Subaru WRX & STI V5-6
Installation Manual

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Product Warranty Statement

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.

Link Engine Management Ltd License Agreement

The software programme in this ECU is licensed not sold. Link Engine Management Ltd grants the user a license for the programme only in the country where the programme was acquired. No other rights are granted under this license and the programme may only be used on one machine at a time. If the programme is transferred a copy of this license and all other documentation must be transferred at the same time. The license may be terminated by the user at any time. Link Engine Management Ltd may terminate the licence if the user fails to comply with the terms and conditions of this license. In either event the copy of the programme must be destroyed.

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1   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.

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 G4X 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 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 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.

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.

<p style="text-align:center;color:red;">WARNING!
Failure to follow all installation and operating instructions may result in damage to
the Link ECU, personal injury, or harm to property.</p>

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 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   WRXLink (5-6)

Some models are wired with their cam and crank sensors connected to different pins. This usually depends on if the vehicle was shipped with a factory fitted immobiliser. To allow for this four dip switches have been provided on the ECU
Set the DIP switches according to the diagram below:

1.2.2   Injector Impedance

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

1.2.2.1   Subaru Impreza WRX V1-11 ECU

The G4X Subaru V1-11 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 ECU has been designed to be used with HIGH impedance (greater than 6 Ohms) injectors. Ballast resistors must be wired if low impedance injectors are to be used. This means that the ECU is plug-in compatible with factory fitted injector combinations on all models, however if fitting low impedance injectors then ballast resistors must be wired. Contact your nearest Link dealer to purchase a ballast resistor pack if required.

1.3   Installation

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

1.3.1   ECU Handling Procedures

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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.

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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 WRXLink (1-2), WRXLink (3-4), WRXLink (5-6), WRXLink (7-9)

The following steps outline the installation procedure for Subaru Plug-In ECUs:

1. Remove the factory ECU from the vehicle: Ensure the key is in the OFF position. The factory ECU is located under a steel cover on the passengers side floor (below the passengers feet). Lift the carpet, remove the cover panel. 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 ECUs 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 and cover from the ECU enclosure by removing the side retaining screws. Remove the circuit board by removing the retaining screws. Hold it only by the plastic header and place it aside.
3. Fit the Link Plug-In ECU: Remove the ECU from its packaging and place it immediately in the factory enclosure. Place the factory ECU in the packaging your Link ECU came in for its protection.
4. If the ECUs USB tuning cable is to be left permanently connected, a slot will need to be cut in the top cover. The best place to do this is usually beside the factory header.
5. Reassemble the enclosure and fit the ECU back to the vehicle.
6. Connect the ECU to the factory wiring loom.
7. Do NOT attempt to start the vehicle. Proceed to read through the remaining sections of this manual first.

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 WRXLink (1-2), WRXLink (3-4), WRXLink (5-6), WRXLink (7-9)

The G4X WRXLink (1-2), WRXLink (3-4), WRXLink (5-6), and WRXLink (7-9) Plug-In ECUs supports several options for fitting of a MAP sensor. Any one of the following options can be used:
1. Factory MAP Sensor – From factory, all models supported by this ECU are fitted with a factory MAP sensor. The factory MAP sensor is wired to An Volt 1. For version 1 to 6 the limit of the factory sensor is 125kPa (18 psi) of boost. For version 7 - 9, 23psi.
2. Factory MAP Sensor Upgrade – The factory MAP sensor can be upgraded by simply replacing the factory 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 WRXLink (5-6)

From factory, models supported by the G4X WRXLink (5-6) Plug-In ECU are not fitted with an IAT sensor. No suitable wiring is run into the engine bay therefore the ECU is designed to have an IAT sensor wired to the Expansion Connector. 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 WRXLink (5-6)

Bottom Board V1.4 Onwards has a dedicated E-Throttle plug with Aux9 & 10 (the internal H Bridge Outputs), 3 Analog inputs, signal ground and a 5V supply.
If using a pre V1.4 Bottom Board Aux 9 & 10 are not exposed and so to use E-Throttle it is recommended to rearrange some ECU pins so Aux 1&2 or Aux 3&4 can be used with an external E-Throttle controller while keeping the Tacho and Fuel Pump Control. More than three Analog inputs are available on the expansion connectors which can be used to add TPS (Sub) and the APS inputs.

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.

1.6   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.

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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.

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1.6.1   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.

1.6.2   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.

1.6.3   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.

1.7   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.

1.7.3   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

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 window (F12 or 'R').
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.

1.7.5 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.

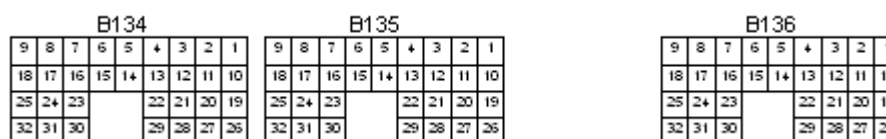#### Traditional Fuel Equation Mode Master Fuel Setting

If using Traditional Fuel Equattion 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.

1.9 Pinouts

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

1.9.1 WRXLink (5-6)

Pin	ECU Pin	Function	Pin	ECU Pin	Function
B134-1	Aux 1	Fuel Pump Relay	B135-30	nc	
B134-2	nc		B135-31	nc	
B134-3	nc		B135-32	nc	
B134-4	Ignition 3 (Aux)	Fan Relay 1			
B134-5	Aux 6	Idle Stepper Motor	B136-1	An Volt 2	AFM Signal
B134-6	Aux 5	Idle Stepper Motor	B136-2	nc	
B134-7	Ignition 1	Ignition	B136-3	nc	
B134-8	Ground		B136-4	nc	
B134-9	Ground		B136-5	Trig 1 / Trig 2	via dip switch
B134-10	nc		B136-6	Trig 2 / Trig 1	via dip switch
B134-11	nc		B136-7	An Volt 1	Factory MAP Sensor
B134-12	nc		B136-8	+14V Main Relay	ECU Power
B134-13	Ignition 4 (Aux)	Fan Relay 2	B136-9	+14V Main Relay	ECU Power
B134-14	Aux 7	Idle Stepper Motor	B136-10	nc	
B134-15	Aux 8	Idle Stepper Motor	B136-11	nc	
B134-16	Ignition 2	Ignition	B136-12	+5V Out	
B134-17	Ground		B136-13	nc	
B134-18	Injector 4	Injection	B136-14	nc	
B134-19	Aux 2	Wastegate Solenoid	B136-15	nc	
B134-20	nc		B136-16	nc	
B134-21	Aux 1	Fuel Pump Relay	B136-17	Ground	
B134-22	Aux 3	A/C Out	B136-18	Ground	
B134-23	nc		B136-19	An Temp 3	Spare
B134-24	nc		B136-20	An Volt 3	TPS (Main)
B134-25	Injector 3	Injection	B136-21	An Volt 4	Oxygen Sensor Signal
B134-26	nc		B136-22	nc	
B134-27	nc		B136-23	Ground (Triggers)	
B134-28	Injector 5 (Aux)	CE Light	B136-24	Ground (Signal)	
B134-29	nc		B136-25	DI 4	Ignition Switch
B134-30	nc		B136-26	Knock 1	Knock
B134-31	Injector 1	Injection	B136-27	nc	
B134-32	Injector 2	Injection	B136-28	An Temp 1	ECT
			B136-29	Ground (Knock Shield)	

Subaru V5-6 WRX/STi					
Pin	**ECU Pin**	**Function**	**Pin**	**ECU Pin**	**Function**
B135-1	DI 2	Power Steer Signal	B136-30	Ground (Signal)	
B135-2	DI 1	Start Signal	B136-31	Ground (MAF)	
B135-3	nc		B136-32	Injector 6 (Aux)	ECU Hold Power
B135-4	nc				
B135-5	nc		Expansion 1	Ground (Signal)	
B135-6	nc		Expansion 2	+5V Out	
B135-7	nc		Expansion 3	DI 5	
B135-8	nc		Expansion 4	DI 7	
B135-9	nc		Expansion 5	An Volt 5	
B135-10	nc		Expansion 6	An Volt 6	
B135-11	DI 6	A/C In	Expansion 7	An Temp 2	
B135-12	nc		Expansion 8	An Temp 3	
B135-13	nc		Expansion 9	Ground (Signal)	
B135-14	Aux 4	Tacho	Expansion 10	+5V Out	
B135-15	nc		Expansion 11	DI 8	
B135-16	nc		Expansion 12	DI 9	
B135-17	nc		Expansion 13	An Volt 8	
B135-18	nc		Expansion 14	An Volt 9	
B135-19	nc		Expansion 15	Ignition 7 (Aux)	
B135-20	nc		Expansion 16	Ignition 8 (Aux)	
B135-21	nc				
B135-22	nc		E-Throttle 1	Ground (Signal)	
B135-23	nc		E-Throttle 2	+5V Out	
B135-24	nc		E-Throttle 3	An Volt 11	
B135-25	nc		E-Throttle 4	An Volt 10	
B135-26	DI 3	Vehicle Speed	E-Throttle 5	An Volt 7	
B135-27	nc		E-Throttle 6	nc	
B135-28	nc		E-Throttle 7	Aux 10	
B135-29	nc		E-Throttle 8	Aux 9	

Note: Injector Drives 7 and 8 aren't exposed and don't have the hardware required to drive Injectors.
Note: The E-Throttle Connector is not present on pre V1.4 Bottom Boards.

1.10 CAN Information

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

1.10.1 WRXLink (5-6)

The G4X WRXLink (5-6) Plug-in ECU has two CAN buses. These CAN buses exist to support aftermarket CAN devices.

Pre V1.4 bottom board uses the following:

CAN bus 1 uses a 5 pin connector and is labeled on the ECU as 'CAN 1/RS232'.
If using this connector for CAN ensure the cable being used doesn't have Serial wires connected as this can

act as an aerial and prevent USB communications from working.

CAN 1/RS232 Connector		
Pin	**Function**	**Colour**
1	Comms GND	Brown
2	CAN1 L	Green
3	CAN1 H	White
4	RS232-RX	Grey
5	RS232-TX	Yellow

CAN bus 2 uses a 5 pin connector and is labeled on the ECU as 'CAN 2/OBD'.

CAN 2/OBD Connector		
Pin	**Function**	**Colour**
1	GND	Brown
2	CAN2 L	Green
3	CAN2 H	White
4	NC	Grey
5	+14V	Yellow

V1.4 onwards bottom board uses the following 4 pin connector for both CAN 1&2 and has a second CAN 1 plug with 5 pins.

4 pin CAN 1 & 2 plugs:

CAN Connector		
Pin	**Function**	**Colour**
1	GND	Black
2	CAN L	Green
3	CAN H	White
4	+14V	Red

Second CAN 1 plug:
You can use either this plug for CAN 1 or the 4 pin version as they are both connected to the same hardware:
CAN bus 1 uses a 5 pin connector and is labeled on the ECU as 'CAN 1/RS232'.
If using this connector for CAN ensure the cable being used doesn't have Serial wires connected as this can act as an aerial and prevent USB communications from working.

CAN 1/RS232 Connector		
Pin	**Function**	**Colour**
1	Comms GND	Brown
2	CAN1 L	Green
3	CAN1 H	White
4	RS232-RX	Grey
5	RS232-TX	Yellow

To learn more about CAN see PCLink help.

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   WRXLink (5-6)

Current known issues with the G4X WRXLink (5-6) Plug-In ECU:

- Some version 6 WRX impreza models will require the MAP sensor calibration to be changed to Subaru V7-8. With the correct calibration selected the MAP sensor should read approximately 101 kPa (with the ignition on and engine not running).