Ruptela
Transport Telematics

FM-Plug 4 / 4+
User Manual

2018/05

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1 Preface

1.1 Use of this document

This document provides required information for proper device handling, preparation, configuration and installation to a vehicle. This document has a linear structure – from the device package box reception to the recommendations on how to install the device to the vehicle. However it is not overfilled with unnecessary information. You will find only basic descriptions about various functions and actions needed to start using the device with the reference to extensive descriptions of the contents.

The following markings are used to highlight important information:
- Notes contain important information that you need to pay attention to.

> **Note**
> Notes like this contain important information!

- Actions and various elements of the software required for configuration of the device are marked in **bold**.
- All actions are described in sequence in the following five sections: Introduction, Device description, Device preparation, Device configuration and Installation recommendations.

1.2 Document change log

Date	Version	Change details
2015-08-01	1.0	Initial draft.
2016-01-19	1.1	Battery safety.
2016-01-26	1.2	Towing detection, Sleep timer, Voltage thresholds for Virtual ignition.
2016-02-12	1.3	SELV Limited power source, device installation position.
2016-04-18	1.4	2nd level temporary black list, geozones removed.
2016-04-20	1.5	Firmware downgrading and older firmware support restrictions.
2017-02-07	1.6	"Constant TCP link" functionality description in "Profile settings" chapter.
2017-03-09	1.7	Changed DIFF file description in "Advanced Configuration" chapter.
2017-04-07	1.8	Added option to disable OBD Pin1 automatic check.
2017-05-22	1.9	"GSM tracking" feature description in "Global settings" chapter. Configurable sleep mode description in "Profile settings" chapter.
2017-06-08	1.10	Automatic IO enable function in IO setting chapter.
2017-08-30	1.11	Debounce description added in "IO settings" section.
2017-12-22	1.12	Added note regarding greyed out fields in "Global settings".
2018-05-11	1.13	Added description of automatic firmware update from configurator.

2 Introduction

2.1 Purpose

The purpose of this document is to provide physical and technical data of the device, to explain device's behavior and how various conditions are indicated. Also, device preparation for operation and its configuration instructions are included.

2.2 Acronyms

AC / DC – Alternating Current/Direct Current;
ACK - A signal to acknowledge the receipt of data;
GLONASS – Global Navigation Satellite System;
GNSS – Global Navigation Satellite System;
GPRS – General Packet Radio Service;
GPS – Global Positioning System;
GSM – Global System for Mobile Communications;
I / O – Inputs / Outputs;
LED – Light Emitting Diode;
PC – Personal Computer;
PCB – Printed Circuit Board;
SELV – stands for Safety Extra Low Voltage. A SELV circuit is a secondary circuit which is so designed and protected that under normal and single fault conditions, its voltages do not exceed a safe value.
SMS – Short Message Service;
UMTS – Universal Mobile Telecommunications System;

2.3 Legal Information

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2.4 Safety

⚠ All the associated (additional) equipment such as PC's, batteries, sensors etc., shall meet the requirements of standard EN60950-1.

⚠ Do not disassemble the terminal. If the enclosure of the terminal is damaged, or the insulation of wires is damaged, first of all disconnect power supply cables from the power supply source.

⚠ All of the wireless data transferring equipment produces interference that may affect other devices, which are placed nearby.

🔧 The terminal can be installed or dismounted only by qualified personnel!

✔ The terminal must be firmly fastened in the predefined location. Predefined location is described in the mounting instructions.

✔ The programming must be performed using a 2nd safety class PCs (with an autonomic power supply).

☂ Make sure that the terminal is installed in a place, where it will not be subjected to harsh environmental conditions for extended time periods.

Any installation and/or handling during a lightning storm is prohibited.

For configuration use cables that were purchased from Ruptela. Ruptela is not responsible for any harm caused, while using wrong cables for the PC ↔ Terminal connection.

This crossed-out wheelie bin symbol means that waste equipment should not be disposed of with your other household waste. The product must be taken to separate collection points at the product`s end-of life.

This chapter contains procedures to help you safely operate the FM-Plug4/4+ terminal. By following these requirements and recommendations, you will avoid dangerous situations. You must read these instructions carefully and follow them strictly before operating the device! The terminal is supplied from a car battery with these ratings: 12/24 V DC. The allowed voltage range from the battery is from 10 volts to 36 volts DC (*Supplied from SELV power supply source*).

To avoid mechanical damage, it is advised to transport the FM terminal in an impact-proof package.

The terminal is intended to be installed in a restricted access location, which is not accessible for the operator.

2.5 Battery handling safety

When your device has a battery pack you must also observe the following cautions:

If the battery pack is mishandled, the battery pack can burst, cause a fire or even chemical burns.

Do not crush and do not expose the battery pack to any shock or force such as hammering, dropping or stepping on it.

Do not short circuit and do not allow metal objects to come into contact with the battery terminals.

Do not expose to high temperature (limiting values provided in user manuals and datasheets) such as in direct sunlight.

Do not incinerate or dispose of in fire.

Do not handle damaged or leaking lithium ion batteries.

Caution! If an incorrect type of battery is used for replacement, there is a high explosion risk. Dispose used batteries according to the environmental requirements.

Any installation and/or handling during a lightning storm is prohibited.

When it comes time to replace your batteries, make sure you are disposing of the old batteries properly so no laws are broken. Check with your local solid waste management district for any outlets for household battery recycling. Everything from AAA cells to mobile phone batteries and button cells must be separated from household rubbish. For disposal of small quantities of batteries, see if your local hardware/auto parts store or battery retailer will accept them for recycling. Recycling bins in shops or other recycling points can also be used. Note, that most large battery recycling agencies and disposal companies are usually set up to serve industrial or municipal customers with bulk amounts of batteries rather than individuals.

2.6 References

This document is designed to work in a conjunction with other documents. Documentation is kept light, unnecessary information is omitted. Additional and extensive explanations can be found in the documentation referenced below:

- FM-Plug4/4+ Datasheet – Contains technical data of the FM-Plug4/4+ device. Can be acquired from support@ruptela.com
- Quick start guide – A quick guide for a better understanding of the device configuration process and functions.
- Peripheral accessories – Instructions on how to use peripheral accessories together with the FM-Plug4/4+ device.
- Website – Our documentation website that contains the latest firmware, configurator and sample configuration files.
- Microsoft Framework – This additional software is required in order to run our configurator.
- VCOM drivers – Drivers are required in order to connect the device to a PC.

All links are also provided in corresponding sections, where additional information might be needed.

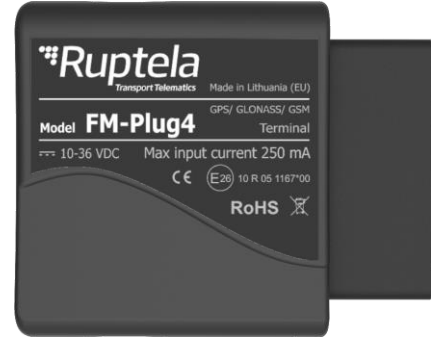## Note
Ruptela documentation website address: doc.ruptela.lt

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3 Device description

3.1 About

Ruptela's FM-Plug4/4+ device is a 1st generation low cost, low power consumption, compact FM tracking device with easy pluggable OBD connector. It acquires its position by a GPS/GLONASS signal and transfers data to a server via a GPRS cellular network. The FM-Plug4/4+ device features:

- Low power consumption
- Small size
- Internal power supply*
- Real time process monitoring
- OBD2 fault code reading*

*Available only for FM-Plug4+ device.

3.2 Package contents

FM-Plug4/4+ device is supplied in a cardboard.
Package contents:

- FM-Plug4/4+ device
- USB 2.0 cable: USB A - male to micro USB B (as optional accessory)

Note

Providing a SIM card is optional, according to your payment plan. The SIM card is necessary for connection to the GSM network. The SIM card can be obtained from your local GSM service provider. The SIM card can work with the terminal only when all SIM card security codes are disabled.

3.3 Physical characteristics

Properties	
Enclosure dimensions	62,3L x 62W x 28H mm
Indication	1 LED
Housing	Plastic
Configuration interface	Micro USB
Connectors	OBD2

3.4 Technical characteristics

Power consumption @ 12V	FM-Plug4	FM-Plug4+
Idle mode, mA	250	350
Internal power supply	✖	LiPo 3,7 V 190 mAh

[1]Ambient temperature ratings, °C:		
Temperature range for device (without battery)	FM-Plug4	FM-Plug4+
Storage temperature, °C	-40 ~ +65	-40 ~ +65
Operating temperature, °C	-35 ~ +60	-35 ~ +60
[2] Temperature range for battery		
[3]Charging, °C	✖	0 ~ +45
[3]Discharging (operating), °C	✖	-20 ~ +60
[3]Storage, °C	✖	-20 ~ +70
[3]Humidity %	20 − 80	

Common specifications	
Power supply	10/24 V DC (range: 10 - 36 DC Supplied from SELV Limited power supply source.)
GPS/GLONASS module	Internal, Ublox EVA-M8M
Channels	72 channels
Sensitivity	-163 dBm (GPS) -164 dBm (Glonass&GPS)
Cold start	30s
Aided start	3s
GPS/GLONASS antenna	Internal
GPS Frequency	1575,42± 3 MHz
GLONASS Frequency	1592-1608 MHz
GSM modem	Quectel M95
GSM antenna	Internal GSM850/GSM900 DCS1800/PCS1900 MHz @ GSM
Accelerometer	3-axis; 2g/4g/8g/16g

Protections
Short circuit protection
Reverse polarity protection
Electrostatic discharge protection on USB
Electrostatic discharge protection on sim card slot
[4]Charging protection (on FM-Plug4+)

[1] Currently parameter values only theoretical.

[2] FM-Plug4+ only.

[3] Currently parameter values are only theoretical.

[4] If temp is >45C, charging is disabled, if >60C battery is disconnected from the system at all

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3.5 Inputs/Outputs and OBD2 pin out

Inputs/Outputs of the FM-Plug4/4+ device:
- OBD2 Plug
- LED
- Microphone (internal)
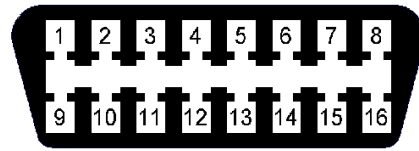
An example of vehicle's OBD2 socket pin numbering pattern is shown on the right. Pin designations provided in the table below.

OBD2 Pin out – Vehicle's side			
PIN	**Description**	**PIN**	**Description**
1	[5]Vendor Option	9	[5]Vendor Option
2	J1850 Bus High	10	J1850 Bus Low
3	[5]Vendor Option	11	[5]Vendor Option
4	Chassis Ground	12	[5]Vendor Option
5	Signal Ground	13	[5]Vendor Option
6	CAN (J-2234) High	14	CAN (J-2234) Low
7	ISO 9141-2 K-Line	15	ISO 9141-2 L-Line
8	[5]Vendor Option	16	Battery Power

[5] Pin function depends on vehicle manufacturer.

3.6 Peripheral accessories

There are several peripheral accessories that can be mounted with the FM-Plug4/4+ device. With these peripherals you can get even more features and extended functionality. All available peripherals can be purchased from Ruptela. Please contact your manager for details.

Available on USB:
- 1 × Panic button (*This feature is under development.*)

You can find peripheral accessories installation instructions and documentation on our website.

3.7 Certification

FM-Plug4/4+ devices have passed quality tests and comply with the following certifications:
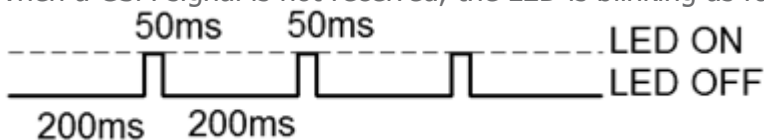- E-Mark
- RoHS

3.8 LED Status

The FM-Plug4/4+ device has a single LED to indicate various device's states during device installation and troubleshooting, it also indicates GSM/GPRS, GPS/GLONASS (GNSS) status
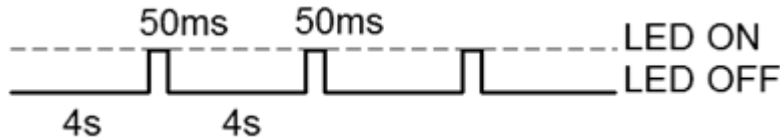
3.8.1 LED when GNSS fix is acquired

When a GSM signal is not received, the LED is blinking as follows:

When device has a good GSM signal, but no GPRS, the LED is blinking as follows:
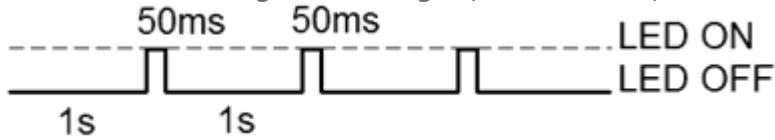
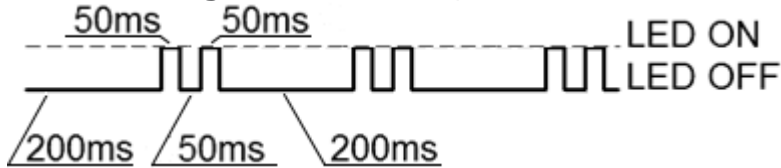When device acquires a good GSM signal and is connected to GPRS, then the LED is blinking as follows:

When the FM-Plug4/4+ terminal acquires a GSM signal and is sending data via GPRS, the LED is on while sending data:
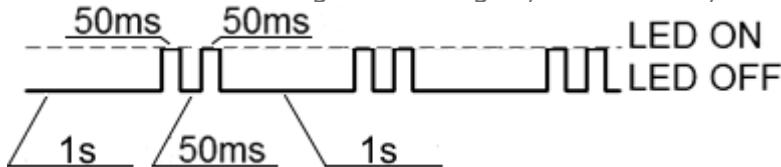

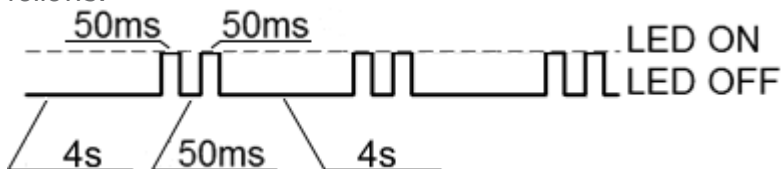
3.8.2 LED when GNSS fix is not acquired

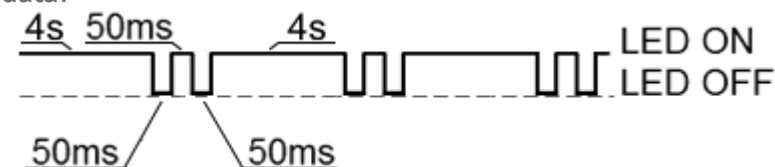When a GSM signal is not received, the LED blinks as follows:

When the device has a good GSM signal, but no GPRS, the LED is blinking as follows:

When the device acquires a good GSM signal and is connected to GPRS, then the LED is blinking as follows:

When the device acquires a GSM signal and is sending data via GPRS, the LED is on while sending data:

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4   Device preparation

In order for the device to work you have to configure it and insert a SIM card. To do so, you have to open the device's enclosure. It has no screws, the top part can be easily removed using screw driver or similar tool (*see figure on the right*).

4.1 Opening/Closing the device

Use a screwdriver or a similar tool to open up the plastic housing of the device. It is recommended to use a "slot" type screwdriver (*see figure on the right*). Inappropriate tools might cause permanent damage to the device.
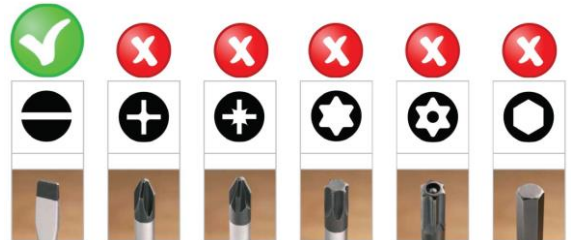
FM-Plug4/4+ PCB is made out of 3 smaller PCB's parts. The main PCB with the OBD connector is at the bottom. PCB with the GSM modem and antenna is at the top. PCB with the GPS/GLONASS module and antenna is on the left side. These parts must be joined together (*see figure below*) before placing them into the plastic housing.

To correctly assemble the device you have to know the exact positions of all the plastic pins used to hold the PCB in place (*see below*).

Proper assembly sequence:

1. The bottom part of the fully assembled PCB goes under the plastic pin 1 (*see below*).
2. The other side of the PCB is pressed down under the plastic pins 2 and 3 until you hear a "click" sound, which indicates that the PCB is locked in its place.
3. Finally use a small screw to fasten the PCB (*see below*).
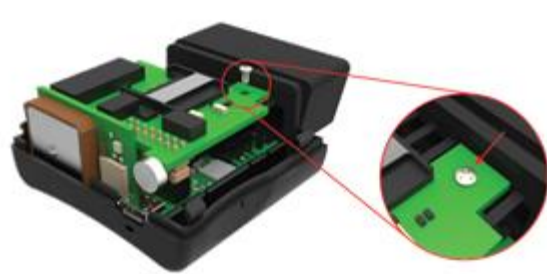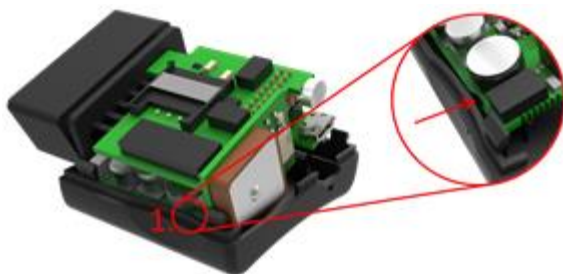
To correctly seal the plastic housing of the device, start by placing the plastic lid at either side of the device (*see figure below*). Then push the remaining side down until the housing is fully closed.
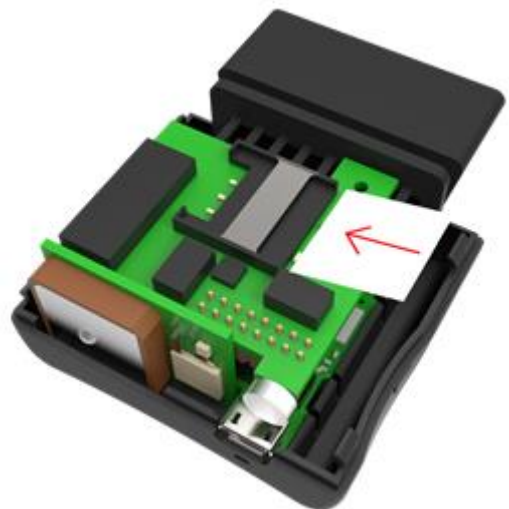
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4.2 Inserting a SIM card

If you received a device without a SIM card, place your own SIM card into the device as shown in the picture below. The microchip must be facing down.

4.3 Connecting the USB cable

Device - PC connection is done via USB A to micro USB B cable. The device has a micro USB socket [2.] (*See the figure on the right*). The cable can be connected only in one way, be careful not to damage the plug. Connect the other end to your PC or a laptop. Configuration can be done without external power supply - for the configuration the device can be powered from the USB.
[1.] Microphone; [3.] LED.

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5 Device configuration

5.1 Driver installation

Virtual COM port driver installation is mandatory, only then your PC will recognize the FM-Eco4 light device that was connected to the USB port. You can download the latest driver from our documentation website server (VCOM drivers).

Choose correct archive file with drivers for your OS version and download it to your PC.
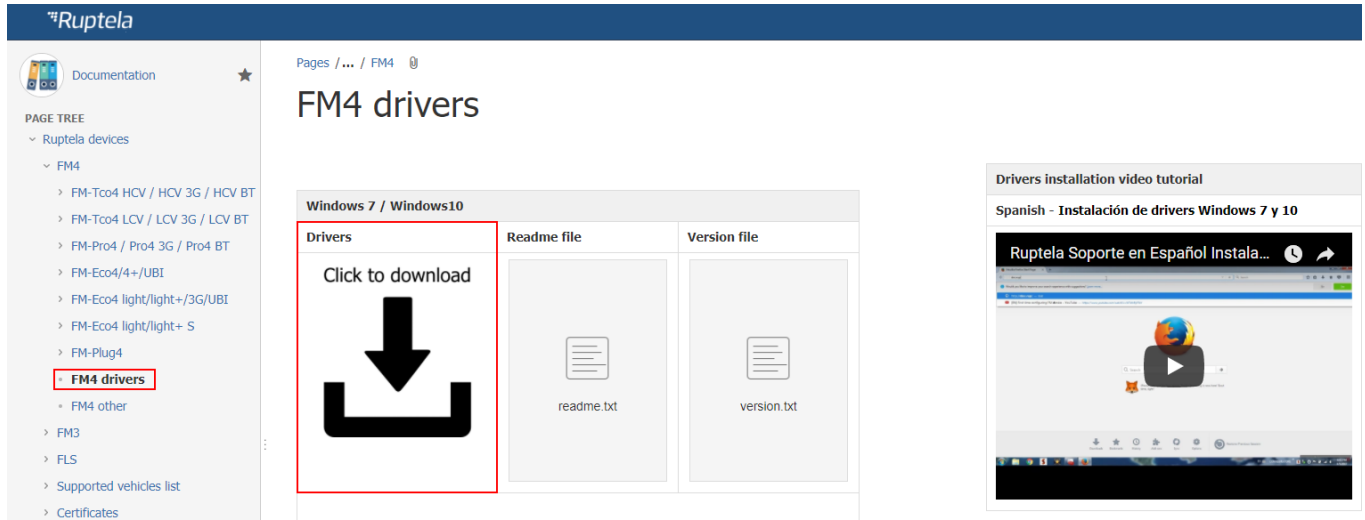

Installation procedure:
- Uninstall any previous Virtual COM port driver versions:
  - Start -> Settings -> Control Panel -> Add or remove programs (Windows 7);
  - Start -> Settings -> Apps -> Apps & features (Windows 10);
- Extract archive file "Win7.zip" or "Win8.zip" to a desired location on your PC.
  - If you are running a 32-bits OS version, launch the "dpinst_x86.exe" [1.]
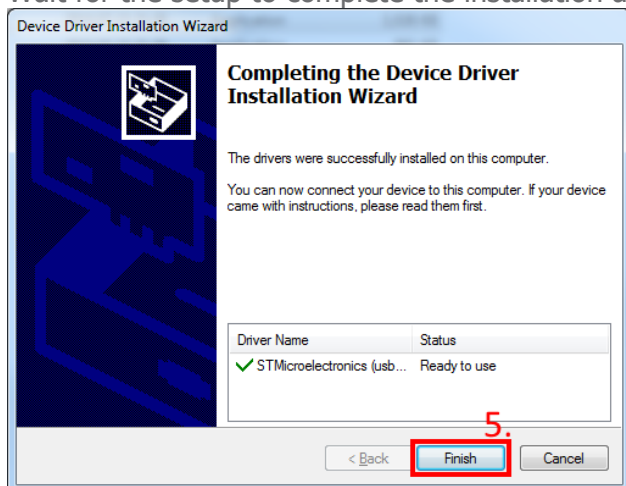 - If you are running a 64-bits OS version, launch the "dpinst_amd64.exe" [2.]

Windows 7 Users might get a Security Warning message. Click "Yes" [3.].
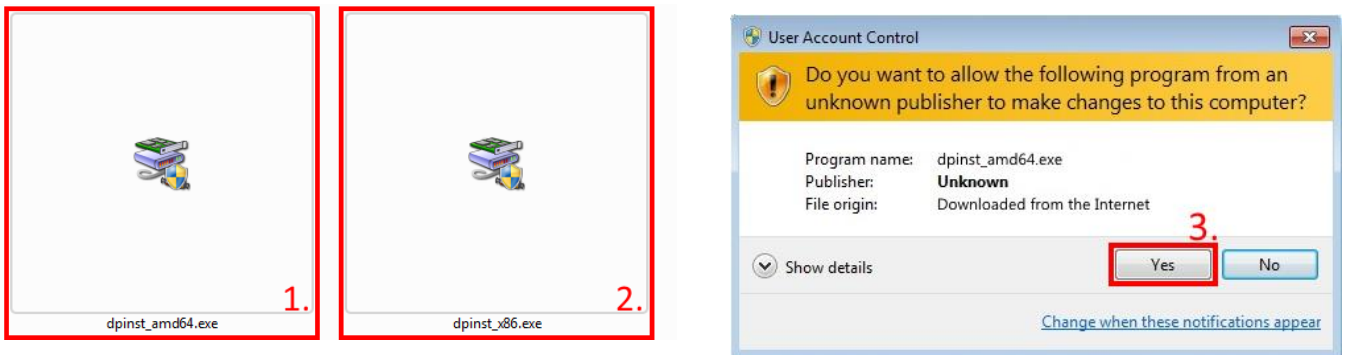
In the next window select "Next" [4.].
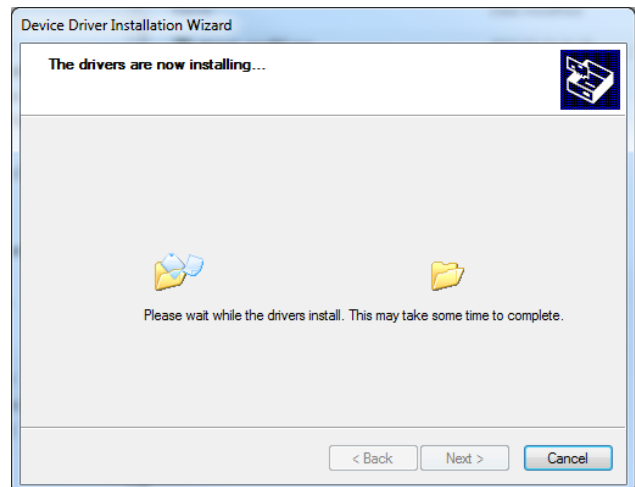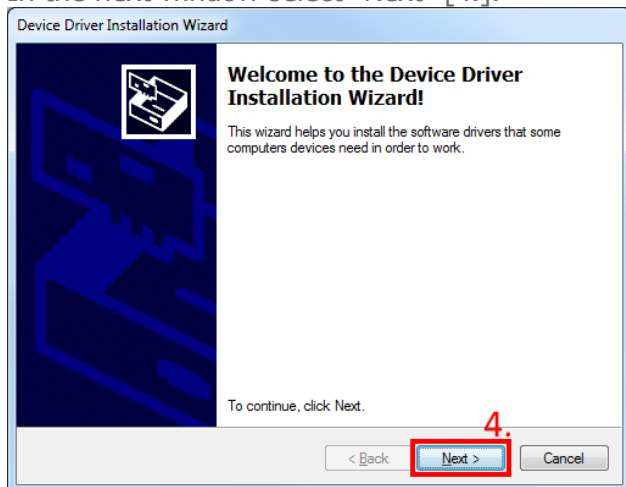
Wait for the setup to complete the installation and click "Finish" [5.].

The driver is now installed and ready to use.

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5.2 Sample configuration

Go to our documentation website server and download sample configuration and the latest configurator. Also you will need the latest version of Microsoft Framework.

Operating system requirements:
- MS Windows XP/Vista/7/8/10

Start VCP.exe from configurator folder.
1. Select **Plug4**.
2. Click **File → Open CFG**.
3. In the dialog window, browse the sample configuration file that you have downloaded from the documentation website.
4. Click **Open**.
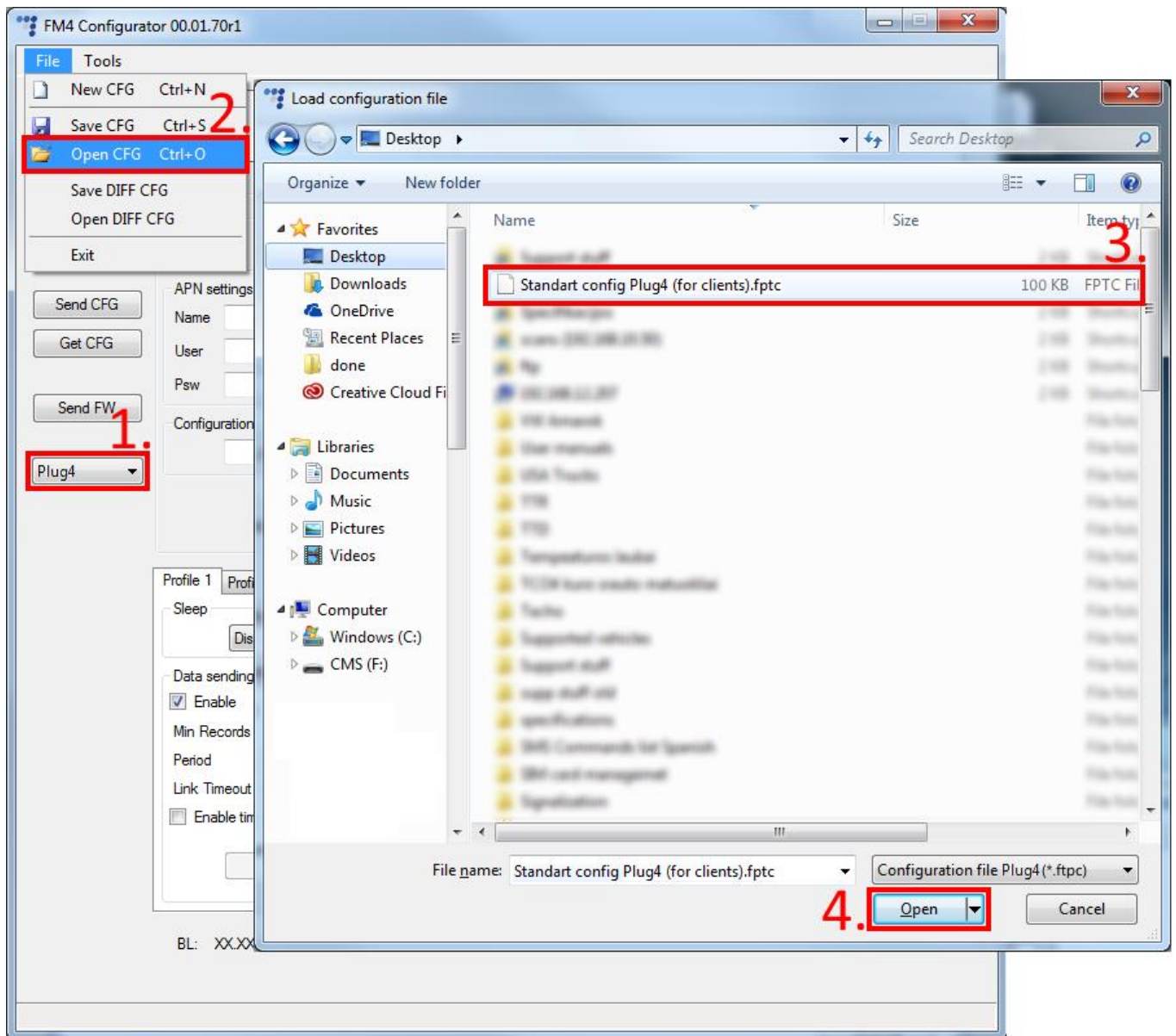
Sample parameters will be loaded. However you will need to enter other parameters on your own.
1. Enter IP (in the 255.255.255.255 format) or a Domain Name (not exceeding 40 characters) and PORT to which the device should send data.
2. Enter APN settings: APN name, User login and Password (if login and password needed).

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3. Select a COM port you connected the device to and click **Connect**. At this point the configuration is ready to be send to the device, so the device must be connected to the computer.
4. Click the **Send CFG** button. The configuration will be uploaded to the device.

Note
APN name, login and password should be provided by your mobile network operator

Now the device is configured to send data to the specific server. Sample IO parameters are enabled (loaded with configuration file). You can log in to your tracking platform to see whether the device is sending data.

5.3 Advanced configuration

The configuration tool is quite similar to the ones used for other 4th generation devices. Overview of the configuration is described in sections.

The **File** menu gives you access to control configuration files. Choose *New/Save/Open CFG* to perform the corresponding action. CFG means full configuration file.
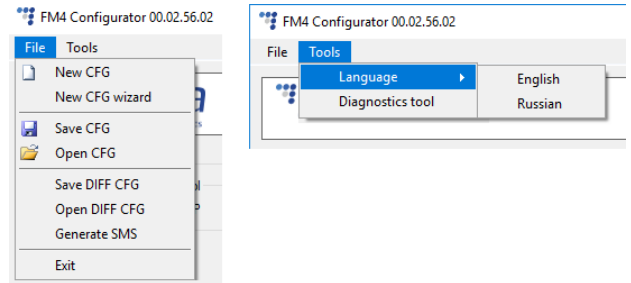
New CFG wizard – It helps users to go through all basic configuration steps.

The **Tools** menu contains:
- Language selection options: English or Russian are available.
- Diagnostics tool.

Save/Open DIFF allows you to create a DIFF file. DIFF files are used to change only one or few certain parameters without a need to upload the full configuration to the device. It is useful, when updating over-the-air.

Attention

A DIFF file will save all made changes to a configuration. For example changing a number in the IP filed, or marking a checkbox, but, if a change was made, and afterwards reverted to the previous state (checkbox checked, and unchecked afterwards), this will not be marked as a "change made". DIFF will only record changes made to the initial configuration (a loaded pre-set configuration is considered an initial configuration). Particular attention must be taken, when creating a DIFF file, to avoid accidental changes to the configuration.

The control panel on the left hand side allows you to select and control the device.

Select the COM port that the device is connected to and click "Connect". At this point the FM4 configurator checks the compatibility between itself and firmware in the device. Every firmware version is released together with a recommended FM4 configurator. More information about different firmwares and recommended configurators for them can be found in firmware changelogs. After the compatibility check, three outcomes are possible:

1. The firmware and configurator versions are compatible. Go ahead and continue configuring the FM device.
2. The configurator is too old for the current firmware version. An error message will appear. The "Send CFG" and "Get CFG" buttons will be disabled. You will need to download a new version of the configurator, recommended for the firmware version.
3. The firmware is too old for the current configurator version. An error message will appear. The configurator will suggest to update the firmware automatically. To update the firmware, click "Yes". The firmware will be updated to the version supported by the configurator. This can be done without an internet connection. Click "No" to close the message without updating the firmware. If the firmware is not updated, the "Send CFG" and "Get CFG" buttons will be disabled. We highly recommend using the latest firmware and configurator.

The "Send CFG" and "Get CFG" buttons are used to send and receive the configuration file to/from the device.

"Send FW" is used to send new firmware to your device manually.

In the drop-down list below you can select the model of the device. If you connected one to your PC, it will be displayed. Now Plug4 should be displayed.

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5.3.1 Global settings

The first part of the configuration tool is "Global" settings. Global includes connection settings and other settings independent from the profile settings – global settings are the same for all profiles.

Connection settings here you should enter server IP and port that the device should connect to. The IP can be entered in the numeric format: 255.255.255.255. You can also use a Domain name (not exceeding 40 characters). IP 2 is a backup IP address, which is used when the device is unable to connect to the first server.

Note

Please have in mind that ports for TCP and UDP transfer protocols usually are different – please select the correct transfer protocol and enter the correct port.

- **Two servers** – checkbox changes the logic described above. It enables a two servers mode – the same data is repeatedly transmitted to another server with IP2, unless we get a timeout. IP1 is dedicated IP for server, from which we get the ACK's for our record packets sent. After we get the ACK from this IP, record data is considered as successfully transmitted to the server and it is removed from the memory.

  In this mode data is sent to IP2 only when connection to the IP1 is established. Packet, which is sent to the IP1 server is also sent to the IP2 server.

  Only records are going to be send to the IP2. Data packets such as Transparent Channel, Tachograph, SD card, Garmin will not be send to the IP2.

  Unable to send data:

  When unable to establish connection to IP1, device does not connect to the IP2 as well. When connected to IP1 and doing data transmission, but IP2 is unreachable – after receiving ACK from IP1 server, data is removed from memory, which can cause information loss in IP2 server.

Note

Two server mode doubles the amount of data that is being sent. Before using this functionality consider the cost which arises from the higher data traffic.

Starting with the version FM-Plug4 00.01.04.00 geofencing feature is removed, however bug fixing will be available. The recommended FM4 Configurator 00.02.20 for this firmware version does not permit firmware downgrades.

Note

Older firmware versions also including the FM-Plug4 00.01.03.02 are no longer supported. If any bugs are found in these firmwares, they will not be fixed.

Protocol sections allows you to choose from two protocols. **UDP** protocol is less reliable than the **TCP,** but also uses less traffic. TCP uses more internet traffic, but it is more reliable. Choose one according to your needs.

Note

If the IP, port or APN fields are greyed out when the device is connected to the configurator, their values cannot be changed.

APN settings are needed for internet connection. These settings must be provided by your mobile network provider. Without APN settings the device will not send any data.

Configuration password allows to lock the configuration – without the password no one can change the device configuration via cable. However, over-the-air update ignores the configuration password.

Send data without GPS fix – this function is limited to the GSM tracking function. The "Send data without GPS fix" function is disabled for the FM-Plug4 device. When the device loses GPS fix, there is no way to determine its location. GSM tracking feature can now be used to obtain an approximate location in the densely urbanized areas, where GPS signal is not available. This feature cannot be used with TrustTrack server! Full functionality description can be found in "Send data without GPS fix" document on our documentation website.

Towing detection - with Towing detection driver can be informed, that his car is being towed. Information about such event is sent to the server, therefore driver might still have time to come back to his vehicle before it is taken away. Full functionality description can be found on our documentation website.

Authorized numbers
- ● Set a **Password** to restrict access to the SMS commands feature.
- ● **SMS Alert Number**. When specific I/O parameter is triggered, the FM device will send an alert message to this number.
- ● In the **Valid Numbers** table enter specific numbers that will be able to send commands to the device.
- ● If you check **Enable list for voice calls** entered numbers will be able to make a call to the device.

ECO Driving options are used to choose sensitivity for the ECO Drive functionality. It helps to rate drivers according to their safety or according to driver's behavior. Full functionality description can be found on our documentation website, ECO Drive.

Movement sensor sensitivity allows you to configure movement sensor according to your needs. If you slide the bar towards the Max, the sensor will detect even very slight movements. If you slide it to the Min, than only stronger movements will be detected.

Send identification string feature forces FM device to send an identification packet to the server. After that the device waits for the ACK packet from the server. Once device receives this packet, it begins data transfer.

5.3.2 Profile settings

The second part of the configuration tool is for profile settings. This section also contain explanations for other features that needs extensive configuration. Functionalities descriptions are available.

Each **Profile** is a settings set for specific circumstances (e.g. One profile for the vehicle, when it is operated in the native country and another profile, when it is abroad).

Sleep can be *Disabled* , *Deep sleep or Custom*.

- "Disabled" – the device never goes to the Deep sleep mode and is working as long as there is power.
- "Deep sleep" – device's ability to go to the Deep sleep mode depends on the ignition detection settings (ignition detection settings are reviewed below, under the **Data collection** section, where the **Engine** drop box values are described):
  - •• If "Always on" or "Power voltage" is selected in the Engine drop box, then the device will never enter the Deep sleep mode. As soon as the ignition is turned off in the vehicle, the voltage level at the OBD2 Pin 16 will drop to zero and the device will shut down immediately.

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(In some older vehicle models the voltage level at the OBD Pin 16 drops below 13 V, but not to 0 V. In such cases the device will enter the Deep sleep mode, after a certain amount of time have passed, usually this takes 10 minutes).

- •• If "MovSensor" is selected in the Engine drop box, then the device can enter the Deep sleep mode. This will happen when the vehicle spends enough time idling (not moving) with the ignition on/engine running. In this case the ignition will be considered to be off, but since there is still power in the OBD, the device will enter the Deep sleep mode, after a certain amount of time have passed, usually this takes 10 minutes.

Deep sleep extends internal battery life by turning off GNSS/GSM modules and all internal interfaces to the car BUSes.

The device will wake up from the Deep sleep mode when these conditions are met:

- •• Movement sensor detects movement.
- •• Voltage level is higher than 13 V.
- ● When "*Custom*" is selected you can choose, which functionalities should work during device sleep and which functionalities should be disabled. Like previously, it possible to set a time limit. Once this time limit is reached, the device will switch to Custom sleep mode. Full functionality description can be found on our documentation website.

With **Data sending** settings you can configure the data sending frequency and conditions.

- ● The **Enable** check box must be enabled.

  - •• Min. records – Minimum number of records required to establish a connection to the server. If the device detects less records than entered value, link to the server will not be opened.
  - •• Period – sets how often the device will check for required number of records.
  - •• Link timeout – this value indicates how long the device should wait before closing the link, after this link was successfully established with the server and all the records had been sent. The default value is 7 seconds, it is recommended not to change it.

- ● **Timetable** allows you to select particular days and hours for the data to be sent.

Data collection must be enabled to collect the information.

- **Time without engine** means how often records should be made, when the engine is off.
- **Engine** drop box allows you to choose how the device will pick up the ignition (consider that the engine is on).
  - *Always on* – No ignition pick up, engine considered always to be on.
  - *MovSensor* – Detect moving of vehicle and consider engine to be on.
  - *Power voltage* – Voltage in the Pin 16 of the OBD2 connector is used for the ignition pick up.
    - There is also a possibility to set **custom** power supply voltage thresholds for virtual ignition. Both voltage thresholds for switching virtual ignition ON and OFF are configurable. In order to enable this feature put a tick on **Customize** checkbox.

      Default value in **Switch ON when >** field is 13200 mV. Range from 0 to 40000 mV.
      Default value in **Switch OFF when <** field is 12800 mV. Range from 0 to 40000 mV.
      Example. 13200 mV value is configured to switch the ignition ON. In this case, if voltage level in the OBD Pin 16 is equal or higher than 13201 mV, the engine will be considered to be on.
    - In some cases users might experience problems with an engine state detection. If custom voltage ranges for engine detection are not suitable and they need a plug and play solution, they can rely on an automatic engine state detection functionality. This feature is described in "Automatic engine detection" document, which can be found [here].
- **GPS stationary navigation filtering** eliminates GPS jumps, when the vehicle is not moving.
- **Coefficients** are used to collect records in addition to the engine on/off parameters. A record will be made when:
  - **Distance** that was set - has been achieved
  - **Time with engine** has passed
  - **Radial** turn of degrees that was entered - has been detected

Note

Keep in mind that the FM device is not designed to have a perfectly accurate time tracking function. Due to various reasons minimal deviations are possible. Over prolonged time periods these small deviations might add up and produce time tracking inaccuracies. Few examples:

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● Device is configured to track one event for 1h. However actual event tracking might last for 1h ± Error (i.e. 5 seconds).
● Device is configured to gather records every second. Depending on the device's state, record gathering time might deviate and last longer (i.e. 2, 3 or even 5 seconds).

Operator list

- **1st... 3rd Profile** tab – operators list in this tab allows selection of operators used in current profile. If operator that is in the list was not found, then device will search for other operator in the list. If no operators were found, device will switch to the next profile.
- **Blacklist** has opposite meaning for operator list. Operators that are in blacklist will not joined.
- **Enable priority in list -** search for operators according to number in list. If it is not selected, device will search for operator randomly.

Note
Black list is one for all profiles, but operator lists are different for each profile.

- **GPRS Attempt** – how many times device will try to attach to operator`s GPRS before trying another operator.
- **GPRS data counter** – how many kilobytes of data device should send before performing next operator search.
- **Temporary blacklist** – temporal ban period in seconds. Sometimes when the FM device connects to the operator with unavailable GPRS, the device is connected, but cannot transmit any data to the server. In such case temporary blacklist is used. Operator with unavailable GPRS gets into the temporary blacklist, which prevents the FM device's connection to this operator on the next operator search.
  In other case, device connects to mobile operator and successfully obtains GSM and GPRS signal. However, records still do not reach the server. Device has an ability to work around the faulty network (i.e. when network connection is lost) by putting this operator into the temporary backlist. Ban in this case is implemented via 2nd level temporary black list logic. Network verification is done as follows:
  - •• Server pinging – device performs server pinging only when there is no response (no ACK) from the server and if the connection to server is not available.

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It will make up to 3 separate pinging attempts. If any of these attempts are successful, network will be verified. In an ideal case, server responds after the first attempt, network is verified and no more pinging operations are needed.

If the server fails to respond to all of them, the device will switch to another operator, after putting current operator into the temporary black list.

During a single pinging operation device transmits approximately 256 bytes of data. If device needs to make all three attempts, it will send approximately 768 bytes.

•• Operator is also added to the temporary black list, when the device receives "13110" error code from the operator. According to Quectel M95 AT command manual the first number in error code "1" stands for "Cause for protocol stack (PS) layer" and the rest "3110" stands for "Network fail".
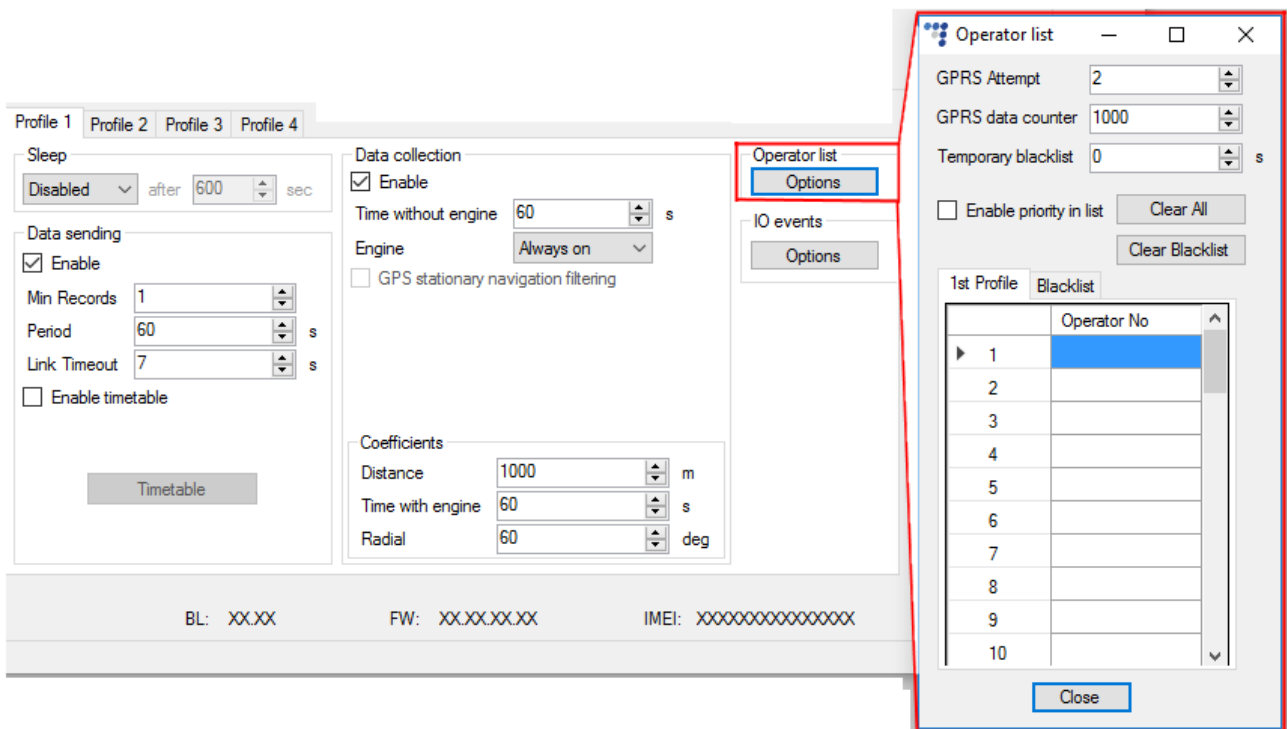
Received trouble codes can be monitored with the help of "GSM trouble codes" IO parameter.

Note
This functionality might be compatible and might be supported with 3G modems used in Ruptela's FM devices.


Key point about the temporary black list:

•• Ban period is configurable. When all operators get into the ban list, ban list is cleared.
•• Banned means that the terminal was not able to get the GPRS context, it was unable to connect to the operator, server failed to respond to 3 consecutive ping requests or that the terminal received "3110" error code from the mobile operator.
•• Ban list is in the RAM the memory, it is cleared after reset or power off.

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5.3.3 IO settings

IO events "Options" buttons opens up a new "IO settings" window, here you can enable or disable IO parameters that will be sent to a server. The setting the user should configure, is the protocol selection. **Protocol selection** section has a checkbox, where you can choose to "Send I/O data with v1.1 protocol".
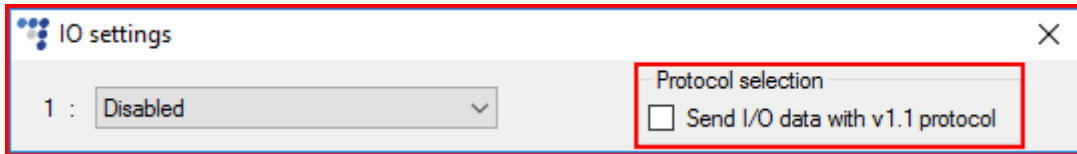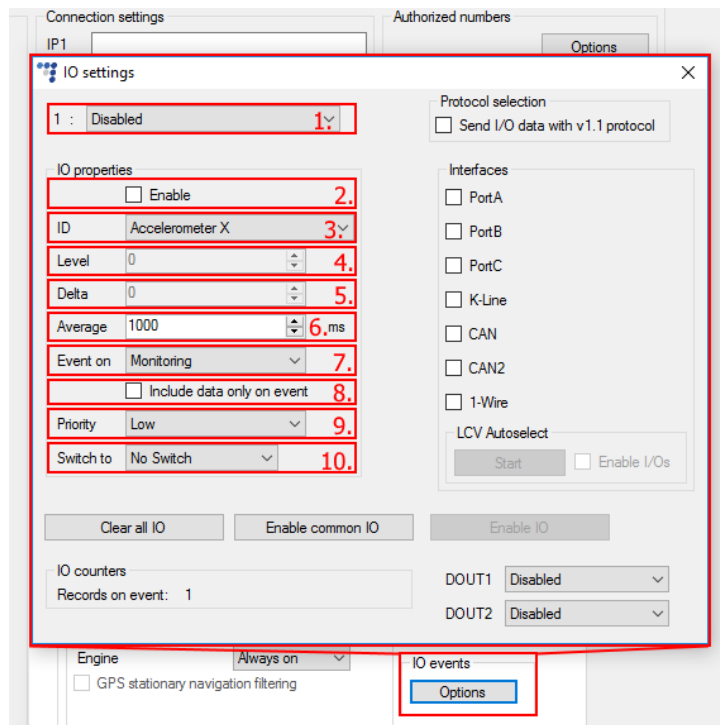

> **Note**
> A significant part of the IO parameters require that the protocol v1.1 is enabled! Without it enabled, these parameters will not be displayed in the ID list. Enabling the protocol will delete all unsent records from the device.

After the user decided on the protocol settings in accordance with his needs, he can move on to the IO parameters. There are several ways to enable IO parameters, the first way described is the fully manual way, where the user enables and configures each IO by hand:

1. You have 40 slots for parameters. Select slot you want to enable.
2. In the **IO properties** section tick the **Enable** check box, otherwise the slot will remain empty.
3. **ID** contains the parameter list. Choose a parameter you want to enable for the selected slot. One parameter can be enabled only one time.
4. **Level** is used with hysteresis mode, *see 7.c below for more details.*
5. **Delta** is used with hysteresis mode, *see 7.c below for more details.*
6. **Average**. Some parameter`s values change rapidly and do not correspond any valuable information. Averaging values for some period of time gives a more usable value of the parameter (e.g. fuel level often oscillates. Averaging gives you an approximated value that correspond to the real fuel level in the tank).
7. **Event on** – describes how the parameter will be measured and sent:
   a. *Monitoring* – Parameter value is always monitored and sent with every record
   b. *Change* – when value is changed record will be made regarding this change. However parameter is monitored and sent to server with every record
   c. *Hysteresis* – Record is generated because of specified change in parameter value. E.g. parameter is Power Supply voltage. Level sets point of reference, in this case 12700 mV. Delta is variation in value, e.g. 1000 mV. Record will be generated (because of parameter value change) when Power supply voltage drops to < 11700 mV and/or > 13700 mV. You can select condition "on rising" or "on falling"
8. Select **Include data only on event** to get a parameter value only when the condition (set in step 7) is met. In other cases the parameter value will not be included in the records.
9. If **Priority** is set to "High", the record will be sent immediately, disregarding data sending settings. If it is "Low", the device will wait for suitable conditions to open a link to server.
10. Upon an event of a value change in some parameter you can configure the device to **Switch to** the other profile.
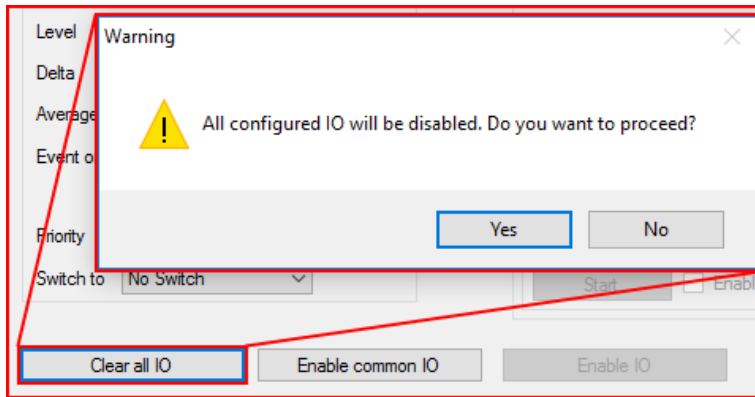
Note

Some IOs will have a "Debounce" setting instead of the "Average" setting. Debounce defines for how long the device must receive a changed state of an IO, before it registers the changed state. For example, the DIN state changed from 0 to 1 and Debounce is set to 5000ms, so the signal from the DIN must remain constant for the period of 5000ms to actually change the state of the IO from 0 to 1.
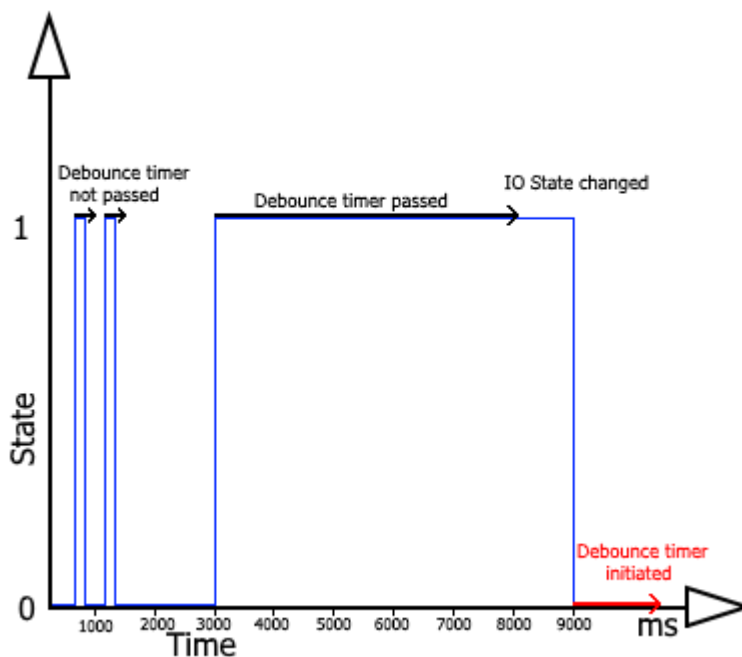

If IOs were configured incorrectly, or the user simply decides to re-do the configuration, he can use the "Clear all IO" button, which disables all the enabled IOs along with their configuration in the selected profile.

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The next method describes how to automatically enable and configure commonly used IOs. To do this, the user must simply click the "Enable common IO" button. This will open a window with a list of IO parameters that will be enabled along with additional information, such as:

● Free IO slots remaining after the selected IOs are enabled;
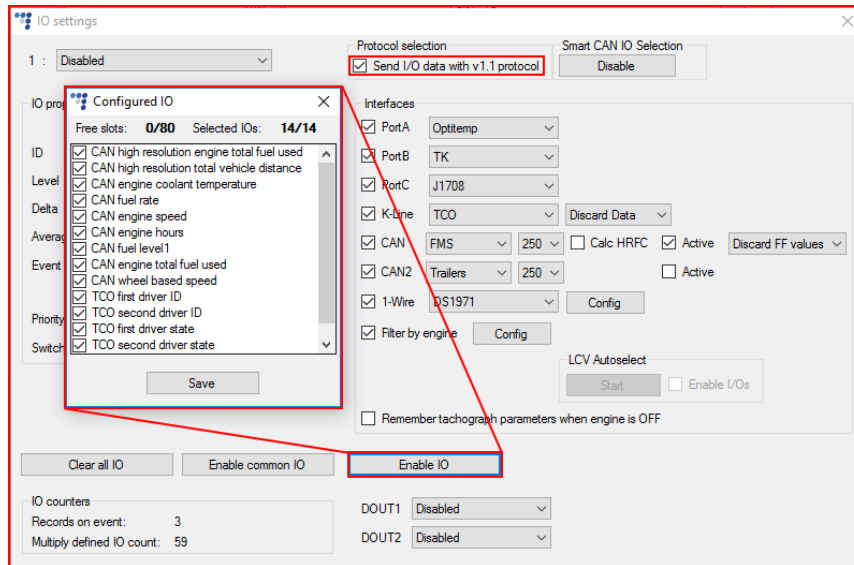● Amount of IO parameters selected.

The user can also choose, which of the IO parameters to enable, this can be done by unchecking the checkbox before the IO parameter name. To enable the selected parameters, the user must click "Save".
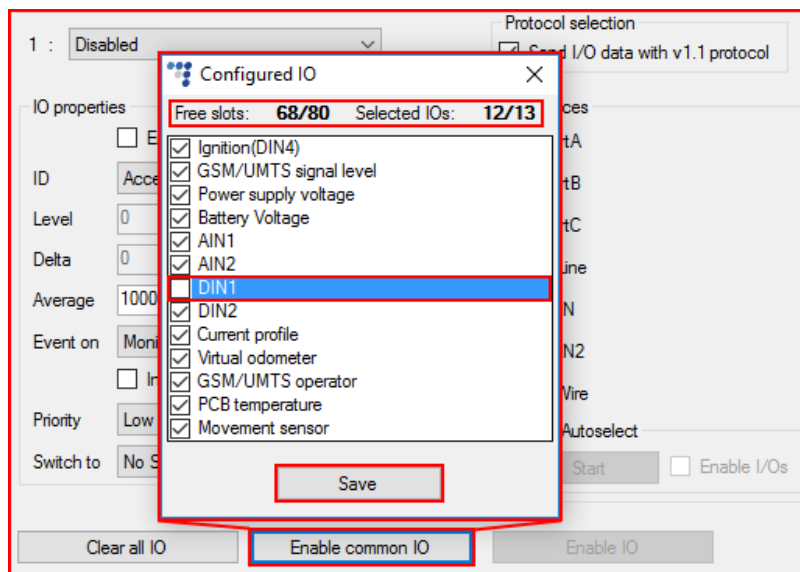
If there are not enough slots to enable the selected IO parameters, an error window will appear.
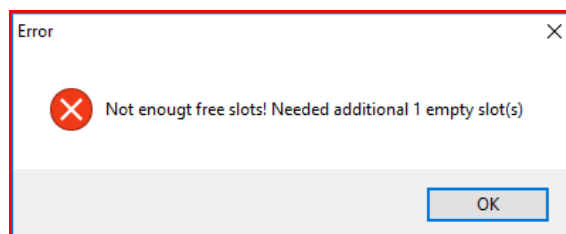
Lastly, the "Enable IO" button enables IOs for the selected interfaces. **This button is available only if the "Protocol v1.1" is enabled!**

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Interfaces are described further down in this document.

Interfaces section gives ability to enable or disable all of the device's interfaces. Bellow you will find checkboxes for the K-Line and CAN interfaces.

K-Line – if you put a tick in the K-Line checkbox, then a windows will appear where you can choose:
- **DTC enable** - here you can specify Diagnostic Trouble Codes reading interval in minutes. Below two additional checkboxes are displayed, meant to specify **Fuel type**: *"Gasoline", "Diesel"*.

CAN – if you put a tick in the CAN interface checkbox, a windows will appear where you can choose:
- **DTC enable** - here you can specify Diagnostic Trouble Codes reading interval in minutes. Below two additional checkboxes are displayed, meant to specify **Fuel type**: *"Gasoline", "Diesel"*.

More information available at our on our documentation website.

5.4 Integration protocol
All integration related questions and documentation can be acquired from Ruptela technical support: support@ruptela.com

6   Device installation

Locate the OBD2 socket in your vehicle. Insert the FM-Plug4 / FM-Plug4+ device into the OBD2 socket as shown in the picture below. There is only one way to plug the device in, be careful not to damage the pins.

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