

PossumLink

A joint project between Link ElectroSystems
and Possum Bourne Motor Sport

Series 5 WRX

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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..99, 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.

eg. 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 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)

VHIGH (555) Very high range “race” version (300 kPa max)

Use the adjust buttons to select the appropriate sensor. Check that the correct selection has been made by selecting the **TEST MAP** function. The display should show 102 kPa ± 5 at about sea level.

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: Sixteen zones are used to hold a

target boost value for each 500 Rpm interval between 500 and 8,000 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 16 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 16 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.

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. During operation, a number of symbols (annunciators) will appear to show the system status:

V = Vacuum - Manifold Air Pressure (MAP) is in a very high vacuum (over-run) condition. The system will hold the current settings.

T = TPS - Throttle is not fully closed. System will hold current settings.

+ - Idle RPM is too low. The stepper motor is increasing the idle speed.

- - Idle RPM is too high. The stepper motor is decreasing the idle speed.

= - Idle RPM is correct. The current stepper position is held constant.

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 96 fuel zones arranged in a rectangular grid consisting of 6 ROWS by 16 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..99

ZONE IGN There are 96 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 = $27^{\circ} + 10^{\circ}$ 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), 4 units are added (UP) to zone 230, then ALL zones along ROW 2 (200..275) 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 96 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	35%	
RPM LIMIT	7300	
MAP LIMIT	210 kPa	
ADV LIMIT	27	
MAP =	STD	
KNOCK (0)	ON	
ACCEL Z = 1	10%	
COLD (88)	0%	
VOLTS V = 13.8	15	
STORE		(Both Adjust together)
RELOAD		(Both Adjust together)
ZONEFUEL 105	37%	(Row 1, 500 - 1,000 rpm)
ZONE IGN 105	11	
ROWFUEL (1)	37%	
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 six 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. The 96 adjustable zones effectively become 32,000 micro zones after interpolation.
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.

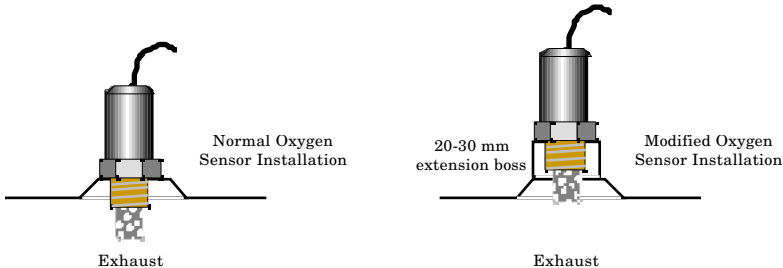
Closed loop operation involves the use of an exhaust gas oxygen sensor (Lambda probe) to provide the PossumLink with a feedback signal indicating the actual fuel/air ratio. This signal allows the PossumLink to make instantaneous corrections to the injector fuel flow until the required air/fuel ratio 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 Module 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 Module 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. The following Link Tuning Module functions will change when the LAMBDA control is switched on:
 - a. MASTER: Master works in exactly the same manner as in open loop mode except the corrections are automatic and result in the MASTER value being acted upon. The ADJUST buttons have no effect, and the display shows the current MASTER value which will change as the system makes corrections. (See previous cautions

regarding MASTER adjustment).

NOTE: Auto MASTER tuning will only occur while the engine RPM is greater than 2000 RPM, and all other closed loop conditions are met.

- b. ROW FUEL: Operation as per open loop mode except fully automatic. ROWFUEL adjusts ALL zones in the current ROW irrespective of the current RPM value. ADJUST switches have no effect, and display shows value of the current fuel zone. Operating conditions apply as per MASTER. (RPM > 2000 etc.)
- c. ZONE FUEL: Fully automatic zone fuel tuning. Operation identical to ROWFUEL except corrections effect ONE zone only, rather than the entire row. There are no RPM restrictions, but normal closed loop criteria apply.

This is the mode in which the majority of the tuning should 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>Target Zone</u>	<u>Conditions</u>	<u>Fuel Zones</u>	<u>Comments</u>
26	Less than 1500 rpm Rows 1 & 2	100; 105; 110; 200; 205; 210:	“Idle” block. Normally set slightly rich for good stability
27	Greater than 1500 rpm Rows 1 and 2	115 - 175 215 - 275	“Cruise” block. Normally set relatively “lean” for good economy.
28	Row 3, all rpm 0.8 - 1.2 bar	300 - 375	“Power” or full throttle block for non-turbo engines. Set medium rich for power and safety.
29	Row 4, all rpm’s 1.2 - 1.6 bar	400 - 475	Low boost for turbo engines. Medium rich for detonation & exhaust temp control.
30	Row 5, all rpm’s 1.6 - 2.0 bar	500 - 575	Medium boost for turbo engines. Medium / full rich (see row 4 comments).
31	Row 6, all rpm’s 2.0 bar +	600 - 675	High boost. Usually very rich to control temperature and detonation. Actual value depends on engine geometry and 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. Typical tuning procedure.

1. Tune engine manually until reasonable results are achieved.
2. Turn on closed loop system (LAMBDA = ON).
3. Select CLAMP or RPM limit (either side of MASTER) and bring vehicle up to a medium power cruise on a suitable road (preferred) or dyno. Select MASTER and observe the display. See previous cautions regarding adjusting MASTER.

After a few seconds the numbers will start to change as the system starts auto-tuning. Try and maintain a steady power setting until the display stabilises, then select CLAMP or RPM limit to cease the MASTER auto-tune. Try not to let the system auto-tune in unrealistic driving situations (idle or full power) since the purpose of MASTER setting is to find a value that represents a good compromise value at medium power. If at any time you are unable to maintain steady conditions (traffic, corners etc.) then shift the Link Tuning Module off MASTER until you regain suitable conditions.

4. Select ROWFUEL and basically repeat the above (3) procedure remembering that slope has 3 stages (normally aspirated) or up to 6 stages (turbo). Once again, drive the vehicle to allow some stabilisation time for each ROW until the display numbers stabilise. You will probably notice some interaction between ROWS as the system zeros in so repeat the exercise until things look fairly stable. A STORE operation at this point may be advisable to lock in the corrections so far.
5. Select ZONE FUEL and continue the process. Zone Fuel

makes localised corrections throughout the entire operating range so be prepared to spend some time exploring the range, especially at low speed, light throttle where the majority of driving will occur for a street car. Remember to STORE all the corrections BEFORE turning off the engine!

6. Once tuning is complete, select the TEST function, INJ/OXY, or disconnect the Link Tuning Module. This will enable the "continuous" closed loop function to make the necessary day to day corrections on a limited range basis.

The limited tuning range of this mode is sufficient to compensate for normal variations in temperature, fuel types, engine aging etc., but limited to prevent gross mis-fueling should the oxygen sensor or associated wiring develop a fault.

Periodic "tune- ups" may be done by connecting the Link Tuning Module and driving the vehicle while TEST or INJ/OXY is selected, and then initiating a STORE function. The temporary corrections made during the calibration drive will then be stored, and the Link Tuning Module may then be removed.

7. Tuning Port

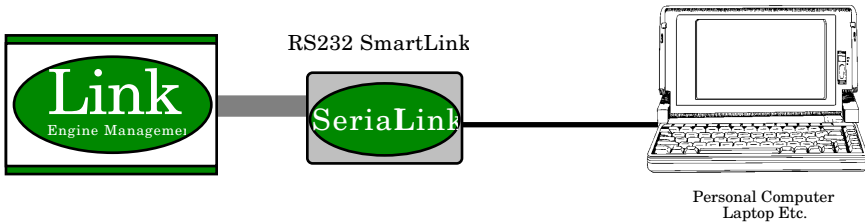
The fourteen pin connector located at one corner of the circuit board allows connection of various tuning and diagnostic tools to the system. All devices use a fourteen line flat ribbon cable, and connectors are keyed to prevent incorrect installation. The following devices are currently available.

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.

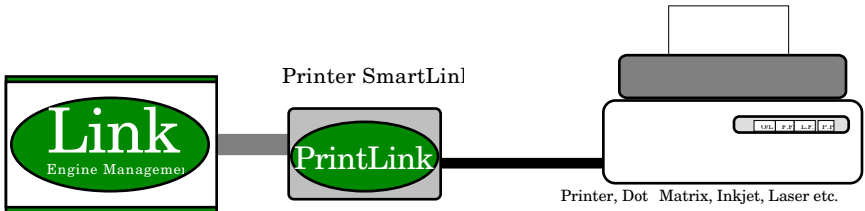


SerialLink



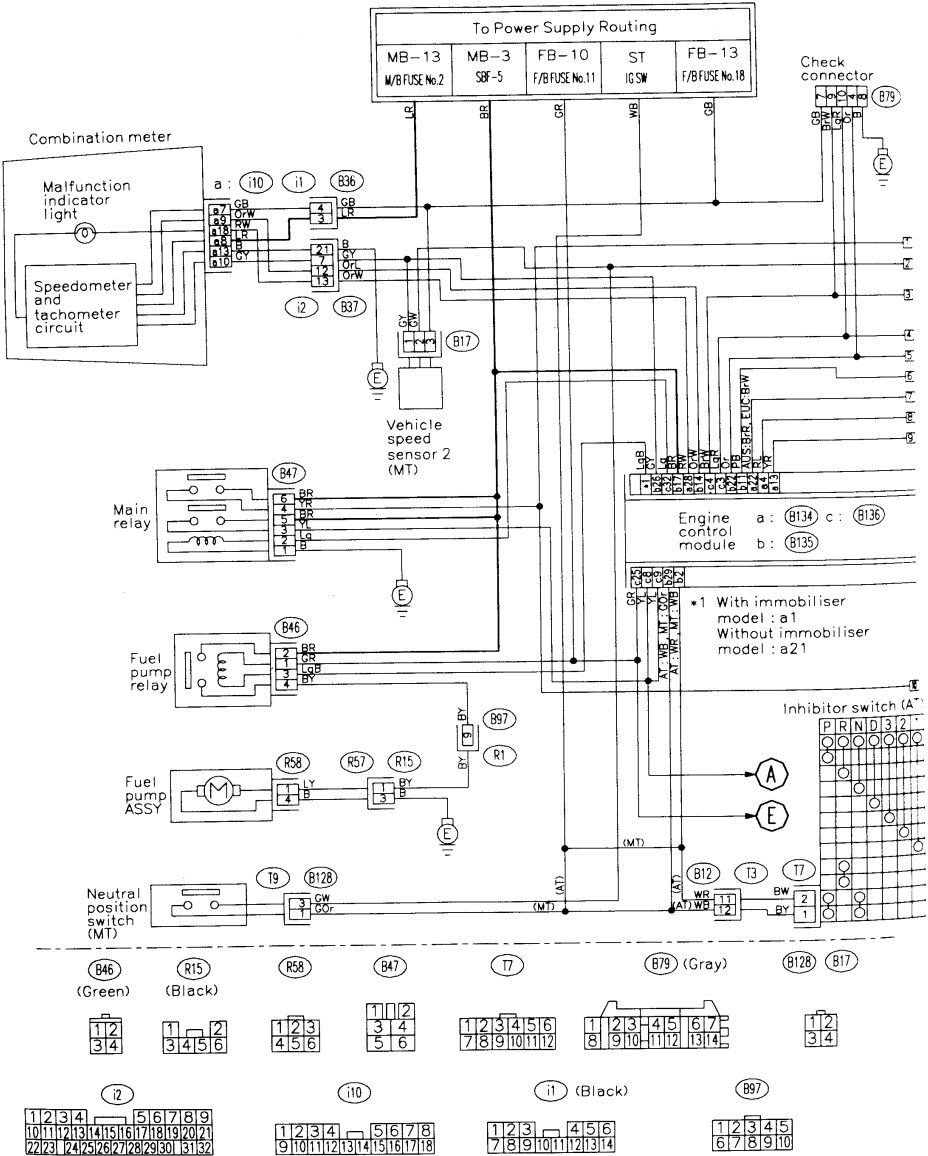
The SerialLink allows communication between the PossumLink and a personal computer via the PC's RS232 serial port for data-logging and downloading of the PossumLink settings. While the engine a stream sent to the PC shows all major engine parameters such as RPM, pressures, temperatures and flows. The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

PrintLink

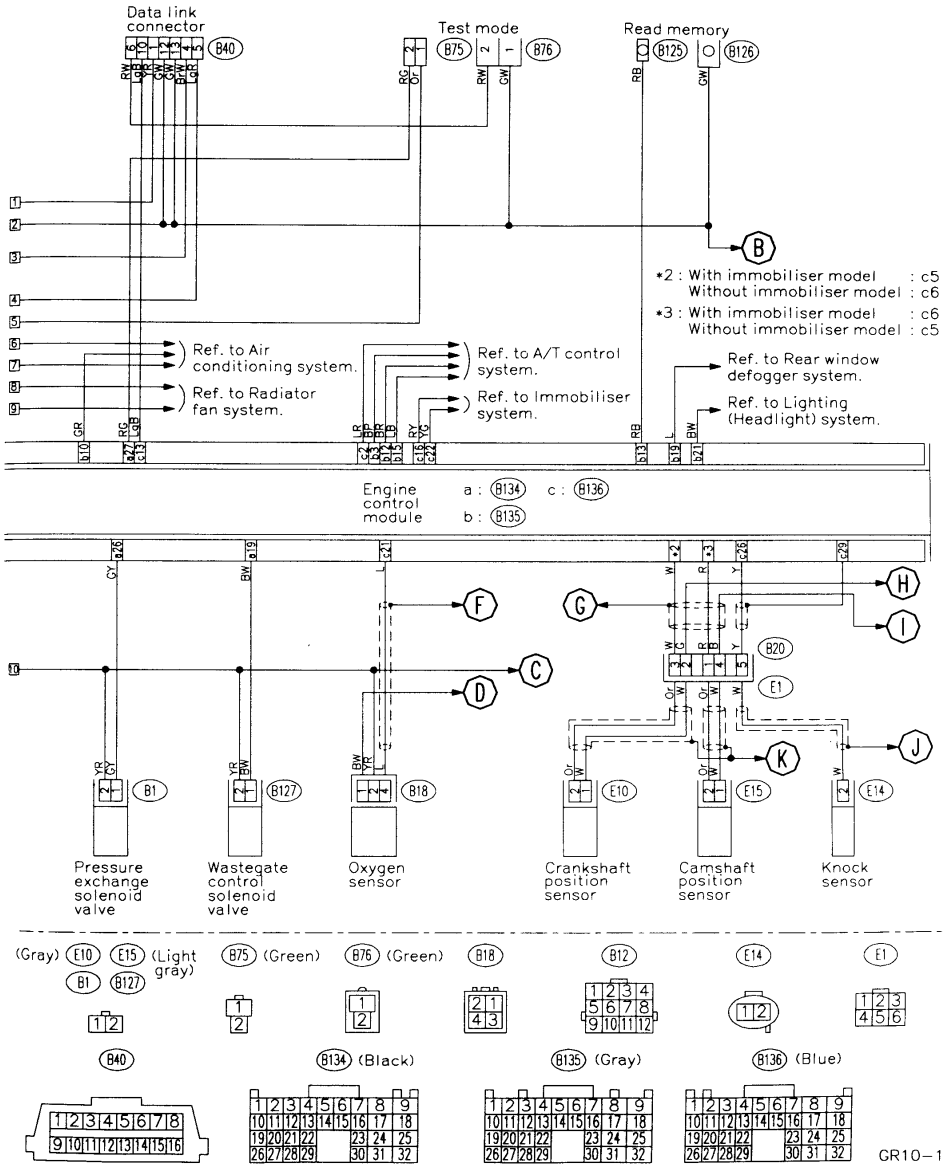


The PrintLink is similar to the SerialLink above except that the PrintLink connects directly to any type of printer for instant hard copy data. An alternative option is to use a battery backed “printer buffer” to store information while test driving and then downloading the buffer to a printer. Typical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

Engine Electrical System (RHD)

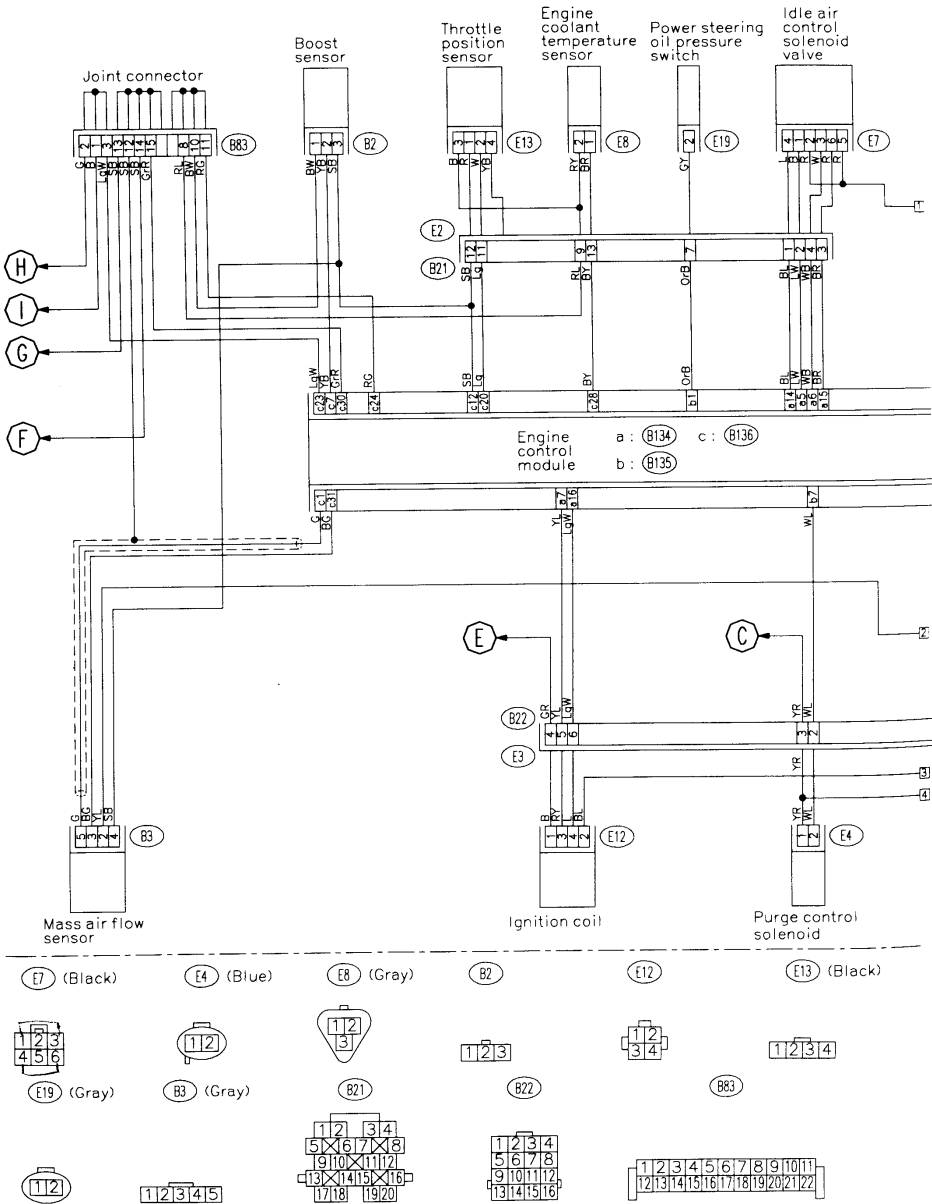


Engine Electrical System cont.



GR10-10

Engine Electrical System cont.



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

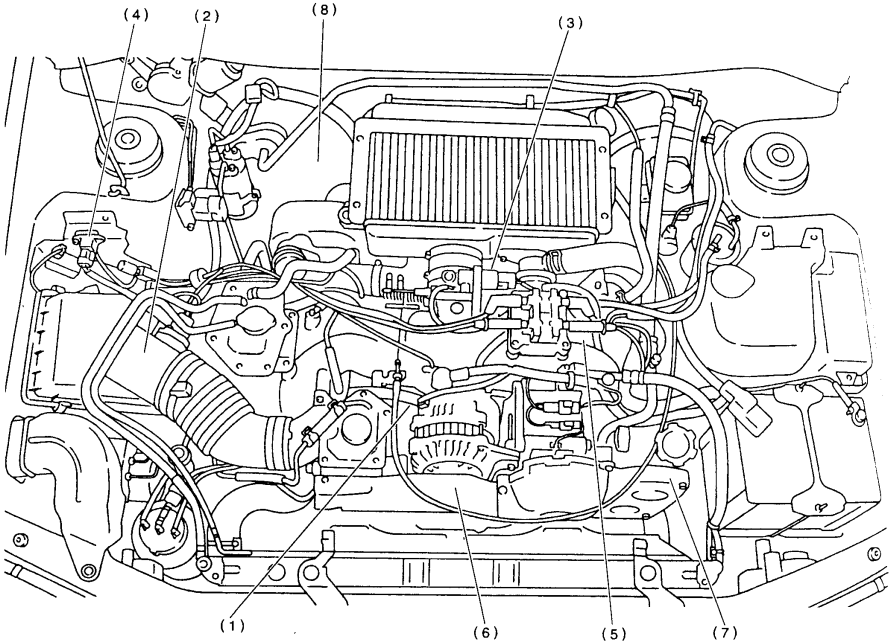
* With immobiliser

Factory and PossumLink I/O Signal

Content		Connector No.	Terminal No.		Signal (V)		Note
					Ignition SW	Engine ON (Idling)	
					ON (Engine OFF)		
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	0	—
	B136	1*	21	0	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

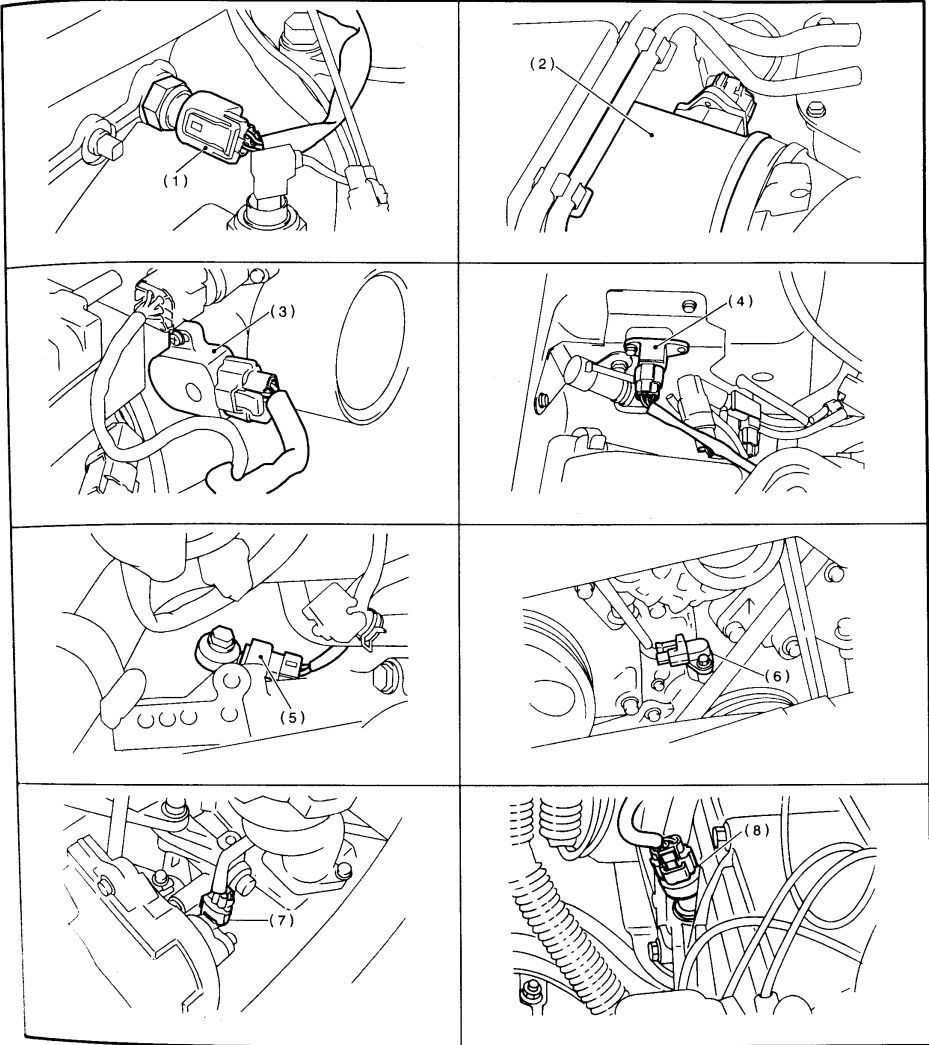


- (1) Engine coolant temperature sensor
- (2) Mass air flow sensor

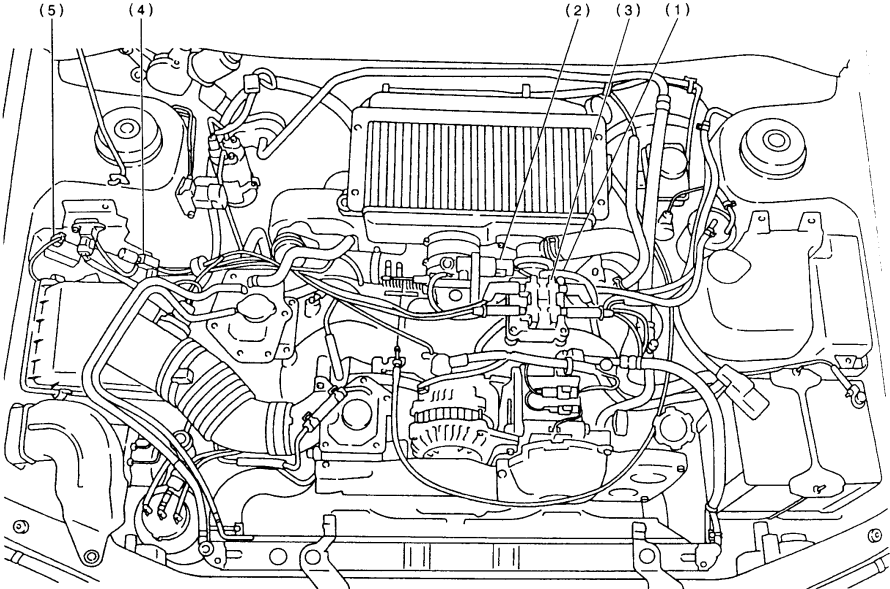
- (3) Throttle position sensor
- (4) Pressure sensor
- (5) Knock sensor

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

Component Location



Solenoid Valve, Emission Control System & Ignition System



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

