46           - IO element ID = 70 (dec)
00000134     - IO element's value
48           - IO element ID = 72 (dec)
00000bb8     - IO element's value
49           - IO element ID = 73 (dec)
00000bb8     - IO element's value
4a           - IO element ID = 74 (dec)
00000bb8     - IO element's value
4c           - IO element ID = 76 (dec)
00000000     - IO element's value

02 - 2 IO elements, which value length is 8 Bytes
   4e                    - IO element ID = 78 (dec)
   0000000000000000      - IO element's value
   cf                    - IO element ID = 207 (dec)
   0000000000000000      - IO element's value

01          - Number of Data (1 record)
00003fca    - CRC-16, 4 Bytes (first 2 are always zeroes)
```

1.7 Codec 16 description and example

Records to server will be sended as shown in table bellow. The main difference between CODEC8 and CODEC16 is CODEC ID which will be 0x10 instead of 0x08, AVL ID's in AVL data is sent in 2 bytes, instead of 1 byte. Also new parameter - Generation type is adeed. By receiving 0x10 codec ID server must know that AVL data record will be parsed different.

Codec16 is supported from firmware – 00.03.xx and newer. All AVL ID's which are higher then 255 will can be used only in CODEC16 protocol.

Generation type elements

Value	Record created
0	On exit
1	On Entrance
2	On Both
3	Reserved
4	Hysterisis
5	On Change
6	Eventual
7	Periodcal

Codec16 TCP packet frame

Header	Data length	Codec.ID	NOD1	AVL DATA	NOD2	CRC16
4 Bytes	4 Bytes	0x10	1B	Variable	1B	4 Bytes

NOD1, NOD2 – number of data (number of packed records)
Codec ID – constant 0x10.
Data length – the length of packet from CodecID to NOD2.
NOD2 should be equal to NOD1.

CRC16 is 4 bytes, but first two are zeroes and last two are CRC-16 calculated for CodecID to NOD2

Received data:

```
00000000000009D1002000013feb55ff74000f0ea850209a690000AE00B90B0000000070
A05000100000200000300000400012000020018000000460129020C700000000004C00
00000001003E000000000000000000000015B198C7498000F0DBC502095872F00AE00B90B0
0000000070A05000100000200000300000400012000020018000000460129020C7000000
00004C0000000001003E000000000000000002000009A5
```

00000000 **4 zeroes**, 4 bytes
0000009D **data length**, 4 bytes
10 - **Codec ID**
02- **Number of Data** (2 records)

1'st record data

0000013feb55ff74 - **Timestamp** in milliseconds (1374042849140)
GMT: Wed, 17 Jul 2013 06:34:09 GMT
00 - **Priority**

GPS Elements

0f0ea850 - Longitude 252618832 = 25,2618832° N
209a6900 - Latitude 546990336 = 54,6990336 ° E
00AE - Altitude 148 meters
00B9 - Angle 214°
0B - 12 Visible sattelites
0000 - 0 km/h speed

IO Elements

0000 - IO element ID of Event generated (in this case when 00 - data generated not on event)

07 - Generation type

0A - 10 IO elements in record (total)
05 - 5 IO elements, which length is 1 Byte
0001 - IO element ID = 01
00 - IO element's value = 0
0002 - IO element ID = 02
00 - IO element's value = 0
0003 - IO element ID = 03
00 - IO element's value = 0
0004 - IO element ID = 04
00 - IO element's value = 0
0120 - IO element ID = 288 (dec)
00 - IO element's value = 0

```
02    - 2 IO elements, which value length is 2 Bytes
  0018    - IO element ID = 24 (dec)
  0000    - IO element's value
  0046    - IO element ID = 70 (dec)
  0129    - IO element's value

02 - 2 IO elements, which value length is 4 Bytes

  00C7         - IO element ID = 199 (dec)
  00000000     - IO element's value
  0046         - IO element ID = 70 (dec)
  00000000     - IO element's value


01 - 1 IO elements, which value length is 8 Bytes
  003E                   - IO element ID = 62 (dec)
  0000000000000000       - IO element's value
```

2'st record data

0000015B198C7498000F0DBC502095872F00AE00B90B00000000070A0500010000020000030000040001200002001800000046012902 00C700000000004C0000000001003E0000000000000000

```
02              - Number of Data (2 records)
000009A5        - CRC-16, 4 Bytes (first 2 are always zeroes)
```

1.8 Communication with server

First when module connects to server, module sends its IMEI. First comes short identifying number of bytes written and then goes IMEI as text (bytes).

For example IMEI 123456789012345 would be sent as 000f333536333037303432343431303133

First two bytes denote IMEI length. In this case 000F means, that imei is 15 bytes long.

After receiving IMEI, server should determine if it would accept data from this module. If yes server will reply to module 01 if not 00. Note that confirmation should be sent as binary packet. I.e. 1 byte 0x01 or 0x00.

Then module starts to send first AVL data packet. After server receives packet and parses it, server must report to module number of data received as integer (four bytes).

If sent data number and reported by server doesn't match module resends sent data.

Example:

Module connects to server and sends IMEI:

000f333536333037303432343431303133

Server accepts the module:

01

Module sends data packet:

Codec type	*AVL data packet header*	*AVL data array*	*CRC*
	Four zero bytes, 'AVL data array' length – 254	CodecId – 08 or codec 16, NumberOfData – 2. (Encoded using continuous bit	CRC of 'AVL data array'

		stream. Last byte padded to align to byte boundary)	
Codec8	00000000000000FE	0802...(data elements)...02	00008612
Codec16	00000000000000FE	1002...(data elements)...02	00008612

Server acknowledges data reception (2 data elements):
00000002

2. SENDING DATA OVER UDP/IP

2.1 UDP channel protocol

UDP channel is a transport layer protocol above UDP/IP to add reliability to plain UDP/IP using acknowledgment packets. The packet structure is as follows:

UDP datagram			
UDP channel packet x N	Packet length	2 bytes	Packet length (excluding this field) in big endian byte order
	Packet Id	2 bytes	Packet id unique for this channel
	Packet Type	1 byte	Type of this packet
	Packet payload	m bytes	Data payload

Packet Type	
0	Data packet requiring acknowledgment
1	Data packet NOT requiring acknowledgment
2	Acknowledgment packet

Acknowledgment packet should have the same *packet id* as acknowledged data packet and empty data payload. Acknowledgement should be sent in binary format.

Acknowledgment packet		
Packet length	2 bytes	0x0003
Packet id	2 bytes	same as in acknowledged packet
Packet type	1 byte	0x02

2.2 Sending AVL data using UDP channel

AVL data are sent encapsulated in UDP channel packets (*Data payload* field).

AVL data encapsulated in UDP channel packet		
AVL packet id (1 byte)	Module IMEI	AVL data array

AVL packet id (1 byte) – id identifying this AVL packet
Module IMEI – IMEI of a sending module encoded the same as with TCP

AVL data array – array of encoded AVL data

Server response to AVL data packet	
AVL packet id (1 byte)	Number of accepted AVL elements (1 byte)

AVL packet id (1 byte) – id of received AVL data packet
Number of AVL data elements accepted (1 byte) – number of AVL data array entries from the beginning of array, which were accepted by the server.

Scenario:
Module sends UDP channel packet with encapsulated AVL data packet (*Packet* type=1 or 0). If packet type is 0, server should respond with valid UDP channel acknowledgment packet. Since server should respond to the AVL data packet, UDP channel acknowledgment is not necessary in this scenario, so *Packet type=1* is recommended.
Server sends UDP channel packet with encapsulated response (*Packet type=1* – this packet should not require acknowledgment)
Module validates *AVL packet id* and *Number of accepted AVL elements*. If server response with valid *AVL packet id* is not received within configured timeout, module can retry sending.

Example:
Module sends the data:

Codec	***UDP channel header***	***AVL packet header***	***AVL data array***
	Len – 253, Id – 0xCAFE, Packet type – 01 (without ACK)	AVL packet id – 0xDD, IMEI – 1234567890123456	CodecId – 08 or codec 16, NumberOfData – 2. (Encoded using continuous bit stream)
Codec8	00FDCAFE01	DD000F313334353637383930313233435	0802...(data elements)...02
Codec16	00FDCAFE01	DD000F313334353637383930313233435	1002...(data elements)...02

Server must respond with acknowledgment:

UDP channel header	***AVL packet acknowledgment***
Len – 5, Id – 0xABCD, Packet type – 01 (without ACK)	AVL packet id – 0xDD, NumberOfAcceptedData – 2
0005ABCD01	DD02

Another example, with all IO id's enabled

```
Server received data:
00a1cafe011b000f333536333037303432343431303133080100000013febdd19c8000f0e9
ff0209a7180006900001200000001e0901000200030004001601470 3f0001504c8000c0900
910a00440b004d13004443155544000 0b5000bb60005422e9b180000cd0386ce000107c70
0000000f10000601a460000013c4800000bb84900000bb84a00000bb84c00000000024e00
000000000000000cf0000000000000000 01
```

Data length: 00a1 or 161 Bytes (not counting the first 2 data length bytes)
Packet identification: 0xCAFE 2 bytes

Packet type:	01
Packet id:	1b
Imei length:	000f
Actual imei:	333536333037303432343431303133
Codec id:	08
Number of data:	01
Timestamp:	0000013febdd19c8
Priority:	00
GPS data:	0f0e9ff0209a7180006900001200000

UDP protocol is the same as TCP except message header is 7 bytes, which consist of: data length, packet identification, packet type and packet id.
Then goes imei length and imei itself.
And after that goes AVL data.
And at the very end number of data byte. There is no CRC in UDP.

3. SENDING DATA USING SMS

AVL data or events can be sent encapsulated in binary SMS. TP-DCS field of these SMS should indicate that message contains 8-bit data (for example: TP-DCS can be 0x04).

SM data (TP-UD)	
AVL data array	*IMEI:* 8 bytes

AVL data array – array of encoded AVL data
IMEI – IMEI of sending module encoded as a big endian 8-byte long number.

4. 24 POSITION SMS DATA PROTOCOL

24-hour SMS is usually sent once every day and contains GPS data of last 24 hours. TP-DCS field of this SMS should indicate that message contains 8-bit data (i.e. TP-DCS can be 0x04).

Note, that 24 position data protocol is used only with subscribed SMS. Event SMS use standard AVL data protocol.

4.1 Encoding

To be able to compress 24 GPS data entries into one SMS (140 octets), the data is encoded extensively using bit fields. Data packet can be interpreted as a bit stream, where all bits are numbered as follows:

Byte 1	***Byte 2***	***Byte 3***	***Bytes 4-…***
Bits 0-7	Bits 8-15	Bits 16-24	Bits 25-…

Bits in a byte are numbered starting from least significant bit. A field of 25 bits would consist of bits 0 to 24 where 0 is the least significant bit and bit 24 – most significant bit.

4.2 Structure

SMS Data Structure			
	Size (bits)	Field	Description
	8	CodecId	CodecId = 4
	35	Timestamp	Time corresponding to the first (oldest) GPS data element, represented in seconds elapsed from 2000.01.01 00:00 EET.
	5	ElementCount	Number of GPS data elements.
ElementCount *		GPSDataElement	GPS data elements.
		Byte-aling padding	Padding bits to align to 8-bits boundary
	64	IMEI	IMEI of sending device as 8-byte long integer

The time of only the first GPS data element is specified in *Timestamp* field. Time corresponding to each further element can be computed as e*lementTime* = *Timestamp* + (1 hour * elementNumber).

GPSDataElement				
		Size (bits)	Field	Description
		1	ValidElement	ValidElement=1 – there is a valid GpdDataElement following, ValidElement=0 – no element at this position.

GPSDataElement				
ValidElement == 1		1	DifferentialCoords	Format of following data.
	DifferentialCoords == 1	14	LongitudeDiff	Difference from previous element's longitude. LongitudeDiff = prevLongitude – Longitude + 2^{13} – 1
		14	LatitudeDiff	Difference from previous element's latitude LatitudeDiff = prevLatitude – Latitude + 2^{13} – 1
	DifferentialCoords == 0	21	Longitude	Longitude= {(LongDegMult + 18 * 10^8) * (2^{21} – 1)} over {36*10^8}
		20	Latitude	Latitude=(LatDegMult + 9*10^8) * (2^{20} – 1) over {18*10^8}
		8	Speed	Speed in km/h.

Longitude	longitude field value of *GPSDataElement*
Latitude	latitude field value of *GPSDataElement*
LongDegMult	longitude in degrees multiplied by 10^7 (integer part)
LatDegMult	latitude in degrees multiplied by 10^7 (integer part)
prevLongitude	longitude field value of previous *GPSDataElemen*
prevLatitude	latitude field value of previous *GPSDataElement*

4.3 Decoding GPS position

When decoding GPS data with *DifferentialCoords*=1, *Latitude* and *Longitude* values can be computed as follows: *Longitude*=*prevLongitude* – *LongitudeDiff* + 2^{13} – 1, Latitude=*prevLatitude* – *LatitudeDiff* + 2^{13} – 1.

If there were no previous non-differential positions, differential coordinates should be computed assuming prevLongitude=prevLatitude=0.

When *Longitude* and *Latitude* values are known, longitude and latitude representation in degrees can be computed as follows:

$$LongDeg = \frac{Longitude * 360}{2^{21} - 1} - 180 \qquad LatDeg = \frac{Latitude * 180}{2^{20} - 1} - 90$$

5. SMS EVENTS

When Configured to generate SMS event user will get this SMS upon event

<Year/Month/Day> <Hour:Minute:Second> P:<profile_nr> **<SMS Text**> **Va**l:<Event Value>
Lon:<longitude> **Lat**:<latitude> **Q:**<HDOP>

Example:
2016./04/11 12:00:00 P:3 Digital Input 1 Val:1 Lon:51.12258 Lat: 25.7461 Q:0.6

6. CHANGE LOG

03191

Nr.	Date	New version number	Comments
1	2017.04.25	0.1	First release
2	2017.06.02	0.2	Jamming detection AVL ID, and description added
3	2017.06.29	0.3	Added and udated LVCAN parameters.
4	2017.07.03	0.4	Updated Cell ID element description
5	2017.07.27	0.5	CAN0…9 AVL ID's renamed as Manual CAN1 0…9. Manual CAN2 AVL ID's added.