QM4/QI4

This product is for racing and off road use applications.
This product is not to be used on Aircraft.
This product must not be used on emission controlled vehicles unless appropriately certified.

AUTOMOTIVE ENGINE MANAGEMENT
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Engine Management Systems takes no responsibility for any of its products being incorrectly fitted or adjusted and therefore causing personal injury or damages.

Version 6.00

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CONTENTS

INSTALLATION

EMS Computer *(black box)*

The EMS Computer should be mounted away from the engine in a dry and vibration free environment e.g.: vehicle cabin. The EMS Computer should never be placed in the engine bay. Make sure the Intelligent interface socket (outlet) is easily accessible.

NOTE: If the Computer is to be used in a racing or off road environment it should be rubber mounted.

Wiring Loom

A 30mm dia hole has to be cut in the vehicle fire wall. Be careful that you do not cause any damage to existing wiring or ducting before cutting. When placing the wiring loom in the vehicle start at the engine bay side and only place the computer connections through the fire wall.
Avoid other electrical wires especially high tension leads eg: coil and spark plug leads. Also make sure wires are not placed near exhaust manifold or piping. The Loom wires are all marked with their locations.

NOTE: Ground must go to engine block - engine must be well grounded to chassis.

Sensors

Make sure the Water Temperature sensor is on the block side, not the radiator side of the thermostat.
The Air Temperature sensor should be placed in the airflow stream of the engine's intake.
Try to avoid the intake manifold area so that heat soak (sensor absorbing radiated heat) is kept to a minimum.
On Turbo engines the Air Temperature sensor should be mounted after any heat exchangers (intercooler) and be on the boost side of the turbo.

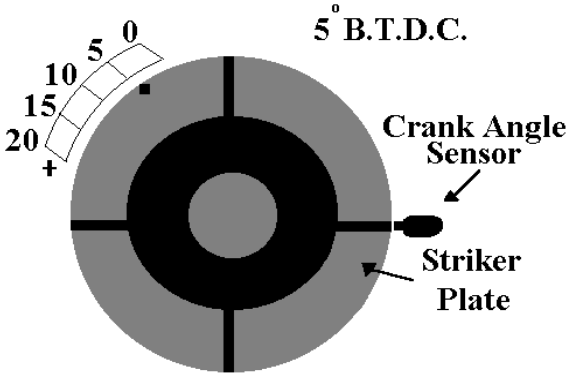
NOTE: If the Air Temperature Sensor or Water Temperature Sensor become disconnected the computer will read 24 ?deg C.

*** Water and Air Temp. Sensors are 1/4 BSP THREAD***

The position of the crank Angle sensor or dizzy is critical as this will determine the ignition timing on cranking.

Eg: a) Rotate the engine to the correct timing position.
b) Place the striker plate on the harmonic balancer in a position that when you align the Crank Angles sensor it will have room to be mounted.
c) Now the Crank Angle sensor can be placed adjacent to the striker plate.

If you require 5? BTDC when cranking, crank angle sensor should be set as example below:



Power Supply

The power supply for the EMS Computer must come directly from the engine's battery. Positive +(from Battery) and Negative -(from Engine Block).

Positive + = RED (BATTERY)
Negative - = Black (ENGINE BLOCK MUST HAVE GOOD GROUND TO CHASSIS)

IGNITION LEADS

The selection of ignition leads is important, the use of wire core ignition leads MUST NEVER be used when using a computer controlled Engine Management System. Some spiral core leads must not be used as they too will emit RFI (Radio Frequency Interference) that will alter the correct function of the computer. A good quality Silicone suppressed lead or spiral core lead, with an impedance of not less than 3000? per foot (eg. Magnecor KV85 & R-100 leads) is recommended and will not effect the computers function.

NOTE: When using Multiple Coil ignition control, Silicone Suppressed leads must be used.

PROGRAMMING

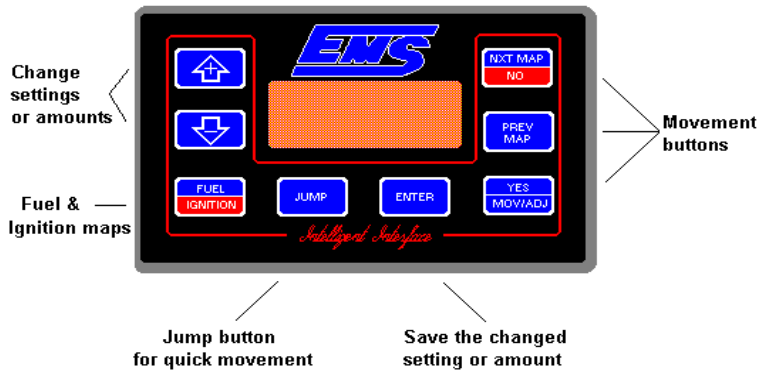
YOUR EMS QM4/QI4 MANAGEMENT SYSTEMS

This section gives you instructions on how to program your **QM4/QI4** Engine Management Systems (EMS COMPUTER).

The EMS **QM4/QI4** Computer has 14 main Heading prompts.

1. ENGINE MANAGEMENT SYSTEMS
2. SETUP
3. GAUGES
4. AUX ADJ
5. MAPS
6. CURVE
7. AUX 1
8. AUX 2
9. AUX
10. AUX4
11. AUX I/P
12. S/MODES
13. ENT TMR
14. ENT SEC

Plug in your EMS handpiece (Intelligent Interface) into the EMS Computer, turn the engine's ignition on. You will see that the screen lights up showing "ENGINE MANAGEMENT SYSTEMS". You are now ready to start programming.

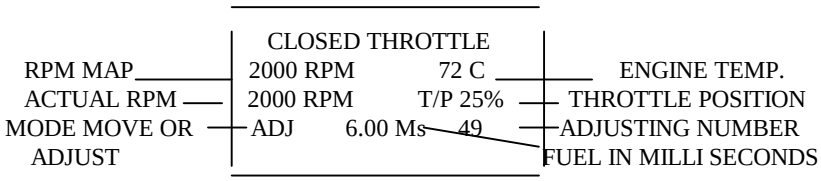


CLOSED THROTTLE MAP

These maps will only appear when throttle position sensor has been fitted and has been selected in set-up. The computer will use these maps corresponding to RPM when the throttle is in a closed position, as you accelerate the computer jumps to map sensing and does not use the closed throttle maps.

ADJUSTING CLOSED THROTTLE MAP

To enter an amount of fuel in these maps, move to the RPM range by using the "NXT MAP" button to move down the RPM range use the "PREV MAP" button. Once you have the desired RPM range you must have set the screen to read "ADJ" in the bottom left hand corner by pressing the "MOV/ADJ" button. Now by using the up and down arrow button you can increase or decrease the fuel for that RPM range. Once you have the desired fuel setting press the "ENTER" button.



MOVING AROUND

There are two areas of movement in the EMS Computer.

a) Major Headings
1. ENGINE MANAGEMENT SYSTEMS
2. INITIAL SETUP
3. ENGINE STATUS
4. AUXILIARY

b) Fuel or Ignition Maps
5. ADJUST FUEL OR IGNITION MAPS

a) Press the "NXT/MAP" button and you will see "SETUP" section. Now continue pressing the "NXT/MAP" button and notice the section headings that come to screen. If you keep pressing the "NXT/MAP" button you will return to the "ENGINE MANAGEMENT SYSTEMS" screen. You can reverse your direction by pressing the "PREV MAP" button. To enter into any section press the "YES" button at the main heading prompt. To move within a section, use the "NXT/MAP or PREV MAP" buttons. To exit a section keep pressing "NXT/MAP or PREV MAP" buttons until you return to the main heading prompt or press the "JUMP" button and you will automatically move to the main heading of which you are in. Now press "NXT/MAP" button to move onto the next main heading prompt.

b) When you have entered "YES" to enter into the Fuel or Ignition Map section you will find that the screen is in MOV mode. This means that you can move within the fuel maps checking the settings. The hand-piece screen will also display "MOV" in the lower left-hand corner. To move in the fuel or Ignition maps, you push the NXT/MAP or PREV/MAP button. NXT/MAP taking you to the right. PREV/MAP taking you to the left. To move up or down use the arrow buttons. To move from fuel to ignition maps press the FUEL/IGNITION button or the same button again to move back. If you continue pressing the up arrow button while in "mov" mode in the fuel or ignition maps the computer will jump out of the maps you are in into the main heading prompt. If you wish to go back into the map you where in press the YES button and the computer will take you back to the same map.

NOTE: To change the Fuel or Ignition Map settings see the MAPS section.

JUMP BUTTON

The "JUMP" button is for quick and easy movement within the EMS computer. The "JUMP" button has been programmed for different movements in the EMS computer depending on which section you are in. These different movements are:

1. From any adjusting area to the main heading for that section.
2. From any main heading to the ENGINE MANAGEMENT SYSTEMS heading.
3. From the ENGINE MANAGEMENT SYSTEMS heading to the Fuel or Ignition Map/R.P.M. and Load position that the engine is currently doing.
4. From within Fuel Ignition Maps to the current R.P.M. Load position that the engine is using.

CHANGING SETTINGS

To change settings in any other screens apart from fuel or ignition maps press the (+) or (-) arrow buttons. Once you have the desired setting press "ENTER". Now your setting is saved.

CAUTION: If you don't press "ENTER", an adjustment setting is not saved and the computer will use the previous setting.

FUEL OR IGNITION MAP SETTING

Once you have entered the Fuel or Ignition Map section you will find that you are in "MOV" mode. To change into "ADJ" mode, press "MOV/ADJ" button. You will see in the left-hand corner of the screen, has now changed from "MOV" to "ADJ". You can now adjust the Fuel or Ignition setting by using the (+) arrow button to increase the setting or by the (-) arrow button to decrease the setting. Once you have adjusted the Fuel or Ignition Map setting press "ENTER". The computer will automatically change back to "MOV" mode.

SETUP

ENGINE SETUP

EMS QM4/QI4 has the unique option of being able to program two different engine settings into the one EMS Computer. Select engine set up " 1 " go through and tune your engine, then select engine set-up "2" and tune a different engine or the same engine again, If using a EMS memory cartridge you may have a different tune for each engine set up. Or you can have 3 different tunes for the same engine. You may change from one set-up to the other while the engine is idling. The two set-up's must have been programmed for the same engine or the engine will stall due to the incorrect information in the other set-up.

TYPE OF INJECTION (INJ TYPE)

Check the position of the fuel injectors. They may be fitted to a Throttle Body (all injectors at one single point) or Multi Point (injectors at each cylinder). Adjust the EMS Computer to the correct setting, then press "ENTER". 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. When Multi-point is selected regardless of the number of cylinders the computer will fire twice every cycle (two complete engine revolutions). Throttle body should be selected for 2 strokes.

TRIGGER SENSOR TYPE

Signals from Optical, Hall or Magnetic sensors can be used to trigger the computer on the trigger circuit or the sync circuit. In the SETUP the pages "TRIGGER", "SYNC", "TRIGGER EDGE" & "SYNC EDGE" will appear.

TRIGGER SENSOR

The trigger sensor page can be selected to "MAGNETIC", "HALL\OPTICAL" this allows the computer to be triggered by any one of these sensor, By using the up or down arrow buttons and entering to save your selection.

SYNC SENSOR

The sync sensor can be selected the same way as the trigger sensor, this sensor is only required if sequencing of coils or injectors are required.

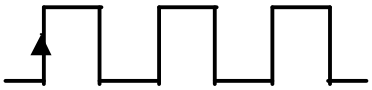
TRIGGER EDGE

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, using the up & down arrow buttons and entering the appropriate edge.

SYNC EDGE

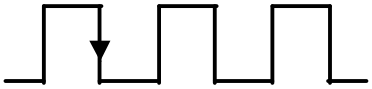
Can be selected the same way as the trigger edge.

a)



Rising edge = +Volts Trigger

b)

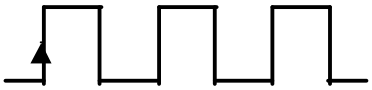


Falling edge = -Volts Trigger

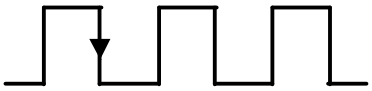
In example a) the computer will be triggered on the signals rising edge when +Volts Trigger is selected.
In example b) -Volts Trigger selection will trigger the computer on the falling edge of the signal.

OUTPUT VOLTAGE SIGNAL TO FIRE IGNITION COILS (IGN FIRE)

The computer outputs a signal to the particular ignition IGNITER being used.
The output can be changed as in the following eg's below:



Fire coil on rising edge when +Volts to fire is selected.



Fire coil on falling edge when -Volts to fire is selected.

T.P.S.

If TPS is used and selected the computer will initiate some extra menus, the screens will read as (intake ASP/Turbo/S/Charged), (Max KPA +80 KPA), (Sensitivity 0, 1, 2,).

INTAKE ASP/TURBO

If the vehicle is normally aspirated or turbo charged, select correct setting in this page. If it is supercharged select s/charged.

MAX KPA

If the engine is supercharged this page must be set to read max. kpa pressure, that the engine is to boost to. For normally aspirated & turbo engines, this screen will not appear.

ACCELERATOR 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 for the use of a small throttle body, medium is for a large throttle body and fine is for the use of a larger throttle body. This function will only appear on screen if a throttle position sensor has been fitted and selected in the set-up.

FUEL CUT

This feature allows the tuner to cut fuel to the engine on deceleration. Select at which vacuum you would like the computer to cut fuel and enter. If this feature is not required press the down arrow button until OFF appears.

CYLINDERS

Adjust the EMS Computer to the correct number of cylinders for your engine, then press "ENTER".

NOTE: For Two Stroke engines, double the number of cylinders to achieve the correct R.P.M.
Eg: Two cylinder Two stroke = 4 in the amount of cylinders.
For two rotor rotary select 4 cyl setting and for three rotor rotary select 6cyl.

IGN TYPE

The QI4 has 5 different ignition modes listed below. Most common mode used in most applications is mode 00.

IGN TYPE (01) Nissan

Is for Multi-coil applications using cam mounted crank angle sensors e.g.; CA18, RB20, VG30, SR20.
Ignition outputs 1, 2 & 3 can be used, 4 cyl engines use outputs 1 & 2 as wasted spark, 6 cyl engines would use 1, 2 & 3 as wasted spark, 0 TRIG/CYC must be used with all Nissan modes

IGN TYPE (02) Nissan

Is for Multi Coil applications when a distributor is used instead of a cam mounted crank angle sensor .Eg, FJ20, ET PULSAR Ignition outputs 1 & 2 can be used as wasted spark using original distributors. Note When using 1 coil , select ignition type 00 and do not connect sync wire.

IGN TYPE (03) WRX SUBARU

Select 4 cyl 0 TRIG/CYC 2 igniters use outputs 1&2 as wasted spark.

IGN TYPE (04)

Direct fire rotarys 2 rotor Select 24 in the TRIG/CYC page and 4 cyl 2 Igniters. Output 1(pink) is for leading. Output 2 (o/r) is for trailing 1, Output 3(gry/blk) is for trailing 2. For 3 rotor select 6 cyl, 24 in the TRIG/CYC page 3 igniters Output 2 leading & trailing 1, Output 3 leading & trailing 2, Output 4 leading & trailing 3.

IGN TYPE (00) Normal

For piston engines with 24 tooth distributors & crank angle sensors 24 should be selected in the TRIG/CYC page and the correct amount of cylinders and igniters in the appropriate pages. This set up is used for TOYOTA 4 cyl, 6cyl,and lexus quad cam V8.

IGN TYPE (00) Normal

For engines with same amount of teeth in distributor or cam sensor as cylinders should select 0 in the TRIG/CYL page.

NOTE: To use the TRIG/CYC page you must have evenly spaced and even amount 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 centre. Use only one sync tooth per cycle.

IGNITERS

This option enables you to fire up to 4 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 amount of Igniters that will be sequenced. If using a dissy 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. To enable the computer to fire more than one igniter sequentially, an extra reset sync must be given to trigger the computer.

LAMBDA 00

Lambda 00 selects Air/Fuel ratio to be displayed on various LCD screens. This feature is designed to be used with Bosch wide band Lambda sensor. When no sensor is connected to the ECU 16.0 A/F will be displayed.

NOTE: The ECU will not display correct A/F readings until 4 minutes after power on, when the Sensor has reached proper operating temp.

The ECU will perform temperature compensation calculations if the Lambda sensor temperature is overridden by the exhaust temperature. The sensor should be fitted just after the collector of the exhaust system when normally aspirated or Supercharged. If turbo charged the sensor should be fitted approx. 1 metre down stream of the turbo.

LAMBDA 01 & 02
Not Implemented.

NOTE: Use Sensor safe sealants on the exhaust system.

INJ OHMS
Set this function to the approximate ohms (? , Resistance) of your fuel injectors. You can do a self 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 EMS Computer by using the table below to the closest setting, then press "ENTER".
0 = 0.5? , 1 = 1.2? , 2 = 2.0? , 3 = 2.2? , 4 = 2.4? , 5 = 2.5? , 6 = 3.0? , 7 = 3.5? , 8 = 4.5? , 9 = 16?

IGNITION DWELL TIME
Ignition dwell time is the amount of charge time the coil is charged for before it is fired. This time may vary between different ignition and coil systems. Typically 3.5Ms is used. The ECU may be set up to 5Ms of dwell and down to no dwell (25/75 duty cycle) using the arrow buttons. No dwell time is set in the ECU when using an ignition system that can control its own dwell or when a ballast resistor is used.

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

0% TP ENT
(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. Have your throttle closed, then press "ENTER".

100% ENT
(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 "ENTER".

After adjusting both the throttle functions you will see in the gauges screen that the throttle position is displayed from 0 - 100%. The QI & QM model computers use throttle position sensing for the accelerator enrichment and for calculating fuel from closed throttle position. On deceleration these computers have closed throttle position maps so you can adjust the amount of fuel the engine requires in a closed throttle situation. This function can be adjusted from idle to 12,500 RPM and can be turned off (01 is adjusted on the screen) or on every 500 RPM, when NOT USED is selected the ECU will calculate fuel from vacuum rather than closed throttle but the acc pump will be calculated from TPS. This function can only be used if a throttle position sensor has been fitted and the fitted function in set-up has been selected. If the engine has not had the throttle position sensor connected the NOT FITTED function should have been selected in the throttle position sensor screen in " SETUP". The reason for this set-up is so the computer will still calculate acceleration enrichment using the map sensor. If the throttle is adjusted the Closed throttle must be re-entered in the computer.

ADJ PIN
Adjust Pin allows you to enter a 4 digit pin number. Once the pin number has been entered, the computer will prompt you to repeat the same number again to ensure it is correct. If the same number hasn't been repeated twice in a row, the computer will keep prompting you to repeat until it sees the same number twice in a row. Once the number has been accepted, the computer will only allow you to enter the GAUGES and engine SETUP pages on the next computer power up. Any attempt to enter other menus will prompt the ADJ PIN to appear, pin number will be needed to enter these menus. To deactivate the ADJ PIN feature you have to enter in the set-up, and enter 1111 in the ADJ PIN page.

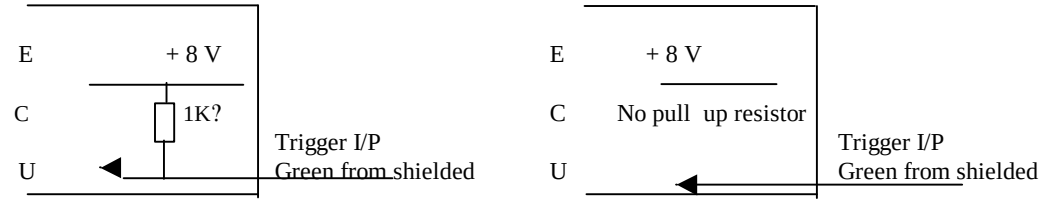
NOTE; If the pin number has been lost the ECU will have to be sent to E M S to be reset.

SECURITY PIN (sec pin)
Security pin allows you to enter a 4 digit pin number, after the pin number has been entered the computer will prompt you to repeat the same number again to ensure it is correct. Once the number is accepted you may put your engine in safe mode by selecting ENG SAFE in the ent sec page and pressing enter. On next computer power up the SEC PIN page will appear and you must enter your 4 digit number or the computer will not enable itself to start your engine.

NOTE; If the pin number has been lost the ECU will have to be sent to E M S to be reset.

TRIGGER RESISTOR (TRIG RES)

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 1K? pull up resistor to 8V or "OFF" if the 1K? resistor is to be disconnected.



TRIG RES "ON" TRIG RES "OFF"

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

If EMS 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 EMS pull up should be selected to be "OFF".

SYNC RESISTOR (SYNC RES)

This is the same as Trig Res but for the Sync Input (Yellow wire from shielded cable). See "TRIG RES".

GAUGES

There are two Gauges screens that display current variables.

Screen 1	**ENG TEMP**	**84C**	Screen 2	**FUEL A/F**	**6.25Ms**
	AIR TEMP	**60C**		**IGN ADV**	**25.6**
	PRESSURE	**00KPA**		**BATTERY**	**12.1V**
	4000RPM			**THROTTLE**	**00%**

These screens are visual only. No adjustment can be made in this section.

AUXILIARY ADJUST

CHOKE FOR ENGINE WARM UP

There are five Choke Water Temperature settings used during engine warm up. The settings are expressed as percentages (%) of extra fuel, at

1. -20?c
2. 0?c
3. 20?c
4. 40?c
5. 60?c

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

NOTE: The Choke is automatically turned off after 70?c.

C/CRANK

Some engines may need the use of extra fuel while starting. This function allows extra fuel for start-up outside the choke settings. Adjust the choke setting prior to adjusting "Cold Cranking Enrichment". Cold cranking enrichment adds fuel by a percentage of what the computer calculates at that time. When the engine is cranking, it is using the "0000 RPM" map in Closed Throttle if the throttle position sensor has been fitted and selected. If no throttle position sensor has been fitted the "Not fitted" should have been selected and the computer would use the "0000 RPM" 0 KPA map in the fuel maps,
eg: If 2mS was the fuel calculated while cranking and 50% enrichment was chosen in cold cranking , 3mS would be the fuel to be injected at hat time.

ACC PUMP

Acc pump adds extra fuel for immediate acceleration. Through acceleration testing, adjust the EMS Computer until you have reached a satisfactory engine response. Acc pump = The amount of extra fuel added.

NOTE: You will need to place an amount in " PUMP TIME" function so you can correctly fine tune the "ACC PUMP". There is a pre-set figure of 20 in acc pump and pump time but you may need to adjust this figure.

PUMP TIME

Pump Time sets the time for which the fuel is added. Through acceleration testing adjust the EMS Computer until you have reached a satisfactory engine response. You will need to move back and forward between Acc Pump and Pump time to get the best settings. PUMP TIME = The amount of engine ignition pulses that extra fuel is added.

STG INJ%

Staged injection is for engines with supplementary fuel injectors (ie; two injectors per cylinder). If your engine is not using supplementary fuel injectors then set the screen to read "OFF", then press "ENTER".

WARNING!!

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

If you are using supplementary fuel injectors, the r.p.m. cut in position must be determined first, adjust the screen to read "STG INJ% OFF", then press "ENTER". You will need to adjust this function later when you have the approx. r.p.m. cut in position. When you are tuning the Fuel Maps you will see the screen flashing at a certain r.p.m. The screen flashing is a indication that your fuel injectors are fully on. Make note of the RPM position of when the screen flashed. The approximate cut in position of your Staged Injectors is now calculated at 500-1000 RPM below the screen's flashing point.

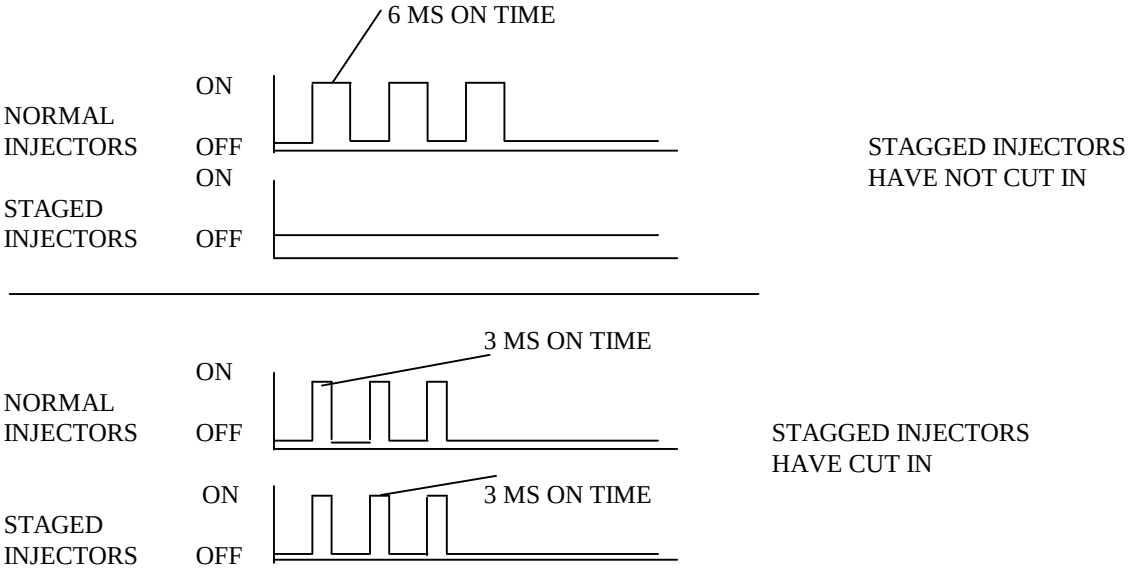
eg: The screen is flashing and the engine is at 5,000 r.p.m. 5,000 r.p.m.

-500

Cut in position is approx. 4,500

After you have the fuel cut in position, you can return to the "STG INJ %" page in the "AUX ADJ" section place the engine under load and bring the r.p.m. to the cut in position. Now with the arrow keys adjust the Air/Fuel ratio to reads the same as you have previously set at this r.p.m. and load and press "ENTER". Now Staged Injection is complete as the EMS computer will calculate a smooth introduction of the secondary injectors. Now you can return to the Fuel Maps section and continue to tune as per normal.

NOTE: The computer will actuate the staged set of injectors when the engine is over 1500 rpm and the load is less than -5 kpa while in the "STG INJ" page. The computer does this so you can adjust the fuel mixture with all injectors on by using the arrow buttons. If the staged injectors are the same flow rate as the normal injectors, the staged injection setting should be set at approx. 72. If staged injectors are larger the number will decrease in value and if staged injectors are smaller the number will increase.



BOOST CUT

Allows the user to set a pressure at when reached will cut the fuel to the engine. The fuel will be injected again once the pressure has dropped below the value set. If boost cut is not required press the down arrow button until OFF appears and enter.

STAT IGN

Press & hold down arrow button until screen reads "locked" and press enter. 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, eg. 10 BTDC. The screen should be adjusted to the reading recorded using the up arrow button to 10 BTDC and enter.

REV SOFT

EMS has a Rev Limiter that can be adjusted from 0 to 12,500 r.p.m. in 50 r.p.m. increments. If you wish to use this option, adjust the arrow keys to read the desired rev limit then press "ENTER". The EMS rev limiter cuts the fuel out on every second engine cycle eg. 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.

REV CUT

To use this option the desired rev should be entered in this page by using the arrow buttons, the computer will cut the fuel at the rpm chosen and will enable the fuel back when the rpm has dropped below the rev chosen.

IGN TRIM

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.

FUEL TRIM

This function adjusts ALL fuel settings. This Trim must be set to 0% when tuning turbo or supercharged engines. Only adjust this function off 0% after all Fuel Map settings have been adjusted. Use this function as an overall Trim in percentage (%).

NOTE: For normally aspirated engines 35% should be added in the fuel trim before tuning to ensure 100% duty cycle of the injectors under full load. For first time engine set up you will need to adjust the Fuel Trim prior to setting the Fuel Maps. See "Adjust Fuel Maps " section for more information.

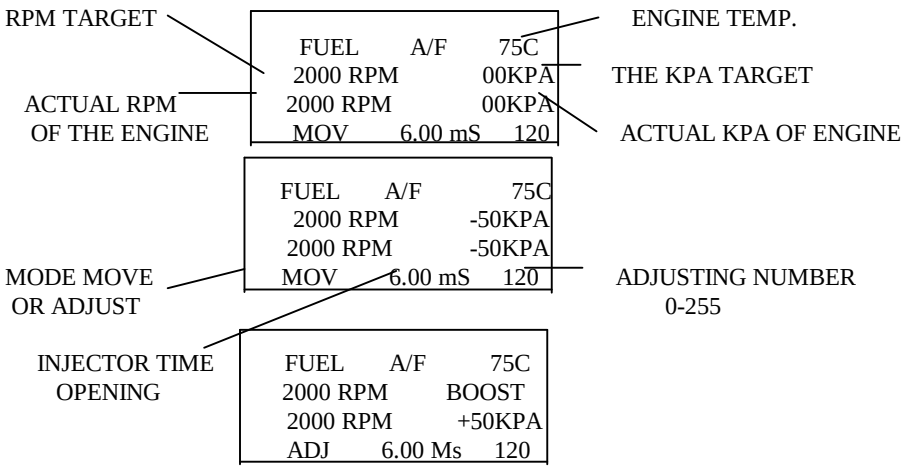
PWM FREQ (PULSE WIDTH MODULATED FREQUENCY)

TO BE EXPLAINED IN PWM MODE SECTION, page num 18.

ADJUST FUEL & IGNITION MAPS

ADJUST FUEL MAPS

This section is for adjusting fuel maps for each 500 r.p.m. increment. Starting at 0 r.p.m. through to 12,500 r.p.m. For normally aspirated engines there will be two settings per 500 r.p.m. increments, 1st at 0 kpa Full load and 2nd at Light load (Bring engine to lightest load possible). On forced induction engines ie: Turbo's, there is another setting at full boost.



EMS have already pre-programmed temporary Fuel Map settings for all 500 r.p.m increments. You can change these figures if you already know your Fuel Map settings. If this is the first time you have set up a particular engine you should use the "Fuel Trim" function in "AUXILIARIES" to help get the engine started.

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

1. Adjust the screen to read "AUXILIARIES", then press "YES".
2. Press the "NXT/MAP" button until "OVERALL FUEL TRIM" appears.
3. Start the engine and at the same time adjust the Overall Fuel Trim by using the Arrow keys. Adjust the percentage back and forward until the engine runs adequately, then press "ENTER".

ADJUSTING FUEL MAPS

Place the engine to the matching condition according to the map screen that you are in. Adjust the fuel setting by the arrow keys to the desired Air/Fuel ratio and press enter.

IMPORTANT

a) The engine must be above 70C? before tuning. If you tune below 70C? then the appropriate choke settings must be at zero (0).
b) All 0 kpa Fuel Map positions must read as close as possible to 0 when tuning the engine.
c) Ensure that the engine r.p.m. is as close to the screen r.p.m. target.
d) When tuning light load positions bring the engine to the lightest negative -kpa pressure as possible. When tuning boost position, adjust to the desired Air/Fuel ratio while in boost and enter.

NOTE: a) Flashing screen = Injectors fully on.
? b) If the screen starts to flash and you are only running single injectors then increase the fuel pressure, use
? larger injectors or fit second set of injectors (Staged Injection).

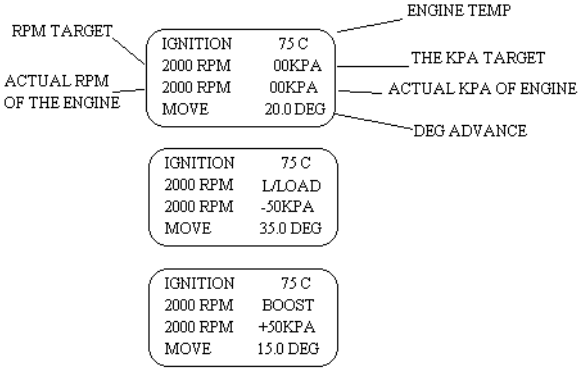
CLEAR FLOOD MODE

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

IGN

ADJUSTING IGNITION MAPS

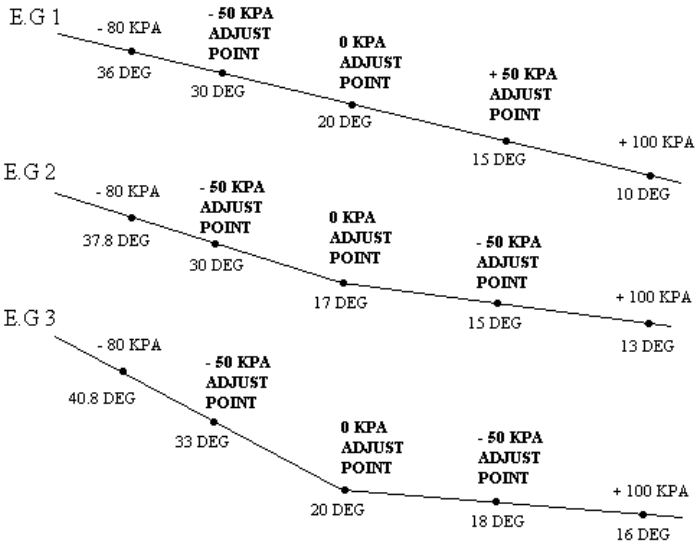
This section is for adjusting Ignition maps for each 500 r.p.m. increment. Starting at 0 r.p.m. through to 12,500 r.p.m. For normally aspirated engines there will be two settings per 500 r.p.m. increments, 1st at 0 kpa Full load and 2nd at Light load. On forced induction engines ie: Turbo's, there is another setting at full boost.



EMS have already pre-programmed temporary Ignition Map settings for all 500 r.p.m increments. You can change these figures if you already know your Ignition Map settings. If this is the first time you have set up a particular engine you should use the "Ignition Trim" function in "AUXILIARIES" to help get the engine started. You must use sensible numbers in the ignition maps to start the engine. Place the engine to the matching condition according to the map screen that you are in, adjust the ignition setting by the arrow buttons to the desired advance and press enter.

IGNITION TIMING EXAMPLES

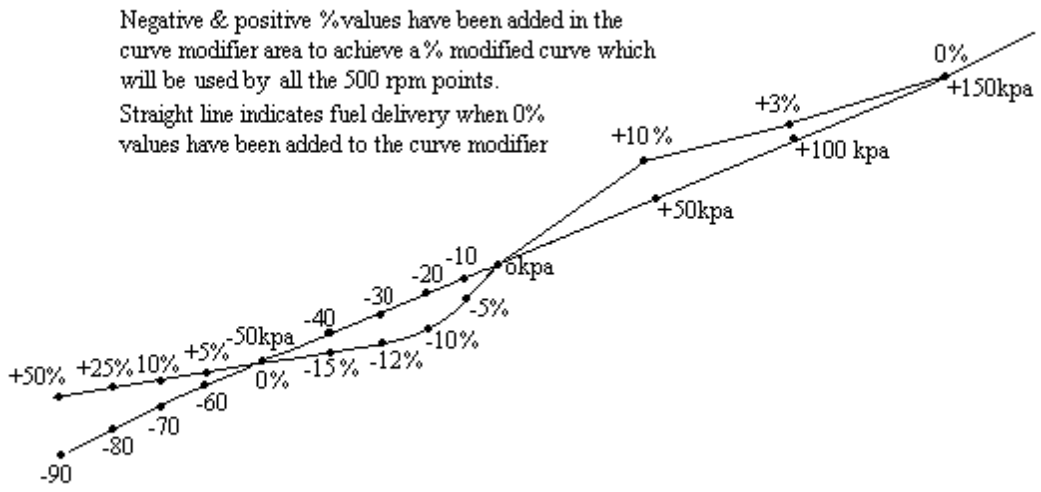
The computer will re-calculate for every 1 KPA change in the manifold vacuum. In the examples below you can see how the computer will change the timing at +100 and -80 by adjusting the 0 KPA point. For turbo charged or super charged engines the 0 KPA must have a greater value than boost for the computer to retard timing while in boost. If the boost is increased the computer will continue to retard the timing until it reaches the static timing value eg, if 10 Deg. is in the static timing the computer will not retard past this point. The examples below are shown when 0% is in all the curve modifier load points.



CURVE

The load points in the curve modifier screen should only be adjusted after you have tuned the 0 KPA, -50 KPA & +50 KPA Fuel and Ignition points every 500 RPM. To tune this section every 10 KPA in the vacuum you would choose the RPM range where the engine would be mostly driven or the mid point of the engines RPM range. For example the 3000 RPM range has been chosen, bring your engine to the corresponding with the kpa load point which your screen has been set to and adjust the fuel change by using the arrow buttons. To tune in boost the engine may have to be loaded in a high rev. range to obtain boost depending on turbo size and the same procedure used to tune as in vacuum but only using the +50, +100, +150 kpa adjusting points.

The (+) button will increase the fuel at that load point and (-) button will decrease the fuel. Once you have set the load points to your desired air/fuel ratio, the computer will automatically apply these settings to all the RPM ranges. If this function is not required, set all the KPA load points to 0%. The Ignition curve modifier is used in the same way as the fuel and the same principles apply as using the % points of the curve modifier. The example below shows how the curve modifier can be used in a fuel map or an ignition map situation.



AUXILLARY OUTPUTS

There are 4 auxiliary outputs which are user selectable, for 12 different functions. These functions fall into 2 categories, Digital o/p that can be on or off depending on the conditions. Typical use of a digital o/p thermo fan shift light etc. The pulse width modulated outputs (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.

FUNCTIONS OF AUX O/P

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

Function No.	Description	Function No.	Description
0	Off	7	Turbo timer
1	Digital RPM	8	Tacho o/p
2	Digital KPA	9	PWM RPM
3	Digital throttle position	10	PWM KPA
4	Digital Engine temp.	11	PWM Throttle position
5	Digital RPM and KPA	12	PWM, Idle control
6	Digital RPM and throttle position		

DIGITAL FUNCTIONS

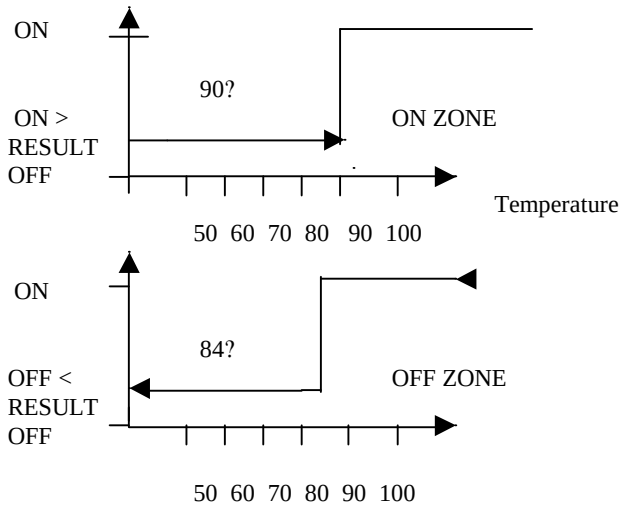
All digital functions follow a set comparison format.

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 eg. 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

Not used is selected by pressing and holding the ? button until the screen displays "0" (Not used). When not used is selected the comparison program ignores that particular setting. In the Engine Temp. (Thermo fan control) eg. 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.



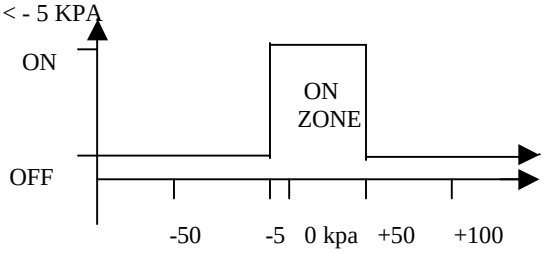
As the fans cool the engine and the engine temperature drops, the fans will remain on until the Programmed OFF< 84?C is reached where the o/p will turn off.

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

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 eg. 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



O/P MODES 5 & 6

These functions are an extension of the already mentioned but require 2 criteria to be true for the o/p to turn on, eg. 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 < 2850 turn OFF AND! when KPA
is > -10 KPA turn ON and KPA Is < - 10 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 < 2850		OFF< - 10)

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

REV ACT
This stands for reverse acting in some circumstances the relay that is connected to the output actually works BACKWARDS!! 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 ie. everything is working backwards. EMS added the 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.

PULSE WIDTH MODULATED MODES

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
EMS PWM signals are fully adjustable for frequency and for duty cycle.

FREQUENCY

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

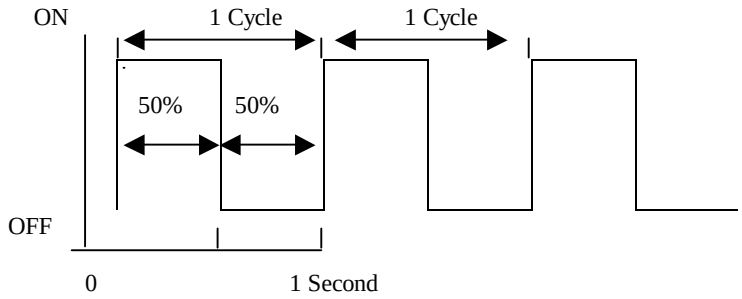


Fig A.
1 Cycle is from when a signal starts to when a signal begins to repeat itself.
In fig A. 1 cycle takes 1 second to complete so the frequency is 1 HZ.

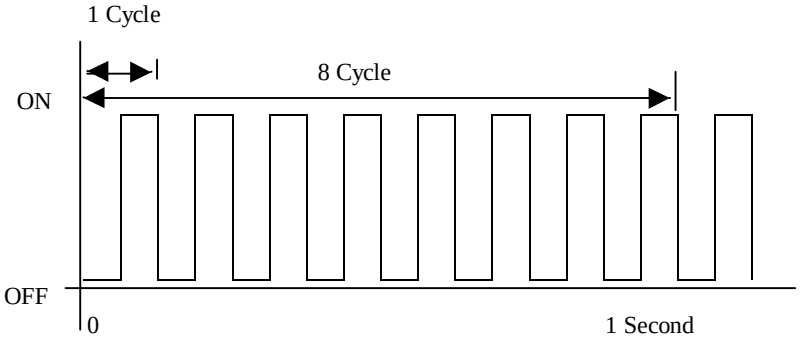
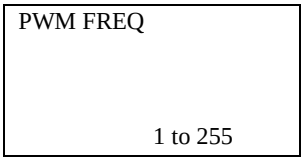


Fig. B
In Fig. B there are 8 cycles in 1 second so the frequency is 8 HZ. There are 2 frequency adjustments with the EMS system. The first adjustment is found at the end of the Aux. Adj (Auxiliary Adjustments) section. This is an overall adjustment and is applied to ALL of the 4 Aux o/p's using any PWM function. (Base Frequency).



The Base Frequency is calculated as follows. BASE FREQ = 3923 ? ADJ. NUM.

Eg. If 100 was selected from this screen, the base frequency would be 3923 ? 100 = 39.23 HZ.
Most valves or idle control valves normally function between 20 HZ to 100 HZ.
For 20 HZ the adjusting number would be 3923 ? 196 = 20 HZ for 100 HZ, 3923 ? 39 = 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 ? 12 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 courser to 1% increments. By adjusting this Freq. Number the frequency = (255 ? Freq Num.) X Base Freq. = Aux. O/p Freq.

Eg. 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.

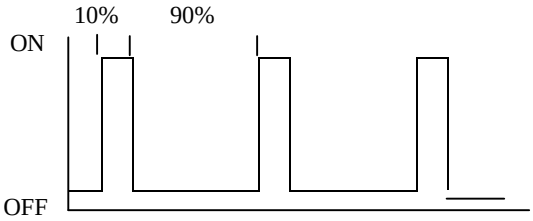


Fig. C

The duty cycle in Fig C is 10%. This means that the Aux O/P gives power to the valve for 10% and off for 90% of each cycle. Theoretically this means that the valve would be 10% open.

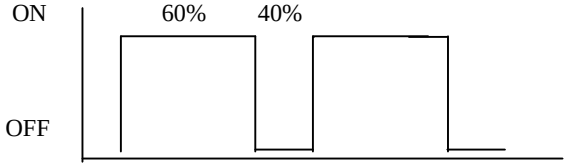


Fig. D

In Fig. D the duty cycle is 60%. This means that power to the valve is on for 60% and off for 40% of each cycle. Theoretically this means that the valve would be 60% open.

MODE 9 PWM VS RPM

In mode 9 you can adjust the duty cycle from 0 to the individual frequency number, (see previous section) normally 255. This duty cycle is adjustable at RPM sites from 0 RPM to 12500 RPM in 500 RPM increments. The EMS ECU will interpolate between these points eg. If a duty number of 128 is entered at 3500 RPM and 135 at 4000 RPM and the actual RPM was 3850 the EMS ECU will calculate 132.9 as the duty number. This function's typical use would be Boost control or induction length control. Example if using this function for boost control you can adjust your boost level every 500 RPM.

MODE 10 PWM VS KPA AND MODE 11 PWM VS THROTTLE POSITION

In these modes you can adjust the duty cycle every 10 KPA from -100 KPA to + 150 KPA in mode 10 and every 5% T/P FROM 0% TO 100% throttle in mode 11. These modes can be explained as a changing duty cycle as engine load changes. The EMS 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.

MODE 12 PWM IDLE CONTROL

This function has three modes, OFF, MANUAL and AUTO. Auto is not supported in this version. Many of the adjusting screens are associated with auto so they too should be ignored. They are "IDLE SPD" "NO STALL" "DECAY" "GAIN" and "GAIN TMR". In manual mode the EMS ECU will perform feed forward idle speed control.

BASE STEPS

This is the base duty cycle which would feed the idle valve. The larger the base steps 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 eg. 900 RPM.

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

BASESTEP% 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 base steps. Example if base steps were set at 160, and the 650 RPM site was set to 15, this would effectively increase the base steps if the engine was at 650 RPM to approx. 180 which would in turn open the idle valve by 15%. A -15% value would close the valve by 15%.

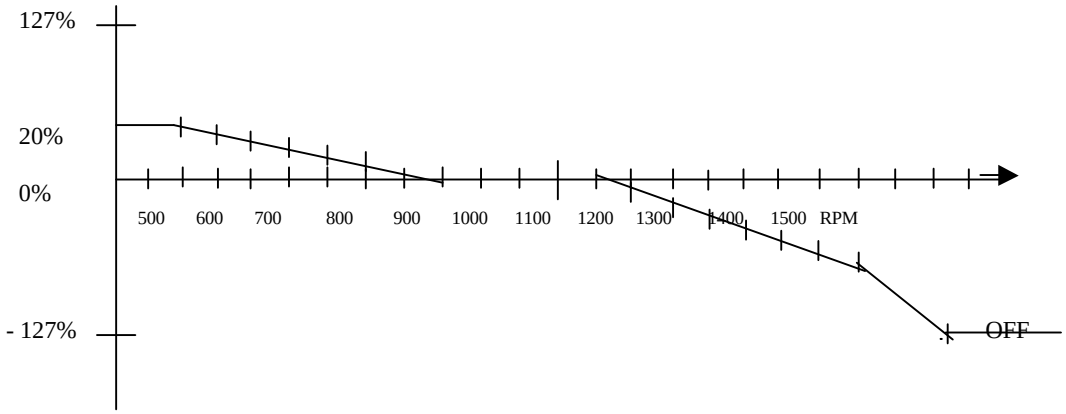
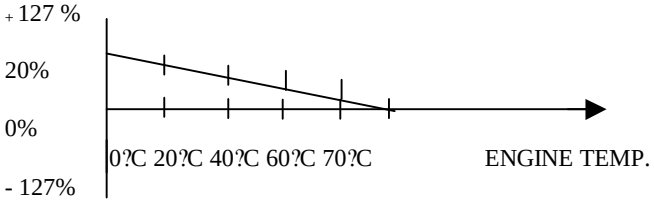


Fig. E shows you a typical configuration for the base steps % RPM sites. Example if idle was set to 900 RPM via the base steps, the RPM sites would continually increase valve opening as the RPM would drop below 850 RPM and close the valve as the rpm would increase above 1050 RPM. Speeds above 1500 RPM would hold the 1500RPM value and speeds below 500 RPM would hold 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 base steps every 20 ?C from 0?C to 70?C. Below 0?C the ECU will hold 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 base steps and the base steps % sites are tuned while the engine is hot.



REV ACT FOR PWM

The Reverse Acting function while a PWM function is set will reverse the duty cycle output of the computer. This function is needed when a valve (eg. 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.

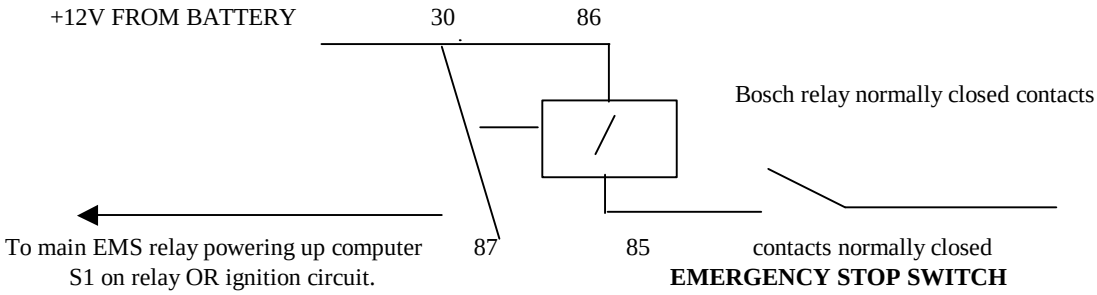
TURBO TIMER

To enable the turbo timer use 1 of the 4 Aux. Outputs and select mode 7 and ENTER. Press the NXT button and screen REV ACT will appear, this is set to ON if using a relay that works backwards (normally closed). This screen should read OFF For most relays, press the NXT button again and the TIME page will appear, select the minutes /seconds by using the ? arrow button until the time required has been reached and ENTER. The time function is now set and the computer will keep the output on for the amount of time selected in this TIME page.

USING TIMER FUNCTION

ENTER the ENT TMR page and press the ENTER button then turn off ignition. The time select in the Aux. O/p chosen will appear on the bottom of the screen and will start counting down in 5 sec. Intervals until it reads 00:00 then your engine will turn off.

WIRING UP FOR TIMER



SPECIAL MODES (S/MODES)
S/Mode 00
Selecting mode 00 turns off special modes.

S/Mode 01
Mode 01 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 energise 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.

S/MODE 02
This mode selects boost enhancement for drag cars when throttle is open. 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) (See Ign. Fire Mode 01)

FUEL TRIM
This will change fuel injected $\pm$ % of what would normally be injected. Normally + %.

IGN. TRIM
This will change the Ign. timing by $\pm$ % of what would normally be - %.

TRIGGERING/IGNITION SYSTEM

Your QI-4 ECU is equipped with very advanced electronics and software which form a very flexible triggering system suited to most engines.
For the QM-4/QI-4 ECU's to operate in harmony with your engine, there are 10 parameters that must be set correctly in the set up section.

These are:-

1)	Trigger Sensor	2)	Sync Sensor
3)	Trigger Edge	4)	Sync Edge
5)	Ign. Fire Edge	6)	Cylinders
7)	Ign. Type	8)	Trigg/Cyc
9)	Igniters	10)	Dwell

TRIGGER AND SYNC SENSORS (1 & 2)

The QM-4/QI-4 ECU's are fitted with intelligent auto tracking magnet and hall/optical electronic circuitry. Depending on what type of sensor is connected to the trigger and sync input wires, the corresponding selection must be made under trigger sensor and sync sensor set up pages. You may select either.

1) Mag. - If a magnetic sensor is connected
2) Hall- If either a hall or optical sensor is connected

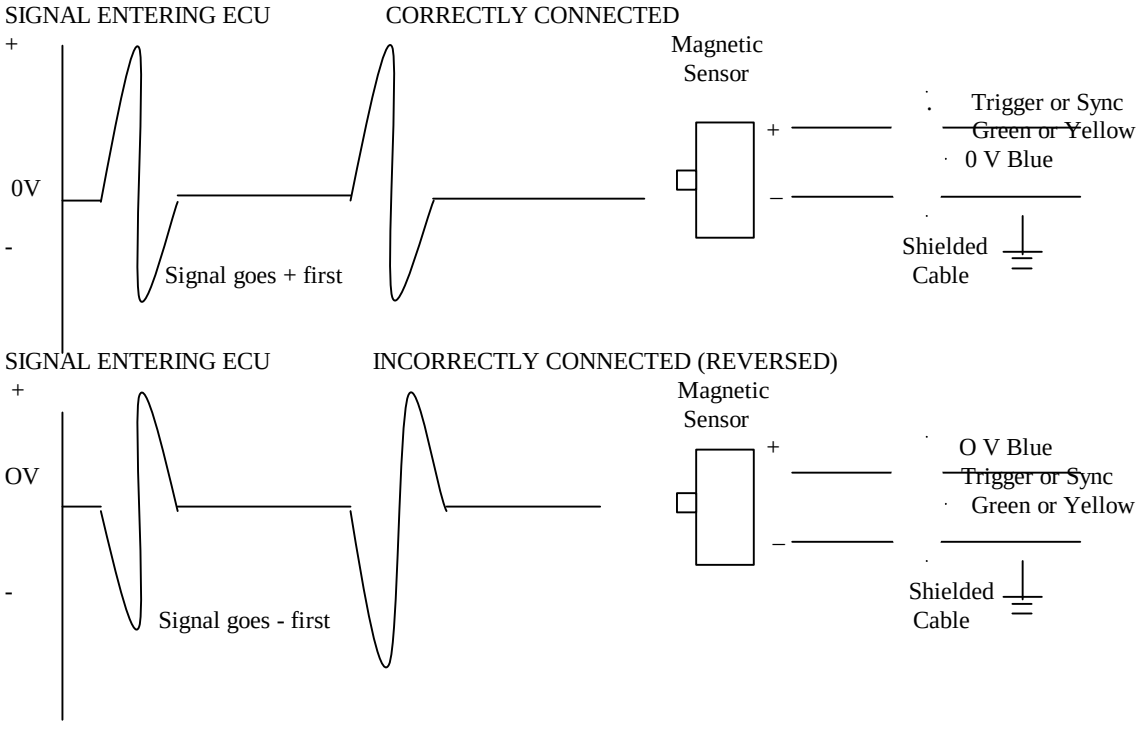
NOTE: When Hall/Optical is selected the ECU circuitry will enable an internal pull up resistor, so external pull ups are not required.

TRIGGER AND SYNC EDGES (3 & 4)

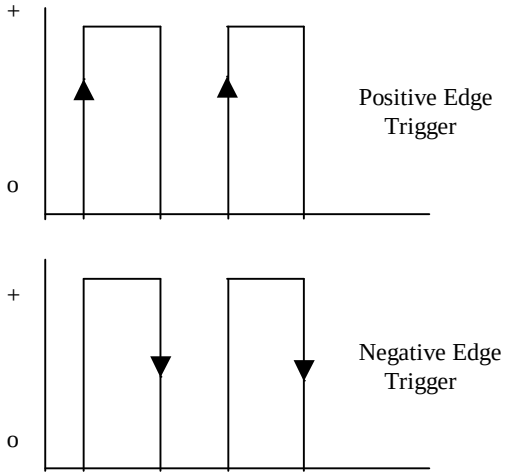
The ECU software is designed to accept both rising and falling edges from the trigger and sync sensors.

1) + Edge
2) - Edge

NOTE: If using magnetic sensors select ONLY + Edge. Also magnetic sensors must be connected with the correct polarity.



When using Hall or optical sensors for the trigger select the edge that results in the most desirable static Ign. Timing.



TRIGGER SENSOR SIGNAL

With "TRIG/CYC' set to 00, the ECU is expecting to receive 1 positive or negative going edge for each cylinder fire, at equal spacing.
Eg. 4 cyl = 4 teeth / engine cycle
1 engine cycle = 1 distributor revolution OR
1 engine cycle = 2 crank shaft revolutions

So a 4 cyl would have 4 teeth in its distributor or if using a crank trigger would have 2 teeth on the crank shaft.
Eg. Trigger sensor in distributor or Trigger sensor on crank shaft

Trig/cyc set to 00	Teeth in Distributor	OR	Teeth on Crank
1 cyl	1		-
2 cyl	2		1
3 cyl	3		-
4 cyl	4		2
5 cyl	5		-
6 cyl	6		3
8 cyl	8		4
10 cyl	10		5
12 cyl	12		6
16 cyl	16		8

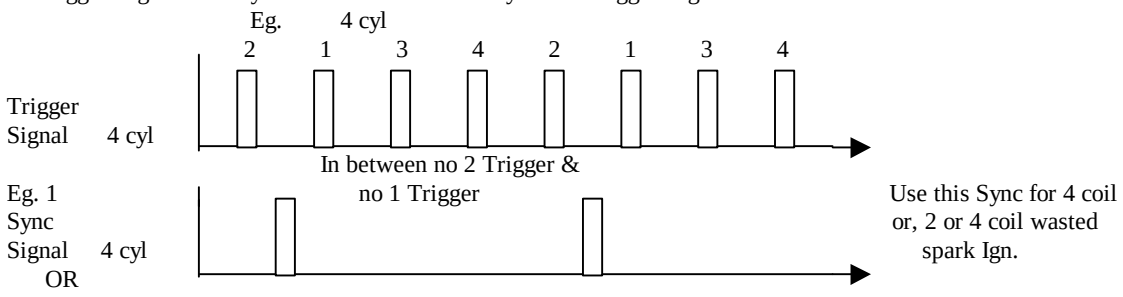
These teeth must be equally spaced and be positioned so that the selected edge (see trig & sync edges) occurs when the engine is approx. 0° BTDC → 20° BTDC Depending on engine requirements (normally 10° BTDC). The ECU will use this static timing position to fire the Ign. spark when engine is cranking and up to 400 RPM. After this speed, the ECU will calculate the timing using the user adjustable Ign. Timing maps. The ECU uses the trigger static timing edge as the minimum timing advance point, ie., the ECU will not retard the Ign. spark past the trigger static timing point.

With most engines using 1 Ign. coil and a distributor the "Sync" sensor is not required (see "Sync Sensor Signal"). For special Ign. types or more trigger teeth than explained see "Ign. Types" and "Trig/cyc" sections.

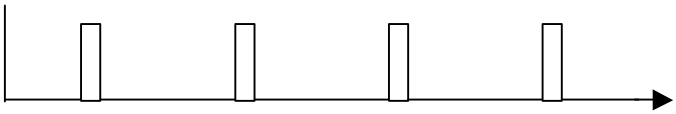
SYNC SENSOR SIGNAL

The sync sensor signal is required when firing sequential coils or coil packs. It is also required when firing 1 coil with a distributor if more than the expected amount of trigger teeth is present (see "Trig/cyc" and "Ign. type" sections).

For normal sequential Ign. systems the sync timing signal edge (see trig and sync edges) must occur before the trigger edge of no 1 cylinder and after the last cylinder's trigger edge.



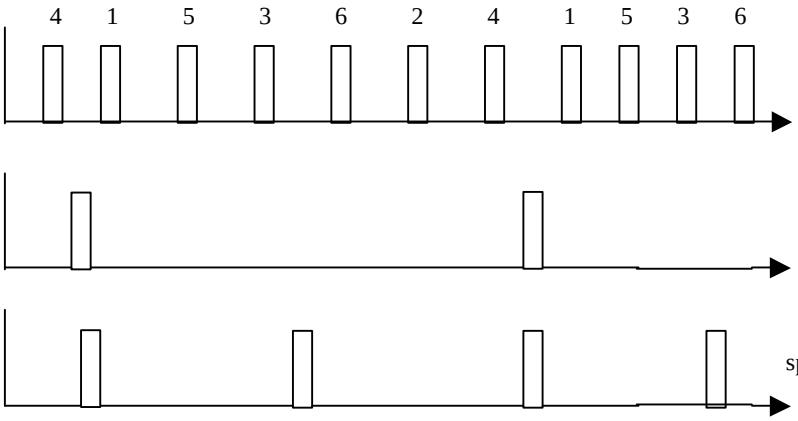
Eg. 2
Sync
Signal 4 cyl
Wasted spark



Use this Sync for
2 or 4 coil wasted
spark ONLY

Both sync schemes are supported for sequential wasted spark set ups but only sync eg. 1 would be used to Sequentially fire 4 separate coils in firing order.

Eg. 6 cyl

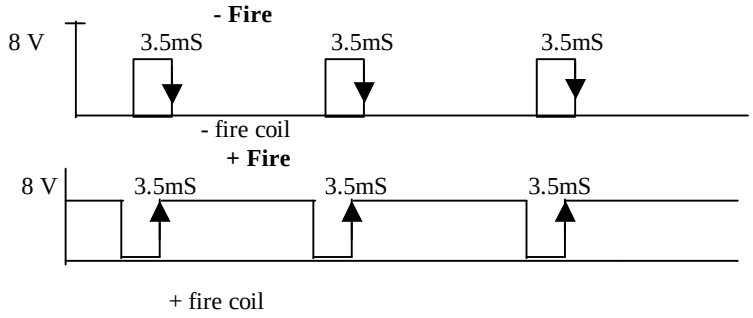


Both sync schemes are supported with sequential wasted Ign. spark set ups.

IGN. FIRE EDGE (5)

The EMS ECU software allows for selection of Ign. module fire edge selection. It is very important to select the correct firing edge for the specific type of Ign. module (Igniter) being used. Most Igniters use - Fire edge and only some use + Fire. Incorrect selection of fire edge will result in overheating of igniter and Ign. coil or maybe even Ign. system failure if Ign. key is left on.

ECU Output signal with 3.5 mS Dwell Selected



If unsure see specific engine electrical schematics for more information or contact your local EMS Dealer.

CYLINDERS (6)

The QM-4/QI-4 ECU's use the cylinders number to help calculate Ign. timing, RPM and Dividing of Multi-Tooth Trigger's.

Set this to the amount of cylinders or double this setting for 2 stroke engines.
For 2 Rotor Rotaries select 4 Cyl.
For 3 Rotor Rotaries select 6 Cyl.

IGN. TYPE (7)

The QI-4 ECU has five Ign. type selections.

Ign. type 00 (Normal Ign)
This selection is used for normal Ign. types with the same number or trigger teeth/cycle as cylinders (see Trigger sensor signal) used for both distributors and direct fire Ignition.

Type 00 is also used when more teeth/cycle (trig/cyc) are present.

Eg. 24 teeth/cycle (see trig/cyc) section.

Ign. type 01 (special Nissan Ign. 1)

Type 01 is used when the ECU is connected to 4 & 6 cyl Nissans with 360° optical cam mounted crank angle sensors. These engines all have sequential coils/coil packs. Both the trigger and sync input wires must be connected for this mode to function (see schematics). In conjunction with this special mode set Trigger edge +, Sync edge +, Trigger Hall, Sync Hall,. If using Nissan Igniters set - Fire. If individual Nissan coils on plugs set Dwell to 1.75mS Trig/cyc = 00

4 cyl set Igniters to 2 (wasted spark)
6 cyl set Igniters to 3 (wasted spark)

Nissan set the position of this sensor to give the standard Nissan ECU a + Trigger edge at ? 60° BTDC. This value is too far advanced for the QI-4, to obtain approx. 10° BTDC + Trigger edge, rotate the crank angle sensor 25° clockwise cam to retard the + edge trigger signal by 50° crank to 10° BTDC crank.

Fault Diagnosis of Nissan Ign. type 01.

1 If no RPM reading on screen when cranking, check the trigger wire and crank angle for for correct supply and connections (ECU is not receiving trigger signal).

2 If only firing Ign. o/p no. 2 every trigger pulse, check sync wire and crank angle for correct connection and supply (ECU is not receiving sync signal).

In both the above check that trigger and sync is selected to hall and + edge.

Ign. type 02 (Nissan 360° Distributor)

This mode is only used when the Nissan engine is fitted with a distributor AND is to be modified to use sequential coils (wasted spark). This 360° optical disc has different size slots and selecting type 01 will result in incorrect operation. Again the distributor must be repositioned (25°) retarded from the standard position to give the QI-4 10° BTDC trigger (for sensor edges & type etc. see type 01).

DO NOT USE type 02 if 1 coil and distributor utilised. Use type 00 and DO NOT connect the sync wire.

Ign. type 03 (Subaru -Boxer-Impreza)

This is a special Ign. mode to suit Subaru flat 4 cylinders. Both the crankshaft (Trigger sensor) and the camshaft (Sync sensor) have staggered uneven teeth and need special ECU calculations to determine crankshaft position

Select	Trigg	Sync
	Mag	Mag
	+ Edge	+ Edge

If standard Igniters are used select (- Fire), 2 Igniters and 3.5 mS Dwell. (Wasted spark only).
Trig/cyl = 00 4 cyl Ign. type 03

Ign. type 04 (Mazda rotary crank angle

This is used with 2 & 3 rotor rotary engines. It is used when 24 tooth + 2 crank angle sensor is used on 2 & 3 rotor engines. Also when 12 + 1 crank angle trigger is fitted to crankshaft eg. Series 6.

In this mode the first trigger tooth after the sync tooth, is accepted as the trigger static timing point.
Eg. At 0° to 15° BTDC the crank angle should be positioned so the trigger sensor is inline with the first trigger tooth after the sync has passed.

Select Trigger Magnetic, Sync Magnetic, Trig + Edge, Sync + Edge, Trig/cyc = 24.

2 Rotor - 4 cyl - 2 Igniters
3 Rotor - 6 cyl - 3 Igniters

Ign. type 05
Not Implemented

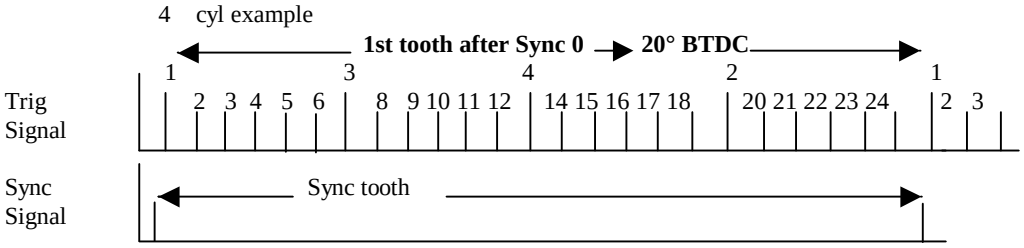
TRIGG/CYC (8)

In normal Trigger set ups this would be set to 00 where 1 trigger pulse is sent to the ECU for every cylinder fire (see trigger sensor signal) section.

In many cases there are more trigger teeth than cylinders firing and trig/cyc must be set so that the ECU can divide down to 1 trig/fire. Eg. Toyota 24 tooth in 4 & 6 & V8 engines If 24 tooth with 4 cyl setting the ECU will perform a divide by 6 calculation to find the teeth that represent 10° BTDC trigger teeth 24/6 = 4

6 cyl = 24/4 = 6

8 cyl = 24/3 = 8



In all cases when Ign. type is 00, the trig/cyc trigger teeth must be spaced evenly and must contain a number of teeth that can be divided down with full numbers (not fraction or numbers) to equal the cylinders

eg. Cylinders	Teeth/cycle
4 cyl	8 teeth, 12 teeth, 16 teeth, 20 teeth, 24 teeth
6 cyl	12 teeth, 18 teeth, 24 teeth
8 cyl	16 teeth, 24 teeth
12 cyl	24 teeth

24 teeth would be the best choice as it can be used with most common cylinder selections. Also when using trig/cyc with Ign. type 00 the FIRST trigger tooth after the sync tooth has passed is taken to ? 10° BTDC trigger tooth.

Trig/cyc should be set to 24 when using Ign. type 04 for rotaries.

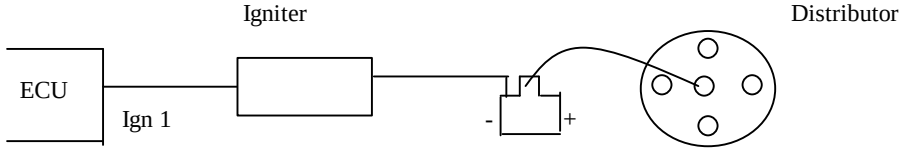
For Ign. type 01, 02, 03, set trig/cyc to 00.

IGNITERS (9)

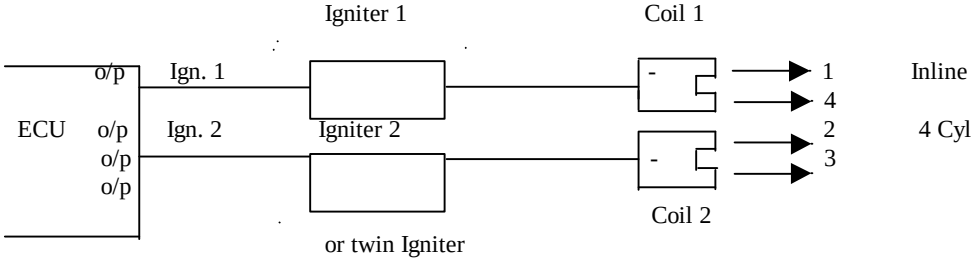
The QI-4 ECU has 4 Ignition outputs as standard. This selection tells the ECU how it should sequence these outputs. If set to 1, the ECU will control Ignition no 1 output only. This setting would be used when 1 coil is used and fed into a distributor for spark distribution. Settings 2, 3 & 4 are used when the ECU is required to perform sequential Ign. firing.

Igniter Setting	Amount of Cyl's	Type of Distribution
1	1,2,3,4,5,6,8,10,12,16	Distributor
2	2	Sequential Fire
2	4	Sequential Wasted Spark
2	8	Sequential Twin Distributor
3	3	Sequential Fire
3	6	Sequential Wasted Spark
4	4	Sequential Fire
4	8	Sequential Wasted Spark

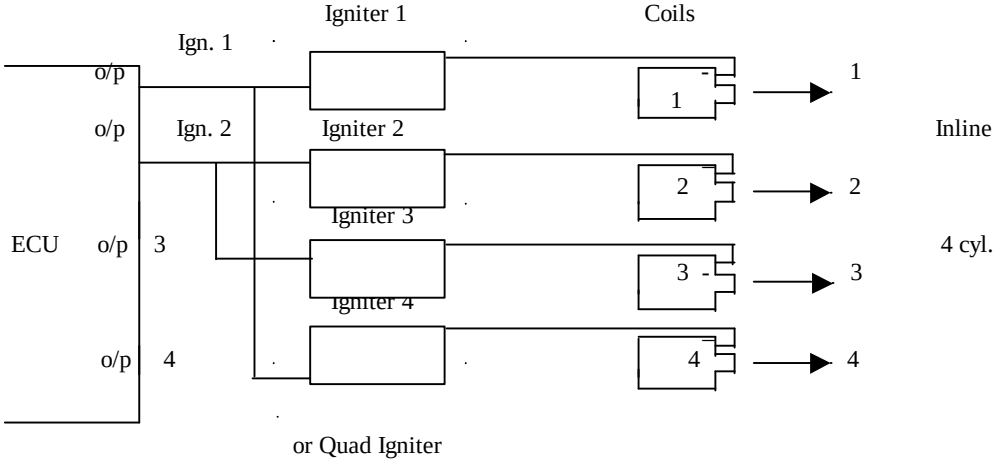
Eg. of 4 cyl Ign. set ups with 1 Igniter setting



Eg. 4 cyl 2 Igniters wasted spark 2 double coils



Eg. 4 cyl 2 Igniters setting wasted spark 4 single coils



or Quad Igniter

ECU firing 2 o/p's will in turn fire cyl.s 1 & 4 then 2 & 3.

These 4 cyl examples can be expanded to suit 6 & 8 cyl engines using ignition o/p's 3 & 4 as well. Special Ign. types are designed to function in a dedicated format and is not completely flexible with the selection of the amount of igniters.

Ign. type 01 & 02 Nissan 360°

These types are designed to function as wasted spark ONLY.
Eg. 4 cyl must select 2 igniters
6 cyl must select 3 igniters

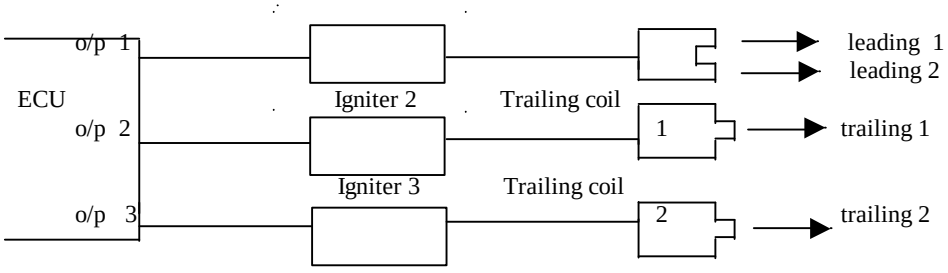
Ign. type 03 WRX (Impreza)

This is designed with flat 4 engines and must have 2 igniters selected. This will perform wasted spark Ign. set up.
Ign. type 04 Mazda 24 Tooth + 2

This Ign. type is for 2 & 3 Rotor engines.
2 Rotor select 2 Igniters.
* 3 Rotor select 3 Igniters.

Even though 2 Igniters are selected the ECU will fire Ignition outputs 1, 2 & 3.

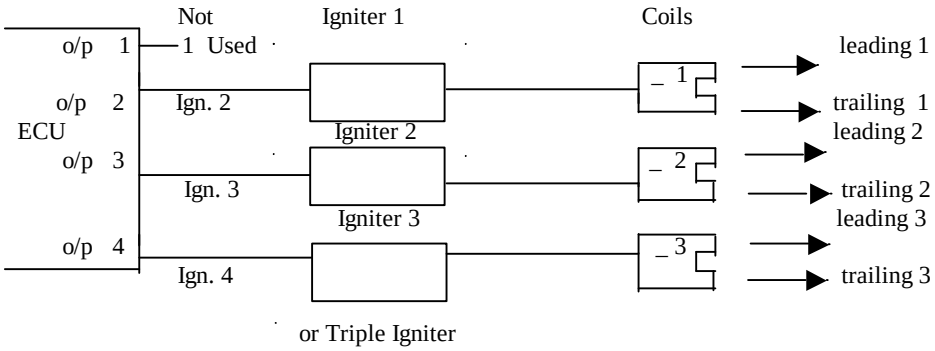
Eg.



or Triple Igniter

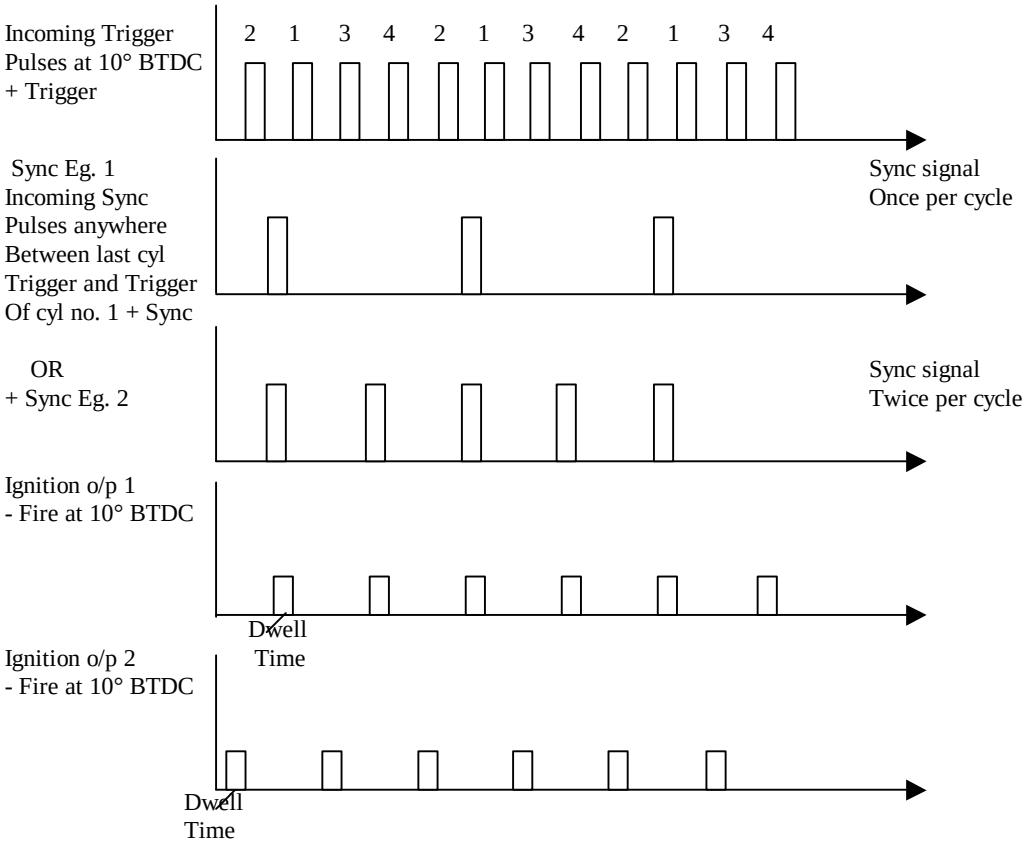
* 3 Rotor - when 3 Igniters are selected the ECU will fire Ign. 2, Ign. 3, Ign.4, DO NOT USE IGNITION O/P 1.

Eg. of Ign.



In all sequential coil applications (when other than 1 Igniter is selected) the ECU is expected to receive a sync signal before it commences to fire it's Ignition o/p's. This sync signal tells the ECU that the next Trigger pulse is the static timing point for cylinder no1.

4 cyl Acceptable sync waveforms to perform wasted spark (2 Igniters)



If 4 cyl 4 Igniter set up, only sync eg. no 1can be used sending 1 sync pulse/cycle. 6 cyl & 8 cyl waste spark Ignition configurations can utilise either 1 sync/cycle or 2 sync's/cycle.

DWELL (10)

The QI-4 ECU is designed with an adjustable dwell time feature. The dwell is a function of time and not engine degrees. There are two modern types of Ignition systems available.

1) Inductive Ignition
Modern Inductive Ignition systems function similar to the old points type ignitions with 3 distinct differences.

1st the ballast resistor is omitted.
2nd the coil primary inductance (resistance) is much lower allowing for more rapid coil charge up time (time required for coil internal magnetic field saturation). Typically 0.45? to 1.2? . primary resistance.
3rd the points & condenser's are replaced with a high power computer controlled Igniter.

Inductive Ignition systems work very well and are found on nearly all production produced motor vehicles. This system is normally satisfactory but has limitations on high revving 6 & 8 cyl engines & on turbo engines producing greater than ?103 Kpa (15psi) boost. The dwell time is the charge time of the coil. Depending on the coil design, it would range from 1.75mS on Nissan coil on plug set ups, to 5mS on slower coils, typically coils charge at 3.5mS. On this type of Ignition system it is important to set both the correct coil dwell time and Ign. fire edge (see Ign fire edge for wave form examples) or Igniter and coil will overheat and may even fail.

2) Capacitor discharge Ignition (CDI)

CDI is a high performance Ignition system mainly used in racing. It is particularly good in high boost and 6 & 8 cyl high revving applications or where non standard fuels are used eg. Methanol. The CDI functions by charging an internal capacitor with 300+ Volts very rapidly (typically 1mS) and then blasting this voltage onto the Ignition coil. This results in a very high energy short duration spark.

For CDI systems eg. MSD or M & W Ignitions it is important that only the CDI systems wires and NO OTHERS are connected to the coils + & - terminals eg. Tachos, etc. When using CDI systems hold the down arrow adjustment button until no dwell is displayed and press enter. These systems do not need intelligent computer dwell control and thus this setting will result in a 50% duty waveform to be outputted.

DEFINITIONS

EMS	Engine Management Systems
QM4	Fuel only System
QI4	Fuel and Ignition System
mm	Millimetres
dia	Diameter
deg	Degrees
BSP	British standard pipe (Taper)
Temp	Temperature
eg	Example
BTDC	Before top-dead centre
Ref	Refer
RPM	Revs per minute
REV	Revolution
cyc	Cycle
cyl	Cylinder
mS	Milliseconds
C	Celsius
V	Volts
Batt	Battery
Ign AdvIgnition	
kpa	kilo pascals
Inj	Injector
F/P	Fuel Pump
A/T	Air Temperature
W/T	Water Temperature
C	Coil
L	Logic
T/P	Throttle position
l/Load	Light Load
DFI	Direct Fire Ignition
NXT	Next
MOV	Move
ADJ	Adjust
PREV	Previous
SYNC	Synchronisation
Pwm	Pulse width modulated
Mag	Magnetic
HZ	Hertz
Tps	Throttle position sensor

INDEX