Spitronics MAP and Altitude Sensors

1. Introduction

MAP (Manifold Absolute Pressure) sensors measure the pressure inside the intake manifold. The ECU uses this information to determine engine load and calculate the correct fuel and ignition requirements.

MAP sensors may also be used as **barometric sensors** to compensate for altitude changes.

This document explains the **Range Gain and Zero Offset calibration method** used in Spitronics software version 3.7 and later.

Most MAP sensors require a **5V supply from the ECU** and produce a signal between **0–5V** depending on the pressure being measured.

Correct calibration ensures accurate engine load calculations and proper fuel delivery.

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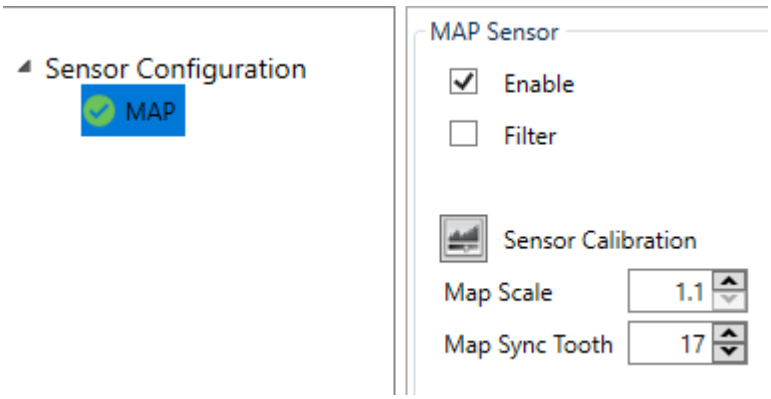
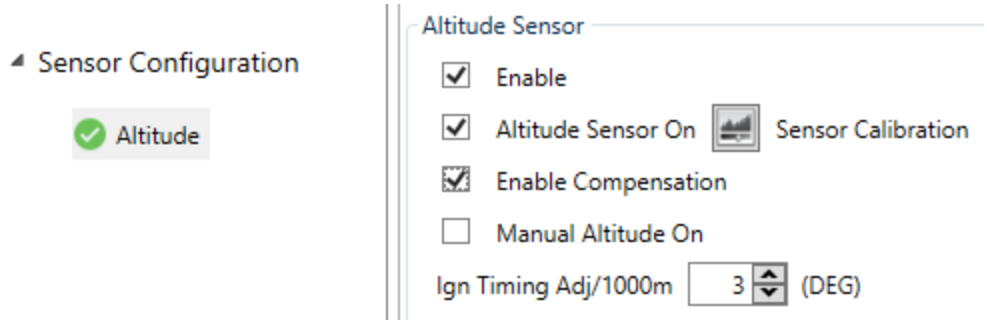
2. Software Location

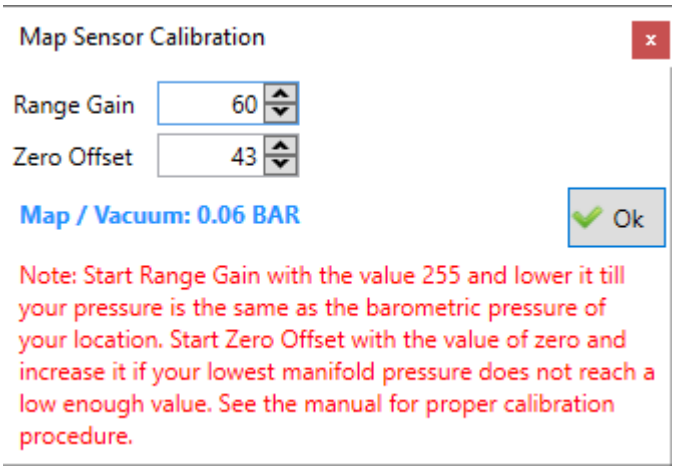
The MAP calibration settings can be accessed from the **sensor configuration menu** in the ECU software.





Press the **Calibrate** button to open the calibration screen.

MAP and Altitude sensors are calibrated separately.



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3. Parameter Explanation

Map Scale

The **MAP Scale** setting defines the maximum intake pressure that the ECU expects from the MAP sensor.

This setting determines how the pressure scale is mapped across the fuel and ignition tables. Selecting the correct range ensures that the full resolution of the tuning maps is used.

Naturally Aspirated Engines
For naturally aspirated engines the MAP scale should normally be set to:
1.1 Bar

This provides the best resolution for vacuum and atmospheric pressure conditions.

Turbocharged Engines
For turbocharged engines the MAP scale should be set slightly above the maximum expected boost pressure.

Example:

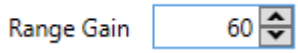
Maximum Boost = 0.8 Bar
Recommended MAP scale ≈ 1.9 Bar

If boost spikes or boost creep are possible, increase the MAP scale slightly to prevent the sensor reaching its maximum scale.

Important
Always select the **lowest MAP scale that safely covers the maximum boost pressure**.
Using an unnecessarily large range reduces sensor resolution and makes tuning less precise.

Range Gain

Range Gain adjusts the **scaling of the sensor signal**.



It determines how the voltage range of the MAP sensor is converted into pressure values within the ECU.

Zero Offset
Zero Offset shifts the pressure reading **up or down**.

It compensates for sensors that do not produce exactly the same output voltage at atmospheric pressure.

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4. Quick Setup

For quick calibration use the following default values:
Range Gain = 255
Zero Offset = 0

Then adjust **Range Gain** until the MAP reading matches the **local barometric pressure**.

After this, adjust **Zero Offset** so that the sensor reaches its minimum pressure during maximum vacuum.

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5. Detailed Setup Procedure

Two calibration methods are available.

Method 1 – Vacuum Syringe Method (Recommended)

This method produces fast and accurate results.

Required Equipment
• 50 cc syringe
• Short length of 3 mm silicone vacuum hose

Refer to the specifications of the MAP sensor being used.

Example specification:
Sensor range down to **0.1 Bar**
The voltage values are not important for this calibration. Only the pressure range is important.

Step 1 – Set Barometric Pressure
Start with the default settings:
Range Gain = 255
Zero Offset = 0

Reduce **Range Gain** until the MAP reading matches the **barometric pressure at your location**.

Step 2 – Apply Maximum Vacuum

1. Remove the MAP sensor from the intake manifold if installed.
2. Push all air out of the syringe.
3. Connect the hose between the syringe and the MAP sensor inlet.
4. Pull the syringe fully to create maximum vacuum.

Observe the MAP reading in the software.

Step 3 – Adjust Zero Offset

Adjust the **Zero Offset** value.
Two calibration options are possible.

Maximum Sensor Range
Increase Zero Offset until the lowest MAP reading reaches **0 Bar**.
Note: the engine will never reach this vacuum level. This method simply uses the full sensor range.

Actual Sensor Range
Alternatively adjust Zero Offset until the lowest value equals the minimum pressure specified for the sensor.
Example:
Minimum pressure = 0.1 Bar

Step 4 – Recheck Barometric Pressure

Remove the syringe so the sensor returns to atmospheric pressure.
Adjust **Range Gain** again until the MAP reading matches the correct barometric pressure.

Step 5 – Save Calibration

Press **OK** and save the calibration using **Map Save**.

Method 2 – Trial and Error Method

This method can be performed while the sensor is installed on the engine.
However, calibration may be more difficult because the MAP sensor influences the fuel calculation.

Start with default values:
Range Gain = 255
Zero Offset = 0

Step 1 – Set Barometric Pressure
Lower Range Gain until the MAP reading matches the local barometric pressure.
Save the map.

Step 2 – Start the Engine
Start the engine and adjust the fuel settings so that the engine idles smoothly.
Rev the engine slightly and release the throttle quickly.

When the throttle closes the intake manifold will produce strong vacuum.
Observe the lowest MAP reading.

Step 3 – Check Lowest MAP Value
If the MAP value drops to approximately:
0.2 Bar or lower

The calibration is normally acceptable.
If the lowest value is higher, further calibration is required.

Step 4 – Adjust Zero Offset
Switch the engine off and on again.
Increase **Zero Offset** slightly.

Then increase **Range Gain** again until the MAP reading matches barometric pressure.
Repeat the test until the sensor reaches the correct minimum pressure.

Step 5 – Save Calibration
Once the readings are stable:
• Save the map on the laptop
• Record the calibration values in the sensor chart

This allows the same calibration values to be reused later.

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6. Practical Tuning Tips

• Always use the **lowest pressure range sensor** suitable for the engine.
• Large pressure range sensors reduce measurement resolution.
• Turbo engines require sensors capable of measuring the maximum boost pressure.
• The MAP Filter option can smooth unstable signals but slightly slows the response.
• If **Range Gain** is reduced too far, the MAP reading will overflow and restart from a low value. When this happens, increase the Range Gain again until the correct barometric pressure is displayed.

Engines with **large camshaft overlap** or **individual throttle bodies (ITBs)** often produce unstable MAP signals at low RPM.
In these cases, the ECU may combine **MAP, TPS, and RPM signals** to determine engine load. For more information check the Fuel Settings manual.

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7. Typical Values / Reference Table

Typical MAP readings:

Condition	MAP Value
Engine Off	~100 kPa
Idle (NA Engine)	30–50 kPa
Light Cruise	40–70 kPa
Full Throttle (NA)	95–100 kPa
Turbo Boost	100–300+ kPa

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8. Diagrams / Installation Guidelines

Recommended sensor installation:
• Mount the sensor above the manifold connection
• Point the sensor inlet downward to prevent moisture accumulation
• Ensure the vacuum hose slopes downward where possible
• Do not share vacuum lines with brake boosters or idle control devices

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9. Troubleshooting

Problem	Possible Cause	Solution
MAP reading incorrect	Sensor not calibrated	Recalibrate Range Gain and Zero Offset
MAP unstable	Vacuum signal unstable	Use MAP filter or improve vacuum line routing
MAP reading too high	Incorrect Range Gain	Re-adjust Range Gain
MAP reading offset	Incorrect Zero Offset	Adjust Zero Offset

Tested Sensor Calibration Values

1.15 Bar Spitronics & ecuDIY Map Sensor

Specifications(1.15Bar)

15 - 115 kPa

180 – 4650 mV

Spitronics Product Infineon Sensor

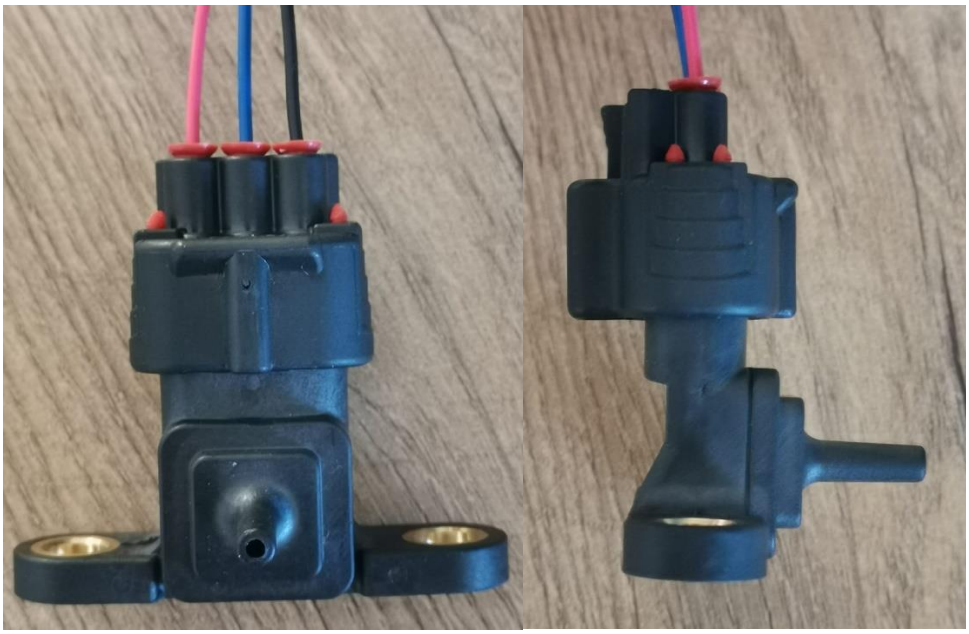
Calibrate for Real Values @10kPa min

Zero Offset = 0

Range Gain

1.1 199

1.38 Bar & 3.23 Bar Chinese Map Sensor Toyota Replica



Specifications (3.23Bar)

10 - 323.5 kPa

973 – 4750 mV

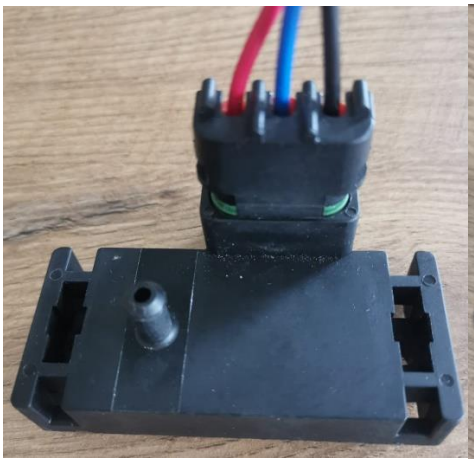
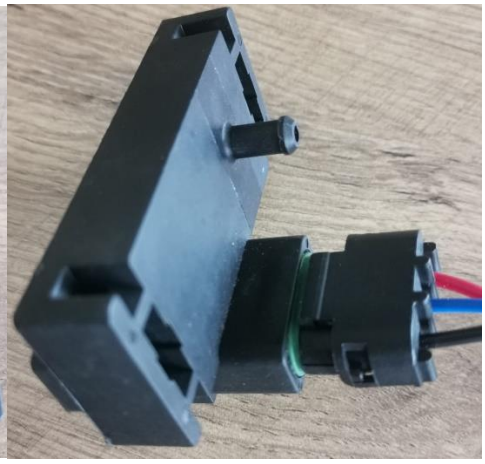
Replica for 3SGTE or 4AGZE or 2JZ

Calibrate for Real Values @10kPa min
Zero Offset = 43
Range Gain
1.1 60
1.5 82
2.0 109
2.5. 136
3.0 162
3.3 174

Specifications(1.38Bar)
10 - 138 kPa
894 – 4637 mV
Replica for 3SGTE or 4AGZE or 2JZ

Calibrate for Real Values @10kPa min
Zero Offset = 30
Range Gain
1.1 145
1.4 183
1.5 197

3Bar Chinese Sensor GM Replica

Calibrate for Maximum Scale
Zero Offset = 13
Range Gain
1.1 61
1.5 92
2.0 123
2.5. 154
3.0 184