

ECU Operation

The Fuel Trim allows overall trimming of the fuel.

The trim is a plus or minus percentage applied to the base injector pulse width that effects all RPM and Load points by the same percentage.

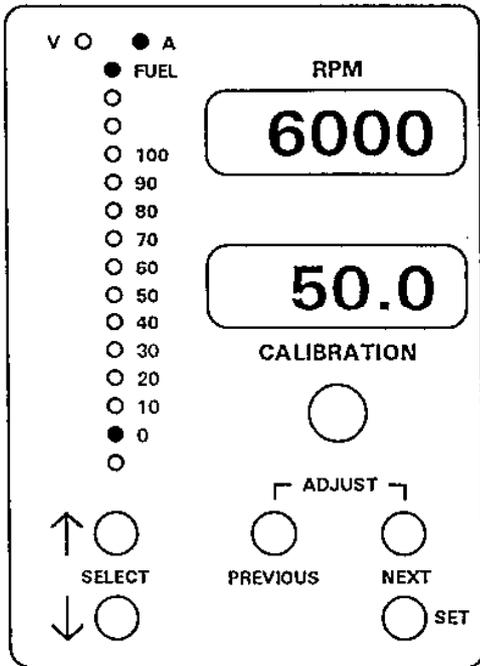
Adjustment Tips

Use for new installations to quickly correct the overall fuelling without changing the overall shape of the main table.

Use the Fuel Trim during trouble shooting to quickly determine if the engine is too lean or too rich.

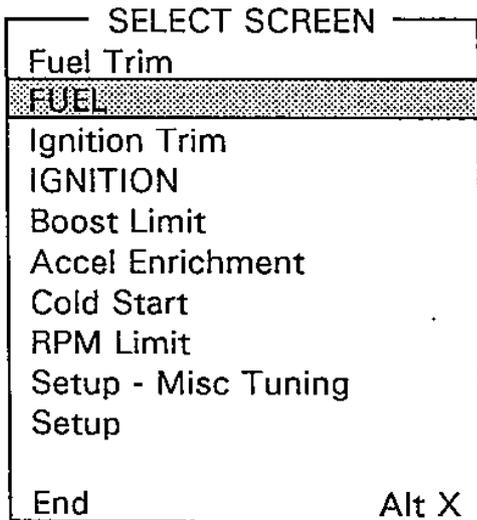
FUEL

Calibrator Operation



- Enter Adjust Mode
- Select FUEL using the SELECT buttons.
- Use the PREVIOUS and NEXT buttons to select the desired RPM Site (shown in the top display).
- Use the SELECT buttons to select the desired Load Site (shown by second LED).
- Ensure that the current engine RPM and Load match the selected RPM and Load Sites using the RPM and Load Cursors.
- Use the KNOB to change the calibration value (shown in the bottom display)
- Press the SET button to Lock in the new calibration value.
- Refer to the Calibrator Operation section for more detail.

E.M.P. Software Operation



- Select Adjust from the Main Menu
- Select FUEL from the Select Screen Menu.
- Use the Arrow keys to move the cursor to the desired RPM & Load Site.
- Ensure that the current engine RPM and Load match the selected RPM & Load Sites using the screen "Target".
- Use the Page Up & Page Down Keys or the Calibrator KNOB to change the calibration value. Press Ctrl for fast adjustments.
- Press the Enter key to Lock in the new calibration value.
- Refer to the E.M.P. Software section for more detail.

E.M.P. Software Operation Cont.

The Fuel calibration data is displayed in a tabular form with Engine Load (Efficiency Point) shown vertically and Engine RPM shown horizontally.

Graphical indicators show the current engine RPM and Load.

Not all the data can be seen at once. If the cursor is moved to the edge of the screen the data will scroll.

The Function Menu has many uses including :

- Jump the cursor to the site nearest the current engine RPM and Load.
- Graph the table.
- Trim the whole table to the value in the Fuel Trim .
- Interpolate Vertical Columns.
- Interpolate Horizontal rows.

ECU Operation

The Fuel Table determines the base fuelling (Injector Pulse Width) for various RPM and Efficiency Points.

If the current engine RPM and Load correspond exactly to a point in the table then the table value for this point determines the actual fuelling. If the current engine RPM and Load do not correspond exactly to a point in the table then the values of the four closest points are mathematically interpolated to arrive at an appropriate value depending on how close the current RPM and Load are to the different points.

The Base Injector Pulse Width is calculated by multiplying the number from the Fuel Table (as a percentage) by 12 msec (25 msec if the injector separation is 360).

e.g. If the Fuel Table No = 50 % then the Base Injector Pulse Width will be 6 msec for that RPM / Eff Site.

The actual pulse width is then determined by adding the Overall Trim and various compensations such as Injector Dead Time, Air Temperature, Manifold Pressure, Engine Temperature and Acceleration Enrichment.

The Fuel must be adjusted to give correct Air Fuel Ratio at the various Load and RPM points. The ECU stores the calibration values in a table of 11 Load sites by 20 RPM sites. The Load sites are 0 to 100% of maximum Load in 10% steps. The RPM sites may be selected from a number of different sets covering the RPM range between 0 and 15000 RPM (see Appendix I - Speed Site Tables).

Adjustment Tips

It is best to start rich then go lean to avoid engine damage.

During initial tuning, if large adjustments are required to a particular site ensure that the sites around it are also adjusted to a similar value so that the adjacent sites have minimal influence on the current site.

Set the Acceleration Enrichment to zero during fuel calibration to avoid undesired enrichment to due to fluctuations in throttle position or manifold pressure.

If using the E.M.P. Software use the overall trim to get the overall fuelling approximately right then use *Overall Trim Table* from the Function Menu to adjust the main table by the current trim. This minimises the amount of adjustment needed on the main table.

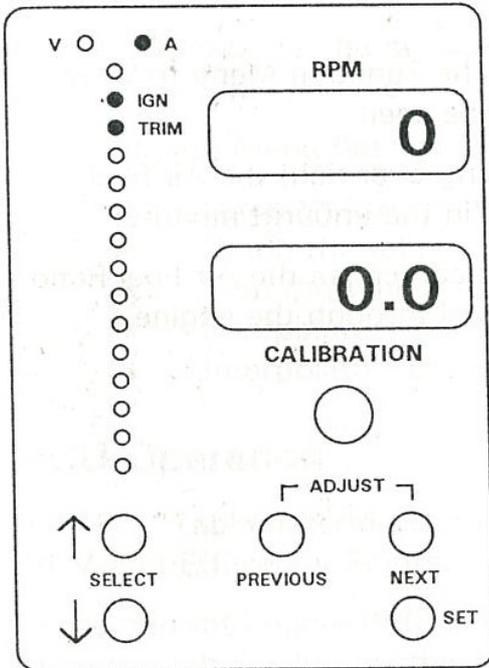
If using the E.M.P. Software use *Graph Table* from the Function Menu to view the calibration data so that any unusual points may be seen.

Note If the engine is missing for any reason (including over rich) the Air Fuel Ratio may falsely read lean due to the oxygen in the unburnt mixture.

Note Cams with high overlap, running at low speed can cause the Air Fuel Ratio to falsely read lean due to extra air being passed through the engine.

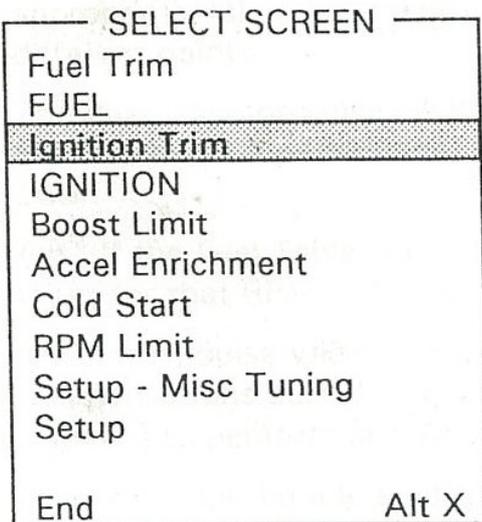
IGNITION TRIM

Calibrator Operation



- Enter Adjust Mode
- Select IGN & TRIM using the SELECT buttons.
- Use the KNOB to change the calibration value (shown in the bottom display).
- Press the SET button to lock in the new calibration value.
- Refer to the Calibrator Operation section for more detail.

E.M.P. Software Operation



- Select Adjust from the Main Menu
- Select Ignition Trim from the Select Screen Menu.
- Use the Page Up & Page Down Keys or the Calibrator KNOB to change the calibration value. Press Ctrl for fast adjustments.
- Press the Enter key to Lock in the new calibration value.
- Refer to the E.M.P. Software section for more detail.

ECU Operation

The Ignition Overall Trim allows overall trimming of the ignition timing.

The Trim is a plus or minus degree offset applied to the base Ignition Timing that effect all RPM and Load points by the same amount.

Ignition Trim may be used to align the Ignition Table Advance with the actual Engine Advance. This is necessary because the reference signal is normally positioned approximately 10 deg. BTDC which is used as the advance during cranking, this is called the Static Advance.

To compensate for a Static Advance of 10 deg. set the Ignition Trim to -10.0 deg.

To set this parameter accurately the value should be adjusted until the actual ignition advance (Use a Timing Light) is the same as the advance indicated on the screen or Calibrator.

Note The Ignition Trim cannot retard behind the Static Advance point.

Note Some Timing Lights do not read correctly on DFI (Direct Fire Ignition) systems.

Adjustment Tips

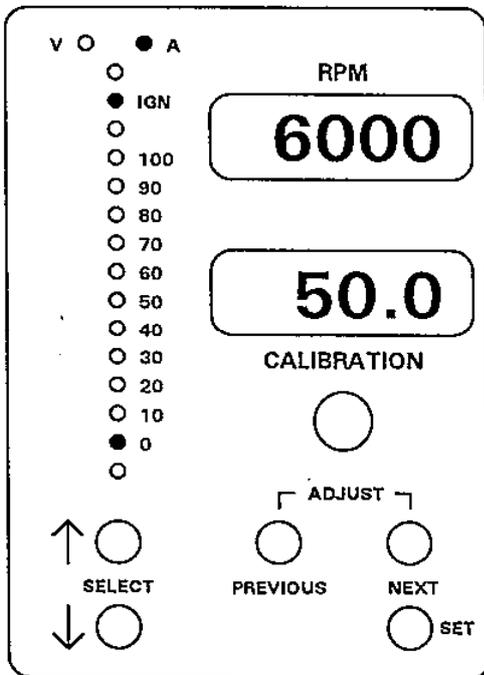
Use the Ignition Trim during trouble shooting to quickly determine if the engine needs more or less advance.

Use for new installations to quickly correct the overall Ignition Timing without changing the overall shape of the main table.

Use to make small overall corrections to compensate for variations in the fuel octane rating etc.

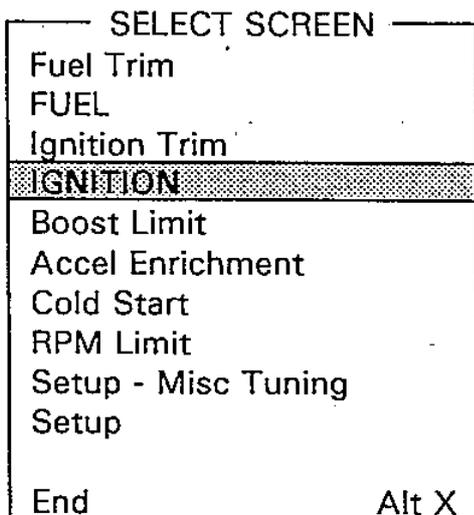
IGNITION

Calibrator Operation



- Enter Adjust Mode
- Select IGN using the SELECT buttons.
- Use the PREVIOUS and NEXT buttons to select the desired RPM Site (Shown in the top display).
- Use the SELECT buttons to select the desired Load Site (shown by second LED).
- Ensure that the current engine RPM and Load match the selected RPM and Load Sites using the RPM and Load Cursors.
- Use the KNOB to change the calibration value (shown in the bottom display).
- Press the SET button to lock in the new calibration value.
- Refer to the Calibrator Operation section for more detail.

E.M.P. Software Operation



- Select Adjust from the Main Menu
- Select IGNITION from the Select Screen Menu.
- Use the Arrow keys to move the cursor to the desired RPM & Load Site.
- Ensure that the current engine RPM and Load match the selected RPM & Load Sites using the screen "Target".
- Use the Page Up & Page Down Keys or the Calibrator KNOB to change the calibration value. Press Ctrl for fast adjustments.
- Press the Enter key to Lock in the new calibration value.
- Refer to the E.M.P. Software section for more detail.

E.M.P. Software Operation Cont.

The Ignition calibration data is displayed in a tabular form with Engine Load shown vertically and Engine RPM shown horizontally.

Graphical indicators show the current engine RPM and Load.

Not all the data can be seen at once. If the cursor is moved to the edge of the screen the data will scroll.

The Function Menu has many uses including :

- Jump the cursor to the site nearest the current engine RPM and Load.
- Graph the table.
- Trim the whole table to the value in the Ignition Trim .
- Interpolate Vertical Columns.
- Interpolate Horizontal rows.

ECU Operation

The Ignition Table determines the base Ignition Timing for various RPM and Load Points.

The values in the table should be the desired advance in deg BTDC.

If the current engine RPM and Load correspond exactly to a point in the table then the table value for this point determines the actual Advance. If the current engine RPM and Load do not correspond exactly to a point in the table then the values of the four closest points are mathematically interpolated to arrive at an appropriate value depending on how close the current RPM and Load are to the different points.

The actual advance relative to the Static Timing point is determined by adding the Overall Trim.

The Ignition Timing must be adjusted to give correct Ignition Timing at the various Load and RPM points. The ECU stores the calibration values in a table of 11 Load sites by 20 RPM sites. The Load sites are 0 to 100% of maximum Load in 10% steps. The RPM sites may be selected from a number of different sets covering the RPM range between 0 and 15000 RPM (see Appendix I - Speed Site Tables).

Note The Ignition Trim may be adjusted to take into account offsets due to the reference pickup not being at Top Dead Center.

Adjustment Tips

Start with a conservative curve then add advance slowly until the torque stops increasing then retard 1 or 2 degrees. Avoid knock, if knock occurs back off the engine load then retard the ignition.

Excessive retard will cause excessive exhaust temperature at high loads.

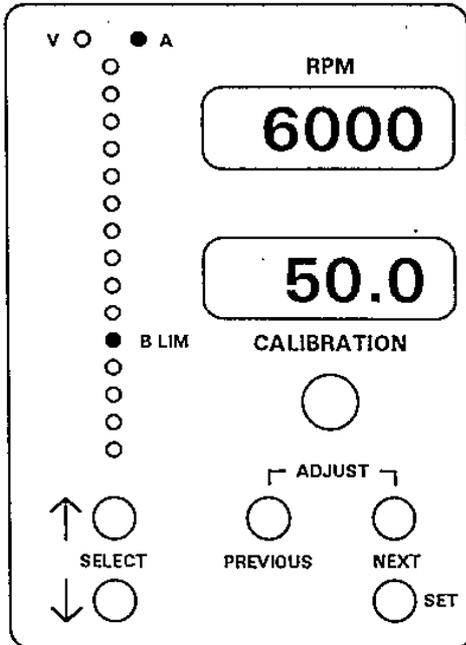
At light load additional advance may improve combustion efficiency.

During initial tuning, if large adjustments are required to a particular site ensure that the sites around it are also adjusted to a similar value so that the adjacent sites have minimal influence on the current site. **Note** Idle the engine while making these adjustments to avoid incorrect advance causing damaging to the engine.

If using the E.M.P. Software use *Graph Table* from the Function Menu to view the calibration data so that any unusual points may be seen.

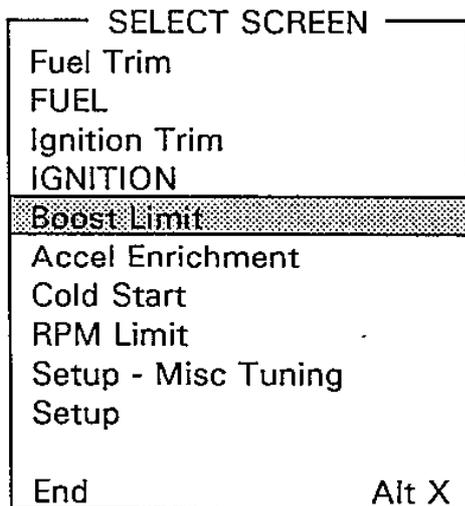
BOOST LIMIT

Calibrator Operation



- Enter Adjust Mode
- Select B LIM using the SELECT buttons.
- Use the PREVIOUS and NEXT buttons to select the desired RPM Site (shown in the top display).
- Ensure that the current engine RPM matches the selected RPM Site using the RPM Cursors.
- Use the KNOB to change the calibration value (shown in the bottom display).
- Press the SET button to lock in the new calibration value.
- Refer to the Calibrator Operation section for more detail.

E.M.P. Software Operation



- Select Adjust from the Main Menu
- Select Boost Limit from the Select Screen Menu.
- Use the Arrow keys to move the cursor to the desired RPM Site.
- Ensure that the current engine RPM matches the selected RPM Site using the screen "Target".
- Use the Page Up & Page Down Keys or the Calibrator KNOB to change the calibration value. Press Ctrl for fast adjustments.
- Press the Enter key to Lock in the new calibration value.
- Refer to the E.M.P. Software section for more detail.

E.M.P. Software Operation Cont.

The Boost calibration data is displayed in a tabular form with Engine RPM shown horizontally.

Graphical indicators show the current engine RPM.

Not all the data can be seen at once. If the cursor is moved to the edge of the screen the data will scroll.

The Function Menu has many uses including :

- Jump the cursor to the site nearest the current engine RPM.
- Graph the table.

ECU Operation

The Boost Limit Table sets the Boost Limit control value for various RPM sites.

The Boost Limit must be adjusted at various RPM points. The ECU stores the calibration values in a table of 20 RPM sites. The RPM sites may be selected from a number of different sets covering the RPM range between 0 and 15000 RPM (see Appendix I - Speed Site Tables).

The Setup parameter *trbo* sets the waste gate control mode.

The table value is either the absolute pressure in kPa or the actuator valve duty cycle depending on the selected mode.

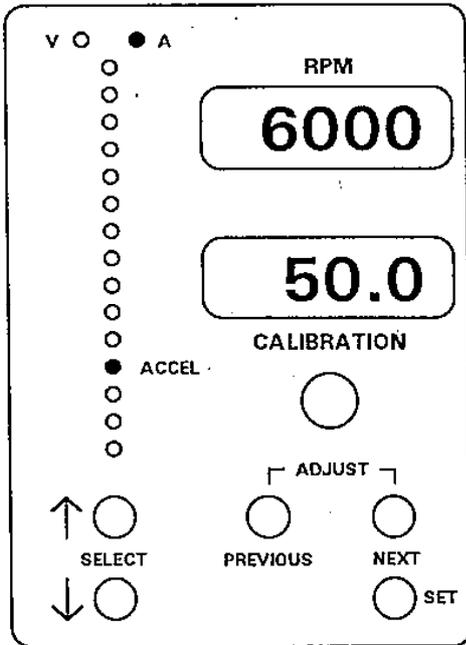
See the topic on Turbo Waste Gate Control for more detail.

Adjustment Tips

If using the E.M.P. Software use *Graph Table* from the Function Menu to view the calibration data so that any unusual points may be seen.

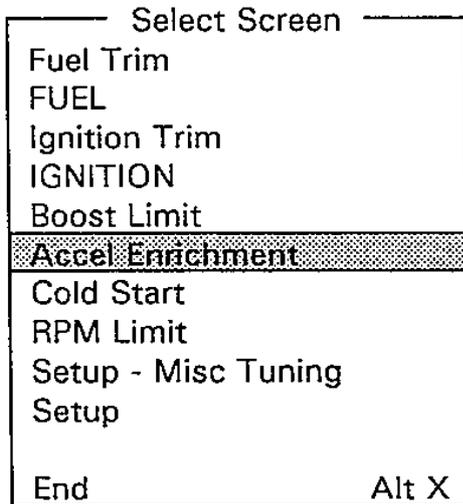
ACCELERATION ENRICHMENT

Calibrator Operation



- Enter Adjust Mode
- Select ACCEL using the SELECT buttons.
- Use the PREVIOUS and NEXT buttons to select the desired RPM Site (shown in the top display).
- Use the KNOB to change the calibration value (shown in the bottom display).
- Press the SET button to lock in the new calibration value.
- Refer to the Calibrator Operation section for more detail.

E.M.P. Software Operation



- Select Adjust from the Main Menu
- Select Accel Enrichment from the Select Screen Menu.
- Use the Arrow keys to move the cursor to the desired RPM Site.
- Use the Page Up & Page Down Keys or the Calibrator KNOB to change the calibration value. Press Ctrl for fast adjustments.
- Press the Enter key to Lock in the new calibration value.
- Refer to the E.M.P. Software section for more detail.

E.M.P. Software Operation Cont.

The Accel calibration data is displayed in a tabular form with Engine RPM shown horizontally.

Graphical indicators show the current engine RPM.

Not all the data can be seen at once. If the cursor is moved to the edge of the screen the data will scroll.

The Function Menu has many uses including :

- Jump the cursor to the site nearest the current engine RPM.
- Graph the Table.

ECU Operation

The Accel Table value is the maximum amount of extra fuel due to rapid increase in engine load for various RPM points.

The Accel Table must be adjusted at various RPM points. The ECU stores the calibration values in a table of 12 RPM sites from 0 to 11000 in 1000 RPM steps.

The actual amount of extra fuel for a given rate of change in efficiency point is dependant on the Setup Parameter *Ac r* but is limited (clamped) to the value in this table.

The Setup Parameter *Ac d* sets the decay rate of the acceleration enrichment.

Adjustment Tips

The Fuel Table must be fully adjusted before the Acceleration Enrichment can be adjusted correctly.

The Acceleration Enrichment is effected by the Accel table and the Setup parameters *Ac r* and *Ac d*.

To set the Accel table first set the Setup parameters *Ac r* and *Ac d* to 50. Select the desired table RPM site then adjust the engine RPM to match the selected site. Stab the throttle to check the engine response. (Stabbing the throttle removes the effect of the *Ac r* parameter). Try more or less Accel and repeat the test. Repeat at the various RPM sites.

Adjust *Ac r* by moving the throttle more gently and check the engine response.

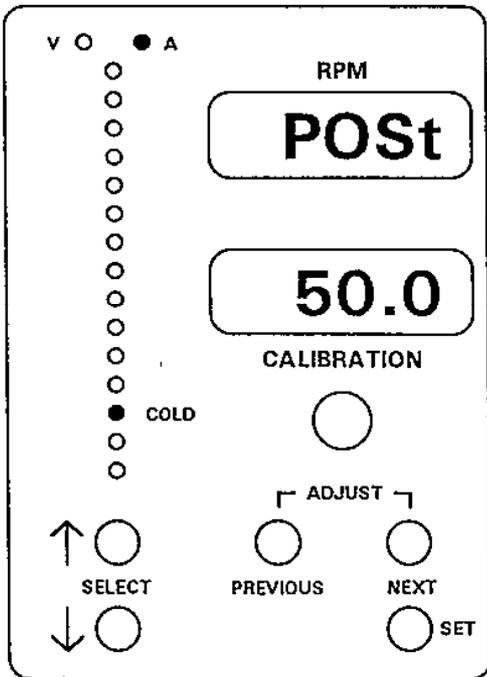
See the SETUP topic for more information on *Ac r* and *Ac d*.

Acceleration Enrichment is not normally required above 4000 RPM.

If using the E.M.P. Software use *Graph Table* from the Function Menu to view the calibration data so that any unusual points may be seen.

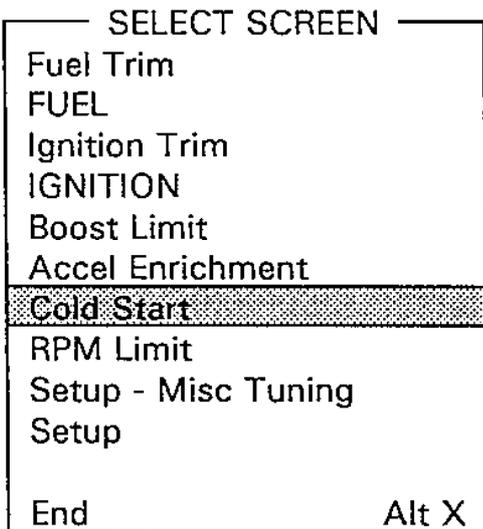
COLD START

Calibrator Operation



- Enter Adjust Mode
- Select COLD using the SELECT buttons.
- Use the PREVIOUS and NEXT buttons to select the desired cold start parameter (Abbreviation shown in the top display).
- Use the KNOB to change the calibration value (shown in the bottom display).
- Press the SET button to lock in the new calibration value.
- Refer to the Calibrator Operation section for more detail.

E.M.P. Software Operation



- Select Adjust from the Main Menu
- Select Cold Start from the Select Screen Menu.
- Use the Arrow keys to select the desired cold start parameter.
- Use the Page Up & Page Down Keys or the Calibrator KNOB to change the calibration value. Press Ctrl for fast adjustments.
- Press the Enter key to Lock in the new calibration value.
- Refer to the E.M.P. Software section for more detail.

E.M.P. Software Operation Cont.

The Cold Start Parameters are shown in a tabular form. The desired parameter may be selected using the Up and Down arrow keys.

ECU Operation

The following parameters may be adjusted :

cold - *WARM UP ENRICHMENT*

Additional fuel during cold start warm up.

The amount of additional fuel reduces as the engine warms up and has no effect above 50 deg C.

The larger the figure the more additional fuel.

Typical Value : 50.

POST - *POST START ENRICHMENT*

Additional fuel after engine has started.

The additional fuel decays to nothing at a rate determined by the Cold Start *dECY* parameter.

The amount of additional fuel is a percentage of the warm up enrichment and is therefore temperature dependant and has no effect above 50 deg C.

The larger the figure the more additional fuel.

Typical Value : 120.

crn - *CRANKING ENRICHMENT*

During Cranking additional fuel is required, this is reduced to nothing over a number of engine revolutions.

The amount of additional fuel is a percentage of the warm up enrichment and is therefore temperature dependant and has no effect above 50 deg C.

The larger the figure the more additional fuel.

Typical Value : 120.

dECY - *POST START DECAY RATE*

The rate at which the post start enrichment is reduced to zero.

The larger the figure the faster the additional fuel is reduced to zero.

Typical Value : 20.

Accl - ACCEL ENRICHMENT

Additional Acceleration Enrichment while the engine is cold.

The amount of additional Acceleration Enrichment is a percentage of the warm up enrichment and is therefore temperature dependant and has no effect above 50 deg C.

The larger the figure the more additional acceleration enrichment.

Has no effect above 50 deg C.

Typical Value : 20.

Adjustment Tips

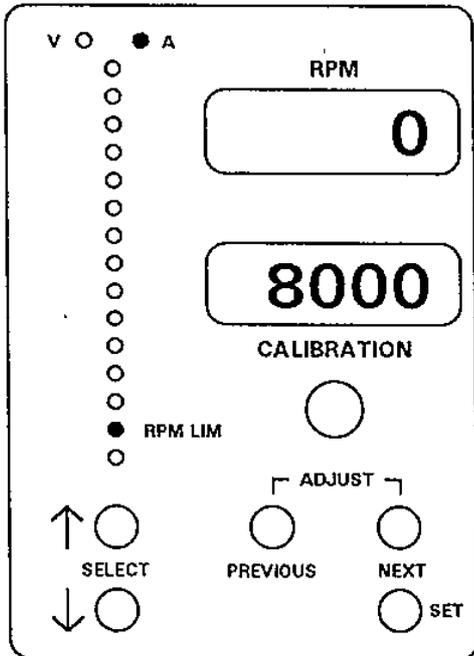
The Fuel Table must be fully adjusted before the Cold Start parameters can be adjusted correctly.

The *cold* parameter should not be adjusted until the engine has stabilised after starting and the post start enrichment has decayed to zero (approx. 30 seconds). The engine temperature should be as cold as possible to ensure adjustments have maximum effect.

If the engine hesitates or stalls just after starting, adjust the *POSr* and *dECY* parameters.

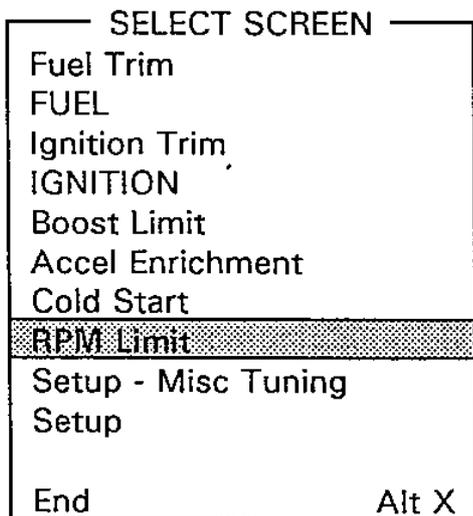
RPM LIMIT

Calibrator Operation



- Enter Adjust Mode
- Select RPM LIM using the SELECT buttons.
- Use the KNOB to change the calibration value (shown in the bottom display).
- Press the SET button to lock in the new calibration value.
- Refer to the Calibrator Operation section for more detail.

E.M.P. Software Operation



- Select Adjust from the Main Menu
- Select RPM Limit from the Select Screen Menu.
- Use the Page Up & Page Down Keys or the Calibrator KNOB to change the calibration value. Press Ctrl for fast adjustments.
- Press the Enter key to Lock in the new calibration value.
- Refer to the E.M.P. Software section for more detail.

ECU Operation

Sets the RPM at which the fuel will be Cut.

Two modes are available :

Soft Cut

Positive Numbers e.g. 8000. Cuts one Group at the RPM Limit then the second Group 100 RPM over the limit.

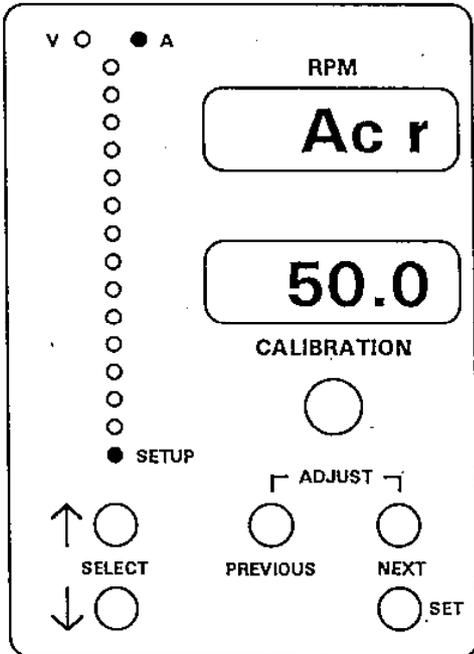
DO NOT Use if both Groups feed the same cylinder.

Hard Cut

Negative Numbers e.g. -8000 Cuts both Groups at the RPM Limit.

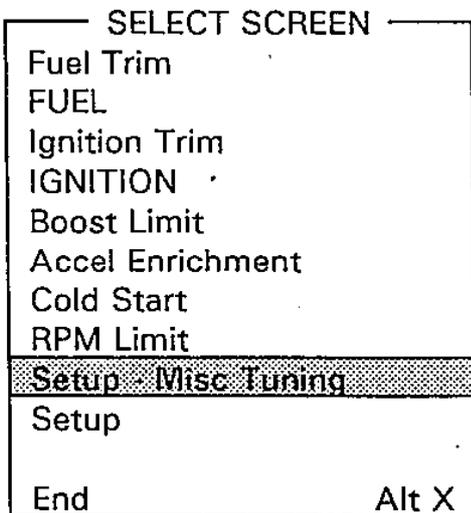
SETUP

Calibrator Operation



- Enter Adjust Mode
- Select SETUP using the SELECT buttons.
- Use the PREVIOUS and NEXT buttons to select the desired Setup parameter (Abbreviation shown in the top display).
- Use the KNOB to change the calibration value (shown in the bottom display).
- Press the SET button to lock in the new calibration value.
- Reset the ECU (Power OFF / ON) for all items after and including TPC. These items do not take effect until the ECU is reset.
- Refer to the Calibrator Operation section for more detail.

E.M.P. Software Operation



- Select Adjust from the Main Menu
- Select either Setup - Misc Tuning or Setup from the Select Screen Menu.
- Use the Arrow keys to select the desired Setup parameter.
- Use the Page Up & Page Down Keys or the Calibrator KNOB to change the calibration value. Press Ctrl for fast adjustments.
- Press the Enter key to Lock in the new calibration value.
- The Setup - Misc Tuning parameters take immediate effect. The Setup items do not take effect until the ECU is reset, which is performed automatically on changing to another screen.
- Refer to the E.M.P. Software section for more detail.

E.M.P. Software Operation Cont.

The Setup Parameters are shown in a tabular form. The desired parameter may be selected using the Up and Down arrow keys.

The Setup Parameters are divided into two groups Setup - Misc Tuning and Setup. The Setup - Misc Tuning parameters effect the ECU operation as they are adjusted. The Setup Parameters only take effect once the ECU has been reset, which will be done automatically when changing to another screen.

ECU Operation

Ac r - ACCEL ENRICHMENT RATE

Sensitivity of the acceleration enrichment to throttle movement (or change in manifold pressure if the Throttle Position sensor is not fitted).

The larger the number the more sensitive to changes.

Note The Accel Table determines the maximum amount of Acceleration Enrichment for various RPM sites.

Typical Value : 50.

Ac d - ACCEL ENRICHMENT DECAY

Rate of decay of acceleration enrichment.

The larger the number the quicker the additional fuel decays to zero.

Note The Accel Table determines the maximum amount of Acceleration Enrichment for various RPM sites.

Typical Value : 50.

idLE - IDLE SPEED

Used for one of two functions depending on the Setup parameter *Aout*.

1. Sets the desired Idle RPM for a warm engine if the Auxiliary Output Function *Aout* is set to Idle Speed Control. The idle speed is increased when the engine is cold.

Refer to the topic on Idle Speed Control for details on the other setup parameters that effect idle speed control.

2. Sets the RPM at which Auxiliary output is activated if the Auxiliary Output Function *Aout* is set to an RPM Activated Output.

dF - AUX OUTPUT DAMPING FACTOR

Used when the Auxiliary output is used for Turbo Waste Gate control or Idle Speed control .

Refer to the topics on Turbo Waste Gate Control and Idle Speed Control for details.

gF - AUX OUTPUT GAIN FACTOR

Used when the Auxiliary output is used for Turbo Waste Gate control or Idle Speed control .

Refer to the topics on Turbo Waste Gate Control and Idle Speed Control for details.

AAP - AUX AVERAGE POSITION

Used when the Auxiliary output is used for Turbo Waste Gate control or Idle Speed control .

Refer to the topics on Turbo Waste Gate Control and Idle Speed Control for details.

LA g - LAMBDA GAIN

Speed of response of the Lambda Control to deviation from the desired Lambda value.

Larger numbers give faster response.

Too large a number will cause excessive deviations either side of the desired lambda value.

Too small a number will cause slow correction of deviations from the desired lambda.

Typical Value : 60.

FCAL - FUEL USED CALIBRATION

Total Injector Flow Rate

If set to cc/min Fuel Used will be displayed in litres,

If set to 0.001 gal/min Fuel Used will be displayed in gallons.

If set to 0 Fuel Used will read total seconds of injector on time.

TPC - THROTTLE / MAP CONTROL

Selects Throttle Position or Manifold Pressure (MAP) mapping of the Fuel and Ignition tables.

- 0 Manifold Pressure.
- 1 Throttle Standard.
- 2 Throttle V3 Compatible.
- 3 Throttle Linear.

10,11,12,13 as above except Over Run Cut Out is enabled.

Note The ECU must be reset before this parameter takes effect.

SP S - SPEED SITE TABLE

Selects the RPM speed sites for the Fuel and Ignition and Boost Limit Tables.

The Speed Site Tables determine the RPM speed sites at which the various calibration tables may be adjusted. Different tables are available to suit different engines. The tables are divided into groups to suit different maximum speed engines.

Refer to Appendix I - Speed Site Tables for a list of the Tables.

If using the E.M.P. Software the available Speed Site Tables may be viewed by selecting ***Show Speed Site Tables*** from the Function Menu or by pressing the F10 key. The Speed Site Tables are shown graphically with the Table numbers at the left and the site RPM displayed across the top. The available sites for each Table are marked with an * under the corresponding RPM point.

If using the E.M.P. Software and the Speed Site Table selection is changed the tables that rely on this parameter (such as FUEL and IGNITION) may be interpolated to correspond to the new table. This ensures that the existing calibration data is still valid. Note that the engine may run incorrectly during the table interpolation, it is therefore best if the engine is stopped during the interpolation.

Note The ECU must be reset before this parameter takes effect.

LA C - LAMBDA CONTROL

0	Disabled.
1	Narrow Band Control.
78-110	Wide Band Control.
	78 gives 0.78 Lambda.
	110 gives 1.10 Lambda.

Note The ECU must be reset before this parameter takes effect.

Narrow Band Lambda Control

Controls the Air Fuel Ratio to Lambda 1.0 using a narrow band O₂ sensor.

Control is disabled for Throttle Position > 70%, load > 100%, RPM > 4000, duty cycle > 40% or Engine Temp < 25 deg C.

Control is also disabled if adjusting the Fuel or Ignition Tables.

The Fuel Table should be calibrated for Lambda 1.0 for RPM < 4000 and Throttle Position < 70% or Load < 100%, at other points Lambda may be adjusted to any desired value (Typically 0.8 to 0.95 Lambda depending on load and engine type).

The Fuel Trim value cannot be adjusted if Lambda Control is enabled as the ECU takes over control of the Fuel Trim value in order to correct the Air Fuel Ratio.

The maximum amount of trim that can be applied is $\pm 15\%$. If Lambda 1.0 cannot be achieved using this range then Lambda Control will be abandoned. This could be caused by a faulty sensor or a Fuel Table that has not been calibrated close enough to Lambda 1.0.

The speed of response is controlled by the Lambda Gain Factor *LA g*.

Wide Band Lambda Control

Requires the *MoTeC* Air Fuel Ratio meter to be connected to the A/F input of the ECU.

Controls the Air Fuel Ratio to the desired value for all Loads and RPM values.

The Fuel Table should be calibrated to the Lambda value specified by this parameter for all RPM and Load conditions.

The Fuel Trim value cannot be adjusted if Lambda Control is enabled as the ECU takes over control of the Fuel Trim value in order to correct the Air Fuel Ratio.

The maximum amount of trim that can be applied is $\pm 15\%$. If the required Lambda value cannot be achieved using this range then Lambda Control will be abandoned. This could be caused by a faulty sensor or a Fuel Table that has not been calibrated close enough to the required Lambda.

If the Lambda Control value is set to a negative number then Lambda Control will be enabled when adjusting the Fuel Table. Pressing the Set key will add the Fuel Trim value to the current site value then zero the Trim. This method can give automatic adjustment of the Fuel Table value during calibration.

The speed of response is controlled by the Lambda Gain Factor *LA g*.

TPLO - THROTTLE POSITION LO

Records the Throttle Position with the throttle fully closed.

This parameter must be set every time the Throttle Pot is moved.

Adjust by moving the throttle to the fully closed position then press SET.

Note The bottom display briefly shows the currently set value when *TPLO* is selected then it shows the current throttle position.

The value must be > 3.0 otherwise the sensor will be considered to be in error (Rotate the sensor if necessary).

Only Used if the Throttle Pot is fitted.

Note The ECU must be reset before this parameter takes effect.

TPHI - THROTTLE POSITION HI

Records the Throttle Position with the throttle fully open.

This parameter must be set every time the Throttle Pot is moved.

Adjust by moving the throttle to the fully open position then press SET.

Note The bottom display briefly shows the currently set value when *TPHI* is selected then it shows the current throttle position.

The value must be < 99.0 otherwise the sensor will be considered to be in error (Rotate the sensor if necessary).

Only Used if the Throttle Pot is fitted.

Note The ECU must be reset before this parameter takes effect.

Aout - AUX OUTPUT FUNCTION

Selects the function performed by the Auxiliary Output.

- 0 Waste Gate control.
- 1 Idle speed control with cold start idle up.
- 2 Idle speed control with cold idle up and dash pot function (Throttle Pot must be fitted).
- 3 Electric cooling fan Control On > 95 deg C - Off < 90 deg C.
- 4 Air conditioner cut-out at WOT.
- 5 Calibrated fuel usage pulse.
- 6 Waste Gate control + Fuel Pump output used for Anti-Stall.
- 7 RPM Activated : On if RPM > Idle Speed.
- 8 RPM Activated : Off if RPM > Idle Speed.
- 9 Tacho Output.

Note The ECU must be reset before this parameter takes effect.

A Fr - AUX OUTPUT FREQUENCY

Selects the Frequency used to operate the Auxiliary Output Valve.

The required frequency is dependant on the type of valve being used - Refer to the valve details (Available from *MoTeC*).

Note The ECU must be reset before this parameter takes effect.

trbo - TURBO TYPE

Selects the type of turbo if any and type of Waste Gate control.

- 0 No turbo.
- 1 Absolute pressure control using the MAP sensor. The actuator duty is REDUCED if the MAP value is greater than the pressure set in the Boost Limit table. The actuator is off for MAP below 130 kPa (to prevent vacuum leaks).

- 2 Same as mode 1 except the duty is **INCREASED** if the MAP value is greater than the pressure set in the Boost Limit table.
- 3 Not used.
- 4 Not used.
- 5 Duty Cycle pressure control. The boost is controlled by applying a specified duty cycle to the actuator. The Boost Limit table specifies the actuator Duty Cycle for various RPM sites, rather than an absolute kPa value. The actuator is fully OFF at 100% duty.
- 6 Same as 5 except the actuator is fully ON at 100% duty.

Refer to the topic on Turbo Waste Gate Control for details on the various setup parameters that effect Waste Gate control.

Note The ECU must be reset before this parameter takes effect.

CYLS - NUMBER OF CYLINDERS

Selects Number of cylinders for 4 stroke engines.

For 2 stroke engines double the number of cylinders.

Note The ECU must be reset before this parameter takes effect.

inj - INJECTOR TYPE NUMBER

Sets the Injector Drive Circuit Parameters.

Use negative numbers if the Injectors are to be synchronised to the synchronisation input. (Positive numbers default the Auxiliary input for Nitrous use).

The Injector drive number is made up of three parts :

1. The total peak injector current per group.
2. The Recirculation Time.
3. The Injector Dead Time.

Refer to Appendix K - Injector Setup Number (inj) for details on how to construct the Injector type number for various injectors.

Note The ECU must be reset before this parameter takes effect.

ign - IGNITION TYPE NUMBER

Sets the Ignition Module and Trigger Type Parameters.

Refer to Appendix J - Ignition Setup Number (ign) for general details.

Refer to the drawing for the specific ignition system for specific details (Available from *MoTeC*).

Note The ECU must be reset before this parameter takes effect.

NITROUS ENRICHMENT / RETARD

The Auxiliary Input may be used to activate the Nitrous Enrichment and Ignition Retard function.

The Injector Setup Parameter *inj* must be positive. (Negative numbers set the Auxiliary input for use as a synchronisation input).

Fuel Enrichment

The Percentage Fuel Enrichment should be entered into the Fuel Table at the 0 RPM / 100 % load Point.

Ignition Retard

The degrees of Ignition Retard should be entered into the Ignition Table at the 0 RPM / 100 % load Point.

IDLE SPEED CONTROL

The Auxiliary Output may be used to control a PWM Idle Speed Control valve. The Auxiliary Output Function *Aout* must be set to Idle Speed Control.

The setup parameters *idLE*, *dF*, *gF* and *AAP* are used to adjust the idle speed control system.

idLE : Idle Speed

Sets the desired Idle RPM for a warm engine.

Note The idle speed is increased when the engine is cold.

dF : Damping Factor (Integration Rate)

Controls the rate of correction of Idle speed.

Larger values slow the rate of correction.

Too large a value will cause deviations to be corrected too slowly.

Too small a value will cause surging of the idle speed.

Typical Value : 95.

gF : Gain Factor (Anti-stall Gain)

Controls the amount of correction due to deviations from the desired idle speed.

Too small a value gives insufficient response to sudden loading.
(Insufficient anti-stall correction)

Too large a value will cause surging of the idle speed.

Typical Value : 30.

AAP : Average Actuator Position (Starting Position)

Sets the starting position (Duty Cycle) of the actuator valve.

Adjust to give correct idle on starting.

Typical Value : 40.

A Fr : Auxiliary Output Frequency

Sets the operating frequency of the actuator. Refer to the Valve Drawing (Available from *MoTeC*).

TURBO WASTE GATE CONTROL

The Auxiliary Output may be used to control a PWM (Pulse Width Modulated) Waste Gate Control valve. The Auxiliary Output Function *Aout* must be set to a Waste Gate Control mode.

Two types of waste gate control methods are available :

- 1 Absolute Control (Modes 1 & 2)
- 2 Duty Cycle Control (Modes 5 & 6).

The setup parameter *A Fr* must be set for both types of control.

A Fr : Auxiliary Output Frequency

Sets the operating frequency of the actuator. Refer to the Valve Drawing (Available from *MoTeC*).

Absolute Control - (Modes 1 & 2)

The Boost Limit table specifies the desired pressure in kPa Absolute for various RPM sites.

A PD (Proportional Derivative) algorithm is used to vary the actuator duty cycle in order to achieve the desired pressure. The PD algorithm requires a number of parameters to be adjusted to ensure stable control. The setup parameters *dF*, *gF* and *AAP* must be adjusted to suit each application.

dF : Damping Factor

PD Algorithm Derivative Factor.

Reduces overshoots of pressure during pressure transitions. Increasing the value will reduce the amount of overshoot. Too large a value can cause erratic control due to pressure pulsation's being interpreted as pressure changes.

Typical Value : 20.

gF : Gain Factor

PD Algorithm Gain Factor.

Use as high a value as possible without hunting then back off approximately 10%. Too low a value will result in a difference between the desired pressure and the actual pressure.

Typical Value : 30.

AAP : Average Actuator Position

Removes differences between the desired pressure and the actual pressure without requiring an "Integral" factor.

Set at the normal average Duty Cycle of the actuator. Differences between *AAP* and the actual Duty Cycle will cause a difference between the desired pressure and the actual pressure which can be minimised by ensuring that the Gain Factor *gF* is as high as possible.

Typical Value : 40.

Duty Cycle Control - (Modes 5 & 6).

The Boost Limit table specifies the actuator duty cycle.

The duty cycle should be set by moving to the required site then adjusting the duty cycle to achieve the required Boost Pressure.

This method is simpler to get right than the Absolute Control method as it does not require adjustment of any control factors.

Note This method maintains gauge boost pressure not absolute boost pressure if the barometric pressure changes.

PC Software Installation

Personal Computer

The Personal Computer (PC) must be IBM PC compatible and must have at least 640K of RAM one Serial Communications Port and one Printer Port.

Installing the Software

The *MoTeC* Master Disk contains all the *MoTeC* software programs.

Before starting, make a copy of the Master Disk using the DOS 'diskcopy' command :

i.e. Type DISKCOPY A: B: <Enter>

Before making a copy ensure that the Master Disk write protect tab is in the "protect" position to avoid inadvertently writing to the Master Disk.

PC with 1 Floppy Drive

The *MoTeC* Master Disk cannot be used as a 'Bootable' disk as it does not contain the Disk Operating System (DOS).

To "Boot" the PC place a disk containing the Disk Operating System (DOS) in the Disk Drive and turn on the PC power.

After the PC has booted place the *MoTeC* Disk in the Disk Drive and start the *MoTeC* software.

Alternatively a bootable disk may be created and the *MoTeC* software placed on it. This allows the PC to be booted from the *MoTeC* disk (See Appendix A - Creating a Bootable Floppy Disk).

PC with 2 Floppy Drives

The *MoTeC* Master Disk cannot be used as a 'Bootable' disk as it does not contain the Disk Operating System (DOS).

To 'Boot' the PC place a disk containing the Disk Operating System (DOS) in the A: Disk Drive and turn on the PC power.

Place the *MoTeC* Disk in the B: Disk Drive.

After the PC has booted change the current drive to B: by typing B: <Enter>

Start the *MoTeC* Software.

Alternatively a bootable disk may be created and the *MoTeC* software placed on it. This allows the PC to be booted from the *MoTeC* disk (See Appendix A - Creating a Bootable Floppy Disk).

PC with Hard Disk Drive

To install the *MoTeC* Software onto a Hard Disk place the *MoTeC* Software Disk into a Floppy Drive. Change the current drive to the Floppy Drive by typing A:<Enter> or B:<Enter> then type INSTALL<Enter> to automatically install the *MoTeC* software onto the Hard Disk.

The *MoTeC* Software will be copied to a sub-directory under the Directory C:\MOTEC. The sub-directory will be different for different ECU types or versions. The different sub-directories may be accessed using the *MoTeC* PROGRAM INTEGRATOR Software.

Starting the PC Software Programs

The *MoTeC* PROGRAM INTEGRATOR may be used to start any of the *MoTeC* software programs.

Floppy Disk

Choose the disk with the correct version of the software programs on it (i.e. use V3 for V3 ECUs and V4 for V4 ECUs).

To start a program start the *MoTeC* PROGRAM INTEGRATOR by typing
MOTEC <Enter>

Select the appropriate program from the list using the Up and Down Arrow keys then press the Enter key.

Hard Disk

To start a program first change to the MOTEC directory by typing
CD C:\MOTEC <Enter>

Start the *MoTeC* PROGRAM INTEGRATOR by typing
MOTEC <Enter>

Select the appropriate program from the list using the Up and Down Arrow keys then press the Enter key.

If multiple versions of the programs are available a list of the available versions will be displayed so that the appropriate version may be chosen (This changes the current directory to the chosen version).

To change to another version at any time press the Esc key to re-display the version select menu and choose the desired version.

Screen Colours

On some PCs the screen colours may not appear correctly. To toggle the screen colours between Colour and Mono press the F9 key while the Main Menu is displayed.

Exiting back to DOS

Press the Alt and X key together to exit the *MoTeC* PROGRAM INTEGRATOR and return to DOS.

E.M.P. Software

Introduction

The *MoTeC* Engine Management Program (E.M.P.) provides an alternative method of calibrating the ECU.

E.M.P. provides additional facilities not available when using the calibrator alone, including the following :

- Storage of the Calibration Data on disk.
- Printing of the Calibration Data.
- Viewing of the Calibration data in tabular form.
- 3 Dimensional Graphing of the Calibration Data.
- Transfer of the Calibration Data from disk to the ECU.
- Viewing of all Engine Sensor Values and other ECU Operating Parameters on one screen.
- Graphical RPM and Load Indicators.
- Table Interpolation.
- Injector Test and Ignition Test modes.
- Context Sensitive Help.

Starting the Program

E.M.P. is available for 2D and 3D ECUs :

EMP3 is used for 3D ECUs

EMP2 is used for 2D ECUs

Also different versions of E.M.P. must be used for V3 and V4 ECUs.

Start the *MoTeC* PROGRAM INTEGRATOR by typing MOTEC then select EMP from the Menu. Refer to the Starting the PC Software Programs section for more detail.

Refer to Appendix B - E.M.P. Command Line Options if E.M.P. must be started alone or with special options.

Connections

Connect the PC to the ECU via the Computer Interface Unit and optionally connect the Calibrator.

Refer to the Computer Interface section for details.

Calibrator

The Hand Held Calibrator may be used in conjunction with the E.M.P. Software. Connection of the Calibrator is optional and is not necessary for correct operation.

Using the calibrator gives the advantage of being able to adjust the calibration data using the rotary knob and change sites using the Calibrator Buttons.

Screen Colours

On some PCs the screen colours may not appear correctly. To toggle the screen colours between Colour and Mono press the F9 key while the Main Menu is displayed.

Help

Context Sensitive Help is available at most times and may be activated by pressing the F1 Key.

"Context Sensitive" means that the help screen shows information relevant to the current screen or menu.

Files

E.M.P. records the ECU calibration data in files that are stored on the disk, this ensures that a permanent record of the data is kept. The files also record comments to allow easy identification of each file. Any file may be sent to the ECU which allows quick programming of a new ECU or modification of an old one.

The file name is automatically generated when the file is created, it is made up from the date on which the file was created plus a sequence number, e.g. The first file created on the 12th of February 1993 will be named 93021200 (YEAR, MONTH, DAY, Sequence Number). It is important therefore that the date is set correctly on the PC which can usually be achieved using the "date" command. i.e. From the DOS prompt type : DATE <Enter> then enter the correct date.

File Matching

Before entering the Adjust Screens the calibration data is first retrieved from the ECU then "Matched" to a file. If the ECU data does not match a file exactly then the closest file will be chosen (up to a maximum of 20 differences) the user may then choose to use this file or create a new file. If a close match can not be found then a new file will be created.

Any subsequent changes to the ECU data can be saved to the current file or optionally saved to a new file.

Adjust Concepts

It is important to note that all adjustments are made directly to the ECU rather than the File. The File Data is only updated when exiting from the Adjust Screens back to the Main Menu (or if the F2 key is pressed) at which time the current data is retrieved from the ECU then saved to the file.

Status Line

The top line on the screen is called the status line.

This line shows the following :

1. The current file number
2. Customer (Entered when the file is created)
3. Engine Description (Entered when the file is created)
4. ECU Status, Connected / NOT Connected - Shows if the ECU is connected.

e.g.

93021200 / Customer / Engine Description	ECU Connected
--	---------------

Menu Bar

The bottom line is called the Menu Bar. This shows which key strokes are valid and what they do, or it gives special instructions.

e.g.

F1-Help	F3-Diags	F9-Function	PgUp/Dn-Adj	Enter-Set	Esc-Screen/End
---------	----------	-------------	-------------	-----------	----------------

Always look at this line to see what options are available.

File Only Edit Mode

If the ECU is NOT CONNECTED the File Data may be adjusted directly, the changes can then be sent to the ECU at a latter date.

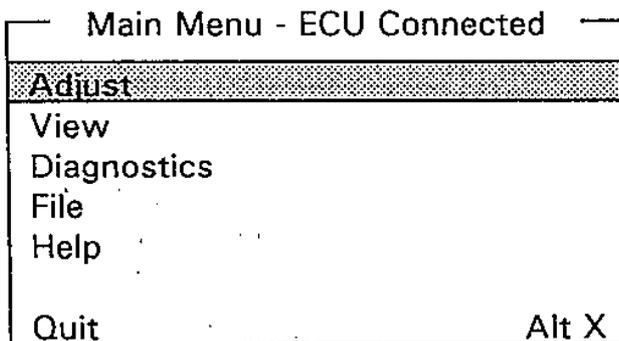
Note It is normally better to make changes with the ECU Connected.

MAIN MENU

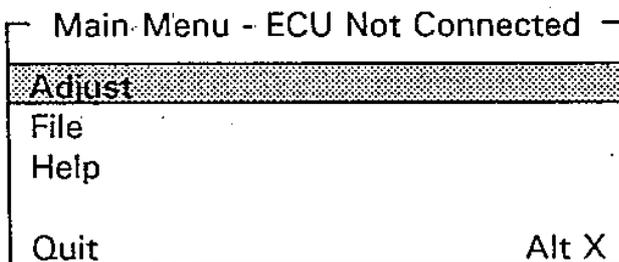
When the program is started the Main Menu will appear. To select an item use the Up and Down Arrow keys then press the Enter key.

To get help on any item position the selection bar to the item of interest then press the F1 key.

If the ECU is Connected The following items will appear on the Main Menu :



If the ECU is NOT Connected The following items will appear on the Main Menu :

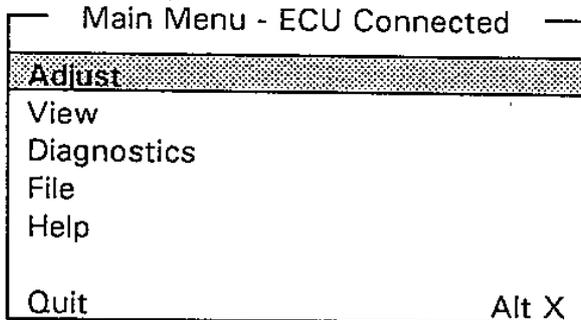


Note that the "ECU Not Connected" Main Menu is a subset of the "ECU Connected" Main Menu.

Key Actions

F1	Show help on the chosen item.
Up / Down	Choose Item.
Enter	Select the chosen item
F9	Toggle Colour / Mono.
Esc	Show Previous Menu (if any).

ADJUST

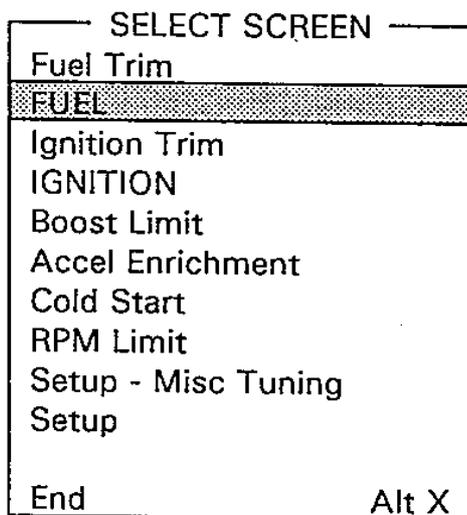


- Use the Up and Down Arrow keys to choose Adjust.
- Press the Enter key to show the Adjust screen.

Allows Adjustment of ECU Calibration data.

Before entering the Adjust Screens the calibration data is first retrieved from the ECU then "Matched" to a file, if the ECU data does not match a file on the disk a new file will be created.

The Select Screen Menu will then be displayed so that the desired Adjust Screen may be selected.



- Use the Up and Down Arrow keys to choose the desired screen.
- Press the Enter key to show the chosen screen.

Selecting the Adjust Screen

The Adjust Screen may be changed at any time by pressing the Esc key to re-display the Select Screen Menu. The desired screen may then be chosen from the Menu.

The screen will also change if the Adjust Mode is changed on the Hand Held Calibrator.

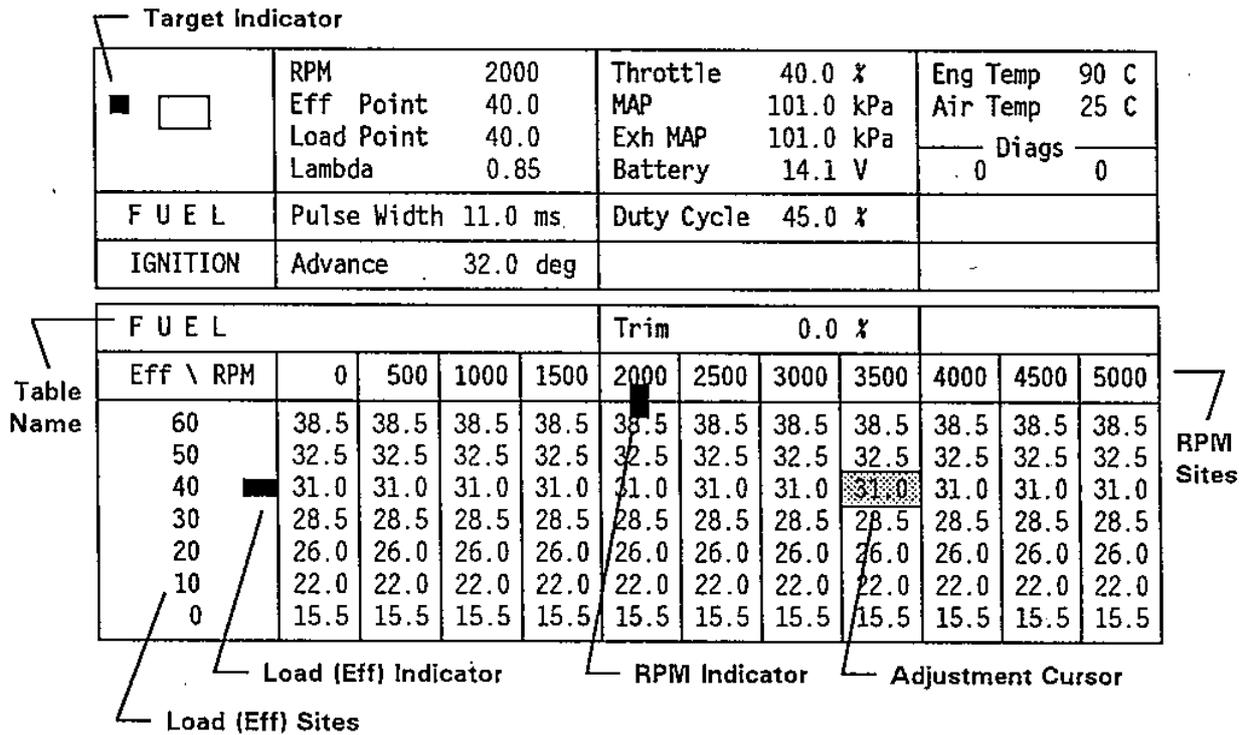
Exiting to the Main Menu

Press the Esc key to show the Select Screen Menu then select End. Alternatively press the Alt and X keys together.

Before exiting to the Main Menu the ECU data will be retrieved and the user will be given the choice of saving the ECU Data to the Current File or to a New File. Saving to a New File leaves the original file unchanged.

Adjust Screens

The Fuel adjust screen (for the ECU connected) is shown below. Not all the calibration data can be seen at once, if the Adjustment cursor is moved to the edges of the table the table will scroll.



Engine Data (ECU Connected Only)

Most screens show basic engine and sensor data at the top of the screen including RPM, Load Point, Throttle Position etc. The Diagnostic Errors are also shown.

Graphical Indicators (ECU Connected Only)

Graphical Indicators are shown at the top and side of the table.

The Indicators move horizontally along the top of the table and vertically at the side of the table. The indicators show the current engine operating point and therefore indicate which table value (or values) the ECU is currently using. If the indicators are between sites then the ECU will interpolate the table values for those sites to arrive at an in-between value.

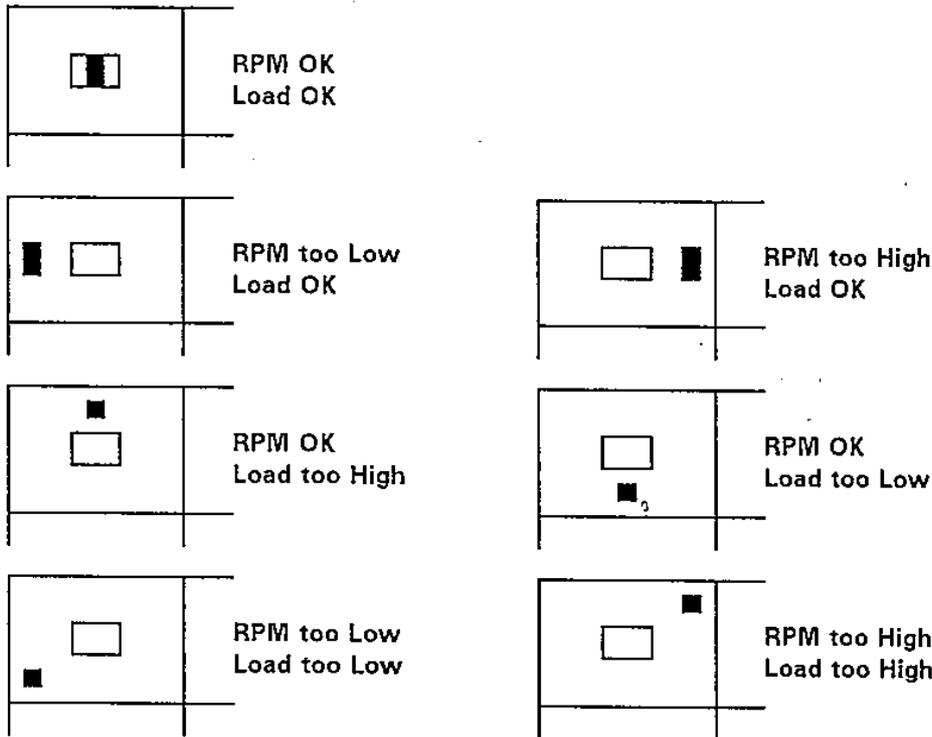
The indicators must point to the same site as the adjustment cursor for any adjustments to change the current engine tuning.

Target (ECU Connected Only)

A Target is shown at the top left of the screen. This allows more accurate positioning of the engine operating point.

The indicator only moves if the engine is within the current adjustment site.

For best calibration the indicator should be within or close to the center rectangle, this ensures that the ECU tuning is determined mainly by the site being adjusted and not by the adjacent sites.



Making Adjustments

Adjustments may be made to the calibration data by moving the Adjustment Cursor to the desired site with the Arrow keys then using the PgUp and PgDn keys or the Calibrator Adjust Knob to change the value.

Note Fast adjustments may be made by pressing the PgUp or PgDn keys in conjunction with the Ctrl key. This will increment the value by 10 times the normal amount.

Setting the new Value

When the desired adjustment has been made the new value must be "Set" by pressing the Enter key or the Calibrator SET button. This stores the new adjustment in the ECU programmable memory.

Set Indicators (*)

An * will appear next to items that have been set, with the exception of tables that are dependent on the engine operating point e.g. FUEL, IGNITION etc. where

an * will only appear if the engine operating point corresponds to the currently selected site.

The *'s are saved in the same file as the ECU Data and will therefore remain set until they are purposely cleared.

The *'s may be cleared individually or ALL *'s may be cleared at once. To clear an individual * select *Clear** from the Function Menu or press the Backspace key. To clear ALL *'s select *Clear ALL*'s* from the Function Menu.

F4 Key

The F4 key may be used to switch quickly between the Fuel Table screen and Fuel Overall Trim screen or the Ignition Table screen and Ignition Overall Trim screen.

F5 Key

The F5 key may be used to switch quickly between a Fuel screen and the corresponding Ignition screen or vice versa.

If the current screen is neither a Fuel or Ignition screen then the F5 key will select the FUEL screen.

Saving the Calibration Data to a Disk File

The Calibration Data will be saved to a File when exiting from the Adjust Screens back to the Main Menu. The F2 key may also be used to save the data during a calibration session.

The user may choose to save the data to the current file or to create a new file which will leave the current file unchanged.

Setup - Automatic ECU Reset (ECU Connected Only)

Changes to the SETUP requires that the ECU be Reset so that the new values will take effect. This is done automatically on exiting the SETUP Adjust Screen.

To avoid misfire the engine should be turned off when the SETUP Screen is exited. A warning will be given before the Reset takes place.

View Screen (ECU Connected Only)

The View Screen displays detailed engine and sensor data as well as the maximum RPM and Fuel Used.

The View Screen may be viewed by pressing the V key or by selecting *Show View Screen* from the Function Menu.

The View Screen will also be displayed if the Hand Held Calibrator mode is changed from Adjust mode to View mode.

The View Screen may be removed by pressing the Esc key or by changing the Calibrator back to Adjust mode.

Diagnostic Errors Screen (ECU Connected Only)

The Diagnostic Errors Screen may be viewed by pressing the F3 key or by selecting *Show Diagnostic Errors* from the Function Menu.

Function Menu

The Function Menu may be displayed by pressing the F9 key. The Function Menu allows selection of various functions such as Graph Table, Overall Trim Table, Interpolate Vertical Column etc.

To select a Function use the Up and Down Arrow keys to choose the Function item then press the Enter key to start that function. Some items may also be activated by pressing the "HOT KEY" indicated at the right of the Function Menu. Note that the HOT KEY will also work from the Adjust Screen without first displaying the Function Menu.

Not all functions have a HOT KEY and therefore can only be activated from the Function Menu.

Context Sensitive Help is available on each item by positioning the selection bar on the item of interest and pressing the F1 key.

Note The Items in the Function Menu vary depending on which Adjust Screen is selected at the time.

FUNCTION MENU	
Graph	G
Jump to Site	SPACE BAR
Trim Fuel Map	
Interpolate VERTICAL Column	
Interpolate HORIZONTAL Row	
Copy Vertical Column Right	
Show Diagnostics Errors	F3
Show View Screen	V
Edit File Comments	
Save to File	F2
Clear All *	
Clear Current *	Delete
Set with *	Backspace

- Use the Up and Down Arrow keys to choose the desired function.
- Press the F1 key for help on the chosen function.
- Press the Enter key to execute the chosen function.

Function - GRAPH

Graphs the Table Data.

Hot Key - G

Function - JUMP TO SITE

Moves the Adjustment Cursor to the Speed and Load Site closest to the current engine speed and load.

Hot Key - SPACE BAR

Function - TRIM FUEL MAP

Trims the whole Fuel Map by the percentage indicated by the current Fuel Trim then sets the Trim back to 0.

This is useful during initial tuning since an existing MAP can be used then trimmed to take into account variations in injector sizing etc.

Note that during the interpolation the engine may run rich. It is therefore best if the engine is stopped during the interpolation. If the engine is running a warning will be given before the interpolation is started.

Function - TRIM IGNITION MAP

Trims the whole Ignition Map by the amount indicated by the current Ignition Trim then sets the Trim back to 0.

Note that during the interpolation the engine may run retarded. It is therefore best if the engine is stopped during the interpolation. If the engine is running a warning will be given before the interpolation is started.

Function - INTERPOLATE VERTICAL COLUMN

Linearly interpolates the current Column between Full load and No Load leaving the Full Load, No Load and any points marked with an * unchanged.

Note that it may be necessary to use the BACKSPACE key to mark the desired points with an *.

Function - INTERPOLATE HORIZONTAL ROW

Linearly interpolates the current Row between 0 RPM and the Maximum RPM leaving the 0 RPM, Maximum RPM and any points marked with an * unchanged.

Note that it may be necessary to use the BACKSPACE key to mark the desired points with an *.

Function - COPY VERTICAL COLUMN RIGHT

Copies the data in the current Column to the Column immediately to its right.

This may be useful during initial tuning.

Function - SHOW DIAGNOSTICS ERRORS

Shows the Diagnostic Errors Screen

Hot Key - F3

Function - SHOW VIEW SCREEN

Shows the VIEW Screen.

Hot Key - V

Function - EDIT FILE COMMENTS

Edit the Current File Comments.

Function - SAVE TO FILE

Saves the Current ECU Data to either the current file or a new file.

Note that the ECU Data will be saved on exit of the Adjust Screens also.

Hot.Key - F2

Function - CLEAR ALL *

Clears all *'s in either the current table or all tables.

Function - CLEAR CURRENT *

Clears the * on the current site.

Hot Key - Delete

Function - SET WITH *

Sets an * on the current site whether or not the engine is currently at that site.

Hot Key - Backspace

Function - SHOW SPEED SITE TABLES

Shows the available Speed Site Tables in a graphical format.

Only available if the current screen is SETUP.

Hot Key - F10

VIEW

Main Menu - ECU Connected	
Adjust	
View	
Diagnostics	
File	
Help	
Quit	Alt X

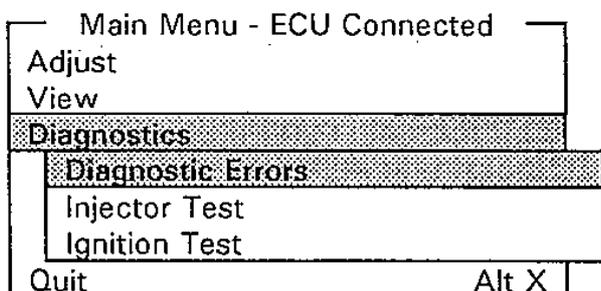
- Use the **Up** and **Down** Arrow keys to choose **View**.
- Press the **Enter** key to show the **View** screen.

Shows detailed engine and sensor data and allows resetting of the Maximum RPM and the Fuel Used.

Key Actions :

- | | |
|----|-------------------------------------|
| F3 | Show the Diagnostics Errors Screen. |
| F4 | Reset the Maximum RPM. |
| F5 | Reset the Fuel Used to 0. |

DIAGNOSTICS



- Use the Up and Down Arrow keys to choose Diagnostics.
- Press the Enter key to show the Diagnostics sub menu.
- Use the Up and Down Arrow keys to choose the desired function.
- Press the F1 key for help on the chosen function.
- Press the Enter key to start the chosen function.

Diagnostic Errors

Shows all diagnostic errors.

The Enter key may be used to reset all non current errors.

Note that the error indicators are set when the errors occur and are only reset when the Enter key is pressed or the ECU is turned off.

Injector Test

Allows testing of the Injectors while the engine is stopped.

WARNING The Fuel Pump must be off when running this test otherwise flooding of the engine may occur.

Key Actions

PgUp	Increase the Test RPM
PgDn	Decrease the Test RPM
Ctrl + PgUp	Fast Increase the Test RPM
Ctrl + PgDn	Fast Decrease the Test RPM
Esc	End the Test.

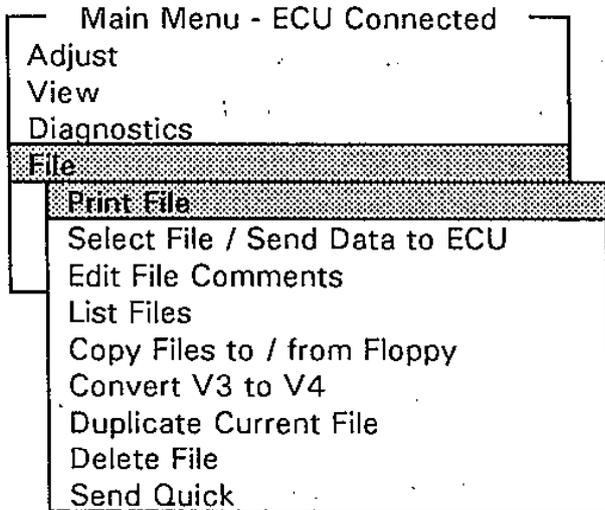
Ignition Test

Allows testing of the Ignition System while the engine is stopped.

Key Actions

PgUp	Increase the Test RPM
PgDn	Decrease the Test RPM
Ctrl + PgUp	Fast Increase the Test RPM
Ctrl + PgDn	Fast Decrease the Test RPM
Esc	End the Test.

FILE



- Use the Up and Down Arrow keys to choose File.
- Press the Enter key to show the File sub menu.
- Use the Up and Down Arrow keys to choose the desired function.
- Press the F1 key for help on the chosen function.
- Press the Enter key to start the chosen function.

Print File

Prints all Calibration and Setup Data for the currently selected file to any PC compatible printer.

Some printers may not print the border lines correctly, if this is the case answer NO to the question "Print Border Lines ?", or change the configuration of the printer from "Italics" to "Graphics".

Select File / Send Data to ECU

Shows all files in a Menu format and allows any file to be sent to the ECU.

This allows quick setup of a new ECU by sending a existing file to the ECU.

Only available when the ECU is Connected.

Key Actions

Up / Down	Choose File
Enter	Send the Chosen File to the ECU
F2	View File Comments
F3	Sort Toggle - Allows Sorting of the File list using either Date and Time, File Number, Customer or Engine Description
Esc	Abort

Select File

Shows all files in a Menu format and allows any file to be selected as the current file.

Only available when the ECU is NOT Connected.

Key Actions

Up / Down	Choose File
Enter	Select Chosen File
F2	View File Comments
F3	Sort Toggle - Allows Sorting of the File list using either Date and Time, File Number, Customer or Engine Description
Esc	Abort

Edit File Comments

Allows editing of the current files comments.

The comments "Engine Description" and "Customer Name" will appear on the Status Line at the top of the Screen when the file is selected.

The "Notes" may be used to record additional information. (e.g. Turbo Type, Manifold Type etc.)

Key Actions

F4	Copy Comments from another file
F5	Clear all Comments
Up	Move to Previous Comment
Down	Move to Next Comment
Enter	Move to Next Comment
Esc	End and Save Changes
Left / Right	Move Cursor Left or Right
Backspace	Rubout Previous Character
Delete	Delete Character at Cursor
Insert	Toggle Insert / Overtyping Mode

List Files

Lists the available files and allows viewing of the file comments.

Key Actions

Up / Down	Scroll through List
F2	View File Comments
F3	Sort Toggle - Allows Sorting of the File list using either Date and Time, File Number, Customer or Engine Description
Esc	End

Copy Files to / from Floppy

Allows one or more files to be copied to or from a floppy disk drive.

The files to be copied are listed in a Menu format.

To copy one file only, position the selection bar to the file to be copied then press the Enter key.

To copy more than one file "Tag" the files to be copied by positioning the selection bar to the desired file then press the Space Bar. Tagged files are indicated by a square at the left and right sides of the screen. Press the Enter key to start copying the files. Files may also be "Un-Tagged" with the Space Bar.

If using a PC with only one Floppy Drive the user will be prompted to insert the "Source" Disk, this is the Disk containing the Files to be copied. After reading the files the user will be prompted to insert the "Destination" Disk, this is the disk that the files will be copied to.

Key Actions

Up / Down	Choose File
Space Bar	Tag (OR Un Tag) File
F2	View File Comments
F3	Sort Toggle - Allows Sorting of the File list using either Date and Time, File Number, Customer or Engine Description
Enter	Start Copy
Esc	Abort

Convert V3 to V4

Copies Version 3 (V3) Files and converts them to Version 4 (V4) format.

To convert one file only, position the selection bar to the file to be converted then press the Enter key.

To convert more than one file "Tag" the files to be converted by positioning the selection bar to the desired file then press the Space bar. Tagged files are indicated by a square at the left and right sides of the screen. Press the Enter key to start the conversion. Files may also be "Un Tagged" with the Space Bar.

If operating on a floppy disk the user will be prompted to insert the "Source" Disk, this is the Disk that contains the V3 files. After reading the V3 files the user will be prompted to insert the "Destination" Disk, this is the disk that the V4 files should be written to (Probably the original disk).

Key Actions

Up / Down	Choose File
Space Bar	Tag (Un Tag) File
F2	View File Comments
F3	Sort Toggle - Allows Sorting of the File list using either Date and Time, File Number, Customer or Engine Description
Enter	Start Conversion
Esc	Abort

Duplicate Current File

Copies the current file to a new file.

This allows a new file to be created so that the current file may remain unchanged.

Delete File

Shows all files and allows any file to be deleted.

Key Actions

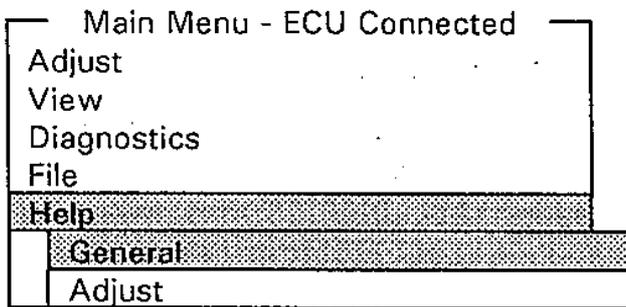
Up / Down	Choose File
F2	View File Comments
F3	Sort Toggle - Allows Sorting of the File list using either Date and Time, File Number, Customer or Engine Description
Enter	Delete File
Esc	End

Send Quick

Sends the currently selected file to the ECU without first retrieving the ECU data.

Note Send Quick is designed to send data quickly to the ECU during race situations. It should not be used for normal work as it does not retrieve the current ECU data and therefore cannot guarantee that the current ECU data is stored on disk.

HELP



- Use the Up and Down Arrow keys to choose Help.
- Press the Enter key to show the Help sub menu.
- Use the Up and Down Arrow keys to choose the desired function.
- Press the Enter key to start the chosen function.

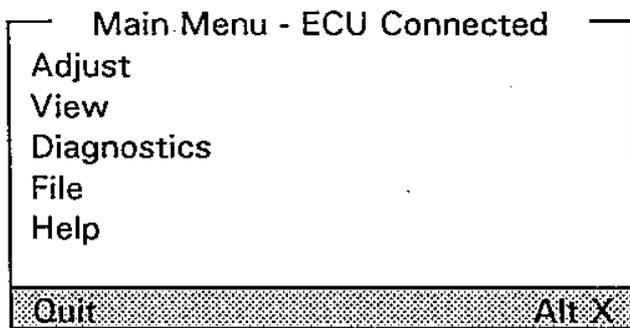
General

Show General Help Information not available through the Context Sensitive Help System.

Adjust

Show Help Information about the Adjust Screens.

QUIT



- Use the Up and Down Arrow keys to choose Quit.
- Press the Enter key to show the View screen.
- Alternatively press the Alt and X keys together.

Quit E.M.P. and return to the *MoTeC* Program Integrator or DOS.

MONITOR Software

Introduction

The *MoTeC* MONITOR Program allows Monitoring and Data Logging of various ECU sensors and parameters. MONITOR is a one way communications program (i.e. Data is sent from the ECU to the PC only) this allows the Personal Computer to be connected via the *MoTeC* Telemetry Link as well as directly to the ECU.

Starting the Program

Start the *MoTeC* PROGRAM INTEGRATOR by typing MOTEC then select MONITOR from the Menu. Refer to the Starting the PC Software Programs section for more detail.

Refer to Appendix C - MONITOR Command Line Options if MONITOR must be started alone or with special options.

Connections

The PC may be connected in one of two ways :

Direct Connection

Connect the PC to the ECU via the *MoTeC* Computer Interface Unit.
See the Computer Interface Section for more detail.

Telemetry Link

Connect the ECU to the *MoTeC* Computer Interface + Transmit Modem and Radio.

Connect the PC to the *MoTeC* Receive Modem and Radio.

See the Telemetry Link Sections for more detail.

Calibrator

The Hand Held Calibrator may be used while the MONITOR program is running. The calibrator has no effect on the operation of the MONITOR program.

Communications Baud Rate

The communications baud rate will usually be set to the correct rate by the *MoTeC* PROGRAM INTEGRATOR.

Note that the Baud Rate must be 1200 baud for the *MoTeC* 1200 Baud Telemetry Link.

Refer to Appendix C - MONITOR Command Line Options if a special baud rate is required.

Screen Colours

On some PCs the screen colours may not appear correctly in this case the colours may be toggled between Colour and Mono by pressing the F9 key.

Status Line

The top line on the screen is called the status line. This line shows the following :

1. The logging Status (ON/OFF)
2. The number of Logging Records remaining.
3. The number of Markers placed in the Log File
4. The logging Rate e.g. 3 / Sec (3 per second).
5. The ECU Status (Connected / NOT Connected)

e.g.

Logging ON	1012	7	Log Rate 3 / Sec	ECU Connected
------------	------	---	------------------	---------------

Menu Bar

The bottom line is called the Menu Bar. This shows which key strokes are valid and what they do.

e.g.

F1-Help	F2-Acc Run	F4-Print	F5-Start	F7-Save	Up/Down-Rate	Alt-X Exit
---------	------------	----------	----------	---------	--------------	------------

Always look at this line to see what options are available.

Main Display

The Main Display shows all ECU Sensors and Parameters including Diagnostic Errors and the time of the last screen update.

Key Actions :

F1	HELP	Show help Screen.
F2	ACC RUN	Show the Accel Run Screen
F3	PRINT	Send the Current ECU data to the Printer.
F5	START	Start Logging
F6	STOP	Stop Logging
F7	SAVE	Save the Logged data to disk
F9	COLOURS	Toggle Screen Colours.
Space Bar	MARK	Place Marker in the Log File
Up / Down	RATE	Change the logging rate.
Alt+X	EXIT	Exit the MONITOR Program

Accel Run Display

The Acceleration Run Display shows the engine data in a column format. A line is written to the display each time the engine passes through a 250 RPM point. The bottom line shows the current engine data.

To change from the Main Display to the Acceleration Run Display press the F2 key.

To Change back to the Main Display press the F3 key.

To reset the Accel Run Display press the F2 key.

See Appendix C - MONITOR Command Line Options if steps other than 250 RPM are required.

Logging

Logging may be started by pressing the F5 key.

During logging the ECU data is recorded in memory at a rate determined by the currently selected Logging Rate which may be adjusted using the Up and Down arrow keys.

The maximum logging rate is determined by the communications baud rate i.e. at 9600 baud the maximum logging rate is 20 times per second and at 1200 baud the maximum logging rate is 3 times per second.

Logging may be stopped at any time by pressing the F6 key. Restarting the logging will add to the previously logged data.

The logged data may be saved to disk at any time by pressing the F7 key. Logging must be stopped (Press the F6 key) before the data can be saved to the disk. Saving the data resets the log memory so that the entire memory is again available for logged data. The data may be saved to any file or to the default file (DATA). If the file already exists the user may chose to append the logged data to the existing file or overwrite the existing file.

The amount of logging records (memory) available is shown on the Status Line, this will decrement by one each time a record is written to memory. When the number of records reaches zero the current logged data will begin to overwrite the oldest logged data.

Markers

If Logging is ON a Marker may be placed in the logged data by pressing the Space Bar.

The Marker appears as ********* followed by a number when viewed with the *MoTeC* VIEW Program. The Status Line indicates the number of Markers placed.

This feature may be useful to mark the start of each lap.

Viewing the Logged Data

Use the *MoTeC* VIEW Program (Refer to the VIEW Software section).

Exiting the Program

Press the Alt and X key together to exit the MONITOR Program.

If there is any logged data that has not been saved the user will be given a choice of loosing the logged data or saving the logged data to a file.

VIEW Software

The *MoTeC* VIEW Program allows viewing and printing of the logged data produced by the MONITOR Program. VIEW also allows the logged data to be converted to data that is compatible with various spread sheets or graph plotting programs.

Starting the Program

Start the *MoTeC* PROGRAM INTEGRATOR by typing MOTEC then select VIEW from the Menu. Refer to the Starting the PC Software Programs section for more detail.

Connections

The ECU need not be connected to the PC to operate the VIEW Program.

Screen Colours

On some PCs the screen colours may not appear correctly in this case the colours may be toggled between Colour and Mono by pressing the F9 key.

Files

The VIEW Program requires that there be at least one Log File that has been generated by the MONITOR program on the current disk.

Status Line

The top line on the screen is called the status line.

This line shows the following :

1. The Current File Name.
2. The Line Number that is currently at the top of the screen.
3. The current position in the file expressed as a percentage of the overall file length.

e.g.

File : DATA.LOG	Line : 45	65%
-----------------	-----------	-----

Menu Bar

The bottom line is called the Menu Bar. This shows which key strokes are valid and what they do.

Main Display

The main display shows the Logged Data. Each column corresponds to an engine sensor or other engine data. Each line shows the data that was logged to the file starting with the first line at the top of the screen. Each column may be assigned to a particular item by using the Column Sequencing facility (Press the F5 key) see below.

While the Main display is shown the following keys may be used :

The * indicates that detailed information is available elsewhere in this document.

Key Actions

Up	Move to the previous line.
Down	Move to the next line.
PgUp	Move Up one Page.
PgDn	Move Down one Page.
Home	Move to the Beginning of the File.
End	Move to the End of the File.
Alt+X	Exit the VIEW Program.
F1	Show a Help message relating to the current screen. Help on other topics can be obtained by pressing the PgUp or PgDn keys.
* F2	Select a file.
* F3	Go to a line Number.
* F4	Print the Log Data to the Printer.
* Alt+F4	Print the Log Data to a disk file in the same format as that used for the printer.
* F5	Change the Column Sequencing.
F6	Toggle the Time Data between Time of Day or time from beginning of the Log Data.
* F8	Save the Log Data to a disk file as a column formatted text file with comma and " separators.
* Alt+F8	Save the Log Data to a disk file as a column formatted text file without comma separators.

Selecting a File

When the VIEW program is started a list of available files will be displayed. Choose the desired file by using the Up and Down Arrow keys then press Enter.

To load a different file press the F2 key to re-display the file list then select the new file. If the Disk has been changed since starting the program it will be necessary to press the F2 key again to read the files from the new disk.

While the File List is displayed the following keys may be used :

Key Actions

F2	Re-Scan the Disk for log Files.
F3	Change the Sort order of the files. The files may be sorted by File Name, Comment or Date and Time.

F7	Select a file by name. The filename may specify another drive or directory.
Up / Down	Choose a file:
Enter	Load the chosen file.
Esc	Abort the selection process and return to the previous file.

Column Sequencing

The columns in which each of the items appear may be changed using the column sequencing screen. To activate the Column Sequencing screen press the F5 key.

The screen shows all available items and a number relating to the column in which the item will be displayed. The left most column on the main screen is column number 1.

As many columns as possible are shown on the main screen. If too many columns are selected then the additional columns will not be visible.

If a column number is changed or turned off all other items will have their column numbers adjusted as required.

Note that the new column number will not be set until the Enter key is pressed.

While the Column Sequencing Screen is displayed the following keys may be used.

Key Actions

Up / Down	Select the desired item.
PgUp	Increment the column number. If currently set to off it will be set to one.
PgDn	Decrement the column number. If currently set to 1 it will be set to off.
Enter	Set the Column sequence number.
Esc	Finish column sequence editing.

Printing and Converting

The Logged Data may be Printed or Converted to suit various Spread Sheet or Graph Plotting Programs.

Printing or Converting always starts at the line currently displayed at the top of the screen.

All items not marked as off will be used.

The number of lines to be Printed or Converted may be entered or E or END may be typed to indicate that the rest of the file should be used.

The following keys are used to initiate Printing or Conversion :

F4

Sends a specified number of lines of data to the Printer. Each page will contain 50 Lines and a heading will be printed at the top of each page.

Alt + F4

The same as F4 except that the data will be sent to a file instead of the printer.

F8

Generates a column formatted text file and saves it to a disk file. The columns are separated by commas and the headings are enclosed in quotation marks. This Format will suit various Spread Sheet or Graph Plotting Programs.

Alt + F8

The same as F8 except that the commas are removed. This Format will suit various Spread Sheet or Graph Plotting Programs where the F8 format is not suitable.

Go To Line Number

The data may be scrolled to a specific line number by pressing the F3 key while the main screen is displayed. The specified line will become the line at the top of the screen.

After pressing the F3 key the user should enter the desired line number or type E or END to go to the end of the data or S or START to go to the start of the data.

Exiting the Program

Press the Alt and X key together to exit the VIEW Program.

Computer Interface

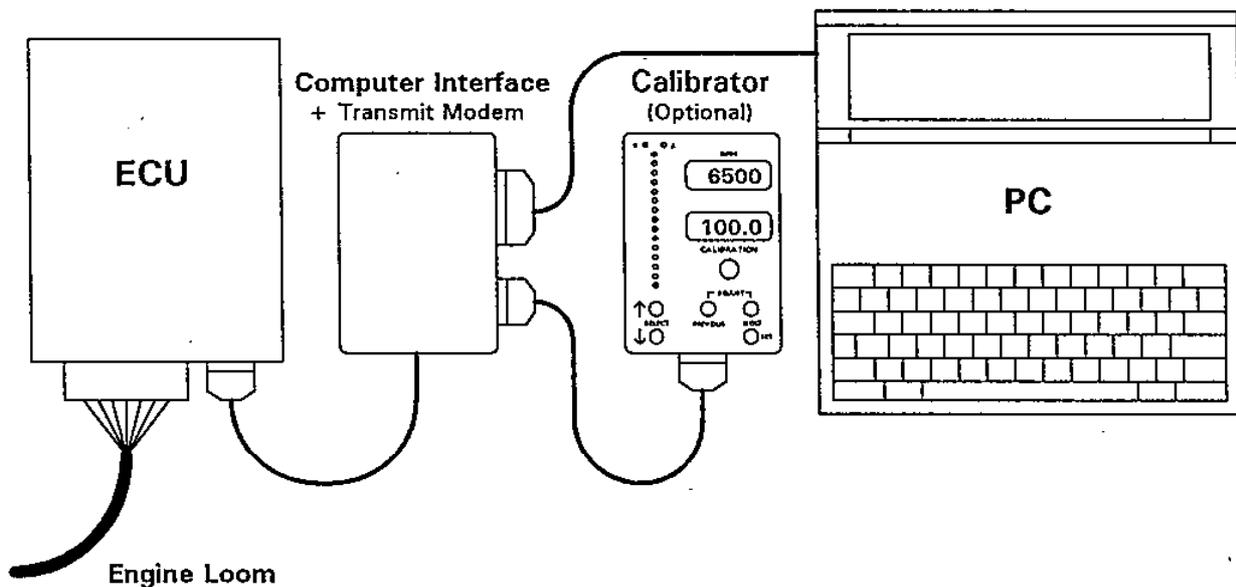
The *MoTeC* Computer Interface + Transmit Modem may be used for two purposes :

- 1 Computer Interface
Allows a Personal Computer to communicate with the ECU.
- 2 Transmit Modem
Forms the transmit half of the *MoTeC* 1200 Baud Telemetry Link.
See the Telemetry Link Section for details.

Specifications

Interface	RS232
Baud Rate	1200, 2400, 4800, 9600 Selectable
Power	Supplied from the ECU

Connections



ECU Connection

The Computer Interface should be connected to the ECU using the attached cable. This cable should not be extended otherwise improper operation may occur.

Calibrator Connection

Optionally the Calibrator may be connected to the 9 Pin Connector on the Computer Interface using the standard Calibrator Cable.

PC Connection

The cable supplied should be connected between the PC serial communications port marked COM1 and the Computer Interface. The 9 Pin Connector should be connected to the PC and the 25 Pin Connector should be connected to the Computer Interface.

If the PC serial communications port has a 25 pin connector rather than a 9 Pin connector a 25 to 9 pin adapter will be needed.

Wiring details can be found in Appendix D - Computer Interface to PC Wiring.

Baud Rate Selection

The communications Baud Rate may be selected by placing link wires in the 25 pin connector of the PC / Interface Cable. No Link wires are required for the default Baud Rate of 9600 baud.

The standard cable is set to the default of 9600 baud.

For details See Appendix E - Computer Interface Baud Rate Selection.

PC Software

The Interface may be used with all *MoTeC* ECU software, e.g. E.M.P. and MONITOR.

The software Baud Rate must match the Interface Baud Rate (Normally the default will be 9600 baud).

LED Indicators

When used as a Computer Interface the LED Indicators have the following meanings :

Power :

Indicates that the Computer Interface has power. This should be lit when the Computer Interface is connected to the ECU and the ECU has power.

Tx :

Indicates that data is being transmitted from the ECU to the PC.

This LED may flicker as data is transmitted.

Rx :

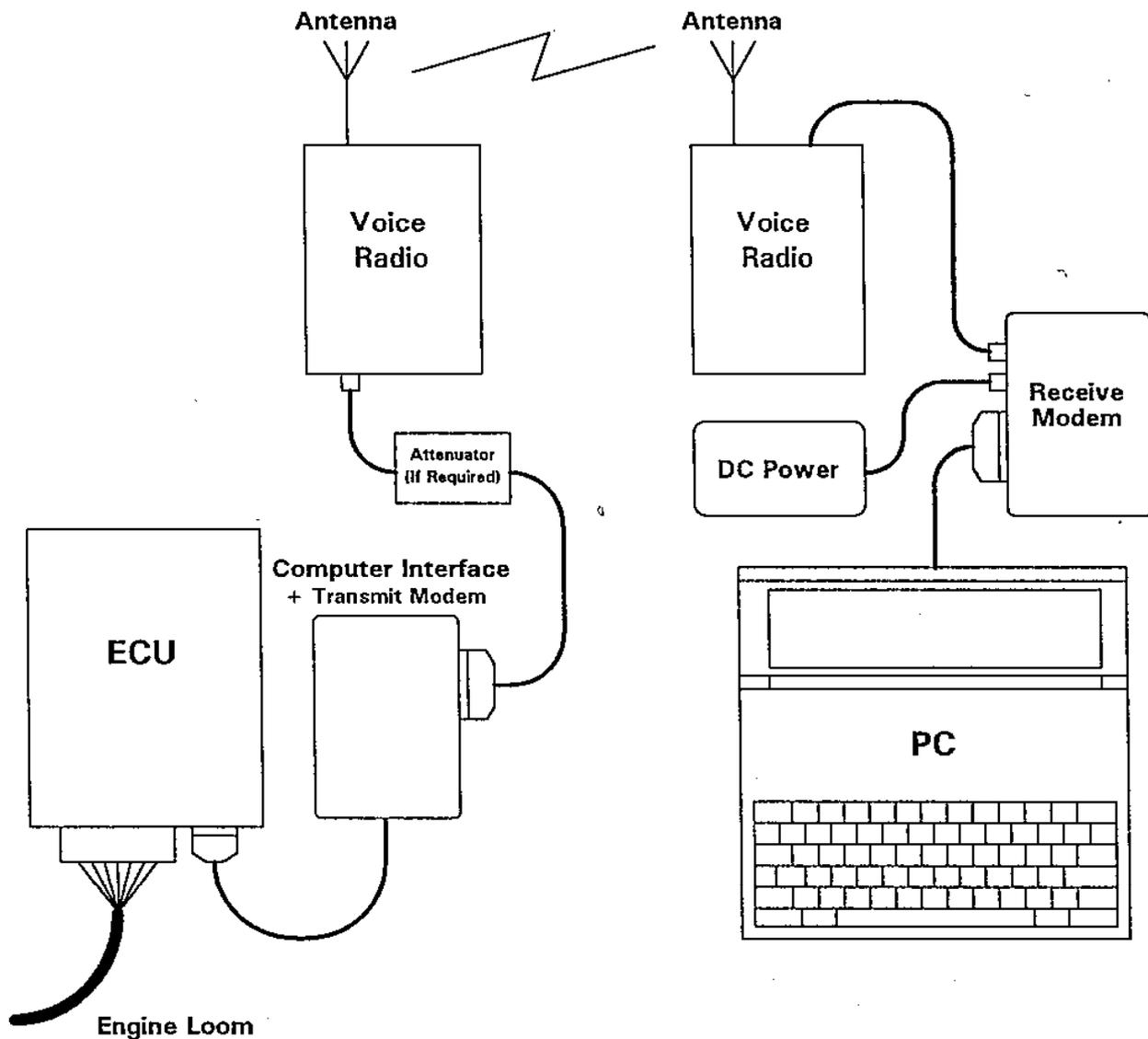
Indicates that data is being received by the ECU from the PC.

This LED may flicker as data is received.

1200 Baud - Telemetry Link

The *MoTeC* 1200 Baud Telemetry Link is formed using two normal 2 Way Voice Radios, the *MoTeC* Receive Modem and the *MoTeC* Computer Interface + Transmit Modem (used as a Transmit Modem).

Connections



PC Software

The Telemetry Link is only usable with one way communications programs, e.g. MONITOR.

The program must be started with the 1200 baud option.

Transmit Modem

Specifications

Baud Rate	1200 Baud Only
Output Voltage	1 Volt pp Into 600R
Power	Supplied From The ECU

Radio Requirements

Type	2 way Voice
Input Level	High Level (1V pp) OR Low Level e.g. Microphone (Requires Attenuator)
Transmit Duty	Continuous

ECU Connection

The Transmit Modem should be connected to the ECU using the attached cable. This cable should not be extended otherwise improper operation may occur.

Calibrator Connection

Optionally the Calibrator may be connected to the 9 Pin Connector on the Transmit Modem using the standard Calibrator Cable.

Radio Connection

The Radio Input should be connected to the 25 Pin Connector on the Transmit Modem.

See Appendix F - Transmit Modem to Radio Wiring for the correct wiring details.

If the Radio has a low level microphone input an Attenuator is needed to reduce the signal to the correct level.

The cable supplied with the Receive Modem may be used for this purpose if the Radio has a 4 Pin CB style microphone connector and an input level of 5 mV pp is acceptable.

See Appendix G - Transmit Modem Attenuator for the recommended attenuator circuit.

LED Indicators

The LED Indicators have the following meanings

Power :

Indicates that the Transmit Modem has power. This should be lit when the Transmit Modem is connected to the ECU and the ECU has power.

Tx :

Indicates that data is being transmitted from the ECU to the Radio.

This LED may flicker as data is transmitted.

Rx :

Should be off.

Receive Modem

Specifications

Power	6V DC to 16V DC / 60mA
Computer I'face	RS232
Baud Rate	1200 Baud Only
Input Signal	0.5 V pp Nominal / 20 mV pp Min / 2 V pp Max.

Radio Requirements

Type	2 Way Voice
Audio Output	20 mV pp Min / 2 V pp Max.

PC Connection

The interface cable supplied with the Computer Interface + Transmit Modem should be used to connect the PC serial communications port marked COM 1 to the Receive Modem. The 9 Pin Connector should be connected to the PC and the 25 Pin Connector should be connected to the Receive Modem.

If the PC serial communications port has a 25 pin connector rather than a 9 Pin connector a 25 to 9 pin adapter will be needed.

Wiring details can be found in Appendix H - Receive Modem to PC Wiring.

DC Power Connection

The DC Power may be supplied from any DC Power Source that meets the voltage and current requirements stated in the specifications. e.g. 12V Battery or 12V DC power Supply.

Use the lead supplied ensuring that the center pin is positive. Reverse polarity will not cause damage to the unit however it will not function (Power LED off).

Radio Connection

The Radio Audio Output (or Headphone Output) should be connected to the Receive Modem using a 3.5mm Audio Connector.

The Polarity of the connection is not important.

Radio Output Level Adjustment

The output level of the Radio must be in the range stated in the specifications.

If the Output Level is adjustable (e.g. By using the Volume Control) and special equipment is not available to adjust the level, then the level should be set so that the Carrier LED just lights. This corresponds to the minimum acceptable signal level. The control should then be rotated approximately the same amount again to

ensure a strong signal. If the signal level is too high the input circuit will overload resulting in poor signal demodulation. Some experimentation may be necessary to get good results.

LED Indicators

The front panel LED Indicators have the following meanings :

Power

Indicates that the Interface has power.

Data

Indicates that data is being received.

This LED may flicker as data is received.

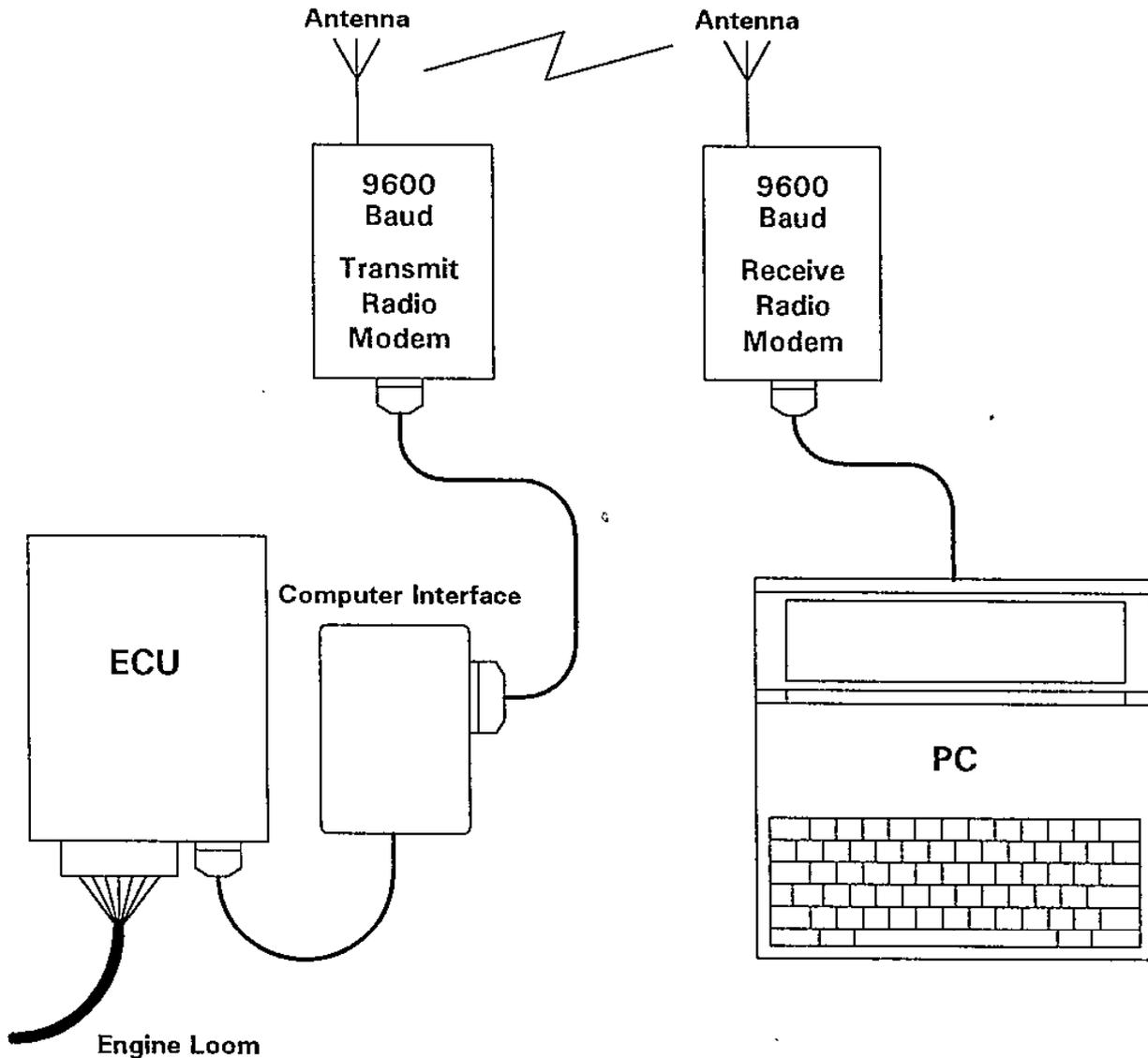
Carrier

Indicates that a sufficiently strong modulated carrier signal is being received from the radio.

9600 Baud - Telemetry Link

The *MoTeC* 9600 Baud Telemetry Link is formed using two 9600 Baud Radio Modems and the *MoTeC* Computer Interface.

Connections



PC Software

The Telemetry Link is only usable with one way communications programs, e.g. MONITOR.

ECU Connection

The Computer Interface should be connected to the ECU using the attached cable. This cable should not be extended otherwise improper operation may occur.

Calibrator Connection

Optionally the Calibrator may be connected to the 9 Pin Connector on the Computer Interface using the standard Calibrator Cable.

Transmit Radio Modem Connection

The Transmit Radio Modem should be connected to the Computer Interface using the cable supplied with the Transmit Radio Modem.

Receive Radio Modem Connection

The Receive Radio Modem should be connected to the PC using the cable supplied with the Receive Radio Modem.

Appendices

Appendix A - Creating a Bootable Floppy Disk

Place a bootable DOS disk in Drive A: then turn on the computer.

PC with 2 Floppy Drives

After the computer has booted place a new disk in drive B: then type:

```
FORMAT B: /S <Enter>
```

(Formats the new disk and places the Disk Operating System (DOS) on it)

Put the *MoTeC* Master disk in drive A: then type:

```
COPY A:*. * B: <Enter>
```

(Copies the *MoTeC* software to the new disk)

PC with 1 Floppy Drive

After the computer has booted type:

```
FORMAT B: /S <Enter>
```

(Formats a new disk and places the Disk Operating System (DOS) on it)

Note - Remove the DOS disk and replace it with a new disk when the PC asks.

Put the *MoTeC* Master disk in drive A then type:

```
XCOPY A:*. * B:<Enter> OR COPY A:*. * B:<Enter>
```

(Copies the *MoTeC* software to the new disk)

Note - It is necessary to swap between the *MoTeC* disk and the new disk when the PC asks.

The new disk may then be used as the BOOT disk.

Appendix B - E.M.P. Command Line Options

E.M.P. may be started directly from the DOS prompt (Type EMP2 or EMP3 then press the Enter key).

Various command line options are available. The options must be typed after the word EMP2 or EMP3 and must be separated by spaces.

e.g. EMP3 1200 M <Enter>

This will start EMP3 with the Communications Baud Rate set to 1200 and the screen colours forced to Mono.

Command Line Options :

1200	1200 Communications Baud Rate
2400	2400 Communications Baud Rate
4800	4800 Communications Baud Rate
9600	9600 Communications Baud Rate
COM2	Use Communications Port COM2
M	Monochrome Screen
C	Colour Screen

Appendix C - MONITOR Command Line Options

The MONITOR program may be started from the DOS prompt (Type MONITOR then press the Enter key).

Various command line options are available. The options must be typed after the word MONITOR and must be separated by spaces.

e.g. MONITOR 1200 M A500 <Enter>

This will start the MONITOR Program with the Communications Baud Rate set to 1200, the screen colours forced to Monochrome and the Acceleration Run step size set to 500 RPM.

Command Line Options :

1200	- 1200 Communications Baud Rate
2400	- 2400 Communications Baud Rate
4800	- 4800 Communications Baud Rate
9600	- 9600 Communications Baud Rate
COM2	- Use Communications Port COM2
M	- Monochrome Screen
C	- Colour Screen
Annn	- Acceleration Run Step Size nnn RPM

Appendix D - Computer Interface to PC Wiring

25 Pin Interface Connector

Pin Number	Purpose
2	Transmit Data to PC
3	Receive Data from PC
7	0V

Interface to PC AT (9 Pin Communications Connector)

Pin Numbers	
Interface	PC AT (9 Pin)
2	2
3	3
7	5

Interface to PC XT (25 Pin Communications Connector)

Pin Numbers	
Interface	PC XT (25 Pin)
2	3
3	2
7	7

Appendix E - Computer Interface Baud Rate Selection

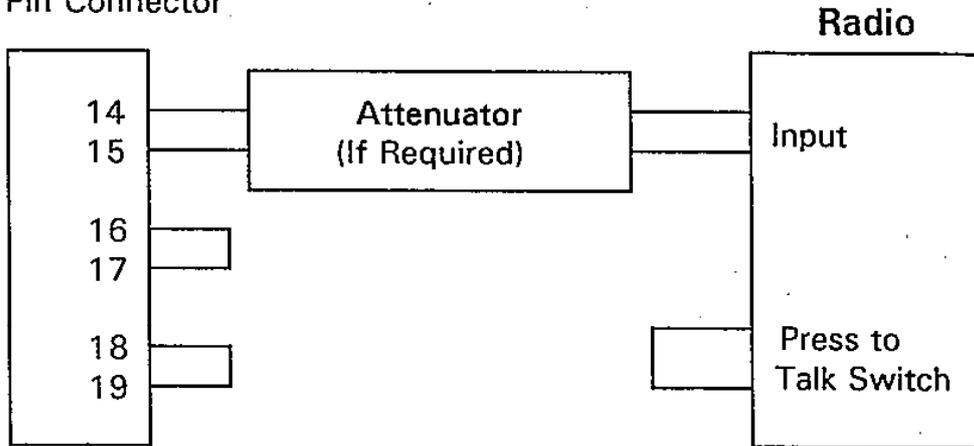
The communications Baud Rate may be selected by placing link wires in the 25 pin Computer Interface + Transmit Modem Connector.

No Link wires are required for the default Baud Rate of 9600 Baud.

Baud Rate	Pin Number			
	16	17	18	19
1200	■		■	
2400			■	
4800	■			
9600				

Appendix F - Transmit Modem to Radio Wiring

Transmit Modem
25 Pin Connector



Pins 14 and 15 of the 25 Pin Connector on the Computer Interface + Transmit Modem should be connected to the Radio Input via an attenuator (if required).

Pins 16 and 17 and pins 18 and 19 must be linked to force the Baud Rate to 1200 baud.

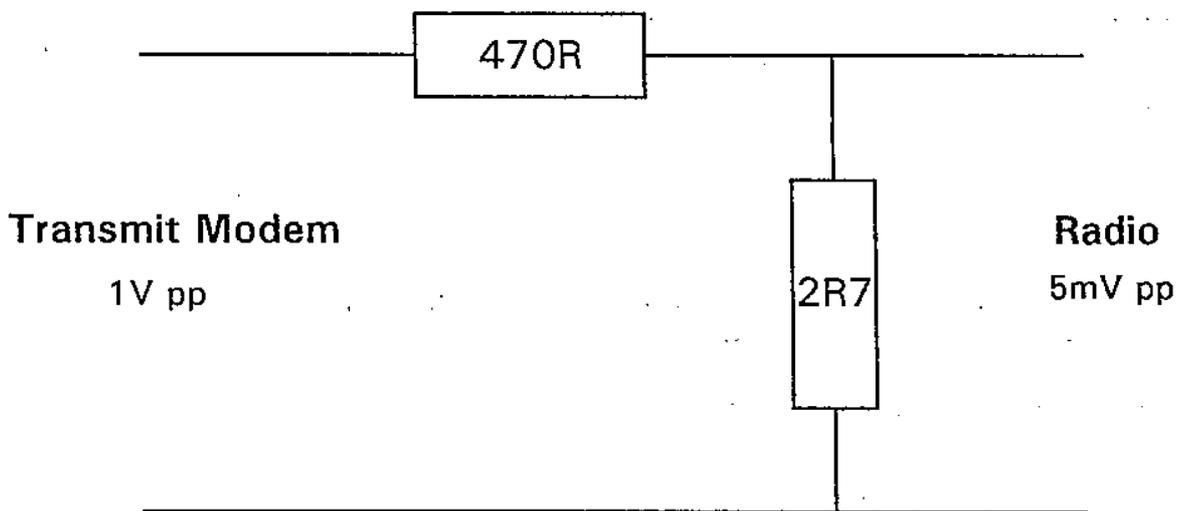
If the Radio has a "Press to Talk" switch then this must be wired closed so that the Radio will transmit continuously. (Note that the Radio must be rated for continuous transmission)

Appendix G - Transmit Modem Attenuator

The following circuit will reduce the 1 Volt pp Output Level to approximately 5 mV pp which is suitable for most low level microphone inputs. The resistors should be at least 1/8 watt rated.

If the radio has a maximum input level specification other than 5 mV pp the 2R7 resistor should be varied to give the correct level.

The Attenuator must be placed as close as possible to the radio input to avoid interference. Preferably it should be placed in the input connector housing or inside the radio.



Appendix H - Receive Modem to PC Wiring

25 Pin Receive Modem Connector Pin Out

Pin Number	Purpose
2	Transmit Data to PC
7	0V

Receive Modem to PC AT Connections (9 Pin Communications Connector)

Pin Numbers	
Receive Modem	PC AT (9 Pin)
2	2
7	5

Receive Modem to PC XT (25 Pin Communications Connector)

Pin Numbers	
Receive Modem	PC XT (25 Pin)
2	3
7	7

RPM x 1000

Table	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
40	*	*****	*	*	*	*	*	*	*	*	*	*	*	*	*	*
41	*	*	*	*****	*	*	*	*	*	*	*	*	*	*	*	*
42	*	*	*	*	*****	*	*	*	*	*	*	*	*	*	*	*
43	*	*	*	*	*	*****	*	*	*	*	*	*	*	*	*	*
44	*	*	*	*	*	*	*****	*	*	*	*	*	*	*	*	*
45	*	*	*	*	*	*	*	*****	*	*	*	*	*	*	*	*
46	*	*	*	*	*	*	*	*	*****	*	*	*	*	*	*	*
47	*	*	*	*	*	*	*	*	*	*****	*	*	*	*	*	*
48	*	*	*	*	*	*	*	*	*	*	*****	*	*	*	*	*
49	*	*	*	*	*	*	*	*	*	*	*	*****	*	*	*	*
50	*	*	*	*	*****	*	*	*	*	*	*	*	*	*	*	*
51	*	*	*	*	*	*****	*	*	*	*	*	*	*	*	*	*
52	*	*	*	*	*	*	*****	*	*	*	*	*	*	*	*	*
53	*	*	*	*	*	*	*	*****	*	*	*	*	*	*	*	*
54	*	*	*	*	*	*	*	*	*****	*	*	*	*	*	*	*
55	*	*	*	*	*	*	*	*	*	*****	*	*	*	*	*	*
56	*	*	*	*	*	*	*	*	*	*	*****	*	*	*	*	*
57	*	*	*	*	*	*	*	*	*	*	*	*****	*	*	*	*
58	*	*	*	*	*	*	*	*	*	*	*	*	*****	*	*	*
59	*	*	*	*	*	*	*	*	*	*	*	*	*	*****	*	*
60	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
61	*	*	*****	*	*	*	*	*	*	*	*	*	*	*	*	*
62	*	*	*	*****	*	*	*	*	*	*	*	*	*	*	*	*
63	*	*	*	*	*****	*	*	*	*	*	*	*	*	*	*	*
64	*	*	*	*	*	*****	*	*	*	*	*	*	*	*	*	*
65	*	*	*	*	*	*	*****	*	*	*	*	*	*	*	*	*
66	*	*	*	*	*	*	*	*****	*	*	*	*	*	*	*	*
67	*	*	*	*	*	*	*	*	*****	*	*	*	*	*	*	*
68	*	*	*	*	*	*	*	*	*	*****	*	*	*	*	*	*
69	*	*	*	*	*	*	*	*	*	*	*****	*	*	*	*	*
70	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
71	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
72	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
73	*	*	*	*	*****	*	*	*	*	*	*	*	*	*	*	*
74	*	*	*	*	*	*****	*	*	*	*	*	*	*	*	*	*
75	*	*	*	*	*	*	*****	*	*	*	*	*	*	*	*	*
76	*	*	*	*	*	*	*	*****	*	*	*	*	*	*	*	*
77	*	*	*	*	*	*	*	*	*****	*	*	*	*	*	*	*
78	*	*	*	*	*	*	*	*	*	*****	*	*	*	*	*	*
79	*	*	*	*	*	*	*	*	*	*	*****	*	*	*	*	*
80	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
81	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
82	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
83	*	*	*	*	*****	*	*	*	*	*	*	*	*	*	*	*
84	*	*	*	*	*	*****	*	*	*	*	*	*	*	*	*	*
85	*	*	*	*	*	*	*****	*	*	*	*	*	*	*	*	*
86	*	*	*	*	*	*	*	*****	*	*	*	*	*	*	*	*
87	*	*	*	*	*	*	*	*	*****	*	*	*	*	*	*	*
88	*	*	*	*	*	*	*	*	*	*****	*	*	*	*	*	*
89	*	*	*	*	*	*	*	*	*	*	*****	*	*	*	*	*

RPM x 1000

Table	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
140	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
141	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
142	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
143	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
144	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
145	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
146	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
147	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
148	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
149	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
150	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
151	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
152	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
153	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
154	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
155	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
156	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
157	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
158	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
159	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
160	***** * * * * *															
161	* ***** * * * * *															
162	* * ***** * * * * *															
163	* * * ***** * * * * *															
164	* * * * ***** * * * * *															
165	* * * * * ***** * * * * *															
166	* ***** * * * * * * * * *															
167	* * * * * * * * * * * * * * *															
168	* * * * * * * * * * * * * * *															
169	* * * * * * * * * * * * * * *															
170	***** * * * * * * * * *															
171	* ***** * * * * * * * * *															
172	* * ***** * * * * * * * * *															
173	* * * ***** * * * * * * * * *															
174	* * * * ***** * * * * * * * * *															
175	* * * * * ***** * * * * * * * * *															
176	* * * * * * * * * * * * * * *															
177	* * * * * * * * * * * * * * *															
178	* * * * * * * * * * * * * * *															
179	* * * * * * * * * * * * * * *															

Appendix J - Ignition Setup Number (ign)

The Ignition Setup Number specifies the trigger edges for both the Crank Trigger Input and the Ignition Module Output.

Negative numbers specify that the Ignition Module is NOT dwell controlled and the ECU should control the dwell.

For non dwell control (positive numbers) the output signal is 50% duty.

Other numbers are used for special ignition systems (Refer to the drawing for the specific ignition system)

	Input Trigger Edge	Ignition Module Edge
1	Rise	Fall
2	Rise	Rise
3	Fall	Fall
4	Fall	Rise

Appendix K - Injector Setup Number (inj)

The inj Setup parameter sets the Injector Drive Circuit Parameters.

Use negative numbers if the Injectors are to be synchronised to the synchronisation input.

The Injector drive number is made up of three parts :

1. The total peak injector current per group.
2. The Recirculation Time.
3. The Injector Dead Time.

The details on the following page show how to construct the Injector type number for various injectors.

Example 8 cyl with 8 Bosch 0280150 803 Injectors (4 Injectors per group)

Peak Current	= 6 Amps (4 x 1.5 Amps)
Recirc Time	= 5
Dead Time	= 3
Use Inj number	653

1888

Total Peak Injector Current Per Group (Amps)
 Multiply the Peak Injector Current per Injector by the number of Injectors per group (Max 18 Amps)

Injector Type	Brand	Ohms	Peak Current per Injector	Recirc Time	Dead Time
0280150 007	Bosch	2.5	2.0	5	3
0280150 035	Bosch	2.5	2.0	5	3
0280150 036	Bosch	2.5	2.0	5	3
0280150 217	Bosch	16	1.5	5	4
0280150 351	Bosch	0.5	4.5	4	0
0280150 403	Bosch	2.0	2.0	5	2
0280150 706	Bosch	16	1.5	5	4
0280150 803	Bosch	4.5	1.5	5	3
M/Sport 910	Bosch	2.4	3.0	5	2
M/Sport 911	Bosch	3.0	3.0	5	2
M/Sport 912	Bosch	4.5	2.0	5	3
4AGE	Toyota	3.5	2.5	5	3
988	Rochester	2.2	4.0	4	0
989A	Rochester	2.2	4.0	4	0

Appendix L - Diagnostics Errors

Top Display

- 0 No Errors
- 1 Crank Sensor Error
- 2 RPM Limit Exceeded
- 3 ECU Reset while Engine Running
- 4 Injector Maximum Duty Exceeded
- 5 Synchronisation Pulse Error
- 6 Battery Voltage below 10V while engine above 2000 RPM
- 7 Internal Memory Error
- 8 Overboost

Bottom Display

- 0 No Errors
- 1 Ignore
- 2 MAP Sensor Error
- 3 TP Sensor Error
- 4 AT Sensor Error
- 5 ET Sensor Error
- 6 Battery Voltage Error
- 7 EMAP Sensor Error
- 8 A/F Sensor Error

Appendix K - Wiring Schematic

