SMT8L

Technical Manual V2.3

LetRipp II

Featuring Wireless

dds

Table of Contents: **Page no:**

Table of Figures: **Page no:**

1. INTRODUCTION

Welcome to the Digital Data Systems (DDS) SMT8-L (USB) and SMT8-LW (Wireless) Technical Manual. The Technical Manual needs to be used in conjunction with the Windows Software Manual. The Technical Manual will assist you in the operation of the DDS SMT8L.

The SMT8L is the result of many years of development in the "Piggy-Back" industry.

2. FEATURES

Here is a brief list of the features:

- Two maps to influence analog signals
- One Map to influence one ignition signal
- Extra Injector drive with full mapping
- Boost control
- Frequency/PWM input/output with full mapping
- Bipolar Ignition output
- USB or Wireless communication
- ETC mapping
- Engine safety control
- AFR (Lambda) mapping
- Calibration of all inputs

2.1 ANALOG #1 MAP

An analog signal is intercepted via the A1IN (pin 7/12) to A1OUT (pin 5/10) connections and mapped via Throttle/RPM, Engine, Air temperature and AMP, for the purpose of altering fuel at specific engine conditions. Full calibration and limiting is available. The output signal can be limited (high and low) and zero offset calibrated.

2.2 ANALOG #2 MAP

The analog signal on A2IN (pin 9/12) is mapped to the A2OUT (pin 10/10) via Throttle/RPM, AMP, Air and Engine temperature, for the purpose of altering (mapping) an analog signal, which in turn may alter certain engine operations. The output signal can be limited (high and low) and zero offset calibrated.

2.3 ANALOG #3

The SMT8L has an Analog #3 circuit, which is primarily used for protection MOD and ETC operations. A simple 16 X 24 celled map can be enabled for basic tuning.

2.4 IGNITION MAP

One ignition signal (CRANK) can be intercepted and mapped via Throttle/RPM, AMP, Air and Engine temperature, for the purpose of retarding/advancing the ignition.

2.5 INJECTION MAP

The SMT8L can drive one extra injector (13 ohm) for supplementing fuel at high boost. The extra injector can be controlled via Throttle/RPM, AMP, Engine and Air temperature maps. This allows for precise fuel delivery at boost conditions. This feature is very popular with turbo and supercharger installations.

2.6 AFR MODIFICATION

A large 16 x 24 map allows the precise AFR (Lambda) signal modification via the AFR INPUT (pin 12/12) to the AFROUT (pin 9/10). The AFR is mapped via Throttle/RPM, AMP, Engine and Air temperature.

2.7 FREQUENCY/PWM MODIFICATION

A digital signal (PWM or FREQUENCY) can be modified via the FREQIN (pin 2/12) and the FREQ (pin 2/10) output signal path. The mapping is via RPM/TPS, AMP, Engine and Air temperature.

2.8 MAP A/B

The unit has two complete maps. That is to say that you can switch between two different tuned maps while driving. It is possible to have one map for economy, the other for performance. Or use the maps for different weather conditions. The Maps can be switched from the hardware input (Switch). The parameters and calibration are not switched. The maps can be 'locked' in to a fixed position from the PC for tuning and downloading.

2.9 CALIBRATION

The Throttle, RPM range, AMP sensor, Air temperature and Engine temperature sensor and scales can be calibrated and specified. The Calibration is applicable to both tune maps A/B.

2.10 HELP

Help is available in various forms:

A) Right click on any item and a short explanation is available
B) This TECHNICAL MANUAL
C) The LETRIPP WINDOWS SOFTWARE GUIDE
D) Some WINDOWS ITEMS are explained 'ONLINE'

2.11 PROTECTION

A Piggyback unit is normally applied to an engine after a modification. The professional tuner then takes great care to tune the engine perfectly. But he also has to 'anticipate' the problems that could happen as a result of normal use, or abuse, or tinkering with the engine. Whatever the problem, the professional tuner needs to protect against engine failure. The SMT8L is the first unit in the piggyback range worldwide, which allows multiple protection mechanism:

IGNITION CUT
IGNITION RETARD + TIME
ANALOG MOD + TIME

Some times, the protection can take the form of a control loop. This is specially so for the NON-CUT modes. As an example: The amount of ignition retard is proportional to the amount the limit was exceeded.

Each of the above groups has a set of PARAMETERS (Limits). Entering a ZERO disables the parameter. Each group consists of:

- AMP Limit
- Engine Temperature limit
- Air Temperature limit
- RPM limit
- Frequency limit
- Speed limit
- (Time Limit, zero entry is allowed!)

All items in a group are combined. The time limit specifies the amount of SECONDS the limit can be violated before the protection is applied. A zero entry in the time means that the protection becomes effective immediately.

The protection from the IGNITION CUT and RETARD groups imply that the crank signal is routed through the SMT8L. The ANALOG MOD group can be used on:

- TPS signal
- ETC Position feedback signals
- Not recommended: AMP signal

Check the ANALOG #3 sections for more details!

2.12 ETC MODIFICATIONS

This is the first Piggyback unit to allow ETC modifications. The ETC flap control can be modified (re-mapped) with the SMT8L. It takes some skill to NEGATE the effect of the ECU traction or launch control, but if you want to spin tires, then this is the way to go!
For more details: See ANALOG #2 MODIFICATIONS.

2.13 FAULT REPORTING

The unit has a powerful fault reporting feature. The SMT8L monitors vital parameters and maps, and if any entry, or the outcome of some computations gets out of range, then a fault is lodged against it and reported to the PC.

3. GENERAL USE OF THE WINDOWS SOFTWARE

This is explained in the LETRIPP SOFTWARE GUIDE, which covers items like software installation, the use, and features.

3.1 COMMUNICATION WITH THE SMT8L

The SMT8L comes in two versions:

3.1.1 USB COMMUNICATION

The SMT8-L uses a USB2.0 communication. The supplied cable should be used or any standard cable with an 'interference prevention ferrite'.

3.1.2 WIRELESS COMMUNICATION

The SMT8-LW uses the 2.4GHz band for secure and convenient Wireless communication. It requires an USB/Wireless pod (Part number: WireX) and works otherwise in the same way as the USB communication.

The system can recognize up to 8 different active units in your workshop, and it operates on 16 different frequencies. The operating distance depends largely on the installation, but 5 to 20 meters is normal. It prevents any PC interference.

4. CONNECTIONS

The SMT8L has 2 connectors and a USB communications port.

4.1 PIN-OUT TABLE

NOTE: The GROUND pin on the 10pin INJECTOR CONNECTOR is conducting CURRENT and therefore must be connected via heavy gauge wires to chassis,

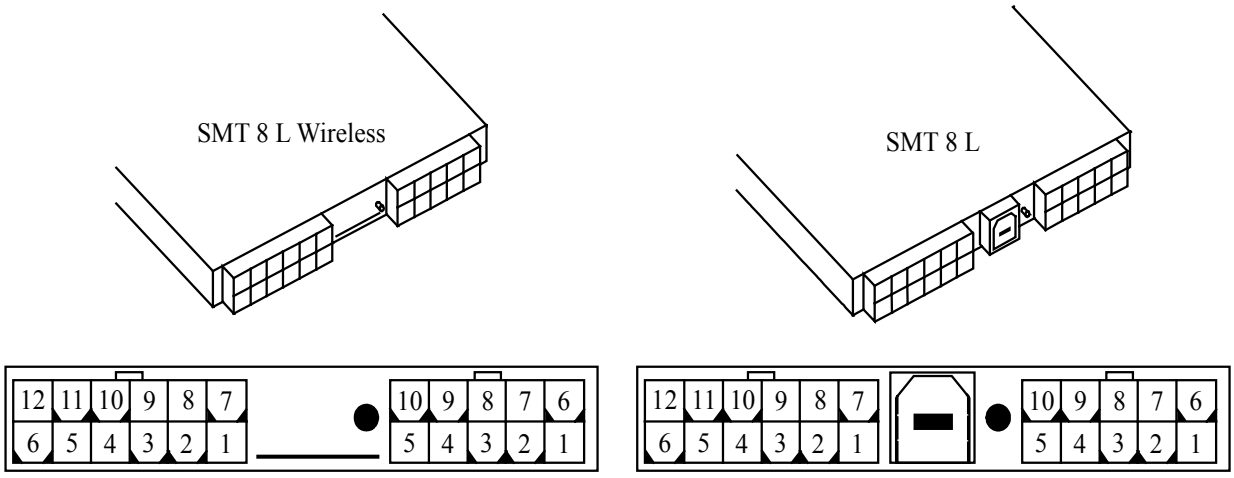


FIGURE 1. SMT8L PIN OUT

SMT 8L Main Connector (12 Pin Connector)
Molex connector part # 5557-12 with crimp pin 5556
Wire: 1.5meter long, 0.5mmsq automotive wire

	Pin	Signal	Description
Red	1	+12V SUPPLY	Switched Battery Supply
White / black	2	Freq (in)	Frequency input
Red / black	3	Analog 3 (in)	Load Signal 3 input
Blue	4	AIRT (in)	Air Temperature input
Grey	5	TPS (in)	Throttle Position input
Black	6	GND	Signal Ground
Green	7	Analog 1 (in)	Load Signal 1 input
White	8	Map Switch	Map Switch Input, Open=high=A
White/red	9	Analog 2 (in)	Load Signal 2 input
Yellow	10	AMP (in)	Absolute Manifold Pressure input
Pink	11	Eng temp (in)	Engine Temperature input
Grey / blue	12	AFR (in)	AFR/Lambda input

SMT 8L Injector Connector (10 Pin Connector)
Molex connector part # 5557-10 with crimp pin 5556
Wire: 1.5meter long, 0.5mmsq automotive wire

	Pin	Signal	Description
Black	1	GND	Chassis Ground
White / red	2	Freq (out)	Frequency output
Blue / black	3	WB (out)	Wide Band Lambda output
Yellow / black	4	Analog 3 (out)	Load Signal 3 output
Blue / white	5	Analog 1 (out)	Load Signal 1 output
Orange	6	Injector 1 (out)	Injector drive, 1AMP
Brown / black	7	IG (out)	Crank trigger output
Brown	8	IGIN	Crank trigger input
Grey black	9	AFR (out)	Narrow Band Lambda output
White / black	10	Analog 2 (out)	Load Signal 2 output

4.2 SPECIFICATIONS

Power consumption:	<100mA (0,1A)
Power supply voltage:	8 – 36 V
Reverse Polarity Protection:	Yes
Momentary power supply:	up to 60 V, 5 ms
Signal input impedance:	>10 K Ohm
Pull up:	2k2 Ohm
Ambient temperature:	Up to 60 deg C (Passenger compartment)
Ignition signal output:	Bipolar, -5 to +5Volts, 10mA
Injector drive:	1 Amp, 13-Ohm injector
Analog output drive 3 x:	0.005 Amp (5 mA), 0 - 5volts
Analog input range:	0 - 5 Volts
Ignition resolution:	0.143 of crank degree

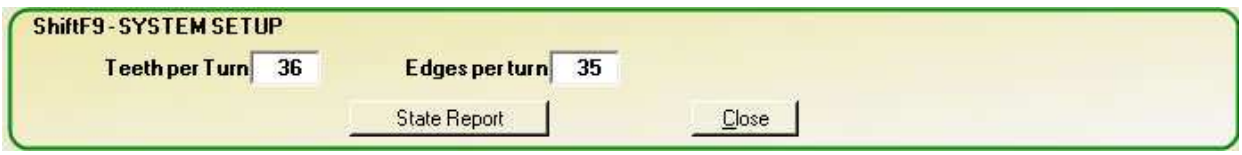
5. TRIGGER INPUTS

The SMT8L derives the RPM reading from the CRANK signal input (pin8/10).

All trigger inputs require

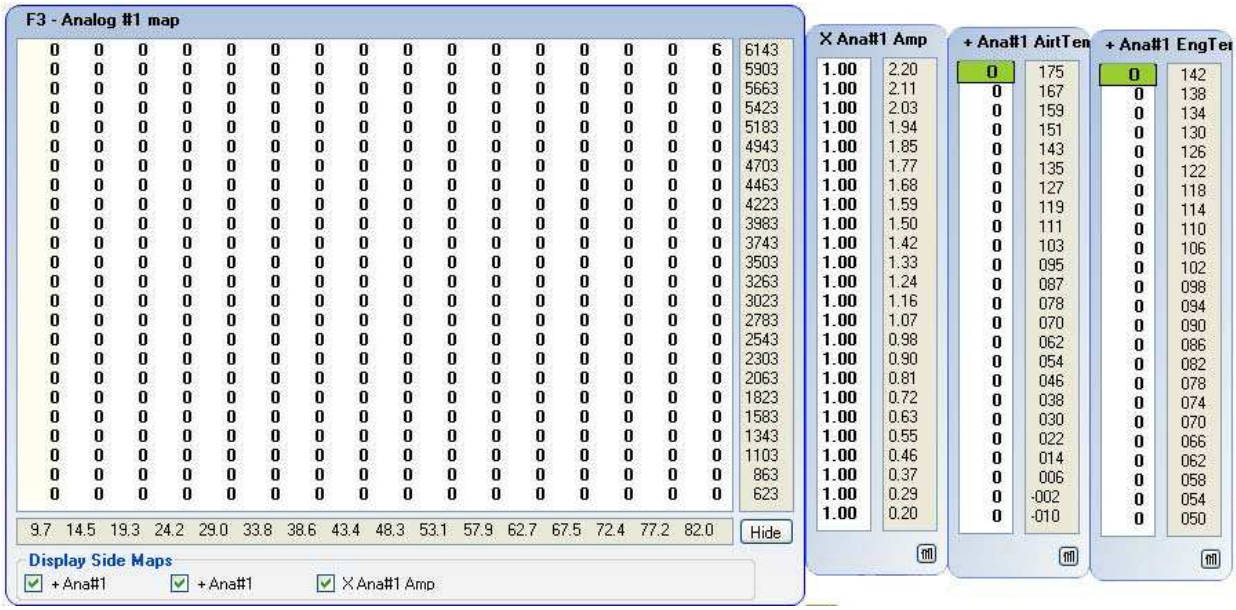
A) Connecting to wires (pickup, sensor)
B) Comparing the input signal to some preset trigger level

The type of trigger signal used is set up via the System Setup screen. The settings below are for a 36 – 1 crank signal.



TEETH PER TURN (INCLUDING MISSING)
EDGES PER TURN

6. ANALOG #1 MODIFICATION



The SMT8L ANA1 feature can modify one analog signal, on ANALOG #1 INPUT and output the mapped signal on ANALOG #1 OUT.

6.1 USAGE

An analog signal is a DC voltage generated from a number of different types of sensors; examples of these are the air flow meter, mass air flow meter (MAF) and pressure transducer (MAP) or temperature transducer.

Most analog signals, with a few exceptions, range from 0 to 5 Volts and are used by the ECU to determine the fuel quantity. By routing the signal through the SMT8L the analog voltage is changed, which in turn results in a fuel change. Thus allowing the car to be tuned. The input to output voltage relationship can be changed at various engine-operating points. This process is called "MAPPING".

6.2 ASSOCIATED PINS

ANALOG 1 input	Analog 1 (in)	Pin 7 of the 12-pin connector
ANALOG 1 output	Analog 1 (out)	Pin 5 of the 10-pin connector

6.3 MAIN (RPM/THROTTLE) MAP

For the RPM to work: Connect CRANK (see: RPM trigger).
For the Throttle (deflection) to work: Connect pin 5 of the 12-pin connector to the analog deflection signal (normally the throttle position sensor).

6.4 ANALOG #1 AMP SIDE MAP

The AMP map deflection comes from the AMP (in), Pin 10 of 12-pin connector. The input can be calibrated. The values in the map are ADDED to the main map entry, and the entry is in counts: 100 counts = 1.00 volts.

6.5 ANALOG #1 ENGINE TEMPERATURE SIDE MAP

The Engine Temperature map deflection comes from the ENGTIN, pin 11 of the 12-pin connector. The values in the map are ADDED to the main map entry. The map entries are in counts: 100 counts = 1.00 Volts.

6.6 ANALOG #1 AIR TEMPERATURE SIDE MAP

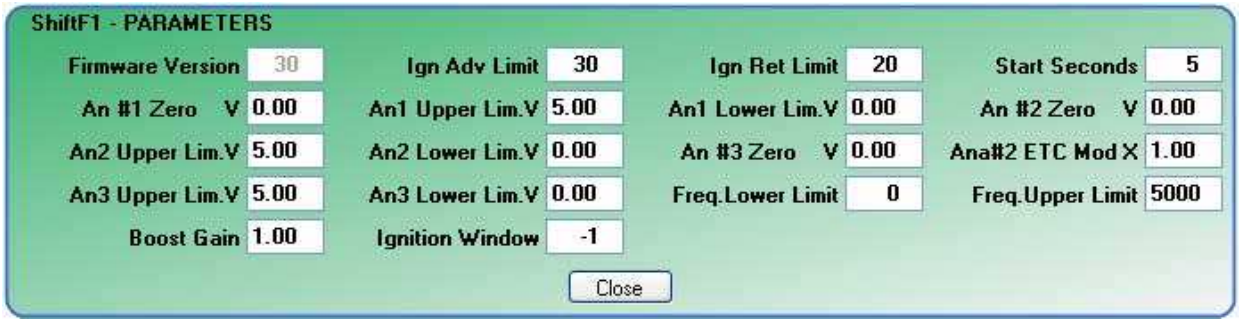
The Air Temperature map deflection comes from the AIRTIN, pin 4 of the 12-pin connector. The values in the map are ADDED to the main map entry: A 100 count entry results in 1.00Volt.

6.7 COMPLETE CALCULATION

Analog 1 (out) = Analog 1 (in) +- ZERO OFFSET
+- ANA1 MAP (main map)
+- AN1 ENGT (side amp)
+- AN1 AIRT (side map)
X AN1 AMP (side map)

The Analog 1 (out) signal is limited to the low and high limits.

6.8 PARAMETERS



ANALOG1 ZERO OFFSET:

With all map values zero (no modification), the input to output difference when measured with a voltage meter, should be zero. If not, then this value should be adjusted. This value can also be used to tune the complete map up or down (richer/leaner).

ANALOG1 UPPER LIMIT:

Entering 5 volts, which is the max output voltage, renders the limit useless.
Any other entry prevents the output to exceed the set limit.

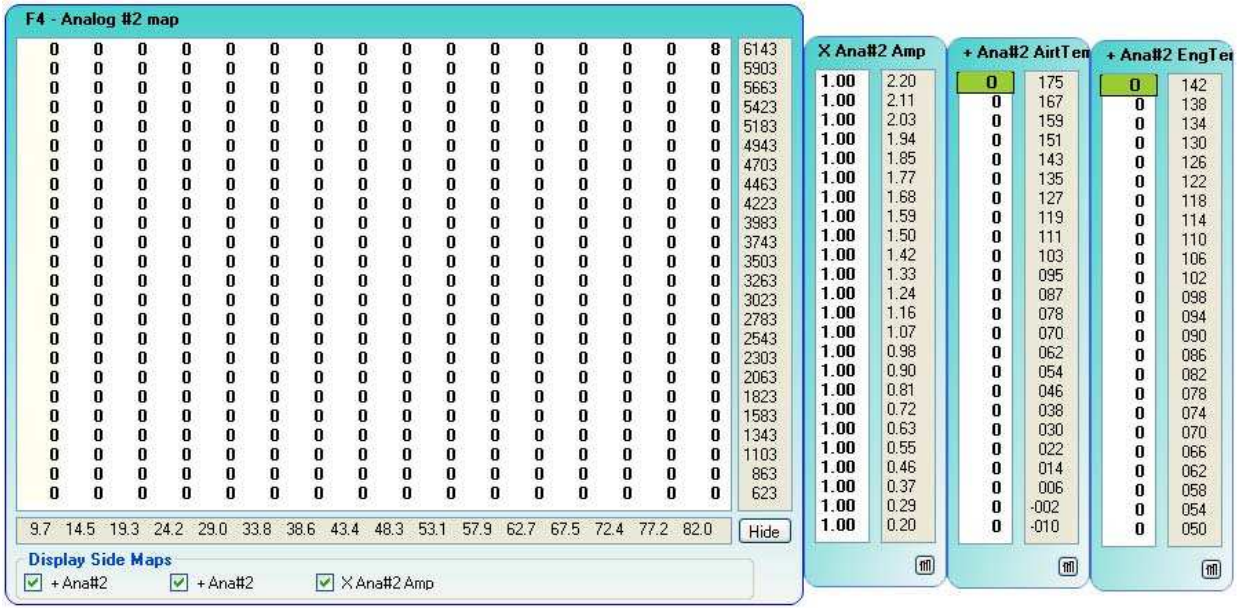
ANALOG1 LOWER LIMIT:

The minimum output voltage is zero volts. Any other setting prevents the output from falling below the set limit.

7. ANALOG #2 MODIFICATIONS

This map follows the concept of the ANALOG #1, but has extra features useful for:

Engine protection
Electronic Throttle Control (ETC) modification

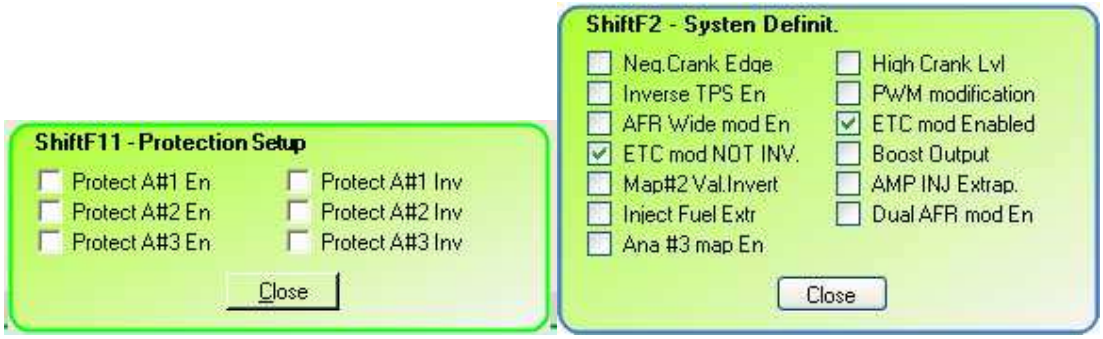


The Analog#2 output depends on the following SYSDEF setup.

CASE	MOD Protection	ETC mod Enabled	Analog 2 (out) = Analog 2 (in)
1	0	0	+ MAP#2
2	1	0	+ MAP#2
3	0	1	+ MAP#2
4	1	1	+ MAP#2 – MOD

The term Map#2 means the sum of Main map, ENGT, AIRT, and AMP side maps.
The term MOD comes from the protection modification. It is the sum of the RPM, AIRT, ENGT, and AMP protection.

The MAP#2 sign can be switched with the SYSDEF, Map2Invert, and (Shift F2)
The MOD sign can be switched with the Protection Setup, (Shift F11).



7.1 NORMAL OPERATION, CASE 1-3

This follows the ANALOG #1 principle, except the I/O connections:

ANALOG 2 input	Analog 2 (in)	Pin 9 of the 12-pin connector
ANALOG 2 output	Analog 2 (out)	Pin 10 of the 10-pin connector

Analog 2 (out) = Analog 2 (in) +- ZERO OFFSET
+ ANA2 MAP
+ AN2 ENGT
+ AN2 AIRT
X AN2 AMP

The above assumes: Map2Invert=0. With Map2Invert=1 the calculations are:

Analog 2 (out) = Analog 2 (in) +- ZERO OFFSET
- ANA2 MAP
- AN2 ENGT
- AN2 AIRT
X AN2 AMP

Note: The sign of the individual map entries is not considered!

MAP POLARITY: The polarity of the SUM of all map entries can be changed with:
SYSDEF, Map2Invert

7.2 SPECIAL PROTECTION OPERATION, CASE 4

This mode of operation allows the user to modify the A2OUT signal further in addition to the above modifications. Of course, it is the user's responsibility to assure that the extra modifications make any sense, and in effect protect the engine.

Analog 2 (out) = Analog 2 (in) +- ZERO OFFSET
+ ANA2 MAP
+ AN2 ENGT
+ AN2 AIRT
X AN2 AMP
- MOD

The above assumes: Map2Invert=0 and ProtectInvert =0

NOTE: DO NOT make the engine LEAN while protecting!

The engine protection can be affected from:

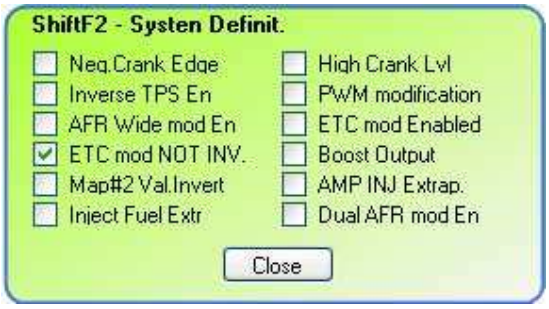
AMP input	AMPIN	pin 10 of 12
Engine Temperature input	ENGTIN	pin 11 of 12
Air Temperature input	AIRTIN	pin 4 of 12
RPM	IGIN	pin 8 of 10

This mode is active when the SYSDEF, ETCModEn and Protection Setup (Shift F11) are set.

Each individual item in the group must be enabled by entering a value other than zero in to the limits. It also means that ALL protection items can be used simultaneously. The magnitude of all protection items is PROPORTIONAL to the limit they exceeded. That is to say that control loops can be constructed with the MOD value.

Case 3+4 specify ETC modification. This automatically engages Analog#3 circuit and modifies it OPPOSITE to analog#2.

In other words: If the analog #2 is modified up, then Analog #3 is modified down!



When the ETC has the same polarity voltage the ETC mod NOT INV must be ticked. Analog2 and analog 3 will be modified up and down by the same amount.

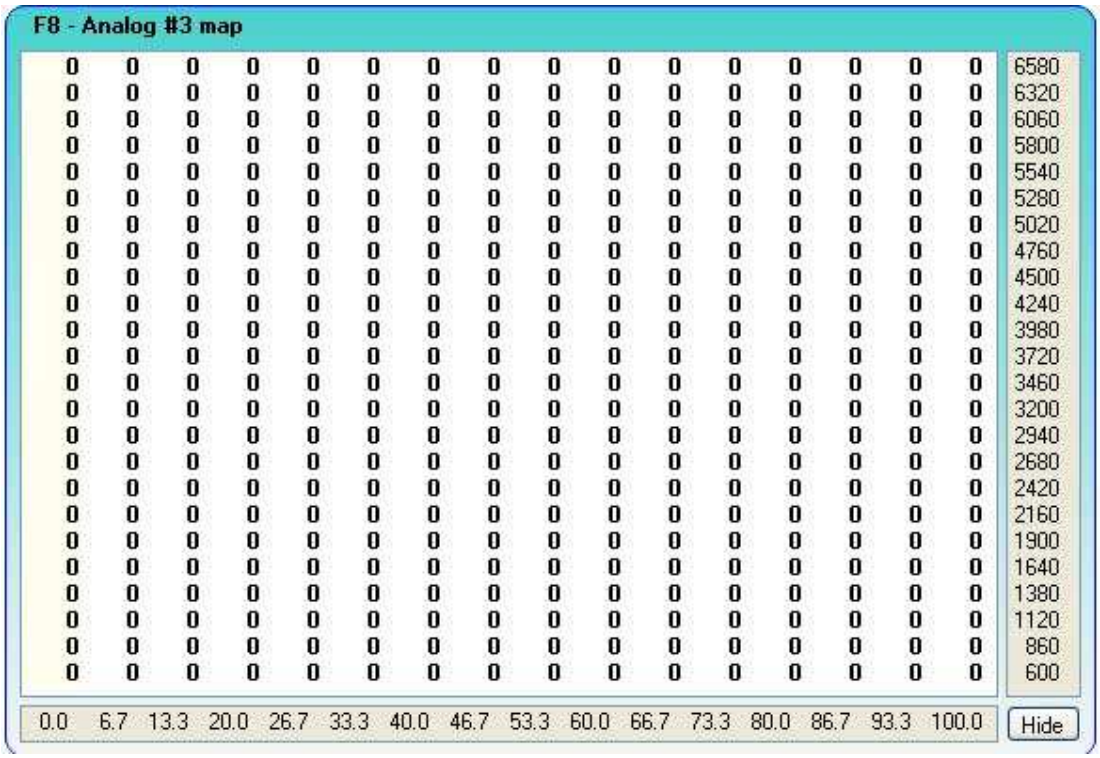
If the ratio between Analog 2 and Analog 3 is not the same then the 'ana#2 ETC Mod X' must be changed from 1.00. This value is a multiplier an entry of 0.5 will effectively halve the modification on analog 3

Protection POLARITY: The polarity of the protection can be changed for the whole group by:
Protection Setup (Shift F11)

Of course, once the polarity changes for Analog #2 it changes for analog #3 as well!

8. ANALOG #3 MODIFICATIONS

The Analog #3 circuit has no side maps attached.



Analog 3 map is enabled by ticking the 'Ana#3 map En'. Once enabled this map will control the analog 3 output.

It uses the following pins:

Analog #3 input	Analog 3 (in)	pin 3 of 12
Analog #3 output	Analog 3 (out)	pin 4 of 10

The Analog#3 output depends on the following SYSDEF setup.

CASE	MOD Protection	ETC mod Enabled	Analog 3 (out)= Analog 3 (in)
1	0	0	
2	1	0	+ MOD
3	0	1	- MAP#2
4	1	1	- MAP#2 + MOD

The term Map#2 means the sum of Main map#2, ENGT, AIRT, and AMP side maps. The term MOD comes from the protection modification. It is the sum of the RPM, AIRT, ENGT, and AMP protection.

For ETC and Dual AFR modes the 'Ana#3 map En' must be OFF or unticked.

The MAP#2 sign can be switched with the SYSDEF, Map2Invert.
The MOD sign can be switched with the Protection (Shift F11).

8.1 NO MODIFICATION, CASE #1

Simple tuning on a 16 x 24 map.

8.2 PROTECTION MODIFICATION, CASE #2

In this mode the protection term MOD is added to the output. The way MOD is calculated can be seen further down.

8.3 ETC MODIFICATION, CASE #3

In this mode the ANALOG #2 MAP VALUE is subtracted from the input. This applies to the two opposing signals of an ETC modification. If one goes up, the other must go down. In the case of no opposing signals the system def 'ETC mod NOT INV' must be ticked on. The ratio between analog 2 and analog 3 can be altered by the 'Ana#2 ETC Mod X'. Units are shipped with the same ratio between the two maps
The Map#2 polarity can be changed with the SYSDEF, Map2Invert.

8.4 ETC + PROTECTION, CASE #4

In essence is it case 2 and 3 combined. You can do ETC mapping and Protection simultaneously.

8.5 MOD PROTECTION and TIME

The term MOD is short for MODIFY protection, because it affects an analog output. There are other protections: RETARD and CUT, which apply to the ignition circuit. The MOD value is the sum of 4 individual items. The outcome of each item it is a POSITIVE value. The polarity of the sum (MOD) can be changed by:
Protection Setup (Shift F11)

An optional TIME can be associated with the MOD value. The time is entered in seconds, it allows the protection to be exceeded for the specified time before coming in effect.

8.6 MOD RPM LIMIT

This mode requires that the:
PARAMETER: MOD RPM Limit Value, other than zero
The protection value is derived from:
Rpm Protection = Rpm – Mod Rpm Limit
It is a POSITIVE value when the RPM exceeds the set limit otherwise it is zero.

8.7 MOD AMP LIMIT

This mode requires that the:
PARAMETER: MOD AMP Limit Value, other than zero
The protection value is derived from:
Amp Protection = Amp – Mod AMP Limit
It is a POSITIVE value when the AMP exceeds the set limit otherwise it is zero.

8.8 MOD ENGINE TEMP. LIMIT

This mode requires that the:
PARAMETER: Mod ENGT Limit Value, other than zero
The protection value is derived from:
ENGT Protection = ENGT – Mod ENGT Limit
It is a POSITIVE value when the rpm exceeds the set limit otherwise it is zero.

8.9 MOD AIR TEMP. LIMIT

This mode requires that the:
PARAMETER: MOD AIRT Limit Value, other than zero
The protection value is derived from:
AIRT Protection = AIR Temp. – MOD AIRT Limit
It is a POSITIVE value when the rpm exceeds the set limit otherwise it is zero.

8.10 MOD PROTECTION USAGE

The value by which a protection limit is exceeded is converted to an ANALOG value and ADDED/SUBTRACTED from Analog #2 circuit. Analog #3 mirrors the modifications of analog #2. This means the protection mechanism is suited for control loops.
A control loop requires that the engine can be CONTROLLED VIA AN ANALOG signal. Applications that come to mind are:

AMP Control: An engine with turbo boost control (Diesel or petrol) measures the AMP and then controls the waste gate. Modify the AMP signal UP, and the ECU will reduce the effective manifold pressure.

AMP Control via TPS: Modify the TPS voltage down once the boost target is exceeded. This applies to diesel engines and ETC controlled petrol engines.

Engine/Air temperature control: Once the temperature exceeds the preset limit modify the TPS voltage DOWN.

RPM Control via TPS: Modify the TPS voltage DOWN once the RPM is exceeded. This method works only with ETC controlled engines.

AMP control via ETC: When the engine was fitted with an aftermarket turbo then it is possible to control the boost pressure via the ETC. Modify the ETC throttle position feedback signals to open the flap, and the ECU will close it.

AFR Control:
Unless the engine runs on full power on NARROW BAND AFR the protection is not recommended.

SUMMARY: TPS and ETC are very good subjects for protection. Both require that the ECU controls an ETC, but by controlling the TPS less SMT8L resources are used.
In essence you have to find a method to make the ECU reduce the power, which is a challenge when the driver demands WOT.

9. IGNITION MAP

9.1 PURPOSE

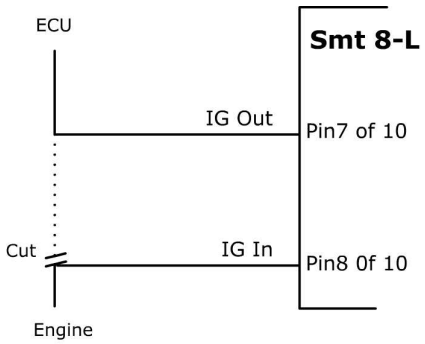
The ignition angle of an engine can be modified (retarded or advanced) to achieve one of the following effects:

A) More power with high quality fuel (advance).
B) Avoid detonation after a turbo (Supercharger) installation (retard).
C) Retarding for poor quality fuel

There are numerous other applications, which require better ignition angle control. Ignition control is not successful on engines with active knock sensor control.

9.2 ASSOCIATED PINS

CRANK SIGNAL	IGIN	pin 8 of 10
Crank Output	IGOUT	pin 7 of 10



Crank Wiring.

FIGURE 2. CRANK WIRING

9.3 MAX ADVANCE LIMIT

This is the maximum total advance the unit will allow for modification. It must be a positive entry. See: CONFIG, PARAMETERS

9.4 MAX RETARD LIMIT

This is the maximum total retard the unit will allow for modification. It can be positive or negative entry. See: CONFIG, PARAMETERS

9.5 MAPPING

The Ignition signal can be mapped within the specified (above) limits by:

9.5.1 MAIN (RPM / THROTTLE) MAP

For the RPM to work: Connect CRANK signal

For the Throttle to work: Connect pin 5 of the 12-pin connector to the analog deflection signal (normally the throttle position sensor).

Enter a number in the range from the max retard limit to max advance limit on the main map. Zero does no modification to the signal!

9.5.2 OPTIONAL AMP MAP

The active value will be added to the value on the main map, for no modification place a zero on this map.

The MAP deflection comes from the AMPIN pin 10 of the 12-pin connector.

9.5.3 OPTIONAL AIR TEMPERATURE MAP

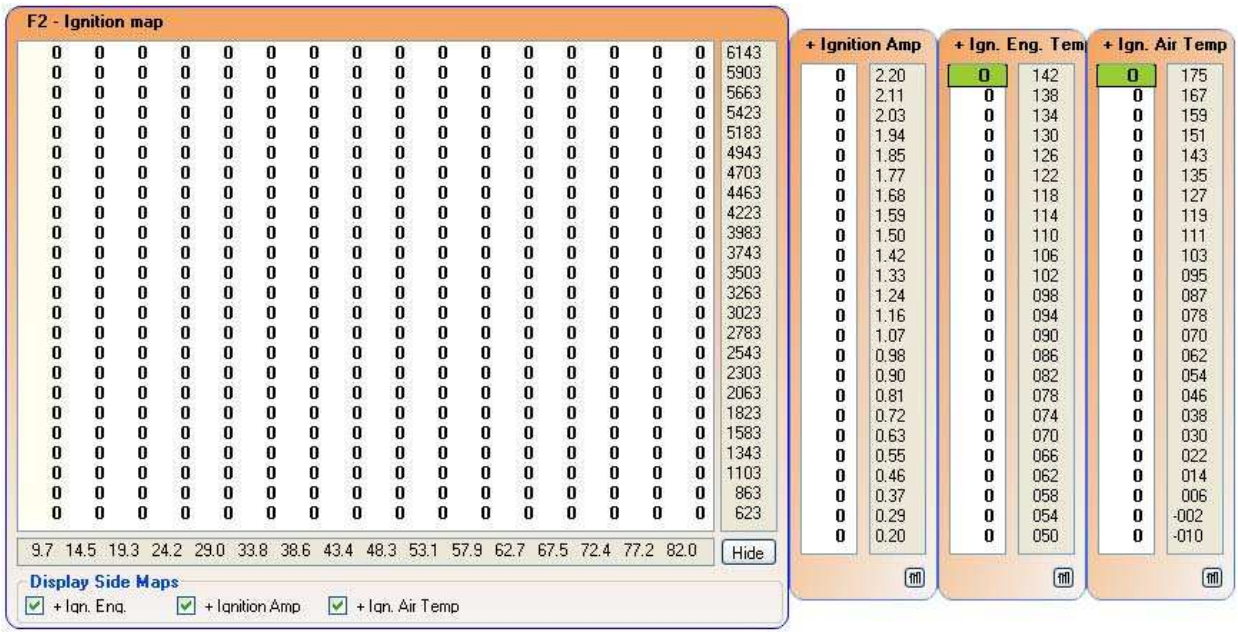
The value will be added to the value on the main map, for no modification place a zero on this map.

The air temperature deflection comes from AIRTIN pin 4 of the 12-pin connector.

9.5.4 OPTIONAL ENGINE TEMPERATURE MAP

The active value is added to the other values to form the overall IGNITION modification.

The Engine Temperature input comes from pin 11 of the 12-pin connector.



9.6 PARAMETERS

MAX ADVANCE LIMIT

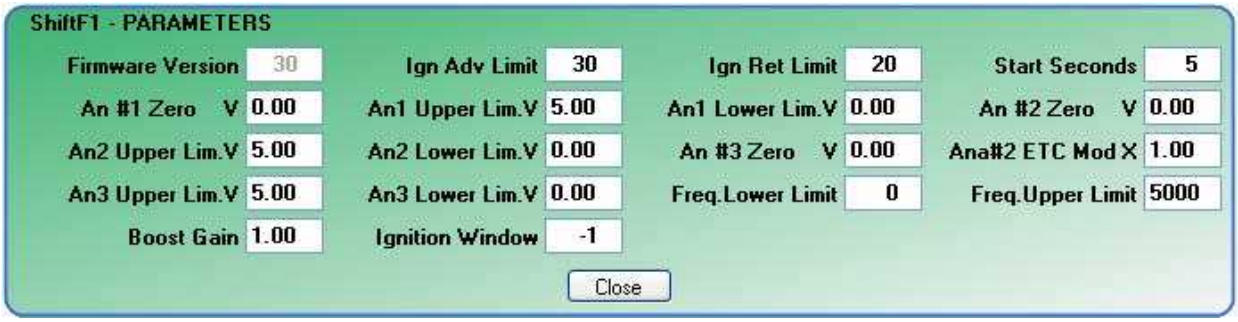
This restricts the maximum overall ADVANCE from the neutral point.

MAX RETARD LIMIT

This restricts the maximum overall RETARD from the neutral point.

IGNITION WINDOW

This allows the Smt8 to be less sensitive to the incoming ignition/crank signal. A value of –1 will disable the Smt8L's error checking of the incoming signal. Typical values of 1 to 10 are normal.



9.7 IGNITION INDICATIONS

STATUS, CRANK ACTIVE

This indicates that the unit sees an input on the IGIN, pin 8-10.

STATUS, RETARD ONLY

This indicates that the unit cannot decode the crank signal and will retard only.

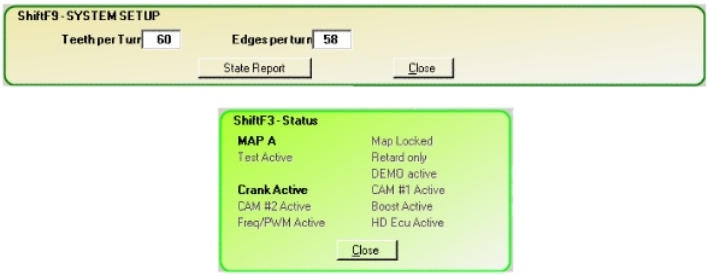
The two special SYSTEM PARAMETERS:

Teeth per Turn

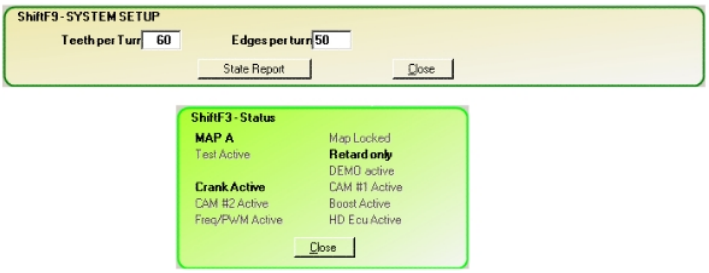
Edges per Turn

Must be set correctly. If they are set correctly, and the RETARD ONLY indication persists then this means that the SMT8L is unable to work with this crank signal.

If the engine runs with it, then you have to be content to run with it. If the engine does not run, then the level may be too low.



Picture above shows correct settings for a 60 – 2 crank signal.



Picture above shows the incorrect settings for a 60 – 2 crank signal as can be seen by the highlighted "retard only".

To set up the ignition, the edges per turn must first be set until the Smt8-L displays the correct RPM. The teeth per turn is setup last and when the number is correct the Retard only will be grayed out. Correct settings for a 60 – 2 crank signal are: teeth per turn 60 and edges per turn 58.

9.8 CUT PROTECTION

The SMT8L has 6 ignition CUT limits (PARAMETERS). Enter a value other than zero and the limit is effective. Exceeding a limit cuts the IGOUT signal.

9.9 RETARD PROTECTION AND TIME

The RETARD protection is the sum of 6 individual limits. The outcome of each limit evaluation is a positive number and proportional to the amount by which the limit was exceeded. Optional time limit in seconds can be used to allow exceeding the limit. The polarity of the retard protection is fixed to retarding.

9.10 RPM RETARD

Entering a value other than zero in to Retard RPM LIMIT (PARAMETER) enables this.
Total computation:

Retard degree = (RPM – Retard RPM Limit)/10

Exceeding the limit by 100RPM results in 10 degree retard.

9.11 AMP RETARD

Entering a value other than zero in to Retard AMP LIMIT (PARAMETER) enables this.
Total computation:

Retard degree = AMP – Retard AMP Limit

Exceeding the limit by 0.1 BAR results in 25 degree retard.

9.12 ENGINE TEMP. RETARD

Entering a value other than zero in to Retard ENGT LIMIT (PARAMETER) enables this.
Total computation:

Retard degree = (ENGT – Retard ENGT Limit)*4

Exceeding the limit by 5 degree C results in 20 degree retard.

9.13 AIR TEMP. RETARD

Entering a value other than zero in to Retard AIRT LIMIT (PARAMETER) enables this.
Total computation:

Retard degree = (AIRT – Retard AIRT Limit)*4

Exceeding the limit by 5 degree C results in 20 degree retard.

9.14 FREQUENCY. RETARD

Entering a value other than zero in to Retard FREQ LIMIT (PARAMETER) enables this.
Total computation:

Retard degree = (FREQ – Retard FREQ Limit)/10*2

Exceeding the limit by 100 Hz results in 20 degree retard.

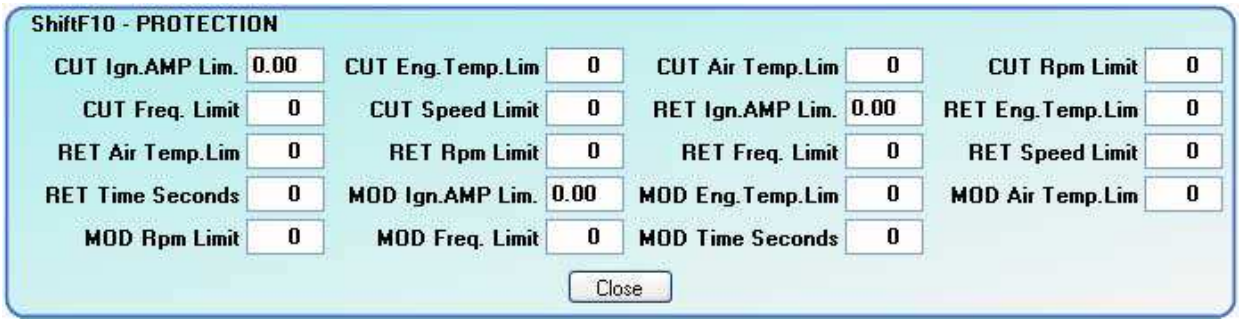
9.15 SPEED. RETARD

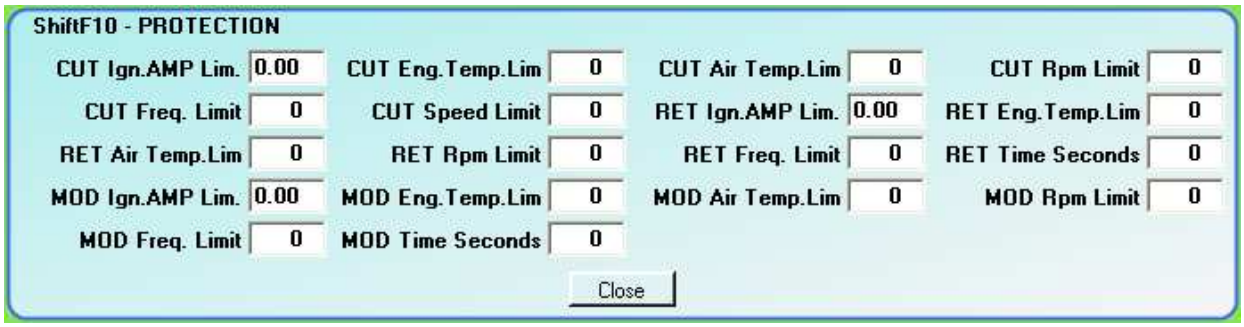
Entering a value other than zero in to Retard SPEED LIMIT (PARAMETER) enables this.
Total computation:

Retard degree = (SPEED – Retard SPEED Limit)/10*2

Exceeding the limit by 100 Hz results in 20 degree retard.

Note: Units with firmware37 or higher do NOT have this Speed Retard feature.




ShiftF10 - PROTECTION
CUT Ign.AMP Lim. 0.00
CUT Eng.Temp.Lim 0
CUT Air Temp.Lim 0
CUT Rpm Limit 0
CUT Freq. Limit 0
CUT Speed Limit 0
RET Ign.AMP Lim. 0.00
RET Eng.Temp.Lim 0
RET Air Temp.Lim 0
RET Rpm Limit 0
RET Freq. Limit 0
RET Time Seconds 0
MOD Ign.AMP Lim. 0.00
MOD Eng.Temp.Lim 0
MOD Air Temp.Lim 0
MOD Rpm Limit 0
MOD Freq. Limit 0
MOD Time Seconds 0
Close

Firmware 37

10. INJECTION MAP

10.1 PURPOSE

After fitting a supercharger or turbo it is often required to add extra fuel to the engine. This is best done by placing an EXTRA Injector in the manifold and controlling it from the SMT8L.

10.2 ASSOCIATED PINS:

Throttle deflection	Pin 5 of the 12-pin connector
Manifold pressure	Pin 10 of the 12-pin connector
Injector output	Pin 6 of the 10-pin connector
	POWER GROUND: pin 1 of the 10pin connector

10.2.1 MAIN (RPM / THROTTLE) MAP

Enter a number in the range from 0 to 999 on the main map. A zero entry disables the injector output. An entry of 100 is the equivalent of 1.00 MS (milliseconds) injection.

10.2.2 AMP MAP

A multiplication factor in the range from 0.01 to 9.99 can be used. An entry of 1.00 does no multiplication to the value in the main map. The MAP deflection comes from the AMPIN pin 10 of the 12-pin connector.

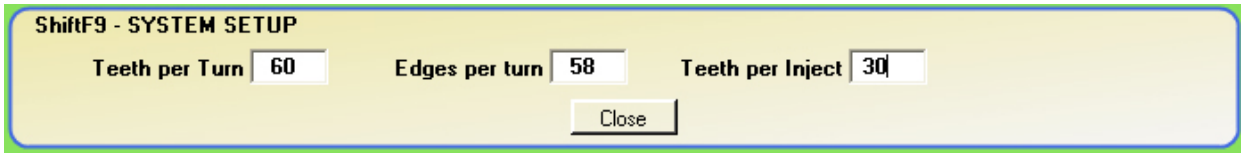
10.2.3 ENGINE TEMPERATURE MAP

The entry in this map is ADDED to the main fuel map entry. Entries range from 0 to 999. 100 counts equate to 1.00 MS.

10.2.4 AIR TEMPERATURE MAP

The entry in this map in the range from 0 to 999 is added to the other map values. An entry of 100 results in 1.00 MS added fuel.

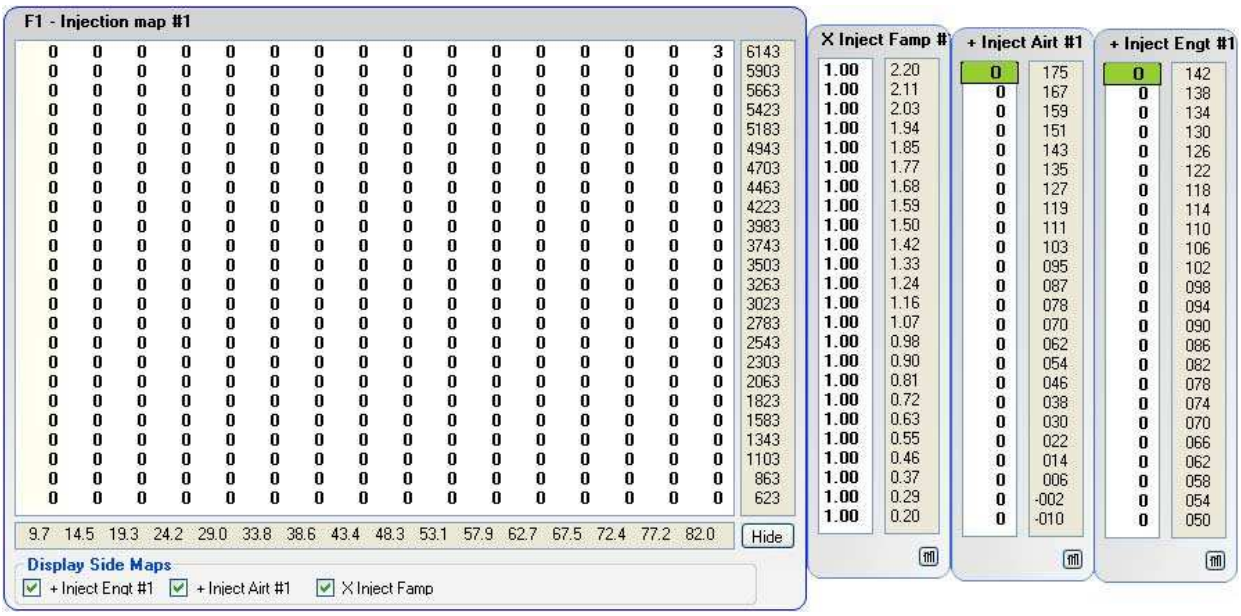
10.2.5 TEETH PER INJECT



This entry defines how many times the injector is pulsed every crankshaft revolution. The above setting is typical for a 4 cylinder engine with a 60-2 crankshaft trigger.
Note: Units with firmware 37 or higher have this feature

10.3 COMPLETE CALCULATION

OPEN TIME = MAIN TABLE
+ ENGINE TEMP MAP
+ AIRT TEMP MAP
X AMP MAP

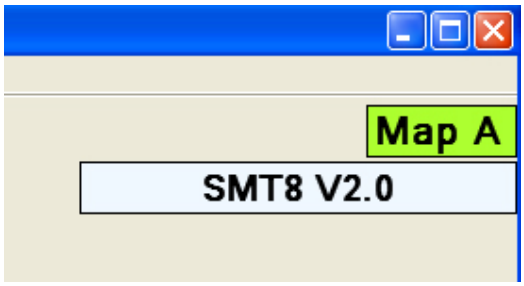


11. MAP SWITCHING

The SMT8L comes with two entirely separate tune maps in memory. We call them map "A" and map "B". The LETRIPP PC software displays the present map in the upper right hand corner or in the STATUS display. Two maps are used for:

- Performance versus Economy
- Tested versus un-tested
- Normal versus high altitude
- Good fuel versus bad fuel
- Weather

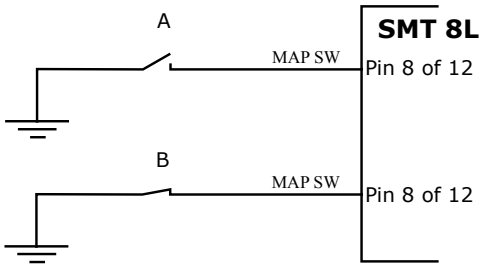
NOTE: Please make sure that you have a valid tune map in map "B" before you flip the switch.



The two tune maps can be invoked by:

11.1 MECHANICAL SWITCH

There is an option to connect (8-12) an external mechanical switch to the SMT8L to enable it to do map switching. Without this mechanical external switch, the unit will default on power up to Map A (open pin). Should the mechanical switch be installed, the unit will power up and run on the map selected. The transition between maps switching is seamless and can be performed while the vehicle is in operation, provided both maps are loaded with valid entries.

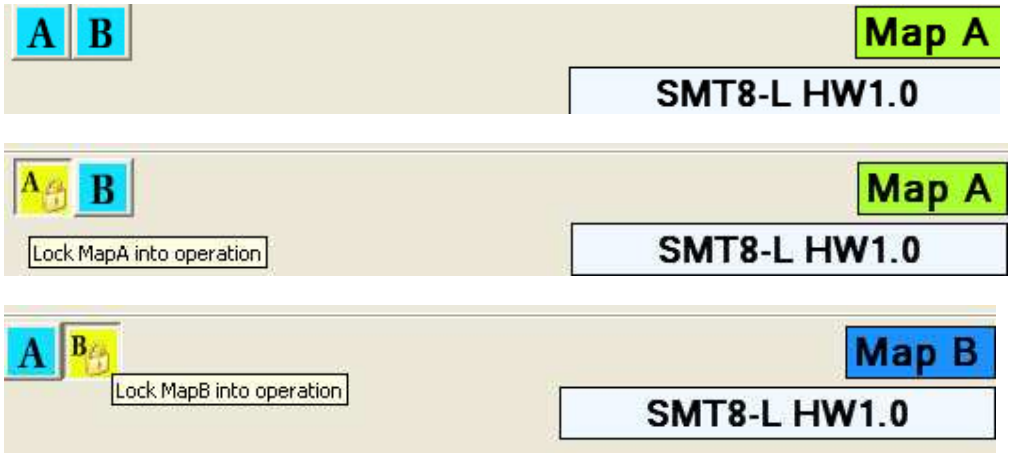


MAP (A,B) Switch Wiring.

FIGURE 3. MAP (A, B) SWITCH WIRING

11.2 SOFTWARE SWITCH

The tuning software can also change the Selected Map, regardless of what the external mechanical switch is presently set to. However, as soon as the unit is reset or is powered up, the SMT8L will revert back to the external mechanical switch setting. By changing the software map switch, the unit will switch maps, even while the vehicle is in use. The PC FREEZES the selected map and disables any other map switching.



12. FREQUENCY/PWM MODIFICATION

The SMT8L has a separate FREQUENCY/PWM modification channel for the purpose of tuning a digital signal. These signals are used in airflow meters and solenoid drives. The SMT8L can tune the ON and OFF periods of the signal simultaneously in the frequency mode, or just the ON period length in the PWM mode.

FREQUENCY MODIFICATION:
The ON and OFF periods are equally tuned, thus the frequency changes, but the PWM is retained.
PWM MODIFICATION:
The ON period is tuned opposite to the OFF period, thus the PWM changes, but the frequency is retained.

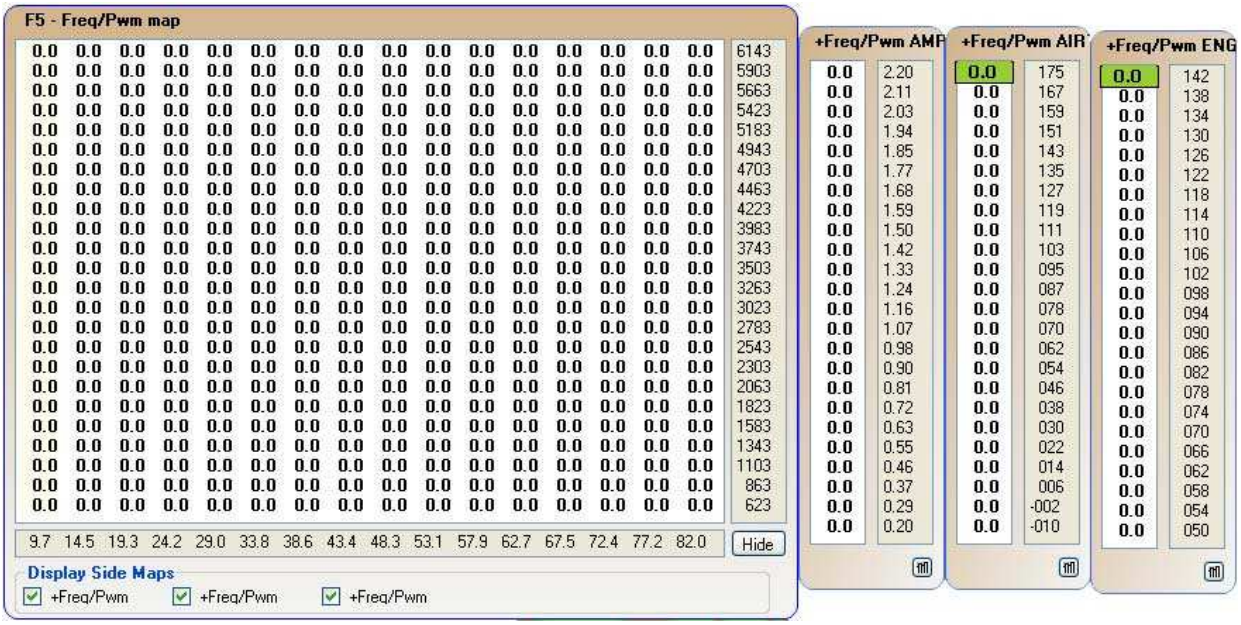
12.1 ASSOCIATED PINS

FREQUENCY INPUT	Pin2 of 12	FREQIN
FREQUENCY OUTPUT	Pin2 of 10	FREQOUT

12.2 COMPLETE CALCULATION

FREQOUT = FREQIN
+-Freq AMP
+-Freq ENGT
+-Freq AIRT

The output is limited to the High/Low Frequency parameter. Entry is in PERCENT. The PWM modification is the same as above, but the limit parameters do NOT apply. Positive and negative map entries are allowed.



13. AFR (LAMBDA) MODIFICATIONS

The purpose of the AFR (Lambda) modification channel is to change the AFR reading the ECU receives from an exhaust sensor. This in turn affects the ECU fuel loop. Thus AFR tuning becomes a powerful tool for fuel.

13.1 ASSOCIATED PINS

AFRIN	Pin 12 of 12
AFROUT	Pin 9 of 10
WBOUT	Pin 3 of 10

13.2 NARROW BAND

The narrow band sensor has an output signal from 0 (lean) to 1Volt (Rich). This signal can be interpreted by the SMT8L and it is available for display in AFR or LAMBDA. The signal from the sensor is routed to the AFRIN pin and exits the unit by the AFROUT pin. The table entry is in AFR or LAMBDA, depending on the 'Units' choice (Tools).

The same modification could be achieved via the ANALOG #1/2 maps in volts, but the signal remains in volts.
The narrow band modification is very accurate because the sensor VOLTAGE is known.

13.3 WIDE BAND

This feature allows the 'TUNING' of a BOSCH LSU4 sensor. The mode is enabled in the SYSTEM DEFINITION screen. Because of the special LSU4 sensor controller and signals, the AFR/LAMBDA cannot be interpreted by the SMT8L, but the signal can be modified none the less.

WIDE BAND CONNECTIONS:

Connect AFRIN (12/12) to WBOUT (3/10) to LSU4 pin 6 (RED, IP)

The wide band modification is not very accurate, because the sensor does not operate on a voltage but on a current principle. The expected error could be 0.1AFR on a modification of 0.5AFR. In other words: you enter 0.5AFR, but the SMT8L modifies 0.4AFR!

13.4 MAIN MAP

The entry is in AFR/Lambda values with a sign. Positive entries make the engine LEAN!

13.5 AMP SIDE MAP

The entries are in signed AFR/Lambda. Positive entries make the engine LEAN! The map is optional.

13.6 ENGINE TEMPERATURE SIDE MAP

The same as above!

13.7 AIR TEMPERATURE SIDE MAP

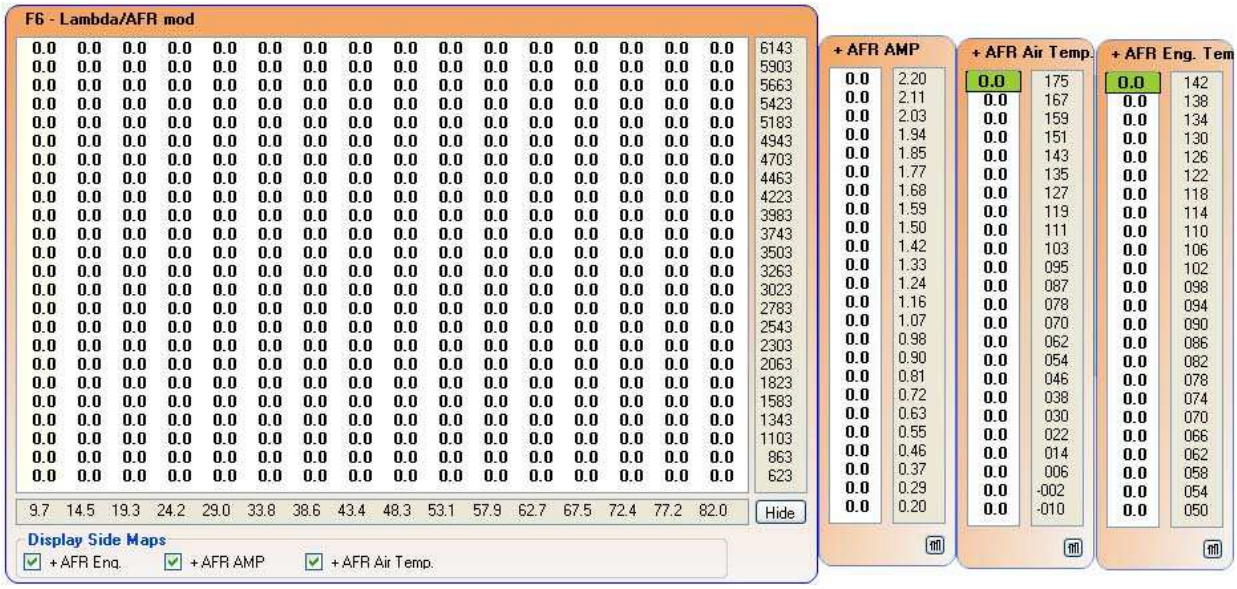
The same as above!

13.8 TOTAL CALCULATION

Total AFR modification= Main map entry
+- AFR_AMP
+- AFR_ENGT
+- AFR_AIRT

13.9 DUAL AFR MODIFICATION

Analog #3 can be used as a second AFR channel which is mapped at the same time as the first AFR channel. Dual AFR Mod must be enabled and this mode only works with narrow band lambda signals (0 – 1 volt)



14. BOOST CONTROL

The SMT8L has a boost control feature, which can be used to IMPLEMENT a boost control loop after adding a turbo.

This does NOT MODIFY an existing boost control loop, but constructs a new one. The manifold pressure is measured via the AMPIN (pin 10 of 12) and compared to a target map. Depending on the difference to the target boost pressure the output PWM to the bleeder solenoid is modified so that the waste gate is closed/opened to achieve the target pressure.

The BOOST CONTROL shares the output with the FREQUENCY circuit. Thus both can't be operated together.

14.1 PURPOSE

It is often desirable to add a turbo to an engine without DE-COMPRESSING the engine. In this application precise boost control is required at lower RPM to avoid knocking, but higher boost pressures can be used at high RPM.

The boost control is achieved via a "BLEEDER" valve, which controls the effective canister pressure, and thus operates the waste gate. The signal to the bleeder valve is PWM.

14.2 ASSOCIATED PINS

AMP input	AMPIN	pin 10 of 12
Solenoid drive	FREQOUT	pin 2 of 10

14.3 BOOST TARGET MAP

Entry is in pressure (bar/lbs). For each RPM point a different boost target can be specified.

14.4 BOOST AIR TEMPERATURE

The entry is in percent (of PWM). The value is added/subtracted from the PWM base.

14.5 BOOST LOW PWM

This is the PWM BASE duty cycle in percent for LOW TPS settings.

14.6 BOOST HIGH PWM

This is the PWM BASE duty cycle in percent for HIGH TPS settings.

14.7 BOOST GAIN (PARAMETER)

This is a multiplier (0.01 to 9.99) by which the target to manifold difference is multiplied with before adding the result to the BASE PWM. If the actual manifold pressure differs too much from the target then the gain is too low. If the loop 'oscillates' then the gain is too high. The gain depends on the bleeder valve construction, the size of the waste gate canister, and the piping used. Enter a zero to disable the loop.

14.8 WASTE GATE CANISTER

A waste gate canister with a pressure of less or equal to the LOWEST boost pressure must be used. Normally 0.2-0.3 bars (3.5lb) are sufficient.

15. KEYWORDS

15.1 ANALOG INPUT/OUTPUTS

The SMT8L has three circuits. Circuit #1 and #2 can be fully mapped. Circuit #3 is for protection and for ETC modification, which require DUAL circuits.

15.2 AMP

Absolute Manifold Pressure. The same thing as a MAP! We like this term because it can't be confused with a tuning "map".

15.3 BALANCED INPUT

Refers to a magnetic pickup (CRANK/CAM position) where the pickup coil is isolated from ground. If a balanced input is tested with a scope, then both wires have an opposing signal on it. The SMT8L has a NON-BALANCED input and one side of the sensor (magnetic) must be grounded.

15.4 CHIPPING

Traditionally this applies to changing the "chip" of the ECU to provide better performance. When ECU's started to control the engine it meant changing an EEPROM. The term now also applies to adding a SMT8L to the car, without changing any chips or EEPROMS. The SMT8L has the advantage over chipping because of the online tune and the retune capability.

15.5 CAM SIGNALS

The SMT8L can't operate on them, but the much larger SMT8 can!

15.6 CONTROL LOOP

This refers to control mechanism, which changes an output until an input comparison with a target is satisfied.

15.7 DEFLECTION or THROTTLE input

It is a tee-in signal in the range from 0 –5Volts. Normally a low voltage refers to a closed throttle.

15.8 DEFAULT MAP

The unit has a built in default map, which can be invoked from the LETRIPP PC software. The map consists of ZEROS and it does not modify anything!

15.9 ECU

The computer "box", which is controlling the engine's operation

15.10 ETC

Electronic Throttle Control, or 'Fly by Wire'. The throttle flap is operated by a DC-MOTOR and the position of the throttle blade is reported to the ECU via two opposing analog signals. The ECU 'decides' on a throttle opening, and drives the motor until the feedback signal is to its liking.

15.11 EXTRA INJECTION

The SMT8L can drive ONE 13 Ohm injector directly. The injection can be fully mapped. The injector is placed in the manifold, above the throttle.

15.12 FREQUENCY

The SMT8L has a frequency input and output. The pin is shared with the PWM operation. The frequency signal is normally a 'SQUARE WAVE' generated by an airflow meter.

15.13 FEED-THRU

A method where a wire is cut and routed through the SMT8L for the purpose of modifying the electrical signal.

15.14 INJECTOR DRIVE

The SMT8L switches to ground. The current rating is sufficient for ONE 13 ohm injector per output.

15.15 INTERCEPTING

A wire is cut, and the two ends are "routed" through the SMT8L for the purpose of changing the signal.

15.16 LAMBDA, OXYGEN, AFR

A lambda probe, oxygen probe, or AFR sensor all measure the oxygen content in the exhaust pipe. At lambda 1.00 the AFR=14.7 and a narrow band sensor generates a voltage between 0.2 and 0.8 Volts.

15.17 MAPPING

A process by which, a signal is manipulated via the various tuning maps.

15.18 MAX RECORDING

The SMT8L records the maximum readings for: AMP, Engine and Air Temperature, and RPM.

15.19 MAF

Mass Air Flow sensor. It could be a device with a "FLAP" or a solid-state "hot wire" sensor. It basically generates an analog output voltage, which increases with higher airflow. Some devices compensate for air temperature (density).

15.20 MAP

Manifold Absolute Pressure. It is a solid-state device with 3 wires and provides an analog output voltage, which increases as the manifold pressure increases. Since it measures the absolute pressure the output voltage DECREASES at idle. We don't like this term because is also applies to a tuning map.

15.21 MAP SWITCHING

The SMT8L has TWO tuning maps, which can be switched while driving.

15.22 MAP SWITCH INPUT

A switch input when not used defaults to MAP=A.

15.23 MAF/MAP CONVERSION

In older cars the MAF sensor is unreliable, because it is a mechanical device with a 'swing door'. It can be replaced with MAP (AMP) sensor, but the output must be matched to EMULATE the MAF sensor.

15.24 PROTECTION

In the content of this manual the word protection refers to processes by which the engine is protected. In all instances the drive is reduced so that the engine survives. The protection can come in effect after a settable time.

15.25 PWM

Pulse Width Modulation. The information is in the ON to OFF signal ratio.

15.26 PICKUP

It is a sensor, which "picks up" an engine measurement like temperature or crank angle position. The sensor can be a Hall Effect (square wave) or magnetic (sine wave).

15.27 RETARD

The unit works in "Retard only", which indicates that it has a problem with the amount of teeth per turn. Otherwise the RETARD refers to the protection mechanism, which retards the ignition once preset limits are exceeded.

15.28 TEE IN

A wire from the SMT8L is joined to the standard wiring loom. The signal is only read, and no modifications take place.

15.29 WIDE BAND LAMBDA

This is a 5 wire lambda probe (BOSCH LSU-4) with the part number starting with 025800. The SMT8L can't read the probe information, but can modify it. This probe is very popular because it measures the AFR very fast and at very RICH mixtures, which is useful for turbo/supercharger applications.

15.30 WIRELESS

This option is available with the SMT8LW. Is uses secure 2.4GHz transmission and requires an USB/WIRELESS adapter (Part number: WireX). The WireX adapter can be used for all wireless products. Data security is excellent, and is enhanced with the Branding option. The wireless communication works over a distance of 5-20 meters, and on 16 frequencies with manual frequency hopping.

16. PIN OUT BY FUNCTION

16.1 POWER

Ground	6-12
+12V	1-12

16.2 THROTTLE INPUT

TPSIN	5-12

16.3 CRANK INPUT

IGNIN	8-10
(magnetic return	1-10)

16.4 CRANK OUTPUT

IGOUT	7-10

16.5 AMP (MAP) INPUT

AMPIN	10-12

16.6 ENGINE TEMPERATURE

ENGTIN	11-12

16.7 AIR TEMPERATURE

AIRTIN	4-12

16.8 ANALOG #1

AN1IN	7-12
A1OUT	5-10

16.9 ANALOG #2

AN2IN	9-12
A2OUT	10-10

16.10 ANALOG #3

AN3IN	3-12
A3OUT	4-10

16.11 INJECTION DRIVE

IJ1	6-10

16.12 MAP SWITCH

MAPSW	8-12

16.13 AFR/LAMBDA

AFRIN	12-12
AFROUT	9-10
WBOUT	3-10

16.14 FREQUENCY/PWM

FREQIN	2-12
FREQOUT	2-10