Augment Automotive Technical Manual Title: Augment Automotive 3D Tuner 2.2 Manual Document Number: AUG/MAN/007 Version: 007 Author: Tom Barker Date: November 2025	

Purpose

This manual provides a reference for users of the Augment Automotive 3D Tuner application version 2.2. Typical users are engine tuners and customers who have purchased our AugTronic ECU who are calibrating their own engine themselves.

The functions of the 3D tuner software include:

1. Editing calibration files for AugTronic ECUs in offline mode.
2. Saving and loading calibration files from/to connected AugTronic ECUs.
3. Carrying out data logging and diagnostics for AugTronic ECUs.
4. Carrying out engine calibration of an AugTronic ECU.

There are a number of supporting manuals as well as installation manuals and a quick start guide for customers installing and configuring their own ECU. It is recommended that these manuals are read along with this one when first starting out with AugTronic ECUs.

Scope

This manual covers the operation of Augment Automotive 3D Tuner at version 2.2 specifically. It may be partially relevant to other future versions of 3D Tuner. This version of 3D Tuner is only for use with specific versions of our AugTronic ECU firmware. Typically 3D Tuner will display an error message if it is connected to an incompatible AugTronic ECU. If you are unsure if you have the correct version please contact Augment Automotive for support.

Primarily this manual is designed for users who understand engine calibration and need to know how to manipulate the 3D Tuner software. It is not intended as a guide to tuning engines.

Table of Contents

Introduction

Augment Automotive 3D Tuner is a Windows based software application which provides a number of functions in support of Augment Automotive's AugTronic ECU. Primarily it is designed to manipulate the calibration data stored within the AugTronic ECU to adapt it for a specific engine. In addition to this it also provides data logging and diagnostics functions and the facility to save, load and manipulate calibration files which represent the data stored within an AugTronic ECU.

The Augment Automotive AugTronic ECUs support connection to a computer via a USB or Bluetooth Serial connection.

Once the 3D tuner application is connected to the AugTronic ECU data logging and diagnostic data is continuously retrieved from the AugTronic ECU. Other functions are initiated by the user as and when required and these are carried out in series with data logging requests.

Installing 3D Tuner

Augment Automotive 3D Tuner is intended for use on Windows 10/11 computers, but may work on some earlier versions. Typically a 64-bit version is provided as this covers the majority of modern computers. On request 32-bit versions may be provided.

Installation is done using a dedicated installer which is typically available on the Augment Automotive website. Once downloaded the installer can be executed and will take the user through several prompts before installing the application. If you require support with installation please contact Augment Automotive Limited. Once installed shortcuts should be available on the Start Menu or Windows Desktop which can be used to launch the application.

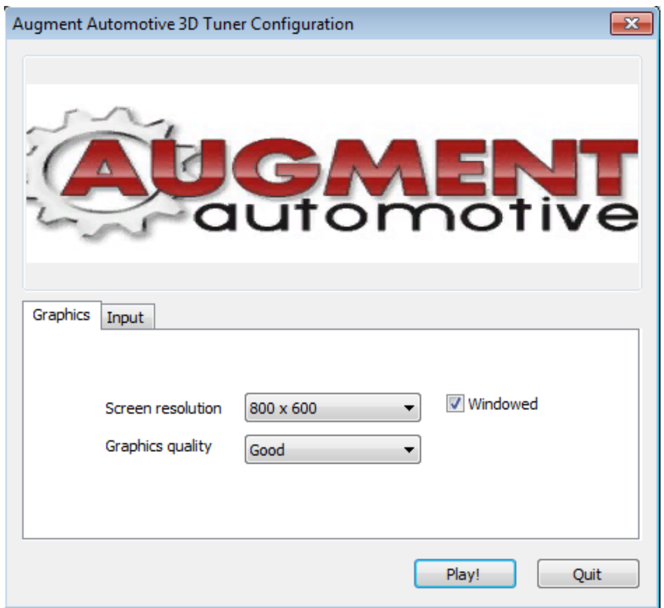
If you wish to locate the installation folder to access logs and config files it is typically installed in:

C:\Users\<username>\AppData\Local\Programs\Augment Automotive 3D Tuner 2.2

Alternatively you can right click on a shortcut and select open file location from the right click menu. You may have to do this twice as the shortcut is often double referenced.

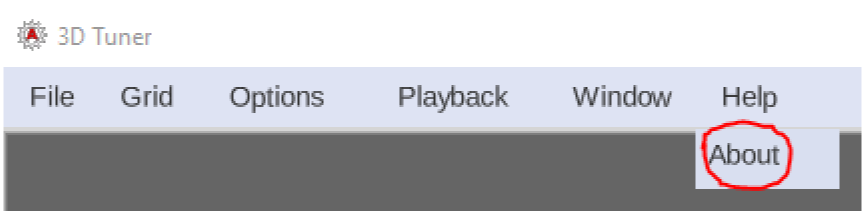
Starting Augment Automotive 3D Tuner

Click on one of the available shortcuts to start the 3D Tuner application. Alternatively locate the install directory and double click the 3D Tuner executable. Once started a launch window will appear as shown below. Select the screen resolution, graphics quality and whether the application should run in a window. If the application runs slowly, reduce the resolution and or graphics quality to suit your computer. Press “Play” to start the tuning application.



Once started the 3D tuner application is in offline mode which will allow calibration files to be loaded, edited and saved to the computer's hard drive.

Information about the version of 3D tuner can be viewed on the About Screen which is accessed from the help menu. Left click on Help then About to view the About Screen.



The About Screen also gives useful information about the connection status of an AugTronic ECU. This includes its firmware information and the amount of data transferred.

Connecting to an AugTronic ECU

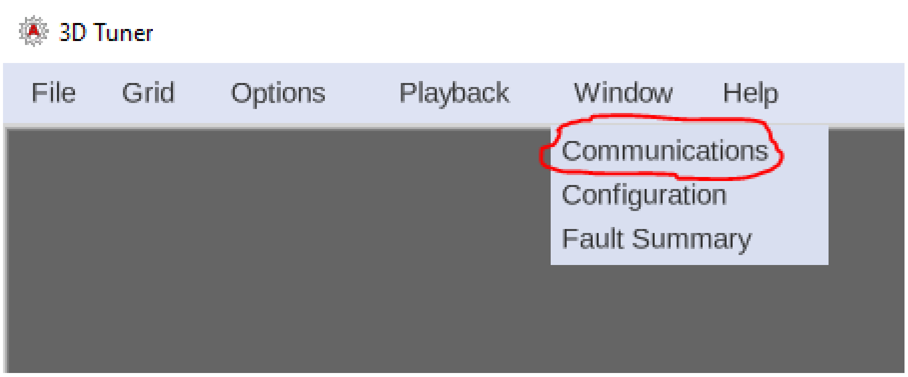
In order to carry out the following functions 3D Tuner needs to be connected to an AugTronic ECU:

1. Saving and loading calibration files from/to AugTronic ECUs.
2. Carrying out data logging and diagnostics for AugTronic ECUs.
3. Carrying out live engine calibration of an AugTronic ECU.

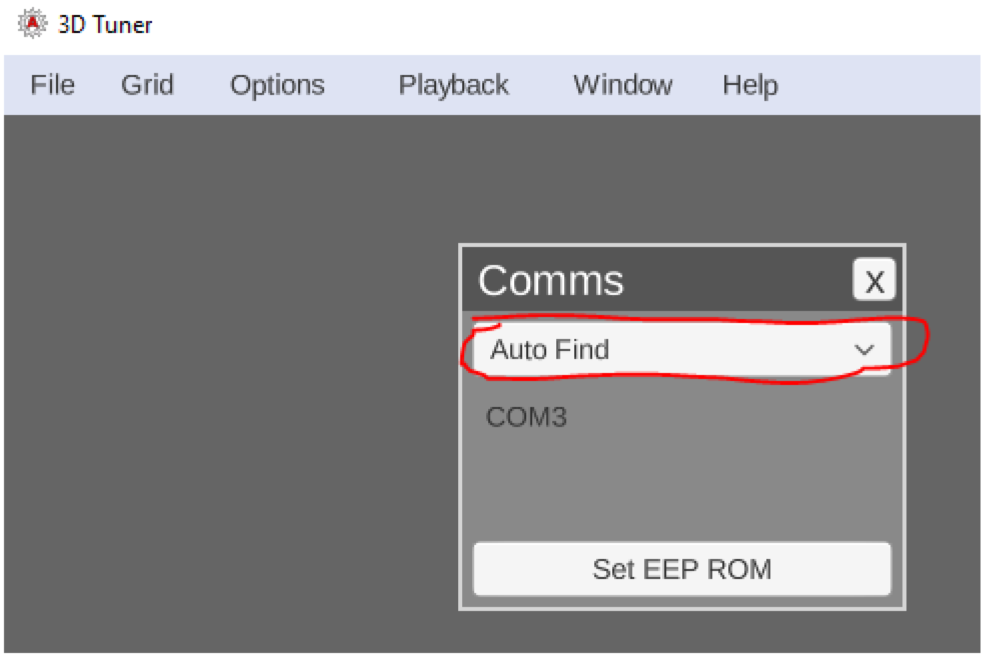
Configure a COM port (a type of external device communication port found on many computers) as per the “Augment Automotive Serial Connection Manual”. Once your COM port has been configured you can connect 3D tuner to the AugTronic ECU. COM ports have a numerical designation such as COM1 which represents a specific device that can be communicated with.

3D Tuner will typically attempt to connect to any available COM port on the system. This will typically find any connected AugTronic ECU. However in some cases it may be necessary to select a specific COM port. It can also be quicker to connect if there are a lot of COM ports on the system for example.

To select the COM port open the communications window. To do this select ‘Window’ -> ‘Communications’ from the top menu bar.



A specific COM port can then be selected from the Communications drop down menu.



When trying to connect to and AugTronic ECU 3D Tuner displays a flashing magnifying glass above the serial port connector icon.

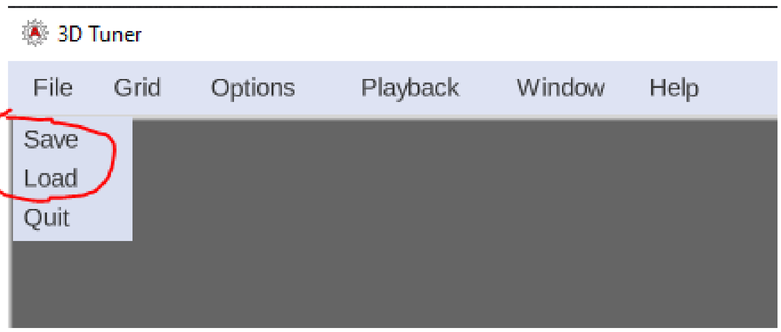
A flashing blue and yellow SYNC icon in the top right indicates the ECU is connected. A popup message will also state the ECU is connected.

If 3D Tuner already has a calibration file loaded when it connects to an AugTronic ECU it will compare its calibration to that of the ECU. If it matches it will connect automatically as it is syncronised. If there is a mismatch it will ask the user which calibration file it wishes to keep. Either the file received from AugTronic or the file currently loaded in 3D tuner. The file that is discarded is overwritten. Data can be lost in this way if the AugTronic or 3D Tuner calibration file is not saved to disk.

Saving and Loading ECU Configurations

ECU configurations can be loaded from and saved to the computer's hard disk for backup and sharing. There are two file types: a binary file which has a ".augee" extension and an XML format file which has a ".augml" file extension. The XML file type can be edited using a simple text editor which can be useful in some situations.

Saving and Loading is done through the "File" menu. Left click on the "File" menu button and select "Save" or "Load to gain access to the "Save" and "Load" functions.



A drop down list on the File Browser window can be used to select between file types.

Saving and loading functions can be used in offline mode and when connected to an AugTronic ECU. When offline a file must be loaded and can then be edited and saved again. When connected to an AugTronic ECU the functionality is the same except that when a file is loaded it is immediately sent to the AugTronic ECU as an update. It is recommended that the engine be stopped when loading a calibration file to a connected AugTronic ECU.

When saving, enter the file name in the text box or click on an existing file then hit the save button. If the file exists it will not be overwritten but the name appended with a number that generates a unique name. When loading left click a file from the scrollable list of files and click load.

Data Logging and Diagnostics

3D Tuner is able to retrieve live data, including fault diagnostics, from the AugTronic ECU. This includes information about the state of the ECU and the connected engine.

When connected to an AugTronic ECU live data is continuously stored in CSV format to the Log folder within the 3D Tuner installation directory. This data can be viewed in various external 3rd applications that will generate graphs showing how the different parameters vary over time.

A good example is MegaLogViewer which can be found at:

https://www.efianalytics.com/MegaLogViewer/

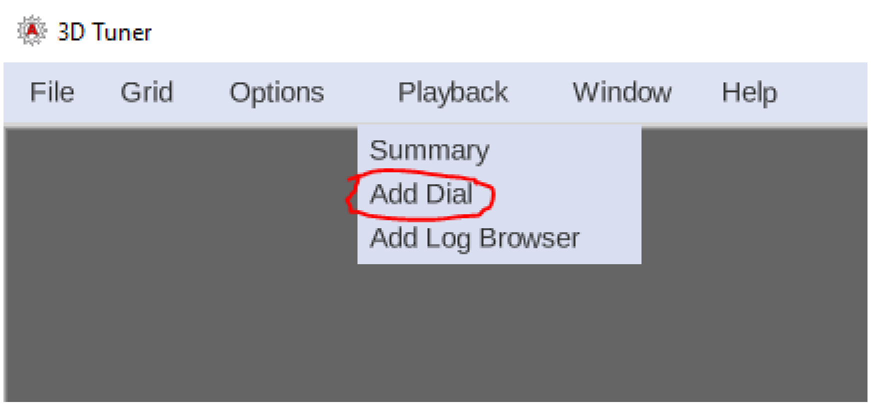
3D Tuner also has the ability to display the real time data in real time using the following facilities:

- The customisable Dial system which also provides user configurable alarms
- The Summary Window
- The Log Browser windows

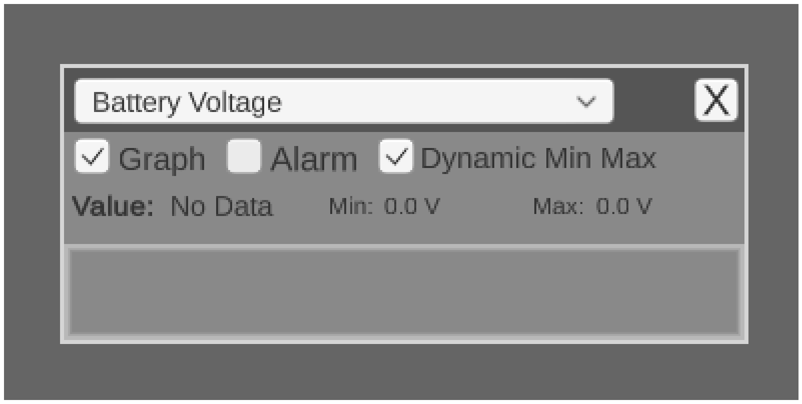
Dial System and Alarms

3D Tuner has a Dial system which consists of one or more customisable and positionable Dial windows which display current, min and max values for a user selectable parameter and additionally allow for Alarm setpoints to be configured to alert the user to an undesirable state.

A new Dial can be added to the 3D tuner window by left clicking the “Playback” menu and then left clicking “Add Dial”.

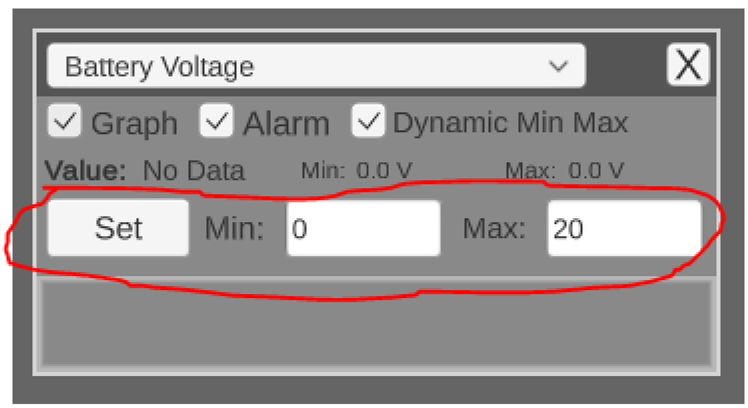


This will create a new floating Dial window that can be moved around the screen by left clicking and holding to the dark grey area at the top whilst moving the mouse to locate the window. This way a user customisable layout of key parameters can be created. Multiple dial windows can be added in this way. When the Graph checkbox is selected a graph of previous values is displayed.



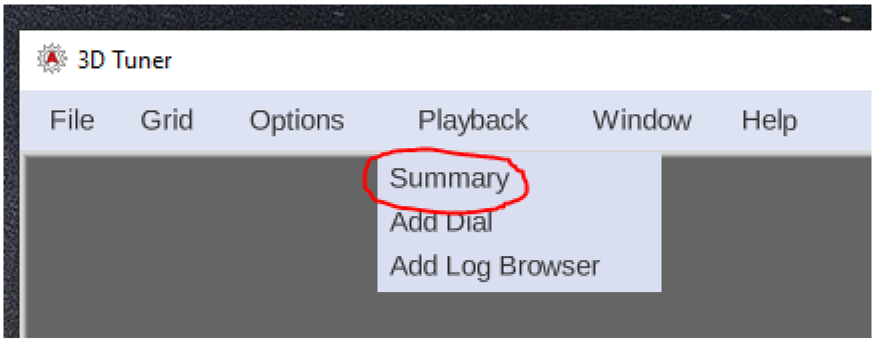
Each Dial has the same layout. A dropdown window at the top allows the user to select the parameter of interest. Click boxes allow the user to select Graph, Alarm and whether the min and max values are based on observed (dynamic) data or fixed limits already in the software.

When the Alarm tick box is selected additional numerical input fields are provided. These allow the user to set min and max values outside of which the screen will flash red and an alarm will sound. This is useful for example for coolant temperature when on a rolling road.

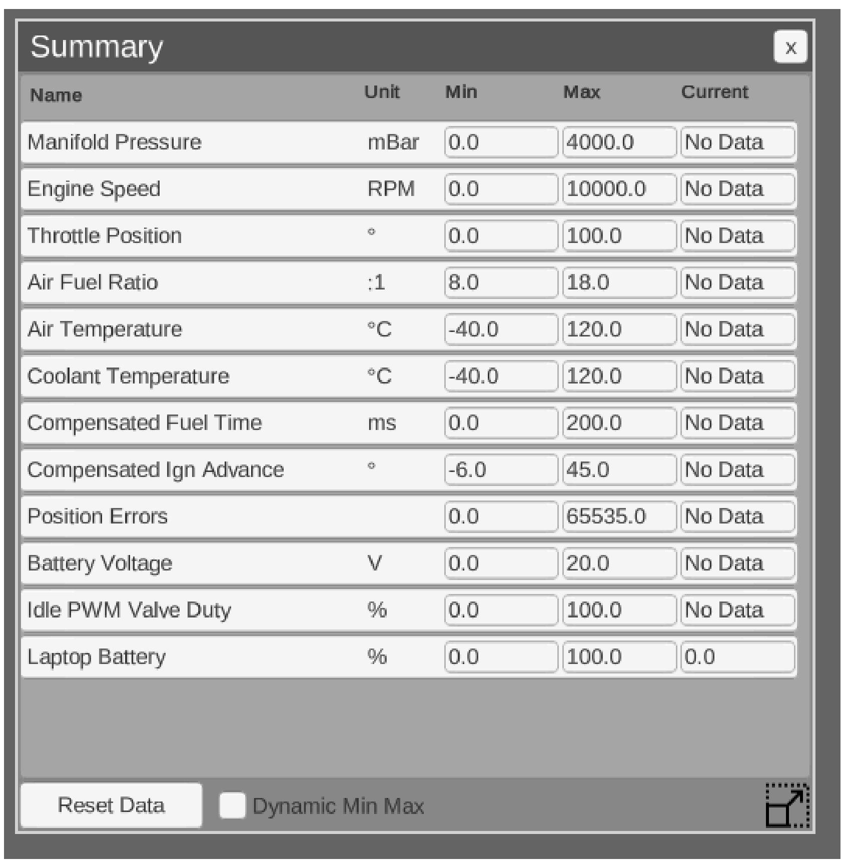


Summary Window

In order to display key values in a concise way a summary window is provided. It can be displayed by left clicking the Playback menu and then left clicking Summary.



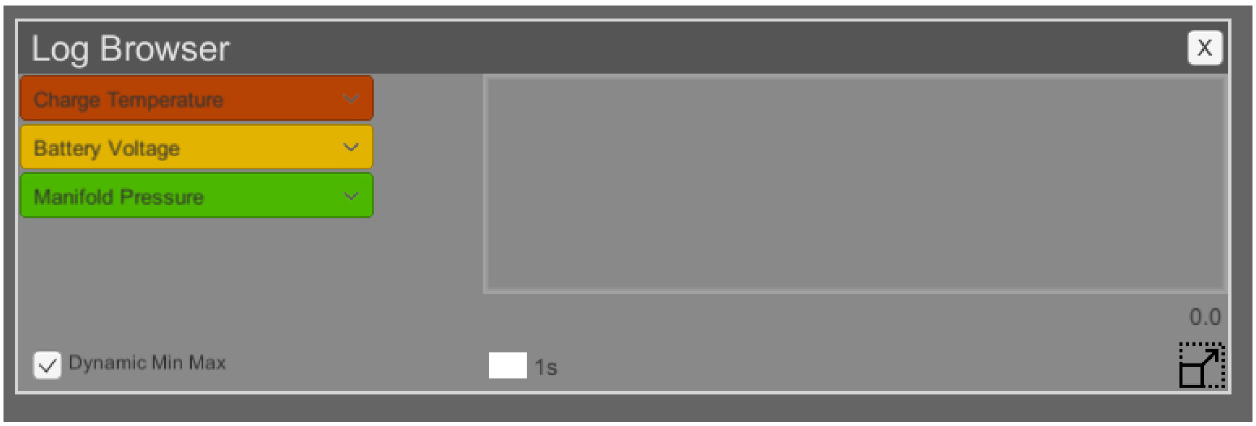
This will bring up the summary window that can be moved around the screen by left clicking and holding to the dark grey area at the top whilst moving the mouse to locate the window. It can also be resized by left clicking and holding on the icon in the bottom right whilst moving the mouse.



As per the Dial system the min and max values can be derived from the observed (dynamic) data or from fixed min and max values set in the software. Left clicking the "Reset Data" button will reset the observed (dynamic) min and max values.

Log Browser

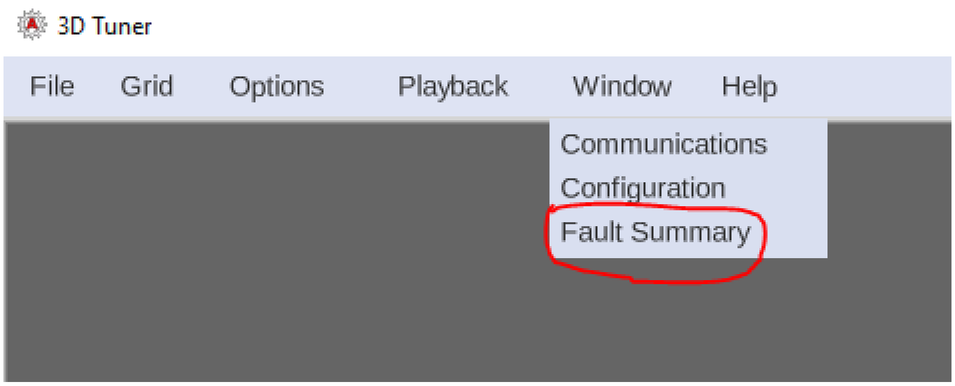
The log browser can be used to view graph trends of up to 3 parameters at the same time. Multiple Log Browser windows can be added to the 3D Tuner display and they can be moved and resized in the same way as the summary window.



Left clicking on any of the 3 drop down windows allows for a different parameter to be selected. The 3 parameters are coloured Red, Yellow and Green which correspond to the colour of the dropdown box, the colour of the graph line and to the value markers. Left clicking on the log browser window to select it and then pressing the I and O keys allows the timescale to be adjusted so a longer period of time can be observed. If the cursor is placed over the graph area a white rectangle will be highlighted and the mouse wheel can then be used to adjust the timescale and left clicking and holding will give the value of the data at the point where the mouse is clicked. This can be used to find peak values etc. As per the Dial and Summary window min and max values can be selected between observed (dynamic) data and fixed min and max values in the software.

Fault Summary

A Fault Summary window can be accessed by left clicking the Window menu and then left clicking on Fault Summary.



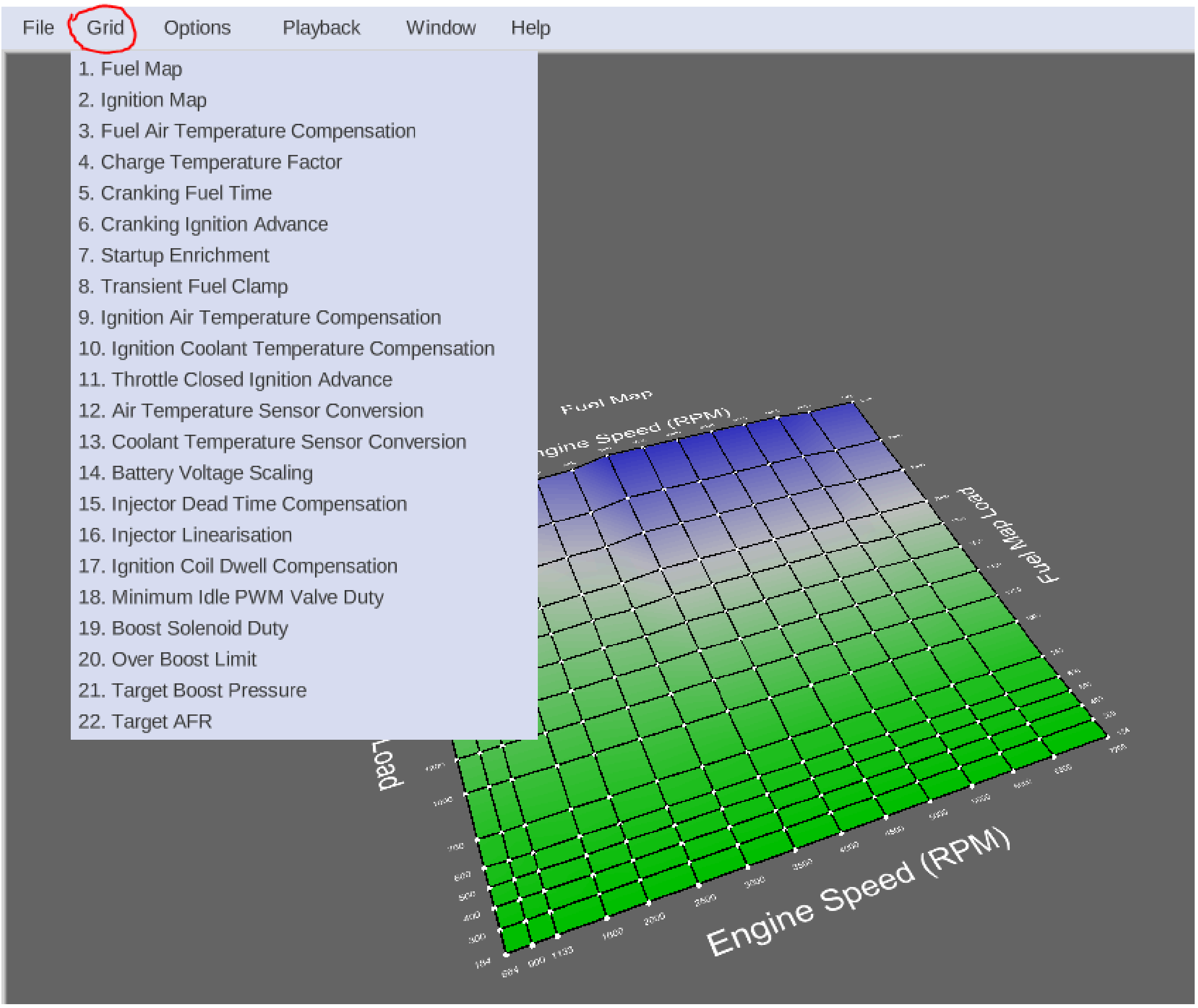
This will bring up a new window that shows the status of a number of different fault flags sent from the AugTronic ECU to 3D Tuner. When the error flag is displayed green there is no error and when it is orange an error is present. Each error has a brief description of the error, for further information on an error please contact Augment Automotive. Error flags are not stored and any error is cleared on a reset of the AugTronic ECU if the fault condition is no longer present.

A full list of fault flags and their meanings is provided in Appendix 5.

When a 'Test Value' of 9 is set the 'Throttle Sensor Error' flag will go faulty to indicate the closed throttle switch is in the closed position. This can be used to diagnose issues with the throttle switch. For example if the AugTronic ECU is not going into idle control mode.

Calibration Maps

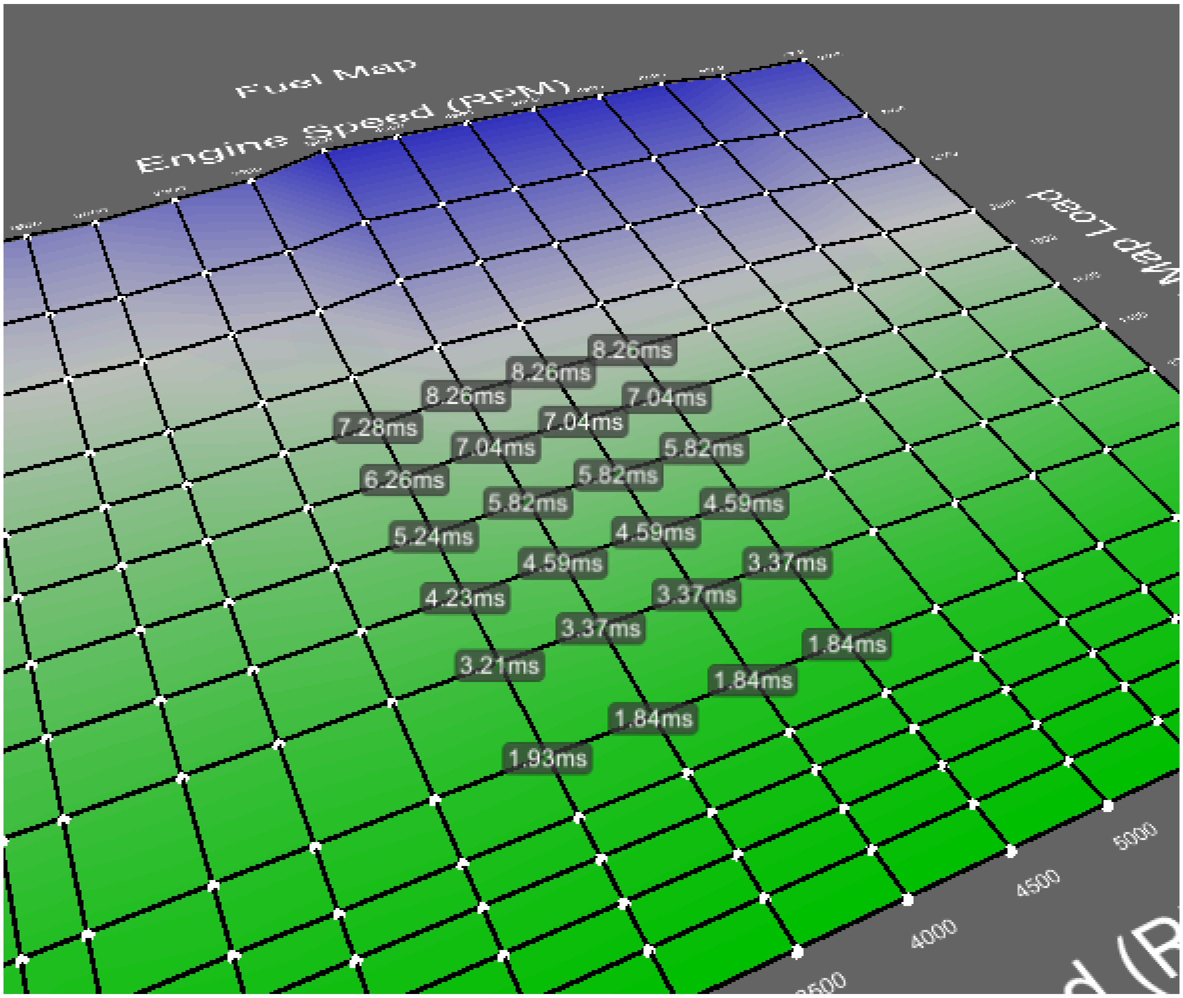
In the Augment Automotive 3D tuner the calibration maps on the AugTronic ECU are represented as 2D or 3D grids that can be selected by left clicking on the “Grid” button and left clicking an option. The number keys 1-9 can also be used to select maps 1-9 respectively.



The displayed 2D or 3D grid can be panned by holding the TAB or Middle Mouse button whilst moving the mouse. In a 3D grid holding the right mouse button will rotate the map view. In order to do this the main window must be selected by left clicking anywhere in the window. A grey highlight is present around the window when it is selected.

See the Hotkey section in Appendix 1 for controls used in manipulation of the grids as part of the tuning process.

The grid points are manipulated by selecting a single point by left clicking or by holding the left mouse button and dragging over a group of points and releasing the left mouse button.



The point values can then be altered by pressing or holding the up or down arrows. The shift key can be used to increase the rate of increase/decrease. The ‘Q’ or ‘A’ keys add and subtract 5% from the selected value.

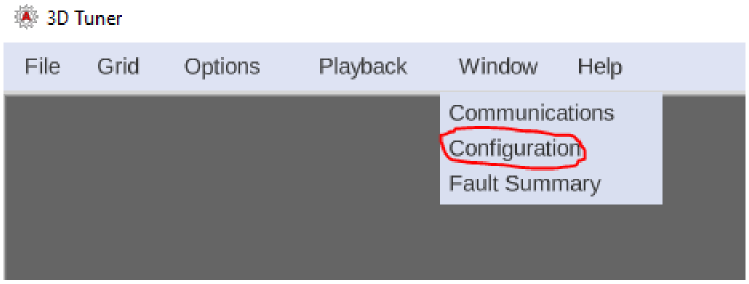
Grid point labels showing the value of each data point can be displayed only on the selected points or on all points by toggling the “Label all points” option in the “Options” menu. The size of the point label text can be adjusted with the ‘M’ and ‘N’ keys The position of the grid sites can be adjusted in “Grid Manipulation Mode” which can be selected under the “Mode” menu.

For a description of the function of each map see the ‘AugTronic Map Description’ section in Appendix 4.

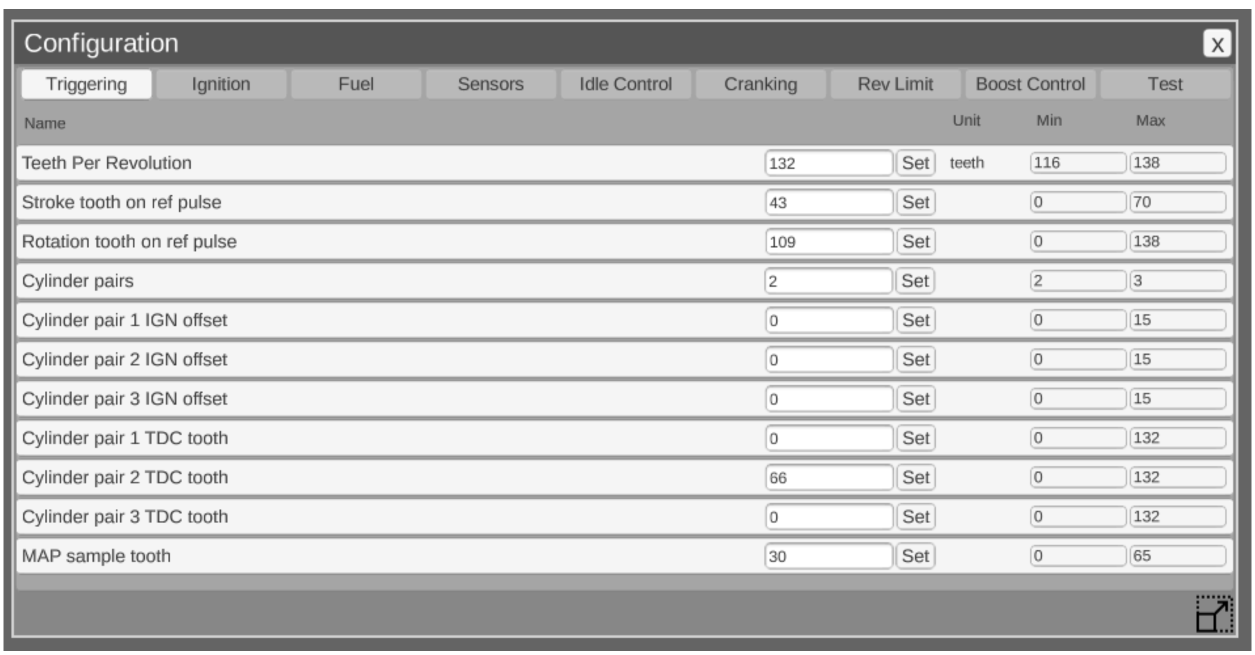
A command window can be used to carry out mathematical operations on one or more selected points. The ‘C’ key is used to open the command entry window. For a list of commands see the ‘Command Terminal’ section in Appendix 2.

ECU Configuration

Various ECU configuration parameters are available through left clicking on "Window" then "Configuration". This brings up the ECU configuration window. These values control many important aspects of the AugTronic ECU.



This will bring up the Configuration window which can be used to view and edit important parameters of the AugTronic ECU configuration. The parameters are split into groups and each group can be viewed by left clicking on the buttons at the top of the window. As per other windows the Configuration window can be moved and resized.

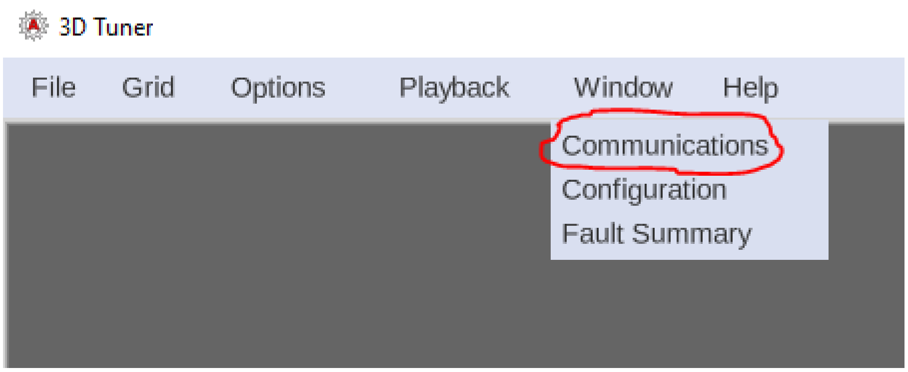


Name			Unit	Min	Max
Teeth Per Revolution	132	Set	teeth	116	138
Stroke tooth on ref pulse	43	Set		0	70
Rotation tooth on ref pulse	109	Set		0	138
Cylinder pairs	2	Set		2	3
Cylinder pair 1 IGN offset	0	Set		0	15
Cylinder pair 2 IGN offset	0	Set		0	15
Cylinder pair 3 IGN offset	0	Set		0	15
Cylinder pair 1 TDC tooth	0	Set		0	132
Cylinder pair 2 TDC tooth	66	Set		0	132
Cylinder pair 3 TDC tooth	0	Set		0	132
MAP sample tooth	30	Set		0	65

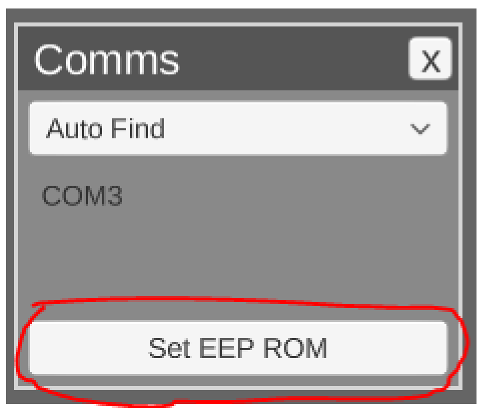
Values can be edited by clicking in the text box associated with the parameter being altered and then clicking the Set button. When the parameter is altered the box is turned red. When the set button is pressed the box will turn green if the value is within limits. Each value has a maximum and minimum limit. For descriptions of each value and how to determine the correct value for your engine see the AugTronic Configuration section in Appendix 3.

Saving ECU Memory

Changes made to the AugTronic ECU configuration in live mode are not permanent. They will be lost when the AugTronic ECU loses power. In order to make the changes permanent, open the Communications window.



Click the Set EEPROM button in the Communications window.

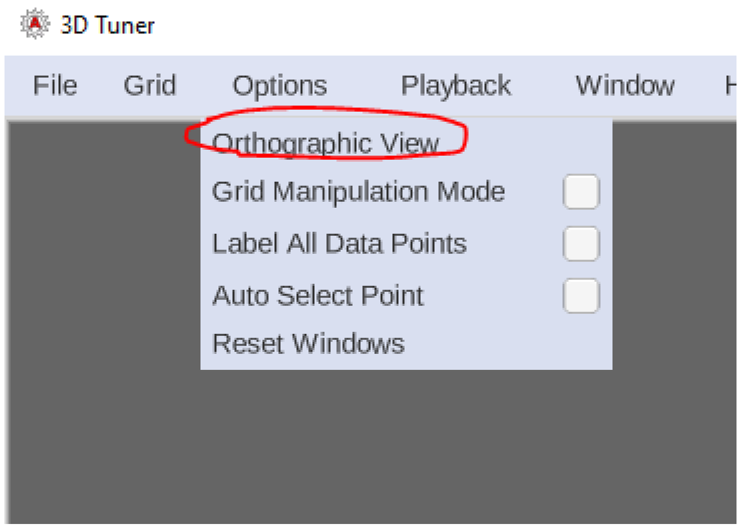


Once EEPROM saving is complete the activity indicator in the top right will flash (usually immediately unless lots of changes have been made). In addition a popup should state the save operation has completed. In some cases if a lot of data is changed 3D tuners connection may timeout. This is because saving the memory can take a long time. In this case simply wait for 3D Tuner to reconnect and the changes should be saved. To confirm you can click Set EEPROM again after it is reconnected.

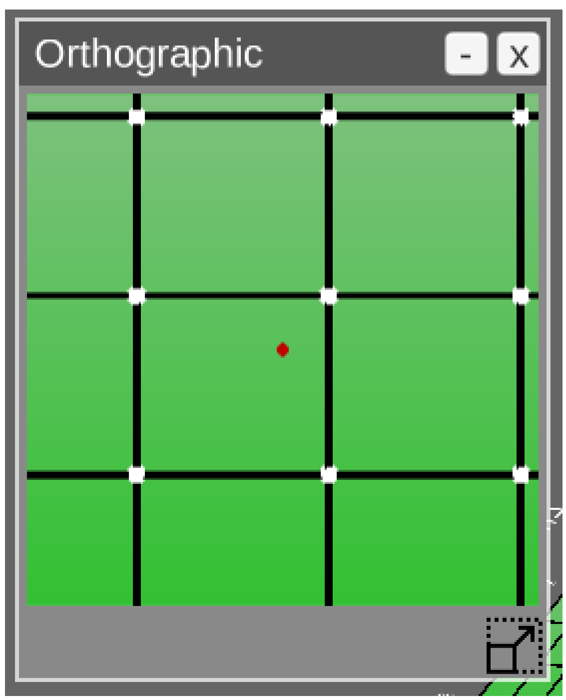
If modifications are made to the AugTronic configuration and the ECU is reset the changes will be reverted on the ECU. If the changes are not stored within 3D Tuner the changes are lost permanently. If 3D Tuner reconnects to the ECU and the user chooses to discard the data in 3D Tuner then the changes can be lost from 3D Tuner as well. If you accidentally reset the AugTronic ECU with unsaved changes then it is best to save the calibration file to disk immediately to prevent possible loss of work.

Orthographic View

To help locate the engine on a particular site during tuning an orthographic view is provided. It can be enabled through the “Options” menu.



The window can be dragged via the top bar to an appropriate position on screen.



Appendix 1 - Hotkeys

Key	Function
I	Zoom in
O	Zoom out
L	Lock selected grid site for editing
U	Unlock selected grid site for editing
Left Mouse	Select point
Hold Right Mouse	Rotate grid
Hold Middle Mouse/Tab	Pan grid
M	Increase size of grid site labels
N	Decrease size of grid site labels
Press Up Arrow	Increase value of grid site by one increment
Press Down Arrow	Decrease value of selected grid site by one increment
Hold Up Arrow	Increase value of selected grid site by 3% per second
Hold Down Arrow	Decrease value of selected grid site 3% per second
Left Shift	Hold to force change in value of point of 40% of range per second while up or down error is held
Q	Increase value of selected grid site by 5%
A	Decrease value of selected grid site by 5%
C	Bring up the command terminal.
P	Auto detect com port (Experimental - application may freeze while searching)

Appendix 2 - Command terminal

As of 3D Tuner version 1.27 a command terminal can be brought up by pressing ‘c’. This feature is only active on 3D maps. This can be used to set and manipulate the values of single or multiple data points on the maps. The command terminal accepts a number of command value inputs e.g. =100 would set all selected points to a value 100. The following commands are available:

Command	**Value**	**Description**
+	decimal e.g. 10.1	Add the value to the selected data point(s) existing value(s)
-	decimal e.g. 10.1	Subtract the value from the selected data point(s) existing value(s)
*	decimal e.g. 10.1	Multiply the selected data point(s) existing value(s) by the value
=	decimal e.g. 10.1	Set the existing data point(s) value(s) to the value. Also sets the value of the last value moved in grid manipulation mode.
/	decimal e.g. 10.1	Divide the selected data point(s) existing value(s) by the value
l (lower case L)	none	Set the value(s) of the data point(s) selected to the value left of it
d (lower case D)	none	Set the value(s) of the data point(s) selected to the value below it
i (lower case I)	none	Interpolate the value(s) of the data point(s) selected using the values below them.

Appendix 3 - AugTronic Configuration Parameters for AugTronic Firmware 1.22

Name	Description
Triggering	
Teeth per revolution	The number of teeth counted in one revolution of the flywheel
Stroke tooth set on reference pulse	The internal stroke counter value set when the reference pulse is seen
Rotation tooth set on reference pulse	The internal rotation tooth set when the reference pulse is seen
Cylinder banks	The number of cylinder banks (pairs) e.g. for a 4 cylinder there are 2
Cylinder TDC tooth (1-3)	The TDC (TD really) tooth for each cylinder bank specifies at what point in the rotation of the engine the cylinder bank reaches its top dead position
Ignition	
Wasted spark mode	0 - Wasted spark disabled 1 - Wasted spark enabled on internal header 2 - Wasted spark enabled on breakout box
Fuel	
Idle/Stable Fuel Filter Constant	Filtering of the fueling when the engine is at idle or stable - 0 is no filtering. Higher value is more filtering.
Injections/4 Stroke Cycle	The number of times the injectors are batch fired per engine cycle (2 rotations)
Closed Loop Fueling Enabled	Enables/disables closed loop fueling
Closed Loop Fueling Int Gain L	Gain when error is low - error / gain = adjustment
Closed Loop Fueling Int Gain H	Gain when error is high - error / gain = adjustment
Closed Loop Fueling Prop Gain L	Gain when error is low - error / gain = adjustment
Closed Loop Fueling Prop Gain H	Gain when error is high - error / gain = adjustment
Closed Loop Max Correction	The maximum correction that can be applied in closed loop
Batch Injection Strategy	0/1/2 - recommend to leave set to 1.
Transient fuel pooling percentage	The amount of fuel in percent of base fuel time that is assumed to be pooled e.g. on the internal surfaces of the manifold etc
Transient fuel recover percentage	The rate at which the fuel pool size corrects itself during transient periods in percentage of the difference between the current pool value and the new one
Enable Engine Stable Fuel Filter	Enable or disable filtering of fueling when the engine is stable. The amount of filtering is controlled by ‘Idle/Stable Fuel Filter Constant’
Coasting fuel cut enabled	Enables/disables fuel cut on the overrun

Coasting RPM limit	Determines the RPM below which fuel cut is disabled
Sensors	
EGT Source	The ADC channel which EGT is being measured on
MAP sensor min value	The minimum value of the MAP sensor e.g. 200 mBar
MAP sensor max value	The maximum value of the MAP sensors e.g. 4000 mBar
MAP sensor min offset	The ADC offset of the minimum MAP sensor value e.g. for 0.4V the value is 0.4 / (5/1023) = 82
MAP sensor max offset	The ADC offset of the maximum MAP sensor value e.g. for 4.8V the value is 4.8 / (5/1023) = 982
MAP Low Error Filter	Filter constant used when error is small
MAP Filter Constant	Main filter constant
MAP Filter 1500RPM Min Threshold	Used to determine MAP stability from 1500RPM
MAP Filter 3000RPM Min Threshold	Used to determine MAP stability from 3000rpm
Wideband min value	The minimum value output by the wideband sensor multiplied by 100 e.g. 850 for (8.5:1 AFR)
Wideband max value	The maximum value output by the wideband sensor multiplied by 100 e.g. 1800 for (18:1 AFR)
Wideband min offset	The minimum voltage offset in bits (255 is 5V) e.g. for 0.5V value = 0.5 / (5 / 255) = 25
Wideband max offset	The maximum voltage offset in bits (255 is 5V) e.g. for 4.5V value = 4.5 / (5 / 255) = 230
TPS closed ADC	The TPS raw value for the throttle closed position e.g. for 0.4V the value is 0.4 / (5/1023) = 82
TPS open ADC	The TPS raw value for the throttle open position e.g. for 4.8V the value is 4.8 / (5/1023) = 982
Idle Control	
Idle Target	The target idle speed
Idle Ignition Advance Mode	0 - Use the Ignition Map 1 - Ignition set to Throttle Closed Ignition Advance map.
Idle Disable Transient Fuel	Disables transient fueling when idling.
Idle PWM Integral Gain	The integral gain for PWM idle control
Idle PWM Max Integral Gain	The maximum integral amount.
Idle PWM Integral Frequency	The rate of execution of the idle control algorithm.
Idle PWM Slow Rate Threshold	The threshold engine speed error that causes the idle control algorithm to slow.
Idle PWM Slow Rate Counter	The number of executions that are required before an adjustment is made to the idle PWM duty.

Coastdown Deccel Accel Trigger	The rate of engine deceleration that causes the idle valve to open by the amount specified by the Idle Coastdown Boost Idle Valve PWM Boost.
Coastdown Deccel Idle Valve Boost	The amount to increase the idle valve opening by in % duty.
Cranking	
Cranking RPM threshold	The RPM value above which the ECU switches from cranking to normal running parameters
Cranking dwell teeth	The number of flywheel teeth that the ignition is in dwell during cranking
Cranking idle valve boost	The idle valve duty boost when cranking.
Rev Limit	
Rev limit	The RPM above which the fuel cut is activated
Rev limit limp mode RPM	The rev limit if the ECU is in limp mode due to position sensor faults
Boost Control	
EBC Freq	The frequency of electronic boost control. Defined as ticks of an 87hz timer so a value of 8 is approx 10 hz. The EBC duty is updated at this frequency.
EBC MAP Trigger	The MAP above which EBC is enabled
EBC TPS Control Enabled	Scale the boost duty cycle by throttle position.
EBC TPS Threshold	The amount of throttle which must be attained before boost solenoid duty cycle scaling begins.
EBC Integral Gain Low	The integral gain when the boost error is low - smaller adjustments for small errors - error / gain = adjustment
EBC Integral Gain High	The integral gain when the boost error is high - larger adjustments for small errors - error / gain = adjustment
EBC Prop Gain Low	The prop gain when the boost error is low - smaller adjustments for small errors - error / gain = adjustment
EBC Prop Gain High	The prop gain when the boost error is high - larger adjustments for small errors - error / gain = adjustment
EBC Max Correction	The maximum permissible boost correction for closed loop
EBC Permit Boost Scram	Enable boost scram which will set boost duty to 100% until target is reached - EXPERIMENTAL - May cause overboost.
Test	
Debug	Not for end user use
Test Value	1. Test fuel pump 2. Test boost solenoid 3. Batch injection test value 4. Batch injection test value 5. Select speed sensor rising edge trigger 6. Disable the ref sensor above “Rev limit limp mode RPM”

	7. Test the ignition coil 8. Enable a low pass MAP filter instead of the default map averaging function 9. Generate a Throttle Error when the throttle is closed to test throttle closed switch

Appendix 4 - AugTronic Map Descriptions

Each calibration map is used in conjunction with input values to calculate a current map value which is used by the ECU for specific purposes. A technique called linear interpolation is used to calculate the current value when the inputs do not align with a specific point on the map.

Maps can be 3-Dimensional and 2-Dimensional. This depends on the need for any specific calculation.

Fuel Map

The 'Fuel Map' contains the calibration data that the AugTronic ECU uses to derive its 'Base Fuel Time'. This is a time in milliseconds that the injector will be open for over the course of a 4-stroke cycle. Multiple adjustments are applied to this base map before the fuel is injected so this is typically not the final value injected.

In the linear region of injector operation the time that the injector is open is proportional to the mass of fuel injected.

The ECU interpolates a 'Base Fuel Time' based on 'Engine Speed' and 'Fuel Map Load'. 'Fuel Map Load' is either Manifold Absolute Pressure' or a calculated 'Air Density' dependent on the setting of 'Fuel Map Load' in the ECU configuration settings.

Ignition Map

The 'Ignition Map' contains the calibration data that the AugTronic ECU uses to compute its 'Base Ignition Advance' This is an advance in degrees back from the pistons top position in the cylinder bore. Currently only positive ignition advance is supported. Multiple adjustments are made to this base map before the ignition timing is used to generate a spark.

This map is bypassed when the engine is cranking or the throttle is closed and 'Idle Ignition Advance Mode' is set to 1 in the configuration menu. Under these conditions separate map tables are used to determine the 'Base Ignition Advance'.

Fuel Air Temperature Compensation

The fuel air temperature compensation map applies a % modification to the 'Base Fuel Time' dependent on the current 'Intake Air Temperature'. It should be used differently depending on the way that the AugTronic ECU calculates fuel map load.

If 'Manifold Absolute Pressure' is used as fuel map load then this should be used to compensate for changes in air density due to ambient air temperature. It can also be used to alter the Air Fuel Ratio based on the air temperature.

If 'Air Density' is used as fuel map load then this should be used to alter the Air Fuel Ratio based on the air temperature. For example, richening the mixture for high air temperature to reduce combustion temperatures and prevent engine knock.

This is not applied to cranking fuel.

Charge Temperature Factor

Due to the length of time the air takes to travel the intake path the intake air can warm up to wards engine temperature. This factor takes an approximation of gas flow and estimates the Charge Temperature used in fuel calculations as a factor between Intake Air Temperature and Coolant Temperature. 100% would mean that the Charge Temperature is Coolant Temperature. 0% would mean that the Charge Temperature is Air Temperature.

Cranking Fuel Time

This map is the 'Compensated Fuel Time' when the engine is cranking. It is derived from the 'Coolant Temperature' alone. Injector dead time is also included in this map as the battery voltage is unstable during this cranking period. No air or coolant Temperature modifiers are applied to this value.

Cranking Ignition Advance

This map is the 'Compensated Ignition Advance' when the engine is cranking. It is derived from the 'Coolant Temperature'. No air or coolant temperature modifiers are applied to this value.

Startup Fuel Enrichment

This map is a % modifier applied to the 'Base Fuel Time' immediately after the engine is started. The map is based on runtime and coolant temperature. The fuel modified is calculated and applied to the fuel calculations.

Transient Fuel Clamp

This map is a percentage of the base fuel time that represents the maximum amount of fuel that can be applied by the transient fuel enrichment algorithm. This algorithm ensures that the mixture does not go excessively lean when the engine load is changed rapidly. A limit should be applied to prevent the mixture being excessively rich but permitting an adequately fast response to transient conditions. 40% is a common value at low to moderate engine speeds. The need typically diminishes at higher rpm. It is used in conjunction with the 'Transient Pool Percentage' and 'Transient Recovery Percentage' to compute the final 'Transient Fuel Enrichment'.

Ignition Air Temperature Compensation

This table is used to compensate the ignition advance for changes in air temperature. This can be used to compensate for reduced flame speeds at low temperatures or to retard ignition at high temperatures to prevent engine knock.

This is not applied to cranking ignition advance.

Ignition Coolant Temperature Compensation

This map is used to compensate the ignition advance for changes in coolant temperature. This can be used to compensate for reduced flame speeds at low temperatures or to retard ignition at high temperatures to prevent engine knock.

This is not applied to cranking ignition advance.

Throttle Closed Ignition Advance

This map is used to derive the 'Base Ignition Advance' degrees when the throttle is closed and 'Idle Ignition Advance Mode' is set to '1' in the configuration menu.

It is derived using 'Engine Speed' as its input.

Air Temperature Sensor Conversion

This map is used to calculate the air temperature in degrees Celcius from the resistance of the air temperature sensor.

Air Temperature Sensor Conversion

This map is used to calculate the air temperature in degrees Celcius from the resistance of the air temperature sensor.

Battery Voltage Scaling

This map is used to calculate the real battery voltage from an internal value which has the range 0-5V.

Injector Dead Time Compensation

This map is used to calculate the time in milliseconds that it takes the engine's fuel injectors to open at a given battery voltage. It is applied each time the injectors are opened to inject a specific amount of fuel. This ensures a consistent amount of fuel is injected despite changes in battery voltage due to system loads and state of battery charge.

Injector Linearisation

This map is used to compensate for the non-linearity of injectors at low opening times. It is a % modifier to the compensated fuel time that is applied at the point of injection. The input is the 'Injector Pulse Length' which is the time that the injector should be open before the injector dead time is added. Note that this is not necessarily the 'Compensated Fuel Time' as in Batch Injection strategies the injector may be opened twice or more during each 4-stroke cycle.

Ignition Coil Dwell Compensation

This map is used to calculate how long it will take the ignition coil to reach peak current during dwell at any particular battery voltage. This is used to ensure maximum spark strength with minimum heat generation within the coil and associated circuitry. It represents the time in milliseconds that the coil is put into dwell prior to an ignition event.

Minimum Idle PWM Valve Duty

This map is used to calculate the minimum pulse width for the idle stabilisation valve based on the current 'Coolant Temperature'. This helps ensure idle stability across the range of operating temperature of the engine.

Boost Solenoid Duty

This map is used to calculate the base boost solenoid duty when boost control is active. It is based on the 'Engine Speed'. The higher the solenoid duty the higher the boost pressure that will be obtained.

Over Boost Limit

This map is used to calculate the 'Over Boost Limit' using the 'Engine Speed'. This is a fuel cut threshold that is designed to protect the engine in the event of excessive turbo boost pressure. The value is in 'Manifold Absolute Pressure'.

Target Boost Pressure

This map is used to calculate the 'Target Boost Pressure' for the closed loop boost control algorithm. The value is in 'Manifold Absolute Pressure'.

Target AFR

This map is used to calculate the target 'Air Fuel Ratio' for the closed loop fuel control algorithm.

Appendix 5 - Fault Flag Descriptions

Fault	Description
Config Error	The config in the ECU has a fault - contact Augment Automotive for support.
Limp Mode	The ECU has detected an issue and whilst it will allow the engine to run it will not allow it to rev above the limp mode rpm limit and may not run correctly.
Security Enabled	ECU is locked/immobilised.
Throttle Is Closed	The ECU has detected the throttle is closed.
Boost Control Active	-
Closed Loop Fueling Active	-
Fuel Cut Active	-
Engine Stable	The ECU has determined the engine is stable i.e. RPM and load are remaining constant.
Engine at Idle	The ECU has determined the engine is idling.
Manifold Pressure Stable	The ECU has determined the MAP/engine load is stable.
ECU Watchdog Reset	The ECU was last reset by the watchdog e.g. engine stalled.
ECU Power on Reset	The ECU was just powered on.
Misfire Detection Active	DISABLED IN CONSUMER UNITS
Misfire Detected Cyl 1	DISABLED IN CONSUMER UNITS
Misfire Detected Cyl 2	DISABLED IN CONSUMER UNITS
Misfire Detected Cyl 3	DISABLED IN CONSUMER UNITS
Misfire Detected Cyl 4	DISABLED IN CONSUMER UNITS
Reference Sensor Detected	The ECU has picked up the reference sensor on the crankshaft
Speed Sensor Functional	The ECU has determined the speed sensor on the crankshaft is functional.

AFR Sensor Operational	The ECU has determined the AFR sensor is operational - has seen a varying range of values.
Permit Boost Scram	Boost scram is permitted - has various conditions for engagement.
Boost Scram Active	-
Overboost Protection Triggered	Overboost has been triggered - latches until ECU reset.