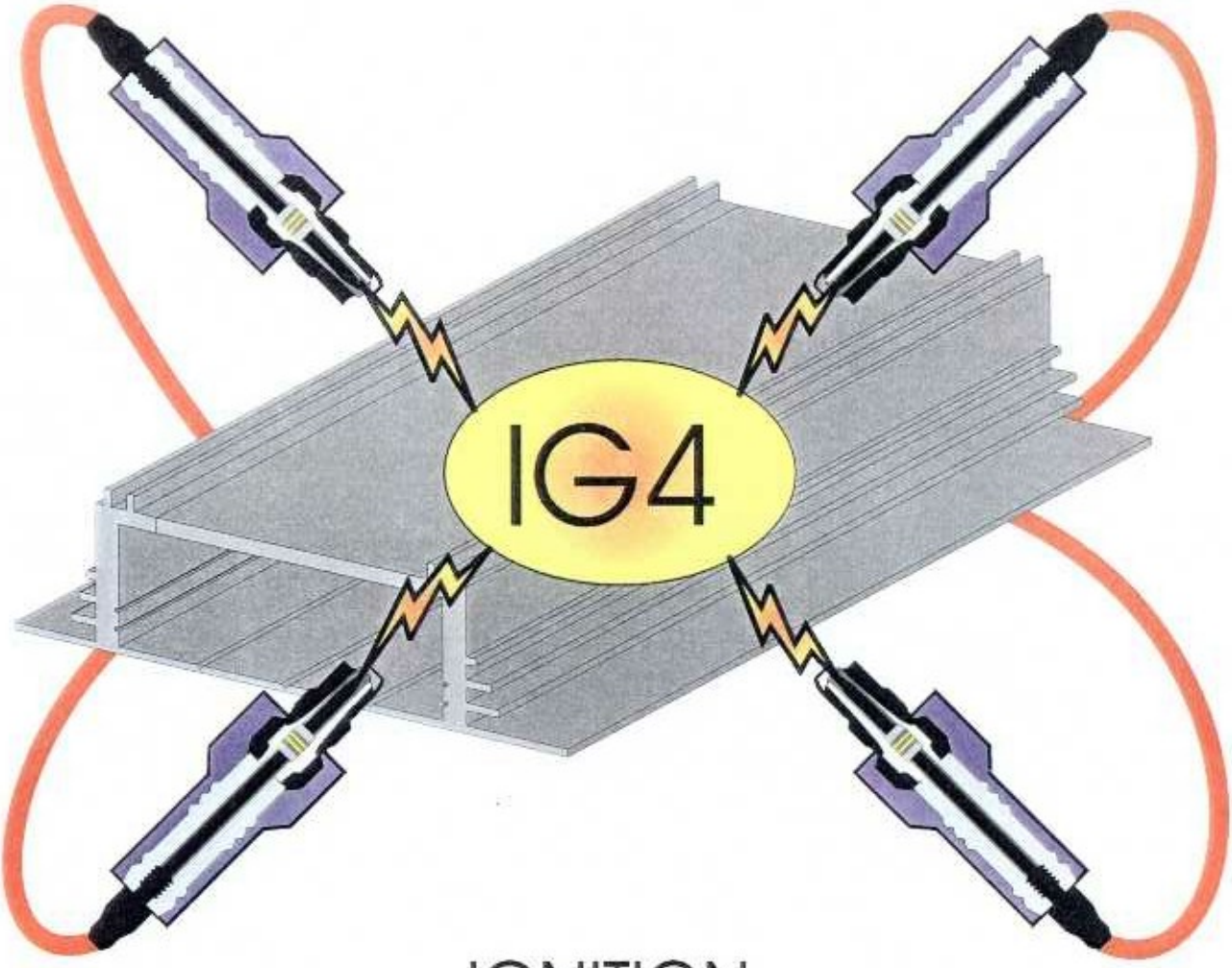
HALTECH™



IGNITION MANAGEMENT SYSTEM

INSTRUCTION MANUAL

IG4 Product Description

The Haltech IG4 ™ Ignition Computer is a high performance ignition timing computer. By using the Haltech IG4 ™ computer in conjunction with a standard ignition system or a high performance igniton system such as MSD manufactured by Autotronics control Inc. or Jacobs manufactured by Jacobs Ignitions Inc. the user is able to fully map the ignition timing very accurately right through the RPM range so that the exact timing required to obtain optimum performance is applied in every RPM and load range. This allows a flexibility and precision of timing that cannot be obtained by older conventional methods.

Precision timing is desirable for all performance applications but it is particularly important for turbo or supercharged applications to obtain optimum performance and at the same time eliminate detonation or keep it to an absolute minimum.

The Haltech IG4 ™ is programmed by plugging in an IBM compatible personal computer and this method of programming gives accuracy and flexibility not obtainable by any other method of programming. It also gives benefits such as the ability to save and change sets of timing maps, data logging and fault diagnosis. User friendly software is provided which at all times provides an overview of what is happening and various options which speed up and simplify the programming process.

IG4 System Features

- 16 engine rpm ranges
- RPM maps every 600 RPM from 0 - 9000 RPM
- Each map has 32 load points
- Load span depends on map sensor type
    - 1 bar map sensor MINUS 100 KPa to 0 KPa
    - 2 bar map sensor MINUS 100 KPa to 100 KPa
    - 3 bar map sensor MINUS 100 KPa to 200 KPa
- Can be used in throttle position mode (without map sensors) if required e.g. for certain motorcycle applications, rotaries etc.
- Timing adjustment is from 55 BTDC to TDC
- Timing is adjusted in one degree steps
- The IG4 ™ controls dwell (coil on time duration)
- Programmable by any IBM compatible personal computer (which must have CGA graphics or be capable of displaying CGA graphics and have a minimum of 512 K bytes of ram) via a standard RS232C port. A laptop is more convenient.
- The optional timing trim allows manual adjustment from -7 to +8 degrees. This is particularly convenient when programming.
- A data log can be taken so that parameters are recorded at eight times per second.
- An auto datalog feature allows the data log to be automatically recorded to floppy disk
- Maps can be saved to disk and re-inserted back into the Haltch if required. This means that the user can experiment with various settings for various tracks or conditions, or use the same Haltech IG4 ™ on different engines
- The timing tables or "maps" are displayed in bar graph form
- Timing adjustments are as simple as pressing arrow keys up or down or alternatives to speed the process.
- The system can be used "OFF-LINE" I.E. not connected to the Haltech IG4 ™ to construct or examine maps or to become familiar with the system.
- The system automatically tracks the load point being used by the engine at any moment by an arrow which appears over the relevant bar.
- An "All Ranges" option speeds initial set up
- A "Current Position" option changes maps automatically as the engine accesses each different map.

- RPM limiter option.
- Engine parameters are displayed in real time
- Ignition input edge can be configured as rising or falling edge.
- The system measures the following engine parameters
    - Engine speed
    - Manifold pressure (Unless used in throttle position mode)
    - Battery voltage
    - Timing trim when the optional trim is connected

CHAPTER ONE

Installation

Overview

Note : THIS SYSTEM SHOULD NOT BE USED WITH SOLID WIRE IGNITION LEADS.

To Install a Haltech IG4 System you must

1 : Mount Manifold Absolute Pressure sensor part #32560 or #32586 or #32549

* Note - This component not required when using Throttle Position Mode

2 : Mount Power Relay part #36434

3 : Route wire harness and connect engine bay sensors

4 : Mount Electronic Control Unit (ECU) inside passenger compartment

5 : Connect suitable Tach Adapter

* Note - Only required when using magnetic or reluctor trigger.

6 : Locate and connect the following wires - RED - Always + 12 volts

GREY - Ignition ON +12 volts

BLACK - Chassis ground

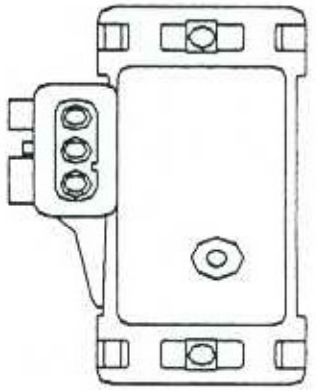
7 : Connect ECU and test.

8 : Connect optional ignition trim and mount trim inside cabin.

Expanded Installation Guide

1. Mount Manifold Absolute Pressure (MAP) Sensor Part #32560, 32586 or 32549

MAP SENSOR PIN OUT
A - ground
B - MAP SENSOR OUTPUT
C - +5V REF



NOTES:

GM MAP SENSOR PN: 16040749 = 3 BAR (ORG)

GM MAP SENSOR PN: 16009886 = 2 BAR (ORG)

GM MAP SENSOR PN: 16017460 = 1 BAR (GRN/NONE)

The MAP sensor allows the Haltech IG4 ECU to measure the Inlet Manifold Pressure. There are three types of MAP Sensors available

1 BAR - For non Turbocharged/Supercharged engines part # 32560 - COLOR CODE GREEN

2 BAR - For Turbocharged/Supercharged engines boosted up to 15 PSI (100KPa) part # 32586 COLOR CODE YELLOW

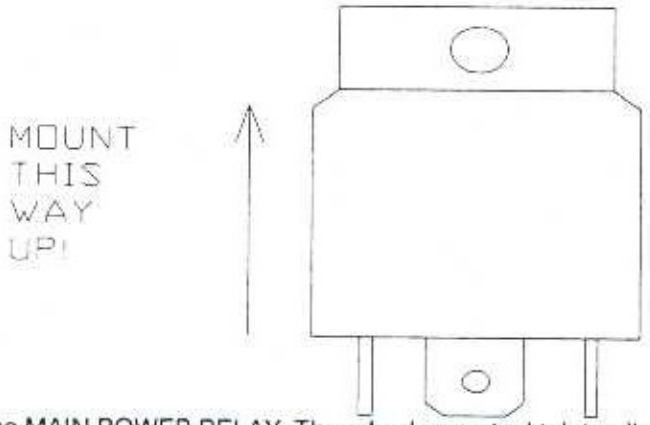
3 BAR - For Turbocharged/Supercharged engines boosted up to 30 PSI (200 KPa) part # 32549 COLOR CODE RED

Make sure that you have the correct MAP sensor to suit your engine.

The MAP Sensor is designed to mount on the firewall of the engine bay with the hose barb facing outward. The MAP SENSOR has two mounting screw holes. Locate a suitable position on the engine bay firewall, so that the sensor can be mounted and attach the sensor to the firewall. The barb on the sensor is connected to the inlet manifold vacuum through a short length of hose. Locate a suitable vacuum port on the inlet manifold that sees continuous manifold vacuum. Attach a hose to this port. Secure the hose to the port with a hose clamp or nylon tie. Cut the hose to length so that the other end connects neatly to the barb on the MAP sensor. Connect the hose to the MAP sensor and secure with a hose clamp or nylon tie.

NOTE : Do not position the MAP sensor too close to any Turbocharger. Avoid damage to the sensor from the extreme heat generated by a turbocharger.

2 : Mount the Power Relay to the firewall



The relay is the MAIN POWER RELAY. The relay has a steel tab to allow it to mount with a single screw to a semi flat surface. Locate a suitable place on the firewall or on the inner fender to mount the relay.

Do not mount the relay upside down such that it catches spashed water. Residual water inside the relay housing will cause it to fail.

3 : Route Wire Harness and Connect Engine Bay Sensors.

Lay the main harness out in the engine bay with the sensors mounted to ascertain the best fit for harness in the bay.

Punch a hole in the firewall to allow the harness to pass into the passenger compartment.

The Main Harness is designed to pass into the engine bay from inside the passenger compartment.

IMPORTANT

DO NOT allow the harness to touch hot exhaust parts including headers and turbochargers

BE NEAT. Run the harness in a tidy fashion. Try to run the harness along paths used by stock harnesses. Use nylon cable ties to hold the harness in place.

4 : Mount the ECU inside the passengers compartment

The Haltech IG4 ECU is not designed to be highly water resistant. It is desireable that the ECU be given as much protection from the enviroment as possible. It is recommended that the ECU be mounted inside the passenger compartment.

The ECU has four mounting holes that allow it to be mounted to most flat surfaces. In cases of extreme vibration use anti-vibration mounts which incorporate rubber mouldings to absorb vibration (ie Lord mounts etc). When mounting the ECU remember that the communications connector should remain accessible for ease of programming.

5 : Locate and Connect the Following Wires

Note : These connections are the same on every IG4.

BLACK - Locate a good chassis ground point and connect the BLACK WIRE. Note the Haltech IG4 system's noise immunity is enhanced if the chassis ground is improved. Negative battery terminal is best.

RED - Locate a source of continuous +12 volts and connect the RED WIRE. Positive battery terminal is best.

GREY - Locate a switched source of +12 volts and connect the GREY WIRE. This wire should see +12 volts only when the ignition key is turned ON.

Remaining Connections

Each IG4 is preconfigured for the application required. Refer to the application sheet attached for special connections.

CHAPTER TWO

Operation

Now that your Haltech IG4 system is wired with all sensors in place, the system can be connected to a personal computer. This will allow the readings from the sensors you have connected to be tested and the results displayed on the computer's screen.

What You Will Need

To connect the PC to the Haltech™ ECU you will need the program disk and communication cable provided.

Computer Compatibility

The computer you use can be any MS DOS compatible personal computer (PC) or IBM PC AT, XT or clone. As a minimum, your computer must have 512 Kilobytes (512K) of Random Access Memory (RAM), a CGA,EGA or VGA screen driver and at least one disk drive. In addition, it is usually more convenient if you use a laptop computer. Most laptop computers have a suitable screen driver and 3-1/2 inch floppy disk drive as standard equipment.

STEP ONE

Connecting the Haltech™ ECU to a Computer

The D connector end of the communication cable connects to the RS232C port on your computer. The other end plugs into the nine position D connector on the main loom. Communications cables are supplied standard with a 9 pin D connector. This is the format most laptop computers use. Some desktop computers have a 25 pin RS232C port. Communications cables with 25 pin connectors are available on request.

The programming cable can be up to 100 feet in length if you need it. This can be handy in dynamometer room situations where the Haltech ™ system is in the Dyno room with the engine and you wish to adjust it from the dyno control room.

Power Requirements

Anytime you want to communicate with Haltech ECU through your computer the ECU must have power. This usually involves turning on the ignition switch. The grey and red wires must have +12 volts and the black wire must go to ground.

If power is lost in any way, the message "Reconnect Haltech" will appear on the computer screen.

STEP TWO

Installing The Software

When you turn on your computer, it should "boot up". If you already have MS DOS installed in your computer or on your "booting up" disc, you will see one of the following (or a simple variation) on your computer screen. This is called the DOS prompt:

A:\> C:\> or D:\>

If your screen gives you the message "Please Insert a System disk" and the Haltech disk is NOT in the floppy drive it is necessary to run a registered copy of MS DOS according to the instructions that come with your computer.

Switching disk drives

Once you have the DOS prompt visible on your screen, you must insure that you are working in drive "A". To do this, type the following command after your DOS prompt: (Note some systems use **B:** not **A:**)

A: <Enter>

You should then see the following DOS prompt (or a simple variation):

A:\>

You are now ready to install, or run, the Haltech™ software

How to run your Haltech™ software

Insert the Haltech disc into Drive A.

Type the following command:

Autoexec <Enter>

The program will run automatically. The title page should appear on the screen briefly before the software starts to run. A screen will then appear that allows you to select between online and offline mode.

The Online and Offline Modes

You simply select the mode you desire for this session by pressing "Y" on the keyboard for online mode or "N" for offline mode.

The offline mode option is an advanced mode and if you are using the system for the first time we suggest that you first try using the online mode.

Using The System Online

In the online mode there is a two-way flow of information between the ECU and your computer. The online mode is used to program the Haltech™ system. The communication cable must be connected and the ECU must have power.

The online mode is the one that you will use most frequently. While using the system online, you can view engine information directly and make adjustments. Any changes or modifications you make will immediately be recorded by the ECU and implemented. Changes made online are instantaneous. There is no need to save these changes. Once you unplug the communication cable, the ECU will remain in the configuration you have set up.

NOTE: If there is a power shortage or the communication cable is disconnected or interfered with, the following message will be displayed on your computer screen:

RECONNECT HALTECH

When this message appears, check all connections and ensure that the communications cable is not being interfered with. Also be sure that the Haltech™ unit is receiving power. (i.e. the ignition switch is turned "on" or the engine is running.)

Using The System Offline

The characteristics you set for a particular engine are saved by the Haltech™ ECU. This saved information is called a MAP.

MAPS can be stored or loaded from a computer disk. The offline mode enables you to alter one of these stored MAPS without having to be connected to the car itself.

To select the offline mode press "N" at beginning of the program when prompted by the proper screen. Load in the MAP that you wish to view or alter. You can now view or change the listed information. Of course, since you are not connected to an actual engine, you cannot use the view engine data functions. Once you have made changes to a MAP, you should store the changed MAP to floppy disk.

REMEMBER: When using the offline mode you are not changing the information in the ECU. To alter the information in the ECU you should select online mode when connected to the ECU and load your stored MAP.

STEP THREE

The Identification Screen

When you select online mode the Haltech MAIN MENU screen appears. The ECU stores a page of information as a record of the engine configuration. The identification information is accessable via the main-menu by typing <I>. The identification screen contains information sent back from the ECU to ensure that the ECU is configured the way you want. Alterations can be made on this page.

The Main Menu

When you select online mode the Haltech MAIN MENU screen appears. This menu allows access to the ignition timing curves, file storage/retrieval functions, System Identification page, Engine Data screen and the options page.

Accessing The Ignition Curves

The function keys marked X, F1 to F10 and <ALT> are used to bring up the different Ignition Timing curves. These keys are usually found in a block to one side or above the keyboard.The keys F1 to F10 bring up the ten ignition timing curves from 600 RPM to 6000 RPM . Pressing ALT and F1 to F5 brings up the ignition timing curves from 6600 RPM to 9000 RPM. .ie If you want the 2400 RPM map you press F4. If you want the 8400 RPM MAP you press ALT and F4. The zero RPM or cranking map is displayed by pressing X. Return to the main menu from any fuel map by pressing the space bar.

Finding The Current Use Ignition Curve

Pressing the HOME key brings up the Ignition curve currently being used by the engine. Ideal for tracking in on the engine's current operating point quickly. Pressing any of the keys displayed on the menu page, while in any of the graphs, will bring up the appropriate ignition curve. This includes the home key. Also pressing "P" and "N" while in any graph will bring up the previous and next range respectively.

Adjusting Bar Height In The Ignition Curves

The height of the bars in the MAP graphs can be readily adjusted by using the keys identified below. The bar that is outlined on the computer screen indicates the bar that you are currently adjusting.

To move the adjusting bar, use the left and right arrow keys. If the engine is using one of the values in the graph you are currently viewing then an arrow will appear on the screen above the value being used. If the engine is operating outside the speed range that is being displayed on the screen then the arrow will disappear until the engine again enters the speed range being viewed. To adjust the height of the bar being viewed use the following keys:

up arrow raises the height of a bar one increment

down arrow lowers the height of a bar one increment

PgUp raises the height of a bar five increments

PgDn lowers the height of a bar five increments

While holding the SHIFT key down:

PgUp raises the height of a bar ten increments

PgDn lowers the height of a bar ten increments

While holding the CONTROL key down:

PgUp raises the height of a bar thirty increments

PgDn lowers the height of a bar thirty increments

Duration Of Increments

For the ignition timing graphs each increment is one degree of engine crankshaft rotation. When the height of a bar is being adjusted the ECU is unable to run the ignition timing function for some thirty milliseconds. If the engine is under load the engine will stutter while this updating is occurring. If this is a problem then the adjustments should be made when the engine is not under heavy load.

How To Quit

You can adjust the shape of any of the ignition curves to suit the engine. To return to the main menu from any of the ignition curves press the spacebar on the PC.

Throughout the program you can return from any function by pressing either the spacebar or the escape key depending on the screen you are in. Press it again to return to the main menu. Pressing the <CRTL> key and the Q key simaltaneously at the Main Menu will allow you to exit the Haltech program and will return you to MS-DOS.

Disc Storage And MAP Retrieval

The Floppy Disk storage and retrieval functions can be accessed from the Main Menu by pressing "F" for files. This function allows you to save the complete set of MAPS and system identification to computer disk or to load the stored MAPS and identification from computer data disk into a computer.

Saving MAPS: Haltech™ ECU to Floppy Disc

The Save Command

To store the MAPS and identification to computer disk with the system running online press "F" at the Main Menu then press "S". The list of MAPS already stored will appear on the screen.

Giving Your MAP A Filename

Choose a name to call your saved file. If you choose the same name as a file (MAP) that has already been saved, the old file will be overwritten and replaced with the file you are currently saving with the same name. If you do not wish to erase any files already saved, choose a new filename - one that does not appear on the screen.

The name you choose should not include any spaces or full stops and should be less than SEVEN characters in length. The name must start with a letter from the alphabet, not a number. For the sake of your own memory, try to select a name that you will be able to recognize in six months time.

As you perfect the ignition curves for a particular application you might add a number to the end of the name to indicate which MAP is most recent. For example you might call the MAPS for a Celica Celica1, Celica2, etc.

After you have chosen a name to save the maps under, you must enter the name in the space provided. The system will pause and ask if it is OK to continue with the save. If everything looks OK, continue by pressing "Y". If you incorrectly enter the name, abort the storing function by pressing "N".

The store function takes a few seconds to complete and then the program returns to the Files Menu. To return to the MAIN MENU press the <SPACE BAR> key.

Loading MAPS: Floppy Disc To Haltech™ ECU

While the ECU system is online, you can load a set of MAPS that you have previously saved from your computer to the ECU. To do this, press "F" when the Main Menu appears then press "L". The load command erases the contents of the ECU and replaces it with the set of MAPS stored on the floppy disc you are loading into the system. To view the list stored, press "S".

Remember to save any MAPS currently in the ECU that you wish to retain before loading new MAPS from a disc.

The engine cannot be running while MAPS are being loaded.

Select the name of the MAP you wish to load by using the arrow keys to highlight that name and press return. Your computer will then pause to ask if everything is OK before continuing the load. If you're ready to proceed, press "Y" to continue. If there is an error, abort by pressing "N". The load will take approximately thirty seconds.

Erasing Unwanted Maps

To remove unwanted MAPS from the floppy disk press "F" when the Main Menu appears and then "E". The list of MAPS stored on the disk will appear. Select the name of the MAP(S) you wish to erase by using the arrow keys to highlight that name and press return. The computer will pause to check that everything is OK. Press "Y" to continue to erase, if in error press "N" to abort the erasure.

Extra Functions Available In The OPTIONS Menu

To get access to the other functions of the system, press "O" when the Main Menu appears. This will bring up the OPTIONS menu. A list of options appears down the left-hand side of the screen. Pressing the corresponding key activates the function listed.

Options <R> AND <M> toggle between two states when the key is pressed.

All Ranges Option - Press <R>

In order to allow all sixteen ignition curves to initially be set up as quickly as possible, the Haltech™ IG4 system has an All Ranges function which allows all curves to be set up at the same time.

When the All Ranges function is active, adjustment of a bar on one graph is duplicated to the same bar graph on all the ignition curves. If you use the all ranges option, you can set the shape of any one ignition curve and all other curves will be identical at every bar you adjusted. This feature enables all graphs to be given some rough initial shape quickly. Once you have used the All Ranges Option for a starting point, exit the all ranges option to tailor each ignition curve individually.

Online/Offline Option - Press <M>

At the beginning of the program you are asked whether you want to be operating the system online or offline. If you wish to change between online and offline while the program is running then press "M" when the OPTION menu is displayed.

When changing from offline to online the computer must be connected to the ECU and the ECU must be powered on. All MAPS currently in the PC will be lost when you go from offline to online so store them on a data disc if you wish to keep them. When you change to online the system will automatically load the MAPS from the ECU into your computer.

The Datalog Engine Option

This option allows the engine's performance to be accurately recorded. All of the engine variables can be recorded approximately eight times per second while the car is being driven. This information includes the manifold pressure, engine speed, speed range, ignition timing, batttery voltage, the bar within that Ignition curve that the ECU was using and the time from start that each reading was taken in minutes, seconds and tenths of seconds.

To do a datalog the system must be online to the ECU. There are two ways to datalog the engine. To bring up the datalog options press "D" when the OPTION MENU appears. Pressing "D" again starts a normal datalog running.

A normal datalog will record engine data for about three minutes. This is an endless loop process. When you stop the datalog, it has a record of the previous three minutes of engine data.

TO VIEW A DATALOG PRESS "V" WHEN THE DATALOG MENU PAGE IS DISP

To stop a normal datalog press the spacebar. To scroll up and down the pages of data use the up and down arrow keys or the "page up" and the "page down" key. To go to the beginning of the data press <HOME>. To go to the end of the data, press <END>. Pressing <S> brings up a display of the maximum, minimum and average of all engine variables recorded over the three minutes.

If the power to the ECU is interrupted while a datalog is running, the datalog will stop until the power resumes. This can be useful because you can start the DATALOG going but not have information recorded until the ignition is switched on.

Storing Datalogs

The datalog can be recorded to computer floppy disk if required. To do this press Esc to return to the datalog options page and then press "S". The system will display

the list of current stored datalogs. Choose a name for the datalog file. The name must be no more than eight characters and must begin with a letter of the alphabet.

Unless you intend to overwrite an existing datalog, the name you choose for the datalog you are saving must be a new name not already contained in the list of stored datalogs.

Loading Datalogs

Stored datalogs can be loaded by pressing "L" when the datalog options menu appears. The computer will display the list of stored files. Select the name of the datalog you want to load by using the arrow keys to highlight the name of the appropriate file and press return. This will load the datalog from floppy disk. The datalog can be viewed by pressing "V" when the datalog options page is displayed.

Auto-Datalogs

Your computer can also do an auto-datalog. As your PC receives each block of data it saves it to disk until you press the space bar or until the disk is full.

To start press "A" when the datalog options page is displayed. The system will ask for a name to identify the stored datalogs. This name is similar to the names used to store normal datalogs to disk. Stored datalogs can be loaded and viewed as desired. If the datalog is longer than three minutes, there will be a small delay viewing some pages as the PC reads the next block from disk.

Erasing Stored Datalogs

Unwanted datalogs can be removed from the floppy disk by typing "E" when the datalog options page is displayed. The datalogs stored on the disk are listed. Type the name of the datalog that you want to erase and type return.

The computer will pause for you to check that the name has been entered correctly. If everything is OK then type "Y" to continue. To abort the erase command type "N".

System Identification

The system Identification screen displays a page of information that is stored in the Haltech IG4 ECU. This information is used by the ECU to match the target engine's characteristics. To view or change the Identification information press "I" when the MAIN MENU screen appears.

To alter a variable in the Identification page move the highlighted area up and down using the up and down arrow keys until the field you want to alter is highlighted. Press the enter key. A prompt will appear at the bottom of the screen requesting the new information for that field. Enter the new information and then press <ENTER>. Repeat this process until the information in the Identification screen matches the characteristics of the target engine.

To return to the MAIN MENU press <ESC>.

What each field in the Identification Screen is used for is discussed in the next chapter.

Some fields have a number of predefined values which you can select from. This is indicated at the bottom of the screen. Use the down arrow to display each of the values in turn. When the value you want appears press <ENTER>.

Engine Data

The engine data option can only be used when the system is online. This function allows all of the engine variables to be displayed on the computer screen.

This is a very useful function for analyzing the engine sensors. To bring up the engine variables press "E" when the MAIN MENU is being displayed. To return to the OPTIONS menu press any key.

CHAPTER THREE

Mapping the Engine

Over advanced Ignition Timing Will Destroy Your Engine in seconds!!

If you are unsure about the ignition timing requirements of your engine then seek proffessional help before proceeding!!

It is beyond the scope of this manual to discuss techniques used to determine the correct number of degrees of ignition timing suitable for different engine types. You should refer to your manufacturers engine manual or to advice from your engine builder for the maximum ignition advance your engine can run. Do not exceed the maximum advance recomended for your engine.

STEP ONE

Check All Systems

Before attempting to program the ignition timing you must ensure that the following areas are correctly implemented:

1. The ignition ignitor and coil(s) are compatible and is functioning correctly.

3. The sensors and wiring looms have been fitted correctly.

4. The ECU has a good ground and a clean power feed from the positive side of the battery through a relay.

5. The communication cable is connected and the Haltech™ system is powered and online.

If you are unsure about any of the above concerns, it is important that you review the relevant sections in this manual before proceeding. This section assumes that you are now familiar with the operation of the Haltech™ system controls and that the engine is ready to start.

STEP TWO

Programming The Haltech™ System

How To Get Going

- Power up the Haltech™ system in the car by turning the ignition on.
- Connect the interface cable to your computer.
- Turn the computer on and insert the programming disk.
- Select the online option and note the vehicle information present in the computer.

Using the System Identification to enter Engine Information

You must enter the correct information into the Identification page or the system will not function correctly. Use the following as a guide when setting up the Identification screen.

Identification Field	What information to enter
Version	This field describes the version number of the Haltech System you have purchased and cannot be altered
Cylinders	Select the number of engine cylinders using the down arrow.
Trigger Degrees	Enter the number of degrees of engine rotation before TOP DEAD CENTRE that the trigger signal occurs.
Load Sensor	If the system uses a MAP Sensor then enter the pressure range for that MAP sensor. If the system uses throttle position then select THROTTLE. This is done using the down arrow.
Rev Limit	Set the RPM at which the ignition is to cut.
Input edge	Press "Enter" then the down arrow until "rising" or "falling" is displayed. This field determines if the Haltech IG4 is triggered by a signal with a rising or falling edge. In most cases, this will be preset for a particular engine or the setting will be noted in the application sheet.
Owners name	This field is for user reference only. Use it to store the system owners name.
Engine Details	This field is for user reference only. Use this field to store details of the target engine.

Identification Field	What information to enter
Note Fields	Both the note fields are not directly used by the Haltech ECU. The note fields are for user notes on the target system.

Starting The Engine

The IG4 comes with all ranges set to 10 degrees before top dead centre (BTDC). This is to allow the base timing to be checked. When you have checked your installation and you are happy that everything is OK the engine should be started.

Check the Base Timing

The next step is to check that the timing displayed by the laptop is correct. Connect a timing light. With the engine at idle make sure the timing is actually at 10 degrees BTDC. If the timing is within a few degrees then the distributor or crank reference may be adjusted until the correct timing is obtained.

If it is not within a few degrees then there is something wrong. At this point you should contact your Haltech dealer for advice.

Once the timing is constant at 10 degrees with the engine at idle you should rev the engine under no load and check that the timing remains at 10 degrees BTDC. The timing should remain at ten degrees BTDC.

If the timing is correct you know the system is properly configured and you may enter the desired ignition timing by adjusting the bar graphs. Once the base timing has been checked the timing light may be removed since all further timing adjustments are done using the laptop.

Recommended Method of Use

If the system is to be tuned for maximum horsepower then the ideal method is to tune the engine under full load constant speed operation such as possible on an engine or chassis dynamometer. It is possible to tune ignition timing using "seat of the pants" methods, however, in order to get maximum performance a dynamometer is a must.

The basic method is to pick an RPM (E.G. 3000 RPM). Adjust the bars until the timing is around the desired degrees BTDC you think the engine will need (E.G. 30 Degrees BTDC) then take the engine to full load and use the timing trim (-7 to +8 degrees) to trim the timing until the maximum horsepower is obtained. The bars can then be adjusted (E.G. 30 degrees BTDC +5 degrees BTDC trim = 35 degrees BTDC) to the final timing figure.

In this way, as you go through the speed and load ranges, you will gradually build up the best timing settings for the engine.

Performance Engine Considerations

Note : The following recommendations assume that the air/fuel ratio is correct.

What Ignition timing should I run?

This is a standard question but there is no standard answer. Every engine is different and there are a vast number of parameters (most of which are outside the scope of this manual) that influence ignition timing settings. Apart from combustion chamber design the most basic parameters are compression ratio and type of fuel. The best way to start is to use the same timing as used by the original mechanical distributor system. The mechanical advance and vacuum advance curve can be graphed by using a distributor test machine if the manufacturers figures are not available.

When using the IG4 on an engine that already had computer controlled timing this is not possible so more trial and error may be necessary. If possible use the timing settings from a similar type of engine as this will at least give you a starting point.

On most performance engines you will find some load/speed combination where detonation (KNOCK) occurs at the same ignition timing needed for maximum horsepower. In this case, the only thing you can do is retard the ignition timing in this area to prevent engine damage. This, however, is what fully MAPPED ignition timing is all about. It enables you to profile the exact ignition timing right through the range. In the past, if the timing had to be retarded at one point it affected the rest of the range as well.

Most engines are prone to knock around the point of peak torque. It is when adjusting timing in this area that care must be taken. (This area is easily identified when using a dynamometer.)

The IG4 is particularly suited to turbocharged engines where the timing can be mapped to give maximum performance on and off boost.

Making Adjustments To The Bar Graphs

Press the <HOME> key to bring up the bar that the engine is using. The arrow should appear on the screen above the bar that the engine is using. Move to the bar you desire to change by using the left and right arrow keys. Adjust the height of a selected bar by using the page up and page down keys.

As you change the height of the bars the ignition timing to the engine will immediately change. Since the Haltech™ ECU has to pause while it is being changed the ignition spark to the engine will stop for a fraction of a second. This will cause the engine to falter. Do not alter the height of the bars when the engine is under heavy load. It is better to lower the load on the engine, make the change, then run the engine back up again.

When the system is in the All Ranges option the computer takes longer to update since it is actually adjusting the same bar in all speed ranges.

By this stage the engine should be operating correctly throughout the operating range and the throttle response should be good. With the engine running you should be able to bring up the engine variables option from the MAIN MENU.

Note that the engine speed, battery voltage and manifold pressure are stable. These readings should reflect what the engine is actually doing.

When displaying any of the Ignition curves both the manifold pressure and the ignition timing being used are displayed on the screen.

CHAPTER FOUR

Trouble Shooting

This Chapter is devoted to trouble shooting problems that may occur in setting up your engine. To use this chapter first identify the closest symptom or symptoms that you have from the list below and then go to that section of this chapter and follow the problem solving flow chart.

Control Program Problems

* Haltech control program will not operate on your IBM Personal Computer
* The control program will not operate in ONLINE MODE
ie. The message "Reconnect Haltech" Appears.
* In ONLINE MODE the control program displays bad sensor readings.

Starting Problems

* The engine makes no attempt to start
* The engine is difficult to start

Idling Problems

* The engine surges at idle

Light Throttle / Cruise Problems

* Engine will not run at all at light throttle
* Engine surges at light throttle

Full Power Problems

* Engine falters under full throttle
* Engine detonates at full throttle

Throttle Response Problems

* Poor throttle response everywhere

Fuel Economy Problems

* Poor fuel consumption

Haltech Control Program will not operate on your IBM Personal Computer

Possible Problem / Symptom	Probable Cause / Cure
No MS DOS on your system. This will cause an error message such as "Non System Disk or disk error" to appear.	Run MS DOS before attempting to run the Haltech Control Program or copy your licensed copy of MS DOS to the Haltech control disk. Read the MS DOS manual supplied with your personal computer.
Your personal computer is of the wrong type or is configured incorrectly to run the Haltech control program	Check that your computer is an XT or AT IBM compatible computer with more than 512K of memory and a CGA, EGA or VGA video screen and driver. NOTE : Most laptop computers emulate CGA or VGA drivers.
The Haltech Control Disk is Damaged	Request a new copy of the Haltech control disk from your Haltech dealer
The message "INVALID FILENAME" appears when loading or saving maps.	Disk "write protect" tab is on. To change write protect tab see MS DOS manual supplied with your personal computer.

HALTECH control program will not operate in ONLINE MODE. The Message "RECONNECT HALTECH" appears.

Possible Problem / Symptom	Probable Cause / Cure
Damaged Communications Cable	Get a new communications cable from your Haltech distributor
Ignition not switched on	Switch ignition on.
Haltech loom incorrectly wired	Check black wire connects to ground, red wire to Battery +ve and Grey wire to switched +ve battery.
Haltech system fuse blown	Replace fuse
Haltech power relay damaged or defective.	Check relay makes "click" sound when switched power is turned on and off. 1.Check for water damaged power relay. 2.Check for defective relay. 3.Check for corrosion damage at relay terminals.
Haltech Harness damaged	Replace harness.

Possible Problem / Symptom	Probable Cause / Cure
RS232C port on personal computer not configured properly	Check communications cable is connected to COM1 on personal computer.
Personal computer damaged	Check PC and serial interface card.
Damaged Haltech ECU	Replace ECU.

Engine will not crank.

Possible Problem / Symptom	Probable Cause / Cure
Dead battery. Starter motor not getting power.	Recharge / replace battery.
Battery terminal connections poor. Starter motor not getting power.	Repair / replace / clean battery terminals.
Starter solenoid not getting crank signal. Starter motor not getting power.	Test for power at solenoid crank wire. Consult engine repair manual.
Engine mechanically inhibited from cranking.	Check engine wants to turn over. Use socket/driver on front crankshaft bolt to turn engine by hand. Check for mechanically damaged engine. Check for cylinder bores filled with fuel from leaking injector(s) or water from damaged head gasket.

The engine makes no attempt to start when cranking

Possible Problem / Symptom	Probable Cause / Cure
Engine not getting fuel.	Check fuel injection or carburetion system.
Engine getting too much fuel. Engine flooded.	Remove one spark plug and look for presence of excessive fuel. If flooded remove all plugs and allow to dry then replace in engine. CAUTION FUEL IS HIGHLY FLAMMABLE.

Possible Problem / Symptom	Probable Cause / Cure
Engine not getting compression.	Check compression using compression gauge. See repair manual on engine for correct compression and test methods. Check camshaft timing. Check valves. Check piston rings. Check for damaged pistons.
Engine not getting ignition spark.	Check that spark is present by disconnecting high tension lead from one spark plug and connecting to spare spark plug grounded to engine bay / engine. Alternatively use engine ignition system analyser. Check for bad ignition ampifier / igniter. Check for bad high tension leads. Check for bad / leaking distributor cap / rotor. Check connections to ignition amplifier / igniter. Check for valid signal to ignition amplifier / ignitor from distributor / ECU.
Engine not getting ignition spark. Ignition spark mis-timed.	Check firing order of engine against firing order of high tension leads. Check base timing of engine. Use spark timing strobe light to check actual firing position of engine.
ECU disrupted. Engine is fitted with solid core ignition leads.	Replace high tension leads with supression type high tension leads.

Engine is difficult to start.

Possible Problem / Symptom	Probable Cause / Cure
ECU disrupted. Battery voltage too low at cold crank.	Check cold cranking voltage to ECU with voltmeter during cold crank. Check ECU continous to communicate with IBM control program in ONLINE MODE whilst cold cranking. If ECU drops out due to insufficient voltage the message "Reconnect Haltech" will appear. Replace / Upgrade battery.
Engine not getting Ignition spark. Battery voltage too low at cold crank.	Check for spark present during cold crank using ignition analyser. Replace / upgrade battery.
Bad Haltech engine sensor.	Check sensors by viewing sensor readings on engine data page using Haltech control program. Check vacuum hose from inlet manifold to Manifold absolute pressure sensor.
The cold crank voltage is too low. ECU intermittent.	Check for consistent ECU operation during crank by having control program ONLINE while cranking. Intermittent operation will show "Reconnect Haltech" on engine data screen. Replace / Upgrade battery. Upgrade gauge of power wire connections to ECU.

Idling Problems

Possible Problem / Symptom	Probable Cause / Cure
Engine surges at idle. Ignition timing values poorly selected.	Ignition timing too retarded at idle causes flat idle and poor off idle throttle response. Ignition timing too advanced at idle causes the engine to race unstably at idle. Also note a slight misfiring when idle ignition timing is over-advanced. Typically idle ignition timing is in the range 12 to 22 degrees for a typical four stroke petrol engine. Note that ignition timing values should be selected to be constant from 400 RPM to at least 200 RPM above target hot engine idle speed to avoid surge from varying idle ignition values.

Light Throttle/Cruise Problems

Possible Problem / Symptom	Probable Cause / Cure
Engine falters at light throttle. Spark plugs damaged / worn / fouled.	Replace spark plugs.
Poor cruise fuel consumption.	Ignition timing too retarded at cruise. Check cruise MAP values in ECU. (Some petrol four stroke engines can use a total ignition advance of up to 50 degrees at light throttle cruise.)

Full Power Problems

Possible Problem / Symptom	Probable Cause / Cure
Engine falters under full throttle. Hole in MAP.	Check that Ignition MAPs are correct in full power band.
Engine dies under full power. RPM limit set too low.	Check RPM limit in ECU and adjust if necessary.
Engine lacks power at full power. Engine too retarded.	Increase ignition timing to manufacturers recommended setting for engine.

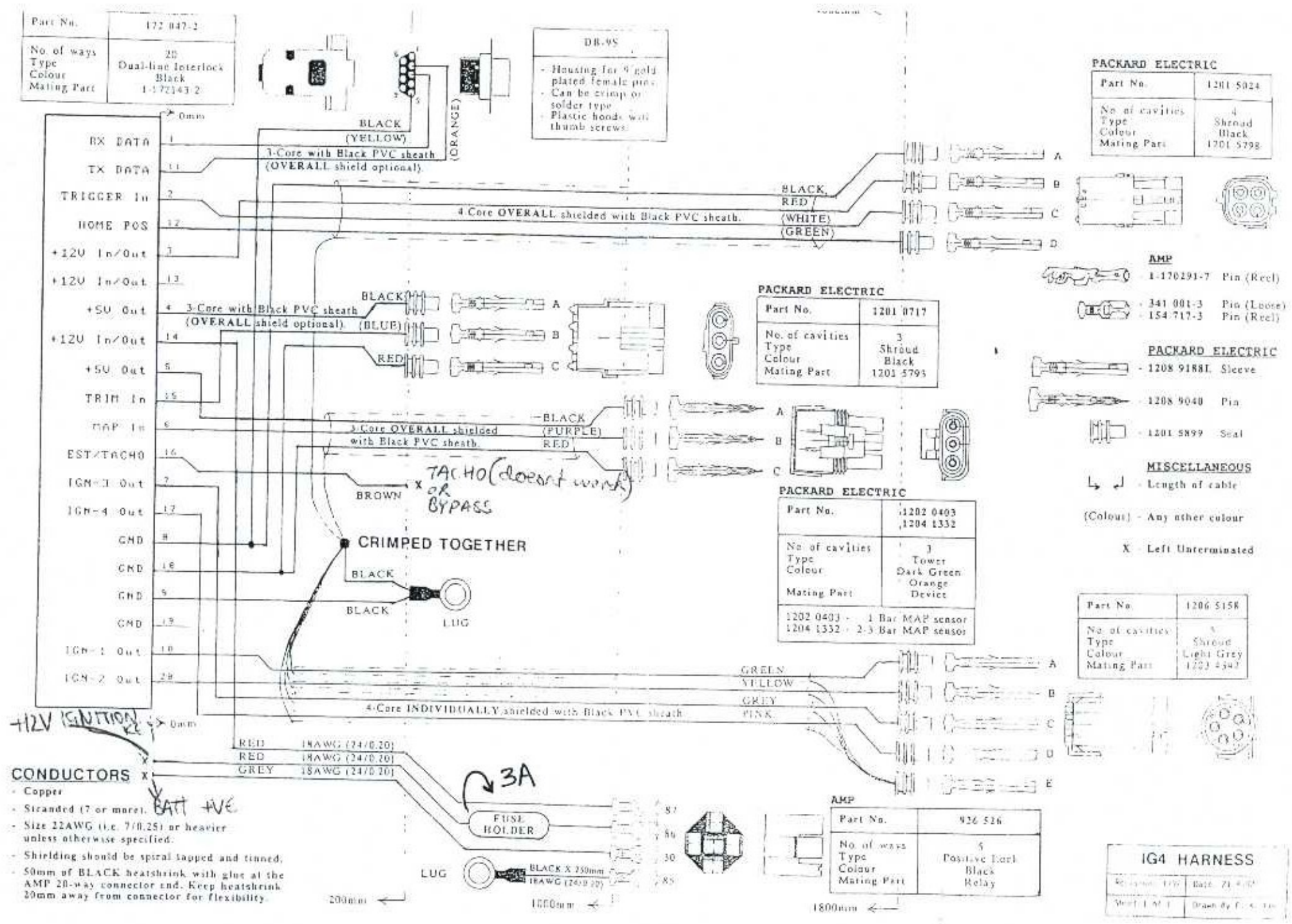
Possible Problem / Symptom	Probable Cause / Cure
Engine lacks power at full power. Engine detonates at high loads.	Ignition timing is over advanced. THIS CONDITION CAN CAUSE SERIOUS ENGINE DAMAGE IF ALLOWED TO CONTINUE! Retard ignition timing in ECU ignition timing MAPs until detonation disappears. NEVER ADJUST IGNITION TIMING WITH THE ENGINE UNDER HIGH LOADS.
Engine lacks power at full power. Mechanical problem.	Check cylinder compressions as per manufacturer's engine manual. Check for mistimed/worn camshafts. Check for worn/bent valve timing components. Check for worn/broken compression rings. Check for holes in piston tops. Check for warped valves. Check for blocked exhaust system.

Throttle Response Problems

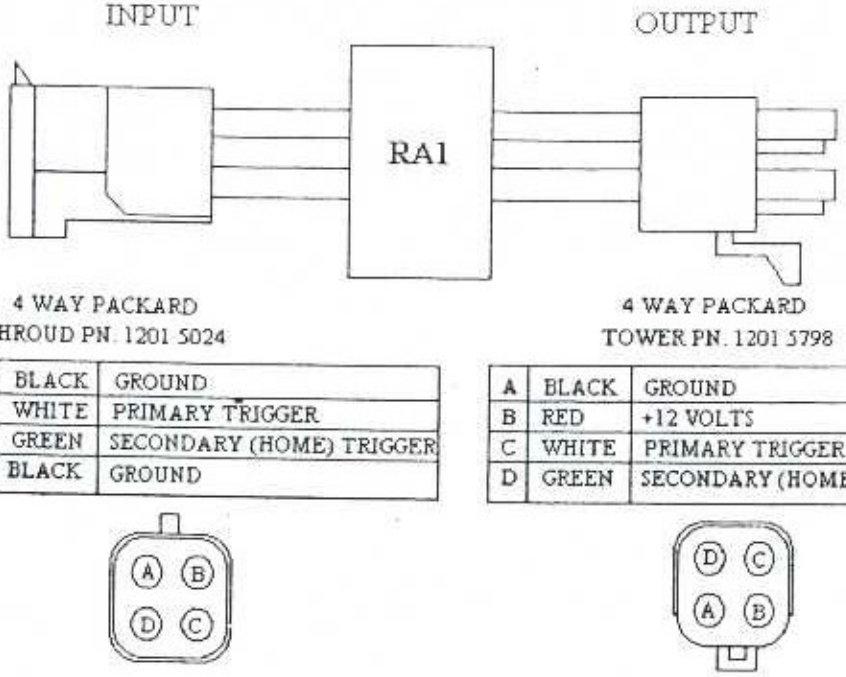
Possible Problem / Symptom	Probable Cause / Cure
Poor throttle response. Ignition timing too retarded.	Ignition timing may be too retarded to allow the engine to cleanly pull from problem area. Check / alter ignition timing values.

Fuel Consumption Poor

Possible Problem / Symptom	Probable Cause / Cure
Poor fuel consumption. Insufficient ignition timing.	Too retarded ignition timing will cause poor fuel consumption. Check ignition timing MAPs in ECU against manufacturers ignition timing specifications for engine. Adjust as required.


Part No. 172 047-2
No. of ways 20
Type Dual-line Interlock
Colour Black
Mating Part 1-172143-2
DB-9S
- Housing for 9 gold plated female pins
- Can be crimp or solder type
- Plastic hoods with thumb screws
PACKARD ELECTRIC
Part No. 1201 5024
No. of cavities 4
Type Shroud
Colour Black
Mating Part 1201 5798
RX DATA
TX DATA
TRIGGER In
HOME POS
+12V In/Out
+12V In/Out
+5V Out
+12V In/Out
+5V Out
TRIM In
MAP In
EST/TACHO
IGN-3 Out
IGN-4 Out
GND
GND
GND
GND
IGN-1 Out
IGN-2 Out
BLACK (YELLOW)
3-Core with Black PVC sheath (OVERALL shield optional)
(ORANGE)
BLACK, RED
(WHITE)
(GREEN)
4-Core OVERALL shielded with Black PVC sheath.
3-Core with Black PVC sheath (OVERALL shield optional).
BLACK (BLUE)
RED
PACKARD ELECTRIC
Part No. 1201 0717
No. of cavities 3
Type Shroud
Colour Black
Mating Part 1201 5795
AMP
1-170291-7 Pin (Reel)
- 341 001-3 Pin (Loose)
- 154 717-3 Pin (Reel)
PACKARD ELECTRIC
- 1208 9188L Sleeve
- 1208 9040 Pin
- 1201 5899 Seal
MISCELLANEOUS
Length of cable
(Colour) - Any other colour
X - Left Unterminated
BLACK
3-Core OVERALL shielded with Black PVC sheath.
(PURPLE)
RED
BROWN
X
TACHO (doesn't work) OR BYPASS
CRIMPED TOGETHER
BLACK
BLACK
LUG
PACKARD ELECTRIC
Part No. 1202 0403 / 1204 1332
No. of cavities 3
Type Tower
Colour Dark Green / Orange
Mating Part Device
1202 0403 - 1 Bar MAP sensor
1204 1332 - 2-3 Bar MAP sensor
Part No. 1206 5158
No. of cavities 5
Type Shroud
Colour Light Grey
Mating Part 1203 4343
GREEN
YELLOW
GREY
PINK
4-Core INDIVIDUALLY shielded with Black PVC sheath
+12V IGNITION
CONDUCTORS
- Copper
- Stranded (7 or more).
- Size 22AWG (i.e. 7/0.25) or heavier unless otherwise specified.
- Shielding should be spiral lapped and tinned.
- 50mm of BLACK heatshrink with glue at the AMP 28-way connector end. Keep heatshrink 20mm away from connector for flexibility.
RED 18AWG (24/0.20)
RED 18AWG (24/0.20)
GREY 18AWG (24/0.20)
BATT +VE
3A
FUSE HOLDER
LUG
BLACK X 250mm 18AWG (24/0.20)
87
86
30
85
200mm
1800mm
AMP
Part No. 926 526
No. of ways 5
Type Positive Lock
Colour Black
Mating Part Relay
1800mm
IG4 HARNESS

RELUCTOR ADAPTOR. RA1



The **Reluctor Adaptor**, or **RA1**, is used with magnetic reluctor pickups used in as crank triggers and some distributors. This pickup is basically a coil of wire wrapped around a magnetic core and attached to a sensor face, which is called the pole piece. The physical size and shape of such a pickup can take on many forms.

A magnetic pickup has two wires, one positive (+), and the other negative (-). The wires are sometimes marked as such, but more often then not they are not marked. It is very important that the positive wire go to the input pin of the reluctor adaptor (pin B for primary trigger, C for secondary), and that the negative go to the ground reference pin (pin A for primary trigger, D for secondary). If you can not determine which wire is positive, from marking or wire colour, then it would be necessary to check the signal going into the RA1 using an oscilloscope.

When ferrous metal, ie. metal which a magnet will attract, is passed very close to the pole piece, the pickup will generate a voltage signal, similar to figure 2a, on the positive wire. The amplitude of the signal will vary with the speed at which the ferrous metal passes the pole piece. At low speeds the signal may only be several hundred mV, but at high speed it could rise to 20 volts or more. This signal does not look very much like the signal we need to trigger the HALTECH™, so we have to convert it into a square signal pulse using the RA1 Reluctor Adaptor.

The input to the reluctor adaptor must first go positive (+), this arms the circuit in the RA1. When the signal falls and crosses zero volts the RA1 will generate an output pulse of a fixed width which an be used to trigger the HALTECH™. If the wires are reversed and the signal goes negative (-) first, then the RA1 will generate a pulse but it **will NOT trigger the HALTECH™ correctly** and very weird things happen to the ignition timing. Usually this causes the timing to be retarded as revs increase, but sometimes multiple triggers can occur. Both of these are things to avoid, so if your using reluctor pickups make sure they are wired correctly.

The pulse generated by the RA1 is a falling edge trigger as seen in figure 3. It has a fixed duration of around 500 microseconds.

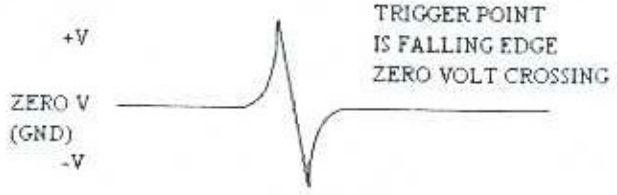
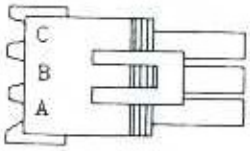


FIGURE 2a

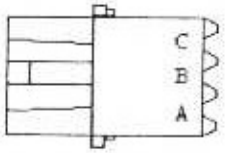
FIGURE 2b

There is a variation on this type of pickup which uses magnets moving pass the pole piece instead of ferrous metal. An example of this type is the MSD flying magnet crank trigger. This pickup can also be used with the RA1 to trigger the HALTECH™ ECU.

IG4 MAP AND THROTTLE POSITION SENSORS



FROM HARNESS



TO THROTTLE POSITION SENSOR
OR MAP SENSOR

PIN	HARNESS COLOUR	SIGNAL
A	BLACK	GROUND
B	WHITE	SENSOR SIGNAL
C	RED	+5 VOLTS

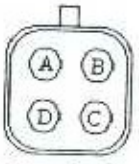
IG4 TRIGGER INPUT PINOUT

4 WAY SQUARE PACKARD SHROUD

P/N 1201 5024

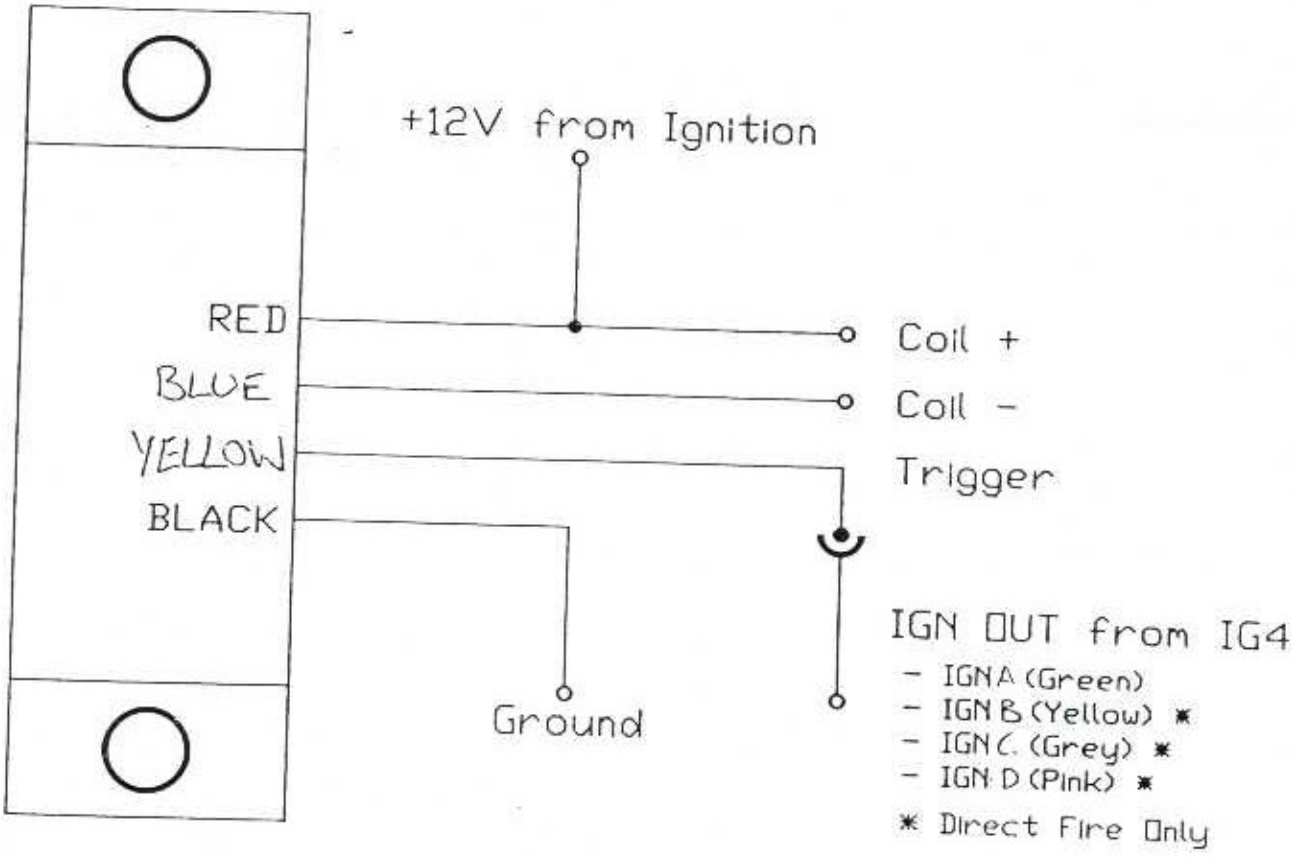
PIN	COLOUR	SIGNAL
A	BLACK	GROUND
B	RED	+12 VOLTS POWER TO TRIGGER DEVICE
C	WHITE	MAIN TRIGGER
D	GREEN	SECONDARY (HOME) TRIGGER

NB : The secondary trigger is used on direct fire applications only



View from terminal end of plug.

IG1 igniter pinout and connection to IG4 Ignition Computer



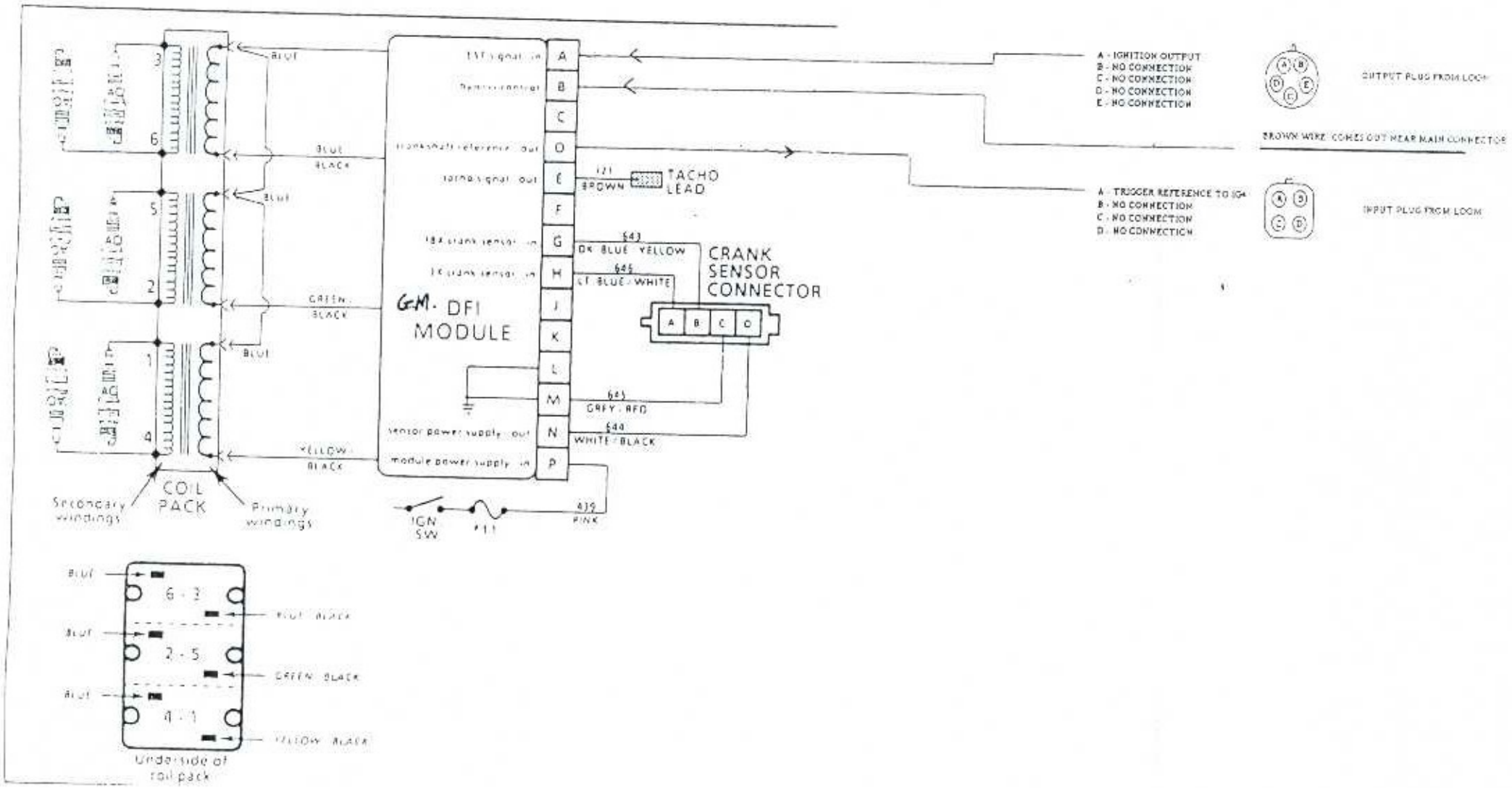
For correct operation, it is essential to have an igniter for each coil used.

For example:-

When using two coils, two igniters are used. One being triggered by IGN A out signal (Green wire), the other by IGN B out signal (Yellow wire) of the IG4 Ignition Computer.

Similarly, IGN 3 out signal (Grey wire) and IGN 4 out signal (Pink wire) from the Ignition Computer fires the third and fourth coil.

6C1-74 ENGINE MANAGEMENT

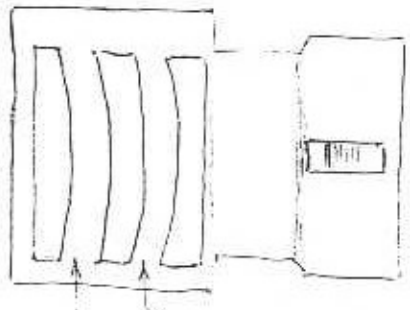


ORIGINAL WIRE COLOURS FROM DFI MODULE TO GM ECU

PIN	
A	WHITE
B	TAN/BLACK
C	WHITE/VIOLET

INVENT ENGINEERING PTY. LTD. (Inc. in N.S.W.) TRADING AS efi technology
HALTECH™ Engine Management Systems
A.C.N. NO. 000 813 632

CONNECTIONS FOR GM CRANK SENSOR - 24500988 TO 164 DIRECT FIRE. ECU.

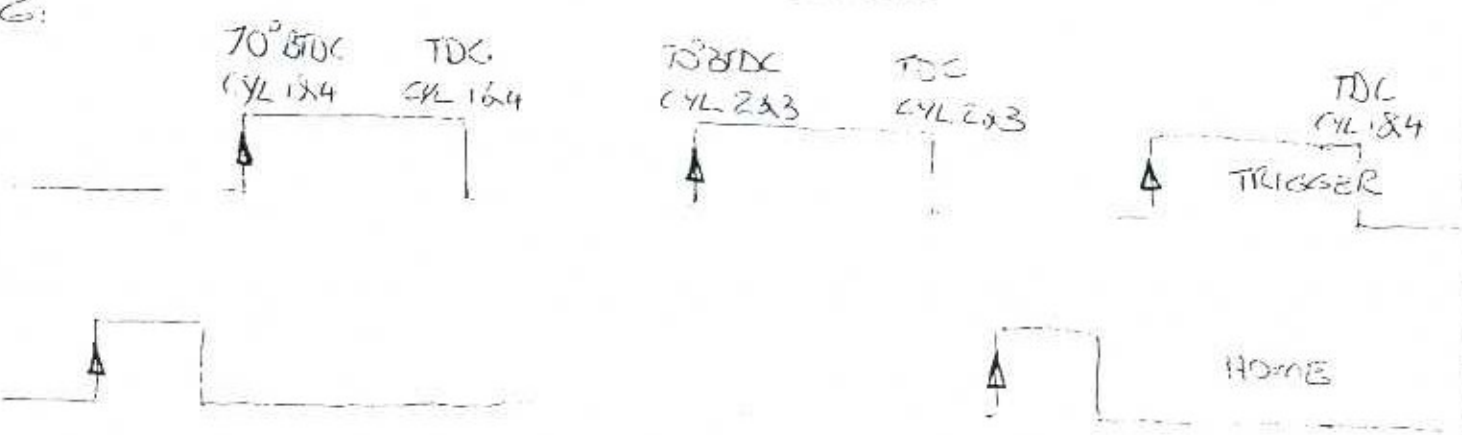


RED +12V POWER
BLACK GROUND
WHITE TRIGGER
GREEN HOME

TRIGGER : EDGE APPROX 70° BTDC FOR EACH IGNITION EVENT REQUIRED.

HOME : SINGLE EDGE BEFORE CYLINDER 1 TRIGGER EDGE

EG:



* ASSUMES FIRING ORDER IS 1-3-4-2 OR 1-2-4-3

UNIT 7, 130 TAREN POINT ROAD, TAREN POINT N.S.W. 2229 AUSTRALIA
COUNTRY CODE 61 AREA CODE 02 PHONE: 525 2488 TELEFAX 525 2001

USING THE HALTECH IG 4 IGNITION TIMING COMPUTER TO DIRECT FIRE

The standard and direct fire IG4 versions are identical except for the code in the main chip. The versions can be changed from one to the other by re-encoding the chip at the factory or by ordering a replacement chip where distance makes it impractical to return the IG4 to the factory.

The Direct Fire IG4 can fire up to four ignition channels, IGN-A thru IGN-D. Each channel will produce a spark on TWO cylinders at the same time. One of the cylinders will be approaching TDC on compression, and the other, TDC on exhaust. These two cylinders are referred to as companion cylinders.

Assume for an exercise that it is required to direct fire a V8 and the firing order is 1-5-3-8-4-7-2-6, the companion cylinders would be

1	&	4		1		4	
5	&	7			5		7
3	&	2				3	2
8	&	6			8		6

The ignition channels fire in sequence (A-D) so we would connect channel

IGN-A	to cylinders	1	&	4
IGN-B	" "	5	&	7
IGN-C	" "	3	&	2
IGN-D	" "	8	&	6

The first time through the sequence 'good' sparks would be produced for cylinders 1-5-3-8- and 'waste' sparks would be produced for 4-7-2-6. The second time through the sequence 'good' sparks would be produced for 4-7-2-6 and 'waste' sparks would be produced for cylinders 1-5-3-8.

When and how to start the sequence? For this exercise we will assume that magnetic reluctor pickups are being used and therefore a RA1 reluctor adaptor is required. The RA1 plugs directly into the IG4 harness and its input side has provision for two magnetic reluctors, both of which are needed. The two inputs are referred to as the primary and secondary triggers (see RA1 drawing), the secondary trigger is also known as the HOME trigger.

IN OPERATION THE DIRECT FIRE IG4 WAITS AND WILL PRODUCE NO SPARKS UNTIL IT GETS A PULSE ON THE SECONDARY TRIGGER INPUT (HOME PULSE). This pulse is an indication to the IG4 that the NEXT primary trigger is the trigger for ignition channel IGN-A. Subsequent primary triggers fire the next igntion channel in sequence, until one of two things occur-

In normal operation a HOME pulse would reset the sequence to restart from IGN-A. On an 8 cylinder this would occur after the primary trigger that caused IGN-D to fire and BEFORE the next primary trigger.

If the IG4 has fired channel IGN-D and it gets antoher primary trigger BEFORE it gets a home pulse it will not fire a spark on any channel until it gets a HOME pulse.

SUMMARY OF TRIGGER REQUIREMENTS

Two pick-ups are required, the Primary trigger and the secondary trigger (HOME). The primary trigger works the same as a standard IG4 in that it is used as the reference for the ignition timing and it should occur about 70 deg. BTDC. The secondary trigger is used ONLY to start or re-start the ignition channel sequence. It's timing is not critical but it MUST occur after the primary trigger for IGN-D and BEFORE the primary trigger for IGN-A.

If triggering from the crankshaft one HOME trigger is required plus a primary trigger for each two cylinders per crankshaft revolution e.g. 4 triggers for a V8.

If triggering from the camshaft two HOME pulses are required and two primary triggers for each cylinder per camshaft revolution e.g. in the case of a V8, two HOME pulses and eight primary pulses per camshaft revolution.

SUMMARY RE OUTPUT CHANNEL REQUIREMENTS

An output channel is used for each two cylinders, in the case of the V8 example this would be channels A through D. In the case of a 4 cylinder channels A and B would be used. Each channel will fire a direct fire coil that will produce a spark in two cylinders at once, one being a 'good' spark, the other a 'waste' spark.