SMT8_X

Technical Manual

LetRipp II

dds

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1. INTRODUCTION

Welcome to the Digital Data Systems SMT8_X Technical Manual. The Technical Manual needs to be used in conjunction with the LetRipp II Software User Guide.

The SMT8_X is the result of many years of development in the “Piggy-Back” industry. Its performance is complemented by other SMT8, SMT8_L and SMT8_T products. This product was optimized for 6-8 cylinder lambda (closed loop) modifications, and specifically fuel economy.

2. FEATURES

Here is a brief list of the features:

- 1 map to influence analog signals: ANA MAP
- 1 Map to influence one crank signal IGN MAP
- 1 AFR (Lambda) modification map for TWO narrow probes NAFR
- 1 AFR (Lambda) modification map for TWO wide band probes WAFR
- Calibration of all inputs: Throttle position
  RPM
- USB Communication

2.1 ANALOG MAP

An analog signal is intercepted via the ANIN (pin 9/14) to AOUT (pin 12/14) connections. It is mapped via Throttle/RPM for the purpose of altering fuel at specific engine conditions. The output signal can be limited (high and low). This map is helpful to restrict manifold pressure or modify airflow.

2.2 IGN MAP

One ignition signal (CRANK) can be intercepted and mapped for the purpose of retarding/advancing the ignition. The output signal can be set to maximum advance and retard limits. This map is particular helpful to advance the ignition at cruising and low loads with high octane fuel. For engines with multiple and variable CAM’s a different unit is available.

2.3 WIDE BAND AFR MODIFICATION

Two wide band LSU-4 channels can be tuned simultaneously. A large 16 x 24 map allows for the precise AFR (Lambda) signal modification via the WAFR1 (pin 3/14) and WAFR2 (pin 4/14).

2.4 NARROW BAND AFR MODIFICATION

Two narrow band AFR probes can be tuned simultaneously. A large 16 x 24 map allows for the precise AFR (Lambda) signal modification via the NAF1IN (pin 14/14) and NAF2IN (pin 7/14) to the NAF1OUT (pin 13/14) and NAF2OUT (pin 6/14). The narrow band signal can also be tuned from the wideband map by activating a LINK feature.
As an alternative, these two narrow band channels can be converted to two analogue channels in the system definition. Then the map entries are in volts. This feature allows the AFR modification of other probes than BOSCH.

2.5 CALIBRATION

The Throttle and RPM range can be calibrated and specified. The Calibration is applicable to both tune maps A/B.

2.6 MAP SWITCHING

The unit has a ‘Map switching’ feature. It contains 2 sets of maps, which can be toggled from an optional switch. In the absence of this switch the unit operates from map ‘A’.

2.7 DISPLAY

The SMT8_X has an external display feature, which is set up by the PC. Up to 8 displays can be driven, showing 8 selectable engine measurements. The display itself is an option.

2.8 HELP

Help is available in various forms:

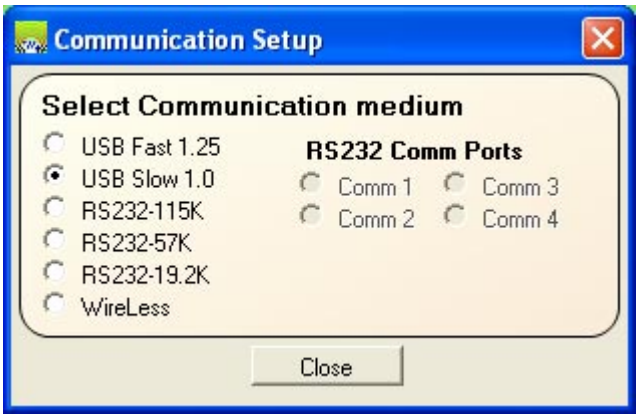
A) Right click on any item and a short explanation is available
B) This TECHNICAL MANUAL
C) The LETRIPP SOFTWARE USER GUIDE
D) Some WINDOWS ITEMS are explained 'ONLINE'

3. GENERAL USE OF THE WINDOWS SOFTWARE

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

3.1.1 USB COMMUNICATION

The SMT8_X uses a USB2.0 communication. The supplied cable should be used or any standard cable with an 'interference prevention ferrite'.



4. CONNECTIONS

The SMT8_X has one connectors and a USB communications port.

4.1 PIN-OUT TABLE

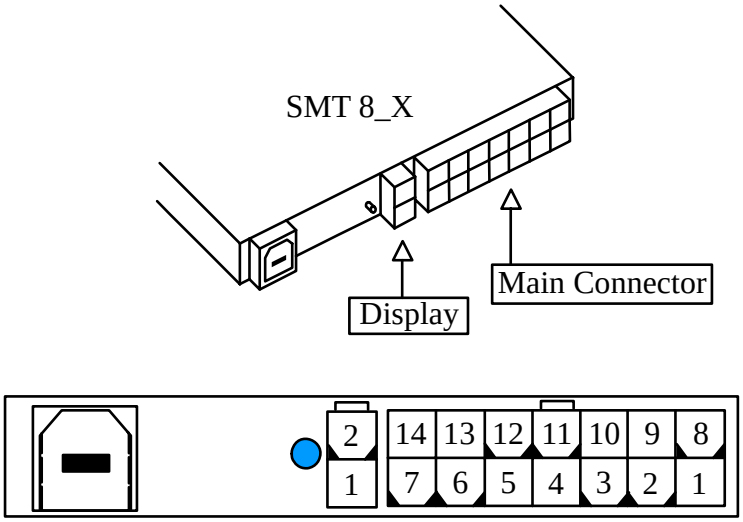


FIGURE 1. SMT8X PIN OUT

SMT8X Main Connector (14 Pin Connector)

Pin	Signal	Description
1	GROUND	CHASSIS
2	IGOUT	IGNITION OUTPUT
3	WAFR1	Wide band #1 connection
4	WAFR2	Wide band #2 connection
5	MAPSW	Map switch input
6	NAF2OUT	Narrow band #2 output
7	NAF2IN	Narrow band #2 input
8	+13V	Switched battery supply
9	ANIN	Analogue input
10	+IGIN	Ignition input
11	TPSIN	Throttle input
12	AOUT	Analog output
13	NAF1OUT	Narrow band #1 output
14	NAF1IN	Narrow band #1 input

4.2 SPECIFICATIONS

Power consumption:	~ 100mA (0,1A)
Power supply voltage:	8 – 36 V
Reverse Polarity Protection:	Yes
Momentary power supply:	up to 40 V, 5 ms
Signal input impedance:	>10 K Ohm
Ambient temperature:	Up to 60 deg C (Passenger compartment)
Ignition signal output:	bipolar, +-6Volt in to 100K Ohm
Analog output drive:	0.005 Amp (5 mA), 0 - 5volts
Analog input range:	0 - 5 Volts
Narrow band input range:	0 – 5 Volts
Wide band input range:	0 – 5 Volts

5. RPM TRIGGER INPUT

The SMT8_X derives the RPM reading from the CRANK signal input (+IGIN, pin10/14).

The SMT8_X has one trigger input and output located on the 14 pin connector.

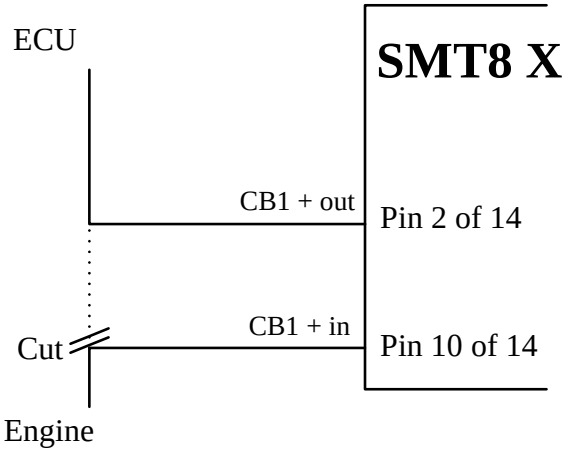
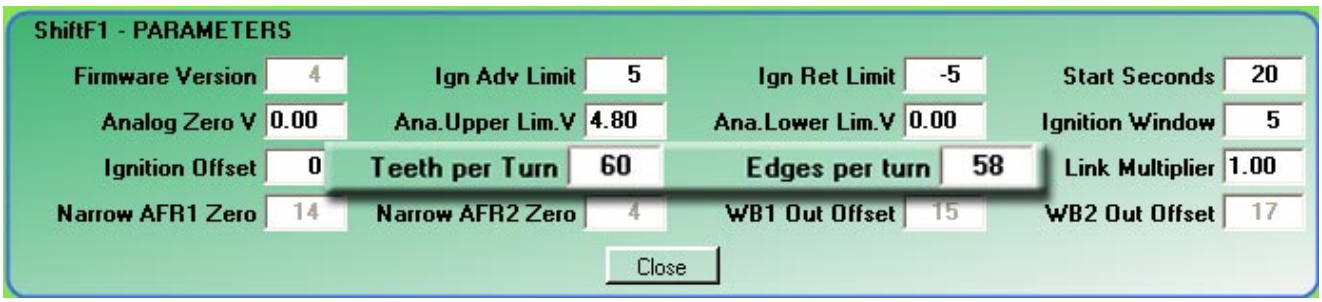


FIGURE 2. BALANCE CRANK SIGNAL WIRING

Description	Input	Pin	Output	Pin
CRANK SIGNAL	CRANK	10	CROUT	2

The type of trigger signal used is set up via the parameter screen.

TEETH PER TURN (INCLUDING MISSING) (eg:60)
EDGES PER TURN (eg:58)



6. ANALOG MODIFICATION

The SMT8_X can modify one analog signal, namely ANIN and output the mapped signal on AOUT.

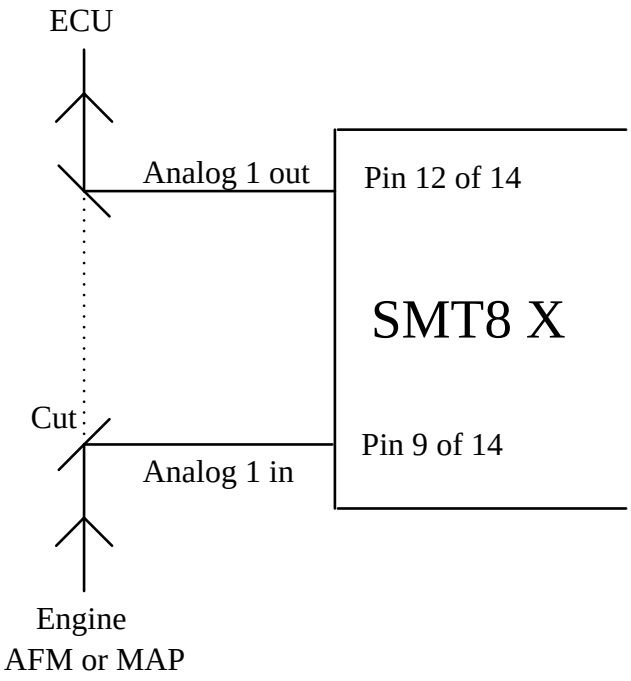
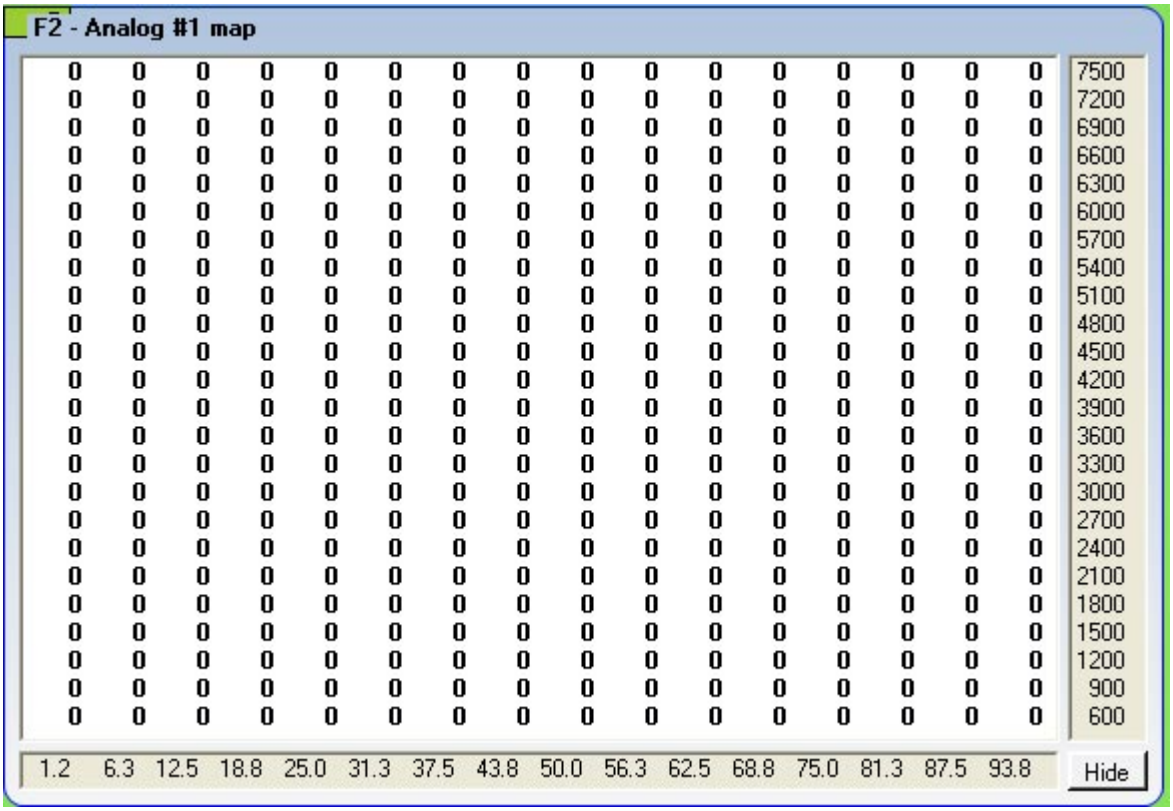


FIGURE 3. ANALOG 1 WIRING



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 SMT8_X 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 input	Pin 9 of the 14-pin connector
ANALOG output	Pin 12 of the 14-pin connector

6.3 REQUIREMENTS

1) ANALOG #1 lower limit (Volts):
   This voltage setting prohibits the analog output to go BELOW the limit.
2) ANALOG #1 high limit (Volts):
   This voltage setting prohibits the analog output to go ABOVE the limit

6.4 MAIN (RPM/THROTTLE) MAP

For the RPM to work: Connect CRANK (see: RPM trigger).

For the Throttle (deflection) to work: Connect pin 11 of the 14-pin connector to the analog deflection signal (normally the throttle position sensor).

All map entries are in counts (without a decimal point) 100 counts entry equals 1.00 Volts.

6.5 COMPLETE CALCULATION

AOUT = ANIN +- ANA1 MAP

The AOUT signal is limited to the low and high limits.

6.6 PARAMETERS

ANALOG 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.

ANALOG LOWER LIMIT:

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

7. IGN (IGNITION) MAP

7.1 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.

7.2 ASSOCIATED PINS (on 14 pin connector)

	Input Pin	Output Pin
CRANK :	**10**	**2**

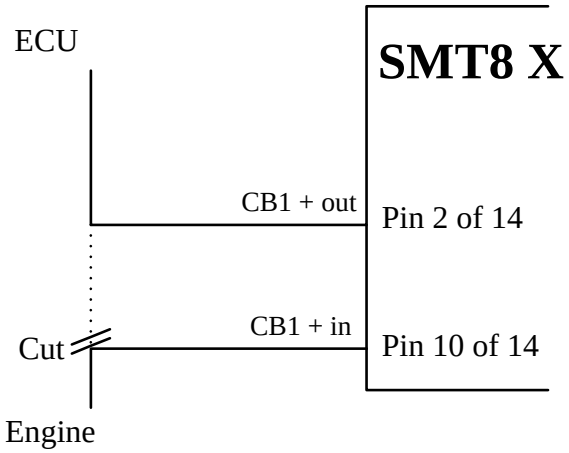


FIGURE 4. CRANK WIRING

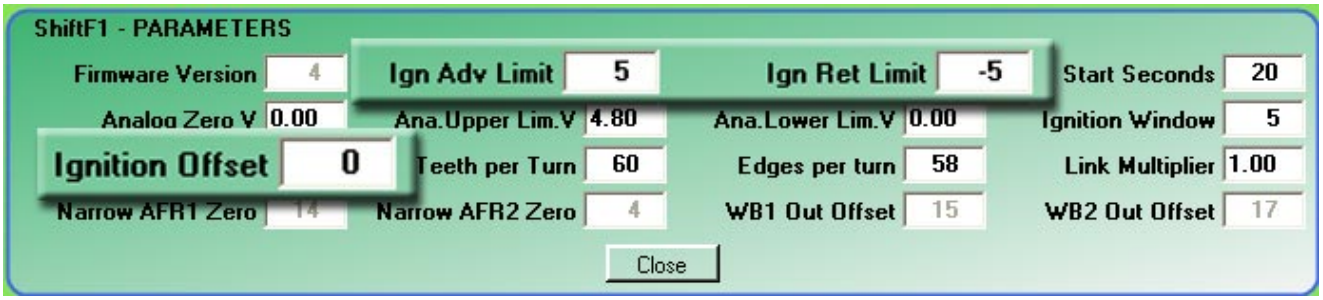
7.3 PARAMETERS

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.

START SECONDS
This is the time in seconds after starting the SMT8X waits before it will modify the ignition signal.

IGNITION WINDOW
This allows the SMT8_X to be less sensitive to the incoming ignition/crank signal. A value of –1 will disable the SMT8_X's error checking of the incoming signal. Typical values of 1 to 30 are normal.



7.4 MAPPING

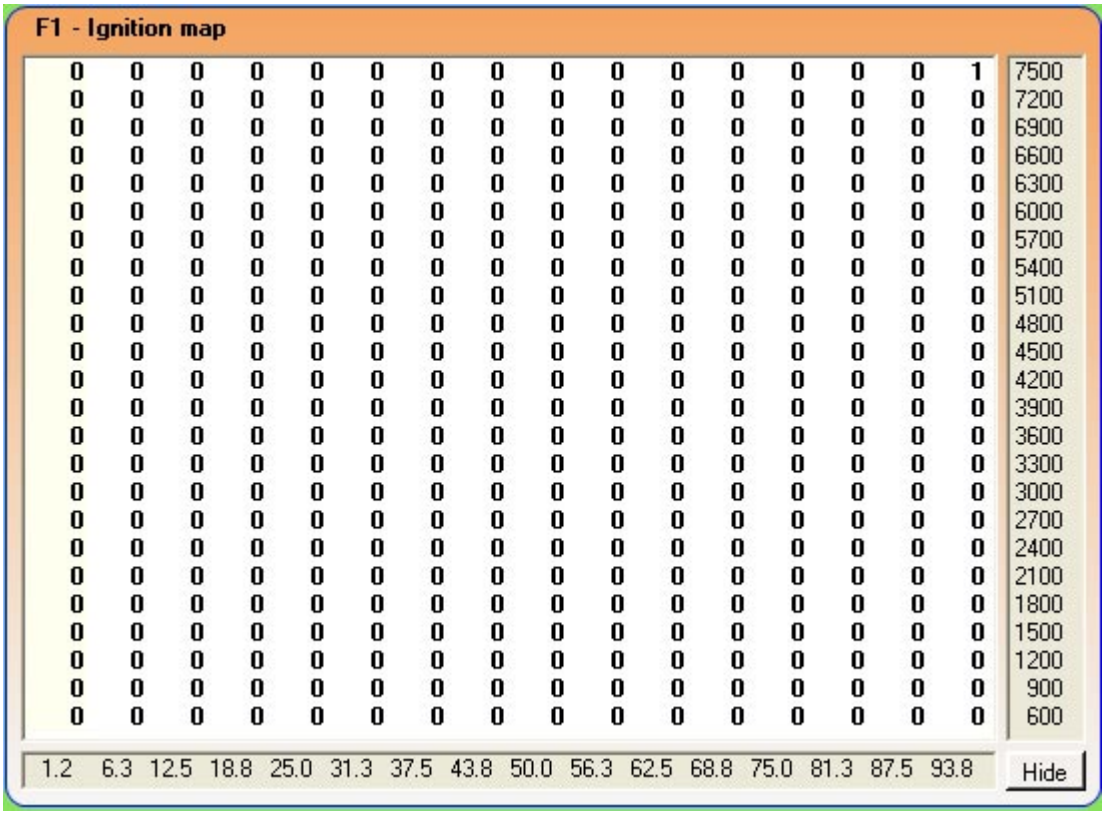
The Ignition signal can be mapped within the specified (above) limits by:

7.4.1 MAIN (RPM / THROTTLE) MAP

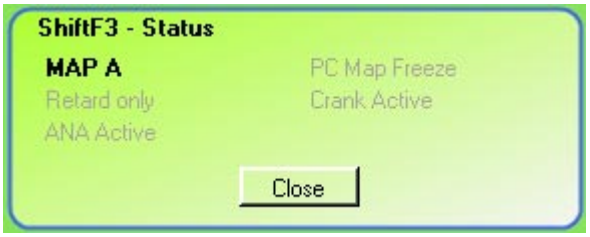
For the RPM to work: Connect CRANK signal

For the Throttle to work: Connect pin 11 of the 14-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, will do no modification to the signal!



7.4.2 IGNITION SETUP



CRANK ACTIVE
This indicates that the SMT8_X sees an input on the Crank, pin 10/14
RETARD ONLY
This indicates that the SMT8_X 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 SMT8_X is unable to work with this crank signal.

If the engine runs with it, then you have to be content to have the ability to retard the timing.

8. MAP SWITCHING

The SMT8_X comes with two entirely separate tune maps in memory. We call them map “A” and map “B”. The LETRIPP 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.

8.1 MECHANICAL SWITCH

There is an option to connect (pin 5/14) an external mechanical switch to the SMT8X 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.

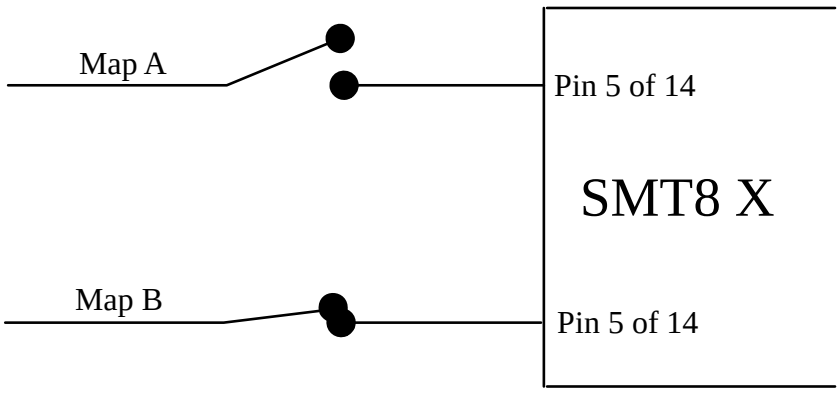


FIGURE 5. WIRING DIAGRAM FOR MECHANICAL SWITCH

9. NARROW AFR (LAMBDA) MODIFICATIONS

The SMT8_X has 2 narrow band AFR channels; both are modified with the same map. The purpose of the AFR (Lambda) modification channels is to change the AFR reading the ECU receives from an BOSCH exhaust sensor. This in turn affects the ECU fuel loop. Thus AFR tuning becomes a powerful tool for fuel modifications.

9.1 ASSOCIATED PINS

NAF1IN	Pin 14 of 14
NAF1OUT	Pin 13 of 14
NAF2IN	Pin 7 of 14
NAF2OUT	Pin 6 of 14

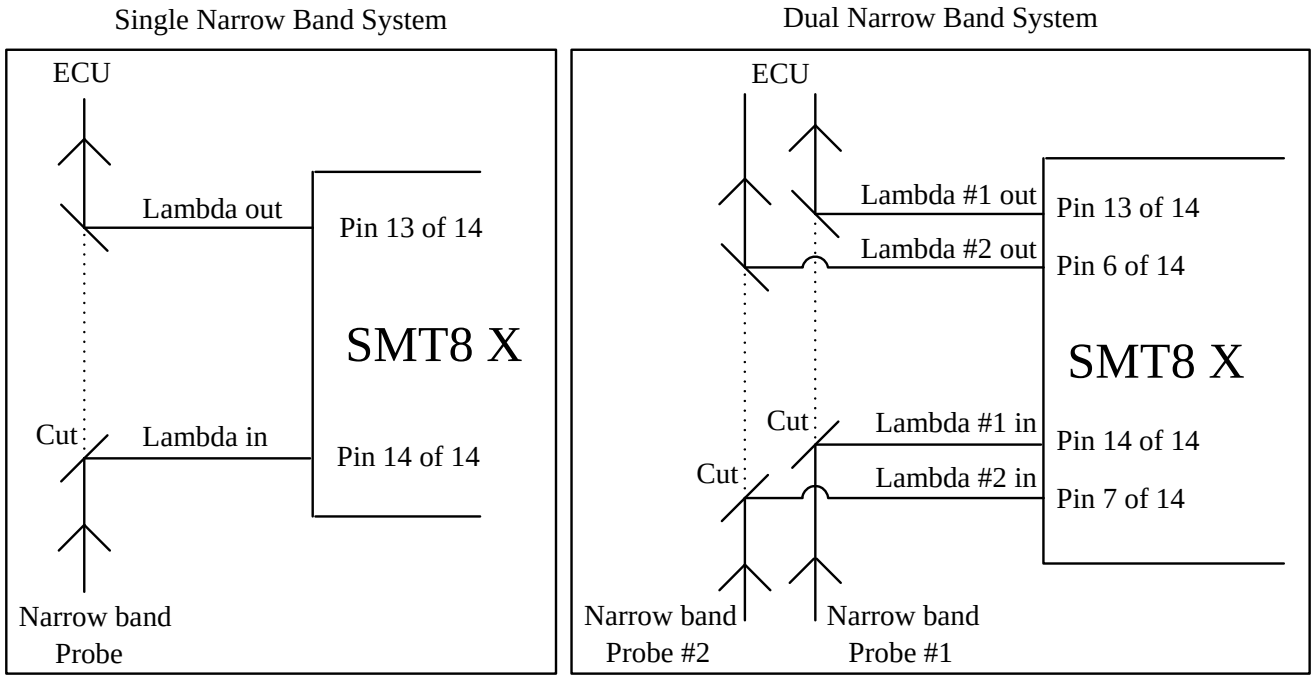


FIGURE 6. NARROW BAND LAMBDA WIRING

9.2 ANALOGUE AFR MODIFICATIONS

The two channels can be converted to analogue channels by ticking the SYSTEM DEFINITION boxes. This allows a voltage from 0-5Volts to be modified, instead of the traditional 0-1Volt signal. In the analog mode the map entries are in volts. The connections stay the same. Of course, a 0-1Volt BOSCH signal can also be modified in this mode.

10. WIDE BAND AFR MODIFICATIONS

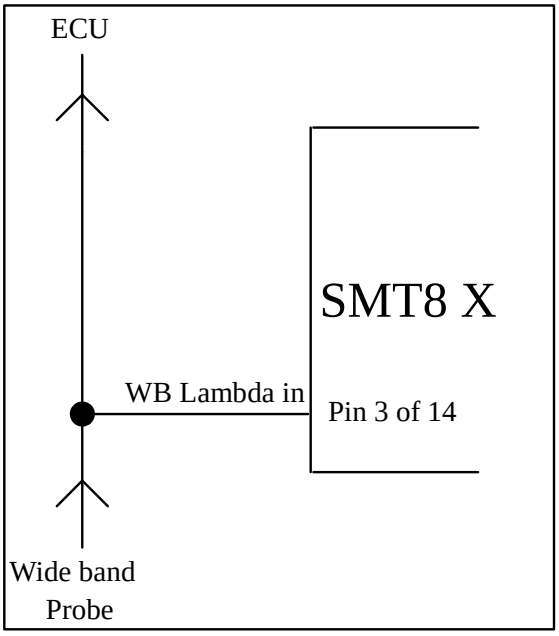
This feature allows the 'TUNING' of two BOSCH LSU4 sensors. The tuning is independent of the two narrow band channels. Both channels are mapped by the same modification.

10.1 ASSOCIATED PINS

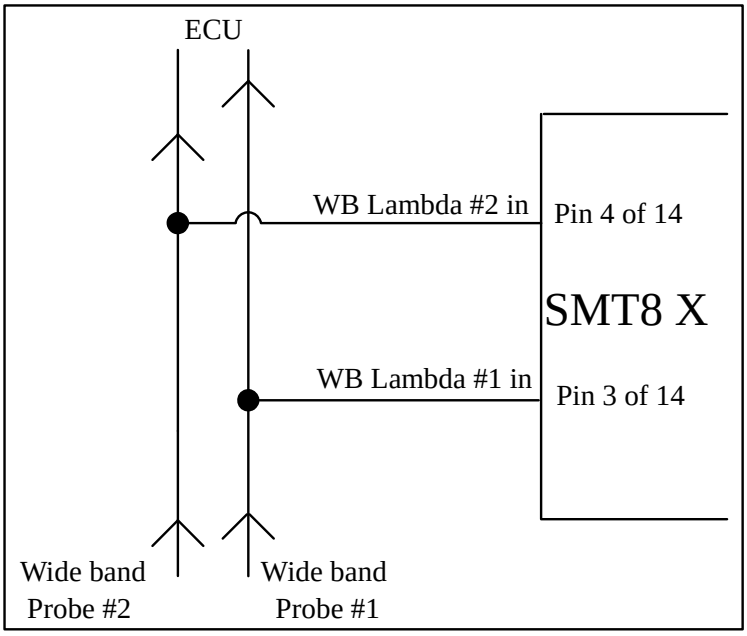
WAFR1 Pin 3 of 14
WAFR2 Pin 4 of 14

10.2 WIDE BAND CONNECTIONS

Single Wide Band System



Dual Wide Band System



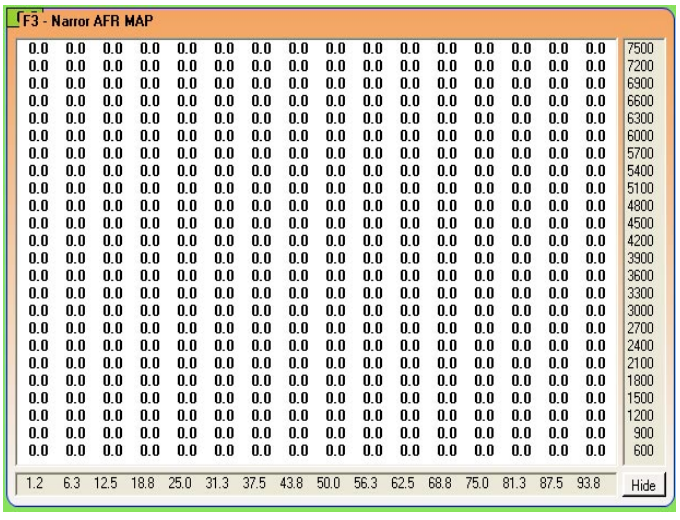
WAFR1 IP (Red) LSU-4 Sensor #1
WAFR2 IP (Red) LSU-4 Sensor #2

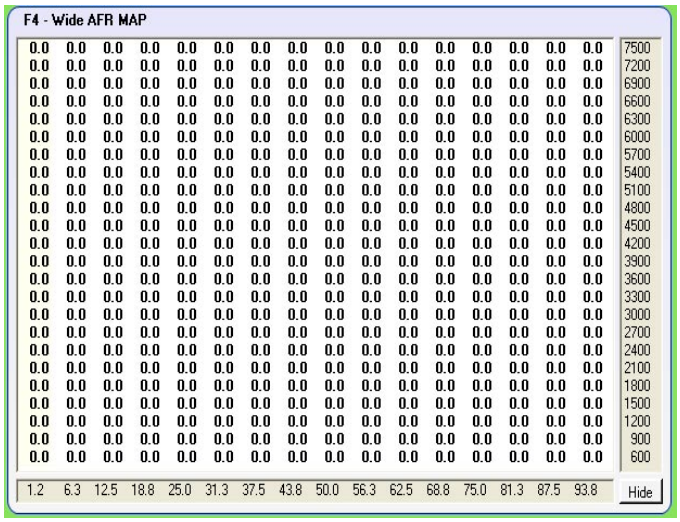
10.3 WIDE BAND SENSOR

The LSU-4 sensor is in essence a narrow band sensor, which is 'tuned' by a small current to 14.7AFR. The amount and direction of the tuning current determines the actual AFR in the exhaust gas. This in turn means that at 14.7 exhaust AFR the tuning current is zero, and the probe (Red wire) is 0.45V above the IP terminal.

Therefore the voltages on the sensor are meaningless, but the current through the calibration resistor is a measure of the AFR.

10.4 MAPS





The entered Map modification values are not precise. The reason for this is that current/AFR ratio is un-linear. However, the error is relative small when compared to the AFR range.

10.5 AFR TUNING

You can tune the NARROW and the WIDE BAND probes separately by entering numbers in to the respective maps.
Positive numbers in the narrow band map make the mixture APPEAR richer, thus the ECU will reduce the fuel.
Positive numbers in the wide band map will make the mixture APPEAR leaner, thus the ECU will add fuel to restore the closed loop target.

10.6 TUNING BOTH SET OF SENSORS FROM ONE MAP

The Wide band sensors are before the CAT. The entries in this map can be used to tune the narrow band probes.

Requirements:

Set the SYSTEM DEFINITION:	Link enabled
Set the SYSTEM DEFINITION:	Inverse link (as required)
Set the PARAMETER:	Link Multiplier to a value greater then ZERO

Tuning operation:
Display the narrow AFR value without and tuning.
Affect the wide AFR by a small amount and observe the changes in the narrow display. Reverse the direction if indicated, and change the multiplier up or down to bring the narrow band display in to range again.
The narrow band display must stay reasonable at 14.7 AFR with light throttle.

11. KEYWORDS

11.1 ECU

The computer “box”, which is controlling the engine’s operation

11.2 MAPPING

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

11.3 INTERCEPTING

A wire is cut, and the two ends are “routed” through the SMT8_X for the purpose of changing the signal.

11.4 TEE IN

A wire from the SMT8_X is joined to the standard wiring loom. The signal is only read, and no modifications take place.

11.5 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.

11.6 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 SMT8_X to the car, without changing any chips or EEPROMS. The SMT8_X has the advantage over chipping because of the online tune and the retune capability.

11.7 MAF

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

11.8 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.

11.9 AMP

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

11.10 MAP SWITCHING

All of our units have two tuning maps, which can be switched while driving. There are THREE possible map-switching scenarios.

11.11 WIDE BAND LAMBDA

This is a 5 wire lambda probe (BOSCH LSU-4) with the part number starting with 025800. The SMT8_X 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.

11.12 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).

11.13 FEED-THRU

A method where a wire is cut and routed through the SMT8_X for the purpose of modifying the electrical signal.

11.14 BALANCED INPUT

Refers to a magnetic pickup (CRANK) 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.

11.15 MAP SWITCH INPUT

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

11.16 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.

11.17 ETC

Electronic throttle control. This is a throttle body that is controlled by the ecu electronically and not by a conventional cable. The ETC has a ‘feedback’ signal, which can be used as a TPS input.

12. PIN OUT BY FUNCTION

12.1 POWER

Ground	1-14
+13V	8-14

12.2 THROTTLE INPUT

TPSIN	11-14

12.3 CRANK INPUT

+IGIN	10-14

12.4 CRANK OUTPUT

IGOUT	2-14

12.5 ANALOG

ANIN	9-14
AOUT	12-14

12.6 MAP SWITCH

MAPSW	5-14

12.7 NARROW AFR

NAF1IN	14-14
NAF2IN	7-14
NAF1OUT	13-14
NAF2OUT	6-14

12.8 WIDE AFR

WAFR1	3-14
WAFR2	4-14