



GT86

G5 PLUG-IN

**GT86/BRZ/FRS
Installation Manual**

**EXHILARATION
STARTS HERE**

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LINK ENGINE MANAGEMENT LTD – LIMITED LIFETIME WARRANTY

All Engine Control Units (ECUs) manufactured or distributed by Link Engine Management Ltd are subject to the following LIMITED LIFETIME WARRANTIES, and no others.

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.

For off-road use only, not intended for highway vehicles. This ECU contains a user-configurable software programme, which is updated by Link Engine Management Ltd from time to time. The user must ensure the current correct version of this programme is downloaded from the website of Link Engine Management Ltd and installed in the ECU prior to use. This limited lifetime warranty does not apply where the ECU has been installed with the incorrect version of the software programme. The user is solely responsible for the setup and testing of all user-configurable features.

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I Plug-In ECU Installation Manual

I.1 Introduction

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

Link 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, fuel pressure compensation, intake air temperature correction and more this gives an unprecedented level of tuning accuracy. All Link G5 ECUs are in-field upgradeable, there is no need to return the unit for firmware or software updates.

All Link Plug-In Engine Management Systems are designed with flexibility and ease of installation in mind. Link Plug-In systems are designed to replace the factory ECU and in most cases are designed to fit inside the factory ECU's 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. Link 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 Link 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 G5 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 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 ECU is detailed in the help section of PCLink. Link Plug-In 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.

I.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.

I.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.

I.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 with Online Discussion Forum.
4. Technical Support Email: 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 ECU into the vehicle some pre-installation checks must be performed.

1.2.1 Board Switch Settings

Some Link Plug-In ECUs require switches on the board to be set before installation.

1.2.1.1 Toyota GT86/Subaru BRZ

The Toyota GT86/Subaru BRZ plug-in ECU has two groups of jumpers. These groups of jumpers are a group for determining where the signal for three analog inputs come from and a group for changing the output signal type of the injector drives wired to the factory DI driver box.

The three jumpers for determining where several ECU analog inputs are taken from operate as described below:

- An Volt 6 - This input can be connected to either the Battery Current Sensor or to the expansion connector depending on the position of it's jumper.
- An Volt 11 - This input can be connected to either the Narrowband O2 Sensor or to the expansion connector depending on the position of it's jumper.
- An Temp 4 - This input can be connected to either the Battery Temperature Sensor or to the expansion connector depending on the position of it's jumper.

Each jumper can be moved independently of the others.

The 4 jumpers for controlling injector output type are connected to the Injector 1-4 outputs and are used to either connect the Topboard's outputs directly to the main ECU header or to send the Topboard's outputs through hardware which converts the output into the format required by the factory DI driver. If you are using the factory DI driver on Injector 1-4 outputs then you need to have these jumpers configured such that the injector signal is modified to suit the DI driver, if you are using the Injector 1-4 outputs to directly control Port Injectors (e.g. in an engine swapped vehicle) you need to configure these jumpers such that the injector signal is not modified between the Topboard and main ECU header.

There are markings on the board indicating how the jumpers should be located for each option.

1.3 Installation

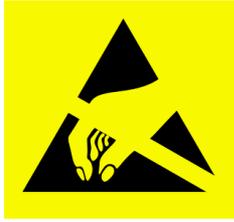
This guide provides information on correctly and safely installing your new Link Plug-In ECU.

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.

I.3.2 Fitting the ECU

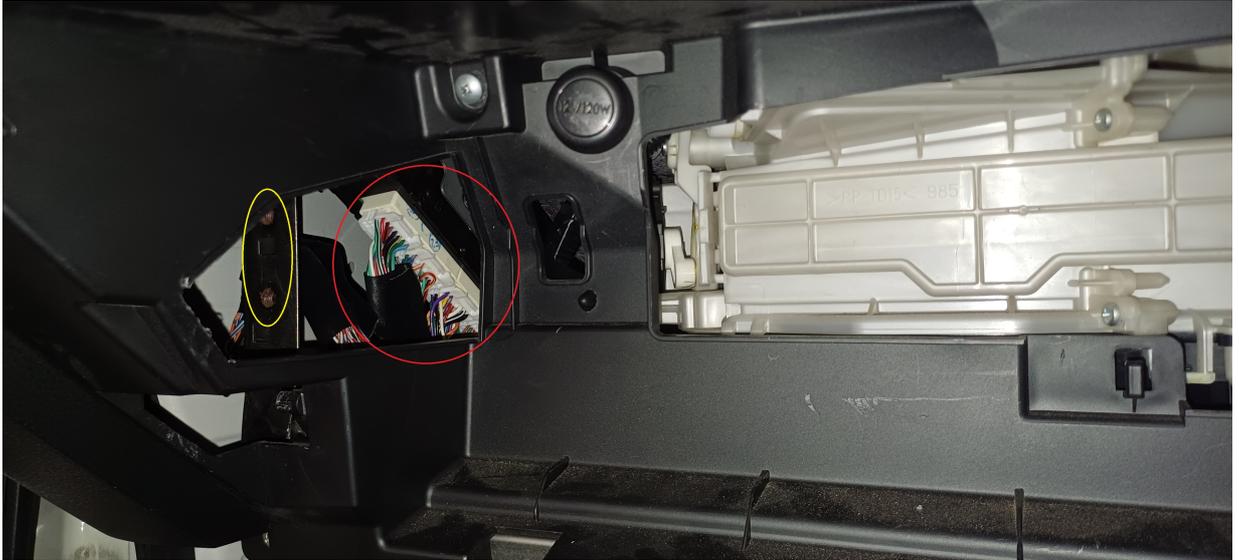
Information is provided to assist in fitting the ECU into the vehicle.

I.3.2.1 Toyota GT86/Subaru BRZ

The factory ECU is located inside the dash in the passenger foot well, the following steps explain how to remove it.

1. Open the glove box.
2. Remove the damper from the side of the glove box and then remove the glove box, it is just clipped in.

3. You should now be able to see the ECU plugs as shown in the image below.



View of ECU Plugs from where the glovebox is located, note picture is from a RHD car.
Yellow circle indicates position of "MAIN ECU ASSY" mounting points if the vehicle is push-start.
Red indicates factory ECU plugs.

4. If you have push-start instead of key start you will need to remove the "MAIN ECU ASSY" at this point, unplug it and then remove the two screws in the yellow circle in the image above.
5. Unplug the factory ECU and pull the loom out of the way.
6. There are two nuts holding the ECU to the body of the car, loosen these off enough that the ECU can be removed through the bottom of the dash.

Note: The ECU bracket has slots instead of holes and so can be lifted vertically to get it off the studs.

Note: It may be useful to remove the door sill trim and then the kick panel below the ECU to make it easier to pull it out.



Picture of the Factory ECU from underneath the dash



Factory ECU with bracket.

To install the Link Toyota GT86/Subaru BRZ plug and play ECU follow the steps below:

1. If you are fitting an expansion loom then connect this to the ECU prior to doing the following steps.

2. Remove the metal bracket from the factory ECU and bolt it to the Link ECU as pictured below.



Link PNP ECU on OE bracket

3. Install the ECU in the factory location and tighten the two nuts to hold it in place.
4. Connect the factory plugs to the Link ECU.
5. Install the USB extension in your desired location and then run the cable to the ECU and plug the USB-C connector into the ECU. Ensure you tighten the retention screw so that it remains connected.
6. Reassemble interior plastics.

1.4 Additional Sensors/Functions

Link 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 Toyota GT86/Subaru BRZ

The G5 Toyota GT86/Subaru BRZ 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 factory MAP sensor is wired to An Volt 1. This sensor will need to be replaced if you are wanting to add boost.
2. Factory MAP Sensor Upgrade – The factory MAP sensor can be upgraded by simply replacing the factory MAP sensor (and plug that connects to it depending on selected MAP sensor). Contact your nearest Link dealer for upgrade options.
3. 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 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 Toyota GT86/Subaru BRZ

The G5 Toyota GT86/Subaru BRZ Plug-In ECU supports several options for fitting of a IAT sensor. Any of the following options can be used:

1. IAT in factory MAF - The factory MAF contains an IAT sensor that can be used as long as the MAF is retained. Note if you have added forced induction it is best to fit an air temperature sensor after the turbo or supercharger so that it is seeing the air temperature after it has been heated by the compression.
2. IAT Through MAF Plug – To avoid running additional wires into the engine bay, an IAT signal can be brought in through the MAF wires. The MAF temperature sensor is wired to An Temp 2, refer to factory wiring manuals for MAF wiring connections.
3. IAT Through Expansion Connector – The expansion connector provides ground and temperature channels for the connection of an IAT sensor. Note spare An Volt channels can be used as temperature inputs when a pullup resistor (to +5V) is added. An Temp 4 is only available on one of the expansion connectors if the jumper for it is set in the correct position, otherwise it is connected to the battery temperature sensor. Note this does mean you could use the battery temp sensor wiring instead of the expansion wiring to connect An Temp 4 to an IAT sensor (or other temperature sensor) if the jumper is in the correct position for this.

1.4.3 E-Throttle Output

1.4.3.1 Toyota GT86/Subaru BRZ

This vehicle has E-Throttle from factory.

The E-Throttle Output pins are Aux 9 & 10 and the E-Throttle Relay is Aux 11. If the E-Throttle is found to be operating in the wrong direction this can be rectified by changing the Aux 9 Active State (Electronic Throttle - > E-Throttle 1 -> E-Throttle Setup or by swapping the +ve and -ve pins at the throttle plug.

1.5 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.

I.6 PC Tuning

Link 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. 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 ECUs must be used with the correct version of PCLink.

IMPORTANT!

The Link 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 may not work with the Link ECU and are difficult to uninstall. The correct USB drivers are installed as part of PCLink installation, as described in the following section.

I.6.1 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.

I.6.2 Installing PCLink Tuning Software

The latest version of PCLink is available on the Link website: 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 Products -> Software -> PCLink 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.

I.6.3 Communicating With Your ECU

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

1. Connect the ECU to your laptop using the appropriate 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 (typically has a red O-ring on the end of the cable).
2. Start PCLink by double clicking on the PCLink icon on the windows desktop.
3. Switch the key to the ON position. This will provide power to the ECU.
4. In PCLink, under the 'Options' menu, select 'Connection'. The connection options dialogue will open. Selecting USB will give you the fastest connection, the 'Auto' connection port option will search for ECUs on Wifi, USB and COM Ports before displaying a list of possible devices to connect to.
5. 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.
6. Make sure the connection shows "ONLINE" in the top right corner of PCLink.
7. 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.

I.7 Pre-Start Configuration

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

1.7.1 Firmware Version

It is recommended to ensure that the 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 firmware updates are 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.

1.7.2 Base Configuration

All 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 or .pcl5 file and then select 'Open'. Downloading large configuration files can take up to a few minutes. Be patient and acknowledge any messages PCLink shows.

1.7.2.1 Toyota GT86/Subaru BRZ

This vehicle can come as "Push Button start" or "Key start" and there are two separate sample maps provided to suit this (Push button start have the ECU control the starter, Key start have the key barrel control the starter). Automatic and Manual cars both use the same sample maps.

1.7.3 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 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 or G5 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 Inputs menu, select 'MAP' then set the Source setting to the correct Analog Input and set the Calibration value to the correct option for your MAP sensor.
3. Either in the MAP window or under the 'ECU Controls' menu, select 'MAP sensor calibration'.
4. Follow the on screen instructions.
5. Open the Runtime View (F12 or 'R') and select the 'General' tab.
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.

1.7.4 TPS Calibration

E-Throttle Vehicles:

The Throttle Position Sensors (TPS Main and Sub) and Accelerator Position Sensors (APS Man and Sub) are used by the ECU to control the throttle blade position and to calculate various engine management parameters used by functions such as idle speed control, acceleration enrichment and motor sport features. It is very important that these inputs are setup correctly and the E-Throttle operation is tuned properly before starting or driving the vehicle, failure to do so can result in damage to the Throttle body, engine, vehicle and even the operator and bystanders. The following procedure shows how to calibrate the APS and TPS sensors:

1. Connect a laptop/notebook PC to the ECU and connect to the ECU using PCLink.
2. Open Electronic Throttle -> Accelerator Position Sensor and ensure that the APS (Main) Source and APS (Sub) Source settings are set to the correct inputs. Refer to the Pinouts section of this manual for details.
3. In the same window double-click on 'APS Calibration' and follow the instructions on the screen.
4. Open Electronic Throttle -> E-Throttle 1 -> Throttle Position Sensor and ensure that the TPS (Main) Source and TPS (Sub) Source settings are set to the correct inputs. Refer to the Pinouts section of this manual for details.
5. In the same window double-click on 'TPS Calibration' and follow the instructions on the screen.
6. If your vehicle has two E-Throttles then repeat the above two steps for TPS 2(Main) and TPS 2 (Sub) in E-Throttle 2.
7. Select the 'General' tab in the Runtime Values window (F12 or 'R').
8. Ensure the APS (Main) and APS (Sub) values read 0% when the pedal is released and 100% when fully depressed.
9. Perform a 'Store' by pressing F4.

1.7.5 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.

1.7.6 Input and Output Setup

As the Link G4X & G5 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 tab in the Runtime Values window (F12 or 'R') to confirm each channels operation.

All Analog Volt and Temperature Inputs

Look at the Analog tab in the Runtime Values window (F12 or 'R') to confirm each channels operation.

1.7.7 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 Link ECU is calibrated to precisely measure engine position.

1. Connect the ECU to PCLink.
2. Select Fuel -> Fuel Setup -> Fuel Main:
 - 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. Select Triggers -> Calibrate and then open the Set Base Timing window.
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 ECU Tuning Functions -> Triggers -> Calibration.

1.8 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, compare to BAP if not 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.

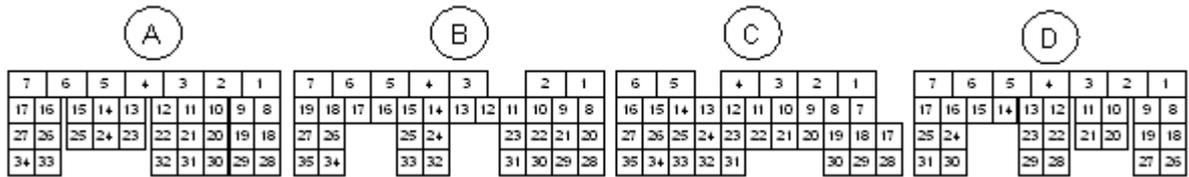
Traditional Fuel Equation Mode Master Fuel Setting

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.

I.9 Pinouts

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

I.9.1 Toyota GT86/Subaru BRZ



Pin	ECU Pin	Function	Pin	ECU Pin	Function
A1	Aux 10	E-Throttle -	C7	An Volt 4	Bank 2 DI Rail Pressure ^{*5}
A2	Aux 9	E-Throttle +	C8	nc	
A3	Ground (Power)		C9	An Volt 3	DI Rail Pressure
A4	Ground (Power)		C10	nc	
A5	Aux 4	Bank 2 Exhaust VVT Solenoid	C11	nc	
A6	Ignition 5 (Aux)		C12	nc	
A7	Aux 3	Bank 1 Exhaust VVT Solenoid	C13	nc	
A8	Ignition 4	Ignition	C14	DI 2	Bank 1 Exhaust Sensor
A9	nc		C15	Trig 2	Bank 2 Inlet Sensor
A10	Ignition 2	Ignition	C16	Trig 1	Crank Sensor
A11	Aux 13	Purge Solenoid	C17	Knock 2	Bank 2 knock sensor
A12	Injector 5	Port Injector 1	C18	nc	
A13	Injector 8	Port Injector 4	C19	nc	
A14	Injector 1	DI Injector 1 ^{*1}	C20	An Volt 1	MAP
A15	nc		C21	An volt 11 ^{*4}	Narrowband O2
A16	Aux 2	Bank 2 Inlet VVT Solenoid	C22	nc	
A17	Aux 1	Bank 1 Inlet VVT Solenoid	C23	nc	
A18	An Volt 9	TPS (Main)	C24	nc	
A19	5V (MAP and TPS)		C25	DI 3	Bank 2 Exhaust Sensor
A20	An Temp 3	Oil Temperature	C26	DI 1	Bank 1 Inlet Sensor
A21	Ignition 1	Ignition	C27	Ground (Crank Sensor)	
A22	Injector 6	Port Injector 2	C28	Knock 1	Bank 1 knock sensor
A23	Injector 4	DI Injector 4 ^{*1}	C29	Ground (Knock Shield)	
A24	Injector 3	DI Injector 3 ^{*1}	C30	Ground (O2 Sensor)	
A25	Injector 2	DI Injector 2 ^{*1}	C31	nc	
A26	nc		C32	Ignition 6	DI Fuel Pump
A27	nc		C33	nc	
A28	An Volt 10	TPS (Sub)	C34	Ground (Cam Sensors)	

Pin	ECU Pin	Function	Pin	ECU Pin	Function
A29	Ground (Sensors)		C35	Ground (Crank Shield)	
A30	An Temp 1	ECT			
A31	Ignition 3	Ignition	D1	+14V From Main Relay	ECU Power
A32	Injector 7	Port Injector 3	D2	+14V Constant From Batt	nc
A33	nc		D3	DI 8	Brake Sw NO
A34	nc		D4	Ground (Sensor & Shield)	
			D5	nc	
B1	nc		D6	nc	
B2	nc		D7	nc	
B3	nc		D8	DI 4	AC Pressure Sw ^{*6}
B4	nc		D9	nc	
B5	Aux 14	DI Box Relay ^{*2}	D10	nc	
B6	nc		D11	An Volt 6 ^{*4}	Battery Current Sensor
B7	+14V E-Throttle	From the E-Throttle Relay	D12	An Temp 2	MAF Air Temp/IAT
B8	nc		D13	nc	
B9	nc		D14	nc	
B10	nc		D15	DI 5	Clutch Sw
B11	Aux 7	Fan 2 Relay	D16	DI 6	Park/Neutral Sw
B12	Aux 6	Fan 1 Relay	D17	DI 7	Starter Request ^{*3}
B13	Main Relay Output	Triggered by Ignition Sw (D27)	D18	CAN 2 Low	
B14	nc		D19	CAN 2 High	
B15	Aux 8	Tacho	D20	nc	
B16	nc		D21	nc	
B17	Aux 11	E-Throttle Relay Output	D22	An Volt 5	MAF
B18	Ignition 8	Alternator Control	D23	nc	
B19	Aux 5	Low Pressure Fuel Pump Output	D24	An Temp 4 ^{*4}	Battery Temperature Sensor
B20	nc		D25	nc	
B21	+5V Out (APS)		D26	nc	
B22	+5V Out (APS & TPS)		D27	Controls Main Relay (B13)	Ignition Sw
B23	An Volt 7	APS (Main)	D28	Ground (MAF Shield)	
B24	nc		D29	Ground (MAF)	
B25	Immobiliser		D30	An Volt 2	Cruise Switches
B26	Aux 12	Starter Relay ^{*3}	D31	nc	
B27	nc		Expansion 1	+14V Out	
B28	nc		Expansion 2	Aux 15	
B29	Ground (APS)		Expansion 3	Aux 16	
B30	Ground (APS & TPS)		Expansion 4	DI 11	

Pin	ECU Pin	Function	Pin	ECU Pin	Function
B31	An Volt 8	APS (Sub)	Expansion 5	DI 10	
B32	nc		Expansion 6	DI 9	
B33	nc		Expansion 7	+5V Out	
B34	nc		Expansion 8	Ground	
B35	Ignition 7	AC Clutch	Expansion 9	+14V Out	
			Expansion 10	nc	
C1	Ground (Power)		Expansion 11	An Volt 12	
C2	Ground (Power)		Expansion 12	An Volt 11 ^{*4}	These inputs each have a jumper to either connect them to the Expansion plug or to their normal functions on the main header.
C3	Ground (Power)		Expansion 13	An Volt 6 ^{*4}	
C4	nc		Expansion 14	An Temp 4 ^{*4}	
C5	nc		Expansion 15	+5V Out	
C6	+14V From Main Relay	ECU Power	Expansion 16	Ground	

- Note:** Injector Drives 1-4 (The DI Injector outputs) can be configured to either output standard injector signals (for engine swaps) or to output the correct signal for the factory DI Driver box using the jumpers on the board. Leave the Injector setting set to Standard NOT Inversed with Pull-up.
- Note:** The Aux 14 (DI Box Relay, B5) must be pulled low to turn on the factory DI Driver box which controls the DI Injectors and the mechanical DI Fuel Pump's solenoid.
- Note:** Starter Relay (Aux 12, B26) control varies between key start and push button start vehicles. On vehicles with physical keys and key barrels Aux 12 must be pulled low before the starter can be operated from the key and the Start signal (DI 7) is feedback that the starter is being activated. On vehicles with push button start Aux 12 directly controls the starter and the Start signal (DI 7) is a request to the ECU to turn on the starter.
- Note:** An Temp 4 (Battery Temperature, D24), An Volt 11 (Narrowband O2, C21) and An Volt 6 (Battery Current, D11) all have the ability to be connected to the main header or to the expansion header via user configurable jumpers.
- Note:** Bank 2 DI Rail Pressure (C7, An Volt 4) is only present on later model vehicles (~2017 onwards).
- Note:** AC Pressure Switch (DI4, pin D8) specifies when the system pressure is too low for the AC to run but the same sensor does also force the AC Clutch relay off and so no action from the ECU is required to turn the AC Clutch.

I.10 CAN Information

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

I.10.1 Toyota GT86/Subaru BRZ

CAN bus 1 is available on a 4 pin connector with the pinout as shown below. CAN bus 2 is connected directly to the main header and is used to interface with the vehicle's factory CAN system.

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

Note: This CAN Mode has not yet been widely tested in all geographic regions and on all model variants, if you have issues with this mode please contact tech support.

Estimated Torque value (from Torque Control function), Clutch Switch, Gear and Inst Fuel Consumption are used by this CAN Mode. The CE Light is controlled by CAN Aux 1.

This CAN Mode does support automatic vehicles with the Automatic torque request coming in on the Transmission Torque Request runtime. The DSC Torque Request comes in on the DSC Torque Request runtime.

Note: The driver Torque Request Table needs to be setup correctly for this CAN mode to work properly. (Gear Shift Reduction setting in Torque Management folder turned on).

CAN Channel	Function
CAN DI 1 Frequency	LF wheel speed
CAN DI 2 Frequency	RF wheel speed
CAN DI 3 Frequency	LR wheel speed
CAN DI 4 Frequency	RR wheel speed
CAN DI 5 Frequency	Vehicle Speed
CAN DI 1	Traction Control Disable
CAN DI 2	VSC Sport Mode on
CAN DI 3	Brake Pedal pressed
CAN DI 4	Handbrake on
CAN DI 5	AC Request
CAN DI 6	Sport Mode (Automatic cars only)
CAN DI 7	Snow Mode (Automatic cars only)
CAN An 1	Brake Pressure (Bar)
Controls Runtime directly	Steering wheel position (But not ROC)
CAN Aux 1	CE Light

1.11 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 and check the latest status of known issues before installing the ECU.

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

1.11.1 Toyota GT86/Subaru BRZ

Storing (F4) the tune to the ECU can cause the ABS and CE lights to come on, turning the car off and back on clears this.

There are however several things that are not issues but are still worth mentioning here:

- Aux14 needs to output a ground signal (active low and active) for the DI box to be powered and so for the DI injectors and DI Fuel pump to operate.
- Fuel -> Fuel Setup -> Injector Setup -> DI Injector Drive mode needs to be set to 'Standard' as there is hardware in the plug-in to flip polarity and apply a pullup to convert the signal to an active high style signal.
- Starter relay and Starter input are different between key start and push start models, key start models need the starter relay on before it will start and the start signal only comes through when the starter is on, push start has the start signal coming into the ECU to request that the starter relay is turned on. In other words key start has key control starter but ECU can disable it and push start has ECU control the starter.