

FMB640 Protocols

V0.05

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FM64 DATA PROTOCOL

Difference between codec8 and codec8 extended

	Codec 8	Codec 8 extended
<i>Codec ID</i>	<i>0x08</i>	<i>0x8E</i>
<i>AVL Data IO element length</i>	<i>1 Byte</i>	<i>2 Bytes</i>
<i>AVL Data IO element total IO count length</i>	<i>1 Byte</i>	<i>2 Bytes</i>
<i>AVL Data IO element IO count length</i>	<i>1 Byte</i>	<i>2 Bytes</i>
<i>AVL Data IO element AVL ID length</i>	<i>1 Byte</i>	<i>2 Bytes</i>
<i>Variable size IO elements</i>	<i>Does not include</i>	<i>Includes variable size elements</i>

Codec 8 and codec 8 extended differences

Main differences between codec 08 and codec 08 extended are shown in table above. AVL data element sizes in codec 8 extended protocol was increased to 2 bytes and new variable type added. For more detailed description please look in codec 8 and codec 8 extended chapters.

1. CODEC 8 PROTOCOL SENDING OVER TCP

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 FM64 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 30 bytes (all IO elements disabled).

Maximum AVL packet size for one record is 252 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

Converted to DEC: 547146368

For more information see two's complement 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'sth IO ID	N1'sth IO Value	N2 of Two Bytes IO	1'st IO ID	1'st IO Value	...	N2'sth IO ID	N2'sth IO Value	N4 of Four Bytes IO	1'st IO ID	1'st IO Value	...	N4'sth IO ID	N4'sth IO Value	N8 of Eight Bytes IO	1'st IO ID	1'st IO Value	...	N8'sth IO ID	N8'sth 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
245	Analog Input 4	2	Voltage: mV, 0 – 30 V *Depends on configuration
21	GSM signal level	1	Value in scale 0 – 5
22	Data mode	1	Value in scale 0 – 5
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/ 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	8	ID of Dallas Temperature Sensor 3
75	Dallas Temperature 4	2	10 * Degrees (°C), -55 - +115, if 3000 – Dallas error
65	Dallas Temperature ID4	8	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	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
181	GPS PDOP	2	Probability * 10; 0-500
182	GPS HDOP	2	Probability * 10; 0-500

Permanent I/O elements (are always sent (with every record) to server if enabled)			
Property ID in AVL packet	Property Name	Bytes	Description
199	Trip Odometer	4	Distance between two records: m Trip Distance: m * Depends on configuration
200	Deep Sleep	1	0 – normal 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
241	Current Operator Code	4	Currently used GSM Operator code
201	LLS 1 Fuel Level	2	Fuel level, measured by LLS sensor on COM1/COM2 or RS485, in kvants or liters.
202	LLS 1 Temperature	1	Fuel temperature, measured by LLS sensor on COM1/COM2 or RS485, in degrees Celsius.
203	LLS 2 Fuel Level	2	Fuel level, measured by LLS sensor on COM1/COM2 or RS485, in kvants or liters.
204	LLS 2 Temperature	1	Fuel temperature, measured by LLS sensor on COM1/COM2 or RS485, in degrees Celsius.
210	LLS 3 Fuel Level	2	Fuel level, measured by LLS sensor on RS485, in kvants or liters.
211	LLS 3 Temperature	1	Fuel temperature, measured by LLS sensor on RS485 interface
212	LLS 4 Fuel Level	2	Fuel level, measured by LLS sensor on RS485, in kvants or liters.
213	LLS 4 Temperature	1	Fuel temperature, measured by LLS sensor on RS485 interface
214	LLS 5 Fuel Level	2	Fuel level, measured by LLS sensor on RS485, in kvants or liters.
215	LLS 5 Temperature	1	Fuel temperature, measured by LLS sensor on RS485 interface
224	Ultrasonic UL220 Fuel Level 1	2	Fuel level, measured by UL202 sensor on COM1 interface.
225	Ultrasonic UL220 Fuel Level 2	2	Fuel level, measured by UL202 sensor on COM2 interface.
208	Ultrasonic UL220 Status 1	1	UL202 sensor status reported on COM1 interface.
209	Ultrasonic UL220 Status 2	1	UL202 sensor status reported on COM2 interface.
207	RFID ID COM1	8	Read COM1 RFID value, depending on RFID mode, values can be: for RFID mode in hexadecimal format, RFID M7 mode in decimal format.
216	Total odometer	4	Total odometer distance value (m)
217	RFID ID COM2	8	Read COM2 RFID value, depending on RFID mode, values can be: for RFID mode in hexadecimal format, RFID M7 mode in decimal format.
218	IMSI	8	IMSI code
219-221	CCID	Max 24	SIM card CCID. 221 LSB - 219 MSB
236	Axis X	2	X accelerometer axis value, mg

Permanent I/O elements (are always sent (with every record) to server if enabled)			
Property ID in AVL packet	Property Name	Bytes	Description
237	Axis Y	2	Y accelerometer axis value, mg
238	Axis Z	2	Z accelerometer axis value, mg
216	Total odometer	4	Separate odometer element, not related with TRIP functionality.
144	SD status	1	0 –not present, 1 –present

There are 23 IO elements of 1 byte size.

Also 24 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
FMS elements			
79	Brake switch	1	0 – Parking brake not set; 1 – Parking brake set; 2 – Error; 3 – Not available
80	Wheel based speed	4	0-65536 (km/h)*
81	Cruise control active	1	0 - switched off ; 1 - switched on; 2 – Error; 3 – Not available
82	Slutch switch	1	0 – Pedal released; 1 – Pedal depressed; 2 – Error; 3 – Not available
83	PTO state	1	0 – off/disabled; 5 – Set; 31 – 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	4	1-102 (%)*
88	Engine speed	4	0 – 8031,875 (rpm)*
89-103	Axle weight	4	32766 (kg)*
104	Engine total hours of Operation	4	0 – 214748364 (Hours)*
105-108	Vehicle identification number	Max 24	Max 24 ASCII bytes
109	SW-version supported	4	4 ASCII bytes (Version format – ab.cd)
110	Diagnostics supported	1	0 – Diagnostics is not supported; 1 – Diagnostics is supported; 2 – Reserved; 3 – Not available
111	Requests supported	1	0 – On request mode is Not supported; 1– On request mode is Supported; 2 – reserved; 3 – Not available;
112	High resolution total vehicle distance	4	0 - 21055406 km*
113	Service distance	4	-160 635 – 167040 km*
114	Vehicle motion	1	0 – Motion Not Detected; 1 – Motion Detected; 2 – Error; 3 – Not available

Property ID in AVL packet	Property Name	Bytes	Description
115	Driver 2 working state	1	0 – Rest; 1 – Driver Available; 2 – Work; 3 – Drive; 4 – 5 Reserved; 6 - Error; 7 – not available;
116	Driver 1 working state	1	0 – Rest; 1 – Driver Available; 2 – Work; 3 – Drive; 4 – 5 Reserved; 6 - Error; 7 – not available;
117	Vehicle overspeed	1	0 – No Overspeed; 1 – Overspeed; 2 – Error; 3 – Not available
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 – 12 reserved; 13 – Other; 14 - Error; 15 – 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 – 12 reserved; 13 – Other; 14 - Error; 15 – not available;
120	Driver 1 card	1	0 – Card Not Present; 1 – Card Present; 2 – Error; 3 – Not available
121	Driver 2 card	1	0 – Card Not Present; 1 – Card Present; 2 – Error; 3 – Not available
122	Direction indicator	1	0 – Forward; 1 – Reverse; 2 – Error; 3 – Not available
123	Tachograph performance	1	0 – No Handling Information; 1 – Handling Information; 2 – Error; 3 – Not available
124	Tachograph handling information	1	0 - No handling information, 1- Handling information is available
125	System event	1	0 – No Tacho Event; 1 – Tacho Event; 2 – Error; 3 – Not available
126	Tachograph vehicle speed X	2	[0 – 65000] – Tacho Vehicle Speed km/h*
127	Engine coolant temperature	1	[-40 – 210] oC– Engine Coolant Temperature*
128	Ambient Air Temperature	2	[-273 – 1770]oC – Ambient Air Temperature*
129-131	Driver 1 Identification	32	24 ASCII Bytes per Driver ID
132-134	Driver 2 Identification	32	24 ASCII Bytes per Driver ID
135	Fuel rate	2	[0 – 3212,75] litres/h*
136	Instantaneous Fuel Economy	2	[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 or mililiters
139	Gross Combination Vehicle Weight	2	0-642550 kg
357	Brake Pedal Position	1	0-100 (%)*
Manual CAN elements			
145	Manual CAN1 0	Varying ²	ID Specific data
146	Manual CAN1 1	Varying ²	ID Specific data

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
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
380	Manual CAN2 0	Varying ²	ID Specific data
381	Manual CAN2 1	Varying ²	ID Specific data
382	Manual CAN2 2	Varying ²	ID Specific data
383	Manual CAN2 3	Varying ²	ID Specific data
384	Manual CAN2 4	Varying ²	ID Specific data
385	Manual CAN2 5	Varying ²	ID Specific data
386	Manual CAN2 6	Varying ²	ID Specific data
387	Manual CAN2 7	Varying ²	ID Specific data
388	Manual CAN2 8	Varying ²	ID Specific data
389	Manual CAN2 9	Varying ²	ID Specific data
Eventual I/O elements			
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
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
327	Geofence zone 21	1	Event: 0 – target left zone, 1 – target entered zone
328	Geofence zone 22	1	Event: 0 – target left zone, 1 – target entered zone
329	Geofence zone 23	1	Event: 0 – target left zone, 1 – target entered zone
330	Geofence zone 24	1	Event: 0 – target left zone, 1 – target entered zone
331	Geofence zone 25	1	Event: 0 – target left zone, 1 – target entered zone
332	Geofence zone 26	1	Event: 0 – target left zone, 1 – target entered zone
333	Geofence zone 27	1	Event: 0 – target left zone, 1 – target entered zone

Property ID in AVL packet	Property Name	Bytes	Description
334	Geofence zone 28	1	Event: 0 – target left zone, 1 – target entered zone
335	Geofence zone 29	1	Event: 0 – target left zone, 1 – target entered zone
336	Geofence zone 30	1	Event: 0 – target left zone, 1 – target entered zone
337	Geofence zone 31	1	Event: 0 – target left zone, 1 – target entered zone
338	Geofence zone 32	1	Event: 0 – target left zone, 1 – target entered zone
339	Geofence zone 33	1	Event: 0 – target left zone, 1 – target entered zone
340	Geofence zone 34	1	Event: 0 – target left zone, 1 – target entered zone
341	Geofence zone 35	1	Event: 0 – target left zone, 1 – target entered zone
342	Geofence zone 36	1	Event: 0 – target left zone, 1 – target entered zone
343	Geofence zone 37	1	Event: 0 – target left zone, 1 – target entered zone
344	Geofence zone 38	1	Event: 0 – target left zone, 1 – target entered zone
345	Geofence zone 39	1	Event: 0 – target left zone, 1 – target entered zone
346	Geofence zone 40	1	Event: 0 – target left zone, 1 – target entered zone
347	Geofence zone 41	1	Event: 0 – target left zone, 1 – target entered zone
348	Geofence zone 42	1	Event: 0 – target left zone, 1 – target entered zone
349	Geofence zone 43	1	Event: 0 – target left zone, 1 – target entered zone
350	Geofence zone 44	1	Event: 0 – target left zone, 1 – target entered zone
351	Geofence zone 45	1	Event: 0 – target left zone, 1 – target entered zone
352	Geofence zone 46	1	Event: 0 – target left zone, 1 – target entered zone
353	Geofence zone 47	1	Event: 0 – target left zone, 1 – target entered zone
354	Geofence zone 48	1	Event: 0 – target left zone, 1 – target entered zone
355	Geofence zone 49	1	Event: 0 – target left zone, 1 – target entered zone
356	Geofence zone 50	1	Event: 0 – target left zone, 1 – target entered zone
175	Auto Geofence	1	0 – Target left zone, 1 – Target entered zone
249	Jamming detection	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 – $g \cdot 10 \text{ m/s}^2$
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, 0 – data limit hit in home, 1 – data limit hit in roaming
243	Excessive Idling	1	Send When Idling with Ignition ON 1- Idling; 0 – Idling End
246	Towing detection	1	0 – steady, 1 – towing
247	Crash detection	1	0 – no crash, 1 – crash
248	Geozone Overspeeding	1	Geozone Idx, that generated event
362	Trace Order	2	
358	Custom Scenario 1	1	
359	Custom Scenario 2	1	
360	Custom Scenario 3	1	
361	Custom Scenario 4	1	
K-line data			
183	Drive recognize	1	0 – vehicle not in motion, 1 – vehicle in motion

Property ID in AVL packet	Property Name	Bytes	Description
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	0 – card not present, 1 – card present
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 7 – 12 reserved 13 – Other 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
231-232	Vehicle registration number	Max 16	ASCII bytes
233-235	VIN number	Max 24	ASCII bytes
222	Driver card1 issuing member state	1	Driver card 1 issuing member state, check table 37
223	Driver card2 issuing member state	1	Driver card 2 issuing member state, check table 37
LVCAN elements			
30	LVCAN Speed	1	Value in km/h
31	LVCAN Acc Pedal	1	Value in percentages, %
33	LVCAN Fuel Consumed	4	Value in liters, L *10
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	4	LVCAN Program Number

Property ID in AVL packet	Property Name	Bytes	Description
	Number		
13	LVCAN ModuleID	8	Module ID
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	Byte0 (LSB): 0x01 – STOP 0x02 – Oil pressure / level 0x04 – Coolant liquid temperature / level 0x08 – Handbrake system 0x10 – Battery charging 0x20 – AIRBAG Byte1: 0x01 – CHECK ENGINE 0x02 – Lights failure 0x04 – Low tire pressure 0x08 – Wear of brake pads 0x10 – Warning 0x20 – ABS 0x40 – Low Fuel Byte2: 0x01 – ESP 0x02 – Glow plug indicator 0x04 – FAP 0x08 – Electronics pressure control 0x10 – Parking lights 0x20 – Dipped headlights 0x40 – Full beam headlights Byte3: 0x40 – Passenger's seat belt

Property ID in AVL packet	Property Name	Bytes	Description
			0x80 – Driver's seat belt
39	LVCAN Agricultural Machinery Flags	8	<p>Byte0 (LSB):</p> <ul style="list-style-type: none"> 0x01 – Mowing 0x02 – Grain release from hopper 0x04 – First front hydraulic turned on 0x08 – Rear Power Take-Off turned on <p>Byte1:</p> <ul style="list-style-type: none"> 0x01 – Excessive play under the threshing drum 0x02 – Grain tank is open 0x04 – 100% of Grain tank 0x08 – 70% of Grain tank 0x10 – Drain filter in hydraulic system of drive cylinders is plugged 0x20 – Pressure filter of drive cylinders hydraulic system is plugged 0x40 – Alarm oil level in oil tank 0x80 – Pressure filter of brakes hydraulic system is plugged <p>Byte2:</p> <ul style="list-style-type: none"> 0x01 – Oil filter of engine is plugged 0x02 – Fuel filter is plugged 0x04 – Air filter is plugged 0x08 – Alarm oil temperature in hydraulic system of chasis 0x10 – Alarm oil temperature in hydraulic system of drive cylinders 0x20 – Alarm oil pressure in engine 0x40 – Alarm coolant level 0x80 – Overflow chamber of hydraulic unit <p>Byte3:</p> <ul style="list-style-type: none"> 0x01 – Unloader drive is ON. Unloading tube pivot is in idle position 0x02 – No operator! 0x04 – Straw walker is plugged 0x08 – Water in fuel 0x10 – Cleaning fan RPM 0x20 – Trashing drum RPM <p>Byte4:</p> <ul style="list-style-type: none"> 0x02 – Low water level in the tank 0x04 – First rear hydraulic turned on 0x08 – Standalone engine working 0x10 – Right joystick moved right 0x20 – Right joystick moved left 0x40 – Right joystick moved front 0x80 – Right joystick moved back <p>Byte5:</p> <ul style="list-style-type: none"> 0x01 – Brushes turned on

Property ID in AVL packet	Property Name	Bytes	Description
			<p> 0x02 – Water supply turned on 0x04 – Vacuum cleaner 0x08 – Unloading from the hopper 0x10 – High Pressure washer (Karcher) 0x20 – Salt (sand) disperser ON 0x40 – Low salt (sand) level Byte6: 0x01 – Second front hydraulic turned on 0x02 – Third front hydraulic turned on 0x04 – Fourth front hydraulic turned on 0x08 – Second rear hydraulic turned on 0x10 – Third rear hydraulic turned on 0x20 – Fourth rear hydraulic turned on 0x40 – Front three-point Hitch turned on 0x80 – Rear three-point Hitch turned on Byte7: 0x01 – Left joystick moved right 0x02 – Left joystick moved left 0x04 – Left joystick moved front 0x08 – Left joystick moved back 0x10 – Front Power Take-Off turned on </p>
40	LVCAN Harvesting Time	4	Harvesting Time, minutes
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	<p> Byte0 (LSB): Every two bits in this byte correspond to a different CAN bus number. 00 – CAN not connected, connection not required 01 – CAN connected, but currently module not received data 10 – CAN not connected, require connection 11 – CAN connected Example: Byte0 - 0F hex – 00001111 binary CAN4, CAN3, CAN2, CAN1 Byte1: Not used Byte2: 0x20 – bit appears when any operate button in </p>

Property ID in AVL packet	Property Name	Bytes	Description
			<p>car was put</p> <p>0x40 – bit appears when immobilizer is in service mode</p> <p>0x80 – immobiliser, bit appears during introduction of a programmed sequence of keys in the car.</p> <p>Byte3:</p> <p>0x01 – the key is in ignition lock</p> <p>0x02 – ignition on</p> <p>0x04 – dynamic ignition on</p> <p>0x08 – webasto</p> <p>0x20 – car closed by factory's remote control</p> <p>0x40 – factory-installed alarm system is actuated (is in panic mode)</p> <p>0x80 – factory-installed alarm system is emulated by module</p> <p>Byte4:</p> <p>0x01 – parking activated (automatic gearbox)</p> <p>0x10 – handbrake is actuated (information available only with ignition on)</p> <p>0x20 – footbrake is actuated (information available only with ignition on)</p> <p>0x40 – engine is working (information available only when the ignition on)</p> <p>0x80 – revers is on</p> <p>Byte5:</p> <p>0x01 – Front left door opened</p> <p>0x02 – Front right door opened</p> <p>0x04 – Rear left door opened</p> <p>0x08 – Rear right door opened</p> <p>0x10 – engine cover opened</p> <p>0x20 – trunk door opened</p> <p>Byte6:</p> <p>0x01 – car was closed by the factory's remote control</p> <p>0x02 – car was opened by the factory's remote control</p> <p>0x03 – trunk cover was opened by the factory's remote control</p> <p>0x04 – module has sent a rearming signal</p> <p>0x05 – car was closed three times by the factory's remote control</p> <p>- High nibble (mask 0xF0 bit)</p> <p>0x80 – CAN module goes to sleep mode</p> <p>Byte7:</p> <p>Not used</p>
48	LVCAN Tacho Total Vehicle Distance	4	Tacho Total Vehicle Distance, m
49	LVCAN Trip Distance	4	Trip Distance, m
52	LVCAN Tacho Vehicle	2	Tacho Vehicle Speed, km/h

Property ID in AVL packet	Property Name	Bytes	Description
	Speed		
53	LVCAN Tacho Driver Card Presence	1	0x00 – No driver card 0x01 – Driver1 card presence 0x02 – Driver2 card presence 0x03 – Driver1 and driver2 cards present
54	LVCAN Driver1 States	1	0xX0 – break/rest 0xX1 – availability 0xX2 – work 0xX3 – driving 0x0X – no time-related warning detected 0x1X – limit #1: 15 min before 4 1/2 h 0x2X – limit #2: 4 1/2 h reached (continuous driving time exceeded) 0x3X – limit #3: 15 minutes before optional warning 1 0x4X – limit #4: optional warning 1 reached 0x5X – limit #5: 15 min before optional warning 0x6X – limit #6: optional warning 2 reached
55	LVCAN Driver2 States	1	
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
229	LVCAN Driver1 ID High	8	Driver1 ID High
230	LVCAN Driver1 ID Low	8	Driver1 ID Low
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	1	Value in percentages, %

Property ID in AVL packet	Property Name	Bytes	Description
	(percent)		
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
177	LVCAN DTC Error Codes	8	DTC error code, with every new record next received error code will be sent to server.
EuroScan/DataCold IO Elements			
390	Temperature Probe 1	2	Degrees, °C
391	Temperature Probe 2	2	Degrees, °C
392	Temperature Probe 3	2	Degrees, °C
393	Temperature Probe 4	2	Degrees, °C
394	Temperature Probe 5	2	Degrees, °C
395	Temperature Probe 6	2	Degrees, °C
Ibox elements			
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
261	IBOX Zone 1 Alarm Type*	1	0 – no alarm 1 – level 0 alarm (log-stored/routine maintenance required)

Property ID in AVL packet	Property Name	Bytes	Description
			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 catastrophic 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.
270	IBOX Zone 2 Alarm Type*	1	0 – no alarm 1 – level 0 alarm (log-stored/routine maintenance required) 2 – level 1 alarm (low fuel) 3 – level 2 alarm (maintenance past due) 4 – level 3 alarm (reserved for future use)

Property ID in AVL packet	Property Name	Bytes	Description
			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 catastrophic 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.
279	IBOX Zone 3 Alarm Type*	1	0 – no alarm 1 – level 0 alarm (log-stored/routine maintenance required) 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)

Property ID in AVL packet	Property Name	Bytes	Description
			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 catastrophic 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.
Mobileye elements			
288	MOBILEYE sound type	1	0 – silent 1 – left line departure warning 2 – right 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	1	0 – no warning

Property ID in AVL packet	Property Name	Bytes	Description
	DZ		1 – pedestrians in danger zone warning
290	MOBILEYE peds FCW	1	0 – no warning 1 – pedestrians in forward collision warning
291	MOBILEYE time indicator	1	0 – day indicated 1 – dusk indicated 2 – night 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 – host 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 departure warnings are disabled due to low speed or configuration
298	MOBILEYE left LDW on	1	0 – no left line departure warning 1 – left line departure warning event
299	MOBILEYE right LDW on	1	0 – no right line departure warning 1 – right line departure 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 blocking, 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 – traffic sign recognition OFF 1 – traffic sign recognition ON
304	MOBILEYE headway wrn. Repeat	1	1 – indicates that headway repeatable feature is ON
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

Property ID in AVL packet	Property Name	Bytes	Description
			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
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
TPMS IO Elements			
400	Total Tires Controlled	1	

Property ID in AVL packet	Property Name	Bytes	Description
401	Total Number of Axl	1	
402	Graphical position	8	
410	Tire 1	8	Tire ID 1
411	Tire 2	8	Tire ID 2
412	Tire 3	8	Tire ID 3
413	Tire 4	8	Tire ID 4
414	Tire 5	8	Tire ID 5
415	Tire 6	8	Tire ID 6
416	Tire 7	8	Tire ID 7
417	Tire 8	8	Tire ID 8
418	Tire 9	8	Tire ID 9
419	Tire 10	8	Tire ID 10
420	Tire 11	8	Tire ID 11
421	Tire 12	8	Tire ID 12
422	Tire 13	8	Tire ID 13
423	Tire 14	8	Tire ID 14
424	Tire 15	8	Tire ID 15
425	Tire 16	8	Tire ID 16
426	Tire 17	8	Tire ID 17
427	Tire 18	8	Tire ID 18
428	Tire 19	8	Tire ID 19
429	Tire 20	8	Tire ID 20
430	Tire 21	8	Tire ID 21
431	Tire 22	8	Tire ID 22
432	Tire 23	8	Tire ID 23
433	Tire 24	8	Tire ID 24

1.6 Codec 8 Example

Received data:

```
000000000000008c08010000013feb55ff74000f0ea850209a690000940000120000001e0
9010002000300040016014703f0001504c8000c0900730a00460b00501300464306d74400
00b5000bb60007422e9f180000cd0386ce000107c700000000f10000601a4600000134480
0000bb84900000bb84a00000bb84c00000000024e000000000000000cf00000000000000
000100003fca
```

In total 152 Bytes.

```
00000000 4 zeroes, 4 bytes
0000008c data length, 4 bytes
```

08 - Codec ID

0- 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 0°

12 - 18 Visible satellites

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 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:

<i>Codec type</i>	<i>AVL data packet header</i>	<i>AVL data array</i>	<i>CRC</i>
	Four zero bytes, 'AVL data array' length – 254	CodecId – 08 NumberOfData – 2. (Encoded using continuous bit stream. Last byte padded to align to byte boundary)	CRC of 'AVL data array'
Codec8	00000000000000FE	0802...(data elements)...02	00008612

Server acknowledges data reception (2 data elements):

00000002

2. CODEC 8 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:

<i>UDP datagram</i>			
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

<i>Packet Type</i>	
1	Data packet requiring acknowledgment

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

<i>Acknowledgment packet</i>		
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).

<i>AVL data encapsulated in UDP channel packet</i>		
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

<i>Server response to AVL data packet</i>

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:

<i>Codec</i>	<i>UDP channel header</i>	<i>AVL packet header</i>	<i>AVL data array</i>
	Len – 253, Id – 0xCAFE, Packet type – 01 (without ACK)	AVL packet id – 0xDD, IMEI – 1234567890123456	CodecId – 08, NumberOfData – 2. (Encoded using continuous bit stream)
Codec8	00FDCAFE01	DD000F313334353637383930313233 33435	0802...(data elements)...02

Server must respond with acknowledgment:

<i>UDP channel header</i>	<i>AVL packet acknowledgment</i>
Len – 5, Id – 0xABCD, Packet type – 01 (without ACK)	AVL packet id – 0xDD, NumberOfAcceptedData – 2
0005CAFE01	DD02

Another example, with all IO id's enabled

Server received data:

```
00a1cafe011b000f33353633303730343234343130313308010000013febdd19c8000f0e9
ff0209a718000690000120000001e09010002000300040016014703f0001504c8000c0900
910a00440b004d130044431555440000b5000bb60005422e9b180000cd0386ce000107c70
0000000f10000601a460000013c4800000bb84900000bb84a00000bb84c00000000024e00
000000000000000cf000000000000000001
```

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: 0f0e9ff0209a718000690000120000

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. CODEC 8 EXTENDED PROTOCOL SENDING OVER TCP

3.1 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	38 - 768 Bytes	1 Byte	4 bytes

AVL data packet structure

Number of data – number of encoded data (number of records).

Codec ID is constant 0x8E.

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 53 bytes (all IO elements disabled).

3.2 AVL Data

Timestamp	Priority	GPS Element	IO Element
8 Bytes	1 Byte	15 Bytes	14 - 744

AVL Data structure

3.3 Priority

0	Low
1	High
2	Panic

Priority element values

3.4 GPS Element

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

GPS element structure

3.5 IO Element

Event IO ID	2 bytes
N of Total IO	2 bytes
N1 of One Byte IO	2 bytes
1'st IO ID	2 bytes
1'st IO Value	1 bytes
...	
N1'th IO ID	2 bytes
N1'st IO Value	1 bytes
N2 of Two Byte IO	2 bytes
1'st IO ID	2 bytes

1'st IO Value	2 bytes
...	
N2'th IO ID	2 bytes
N2'st IO Value	2 bytes
N4 of Four Byte IO	2 bytes
1'st IO ID	2 bytes
1'st IO Value	4 bytes
...	
N4'th IO ID	2 bytes
N4'st IO Value	4 bytes
N2 of Eight Byte IO	2 bytes
1'st IO ID	2 bytes
1'st IO Value	8 bytes
...	
N8'th IO ID	2 bytes
N8'st IO Value	8 bytes
NX of X Byte IO	2 bytes
1'st IO ID	2 bytes
1'st IO Length	2 bytes
1'st IO Value	defined by length
...	
NX'st IO ID	2 bytes
NX'st IO Length	2 bytes
NX'st IO Value	defined by length

IO element structure

N	total number of properties coming with record ($N=N1+N2+N4+N8+NX$)
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
NX	number of properties, which length is defined by length element

3.6 Communication with server

Communication with server is the same as with codec 8 protocol, except in codec8 extended protocol codec id is 0x8E.

Example:

Module connects to server and sends IMEI:

000f3335363330373034323431303133

Server accepts the module:

01

Module sends data packet:

0000000029BFE4D1 – IO element's value

0001 – 1 IO elements, which length is X Byte

0100 – IO element ID = 256 (dec)

0011 – IO element length = 17 (dec)

00000000000000000000000000000000 – IO element's value

01 – Number of Data (1 record)

0000D153 – CRC-16, 4 Bytes (first 2 are always zeroes)

4. CODEC 8 EXTENDED PROTOCOL SENDING OVER UDP

4.1 AVL data packet

AVL data packet is the same as with codec 8, except codec ID is changed to 0x8E.

Example:

Module sends the data:

UDP channel header	AVL packet header	AVL data array
Len – 253, Id – 0xCAFE, Packet type – 01	AVL packet id – 0xDD, IMEI – 1234567890123456	Codec Id – 8E, NumberOfData – 02. (Encoded using continuous bit stream)
00FDCAFE01	DD000F3133343536373839303132333435	8E02...(data elements)...02

Table 22 – Example packet sent to server

Server must respond with acknowledgment:

UDP channel header	AVL packet acknowledgment
Len – 5, Id – 0xCAFE, Packet type – 01	AVL packet id – 0xDD, NumberOfAcceptedData – 2
0005CAFE01	DD02

Table 23 – Example packet server response

4.2 Example

Server received data:

00a1cafe011b000f3335363330373034323434313031338E010000013febdd19c8000f0e9ff0209a718000690000120000001e09010002000300040016014703f0001504c8000c0900910a00440b004d130044431555440000b5000bb60005422e9b180000cd0386ce000107c700000000f10000601a460000013c4800000bb84900000bb84a0000bb84c00000000024e000000000000000cf000000000000000001

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: 8E

Number of data: 01

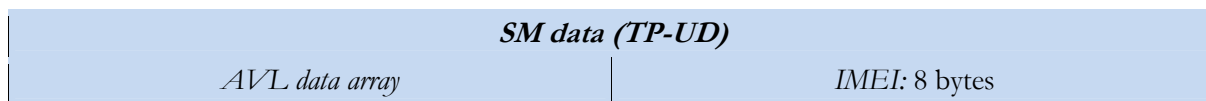
Timestamp: 0000013febdd19c8

Priority: 00

GPS data: 0f0e9ff0209a718000690000120000

5. 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).



AVL data array – array of encoded AVL data

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

6. 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> Val:<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

7. NUMERIC STATE TABLE

No information available	0	Iceland	1C
Austria	1	Kazakhstan	1D
Albania	2	Luxembourg	1E
Andorra	3	Lithuania	1F
Armenia	4	Latvia	20
Azerbaijan	5	Malta	21
Belgium	6	Monaco	22
Bulgaria	7	Republic of Moldova	23
Bosnia and Herzegovina	8	Macedonia	24
Belarus	9	Norway	25
Switzerland	0A	Netherlands	26
Cyprus	0B	Portugal	27
Czech Republic	0C	Poland	28
Germany	0D	Romania	29
Denmark	0E	San Marino	2A
Spain	0F	Russian Federation	2B
Estonia	10	Sweden	2C
France	11	Slovakia	2D
Finland	12	Slovenia	2E
Liechtenstein	13	Turkmenistan	2F
Faeroe Islands	14	Turkey	30
United Kingdom	15	Ukraine	31
Georgia	16	Vatican City	32
Greece	17	Yugoslavia	33
Hungary	18	RFU	34..FC
Croatia	19	European Community	FD
Italy	1A	Rest of Europe	FE
Ireland	1B	Rest of the world	FF

8. CHANGE LOG

[illegible]