SMC

INSTALLATION AND USERS MANUAL

Ray Hall Turbocharging
57 Anderson Street
Cairns, Qld
Australia
Ph: (61) 7 4051 6672 Fax: (61) 7 4051 3683
info@autronic.com

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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.

Before You Begin

1) **READ THIS ENTIRE MANUAL BEFORE STARTING.**
The greater your knowledge of the operation of the Autronic ECU, the easier you will find it to understand what you are doing, and why.

2) Read any additional material accompanying this manual that updates the document since it was written.

3) You may need special parts or additional tools or test equipment in order to complete installation. Make sure you have these items on hand before you begin to avoid frustration. Contact your Autronic dealer if you have difficulty.

4) Do not take any shortcuts. Mistakes in the early stages of installation can cause you major headaches later on, be it in a few days or a few months time. Mistakes or shortcuts will cost you money and frustration in finding and fixing unnecessary problems. You have the opportunity to make your Autronic´s ECU operation extremely dependable and easy to use by doing it right the first time.

Avoid open sparks, flames, or operation of electrical devices near flammable substances.

Always disconnect the Battery cables when doing electrical work on your vehicle.

All fuel system components and wiring should be mounted away from heat sources, shielded if necessary, and well vented.

Make sure there are no leaks in the fuel system and that all connections are secure.

Disconnect the Autronic ECU from the electrical system whenever doing any arc welding on the vehicle by unplugging the wiring harness connector from the ECU.

Software.

PC hardware requirements.

The calibration and data logging software supplied with Autronic SMC 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.

The following functions are available using this program:-

1. Real-time display of the current operating status of the ECU and engine.
2. Display of error/fault condition history information recorded in the ECU and the cancellation of stored error history.
3. Display of the relative timing of the engine position reference signals for ease of setup.
4. Setup of ECU data logging.
5. Data logging using PC memory.
6. Display of logged ECU or PC memory data.

Calibration Adjustment:-

- Non-interactive calibration of the ECU. (Off-line calibration editing).
- Interactive calibration of the ECU (online calibration editing).
- Disk file storage and retrieval of calibrations.
- Free transfer of calibrations between file, screen and ECU.
- Calibration process does not effect normal ECU operation ie:- No hiccups during online adjustment.
- Calibration may be password secured in ECU to prevent unauthorised access.
- User ID may be included with calibration in ECU when required.

Software installation Windows 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.

Software Installation MS-DOS Software.

Step 1. Start Windows

Step 2. Place floppy disk in A: drive.

Step 3. Click “Start” and then “Run” Type A:\INSTALL.EXE and Click “Ok”.

Step 4 Select version to install and press Enter.

Step 5. Select “Complete Installation” and press Enter.

Step 6. Press Enter again to start the installation. After Installation is complete, select Exit and press Enter.

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

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.

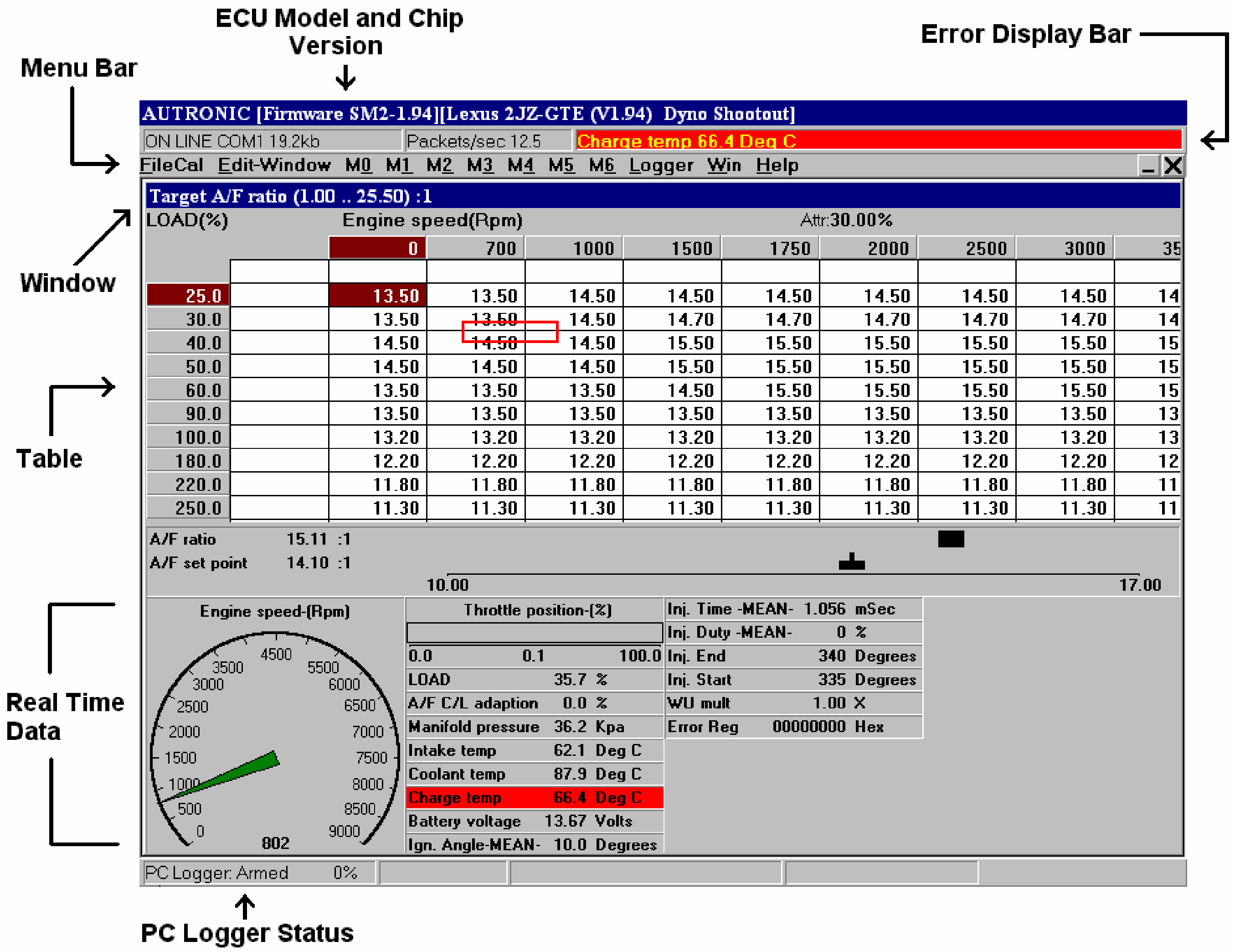
F8………………………….Starts and stops PC logger.
F10…………………………Graph logged data.
Z or Arrow Up……………..Zoom in on graphed data.

Software Interface and Menus

The options available under menu “Edit-Window” will change depending on which table or window is displayed. Always check this menu for possible options. Some of the hot keys on the previous page will only be available when certain tables or windows are displayed.

Example:- The setup options for Autotune are only visible in the Edit-Window menu when the Base Fuel Delivery table is displayed.

The drop down menus can be selected by pressing the ESC key or by pressing Alt + the underscored letter of the menu item. e.g:- Alt + 1 will open the M1 menu.



Real time display of engine parameters are displayed below open tables. The items displayed can be selected from the “PC Limits/Log setup” under the “Logger” menu.

The User ID/Error bar will turn red and display any error or engine parameters outside the limits set in the “PC Limits/Log setup” under the “Logger” menu. These limits can be set so you do not have to monitor engine parameters while tuning for example, as the Software will do this for you.

Mode Flags.

Autronic ECU use mode flags to select functions not selectable from the software menus. Do not change Mode flags 0 to 3 as these are automaticly set when items are selected in the “Engine Setup” menu.

In this example we will set mode flag 5. Mode flag five is used to select the Auxiliary and On/Off outputs. In this example we require the folowing function and outputs for a 4 cylinder engine,

Boost control = Auxiliary Output
Engine cooling fan = Injector 6 Output.

Using mode flag 5 information below we can find the value required is 66.

Function	Flag Value
ENABLE AUXILIARY O/P FUNCTION AS BOOST CONTROL.	2
ENABLE MAIN COOLING PAN (FAN1) FUNCTION TO AUXILIARY O/P OR INJ6 O/P	64
	2 + 64 = 66
	Mode Flag 5 = 66

5	ENABLE AUXILIARY O/P FUNCTION AS BOOST CONTROL.	ADD 2
5	DIRECT MAIN COOLING FAN (FAN1) TO AUXILIARY O/P.	ADD 3
5	DIRECT USER DEFINED PWM 0/P OR ANTI-LAG FUNCTION TO AUXILIARY O/P.	ADD 4
5	ENABLE AUXILIARY O/P FUNCTION AS FUEL USED 0/P.	ADD 5
5	RE-DIRECT USER ON/OFF 0/P FUNCTION FROM EITHER INJ5 OR INJ8 TO AUXILIARY O/P.	ADD 6
5	SELECT (THROTTLE POSITION AS CALIBRATION VARIABLE F0R USER DEFINED PWM OR ANTI-LAG FUNCTION.	ADD 0
5	SELECT “LOAD” AS CALIBRATION VARIABLE FOR USER DEFINE PWM OR ANTI-LAG FUNCTION.	ADD 8
5	SELECT THROTTLE POSITION AS CALIBRATION VARIABLE FOR USER DEFINED ON/OFF O/P.	ADD 0
5	SELECT “LOAD” AS CALIBRATION VARIABLE FOR USER DEFINED USER DEFINED ON/0FF O/P.	ADD 16
5	ENABLE ON/OFF O/P FUNCTION TO AUXILIARY 0/P OR INJ5 O/P OR INJ8 O/P (AUX O/P OR INJ5 O/P IF ANTI-LAG SELECTED)	ADD 32
5	ENABLE MAIN COOLING PAN (FAN1) FUNCTION TO AUXILIARY O/P OR INJ6 O/P	ADD 64

Software Tables.

The base Fuel and Ignition tables and most other tables have user selectable X and Y axis sites. See the “Edit” keys section for keys to insert, delete and edit an axis value.

Fuel and Ignition.

The fuel and ignition tables have RPM and Load axis. Any axis value inserted, deleted or edited in either fuel or ignition table will be mirrored in the both tables.

The load axis when throttle mapping an engine relates to the throttle position. e.g:- Load axis 30 = 30% throttle position. When pressure mapping the Load sites relate to manifold pressure in Kpa absolute.

Example:-
Load axis of 100 = 0 kpa gauge pressure.
Load axis of 50 = -50 kpa gauge pressure.
Load axis of 200 = 100 kpa gauge pressure.

To convert psi to Kpa absolute, Psi x 6.8 + 100 = KPA absolute.

Idle ignition table.

The idle ignition table can be very useful to maintain a stable idle rpm on engines without idle control valves.

By setting up the table as below the engine idle rpm will drop only slightly when AC or auto transmission is put into drive. In this example the idle speed of the engine is 850 RPM.

RPM				
750	800	1500	2000	3000
30	10	10	25	35

When a load is placed on the engine and the RPM drops below 800 RPM the ignition timing advances, this can help prevent the engine RPM dropping as the engine produces more power with the extra advance. In some cases 0 deg is required at the 800 and 1500 rpm sites on engines with AC and automatic transmissions.

Auxiliary output tables.

PWM table.

This table can be use to control any device requiring pulse width modulated signal. Values anywhere from 0 to 100 can be selected, with 0 = Off and 100 = On.

The PWM frequency and Y axis can be defined in the “PWM & on/off setup” under menu M4.

On/Off table.

This table can control any device requiring on or off operation. 0 = Off and 1 = On.

The on/off Y axis can be defined in the “PWM & on/off setup” under menu M4.

Basic Software setup.

This guide is will setup the software to get the engine running.

The Software has many options that can be set. For 95% of applications most of these will not need changing from the defaults. The warmup/cold start settings and acceleration table values should not need to be modified if the main fuel and ignition tables have been correctly tuned.

If the acceleration enrichment table is modified before the main fuel table is fully tuned this can lead to confusing engine tune problems.

Information required before you start.

Engine size in cubic centimetres (CC) CC = CI * 16.378.
Number of cylinders.
Compression ratio.
Injector flow a 100% duty.
Injector ohms resistance.
Number of ignition coils.
Cylinder trigger pulse signal +ve or –ve (see below for more information on this).
Reference trigger pulse signal +ve or –ve (see below for more information on this).
Type of ignition trigger signal +ve or –ve (see below for more information on this).
Type of idle control valve (pulse width or proportional).

Starting the calibration program.

Connect the PC Data Cable to the PC and ECU. Turn on the ignition switch.

Double click on the Autronic software icon on the desktop to start the software.

Base Settings.

Select from M1, Base settings.

1. Set the “Overall fuel cal mul” using the following formula.

   OVERALL FUEL CAL MUL. = 8.112 * D / I

   Where:-

   D = CYLINDER DISPLACEMENT (in c.c.)
   I   = INJECTOR FLOW RATE (in c.c/minute) @ operating pressure.
   Using Petrol (Gasoline) with a density of 0.765 g/c.c.

2. Set “Comp. Ratio” to compression ratio of the engine.

No other items in this menu need changing.

Engine Setup.

Select from M1, Engine Setup.

1. Select method of mapping.

Options are,

Manifold pressure.
Throttle position.
Thr/Manifold (See Advanced software setup).

Engines with one throttle butterfly for every intake port and not turbocharged, select Throttle position or Thr/Manifold. When mapping only using throttle position, the map sensor hose is not connected and is vented to atmosphere.

Engines with one throttle butterfly for every intake port and turbocharged, select Thr/Manifold position. (See Advanced software setup for information on this).

All other engines select Manifold pressure. Map sensor hose is connected to the intake manifold after the throttle body.

2. Select engine cycles.
   4 Stroke.
   2 Stroke or rotary

3. Set Cylinders.
   The number of cylinders. On some V engines with odd fire, this value is set the virtual number of cylinders. Example:- Harley Davidson motorcycle is a V16 engine with 14 cylinders missing. See “Odd Fire Engines Setup”.

4. Set number of ignition coils. e.g:- A six cylinder engine with three double ended coils, set the number of coils = 3.

5. Set Ignition trigger, to –ve or +ve.
   +ve = MSD CDI
   +ve = Internal dwell board in ECU.
   -ve = Autronic CDI
   -ve = Ignition modules e.g:- Bosch 008

6. Set Cylinder reference.

   Options, -ve or +ve edge.
   This is the sensor triggering edge for the number one cylinder reference signal.

   Bosch or Siemens hall effect sensors, optical sensors or if using a reluctor interface produce +ve (rising signal) as metal trigger the sensor and –ve (falling signal) as metal leaves the sensor.

   If using a No1 spark plug pickup select +ve edge

Honeywell gear tooth sensors produce a –ve (falling signal) as metal enters the sensor and a +ve (rising signal) as metal leaves the sensor.

7. Set Cylinder pulse, options are,
   -ve
   +ve
   +ve AND –ve edge.

   This is the sensor triggering edge for the cylinder pulse signal.

   Bosch or Siemens hall effect sensors, optical sensors or if using a reluctor interface produce +ve (rising signal) as metal trigger the sensor and –ve (falling signal) as metal leaves the sensor.

   Honeywell gear tooth sensors produce a –ve (falling signal) as metal enters the sensor and +ve (rising signal) as metal leaves the sensor.

   For information on using +ve AND –ve edge ask a Autronic dealer about this feature.

8. Set Trigger Pulse Offset,

   For Subaru or Mitsubishi see “Subaru and Mitsubishi Trigger Selection” in the manual.

   For all other engines set Trigger Pulse Offset = 60 deg.

No other items in this table need modifying.

Triggering Setup.

The SMC requires one cylinder pulse per cylinder per engine cycle.

Example:- A four stroke engine turns through two complete revolutions per engine cycle.
360 + 360 = 720 deg.

On a six cylinder engine 6 pulses are required for every 720 deg the crankshaft turns. To get the required 6 pulses a crank trigger producing 3 signals per crankshaft revolution (360deg) can be used or a distributor producing 6 signals per distributor revolution (360 deg distributor/720 deg crankshaft).

4 cylinder = 4 signals per engine cycle (720 deg crankshaft).
6 cylinder = 6 signals per engine cycle (720 deg crankshaft).
8 cylinder = 8 signals per engine cycle (720 deg crankshaft).

Select from M1 “Old mode flags 0 to 15”.

If crank trigger or distributor produces the correct number of signals per engine cycle then set Mode Flags 13,14 and 15 as follows,

Mode Flag13 = 0

Mode Flag14 = 0
Mode Flag15 = 0

If the crank trigger or distributor produces more signals per engine cycle then the number of cylinders, then mode flags 13, 14 and 15 are setup as follows,

Example 1:- A six cylinder engine with crank trigger with 60-2 teeth.
Mode Flag13 = 2 (number of missing teeth)
Mode Flag14 = 20 (see advanced trigger setup Page62)
Mode Flag15 = 0 to 19 (see advanced trigger setup Page62)

Example 2:- A six cylinder engine with crank trigger with 12 teeth.
Mode Flag13 = 0
Mode Flag14 = 4 (see advanced trigger setup Page62)
Mode Flag15 = 0 to 3 (see advanced trigger setup Page62)

Example 3:- A four cylinder engine with distributor producing 24 signals per engine cycle.
Mode Flag13 = 0
Mode Flag14 = 6 (see advanced trigger setup Page62)
Mode Flag15 = 0 to 5 (see advanced trigger setup Page62)

If using a distrubtor it is important that the distrubtor phasing is correct. See “Distrubtor phasing” Page63.

Subaru and Mitsubishi Trigger selection.

Mode Flag13 is used to select Subaru 1998 to 2000 model or Mitsubishi trigger setup.

Select “Old mode flags 0 to 15” under menu “M1”.

Subaru 1998 - 2000 model Mode Flag13 = 32
Mitsubishi Mode Flag13 = 64

Set Mode Flag14 = 0
Set Mode Flag15 = 0.

Select “Engine Setup” under menu “M1”.
Set “Trigger Pulse Offset”

Subaru = 63 deg
Mitsubishi = 78 deg.

Injector selection.

Select from M1, Engine Setup.

If the injector you are using is in the list then select this. Most injectors with around 16 ohms resistance select “Bosch L late EG 901”

Injectors sent to Autronic for testing or those that have been tested previously can be defined in the USER DEFINE Sel. Ask a Autronic dealer to see if these parameters are available for your injectors.

Base Fuel Delivery.

Select from M2, Base Fuel Delivery, or press Ctrl + F10.

Setup the fuel tables using the information below. See Keyboard Keys for information on inserting, deleting, editing Load and RPM sites.

Generally RPM sites every 500 RPM are all that is required in most cases.

i. Engine is to be setup using throttle position as the primary load input.

Engines using throttle position for mapping should have the load sites setup as per the sample with a lot of small throttle position sites.

_______< Base Fuel Delivery (Vol. Eff) % (0 to 200) >_________

	ENGINE SPEED RPM			
LOAD	0	2000	PEAK TORQUE RPM	PEAK POWER RPM
0.0	25.0	25.0	25.0	30.0
2.0	30.0	30.0	30.0	35.0
5.0	50.0	45.0	45.0	40.0
10.0	60.0	55.0	55.0	45.0
30.0	70.0	60.0	60.0	50.0
70.0	80.0	80.0	100.0	90.0
100.0	80.0	80.0	110.0	100.0

ii. Engine is to be setup using manifold absolute pressure as the primary load input.

Engines using manifold pressure for mapping should have the load sites setup as per the sample. Engines not turbocharged or supercharged will not require load sites greater then 100.

_______< Base Fuel Delivery (Vol. Eff) % (0 to 200) >_________

	ENGINE SPEED RPM			
LOAD	0	2000	PEAK TORQUE RPM	PEAK POWER RPM
30.0	60.0	70.0	80.0	70.0
50.0	65.0	75.0	90.0	85.0
70.0	70.0	80.0	100 .0	100.0
90.0	70.0	80.0	110.0	100.0
100.0	70.0	80.0	110.0	100.0
200.0	75.0	80.0	110.0	100.0
400.0	80.0	80.0	110.0	100.0

!! CAUTION !!

This preliminary selection will generally result in a safe RICH fuel calibration, but extreme caution should be exercised until the fuel delivery has been fully matched to the engines exact requirements.

Base Ignition Timing.

Select from M2, Base Ignition Timing, or press Shift + F10.

The following is a guide to setting the ignition table.

Engine paramenter	Less timing	More Timing
Bore diameter	Small	Large
Combustion chamber size	Small	Large
Connection rod length	Long	Short
Compression ratio	High	Low
Fuel octane	Low	High
Combustion chamber design	Multi valve	Two valve, wedge or open chamber
Turbocharged	Yes	No

A turbocharged big block Chev with 7.5:1 compression ratio, 1bar boost and 100 octane fuel would be happy with 34 degrees timing at the engines maximum torque rpm.

While Mitsubishi EVO5 with 9.3:1 compression ratio, 1bar boost and 96 octane fuel would require only 8 degrees timing at the engines maximum torque rpm.

These examples are based on air fuel ratios of 10.8 to 11.2 at 1bar boost.

See following sample tables for a guide to ignition table requirements.

Turbocharged big block Chev 7.5:1 compression ratio, 100 octane fuel.

				RPM			
Load	0	1000	2000	3000	4000	5000	6000
30	30	35	38	40	45	45	45
50	28	32	36	40	45	45	45
70	24	30	35	40	40	40	40
90	20	28	32	38	38	38	38
100	20	28	32	37	38	38	38
150	18	26	31	36	34	36	36
200	16	20	30	34	33	34	34
220	14	18	28	33	32	33	33

Base Ignition Timing table.

Turbocharged Mitsubishi EVO5 9.3:1 compression ratio, 96 octane fuel.

				RPM			
Load	0	1000	2000	3000	4000	5000	6000
30	25	25	35	40	40	40	40
50	20	20	30	35	35	35	35
70	10	10	20	30	30	30	33
90	10	10	20	30	30	30	32
100	10	10	20	30	30	30	31
150	10	10	12	17	17	17	18
200	8	8	10	8	8	8	9
220	6	6	8	6	6	6	7

Base Ignition Timing table.

Naturally aspirated small bore multi valve engine 10.0:1 compression ratio, 96 octane fuel.

				RPM			
Load	0	1000	2000	3000	4000	5000	6000
30	30	36	40	45	45	45	45
50	24	26	34	38	40	40	40
70	18	22	28	32	36	36	36
80	12	20	24	30	34	34	34
100	10	18	22	28	30	32	32

Base Ignition Timing table.

Auxiliary and On/Off Outputs

Use Mode Flag 5 to select which functions are assigned to the spare outputs.

See Mode Flags setting on page 9 and mode flags at end of this manual.

Available from the Autronic website is a program called ModeFlags that will calculate the values for you.

Website http://www.autronic.com/software.html

Hardware Setup.

Wiring Notes.

The wiring diagrams should be followed 100%. Do not make changes that you believe will not effect the operation of the ECU. This is one of the major causes of the engine not starting, misfiring or ECU diagnostic errors.

The “System Ground” (earth) shown on the wiring diagram is on the engine block or cylinder head. Do not use the body of the car as a ground.

The ground for the air and water temperature sensors, throttle position sensor and 02 sensor must be connected to the sensor ground on the ECU (Pin 17). Failure to do this will result in ECU diagnostic errors.

If there is some doubt as to the amperage available via the ignition switch, then the use an additional relay that is ignition switched to power the ECU. See alternative wiring diagram.

The injector output sequence has to be matched to your engine firing order.

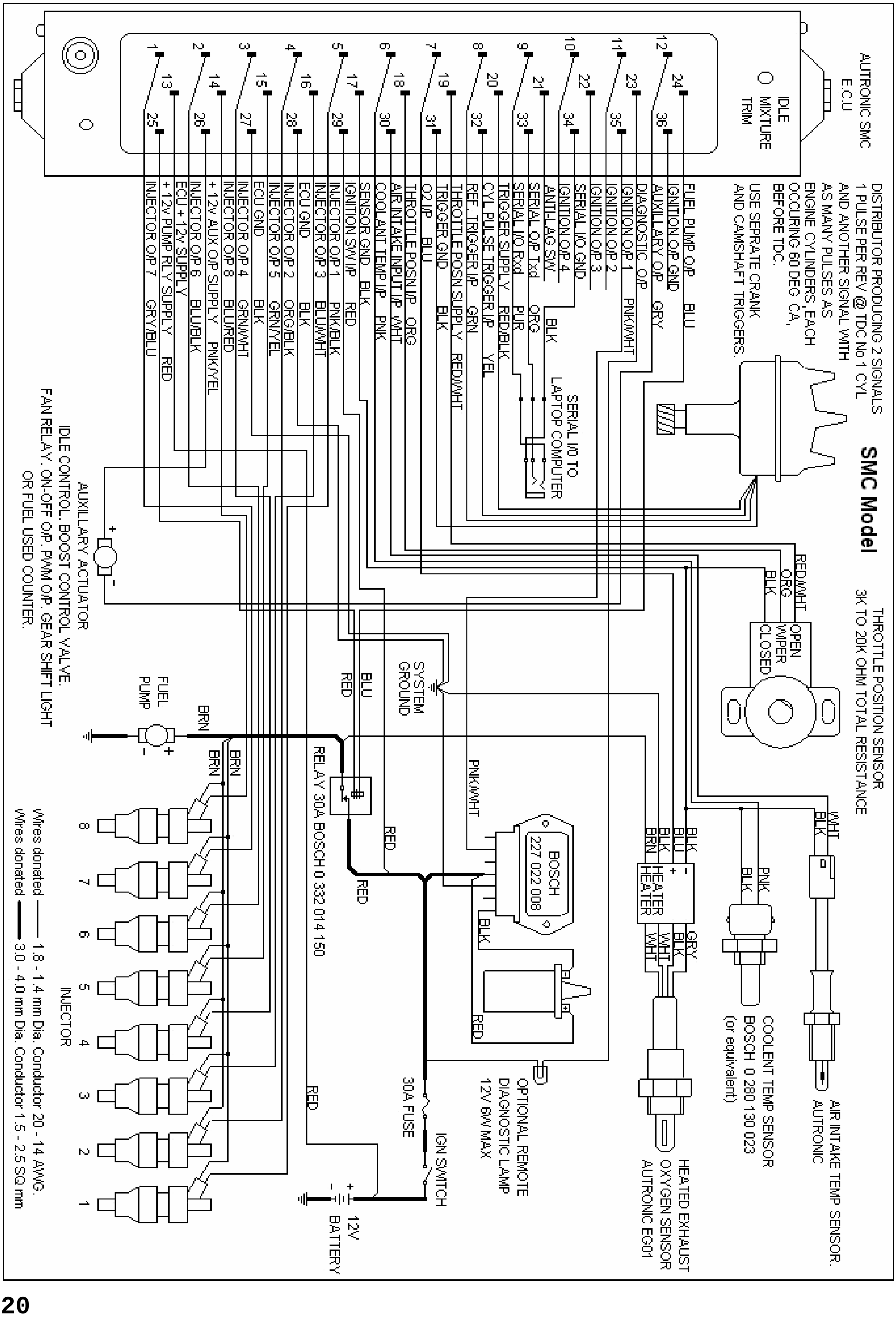
Example:- Four cylinder engine with a 1,3,4,2 firing order.

Injector 1 O/P = Cylinder 1
Injector 2 O/P = Cylinder 3
Injector 3 O/P = Cylinder 4
Injector 4 O/P = Cylinder 2

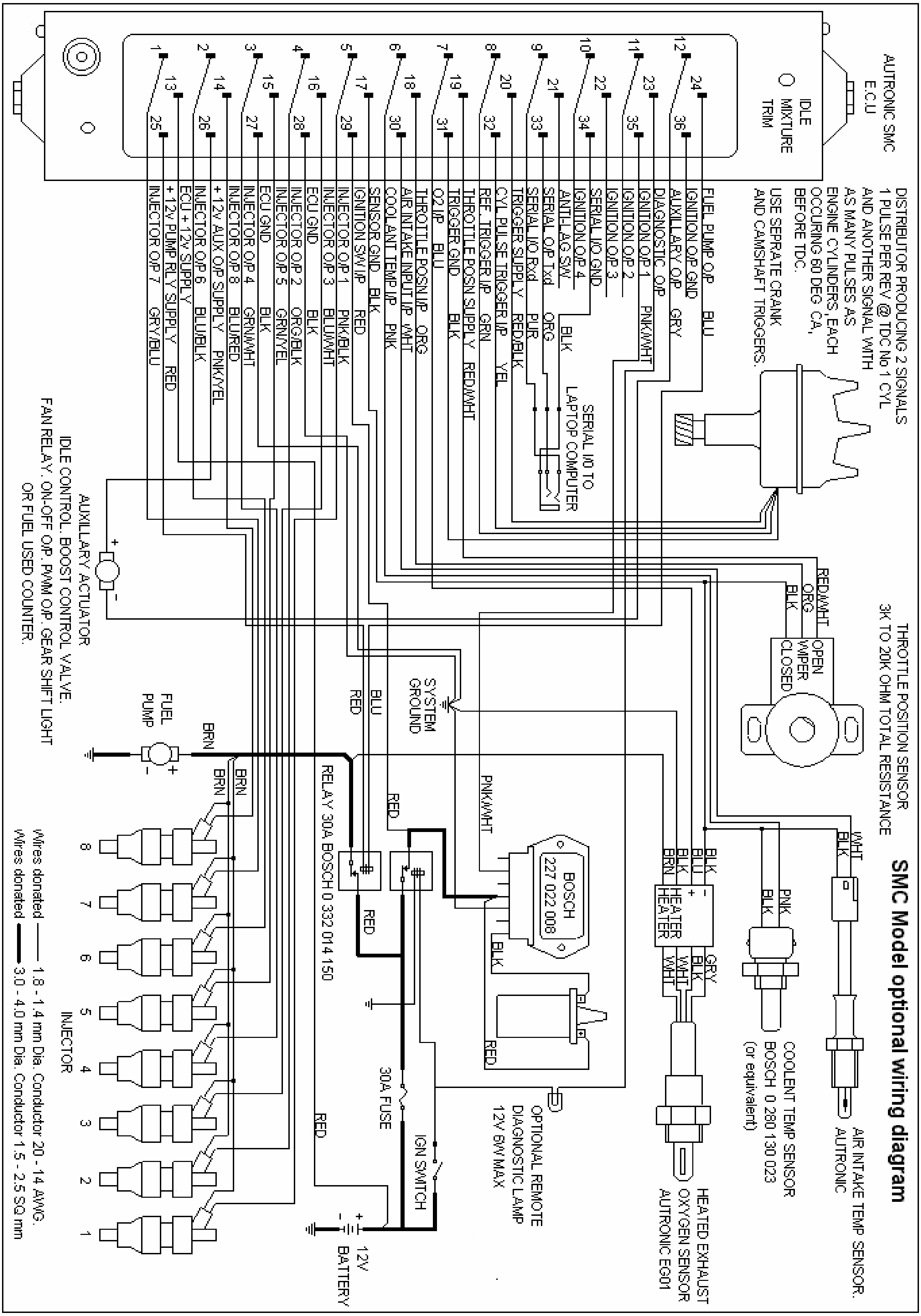
The ignition output sequence if using more than one ignition coil must also be wired in the correct sequence. See the “Ignition Output Sequence” in the hardware section of this manual.

If using a reluctor interface to convert inductive signals to hall effect type signals, then the reluctor interface should be mounted close to the distributor or trigger sensors. The shielded wires should directly connect to the distributor or trigger sensors, Do not use unshielded wire to lengthen these wires.

Main wiring diagram



Alternative wiring diagram

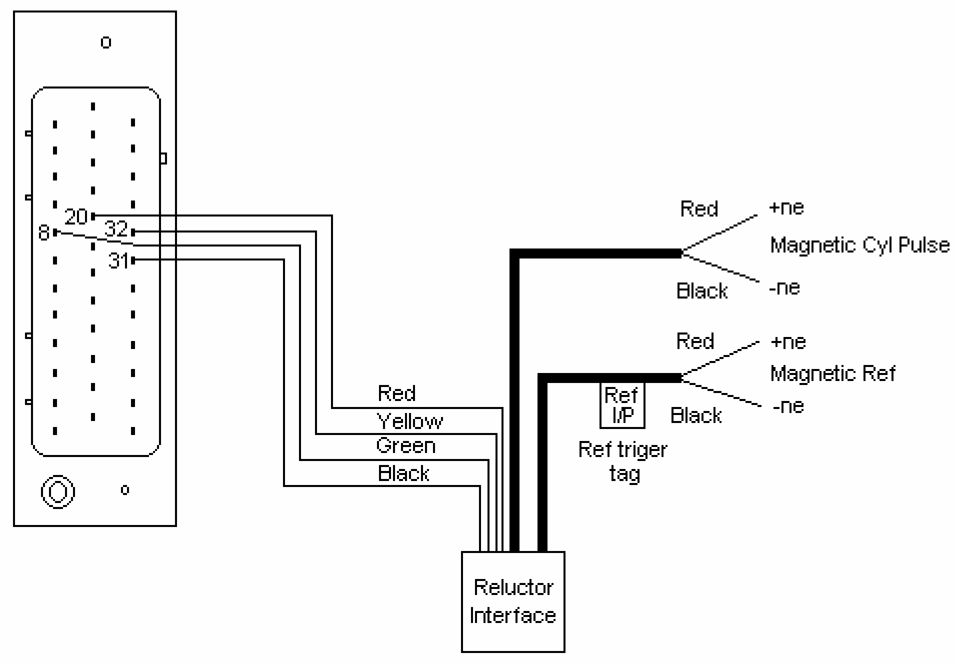


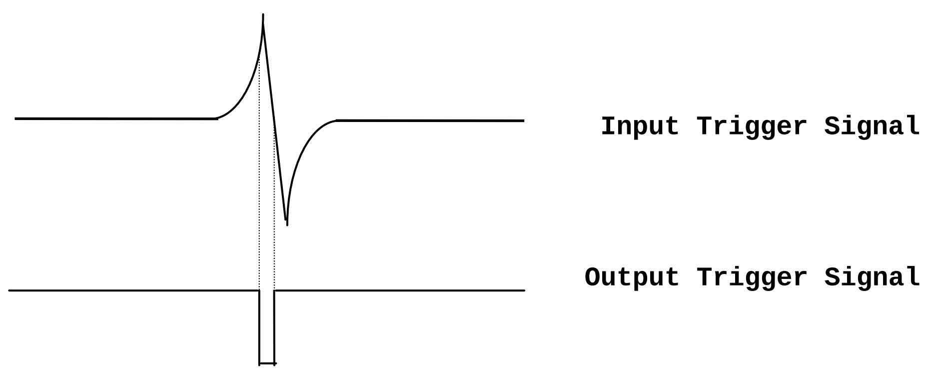
Reluctor interface (required for inductive sensors)

When using inductive sensors a reluctor interface is required. This is an option and is not included with the ECU's. This interface will make a square wave from the small spike generated form the inductive sensor.

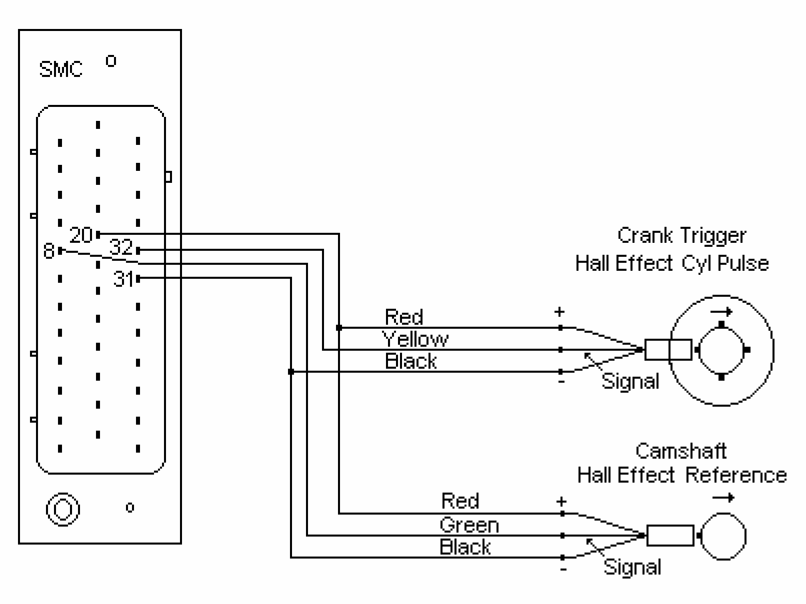
For proper function, the positive and negative wire from the sensor must be wired correctly to the interface. If they are not marked use an oscilloscope or multi-meter to check the signal. The +ne (red wire) connects to the wire/pin on the on the sensor that gives a positive voltage as metal approaches the sensor.

One channel can be used if one engine sensor is inductive and the other hall-effect sensor is wired direct to the ECU.

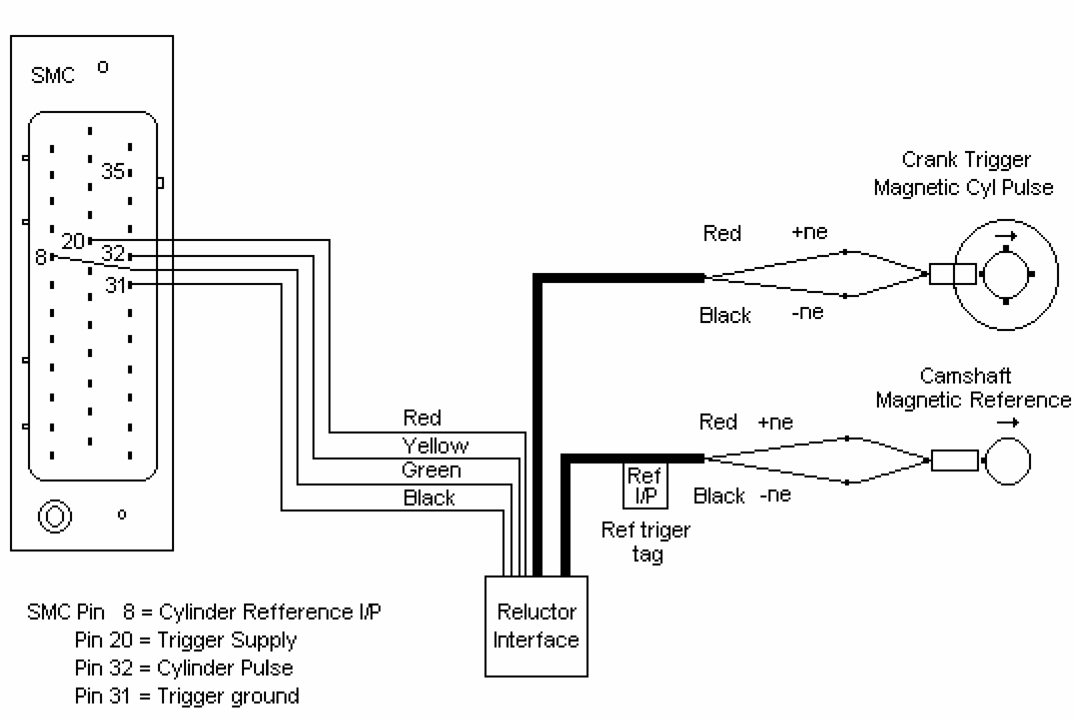




Crank Trigger wiring with hall effect sensors.

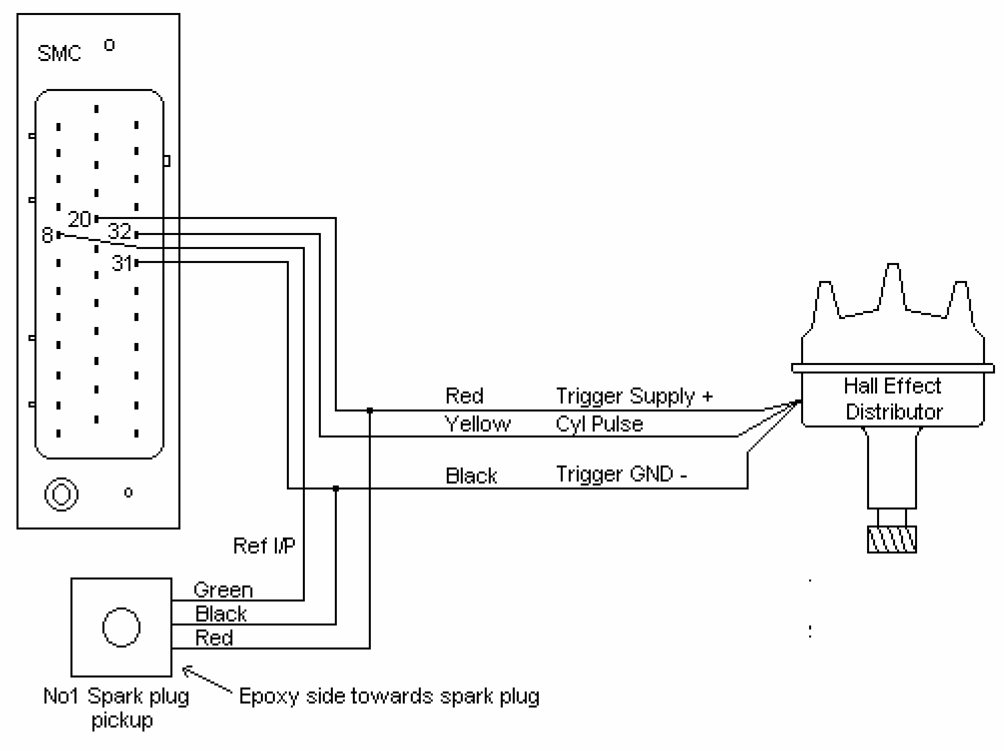


Crank Trigger wiring with magnetic sensors.

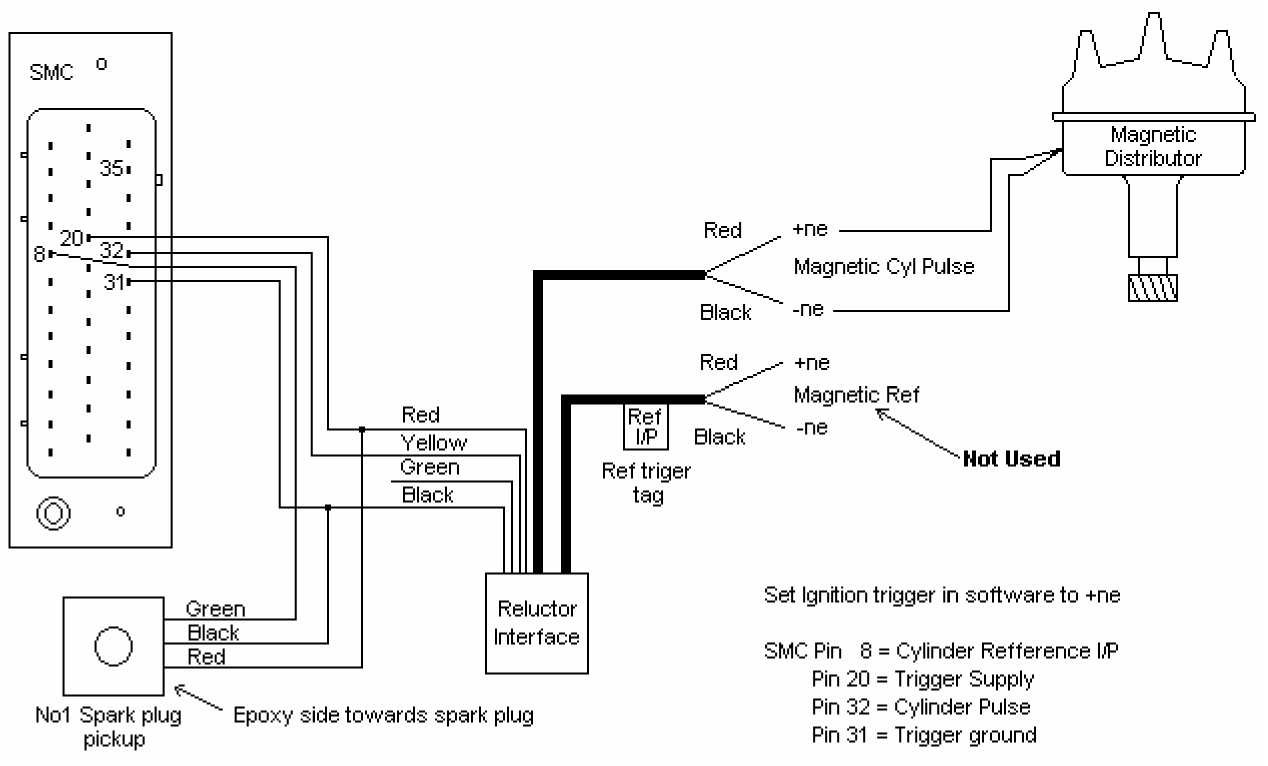


No1 Spark plug reference sensor and reluctor interface.

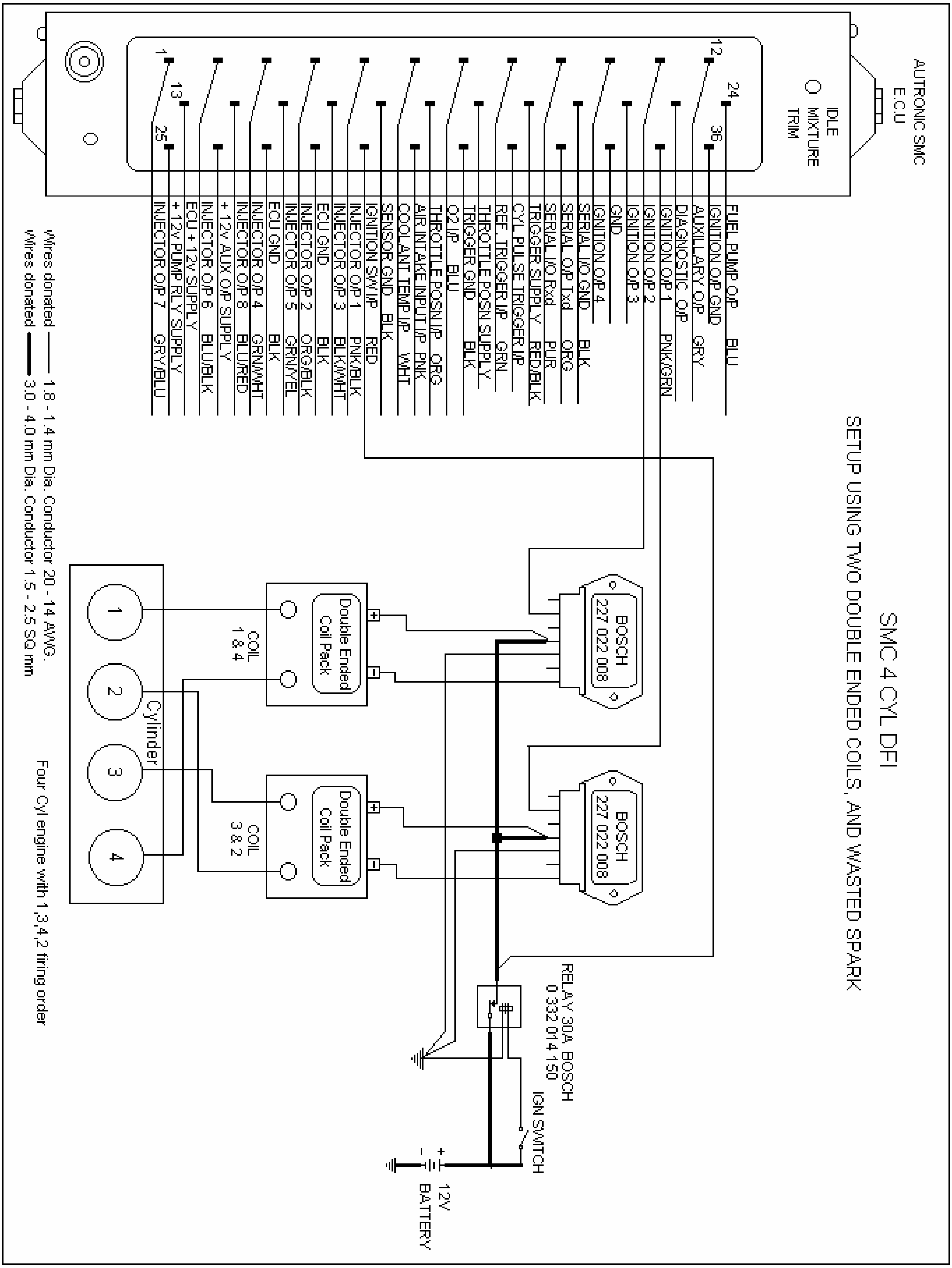
With hall effect distributor providing cylinder pulse.



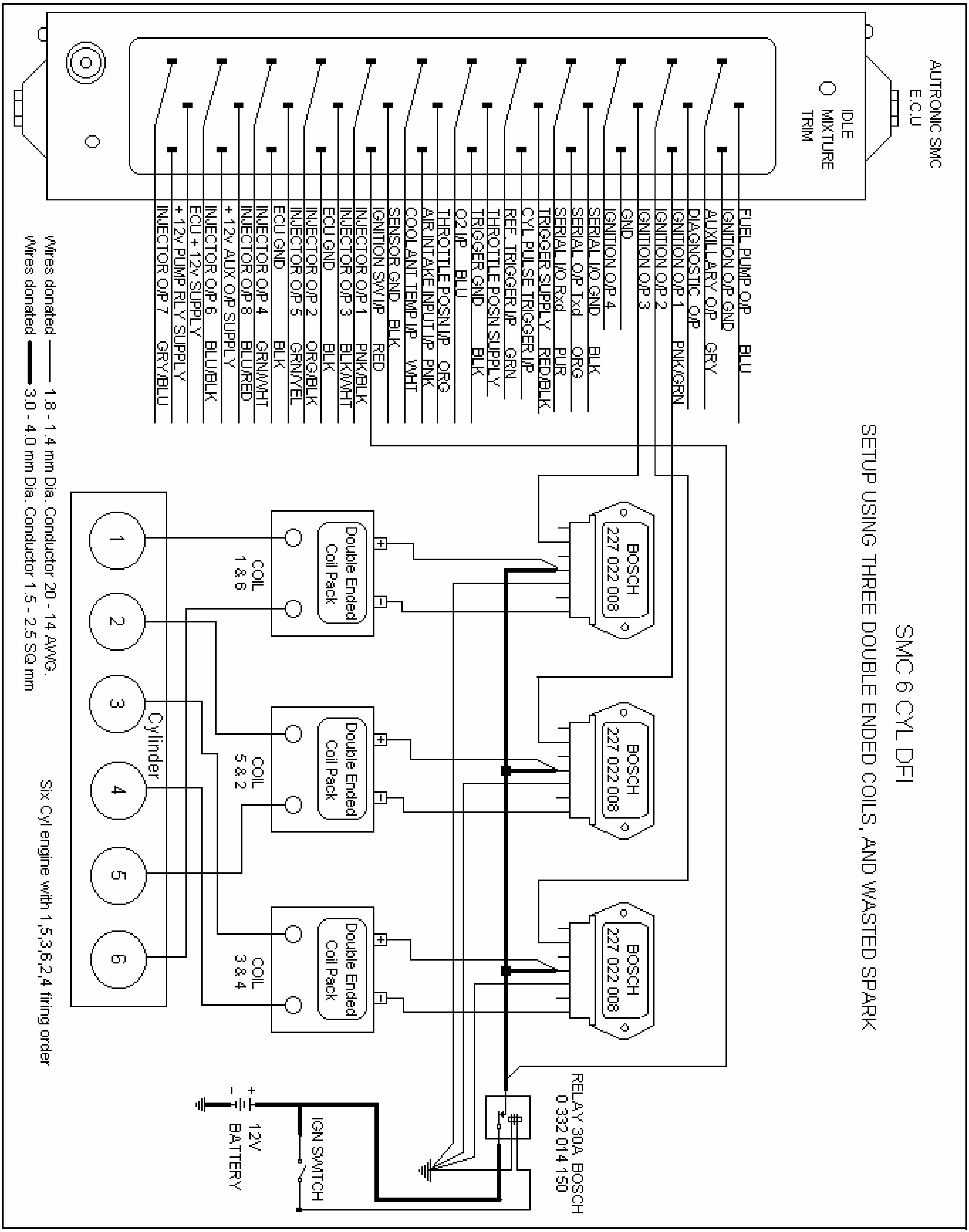
With magnetic distributor providing cylinder pulse.



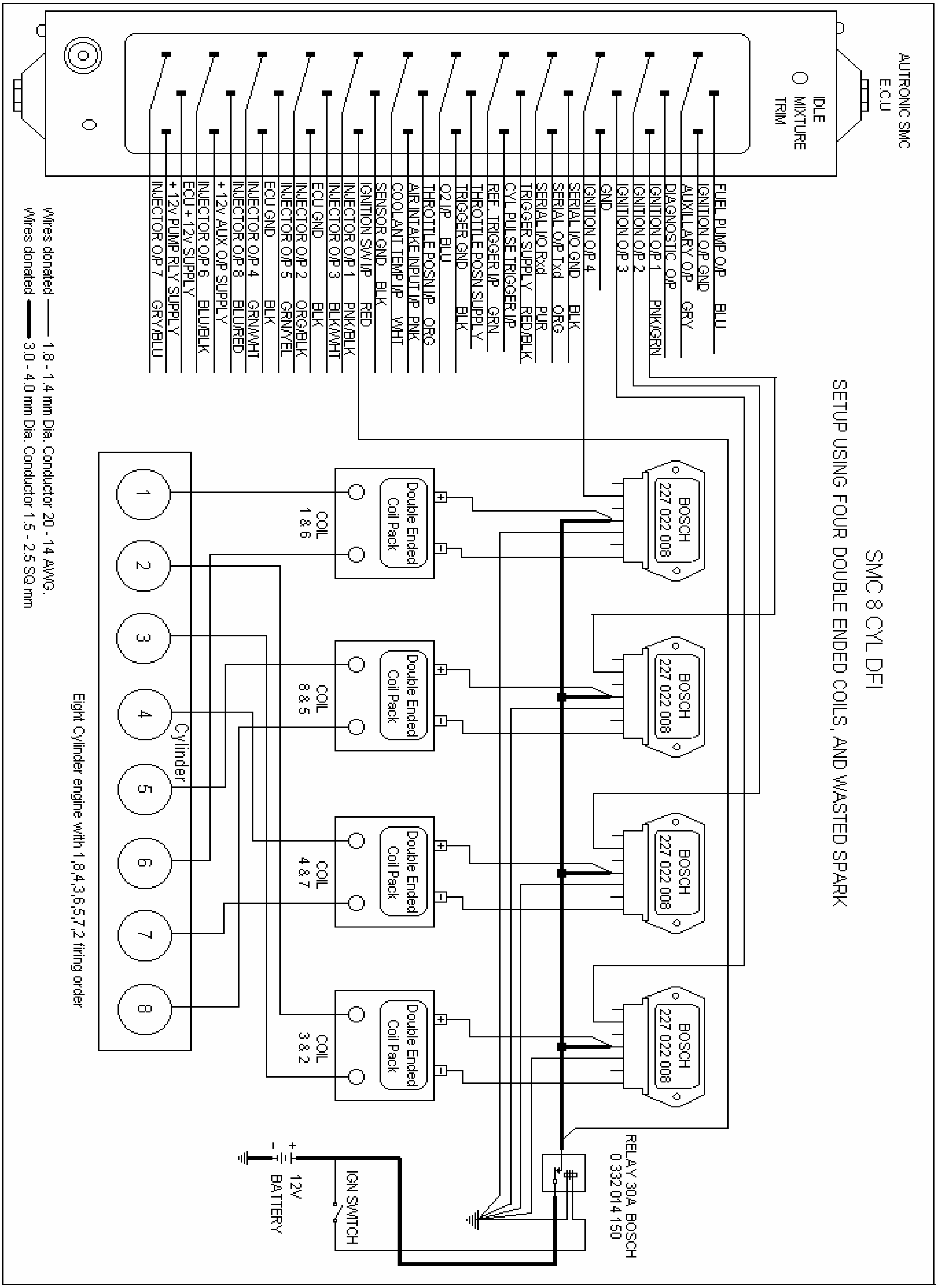
Ignition setup 4-cyl, 2 x double ended coils (Bosch 008 modules)



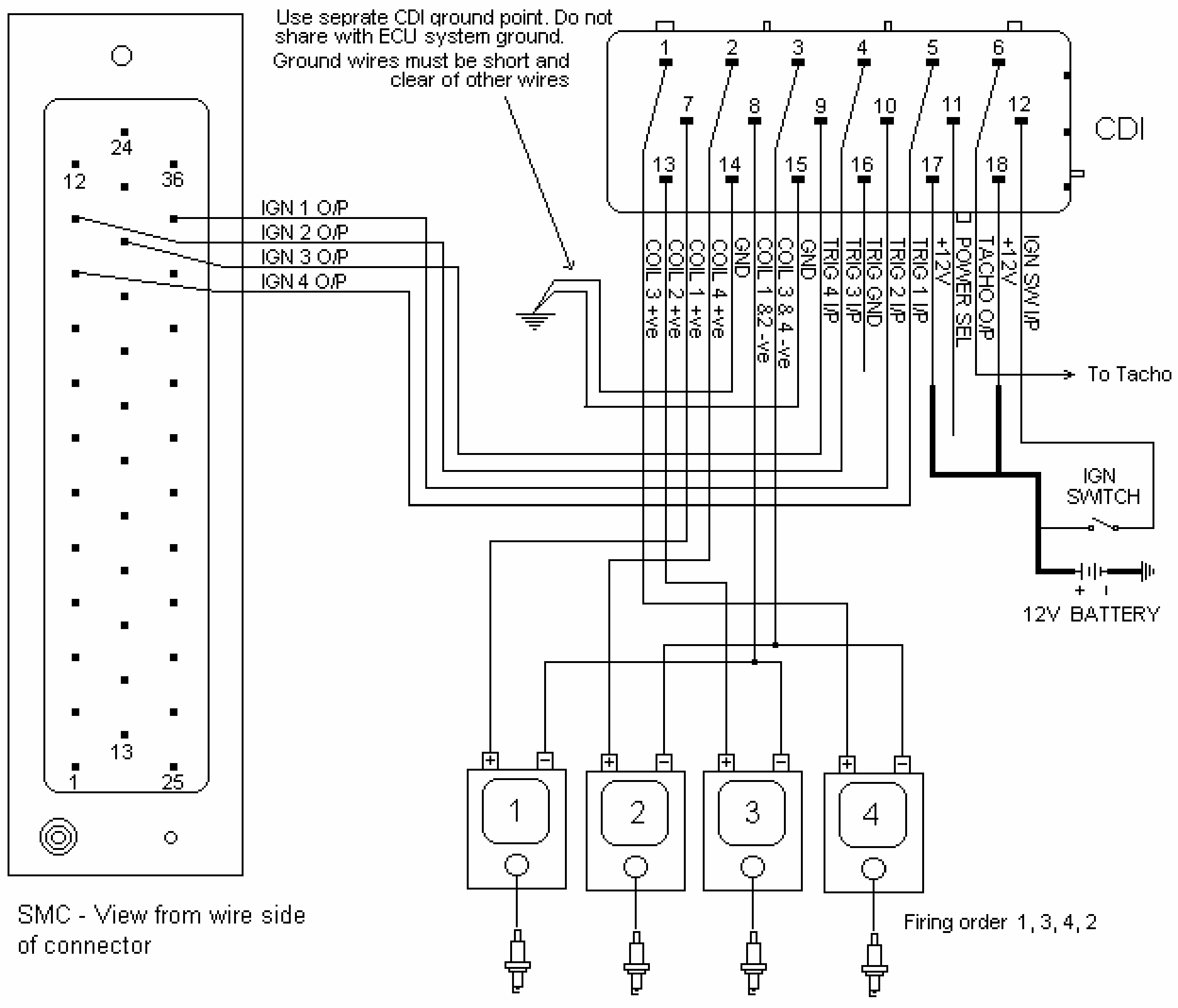
Ignition setup 6-cyl, 3 x double ended coils (Bosch 008 modules)



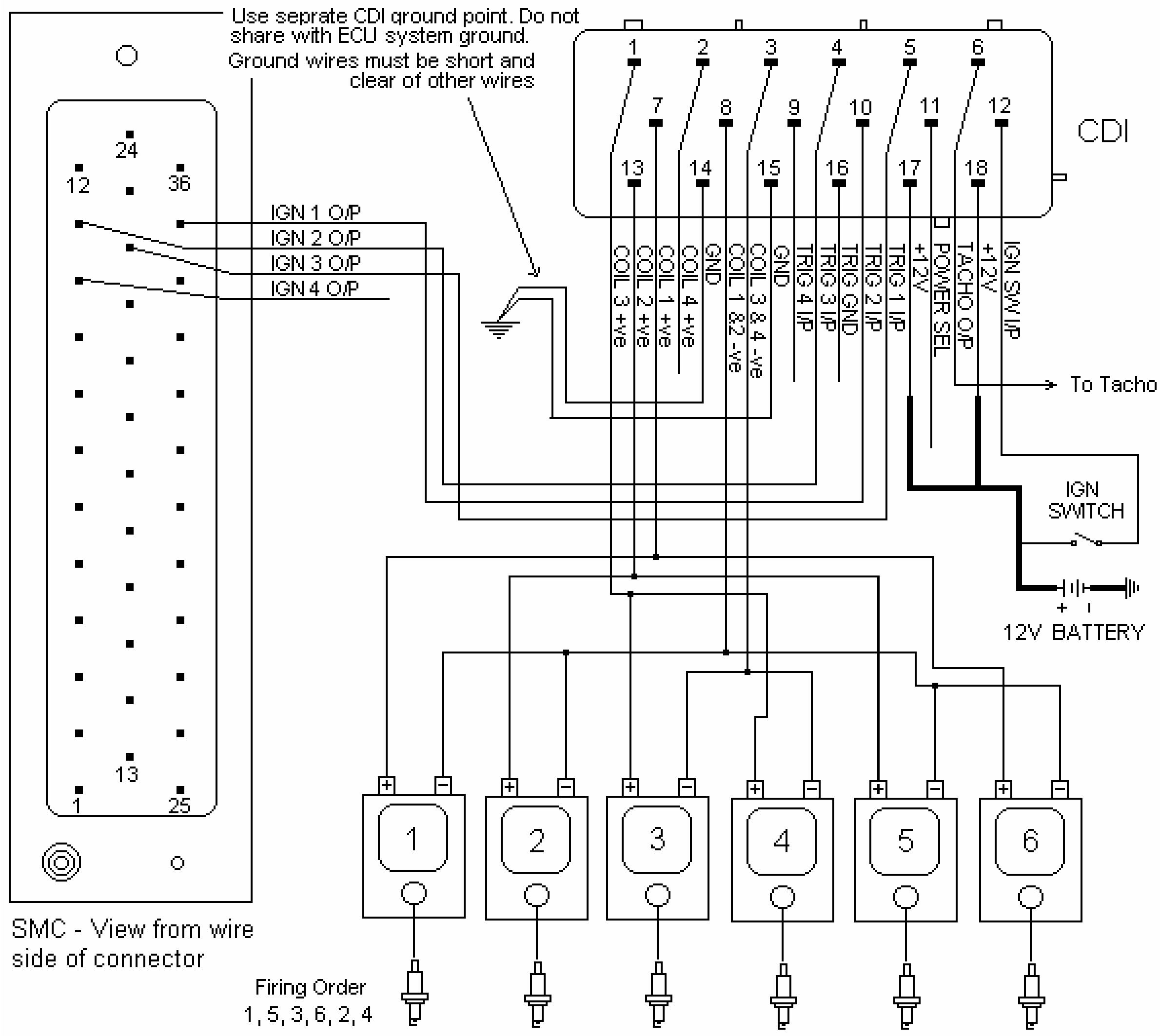
Ignition setup 8-cyl, 4 x double ended coils (Bosch 008 modules)



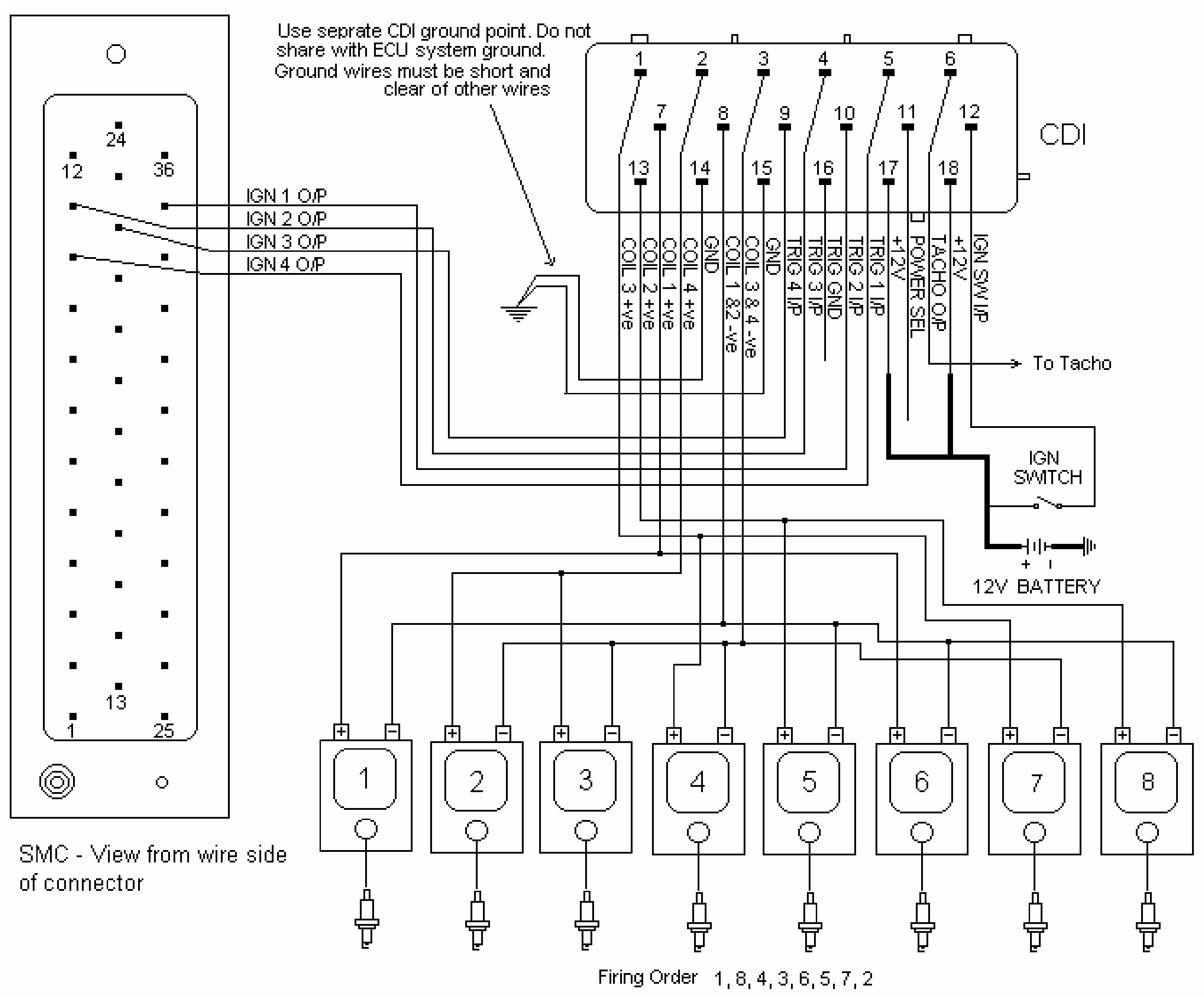
Ignition setup 4-cyl, 4 x single coils (R500 CDI)



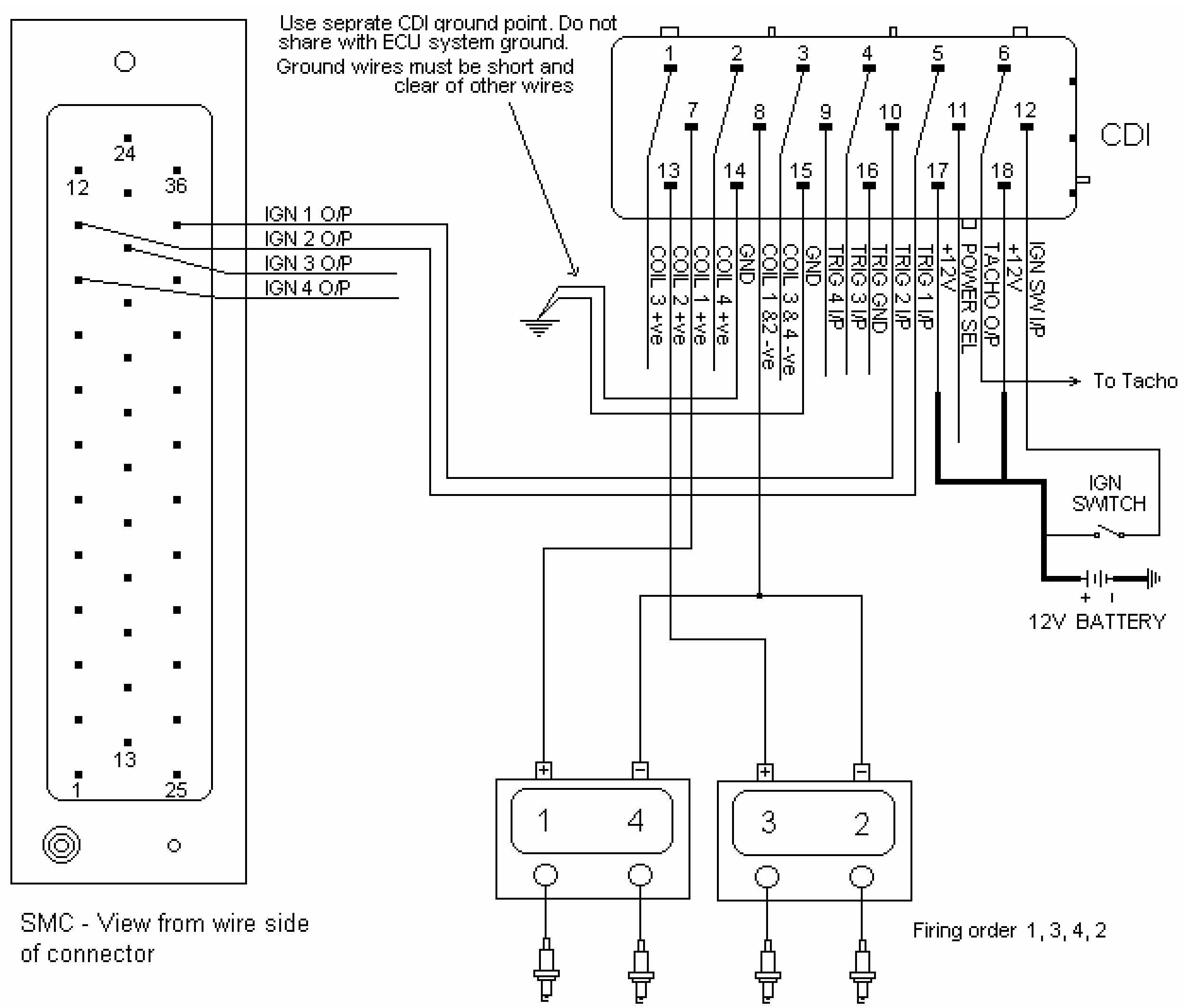
Ignition setup 6-cyl, 6 x single coils (R500 CDI)



Ignition setup 8-cyl, 8 x single coils (R500 CDI)

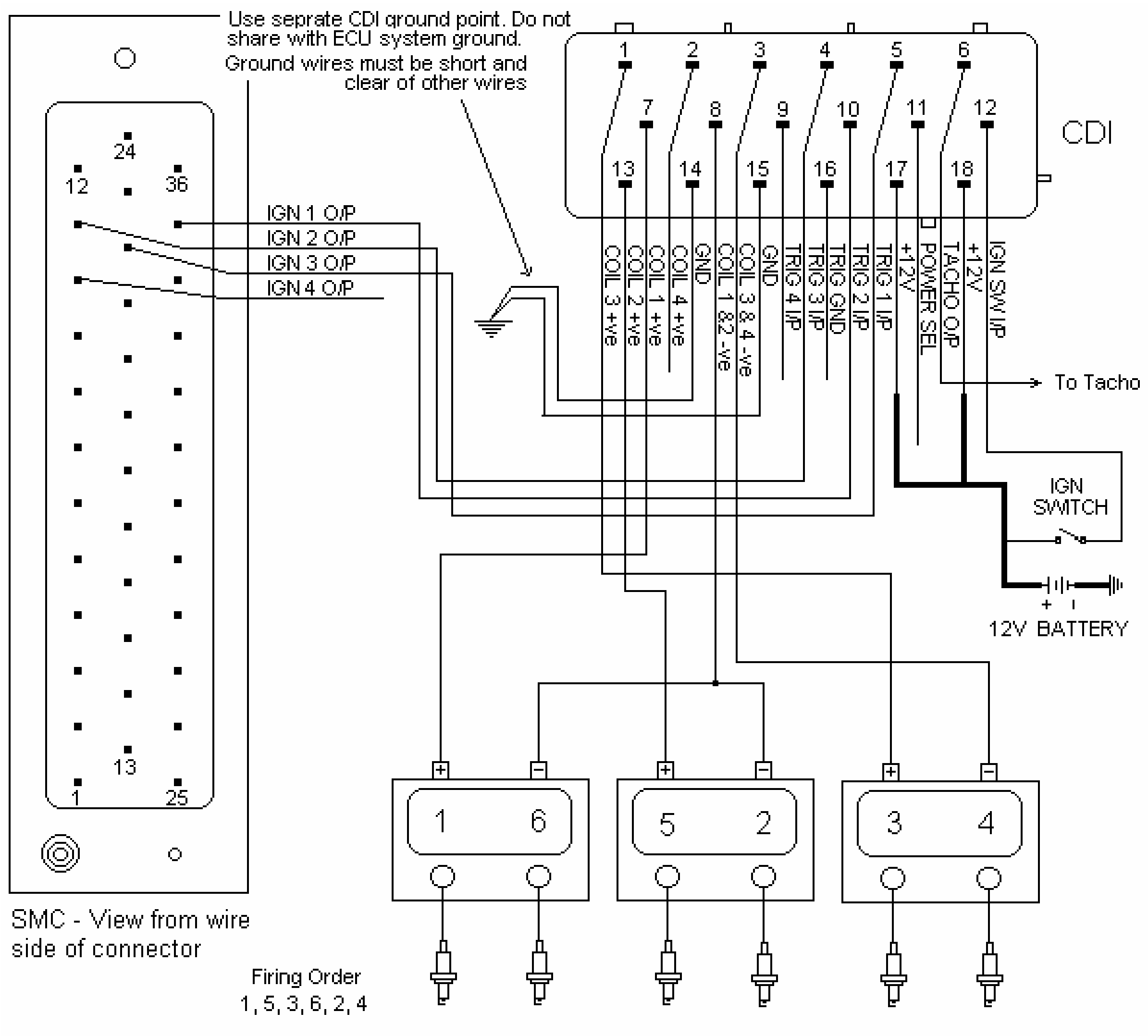


Ignition Setup 4-cyl, 2 x double ended coils (R500 CDI)

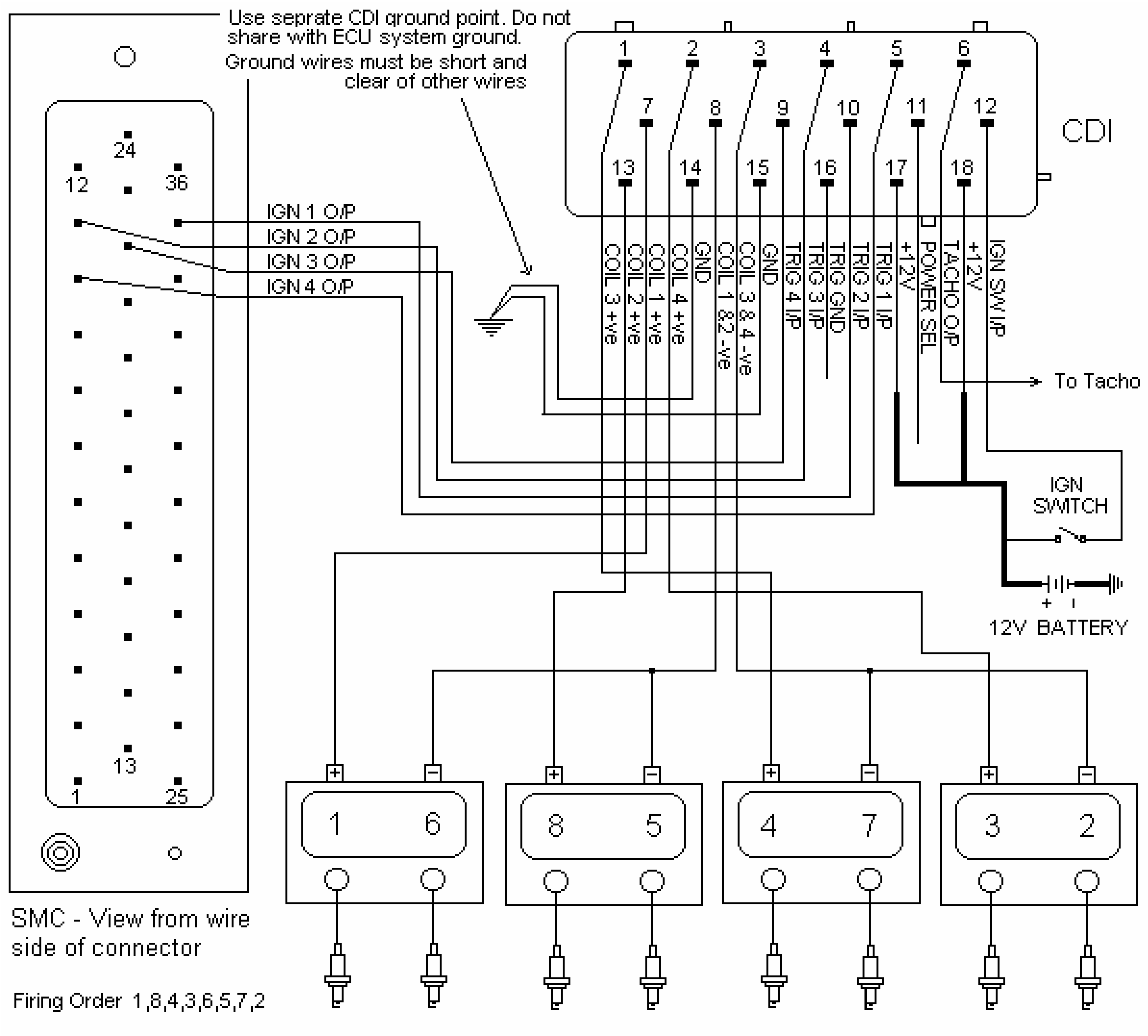


SMC - View from wire side of connector

Ignition Setup 6-cyl, 3 x double ended coils (R500 CDI).



Ignition Setup 8-cyl, 4 x double ended coils(R500 CDI)



Direct Fire CDI

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 SMC 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.

SMC Ign O/P sequence	4, 1, 2, 3
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.

SMC Ign O/P sequence	2	1
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.

SMC Ign O/P sequence	3	1	2
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.

The –ve and +ve coil wires should be twisted and keep away from any wires relating to the Cylinder Pulse and Reference Pulse trigger wires.

CDI ground wires must be twisted and keep short (max 150mm – 6 inch) and grounded near the CDI. Do not share CDI ground with SMC ground.

Trigger ground on the SMC and CDI is not used.

Throttle position sensor (TPS).

Read the requirements for this sensor in the “Sensor” section of this manual.

Before connecting to the sensor, you need to find the OPEN, CLOSED and WIPER 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 the OPEN, CLOSED and WIPER terminals on the sensor use a multimeter to test the Ohms resistance across the terminals.

The OPEN and CLOSED terminals will give a ohms resistance that will not change as the throttle is opened and closed.

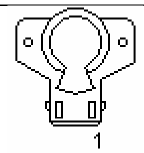
When you have found these, test from each one of these to another terminal until you find the two terminals that the resistance decreases as the throttle is opened.

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 OPEN and WIPER. The other terminal is the CLOSED.

CLOSED = SM2 pin 17
WIPER = SM2 pin 18
OPEN = SM2 pin 19

Autronic TPS sensor are available in clockwise and anticlockwise versions (Gray and Black). Below are the pin outs for these.

<table>
<tr><td colspan="5">Sensor terminal number</td></tr>
<tr><td></td><td>1</td><td>2</td><td>3</td><td rowspan="4">
</td></tr>
<tr><td>Black</td><td>CLOSED</td><td>WIPER</td><td>OPEN</td></tr>
<tr><td>Grey</td><td>OPEN</td><td>WIPER</td><td>CLOSED</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

Water temperature sensor.

Read the requirements for this sensor in the “Sensor” section of this manual (Page 42).

On 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.

Air temperature sensor.

Read the requirements for this sensor in the “Sensor” section of this manual (Page 42).

Reference Trigger Setup for Distributors.

The SMC requires a reference signal for secqenical operation. When using a distrubtor and one ignition coil, The Autronic No1 spark plug pickup sensor can be used to provide the refference signal, provided a multi-spark CDI is not used.

If the engine has a distrubtor and more then one coil, or the No1 pickup is not used then Another sensor and trigger wheel will need to be added in the distrubtor to provide the refference signal.

Distrubtor with one tooth for every engine cylinder.

Distrubtor has only one trigger wheel and sensor producing the same number of signals per distrubtor revloution as the number of engine cylinders.

1. Turn the engine to 112 degrees BTDC.

2. Turn the engine in direction or rotation until the first tooth of the trigger wheel lines up with the sensor. Record this crankshaft trigger angle as it will be used in the “Trigger Pulse Offset” in “Engine Setup” under menu “M1”

3. Turn the engine another 20deg crankshaft. Mount the single tooth trigger wheel and sensor.

Distrubtor with more then one tooth for every engine cylinder.

Distrubtor has only one trigger wheel and sensor, producing more signals per distrubtor revloution then number of engine cylinders.

1. Turn the engine to 112 degrees BTDC.

2. Turn the engine in direction of rotation until one of the teeth lines up with the sensor around 75 to 60 deg BTDC. Record this crankshaft trigger angle as it will be used in the “Trigger Pulse Offset” in “Engine Setup” under menu “M1”

3. Turn the engine another 20deg crankshaft. Mount the single tooth trigger wheel and sensor.

Software program (TriggerSetup.exe) is available from the Autronic website that will help in understanding the trigger requirements http://www.autronic.com/software.html

Crankshaft and Camshaft Trigger Setup with Hall Effect Sensor

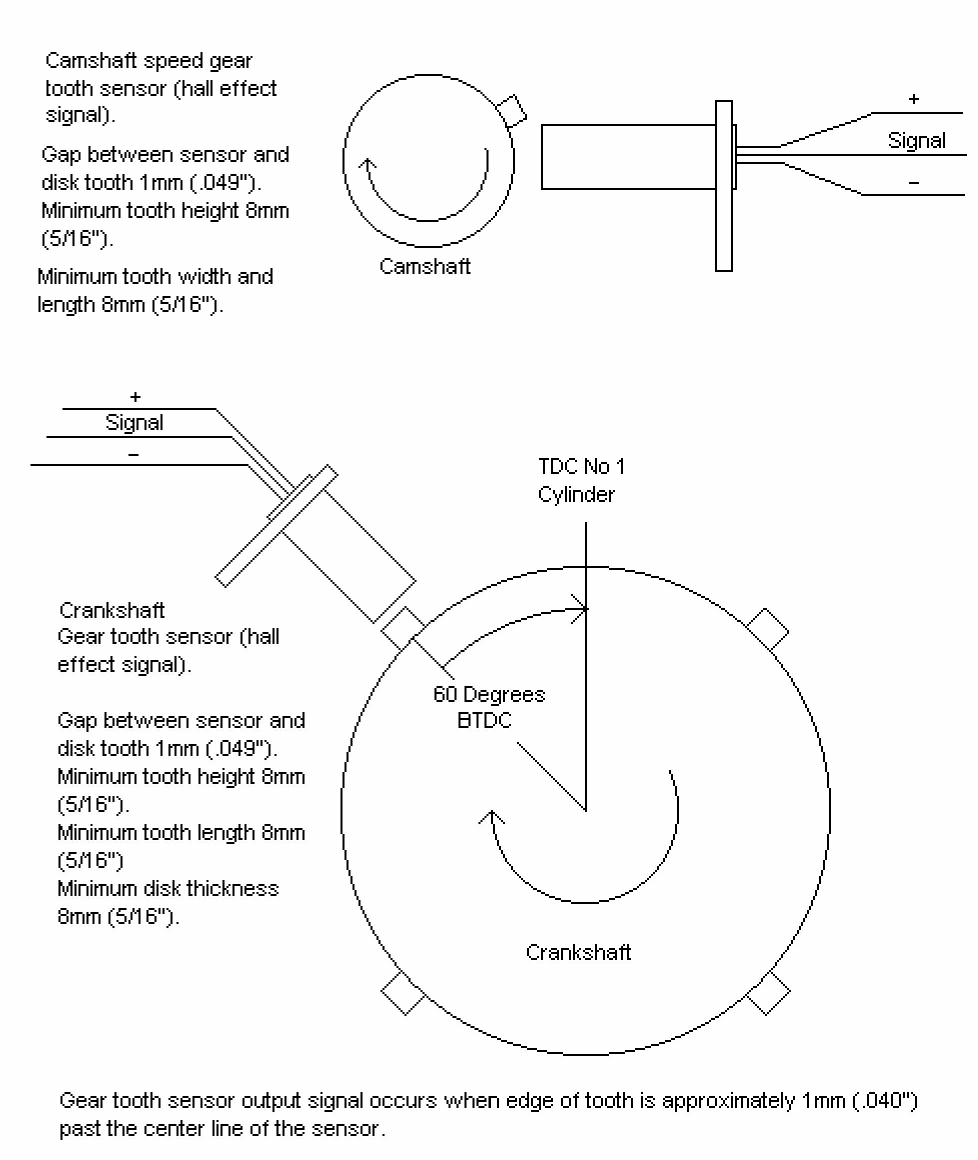


Figure 1. (Engine 60 degrees before cyl 1 TDC)

1. Turn engine to 60 degrees BTDC No 1 cylinder.

2. Mount trigger disk so that one edge of one of the tooth is approximately 1mm (.040") past the centre of the sensor. You can use either edge of the tooth.

3. Next turn the engine so the crankshaft tooth is no longer aligned with the crank sensor, but before the next tooth on the crank disk. See **figure 2.**

4. The nearest crankshaft tooth must be greater than 10 degrees away from the sensor.

5. Mount the cam shaft sensor so that one edge of one of the tooth is approximately 1mm (.040") past the centre of the sensor. You use either edge of the tooth.

The number of tooth disk required in relation to engine cylinders is as follows:

8 cylinder engine = 4 tooth disk.
6 cylinder engine = 3 tooth disk.
4 cylinder engine = 2 tooth disk.

The SMC will accept 45 to 112 degree crankshaft trigger angle (Trigger Pulse Offset). So it is possible to setup the crank trigger at any angle between 45 and 112, but it is recommended 60 deg be used.

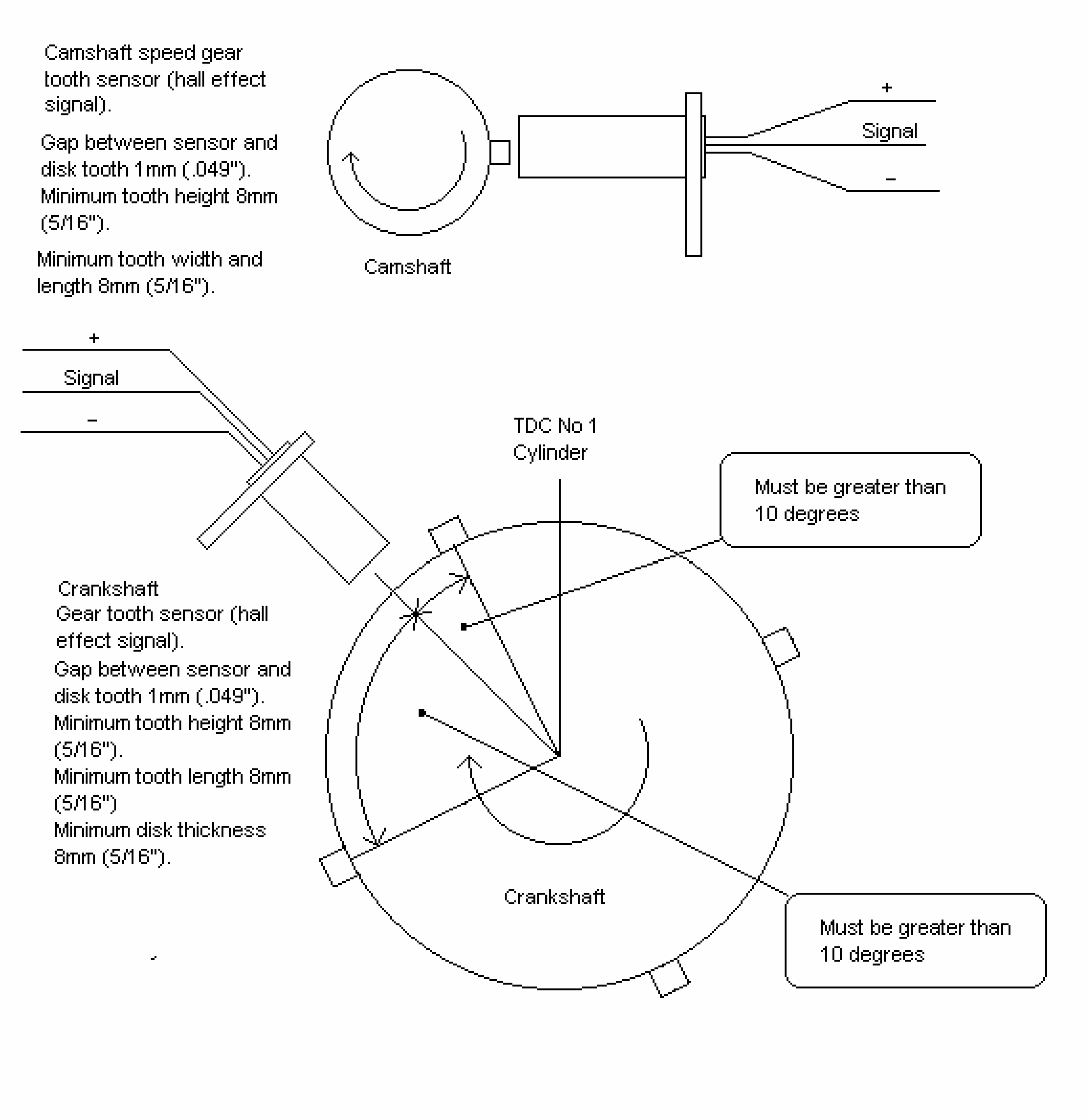


Figure 2.

Software program (TriggerSetup.exe) is available from the Autronic website that will help in understanding the trigger requirements http://www.autronic.com/software.html

Crankshaft and Camshaft Trigger Setup with magnetic-reluctor sensor

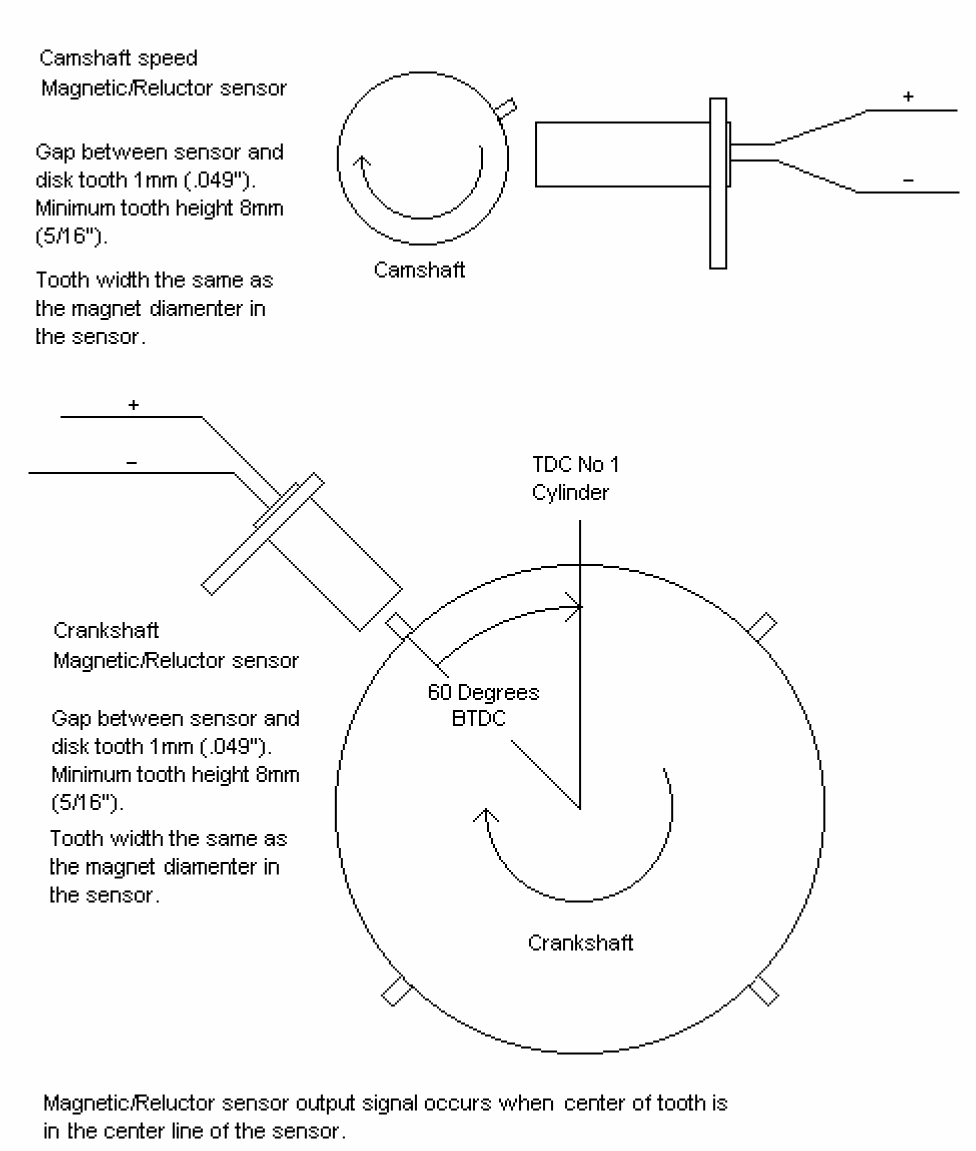


Figure 1. (Engine 60 degrees before cyl 1 TDC)

1. Turn engine to 60 degrees BTDC cylinder No 1.

2. Mount trigger disk so that the centre of one tooth is in the centre of the sensor.

3. Next turn the engine so the crankshaft tooth is no longer aligned with the crank sensor, but before the next tooth on the crank disk. See **figure 2.**

4. The nearest crankshaft tooth must be greater than 10 degrees away from the sensor.

5. Mount the cam shaft sensor so that the centre of the tooth is in the centre of the sensor.

The number of tooth disk required in relation to engine cylinders is as follows.

8 cylinder engine = 4 tooth disk.
6 cylinder engine = 3 tooth disk.
4 cylinder engine = 2 tooth disk.

The SMC will accept 45 to 112 degree crankshaft trigger angle (Trigger Pulse Offset). So it is possible to setup the crank trigger at any angle between 45 and 112, but it is recommended 60 deg be used.

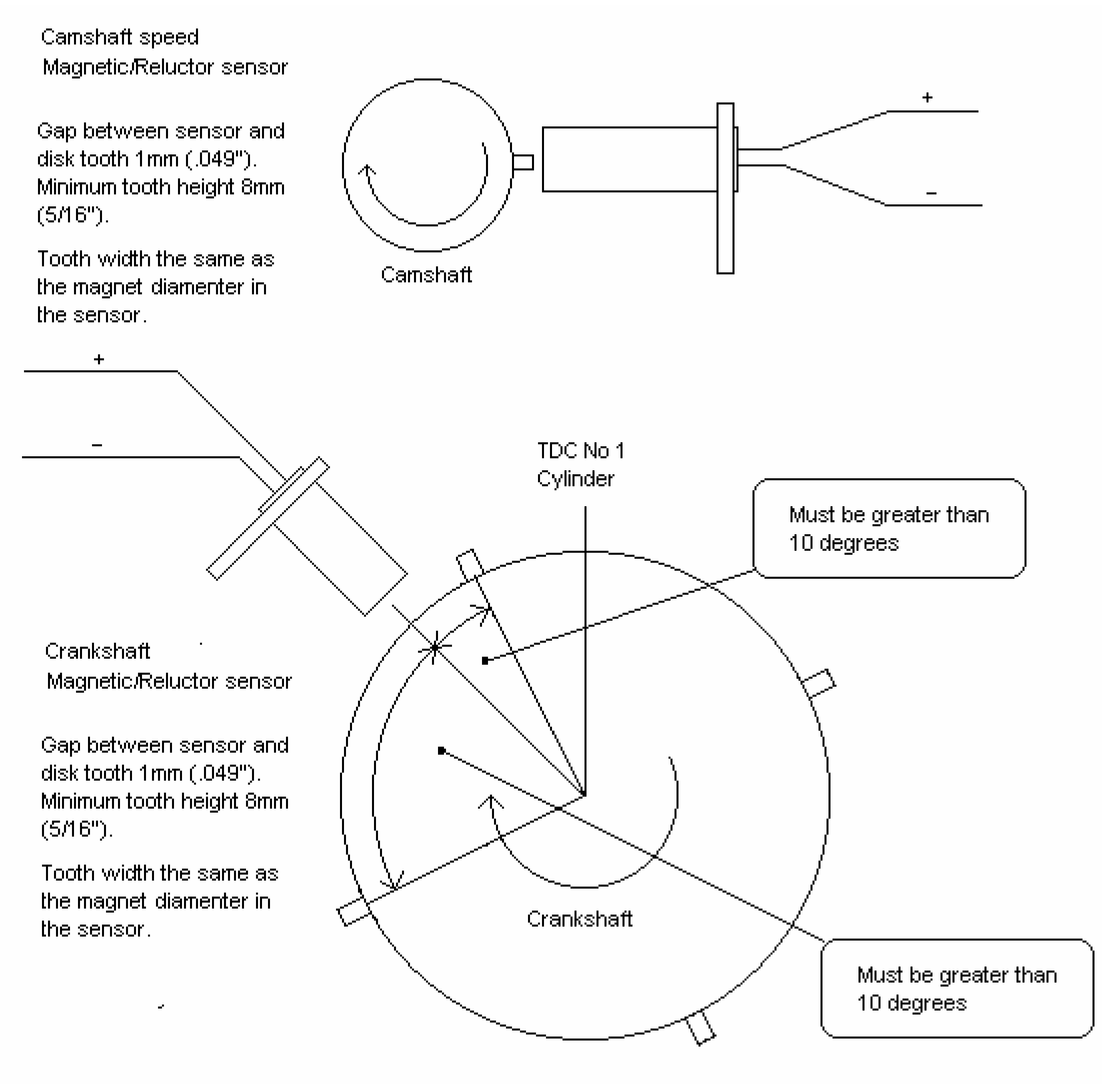


Figure 2.

When using inductive sensors a reluctor interface is required, see page 7.

Software program (TriggerSetup.exe) is available from the Autronic website that will help in understanding the trigger requirements http://www.autronic.com/software.html

Ignition Output Sequence

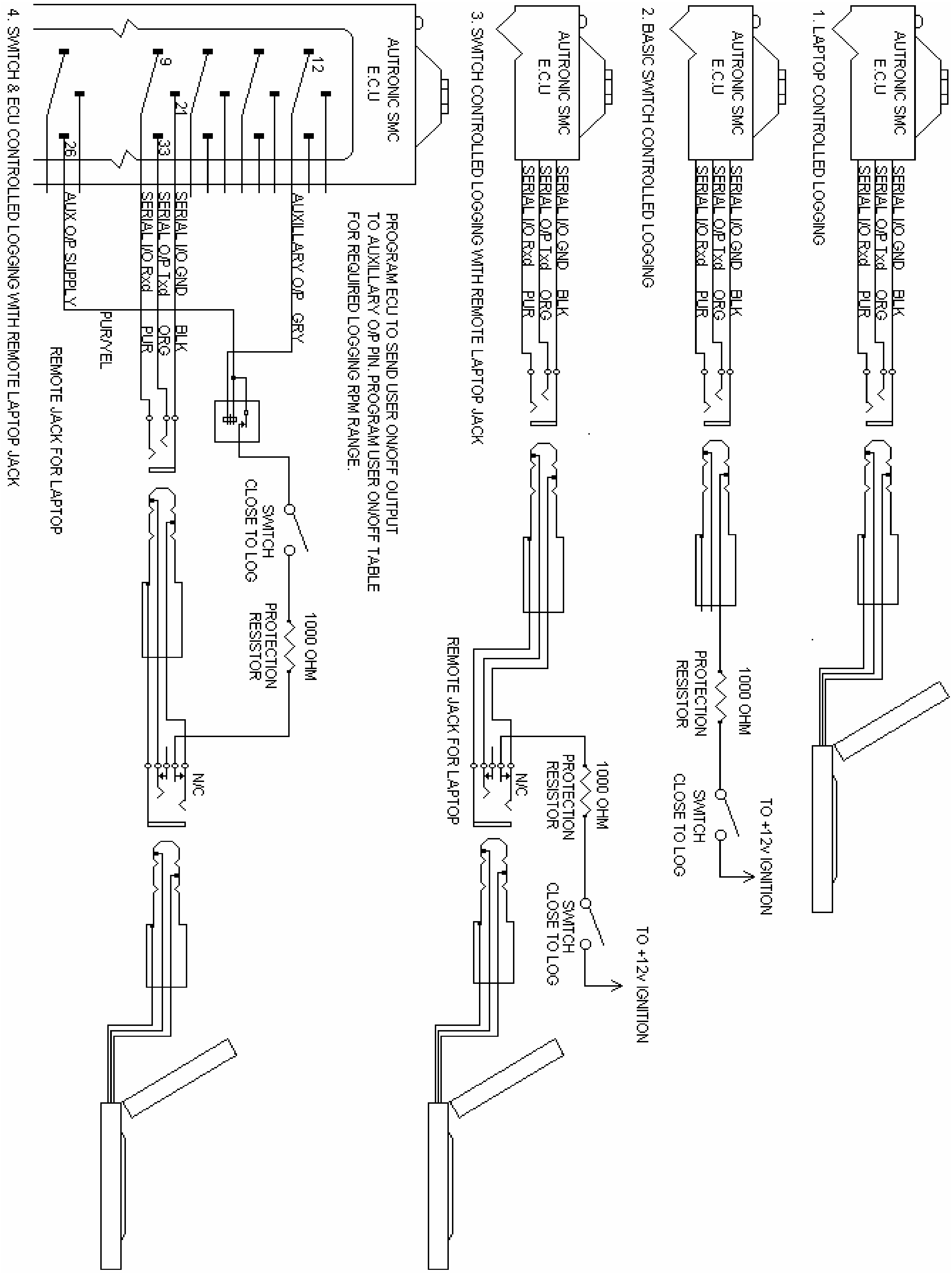
The normal ignition output sequence is last output first, if the reference signal occurs at the recommended position.

Ignition coils selected (number of ignition outputs)	Sequence
1	1
2	2, 1
3	3, 1, 2
4	4, 1, 2, 3

The following are examples of different firing orders and ignition sequences

Cylinders	Number of ignition outputs	Number of actual coils	Engine Firing order	Sequence	Ignition O/P to cylinders
4	1	1	1, 3, 4, 2	1	1 = 1, 3, 4, 2
4	2	2	1, 3, 4, 2	2, 1	2 = 1 & 4 1 = 3 & 2
4	4	4	1, 3, 4, 2	4, 1, 2, 3	4 = 1 1 = 3 2 = 4 3 = 2
6	1	1	1, 5, 3, 6, 2, 4	1	1 = 1,5,3,6,2,4
6	3	6	1, 5, 3, 6, 2, 4	3, 1, 2	3 = 1 & 6 1 = 5 & 2 2 = 3 & 4
8	1	1	1, 8, 4, 3, 6, 5, 7, 2	1	1 = 1,8,4,3,6,5,7,2
8	4	4	1, 8, 4, 3, 6, 5, 7, 2	4, 1, 2, 3	4 = 1 & 6 1 = 8 & 5 2 = 4 & 7 3 = 3 & 2

Data logging setup, wiring



Datalogging notes:

- 1000 ohm protection resistor prevents damage to wiring due to ground short circuit in serial connector if it becomes partial disengaged from jack.
- Preferably use ¼ inch remote jack, these are more durable and easier to use than 1/8 inch switched jacks, especially if dash mounted. A 1/8” female to ¼ “ male stereo adaptor can be installed on the PC data cable to adapt to the larger ¼ inch jack.
- Plugging laptop into remote jack inhibits logging activation by switch. Laptop can then control logging. Setup logger and extract logged data from ECU (See Options 3 & 4).

Sensors

Coolant Temperature Sensor

The coolant temperature is used by the Autronic to determine warm up corrections and adjust fuel mixtures.

The coolant temperature sensor has 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 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 will automatically compensate using the signal received from the air temperature sensor.

This sensor is of Autronic manufacture and should not be replaced by some other type of sensor. On some versions of the ECU's a NTC sensor can be used rather then the Autronic.

The sensor should be mounted to provide the best representation of the actual temperature of the air entering the combustion chamber, ie. 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.

Throttle Position Sensor Setup (TPS)

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. 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 voltage 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.

Throttle Limit Learning

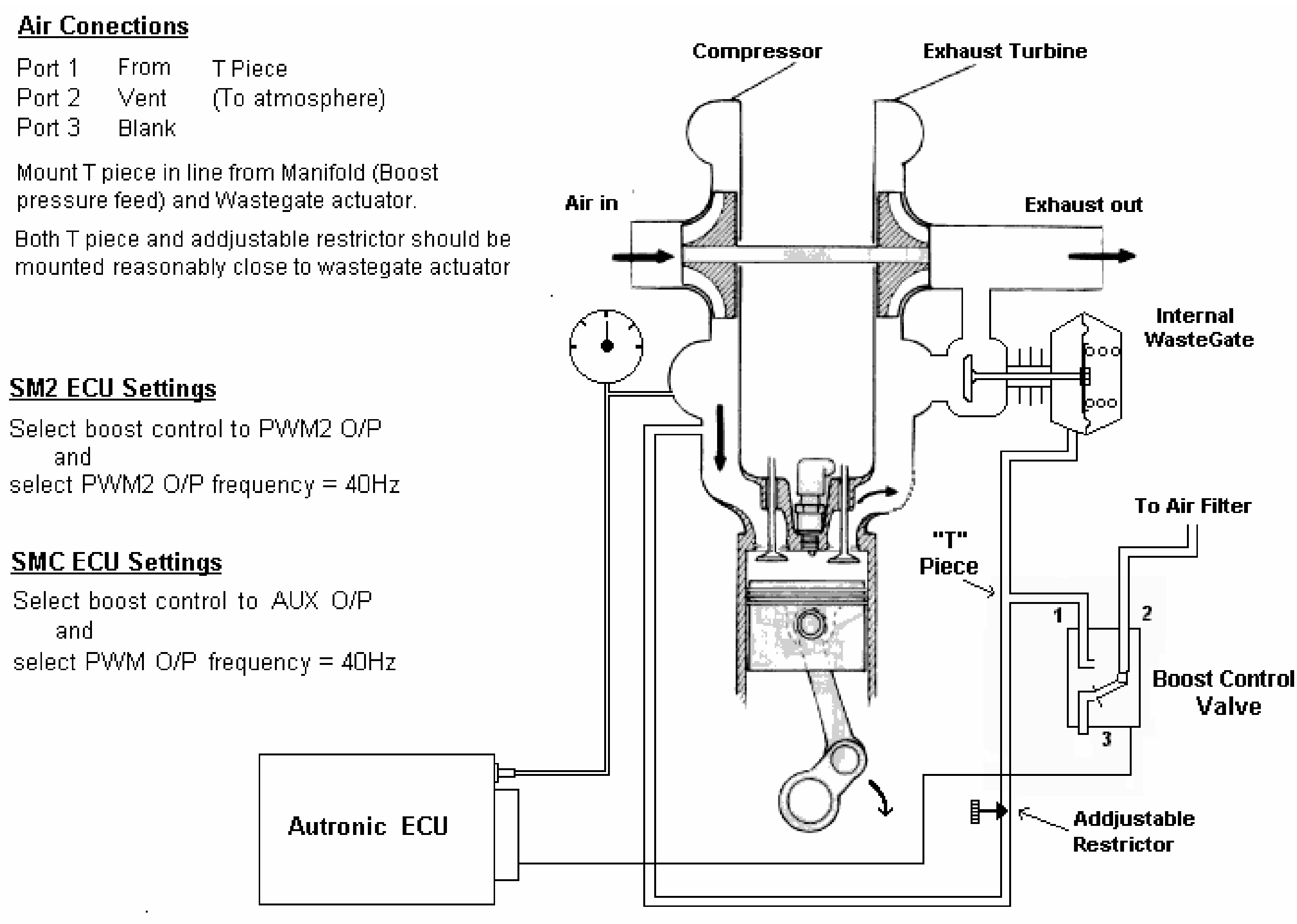
The ECU is equipped with an automatic adaptive learning function that simplifies the procedure of throttle position sensing. Setup is much simplified, not requiring any diagnostic aid, calibrator or laptop computer. The procedure is as follows:

5. Ignition switch on, engine stopped.
6. Disconnect throttle position electrical connector for at least 20 seconds.
7. Reconnect throttle position electrical connector.
8. Ensure that throttle is closed for at least 5 seconds.
9. 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 stop 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.

Advanced Software Setup

Boost Control Valve (Internal wastegate)

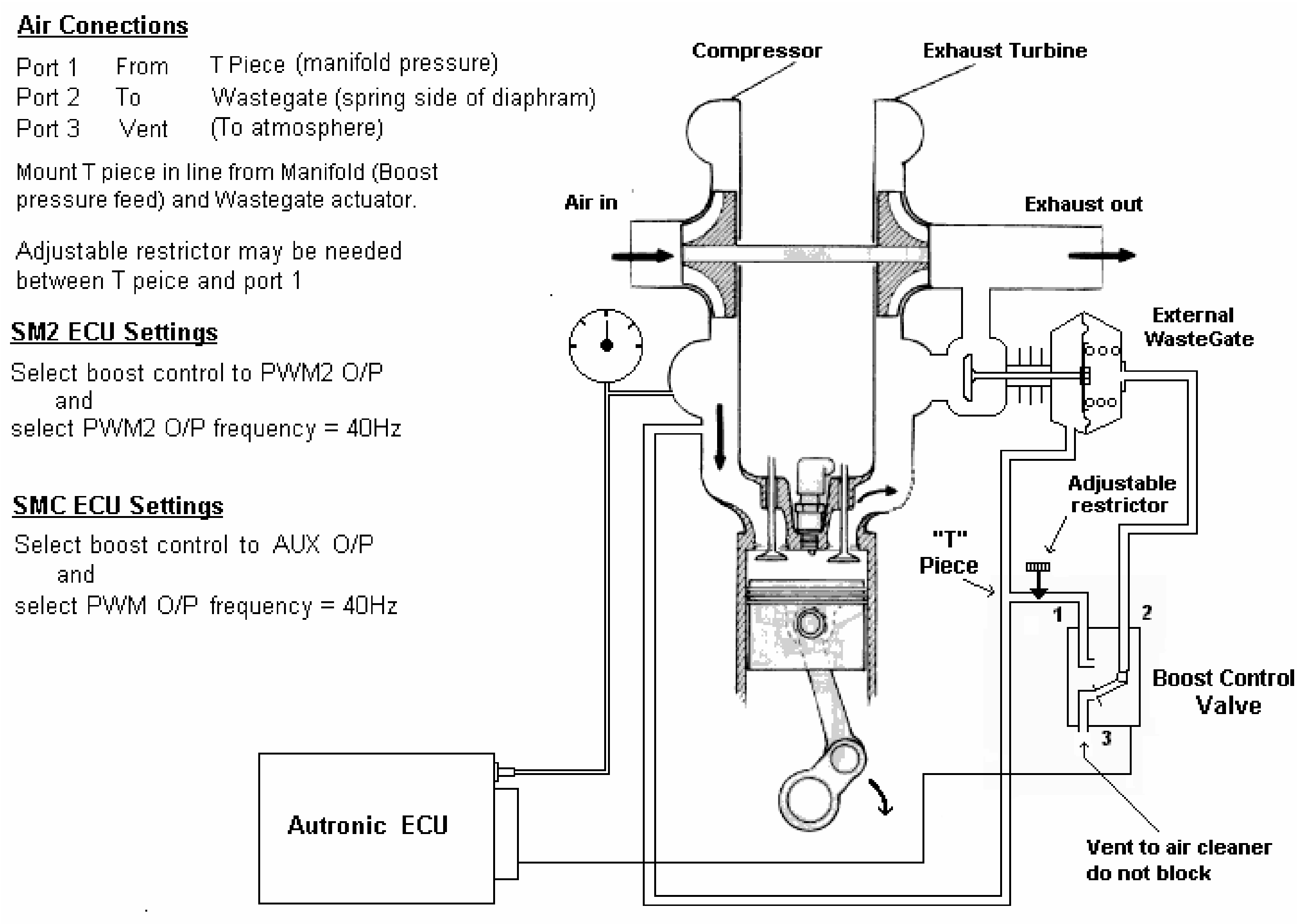


Adjustable restrictor can be replaced with a fixed restrictor. The table below give a guide to restrictor hole size for the small Autronic boost control valve on a turbocharger with and internal wastegate.

Standard Wastegate Boost Setting Kpa	Restrictor Size in mm	Maximum Boost at 100% valve duty
50	1.5	170
50	2.0	110
50	3.5	80
25	2.0	75
75	2.0	150

See “Wastegate Control” in the “Software Table Descriptions” for more wastegate settings.

Boost Control Valve (External wastegate)



See “Wastegate Control” in the “Software Table Descriptions” for more wastegate settings.

For correct operation of the boost controller, the following software settings will the best control when using the small Autronic boost control valve with external wastegate.

PWM O/P frequency = 40Hz.
Control Range = 150
Dynamic Comp = 0 or 1

Closed Loop Control

Some SMC models have Closed Loop control (CLC).

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.

The CLC has two modes, city and highway. City mode 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 city and highway AF ratios.

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

In example 1 the CLC would operate from 30 to 90% load.
In example 2 the CLC would operate form 30 to 90% load and maintain 14.7 during city mode. In high way mode it would maintain any air fuel ratio less than 14.7, in this case it would be from 30 to 60% load.

Example 1.

	RPM				
	1000	2000	3000	4000	5000
Load					
30	14.7	14.7	14.7	14.7	14.7
50	14.7	14.7	14.7	14.7	14.7
60	14.7	14.7	14.7	14.7	14.7
90	14.7	14.7	14.7	14.7	14.7
100	12.7	12.7	12.7	12.7	12.7

Example 2.

	RPM				
	1000	2000	3000	4000	5000
Load					
30	14.7	17.0	17.0	17.0	17.0
50	14.7	17.0	17.0	17.0	17.0
60	14.7	14.7	14.7	14.7	14.7
90	14.7	14.7	14.7	14.7	14.7
100	12.7	12.7	12.7	12.7	12.7

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

Setup:
1. Enable Open Loop Table.
2. Enable ECU Internal CLC.
3. Enable Open Loop Lean Highway (If required).
4. Set Gain = 10. (Default value)
5. Set Adapt Rate = 30. (Default value)

You can change the Stoichiometric air fuel ratio from the default of 14.7 to a new value in the “Engine Setup” table.

Idle Valve Setup SMC

To get the best idle it is important that the base fuel table values at and around the idle site have the same value, and the ignition timing table is setup so ignition angle will not change as the rpm increases or decreases.

To use an idle valve with the SMC requires the AUX (Auxiliary) output being used to control the idle valve. As the SMC has only one AUX output you will not be able to use a boost control valve or any other device that requires PWM (Pulse Width Modulation).

1. Chip version 1.99 select under menu M1 “Relay/Analog O/P” table. For “Aux output” select either “Bosch 2 wire type” or “Idle proportion type”. This type of valve is controled by pulse width, eg. Ford EECIV Type Valve.

   All other chip versions use “Old mode flags 0 to15” and set mode flag5 = 0 for Bosch idle valve or mode flag5 = 1 for proportional valve (Ford type).

2. From menu M6 select the “Idle Spd Ctrl” table. The engine idle speed is based on battery voltage.

   Example:- Battery voltage is 13.5 with no accessorys turned on (AC, cooling fans, lights)
   Required idle speed 850 RPM.

   a. Set the first voltage axis site to 12.00 volts. Put 1200 RPM as the idle speed require when battery voltage is low.

   b. Set all other axis values to 13.5 and put 800 rpm in these sites.

3. Select from menu M6 the “Idle setup” table. This is where you setup the idle valve range and other parameters. IAC = Idle Air Control.

IAC adaptation rate:
The rate at which the idle valve becomes active below the throttle limit.

IAC range:
The RPM range the valve has control over. Set this 50 RPM more than the valve range. See below how to determine the valve range.

IAC dynamic comp:
How fast the idle control attempts to correct changes in RPM. If the engine RPM hunts up and down try increasing this value.

IAC reset engine spd:
The engine speed at which the idle control is deactivated. This can help engine braking.

IAC fuel comp:
Fuel compensation can be used where extra enrichment is required during idle control.

IAC throttle limit:
The throttle position range of idle control. In this case idle control will be from 0 to 2%.

Finding Control Range.

To determine the range of an idle valve set the idle speed in the “idle speed” table to a very low value (100 rpm) so the valve is not operating. If the engine stalls, temporally set the idle speed via the throttle stop to a rpm where the engine will idle. Note the idle speed of the engine, as an example the engine is idling at 1000 rpm.

Now set the idle speed value in the table to 5000 rpm. Note the engine speed, in this example we get 2800 rpm. Using this information do the following to determine the idle control range,

2800 – 1000 = 1800 rpm range, we need to add about 50 rpm to this to get the final range, 1800 + 50 = 1850.

4. In menu M5 are other setting to control idle speed based on engine temperature,

“W-U fastIdle inc”	Set the idle speed in relation to engine temperature. Used to control the engine idle fast while warming up.
“P-S fastIdle inc”	Set the extra rpm required on top of the idle speed after starting the engine.
“P-S fastIdle timeout”	The period of time after starting the engine the extra idle rpm selected in “P-S fastIdle inc” continues.

Anti-Lag for Turbocharged Engines

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. A 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.

Operating Modes

1. Throttle opening/bypass controlled anti-lag, using a mechanical or electro-mechanical throttle opener or bypass. ECU activation of the anti-lag function with dash mounted inhibit switch.

2. ECU controlled throttle opening/bypass using an electro-mechanical throttle opener or bypass valve. Dash mounted switch allows driver selection of and-lag function.

3. Fixed throttle opening with full automatic control by ECU with manual override or manual control of and-lag and cool-down function

Notes:- Modes 1 & 2 do not effectively use the fast cool-down function.
Anti-lag action is terminated by excessive engine temperature(> 110 degC)

Mode 3 is the simplest mode to use, since it requires no additional engine mounted hardware (eg: throttle kickers or solenoid controlled by-pass valves). The cool-down mode is also most effective in this mode.

Mode 3 Fixed Throttle Opening

Mode 3 use a fixed large throttle opening (typically 8 to 20%). This modes anti-lag function uses this large opening, high idle speed (typically 2500 to 400O RPM) and ignition retard to produce a considerable amount of hot high velocity exhaust gas that sustains high turbo-charger speed. The cool-down mode uses a different strategy to produce a much cooler exhaust gas temperature and simultaneously control idle engine speed with this large initial throttle opening, when anti-lag is not active.

Activation.

1. Manual:- Ground anti-lag I/P pin to switch from cool-down to anti-lag mode.
2. Automatic:- Anti-lag activated by engine RPM exceeding 500O RPM and remains active for 15 seconds after RPM falls below 5000RPM.
3. Auto/Manual:- As per automatic mode above but inhibited if Anti-lag I/P not grounded.

ANTI-LAG SETUP

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 -2O 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.

!!!! 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.

COOL-DOWN SETUP

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. Cool down MIN RPM and MAX RPM settings are set to values above and below the Desired cool-down idle RPM. These values should be at least 800 RPM apart to prevent idle instability. The cool-down mode MAX THROTTLE setting is usually set to 5% for best drivability.

eg:- Cool-down idle @ 1700 RPM
COOLDOWN MIN RPM - 1400 RPM
COOLDOWN MAX RPM - 2400 RPM
COOLDOWN MAX THROTTLE = 5%.

Multi Teeth or Missing Teeth Trigger Setup.

Mode Flags 13, 14 and 15 can be used with crank trigger or distributors with multiple teeth or missing teeth e.g:- Motronic 60-2 or simular combinations.

In the example below we will use a 60-2 as a example.

Mode Flag 13 = Number of missing teeth.
With 60-2 you have 2 missing teeth so Mode Flag13 = 2.

Mode Flag 14 = Number of teeth including the missing teeth on the crank trigger or in the distributor divided by the number of teeth/signals required per engine cycle.

4 cylinder engine = 4 signals per engine cycle.
6 cylinder engine = 6 signals per engine cycle.
8 cylinder engine = 8 signals per engine cycle.

Example:- A six cylinder engine should have six signals per engine cycle, so In this case we have 58 teeth plus 2 missing teeth. As the crankshaft will do two revolutions per cycle the crank trigger will produce 120 signals per engine cycle (720 deg), we must then divide 120 by the number of required signals.

Mode Flag14 = 20 (58 + 2 * 2 / 6 = 20)

Mode Flag 15 = This is the offset in number of teeth, from the closest tooth to the sensor while the engine is at 60 degrees BTDC and the reference signal (camshaft trigger). Mode Flag15 has a value range from 0 to Mode Flag14 value - 1

In this case the number of teeth could be from 0 to 19. There is a unknown area/numbers between 0 and 19 that cannot be used. Selecting above or below this area will cause a change in ignition and injector output sequence.

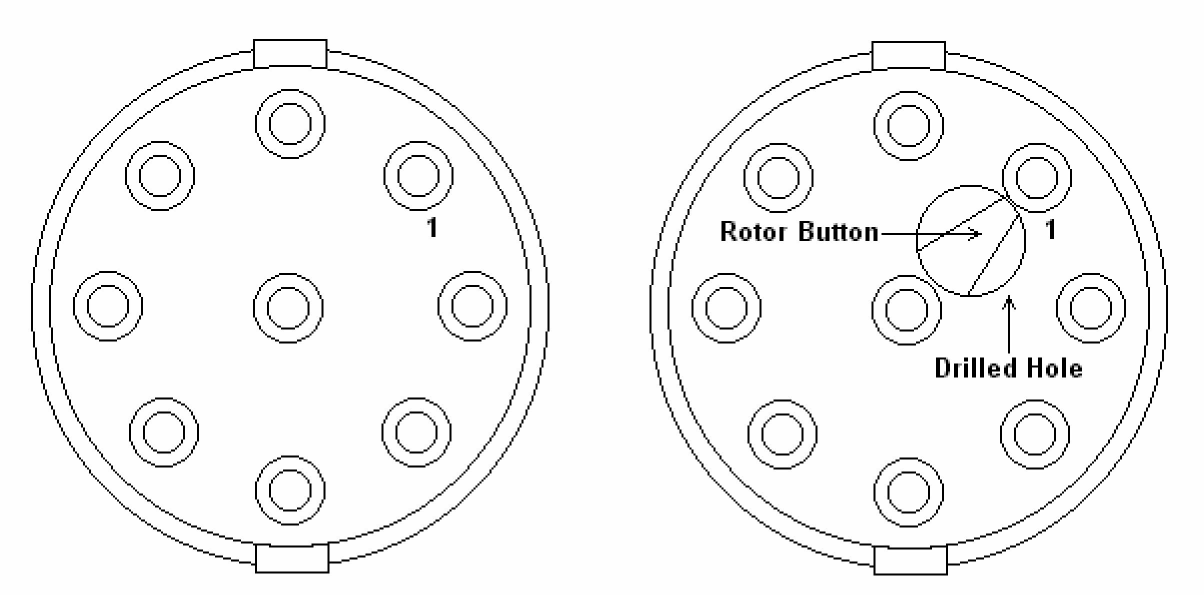
To find this value, turn the engine to TDC number one cylinder and mark the crank pulley with a mark that will be visible when the engine is running. Use a timing light and crank the engine while looking for the mark. If the mark is not visible, keep adjusting mode flag 15 until it is visible and close to your TDC pointer. It does not matter if the mark is after TDC as long as it is visible.

This will be close enough to start the engine. When the engine is running you can make the final adjustment to mode flag 15 so that the ignition timing displayed on the PC screen is as close as possible, by changing mode flag15.

When the best value for mode flag15 is found and if the timing does not match the ignition angle displayed on the PC. Change “Ignition Pulse Offset” under “M1” “Engine Setup” in the software to get the timing correct.

To use this method to find mode flag 15, requires the ignition output sequence being wired correctly for the sequence of you engine. See “Ignition Output Sequence” under the hardware section.

Distributor Phasing.



Drill a hole in a old distributor cap large enough to see the rotor button as it passes by the spark plug lead tower.

Put the cap on the distributor along with all of the spark plug wires.

Set a timing light on the ignition lead that corresponds with the post next to the drilled hole. If the timing light is adjustable, leave it set for 0 degrees.

Disconnect wires to fuel pump or injectors, so engine will not start.

Set all values in the “crank ignition timing” table, in the software, to 23 degrees.

Crank the engine and point the timing light at the drilled hole and observe the position of the rotor button to the ignition lead post.

Move the “Cylinder Pulse Offset” number to align the rotor button with the centre of the ignition lead post. If you are using a multi tooth trigger adjust Mode flag 15 to get as close as possible first (See Page52), then fine tune it with the “Cylinder Pulse Offset” number.

Once you have this adjusted, it is time to check for TDC at the crank. Set the “Cranking ignition timing” to 0 degrees. Move the timing light to cylinder number 1 (if your not already there.)

Crank the engine while pointing the timing light at the crankshaft timing mark and turn the distributor around to get the timing at 0 degrees BTDC .

Reinstall original distributor cap and reconnect fuel pump or injectors. Start engine and turn distributor if necessary to get timing correct with the engine running.

Note: The reason 23 degrees is used to setup the phasing, is the ignition control range is 0 to 45 degrees, 23 degrees puts the rotor button in the centre of the spark plug lead tower in the middle of the ignition control range, so no matter what the ignition timing angle the distance the spark has to jump is a short as possible.

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. The sites marked ***** are the sites that require tuning in the Base Fuel Delivery table. See below.

				RPM			
Load	0	1000	2000	3000	4000	5000	6000
0	*	*	*	*	*	*	*
1	*	*	*	*	*	*	*
3	*	*	*	*	*	*	*
5	*	*	*	*	*	*	*
10	*	*	*	*	*	*	*
30	*	*	*	*	*	*	*
70	*	*	*	*	*	*	*
100	*	*	*	*	*	*	*
150							
200							
220							

Base Fuel Delivery table.

The Base Ignition Timing table is setup using load sites for pressure mapped engines.

				RPM			
Load	0	1000	2000	3000	4000	5000	6000
0							
1							
3							
5							
10							
30	*	*	*	*	*	*	*
70	*	*	*	*	*	*	*
100	*	*	*	*	*	*	*
150	*	*	*	*	*	*	*
200	*	*	*	*	*	*	*
220	*	*	*	*	*	*	*

Base Ignition Timing table

Autotune™

Software Setup

Step 1.
Select menu M1, Engine setup.
Set “A/F ratio sensor” = Linear I/P A/F meter.

Step 2.
Select menu M1, ECU A/F control.
Set “Open loop table” = Enabled.

Step 3.
Select menu M2, Open loop A/F ratio
Setup this table with the “Target” air fuel ratios you wish the Autotune™ software to tune the engine.

Below is an example table for a turbocharged engine. There are many engine variables that effect 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

Open loop A/F ratio table.

Step 4.
Select menu M2, Base fuel delivery.
Only with the base fuel table displayed will the Edit menu will have the option “Setup Autotune™”.

Select “Setup Autotune™” under the Edit menu.

Options.

Color.

Un-Protected = Sites tuned (colored) will have the color and attribute cleared before a change is made to the site.

Protected = Tuned sites (colored) will not have the color and attribute removed when a change is made to the site.

Fine accuracy.

For a quick rough tune set this to 5%. The default accuracy is 2%.

Sensor Position = Select the position of the 02 sensor in the exhaust system.

No further items require changes.

Hardware setup.

Connect analyser to the 02 input and sensor ground on the SMC.

If your analyser was purchased with a “Pwr/Log” cable see Fig2 for setup. Analysers without the “Pwr/Log” cable will require modification to provide the connection, see Fig1.

Other make analysers can be used providing they meet the linear output requirements of 0 to 1 volt = 10.0:1 to 30.0:1 air fuel ratio.

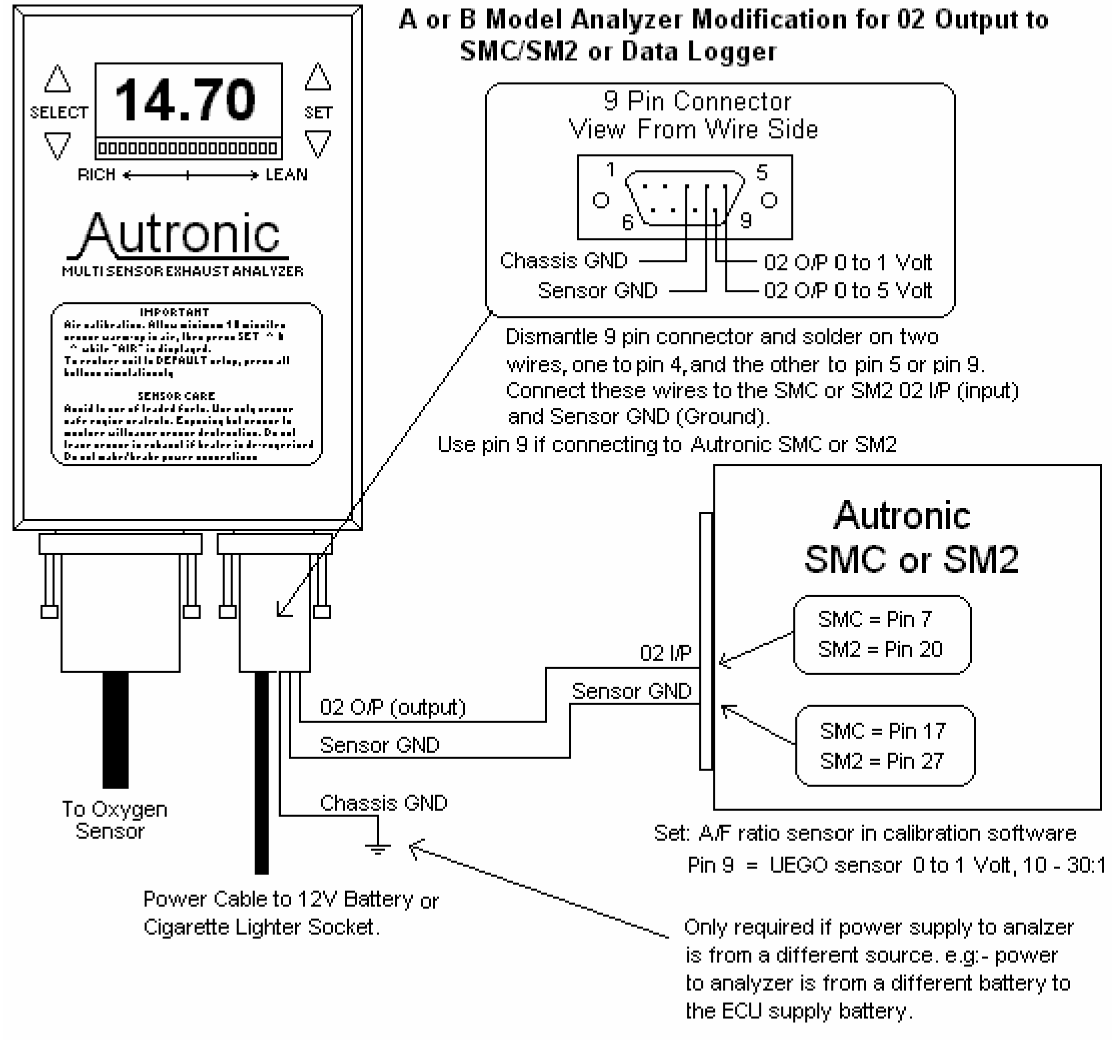


Fig1 Setup without Pwr/Log cable.

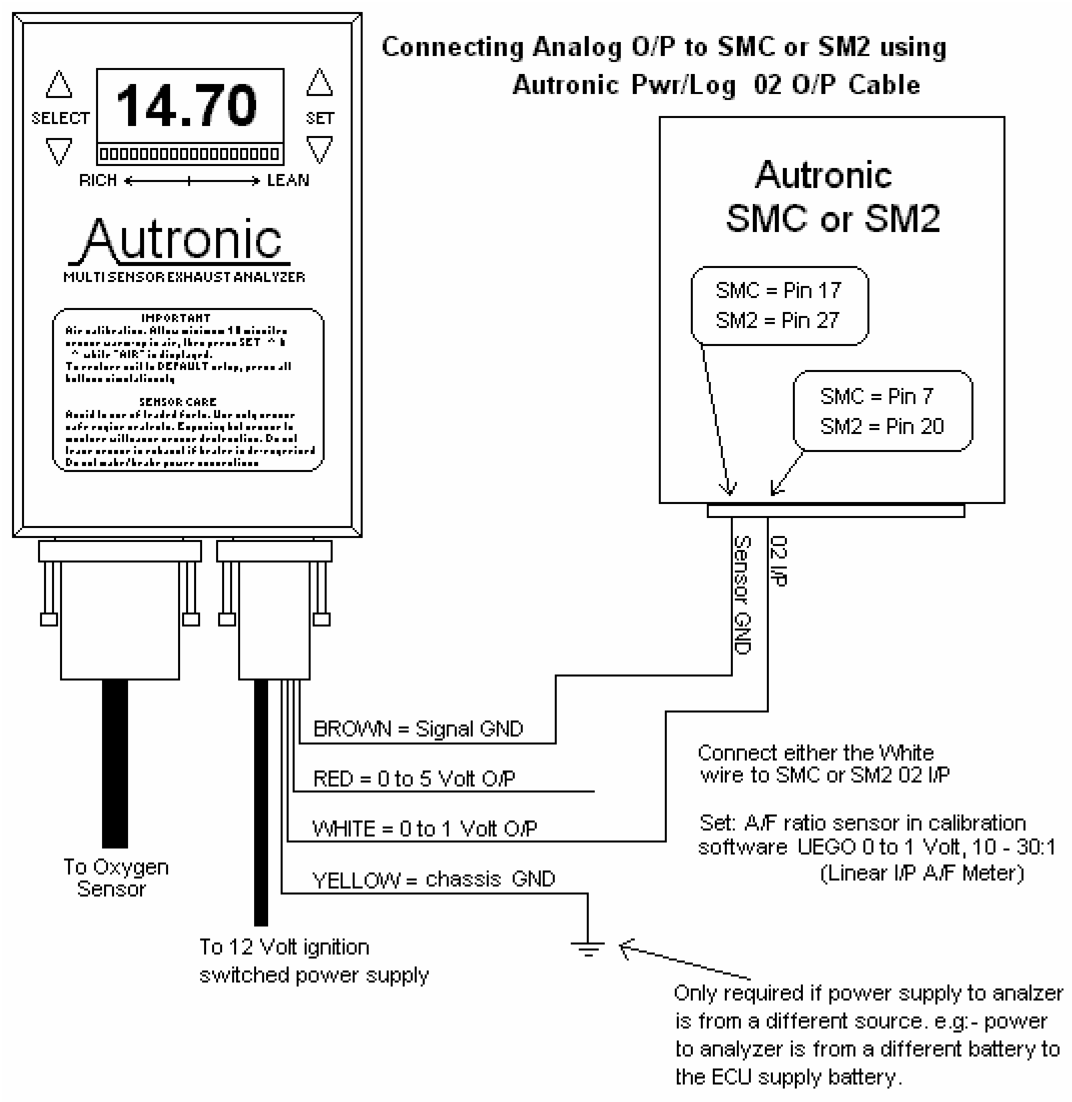


Fig2 Setup using “Pwr/Log” cable.

Running Autotune™

To run Autotune™ press F5 while the base fuel table is displayed. You can also view the Auto-tuning in a 3D graph by pressing the key G before pressing F5.

The Edit menu has many Autotune™ options and functions available while the base fuel table is displayed. When a RPM or Load site is tuned the site has it’s attribute set. To make manual changes to a site after the attribute is set requires the attribute being removed. The key R will remove the attribute. You can show the attribute of all the sites in the able by pressing Ctrl+P.

It is recommended you set the engine parameter limits in the “PC Limits/Log setup” under the Logger menu to minimum or maximum values suitable for your engine before running Autotune™. If any of these limits are exceeded Auto-tuning will stop tuning and the user ID bar will turn red and display and limit that has been excide, also the PC speaker will sound a waring.

During the tuning Load and RPM sites will be coloured Yellow (attribute set) if the site is tuned within 2% of the accuracy you have set in the Autotune™ setup. When a site is tuned to the accuracy you have specified then the site will be coloured Green.

To tune sites requires the engine RPM and Load to be held for 1 to 2 seconds for tuning to occur. Most low engine RPM sites (under 3000 RPM in most cases) can be tuned by road driving the car. The use of different gears a little brake pedal or a hill will help to tune most sites.

The high RPM sites will require in most cases the use of a dyno that will hold a fixed RPM or vehicle speed.

The preferred method to tune the sites on a dyno is to fix the engine RPM and progressively open the throttle stoping at each load site for a few seconds. When all sites are coloured set the fixed RPM to the next RPM site and repeat the process.

After you have finished tuning, any sites not able to be reached can be manual adjusted to values simular to near tuned sites and then there attribute set by pressing the key A.

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 analyzer.

Have these connected before attempting to start the engine.

Software.

1. With the PC connected to the SMC 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+6 to open menu M6 and select the “Idle ignition timing” 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 cal mul” to change the overall fuel trim to get the engine running smoothly.

4. Calibrate the throttle
   See throttle limit learning under the Sensor section of 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 analyzer to see the air fuel ratio is between 12.7 and 11.0, change the “Overall fuel cal mul” 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 cal mul” 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 “Trigger Pulse Offset”.

   Crank trigger:- Move the sensor or turn the trigger disk or change “Trigger Pulse Offset”.

Direct fire ignition sequence testing.

This type of installation is very 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 SMC harness connector 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.

If the only ignition O/P that produces a occasional flash from the timing light is Ign O/P1 then the camshaft reference signal is missing or cylinder pulse errors.

Software Table Descriptions

Base Fuel Delivery Calibration

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.

Base Ignition Timing Calibration

Basic ignition timing calibration table for "normal" engine operation, excluding cranking, idling and over-run conditions. The table uses the same site calibrations as the base fuel delivery table and therefore is of equal size. Timing is selectable in 0.25 Degrees increments over a range from 0 to 50 Degrees crank angle. The calibration from this table is combined with temperature dependent corrections and. an external trim to produce the actual engine "running" ignition timing.

Overrun Ignition Timing Calibration

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.

Cranking Ignition Timing

Ignition timing for engine cranking calibration allows the selection of an engine speed dependent timing characteristic that minimises the possibility of starting gear damage due to engine kick-tack yet aids in the rapid acceleration of the engine up to running speed. The range of calibration is as for the bass ignition table and up to 5 engine speed calibration sites may be chosen.

Idling Ignition Timing Calibration

Idling ignition timing calibration allows optimal timing during this condition for good idle quality and improved idle speed stability. The range of calibration is as for the base ignition table and up to 5 engine speed calibration sites may be chosen.

Coolant Ignition Timing Modifier Calibration

Base ignition timing modification dependent upon engine coolant temperature and engine load to ensure efficient operation during warm-up and to minimise the possibility of engine damage if over-heating occurs. Table size is 12 engine coolant temperature calibration sites by 6 engine load calibration sites and the correction range is +/- 31.75 degrees.

Altitude Ignition timing Modifier Calibration

Base ignition timing modification, dependent upon barometric pressure and engine load to ensure efficient operation at high altitude. Table size is 7 engine load calibration sites by 2 barometric pressure calibration sites and the correction range is +/- 31.75 degrees.

Fuel Injection Delivery Timing

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.

Individual Cylinder Fuel Delivery Trimming

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 manifolding. These tables share common calibrations sites with the injection timing calibration data (20 X 5) and allow +/- 61% adjustment range in 0.4% increments.

Manifold Absolute Pressure Sensor Failure limp Home Calibration

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. This table can have up to 8 engine speed calibration sites and 6 throttle position calibration sites. Calibration range is 20 to 420 KPa in 0.1 KPa increments.

Throttle Position Sensor Failure limp Home Calibration

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.

Transient Engine Operation Calibration

Calibrations to optimise the operation of the engine during- acceleration and deceleration. These calibrations all have common engine speed calibration sites (up to 8 max).

- IGNITION ADVANCE ATTACK RATE. 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 to 1590 deg/sec.

- IGNITION ADVANCE RETARD RATE.
  Set the maximum rate at which the ignition timing is allowed to
  retard. Can be used in conjunction with above to improve driveability and/or reduce exhaust emissions. Calibration range. 6 to 1590 deg/sec.

- CLOSED THROTTLE ACCELERATION 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

- OPEN THROTTLE ACCELERATION 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.

- PART THROTTLE ACCELERATION LIMIT. 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.

- ACCELERATION ENRICHMENT DECAY TIME. Sets the duration of the acceleration enrichment. Calibration range is 0.08 to 2 SEC.

- ACCELERATION ENRICHMENT RECOVERY TIME/ DECELERATION ENLEANMENT DECAY TIME. Sets the time taken for the acceleration enrichment to recover in readiness for the next acceleration enrichment. Also controls the duration of enleanment when a throttle opening reduction occurs. Calibration range is 0.08 to 2 SEC.

- DECELERATION ENLEANMENT MULTIPLIER. Sets the amount of fuel delivery reduction immediately following any throttle opening reduction.

Charge Temperature Estimation Calibration

Calibration that allows the estimation of the heat transferred to the incoming charge by the hot manifold and intake port, so that an actual charge temperature may be estimated for the calculation of correct fuel delivery. This table can have up to 16 engine speed calibration sites and 10 engine "load" calibration sites. 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:

Warm-Up 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.

Post Start Enrichment Calibration

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.

Post Start Enrichment Timeout Calibration

The decay time for the additional fuel delivery immediately after start-up is controlled by this table. Calibration range is 0 to 20 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.

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.

Warm-Up Fast Idle Rpm Calibration

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.

Post Start Fast Idle Rpm Calibration

Calibration for idle speed increase 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.

Post Start Fast Idle Rpm Timeout Calibration

Decay time for post start fast idle increase. Calibration range is 0 to 41 SEC. This calibration uses the same engine coolant temperature calibration sites as chosen for the warm-up enrichment calibration table above.

Wastegate Control

1. BOOST CONTROL CALIBRATION TABLES. One turbocharger wastegate control calibration table is available. The table allows engine speed and engine coolant temperature dependent setting 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 table can have up to 10 engine speed calibration sites and 5 engine coolant temperature calibration sites. Calibration range is 110 to 500 KPa.

2. BOOST CONTROL THROTTLE MODIFIER CALIBRATION The boost level determined by the above calibration table may be made throttle position dependent by setting this table to effect a reduction in boost under conditions less than full throttle. The table may have up to 4 throttle position dependent calibration sites and the range for calibration is 0 to 300KPa.

3. BOOST CONTROL RANGE OFFSET. Use to correct actual decreces or increces in boost that occour above or below the desired boost levels set in boost table at varing engine RPM's. Correction values of –250Kpa to 250Kpa can be used.

4. 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.

5 . OVERBOOST PROTECTION. (2 adjustments) Two stage overboost protection is adjustable for detection level and detection tire so that damaging overboost causes engine shutdown but pressure spikes are ignored.

Engine Speed Limit

Engine rev limiting may be made coolant temperature dependent with this table. A maximum of 6 engine coolant temperature calibration sites may be selected. Calibrations may be selected in the range 0 to 30000 RPM in 1 RPM increments. Additional control variables allow the characteristics of the rev limiter function to be tailored for the application.

Overrun Fuel Delivery Cut Off

Two engine coolant temperature dependent engine speed calibrations may be defined, one specifies the minimum engine speed that fuel delivery shutoff can commence under trailing throttle conditions and the other the minimum engine speed down to which fuel shutoff will be sustained. Higher engine speeds can be selected during engine warm-up to minimise the drivability problems associated with fuel delivery shutoff. The engine coolant temperature calibration sites chosen for the engine speed limit calibration function are also used by this function. Calibrations may be selected in the range 0 to 30000 RPM in 1 RPM increments.

Base Idle Speed control Calibration

Base idle speed calibration adjustment to provide the idle speed steeping for the automatic idle stabilisation function. This table allows battery voltage dependent idle speed selection if desired. This function helps ensure battery charge is maintained under all conditions. A maximum of 3 battery voltage calibration sites may be selected. Calibrations may be selected in the range 300 to 5000 RPM in 1 RPM increments.

User Defined Duty Ratio Output Calibration

This user-defined table is a 16 by 10 table that allows the user to define the output-characteristics of a spare pulse width modulated output as a function of any 2 variables that the ECU measures. A typical application would be the control of the actuation of an auxiliary upstream butterfly depending upon throttle position and engine speed in a turbocharged application in order to minimise turbocharger lag.

User Defined On/Off Output Calibration

This user defined table is a 6 by 4 table that allow the user to define the on /off characteristics of a spare relay output as a function of any 2 variables that the ECU measures. A typical application might be the control of camshaft timing adjustment actuator depending upon engine speed and load.

Idle Mixture Control range Calibration

The idle mixture trim screwdriver adjustment can be configured to operate over any defined engine speed and load range with up to +/- 25% of adjustment range. This allows the control to suit road and race tuned engines and also allows the action of the control to be inhibited if government authority regulations exclude any idle mixture adjustment. Calibration may be selected at up to 2 engine speed sites and 2 engine load sites with an adjustment range of 0 to +/- 25% in 0.1% increments.

Barometric Pressure Estimation Offset Calibration

Calibration table that allows the ECU to estimate barometric pressure at times other than before engine start-up using the internal MAP sensor. The table may have a maximum of 3 engine speed calibration sites and 6 throttle position sites. Calibration range is 0 to 50 KPa IN 0.2 KPa increments.

Open Loop Air fuel Ratio Calibration

This 16 by 10 calibration table is for use in applications where closed loop air fuel ratio operation is required. Details of this function are presently supplied to customers only on request.

Miscellaneous Calibration

Many variables exist that work with the above calibration functions, some are selected automatically by the laptop program depending upon the users response to questions asked by the program, others may be adjusted directly from a special screen display. These calibrations include:

- SELECT NUMBER OF ENGINE CYLINDERS.

- SELECT 4 CYCLE OR 2 CYCLE ENGINE.

- SELECT MANIFOLD ABSOLUTE PRESSURE/THROTTLE POSITION OR BOTH AS ENGINE LOAD INPUT.

- SELECT ENGINE COMPRESSION RATIO.
  Correct selection ensures precise correction for baro and exhaust backpressure changes.

- OVERALL FUEL DELIVERY MULTIPLIER.
  Provides correct scaling for, all fuel delivery tables and allows changes to injector sizing and/or fuel pressure without having to re-calibrate the fuel delivery tables.

- SELECTION OF INJECTION RESPONSE COMPENSATION.
  Selects the correct response characteristics for all commonly available injectors.

- OVERBOOST PROTECTION. (2 adjustments) Two stage overboost protection is adjustable for detection level and detection tire so that damaging overboost causes engine shutdown but pressure spikes are ignored.

- ACCELERATION ENRICHMENT. (2 adjustments) Throttle sensitivity and maximum acceleration fuel delivery allow trimming of the minimum and maximum limits of enrichment.

- COOLING FAN CONTROL ADJUSTMENTS. (off) Allows co-ordination of two cooling fans according to vehicle speed, engine coolant temperature and air conditioner operation.

- AUTOMATIC IDLE SPEED STABILISATION CONTROL ADJUSTMENTS (2 off). Allows the trimming of the control characteristics of the idle stabilisation function for optimal operation (supplied default values normally ok).

ECU Self Diagnostic

Error Indicator Light

The ECU's red LED indicator flashes error codes to indicate fault conditions. 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 some models (eg:- SMC) 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.

Normal Engine and ECU operation should present only 2 flashes 2.5 seconds apart at ignition on. Indicating that the ECU is without any stored error HISTORY and presently not detecting any new errors.

Error Warning / Diagnostic Light Fault Codes

CODE	ERROR DESCRIPTION
ON	INTERNAL ERROR 120
CONTINUOUSLY	RETURN TO FACTORY FOR REPAIR.
FLASHING FAST	INTERNAL ERROR 121 RETURN TO FACTORY FOR REPAIR.
11	NO ERROR.
13	THROTTLE I/P.
14	02 I/P.
21	AIR INTAKE TEMPERATURE I/P
22	COOLANT TEMPERATURE I/P.
23	BAROMETRIC PRESSURE.
25	VEHICLE (WHEEL) SPEED I/P.
26	OVER BOOST ERROR.
31	PRESSURE I/P.
33	CYLINDER PULSE I/P MISSING.
34	"SYNC" REFERENCE PULSE I/P MISSING.
41	EBP I/P.
43	"SYNC" ERROR DETECTED WHILE ENGINE RUNNING.
53	SUPPLY OVER VOLTAGE ERROR.
73	POWER FAIL DETECTOR ERROR CONTACT SUPPLIER.
82	CMOS RAM MEMORY LOSS.
99	EEROM ERROR CONTACT SUPPLIER.

Example of error indication

Air Intake temperature error

User action	System Error	ECU error HISTORY memory	ECU indication
No power	nil	nil	
Ign on	nil	nil	1 flash, pause 2.5 sec, 1 flash = code 11, no error HISTORY. no flashes for 10 sec = pause. no further flash = no existing/new errors.
Disconnect ait temp sensor	21	nil	2 flashes, pause 2.5 sec, 1 flash = code 21 Air intake temperature sensor fault.
Ign off	21	21	
Ign on	21	21	2 flashes, pause 2.5 sec, 1 flash = HISTORY code 21 Air temperature sensor previously faulty. No flashes for 10 sec = pause after error code. Or 2 flashes, pause 2.5 sec, 1 flash = Air temperature sensor still faulty
Reconnect air temp sensor	nil	21	
Ign off	nil	21	
Ign on	nil	21	2 flashes, pause 2.5 sec, 1 flash = HISTORY code 21 Air intake sensor previously faulty. No flashes for 10 sec = pause after history code. No more flashes = no existing/new errors.

Mode Flags

SMC v 1.92 Mode Flags (Autotune Chip)

MODE FLAG NO.	FUNCTION	VALUE
0	SELECT MANIFOLD ABSOLUTE PRESSURE MAPPED CALIBRATION	0
0	SELECT THROTTLE POSITION MAPPED CALIBRATION	1
0	SELECT THROTTLE MAPPED FUEL DELIVERY WITH PRESSURE OVERRIDE (IGNITION PRESSURE MAPPED)	8
0	SELECT FOR 4 CYCLE ENGINE	ADD 0
0	SELECT FOR 2 CYCLE ENGINE (AND ROTARY ENGINES)	ADD 4
0	ENABLE OPEN LOOP A/F RATIO TABLE	ADD 16
0	ENABLE OPEN LOOP LEAN HWY MODE	ADD 32
0	ACTIVATE CLOSED LOOP A/F CONTROL	ADD 64
0	SELECT SPECIAL IGNITION OUTPUT DWELL SETTING (CONSULT YOUR DEALER ABOUT SPECIAL IGNITIONS).	ADD 128
1	1 COIL IGNITION SYSTEM 2 COIL IGNITION SYSTEM 3 COIL IGNITION SYSTEM 4 COIL IGNITION SYSTEM	1 2 3 4
1	SPECIAL IGNITION INHIBIT FUNCTION (DO NOT USE !!!)	ADD 8
1	NEGATIVE TRIGGERED IGNITION AMPLIFIER (MODULE) eg:- Bosch HEI	ADD 0
1	POSITIVE TRIGGERED IGNITION AMPLIFIER (MODULE) eg:- - MSD	ADD 32
1	CYLINDER REFERENCE PULSE INPUT POSITIVE TRIGGERED	ADD 0
1	CYLINDER REFERENCE PULSE INPUT NEGATIVE TRIGGERED	ADD 16
1	CYLINDER PULSE INPUT POSITIVE TRIGGERED.	ADD 0
1	CYLINDER PULSE INPUT NEGATIVE TRIGGERED	ADD 64
1	CYLINDER PULSE INPUT POSITIVE & NEGATIVE (RISING & FALLING SIGNAL) TRIGGERED.	ADD 128

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MODE FLAG NO.	FUNCTION	VALUE
2	NO AIR/FUEL RATIO SENSOR	0
2	PROPORTIONAL AIR/FUEL RATIO I /P 0 - 1.O Volt => 10:1 to 30:1 AIR/FUEL RATIO	1
2	BOSCH OR "AUTRONIC" 4 WIRE 02 SENSOR	2
2	ENABLE DIGITAL I/P AIRFLOW METER (CONSULT YOUR DEALER ABOUT THIS SPECIAL FEATURE).	ADD 8
2	SELECT NTC INTAKE TEMP SENSOR (IGNORE WHEN USING AUTRONIC AIR TEMP SENSOR - FOR SPECIAL APPLICATIONS ONLY. REQUIRES ECU MODIFICATION)	ADD 16
3	AUX COOLING FAN (FAN 2) TO INJ7 O/P (ONLY AVAILABLE IF INJ7 O/P NOT USED FOR FUEL INJ).	0
3	MODIFY AUX COOLING FAN FUNCTION FOR CHARGE COOLING FUNCTION ON INJ7 O/P.	1
5	ENABLE AUXILIARY O/P FUNCTION AS IDLE SPEED CONTROL (FOR BOSCH 2 WIRE IDLE CONTROL ACTUATOR).	0
5	ENABLE AUXILIARY O/P FUNCTION AS IDLE SPEED CONTROL. (FOR PROPORTIONAL TYPE VALVE).	1
5	ENABLE AUXILIARY O/P FUNCTION AS BOOST CONTROL.	2
5	DIRECT MAIN COOLING FAN (FAN1) TO AUXILIARY O/P.	3
5	DIRECT USER DEFINED PWM 0/P OR ANTI-LAG FUNCTION TO AUXILIARY O/P.	4
5	ENABLE AUXILIARY O/P FUNCTION AS FUEL USED 0/P.	5
5	RE-DIRECT USER ON/OFF 0/P FUNCTION FROM EITHER INJ5 OR INJ8 TO AUXILIARY O/P.	6
5	SELECT (THROTTLE POSITION AS CALIBRATION VARIABLE F0R USER DEFINED PWM OR ANTI-LAG FUNCTION.	ADD 0
5	SELECT “LOAD” AS CALIBRATION VARIABLE FOR USER DEFINE PWM OR ANTI-LAG FUNCTION.	ADD 8
5	SELECT THROTTLE POSITION AS CALIBRATION VARIABLE FOR USER DEFINED ON/OFF O/P.	ADD 0
5	SELECT “LOAD” AS CALIBRATION VARIABLE FOR USER DEFINED USER DEFINED ON/0FF O/P.	ADD 16
5	ENABLE ON/OFF O/P FUNCTION TO AUXILIARY 0/P OR INJ5 O/P OR INJ8 O/P (AUX O/P OR INJ5 O/P IF ANTI-LAG SELECTED)	ADD 32
5	ENABLE MAIN COOLING PAN (FAN1) FUNCTION TO AUXILIARY O/P OR INJ6 O/P	ADD 64
5	ENABLE ANTI-LAG FUNCTION TO AUX O/P OR INJ8 O/P	ADD 128

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MODE FLAG NO.	FUNCTION	VALUE
6	PWM 0/P FREQUENCY = 10Hz	0
6	PWM O/P FREQUENCY = 20Hz	ADD 4
6	PWM O/P FREQUENCY = 30Hz	ADD 8
6	PWM O/P FREQUENCY = 40Hz	ADD 12
6	PWM O/P FREQUENCY = 50Hz	ADD 16
6	PWM O/P FREQUENCY = 60Hz	ADD 20
6	PWM O/P FREQUENCY = 70Hz	ADD 24
6	PWM O/P FREQUENCY = 80Hz	ADD 28
6	PWM O/P FREQUENCY = 90Hz	ADD 32
6	PWM O/P FREQUENCY = 100Hz	ADD 36
6	PWM O/P FREQUENCY = 110Hz	ADD 40
6	PWM O/P FREQUENCY = 120Hz	ADD 44
6	PWM O/P FREQUENCY = 130Hz	ADD 48
7	SELECT 150/90 DEG (V6) IGNITION OPTION.	4
7	SELECT ANTI-LAG DROPPED INJECTION COOL-DOWN FUNCTION.	ADD 16
7	SELECT ANTI-LAG THROTTLE CLOSED INHIBIT FUNCTION.	ADD 32
7	SELECT AUTOMATIC ANTI-LAG (ANTI-LAG TO ON FOR 15.0 SEC AFTER RPM EXCEEDS 5000).	ADD 64
7	SELECT ANTI-LAG CONTROL BY SWITCH I/P (GROUND I/P TO ACTIVATE).	ADD 128
8	IGNITION TRIGGERING OF ALL CYLINDERS 1 To 8 ALLOWED.	0
8	INHIBIT CYLINDER 1 IGNITION	ADD 1
8	INHIBIT CYLINDER 2 IGNITION	ADD 2
8	INHIBIT CYLINDER 3 IGNITION	ADD 4
8	INHIBIT CYLINDER 4 IGNITION	ADD 8
8	INHIBIT CYLINDER 5 IGNITION	ADD 16
8	INHIBIT CYLINDER 6 IGNITION	ADD 32
8	INHIBIT CYLINDER 7 IGNITION	ADD 64
8	INHIBIT CYLINDER 8 IGNITION	ADD 128
9	IGNITION TRIGGERING OF ALL CYLINDERS 9 TO 16 ALLOWED.	0
9	INHIBIT CYLINDER 9 IGNITION	ADD 1
9	INHIBIT CYLINDER 10 IGNITION	ADD 2
9	INHIBIT CYLINDER 11 IGNITION	ADD 4
9	INHIBIT CYLINDER 12 IGNITION	ADD 8
9	INHIBIT CYLINDER 13 IGNITION	ADD 16
9	INHIBIT CYLINDER 14 IGNITION	ADD 32
9	INHIBIT CYLINDER 15 IGNITION	ADD 64
9	INHIBIT CYLINDER 16 IGNITION	ADD 128

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MODE FLAG	FUNCTION	VALUE
10	USE IDLE IGNITION TIMING TABLE @ IDLE.	0
10	USE MAIN IGNITION TIMING TABLE @ IDLE.	1
10	IGNITION TIMING MODIFIER 1 CHARGE TEMPERATURE DEPENDENT.	ADD 0
10	IGNITION TIMING MODIFIER 1 COOLANT TEMPERATURE DEPENDENT.	ADD 2
11	WIRING LOOM HAS POWER SUPPLY AND FUEL PUMP/INJECTOR SUPPLY RELAYS (I.E:- ECU POWER FEED IS TO PIN 25 OR 26 FROM A RELAY THAT DE-ENERGIZES DURING BATTERY REVERSAL).	0
11	WIRING LOOM HAS FUEL PUMP/INJECTOR SUPPLY ONLY. (IE:- ECU POWER FEED IS TO PIN 29 DIRECT FROM IGNITION SWITCH/RELAY.	1
12	DISABLE SOFT REV LIMIT	0
12	ENABLE SOFT REV LIMIT FUEL CUT	ADD 1
12	ENABLE SOFT REV LIMIT SPARE CUT	ADD 2
13	MISSING PULSE CYL I/P SYNC (eg Motronic) SET = MISSING TOOTH COUNT.	0 TO 7
13	SUBARU 1999-2000 TRIGGER PATTERN SELECT	32
13	MITSUBISHI EVO 4, 5 AND 6 TRIGGER PATTERN SELECT	64
13	EXTRA CYLINDER PULSE SYNC FUNCTION.	128
14	CYL PULSE PRE-SCALE FACTOR	(0 = disables)
15	CYL PULSE PRE-SCALE OFFSET	0 TO Mode Flag 14 - 1

SPECIAL FEATURES

EITHER CLOSE LOOP A/F RATIO CONTROL OR ANTI-LAG CAN BE SELECTED BUT BOTH CANNOT OPERATE SIMULTANEOUSLY

IDLE SPEED CONTROL = CHARGE COOLING MINIMUM RPM RESET ENGINE SPEED.

FAN 2 ON VEH SPEED THRESH.	= MAP THRESHOLD FOR CHARGE COOLING
AIRCON RESTART ENGINE SPEED.	= ANTI-LAG COOL-DOWN MODE MIN RPM
AIRCON CUTOUT ENGINE SPEED.	= ANTI-LAG COOL-DOWN MUCH MAX RPM
AIRCON RESTART DELAY TIME	= ANTI-LAG COOL-DOWN MAX THROTTLE (10 SEC = 20% THROTTLE).