

PossumLink

A joint project between Link ElectroSystems
and Possum Bourne Motor Sport

MY99 (V5) WRX

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ElectroSystems and Possum
Bourne Motor Sport

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Table of Contents

1.	System Installation	3
2.	Remote Control Functions	4
3.	Typical Setup Procedure	14
4.	Additional Tuning Tips	18
5.	Closed loop Operation.	19
6.	Idle speed control.....	25
7.	Tuning Port	28
	Engine Electrical System (RHD)	31
	Factory and PossumLink I/O Signal.....	35
	Component Location.....	37
	Solenoid Valve, Emission Control System & Ignition System	39
	Appendix A.....	40

1. SYSTEM INSTALLATION

The factory computer is located in the front of the passengers foot well (right hand drive vehicles). To gain access carefully pull the carpet back to expose the kick plate that covers the computer assembly. Remove the bolts holding the kick plate in place and remove the kick plate. The computer will now be visible. The next step is to disconnect the wiring harness. Each of the three cable connectors are removed by depressing the lock tab to remove. Unbolt the computer (ECU) and remove it from the vehicle.

Board Replacement

1. Remove the ECU cover by removing the four (sometimes six) screws. These are factory "Loctited" and usually difficult to undo
- Caution**
Static Electricity Hazard
2. WRX Remove the screws retaining the circuit board. Lift the circuit board clear of the aluminium case. Insert the PossumLink board and replace the retaining screws. The PossumLink board may have transit screws and nuts in these locations. Remove before installation.
 3. If any tuning / adjustment is required then do not replace the cover at this stage to allow access to the tuning port on the circuit board. Note that there are several other "devices" that may be plugged in for various functions.
 4. Once tuning is complete or if tuning is not required then replace the cover and fit the ECU onto the mounting bracket and reconnect cables. Replace kick plate trim and carpet.

Some WRX's are fitted with an immobiliser system. On installation of a PossumLink into these vehicles it is necessary to set the small blue switch on the PossumLink board accordingly.

If the car has a immobiliser system then the inner switches (#2 & #3) are switched on. The Outer two switches #1 & #4 off.

If the car does not have an immobiliser system then the two outside switches #1 & #4 should be on (#2 & #3 off).

2. REMOTE CONTROL FUNCTIONS

- + Ignition switch (key) must be OFF before installing any device. When the key is switched on, the PossumLink will automatically determine which device is fitted and run the appropriate software to support it.

TEST All functions in this mode are "read only" and have no effect on the operation of the system.

TEST RPM is the default display and shows engine RPM. This reading should be stable and in accordance with the engine tachometer.

TEST MAP (Press and hold the ADJUST DOWN switch) shows the current Manifold Air Pressure (MAP) in kPa. With the engine stationary, the value should show approximately 101 kPa +/-5 at sea level.

TEST ENGT (Press and hold the ADJUST DOWN switch) shows the current engine coolant temperature in degrees Celsius.

EDIT UP switch shows the software ID and date code for diagnostic purposes.

CODE A user entered code allows access to all tuning functions. An unlocked PossumLink will show "*****" on the display and all functions will be available. A "locked" PossumLink will show a three digit number which must be changed using the "Adjust" buttons to the correct value and then "STORE" to unlock the PossumLink.

The STORE function is always active although partially hidden among the ACCESS DENIED messages. Use the SELECT buttons to search the menu.

TPS SPAN Allows the Throttle Position Sensor (TPS) span to be set. The ADJUST switches are used to set the "low" (throttle closed) 10 and "high" (throttle fully open) 100, values. These values must always be set unless otherwise specified.

CLAMP Clamps the Manifold Air Pressure signal to a minimum value (high Vacuum) to stabilise the RPM at idle. This helps prevent idle surge present in some engines. The value shown in (xxx) is actual MAP and the far right value = the clamp value. Typical settings range from 30..35 for normal engines.

MASTER FUEL Controls overall fuel injection scheduling and is effective throughout the entire operating range from idle to full power. The scale ranges from 0..255, the higher the value, the greater the overall fuel.

RPM LIMIT Sets the RPM limit. Limiting is achieved by 100% fuel cut until the RPM drops below the preset value.

MAP LIMIT Set Manifold Air Pressure limit to prevent over boost. Values are expressed in absolute pressure so all values above 100 kPa represent boost pressures.

e.g. 150 KPa = 9 psi boost

200 KPa = 15 psi boost

Upper limit = 254 kPa. No limit 255 kPa. (Display = OFF)

ADVANCE LIMIT Sets the absolute maximum ignition advance irrespective of any value programmed into the ZONE IGNITION table. Note that this is a numeric limiter only and does not invoke any actual ignition or fuel cuts.

KNOCK LIMIT May be switched ON / OFF. Provides some detonation control by reducing ignition advance in any zones where the knock sensor detects detonation. The maximum reduction is six degrees in any one ignition zone. The number in brackets shows the total number of detonations detected by the PossumLink since the key was last switched on (knock count).

KNOCK TARGET XXX Allows setting of the knock control system action threshold. When the “noise” level exceeds the target, retard action takes place in the current ignition zone. Default value is 60, higher numbers raise the target value thus decreasing the sensitivity. Use in conjunction with Knock Count display for best results.

MAP = Use to select the MAP sensor currently fitted.

STD (020) Standard Subaru MAP sensor (240 kPa max)

"GM" MAP sensor option

The previous "555" MAP sensor option has been replaced with a GM version allowing boost pressures up to 3 bar (absolute). The sensor will require installation into the existing wiring, basically matching the wire colours as follows;

BLACK/WHITE = ground/earth

BLUE/BLACK = +5 volts

YELLOW/BLACK = signal out

(If wire colours are different to these it will be necessary to measure the voltages at the MAP connector and connect accordingly.)

Remember to connect the vacuum hose to the snout of the GM sensor.

Select the "MAP = xxxx " menu and using the ADJUST keys select the required sensor type. (Automatically "STORED"). Now select "RELOAD" and press both ADJUST keys until "*****" appears on the display.

**NOTE: ALWAYS RELOAD THE ECU WHENEVER
THE MAP SENSOR TYPE IS CHANGED.**

ACCEL Controls acceleration enrichment during abrupt opening of the throttle. There are 4 zones each covering a 2000 RPM span to allow optimum enrichment figures to be set for varying conditions. Note that ACCEL is only effective during the actual movement of the throttle to cover any brief flat spots occurring at that time. The actual zone is selected automatically, and is shown as Z=x where x = the currently active zone. e.g. Z=2 indicates transient zone 2 (2000..4000 RPM range).

COLD Controls cold start and warm up enrichment by adding extra fuel to the engine. The adjustment value is shown on the right hand side of the display and will gradually reduce to zero as the engine temperature rises towards 70°C. The value

shown in parenthesis (xxx) is the actual engine temperature for monitoring purposes.

VOLTS Provides a compensation value for fluctuations in battery voltage caused by heavy electrical loads being switched on and off e.g. headlights, heaters, fans etc. These voltage fluctuations cause the injector opening time to vary, resulting in erratic, surging idle speeds.

Initially set the value to "15" (STORE) and tune the engine with minimum electrical loads switched on. Once a satisfactory tune is found, allow engine to idle and switch on maximum electrical loads. Readjust the VOLTS value to restore the "unloaded" idle quality and STORE the result. The actual battery (PossumLink) voltage is also displayed for monitoring purposes.

Note that the adjustable value does not represent actual voltage but is a trim value with no particular units.

TEMP SWITCH Sets the value at which the radiator fan will switch on. Display in C°. The software features hysteresis on the switch point to prevent short repetitive cycles. The fan will switch off when the temperature drops 2°C below the on temperature.

LAMBDA This control allows the closed-loop oxygen system to be selected on or off. Press ADJUST UP to enable, and ADJUST DOWN to disable the closed loop system. The display will show ON or OFF accordingly, and the change is automatically stored. (No need to select STORE etc.)

CAUTION: Do not select closed loop ON unless lambda probe is correctly installed and wired.

See the subsequent chapter "Closed Loop Operation".

BOOST Boost target values: Twenty zones are used to hold a target boost value for each 500 Rpm interval between 500 and 10,000 Rpm. This allows the boost curve to be tailored for the application eg. the boost may be held at lower levels through the Rpm mid range to suppress detonation and then

allowed to rise at higher Rpm where detonation is less likely. The target values may be changed as follows:

1. Select “BOOST =” on the remote and use ADJUST keys to set as required. Note that this will affect all 20 zones in a manner similar to row fuel e.g. if 5 kPa is added to zone 750 then 5 kPa is added to zone 750, then 5 kPa will be added to all 20 zones.
2. EDIT mode; select each zone individually and ADJUST to the required value. EDIT mode affects one zone only.

The values are shown in KPa (absolute) and may be cross referenced using the following table. The values must always be greater than 100 since below 100 represents vacuum.

KPa (Absolute)	PSI (boost)
100	0
120	3
140	6
160	9
180	12
200	15
220	18 Max for “std” MAP Sensor
240	21
250	23

2. WG BASE This value is used for calculating a base line duty cycle which the software uses to initially guess the final value. This base line is used mainly during the turbo spool up time when the system is unable to control the boost and holds the waste gate setting close to the final (settled) value.

Drive the engine at Mid to high rpm (eg. 5,000 rpm) and snap open the throttle. Watch the boost gauge and as soon as the boost stabilises at the target value read the wastegate duty cycle shown in parenthesis (xxx). Return to 5,000 rpm and again snap open the throttle while watching the duty cycle window (xxx). Use the ADJUST buttons to change the

BASE value until the settled duty cycle noted initially is forced into the duty cycle window.

e.g. Settled duty cycle = 75% (at 5,000 rpm).

Adjust WGBASE until a value of 70–75% is forced into the duty cycle window at throttle snap.

If WGBASE is set too high, then the boost will initially overshoot the target value, then decay slowly to the settled value. If set too low, then boost will initially rise short of target, then slowly increase toward the final value.

WGATE SENS Sensitivity Control: All closed-loop (feedback) systems require an optimum sensitivity level which is a compromise between fast response time and overall stability. High sensitivity values produce fast response at the expense of instability (hunting or oscillation around the target value), and low sensitivity may result in slow settling times.

Experience has shown a “WGATE SENS xx” value of about 5 to 10 to be fairly close. (Never set the value to 0). Generally a “soft” waste gate requires higher numbers, especially when operating at high boost levels (>1.0 Bar).

WG RPM Sets the engine RPM at which the system will start controlling the boost. At low RPM (about 3,000 rpm) there may not be sufficient gas flow to spool the turbo thus limiting the amount of usable boost. Under these conditions the control system would attempt to increase the boost by increasing the duty-cycle without effect, and when the boost does arrive would grossly over-shoot since the waste gate is fully shut down. Typical rpm lock out values depend somewhat on the turbo size and matching, but a typical value usually falls between 3,300 and 3,800 rpm. If boost overshoots at low RPM when driving in higher gears (4th / 5th etc.) try raising the rpm point.

Note: A throttle position lockout also exists which inhibits the control system when the throttle is less than 60% open. This feature is not adjustable.

IDLE RPM Sets the idle speed in steps of 50 rpm. When the engine is cold, the idle speed is automatically increased and will decay to normal as the engine warms up. (See Chapter 6 for further details.)

EDIT Enables the zone editor function which allows random access to all zones for viewing and editing. The EDIT function may be used at any time, with or without the engine running. Use the EDIT push buttons to select the appropriate zone(s) and the ADJUST buttons to change the selected zone. The zone is identified by a number which may be correlated to its function by consulting the zone editor sheet. ZONE FUEL and ZONE IGN are identified by an "F" or "I" respectively to discriminate between fuel and ignition values. Storing of edited values may be done by pressing BOTH EDIT buttons together until display shows "*****" and then releasing. Alternatively, STORE may be selected and used as normal.

STORE Used to store corrections into the semi-permanent memory. STORE is initiated by pressing BOTH ADJUST buttons together until the display shows "*****" and then releasing. The process will take from 2..30 seconds depending on the number of corrections to be stored.

Note that the engine may run a bit rough during STORE so it is advisable to do so only at idle. If engine stops running during STORE, allow the process to finish before turning off key or trying to restart the engine.

RELOAD This process presets all the zones to typical values to allow a base for subsequent tuning. RELOAD is initiated by pressing BOTH ADJUST buttons together until the display shows "*****" and then released.

CAUTION: RELOAD will over-write all values currently stored in the PossumLink memory and should only be used during initial setup or if you wish to restart the tuning procedure again from scratch.

ZONEFUEL There are 200 fuel zones arranged in a rectangular grid consisting of 10 ROWS by 20 COLUMNS. The ROWS progress in steps of Manifold Air Pressure to provide the "load" axis, and the COLUMNS progress in steps of RPM. Therefore, each zone represents a unique engine operating condition allowing fuel changes to be made in small, localised areas. The selection of zones is completely automatic, depending on the actual RPM and MAP values at that instant. The current (active) zone is identified to allow correlation to the zone sheet and to give an indication of where you are in the table. The zone numbering system is not linear, but designed to provide a clearer indication as to effective location. e.g. zone 110 = ROW 1, 1000..1500 RPM zone 255 = ROW 2, 5500..6000 RPM zone 545 = ROW 5, 4500..5000 RPM etc. Adjustments are made by operating the ADJUST buttons as required, and the actual value is displayed on the right hand side of the display. Adjustment scale = 0..255.

ZONE IGN There are 200 ignition advance zones arranged in an identical manner to the fuel zones (see above). The zone identification system is also the same as ZONE FUEL except it applies to the ignition advance table instead. The adjustment value is shown as degrees of advance. NOTE: The ADV LIMIT control has priority over any ZONE IGN value in excess of the limit value. The limiting value does not inhibit entry of ZONE IGN values in excess of the limit, rather it limits the value displayed and actually used at the time.

The ignition values displayed are the value + the static value. i.e. ZONE IGN 27 = 27°+10° static = 37° degrees crank (typically).

ROWFUEL Allows the ZONE FUEL table to be adjusted a WHOLE ROW at a time. i.e. All values on the current ROW will be adjusted up or down irrespective of the RPM. e.g. current zone = 230 (ROW 2, RPM = 3000..3500), if 4 units were added (UP) to zone 230, then ALL zones along ROW 2 (200..295) will have 4 units added to their current values. ROWFUEL

is primarily intended as a coarse adjustment to allow broad shaping of the ZONE FUEL table during initial tuning, and would normally be used after MASTER has been set, but before ZONE FUEL is used.

Careful use of ROWFUEL will eliminate the need to spend large amounts of time in ZONEFUEL trying to make major changes overall by wondering about the table making localised corrections. (It is quite difficult to hold the engine in any one of 200 zones while corrections are made even under the most favourable conditions.) The current ROW is displayed in parenthesis to show the currently active ROW, but the RPM information is suppressed since this feature is not RPM dependent.

INJ / OXY This is a read-only function which displays the actual injector duty-cycle as a percentage of maximum. e.g. 28% indicates that the injectors are flowing 28% of their maximum volume. The OXY displays shows the output signal of oxygen sensor in volts. Refer to "Closed Loop" information for the significance of these readings.

Storing Values

To Store select STORE. Press both ADJUST buttons together until display shows "*****" and then release.

The default (factory) programme in the PossumLink is the result of extensive testing on a engine dyno meter, on the road and from data gathered from the Possum Bourne Motor Sport rally cars (Legacy / Liberty and WRX). For vehicles in standard trim additional tuning should not be necessary.

The programme is preset to a performance level offering optimum performance while aiming for engine longevity. The programme is also set for optimum economy while under "cruise" conditions.

Possum Bourne Motor Sport and Link ElectroSystems do not endorse any use of the PossumLink that endangers in any way the vehicle, driver and passengers or any member of the community.

3. TYPICAL SETUP PROCEDURE

The following list shows (in order) a typical set of numbers for the engine at idle. This list is useful for quick reference while becoming familiar with the function locations.

TEST RPM	800	
TEST MAP	38 kPa	(Adjust button up)
TEST ENGT	88C	(Adjust button down)
CODE # =	XXXX	(Unlocked)
TPS SPAN	10	(Throttle closed)
CLAMP (38)	35	
MASTER FUEL	89%	
RPM LIMIT	7300	
MAP LIMIT	210 kPa	
ADV LIMIT	27	
MAP =	STD	
KNOCK (0)	ON	
ACCEL Z = 1	26%	
COLD (88)	0%	
VOLTS V = 13.8	15	
STORE		(Both Adjust together)
RELOAD		(Both Adjust together)
ZONEFUEL 105	94%	(Row 1, 500 - 1,000 rpm)
ZONE IGN 105	11	
ROWFUEL (1)	94%	
INJ=1% OXY=81		(OXY may be varying)
TEMP SWITCH	96	
LAMBDA	OFF	
IDLE	800*	(* V, T, +, -, =)
BOOST	200 kPa	
WGATE SENS	5	
WG BASE	(43)	
WG RPM	3500	
EDIT Z 0	35	(Editor @ zone 0 "CLAMP")

Do not adjust the PossumLink system unless you are prepared to accept the consequences

i.e. Possible engine damage if you make tuning errors.

See front cover of manual for warranty information.

1. Switch on ignition.
2. If you wish to retune from scratch then - Select RELOAD as per Tuning Module Function instructions in previous section. (Places default table into processor)
3. CLAMP and MASTER will have default values. Do not adjust at this stage.
4. Select RPM LIMIT, and Set Limit as required.
5. Repeat above for MAP LIMIT, ADVANCE LIMIT and KNOCK LIMIT.
6. ACCEL, COLD and VOLTS will have default values. Do not adjust at this stage.
7. Select STORE and press ENTER for one second if you have made any changes (as per Tuning Module Function instructions in previous section).
8. Select MASTER and start engine. Adjust value up or down as necessary to keep engine running smoothly. Allow engine to warm up fully.
 - + It is recommended that MASTER is not changed from its default value unless higher flow injectors or some other major change has been made to the engine.
9. Select ADVANCE LIMIT and set advance limit to zero. With engine at idle or low speed, check ignition initial timing is approximately 10° BTDC (this is not adjustable since the trigger pickups are of fixed position).

10. Select MASTER. Drive or dyno. load engine until engine is producing approximately 50% maximum power. Adjust MASTER for best running performance. Engine power should now be increased into the higher power ranges. Again adjust MASTER for best performance at highest practical power output. This setting is most important if zone tuning is to be successful (see note in step 8).
11. Select ROWFUEL. Run the engine in each of the ten main rows (load rows) and adjust for optimum performance. Refer to the Zone Sheet for explanation of "row" values. (This should only be necessary if major changes to the engine or fuel system have been made).
12. Select ZONEFUEL. The engine should now be operated throughout the entire power range and the UP/DOWN switches used to gradually tune the zones as required. (It is advisable that a "STORE" is carried out after this to prevent loss of correction data (if ignition turned off)). Repeat the above as often as necessary until desired result is obtained. Note that the majority of engine tuning will be carried out in ZONEFUEL mode.
13. Select Zone Advance. Repeat step 11 above but this time adjusting ignition advance. Caution should be observed to prevent over-advancing and thus possible detonation action. Use with care! Periodically check the detonation count in the "KNOCK" menu to see if detonation is occurring. Remember that the PossumLink will automatically remove up to 6° advance from any zone if the "KNOCK" system is turned on.
14. Select ACCEL. Run engine at idle and snap open throttle. Adjust for cleanest response. Repeat this at higher RPM (four zones which will change as engine RPM increases). "STORE" after setting.

NOTE: ACCEL is exclusively used to enrich the mixture while the throttle is actually moving. If the engine is hesitant AFTER the throttle has finished moving then the base fuel

eg ZONEFUEL value is probably too low. DO NOT use ACCEL to cover up lean ZONEFUEL values.

15. Assuming all the above operations are completed successfully, allow the engine to cool down completely. (preferable overnight). Select COLD and start engine. Adjust as required for clean operation with minimum hesitation. Excessive "COLD" will result in poor running and excessive exhaust emissions.

4. ADDITIONAL TUNING TIPS

1. Large steps between zones are permitted since the PossumLink System interpolates (ie. calculates intermediate values) on all tabled data.
2. Always STORE changes before turning off ignition or they will be lost.
3. TAKE NOTES as you go of the various settings and values to enable a logical picture to be built up for future reference. The PossumLink System can produce millions of possible combinations so keep trace.

5. CLOSED LOOP OPERATION.

Note: The closed loop system will only operate correctly if the oxygen sensor is correctly located and in good condition. If the engine has been significantly modified (especially cams) then the closed loop operation is NOT recommended. The incomplete combustion will cause oxygen to be present in the exhaust gas resulting in false readings from the probe.

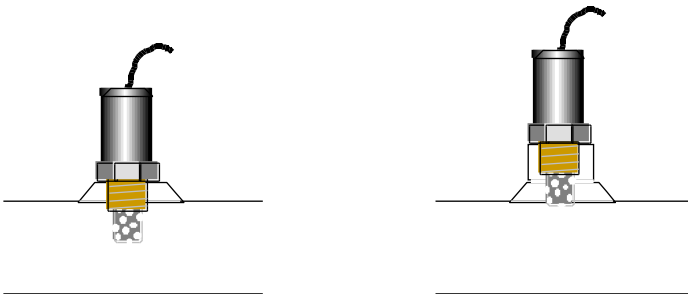
Closed loop operation involves the use of an exhaust gas oxygen sensor (Lambda probe) to provide the PossumLink with a feedback signal indicating the actual fuel/air ratio. This signal allows the PossumLink to make instantaneous corrections to the injector fuel flow until the required air/fuel ratio is achieved. This automatically compensates for all the variables that may cause incorrect fuel scheduling, and has two modes of operation;

1. **Tuning Mode (Tuning Remote connected):** The PossumLink is able to "tune" itself throughout the entire operating range simply by driving the vehicle and allowing the PossumLink to do all the work. The air/fuel ratio "targets" may be set to any required value depending on the application. A software limit of +/- 8% (ZONEFUEL) prevents excessive errors if the oxygen probe is damaged or misreading.
2. **Continuous mode (Tuning Remote disconnected):** The PossumLink operates in continuous mode after auto or manual tuning is complete and compensates for all the day-to-day variables that cause the air/fuel ratio to drift, resulting in absolutely consistent running and low exhaust emissions. A software limit of +/-3% (ZONEFUEL) prevents excessive errors if the oxygen probe is damaged or misreading.

Closed loop Requirements.

Hardware for closed loop operation is essentially the same as for open loop with the following exceptions;

1. An exhaust gas oxygen sensor (Lambda probe) mounted in the exhaust pipe after the turbo charger. Ideally the probe works best about 600 mm behind the turbocharger but this is often not practical as it exposes the probe to water and stone damage. The factory location (immediately after the turbocharger) can result in the probe overheating during prolonged high power runs. All tuning should be done in a series of short bursts at high power followed by a minute or more at low power to allow the exhaust temperatures to fall. Some improvement may be made by spacing the probe so that the probe tip is not in the direct exhaust stream but off to one side.



This helps reduce the tip temperature resulting in improved high power readings.

The probe temperature must exceed 300 degrees Celsius for normal operation, and most types have a built-in electrical heater to assist with this requirement. The heater also allows the system to come on line faster after a cold start and ensures that temperature is always adequate during prolonged idle running.

Operation and setup.

1. The closed loop mode is enabled by selecting LAMBDA on the Link Tuning Module and switching to "ON".
2. The system should first be tuned in open loop mode (LAMBDA = OFF) until a reasonable state of tune is achieved. This step allows the subsequent AUTO-TUNE system to achieve a faster lock-on since it shouldn't have to make major corrections if the initial tune is about right. Closed loop operation will only occur if the following conditions are met:
 - Engine temperature above 70 C
 - Engine been running for 90 seconds after start
 - Manifold vacuum 26+ kPa (ie not in over-run vacuum)
 - No acceleration (transient) fuel pending

The system samples and corrects at a variable rate depending on engine rpm. At idle the sampling rate is slow due to the low exhaust gas velocity and increases to four samples / second for rpm's above two thousand rpm. (The feedback system is not instantaneous and therefore needs a short stabilising period)

3. Closed loop operation only takes place when the remote is selected to one of the following menus;
 - TEST (any mode)
 - ZONEFUEL
 - INJ/OXY

All other selections cause the system to suspend operations.

When active, the system works in a ZONEFUEL mode where corrections are made to the 200 zone fuel table according to the current RPM and MAP values. A status character will also appear in ZONEFUEL selection to show system status as follows:

- "T"imer - 1 minute delay after starting
- "E"ngine Temp - Engine temperature below 70°C
- "A"ccel - Acceleration fuel is currently being added

“V”acuum - Manifold vacuum is very high (over-run condition)

When any of the above are showing, the system will pause until the condition is cleared.

“+” - System is adding fuel (making richer)

“-” - System is removing fuel (making leaner)

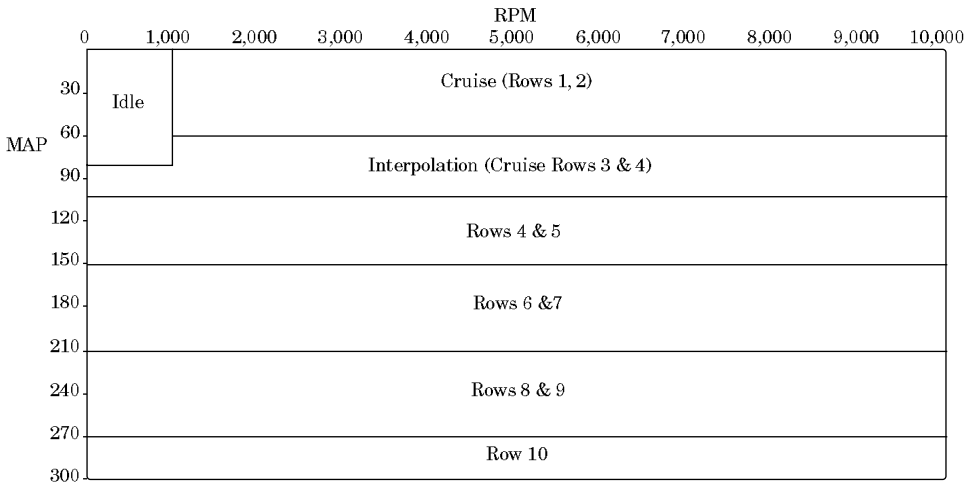
“=” - Probe voltage equals target value

“x” - System has reached maximum allowable correction (+/- 8%). Check for possible errors or system failure before STORING. (A ‘STORE’ function will store all current corrections and allow a further +/- 8% of adjustment to take place.)

NOTE: All corrections made by the AUTO-TUNE system are temporary until a STORE is carried out. All other Tuning Module functions remain unchanged.

Lambda "target" system.

The actual required fuel/air ratio is dependent on the operating conditions prevailing at the time, and is generally "load" sensitive. During operation at idle and light throttle cruise, the A/F ratio should be fairly lean in the interests of fuel economy and low exhaust emissions. At high power however, the A/F ratio needs to be richer to produce satisfactory horsepower, reduce cylinder head temperature, and control detonation. A separate block of zones (26 .. 31) are used to store the target values, and may only be changed in the EDIT mode. The default values loaded on dispatch were determined after much testing and should be correct for the majority of applications. The target values are displayed as a voltage which the software compares to the actual probe voltage and makes the necessary correction. e.g. 60 = 0.6 volts. Default values are shown below:



<u>Zone</u>	<u>Target Area</u>	<u>Target Value</u>
26	Idle	84
27	Cruise	78
28	Rows 4 & 5	82
29	Rows 6 & 7	83
30	Rows 8 & 9	85
31	Row 10	87

“Idle” block. Normally set slightly rich for good stability

“Cruise” block. Normally set relatively lean for good economy

“Interpolation” between cruise and light boost

Low boost (rows 4 & 5) for turbo engines. Medium rich for detonation & exhaust temp control

Medium boost (rows 6 & 7) for turbo engines. Medium/full rich (see row 4 comments)

High boost (rows 8 - 10). Usually very rich to control temperature & detonation. Actual value depends on engine geometry & fuel quality.

The relationship between Lambda probe voltage and the A/F ratio is not very linear since the Lambda probe shows a steep voltage

step at stoichiometric mixtures. This transition voltage indicates that no excess oxygen or fuel is present i.e chemically perfect combustion, and is the desired voltage for minimum exhaust emissions. At low to medium power, the system should be "rocking" back and forth over this transition line so that the catalytic converter can do its job. The actual voltage at which this occurs lies between 0.4 to 0.6 volts. Tests have shown that if the target is set much below 60 (.6 volts) that undesirable idle surging will result in some engines. Some experimentation may be necessary. Above the stoichiometric point the curve flattens out as the A/F ratio becomes richer. The maximum voltage produced is normally about 0.92 volts which equates to VERY rich A/F ratios. The targets should never be set above 90 (.9 V) for this reason. As a rough guide..

VOLTAGE	%CO	A/F RATIO	(approximately)
< 0.6	< 1.0	> 15:1	(lean)
0.72	1.0	14:1	
0.76	2.0		
0.80	3.0		
0.84	5.0	13:1	
0.86	6.0	12:1	
0.88	8.0 +	11:1	(rich)

Note that the enrichment becomes fairly compressed at higher voltages i.e. small voltage changes = large ratio changes.

6. IDLE SPEED CONTROL

This engine utilises a stepper motor for idle speed control purposes. This motor has approx. 150 steps from fully closed to fully open, but does not supply any feedback as to what it's actual position is at any given time. To this end, the software assumes that at key-on the ISC actuator is already positioned at it's normal "hot idle" position, and assigns a position value of "60" to this current position. If the engine temperature is less than 70 C, the system will add extra steps to provide a faster cold idle at start up. Once the engine is running, the software will add or subtract steps as required to meet the target RPM.

THE DEFAULT POSITION NUMBERS QUOTED HERE ARE FOR A TYPICAL VEHICLE WITH THE THROTTLE STOP SCREW SET TO THE "FACTORY" POSITION. IT MAY BE NECESSARY TO RESET THE STOP SCREW TO BRING THE ISC INTO IT'S PROPER WORKING RANGE.

Do this (if necessary) by doing several start cycles on a hot engine and allow the engine to stabilise it's idle each time. Whenever the engine achieves a stable idle ("=" sign for at least 2 seconds), AND the engine temp. is greater than 80C, AND the aircon/fans are both OFF, then the software will force the step value to "60" in order to remove any cumulative counting errors that may occur from time to time.

NOTE: The "60" step value may or may not actually be 60 steps off closed. This number is simply a reference point for the system to work with.

There are three adjustments that may be made to the system:

1. IDLE = (normal menu item on remote)

Sets the required idle speed in increments of 50 RPM. A value of about 800 RPM is typical. The number in parentheses (xxx) shows the actual ISC position on a scale of 0 = fully

closed, and 150 = fully open. Also, one of 5 different symbols will appear in the right-most position to show the status of the system to aid adjustment.

T = throttle not fully closed. System will set and hold the ISC position until the throttle closes. Ensure that the TPS SPAN is set to "10" at closed throttle and "100" at full throttle. The actual position that the ISC is forced to depends on a number of factors including engine temperature, air-con on/off, and "base" setting described later in this document.

V = over-run vacuum condition. (vacuum (kPa) is less than pre-set over-run target described below). System will "default" as described above.

= the actual idle speed = the target idle speed. The step number (xxx) will be steady at this time.

+ the idle speed is less than the target value. The step number (xxx) will be increasing to compensate.

- the idle speed is above the target value. Step number (xxx) will be decreasing.

2. OVER-RUN VACUUM (EDIT only, zone #17).

Sets the vacuum value BELOW which the idle speed system will pre-set the ISC to a default (constant) position. This will occur while the vehicle is coasting on closed throttle, and normal ISC operation will resume when vacuum rises upward toward normal idle values. Default value = 24 (kPa). If this value is set too low, then the idle system may try to make corrections while the vehicle is coasting to a stop, usually resulting in the engine stalling. If set too high, the ISC will maintain a constant position resulting in high, fixed idle speed.

3. "BASE" value (EDIT only, zone #18)

Sets the base step position from which corrections due to engine temp, air-con etc are made. Default value = 80.

The ideal value results in the RPM dropping quickly to about

1000 RPM, then slowly decaying to about 800 RPM over a period of about 2 seconds. If the BASE is set too high, the RPM will drop rapidly to about 1400 RPM, and then take a relatively long time to finally stabilise at the target value. If set too low, the RPM will quickly fall to a low value and may even cause the engine to stall. (This feature is similar to the "IDHOT" and "IDCOLD" values of the earlier, linear ISC motors)

4. AIRCON step-up.

A fixed number of "open" steps are applied BEFORE the air-con clutch is engaged to prevent engine stalling with the increased load. Default value = 22. (Not adjustable)

7. TUNING PORT

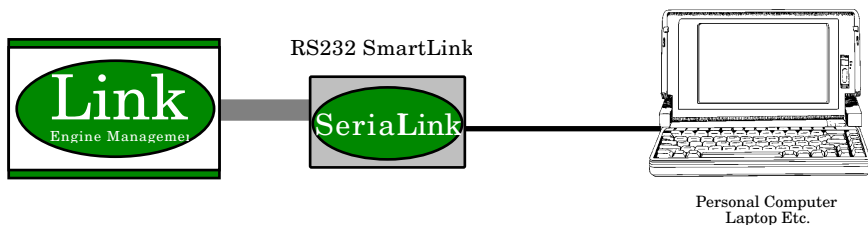
The fourteen pin connector located at one corner of the circuit board allows connection of various tuning and diagnostic tools to the system. All devices use a fourteen line flat ribbon cable, and connectors are keyed to prevent incorrect installation. The following devices are currently available.

Link Tuning Module

The Link Tuning module allows all aspects of fuel, ignition, boost and utility functions to be adjusted, edited and stored. A security code prevents unauthorised tampering on all adjustments except diagnostic (read only) functions. Detailed instructions are included elsewhere in this manual.

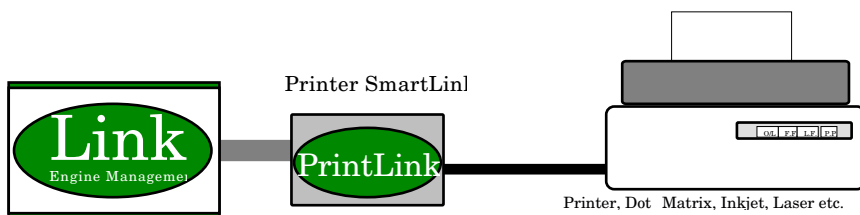


SerialLink



The SerialLink allows communication between the PossumLink and a personal computer via the PC's RS232 serial port for data-logging and downloading of the PossumLink settings. While the engine a stream sent to the PC shows all major engine parameters such as RPM, pressures, temperatures and flows. The information may be recorded using the PC's memory / disk drive. Graphs etc. may be created using spread sheets etc.

PrintLink



The PrintLink is similar to the SerialLink above except that the PrintLink connects directly to any type of printer for instant hard copy data. An alternative option is to use a battery backed "printer buffer" to store information while test driving and then downloading the buffer to a printer. Typical buffers allow in excess of one hours logging time.

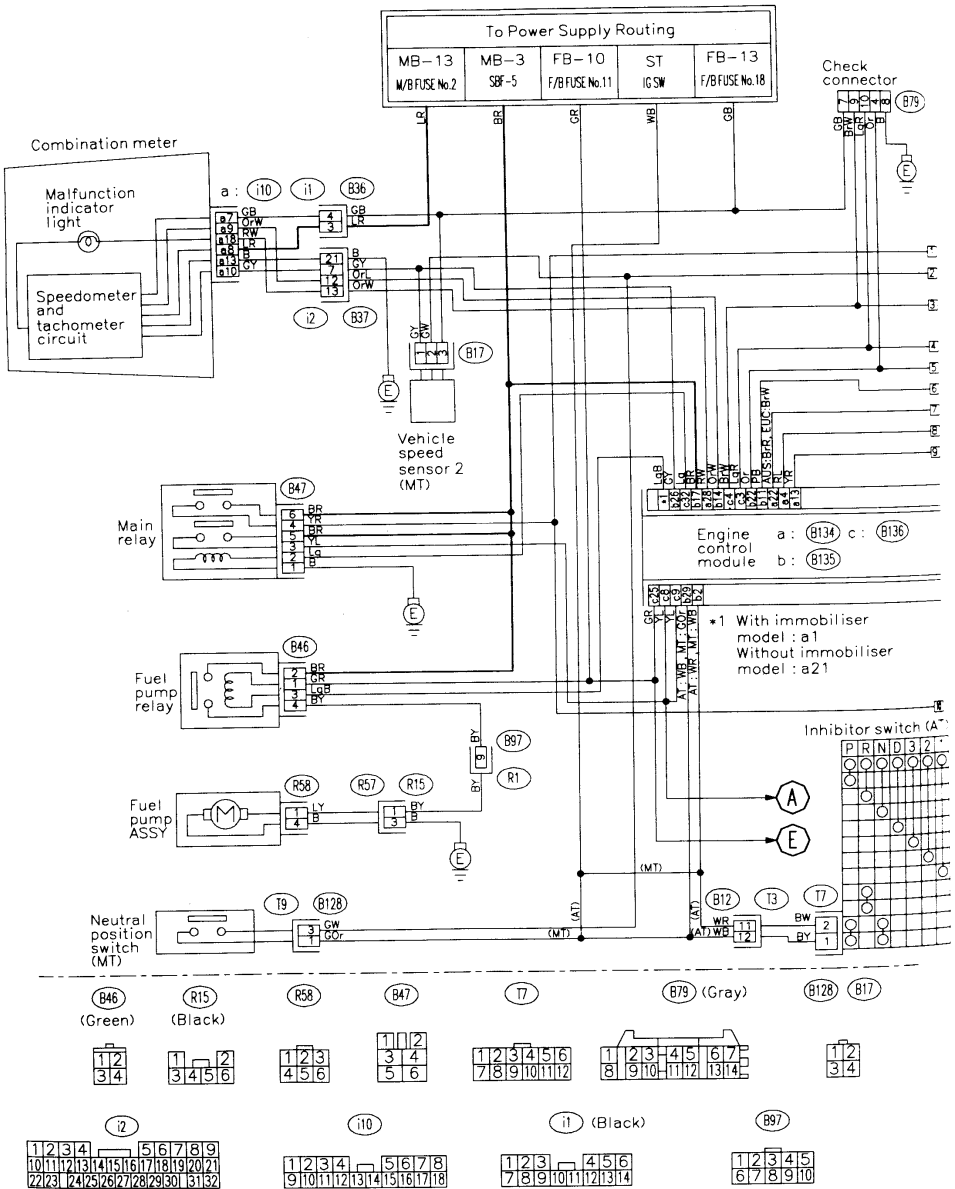
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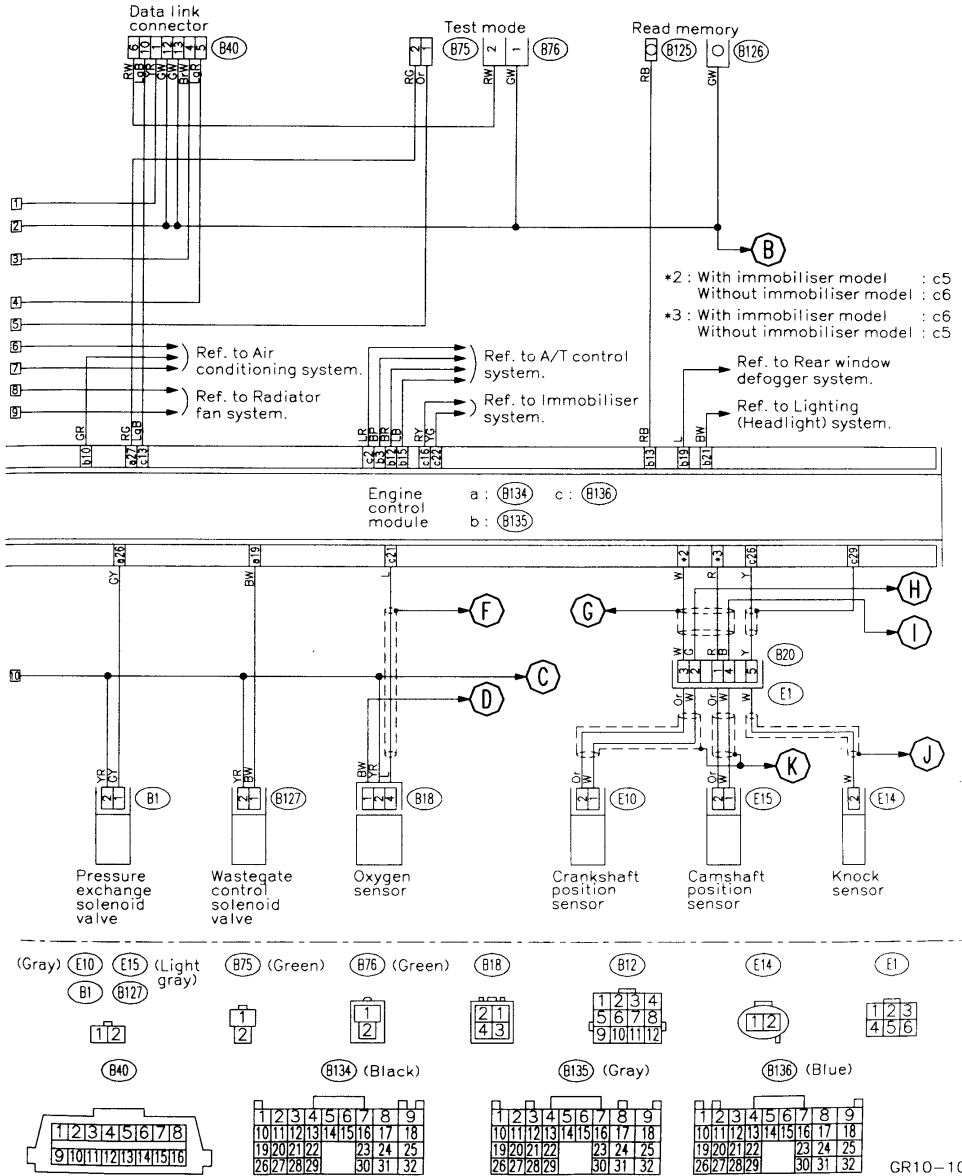
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ENGINE ELECTRICAL SYSTEM (RHD)

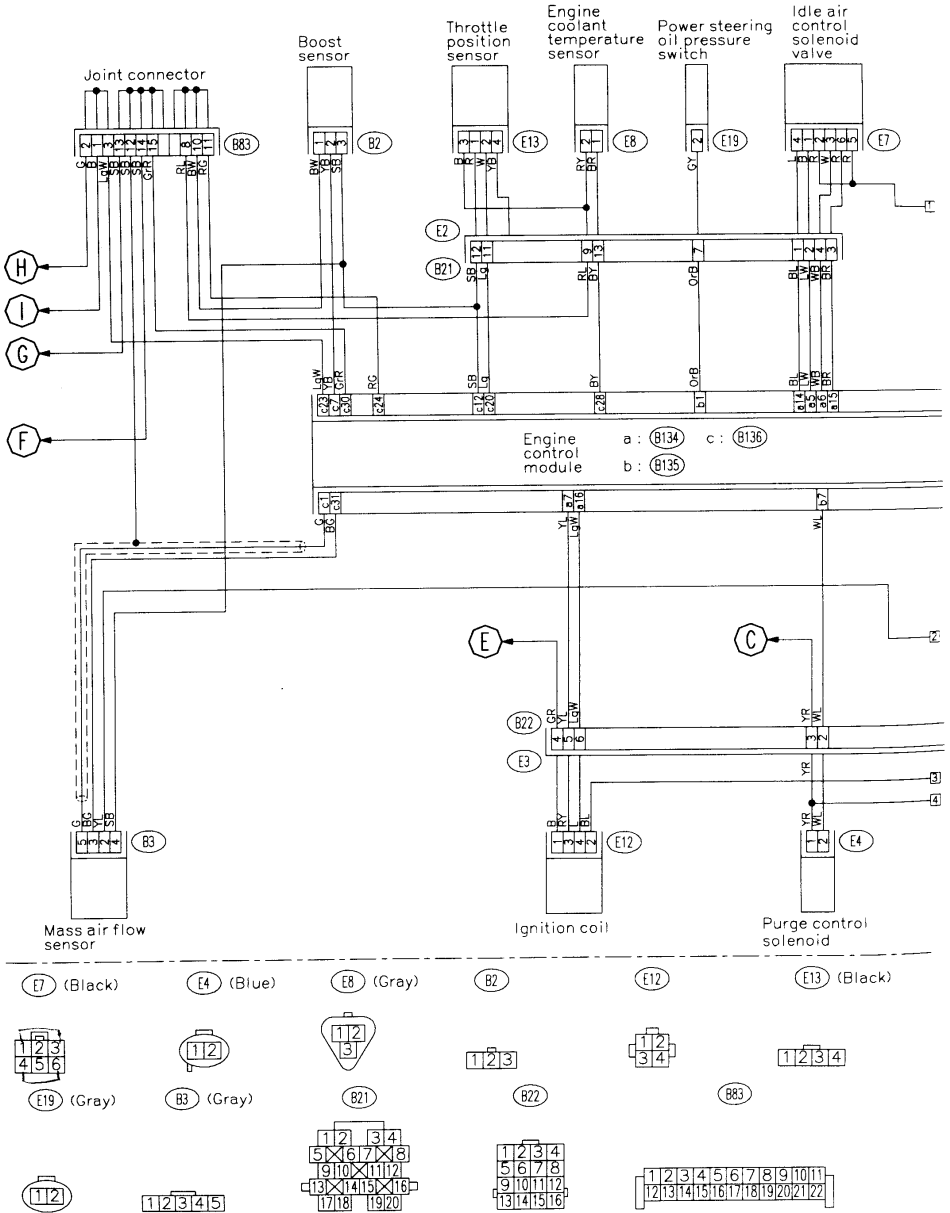


Engine Electrical System cont.

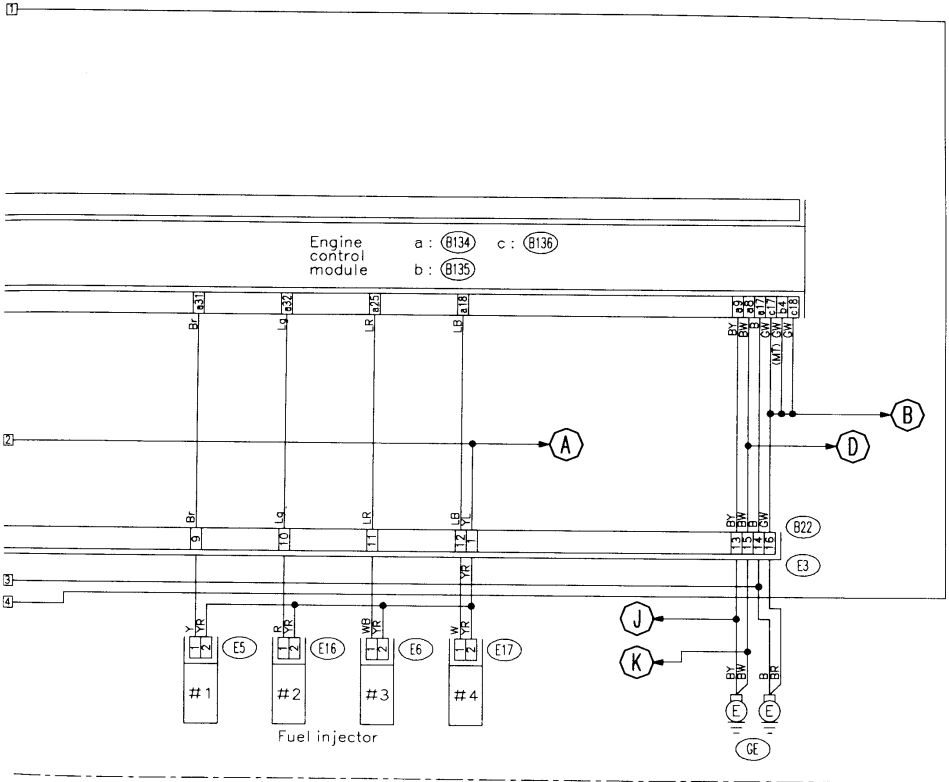


GR10-10

Engine Electrical System cont.



Engine Electrical System cont.



(Gray) (E5) (E6) (Black)

(Gray) (E16) (E17) (Black)

(B134) (Black)

(B135) (Gray)

(B136) (Blue)



1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25		
26	27	28	29	30	31	32		

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25		
26	27	28	29	30	31	32		

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25		
26	27	28	29	30	31	32		

FACTORY AND POSSUMLINK I/O SIGNAL

Content		Connector No.	Terminal No.		Signal (V)		Note	
					Ignition SW			Engine ON (Idling)
					ON (Engine OFF)			
Crankshaft position sensor	Signal (+)	B136	5*	6	0	±6	Sensor output waveform	
	Signal (-)	B136	23		0	0	—	
	Shield	B136	30		0	0	—	
Camshaft position sensor	Signal (+)	B136	6*	5	0	±6	Sensor output waveform	
	Signal (-)	B136	23		0	0	—	
	Shield	B136	30		0	0	—	
Mass air flow sensor	Signal	B136	1		1	1.0 — 1.7	—	
	Shield	B136	30		0	0	—	
	GND	B136	31		0	0	—	
Throttle position sensor	Signal	B136	20		Fully closed: 0.5±0.3 Fully opened: 4.3±0.3		—	
	Power supply	B136	12		5	5	—	
	GND	B136	24		0	0	—	
Oxygen sensor	Signal	B136	21		0		Rich mixture: 0.7 Lean mixture: 0	
	Shield	B136	30		0	0	—	
Engine coolant temperature sensor	Signal	B136	28		0.6 — 1.0	0.6 — 1.0	After warm-up	
	GND	B136	24		0	0	—	
Vehicle speed sensor		B135	26		0 or 5	0 or 5	"5" and "0" are repeatedly displayed when vehicle is driven.	
Starter switch		B135	2		0	0	Cranking: 10 to 14	
A/C switch		B135	11		ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—	
Ignition switch		B136	25		10 — 13	13 — 14	—	
Neutral position switch (MT)		B135	29		ON: 5 OFF: 0		Switch is ON when gear is in neutral position.	
Park/Neutral position switch (AT)		B135	29		ON: 0 OFF: 5		Switch is ON when shift lever is in "P" or "N" position.	
Test mode connector		B135	22		5	5	When connected: 0	
Read memory connector		B135	13		5	5	When connected: 0	
Back-up power supply		B135	17		10 — 13	13 — 14	—	
Control unit power supply		B136	9		10 — 13	13 — 14	—	
			8					
Ignition control	# 1, # 2	B134	7		0	3.4, max.	—	
	# 3, # 4	B134	16		0	3.4, max.	—	
Fuel injector	# 1	B134	31		10 — 13	13 — 14	Waveform	
	# 2	B134	32		10 — 13	13 — 14	Waveform	
	# 3	B134	25		10 — 13	13 — 14	Waveform	
	# 4	B134	18		10 — 13	13 — 14	Waveform	

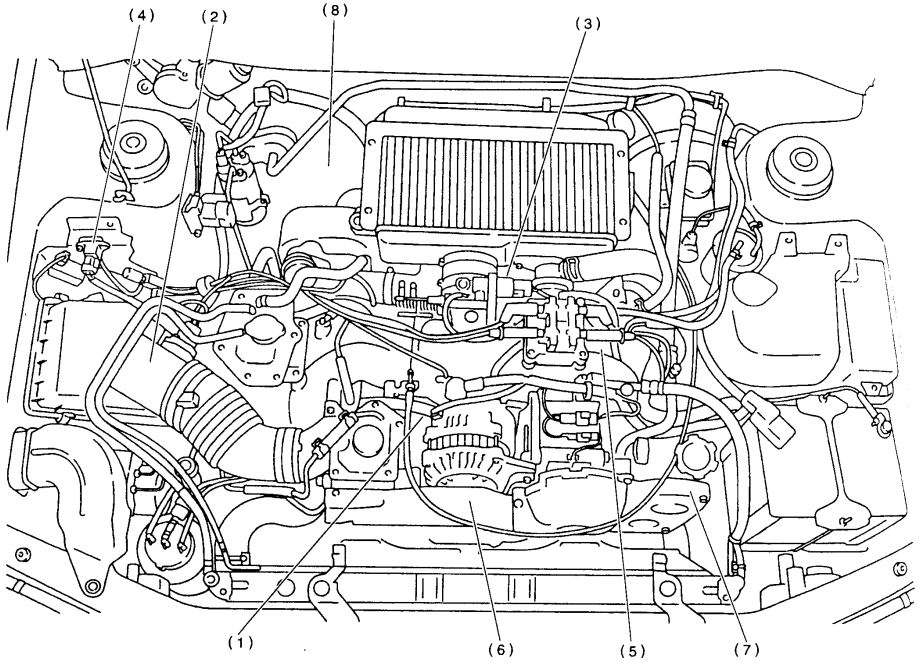
* With immobiliser

Factory and PossumLink I/O Signal

Content		Connector No.	Terminal No.		Signal (V)		Note
					Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Idle air control solenoid valve	Signal 1	B134	14	—	1 — 13	Waveform	
	Signal 2	B134	5	—	1 — 13	Waveform	
	Signal 3	B134	15	—	1 — 13	Waveform	
	Signal 4	B134	6	—	1 — 13	Waveform	
Torque control signal 1		B135	3	5	5	—	
Torque control signal 2		B135	12	5	5	—	
Fuel pump relay control		B134	1* 21	ON: 0 OFF: 10 — 13	0	—	
A/C relay control		B134	22	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—	
Radiator fan relay 1 control		B134	4	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—	
Radiator fan relay 2 control		B134	13	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—	
Self-shutoff control		B136	32	10 — 13	13 — 14	—	
Malfunction indicator lamp		B134	28	—	—	Light "ON": 1, max. Light "OFF": 10 — 14	
Engine speed output		B135	14	—	0 — 13, min.	Waveform	
Knock sensor	Signal	B136	26	2.8	2.8	—	
	Shield	B136	29	0	0	—	
Wastegate control		B134	19	10 — 13	13 — 14	—	
Pressure sources switching solenoid valve		B134	26	10 — 13	13 — 14	—	
Purge control solenoid valve		B135	7	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—	
GND (sensors)		B136	24	0	0	—	
GND (injectors)		B134	9	0	0	—	
GND (ignition system)		B134	17	0	0	—	
GND (power supply)		B134	8	0	0	—	
GND (control systems)		B136	18	0	0	—	
		B136	1* 21	0	0	—	
Select monitor signal		B136	3	—	—	—	
		B136	4	—	—	—	
Power steering switch		B135	1	ON: 0 OFF: 10 — 13	ON: 0 OFF: 10 — 13	—	
Torque control cut signal		B135	15	8	8	—	
AT load signal		B136	2	0 — 0.3	0.8 — 1.2	—	
MT/AT identification		B135	4	MT: 0 AT: 5	MT: 0 AT: 5	—	
Pressure sensor		B136	7	5	5	—	

*: With immobiliser

COMPONENT LOCATION



- (1) Engine coolant temperature sensor
- (2) Mass air flow sensor

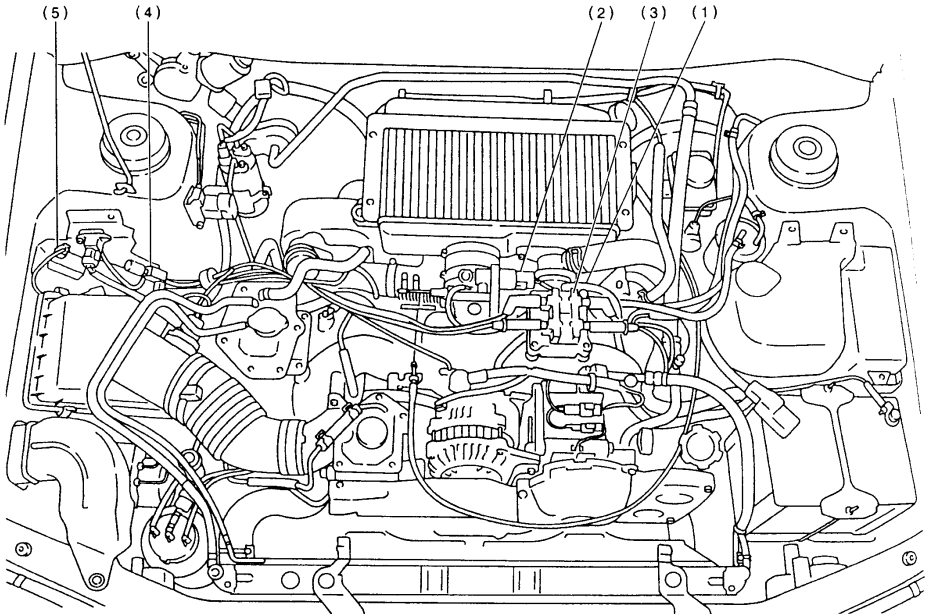
- (3) Throttle position sensor
- (4) Pressure sensor
- (5) Knock sensor

- (6) Crankshaft position sensor
- (7) Camshaft position sensor
- (8) Vehicle speed sensor

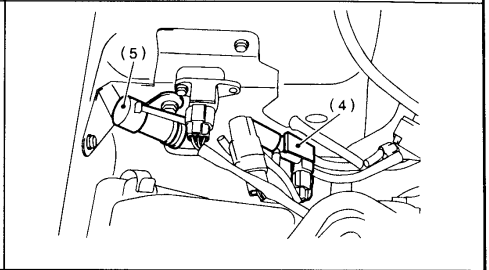
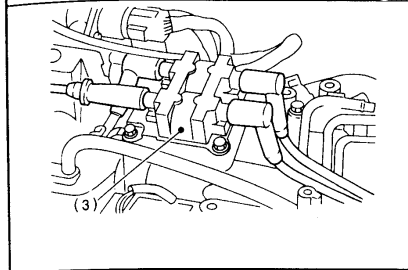
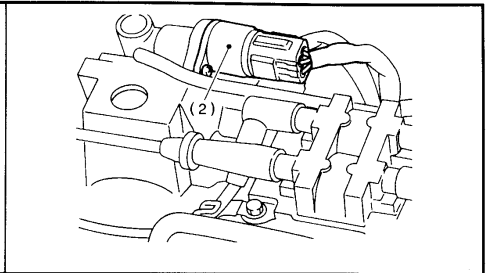
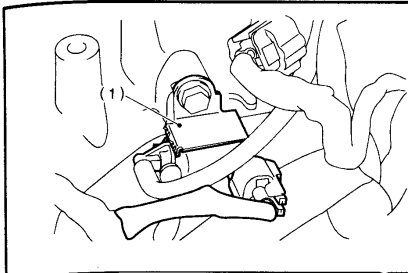
Component Location



SOLENOID VALVE, EMISSION CONTROL SYSTEM & IGNITION SYSTEM



- | | | |
|-------------------------------------|------------------------------------|---|
| (1) Purge control solenoid valve | (3) Ignition coil and ignitor ASSY | (4) Pressure sources switching solenoid valve |
| (2) Idle air control solenoid valve | | (5) Wastegate control solenoid valve |



APPENDIX A

Absolute to % Conversion

%	Absolute	%	Absolute
1	3	51	130
2	5	52	133
3	8	53	135
4	10	54	138
5	13	55	140
6	15	56	143
7	18	57	145
8	20	58	148
9	23	59	150
10	26	60	153
11	28	61	156
12	31	62	158
13	33	63	161
14	36	64	163
15	38	65	166
16	41	66	168
17	43	67	171
18	46	68	173
19	48	69	176
20	51	70	179
21	54	71	181
22	56	72	184
23	59	73	186
24	61	74	189
25	64	75	191
26	66	76	194
27	69	77	196
28	71	78	199
29	74	79	201
30	77	80	204
31	79	81	207
32	82	82	209
33	84	83	212
34	87	84	214
35	89	85	217
36	92	86	219
37	94	87	222
38	97	88	224
39	99	89	227
40	102	90	230
41	105	91	232
42	107	92	235
43	110	93	237
44	112	94	240
45	115	95	242
46	117	96	245
47	120	97	247
48	122	98	250
49	125	99	252
50	128	100	255