

SIERRA SAPPHIRE RS COSWORTH **TECHNICAL & FUEL INJECTION** **DIAGNOSIS INFORMATION**

THE FUEL INJECTION SYSTEM USED IS THE WEBER MARELLI MULTI POINT INJECTION SYSTEM.

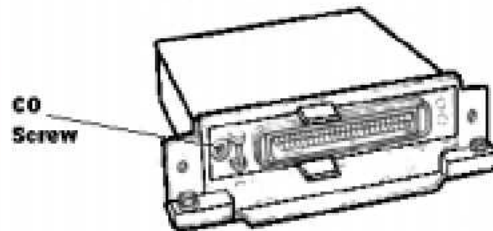
RECOMMENDED TOOLS.

FAULT CODE READER OR LED TESTER
FUEL PRESSURE GAUGE
MULTIMETER
SCOPE
BREAKOUT BOX
CO METER
HAND VACUUM PUMP

IT IS POSSIBLE TO REPAIR THE VEHICLE WITHOUT SOME OF THE TOOLS LISTED ABOVE BUT IT MAKES LIFE A LITTLE EASIER IF YOU DO HAVE THEM.

INPUTS TO ENGINE MANAGEMENT ECU

AIR TEMPERATURE, WATER TEMPERATURE, MANIFOLD PRESSURE, CRANKSHAFT POSITION AND SPEED, THROTTLE POSITION AND PHASE SENSOR.



OUTPUTS FROM ENGINE MANAGEMENT ECU

BOOST CONTROL VALVE, IGNITION MODULE, INJECTORS AND IDLE SPEED CONTROL.

TECHNICAL DATA

SPARK PLUG GAP
FIRING ORDER
IDLE SPEED
CO
ALTERNATOR POWER
ALTERNATOR VOLTAGE

1MM
1-3-4-2
850 RPM
1-2% @ IDLE
70/90 AMP
13.7 TO 14.6 VOLT

COIL
PRIMARY RESISTANCE
SECONDARY RESISTANCE

BOSCH
0.7 TO 0.9 OHMS
4500 TO 7000 OHMS

DISTRIBUTOR
TYPE
ROTATION
STATIC ADVANCE
IDLE SPEED
HT LEAD RESISTANCE

MERELLI
BREAKERLESS
CLOCKWISE
16 DEG @IDLE (NOT ADJUSTABLE)
850-900RPM
30,000 OHMS MAXIMUM

ENGINE SPEED/TDC SENSOR
CLEARANCE TO CRANKSHAFT PULLEY

0.6-1.0MM

INJECTORS
TYPE

WEBER
ELECTRONICALLY OPERATED

FUEL PUMP
TYPE
PRESSURE

BOSCH
ELECTRIC ROLLER CELL
OVER 10 BAR

PRESSURE REGULATOR
SYSTEM PRESSURE, IGN ON
SYSTEM PRESSURE AT IDLE

WEBER
3.2-3.8 BAR
2.7-3.3 BAR

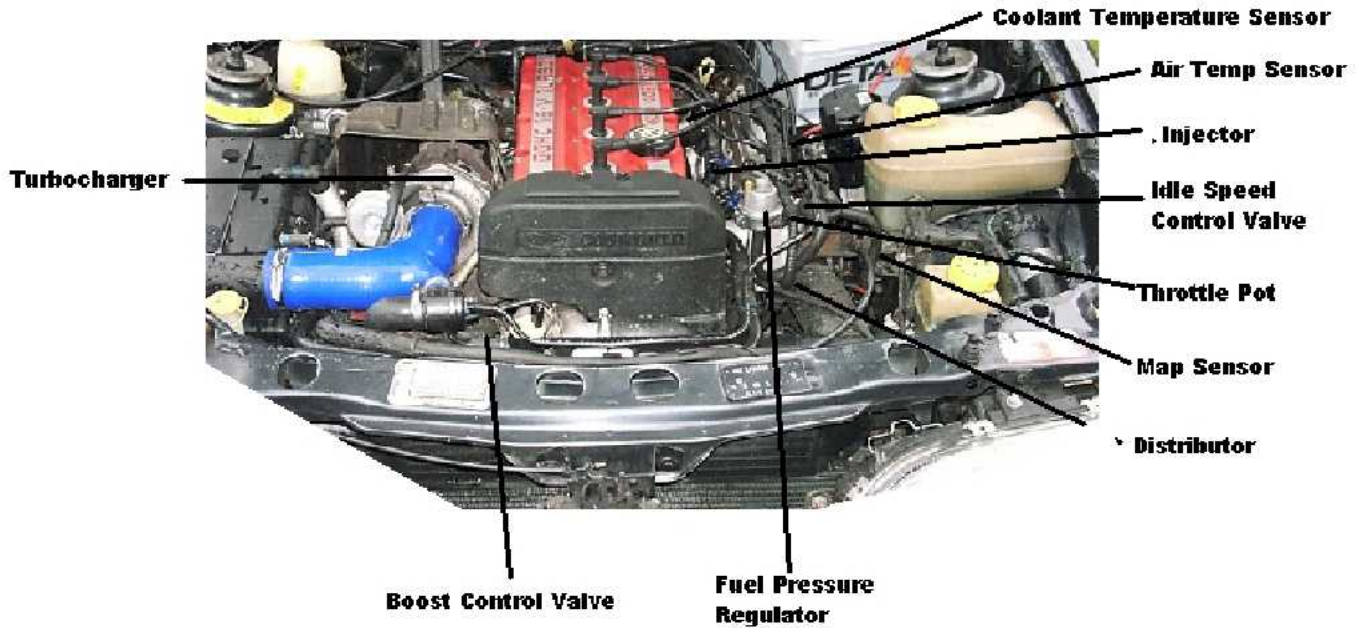
TURBOCHARGER
BOOST PRESSURE 4X4 (STD)
BOOST PRESSURE 2WD (STD)

0.8-0.9 BAR
0.7 BAR

COOLANT TEMP SENSOR / AIR TEMP SENSOR RESISTANCE

10 DEG C	6	K OHMS
20 DEG C	3.75	K OHMS OR 3 VOLTS
30 DEG C	2.42	K OHMS
40 DEG C	1.6	K OHMS
50 DEG C	1.08	K OHMS OR 1 VOLT
60 DEG C	0.75	K OHMS
70 DEG C	0.53	K OHMS
80 DEG C	0.38	K OHMS OR 0.3-0.5 VOLTS
90 DEC C	0.27	K OHMS

COMPONENT LOCATIONS



Engine Management Control Unit - Behind N/S Dash (above g.box)
Fuel Filter and Fuel Pump - L/H rear



SENSORS



AIR TEMPERATURE SENSOR

THE SENSOR HAS TWO WIRES, TO CHECK THE RESISTANCE, FIRST UN-PLUG THE SENSOR AND CHECK BY PUTTING A OHM METER BETWEEN THE TERMINALS. TO CHECK THE VOLTAGE READING YOU NEED TO PLUG IN THE SENSOR, AND CONNECT A VOLT METER BETWEEN ONE OF THE SENSOR WIRES AND EARTH. CHECK THE RESISTANCE AND VOLTAGE VALUES AT DIFFERENT TEMPERATURES AND MAKE SURE THAT THEY ARE WITHIN THE REQUIRED LIMITS. IF IT IS NOT WITHIN LIMITS THEN THE SENSOR WILL NEED TO BE REPLACED. IF YOU GET A READING OF AROUND 5 VOLTS THEN THERE IS AN OPEN CIRCUIT, IF YOU GET A READING OF 0 VOLTS THEN THERE IS A SHORT TO EARTH.

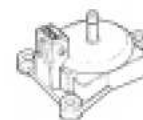


COOLANT TEMPERATURE SENSOR

SAME TESTS AS AIR TEMP SENSOR.

CO POTENTIOMETER

THIS IS PART OF THE ECU AND IF IT IS FOUND TO BE FAULTY THE ECU WILL HAVE TO BE REPLACED.



MAP SENSOR

TERMINAL (2WD) 4WD IS THE SAME BUT THE TERMINALS ARE IN A DIFFERENT ORDER.

1	EARTH	0.25 V MAX
2	SUPPLY VOLTAGE	5V +/- 0.1V
3	SIGNAL VOLTAGE	(SEE BELOW)

THE BEST WAY TO TEST THIS SENSOR IS TO USE A HAND HELP VACUUM PUMP.

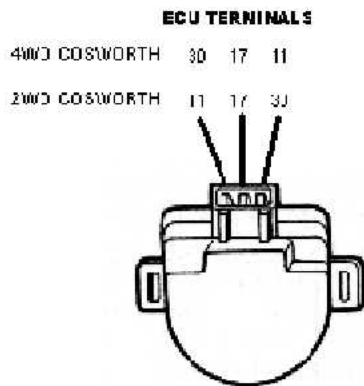
VACUUM APPLIED	VOLTS
280 MM HG	0.66 – 0.76
500 MM HG	1.36 – 1.45
650 MM HG	1.81 – 1.91
750 MM HG	2.11 – 2.20

IF YOU DO NOT HAVE A VACUUM PUMP THEN CHECK THESE VALUES.

IGNITION ON	2.2 V
IDLE	0.25 – 0.6 V

ALSO CHECK THAT THE VOLTAGE CHANGES WHEN YOU INCREASE ENGINE SPEED.

THROTTLE POSITION SWITCH



TERMINAL (2WD)

11	EARTH	0.25 V MAX
17	SIGNAL VOLTAGE	(SEE BELOW)
30	SUPPLY VOLTAGE	5V +/- 0.1V

RESISTANCE CHECKS (MULTI-PLUG DISCONNECTED)

TERMINALS 1 AND 2	THROTTLE CLOSED	40-150 OHMS
TERMINALS 1 AND 2	THROTTLE FULLY OPEN	300-600 OHMS
TERMINALS 2 AND 3	THROTTLE CLOSED	300-600 OHMS
TERMINALS 2 AND 3	THROTTLE FULLY OPEN	40-150 OHMS

VOLTAGE CHECKS (MIDDLE TERMINAL, MULTI-PLUG CONNECTED)

CONNECT A VOLTMETER BETWEEN THE CENTRE TERMINAL AND EARTH.
 AT IDLE YOU SHOULD HAVE AROUND 5 VOLTS.
 WHEN THE THROTTLE IS SLOWLY OPENED UNTIL IT IS FULLY OPEN THE
 VOLTAGE SHOULD SLOWLY CHANGE TO 0.5 VOLTS.

RESISTANCE CHECKS (4WD)

LEAVE THE SENSOR CONNECTED, UNPLUG THE ENGINE MANAGEMENT ECU.
 CONNECT AN OHMMETER BETWEEN THE MULTIPLUG TERMINALS:

11 AND 30		300-600 OHMS
30 AND 17		300-600 OHMS
30 AND 17	WHILE OPENING THROTTLE	FROM 600 TO 40 OHMS

VOLTAGE CHECKS

CONNECT A VOLTMETER BETWEEN THE CENTRE TERMINAL AND EARTH.
 AT IDLE YOU SHOULD HAVE AROUND 0.6 VOLTS.
 WHEN THE THROTTLE IS SLOWLY OPENED UNTIL IT IS FULLY OPEN THE
 VOLTAGE SHOULD SLOWLY CHANGE TO 4.5 VOLTS.

ENGINE SPEED/TDC SENSOR

THE SENSOR IS LOCATED ADJACENT TO THE CRANKSHAFT PULLEY WHICH HAS 4 REFERENCE TEETH. THE SENSOR SENDS A SIGNAL TO THE ENGINE MANAGEMENT ECU AS EACH REFERENCE POINT PASSES, THE ECU USES THIS INFORMATION TO DETERMINE ENGINE SPEED.

FIRST CHECK THAT ALL 4 TEETH ARE ON THE CRANKSHAFT PULLEY AND THEY AND THE SENSOR ARE IN GOOD CONDITION.

THEN MAKE SURE THE DISTANCE BETWEEN THE PULLEY TEETH AND SENSOR, AND CHECK WITH THE REQUIRED VALUE.

IF CORRECT THEN MEASURE THE RESISTANCE BETWEEN PINS 3 AND 4 OF THE ENGINE MANAGEMENT ECU MULTIPLUG (ECU DISCONNECTED), IT SHOULD BE BETWEEN 600-1K OHMS.



DISTRIBUTOR PHASE SENSOR

THE SENSOR IS USED BY THE ENGINE MANAGEMENT ECU TO ESTABLISH WHEN TO START AND STOP EACH SEQUENCE OF THE INJECTION CYCLE.

FIRST MAKE SURE THAT THE SENSOR IS NOT DAMAGED, AND SET THE SENSOR DISTANCE FROM THE DISTRIBUTOR CAMS, THIS SHOULD BE BETWEEN 0.2 AND 0.3 MM.

IF THIS IS CORRECT THEN CHECK THE RESISTANCE OF THE SENSOR (PINS 23 AND 5 OF ENGINE MANAGEMENT ECU MULTIPLUG) IT SHOULD BE BETWEEN 700-1.2K OHMS. IF IT NOT CORRECT THEN CHECK THE WIRING AND SENSOR.

LAMBDA (HEGO, OXYGEN) SENSOR (IF FITTED)

CHECK THAT THE SENSOR MULTIPLUG IS CLEAN AND THE CONTACTS ARE IN GOOD CONDITION.

THE SENSOR HAS 3 WIRES, 12V POSITIVE, EARTH AND SIGNAL WIRE.

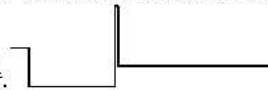
FIRST CHECK THAT THE LIVE AND EARTH ARE PRESENT.

THEN RUN THE ENGINE UNTIL IT HAS REACHED NORMAL OPERATING TEMPERATURE AND WITH A MULTIMETER (A SCOPE IS BETTER IF YOU HAVE ONE) CONNECT 1 LEAD TO THE SIGNAL WIRE OFF OF SENSOR AND THE OTHER TO EARTH. YOU SHOULD GET A SWITCHING VOLTAGE READING OF BETWEEN 0 AND 1 VOLT.

INJECTORS

THE INJECTORS ARE SUPPLIED WITH BATTERY VOLTAGE FROM THE MAIN RELAY AND ARE SWITCHED EARTH BY THE ENGINE MANAGEMENT ECU. IF YOU HAVE A SCOPE CONNECT ONE WIRE TO EARTH, THE OTHER TO THE INJECTOR. YOU

SHOULD SEE A SIGNAL SIMILAR TO THE FOLLOWING.



CHECK THE RESISTANCE OF THE INJECTORS BETWEEN THE 2 TERMINALS WITH THE MULTI PLUG DISCONNECTED, IT SHOULD BE APPROXIMATELY 2 – 2.5 OHMS.



IDLE SPEED CONTROL VALVE

THIS VALVE IS A SOLENOID TYPE. THE ECU RAPIDLY SWITCHES THE EARTH CIRCUIT TO ALLOW THE VALVE TO ADOPT THE REQUIRED POSITION TO REGULATE THE IDLE SPEED.

IN THIS SYSTEM THE VALVE IS USED TO RAISE THE ENGINE SPEED WHEN THE VEHICLE IS COLD AND ALSO WHEN A LOAD IS APPLIED ON THE VEHICLE. THE BEST WAY TO TEST THIS VALVE IS TO USE A OSCILLOSCOPE, IT HAS TWO TERMINALS, ONE OF THEM SHOULD HAVE A BATTERY +VE AND THE OTHER IS AN EARTH SWITCHED BY THE ECU. TO CHECK THIS CONNECT AN OSCILLOSCOPE. USING A PERCENT SCALE ON THE OSCILLOSCOPE WHEN THE ENGINE IS WARM WITH NO LOAD YOU SHOULD HAVE A READING OF AROUND 32%. WHEN YOU APPLY AN ELECTRICAL LOAD ON THE ENGINE IT SHOULD INCREASE I.E HEATED REAR WINDOW AND HEADLIGHTS ON, YOU SHOULD NOW HAVE A READING OF AROUND 40%. IF THERE IS NO READING FIRST CHECK THE SUPPLY VOLTAGE TO THE VALVE, THEN THE SIGNAL OUT OF THE ECU. ALSO CHECK THE RESISTANCE OF THE VALVE, A READING OF BETWEEN 6 TO 8 OHMS.

FUEL PRESSURE

CONNECT A SUITABLE PRESSURE GUAGE BETWEEN THE FUEL PRESSURE REGULATOR AND THE FUEL RAIL AND CHECK THAT THE PRESSURE IS WITHIN THE REQUIRED VALUE.

IF THE PRESSURE IS TOO HIGH, FIRST CHECK THAT THE RETURN LINE IS NOT BLOCKED, THE BEST WAY TO CHECK THIS IS TO REMOVE THE RETURN LINE FROM THE PRESSURE REGULATOR AND CONNECT YOUR OWN PIPE FROM THE REGULATOR TO A JUG AND THEN RE-TEST THE PRESSURE.

IF THIS DOES NOT CURE THE PROBLEM THEN THE REGULATOR WILL EITHER NEED TO BE ADJUSTED OR REPLACED.

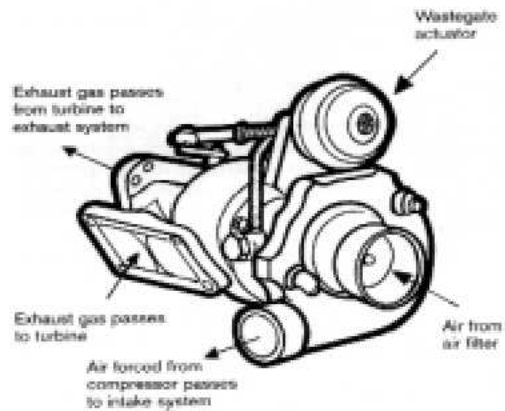
FUEL DELIVERY

TO TEST THE FUEL PUMP DELIVERY FIRST DISCONNECT THE MAIN FUEL LINE AND PUT THE PIPE INTO A MEASURING JUG AND RUN THE FUEL PUMP. MEASURE THE AMOUNT FOR 1 MINUTE AND YOU SHOULD GET APPROXIMATELY 2.5 LITRES (OR CHECK FOR 30 SECONDS AND HALF THE AMOUNT). IF THE PUMP DELIVERY IS LOW DO ANOTHER CHECK STREIGHT OUT OF THE PUMP (BEFORE THE FILTER) IF IT IS STILL LOW SUSPECT THE PUMP (ALSO CHECK THE SUPPLY VOLTAGE TO THE PUMP) IF THE DELIVERY IS NOW CORRECT THEN REPLACE THE FUEL FILTER.

IGNITION MODULE

THE IGNITION MODULE IS TRIGGERED BY A REFERENCE SIGNAL FROM THE ENGINE MANAGEMENT ECU

TURBOCHARGER INFORMATION



BOOST PRESSURE CONTROL SOLENOID

THE TWO ELECTRICAL CONNECTIONS ON THE SOLENOID PROVIDE A POWERSUPPLY AND EARTH .THE EARTH IS SWITCHED BY THE ECU. YOU CAN CHECK THE SOLENOID WINDING ACROSS THE TWO TERMINALS WITH A OHM METER, THE RESISTANCE SHOULD BE BETWEEN 20 AND 50 OHMS, IF THIS IS INCORRECT THEN IT WILL NEED REPLACING.

THE 3 PORTS ARE CONNECTED TO THE :
COMPRESSOR OUTPUT, WASTE GATE ACTUATOR AND THE RETURN TO LOW PRESSURE SIDE (AIR FILTER)

THE ECU CONTROLS THE TURBO BOOST PRESSURE BY SENDING A PULSED SIGNAL (ON/OFF) TO THE SOLENOID, DEPENDING ON HOW MUCH BOOST PRESSURE THERE IS IT CAN CHANGE THE SIGNAL TO ALLOW MORE OR LESS PRESSURE TO THE WASTE GATE ACTUATOR TO EITHER INCREASE OR DECREASE THE BOOST PRESSURE.

ADJUSTING THE BOOST PRESSURE

YOU CAN ADJUST THE TURBO BOOST PRESSURE BY EITHER FITTING AN UPRATED ACTUATOR OR ADJUSTING THE STANDARD ONE.

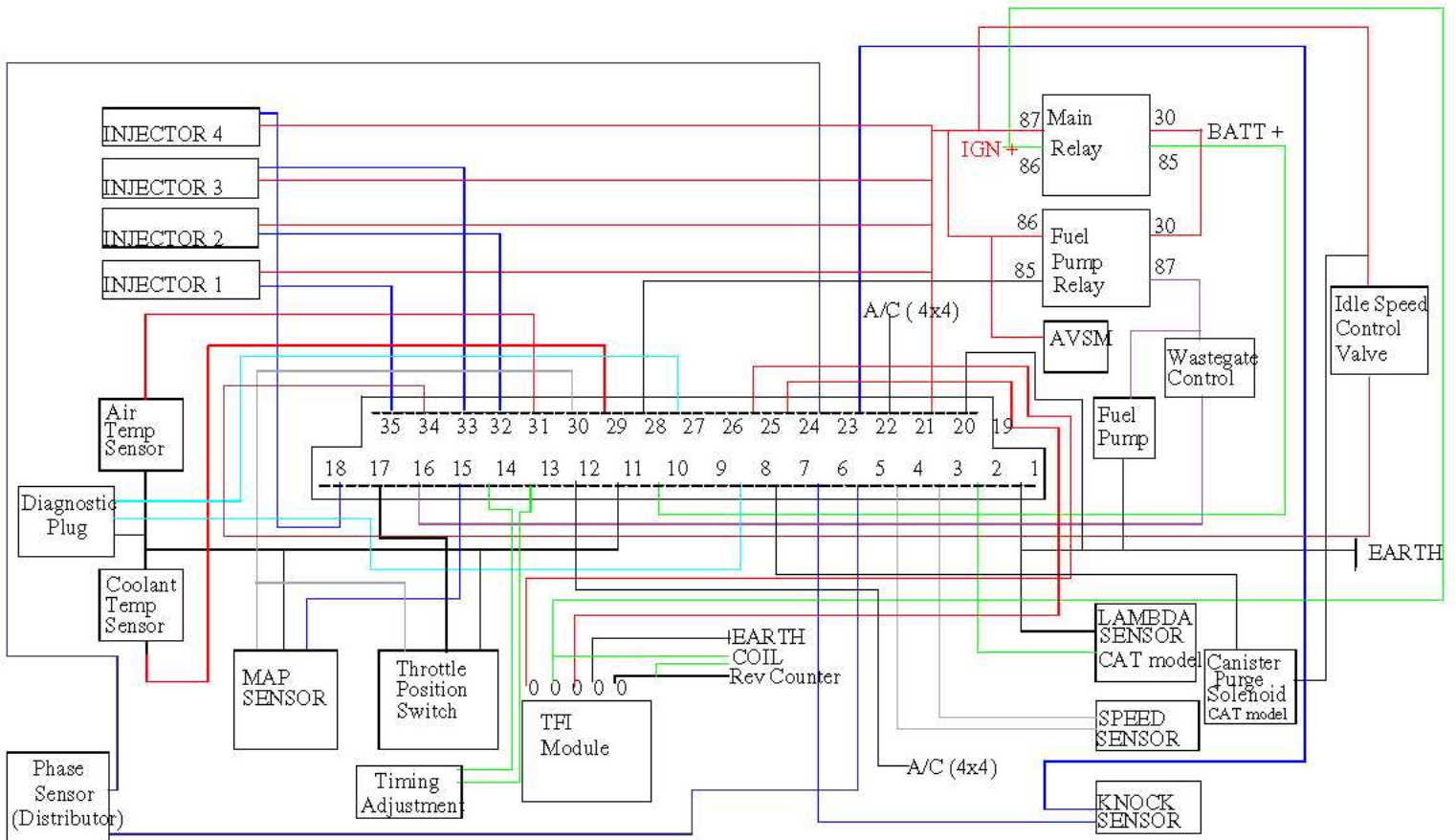
TO ADJUST IT YOU HAVE TO EITHER LENGTHEN THE ACTUATOR ROD (UNDO LOCKNUT AND TURN ADJUSTING SLEEVE) TO REDUCE THE PRESSURE OR SHORTEN THE ACTUATOR ROD TO INCREASE THE BOOST PRESSURE.

NOTE. IF THE BOOST IS ADJUSTED MORE THAN THE MAXIMUM LIMIT THE ECU WILL HAVE TO BE CHIPPED.

I HOPE YOU FIND THIS INFORMATION USEFUL, PLEASE NOTE EVERY EFFORT HAS BEEN MADE TO INSURE ALL OF THE INFORMATION IN THIS DOCUMENT IS CORRECT BUT IT CANNOT BE GUARANTEED.

BELOW IS A WIRING DIAGRAM

IT COVERS BOTH THE 2WD AND THE 4WD COSWORTH.



EARTH TERMINALS 1 AND 19. CHECK MAXIMUM OF 0.5 VOLT DROP BETWEEN TERMINAL AND BATTERY NEGATIVE.