Subaru Impreza WRX V11

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   G4X 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 employs high resolution fuel and ignition tables with configurable load and RPM centres. When coupled with up to six dimensional fuel and ignition mapping, barometric pressure compensation and intake air temperature correction this gives an unprecedented level of tuning accuracy. All 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.

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

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

1.2.1   Board Switch Settings

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

1.2.1.1   WRXLink (11)

The WRX11 ECU has 4 jumpers on the circuit board, these jumpers are used to redirect analog inputs from certain pins on the main header that aren't commonly used in performance applications to the expansion connector so they can be repurposed for other uses such as extra sensors. For example the MAF sensor is not commonly used in a performance application, so if an extra analog input is required the MAF input pin (AN Volt 8) can be redirected to the expansion connector by moving the jumper to the right position.

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 G4X 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 (11)

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 passenger's 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. Cut a rectangular hole in the back wall of the ECU case as per the picture below to allow the USB cable to pass through. Suggest also adding two small holes in the back wall to allow a cable tie to strain relieve the USB cable.
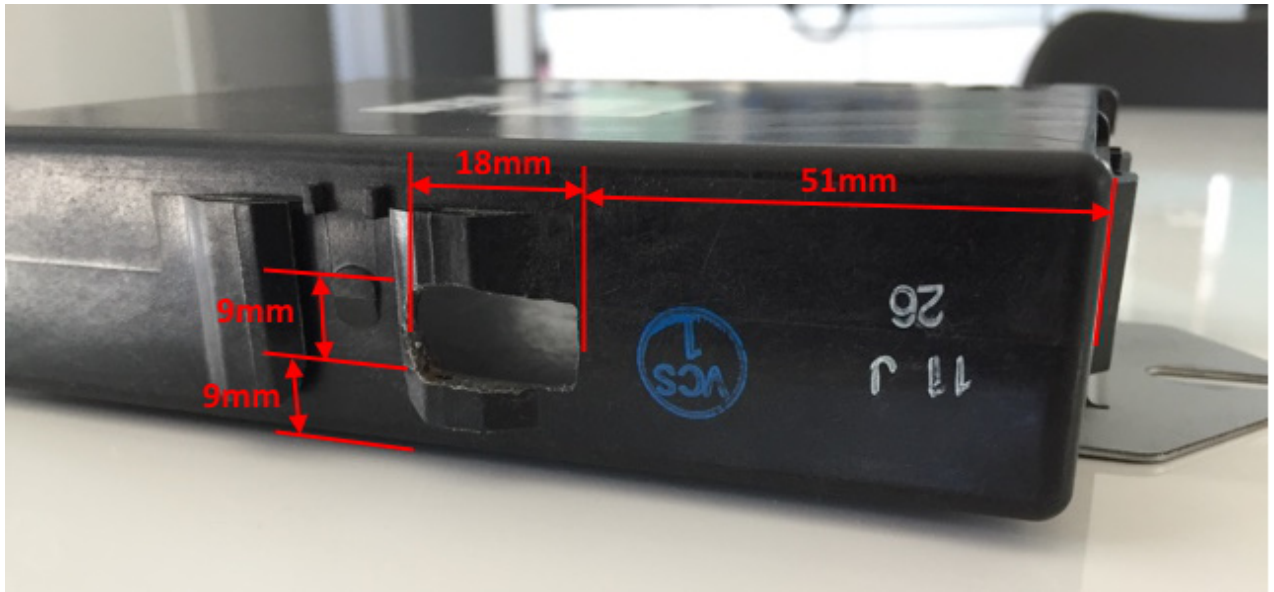
USB Cable Hole

4. Fit the Link Plug-In ECU: Remove the ECU from its packaging, unplug the USB cable from the socket on the topboard and place ECU into the factory enclosure. Ensure the PCB is slotted into the slots inside the case. Place the factory ECU in the packaging your Link ECU came in for its protection.

5. Refit the front cover then plug the USB cable into the socket through the hole in the back wall of the ecu case. Secure the cable with a cable tie to prevent it being yanked.
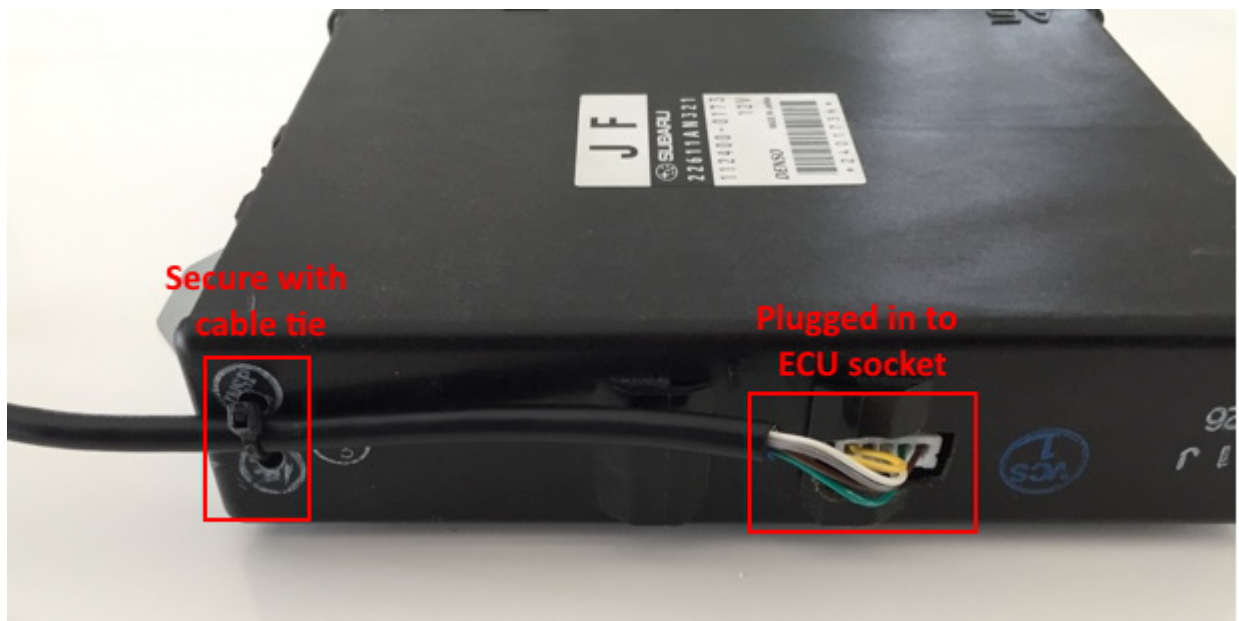
USB Cable Fitting

6. If an expansion cable or CAN cable is required these are easiest to pass through the front cover beside the header in the area shown below.
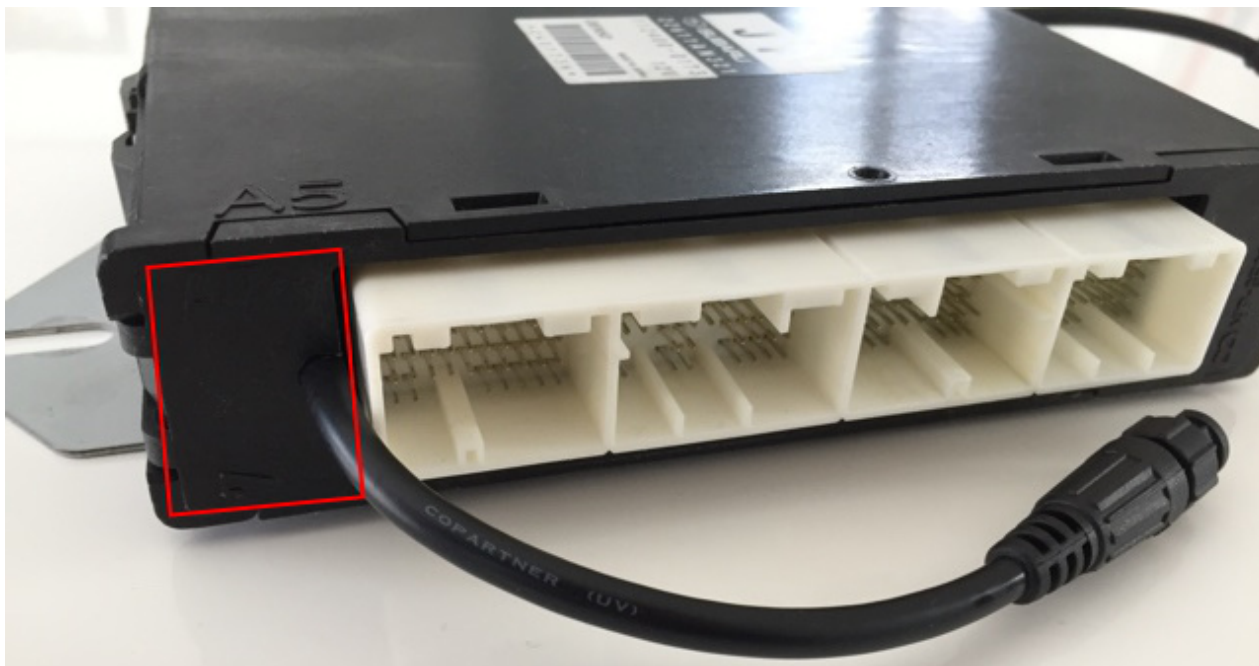
CAN & Expansion Cable Fitting

7. 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.

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   WRXLink (04), WRXLink (07) & WRXLink (11)

The Link G4X WRXLink (04), WRXLink (07) & WRXLink (11) plugins support 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. The factory sensor is good for 160kPa (23psi) of boost.
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.

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.

Note: We have found two different MAP sensor calibrations used in the WRXLink (11). Most STI's use the "Subaru V9" calibration and the more basic WRX's use the "Subaru V7-8" calibration. The correct selection can be confirmed by checking that the BAP runtime matches the MAP runtime. See section 1.6.3
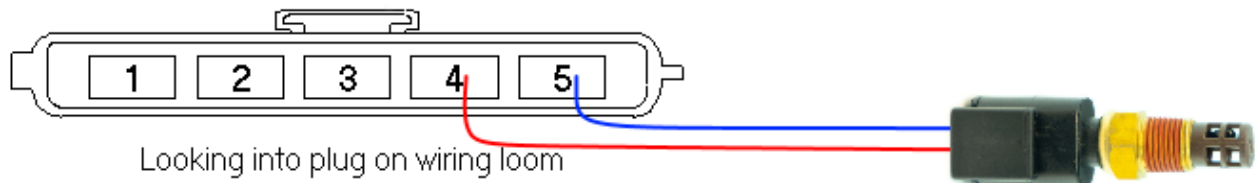
1.4.2 IAT Sensor

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 (04), WRXLink (07) & WRXLink (11)

Some STI's have a factory fitted IAT sensor near the throttle body, if your car has this it is suitable for use as is. This STI sensor is connected to AN Temp 3.

The AFM has a factory fitted IAT sensor. Due to its location this sensor is not suitable for tuning. A suitable IAT sensor can however be wired to the AFM wiring. The AFMs IAT signal is wired to An Temp 2. Factory AFM wiring information follows:

Looking into plug on wiring loom

1 +14V
2 Ground
3 Mass Air Flow Meter (Typically An Volt8)
4 Intake Air Temperature (An Temp 2)
5 Ground

Note: It is important that the factory IAT sensor is completely disconnected as not to affect the after market IAT sensor signal.

An IAT sensor can also be wired in using any spare An Temp or An Volt pin (several are available on the expansion connectors). Note spare An Volt channels require a pullup resistor (to +5V) to be added for temperature input use.

1.4.3 E-Throttle Output

1.4.3.1 WRXLink (04), WRXLink (07) and WRXLink (11)

This vehicle has E-Throttle from factory.

The E-Throttle Output pins are Aux 9 & 10 and the EThrottle Relay is Aux Ignition 8. If the EThrottle 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.

1.4.4 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. 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.

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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.

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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
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 USB ECU 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.

1.6.2.1 WRXLink (11)

The WRX 11 has many model variations, however, most of the differences seem to be related to whether the car is a "Push Button start" or "Key start" model. There are also 2 different sized engines and some with AVCS on both exhaust and intake vs some with intake AVCS only. There are also some CAN bus differences. For this reason there are two base maps available in PC Link which will cover most of the set up differences, load the map that matches your "starter type".

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 Tuning Software programs (pclx Files) give a consistent state of tune throughout the ECU range. This allows a pclx 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 G4X Users Manual -> Tuning Operating Procedures -> ECU Controls -> MAP Sensor Calibration.

1.6.4 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 section of PCLink (lower part of the screen).
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.

1.6.5 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 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 settingcan 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.

1.8 Pinouts

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

1.8.1 WRXLink (11)

Pin	ECU Pin	Function	Pin	ECU Pin	Function
A1	nc		C3	nc	Front O2 Sensor Heater
A2	nc		C4	Injector 7 (Aux)	Rear O2 Heater
A3	nc		C5	nc	
A4	An Temp 3	IAT	C6	Ground	
A5	Ground		C7	nc	
A6	An Volt 1	MAP	C8	nc	
A7	+14V	ECU Power	C9	Ignition 6 (Aux)	AC Relay
A8	nc		C10	nc	Alternator Control
A9	nc		C11	Aux 11	CE Light
A10	nc		C12	Aux 6	Fuel Pump Speed
A11	DI 1	R/H Intake Cam Sensor	C13	nc	
A12	DI 3	R/H Exhaust Cam Sensor	C14	Ground	
A13	Trig 1	Crank Sensor	C15	Ground	
A14	Ground (Crank Sensor)		C16	nc	
A15	Knock 1	Knock Sensor	C17	nc	
A16	An Volt 4	Left TGV Pos (Jumper dependent)	C18	Ignition 7 (Aux)	Sub Fan Relay
A17	nc		C19	nc	Secondary Air Valve
A18	An Volt 2	TPS (Main)	C20	Aux 12	Starter Relay
A19	+5V Out		C21	Aux 13	E-Throttle Relay
A20	nc		C22	Ignition 8 (Aux)	Tacho
A21	Trig 2	L/H Intake Cam Sensor	C23	Main Relay Control	Triggered by B19
A22	Ground (Cam Sensor)		C24	DI 7	AC Request
A23	nc		C25	DI 4	Clutch Sw
A24	Ground (Crank Shield)		C26	nc	
A25	Ground (Knock Shield)		C27	CAN H	
A26	An Volt 5	Right TGV Pos (Jumper dependent)	C28	nc	
A27	nc		C29	Ignition 5 (Aux)	Main Fan Relay
A28	An Volt 3	TPS (Sub)	C30	nc	
A29	Ground		C31	DI 9	Neutral Sw
A30	nc		C32	DI 8	2nd Start Signal
A31	DI 2	L/H Exhaust Cam Sensor	C33	nc	
A32	nc		C34	nc	

A33	An Volt 6	Power Steer Sw	C35	CAN L	
A34	An Temp 1	ECT			
			D1	Ground	
B1	Ground (O2 Shield)		D2	Ground	
B2	+14V	ECU Power	D3	Ground	
B3	nc		D4	Aux 9	E-Throttle Motor +
B4	An Volt 7	Rear O2 Signal (Jumper dependent)	D5	Aux 10	E-Throttle Motor -
B5	nc (Constant +12V)		D6	Ground (Ignition)	
B6	nc		D7	Ground	
B7	nc		D8	Injector 1	Injection
B8	nc	Front O2 Signal -	D9	Injector 2	Injection
B9	nc	Front O2 Signal +	D10	Injector 3	Injection
B10	nc		D11	Injector 4	Injection
B11	nc		D12	Linked to Pin D23	L/H TGV Motor +
B12	DI 10	Cruise Main Sw	D13	Aux 8	L/H TGV Motor -
B13	DI 6	Start Signal	D14	Aux 1	L/H Intake AVCS Solenoid
B14	nc		D15	+14V Out	L/H Intake AVCS Solenoid
B15	nc		D16	Aux 2	R/H Intake AVCS Solenoid
B16	nc		D17	+14V Out	R/H Intake AVCS Solenoid
B17	nc		D18	Ignition 1	Ignition
B18	An Temp 2	MAF Temp	D19	Ignition 2	Ignition
B19	Ignition Sw	Used to Control Main Relay	D20	Ignition 3	Ignition
B20	DI 5	Brake Sw NC	D21	Ignition 4	Ignition
B21	+5V Out (APS Main)		D22	Aux 7	L/H TGV Motor +
B22	+5V Out (APS Sub)		D23	Linked to Pin D12	L/H TGV Motor -
B23	An Volt 10	APS (Main)	D24	Aux 4	R/H Exhaust AVCS Solenoid
B24	An Volt 11	Cruise Switches	D25	+14V Out	R/H Exhaust AVCS Solenoid
B25	nc		D26	Ground	
B26	An Volt 8	MAF (Jumper dependent)	D27	Aux 5	Wastegate Solenoid
B27	nc		D28	nc	
B28	nc	Brake Sw NO	D29	Aux 14	Purge Solenoid
B29	Ground (APS Main)		D30	Aux 3	L/H Exhaust AVCS Solenoid
B30	Ground		D31	+14V Out	L/H Exhaust AVCS Solenoid
B31	An Volt 9	APS (Sub)	Expansion 1	Aux 16	
B32	nc		Expansion 2	DI 11	
B33	nc		Expansion 3	An Temp 4	
B34	Ground (MAF)		Expansion 4	Knock 2	
B35	Ground (MAF Shield)		Expansion 5	Injector 6	

			Expansion 6	Injector 5	
C1	+14V E-Throttle		Expansion 7	+5V Out	
C2	nc	Front O2 Sensor Heater	Expansion 8	Ground	

Note: An Volt 6 & 11 (A33 & B24) have Pullup resistors on them and so can't be used for typical An Volt purposes.
Note: Ignition 8 (C19) has a pullup resistor and so can't be used for typical Ignition purposes.
Note: Injector 8 isn't exposed and so staged injection is only possible with Group Secondaries.

1.9 CAN Information

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

1.9.1 WRXLink (11)

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	Comms GND	Brown
2	CAN L	Green
3	CAN H	White
4	+14V	Yellow

Factory CAN Bus Information:
Estimated Torque value (from Torque Control function), Clutch Switch, Gear and Inst Fuel Consumption are used by this CAN Mode.
The AC Clutch, CE Light and Cruise lights are controlled over CAN in some models and hard wired in others.

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 1	Traction Control Switch
CAN DI 2	Rear Demister
CAN DI 3	Handbrake
CAN DI 4	DCCD Auto/Manual Status (0 = Manual, 1 = Auto)
CAN An 1	SI Drive Mode (1 = Sports Sharp (S#), 2 = Intelligent (I), 3 = Sports (S))
CAN An 2	Ambient temp (°C)
CAN An 3	Brake Pressure (Bar)
CAN An 4	DCCD Auto Level (Auto = 1, Auto- = 2, Auto+ = 3)
CAN An 5	Fuel Level (Ohms)
CAN An 6	DCCD bargraph
Controls Runtime directly	Steering wheel position (But not ROC)

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 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 WRXLink (11)

Some key start models may have the security/immobilizer lamp remaining on on the dash after fitting an aftermarket ecu.