

Spitronics ECU - Graph MAP Timing Tuning - Guide

1. Overview

Graph MAP Timing uses two timing systems together:

1. Dynamic Timing Graph
2. Cruise Timing / Vacuum Timing Graphs

The Dynamic Timing Graph sets the main ignition timing according to RPM.

The Vacuum Timing Graphs then add or remove timing according to manifold pressure.

This works in a similar way to an older distributor system with mechanical advance and vacuum advance, but with much more control.

2. Dynamic Timing Graph

The Dynamic Timing Graph is the main ignition timing curve.

It is RPM based.

The graph has 10 points per 1000 RPM and can be adjusted from 0 to 60 degrees BTDC.

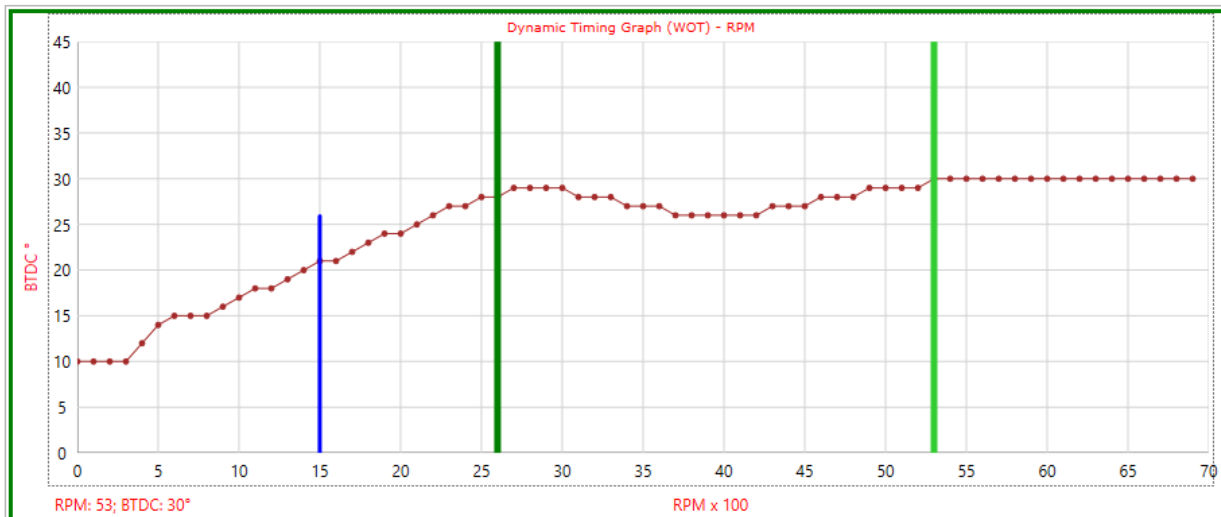
This graph normally controls:

- Starting timing
- Idle timing
- Part-throttle base timing
- Full-load timing
- High-RPM timing

Typical naturally aspirated starting values:

- Cranking / low RPM: 10° BTDC
- Idle: 10° to 15° BTDC
- Mid-range: 25° to 30° BTDC
- High RPM: 28° to 34° BTDC

These values are only safe starting points. Final timing must be tuned for the engine, fuel, compression ratio and load.



3. Vacuum Timing Graphs

The Vacuum Timing system adjusts ignition timing according to manifold pressure.

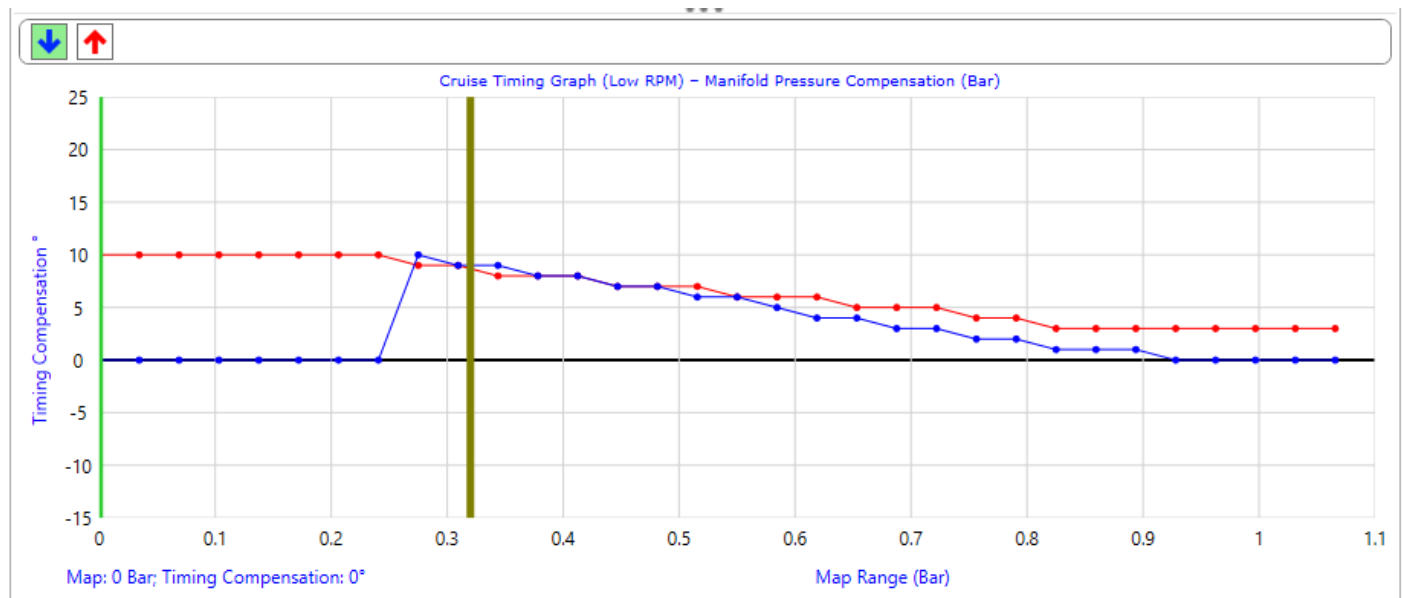
There are two vacuum timing graphs:

1. Low RPM Vacuum Timing
2. High RPM Vacuum Timing

Each graph has 32 points over the pressure range and can adjust timing from: -15° to +25°

This means the system can:

- Add timing during light load cruise
- Remove timing during boost
- Improve throttle response
- Improve fuel economy
- Improve plug cleaning during deceleration



4. Low RPM and High RPM Vacuum Timing

An RPM index line is used to split the two vacuum timing graphs.

This index is commonly set around:
1500 RPM

Below the index, the Low RPM Vacuum Timing graph is used.

Above the index, the High RPM Vacuum Timing graph is used.

The ECU interpolates between these areas to provide a smooth timing transition.

This allows the tuner to use different timing strategies for low RPM and high RPM operation.

5. Why Two Vacuum Timing Graphs Are Useful

The low RPM area often needs different timing behaviour than the high RPM area.

For example:

At idle:

- Vacuum timing can be kept at 0°
- This prevents unstable idle timing
- Idle control remains predictable

During deceleration below the throttle:

- Additional timing can be added
- This can help burn plugs cleaner
- It can improve low-speed drivability

At higher RPM cruise:

- More timing can be added under light load
- This improves fuel economy
- This improves throttle response

Under boost:

- Timing can be removed
 - Up to 15° can be pulled out using vacuum timing
 - This helps protect the engine from detonation
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6. Fuel and Timing Work Together

Fuel and ignition timing must be tuned together.

Changing timing can change the fuel requirement.

Changing fuel mixture can change the amount of timing the engine will tolerate.

For this reason, tuning should be treated as an optimisation process:

1. Tune fuel to a safe AFR.
 2. Increase timing carefully.
 3. Watch torque or engine response.
 4. Listen for detonation.
 5. Correct timing if detonation occurs.
 6. Recheck AFR.
 7. Repeat until no further improvement is achieved.
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7. MBT Timing

The ideal timing value is called MBT.

MBT means Minimum Timing for Best Torque.

This is the least amount of timing advance required to produce maximum torque.

Adding more timing after MBT usually does not produce more power.

The objective is not to use the maximum possible timing.

The objective is to use the least timing that produces best torque.

This gives maximum performance with the safest timing margin.

8. Detonation Limited Timing

Some engines start detonating before MBT is reached.

This is common with:

- High compression engines
- Turbocharged engines
- Poor fuel quality
- High intake air temperature
- Heavy load operation

In this case, detonation becomes the timing limit.

If detonation is heard:

1. Back off the throttle immediately.
2. Reduce timing in that RPM and load area.
3. A practical starting correction is to remove approximately 3°.
4. Retest carefully.

Never continue tuning while detonation is present.

9. Dyno Timing Method

On a dyno, timing can be tuned by monitoring torque.

Procedure:

1. Start with conservative timing.
2. Hold a fixed RPM and load.
3. Increase timing in small steps.
4. Watch torque.
5. Stop increasing timing when torque no longer improves.
6. If detonation occurs, reduce timing immediately.
7. Recheck AFR after timing changes.

In many engines torque may remain almost unchanged for a few degrees after MBT.

This does not mean the extra timing is useful.

It only means the engine has entered a timing plateau.

Use the lowest timing value that gives best torque.

10. Road Timing Method

Road timing is less accurate than dyno timing because torque cannot be measured directly.

Procedure:

1. Start with conservative timing.
2. Increase timing gradually.
3. Test under controlled load.
4. Listen carefully for detonation.
5. If detonation is heard, reduce timing by approximately 3° in that area.
6. Retest under different conditions.

Road tuning should always be conservative.

A tune that is safe on a cool day may detonate on a hot day or with poor fuel.

11. Turbo Timing Strategy

On turbocharged engines the Vacuum Timing Graph can be used to remove timing under boost. Because the graph can remove up to 15°, it can be used as a boost timing compensation table.

General strategy:

- Use conservative Dynamic Timing
- Add cruise timing only under vacuum
- Remove timing as boost increases
- Retest carefully under full boost

Turbo engines should always be tuned conservatively.

Detonation under boost can damage an engine very quickly.

12. Idle Timing Considerations

Graph MAP timing can work well at idle, but Matrix timing may offer finer idle control in some applications.

For stable idle:

- Keep vacuum timing close to 0° at idle
- Use Dynamic Timing to set the base idle timing
- Avoid large timing changes around the idle MAP area
- Make sure the idle timing area is smooth

Unstable timing at idle can cause unstable idle speed.

Refer to:

Spitronics ECU – Idle Control Tuning - Guide

13. Final Verification

After timing tuning is complete, verify:

- Hot idle
- Cold idle
- Light cruise
- Acceleration
- Deceleration
- Full load
- Boost area if applicable
- Engine temperature
- Detonation margin

Final timing should always be tested under real operating conditions.

14. Final Notes

Graph MAP timing is a powerful and practical timing system.

The Dynamic Timing Graph controls the main RPM timing curve.

The Vacuum Timing Graphs add or remove timing according to engine load.

Together they provide a timing system similar to mechanical and vacuum advance on a distributor, but with far greater flexibility.

The safest and most effective timing tune is achieved by finding the minimum timing required for best torque while maintaining a safe margin from detonation.