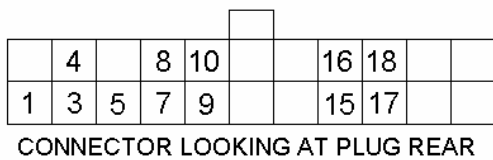
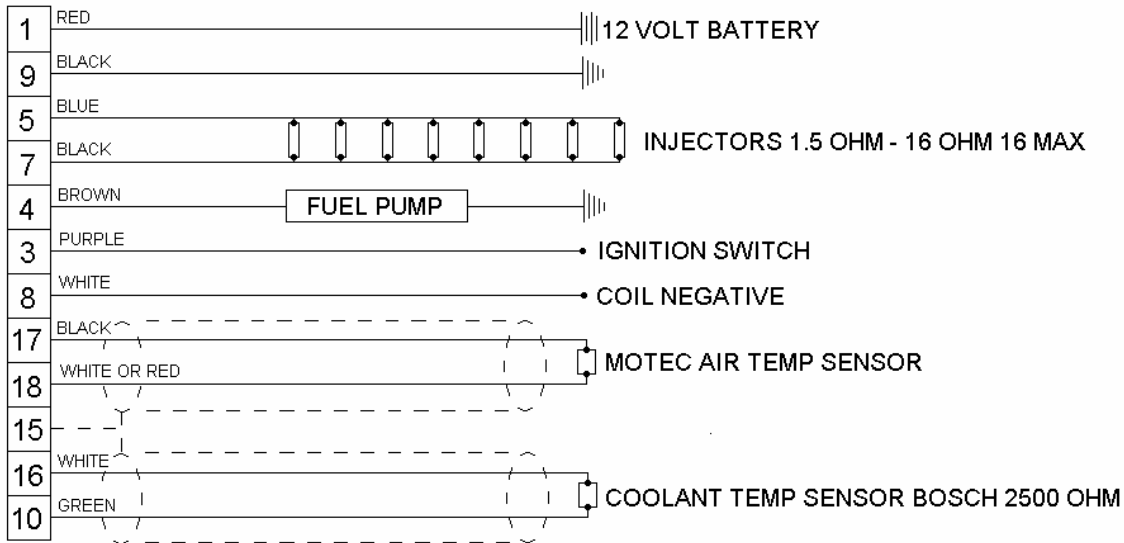




SCREWDRIVER ECU



MOTEC
MK 2 WIRING DIAGRAM (SCREWDRIVER)
MAY 1990 REV 003

WIRING CONNECTIONS

- Red 12V (+) direct from battery }
} paired together
- Black 12V (--) direct to battery }
- Blue injector supply }
} paired together
- Black injector earth }
- Brown 12V + supply to one high pressure fuel pump
- Purple 12V + supply from ignition switch
- White ignition contact breaker
- Black }
} Sheathed with two pin plug for intake air temperature sensor
- White }



SETTING UP THE MOTEC E.C.U.

CYLINDER SELECTION

Switches 1 and 2 can be arranged by the user to give settings for 4, 6, 8 and 12 cylinder setting by following the coding arrangement on the facie board. Be careful to follow the printed lines from the code panel to the switches. Rotary engines and twin ignition V8 engines require 4 cylinder settings (see section- THINGS TO BE AWARE OF).

INJECTION TIME RANGE SWITCHES

Switches 3, 4 and 5 give 8 combinations of injection maximum on times varying from 4.5 ms. to 30 ms. Each range has a 20% overlap with the ranges preceding and subsequent to the one in operation.

SWITCH SEQUENCES

SWITCH No. 3, 4 & 5

Range 1	OFF	OFF	OFF	LEANEST SETTING
2	ON	OFF	OFF	
3	OFF	ON	OFF	
4	ON	ON	OFF	
5	OFF	OFF	ON	
6	ON	OFF	ON	
7	OFF	ON	ON	
8	ON	ON	ON	RICHEST SETTING

To make a range setting change push rocker switches gently with screwdriver. It should be clearly understood that if the injectors used are too small in their flow capacity, they may be full on and not supply sufficient fuel to cater for the requirements of a modified engine. Most standard injectors as fitted by the motor manufacturer are sized to suit the H.P. output of that particular engine and have very little extra capacity at all. We can assist in injector sizing or injector supply.

INJECTOR TYPE (ELECTRICAL RESISTANCE VALUE) SWITCH NO. 6

Broadly most injectors can be classified as either high or low resistance types. We have provided for both types. Low value injectors of the 1 to 6 OHMS type would be controlled with the switch No. 6 in the OFF position while high value injectors of the 6 to 16 OHMS type would be controlled with switch No. 6 in the ON position. A simple multimeter can determine the type of injector by measuring resistance across the two contact pins of the injector.

FUEL SUPPLY

It is most important that the following recommendations are adhered to for correct operation of the injection system. If the system is being fitted to a vehicle not designed for fuel injection, it is highly probable that the fuel tank has no provision for the prevention of surge or slosh as the tank nears 1/3 or less capacity. This results in the high pressure pump being momentarily starved and therefore running dry during cornering and under acceleration. This situation will most certainly result in the engine cutting out when power is needed and the total destruction of the pump within a very short period, as they require continuous fuel flow for their speed regulation and internal cooling. This can be a very expensive problem. With the exception of some race vehicles, it is difficult to have the H.P. pump(s) mounted below the minimum tank level and drawing from the bottom of the tank thus we recommend the use of the following system:

1. Construct a header tank typically 3 inches dia. (75 mm) and 4 inches high (100 mm) with two 3/8" O.D. pipes brazed or welded into the bottom and two one 3/8" O.D. pipes brazed or welded into the sides near the top. Material preferably aluminium but steel O.K. This header tank can be firewall mounted or boot mounted but should be several inches above level of H.P. pump. This header tank



is not under pressure other than the residual tank return line pressure drop, but welding must be checked for leaks.

2. Use either vehicles low pressure standard pump to lift from fuel tank via water separator/fuel filter to header tank into one of the bottom connections.

3. Draw off from other bottom connection to high pressure pump and then to engine fuel rail.

4. The fuel rail carries fuel to the injectors and is pressurised by the fuel regulator to 45-50 PSI. As the high pressure pumps) should always be supplying in excess of maximum engine demand, the fuel not required by the engine is forced across the regulator and then directed to one of the top header tank connections to supplement the L.P. pump. The excess is then returned via the other top connection to the fuel tank. In particular single rayon braid nose (SAE 10085) hydraulic hose 250 PSI W.P. with high grade correct dia worm/drive clips must be used. Screw fittings and hoses are obviously O.K. but do not use normal low pressure fuel hose under any circumstances as it is not designed for use at 50 P.S.I.

BEFORE FIRST START UP

CHECK FUEL SYSTEM FOR LEAKS

Disconnect brown 12V. pump supply and connect pumps (both low pressure and high pressure in turn) to battery supply. Run for 5 mins and check all threaded and push on connections for any leaks. Rectify and check again. Your thoroughness in this area could well determine your investment's life as well as your own.

E.C.U. CHECK

Plug in loom to E.C.U. Turn on ignition, both relays should close, one supplying power to the E.C.U. the other power to the fuel pump(s). After 3 seconds the pump relay should drop out. The red L.E.D's next to the fuel calibration adjustments should light up in order, giving a display of the value relative to the appropriate adjustment. This should step through each adjustment every 15 seconds until the cycle is complete, when it will repeat for as long as is required, only to be stopped by turning the ignition off or starting the engine.

SUGGESTED INITIAL START UP SETTINGS

1. Set switches 1 and 2 for cylinder number.

2. Set switches 3, 4 and 5 to ON, OFF, ON.

3. Set switch 6 to appropriate setting.

4. Turn on ignition switch. But do not start engine.

5. As and only when the red L.E.D. is illuminated adjust the calibration adjustment with a small screwdriver until the number 50 appears in the display panel. Set all the adjustments at this level. Depending on the injector size, these settings will allow the engine to both start and run, although it may be too rich. If much too rich, stop and reset switches 3, 4, and 5 back to OFF, OFF, ON which will effectively reduce fuel flow by approximately 20% and repeat engine run until rough setting has been achieved.

Setting fuel calibration for full load

Start the engine, and after any run in period, during which time the light load setting and the range may have to be adjusted, increase engine speed to 3000 R.P.M. (4000 RPM for a highly tuned engine) and gradually increase dynamometer load while watching the CO reading. Remember most CO meters have lag or delay period of up to and, in some cases, over 10 seconds. If the engine is very highly tuned you may not want to hold it for a long period but 5 seconds is long enough. Then back off and watch the CO meter and it will respond as the slug of gas produced while under load passes through the meter and is processed. Adjustment of the 4000 R.P.M. calibration can then be carried out and the same speed and load be again applied and the results checked. Most engines give maximum power with CO readings in the 5% region. Anything under 3.0% is dangerous as it is too lean for constant high power operation. Although if tuning a



lightly modified engine for maximum fuel economy a figure of 4% is O.K. One problem often encountered is that, while the gas analyser is adjusted for zero and span, it may not have been calibrated with span gas of a known CO percentage for some time. We have found a number of analysers with errors greater than 2% CO, which is enough to give seriously defective information which you are using to tune your mega dollar engine. Periodic calibration checks with Span gas minimises this source of error. Once you have worked up to full power at 3000 (or 4000 R.P.M.), which is indicated by the appropriate R.P.M. light coming up, and are happy with the reading of CO level, we recommend that you stop and record the number displayed by allowing the E.C.U. to cycle through to the appropriate R.P.M. setting. If the number is high, e.g. 90, the basic range setting is too low, we would suggest you go up two ranges and, bearing in mind each range changes the number by 20 units, therefore in this case 2 ranges would be 40 units, which means that the setting of 90 would have to be reduced by 40 to read 50. On the other hand if the R.P.M. setting was low e.g. 25, it would suggest the range setting is too high and should be reduced one range and that 20 should be added to the 25 and therefore should read 45. Having established a basic setting at one R.P.M., in this case 45, cycle the ECU through and set R.P.M. adjustments below this R.P.M. range by adding 20 units to higher R.P.M. adjustments e.g. 4000-65, 5000-65, 6000-65, 1000-65 etc. and decrease by 5 units for lower R.P.M. settings e.g. 3500-40, 3000-40, 2500-400 etc. This will give a fuel curve which may assist in reaching optimum settings a little more quickly than starting from a random number. Repeat this gradual working up to full load and CO level checking and fuel adjustment at each other R.P.M. range. The results of excessively rich mixtures over a long period are washed bores and high ring wear while the results of running with lean mixture for very short periods are total destruction of the engine - always start with rich settings and creep up to full power. If using an engine dynamometer that has fast and stable torque read-out, it is possible to simply dial fuel supply to maximum torque at each speed range very quickly.

LIGHT LOAD

When setting the light load it is suggested that the engine is run at a speed corresponding to the maximum torque speed but with little load (approximately 1/5 to 1/10 of full throttle torque) to simulate road load and the adjustment set to the lowest setting that produces smooth engine operation. On lightly modified engines, this point may correspond to 0.5% to 1% CO, but will probably be more for highly tuned engines. Again this adjustment is carried out only when the red L.E.D. for the light load is illuminated.

ACCELERATION ENRICHMENT

Best carried out on road. Is applicable primarily to lightly modified engines or engines which capable of running satisfactory with a lean light load (part throttle or cruising) mixture and therefore require additional fuel for hesitation free acceleration. The adjustment should be set to the minimum setting that produces stumble free acceleration from a low speed post throttle condition.



TURBO OR SUPERCHARGED ENGINES

The vacuum line (now a pressure line when on boost) should be placed so that it will read what the engine sees under all conditions. If a Plenum system is used a tapping into it is O.K. If multiple runners with butterflies in each runner is used the tapping must be on the engine side of the butterflies. The set up is carried out exactly the same way as for a naturally aspirated engine, but giving only enough throttle to avoid the boost mix light from coming on. This allows the establishment of a fuel curve for the engine under naturally aspirated conditions. Once this has been achieved the examination of the fuel numbers will show where the highest number occurs. This will be peak torque speed. Then run the engine at this speed and gradually increase the load and throttle opening, the boost mix light will come on and the mixture enrichment should be wound on while watching the CO levels. We must emphasise that the load should be increased slowly to allow the boost mixture compensation to be given relative to the increased in load. If the load/boost is increased too quickly relative to the increase of fuel, detonation or piston burning will occur as a result of a lean mixture. We suggest that 6% CO be a minimum level. This is a little on the rich side but safe. Under some circumstances where turbo temperatures are a problem at high engine speeds due to other problems, a richer boost mix setting can help cooling although after 8% CO, some power loss will result. It is only necessary to do one full boost run to establish the upper limit of engine operation. At this point it is related to the previously set naturally aspirated curve however, it is advisable to check the level of enrichment 1000 RPM either side of the max. torque setting. If necessary the naturally aspirated settings can be compromised a little to give adjustment to the full boost fuel curve.

THINGS TO BE AWARE OF DURING INSTALLATION

1. It is advisable not to take battery 12V * from master switch (if fitted to vehicle) supply problems can occur if switch is worn or has high resistance contacts.
2. Never supply 12V + direct to injectors for checking or testing as permanent damage usually occurs. All injectors run at considerably reduced, but various voltages depending on type. The MoTeC E.C.U. allows for this.
3. The brown fuel pump supply wire is designed to operate only one Bosch type high pressure fuel pump (current capacity is a peak 10 amps continuous). If additional pumps are required the brown wire can be used to signal external relays for multiple pump operation. This system is protected by a 15 amp fuse in the E.C.U. We strongly advise that that brown supply line be used wherever possible, as it is controlled by the microprocessor to isolate pumps in the event of accident where the engine has stopped, but pumps are not manually stopped. After 3 seconds this is done automatically, thus reducing any potential for fire if, the driver is incapacitated.
4. If connection for purple ignition supply is made at coil positive terminal make sure that the system is not fitted with ballast resistor and that full 12 volts is available.
5. The temperature sensor must be placed in the air stream that the engine sees, eg. in turbo it must be placed after the intercooler if fitted or after the compressor if no intercooler fitted.
6. Vacuum lines must be after the butterfly(s) and from each runner if individual runner multiple butterfly system is fitted. Length of this line is not critical.
7. The E.C.U. must not be fitted in the engine compartment or exposed to direct sunlight through glass, and should always be mounted on soft anti, vibration mounts.
8. In the case of V8 engines fitted with twin points and twin coils it is necessary to connect the white wire to the points or earth side of one coil only and the E.C.U. to be switched for 4 cylinder operation.
9. If a rotary engine is being used the white wire is to be connected to one coil only (points side) and the E.C.U. to be switched to 4 cylinder operation.
10. Fuel regulator vacuum lines to be connected below butterflies apart from high boost turbo or supercharger applications.