



# Toyota JZX90 Installation Manual

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**G4X**



# Product Warranty Statement

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Link Engine Management Ltd warrants only to the original purchaser of the ECU, for the lifetime of the ECU, (subject to the limitations set out below), that the ECU shall be free from defects of materials and workmanship in the manufacturing process. This warranty ceases to apply and does not apply to ECUs that have not been manufactured or distributed by Link Engine Management Ltd for a period of greater than one year.

An ECU claimed to be defective must be returned to the place of purchase. Link Engine Management Ltd, at its sole option, may replace the defective ECU with a comparable new ECU or repair the defective ECU.

This limited lifetime warranty is not transferable and does not apply to any ECU not properly installed or properly used by the purchaser or end user, or to any ECU damaged or impaired by external forces. The above warranties are the full extent of the warranties available on the ECU. Link Engine Management Ltd has no liability to the original purchaser or any other person for any loss, injury or damage to persons or property resulting from the use of the ECU or any failure of or defect in the ECU whether by general, special, direct, indirect, incidental, consequential, exemplary, punitive, or any other damages of any kind or nature whatsoever. Link Engine Management Ltd specifically disclaims and disavows all other warranties, express or implied, including, without limitation, all warranties of fitness for a particular purpose, warranties of description, warranties of merchantability, trade usage or warranties of trade usage.

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# 1 G4X and G5 Plug-In ECU Installation Manual

## 1.1 Introduction

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

G4X software employ 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 Link G4X ECUs are in-field upgradeable, there is no need to return the unit for software updates.

All Link G4X Plug-In Engine Management Systems are designed with flexibility and ease of installation in mind. Link Plug-In systems are designed 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.

Installing and tuning any after market engine management system is not to be taken lightly. G4X 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 G4X 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 G4X 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 G4X ECU has been installed it will need to be tuned using a laptop computer with PCLink software. Information on the configuration and tuning of the G4X ECU is detailed in the help section of PCLink. G4X 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.

### 1.1.1 Safety Notice

Your Link 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.

#### **WARNING!**

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

### 1.1.2 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. Link will not be held responsible for any damage caused by the incorrect installation of this product.

### 1.1.3 Support Options

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

1. PCLink help, press F1 while running PCLink
2. Contact your nearest Link dealer. A Link dealer list is available on our website.
3. Link website: [www.linkecu.com](http://www.linkecu.com) with Online Discussion Forum.
4. Technical Support Email: [tech@linkecu.com](mailto:tech@linkecu.com)

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

## 1.2 Pre-Installation

Before installing the Link G4X ECU into the vehicle some pre-installation checks must be performed.

## 1.2.1 Board Switch Settings

Some Link G4X require switches on the board to be set before installation.

### 1.2.1.1 JZX90

The G4X JZX90 plug-in ECU has a jumper to select where the MAP signal is coming from. The ECU contains an internal 7Bar (3Bar of boost) MAP sensor and this jumper connects either this sensor to An Volt 1 or connects the signal from the factory MAP sensor to An Volt 1. A diagram is provided on the PCB to indicate how the jumper should be installed for each setup.

## 1.2.2 Loom Modifications

### 1.2.2.1 JZX90

The JZX90 Plug-in ECU is capable of Sequential Injection, To use Sequential Injection follow the steps below:

1. Run new wires from the expansion plug with Injector drives 4, 5 & 6 through to the engine bay. The Link expansion loom or a custom loom can be used for this.
2. Wire each injector drive to the injector on it's corresponding cylinder, cylinder 1 and injector drive at the front of the engine, cylinder 6 and injector drive 6 at the rear of the engine (gearbox end). which injector drive is which can be found by looking at wire colours at the ECU header plug or by using the injector test settings.
3. Set Injection Mode to sequential and store.
4. Test your wiring by running the injector test on each injector and ensuring the correct injector and only that injector operates when it is being tested. It is best to do this without having the fuel system primed to prevent flooding but preferably not completely dry to prevent injector wear.

## 1.3 Installation

This guide provides information on correctly and safely installing your new Link G4X Plug-In ECU.

### 1.3.1 ECU Handling Procedures

#### **WARNING!!!**

The following installation process will require handling of both the Link 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.

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

1. Work only on a conductive surface. A clean steel bench is suitable.
2. Always wear a wrist strap that is electrically connected to the conductive working surface. An Anti-static wrist strap is included for use during install
3. Touch the working surface regularly.
4. Do NOT touch components on the circuit board.
5. Where possible, only handle the ECU by its plastic header.
6. Do NOT carry the ECU around without anti-static packaging.
7. 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.

### 1.3.2 Fitting the ECU

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

#### 1.3.2.1 MR2Link V1, MR2Link V2-3, JZX90, JZX100 and SupraLink

The following steps outline the installation procedure:

1. Remove the factory ECU from the vehicle: Ensure the key is in the OFF position. The factory ECU is located:
  - Celica, JZX90 and JZX100 - in the center of the vehicle under the dash
  - MR2 - in the boot attached to the firewall
  - Supra - under the passenger foot panelUnplug the wiring harness from the factory ECU. Remove the bolts that retain the ECU mounting structure 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. Modify the case if required: It may be necessary to cut the center bar out of the enclosure using the appropriate tool. This will be necessary if the center bar interferes with the ECU.
4. Connect the ECU USB tuning cable and the expansion loom to the Link Plug-In ECU if required.
5. Fit the Link Plug-In ECU: Place the Link ECU on the base plate and carefully fit the four corner screws. Place the factory ECU in the packaging your Link ECU came in for its protection.
6. 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.
7. Reassemble the enclosure and fit the ECU back to the vehicle.
8. Connect the ECU to the factory wiring loom.
9. Do NOT attempt to start the vehicle. Proceed to read through the remaining sections of this manual first.



**Note:** The bolt that holds the Toyota Supra header plug in place will screw right through all the thread and spin. This is normal.

## 1.4 Additional Sensors/Functions

G4X 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 Link dealer.

### 1.4.1 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.

**Note:** Internal MAP Sensors on new plug-in ECUs have changed from 4Bar to 7Bar. The 7Bar versions should be identifiable by a sticker on the bottom board and can also be confirmed by comparing MAP and BAP when the MAP vacuum line isn't connected to see if they match with the calibration being used.

#### 1.4.1.1 JZX90

The G4X JZX90 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 – The JZX90 has a MAP sensor from factory, this sensor is connected to An Volt 1 via a jumper so either the factory or the internal Map sensor is connected to An Volt 1.
2. Internal MAP Sensor – To ease installation the G4X JZX90 ECU is fitted with an internal MAP sensor. This sensor is either rated to 4.0 Bar absolute pressure (3.0 bar boost) or 7.0 Bar absolute pressure (6.0 bar boost) depending on the age of the bottom board. Which sensor is fitted can be ascertained by looking at the sticker on the bottom board (should say 7 Bar for 7 Bar models and nothing for 4 Bar) or by looking at the MAP value when at atmospheric pressure and changing the calibration setting. The internal MAP sensor is wired to An Volt 1 via a jumper so either the internal or the factory Map sensor is connected to An Volt 1.
3. MAP Via Expansion Connector - The expansion connectors provide power, ground, and analog channels for the connection of a MAP sensor.

Make sure that the correct MAP sensor input has been selected in PCLink and a MAP calibration has been performed before attempting to start the vehicle.

### 1.4.2 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.

#### 1.4.2.1 JZX90

From factory, models supported by the G4X JZX90 Plug-In ECU are fitted with an IAT sensor. The G4X JZX90 Plug-In ECU supports several options for fitting of an IAT sensor. Any one of the following options can be used:

1. Factory IAT – An Temp 2 is wired to the factory IAT sensor.
2. IAT Through Expansion Connector - The expansion connector provides ground and temperature channels for the connection of an IAT sensor. Wire the sensor between the Ground pin and an An Temp channel pin. Note spare An Volt channels can be used as temperature inputs when a pullup resistor (to +5V) is added.

## 1.4.3 E-Throttle Output

### 1.4.3.1 JZX90

This ECU has a dedicated E-Throttle Expansion Connector which contains Aux 9 & Aux 10 and four An Volt inputs. Aux 16 is setup to control the E-throttle power and so needs to be set as the E-Throttle Relay.

## 1.4.4 Expansion Connector

Expansion connectors are provided to allow easy connection of additional ECU inputs. An “expansion cable” can be purchased from your Link 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 introduce unnecessary interference. Use this pin only to ground external sensors that are isolated from chassis ground.

The Expansion connectors available for each ECU can be found under the Pinouts Section.

## 1.5 PC Tuning

G4X ECUs require PC/laptop tuning using the PCLink Tuning Software application running on a Windows based computer. PCLink may be downloaded from [www.linkecu.com](http://www.linkecu.com). Note that when new versions of PCLink are released they are posted on the website and may be downloaded at no cost. Also note that G4X ECUs must be used with the correct version of PCLink.

### **IMPORTANT!**

The G4X 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 G4X ECU and are difficult to uninstall. The correct USB drivers are installed as part of PCLink 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 Link dealer.

### 1.5.1 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 PCLink installation as described in the following section.

### 1.5.2 Installing PCLink Tuning Software

Due to the frequent updates PCLink is no longer shipped with each ECU. You will be required to download the latest version of PCLink from: [linkecu.com](http://linkecu.com)

Should access to an Internet connection be impractical, download the latest version of PCLink elsewhere to a USB drive, and then install on your laptop.

#### **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 PCLink. 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 PCLink by double clicking on the icon that has been placed on the desktop.

### 1.5.3 Communicating With Your ECU

After PCLink installation, you will be able to connect the G4X ECU to the laptop to perform set-up and tuning work.

1. Connect the ECU to your laptop using a Link G4X ECU USB Cable. If not supplied with the ECU, these can be purchased from a Link 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 G4X ECU USB cable to your laptop follow the driver installation instructions that appear. When prompted if you want to install drivers select 'Continue Anyway'.
3. Start PCLink by double clicking on the PCLink icon on the windows desktop.
4. Switch the key to the ON position. This will provide power to the ECU.
5. In PCLink, 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. PCLink offers both mouse and keyboard control. To establish a connection between the PC and ECU press the F3 key. The same process can be used to disconnect. If a successful connection is established, PCLink 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 PCLink.
8. To permanently STORE any changes made to the ECU press F4. If this is not done before turning the ECUs power off all changes made will be lost.

## 1.6 Pre-Start Configuration

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

### 1.6.1 Firmware Version

It is recommended to ensure that the Link G4X ECU is running the most up to date firmware. Firmware version information can be obtained by connecting to the ECU with PCLink and selecting 'ECU Information' under the Help menu.

The latest firmware can be downloaded from our website with PCLink.

It is recommended that this is performed by an experienced Link 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 PCLink, follow the on screen instructions to complete the firmware update process.

### 1.6.2 Base Configuration

All G4X 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. PCLink includes base configurations for various models. Download the appropriate base configuration into your ECU with PCLink by connecting to the ECU (described in the Connecting To PCLink section of this manual), then selecting 'Open' under the 'File' menu. Select the appropriate .pclx file and then select 'Open'. Downloading large configuration files can take up to a few minutes. Be patient and acknowledge any messages PCLink shows.

### 1.6.3 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.

Link G4X ECUs use an on-board barometric sensor that is calibrated prior to dispatch. This ensures that all PCLink tune files (pclx Files for G4X or pcl5 for G5) give a consistent state of tune throughout the ECU range. This allows a tune file to be transferred between G4X 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 PCLink.
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.
5. Select the 'Analog Inputs' tab in the runtime values section of PCLink (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 pressing F4.

A more in depth explanation is provided in the PCLink help Manual under PCLink G5 Users Manual -> Tuning Operating Procedures -> ECU Controls -> MAP Sensor Calibration.

## 1.6.4 TPS Calibration

### Non E-Throttle Vehicles:

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 and is for engines using a cable driven throttle:

1. Connect a laptop/notebook PC to the ECU and connect to the ECU using PCLink.
2. Open Analog Inputs -> Throttle Position Sensor and ensure that the TPS (Main) Source is set to the correct input. Refer to the Pinouts section of this manual for details.
3. Under the 'Options' menu, select 'TPS calibration'.
4. Follow the on screen instructions.
5. Select the 'General' tab in the runtime values section of PCLink (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 pressing F4.

## 1.6.5 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 PCLink.
2. Click on 'Analog 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 PCLink (lower part of the screen).
7. Ensure that IAT reads the correct temperature.
8. Perform a 'Store' by pressing F4.

## 1.6.6 Input and Output Setup

As the Link G4X Plug-In ECUs are often designed to run several models there are a few items that must be set-up to make the ECU specific to your model.

The Pinouts 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 PCLink screen) to confirm each channels operation.

### *All Analog Volt and Temperature Inputs*

Look at the Analog Inputs runtime values (lower section of the PCLink screen) to confirm each channels operation.

## 1.6.7 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 G4X ECU is calibrated to precisely measure engine position.

1. Connect the ECU to PCLink.
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 PCLink 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.

A more in depth explanation is provided in the PCLink help Manual under G4X ECU Tuning Functions -> Triggers -> Calibration.

## 1.7 First Time Startup

For further help on any of the settings discussed below, consult the Help in PCLink Tuning Software. 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:

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 PCLink Tuning Software

Use the following procedure to establish a connection between your Link ECU and PCLink 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 PCLink as described in the 'Communicating with your ECU' section of this manual.

### 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 PCLink.
3. Access the runtimes values by pressing the F12 Key, click the 'Analog' tab:
  - a. TPS – spans from 0 to 100% when throttle is pressed. If not, perform a TPS Calibration. If the vehicle has an E-Throttle confirm that APS (Sub), APS (Main), TPS (Sub), TPS (Main) all operate correctly and that the throttle blade tracks the target correctly.
  - 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 (click the 'Digital' tab) – 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. Ensure the basic Fuelling setup is correct.
  - a. If using Traditional Fuel Equation Mode then locate the 'Master Fuel' setting in the ECU Settings Menu under: *Fuel > Fuel Setup > Fuel Main*. This will need to be adjusted during or just after start-up.
  - b. If using one of the Modelled Fuel Equation Modes then navigate to *Fuel > Fuel Setup > Fuel main* and enter the correct engine capacity, correct base fuel pressure, and correct fuel properties. Navigate to *>Fuel>Fuel Setup>Injector Setup*, enter correct injector flow rate and rated pressure.

6. Crank the engine until it starts. Some throttle may be required for first time start-up due to imperfect tuning.
  - a. If using Traditional Fuel Equation Mode the Master Fuel setting can be used to enrich/lean the engine (increase to enrich).
  - b. If using one of the Modelled Fuel Equation Modes the Injector Flow Rate can be decreased to add more fuel, this will need to be changed back to the correct value later but works well for first start purposes.
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:
  - a. If using Traditional Fuel Equation Mode adjust the Master Fuel setting to achieve best possible running
  - b. If using one of the Modelled Fuel Equation Modes adjust the Injector Flow Rate setting to achieve best possible running, this will need to be changed back to the correct value later but works well for first start purposes.
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.

## 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.

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.

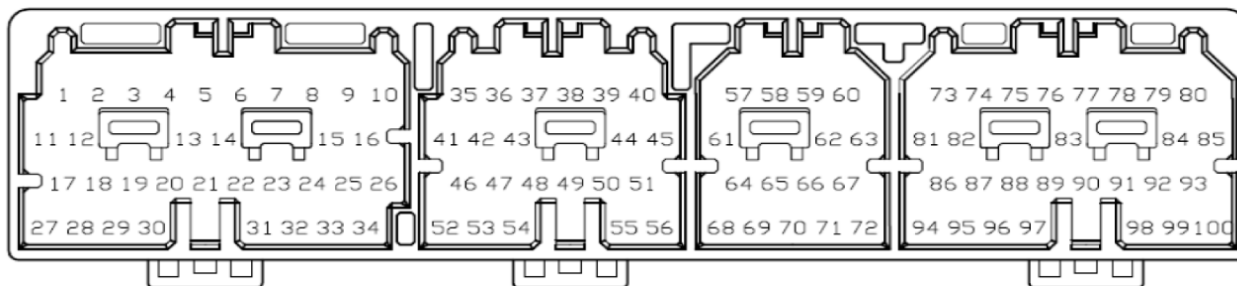
### Traditional Fuel Equation Mode Master Fuel Setting

If using Traditional Fuel Equation mode the Master Fuel setting 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.

## 1.8 Pinouts

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

### 1.8.1 JZX90



Pin	ECU Pin	Function	Pin	ECU Pin	Function
1	Injector 1	Injection	65	nc	
2	Injector 2	Injection	66	nc	
3	Injector 3	Injection	67	nc	
4	Aux 1	Purge	68	Ground	
5	nc		69	nc	
6	Knock 1	Knock	70	nc	
7	Knock 2	Knock	71	nc	
8	Injector 7 (Aux)	NB O2 Heater	72	nc	
9	nc		73	nc	
10	nc		74	nc	
11	Ignition 2	Ignition	75	nc	
12	Ignition 3	Ignition	76	Ignition 7	AC Clutch
13	nc		77	nc	
14	DI 1	Start Switch	78	nc	
15	nc		79	nc	
16	nc		80	nc	
17	Ignition 4	Ignition	81	nc	
18	nc		82	DI 3	Gearbox Speed
19	Ignition 1	Ignition	83	nc	
20	Aux 5	ISC Stepper	84	nc	
21	Aux 6	ISC Stepper	85	DI 5	Ignition Switch (Controls Main Relay Output)
22	Aux 7	ISC Stepper	86	nc	
23	Aux 8	ISC Stepper	87	DI 6	AC Request
24	nc		88	nc	
25	nc		89	nc	

26	nc		90	nc	
27	Ground (Signal)		91	nc	
28	Ground (Signal)		92	nc	
29	nc		93	nc (+12V Hot feed)	
30	nc		94	nc	
31	Ignition 5	Ignition	95	nc	
32	Ignition 6	Ignition	96	nc	
33	Ground		97	nc	
34	nc		98	nc	
35	Ground (Triggers)		99	+14V	ECU Power
36	Trig 1	Trigger 1	100	+14V	ECU Power
37	nc				
38	nc		Main Relay Control	Injector 8	ECU Hold Power
39	nc		On Board MAP	An Volt 1 via jumper	MAP
40	+5V Out		E-Throttle Relay	Aux 16	(Only needed if converting to E-Throttle)
41	Ground (Triggers)		E-Throttle plug 1	Ground (Signal)	
42	Trig 2	Trigger 2	E-Throttle plug 2	+5V Out	
43	nc		E-Throttle plug 3	An Volt 4	
44	An Volt 1 via jumper	Factory MAP Sensor	E-Throttle plug 4	An Volt 5	
45	An Volt 2	TPS	E-Throttle plug 5	An Volt 6	
46	Ground (Triggers)		E-Throttle plug 6	An Volt 7	
47	DI 2	Another CAM Sensor	E-Throttle plug 7	Aux 10	
48	nc		E-Throttle plug 8	Aux 9	
49	An Temp 2	IAT	Expansion 1	Ground (Signal)	
50	An Volt 3	NB O2 Sensor	Expansion 2	+5V Out	
51	VTA2	Buffered copy sent out pin 64	Expansion 3	Injector 4	
52	Ground		Expansion 4	Injector 5	
53	nc		Expansion 5	Injector 6	
54	An Temp 1	ECT	Expansion 6	Aux 4	
55	nc		Expansion 7	An Temp 4	
56	nc		Expansion 8	An Temp 3	
57	Aux 2	FP Speed (PWM)	Expansion 9	Ground (Signal)	



58	Aux 3	CE Light	Expansion 10	+5V Out	
59	Main Relay Output	Pull high to activate	Expansion 11	DI 7	
60	Trig 1	Trigger 1 Output	Expansion 12	DI 8	
61	Buffered Copy of An Volt 2		Expansion 13	DI 9	
62	DI 4	Timing Retard Request	Expansion 14	An Volt 8	
63	nc		Expansion 15	An Volt 9	
64	Buffered Copy of VTA2 (Pin 51)		Expansion 16	An Volt 10	

**Note:** Injector Drive 8 has special hardware on it to control the Main Relay and so can't be used for Injection.

## 1.9 CAN Information

The following CAN (Controller Area Network) information is provided:

### 1.9.1 JZX90

CAN bus 1 and 2 each use a 4 pin connector with the same pinout as shown below.

CAN Connector		
Pin	Function	Colour
1	GND	Brown
2	CAN L	Green
3	CAN H	White
4	+14V	Yellow

## 1.10 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.

**WARNING:** Always download the latest Installation Manual from [linkecu.com](http://linkecu.com) and check the latest status of known issues before installing the ECU.

Please contact your nearest Link dealer when suspecting a compatibility issue.

### 1.10.1 JZX90

The TRC light may come on, the factory TRC system is not supported by the Link ECU.

V1.4 and earlier will have two of the idle stepper motor wires the wrong way around, swap Aux 6 and Aux 7 pins around to make it work correctly.