



PSC1-003 Programmable Signal Calibrator

Description:

The PSC1-003 Programmable Signal Calibrator provides precise calibration of fuel by adjusting fuel control signals. It can be used with naturally aspirated or forced induction engines. It is intended for use on any application that uses a zero to five volt load sensor and is generally used to adjust fuel by calibrating the mass air flow (MAF) or manifold absolute pressure (MAP) signal.

Through a serial interface, the PSC1-003 can be programmed by a laptop computer running the Split Second R4 engine management software for Windows. The software provides three dimensional mapping of the MAF/MAP signal. The PSC1-003 can be used in either direct or signal modify mode. In direct mode, the output is determined by the active cell value. The active cell is determined by table look-up based on load voltage and RPM.

Two separate load inputs are used in signal modify mode. One of those inputs is offset according to cell value. The other input determines the load used for table look-up. The two inputs may be tied together for cases where one signal is used for both the modify input and table look-up.

The software provides real time display of RPM, input voltage, and cell value. A variety of editing tools ease the task of setting up an initial map and quickly fine tuning for optimum performance.

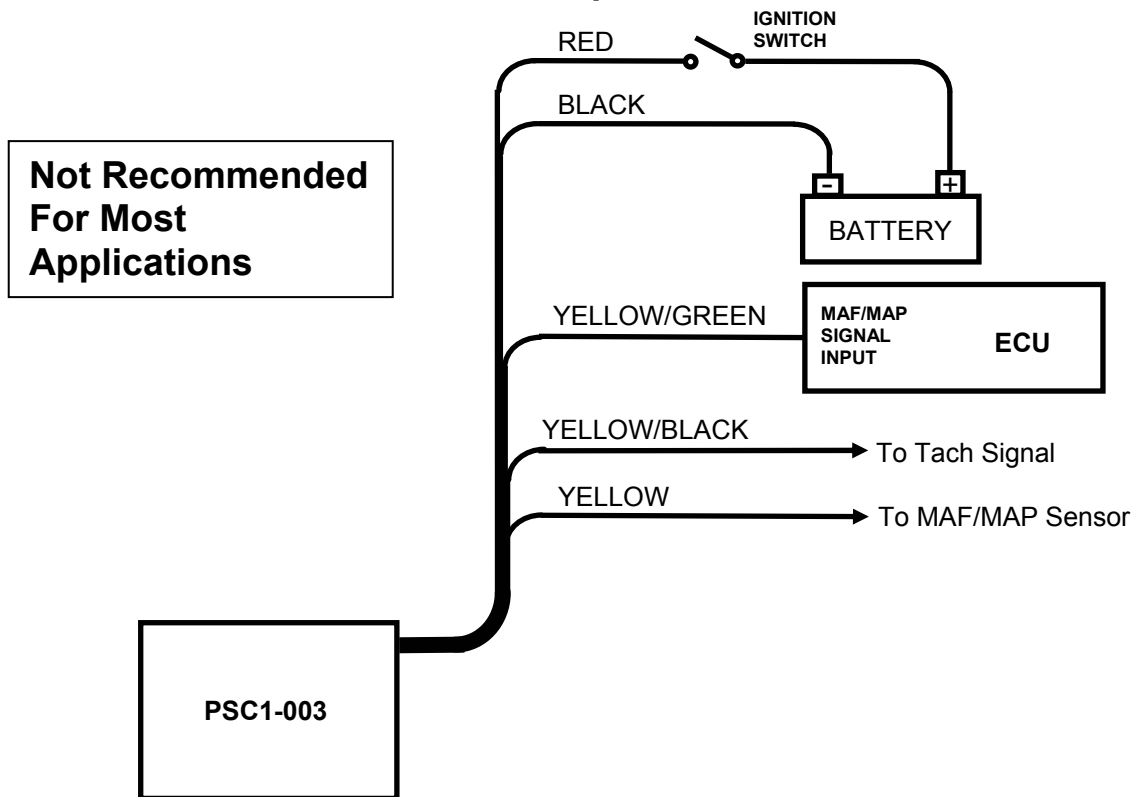
Features:

- Three-dimensional map table defined by MAF/MAP voltage and RPM
- Compatible with 2 and 4 stroke engines from 1 to 12 cylinders
- Laptop adjustable
- Two modes for either direct output or signal modification
- Can be mounted in the engine compartment
- Transient surge and battery reversal protection

Wire Assignments:

LABEL	CONNECT TO	WIRE COLOR
B+	Switched battery positive (+12V)	Red
B-	Signal common	Black
DIRECT OUT	ECU MAF/MAP input (in direct mode)	Yellow/Green
V IN	MAF/MAP output or external control signal	Yellow
MAF/MAP	MAF/MAP signal source	Green
MODIFY OUT	ECU MAF/MAP input (in signal modify mode)	Violet
TACH	Tach signal (pulses per rev = #cyl/2)	Yellow/Black
F-DB9	Serial connector on computer	-

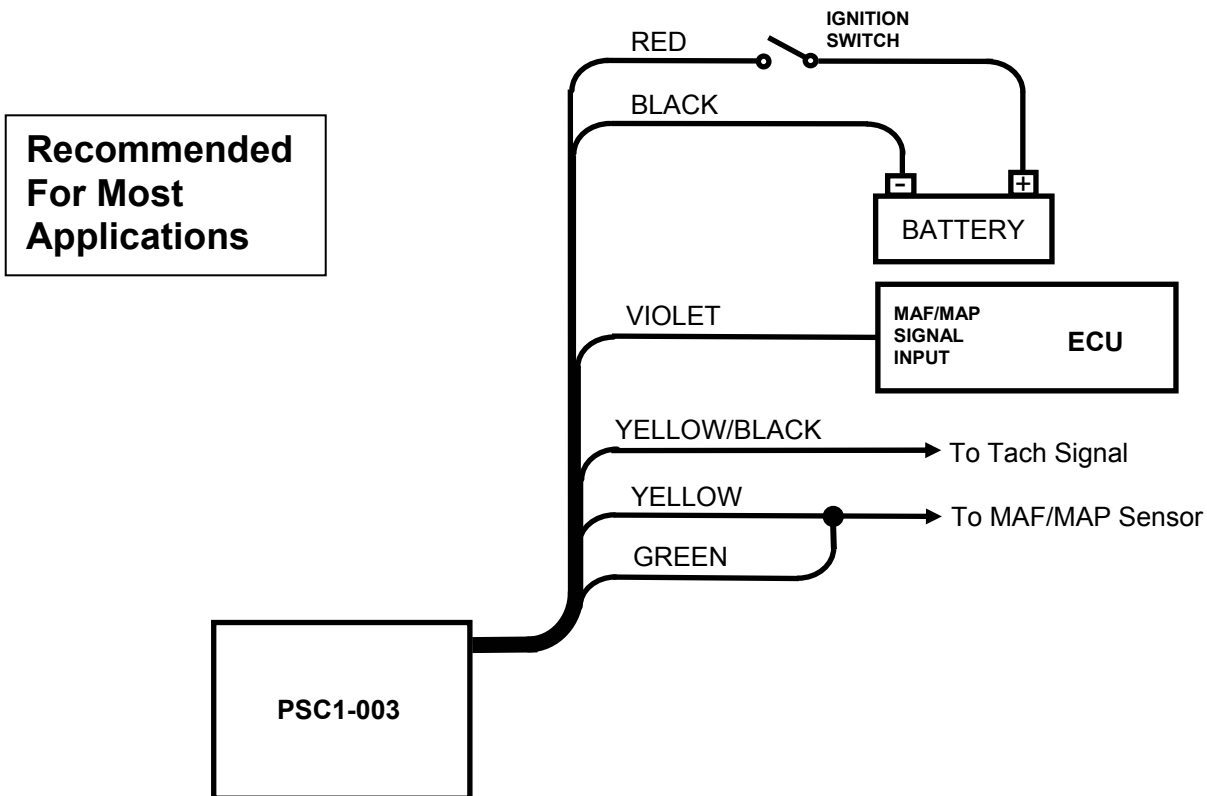
Basic Connection – Direct Output:



In direct mode, the values in the map table are used to directly generate the output voltage. This mode is particularly useful to limit the output voltage within the allowable range of the ECU. The output voltage can be set anywhere between 0 and 5V over the entire map table.

The output voltage equals cell value divided by 4. Therefore, a cell value of 4.0 outputs 1V, 8.0 outputs 2V, 12.0 outputs 3V etc. There are 200 levels which correspond to a minimum step size of 25mV.

Signal Modify Configuration Using a Single Load Signal:



In this mode, the output to the ECU is a modified version of the MAF/MAP sensor signal. The same input is used both as the sensor input and as the table look-up signal. The map table in the PSC1-003 is used to offset the MAF/MAP signal as necessary.

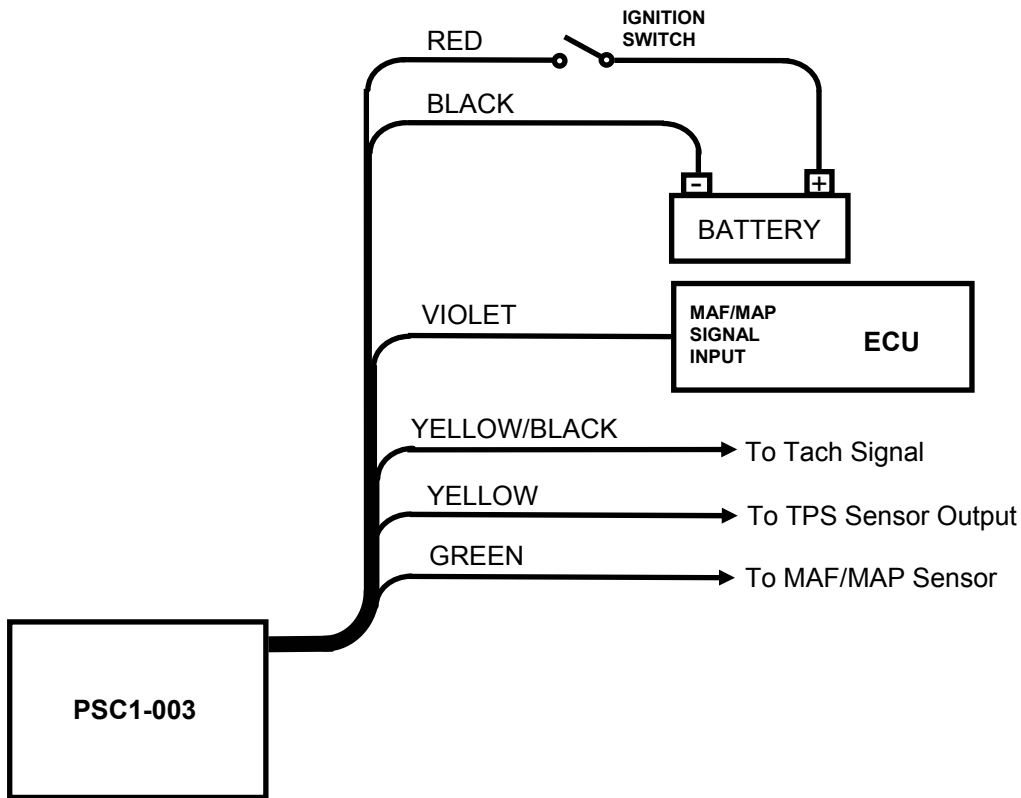
The sensor input is offset by cell value. The offset is given by the formula:

$$\text{Offset} = (\text{cell value} - 10) / 4$$

The range of adjustment in this mode is +/- 2.5V. A cell value of 0 will subtract 2.5V from the signal. A cell value of 10.0 will not alter the signal. A cell value of 20.0 will add 2.5V to the signal. The starting map for this configuration is a map loaded with 10 in every cell.

The signal modify connection is recommended for most engine management applications. It will result in the smoothest and most stable operation possible.

Signal Modify Mode with an External Input Signal:



This mode is commonly used to modify an MAF/MAP signal according to an independent control input and RPM. In the example shown, the MAF sensor signal is modified as a function of TPS voltage. In this configuration the external input is designed for a 0-5V signal. The cell value is used in the same way as the previous configuration. A cell value of zero to 20 offsets the signal by a range of $-2.5V$ to $+2.5V$.

Software:

The PSC1 is programmed with the R4 engine management software. When the software is launched an identification screen will appear that says Split Second. After four seconds, the main menu will appear. If this is a new application, select **File** then **New Customer** to create a new customer. Type in the customer name and save. The default location for customer names is My Documents.

When you return to the main screen, select **File** and **Open Customer** to open the customer file that you just created. Once the customer is open, the Maps, **View**, **Options** and **Help** tabs become active. Whenever you open a new file for the first time you must set the **System Settings** to match the hardware you are using. You can fill in the various fields such as name, address etc. if you like.

Connections:

Connect the PSC1 to the computer using a USB to serial adapter cable. These cables require a software driver that must be properly installed on the computer. Select the proper com port for the serial adapter. The correct com port setting may be found under Ports in the Device Manager of the computer.

Remove the lid on the PSC1. Once the cable is plugged in and the PSC1 is powered up, you may connect to the PSC1 by selecting the **Connect to ECU** icon. Once communication has been established with the ECU, the **Real Time** pull down becomes active.

Programming:

Use the **Options** pull down and **Systems Settings** option to select Voltage mode and Programmable Signal Calibrator. Use the **Options** pull down and **Engine Settings** to select the number of cylinders of the engine. The setting for number of cylinders depends on the signal used for the tach reading. If the signal pulses at the true-tach rate, the actual number of cylinders should be used. If the signal pulses at a lower rate, a lower number of cylinders can be used to obtain the correct RPM reading.

Use the **Maps** pull down to access the fuel map tables. There are two map tables in the R4 program. The PSC1 uses table A. The active cell at any given time is determined by the load voltage reading and RPM.

The number entered into the cells on the map represent either the actual output voltage (direct mode) or the amount that the input voltage is offset (signal modify mode). The number entered in the cell can range from 0.0 to 20.0. The step size in both modes is 25mV. Example outputs are shown on the following table.

The direct output voltage is determined by cell value divided by 4.

The sensor input is offset by cell value. The offset is given by the formula:

$$\text{Offset} = (\text{cell value} - 10) / 4$$

This table shows the output voltage for direct and signal modify modes of operation. Note that there are 200 cell values. Only 20 are shown for simplicity.

Cell Value	Mode	
	Direct	Signal Modify
0	0.0	-2.5
1	1.25	-2.25
2	0.5	-2.0
3	0.75	-1.75
4	1.0	-1.5
5	1.25	-1.25
6	1.5	-1.0
7	1.75	-0.75
8	2.0	-0.5
9	2.25	-0.25
10	2.5	0.0
11	2.75	0.25
12	3.0	0.5
13	3.25	0.75
14	3.5	1.0
15	3.75	1.25
16	4.0	1.50
17	4.25	1.75
18	4.5	2.0
19	4.75	2.25
20	5.0	2.5

You can click and drag to highlight an area of cells. Once highlighted, you can use the icons across the top of the window to fill all the selected cells with a value. For example, in the direct mode, if you fill the selected cells with the value 10, whenever the manifold pressure and RPM match one of those cell locations, the output voltage will be 2.5V.

A highlighted area of cells can also be changed by a percentage by using the **Change By** button. To increase a highlighted area of cells by 10 percent for example, select the cells, click on the **Change By** button and enter 10. To reduce by 50 percent, enter -50.

You can also fill a range of cells with values that are interpolated from the end points. This works over a row, column or 2-dimensional area. To fill values over a two dimensional area, fill the four corners of the area with cell values. Then click and drag to select the area encompassed by those corner cells. Click on

the **Auto Fill** button. The software will calculate and fill the correct values for all highlighted cells.

Once the maps are set up, you can write to the ECU in the PSC1. To write to the ECU, the ignition must be on so that the PSC1 is powered up. The engine must be off so that tach pulses are not present during programming. To write to the ECU press the **Write Data to the ECU** button. The operation of writing the data will also save the configuration and map information in the current file that is open. You can also upload from the ECU using the **Read Data From the ECU** button. You can then save or modify the data.

Operation:

Once the data is loaded into the PSC1, the engine can be started. From the main screen, the **Real Time** pull down can be used to observe a variety of operating parameters. The **All** option brings up a window that displays input voltage and RPM as well as cell value. The All window can be enlarged to full screen size to make it easy to read while working on the engine. The **RPM** and **Voltage** options display analog gauges that show those parameters. The **All**, **RPM** and **Voltage** options can all be displayed simultaneously.

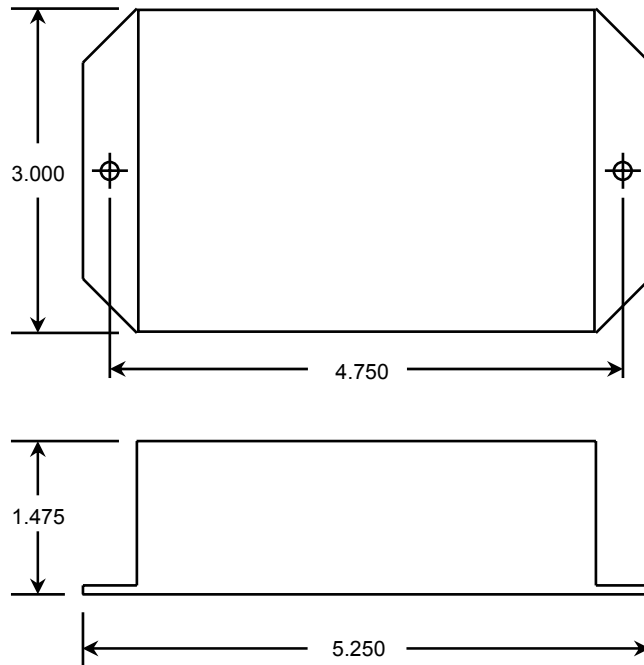
Custom Versions:

Higher resolution versions of the PSC1-003 are available. The PSC1-003F has a step size of 12.5mV and a range of adjustment of +/-1.25V. The PSC1-003SF has a step size of 6.3mV and a range of adjustment of +/-0.625V.

Electrical Characteristics:

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	BATT+ to BATT-	12	13.5	15	V
Supply Current	Into BATT+ terminal		16		mA
Tach threshold	Normal operation		1.6		V
Tach Hysteresis	Normal operation		0.5		V
Input Voltage	Signal in, table look-up	0		5	V
Output Voltage	Direct or Modify out	0		5	V
Output Current	Steady state source current		10		mA

Mechanical Characteristics:



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