MAP and Altitude Sensors (New Method Ver 3.7 Onwards)

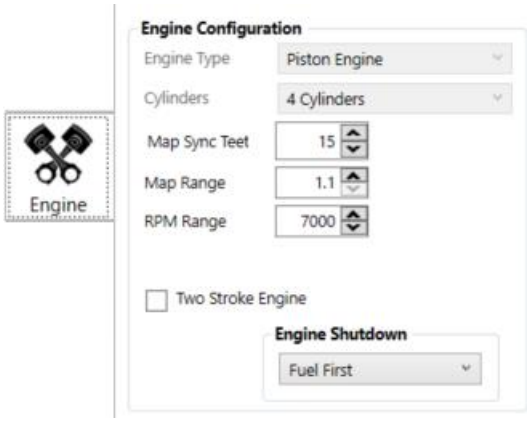
Note: This document covers the new development where the sensor is calibrated with the Range Gain and Zero Offset method. If your software doesn't look like this use the ***Map Sensor*** *document.*

This MAP (Mean Absolute Pressure) sensor measures the vacuum or pressure in the intake manifold. This is the main sensor for the ECU to calculate the fuel amount which is injected into the engine at different conditions and load requirements. The same sensors are also used to measure barometric pressure so that the ECU can compensate for fuel and timing variation according to altitude.

This sensor, however, does have its shortcomings when it comes to engines with overlap cams where the intake vacuum falls away at low RPM's. Then the ECU relies on other type of sensors like TPS or Air Mass volume in conjunction to air temperature, altitude and RPM's. For multiple throttles this sensor is usually inadequate but Spitronics developed a feature that can the Map sensor with them. (See multiple throttle bodies.)

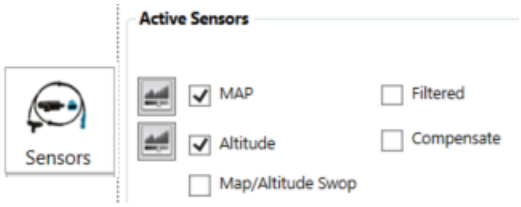
If you have Map sensors try and use 1.1 Bar sensors for Altitude and normal aspirated engines. The reason is they are more sensitive as the scale is larger. If it is a turbo engine, then use the lowest turbo Map sensor that is adequate for the boost that you plan to run on the engine. The software does allow you to use any sensor up to 7 Bar and recalibrate it but you lose sensitivity if you use them in a small part of its range.

Settings and Calibration

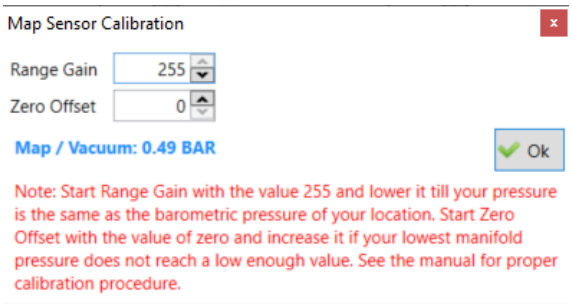


The first setting to adjust is the **Map Range**. This will indicate to the ECU what intake pressures are going to be achieved so that your fuel and RPM maps are set up properly. This will let the tuner use the maximum tuning space to his advantage. If it is a normal aspirated engine then set it up to 1.1 Bar which is the minimum. For turbo engines set it to the maximum boost pressure. If you plan a maximum boost of 0.8 Bar then put the sensor on 1.9 bar. If you might have boost creep then make the scale slightly larger.

Map Sync Teeth is not available in all firmware, mostly crank trigger wheel setups. This will read the map sensor value at a specific crank angle. Usually, 90° after TDC. This creates the best vacuum signal. It is also important to use with ITB throttles. In this sample of a 60-2 trigger wheel, the value of 15 means 15 teeth after TDC which amounts to 90 degrees.



The next settings are to calibrate the sensors. The  calibrate button will open the calibration settings below. Map and Altitude is calibrated separately.



If you know the calibration values of that specific sensor, then enter them now. At the bottom of this document is a list of sensors that we tested so far. Otherwise, you will need to enter a zero offset and range gain value. The zero offset can be chosen to give maximum tuning space available, or to allow the ECU to read the actual pressure. Actual pressure must be used if you have an altitude sensor and will do altitude compensation. In this case the ECU will calculate fuel compensation based on actual measured pressures and bring injector dead band into consideration. See the Altitude Sensor manual for more information on this topic.

Calibration
Start with a Gain value of 255 and Zero Offset of 0.
Use one of the following methods.

1. With a syringe.

This method gives best results fast. Especially if you have the specifications of the sensor. You will need a 50cc Syringe and a short 3mm hole silicone rubber pipe. Look at the specks of the sensor. Below is an example:

The volts are not important but this sensor can only measure down to 0.1 Bar. You can now lower the Range Gain value till your barometric pressure of your location is reached. Now push all the air out of the syringe and put the shortest pipe on to the map sensor at its inlet. If it is installed in an intake you need to take it out. Now let someone pull the syringe as far out as possible. Look at the map reading. If you go for max range, then you increase the Zero Offset till the sensors lowest

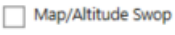
value go down to 0 on the software. Remember the engine will never suck that low a vacuum. If you want actual reading then increase the setting till the lowest value is 0.1 Bar for this sensor. Now take the syringe off the sensor so it can sample barometric pressure. You can now increase the Range Gain value till your barometric pressure back at your altitude reading. If you don't know what your altitude is, then get a barro meter or check online for barro pressure. Most phones have a barometric pressure app. Remember barro pressure differ with temperature and whether. Press OK and save the calibration with map save. If you don't have the sensors specs then you can connect the sensor with a vacuum gauge and see what pressure the sensor stops responding. Then use that value.

2. Trial and error on the car method.

This may be frustrating because the sensor also fuels the engine. Here it is best to start with Zero Offset at 0' again and Range Gain at 255 before you start. Lower Range zero till the sensor reads your barometric pressure. Click OK and save the map. Now start the engine and get the fuel so that the engine can idle. Now see if you can rev the engine and close the throttle quickly. The decompression will suck the map sensor to the lowest value possible. If it goes below 0.2 bar on the software then leave it there. If it is very high then switch the engine off and on. Increase the Offset value a bit. Now increase the gain value to reach barometric pressure again. Click OK and save. Then repeat the testing of the sensor again. If you are happy then save this map on your laptop for future use of the calibration values or make a note in a chart.

Now you can do the same for the altitude sensor. The best Map sensors to use for altitude sensor is the normal aspirated ones or dedicated barro sensors. They will respond better in fine resolution than a 3 Bar sensor for instance. Altitude sensors must be calibrated to read low and high pressure correctly. Otherwise, your tune may go leaner or richer with altitude deviations.

The Filtered checkbox can be used to smooth an erratic map sensor signal. It will average the current sample with the previous sample. The down fall is that it may create a minor flat spot under blip conditions. This needs to be corrected with the accelerator pump feature.



This setting is handy if the ECU has an onboard map sensor. Then it can be used to read altitude if the box is un checked and it can read Manifold pressure if it is checked.

If the sensor is not used, uncheck its selection to free up valuable processor time.

Sensor Description

The Mean Absolute Pressure (MAP) sensor provides instantaneous manifold pressure information to the ECU. The data is used to calculate air density and determine the amount fuel required for optimum combustion. This sensor influences also the advancement or retardation of ignition timing. This sensor is a reliable replacement for the Mass meter type sensors.

Due to the availability of sensors and the many different types found on vehicles we will not include samples at this stage. As we progress wit stats an data from our customers we will try and build a list of the popular ones and their calibration values.

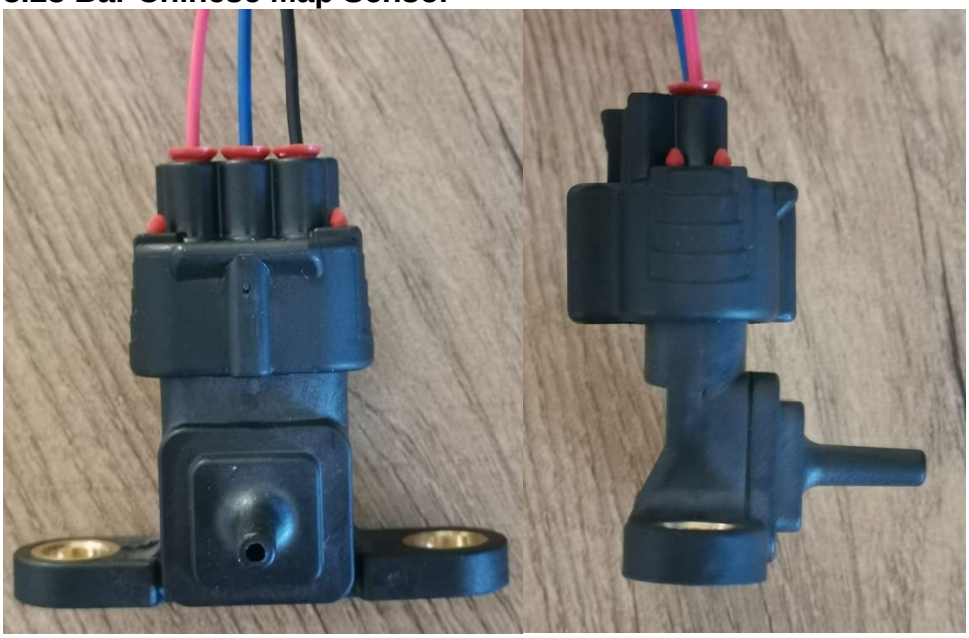
Operation

Most Pressure Sensor requires 5 volts DC which is supplied to the sensor by the ECU. It then generates a signal from 0 to 5 Volt equivalent to the pressure range of the sensor. A sensors speck is given in Pressure = Volts chart and then a Min and Max pressure value.

Sensor Location
The manifold take-off point should be at a position that best represents the average manifold pressure with minimum pulsations. A filter can be fitted inline to reduce manifold pressure pulsations. Do not T-off idle or brake booster fittings etc. The take-off pipe must be direct to the manifold. When mounting the MAP sensor, face the intake port down and mount it above the take-off point. This will prevent moisture to build up so it can drain out. Ensure that the hose runs downhill all the way to the manifold if possible.

Map Sensor Calibration Chart Ver 3.7 up

3.23 Bar Chinese Map Sensor



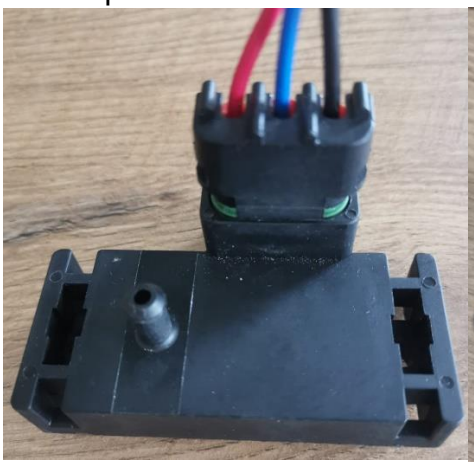
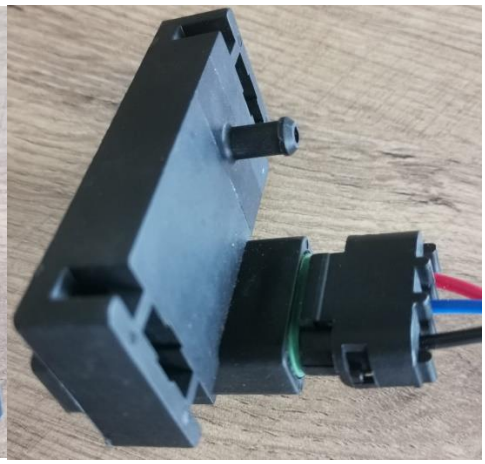
Specifications
10 - 323.5 kPa
973 – 4750 mV
Relica for 3SGTE or 4AGZE or 2JZ

Calibrate for Maximum Scale
Zero Offset = 46
Range Gain
1.1 60
1.5 81
2.0 108
2.5. 135
3.0 161
3.3 177

Calibrate for Real Values @10kPa min
Zero Offset = 39
Range Gain
1.1 66
1.5 90
2.0 119

2.5 150
3.0 182
3.3 197

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