Hondata Installation Manual

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Table of Contents

Introduction

This installation manual covers the installation of all Hondata stages. Some information in this manual will not apply if you are not installing all the Hondata features.

Stage 2 features

Shift light
This is a high intensity LED wired in parallel with the factory check engine light. At a certain rpm the LED will light as an indication of when you should change gear. The shift light rpm can be set with a dash mounted push button.

VTEC control
The point where the ECU switches camshafts can be adjusted from 3000-7000 rpm using the dash mounted push button. Unlike other VTEC controllers the ECU will switch ignition and fuel tables at the correctly point to ensure the mixture and ignition is optimum for each camshaft.

Rev limiter
The overall rev limiter can be set up to 9000 rpm using the dash mounted push button.

Stage 3 features

Three stage rev limit
When the car is stationary and the clutch is in, a launch limiter is used so that the revs can be held accurately to maximise traction and repeatability while launching. When the car is moving and the clutch is depressed, a shift limiter reduces engine speed so that full throttle gearchanges can be made. The overall rev limiter limits rpm to prevent engine damage.

Stage 4 features

This stage consists mainly of software upgrades detailed in 2 separate manuals and requires the use of a PC (laptop recommended).

HondaLogger
Windows based real time datalogging system (also available as an option on stages 2 and 3).

ROM Editor
Windows based editing software allows the user to alter fuel and ignition curves, injector sizing, set limits and more. ROM Editor can be used to tune ROMs for use with stage 2, 3 or 4 systems.

Tools

Installation

The ECU needs to be modified to use an external ROM, and other components added to the circuit board. There are three ways to do this:

1) Send the ECU to Hondata.
2) Have a local electronics technican install it.
3) Do it yourself.

It is recommended that the ECU is sent to Hondata unless you are experienced in working with Honda ECUs.

Tools

To modify the ECU we recommend the following tools:

• Hakko 936 Temp controlled soldering iron
• Hakko 808 Desoldering gun
• CRC Brakleen
• Liquid flux

Hints

Using flux is recommended when soldering. Follow the flux manufacturers instructions.

Before and after soldering, spray the underside of the circuit board with Brakleen (use only CRC Brakleen). Scrub the solder joints with a non metallic brush, like a toothbrush or similar plastic brush.

Hakko 808 Desoldering gun

Hakko 936 Temp controlled soldering iron

Liquid flux   *Brakleen*

ECUs Swap Table

This table lists the functions of the various ECUs that Hondata upgrade. Any ecu may be used as long as it has the functions you require. Hondata ROMEditor can install the fuel and ignition tables from any ECU into any other ECU.

ECU	VTEC control	Knock Sensor	Intake runner control
OBD O			
PR3	Yes	Yes	No
PWO	Yes	Yes	No

(these ECUs need a 16 tooth distributor)

OBD I			
P72	Yes	Yes	Yes
P30	Yes	Yes	No
P30-G00 & G01	Yes	No	No
P61	Yes	Yes	No
P28	Yes	No	No
P06	No	No	No
P74/P75	No	No	No

(these ECUs need a 24 tooth distributor found in all later model Hondas)

Intake runner control refers to the ECU's ability to switch the length of the intake runner from long to short. Commonly found in the GSR, Prelude and certain Accords. If you have swapped to a Type R manifold, then a P30 computer will work fine. The top two ECUs, PR3-PWO, are interchangeable.

When using ROM Editor, an ECU from our conversion table can be adapted to drive any other Honda up to the current models. For example a P28 ECU from a 94 SOHC Civic EX can be adapted to drive a '93 VTEC Accord, 99 Civic Si (B16A), 2000 Type R Integra or Prelude all normally aspirated or with boost pressure.

1990-1995 Accord and 92-95 Prelude ECUs

These computers use a different processor from those used on the other OBD I computers. If you want a Hondata stage 2, 3 or 4 for one of these cars, you will need to substitute the stock ECU with an ECU listed on the swap table on the previous page.The OBD I ecus listed in the table above are a direct plug in replacement.

ECUs covered

OBD II ECUs

1996 and later OBD II ECUs do not utilize a removable EPROM. Instead they use a One Time Programmable combined microprocessor / ROM chip. These ECUs are expensive to program as every time you make a change you need to replace the combined microprocessor / ROM chip. A conversion to OBD I is quite economical since these blank OTP chips cost close to $200 per unit.

There are two types of adaptor cables. One for 96-98 4 cylinder Hondas and and one for 99-2000. Some 2001 models are covered, but with the 2002 Civic and Acura RSX utilizing Direct Ignition Honda used a different computer and connector configuration.

The cables are simply plug and play. At any later time you can simply unplug the OBD I ecu and return to your stock OBD II ECU.

Using the swap table on the previous page you can select an OBD I computer to drive most newer OBD I Hondas.

An extensive and up to date swap guide is found at http://www.hondata.com/products.html

OBD I to OBD II adaptor cable

From Top to Bottom: OBD II 99-2001, OBD II 96-98, OBD 1 92-95, OBD 0 89-91

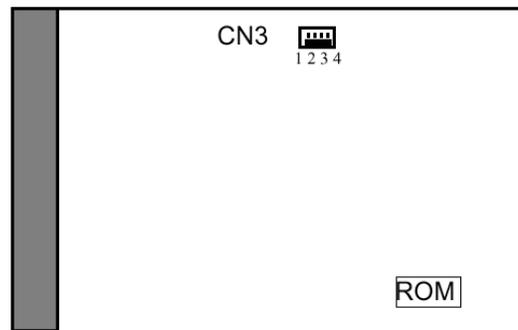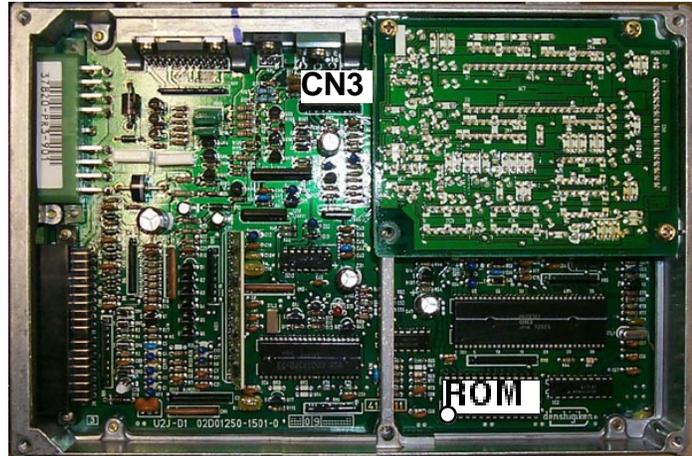# ECU Installation

JDM PR3/PWO ECUs

1. Desolder holes 1-4 from CN3.

2. Install the 4 pin connector with the lock tab as shown. Pin 1 is ground (black wire). Please note correct orientation.

3. Desolder the stock 28 pin ROM and install the 28 pin socket with the notch facing the wiring harness.

4. Plug in the external interface box into CN3. Note: with stages 2, 3 & 4 the interface box must always be connected.

5. Install the Hondata 28 pin ROM (h058 for the PR3 or h071 for the PWO) with the notch facing the wiring harness. The notch is also drawn in white on the circuit board.

Caution: If you plug in an EPROM or EEPROM backwards it will overheat and erase or damage the device.

6. Start and run the car. If you get a check light, plug back in the stock ROM to test your soldering.

Conversion of PR3-901 from automatic to manual

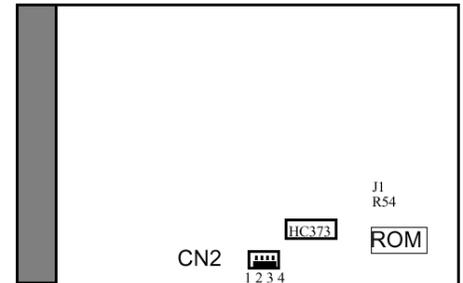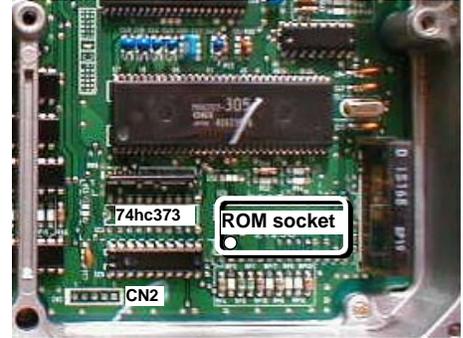Move the jumper from R68 to R67 (both locations are to the left of the ROM).

PR3/PWO component locations

ECU Installation

US OBD I ECUs

This series of computers has the ROM and microprocessor combined. Circuitry needs to be added to run an external ROM. Part locations and numbers and orientation are clearly printed in the circuit board.

1. Desolder all holes for the components.

2. Solder in a 28 pin socket.

3. Solder in the 74HC373.

4. Solder a 1.1K ohm resistor into R54 location marked in white lettering (not needed on P72).

5. Solder in two 0.1uF ceramic disc capacitors into C51 and C52.

6. Solder the 4 pin external connector to into CN2 pins 1-4. Pin 1 is ground (black)

7. Solder in J1. This jumper can activated by utilizing an unused resistor lead or extra section of spare wire.

8. Plug in the external interface box into CN2. Note: with stages 2, 3 & 4 the interface box must always be connected.

9. Insert the Hondata 28 pin DIP ROM in the proper orientation and start the car.

Caution: If you plug in an EPROM or EEPROM backwards it will overheat and erase or damage the device.

Hondata ROMS are matched to the ECUs and cannot be mixed. If you purchased stage 4, there are a list of stock ROMS installed on your computer's hard drive. See page 6 for the list. If you are getting an error that was not there with the stock ECU, write the appropriate stock .bin file to a blank chip and install in your ECU . If there is still an error, there may be a soldering problem. Cut J1 to return the ECU to stock.

Conversion from automatic to manual

Between the ROM and the side of the ECU case are a number of jumper resistors labelled with RP. Remove RP17 and install a jumper across RP18.

US ECU component locations

ECU Installation

JDM OBD I ECUs

This series of ECUs is about 2/3 the size of the US ECUs and uses mostly surface mount technology. This series of computers also has the ROM and microprocessor combined. A fine tipped soldering iron and lots of soldering experience is needed to install the surface mounted 74HC373 chip.

1. Desolder all holes for the components.

2. Solder in a 28 pin DIP thru-hole type ROM socket.

3. Solder in the 74HC373 SMD Chip. If the the IC chip is the wide package type you need to bend the leads to line up. Use flux when soldering. Pin one is at the lower right hand corner in the diagram.

4. Solder the 4 pin external connector to into CN2 pins 1-4. Pin 1 is ground (black). Please note correct orientation.

5. Solder in J1. This jumper can activated by utilizing an unused resistor lead or extra section of spare wire. This location is on the backside of the ECU motherboard.

6. Plug in the external interface box into CN2. Note: with stages 2, 3 & 4 the interface box must always be connected.

9. Insert the Hondata 28 pin DIP ROM in the proper orientation and start the car.
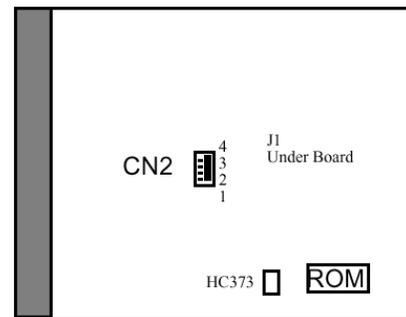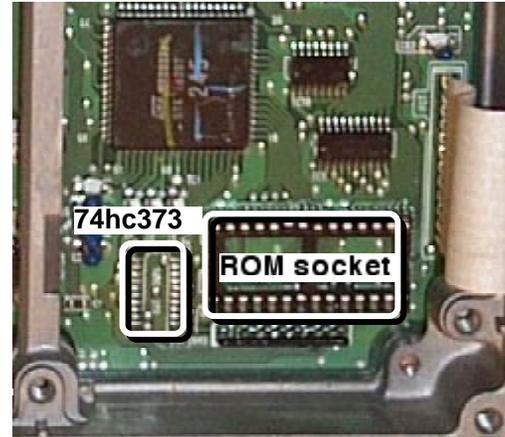
P30 ecu with ROM socket

Caution: If you plug in an EPROM or EEPROM backwards it will overheat and erase or damage the device.

Hondata ROMS are matched to the ECUs and cannot be mixed. If you purchased stage 4, there are a list of stock ROMS installed on your computer's hard drive. See page 6 for the list. If you are getting an error that was not there with the stock ECU, write the appropriate stock .bin file to a blank chip and install in your ECU . If there is still an error, there may be a soldering problem. Cut J1 to return the ECU to stock.

Conversion from automatic to manual

RP18 needs to be lowered in value from 2.4k ohms to 1.4k ohms.

ECU Installation

Installing the interface box

The interface box should be located close to the ECU where the wiring will not be pulled or pinched. For datalogging the serial connector should be accessable. It is useful if the interface box is mounted so that the diagnostic LED on the front can be seen if necessary. The interface box does not need to be grounded.

Wiring

Route the ECU to interface box cable out either under the lid or through near where the connectors exit the ECU case. In both cases make sure that there is no chance of the cable being pinched or chaffed where it passed out of the ECU. A slot may need to be filed so that there is room of the cable to pass out of the ECU. Make sure the edges are not sharp. A rubber gromit make help.
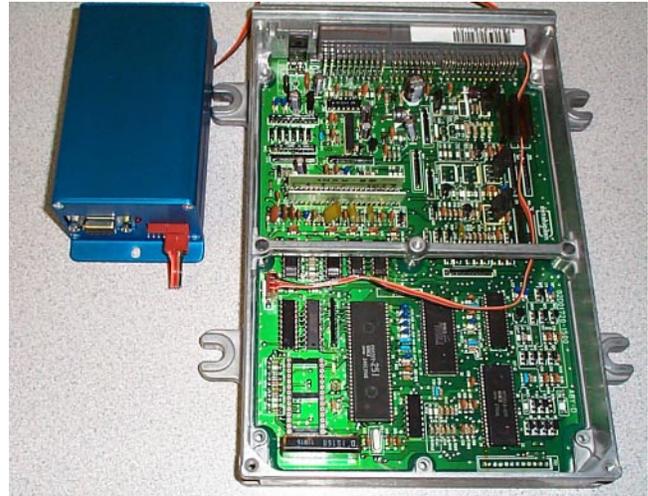
Interface box plugged into a US P28 OBD I ecu

Connecting the 4 wire lead

This is done as per the photo and diagram.

Inserting the ROMs

Stage 4 ships with a ZIF socket (zero insertion force) and a stack of machine pin sockets high enough to clear the internal air pressure sensor. The sockets and EEPROM should be inserted with the notch pointing towards the wiring harness end of the ECU. This arrangement is only necessary while using the ZIF socket. Once tuning has been completed the ZIF socket should be removed, and an EPROM placed directly into the socket on the ECU.
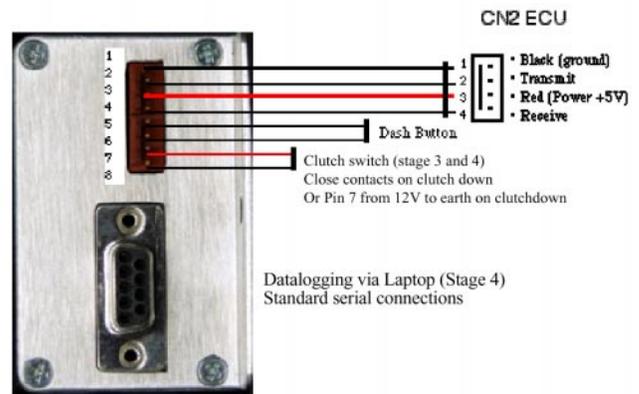
Interface box pinouts
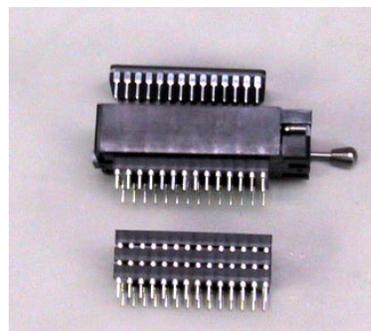
Zero Insertion force socket EPROM and 4 sockets to clear PA sensor
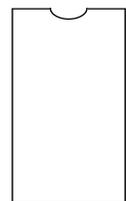
Notch on Chip

Resolving Problems

Take note of what the LED on the front panel of the interface box does when the ignition is switched on (with early interface boxes this LED is inside the interface box).

The engine will only rev to 3200 rpm

In this situation the error codes cannot be retrieved from the ECU (the check light will remain on solidly). The ECU is in 'limp home mode', which means that there is a problem accessing the ROM so the ECU is running off a backup processor. The ECU will use fixed ignition and fuel values.

Possible causes for this problem:

- ROM inserted the wrong way around.
- Incorrect ROM for the ECU (see page 6).
- Jumper J1 not installed or incorrect value.
- Bad solder connection to the socket or latch IC (especially with surface mount latch ICs).

The interface box LED does not come on

The interface box is not getting power from the ECU. Possible causes for this problem:

- Interface box cable is not plugged in correctly.
- The cable has broken wires or is shorting out. Check for +5V between CN2 or CN3 pins 1 and 3 on the ECU.

The interface box LED flashes once and goes out

Reset the interface box by holding down the rev set button while switching the ignition on.

The interface box LED is flashing slowly

The problem lies with the Hondata interface box not being able to communicate with the ECU. Possible causes for this problem:

- Incorrect ROM used for the ECU.
- ROM inserted the wrong way around.

The interface box LED flashes and stays on

This is normal behaviour for the interface box. The problem lies with the ECU or car. Short the diagnostic connector and read the error codes (see appendix 2 for instructions on how to do this.)

Shift Light Installation

Installation of the shift light

This is a high intensity LED wired in parallel with the factory check engine light. At a certain rpm the LED (and check engine light) will light as an indication of when you should change gear. The shift light rpm can be set with a dash mounted push button. The 470 ohm resistor is built into the shift light wiring and does not need to be added.
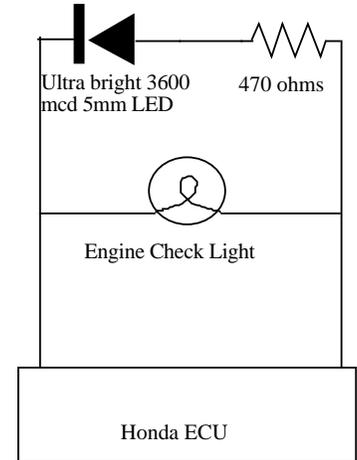
Install the LED where the driver can see it (make sure you allow for the steering wheel). The LED is directional so should be mounted facing the driver.

The copper colored wire of the shift light should be wired into ignition switched +12V which is ECU pin A15 (OBD 0) or A25 (OBD I). The shift light can be wired in with the supplied snaplocks or soldered in place (which is recommended). To wire in using the snaplock connector open the snaplock connector and thread the wire from the wiring loom through. Insert the shift light wire, close the connection and squeeze closed with pliers. The snaplock connector can be removed at any time leaving the wire intact.
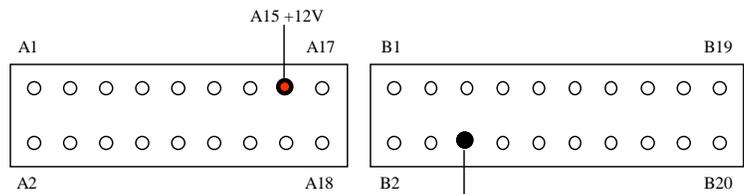
The silver coloured wire of the shift light should be connected to ECU pin B6 (OBD 0) or A13 (OBD I). The engine computer grounds this connection to switch the engine check light on.

Switch on the car. The engine check light and LED should both come on as the ECU primes the fuel pump (for about 2 seconds).
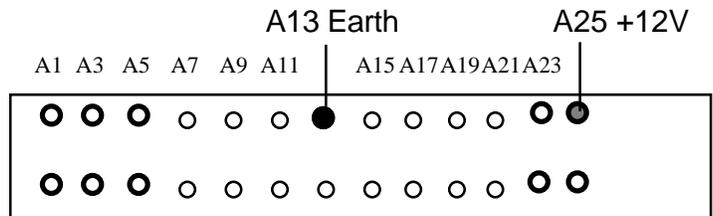
Alternately the shift light can be wired directly across the check engine light in the instrument cluster. The LED is polarised and will not light if wired in reverse, but will not be damaged if this is done accidentally.

Ultra bright 3600 mcd 5mm LED   470 ohms

Engine Check Light

Honda ECU

Shift Light Diagram

A15 +12V

A1   A17   B1   B19

A2   A18   B2   B20

B6 Earth

PWO / PR3 ECU pinouts (looking at the ECU)

A13 Earth   A25 +12V

A1 A3 A5 A7 A9 A11   A15 A17 A19 A21 A23

OBD I ECU pinouts (looking at the ECU)

Rev set button mounted in dash

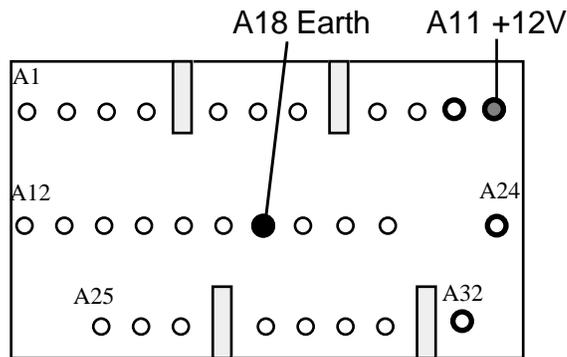*Shift light mounted in dash*

Shift Light Installation

OBD II wiring harness adaptors.

If you have a Hondata system connected to an OBD II Honda, it will have either the 96-98 or the 99-2000 configuration connector. The diagrams below show shift light connections all 96-2000 OBD II vehicles.

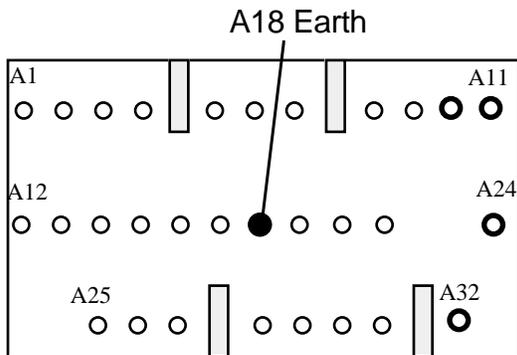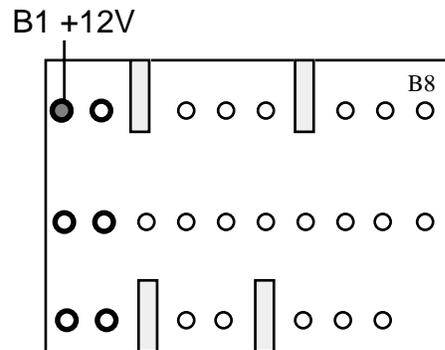*From Top to Bottom: OBD II 99-2001, OBD II 96-98, OBD 1 92-95, OBD 0 89-91*

OBD II 96-98 shift light wiring, looking at the wiring from the engine side towards the harness

OBD II 99-2000 shift light wiring, looking at the wiring from the engine side towards the harness

Clutch Switch

Positioning the clutch switch (Stage 3)

For stage 3 a clutch switch needs to be mounted so that it is activated close to the point where the clutch engages. Standard vehicles will have none, one or two clutch switches mounted either above or below the clutch pedal. For some cars the lower position can be used to mount the supplied clutch switch.

The lower position

The easiest location to install the Hondata clutch switch is in the position of the cruise control switch. If cruise control is still used then this will mean that the cruise control will not deactivate when the clutch is depressed, so it is only recommended for use in cars without cruise control.

In this location, the car activates its full throttle shift when the clutch is depressed slightly. As most clutches have some free play in them, screw in the clutch switch until the free play is minimal. Be careful not to remove all the free play as this will cause the clutch to slip and burn out over time.

In this position the switch is sensitive to riding the clutch. If you ride the clutch even the slightly, you car will be rev limited to the full throttle shift point of 6000 rpm.

Custom Switch

The best position for the clutch switch is to use a bracket to locate the clutch switch closed to the pedal pivot point, so that the clutch switch will activate slightly above the clutch disengage point. Alternatively a replacement switch with a longer switching throw can be used (microswitches work well).

Testing the clutch switch

Start the car and bring the revs up to 4000 rpm while stationary. Depress the clutch. The revs should drop to 3000 rpm (or whatever the launch rpm is set to).

If your rev limit is 3000 rpm while you are stationery and 6000 rpm while moving is is likely your clutch switch is stuck on. Unplug your clutch switch and re-test.

Hints

If you do not intend to use launch control immediately then do not plug in the clutch switch. For circuit racing applications add a dash mounted switch in the wiring to the clutch switch so that the clutch switch can be disabled if necessary.
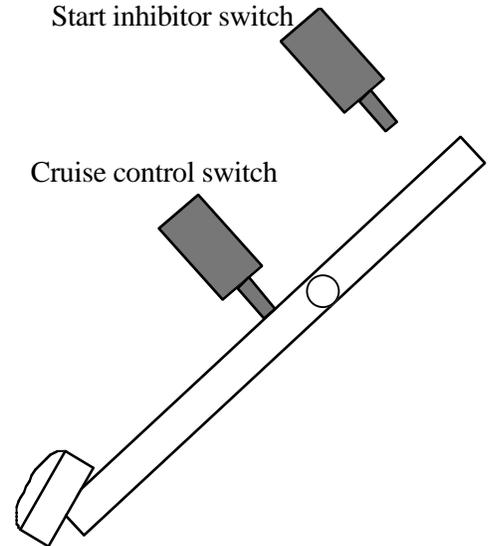
Clutch pedal and switch positions
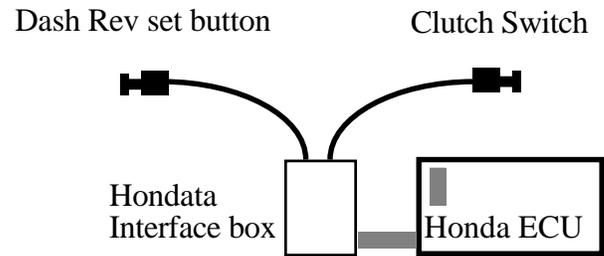
Clutch switch wiring for the lower position

Switch in lower position

Setting Rev limits

Programming the revs

The rpm points are initially set to the following:

Launch limiter   3000 rpm (stage 3 & 4)
Cam change point   4800 rpm
Shift limiter   6000 rpm (stage 3 & 4)
Shift light   7800 rpm
Rev limiter   8500 rpm

Pressing and holding the button for several seconds while switching the ignition on will reset all the rpm points to the Hondata defaults. Do this the first time the system is installed into the car.
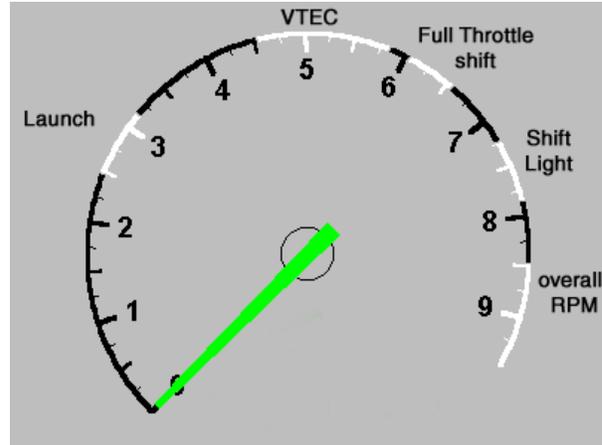

The five Hondata rev limits

Methods of setting revs

There are two methods of setting the rev points: *dynamic* which is quick and *static* which is accurate. A video explanation of this is available from http://www.hondata.com/media.html

The launch limiter, cam change point, shift limiter, shift light and overall rev limiter can all be adjusted using the rev set button. Pressing the button will put the computer into a 'setup mode'. If the engine is running, then the revs can be set by varying the engine speed and pressing the brake pedal (dynamic rpm setting). If the engine is not running, the rpm points can be set by pressing the button to set the thousands and hundreds of revs (static rpm setting).

Dynamic rpm setting

Dynamic rpm setting is quick but less accurate than static setting. With your foot off the brake start the engine. Press the rev set button once. The check engine light will start flashing a sequence of between 1 and 5 flashes, which indicates the rpm value that is to be changed. Pressing the button again will cycle through the rpm point that is to be changed 1,2,3,4,5, 1,2,3,4,5, 1,2,3,...

Check engine light	Function	Allowable rpm range
1 flash =	launch limiter rpm	1500 - 8000 rpm (stage 3 and above)
2 flashes =	cam change rpm	2000 - 8000 rpm
3 flashes =	shift limiter rpm	5000 - 8000 rpm (stage 3 and above)
4 flashes =	shift light rpm	2000 - 9000 rpm
5 flashes =	rev limiter rpm	5000 - 9000 rpm

The revs for the *launch limiter* and *cam change* point, are set by selecting the mode, bringing the engine revs up to the desired point and tapping the brake pedal. The engine revs at that point will be remembered. Because it is difficult to set the higher rpm points by revving the engine to over 7000 rpm, the *shift limiter, shift light* and overall *rev limiter* are set at twice the revs when the brake pedal is tapped.

Setting Rev limits

1 flash =	launch limiter rpm	current rpm (stage 3 and above)
2 flashes =	cam change rpm	current rpm
3 flashes =	shift limiter rpm	twice current rpm (stage 3 and above)
4 flashes =	shift light rpm	twice current rpm
5 flashes =	rev limiter	twice current rpm

Examples

To set the launch limiter to 3500 rpm: Press the button once. The check engine light will flash once, with a one second pause between flashes. Increase the engine revs to 3500 rpm and tap the brake pedal. Switch the ignition off. The launch limiter is now set to 3500 rpm.

To set the shift light to 8000 rpm: Press the button four times. The check engine light will flash four times quickly, with a one second pause between groups of flashes. Increase the engine revs to 4000 rpm, and tap the brake pedal. Switch the engine off then restart. The shift light will now be set to 8000 rpm.

Note that if the rev set button is pressed with the brake on, the launch rpm will be set to the engine speed at the time the button was pressed (within the allowable default RPM limits).

Static rpm setting

Static rpm setting is more accurate than dynamic setting but more time consuming to perform. With your foot off the brake turn on the ignition but do not start the car. Press the rev set button once. The check engine light will start flashing the rpm option that is to be changed, as in dynamic setup. Press the button additionally to select the rpm point to change, then tap the brake pedal.

The check engine light will now start flashing the thousands of revs, from 1 to 9 flashes. 1 flash = 1000 rpm, 9 flashes = 9000 rpm. Pressing the button will increase the thousand rev flashes. Tap the brake pedal to select the thousands of revs.

The check engine light will then start to flash the hundreds of revs, from 1 to 10 flashes. 1 flash = 0 rpm, 10 flashes = 900 rpm.

Switch the ignition off after setting both static and dynamic the static limits. After the car starts rev limits will not be active for 10 seconds until the Hondata interface board and ECU complete their diagnostics.

Setting Rev limits

Examples

To set the launch limiter to 3500: Press the button once. The check engine light will flash once, with a one second pause between flashes. Tap the brake pedal. The check engine light will start to flash the thousands of revs. Press the button twice, so the check engine light flashes groups of three (3000 rpm). Tap the brake pedal. The check engine light will start to flash hundreds of revs. Press the button five times, so the check engine light flashes groups of six (500 rpm). Tap the brake pedal. Switch the engine off then restart. The launch limit is set to 3500 rpm.

To set the shift light to 8000 rpm: Press the button four times. The check engine light will flash four times quickly, with a one second pause between groups of flashes. Tap the brake pedal. The check engine light will start to flash the thousands of revs. Press the button eight times, so the check engine light flashes groups of eight (8000 rpm). Tap the brake pedal. The check engine light will start to flash hundreds of revs. Tap the brake pedal without pressing the button. The shift light is set to 8000 rpm.

Rev counter accuracy

The static method used to determine the engine speed is very accurate, usually much more accurate than the rev counter which can be between 5 and 10 % out. The rev limits that you set will often be different from that shown on the rev counter.

HondaLogger

Datalogging

Datalogging is standard with stage 4 and optional on stages 2 and 3. It is very useful for tuning and trouble-shooting vehicles, in particular those who live some distance away and have their own laptop. Usage is covered in the separate HondaLogger manual.

Datalogging includes:

• HondaLogger software and manual
• PC serial cable

The latest version of HondaLogger is available from:
 http://hondata.com/downloads.html

A laptop strongly recommended.

Stage 4 layout

Hardware Requirements

Pentium PC running Windows 95, 98, ME, NT or 2000. 32 Mb RAM recommended.

Installation of Hondalogger

Plug the serial cable into the D9 connector on the Hondata interface board and the other end into the D9 serial connector on your PC. In HondaLogger preferences set the serial port to the serial port which the cable is attached to (this may not be COM1 for some laptops with only one serial port).

Macintosh

As an unsupported option HondaLogger has been tested on an Apple Macintosh running Virtual PC 2.1.3 with 64 Mb Ram and Keyspan PDA USB-D9 serial adaptor, and also on an iBook with 96Mb ram and Virtual PC 3.0 running Windows 95.

The Keyspan usb-D9 serial adaptor must be plugged in before launching Virtual PC. In the Virtual PC preferences, set COM1 to Keyspan and click the box *non modem device*. Virtual PC on an iBook will log at around 60-80 sensors per second.
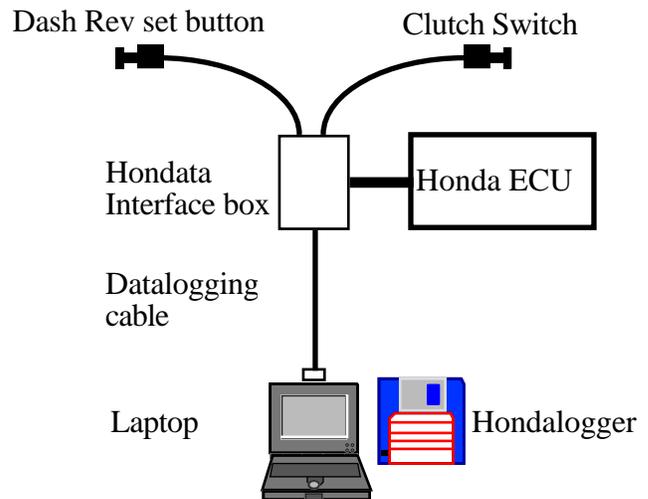
ROM Editor

Tuning the ECU

ROM Editor can be used to edit the fueling ignition and injector values of any stage 2 or 3 ROM image (as long as it has not been password protected.) Extensive instructions are in the Hondata Rom Editor manual.

Install the software from the supplied floppy onto the hard drive of your PC.

ROM Editor works with ROM image files, which can then be programmed into an EPROM or downloaded into an emulator in the ECU. To create a new ROM image file use New from the File menu in ROM Editor. Once a ROM image file is created, the fuel and ignition settings can be edtied, then the ROM image saved to a new file.

The ROM image is then programmed to an EEPROM or EPROM via an EPROM programmer and placed into the Honda ECU.

When dyno tuning, an emulator can be used to make very rapid changes. The EPROM is then written at the end of the dyno session.

Stock ROM image files associated with the ECUs Hondata supports are installed into the ROM Editor sub-directory. The stock files are not editable, but can be used whenever an ECU problem is suspected, to return the ECU back to stock operation.
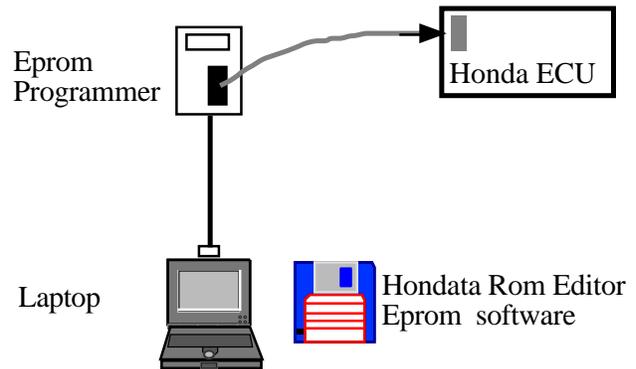
Programming setup
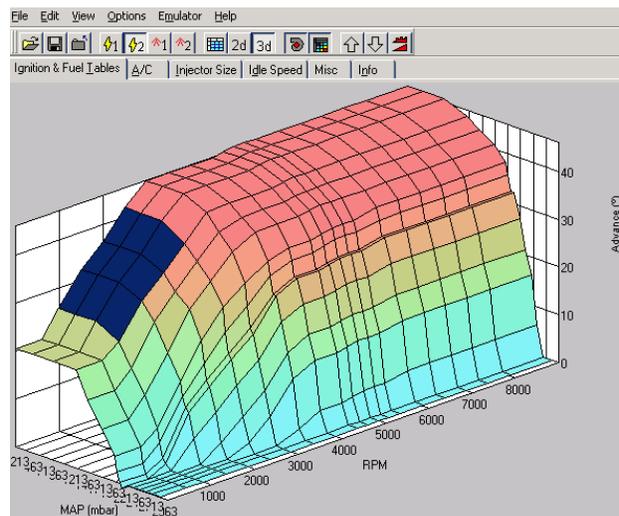
High speed ignition map

3 BAR MAP Sensor

The standard Honda MAP sensor can read boost up to 11 lbs. By using a GM 3 bar MAP sensor boost up to 28 lbs can be read. The same fuel and ignition tables are used for both MAP sensor to swapping between the sensors is only a matter of wiring the sensor in and using ROM Editor to change the MAP sensor type.

To wire in the GM sensor splice the three wires into the existing wiring loom so that you can swap between the MAP sensors if necessary, or revert back to the stock MAP sensor. Make sure that only one MAP sensor is connected at a time. The connectors are stamped A, B & C on the MAP sensor.

3 BAR Map sensor connectors

Wire	GM Code	Honda Wire Colour
GND	A	Green/White
MAP signal	B	White
5V	C	Yellow/Red

Check the wire voltage with a multi-meter to make sure the wiring has been performed correctly (alternatively HondaLogger can be used to datalog the voltage). With the ignition switch on but the engine not running the standard MAP sensor should read 2.85V between the MAP signal and GND wires. The GM MAP sensor should read 1.6V. (All voltages are correct for sea level - at higher altitudes the voltage will be lower.)

3 Bar pigtail spliced into stock wiring

Tuning for Boost

General tuning for boosted engines

Hondata take no responsibility for any engine damage caused by the use of its products. All cars should be tuned on a dyno using an accurate air/fuel meter, knock monitor and exhaust gas temperature meter. This is a recommendation only; the final responsibility of the parameters which are used lies with the person performing the tuning.

Before you start tuning

- Check that the injectors are the correct impedance for the ECU. Low impedance injectors need to use a resistor box.

- Check that the cam timing is correct.

- Set the ignition timing to the base setting (middle timing mark) at an idle speed below 600 rpm. Pull the EACV plug off the manifold to get the engine to idle at about 500 rpm. It is important to set the idle below 600 rpm, otherwise it can be up to 10 degrees retarded.

- Make sure that you have not wired one oxygen sensor into the two wires for the PWO/PR3 ECU, or have swapped the primary and secondary oxygen sensors around. If you do either of these things then the engine will run very lean on two cylinders, and very rich on the other two cylinders, but an lambda meter will show a normal mixture.

- Make sure that there are no check valves in the MAP sensor line.

- Run the engine in open loop while tuning. Otherwise the ECU will vary the mixture as it uses the oxygen sensors to change the fueling.

- Make sure that there are no ECU problem codes. If there are any, fix them before you begin.

Fuel Pressure

Set the fuel pressure fairly high - around 50 lbs. Measure this during fuel pump prime (when the ignition is switched on and the engine not running). Measuring fuel pressure at idle is inaccurate as idle vacuum is not constant. If you run into duty cycle problems later on you can increase the fuel pressure. Make sure you measure the stock fuel pressure and re-calibrate the Hondata ROM for any change. (See the Hondata ROM Editor software for re-calibration instructions.)

While tuning on the dyno verify that the fuel pressure does not drop at any point while under full load. With a naturally aspirated engine the fuel pressure under full load should be the same as the fuel pressure during fuel pump prime. With a forced induction engine the fuel pressure should increase over the prime pressure by the amount of boost. If the fuel pressure decreases, or does not rise as expected, to is decreasing you may have a problem with a clogged fuel filter, or an fuel pump that cannot supply sufficient volume.

Tuning for Boost

Tuning

If at all possible it is best to first tune the engine without any boost. Once this is done the naturally aspirated portions of the fuel and ignition tables can be extrapolated to cover the boosted portion of the tables. This method will minimise the amount of tuning which needs to be performed under boost. To make the engine run without boost hold the wastegate open, or remove the spring in the wastegate. Do not disconnect the pressure side of the intake piping as this will over-rev the turbo.

First adjust the injector multiplier. Check the mixture while running from 3000 - 4000 rpm under light to moderate throttle. Adjust the injector multiplier using ROM Editor until the desired part load cruise mixture is reached (13.5:1 - 14.5:1 for a boosted car). Check the exhaust gas temperature (EGT) while doing this as running lean for extended periods of time while cruising will over heat the turbo. You may need to adjust the ignition timing to achieve best power and EGTs. While tuning under part load it is best to adjust the fuel tables by selecting a number of columns, and adjusting the values for all the rows in those columns.

Once part throttle is tuned do a full throttle run from about 2000 to 8000 rpm. Adjust the top two naturally aspirated columns (normally columns 9 and 10) until the correct mixture is obtained. If large adjustments are made then merge the changes into the previous columns so that there is a smooth transition from cruising mixture to full throttle mixture. The mixture should be around 13.0:1 to 13.5:1 at atmospheric pressure for maximum power, but other factors like the EGT might make it necessary the make the mixture richer. Adjust timing until maximum power is achieved. You should not have to alter stock timing more than a few degrees in order to achieve this, unless the engine is radically altered or timing was not set correctly in the first step.

Once the tables are tuned up to (and including) atmospheric pressure, use the create tables function in ROM Editor to extrapolate the tables over the boosted portion of the tables. If possible set the boost as low as possible and perform a full throttle run from about 4000-8000 rpm. The mixture should be richer than at atmospheric pressure - about 12.0:1 - 12.5:1 while under boost. Increase the boost slowly and check that the mixture is correct. Timing can be adjusted at the same time. Advancing the timing will create more power and lower the exhaust temperature but increase the chance of detonation.

Final tuning involves adjusting the VTEC point for the minimum change in engine output as the cams change. By looking at the way the manifold pressure increases as the turbo spools up it may be possible to increase the response of the turbo by changing the mixture and timing for less power, but a faster turbo spool up time.

Jackson Racing SC

Observations of the installation and operation of the JR supercharger :

Top end mixture problem. Above 6000 RPM as supplied the JRSC system has been observed to run very rich at an airfuel ratio 9 or 10:1.

Insufficient fuel pump volume. The stock fuel pump in a Civic Si is good for 400Hp at 35 psi but only 200Hp at 75 psi. The factory pump should be replaced with a high volume before tuning.

Excessive idle fuel pressure. Some replacement high volume pumps generate too much fuel pressure causing overfueling at idle.

Ignition timing retard. Retarding the ignition to reduce detonation reduces performance across the RPM range. The Hondata will allow you to tune properly and make more power.

Closed loop boost. The car runs rough under light (<25%) throttle under boost as the ECU is still in closed loop and adjusting the A/F mixture.

Boost retard problem. Retard per lb of boost is greater at lower RPMs than higher with boost retard electronics. Very little retard if any is needed at high RPM.

Light throttle detonation problem. Transitional light throttle detonation is common for two reasons:
   • The supercharger reaches boost very quickly, while the MAP sensor still sees partial vacuum, so the ECU provides a incorrect lean mixture.
   • Not enough acceleration enrichment fuel is supplied.

To apply the fixes

Remove the relay mechanism that JR use on the air temperature sensor. This "tricks" the computer into thinking the air is at a very low temperature when on boost, which opens the injectors more to deliver more fuel.

Remove the rising rate fuel regulator and either reinstall the stock regulator or a 1:1 rising rate regulator. The fuel pump actually flows less fuel at higher fuel pressure. See the fuel pump tech page for detailed info.

Remove any VTEC, MAP or boost timing controllers. The Hondata system will deliver the retard that is needed.

Transfer the map sensor from the throttle body to the fitting where the rising rate regulator was removed. (displayed) If this is not done, the map sensor will only see atmospheric pressure and will run dangerously lean. In this example a piece of sturdy silicon hose is used.

For the later model Civics the OBD I computer and adaptor cable despite its larger size can be installed to the old location.

Mounting the OBD I ECU and adaptor cable

Jackson Racing SC

Install RC 440cc injectors and a 1:1 rising rate fuel regulator. These are good for about 220 wheel HP at the stock 50 lb fuel pressure.

On early model Hondas the intake air temperature sensor is located at the rear of the JRSC where it measures the temperature of the intake charge.

In later model Hondas (Civic Si) this location is left blank as the intake air temperature sensor is mounted between the throttle body and air filter. If the temperature sensor is left in that position it cannot compensate for increased intake temperatures and the car will run richer under boost.

Purchase an OBD I intake air temperature sensor (about $60) and mount it in the blower manifold. The OBD I air temperature sensor is a variable resistor and can be wired onto the OBD II wiring in any polarity.

Map sensor relocated to see boost

Plug the old MAP sensor hole


Mount an OBD I TA sensor here

ECU Problem Codes

What are ECU problem codes?

ECU problems codes are diagnostic outputs from the ECU, used to indicate in what area a problem lies. Usually the check engine warning light (on the dash) will come on for a serious problem, but will not necessarily come on for a minor problem. The ECU will remember problem codes with the ignition off; the only way to clear the codes is to disconnect the battery or remove the hazard fuse for half a minute or so.

How to read ECU codes

Pre OBDI ECUs
To read the codes, turn the ignition on and look at the LED inside the ECU. The LED is visible through a small plastic window in the top of the ECU. The ECU can signal simultaneous problems by blinking separate codes, one after the other. Problem codes 1 - 9 are indicated by 1 - 9 flashes, problem codes over 9 use one long flash as ten short flashes.
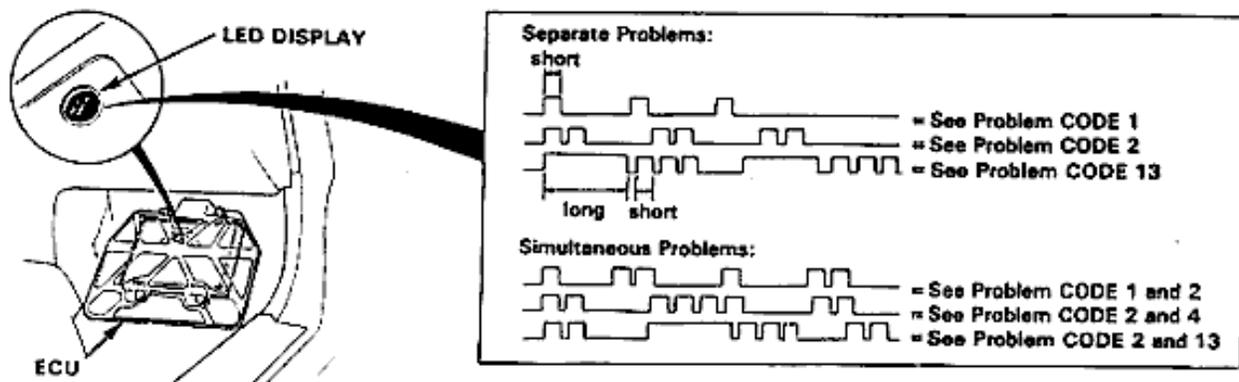
OBDI and later ECUs
Find the diagnostic connector, which is a two wire blue connector found near the passengers feet, or in the centre console.
Short out the diagnostic connector with a piece of wire. The check engine light on the dash will flash the problem codes.

Problem codes

1	O2A - Oxygen sensor #1
2	O2B - Oxygen sensor #2
3	MAP - manifold absolute pressure sensor
4	CKP - crank position sensor
5	MAP - manifold absolute pressure sensor
6	ECT - water temperature sensor
7	TPS - throttle position sensor
8	TDC - top dead centre sensor
9	CYP - cylinder sensor
10	IAT - intake air temperature sensor

ECU Problem Codes

12   EGR - exhaust gas re-circulation lift valve
13   BARO - atmospheric pressure sensor
14   IAC (EACV) - idle air control valve
15   Ignition output signal
16   Fuel injectors
17   VSS - speed sensor
19   Automatic transmission lockup control valve
20   Electrical load detector
21   VTEC spool solenoid valve
22   VTEC pressure valve
23   Knock sensor
30   Automatic transmission A signal
31   Automatic transmission B signal
41   Primary oxygen sensor heater
43   Fuel supply system
45   Fuel system too rich or lean
48   LAF - lean air fuel sensor
54   CKF - crank fluctuation sensor
58   TDC sensor #2
61   Primary oxygen sensor
63   Secondary oxygen sensor
65   Secondary oxygen sensor heater

OBD II specific codes

67   Catalyst system efficiency below threshold
70   Automatic transmission malfunction
71   Cylinder 1 misfire or a random misfire
72   Cylinder 2 misfire or a random misfire
73   Cylinder 3 misfire or a random misfire
74   Cylinder 4 misfire or a random misfire
75   Cylinder 5 misfire or a random misfire
76   Cylinder 6 misfire or a random misfire
80   Exhaust gas re-circulation
86   ECT (engine coolant temperature) sensor
90   Evaporative emission control system
91   Fuel tank pressure sensor
92   Evaporative emission control system (insufficient purge flow)