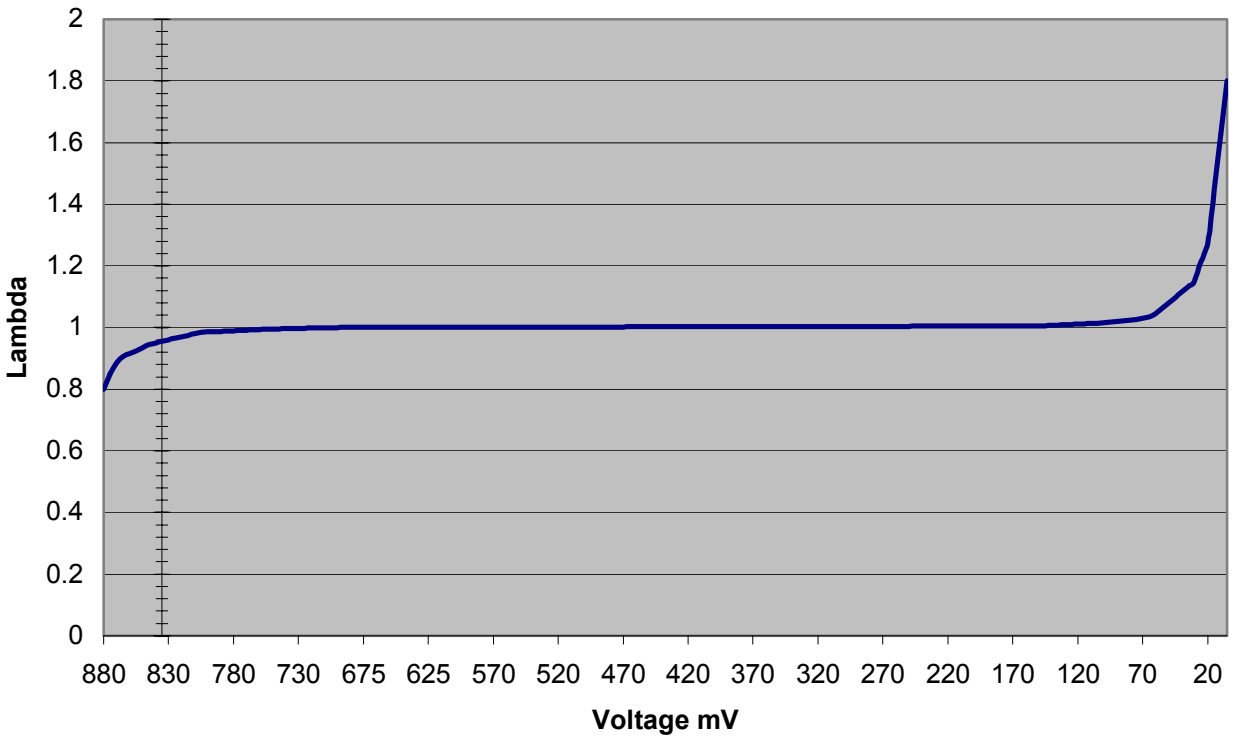
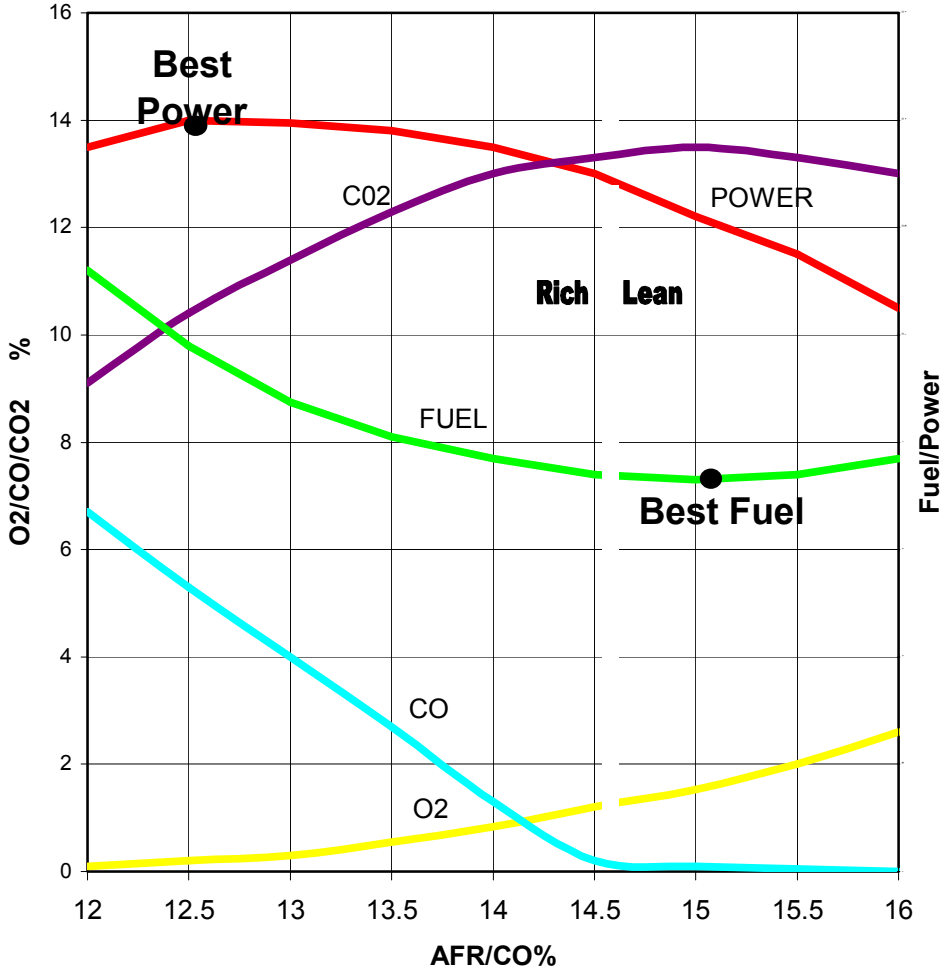
This application note describes the process of "TUNING" the lambda reading, thus affecting fuel in the lambda CLOSED LOOP operation.

Background

Some engines "Run" on lambda up to 2500 RPM and half throttle, others run lambda all the way up to full throttle. This implies that the ECU controls the fuel (injection) according to the lambda readings from the exhaust. Some engines control the fuel not just up to 2500 RPM, but also up to full throttle and any RPM. Some of these engines use a "WIDE BAND" lambda sensor, but the majority us the "NARROW" band stock sensor. A lambda sensor is constructed so that it produces an output at LAMBDA=1.0 which is a 14.7 AFR (Air Fuel Ratio). This ratio is NOT ideal, but it is a good compromise between max power and best fuel efficiency. The following graphs explain:





Limitations

Once you decide to tune the LAMBDA, then your tuning is only effective if the CLOSED LOOP is active. Engines which run in closed loop up to 2500 RPM and half throttle can be tuned up to these limits, but an ADDITIONAL SMT6 is required to tune the airflow meter or other fuel devices. A SMT has only one ANALOG MAP!

What If The Engine Has More Than One Lambda Sensor?

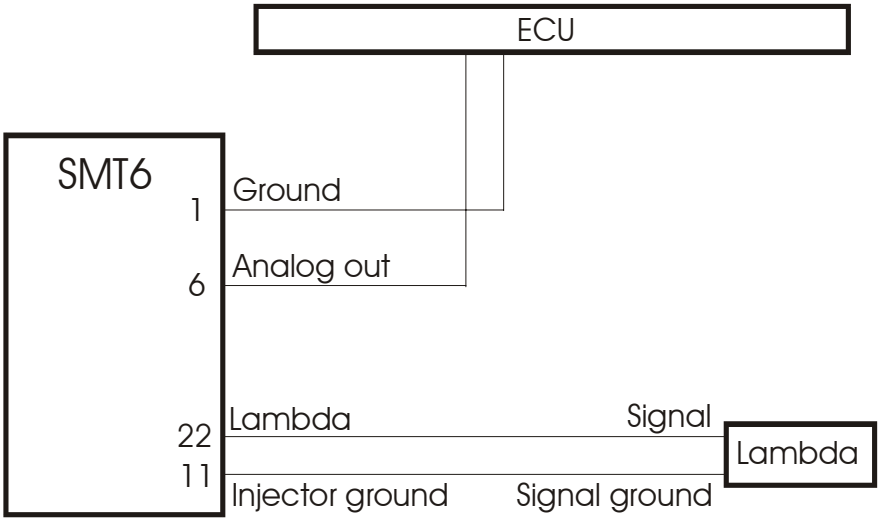
The SMT6 has only one LAMBDA SIGNAL TUNING CIRCUIT. But the following circuit can be used to circumvent the use of more than one SMT for this purpose.

Application

The SMT6 should be wired up as follows:

This circuit assumes that the ignition and extra injection is not used. The application of these two items is explained in different notes.

Connection of lambda sensor to ecu.



The following tuning map assumes:

- We like to improve the economy while cruising
- We like to improve power at full throttle
- The engine runs on lambda through its entire range

SMART TUNER SMT6: Digital Technology Pty Ltd WWW.PERFECTPOWER.COM
Dscr:
Map:

		Analog deflection (%)										ANALOG
AnaDefl:	%	4	8	14	23	36	50	71	99			
Rpm:		0	0	0	0	0	0	-7	-15	6010	0.50	120
An Input:	V	0	0	0	0	0	0	-7	-15	5661	1.00	112
Eng Temp:		0	0	0	0	5	0	-7	-15	5279	1.00	103
AMP:		0	0	0	0	5	0	-7	-15	4924	1.00	95
AFR:	V	0	0	0	10	5	0	-7	-15	4560	1.00	86
AnOutput:	V	0	0	7	10	5	0	-7	-15	4200	1.00	78
An mod:		0	0	7	10	5	0	-7	-15	3842	0.90	69
Inject:		0	5	7	10	5	0	-7	-15	3488	0.80	61
Ignmod:		0	5	7	10	5	0	-7	-15	3125	0.70	52
		0	5	7	10	5	0	-7	-15	2764	0.60	44
No Tune:		0	5	7	10	5	0	-7	-15	2401	0.30	35
Mode bad:		0	5	7	10	5	0	-7	-15	2042	0.00	27
RPM bad:		0	5	7	10	5	0	-7	-15	1681	0.00	18
Ign bad:		0	5	7	10	5	0	-7	-15	1321	0.00	10
StoreSel:		0	5	7	10	5	0	-7	-15	961	0.00	1
Version:	0	0	0	0	0	0	0	-7	-15	600	0.00	-8
										RPM		A_ENGT

Error:

In addition to the above map the following settings are active:

- ANALOG ZERO
- ENGINE TEMPERATURE CALIBRATION
- RPM CALIBRATION

Note

1) The map is blended in with the engine temperature. At low temperatures the map is OFF (zero), and from 78 degree C the map is fully effective.
2) A positive number means that the engine runs LEAN, and that the SMT6 adds lambda to bring the ECU lambda input back to 14.7.
3) A negative map value means the engine runs RICH, and the SMT6 reduces the lambda reading to conform to the closed loop value of 14.7 AFR.
4) Each count in the map presents approx. 0.05 AFR. The map value of -15 at full throttle lets the engine run at 13.95 AFR (14.7 - 15x0.05 = 13.95)
5) The ANALOG ZERO value in the global map is active, and can be used to OFFSET the complete map.

Conclusion

Very easy modification! Very effective for fuel economy and gaining power at full throttle. Practical test have confirmed the fuel economy. The power gains depend on how rich (or lean) the engine runs in stock configuration. The best approach is to measure the lambda before any modification, and then decide with the above fuel/power graph what to do, and how much to do.