

Template:FMB640 Accelerometer Features settings

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Accelerometer Calibration

Accelerometer auto calibration functionality has one purpose - determine how FMB device is mounted in a vehicle. After the calibration process *eco driving* functionality becomes active and calibration data will be used to determine harsh acceleration, braking and cornering events.

There are two conditions when auto calibration takes place:

- If on device startup no calibration was detected;
- If the device receives an SMS/GPRS message with *auto_calibrate:set* text.

After functionality has started FMB device periodically checks current appliance GNSS, ignition and movement source parameters and if the conditions match:

- position fix got;
- GNSS speed is zero;
- ignition is ON;
- first calibration vector was not saved yet;

Then first vector is taken. Saved vector will be considered as ground vector and it will be used at further calibration calculations.

Note: When FMB device saves first ground vector vehicle must be parked on flat ground. Crooked vector may have an impact on further calculations.

Afterwards first ground vector was taken, device analyses conditions:

- position fix got;
- GNSS speed is at least 20 km/h;
- ignition is ON;
- second vector was not saved yet;
- vehicle driving in the same direction with 5° tolerance;
- vehicle speed increase by 7km/h within 1 second.

For next vector. Second vector will be taken if all conditions match. Immediately after second vector is received, it will be multiplied by first (ground) vector, the result of these vectors is vector multiplication cross product which is the right side of a car. By using same vector multiplication method, device front, left side will be calculated. At this point calibration is successfully ended as indication device sends an SMS/GPRS message with *Device is calibrated, to recalibrate send:auto_calibrate:set*.

Note: SMS/GPRS message will be sent only if auto calibration functionality was triggered by SMS/GPRS message.

For user convenience in case auto calibration functionality fails then notification message will be sent. For exact messages, check algorithm section.

Note: SMS/GPRS message will be sent only if auto calibration functionality was triggered by SMS/GPRS message.

To get current calibration status *auto_calibrate:get* SMS/GPRS command must be sent to the device. If device is calibrated it will respond with *Calibration state: calibrated* or otherwise *Calibration state: not calibrated*. Also this command returns saved Ground and Side vectors.

After every TRIP START event, device starts shadow calibration. This type of calibration is running in parallel with already saved vectors (this means that vectors does not reset until shadow calibration have both new vectors). After shadow calibration is done, device updates the vector values to the new ones. There are two conditions when shadow calibration does not run at TRIP start event:

- Normal calibration is still running.
- Shadow calibration is still running from previous TRIP event.

To take ground vector these conditions should be met:

- Ignition is ON
- Device got GPS FIX
- Vehicle speed = 0km/h

Device will check these conditions every 1sec until they will pass.

To take side vector these conditions should be met:

- Vehicle speed \geq 20km/h
 - Device got GPS FIX
 - Ignition is ON
 - Device angle does not change more than 5 degrees in past 1 sec
 - Speed need to increase by 7km/h in 1s period.
- Device will check these conditions every 1 sec until they will pass.

Excessive Idling



If ignition (DIN1 or Power Voltage) is ON and the vehicle is not moving, FMB640 will generate the

Excessive Idling event when the configured time period passes. When vehicle starts moving and configured period of time passes, FMB640 will generate event that vehicle idle time ends. Auto Geofencing option can be configured by the following parameters:

- Time to stopped - scenario is activated until vehicle starts moving and keeps moving (moving is detected only from the accelerometer) for the amount of time that is configured.
- Time to moving - scenario is activated until vehicle stops and stays idle (moving is detected only from the accelerometer) for the amount of time that is configured.
- Start speed threshold - scenario is activated, when the vehicle's speed exceeds the *start speed threshold* value.
- Stop speed threshold - scenario is activated, when the vehicle's speed drops below the *stop speed threshold* value.

Digital output 1 or digital output 2 can be activated for a period of time to warn the driver. Output on-time is configured separately for each feature case. For more information please refer to [DOUT controls](#).

In order for vehicle to enter idling, state ignition has to be ON and at least one of these conditions have to be satisfied:

- detected speed is less than configured speed (Excessive Idling start speed threshold) for configured time duration (Time to stopped timeout);
- no GPS fix AND speed configured as GPS speed in Speed source settings AND no movement detected for configured time duration (Time to stopped timeout);

The vehicle is considered to be leaving the idling state if at least one of these conditions is satisfied:

- if detected speed is greater than configured speed (Excessive Idling stop speed threshold) for configured time duration (Time to moving timeout);
- if for configured time duration (Time to moving timeout) there is no GPS fix AND movement is detected AND speed is configured as GPS speed in Speed source settings;
- if the ignition is not detected for configured time duration (Time to moving timeout).

If the Excessive idling Eventual records parameter is enabled, the event is generated and saved with low priority on every idling state change.

Towing Detection



Towing Detection feature helps to inform the driver about unexpected car movement when it was parked. FMB640 generates an event when car is being towed or lifted, for example, in a case of vehicle evacuation. FMB640 activates towing function when following conditions are met:

1. Ignition (configured Ignition Source) is OFF.
2. *Activation Timeout* is reached.

When towing function is engaged FMB640 monitors accelerometer data. If acceleration *Threshold* or *Angle* reach configured values for a configured *Duration*, and Ignition is still OFF for a period of time that is longer than *Event Timeout*, then an event is generated. When configured, *Make Call To* and *Send SMS To* functions make a call or send an SMS to a predefined phone number. Towing

function will be reactivated after FMB640 detects a change of Ignition state from ON to OFF.

Crash detection



If *Crash Detection* is enabled, it monitors acceleration on each axis which helps to detect an accident. *Threshold* and *Duration* values are set depending on the impact magnitude that is required to be detected. FMT100 can detect events ranging between a slight tapping on the device and a severe accident.

If *Crash Trace* is disabled only one eventual crash record will be generated when *Duration (ms)* and *Threshold (mg)* values are exceeded.

If *Crash Trace* is enabled, FMB640 will collect crash trace data with frequency defined by *Trace ODR (Hz)* parameter. Acceleration, GNSS and IO data monitoring duration during the crash event is defined by these parameters:

- *Accel duration (s)*. Acceleration data duration can be set for up to 15 seconds before crash event and 15 seconds after;
- *GNSS duration (s)*. GNSS data duration can be set for up to 30 seconds before crash event and 30 seconds after.
- *IO duration (s)*. IO data duration can be set for up to 30 seconds before crash event and 30 seconds after.

There are three configurable Crash Trace modes:

Trace Full

- Data tracked: all GNSS and acceleration data

Trace Full with IO's

- Data tracked: all GNSS and acceleration data with IO's, configured in I/O settings as "Crash" parameter (see picture below)



Trace Changes

- Data tracked: GNSS and acceleration data, when acceleration values are changed by more than 50mG

NOTE: with Crash Trace mode enabled, it is recommended to use [Codec 8 Extended](#) Data Protocol. This helps to optimize crash trace data sending from device to server.



Each record will have accurate timestamps in milliseconds.



Crash Data Visualisation

With Teltonika *CrashDataVisualizer* tool you can analyze crash trace data visually: determine impact to vehicle direction, view crash trace on the map, also see the change of mG and speed values during crash time period. CrashDataVisualizer is dedicated to work with TAVL application, it means that only crash trace log files exported from TAVL is compatible. To have ability to export crash trace log files, device must be configured to send data by [Codec8E](#).

To start using CrashDataVisualizer

Download and install TAVL (version 4.15.0.1 or later) + CrashDataVisualizer applications from here:

Link: <https://drive.teltonika.lt/d/05369fc90d9744afb14f/>

Password: TJEk24YApbRhWrQQ

To get crash data

Login to TAVL application (please contact your Sales manager for TAVL login information).



In TAVL application:

1. Go to Events
2. Set the date of event
3. Select the object you want to analyze
4. Press "Crashes" button

Crash event list window will show up. Press Download icon and save crash event file (.JSON).



Viewing crash data in application

Open CrashDataVisualizer application. Drag and Drop or Browse crash data file (.JSON).



Use the Visualizer.



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Crash Trace Explanation

Device continuously reads data from accelerometer. When accelerometer's axes magnitude is above configured threshold for defined duration, crash event is detected. After crash is detected, crash trace is performed. Crash trace functionality collects accelerometer, GNSS and additional configured IO data (configurable). Collected data holds configured seconds of information before

crash and configured seconds of information after crash.

Example: accel and GNSS duration set to 2s. Total data length will be 4s (2 before event 2 after event).

Structure

Crash trace records follows AVL records structure, and can be parsed using the same parsers. Records are sent together with usual device records.

Table 1. Crash Trace Record Part 1

Timestamp	Priority	Longitude	Latitude	Altitude	Angle	Sat in Use	Speed
8B	1B	4B	4B	2B	2B	1B	2B

Table 2. Crash Trace Record Part 2

Eventual ID	Total, IO Count	1B IO elements	Crash Event, ID	Crash Event, Value
1B Always 247	1B Always 0x04	1B Always 0x01	1B Always 247	1B Always [2-5]*

- This value depends on user configuration :

- 2 - Trace changes and device is not calibrated.
- 3 - Trace changes and device is calibrated.
- 4 - Trace full and device is not calibrated.
- 5 - Trace full and device is calibrated.

Table 3. Crash Trace Record Part 3

1B IO elements*	Ignition Value*	2B IO elements	Axis X, ID	Axis X, Value	Axis Y, ID	Axis Y, Value	Axis Z, ID	Axis Z, Value	4B IO elements	8B IO Elements
1B Always 1	1B Ignition value	1B Always 3	1B Always 0x17	2B	1B Always 0x18	2B	1B Always 0x19	2B	1B Always 0x00	1B Always 0x00

- Ignition value is only added to the trace records if crash trace parameter is configured as „Trace Full“

ODR explanation:

When crash ODR is set to 100 Hz then device should collect 100 samples of AXL data over one second. You should see records timestamp every 1 second and each record should contain Crash trace data (AVL ID 257). This IO element should has 100 samples of X,Y,Z values. Also I notice that you use Codec8 protocol. We strongly recommend to use Codec8 extended.

Parsing

0001010102580234001F00270269003A0035026C002A002B0257FFC300180255FF8C00130258FF95000B0283FF800012027EFF860007026EFF63FFFA02D5F
F75000F0352FFBA003D03BEFFA70081043BFEE400EE04550027011003CBFFB8009103AFFFB0007D039BFEE0006D0357FFD70044039F0008007803AFFFEF008B03D9
FFD200BF040F0018010904210030013E03F6001A012E03BB003A01140336006A00C502A4000900780269FF9A00730228FF75006A0234FFBE007B024BFFD800990262FFE00BE
02B000530123028FFFE70123016FFF11008C00C2FEE2005AFFB6FF8AFF8FF46FFA5FFE6FEFBFFBDFDAFEEDFFCEFFD6FE66FFF6FFD8FEC4004BFFD5FF730047FEE2FFD8F
FE6FFF100FB0040007C00A6FF1D006C0036FE6E007EFF46FF0FFFE8FE87001FFFA9FE370042FFA3FE500066FFA3FE35FF56FFBDFDCD0016FFB5FDD006CFFBAFE770019
FFAFFE830020FFB1FE8E0032FFB3FE970034FFB6FE94FF8FFBAFEA20028FFBBFEAC0027FFBDFEB00025FFBFFEB1002FFFC1FEB70027FFC3FEBB0025FFC5FEB90031FFC6FEB
F002FFFC8FED1000FFCAFED6000DFCCFED40023FFCDFED80024FFCFEDA0026FFD0FEE00024FFD1FEE80022FFD3FEE2002CFFD4FEED0028FFD5FEE0028FFD6FE
F10027FFD8FEF70025FFD9FEFC0024FFDAFEFD0022FFDBFF050028FFDDFFD0023FFDEFF180021FFDFFF030021FFE0FF020027FFE1FF150021FFE2FF190
023FFE3FF1E0024FFE4FF220023FFE5FF260022FFE6FF260020FFE6FF2C0023FFE7FF310022FFE8FF360020FFE9FF37001DFFEAF3C001CFEAF
F3F001EFFEBFF43001EFFECCFF46001EFFEC

- 0001 - IO element count
- 0101 - IO element ID 257 (dec)
- 0258 - Data length 600 (dec)

Accelerometer data:

1'st sample:

- 0234 - X axis data 564 mG (dec)
- 001F - Y axis data 31 mG (dec)
- 0027 - Z axis data 39 mG (dec)

2'nd sample:

- 0269 - X axis data 617 mG (dec)
- 003A - Y axis data 58 mG (dec)
- 0035 - Z axis data 53 mG (dec)

3'rd sample:

- 026C - X axis data 620 mG (dec)
- 002A - Y axis data 42 mG (dec)
- 002B - Z axis data 43 mG (dec)

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N'th sample:

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