IntegraLink & CivicLink

Plug-in, fully programmable Engine Management System for the Honda Integra & Civic

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By Link ElectroSystems Ltd.

Please note: The term IntegraLink throughout this manual can refer to both the CivicLink as well as the IntegraLink

Table of Contents

1. SYSTEM INSTALLATION

The factory computer is located behind the passenger's side kick panel as shown in Figure 1.1 To gain access remove the two nylon button screws and carefully pull off the plastic cover. The computer will now be visible. The next step is to remove the computer. Use a 10mm socket to remove and loosen the bolts that secure it. Note a light metal bracket is used to protect the wiring harness, which will pull free exposing the main connector when the bolts have been removed. With the battery negative disconnected carefully unplug the wiring harness and remove the factory computer (ECU) from the vehicle.

Figure 1.1 - ECU Location

Board Replacement

1. Remove the ECU cover. These are factory "Loctited" and usually difficult to undo.

Caution
Static Electricity Hazard

2. Remove the screws retaining the circuit board (these include screws on the side of the enclosure). Lift the circuit board clear of the aluminium case. Insert the Integra/CivicLink board and replace the retaining screws.

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 “Link 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 the plastic cover and nylon button screws.

5. DO NOT under any circumstance try to start the engine. There are several basic tests to be carried out first. Refer to Section 2 for information.

2. PRE-START SETUP PROCEDURE

The aim of this procedure is to ensure ALL sensors are connected and configured correctly. Firstly install the Integra/CivicLink as detailed in Section 1. DO NOT attempt to start or drive the vehicle. The Tuning Module or PCLink software can be used to setup the Integra/CivicLink but the Tuning Module is recommended for first time users. For information on the Tuning Module and location of various functions refer to Section 3. For information on connecting the Integra/CivicLink to the Windows PC tuning software, refer to Section 19.

Carefully follow the step by step instructions ensuring all the readings are within the specified values.

Step 1: Plug in the Tuning Module or connect the PCLink software. Switch ignition ON.

Step 2: Manifold Air Pressure. Check the MAP reading shows atmospheric pressure. This should read 100kPa ±5 at sea level.

Step 3: Engine Temperature. If the engine is cold, check the reading is consistent with this (i.e. less 30 degrees). Likewise a hot engine should reflect a reading >70 degrees.

Step 4: Inlet Air Temperature. If the engine is cold this should reflect ambient air temperature. If the engine is hot, heat soak can cause inlet air temperatures to rise above 50 degrees.

Step 5: System Voltage. A reading higher than 11.5V is acceptable. A lower reading indicates a possible power supply problem.

Step 6: Vehicle Model. Move to the *configuration* heading and select the vehicle model menu. This should match the vehicle the ECU is installed in. The options are Integra 96-99, Civic 92-98.

The following 2 steps are **COMPULSORY**. ALWAYS check and complete before starting and tuning the engine.

Step 7: TPS SPAN Setup. The position of the TPS may vary from engine to engine and MUST be checked. It is particularly important the “low” value equals 10 as this effects idle speed and fuelling. The Utilities Section describes the function of the TPS sensor and how to set the span. This information is duplicated below.

TPS SPAN Requirements. This should read 10 at closed throttle and 100 ±2 at full throttle.

TPS SPAN Adjustment. Move to the Utilities heading. Observe the TPS Span at closed throttle. If this does not read 10 use the ADJUST keys (Tuning Module) or mouse (PCLink) to select 10. Next fully open the throttle. This should read 100. If this is not correct, adjust. Once satisfied, return the throttle to the closed position and observe the “low” value. This may have changed so reset to 10. The “low” and “high” values interact so it will be necessary to repeat the procedure until the Span is set correctly. Select STORE and store this setting before proceeding.

Note: If the TPS is used for Mixed Mode Scheduling (see Section 13) NEVER readjust the closed throttle value of 10. The fully open throttle value can be adjusted anywhere between 100 and 255.

Step 8: Base Timing Adjustment. The base timing of the engine should now be retarded. With the distributor in its original position the Integra/CivicLink will produce a 20°BTDC base timing. This is too advanced and may cause the engine to detonate. Figure 2.1 illustrates the location of the distributor. Loosen the three bolts and rotate in a clockwise direction to retard the spark. Next select the ADV LIMIT menu from the * IGNITION * heading and set to zero. This will prevent the Integra/CivicLink scheduling any electronic advance and will provide spark at base timing. Now start the engine. At idle check the timing is approximately 10°BTC. The RED mark on the front pulley indicates 20°BTDC and the WHITE mark is TDC (set midway between Red and White marks). When finished switch the engine off and re-tighten the bolts.

Note - The ADV LIMIT will return to its default value when the engine is switched off provided a STORE has not been initiated.

Retard base timing
(clockwise direction)

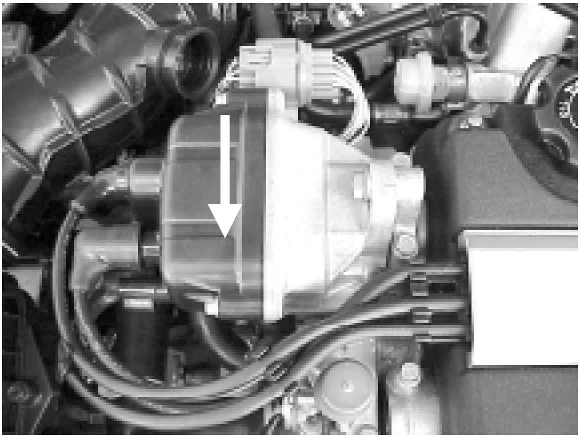


Figure 2.1

Once Step 7 has been completed the vehicle can be driven and tuning can begin if required.

3. TUNING MODULE FUNCTIONS

The Link Tuning module allows all aspects of fuel, ignition, boost and utility functions to be adjusted, edited and stored. This section will describe the functions available on the Integra/CivicLink.

Menu Structure

Each function is allocated a menu from which adjustments can be made. The first 7 menus are read only providing real-time information about the engine. The remaining adjustable functions for simplicity have been grouped under an appropriate heading, designated by the '* ' symbol. For example, all functions related to the fuel map such as MASTER, ROWFUEL, ZONEFUEL have been grouped under one heading. These tuning functions can only be accessed from this heading using the EDIT buttons. All read only menus and headings are displayed in upper case and all adjustable functions displayed in lower case. Figure 3.1 illustrates this menu structure.

Tuning Module Buttons

The SELECT Buttons allow scrolling through the read only menus and main headings. From any main heading (shown by the * symbol), pressing EDIT down will allow access to the grouped tuning functions. Pressing EDIT up will return the menu to its main heading. The EDIT buttons are also used to move through the Zone Editor, which appears as the last menu. (See Section 17 for more information on the Zone Editor.) To change a value use the ADJUST buttons.

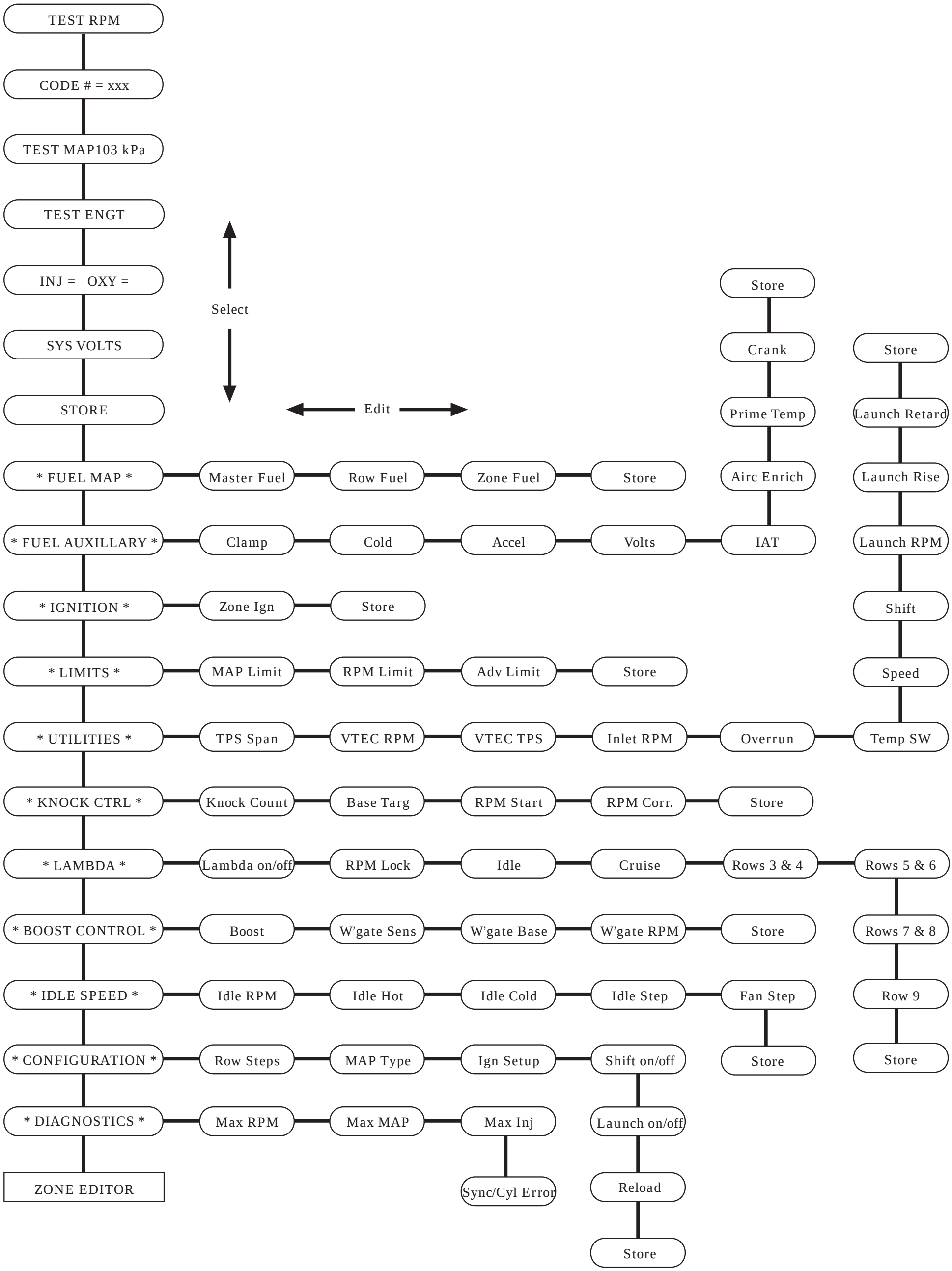


Figure 3.1 Integra/CivicLink Menu Structure

Read Only Functions

☞ Ignition switch (key) must be OFF before installing any device.

When the key is switched on, the Integra/CivicLink will automatically determine which device is fitted and run the appropriate software to support it.

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

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 Integra/CivicLink will show "****" on the display and all functions will be available. A "locked" Integra/CivicLink will show a three digit number which must be changed using the ADJUST buttons to the correct value and then "STORE" to unlock the Integra/CivicLink. The only menus available when locked are read only. All other menus will display the ACCESS DENIED message.

TEST MAP 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 shows the current engine coolant temperature in degrees Celsius.

INJ/OXY this displays the actual injector duty cycle as a percentage e.g. 28% indicates that the injectors are flowing 28% of their maximum volume. The OXY display shows the output signal of the oxygen sensor in volts. Refer to the Lambda section for more information.

SYSTEM VOLTS This menu displays the current operating voltage of the battery.

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 be stored.

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

4. FUEL

Functions

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.

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.

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/Throttle Position 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/TPS 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.

Note: The fuel pump can be activated with the engine off. To start move to the “TEST RPM” menu, then press and hold both ADJUST buttons. This will force the pump into high speed mode for the purpose of a fuel flow test.

5. FUEL AUXILIARY

Functions

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.

COLD (POST-START WARM-UP) 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. Note this is the temperature-decayed-value rather than the full cold value. The number shown in parenthesis (xxx) is the actual engine temperature for monitoring purposes.

ACCEL When the throttle is abruptly opened, the air-mixture is leaned out briefly. To achieve good throttle response acceleration, enrichment is required. There are 4 ACCEL zones, the first 3 covering a 2000-RPM span, the last zone covering a 4000 RPM span. By definition:

ACCEL zone 1 covers 0 - 2000 RPM

ACCEL zone 2 covers 2000 – 4000 RPM

ACCEL zone 3 covers 4000 – 6000 RPM

ACCEL zone 4 covers 6000 – 10000 RPM

By using 4 zones it allows the enrichment to be optimised and set for varying conditions. The amount of enrichment is dependent on rate of change, and engine temperature. 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).

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 (Integra/CivicLink) 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.

INLET AIR TEMPERATURE (IAT) Allows adjustment for compensation of inlet air temperature on air/fuel ratio. Cold air is denser, so for the same throttle position, the volumetric efficiency of the engine will reduce as air temperature increases. As inlet air temperature rises the fuel is reduced to compensate for the lower air density. The number in brackets shows the actual air temperature in degrees Celsius. The fuel correction number is displayed on the right.

AIR CONDITIONING ENRICHMENT From this menu extra fuel can be added when the Air conditioning is switched on. When the AirCon compressor is engaged the extra load can cause unstable idle, so extra enrichment can be introduced to help stabilise this. The default value is 0 implying no added fuel. The enrichment is only active below 1500 RPM. To change this setting use the adjust buttons.

PRIME TEMPERATURE This allows the pre-start injector prime temperature to be adjusted. At low temperatures the mixture formation is inadequate to start the engine. This is due to the poor mixing of air and fuel, as well as fuel condensation on the cylinder walls. To compensate for these losses, if the engine temperature is BELOW the prime threshold at key-on, the engine will receive a short injector shot to assist starting.

Note: this setting is checked when the Integra/CivicLink is powered up, so any adjustment will only take effect if the power is recycled. Use the ADJUST buttons to alter the temperature.

CRANK ENRICHMENT This is the amount of extra fuel added while the engine is cranked and for a short period after starting. It is a temperature dependent enrichment and only effective when the engine temperature is below 50^{o}C. The actual value used by the Integra/CivicLink will provide more crank enrichment with decreasing engine temperature and will decay with time.

The SMALLER the number, the GREATER the enrichment. The base default value is 70.

6. IGNITION

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).

7. LIMITS

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

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.

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. 170 KPa = 9 psi boost

200 KPa = 15 psi boost

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

8. UTILITIES

8.1 Functions

TPS SPAN The Throttle Position Sensor is used in the control of:

- Idle speed control
- Boost control
- Fuel cuts

The 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 <u>must</u> always be set unless otherwise specified. Refer to Section 8.2.

VTEC RPM Sets the RPM at which the Vtec solenoid will be engaged and uses 200 RPM of hysteresis.

VTEC TPS When the throttle position is above this number the VTEC solenoid will be engaged.

Note: The switching of the VTEC solenoid is a function of RPM and throttle. Both conditions must be met before the solenoid is energised.

INLET RPM (Post ‘96 Integra) Sets the RPM at which the Inlet Runner control system is activated. At a preset RPM 4 bypass butterflies inside the manifold are opened, providing a shorter inlet path to the combustion chamber. The switching uses 200 RPM of hysteresis.

OVERRUN VACUUM This represents the engines MAP when it is running in overrun vacuum. It is a target value used by the Integra/CivicLink to aid in idle speed and fuel control. When the engines manifold air pressure drops below this target, various tasks are actioned. As this value is a function of the engine modification state, it will vary and should always be adjusted as described.

Overrun Vacuum Setup: Observe the engines Manifold Air Pressure as the throttle is fully opened. Allow the engine to reach around 4- 5000 RPM then snap the throttle closed to put the engine in overrun vacuum. Now record the LOWEST MAP. Use this number subtract 2 and enter this value as the overrun vacuum number. The units are kPa.

TEMP SWITCH (Not applicable on some models) 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 preset value.

SPEED Displays the vehicle's speed in kph.

SHIFT The CE (Check Engine) light can be configured as a shift light. If the menu displays 'N/A' this function is not activated. Use the *Configuration* menu to activate it. The ADJUST buttons will change the shift RPM in steps of 100RPM.

Launch RPM

The Launch RPM can ONLY be adjusted if this function has been activated from the * CONFIGURATION * heading. This sets the RPM at which the engine will limit when the launch system is activated via a clutch switch or gear knob button. See section 8.3 for setup information.

Launch Rise

Sets the rate of rise of RPM after the clutch has been released. Effective range = 800/sec to 25,000/sec. Default = 3000/sec.

Launch Retard 25

Sets the amount of ignition timing retard while the clutch is depressed. This value is SUBTRACTED from the current advance angle value right down to zero degrees (TDC), but not beyond. This feature should help improve turbo spooling prior to launch. Set to 0 if no retard is required. Default value = 25 degrees.

8.2 Setting TPS Span using the Tuning Module

With the throttle fully closed, note the displayed value on the Link Tuning Module. Use the ADJUST buttons to set the "low" value of 10, then fully open the throttle and note the new value. The TPS must be spanned 10 to 100. Use the ADJUST buttons again to set the "high" value of 100 and then fully close the throttle and observe the "low" value. This will probably have changed so reset to 10 again. The "low" and "high" interact, so it will be necessary to repeat the procedure until the required values are achieved. Select STORE and store the settings before proceeding.

8.3 Launch Control Setup

This function allows full throttle stationary launching and full throttle upshifts. When launching a vehicle from stationary, the throttle fully open and the clutch engaged, the Integra/CivicLink will limit the engine to an adjustable preset RPM. When the clutch is released, the hard limit is turned off, replaced by the "Launch Rise" function which controls the rise in engine RPM. When the next gear is selected by depressing the clutch, the driver can keep full throttle, as the Integra/CivicLink limits the engine RPM while the clutch is engaged.

Advantages

On a normally aspirated engine it allows smoother and quicker gearshifts with less wear on gearbox components. On a turbo charged engine as well as the above benefits, it allows boost to be maintained during gearshifts. If the throttle is temporary closed the air in the inlet manifold is stalled which means a small lag in boost recovery when the throttle is opened.

Procedure

Hardware Installation: A clutch switch MUST be fitted. It should be positioned so the switch makes contact when the clutch pedal is fully released. This allows the clutch 'weight' to be taken up when the launch system is activated. When the pedal is fully released the switch makes contact which deactivates the launch system.

Clutch System Requirements: This MUST be a NO (Normally Open) switch. With the clutch engaged, the switch should be an open circuit. With the clutch fully released the switch should be closed.

Wiring of Clutch Switch: The factory ‘Power Steer’ input is used to feed the clutch position into the Integra/CivicLink. Cut this wire and re-terminate to the clutch switch as shown in Figure 8.1.

> Note: The Power Steer Input may be used as part of the ISC system. This function cannot be used when launch control is required. Zero this function under the Idle Speed menu.

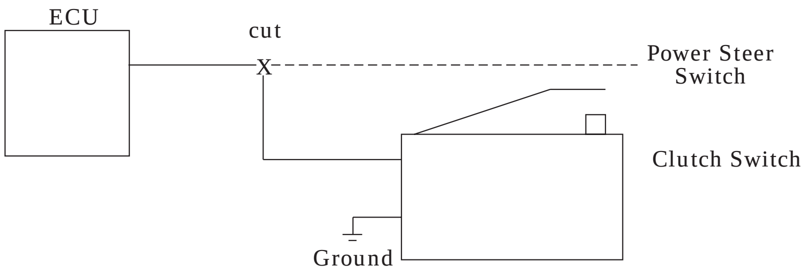


Figure 8.1

Terminate the second terminal of the clutch switch to ground. Refer to Appendix D/E/F for the location of the power steer wiring (Connector C pin 16 for post ‘96 Integra), (Connector B pin 8 for 92-96 Civic).

To activate launch control: Move to the * CONFIGURATION * heading. Use the EDIT DOWN button to move to the Launch control menu and press the ADJUST UP button. The Tuning Module will display "Launch Ctrl = ON". Next move to the Launch RPM menu under the *UTILITIES * heading.

- The clutch switch should now be checked to ensure it is correctly connected. On the Launch RPM menu a "*" will appear when the clutch is depressed to the floor. Release the clutch.

- The “*” symbol should disappear. If not, re-check the wiring.
- Adjust the Launch Rise and Launch Retard as required.
- Next select the required RPM by using the ADJUST buttons.

9. KNOCK CONTROL

Knock control uses a block mounted, piezo electric microphone (knock sensors) to "listen" for abnormal engine noise / vibrations which occur when the engine detonates (knocks). Analogue filters inside the ECU reject the majority of unwanted signals but the software processing this signal requires a certain amount of discrimination. Once a knock event has been detected, ignition timing is removed from the current ignition zone (1 of 200). The maximum amount of retard is six degrees from any one zone, although the system will not retard beyond zero degrees electronic advance (base timing).

E.g. If original zone value was 5 degrees, then at maximum retard produced by the Integra/CivicLink would be ZERO, not -1 degrees.

☛ Note: All Corrections are temporary unless stored i.e. they will be lost when the key is turned off.

This arrangement allows the system to be more adaptive to the current conditions. For example, driving one day with poor fuel will cause the system to make corrections where necessary but with no long-term storage. This means when superior fuel is used or climatic conditions change, the ignition map will have a "clean slate" rather than previously compromised values.

☛ Note: ‘92-’96 Civic does not have a factory knock sensor. If Knock Control is required insert a wire into connector D pin 5.

The 3 main adjustments for the knock system are:

- Set Base Target
- RPM Target Correction
- RPM Start Point

Functions

The following functions are available from the Knock heading.

1. Knock Count

   A "knock event" occurs when the engine noise, transmitted by the knock sensor exceeds the Knock target. Once detected, the current ignition zone has one degree of timing removed and the Knock Count is incremented by one. To switch OFF press the ADJUST DOWN button and the menu will display "Knock Limit OFF ". Pressing ADJUST UP will reactivate the knock control system displaying "KNOCK (xxx)   zzz".

   - xxx = Knock Count. This is the total number of "knock events" detected by the system for this current run.

     zzz = Knock Signal. Shows the actual "processed" knock signal fed into the microprocessor. This value should be small at idle (type less than "10") and increase with RPM and load (boost) as the background noise rises i.e. The signal will always rise with increasing power at a PROGRESSIVE rate if there is no detonation. The amplitude of the Knock Signal will depend on knock sensor position and the engines type/modification state.

     For example a Knock Count of 5 (xxx = 5) indicates the knock level processed from the engine, has exceeded the Knock target 5 times.

NOTE: Any changes (ON/OFF) are automatically stored.

2. Knock Base Target

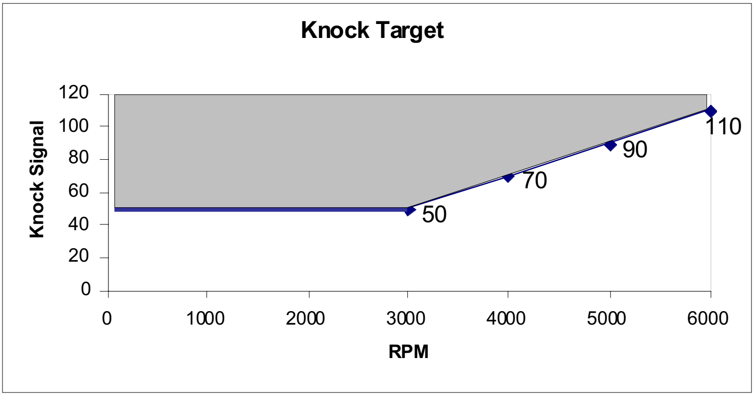
   This allows the knock base target to be set. This is the amplitude of the Knock signal when the engine starts to generate noise. From this point, engine noise will normally rise as the RPM and load increases. To match the Knock target to the engines noise profile the target requires RPM correction.

3. Knock RPM Correction

The microprocessor uses the base target and RPM correction to produce a knock target that is proportional to RPM i.e. at higher engine RPM more "noise" is generated, hence the knock threshold needs to be increased. For every 1000 RPM the RPM correction value will be added to the Base Target. Intermediate values will also be calculated.

Example 9: Base Target of 50 starting at 3000 RPM.

RPM Correction = 20



RPM	Knock Target
3,000 & less	50
4,000	70
5,000	90
6,000	110

The example illustrates the knock target as it varies with RPM. If the Knock signal enters the gray region a knock event will be generated and timing will be removed. Note: Below 3000 RPM the Integra/CivicLink uses the "base target", having no RPM compensation.

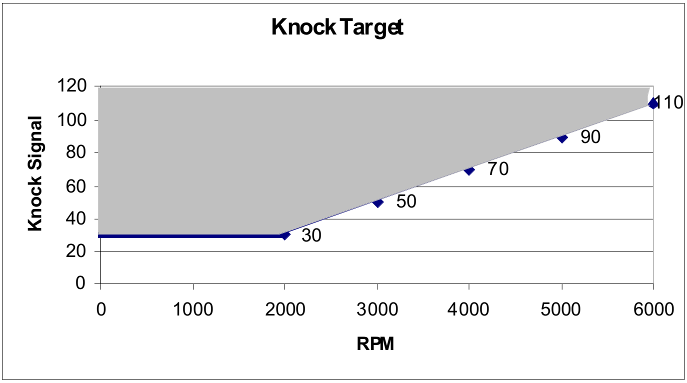
4. Knock RPM Start.

The last adjustable factor that will vary from engine to engine, is the RPM point where the engine begins to generate noise. It can range from 1000 through to 4000. See Example 9.1.

Example 9.1: Base Target of 30

RPM Correction = 20

RPM Start = 2000



RPM	Knock Target
2,000	30
3,000	50
4,000	70
5,000	90
6,000	110

If the knock level enters the "grey" region, ignition will be removed from the engines current ignition zone. Note below 2000 RPM the "base target" is used, having no RPM correction.

The default values for the Integra/CivicLink are:

Base Target	=	30
RPM Correction	=	40
RPM Start	=	2000

10. LAMBDA

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 Integra/CivicLink with a feedback signal indicating the actual fuel/air ratio. This signal allows the Integra/CivicLink 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 Integra/CivicLink is able to "tune" itself throughout the entire operating range simply by driving the vehicle and allowing the Integra/CivicLink 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 +/- 21 (ZONEFUEL) prevents excessive errors if the oxygen probe is damaged or misreading.

2. Continuous mode (Tuning Remote disconnected): The Integra/CivicLink 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 +/-8 (ZONEFUEL) prevents excessive errors if the oxygen probe is damaged or misreading.

10.1 Functions

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.

Lambda ON Press the ADJUST UP button to switch ON the Closed Loop Lambda Control. To switch OFF press the ADJUST DOWN button.

PLEASE NOTE: The oxygen sensor (and associated wiring) must be 100% serviceable if the tuning option is to be used. Failure to meet this requirement may result in engine damage if not carefully monitored.

RPM LOCKOUT This will prevent the Closed Loop System operating below this target RPM, independent of manifold air pressure. The default value is 500RPM. To change use the ADJUST button.

LAMBDA TARGET The next 6 menus allow the Lambda Targets to be edited.

10.2 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 manifold as close as possible to the cylinder head (rather than down the tail-pipe) to ensure fast response. 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.

CAUTION: The oxygen sensor (and associated wiring) must be 100% serviceable if this tuning option is to be used. Failure to meet this requirement may result in engine damage if not carefully monitored

10.3 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 (i.e. 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 RPM
   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/TPS 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 (±21). Check for possible errors or system failure before STORING. (A 'STORE' function will store all current corrections and allow a further ±21 units 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.

10.4 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. Both engine RPM and manifold air pressure (MAP) are used to select one of six Lambda "target" values for the system to use as a reference.

10.5 Adjusting Lambda Targets

A separate block of zones are used to store the target values, adjustable from the * LAMBDA * heading on the tuning module. The default values loaded will depend on the type of "ROW STEPS" selected from the * Configurations * heading (For more information on ROW STEPS see section 13.2).

These values 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.

NOTE: The "cruise" target (zone 27) MUST be smaller than or equal to the "power" target (zone 28). The simple interpolator used on the lambda targets will not handle negative (reverse) trends.

10.5.1 Row Steps = Vacuum

In this mode the Integra/CivicLink will use the Zone Sheet shown in Appendix B, allowing a maximum of 200 fuel zones on a normally aspirated engine. Figure 10.1 illustrates the zones covered by each lambda target.

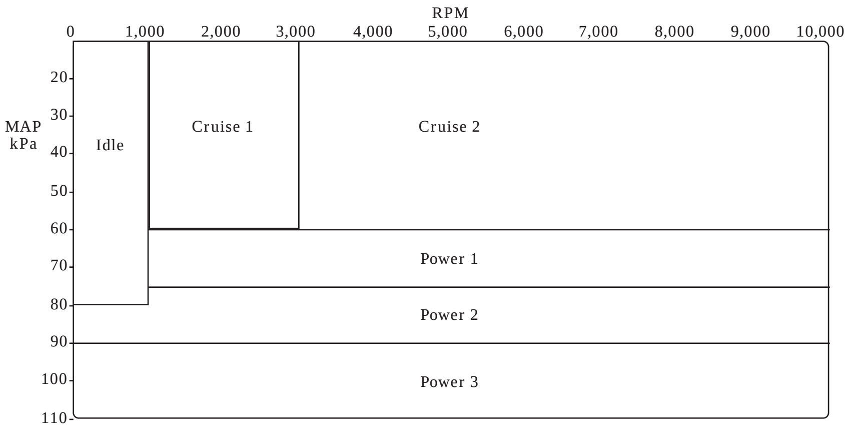


Figure 10.1. Lambda Target with Vacuum Row Steps selected.

Zone	Target Area	Target Value
26	Idle	84
27	Cruise 1	78
28	Cruise 2	79
29	Power 1	80
30	Power 2	81
31	Power 3	82

Table 10.0

The default lambda values are shown in Table 10.0

These values can be edited by moving to the * Lambda * heading on the tuning module, and selecting the appropriate zone.

10.5.2 Row Steps = Map, TPS, MAP+TPS

In this mode the Integra/CivicLink will use the Zone Sheet shown in Appendix A. Figure 10.2 illustrates the zones covered by each lambda target.

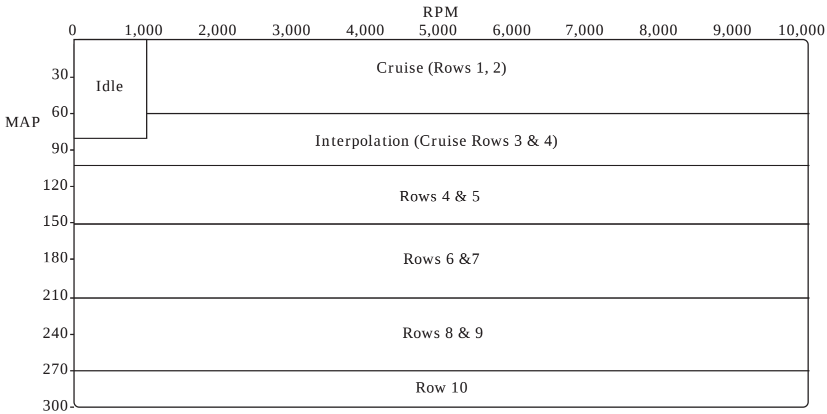


Figure 10.2 Lambda Target ROW STEPS = MAP, TPS, MAP+TPS

Zone	Target Area	Target Value
26	Idle	84
27	Cruise	78
28	Rows 3 & 4	82
29	Rows 5 & 6	83
30	Rows 7 & 8	85
31	Row 9	87

Table 10.1

The default lambda values are shown in Table 10.1

These values can be edited by moving to the * Lambda * heading on the tuning module, and selecting the appropriate zone.

10.6 Probe Voltage vs A/F Ratio

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.

11. BOOST CONTROL

If required, the Integra/CivicLink can offer Closed Loop Boost Control for engines that have been turbo charged. This Section provides hardware configurations and wiring information to achieve this.

Operation

Boost control is achieved by modifying the pressure signal between the waste gate actuator and the compressor outlet using a solenoid assembly. The valve has three ports arranged as follows and illustrated in Figure 11.1:

- common port is connected to the actuator
- pressure port is connected to the compressor outlet
- bleed port is vented to the atmosphere (usually via a filter)

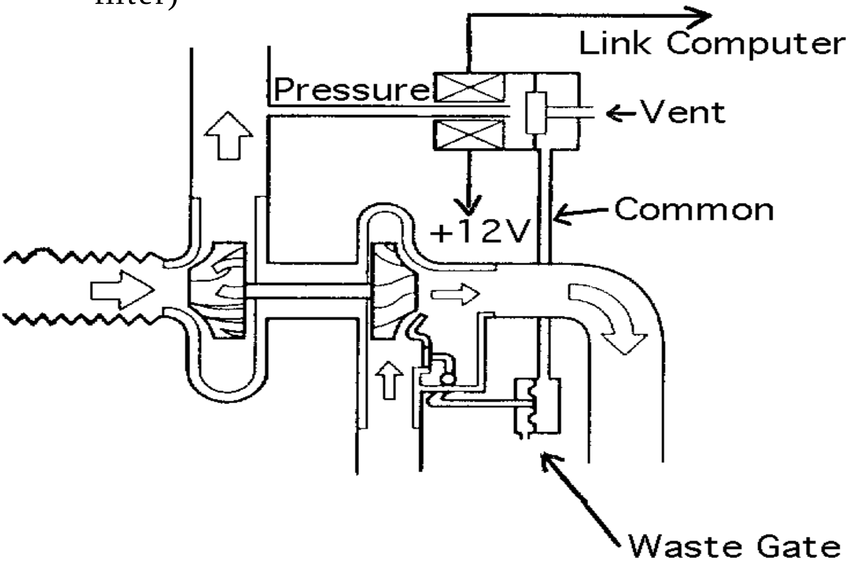


Figure 11.1

When the solenoid is de-energised the common and pressure ports are connected and compressor pressure is allowed to fill the actuator and open the waste gate. The actual boost pressure that results is entirely dependent on the waste gate construction and therefore determines the minimum boost for the system. When the solenoid is energised the common and vent ports are connected and the air pressure in the actuator is bled off to atmosphere. This causes the waste gate to close and boost to rise. By varying the ON/OFF ratio of the solenoid (duty cycle) any level of boost may be achieved and since the Integra/CivicLink is measuring the manifold air pressure (MAP) the boost may be precisely programmed and controlled.

Solenoid Types

The correct type of solenoid valve must be used and devices intended for this purpose should be used wherever possible. Some types of plastic bodied units may work satisfactorily but may not withstand the constant cycling imposed upon it and subsequently fail after several hours of service. In either case do check that the "sense" of operation is correct by blowing through the ports with the solenoid both energised and de-energised to confirm correct operation. Figure 11.2 shows the recommended three port solenoid which can be supplied with the Integra/CivicLink for turbo charged applications

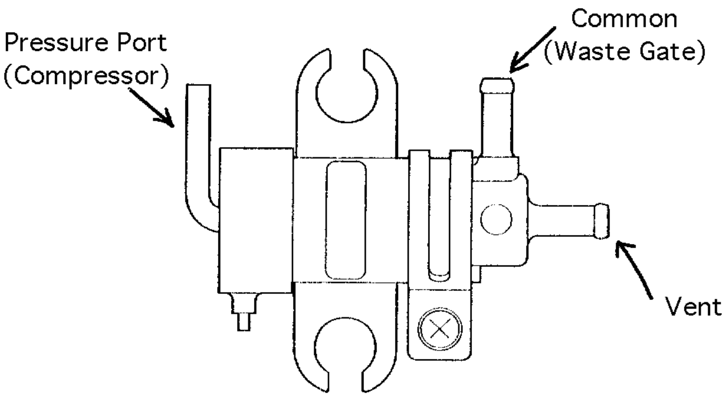


Figure 11.2 Three Port Boost Control Solenoid

Two Port Control Valves

Some OEM boost control systems use a simple two port solenoid rather than the three port type previously described. These basically work as “variable bleeds” and require some form of restrictor between the compressor (pressure source) and the boost control solenoid.

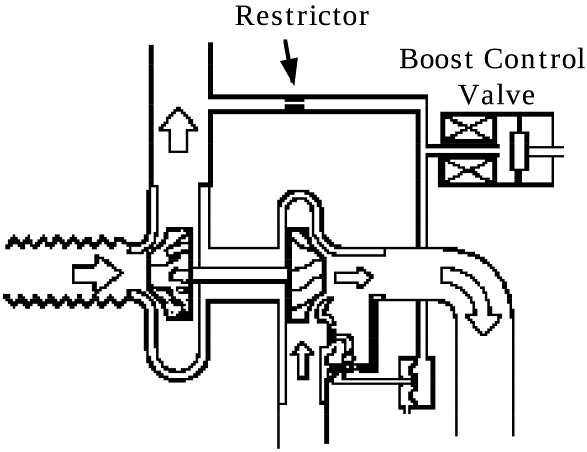


Figure 11.3

Typical size for the restrictor is 1.00 to 1.50 mm. The actual size varies somewhat depending on the wastegate construction, length of tubing between the pressure source and the solenoid, diameter of tubing etc.

If the restrictor is too small then boost will tend to overshoot since it limits the rate at which the wastegate will fill and therefore move the actuator arm. If the restrictor is too large the Integra/CivicLink will be unable to achieve high boost operation. The solenoid is unable to bypass sufficient pressure so the wastegate opens prematurely.

It is recommended that two port type solenoids be used for small to moderate increases in boost over the normal wastegate operating pressure and the three port types for high boost applications requiring higher precision and better control.

Wiring of Boost Control Solenoid

The Integra/Civic engine does not have any electronic boost control as original equipment, so requires some form of modulating valve to be fitted if ECU controlled boost is required. Using Figure 11.4 follow the wiring diagram noting the optional "defeat" switch which will force the system into a minimum boost mode. This may be useful if driving conditions are adverse, alternatively a hidden switch may be installed to prevent unauthorised high boost operation.

The boost control solenoid should be mounted in the engine compartment as close to the wastegate as possible. This will keep the pressure line to the solenoid as short as possible and minimise any signal delay.

The boost control solenoid signal is via the ECU terminal #C7, formally a diagnostic function. To connect to this wire locate the diagnostic plug below the passenger glove compartment. Figure 11.5 shows the connector. Pin 5 (Brown Wire) of this plug connects to pin #C7 on the 96-99 IntegraLink and pin #D4 on the 92-96 CivicLink. As the wire is located inside the vehicle, a extra wire will need to be run into the engine compartment and connected to the Boost Control Solenoid as shown in Figure 11.4. Note that this signal is an EARTH souring signal so the other side of the solenoid requires +12 volt key-switched supply.

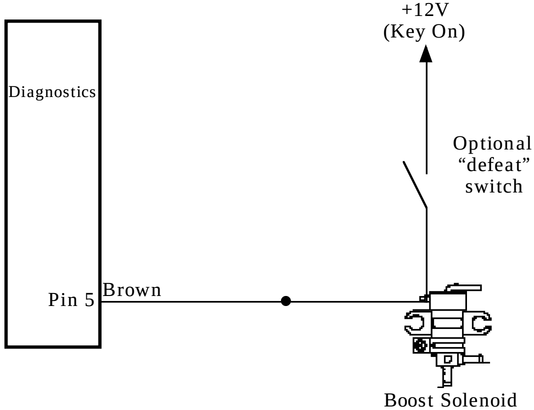


Figure 11.4 Boost Control Wiring

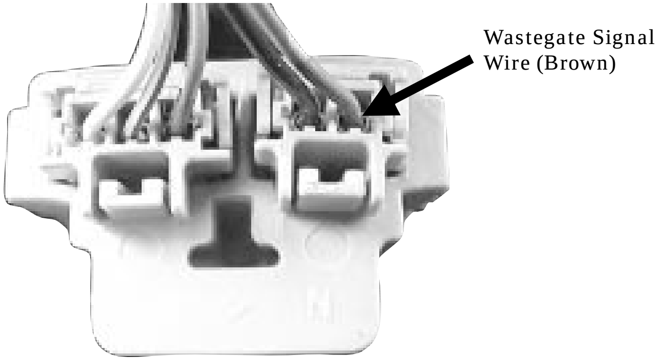


Figure 11.5 Diagnostics Plug

External Map Sensor

The factory Map sensor is capable of measuring 170kPa. If more boost is required an external Link Map sensor will need to be fitted. Figure 11.6 shows the location of the factory sensor. Unplug this connector and reconnect to the Link Map Sensor as follows.

Function	Link Map Sensor	Factory Map Sensor
Power (+5V)	Pink	White/Yellow
Ground	Green	Green/White
Signal	White	White/Yellow

Remember to run the vacuum line from the link map sensor to the manifold. Lastly move to the *CONFIGURATION* heading on the Tuning Module and scroll down to select Map = High 3 Bar. The Integra/CivicLink is now configured to use the external map sensor capable of measuring a maximum 300kPa. As a final check move to the TEST MAP menu on the Tuning Module. With the key on this should read 100kPa +/- 4 kPa at sea level.

Factory Map
Sensor

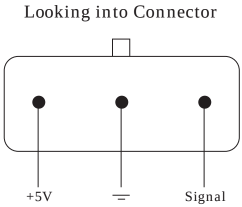
Figure 11.6 Map Sensor

Factory Map Sensor Wire Colour:

Yellow/White - +5.0V

Green/White - Ground

White/Yellow - Signal Wire



Note: The trace colour may vary on different models.

Electronic Boost Control

The computer software features a number of adjustment facilities for closed loop boost control and may be accessed by plugging in the Link Tuning Module before switching on the ignition.

Functions

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 e.g. 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. From the *BOOST CTRL* heading, 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. (See Section 17.)

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	Max for “std” MAP Sensor
180	12	
200	15	
220	18	
240	21	
250	23	

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 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 (e.g. 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.

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.

12. IDLE SPEED

12.1 Function

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. The value in parenthesis (xx%) shows the actual duty cycle of the idle speed actuator. This menu also contains an annunciator used to display the system status.

Annunciators

T	Throttle open
V	Engine in over-run vacuum
A	Acceleration fuel pending
=	Idle speed equals target value
+	System is increasing idle speed
-	System is decreasing idle speed

The default mode is when the annunciator shows T, V, A. In this state the system is using the IDHOT/IDCOLD default duty cycles. No idle speed correction will be performed in this mode.

IDLE DUTY CYCLE DEFAULTS There are 2 default values labelled "Idle Hot" and "Idle Cold". These are used by the software to preset the ISC duty cycle to about the correct value during gear shifts, over run vacuum, returning to idle etc.

IDLE HOT When the engine is above 50°C, the "Idle hot" value is the default duty cycle forced into the solenoid. This should provide an idle RPM close to the required value. To change use the ADJUST buttons.

IDLE COLD When the engine is below 20°C the "Idle Cold" value is the default duty cycle. Between this temperature and 50 the software will interpolate to create an intermediate duty cycle. To change use the ADJUST buttons.

AIRC STEP When an air conditioning request is generated, the Integra/CivicLink will increase the engines idle before engaging the compressor clutch. The default setting is 10, implying a 10% increase in duty cycle before engaging the clutch. This compensates for the extra load preventing idle surge or the engine stalling. Note that extra enrichment can also be added from the * FUEL AUXILIARY * heading.

FAN STEP Allows the idle to be increased before switching the radiator fan. The default value is 5%.

12.2 Idle Speed Setup

The Idle speed control system has three main adjustments for correct operation.

1. "IDLE (xx%) yyyz" sets the required idle speed in steps of 50 rpm. The (xx%) value shows the actual duty cycle to assist settings and monitoring. Use the ADJUST buttons to select the idle RPM.

2. Two default values for cold and hot engines.

   Hot Engine
   Select "IDLE (xx%) yyy z" on the remote and set the required idle speed. Once the idle rpm has stabilised note the duty cycle value shown in parentheses (xx%) and record the value. Select the "Idle Hot xx%" menu and enter the recorded value +/- 2%.

   e.g. Duty Cycle = 43% (stable hot idle) then enter a value of 45%

Cold Engine

Use the same procedure as above except note the duty cycle shortly after a cold start. Enter this value using the menu " Idle Cold   xx%" under the "IDLE SPEED" heading. The engines idle will always be higher when it is cold implying the IDLE COLD value will be larger than IDLE HOT.

Store the new value by moving to a STORE menu and holding both ADJUST buttons until the display shows "********" and then release.

Note that the software also generates an intermediate (warm) value, which is the average of the cold and hot settings but is not independently adjustable. If the target rpm is changed at a later date, the HOT and COLD default values may require adjustment.

3. To aid in the control of the Idle Speed solenoid the software uses TPS to determine throttle position. Always ensure the TPS "low" value is 10. This is the value used to determine closed throttle and MUST be set to ensure the correct operation of the Idle Speed system. See the * UTILITIES * Section for TPS setup information.

4. The Idle speed system will perform idle correction under the following conditions

   - TPS < 13 (Throttle Closed)
   - Speed < 10kph
   - Engine MAP > Overrun Vacuum Target

   All other conditions will cause the idle system to enter hold mode, where "Idle Hot" and "Idle Cold" are used to determine duty cycle.

13.CONFIGURATION

13.1 Functions

Row Steps

This control allows the zone table row selection to be setup in one of four modes. These are Map, Vacuum, MAP+TPS, and TPS. To scroll through these modes used the ADJUST buttons.

MAP - FACTORY This allows the option of using the factory or Link Map sensor. This setting should only be adjusted when the engine is being turbo charged. For an engine requiring more than 170kPa, the Link Map sensor should be fitted and the setting changed to Map = High 3 Bar. To toggle the setting use the ADJUST buttons. Refer to the Boost Control section for more information.

IGN - DISTRIBUTOR The Integra/CivicLink offers ignition control on the factory distributor setup or can be configured for wasted spark using two dual coils. Do not adjust this menu unless a multi-coil setup has been considered. To toggle the menu use the ADJUST buttons. Refer the Wasted Spark section for more details.

SHIFT LIGHT The CE (Check Engine) light can be converted to a shift light. Use the ADJUST UP to switch this function on. Use the *Utilities* menu to adjust the switching RPM.

LAUNCH CTRL This will activate the launch control function. To switch ON press the ADJUST UP button. The required launch RPM can be adjusted from the * UTILITIES * heading. See section 8.3 for setup information.

VEHICLE TYPE This menu sets the software to run a particular Honda model. The options are: Integra 96-99, Civic 92-96. Use the ADJUST buttons to change.

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 Integra/CivicLink memory and should only be used during initial setup or if you wish to restart the tuning procedure again from scratch.

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.

13.2 Mixed Mode Scheduling

Mixed mode scheduling refers to the way in which the zone table ROWS are selected. There are four options available, each one specific to an engine configuration. The default mode is MAP meaning ROW selection is based ONLY on the engines Manifold Air Pressure. When using high lift, long duration cams this can create problems for EFI systems due to irregular, low manifold vacuum at low RPM. This results in the engine being "over fuelled" since the MAP sensor interprets the poor vacuum as the throttle being mostly open, when in fact, the throttle is closed on the idle stop. Although the over-fuelling can be tuned out using the ZONE FUEL table, the actual zone selected by the software is incorrect since the zone in use is also a function of the "incorrect" MAP signal. The following options are available.

> ☛ The actual injector pulse width is still a function of MAP at all times, so mixed mode scheduling will ONLY effect the zone table ROW selection.

MAP Mode

Application: Normally aspirated OR Turbo charged engine.

This allows Manifold Air Pressure to select the current zone table ROW. This will give 4 tuning rows for a normally aspirated engine and allow a maximum of 10 rows for a turbo charged engine. See Appendix A for the zone sheet. To effectively use this mode the engine should have good idle vacuum, operating in ROW 1 or 2. This will maximise the number of rows available for tuning. If the engine exhibits poor vacuum as discussed in the introduction use one of the following modes.

MAP+TPS Mode

Application: Turbo Charged engines ONLY.

If the MAP of the engine is going to exceed 110kPa (1.5PSI boost) due to turbo charging or forced induction and the engine exhibits poor idle vacuum, this mode should be selected. The TPS is used to select the vacuum rows 1,2,3 and 4 helping to stabilise ROW selection. As soon as the engine comes on boost, greater than 1.5PSI (110kPa absolute), the row selection will automatically revert to MAP zoning. To ensure correct operation the TPS should be set to span 10-100. This means at the cross-over point (110kPa) there will be no sudden fuel steps in the selected zone, i.e. the "MAP" selected zone and the "TPS" selected zone should be the same.

VACUUM Mode

Application: Normally Aspirated engines ONLY

Use this mode ONLY on a normally aspirated engine. DO NOT select if the engine is turbo charged. The zone table has been scaled to span 10 ROWS of vacuum as shown in Appendix B. This structure provides more rows to tune with when compared to the default MAP Mode, which allows only 4 rows for a normally aspirated engine. These additional rows are useful on engines with low vacuum by providing finer control over idle and cruise mixtures

Note: Rows 5 - 10 of the zone table are configured by default for a turbo charged engine. When spanning 10 rows remember to reconfigure the fuel and ignition tables as well as lambda targets.

Throttle Position Sensor (TPS) Mode

Application: Normally Aspirated Mode

Use this mode ONLY if the engine is normally aspired and MAP or VACUUM modes have produced unsatisfactory results. The purpose of selecting rows using TPS is to provide stable zone selection when the MAP signal is fluctuating due to special cams etc. When using this mode ensure the TPS span is setup correctly as described in the next section.

Selecting TPS Range

This section ONLY applies if ROW STEPS = TPS. DO NOT change “high” span value if ROW STEPS = TPS + MAP. Always set 10-100.

The "TPS high" value is user defined and controls the numbers of ROWS available for tuning. Hence the purpose of this step is to setup the number of ROWS required for tuning, by selecting a suitable "TPS high" value. For example a TPS range of 10 to 100 would access 4 ROWS, since three zone boundaries (30, 60, 90) were crossed, while a span of 10 to 200 would allow access to 7 ROWS.

> Note: Maximum allowable span is 10-255.

The ROW boundaries are as follows;

ROW	SPAN	CENTRE	ZONES
ROW 1	0 to 30	(10)	[100..195]
ROW 2	31 to 60	(45)	[200..295]
ROW 3	61 to 90	(75)	[300..395]
ROW 4	91 to 120	(105)	[400..495]
ROW 5	121 to 150	(135)	[500..595]
ROW 6	151 to 180	(165)	[600..695]
ROW 7	181 to 210	(195)	[700..795]
ROW 8	210 to 240	(225)	[800..895]

NOTE - The zoning structure for ZONE ADVANCE is identical to ZONE FUEL.

The "high" value should be selected based on the required tuning Rows. For example:

1) 4 Rows Required for tuning

   Set TPS span between 10 – 105

2) 6 Rows required for tuning

   Set TPS span between 10 – 165

3) 9 Rows required for tuning

   Set TPS span between 10 - 255

14. WASTED SPARK

The Integra/CivicLink offers the option of converting the factory distributor setup into a wasted spark configuration using two dual coils. This will require addition hardware and wiring to be added. Before attempting any conversion read this section thoroughly.

Hardware Requirements - Using wasted spark will require a Link two channel igniter module and two dual post coils. A jumper will also need to be adjusted on the Integra/CivicLink board as shown in Figure 14a and 14b. With the jumper located on one pin, the Integra/CivicLink is configured for distributor only (figure 14a). Moving the jumper across the both pins will configure the ignition for waster spark (figure 14b). Note the factory coil and igniter contained inside the distributor cannot be used.

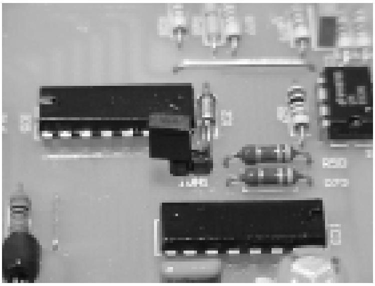


Figure 14a (off)

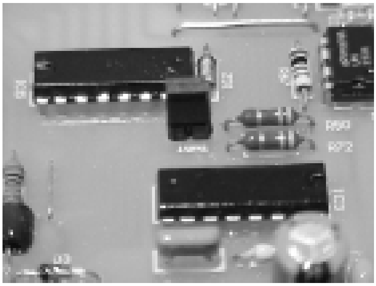


Figure 14b (on)

Software Requirements - The software to run this setup is already contained within the Integra/CivicLink system. To change the ignition setup requires a Link Tuning Module. See below for more information.

Installation

Figure 14.1 illustrates the wasted spark hardware and wiring layout. The dual post coils and igniter should be mounted before any wiring is started.

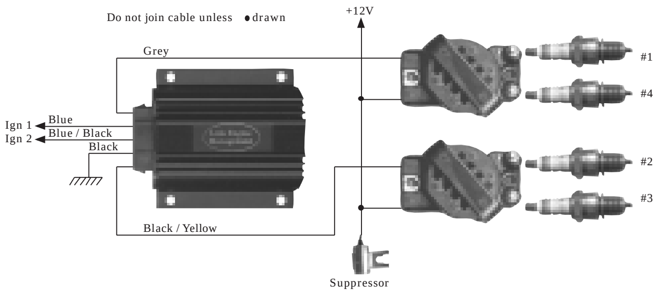


Figure 14.1 Wasted spark wiring diagram. Firing Order 1, 3, 4, 2.

i) Hardware Installation

Dual Post Coils

The coils should be positioned such that it minimises the length of the HT Leads. This will help reduce the noise generated when the spark plug is fired. Coil 1 shown in Figure 14.1 will provide spark energy to cylinders 1 & 4 while Coil 2 will fire cylinders 2 & 3. Once mounted the HT leads should be fitted, ensuring each cylinder is connected to the correct coil.

Igniter Module

The Igniter module is a device used to switch the Coils off or on by supplying a ground for the coil negative. This is shown in Figure 14.2. The signal used to control this is fed from the Integra/ CivicLink, labelled 'IGN1' and 'IGN2 ' in Figure 14.1. As the igniter will be carrying coil primary current when switched on, it MUST be mounted inside the engine bay and placed as close as possible to the coil pack. DO NOT mount the igniter inside the passenger compartment or close to hot engine components such as exhaust manifolds.

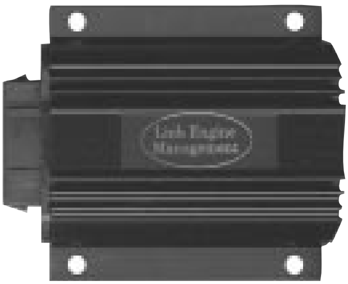


Figure 14.2. Link Igniter.

Wiring loom colours:

Black	=	Ground
Blue	=	Ign 1
Blue/back	=	Ign 2
Grey	=	Coil 1
Black/Yellow	=	Coil 2

IMPORTANT POINTS - Dual Coil Setup

The main concern when using dual post coils is the generation of interface. When two spark plugs are fired together there is twice the spark energy generated and hence twice the radiation produced per engine TDC. This noise level increase can interfere with ECU operation and cause unwanted static on car radios. The following precautions should be used to minimise these effects.

Firstly install 'Resistive Spark Plugs' even if the engine does not currently use them. This will reduce radiation levels and also help even out spark energy distribution. Without it, the spark plug with the least load (exhaust stroke) tends to monopolise spark.

Secondly, ALWAYS use suppressed HT leads, which can be identified by measuring their resistance. Typically they vary from 1000 ohms to 5000 ohms depending on lead length. DO NOT use copper leads under any circumstances.

Lastly always fit a Coil suppresser to the coil positive as shown in Figure 14.1. Any value between 1uF and 10uF will be suitable.

So when using Dual Coils always combine the following:

- Resistive sparks plugs
- Suppressed Leads
- Coil Suppresser (1uF - 10uF)

ii) Wiring Igniter and Coils

Assuming the Coils and Igniter have been mounted the wiring can now be started. Refer to Figure 14.1 for information.

- The signal to control Coil 1 labelled IGN1 is fed through the factory Yellow/Green igniter wire. This coil will control spark energy for cylinders 1 & 4. The wire can be located on the 8-way connector positioned on the side of the distributor. Figure 14.3 illustrates the plug location and Figure 14.4 shows the wire location inside the plug. Cut the Yellow/green wire and connect the wiring loom side to the blue wire on the Link Igniter loom. IGN 1 is now configured.

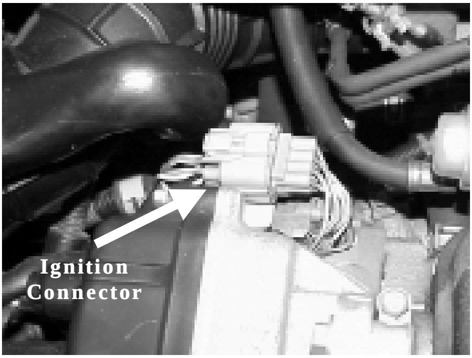


Figure 14.3. Distributor Plug Location

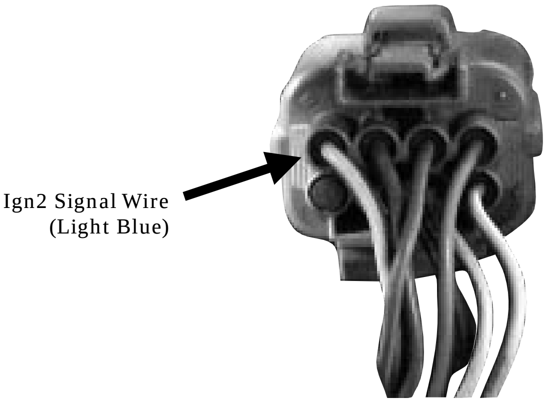


Figure 14.4. Ign 1 location on Distributor plug.

- The signal to control Coil 2, labelled IGN2 is fed from: pin C8 on the 96-99 Integra; pin D7 on the 92-96 Civic. This signal appears on the diagnostics plug shown in Figure 14.5 and is located below the passenger glove compartment. As this plug is located inside the car and the Link Igniter is mounted in the engine bay a wire will need to be taken through the bulkhead. Connect the light blue wire on the diagnostics plug to the Blue/Black wire in the igniter loom.

Note - If there is no blue wire located in the diagnostics plug the signal IGN2 will need to be directly taken from the main header. Refer to Appendix C/D for pinout information. IGN2 is now configured

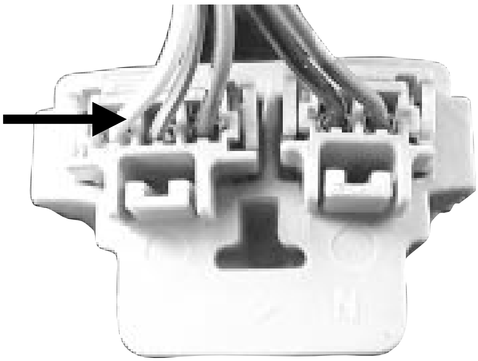


Figure 14.5 Diagnostics Plug

- Lastly connect the Grey wire on the Link Igniter loom to the Coil 1 negative terminal and the Black/Yellow wire to the Coil 2 negative terminal. Remember to supply +12V to the Coil positives and fit the Coil suppresser as shown in Figure 14.1. Remember to connect the black wire in the igniter loom to ground.

Software Setup

Firstly plug a Link Tuning Module into the Integra/CivicLink and switch the ignition on. The first menu to appear on the Tuning Module will read TEST RPM 00. To change the ignition setup from Distributed to Wasted Spark move to the * CONFIGURATION * heading on the tuning module by using the SELECT UP button. Once on this heading use the EDIT Down button to scroll to the 'Ign = Distributor menu'. Press the ADJUST UP to change the menu to 'Ign = Wasted-Spark'. The software is now configured. Switch off the ignition. After completing the hardware, wiring and software modifications the engine can now be started on a wasted spark setup.

15. 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	750	
TEST MAP	33 kPa	
TEST ENGT	88C	
INJ=1% OXY=81		(OXY may be varying)
SYS VOLTS	14.4	
STORE		(Both Adjust together)
MASTER FUEL	128	
ROWFUEL (1)	94	
ZONEFUEL 105	94	(Row 1, 000 - 500RPM)
CLAMP (33)	32	
COLD (88)	0	
ACCEL Z = 1	15	
VOLTS V = 13.8	15	
IAT (40C)	20	
PRIME TEMP	<20C	
ZONE IGN 105	0	
ADV LIMIT	32	
MAP LIMIT	210 kPa	
RPM LIMIT	8200	
VTEC RPM	5000	
INLET RPM	6000	
KNK ( )	ON	
KNK SENS	30	
LAMBDA	OFF	
IDLE (36%)	750	
IDCOLD	50%	
IDHOLD	40%	
IDLE STEP	4%	
TPS SPAN	10	(Throttle closed)
RELOAD		(Both Adjust together)
EDIT Z 0	32	(Editor @ zone 0 “CLAMP”)

Do not adjust the Integra/CivicLink 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. DO NOT start the engine.
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. MASTER under the *FUEL MAP* heading will have a default value. Do not adjust at this stage.
4. ACCEL, COLD, VOLTS and IAT under the* FUEL AUXILIARY * heading will have default values. Do not adjust at this stage.
5. Select the *LIMITS* heading. Set the RPM LIMIT as required.
6. Repeat above for MAP LIMIT if the engine is turbo charged.
7. Move to the * UTILITIES * heading select the VTEC RPM menu. Set the required RPM to energise the Vtec solenoid. Press the EDIT down to select the VTEC TPS menu. Adjust the TPS setting as required. Press the EDIT down to select the INLET RPM menu. Adjust the switching RPM as required. (Inlet RPM does NOT apply to 92-96 Civic.)
   Default Values:
      Vtec Rpm = 5000
      VTEC TPS = 40
      Inlet Rpm = 6000 (Does NOT apply to 92-96 Civic.)

   CAUTION. There are several consequences to consider before any adjustment should be made to the Vtec or Inlet switching RPM.

   - Firstly the Fuel and Ignition Maps have been setup to match the default RPM values. When making adjustments to either the VTEC or INLET solenoid the corresponding fuel step MUST also be altered.
   - To prevent engine damage the Vtec solenoid should be engaged when there is sufficient engine oil pressure. For this reason the latching RPM should be kept above 3000.

8. Select STORE and press both EDIT buttons for one second if you have made any changes (as per Tuning Module Function instructions in previous section).

9. Move to the * FUEL MAP * heading. From here MASTER, ROWFUEL and ZONEFUEL can be selected. Refer to section 4 for more information. Press the Edit Down button once to select MASTER. *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.* If a MASTER change is required, start the engine and adjust up or down as necessary to keep engine running smoothly. Allow engine to warm up fully.

10. With the engine now warm drive or dyno load engine until it 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 9).

11. Select ROWFUEL by pressing EDIT Down button. Run the engine in each of the four 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 by pressing EDIT Down button. The engine should now be operated throughout the entire power range and the ADJUST 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 IGN from the * IGNITION * heading. Run the engine throughout its full operating range. Changes can be made using the ADJUST buttons. 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 Integra/CivicLink will automatically remove up to 6º advance from any zone if the "KNOCK" system is turned on.

14. Select ACCEL under the * FUEL AUXILIARY * heading. Run engine at idle and snap open throttle. Adjust for the 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 e.g. ZONEFUEL value is probably too low. DO NOT use ACCEL to cover up lean ZONEFUEL values.

15. Move to the * IDLE SPEED * heading and select the IDLE menu by pressing the EDIT down button. Select the required idle speed by using the IDLE function to set the RPM in steps of 50. If the required idle RPM is the default value of 750 and no major engine modifications have been done IDHOT and IDCOLD should NOT be changed. Otherwise setup as follows:
    a. COLD engine. Select IDLE on the Remote Control and start the engine. Observe the ISC duty cycle (XX%) on the display. After about fifteen seconds make a note of the duty cycle then allow the engine too fully warm up.
    b. HOT engine. See above but record the hot duty cycle this time. Under the * IDLE SPEED * heading move to the IDLE HOT menu and enter the required HOT duty cycle using the ADJUST buttons. Next move to the IDLE COLD menu and enter the COLD duty cycle. Move to a STORE menu to save any changes

The idle speed software during transient conditions inserts these defaults when the engine is accelerating or de-accelerating to ensure that “reasonable” numbers are present when the idle control resumes operation.

During operation, a number of symbols will appear to show the idle system status as follows,

T	Throttle open
V	Engine in over-run vacuum
A	Acceleration fuel pending
=	Idle speed equals target value
+	System is increasing idle speed
-	System is decreasing idle speed

16. Assuming all the above operations are completed successfully, allow the engine to cool down completely (preferably overnight). Select COLD from the FUEL AUXILIARY menu and restart engine. Adjust as required for clean operation. “STORE” after setting.

16. ADDITIONAL TUNING TIPS

1. Large steps between zones are permitted since the Integra/CivicLink System interpolates (i.e. 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 Integra/CivicLink System can produce millions of possible combinations so keep trace.

17.STORING & EDITING VALUES

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

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.

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.

18. TUNING PORT

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

The fourteen pin connector located at one corner of the circuit board (Figure 18.1) 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.

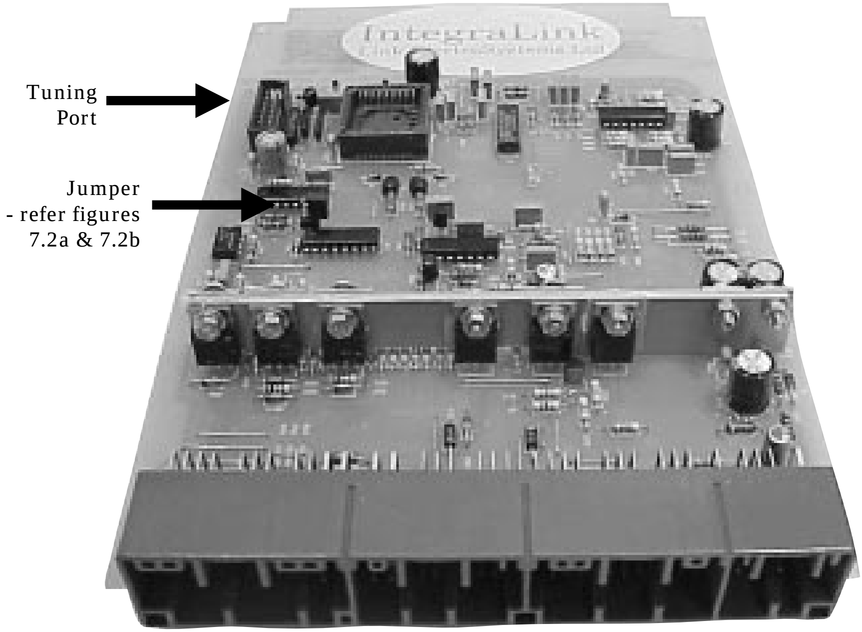
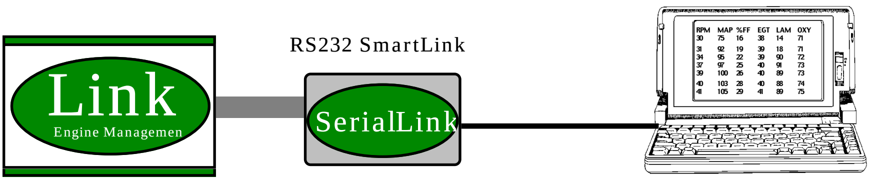


Figure 18.1. Integra/CivicLink Tuning Port

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 one way communication between the Integra/CivicLink and a personal computer via the PC's RS232 serial port for data-logging and downloading of the Integra/CivicLink settings. While the engine is running a data 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.

The Software used to view and store this data is called "Comlink" and can be copied from the CD supplied with the Integra/CivicLink (Alternatively it can be downloaded from our web site www.link-electro.co.nz. Place the CD in the CD ROM drive and select the directory "PCLink \ PCLink Software Installer \ Comlink.exe". Copy comlink.exe to the hard drive where the program can be executed. Connect the 14 way flat ribbon cable between the Integra/CivicLink and SerialLink. Next connect the standard serial cable between the SerialLink and an available COM Port on the PC. Now start Comlink. There are 2 setup options

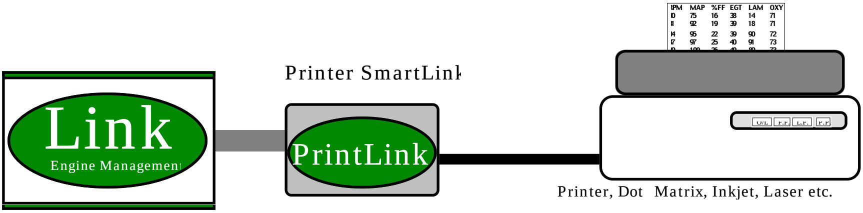
- First select the correct COM Port. Use the keyboard buttons Q & A to change the settings. Once configured press the Enter button on the keyboard
- Next select the correct baud rate using the Q and A Keys.

  If the Integra/CivicLink has laptop tuning, select 9600 baud. (If the software date stamp is after Sept 01 the software will have PC tuning.)

  If no Laptop tuning select 2400 baud

  Once configured press the Enter key on the keyboard
- Switch the ignition key ON. The initial data dump will be in the same format as the Zone Table shown in Appendix A or B. The first 3 rows are configuration and tuning functions. Next is the Fuel table, followed by the ignition table, and lastly the boost table.
- Now start the engine and observe the runtime data. Follow the onscreen help for storing this data.

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.

PCLink

This allows the Integra/CivicLink and PC to perform 2-way communication using the SerialLink. Once the PCLink software has been installed from CD the Integra/CivicLink can be tuned from laptop or personal computer. See Section 19 for software installation and hardware setup.

19. WINDOWS PC TUNING

The Integra/CivicLink offers PC/Laptop tuning using PCLink Software. A copy can be found on the CD supplied with the computer or from our web site: www.link-electro.co.nz. It allows real time 2-way communication between the Integra/CivicLink and Laptop computer.

Installing PCLink Software from CD

- Insert PCLink CD into the CD ROM drive.
- The software in located in the "PCLink\PCLink Software Installer\Setup.exe" folder.
- Double click on the "setup.exe" file to start the installation process.

  During the installation process a PCLink icon will be generated and place on the desktop. To start, simply double click on this icon.
- For detailed information on the operation of the PCLink software, start the program and read the online Instructions.
- A Tutorial is also available and can be copied from the CD in directory, "PCLink\PCLink Tutorial\PCLink_Tute.pdf". This is PDF document, which requires Acrobat reader. A copy of this software is also available on CD if required.

PCLink hardware connection.

This requires one 14-way flat ribbon cable, one SerialLink, one standard serial cable and a PC.

- Connect one end of the ribbon cable to the Link Tuning Port, the other end should connect to the SerialLink.
- Take a standard serial cable and connect one end to the SerialLink. Connect the other end to an available COM Port on the PC.

- Start the PCLink Software by double clicking on the desktop icon or using the START, programs menu.
- Switch the ignition on which will power up the Integra/ CivicLink

  NOTE. The SerialLink should ALWAYS be connected before the ignition key is switched ON.
- The PCLink offers both mouse and keyboard control. To start the connection between PC and Integra/CivicLink using the mouse, move to the "Link Control" menu and select "Connect Link". Using the keyboard, press and hold the Ctrl, Alt and L keys. This will bring up an "Options" box. Check the following settings
- Make sure the Link Connection shows "ONLINE"
- Select the correct COM Port
- Click the OK button. Once the PC is communicating with the Integra/CivicLink, tuning can begin. Remember to STORE any changes before disconnecting the PCLink software from the Integra/CivicLink.

20. DIAGNOSTICS

The section provides basic engine information for diagnostic and monitoring purposes. All information is temporary stored and will be lost when power is removed from the Integra/CivicLink.

Max RPM

This menu displays the engine maximum RPM. This menu is used to check for trigger glitches, indicated by an unrealistic RPM figure.

Max Map

Displays the maximum manifold air pressure for turbo charged engine.

Max Injector Duty Cycle

Displays the maximum duty cycle of the injector. If this value is between 90 – 95% the fuel system is struggling to supply enough fuel to the engine. A value of 99% means the fuel system cannot delivery the required fuel.

Sync/Cyl Err. xx

The menu displays a counter, which is incremented every time any inconsistency is found between the “expected” Sync/Cyl Ratio and the measured ratio. A value of 1 or 2 may be observed on startup. This is normal as the ECU is just beginning its triggering sequence.

This counter can be useful when trying to fault find engine misfire under load. Simply observe the counter value before and after misfire. If the value has increased a triggering anomaly has occurred.

IntegraLink/CivicLink

Rowstep = Vacuum / Boost

Clamp	Master	R Lim	M Lim	A Lim	Mode	Code	Volt	Idle	Fan	TPS Low	TPS High	Targets Sens	Targets Knk Rate	Targets Base	Targets RPM	Cold	Knk RPM	Id Hot	IdCold
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

Overrun	Knock	Acceleration 2,000	Acceleration 4,000	Acceleration 6,000	Acceleration 8,000	Lambda Targets Idle	Lambda Targets Cruise	Lambda Targets Row 4&5	Lambda Targets Row 6&7	Lambda Targets Row 8&9	Row 10	AirF	AmbF	Prime°	AC Idle	Crank	VTEC	Inlet	Shift
20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39

Vtec TPS	RPM Lock	Launch RPM	Launch Rise	Launch Retard	Fan Step	Model	Hot	Psteer	Startup										
40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59

Zone Fuel

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

kPa																				
30	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195
60	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	185	290	295
90	300	305	310	315	320	325	330	335	340	345	350	355	360	365	370	375	380	385	390	395
120	400	405	410	415	420	425	430	435	440	445	450	455	460	465	470	475	480	185	490	495
150	500	505	510	515	520	525	530	535	540	545	550	555	560	565	570	575	580	585	590	595
180	600	605	610	615	620	625	630	635	640	645	650	655	660	665	670	675	680	685	690	695
210	700	705	710	715	720	725	730	735	740	745	750	755	760	765	770	775	780	785	790	795
240	800	805	810	815	820	825	830	835	840	845	850	855	860	865	870	875	880	885	890	895
270	900	905	910	915	920	925	930	935	940	945	950	955	960	965	970	975	980	985	990	995
300	1000	1005	1010	1015	1020	1025	1030	1035	1040	1045	1050	1055	1060	1065	1070	1075	1080	1085	1090	1095

Zone Ignition

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

kPa																				
30	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195
60	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	185	290	295
90	300	305	310	315	320	325	330	335	340	345	350	355	360	365	370	375	380	385	390	395
120	400	405	410	415	420	425	430	435	440	445	450	455	460	465	470	475	480	185	490	495
150	500	505	510	515	520	525	530	535	540	545	550	555	560	565	570	575	580	585	590	595
180	600	605	610	615	620	625	630	635	640	645	650	655	660	665	670	675	680	685	690	695
210	700	705	710	715	720	725	730	735	740	745	750	755	760	765	770	775	780	785	790	795
240	800	805	810	815	820	825	830	835	840	845	850	855	860	865	870	875	880	885	890	895
270	900	905	910	915	920	925	930	935	940	945	950	955	960	965	970	975	980	985	990	995
300	1000	1005	1010	1015	1020	1025	1030	1035	1040	1045	1050	1055	1060	1065	1070	1075	1080	1085	1090	1095

15 October 2001

Boost

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195

APPENDIX B Zone Sheet Vacuum

IntegraLink/CivicLink

Rowstep = Vacuum

TPS — Targets

Clamp	Master	R Lim	M Lim	A Lim	Mode	Code	Volt	Idle	Fan	Low	High	Sens	Knk Rate	Base	RPM	Cold	Knk RPM	Id Hot	IdCold
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

Acceleration — Lambda Targets

Overrun	Knock	2,000	4,000	6,000	8,000	Idle	Cruise 1	Cruise 2	Power 1	Power 2	Power 3	AirF	AmbF	Prime°	AC Idle	Crank	VTEC	Inlet	Shift
20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39

Vtec TPS	RPM Lock	Launch RPM	Launch Rise	Launch Retard	Fan Step	Model	Hot	Psteer	Startup										
40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59

Zone Fuel

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

kPa																				
20	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195
30	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	185	290	295
40	300	305	310	315	320	325	330	335	340	345	350	355	360	365	370	375	380	385	390	395
50	400	405	410	415	420	425	430	435	440	445	450	455	460	465	470	475	480	185	490	495
60	500	505	510	515	520	525	530	535	540	545	550	555	560	565	570	575	580	585	590	595
70	600	605	610	615	620	625	630	635	640	645	650	655	660	665	670	675	680	685	690	695
80	700	705	710	715	720	725	730	735	740	745	750	755	760	765	770	775	780	785	790	795
90	800	805	810	815	820	825	830	835	840	845	850	855	860	865	870	875	880	885	890	895
100	900	905	910	915	920	925	930	935	940	945	950	955	960	965	970	975	980	985	990	995
110	1000	1005	1010	1015	1020	1025	1030	1035	1040	1045	1050	1055	1060	1065	1070	1075	1080	1085	1090	1095

15 October 2001

Zone Ignition

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

kPa																				
20	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195
30	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	185	290	295
40	300	305	310	315	320	325	330	335	340	345	350	355	360	365	370	375	380	385	390	395
50	400	405	410	415	420	425	430	435	440	445	450	455	460	465	470	475	480	185	490	495
60	500	505	510	515	520	525	530	535	540	545	550	555	560	565	570	575	580	585	590	595
70	600	605	610	615	620	625	630	635	640	645	650	655	660	665	670	675	680	685	690	695
80	700	705	710	715	720	725	730	735	740	745	750	755	760	765	770	775	780	785	790	795
90	800	805	810	815	820	825	830	835	840	845	850	855	860	865	870	875	880	885	890	895
100	900	905	910	915	920	925	930	935	940	945	950	955	960	965	970	975	980	985	990	995
110	1000	1005	1010	1015	1020	1025	1030	1035	1040	1045	1050	1055	1060	1065	1070	1075	1080	1085	1090	1095

APPENDIX C Pressure Conversion

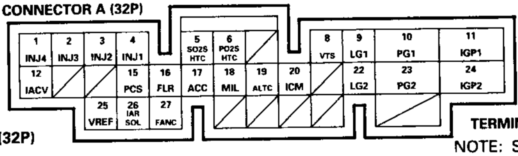
kPa (Absolute)	InHg
32	20
35	19
39	18
42	17
45	16
49	15
52	14
55	13
59	12
62	11
66	10
69	9
72	8
76	7
79	6
83	5
86	4
89	3
93	2
96	1
100	0

kPa (Absolute)	Pressure (PSI)
100	0.00
105	0.73
110	1.45
115	2.18
120	2.90
125	3.63
130	4.35
135	5.08
140	5.80
145	6.53
150	7.25
155	7.98
160	8.70
165	9.43
170	10.15
175	10.88
180	11.60
185	12.33
190	13.05
195	13.78
200	14.50
205	15.23
210	15.95
215	16.68
220	17.40
225	18.13
230	18.85
235	19.58
240	20.31
245	21.03
250	21.76
255	22.48
260	23.21
265	23.93
270	24.66
275	25.38
280	26.11
285	26.83
290	27.56
295	28.28
300	29.01

APPENDIX D Post '96 Integra Pinout

Engine Control Module Terminal Arrangement

ECM CONNECTOR A (32P)



ECM CONNECTOR A (32P)

TERMINAL SIDE OF MALE TERMINALS

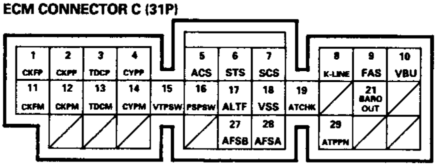
NOTE: Standard battery voltage is 12 V.

Terminal number	Wire color	Terminal name	Description	Signal
1	YEL	INJ4 (No. 4 FUEL INJECTOR)	Drives No. 4 fuel injector.	With engine running: pulses
2	BLU	INJ3 (No. 3 FUEL INJECTOR)	Drives No. 3 fuel injector.	
3	RED	INJ2 (No. 2 FUEL INJECTOR)	Drives No. 2 fuel injector.	
4	BRN	INJ1 (No. 1 FUEL INJECTOR)	Drives No. 1 fuel injector.	
5	GRN/RED	S O2SHTC (SECONDARY HEATED OXYGEN SENSOR HEATER CONTROL)	Drives secondary heated oxygen sensor heater.	With ignition switch ON (II): battery voltage With fully warmed up engine running: duty controlled
6	ORN/BLK	P O2SHTC (PRIMARY HEATED OXYGEN SENSOR HEATER CONTROL)	Drives primary heated oxygen sensor heater.	With ignition switch ON (II): battery voltage With fully warmed up engine running: duty controlled
8	GRN/YEL	VTS (VTEC SOLENOID VALVE)	Drives VTEC solenoid valve.	With engine at low rpm: 0 V With engine at high rpm: battery voltage
9	BRN/BLK	LG1 (LOGIC GROUND)	Ground for the ECM control circuit.	Less than 1.0 V at all times
10	BLK	PG1 (POWER GROUND)	Ground for the ECM power circuit.	Less than 1.0 V at all times
11	YEL/BLK	IGP1 (POWER SOURCE)	Power source for the ECM control circuit.	With ignition switch ON (II): battery voltage With ignition switch OFF: 0 V
12	BLK/BLU	IACV (IDLE AIR CONTROL VALVE)	Drives IACV.	With engine running: about 6 V – 10 V (depending on engine speed)
15	RED	PCS (EVAP PURGE CONTROL SOLENOID VALVE)	Drives EVAP purge control solenoid valve.	With engine running, engine coolant above 154°F (68°C): duty controlled
16	GRN/BLU	FLR (FUEL PUMP RELAY)	Drives fuel pump relay.	0 V for two seconds after turning ignition switch ON (II), then battery voltage
17	BLK/RED	ACC (A/C CLUTCH RELAY)	Drives A/C clutch relay.	With compressor ON: 0 V With compressor OFF: battery voltage
18	GRN/ORN	MIL (MALFUNCTION INDICATOR LAMP)	Drives MIL.	With MIL turned ON: 0 V With MIL turned OFF: battery voltage
19	WHT/GRN	ALTC (ALTERNATOR CONTROL)	Sends alternator control signal.	With fully warmed up engine running: battery voltage During driving with small electrical load: 0 V
20	YEL/GRN	ICM (IGNITION CONTROL MODULE)	Sends ignition pulse.	With ignition switch ON (II): battery voltage With engine running: about 10 V (depending on engine speed)
22	BRN/BLK	LG2 (LOGIC GROUND)	Ground for the ECM control circuit.	Less than 1.0 V at all times
23	BLK	PG2 (POWER GROUND)	Ground for the ECM power circuit.	Less than 1.0 V at all times
24	YEL/BLK	IGP2 (POWER SOURCE)	Power source for the ECM control circuit.	With ignition switch ON (II): battery voltage With ignition switch OFF: 0 V
25	WHT/BLK	VREF (REFERENCE VOLTAGE)	Provides reference voltage to other control units.	With ignition switch ON (II): about 5 V With ignition switch OFF: 0 V
26	PNK/BLU	IAB SOL (INTAKE AIR BYPASS CONTROL SOLENOID VALVE)	Drives IAB control solenoid valve.	With engine running, engine speed below 5,750 rpm: battery voltage With engine running, engine speed above 5,750 rpm: 0 V
27	GRN	FANC (RADIATOR FAN CONTROL)	Drives radiator fan relay.	With radiator fan running: 0 V With radiator fan stopped: battery voltage

(cont'd)

Engine Control Module Terminal Arrangement (cont'd)

ECM CONNECTOR C (31P)



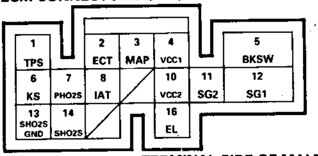
TERMINAL SIDE OF MALE TERMINALS

ECM CONNECTOR (31P)

NOTE: Standard battery voltage is 12 V.

Terminal number	Wire color	Terminal name	Description	Signal
1	BLU/RED	CKF P (CKF SENSOR P SIDE)	Detects CKF sensor.	With engine running: pulses
2	BLU/GRN	CKP P (CKP SENSOR P SIDE)	Detects CKP sensor.	With engine running: pulses
3	ORN/BLU	TDC P (TDC SENSOR P SIDE)	Detects TDC sensor.	With engine running: pulses
4	ORN	CYP P (CYP SENSOR P SIDE)	Detects CYP sensor.	With engine running: pulses
5	BLU/RED	ACS (A/C SWITCH SIGNAL)	Detects A/C switch signal.	With A/C switch ON: 0 V With A/C switch OFF: battery voltage
6	BLU/WHT	STS (STARTER SWITCH SIGNAL)	Detects starter switch signal.	With starter switch ON: battery voltage With starter switch OFF: 0 V
7	BRN/WHT	SCS (SERVICE CHECK SIGNAL)	Detects service check connector signal (the signal causing a DTC indication).	With the connector connected: 0 V With the connector disconnected: about 5 V
8	GRN/WHT	K-LINE	Sends and receives OBD-II scan tool and PGM tester signal.	With ignition switch ON (II): about 5 V
9	YEL	FAS (FEEDBACK AT SIGNAL)	Sends feedback signal for the TCM.	At idle: about 5 V During shifting: momentary change to 0 V
10	WHT/BLU	VBU (VOLTAGE BACK UP)	Power source for the ECM control circuit. Power source for the DTC memory.	Battery voltage at all times
11	WHT/RED	CKF M (CKF SENSOR M SIDE)	Ground for CKF sensor.	
12	BLU/YEL	CKP M (CKP SENSOR M SIDE)	Ground for CKP sensor.	
13	WHT/BLU	TDCM (TDC SENSOR M SIDE)	Ground for TDC sensor.	
14	WHT	CYPM (CYP SENSOR M SIDE)	Ground for CYP sensor.	
15	BLU/BLK	VTP SW (VTEC PRESSURE SWITCH)	Detects VTEC pressure switch signal.	With engine at low rpm: 0 V With engine at high rpm: battery voltage
16	GRN	PSPSW (P/S OIL PRESSURE SWITCH)	Detects PSP switch signal.	At idle with steering wheel in straight ahead position: 0 V At idle with steering wheel rotated: battery voltage
17	WHT/RED	ALTF (ALTERNATOR FR SIGNAL)	Detects alternator FR signal.	With fully warmed up engine running: 0 V – battery voltage (depending on electrical load)
18	ORN	VSS (VEHICLE SPEED SENSOR)	Detects VSS signal.	With ignition switch ON (II) and front wheels rotating: cycles 0 V – 5 V
19	BLU	AT CHK (A/T FI DATA LINE)	Detects TCM data signal.	With ignition switch ON (II): pulses
21	LT GRN	BARO OUT (BAROMETRIC SENSOR OUTPUT SIGNAL)	Sends barometric sensor output signal.	With ignition switch ON (II): about 3 V (depending on barometric pressure)
27	GRY	AFSB (A/T FI SIGNAL B)	Detects retard signal from the TCM.	At idle: about 5 V During shifting: momentary change to 0 V
28	GRN/BLU	AFSA (A/T FI SIGNAL A)	Detects retard signal from the TCM.	At idle: about 5 V During shifting: momentary change to 0 V
29	LT GRN/BLK	ATPPN (A/T GEAR POSITION SWITCH)	Detects A/T gear position switch signal.	In [N] or [P] position: 0 V In any other position: battery voltage

ECM CONNECTOR D (16P)



TERMINAL SIDE OF MALE TERMINALS

ECM CONNECTOR D (16P)

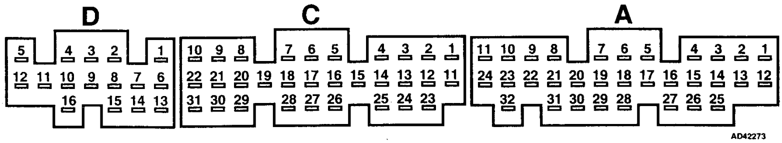
NOTE: Standard battery voltage is 12 V.

Terminal number	Wire color	Terminal name	Description	Signal
1	RED/BLK	TPS (THROTTLE POSITION SENSOR)	Detects TP sensor signal.	With throttle fully open: about 4.5 V With throttle fully closed: about 0.5 V
2	RED/WHT	ECT (ENGINE COOLANT TEMPERATURE SENSOR)	Detects ECT sensor signal.	With ignition switch ON (II): about 0.1 – 4.8 V (depending on engine coolant temperature)
3	WHT/YEL	MAP (MANIFOLD ABSOLUTE PRESSURE SENSOR)	Detects MAP sensor signal.	With ignition switch ON (II): about 3 V At idle: about 1.0 V (depending on engine speed)
4	YEL/WHT	VCC1 (SENSOR VOLTAGE)	Power source for MAP sensor.	With ignition switch ON (II): about 5 V
5	GRN/WHT	BKSW (BRAKE SWITCH)	Detects brake switch signal.	With brake pedal released: 0 V With brake pedal depressed: battery voltage
6	RED/BLU	KS (KNOCK SENSOR)	Detects KS signal.	With engine running: pulses
7	WHT/RED	PHO2S (PRIMARY HEATED OXYGEN GENSOR)	Detects primary oxygen sensor signal.	With throttle fully opened, fully warmed up engine: above 0.6 V With throttle quickly closed: below 0.4 V
8	RED/YEL	IAT (INTAKE AIR TEMPERATURE SENSOR)	Detects IAT sensor signal.	With ignition switch ON (II): about 0.1 – 4.8 V (depending on intake air temperature)
10	YEL/BLU	VCC2 (SENSOR VOLTAGE)	Provides sensor voltage.	With ignition switch ON (II): about 5 V With ignition switch OFF: 0 V
11	GRN/BLU	SG2 (SENSOR GROUND)	Sensor ground.	Less than 1.0 V at all times.
12	GRN/WHT	SG1 (SENSOR GROUND)	Ground for MAP sensor.	Less than 1.0 V at all times.
13	ORN/BLU	SHO2S GND (SECONDARY HEATED OXYGEN SENSOR GROUND)	Ground for secondary heated oxygen sensor.	Less than 1.0 V at all times.
14	BLU/GRN	SHO2S (SECONDARY HEATED OXYGEN SENSOR)	Detects secondary oxygen sensor signal.	With throttle fully opened, fully warmed up engine: above 0.6 V With throttle quickly closed: below 0.4 V
16	GRN/RED	EL (ELD)	Detects ELD signal.	With parking lights turned on at idle: about 2.5 – 3.5 V With low beam headlights turned on at idle: about 1.5 – 2.5 V

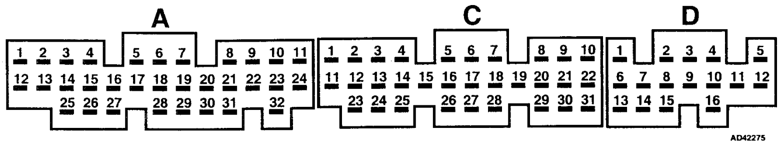
APPENDIX E '96-'99 Civic Pinout

ECM harness multi-plug

Terminal side



Wire side



Component/circuit description	ECM pin	Signal	Condition	Typical value
AC compressor clutch relay – if fitted	**A17**	⊣▷	AC compressor OFF	11-14 V
	A17	⊣▷	AC compressor ON	0-1 V
AC refrigerant pressure switch – if fitted	**C5**	←	Ignition ON – AC OFF	11-14 V
	C5	←	Ignition ON – AC ON	0-1 V
Alternator	**A19**	←	Engine running – engine hot – electrical loads OFF	11-14 V
	A19	←	Engine running – engine hot – electrical loads ON	0 V
	C17	←	Engine running – engine hot	0-14 V varies with electrical load
Battery	**C10**	←	Ignition OFF	11-14 V
Brake pedal position (BPP) switch	**D5**	←	Brake pedal released	0 V
	D5	←	Brake pedal depressed	11-14 V
Camshaft position (CMP) actuator	**A8**	⇨	Ignition ON	0 V
	A8	⇨	Engine running – low RPM	0 V
	A8	⇨	Engine running – high RPM	11-14 V
Camshaft position (CMP) sensor	**C4**	←	Engine cranking	0,2 V ac
	C4	←	Engine idling	33
	C14	←	Engine cranking	0 V
	C14	←	Engine idling	0 V
Crankshaft position (CKP) sensor	**C3**	←	Engine cranking	0,4 V ac
	C3	←	Engine idling	1
	C13	←	Engine cranking	0 V
	C13	←	Engine idling	0 V
Data link connector (DLC)	**C8**	◀▷	Ignition ON	5 V
Earth	**A9**		Ignition ON	0 V
	A10		Ignition ON	0 V
	A22		Ignition ON	0 V
	A23		Ignition ON	0 V
Econolight	**A30**	⊣▷	Ignition ON – lamp ON	0-1 V
	A30	⊣▷	Ignition ON – lamp OFF	11-14 V

Component/circuit description	ECM pin	Signal	Condition	Typical value
Electrical load control module	**D16**	⬅	Engine idling	0-5 V varies with electrical load
Engine coolant blower motor relay	**A27**	⏚▷	Coolant blower motor OFF	11-14 V
	A27	⏚▷	Coolant blower motor ON	0-1 V
Engine coolant temperature (ECT) sensor	**D2**	⬅	Ignition ON – 20°C	3,3 V
	D2	⬅	Ignition ON – 80°C	0,6 V
	D11	⏚	Ignition ON	0 V
Engine diagnostic link	**C7**	⇨		[1]
Engine speed (RPM) sensor	**C2**	⬅	Engine cranking	1 V ac
	C2	⬅	Engine idling	17
	C12	⬅	Engine cranking	0 V
	C12	⬅	Engine idling	0 V
Engine speed fluctuation sensor	**C1 (C11)**	⬅	Engine idling	17
	C11 (C1)	⬅	Engine idling	17
Evaporative emission (EVAP) cut-off valve	**A15**	⏚▷	Engine running – coolant temp. 68°C max.	0 V
	A15	⏚▷	Engine running – coolant temp. 68°C min.	11-14 V
Exhaust gas recirculation (EGR) solenoid	**A7**	⇨	Ignition ON	0 V
	A7	⇨	Engine running – valve operating	11-14 V
	A7	⇨	Engine running – valve operating	19
Exhaust gas recirculation (EGR) valve position sensor	**D9**	⬅	Ignition ON	1,2 V
	D9	⬅	Engine idling – vacuum 0,27 bar	4,3 V
	D10	⇨	Ignition ON	5 V
	D11	⏚	Ignition ON	0 V
Heated oxygen sensor (HO2S)	**A6**	⏚▷	Ignition ON	11-14 V
	A6	⏚▷	Engine idling	0-1 V
	D7	⬅	Engine running – engine hot	0,1-0,9 V
Idle air control (IAC) valve – AT	**A13**	⏚▷	Ignition ON	11-14 V
	A13	⏚▷	Engine idling	25
	A14	⏚▷	Ignition ON	11-14 V
	A14	⏚▷	Engine idling	25
Idle air control (IAC) valve – MT	**A12**	⏚▷	Ignition ON	11-14 V
	A12	⏚▷	Engine idling	24
Ignition control module (ICM)	**A20**	⇨	Ignition ON	11-14 V
	A20	⇨	Engine cranking	10 Hz
	A20	⇨	Engine idling	30 Hz
	A20	⇨	3000 rpm	100 Hz
	A20	⇨	Engine idling	32
Ignition switch	**C6**	⬅	Engine cranking	11-14 V
Immobilizer control module	**C22**	⬅		[1]
Injector 1	**A4**	⏚▷	Ignition ON	11-14 V
	A4	⏚▷	Engine idling	2 ms
	A4	⏚▷	Engine idling	35
Injector 2	**A3**	⏚▷	Ignition ON	11-14 V
	A3	⏚▷	Engine idling	2 ms
	A3	⏚▷	Engine idling	35

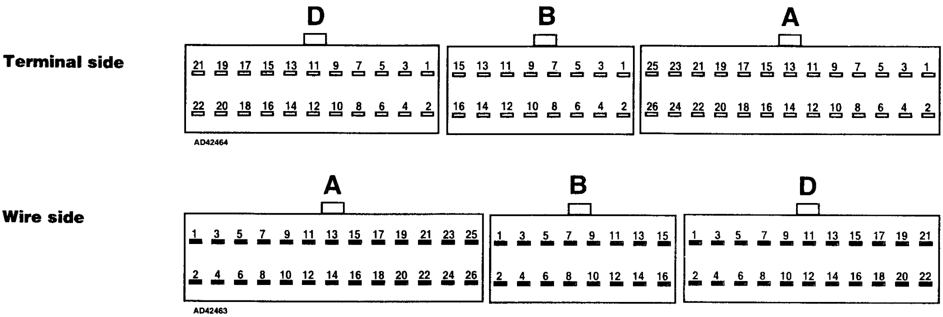
Table continued on next page ➡

Component/circuit description	ECM pin	Signal	Condition	Typical value
Injector 3	**A2**	⊣▷	Ignition ON	11-14 V
	A2	⊣▷	Engine idling	2 ms
	A2	⊣▷	Engine idling	35
Injector 4	**A1**	⊣▷	Ignition ON	11-14 V
	A1	⊣▷	Engine idling	2 ms
	A1	⊣▷	Engine idling	35
Intake air temperature (IAT) sensor	**D8**	◀	Ignition ON – 15°C	3,5 V
	D11	⊣—	Ignition ON	0 V
Knock sensor (KS)	**D6**	◀	Engine idling – accelerate briefly	38
Malfunction indicator lamp (MIL)	**A18**	⊣▷	Ignition ON – MIL ON	0-1 V
	A18	⊣▷	Ignition ON – MIL OFF	11-14 V
Manifold absolute pressure (MAP) sensor	**D3**	◀	Ignition ON	3 V
	D3	◀	Engine idling	0,9 V
	D3	◀	Full throttle briefly	2,8 V
	D4	⇨	Ignition ON	5 V
	D12	⊣—	Ignition ON	0 V
Power steering pressure (PSP) switch	**C16**	⇨	Engine idling – steering wheel not turned	0 V
	C16	⇨	Engine idling – steering wheel turned	11-14 V
Relay module	**A11**	◀	Ignition OFF	0 V
	A11	◀	Ignition ON	11-14 V
	A16	⊣▷	Ignition ON	0-1 V briefly then 11-14 V
	A16	⊣▷	Engine idling	0-1 V
	A24	◀	Ignition OFF	0 V
	A24	◀	Ignition ON	11-14 V
Throttle position (TP) sensor	**D1**	◀	Ignition ON – throttle closed	0,1 V
	D1	◀	Ignition ON – throttle fully open	4,8 V
	D10	⇨	Ignition ON	5 V
	D11	⊣—	Ignition ON	0 V
Transmission control module (TCM)	**A25**	⇨	Ignition ON	5 V
	C9	◀▷		1
	C30	◀▷		1
Transmission range (TR) switch – AT	**C29**	◀	Ignition ON – AT in P or N	0 V
	C29	◀	Ignition ON – AT not in P or N	11-14 V
Vehicle speed sensor (VSS)	**C18**	◀	Ignition ON – vehicle pushed	0 or 5 V fluctuating

1 **Connected pin - no test data available**

APPENDIX F '92-'96 Civic Pinout

ECM harness multi-plug



Component/circuit description	ECM pin	Signal	Condition	Typical value
AC compressor clutch relay	A15	⊣▷	AC compressor ON	0-1 V
	A15	⊣▷	AC compressor OFF	11-14 V
AC master switch	B5	⇨	Ignition ON – AC OFF	5 V
	B5	⇨	Ignition ON – AC ON	0-1 V
Alternator	D9	←	Ignition ON	1,5 V
	D9	←	Engine idling	3,5 V
Battery	D1	←	Ignition OFF	11-14 V
Brake pedal position (BPP) switch – some models	D2	←	Ignition ON – brake pedal released	0 V
	D2	←	Ignition ON – brake pedal depressed	11-14 V
Camshaft position (CMP) actuator – V-Tec	A4	⇨	Ignition ON	0 V
Camshaft position (CMP) oil pressure switch – V-Tec	D6	⊣▷	Engine idling	0 V
Camshaft position (CMP) sensor	B11	←	Engine cranking	0,2 V ac
	B11	←	Engine idling	0,7 V ac
	B11	←	3000 rpm	2,5 V ac
	B11	←	Engine idling	33
	B12	←	Engine cranking	0 V
	B12	←	Engine idling	0 V
	B12	←	3000 rpm	0 V
Crankshaft position (CKP) sensor	B13	←	Engine cranking	0,4 V ac
	B13	←	Engine idling	1,5 V ac
	B13	←	3000 rpm	5 V ac
	B13	←	Engine idling	1
	B14	←	Engine cranking	0 V
	B14	←	Engine idling	0 V
	B14	←	3000 rpm	0 V
Data link connector (DLC)	D7	⇨	Ignition ON	5 V
	D22	⊣—	Ignition ON	0 V

Component/circuit description	ECM pin	Signal	Condition	Typical value
Earth	**A23**		Ignition ON	0 V
	A24		Ignition ON	0 V
	A26		Ignition ON	0 V
	B2		Ignition ON	0 V
Engine coolant temperature (ECT) sensor	**D13**	⬅	Ignition ON – engine cold	3,4 V
	D13	⬅	Ignition ON – engine hot	0,5 V
	D22	⏚	Ignition ON	0 V
Engine diagnostic link	**D4**	⇨	Ignition ON	5 V
	D22	⏚	Ignition ON	0 V
Engine speed (RPM) sensor	**B15**	⬅	Engine cranking	1 V ac
	B15	⬅	Engine idling	2,8 V ac
	B15	⬅	3000 rpm	9 V ac
	B15	⬅	Engine idling	17
	B16	⬅	Engine cranking	0 V
	B16	⬅	Engine idling	0 V
	B16	⬅	3000 rpm	0 V
Evaporative emission (EVAP) cut-off valve	**A20**	⏚▷	Engine running – coolant temp. 70°C max.	0 V
	A20	⏚▷	Engine running – coolant temp. 70°C min.	11-14 V
Exhaust gas recirculation (EGR) valve position sensor – some models – supply voltage	**D20**	⇨	Ignition ON	5 V
Exhaust gas recirculation (EGR) valve position sensor – some models	**D22**	⏚	Ignition ON	0 V
Heated oxygen sensor (HO2S)	**A6**	⏚▷	Ignition ON	11-14 V
	A6	⏚▷	Engine idling	0-1 V
	D14	⬅	Engine idling – engine hot	0,1-0,9 V fluctuating
	D22	⏚	Ignition ON	0 V
Idle air control (IAC) valve	**A9**	⏚▷	Ignition ON	11-14 V
	A9	⏚▷	Engine idling – engine cold	9,5 V
	A9	⏚▷	Engine idling – engine cold	29%
	A9	⏚▷	Engine idling – engine hot	10,5 V
	A9	⏚▷	Engine idling – engine hot	22%
	A9	⏚▷	Engine idling	24
Ignition amplifier	**A21**	⇨	Ignition ON	10 V
	A21	⇨	Engine cranking	6-8 V/9 Hz
	A21	⇨	Engine idling	10-11 V/25 Hz
	A21	⇨	Engine idling	32
	A21	⇨	3000 rpm	7-8 V/98 Hz
	A22	⇨	Engine idling	32
Ignition amplifier – some models	**A22**	⇨	Ignition ON	10 V
	A22	⇨	Engine cranking	6-8 V/9 Hz
	A22	⇨	Engine idling	10-11 V/25 Hz
	A22	⇨	3000 rpm	7-8 V/98 Hz
Ignition switch – start signal	**B9**	⬅	Engine cranking	9 V
Injector 1	**A1**	⏚▷	Ignition ON	11-14 V
	A1	⏚▷	Engine idling	2 ms
	A1	⏚▷	Engine idling	35

Table continued on next page ➡

Component/circuit description	ECM pin	Signal	Condition	Typical value
Injector 2	**A3**	⊣▷	Ignition ON	11-14 V
	A3	⊣▷	Engine idling	2 ms
	A3	⊣▷	Engine idling	35
Injector 3	**A5**	⊣▷	Ignition ON	11-14 V
	A5	⊣▷	Engine idling	2 ms
	A5	⊣▷	Engine idling	35
Injector 4	**A2**	⊣▷	Ignition ON	11-14 V
	A2	⊣▷	Engine idling	2 ms
	A2	⊣▷	Engine idling	35
Intake air temperature (IAT) sensor	**D15**	←	Ignition ON – 15°C	3,5 V
	D22	⊣—	Ignition ON	0 V
Malfunction indicator lamp (MIL)	**A13**	⊣▷	Ignition ON – MIL ON	0-1 V
	A13	⊣▷	Ignition ON – MIL OFF	11-14 V
Manifold absolute pressure (MAP) sensor	**D17**	←	Ignition ON	3 V
	D17	←	Engine idling	0,85 V
	D17	←	Full throttle briefly	2,8 V
	D19	⇨	Ignition ON	5 V
	D21	⊣—	Ignition ON	0 V
Power steering pressure (PSP) switch	**B8**	←	Ignition ON	0-1 V
	B8	←	Engine idling – steering wheel turned	11-14 V
	D22	⊣—	Ignition ON	0 V
Relay module	**A7**	⊣▷	Ignition ON	0-1 V briefly then 11-14 V
	A7	⊣▷	Engine idling	0-1 V
	A8	⊣▷	Ignition ON	0-1 V briefly then 11-14 V
	A8	⊣▷	Engine idling	0-1 V
	A23	⊣—	Ignition ON	0 V
	A25	←	Ignition ON	11-14 V
	B1	←	Ignition ON	11-14 V
Throttle position (TP) sensor	**D22**	⊣—	Ignition ON	0 V
	D11	←	Ignition ON – throttle closed	0,5 V
	D11	←	Ignition ON – throttle fully open	4,5 V
Throttle position (TP) sensor – supply voltage	**D20**	⇨	Ignition ON	5 V
Transmission lockup control valve A – AT	**A19**	⇨		[1]
Transmission lockup control valve B – AT	**A17**	⇨		[1]
Transmission range (TR) switch – AT	**B3**	←	Ignition ON – AT in D3	0-1 V
	B3	←	Ignition ON – AT not in D3	5 V
	B4	←	Ignition ON – AT in D4	0-1 V
	B4	←	Ignition ON – AT not in D4	5 V
	B7	←	Ignition ON – AT in P or N	0-1 V
	B7	←	Ignition ON – AT not in P or N	5 V
Vehicle speed sensor (VSS)	**B10**	←	Ignition ON – vehicle pushed	0 V or 5-12 V

[1] **Connected pin - no test data available**