GFB G-Force III

Installation Instructions

Part #3005

(3-Port solenoid included)

CONTENTS

Intro

About the G-Force III	2
Important Information	3

Installation

Wiring Diagram	4
Solenoid Valve Installation Diagram	5

Menu Navigation

Menu Structure	6
Boost Presets	7

Setting the Boost Pressure

Duty Cycle	8
Gain	9
Sensitivity	10

Controller Functions

Scramble Boost	11
Lean Cutout	12
Overboost	12
Peak Hold	13
Display Setting - Units of Pressure	13
Input 1 Setup - External Trigger	14
Input 2 Setup - Wideband AFR	14
Stoichiometric Ratio	15
Boost Gauge Calibration	15
Colour Settings	16

Additional Info

Tips	17
Troubleshooting	17-18
Tech	19
Warranty	20

ABOUT THE G-FORCE III 3005 KIT

The G-Force III incorporates an advanced boost control strategy that allows the user fine control over the peak boost, rise rate, and closed-loop correction. You can also integrate a 3rd party wideband O2 sensor and controller to show air/fuel ratio on the G-Force III display, and implement a warning and boost cut strategy if the mixture goes lean.

The 3005 kit includes a MAC 3-port solenoid. If you need to run boost pressures greater than double the wastegate base pressure, you might consider purchasing the 3008 kit instead, which includes a 4-port solenoid instead.

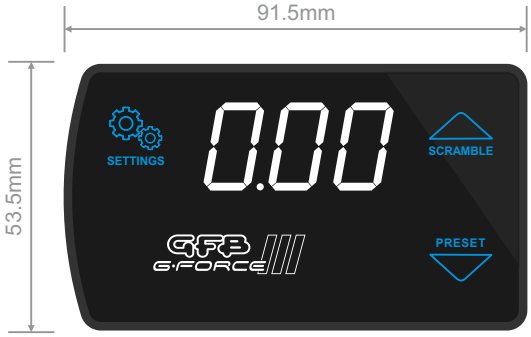
Features at a glance:

- Multifunction boost and AFR (Air/Fuel Ratio) gauge with simple menu button toggle
- Lean AFR warning can be set to cut boost pressure if engine runs too lean under load
- 6 individually programmable boost preset memories, selectable on-the-fly
- Closed-loop correction - helps prevent boost variations
- Unique scramble boost strategy - increase or decrease boost for a certain amount of time at the push of a button
- Overboost protection - shuts down the solenoid and flashes a warning if boost goes too high
- External input - can be used to activate scramble or select boost presets remotely
- Adjustable button illumination colours - match your car's existing lighting
- AFR gauge can display Lambda or AFR, and can be configured for different fuel types
- Boost/vacuum gauge display - in BAR, kPa, or PSI
- Peak hold boost pressure display
- 3-port solenoid included

Installing the Head Unit

The G-Force III casing is a ½ DIN size, allowing to be mounted into one half of a standard stereo slot.

Alternatively, with its thin profile (18.5mm), the G-Force III can be mounted on a vertical face of the dashboard, or stood up on its edge using the supplied double-sided mounting tape.



Warning!!!

Danger to Manifold

No, seriously. The G-Force III (and any other boost controller), **should be considered a tuning tool**, NOT a pre-configured bolt-on power adder.

Boost makes great power, but with great power comes great responsibility! You can very easily damage or destroy your engine if you get it wrong, so please take the time to thoroughly read this instruction manual and pay attention to all appropriate notes and warnings.

If you are not familiar with vehicle wiring, or your engine and turbo system limitations, it is recommended that the installation be carried out by a qualified professional.

ENGINE LIMITATIONS

Before you start, you should be aware of your engine and turbo system limitations. GFB makes no recommendations or guarantees about the maximum “safe” level of boost for any particular engine, or other limitations imposed by the ECU, fuel system, exhaust, intercooler, or turbocharger. It is the user’s responsibility to be aware of their vehicle’s limitations to ensure they are not exceeded.

SAFETY AND PROTECTION FEATURES

The G-Force’s primary safety feature is the overboost protection function. It lowers boost to the minimum level if boost pressure exceeds the user-adjustable threshold. Note that since the G-Force III controls boost via the wastegate, it cannot protect against overboost events that occur as a result of wastegate failure.

Most ECUs will have a boost cut feature to protect the engine (even if the wastegate fails), although this is typically much more aggressive as the fuel and/or ignition is cut and the engine’s power is completely cut. Therefore it is best to have the G-Force III cut boost at a slightly lower threshold than the ECU’s cut.

If you choose to connect a 3rd party wideband O2 sensor and controller (not supplied) to the G-Force III, a lean mixture boost cut is also available as additional protection against engine damage caused by a lean event.

G-FORCE III LIMITATIONS

The G-Force III part # 3005 is for use on turbocharged vehicles that utilize a boost referenced wastegate, where the intended peak boost is equal to or less than double the wastegate’s base boost pressure.

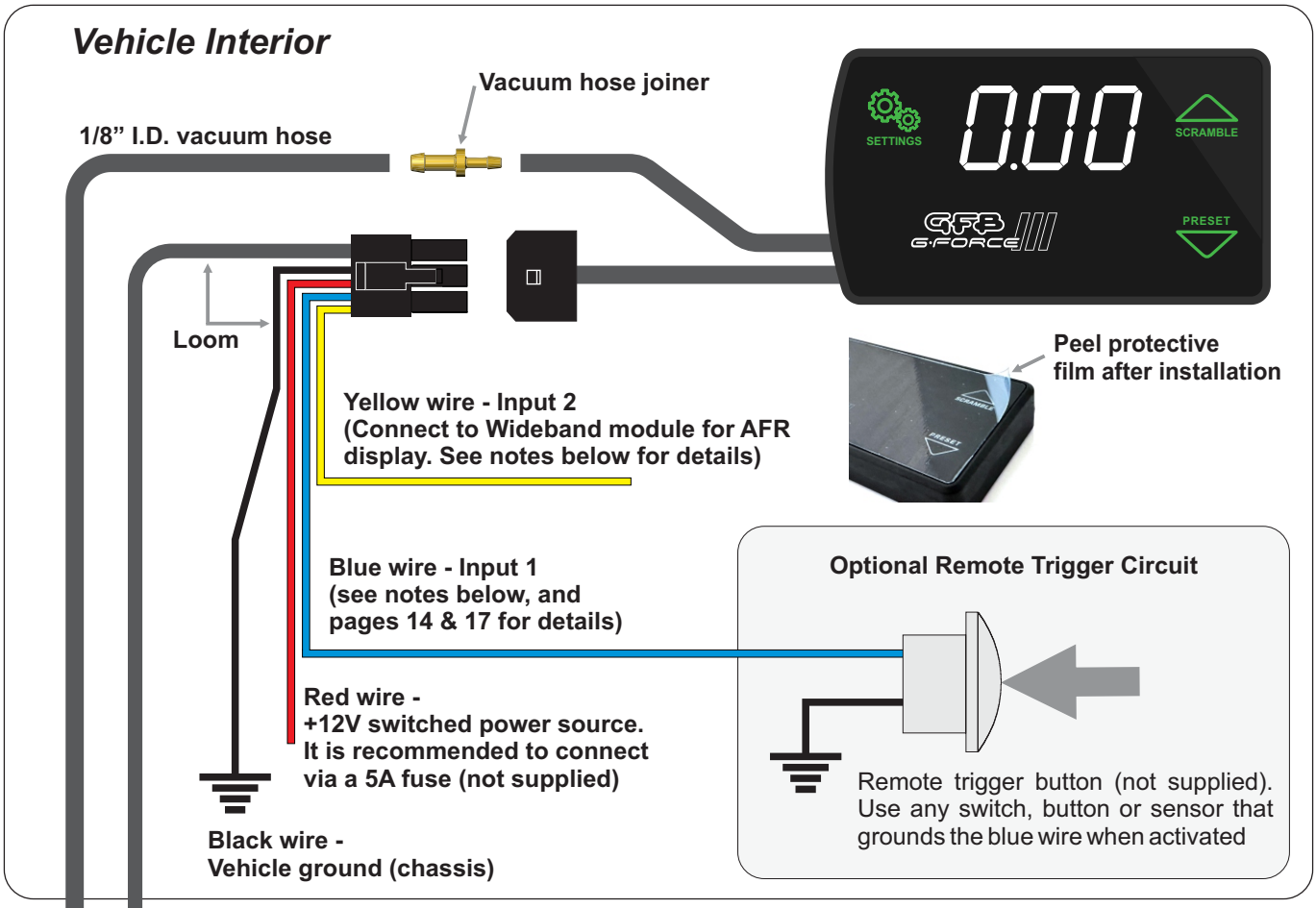
It is possible but not ***optimal*** to use the 3005 kit in the following situations:

- **Diesel engines** - it is *possible* to use the 3005 on diesel engines, but it is *better* to use D-Force kit 3006 or 3007- the programming of those units is tailored for diesel engines.
- **Where peak boost is more than double the wastegate’s base boost pressure** - whilst it is possible to use the 3005 at boost levels more than double the wastegate pressure, boost tends to be less stable. The better solution is to increase the base boost pressure by adding springs to the wastegate, or use the G-Force III kit part # 3008.

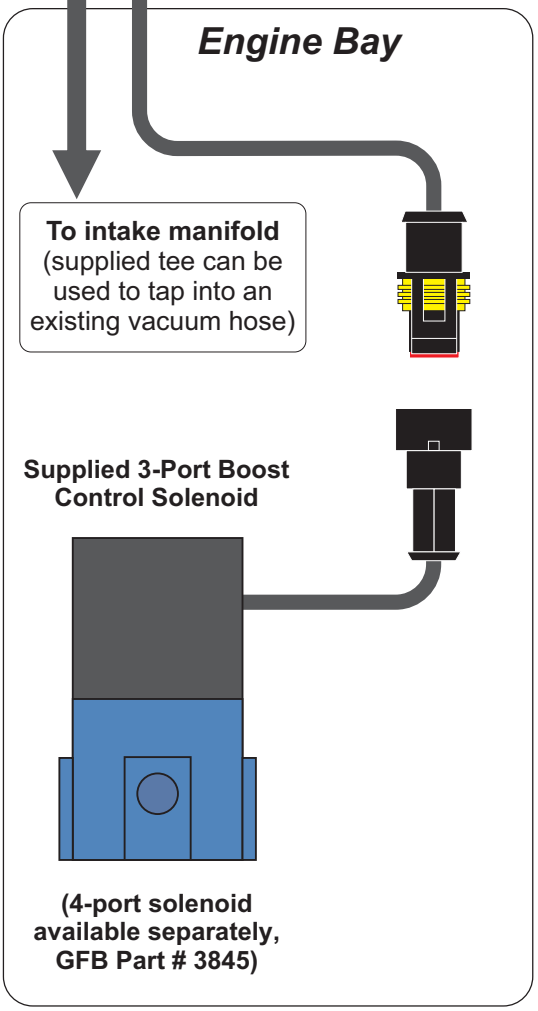
It is ***not recommended*** to use the G-Force III in the following cases:

- **Variable geometry turbochargers (VGT/VNT)**
- **Vacuum referenced or electronic wastegate actuators**
- **Vehicles with 24V power systems**
- **Vehicles where the G-Force III head unit will get wet**
- **”Draw through” turbo systems where the fuel/air mixture passes through the turbocharger compressor**

Vehicle Interior



Engine Bay



WARNING

DO NOT connect the blue or yellow wire to a 12V source.

Ensure the head unit does not share power or ground with high-current systems.

Keep the head unit and wiring away from potential sources of RF or electrical interference, e.g. radio antennae, heavy gauge wiring that carry large electrical loads etc.

The G-Force III is intended for use on 12V systems only, it is NOT for use with 24V systems.

Ensure wiring is protected from heat, vibration, and abrasion.

Input 1 (blue wire) can be used as a remote trigger simply by connecting it to any kind of switch, button, or programmable ECU output that grounds the blue wire to the vehicle earth when activated. For ideas on different ways to use this feature, see page 17. Once connected, the function of Input 1 must be configured within the **"In.1"** sub-menu (see page 14).

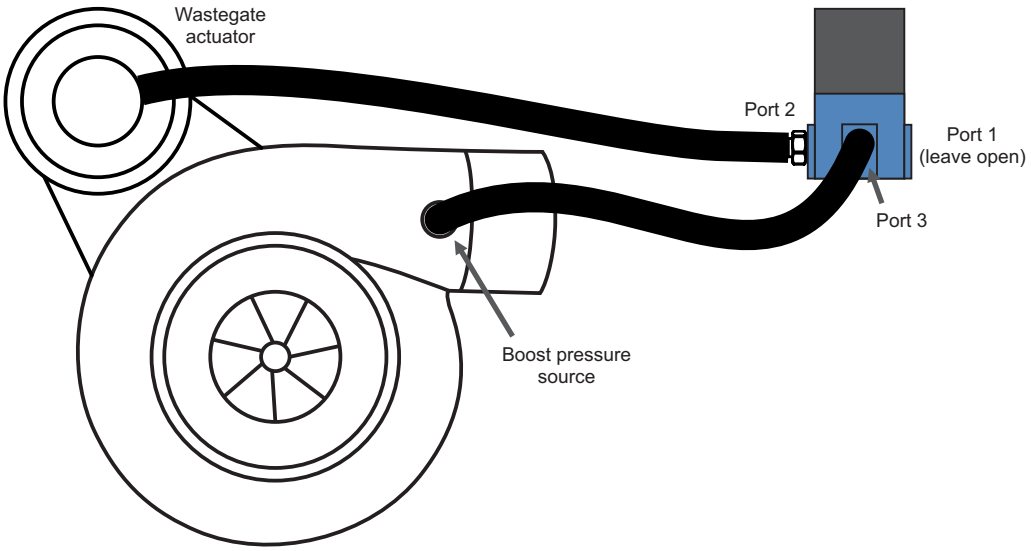
Input 2 (yellow wire) may be connected to an external Wideband O2 control module/sensor (not supplied). Connect the yellow wire directly to your wideband controller's auxiliary 0-5V analogue output, then configure using the **"In.2"** sub-menu (see page 14). We recommended that the same ground location is used for the G-Force and wideband controller for accurate results.

If either the blue or yellow wire are not used, simply cut or bundle them and make sure they are insulated.

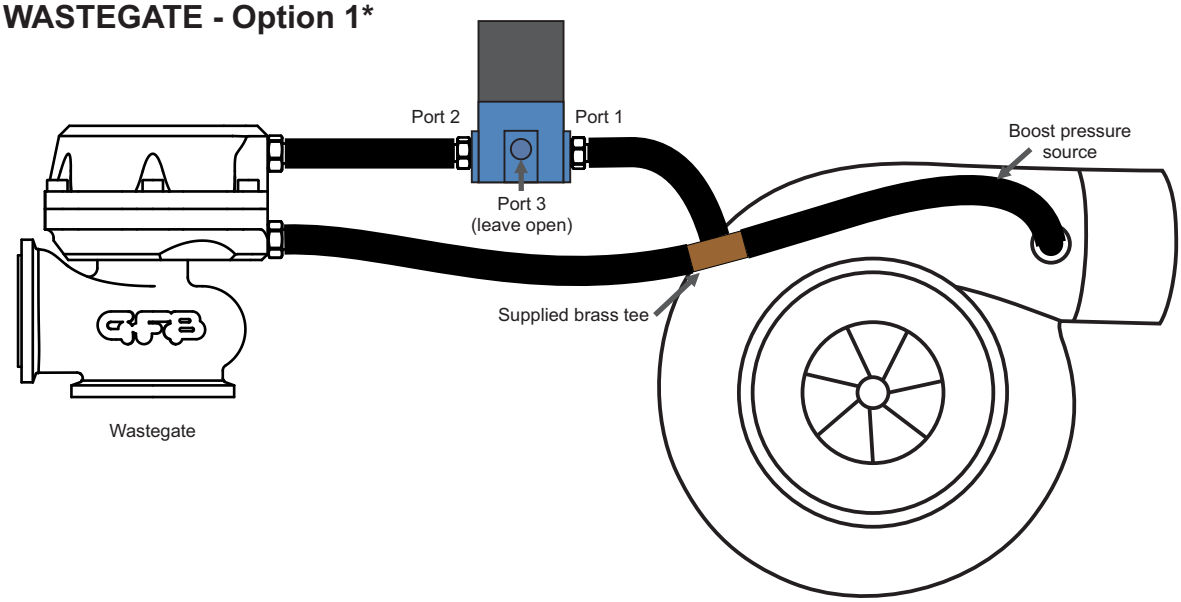
GFB GO FAST BITS

SOLENOID VALVE INSTALLATION

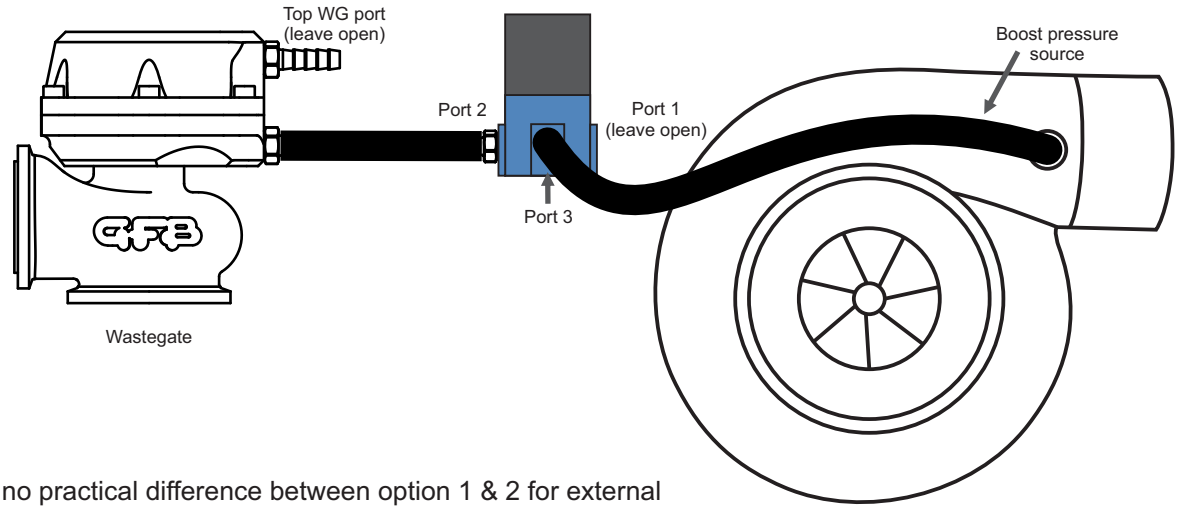
INTERNAL WASTEGATE



EXTERNAL WASTEGATE - Option 1*

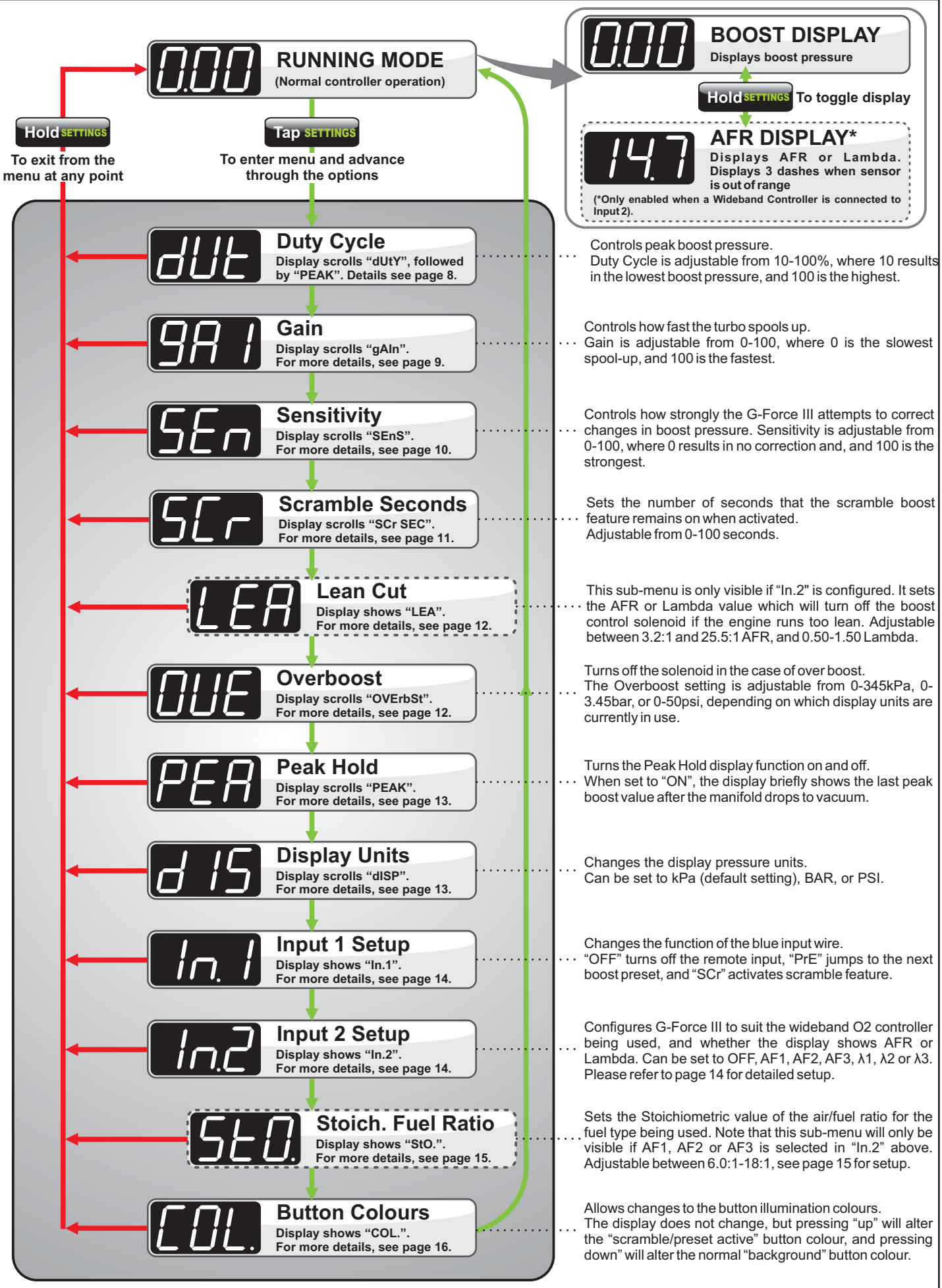


EXTERNAL WASTEGATE - Option 2*



* Note there is no practical difference between option 1 & 2 for external wastegate connection, boost control will be exactly the same in either case.

MENU STRUCTURE



GFB GO FAST BITS

BOOST PRESETS

The G-Force III has 6 boost presets (P1-6), each of which can be individually programmed and accessed quickly on-the-fly using either the “PRESET” button on the G-Force III, or remotely by using the “Input 1" wire connected to a push button switch.

There is an additional preset called “SCr”, which is the preset that is activated when the scramble feature is used. See page 11 for more info on the scramble boost feature. “SCr” can be set up and used just like any other preset, so effectively there are actually 7 presets in total.

Whilst 7 presets may be more than most people will use, there are a number of ways they can be utilized to further fine-tune your boost to suit whatever it is you plan to do with your car, whether it be for street, drag, circuit, or drift. See the suggestions listed on page 17 for ideas on different ways the boost presets (and other features) can be used.

Each boost preset consists of 3 adjustments that can be used to tailor the boost characteristics:

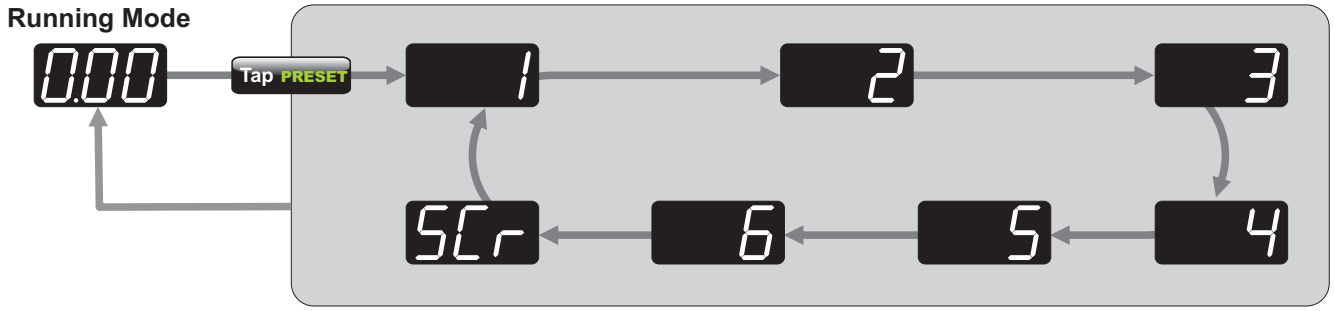
- **Duty cycle** - controls peak boost pressure
- **Gain** - controls how fast the boost rises
- **Sensitivity** - controls the strength of the closed-loop correction – i.e. how strongly the controller attempts to correct boost pressure changes and taper

Note that it is not necessary to set or use Gain and Sensitivity to set the boost pressure - for simplicity, boost can be controlled only by Duty Cycle if so desired. Usually, a well-matched turbo/wastegate/engine will respond very well with only Duty Cycle adjustments, however these features are helpful when your goal is to extract the most out of your turbo system.

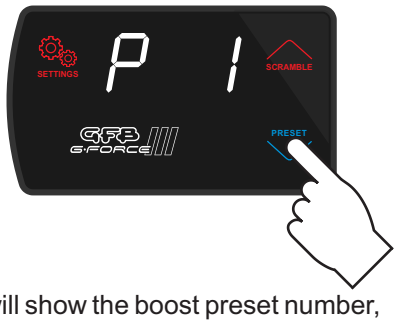
For best results, these three adjustments should be made in the order listed above, as each correction builds on the previous one.

To select boost presets:

From **Running Mode**, tap the PRESET button (or the remote input 1 if installed and configured, see page 3 and 14 for details) to sequentially scroll through the boost presets from 1-SCr, as shown below:



Whenever the PRESET button or remote trigger is used to change the preset, the PRESET button momentarily changes colour as an additional visual indication that a preset change has occurred. The colour that the button changes to can be set in the COL (Colour) menu (see page 16).



Whenever the manifold is in vacuum and a new boost preset is selected, the display will show the boost preset number, followed by the target boost pressure associated with that preset before returning to Running Mode after a few seconds:

If the manifold is in boost, the display stays as a boost gauge, but the PRESET button still changes colour to indicate a preset change.

DUTY CYCLE

To protect your engine it is HIGHLY recommended that you first set up the OVERBOOST feature (see page 12 for more information).

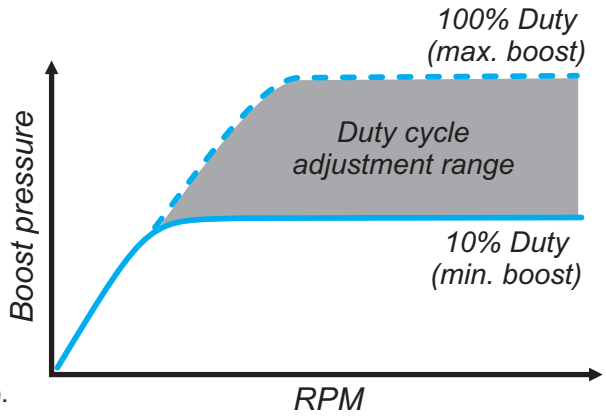
OVERBOOST is a "global" setting intended to prevent engine damage in the event of incorrect or accidental adjustment. The G-Force III will reduce boost to the lowest setting should the overboost limit be exceeded.

The factory default setting is 100kPa (1 bar, 14.5psi).

The duty cycle setting controls the peak boost pressure, and is adjustable from 10-100%, where 10 represents the *lowest* possible boost pressure your turbo system is capable of running (commonly referred to as "base" or "wastegate" pressure), and 100 represents the *highest.*

See page 19 for a detailed description of how duty cycle works.

The duty cycle must be increased carefully and incrementally until you arrive at your desired boost pressure. Large adjustments can potentially damage your engine.



1. Select the boost preset that you want to adjust (see page 7).
2. Tap "SETTINGS" once to navigate to "Duty Cycle" - the screen will scroll "DUtY", followed by the current duty cycle setting, then "PEAK", followed by the current peak boost recorded for that duty cycle setting. **DO NOT EXIT the menu until the boost setup process is complete.**
3. Tap the up/down buttons to adjust the duty cycle setting - it is safest to start at 10 so you can see your car's minimum boost pressure, and make adjustments from there. **NOTE:** whenever you make adjustments to the duty cycle, the "PEAK" boost value will clear to 0.
4. Perform a full throttle pull to record the peak boost, **ensuring all applicable road rules are adhered to**. You do not need to go to redline, but do make sure you pass through the engine's peak torque RPM in the highest gear practical to ensure the controller records the true peak boost - you can do this as many times as you like until you're sure you've recorded the true peak boost.
5. After lifting off the throttle, the display will show the duty cycle followed by the peak boost. If the peak boost is lower than your desired target, adjust the duty cycle then drive the car again to record the new peak boost.
6. Continue to make adjustments until you achieve your desired target boost. Do NOT make any further duty cycle adjustments or the peak value will reset to 0.
7. Tap "SETTINGS" to move on to GAIN, or hold "SETTINGS" to exit. The duty cycle setting and peak boost will be saved to the boost preset that you are currently in. The G-Force III will use these stored values for the GAIN and SENSITIVITY features. If the peak boost is 0, the GAIN and SENSITIVITY functions will not work and boost control will be open-loop.
8. Repeat this procedure for any other boost presets you may wish to set up.

NOTES:

- 10% duty cycle represents the lowest possible boost pressure your engine/turbo can achieve. The only way to reduce boost further is to change the wastegate spring. Similarly, above approximately 95% duty the wastegate is being held completely shut and the resulting boost is as high as your turbo system will allow.
- It is not unusual for duty cycle values up to 20% to make little change to the boost pressure, because the solenoid valve response is non-linear. That is why the minimum duty cycle in all boost presets is 10%. You may find it necessary to adjust duty as high as 25% before you start to notice an increase in boost pressure - this is completely normal.
- The higher the required duty cycle to achieve your target boost, the harder boost is to control - it is more likely that boost will taper at high RPM and vary more according to atmospheric conditions with duty cycles in the upper end of the range.
- For the reason above, it is best practice to configure your wastegate spring so it achieves a base boost pressure as close as possible to your intended minimum boost setting, then use duty cycle to achieve your high boost setting.

GFB GO FAST BITS

GAIN

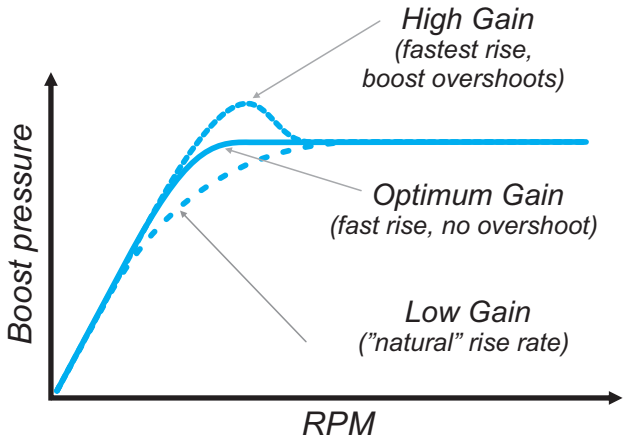
The Gain setting can help spool up the turbo faster by holding the wastegate closed until boost pressure is closer to the target boost.

NOTE: the Gain setting requires a peak "target" boost to be set up in the Duty Cycle menu (page 8). If you adjust Duty Cycle without performing a boost run, the target boost will be 0 and the Gain function will not be operational.

Gain is adjustable from 0-100, where a setting of 0 is the "natural" rise rate of the turbo system, and a setting of 100 will attempt to make boost rise ***as fast as the turbo system is capable of*** by delaying the opening of the wastegate until the target boost is met.

It may then be tempting to assume that gain should simply be set to 100 for fastest possible spool-up, but in practice this will result in an overshoot (boost spike). The wastegate needs a certain amount of time to open, so the Gain function must be set to less than 100 if boost overshoot is to be avoided.

Every turbo system is different, and some will handle more gain without noticeable spiking, whilst others may require a lower setting. The Gain setting is optimized when boost pressure rises as fast as possible without overshoot.



1. Make sure duty cycle has first been set and a peak "target" boost recorded, as per page 8.

2. Select the boost preset that you want to adjust (see page 7), then navigate to the "Gain" menu (tap "SETTINGS" twice from Running Mode) – the screen will scroll "gAIn", followed by the current gain setting (default is 0).

3. With gain set to 0, drive the car in such a way that the boost pressure rises as fast as possible – this is usually done by accelerating gently to the RPM at which your engine makes peak power, then flooring the throttle.

4. Increase the gain setting by 20 using the "UP" button, then drive the car again in the same way.

5. Note how the boost spool-up rate changes, and continue to increase the gain setting to achieve the desired boost response. If you notice that boost starts to overshoot, reduce Gain until boost pressure hits the target consistently without overshooting.

6. When finished, tap "SETTINGS" to move on to Sensitivity, or hold "SETTINGS" to exit. The Gain setting will be saved to the boost preset that you are currently in.

7. Repeat this procedure for any other boost presets you may wish to set up.

NOTE: the Gain function is automatically disabled when adjusting Duty Cycle. This prevents high Gain settings from causing incorrect peak boost readings from spikes, however the Gain setting will be reactivated when you return to Running Mode.

You may find it necessary to re-adjust the Gain setting after changing the boost pressure.

SENSITIVTY

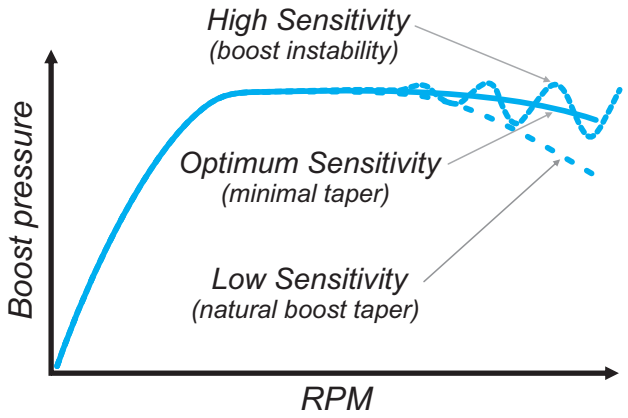
The Sensitivity setting controls a closed-loop correction factor that attempts to correct any difference between the actual boost and the target boost pressure. This is useful on a smaller turbo that tends to drop boost pressure at high RPM (i.e. boost taper), and can also help pull boost pressure up to the target when it is rising very slowly (such as when accelerating in a high gear at low RPM).

NOTE: the Sensitivity setting requires a peak "target" boost to be set up in the Duty Cycle menu (page 8). If you adjust duty cycle without performing a boost run, the target boost will be 0 and Sensitivity will not perform closed-loop corrections.

The Sensitivity feature is adjustable between 0-100, where 0 results in no closed-loop correction at all, and 100 is the strongest correction possible.

If the setting is too high, the boost pressure might start to become unstable, where it "hunts" up and down, so this is another setting that should be tested experimentally to find what works best for your turbo.

If you notice that boost pressure falls away at high RPM and you want to try to correct this behaviour, follow the steps below:



1. Make sure Duty Cycle has first been adjusted and peak boost set, as per page 8. It is not necessary to set gain for sensitivity to work, but if you do plan to use gain you should set it before adjusting sensitivity.

2. Select the boost preset that you want to adjust (see page 7), then navigate to the "Sensitivity" menu (tap "SETTINGS" three times from Running Mode) – the screen will scroll "SEnS", followed by the current Sensitivity setting (default is 0).

3. Drive the car in such a way that the boost pressure falls off at high RPM, and take note of the highest pressure drop and the RPM, e.g. boost falls from 18psi at 5000RPM to 15psi by 7000RPM.

4. Now increase the Sensitivity setting using the up/down buttons, then drive the car again in the same way.

5. Note how the boost taper rate changes, and continue to adjust the Sensitivity setting to achieve the desired result. If you notice that boost starts to become unstable (i.e. oscillates up and down rapidly), reduce the sensitivity setting until stable boost pressure is achieved. It may not always be possible to completely eliminate boost taper depending on how severe it is, but this setting will at least ensure that everything the turbo system is capable of is being delivered.

6. When done, tap "SETTINGS" to move on to the next menu item, or hold "SETTINGS" to exit. The Sensitivity setting will be saved to the boost preset that you are currently in.

7. Repeat this procedure for any other boost memories you may wish to set up.

NOTE: the Sensitivity function is automatically turned off when making boost pressure adjustments (in the Duty Cycle menu) so it does not interfere, however it will be reactivated when you return to Running Mode.

There are limits to what the G-Force III can do with the turbo and wastegate – if the duty cycle setting is already quite high, there is not much adjustment left for the controller to make if boost drops off – once the closed-loop corrections reach 100% duty cycle, there's nothing more the controller can do as this is the limit of the turbo system.

Because of this, it may not always be possible to completely eliminate boost taper, although it should be able to be reduced at the very least. Two typical scenarios where boost taper occurs are with small factory turbos attempting to run high boost, and/or when the peak boost pressure is more than double the wastegate's "base" pressure.

Keep in mind that attempting to force a small factory turbo to make high boost at high RPM can potentially increase the exhaust backpressure, charge temperature, and turbo shaft speed without making any significant improvement in power. The only solution when you reach this point is to upgrade to a larger turbo, different wastegate spring, or both.

SCRAMBLE BOOST

Scramble boost is a feature that allows you to increase or decrease boost pressure for a certain amount of time by clicking a remote-mounted button or switch (see page 3 for details on how to wire up a remote button/switch), or the "SCRAMBLE" button on the G-Force's screen. This feature may be useful in the following example situations:

- In a drag race, the Scramble feature could be set up to allow the car to launch on a low boost setting to maintain traction off the line, then activate a high boost setting further down the track either manually by pressing a steering wheel-mounted button or automatically using the Scramble timer.
- In circuit racing, Scramble could be used as a "push-to-pass" system, where a little extra boost pressure could help during overtaking, but is not desired throughout the entire race for the longevity of the engine.
- In a high-powered car it might be desirable to run lower boost for better drivability, civilised behaviour on the street or better fuel economy, then use Scramble when full power is needed.
- Use Scramble to LOWER boost pressure to safe-guard the engine, such as when a water spray or water/meth injection tank is empty, or the ambient temperature is very high - this could even be set up to be automatic if connected to a sensor or warning output.

The G-Force III uses a unique approach to Scramble where it jumps to a dedicated Scramble boost preset when activated, instead of simply adding extra boost. This method offers much more flexibility in how it can be used because you can tailor the duty cycle, gain, and closed-loop correction specifically to suit the purpose that you intend to use this feature for. In this way, you can raise OR lower boost pressure, as well as change the spool-up rate and closed-loop correction, which cannot be done with traditional scramble methods.

Setting up Scramble:

When activated, the Scramble feature jumps from whatever boost preset you are currently in to the boost preset called "SCr". Therefore, you need to set the desired Duty Cycle, Gain, and Sensitivity parameters that you want when Scramble is activated. To do this, you simply set up the boost preset called "SCr" just as you would for any of the other 6 boost presets (see pages 7-10).

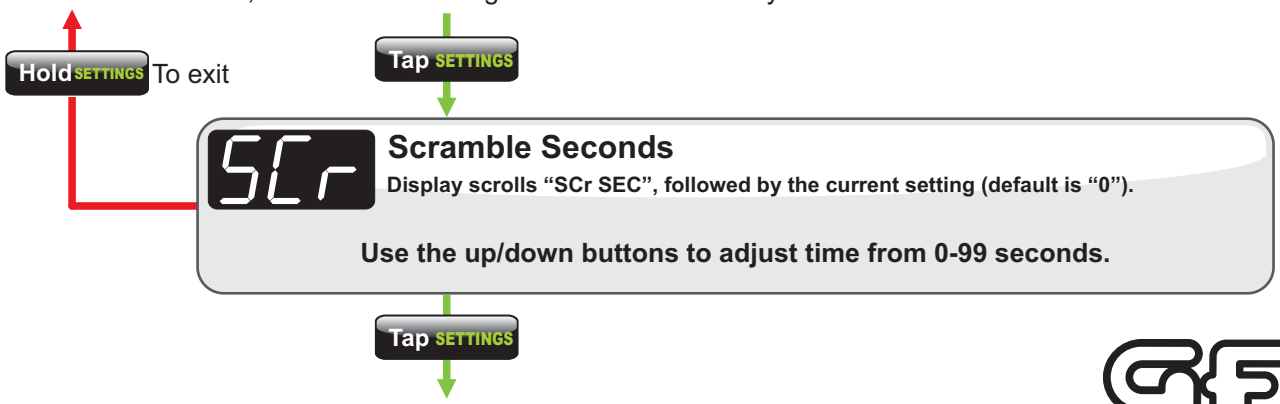
In the Scramble setting, you adjust the number of seconds that scramble remains active after the button or trigger is released.

Navigate to the Scramble setting (display shows "SCr", which then scrolls "SCr. SEC") using the "SETTINGS" button, then use the up/down buttons to adjust the scramble time. This setting is adjustable from 0-99 seconds (default is 0). When 0 is selected, the Scramble feature is inactive.

Using the Scramble feature:

Once the SCr boost preset and Scramble Seconds are set up, you can activate the Scramble feature at any time by tapping the "SCRAMBLE" button, or grounding the remote input (see below). The "SCRAMBLE" button will change colour (you can alter the colour that it changes to in the **Colour** menu, see page 16) and Scramble will activate immediately. The scramble timer however will only start when you *release* the button. The button will remain lit in a different colour to indicate that Scramble is active until the timer finishes.

If you want to activate Scramble using a remote-mounted button, switch, ECU output etc, you need to first connect the blue "Input 1" wire to the button/switch/ECU output you want to use (see page 3 for wiring diagram), then set "Input 1" to "SCr" (see page 14, "Input Setup"). Once you have done this, the remote input will replicate the function of the "SCRAMBLE" button, which will also change colour in the same way to indicate when the Scramble function is active.



GFB GO FAST BITS

LEAN CUTOUT

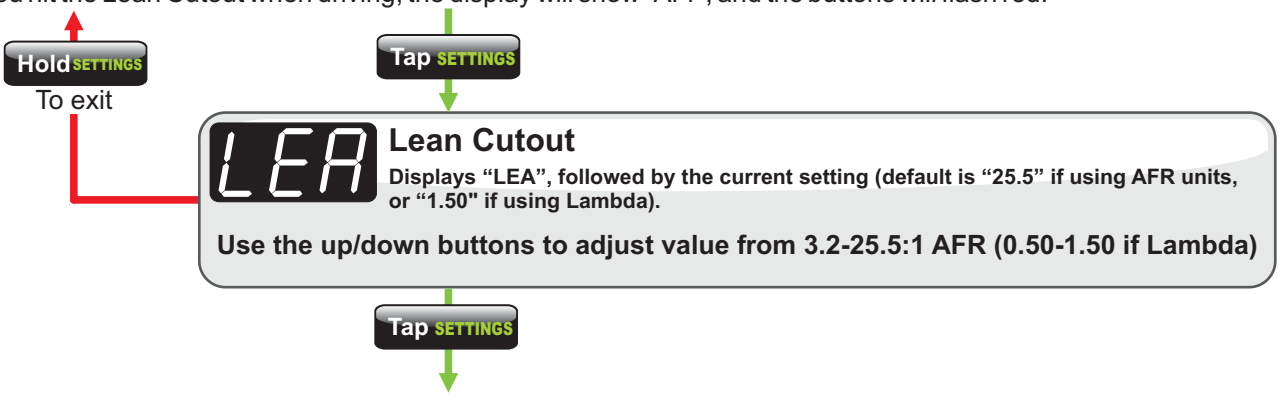
Lean Cutout (when enabled through Input 2 setup, page 14) is a safety feature which will instantaneously switch off the boost control solenoid to lower boost pressure to protect the engine if it runs leaner than this user-adjustable AFR value AND the boost pressure is greater than 80% of your peak "target" boost. For this feature to work correctly, you need to ensure you have recorded a peak "target" boost in the Duty Cycle menu (see page 8).

Lean Cutout is a global setting, and once set up will function in all presets regardless of whether the display is showing boost or air/fuel ratio.

This setting appears in the same units as what you set the AFR gauge to (see page 14, "In.2" setting). If you have chosen AFR, the Lean Cutout value can be adjusted between 3.2:1 and 25.5:1. If you are using Lambda, the Lean Cutout value is adjustable between 0.50 and 1.50.

Note the default setting is 25.5 AFR/1.5 Lambda, which effectively turns this function off. This Lean Cutout value should be lowered to just above the maximum air/fuel ratio you expect to see when the car is at full boost.

If you hit the Lean Cutout when driving, the display will show "AFr", and the buttons will flash red.



OVERBOOST

Overboost is a safety feature that will turn off the solenoid if the boost pressure exceeds the limit set in this menu option. This will help prevent damage to the engine if an accidental or incorrect adjustment is made to the controller, which is particularly helpful during boost setup.

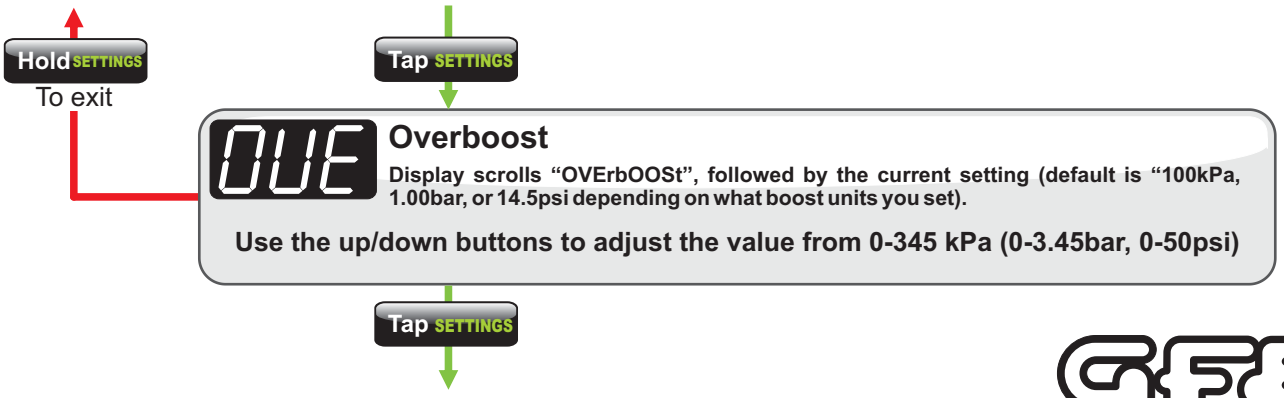
This is a "global" controller setting, and is shown in the same pressure units as the display. It functions the same for every boost memory regardless of whether the gauge is showing boost or air/fuel ratio.
The factory default value for Overboost is 100kPa (1bar, or 14.5psi). Overboost is adjustable between 0 - 345 kPa (0 - 3.45 bar, 0 - 50 psi). If you do not want to use this feature, simply set it to the maximum boost pressure.

It is strongly advised that Overboost is set BEFORE making boost pressure adjustments. You should choose a maximum limit slightly above your intended peak boost pressure so it doesn't trigger prematurely with small boost fluctuations. Typically, a good setting for Overboost is 10% higher than your peak target boost.

NOTE: The Overboost feature CANNOT protect against a boost overshoot caused by a stuck wastegate or popped wastegate/solenoid hose connection, since these kinds of failures are outside of the G-Force III's control.

If you hit the Overboost function when driving, the display will show "Cut", and the buttons will flash red.

- From **Running Mode,** use the "SETTINGS" button to navigate to the **Overboost** setting (display scrolls "OVEr bSt")
- Use the "UP/DOWN" buttons to adjust the value
- Tap "SETTINGS" to save and move to the next menu item, or hold "SETTINGS" to save and exit to **Running Mode**



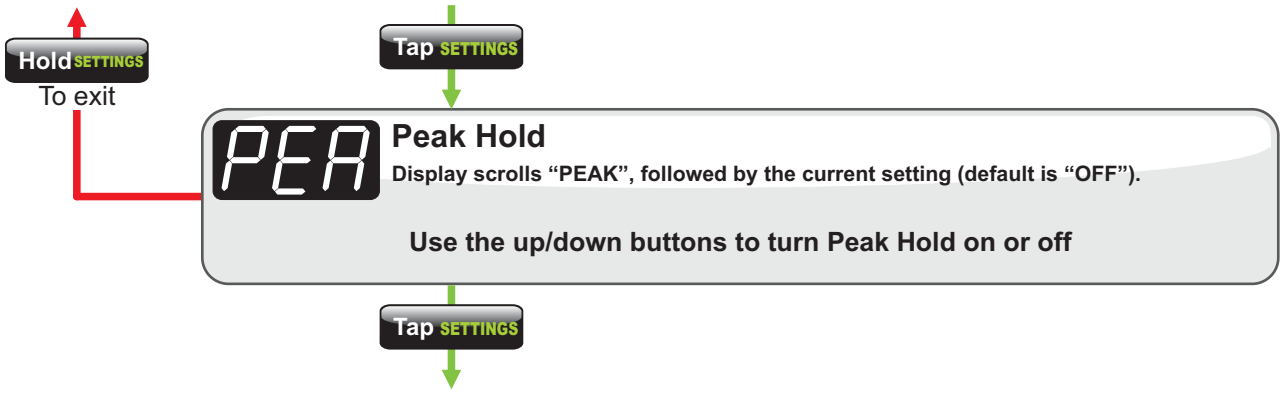
PEAK HOLD

The **Peak Hold** function (when activated in the menu) will momentarily display the highest boost pressure recorded during a boost run, and the display is set to show boost pressure (not during AFR display).

Whenever the manifold starts to see positive boost pressure, **Peak Hold** will begin recording and will displayed the highest achieved value for 3 seconds as soon as the manifold drops back into vacuum. Each time the manifold goes into boost, **Peak Hold** is cleared and it starts recording again.

Peak Hold can be set to "ON" or "OFF".

- From **Running Mode,** use the "SETTINGS" button to navigate to the **Peak Hold** setting (display scrolls "PEAK")
- Use the "UP/DOWN" buttons to toggle it on or off
- Tap "SETTINGS" to save and move to the next menu item, or hold "SETTINGS" to save and exit to **Running Mode**

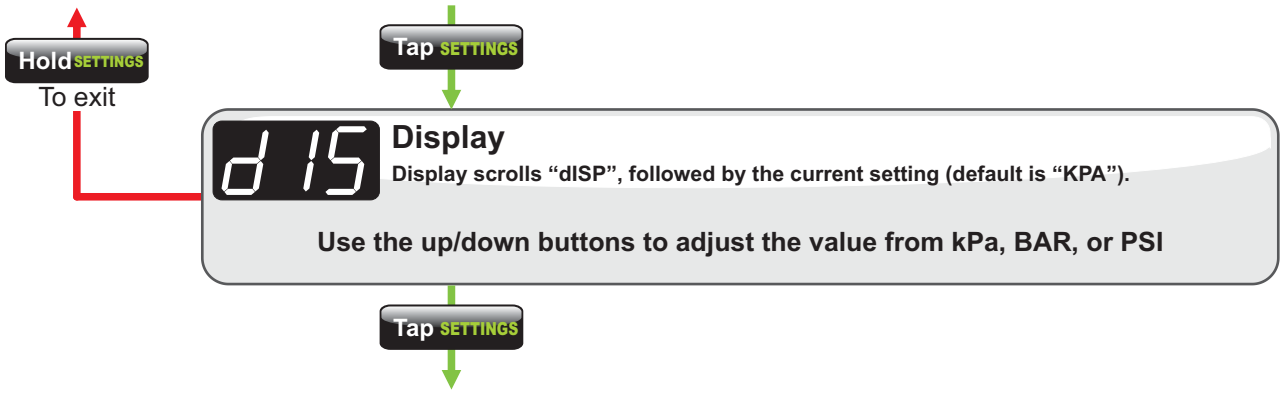


DISPLAY SETTINGS - UNITS OF PRESSURE

Display allows you to configure the boost gauge display to read boost pressure in kPa (default), BAR or PSI.

Note that when PSI is selected, vacuum is displayed in inHg (inches mercury), which is the same as found on most psi unit boost gauges.

- From **Running Mode,** use the "SETTINGS" button to navigate to the **Display** setting (display scrolls "dISP")
- Use the "UP/DOWN" buttons to select from "KPA" (default), "BAR" or "PSI"
- Tap "SETTINGS" to save and move to the next menu item, or hold "SETTINGS" to save and exit to **Running Mode**



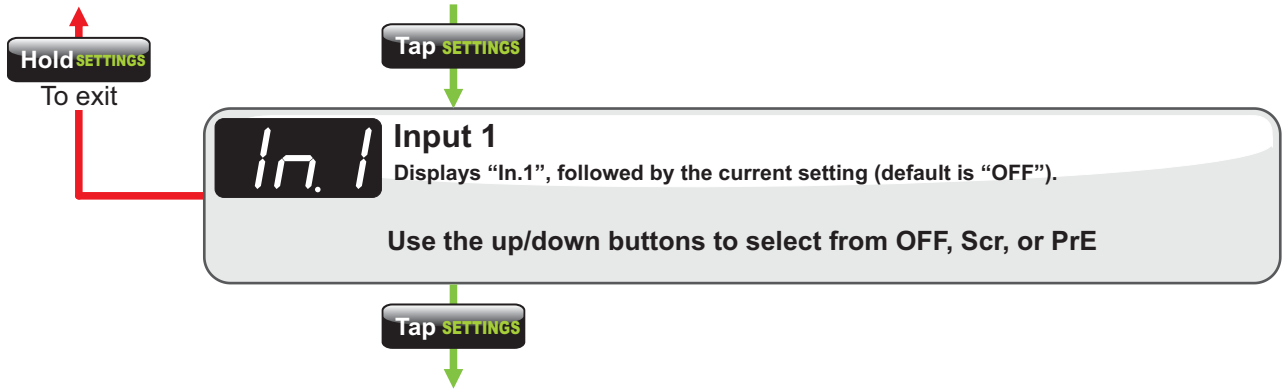
INPUT 1 SETUP - EXTERNAL TRIGGER

Input 1 Setup allows you to configure the purpose of the external input 1 (blue wire). For information on how to connect external input 1 to a button or switch, see the wiring diagram on page 3.

There are three modes for this input:

- **OFF** - no action
- **SCr** - the scramble feature is activated when the external input is triggered
- **PrE** - scrolls sequentially through the boost pressure memories when triggered (in the same way as pressing the "down" button in running mode)

- From **Running Mode,** use the "SETTINGS" button to navigate to the **Input 1** setting (displays "In.1")
- Use the "UP/DOWN" buttons to select from "OFF" (default), SCr, or PrE
- Tap "SETTINGS" to save and move to the next menu item, or hold "SETTINGS" to save and exit to **Running Mode**



INPUT 2 SETUP - WIDEBAND AFR

Input 2 Setup configures the external input 2 (yellow wire, see page 3) to a third party wideband AFR module, and also allows you to choose whether the gauge shows AFR units or Lambda. Please note that different brands of wideband modules output different analogue voltage ranges - some are configurable, others are fixed. The G-Force III has 3 different presets to suit the more popular wideband modules on the market.

Select your preferred units and the corresponding wideband module you are using from the following list:

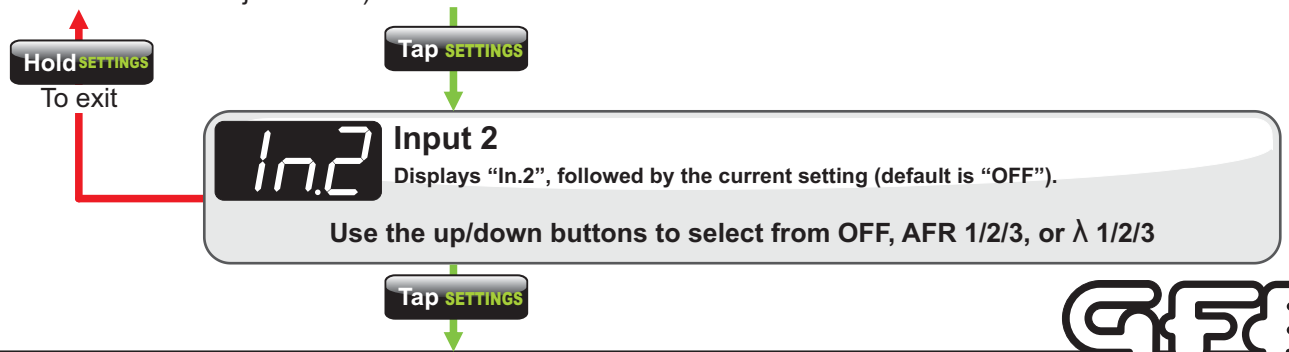
- **OFF** - no action, disables the external wideband AFR module (menu item "Lean Cutout" will not be visible).
- **AF1** - Innovate LC1/LC2 wideband module, displaying Air/Fuel Ratio (0V=7.3AFR, 4.5V=20.8AFR)
- **AF2** - AEM X-Series inline and gauge wideband module, displaying Air/Fuel Ratio (0.5V=8.5AFR, 4.5V=18AFR)
- **AF3** - AEM UEGO, PLX SM-AFR, APSX, 14point7, or other** module, displaying AFR (0V=10AFR, 4.5V=19AFR)
- **λ1** - Innovate LC1/LC2 wideband module, displaying Lambda (0V=0.50λ, 4.5V=1.42λ)
- **λ2** - AEM X-Series inline and gauge wideband module, displaying Lambda (0.5V=0.58λ, 4.5V=1.23λ)
- **λ3** - AEM UEGO, PLX SM-AFR, APSX, 14point7, or other** module, displaying Lambda (0V=0.68λ, 4.5V=1.29λ)

- From **Running Mode,** use the "SETTINGS" button to navigate to the **Input 2** setting (displays "In.2")
- Use the "UP/DOWN" buttons to select from "OFF" (default), AFr1, AFr2, Afr3, λ1, λ2 or λ3
- Tap "SETTINGS" to save and move to the next menu item, or hold "SETTINGS" to save and exit to **Running Mode**

NOTE: If you are running a Flex Fuel Sensor, we recommend using Lambda and not AFR.

** When running an unlisted wideband module with a configurable analogue output, use Af3 or λ3 and calibrate the output voltage range to the following: 0V=0.68 lambda/10 AFR, and4.5V=1.29 lambda/19 AFR.

The G-Force III display will show 3 dashes (---) when the sensor is warming up or if the AFR is off the scale (i.e. during deceleration when the injectors cut).



GFB GO FAST BITS

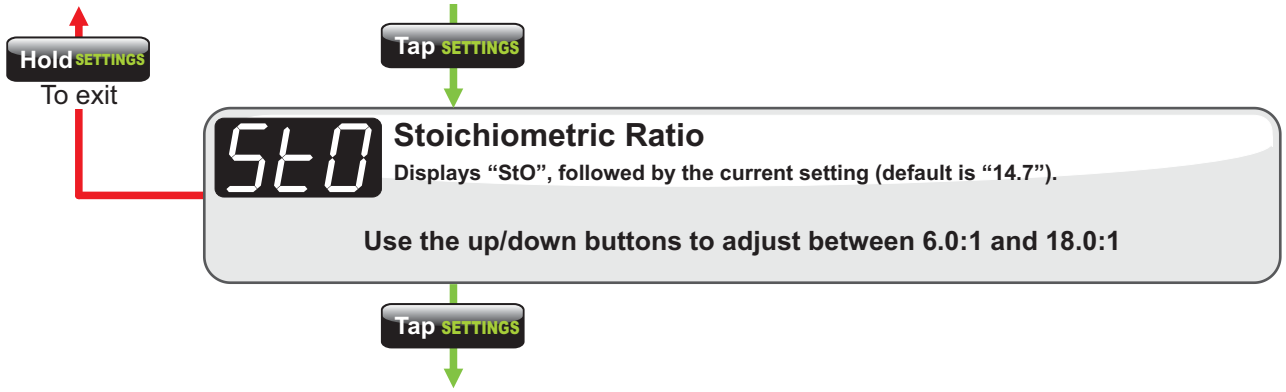
STOICHIOMETRIC RATIO

Stoichiometric Ratio setting requires you to configure the G-Force III to the specific fuel you are using. By default, we have configured this setting to 14.7:1 for regular gasoline. If you do not make the correct changes to the stoichiometric ratio for the fuel type you are running, the display gauge will be inaccurate.

Here is a basic list of stoichiometric ratios of commonly used fuels:

Unleaded Gasoline:	14.7:1
Diesel:	14.6:1
Compressed Natural Gas:	17.2:1
Liquid Propane (LPG):	15.6:1
85% Ethanol (E85):	9.8:1
100% Ethanol (ETOH):	9.0:1
Methanol (MEOH):	6.5:1

NOTE: The Stoichiometric Ratio setting will only be shown in the menu if you have selected Af1, Af2, or Af3 in the Input 2 setup of the previous step.

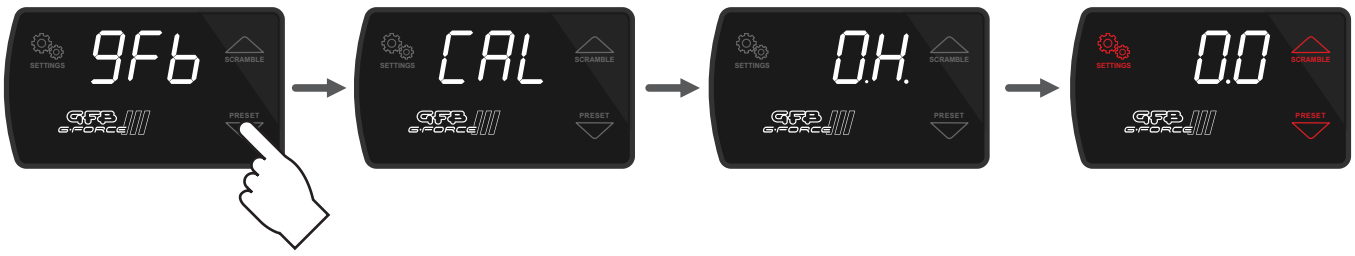


BOOST GAUGE CALIBRATION

Boost Gauge Calibration is a feature that is not accessed via the menu. It is only to be used if the boost gauge display does not read zero with the engine off. If your gauge is not reading zero with the engine off, you will most likely not be able to access the menu and the buttons may appear "dead" and non functional

To re-zero the boost gauge:

- Turn the ignition off
- Turn the ignition on, but DO NOT START THE ENGINE
- When the display starts to show "gFb", press and hold the down button
- When the display shows "CAL", you can release the down button
- The display will now show "OH." (i.e. "OK") to indicate a successful calibration
- The G-Force III is now functional and the gauge will read zero



COLOUR SETTINGS

Colour allows you to configure the button colours - both the normal “background” colour (i.e. when not pressed), and also the “feature active” colour, which is the colour a button turns when either scramble or preset features are activated (see pages 7 and 11).

There are seven options available:

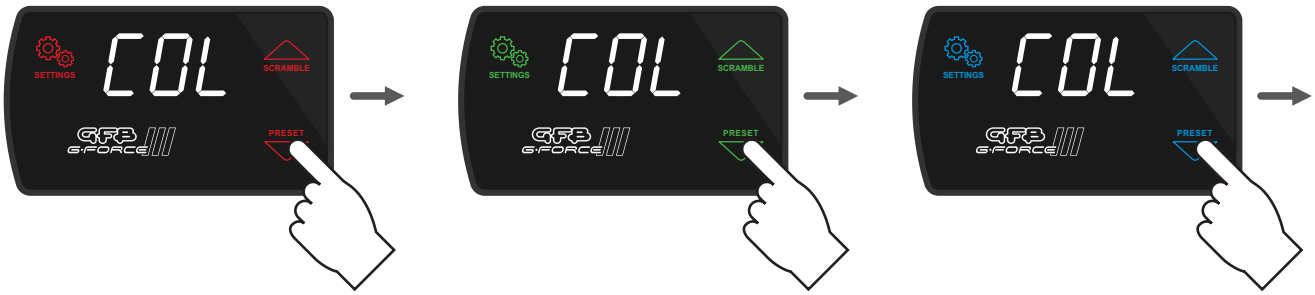
- Red
- Green
- Blue
- Aqua (green/blue)
- Purple (red/blue)
- Yellow (green/red)
- Off (no light)

“Off” is provided as an option, which could be used for example if you don’t want the buttons lit at night, but still want a visual indication when scramble is activated.

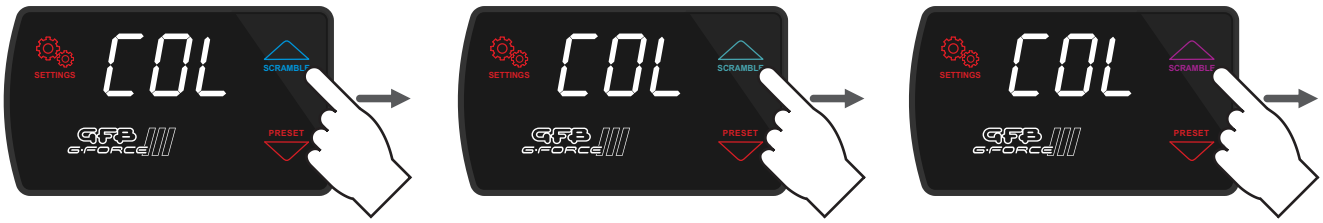
Within the **Colour** menu, tap “DOWN” to scroll through the “background” colour options - you will see the buttons change colour as you do this - the display screen will not change.

Tap “UP” to scroll through the “active” colour options - you will see the button you are tapping briefly change colour, indicating what the buttons will change to when activated.

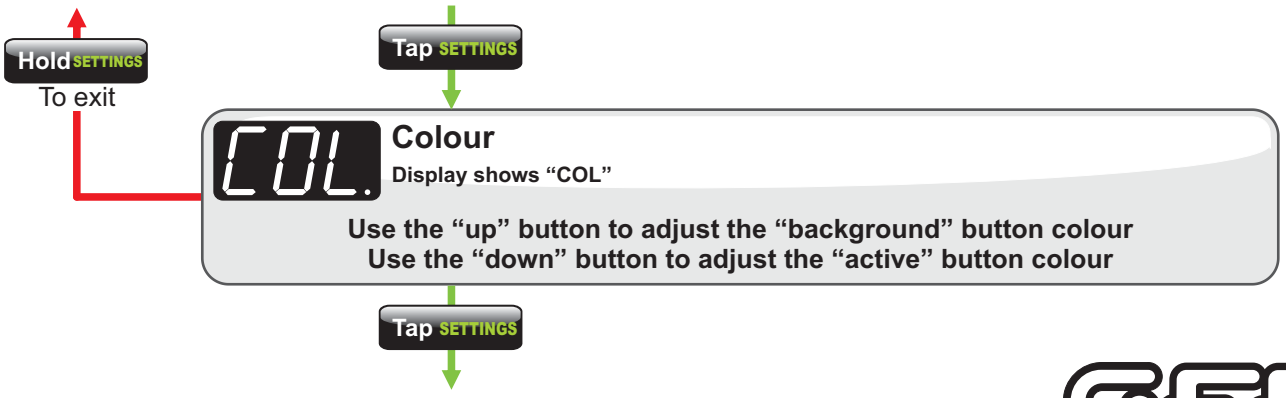
Example 1: Changing “background” colours



Example 1: Changing “feature active” colours



- From **Running Mode,** use the “SETTINGS” button to navigate to the **Colour** setting (display shows “COL”)
- Use the “UP/DOWN” buttons to make your selection as described above
- Tap “SETTINGS” to save and move to the next menu item, or hold “SETTINGS” to save and exit to **Running Mode**



TIPS

Here are some handy suggestions for different ways you can set up and use the features on your G-Force III.

If you set the “IN.1” menu item to “SCr” (scramble), then you can use the blue external input wire to trigger scramble in a variety of different ways to achieve different outcomes.

For example, you can connect the external input wire to:

- Steering wheel button - easy access to use as a “push-to-pass” system. You can drive normally on low boost and access high boot immediately when required (or when you have traction). If you set the scramble seconds to 0, it will return to low boost as soon as the button is released, or you can have it time out after a few seconds.
- Throttle switch - using a micro-switch on the throttle pedal (like a “kick-down” switch), or a configured output from an aftermarket ECU, you can make the scramble feature activate when the throttle is floored, for an “automatic” version of “push-to-pass” - i.e. you get high boost when you need it simply by flooring the throttle.
- Brake/handbrake switch - you can activate high boost after a certain amount of time has passed during a drag race to aid traction off the line. In this case, you would set the scramble boost preset to a lower boost setting for launch, and set the scramble seconds to whatever time you want to engage the high boost setting (i.e. when scramble times out). So when you are staging, the brake pedal/handbrake is held and scramble is active on a low boost preset. When the brake is released and the run begins, the scramble timer starts and will turn off after the chosen amount of time, reverting back to the original (high) boost preset.
- Toggle switch - use a toggle (on/off) switch instead of a momentary button (press and release) to keep scramble activated as long as the switch is on. This method gives you easy high/low boost selection, perhaps useful if you need to fill the car with low octane fuel and the toggle switch gives you a good visual reminder that you’re in low boost.
- Warning light or programmable output from ECU - if you have other warning devices such as a knock light, low water level (for water injection/intercooler spray), high intake air/water/oil/transmission temperature, you could use such a warning light or programmable ECU output to activate scramble to a lower boost pressure to help protect the engine.

If you set the “IN.1” menu item to “bOOSt” (boost preset selection), every time you activate the external input, the controller jumps to the next boost preset.

This can be used to set up a kind of “boost-by-gear” feature for drag racing situations. You would connect the external input to a clutch switch or gear selector switch in such a way that it triggers with each gearshift. Then, when you stage your car, manually select boost preset 1 using the buttons on the G-Force III, and then each time you shift gears after your launch, the external input on the clutch or gear selector will activate the next boost preset. Since there are 6 boost presets, you can tailor the peak boost, rise rate and taper for each gear.

TROUBLESHOOTING

The buttons appear to be locked:

If the boost gauge is currently reading higher than zero, the menu is locked out and the scramble/preset buttons do still work, but the display will not change to register a button press. If the engine is off and the gauge is still showing higher than zero, re-calibrate the gauge - see page 15.

The solenoid buzzes constantly with the ignition on when the engine isn’t running:

As above, it’s likely that the gauge is showing higher than zero, and hence the controller is attempting to regulate boost. Re-zero the gauge as per page 15. Also, hit SETTINGS once to check that the duty cycle menu shows a recorded peak boost. If peak boost is 0, your gain function isn’t working and the solenoid starts pulsing from just above zero.

With the engine off, the gauge does not show zero:

Perform a boost gauge calibration, as described on page 15.

GFB GO FAST BITS

Boost pressure remains the same regardless of the duty cycle setting:

Turn the ignition off, then on again and listen for the solenoid to click rapidly for about 1 second. If you can't hear it click on power up, check the wiring loom to the solenoid valve.

If the solenoid does click rapidly on power up, check the hose connections to the solenoid valve and wastegate - make sure the un-used solenoid valve port is not plugged, and that the boost pressure and wastegate hoses are connected to the right ports.

Check the controller is receiving full battery voltage. If it is powered from a low voltage supply, the display will work but the solenoid will not.

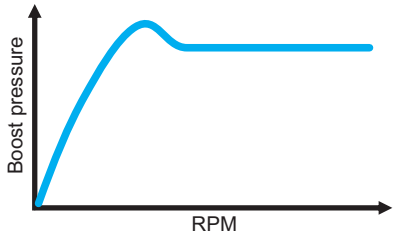
The peak boost pressure always seems to be higher than the target that was originally set:

The car may not have been driven in a way that achieved the "true" peak boost whilst duty cycle was being set up. Go back into **Duty Cycle** and either reduce the duty cycle value so that peak boost comes down to where you want it, or leave the duty cycle alone and drive the car again to learn the "true' peak boost.

Boost pressure spikes (overshoots the target):

Reduce the **Gain** setting

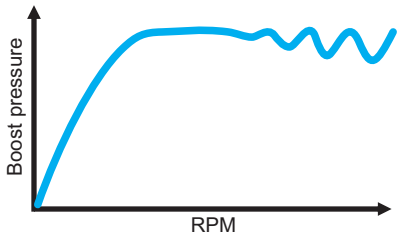
Boost spiking should not be confused with boost taper (see below). Boost taper often looks similar to spiking in low gears because the RPM increases so quickly.



Boost pressure oscillates significantly:

Reduce the **Sensitivity** setting

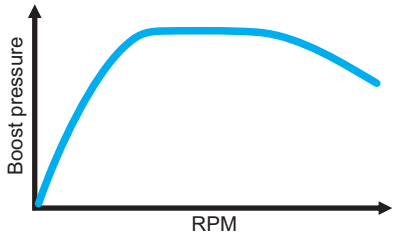
If the closed-loop taper correction is set too high, the boost may fluctuate rapidly up and down, which is a sign that the system is going "unstable". It means the correction is too strong, and whilst a weaker setting will eliminate the instability, boost will likely still drop off a little because the turbo is nearing its limits (see boost taper below).



Boost tapers off even with a high Sensitivity setting

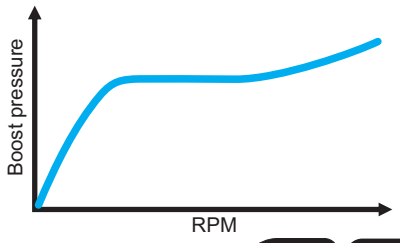
Check that the boost preset you are using has a recorded peak boost by pressing SETTINGS once to go into the duty menu, and read the peak value. If it is 0, the Sensitivity feature will not function, and a peak value should be recorded.

If a peak boost is recorded and boost is still tapering, this is a sign that the turbo system is operating beyond its efficient limits. Either the turbo is too small to hold high boost to redline, or the wastegate spring is too soft. If you are using a duty cycle of more than 70%, it's possible that a stronger wastegate spring and lower duty cycle will hold a more stable boost pressure.



Boost pressure starts to increase significantly at high RPM:

This is called boost creep, which is a result of the wastegate not being large enough. It may hold boost stable for some of the rev range, but at high RPM it is wide open and not flowing enough to prevent boost from rising further. At this point the G-Force III can do no more, the only solution is a larger wastegate.



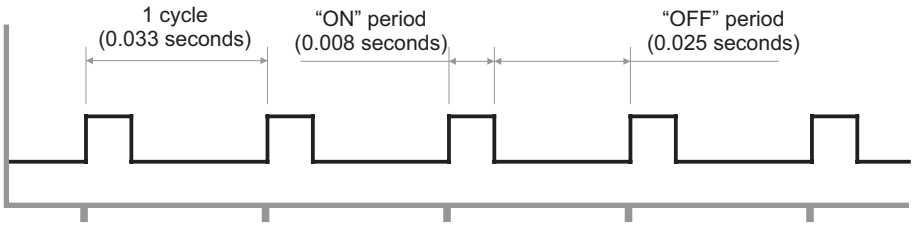
GFB GO FAST BITS

Duty Cycle - what is it?

Duty cycle refers to how the solenoid valve is actually controlled. The G-Force III boost controller outputs a signal to the solenoid valve that rapidly pulses it on and off about 30 times a second to control pressure to the wastegate, which ultimately adjusts boost pressure.

For example, a duty cycle of 25% means that the solenoid valve is pulsed ON for 25% of each cycle, and OFF for 75% of the cycle. A 25% duty cycle output from the G-Force to the solenoid valve is illustrated below:

A 4-port solenoid alternates the pressure signal between the top and bottom ports of the wastegate. In the example opposite, a duty cycle of 25% will apply pressure to the top port of the wastegate for 25% of the time, and the bottom port for 75%.



The higher the duty cycle, the more pressure is applied to the top port of the wastegate, which achieves a higher boost pressure.

Duty Cycle limits

Running 10% duty cycle means that the solenoid is effectively off and all of the pressure is applied to the bottom wastegate port and the turbo will run the minimum pressure possible (aka "gate" pressure).

Running the solenoid at 100% duty cycle sends ALL of the pressure to the top wastegate port, which effectively holds the wastegate shut, resulting in the highest boost pressure the turbo is capable of supplying.

Why can't I just dial-in how much boost I want instead of adjusting duty cycle manually?

Fair question. Unfortunately, the G-Force III (or any boost controller for that matter) doesn't know what boost pressure your specific turbo/wastegate/engine/weather conditions/etc will return for a given duty cycle - there simply is no formula that says "for this turbo on that car, "X"% duty cycle will give "Y"psi of boost".

The controller NEEDS to know this relationship between duty cycle and resulting boost pressure, because when boost is rising quickly, it must pulse the solenoid at the correct duty cycle **BEFORE** the boost reaches the target boost pressure. If it doesn't know the correct duty cycle, it cannot do this.

The reason it must pulse the solenoid before boost reaches the target is because there is always a small delay between the controller making a change to the duty cycle, and the wastegate (and therefore boost pressure) responding to the change. This delay means that if the controller simply waited until the boost pressure reached the target and then responded accordingly, boost pressure would overshoot the target.

Therefore, the only way to determine the duty cycle/boost relationship is through trial-and-error, by starting at a low duty cycle, reading the resulting boost pressure, and increasing it until you reach the desired boost.

Once the G-Force III knows the duty cycle that results in the target boost pressure, it can then make changes to the duty cycle to compensate for small variations in boost (when a value for "Sensitivity" has been entered).

TECH SUPPORT

We want you to get the best advice, first time. No-one has as much experience with these products as our own engineers, so make us your first point of contact!

Head to www.gfb.com.au/contact-us to get in touch, or use the QR code:

WARRANTY

WARNING: GFB recommends that only qualified motor engineers fit this product. GFB products are engineered for best performance, however incorrect use or modification may cause damage to or reduce the longevity of the engine, turbo, or drive-train components.

GFB LIFETIME WARRANTY: Our commitment to quality means that when we put our name to something, we are also staking our reputation on it. That's why we back our products with the best warranty in the business!

You should expect a lifetime of use from a well-engineered product, so if your GFB product fails as a result of defective materials or faulty workmanship whilst you remain the original owner, we will repair or replace it (limited only to the repair or replacement of GFB products provided they are used as intended and in accordance with all appropriate warnings and limitations. No other warranty is expressed or implied).

If a fault occurs as a result of usage outside of the terms of the warranty, or you are not the original owner fear not, we can still help you. You should never need to throw a GFB product away, as spare parts are available and won't cost the earth.