How to Tune the *XEDE*

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What is an XEDE?

ChipTorque's *XEDE* is a sophisticated tuning tool designed to deliver increased power and torque, optimal throttle response, improved fuel economy and smoother acceleration.

The concept of ChipTorque's *XEDE* began as a solution to the need to re-tune vehicles whose engine management systems had migrated from the previously standard performance chip. The *XEDE* was created by Lachlan Riddel and his in-house Research & Development team.

The *XEDE* is an interceptor style Engine Management System. It generates changes in fuel and ignition by changing the factory ECUs load and crank reference input signals. The *XEDE* then uses the factory control of coils and injectors to deliver the fuel and timing. It has additional functions of boost control, water spray control or potentially any other on/off or PWM function including injector drive for an additional injector.

All *XEDE*s are supplied with a base map selected from ChipTorque's program database and based on the vehicle's modifications which you would list on ChipTorque's Order Form. Through easy installation using either a direct plug-in harness or wire-in harness, the *XEDE* allows you, the programmer, to fully custom tune the vehicle's parameters using *XMAP* software to give the most accurate result for your customer.

How it works

XEDE is wired or connected into a vehicle's factory wiring loom and intercepts the signals traveling to the ECU. By intercepting the crank reference signal we can advance or retard timing. By intercepting the load signals, e.g. analogue voltage of an Air Flow Meter, we can make the mixtures richer or leaner by giving a higher or lower load signal to the ECU.

Benefits

The benefits of using an *XEDE* over other tuning options are:

Most factory parameters are retained
- § Cold start functions
- § Idle control
- § Knock sensor functions
- § Closed loop control
- § Limp home operating strategies
- § Fan and Air Conditioner controls
- § Immobiliser functions

Fast Tuning in Real Time

§ With over 15 years experience in tuning engine management systems – both factory and aftermarket – from Australia, Europe and USA, Lachlan and his design team incorporated what they believe to be the best functions from all the engine management systems they had tuned into the *XEDE*'s tuning software – *XMAP*. This means fast on-screen tuning in real time.

Base Tuning Maps Supplied

§ ChipTorque's extensive database of performance programs collated from many instances of custom tuning in Australia and the USA can give you a great start point for your tuning.

§ Base maps can be emailed on request

Not Processor Specific

§ Can be tuned to auto / manual / series I / series II regardless of current software in factory ECU.

Cost Effective Tuning Solution

§ No contracts

§ *XMAP* software available as free download from ChipTorque's *XEDE* internet site www.*XEDE*.com.au

§ Cheaper and easier than using an aftermarket engine management system

§ Can be tuned at any time, in the car, anywhere.

Customer Support

§ Ongoing local R&D

§ Expanding product range

§ Tuning phone support available

Specifications

- Maximum of 4800 adjustments
- 0.1% full-scale accuracy on MAF, MAP and TPS adjustments
- Degree accuracy on timing adjustments
- Support for hall and reluctor type crank and/or cam timing signals
- Support for analogue or frequency MAF and MAP/load signals
- Internal Storage space for up to 12 tuning maps
- One additional 10-bit analog input
- User configurable load axis, input and output variables, adjustment range, and math function for each map
- Two unique Tuning map banks
- Two high current outputs for boost control, water spray or auxiliary injector, etc.
- Remotely installable bi-color status LED
- Fully sealed unit has rugged and lightweight housing

Supported Vehicles

Our *XEDE* range is constantly expanding through continual Research and Development at ChipTorque and also through development assistance from our trade outlets in Australia and the US.

Make	Model	Year	Engine
Ford (AU)	Falcon	EL – AU	4.0L 6cyl
	Falcon	BA	4.0L 6cyl
	Falcon	BA	5.4L V8
Holden (AU)	Commodore	VN-VZ	-
	Jackaroo		3.0L
Lotus (US)	Elise	'05-'06	1ZZFE
Mazda (AU)	323 Protégé	01-05	1.8L
(US)	323 Protégé Turbo	01-05	2.0 LT
	SP20	01-05	2.0L
	RX-8	04-05	Renesis 13B
(US / AU)	MX-5 / Miata / Mazdaspeed	04 onwards	1.8LT
Mitsubishi	Lancer	98-01	1.8L
	Lancer	02-?	2.0L
	Lancer	EVO 6-8	2.0L
	Magna		3.5L V6
	Mirage	95-01	1.5L
	Lancer		1.5L
Nissan	350Z	04-05	3,5L
Porsche	Some 993/996		
Subaru	WRX	94-05	EJ20T
	WRX STi	94-05	EJ20T
	Forester XT	03-05	EJ25T
	Forester GT	94-05	EJ20T
	Liberty	91-	2.2L
	Liberty RS	91-93	EJ20T
	Liberty B4	98-	EJ20T
	Liberty B4		2.5L
	Impreza STi	05	2.5L
	Impreza	01-05	2.5L
Toyota (AU)	Landcruiser	100 Series	4L V8
	Landcruiser	Prado	4.7L Petrol
	Hilux		3.4L V6
	Soarer		1JZGTE
	Corolla		2ZZGE
	Corolla		1ZZFE

Suitable Applications

ChipTorque recommends taking the following into consideration when deciding if the *XEDE* is a suitable option for programming your vehicle.

- § Vehicle's current modifications
- § Your planned future modifications
- § Camshafts
- § Injector size
- § Boost level
- § Performance expectations
- § And budget!

The *XEDE* does have limitations. An interceptor unit cannot:

- § Increase rev limits
- § Adjust commanded idle speed
- § Easily increase speed limits
- § Easily change gear shift points
- § Facilitate injector changes greater than 30%

Always feel free to contact Vishnu in the USA or ChipTorque for advice on the best solution.

How to tune with the *XEDE*

Introduction

It is important to understand that the **XEDE** is an interceptor style of Engine Management System, sometimes referred to as a piggy-back system. As such there are certain fundamental rules and principles that must be adhered to when attempting to tune an existing engine management system using an **XEDE**.

The Basics

The **XEDE** integrates with an existing (usually factory) Engine Management System. The operation of the **XEDE** is to modify the signals (Voltage or Frequency and Crankshaft Reference signals) before the main PCM/ECU sees the signals. By changing the values of these signals, the resultant outputs from the PCM will be changed. If, for example, we effectively reduce the voltage that the PCM sees on the MAP sensor wire at Full Load, the PCM will see a signal that equates to less load. Using this modified input signal, the PCM will open the injectors for less time as it expects the engine is under less load and therefore requires less fuel.

Changes are made in the Maps on the screen and provided the **XEDE** is on-line the changes will be made immediately in the **XEDE**. When there is a difference between the data stored in the **XEDE**'s RAM and the data on screen, an error message will be displayed.

Uploading the *data* will load the data from the screen into the **XEDE**'s RAM. It will remain there, active, unless the **XEDE** power is removed. (i.e. if the ignition is turned off.) Before completion of tuning, or at any time during the tuning, the data must be "burned" to the **XEDE** thus making it permanent in the **XEDE** ROM.

While the engine is running, temporary changes can be tested in the **XEDE** without changing the permanently stored (burned) data by using the upload function but not burning the data before disconnecting the laptop from the **XEDE**.

Best Practice Procedure:

1. Connect cables to laptop
2. Open XMap software
3. Turn ignition on

4. Press F8 to download and show all Maps
5. Alt-F / Save As to save the existing file before making any changes
6. Make changes and tune as appropriate
7. Alt-F / Save As to save as a **new file name**
8. Ctrl-U to upload (if necessary)
9. Ctrl-B to burn to *XEDE*
10. Ignition off
11. Exit software
12. Disconnect laptop

Glossary of Basic Terms

AFR   Air/Fuel Ratio as measured using a 'Wide Band' style O_2 exhaust gas sensor and meter.

Map   The editable Table / Grid of data in the *XMAP* software.

MAP   The Manifold Absolute Pressure as derived from the MAP sensor.

Key Shortcuts: (in order of usage)

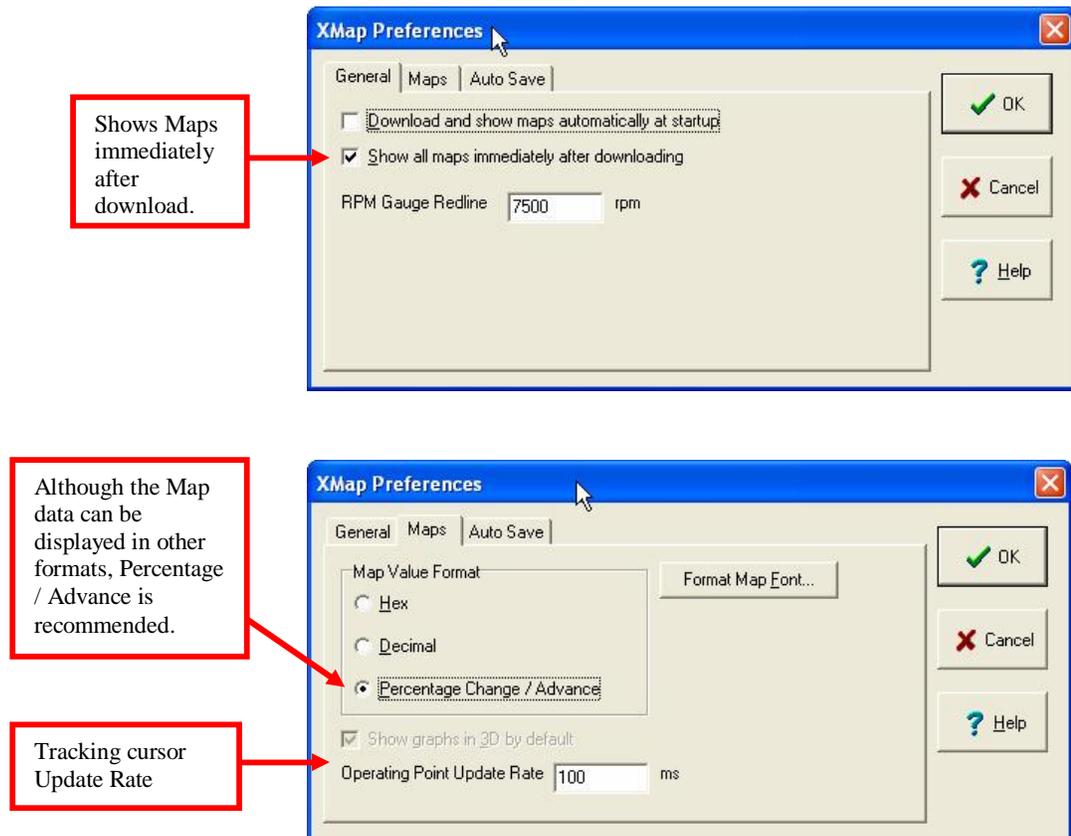|	
F8	Download and show all Maps
Ctrl-U	Upload the data on-screen into the *XEDE*
Ctrl-B	Burn (make permanent) the uploaded data into the *XEDE* memory
Spacebar	Move cursor to current active point or cell.
Right mouse click	Activate Edit Menu options
F11	Align Graphs with Maps

Connecting to the *XEDE*

Comms Setup

The *XEDE* communicates with the laptop using the XMap software and a serial port. The serial port can be specified (even if it is a USB or PCMCIA adapted serial port) from the options menu under Comms Setup.

Preferences

Some basic preferences can be set up from the Preferences under the File menu. Important ones that avoid common errors are:

Shows Maps immediately after download.

XMap Preferences

General | Maps | Auto Save |

☐ Download and show maps automatically at startup
☑ Show all maps immediately after downloading

RPM Gauge Redline   7500   rpm

✔ OK
✘ Cancel
? Help

Although the Map data can be displayed in other formats, Percentage / Advance is recommended.

XMap Preferences

General | Maps | Auto Save |

Map Value Format
○ Hex
○ Decimal
⦿ Percentage Change / Advance

Format Map Font...

☑ Show graphs in 3D by default

Operating Point Update Rate   100   ms

✔ OK
✘ Cancel
? Help

Tracking cursor Update Rate

Modifying fuel

The **XEDE** modifies the fuel delivery by changing the load variable before the PCM sees the result. The load variable might be MAP (Manifold Absolute Pressure) or MAF signal (Mass of Air Flow). Lowering the value (ie -10%) will lower the amount of fuel delivered as the PCM reads a lower load signal. Increasing the value (ie +10%) will increase the amount of fuel delivered as the PCM reads a higher load signal. This should work as stated for MAF systems.

In a MAP (speed/density) based system, on a naturally aspirated engine, the load value cannot exceed the value for atmospheric pressure or the PCM is likely to set an error (faulty map sensor – voltage too high). In order to achieve more fuel delivery in this application it would be necessary to mechanically increase (bigger injector or more fuel pressure) the total fuel delivery and decrease the load signal everywhere other than where the extra fuel is needed.

It is extremely important to remember that in changing the load variable, as described above, the fuel delivery is changed, but at the same time the PCM is given signals which would equate to less load and the PCM's original program is likely to have more ignition advance at these loads. The normal procedure for safe tuning, then, is to start with, say, -2° (minus two degrees) in the high load section of the timing map and then use the fuel style (MAF or MAP) map to lean out the fuel mixtures to an appropriate value, then re-advance the ignition timing if possible. [For example -10% in MAF table may add 4° (4 degrees) more advance however the engine only requires two more degrees of advance. So for this point the MAF table value will be -10% and the timing table value will be -2° (minus 2 degrees). Note that this is 2° (2 degrees) more advanced than the standard PCM program had at this point.]
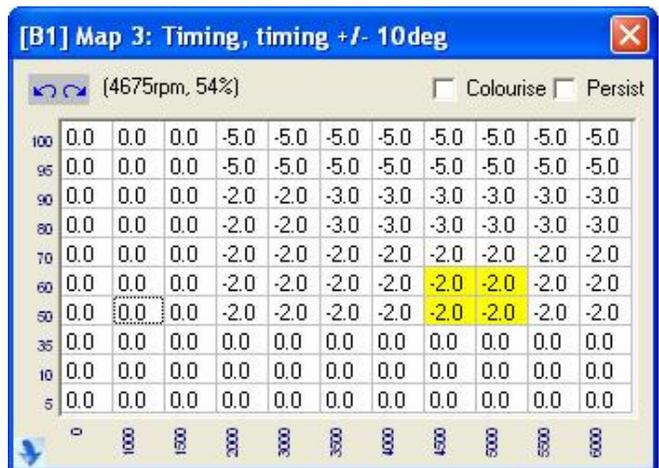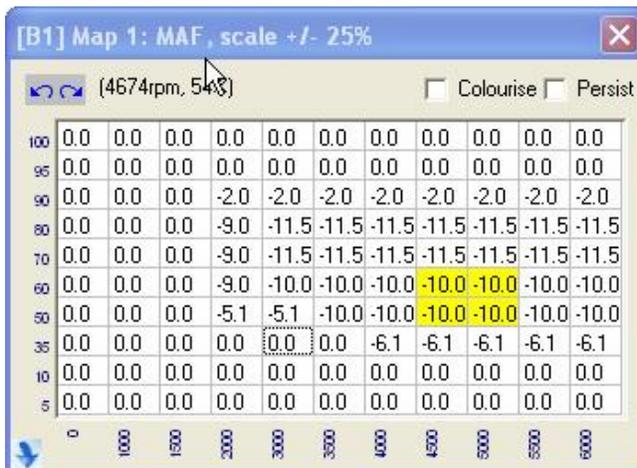
Modifying Timing Values

The *XEDE* relies on modifying the crankshaft reference signal (whether from the distributor or a crank angle sensor) before it is read by the PCM, in order to change the effective ignition timing. This means that all things related to this crank angle reference are also likely to be moved, provided that the original engine management (PCM) software is configured to do so. Importantly, these can include variable camshaft timing.

If the timing signal is advanced by, say, 5° (5 degrees) then the ignition timing will be advanced by 5°, however in an engine with variable camshaft timing it is likely that the camshaft timing will be advanced by 5° also because the entire crank angle reference signal is now 5° further advanced. This may be either advantageous or disadvantageous but needs to be kept in mind when tuning an engine with infinitely variable cam timing. Aside from the above point, tuning the engine's timing is achieved by adding or subtracting (advancing or retarding) a number of degrees from the car's original ignition curve at any given point.
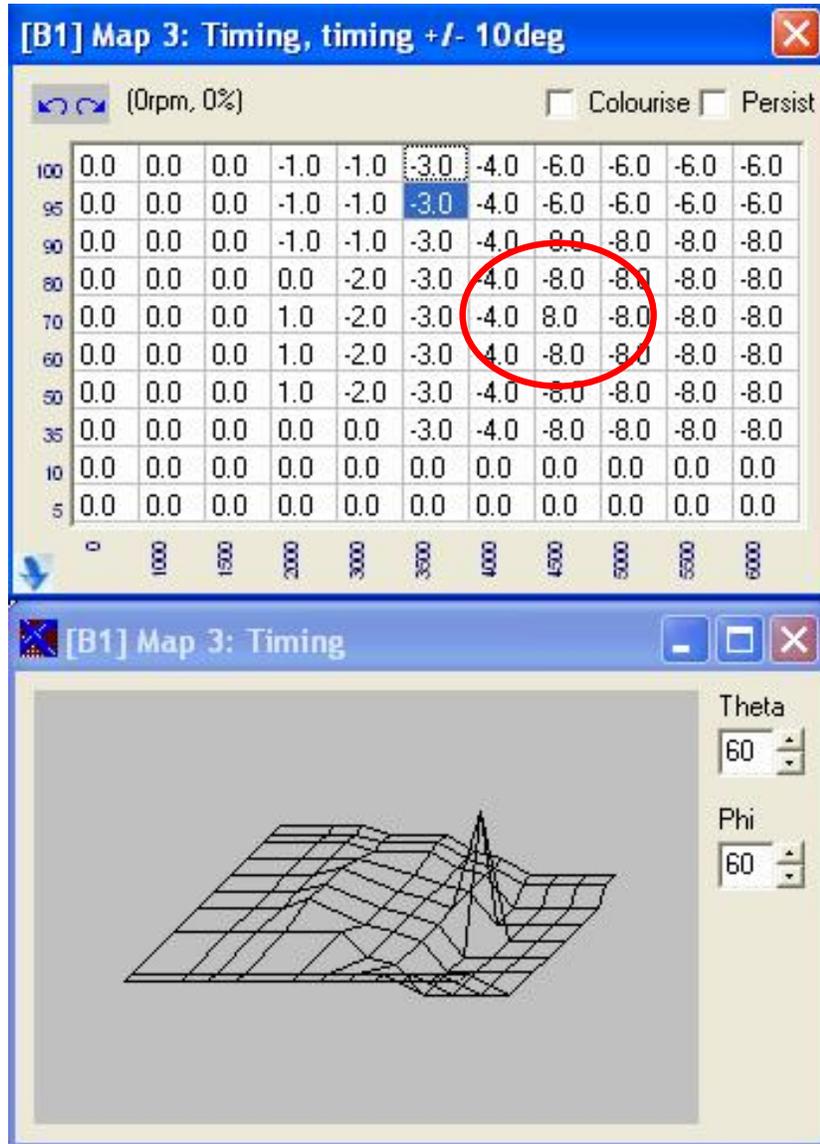
The *XMAP* software and *XEDE* hardware perform extremely detailed interpolation between operating points in the maps. It is entirely viable to have -5 (minus five) in one point and +5 (plus five) in an adjacent point. The interpolation software will generate a smooth, proportionally linear (three dimensional) ramp between the points.

Screen Functions

When the *XMAP* software is communicating with an *XEDE* via the comms cable each map will show, at the top of the map display, an RPM and load value (x and y axis for the map) in real time. Also in each map a yellow highlighted block will show the current position within the map. Beside the real-time display on each map are the undo and redo buttons which will undo or redo one change per button press.
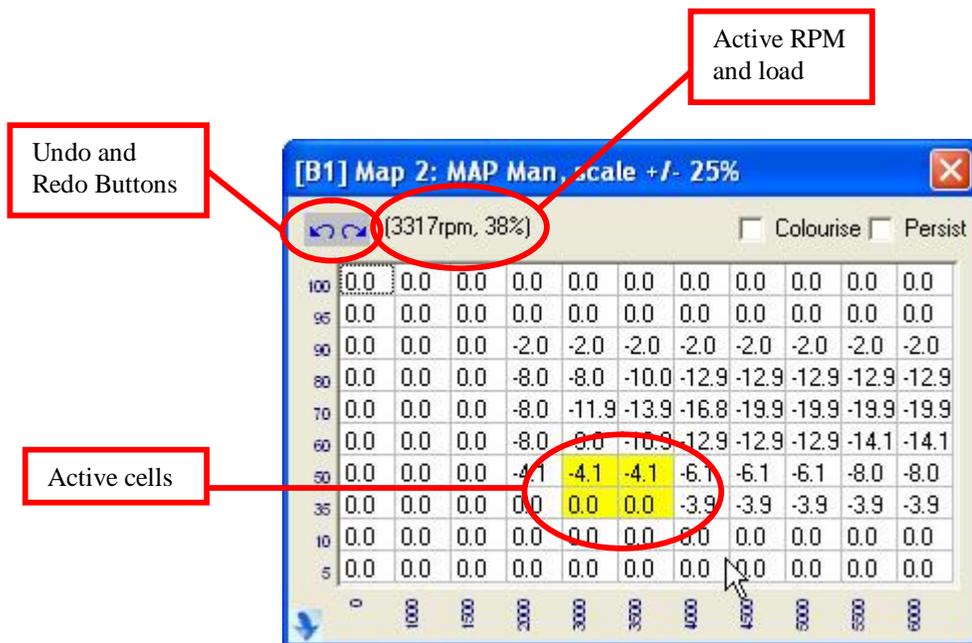
The graphic (3D) display is best used as a guide to mis-typing. This is particularly good for finding a negative instead of a positive value; or vice versa.

[B1] Map 3: Timing, timing +/- 10deg

(0rpm, 0%)   ☐ Colourise ☐ Persist

100	0.0	0.0	0.0	-1.0	-1.0	-3.0	-4.0	-6.0	-6.0	-6.0	-6.0
95	0.0	0.0	0.0	-1.0	-1.0	-3.0	-4.0	-6.0	-6.0	-6.0	-6.0
90	0.0	0.0	0.0	-1.0	-1.0	-3.0	-4.0	-8.0	-8.0	-8.0	-8.0
80	0.0	0.0	0.0	0.0	-2.0	-3.0	-4.0	-8.0	-8.0	-8.0	-8.0
70	0.0	0.0	0.0	1.0	-2.0	-3.0	-4.0	8.0	-8.0	-8.0	-8.0
60	0.0	0.0	0.0	1.0	-2.0	-3.0	4.0	-8.0	-8.0	-8.0	-8.0
50	0.0	0.0	0.0	1.0	-2.0	-3.0	-4.0	-8.0	-8.0	-8.0	-8.0
35	0.0	0.0	0.0	0.0	0.0	-3.0	-4.0	-8.0	-8.0	-8.0	-8.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[B1] Map 3: Timing

Theta
60

Phi
60

Editing a Map

There are several ways to change the values in a map. In order to edit the values in a particular map, that map must be *active* (ie. in the Active Window). Click anywhere in the required map with the mouse or use key combinations Alt-1; Alt-2; Alt-3 etc. will cycle through the maps to activate. (i.e. Hold down the ALT key and press the 1, 2 or 3 key etc. at the same time.)

1. ## Navigating within the Active Map:
   - Use the mouse to click on an individual cell. The cell will highlight with dots on the border of the cell.
   - Or use the Arrow keys to move the Active Cell around within the map.

2. ## Editing a cell:
   - Type the value directly into the cell. To type a negative value put a minus sign before the value.
   - Right mouse click in the cell to bring up a window of options for editing the point or the whole map.
     - The value can be scaled with a + or – percentage
     - The value can have an offset added (including a negative offset)
     - The value can be entered (filled) directly
     - The value can be zeroed

Right click anywhere in the map
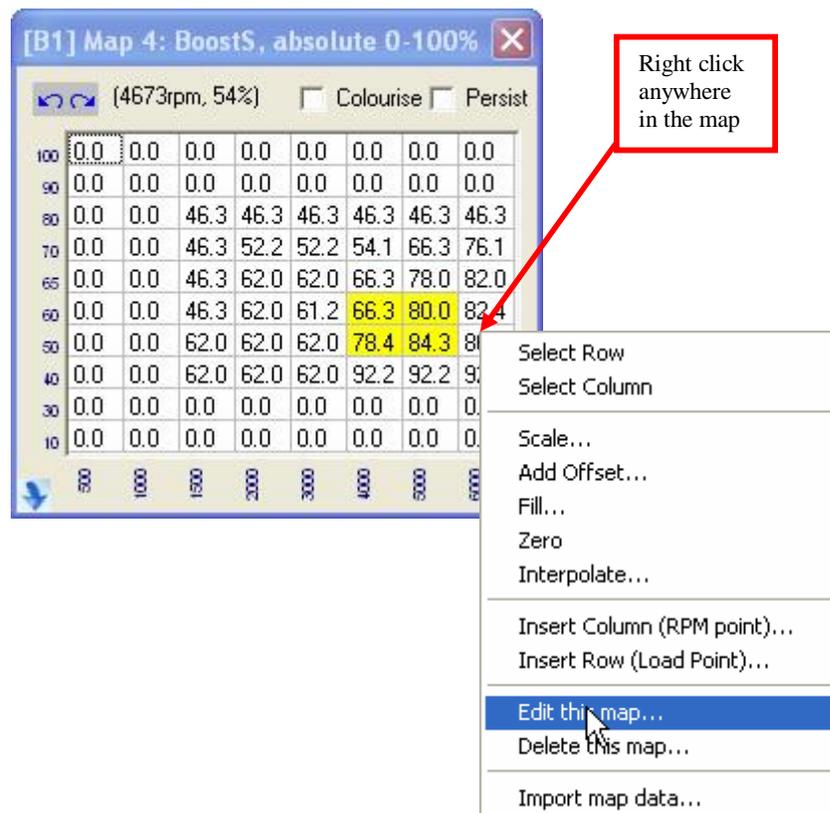
3.   Editing a block or area:

- To select a block or area of the map hold the shift key and use the arrow keys to mark (highlights in blue) an area.
- Or left mouse click and drag to mark a block.
- Once the block is marked, either right mouse click in the block or use Alt-e to activate the Edit menu.
- From the Edit menu the modification options will be available including Fill, Offset, Percentage or Interpolate through an axis. Interpolating through the x then the y axis will interpolate through a plane or marked block.

[NOTE: The Edit menu has Options to: Edit the whole active map or Selection to Edit the Marked Block. It is important to activate Selection not Map if you wish to operate only on the marked block.]

[HINT: To edit at the current point, hit the spacebar to take the cursor to the current active cell(s) in the Map.]

4.   Inserting a row or column:

- To insert a new axis point, right mouse click on the cell just above the required insertion point, click *Insert column or row* and select the Load or RPM Value to insert.

5.   Editing the axis values:

- A number of important possibilities are available when editing or creating a Map. Right mouse click in the Map of choice and select Edit Map. This will bring up the edit window with several options.

- Editing the RPM or LOAD POINTS – Directly enter the values into the RPM and LOAD POINT lists. The minimum RPM spacing between adjacent points is 100RPM. [Note as at Version 2.0 of *XMAP* software, that inserting additional values will add rows or columns to the end of the maps at full scale. This will be adjusted to a zero value in a later version of software.]

- Changing the LOAD VARIABLE – The Load Variable can be different for different maps in a map bank. The Load Variable will normally be the primary Load variable for the PCM ie. MAP if MAP based or MAF if primarily MAF based. It can also be TPS or another input. NOTE: a combination of variables can be used in two maps to generate a complex axis. This will be discussed later under NESTED or COMPLEX MAP FUNCTIONS.

- Changing the Math function – For most maps, the function should be set as "Scale (Multiply)" and obviously the ignition timing change map should be set to "Timing Change". The scale function literally applies a multiplier to the current value. Eg. A 2volt input signal with a +10% scale value in the map will output 2.2volts. There is similarly "Offset (Add)" which will add a percentage to the value. Adding a (–) Negative percentage will obviously decrease the values by the amount.

- Setting the output to Pulse Width will allow direct setting of Pulse width output (in Milliseconds) for the outputs on *XEDE* Pin B8 and B9. See PWM OUTPUTS for more detail.

- Setting the output to Absolute Output will allow direct output of 0-5 volt analogue voltage or if output is PWM0 will output duty cycle for controlling a solenoid valve i.e. Wastegate control for boost.

Your screen will look like this – don't be afraid – click on the map you want to change to make it the "Active MAP" (the one you're working with right now).
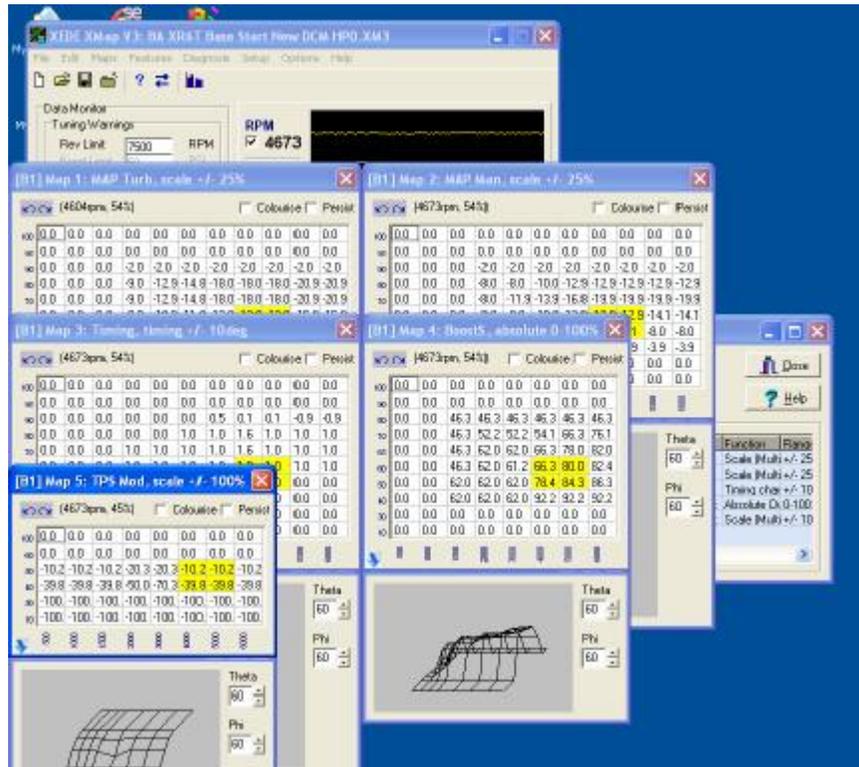
Output Scaling

Output Scaling is accessed from the Features / Output Scaling menu.
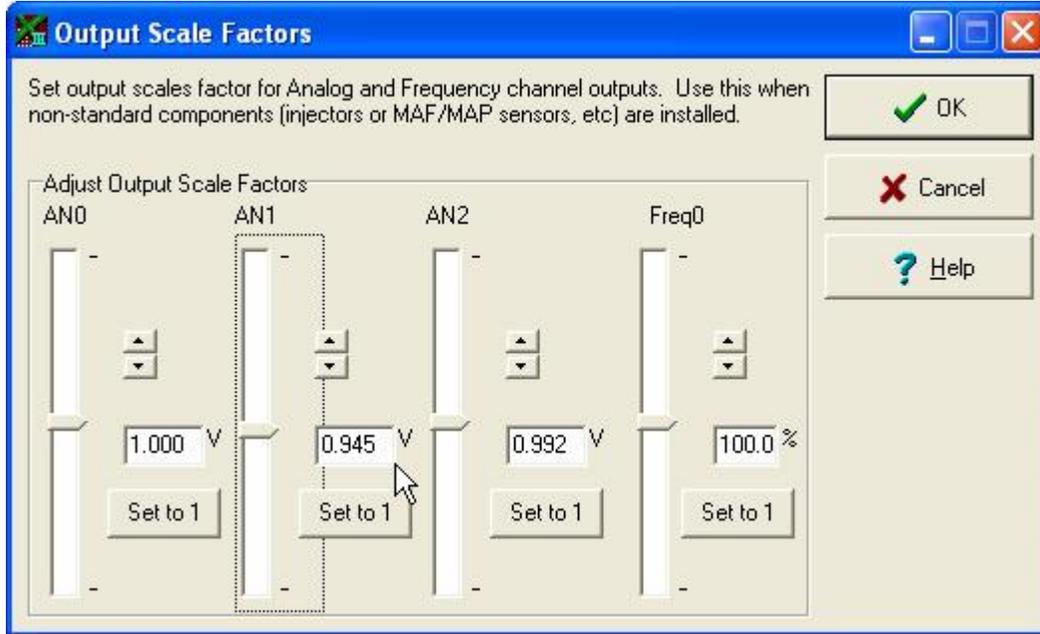
Output scaling allows a global change to be applied to an individual analogue voltage or frequency. This is useful for an increase in injector size, for example. By multiplying the Map sensor input voltage by 0.945 as in the example above, we may globally allow for a slightly larger injector by providing a lower load signal to the ECU under all operating conditions. Obviously there are bounds outside of which the ECU will not accept such input changes.

Output Clamps

Output Clamps are accessed from the Features / Output Clamps menu.
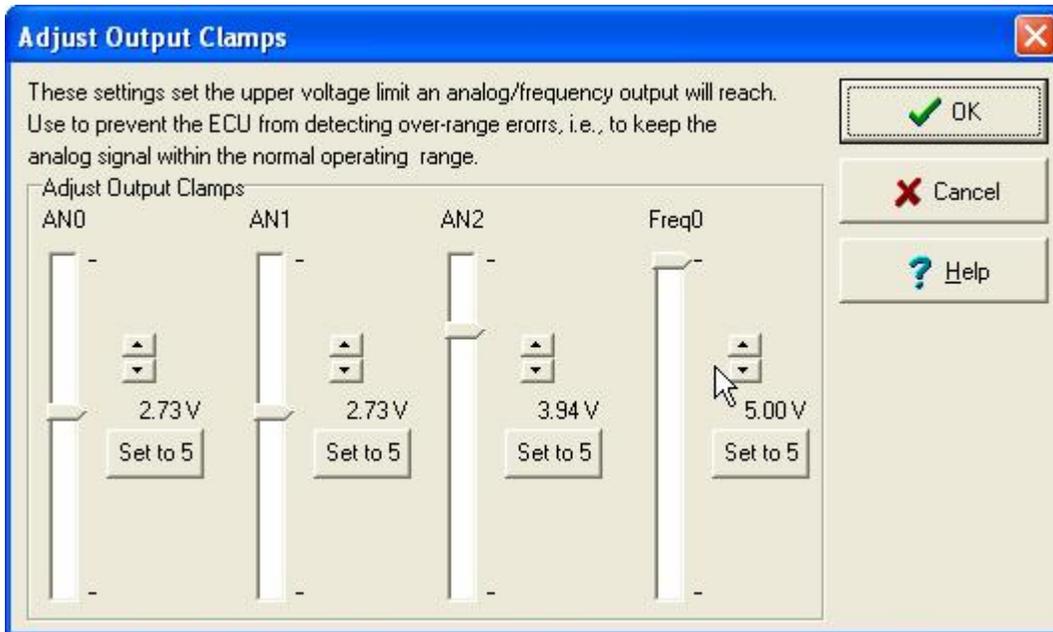
Output clamps allow a voltage or frequency clamp to be applied to any of the output variables, meaning that regardless of how high the input value gets, or how much more is applied to the value through the Map tables, the value will not exceed the clamp. 2.73 volts in the example above for AN0 and AN1; and 3.94 volts for AN2.

Security

The *XEDE* has a security function allowing a password to be entered to protect the data stored in the Maps. The password is entered from the Maps / Security pull down menu.
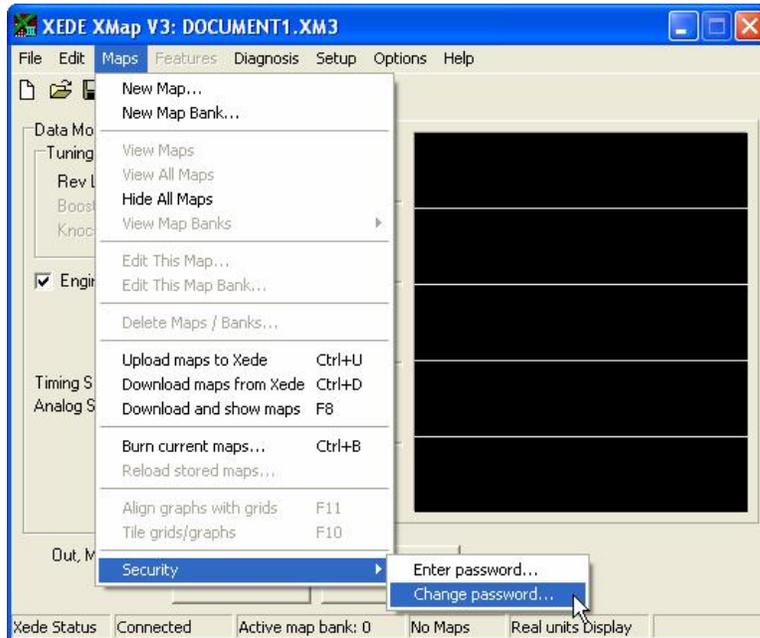
When you connect to an *XEDE* which has the security password already set, the following screen should appear:
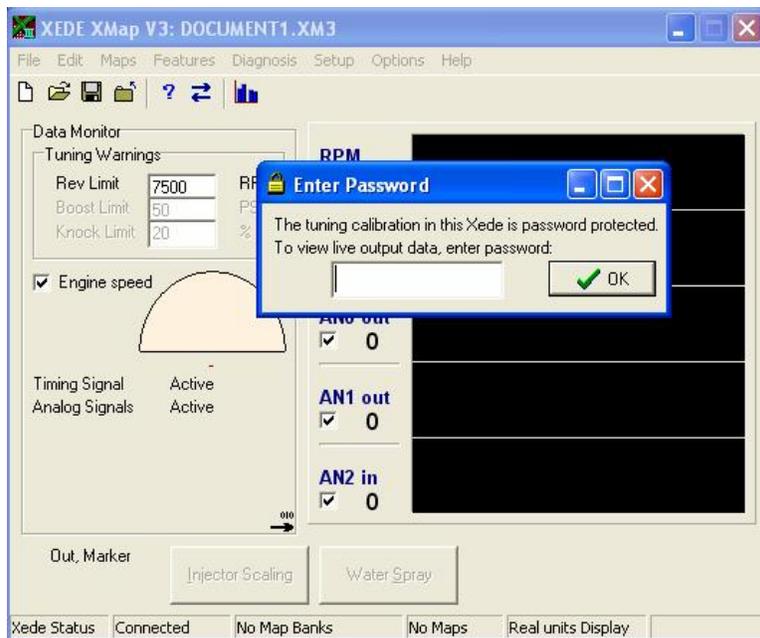
If you incorrectly enter the password, or attempt to enter past the password, the following screen will be displayed. You can display input variables but not modified i.e. output, variables.
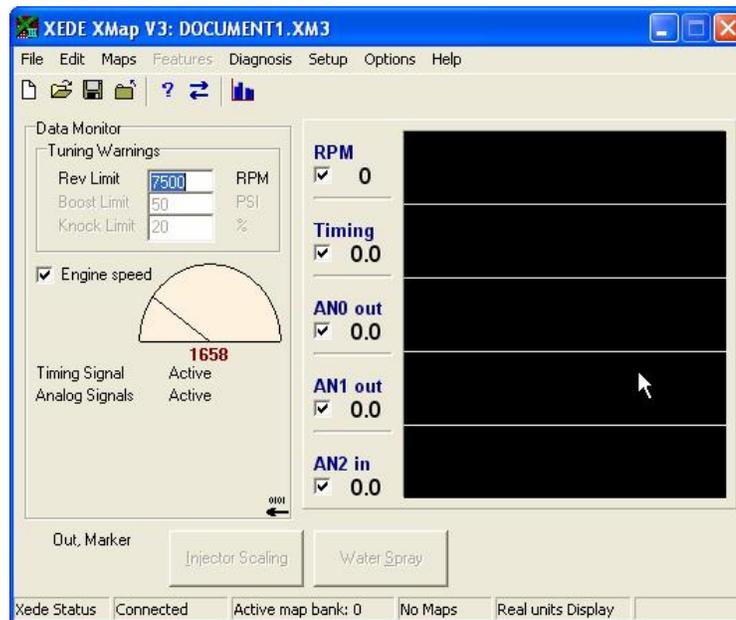
You cannot tune the Maps at this point without knowing the password. However, you can reset the password, but it will clear the data in all Maps back to zeros.

To do this, hit F8 or Ctrl-D to begin the download of Maps.
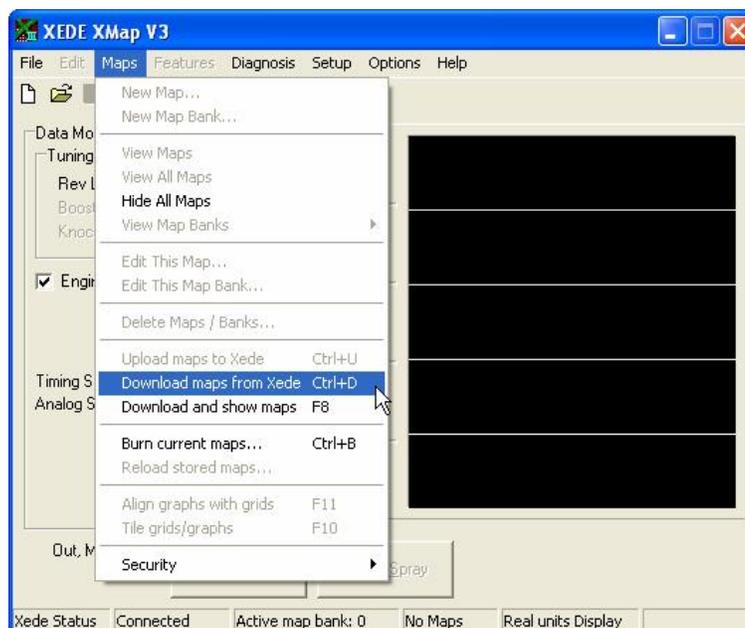
The following screen should appear:
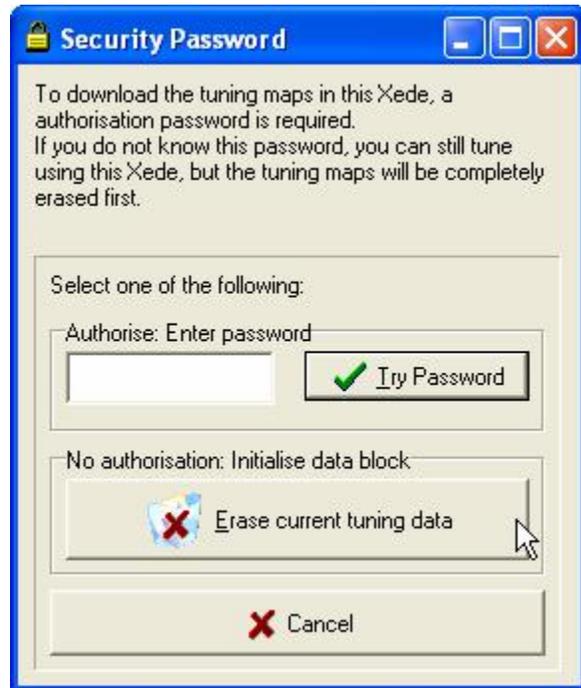
If you click the Erase current tuning data button, the following screens will appear:

Then we give you a chance …
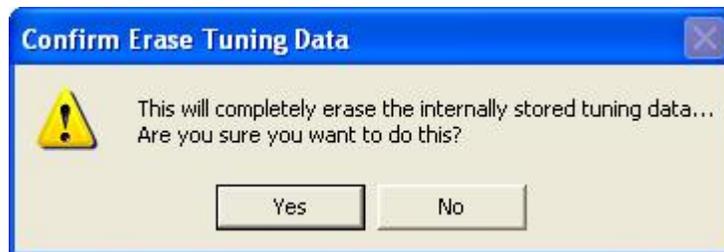
And another …..
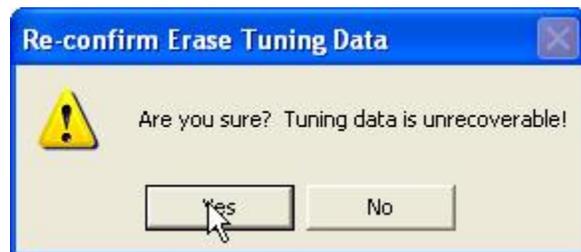
And finally ……!
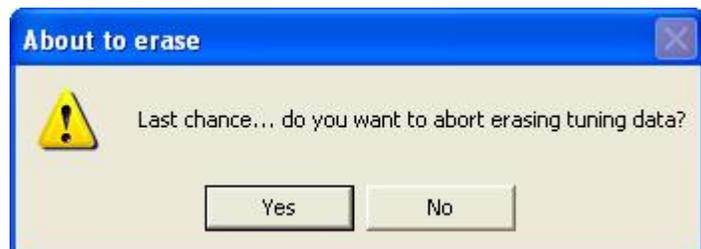
Then you get …. Maps full of zeros!!
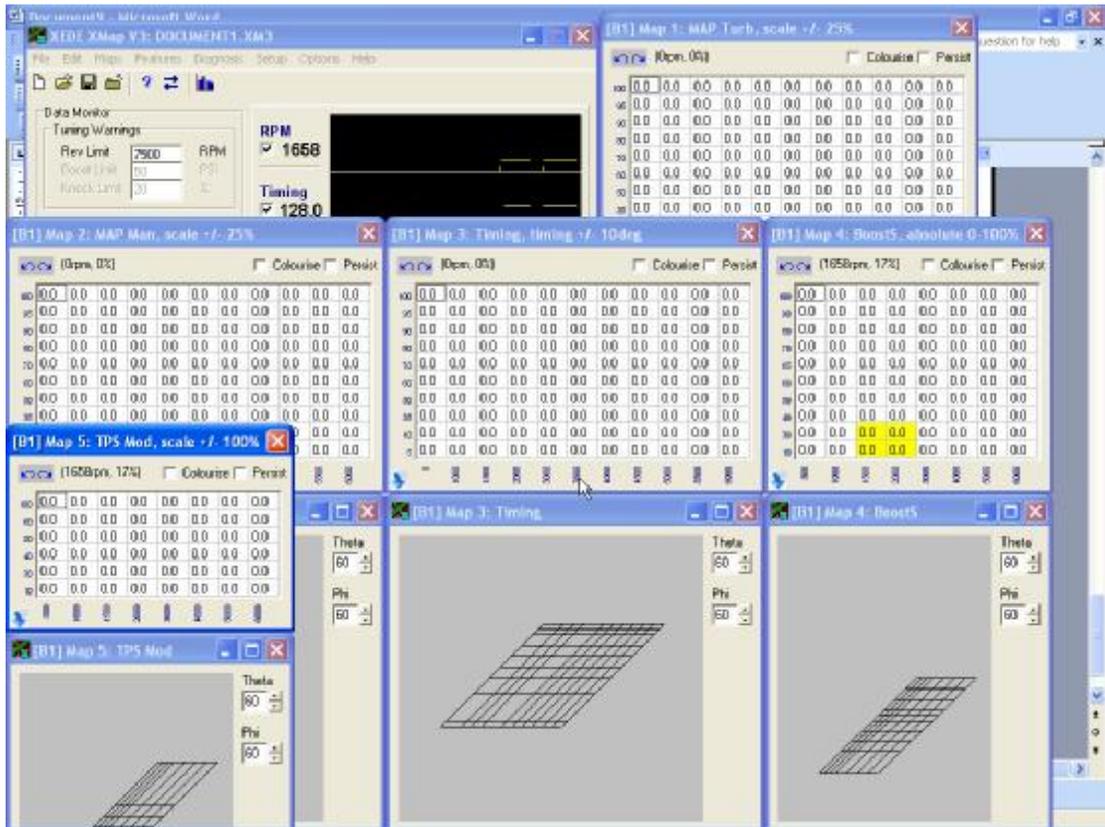
Tune as normal ….

PWM Outputs

The *XEDE* has two possible PWM outputs. The most common use is for boost control. The second is auxiliary injector drive.

Wastegate Solenoid (Boost) Control

When the output is set to PWM0 out and the Math Function is set to Absolute Output, the value in the table will be the duty cycle output to the solenoid valve connected to Black Connector Pin 6.

NOTE: This is a grounding output i.e. it grounds the earth side of the solenoid on Black Connector Pin 6 to Black Connector Pin 5 which must be connected to chassis earth. This is a separate high current earth connection to the normal *XEDE* earth connection on Grey Connector Pin 6. It must NOT be connected to Grey Connector Pin 6; otherwise interference will occur, causing false trigger events.

NOTE: when set to Absolute Output or Pulse Width the input variable will be disregarded (it can be anything). The operating frequency for this output is set under the Features menu, then Miscellaneous then Wastegate Solenoid.

For systems that already have boost control, i.e. Subaru WRX, the configuration is often best done by using a scaled Math Function on the original measured Wastegate Duty Cycle Input. For example, the factory ECU's boost control duty cycle will be measured by the *XEDE* on Black Connector Pin 1 (usually blue wire / white trace) and output to Black Connector Pin 6 (usually blue wire) plus any additional scaling from the table, as in the example below. i.e. at 6,000 RPM and 70% load, 32% more duty cycle will be added to what the factory ECU is outputting.

The Wastegate solenoid frequency is adjusted separately from the table using this pull down menu under Features / Miscellaneous. The frequency is set in Hertz. Subaru solenoids are normally 14 Hertz. Ford BA XR6 Turbo solenoids are normally 32 Hertz.

Auxiliary Injector Control

Setting the Math Function to Pulse Width and the output variable to Injector out 1 will allow a table of injector on time in milliseconds. A small hardware change needs to be effected on the circuit board of the *XEDE* for this function to operate. For details, before use contact Vishnu in the US or ChipTorque.
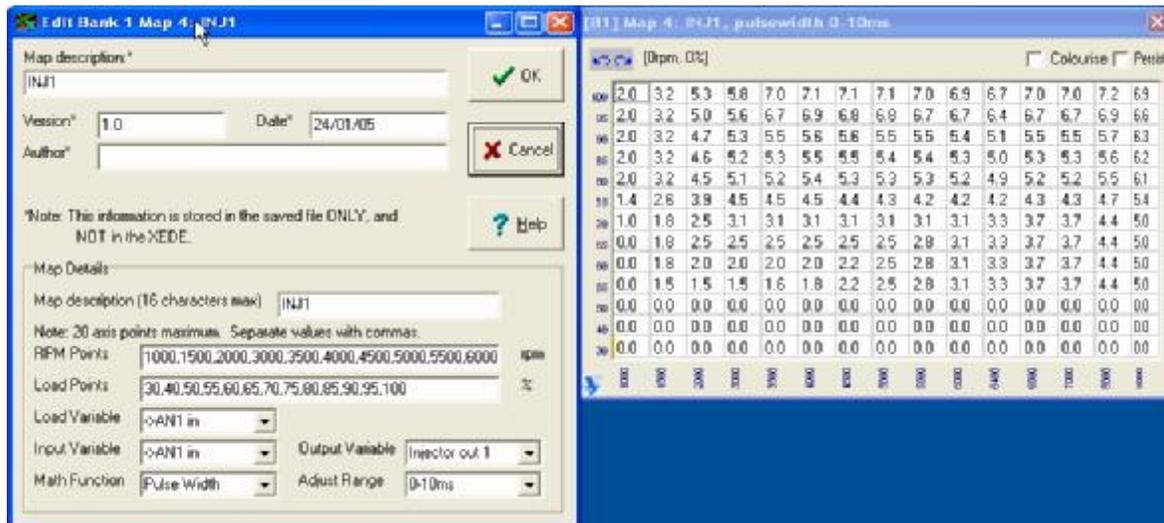
Nested or Complex Map Functions

Maps may be nested so that an output result is the combination of say (2) consecutive MAPS. This is perhaps best demonstrated with an example: to achieve a semi-closed loop boost control with TPS modification, you could use two nested MAPS like the following from a Ford XR6T

Edit the Wastegate Solenoid Map

[B1] Map 4: BoostS, absolute 0-100%

(4673rpm, 54%) ☐ Colourise ☐ Persist

	800	1000	1500	2000	3000	4000		
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80	0.0	0.0	46.3	46.3	46.3	46.3	46.3	46.3
70	0.0	0.0	46.3	52.2	52.2	54.1	66.3	76.1
65	0.0	0.0	46.3	62.0	62.0	66.3	78.0	82.0
60	0.0	0.0	46.3	62.0	61.2	66.3	80.0	82.4
50	0.0	0.0	62.0	62.0	62.0	78.4	84.3	86.3
40	0.0	0.0	62.0	62.0	62.0	92.2	92.2	92.
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.

Right click anywhere in the map

Select Row
Select Column

Scale...
Add Offset...
Fill...
Zero
Interpolate...

Insert Column (RPM point)...
Insert Row (Load Point)...

Edit this map...
Delete this map...

Import map data...

Click on Edit this map

Edit Bank 1 Map 4: Boost

Map description:*
Boost

Version* 3.0   Date* 23/10/03

Author*

✔ OK

✘ Cancel

? Help

*Note: This information is stored in the saved file ONLY, and NOT in the XEDE.

Map Details

Map description (16 characters max)   BoostS

Note: 20 axis points maximum. Separate values with commas.

RPM Points   500,1000,1500,2000,3000,4000,5000,6000   rpm

Load Points   10,30,40,50,60,65,70,80,90,100   %

Load Variable   ->AN1 in ▼

Input Variable   ->PWM0 in ▼   Output Variable   User 1 ▼

Math Function   Absolute Output ▼   Adjust Range   0-100% ▼

Input variable is ignored if math function is Absolute Output.

Set math function to Absolute Output to set absolute duty cycle output.

Load variable is 'Y axis" of map ie AN1 is manifold pressure in this example, ie Map.

Output to temporary variable User1

Then edit the TPS Modifier Map

[B1] Map 5: TPS Mod, scale +/- 100% ✕

(4673rpm, 45%)   ☐ Colourise ☐ Persist

100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	-10.2	-10.2	-10.2	-20.3	-20.3	-10.2	-10.2	-10.2
40	-39.8	-39.8	-39.8	-50.0	-70.3	-39.8	-39.8	-39.8
30	-100.	-100.	-100.	-100.	-100.	-100.	-100.	
10	-100.	-100.	-100.	-100.	-100.	-100.	-100.	

Right click and select Edit this Map

Select Row
Select Column

Scale...
Add Offset...
Fill...
Zero
Interpolate...

Insert Column (RPM point)...
Insert Row (Load Point)...

Edit this map...
Delete this map...

Import map data...

Edit Bank 1 Map 5: TPS Mod

Map description:*
TPS Mod

✔ OK

Version*   3.0   Date*   23/10/03
Author*

✗ Cancel

*Note: This information is stored in the saved file ONLY, and
NOT in the XEDE.

? Help

Map Details

Map description (16 characters max)   TPS Mod

Note: 20 axis points maximum. Separate values with commas.
RPM Points   500,1000,1500,2000,3000,4000,5000,6000   rpm

Load Points   10,30,40,50,60,100   %

Load Variable   ->AN2 in ▼

Input Variable   User 1 ▼   Output Variable   ->PWM0 out ▼

Math Function   Scale (Multiply) ▼   Adjust Range   +/- 100% ▼

Load Variable "Y axis" of Map is set to TPS i.e. AN2 in this case.

Input temporary Variable User1 from Map #4 BoostS

Output Variable PWM0 out

Math Function is set to Scale and Adjust Range is set to ± 100% i.e. we can have 100% more or 100% less than the input valve. Zero would be no change. The input value is the output value from Map #4 which was temporarily stored in User1.

The actual PWM0 Output then is, in this case, the duty cycle for the boost control solenoid. It is derived from the output of Map #4 and effectively modified to reduce boost (duty cycle) at low TPS values.

In the example, no matter what duty cycle is output from Map #4, the result will be zero duty cycle for TPS values of less than 30% (minus 100% of any duty cycle set). The two Maps are nested so that the actual output is derived from the functions of both Maps operated consecutively. When using the nested functions like this, the intermediate variable should be one of the User variables User1 – User8. These are not input or output but assign the output of one Map into the input of the next. They are temporary variables allowing nested control.

Special Applications

Tuning with Subaru Active Timing system

Aim points for timing and fuel under high load/boost

It is very difficult to tune a post MY01 WRX or STi without serial data information from a scanner or similar tool.

The Engine Management on MY99 onward WRXs uses the Knock Sensor in a unique way. The timing control algorithm in the factory ECU can add ignition advance as well as ignition timing retard using feedback from the Knock Sensor.
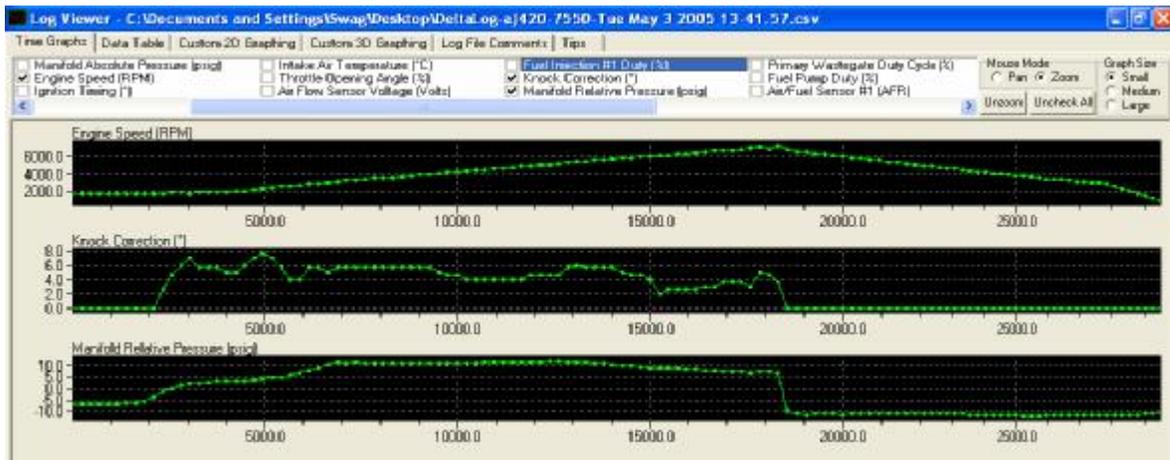
The Subaru system expects to learn timing IN under load as well as remove timing under the engine tuning conditions described as 'Knock' or 'Detonation'. Use a scanner or similar data acquisition tool to read the 'Serial Data' from the ECU. The learned numbers for knock will probably appear (+) positive and (-) negative as you accelerate the engine through a full power run. For MY99 and MY00 vehicles, this number appears to give most stable power and work best when between +2 and 0. For MY01 onward, it is very important that it is > +4 preferably between +4 and +7 on the dyno. This should yield between +6 and +8 degrees of additional advance on the road with the extra cooling of full road speed airflow over the intercooler etc. It is also important to use extra fuel as a cooling agent to 'Quench' the chamber slightly to achieve the best 'learned values' for timing. The AFR aim points for 98octane Australian fuel (i.e. BP Ultimate or Shell Optimax) seem to be best at 11.8:1 and for Australian PULP 96octane, approximately 11.0:1. For other fuels in other countries contact your local *XEDE* tuning representative.

DeltaDash * Data log file for WRX MY-01 onwards
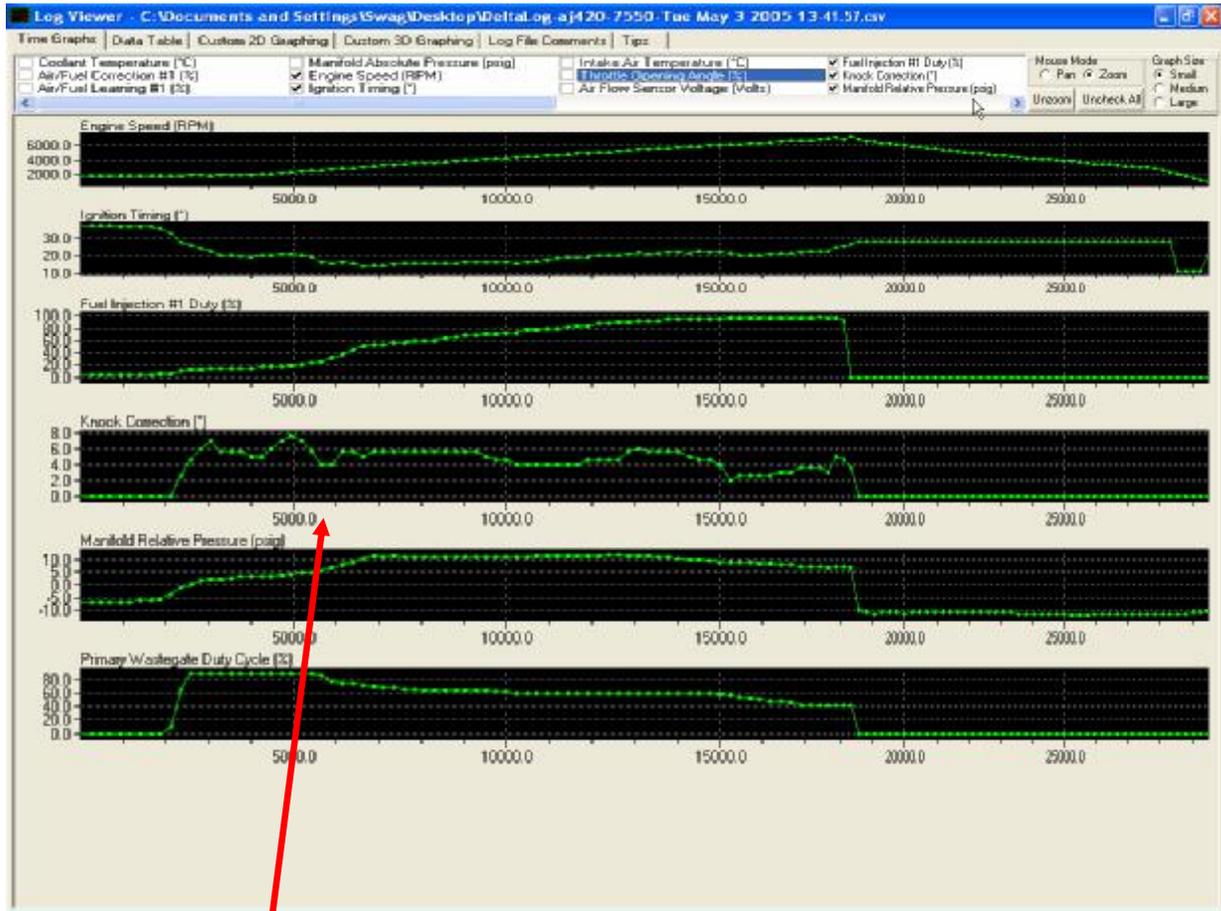
NOTE: For optimum performance timing curve in *XEDE* should be adjusted so that knock remains greater than positive 4 throughout acceleration run (dyno ramp).

* DeltaDash Subaru Diagnostic Tool used for reference purposes. Any good scanner will provide suitable information for quality tuning.
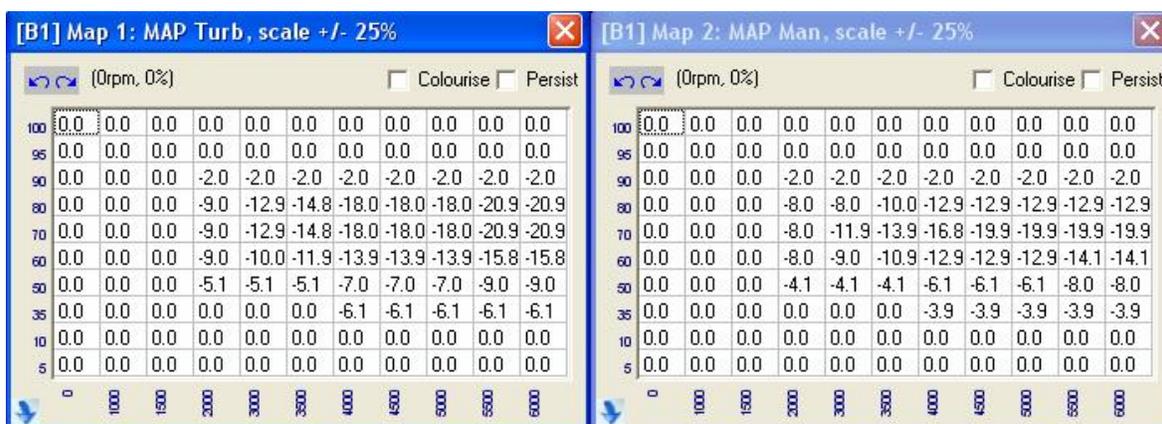
Tuning the Ford XR6 Turbo system

First we'll cover the MAP sensors.

The BA Falcon XR6 Turbo uses 2 MAP sensors to measure pressure. The primary load one is in the normal position in the Intake Manifold (we labelled this MAP Man). The second one is in the intake tract post intercooler but before the throttle body (we labelled this MAP Turb). The primary one is used in the normal configuration to define engine load and the values can be lessened in order to lean the mixtures out. If the turbo boost pressure is increased, (as you would normally want to do on a turbocharged application for more power), without using the *XEDE* to decrease the MAP signal, the MAP value will likely be high enough to reach the 'Boost Limit' value at which the PCM will stop fuel injection (in a similar manner to 'Rev Limit').

The complication is that the decreased values from the intake MAP sensor (MAP Man) should reasonably match the values from the intake tract sensor 'MAP Turb' plus any allowance for throttle angle. It is expected that the 'MAP Turb' value will be at or slightly above the current ambient Barometric pressure while the intake manifold shows any vacuum. As the engine revs increase and the turbo begins to build boost, the 'MAP Turb' could show boost even while the intake 'MAP Man' still shows slight vacuum depending upon the current throttle blade angle. Under higher throttle angles, the 'MAP Turb' value should be almost identical to the manifold 'MAP Man' value. It is expected that the 'MAP Turb' value may be just slightly higher expecting a slight pressure drop across the transfer pipe and throttle body.

The recommended method, then, is to keep the amount of change in the 'MAP Turb' values the same as in the 'MAP Man' table values but with possibly 1% less at values over 40% load.

[B1] Map 1: MAP Turb, scale +/- 25% (0rpm, 0%) ☐ Colourise ☐ Persist

	0	1000	1500	2000	2500	3000	3500	4000	4500	5500	6000
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90	0.0	0.0	0.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
80	0.0	0.0	0.0	-9.0	-12.9	-14.8	-18.0	-18.0	-18.0	-20.9	-20.9
70	0.0	0.0	0.0	-9.0	-12.9	-14.8	-18.0	-18.0	-18.0	-20.9	-20.9
60	0.0	0.0	0.0	-9.0	-10.0	-11.9	-13.9	-13.9	-13.9	-15.8	-15.8
50	0.0	0.0	0.0	-5.1	-5.1	-5.1	-7.0	-7.0	-7.0	-9.0	-9.0
35	0.0	0.0	0.0	0.0	0.0	0.0	-6.1	-6.1	-6.1	-6.1	-6.1
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[B1] Map 2: MAP Man, scale +/- 25% (0rpm, 0%) ☐ Colourise ☐ Persist

	0	1000	1500	2000	2500	3000	3500	4000	4500	5500	6000
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90	0.0	0.0	0.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
80	0.0	0.0	0.0	-8.0	-8.0	-10.0	-12.9	-12.9	-12.9	-12.9	-12.9
70	0.0	0.0	0.0	-8.0	-11.9	-13.9	-16.8	-19.9	-19.9	-19.9	-19.9
60	0.0	0.0	0.0	-8.0	-9.0	-10.9	-12.9	-12.9	-12.9	-14.1	-14.1
50	0.0	0.0	0.0	-4.1	-4.1	-4.1	-6.1	-6.1	-6.1	-8.0	-8.0
35	0.0	0.0	0.0	0.0	0.0	0.0	-3.9	-3.9	-3.9	-3.9	-3.9
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Next we need to consider timing.

Although the timing works exactly as in other applications, it is important to remember that the BA Falcon Engines (excluding 4Valve V8s) have variable intake and exhaust camshaft control referenced from the crank signal that we are using to change ignition timing. This means that each degree of retard or advance of ignition timing in the normal Timing Map is likely to change both cam positions by the same amount. A suitable balance between minimising the timing changes to reduce cam position change and retarding the timing to prevent detonation must be struck during the tune process. Remember it may be possible to command a timing retard that could be further than the PCM can physically move the cam timing to. This would obviously set an error condition which may be sufficient to cause a 'Limp Home Strategy' to be employed.

Now Boost Control

The original PCM has throttle and RPM based boost control. It is advisable to retain this structure both for good vehicle drivability and to minimise any error conditions in the original PCM. The base maps come with the Nested Map Structure of using the 'BoostS' Map to define the absolute Wastegate Solenoid Duty Cycle as a percentage and the 'TPS Mod' table to modify that duty cycle.
As an example, at a say 2000RPM and 40% load, the 'BoostS' Map has a duty cycle value of 100% and the 'TPS Mod' table has a value of –50%.
The actual duty cycle for the Wastegate control solenoid will be 100% x –50% = 50%

Import Map Data Function

This is the Map you will be importing into.

This allows import into the current Map or adding an extra Map.

Once all selections are made, click **GO-Create** to do the import, then click **All Done** to return to tuning screen.

Select the existing file that we will be importing the Maps from.
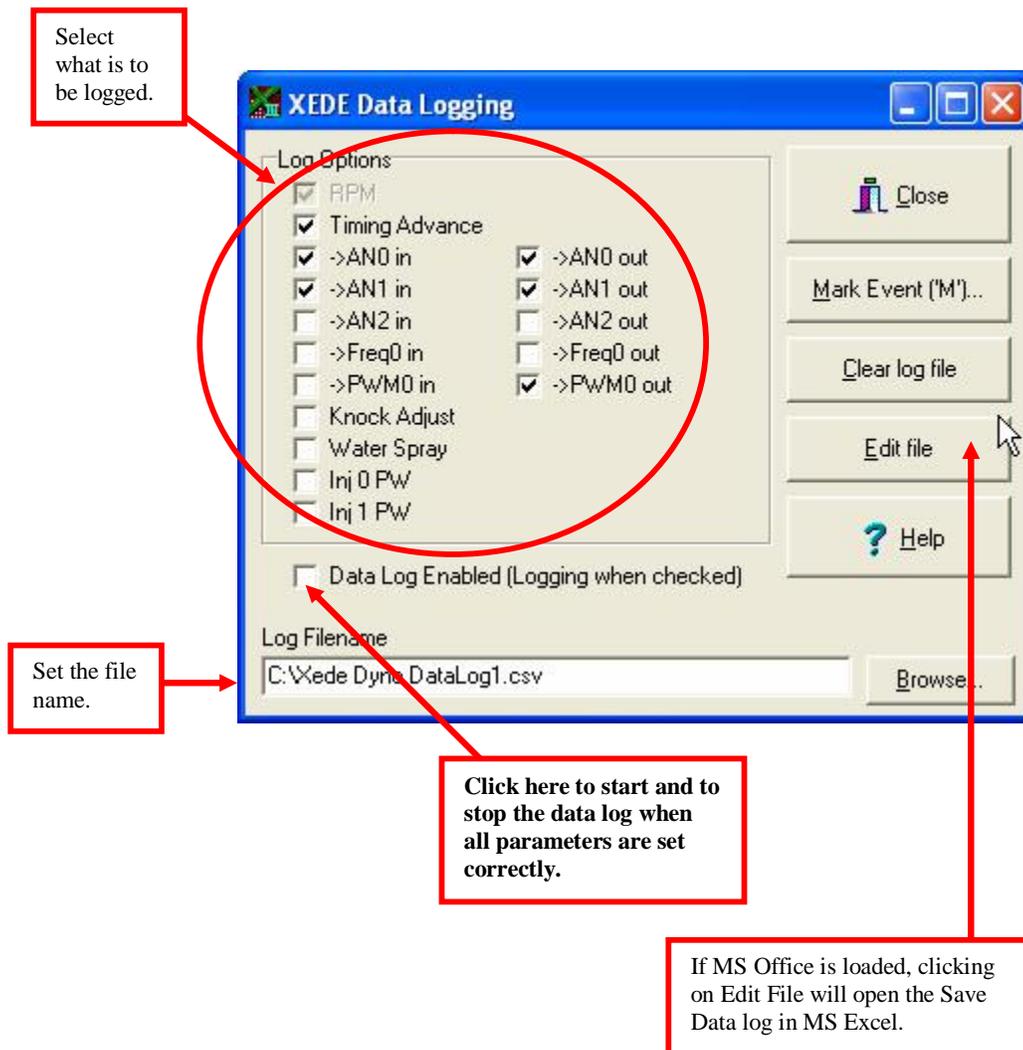
Live Data Display

A useful way to visually see the changes as they are applied to the load variables is the Live Data Display screen. Select the items to be displayed, the bar graphs will display the value as a percentage of total measurable value. If an output clamp is set and the value reaches that clamp the Bar Graph will turn red.
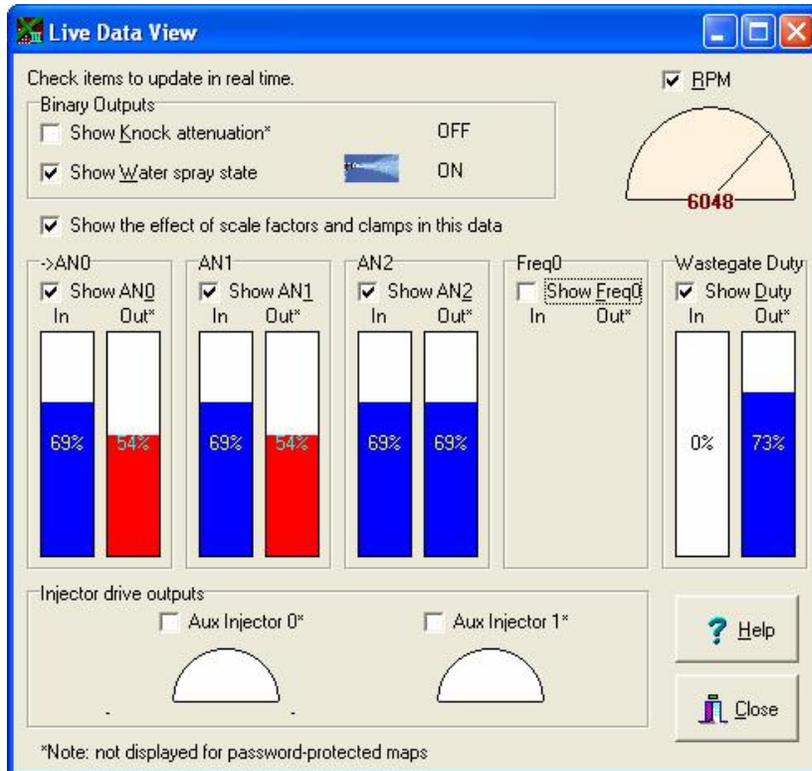
Data Logging

The XMap software can generate datalog files to assist with the tuning. The files are saved in a .csv format meaning they can be opened in MS Excel and edited or analysed or graphed using the standard Excel capabilities. This is particularly useful for checking the correlation between current RPM, current MAP value and current Wastegate duty cycle, for example.

The datalog is enabled from the Diagnosis / Data logging pull down menu.

Select what is to be logged.

Set the file name.

Click here to start and to stop the data log when all parameters are set correctly.

If MS Office is loaded, clicking on Edit File will open the Save Data log in MS Excel.

Installation

XEDE Direct Plug-In

Subaru MY01-05 WRX, WRX STi, Forester GT, Liberty RS and Liberty B4

Tools required

10mm socket and ratchet
Straight blade (no 3) screwdriver

Remove the three trim/carpet retaining buttons from
around the passenger floor (two at upper left and one
at right).

Peel back the carpet to expose the metal ECU cover
plate.

Fig.1

Remove the three 10mm bolts and one nut which
secure the cover plate and remove the cover plate.
(**Note:** The edges of the cover plate are sharp. Care should be taken when removing or
replacing the plate from the floor area.) (Fig.1)

Confirm that the ignition is off and disconnect all the
connectors from the ECU.

Plug the *XEDE* harness connectors into the ECU.

Fig.2

Next plug the original ECU connectors into the
matching *XEDE* connectors. (Fig.2)

Using the lower 10mm ECU retaining nut, secure the
XEDE chassis ground. (Fig.3)

Route the *XEDE* harness to a suitable location in
which to fit the *XEDE* unit. Care should be taken to
prevent any wiring from becoming pinched between
the cover plate and the ECU, etc.

Fig.3

Connect the *XEDE* unit to the harness.
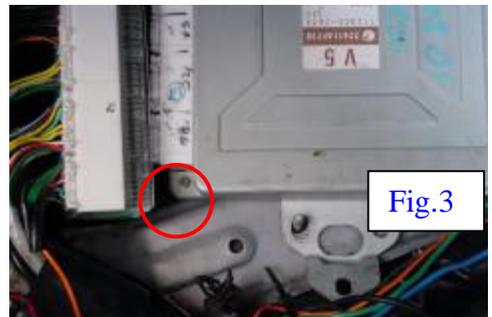
Switch the ignition on and check for a flashing red LED between the connectors of the *XEDE* unit. Start the engine and confirm the LED switches to green. (Fig. 4&5)

Fig.4

Fig.5
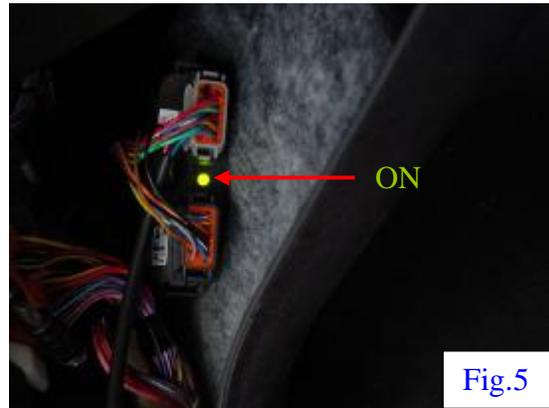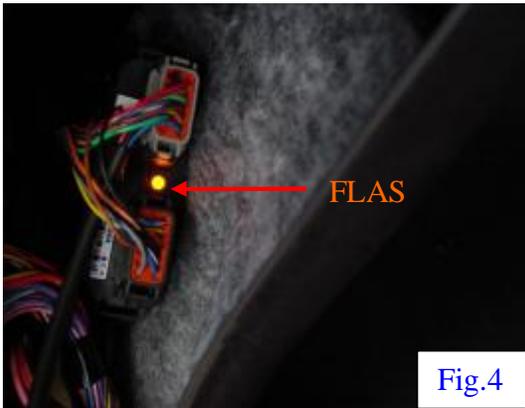
Refit the metal cover plate, carpet, etc. leaving the *XEDE* tuning cable accessible until tuning has been completed.

Mitsubishi Lancer EVO 6 – 8

The factory ECM is located behind the glove box and mounted vertically.

Open the glove box and remove the clip/stop on the RH side of the glove box, then carefully lever the left hand stop past the dash pad and lower and remove the glove box.

Remove the ECM wiring cover panel.

Remove the connectors from the ECM which is located behind the left front kick panel.

Find the brown/white wire which is located in the largest of the four ECM connectors. (Fig.1)

Remove the brown/white wire and terminal from the connector body. To remove the terminal, carefully lift the white locking tab that runs across the connector body using a small screwdriver. Next, use a small pick to carefully lift the terminal retaining clip. Whilst the clip is lifted, gently remove the terminal by pulling on the brown/white wire.

Fig.1
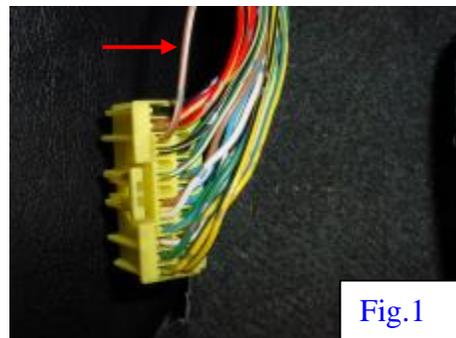
The *XEDE* harness contains a terminal of the same type that was removed. Fit this terminal into the space that originally contained the brown/white wire.

Join the original brown/white female terminal to the corresponding male terminal of the *XEDE* harness and insulate using the heat shrink supplied. (Fig.2&3)

Fig.2

Fig.3
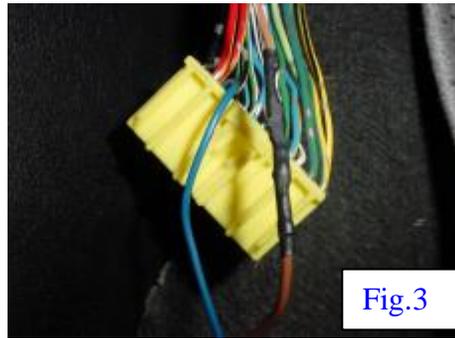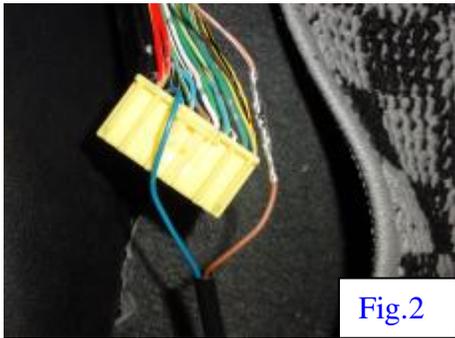
Connect the matching ECM connector into the main *XEDE* connector.

Refit all of the connectors into the ECM, fitting the main *XEDE* connector into the forward most connector location.

Connect the power ground wire of the *XEDE* (Wire with the eye terminal fitted) to a suitable chassis ground. (eg. 10mm bolt that secures the vehicle grounds at the ECM bracket)

Turn the ignition on and the LED located between the 2 *XEDE* connectors should flash orange.
Start the engine and the LED should switch to a continuous green color. (Fig.4)

Fig.4

XEDE Wire-In

For any vehicle other than the Subaru and Mitsubishi listed above, the *XEDE* is fitted using a generic harness wired into the vehicle's factory wiring loom.

Crimp Connections

A crucial part of wiring an *XEDE* is reliable fitment using suggested crimps. No scotch locks!!

Recommended products for *XEDE* wire-in fitment.

- Crimping tool: Utilux No. 61
- Crimps: CT Part No. AMG 0-0062306-2

Tools required for Quality Crimping

Examples of Crimp tools:

1 = Utilux No. 61 Crimp tool

2 = Wire stripper pliers

3 = Heat shrink torch

4 = Insulation tape

5 = Fine work insulation tape

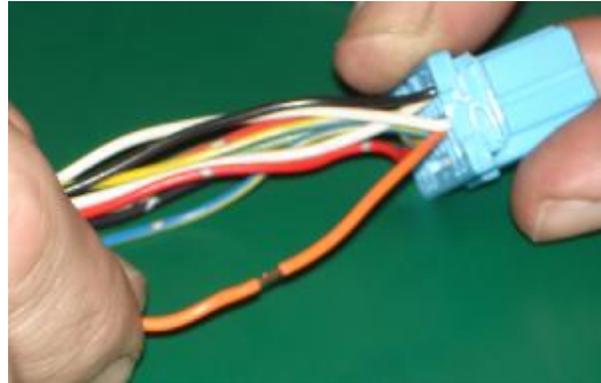6 = Heat shrink tubing

7 = ChipTorque crimps
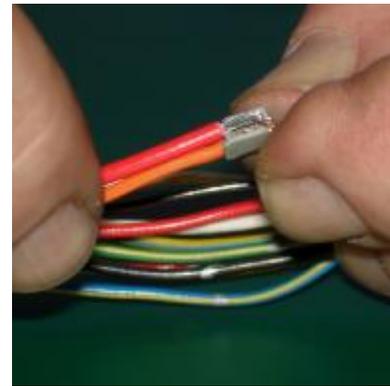
How to perform a good crimp

Splice On

A Splice On crimp is the means to splice an additional wire onto an existing harness.

Step 1:   Strip insulation from factory wiring loom to approximately 5-10mm.

Step 2:   Position stripped *XEDE* loom wire and stripped wire from factory loom in crimp.

Step 3:   Crimp using No 2.0 position as shown.
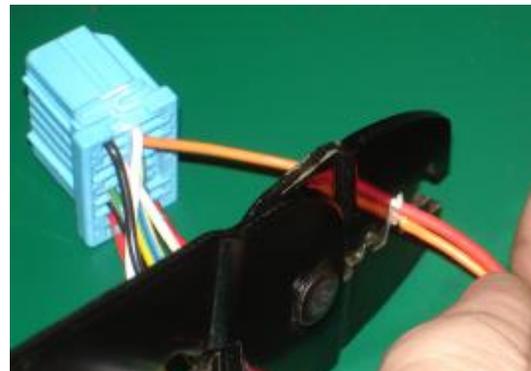
Step 4:   Apply pressure to secure a neat crimp. This can be done in two stages as shown – first half of crimp completed.
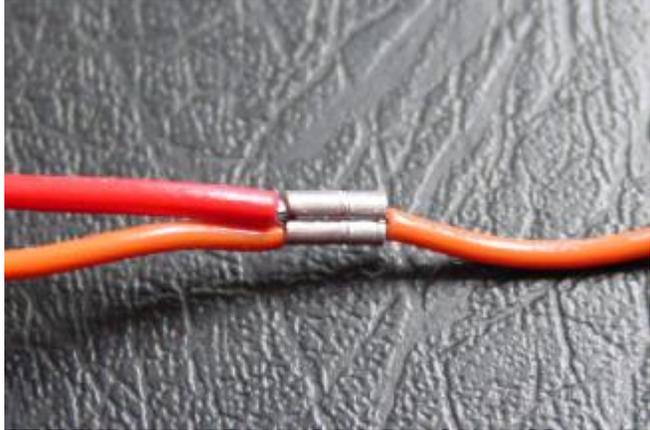
Step 5:   Insulate finished crimp with electrical tape.
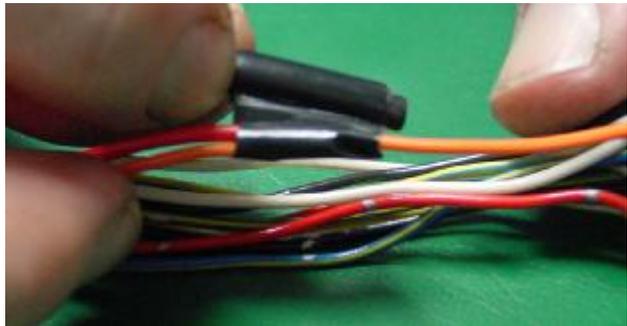
Special Wiring Hint: roll tape backwards around a nylon tube or the centre of a Bic pen to work in tight spaces at wiring harness end.

In-line joint

An in-line joint is where the wire is to be cut and additional wiring inserted.

Step 1:   Cut wiring loom wire.
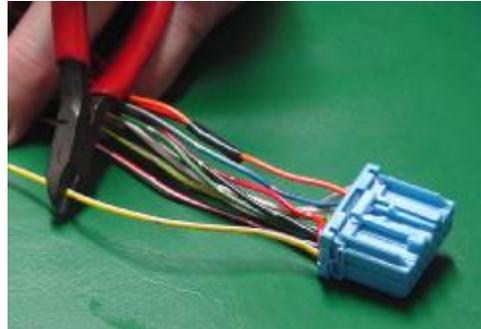
Step 2:   Strip the wires:

Step 3:   Fit the heat shrink tube over the wire

Step 4:   Load crimp into crimp tool at 2.0 position.
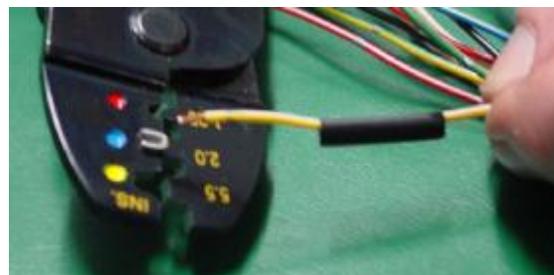
Step 5:   Position *XEDE* loom wire and factory wiring harness wire in crimp.
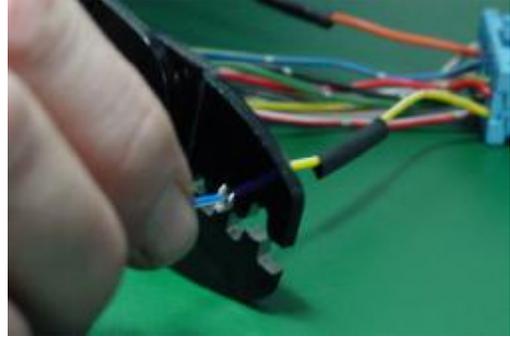
Step 6:   Apply pressure to the crimping tool to achieve a neat crimp over the wires – see example.
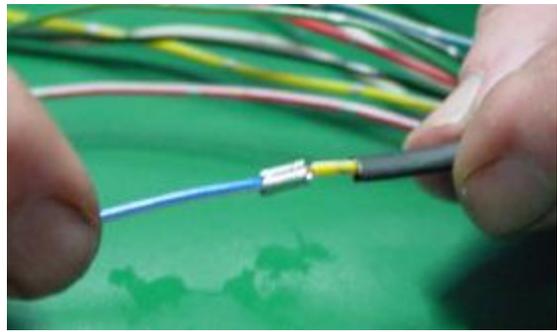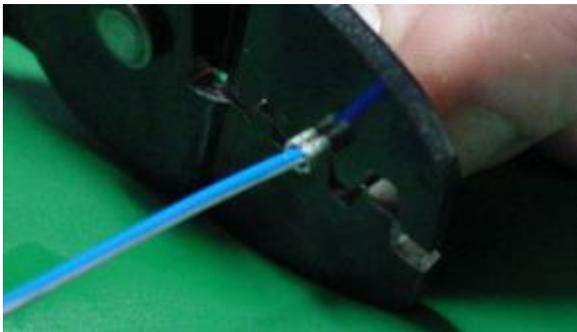
Step 7:   Slide the heat shrink over the wires at the crimp.

Step 8:   Use heat gun to complete the heat shrink process. See example.
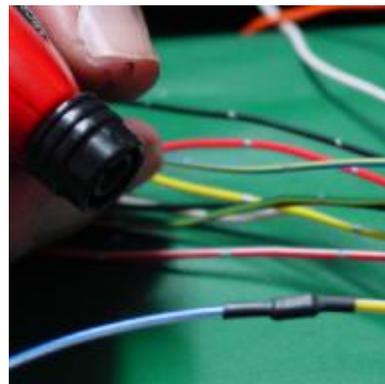
A finished crimp should look like this:
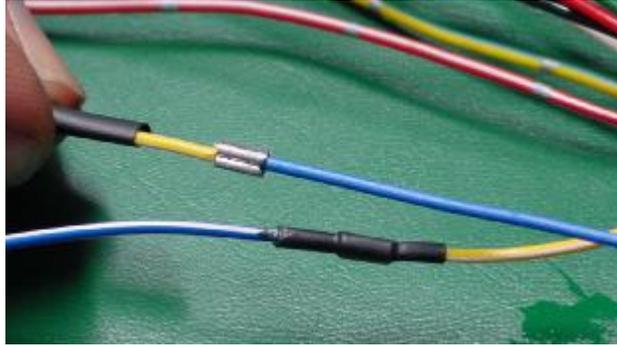
However, there is a WRONG way to crimp. These examples show BAD crimps and UNSUITABLE crimping tools – don't let your crimps look like this one!!

These are unsuitable crimp tools

To achieve a reliable crimp connection ChipTorque recommends using only Utilux Crimp Tool No. 61, with our recommended Crimps.

Additional Functions / Wiring

Dual Maps

This section describes how to program and use dual map banks in the *XEDE*
Processor (excluding Rev A circuit board).

Overview

What is a map bank?

A map bank is a collection of tuning maps stored in the *XEDE*. When you save a
tuning program to disc, you are saving the current map bank. *XEDE* Rev B
onwards hardware supports 2 map banks, selectable by the user via a toggle
switch.

How many maps can I have?

The *XEDE* can store up to 12 maps in total. This means a map bank can consist
of up to 12 maps, but to use dual banks, they must be divided so the total
number in both banks is 12 or less. It is easiest to have the same number of
maps in each bank, as it is less confusing to the tuner.

What maps must I have?

In each bank, there *must* be a tuning map for each intercepted signal for the
vehicle to function correctly. For example, if the *XEDE* intercepts MAF, MAP,
crank angle sensor, TPS, and Wastegate Solenoid drive (as in the WRX
configuration), there must be at least a map for each of these. If the TPS is
intercepted and you do not include a TPS map for example, the TPS output will
be undefined, and will cause the vehicle to run poorly, if at all.

If there are no maps at all in a map bank, the standard set of signals (MAF,
MAP, timing, TPS, Wastegate) will be passed through unaltered, as if the *XEDE*
was not there. In this case, the LED will be solid red.

Connections

#### What wiring must be in place for this to work?

In its default state, the *XEDE* uses map bank 0, as is the case with no bank
switching wires connected. When the map bank switch is shorted to *XEDE*
ground (Grey Connector Pin 6 (NOT CHASSIS GROUND)), map bank 1 is
loaded into memory.

The map bank switch pin is located in the BLACK *XEDE* connector, on pin 10. Grounds can be located in the GREY connector, on pins 4 and 6 (splicing required). **Do not use a chassis ground point** for the ground connection as these can often be noisy enough to cause erroneous bank switching. For direct plug-in harnesses, these two wires are already supplied, and just need to be shorted together with a toggle switch to enable bank 1.

XEDE Connector

Use a toggle switch located on the dash or other convenient access point to short the bank switch pin to *XEDE* ground.

You may want to conceal this switch if one of the banks is a valet mode or security program.

(Black)
Viewed from back of connector
(wire side)

1 2 3 4 5 6
12 11 10 9 8 7

Map Bank Select
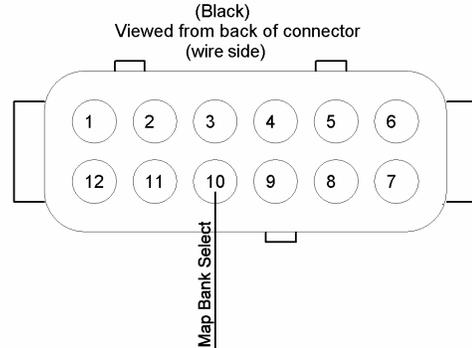
Programming

How do I program the banks?

QUICK START NOTE:
If starting with a new XEDE or one that has maps in bank 0 only, download the maps from bank 0, switch over to bank 1, and upload/burn the bank 0 maps in bank 1. Then tune each bank individually.

Each bank is programmed totally independently of the other, with the exception of the bank description, which is common to both (on V2 *XEDE* s).

If there are no maps in the currently enabled bank, the *XEDE* LED will turn red when vehicle power is turned on; this is normal, and lets the user know that the *XEDE* is performing no tuning function. In this state, a map bank can be uploaded and burned using *XMAP* or *XUPDATE* as per usual.

When changing from one valid bank to another, the *XEDE* LED will turn orange for a second or so while the new bank is loaded into memory, and then green to indicate a successful transfer. The current map bank status is displayed in the status bar of *XMAP*, if connected.

[NOTE: While changing banks the tuning Maps will be bypassed but output scaling and clamps will still operate.]

To use and edit bank 0: set the switch to bank 0 (wires NOT shorted together). All download, upload, tuning, and burning operations you do here will apply only to bank 0.

To use and edit bank 1: set the switch to bank 1 (wires shorted together). All download, upload, tuning, and burning operations you do here will apply only to bank 1.

Intercooler Water Spray on Rev B onwards

This section describes how to connect and configure intercooler water spray output in the *XEDE* Processor (Rev B onwards). This output can also be configured to drive a cam adjustment such as VTEC.

Overview

What is intercooler water spray used for?
Under certain heavy driving conditions, spraying a small amount of water on the front / top of the intercooler can assist in raising the cooling efficiency of the intercooler, reducing the temperature of the air inside. Cooler air means higher air density, which means higher mass air flow. More air mass means more fuel can be combusted efficiently and therefore more power if tuned correctly.

How does it work?
The *XEDE* turns the water spray on at a preset user-definable operating point, above a certain RPM and engine load. There are two definable stages where this can occur, to cover the two cases of high RPM and low load, and low RPM and high load. Once turned on, the water spray will stay on for a preset minimum time. When turned off, the water spray will stay off for a preset minimum time.

Connections

How do I wire it up?
There are two ways to connect it in. the first ('1.') allows the *XEDE* to drive the water spray motor directly, without the need for a relay. The second ('2.') uses a relay to either close a switch that already exists for water spray (as in the Subaru WRX STi), or apply power to the motor.

Pins 5 and 8 of the Deutsch Connector 'B' are connected internally in the *XEDE*, so if pin 5 is already tied to chassis ground for Wastegate solenoid drive, the connection on pin 8 is not required.

Waterspray Connection Options 1 and 2

Deutsch Connector 'B'
(Black)

Water Spray Connection Options

1. Drive motor directly

+12V (Ign switched)

Water Spray Motor

Water Spray Drive from Xede
(Xede black connector, pin 7)

Note: Xede black connector pin 8 MUST be connected
to chassis ground for operation.

Water Spray Output (Open Drain)

Water Spray Ground (MUST be connected)

2. Use relay to 'press' manual spray switch

+12V (Ign switched)

WS Switch (Pin 3 for STI)

* For Subaru WRX STI, wire colours on
Intercooler Water Spray switch are:
Yellow/Red (Pin 3)
Red/White (Pin 5)

Water Spray Drive from Xede
(Xede black connector, pin 7)

Note: Xede black connector pin 8 MUST be connected
to chassis ground for operation.

WS Switch (Pin 5 for STI)

Programming

How do I configure the software?

QUICK START NOTE:
Every *XEDE* is shipped from factory with the intercooler water spray feature enabled, with a default set of parameters that should be sufficient as a starting point, so no further adjustment is required for it to function.

The water spray settings can be adjusted through *XMAP* (Features-Water Spray…). The following is a screen shot of the dialog:

Adjust the RPM and MAP points and minimum on time for each stage. The minimum off time applies to both stages. The graph shows the region where the water spray will turn on, indicated by the solid yellow area.

☑ Enable Water Spray output

MAP % — Active region drawn yellow.

RPM

Stage 1
Shown as RED on graph.
Water spray is initiated when:
RPM >= 3500 rpm
and
MAP >= 85 %
Once started, spray will stay on
for at least 0.5 s

Stage 2
Shown as BLUE on graph.
Water spray is initiated when:
RPM >= 5500 rpm
and
MAP >= 60 %
Once started, spray will stay on
for at least .5 s

Spray will stop when neither the above conditions are true.
When spray stops, it will stay off for st least 1.0 s

[Burn Values] [✓ Done] [✗ Cancel]

NOTE: the output will be active when, in EITHER stage 1 or 2, RPM **and** MAP are above the set point for that stage, at the same time.

When the settings are adjusted to your requirements, click 'Burn Values' to store the settings inside the *XEDE*. If you do note do this, the settings will not take effect.

Special Note

The *XEDE* has no means of detecting when the water reservoir that is used here is empty. To prevent possible overheating of the water spray motor, check the water level regularly particularly after extended periods of heavy driving.

Other Applications – VTEC, Auxiliary Fuel Pump, Shift Light

VTEC
The water spray output is also suitable for driving such devices as a VTEC solenoid or other device which needs to change state under heavy driving conditions.

Warning: Since it is not possible to pre-test every possible scenario with the *XEDE*, proceed with caution when attempting to drive a new device. ChipTorque will not be held responsible for any damage howsoever caused as a result of using the *XEDE* in any application. The drive transistor is capable of sinking about 10A for **low duty cycles only** (up to 30%).

Fuel Pump
On a supercharged or turbo application, it may be appropriate to turn on a second fuel pump at a specific load and RPM point for additional fuel flow.

NOTE:
   (1) use relays for fuel pump current requirements and ensure the pump is not enabled if the engine is not running.
   (2) use "T" pieces and one way valves as appropriate to ensure correct fuel flow.

Shift Light
By setting the load (control valve) to minimum the RPM set point can be set as an RPM trigger and an LED or bulb wired up in a similar way to the water spray to act as a shift light.

Auxiliary Fuel Injection on Rev B onwards *XEDE*

Overview

Describes how to connect and configure the auxiliary fuel injection output in the *XEDE* Processor (Rev B model onwards). This output can just as easily be used to drive a water injection or methanol injection system also.

What is auxiliary fuel injection used for?

When the level of engine modifications go beyond a certain point, the standard (factory) fuel injectors are unable to supply enough fuel to the engine to maintain the correct mixture. There are several ways to overcome this:

1. Replace standard with injectors with units that have a higher flow rate;
2. Increase pressure and if necessary, the fuel flow (stronger pump);
3. Add an extra injector/s, and supply extra fuel when needed.

How does it work?

The *XEDE* has outputs capable of directly driving fuel injectors. Based on the tuning map, an injector output will fire four times per engine cycle, with an on-time of up to 10ms (0.01s). This provides the extra fuel required to enrich the mixture.

What about water injection?

Injecting a small amount of water into each cylinder with the fuel and air mixture can help to prevent detonation, raising the effective octane rating of the fuel. One downside of doing this is that it also lessens the 'charge' of the firing event, reducing overall power slightly.

Connections

How do I wire it up?

The *XEDE* has 2 high current outputs (Rev A and B models). These can be configured for TWO ONLY of the following features:

1. Wastegate solenoid (boost control)   OR
2. Auxiliary injector (0),   AND
3. Intercooler water spray / cam timing solenoid (e.g., VTEC)   OR
4. (Proposed future feature with Auxiliary injector)

To use any of the high-current outputs, at least one of the power ground connections must be made. These connections are on pins 5 and 8 of the Deutsch Connector 'B' (black); they are connected together inside the *XEDE*, so

if you only use one, it doesn't matter which. Firmly connect these wires to chassis ground, e.g., an ECU mounting screw.
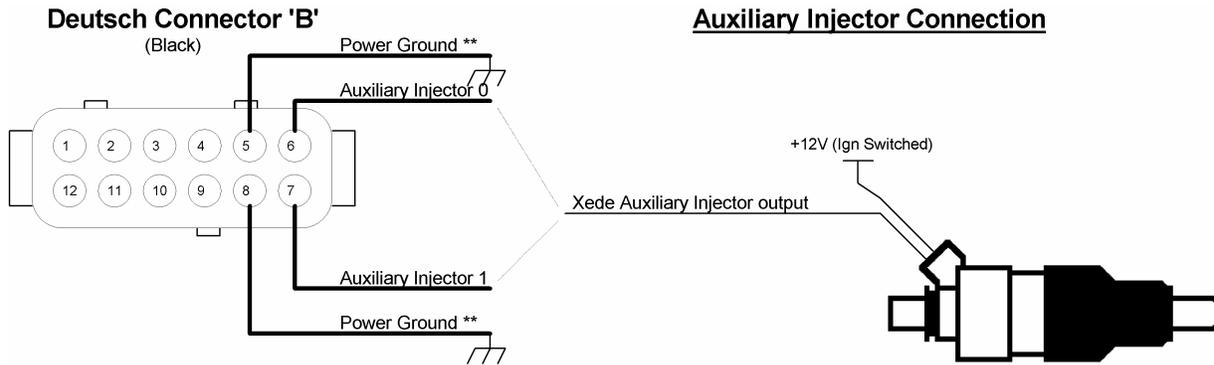
Instructions on the following pages describe how to configure either injector output; a minor circuit board change is required (a solder link).

Ø IMPORTANT NOTE ×
This work should only be performed by competent electronics professionals. It is possible to damage the *XEDE* unit or the factory ECU or other associated components by performing this work incorrectly.
No liability will be accepted for any failure related to performing this procedure.

The wiring diagram for connecting the injectors to the *XEDE* is as follows:

Deutsch Connector 'B'
(Black)

Power Ground **

Auxiliary Injector 0

Auxiliary Injector Connection

+12V (Ign Switched)

Xede Auxiliary Injector output

Auxiliary Injector 1

Power Ground **

** One or both of the power grounds MUST be connected to CHASSIS GROUND.

Injector 0 or Injector 1 Set up
(to be performed only by the ChipTorque or the Authorised XEDE Distributor).

For use of this proposed feature, contact ChipTorque or Vishnu for relevant details. There are hardware changes which must be carried out to the circuit board of the *XEDE* internally.

Special Note

For the case of water injection, the *XEDE* has no means of detecting when the water reservoir used here is empty. If the water reservoir empties, the lack of water injection will rapidly increase the likelihood of detonation (pinging). We recommend a water level sensor and a hardware interlock using the output of the water level sensor to prevent this occurring.

Future Enhancements

V2 V3 Conversion in the field

At the present time, upgrades from V2 to V3 *XEDE* s should be done at ChipTorque, i.e. return the unit to ChipTorque, or at least contact ChipTorque. These may include hardware upgrades at no or limited charge. NOTE: the V3 *XEDE* does not use full crank reference wave shape replication but instead uses trigger edge methods.

V3 Nameable Variables

As this document goes to print, the additional software to allow naming of, and indeed engineering unit representation of the analogue input and output variables, is being written and tested. This should allow both the axes of the Maps and the display variables on the *XMAP* home page to display engineering units for the variables. For example, vacuum and boost pressure from a Map sensor rather than percentage of 0-5 volts.

Smart Knock and Smart Fuel Control

An exciting new development in interceptor timing and fuel control is currently being tested by our US *XEDE* distributors. The process is described as smart because it uses the nested Map function of the *XEDE* and feedback control from the knock sensor for ignition and an externally added wide band lambda sensor for fuel control to generate a closed loop fuel and timing trim. This smart function allows the tuner to set the aim points for fuel and timing and use the advanced processing power of the *XEDE* to control the fuel and timing.

Auxiliary Injector Control

As mentioned in the text above, the proposed auxiliary injector drive functions will be implemented shortly. The documentation will be updated at the time.

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