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Transport Telematics

Eco-Drive Parameters Description

2018/05
VILNIUS

Contents

1 Preface

1.1 Introduction

The aim of this solution is to teach drivers fuel efficient driving and to cut transport operation costs. The main principles of Eco-Drive are to drive safely and avoid wasting fuel. This also helps to reduce damage to the vehicle, environment and people's health.

A variety of reports on fuel efficient driving allow to analyse drivers' performance and improve where needed. The data to enable Eco-Drive can be gathered from vehicles on-board computer, accelerometer and GPS. Data is sorted into a number of different Eco-Drive parameters, which are then processed in real time transport monitoring and control system TrustTrack, which provides you with the insights on how to reduce and optimize fuel consumption.

1.2 Document application

This feature description applies to FM devices with the latest firmware version in them.

You can get the latest firmware and configurator from our documentation website: doc.ruptela.lt

1.3 Legal notice

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1.4 Document change log

Date	Version	Change details
2015-12-03	1.0	Initial draft.
2016-02-22	1.1	Various description improvements.
2016-06-22	1.2	New data sources (GPS+CAN and GPS+OBD) included in the description.
2016-10-10	1.3	Added a description for engine's state detection logic.
2016-11-24	1.4	Changes related with the "Alternative data source selection" check box.
2016-12-07	1.5	Corrections in the "Engine state detection logic" chapter.
2017-01-06	1.6	Voltage ranges defined in the "Engine state detection logic" chapter.
2017-02-13	1.7	Custom engine state description in the "Engine state detection logic" chapter.
2017-04-14	1.8	Option to ignore RPM values when fuel rate is below defined limit; "ECO braking counter" and "ECO extreme and harsh brake counter" parameters calculation mechanism description improved.
2017-05-17	1.9	New "ECO RPM in red band distance" IO parameter; Ignore over speeding, when the fuel rate is below the set limit.
2017-08-23	1.10	Review of the "ECO driving idling event" description.
2017-09-18	1.11	Added a new "ECO engine braking distance" parameter.
2017-12-08	1.12	Added description for the "Calculate data only when engine is on" function.
2018-05-29	1.13	New extended parameters added: "ECO stops counter", "ECO braking distance", "ECO braking duration", "ECO retarder duration".

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2 Eco-Drive parameters compatibility with FM devices

Parameter	FM-Tco3 FM-Tco4 HCV FM-Tco4 LCV	FM-Pro3/4	FM-Eco3	FM-Basic FM-Eco4/UBI FM-Eco4 light FM-Eco4 S	FM-Plug4
ECO max speed	●	●	●	●	●
ECO overspeeding timer	●	●	●	●	●
ECO RPM in red band timer	●	●			●
ECO max RPM	●	●			●
ECO brake counter	●	●	●	●	●
ECO extreme and harsh brake counter	●	●	●	●	●
ECO harsh acceleration counter	●	●	●	●	●
ECO idling timer	●	●	●	●	●
ECO cruise control timer	●	●			
ECO engine on timer	●	●	●	●	●
ECO RPM in green band distance	●	●			●
ECO RPM in red band distance[2]	●	●			
ECO normal speed distance	●	●	●	●	●
ECO cruise control distance	●	●			
ECO cornering counter	●	●	●	●	●
ECO idling event	●	●	●	●	●
ECO Absolute idling time	●	●	●	●	●
ECO braking value[1]	●	●	●	●	●
ECO acceleration value[1]	●	●	●	●	●
ECO cornering value[1]	●	●	●	●	●

[1] These parameters are available only for 4th generation devices. To enable them, you must use v1.1 protocol version.

[2] This parameter is available only for FM-Tco4 HCV / HCV 3G and FM-Pro4 / Pro4 3G devices. To enable this parameter, you must use v1.1 protocol version.

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3 Engine state detection logic

Engine state detection logic can be influenced by:
- FM device type.
- Current settings in FM4 configurator's "Data collection" section, "Engine" field.
- Current settings in FM4 configurator's "Eco-drive" section, "Custom engine source" field.
- Current settings in FM4 configurator's "Eco-drive" section, "Data source" field.
- Firmware version currently present in the FM device.

> ## Note
> It is particularly important to pay extra attention to the "engine source" configuration since it can be done in two different places. Possible configuration variants:
> - Engine source is configured only in "Data collection" section, "Engine" field.
> - Engine source is configured in "Data collection" section, "Engine" field and in "Eco-drive" section, "Custom engine source" field.

3.1 Detection based on "Engine" field settings in "Data collection" section

Engine source is configured only in "Data collection" section, "Engine" field and "Eco-drive" section, "Custom engine source" field is disabled. This means that the same engine state detection logic is used for data sending, entering/exiting sleep modes, eco drive parameter calculation and other processes. Possible configurations and their effect is described below.

Tables below define how engine state will be detected. Description for used abbreviations:
- **Always** – engine is considered to be always on.
- **RPM** – engine is considered to be on, when the FM device receives RPM data from the data source.
- **DIN4 + Voltage*** - engine is considered to be on, when the battery voltage level is within acceptable limits and signal level in the DIN4 is high.
- **Movement + Voltage*** - engine is considered to be on, when the battery voltage level is within acceptable limits and the built-in movement sensor detects motion.
- **Custom** - engine is considered to be on, when conditions defined in the "Custom Ignition" configuration are satisfied.
- **Movement + Voltage* / Power pin** - engine is considered to be on, when the battery voltage level is within acceptable limits and the built-in movement sensor detects motion, or when the voltage level in OBD pin16 is within acceptable limits.
- **Voltage* / Power pin** - engine is considered to be on, when the battery voltage level is within acceptable limits, or when the voltage level in OBD pin16 is within acceptable limits.
- **RPM / DIN4+Voltage*** - engine is considered to be on, when the FM device receives RPM data from the data source, or when the battery voltage level is within acceptable limits and signal level in the DIN4 is high.
- **RPM / Movement + Voltage*** - engine is considered to be on, when the FM device receives RPM data from the data source, or when the battery voltage level is within acceptable limits and the built-in movement sensor detects motion.
- **RPM / Custom** - engine is considered to be on, when the FM device receives RPM data from the data source, or when conditions defined in the "Custom Ignition" configuration are satisfied.
- **N/A** – this combination is not possible.

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*Voltage ranges:

Eco and Pro family devices	Engine ON condition	Engine OFF condition
Voltage range for light vehicles	Voltage > 13000 mV	Voltage < 13000 mV
Voltage range for trucks	Voltage > 26000 mV	Voltage < 18000 mV

FM-Plug4 / 4+ device	Engine ON condition	Engine OFF condition
Voltage range for light vehicles	Voltage > 13200 mV	Voltage < 12800 mV
Voltage range for trucks	Voltage > 27000 mV	Voltage < 12600 mV

"Eco-Drive - Data source" and "Data collection – Engine" configuration relations tables

Data source / "Data collection" - Engine	FM-Eco4 / UBI; FM-Eco4 light	FM-Plug4 / 4+	
	ACC / GPS	ACC / GPS	OBD
Always on	Always	Always	Always
Ignition(DIN4)	DIN4 + Voltage	N/A	N/A
Mov Sensor	Movement + Voltage	Movement + Voltage / Power pin	RPM
Custom	Custom	N/A	N/A
Power voltage	N/A	Voltage / Power pin	RPM

Data source / "Data collection" - Engine	FM-Pro4 / Pro4 3G		
	ACC / GPS	CAN / CAN+ACC / CAN+GPS	CAN + Alternative data source selection
Always on	Always	Always	Always
Ignition(DIN4)	DIN4 + Voltage	RPM	RPM / DIN4+Voltage
Mov Sensor	Movement+Voltage	RPM	RPM / Movement+Voltage
Custom	Custom	RPM	RPM / Custom
Power voltage	N/A	N/A	N/A

Data source / "Data collection" - Engine	FM-Tco4 / HCV 3G; FM-Tco4 LCV / LCV 3G		
	ACC / GPS	CAN / CAN+ACC / CAN+GPS OBD / OBD+ACC / OBD+GPS	CAN + Alternative data source selection
Always on	Always	Always	Always
Ignition(DIN4)	DIN4 + Voltage	RPM	RPM / DIN4+Voltage
Mov Sensor	Movement+Voltage	RPM	RPM / Movement+Voltage
Custom	Custom	RPM	RPM / Custom
Power voltage	N/A	N/A	N/A

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3.2 Detection based on "Custom engine source" field settings in "Eco-drive" section

Engine source is configured in "Data collection" section, "Engine" field and in "Eco-drive" section, "Custom engine source" field. This means that the engine state detection logic used for data sending, entering/exiting sleep mode and other processes is not the same as the engine state detection logic used for calculating eco drive parameter values.

> **Note**
> When "Custom engine source" in "Eco-drive" section is configured, "Alternative data source selection" and "Data source" field values have no effect on engine state detection logic used for calculating eco drive parameter values.

3.2.1 Custom engine source – feature description

Engine state used for calculating eco-drive parameter values is based on the state of other IO parameters. List of them is available below:

1. DIN1
2. DIN2
3. DIN3
4. DIN4
5. Mov sensor
6. CAN ignition (from CAN)
7. Power supply voltage
8. RPM (from CAN)

During custom engine source configuration, a specific set of parameters is combined together. Combination means that a certain number of them have to be selected. This is done in configurator. More information on configuration procedure available in next chapter.

These parameters can be linked with a logical "AND" operation or a logical "OR" operation. User decides which should be used. By default, "AND" is used.

AND

This means that conditions for all selected parameters have to be satisfied. Only then the ignition will be considered to be on.

OR

Logical "OR" operation means that conditions for at least one of the selected parameters have to be satisfied. Only then the ignition will be considered to be on.

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3.2.2 Custom engine source – configuration

Follow these steps to configure your FM Device:
1. In the configurator choose your device.
2. In the global settings, in the **Eco-drive** section click on the "Options" button.
3. Eco-drive settings window will be displayed. Find a Custom engine source check box and put a tick on it. "Customize" button will be enabled on the right.
4. "Customize" button opens up a new popup window. Custom engine ignition pickup configuration for eco-drive function is done here.
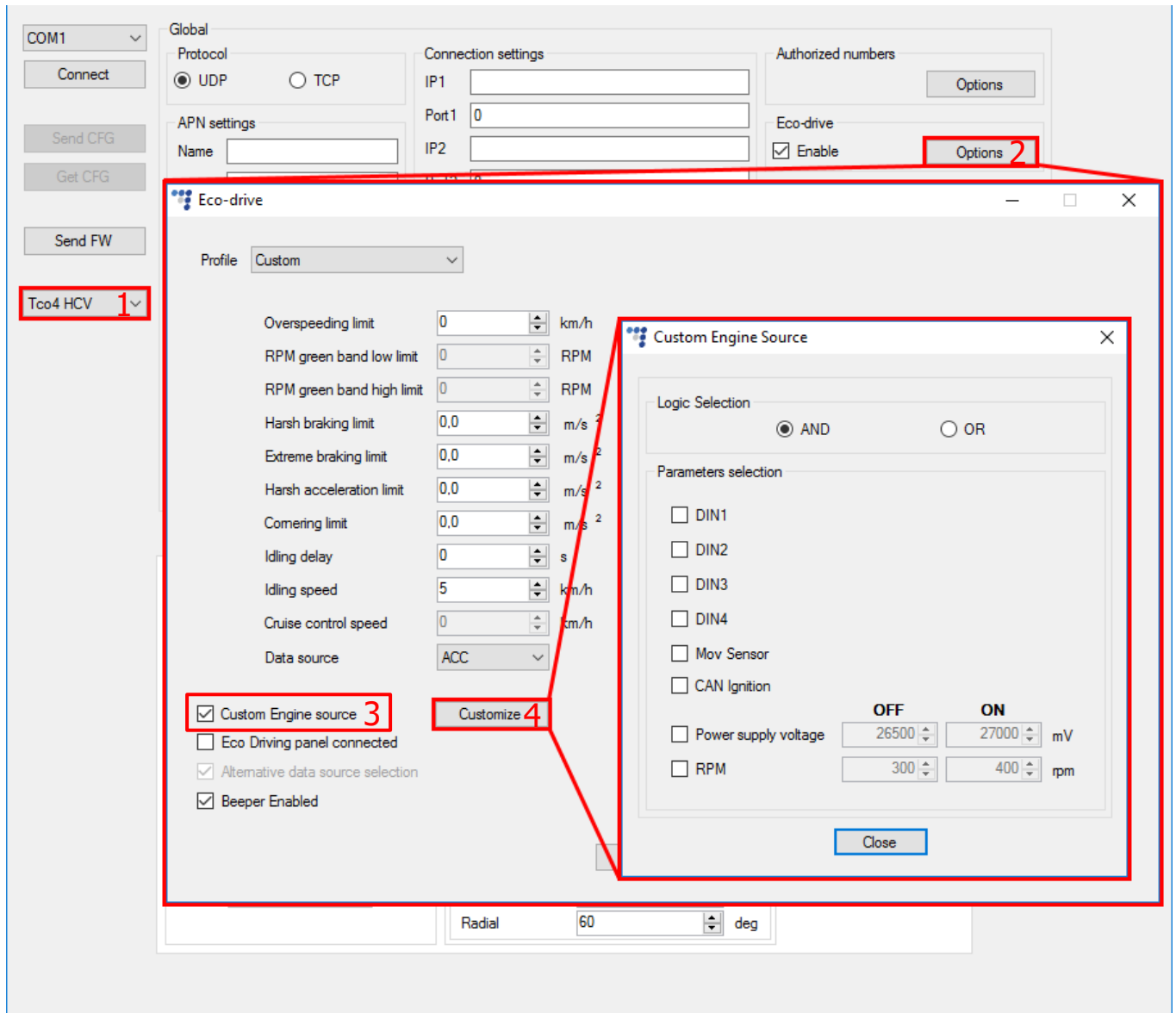
Notes
- Custom engine source functionality also depends on interface configuration, which is done in the "IO settings" window, **Interfaces** section. **RPM** and **CAN ignition** sections in "Custom Engine source" window will be greyed out, if **CAN**: FMS/HCV/LCV is not enabled or if "Deep sleep" mode is activated in the configurator.
- Note that some FM devices do not have CAN interfaces.

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Some data sources for parameters have an option to be enabled/disabled, other sources also have configurable threshold values. Detailed description available below.

5. **Logic selection** – For the custom engine source configuration a specific set of parameters have to be combined together. Available parameters are listed in the previous chapter. Combination means that a certain number of them have to be selected. These parameters can be linked with a logical "AND" operation or a logical "OR" operation.
6. **DIN1**, **DIN2**, **DIN3** and **DIN4** – Engine ignition detection based on digital inputs states.
7. **Mov Sensor** – Detect vehicle movement and consider engine to be on. Movement sensor sensitivity is configurable in the **Global** settings section.
8. **CAN ignition** – In some cases CANbus data obtained from specific vehicles contain information about vehicle's ignition state. When CAN interface on the FM device is set into the FMS/HCV/LCV mode, this information could be read and used as custom ignition parameter.
9. **Power supply voltage**
    ● **ON -** Voltage level in mV. Range from 0 mV to 65535 mV. When power supply voltage is greater than the value provided by the user this condition is considered to be "TRUE".
    ● **OFF** - Voltage level in mV. Value must be lower than voltage entered in the ON column. Range from 0 mV to 65534 mV. When power supply voltage is lower than the value provided by the user this condition is considered to be "FALSE".
10. **RPM** - RPM's value, obtained from CAN data.
    ● **ON** - Range from 0 rpm to 8031 rpm. When RPM value is greater than the value provided by the user this condition is considered to be "TRUE".
    ● **OFF** - Range from 0 rpm to 8030 rpm. Value must be lower than RPM number entered in the ON column. When RPM value is lower than the value provided by the user this condition is considered to be "FALSE".

Note

If the device receives an error value for RPM data from CAN source, then the Boolean value for this parameters will be considered to be "FALSE".

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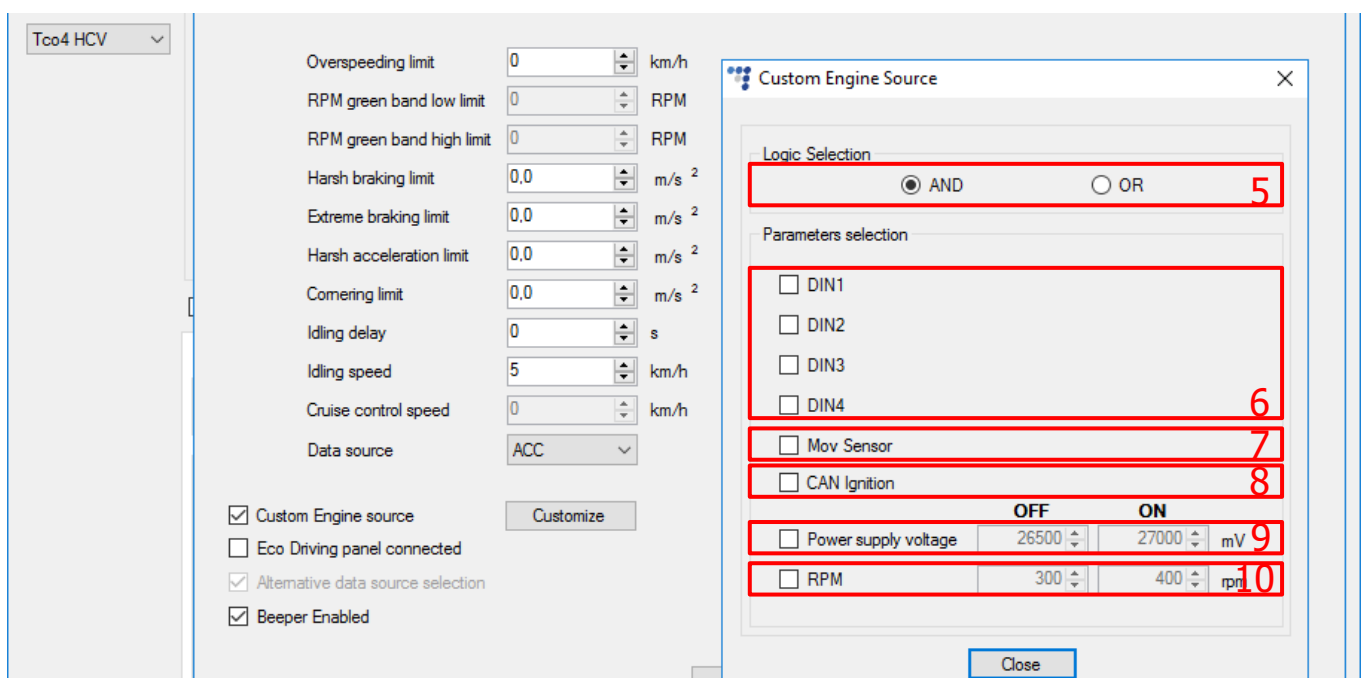
3.2.3 Custom engine source – operation examples

Case 1

"AND" logic is used to combine custom engine detection parameters. Ignition detection is based on **DIN4** state and engine **RPM** value. Other parameters are not enabled.
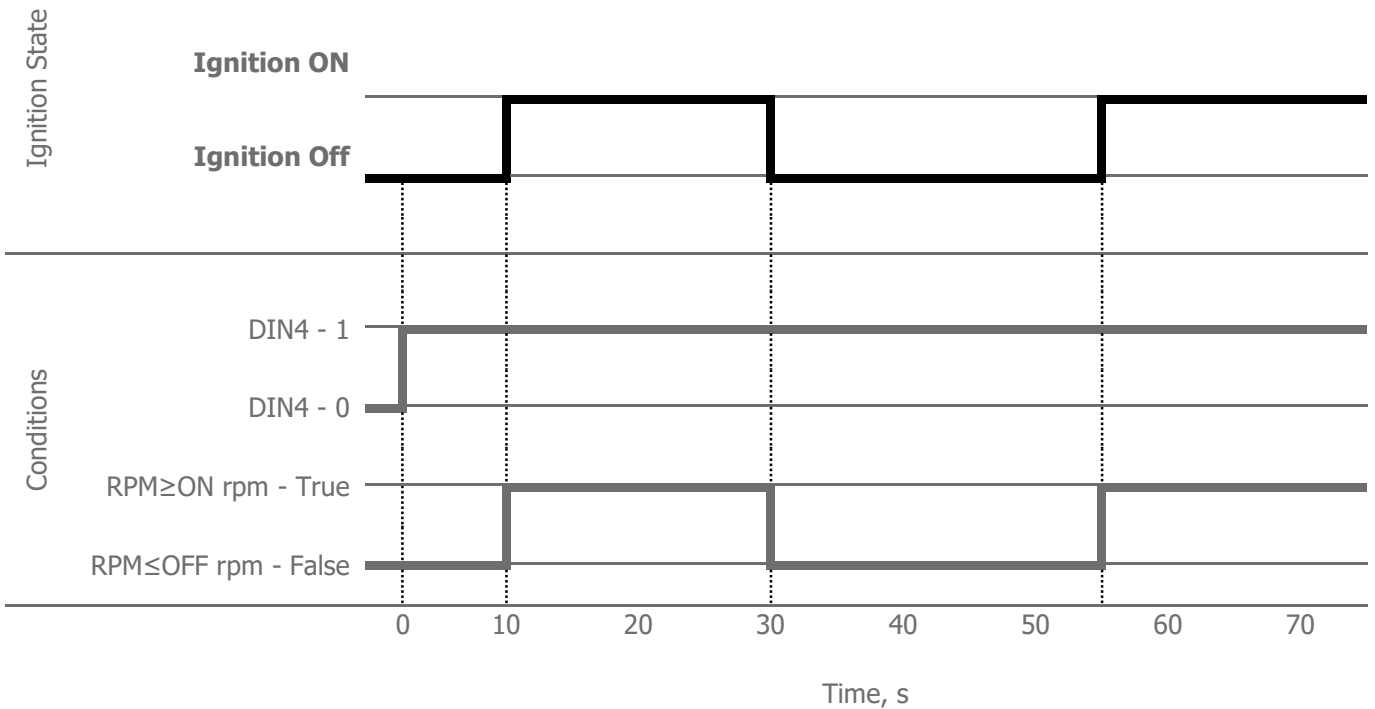
Case 2

"OR" logic is used to combine custom engine parameters. Ignition detection is based on **DIN4** state and engine **RPM** value. Other parameters are not enabled.
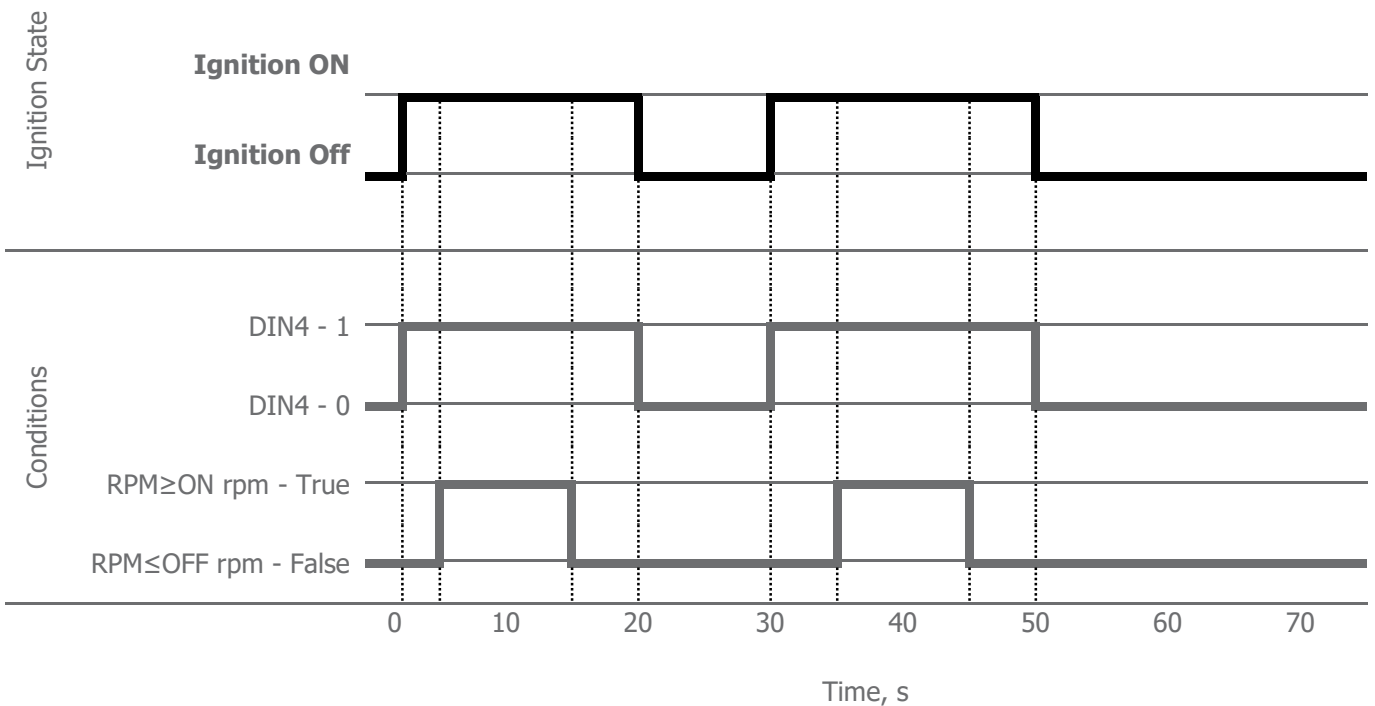
3.2.4 Calculate data only when engine is on

Independently of the configuration or which data source is selected, it is highly recommended to enable the "Calculate data only when engine is on" function.
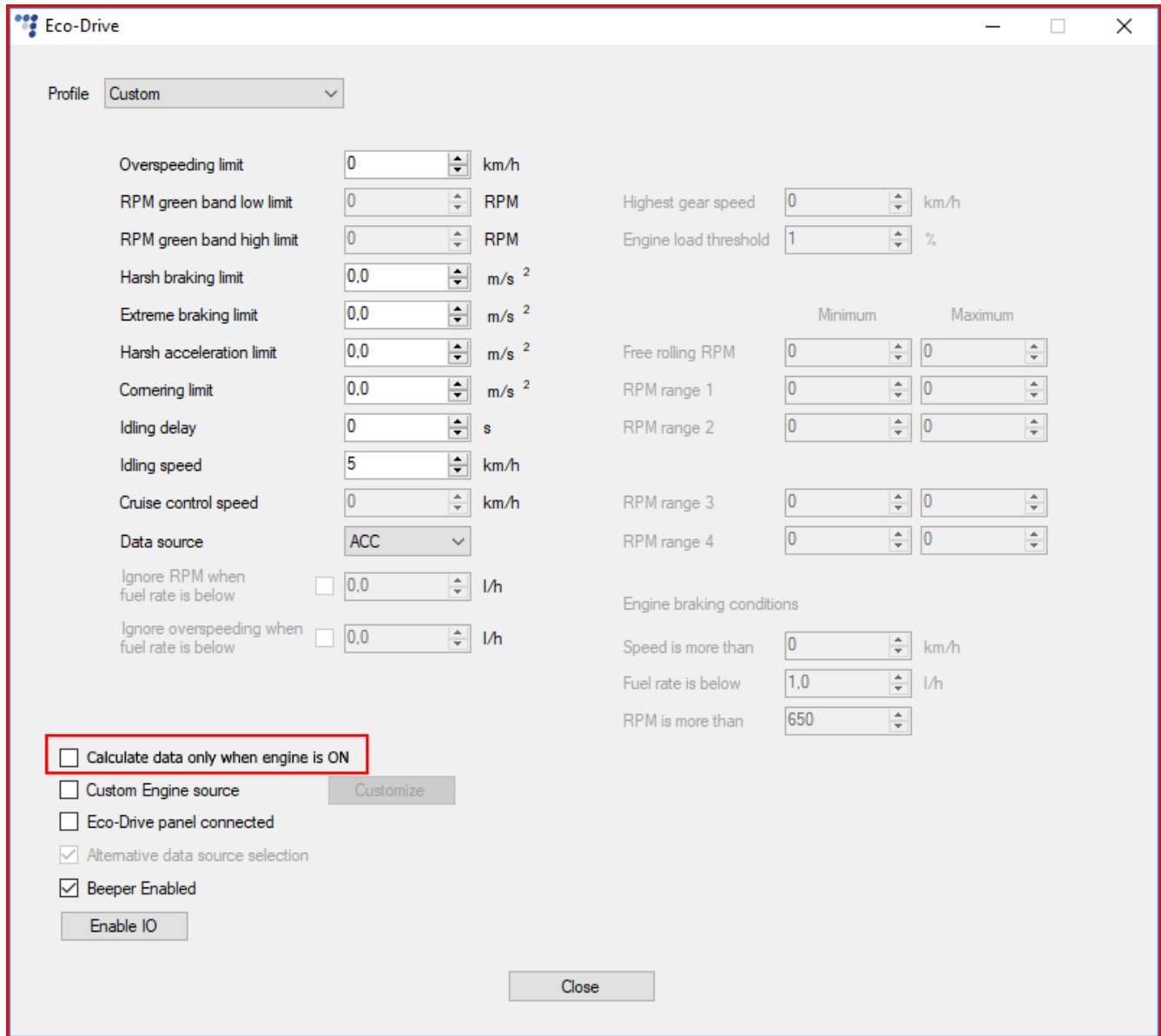
Enabling this function will prevent calculation of false values and generation of false records when ignition is off and the vehicle is standing.

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4 Ignore RPM values when fuel rate is below defined limit

Description

Ignore RPM values when fuel rate is below defined limit is self-explanatory. Engine RPMs can be set to be ignored in cases when fuel rate is lower than the value set by the user. This functionality was developed to improve ECO drive tracking in cases when drivers are engine braking instead of actually using brakes. Engine braking occurs because of traffic regulations in many countries, which require truck drivers to always drive with an engaged gear, which in turn provides a certain amount of engine braking.

Ignore RPM works only with these 4th generation devices:
- FM-Pro4 / Pro4 3G
- FM-Tco4 LCV / LCV 3G
- FM-Tco4 HCV / HCV 3G

Data source

This function works only with these data sources:
CAN, CAN + ACC, CAN + GPS

Ignore RPM when fuel rate is below set value function is enabled and configured in the FM device configurator - ECO driving setting window. Here the user can enable the function (disabled by default). Fuel rate value range is from 0,0 to 25,0 l/h.

Data from the following parameters must be available for this function to work:

ID	Name	Name in configurator	Size, B	Value	IO factor
116	CANBUS_fuel_rate	CAN fuel rate	2	0 - 64255	0,05 L/h per Bit
197	CANBUS_RPM	CAN engine speed	2	0 - 65535	0,125 RPM /Bit

When fuel rate is below configured limit, values will not be counted for the following IO parameters:

ID	Name	Name in configurator	Size, B	Value	IO factor
132	ECO_rpm_red	ECO RPM in red band timer	2	0 - 65535	1 s/Bit
539	ECO_RPM_in_red_band_distance	ECO RPM in red band distance	2	0 - 65535	5 m/Bit

When the previously mentioned IO parameters are ignored, the FM device recognizes the distance travelled during that time as ECO RPM in green band distance:

ID	Name	Name in configurator	Size, B	Value	IO factor
140	ECO_rpm_green	ECO RPM in green band distance	4	0-4294967295	1 m/Bit

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5 Ignore over speeding when fuel rate is below defined limit

Description

Vehicle's over speeding can be ignored in cases, when fuel rate is lower, than the value set by the user. This functionality was developed to improve ECO drive tracking in cases, when drivers are engine braking instead of actually using brakes. Engine braking occurs because of traffic regulations in many countries, which require truck drivers to always drive with an engaged gear, which in turn provides a certain amount of engine braking.

Ignore overspeeding works only with these 4th generation devices:
- FM-Pro4 / Pro4 3G
- FM-Tco4 LCV / LCV 3G
- FM-Tco4 HCV / HCV 3G

Data source

This function works only with these data sources: CAN, CAN + ACC, CAN + GPS

Ignore over speeding, when fuel rate is below set limit can be enabled and configured in the FM device configurator - ECO driving settings window. Function is disabled by default. Fuel rate value range is from 0,0 to 25,0 l/h.

Data from the following parameters must be available for this function to work:

ID	Name	Name in configurator	Size, B	Value	IO factor
92	CANBUS HRFC	CAN high resolution engine total fuel used	4	0 - 4211081215	0,001 L per Bit
114	CANBUS Distance	CAN high resolution total vehicle distance	4	0 - 4211081215	5 m per Bit
116	CANBUS_fuel_rate	CAN fuel rate	2	0 - 64255	0,05 L/h per Bit
210	CANBUS WBSpeed	CAN wheel based speed	2	0 - 65535	1/256 km/h per Bit

When fuel rate is below configured limit, values will not be counted for the following IO parameters:

ID	Name	Name in configurator	Size, B	Value	IO factor
131	ECO_overspeed	ECO overspeeding timer	2	0 - 65535	1 s/Bit
544	ECO_overspeeding_distance	ECO overspeeding distance	2	0 - 65535	5 m/Bit
545	ECO_overspeeding_fuel_used	ECO overspeeding fuel used	2	0 - 65535	1 ml/Bit

When the previously mentioned IO parameters are ignored, the FM device recognizes the distance travelled during that time as ECO normal speed distance:

ID	Name	Name in configurator	Size, B	Value	IO factor
141	ECO_normal_speed	ECO normal speed distance	4	0-4294967295	1 m/Bit

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6 ECO Driving parameters

In 3rd generation devices, when the "extended ECO-drive parameters" option is not used, only the common ECO-drive parameters are available. In this case, in the "IO settings" window you will see ungrouped parameters.

In 4th generation devices, the common ECO-drive parameters and extended ECO-drive parameters have different FMIO ID numbers, therefore they can be configured independently.

Common ECO-drive parameters are described in sections 6.1 - 6.20.

6.1 ECO max speed

ID	Name	Name in configurator	Size, B	Value	IO factor
130	ECO_max_speed	ECO max speed	1	0 - 255	1 km/h / Bit

Description

Maximum speed value during overall data period. Parameter value is expressed in km/h.

Data source

Information from several different data sources can be used to calculate value for this parameter:
1. CAN (CAN+ACC, CAN+GPS) – Parameter value is calculated from speed values that were taken from CAN data. If data from CAN is not available, but "Alternative data source selection" check box is enabled, then speed value from GPS data is used.
2. OBD (OBD+ACC, OBD+GPS) – Parameter value is calculated from speed values that were taken from OBD data. If data from OBD is not available, but "Alternative data source selection" check box is enabled, then speed value from GPS data is used.
3. Accelerometer - Parameter value is calculated from speed values that were taken from GPS data.
4. GPS - Parameter value is calculated from speed values that were taken from GPS data. (When information for Eco drive parameters is obtained from GPS data, they will be counted as valid only when HDOP level is lower or equal to 1.5).

6.2 ECO overspeeding timer

ID	Name	Name in configurator	Size, B	Value	IO factor
131	ECO_overspeed	ECO overspeeding timer	2	0 - 65535	1 s/Bit

Description

Duration, when the vehicle was over speeding (speed limit is configurable). During overall data period. Parameter value is expressed in seconds.

Data source

Information from several different data sources can be used to calculate value for this parameter:
1. CAN (CAN+ACC, CAN+GPS) – Parameter value is calculated from speed values that were taken from CAN data. If data from CAN is not available, but "Alternative data source selection" check box is enabled, then speed value from GPS data is used.
2. OBD (OBD+ACC, OBD+GPS) – Parameter value is calculated from speed values that were taken from OBD data. If data from OBD is not available, but "Alternative data source selection" check box is enabled, then speed value from GPS data is used.

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3. Accelerometer - Parameter value is calculated from speed values that were taken from GPS data.
4. GPS - Parameter value is calculated from speed values that were taken from GPS data. (When information for Eco drive parameters is obtained from GPS data, they will be counted as valid only when HDOP level is lower or equal to 1.5).

6.3 ECO RPM in red band timer

ID	Name	Name in configurator	Size, B	Value	IO factor
132	ECO_rpm_red	ECO RPM in red band timer	2	0 - 65535	1 s/Bit

Description

Duration, when the RPM value was out of the acceptable range (RPM range is configurable). During overall data period. Parameter value is expressed in seconds.

Data source

Information from several different data sources can be used to calculate value for this parameter:
1. CAN (CAN+ACC, CAN+GPS) - Parameter value is calculated after analysing RPM values that were taken from CAN data.
2. OBD (OBD+ACC, OBD+GPS) - Parameter value is calculated after analysing RPM values that were taken from OBD data.
3. Accelerometer – Parameter unavailable.
4. GPS - Parameter unavailable.

6.4 ECO max RPM

ID	Name	Name in configurator	Size, B	Value	IO factor
133	ECO_max_rpm	ECO max RPM	2	0 - 65535	1 RPM/min / Bit

Description

Maximum RPM value during overall data period.

Data source

Information from several different data sources can be used to calculate value for this parameter:
1. CAN (CAN+ACC, CAN+GPS) - Parameter value is calculated after analysing RPM values that were taken from CAN data.
2. OBD (OBD+ACC, OBD+GPS) - Parameter value is calculated after analysing RPM values that were taken from OBD data.
3. Accelerometer – Parameter unavailable.
4. GPS - Parameter unavailable.

6.5 ECO braking counter

ID	Name	Name in configurator	Size, B	Value	IO factor
134	ECO_braking events	ECO brake counter	1	0 - 255	1 event/Bit

Description

Number of stops since the last record. Value is expressed as number of events.

Data source

Information from several different data sources can be used to calculate value for this parameter:

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1. CAN (CAN+ACC, CAN+GPS) – Parameter value is calculated from speed and brake pedal position values that were taken from CAN data. This is valid for FMS, LCV and HCV modes.
    a. If speed data from CAN is not available (FF values or no data at all), but "Alternative data source selection" check box is enabled, then speed value from GPS data is used. Brake pedal position values are still taken from CAN data.
    b. If speed data from CAN is available, but brake pedal position values from CAN are not available (FF values or no data at all), then "ECO braking counter" parameter will not be counted at all. This is true even if "Alternative data source selection" checkbox is enabled.
    c. If speed and brake pedal position data from CAN is not available (FF values or no data at all), then "ECO braking counter" parameter will not be counted at all. This is true even if "Alternative data source selection" checkbox is enabled.

2. OBD (OBD+ACC, OBD+GPS) – Parameter value is calculated from speed values that were taken from OBD data. If data from OBD is not available, but "Alternative data source selection" check box is enabled, then speed value from GPS data is used.
3. Accelerometer - Parameter value is calculated from detected acceleration.
4. GPS - Parameter value is calculated from speed values that were taken from GPS data. (When information for Eco drive parameters is obtained from GPS data, they will be counted as valid only when HDOP level is lower or equal to 1.5).

Methodology
1. Braking events are detected after analysing acceleration and brake pedal position data.
2. Information from several different data sources can be used to gather acceleration data. Data source is determined in the configuration. It can be CAN, OBD, Accelerometer and GPS data.
3. Acceleration needed to register a braking event is -0,5 m/s^2.
4. Braking event will be registered, breaking acceleration value is lower than -0,5 m/s^2.
5. If one braking event was registered, then the next such event can be registered only after the acceleration value increases above the -0,4 m/s^2 limit.

6.6 ECO extreme harsh brake counter

ID	Name	Name in configurator	Size, B	Value	IO factor
135	ECO_ext_hrsh_ braking	ECO extreme and harsh brake counter	1	0 - 255	1 event/Bit

Description
Extreme braking – number of events stored in the first 4 bits. This number represents extreme braking events registered since the last record. Extreme braking event is registered, when braking acceleration exceeds configured limit. Extreme braking limit is set in the ECO drive section in the device configuration.

Harsh braking - number of events stored in the last 4 bits. This number represents harsh braking events registered since the last record. Harsh braking event is registered, when braking acceleration exceeds configured limit. Harsh braking limit is set in the ECO drive section in the device configuration.

Data source
Information from several different data sources can be used to calculate value for this parameter:
1. CAN (CAN+ACC, CAN+GPS) – Parameter value is calculated from speed and brake pedal position values that were taken from CAN data. This is valid for FMS, LCV and HCV modes.

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a. If speed data from CAN is not available (FF values or no data at all), but "Alternative data source selection" check box is enabled, then speed value from GPS data is used. Brake pedal position values are still taken from CAN data.
b. If speed data from CAN is available, but brake pedal position values from CAN are not available (FF values or no data at all), then "ECO extreme and harsh brake counter" parameter will not be counted at all. This is true even if "Alternative data source selection" checkbox is enabled.
c. If speed and brake pedal position data from CAN is not available (FF values or no data at all), then "ECO extreme and harsh brake counter" parameter will not be counted at all. This is true even if "Alternative data source selection" checkbox is enabled.

2. OBD (OBD+ACC, OBD+GPS) – Parameter value is calculated from speed values that were taken from OBD data. If data from OBD is not available, but "Alternative data source selection" check box is enabled, then speed value from GPS data is used.
3. Accelerometer - Parameter value is calculated from detected acceleration.
4. GPS - Parameter value is calculated from speed values that were taken from GPS data. (When information for Eco drive parameters is obtained from GPS data, they will be counted as valid only when HDOP level is lower or equal to 1.5).

Methodology for "harsh" braking detection
1. Breaking events are detected after analysing acceleration and brake pedal position data.
2. Information from several different data sources can be used to gather acceleration data. Data source is determined in the configuration. It can be CAN, OBD, Accelerometer and GPS data.
3. Acceleration needed to register a harsh braking event is -1 m/s^2.
4. Harsh braking event will be registered, when the acceleration value is lower than -1 m/s^2.
5. If one harsh braking event was registered, then the next such event can be registered only after the acceleration value increases above the -1 m/s^2 limit.

Methodology for "extreme" braking detection
1. Breaking events are detected after analysing acceleration and brake pedal position data.
2. Information from several different data sources can be used to gather acceleration data. Data source is determined in the configuration. It can be CAN, OBD, Accelerometer and GPS data.
3. Acceleration needed to register an extreme braking event is -2 m/s^2.
4. Extreme braking event will be registered, when the acceleration value is below -2 m/s^2 limit.
5. If one extreme braking event was registered, then the next such event can be registered only after the acceleration value increases above the -2 m/s^2 limit.

6.7 ECO harsh acceleration counter

ID	Name	Name in configurator	Size, B	Value	IO factor
136	ECO harsh acceleration counter	ECO harsh acceleration counter	1	0 - 255	1 event/Bit

Description
Number of harsh acceleration events registered since the last record. Harsh acceleration event is registered, when the acceleration exceeds configured limit. Harsh acceleration limit is set in the ECO drive section in the device configuration.

Data source
Information from several different data sources can be used to calculate value for this parameter:

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1. CAN (CAN+ACC, CAN+GPS) – Parameter value is calculated from speed values that were taken from CAN data. If data from CAN is not available, but "Alternative data source selection" check box is enabled, then speed value from GPS data is used.
2. OBD (OBD+ACC, OBD+GPS) – Parameter value is calculated from speed values that were taken from OBD data. If data from OBD is not available, but "Alternative data source selection" check box is enabled, then speed value from GPS data is used.
3. Accelerometer - Parameter value is calculated from detected acceleration.
4. GPS - Parameter value is calculated from speed values that were taken from GPS data. (When information for Eco drive parameters is obtained from GPS data, they will be counted as valid only when HDOP level is lower or equal to 1.5).

6.8 ECO idling time

ID	Name	Name in configurator	Size, B	Value	IO factor
137	ECO_idling_time	ECO idling timer	2	0 - 65535	1 s/Bit

Description
Idling duration - How long vehicle's engine was on, but it remained stationary. Device counts idling time, when the engine is on for a certain duration (idling delay) and vehicle's speed is lower than the threshold (idling speed). If time spent with engine on is shorter than the configured limit, then this time will not be added to the idling duration. If time spent with engine on is longer than the configured limit, then this time will be added to the idling duration.

Data source
Information from several different data sources can be used to calculate value for this parameter:
1. Engine state detection is based on process described in the "Engine state detection logic" chapter.
2. When information for Eco drive parameters is obtained from GPS data, they will be counted as valid only when HDOP level is lower or equal to 1.5.

6.9 ECO cruise control timer

ID	Name	Name in configurator	Size, B	Value	IO factor
138	ECO_cruise_control	ECO cruise control timer	4B (2B + 2B)	0-65535 (each)	1 s/Bit

Description
Cruise plan – cruise control could be on. The first two bytes show, how much time a vehicle have spent while driving at a certain speed limit or above it (speed limit is configurable). Count starts, if the vehicle successfully maintains its speed at the speed limit or above it for 60 seconds. Parameter value is expressed in seconds.
Cruise fact – cruise control was on. The last two bytes show, how much time a vehicle have spent while driving with cruise control on. Count starts, if the vehicle successfully maintains its speed at the speed limit or above it for 60 seconds (speed limit is configurable). Parameter value is expressed in seconds.

Data source
Information from several different data sources can be used to calculate value for this parameter:
1. CAN (CAN+ACC, CAN+GPS) - Parameter value is calculated after analysing speed and cruise control status values that were taken from CAN data. If speed data from CAN is not available,

but „Alternative data source selection" check box is enabled, then speed value from GPS data is used.
2. OBD (OBD+ACC, OBD+GPS) - Parameter unavailable.
3. Accelerometer – Parameter unavailable.
4. GPS - Parameter unavailable.

6.10 ECO engine on timer

ID	Name	Name in configurator	Size, B	Value	IO factor
139	ECO_engine_on	ECO engine on timer	2	0 - 65535	1 s/Bit

Description

Engine on duration, during overall data period - how much time vehicle spent with its engine turned on. Parameter value is expressed in seconds.

Data source

Information from several different data sources can be used to calculate value for this parameter:
1. Engine state detection is based on process described in the "Engine state detection logic" chapter.
2. When information for Eco drive parameters is obtained from GPS data, they will be counted as valid only when HDOP level is lower or equal to 1.5.

6.11 ECO RPM in green band distance

ID	Name	Name in configurator	Size, B	Value	IO factor
140	ECO_rpm_ green	ECO RPM in green band distance	4	0-4294967295	1 m/Bit

Description

Distance travelled, when the RPM value was in the acceptable range (RPM range is configurable). During overall data period. Parameter value is expressed in meters.

Data source

Information from several different data sources can be used to calculate value for this parameter:
1. CAN (CAN+ACC, CAN+GPS) - Parameter value is calculated after analysing RPM and distance values that were taken from CAN data.
2. OBD (OBD+ACC, OBD+GPS) - Parameter value is calculated after analysing RPM and distance values that were taken from OBD data.
3. Accelerometer – Parameter unavailable.
4. GPS - Parameter unavailable.

6.12 ECO RPM in red band distance

ID	Name	Name in configurator	Size, B	Value	IO factor
539	ECO_RPM_in_red_ band_distance	ECO RPM in red band distance	2	0-65535	5 m/Bit

Description

Distance travelled, when the RPM value was out of the acceptable (green band) range (RPM range is configurable). During overall data period. Parameter value is expressed in meters.

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Data source

Information from several different data sources can be used to calculate value for this parameter:
1. CAN (CAN+ACC, CAN+GPS) - Parameter value is calculated after analysing RPM and distance values that were taken from CAN data.
2. OBD (OBD+ACC, OBD+GPS) - Parameter value is calculated after analysing RPM and distance values that were taken from OBD data.
3. Accelerometer – Parameter unavailable.
4. GPS - Parameter unavailable.

6.13 ECO normal speed distance

ID	Name	Name in configurator	Size, B	Value	IO factor
141	ECO_normal_speed	ECO normal speed distance	4	0-4294967295	1 m/Bit

Description

Distance travelled during overall data period, when vehicle's speed was below the speed limit (speed limit is configurable). Parameter value is expressed in meters.

Data source

Information from several different data sources can be used to calculate value for this parameter:
1. CAN (CAN+ACC, CAN+GPS) - Parameter value is calculated after analysing speed and distance values that were taken from CAN data. If speed data from CAN is not available, but „Alternative data source selection" check box is enabled, then speed value from GPS data is used.
2. OBD (OBD+ACC, OBD+GPS) - Parameter value is calculated after analysing speed and distance values that were taken from OBD data. If speed data from OBD is not available, but „Alternative data source selection" check box is enabled, then speed value from GPS data is used.
3. Accelerometer - Parameter value is calculated from speed and distance values that were taken from GPS data.
4. GPS - Parameter value is calculated from speed and distance values that were taken from GPS data. (When information for Eco drive parameters is obtained from GPS data, they will be counted as valid only when HDOP level is lower or equal to 1.5).

6.14 ECO cruise control distance

ID	Name	Name in configurator	Size, B	Value	IO factor
142	ECO_cruise_control_mileage	ECO cruise control distance	8B (4B + 4B)	0-4294967295 (each)	1 m/Bit

Description

Cruise plan – cruise control could be on. The first two bytes show, how far a vehicle have travelled while driving at a certain speed limit or above it (speed limit is configurable). Count starts, if the vehicle successfully maintains its speed at the speed limit or above it for 60 seconds. Parameter value is expressed in meters.

Cruise fact – cruise control was on. The last two bytes show, how far a vehicle have travelled while driving with cruise control on. Count starts, if the vehicle successfully maintains its speed at the speed limit or above it for 60 seconds (speed limit is configurable). Parameter value is expressed in meters.

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Data source

Information from several different data sources can be used to calculate value for this parameter:

1. CAN (CAN+ACC, CAN+GPS) - Parameter value is calculated after analysing distance and cruise control status values that were taken from CAN data.
2. OBD (OBD+ACC, OBD+GPS) - Parameter unavailable.
3. Accelerometer – Parameter unavailable.
4. GPS - Parameter unavailable.

6.15 ECO cornering counter

ID	Name	Name in configurator	Size, B	Value	IO factor
143	ECO_cornering	ECO cornering counter	1	1 - 255	1 event/Bit

Description

Number of harsh cornering events registered since the last record. Cornering event is registered, when the cornering acceleration exceeds configured limit. Cornering limit is set in the ECO drive section in the device configuration.

Data source

Information from several different data sources can be used to calculate value for this parameter:

1. CAN (CAN+ACC, CAN+GPS)*
   a. If only CAN source is used, then parameter unavailable.
   b. If CAN+ACC source is used, then parameter value is calculated from detected acceleration.
   c. If CAN+GPS source is used and "Alternative data source selection" check box is enabled, parameter value is calculated from GPS data.

2. OBD (OBD+ACC, OBD+GPS)*
   a. If only OBD source is used, then parameter unavailable.
   b. If OBD+ACC source is used, then parameter value is calculated from detected acceleration.
   c. If OBD+GPS source is used and "Alternative data source selection" check box is enabled, parameter value is calculated from GPS data.

3. ACC - Parameter value is calculated from detected acceleration.
4. GPS - Parameter value is calculated from GPS data. (When information for Eco drive parameters is obtained from GPS data, they will be counted as valid only when HDOP level is lower or equal to 1.5).

*Firmware versions that support these new data sources can be identified by analysing device firmware change log file.

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6.16 ECO idling event

ID	Name	Name in configurator	Size, B	Value	IO factor
169	ECO_idling_ state	ECO idling event	1	0-1	1 event/Bit

Description

Parameter defines whether the vehicle is idling or not. Device registers the idling event, when the engine is on for a certain duration (idling delay) and vehicle's speed is lower than the threshold (idling speed). Parameters are configurable. It is recommended to set this IO parameter **Event On** – **Change** or **Hysteresis**, so the device will generate a record every time the idling state changes.

Data source

Information from several different data sources can be used to calculate value for this parameter:
1. Engine state detection is based on process described in the "Engine state detection logic" chapter.
2. When information for Eco drive parameters is obtained from GPS data, they will be counted as valid only when HDOP level is lower or equal to 1.5.

6.17 ECO Absolute idling time

ID	Name	Name in configurator	Size, B	Value	IO factor
175	ECO_absolute_ idling_time	ECO Absolute idling time	4	0 - 4294967295	1 s/Bit

Description

Absolute idling time calculation uses the same logic, which was described in the "6.8 ECO idling time" chapter.

Value of this parameter expresses a sum of all time periods, when this vehicle was idling. Count begins after device configuration and its connection to the power supply source.

6.18 ECO braking value

ID	Name	Name in configurator	Size, B	Value	IO factor
402	ECO_braking_ value	ECO braking value	2	0 - 65535	0,01 m/s^2 / Bit

Description

Acceleration detected during a breaking event.

Data source

Information from several different data sources can be used to calculate value for this parameter:
1. CAN (CAN+ACC, CAN+GPS)*
   a. If only CAN source is used, then parameter value is calculated from speed values that were taken from CAN data.
   b. If CAN+ACC source is used, then parameter value is calculated from detected acceleration.

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c. If CAN+GPS source is used, then parameter value is calculated from speed values that were taken from CAN data. If data from CAN is not available, but "Alternative data source selection" check box is enabled, then speed value from GPS data is used.

2. OBD (OBD+ACC, OBD+GPS)*
    a. If only OBD source is used, then parameter value is calculated from speed values that were taken from OBD data.
    b. If OBD+ACC source is used, then parameter value is calculated from detected acceleration.
    c. If OBD+GPS source is used, then parameter value is calculated from speed values that were taken from OBD data. If data from OBD is not available, but "Alternative data source selection" check box is enabled, then speed value from GPS data is used.

3. Accelerometer - Parameter value is calculated from detected acceleration.
4. GPS - Parameter value is calculated from speed values that were taken from GPS data. (When information for Eco drive parameters is obtained from GPS data, they will be counted as valid only when HDOP level is lower or equal to 1.5).

*Firmware versions that support these new data sources can be identified by analysing device firmware change log file.

Configuration

1. "Event on" – *Monitoring.* Braking value can be registered, only if the braking acceleration exceeds configured lower limit. If this condition is fulfilled, then this parameter will be equal to the highest braking acceleration value detected in time period between two data records.
2. "Event on" – *Change* and "Include data only on event" check box enabled. Braking value can be registered and data record can be generated, only if the braking acceleration exceeds configured lower limit. If this condition is fulfilled, then data record with the highest braking acceleration value will be generated as soon as the acceleration drops below the configured lower limit.

6.19 ECO acceleration value

ID	Name	Name in configurator	Size, B	Value	IO factor
403	ECO_acceleration_ value	ECO acceleration value	2	0 - 65535	0,01 m/s^2 / Bit

Description
Detected speedup acceleration value.

Data source
Information from several different data sources can be used to calculate value for this parameter:
1. CAN (CAN+ACC, CAN+GPS)*
    a. If only CAN source is used, then parameter value is calculated from speed values that were taken from CAN data.
    b. If CAN+ACC source is used, then parameter value is calculated from detected acceleration.
    c. If CAN+GPS source is used, then parameter value is calculated from speed values that were taken from CAN data. If data from CAN is not available, but "Alternative data source selection" check box is enabled, then speed value from GPS data is used.

2. OBD (OBD+ACC, OBD+GPS)*

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a. If only OBD source is used, then parameter value is calculated from speed values that were taken from OBD data.
b. If OBD+ACC source is used, then parameter value is calculated from detected acceleration.
c. If OBD+GPS source is used, then parameter value is calculated from speed values that were taken from OBD data. If data from OBD is not available, but "Alternative data source selection" check box is enabled, then speed value from GPS data is used.

3. Accelerometer - Parameter value is calculated from detected acceleration.
4. GPS - Parameter value is calculated from speed values that were taken from GPS data. (When information for Eco drive parameters is obtained from GPS data, they will be counted as valid only when HDOP level is lower or equal to 1.5).

*Firmware versions that support these new data sources can be identified by analysing device firmware change log file.

Configuration

1. "Event on" – *Monitoring.* Speedup acceleration value can be registered, only if its value exceeds configured lower limit. If this condition is fulfilled, then this parameter will be equal to the highest speedup acceleration value detected in time period between two data records.
2. "Event on" – *Change* and "Include data only on event" check box enabled. Speedup acceleration value can be registered and data record can be generated, only if the speedup acceleration exceeds configured lower limit. If this condition is fulfilled, then data record with the highest speedup acceleration value will be generated as soon as the acceleration drops below the configured lower limit.

6.20 ECO cornering value

ID	Name	Name in configurator	Size, B	Value	IO factor
404	ECO_cornering_ value	ECO cornering value	2	0 - 65535	0,01 m/s^2 / Bit

Description
Cornering acceleration value detected during tight turns.

Data source
Information from several different data sources can be used to calculate value for this parameter:
1. CAN (CAN+ACC, CAN+GPS)*
   a. If only CAN source is used, then parameter unavailable.
   b. If CAN+ACC source is used, then parameter value is calculated from detected acceleration.
   c. If CAN+GPS source is used and "Alternative data source selection" check box is enabled, parameter value is calculated from GPS data.

2. OBD (OBD+ACC, OBD+GPS)*
   a. If only OBD source is used, then parameter unavailable.
   b. If OBD+ACC source is used, then parameter value is calculated from detected acceleration.
   c. If OBD+GPS source is used and "Alternative data source selection" check box is enabled, parameter value is calculated from GPS data.

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3. ACC - Parameter value is calculated from detected acceleration.
4. GPS - Parameter value is calculated from GPS data. (When information for Eco drive parameters is obtained from GPS data, they will be counted as valid only when HDOP level is lower or equal to 1.5).

*Firmware versions that support these new data sources can be identified by analysing device firmware change log file.

Configuration

1. "Event on" – *Monitoring.* Cornering acceleration value can be registered, only if its value exceeds configured lower limit. If this condition is fulfilled, then this parameter will be equal to the highest cornering acceleration value detected in time period between two data records.
2. "Event on" – *Change* and "Include data only on event" check box enabled. Cornering acceleration value can be registered and data record can be generated, only if the cornering acceleration exceeds configured lower limit. If this condition is fulfilled, then data record with the highest cornering acceleration value will be generated as soon as the acceleration drops below the configured lower limit.

7 Extended ECO drive parameters

7.1 Extended parameters for FM3 devices

Eco drive parameters list and its structure displayed in the list below are compatible with FM-Tco3 and FM-Pro3 devices. Parameter values can be obtained, only if CANbus data (FMS parameters) can be received from the corresponding vehicle.

Extended Eco drive parameters will be available, after the "Extended protocol for eco-drive" check box is enabled in the FM3 configurator.

- When user enables the "Extended protocol for eco-drive" check box, all common Eco drive parameters are rearranged into nine groups. Common groups will not be shown, because only nine groups will be displayed.
- If user disables the "Extended protocol for eco-drive" check box, only common Eco drive parameters will be shown.

Extended parameters can be configured to generate records with "Event on": *Monitoring*. *Averaging* – is not applied for these parameters.

With extended Eco drive parameters, values for the fuel used parameters are calculated according to the HRLFC (High resolution Liquid Fuel Consumption) data. If HRLFC data is not available, then fuel used parameters are calculated according to the "Fuel Rate" data. The "Fuel used" parameter (ID 208) itself **will not be calculated**.

Extended Eco drive parameters list also contains some new parameters. They are described in chapters 7.3-7.25.

ID	Name	Size, B	Structure	IO factor
220	ECO_drive_group1	8	ECO max speed (1B), MSB	1 km/h /Bit
			ECO overspeeding timer (2B)	1 s/Bit
			ECO RPM in red band timer (2B)	1 s/Bit
			ECO max RPM (2B)	1 RPM/Bit
			ECO brake counter (1B), LSB	1 event/Bit
221	ECO_drive_group2	8	ECO extreme and harsh brake counter (1B), MSB	1 event/Bit
			ECO harsh acceleration counter (1B)	1 event/Bit
			ECO idling timer (2B)	1 s/Bit
			ECO cruise control timer (2B)	1 s/Bit
			ECO cruise control timer (2B) - LSB	1 s/Bit
222	ECO_drive_group3	8	ECO RPM in green band distance (4B), MSB	1 m/Bit
			ECO normal speed distance (4B), LSB	1 m/Bit
223	ECO_drive_group4	8	ECO stops counter (1B), MSB	1 event/Bit
			ECO fuel used while idling (2B)	0,001 l/Bit
			ECO free rolling distance (2B)	5 m/Bit
			ECO engine on timer (2B)	1 s/Bit
			LSB is reserved	
224	ECO_drive_	8	ECO engine overloaded distance (2B) - MSB,	5 m/Bit
			ECO engine overloaded fuel used (2B),	0,001 l/Bit

			ECO overspeeding distance (2B),	5 m/Bit
	group5		ECO overspeeding fuel used (2B) – LSB.	0,001 l/Bit
225	ECO_drive_ group6	8	ECO cruise control on distance (2B) - MSB,	5 m/Bit
			ECO cruise control on fuel used (2B),	0,001 l/Bit
			ECO highest gear distance (2B),	5 m/Bit
			ECO highest gear fuel used (2B) – LSB.	0,001 l/Bit
226	ECO_drive_ group7	8	ECO RPM range1 distance (2B) - MSB,	5 m/Bit
			ECO RPM range1 fuel used (2B),	0,001 l/Bit
			ECO RPM range2 distance (2B),	5 m/Bit
			ECO RPM range2 fuel used (2B) - LSB	0,001 l/Bit
227	ECO_drive_ group8	8	ECO RPM range3 distance (2B) - MSB,	5 m/Bit
			ECO RPM range3 fuel used (2B),	0,001 l/Bit
			ECO RPM range4 distance (2B),	5 m/Bit
			ECO RPM range4 fuel used (2B) - LSB	0,001 l/Bit
228	ECO_drive_ group9	8	ECO cruise control distance (4B),	1 m/Bit
			ECO cruise control distance (4B).	1 m/Bit

Configuration

In the first part of configuration we show how to enable extended parameters. Follow these steps to configure your FM Device:
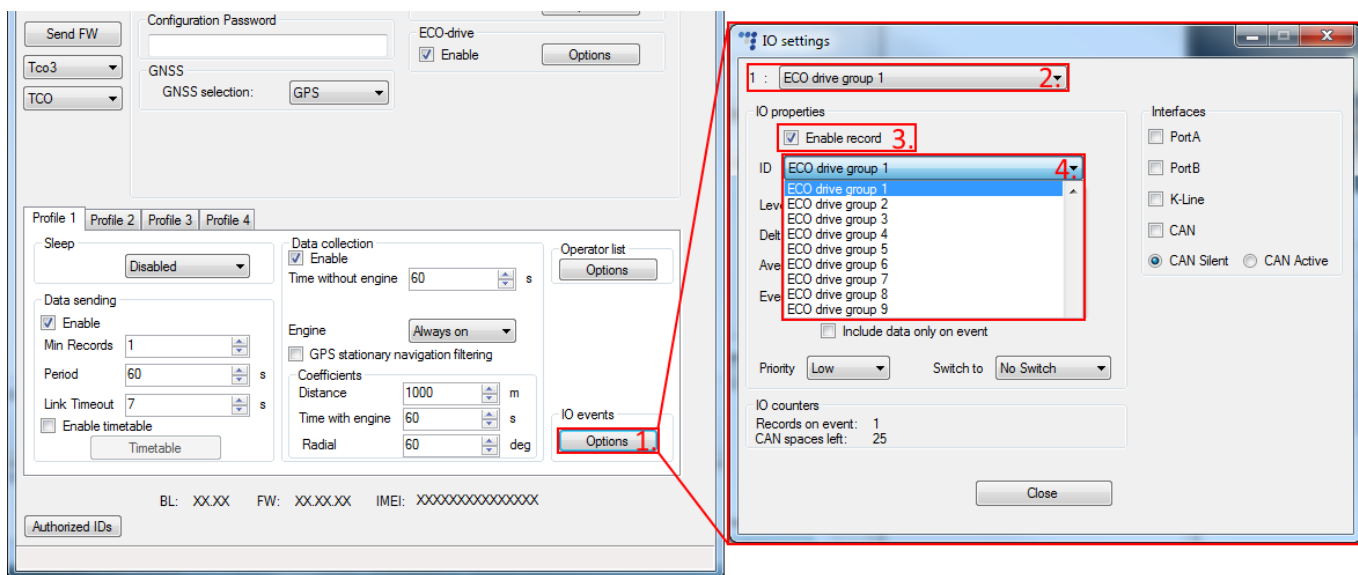
1. In the main configurator window choose your device *(FM-Tco3 or FM-Pro3)*.
2. Under **Eco-drive** section put a tick on **Enable** checkbox.
3. Click "Options" button.
4. Put a tick on **Expanded protocol for eco-drive** checkbox. This checkbox enables fields on the right that were previously greyed out. Also, standard Eco-Drive parameters and extended Eco-Drive parameters are grouped.
5. **Highest gear speed** – not every vehicle provides gear parameters in FMS data. It is considered that vehicle is driven in the highest gear, when its speed is above a set limit. "ECO highest gear distance" and "ECO highest gear fuel used" parameters are calculated, when vehicle exceeds this limit. Value range is from 0 to 255 km/h.
6. **Engine load threshold** – "ECO engine overloaded distance" and "ECO engine overloaded fuel used" parameters are calculated, when Engine Percent Load At Current Speed is above set limit. Value range is from 0 to 125 %.
7. **Free - rolling RPM range** – sets RPM range, which is used for "ECO free rolling distance" parameter calculation. Value range is from 0 to 10000 rpm's. Value in the Min column cannot be higher, than in the Max column.
8. **RPM range 1**, **2**, **3 and 4** – sets RPM ranges for 4 "ECO RPM range distance" and 4 "ECO RPM range fuel used" parameters. Value range in each field is from 0 to 10000 rpm's. Value in the Min column cannot be higher, than in the Max column.
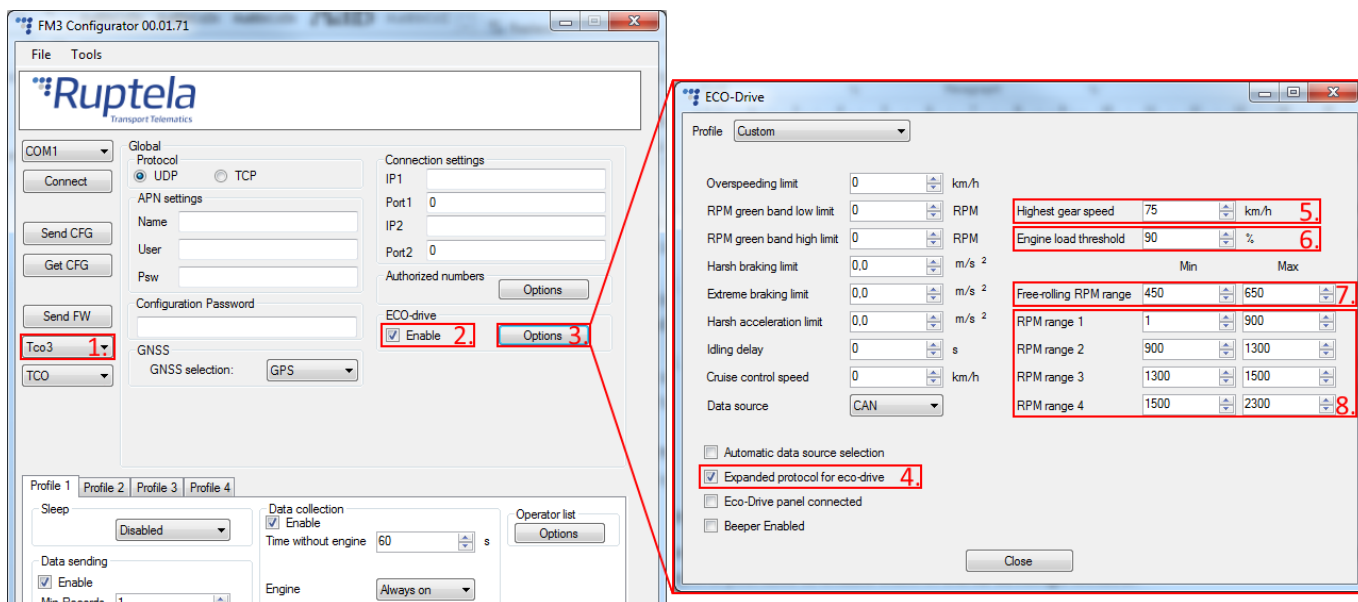
Enable Extended Eco-Drive parameters in IO settings

Second part of configuration deals with IO events. In order to see Extended Eco-Drive parameters in reports you have to enable them in the **IO settings** window.

1. In the **IO events** section click on "Options" button. It opens up a new "IO settings" window.
2. Select a free slot for a new parameter that you want to enable.
3. In the **IO properties** section tick the **Enable** check box, otherwise the slot will remain empty.
4. **ID** contains the parameters list. Choose and enable all the parameters starting with *ECO drive group 1* up to *ECO drive group 9*.

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7.2 Extended parameters for FM4 devices

Eco drive parameters and their structure displayed in the list below are compatible with FM-Tco4 HCV, FM-Tco4 LCV and FM-Pro4 devices. It is a must to use v1.1 protocol version. Parameter values can be obtained, only if CANbus data (FMS parameters) can be received form the corresponding vehicle. Main principles that govern calculations are the same as in FM3 devices.

Eco drive parameters displayed in the list below are available in the "IO settings" window, when the data source is set to CAN, CAN+ACC or CAN+GPS.

These parameters can be configured to generate records with "Event on": *Monitoring, Change* and *Hysteresis. Averaging* is not applied for them.

With extended Eco drive parameters, values for the fuel used parameters are calculated according to the HRLFC (High resolution Liquid Fuel Consumption) data. If HRLFC data is not available, then fuel used parameters are calculated according to the "Fuel Rate" data. The "Fuel used" parameter (ID 208) itself **will not be calculated**.

Extended Eco drive parameters list also contains some new parameters. They are described in chapters 7.3-7.25.

| ID	Name	Name in configurator	Size, B	Value	IO factor
526	ECO_stops_counter	ECO stops counter	2	0-65535	1 event/Bit
527	ECO_braking_distance	ECO braking distance	2	0-65535	5 m/Bit
528	ECO_braking_duration	ECO braking duration	2	0-65535	1 s/Bit
529	ECO_retarder_duration	ECO retarder duration	2	0-65535	1 s/Bit
540	ECO_fuel_used_ while_idling	ECO fuel used while idling	2	0-65535	1 ml/Bit
541	ECO_free_rolling_ distance	ECO free rolling distance	2	0-65535	5 m/Bit
542	ECO_engine_ overloaded_distance	ECO engine overloaded distance	2	0-65535	5 m/Bit
543	ECO_engine_ overloaded_fuel_used	ECO engine overloaded fuel used	2	0-65535	1 ml/Bit
544	ECO_overspeeding_ distance	ECO overspeeding distance	2	0-65535	5 m/Bit
545	ECO_overspeeding_ fuel_used	ECO overspeeding fuel used	2	0-65535	1 ml/Bit
546	ECO_cruise_control_ on_distance	ECO cruise control on distance	2	0-65535	5 m/Bit
547	ECO_cruise_control_ on_fuel_used	ECO cruise control on fuel used	2	0-65535	1 ml/Bit
548	ECO_highest_gear_ distance	ECO highest gear distance	2	0-65535	5 m/Bit
549	ECO_highest_gear_ fuel_used	ECO highest gear fuel used	2	0-65535	1 ml/Bit
550	ECO_rpm_range1_ distance	ECO RPM range1 distance	2	0-65535	5 m/Bit

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ID	Name	Name in configurator	Size, B	Value	IO factor
551	ECO_rpm_range1_fuel_used	ECO RPM range1 fuel used	2	0-65535	1 ml/Bit
552	ECO_rpm_range2_distance	ECO RPM range2 distance	2	0-65535	5 m/bit
553	ECO_rpm_range2_fuel_used	ECO RPM range2 fuel used	2	0-65535	1 ml/Bit
554	ECO_rpm_range3_distance	ECO RPM range3 distance	2	0-65535	5 m/Bit
555	ECO_rpm_range3_fuel_used	ECO RPM range3 fuel used	2	0-65535	1 ml/Bit
556	ECO_rpm_range4_distance	ECO RPM range4 distance	2	0-65535	5 m/Bit
557	ECO_rpm_range4_fuel_used	ECO RPM range4 fuel used	2	0-65535	1 ml/Bit
597	ECO_engine_braking_distance	ECO engine braking distance	2	0-65535	5 m/Bit

Configuration

In the first part of configuration we show how to enable extended parameters. Follow these steps to configure your FM Device:

1. In the main configurator window choose your device *(FM-Tco4 HCV, FM-Tco4 LCV or FM-Pro4)*.
2. Under **Eco-drive** section put a tick on **Enable** checkbox.
3. Click "Options" button.
4. In **Data source** section choose *CAN* or *CAN+ACC*. This action enables fields on the right that were previously greyed out.
5. **Highest gear speed** – not every vehicle provides gear parameters in FMS data. It is considered that vehicle is driven in the highest gear, when its speed is above a set limit. "ECO highest gear distance" and "ECO highest gear fuel used" parameters are calculated, when vehicle exceeds this limit. Value range is from 0 to 255 km/h. Default is 75 km/h.
6. **Engine load threshold** – "ECO engine overloaded distance" and "ECO engine overloaded fuel used" parameters are calculated, when Engine Percent Load At Current Speed is above set limit. Value range is from 0 to 125 %. Default is 90 %.
7. **Free - rolling RPM range** – sets RPM range, which is used for "ECO free rolling distance" parameter calculation. Value range is from 0 to 10000 rpm. Value in the Minimum column cannot be higher, than in the Maximum column. Default range is 450 - 650 rpm.
8. **RPM range 1**, **2**, **3 and 4** – sets RPM ranges for 4 "ECO RPM range distance" and 4 "ECO RPM range fuel used" parameters. Value range in each field is from 0 to 10000 rpm. Value in the Minimum column cannot be higher, than in the Maximum column.
   a. Default value for range 1 is 1 – 900 rpm.
   b. Default value for range 2 is 900 – 1300 rpm.
   c. Default value for range 3 is 1300 – 1500 rpm.
   d. Default value for range 4 is 1500 – 2300 rpm.
9. **Engine braking conditions** – sets the configurable conditional values that need to be met for the calculation of the "ECO engine braking distance" parameter.
   a. *Speed is more than* – the condition is met when the speed of the vehicle is above the configured value. The allowed values are 0-250 km/h. The default value is 0 km/h.
   b. *Fuel rate is below* – the condition is met when the fuel consumption level of the vehicle is below the configured value. The allowed values are 0.0-25.0 l/h. The default value is 1.0 l/h.

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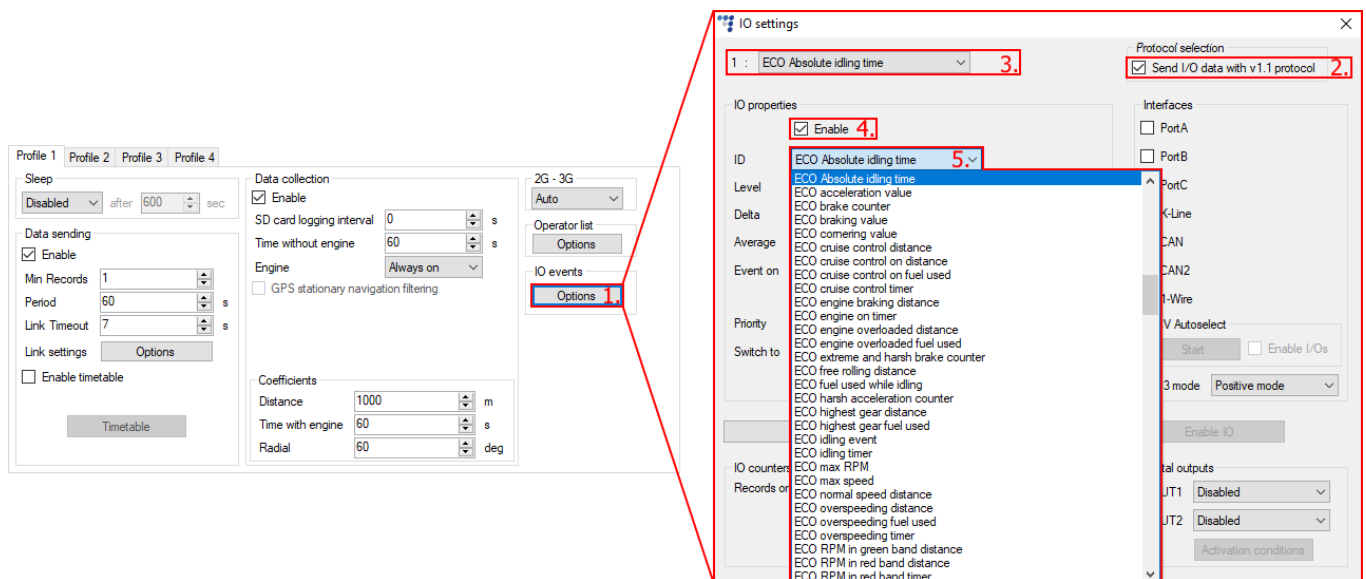Transport Telematics

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c. *RPM is more than* – the condition is met when the RPM of the engine is above the configured value. The allowed values are 0-10000 rpm. The default value is 650 rpm.
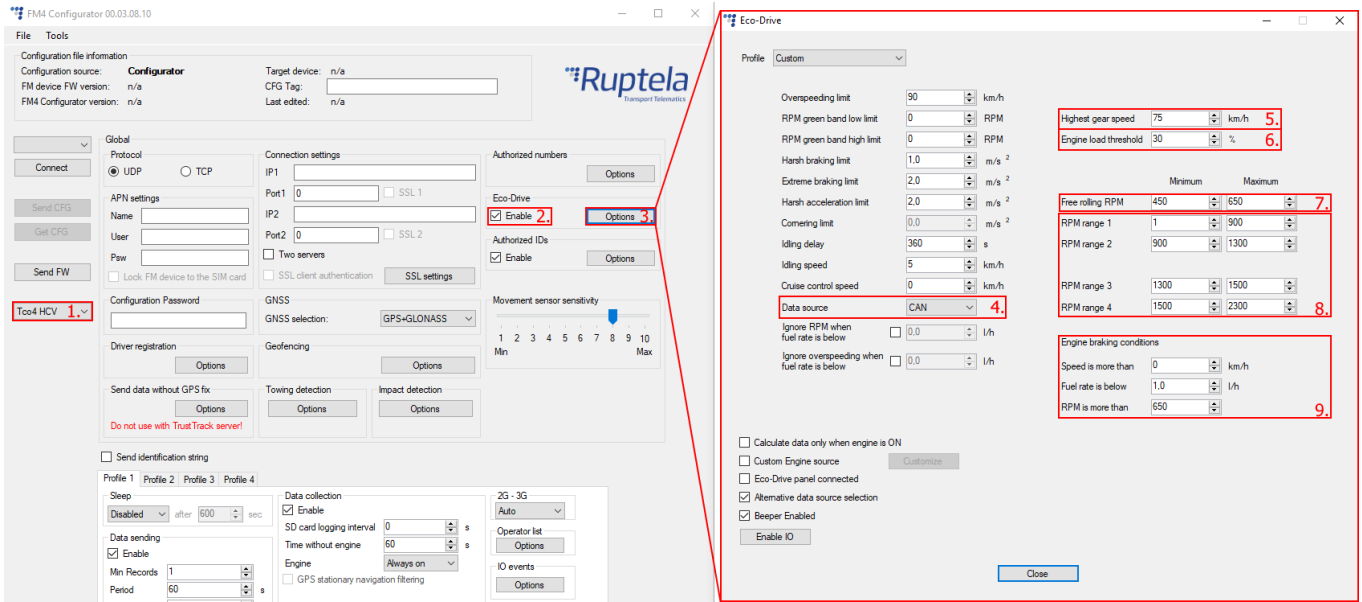
Enable Extended Eco-Drive parameters in IO settings

Second part of configuration deals with IO events. In order to see Extended Eco-Drive parameters in reports you have to enable them in the **IO settings** window.

1. In the **IO events** section click on "Options" button. It opens up a new "IO settings" window.
2. In **Protocol selection** section add a tick in **Send I/O data with v1.1 protocol** checkbox. Now you will be able to see extended Eco-Drive parameters in the IO list.
3. Select a free slot for a new parameter that you want to enable.
4. In the **IO properties** section tick the **Enable** check box, otherwise the slot will remain empty.
5. **ID** contains the parameters list. Choose and enable all the ECO drive parameters.

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7.3 ECO fuel used while idling

This parameter counts fuel used value, while vehicle is standing still with its engine running (idling). Fuel used value will contain diff data (fuel used from the last record) in 0.001 L/bit gain. Idling detection logic was described in 6.8 chapter. If vehicle fails to meet all the conditions for the idling, then fuel used value is added to the fuel used while driving.

Fuel used while driving calculations are done on the server (total fuel used difference between records minus fuel used while idling).

7.4 ECO free rolling distance

This parameter stores driven distance in 5 m/bit gain, while vehicle was free-rolling. Conditions: engine on, accelerator pedal off (0%), RPM in range 450-650 (configurable).

Distance, when vehicle was not considered free-rolling must be calculated at the server side (distance between records minus distance while vehicle was free-rolling).

7.5 ECO engine overloaded distance

This parameter stores driven distance in 5 m/bit gain, while engine was overloaded. Conditions: we calculate engine overloaded distance, when the engine percent load parameter (CAN engine PLCS) is above the threshold. Threshold value is configurable, default value is 100%, range from 0% to 125%.

Distance, when engine was considered to be in normal load, must be calculated at the server side (distance between records minus distance while vehicle's engine was overloaded).

7.6 ECO engine overloaded fuel used

This parameter stores fuel used in 0.001 L/bit gain, while engine was overloaded. Fuel used is sent as a diff value (fuel used from the last record). Conditions: we calculate engine overloaded fuel used, when the engine percent load parameter (CAN engine PLCS) is above the threshold. Threshold value is configurable, default value is 100%, range from 1% to 125%.

Fuel used, when engine was considered to be in normal load, must be calculated at the server side (difference of the total fuel used, minus fuel used while engine was overloaded).

7.7 ECO overspeeding distance

This parameter stores driven distance in 5 m/bit gain, while vehicle was over speeding. Conditions: Vehicle's speed is above set-up threshold. Threshold is configurable in the ECO-driving menu: "Overspeeding limit". Default value is 75 km/h, range is from 1 km/h to 255 km/h.

7.8 ECO overspeeding fuel used

This parameter stores fuel used in 0.001 L/bit gain, while vehicle was over speeding. Fuel used is sent as a diff value (fuel used from the last record). Conditions: Vehicle's speed is above set-up threshold. Threshold is configurable in the ECO-driving menu: "Overspeeding limit". Default value is 75 km/h, range is from 1 km/h to 255 km/h.

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7.9 ECO cruise control on distance

This parameter stores driven distance in 5 m/bit gain, while cruise control was on, vehicle's speed is not important. Distance calculation logic was described in 6.14 chapter, "Cruise fact" section.

7.10 ECO cruise control on fuel used

This parameter stores fuel used in 0.001 L/bit gain, while cruise control was on, vehicle's speed is not important.

7.11 ECO highest gear distance

This parameter stores driven distance in 5 m/bit gain. Count starts, when vehicle's speed exceeds configured "overspeeding limit". This signifies that vehicle is driving in the highest gear. Overspeeding limit is used, because not every vehicle in the fleet provides gear parameters from the FMS. Default "Overspeeding limit" value is 75 km/h, range is from 1 km/h to 255 km/h.

7.12 ECO highest gear fuel used

This parameter stores fuel used in 0.001 L/bit gain. Fuel used is sent as a diff value (fuel used from the last record). Count starts, when vehicle's speed exceeds configured "overspeeding limit". This signifies that vehicle is driving in the highest gear. Overspeeding limit is used, because not every vehicle in the fleet provides gear parameters from the FMS. Default "Overspeeding limit" value is 75 km/h, range is from 1 km/h to 255 km/h.

7.13 ECO RPM range1 distance

This parameter stores driven distance in 5 m/bit gain, while vehicle's engine was running in RPM range 1. Default values for RPM range 1 is from 1 rpm to 900 rpm. Range is configurable. Parameter is sent as a diff value from the last record.

7.14 ECO RPM range1 fuel used

This parameter stores fuel used in 0.001 L/bit gain, while vehicle's engine was running in RPM range 1. Default values for RPM range 1 is from 1 rpm to 900 rpm. Range is configurable. Parameter is sent as a diff value from the last record.

7.15 ECO RPM range2 distance

This parameter stores driven distance in 5 m/bit gain, while vehicle's engine was running in RPM range 2. Default values for RPM range 2 is from 900 rpm to 1300 rpm. Range is configurable. Parameter is sent as a diff value from the last record.

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7.16 ECO RPM range2 fuel used

This parameter stores fuel used in 0.001 L/bit gain, while vehicle's engine was running in RPM range 2. Default values for RPM range 2 is from 900 rpm to 1300 rpm. Range is configurable. Parameter is sent as a diff value from the last record.

7.17 ECO RPM range3 distance

This parameter stores driven distance in 5 m/bit gain, while vehicle's engine was running in RPM range 3. Default values for RPM range 3 is from 1300 rpm to 1500 rpm. Range is configurable. Parameter is sent as a diff value from the last record.

7.18 ECO RPM range3 fuel used

This parameter stores fuel used in 0.001 L/bit gain, while vehicle's engine was running in RPM range 3. Default values for RPM range 3 is from 1300 rpm to 1500 rpm. Range is configurable. Parameter is sent as a diff value from the last record.

7.19 ECO RPM range4 distance

This parameter stores driven distance in 5 m/bit gain, while vehicle's engine was running in RPM range 4. Default values for RPM range 4 is from 1500 rpm to 2300 rpm. Range is configurable. Parameter is sent as a diff value from the last record.

This parameter is also used to detect engine braking. 1500-2300 rpms are considered to be the most effective for engine braking. By analysing this parameter, the client can also tell, if the engine braking was really used.

7.20 ECO RPM range4 fuel used

This parameter stores fuel used in 0.001 L/bit gain, while vehicle's engine was running in RPM range 4. Default values for RPM range 4 is from 1500 rpm to 2300 rpm. Range is configurable. Parameter is sent as a diff value from the last record.

This parameter is also used to detect engine braking. 1500-2300 rpms are considered to be the most effective for engine braking. By analysing this parameter, the client can also tell, if the engine braking was really used.

7.21 ECO engine braking distance

This parameter stores the distance travelled in 5 m/bit gain, while using engine braking (gear engaged) to slow down the vehicle. The data source must be CAN (CAN+ACC, CAN+GPS). There are 4 conditions that must be met for the parameter to be calculated:

1. The speed of the vehicle must be more than some configurable value (0-250 km/h; default value: 0 km/h).
2. The position of the acceleration pedal is 0%.
3. The fuel rate is below some configurable value (0.0-25.0 l/h; default value: 1.0 l/h).
4. The RPM of the engine is more than some configurable value (0-10000 rpm; default value: 650 rpm).

7.22 ECO stops counter

This parameter stores the amount of stops made since the last record. The vehicle is considered to have stopped when CAN wheel based speed is equal to zero.

7.23 ECO braking distance

This parameter stores the distance driven since the last record in 5 m/bit gain while the braking pedal was pressed.

7.24 ECO braking duration

This parameter stores the time period since the last record in 1 s/bit gain, during which the braking pedal was pressed and CAN vehicle speed was above zero.

7.25 ECO retarder duration

This parameter stores the time period since the last record in 1 s/bit gain, during which the retarder torque mode was above zero.