

Spitronics ECU - Practical Road Tuning - Guide

1. Overview

Road tuning is a practical and cost-effective method of tuning an engine without access to a chassis dynamometer.

Using suitable roads, careful testing procedures and the Spitronics Data Logger, it is possible to achieve excellent drivability, fuel economy and engine performance.

Many successful Spitronics installations have been tuned entirely on the road using this method.

Road tuning can be performed using:

- Narrowband lambda sensors
- Wideband lambda sensors
- Data logging
- Timing light verification
- Knock detection equipment

The objective is to progressively tune the engine under increasing load conditions while maintaining safe engine operation.

⚠ Always obey local traffic laws and perform testing in a safe environment.

2. Before You Start

Before tuning begins, verify that the engine is mechanically sound.

Mechanical Checks

- No vacuum leaks
- Correct fuel pressure
- Good spark plugs
- Correct ignition leads
- Cooling system functioning correctly
- Correct injector sizing
- No exhaust leaks ahead of the lambda sensor

Sensor Checks

- TPS calibrated
- MAP sensor calibrated
- Coolant temperature sensor calibrated
- Air temperature sensor calibrated
- Lambda sensor operating correctly

ECU Checks

- Correct trigger pattern selected
- Base timing calibrated
- Accelerator enrichment configured
- Suitable startup map loaded

Many tuning problems are caused by mechanical or sensor faults rather than incorrect fuel or ignition settings.

Always check for diagnostic fault codes before making tuning changes.

3. Base Timing Calibration

Before any fuel or ignition tuning can be performed, ignition timing must be verified.

Procedure

1. Lock the ECU timing if required.
2. Set a known timing value in the ECU.
3. Use a timing light to measure actual crankshaft timing.
4. Adjust trigger calibration until commanded timing matches measured timing.

The ECU and crankshaft timing must agree before ignition tuning can begin.

⚠ Incorrect timing calibration can result in severe engine damage.

Refer to:

Spitronics ECU – Timing Setup – Guide

4. Initial Engine Setup

The objective at this stage is not maximum performance.

The objective is:

- Easy starting
- Stable idle
- Clean throttle response
- Basic drivability

Verify:

- Idle fuel settings
- Idle ignition timing
- Engine operating temperature
- Charging system operation

The engine should now start easily, idle consistently and rev cleanly.

5. Accelerator Enrichment Setup

Before fuel mapping begins, throttle response should be corrected.

Too Little Enrichment

Symptoms:

- Hesitation
- Flat spots
- Engine stumble

Too Much Enrichment

Symptoms:

- Black smoke
- Rich stumble
- Sluggish response

Adjust:

- TPS Acceleration
- MAP Acceleration

until throttle response is clean throughout the operating range.

Fuel mapping should only begin once throttle response is acceptable.

6. Selecting a Test Road

Different road conditions can be used to simulate different engine loads.

Flat Road

Suitable for:

- Idle tuning
- Cruise tuning
- Light load tuning

Mild Incline

Suitable for:

- Medium load tuning
- Part-throttle acceleration

Steep Incline

Suitable for:

- High load tuning
- Wide Open Throttle (WOT) tuning

Different gears can also be used to increase or decrease engine load at the same road speed.

This allows a wide range of operating conditions to be tested safely.

7. Fuel Tuning Strategy

Fuel tuning should always progress from low load to high load.

Recommended Sequence

1. Idle
2. Light Cruise
3. Moderate Load
4. Heavy Load
5. Wide Open Throttle (WOT)

Never begin tuning at full throttle.

Verify each operating area before moving to the next.

Small changes followed by testing will usually produce better results than large adjustments.

Refer to the applicable fuel tuning guide for the tuning method being used.

8. Fuel Tuning with a Narrowband Sensor

A narrowband sensor can be used to establish a reliable base fuel map.

The objective is to tune the engine close to stoichiometric operation throughout the normal operating range.

Advantages:

- Low cost
- Available on most vehicles
- Good fuel economy
- Simple fault finding

Once the base fuel map is complete, additional enrichment can be added using TPS Fuel Compensation.

Refer to:

Spitronics ECU - Practical Narrowband Fuel Tuning Method - Guide

9. Fuel Tuning with a Wideband Sensor

A wideband sensor allows actual AFR to be measured.

This enables:

- Accurate fuel tuning
- Power tuning
- Turbocharged engine tuning
- Verification of narrowband tuning results

Typical AFR targets vary according to engine type and application.

Refer to:

Spitronics ECU - AFR Fundamentals - Guide

10. Using the Data Logger

The Spitronics Data Logger is one of the most powerful tuning tools available.

Typical Procedure

1. Perform a test run.
2. Save the log.
3. Replay the log.
4. Identify rich or lean operating areas.
5. Locate the corresponding fuel cell.
6. Adjust the fuel value.
7. Repeat the test.

This process allows the fuel map to be refined systematically.

Wideband Logging Tip

Many wideband controllers provide a 0-5V analogue output.

This signal can be connected to a spare Spitronics analogue input and recorded in the Data Logger.

The wideband system does not need to remain permanently installed.

Refer to:

Spitronics ECU - Data Logging - Guide

11. Ignition Timing Tuning

Fuel and ignition tuning should be developed together.

Changes in fuel mixture can influence ignition requirements, while ignition changes can influence fuel requirements.

After completing each load section:

- Verify fuel settings
- Verify ignition timing
- Check for signs of detonation

Begin with conservative timing values and increase timing gradually.

Benefits of correct ignition timing:

- Improved torque
- Improved throttle response
- Improved fuel economy

Excessive timing may cause:

- Detonation
- Overheating
- Engine damage

⚠ Always approach ignition tuning conservatively.

12. Knock Detection

Detonation should be monitored whenever ignition timing or high-load fueling is adjusted.

Simple Knock Listening Device

A basic knock detector can be made using:

- Hearing protection earmuffs
- Clear plastic tubing
- A metal tube mounted to the engine block

The tubing transfers engine noise directly to the operator and often allows detonation to be detected before it becomes audible inside the vehicle.

Commercial electronic knock detection systems may also be used.

13. Final Verification

Once tuning is complete, verify:

- Cold starting
- Hot starting
- Idle quality
- Throttle response
- Cruise operation
- Full-load operation
- Engine operating temperatures

Review data logs and correct any remaining issues.

A good tune should be consistent on different days and under different weather conditions.

14. When a Dyno is Recommended

Road tuning can produce excellent results, but a chassis dynamometer is recommended when:

- Maximum power is required
- Turbocharged engines are used
- Competition vehicles are tuned
- Engine development work is being performed

A dyno provides a controlled environment and allows steady-state tuning under repeatable load conditions.

15. Final Notes

The objective of road tuning is not maximum power on the first day.

The objective is to build a safe, reliable and repeatable tune by progressively increasing engine load while refining the fuel and ignition maps.

A systematic approach will usually produce better results than making large tuning changes without testing.

Many successful Spitronics installations have been tuned entirely on the road using this method.