FM2

Parameters and functionality description
V1.0
(Confidential document)

FM2 Parameters and functionality description V1.0 2008

This document describes basic functionality of FM2 (possibilities) and configuration parameters

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1. Parameter list

1.1 Parameters value types

S8 – Signed Char
U8 – Unsigned Char
U32 – Unsigned Integer
U16 – Unsigned Short
S8[n] – String of n Char

1.2 Global Parameters

1.2.1 Record search (ID 105)

Record search parameter is responsible for record searching order. Value of 0 arranging data starting from newest, while value of 1 arranging data starting from oldest.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
0	1	-	Data Send interval (ID=270)	S8

1.3 Data acquisition and sending parameters

1.3.1 Time based acquire interval (ID=11)

Time interval in seconds, indicating condition to acquire new record.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
1	9999999	5	Distance based acquire interval (ID=12) Angle based coordinate acquisition (ID=13)	U32

1.3.2 Distance based acquire interval (ID=12)

Distance in meters, indicating condition to acquire new record. Record is stored when the distance between previous record is greater than parameter's value.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
1	65535	50	Time based acquire interval (ID=11) Angle based coordinate acquisition (ID=13)	U16

1.3.3 Angle based coordinate acquisition (ID=13)

Angle in degrees, indicating condition to acquire new record. If angle difference between last recorded coordinate and current position is greater than defined value, new record is stored. This parameter is operational, when speed is higher then 10km/h.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
1	359	10	Time based acquire interval (ID=11) Distance based acquire interval (ID=12)	U32

1.3.4 Data Send interval (ID=270)

Time interval in seconds, indicating frequency of sending data to server.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
0	65535	5	GPRS Enable (ID=240) GPRS Data send week time schedule (ID=272) Minimum records number in packet (ID=232)	U16

1.3.5 Minimum records number in packet (ID=232)

Minimum number of records in one data packet that can be sent to server. This parameter has higher priority than Data Send interval (ID=270).

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
1	25	1	Time based acquire interval (ID=11) Distance based acquire interval (ID=12) GPRS Data send week time schedule (ID=272) Data Send interval (ID=270)	U8

1.3.6 GPRS Enable (ID=240)

Parameter allows or does not allow using GPRS. If GPRS is not allowed value is 0, if GPRS is allowed - 1.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
0	1	1	Data Send interval (ID=270) Minimum records number in packet (ID=232) GPRS Data send week time schedule (ID=272)	S8

1.3.7 GSM Operator list (ID=271)

Parameter defines operator list. According to this list module allows GPRS connection only while operating under listed operators. GSM operator codes are comma separated. Example: 24601, 24602, 24705…24503

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
Empty	-	-	-	U32

1.3.8 GPRS Data send week time schedule (ID=272)

This parameter manages when it is allowed to open GPRS context. When module starts it is prohibited to open the context. When modem's GPRS context is being closed (for example changing network) it is allowed to open it only at defined time. It is possible to allow connections every 10 minutes up to once per day.

Example value: 7FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

Format is described in chapter 1.3.10

1.3.9 SMS Data send week time schedule (ID=273)

Parameter defines SMS data sending according to week time schedule. This parameter is used to set data sending on selected week days and hours. Minimum time step is 10 minutes.

Example value: 7FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

Format is described in chapter 1.3.10

1.3.10 Schedule parameter format

Time is defined as 19 byte array. First byte of array defines week days, the rest 18 bytes define timestamps with 10 minute interval. In first byte, first bit (LSB) defines if module should connect to GPRS (send SMS) on Monday, second bit – on Tuesday and so on up to seventh bit – which means Sunday. Eighth bit (MSB) is not used. If bits value is 0 then device is not allowed to open GPRS context, but if it is already open – does not close it. If value is 1 it will work as day minutes are defined in rest of the bytes.

Day's minutes are defined by 18 bytes (144 bits). Every n'th bit (beginning from the first bit (LSB) and ending 18 bytes 8'th bit (MSB)) indicates every 10'th minute of the day (day has 1440 minutes).

Sample:

GPRS will be allowed on Monday to Friday at 8:00 and 16:00 GMT the following value should be configured:

00011111 00000000 00000000 00000000 000000000 00000000 00000000 00000001 00000000 00000000 00000000 00000000 00000000 000000001 00000000 00000000 00000000 00000000 00000000

Red bits indicate that GPRS will be allowed everyday except Saturdays and Sundays. Blue bits indicate 480 and 720 minutes (480min = 8h and 720min = 16h). So the parameter value should be:

1F 00 00 00 00 00 00 01 00 00 00 00 00 01 00 00 00 00 00

It should be sent as UTF8 encoded string.

1.3.11 SMS Data send allow (ID=250)

Parameter allows or does not allow using binary SMS to send Avl data. If SMS use is not allowed value is 0, and 1 if SMS use is allowed.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
0	1	0	SMS Data send week time schedule (ID=273) SMS Data send allow (ID=250) **Error! Reference source not found.**	S8

1.3.12 24 Records time step (ID=274)

Module is able to send binary SMS which contains 24 coordinates. Parameter ID=274 defines time step (in milliseconds) between each coordinate.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
1	4294967295	3600000	SMS Data send allow (ID=250) **Error! Reference source not found.** SMS Data send week time schedule (ID=273)	U32

1.4 Security settings and parameters

1.4.1 SMS User login (ID=252)

User login is used to ensure module security. Used in every SMS that is sent to device.
Example: ba321

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
empty	5 char string	-	SMS User password (ID=253) Server Number (ID=260) Authorized Number #1 (ID=261)	S8[5]

1.4.2 SMS User password (ID=253)

User password is used to ensure module security. Used in every SMS that is sent to device.
Example: ab123

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
Empty	5 char string	-	SMS User login (ID=252) Server Number (ID=260) Authorized Number #1 (ID=261)	S8[5]

1.4.3 Server Number (ID=260)

Parameter value is server GSM number. To this number the SMS with 24 coordinates is sent.
Example: 37060012345

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
Empty	16 char string	-	SMS Data send allow (ID=250)	S8[16]

1.4.4 Authorized Number #1 (ID=261)

Parameters ID=262 to ID=269 have values for 8 more authorized numbers If at least one number is entered then only those number can send messages to device.
Example: 37060012346

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
Empty	16 char string	-	SMS Data send allow (ID=250)	S8[16]

1.5 GPRS access and address settings

1.5.1 APN Name (ID=242)

Parameter defines GPRS Access Point Name.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
Empty	32 char string	-	GPRS Enable (ID=240) APN username (ID=243) APN Password (ID=244)	S8[32]

1.5.2 APN username (ID=243)

Parameter defines APN username. In case operator does not use username for login, value should be empty.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
Empty	6 char string	-	APN Name (ID=242) APN Password (ID=244)	S8[6]

1.5.3 APN Password (ID=244)

Parameter defines APN password. . In case operator does not use password for login, value should be empty.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
Empty	6 char string	-	APN Name (ID=242) APN username (ID=243)	S8[6]

1.5.4 Data send protocol (ID=231)

Parameter defines GPRS data transport protocol. Module can use TCP or UDP transport protocol to send data to server. For TCP protocol value is 0, for UDP protocol value is 1.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
0	1	0	GPRS Enable (ID=240)	U8

1.5.5 Server IP address (ID=245)

Parameter defines Avl data destination server IP address. Example: 212.47.99.62

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
Empty	16 char string	-	GPRS Enable (ID=240) Server port number (ID=246)	S8[16]

1.5.6 Server port number (ID=246)

Parameter defines Avl data destination server port number. Example: 12050

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
Empty	65535	-	GPRS Enable (ID=240) Server IP address (ID=245)	U16

1.6 Geofence zones settings and parameters

In this chapter it is explained how to get all parameters for the first GeoFence zone (all ID numbers are for the 1st zone). And at the end of the chapter (part 1.6.7) is presented a table with the IDs of all the rest GeoFence zones.

1.6.1 GeoFence border width (ID=20)

GeoFence border thickness, measured in meters.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
100	9999999	1000	GeoFence Zone #1 Configuration Parameter (ID=30) All the rest zones	U32

1.6.2 GeoFence Zone #1 Configuration Parameter (ID=30)

GeoFence Zone #1 Configuration is 1st zone basic settings parameter: GeoFence zone shape, priority, zone entering event, zone leaving event. There are two GeoFence zone shapes: circle, rectangle. GeoFence Zone priority has eight levels (0 to 7). Parameter value is four bytes that have bit encoded values.

0 bit – GeoFence zone shape
1-3 bits – GeoFence event priority
4 bit – Zone entering event
5 bit – Zone leaving event
6-31 bits reserved

Example:

Value to set: 51 (integer) is [M]00110011[L], where GeoFence Zone shape is Rectangular, priority of 1, Zone entering event is enabled, Zone leaving event is enabled.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
0	-	-	GeoFence border width (ID=20) GeoFence x1 (ID=31) GeoFence y1 (ID=32) GeoFence x2 (ID=33) GeoFence y2 (ID=34)	U32

1.6.3 GeoFence x1 (ID=31)

Parameter has two meanings dependent on zone shape. If shape is rectangular, then ID=31 is left down corner X coordinate in WGS. If shape is circle, then ID=31 is center of that circle X coordinate in WGS.

Sample value: 25.30528

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
-180.0	180.0	-	GeoFence border width (ID=20) GeoFence Zone #1 Configuration Parameter (ID=30)	Float

1.6.4 GeoFence y1 (ID=32)

Parameter has two meanings dependent on zone shape. If shape is rectangular, then ID=32 is left down corner Y coordinate in WGS. If shape is circle, then ID=32 is center of that circle Y coordinate in WGS.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
-90.0	90.0	-	GeoFence border width (ID=20) GeoFence Zone #1 Configuration Parameter (ID=30)	Float

1.6.5 GeoFence x2 (ID=33)

Parameter has two meanings dependent on zone shape. If shape is rectangular, then ID=33 is right upper corner X coordinate in WGS. If shape is circle, then ID=33 is radius of circle with center of ID=31 and ID=32.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
-180.0	180.0	-	GeoFence border width (ID=20) GeoFence Zone #1 Configuration Parameter (ID=30)	Float

1.6.6 GeoFence y2 (ID=34)

If shape is rectangular, then ID=34 is right upper corner Y coordinate in WGS. If shape circle, ID=34 is not used.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
-90.0	90.0	-	GeoFence border width (ID=20) GeoFence Zone #1 Configuration Parameter (ID=30)	Float

1.6.7 All the rest zones

Other 19 GeoFence zone's parameters have the same logic as shown in GeoFence Zone #1.

GeoFence Zone Number	GeoFence Zone's parameters
2	**40 – 44**
3	**50 – 54**
4	**60 – 64**
5	**70 – 74**

1.7 System parameters

1.7.1 Device Power mode (ID=0)

Device can operate in two modes: active or sleep. In active mode (value 0) module is able to operate all tasks, while in sleep mode (value 1) module reduces level of power usage.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
0	1	-	-	Enum

1.7.2 GPS Enable (ID=10)

Parameter enables or disables GPS receiver. When GPS is disabled value is 0, and 1 when enabled.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
0	1	-	Time based acquire interval (ID=11) Distance based acquire interval (ID=12) Angle based coordinate acquisition (ID=13) Geofence zones settings and parameters	S8

1.8 IO properties

IO properties – are additional data sources which are recorded along with usual GPS data.

1.8.1 IO#1 property parameter (ID=300)

Parameter defines IO property value. Possible values:

0	1
Disabled	Enabled

If value is 'CAN', then CAN data is automatically added to this property.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
0	byte	-	IO#1 priority (ID=301) **IO#1 High level (ID=302)** **IO#1 Low level (ID=303)** IO#1 logic operand (ID=304) IO#1 averaging length (ID=305)	S8

1.8.2 IO#1 priority (ID=301)

Parameter defines IO property type of priority: 0 is low, 1 – high, 2 – panic, 3 – security priority type.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
0	3	0	IO#1 property parameter (ID=300) **IO#1 High level (ID=302)** **IO#1 Low level (ID=303)** IO#1 logic operand (ID=304) IO#1 averaging length (ID=305)	S8

1.8.3 IO#1 High level (ID=302)

Parameter defines high value of triggered IO property. This parameter is used to set thresholds for IO properties to generate events.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
-2147483648	2147483648	1	IO#1 property parameter (ID=300) IO#1 priority (ID=301) **IO#1 Low level (ID=303)** IO#1 logic operand (ID=304) IO#1 averaging length (ID=305)	S32

1.8.4 IO#1 Low level (ID=303)

Parameter defines low value of triggered IO property. This parameter is used to set thresholds for IO properties to generate events.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
-2147483648	2147483648	0	IO#1 property parameter (ID=300) IO#1 priority (ID=301) **IO#1 High level (ID=302)** IO#1 logic operand (ID=304) IO#1 averaging length (ID=305)	S32

1.8.5 IO#1 logic operand (ID=304)

Parameter defines when event is sent: 0: on range exit, 1: on range entrance, 2: both

Minimal value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
0	2	2	IO#1 property parameter (ID=300) IO#1 priority (ID=301) IO#1 **High level (ID=302)** **IO#1 Low level (ID=303)** IO#1 averaging length (ID=305)	S8

1.8.6 IO#1 averaging length (ID=305)

Parameter defines IO property sample length to average. If no averaging needed default value is 1.

Minimum value	Maximum value	Recommended value	Goes with (depends on) parameters	Value type
0	2147483648	1	IO#1 property parameter (ID=300) IO#1 priority (ID=301) **IO#1 High level (ID=302)** **IO#1 Low level (ID=303)** IO#1 logic operand (ID=304)	S32

Other IO property elements are configuring in same logic. All IO elements parameter list is below.

IO Element Number	IO element parameters
IO#1 – Digital input 1	300 – 305
IO#2 – Digital input 2	310 – 315
IO#3 – Digital output 1	320 – 325
IO#4 – Digital output 2	330 – 335
IO#5 – PDOP	340 – 345
IO#6 – HDOP	350 – 355
IO#7 – Power voltage	360 – 365
IO#8 – GPS power	370 – 375
IO#9 – PCB temperature	380 – 385
IO#10 – Movement sensor	390 – 395
IO#11 – Odometer	400 – 405
IO#12 – n/a	410 – 415
IO#13 – n/a	420 – 425
IO#14 – n/a	430 – 435

2. Basics of functionality

2.1 Basics of connectivity

FM2 uses operator list to identify if it is able to use GPRS connection: if it is operating under an operator that is not included in the list, the FM2 is not allowed to open GPRS context no matter what the Data send week time schedule indicates.

After loading profile, module starts data acquire task. Module acquires positions according to Time based acquire interval (ID=11), Distance based acquire interval (ID=12), Angle based coordinate acquisition (ID=13) parameters. Next step is data sending to server task. Acquired data sending task depends on GPRS Enable (ID=240), GPRS Data send week time schedule (ID=272), Data Send interval (ID=270). According to these parameters module connects to GPRS and handles GPRS connection as long as able. If there is no way to establish GPRS connection (No GPRS/ Network Busy/ GPRS use is not allowed) collected data could be sent by SMS (if configured). SMS data sending depends on SMS Data send allow (ID=250), **Error! Reference source not found.**, 24 Records time step (ID=274), SMS Data send week time schedule (ID=273), Server Number (ID=260). If GPRS is available, module sends data via GPRS to server. Special thread runs in background checking for current available operators.

Figure below illustrates GPRS Data send week time schedule (ID=272) and SMS Data send week time schedule (ID=273) parameter configuration logic.

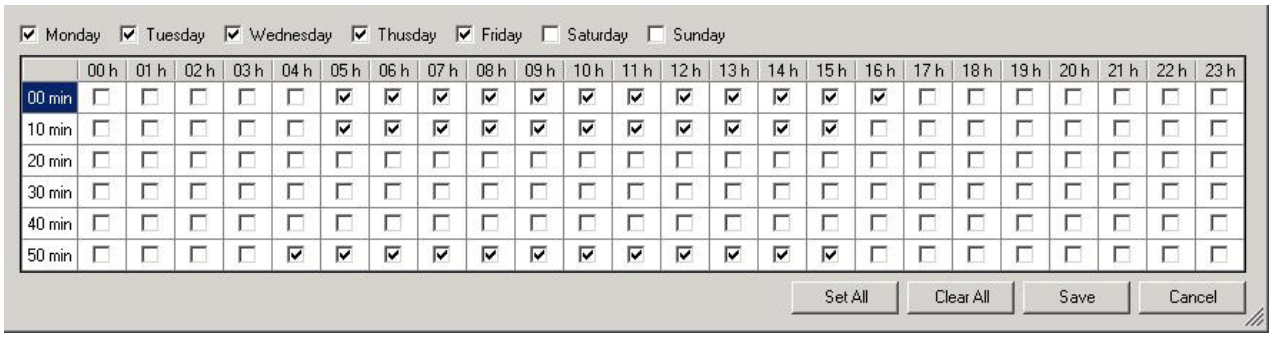

Figure 1. Data send week time table

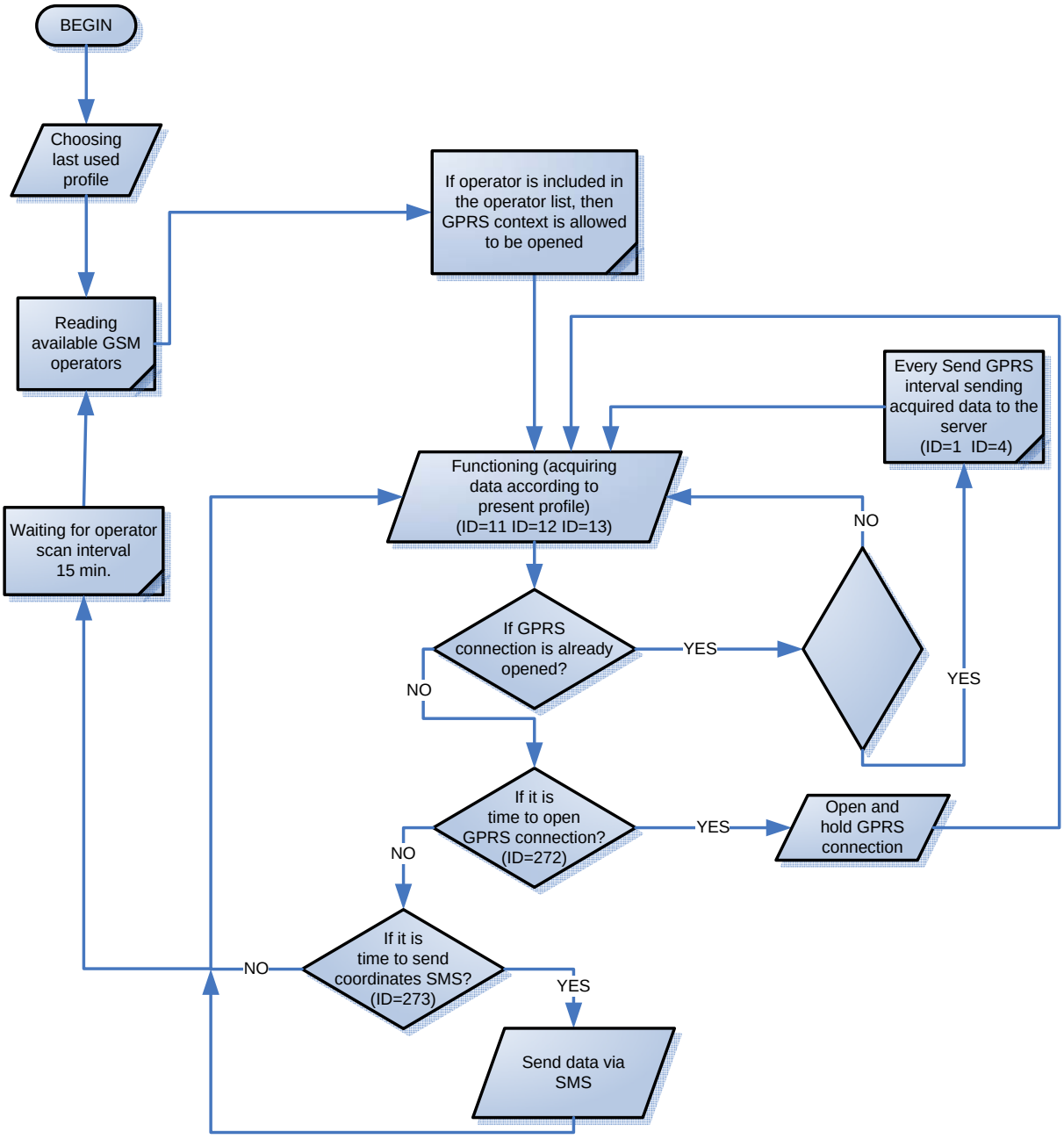

Figure 2. FM2 module working principals

2.2 FM2 properties list

Property ID	Property Name	Bytes	Description
1	Digital Input Status 1	1	Logic: 0 / 1
2	Digital Input Status 2	1	Logic: 0 / 1
66	Power Supply Voltage	2	Voltage: mV
69	GPS Power	1	States: 0 – short circ., 1 – connected.
70	PCB Temperature	2	10 * Degrees (°C)
155	Geozone 01	1	Event: 0 – target left zone, 1 – target entered zone
156	Geozone 02	1	Event: 0 – target left zone, 1 – target entered zone
157	Geozone 03	1	Event: 0 – target left zone, 1 – target entered zone
158	Geozone 04	1	Event: 0 – target left zone, 1 – target entered zone
159	Geozone 05	1	Event: 0 – target left zone, 1 – target entered zone
199	Virtual Odometer	4	Value returned in meters.
240	Movement	1	0 – not moving., 1 – moving.
179	Digital output 1 state	1	Logic: 0 / 1
180	Digital output 2 state	1	Logic: 0 / 1
181	PDOP	2	Probability*10; 0-500
182	HDOP	2	Probability*10; 0-500

3. Changes Log Sheet

Nr.	Date	New version number	Comments