

Spitronics ECU - Graph MAP Fuel Tuning - Guide

1. Overview

Graph MAP Tuning is a fuel modelling strategy that separates engine fuel requirements into two independent components:

1. Load Fuel Requirement
2. RPM Fuel Correction

Rather than tuning hundreds of individual fuel cells, the tuner first creates a Load Model and then applies RPM Corrections for different operating conditions.

This method has been used successfully on thousands of Spitronics installations and remains one of the fastest methods available for dyno tuning.

Graph MAP tuning excels when:

- A chassis dyno is available
- Similar engine maps already exist
- Multiple similar engines require tuning
- Fast calibration is important

When a suitable calibration already exists, Graph MAP tuning can also be used very successfully for road tuning.

It is generally not recommended for building a fuel model completely from scratch on the road.

2. Understanding The Fuel Model

The fuel calculation consists of:

Fuel Load Graph

This graph determines the engine's basic fuel requirement according to manifold pressure. Think of this as the engine's primary fuel curve.

RPM Compensation Graphs

Five RPM compensation graphs modify the fuel requirement according to engine speed.

The five operating zones are:

- Low
- Low Cruise
- Cruise
- High Cruise
- WOT

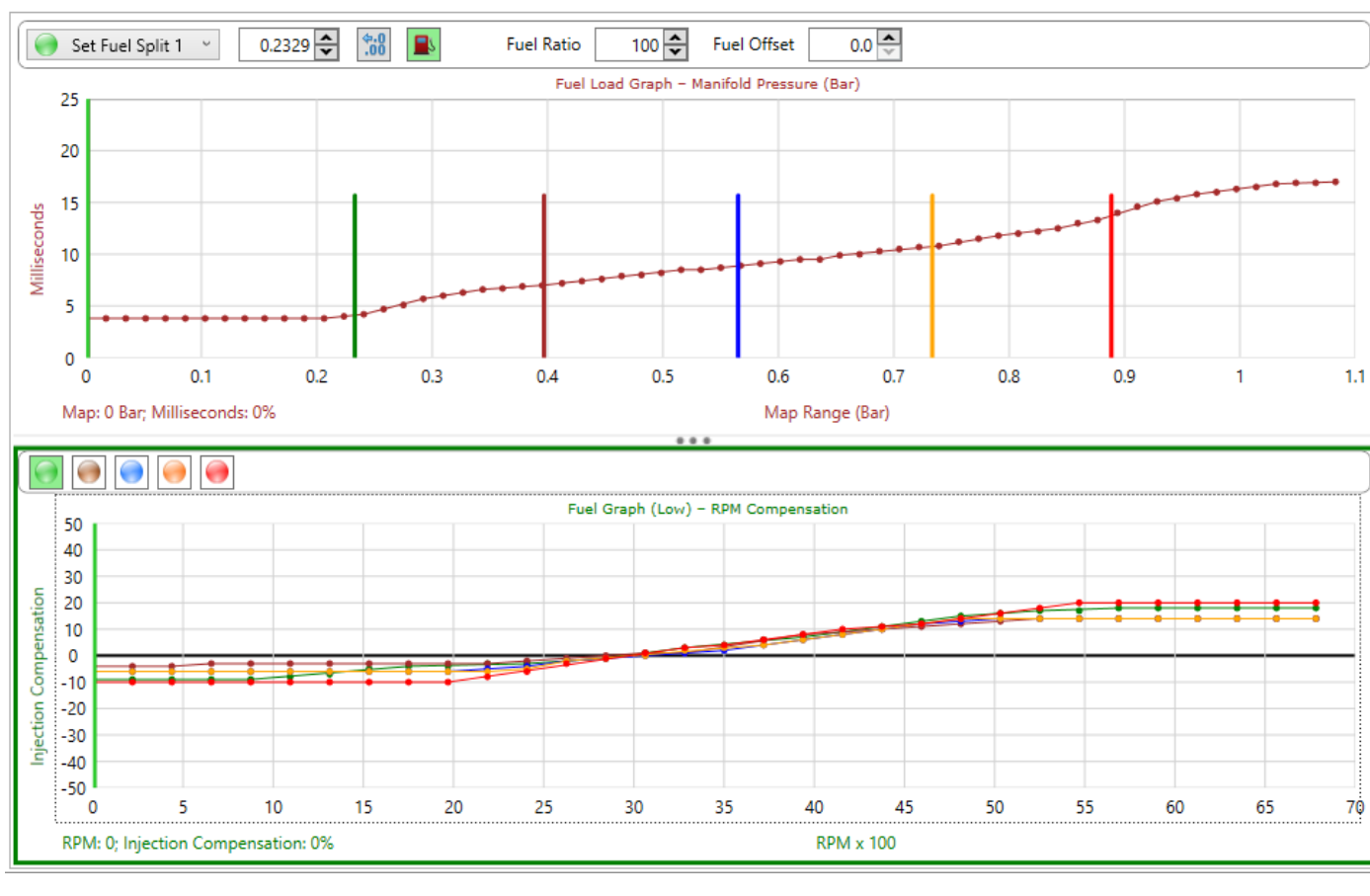
Each graph represents one operating zone.

The ECU continuously interpolates between these zones to provide smooth fuel delivery.

Final Fuel Calculation

The final injector pulse width is calculated from:

Fuel Load Graph PLUS RPM Compensation From The Active Load Zone



3. Why This Method Tunes Quickly

Most matrix systems require the tuner to visit a large number of operating cells.

Graph MAP tuning works differently.

The tuner first establishes the complete load model of the engine.

Once this is correct, RPM corrections are added independently.

Because the tuning process follows the natural behaviour of an engine, large sections of the fuel model can be adjusted simultaneously.

The Easy Tune All Right function further speeds up this process by allowing complete graph sections to be adjusted together.

For this reason Graph MAP tuning is often significantly faster than matrix tuning when used on a chassis dyno.

4. Fuel And Timing Work Together

A common mistake is to think fuel tuning and ignition tuning are separate activities. In reality they influence each other continuously.

Examples:

- Excessive ignition timing may require additional fuel to avoid detonation.
- Conservative timing may respond better to additional timing rather than additional fuel.
- Changes in fuel mixture often influence optimum ignition timing.
- Changes in ignition timing often influence AFR requirements.

For this reason tuning should be viewed as an optimisation process.

The typical workflow is:

1. Optimise fuel.
2. Optimise timing.
3. Recheck fuel.
4. Recheck timing.

Repeat until no further improvement is achieved.

Maximum power is normally achieved when both fuel and ignition timing are optimised together.

Refer to:

Spitronics ECU - Ignition Timing Fundamentals - Guide

5. The Neutral RPM Concept

The first stage of tuning is performed at a fixed RPM.

This RPM is normally selected near the middle of the engine operating range.

Example:

Maximum RPM = 7000 RPM

Neutral RPM = 3500 RPM

At this RPM all RPM Compensation Graphs are set to zero.

This creates a Neutral Zone.

At the Neutral Zone:

Fuel Calculation = Fuel Load Graph Only

No RPM compensation is active.

The Fuel Load Graph can therefore be tuned independently without interference from RPM corrections.

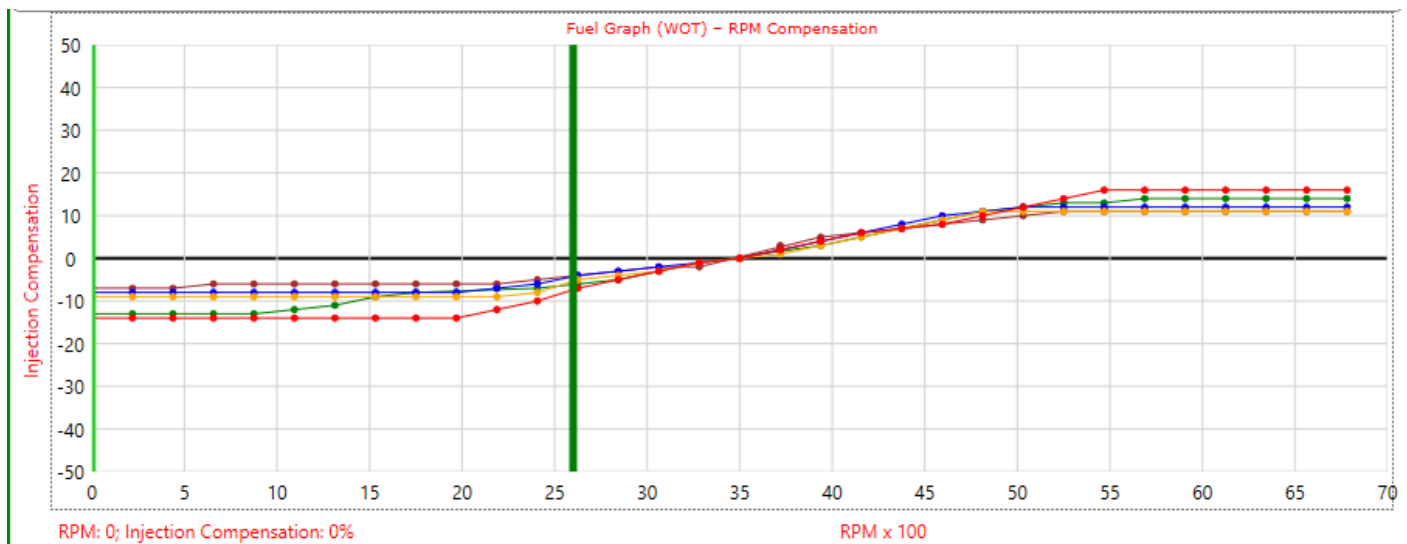
Why tune at mid RPM?

At lower RPMs the engine may require additional fuel because of cylinder filling characteristics.

At higher RPMs the engine may require additional fuel because of volumetric efficiency changes.

Selecting a midpoint creates a stable reference from which RPM compensation can later be added.

Once completed, the Fuel Load Graph becomes the primary fuel model and normally only requires minor adjustments during final optimisation.



6. Understanding The Five Load Zones

The Fuel Load Graph contains five tuning markers:

- Low (Green)
- Low Cruise (Brown)
- Cruise (Blue)
- High Cruise (Orange)
- WOT (Red)

Each marker selects a corresponding RPM Compensation Graph.

When the MAP signal falls between two markers, the ECU automatically interpolates between the two graphs.

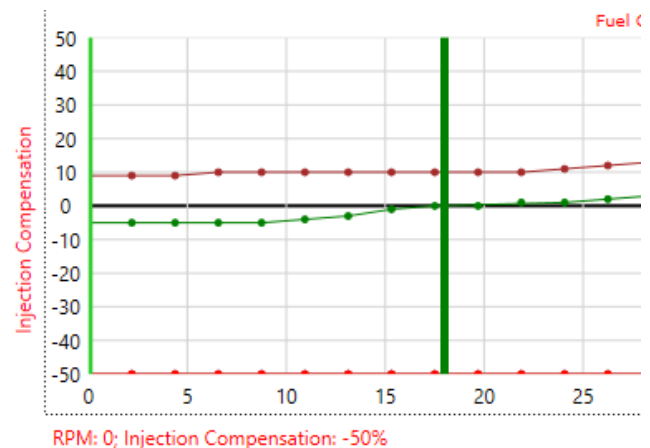
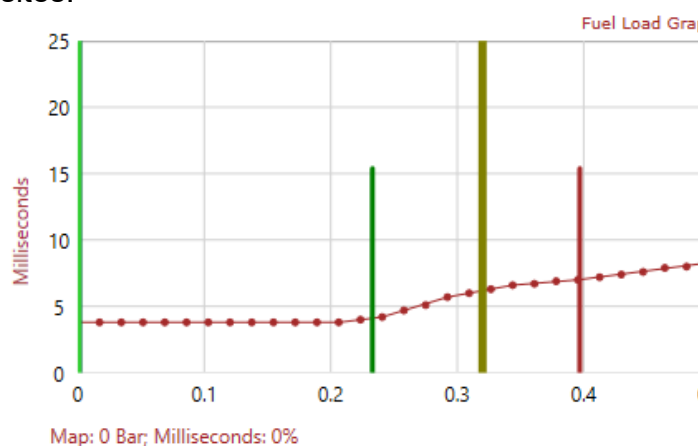
Example:

Low = 0%

Low Cruise = 10%

A MAP value halfway between the markers will receive approximately 5% compensation.

This provides smooth transitions between operating conditions without requiring additional tuning sites.



7. Before You Start

Verify:

- Timing calibration completed
- Sensors calibrated
- Engine at operating temperature
- Lambda control disabled
- Fuel pressure verified
- No mechanical faults present

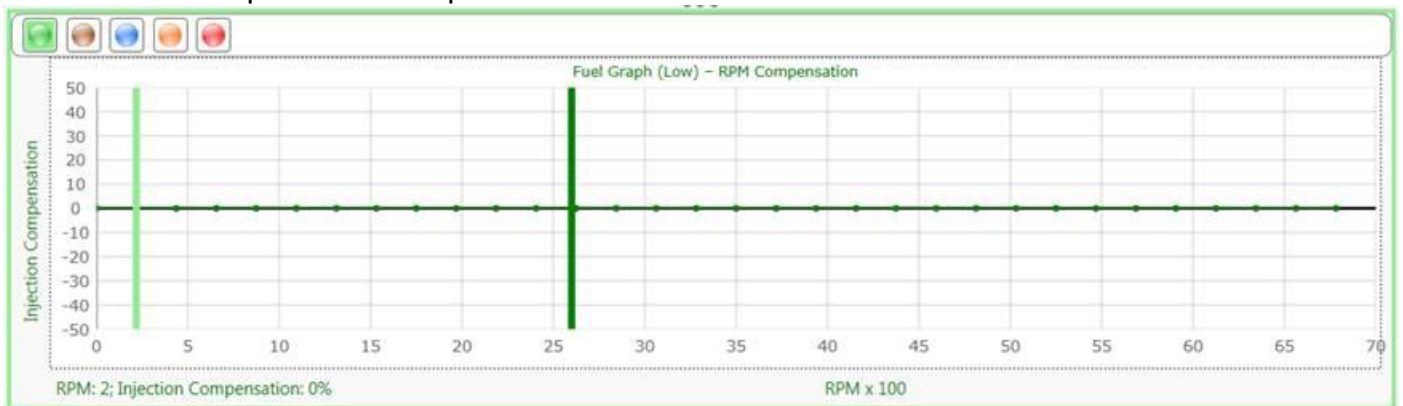
Refer to:

Spitronics - ECU - First Start and Basic Setup - Guide

8. Creating A Startup Map

Reset:

- RPM Compensation Graphs



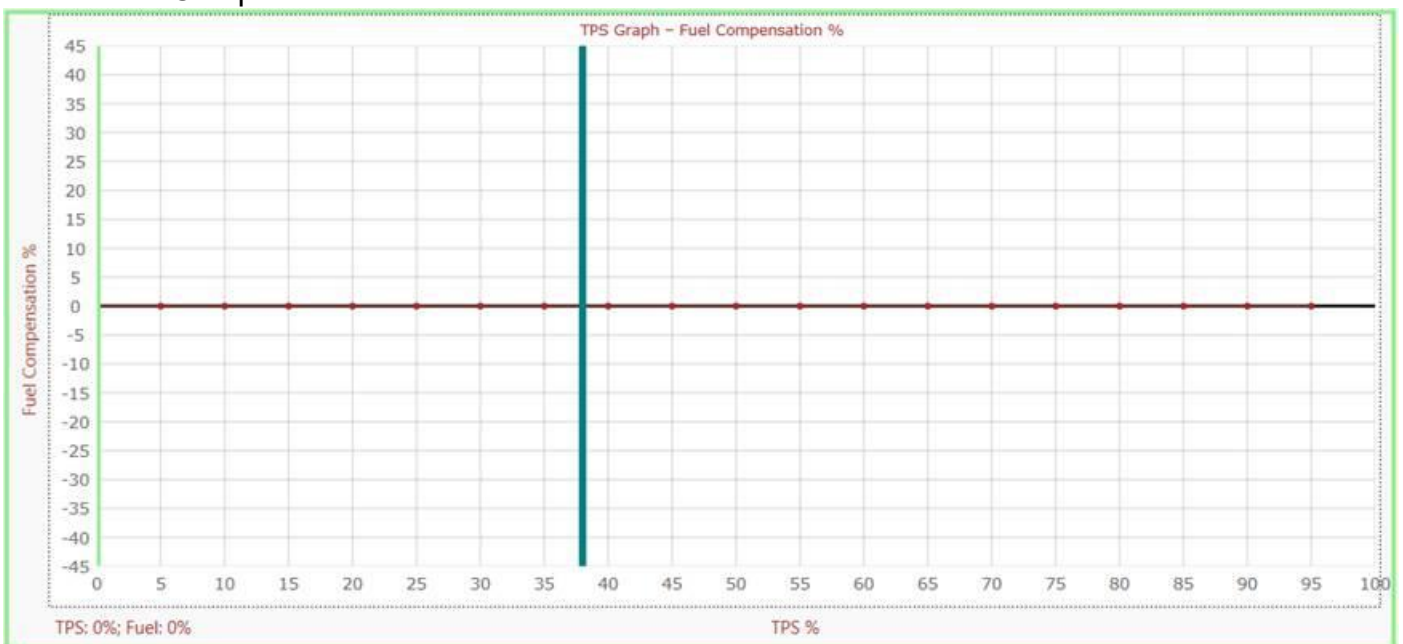
- Fuel Ratio = 100%

Fuel Ratio

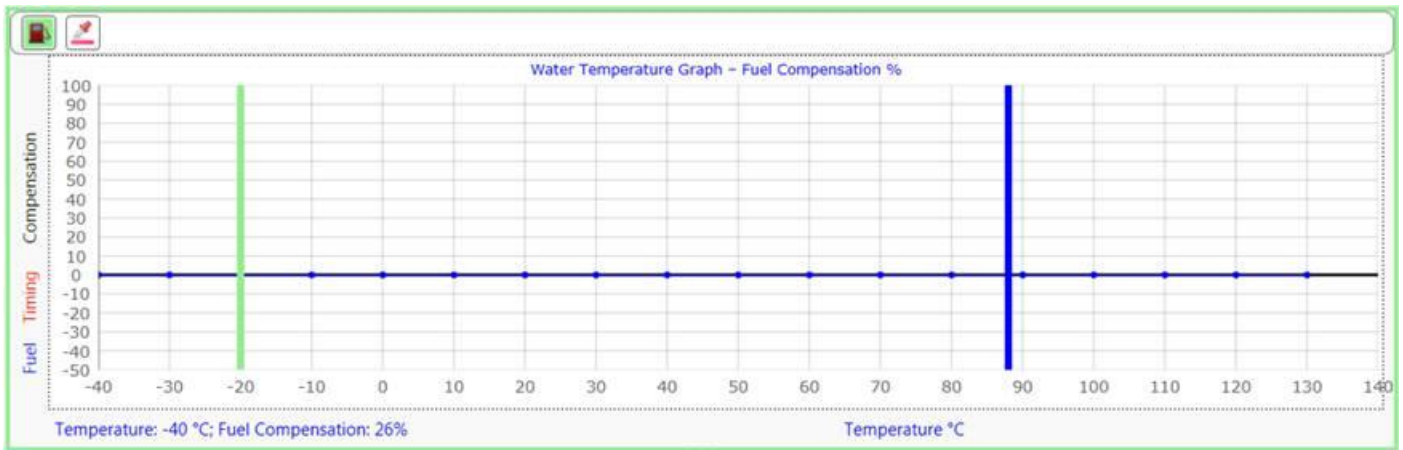
- Fuel Offset = 0

Fuel Offset

- TPS Compensation



- Temperature Compensation Graphs



Establish a safe ignition timing map.

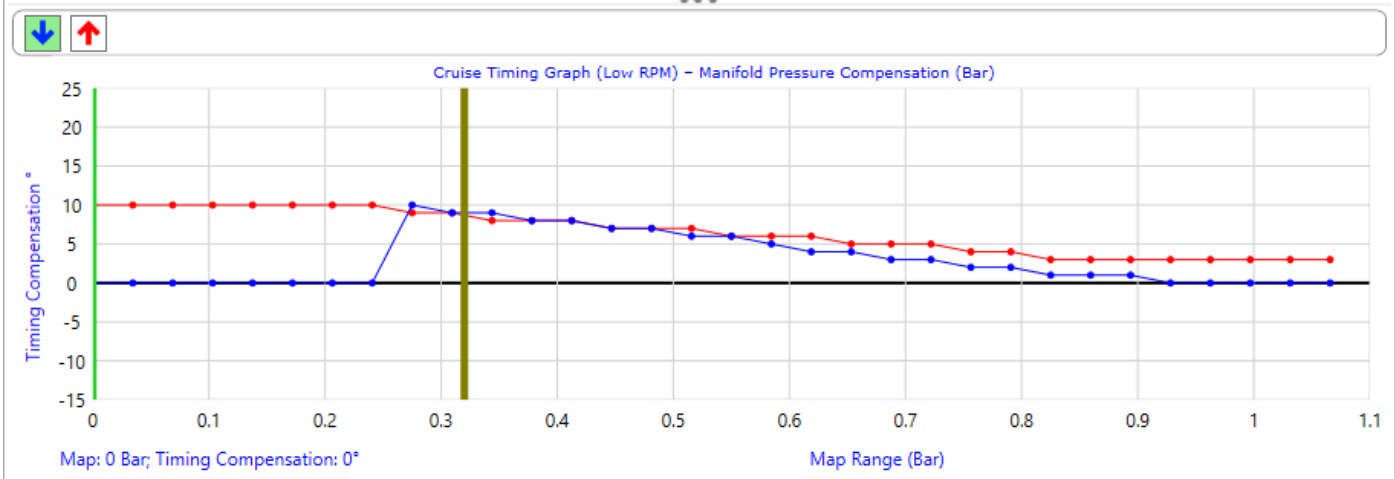
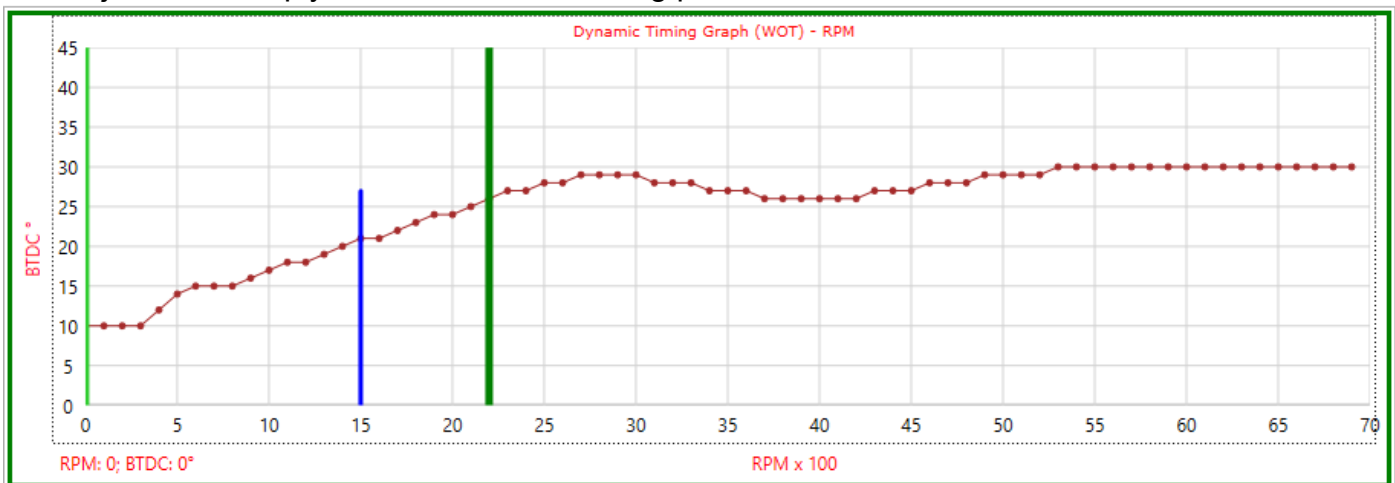
If available, use a proven map from a similar engine.

This reduces the amount of fuel and timing development required.

Create a basic fuel profile that allows the engine to:

- Start
- Idle
- Rev cleanly

The objective is simply to create a safe starting point.



9. Stage 1 - Tune The Fuel Load Graph

Purpose

Create the engine's primary load model.

Procedure

1. Set all RPM Compensation Graphs to zero.
2. Select a Neutral RPM approximately halfway through the operating range.
3. Hold this RPM using the dyno.
4. Enable Real Time Tuning - Tune All Right.
5. Gradually increase engine load from light load to maximum load.
6. Adjust the Fuel Load Graph until AFR follows the desired target.
7. Optimise ignition timing.
8. Recheck fuel.
9. Recheck timing.

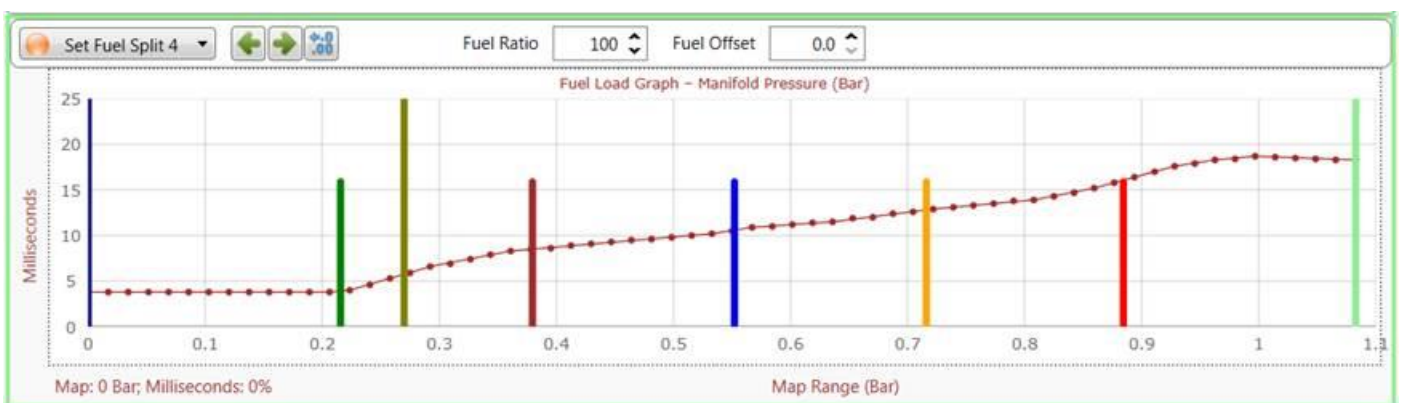
Repeat until no further improvement is achieved.

The engine RPM remains fixed throughout this process.

Only load changes.

When complete:

The Fuel Load Graph should accurately represent fuel requirements from light load to full load.



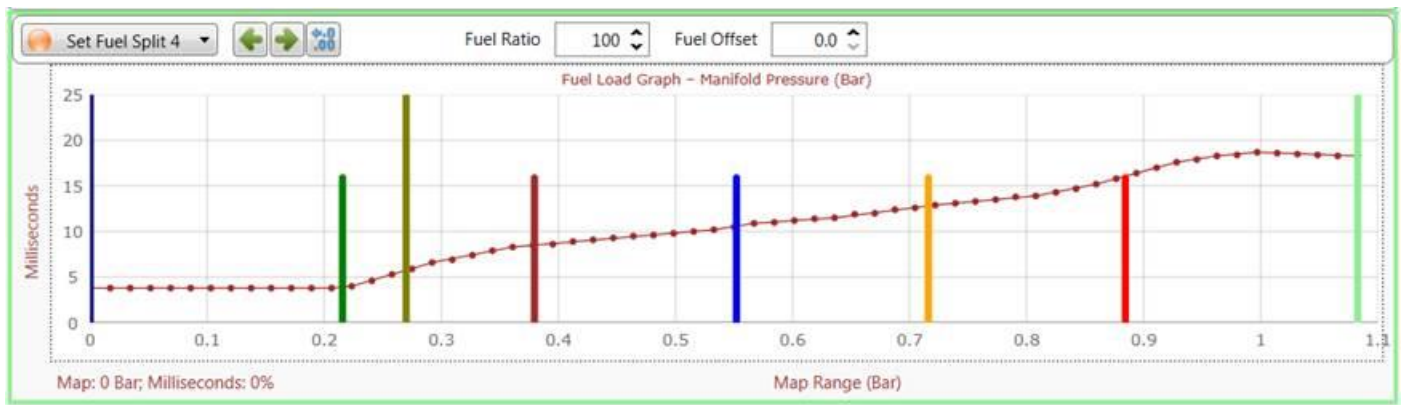
10. Using TPS Compensation For Power Enrichment

There are two common tuning strategies.

Method 1

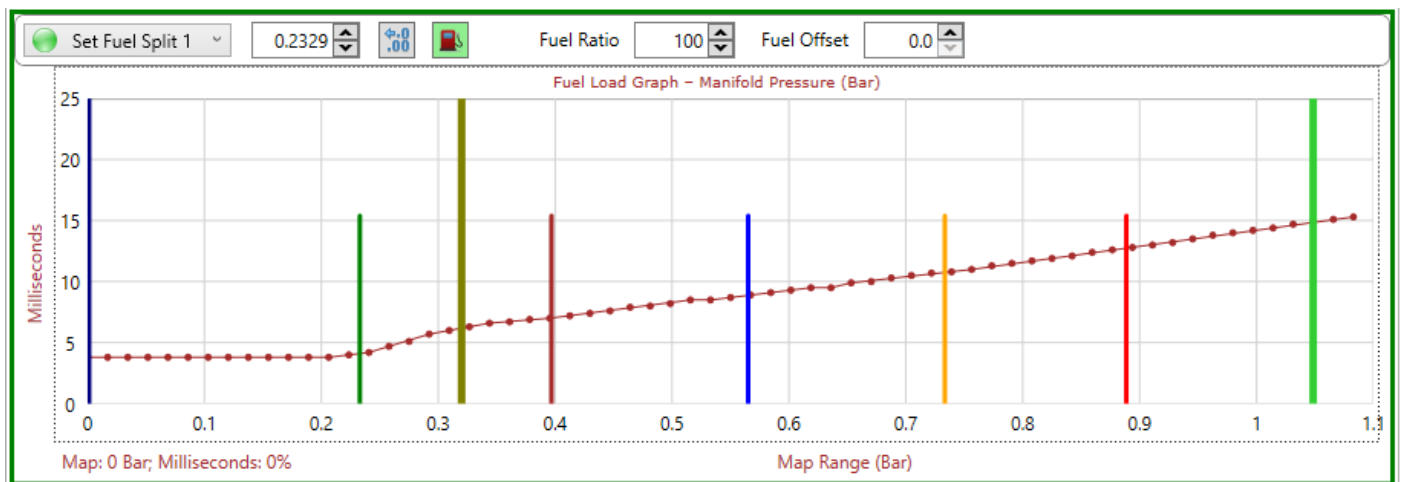
Tune the Fuel Load Graph directly for power AFR.

This method is simple and works well when altitude changes are minimal.

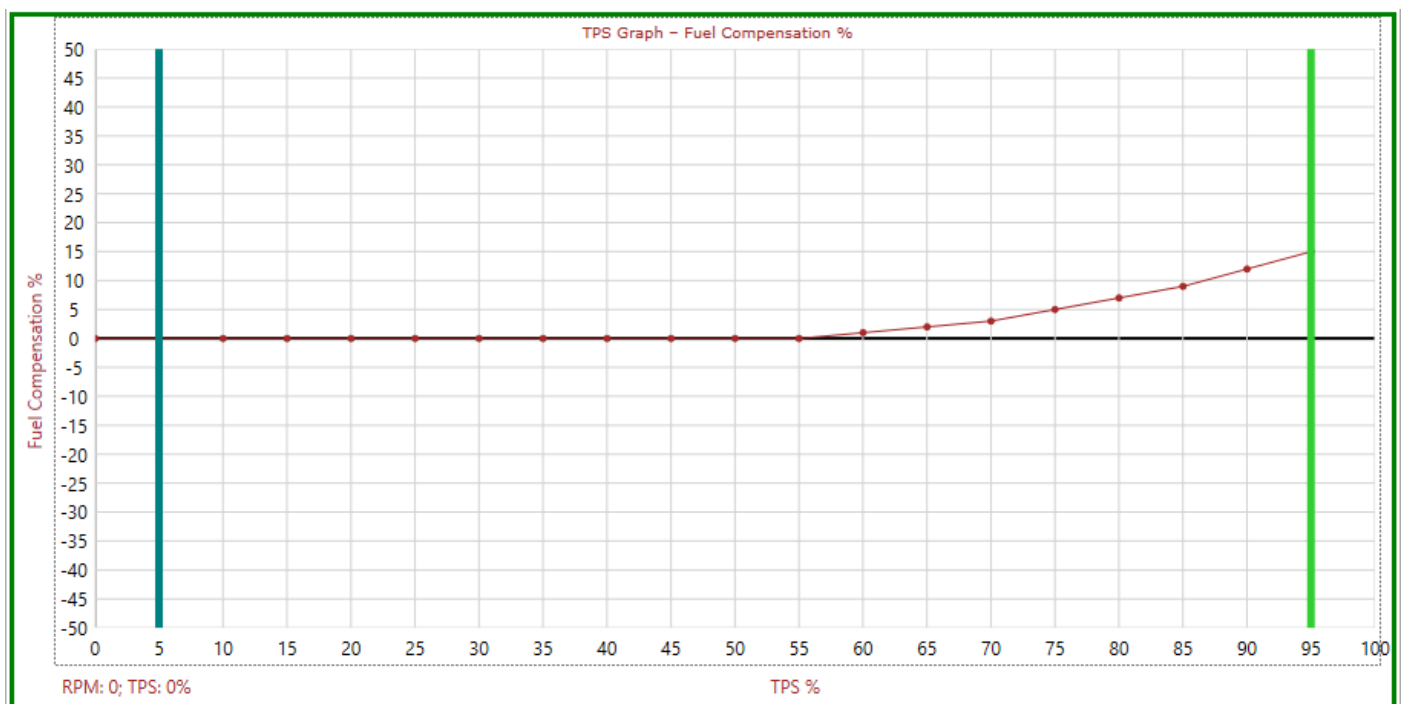


Method 2

Tune the Fuel Load Graph close to stoichiometric throughout the load range.



Then add power enrichment using the TPS Compensation Graph.



Advantages:

- Improved altitude compensation
- Better consistency across different atmospheric conditions

- Particularly useful on turbocharged engines
- Easier to maintain fuel economy during normal driving

This is generally the preferred method when a reliable TPS signal is available.

TPS Compensation should be tuned before the RPM Compensation Graphs.

11. Stage 2 - Tune RPM Compensation Graphs

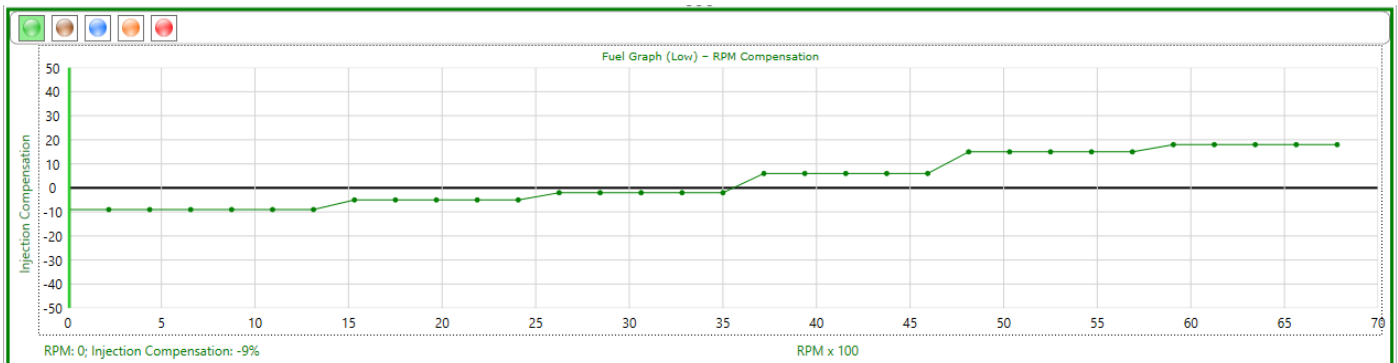
Purpose

Correct fuel requirements as RPM changes.

Procedure

1. Set the dyno to a fixed RPM, typically starting at 1000 RPM.
2. Enable Real Time Tuning - Tune All Right.
3. Tune the Low zone.
4. Tune the Low Cruise zone.
5. Tune the Cruise zone.
6. Tune the High Cruise zone.
7. Tune the WOT zone.
8. Increase RPM and repeat.

Continue until the full RPM range has been covered.



Tuning Beyond The WOT Marker

The Red marker represents the final mapped load zone.

Load values beyond the Red marker are not fully established during the previous procedure.

This area must therefore be verified separately.

Procedure:

1. Hold a fixed RPM on each of the load zones.
2. Increase load beyond the Red marker.
3. Continue increasing load to maximum.
4. Verify AFR throughout the region.
5. Correct fuel values where required.

Take particular care to avoid lean conditions in this area.

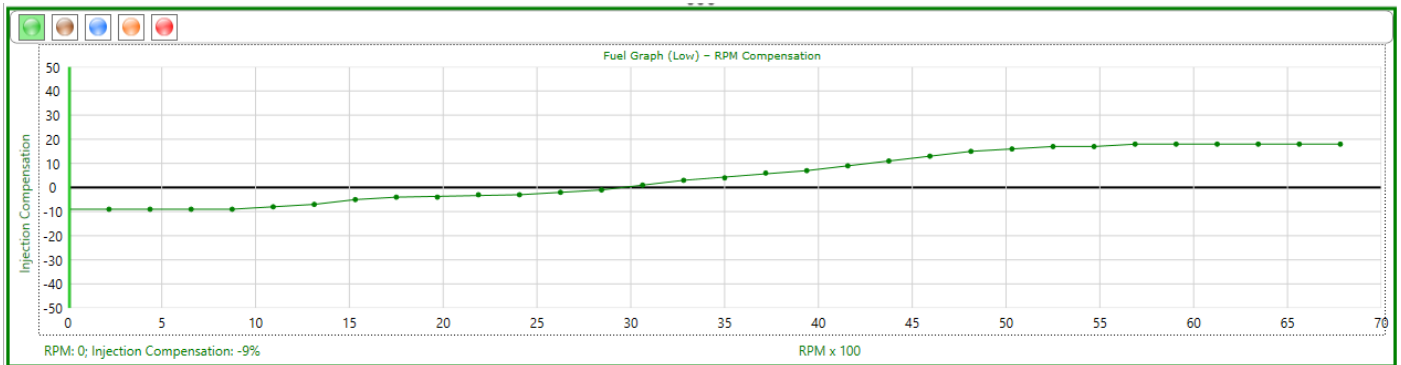
12. Stage 3 - Smooth The Graphs

Once all tuning points have been established:

1. Disable Real Time Tuning.
2. Enable Zoom.
3. Display one graph at a time.
4. Smooth the graph between tuning points.
5. Ensure the graph still passes through the calibrated reference points.

The objective is not to create a perfectly straight graph.

The objective is to create a graph that follows the natural behaviour of the engine while maintaining the calibrated tuning points.



13. Final Verification

After smoothing:

1. Save the calibration.
2. Repeat dyno testing.
3. Verify ignition timing.
4. Verify all operating zones.
5. Verify AFR targets.
6. Verify drivability.

Minor corrections may still be required.

14. Road Tuning

Graph MAP tuning was originally designed around dyno tuning because the Fuel Load Graph and RPM Compensation Graphs are easier to establish when engine load and RPM can be controlled independently.

For this reason Graph MAP tuning is generally not recommended when creating a fuel model completely from scratch on the road.

However, when a suitable map already exists for a similar engine, Graph MAP tuning becomes an excellent road tuning method.

Typical adjustments include:

- Fuel Ratio
- Idle corrections
- Minor RPM Compensation corrections
- Timing corrections

- TPS Compensation adjustments

This allows similar engines to be calibrated quickly without requiring a chassis dyno.

Refer to:

Spitronics ECU - Practical Road Tuning - Guide

15. Final Notes

Graph MAP tuning separates the fuel model into:

- Load Requirements
- RPM Corrections

This allows the tuner to optimise the engine in a structured and logical manner.

Rather than tuning hundreds of individual cells, the tuner creates an accurate load model and then applies RPM corrections where required.

When combined with a chassis dyno and proper ignition optimisation, Graph MAP tuning remains one of the fastest methods available for producing accurate fuel and ignition calibrations.

Once a suitable calibration exists, it also becomes one of the fastest methods available for adapting proven maps to similar engines.