8860

Engine Management System

Dual mode closed loop lambda control
Dual mode closed loop idle control
Stepper motor control
Plug n Play data logging
32 X 96 User definable load points
2 Wide Band Temperature compensated Air/Fuel Ratio Inputs
8 injector outputs
8 ignition outputs
16 User definable inputs
8 User definable outputs
60 psi (400 Kpa) built-in MAP sensor

ENGINE MANAGEMENT SYSTEMS
EMS
FUEL INJECTION

Getting Started

When you start the 8860 ECU Control Software the first screen to appear is the tuning screen.

You can read data from the ECU or a saved file by selecting the appropriate menu option.

To read from a saved file you go to menu option "File -> Open Tune File", select the file you want and press the "OPEN" button.

To read from an ECU you must first have one connected and on-Line. You can tell if an ECU is on line when the green light on the bottom right corner of the window is flashing.

To bring a connected ECU on-line go to menu option "ECU -> On Line". If the command is successful then the green light will be flashing.

To read from the ECU go to menu option "ECU -> Read from ECU". If the ECU is connected and On Line then the information will start down loading into the PC/Laptop.

All ECU data is saved in files. You can create any number of files each with a different name. To save the data to a file go to menu option "File -> Save Tune File" and press the "SAVE" button.

Setting the ECU parameters for a specific engine

Press the Goto "ECU Setup" button to go to the ECU Setup screen. Use this screen to set the parameters for a specific engine. You can set parameters such as number of cylinders, number of igniters, types of engine sensors attached, load sensor type etc.

See ECU Setup Screen

Auxiliaries

There are 2 parts to the Auxiliary Control Settings screen.
Output Control Circuits and Input Control circuits

see digital Input
See Turbo Anti Lag

Output Control circuits

The 8860 provides 8 programmable auxiliary outputs, each output can perform one of 12 functions. 8 of the 12 functions can be used to control relays and tachos, the remaining 4 provide pulse width modulated output for controlling variable devices such as idle control motors, stepper motors and boost control.

Use the Auxiliary Output screen to define the function for each output.

See Auxiliary Outputs
See PWM Modes 9 - 12

Engine Tuning

The 8860 control software provides a graphical view of the ECU mappings.

This gives the user an instant overall picture of how an engine is tuned, highlighting any abnormalities.

All engine tuning is performed via this screen.
If the Ecu is on line with this computer ,any change made to the tuning maps is instantly transmitted to the ECU.

See Fuel and Ignition Tuning Maps
See Barometric Compensation
See Temperature Compensation

Tune Analyser

Tune Analyser is a feature designed by EMS to assist in tuning an engine to its peak performance

See Tune Analyzer

Data Logging

The 8860 system provides flexible data logging capabilities to assist in gaining the maximum efficiency from an engine.

NOTE: Data logging is only available if the ECU is attached for data logging.

See Log Controls

Wiring Diagrams

ECU Connections
Auxiliary Input Connections
Auxiliary Output Connections
Injector Connections
Trigger and Sync Sensor Connections
Hall Sensor
EMS Igniter Wiring
NOS Wiring Diagram
6 Cylinder DFI Wiring Diagram
4 Cylinder DFI Wiring Diagram
2 Rotor DFI Wiring Diagram
3 Rotor DFI Wiring Diagram

ECU Setup Screen

Describe all of the engine specific parameters in this screen.

Load Source
Injector Arrangement
Trigger Sensor
Trigger Edge
Trigger Pull Up Resistor
Number of Trigger Teeth
Sync Sensor
Sync Edge
Sync Pull Up Resistor
Static Timing
Lambda Sensor
Number of Cylinders
Ignition Type
Number of Igniters
Ignition Dwell mS
Injector Ohms
Sensitivity
Aspiration (Intake Induction)
Supercharger Boost
Acceleration Enrichment
Enrichment Duration
Soft Rev Limiter
Hard Rev Limiter
Boost Cut
Deceleration Fuel Cut
Calibrate Throttle Position Sensor
Base PWM Frequency

Load Source

There are two load source .

Load source 1 is the main default load source that the ecu uses in the
Fuel and ignition main MAPS if load source 2 is selected to Off.

If load source 2 is also selected, the ECU will take an average of both and
use the result in the fuel and ignition maps.

The main use is e.g. Nissan GTR twin turbo.(or any engine with 2 air flow meters)
If the tuner would like to tune off the 2 original air flow meters,
They would be connected to 2 of the Analog input channels.
Select analog # for the first load source
Select analog # for the second load source
The ecu will then take the average reading of both the air
flow meters and use this result in the fuel and ignition maps.

Injector Arrangement

Multi point 360 *for rotary and piston engines*

Check the position of the fuel injectors. They must be fitted as Multi Point (1 injector per cylinder).

When Multi-point 360 is selected regardless of the number of cylinders, the computer will fire the injectors twice every engine cycle (once per crank revolution).

NOTE: Throttle body should be selected for 2 strokes.

Multi point 720 *for piston engines only*

Check the position of the fuel injectors. They must be fitted as Multi Point (1 injector per cylinder).

When Multi-point 720 is selected regardless of the number of cylinders, the computer will fire the injectors once every engine cycle (two complete crank revolutions).

Using Multi point 720 will provide smother idle with larger injectors.

Throttle body should be selected for 2 strokes.

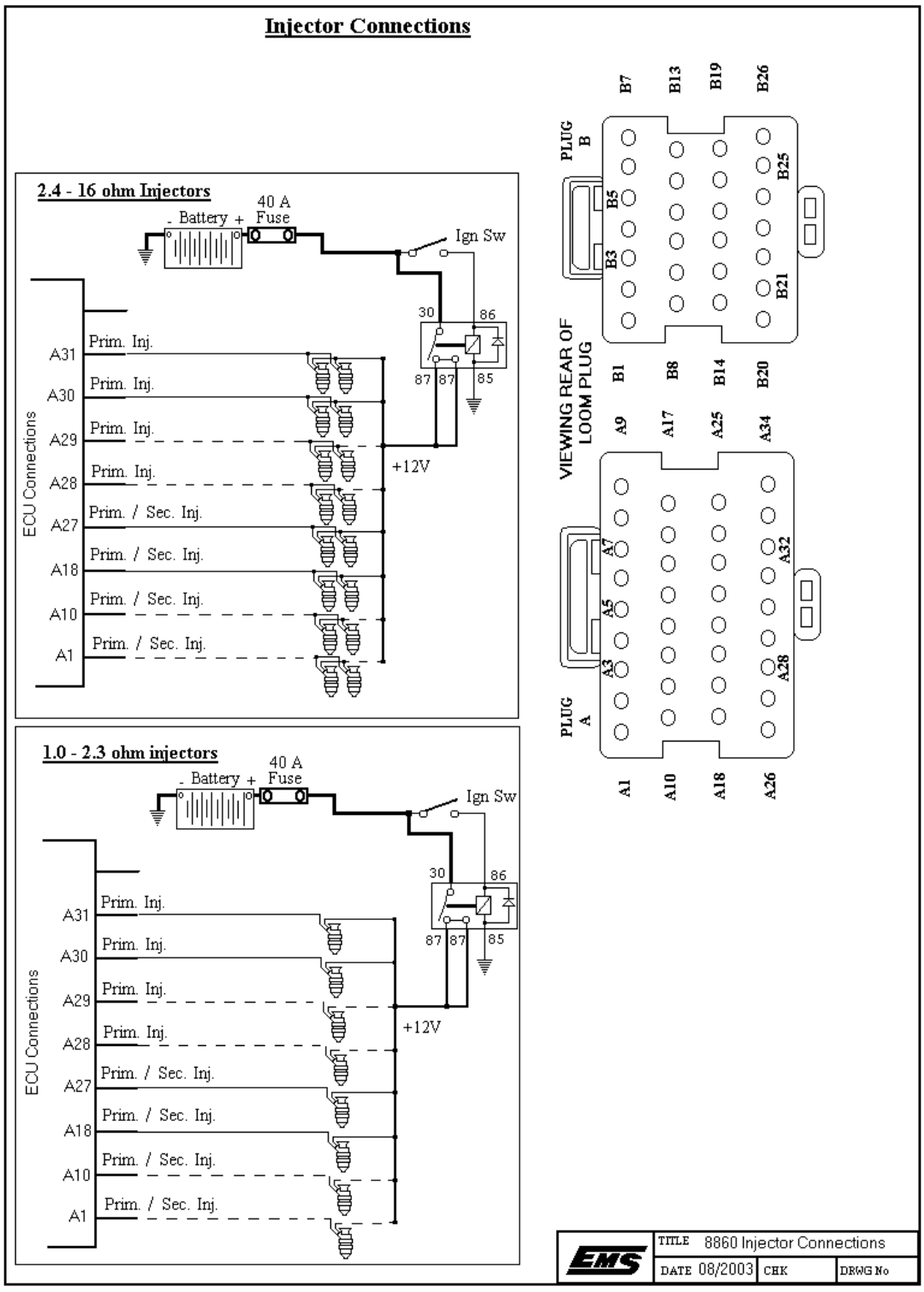
Throttle Body *for rotary and 2 or 4 cycle piston engines*

Check the position of the fuel injectors. They may be fitted to a Throttle Body (all injectors at one single point).

When throttle body is selected the computer fires the injectors every ignition pulse if it is a 6cyl or less. If it is a V8 or more the computer will fire the injectors every 2nd ignition pulse.

See Injector connections

Injector Connections



Trigger Sensor Type

General

Signals from Optical, Hall or Magnetic sensors can be used to trigger the Ecu on the trigger circuit or the sync circuit. These inputs are programmable by selecting either of the following.

Hall / Optical

Hall and Optical sensors are usually 3 wire sensors.
They produce a square wave signal.

See Trigger and sync sensor connections

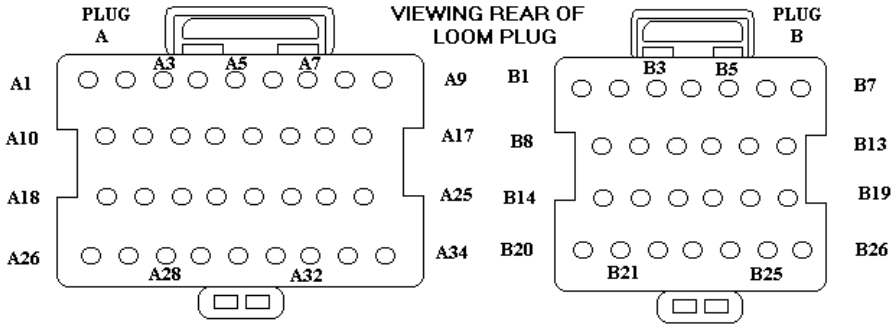
Magnetic

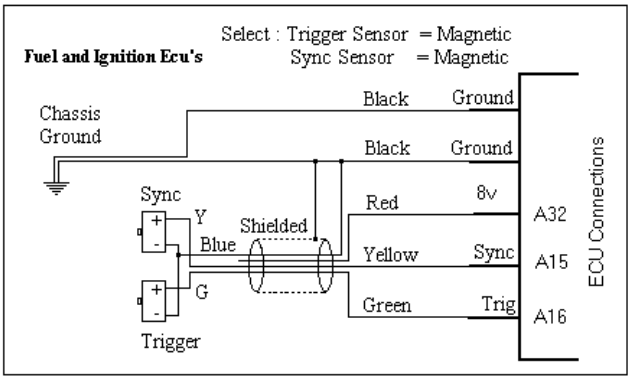
Magnetic sensors are 2 wire sensors.
They produce a sine wave signal.

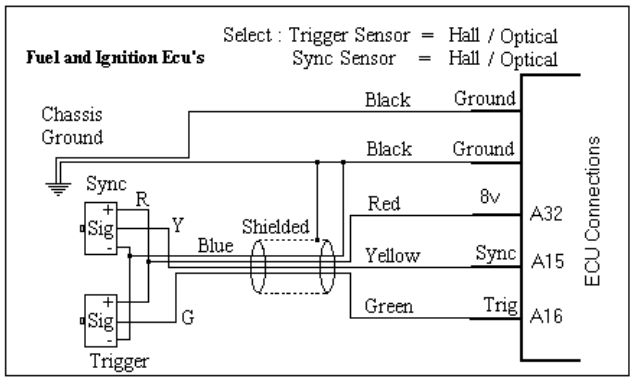
See Trigger and sync sensor connections.

Trigger and Sync Sensor Connections

Trigger and Sync Connections.







Trigger and Sync sensor types are user programmable.
This allows for any combination of Hall, optical or Magnetic sensors to be used.

	TITLE 8860 Trigger and Sync		
	DATE 08/2003	CHK	DRWG No

Trigger Edge

General

The trigger edge determines whether the computer is triggered by the positive or negative edge of the trigger signal.
The computer can be triggered by either edge.

For Magnetic

The trigger edge must be set to positive.

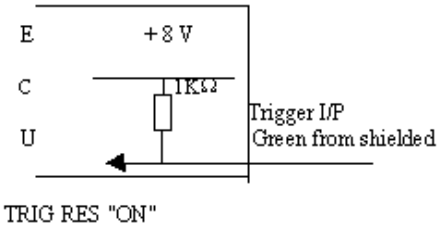
For Hall / Optical sensors

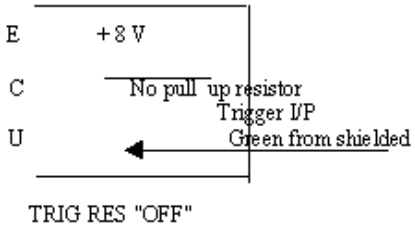
Depending on the sensor Wheel Slots / Teeth, The signal will either be Rising or Falling at approx 10 degrees BTDC.
If unknown, connect a multi meter from the Trigger wire to ground and watch the voltage level change while turning the engine slowly by hand to determine if the signal is Rising or Falling.
If Rising, select + Trigger
If Falling, select - Trigger.

DANGER !
Disconnect the ignition coils before rotating the engine by hand.

Trigger Resistor

When Hall is selected for the trigger input, the "TRIGG RES" feature gives you the option of selecting "ON" if the ECU is to Introduce a 1000 ohm pull up resistor to 8V or "OFF" if the 1000 ohm resistor is to be disconnected.





TRIG RES "ON" TRIG RES "OFF"

The "ON" is usually selected if the 8860 ECU alone is to be connected to the trigger sensor .

If 8860 is installed in a piggy back situation where the original ECU is still connected to the trigger sensor then both computers' will share the signal.

Since the original ECU has a pull up resistor in circuit, the 8860 pull up should be selected to be "OFF".

Magnetic Sensor

When a magnetic sensor is selected for the Trigger sensor, the Trigger Resistor is automatically turned off by the Ecu regardless of this setting.

No. of teeth per cam cycle

1 tooth per cylinder firing

In situations where there is 1 tooth per cylinder firing you can select either "Multi teeth off" or a number that is equal to the number of cylinders

Sync sensor is not required if single ignition coil is used.

See Teeth Per Cycle

Multi tooth

If there are more Trigger teeth per cycle than cylinders, Key in the amount of teeth per cam cycle.

Note: The amount of Teeth per cycle must divide down equally by the amount of cylinders.
E.g. 24 teeth divided by 4 cylinder = 6. This is ok.
E.g. 18 teeth divided by 4 cylinder = 4.5. WILL NOT WORK !

The teeth must be spaced evenly and a sync sensor MUST be used.

The trigger tooth directly after the sync tooth is the index tooth.

The index tooth is usually positioned in front of the Trigger sensor when the engine is at 10 BTDC on cylinder No. 1

If "Missing tooth" Ignition mode is selected then you can set the index tooth by setting the "No. of teeth after missing" field.

NOTE:

If the trigger wheel is running at the same RPM as the crank then you must double the number of teeth counted on the wheel and enter the number into to "No. of teeth per cam cycle" field.

If the trigger wheel is running at the same RPM as the cam then you must count the teeth on the wheel and enter the number into to "No. of teeth per cam cycle" field.

Teeth per cycle

1 engine cycle = 2 complete crankshaft revolutions for 4 stroke engines.

In this time the distributor would rotate 1 complete turn

If the trigger teeth are in the distributor or camshaft driven crank angle sensor,
count the number of trigger teeth and enter it into the "No. of teeth per cam cycle " setting.

If the trigger teeth are on the crankshaft, count the teeth and double.

Sync Sensor Type

General

Signals from Optical, Hall or Magnetic sensors can be used to trigger the Ecu on the trigger circuit or the sync circuit. These inputs are programmable by selecting either of the following.

Hall / Optical

Hall and Optical sensors are usually 3 wire sensors.
They produce a square wave signal.

See Trigger and sync sensor connections

Magnetic

Magnetic sensors are 2 wire sensors.
They produce a sine wave signal.

See Trigger and sync sensor connections

Sync Edge

General

The sync edge determines whether the computer is triggered by the positive or negative edge of the sync signal.
The computer can be triggered by either edge.

For Magnetic

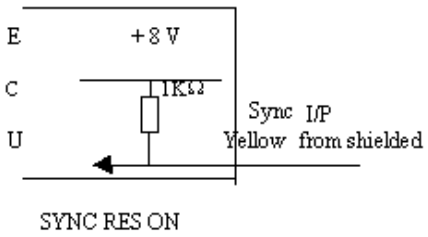
The sync edge must be set to positive.

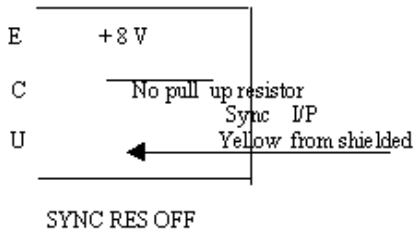
For Hall / Optical sensors

Depending on the sensor Wheel Slots / Teeth, The signal will either be Rising or Falling.
If unknown, connect a multi meter from the Trigger wire to ground and watch the voltage level change while turning the engine slowly by hand to determine if the signal is Rising or Falling.
If Rising, select + Trigger
If Falling, select - Trigger.
DANGER !
Disconnect the ignition coils before rotating the engine by hand.

Sync Resistor

When Hall is selected for the trigger input, the "Trigger Pull up Resistor" feature gives you the option of selecting "ON" if the ECU is to Introduce a 1000 ohm pull up resistor to 8V or "OFF" if the 1000 ohm resistor is to be disconnected.





TRIG RES "ON" TRIG RES "OFF"

The "ON" is usually selected if the 8860 ECU alone is to be connected to the trigger sensor .

If 8860 is installed in a piggy back situation where the original ECU is still connected to the trigger sensor then both computers' will share the signal.

Since the original ECU has a pull up resistor in circuit, the 8860 pull up should be selected to be "OFF".

Magnetic Sensor

When a magnetic sensor is selected for the Trigger sensor, the Trigger Resistor is automatically turned off by the Ecu regardless of this setting.

Static Ignition Timing

Select "locked". The ECU will fire the ignition timing where the trigger has been fitted BTDC. To see where the trigger has been fitted, a timing light should be used to check the timing of the engine.
Once the static timing is established, e.g. 10 BTDC. select 10 degrees BTDC in this field and press enter.

Lambda sensor

This selects the type of lambda sensor that is connected to the Ecu.
The Ecu converts the sensor signal to an Air / fuel Ratio. If a wide band sensor is connected then it can be used as a tuning aid.

NOTE: Use Sensor safe sealants on the exhaust system.

Select Off to this turns lambda off.

Bosch 4 Wire (Bosch Sensor Number 0 258 104 002)

In this mode the Ecu Provides Temperature compensation and Linearization of the sensor to give accurate and repeatable results.
Allow 4 minutes for the sensor to reach minimum operating temperature.

Bosch 5 Wire (Innovate LC-1)

See LC1 Connection Drawing

In this mode the 8860 ECU reads either analog 1 or 2 of the LC-1.

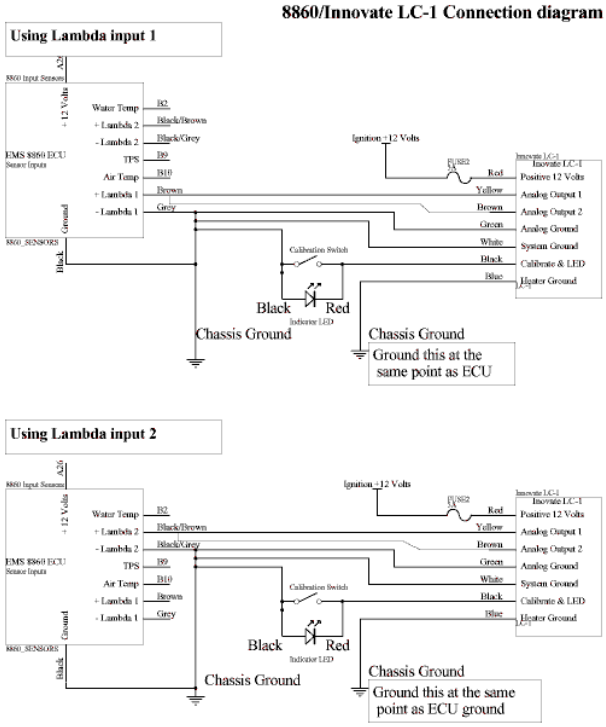
Before the LC-1 can be used with the 8860 it must be calibrated. Use LM Programmer software to calibrate the LC-1.

Set the output to read 0.050 volts for 8.0 air-fuel-ratio and 0.950 volts for 22 air-fuel-ratio.

Narrow Band

You must use narrow a band sensor for this mode to work.

LC1 Connection Drawing



Note:
Either Analog output 1(Yellow) or 2 (Brown) may be used from each LC-1 to connect to the 8860 but not both.

The calibration switch and LED are optional.

For more information please see the LC-1 documentation

No. of Cylinders

Adjust to the correct number of cylinders / Rotors for your engine

NOTE: For Two Stroke engines, double the number of cylinders to achieve the correct R.P.M.

E.g.: Two cylinder Two stroke = 4 in the amount of cylinders.

Ignition Type

General

This feature is constantly being updated as new triggering modes are developed for different engines. We included some explanation on the Nissan triggering modes because they are a little tricky.

Most common mode used in most applications is mode 00.

IGN TYPE (00) Normal

For piston engines with multi tooth distributors or crank angle sensors. The number of teeth/cycle should be selected in the "No. of Trigger Teeth" setting.

For engines with same number of teeth in distributor or cam sensor as cylinders should select 0 in the "No. of Trigger Teeth" setting.

NOTE: To use the TRIG/CYC page you must have evenly spaced and an even number of trigger teeth (Max. 24 per engine cycle). The SYNC tooth must be between the last trigger tooth and trigger tooth 1.Trigger tooth 1 must be approx. 10 deg. before to dead center. Use only one sync tooth per cycle for sequential spark. 1 or 2 sync teeth can be used for wasted spark applications.

IGN TYPE (01) Nissan

Is used for Multi-coil applications using cam mounted crank angle sensors e.g.; CA18, RB20, VG30, SR20.
Ignition outputs 1, 2, 3 can be used, the ECU will fire these outputs in 1 2 3 order, 6 cyl engines would use 1, 2 & 3 as wasted spark.

0 Number of Trigger Teeth must be used with all Nissan modes.

See Nissan crank angle positioning

IGN TYPE (02) Nissan

Is used for Multi Coil applications when a distributor is used instead of a cam mounted crank angle sensor .E.g., FJ20, ET PULSAR.
Ignition outputs 1,4 & 2,3 will be fired if 2 igniters have been selected in the setup screen.

Note: When using a distributor, select ignition type 00 and do not connect sync wire.

See Nissan crank angle positioning

IGN TYPE (03) WRX SUBARU

Set Number of cyl to 4, Number of Trigger Teeth to 0.
If using a coil pack then set Number of igniters to 2 and use outputs 1 & 2 as wasted spark.
If using 4 separate coils then set Number of igniters to 2 and use outputs 1 & 4 for front cylinders and 2 & 3 for rear cylinders.

IGN TYPE (04)

Direct fire rotaries.
For 2 rotor Select 24 in the No. of Trigger Teeth page, 2 Rotor, 2 Igniters.

Output 1(pink) is for leading. Output 2 (o/p) is for trailing 1, Output 3(gry/blk) is for trailing 2.

3 Rotor select IGN TYPE 00
For 3 rotor select 3 Rotor, 24 in the No. of Trigger Teeth page, 3 igniters .
Output 1 leading & trailing 1
Output 2 leading & trailing 2
Output 3 leading & trailing 3.

For Rotaries with Distributors, Select Ignition Type 00
see

See 2 Rotor DFI wiring
See 3 Rotor DFI wiring

Missing tooth mode

This is for crank teeth with 1 or 2 missing teeth.
For this mode to work you must also set Number of trigger teeth, Sync sensor used and Tooth number after missing.

This mode does not work on 3 & 5 cylinder engines.

See Number of teeth per cam cycle
See No.of Teeth after missing
See Sync sensor used

Nissan Crank Angle Positioning

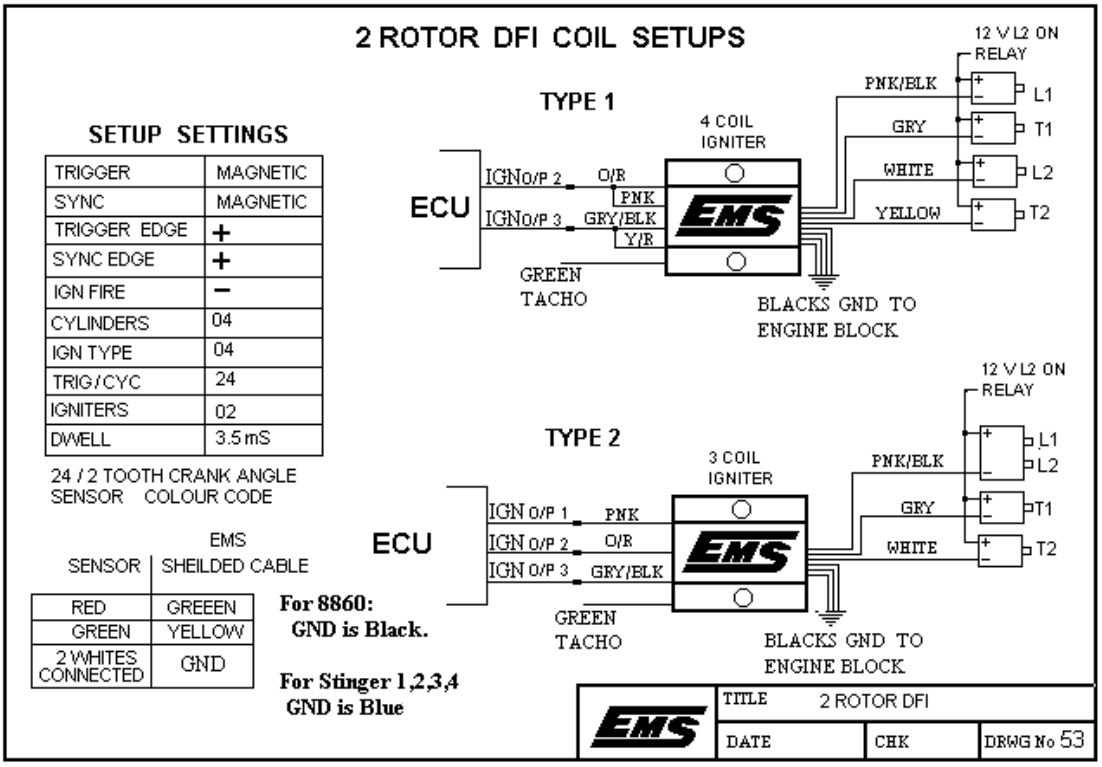
All Nissan Crank Angle Sensors need to be re positioned.

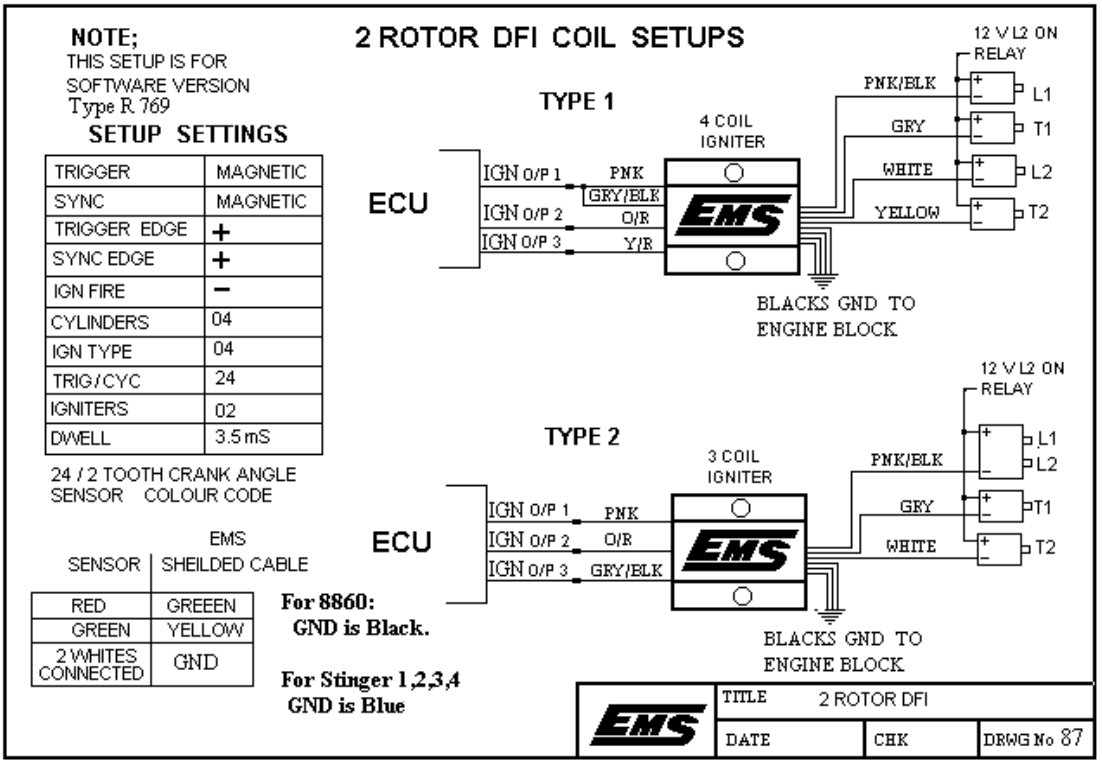
Nissan Sensors are normally set to 60 deg BTDC.

The ecu requires the trigger sensor to be positioned approx.
5 - 15 Deg. BTDC.

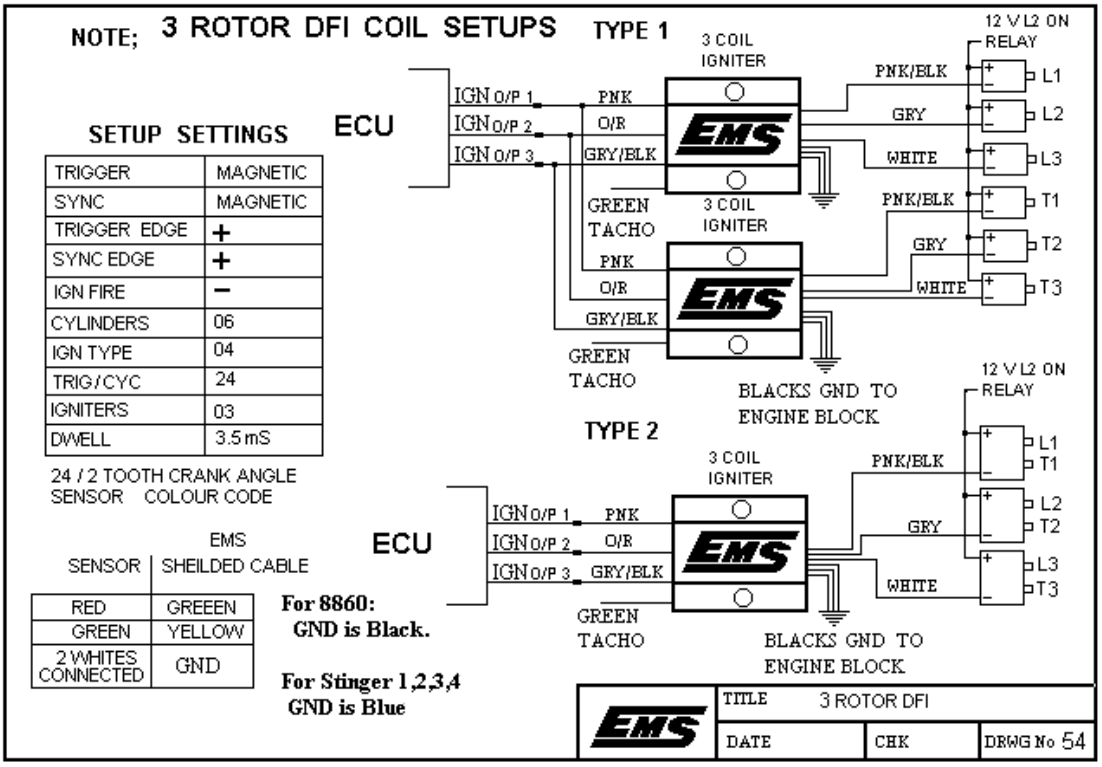
If the engine is fitted with a Distributor the Rotor button(if driven via a gear) or optical sensor or disk needs to be repositioned (if no gear drive) .

2 Rotor DFI Wiring





3 Rotor DFI Wiring



No. of teeth after missing

The ECU needs to know which tooth is the static (index) tooth. This is normally somewhere between 15 deg BTDC and TDC.

EG: If the static tooth is 5 teeth after the missing tooth/teeth then put 5 in this field.

Sync Sensor Used

This is used in conjunction with missing tooth mode if you want to fire injectors and igniters sequentially (one coil per plug and one injector per port).

Because most missing tooth wheels run from the crank (same RPM as Crank) the ECU will receive 2 index signals per engine cycle and therefore true sequential is not obtainable.

By reading a TDC sync signal from a cam or distributor wheel the ECU can then run in true sequential mode.

No. of Igniters

Multi Ignition Coil

This enables you to fire up to 8 coils sequentially. By using multiple coils, you eliminate the use of a distributor cap and rotor button. In this section you must set the correct number of Igniters that will be sequenced.

E.g. 4 cyl with 4 coil sequential, select 4 igniters.
E.g. 4 cyl with 4 coil wasted spark, select 2 igniters.
Fires 1 & 4 together and 2 & 3 together.
E.g. 4 cyl with 2 coil wasted spark, select 2 igniters.

If using a sissy cap and rotor button to distribute the spark, set to 1 igniter. If more than one igniter is chosen, the computer will fire these Igniters sequentially
and requires a Sync sensor to be connected.

To enable the computer to fire more than one igniter sequentially, an extra (reset) sync must be given to trigger the computer.

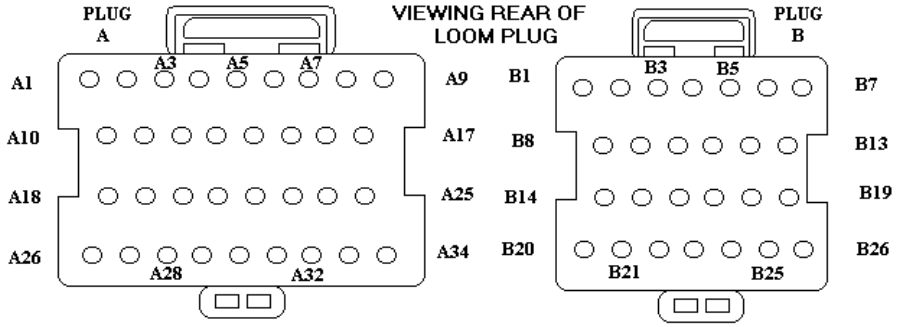
Single Ignition coil

You must use a separate igniter between the ECU and coil.

See ECU Connections

Ecu Connections

8860 WIRING CONNECTIONS



POWER

A26 RED	+12 V SUP
A23 BLACK	GROUND
A24 BLACK	GROUND
B15 BLACK	GROUND
B16 BLACK	GROUND
A32 RED	+ 8 VOLT O/P (SHIELDED)
A33 ORANGE	+ 5 VOLT O/P

INJECTOR O/P 4AMP PEAK@HOLD PER DRIVER

A31 WHITE	INJECTOR 1	PRIM
A30 WHITE/BLACK	INJECTOR 2	PRIM
A29 WHITE/RED	INJECTOR 3	PRIM
A28 WHITE/ORANGE	INJECTOR 4	PRIM
A27 WHITE/VIOLET	INJECTOR 5	PRIM/SEC
A18 WHITE/GREY	INJECTOR 6	PRIM/SEC
A10 WHITE/BROWN	INJECTOR 7	PRIM/SEC
A1 WHITE/GREEN	INJECTOR 8	PRIM/SEC

IGNITION O/P MAX 1 AMP PER DRIVER

A2 PINK	IGNITION O/P 1
A3 PINK/BLACK	IGNITION O/P 2
A4 PINK/RED	IGNITION O/P 3
A5 PINK/ORANGE	IGNITION O/P 4
A6 PINK/VIOLET	IGNITION O/P 5
A7 PINK/GREY	IGNITION O/P 6
A8 PINK/BROWN	IGNITION O/P 7
A9 PINK/GREEN	IGNITION O/P 8

VOLTAGE INPUTS

A11 BLUE	0-5 VOLT I/P 1
A13 BLUE/BLACK	0-5 VOLT I/P 2
A14 BLUE/RED	0-5 VOLT I/P 3
A19 BLUE/ORANGE	0-5 VOLT I/P 4
A20 BLUE/VIOLET	0-5 VOLT I/P 5
A21 BLUE/GREY	0-5 VOLT I/P 6
A22 BLUE/BROWN	0-5 VOLT I/P 7
B1 BLUE/GREEN	0-5 VOLT I/P 8
B3 BLUE/WHITE	0-5 VOLT I/P 9

SIGNNAL I/P (SHIELDED CABLE)

A15 YELLOW SHIELDED SYNC
A16 GREEN SHIELDED TRIGG

AUXILLIARY O/P MAX 1 AMP PER DRIVER

B24 YELLOW	AUX O/P 1
B26 YELLOW/BLACK	AUX O/P 2
A34 YELLOW/RED	AUX O/P 3
B20 YELLOW/ORANGE	AUX O/P 4
B22 YELLOW/VIOLET	AUX O/P 5
B23 YELLOW/GREY	AUX O/P 6
B21 YELLOW/BROWN	AUX O/P 7
B25 YELLOW/GREEN	AUX O/P 8

DIGITAL INPUTS

B4 GREEN	DIGITAL I/P 1
B13 GREEN/BLACK	DIGITAL I/P 2
B19 GREEN/RED	DIGITAL I/P 3
B18 GREEN/ORANGE	DIGITAL I/P 4
B12 GREEN/VIOLET	DIGITAL I/P 5
B7 GREEN/GREY	DIGITAL I/P 6
A12 GREEN/BROWN	DIGITAL I/P 7

SENSOR INPUTS

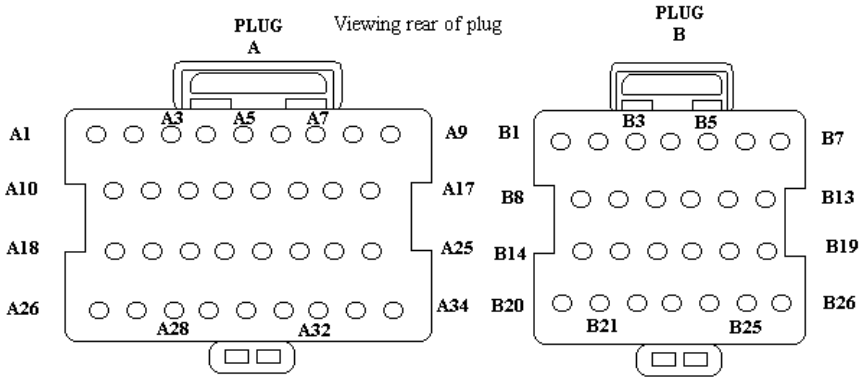
B11 BROWN	LAMBDA +1
B17 GREY	LAMBDA -1
B5 BROWN/BLACK	LAMBDA +2
B6 GREY/BLACK	LAMBDA -2
B2 GREY/BLUE	WATER TEMP
B10 GREY/YELLOW	AIR TEMP
B9 BLUE/PINK	THROTTLE POSITION 0-5 VOLT

STEPPER MOTOR OUTPUTS

B14 VIOLET	STEPPER O/P 1
B8 VIOLET/BLACK	STEPPER O/P 2
A17 VIOLET/RED	STEPPER O/P 3
A25 VIOLET/ORANGE	STEPPER O/P 4

EMS	TITLE 8860 PIN OUT		
	DATE 26/6/03	CHK	DRWG No 50

8860 CONNECTIONS WIRING DIAGRAM



A1 White/Green Injector 8
A2 Pink Ignition O/P 1
A3 Pink/Black Ignition O/P 2
A4 Pink/Red Ignition O/P 3
A5 Pink/Orange Ignition O/P 4
A6 Pink/Violet Igntion O/P 5
A7 Pink/Grey Ignition O/P 6
A8 Pink/Brown Ignition O/P 7
A9 Pink/Green Ignition O/P 8
A10 White/Brown Injector 7
A11 Blue 0-5 Volt I/P 1
A12 Green/Brown Digital I/P 7
A13 Blue/Black 0-5 Volt I/P 2
A14 Blue/Red 0-5 Volt I/P 3
A15 Yellow Shielded Sync
A16 Green Shielded Trigg
A17 Violet/Red Stepper O/P 3
A18 White/Grey Injector O/P 6
A19 Blue/Orange 0-5 Volt I/P 4
A20 Blue/Violet 0-5 Volt I/P 5
A21 Blue/Grey 0-5 Volt I/P 6
A22 Blue/Brown 0-5 Volt I/P 7
A23 Black Ground
A24 Black Ground
A25 Violet/Orange Stepper O/P 4
A26 Red + 12 Volt Sup
A27 White/Violet Injector 5
A28 White/Orange Injector 4
A29 White/Red Injector 3
A30 White/Black Injector 2
A31 White Injector 1
A32 Red Shielded + 8 Volts O/P
A33 Orange +5 Volts O/P
A34 Yellow/Red Aux O/P 3

B1 Blue/Green 0-5 Volt I/P 8
B2 Grey/Blue Water Temp
B3 Blue/White 0-5 Volt I/P 9
B4 Green Digital I/P 1
B5 Brown/Black Lambda + 2
B6 Grey/Black Lambda − 2
B7 Green/Grey Digital I/P 6
B8 Violet/Black Stepper O/P 2
B9 Blue/Pink 0-5 Volt I/P 10
B10 Grey/Yellow AirTemp
B11 Brown Lambda +1
B12 Green/Violet Digital I/P 5
B13 Green/Black Digital I/P 2
B14 Violet Stepper O/P 1
B15 Black Ground
B16 Black Ground
B17 Grey Lambda − 1
B18 Green/Orange Digital I/P 4
B19 Green/Red Digital I/P 3
B20 Yellow/Orange Aux O/P 4
B21 Yellow/Brown Aux O/P 7
B22 Yellow/Violet Aux O/P 5
B23 Yellow/Grey Aux O/P 6
B24 Yellow Aux O/P 1
B25 Yellow/Green Aux O/P 8
B26 Yellow/Black Aux O/P 2

EMS	TITLE 8860 PLUG		
	DATE 9/4/03	CHK	DRWG No 68

Ignition Dwell mS

Ignition dwell time is the amount of charge time the coil is charged for, before it is fired. This time will vary between different ignition and coil systems. Typically 3.5mS is used.

The ECU is adjustable between 1.5 mS and 5 mS of dwell.

Nissan direct coil on plug, set dwell to 2 mS.

NOTE: Incorrect dwell time will result in a weak spark or overheating the ignition system. For more information contact your local EMS dealer.

Injector Ohms

The ECU uses this value to determine the injector latency and compensate for it.

Low ohm injectors have a faster response time than high ohm injectors. So by setting the correct injector resistance will allow the ECU to compensate for injector latency more accurately.

Set this setting to the approximate ohms (Resistance) of your fuel injectors.

You can do a test by using a Multi-Meter. Unplug the electrical harness off one of the injectors and place the Multi-Meter's probes on the injector pin outs (where the electrical harness clips on) and measure the resistance.
When you have a reading adjust the Ecu to the closest setting.

Note: If you are using Staged Injectors with a different value of Ohms, Set the Ecu to the value corresponding to the Primary Injectors.

See Injector connections

Sensitivity

In this section you will find that you have 3 settings to choose from; Coarse(0), Medium(1) and Fine(2). You may need to experiment with these settings to obtain the best response time.

The coarse setting is used for normal throttle bodies, medium is for a large throttle bodies and fine is for the use of a larger throttle bodies.

This function will only appear on screen if a throttle position sensor has been fitted and selected in the "ECU Setup" screen.

These settings affect both the amount of fuel and how quickly the accelerator pump fuel enrichment is activated.

Intake Induction

Normal / Turbo

Select this setting if the engine is Normally aspirated or Turbo charged

Super Charged

Select this setting if the engine is Super Charged.

Super Charger Boost

Set this value equal to the max boost pressure that will be reached .

This setting is only for super charged engines, not used for turbo engines.

Accelerator Enrichment

"Acceleration Enrichment" setting adds % of extra fuel for immediate acceleration.

Through acceleration testing, adjust the ECU until you have reached a satisfactory engine response.

The value in this setting represents a percentage increase of fuel when the accelerator is pushed. This is normally set between 5 and 30%. The duration of the increase is defined in the "Enrichment Duration" setting.

NOTE: You will need to place an amount in the "Enrichment Duration" setting so you can correctly fine tune the "Accelerator Enrichment".

There is a pre-set figure of 16 in "Accelerator Enrichment" and 20 in "Enrichment Duration" but you may need to adjust these figures.

When Tuning the fuel Maps at steady state, temporarily set these to 0 **and don't forget to reset afterwards.**

Enrichment Duration

Enrichment Duration sets the time for which the fuel is added.
Through acceleration testing, adjust the Ecu until you have reached a satisfactory engine response.

You will need to move back and forward between Acceleration Enrichment and Enrichment Duration to get the best settings.

Enrichment Duration = The amount of cylinders fired with extra fuel is added.

Normally set to 20 for 4 cyl and 30 for 6 cyl etc. but can be reduced.

When tuning the fuel maps at steady state, temporarily set this to 0 **and don't forget to reset it back afterwards.**

Soft Rev Limit

The Ecu has a Rpm Limiter that can be adjusted from 0 to 32000 RPM

If you wish to use this option, set to the required rpm limit and press the enter button.

The rpm limiter cuts the fuel out on every second engine cycle e.g. the engine will be injected with the correct amount of fuel for one cycle and no fuel for the next cycle, in turn not running the engine lean at any stage.

To disable the Soft Rpm Limiter set it to 0 RPM.

NOTE: Rev limiter should only be used if there is one injector per cylinder runner.

Hard RPM Limit

The Ecu has a Rpm Limiter that can be adjusted from 0 to 32000 RPM

The Ecu will cut the fuel at the selected R.P.M and will enable the fuel when the R.P.M has dropped below this value. This will prevent an engine from over revving.

If you wish to use this option, set to the required rpm limit and press the enter button.

To disable the Hard Rpm Limiter set it to 0 RPM.

Boost Cut

Select the allowable pressure limit before cutting the fuel injectors off.

The fuel will be injected again once the pressure has dropped below the value set.

If boost cut is not required select OFF.

Deceleration Fuel Cut

This feature allows the tuner to cut fuel to the engine on deceleration. Select at which vacuum value you would like the computer to cut fuel.

If this feature is not required select No Fuel Cut.

The fuel injection is stopped when the vacuum is stronger than the selected value.

Throttle Position Sensor Calibration

The Throttle Calibration is located in the ECU Settings screen

Use Throttle Sensor

If a Throttle sensor is fitted and is required to be used in the accelerator pump maps calculations, (tick) the "Use Throttle Sensor" check box.

Close Throttle

(Use only if a throttle position sensor is fitted)

Note: With the engine turned off, make a visual and physical check of the throttle to see that it does fully open and close.

With your throttle closed, press "Read Closed Throttle" button on the setup screen.

Fully Open Throttle

(Use only if a throttle position sensor is fitted)

NOTE: With the ENGINE TURNED OFF make a visual and physical check of the throttle to see that it does fully open and close.

Open your throttle fully, then press "Read Open Throttle" button on the setup screen.

This function can only be used if a throttle position sensor has been fitted and the Use Throttle sensor check box is ticked.

If the engine has not had the throttle position sensor connected ,
the Use Throttle sensor check box must be unchecked.
The reason for this set-up is so the computer will still calculate acceleration enrichment using the map sensor.

If the throttle is mechanically adjusted, the throttle calibration must be re-entered.

PWM Base Frequency

The Base Frequency is used in mode 9 to 12 of the Auxiliary outputs.
This is an overall frequency setting used by all 4 outputs when a pwm function is selected on that output.
The frequency range is adjustable between 1hz and 3923hz.

Most valves or idle control valves normally function between 20 HZ to 100 HZ.

Digital Input

General

There are 4 user selectable modes. Depending which mode is selected, different grey fields will become active for values to be changed.

See Auxiliary input connections

Disable Anti lag

This mode will disable (turn off) the anti lag if active.
Most common use is to connect to a switch that is actuated by the Clutch pedal or thumb operated switch. When pedal is release, the switch will be actuated thus disabling the anti lag.

Two Step RPM limiter

This mode will enable the "Rpm Limit" field. In one switch position, the Ecu will engage the Soft RPM limit to the value selected in the field.
In the other switch position, the Ecu reverts back to the normal RPM limits set in the main setup page.

This mode gives the user an extra stall Rpm limit.

Idle Up Percentage

This mode is used in conjunction with one of the Auxiliary Outputs set to Idle control mode.

The In Gear Idle up % field will become active.

The Input can be connected to auto transmission or air / con compressor clutch so that if a gear is selected or the air air / con cuts in, the extra idle up % value will open the idle valve to help stop engine stalling with the additional load shock.

Nos Function

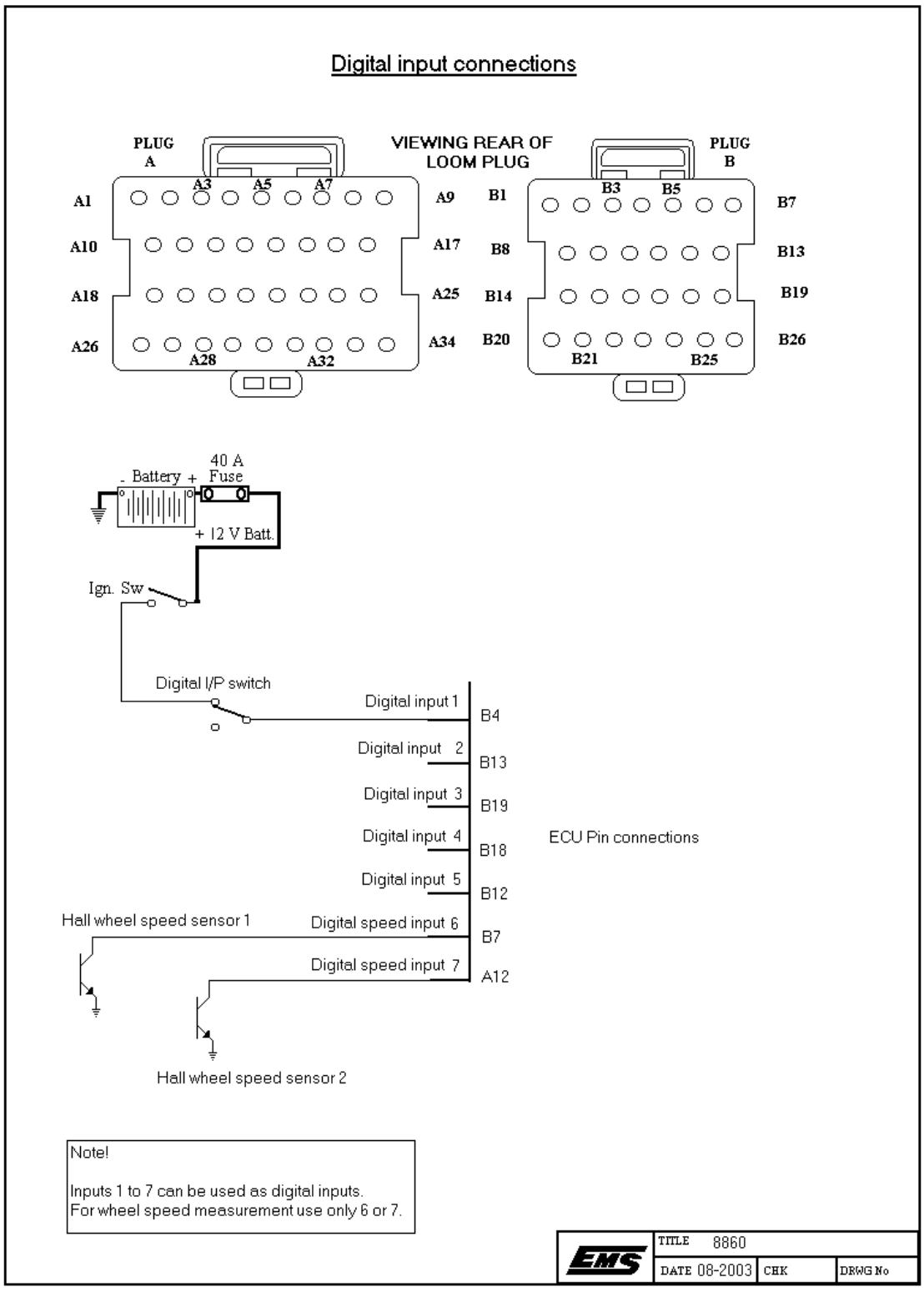
This mode is used when Nitros oxide injection is activated.
The auxiliary input would be connected to the Nos solenoid.

When activated, The user can select the amount of Ignition retard in degrees and fuel enrichment in mS to be performed.

These two fields will become active when this mode is selected.

Note:
It is recommended that the fuel portion required with the gas be injected by a separate fuel solenoid and only use the Nos Fuel Increase to trim if a little extra fuel is needed.
If you use the Nos Fuel Increase to inject all the fuel required to mix with the Nos, ensure that the fuel injectors are large enough!

Auxiliary Input Connections



Turbo Anti Lag

Note!
Anti lag can be disabled via Digital input.

See Digital Input

Rally Mode

Rally mode selects boost enhancement for rally cars on throttle back off. When the throttle position signal is BELOW the pre-set TPS level AND when the engines RPM is above the pre-set RPM level, the boost enhancement feature is enabled. When the boost enhancement is enabled the ECU misfires the Ignition (see Ign. Fire), retards the timing (see Ign Trim) and adds fuel (see fuel trim). This feature would be used in conjunction with an auxiliary o/p to energize a blow off solenoid valve to either bypass the throttle body or to blow air directly into the exhaust manifold near the exhaust ports.

RPM >
This sets the minimum RPM that the ECU will enable the boost enhancement.

T/P <
When the throttle position signal is BELOW this setting, the boost enhancement will be enabled.

NOTE: Both T/P AND RPM conditions must be true to enable the boost enhancement.

KPA
This setting has no effect in S/Mode 01 (see mode 02).

IGN FIRE
(Ignition Misfiring)

SETTING 00
This selects Ignition misfire sequence
Fire Fire Miss Fire Fire Miss Fire Fire.

SETTING 01
Selects Ignition misfire sequence
Fire Miss Fire Miss Fire Miss Fire Miss.

SETTING 02
Selects Ignition misfire sequence
Miss Miss Fire Miss Miss Fire Miss Miss.

NOTE: In Twin turbo installations, the engines firing order must be studied before deciding on the setting of Ign. Fire.

FUEL TRIM
This setting will select + - 127% fuel while boost enhancement is enabled. This setting in conjunction with (fuel) closed - throttle maps will result in the amount of fuel injected. Normally set to + % to add fuel.

IGN TRIM
This setting will select + - 127% spark timing, while boost enhancement is enabled.

Normally set - % to retard the timing.

Drag Mode

Drag mode selects boost enhancement for drag cars when throttle is opened. When the throttle signal level is ABOVE the pre-set TPS setting AND the engines RPM is ABOVE the pre-set RPM setting AND the boost pressure is below the
Kpa setting the boost enhancement is enabled.

RPM >
This sets the minimum RPM that the ECU will enable the boost enhancement.

T/P>
When the TPS signal is ABOVE this setting the boost enhancement is enabled.

KPA
When the boost pressure is BELOW this setting the boost enhancement is enabled.

IGN. FIRE
(Ignition Misfiring)

SETTING 00
This selects Ignition misfire sequence
Fire Fire Miss Fire Fire Miss Fire Fire.

SETTING 01
Selects Ignition misfire sequence
Fire Miss Fire Miss Fire Miss Fire Miss.

SETTING 02
Selects Ignition misfire sequence
Miss Miss Fire Miss Miss Fire Miss Miss.

NOTE: In Twin turbo installations, the engines firing order must be studied before deciding on the setting of Ign. Fire.

FUEL TRIM
This will change fuel injected by the selected percentage of what would normally be injected. Normally set to + percentage to add fuel.

Auxiliary Outputs

There are 4 auxiliary outputs which are user selectable, for 12 different modes, and another 4 which have 7 different modes.
These modes fall into 2 categories.

Digital Modes that can be ON or OFF depending on the conditions. Typical use of a digital o/p thermo fan shift light etc. (All 8 outputs)

The pulse width modulated modes (pwm) give a signal that varies depending on the duty cycle, this will give a varying average current to the device being controlled. Typical use of the pwm idle control , boost etc. (Outputs 1 - 4)

See Auxiliary outputs connections

Auxiliary Output Modes

Each o/p can be selected to perform any of the following fully adjustable modes.

Mode No.	Description
0	Off
1	Digital RPM
2	Digital KPA
3	Digital throttle position
4	Digital Engine temp.
5	Digital RPM and KPA
6	Digital RPM and throttle position
7	Fuel Pump o/p
8	Tacho o/p
9	PWM RPM
10	PWM KPA
11	PWM Throttle position
12	PWM, Idle control (for ECU Feature Version 1) OR Stepper motor idle control (for ECU Feature Version 2 or greater)

See Also:-

PWM Modes 9 to 12
Idle Motor Control

Relay Control Modes 1 - 4 (Digital)

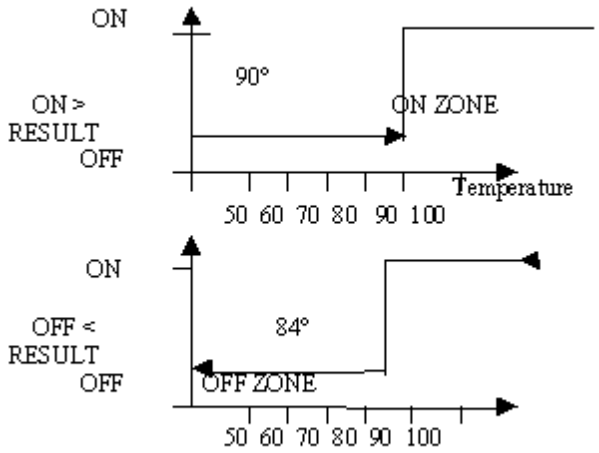
All digital modes follow a set comparison format.

1) ON > (> Greater than)
2) ON < (< Less than)
3) OFF > (> Greater than)
4) OFF < (< Less than)

Using thermo fan control as an example, o/p mode 4 (Digital Engine Temp.) would need to be selected e.g.
If fans are to turn ON when engine temperature is (>Greater than) 90°C and turn OFF when engine temperature is (< Less than) 84°C, the auxiliary o/p would be set up as follows:

AUX O/P No. (Number 1-4)
O/P Mode = 4 (Engine Temperature)
Rev Act = ON or OFF (explained later)
ON > 90
ON < Not used
OFF > Not used
OFF < 84

When not used is selected the comparison program ignores that particular setting.
In the Engine Temp. (Thermo fan control) e.g. both ON< and OFF> are ignored as not used is selected. These will have no effect on the control of that particular o/p.
As temperature rises the o/p remains off until the user programmed 90°C ON> is reached. The o/p will Turn on and remain on until the OFF< condition is reached.



As the fans cool the engine and the engine temperature drops, the fans will remain on until the Programmed OFF< 84°C is reached where the o/p will turn off.

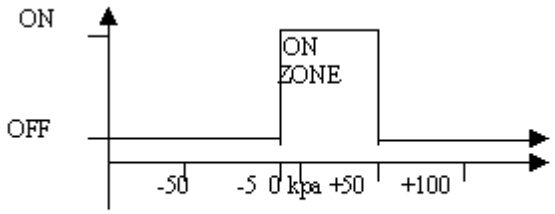
Example no. 2 Shift Light
O/p mode 1 (Digital rpm) would need to be selected, e.g. if shift light is to turn ON when rpm is > Greater than 6750 rpm and turn OFF when rpm is < Less than 6700 rpm.

AUX O/P No. (Number 1-4)
O/P Mode = 1 (RPM)
Rev Act = ON or OFF (explained later)
ON > 6750
ON < Not used
OFF > Not used
OFF < 6700

Example no. 3 turn o/p on within a specified zone. This might be used to control numbers, to help a Turbo engine get on boost.
For this we would use the digital KPA function mode 2 e.g. turn ON when KPA is > Greater than - 5 KPA and stay on until KPA reaches + 50 KPA boost then turn OFF> than + 50 KPA boost and turn off < - 5 KPA vacuum.

AUX O/P No. (Number 1-4)

O/P Mode = 2 (KPA)
Rev Act = ON or OFF (explained later)
ON > - 5 KPA
ON < + 50 KPA
OFF > + 50 KPA
OFF < - 5 KPA



Relay Control Modes 5 - 6 (Digital)

These modes are an extension of the already mentioned but require 2 criteria to be true for the o/p to turn on, e.g. function 5 needs rpm comparison to result with an ON AND the KPA part to result with an on for the o/p to actually turn on.

If either the rpm comparison or the KPA comparison results in an off result the o/p will remain OFF.

Example turn on NOS at a certain rpm and KPA.
If rpm is > 2850 turn ON and < 2800 turn OFF AND! when KPA
is > -10 KPA turn ON and KPA Is < - 5 KPA turn OFF.
Set-up of this would be as follows

AUX O/P No. (Number 1-4)
O/P Mode = 5 (RPM & KPA)
Rev Act = ON or OFF

ON > 2850	AND	ON > - 10)
ON < Not used) RPM		ON< Not used) KPA
OFF > Not used) SECTION		OFF> Not used) SECTION
OFF < 2800		OFF< - 5)

For the o/p to turn on both RPM must be greater than 2850 "AND" KPA must be greater than - 10 KPA.

Reverse Acting

This stands for reverse acting in some circumstances the relay that is connected to the output actually works BACKWARDS!! (normally closed contacts)

This would normally make things very confusing as when things should be on they are actually off and when things should be off they are actually on i.e. everything is working backwards.

The selectable rev act feature to combat this problem. When Rev Act is OFF the o/p will turn on when it should be on and off when it should be off (normal Logic).
When Rev Act is ON the o/p will turn off when it should be on and on when it should be off (reverse Logic). Rev Act would normally be OFF only turn it ON if you are using a backwards relay. (with normally closed contacts)

Fuel Pump Output Mode 7

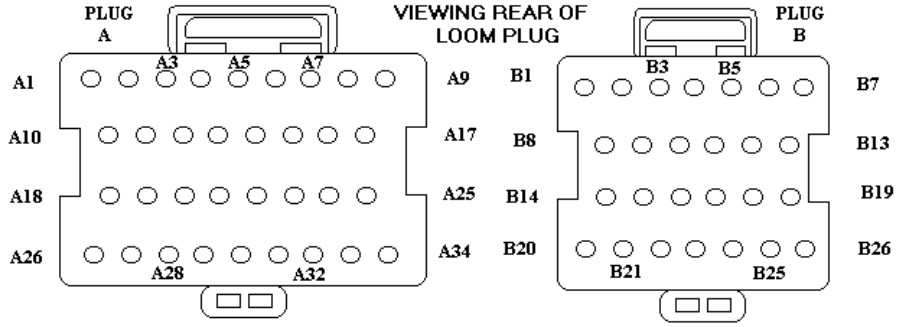
The Fuel pump output is designed to drive a fuel pump relay.
When the ignition is on, the output will energize for approx. 4 seconds and then turn off again.
Once the Ecu sees pulses on the trigger wire it will turn the pump output on again.
If the engine stalls or stops, the Ecu will commence timing the 4 seconds from when it no longer receives trigger pulses. After the 4 seconds has elapsed, the Ecu will turn off the pump output .

Tacho Output Mode 8

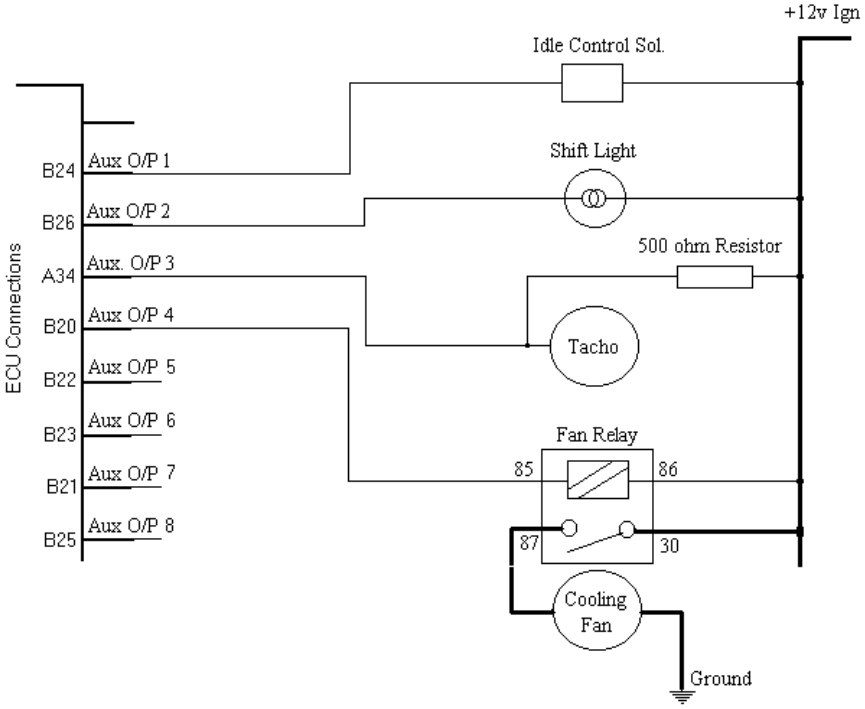
The Tacho output is used when a Tacho signal is required to be manufactured by the Ecu e.g.
When using sequential coils. Connecting to only 1 coil will give a much slower tacho rpm reading. By using the tacho output mode in these situations the Ecu will reproduce a square wave signal with the correct number of pulses in proportion to the engines speed and number of Cylinders / Rotors.

Auxiliary Outputs Connections

Auxillary Output Connections



Examples of Auxillary Output Connections



EMS	TITLE 8860 Auxillary outputs		
	DATE 08-2003	CHK	DRWG No

PWM Modes 9 to 12

The auxiliary o/p can be selected for 4 different pulse width modulated (PWM) modes.

Mode 9 PWM verses RPM
10 PWM verses KPA
11 PWM verses Throttle position
12 PWM verses idle control

The Ecu PWM signals are fully adjustable for frequency and for duty cycle.

See PWM Base Frequency

Frequency

Frequency is normally expressed in hertz (HZ)
1 HZ = 1 cycle per second
40 HZ = 40 cycles per second

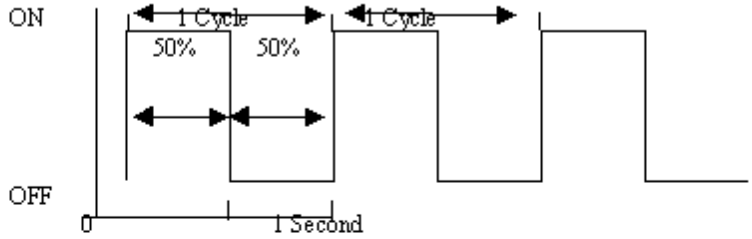


Fig A.
1 Cycle is from when a signal starts to when a signal begins to repeat itself.
In fig A. 1 cycle takes 1 second to complete so the frequency is 1 HZ.

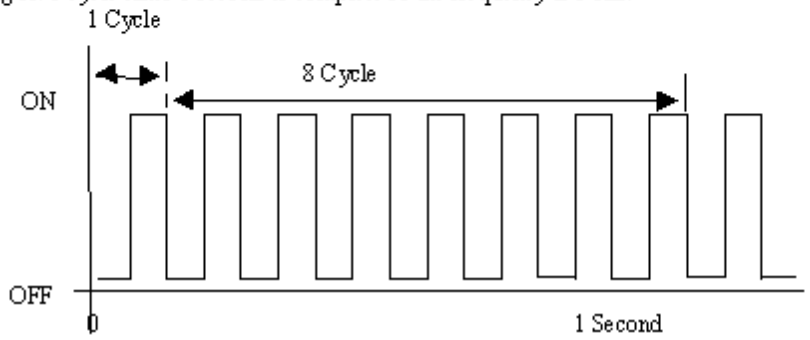


Fig. B

In Fig. B there are 8 cycles in 1 second so the frequency is 8 HZ. There are 2 frequency adjustments within the Ecu. The first adjustment is the Base Frequency.
This is an overall adjustment and is applied to ALL of the 4 Aux o/p's using any PWM function. (Base Frequency).

Most valves or idle control valves normally function between 15 HZ to 100 HZ.

The second adjusting frequency is an individual adjustment. There is a separate adjustment for each Aux. O/p. These are found in each Aux. O/p section but only appears if a PWM function 9 to12 is selected.
It is strongly recommended to try and leave this number at 255. Reducing this number will

increase the frequency for that particular Aux. O/p but there is a trade off.
The normal resolution of the Aux. O/p duty cycle (explained next) is 0 - 255 when this frequency number is set at 255. This is 0.39% increments.

If this frequency number is reduced to 100 for example, the frequency o/p would increase, but the resolution for that Aux. O/p will be reduced to only 0 to 100. This will make any adjustment coarser to 1% increments.

By adjusting this Freq. Number the frequency =
(255 / Freq Num.) X Base Freq. = Aux. O/p Freq.

E.g. If base freq. was 20 HZ, from the previous overall formula, and 200 was selected in this individual Aux. O/p
Freq. adjustment. The Resultant frequency in HZ for this Aux. O/p channel would be as follows:

(255 / 200) X 20 HZ = 25.5 HZ

Duty Cycle

PWM O/P's control devices (valves etc) by giving them an average current (amps).

Even though the PWM O/P is pulsating, the valve only sees the average resultant current.

By increasing the duty cycle, the average current will increase which will increase the opening of the valve.

A duty cycle of 20 will give the valve or motor less current then if a value of 220 were used which would give the valve nearly full current opening it almost fully.

PWM Verses RPM Mode *9*

In mode 9 you can adjust the duty cycle from 0 to the maximum set by the individual frequency number, (see Frequency) normally 255.

This duty cycle is adjustable at RPM sites from 0 RPM to 12500 RPM in 500 RPM increments.

The ECU will interpolate between these points e.g. If a duty number of 128 is entered at 3500 RPM and 135 at 4000 RPM and the actual RPM was 3850 the ECU will calculate 132.9 as the duty number. This mode's typical use would be Boost control or induction length control. Example if using this mode for boost control you can adjust your boost level every 500 RPM.

PWM Verses Kpa Mode 10

In this mode you can adjust the duty cycle every 10 KPA from -100 KPA to + 150 KPA in the normal boost level version Ecu.
Every 20 Kpa fro -100 to + 400 Kpa in the high boost version Ecu.

This mode can be explained as a changing duty cycle as engine load changes. The 8860 ECU will interpolate in between load points to give smooth transitions.

An example would be to control a water injection D.C. motor, increasing duty as the engine load increases would speed up the D.C. motor and reducing the duty would slow down the water injection D.C. motor. This would change the amount of water being injected depending on the load of the engine.

PWM Verses Throttle Position Mode 11

In this mode you can adjust the duty cycle every 5% TPS from 0% TO 100%

This mode can be explained as a changing duty cycle as engine load changes. The 8860 ECU will interpolate in between load points to give smooth transitions.

An example would be to control a water injection D.C. motor, increasing duty as the engine load increases would speed up the D.C. motor and reducing the duty would slow down the water injection D.C. motor. This would change the amount of water being injected depending on the load of the engine.

PWM Idle Control Mode 12

This function has three modes, OFF , MANUAL and AUTO.
Auto is not supported in this version.

In manual mode the ECU will perform feed forward idle speed control.

Base Duty

This is the base duty cycle which would feed the idle valve. The larger the base duty No. the faster the idle speed. Before adjusting the idle speed, the engine must be at operating temperature with the fuel and ignition maps already set.

1) With the idle control in the off position adjust the mechanical idle mechanism so that the engine idles 200 to 300 RPM below the desired idle speed.
2) Select "MANUAL" mode.
3) Adjust the base steps so that the engine idles at desired idle speed e.g. 900 RPM.

The engine should happily idle around this idle speed. If this is not the case, you will need to adjust the % of Duty RPM idle maps when the engine is hot.
On the next cold start up adjust the engine temperature idle speed maps.

Percentage of Duty RPM IDLE MAPS

RPM idle maps go from 500 RPM to 1500 RPM in 50 RPM increments.
At each of these RPM sites you can adjust + and - 100%.

These are expressed as % of duty. Example if duty were set at 160, and the 650 RPM site was set to 15, this would effectively increase the duty by 15 % at that Rpm Site.
-15% value would close the valve by 15% at that rpm site.

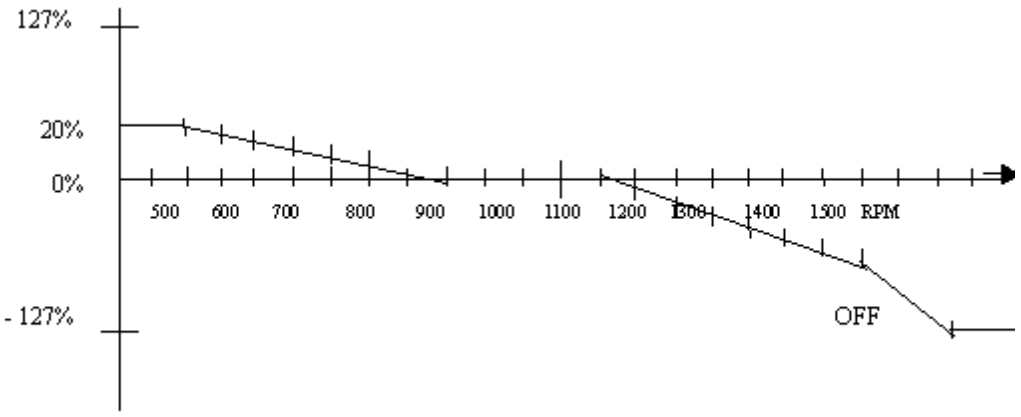


Fig. E shows you a typical configuration for the % of duty RPM sites.

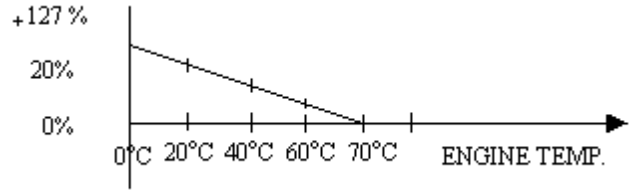
Example if idle was set to 900 RPM via the duty, the RPM sites would continually increase valve opening as the RPM drops below 850 RPM and close the valve as the rpm increases above 1050 RPM.

Speeds above 1500 RPM would use the 1500 RPM value and speeds below 500 RPM would use the 500 RPM value.

THE % AT XX °C SITES

These idle sites are similar to the RPM idle sites. These idle sites add or subtract a % of duty every 20 °C from 0°C to 70°C.
Below 0°C the ECU will use the 0°C % value.
The 70°C is factory set to 0% and is not adjustable.

The ECU will interpolate between temperature sites. These sites are used to increase the idle air while the engine is on choke and needs extra air to help the engine idle at desired speed.
This function should be adjusted ONLY after the duty and the % of duty sites have been tuned hot.
Tune these when the engine is on the warm up cycle, maybe the next day.



REVERSE ACTING FOR PWM

The Reverse Acting function while a PWM function is set will reverse the duty cycle output of the Ecu.

This function is needed when a valve (e.g. idle valve) work backwards, eg. Bosch BMW idle valve.

With these type of valves, increasing the duty cycle will actually slow down the engine and reducing the duty cycle will increase the idle speed.
If you are faced with a valve that works backwards, you should select REV ACT on.
If you have a valve that works normally select REV ACT off.

Idle Motor Control

Although idle control sounds simple do achieve. The parameters and mathematics involved are quite complex.

EMS have tried to make it as simple as possible to setup by allowing only a minimum number parameters and a simple setup procedure.

Step 1: Ensure the engine is well tuned

Ensure that the engine is properly tuned especially in the idle area. The automatic idle control will continually try to adjust a badly tuned engine around the idle RPM

Step 2: Select an output circuit to use

Now we will need to use the laptop software for these adjustments.

NOTE: Only one of the output circuits can be used as a stepper motor controller.

Set control mode to either Stepper motor or PWM control

Set Idle control to off (this ensures that the valve or motor will be closed)

Type in the target idle RPM

Set stepper motor speed to medium

Set Initial open position to around 20

Set Max Steps to 255

Set idle vacuum to whatever the engine is currently idling on while at operating temp

Set Additional Cold Open Position to around 60

These number are only starting points and will be adjusted to suit the engine.

Step 3: Set the mechanical idle speed adjustment

Set the mechanical idle screw until the engine idles 100 RPM lower than the Target RPM. This is a backup to prevent the engine from stalling if the idle control motor or valve fails.

Step 4: final adjustment

Set Idle Control to Manual

Adjust the Initial Open Position (higher or lower) until the engine idles at the Target RPM.

Set the Idle control to Automatic.

Step 5: Cold engine adjustment

Do this the next morning when the engine is fully cold.

Before starting engine set Idle control to Manual.

Start engine and adjust the Additional Cold Open Position only (higher or lower) until the engine idles at the Target RPM.

Set the Idle control to Automatic.

Fuel and Ignition Maps

Depending on the Ecu setup, There are different tuning techniques that can be adopted.

See Normal and Boost vacuum Load Point
See Throttle Position Load Point
See Analog input Load Point

8860 High Boost

This section is for adjusting fuel / ignition maps at user defined R.P.M increments.
Starting at 0 through to 32000 R.P.M.
There are 96 user definable R.P.M columns.

There are 32 user definable vacuum / boost load rows.
Range is from -100kpa to + 412kpa boost
-45psi to + 60psi boost

The Ecu comes pre-programmed Fuel Map settings for each 500 R.P.M increment. These are preset to give a starting point.

If this is the first time you have set up a particular engine you should use the "Fuel Trim" function in the "Trims" section of the "ECU Setting" screen to help get the engine started.

See Grid Commands

Using "FUEL TRIM" for First time engine set-up starting

It is much easier to get the engine running for the first time using the fuel Trim adjustment.

This adjustment is found in the "Trims" section of the "ECU Setting" screen.

Adjusting Fuel / Ignition Maps

Bring the engine up to the desired R.P.M / load and press the "Space bar", this will position the cursor onto the R.P.M load point that matches the actual engine R.P.M / Load. Adjust the fuel / ignition setting by the pressing the "Pg up" or "Pg dn" keys to increase or decrease the injector mS or Ignition timing to the desired value.

IMPORTANT
a) The engine should be up to operating temperature before tuning. If you tune below 70C° then the appropriate choke settings must be at zero (0).

b) The engine must be held as close as possible to kpa / Rpm Fuel Map positions when tuning.

Clear Flood Mode

Clear flood mode is used when engine is flooded. Throttle position sensor must be fitted. Press throttle passed 90% while cranking, the Ecu will not fire injectors.

Tuning grid command keys

These commands are also available on a pop-up menu when you right-click on the tuning grid.

Page-Up and Page-Down Keys

Press the page-up key to increase the value of a cell by 1 and Page-down to decrease the value by 1.

You can also select a range of cells and increase or decease them by pressing the Page-up and Page-down keys.
Use Shift and any combination of arrow buttons to highlight / Select a range of grid cells that you want to adjust and then press the Page-up or Page-down key to increase or decrease each cell by 1.

Auto Trace (Space Bar)

You can automatically position the cursor onto the load/rpm point of an engine while the is running by pressing the space bar.

If you keep the space bar pressed then the system will trace the engine as it moves through each load point. Each load point will be highlighted with a green boarder indicating the load path of the engine.

You can clear the path by pressing the "Clear Trace" button or "alt + c"

NOTE: When barometric compensation is active the load point that the ECU is using may not match with the Manifold Pressure being display on the live gauges.
This is because the ECU now determines the load point based on volumetric efficiently.

Insert RPM Column (Ctrl +Right Arrow or Shft+Alt+C)

Press Ctrl then Right Arrow to Insert a new RPM column in between the current cursor position and the column to the left.
This will push all RPM columns from the cursor (including the cursor) to the right and then insert a new one.

Insert Load Row (Ctrl + Down Arrow or Shft+Alt+R)

Press Ctrl then Down Arrow to Insert a new load row (TPS/KPA/Analog) in between the current cursor position and the row above.
This will push all load rows from the cursor (including the cursor) down and then insert a new one.

Delete RPM Column (Ctrl + Left Arrow or Shft+Ctrl+C)

Press Ctrl then Left Arrow to Delete the RPM column immediately left of the cursor.
This will pull all columns from the cursor (including the cursor) to the left one column.

Delete Row (Ctrl + Up Arrow or Shft+Ctrl+R)

Press Ctrl then Up Arrow to Delete the load row (TPS/KPA) immediately above the cursor.
This will pull all rows from the cursor (including the cursor) up one row.

Copy grid cell Value (Alt + Arrow)

Starting from the cell that you want to copy from.
Use Alt and the arrow button in the direction that you wish to copy to.
This will copy current cell to the next adjacent cell in the direction of the Arrow.

To copy to many other cells, the arrow must be released then repressed for each successful copy.

Interpolate or Fill (Shift + Left or Right or Up or Down Arrows)

Use Shift and any combination of arrow buttons to highlight / Select a range of grid cells that you want to automatically fill or interpolate.
Once selected, use Alt+Ctrl+R if you want to interpolate/fill using the top and bottom rows as the reference points. This means that the system will automatically calculate all the cell values for each cell in between the top and bottom selected rows.

OR

Use Alt+Ctrl+C if you want to interpolate/fill using the left and right columns as the reference points. This means that the system will automatically calculate all the cell values for each cell in between the left and right selected rows.

Create new Tuning grid (Alt+Ctrl + T)

Create or change a tuning grid.
This will allow you to change the number of columns or rows in a tuning grid.
This is normally used on first time setup.

Changing Existing RPM or Load index values (Alt+Ctrl + H)

Change the load and RPM value for the selected column/row.
Use this to adjust the RPM and load for the selected grid cell.
Instead of Ctrl + H, you can double click the grid in the correct row/column.

Alt+Ctrl + R

See interpolate and fill above.
Automatically fill all selected cells from left to right with values based on the value in the first (left) and last (right) selected cells.

Alt+Ctrl + C

See interpolate and fill above.
Automatically fill all selected cells from top to bottom with values based on the value in the first (top) and last (bottom) selected cells.

Changing the page-up & page-down resolution

This is only used on the ignition grid.

You can select the amount of degrees the system increments or decrements each time you press the page-up/down key.
Selecting 0.2 on the resolution selection box will cause each page-up/down key press to change the timing value by 0.2 degrees. If 2.0 degrees is selected then each press will cause a change of 2 degrees.

Throttle Position Load Points

This section is for adjusting fuel / ignition maps at user defined R.P.M increments.
Starting at 0 through to 32000 R.P.M.
There are 96 user definable R.P.M columns.

See Grid Commands

Throttle Position Sensor

Starting at 0 through to 100%.
There are 32 user definable TPS load rows.

See Grid Commands

It is extremely important that a good quality TPS Sensor be
used when tuning using TPS load sensing.

Make sure that the tps is a Variable resistance (potentiometer) type.
Ensure that the sensor reading is repeatable after calibrating it.

First, calibrate the sensor in the Ecu Setup Screen.

See Throttle sensor calibration

Check that the reading follows your foot movement and reaches 100%,
then returns back to 0 %. Do this a number of times ensuring that the reading returns to 0% every time.

This Load source selection heavily relies on the TPS sensor, so ensure its proper operation before commencing tuning.

Analog Input Load Points

This section is for adjusting fuel / ignition maps at user defined R.P.M increments.
Starting at 0 through to 32000 R.P.M.
There are 96 user definable R.P.M columns.

See Grid Commands

Analog voltage sensing

Starting at 0 through to 1024.
There are 32 user definable Analog load rows.

See Grid Commands

Analog readings range from 0 to 1024.
This represents 0 to 5 volts.
Set up as many Load points (rows) as needed to achieve
no compromised results.

Barometric Compensation

NOTE: When barometric compensation is active the load point that the ECU is using may not match with the Manifold Pressure being display on the live gauges.
This is because the ECU now determines the load point based on volumetric efficiently. This will become noticeable when using the Tune Analyzer and Auto Trace at high altitudes.

Although all EMS ECUs compensate for barometric changes without needing to use barometric compensation sensors, there are some applications which require fine tuning where engines are subject to large altitude changes.

NOTE: Because the ECU automatically compensates for barometric changes you may find that changes in fuel mixture at high altitudes are caused by decreasing air temperature. In this case you could install an air temperature sensor to measure the temperature at the air filter and use the air temperature compensation table for fuel adjustments. Be sure to try and minimize the effect of heat soak on the sensor.

See Temperature Compensation

By using a barometer sensor as the second load source the 8860 can be programmed to sense barometric changes. It uses the G.M 1 bar map sensor, this is a 0 - 5 volt 1 bar sensor.
G.M Part Number: 12569240
ACDelco Part Number: 213-1545

Connect the sensor to analog input 9 and then set Load Source 2 to analog input 9 (ECU setup Page).

Depending on the load source 1 setting, the ECU will perform different background calculations.

If load source 1 is set to TPS or any other analog input from 1 - 8 then the ECU will use this as the primary load source to determine fuel and ignition load points and also use the Barometric Compensation table to adjust for barometric changes.

If load source 1 is set to Manifold Pressure (using the in-built MAP sensor), then the ECU uses Analog Input 9 to read the barometer sensor and perform extra calculations to determine the volumetric efficiency load point for fuel and ignition and also compensate for barometric changes.

Using load source 2 as a barometric input

If you have the ECU in-build map sensor connected to the manifold either as a primary load source or as a MAP override (using TPS + MAP) then use the barometric compensation table values below as a starting point. This table determines the amount of fuel to add or subtract as a percentage of the base value in the fuel table.

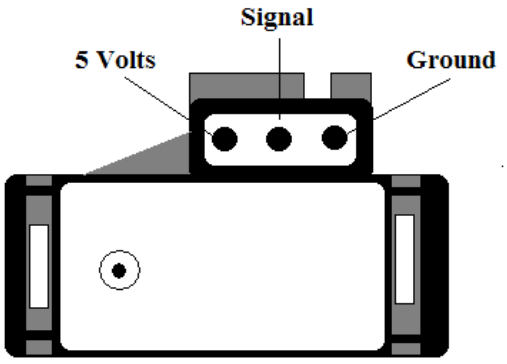
700 hpa	700 hpa	700 hpa	700 hpa	700 hpa	700 hpa	700 hpa	700 hpa
0	0	0	0	0	0	0	0

YES, These are all zeros. This is because the ECU will automatically compensate for barometric changes.
This table should be used if you find that the automatic compensation is not quite what you need.

If load source 1 is NOT set to Manifold Pressure and the ECU in-built map sensor is NOT

connected to the manifold then you DO NOT need to use the barometric compensation tables or sensor. You simply use the Fuel Override Table with the values below as a starting point. This table determines the amount of fuel to add or subtract as a percentage of the base value in the fuel table.
The ECU will actually use the in-built map sensor to sense for barometric changes.

-40 kpa	-40 kpa	-40 kpa	-40 kpa	-40 kpa	-40 kpa
-40	-40	-40	-40	-40	-40



G.M 1 Bar MAP sensor

Connections for 8860 loom

5 Volts connect to orange

Signal connect to Blue/White

Ground connect to any Black

Temperature Compensation

As the temperature of air changes, so does its density. This in turn can cause changes in the air/fuel ratio. As the air temperature decreases, its density increases for any given altitude and therefore more fuel is needed to retain the desired air/fuel ratio.

The same can apply to ignition timing. An increase in air temperature will increase the chance of pinging.

You can compensate for these effects by using the air and water temperature compensation tables for fuel and ignition.

By installing a calibrated air temperature sensor to the air filter box you can measure the incoming air temperature and use the air temperature compensation tables to adjust the fuel delivery and ignition timing.

NOTE: You must ensure to minimize the effect of heat soak on the sensor. You can do this by not installing the sensor in a location that is heavily effect buy engine temperature and thermo fan blow off.

We have done some testing and found that the air temperature compensation table listed below would be a good stating point. We can not recommend a starting point for ignition compensation because this would be different for each engine.

-20C	-10C	0C	10C	20C	30C	40C	50C	60C
12	9	5	2	0	-2	-5	-7	-9

70C	80C	90C	100C	110C	120C	130C	140C	150C
-11	-13	-13	-13	-13	-13	-13	-13	-13

Both air and water compensation tables adjust the fuel delivery and ignition timing by the percentage entered for a particular temperature. A positive number will increase the fuel or timing by the specified percentage and a negative number will decrease the fuel or timing by the specified percentage.

CAUTION: If you will be using air temperature compensation then **DO NOT** start tuning while this table has zero values and then enter the values after.
You must calibrate the sensor and enter these values before you tune the engine. After tuning is finished you may find that you need to adjust the air temperature compensation tables for fuel and timing slightly because of changes in air temperature due to climate or altitude changes.

Tune Analyser

NOTE: When barometric compensation is active the load point that the ECU is using may not match with the Manifold Pressure being display on the live gauges.
This is because the ECU now determines the load point based on volumetric efficiently.

Tune Analyser is a feature designed by EMS to assist in tuning an engine to its peak performance by allowing you to log the average A/F ratio at each load point. You can then analyse the data and make adjustments to the fuel map or have the system automatically adjust the fuel map by comparing the target AF Ratios with the actual AF ratios and adjusting the fuel map accordingly.

Running the Analyser

You can have the system automatically adjust the fuel map if you want. First you must set the target AF ratio for each load point

Press the Run Analyser button while the engine is running. The system will now constantly monitor the AF ratio at each load point. The accuracy of the analysis will increase as you run the engine for longer periods.

Press the Run Analyser button again to stop monitoring.

You can see how many times each load point was recorded by placing the blue grid cursor on a grid cell and looking at the read count field just above the buttons.

The load points that have been analyses will show highlighted on the Fuel Map grid

Applying changes Automatically

You can have the system automatically adjust the fuel map if you want. First you must set the target AF ratio for each load point

Press the Target AF Ratio tab and enter the target AF ratio for each load point you want adjusted. You can also move the actual AF Readings over to the Target map by pressing the Actual to Target button and then adjust each load point to the desired value. Any load point with a 0 (zero) target value will not be adjusted.

Press the Apply Changes button. The system will compare the actual AF ratios with the target ones and adjust the fuel map accordingly.

NOTE:
You can exclude cells from the being applied by selecting the cell and pressing ALT+X or the "Exclude from apply" button.
This can be done from the either the Fuel Map or Tune Analyser tabs.

Applying changes Manually

You can apply changes directly on the Fuel map.

After you have Analised and set the AF targets each load point on the Fuel map will be highlighted with either blue or red. A blue highlight indicates that the Actual AF is within + or - .1 AF of the set Target. You can move to each red load point on the Fuel map and adjust the value up or down until the "Change required" field reads 0 (zero).

Log Controls

New Data Log

Before you can commence logging, the ecu must be connected to the Laptop and communication link established.

Start Logging - F2

To start the logging either click the **Start Logging** button or press the F2 button on the keyboard.

To Stop logging press this button again.

Saving a Data Log session to file

Once you stop logging and wish to save the logging session, it can be saved to file.
Press the "Save to File" button and either click on an existing file to overwrite that file or type in a new file name in to create a new file, then press "Save" button.

Reading a save Data log session

To open a saved log session log session press the "Read from file" button, select the file you want to read and then press the "Open" button

See Viewing Logged Data

Log Graph

This button will display the logged Data in Graphical format.
The graph will display 4 Axis of user selected data.
see:

See Chart Display

Viewing Logged Data

Once logging is stopped, the P.C. will take a few minutes to organize the data.
The Data will then be displayed on the main page in alpha-numerical format.

This data can be scrolled through with the arrow buttons and analyzed.

Starting at the top, The logger records the selected parameters line by line.

Each line represents a group reading.
The first parameter shows the Reading number.
The Second shows the Time stamp, followed by the selected parameters sent by the Ecu.

Chart Display

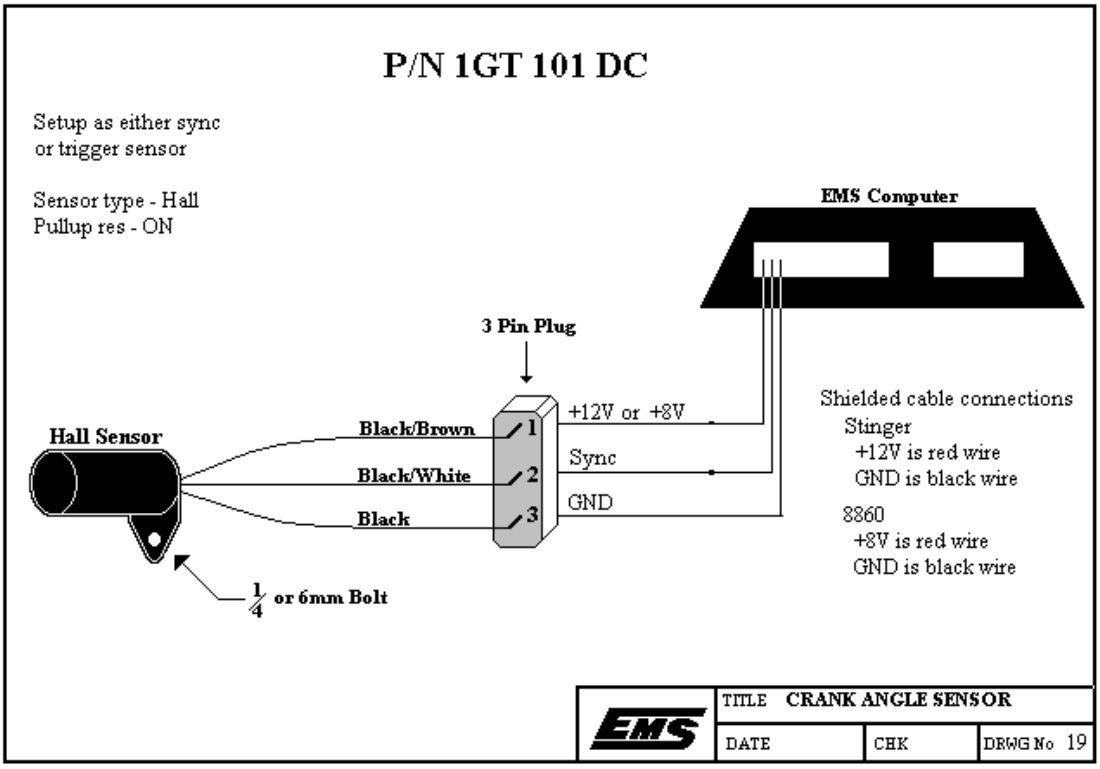
There are 4 Axis on the Graph Display Page.

In this Area you can select any of the Logged parameters to be displayed on the graph. Each Axis is fully selectable.

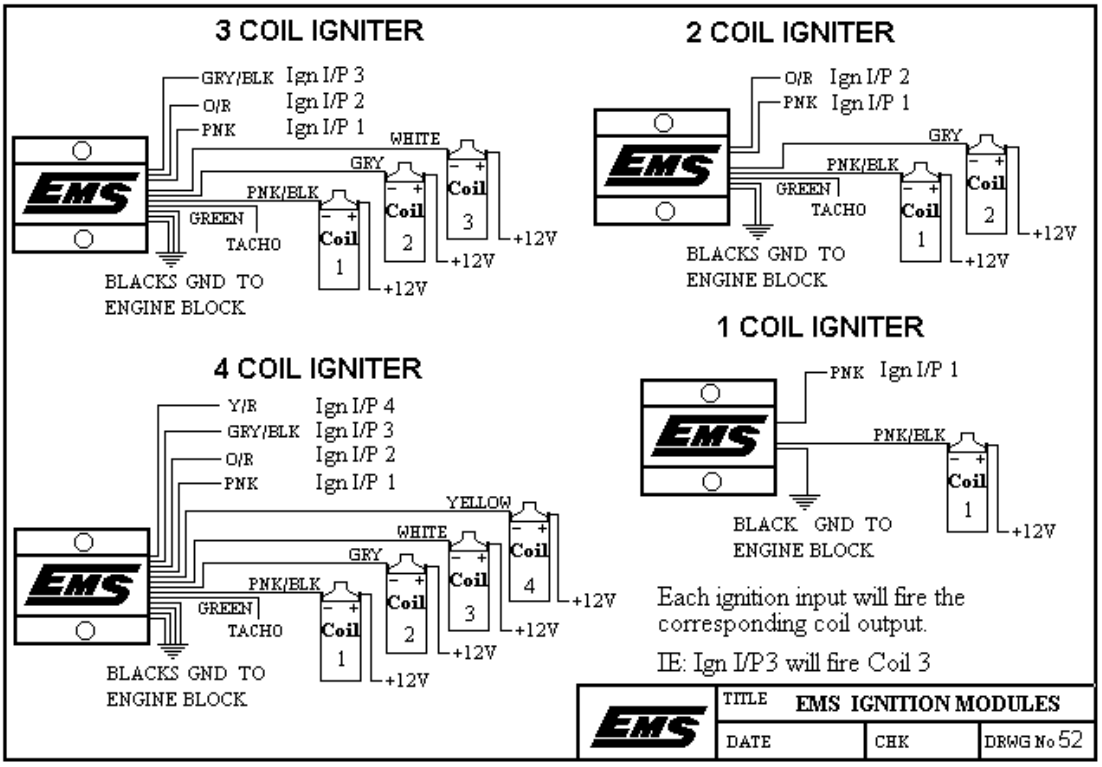
You can display any logged data on any axis.

NOTE: If the parameter was not selected for logging in the Log Data section, It will not be available for viewing.

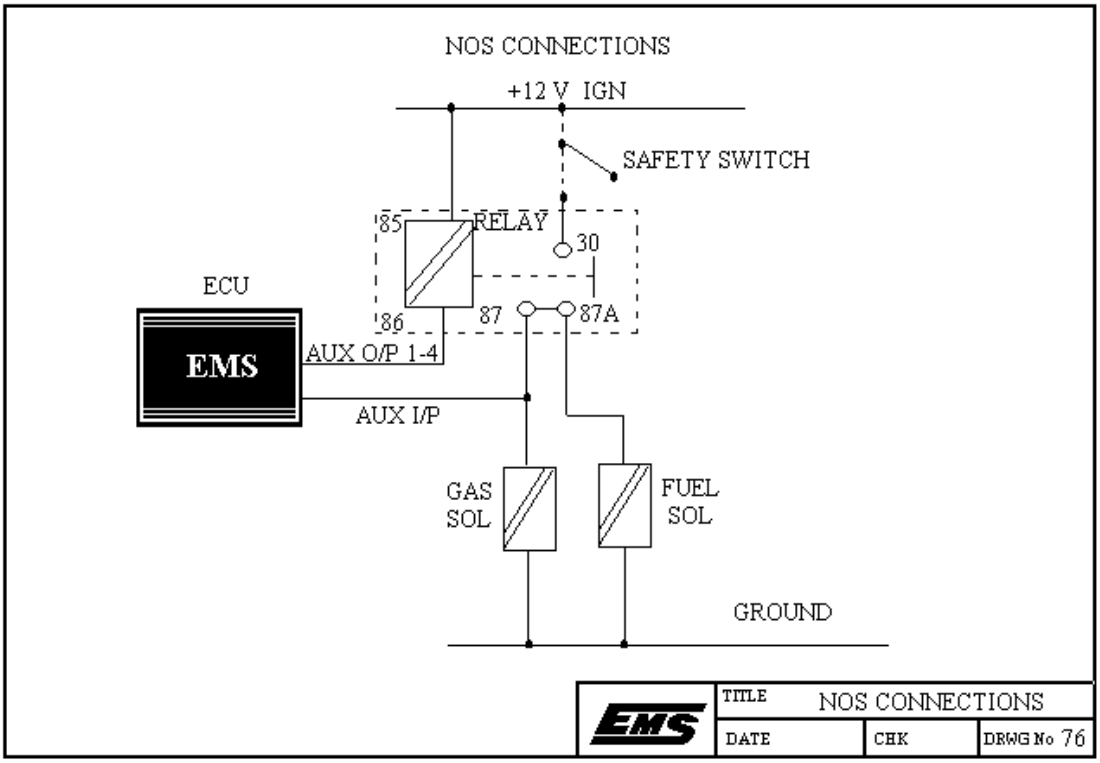
Hall Sensor Wiring



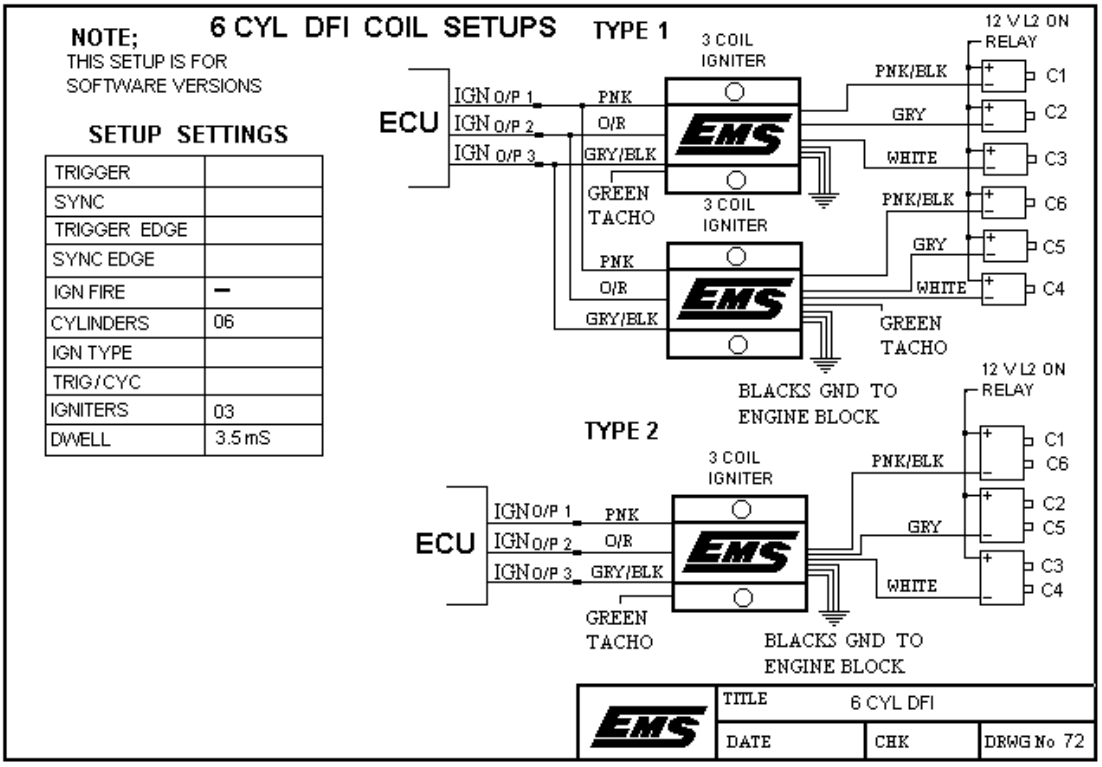
Igniter Wiring



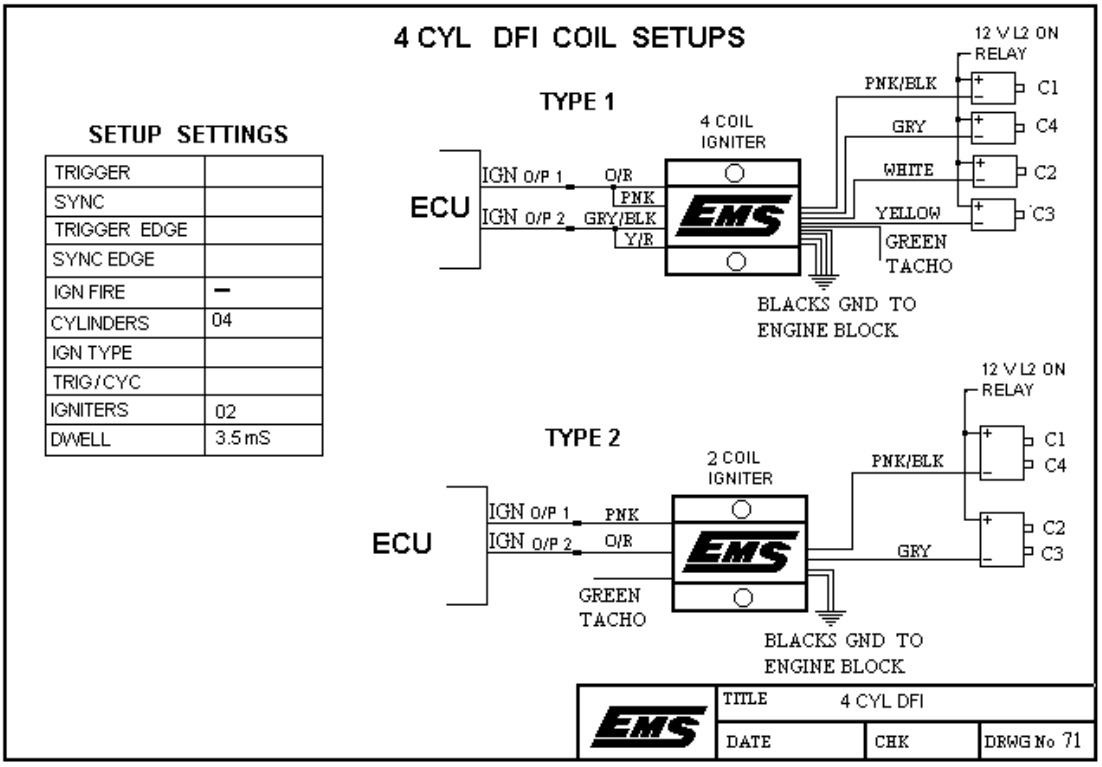
NOS Wiring Diagram



6 Cyl DFI Wiring



4 Cylinder DFI Wiring



Air Sensor Calibration

Use this page to calibrate the ECU for a particular Engine Temperature sensor.

There are many different types of sensor resistances on different cars. This means that we must create a sensor calibration table for each type of sensor.

If you do not find a file that gives you the correct temperature readings, you will need to either create your own new calibration or modify an existing file.

It is also known that O.E.M. sensors can have + or - 10% variation. In an extreme case, you may decide to-re calibrate the file you are using.

Using an existing File

Below is a list of sensor calibration files (filename.emc) pre defined by
EMS. You may down load any of these files into your ECU.

To use a file, click on the file of your choice. It will be highlighted when selected.
Press the "Read from File" button located at the right of the page.
This will write the calibration into the table above.
To send this calibration to the ecu, press the "Write to ECU" button
Once the progress bar has finished, the calibration has been sent to the ECU.

To view the current water temp as seen by the ECU, Goto the tuning page.
If it is not correct, try a different file or create or modify your own file and Write it to the ECU again.

Creating your own File

RULE
All numbers in the table MUST be in ascending or descending order.

In The "Name" Field, type the name of your new file.

Click on the first entry for -20 deg C.
Type the A/D number that represents that temperature.
Pressing the TAB button will move the cursor to the next temperature calibration field where you can enter the A/D number for that temperature.

Press the Save To File button to save your new calibration table. If a calibration table with the same name already exists then it will be over-written.

You can then download the new table to the ECU by pressing the Write to ECU button.

You can also copy an existing table by simply re-naming it and pressing the Save To File button.

To see the current A/D value, press the Read A to D Button. The read A to D reading will be displayed in the center of the page. To accept this reading, press the Accept Reading Button. This will transfer the A to D reading into the table in whichever temperature field is highlighted.

This A/D number is what the Ecu is seeing from the sensor.

A/ D Number.

A/D Is the ECU's Analog to Digital converter.
Temperature sensors change their electrical resistance when the temperature changes. When a temperature sensor is connected to the ECU, the changing resistance causes the voltage to also change. This changing voltage is called an analog voltage. The ECU's A/D converter measures this voltage and converts it into a number between 0 and 1024

This means that if the temperature changes, the Number from the A/D converter will also change.

To calibrate the ECU to the sensor we must place the correct A/D number below each temperature cell.

This is done experimentally, by placing a calibrated temperature probe in the in the vicinity of the air temp sensor and filling out the table as the temperature slowly rises.

Another method is to remove the sensor and slowly heat the bulb of the sensor with a hot air gun, using a calibrated thermometer to measure the temperature.

Choke Control

Engine Temp. Compensation on Fuel

There are 18 Water Temperature Enrichment / Enleanment settings used during engine warm up and over temp. These settings are expressed as percentages + or - (%) of fuels main Map.

The settings begin at -20 deg C and go up in 10 deg increments until 150 deg C which is the last setting.

The Ecu interpolates between these settings to give a smooth warm up cycle. Through warm up testing you can adjust these settings to more closely suit your engine.

NOTE: To disable extra / less fuel at any temperature point,
set that point to 0%.
These settings are located on the 3D tuning page, press the
Fuel MAP Temp Compensation Button.

Air Temp. Compensation on Fuel

There are 18 Air Temperature Enrichment / Enleanment settings .
These settings are expressed as percentages + or - (%) of fuels main Map.

The settings begin at -20 deg C and go up in 10 deg increments until 150 deg C which is the last setting.

The Ecu interpolates between these settings to give a smooth transitions.

NOTE: To disable extra / less fuel at any temperature point,
set that point to 0%.
These settings are located on the 3D tuning page.
Fuel MAP Temp Compensation Button.

Closed Loop Lambda

The 8860 offers two closed loop lambda control modes. Narrow band and Wide band.

Narrow Band

Set the operation mode to Narrow Band.

Select the maximum automatic adjustment allowed in the "Allowable Change +/-" field. This setting prevents the ECU form over-adjusting the fuel delivery.

Set operating range in the "Operating Range" field. This will turn off the lambda control when the engine is above the selected vacuum (closer to zero). The ECU will start controlling again once the engine vacuum goes below the selected level.

The Target A/F Ratio can not be selected in this mode.

Bosch 4 Wire Wide Band

This mode used the Bosch 4 Wire sensor (Bosch Sensor Number 0 258 104 002)

In this mode the Ecu Provides Temperature compensation and Linearization of the sensor to give accurate and repeatable results.
Allow 4 minutes for the sensor to reach minimum operating temperature.

Bosch 5 Wire Wide Band (Innovate LC-1)

In this mode the 8860 ECU reads either analog 1 or 2 of the LC-1.

Before the LC-1 can be used with the 8860 it must be calibrated. Use LM Programmer software to calibrate the LC-1.

Set the output to read 0.050 volts for 8.0 air-fuel-ratio and 0.950 volts for 22 air-fuel-ratio.

Wide Band Closed Loop Control

Select the maximum automatic adjustment allowed in the "Allowable Change +/-" field. This setting prevents the ECU form over-adjusting the fuel delivery.

Set operating range in the "Operating Range" field. This will turn off the lambda control when the engine is above the selected vacuum (closer to zero). The ECU will start controlling again once the engine vacuum goes below the selected level.

Set the target A/F ratio you want to achieve in the "Target A/F Ratio" field. The ECU will automatically adjust the fuel delivery in order to achieve the selected target.

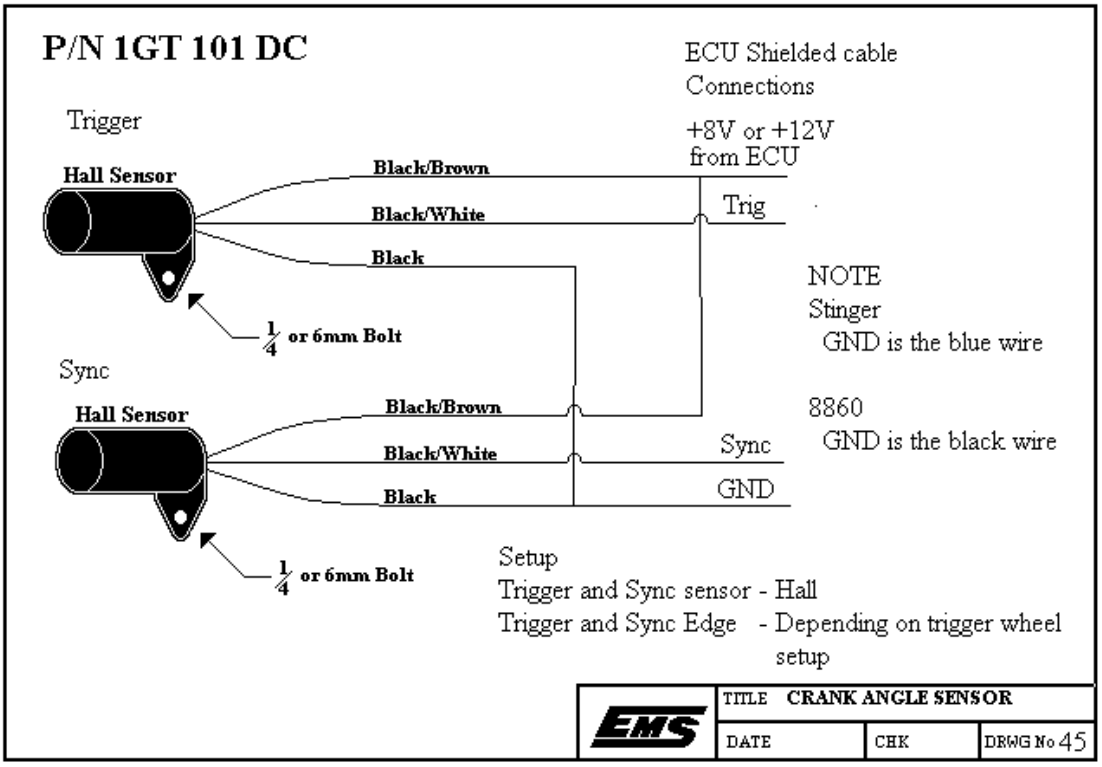
cold crank

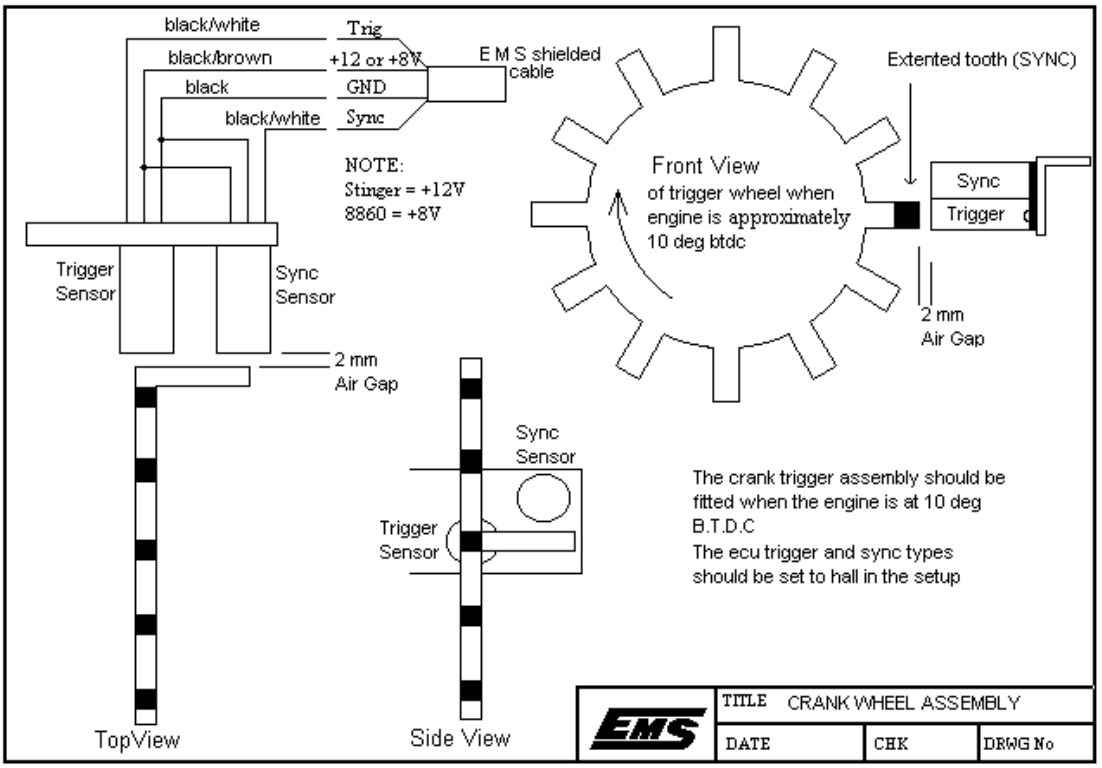
This function allows extra fuel for start-up.
Adjust the choke setting prior to adjusting "Percentage for Cold Crank".

Cold cranking enrichment adds fuel by a percentage of what the computer calculates at that time.

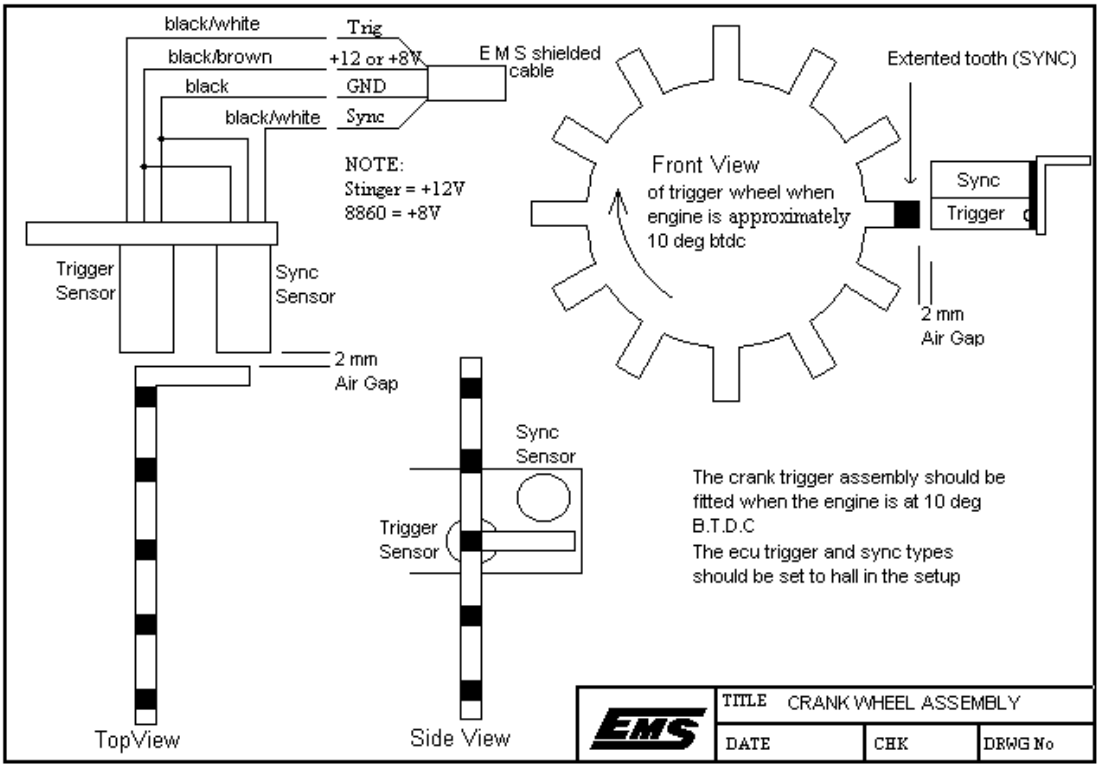
This percentage is relative at -20 deg. C and interpolates automatically down to 0% at 60 C.

Crank and Sync Diagram





Crank Wheel Setup



File Manager

This area of the screen displays any files stored .
A file is selected when you click on it.
When selected, it will be highlighted.

Saving ECU Data to a file

To save ECU data you must type in a name in the "File Name" field and then press the "Save to File" button. After a few seconds the new file will appear in the file list.

Loading Data from a file

To read ECU data from a file you must first select a file from which to read the information.

Select a file by clicking on it. The name of the file should appear in the **File Name** field.

Now you can press the **Read From File** button. This will read all of the information about the ECU Setup and Tuning from the file and place this information into this computers memory.

To down load this information into an ECU go to the ECU drop down menu and select the **Write to ECU** selection. The down load from this computers memory (PC) to the Ecu is complete when the progress bars disappear.

Deleting a file

To delete a file Use right mouse button to select the file.
A drop down menu will appear, click delete with the left button to delete.

Data Logging

To assist in tuning you can perform a time based data log of an engine.

To get to the data logging to laptop section,
Click on the **Goto** drop down menu and click on **Data logging**

See Data Logging

Files Screen

This screen enables the user to manage the data from many ECUs by saving the ECU information into files.

Here you can store many files of ECU data. This data can be retrieved from a file and down loaded into an ECU.

File Selection

See: File Manager

Fuel MAP Override

This feature can be used as a fuel trim for an entire load value. You must have the MAP sensor connected to use this feature.

The ECU uses the values in this grid internally to determine the correct fuel delivery. Normally you would not need to adjust these settings but EMS allow you to adjust them in specialist situations.

This would be used in situations where a throttle position sensor or mass air flow meter is used to determine the fuel delivery. In installations where a turbo charger is used along with these sensors the actual fuel requirement may not be proportional to the TPS or MAF readings.

Enter the increase or decrease percentage of fuel for each load position on the grid. This percentage is calculated from the current load position.

If these values have been removed or changed to the point where the engine is not operating correctly you can easily bring them back to the factory setting by entering the same value as the actual load point at each point.

EG; At the -50 KPA load point enter -50
At the -20 KPA load point enter -20
At the 0 KPA load point enter 0
AT the 25 KPA load point enter 25
AT the 50 KPA load point enter 50.

You must do this for each grid position.

Fuel Trim Percentage

This function trims ALL fuel settings.

Use this function as an overall Trim in percentage (%).

For first time engine start up you can adjust the Fuel Trim prior to setting the Fuel Maps.

Fuel trim is located on the 3D tuning page.

Once you are happy with the performance the selected trim is providing. You can apply the changes directly to the fuel map by pressing the Re-Adjust Map button beside the Fuel Trim selector. This will adjust the map by the trim percentage and then zero the fuel trim value.

Ignition Fire Edge

The Ignition Fire Edge setting determines whether the ignition output is normally ON and then turned OFF to fire the coil or normally OFF and then turned on to fire the coil.

Negative fire will leave the ignition output OFF and then turn it ON to fire the coil.
Positive fire will leave the ignition output ON and then turn it OFF to fire the coil

NOTE:

Be aware that setting the Ignition Fire Edge to positive fire will leave power on the ignition output which could cause coils and igniters to burn out if they are not designed to operate in this mode.

Ignition MAP Override

This feature can be used as an ignition trim for an entire load value. You must have the MAP sensor connected to use this feature.

This would be used in situations where a throttle position sensor of mass air flow meter is used to determine the fuel delivery. In installations where a turbo charger is used along with these sensors the actual timing requirement may not be proportional to TPS or MAF reading.

Enter the increase or decrease percentage of timing for each load position on the grid. This percentage is calculated from the current TPS or MAF readings.

NOTE: If you do not want the system to override at a particular load value you must enter 0 (zero) in that position.

Ignition Trim Percentage

This function adjusts the ignition timing by a + - percentage of what it would normally calculate from the ignition maps.

The trim function can be used to alter the complete ignition curve due to variation in Octane levels of fuel.

Ignition Trim is located in the Trim section off the 3D Tuning Map

Once you are happy with the performance the selected trim is providing. You can apply the changes directly to the ignition map by pressing the Re-Adjust Map button beside the Ignition Trim selector. This will adjust the map by the trim percentage and then zero the ignition trim value.

Injector Scale

The injector scale is used to set the resolution of each increment in the main fuel map. Injector Scale sets the max fuel available .
half the scale number = the max milliseconds.
E.G. scale number of 40 = 20mS max injector opening @ 0% Fuel Map override setting.

Note: As a guide, the injector time scale should be set between 10 and 30 when in multi point 360 mode and between 40 and 80 when in multi point 720 mode. If you find that you need to go above or bellow this range you may need to change injector size or there is a problem in the fuel delivery system.

See Injector Arrangement

Each load point has 0 - 255 increments of injector on-time. The Injector scale is used to calculate the number of milliseconds per increment and is used to set the maximum allowable milliseconds for the size of injectors being used.

IE: Larger injectors would require less milliseconds of on-time to supply the same volume of fuel that smaller injectors would require. This means that the injector scale value determines maximum injector on-time attainable.

You can determine the maximum on-time by dividing the injector scale by 2.

This example applies to TPS and Vacuum load points.
EG: By setting the injector scale to 20 the maximum allowable injector on-time will be 10 milliseconds (20 divided by 2). This means that each increment for each load point will be 0.039 milliseconds (10ms divided by 255 increments).

The same principle applies to vacuum mapped load points when on the 0 Kpa point. At different load points the ECU varies the actual resolution to compensate for differing air densities.

Log Data

This section allows you to select the parameters that are to be logged from the Ecu to the P.C. (Laptop).

To select a parameter, click the check box.
The tick indicates that the parameter is selected for Logging.

Staged Injection

Staged injection is for engines with staged fuel injectors (i.e.; two injectors per cylinder). If your engine is not using staged injectors then select "OFF".

WARNING!!
DO NOT SELECT STAGED INJECTION FOR NON-STAGED INJECTED ENGINES AS THIS WILL CAUSE ENGINE DAMAGE.

The Staged adjustments are located under the Trim Button off the 3D Tuning page.

When a staged number is selected in the staged amount field, the ecu will bring on the staged injectors Automatically, when it sees the primary injectors approaching 100% Duty.
To test the staged fuel amount the user can force the ecu to enable the staged injection earlier by clicking on the "Force Staged inj On" check box.

Via experimental testing, change the staged number until the correct air fuel ratio is achieved.

For engine configurations with primary and secondary injectors of the same size, set the staged number to 57.6% and no need for further adjustment.

If the secondaries are larger that the primary injectors, the staged number will be smaller.
If the secondaries are smaller that the primary injectors, the staged number will be larger.

Water Sensor Calibration

Use this page to calibrate the ECU for a particular Engine Temperature sensor.

There are many different types of sensor resistances on different cars. This means that we must create a sensor calibration table for each type of sensor.

If you do not find a file that gives you the correct temperature readings, you will need to either create your own new calibration or modify an existing file.

It is also known that O.E.M. sensors can have + or - 10% variation. In an extreme case, you may decide to-re calibrate the file you are using.

Using an existing File

On the Bottom of the page is a list of sensor calibration files pre defined by EMS. You may down load any of these files into your ECU.

To use a file, click on the file of your choice. It will be highlighted when selected.
Press the "Read from file" button .
The calibration is now loaded into the table of the laptop memory.

To send the table data to the ecu, press the "Write to ECU" button.
When the progress bar , the data has been written into ECU memory.

Creating your own File

RULE
All numbers in the table MUST be in a sending or descending order.

In The "Name" Field, type the name of your new file.

Click on the first entry for -20 deg C.
Type the A/D number that represents that temperature.
Pressing the TAB button will move the cursor to the next temperature calibration field where you can enter the A/D number for that temperature.

Press the Save To File button to save your new calibration table. If a calibration table with the same name already exists then it will be over-written.

You can then download the new table to the ECU by pressing the Write to ECU button.

You can also copy an existing table by simply re-naming it and pressing the Save To File button.

To see the current A/D value, press the Read A to D Button. The read A to D reading will be displayed in the center of the page. To accept this reading, press the Accept Reading Button. This will transfer the A to D reading into the table in whichever temperature field is highlighted.

This A/D number is what the Ecu is seeing from the sensor.

A/ D Number.

A/D Is the ECU's Analog to Digital converter.
Temperature sensors change their electrical resistance when the temperature changes. When a temperature sensor is connected to the ECU, the changing resistance causes the voltage to also change. This changing voltage is called an analog voltage. The ECU's A/D converter measures this voltage and converts it into a number between 0 and 1024

This means that if the temperature changes, the Number from the A/D converter will also change.

To calibrate the ECU to the sensor we must place the correct A/D number below each temperature cell.

This is done experimentally, by placing a calibrated temperature probe in the in the vicinity of the water temp sensor and filling out the table as the temperature slowly rises.

Another method is to remove the sensor and slowly heat the bulb of the sensor with hot water, using a calibrated thermometer to measure the temperature.

Engine Temp. Compensation on Ign. timing

There are 18 Coolant Temperature Advance / Retard settings .
These settings are expressed as percentages + or - (%) of Ignition main Map.

The settings begin at -20 deg C and go up in 10 deg increments until 150 deg C which is the last setting.

The Ecu interpolates between these settings to give a smooth transitions.

NOTE: To disable Ignition timing Advance / Retard at any Engine temperature point, set that point to 0%.

These settings are located on the 3D tuning page.

Air Temp. Compensation on Ign Timing

There are 18 Air Temperature Advance / Retard settings .
These settings are expressed as percentages + or - (%) of Ignition main Map.

The settings begin at -20 deg C and go up in 10 deg increments until 150 deg C which is the last setting.

The Ecu interpolates between these settings to give a smooth transitions.

NOTE: To disable Ignition timing Advance / Retard at any Air temperature point, set that point to 0%.
These settings are located on the 3D tuning page.