FUEL INJECTION - ADVANCED CONTROLS

Autronic

SM4 Manual

V3.0

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Installation and Wiring Guide

Introduction

Congratulations on your decision to install an Autronic engine management system to your vehicle. Autronic systems have been successfully installed on many vehicles such as rally cars, off road vehicles, street cars, powerboats, offshore powerboats, and in other forms of racing.

Autronic is designed to enable users to precisely control ignition timing and fuel-air mixture. Precise ignition and mixture control also leads to excellent drivability and fuel economy - something that is often lacking in high-performance carburettor engines.
This *Installation and Wiring Guide* Will guide you trough installation of you Autronic SM4 onto you vehicle. This section accompanies the *Setup Guide and Tuning Guide* that you or your tuner will need to refer to before completing you installation and configuration.

Installation Guide

The installation guide will guide you through a typical installation. For details on the sensors and devices mentioned here see section *Sensor and device pin outs.*

Note:

Installation of engine management system is a complex exercise to be undertaken only after careful planning and research into the application for which the product is to be used. Damage to engine components is a distinct possibility if care is not taken during installation and setup of the Autronic SM4 system. If you are unsure about how to wire any components of your engine, please consult an experienced installer for advice.

Flying Lead Loom Installation on engine

The following list outlines the procedure for installing the SM4 ECU with the flying lead harness:

1. Unpack your ECU and identify the following components, some components may vary if ordered a specific kit.
    a. SM4 ECU
    b. Main Flying Lead Harness
    c. Coolant Temperature Sensor, Bosch type 0 280 130 023 or similar
    d. Air Temperature Sensor
    e. SM4 Instruction Manual
    f. Programming Cable
    g. Programming Software

h. Main Relay for Injectors and Fuel Pump, Bosch type 0 332 014 150 or similar
i. Throttle Position Sensor (optional)
j. Idle Speed Motor (optional)
k. Lambda Sensor for CLC (optional)

2. **Mounting Devices:**
   a. Locate a suitable location for the ECU, Ensure that the loom will reach the necessary part of the engine and mount the ECU.
   b. Locate a suitable place for the main relay.

3. Run the loom into the engine bay, but leave the ECU connector disconnected.

4. **Inputs:**
   a. Connect the throttle position sensor (TPS) See Manual *Throttle Position Sensor* for detailed wiring.
   b. Connect the Autronic Air Temperature Sensor, other sensor may be used see software setup A*nalog inputs.*
   c. Connect the Coolant Sensor, other type may be used see software setup A*nalog inputs.*
   d. Run a good quality hose to the internal MAP sensor on the ECU (if used), Make sure the hose not will come off under pressure (on turbocharged engines). Secure the hose with cable clamps or nylon ties. Select a vacuum connection that has no other accessories which will share the vacuum like boost valves, dump valves. If there is no empty connector it can share with fuel regulator or boost gauge. Make sure the point of connection will not cause fuel to get into the hose and run down into the map sensor.
   e. Connect O2 sensor if needed,
   f. Connect the crank angle sensor; The crank sensor can be a hall sensor type or a inductive type. See in this manual "crank and cam sensor set up" for detailed wiring and setup. Make sure only shielded wires are used if using inductive sensor. The crank sensor signal can come from a distributor or the camshaft, and still give crank position.
   g. Connect the cam sync sensor; The cam sync sensor can be a hall sensor type or a inductive type. See in this manual "crank and cam sensor set up" for detailed wiring and setup. Make sure only shielded wires are used if using inductive sensor. If using distributor, a *No1 spark plug pickup* can be used instead of the cam sensor to give the synchronisation pulse to the ECU.
   h. Connect vehicle speed sensor and other inputs if used, like anti-lag, input and more.

5. **Outputs:**

   When running the wiring for outputs, run any power and ground wiring to the locations where they will be connected, but do not connect power or ground the connections yet.

   a. Run the injector wires to the fuel injectors; Remember to wire them in ignition order, injector 1 to cylinder 1, injector 2 to next cylinder in firing order. See wiring diagram fore more information.
   b. Connect your fuel pump to the big brown fuel pump wire.

c. Run the loom from all ignition outputs to the ignition module/modules or CDI. The ignition modules are often called ignition amplifiers. They can be of a dumb type which uses dwell control from SM4 or smart types which use a pulse output, like the CDI. The output sequence is different from SMC/SM2 when used on multi coil setup. The SM4 always start with output number 1 and then output 2. Always wire them in firing order. See wiring diagram fore more information.

d. Connect idle speed engine if used; See wiring at end of manual.

e. Connect any other auxiliary outputs like thermo fans, error light, shift light, anti-lag , boost control valves and more.

6. **Power and Ground:**

    a. Connect all ground connections to a central location, but do not ground the CDI (if used) to same location as the ECU.

    b. Connect the big red power cable direct to the battery through a 30 amp fuse, make sure the wire has the fuse near the battery or is well protected from damage to its insulation. Short circuits on this wire can lead to fires.

7. **Ensure the ignition modules or CDI and fuel injectors are disconnected at this stage.**

8. Connect the ECU to the loom and connect a laptop computer to the serial DB9 connector (RS232). If using a USB to serial adapter make sure the comport are set up correctly in the Autronic software. Proceed to the *Software Basic Setup Guide.*

WARNING:
To avoid damage to ignition components never connect the ignition modules or CDI to the ECU until the ECU is fully configured. Never connect fuel injectors until the ECU is configured, otherwise the engine may flood with fuel.

Sensor and Device Pin Outs

Manifold Absolute Pressure Sensor

Autronic use a built in high quality map sensor with a maximum rating of 3.4 bar gauge or 4.4 bar Absolute pressure.

The MAP sensor is used to convert the manifold pressure to a electrical signal for the ECU to use. The ECU displays the value in absolute pressure, thus its calibration is not affected by change in barometric pressure. The vacuum/pressure, is proportional to the load under which the engine is operating, and the ECU uses this as a load reference. This is only the case when using Baro&Map, and not setup as Baro&TPS. See manual under *Software basic setup.*

a. Secure the hose with cable clamps or nylon ties. Use a vacuum connector where there are no other accessories which will use up the vacuum like boost valves, dump valves. If there is no empty connector it can share with the fuel regulator or boost gauge. Make sure the point of connection will not cause fuel to get into the hose and run down into the map sensor.

The SM4 can use a separate MAP sensor connected to analog 2-3 input (pin 38).

> **Note**
> If setup as BARO&TPS, the internal map sensor should be <u>unconnected</u>.
> This type of mapping is only for naturally aspirated engines and not recommended in most cases. Use Baro&Map and set fuel table axis to TPS.

Coolant Temperature Sensor

The coolant temperature is used by the Autronic to determine warm up corrections and adjust fuel mixtures. The coolant temperature sensor is a Bosch standard type of sensor and some engines may already have provision for this type of sensor.

The coolant temperature sensor is designed to screw into a threaded hole and protrude into the engine coolant stream. For air-cooled engines, the sensor can be embedded directly into the engine block or used to sense oil temperature.

Locate a suitable position on the engine which will allow the hole and thread to be machined, and which gives access to the coolant stream. The sensor should be mounted after the engine and before the thermostat in the coolant circuit. Since most engines have existing temperature sensor holes, it is often possible to mount the Bosch sensor in one of these holes.

A thread adaptor is sometimes necessary. In some engines only one temperature sensor hole exists and is used for the dashboard gauge sender. It is usually possible to install a tee-piece to allow both the dashboard sender and the Bosch sensor to share access to the same threaded hole.

If it is necessary to drain the coolant from the vehicle to fit the temperature sensor then the factory manual for the engine should be consulted for the correct procedure to restore the coolant and purge the cooling system of air.

Air cooled engines this should be mounted so that it is reading the engine oil temperature. As the temperature of the oil is higher then the water in a water cooled engine, the “Limp home temperature” in the software must be set to 200 degrees.

The coolant temperature sensor have M12 x 1.5 mm thread.

Other type of coolant sensor can be setup in the software under *I/P Analogs.*

SM4 pin	Name	Colour
Pin 9	I/P Coolant	Pink
Pin 22	Sensor GND, shared with other sensors	Black

Inlet Air Temperature Sensor

The air temperature sensor is used to compensate for changes in air density due to air temperature. Cold air is denser than warm air and therefore requires a greater volume of fuel to maintain the same air/fuel ratio. This effect is most noticeable in forced induction engines. The Autronic ECU will automatically compensate using the signal received from the air temperature sensor.

The sensor is made by Autronic. NTC sensor can be used and should be setup in the software under *I/P Analogs*.

The sensor should be mounted to provide the best representation of the actual temperature of the air entering the combustion chamber, i.e. after any turbo or supercharger, and intercooler, and as close to the head as possible. The sensor needs to be in the moving air stream to give fast response times and reduce heat-soak effects.
Once a suitable position has been located for the air temperature sensor a hole should be drilled and tapped to accept the sensor.

Remove the manifold or inlet tract from the engine before machining the sensor mount. Do not allow any metal particles to enter the inlet manifold of the engine as these will be drawn into the engine and damage it. Wash all components before reassemble.

The Inlet Air Temperature sensor have 1/8 NPT thread.

SM4 pin	Name	Colour
Pin 23	I/P Air temp	White
Pin 22	Sensor GND, shared with other sensors	Black

Throttle Position Sensor

The throttle position sensor (TPS) should be mounted directly on the main throttle, shaft or alternately connected to this shaft a rigid lash free linkage. Either a linear or rotary type potentiometer sensor may be used. Its electrical resistance should be in the range 2000 to 20,000 OHMS. Movement of the throttle over its full travel must not stroke the sensor to its limits of mechanical travel; otherwise damage to the sensor may result. Mounting and/or linkage construction must be such that the travel is always less that the total available electrical travel.

Before connecting to the sensor, you need to find the TPS supply, TPS ground and TPS signal on the sensor.

Some TPS have more than three wires, these sensor are normally suitable, you will only need to use three of the wires.

To find TPS supply, TPS ground and TPS signal terminals on the sensor use a multimeter to test the Ohms resistance across the terminals.

The TPS supply, TPS ground terminals will give a ohms resistance that will not change as the throttle is opened and closed.

When you have found these, test from each one of these to another terminal until you find the two terminals that the resistance decreases as the throttle is opened.

Example:- Throttle closed resistance 4.2 K ohms.
Throttle open resistance 1.2 K ohms.

When you have found these you are testing across the TPS supply and TPS signal. The other terminal is the TPS ground.

The electrical connections to the two ends of the potentiometer (fixed terminals) must be chosen so that the output voltage increases with increasing throttle opening. If the reverse occurs then the two end terminal connections should be interchanged. A voltmeter should be used to check the output voltages at the extremes of travel. Ideally the sensor should be mounted so that the throttle closed output voltage should be between 0.5 and 0.6 volts.

The following conditions MUST be met:- .

1. Throttle is fully closed the output voltage MUST be in the range 0.4 volts to 1.8 Volts.
2. Throttle fully open the output voltage MUST be in the range 3.2 to 4.7 volts.
3. The difference between the voltages at the extremes of travel should be greater than 2.5 volts.
4. The voltage should increase smoothly with increasing throttle opening; there should be no dead spots in the total throttle travel.

SM4 pin	Name	Colour
Pin 21	I/P TPS	Orange
Pin 22	Sensor GND, shared with other sensors	Black
Pin 36	O/P +5v TPS Supply	Red/white

Throttle Range Learning

With 1.09 chip TPS learning can be set to automatically or manually check software under menu I/P analogs / Throttle.

The ECU is equipped with an automatic adaptive learning function that simplifies the procedure of throttle position sensing. Setup is much simplified, not requiring any diagnostic aid, calibrator or laptop computer. The procedure is as follows:

1. Ignition switch on, engine stopped.
2. Disconnect throttle position electrical connector for at least 20 seconds.
3. Reconnect throttle position electrical connector.
4. Ensure that throttle is closed for at least 5 seconds.
5. Fully open the throttle for at least 5 seconds.

New limits of throttle travel will have been learnt and stored in the ECU during the above procedure. Additional ECU functions ensure that throttle stops and sensor wear are compensated for over the life of the engine. The above procedure need only be repeated if the butterfly / sensor assembly is serviced or replaced.

You also can configure the TPS input under *I/P Analogs* in the software.

Ignition Modules

The ignition modules should be mounted on a flat surface to ensure proper heat dissipation and avoid stress on the wiring connections. It is also important to prevent the modules overheating by mounting it away from hot components such as exhaust manifolds and turbochargers.

Follow the wiring for your modules at the end of this manual and note that smart modules and dumb could have different pin outs. Locate the ignition wires in your harness, using pins, crimp the pins onto the appropriate wires and insert them into appropriate locations in the igniters plug. But do not connect it to the igniters until the ignition settings in the ECU are verified by connecting the ECU to a computer with Autronic software.

The SM4 <u>do not use</u> same output sequence as SMC/SM2, the SM4 always start with output number 1, after that in number order if more than one ignition output is used.

Exhaust Gas Sensor (optional)

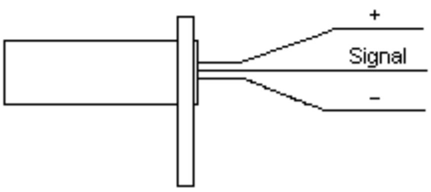
The Optional exhaust gas oxygen sensor must be mounted in the exhaust pipe near the exhaust header or extractors, usually after the collector. The sensor uses exhaust gas to detect if the engine is lean or rich. Many late model engines already have provision for an exhaust gas oxygen sensor and the sensor provided should fit any standard exhaust mount. If the exhaust system does not have an existing sensor mount then a new mount will have to be welded to the exhaust system. When routing the electrical system and connectors to the exhaust gas oxygen sensor do not allow the harness to touch the exhaust pipe, as heat will damage them.

Best oxygen sensor is the 4-wire type. Normally the two white are heating (power and ground) and the black is signal and grey sensor ground. You can also weld an extra mount for tuning with an Autronic analyser. The sensors signal should be wired to any Analog input on the SM4, and be configured under *A/F Ratio* menu *I/P Analogs*.

SM4 pin	Name	Colour
Pin 37	I/P O2	Blue
Pin 8	Analog 1 I/P	
Pin 38	Analog 2 I/P	
Pin 22	Sensor GND (for O2 sensor or/and Autronic	

Crank and Cylinder Reference Wiring

The SM4 is capable of being triggered by magnetic (uses internal reluctor) and digital trigger like Hall Effect and optical. The Hall Effect or Optical trigger requires power (5-12 Volts), signal and ground. If using magnetic triggers you must use shielded wires, se wiring diagram at the end of this manual for wiring, the software is set under menu *I/P Crank & Cyl*.



Autronic Hall effect trigger, the wire with colour strip is the power lead.
Gap between sensor and teeth should be 1 mm (.049”)
Pin out when using Hall or Optical trigger

SM4 pin	Name	Colour
Pin 11	O/P 8v Trigger Supply (for Hall Effect trigger)	Red/Black
Pin 25	I/P Cylinder + ve (signal Hall or Optical trigger)	Red
Pin 26	I/P Sync + ve (signal Hall or Optical trigger)	Red
	Ground Hall trigger using sheild ground	

SM4 pin	Name	Colour
Pin 25	I/P Cylinder +ve (positive, +ve for magnetic trigger)	Red
Pin 40	I/P Cylinder –ve (negative, -ve for magnetic trigger)	Black
Pin 26	I/P Sync +ve (positive, +ve for magnetic trigger)	Red
Pin 41	I/P Sync –ve (negative, -ve for magnetic trigger)	Black

Flying Leads

Locate and connect the following flying leads.
See also main wiring diagram at the end of this manual.

Black (ground)

Locate a good chassis ground and connect the black wires.

Red (12 volt battery)

Locate a source of continuos +12 Volts and connect the red wire. Connecting direct to positive battery terminal is suggested. Use a 30 A Fuse close to battery.

Purple

The purple wire is the 12Volt Ignition lead to the ECU. It needs to be connected so that sees 12 Volt only when ignition switch is on and during cranking. This wire does not draw a lot of current (<0,5A).

Brown

The Brown wire is used to operate the fuel pump, and will deliver +12Volt, ground the other pin on the fuel pump.

Other wires

They are clamped together for easy finding to each function. Always "ring" the wire to the SM4 connector to make sure you use correct wire.

Wiring Injectors

The injector wires are clamped together (10 wires), the two brown wires are 12 volt power and should be split to all injectors. The injectors should be wired in ignition firing order. Write down your firing order on the main wiring diagram, this makes it easy to wire the injector output to the injectors.

The injector output sequence can be adjusted in the software under menu *Advanced setup.* Consult your dealer.

Example:- 4 Cyl engine firing order 1, 3, 4, 2

Injector output 1 to cylinder 1
Injector output 2 to cylinder 3
Injector output 3 to cylinder 4
Injector output 4 to cylinder 2

Wiring Ignition

Distributor engines

Distributor engine always use Ignition output 1.
1 coil should be selected in the software

Direct Fire Ignition engines

In direct fire setup the SM4 <u>always</u> start with ignition output 1 (not like the SMC/SM2), and then Ignition output 2 is fired then 3 & 4 (if used).
The ignition output sequence can be adjusted in the software under menu *Advanced setup.* Consult your dealer.

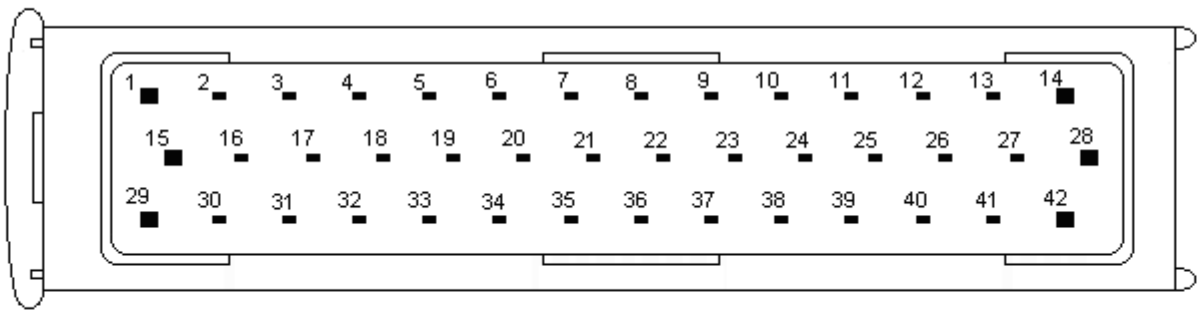
SM4 Connector Pin Out

SM4 PIN	FUNCTION	WIRE COLOUR
1	IGN SW I/P	PUR
2	INJ 8 O/P (SW3)	BLUE/RED
3	INJ 7 O/P (SW2)	GRY/BLUE
4	INJ 5 O/P	GRN/YEL
5	IGN 1 O/P	PNK/WHT
6	IGN 2 O/P	PNK/BLK
7	OUTPUT 1 / STEPPER	RED/GRN
8	ANALOG 1 I/P	GRY/BLU
9	COOLANT I/P	PNK
10	HIGH SPEED 1 I/P	BLU
11	TRIGGER SUPPLY	RED/BLK
12	OUTPUT 8 / TACHO	GRY/BLK
13	OUTPUT 6	BLU
14	PWM 2 O/P	BRN/WHT
15	+12V SUPPLY I/P	RED
16	INJ 4 O/P	GRN/WHT
17	NJ 1 O/P I	PNK/BLK
18	INJ 6 O/P (SW1)	BLU/BLK
19	IGN 3 O/P	YEL/BLK
20	OUTPUT 3 / STEPPER	ORG/WHT
21	TPS I/P	ORG

SM4 PIN	FUNCTION	WIRE COLOUR
22	SENSOR GROUND	BLK
23	AIR TEMP I/P	WHT
24	HIGH SPEED 2 I/P	BLU
25	CYLINDER +VE I/P	WHT
26	SYNC +VE I/P	WHT
27	OUTPUT 5	PNK/YEL
28	PWM 1 O/P	RED/YEL
29	GROUND	BLK
30	+12V RAM I/P	RED
31	INJ 3 O/P	BLU/WHT
32	INJ 2 O/P	ORG/BLK
33	IGN 4 O/P	RED/WHT
34	OUTPUT 2 / STEPPER	BLK/WHT
35	OUTPUT 4 / STEPPER	BRN/BLK
36	+5V TPS SUPPLY O/P	RED/WHT
37	O2 I/P	BLU
38	ANALOG 2 - 3 I/P	GRN/BLK
39	HIGH SPEED 3 I/P	GRY
40	CYLINDER -VE I/P	BLK
41	SYNC -VE I/P	BLK
42	OUTPUT 7	GRN/ORG

LOOM WIRE COLOUR	DESCRIPTION
BLACK	MAIN GROUND
BIG RED	BATTERY 12 VOLT
SMALL RED	+12 VOLT RAM
BIG BROWN	+12 VOLT FUEL PUMP

SM4 connector



Connector view from wire side.

Output Channel Electrical Characteristics

The following table describes the electrical characteristics of the output channels when used for Auxiliary devices such as small solenoids, automotive relays or constant loads.

Output Description	**Output type**
Ignition 1 O/P	Push-Pull Driver 12 Volt to Ground, +/- 1 Amp
Ignition 2 O/P	Push-Pull Driver 12 Volt to Ground, +/- 1 Amp
Ignition 3 O/P	Push-Pull Driver 12 Volt to Ground, +/- 1 Amp
Ignition 4 O/P	Push-Pull Driver 12 Volt to Ground, +/- 1 Amp
Output 1 /Stepper	Push-Pull Driver 12 Volt to Ground, +/- 1 Amp
Output 2 /Stepper	Push-Pull Driver 12 Volt to Ground, +/- 1 Amp
Output 3 /Stepper	Push-Pull Driver 12 Volt to Ground, +/- 1 Amp
Output 4 /Stepper	Push-Pull Driver 12 Volt to Ground, +/- 1 Amp
Injector 1 O/P	On is shorted to ground, 4 Amp
Injector 2 O/P	On is shorted to ground, 4 Amp
Injector 3 O/P	On is shorted to ground, 4 Amp
Injector 4 O/P	On is shorted to ground, 4 Amp
Injector 5 O/P	On is shorted to ground, 4 Amp
Injector 6 O/P	On is shorted to ground, 4 Amp
Injector 7 O/P	On is shorted to ground, 4 Amp
Injector 8 O/P	On is shorted to ground, 4 Amp
PWM 1 O/P	On is shorted to ground, 3.5 Amp 9.5 –1200Hz
PWM 2 O/P	On is shorted to ground, 3.5 Amp 9.5 –1200Hz
Output 5	On is shorted to ground, 2.5 Amp
Output 6	On is shorted to ground, 2.5 Amp
Output 7	On is shorted to ground, 3.5 Amp
Output 8	On is shorted to ground, 2 Amp

Input Channel Electrical Characteristics

Input	**Deskription**
Analog 1 I/P	0 – 5 Volt, When Used as Switched Input add 1K Pull-Up Resistor
Analog 2 I/P	0 – 5 Volt, When Used as Switched Input add 1K Pull-Up Resistor
O2 I/P	0 – 5 Volt, When Used as Switched Input add 1K Pull-Up Resistor
SW1 (Inj6, if not used)	Switched Input, Short to ground for to activate
SW2 (Inj7, if not used)	Switched Input, Short to ground for to activate
SW3 (Inj8, if not used)	Switched Input, Short to ground for to activate
HSI1 (if not used)	Switched Input, Short to ground for to activate
HSI2 (If not used)	Switched Input, Short to ground for to activate
HSI3 (If not used)	Switched Input, Short to ground for to activate

Set Up Guide

Autronic Programming Software

Computer Requirements
The calibration and data logging software supplied with Autronic SM4 ECU may be used with computers operating under Windows 95/98/ME/XP or 2000.

Computer Required Hardware
The computer must have the following hardware

- VGA graphics adaptor (or compatible adaptors).
- Minimum of 2MB random accesses memory.
- One serial communication port, or USB port and serial to USB adaptor (Windows software only).

One 3.5" floppy disk drive.

Installing Autronic Software
Step 1. Start Windows

Step 2. Place floppy disk in A: drive.

Step 3 Click on the “Start” button and then click on “Browse”.

Step 4 Select the A: drive and double click the file on the A drive.

Step 5. Click the OK button.

Step 6. Read the options displayed and click the “Next” buttons to complete the installation.

Step 7. Double click on the icon on the desktop to run the software.

Starting Autronic software
After installing the software, an icon should appear on the desktop. Double click the icon to start the Autronic software

Double click icon to start Autronic Software

Software Basic Setup Guide

Base Settings

When setting up your Autronic software for the first time to control your engine, there are a few simple rules of thumb that will greatly reduce you time to tune the engine.

There are a few setup parameters in the software to be concerned with first, and then we will go through a general description of how the software functions in an attempt to help you understand the correct tuning procedures.

First, under the M1 menu you will want to open the Base Settings table.

In this table you will set:

Primary Fuelling Method

Your choices here are: Baro & MAP or Baro & TPS

Baro & MAP:-

When tuning a forced induction engine, you will want to use this method so that the ECU can have the ability to read the manifold pressure when in vacuum or boost and correctly fuel the engine. When using this method you can select the Y axis for the base fuel table as either Manifold Pressure, or Load. In the case of Load, the actual value of Load is equal to Manifold Pressure/Barometric Pressure

This setting can be used for tuning turbocharged engines with multiple throttle bodies by setting the Y Axis in the Base Fuel table to Throttle Position under the M2 Table Axis setup menu under the M2 table at the top of the screen. You can also use this setting for engines with adjustable camshafts like VVT, VTEC or Vanos. Also on turbocharged engines with wild camshafts and all other engines where you want to map the fuel delivery against throttle position and ignition against manifold pressure. Engines with adjustable camshaft can get at smother fuel map with this method, since it almost automatically will adjust the fuel delivery when the camshaft control is activated.

When using this mode, the values on the Load scale in the Base Fuel Table will represent the actual Throttle angle, even though the ECU will be referencing the Manifold Pressure values at all times and adjusting the injection times accordingly to achieve the desired Target A/F ratios set in the Target A/F table under menu M2. When using Baro & MAP the map sensor must be connected.

Baro & TPS:-

This method should only be used on naturally aspirated multi throttle engines. It does not have the ability to read the manifold pressure for correcting the fuel. Do not use it on forced induction engines.
Select the Y Axis in the Base Fuel table and Y Axis in the Ignition table to Throttle Position under the M2 Table Axis. When using Baro & TPS leave the map sensor unconnected.

Engine Cycles

Select either 4 Stroke or 2 Stroke or Rotary

Overall Fuel Calibration Multiplier

This value can be anything from 0 to 39.987
This is a value that is used by the ECU to determine the scaling to use on the values in the Base Fuel Table.
For example: If the base fuel table has a value of 50 in any particular cell, the actual amount of fuel injected into the engine will be a function of the injector size. A 50 Lb/Hr injector would spray less fuel than a 160 Lb/Hr injector for the same value of 50 in the table, so the Overall Fuel Cal Multiplier sets the scale for the table based on the relationship between the size of your engine and the flow capacity of your injectors.

A good starting point for this value is to use the following formula:

8.112 * D/I
Where:
D = Cylinder Volume in CC's
I = Injector Flow Rate in CC/min

After you have the engine tuned completely, the value in this table can be changed to suit a new size of injector without re-mapping the engine by using the same formula.

Compression Ratio

It is important that you set the correct Compression Ratio for the engine.
The engine's compression ratio affects the mathematical model of the engine created behind the scenes in the Autronic software. An engine's compression ratio has a direct effect on its Volumetric Efficiency and if the wrong ratio is selected it is difficult to get the proper correction factors needed for the software to make automated changes in fuel accurately.

Clear Flood TPS

The default value of 90% TPS is normally okay for startup. This value represents the percentage of throttle opening during cranking where the ECU will no longer provide an injector pulse. This allows a flooded engine to be cranked over without adding any additional fuel until it starts.

Ignition Setup

Next you will want to move to Ignition Setup menu under the M1 tab at the top of your screen.

Under this menu you will select:

Ignition O/Ps

Press F1 in the software to see all the options.

Select the number of ignition outputs and the type of coil system that will be used.
Example:-
Four cylinder engine with four coils = 4cyl-MC
Four cylinder engine with two coils = 4cyl-WS
Six cylinder with three coils = 6cyl=WS
Six cylinder with six coils and using Multiplexer = 6cyl-Mux

Ignition Trigger Edge

This setting is to determine what edge of the signal output from the ECU will remain fixed. One edge of the square wave must always occur at a pre-set time, and the other edge will be flexible and begin or end at various times. If you select the wrong edge the ignition timing will be incorrect as RPM's increase. These setting also let you select between pulse or dwell.

Options are,
-ve edge (DWELL)
+ve edge (DWELL)
-ve edge (PULSE)
+ve edge (PULSE)

For coils with internal igniter modules or If using external modules
select -ve edge (DWELL)

Ignition systems like Honda, that use inverted dwell, select +ve edge (DWELL)

Autronic R500 CDI select -ve edge (PULSE)
MSD or Crane HI-6 select +ve edge (PULSE)

Injector Selection

Next you will want to open the tables called Injectors under the M1 Tab at the top of your screen.

In this menu you will select the type of injectors you will be using from a very large list. Each injector in this list has been carefully mapped for the correct control strategy based on its electronic characteristics as battery voltages change. It is important to choose the correct injector for optimum system performance.

If the injector you have in not in the list, consult you dealer for a recommendation of a similar injector to use.

Injector events

Select number of injector events per engine cycle. For most engines this is the same as the number of cylinders.

I/P Cylinder & sync

This menu consists of parameters for setting up the crank and cam trigger patterns so that the ECU can properly calculate ignition and injection requirements.

It is important that these settings are selected properly, so be sure to consult your dealer for proper settings based on your engine configuration.

Starting the engine for the first time.

If you are using coil packs or direct coils see the Direct Fire Ignition section below before starting the engine.

Items required.

You will require the following items before attempting to start the engine.
Ignition timing light.
Exhaust gas analyser.

Have these connected before attempting to start the engine.

Software.

1. With the PC connected to the SM4 and the calibration software running, turn on the ignition (you should hear the fuel pump start and then turn off) and select "Go online" from the File menu or press F3.

2. Press Alt+4 to open menu M4 and select the *Idle ignition* table. Set all RPM values to 10 degrees.

3. Press Alt+1 to open menu M1 and select *Base settings*. You will need this window visible when starting the engine so you can increase or decrease the *Overall fuel mult* to change the overall fuel trim to get the engine running smoothly.

4. Calibrate the throttle. See *Throttle Limit Learning* in this manual.

5. Before starting the engine check the on screen real time engine data to see if everything makes sense
e.g:- air and water temperatures are correct, throttle position is linear from 0 to 100%.

Starting the engine.

1. Start the engine.
Check the analyser to see the air fuel ratio is between 12.7 and 11.0, change the *Overall fuel mult* to achieve a suitable air fuel ratio the will resalt in smooth running.

   As the engine warms up the air fuel ratio will get leaner. When the engine is up to operating temperature the engine should be idling on 13.0 to 14.7 air fuel ratio. Use the *Overall fuel mult* to make corrections.

   Press F4 to lock the changes into the SMC.

2. Use the timing light to check the ignition timing matches the "Ign. Angle-MEAN-" displayed in the real time engine data. If they do not agree do the following.

   Distributor:- Turn the distributor body or change *Crank IP Lead*

   Crank trigger:- Move the sensor or turn the trigger disk or change *Crank IP Lead*

Direct fire ignition sequence testing.

This type of installation is more difficult to setup and the following should be used to check you have the correct ignition sequence for your engine.

In this example we are using a six cylinder engine with three double ended coils using wasted spark. The firing order is 1,5,3,5,6,2,4

Coil pack 1 fires 1 & 6 cylinders.
Coil pack 2 fires 2 & 5 cylinders.
Coil pack 3 fires 3 & 4 cylinders.

Turn the engine until the piston is on compression TDC No1 cylinder, using a white marker place a single mark on the harmonic balancer that will be visible with a timing light with the engine cranking.

Turn the engine until it is on TDC of one of the cylinders that are on coil pack No2, and place two marks on the harmonic balancer. Do the same for third coil pack, placing three marks.

With the injector connectors disconnected or the fuel pump disconnected, use a timing light connected to No1 spark plug, and crank the engine, you should see only one mark on the harmonic balancer. If you see two or three marks you have the ignition output sequence wrong. Swap the ignition output connectors in the SM4 harness connector or use the software under Menu M1/*Advanced Setup/Base angels (Ign)* until you see one mark on the balancer.

When this is correct put the timing light on the spark plug lead of the second cylinder to fire and check for two marks on the balancer. If incorrect do the same as above. Repeat this on cylinder three in the firing order, looking for three marks.

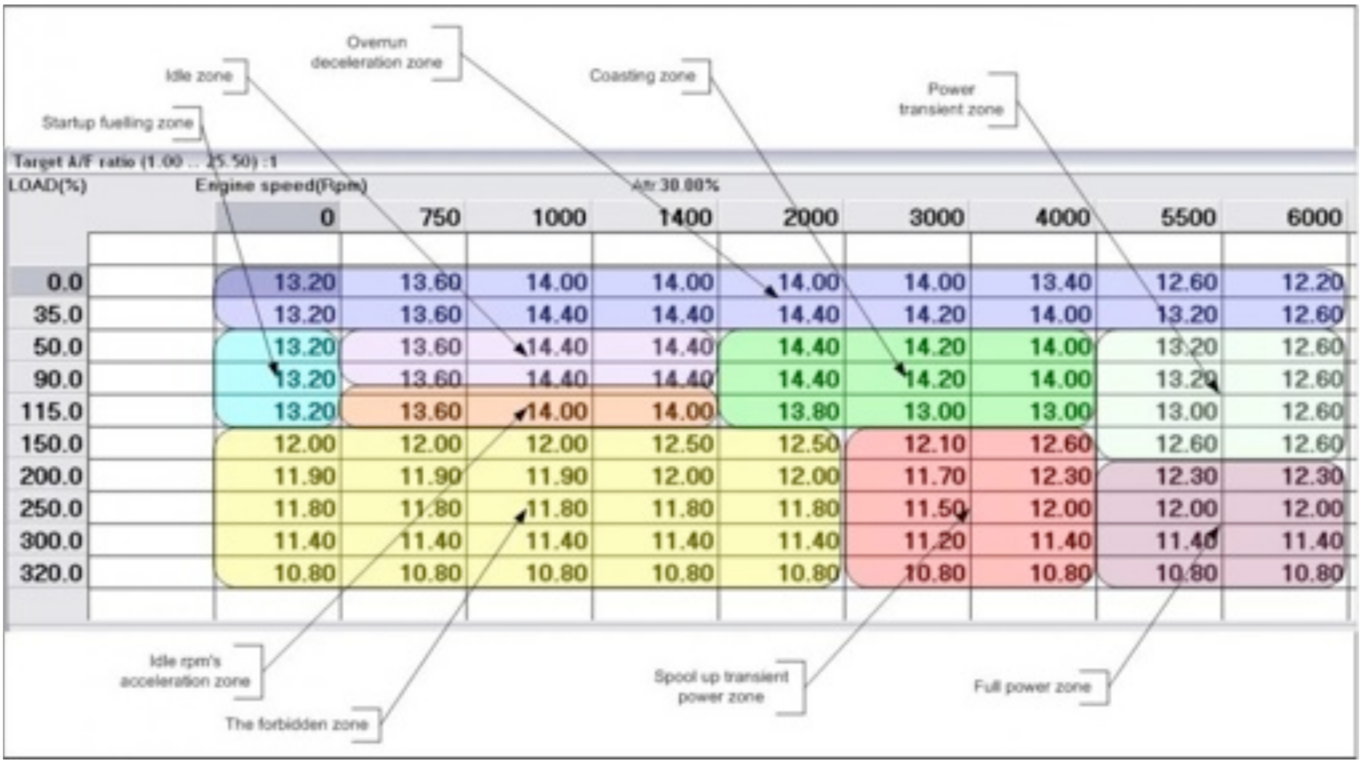
Example of using *Advanced setup* for correcting a wrong sequence wiring:-

Direct fire 4-cyl engine without wasted spark, under menu *Base angles (Ign)* it should read 0, 180, 360, 540, if output 2 & 3 are swapped you should have; 0, 360, 180, 540.

Tuning Guide

Setting up the A/F table

Here is the AF table with some colored fields to show how it works. Below is how the different zones work with the engines fuelling. In this example we use a modern turbo engine.



LOAD(%)	0	750	1000	1400	2000	3000	4000	5500	6000
0.0	13.20	13.60	14.00	14.00	14.00	14.00	13.40	12.60	12.20
35.0	13.20	13.60	14.40	14.40	14.40	14.20	14.00	13.20	12.60
50.0	13.20	13.60	14.40	14.40	14.40	14.20	14.00	13.20	12.60
90.0	13.20	13.60	14.40	14.40	14.40	14.20	14.00	13.20	12.60
115.0	13.20	13.60	14.00	14.00	13.80	13.00	13.00	13.00	12.60
150.0	12.00	12.00	12.00	12.50	12.50	12.10	12.60	12.60	12.60
200.0	11.90	11.90	11.90	12.00	12.00	11.70	12.30	12.30	12.30
250.0	11.80	11.80	11.80	11.80	11.80	11.50	12.00	12.00	12.00
300.0	11.40	11.40	11.40	11.40	11.40	11.20	11.40	11.40	11.40
320.0	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80	10.80

Startup fuelling zone:

This zone determines how rich the engine is fuelled when trying to start.

Idle zone:

This is where the engine idles. Should be fuelled so the engine idles nice and calm, and that it does not heat up to much, and to avoid sot buildup.

Idle rpm's acceleration zone:

This zone determines the fuelling if we where on idle, but start to accelerate from idle.

Spool up transient power zone:

This zone is a bit tricky. The engine will in this zone spool up the turbo very quickly. That leads to fuel starvation. Some of the starvation can be handles by TPS acceleration enrichment. On the SM4, there is much more sophisticated methods to counter the starvation, with rpm rate and boost rate enrichment tables, and with chip version 1.09 we also have the transient enrichment system, wich completely solve the problems with spool up starvation.

We set the fuelling in this zone to assure that the engine will not come out of the spoolup with a debt in fuel that cause starvation all the way up in the full power zone.

Since the engine will not be in this area for so very long, it does not matter much if we are a bit on the rich here. It only helps the engine when it comes into the full power zone.

Full power zone:

This is where the engine produce top power, and the fuelling is set very rich to avoid heat buildup and irregular combustion. Setting it to rich may give the same problems as when setting it to lean.
This is where we put the big effort on the dyno to get the last of the lazy horsies to pull.

Power transient zone:

Here we will end up when gear shifting after being in the full power zone. We can also end up here when the throttle is temporarily lifted. Fuelling here is leaner than on top boost, but there is no use in getting to lean here, since the engine and tubo internals have lots of heat built up. This zone managed the heat buildup when we lower the exhaust flow suddenly by letting go of the throttle.
Care must also be taken for the case that we temporarily lift the throttle, and then go bank on full bost again. If to lean here, the engine will at first get way lean and hot when it gets back to the full power zone.

Overrun deceleration zone:

This zone is where the engine is transient in and out of overrun. Using overrun fuel shut off on a high power turbo engine is nearly a must, since high rpm overrun is the place where EGT can rise dramatically. Either the engine must have fuel cut off, or being rather rich fuelled. Care must also be taken for large injectors not being able to fuel properly with small injector openings on the vaccum line.

Coasting zone:

This zone manages fuelling when we are coasting. On a street engine we want to keep this lean because of emissions and fuel economy. But on a race engine we want this to be fuelled for best driveability without heat buildup, and without filling the engine up with sot.

The forbidden zone:

This is where we never should be able to end up. We are well below the turbo spoolup rpm's.

But still, we can end up here after selecting the wrong gear in a power shifting with boost pressure.

Of different reasons, the turbulence in combustion and flow through the engine is low in this area, and here is where most modern petrol engines are most prone to knock. So this cell must be properly fuelled so the engine does not get damaged if we happen to end up here.
(The ignition table at these load sites should be set rather low).

Best practice in calibrating fuel for the different zones:

The startup zone and the forbidden zone must be estimated.

The overrun deceleration zone can be part autotuned, but most often the lowest KPA cells must be estimated from the neighbour row with higher KPA.

The full power zone must be manual tuned from the log.

The rest of the zones can be partially autotuned.

The spool up transient power zone and the power transient zone partially need to be estimated.

Sometimes the static load condition is the worst case, and sometimes it is the dynamic, (transient), load case. The dangerous zones must be well taken care of that they are tuned for the worst case.

Manual Tuning

This method is done by operating the engine in each Load/RPM cell and experimenting until the value in the cell produces the correct A/F ratio according to the target values set in the Target A/F ratio table.

Manual Tuning with the M (maths) Key on the keyboard

This method is done by using the PC data logger to record the air fuel ratios. Then with the both the data log and fuel table open the "M" key on the keyboard is pressed. A menu will pop up and ask what the recorded A/F ratio was When you type in the recorded A/F ratio and press Enter, the software will compare this value to those set in your Target table and then calculate the correct value for your Base fuel table and automatically set (tune) that number in the cell on the table.

To use the PC logger press F8 to start recording and F8 to stop. To display the data log then press F10. To switch between the data log and fuel table press the Tab key. The "Q" key closes the data log window.

Step1: With the data log displayed move the curser bar (use Left and Right arrow keys) to any point in the data log where the ghost box on the fuel table matches a RPM and Load axis.

Step2: Press the Tab key to switch to the fuel table, move the curser so it is also on the same RPM and Load site as the ghost box.

Step3: Press the M key, a box will appear, type in the recorded air fuel ratio (and Load if TPS/ Manifold mapping), press Ok. The site in the fuel table will now be tuned. Press the Tab key to switch back to the data log.

Step4: Go to step1 and select another rpm site.

After you have corrected all sites that match go to the Logger menu and Reset the PC logger. Then record a new data log and repeat the above process. If you thr/manifold pressure map the engine at WOT (wide open throttle) and use this method only two WOT runs using the data logger and math key will tune the engine at full power.

Tuning with Datalogs and Mixture Table

This method is done by using the PC data logger to record the air fuel ratios. Then with the both the data log and fuel table open, the software will search the data log for any RPM and Load sites that do not match the target A/F ratio table values and display them. You can then just select the sites you wish to be automatically tuned.

Press F8 to start the PC logger.

Now that the logger is running you can operate the engine through various RPM and Load sites and allow the ECU to record the A/F ratios coming in from a Wide Band A/F meter such as the Autronic A or B model analyser.

When you are finished with your run, you can stop the logging process by pressing F8 again. To display the logged data you press the F10 key on the keyboard and the data will display on your screen.

Select the Mixture Table tab on the top of the data log screen. The "L" and "K" keys switch between each tab.

Once you select Mixture Table press the F5 key and a pop-up box will appear and ask a few questions about how you would like to interpret the data. This can be used to filter out spikes in RPM and select what mode of mapping you have used in the cal file. Once you have finished answering the questions just press Ok and then press Enter.

The software will extract the data concerning the A/F mixtures recorded and compare them to the Target A/F ratios for each cell in the base fuel table you encountered during the run and will display the values for each cell as a comparison.

If a cell is coloured RED it means the A/F values were very inaccurate and it will show the actual A/F ratio VS. Target and how many times it sampled this reading.

If a cell is coloured YELLOW it means the A/F values were slightly inaccurate and it will show the actual A/F ratio VS. Target and how many times it sampled this reading.

If a cell is coloured Green it means the A/F values were accurate and it will show the actual A/F ratio VS. Target and how many times it sampled this reading.

You can use the mouse or the Arrow keys on the keyboard to highlight any of the coloured cells and then press Enter. The software will then show a pop-up box and ask you if you would like the ECU to fix the cells in the base fuel table that correspond to the highlighted cell in the mixture table. Press Yes and then Enter and the ECU will calculate the correct values and place them in the base fuel table.

Once you have fixed all the coloured cells in the mixture table, you close the data log by pressing key Q, reset the datalog under menu Logger and PC logger reset. Store the new settings in the ECU by pressing F4 and on the disk by pressing F2. Then do another run similar to the first and then re-open a new data log and extract the new data in the mixture table to see how much improvement was made.

If using this procedure on a dyno, you will only need to do two or three runs to completely tune all the full throttle sites in the Base Fuel Table.

AutoTuning

The Autronic Software has the ability to self tune the Base Fuel Tables in real time when using an input signal from a wide band A/F meter such as the Autronic A or B model meters.

When in the Base Fuel Table, select the Edit Window tab at the top of the software, and then scroll down until you can select Setup AutoTune.

This will bring up an Auto-Tune setup window where you can set the parameters for Auto-Tuning the engine.

The parameters are:

Accuracy: This should be set to 5% for the first rough tuning and can be set lower after the initial tuning is complete.

Colour Protection: This can be enabled to protect the sites that the software has Auto-Tuned from being changed later or un-protected to allow changes after Auto Tuning has been completed.

Initial Map State: This is used to tell the software whether the engine has been tuned before or if it is a brand new calibration.

Sensor Position: This is used to help the ECU create a time offset for making tuning decisions. You can select Header, Collector, or Tail Pipe of Car.

Once you have set up the auto tune parameters you can simply run the engine and press the F5 key to start or stop the Auto Tuning process.

Then simply hold then engine in one load/RPM cell at a time, and the ECU will automatically sample the A/F ratios and compare them to the Target A/F ratio and then make changes to the values in the cells until the correct A/F values are found.

Once a cell is tuned close to its accuracy point it will turn Yellow. When it is tuned to be within the accuracy set point you have selected the cell with turn Green and you can then move on to the next cell and continue tuning.

When all of the cells you wish to Auto Tune have been completed you can then go back to the Edit Window and select Set Up Auto Tune to change the accuracy settings to be finer and then begin the Auto Tune process again for higher accuracy.
When used properly the Auto Tune procedure is by far the fastest way to tune the engine's fuel sites.

Once all of your fuel tuning is completed you can begin working on any necessary adjustments for cold starting, warm-up and acceleration enrichment and deceleration enleanment. Most times the default values will be very close and will not need much adjustment.

The best method of Autotuning is to tune one site at 3000 RPM and 100% Load. Then stop the Autotune and copy this value to all sites in the fuel table other then your idle and start sites. Then start the Autotune again and always tune a site next to one already tuned. See manual setting up A/F table for more information.

Throttle/Manifold mapping.

Engines with one throttle butterfly per intake port and turbocharged must use this method of mapping. This type of mapping has advantages on naturally aspirated engines with big camshafts. The Base Fuel Delivery table is throttle mapped and the Base Ignition Timing table is pressure mapped.

In the fuel table the Load values relate to throttle position. e.g:- Load site 10 = 10% throttle position. On the SM4 you setup this under menu *M2 Table Axis setup.* Set *Base Fuel Axis Y* to *Throttle position.* Do <u>not</u> use Baro & TPS under Menu *Base Settings* since this is only for naturally aspirated cars. After selecting Throttle as y axis you may delete the ***** market load axis in fuel table, they are not used.

				RPM		
Load	0	1000	2000	3000	4000	5000
0	*	*	*	*	*	*
1	*	*	*	*	*	*
3	*	*	*	*	*	*
5	*	*	*	*	*	*
10	*	*	*	*	*	*
30	*	*	*	*	*	*
70	*	*	*	*	*	*
100	*	*	*	*	*	*

Base Fuel Delivery table.

The Base Ignition Timing table should use load sites for pressure mapped engines.

Setting up a superior launch-control with SM4 chip 1.09

This is a guide to setup a very nice launch with the launch rpm set by a potentiometer that use functionality present in the Autronic SM4 with chip version 1.09.

1) First off to setup launch is to define a vehicle speed input:
In menu M1 / I/P HSI / I/P HSI3 setup as follows:

Assign I/P HSI 3 to Speed

Setup HSI Slow Scale to get the correct reading like the following example:
Enter the wheel diameter in meters, and then multiply with PI which is about 3.1415 .
Enter 0.611
Then enter *3.1415
Then divide by the number of pulses from the speed sender per rotation of the wheel.
Enter /4
Your HSI Slow Scale value is now calculated to be **0.4799**, which is correct for a wheel that is 0.611 meters in diameter with four pulses per wheel rotation.

Now go to menu M1 / Gear/Speed Cal / Speed Setup and enter the following:
L driven channel = HSI3
R driven channel = HSI3
L vehicle channel = HSI3
R vehicle channel = HSI3
Driven speed detect = Maximum
Vehicle speed detect = Maximum
Note: For vehicles with traction control the above settings will be different, but this is a good default to get speed input working properly.

Now you have an accurate speed input for your logging, launch control, selecting boost table on basis of speed, and others.
2) Connect a user potentiometer to Analog input 1 and set it up:
Connect a potentiometer with the resistance 4.7 kiloohms to I/P Analog 1, Sensor ground and +5 Volts.

Note: I/P Analog 3 may also be used for this.

Be sure that the potentiometer is connected so that it gives the value ~0 when turned fully anticlockwise, and ~100 when turned fully clockwise.

Now you have a potentiometer that can be turned from 0 to 100 percent.
3) Enable Launch and set up the basics:
In the menu M1 / I/P Switches enter the following:
I/P Launch = I/P Analog 1
Make sure to press the **I** key in the input switch selection menu to invert the switch function so that launch will be active below a set threshold on the analog input.

Then, straight under I/P Launch the paremeter Switch Treshold 1 will appear. Set it:
Switch Treshold = 97.3
Now we can enable Launch when turning the pot below 97.3%, and disable it by turning the pot fully clockwise.

Set up launch in menu M5 / Launch Control like the following:
Launch cut mode = Ign & Fuel cut
Launch rpm trig = 2900
Launch TPS = 101
Launch kph = 5
Launch rpm Source = Launch RPM
Launch RPM = 4500
Retard rpm offset = 50
Launch rate = 10000
Launch ends = 40
Ign retard source = Launch retard
Launch Retard = 10
Now we have a basic Launch Control that activates by turning the pot down.

Note: If your car is non turbo, or you simply do not want to build boost pressure on launch, you can select Launch cut mode to be fuel cut instead of Ign & Fuel cut.

Whenever the pot on I/P Analog 1 is turned to less than 97.3%, and the car is standing still, and we floor the accelerator, we will now have a Launch control that holds at 4500 rpm and builds some boost pressure.
4) Enable GPC12 for use by our Launch Control:
In menu O/P Setup, enable GPC12 by setting:
GPC12 = ON-No O/P
In menu M6 / GPC12 / GPC12 Setup enter the following:
GPC Setpoint = User table J
In menu M6 / GPC12 / GPC12 inhibit enter the following:
Inhibit variable 1 = Disabled
Inhibit variable 2 = Disabled
Inhibit value = 0
Inhibit duration = 0
In menu M6 / GPC12 / GPC12 Table Setup enter the following:
User Table Axis X = I/P Analog 1
User Table Axis Y = Throttle Position

In menu M6 / GPC12 / GPC12 Table, do the following:

Make the table two columns by one row. (By using the INS and DEL keys).

Using the **E** key, Set the axis for I/P Analog 1 to start at 3 and end at 97.

By using the pot from 3% to 97% we get some margin for for the pot mechanical endpoints, and we did set the Launch enable to be below 97.3%.

Using the **E** key, Set the only row of axis for Throttle Position to 100.

Set cell at 3% pot to be 18.8, which will set the lowest available lauch rpm to about 3000 rpm.

Set cell at 97% pot to be 43.1, which will set the highest available lauch rpm to about 7000 rpm.

Then go back to menu M5 / Launch Control and set:
Launch rpm Source = GPC 12 duty
This enables the GPC12 table to set the Launch RPM to between 3000 and 7000 rpm depending on how the pot is set. If pot is turned fully clockwise then launch is completely disabled, and when turning the pot down, Launch will be available. Turning the pot further anticlockwise will lower the launch rpm.
And that's it!

We have now built ourselves a variable launch control with a potentiometer that both enables/disables launch, and also sets the launch rpm to between 3000 rpm and 7000 rpm.

The exact settings of the launch control parameters must be adapted to the car it is implemented in.

Boost control

Theory on boost control

Basic strategies for regulating boost;

- Control pressure: The pressure that affects the wastegate actuator. *(Either over, or under the membrane).*
- Over the membrane: The chamber in a WG that add boost with added pressure.
- Under the membrane: The chamber in a WG that subtract boost with added pressure. *(Normally the only chamber available on a built in wastegate).*
- Two way boost valve: Pneumatic valve with two ports, that open when energized.
- Three way boost valve: Pneumatic valve with three ports, where one connects to one of the other two depending on if it is energized or not.
- Restrictor: A small orifice that limits flow.
- NO: Normally open.
- NC: Normally closed.
- EBP: Exhaust Back Pressure.

The strategies for a built in wastegate are:

- Regulating under the membrane with a restrictor and a two way boost valve that bleed off control pressure to add bost.
- Regulating under the membrane with a three way boost valve that proportionally mix between compressed air and atmospheric air to produce a control pressure that is lower than the actual boost pressure, to add boost.

To add to the above strategies, an external wastegate offers the following strategy:

- Regulating over the membrane with a three way boost valve that proportionally mix between compressed air and atmospheric air to produce a control pressure to add boost pressure to the base pressure that is managed by direct connection from compressor housing to under the membrane. This "cussion/pillow"-pressure can be maintained through the standard boost control function, or with a PWM from a GPC.

  The control pressure for boost regulating must be taken before the throttle. If the control pressure is taken from after the throttle, there will be excessive, uncontrolled backpressure at mid throttle affecting both power output and also the mapping accuracy.

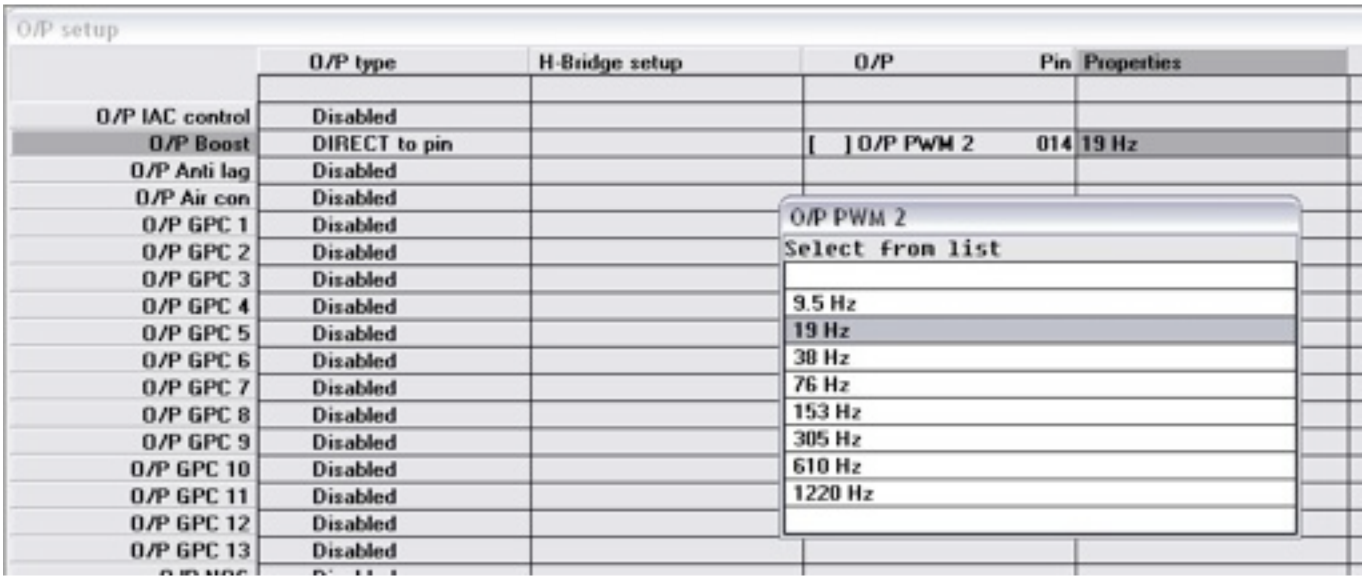
Installation

See wiring later in this manual.

Calibrating boost control

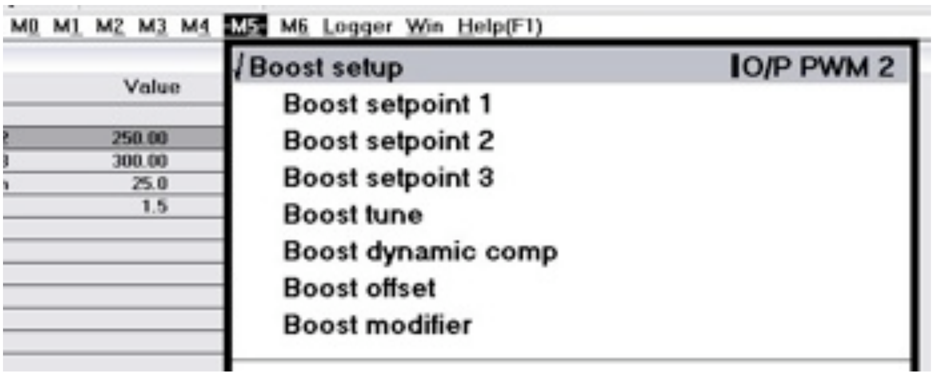
First we need to enable boost control by assigning an output for it in menu **M1 / O/P setup** and configure the output for the boost valve we are using.

In this example we select **O/P PWM 2** as output for boost control, with its output on pin 14. This is one of the dedicated PWM output pins, and it provides a reliable PWM signal with selectable frequency ranging from 9.5 to 1220 Hz. When we have selected the output pin, we can go into the properties cell of the output and select 19 Hz PWM frequency, which is a good starting point for most of the available boost control valves.



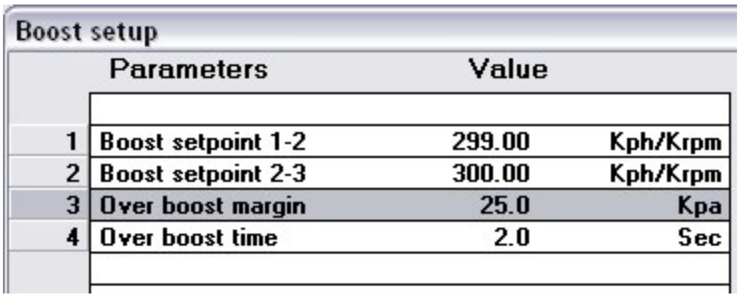
Boost control O/P setup

When the boost control is assinged to an output, the boost control can be configured in the menus under **M5**.



Boost configuration menus

Next step is to look into the menu **M5 / Boost setup**.



Boost setup

	Parameters	Value	
1	Boost setpoint 1-2	299.00	Kph/Krpm
2	Boost setpoint 2-3	300.00	Kph/Krpm
3	Over boost margin	25.0	Kpa
4	Over boost time	2.0	Sec

Boost setup menu

The Autronic SM4 has three different **Boost setpoint** tables, that can be selected by external switches, or let the Autronic select them depending on which gear is currently engaged.

For more information on selecting **Boost setpoint** table depending on which gear is engaged, please read chapter below. Otherwise disable it by setting both **Boost setpoint 1-2** and **Boost setpoint 2-3** to 300.

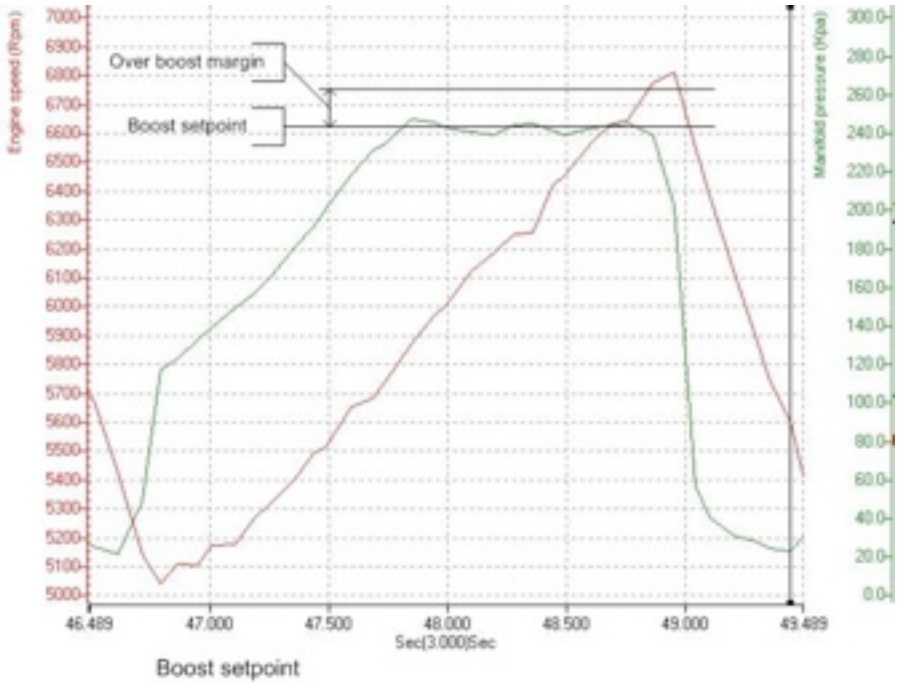
For more information on selecting **Boost setpoint** table by external switches, please read chapter, on how to select input switches to select **Boost setpoint** table.

If neither gear ratio, nor input switches is used to select between the three **Boost setpoint** tables, the SM4 defaults to use the **Boost setpoint 1** table.

Next two parameters in the menu is **Over boost margin** and **Over boost time**. These parameters determine when the SM4 will use **boost cut** to limit the boost pressure and avoid damaging the engine, by shutting off the fuel injectors. If the actual boost pressure is higher than the wanted boost pressure plus the **Over boost margin**, for **Over boost time** seconds, the SM4 will cut fuel to the engine until the boost pressure is down to safe values. At the same time an **Overboost error** condition will be logged in the **ECU error history**.

If the actual boost pressure is over the wanted boost pressure, and is getting near the level of wanted boost pressure plus **Over boost margin**, the SM4 will begin to control the boost control valve more aggressively, to try to avoid the overboost error.

In figure below is an example of boost pressure on a high gear is shown. The boost control has been tuned so the turbo will at most give a boost pressure around the wanted **Boost setpoint**, and well within the **Over boost margin** that otherwise would cause a boost cut to avoid damaging the engine.



Example log of boost pressure

Next step is to configure the **Boost setpoint** table. The procedure is the same for all of the three available **Boost setpoint** tables. Even if you don't use more than one table, it is good practice to setup the other two tables with some safe values.

Below show an example **Boost setpoint 1** table. The X-axis of the table show **Engine speed** (rpm) and the Y-axis show **Coolant temp**. The values in the table represent wanted boost pressure in units of absolute KPA. If we want a boost pressure of 1.5 Bar, (which is 150 KPA relative), we add 100 KPA for the atmospheric pressure to convert the number into absolute pressure in KPA, and so enter the value 250.

Boost setpoint 1 (104 .. 510) Kpa(abs)

Coolant temp(Deg C)		Engine speed(Rpm)				Attr:3
		2000	4000	6000	7000	8000
100.0		250	250	250	240	190
105.0		190	190	190	190	190

Boost setpoint table

It is good practice to have at least two rows in the table, so we can set a boost curve that is used under normal conditions, and another boost curve that is used if the engine is overheated.

In the example **Boost setpoint** table above we regard coolant temperatures below 100 degrees Celsius to be normal conditions, and coolant temperatures above 105 degrees Celsius to be an overheat condition. When the coolant temperature climbs above 100 degrees, the SM4 will start lowering the boost pressure to the values in the lower row, (105 degrees), to save the engine.

In our example **Boost setpoint** table we have entered 250 KPA in each cell for rpm's up to 6000 rpm.

Then, with higher rpm's, the boost pressure will be lowered to 240 KPA at 7000 rpm. The reasons for this can be that there is not enough fuel for a higher boost pressure at that engine speed, or that the engine simply cannot handle a higher boost pressure at that engine speed.

At 8000 rpm we lower the boost pressure all the way down to 190 KPA, which is just above the lowest possible boost pressure that the boost valve can control.

This is a good setup for an engine that has an active rpm range of up to about 7000 rpm, and with a rev limit at about 8000 rpm.

If the engine does not pull any torque above 7000 rpm, it is not useful to continue with the high boost pressure. By lowering the boost pressure all the way down to 190 KPA before going into the rev limiter at 8000 rpm, the engine gets a safe transition into the rev limiter, thus protecting it from potential damage.

The next step is to go into menu **M5 / Boost tune** and set the parameter **Boost range**.

Boost range is the amount of boost pressure in addition to the basic boost pressure that the wastegate will regulate to without the boost control valve being engaged – Basic boost pressure.

Lets say that the basic boost pressure of our wastegate is 0.85 Bar, or 85 KPA relative.
If we want the boost control valve to be able to control boost pressure to be maximum 1,5 Bar, (150 KPA relative pressure), then we need to specify a **Boost range** of at least 150 – 85 = 65 KPA. In fact, **Boost range** is more determined by how much the boost control valve can raise the boost from the basic boost pressure. If our boost valve is theoretically capable of raising the basic boost by 120 KPA, that is the number we need to set **Boost range** to.

But things are a bit more complicated than that. One can tweak the boost control valve by setting a higher or lower **Boost range** than what the boost control valve actually can regulate.

Setting **Boost range** lower than what the valve can regulate will make the boost control more responsive, but at the same time the regulated boost pressure will be a bit rough.

Setting **Boost range** higher than what the valve actually can regulate will make the boost control smoother, but at the same time the it will be slower in reaching the wanted **Boost setpoint**. A higher value on **Boost range** may also make it more difficult for the boost control to achieve the same boost pressure on all gears.

Next step is to setup the table in the menu **M5 / Boost dynamic comp**. Start with setting all the cells to zero, as done in figure belowe. This table can be adjusted to make the boost regulation smoother, with the penalty of a bit less accuracy.

When we have configured the boost control, but the regulated boost pressure is very rough, we can come back to this table and increase the values until we get a smooth pressure curve. But for now we set it to all zeros.

Boost dynamic comp (0 .. 255)

Engine speed(Rpm) Attr:30.00%

	2000	4000	6000	7000	8000
	0	0	0	0	0

Boost dynamic compensation table

Now we continue to set the table in the menu **M5 / Boost offset**. Set it up with the same Engine speed values on X-axis as the previous tables, and with the Y-axis showing both the lowest and the highest Boost setpoint pressures that we want to regulate. (In our example is is 190 and 250 KPA absolute pressure). Then set all the cells in the table to zero. This is a good starting point.

This table is the equalizer. If we have set the correct **Boost range** earlier, then this is the only table we need to change values in to get exactly the boost pressure we want.

If we must go back and change the **Boost range** then we must redo this table after that.

Boost offset (-128 .. 127) Kpa

Boost setpoint(Kpa(abs)) Engine speed(Rpm) Attr:30.00%

		2000	4000	6000	7000	8000
190.0		0	0	0	0	0
250.0		0	0	0	0	0

Boost offset table

Correct procedure for testing that the boost control regulates to the wanted **Boost setpoint** is to first check what boost pressure is achieved in first gear.

If the boost control overshoot the wanted pressure in first gear, the engine and the transmission will not take the same beating as it would do if we where on, for example third gear.

There are two main reasons for this:

- The engine will feel less load in a lower gear
- The time spent on boost is significantly less in a low ger than in a higher gear

That is why we start testing the boost control in a low gear.

Don't go full throttle right away. Start with feeling on the throttle that the boost pressure stops on a reasonable level. If it overshoots on part throttle, it will overboost massively on full throttle.

If everything is good on first gear, then try second gear. And so on.

As a rule of thumb, it is said that the highest boost pressure will be found on third gear.

When we have come this far, we can log the boost pressure, and fine tune **Boost range** and the **Boost offset** table to achieve the target boost.

Lets say we have made a test run, and logged engine speed, **Boost setpoint** and actual Boost pressure. Then we can make adjustments in this table. And lets say the turbo spooled up just before 4000 rpm, and that we did not pull higher than 7000 rpm to be safe.

First we check at the maximum boost pressure. Lets say that at 4000 rpm we got 235 KPA boost instead of the wanted 250 KPA. And that we got the wanted 250 KPA at 6000 rpm. And that we got 250 KPA at 7000 rpm, instead of the wanted 240 KPA. Then we add, 250 - 235 = 15, to the cell at 4000 rpm and 250 KPA, and then subtract, 250 – 240 = 10, from the cell at 7000 rpm and 250 KPA. (250 KPA is near to 240 KPA).

Then we extrapolate the values down to 2000 rpm and up to 8000 rpm. We leave the value at 6000 rpm since we got the boost pressure that we wanted at that engine speed.
Lastly, we copy all the values we got at the 250 KPA row to the 190 KPA row.

Then we get a table that looks like figure below.

Boost offset (-128 .. 127) Kpa

Boost setpoint(Kpa(abs)) Engine speed(Rpm) Diff:15 Attr:30.00%

		2000	4000	6000	7000	8000
190.0		*15	*15	0	*-10	*-10
250.0		*15	*15	0	*-10	*-10

Modified Boost offset table

We log new test runs, and add or subtract values to the **Boost offset** table cells until we are satisfied with the regulated boost pressure around 250 KPA.

We then make a temporary change to the **Boost setpoint** table to select 190 KPA boost over all rpm’s. Then we log a test run at this lower boost, and modify the cells in the Boost offset table for 190 KPA until we get exactly that boost pressure. This time we run a safe, low boost pressure, so we can carefully pull all the way up to rev limit.

Don’t forget to change back the cells in the **Boost setpoint** table to the original values, like it was in figure above

, when done with calibrating the **Boost offset** table.

Now we have calibrated the **Boost range** and the **Boost offset** table so that the boost control valve gives us the boost pressure we want.

Next step is to set up the **M5 / Boost modifier** table.

This table can be set to all zeros. But then the boost control will always try to achieve the set boost pressure. Even if the throttle is only half open. This will make the pressure rise before the throttle, and in turn that the exhaust back pressure before the turbo will rise. The effect of that is that the on/off throttle response may be a bit jerky. It also implies that the fuel consumption will go up slightly, due to the extra work for the pistons to push the exhausts out of the cylinders.

It is beneficial to set up the **Boost modifier** table similar to the example below.

Boost modifier (-510 .. 0) Kpa

Throttle position(%) — Intake temp(Deg C)

		65.0	76.0	95.0	100.0
40.0		-50	-50	-50	-50
80.0		-8	-8	-8	-8
100.0		0	0	0	0

Boost modifier table

Looking at the example **Boost modifier** table above, we can see that if the throttle is only 80% open, the **Boost setpoint** will be lowered by 8 KPA, and if the throttle is 40% open or less, the **Boost setpoint** will be lowered by 50 KPA.

The **Boost modifier** table can also be used for protection of the engine when the intake air temperature rise to a dangerous level.

Boost modifier (-510 .. 0) Kpa

Throttle position(%)		Intake temp(Deg C)			
		65.0	76.0	95.0	100.0
40.0		-50	-60	-60	-60
80.0		-8	-28	-48	-60
100.0		0	-20	-40	-60

Boost modifier table with protection at high intake air temperatures

The Boost modifier **table in**

will protect the engine against increasing intake air temperatures by taking away from the **Boost setpoint** to prevent detonation damages to the engine. The example shows that if the intake temperature rise above 65 degrees, the **Boost setpoint** will start to be lowered. At 76 degrees, boost is reduced by 20 KPA. At 95 degrees it is reduced by 40 KPA. And at 100 degrees the boost pressure is reduced by 60 KPA to protect the engine.

Now we have configured the boost control.

Selecting boost table based on used gear

The first two parameters in the **Boost setup** menu determine which of the three available **Boost setpoint** tables the SM4 will select, based on which gear we are on.

The **Boost setpoint** tables are where one selects the wanted boost pressure.

Parameter **Boost setpoint 1-2** determines which **gear ratio**, (Kph/Krpm) that will select the **Boost setpoint 2** table instead of the **Boost setpoint 1** table.

The **gear ratio** is in units of kilometers per hour times 1000 divided by the engine speed in rpm.

If the **gear ratio** is above the value set in parameter **Boost setpoint 1-2**, then **Boost setpoint 2** table will be used.

For this to work, it is essential that there is a **Vehicle speed** signal connected to the SM4, and that **Speed setup** is properly configured. See chapter about **Speed setup** for more information.

If we want to use the **Boost setpoint 1** table on first gear, and the **Boost setpoint 2** table on gears 2 and up, then set parameter **Boost setpoint 1-2** to a value in between the gear ratios of first and second gear.

Example:

> Lets say that the **gear ratio** on first gear is 8.78 Kph/Krpm, and the **gear ratio** on second gear is 14.79 Kph/Krpm. (8.78 + 14.79) / 2 = 11.785 Kph/Krpm. Setting parameter **Boost setpoint 1-2** to the value 11.79 will make it so that the **Boost setpoint 1** table is used on first gear, and that the **Boost setpoint 2** table will be used on second gear and higher.

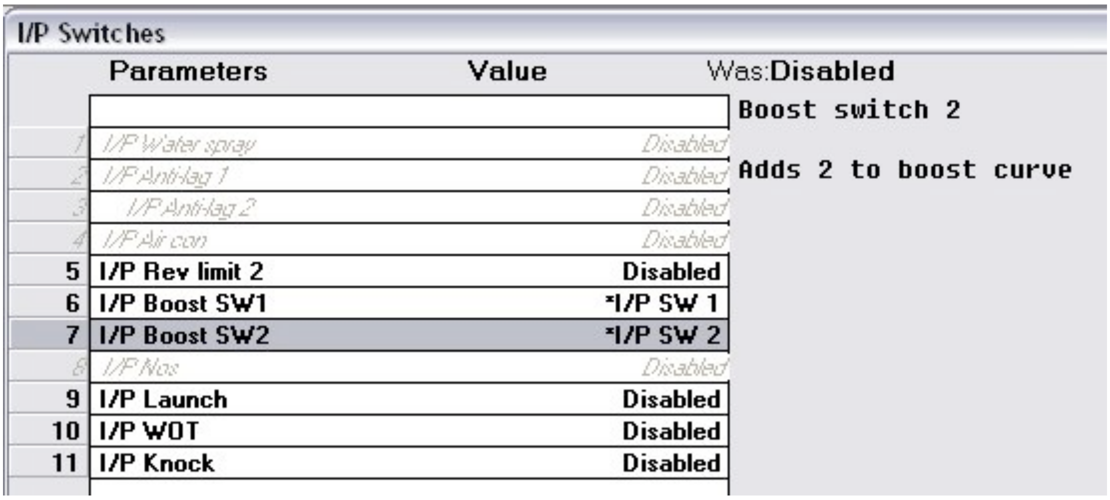
Parameter **Boost setpoint 2-3** determines which **gear ratio** that will select the **Boost setpoint 3** table instead of any of the tables **Boost setpoint 1** and **Boost setpoint 2** in the same way that the parameter **Boost setpoint 1-2** works.

Selecting the **Boost setpoint 3** table has priority over the other two tables. So when the **Boost setpoint 3** table is selected, the parameter **Boost setpoint 1-2** is overridden. This is true for both the ways to select **Boost setpoint** table. Either with the **Boost setpoint** parameters or with external switches.

Lets say we don’t want the boost table to be selected based on choosen gear. Then we simply disable it by setting both the parameters **Boost setpoint 1-2** and **Boost setpoint 2-3** to a very high value that will never be reached. For example 300 Kph/Krpm.

Selecting boost table by external switches

In menu **M1 / I/P Switches**, up to two input switches can be assigned for selecting one of the three **Boost setpoint** tables, using the parameters **I/P Boost SW1** and **I/P Boost SW2**.



Boost setpoint table switches

If both switches are off, the **Boost setpoint 1** table is selected.

If **I/P Boost SW1** is on, the **Boost setpoint 2** table is selected.

But if **I/P Boost SW2** is on, the **Boost setpoint 3** table is selected regardless of how **I/P Boost SW1** is set.

The Boost setpoint tables may be selected by any combination of gear ratio as described in chapter above, or external switches, and even based on internal switches.

Autronic Software User Guide

All menus may not covered here, due to software upgrades . Use F1 to bring up the on screen help.

FileCal Menu

Open cal file

Open a previously saved calibration.
If online to an ECU at the time of opening you will overwrite the existing program in the PC memory and temporarily in the ECU. You will be prompted with "overwrite existing calibration" when doing this. When the program is loaded press F4 to permanently store the program in the ECU.

- With the file window open press "CTRL" key for possible options.

Save cal as

Save calibration file as.
Save ECU program to a new file on PC hard disk.

- With the file window open press "CTRL" key for possible options.

Quick save cal

"F2" key

Quick save calibration file.
Allows the F2 key to save calibration to current selected file.
This feature only becomes active when

- You have selected a file to save
- You then select that file as "Quick save cal".

Compare

Open another file to shown the values that are different from the current calibration.
Values that are different with have a x before them. As curser is positioned over each cell the difference is displayed at the top of the window. Example: Comp = -7.1
Once a compare file is open, you can copy compare data into calibration from table.

Change ECU type

Change ECU type.
Select between different chip versions or models. If your ECU model is not shown, ask an Autronic dealer for the version to use.

File comment

File comments which are stored with in the file you are going to save. This stays with the ECU and file once saved.

COPY files to

BACKUP/RESTORE files.
Copy calibration OR data log files to other drives.

Communication

"F3" key

Go on line.

PC data cable must be connected and ignition switched on. ECU calibration/program will be loaded into PC memory.

Go off line.

Will go off line & prompt you save changes if any have been made.

Communication config

Can set up the communications and disconnect the FIFO on windows 98 ONLY from this dialog. Click on "Advanced" and turn the FIFO tick box. Make sure the FIFO is disabled on the windows serial port settings as this makes communication speed faster.

Windows 98.

Do this via the "FileCal"," Communications config" & click on the advanced button & turn off FIFO.

Windows 2000,XP

This is done via "My computer" properties

1. Device manager
2. Click on Ports(COM & LPT)
3. Click on port using (ie COM1)
4. Go to properties of COM1
5. Click on Port settings
6. Click on advanced
7. Turn FIFO off and Click on OK

Exit

"Alt" + "X" key

Exits the program. Will prompt if want to save changes & store calibration in ECU if any have changed.

Edit-window Menu

This menu has different looks depending from witch menu you came from. Some functions are only available from some menus.

Edit-Window - Table mode

Inc small
“ =” key
Small increment. Uses the "=" key which is labelled with the '+' key.

Dec small
“-“ key
Small decrement. Uses the "-" key

Inc large
“Shift” + “=” key
Large increment. Uses the Shift + "=" key which is labelled with the '+' key.

Dec large
“Shift” + “-“ key
Large decrement. Uses the Shift + "-" key

Enter
“Enter” key
Options for Enter box.
*1.2
Multiply the cell by 1.2

*1.2/1.3
Multiply the cell by 1.2/1.3

/1.2
Divides the cell 1.2

1.2/1.3
Place constant 1.2/1.3 result in cell

XYX+
Adds to cell XYZ

XYZ-
Subtracts XYZ from cell

- If results are outside the cell will be shown as an error. Error can be syntax which means cannot understand what want to do or range which means new data will fall out of range.

Insert axis
“Insert” key
Select axis that you want to insert a line & then will prompt you for the value.
Enter value will enter the value on the axis.

Delete axis

"Delete" key

Deletes a line from a selected axis.

Edit main axis

"E" key

Edits the axis value only.

Keys

Common Keys used for particular window.

Move Right/Left/Up/Down

"Right/Left" key

Moves cursor right.

- If hold cursor down will accelerate.

Start/End table

"Home/End" key

Move to start/end of table.

Next/Prew table

"Page DN/Page UP" key

Jumps to next/prev table in the windows main menu.

Copy value Right/Left/Up/Down

"Shift" + "Right/Left/Up/Down"

Copy current focused table value to the right/left/up/down.

Maths

Copy current focused table value to the right.

Table multiplier

Multiply cells by factor.

- When in tagged mode, only modifies data from tagged cells.

Table offset

Offset cells by offset.

- When in tagged mode, only modifies data from tagged cells.

Export/Import/Print

Allows data to be exported (ie to printer or clipboard) or imported (From another file or a compare file or the original data).

Read from external file

Reads table only from a file you select.

- When in tagged mode, only loads data into tagged cells.
- If importing into table with no sub tables, you can decide to use current or imported axis.

Read from DIFF

Reads table only from the difference seen in calibration.

- When in tagged mode, only loads data into tagged cells.

Read from COMPARE

Reads table only from the compare file calibration.

- When in tagged mode, only loads data into tagged cells.

Import from clipboard (CSV) format

Reads data in from "Export to Clipboard (CSV) format".
This allows you to copy between tables from different screens.

- When in tagged mode, only loads data into tagged cells.
- Can import files from other ECU software programs if they have an export function to CSV format. Copy the CSV file into the clipboard then can import (See format). If not then manually edit the file until it fits the format.

Format

Expects import data to be the following format.

Line
----
1. (Header)
2. (X items)(Comma)
3. (Y items)(Comma)
4. (0)(Comma)(X axis X item)(Comma)
5. (Y axis data)(Comma)(Data)(Comma)
6. Rest of table rows

Print

Prints page.

Export to clipboard

Sends page data to the clipboard. In a format that's easy to past into e-mails etc.

Export to clipboard (CSV) format

Sends page data to the clipboard in CSV format.
Makes it easy to import into a spread sheet program.
Used also when want to copy tables between windows. Export it into clipboard and then "Import from clipboard (CSV) format" into the table.

Attribute

Attributes are used in AUTOTUNE but can be used to show sites you have edited or do not want changed.

Fine tune
"F" key
Sets to fine accuracy. This is shown as a green cell.

Course tune
"C" key
Sets to course accuracy. This is shown as a yellow cell.

Set user attr
"A" key
Sets the user attribute which will not allow AUTOTUNE to modify it.
Shown as a blue cell.

Clear attribute
"R" key
Clears the site attribute.

Edit attr
"CTRL" + "A" key
Edits the attribute to what accuracy you want.

Copy attr
"CTRL" + "Right/Left/Up/Down" key
Copy site attribute right./left/up/down.

View table
Can view the table in different views.

- Can zoom the table to see more detail.
- Can view as table or graph

Zoom Table
"V" key
Zooms table to full screen with out live data detail.

View table
"G" key
Converts table to 3D graph or graph 3D to table.

Find site
Finds the site that engine is running at.

Table running value
Input the axis values and software will return the table running values. Can be used to find the value between table sites.

Manual A/F Tune
Allows manual editing of the fuel table by entering the measured A/F ratio at the site.
NOTE: If attribute set then cannot enter menu.

Setup Auto tune
Sets up the Auto tune parameters.

They are:
Accuracy, Color protection, Initial map state & sensor position (Base fuel only).

Table properties

Shows the table properties.

Sites Used.

How many sites used by table

Maximum sites

How many are possible

Also shows if any axis is common to other tables.

Tag item

You can tag cells so that only those cells are edited via tagging functions.
You may want to multiply only selected cells or load selected cells from another calibration.

Edit-Window - Tagged Mode

Linear left to right

Linear interpolates from left to right.

- When in tagged mode, only modifies data from tagged cells.
- When in tagged mode uses the last tagged cell as basis for interpolating.

Linear top to bottom

Linear interpolates from top to bottom.

- When in tagged mode, only modifies data from tagged cells.
- When in tagged mode uses the last tagged cell as basis for interpolating.

EXP left to right

Exponential function left to right.
You can select the gradient for this.

- When in tagged mode, only modifies data from tagged cells.
- When in tagged mode uses the last tagged cell as basis for exponential function.

EXP top to bottom

Exponential function top to bottom
You can select the gradient for this.

- When in tagged mode, only modifies data from tagged cells.
- When in tagged mode uses the last tagged cell as basis for exponential function.

Edit-Window - Strip chart

Select X axis

"X" key

Selects the X axis for displaying the strip chart.
When select SEC as X axis, its a standard time strip chart but when select Engine speed then its a XY strip chart.

Up/Down arrow keys then adjust time in an XY strip chart which is how long it goes back through the logged data.

Zoom in/out

"Up/Down" key

Zooms graph in/out. Works in default time steps

Lines 1..4 on 1 plot

"1" key

Can select a single item to plot. If want to zoom all items plotted on line 3 to a single line then can do it here.

Lines 1..2

"2" key

Plots data points that are specified in the Colors/ranges menu that are on line 2 or displays line 1 and line 2 on the graph. You toggle between the two modes by pressing 2. Makes it easy to zoom line you want to full screen quickly.

Lines 1..3

"3" key

Plots data points that are specified in the Colors/ranges menu that are on line 3 or displays line 1,line 2 and line 3 on the graph. You toggle between the two modes by pressing 3. Makes it easy to zoom line you want to full screen quickly.

Lines 1..42

"4" key

Plots data points that are specified in the Colors/ranges menu that are on line 4 or displays line 1,line 2,line 3 and line 4 on the graph. You toggle between the two modes by pressing 4. Makes it easy to zoom line you want to full screen quickly.

Graph color/spans

Options.

1. Select items to display on the graph (Space bar).
2. Set minimum and maximum graph or instrument ranges for graphing or virtual drive (Press enter on selected item).
3. Set the line you want to graph to when graphing (Press enter on selected item).
4. Sets the color for graphing (Press enter on selected item).

   Keys: Enter = Set edit limits.

   Space = Select item to graph.
5. To save changes press enter & select "Save new settings" item.

- In virtual drive, "Space bar" graph select does not work. To graph an item you create a strip chart.
- Limits adjusted here has no effect on the "PC warnings & selection" menu.

Print page

Prints the current page to printer.

Edit-Window - Display log

Move

“Right” or “Left” key

Moves cursor right or left.

- If hold cursor down will accelerate.

Move 20%

“CTRL” + “Right” or “Left” key

Moves time buy 20% to the right. Useful when want to scroll quickly but still see what data is doing.

Zoom in/out

“Up” or “Down” key

Zooms graph in or out. Works in default time steps.

Start/End of page

“Home/END” key

Jumps cursor to start or end of current page only.

Start/End of record

“ CTRL” + “Home/END” key

Jumps to start or end of page 1

Center graph

“Space” key

Center cursor to centre of page.

Page forwards/backwards

“Page DN/Page Up” key

Jumps cursor 1 full page forwards or backwards.

View complete record

“V” key

View complete graph record so can see all the data over the logged time span.
Useful when want to see the whole data quickly. When pressing the "V" again will drop back to the last time span.
So press "V" to view the whole graph then move cursor to where you want to examine data then press "V" again and have it zoomed to normal again.

Graph colors/spans

Options.

1. Select items to display on the graph (Space bar).

2. Set minimum and maximum graph or instrument ranges for graphing or virtual drive (Press enter on selected item).
3. Set the line you want to graph to when graphing (Press enter on selected item).
4. Sets the color for graphing (Press enter on selected item).
   Keys: Enter = Set edit limits.
   Space = Select item to graph.
5. To save changes press enter & select "Save new settings" item.

- In virtual drive, "Space bar" graph select does not work. To graph an item you create a strip chart.
- Limits adjusted here has no effect on the "PC warnings & selection" menu.

Single line plot
“1” key

Can select a single item to plot. If want to zoom all items plotted on line 3 to a single line then can do it here.

Lines 1..2
“2” key

Plots data points that are specified in the Colors/ranges menu that are on line 2 or displays line 1 and line 2 on the graph. You toggle between the two modes by pressing 2. Makes it easy to zoom line you want to full screen quickly.

Lines 1..3
“3” key

Plots data points that are specified in the Colors/ranges menu that are on line 3 or displays line 1,line 2 and line 3 on the graph. You toggle between the two modes by pressing 3. Makes it easy to zoom line you want to full screen quickly.

Lines 1..4
“4” key

Plots data points that are specified in the Colors/ranges menu that are on line 4 or displays line 1,line 2,line 3 and line 4 on the graph. You toggle between the two modes by pressing 4. Makes it easy to zoom line you want to full screen quickly.

Insert overlay
“Insert” key

Inserts overlay files.
When found matching logged items will show the running cursor value on the status line. This is only shown to the 1st overlay file. Overlay files can be offset in time.
When more then two overlay files opened will show lines with different symbols.

Statistics
“S” key

When no data marked will show statistics on complete data record.
When marked only shows statistics on marked data. Statistics are the following with in the time range. Minimum & maximum, Mean, Rate(Units/sec from last time range to first time range only, not the average) & standard deviation.

Press ENTER for options to export. Can export to clipboard or printer.

Mark block
“T” key

Starts or stops a marked block.
Press "T" then move cursor or click with mouse to position want to mark then press "S" for statistics on this data. "T" again to clear.

Next/ Prev tab
“L” or “K” key

Jumps to the next or previous tabbed item in the current window.

- This is common to all tabbed items in this window so do not have to uses mouse to jump between tabs.

Print page

Prints the current page to printer.

Print all

Prints all the pages at the current time span. Larger time span means less pages to print.

Edit-Window Monitor – Virtual dash

Insert instrument
“Insert” key

Insert an instrument.
They can be a Normal, Bar graph, Dial or stripchart.

Delete instrument
“Delete” key

Deletes a focused instrument

Edit instrument
“E” key

Edits a the focused instrument. Can change it from a dial to a stripchart.

Open screen layouts

Opens exiting screen layouts.
The preview screen shows how the screen layout looks. Crosses across the instrument means, that item will not be loaded into the screen. Reason is, the live variables in that item, does not exist in the current log file.

Save screen layouts

Saves current screen layout.
Crosses across the instrument means, that the item will not be seen in the current screen if loaded.

Graph colors/spans

Options.

1. Select items to display on the graph (Space bar).
2. Set minimum and maximum graph or instrument ranges for graphing or virtual drive (Press enter on selected item).
3. Set the line you want to graph to when graphing (Press enter on selected item).
4. Sets the color for graphing (Press enter on selected item).

   Keys: Enter = Set edit limits.

   Space = Select item to graph.
5. To save changes press enter & select "Save new settings" item.

- In virtual drive, "Space bar" graph select does not work. To graph an item you create a strip chart.
- Limits adjusted here has no effect on the "PC warnings & selection" menu.

Edit-Window - Virtual drive

Insert instrument
"Insert" key
Insert an instrument.
They can be a Normal, Bar graph, Dial or stripchart.

Delete instrument
"Delete" key
Deletes a focused instrument

Edit instrument
"E" key
Edits a the focused instrument. Can change it from a dial to a stripchart.

Play
"Space" key
Plays or stops the virtual drive.

Forward/Backward
"Right/Left" key
Move forward or backward in time.

Start/End of record
"Home/END" key
Jumps to start or end of page (start/end of logged data)

Open screen layouts
Opens exiting screen layouts.
The preview screen shows how the screen layout looks. Crosses across the instrument means, that item will not be loaded into the screen. Reason is, the live variables in that item, does not exist in the current log file.

Graph colors/spans

Options.

6. Select items to display on the graph (Space bar).
7. Set minimum and maximum graph or instrument ranges for graphing or virtual drive (Press enter on selected item).
8. Set the line you want to graph to when graphing (Press enter on selected item).
9. Sets the color for graphing (Press enter on selected item).

   Keys: Enter = Set edit limits.

   Space = Select item to graph.
10. To save changes press enter & select "Save new settings" item.

- In virtual drive, "Space bar" graph select does not work. To graph an item you create a strip chart.
- Limits adjusted here has no effect on the "PC warnings & selection" menu.

Menu M0

User ID String

User ID string is shown on top of screen. This is saved inside ECU calibration program.

Store cal in ECU

Make changes permanent inside ECU. The F4 key is the shortcut to this feature.

- If you have saved the calibration to disk before this, then can always load the calibration back again.

Undo Store

Undo stores that have been performed.
When doing comparisons on different maps settings, tune then store, then tune new values then store. You then can quickly jump between two settings by selecting each store.
Undo Store shows which table was opened when store and the time stamp.

ECU Error history

Must be on-line. Shows errors recorded in ECU.

Status

Now

Error is now present.

Recent

Error was recent.

ECU telltales

Telltales (Maximum or minimums) recorded inside the ECU.
Only valid when on-line.
"Knock record at" records the boost pressure, engine speed and coolant temperature that the "Knock retard threshold" was reached.

Reset ECU telltales by pressing enter once dialog open.

Stepper power reset

Resets the stepper.

- Setup stepper in "M1,O/P setup" menu.

See Monitor-I/O for stepper position

Monitor – Normal

Monitors the selected variable only.
This give a faster Packets/sec rate on the PC data logging as compared to Monitor all. Parameters selected in the Logger "PC warnings select" menu are shown here.
Useful when ECU is password protected or do not want a table opened to display live data.

- When ECU is password protected, some live data parameters will read zero.
- This is the default window when ECU goes on-line. Press "ALT" or escape key to access menus.

Monitor – Engine

Monitors ECU ENGINE variables.
This gives a slower Packets/sec rate as all request variables must come from ECU.
Useful when ECU is password protected or want to monitor a variable quickly.
Want to check what the throttle volts is in volts as compared to percent.

- When ECU is password protected, some live data parameters will read zero.

Monitor – Sensors

Monitors ECU SENSOR variables.
This give a slower Packets/sec rate as request all variable from ECU.
Useful when ECU is password protected or want to monitor a variable quickly.
Want to check what the throttle volts is in volts as compared to percent.

- When ECU is password protected, some live data parameters will read zero.

Monitor – I/O

Monitors ECU I/O variables.
This give a slower Packets/sec rate as all request variables must come from ECU.
Useful when ECU is password protected or want to monitor a variable quickly.
Want to check what the throttle volts is in volts as compared to percent.

- When ECU is password protected, some live data parameters will read zero.

Monitor GPC

Monitors ECU GPC(General purpose control) variables.
This give a slower Packets/sec rate as all request variables must come from ECU.
Useful when ECU is password protected or want to monitor a variable quickly.
Want to check what the throttle volts is in volts as compared to percent.

- When ECU is password protected, some live data parameters will read zero.

Monitor – Virtual dash

Monitors via a custom screen that can be made up of instruments and strip charts, that can be imported from virtual drive screen layouts.
To get data in stripcharts, PC logger has to be running. See "Logger" menu for more information.
When exiting screen, the current screen layout will be saved as PCDASH.SCR.

- When ECU is password protected, some live data parameters will read zero.

WARNING:
Range of instruments is changed under
"Graph colors/spans" but the warning limits it under the "PC warnings & select". "Graph colors/spans" will not give ANY warning if data goes out of that range.

Menu M1

Base Settings

1	Primary fuel method		Baro & MAP
2	Engine cycles		4 stroke
3	Overall fuel mult	6.600	
4	Comp. ratio	8.5	
5	Clear flood TPS	90.0	%
6	Stoic A/F ratio	14.7	:1

Primary fuel method:

BARO & MAP

Engines with less then one throttle butterfly per cylinder, with or without turbocharger. Set "Base Fuel delivery" y axis as LOAD.
Multi-throttle turbo engines OR Multi-throttle non turbo engines.
(Note pressure readings needs to be after butterfly)
Set "Base fuel delivery" y axis as Throttle.

BARO & TPS

Non turbo multi-throttle engines. (These can also be BARO & MAP)
Set "Base fuel delivery" y axis as Throttle.

Engine Cycles:

Options - 4 Stroke or 2 stroke engine.

Overall fuel calibration Multiplier:

OVERALL FUEL MULT = 8.112 * D / I

D = Cylinder volume (in c.c)

I = Injector flow rate(in c.c/minute) @ operating pressure.

This value is used to get the numbers in the main fuel table within the 0 to 200 range. e.g:- If this value is too small you may need numbers bigger then 200 in the fuel table. This value is only for this purpose and can be changed from the calculated value on startup to get the engine running, rather than changing the main fuel table numbers.

Comp Ratio:

Compression ratio of the engine.

Clear Flood TPS:

Clear flooding throttle limit.

Amount of throttle opening required beyond which no fuel is injected during cranking. Default=90.0

Stoic A/F Ratio:

Stoichiometric air fuel ratio.

The exact air-fuel ratio to completely combust a fuel. Used by CLC (Closed Loop Control)   Default=Petrol engines 14.7.

Ignition Setup

1	Ignition O/Ps	3 O/P 6Cyl-WS	
2	Ign trigger edge	-ve edge (PULSE)	
3	Ign delay time	10	uSec
4	Ign retard clamp	-40.0	
5	Ign advance clamp	50.0	

Ignition Ouputs:

When creating custom firing order/angles, start with the closest type from list and then modify in advanced. For firing order changes, modify "Start at Event" in advanced mode only.

TS=Twin spark (engine with twin spark plug per cylinder)
WS=Wasted spark with (Multi-coil)
SC=Single coil
MC=Multi-coil (one coil per cylinder)
Mux=External multiplexer required to create extra spark events.
4C/6C-Tacho=Spare ignition O/P used as tacho signal

NOTE
TS(Twin spark) split can be setup in Advanced, "Ignition Base angles" or "M2, Ignition trims, Ign cylinder trims".
Major trigger/injection events per cycle.

Some of the common options are,

O/P 1..1 4cyl-SC. (Four cylinder engine with a distrubtor and single coil)
O/P 1..4 4cyl-MC. (Four cylinder engine with four coils)
O/P 1..2 4cyl-WS. (Four cylinder engine with two double ended coils)

O/P 1..1 6cyl-SC. (Six cylinder engine with a distrubtor and single coil)
O/P 1..3 6cyl-WS. (Six cylinder engine with three double ended coils)
O/P 1..4 6cyl-Mux. (Six cylinder engine with six coils and Multiplexer)

O/P 1..1 8cyl-SC. (Eight cylinder engine with a distrubtor and single coil)
O/P 1..4 8cyl-WS. (Eight cylinder engine with four double ended c

Ignition Trigger Edge:

Options are,
-ve edge (DWELL)
+ve edge (DWELL)
-ve edge (PULSE)
+ve edge (PULSE)

For coils with internal igniter modules or If using external dumb modules select -ve edge (DWELL)

Bosch 124, 200, 211, 300 or other dumb ignition modules. Select -ve edge (DWELL)

Ignition systems like Honda , that use inverted dwell, select +ve edge (DWELL)

Autronic R500 CDI select -ve edge (PULSE)
MSD or Crane HI-6 select +ve edge (PULSE)

Ignition Delay Time:

Ignition delay time.
Delay Time between ECU ignition command and commencement of spark.
Default=10.

Ignition Retard Clamp:

Minimum ignition timing allowed.
Can be used set limits for distributor cap ignition systems, so spark will not jump to another spark plug lead tower when using antilag.
For Distributors the default setting is -40

Ign Advance Clamp:

Maximum ignition timing allowed.
Can be used set limits for distributor cap ignition systems, so spark will not jump to another spark plug lead tower at maximum advance.

For Distributors the default setting is 50

Ignition Dwell Table

This table is only effective if using Dwell in menu *Dwell Control Mod.*
If you do not have the correct dwell setting for this table then, see the "How to find the correct dwell time" under Dwell in this manual.

COIL TYPE	TYPICAL CHARGE TIME
COIL ON PLUG	1.8 MS
DUAL POST COIL	3.5 MS
SINGLE STANDARD COIL	2.5 MS
SINGLE FAST CHARGE COIL	2.0 MS

Ignition coil dwell time table. Dwell can be setup based on engine rpm and up to 14 other Y axis parameters. See "M1-Table Axis Setup".
The default for the Y axis is Battery Voltage.

Injectors

Injectors

Injector selection. Select your injectors or similar, If you not find yours contact your dealer for correct settings. If paralleled up two low current injectors, select [Pair] option. High current injectors do not have this option.

Inj group 5..8

Injector groups 5..8 currents. Can be set different to main group 1..4

- When main group low current injectors but using [pair] which is hi-current, then set this group 5..8 to High.

I/P Cylinder & sync

Cylinder and sync patterns, sensors type, edges to trigger, cylinder I/P lead angle (So ignition timing reads same as timing light).

Cyl & Sync pattern

Options:

- Pulse per cycle
- Ford TFI
- Mitsubishi special
- Mitsubishi EVO 1..9
- Subaru 1994-00
- Subaru 2001-05
- Pre-scalar

Pre-Scalar

EFP divider factor:

Number of teeth per engine cycle divided by "Trigger events/cycle".

Example
60 minus 2 trigger(4 stroke)
4 cyl=(60*2/4)=30
60 minus 2 trigger(2 stroke)
6 cyl=(60*1/6)=10

Typical
60 tooth 4 stroke
4 cyl=30
5 cyl=24
6 cyl=20
8 cyl=15
10 cyl=12
12 cyl=10
36 tooth 4 stroke
4 cyl=18
6 cyl=12
8 cyl=9
12 tooth 4 stroke
4 cyl=6
6 cyl=4
8 cyl=3

Divider offset:

Adjust until "Sync/Cyl" is between 20%..80%

Typical
Subaru WRX 01..05=16

NOTE
Cannot be larger then "EFP divider factor"-1.

Number of missing teeth:

Typical
0=Pre-scalar only.
1=36-1 Ford type.
2=60-2 Motronic type and 36-2 Toyota type.

Sync on missing pulse:

Enabled for single sensor triggering.

Typical=Disabled

Enabled
4 stroke with missing teeth on the camshaft once per engine cycle.
2 stroke with missing teeth once per engine cycle.

Cylinder Sensor
Cylinder sensor type

1. Reluctor
Sensor polarity must be as follows. On plus input pin, wave should rise first then fall through trigger point.

2.

2. Hall
Connect sensor to +ve input pin only. No connection to -ve input pin allowed. Either shorten -ve input lead back to shield or cut wire near connector pin.

All two wire sensors are magnetic. Some three wire sensors are also magnetic. Three wire sensors with power supply are Hall Effect.

Cylinder trig edge
Cylinder trigger edge.
Which edge to trigger on.

1. Rising
2. Falling
3. Rising and falling (select this for Ford TFI trigger)

.

Cylinder I/P filter
Cylinder I/P filter.

Subaru WRX 01..04=Fast
One pulse per TDC=Slow

Sync pulses
Default=0
Sync sensor
Sync sensor type

1. Reluctor
Sensor polarity must be as follows. On plus input pin, wave should rise first then fall through trigger point.

2.
2. Hall
Connect sensor to +ve input pin only. No connection to -ve input pin allowed. Either shorten -ve input lead back to shield or cut wire near connector pin.

All two wire sensors are magnetic. Some three wire sensors are also magnetic.
Three wire sensors with power supply are Hall Effect.

Sync trigger edge

Sync trigger edge.
1. Rising
2. Falling

Sync I/P signal

Enabled: If no sync I/P signal, ignition is inhibited. Multi-coil engines needs a sync I/P.

Disabled: Single coil engines will run with no sync I/P. However, the injection angle will be wrong.

Cyl I/P lead

Cylinder Input lead angle.
The number of degrees BTDC the cylinder pulse trigger edge occurs.
Default=60.0 degress
When "Cyl & sync pattern"="SUBARU 01..04"=70.0
Trim up ignition timing so screen and timing light read same.

Digital angle filter:

Fast = Use with precision crank mounted triggers only.

Slow = Cylinder trigger sensor is on the distributor or crank trigger teeth spacing are of poor quality.

I/P Switches

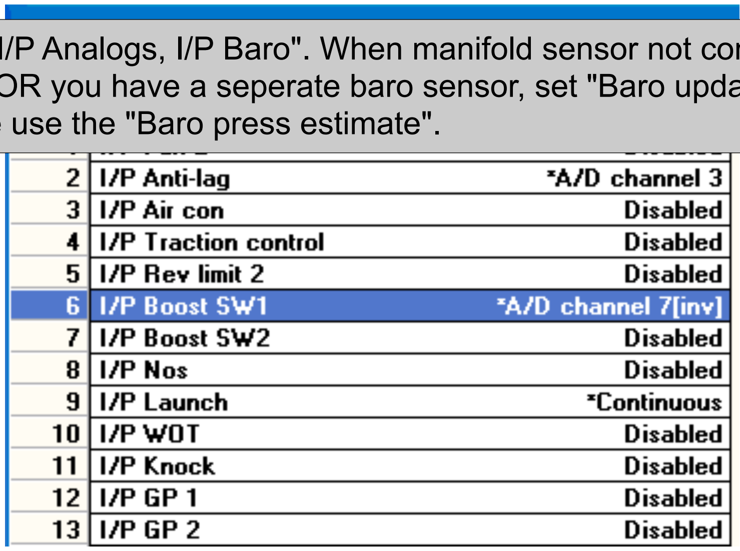
The *I/P Switch* menu is used to enable and configure auxiliary input functions. Inj 6,7 & 8 can be used as switched inputs if not used for fuel. Also HIS 1, 2 & 3 can be used. The analog inputs but can be used as input switches if a pull-up resistor is used, see wiring at the end of this manual. Two different I/P channels can use same analog input pin, some I/P channels can have different thresholds for turning on/off functions at a specific voltage.
When selecting an input channel some functions will be available through other menus like I/P Traction control, launch control, WOT and more. Some auxiliary functions may also need to be configured under *O/P Setup* to be available like *Anti-Lag* and others before the menu will be available.

Chose a function and press “Enter” and you will be directed to a list of selectable inputs, variables or just enabling a function without any input pin (Continuous) .

Example below:-

Select *I/P Launch* press “Enter” then select *continuous* press “Enter”, the function will now always be on. If using a speed sensor and configure Launch under menu M5 *Launch Control* you will have a fully automated Launch control. Anti-lag select channel 3, Boost SW1 select channel 7 Inverted (press key “i” before enter).

NOTE: See "I/P Analogs, I/P Baro". When manifold sensor not connected to the manifold OR you have a seperate baro sensor, set "Baro update" to "Sensor" else use the "Baro press estimate".



2	I/P Anti-lag	*A/D channel 3
3	I/P Air con	Disabled
4	I/P Traction control	Disabled
5	I/P Rev limit 2	Disabled
6	I/P Boost SW1	*A/D channel 7[inv]
7	I/P Boost SW2	Disabled
8	I/P Nos	Disabled
9	I/P Launch	*Continuous
10	I/P WOT	Disabled
11	I/P Knock	Disabled
12	I/P GP 1	Disabled
13	I/P GP 2	Disabled

The Boost SW1 that is inverted means function is normally on and off when channel 7 is grounded. A function that is inverted will be on (even if the wire is not connected at all) and when grounded off.

Some channels have selectable thresholds; if set to 50% the channel switch at 2.5 Volt (I/P anal

NOTE: If changed the fuel pressure then can compensate this number by multiplying by Square_Root(Last_fuel_press/New_fuel_press)

If set to 20% it will switch at 1.0 volt. If you want a I/P function that is off at 0 to 1.0 volt and on at 1.1 to 5.0 you select threshold 20% and Inverts the I/P (if not inverted it will be on 0 to 1.0 volt and off at 1.1 to 5.0).

The I/P GP functions can be used to store variables and using it in other functions like GPC.

O/P Setup

The *O/P Setup* menu is used to enable and configure auxiliary functions.
Some functions need an output to be enabled. Some functions that have no physical output can select "ON-No O/P" which enables the function, but to no pin.
Stepper motors need to select the O/P pins then the stepper sequence(Properties).
H-Bridge types, need both sides of the bridge for this to function. You will need to select push/pull type drivers.
When problem with O/Ps, this menu is shown red with the status "Conflict".

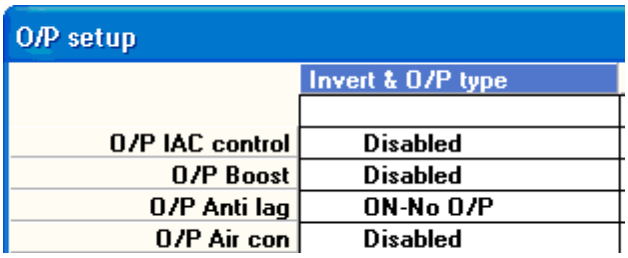
Some outputs can be paralleled for increased output current rate.

Chose a function and press “Enter” and you will be directed to a list of selectable outputs, variables or just enabling a function without any output pin.

Some outputs have more submenus like PWM, Stepper and if selecting Multi select O/P for increased output current. Move to the right with “Arrow” key and press “Enter” for editing the submenus.
Most outputs pull to ground when enabled, but the Ignition outputs (if available) and stepper outputs are push-pull type and switch between +12 Volt and ground, when inhibited or not used they are potential free.
See *Output Channel Electrical Characteristics* in this manual for further information.

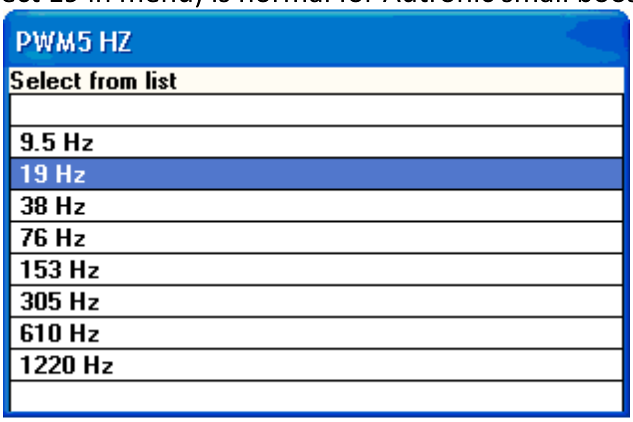
Example Anti-Lag and no output pin are used:-

Select *O/P Anti lag* press “Enter” chose On-No O/P press “Enter”. Anti Lag can now be configured under menu *M5 – Anti Lag*.



Example Boost control to PWM 5 O/P:-

Select *O/P Boost* press “Enter” chose PWM 5 O/P press “Enter”. Move to the right with “Arrow” key to “Properties”, press “Enter” and select frequency for the boost solenoid to operate at, 20Hz (select 19 in menu) is normal for Autronic small boost solenoid.



Example GPC 1 O/P to the four Stepper outputs for increased output current:-

Select O/P *GPC 1* press “Enter” chose one mR type (Multi Re-direct), press “Enter”. Move to the right with “Right Arrow” key to “Invert & Select”, press “Enter” and select the desired outputs (you chose more than one here) with “Space Bar”, press “Enter”. You can also select the fervency like the example above.

O/P setup

	Invert & O/P type	H-Bridge setup	Invert & select Pin	Properties
O/P IAC control	Disabled			
O/P Boost	Disabled			
O/P Anti lag	Disabled			
O/P Air con	Disabled			
O/P GPC 1	[ ] PWM1 O/P		[ ] P5.0 [ ] P5.1 [ ] P5.2 [ ] P5.3	10 Hz

Inverting an output;
When inverting an output it actually inverts the function, if using an output table as below;

User table H (0 .. 30000) Rpm Target[GPc1=Engine speed]

Throttle position(%) \ Engine speed(Rpm)	1000	7000
10.0	0	0
20.0	0	100
30.0	100	100
100.0	100	100

If output is inverted (press “i” when selecting output) and table look like above the output result would be like this;

User table H (0 .. 30000) Rpm Target[GPc1=Engine speed]

Throttle position(%) \ Engine speed(Rpm)	1000	7000
10.0	100	100
20.0	100	0
30.0	0	0
100.0	0	0

Tip:-

If using a Push-Pull output (Stepper & Ignition O/P) and invert you can use it for supplying power (instead of ground, as most outputs) to a Shift-light, Error light, Fan relay or others that needs power (+12 volt) instead of ground.
As said earlier the Push-Pull type switch between +12 volt and ground, when inhibited or not enabled the output are potential free.
When you invert a Push-Pull output it is actually like shifting output polarity, If you connect one Push-Pull output to a stock fan relay and fan stops instead of starting you just needs to invert the output.

I/P Analogs

Setup and liniearizes analog I/Ps

- Manifold pressure (External or internal)
- Throttle position (Self learn or fixed)
- Air temperature (Autronic, NTC etc..)
- Water temperature (Limp home also)
- Battery voltage
- Air fuel ratio
- Baro (Setup also)
- EBP (Setup also)

Other general purpose analog I/Ps
- Oil pressure
- Oil temperature
- Fuel pressure
- Fuel temperature
- Exhaust temperature

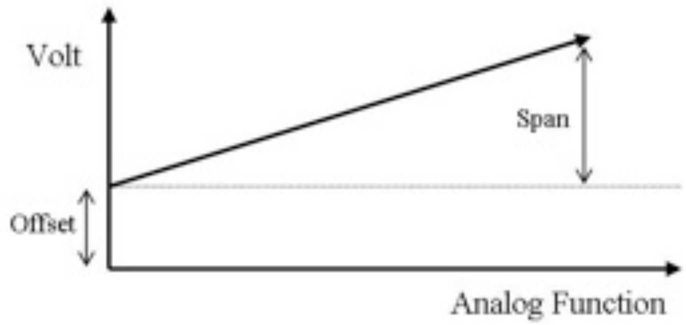
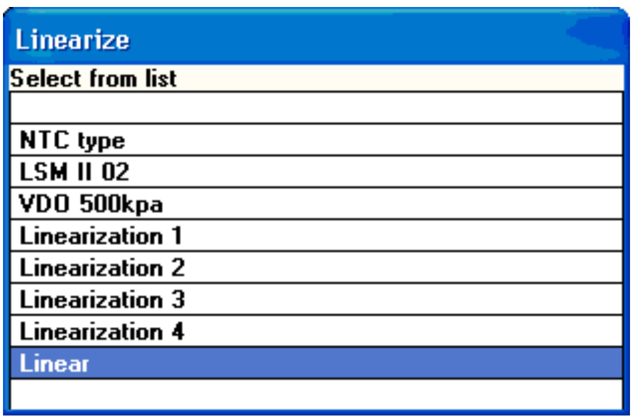


Diagram displaying Offset & Span when using function Linear

Note that each A/D channel only can have one setting, like threshold, span & offset or Linearization table. If you adjust the A/D channels input, see below.
It will affect all other *Analogs* that use same A/D Channel.



I/P Manifold

Manifold pressure input select. Enter for more pre-defined sensors. Default=Internal
USER DEFINED=Define internal or external (On some models only), span and offsets.

I/P TPS

Input Throttle position sensor

Span & offset can be configured manually, but calibration should normally be done as follow;

1. Ignition switch on, engine stopped.
2. Disconnect throttle position electrical connector for at least 20 seconds.
3. Reconnect throttle position electrical connector.
4. Ensure that throttle is closed for at least 5 seconds.
5. Fully open the throttle for at least 5 seconds.

New limits of throttle travel will have been learnt and stored in the ECU during the above procedure. Additional ECU functions ensure that throttle stops and sensor wear are compensated for over the life of the engine. The above procedure need only be repeated if the butterfly / sensor assembly is serviced or replaced.

I/P Air Temp

Input air temperature sensor.
Options;

- Autronic standard(Pre defined lookup)
- NTC(Pre defined lookup)
- Linearization 1..4(Uses linearization tables 1..4).
- Linear(Custom span and offset for linear sensor).

I/P Coolant

Input air temperature sensor.
Options;

- Autronic standard(Pre defined lookup)
- NTC(Pre defined lookup)
- Linearization 1..4(Uses linearization tables 1..4).
- Linear(Custom span and offset for linear sensor).

I/P Batt

Battery voltage.
Linear is only option.
NOTE, May be trimmed to read correct volts.

I/P A/F Ratio

Input air fuel ratio sensor.
Select the analog channel that's A/F sensor is connected too.

- For A/F control, must be in air fuel ratio units only.
- This is a general purpose input so can be linearized to any scale.

I/P Spare A/F

Spare input air fuel ratio sensor.
Select the analog channel that the A/F sensor is connected too.

- For A/F control, must be in air fuel ratio units only.
- This is a general purpose input so can be linearized to any scale.

I/P EBP

EBP input channel.
Analog channel for exhaust back pressure.
If EBP error detection enabled, make sure that the EBP limp home table is mapped.

I/P Baro

Barometer input.
Selects the analog channel for barometric sensing.
Default=Manifold pressure
When manifold sensor not connected to the manifold OR you have a separate baro sensor, set "Baro update" to "Sensor".
If manifold sensor connected to manifold, and do not have a separate baro sensor, set "Baro update" to "Table" and tune the "Baro press estimate" table.

Baro press estimate

If ECU has no extra baro sensor, then ECU can estimate the baro pressure by specifying the pressure drop across the butterfly.
Recommended when throttle/pressure mapping a non turbo engine.

NOTE: -Ve number disables correction.

I/P Analog 1 – 4

Setup an analog channel to be linearization and then written to the destination channel.

- Some sensors need pull up resisters.
- Make sure reading is correct for the whole span of the analog input range (0..100%).
- Make sure that extra sensor do cause interference with engine sensors.
- Make sure that analog channels do not write to same variable.

Linearization 1 – 4

Linearization table.
Analog channels can use these tables.

- If use the same type of sensor more then once, you can linearize this sensor and use the same linearization table for each sensor. That is why the linearization table has no units.
- To see which analog inputs use this table, look at menu.
- Tables axis is in ECU ROM. This is fixed.

I/P HSI

High speed inputs.

Setup

- Vehicle speed.
- Digital air flow meter
- Variable camshaft input

I/P HSI 1&2

Input HSI 1
Select functions
Disable=None
Cam 1=(Camshaft position 1). For camshaft control, need to setup "Variable cam setup" and "GPC"

Trigger edge

Pulse trigger edge.
"SUBARU 01..04 pnp"=-ve edge ONLY.

"SM4"
Reluctor sensor type.
Must fit external reluctor interface & MUST select +ve edge.

Hall.
Can be +ve or -ve edge or divide by 8.

NOTE1
External reluctor sensor setup. Sensor polarity must be as follows. On plus input pin, wave should rise first then fall through trigger point.

NOTE2
Vehicle speed I/Ps, recommended 6 teeth per rev.

HSI scale factor

I scaling factor.
Scales I pulse inputs.
I/P I as
Disabled=(Scale not used)
Cam position=(Set to 1.0000)
Road speed=(Meter/Pulse or Wheel circumference(meters) divided by number of pulse per rev)

I/P HSI 3

Input slow HSI 3
Select functions
Disable
Vehicle speed (Recommended for vehicle speed I/Ps with <10 pulses/rev)

HIS slow scale

HSI scaling factor.
Scales HSI pulse inputs.
Recommended for vehicle speed I/Ps with <10 pulses/rev
I/P HSI as

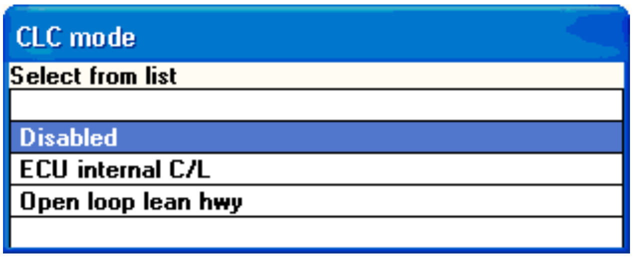
Disabled=(Scale not used)
Road speed=(Meter/Pulse or Wheel circumference(meters) divided by number of pulse per rev)

CLC A/F Ratio

Closed loop control air fuel ratio.
For adaptive correction of air fuel ratio.
Here you enable and configure the CLC (closed loop control). CLC is used to correct air fuel ratios to maintain Stoichiometric air fuel ratio of 14.7:1 to unsure correct operation of catalytic converter.

For the CLC to operate correctly the engine must be first tuned within 1 or 2% of required CLC air fuel ratios.

The CLC has two modes, ECU internal C/L and open loop lean hwy (highway), see below.



For ECU internal C/L to work you need to have a O2 sensor connected to the SM4 and configured under *I/P ANALOGS – I/P A/F Ratio*.

CLC only operates when the engine is no longer in warm up enrichment. The highway mode is optional, and can be selected in the software set up. Highway mode is achieved when the ECU logic determines the engine is in highway mode.

The Open Loop air fuel table is used to setup ECU internal C/L and open loop lean hwy AF ratios.

The CLC will only operate on air fuel ratios Stoichiometric (14.7) or leaner. In internal C/L it will ignore air fuel ratios leaner than stoichiometric and maintain stoichiometric air fuel ratio.

Typhical stoichiometric volts for normal 4-wire Bosch O2 sensors are 0,640 Volt.

Variable Cam Setup

Variable camshaft setup.
Sets the error tolerance and camshaft offsets.
NOTE: Need to setup the "I/P HSI" channel and GPC(General purpose control) for camshaft feedback.

Gearing Ratios

Gearing Ratios are set for each gear so the SM4 can determine which gear is in use. Used for different boost maps on different gears, Traction control and displaying selected gears in the log.

The value corresponds to vehicle Kph at 1000 rpm in each gear.

Example:-

Diff ratio = 4.10
Gear ratio = 3.874
Tyre rolling = 2.1 meter each turn

(1000 / 4.10 / 3.874) x 2.1 = 132.2 meter/min
(132.2 x 60 / 1000) 7.93 Kph/1000 RPM

Air flow Sensor

Air flow sensor are set up here, consult your dealer.

Limp Home Tables

Limp Home tables are used as a backup in case of sensor failure.
Setup limp home tables

1. Manifold pressure
2. Throttle position (TPS)
3. Exhaust back pressure(EBP)

- Coolant temperature limp home is setup under "I/P Analogs", "I/P Coolant".

Limp home Manifold

Calibration table that allows the throttle position sensor to act as a back-up in the event of a pressure sensor failure, thus ensuring almost normal engine operation. This is used for limp home in applications where pressure is the primary engine load input.

Limp home TPS

Calibration table that provides a limp-home function if the throttle position sensor is faulty. This table uses the same engine speed calibration sites as the manifold pressure failure table limp-home table. Calibration range is 0 to 100% in 0.1 % increments.

Limp Home EBP

Calibration table that allows the manifold absolute pressure sensor to act as a back up in the event of this pressure sensor failure, thus ensuring almost normal engine operation. This is used for limp home in applications where pressure is the primary engine load input.
Calibration range is in KPa(Gauge).

Advanced Setup

Setup the engine TDCs for ignition and fuel odd fire/dual injector engines.
THIS IS AN ADVANCED FUNCTION.

Base angles (IGN)

Base angles (Ignition).
First make sure that you coils, number of cylinders, ignition edges and dwell control mode is set as changing any of these later on, will remove your custom TDC setup.
Also make sure that "Engine setup","TDC spacing" is set to a known setup.
Now edit the angles at each TDCs to suit your engine.

NOTE
Rotary, set base splits and tune "M1,Ignition trims,Ignition cylinder trims"

Base angles (Fuel)

Base angles injection.
First make sure that you coils, number of cylinders, ignition edges and dwell control mode is set as changing any of these later on, will remove your custom TDC setup.
Also make sure that "Engine setup","TDC spacing" is set to a known setup.
Now edit the angles at each TDCs to suit your engine.

NOTNOTE:
FOR STAGED INJECTION, TURN INJECTORS ON/OFF BY SETTING INDIVIDUAL CYLINDER TRIMS TO 61.7% FOR OFF STATE.

M1 tables axis setup

Any table that can have the x or y axis changed are setup here.
NOTE, Some of these axis may be in sub menus.

Menu M2

Base Fuel Delivery

Basic fuel delivery calibration table providing fine (0.1%) adjustment of fuel. This table, the engine "load", barometric pressure and corrections dependent upon intake and coolant temperature, acceleration and deceleration and external trims determine the actual rate of fuel delivery for all engine operating conditions. The table data values being a representation of the engines "Volumetric efficiency" allows considerable simplification of the calibration procedure.
Up to 32 engine speed and 16 engine load dependent calibration sites may be chosen at random calibration intervals giving up to 512 adjustment points.

The engine load variable used in this table and others that follow below is a function of throttle position if throttle position is chosen as the primary input and a function of manifold absolute pressure if pressure is the primary input.
Values in the table are just numbers and do not relate to anything. Increase values to richen and decrease to lean.
You can modify directly from taken A/F ratio readings by using Manual Tune or by correcting via a data logged file under mixture tables.
Also see Cylinder fuel trims,AUX fuel comps,Charge temp estimate, Baro press estimate, accelerator pumps warm up/cold start compensations.
See "M1,Base settings" for Fueling overall multiplier and primary fuelling method.

Main Ignition Timing

Base ignition timing table can be setup as throttle position or manifold pressure mapping on the Y axis. Set this up under "M2 tables axis setup".
When pressure mapping, the LOAD values relate to absolute manifold pressure in Kpa.
e.g:- LOAD 50% = -50 kpa
LOAD 100% = 0 kpa
LOAD 200% = 100 kpa
Values in the table are actual degrees of ignition timing. Ignition modifiers can be setup under "Ignition trims".
Make sure ignition advance, retard limits are not exceeded. (See "M1,Engine settings")

Overrun ign Timing

Engine speed dependent ignition timing calibration for stable combustion under closed throttle conditions. The adjustment range is the same as the base ignition timing calibration table above. The table comprises a single row using the same engine speed calibration sites as the base fuel delivery table above.

Overrun ignition timing can be used to set the engine ignition timing on deceleration.
Adding values similar to the light load values in the main ignition table can soften the transition from normal running and deceleration. This also can help engine breaking if all values are set to 0. Overrun ignition timing can have modifiers under "M2, Ignition trims". Overrun limits can be set under "ECU limits setup" menu.

Injection angle

Injection angle in crankshaft degrees. Value can be from 0 to 717.Default value = 360 degrees .Change this value to find the optimum injection angle.

Calibration of the actual positioning of the fuel injection pulse within the engine cycle, dependent upon engine speed and engine load. Calibration may be selected at up to 20 engine speed sites and 5 engine load sites with a resolution of 2.8 crankshaft degrees.

Tune example: With the engine idling, hold down the + or - key to increase or decrease the end angle value at the idle rpm site in the table. Keep sweeping back and forwards from 0 to 720 deg until you find the point where the engine runs the roughest.
There will be two rough points, pick the roughest and make the value in the table 50 less then this value. The high rpm settings will need a dyno to find the correct value, but as a guide make them about 40 less then the idle value.
Example:- Roughest point at idle = 370

370 - 50 = 320

RPM
1000 6000
320 280

NOTE: Y axis also used by Injection cylinder trims.

Target A/F

Target A/F ratio table.
Used by CLC (Closed Loop Control) and Autotune as the target air fuel ratio.

Set air fuel ratio values you require CLC or/and Autotune to tune the engine too.

Below is an example table for a turbocharged engine. There are many engine variables that affect the required air fuel ratio, plus fuel octane and the application the engine will be used. A engine used for drag racing can use leaner mixtures than an endurance engine.

			RPM			
Load	1000	1500	2000	3000	4000	6000
30	13.5	13.5	14.7	14.7	14.7	14.7
50	13.5	13.5	14.7	14.7	14.7	14.7
70	13.5	13.5	14.7	14.7	14.7	14.7
90	13.5	13.5	13.5	14.7	14.7	14.7
100	12.7	12.7	12.7	12.7	12.7	12.7
150	11.8	11.8	11.8	11.8	11.8	11.8
200	11.2	11.2	11.2	11.2	11.2	11.2
220	10.8	10.8	10.8	10.8	10.8	10.8

A/F ratio table.

Fuel trims

Sub menus contain

- Individual cylinder trims 1..8
- Auxiliary fuel compensations 1..3
- Charge temperature estimation table
- Baro pressure estimation table

X & Y axis setup in "M2 tables axis setup".
NOTE, If any trims set, will be shown as "ON".

Inj Cylinder Trims 1-8

Injection cylinder trims

Individual calibration trim tables for each injection group (ie:-cylinder) to correct for injector calibration differences or individual cylinder efficiency differences due to non-ideal manifold.

If you want an extra AUX fuel compensation table, you can uses these tables as long as you use the same compensation value for each cylinder
Y axis is setup under "Tables axis setup"

Aux Fuel Comp 1

This table can be used as and external mixture correction (ie idle mixture control). You select the analog channel under "M2 tables axis setup" and the analog channel percentage is percentage of correction applied.

ie AUX Fuel comp 1=1.2 which is 20% correction.
Analog channel=100%
Formular for gain is (Analog channel-50%)
+ve = multiply
-ve = divide.

Maths is 0.2*(1.0-0.5)=0.1
This will give an AUX Fuel comp 1.1

The X & Y axis is setup under "Tables axis setup".

Make sure that engine is already mapped before applying this auxiliary compensation. These tables can become a band-aid fix if "Base fuel delivery" table is not mapped properly which creates there own problems.

Aux Fuel Comp 2

The X & Y axis is setup under "Tables axis setup".
Make sure that engine is already mapped before applying this auxiliary compensation. These tables can become a band-aid fix if "Base fuel delivery" table is not mapped properly which creates there own problems.

Aux Fuel Comp 3

The X & Y axis is setup under "Tables axis setup".
Make sure that engine is already mapped before applying this auxiliary compensation. These tables can become a band-aid fix if "Base fuel delivery" table is not mapped properly which creates there own problems.

Ignition trims

Sub menus contains;

- Individual ignition cylinder trims 1..16
- Ignition modifier setup
- Ignition modifier 1
- Ignition modifier 2
- Ignition modifier 3

X & Y axis setup in "M2 tables axis setup".

NOTE1, Ignition modifier 1,2,3 can be applied to the following tables;

- Main ignition table.
- Overrun ignition table.
- Idle ignition table.
- Crank ignition table.

NOTE2, Ignition modifier 4 is under "M3" menu.

NOTE3, If any trims set, will be shown as "ON".

Ign cylinder trims 1-16

Individual ignition trims can be applied.
Before applying an ignition trim on a cylinder for knock, make sure that cylinder is not running leaner.
Y axis setup under "M2 tables axis setup".

Ign mod setup

Ignition Modifier 1-4 configures here, if they would affect main, crank, idle and overrun ignitions.

Ign modifier 1-3

Ignition modifier 1-3 can be applied to the following tables:

- Main ignition table.
- Overrun ignition table.
- Idle ignition table.
- Crank ignition table.

This is done via the "Ign mod setup" menu
X & Y axis is setup under "Table axis setup"

NOTE, There are also ignition modifier 4 available under "M3" menu.

Knock Tune

You need to enable this function by assigning it an I/P before you can use it.
You assign I/Ps under "M1","I/P switches". Knock input sets how the knock detector records errors.
NOTE:, Knock detector expects the Tacho O/P to be enabled and correct polarity. Knock board software must be setup.

Charge Temp Estimate

This is the actual temperature of the air that goes into the engine after it has passed by the manifold and entered the combustion table.
Lower engine speeds means that the air will be effected by the water temperature in the manifold. Higher engine speeds means the air temperature is less effected by the water temperature.
Depending on where the air temperature sensor is position can effect the actual charge temperature of the engine.

This is difficult to map, as to do it properly you need to record the air, water and A/F at two different air and water temperatures with no choke or other compensations making an affect.

Calibration represents % contribution that coolant temperature has in determining the charge temperature, its range is 0 to 100% in 0.5% increments. This calibration is particularly useful for 2 stroke engines where the charge temperature is almost totally determined by crankcase temperature.

!! WARNING WARNING WARNING !!
Always re-check mixtures after changes.
Make sure NO warm up trims are active.
Engine should be already mapped.

Recommended to edit this table via "Edit-Window","Charge edit assist" as this will trim the "Base fuel delivery" table for minimal effect on the already mapped engine. If you do this manually, you will have to re-map the "Base fuel delivery" on every change to this table!!.

"Charge temp estimate" is the contribution of coolant & air temperature to make up "Charge temp". If this table is correct, air and coolant temperature changes (With in normal warmed up engine running conditions), will not effect the A/F ratio.

Contribution example.
Charge temp estimat=0%(Charge temp=Air temp)
Charge temp estimat=100%(Charge temp=Coolant)

Higher percentage makes "Charge temp" more bias to coolant temp. The higher the load & rpm, the smaller the "Charge estimate" value should be. This is because the air has less time to be warmed by the coolant.

NOTE1: Water cooled engines, vary the air temp & trim the "Charge est" so that the mixture does not change.

Air cooled engines, vary the engine temp (After a little cool down).

NOTE2: "Water cooled engines (Constant water temp)".
Higher air temp=Leaner mixture then INCREASE "Charge est".

"Air cooled engines (Constant air temperature)".
Higher engine temp=Leaner mixture then DECREASE "Charge est"

NOTE3
SM4-Default
LOAD(%)\Engine speed(Rpm)=Charge temp estimate(%)

	0	850	7000
0.0	99.6	13.7	7.8
100.0	99.6	13.7	7.8
200.0	99.6	10.2	3.1

M2 Tables axis setup

Any table that can have the x or y axis changed are setup here.
NOTE, Some of these axis may be in sub menus.

Menu M3

Accel pumps setup

Setups the following

- Acceleration fuel maximum limit.
- Acceleration Throttle Rate Threshold

Accel part TPS limit

Acceleration enrichment part throttle position.
Throttle position that corresponds to 80% engine torque.
Sets the throttle position above which the closed throttle acceleration multiplier no longer has an effect on acceleration fuel delivery. This calibration is dependent upon the relative size of the throttle butterflies to the engine capacity. Calibration range is 0 to 100% of throttle opening.

Do not change these values until the fuel and ignition tables are fully mapped.
Making changes before all fuel sites are tuned can cause confusing tuning problems.

Accel closed TPS X

Acceleration closed throttle multiplier.
Sets the amount of additional fuel delivered for increasing throttle openings starting from a closed throttle condition. Controls the delivery of fuel for acceleration from small throttle openings

Do not change these values until the fuel and ignition tables have been fully mapped.
Making changes before all fuel sites are fully tuned can cause confusing tuning problems.

Accel open TPS X

Acceleration open throttle multiplier.
Sets the amount of additional fuel delivered for increasing throttle openings starting from a part throttle condition. Controls the delivery of fuel for acceleration from large throttle openings.

Do not change these values until the fuel and ignition tables are fully mapped.
Making changes before all fuel sites are tuned can cause confusing tuning problems.

Accel decay time

Acceleration decay time. The period after the throttle stops moving that enrichment continues.

Do not change these values until the fuel and ignition tables are fully mapped.
Making changes before all fuel sites are tuned can cause confusing tuning problems.

Accel recovery time

Acceleration recovery time. The period of time before enrichment recommences after throttle is again depressed.

Do not change these values until the fuel and ignition tables are fully mapped.
Making changes before all fuel sites are tuned can cause confusing tuning problems.

Decel enlenment mult

Deceleration enleanment multiplier.

Do not change these values until the fuel and ignition tables are fully mapped.
Making changes before all fuel sites are tuned can cause confusing tuning problems.

Ign adv attack rate

Ignition advance attack rate (Degrees/second)
Sets the maximum rate at which the ignition timing is allowed to advance. Can be used to improve driveability and/or reduce exhaust emissions. Calibration range 6.2 to 1593.8 deg/sec.

Ign adv decay rate

Ignition advance decay rate (Degrees/second).
Set the maximum rate at which the ignition timing is allowed toretard. Can be used in conjunction with above to improve driveability and/or reduce exhaust emissions. Calibration range 6.2 to 1593.8.

Decel TPS dashpot

Deceleration throttle dashpot calibration. The amount of delay before idle control valve returns the engine speed back to idle speed.

Ign time const

Ignition acceleration and deceleration time constant.

Ign mod 4 comp

Ignition acceleration and deceleration compensation.

Ign mod 4 min clamp

Ignition acceleration and deceleration retard clamp.

Ign mod 4 max clamp

Ignition acceleration and deceleration advance clamp.

Fuel time const

Fuel acceleration and deceleration time constant.

Fuel accel mult

Fuel acceleration and deceleration multiplier.

Fuel decal clamp

Fuel deceleration clamp.

Fuel accel clamp

Fuel acceleration clamp.

M3 tables axis setup

Any table that can have the x or y axis changed are setup here.
NOTE, Some of these axis may be in sub menus.

Menu M4

W-U Enrichment mul

Warm up enrichment multiplier.
Controls overall warm up enrichment. Values of 1.000 = no enrichment.
This calibration table allows engine coolant temperature and engine "load" dependent control of additional fuel delivery. It controls additional fuel delivery after the initial post start enrichment period has finished, and its main function is to ensure stable engine operation during engine warm-up. It can also be used to enrich the air/fuel mixture at high engine loads if an engine

overheated condition is detected in order to minimise the risk of engine damage. Calibration may be selected at up to 13 engine coolant temperature sites and 10 engine "load" sites and the adjustment range is 1.00 to 1.99 times the base fuel delivery.

Do not change values until base fuel table is fully mapped.

NOTE, When engine's at running temperature, should have enrichment multiplier of 1.000
Y axis setup in "Table axis setup".

P-S Enrichment mul

Post start enrichment multiplier.
Additional fuel delivery immediately after start-up is controlled by this table, this additional delivery decays away with time to the warm-up enrichment value from the table above. Calibration range is 1.00 to 3.99 times the base fuel delivery. This calibration function is only engine coolant temperature dependent and it uses the same engine coolant temperature 'calibration sites as chosen for the warm-up enrichment calibration table above.

Do not change values until base fuel table is fully mapped.

P-S Enrich timeout

Post start enrichment time out.
The period after the engine starts that post start enrichment operates. This table controls the decay time for the additional fuel delivery immediately after start-up. Calibration range is 0 to 51 SEC. This calibration function is only engine coolant temperature dependent and it uses the same engine coolant temperature calibration sites as chosen for the warm up enrichment calibration table above.

Do not change values until base fuel table is fully mapped.

W-U Fast Idle inc

Warm up fast idle increase.
Extra engine RPM increase above idle RPM during engine warm up period.
Uses idle control to provide the higher idle speed.Calibration for idle speed increase required of automatic idle speed control function during low temperature engine operation. This calibration table may also be used to increase the idle speed if engine overheating occurs so that engine driven cooling fan efficiency is improved helping to elevate the condition. Calibration range is 0 to 1020 RPM. This calibration uses the same engine coolant temperature calibration sites as chosen for the warm-up enrichment calibration table above.

P-S Fast idle inc

Post start fast idle increase.
Extra engine RPM above normal idle speed immediately after engine start.
Uses idle control valve to provide the higher idle speed.Calibration for idle speed increases immediately following start-up. Decays away with time to warm-up fast idle RPM calibration. Calibration range is O to 1020 RPM. This calibration uses the same engine coolant temperature calibration sites as chosen for the warm up enrichment calibration table above.

P-S FastIdle timeout

Post start fast idle time out.
Period of time after engine is started "Post start fast idle increase" operates for.

Uses idle control valve to provide the extra RPM. Decay time for post start fast idle increase. Calibration range is 0 to 51 SEC. This calibration uses the same engine coolant temperature calibration sites as chosen for the warm-up enrichment calibration table above.

W-U accel enrich mul

Warm up acceleration enrichment multiplier.
Calibration multiplier for additional engine coolant temperature dependent acceleration enrichment. Calibration range is 1.0 to 8.0 times the "warm" engine value. This calibration uses the same engine coolant temperature calibration sites as chosen for the warm-up enrichment calibration table above.

Do not change values until base fuel table is fully mapped.

W-U decal enleanment

Warm up deceleration enleanment multiplier.

IAC-proportion range

Idle air control proportion range.
To find range of valve select idle speed of 6000 RPM in "Idle speed table".
Record the engine RPM.

Example:- engine RPM = 3400
Next set idle speed to 100 RPM in "idle speed table".
Record the engine RPM. Example:- engine RPM = 600

To find the Range,
3400 - 600 = 2800 Range

Add 50 RPM to the Range to get the final value, 2800 + 50 = 2850 Range.

IAC-closed rpm value

The rpm that corresponds to the IAC valve at the closed position.

IAC-minimum opening

IAC minimum opening. Minimum IAC valve position allowed. Helps stop engine stalling.

Cranking ignition

Cranking ignition timing.
Ignition timing during initial RPM when starting.

Crank ignition timing can have modifiers under "M2,Ignition trims".

Idle ignition

Idle ignition timing while throttle position is less than 1%.

Can be setup on engines without idle control valves to maintain idle speed when A/C or transmission is engaged.

Example:-

Required idle RPM = 800

	Engine speed(Rpm)			
	750	800	2000	3000
IGN Deg	30	10	10	30

If while the engine is idling at 800 RPM the A/C was switched on, the engine RPM would drop only slightly as the additional timing at 750 RPM would stop RPM dropping.
The additional timing at 3000 RPM will help the engine to smoothly return to idle.
When setup as Idle ign delta RPM, the x axis is the idle error. -ve means idle is too fast, +ve means idle speed is too slow.
Manifold pressure(Kpa)\Idle speed error(Rpm)=Idle ignition(Degrees)

	-400	-200	0	200	400	500
40.0	5.0	0.0	10.0	15.0	20.0	20.0
50.0	5.0	0.0	10.0	15.0	20.0	20.0
60.0	5.0	0.0	10.0	15.0	20.0	17.0

- Y axis can be selected in "Table axis setup"
  Idle ignition can drop back to main map with manifold pressure. See "Idle ignition setup" menu. Idle ignition timing can have modifiers under "M2,Ignition trims".

Idle speed table

Idle speed control.
Sets engine idle speed based on battery voltage.

Example:-
Required idle speed 800 RPM

	Battery voltage(Volts)	
	12.00	13.50
RPM	1000	800

The engine would idle at 800 RPM when battery voltage is 13.5 volts or higher.
If battery voltage drops to 12.0 volts the idle speed will increase to 1000 RPM.

Idle ignition setup

Idle table select

Select idle ignition timing table.

Options:
Disable: Does not use the idle ignition table.
Idle ignition table
Uses the idle ignition table.
Idle ign delta RPM X axis of idle ignition tables is the error in idle speed..

Idle ign threshold

The manifold pressure that changes back to the main ignition table.

Typical=65.0
This only applies if "Idle table select" is set to the idle ignition table.

IAC Tuning

Tunes the IAC parameters.

IAC Tuning

	Parameters	Value	
1	IAC Actuator type		Bosch 2 wire
2	IAC Dead band	100	Rpm
3	Slow adapt rate	100	
4	Slow adapt (no F/B)	800	
5	IAC Dynamic comp	10	
6	IAC Stall saver	25.0	%
7	IAC extra fuel	0.0	%
8	IAC position, 0 rpm	60.0	%
9	IAC dither		Enabled

Some of the tunning parameters are also tables, they are

- IAC-proportion range
- IAC-closed rpm value
- IAC-minimum opening

Check the "IAC limits" for parameters that will drop out IAC control.

IAC Actuator type

IAC actuator calibration.

Linear:

1. Ford 2 wire (O/P PWMs)
2. Stepper (O/P stepper)

Bosch 2 wire:

Standard Bosch 2 wire (O/P is PWMs)

USER DEFINED:

Define your own calibration for IAC valve. The "IAC Actuator cal" will appear in the main menu. This is an advanced calibration.

IAC Dead band

IAC dead band +/-
Typical=40

Slow adapt rate

Slow adaption rate, Higher value faster to target rpm, to high it will oscillate.
Typical=1200

Slow adapt rate (no F/B)

Slow adaption rate, no feed back.
Typical=800

IAC Dynamic com

Idle air control valve dynamic compensation.
Controls the idle valve over compensation rate.
Used to stop engine RPM hunting during idle control.
Larger value = more compensation.
Typical=30

IAC Stall saver

Stall saver percent
Typical=2.0
See "IAC-Limits" for engine speed "Stall save threshold".

IAC Extra fuel

IAC extra fuel.
How much extra fuel in percent is given when the IAC valve moves.
Typical=0.2

IAC Position , 0 rpm

IAC position when engine speed is at zero rpm.
Typical=20.0
NOTE: 100% is special case that gives no power to valve when engine speed is zero.

IAC dither

Special function. Helps give higher resolution.
NOTE: This may increase the wear rate of some stepper motors.

IAC limits

Sets the IAC limits. This disables IAC control on particular situations.

IAC TPS follower

This uses the IAC valve to try and give the vehicle smoother driving.
Set "Follower gain" to 0 to disable IAC TPS follower.

1	Follower gain	50.0	
2	Vehicle moving limit	5.0	Kph
3	Enable TPS limit	5.0	%
4	Moving RPM limit	500	Rpm
5	Stopped RPM limit	200	Rpm
6	Moving RPM decay	120	Rpm/sec
7	Stopped RPM decay	20	Rpm/sec

Follower Gain:

Set to 0 to disable this function.
Large value causes quick decay.
Typical setting = 50

Vehicle Moving Limit:

Throttle position that enables the IAC TPS follower logic. Sets the vehicle speed to switch from Stopped and the Moving RPM limits and decay.
Typical setting = 5

Enable TPS Limit:

Trigger throttle position for the follower. Operates any time TPS excides this value.
Typical setting = 5

Moving RPM Limit:

This value is added to the base idle speed and "Stopped RPM Limit" and stays active for the Moving decay period.
Typical setting = 500

Stopped RPM Limit:

This value is added to the base idle speed and stays active until the vehicle is under the moving speed and stays active for the Stopped decay period.
Typical setting = 200

Moving RPM decay:

Rpm/sec that IAC valve tries to follow when the vehicle is moving. Large value causes quick return the base idle speed plus the "Stopped RPM Limit". Smaller values can make for less drive line noise on deceleration.
Typical setting = 120

Stopped RPM decay:

Rpm/sec that IAC valve tries to follow when the vehicle is stopped. Large value Causes quick return to the base idle speed.
Typical setting = 20

IAC Actuator Cal

Only available if selected "User defined" in IAC Tuning Actuator type.
You have to work out the actual idle valve percentage with regard to the IAC valve position(%). If its a stepper, you do not need to compensate with battery voltage.

M4 tables axis setup

Any table that can have the x or y axis changed are setup here.

- Some of these axis may be in sub menus.

Menu M5

Boost Tune

Tunes the boost controller.
Sets the Boost control range and the boost setpoint gear selection.

Boost Range

50 kpa + (maximum boost – preset boost at waste gate) Ex, wastegate manually set to 40 kpa (0,4 Bar) and max boost is 120 kpa (1,2 Bar), 50+(120-40)=130 Boost range should be set to130 kpa.

- A bigger value has the effect of damping spiking.

Boost setpoint 1-2

Vehicle Kph at 1000 engine RPM in each gear.

Example:-

Diff ratio = 4.10
Gear ratio = 3.874
Tyre rolling = 2.1 meter distance

(1000/3.874/4.10)*2.1=132.2 meters/min.
(132.2*60/1000)=7.93 Kph/1000 RPM
"M1 Gearing ratios" uses the same logic

Boost setpoint 2-3

Vehicle Kph at 1000 engine RPM in each gear.

Example:-

Diff ratio = 4.10
Gear ratio = 3.874
Tyre rolling = 2.1 meter distance

(1000/3.874/4.10)*2.1=132.2 meters/min.

(132.2*60/1000)=7.93 Kph/1000 RPM
"M1 Gearing ratios" uses the same logic

Boost setpoint 1 – 3

Boost control set point

Set maximum boost in relation to engine RPM and a selected y axis "Setup under Table axis setup". Three turbocharger wastegate control calibration tables are available. The tables allow engine speed and engine coolant temperature dependent settings of the boost level controlled by the boost control function. The coolant temperature dependency of the table (if used) allows boost to be, reduced at elevated engine coolant temperatures in order to minimise the possibility of engine damage. The tables can have up to 10 engine speed calibration sites and 5 engine coolant temperature calibration sites. Calibration range is 104 to 510 KPa.
Tables 1, 2, 3 can be used so the engine runs different boost for every gear "Boost tune" sets this up or to switch between two boost levels (+1 or +2 levels setup under "M1, I/P Switches").

NOTE1:"Over boost margin", set under "ECU limits setup" is added to the "Boost setpoint X" you are using.

NOTE2: External boost controllers are not synced with the ECU, so they may cause an over boost limit error when you have a programmed "Boost setpoint X".

Boost dynamic comp

Boost control dynamic compensation.

Used to control how aggressively the boost valve is controlled to try and achieve the set point value. Lower value will give slower response but more stable boost with less spiking.

- Do not worry if the boost is above or below the set point. Use this setting to get a smooth boost line with minimum spiking, then use the boost offset tables to correct the pressure and get a flat boost line.

Boost offset

Used to correct actual decreases or increases in boost that occur above or below the desired boost levels set in boost set point tables. Setup this table after the boost controller is tuned and stable using the control range and dynamic comp settings. Correction values of –128 Kpa to 127 Kpa can be used.

Y axis for table can be setup under "Table axis setup".

Default Y axis=Boost setpoint

- Tune this parameter last.

Boost modifier

Boost modification.

Used to reduce boost pressure in relation to other variables.

Example:-

Boost can be reduced on high inlet air temperatures or made throttle position dependent.
X and Y axis can be setup under M5 Table axis setup

ECU limits setup

ECU limits setup

- Rev limiter

  Hard cut(H)=all injector or all ignition outputs are cut.

  Softcut(S)=one injector or one ignition output are cut at a time. Increasing the number of injectors or ignition outputs that are cut until the engine RPM is controlled.

  You can select between combinations of soft and hard. Turbocharged engines should use injector soft or hard cut or ignition hard cut. Soft ignition cut can cause

backfiring in the exhaust which can damage a
turbocharger.

- Overrun limits
  The percentage of throttle opening below which over-run shutdown will operate.
  Over-run is deceleration with closed or very small throttle openings.

- Over boost limits
  Over boost margin. Used to set the amount of boost above the set point is acceptable before the ECU cuts injectors.
  Over boost time. The amount of time the boost can excide the over boost margin before the injectors are cut.

  Typical values are, Over boost margin 50kpa, Over boost time 1 to 2 seconds.

OverRun shutdown com

Over-run shutdown commence.
The engine RPM above which over-run shutdown starts. Typical value would be 2400 RPM. Over-run is deceleration with small or no throttle opening. This will turn injectors off on over-run if engine RPM has exceeded the specified RPM. Can help engine breaking or popping in the exhaust on over-run. See ECU Limits setup for over-run throttle and load limit setting.

OverRun shutdown recovery

Over run shutdown recovery.
The engine RPM below which over run shut down disabled.
Typical value would be 1400 RPM. The engine RPM below which the injectors restart.

Rev limiter 1

Engine rev limiter.
Set engine RPM limits against engine temperature.

Example:-

	Coolant temp (Deg C)			
	0.0	70	115	120
RPM	4000	6500	6500	2000

In this example the engine rev limiter will not allow the engine to achieve maximum RPM until the engine temp is at or above 70 Deg. If the engine temperature exceeds 115 Deg the rev limiter will dramatically reduce the engines maximum RPM making it impossible to damage the engine due to overheating.

Rev limiter 2

You enable this function by assigning it an I/P before you can use it.
You assign I/Ps under "M1","I/P switches".
Engine rev limiter. Set engine RPM limits against engine temperature.

Example:-

	Coolant temp (Deg C)			
	0.0	70	115	120
RPM	4000	6500	6500	2000

In this example the engine rev limiter will not allow the engine to achieve maximum RPM until the engine temp is at or above 70 Deg.

If the engine temperature exceeds 115 Deg the rev limiter will dramatically reduce the engines maximum RPM making it impossible to damage the engine due to overheating.

Cut fuel/ign pattern

Fuel/Ignition cut pattern.
ECU cuts fuel/ignition by using 10 sequence cut pattern.
Pattern bits are for each cylinder 87654321.
0=Off, 1=On Default pattern for cylinders is

```
Cylinders
=========
87654321
=========
11111111  ;Pattern 1  This value only !!
11111111  ;Pattern 2  This value only !!
11101110  ;Pattern 3
11101110  ;Pattern 4
10101010  ;Pattern 5
10101010  ;Pattern 6
10001000  ;Pattern 7
10001000  ;Pattern 8
00000000  ;Pattern 9   This value only !!
00000000  ;Pattern 10 This value only !!
```

Anti-lag setup

You need to enable this function by assigning it an O/P before you can use it.
You assign O/Ps under "M1","O/P setup"

Anti-lag setup

	Parameters	Value	
1	Anti-lag IAC opening	100.0	%
2	Bi-pass load max	400.0	%
3	Anti-lag coolant max	95.0	Deg C
4	Anti-lag TPS min	0.0	%
5	Anti-lag rpm trig	700	Rpm
6	Anti-Lag time out	10.0	Sec
7	Anti-lag extra fuel	0.0	%

Autronic turbo-charger anti-lag system uses a coordinated fuel and ignition control strategy in conjunction with a large effective throttle opening to produce a substantial reduction in turbo-charger "lag". The system is effective from a standing start, throughout up & down shifts and when accelerating out of corners. The system can be used with a large fixed throttle opening, or in conjunction- with electro-mechanical throttle by-pass valve or a throttle "kicker" solenoid. The system incorporates an optional turbo-charger cool-down function that ensures rapid cool-down prior to engine shutdown.

This anti-lag system allows the engine's large throttle opening or bypass to produce a considerable amount of hot high velocity exhaust gas that sustains high turbo-charger speed.

This is achieved with a higher than normal idle speed (2000 to 4000 RPM typ.). The cool-down mode uses a different strategy to produce a large volume of cool exhaust gas for rapid turbo cool-down and it simultaneously controls idle engine speed with the large throttle opening required.

CAUTION
This anti-lag system, like all others, causes considerable heating of engine, exhaust valves, exhaust manifold, turbo-charger and exhaust system. Consideration must be given to the possibility of component damage or possible vehicle fire.

Set-up of the anti-lag system MUST NOT be attempted without monitoring EXHAUST GAS TEMPERATURE (EGT) in the vicinity of the turbine wheel. Knowledge of the maximum safe working temperature of the turbo-charger turbine is essential. A turbo tacho and a pressure gauge to measure the turbo compressor outlet pressure are also useful tools to assist in the setup of anti-lag.

!!!! IMPORTANT!!!!

1. Irrespective of the actual throttle opening used the ECU must be reset so that the selected open is seen by the ECU as 0% open. Throttle limit learning must be performed each time a new throttle stop setting is set.
2. Before attempting anti-lag set-up it is most important that correct fuel and ignition calibration be achieved for "normal" engine operation.

Anti-lag ignition

Ignition retard from base ignition.
Throttle opening, ignition retard and the resulting anti-lag no-load RPM must be chosen to produce the best compromise between excessive exhaust temperature and good anti-lag action. More throttle requires greater ignition retard to control no-load throttle closed RPM, and results in higher EGT. Anti-lag ignition timing for small capacity 4 valve central spark plug combustion

chamber engines should be in range -20 to -30 deg. For large capacity 2 valve engines -2 to -20 deg should suffice. Ignition timing retard should be maintained up to a MAP value as high as possible but must be eliminated before 1 atmosphere is reached to ensure adequate off-boost performance. Below anti-lag RPM normal ignition timing should be restored so that engine torque increases with decreasing RPM in order to stabilise RPM. Additional fuel during and-lag is often required to help control EGT. A value between 10 and 20% extra is usually beneficial. The User defined PWM table functions as the anti-lag ignition offset table 1% = 1 deg retard.

eg:- Anti-lag idle @ 2600 RPM approx. User Define PWM output %(0 to 100)

Load/RPM Example

	RPM		
LOAD	2400	2600	4000
97.0	0.0	40.0	50.0
98.0	0.0	0.0	0.0

TPS/RPM Example

	RPM		
TPS	2400	2600	4000
12.0	0.0	40.0	50.0
15.0	0.0	0.0	0.0

Engine idles @ 2600 RPM with 88 to 92 kPa MAP below butterfly with 30 – 40 = -10 deg ignition. Gives 130 to 150 kPa MAP above butterfly.

Y axis variable can be selected under "M5 table axis setup"

Typical=Throttle position

Anti-lag IAC opening

IAC opening when anti-lag is turned on
Typical=100

Bi-pass load max

LOAD value that will bi-pass anti-lag, When exceeded Anti-lag will continuo but IAC & output (if used to external solenoid) will close/shut off.

Anti-lag coolant max

Temperature below anti-lag will work, when above this anti-lag will shut off directly.

Anti-lag TPS min

Throttle position below this disable anti-lag, when below this anti-lag will shut off directly.

Anti-lag rpm trig

Rpm above which anti-lag is enabled, if using external switch for turning on anti-lag this setting is still effective. If the engine is under rpm trig it starts to count down the Anti-lag timeout until zero and shut off anti-lag (if not over rpm trig before it gets zero).

Anti-lag time out

How long anti-lag stays on after is de-activated, zero will disable the anti-lag function. If you only use external switch set this value to 0.1

Anti-lag extra fuel

How much extra fuel (percent) is added when anti-lag is active.

Anti-lag cut data

Y axis variable can be selected under "M5 table axis setup"
The anti-lag cut data cuts one cylinder at the time (for 25%) for some time before cutting next. If using 50% it cuts 2 igntion outputs (4-cyl with 4 ignition outputs) at the same time. Higher value = more aggressive anti-lag = more unburnt fuel in the exhaust.

Anti-lag cool down

The cooldown function produces a stable idle with an exhaust sound similar to that produced by engines fitted with long duration camshafts. This disappears as soon as the engine is laboured at low RPM or loaded at higher RPMs. Spark plugs normally remain clean even during extend periods of cool-down idling

Traction ctrl setup

You enable this function by assigning it an I/P before you can use it.

You assign I/Ps under "M1","I/P switches".
You also need to set up the vehicle speed inputs "M1,I/P HSI".

Traction ctrl tune

You enable this function by assigning it an I/P before you can use it.
You assign I/Ps under "M1","I/P switches".
You also need to set up the vehicle speed inputs which are HSI under "M1",'I/P HSI".

Tune the following

- Percentage of allowable wheel slip before traction control commences reduction of engine power.
- Engine power will be reduced progressively over this slip range until all power is cut at range limit.

TC Power cut limit

Launch control

You enable this function by assigning it an I/P before you can use it.

You assign I/Ps under "M1","I/P switches".

- Launch control can also be used as a speed limiter.

Launch cut mode

Launch cut mode.Options are

1. Ignition cut
2. Fuel cut
3. Ign & fuel cut

Launch rpm trig

Rpm below that enable launch control.

Launch TPS

Throttle position below which allows launch control

Launch kph

Vehicle speed below which allows launch control

Launch RPM

Rpm that launch begins at

Launch rate

When in launch mode, will ramp the "Launch revlimit" from the "Launch rpm" at the "Launch rate"(Rpm/sec) until launch is terminated.

Launch ends

If launch is active, will be terminated above this vehicle speed.

Launch retard

Timing subtracted from the ignition timing during Launch control. Can help building boost on a turbocharged engine.

WOT shift

Wide Open Throttle gear shifting.
You enable this function by assigning it an I/P before you can use it.
You assign I/Ps under "M1","I/P switches".

WOT cut mode

WOT Cut mode.
Options are

1. Ignition cut
2. Fuel cut
3. Ign & fuel cut

WOT min RPM

RPM above that allows WOT

WOT min TPS

Throttle position above that allows WOT

WOT shift duration

Time that "WOT cut mode" is applied for.

- Larger then 2.00 seconds is continuous while switch I/P is closed.

WOT shift retard

Timing subtracted from the ignition during WOT.
Typical=10.0..20.0 degrees.

M5 tables axis setup

Any table that can have the x or y axis changed are setup here.

- Some of these axis may be in sub menus.

Menu M6

GPC 1-4

General purpose control PID type.

These tables can be used for variable camshaft control or any general purpose PID control.

Variable camshaft control setup.

1. Select camshaft I/P under "M1,I/P HSI".
2. Setup camshaft tolerances under"M1,Variable cam setup"
3. Select an O/P(PWM type) under "M1, O/P Setup" Subaru select PWM with 1khz frequency.
4. Setup "GPC setup" setpoint and feedback variables and the "GPC name" If controlling 2 inlet/exhaust cams, use one table to do each of the two groups.
5. Setup "GPC inhibits" Recommended disabled
6. Setup "GPC Setup table" and "GPC table"
7. Tune PID loop "GPC Tune".

General purpose control

1. Linearize sensors "M1,I/P Analog" and make sure limp home values are logical.
2. Select an O/P(PWM type) under "M1, O/P Setup"
3. Setup "GPC setup" setpoint and feedback variables and the "GPC name"
4. Setup "GPC inhibits"
5. Setup "GPC Setup table" and "GPC table"
6. Tune PID loop "GPC Tune".

GPC 5-13

General purpose control On/Off type.

These tables are general On/Off types. These are not PID types. They cannot have tunable feedback with these GPCs.

To setup an on/off

1. Select an O/P(PWM or on/off) under "M1, O/P Setup"
2. Setup "GPC setup" setpoint and select a GPC name
3. Setup "GPC inhibits"
4. Setup "GPC Setup table" and "GPC table"

- On/offs do not need high precision tables so select user table E,F

O/P Air con

Select O/P and polarity under "M1,O/P setup".
See also O/P Fan1 as this has some setup for the A/C fan control.
Typical O/P=Non PWM type.

O/P fan 1

Select O/P and polarity see "M1,O/P setup".
Typical O/P=Non PWM type.
NOTE, This also controls the air con fan.

O/P fan 2

Select O/P and polarity see "M1,O/P setup".

Typical O/P=Non PWM type.
Has more options then Fan1 & can be used as an intercooler water spray.

O/P Nos

Select I/P under "M1,I/P switches".
Typical O/P=Non PWM type.
NOS input can be used as a switch for extra fuel or/and ignition modifier. Example race fuel or standard fuel switch.

NOS extra fuel

Extra fuel percent

NOS threshold RPM

RPM above that NOS is activated

NOS threshold LOAD

LOAD that will activate NOS, LOAD can be either throttle or manifold pressure.

NOS ign retard

Retard timing that is subtracted from the ignition timing.

O/P Fuel used

Select O/P and polarity under "M1 O/P setup".
Number of seconds per litre of fuel injected.
This output signal can be used by an external data logger or fuel used gauge.
Typical, Non PWM type

Menu Logger

PC Warning & Select

Options.

This only applies to the PC program only and has NO EFFECT ON THE ECU.

1. Select items required for real time display on screen & logged in PC memory.

2. Set minimum and maximum engine parameters while PC is online to ECU.

Top right will display in red any item that exceeds the limits set & be recorded in the "PC error history" along with the time it occurred. PC speaker can also be set to sound warning.

Legend:

Tick	=	Logged & displayed to screen.
@	=	Always logged and displayed.
s	=	Sound warning.
m	=	Summed mean (Option on some -MEAN- variables. Helps increase packets/sec)

Keys:

Enter	=	Set edit limits.
S	=	Select sound.
Space	=	Select PC datalog item
ESC	=	Closes window

- If accept changes will clear the PC logger memory.
- When ECU is password protected, some live data parameters will read zero.
- This has no effect on graph limits
- Some variables may have limits which are lookup tables.
- See "PC Warnings options" on how to auto load limits from ECU or calibration file.

PC Warnings options

1. The PC warnings can be read from a special ECU specific file (Non user readable).
Typical=Enabled

2. PC warnings can be read from the calibration file.
Calibration files contain the warning limits inside the file.
Typical=Disabled

3.Allows screen specific variables to be displayed.
Turn off so that PC logging does not slow down when in tables.
Default=Enabled

PC Min/Max/Freeze

Shows the minimum & maximum limits recorded when ever the live variable has been monitored. The freeze value was the current value when this window was opened.
Useful when want to capture a given condition.
You can reset the recorded limits or print the frozen values by pressing enter and selecting the options.

NOTE1:
'*' means its a currently monitored variable as apposed to a table sensitive variable which may not be current.

NOTE2:

When ECU is password protected, some live data parameters will read zero.

PC Logger setup

Sets up the PC logger rate, trigger and memory model.
F8 always overrides the trigger (Turns PC logger ON or OFF, independent to what the trigger is. However the trigger will take control again when crossing the trigger threshold)
When logger full, will override oldest data in a circle buffer arrangment.
Select items to log under "PC warnings & select" menu.

NOTE
To save the PC logged data, press F10 which opens a graph window. Save graphed data under "Edit-Window", "Save logged file" menu.

PC logger Control

Manual control of the PC logger.
F8 always overrides the trigger (Turns PC logger ON or OFF, independent to what the trigger is. However the trigger will take control again when crossing the trigger threshold)
When logger full, will override oldest data in a circle buffer arrangment.
Select items to log under "PC warnings & select" menu.
Status of PC logger is on bottom left of screen.

PC Logger
Armed
Read to start logging
Running
Logger is running.

NOTE
To save the PC logged data, press F10 which opens a graph window. Save graphed data under "Edit-Window", "Save logged file" menu.

PC Error history

When errors are flashed at top right of screen, they are recorded so can be viewed later.
The last error of the family is always recorded along with the time stamp.
Can check at end of a dyno run to see which errors were recorded or to see errors that were not seen. See also "M0,ECU error history" for more detailed in ECU errors.

PC Logger setup

Sets up the PC logger rate, trigger and memory model.

F8 always overrides the trigger (Turns PC logger ON or OFF, independent to what the trigger is. However the trigger will take control again when crossing the trigger threshold)
When logger full, will override oldest data in a circle buffer arrangement.
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When logger full, will override oldest data in a circle buffer arrangement. Select items to log under "PC warnings & select" menu.

Status of PC logger is on bottom left of screen.

PC Logger

Armed = Read to start logging
Running = Logger is running.

- To save the PC logged data, press F10 which opens a graph window. Save graphed data under "Edit-Window", "Save logged file" menu.

PC logger reset

Resets the PC logger data. To select items to log select them in the "PC warnings & select" menu.

- Once reset cannot be retrieved

- Save PC logged data under the Edit-Window when focused on graphed data when want to save

PC logger graph

When PC logger has data, can be viewed by pressing the F10 hot key.
To select items to log select them in the "PC warnings & select" menu.
Shows how many HOUR:MINUITS:SECONDS has been recorded.

- You save the "PC logged graph", press F10 and see "Edit-Window", "Save logged file".

- If table opened with same axis variables as logged data then an orange cursor shows the table position.

PC Strip chart

SEE EDIT-WINDOW FOR STRIP CHART OPTIONS.

Shows a strip chart to the screen which can be time or XY.

Items that are logged in the PC logger can be shown to the screen via the EDIT-WINDOW menu. F8 or triggering starts/stops the strip chart. Strip chart is data that is being logged in the PC logger memory so any data seen in the strip chart can be stopped and viewed more closely via the F10 function.

Zoom in out with the arrow keys.
1..4 to show 1 to 4 lines of data. To move a item from to different lines you select this via the "Color ranges" menu. Eg. to full screen line 3 press 3 twice.

If want to tune accelerator pumps and have A/F ratio on line 3 you would press 3 until A/F ratio is full screen on the strip chart. You can then adjust accelerator pumps and will get maximum resolution of A/F ratio.

PC data stream 1

Enables the data stream to a serial port.
When disabled, the port is not opened.
This is bi-directional so can be data stream output or input from another acquisition system using ECU data stream format.

- If want to force data stream comm port number then see Help menu, "Trouble shooting" for command line parameter.

- If cannot read/send data with some USB serial ports, press "OK" again to re-initialise the data stream.

Open logged file

Opens data log files that have be saved to disk.

- Data log files may be ECU data log file or PC data log files as this program treats them the same.

You can overlay other logged files on top of the current data & offset them with time so can compare. Parts of the data can be marked & minimum, maximums, mean, Rate & standard deviation are calculated. Can export as comma separated value

From data log files, can create XY plots with filters, Histograms & if logged LOAD, Throttle & A/F ratio can create mixture plots. Mixture plots are shown as text & graphical form. From mixture plots can correct "Base fuel delivery" table via the "F5" key. See Edit-window for more details.

If table opened with same axis variables as logged data then an orange cursor shows the table position.

To jump to graph TABS press "L" go forward & K go backwards.

Virtual drive

Opens a data log file & then you can create dials, bar graphs or plain displays plus time or XY strip charts.

Sizing of instruments are on the bottom right of focused instrument. See Edit-Window for options once file opened. Virtual drive instrument setup screen is automatically saved to disk when exiting. If logged variables correspond to table axis variables, the logger cursor will be shown in the table.

ECU Logger setup

ECU data logger setup:-

Channels:

Select items to data log. The more items logged the more memory is used and the total log time is reduced.

Sample/Sec:

Samples per second each item is recorded.

Memory mode

Protected.-When memory is full logging will stop.
Un-Protected.-When memory is full logger will start to overwrite the first data recorded.

Example:- Log time = 10 min
The logger will always have in it's memory the last 10 minutes of logged data.

Trigger:

External only.-Logger will not start logging until external switch is closed. See logger wiring diagram.

External & RPM.-Logger will not start logging until external switch is closed and engine RPM exceeds specified RPM. See logger wiring diagram.

Always.-Logger will start logging any time the ignition is switched on.

RPM Only:-Logger will start logging when specified RPM is exceeded.

- TRIGGERS ONLY WORK WHEN OFF-LINE.

Total log time is displayed in 00:00:00 = Hours:Min:Sec

Retrieve log data

Retrieve data logged data from ECU.

Retried data will be saved to file. Use "Open logged file" from the file menu to view the data. Data log files can be re-run in "Virtual drive"

Manual logger ctrl

Control ECU data Logger.
Used to start and stop ECU data logger while online. Both PC and ECU memory can be used at the same time to data log totally different items.

- Triggers only work when ECU is OFF-LINE.

Clear ECU logger

Clear ECU data logger memory.
WARNING, Once this is done the ECU logged data will be lost.

Keystrokes Reference

General keys

Esc ....Opens or closes, menus.
Tab............................Next item.
Alt + menu letter...........Opens menu.
Q..............................Closes windows.
Space.........................Find a site, places the curser at the current site.
Page Up.......................Previous table.
Page Down..................Next table.
Ctrl + F10....................Base fuel table.
Shift + F10...................Base ignition table.
G...............................Displays table in 3D graph.
Alt + X.........................Exits the program.
F1..............................Help
F2..............................Saves the current file.
F3..............................Go online to ECU.
F4..............................Lock (store) changes into ECU.

Edit keys

Enter..........................Type a new value into a table.
=...............................Make small increases in table value.
-...............................Make small decreases in table value.
Shift + +......................Make large increases in table value.
Shift + -.......................Make large decreases in table value.
Delete.........................Delete a axis value (e.g:- RPM or Load axis value)
Insert..........................Insert a axis value (e.g:- RPM or Load axis value)
E...............................Edit axis value.
Shift + Right.................Copies a site value to the right of current site.
Shift + Left...................Copies a site value to the left of current site.
Shift + UP....................Copies a site value to the above site.
Shift + Down................Copies a site value to the site below.

Autotune™ keys

F5..............................Run or stop Autotune.
C...............................Course tune.
F...............................Fine tune.
R...............................Remove attribute.
A...............................Set user attribute.
Ctrl + K........................Copy row attribute.
Ctrl + M.......................Copy Column attribute.
Ctrl + K........................Show attribute.

Data Logging keys

F8..............................Starts and stops PC logger.
F10............................Graph logged data.
Z or Arrow Up................Zoom in on graphed data.

Fuel System

The best SM4 installation will yield poor result if the fuel system does not meet the demands of the engine. Insufficient fuel flow can lead to engine lean out and detonation that could destroy you engine. For the best of your engine, we urge you to check that your fuel system's capacity and ensure that there will be sufficient supply at all loads and RPMs. A fuel pressure meter should be used during testing and tuning to ensure the fuel pressure does not fall pout of regulation, meaning pressure drop or oscillate. The SM4 can use an external pressure transducer connected to analog I/P and be logged and displayed in the ECU Error History.
This manual offers guidelines to testing your fuel system and suggests some solutions, if there are supply problems. If you find you need to modify your fuel system and are unsure what to do, contact your Autronic dealer.

Flow Estimation

If you can estimate the power output of a gasoline engine, you can make a reasonable guess at the fuel flow requirement. A simple rule of thumb may be expressed in metric or imperial units.

Th

This assumes a brake specific fuel consumption of 1.50. The actual fuel flow necessary by injectors and pump are likely to exceed a figure derived this way. This is due to the overheads in injector dead time and pumping return fuel to maintain regulation.
A nice help program called Injector Size.exe can be downloaded from http://www.autronic.com

Injector Flow Capacity

If you are using second hand injectors, or have removed the current injectors while doing work on the engine, we strongly recommend that you clean and flow test them.

Your total injector flow capability is given by the sum of the injector flow rate. Injectors are specified in either cc/min or lb/hr. Check that you have enough injector flow to match the estimated power output. Keep in mind that you do not want to exceed 85-90% duty cycle injection on time, and that at high rpm, injector dead time can consume a significant amount of available injection time, thus Autronic is fully sequential and minimize the dead time.

If you find your injector flow rate is insufficient, you can change to larger injectors, or increase the fuel pressure. Raising fuel pressure to increase fuel flow rate is not recommended if the desired flow is more than 20% than the system currently achieves. Fuel flow is not in direct proportion to fuel pressure. Increasing fuel pressure will reduce the flow rate of the pump.

If you change to other injectors change the injector type in menu *Injectors* to match your new type of injectors. After that a changing of the value *Base settings – Overall Fuel Mult* will be needed, Adjust until engine is running on same A/F value as earlier. Some times small adjustments will be necessary at light load (small injector openings).

There is a nice help program called Injector Size, InjSize.exe can be downloaded from http://www.autronic.com

Fuel Pump Capacity

You should ensure that your fuel pump is capable of supplying sufficient fuel to feed the engine at maximum power. With your engine switched of (injector closed) feed the return line of fuel to a measuring container. In the case of a turbo- or supercharged engine, pressurize the manifold pressure port of the fuel regulator top the maximum boost of the engine. This is necessary as the flow rate of the pump decreases with output pressure. Power the pump for one minute and calculate the hourly fuel flow rate of the pump.

Since the pressure regulator operates on a return system, there should always be fuel being returned to the tank, even when fuel flow to the engine has reached its maximum. If this fails to happen, the fuel pressure will fall out of regulation. Therefore the fuel pump must be capable of delivering significant more fuel than the engine is going to use, As a guide, the pump should flow 25-35% more fuel than consumed by the engine.

If you can not achieve the required fuel flow from one pump, you can employ two pumps in parallel. If you use a low-pressure feeding pump to the high pressure pump, place a check valve after the low-pressure pump.

Fuel Rail & Pressure Regulator

A long fuel rail with narrow internal diameter will suffer from pulsation in the fuel rail. The internal diameter should be around 12-13 mm ($^1/_2$”). Even so, oscillations may occur, particularly if injectors are large. A fuel damper can help removing these oscillations. Oscillations may occur only within a certain rpm range, so the fuel pressure have to be monitored throughout the driving rang of the engine.

Many aftermarket fuel pressure regulators do not give stable fuel pressures as the manifold pressure changes. This can lead to confusing tuning problems. As a rule try to always use the original regulator and totally avoid rising rate regulators.

Ignition System

The ECU's interface to the ignition system is trough the ignition module or a CDI. There are two types of ignition modules available in common use on factory ignition systems.

The following can cause fault in the ignition modules

- Over heating
- Incorrect coil charge time
- Incorrect output type (Pulse or Dwell)
- Incorrect output edge
- Poor power or ground circuits

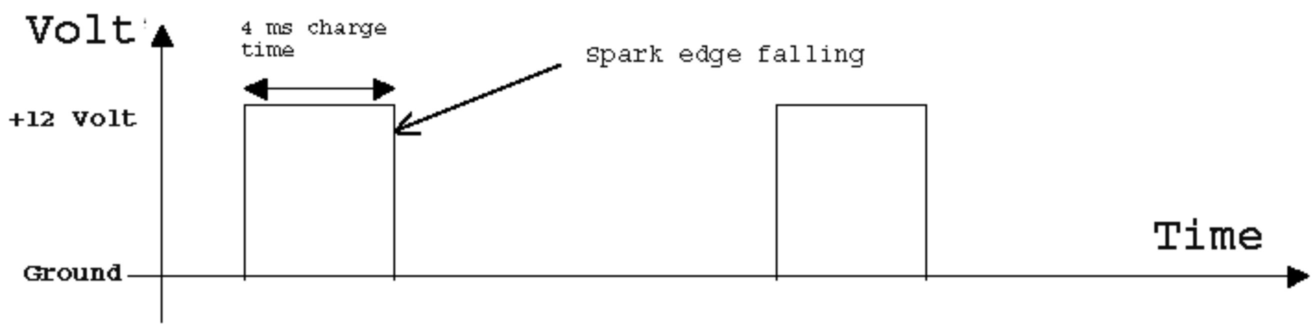
The ignition module ground is vital to the operation of the module. If the ground is not in good condition, it can cause a reduction in primary current which affects current limiting or dwell control. Do not ground igniter at same point as SM4.

Dumb Ignition Modules

The Dumb ignition module requires the SM4 to perform the *dwell control* or *charge time* of the ignition coil. The signal from SM4 determines the charge time of the coil and tries to maintain the specified charge time from the *Ignition Dwell table* at all engine speeds.

Example of dumb ignitions modules:-
Single type Bosch 0 227 100 124
Triple type Bosch 0 227 100 203 and 0 227 100 209.
Quad type Bosch 0 227 100 211

Typically charge time is 2.5 ms for normal coils and 1.8 ms for small coil on plug.
See chapter Dwell for more information regarding how to fin out coil charge time.
For a dumb ignition module with falling spark edge, with 4ms coil charge time, the SM4 ignition output will look like the following waveform:



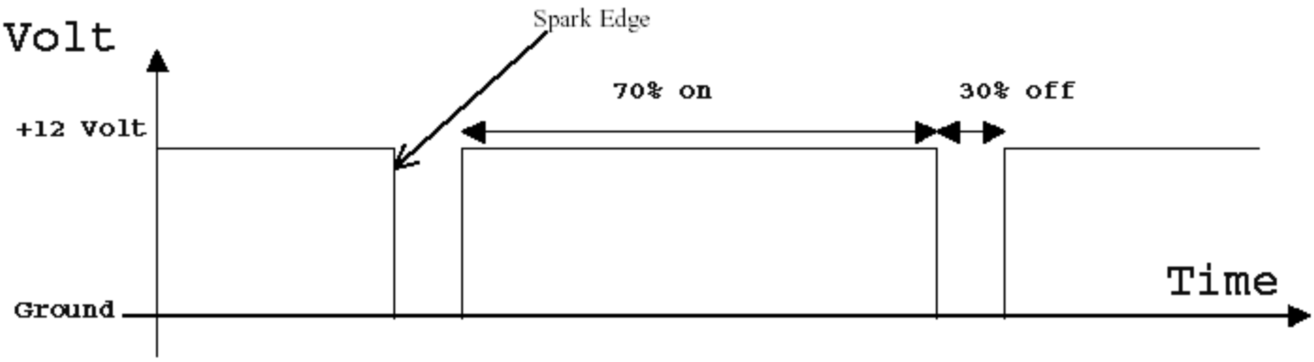
Smart Ignition Modules

Smart Ignition modules like Bosch BIM137 or 139 should not be used.

Falling Egde & Rising Edge on Ignition Modules

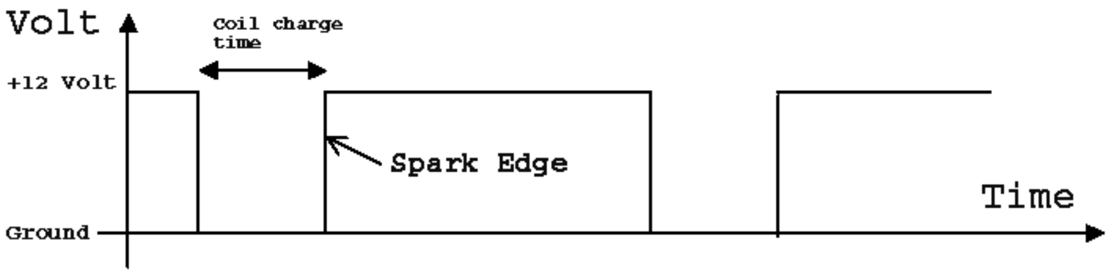
The Waveform that the ignition module expects can vary depending on which edge the module fires a spark.

- Falling edge triggered – Most factory ignition modules are falling edge triggered. These modules expect a 0 Volt input signal when the ignition system is idle. When the voltage goes to 12V, the coil is being charged, when the input returns to 0 V, a spark is fired and the coil then sits idle until the input voltage to the ignition module is again raised to 12 Volt.



Falling spark edge, 70/30 Duty cycle for smart ignition module and Autronic CDI.

- Rising edge triggered – Some ignition modules like Honda and MSD CDI are known to be rising edge triggered. These modules expect a 12 Volt input signal when idle. When the voltage falls to 0 Volt, the module charges the coil. When voltage returns to 12 volt, the spark is fired.

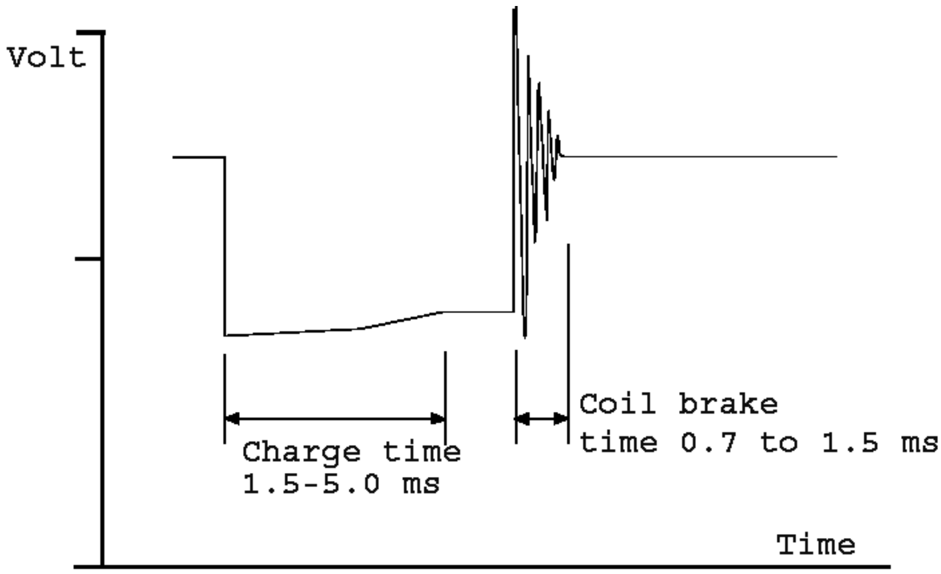


Rising spark edge

The Coil Negative Signal

The coil's charge time determinates from the coil –Ve signal. When the coil switches on, voltage at the coil negative terminal drops to zero. As the coil charges, the voltage rises slightly, until a sharp rise where the ignition module current limits. Leaving the coil switched any longer will not increase the energy in the coil or the spark.

When ignition firing frequency is high, there will not be enough time to charge the coil completely. After firing the spark, the SM4 will wait a short period and then switch the coil on again, regaining much of the lost energy in ringing. This break time is normally 0.7 to 1.5 ms long. See figure below



Direct Fire CDI Autronic 500R

The Autronic CDI has four channels; these can be used in any order. To save any confusion during wiring it is best to keep the CDI input and sequence 1, 2, 3, 4 and the output sequence the engine firing order. A good way to do this is to write down the SM4 Ign O/P sequence, CDI trigger I/P and engine firing order on a piece of paper before wiring.

Example:- 4 cylinder engine four coils with a firing order 1, 3, 4, 2.

SM4 Ign O/P sequence	1, 2, 3, 4
CDI Trigger I/P sequence	1, 2, 3, 4
Ignition coil number	1, 3, 4, 2

Example:- 4 cylinder engine four coils (wasted spark) with a firing order 1, 3, 4, 2.

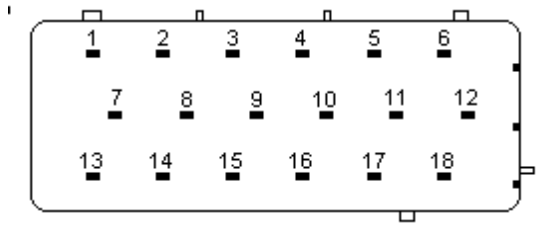
SM4 Ign O/P sequence	1	2
CDI Trigger I/P sequence	1	2
Ignition coil number	1 & 4	3 & 2

Example:- 6 cylinder engine six or three coils (wasted spark) with a firing order 1, 5, 3, 6, 2, 4.

SM4 Ign O/P sequence	1	2	3
CDI Trigger I/P sequence	1	2	3
Ignition coil number	1 & 6	5 & 2	3 & 4

CDI only has two –ve coil outputs and these are wired to the appropriate ignition coil matching +ve Coil outputs.

Trigger ground on the CDI is not used.



CDI PIN	DESCRIPTION
1	COIL 3 +VE
2	COIL 4 +VE
3	COIL 3&4 –VE
4	TRIGGER 3 I/P
5	TRIGGER 1 I/P
6	TACHO O/P
7	COIL 1 +VE
8	COIL 1 &2 –VE
9	TRIGGER 4 I/P
10	TRIGGER 2 I/P
11	POWER SELECT, GROUND FOR HIGHPOWER
12	IGNITION SWITCH I/P
13	COIL 2 +VE
14	GROUND, KEEP SHORT AND TWISTED
15	GROUND, KEEP SHORT AND TWISTED
16	TRIGGER GROUND, NOT USED
17	+ 12 VOLT BATTERY
18	+ 12 VOLT BATTERY

Trigger Interface

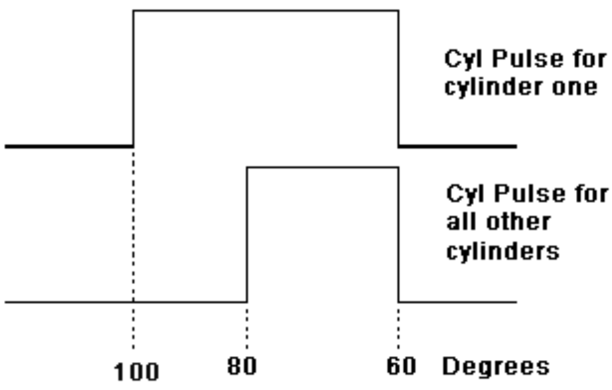
Interfacing the SM4 with your particular trigger system may be fairly straightforward or it may be complicated. The variety of trigger designs available is the primary source of complication. This appendix contains a lot of useful information about the different approaches to trigger design and is essential information to anyone installing the SM4.

The Input Trigger

The SM4 is designed to trigger from either a square wave signal that varies from a low (zero) volt to a (high) voltage between 6 and 15 volt. It may also use magnetic inductive signal in conjunction with the internal reluctor adapter. A reluctor adapter converts the sine like wave signal from the magnetic trigger to a square wave signal. The actual voltage of this voltage is not important because it is from low-to-high or high-to-low that is used to trigger the SM4. This transition is referred to as the Trigger Edge for cylinder pulse or reference pulse. This is shown in the following illustration as an upward or downward facing arrow. An upward arrow would indicate that the trigger edge is the transition from low-to-high and is called *rising edge*. If the trigger edge is the transition from high-to-low, it will be shown as a downward facing arrow, and called *falling edge*.

For the SM4 to operate correctly a trigger edge must be generated. This trigger edge must occur a fixed number of degrees before top dead centre (BTDC) and must not change during different rpm's. The position of the trigger is given in crankshaft degrees and is called "Crank I/P Lead" in menu "I/P Crank & Cyl". In Addition there should not be any variation in the trigger angle between cylinders. The SM4 can be set to have any trigger angle between 0-720 degrees.

In some trigger devices the pulse given for cylinder one would be a different width than pulse for all other cylinders. If the first edge, rising edge in this example were used as the trigger edge than there would be a variation of 20º between the trigger for cylinder one and all other cylinders. This would lead to cylinder one being 20º more advanced than all other cylinders; also the input rpm would not be stable. The solution is use the trigger point that is falling edge and to have the trigger angle "Crank I/P Lead" set to 60.



Trigger Devices

The output of Hall Effect, Optical, or Magnetic inductive (needs internal reluctor) sensors could be connected directly to the input of the SM4. Many distributors used in original equipment manufacturer's computer ignition system would be fitted with Hall or Optical trigger. They normally have a chopper wheel attached to the distributor shaft and passes through a gap in the sensor. These sensors require three wires:

- Ground
- Power Normally 5-12 volt
- Trigger out signal

If using stock distributor components make sure they do not are fitted with mechanical and /or vacuum mechanisms. These mechanisms have to be defeated or removed, and the timing edges set correctly, then they can be used to trigger the SM4.
A third type op pickup, the magnetic inductive is used in distributors as well as on crank trigger units. It is now possible to directly connect this trigger to the SM4 and use the internal reluctor adapter to convert the signal to square wave required for the SM4.

The magnetic trigger is basically a piece of wire wrapped around a magnetic core and attached to the sensor face, which is called the pole piece. The physically size and shape of such trigger can take many forms. This type of pickup has two wires, one positive (+) one negative (-) or three wires with the third being shield. Sometimes the wires are marked as such, but more often than not they are unmarked.

If you cannot tell which wire is the positive from markings or wire diagrams, then it would be necessary to check the signal going into the SM4 with an oscilloscope.
When ferrous metal is passed very close to the pole piece, the pickup will generate a voltage (similar to figure below) on the positive wire. The amplitude of the signal will vary with the speed at which the ferrous metal passes the pole piece. At low speeds the signal may only be several hundreds mV, but at high speed it could be more than 20 volts. The sudden drop from positive to negative corresponds to the metal being directly in line with the sensor. As can be seen, the signal is a sine way type. The voltage input of the reluctor inside the SM4 must first go to a positive peak, which arms the circuit. When the signal raises approximately 75-80% of the peak value the reluctor will generate a falling edge, and when the signal crosses zero volts a rising edge trigger the SM4. If the wires are reversed and the signal first goes negative, the reluctor adapter will generate a pulse but will not trigger the Sm4 correctly resulting in incorrect ignition timing.

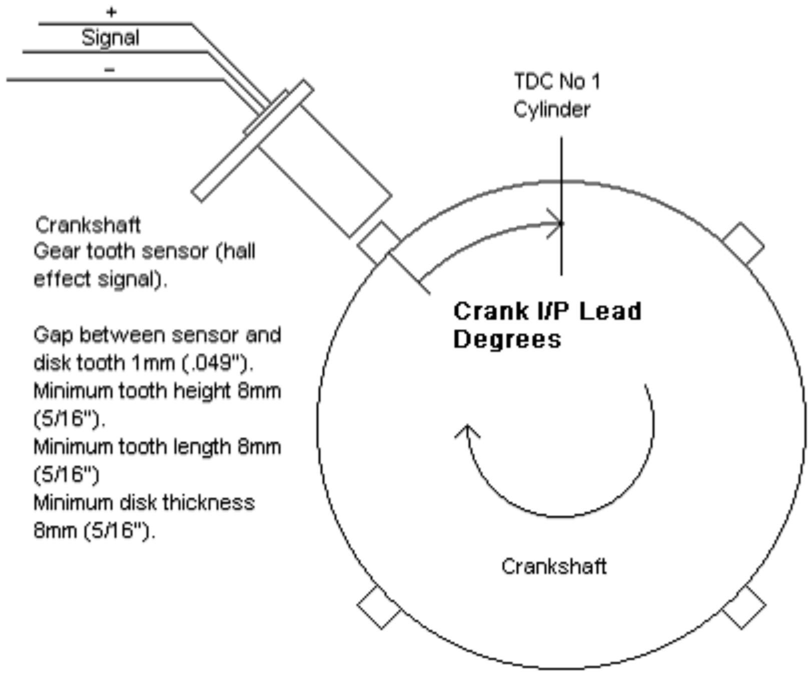
One Pulse per TDC

One Pulse per TDC is standard triggering for Autronic. It needs one pulse for each cylinder for one complete engine revolution cycle (720 degrees, two crank turns, one cam turn). This will give the following table for the cylinder pulse trigger:-

Cylinders	Tooth on crankshaft	Tooth on camshaft
1	N/A	1
2	1	2
4	2	4

5	N/A	5
6	3	6
8	4	8
10	5	10
12	6	12
16	8	16

One pulse per TDC tooth table



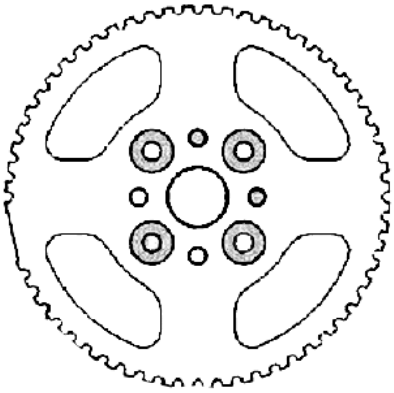
Example setup for 8-cyl engine with Hall Effect trigger at crankshaft, The positive wire from the gear tooth sensor is the one with colour strip, signal in the middle, other ground.

Multi Tooth Trigger

The multi-tooth trigger support any trigger system that has multiple evenly spaced trigger events connected to the cylinder pulse and one pulse for cylinder reference. An example for this is the Toyota trigger with 24 and 1 cam sensor

Motronic Trigger

Motronic trigger are a type of multi-tooth trigger but are distinct in that they use a missing tooth. The Motronic wheels that are supported by SM4 are the 60 teeth with 2 missing and 36 teeth and 1 missing tooth.



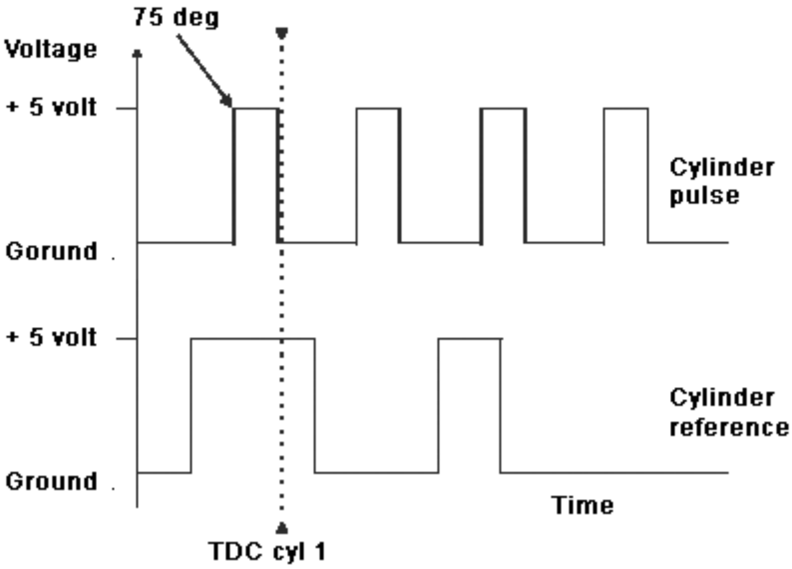
Motronic 60-2 wheel

Note, some motronic sensors may be Hall Effect type, which give out square wave signal, others may be inductive sensor and should use internal reluctor adapter.

Other Triggers

Mitsubishi trigger

Mitsubishi trigger consists of two sensor signals. The cylinder pulse consist of evenly spaced pulses for each cylinder and the cyl ref consists of two unique pulses, 360 degrees apart. The cylinder pulse occurs at 75 deg BTDC rising edge (+Ve),



Nissan trigger

Nissan has three different patterns, sensor is located at camshaft. One signal consists of 360 evenly spaced pulses, each representation of 2 deg engine movement. The other consists of the same numbers of pulses as there are cylinders. Replace the trigger disc to a new with same numbers of pulses as there are cylinders (cylinder pulse) and one pulse for cylinder reference.

With the 1.09 chip the stock trigger disc can be used in conjuction with a diode, consult your dealer.

Autronic Analyzer

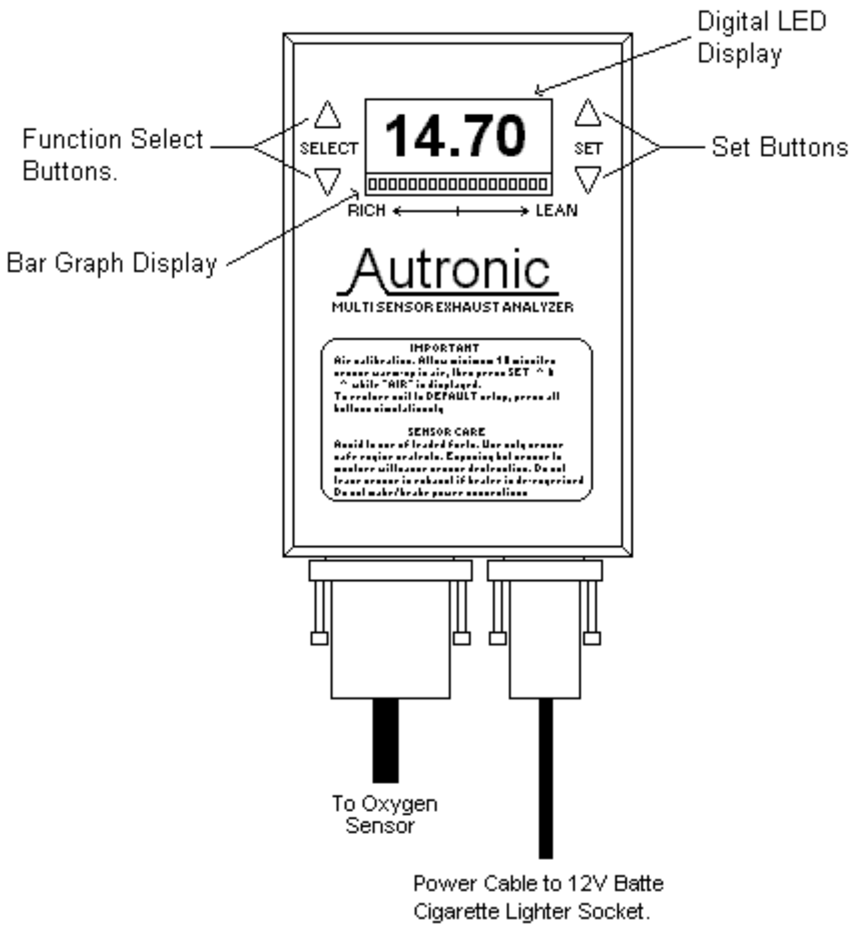
Changing settings

For analyser wiring information to the SM4 see wiring diagram section of this manual.

The A and B model analysers have two FUNCTION SELECT and two SET buttons. These are used to make changes to the default settings. They are also used to calibrate a UEGO sensor, and restore factory default settings.

Pressing all four buttons at the same time will reset all functions to factory defaults.

The B Model analyser can air calibrate the UEGO sensor, by pressing the two set buttons when AIR is displayed.



1. When changing function, press either the up or down FUNCTION SELECT buttons to cycle through the functions. All analysers have functions from Function 0 to Function 10. The B Models also have functions 11 to 14. (See Calibration Functions Section).

2. When the desired function is displayed, use the SET buttons to cycle through the options.

3. After making the changes, the analyser will take a few second to return to the normal display. You can speed this up by pressing both FUNCTION SELECT buttons.

Most used functions

Function 1.

Used to set the seven segment digital display to Lambda or air fuel ratio.

Options.

-LA- = Lambda
AF_P = Air fuel ratio Petrol (Gasoline).
AF_D = Air fuel ratio Diesel.
AF_G = Air fuel ratio LPG (Liquid Petroleum Gas).
AF_A = Air fuel ratio Alcohol (Methanol).

Function 7.

Use to test Analog output voltage. The three options are 0, 1 or 2.
These settings can be used to see if the software span and offset for the analog 02 input are correct.

0 to 1 volt output
0 = 0 volts = 10:1 A/F ratio
1 = 0.5 volts = 20:1 A/F ratio
2 = 1 volts = 30:1 A/F ratio

0 to 5 volt output
0 = 0 volts = 10:1 A/F ratio
1 = 2.5 volts = 20:1 A/F ratio
2 = 5 volts = 30:1 A/F ratio

Function 9.

Use to Set analog output minimum output value. This can be used to reverse the air fuel ratio in relation to output voltage. E.G:- from 0 to 5 volts = 10.0:1 to 30.0:1 to 5 to 0 volts = 30.0:1 to 10.0:1. Changes to 0 to 5 volt output are reflected in the 0 to 1 volt output.

Function 10.

Use to Set analog output maximum output value. This can be used to reverse the air fuel ratio in relation to output voltage. E.G:- from 0 to 5 volts = 10.0:1 to 30.0:1 to 5 to 0 volts = 30.0:1 to 10.0:1. Changes to 0 to 5 volt output are reflected in the 0 to 1 volt output.

Fault Finding

No Communication

- Check communication cable. Check tat it is plugged in firmly and does not have a damage. Cables are easily damaged when shut in car doors.

- Make sure that the FIFO buffers are turned off, se help “Windows FIFO setup”

- Make sure you are using correct Com port, “try another port” menu is showed when trying to go online.

- Check the cable with “check data link” which is viewed when trying to go online.

- Check power to the SM4, Check that the ignition switch input has power when ignition is on.

- Check that no other software is using the COM port.

No RPM signal

- Check that the Hall Effect or Optical trigger has power if either of these types are used as Cylinder Pulse trigger.

- Check that the SM4 has +12 volt on both ignition switch and power inputs while cranking. Some vehicles disconnect power to accessory devices during cranking to minimize power draw from these devices.

- Check the trigger wiring. If you have access to an oscilloscope , then check the input to the SM4.

- Check that the software is setup correct under “I/P Crank & Cyl”.

- If using magnetic triggers, make sure you use shielded wires and that the polarity is wired correctly.

No Spark or Injection pulses

- Check that you have a RPM signal. You should have a cranking speed of 100-300 rpm, if not se above *No RPM Signal.*

- Check power to your injectors and ignitions coil(S) while cranking.

- Check that all power leads to the ECU has power during cranking.

- Check that the software is configured correctly to match your ignition setup.

- If injectors are firing but there are no spark the most common cause will be the reference sensor. Check that there are no “Sync Errors” reported and there is a good Reference signal from the cam sensor.

- If you got an oscilloscope, check the injector/ignition outputs for a pulsing signal.

ECU Self Diagnostic

Error Indicator Light

The ECU's LED indicator flashes error codes to indicate fault conditions. En external error light can be configured under menu *M1--O/P Setup--O/P Error light.*
If selecting it to any Stepper O/P or free ignition O/P and Invert they can drive any stock error light that is grounded at the other end. These outputs when selecting invert (Press i in menu for selecting output) will send +12Volt power to turn on light (normally they and all other outputs pull to ground, meaning the error light has to have 12 volt ignition power at the other end). If online with the ECU the errors will be displayed in the *ECU Error History* in a text format.

Error conditions include:-

- Faulty sensors.
- Out of range signals.
- Electrical interference.
- Operation endangering engine life.
- Internal ECU malfunction

This indicator is located near the main connector, and the SM4 allow connection of a remote indicator light. Each time the ECU is activated (ignition on) previously detected HISTORY or old error conditions are indicated. After the completion of the HISTORY error codes, error codes are displayed as the errors are detected. An error code will remain stored in ECU memory until the fault is repaired and the engine is warned-up (from cold to normal operating temperature) 20 times. This error memory feature allows the engines' user reasonable time to fault find difficult intermittent faults, or drive in limp-home mode to qualified service for repair. When the repair is effected the old stored error codes may be erased by using the laptop calibration program.

Error code format:-

- Error codes are all 2 digits, each digit comprising a number of 1/2 second on, 1/2 second off flashes.
- The 2 digits of each code are separated be 2.5 seconds.
- Error codes are separated by 5 second pause.
- As detected error codes can occur 10 seconds after the completion of the ignition on HISTORY CODES.

Diagnostic Light Fault Codes

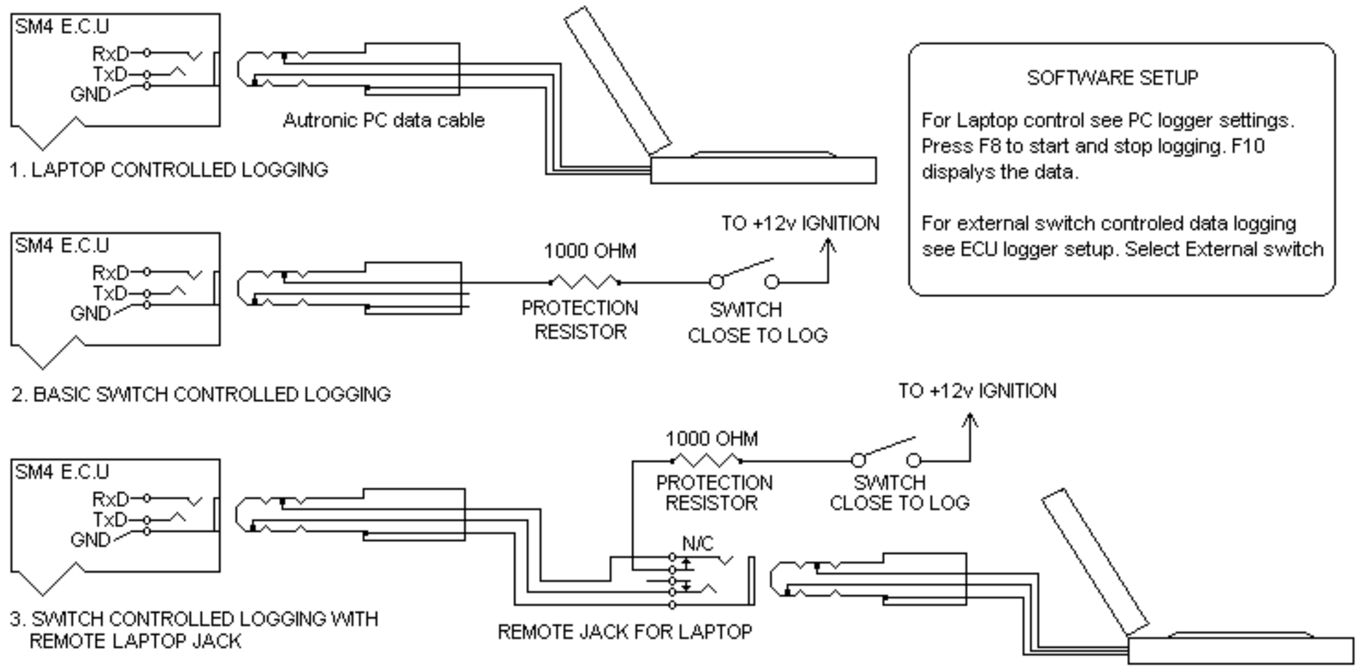
CODE	ERROR DESCRIPTION
ON	INTERNAL ERROR 120
CONTINUOUSLY	RETURN TO DEALER FOR REPAIR
FLASHING FAST	RETURN TO DEALER FOR REPAIR
11	NO ERROR
13	TPS I/P
14	O2 I/P
16	FUEL TEMP
21	AIR INTAKE TEMPERATURE I/P
22	COOLANT TEMPERATURE I/P
23	BAROMETRIC PRESSURE
25	VEHICLE SPEED
26	OVER BOOST ERROR
31	MAP SENSOR I/P
34	REF PULSE I/P MISSING
35	OIL PRESSURE
41	EXHAUST BACK PRESSURE I/P
43	REF PULSE ERROR WHILE ENGINE IS RUNNING
44	OIL TEMP
45	FREE FOR PERSONAL USE
53	SUPPLY OVER VOLTAGE ERROR
54	FREE FOR PERSONAL USE
61	FUEL PRESSURE
62	FREE FOR PERSONAL USE
63	FREE FOR PERSONAL USE
73	POWER FAIL DETECTOR, CONTACT DEALER
82	CMOS RAM MEMORY LOSS, CONTACT DEALER
99	EEPOM ERROR, CONTACT DEALER

ECU Specifications

Microcomputer		Intel 16 bit running @ 20Mhz
Supply Voltage	Normal Operation Safe limits	6.2V to 18 V DC continuous +/- 24V (5 min) +/- 80V alternator load dump (0.5sec). +/- 1000V inductive spike (10 usec)
Current drain	@ Engine idle @ Max engine load	< 1 Amp. < 16 Amp (less depending on injector type and numbers)
Operating Temperature Range	Min/Max	- 40 deg C /+ 85 deg C
Engine Cylinder Number Settings	Number of cylinders	1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 14 and 16
Engine RPM Range	0 to 30,000 RPM 0 to 16,000 RPM 0 to 15,000 RPM	Engines up to 4 cylinders Engines with 5 to 8 cylinders Engines with 10 to 16 cylinders
Injection Duration Timing	Min Max Accuracy Setting Resolution	0.7 msec 30 msec +/- < (10 usec + 1%) 0.1% approx
Injection Timing	Range Accuracy Setting Resolution	0 to 720 grader (crank angle) +/- < (1.4 deg + 0.3 msec (crank angle) +/- 2.8 deg (crank angle)
Ignition Timing	Range Accuracy Setting Resolution	0 to 720 grader (crank angle) +/- < (0.2 deg + 2 usec (crank angle) +/- 0.5 deg (crank angle)
Fuel Delivery and Ignition Mapping	No. Load sites No. RPM sites	16 (max). Both Load and RPM sites 32 (max). are freely selectable.
Size	L * W * H	130 * 124 * 48 mm
Weight		0.5 kg
Connector		42 way "AMP" water and dust resistant socket

PC and ECU logger Diagrams

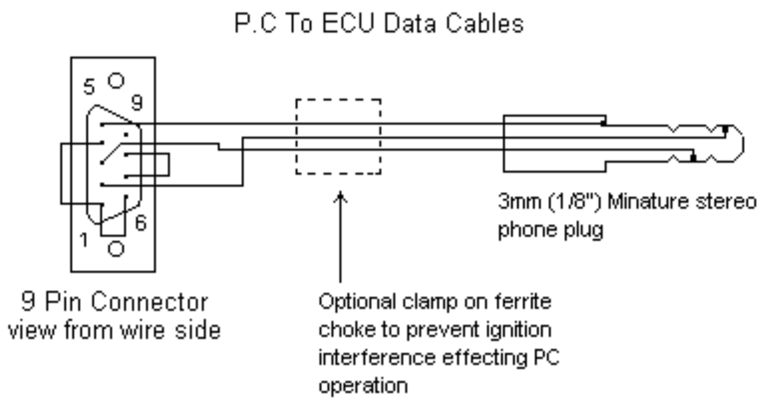
Wiring diagrams



Option 1. Uses standard Autronic PC data cable to log using the PC/Laptop memory.
Option 2. Uses ECU memory to record when switch is closed.
Option 3. The socket required is a double pole single throw stereo socket.

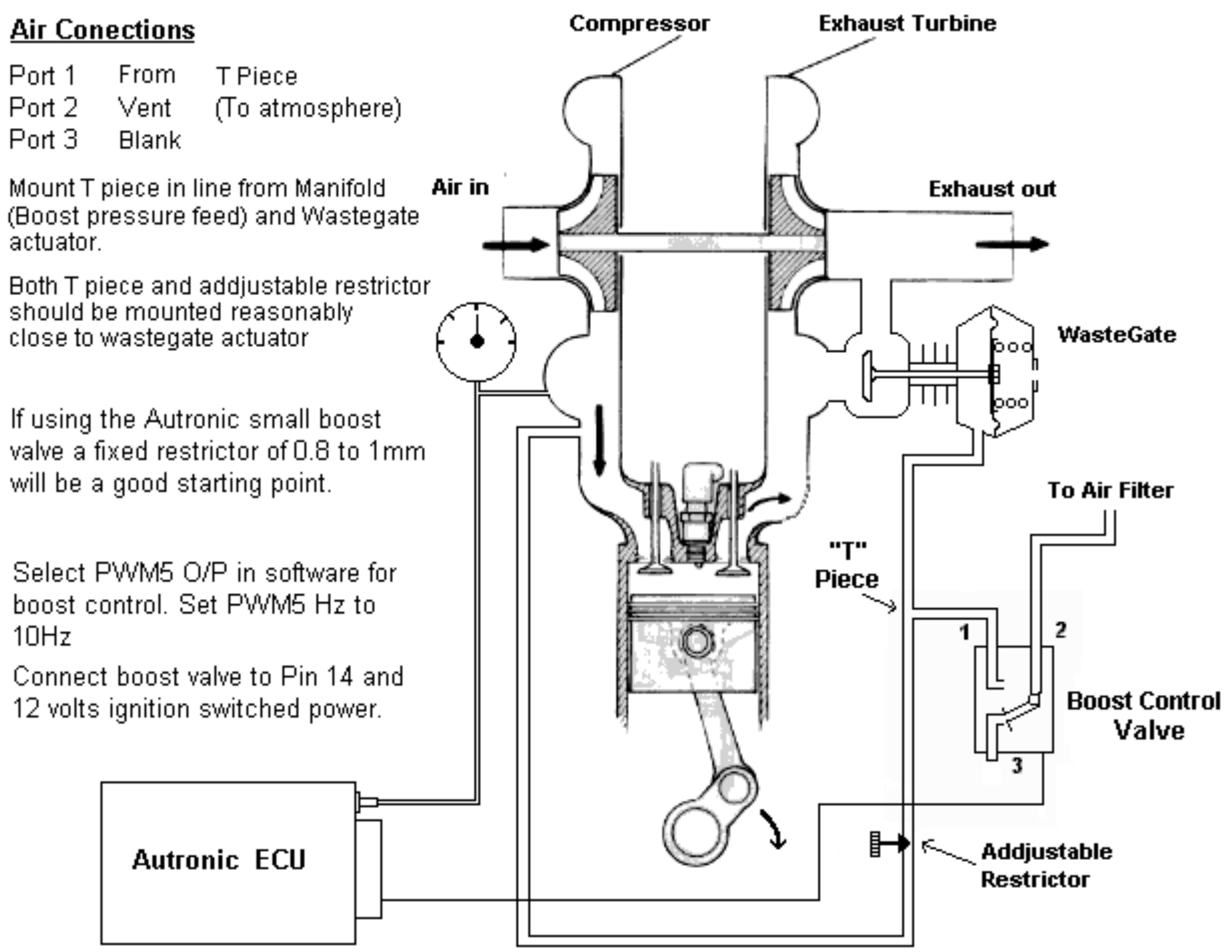
PC Data Cable Diagram

Wiring Diagram.

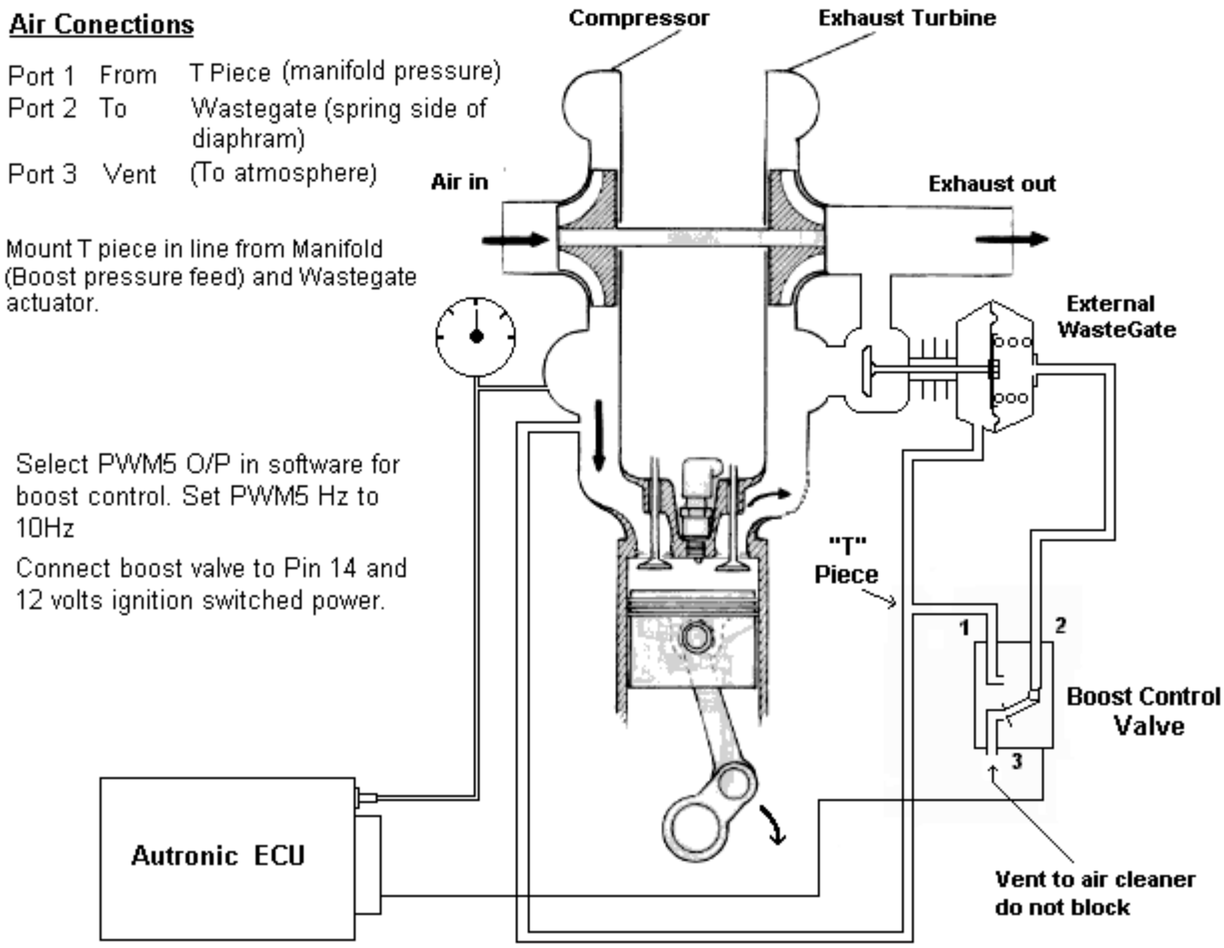


Boost Control Diagrams

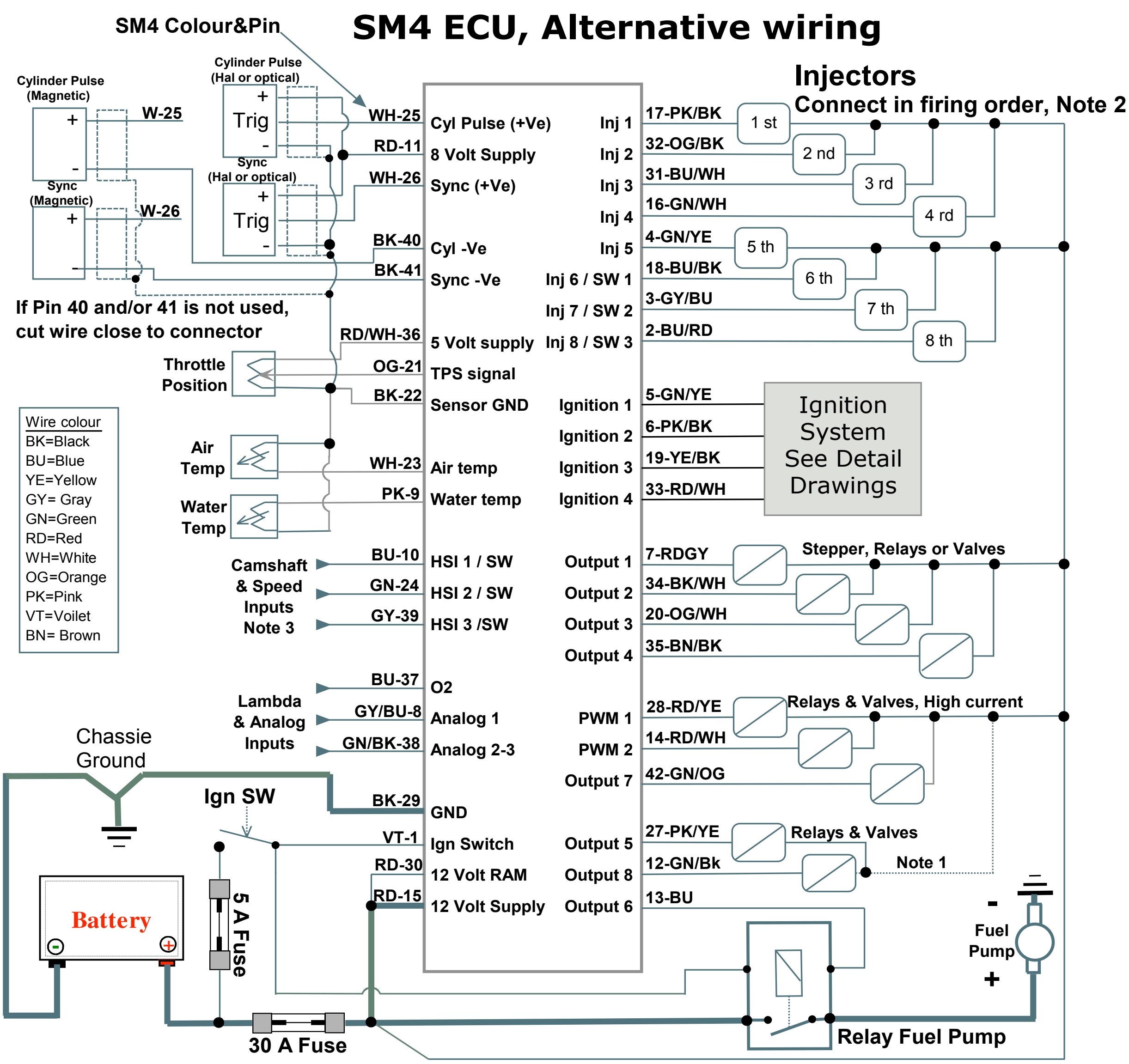
Internal Wastegate



External Wastegate



Main Wiring Diagram – Alternative

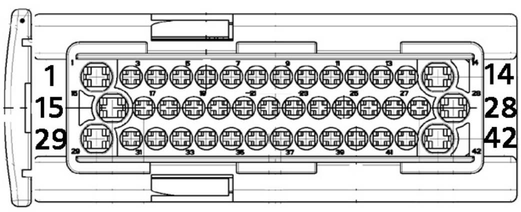


Note 1
Ignition O/P´s not used for ignition can be used to drive relays or valves. Ignition O/P´s and Output 1-4 are Push-Pull type and can supply current as well as sink current, 1 amp each output.
PWM 1, PWM 2 and Output 7 are high current 3,5 amp.
Output 5,6 and 8 can optionally have power from battery or other source.

Note 2
If injectors are wired in cylinder order, then a custom order must be crated in the "Advanced section" in the injector setup.
Injector O/P´s not used can be used to drive relays and valves or be used as switch input, short to ground to activate. Injectors must be powered from same side of fuse as pin 15.

Note 3
HSI inputs can be used as switch input, short to ground to activate.

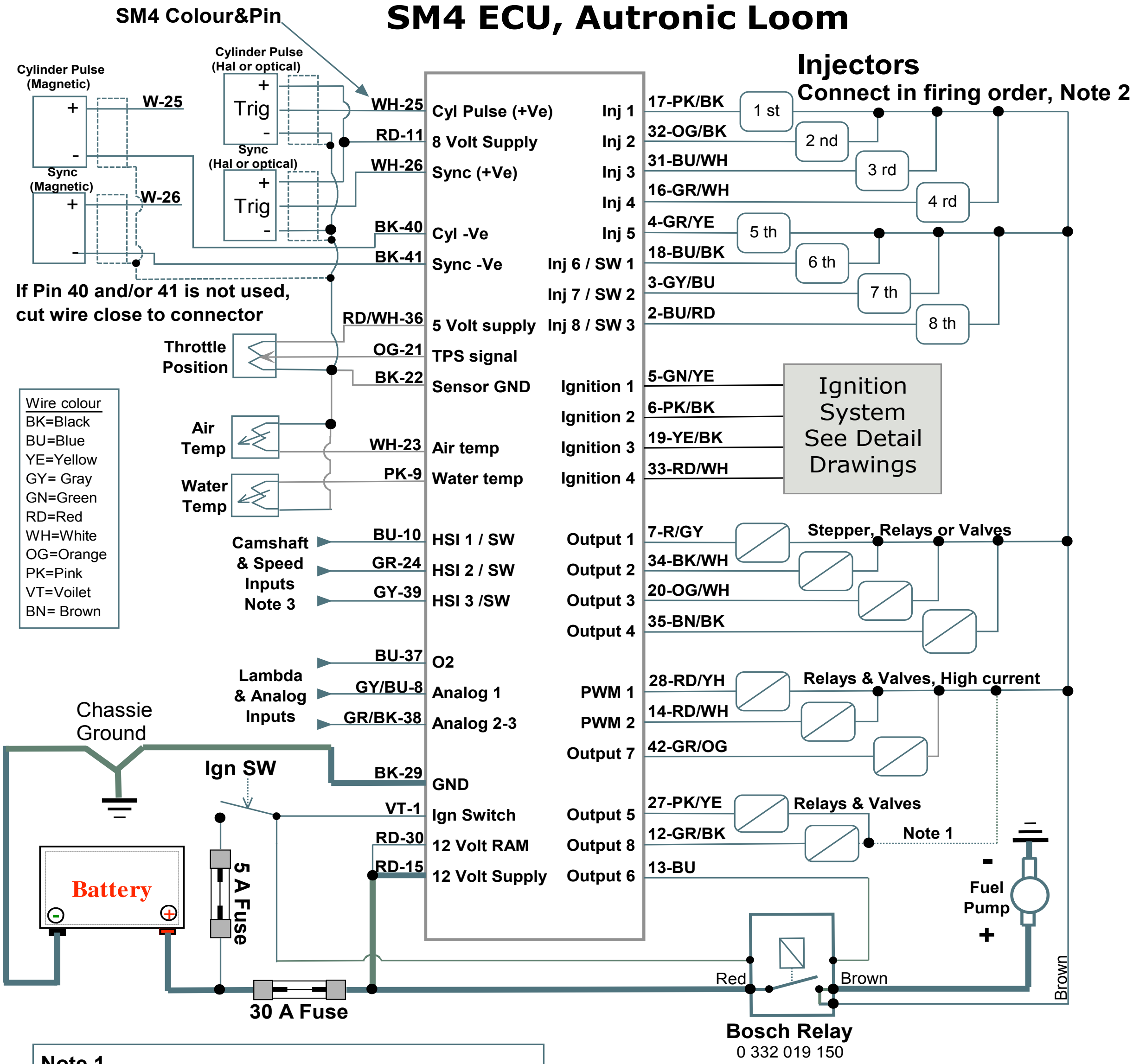
Looking into wire side of SM4 connector



Title **SM4 ECU Alternative wiring**
Date 14/9-2008
Rev 1,1 Robert

Main Wiring Diagram

SM4 ECU, Autronic Loom



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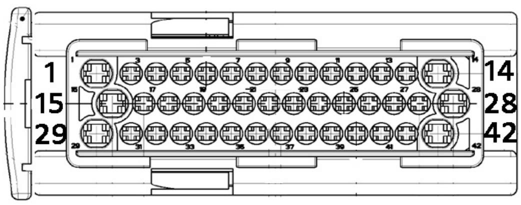

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Note 3
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Title **SM4 ECU Autronic Loom**
Date 14/9-2008
Rev 1,1 Robert