Vi-PEC

versatile intelligent performance engine control

Mazda RX-7 Series 6 - 8

VX Plug-In Installation and Configuration Manual

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Table of Contents

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Part I Introduction 4

1 Safety Notice 4
2 Disclaimer 5
3 Support Options 5

Part II Pre-Installation 6

1 Injector Impedance 6
Mazda ECUs 6
2 Metering Oil Pump Control 6
Mazda RX-7 ECUs 6

Part III Installation 7

1 ECU Handling Procedures 7
2 Fitting the ECU 7
Fitting a Mazda ECU 8

Part IV Additional Sensors 9

1 MAP Sensor 9
Mazda RX-7 S6-8 9
2 IAT Sensor 9
Mazda RX-7 S6-8 9
3 Expansion Connector 9
Mazda RX-7 S6-8 10

Part V PC Tuning 11

1 Installing USB Drivers 11
2 Installing Vi-PEC Tuning Software Tuning Software 11
3 Communicating With Your ECU 12

Part VI Pre-Start Configuration 13

1 Firmware Version 13
2 Base Configuration 13
3 MAP Sensor Calibration 13
4 TPS Calibration 14
5 IAT Sensor Selection 14
6 Input and Output Setup 14
7 Trigger Calibration 15

Part VII First Time Startup 16

1 Final Checks 16
2 Essential Tuning Adjustments 17

Part VIII Pin Functions 19

1 Mazda RX-7 S6-8 19

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Part IX Pinout 20
1 Mazda RX-7 S6 20
2 Mazda RX-7 S7-8 20
Part X Known Issues 22
1 Mazda RX-7 S6-8 22
Index 0

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1 Introduction

Thank you for purchasing your Vi-PEC Plug-In Engine Control Unit (ECU). Vi-PEC VX ECUs are an advanced, fully programmable microprocessor controlled Engine Management System.

The VX software platform boasts an impressive list of features giving a new level of user adjustment. This flexibility allows the tuner to have complete control over the engine management system. VX software employs high resolution fuel and ignition tables with configurable load and RPM centres. When coupled with up to six dimensional fuel and ignition mapping, barometric pressure compensation and intake air temperature correction this gives an unprecedented level of tuning accuracy. All Vi-PEC VX ECUs are in field upgradeable, there is no need to return the unit for software updates.

All Vi-PEC VX Plug-In Engine Management Systems are designed with flexibility and ease of installation in mind. Vi-PEC Plug-In systems are deigned to replace the circuit board inside the factory ECU enclosure. This provides an invisible install that requires minimal modification to vehicle wiring and ECU mounting.

Vi-PEC Engine Management Systems are designed with the final result in mind. Not only do they boast an impressive range of performance features, but are designed with a focus on safety, reliability and drive-ability. However, the ultimate success of your engine management upgrade is determined by how well the system is installed and tuned.

Installing and tuning any after market engine management system is not to be taken lightly. VX ECUs give the tuner the control & flexibility that only top after-market engine management systems in the world can provide. While every effort has been made to keep VX ECUs as user friendly as possible, it should be recognised that added features bring added complexity.

The complete setup of your ECU can be divided into two important tasks:

1. This manual covers the installation of your VX ECU. While it is not strictly essential that this work is performed by an automotive electrician, the knowledge and tools available to these professionals makes it highly recommended. Regardless of who does the installation, it is of utmost importance that instructions provided in this manual are followed exactly throughout the installation.
2. Once the VX ECU has been installed it will need to be tuned using a laptop computer with Vi-PEC Tuning Software software. Information on the configuration and tuning of the VX ECU is detailed in the online help section of Vi-PEC Tuning Software. VX ECUs are shipped pre-loaded with a base configuration that should be close enough to get most engines running after a few application specific adjustments have been made. While hearing the engine running on the new ECU for the first time is always a satisfying feeling, it is important to realise that the job is not complete. The amount of tuning performed and the experience of the tuner are the two most important factors in determining how happy you will be with your engine management system.

1.1 Safety Notice

Your Vi-PEC Plug-In ECU is designed to enhance the performance of your vehicle. However in all cases, your vehicle must be operated in a safe manner. Do not tune your vehicle while operating it on public roads. Obey road rules at all times.

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WARNING!

Failure to follow all installation and operating instructions may result in damage to the Vi-PEC ECU, personal injury, or harm to property.

1.2 Disclaimer

All care has been taken to ensure the pin outs and interconnections of the ECU to the vehicles wiring harness are correct. However due to variations between vehicle models it is the installers responsibility to check wiring connections BEFORE installing the ECU. Vi-PEC will not be held responsible for any damage caused by the incorrect installation of this product.

1.3 Support Options

Should any issues arise during installation, the following options exist for technical support:

1. Vi-PEC Tuning Software help, press F1 while running Vi-PEC Tuning Software
2. Contact your nearest Vi-PEC dealer. A Vi-PEC dealer list is available on our website.
3. Vi-PEC website: www.ViPEC.com
4. Technical Support Email: tech@ViPEC.com
5. Online Discussion Board: Available from the Vi-PEC website.

The majority of questions received by the technical support team are clearly answered in the manuals. To speed up your technical inquiry please consult the manuals to make sure that your question has not already been answered.

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2 Pre-Installation

Before installing theVi-PEC VX ECU into the vehicle some pre-installation checks must be performed.

2.1 Injector Impedance

Injector impedance is important and needs consideration before installing the ECU.

2.1.1 Mazda ECUs

The Mazda VX Plug-In ECUs are NOT designed to be used directly with low impedance injectors.

All models this ECU is designed for are fitted with high impedance injectors from factory. This means that the ECU is plug-in compatible with factory fitted injector combinations on all models. If low impedance injectors are to be fitted then a ballast resistor pack will be required. Contact your Vi-PEC dealer for further information.

2.2 Metering Oil Pump Control

The Metering Oil Pump is used to deliver engine oil to the combustion chambers to provide seal lubrication.

2.2.1 Mazda RX-7 ECUs

The RX7 S6-S7 VX Plug-In ECU is capable of controlling the factory Metering Oil Pump.

WARNING!!!

If the factory Metering Oil Pump is to be retained it is essential to ensure it is set up correctly to avoid running the engine without adequate lubrication.

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3 Installation

This guide provides information on correctly and safely installing your new Vi-PEC VX Plug-In ECU.

3.1 ECU Handling Procedures

WARNING!!!

The following installation process will require handling of both the Vi-PEC ECU and factory ECU. Both of these are highly sensitive to electrostatic discharge and are easily damaged. Follow the anti-static precautions given in this manual carefully to avoid damaging electronic components. Warranty claims for ECUs damaged by electrostatic discharge will NOT be accepted.

ANTI-STATIC HANDLING GUIDELINES

Your body builds up an electrical charge as you move around. This charge can reach very high voltages. Whenever given the opportunity this energy will attempt to discharge (usually through your finger tips!). This can be fatal to most electronic components. Most people have experienced an electrostatic discharge when they step out of their car or touch a metal bench top.

1. The following guidelines describe precautions that can be taken to reduce the possibility of damaging your ECU:

2. Work only on a conductive surface. A clean steel bench is suitable.

3. Always wear a wrist strap that is electrically connected to the conductive working surface.

4. Touch the working surface regularly.

5. Do NOT touch components on the circuit board.

6. Where possible, only handle the ECU by its plastic header.

7. Do NOT carry the ECU around without anti-static packaging.

8. Do NOT touch the bare terminals in the ECU header.

Observing the above procedures will minimise the chance of damaging the ECU. Note that failure due to static damage often does not appear until well after it was caused.

3.2 Fitting the ECU

Information is provided to assist in fitting the ECU into the vehicle.

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3.2.1 Fitting a Mazda ECU

The following steps outline the installation procedure:

1. Ensure the key is in the OFF position and remove the ECU from the vehicle. The factory ECU is located in either of the following places: RX-7 - on the left A pillar about 20cm above the floor, GT-X - behind the centre consol, MX-5/Miata - under the passengers foot well carpet. Unplug the wiring harness from the factory ECU. Remove the 6mm bolts (10mm socket) that retain the ECU and remove the ECU from the vehicle. DO NOT touch the exposed pins in the factory ECU connector.
2. Remove the factory ECU's circuit board from its enclosure: Ensure you are following the given anti-static guidelines and ARE WEARING A CONDUCTIVE WRIST STRAP connected to a conductive working surface. Remove the top cover by removing the side retaining screws. Remove the circuit board by removing the corner screws. Hold it only by the plastic header and place it aside.
3. Connect the ECU USB tuning cable and the expansion loom to the Vi-PEC Plug-In ECU if required.
4. Fit the Vi-PEC Plug-In ECU: Place the Vi-PEC ECU on the base plate and carefully fit the four corner screws. Place the factory ECU in the packaging your Vi-PEC ECU came in for its protection.
5. Refit the top cover: It may be necessary to widen the slot around the main header to allow cables to exit. Ensure that any modifications are de-burred to prevent cutting into cable insulation.
6. Reassemble the enclosure and fit the ECU back to the vehicle.
7. Connect the ECU to the factory wiring loom.
8. Do NOT attempt to start the vehicle. Proceed to read through the remaining sections of this manual first.

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4 Additional Sensors

VX Plug-In ECUs offer various options for the installation of additional sensors and devices. As a minimum it is recommended that all ECUs are installed with a Manifold Absolute Pressure (MAP) sensor and Intake Air Temperature (IAT) sensor. These parts can be purchased if required from your nearest Vi-PEC dealer.

4.1 MAP Sensor

It is important that the pressure source for a MAP sensor be taken from a stable pressure source after the throttle body. It is common to 'T' into the fuel pressure regulators pressure signal. Do NOT share this signal with other devices such as boost gauges or blow off valves.

4.1.1 Mazda RX-7 S6-8

The Vi-PEC VX RX7 S6-S7 Plug-In ECU supports several options for fitting of a MAP sensor. Any one of the following options can be used:

1. Factory MAP Sensor – Models supported by the Vi-PEC RX7 S6-S7 Plug-In ECU are factory fitted with a MAP sensor. The on board MAP sensor is wired to An Volt 3 (S6) or An Volt 4 (S7-8).
2. MAP Through Expansion Connector - The expansion connector provides power ground and analog channels for the connection of a MAP sensor.

Make sure that the correct An Volt channel has been selected as MAP sensor in Vi-PEC Tuning Software and a MAP calibration has been performed before attempting to start the vehicle.

4.2 IAT Sensor

It is highly recommended that an IAT sensor be fitted in all applications to provide an input for correction of fuel and ignition based on the engines air charge temperature.

An IAT sensor should be fitted in the intake system in a location that accurately represents intake temperature. The most common location is just prior to the throttle body. Installing in the manifold is not recommended due to heat soak issues. A fast response sensor must be used in all forced induction applications.

4.2.1 Mazda RX-7 S6-8

From factory, models supported by the Vi-PEC VX RX7 S6-S7 Plug-In ECU are fitted with an IAT sensor. An Temp 1 (S6) or An Temp 3 (S7) is wired to the factory IAT sensor.

4.3 Expansion Connector

The expansion connector is provided to allow easy connection of additional ECU inputs. An “expansion cable” needs to be purchased from your Vi-PEC dealer.

Important points when wiring to the expansion connector:

- Do not overload the +5V Out pin. Although this is protected against ECU damage the +5V out signal also provides power for other sensors.
- Do not connect the ground pin to chassis ground. This could cause ground loops and

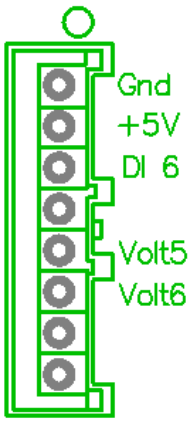
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introduce unnecessary interference. Use this pin only to ground external sensors that are isolated from chassis ground.

4.3.1 Mazda RX-7 S6-8

The following expansion connector outputs are provided:

Gnd	Sensor Ground Only
+5V Out	Supply for MAP sensor
An Volt 5	Analogue 0-5V input
An Volt 6	Analogue 0-5V input
DI 6 (S6 Only)	Digital Input



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5 PC Tuning

VX ECUs require PC/laptop tuning using the Vi-PEC Tuning Software Tuning Software application running on a Windows based computer. Vi-PEC Tuning Software may be downloaded from www.ViPEC.com. Note that when new versions of Vi-PEC Tuning Software are released they are posted on the website and may be downloaded at no cost. Also note that VX ECUs must be used with the correct version of Vi-PEC Tuning Software.

IMPORTANT!

The VX ECU has on board USB.

BEFORE connecting the ECU to your laptop, the USB drivers must be installed. Failure to install the drivers on your laptop first may result in windows assigning incorrect drivers. These drivers will not work with the VX ECU and are difficult to uninstall.

5.1 Installing USB Drivers

Before connecting the ECU to your laptop or PC, the ECU USB drivers must be installed. These drivers are installed as part of Vi-PEC Tuning Software Tuning Software installation as described in the following section. Should internet download not be practical, a copy of the drivers on CD can be obtained from your nearest Vi-PEC dealer.

5.2 Installing Vi-PEC Tuning Software Tuning Software

Due to the frequent updates Vi-PEC Tuning Software Tuning Software is no longer shipped with each ECU. You will be required to download the latest version of Vi-PEC Tuning Software Tuning Software from: www.ViPEC.com

Should access to an Internet connection be impractical, the latest version of Vi-PEC Tuning Software Tuning Software can be requested from your nearest Vi-PEC dealer on CD.

Installing from the web

1. Go to the above website and navigate to the downloads and software updates section.
2. Download the latest version of Vi-PEC Tuning Software. When prompted to run or save the file, select save. It is recommended to save this file on the desktop.
3. Double click the saved file and follow on screen instructions.
4. When prompted to install USB drivers, select yes. This may take some time.
5. When installed, open Vi-PEC Tuning Software by double clicking on the icon that has been placed on the desktop.

Installing from a CD

1. Insert the Vi-PEC Tuning Software disk into you computer's CD ROM drive.
2. Open 'My Computer'
3. Double click your CD ROM drive.
4. Double click the file labelled Vi-PEC Tuning SoftwareSetup.exe (or similar name).
5. Follow the on screen instructions.
6. When prompted to install USB drivers, select yes. This may take some time.
7. When installed, open Vi-PEC Tuning Software by double clicking on the icon that has been placed on the desktop.

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5.3 Communicating With Your ECU

After Vi-PEC Tuning Software installation, you will be able to connect the VX ECU to the laptop to perform set-up and tuning work.

1. Connect the ECU to your laptop using a Vi-PEC VX ECU USB Cable. If not supplied with the ECU, these can be purchased from a Vi-PEC dealer. No other adapter or cabling is required. Connect the cable to the connector labelled USB.
2. If this is the first time you have connected a VX USB ECU to you laptop follow the driver installation instructions that appear. When prompted if you want to install drivers select 'Continue Anyway'.
3. Start Vi-PEC Tuning Software by double clicking on the Vi-PEC Tuning Software icon on the windows desktop.
4. Switch the key to the ON position. This will provide power to the ECU.
5. In Vi-PEC Tuning Software, under the 'Options' menu, select 'Connection'. The connection options dialogue will open. Select the correct COM Port number from the drop down list or select auto for automatic com port detection.
6. Vi-PEC Tuning Software offers both mouse and keyboard control. To establish a connection between the PC and ECU using the mouse, click the ‘L’ icon located near the top centre of the Vi-PEC Tuning Software screen. Alternatively, using the keyboard, press and hold the Ctrl, Shift and L keys. The same process can be used to disconnect. If a successful connection is established, Vi-PEC Tuning Software will download settings from the ECU, otherwise you will be warned that an error has occurred.
7. Make sure the connection shows “ONLINE” in the top right corner of Vi-PEC Tuning Software. The logo should also be spinning in the top right corner.
8. To permanently STORE any changes made to the ECU click on the 'S' icon near the top centre of the screen or press F4. If this is not done before turning the ECUs power off all changes made will be lost.

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6 Pre-Start Configuration

Before starting the vehicle, important pre-start configurations need to be made.

6.1 Firmware Version

It is recommended that the you Vi-PEC VX ECU is running the most up to date firmware. Firmware version information can be obtained by connecting to the ECU with Vi-PEC Tuning Software and selecting 'ECU Information' under the Help menu.

The latest firmware can be downloaded from our website with Vi-PEC Tuning Software.

It is recommended that this is performed by an experienced Vi-PEC dealer as new features may need to be properly configured.

The firmware can be updated by selecting 'Update Firmware' under the 'ECU Controls' menu in Vi-PEC Tuning Software. Follow the on screen instructions to complete the firmware update process.

6.2 Base Configuration

All VX Plug-In ECUs are shipped with base configuration settings. Note that these are provided to reduce initial setup and tuning times. They are NOT recommended tuning values. Vi-PEC Tuning Software includes base configurations for various models. Download the appropriate base configuration into your ECU with Vi-PEC Tuning Software by connecting to the ECU (described in the Connecting To Vi-PEC Tuning Software section of this manual), then selecting 'Open' under the 'File' menu. Select the appropriate .pcl file and then select 'Open'. Downloading large configuration files can take up to a few minutes. Be patient and acknowledge any messages Vi-PEC Tuning Software shows.

6.3 MAP Sensor Calibration

At key on and engine not running the Manifold Absolute Pressure (MAP) Sensor should always match the Barometric Absolute Pressure (BAP) Sensor. As well as providing altitude correction, the BAP sensor also allows the MAP sensor to be calibrated prior to tuning.

Vi-PEC VX ECUs use an on-board barometric sensor that is calibrated prior to dispatch. This ensures that all Vi-PEC Tuning Software Tuning Software programs (pcl Files) give a consistent state of tune throughout the ECU range. This allows a PCL file to be transferred between VX based ECUs giving an equivalent state of tune providing all factors affecting volumetric efficiency are equal.

Without the ability to calibrate all the available types of MAP Sensors to the BAP Sensor there would be significant affects on the accuracy of the resulting tune, especially when tuning with Manifold Gauge Pressure (MGP) as a load index.

To calibrate the MAP sensor:

1. Connect a laptop/notebook PC to the ECU and connect to the ECU using Vi-PEC Tuning Software.
2. Under the Analog Channels menu, select the An Volt channel that has been wired to the MAP sensor. Select the correct MAP Sensor Type.
3. Under the 'Options' menu, select 'MAP sensor calibration'.
4. Follow the on screen instructions.

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5. Select the 'Analog Inputs' tab in the runtime values section of Vi-PEC Tuning Software (lower part of the screen).
6. Compare the MAP and BAP values and ensure they have a similar reading (within 1 kPa).
7. Perform a 'Store' by clicking on the S button (top centre of screen) or press F4.

6.4 TPS Calibration

The Throttle Position Sensor (TPS) is used by the ECU to calculate various engine management parameters used by functions such as idle speed control,acceleration enrichment and motor sport features. It is important that the ECU knows when the throttle is open and closed (or part way in between). The following procedure calibrates the ECU to match the TPS:

1. Connect a laptop/notebook PC to the ECU and connect to the ECU using Vi-PEC Tuning Software.
2. Under the Analog Channels menu, ensure that An Volt 3 is set to 'TPS (Main)'.
3. Under the 'Options' menu, select 'TPS calibration'.
4. Follow the on screen instructions.
5. Select the 'Analog Inputs' tab in the runtime values section of Vi-PEC Tuning Software (lower part of the screen).
6. Ensure the Throttle Position value reads 0% when the throttle is closed and 100% when fully open.
7. Perform a 'Store' by clicking on the S button (top centre of screen) or press F4.

6.5 IAT Sensor Selection

This section only applies when an Intake Air Temperature (IAT) sensor has been wired and fitted to the intake system. It is important that the ECU is calibrated to match the sensor installed in the engine. This procedure is as simple as selecting the correct sensor type as follows:

1. Connect a laptop/notebook PC to the ECU and connect to the ECU using Vi-PEC Tuning Software.
2. Click on 'Analogue Channel' in the configuration tree.
3. Select the An Temp channel the sensor has been wired to.
4. Ensure that channel (and only that channel) is set to 'Inlet Air Temperature'.
5. Select the correct 'Temp Sensor Type'.
6. Select the 'Analog Inputs' tab in the runtime values section of Vi-PEC Tuning Software (lower part of the screen).
7. Ensure that IAT reads the correct temperature.
8. Perform a 'Store' by clicking on the S button (top centre of screen) or press F4.

6.6 Input and Output Setup

As the Vi-PEC VX Plug-In ECUs are designed to run several models there are a few items that must be set-up to make the ECU specific to your model.

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The Pin Functions section of this manual gives a list of the functions of each channel based on the target vehicle.

It is the tuners responsibility to make sure that the following channels are set-up correctly for the vehicle model the ECU is fitted to:

All Auxiliary Output Channels

Use the 'Test On' or 'Test PWM' (at 10 Hz) functions to test the wiring of channels.

All Digital Inputs

Look at the Digital Inputs runtime values (lower section of the Vi-PEC Tuning Software screen) to confirm each channels operation.

All Analogue Volt and Temperature Inputs

Look at the Analogue Inputs runtime values (lower section of the Vi-PEC Tuning Software screen) to confirm each channels operation.

6.7 Trigger Calibration

The following instructions assume that all pre-start set-up instructions given in previous sections have been completed. Only after all pre-start checks have been made should an attempt be made to crank the engine. The following steps must be performed before an attempt is made to start the engine to ensure the VX ECU is calibrated to precisely measure engine position.

1. Connect the ECU to Vi-PEC Tuning Software.
2. Select 'Fuel', then 'Fuel Set-up':
   a. Set ‘Injection Mode’ to OFF. This will prevent the engine from trying to start while the triggers are calibrated.
   b. Perform a Store (press F4) to make sure fuelling is not re-enabled if power to the ECU is lost.
3. Click on ‘Triggers’ then ‘Calibrate Triggers’.
4. Perform the correct trigger calibration procedure specific to your vehicle as described in the Vi-PEC Tuning Software Tuning Software online help (Press F1).

Note that trigger calibration must be performed again once the engine is running. Due to the acceleration and deceleration of the crankshaft at low speeds, an inaccurate measurement of engine timing is usually made. Also it is often harder to see timing marks with a timing light at slow engine speeds. Trigger calibration should be checked again at between 2000-4000 RPM where engine speed is stable and a more consistent timing reading can be obtained.

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7 First Time Startup

After performing all set-up instructions given in previous sections, including trigger calibration, the engine is now ready to be started. The following procedure should be used for first time start-up.

1. Turn the ignition key OFF then ON. The fuel pump should prime momentarily upon power up.
2. Connect the ECU to Vi-PEC Tuning Software.
3. Click on each of the runtime value tabs (located about two thirds of the way down the screen) and check that all values are as expected. Where possible operate sensors (e.g. TPS) to ensure correct readings are displayed. The following values should be checked:
   a. TPS – spans from 0 to 100% when throttle is pressed. If not, perform a TPS Calibration.
   b. MAP – should read approx 101 kPa (at sea level) with the engine not running. If not, check the MAP Sensor Type setting and perform a MAP Calibration.
   c. ECT – should read current engine temperature.
   d. IAT – should read current intake air temperature.
   e. Digital Inputs – Operate switches connected to any digital inputs while watching the runtime value to ensure they operate as expected.
4. Rectify any faults found in Step 3.
5. Click on the 'Fuel' heading, then 'Fuel Set-up':
   a. Locate the 'Master' setting. This will need to be adjusted during or just after start-up.
6. Crank the engine until it starts. Some throttle may be required for first time start-up due to imperfect tuning. If necessary adjust the Master setting to enrich/lean the engine (increase to enrich).
7. If the engine fails to start after several attempts, do not crank it endlessly. Stop and determine the problem before continuing.
8. Check the Trigger Error Counter (found under the Triggers runtime values tab). If this value increases during cranking/running then there is a trigger setup fault. It is not unusual for this number to count one or two on the first engine revolution.
9. Once the engine starts, adjust the 'Master' (under fuel settings) setting to achieve best possible running.
10. The engine should now be allowed to fully warm up. It may be necessary to readjust 'Master' several times to maintain smooth running. Don't forget to keep an eye on engine temperature.
11. Once the engine is warmed up and running well, perform another trigger calibration (known "as setting the base timing").
12. Perform a Store by pressing F4.

7.1 Final Checks

To avoid potential engine damage and wasted time, the adjustments presented in the following sections must be made before attempting to start the engine.

For further help on any of the settings discussed below, consult the online Help in the Vi-PEC Tuning Software Tuning Software. Online help can be invoked by pressing F1, or right clicking any item and selecting 'What's this?'.

Pre-set-up Checks

Before attempting to configure the ECU, ensure the following tasks have been completed:

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1. Ensure the ECU and all associated components are connected and correctly wired/installed.
2. Fully charge the vehicle's battery, as the engine will be required to be cranked during the set-up procedure.
3. Check all oil and water levels are correct.

Connecting to Vi-PEC Tuning Software Tuning Software

Use the following procedure to establish a connection between your Vi-PEC ECU and Vi-PEC Tuning Software Tuning Software tuning software.

1. Make sure your laptop battery is fully charged or plugged in to mains power.
2. Connect the ECU to your laptop and connect to Vi-PEC Tuning Software Tuning Software as described in the 'Communicating with your ECU' section of this manual.

7.2 Essential Tuning Adjustments

It is assumed that at this stage all set-up procedures described in previous sections have been completed and the engine is running. The following steps detail correct set-up procedures for some of the more critical ECU parameters (note that MAP Sensor Calibration should have already been completed by now):

Injector Voltage (Dead-time) Correction

There is always a delay between the injector being energised and the injector actually opening. Likewise, there is a small delay between the injector being de-energised and the injector closing. The opening time is considerably longer than the closing time, however the overall result is that less fuel will flow for a given pulse width than would be expected with an 'ideal injector'. To compensate for this the injector pulse widths are increased to compensate for this 'dead-time'. The dead-time for a given injector is a function of the battery voltage, differential fuel pressure and the type of injector driver (saturated or peak and hold). A typical dead-time at 3 Bar differential fuel pressure and 14 volts is just under 1ms (ms = millisecond = 1 thousandth of a second).

In applications with a linear 1:1 fuel pressure regulator (i.e. not a rising rate regulator), the differential fuel pressure (difference between manifold pressure and fuel pressure) will be constant. Therefore the only variable that is changing will be the battery voltage (this changes with electrical load and sometimes engine speed). Without correction, the changes in dead-time will cause the engine to run lean when the voltage drops. If the Injector Voltage Correction is properly set-up then changes in the battery voltage will not affect the air/fuel ratio.

The injector dead-time table allows the dead-time for different battery voltages to be entered. The values represent the dead-time in milliseconds. These should increase with falling system voltage.

Injector dead-time for a particular set of injectors can be determined using a flow bench or on a running engine.

To determine the injector dead-time using a flow bench, the injectors need to be operated at the intended operating pressure (normally three bar) and at a constant duty cycle as well as a set voltage. Vary the supply voltage to the injector and measure minimum pulse width at which the injectors will flow for a particular voltage. This is the required dead-time for that injector at that tested voltage.

To determine injector dead-time on a running engine, with the engine fully warmed and operating at stable air/fuel ratios (a very precise AFR meter is required – a narrow band O2 sensor will not suffice), electrical drain needs to be applied to the system; the preferred method is disconnecting the alternator main fuse. Battery load testers are also useful here too.

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Watching the air fuel ratios change while the battery voltage drops, the dead-time table can be trimmed to maintain the same stable air/fuel ratio. Injector dead-time can be viewed as a row graph. A smooth curve needs to be maintained at all times.

NOTE: any change to the fuel pressure or injectors will require a recalibration of the injector dead-times.

Master

Master should be set so that the numbers in the middle of the fuel table end up around a value of 50. This is to allow sufficient span of the numbers in the main fuel table.

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8 Pin Functions

A list of pin functions is provided, this is useful when configuring your ECU through Vi-PEC Tuning Software.

8.1 Mazda RX-7 S6-8

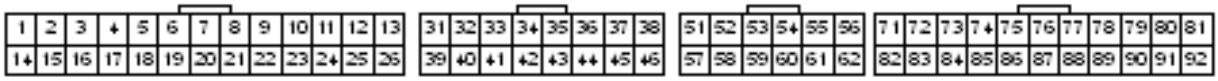
	Mazda RX7 Series 6	Mazda RX7 Series 7 and 8
Auxiliary Outputs		
Aux 1	Boost Solenoid	
Aux 2	ISC Solenoid	
Aux 3	Fuel Pressure Regulator (PRC) Solenoid	Engine Fan Relays
Aux 4	Tacho	
Aux 5	Metering Oil Pump (Rotary Oil Pump)	
Aux 6	Metering Oil Pump (Rotary Oil Pump)	
Aux 7	Metering Oil Pump (Rotary Oil Pump)	
Aux 8	Metering Oil Pump (Rotary Oil Pump)	
Aux – Injection Outputs		
Inj 1	Front Primary Injector	
Inj 2	Rear Primary Injector	
Inj 3	Front Secondary Injector	
Inj 4	Rear Secondary Injector	
Aux - Inj 5	Engine Fan Relays	Fuel Pump Relay
Aux - Inj 6	Fuel Pump Relay	Fuel Pump Speed Relay
Aux - Inj 7	CAT Light (CE Light)	-
Aux - Inj 8	Fuel Pump Speed Relay	-
Analog Channels		
An Volt 1	TPS Signal	Oxygen Sensor Signal
An Volt 2	Metering Oil Pump Position Signal	TPS Signal
An Volt 3	MAP Signal	Metering Oil Pump Position Signal
An Volt 4	Oxygen Sensor Signal	MAP Signal
An Volt 5	Expansion Connector	
An Volt 6	Expansion Connector	
An Temp 1	IAT	Fuel Temp
An Temp 2	ECT	
An Temp 3	Fuel Temp	IAT
Digital Inputs		
DI 1	Vehicle Speed	A/C Request
DI 2	Clutch Switch (Some models)	PS Switch
DI 3	A/C Request	Vehicle Speed
DI 4	Start Signal	Clutch Switch (Some models)
DI 5	PS Switch	Neutral Switch
DI 6	Expansion Connector	Start Signal

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9 Pinout

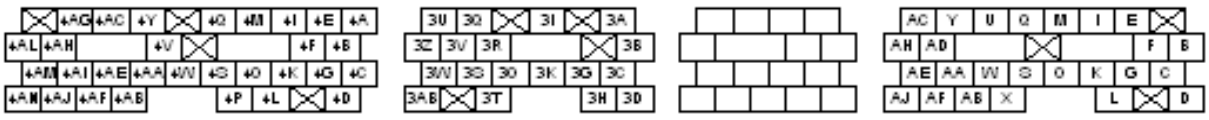
Pin information is provided too assist when troubleshooting. All pinouts are looking into the ECU (wire side).

9.1 Mazda RX-7 S6



Pin	ECU Function	Pin	ECU Function
1	Injection 2	74	An Volt 3
2	Injection 1	75	DI 1
3	Aux 1	76	Aux – Inj 8
5	Aux 2	78	Ignition 3
7	Aux 3	79	DI 3
8	Aux 5	80	DI 4
9	Aux 6	83	Aux – Inj 6
10	Trig 2	86	DI 5
11	Trig 1	87	Aux – Ign 4
14	Injection 4	88	Ignition 2
15	Injection 3	89	Ignition 1
21	Aux 7	92	+14V Main Relay
-	-	13	Ground
22	Aux 8	**Other Connections**	
32	Knock 1	Expansion 1	Signal Ground
35	An Volt 1	Expansion 2	+5V Out
36	An Temp 2	Expansion 3	DI 6
37	An Volt 4	Expansion 4	-
38	An Volt 2	Expansion 5	An Volt 5
41	An Temp 1	Expansion 6	An Volt 6
45	Aux – Inj 5	Expansion 7	-
52	Aux – Inj 7	Expansion 8	-
62	Aux 4		
71	An Temp 3		
73	DI 2		

9.2 Mazda RX-7 S7-8



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Pin	ECU Function	Pin	ECU Function
C	Aux 2	4K	Aux 3
O	Aux 1	4L	Aux 3
Q	Injection 1	4M	Aux 4
S	Aux 7	4Q	DI 3
U	Injection 2	4S	DI 4
W	Aux 6	4V	DI 1
Y	Injection 3	4W	DI 2
AA	Aux 8	4AF	Igniton 3
AC	Injection 4	4AH	An Volt 4
AE	Aux 5	4AJ	Igniton 2
3C	DI 5	4AN	Ignition1
		4A	+14V Main Relay
3D	An Volt 1	AJ	Ground
3H	An Volt 3	**Other Connections**	
3I	An Volt 2	Expansion 1	Signal Ground
3O	Knock 1	Expansion 2	+5V Out
3R	Trig 1	Expansion 3	-
3T	An Temp 3	Expansion 4	-
3U	Trig 2	Expansion 5	An Volt 5
3V	An Temp 1	Expansion 6	An Volt 6
3W	An Termp 2	Expansion 7	-
4C	DI 6	Expansion 8	-
4F	Aux – Inj 5		
4G	Aux – Inj 6		
4I	Aux – Ign 4		

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10 Known Issues

All plug-in ECUs are fully tested on a range of relevant vehicles, although there are often variations that have not been tested. For this reason issues can arise. Please contact your nearest Vi-PEC dealer when suspecting a compatibility issue.

10.1 Mazda RX-7 S6-8

There are currently no known issues.

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