

IgnitionLink

Digital Multi-Coil Ignition with
Closed Loop Knock Control

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1. INTRODUCTION

The Speed Density Principle

In order to inject the correct amount of ignition, the Link Engine Management System must calculate the mass air flow of the engine and convert this air flow signal into ignition advance.

The amount of air an engine is processing at any particular time depends on two main factors:

1. **Engine Speed.** The mass air flow increases in direct proportion to engine speed assuming all other factors are constant.
2. **Cylinder Air Density.** A measure of the air density in the cylinder when the inlet valve/port has just closed.

Determining the Speed

Engine R.P.M. is easily measured by feeding pulses from the triggering system to the Link Engine Management System. This pulse rate in conjunction with the CYLINDER setting determines the ignition advance. This pulse also supplies information for the computer's zoning and RPM limit functions.

Determining the Density

Direct measurement of cylinder air density is not practical, but may be calculated by measuring the inlet manifold air density and applying a correct value. The manifold air density is determined (normally) by measuring manifold air pressure (MAP) with a pressure transducer. The correction factor between manifold density and cylinder density (Volumetric Efficiency, V.E.) is found by the Link Engine Management System looking up a table in its memory and doing a series of mathematical calculations. This table (Zone Ignition) consists of 96 zones each covering a narrow operating range. Each zone may be individually or group programmed to suit the application. In some cases (e.g. performance cams), manifold

air pressure may not give an accurate indication of air density due to reversion flow out of the inlet ports. An alternative scheme is to measure the degree of throttle opening with a rotary position sensor. This mode, throttle position scheduling (TPS) is covered in detail in Section Ten.

2. IGNITIONLINK FEATURES

The IgnitionLink offers the following features:

- 8 Ignition Drives for distributed or Multi-Coil applications
- Dual Input Knock Control for Ignition retard.
- Tacho Drive or Shift Light Option
- Auxiliary input for TPS mixed mode scheduling or launch control

3. SYSTEM INSTALLATION

This section describes how to connect all the IgnitionLink functions, remembering that the required connections will depend on the application. Read this section carefully to ensure the correct devices are connected.

i) IgnitionLink Installation

The IgnitionLink Engine Management System may be installed virtually anywhere but the following precautions must be observed.

1. Avoid areas of high ambient temperature such as exhausts and radiators etc. Preferably mount the unit inside the vehicle cabin. It is preferable that the unit is removable with sufficient cable length so that tuning may be performed while the vehicle is in motion.
2. If water immersion or spray is likely, additional protection may be necessary. Several brands of self sealing plastic may be employed here (e.g. Tupperware), particularly for marine applications.
3. Maintain maximum distance from radio transmitters and co-axial cables etc, where fitted. NEVER place next to an igniter module.
4. Four M3 tapped holes in the sides of the enclosure provide a mounting point for brackets etc. DO NOT drill holes in the case, as this will probably cause internal damage.
5. The MAP sensor (inside the ECU) MUST be connected to a source of vacuum (and pressure for turbo applications) via a suitable length of 3..4 mm vacuum hose. The fuel pressure regulator air pressure port is usually a good source of vacuum pressure.

ii) Breakout Loom

The IgnitionLink can be supplied with either a 2 or 5 metre breakout loom, used to connect various engine sensors and hardware devices. Some connections are made directly to the relevant device, while others require some form of interface such as a relay. Figure 3.0 illustrates the main header layout (& wire colours) when looking into the IgnitionLink connector.

Wire Side -								
Ign 3 Blue / White	Ign 7 Blue / Yellow	Ign 4 Blue / Brown	Ign8 Blue / Green		Sync Black (Screen)	Cyl White (Screen)	Knk 2 Yellow (Screen)	Aux White / Blue
Ign 1 Blue	Ign 5 Blue / Red	Ign 2 Blue / Black	Ign 6 Blue / Orange	Drive A Brown / Black	+12 V Red	Ground Black	Knock1 Orange (Screen)	+5V Red / Blue

Pin Configuration Wire Colour Wire Size

- IG1 Blue 0.5
- IG2 Blue / Black 0.5
- IG3 Blue / White 0.5
- IG4 Blue / Brown 0.5
- IG5 Blue / Red 0.5
- IG6 Blue / Orange 0.5
- IG7 Blue / Yellow 0.5
- IG8 Blue / Green 0.5
- Sync Black Shielded Cable
- Cyl White Shielded Cable
- Knk 1st Orange Shielded Cable
- Knk 2nd Yellow Shielded Cable
- +12V Red 0.85

Figure 3.0 IgnitionLink Header

iii) Calculating Firing Sequence

The firing sequence is a standard pattern containing all cylinders in a specific order. The maximum length is 8 digits. It will only require calculation for multi-coil applications. The first digit represents the 1st cylinder in the firing sequence and the second digit represents the 2nd cylinder in the firing sequence etc. Using this pattern the Ignition drives can be wired, as shown in Table 3.0.

Firing Sequence Position	Ignition Drive
1st Cylinder	Ign 1
2nd Cylinder	Ign 2
3rd Cylinder	Ign 3
4th Cylinder	Ign 4
5th Cylinder	Ign 5
6th Cylinder	Ign 6
7th Cylinder	Ign 7
8th Cylinder	Ign 8

Table 3.0

This firing sequence **MUST** be followed when wiring the IgnitionLink, as the software bases ignition timing on this pattern. Failure to do this will result in incorrect multi-coil operation.

Definition

By definition the firing sequence is merely a shuffle of the firing order. The first cylinder to reach TDC (on compression stroke) after the synchronisation signal now becomes the 1st cylinder in the firing sequence. The next cylinder to arrive at TDC becomes the 2nd cylinder in the firing sequence and so on. The following two parameters are therefore required to correctly determine the firing sequence.

- The firing order of the engine.
- The position of the Synchronisation (Sync) signal. On some applications this information will not be obvious,

so refer to the application specific information at the rear of this manual.

The following examples will help clarify this.

Example 1. 4 -Cylinder engine

Firing order: 1-4-3-2

- (a) Sync Position: Between cylinders 4 and 3 on the camshaft.

The 1st cylinder to reach TDC after the sync pulse is cylinder 3, resulting in a firing sequence 3-2-1-4. See Table 3.1(a)

Firing Sequence Position	Cylinder	Ignition Drive
1st	3	Ign 1
2nd	2	Ign 2
3rd	1	Ign 3
4th	4	Ign 4

Table 3.1(a)

- (b) Sync Position: Between cylinders 3 and 2 on the camshaft.

The first cylinder to reach TDC after the sync pulse is cylinder 2. The firing sequence is 2-1-4-3. See table 3.1 (b)

Firing Sequence Position	Cylinder	Ignition Drive
1st	2	Ign 1
2nd	1	Ign 2
3rd	4	Ign 3
4th	3	Ign 4

Table 3.1(b)

Examples a) & b) use the sync referenced to the camshaft, producing one pulse per engine cycle. If positioned on the crankshaft, two sync pulses per engine cycle will be generated. See example c).

- c) A sync signal on the crankshaft occurring between 1-4 and 3-2. The firing sequence can therefore be 4-3-2-1 OR 1-4-3-2. See tables 3.1 (c) and (d).

Firing Sequence Position	Cylinder	Ign Drive	Position	Cylinder	Ign Drive
1st	3	Ign 1	1st	1	Ign 1
2nd	2	Ign 2	2nd	4	Ign 2
3rd	1	Ign 1	3rd	3	Ign 1
4th	4	Ign 2	4th	2	Ign 2

Tables 3.1 (c) , (d)

Note - Part c) will only apply to Multi-Coil Wasted Spark setup.

3.1 Ignition

The IgnitionLink offers 8 Ignition drives which can be configured from a basic distributor setup through to the more complex Multi-Coil arrangements. Table 3.2 illustrates wire colours.

Ignition		
Ign 1	Blue	0.5
Ign 2	Blue/Black	0.5
Ign 3	Blue/White	0.5
Ign 4	Blue/Brown	0.5
Ign 5	Blue/Red	0.5
Ign 6	Blue/Orange	0.5
Ign 7	Blue/Yellow	0.5
Ign 8	Blue/Green	0.5

Table 3.2 Ignition Wire Colours.



DO NOT connect the ignition drives directly to ground, as this will cause permanent damage.

Before beginning any wiring, read Section 4 on Ignition. This provides information on the different configurations and the hardware requirements to make them run.

3.1.1 Igniter Mounting

Igniter(s) must be mounted well clear of the Link ECU, preferably under the bonnet, next to the coil(s). **DO NOT** mount inside the passenger compartment. If vibration levels are high, some form of soft or rubber mounting is advisable to prevent component and wiring metal fatigue (foam rubber blocks are recommended).

3.1.2 Ignition Suppression

The IgnitionLink employs very high-speed processors, which will behave erratically if subjected to strong radiated electromagnetic fields. These fields are generated by unsuppressed H.T. leads, which act as aerials and radiate very powerful interference signals.

ALL applications must use suppression (resistance) leads.

ALL applications must employ a suppressor capacitor connected directly to the ignition coil(s) **POSITIVE** terminal (0.5 - 1.0 micro farad's (most points condensers are suitable)).

3.2 Distributor

A distributed engine requires one single channel igniter. Connection to the IgnitionLink Ignition drives will depend on the type of signal required to control the Igniter.

IGN 1 (Blue). This drive uses the conventional signal polarity to control ignition. A positive voltage on this pin will place the coil in dwell mode (i.e. Coil charging). The transition from positive to ground will switch the coil off, resulting in spark. All Link Igniters use this method. Use Ignition Drive 1 and connect as shown in Figure 3.2(a). The Link Igniter is used for illustration purposes. Most factory igniters can be used.

Some factory igniters such as Honda and some Ford devices use the opposite polarity. Dwell occurs when the signal is at ground, producing spark on the transition from 0V to positive supply. The IgnitionLink requires hardware modifications to allow this configuration to run. Continue to use Ign Drive 1 as shown in Figure 3.2 (a).



Figure 3.2 (a). Distributor setup with conventional igniter signal (Ign).

3.3 Multi-Coil: Direct Spark

This section provides wiring information on the range of direct spark applications available with the IgnitionLink. There are 8 ignition drives allowing 8 individual coils to be controlled. It is therefore important these drives are matched to control the correct cylinders. This is achieved by determining the firing sequence, and wiring to this pattern.

The first ignition drive is labelled “IGN 1”. This drive will control the ignition on the first cylinder in the firing sequence. The ignition drive labelled “IGN 2” should be connected to the second cylinder in the firing sequence (i.e. 2nd cylinder positioned after the sync pulse). Table 3.3 summaries this for a range of cylinders. The left-hand column is the position of the cylinder with respect to the sync pulse. The 1st represents the first cylinder in the firing sequence, the 2nd represents the second cylinder in the firing sequence and so on. Refer to section 3.3.1 for examples.

Firing Sequence	Cylinder Number					
	2	3	4	5	6	8
1st	Ign 1	Ign 1	Ign 1	Ign 1	Ign 1	Ign 1
2nd	Ign 2	Ign 2	Ign 2	Ign 2	Ign 2	Ign 2
3rd		Ign 3	Ign 3	Ign 3	Ign 3	Ign 3
4th			Ign 4	Ign 4	Ign 4	Ign 4
5th				Ign 5	Ign 5	Ign 5
6th					Ign 6	Ign 6
7th						Ign 7
8th						Ign 8

Table 3.3

3.3.1 Wiring Example

(a) Direct Spark setup for an 8 cylinder Nissan VH45.

Firing order: 1-8-7-3-6-5-4-2.

Sync Position: Between cylinders 2 - 1 on the camshaft.

Cylinder 1 is the first cylinder to reach TDC (compression stroke) after the sync signal. The firing sequence will begin with cylinder 1 resulting in the following sequence 1-8-7-3-6-5-4-2. Table 3.4 illustrates the correct wiring.

Firing Sequence Position	Cylinder	Ignition Drive
1st	1	Ign 1
2nd	8	Ign 2
3rd	7	Ign 3
4th	3	Ign 4
5th	6	Ign 5
6th	5	Ign 6
7th	4	Ign 7
8th	2	Ign 8

Table 3.4

(B) Direct Spark setup for an 8 cylinder.

Typical firing order: 1-8-4-3-6-5-7-2.

Sync Position: Between cylinders 7 - 2 on the camshaft.

Cylinder 2 is the first cylinder to reach TDC after the sync signal. The firing sequence will therefore begin with cylinder 2 resulting in the sequence 2-1-8-4-3-6-5-7. Table 3.5 illustrates the correct wiring.

Firing Sequence Position	Cylinder	Ignition Drive
1st	2	Ign 1
2nd	1	Ign 2
3rd	8	Ign 3
4th	4	Ign 4
5th	3	Ign 5
6th	6	Ign 6
7th	5	Ign 7
8th	7	Ign 8

Table 3.5

3.3.2 General Installation Guide

The following examples provide a general guide to direct spark installation. The label “coil 1st” represents the first cylinder in the firing sequence, “coil 2nd” represents the second cylinder in the firing sequence etc. All setups show the Link Igniter module, although most factory igniters can be used.

- 3 Cylinder

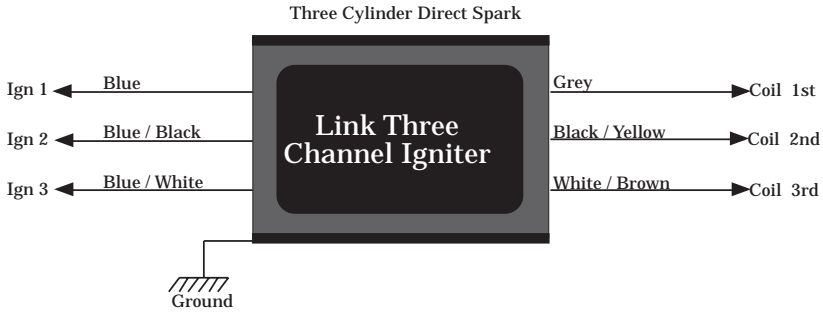


Figure 3.3

- 4 Cylinder

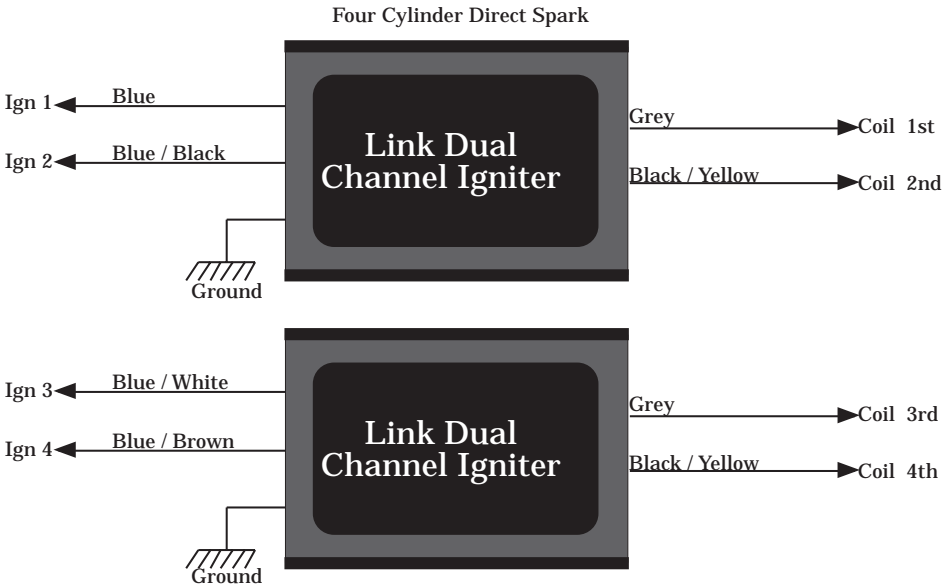


Figure 3.4

- 5 Cylinder

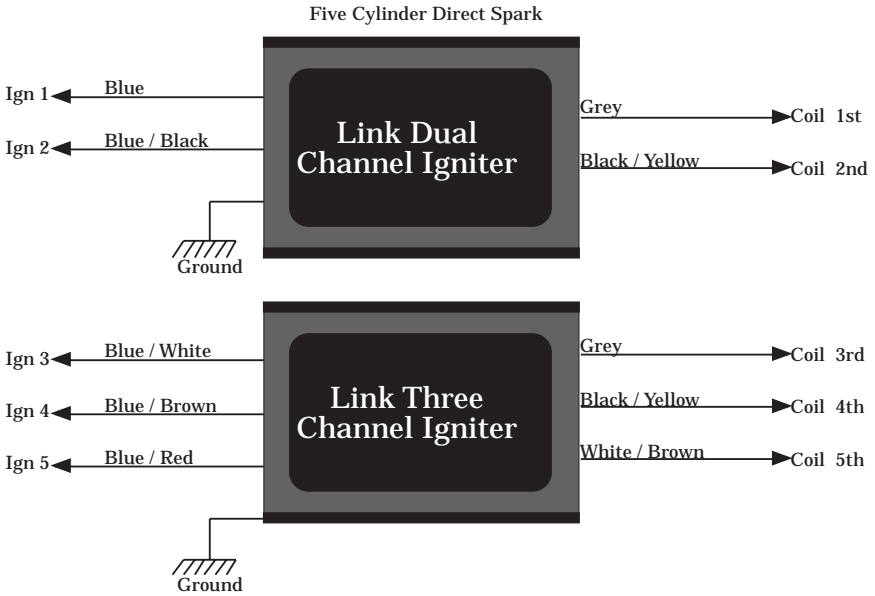


Figure 3.5

- 6 Cylinder

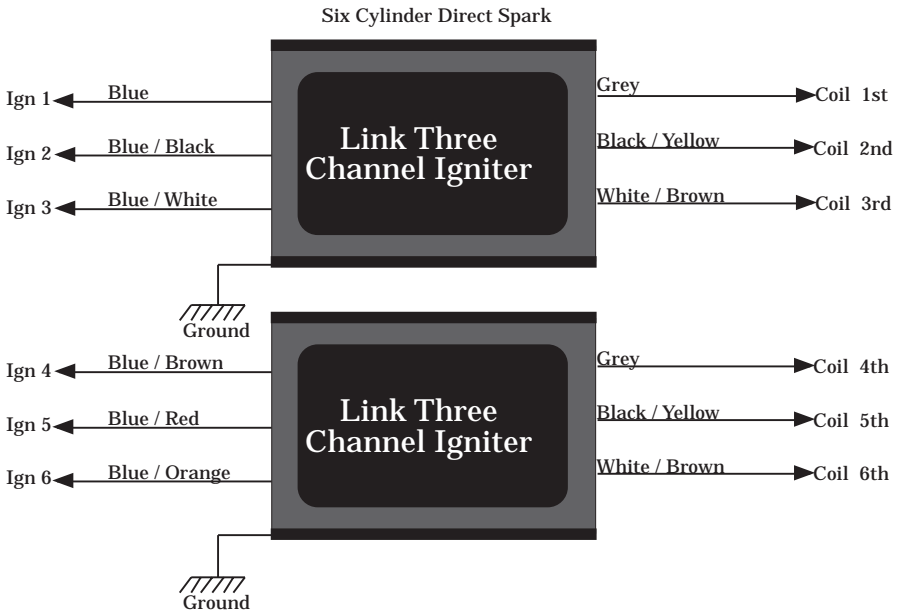


Figure 3.6

- 8 Cylinder

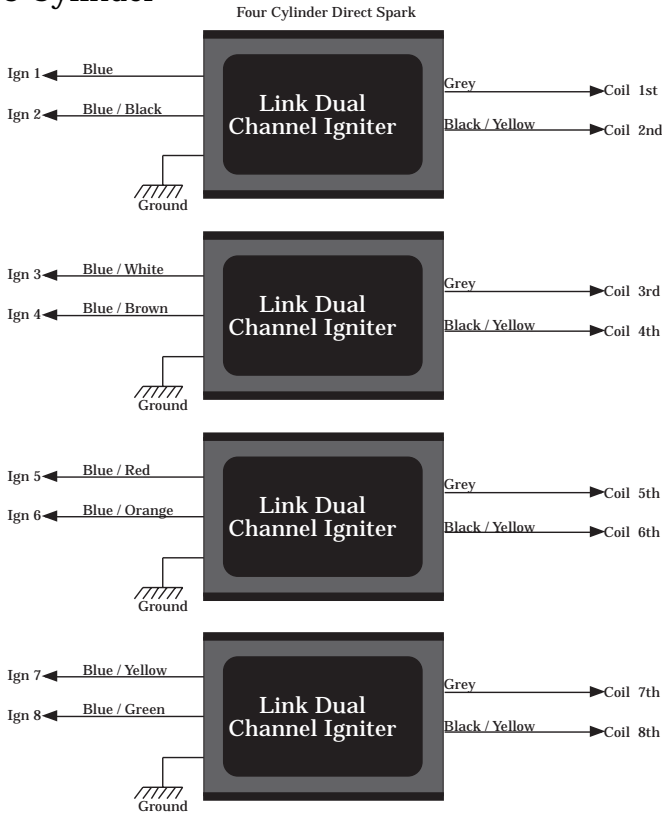


Figure 3.7

3.4 Multi-Coil: Wasted Spark

The following section illustrates how to wire for a wasted spark configuration. To ensure each ignition drive is matched to the correct cylinder, the firing sequence will need to be determined. Note this option is only possible when the engine has an even number of cylinders.

The first ignition drive is labelled “IGN 1”. This drive will control the ignition on the first cylinder in the firing sequence (i.e. 1st cylinder to fire after the sync pulse). When using a wasted spark arrangement this drive will also control its opposing cylinder 360° ahead. The ignition drive labelled “IGN 2” should be connected to

the second cylinder in the firing sequence (i.e. 2nd cylinder positional after the sync pulse), and its opposing cylinder and so on. Table 3.6 summaries this for a range of cylinders. The left-hand column is the position of the cylinder with respect to the sync pulse. The 1st represents the first cylinder in the firing sequence, the 2nd represents the second cylinder in the firing sequence on so on. In most situations the location of this sync will be unknown so refer to the application specific diagrams at the end of this manual. See examples 3.4.1 for more information.

Firing Sequence	Cylinder Number					
	2	4	6	8	10	12
1st	Ign 1	Ign 1	Ign 1	Ign 1	Ign 1	Ign 1
2nd	Ign 2	Ign 2	Ign 2	Ign 2	Ign 2	Ign 2
3rd		Ign 1	Ign 3	Ign 3	Ign 3	Ign 3
4th		Ign 2	Ign 1	Ign 4	Ign 4	Ign 4
5th			Ign 2	Ign 1	Ign 5	Ign 5
6th			Ign 3	Ign 2	Ign 1	Ign 6
7th				Ign 3	Ign 2	Ign 1
8th				Ign 4	Ign 3	Ign 2
9th					Ign 4	Ign 3
10th					Ign 5	Ign 4
11th						Ign 5
12th						Ign 6

Table 3.6

3.4.1 Wiring Example

Wasted Spark setup for a 4 cylinder.

Typical firing order: 1-3-4-2.

- (a) If the sync is on the crank there will be two signals per engine cycle. Otherwise the sync will be at camshaft speed and there will be only one signal per engine cycle.

Sync Position: Between cylinders 1 - 3 with sync on the camshaft.

OR: Between cylinder 1 - 3 & 4 -2 with sync on the crank.

The 1st cylinder to reach TDC after the sync signal is cylinder 3, resulting in the firing sequence 3-4-2-1. Figure 3.8 illustrates the correct connection.

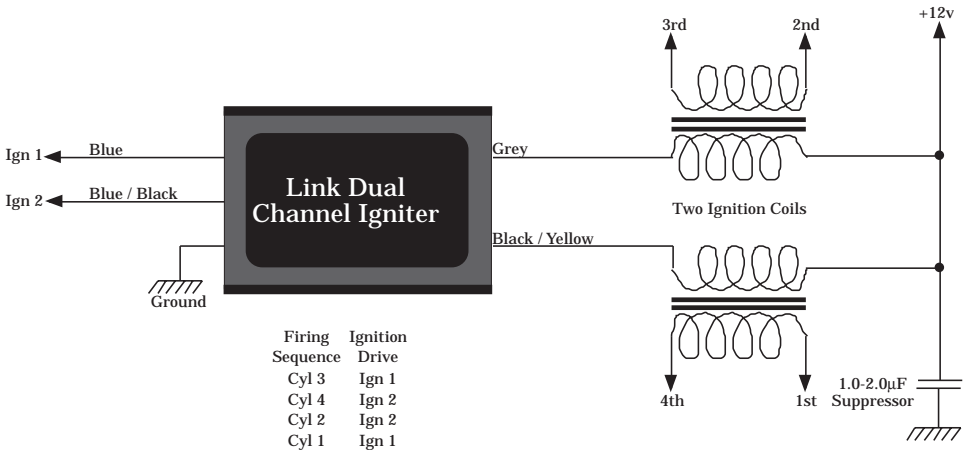


Figure 3.8 Wasted spark example for a 4 cylinder.

- (b) Sync Signal - Between cylinders 3 - 4 with sync on the camshaft.
 Between cylinders 3- 4 and 2-1 with sync on the crankshaft.

The 1st cylinder to reach TDC after the sync signal is cylinder 4, which should connect to 'Ign 1'. The resulting firing sequence is 4-3-1-3. See Figure 3.9.

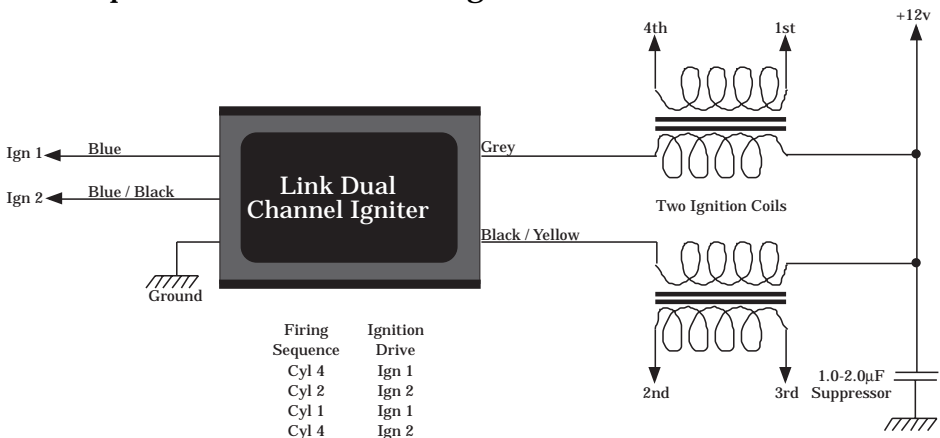


Figure 3.9 Wasted spark setup for a 4 cylinder.

3.4.2 General Installation Guide

The following examples provide a general guide to wasted spark installation. The label “1st” represents the first cylinder in the firing sequence, “2nd” represents the second cylinder in the firing sequence etc. All setups show the Link Igniter module, although most factory igniters can be used.

- 4 Cylinder

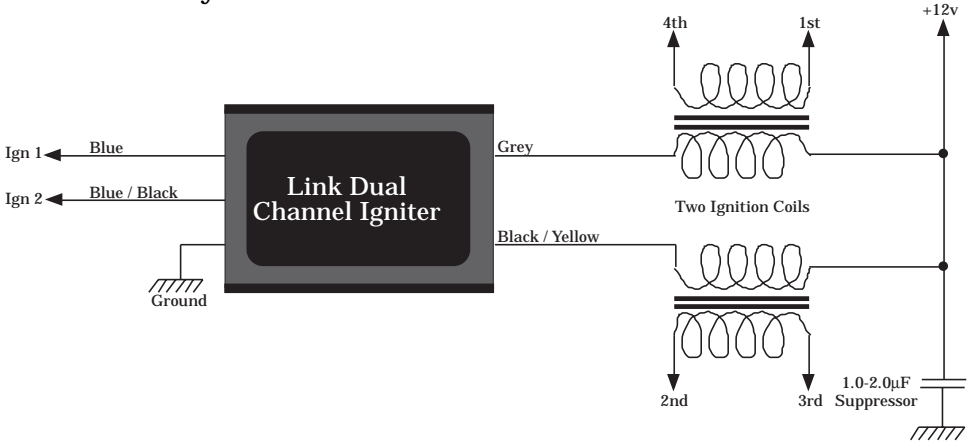


Figure 3.10 Wasted Spark 4 Cylinder

- 6 Cylinder

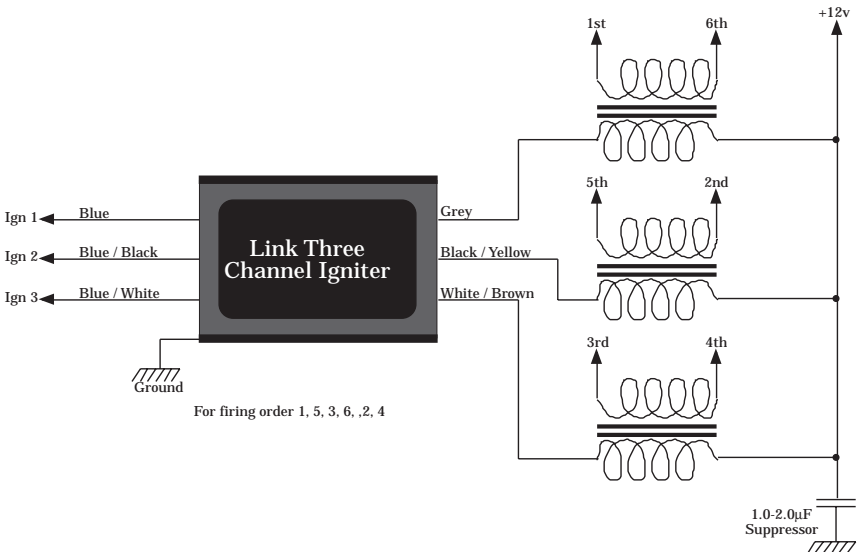


Figure 3.11 Wasted Spark 6 Cylinder

- 8 Cylinder

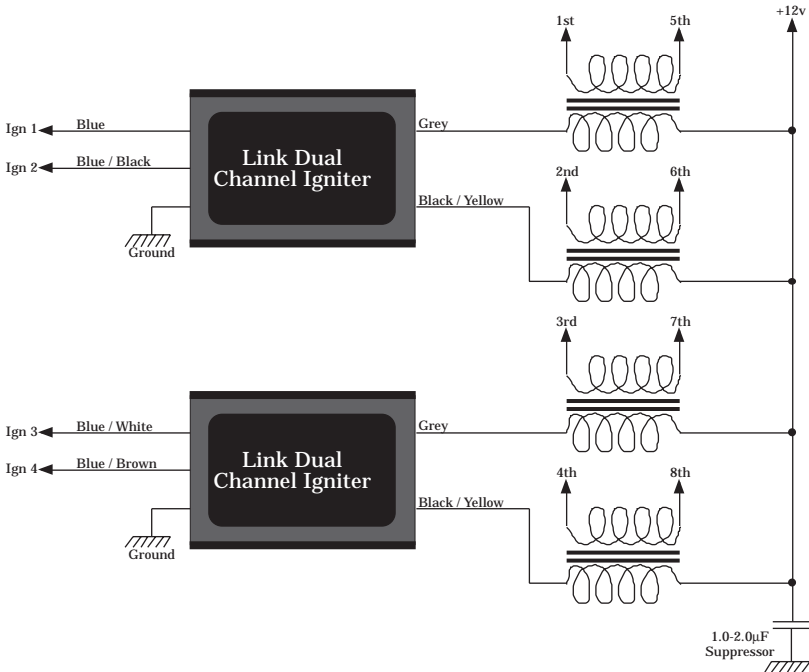


Figure 3.12 Wasted Spark 6 Cylinder

3.5 Drive A Tacho/Shift Light (Brown/Black)

This Output can be configured via software to drive a Tacho or Shift Light.

Tacho: Tachometer Drive produces a +12V Peak-Peak, two-millisecond wide pulse train to drive low level tachometers etc. There is one output pulse for every spark produced irrespective of the number of cylinders. Connect this wire directly to the tachometer.



The IgnitionLink tacho signal will NOT drive a tachometer designed to run from the coil negative.

Shift Light: Used in conjunction with a dash mounted LED light, the shift light provides a programmable gear shift indicator for racing purposes. This drive is current limited and will supply power to a high intensity LED. See Figure 3.13 (a).

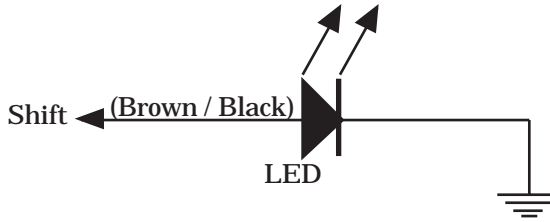


Figure 3.13 (a)

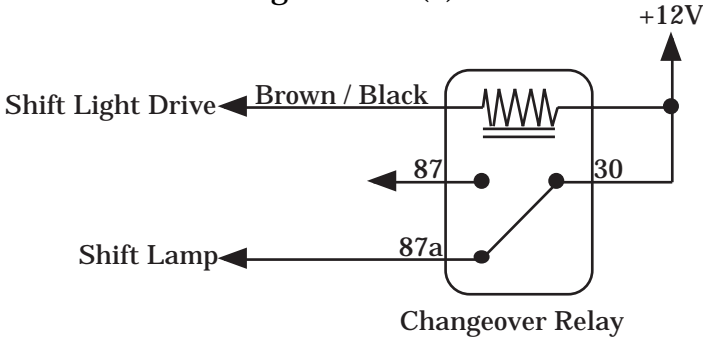


Figure 3.13 (b)



DO NOT connect a bulb style shift light to this drive directly, as permanent damage will result. For this type of shift light use a change-over relay as shown in Figure 3.13 (b).

3.6 Power Supply

3.6.1 Positive 12 Volts (Red)

IgnitionLink +12 volt supply input. This should be connected to an ignition switched 12-volt supply (i.e. always use a relay to supply +12V directly from the battery to the IgnitionLink). Current drain is quite low and may be fused if required. This input is polarity and over-voltage protected, but take the usual precautions when arc-welding on the vehicle.



Check the voltage does not fall below 7.5 volts when the engine is cranked. This is a common fault causing the IgnitionLink to reset and will prevent the engine from starting.

DO NOT use the Coil positive as a power supply for the IgnitionLink. Wherever possible use a separate +12V supply.

3.6.2 Signal Ground (Black)

IgnitionLink signal ground. This input supplies the low current earth supply for all low-level signal processing of the computer, and forms the reference value for all engine mounted sensors. As such, it is **ESSENTIAL** this wire is connected to the **ENGINE BLOCK** rather than the chassis or battery negative. Failure to do so will result in unstable sensor readings causing erratic computer operation.

3.6.3 +5 Volts Outputs (Red/Blue)

A 5 volt supply to power up a TPS sensor if required.

3.7 Trigger

3.7.1 Trig 1 (White(Grey Screened Cable))

This is the cylinder pulse trigger input. This will come from either a distributor or Crank/Cam Angle Sensor (CAS) and is used to control ignition timing and RPM limits/switches. The actual type of signal and its origin is specific to the application and the computer will be dispatched with the appropriate internal module fitted to process the signal, as well as the corresponding wiring diagram and any other special information required. This is a very important signal and must arrive at the computer free of noise and interference.

3.7.2 Trig 2 (Black(Grey Screened Cable))

Sync trigger input. Used for multi-coil and sequential fuel applications. This input provides a synchronising pulse(s) to establish the correct firing order for the ignition and fuel system. Information will be provided as above (TRIG1) when required.

NOTE: Trig 1 and Trig 2 are both within the earthed-screened cable. This is to reduce the chance of any interference entering the system at this point.

3.9 Inputs

3.9.1 Aux1 = TPS (White/Blue)

Aux1 can be used as a TPS input for mixed mode scheduling or as a launch control input. To wire either the factory sensor or one provided by Link, an ohmmeter is required. Two of the terminals will show a fixed resistance as the TPS is moved. Connect these terminals to +5V and Ground. The orientation of the +5V and ground does not matter. The result is that the TPS output will either increase or decrease in voltage with throttle position. As the IgnitionLink will automatically detect this, the +5V and ground can be connected to either of these two terminals. The last terminal must show a variable resistance between the +5V and the ground terminal. Refer to Figure 3.14.

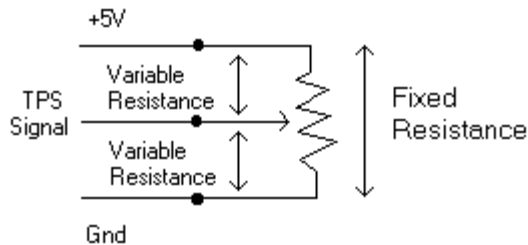


Figure 3.14 TPS Schematic



IMPORTANT

On some factory systems a throttle switch is used instead of a variable resistance. This is can NOT be used with the IgnitionLink. If a TPS based function is required, a TPS must be fitted to the throttle shaft.

When a TPS is connected, the span MUST be setup to ensure the correct operation of a TPS based function. Take time to read the “Utilities” section, which explains in detail how to do this.

3.9.2 Aux1 = Launch Control (Flat Shifting) (White/Blue)

When using "Launch Control" or "Flat shifting", this wire can be connected to a switch on the clutch pedal, as shown in Figure 3.15 (A gear knob button would also be suitable and can be wired in the same manner). Connect the White/Blue wire to one terminal and +12V to the second terminal. With the pedal depressed the launch system is activated. When released the system is deactivated. This will allow launch control to function during take-off and flat shifting.

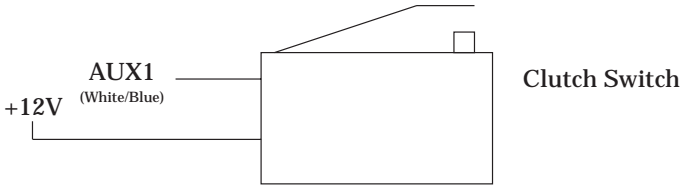


Figure 3.15 Clutch Switch

3.9.3 Knock Sensor

The IgnitionLink offers knock input, 2 single core, Grey screened cable.

Single Terminal Knock Sensor: Connect the orange wire to this terminal and the braid onto the engine block, close to the sensor.

Two Terminal Knock Sensor: Connect the yellow wire to one terminal, the other terminal to the braid. The orientation of these two wires does not matter.

The knock sensor should be tested before the Knock control system is activated. See Section 7.3.

4 IGNITION

The IgnitionLink offers 8 Ignition drives which can be configured from a basic distributor setup through to the more complex Multi-Coil arrangements. The following configurations in Table 4.0 are supported by the IgnitionLink.

Cylinder Number	Distributor	Wasted Spark	Direct Spark
1	YES		1 Single Coil
2	YES	1 Dual Post Coil	2 Single Post Coils
3	YES		3 Single Post Coils
4	YES	2 Dual Post Coils	4 Single Post Coils
5	YES		5 Single Post Coils
6	YES	3 Dual Post Coils	6 Single Coils
8	YES	4 Dual Post Coils	8 Single Coils
12	YES	6 Dual Post Coils	

Table 4.0. IgnitionLink Ignition Configurations

i) Ignition Drives

The igniter drives (labelled IGN1 - IGN8) are used to control an external igniter module producing ignition spark under programmed control. The output from these drives is a pulse waveform with the following features.

- The igniter signal can equal or be advanced in timing with respect to the input trigger signal.

NOTE

The IgnitionLink may advance the timing but cannot retard beyond the base (input) timing).

Below 500 RPM the engine will run ONLY on base timing. The IgnitionLink will not generate electronic advance.

- The dwell angle varies with engine speed to produce maximum coil output with minimum wastage. Essentially the IgnitionLink switches the coil current on at a calculated

time before the spark is required, so as to just reach maximum energy. This system eliminates holding the coil current at high levels thus greatly reducing heat build up and electrical power wastage.

- Under limiting conditions (excessive RPM or boost) the output pulses are progressively inhibited to provide a soft-limiting feature. The limit values may be programmed using the appropriate controller.

ii) Igniter

The Igniter module is a device used to switch the coils off or on by supplying a ground for the coil negative. A link igniter module is shown in Figure 4. The igniter is basically a solid state switch, which also limits the coil current to a predetermined value. This limiting feature eliminates ballast resistors and provides consistent output over a wide range of battery voltages. Over voltage clamping is incorporated to prevent damage to the igniter should a high-tension lead become disconnected or similar.

The signal used to control this is fed from the ignition drives on the IgnitionLink, labelled 'IGN1 to IGN8'. If the factory igniter cannot be used, the Link igniter/s should be mounted inside the engine bay as these carry coil primary current. DO NOT mount the igniter inside the passenger compartment or close to hot engine components such as exhaust manifolds. NEVER mount the Igniter next to the IgnitionLink



Figure 4 Link Igniter

iii) Coil Type

Low resistance coils (i.e. 1 ohm or less) must be used for maximum output energy, although higher resistance types will still function satisfactorily. This applies to both single and dual post coils in distributed and multi coil applications.

4.1 Tuning Module Functions

The IgnitionLink contains all the necessary software to run any configuration from Table 4.0. To select a setup, plug in the Link Tuning Module and select the * IGNITION * heading. Press the EDIT DOWN button once to enter the ignition menu. Use the EDIT buttons to scroll through this menu. The Tuning Module functions appear in the following order.

4.1.1 Zone IGN

There are 200 ignition zones arranged in a rectangular grid consisting of 10 ROWS by 20 COLUMNS. The ROWS progress in steps of Manifold Air Pressure or Throttle Position to provide the “load” axis and the COLUMNS progress in steps of RPM. Each zone therefore represents a unique engine operating condition allowing ignition changes to be made in small, localised areas. The selection of zones is completely automatic, depending on the actual RPM and MAP/TPS values at that instant. The current (active) zone is identified to allow correlation to the zone sheet and to give an indication of where you are in the table. The zone numbering system is not linear, but designed to provide a clearer indication as to the effective location. e.g.

zone 110 = ROW 1, 1000..1500 RPM

zone 255 = ROW 2, 5500..6000 RPM

zone 545 = ROW 5, 4500..5000 RPM etc.

The adjustment value is shown as degrees of advance, displayed on the right hand side of the display. This value is the actual interpolated number and hence the current advance generated by

the IgnitionLink. To change a setting use the ADJUST buttons. To edit any static advance angle (i.e. edit the actual zone advance), use the zone editor. The current operating zone is displayed in the centre of this menu.

4.1.2 Static IGN

This represents the static timing of the engine in degrees BTDC on cylinder number 1 (i.e. base timing of the engine with zero advance generated by the IgnitionLink). This number is for display purposes ONLY and will NOT cause the Link to produce extra timing. This number will be added to the current zone ignition number so the tuning module displays the actual engine advance. The default value is zero.

Example: Zone 245 = 23 , Static Ign = 10 BTDC. The IgnitionLink generates 23 BTDC timing, the engines static timing is 10 BTDC, hence the tuning module will display 33 degrees representing total engine advance.

4.1.3 Set Static-Timing

This allows the static (base) timing of the engine to be adjusted or checked. By pressing the ADJUST UP button, the Static timing function can be switched on, automatically setting the advance limit to zero. From this point zero degrees advance will be generated by the IgnitionLink, allowing the static timing of the engine to be checked. To switch off the function press the SELECT DOWN button. When this function is switched ON, the Advance Limit menu will show 00

Note - When power is removed this function will always return to the default OFF setting.

4.1.4 Ignition Type

This menu allows the ignition setup to be selected. Before selecting one of these options ensure the necessary hardware has been installed and wired in. To prevent an accidental change to this setting, it cannot be altered while the engine is running.

The two options are:

Distributor

To select this option, press the EDIT UP button and the menu will display “Ign Type: Distributor”.

Multi-Coil

To select this option press the ADJUST DOWN and the menu will display “Ign Type: Multi-Coil”. If Multi-Coil is selected the option of Direct or Wasted spark is available.

NOTE. Any changes here will be automatically stored. This option cannot be changed while the engine is running.

4.1.5 Multi-Coil Type

When the ignition system is configured for Multi-Coil operation the following options are available

Wasted Spark

To select this mode press the ADJUST DOWN button. The menu will display “x - Dual Coils”, where ‘x’ represents the required number of dual post coils. This mode will only be permitted when using an even number of cylinders.

Direct Spark

In this mode there is one coil per cylinder. To select this mode press the ADJUST UP button to display “ x - Single Coils”, where ‘x’ represents the required number of coils.

NOTE. Any changes here will be automatically stored. This option cannot be changed while the engine is running.

4.2 Setting Static Timing

This is defined as the mechanical advance of the engine with the IgnitionLink producing no addition timing (i.e. zero degrees electronic advance). The IgnitionLink default ignition curve is based on a 10BTDC base timing so this should be checked before driving the vehicle. Any variation in the base timing will need to be considered when adjusting the advance curve. Also note that below

500 RPM (especially cranking) only the base timing is effective and should be set for optimum starting characteristics.

Adjustment

With the tuning module connected move the * IGNTION * heading. Press the EDIT DOWN button twice to display the "SET STATIC:OFF " menu. Press the ADJUST UP button to turn the function ON (This can only be done with the engine running). This will zero the electronic advance generated by the IgnitionLink, allowing the engines mechanical advance to be checked. (The 'ADV Limit' menu will show 0 degrees). When finished, this function can be turned off by pressing the ADJUST DOWN, or by switching the ignition key off. The IgnitionLink will now begin to reschedule advance.

4.3 Distributor

4.3.1 Definition

A distributor routes the high voltage generated by the coil to the intended spark plug via a rotor and HT wiring. It rotates at half the crankshaft speed.

4.3.2 Trigger Requirements

The only information required for ignition timing, is one signal representing every engine TDC. This can be generated from optical, hall, magnetic pick up etc.

4.4 Multi-Coil: Wasted Spark

4.4.1 Definition

Wasted spark will fire two cylinders simultaneously, using a common dual post coil. During a crankshaft revolution, one cylinder is fired on the compression stroke, the other offset by 360o crankshaft angle (i.e. the opposing stroke = exhaust stroke). One crankshaft rotation later, these two cylinders are two working stokes further ahead and the spark plugs fire again, but now with reversed

roles. The result is that one coil will be fired twice per engine cycle hence the term “wasted spark”. This setup can **ONLY** be used on engines with an even number of cylinders. The maximum number of cylinders the IgnitionLink can drive on wasted spark is 12.

4.4.2 Trigger & Hardware Requirements

Cylinder Pulse

For the correct timing of ignition, the crank or cam sensor **MUST** provide a signal that can be decoded to produce one pulse per engine TDC. On a 4-cylinder engine for example, this is 2 TDC pulses per crankshaft revolution (4 per Camshaft revolution) and an 8-cylinder engine will have 4 TDC per crankshaft revolution (8 per camshaft revolution)

Sync Pulse

To determine the correct firing sequence, a sync pulse is required as a reference to determine engine position. The sync pulse can only appear once on the crankshaft (1 signal per engine revolution) or once on the camshaft (1 signal per engine cycle).

Dual Post Coils

One Dual post coil is required per 2 cylinders with a primary resistance less than or equal to 1 ohm. Figure 6.1 shows a typical coil. The coils should be positioned so they minimise the length of the HT Leads. This will help reduce the noise generated when the spark plugs are fired.

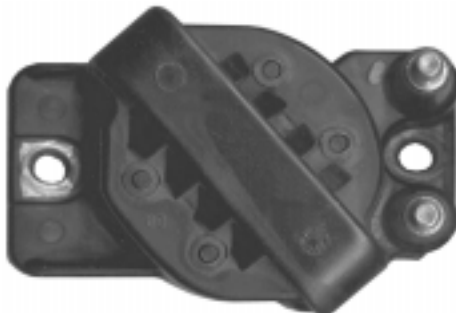


Figure 4.1



Important Points for Wasted Spark

- When two spark plugs are fed from one dual post coil they are connected in series, meaning one plug is “incorrectly” polarised.
- The main concern when using dual post coils is the generation of interface. When two spark plugs are fired together there is twice the spark energy generated and hence twice the radiation produced per engine TDC. This noise level increase can interfere with ECU operation and cause unwanted static on car radios. The following precautions should be used to minimise these effects.

First install ‘Resistive Spark Plugs’ if the engine does not currently use them. This will reduce radiation levels and also help even out spark energy distribution. Without it, the spark plug with the least load (exhaust stroke) tends to monopolise spark.

Secondly, ALWAYS use suppressed HT leads, which can be identified by measuring their resistance. Typically they vary from 1000 ohms to 5000 ohms depending on lead length. DO NOT use copper leads under any circumstances.

Lastly always fit a Coil suppresser to the coil positive. Any value between 1uF and 10uF will be suitable.

Therefore when using Dual Post Coils combine the following:

- Resistive sparks plugs
- Suppressed Leads
- Coil Suppressor (1uF - 10uF)

4.5 Multi-Coil: Direct Spark

4.5.1 Definition

Direct spark uses an ignition coil per cylinder, firing each cylinder once per engine cycle (2 crankshaft revolutions). If multi-coil operation is required for an odd number of cylinders, the only option is to use an ignition coil per cylinder. This mode is also suitable when the number of cylinders is even and 'wasted spark' has not been selected. The IgnitionLink can drive a maximum of 8 cylinders with direct spark.

4.5.2 Trigger & Hardware Requirements

Cylinder Pulse

For the correct timing of ignition the crank or cam sensor **MUST** provide a signal that can be decoded to produce one pulse per engine TDC. For example, on a 4-cylinder engine this is 2 TDC pulses per crankshaft revolution and an 8-cylinder engine will have 4 TDC per crankshaft revolution.

Sync Pulse

When each cylinder is fired using individual coils a sync pulse is required to determine engine position and hence firing sequence. This signal must **ONLY** appear **ONCE** per engine cycle (2 crankshaft revolutions). Hence the camshaft will need to provide a sync signal. If the sync is generated from the crankshaft the rate will be twice that required resulting in incorrect operation.

Single Coils

On factory setups using direct spark, the coil and igniter is usually in one package, mounted over the spark plug. These are normally three terminal devices, +12V, Ground, and an igniter signal. If the coil is accessible, it should have a primary resistance less than or equal to 1 ohm. When using a non-factory arrangement the coils should be positioned so they minimise the length of the HT Leads. This will help reduce the noise generated when the spark plugs are fired.

5 LIMITS

5.1 Functions

The following functions are available from the heading.

5.1.1 Rpm Limit

Sets the RPM limit. Limiting is achieved by 100% fuel cut until the RPM drops below the preset value. A soft limit is evoked 200 RPM before this by removing alternative spark.

5.1.2 Advance Limit

Sets the absolute maximum ignition advance irrespective of any value programmed into the ZONE IGNITION table. Note this is a numeric limit only and does not invoke any actual ignition or fuel cuts.

5.1.3 Map Limit

Sets Manifold Air Pressure limit to prevent over boost. Values are expressed in absolute pressure so all values above 100 kPa represent boost pressures. The IgnitionLink will 'soft' limit the engine 10kPa before the MAP limit. If the engine reaches the actual MAP limit a hard limit will be evoked, cutting all fuel and ignition.

e.g. 150 KPa = 9 psi boost

200 KPa = 15 psi boost

Upper limit = 300 kPa. (When using external MAP sensor)

5.1.4 Map Limit On/Off

This function allows the Map Limit to be switched OFF. This will prevent soft and hard engine limiting when the manifold pressure exceeds the map limit. To switch OFF press the ADJUST DOWN button or the ADJUST UP to switch back ON.

6 UTILITIES

6.1 Functions

The following functions are available under the Utilities heading.

6.1.1 TPS Range

From this menu the TPS range can be defined. This is where the TPS will point to from closed through to wide-open throttle (WOT). By default this menu will display “TPS RANGE 10 - xxx”.

- 10 : At fully closed throttle the TPS will point 10 on the Zone Table load (vertical) axis. This is defined as the “TPS low” value and is NOT adjustable.
- xxx : When the throttle is fully depressed to its wide-open position the TPS will point to ‘xxx’ on the zone table, where ‘xxx’ can be between 45 & 255. This is defined as the “TPS high” value. The default value is 100.

Note this menu ONLY sets the range. To make the TPS span this range, read the next section 6.1.2.

Criteria to setup “TPS High” value

DO NOT adjust the “TPS High” value unless ROW STEPS has been selected to:

- $ROW\ STEPS = TPS$ or
- $ROW\ STEPS = TPS + MAP$

In all other modes the default setting of 100 should remain. For more information on selecting this value, view section 8.2 “Mixed Mode scheduling”. If this value has been changed the TPS will need to be setup to span this new range. See section 6.2. The maximum “high” value is 255.

6.1.2 Throttle Position Sensor (TPS) Span

This allows the TPS to span the range defined in section 6.1.1. The menu will display “TPS Span xxx” where ‘xxx’ represent the TPS

span. For example if the TPS Range was 10 - 100, this menu will setup the TPS span ensuring it points to 10 at closed throttle (i.e. “xxx” = 10) and 100 at wide-open throttle (i.e. “xxx” = 100).

6.1.3 Launch Control

The Launch RPM can ONLY be adjusted if this function has been activated from the * CONFIGURATION * heading. This sets the RPM at which the engine will limit when the launch system is activated via a clutch switch or gear knob button. See section 6.3 for setup information.

6.1.4 Shift RPM

This menu only applies if the Tacho Drive has been selected as a shift light drive (use configuration menu). It sets the RPM at which the shift light is turned ON. Use the ADJUST buttons to change the value in steps of 100 RPM.

6.2 TPS Span Adjustment

Switch the ignition on. DO NOT start the engine. Move to the * UTILITIES * heading and scroll down displaying the TPS Range menu. If required, adjust the ‘TPS high’ value, otherwise leave the default setting at 100. Press the EDIT DOWN button once to display the TPS span menu. The right side value represents the actual TPS Span value.

Setting TPS Span for Closed Throttle

With the tuning module on the TPS menu and ensuring the throttle is closed press and hold the ADJUST UP button. The menu will display “TPS - CLOSED xxx” where ‘x’ represents the throttle voltage. The button can now be released which will store the closed throttle voltage. Now fully open the throttle.

Setting TPS Span for Wide Open Throttle

At Wide Open Throttle (WOT) press and hold the ADJUST DOWN button to display the menu “TPS - WOT xxx”. Release the button and return the throttle to the closed position.

Note. These numbers will be automatically saved so a STORE is not required.

Checking the TPS Span

Once the TPS Span setup is complete the actual “low” and “high” values should be checked. With the throttle closed, the remote MUST show a “low” value of 10. With the throttle fully open the “high” value should show the required number (It will show 100 if the default setting is used).

6.3 Launch Control Setup

This function allows full throttle stationary launching and full throttle upshifts. When launching a vehicle from stationary, the throttle fully open and the clutch engaged, the IgnitionLink will limit the engine to an adjustable preset RPM. When the clutch is released, the limit function is turned off, allowing the engine to function as normal. When the next gear is selected by depressing the clutch, the driver can keep full throttle, as the IgnitionLink limits the engine RPM while the clutch is engaged.

Advantages

On a normally aspirated engine it allows smoother and quicker gearshifts with less wear on gearbox components. On a turbo charged engine as well as the above benefits, it allows boost to be maintained during gearshifts. If the throttle is temporarily closed the air in the inlet manifold is stalled which means a small lag in boost recovery when the throttle is opened.

Procedure

To activate launch control move to the * CONFIGURATION * heading. Use the EDIT DOWN button to move to the Launch control menu and press the ADJUST UP button. The Tuning Module will display “Launch Ctrl = ON”. Next move to the Launch RPM menu under the *UTILITIES * heading.

- The clutch switch should now be checked to ensure it is correctly connected. On the Launch RPM menu a “*” will appear when the clutch is depressed to the floor. If a “*” does not appear re-check the wiring.
- Next select the required RPM by using the ADJUST buttons. This can be set, by observing wheel speed when the vehicle is launched. If the RPM is too low the engine will “bog”, if too high the wheels will spin. The optimal value to achieve maximum traction is an RPM just below wheel spin.

7 KNOCK CONTROL

Knock control uses a block mounted, piezo electric microphone (knock sensors) to “listen” for abnormal engine noise / vibrations which occur when the engine detonates (knocks). Analogue filters inside the ECU reject the majority of unwanted signals but the software processing this signal requires a certain amount of discrimination. Once a knock event has been detected, ignition timing is removed from the current ignition zone (1 of 200). The maximum amount of retard is six degrees from any one zone, although the system will not retard beyond zero degrees electronic advance (base timing).

E.g. If original zone value was 5 degrees, then at maximum retard produced by the IgnitionLink would be ZERO, not -1 degrees.



All Corrections are temporary unless stored i.e. they will be lost when the key is turned off.

This arrangement allows the system to be more adaptive to the current conditions. For example, driving one day with poor fuel will cause the system to make corrections where necessary but with no long-term storage. This means when superior fuel is used or climatic conditions change, the ignition map will have a “clean slate” rather than previously compromised values.

There are 3 main adjustments for the knock system are:

- Set Base Target
- RPM Target Correction
- RPM start Point

7.1 Functions

The following functions are available from the Knock heading.

7.1.1 Knock Count

A “knock event” occurs when the engine noise, transmitted by the knock sensor exceeds the Knock target. Once detected, the current

ignition zone has one degree of timing removed and the Knock Count is incremented by one. To switch OFF press the ADJUST DOWN button and the menu will display “Knock OFF zzz”. Pressing ADJUST UP will reactivate the knock control system displaying “KNOCK (xxx) zzz”.

- xxx = Knock Count. This is the total number of “knock events” detected by the system for this current run.
- zzz = Knock Signal. Shows the actual “processed” knock signal fed into the microprocessor. This value should be small at idle (type. less than “10”) and increase with RPM and load (boost) as the background noise rises i.e. The signal will always rise with increasing power at a PROGRESSIVE rate seen if there is no detonation. The Knock signal will vary significantly, as the amplitude of the signal produced by the knock sensor will depend on knock sensor position and engine type/modification state.

For example a Knock Count of 5 (xxx = 5) indicates the knock level processed from the engine, has exceeded the Knock target 5 times.

NOTE: Any changes (ON/OFF) are automatically stored.

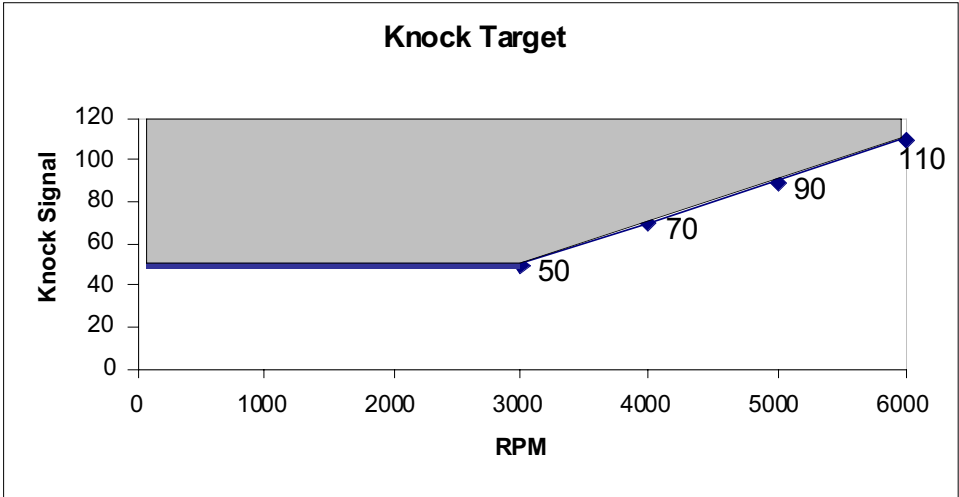
7.1.2 Knock Base Target

This allows the knock base target to be set. This is the amplitude of the Knock signal when the engine starts to generate noise. From this point, engine noise will normally rise as the RPM and load increases. Hence to match the Knock target to the engines noise profile the target requires RPM correction.

7.1.3 Knock RPM Correction

The micro-processor uses this base target and produces a knock target that is proportional to RPM i.e. at higher engine RPM more “noise” is generated, hence the knock threshold needs to be increased. So for every 1000 RPM the RPM correction value will be added to the Base Target. Intermediate values will also be calculated.

**Example 9: Base Target of 50 starting at 3000 RPM.
RPM Correction = 20**



RPM	Knock Target
3,000	50
4,000	70
5,000	90
6,000	110

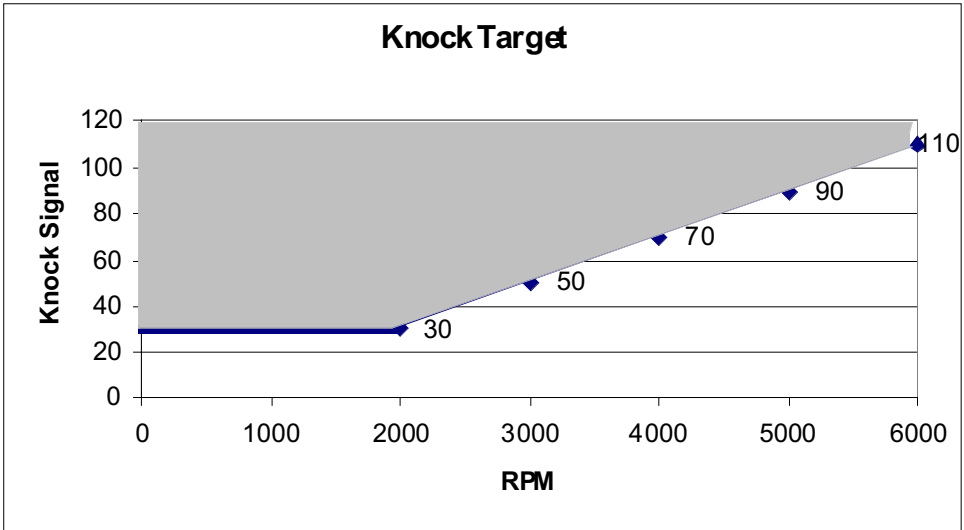
Figure 7.1 illustrates the knock target as it varies with RPM. If the Knock signal enters the gray region a knock event will be generated and timing will be removed. Note that below 3000 RPM the IgnitionLink uses the “base target” which has no RPM compensation.

7.1.4 Knock RPM Start.

The last adjustable factor that varies from engine to engine is the RPM point where the engine starts to generate noise. It can range from 1000 through to 4000. Using example 9 the starting point has been modified.

Example 7.1

- base target = 30, RPM correction = 20, RPM Start = 2000



RPM	Knock Target
-----	--------------

2,000	30
-------	----

3,000	50
-------	----

4,000	70
-------	----

5,000	90
-------	----

6,000	110
-------	-----

If the knock level enters the “grey” region ignition will be removed from the engines current ignition zone. Note below 2000 RPM the “base target” is used.

7.2 Knock Control Setup

To ensure the correct operation & setup of the knock control system, a scientific method is the most comprehensive approach to build up a noise profile of the engine. This involves using some form of data logging (e.g. SerialLink, PrintLink or PCLink) “ to capture all the important ECU signals for in-depth analysis. This has the advantage of allowing plenty of time for analysis together with other information (RPM, MAP, OXY etc.) which all interact to some degree.

Detecting Detonation from data logging

Interpret detonation as a significant jump in value (say 30 - 50 units) within one line of text. Note from Table 9.0 the abrupt level change (marked *****) in the KNK (knock) column indicating probable detonation.

RPM	MAP	WG%	OXY	INJ%	TEMP	KNK	ADV	
4617	151	31	75	44	78	12	13	
4807	193	31	91	66	78	46	9	*****
4994	226	29	89	70	78	25	8	
5131	215	28	89	68	78	25	9	
5344	215	26	88	70	78	30	8	
5453	218	25	88	72	78	31	8	
5651	219	23	87	75	78	40	8	
5800	222	21	88	77	78	33	8	
5976	224	18	87	81	78	45	8	
6103	224	16	89	85	78	49	8	
6288	226	13	89	86	78	56	8	
6418	227	10	89	87	78	58	8	
6542	227	10	90	90	78	63	8	
6706	228	10	89	94	78	71	8	
6779	227	10	91	94	78	75	7	
6917	228	10	90	94	78	79	6	
7034	229	10	17	96	78	85	6	
6892	131	39	78	12	78	70	25	
6225	32	37	68	4	80	46	25	
5711	20	35	73	1	80	33	25	
5124	19	32	2	1	80	17	25	
3728	92	28	4	16	82	4	23	
3750	99	28	5	17	82	4	21	
3839	110	28	4	21	82	6	18	
3907	129	28	5	25	82	8	16	
4025	150	28	9	32	82	7	13	
4159	176	29	84	45	82	10	12	
4353	211	29	90	62	82	33	9	*****
4506	218	27	91	59	82	18	9	
4687	210	26	89	60	82	21	9	
4870	214	25	88	63	82	26	9	
5048	215	24	86	66	82	26	8	
5239	216	22	86	68	82	26	8	
5398	219	20	84	71	82	34	8	
5542	221	18	85	75	82	38	8	
5747	223	16	85	76	82	47	8	
5901	224	14	84	81	82	53	8	
6054	225	11	86	84	82	73	8	*****

Knock example for IgnitionLink Engine Management

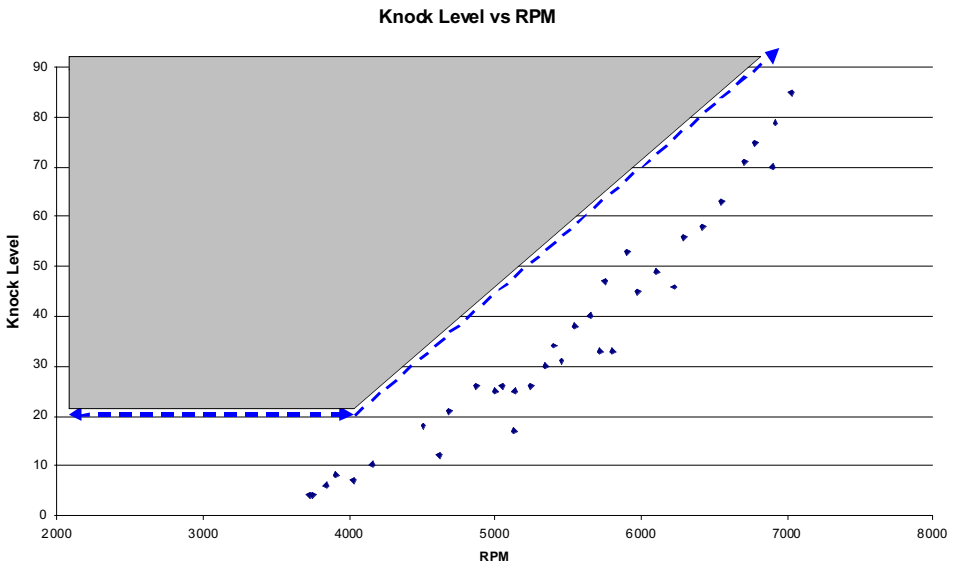
Table 7.0 Data Log

EXAMPLE: This printout is an actual example of a vehicle accelerating during two runs. The easiest way to visualise this data is to graph it as shown in Figure 9.1. This provides a picture of the engines noise profile, clearly showing the contrast between engine noise and the three possible detonations. The dashed line shows one suggested knock target line. From this graph all the relevant parameters can be gather to correctly setup the knock system.

Selecting “Base Target”

The engine does not start producing any significant noise until approximately 4000 RPM. The Knock level this RPM is approximately 10 so a safe “base target” would be 20. This point is somewhat arbitrary and there is no one correct answer.

The knock level increase per 1000 RPM for the IgnitionLink is fixed at 40 counts and will not require adjustment. Note that in some cases transient detonation (between gear shifts) is very difficult to eliminate completely without seriously affecting the power output of engine. The amount of acceptable detonation is a fairly complex issue beyond the scope of this simple guide.



Summary Table

Base Target = 20

Start RPM = 4000

RPM Correction = 25

RPM	Knock Target
4,000	20
5,000	45
6,000	70
7,000	95
8,000	120
9,000	145
10,000	170

7.3 Testing Knock Sensor Installation

Move the Knock Count menu and observe the Knock level (far right characters). Use a metal object such as a spanner and tap the engine block close to the sensor or the actual bolt securing a donut style sensor. The knock level will show a value proportional to how hard the block or sensor bolt is hit. No reading indicates a faulty sensor or a wiring problem.

8 CONFIGURATION

To edit any of the below settings scroll to the * CONFIGURATION * heading and use the EDIT buttons to move through this menu.

8.1 Functions

The following functions are available under the Configurations heading.

8.1.1 Cylinder Setting

Displays the current number of cylinders. Changes are made by pressing the ADJUST buttons and must be stored and power recycled before the new settings become active.

8.1.2 Row Steps

This control allows the zone table row selection to be setup in one of four modes. These are Map, Vacuum, MAP+TPS, and TPS. To scroll through these modes used the ADJUST buttons.

8.1.3 Launch Ctrl

This will activate the launch control function. To switch ON press the ADJUST UP button. The required launch RPM can be adjusted from the * UTILITIES * heading. See section 6.3 for setup information.

8.1.4 Drive A

Allows output drive to be selected to drive a tacho or a shift light.

8.1.5 Dwell Mode

Allows a dwell time of 5.5ms or 4ms to be selected.

8.1.6 Configuration

For Special Applications the software can be configured to match system requirements. These include: Lexus V8, MX5, Honda, VR4. All other applications the menu should be set to 'general'.

8.1.7 Priority

Set interrupt priority between cylinder and sync pulses.

8.1.8 Store

To select STORE press both ADJUST buttons together until the display shows “*****” and then release.

8.1.9 Reload

This process presets all zones to typical values to allow a base for subsequent tuning. There are two separate reload tables available.

RELOAD is initiated by pressing BOTH ADJUST buttons together until the display shows “*****” and then released.



CAUTION: RELOAD will over-write all values currently stored in the IgnitionLink memory and should only be used during initial setup or if you wish to restart the tuning procedure again from scratch.

8.2 Mixed Mode scheduling

Mixed mode scheduling refers to the way in which the zone table ROWS are selected. There are four options available, each one specific to an engine configuration. The default mode is MAP meaning ROW selection is based ONLY on the engines Manifold Air Pressure. When using high lift, long duration cams this can create problems for EFI systems due to irregular, low manifold vacuum at low RPM. This results in the MAP sensor interprets the poor vacuum as the throttle being mostly open, when in fact, the throttle is closed on the idle stop.

This means the actual selected by the software is incorrect as the zone in use is also a function of the “incorrect” MAP signal. The following four options are available:

8.2.1 MAP Mode

Application: Normally aspirated OR Turbo charged engine.

This allows Manifold Air Pressure to select the current zone table ROW. This will give 3 tuning rows for a normally aspirated engine and allow a maximum of 4 rows for a turbo charged engine. See Appendix A for the zone sheet. To effectively use this mode the engine should have good idle vacuum, operating in ROW1. This will maximise the number of rows available for tuning. If the engine exhibits poor vacuum as discussed in the introduction use one of the following modes.

8.2.2 MAP+TPS Mode

Application: Turbo Charged engines ONLY.

If the MAP of the engine is going to exceed 110kPa (1.5PSI boost) due to turbo charging or forced induction and the engine exhibits poor idle vacuum, this mode should be used selected. The TPS is used to select the vacuum rows 1, 2, 3 and 4 helping to stabilise ROW selection. As soon as the engine comes on boost, greater than 1.5PSI (110kPa absolute), the row selection will automatically revert to MAP zoning. To ensure correct operation the TPS should be set to span 10-100. This means at the cross-over point (110kPa) there will be no sudden fuel steps in the selected zone, i.e. the “MAP” selected zone and the “TPS” selected zone should be the same.

8.2.3 VACUUM Mode

Application: Normally Aspirated engines ONLY

Use this mode ONLY on a normally aspirated engine. DO NOT select if the engine is turbo charged. The zone table has been scaled to span 10 ROWS of vacuum as shown in Appendix B. This structure provides more rows to tune with when compared to the default MAP Mode, which allows only 4 rows for a normally aspirated engine. These additional rows are useful on engines with low vacuum by providing finer control over idle and cruise areas.



Rows 5 - 9 of the zone table are configured by default for a turbo charged engine meaning they will have ignition retard. When spanning 10 rows for a normally aspirated engine all rows will need to be re-configured.

8.2.4 Throttle Position Sensor (TPS) Mode

Application: Normally Aspirated Mode

Use this mode ONLY if the engine is normally aspirated and MAP or VACUUM modes have produced unsatisfactory results. The purpose of selecting rows using TPS is to provide stable zone selection when the MAP signal is fluctuating due to special cams etc. When using this mode ensure the TPS span is setup correctly as described in the next section.

Note: Do not select TPS mode unless the TPS sensor is fitted and wired.

8.2.5 Selecting TPS Range

This section ONLY applies if the TPS option has been selected in ROW STEPS, i.e.

$ROW\ STEPS = TPS + MAP$ or

$ROW\ STEPS = MAP$

Before starting section, read section 6.1.1, which explains the TPS Range.

The “TPS low” value is fixed at 10 and cannot be adjusted. The “TPS high” value is user defined and controls the numbers of ROWS available for tuning. Hence the purpose of this step is to setup the number of ROWS required for tuning, by selecting a suitable “TPS high” value. For example a TPS range of 10 to 100 would access 4 ROWS, since three zone boundaries (30, 60, 90) were crossed, while a span of 10 to 200 would allow access to 7 ROWS.

The ROW boundaries are as follows;

ROW	SPAN	CENTRE	ZONES
ROW 1	0 - 30	(15)	[100..195]
ROW 2	31 - 60	(45)	[200..295]
ROW 3	61 - 90	(75)	[300..395]
ROW 4	91 - 120	(105)	[400..495]
ROW 5	121 - 150	(135)	[500..595]
ROW 6	151 - 180	(165)	[600..695]
ROW 7	181 - 210	(195)	[700..795]
ROW 8	211 - 240	(225)	[800..895]
ROW 9	241 - 270	(255)	[900..995]
ROW 10	271 - 300	(285)	[1000...1095]

NOTE - The zoning structure for ZONE ADVANCE is identical to ZONE FUEL.

ROW STEP = TPS+MAP

The TPS range MUST always be set between 10- 100.

“TPS low” = 10

“TPS high” = 100

ROWSTEPS = TPS

The “high” value should be selected based on the required tuning Rows. For example:

- 1) 4 Rows Required for tuning
Set TPS span between 10 - 105 (centre of row 4)
- 2) 6 Rows required for tuning
Set TPS span between 10 - 165 (centre of row 6)

13.2.6 Adjusting TPS Span

Once the TPS range has been selected the TPS span can be set. Refer to Section 6.2 on how to do this.

9 DIAGNOSTICS

The section provides basic engine information for diagnostic and monitoring purposes. All information is temporary stored and will be lost when power is removed from the IgnitionLink.

9.1 Max RPM

This menu displays the engine maximum RPM. This menu is used to check for trigger glitches, indicated by an unrealistic RPM figure.

9.2 Max Map

Displays the maximum manifold air pressure for turbo charged engine.

9.3 Sync/Cyl Ratio

For multi-coil applications this menu is used to setup the “expected” ratio between Cylinder and Sync trigger pulses. This allows the IgnitionLink to measure the “actual” Cylinder and Sync ratio and compare this to the “expected” value. If there are any inconsistencies between the ratios an error will be displayed (see next menu). Set Ratio value as shown in Table 9.1. Do a store after the number has been changed.

Cylinders	Sync/Cyl Ratio	
	1 Sync pulse per engine cycle	2 Sync pulses per engine cycle
3	3	N/A
4	4	2
5	5	N/A
6	6	3
8	8	4
10	10	5
12	12	6

Table 9.1

9.4 Sync/Cyl Err. xx

The menu displays a counter, which is incremented every time any inconsistency is found between the “expected” Sync/Cyl Ratio and the measured ratio. A value of 1 or 2 may be observed on startup. This is normal as the ECU is just beginning its triggering sequence. ‘xx’ will display “NA” if the sync pulse is not required for the current configuration i.e. Fuel deliver mode = Group and Ignition = distributor.

This counter can be useful when trying to fault find engine misfire under load. Simply observe the counter value before and after misfire. If the value has increased a triggering anomaly has occurred.

10 FIRST TIME SETUP

The following checks and adjustments are mandatory before attempting to start the engine. Connect the tuning module to the IgnitionLink and switch the ignition key on. DO NOT attempt to start the engine before reading this section.

Adjust the following options from the *CONFIGURATION* heading.

- Firstly, perform a reload.
- Select the correct number of cylinders
- Select Drive A option
- Select the required ROWSTEPS
- When using a TPS related function adjust the TPS range and span as required.

Move to the *IGNITION* menu and adjust the following

- Select the required ignition; Distributor or Multi-Coil.
- If Multi-Coil is required adjust for Wasted or Direct Spark.

11.STORING & EDITING VALUES

To Store select STORE. Press both ADJUST buttons together until display shows "*****" and then release.

The programme is preset to a performance level offering optimum performance while aiming for engine longevity. The programme is also set for optimum economy while under "cruise" conditions.

EDIT Enables the zone editor function which allows random access to all zones for viewing and editing. The EDIT function may be used at any time, with or without the engine running. Use the EDIT push buttons to select the appropriate zone(s) and the ADJUST buttons to change the selected zone. The zone is identified by a number which may be correlated to its function by consulting the zone editor sheet. ZONE FUEL and ZONE IGN are identified by an "F" or "I" respectively to discriminate between fuel and ignition values. Storing of edited values may be done by pressing BOTH EDIT buttons together until display shows "*****" and then releasing. Alternatively, STORE may be selected and used as normal.

12. TUNING PORT

The fourteen pin connector located at one end of the IgnitionLink allows connection of various tuning and diagnostic tools to the system. All devices use a fourteen line flat ribbon cable, and connectors are keyed to prevent incorrect installation. The following devices are currently available.



Ignition switch (key) must be OFF before installing any device. When the key is switched on, the IgnitionLink will automatically determine which device is fitted and run the appropriate software to support it.

12.1 Tuning Module

The Link Tuning module allows all aspects of fuel, ignition, boost and utility functions to be adjusted, edited and stored.

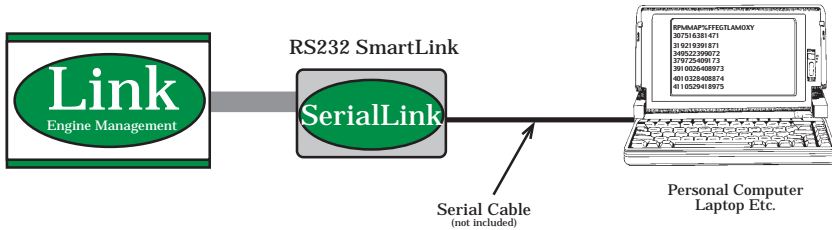
12.1.1 Menu Structure

Each function is allocated a menu from which adjustments can be made. The first 4 menus are read only providing real-time information about the engine. The remaining adjustable functions for simplicity have been grouped under an appropriate heading, designated by the ‘*’ symbol. For example, all functions related to the ignition map such as ZONE IGN, IGN TYPE have been grouped under one heading. These tuning functions can only be accessed from this heading using the EDIT buttons. All read only menus and headings are displayed in upper case and all adjustable functions displayed in lower case. Figure 12.1 illustrates this menu structure.

12.1.2 Tuning Module Buttons

The SELECT Buttons allow scrolling through the read only menus and main headings. From any main heading (shown by the * symbol), pressing EDIT down will allow access to the grouped tuning functions. Pressing EDIT up will return the menu to its main heading. The EDIT buttons are also used to move through the Zone Editor, which appears as the last menu. To change a value use the ADJUST buttons.

12.2 SerialLink



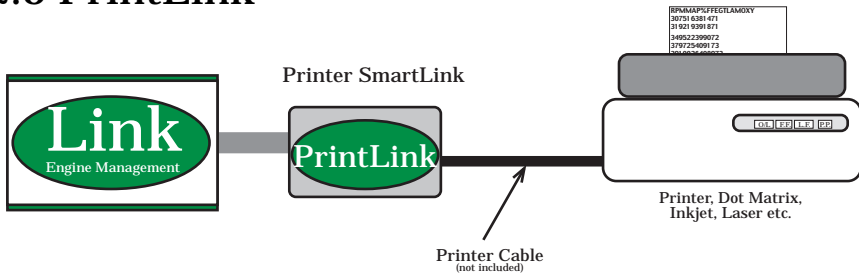
The SerialLink allows communication between the IgnitionLink and a personal computer via the PC's RS232 serial port for data-logging and downloading of the IgnitionLink settings. While the engine a stream sent to the PC shows all major engine parameters such as RPM, pressures, temperatures and flows. The information may be recorded using the PC's memory / disk drive. Graphs etc. may be created using spread sheets etc.

The Software used to view and store this data is called "Comlink" and can be copied from the CD supplied with the IgnitionLink. (Alternatively it can be downloaded from our web site www.link-electro.co.nz.) Place the CD in the CD ROM drive and select the directory "PCLink\PCLink Software Installer\Comlink.exe". Copy comlink.exe to the hard drive where the program can be executed. Connect the 14 way flat ribbon cable between the IgnitionLink and SerialLink. Next connect the standard serial cable between the SerialLink and an available COM Port on the PC. Now start Comlink. There are 2 setup options

- First select the correct COM Port. Use the keyboard buttons Q & A to change the settings. Once configured press the Enter button on the keyboard
- Next select the baud rate to 9600 using the Q and A Keys. Once configured press the Enter key on the keyboard
- Switch the ignition key ON. The initial data dump will be in the same format as the Zone Table shown in Appendix A or B. The first 2 rows are configuration and tuning functions. Next is the Fuel table, followed by the ignition table, and lastly the boost table.

- Now start the engine and observe the runtime data. Follow the onscreen help for storing this data.

12.3 PrintLink



The PrintLink is similar to the SerialLink above except that the PrintLink connects directly to any type of printer for instant hard copy data. An alternative option is to use a battery backed “printer buffer” to store information while test driving and then downloading the buffer to a printer. Typical buffers allow in excess of one hours logging time.

12.4 DataTrap

The Link DataTrap is designed to store information collected from the IgnitionLink for later playback. The DataTrap is a stand alone unit, taking ASCII format data from the computer, compressing it, then storing the data in nonvolatile Flash ROM i.e. (no PC is required to store information). The stored data can then be played back on PC at a later date.

12.5 PCLink

This allows the IgnitionLink and PC to perform 2-way communication using the SerialLink. Once the PCLink software has been installed from CD the IgnitionLink can be tuned from laptop or personal computer. For more information see Section 13.

13. WINDOWS LAPTOP TUNING

The IgnitionLink offers PC/Laptop tuning using PCLink Software. A copy can be found on the CD supplied with the computer or from our web site: www.link-electro.co.nz. It allows real time 2-way communication between the IgnitionLink and Laptop computer.

Installing PCLink Software from CD

- Insert PCLink CD into the CD ROM drive.
- The software is located in the "PCLink\PCLink Software Installer\Setup.exe" folder.
- Double click on the "setup.exe" file to start the installation process.

During the installation process a PCLink icon will be generated and placed on the desktop. To start, simply double click on this icon.

- For detailed information on the operation of the PCLink software, start the program and read the online Instructions.
- A Tutorial is also available and can be copied from the CD in directory, "PCLink\PCLink Tutorial\PCLink_Tute.pdf". This is a PDF document, which requires Acrobat reader. A copy of this software is also available on CD if required.

PCLink hardware connection.

This requires one 14-way flat ribbon cable, one SerialLink, one standard serial cable and a PC.

- Connect one end of the ribbon cable to the Link Tuning Port, the other end should connect to the SerialLink.
- Take a standard serial cable and connect one end to the SerialLink. Connect the other end to an available COM Port on the PC.

- Start the PCLink Software by double clicking on the desktop icon or using the START, programs menu.
- Switch the ignition on which will power up the IgnitionLink
NOTE. The SerialLink should ALWAYS be connected before the ignition key is switched ON.
- The PCLink offers both mouse and keyboard control. To start the connection between PC and IgnitionLink using the mouse, move to the "Link Control" menu and select "Connect Link". Using the keyboard, press and hold the Ctrl, Alt and L keys. This will bring up an "Options" box. Check the following settings
- Make sure the Link Connection shows "ONLINE"
- Select the correct COM Port
- Click the OK button. Once the PC is communicating with the IgnitionLink, tuning can begin. Remember to STORE any changes before disconnecting the PCLink software from the IgnitionLink.

14.SENSOR INSTALLATION & WIRING

The following provides information on how to install additional hardware relating to IgnitionLink engine management.

13.1 TPS

The Throttle Position sensor is connected directly to the throttle shaft on the butterfly. Ensure the mounting position allows the TPS to move through its range as the throttle is opened.

13.2 Knock Sensor

The knock sensor **MUST** be in direct contact with the engine block to ensure the noise signal is transmitted correctly. The after market sensor supplied by Link is a donut style (see Figure 13.1), approximately 25mm in diameter, with an internal size hole of 8mm. A suitable tapped hole or stepped stud will be required for mounting.



Figure 13.1

15. FAULT FINDING & DIAGNOSTICS

14.1 Engine Misfire

- Check for stable “TEST RPM” on the Tuning Module
- Ensure the plug gap is not too large. Typical value range from 25 to 35 thou.

14.2 Idle Surge

If fuel cannot smooth out an engines idle, one method is to advance the engine with falling idle speed. For example, if the engine is idling in zone 105, enter a larger advance number into zone 100 and perhaps zones 100 and 200.

14.3 Engine will not or hard to start

The first check is for low voltage on crank. Connect the Tuning Module and move away from the “TEST RPM “ menu. Now try and start the engine. If the Tuning Module resets to the “TEST RPM” menu, the IgnitionLink has been put through reset because the supply voltage has dropped below 7.5V. Check to ensure the power supply is not going through the ignition switch, as this can create voltage drops on crank. Wherever possible, always use a relay to supply +12V directly from the battery to the IgnitionLink.

APPENDIX A

IgnitionLink Vacuum/Turbo Zone Sheet

IgnitionLink Engine Management

Miscellaneous

TPS

Knk Base

Specials

Clamp	Master	R.Lim	M.Lim	A.Lim	Mode	Cyl	Knk Rate	Ratio	High	Low	High	Launch	Offset	Shift	Mode	Knk RPM
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

Zone Ignition

	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000									
kPa																				
30	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195
60	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	185	290	295
90	300	305	310	315	320	325	330	335	340	345	350	355	360	365	370	375	380	385	390	395
120	400	405	410	415	420	425	430	435	440	445	450	455	460	465	470	475	480	185	490	495
150	500	505	510	515	520	525	530	535	540	545	550	555	560	565	570	575	580	585	590	595
180	600	605	610	615	620	625	630	635	640	645	650	655	660	665	670	675	680	685	690	695
210	700	705	710	715	720	725	730	735	740	745	750	755	760	765	770	775	780	785	790	795
240	800	805	810	815	820	825	830	835	840	845	850	855	860	865	870	875	880	885	890	895
270	900	905	910	915	920	925	930	935	940	945	950	955	960	965	970	975	980	985	990	995
300	1000	1005	1010	1015	1020	1025	1030	1035	1040	1045	1050	1055	1060	1065	1070	1075	1080	1085	1090	1095

13 October 2001

Vacuum / Boost Conversion Guide

- 0.4 Bar=18"Hg Vacuum="Slightly above typical life (about 0.3 Bar)"
- 0.8 Bar= 6" Hg Vacuum="Medium to high power for non - turbo engine"
- 1.0 Bar= 1 Atmosphere="WOT non turbo engine"
- 1.2 Bar=3 Psi Boost="Low boost"
- 1.6 Bar=9 Psi Boost="Medium boost"

APPENDIX B

IgnitionLink Vacuum Zone Sheet

IgnitionLink Engine Management

Miscellaneous

TPS

Knk Base Specials

Clamp	Master	R.Lim	M.Lim	A.Lim	Mode	Cyl	Knk Rate	Ratio	High	Low	High	Knk Base	Launch	Offset	Shift	Mode	Knk RPM
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		

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Zone Ignition

	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000									
kPa	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195
20	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	185	290	295
30	300	305	310	315	320	325	330	335	340	345	350	355	360	365	370	375	380	385	390	395
40	400	405	410	415	420	425	430	435	440	445	450	455	460	465	470	475	480	185	490	495
50	500	505	510	515	520	525	530	535	540	545	550	555	560	565	570	575	580	585	590	595
60	600	605	610	615	620	625	630	635	640	645	650	655	660	665	670	675	680	685	690	695
70	700	705	710	715	720	725	730	735	740	745	750	755	760	765	770	775	780	785	790	795
80	800	805	810	815	820	825	830	835	840	845	850	855	860	865	870	875	880	885	890	895
90	900	905	910	915	920	925	930	935	940	945	950	955	960	965	970	975	980	985	990	995
100	1000	1005	1010	1015	1020	1025	1030	1035	1040	1045	1050	1055	1060	1065	1070	1075	1080	1085	1090	1095
110																				

Vacuum / Boost Conversion Guide

- 0.4 Bar=18"Hg Vacuum="Slightly above typical idle (about 0.3 Bar)"
- 0.8 Bar= 6" Hg Vacuum="Medium to high power for non - turbo engine"
- 1.0 Bar=1 Atmosphere="WOT non turbo engine"
- 1.2 Bar=3 Psi Boost="Low boost"
- 1.6 Bar=9 Psi Boost="Medium boost"