Introduction

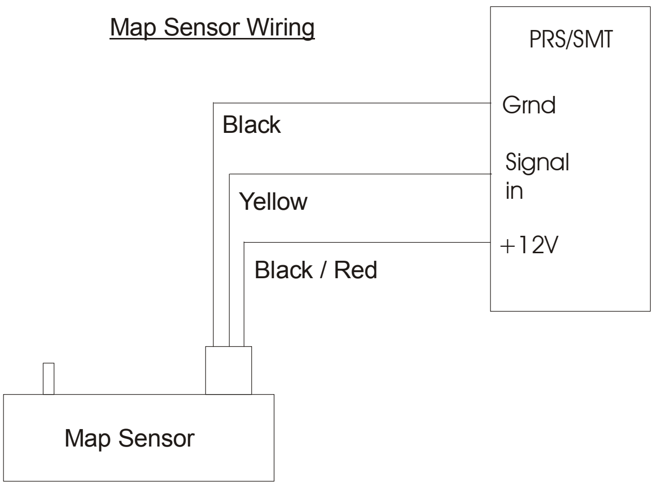
The principles in this application note hold true in both the SMT and PRS range of products. The PRS and the SMT units are all about sensor readings, if you have the correct signal it does not matter where it comes from the unit will read it. We can claim that these units are compatible with such a wide range of sensors for two reasons:

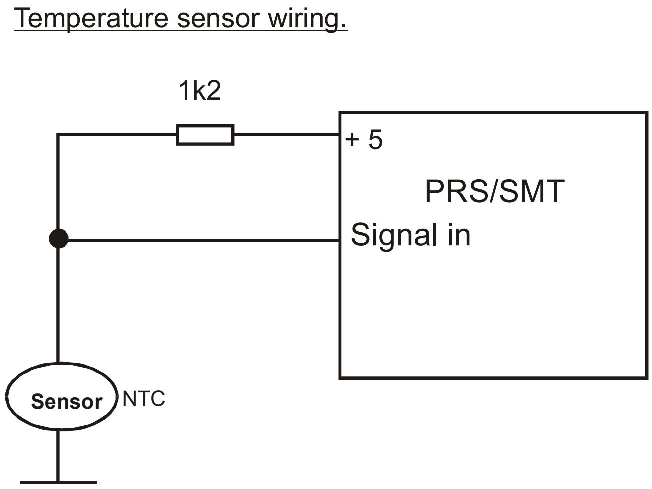
1) Most sensors have an analog range between 0-5V, with exception of the frequency-based signals.
2) In both units we can calibrate the software to read a portion of the 0-5V range, it makes better sense do adjust the sensor range to read between 2-3V if the sensor being used only moves between 2-3V.

It is the ability to calibrate the curves that gives it flexibility but we have found that it is also a bit difficult to understand, hence this application note.

Diagrams

The following diagrams show the installation of Perfectpower temperature and airflow sensors, diagrams for other types of sensors can be found in the PRS development manual.





Software calibration

PRS units have a unique feature used for calibration of sensors, you can save the curve of a sensor alone and load them without affecting the other settings of the unit, so this would be the simplest way to setup a sensor, simply wire it in and load the file. The file names of the Perfect Power sensors are, 15AMP.PRS, 25AMP.PRS and TEMP.PRS and can be found on the development cd. We should be implementing this in the SMT6 as well soon.

Temperature sensors can be calibrated to measure degrees Celsius, Fahrenheit or even Kelvin, you could even get them to read peanuts if you want, what you will understand at the end of this application note is that it is the voltage that is important the number on the display is just a number. The same is true for the airflow sensor.

There are two ways of calibrating the sensors:

Method 1:

To calibrate the sensors using this method you need two points, a low value and a high value. Both units use the same command to calibrate sensors, AL and AH for airflow sensors and TL and TH for temperature sensors. The commands with L's are the lower settings while the commands with H's are the upper settings, a typical setting for the lower settings of an airflow sensor would be:

AL 0 0.2 20

I will explain what this means now.

AL <Grid position> <display value> <voltage>

Grid position:

Grid position is the first step, if you go to one of the map screens you will see that the temp sensor and airflow sensor is a coulomb of 16 steps. This is the grid position, they start at 0 and end at 15 (zero is included as a number), in the example we would be calibrating the bottom most point on the grid.

Display value:

What I said about this value not being important is not strictly true, its not important to the unit itself but for you as the tuner its is important because it is what you want to read, so you need to match the value you intend to put here with the correct voltage on the sensor, more on this later.

Voltage:

I will try not to get to technical in this next bit, but like I mentioned before the PRS/SMT reads these sensors over a range of 0-5V, this range is split up by the processor into segments, like pieces of a pie, of 256 steps. If this is confusing all you really need to know is that every value of one represents 19mV. So in the example above we have set the bottom point of the graph to display 0.02 (bar or whatever) at a voltage of (19mV x 20) 380mV.

Next set the high point, the same rules apply:

AH 14 0.09 220

Point 14 (second from the top) of the airflow graph shows 0.09 for a voltage of 4,18V, the software will then fill in all the points between, above and below these points.

I don't know of any other method of finding these two points on a airflow sensors other than finding its data sheet and looking it up on the voltage curve, you can send this curve to our technical desk at info@perfectpower.com if you need help setting this up.

For the temperature sensor this is a little different, same as with the amp sensor you can get these points on the data sheet. Another option is to calibrate it with hot and cold water. Connect the sensor to the unit as in the diagrams, supply power to the unit, place a multimeter across the sensor, put the sensor into cold water, use a thermometer to read water temperature and read the voltage on the multimeter to find its corresponding voltage. Do the same with the hot water and you will have your two voltage points as well as there corresponding temperatures on the thermometer.

One thing to note is that with temperature sensors you will find that voltage decreases as temperature increases, unlike the airflow sensors where voltage increases as pressure increases, this is not a problem for our systems but something to bear in mind when calibrating. To avoid confusion this means that for a temperature sensor your high point on the grid will be a low voltage and your low point on the grid will be a high voltage.

Example:

TL 0 –12 220
TH 15 120 20

Means that the bottom of the grid displays –12 at a voltage of 4,18V and the top of the grid has 120 for 0.38V.

Method 2:

For this method all you need is one single point, in this example I will be talking about temperature but the same principle holds true for airflow. Let us say you have a temperature sensor connected to the unit and you know what reading it should have in degrees Celsius, say this value is 25°C and you want the grid to have 25°C in the 4th slot of the grid (remember 0 is a valid number) then you would type:

TL 3 25

The software will automatically match the voltage it is reading with 25°C and fill in the values above and below it. The advantage of this method is that it is a lot easier to use, but the disadvantage is you don't have full control of the voltage range on the points on the grid, which you had in method one.

Conclusion

Windows software should be coming out with a graphical method of calibration that will be a lot easier to use, but because of the dos recognition in windows the above methods will work in windows software as well.