RaceROM Features

for

Mazda MX-5

v1.5

Index

Warning

!!! CAUTION !!!

EcuTek ProECU tuning tools should only be used by experienced tuners who understand the product and engine calibration.

If you do not fully understand this product then you WILL damage your engine, ECU or your vehicle.

Please ensure you fully read all EcuTek manuals BEFORE attempting to use ProECU with your laptop or your vehicle.

Use with extreme caution and understanding at all times, if in doubt then do not proceed.

EcuTek accepts no responsibility for any damage to the engine, ECU or any part of the vehicle that results directly or indirectly from using the product.

** If you are in any doubt that you do NOT have the experience required to use this product then you should NOT USE IT **

Introduction

EcuTek RaceROM is a package of special software features that can be installed into the ECU of the supported vehicles. You simply open your ECU ROM file using EcuTek software, apply the RaceROM Feature File (Patch) to it, adjust the RaceROM maps as necessary, and then program the ROM file into the vehicle.

Please read the **ProECU Tuning RaceROM Feature File Guide** for info on how RaceROM works, how to install and uninstall RaceROM feature files, and further hints and tips.

Please also see our website for various videos and webinars for further information.

Feature list

EcuTek RaceROM for Mazda MX5 currently includes the following features:

- Map Switching
- Speed Density
- Launch Control
- Flat Foot Shifting
- Downshift Auto Blip
- Per Gear Rev Limits

Supported Vehicle Models

This product supports Mazda MX5 NC (3rd Generation, 2006 - 2014) 1.8 and 2.0 litre models in all worldwide markets.

We have similar products available for other vehicles. Please contact our sales team for further details.

Availability

EcuTek RaceROM Feature Files (RRFF) will be made available via EcuTek Update, always use the latest RRFF version that is in the RaceROM folder.

Overview

This section gives a brief description of the RaceROM features. More detailed information is available later in this document.

Map Switching

The Map Switching feature allows you to define four different calibrations in the ECU ROM. The driver can switch between the calibrations using the cruise control lever.

The Map Switching feature can also be used as a trigger to activate other RaceROM features. For example: the Launch Control, Flat Foot Shift and Auto Blip features can each be configured to operate in any of the four modes.

Speed Density

The Speed Density (SD) feature changes the way that mass airflow is calculated. When SD mode is activated, the ECU will disregard the MAF sensor reading and calculate mass airflow based on Engine Speed, Manifold Pressure and Air Temperature instead. This allows you to remove the MAF sensor and fit a larger intake if desired.

Launch Control

The Launch Control feature limits maximum RPM during launch in an attempt to control wheel spin and allow the fastest possible take off.

Flat Foot Shifting

The Flat Foot Shifting feature allows the driver to up-shift without lifting his foot from the accelerator pedal.

Auto Blip

The Auto Blip feature applies a short burst of throttle when the driver is down-shifting under braking. This raises the RPM to keep the engine operating within its power band and provides a smooth entry into the lower gear by reducing engine braking.

Per Gear Rev Limits

The Per Gear Rev Limits feature allows you to define different rev limits for each gear. By setting a higher rev limit in lower gears you may be able to reduce the number of gearshifts required in attaining a given speed. E.g. 0-60mph (0-100km/h) tests.

RaceROM Feature File Installation

Please refer to the **ProECU RaceROM Feature File Guide** found under the Help menu of ProECU for more info on how to install, remove and update RaceROM Feature Files.

Configuration

Custom Feature Control Maps

Go to the 'Maps' Tab, expand 'EcuTek RaceROM Maps'. This will show you all of the maps that have been added by the RaceROM Feature File.
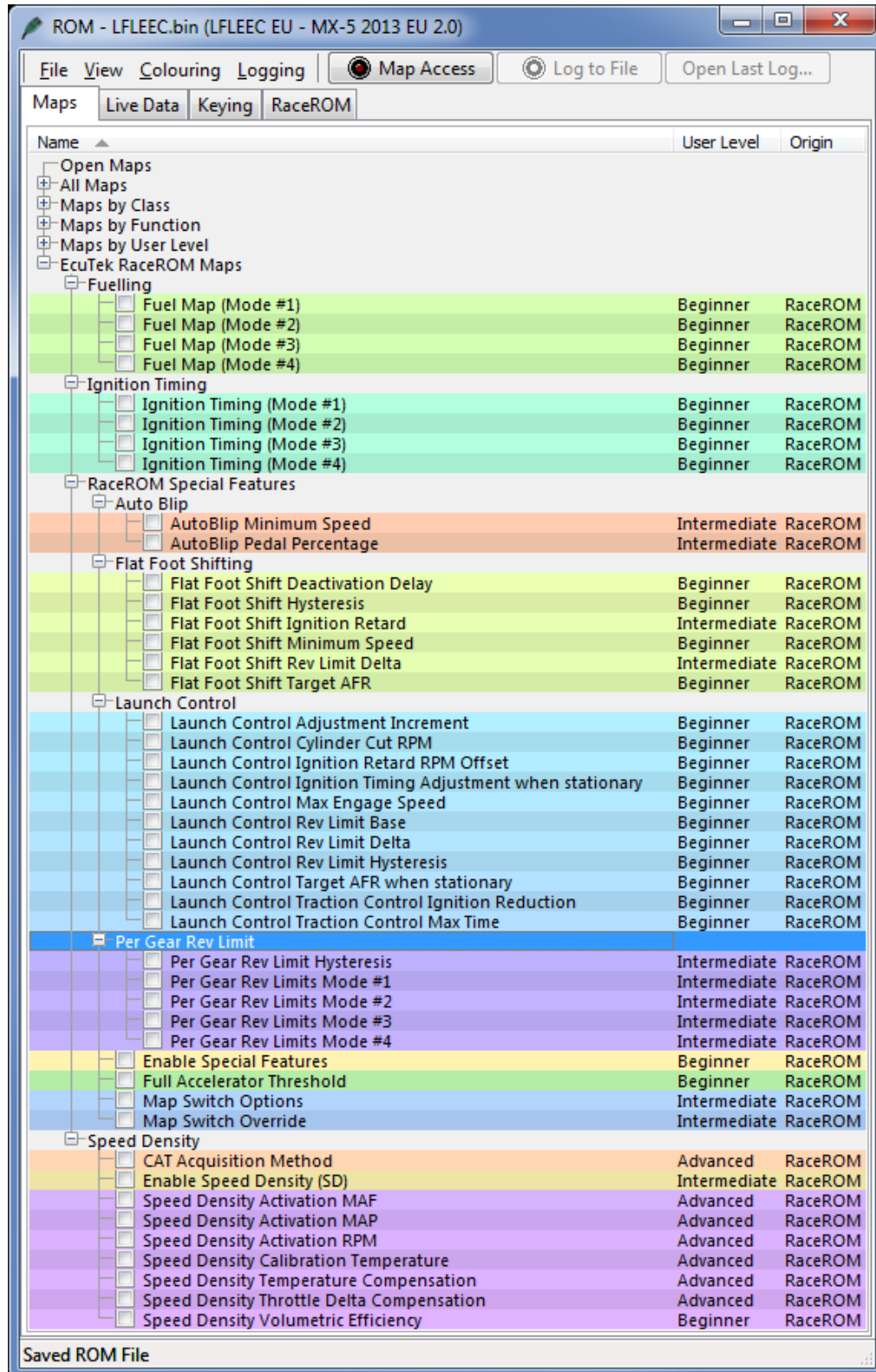
Map Switching Feature

Method of Operation

The Map Switching feature is enabled by the option buttons in the 'Map Switch Options' map. Four modes are allowed by default, but this can be reduced if desired.

In "Mode 1", the ECU will use the original ECU maps for Fuelling and Ignition Timing.

In the other three modes, the ECU will use the new Fuel, and Ignition Timing maps labelled Mode2, Mode3 and Mode4 as appropriate.
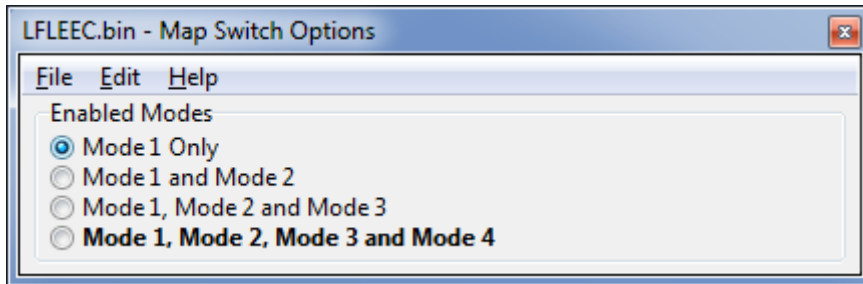
There is also an option to disable the RaceROM Maps in Mode 1 to retain the factory fuel and ignition strategy.
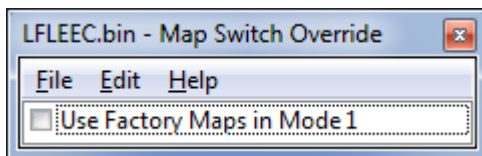
Switching mode using the cruise control instruments

- Ignition must be ON
- Ensure cruise control master switch is OFF
- Press the cruise control cancel button on the steering wheel.
- The tachometer will move to 1000, 2000, 3000 or 4000 rpm to indicate the currently active mode.
- Move the cruise lever up (res/acc position) to increase the mode.
- Move the cruise lever down (set/cst position) to decrease the mode.
- Save the selected mode by pressing the cancel button again or waiting 2 seconds.

The last selected Map Switch mode will be saved when the vehicle is turned off, so when you restart the engine it will default back to the last selected mode.

Integration with Launch Control, Flat Foot Shifting and Auto Blip

The Launch Control, Flat Foot Shifting and Auto Blip features can be independently enabled in each of the four modes.

Logging

The "Mapswitch Mode" diagnostic parameter can be used to log the current map switch mode.

Speed Density Feature

Method of Operation

The Speed Density (SD) feature is enabled by selecting the checkbox in the Speed Density Enable map.

The Speed Density Feature can be enabled in any of the four calibration modes by selecting the appropriate checkboxes in the "Enable Speed Density (SD)" map.
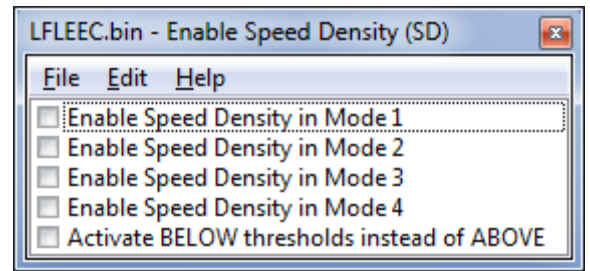
When this feature is active, the ECU will ignore the reading from the Mass Airflow sensor and will calculate mass airflow as follows:

- Estimated mass airflow is calculated from RPM, Manifold Pressure, Charge Air Temperature, and Volumetric Efficiency (VE), output from the Speed Density Volumetric Efficiency (Speed Density Volumetric Efficiency) map.
- This value is then multiplied by an adjustment factor selected from the 2D "Speed Density Temperature Compensation" map based on Intake Air Temperature.
- This is then multiplied by a value selected from the 2D "Speed Density Throttle Delta Compensation" map, resulting in a mass airflow value in grams/second.
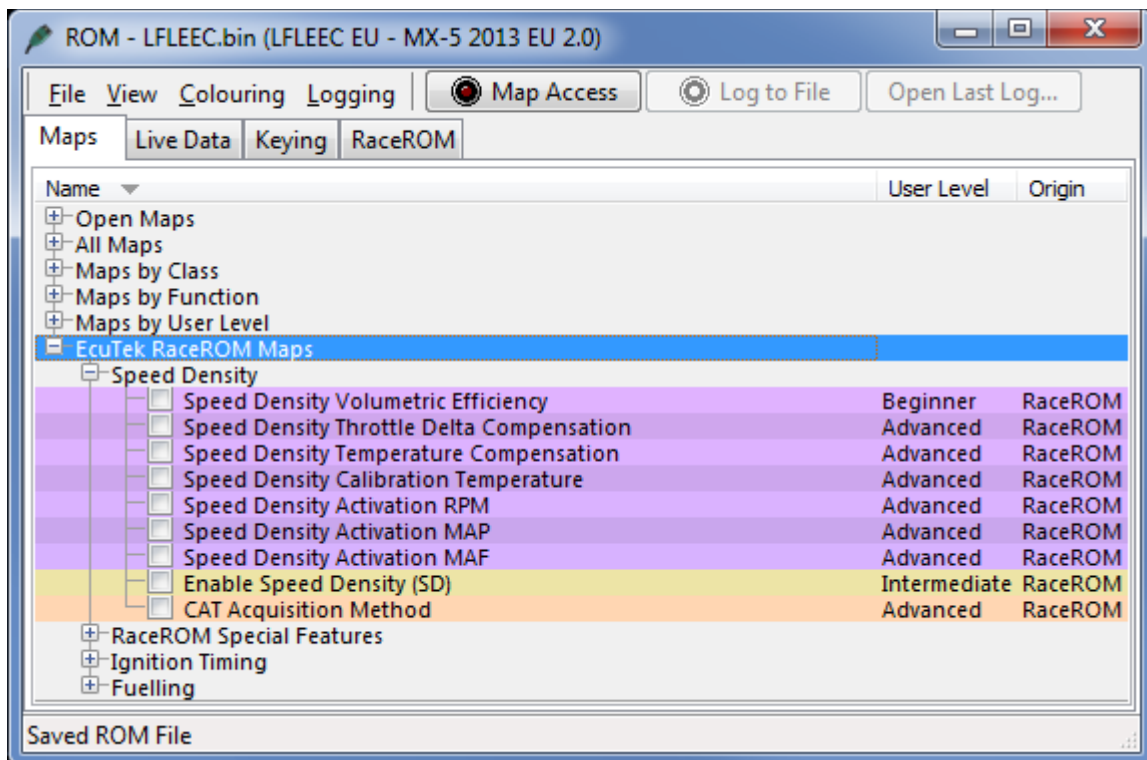
The state of the SD system can be monitored in Live Data using the "SD Active" parameter. (0 for Off, 1 for On). The "SD VE Actual" parameter will display the output from the SD VE map, or 0 if the system is not active. The "SD VE Calculated" parameter provides a theoretical value for volumetric efficiency based on Mass Air Flow, Intake Air Temperature, Engine Speed and Manifold Relative Pressure, helpful when calibrating the SD VE Map.

Using Speed Density and MAF sensor together

The Speed Density feature can also be useful in applications where the MAF sensor is present, but the amount of airflow is higher than the MAF sensor can measure. In this scenario, the ECU can be programmed to use the MAF sensor at lower mass airflow values and switch to Speed Density for the higher values.

You can specify threshold values of MAF, RPM and MAP that are required for Speed Density activation. The ECU will activate the Speed Density feature only when all three of these values are **above** their respective thresholds.

The threshold values are implemented using hysteresis. The 1st value should be higher than the 2nd value. The feature will activate when the parameter rises above the 1st value, and will deactivate when it falls below the 2nd value.

You can also use the Speed Density feature in applications where the amount of airflow is lower than the MAF sensor can accurately measure. In this situation, enable the "Activate BELOW thresholds instead of ABOVE" checkbox. The ECU will activate the Speed Density feature when MAF, RPM and MAP are all **below** their respective thresholds.

The default value for the thresholds is zero. If you use the "Activate BELOW thresholds instead of ABOVE" checkbox, then the feature will only be activated when all three parameters are below their respective thresholds. Therefore you need to set a high value into any thresholds that you are not using, otherwise the feature will not activate.

Integration with Map Switching Feature

Speed density can be enabled in each of the four map switch modes however there is only one set of speed density maps.

Launch Control Feature
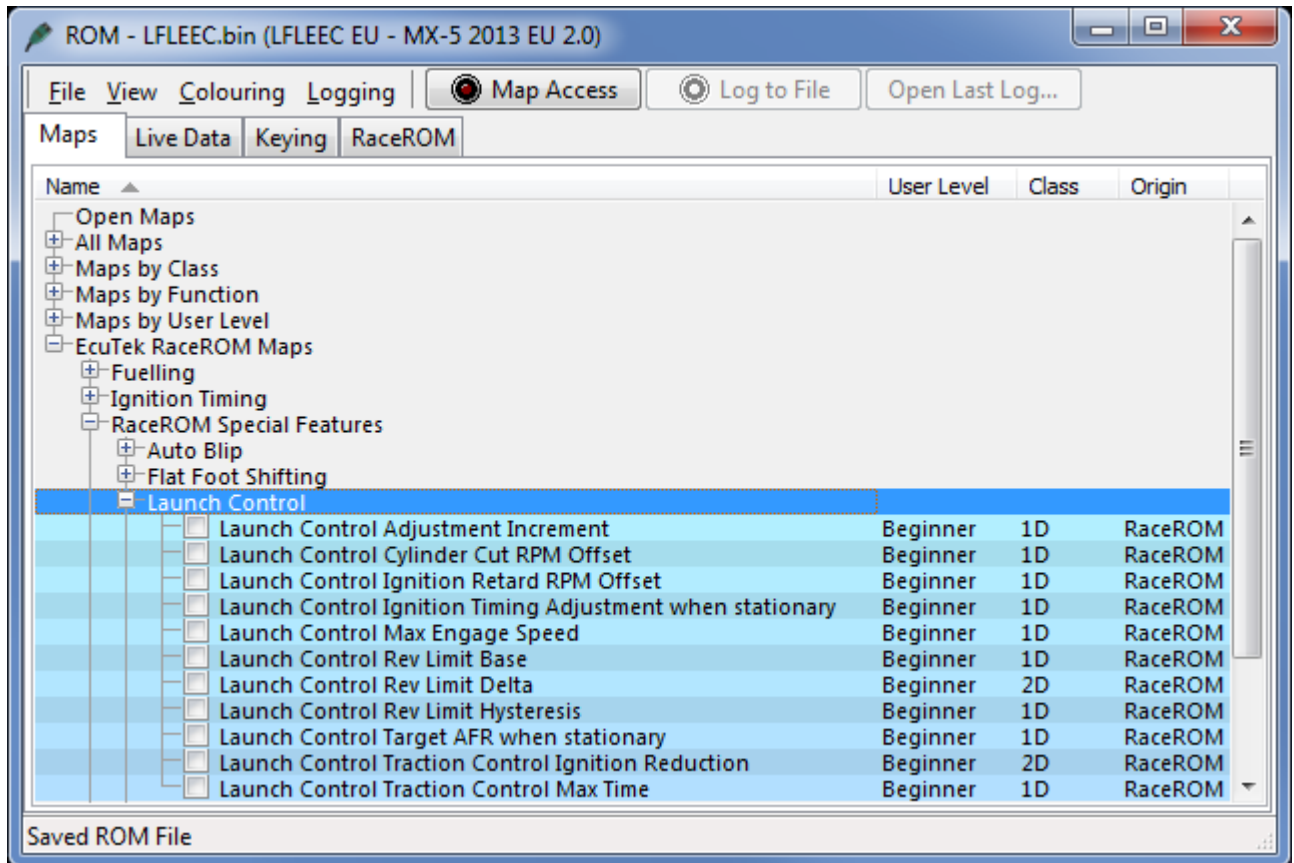
Method of Operation

Activate the launch control as follows

- Ensure the 'Launch Control Enable' checkbox is ON for the current Map Switch Mode
- Engine must be running and Vehicle must be stationary
- Press clutch pedal and move the gear stick to 1st position
- Quickly press the accelerator all the way to the floor
- Adjust launch RPM using the cruise control instruments
- Release the clutch to commence launch

When Launch Control is active, the rev limit will be set to the 'Launch Control Rev Limit'. This limit defaults to the 'Launch Control Rev Limit Base" value and can be adjusted up and down using the cruise control instruments. Select "Res/Acc" to increase the launch RPM and "Set/Cst" to decrease it.

During the launch, the rev limit increases according to the 'Launch Control Rev Limit Delta, This 2D map, indexed by elapsed time, has multiple columns to allow you to set up a multi-stage system for best results.

Adjustments are provided that allow you to enrich the AFR and retard the timing when the vehicle is stationary in order to create pops and bangs. This adjustment is removed as soon as the vehicle starts to move.
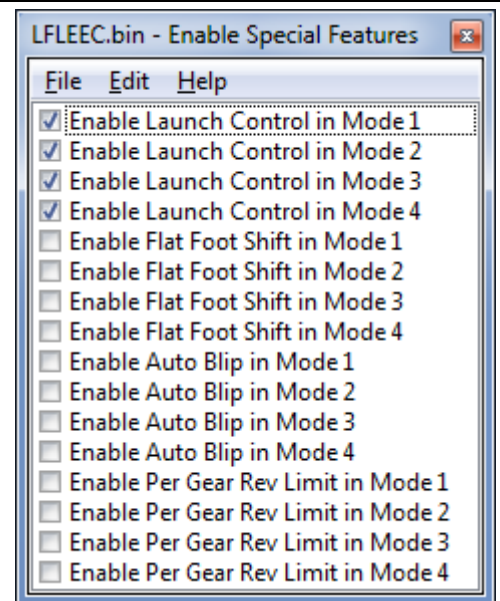
The Launch Control feature is deactivated when one of the following conditions occurs:
- The vehicle speed exceeds the last column on the 'Launch Control Rev Limit Delta Map'

- The driver lifts off the accelerator
- The driver performs a flatfoot shift

## Integration with Map Switching Feature

The Launch Control Feature can be enabled in any of the four calibration modes by selecting the appropriate checkboxes in the "Enable Special Features" map.

LFLEEC.bin - Enable Special Features

File   Edit   Help

☑ Enable Launch Control in Mode 1
☑ Enable Launch Control in Mode 2
☑ Enable Launch Control in Mode 3
☑ Enable Launch Control in Mode 4
☐ Enable Flat Foot Shift in Mode 1
☐ Enable Flat Foot Shift in Mode 2
☐ Enable Flat Foot Shift in Mode 3
☐ Enable Flat Foot Shift in Mode 4
☐ Enable Auto Blip in Mode 1
☐ Enable Auto Blip in Mode 2
☐ Enable Auto Blip in Mode 3
☐ Enable Auto Blip in Mode 4
☐ Enable Per Gear Rev Limit in Mode 1
☐ Enable Per Gear Rev Limit in Mode 2
☐ Enable Per Gear Rev Limit in Mode 3
☐ Enable Per Gear Rev Limit in Mode 4

Example of use

Please see our website video showing the adjustable Launch Control feature in operation.

Flat Foot Shifting Feature
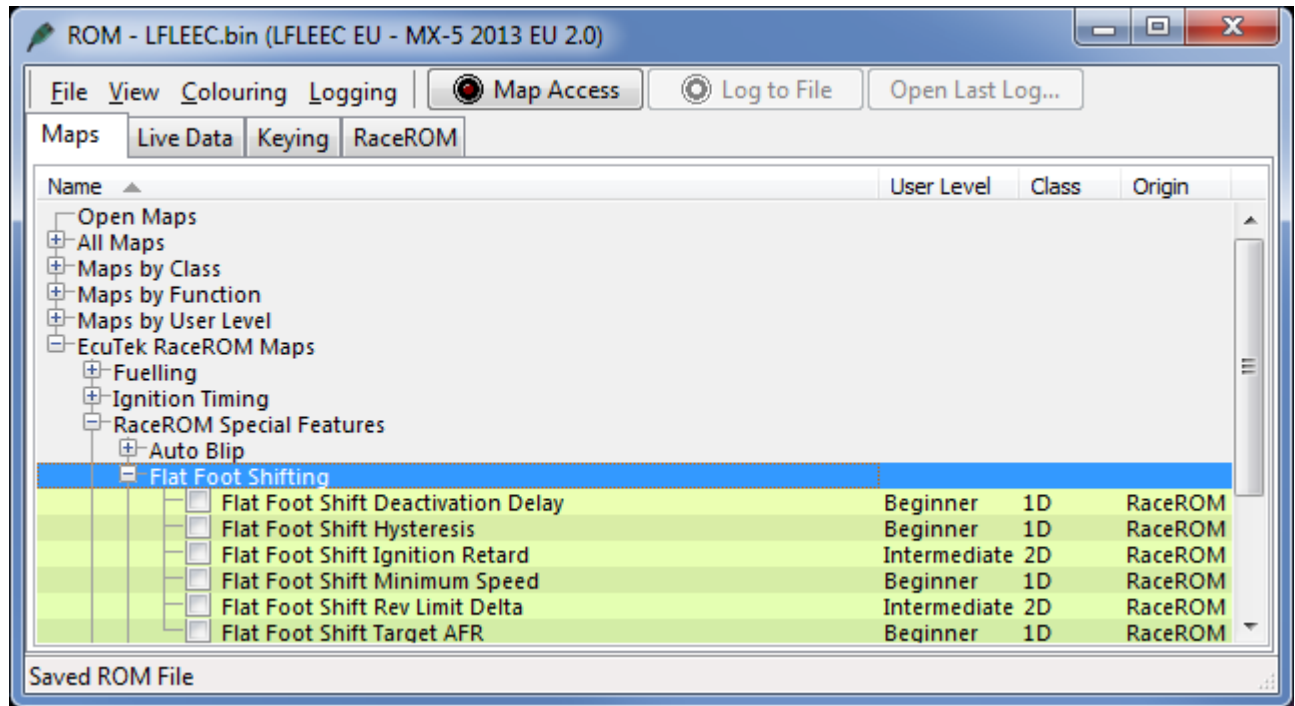
Method of Operation

The Flat Foot Shifting Feature (FFS) is activated when all of the following conditions are met:

- 'The Flat Foot Shift Enable' checkbox is ON for the current Map Switch Mode
- The vehicle is travelling faster than the 'Flat Foot Shift Minimum Speed'
- The accelerator amount is greater than the value in the 'Full Accelerator Threshold Map'
- The driver is pressing the Clutch pedal

At the moment when the Flat Foot Shifting feature activates, a temporary rev limit is set that is slightly higher than the current RPM. The ignition timing is retarded by a specified amount that reduces engine torque while preventing the RPM from rising too rapidly. When the driver completes the gear change, the temporary rev limit and timing adjustment are removed.

The Flat Foot Shifting Feature is cancelled when one of the following conditions occurs:

- The driver releases the Clutch pedal
- The driver lifts off the accelerator
- The vehicle speed falls below the value in the 'Flat Foot Shift Minimum Speed Map'

Note: Flat Foot Shifting is not available on vehicles fitted with Automatic Transmissions.

An AFR adjustment is provided that allows you to enrich the AFR during the shift. The richer AFR cannot be measured from the exhaust gas due to the operation of the rev limiter.
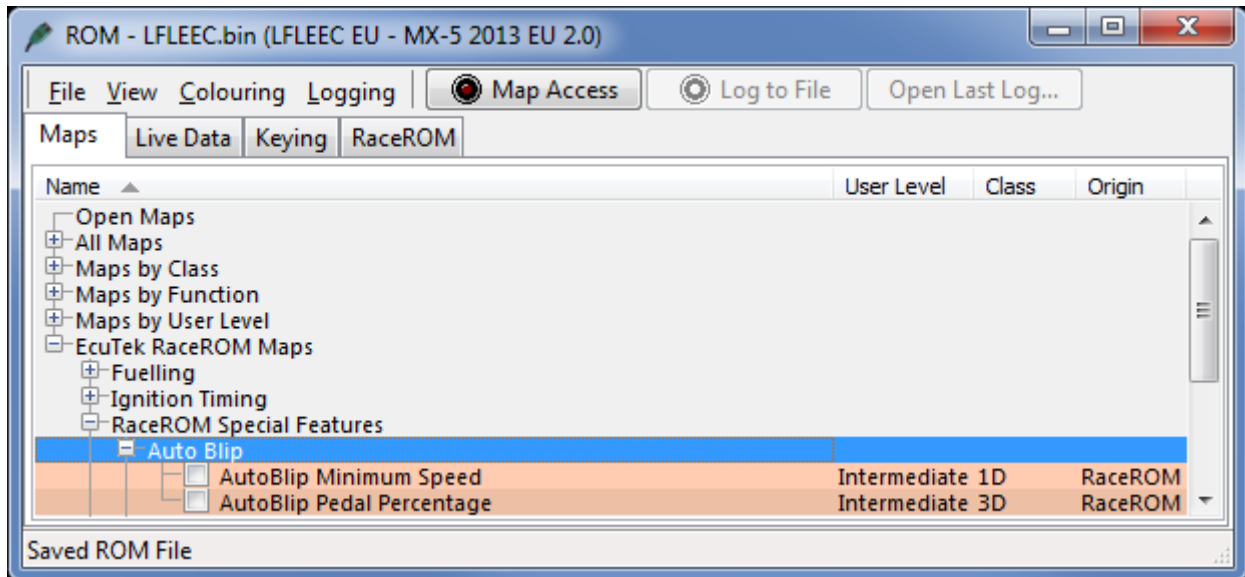
Integration with Map Switching Feature

The Flat Foot Shift Feature can be enabled each of the four modes by selecting the appropriate checkboxes in the "Enable Special Features" map.

Example of use

Please see our website video showing the Flat Foot Shifting feature in operation.

Auto Blip Feature

Method of Operation

When the driver down-shifts while braking, the ECU will blip the accelerator. The amount of accelerator to apply is controlled by the 'AutoBlip Pedal Percentage Map' and is dependent on the engine RPM at the time of activation. The duration of the blip is controlled by the 'AutoBlip Max Duration Map'.

The Auto Blip feature is activated when all of the following conditions are met:

- The 'Auto Blip Enable checkbox' is ON for the current Map Switch Mode
- The vehicle is travelling faster than the Auto Blip Minimum Speed
- The driver presses the clutch pedal while braking
- A minimum of 1 second has elapsed since the last auto blip

The accelerator blip is immediately cancelled when one of the following conditions occurs:

- The driver releases the Brake Pedal
- The driver releases the Clutch Pedal
- The driver presses the Accelerator Pedal
- The vehicle speed falls below the 'Auto Blip Minimum Speed'
- The Auto Blip timer exceeds the value in the 'Auto Blip Max Duration Map'

Note: Auto Blip is not available on vehicles fitted with Automatic Transmissions.

Integration with Map Switching Feature

The Auto Blip Feature can be enabled each of the 4 modes by selecting the appropriate checkboxes in the "Enable Special Features" map.
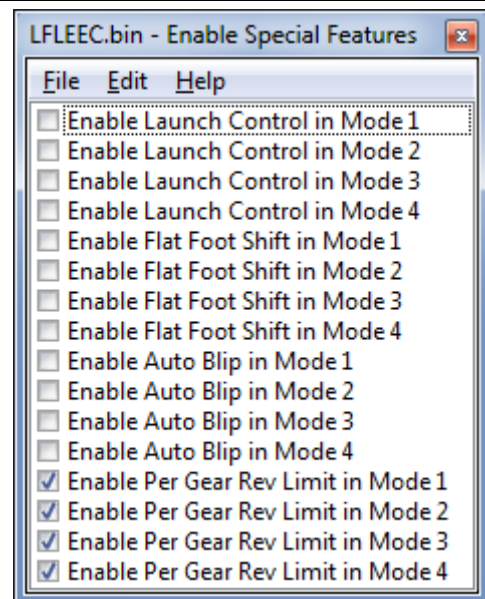
Per Gear Rev Limits Feature
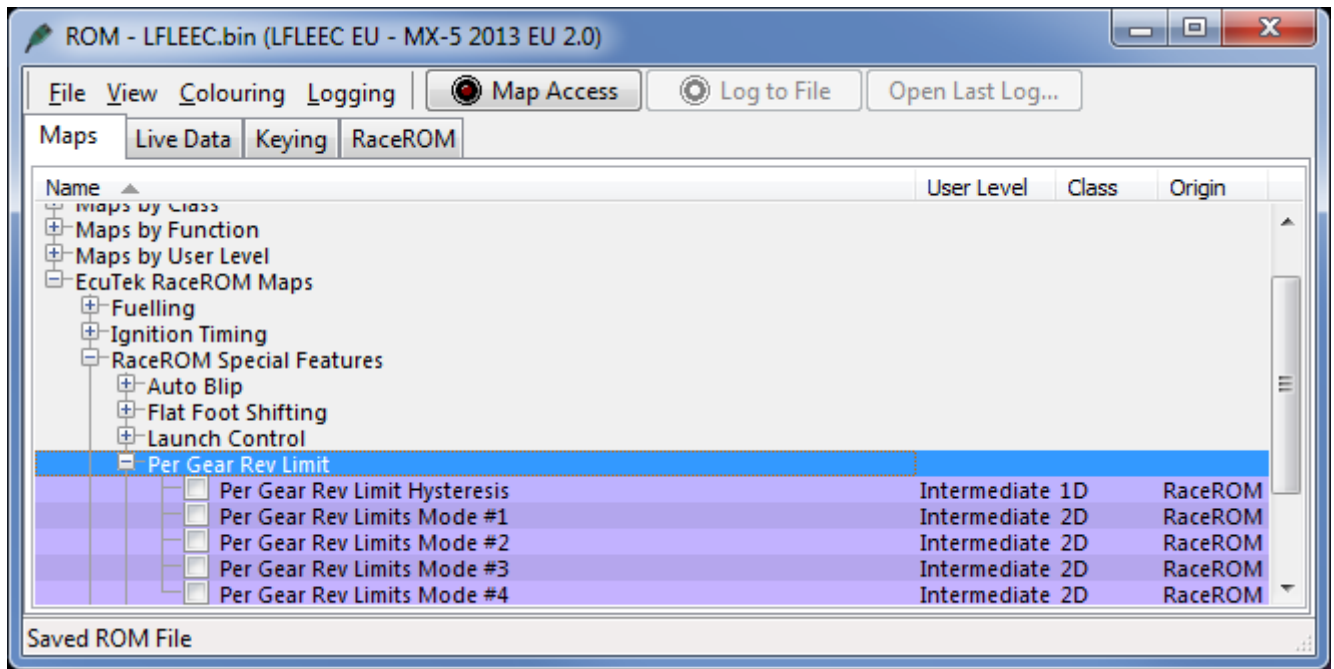
Method of Operation

The Per Gear Rev Limits feature is enabled by the 'Enable Per Gear Rev Limit' checkboxes in the 'Enable Special Features' map. When this feature is enabled, the ECU will use separate rev limits for each gear.

The upper rev limit (fuel cut) is defined in the "Per Gear Rev Limits" map for each mode.

The lower rev limit (fuel resume) is calculated by subtracting the value of "Per Gear Rev Limit Hysteresis" from the upper limit. For example, if the upper limit for the current gear is 7400 and the hysteresis is 100 then the lower limit will be 7300.

Integration with Map Switching Feature

Separate sets of Per Gear Rev Limit maps are provided for each of the 4 modes.
When Per Gear Rev Limits are not enabled, all modes will use the original ECU rev limit map.

RaceROM Live Data

RaceROM provides additional diagnostics parameters to aid tuning and fault finding. Below is a list of the custom parameters:

- **Accelerator Pedal** – High resolution accelerator pedal position in %.
- **Brake Pedal** – An On / Off flag to display the state of the brake pedal.
- **Clutch Pedal** – An On / Off flag to display the state of the clutch pedal.
- **Engine Load** – High resolution engine load reading in g/rev. The same value used as the input to the fuel and ignition maps.
- **Engine Speed** – High resolution engine speed in RPM.
- **Fuel Trim – Combined** – An addition of Fuel Trim Long Term and Fuel Trim Short Term to display the total amount of fuel trim.
- **Gear** – The currently calculated gear from engine speed and vehicle speed.
- **Intake Air Temperature** – High resolution intake air temperature reading.
- **Knock Sensor Input** – The input value to the knock sensitivity map.
- **MAF Sensor** – The output from the mass air flow sensor before the speed density calculation. Will read zero if the MAF Sensor is unplugged.
- **Manifold Absolute Pressure** – The pressure in the manifold.
- **Manifold Relative Pressure** – The difference in pressure between atmospheric pressure and manifold pressure. This value is used as the input axis to the Injector Lag Time and Injector Flow Rate Compensation maps.
- **Map Switch Mode** – The currently selected map switch mode.
- **Mass Air Flow** – High resolution mass air flow reading. This is the value after the Speed Density calculation (if SD has been enabled) so may differ from the MAF Sensor value if SD is active.
- **SD On / Off** – An On / Off flag to display the operating state of the Speed Density system. Will only be enabled if all the conditions for Speed Density are met.
- **SD Volumetric Efficiency** – The output from the Speed Density Volumetric Efficiency map, before the intake air temperature and throttle delta compensations.
- **SD Volumetric Efficiency – Calc** – The approximate Speed Density Volumetric Efficiency. This value is calculated from Engine Speed, Intake Air Temperature, Manifold Pressure and Mass Air Flow.
- **Throttle Delta** – The rate of change of the throttle pedal in a specific time period.
- **Wheel Speed – Front Left** – The wheel speed of the front left wheel.
- **Wheel Speed – Front Right** – The wheel speed of the front right wheel.
- **Wheel Speed – Rear Left** – The wheel speed of the rear left wheel.
- **Wheel Speed – Rear Right** – The wheel speed of the rear right wheel.

Programming

Please refer to the **ProECU Programming Overview** manual found under the Help menu of ProECU for more info on how to program the ECU.