



HOW-TO

How-to Configure Fuel Film in EMU PRO

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1. Introduction

This document describes the Fuel Film strategy in EMU PRO and presents practical steps for the tuning process.

The Fuel Film strategy provides a way to make fuel corrections for sudden changes in the throttle position. Often called acceleration enrichment or wall wetting.

The concept of this strategy is to model the realistic behavior of the fuel sticking to the intake path and evaporating. Five main variables change the amount of fuel film formed on the walls:

- intake manifold pressure – higher pressure = larger film,
- air flow speed (represented by RPM) – lower RPM = larger film,
- engine temperature – lower temperature = larger film,
- intake charge temperature – lower temperature = larger film,
- relative fuel amount (represented by lambda target) – richer mixture = larger film.

Fuel film in the engine is controlled by adding or removing a specific fuel volume and tracking all those corrections. The strategy is making corrections to achieve the fuel film volume target set by the user. This film target is set in microliters for a single cylinder, and all corrections are controlled and tracked independently for each cylinder.

Corrections are applied after a sudden change in the film target and decay over time. The duration of that decay must also be set by the user. There are separate duration settings for increasing and decreasing the fuel film.

2. Channels

Fuel Film State – state of the strategy

Fuel Film Volume – the volume of the fuel film tracked by the strategy

Fuel Film Correction – currently applied fuel correction

Fuel Film Target – the current target for the film calculated from the base table and corrections

3. Parameters

Fuel / Film / Activation / Instant correction max – the amount of fuel film target change to activate the corrections

Fuel / Film / Target / Base – base table for setting the film volume target in microliters

Fuel / Film / Target / Corrections – tables with film target corrections in percent

Fuel / Film / Increase duration / Base – base table for setting decay time in milliseconds when increasing the film

Fuel / Film / Decrease duration / Base – base table for setting the decay time in milliseconds when decreasing the film

Fuel / Film / Duration corrections – tables with decay duration corrections in percent

4. Tuning requirements

- Good base fuel map
- Engine at operating temperature
- Disabled short term trim

5. Tuning process

Ideally, we want to isolate as many variables as possible. That's why the best way to tune fuel film is on a load dyno, keeping constant RPM, but it can also be done on the road or even without any load on the engine.

The first situation to tune is the worst-case scenario (for a warm engine). This means low RPM and the biggest change in manifold pressure. For most engines, we recommend starting with 2000 RPM. Engine speed should be relatively low but out of the idle range, so the idle control doesn't affect the tuning process.

To check the effects of fuel film, keep the engine at the RPM you chose. Next, push the throttle to 100% and hold it there for 1-2 seconds, then release it. Don't make a fast push of the throttle and immediate release because that creates a situation where you first need to add fuel and then remove it shortly after that, which makes tuning harder.

After the throttle stab, there will be a lean spike if there is insufficient fuel correction. Adjusting the correction is done by changing the fuel film target. Open the Fuel Film Target Base table and double all the values. Do the throttle stab again and check the effects. Repeat that process until you start seeing the positive effects of the fuel correction. Then you can begin dialing values more

precisely. The maximum value in the table can be in the range from a few tenths to a few thousand microlitres, depending on the engine setup. Engines with ITB and injectors very close to intake ports create low amounts of fuel film, while engines with long intake injectors far from the head and running on ethanol will have much larger film.

The decay duration should be adjusted to replicate the needed correction over time. If the duration is too short, the lambda after pushing the throttle will be correct initially but then will have a lean spot. If the duration is too long, there will be a rich spot after the correct lambda. Changing the duration might require additional fine-tuning of the film target.

The rest of the process is fine-tuning for different conditions. Use the correction tables for target and duration to adjust the film at different engine speeds, amount of throttle actuation, and temperatures.

6. Document history

Revision	Date	Changes
1.0	2024.03.07	Initial release