

GS4 / GS6 Ignition Systems. Diesel-to-Gas Conversion Kit for Vehicles

User Manual



Contents

	Page
1 Introduction	2
2 Installation	4
2.1 Step-by-step guide	4
2.2 Igniter LED Display	12
3 GillFire Software	13
3.1 Introduction	13
3.2 Installing GillFire Software	13
3.3 GillFire enhanced access	13
3.4 GillFire Basic features	14
3.5 Advanced Features	18
4 Igniter Connector Pin-out arrangement	23
Advanced Wiring Diagram	24

1. Introduction

Thank you for purchasing a Vehicle Conversion Kit from Gill Sensors & Controls. Kits using GS4 and GS6 Ignition Systems are specifically designed for conversion from diesel to gas (natural gas, CNG, LPG, etc) for engines with up to 6 cylinders.

Prior to installing the GS4 or GS6 system, please carefully read section 2 including the wiring diagrams. Also, please ensure that you have all relevant components, especially the correct number of ignition coils and the correct timing disc - the 4 cylinder disc has 9 pegs and the 6 cylinder disc has 13 pegs. The complete systems are shown in the following photographs.

1.1 GS4 Ignition Kit



The 4 cylinder ignition kit consists of:-

- | | | |
|---------------------------|------------------------------|-----|
| • GS4 Igniter | Gill part number 1521-00-041 | x 1 |
| • Coils SM60T (Terminal) | Gill part number 1395-10-014 | x 4 |
| o OR | | |
| • Coils SM60A (Connector) | Gill part number 1395-10-022 | x 4 |
| • 4 cylinder Timing Disc | Gill part number 1257-30-006 | x 1 |
| • Wiring loom | Gill part number 1257-10-074 | x 1 |
| • Pickup | Gill part number 1265-00-016 | x 1 |

1.2 GS6 Ignition Kit



The 4 cylinder ignition kit consists of:-

- | | | |
|---------------------------|------------------------------|-----|
| • GS6 Igniter | Gill part number 1521-00-011 | x 1 |
| • Coils SM60T (Terminal) | Gill part number 1395-10-014 | x 6 |
| ○ OR | | |
| • Coils SM60A (Connector) | Gill part number 1395-10-022 | x 6 |
| • 6 cylinder Timing Disc | Gill part number 1257-30-042 | x 1 |
| • Wiring loom | Gill part number 1257-10-074 | x 1 |
| • Pickup | Gill part number 1265-00-016 | x 1 |

2. Installation

2.1 Step-by-step guide

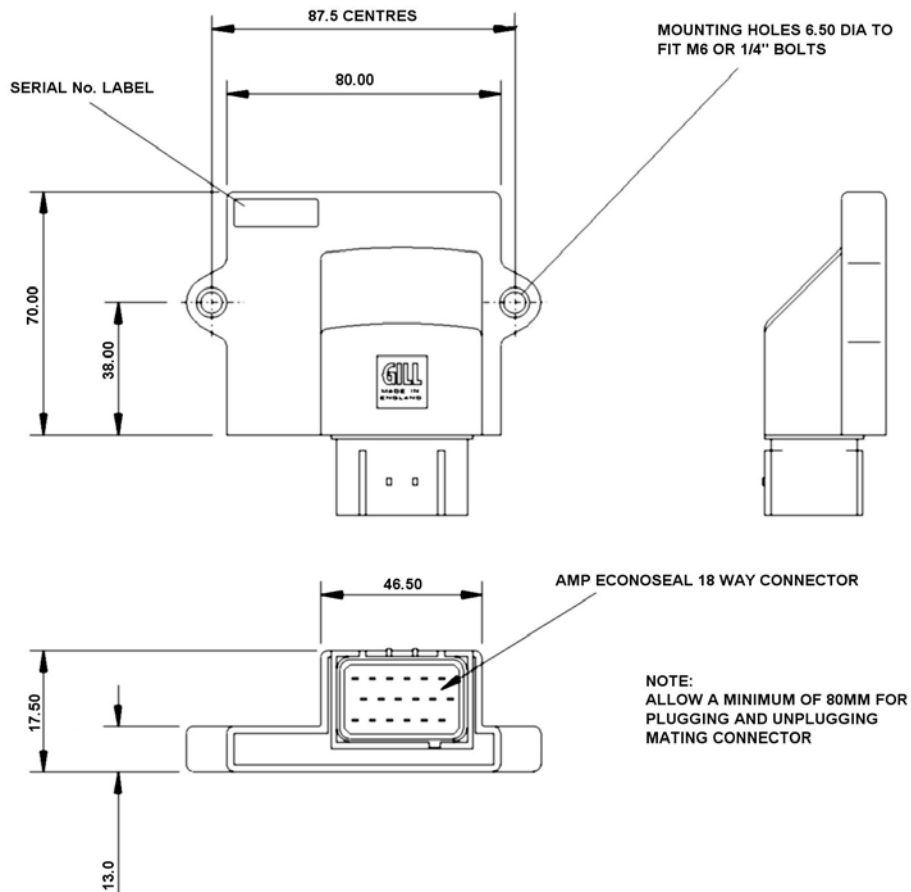
Step 1 Igniter

The Igniter should be mounted away from sources of heat and excessive vibration for optimum reliability. If installed in the engine compartment, mount the igniter low down and away from exhaust pipes and hot air from radiators.

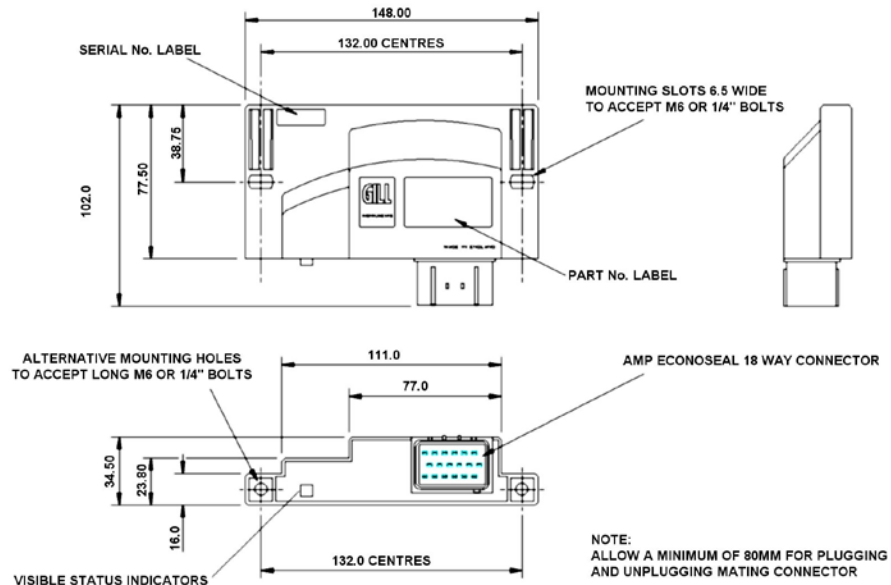
If the Igniter is to be installed remote from the engine, and therefore the ignition coils, **ensure the wiring harness is of sufficient length to reach coils and pickup intended mounting location** – please contact Gill if an extended wiring harness is required.

Note: the Igniter is designed for **NEGATIVE EARTH** battery operation only.

Gill recommends a torque setting not exceeding 3.5Nm (2.6lbf.ft) for the fixing bolts. Assuming a standard M6 washer (or larger) is fitted.



GS4 Dimensions



GS6 Dimensions

Step 2 Coils

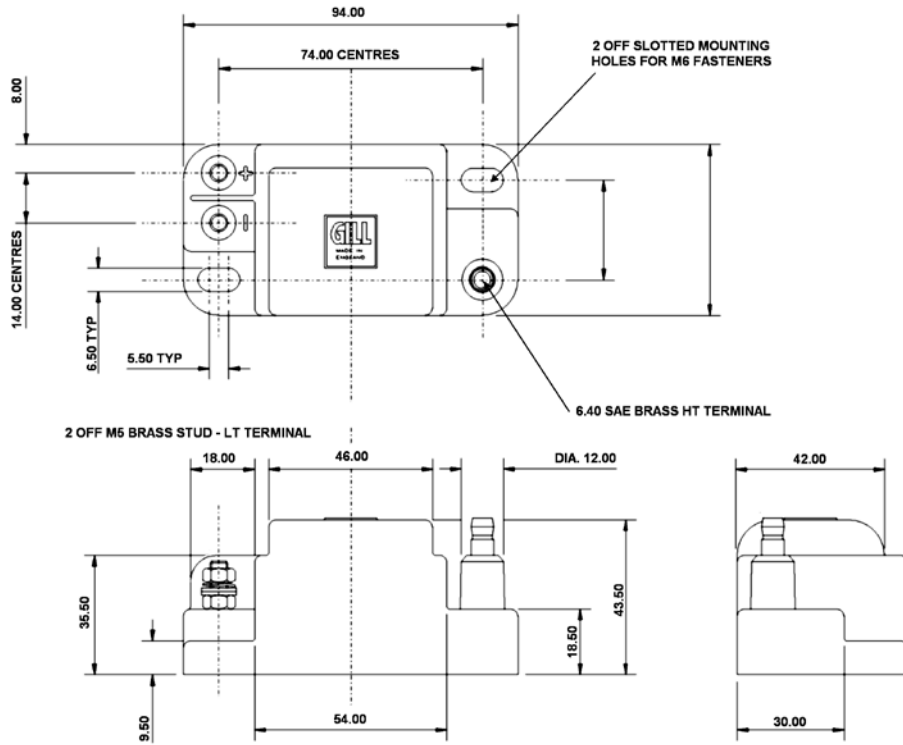
Gill have 2 options of ignition coil, terminal and connector types (the connector coil is supplied as standard).

Ensure that the coils are securely mounted and that the mounting flanges are not stressed. Keep the coils away from direct contact with the engine cylinder head or exhaust manifold, preferably using rubber mountings for resistance to any vibration-induced damage.

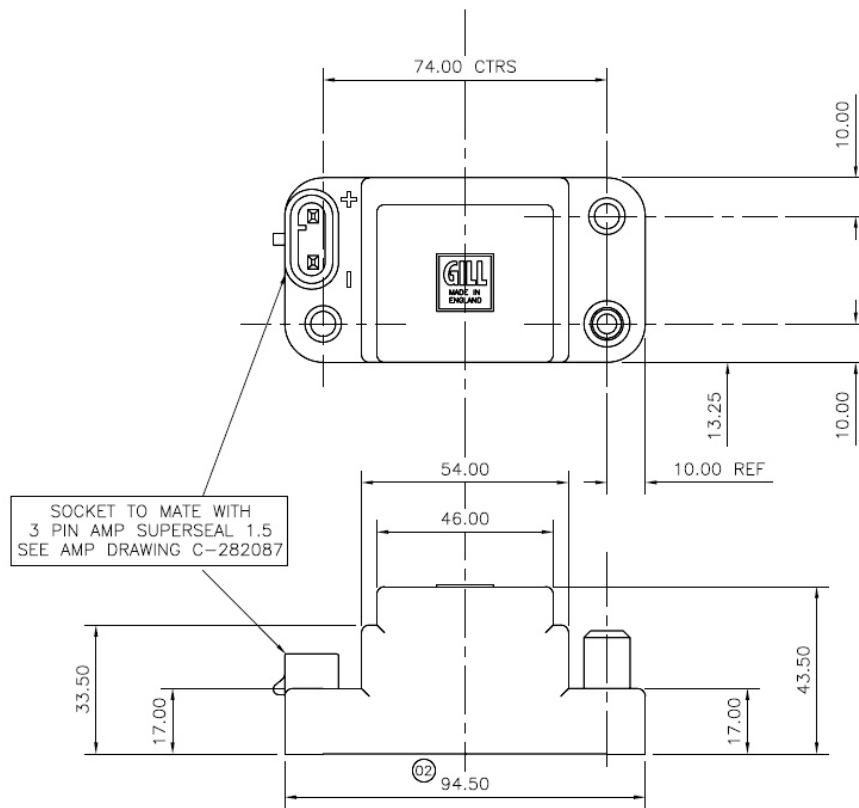
The coils should be installed as close as practicable to the engine to avoid long HT cable length.

Gill recommends a torque setting of 8.0Nm (5.5 lbf.ft) for the coil fixing bolts and a maximum of 2Nm (1.5 lbf.ft) for the brass low-tension terminal nuts on terminal type coils.

Ensure the correct coil connection polarity is observed, otherwise operation and reliability may be degraded.



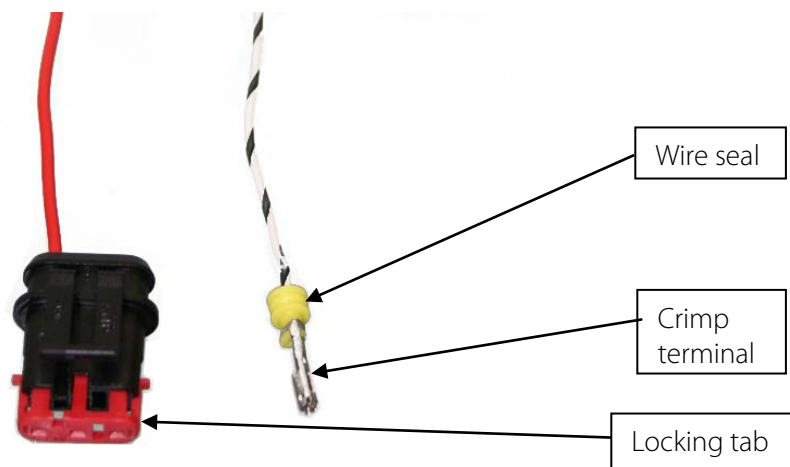
SM60T terminal coil



SM60A connector coil

SM60 A Connector wiring

Using suitable wire crimpers, crimp the connector terminal as shown below, slide into correct connector position and insert locking tab.



This connector can be purchased from your Gill distributor as a kit part number:-

1395-PK-023 (1 per coil)

or direct from AMP (Tyco):-

Housing AMP Part Number 282087-1	1 per coil
Wire seal AMP Part Number 281934-2	2 per coil
Wire crimp AMP Part Number 282025-1	2 per coil

Ensure the correct coil connection polarity is observed, otherwise operation and reliability will be degraded.

HT Lead recommendations

Gill recommends the use of spark plugs with a built in interference suppressor and carbon core HT leads with suitable coil and spark plug caps. It is preferable to maintain the same length of HT lead to each spark plug with this type of lead as their resistance varies with length.

Do not exceed a total nominal resistance of 20kohm (plug plus cap plus lead).

It is the responsibility of the user to choose the correct types of spark plugs, caps and HT leads in order to meet EMC (interference) emission regulations.

Step 3 Timing Disc and Engine Position Sensor

The correct installation of the Timing Disc and Pickup or Engine Position Sensor (EPS) is critical for reliable operation of the ignition system.

The timing disc should be fitted to the camshaft, or another half crankshaft speed shaft. The disc should normally rotate anti-clockwise in the direction of the arrow; for clockwise rotation reverse the disc so the arrow is on the inner face.

The mounting shaft that the disc is fitted to should be supported by at least 2 bearings to prevent movement. The disc should be securely fitted to the shaft, if necessary using additional means of ensuring it cannot move, e.g. keyway or dowelling accordingly. Gill recommends a torque setting of 11.0Nm (8.0 lbf.ft.) for the fixing bolts. The timing disc is supplied as standard with a centre-mounting hole of 10mm diameter.

It is essential that both radial and sideways run out of the disc is less than 0.2mm each way and the total of sideways run out and end float must not exceed 0.5mm.

Engine Position Sensor

The standard Gill Engine Position Sensor (EPS) is a conventional inductive unit. It is polarity sensitive; if connected in reverse the engine may not run at all, or if it does, it will experience substantial timing errors and is likely to misfire.

It is important to mount the EPS rigidly so that it cannot be affected by vibration, to ensure reliable performance of the Ignition system

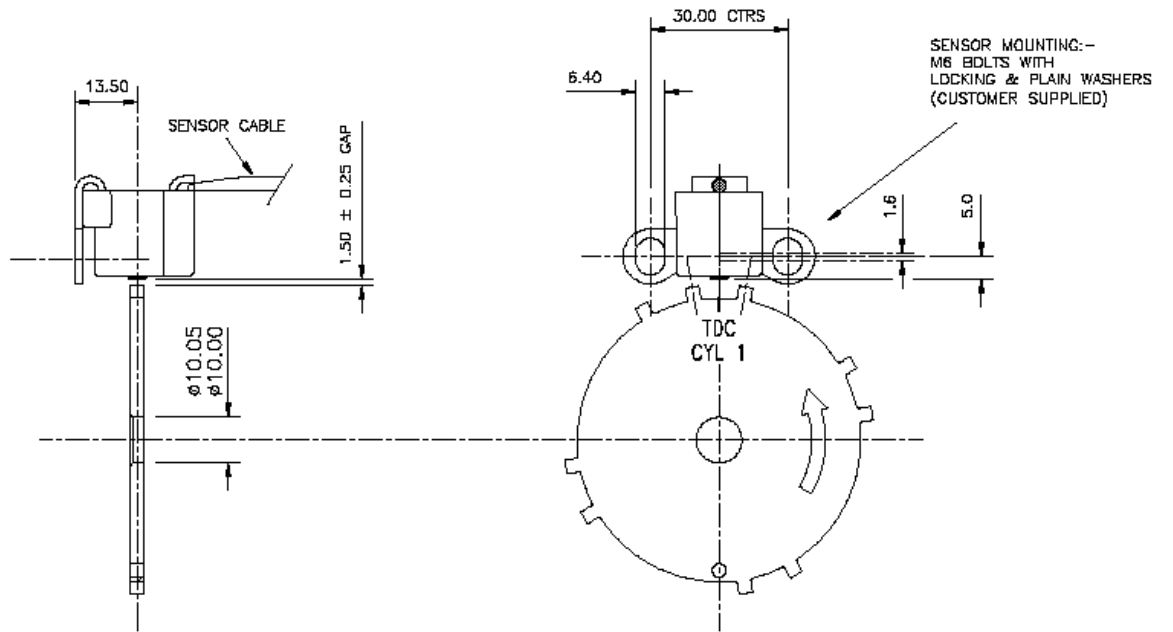
The clearance between the EPS and timing disc pegs should be set to 1.5mm \pm 0.25mm (0.060" nominal). See drawings on page 9.

The wires from the EPS must be run close together, but should not be run with other wiring over large distances. Screened twisted pair wiring is recommended for lengths over 2 metres.

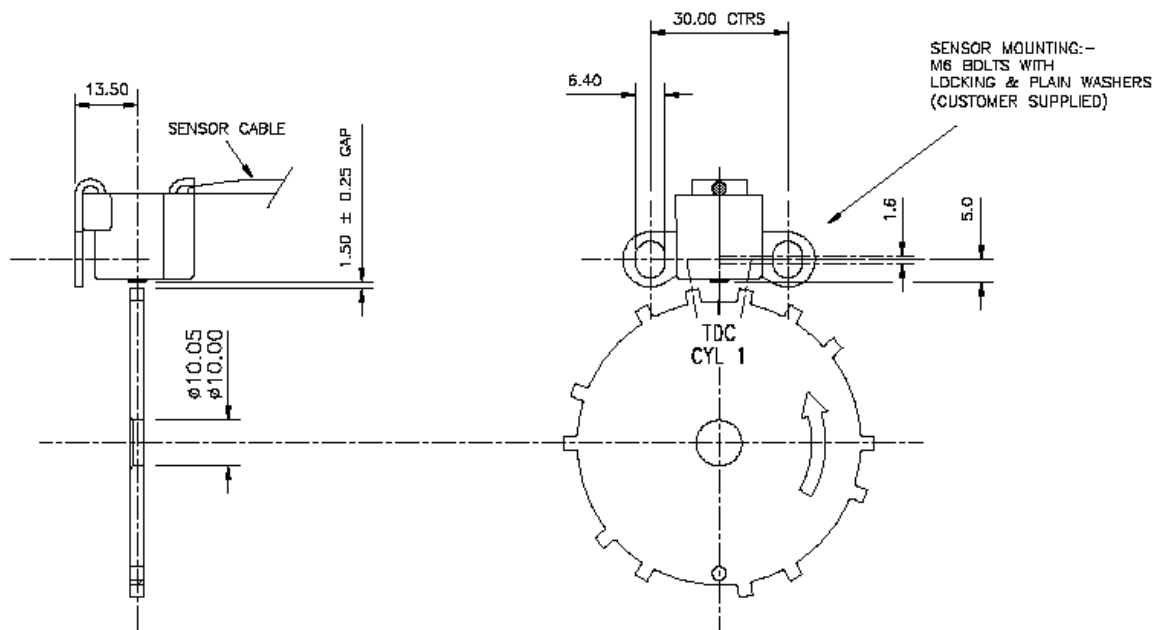
Gill does not recommend sensor cable lengths over 5 metres.

Step 4 Static Timing of the System

Set the engine to TDC on cylinder 1 (firing), then align the scribed TDC line on the disc with the centre of the Engine Position Sensor "pin" (see drawings on page 9). Now lock the disc securely in this position. Gill recommends a torque setting of 11.0Nm (8.0 lbf.ft.) for the fixing bolts.



GILL 4 CYLINDER DISC ARRANGEMENT



GILL 6 CYLINDER DISC ARRANGEMENT

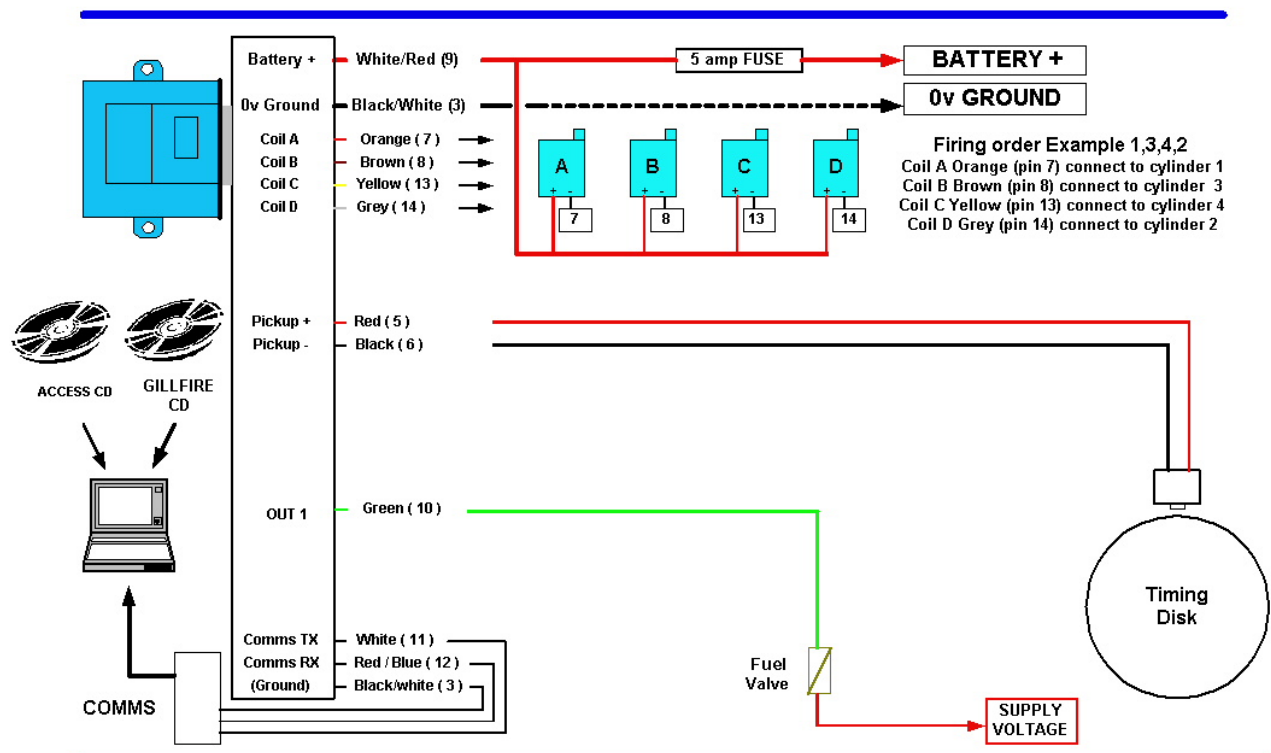
Step 5 Wiring Harness

Ensure that the wiring is correctly fitted into the Igniter connector header
 Also ensure that the wiring loom is suitably clipped along its length for security.

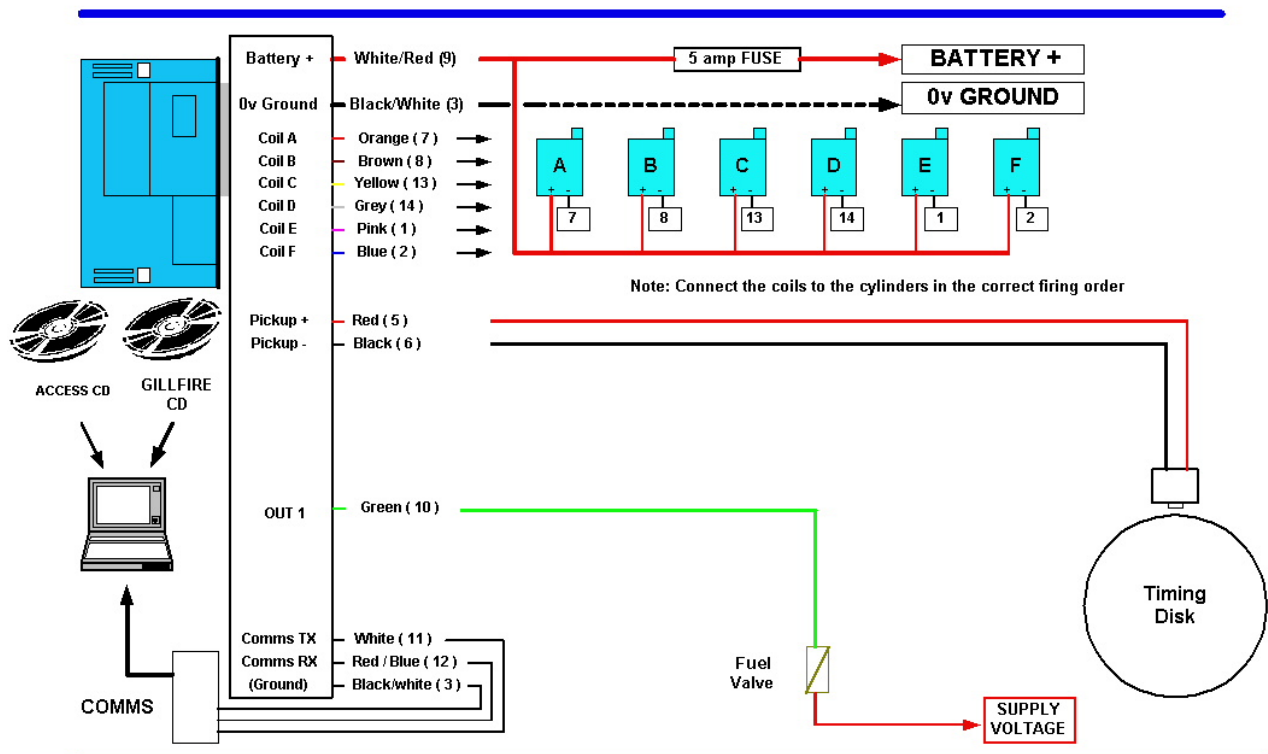
Avoid installing the wiring loom too close to the Ignition coils to ensure freedom from any possible electrical interference effects, in particular ensure the pickup wiring is kept well clear of ignition coils, HT leads and coil LT wiring.

The following diagrams show the wiring for standard 4 and 6 cylinder installations. See page 24 for a diagram showing additional wiring for optional advanced features.

GILL GS4 CONVERSION KIT WIRING DIAGRAM



GILL GS6 CONVERSION KIT WIRING DIAGRAM



Step 6 Initial test (GAS OFF)

Before attempting to start the engine a final check should be made to check all setup stages are correct. Check all power wires, coil wires and pickup connections.

Turn OFF the gas supply. Turn on the ignition power - the LED lamp on the igniter should start flashing (this shows that igniter is correctly powered).

Crank the engine (gas still OFF) and watch the red LED lamp on the igniter - during cranking this should change from flashing to "permanently on" (this shows that the igniter is correctly reading the timing disc information).

Connect a strobe light to cylinder 1 HT lead, crank the engine again, and check that the engine timing is 5° Before Top Dead Centre (BTDC) (Note - 5°BTDC is the standard timing at cranking speeds, but this may have been changed in your unit if you requested a different timing curve). If the timing is not correct, adjust the timing disc position to correct the error. Alternatively, you may use the software timing adjust feature described in section 3.4.3 of this manual. If it is required to change the complete timing curve, refer to section 3.5.1 of this manual.

Step 7 Start Engine Gas On

When correct timing has been confirmed found, the gas can be turned on and the engine started.

2.2 Igniter Led Display

One on-board status indicator is provided:-

Flashing On 0.2 Seconds Off 0.8 Seconds - this indicates that there is power to the Igniter.

Flashing On 0.25 Seconds Off 0.25 Seconds - this indicates that the igniter has not been loaded with a correct configuration file. Contact your Gill supplier for further information.

Permanently On - the LED will remain lit when the Igniter is successfully synchronised to the timing disc.

3 GillFire Software

3.1 Introduction

This section covers programming requirements and steps involved to install and run the GillFire Graphical User Interface (GUI) software. This allows operation of the igniter to be monitored and also for additional functions to be set.

A 9 way D type connector is fitted in the wiring loom. This should be connected to a COM port of the user's PC, using a standard RS232 comms cable and/or an RS232/USB comms adapter.

3.2 Installing GillFire Software

Follow normal Windows® procedure to remove any existing GillFire software (Start – Settings – Control Panel – Add / Remove Programs).

Load the GillFire Installation CD into the PC.

Click on Start – Run – Browse – locate the "GillFire" CD icon and click on it.

Click on the Setup icon that appears in the window. Click on Open, and then click on OK.

Follow the Wizard Instructions.

3.3 GillFire enhanced access

The basic GillFire programme allows the user to monitor operation of the igniter. An optional "access key" can be supplied by your Gill supplier to allow enhanced features to be assessed - eg adjustment of timing curves. See section 3.5.

!!Do NOT pass the access key to any personnel unless you wish them to be able to modify igniter settings. There is no need for an access key for normal system monitoring!!

3.4 GillFire Basic Features

3.4.1 Launching GillFire

Click on Start – Programs – GillFire, and click on the GillFire tab to run the program.

Alternatively, “Drag and Drop” the GillFire tab to create a desktop icon ‘shortcut’ on your PC as required. Then double click on this GillFire GUI icon ‘shortcut’ to run the program



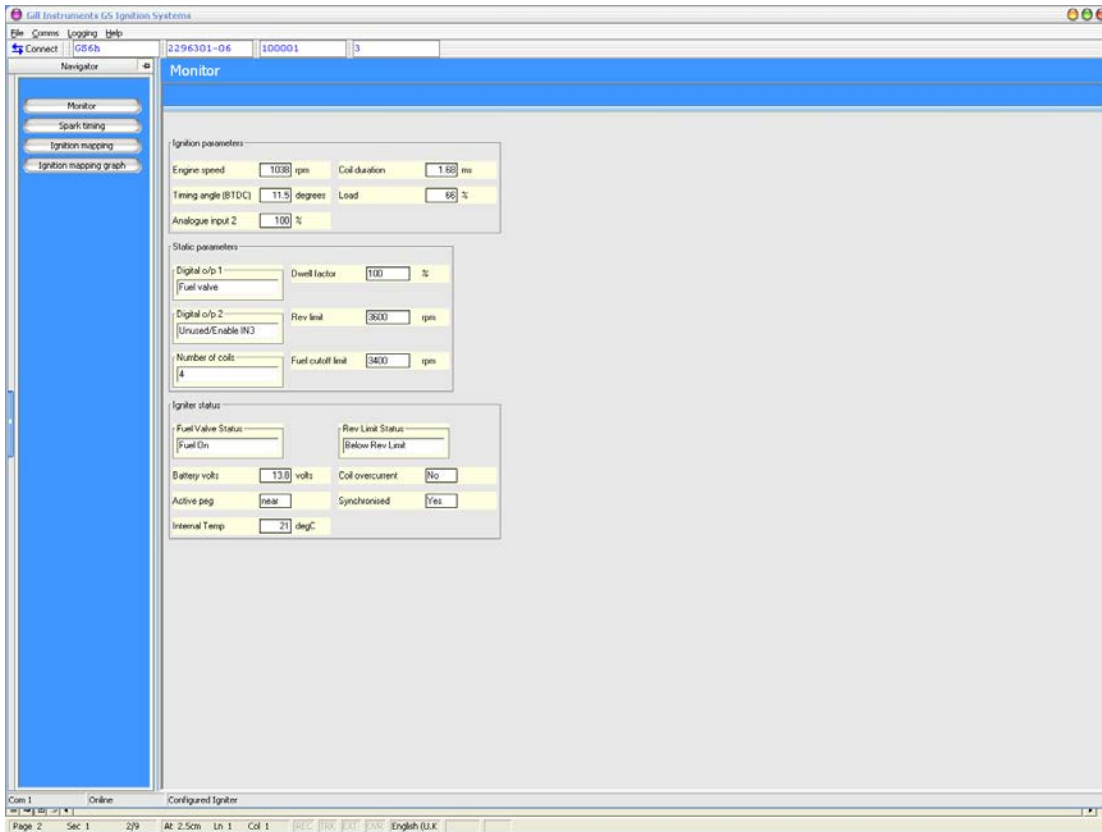
When the Gill-Fire software program is opened, the above screen will appear after a few moments. Note the command line at the bottom of the screen identifies if there is communication with the Igniter.

If there is a no communication with the Igniter, click on the Connect icon to restart communications. If necessary, click on the comms tab and select an alternative Comms Port.

The software version of the igniter is shown in the third line down from the top of the screen. The software version of GillFire can be found by clicking on the Help button. This manual covers GillFire 3.00.XX and igniter software 2296301-XX.

Click on the buttons in the left hand column to access the required pages, as described in the next sections.

3.4.2 The Monitor Screen



The monitor screen provides basic operating information:-

Ignition Parameters:-

Engine speed

- Displays current engine rpm

Timing angle (BTDC)

- This shows the current timing angle

Coil duration

- Actual coil on time

Load %

- This shows the load sensor reading (optional advanced feature)

Analogue input 2

- This shows the thermistor or fuel switch input (optional advanced feature)

Static Parameters:-

Digital outputs 1 and 2

- These fields show the output function selected

Dwell factor

- Shows the dwell setting

Rev limit

- Shows the ignition rpm limit

Number of coils

- Shows the configured number of coils

Ignition Status:-

Fuel valve and Rev limit status Battery Voltage

- These show current operating status

Battery Voltage

- This displays the current supply voltage to the igniter

Synchronised

- This shows whether the igniter is synchronised to the timing disk

Coil overcurrent

- This displays if the coils are being over-driven

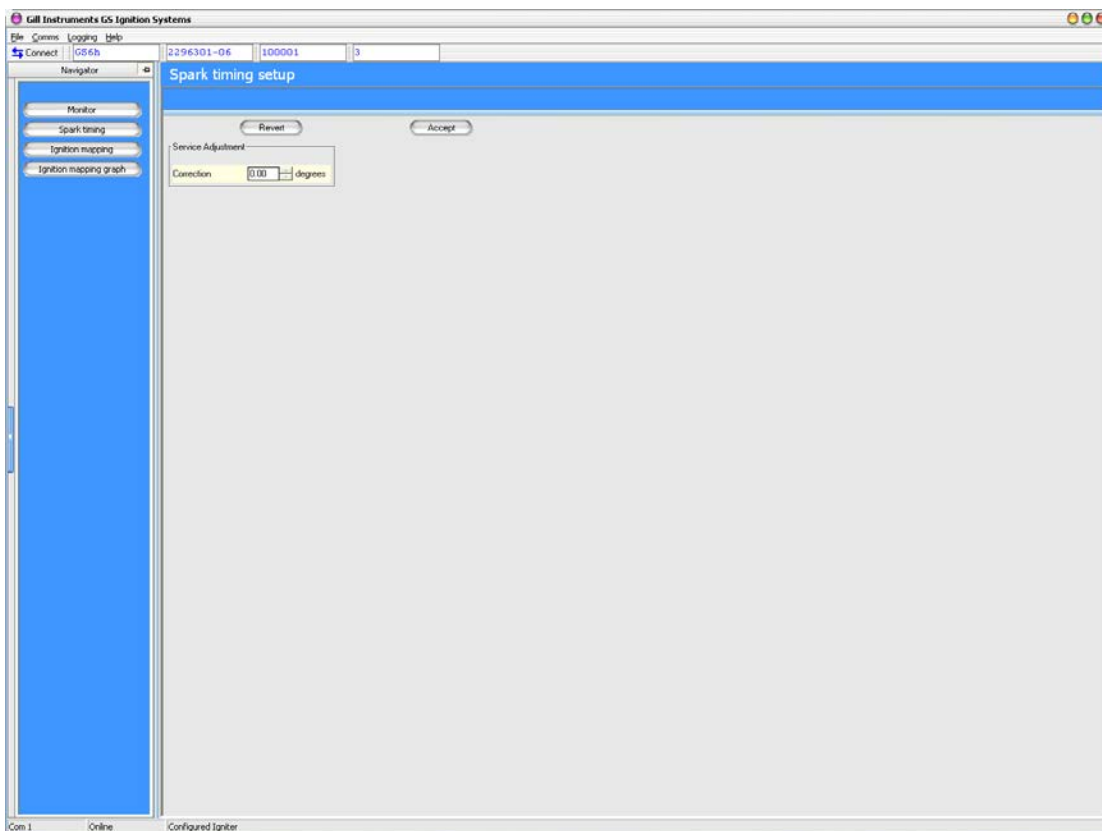
Active peg

- This displays the timing disk peg currently in use for spark timing

Internal temp

- This displays the igniter temperature

3.4.3 Spark Timing



This allows a timing correction of up to $\pm 2^\circ$ to be applied to correct for timing disk / pickup alignment errors. A password is required to access this feature (the password is "pickup").

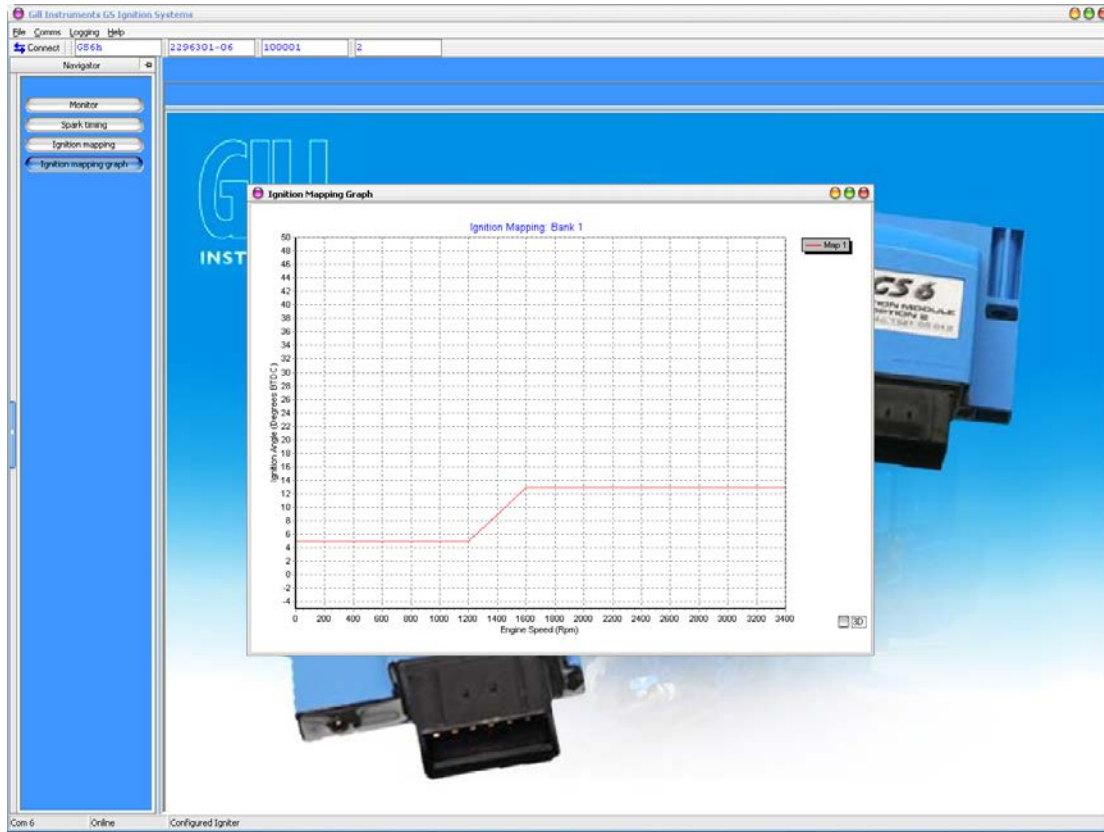
(Note - This feature is only available on igniters with software version 2296301 onwards.)

!!Do NOT give the password to any personnel unless you wish them to be able to modify the system's timing. This function is intended for use by installation personnel only!!

3.4.4 Ignition Mapping

This feature is not available in basic mode.

3.4.5 Ignition Mapping Graph



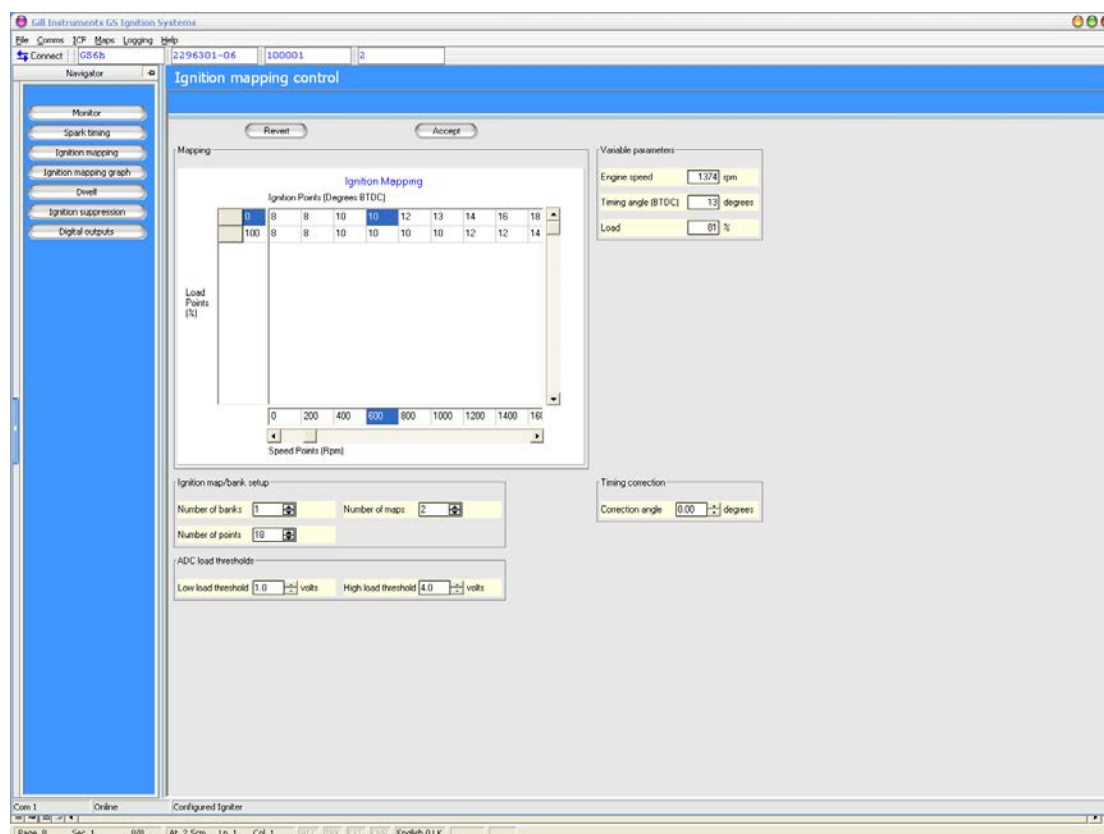
This displays in graphical form the map(s) programmed in the igniter. The default GS4/GS6 timing curve is shown above, but your igniter may have a different curve if it has been requested.

3.5 Advanced Features

If you have been supplied an access file this needs to be loaded after you have installed GillFire. Use the same procedure as for GillFire, i.e. remove any existing access key and follow steps 1 to 4 from section 3.2 to install the new access key.

Some advanced features require additional wiring - see wiring diagram on page 24.

3.5.1 Ignition Mapping



The **Ignition Mapping** screen allows you to program the ignition advance curve(s), set the number of curves for load mapping, load points used, number of rpm points and rpm points used.

Variable Parameters

- These are repeated from the Monitor page to facilitate engine mapping.

Timing Correction

- This is similar to Spark Timing but allows a bigger range of $\pm 10^\circ$. This is an overall background timing adjustment which will not show on the Monitor screen.

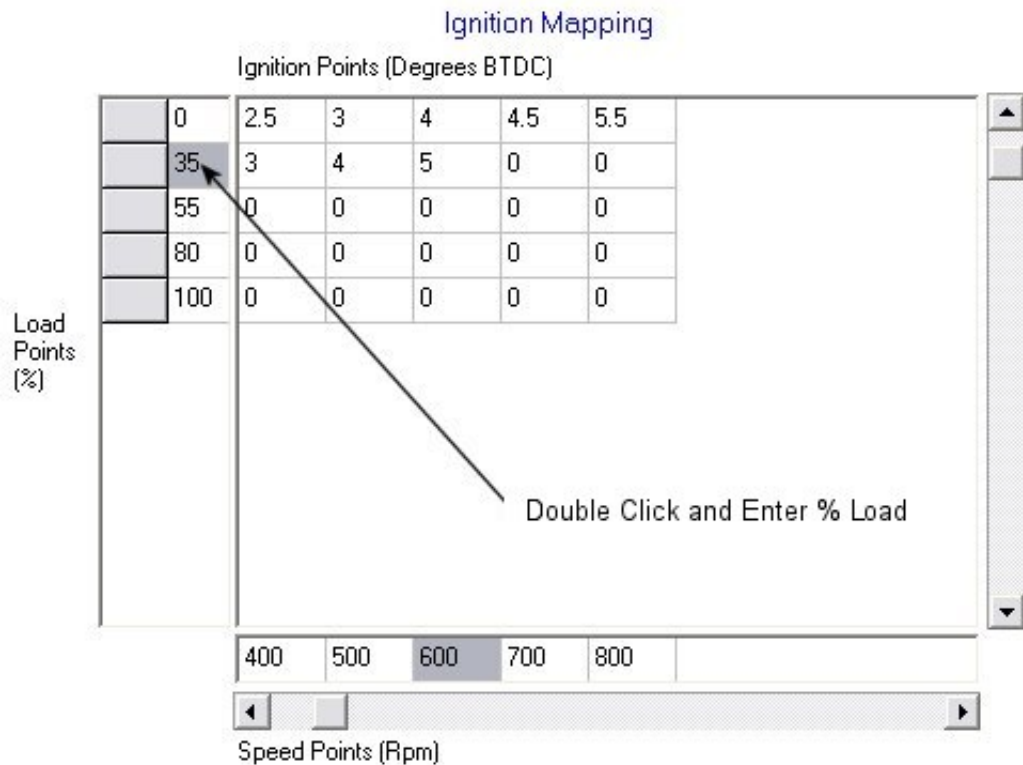
Number of Banks

- Each bank holds a separate set of maps that can be used for different fuel types or for different engine temperatures. These are selected using Input 2 (pin 16). The percentage voltage threshold (100% = 5V) for switching banks is entered in the "Bank select thresh" box. Normally only 1 bank will be used.

Number of Maps

- If you are using load mapping, each map represents an engine load measured using a MAP sensor or equivalent with a 0 – 5 V signal. The user is able to enter in the % for each map. Therefore if you are using 5 maps they could be configured as:-

Map 1	-	0% Load
Map 2	-	35% Load
Map 3	-	55% Load
Map 4	-	80% Load
Map 5	-	100% Load



ADC Load Thresholds

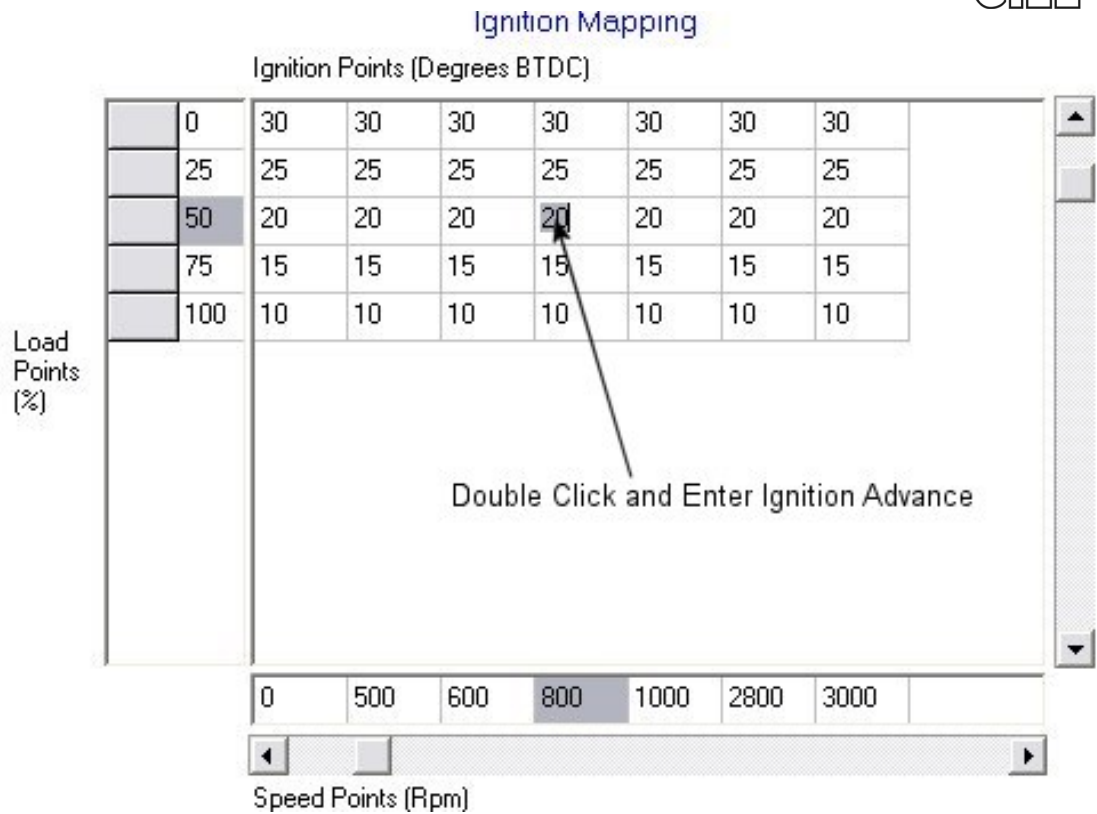
- This allows the operating voltage range of a Manifold Absolute Pressure or Throttle Position Sensor to be set (connected to Input 1, pin 4)
- Low Load Threshold – at or below this voltage the igniter will register 0% load
- High Load Threshold – at or above this voltage the igniter will register 100% load
- In between the igniter will interpolate linearly.

Number of Points

- The number of RPM points used for ignition advance mapping. Each point can be set to an arbitrary value (in multiples of 100rpm), eg:-

0	Rpm
500Rpm	
600Rpm	
800Rpm	
1000	Rpm
2800	Rpm

To change the ignition point (Degree BTDC) simply double click on the relevant entry in the table, input the required ignition point in degrees and press Enter (↵) as below –



The igniter interpolates between both the rpm points and the load points when calculating the timing advance to apply. There is no interpolation when switching between map banks.

Note - GS4/GS6 are capable of operating with up to 100 points of timing data. The data can be arranged in one or more tables with one or more maps, subject to the limit of 100 points.

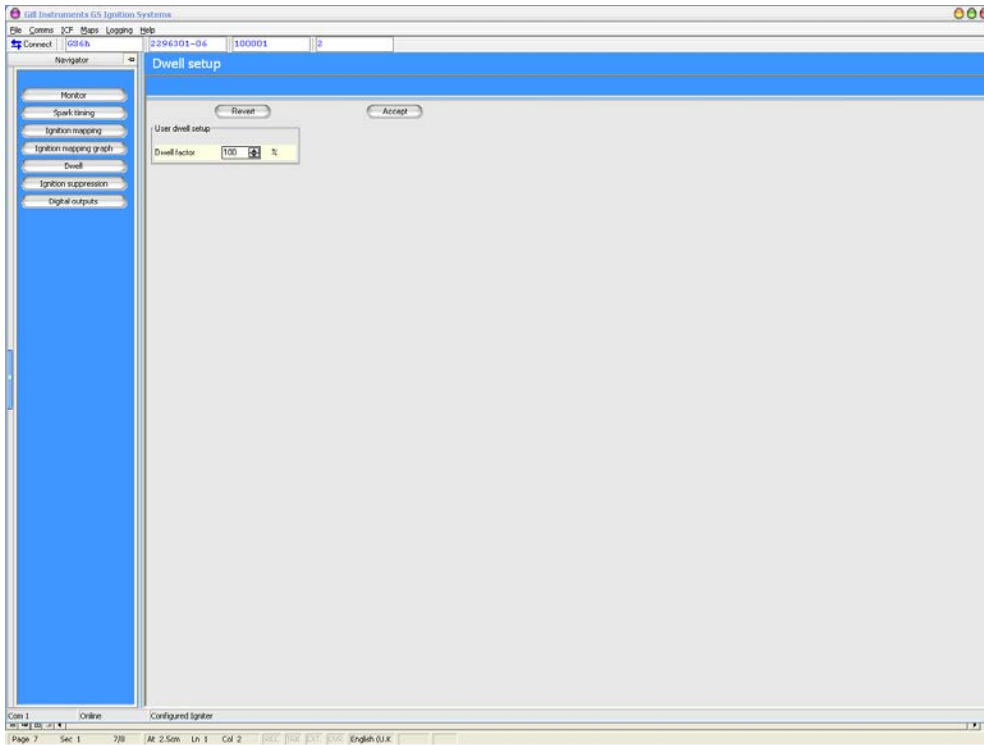
For example:-

Number of Banks (2) x Load Points (5) x RPM Points (10) = 100 ✓

Number of Banks (5) x Load Points (10) x RPM Points (10) = 500 ✗

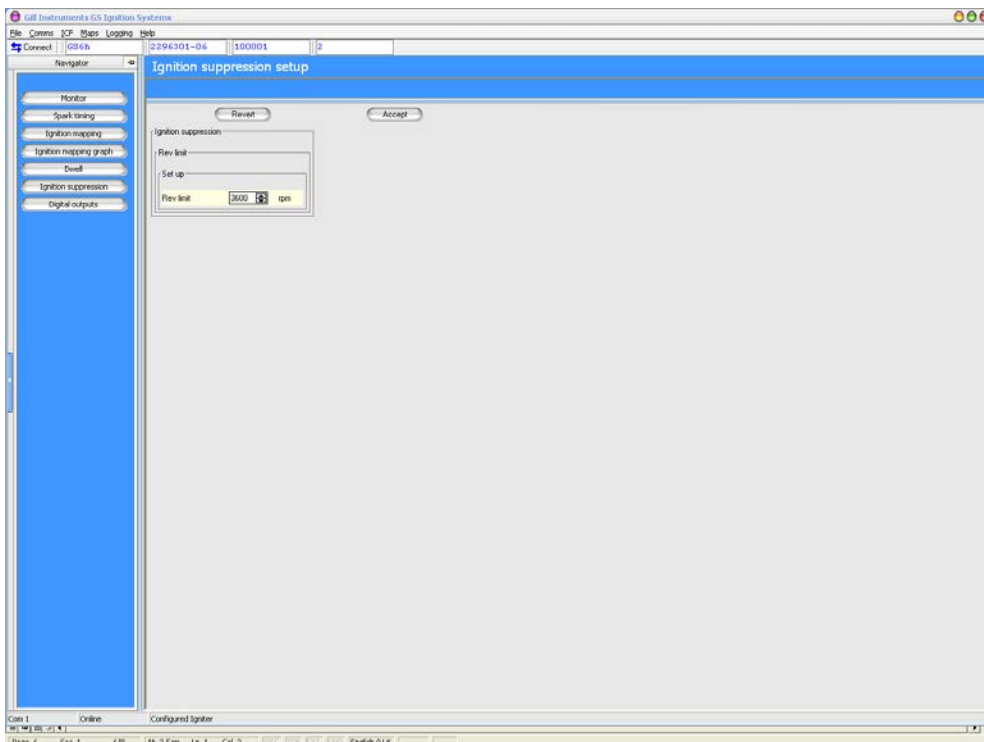
3.5.2 Dwell Setup Screen

This screen allows the user to change the coil on time – “Dwell” – to optimise combustion and emissions on an engine. Typical figure is 100%.



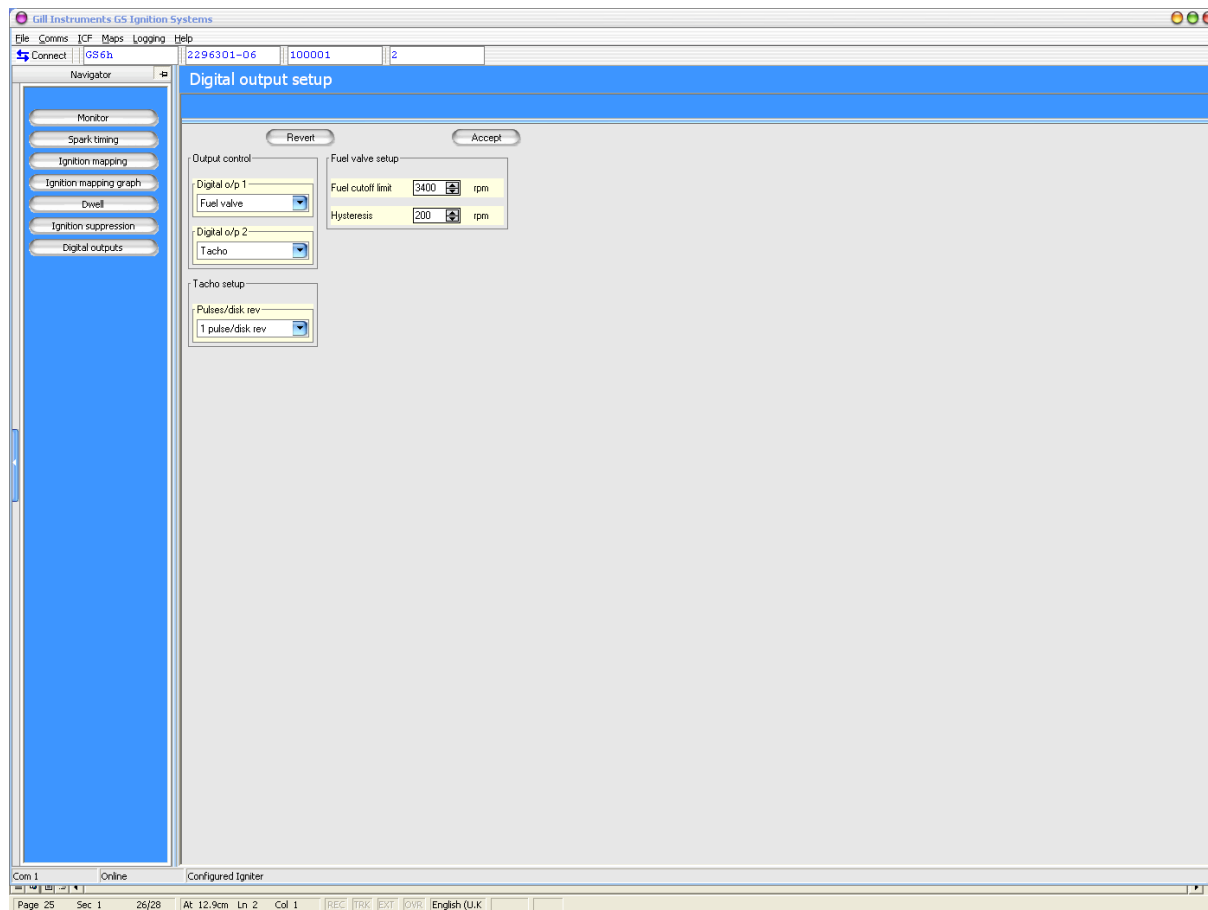
3.5.3 GillFire Ignition Suppression Screen

In this screen the User can change the ignition RPM Limit. This can be set in increments of 10rpm.



3.5.4 Digital Output Screen

On this screen the user is able to configure the two available digital outputs on the igniter. They are on Pin 10 (Output 1, normally fuel valve) and Pin 17 (Output 2, normally tacho/speed).



Output Control

- The two Digital Outputs are able to be set to –
 - Unused
 - Tacho
 - Fuel Valve

Tacho Setup

- The Tacho output can be set to pulse at either once per timing disk revolution or once per two timing disk revolutions.
- This signal can drive a tachometer or an Air/Fuel Ratio Controller.

Fuel Valve Setup

- Fuel Cut off limit – above this limit the output is switched off. This limit should be set lower than the ignition rpm limit so that no unburnt fuel is left in the exhaust system or catalytic converter.
- Hysteresis – Once the Fuel Cut off limit has been exceeded the igniter will not set the relevant digital output back to low until the engine rpm drops below –
Fuel Cut off Limit minus Hysteresis
- The fuel valve is only switched on when the igniter is synchronised to the timing disk and the engine is below the fuel cut-off limit.

4. Igniter Connector Pin-out arrangement

Note that Pin 1 is located at the bottom right hand side of the Igniter connector (cable entry side). Pins are numbered right to left in each row.

Pin	Description	Comment
1	Coil E	Not GS4
2	Coil F	Not GS4
3	Battery -ve	0V (power ground)
4	Load Sensor	TPS or MAP sensor signal input
5	Pickup Input	Inductive Pickup +
6	Pickup Ground	Inductive Pickup -
7	Coil A	
8	Coil B	
9	Battery +ve	Igniter power +ve (+12V or +24V)
10	Output 1	Fuel valve drive
11	RS232 TX	Comms
12	RS232 RX	Comms
13	Coil C	
14	Coil D	
15	Sensor Ground	0V for sensors and switches
16	Map bank select	Fuel switch or thermistor
17	Output 2	Tacho / speed signal
18	Sensor +ve	+5V for load sensors (max 50mA)

The full GS4/GS6 wiring diagram for advanced features is shown on the next page.

GILL GS6 CONVERSION KIT ADVANCED WIRING DIAGRAM

