Yamaha Nytro Turbo EFI Control Box Instructions

Before you begin, please read all the instructions below and check kit contents.

Control Box Kit Contents:

Quality check by:

___1 Control Box
___1 EFI harness
___1 3 Wire Battery/ Jumper connector
___ 1 Transducer
___ 1 Transducer bracket
___ 1 Reusable zip-tie

IMPORTANT - PRODUCT REGISTRATION: Please register this product online as soon as possible. (If you do not have internet access, please call us at 208-542-4411.) It is required that you register this product so you can receive technical support, warranty claims, and so you can keep informed of product updates.

To register, go to **www.boondockers.com,** select "**SUPPORT"** then select "**PRODUCT REGISTRATION**". Please complete the on-line form.

I. Theory of Operation:

The Boondocker Control Box connects between the sled's ECU (Engine Control Unit) and the fuel injectors. It does not reprogram or communicate with the ECU. It only modifies the existing signals sent from the ECU to the fuel injectors. By modifying only these signals, it is possible to make fuel changes while keeping the stock fuel map. This means the ECU can still compensate for engine speed, throttle position, barometric pressure, engine temperature, air temperature, etc.

The Control Box can add or subtract fuel amounts for certain rpm ranges and load conditions. This is done by using the buttons and LCD display to change its fuel adjustment settings. As with tuning a carburetor, it is possible to go too rich or too lean!

Note: Be sure you know how to properly tune an engine before you adjust the fuel settings! Use of an Air/Fuel Mixture Gauge and plug readings are highly recommended when tuning.

IMPORTANT NOTES – READ THIS!

Note1: Never unplug the Control Box when the engine is still running! Electrical damage may result which is not covered under warranty!

Note 2: We recommend using **Silicone Dielectric Grease** on all connections to help prevent corrosion on the terminals. This is available from automotive supply stores, commonly labeled as "Light Bulb Grease".

Note 3: Avoid exposing the Control Box to environments where **static charges** may exist. For example, quickly removing a sled cover from the sled in a dry environment can create a static spark that can damage the box (especially if the box is mounted up on the handlebars).

Note 4: The Control Box is sealed – do not take it apart or it will no longer be sealed. The Control Box is designed to be splash-proof. Do not submerge or subject the box to high-pressure spray. During long periods of non-use it is recommended that you do not leave the control box exposed to the elements.

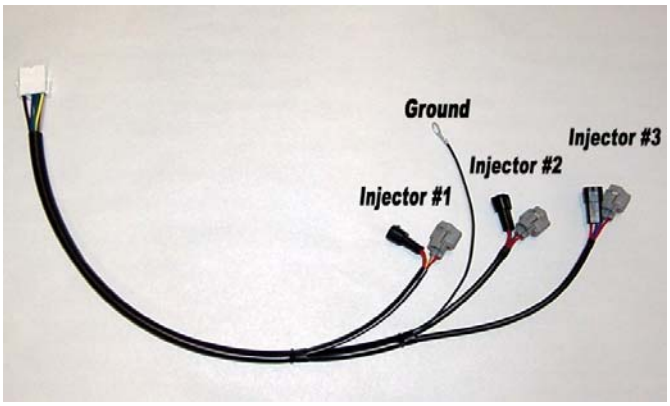
Note 5: Always use Resistor Spark Plugs! Non-resistor plugs WILL cause electrical interference with the Control Box.

II. Wiring:

A. Injector Harness:

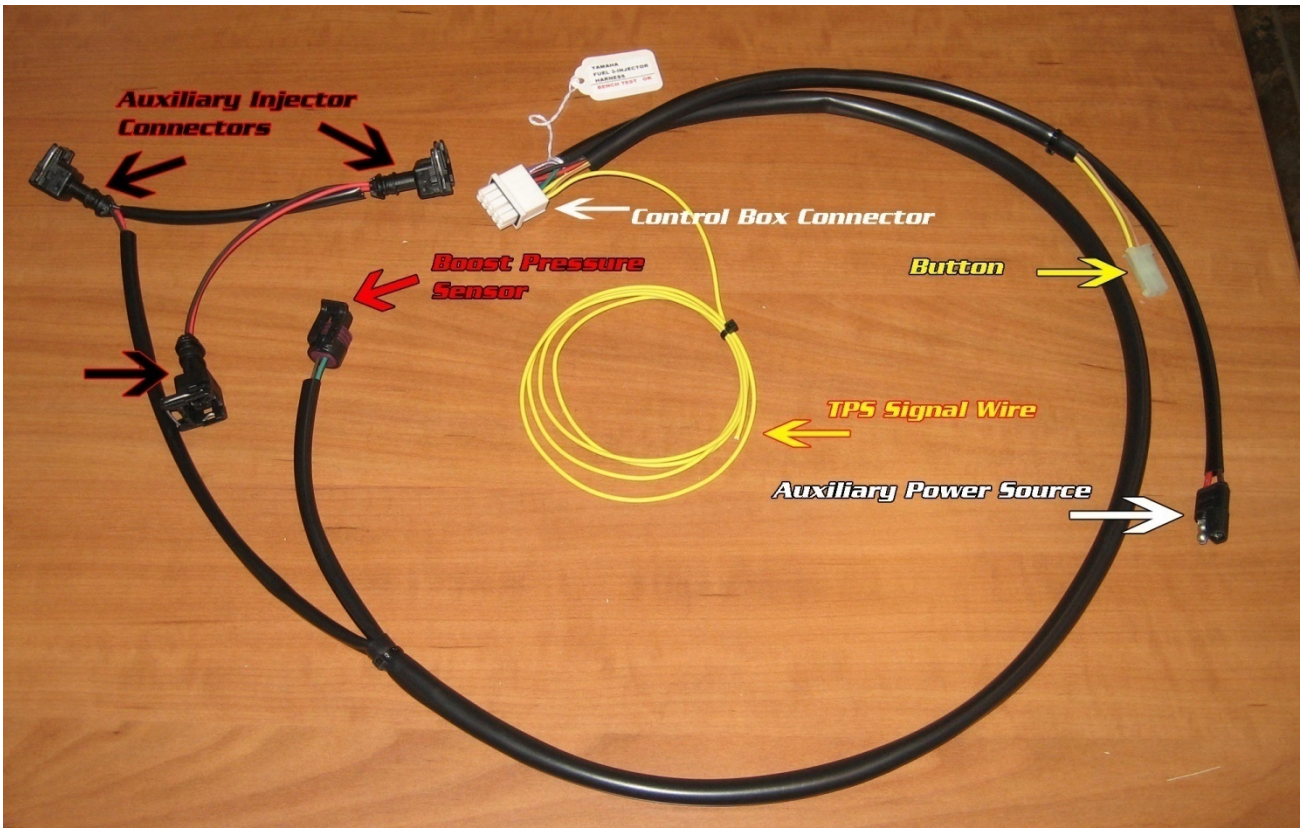
The pigtail pairs of the Control Box EFI wiring harness plug in between the injector connectors from the stock harness and the injectors. Starting with the shortest pair of connectors (yellow and tan wires), plug these into the injector for cylinder #1 (PTO side). Continue with the middle pair, then plug the longest set of wires injector for cylinder #3 (MAG side).

The white connector connects to the Control Box. Route this harness to keep it away from heat and moving parts. Use zip ties to secure it in place.



B. Turbo Harness

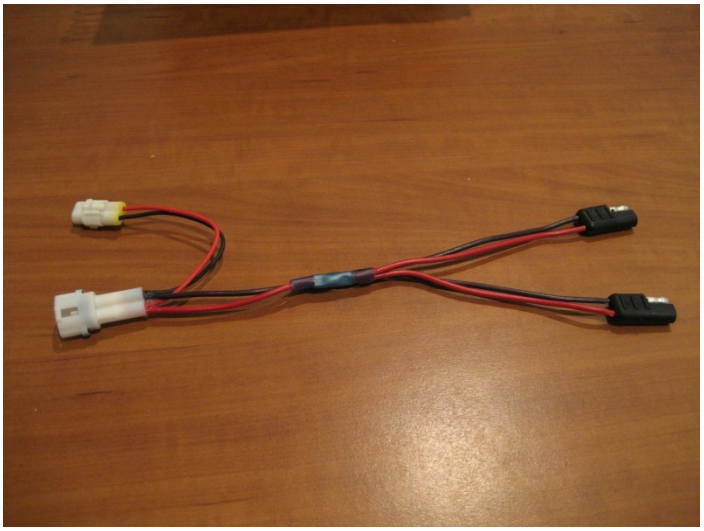
Note in the picture below where each connection goes. Route this harness so that the Control Box connector is adjacent to the Injector Harness Control Box connector. Route the other wires as required. Keep the harness away from heat and moving parts. Use zip ties to secure it in place. The auxiliary power source will be covered in the next section.



Connect the yellow wire on the Turbo Harness to the yellow TPS wire on the stock harness as described below. It can be spliced in near the TPS switch or near the large gray 16-pin connector (14 wires used) near the top left in the engine compartment. (Connecting this wire is not mandatory if you don't want to use throttle position to trigger nitrous injection.)

Note on using the supplied butt splice connector: If installed correctly, this butt splice will provide a reliable connection. Be sure to use a quality crimping tool. DO NOT USE A CRIMPER THAT PUNCHES INTO THE INSULATION. DO NOT USE PLIERS. After crimping you will use heat to shrink the insulation. Adhesive inside the connector will melt and flow around the wires, which will hold the wire and seal out moisture.

1. Choose your location to connect the wire.
2. Cut the stock yellow wire and strip the ends ¼". Do not cut closer than 2" from any connector to allow working room and to allow extra length for mistakes.
3. Cut the Boondocker Turbo Harness yellow wire to the appropriate length, leaving a little working length. Strip this wire ¼".
4. Twist one of the yellow wires from the sled's harness together with the yellow wire from the Turbo Harness, insert into one end of the butt splice, and crimp. Insert the remaining wire into the other end of the butt splice and crimp. (Two wires will go into one end of the butt splice connector and one wire will go in the other end.)
5. After crimping, pull on the wires to be sure they are securely crimped.
6. Apply heat to shrink the connector's insulation tightly around the wires.
7. If you have an optional N2O button, mount it, route the wires, and plug it into the connector on this harness.



C. Auxiliary Power Harness

The harness shown to the left plugs into the sled's auxiliary power circuit. Near the top left of the engine compartment is a connector having a black wire and an orange wire with a black stripe. Plug one of the white connectors from the Boondocker Auxiliary Power Harness into this. If there is already something connected here, unplug the connector and plug the white connectors from the Boondocker Auxiliary Power Harness between the existing connectors. One of the molded rubber plugs is for the turbo oil pump. The other molded plug provides power to the auxiliary injectors. Plug it into the molded rubber connector on the turbo harness.

IMPORTANT: Perform the following two tests (Parts D and E) after the Turbo and Auxiliary Power Harnesses have been installed to verify that installation is correct!

D. Auxiliary Injector Test:

1. Start the sled and check for fuel leaks.
2. Using the Control Box, go to the **N2O** menu. (From startup menu, press "**SEL**", cursor to "**N2O,**" and press "**SEL**.") The screen should appear as shown below. Set the **Fuel** value to 50, **TPS** to OFF, **RPM** to OFF, and Btn to N2O. (Refer to Section VI, parts 1 and 2 for instructions on how to do this.)

```
Fuel TPS RPM Btn
→050 OFF OFF N2O
```

3. If you have an optional N2O button, press it. This should immediately add fuel through the auxiliary injectors. You should notice the engine load up with fuel. If you don't have a button, use a small piece of wire or a paper clip to jump between the two terminals on the Turbo Harness Button Connector (yellow and tan wires).

E. Oil Pump Test

1. Be sure there is oil in the turbo reservoir.
2. Disconnect the top oil line from the turbo.
3. Hold the oil line over a container and start the sled.
4. Hold the sled RPMs above 3000 for 10 seconds. A thin stream of oil should be observed flowing from the line.
5. If no oil is seen, verify that the voltage into the oil pump is between +12 and +15V DC when the engine is revved up (red lead on terminal for red wire). If so, then feel the pump to see if it is vibrating.

F. Jumper/Battery Connector - The jumper can be used in one of the following two ways:

1. A 9-volt battery can be plugged into the jumper and the jumper can be plugged into the female connector (pressure transducer connector must be unplugged) to power the Control Box. This allows the Control Box to be turned on when the engine is off.

2. If the Control Box is unplugged from the injector harness, the jumper can be plugged in its place into the Boondocker injector harness (9-volt battery is not required). This reconnects the injectors to the ECU, bypassing the Control Box. <u>This is for emergency or diagnostic use only! Do not use nitrous or allow engine to build boost as no extra fuel will be added and engine can be damaged!</u>

III. Control Box Mounting Location

The Control Box can be mounted on the panel below the handlebars. The box can also be mounted under the hood, on the dash, or on the handlebars (with custom bracket as shown). Before applying the adhesive strips, thoroughly clean each surface (rubbing alcohol works well). It is also best if each surface is room temperature or a little higher.

If the box is mounted under the hood, keep the box away from excess heat, including radiant heat. Also keep the box away from the ignition coils.

IV. Control Box Operation

The control box is powered only when the injectors are on which occurs for a few seconds when the key is first turned on or when the engine is running. Up to 5 different fuel-adjustment maps are stored in the box (currently all with zero values). The box will remember which map was last selected and what its settings are – you do not need to do anything to save a map when making adjustments (see Fuel Adjustments below).

A. Intro / Startup Screen

When the box is first turned on (by the engine or battery), the Intro screen is displayed. Press any key to go to the main menu. An example Intro screen display is shown below:

```
FX Nytro Turbo .
4B5iBD   N2O:FIX
```

In the example shown above, this screen displays the following information:

FX Nytro Turbo Sled model and application. This box is designed for the Yamaha Nytro with a turbocharger. Boxes for other sleds will have other lettering.

4B5iBD This is the software version of the box. The box can be reprogrammed only by sending the box back to Boondocker

N2O: Shows that this Control Box is nitrous capable.

FIX Nitrous pressure regulator type (refer to Nitrous Section for more description)

B. Main Menu

The Main Menu is shown below:

```
MAIN →Fuel Stats
MENU  N2O  Map1U
```

The current selection is shown by the **Right-Arrow** and the **cursor** (underscore below the "**F**"). Use the **arrow keys** to move the cursor. Move the cursor to the desired selection and press the "**SEL**" key to select the desired menu option from one of the following:

- **Fuel** Go to the **Fuel** adjust menus (see Section 1). Here you can tune according to RPM and turbo boost.
- **Stats** Display runtime data, captured data, and recorded maximum data (see Section 3).
- **N2O** Go to the configuration menus for optional Boondocker Nitrous kit (see Chapters VII and IX..).
- **Map** Go to the **Map** management menu (see Section 2). Additional nitrous configuration and tuning factors are also found by selecting MapXX and StUp.

The current **Map** number is displayed as "**Map1U**". This indicates that map number **1** is being used and it is **U**nlocked.

1. Fuel Adjust Menus

From the **Main Menu**, select **FUEL** to make adjustments for RPMs, turbo boost, and accelerator pump.

1.a RPM-based Tuning – There are four RPM-based **Fuel** adjust screens (examples shown below). The first screen comes up after selecting **Fuel** from the Main Menu.

Fuel screen1:
```
M1U  Id LO MD
3000 00 00 00
```

Fuel screen2:
```
M1U  LO MD HI
5000 00 00 00
```

Fuel screen3:
```
M1U  LO MD HI
7000 00 00 00
```

Fuel screen4:
```
M1U  LO MD HI
8500 00 00 00
```

Use the **Left/Right Arrow** keys to switch between the LO/MD/HI load ranges. Use the **Up/Down Arrow** keys to change the fuel settings. Go to the next adjustment screen by pressing the "**SEL**" button. After pressing the "**SEL**" on the last RPM-based **Fuel** adjust screen, you will go to the first turbo **Fuel** adjust screen.

The RPM-based fuel adjustments can be made according to the following two factors: RPM and Engine Load.

RPM Regions:
Four or more RPM regions are pre-programmed into the control box which allow fuel adjustments to be made at specific RPMs. Whenever the engine RPMs are between these specific RPMs, the fuel adjustment will be the result of the adjacent RPM fuel settings blended together proportionately. For example, the fuel setting at 5000 RPM is centered at 5000 RPM, but this value also has an affect on fuel whenever RPMs are above 3000 RPM and below 7000 RPM (the two adjacent settings for this example). Suppose the 3000 fuel setting is at "4" and the 5000 fuel setting is at "8". If engine RPMs are at 4000 (mid way between 3000 and 5000) the actual fuel adjustment made will be "6", which is mid way between "4"and "8".

Load Ranges:
Each RPM Region is split into 3 load ranges: LO (low), MD (medium), HI (high). Each load range is roughly equivalent to the throttle position divided into thirds: LO is closed throttle (idle) to 1/3 open, MD is 1/3 to 2/3 open, and HI is 2/3 to full open. During light-throttle conditions (slow cruising or deceleration), the LO RPM settings will be used. During part-throttle conditions (normal or faster cruising), the MD RPM settings will be mostly used. During heavy-throttle conditions (accelerating or heavy load operation), the HI RPM settings will be used.

Making RPM fuel adjustments

```
M1L →Id MD HI
3000  00 00 00
```

M1L This displays current map that is being used – in this case, **M1** stands for **Map1**, and **L** indicates the map is **Locked** (changes are not allowed). Five possible fuel maps can be used. Each map consists of all the fuel settings for a particular setup. If the map is **Locked,** the settings cannot be changed and the up/down buttons have no effect. If **U** is displayed, the map is **Unlocked,** adjustments can be made to any setting and these changes will be automatically saved to the selected map. Refer to the Section 2 for more details about how to **Lock, Unlock, Load**, and **Copy** different **Maps**.

3000 This is the **RPM Region** for the fuel adjustments on this screen. For this example, this screen's adjustments will be centered at 3000rpm. The effect of the 3000rpm setting decreases until 5000rpm, while the effect of the 5000rpm setting increases as RPMs go towards 5000. The other regions work similar to this.

Id (3000 screen only) This adjustment is for **Idle** only (up to 2000rpm).

LO,MD,HI The fuel added or subtracted in each RPM region depends upon engine load. A different fuel number can be entered for each load (low, medium, or high). Since engine load is directly related to throttle position, each load range is equivalent to the following approximate throttle positions:

LO = 0 up to 1/3 throttle
MD = 1/2 up to 2/3 throttle
HI = 2/3 up to full throttle

00 **Fuel adjustment value.** Each setting can go from –99 to 127. Refer to the EFI tuning section for general tuning guidelines. A value of 00 means no fuel adjustment will be made and the original injector signal (from the stock ECU) will be passed through unmodified. Negative values will reduce the fuel. Positive values will increase the fuel.

Note 1: Each number is equal to about 1/2% of the total available fuel from the stock injectors. The maximum available fuel will vary with each engine as well as with elevation and air temperature.

Note 2: It is possible to max the injector (duty cycle > 100%) **before** the adjustment setting is maxed! Pay careful attention to EGT's, O2/mixture readings, and fuel pressure when running with engine modifications that require a lot of additional fuel!

1.b Turbo Tuning – There are two turbo adjust screens (examples shown below). These are in the **Fuel** Menu and appear following the four RPM screens.

Turbo screen1:

```
M1U  -4  0 +4 +8
TboL 00 00 00 00
```

Turbo screen2:

```
M1U  12 16 20 24
TboH 00 00 00 00
```

Use the **Left/Right Arrow** keys to switch between boost ranges. Use the **Up/Down Arrow** keys to change the fuel settings at a given boost pressure. Go to the next adjustment screen by pressing the "**SEL**" button. After pressing the "**SEL**" on the second turbo adjust screen, you will go to the accelerator pump menu.

The first turbo screen is for adjusting fuel for low boost pressures (-4 to 8psi), and the second is for high boost pressures (12 to 24psi).

Note that in the upper left-hand corner, the current **Map** number is shown (**M1**) along with whether it is locked (**L**) or unlocked (**U**). Across the top of each screen is the boost pressure range. Across the bottom of each screen is the user-adjustable fuel number. For any boost pressures between the values displayed, the actual fuel quantity is computed proportionately. The value at -4psi (-2"Hg) is used for any pressure below -4psi. The value at 24psi is used for any pressure over 24psi. Therefore, do not allow a boost pressure over 24psi as it will run too lean.

Each fuel setting can go from –99 to 127. Refer to the EFI tuning section for general tuning guidelines. **CAUTION: The exact amount of fuel added for turbo boost is entirely up to the user. A value of 00 means no fuel will be added for boost and the original injector signal (from the stock ECU) will be passed through unmodified (except for RPM-based adjustment).** Negative values will reduce the fuel. Positive values will increase the fuel. Positive fuel values must be used for positive turbo pressures in order to compensate for increased air. And greater boost pressures require more fuel.

Note 1: Each number is equal to about 1/2% of the total available fuel from the stock injectors. The maximum available fuel will vary with each engine as well as with elevation and air temperature.

Note 2: It is possible to max the injector (duty cycle > 100%) **before** the adjustment setting is maxed! Pay careful attention to EGT's, O2/mixture readings, and fuel pressure when running with engine modifications that require a lot of additional fuel!

1.c Accelerator Pump Tuning – The final screen in the **Fuel** menu is for adjusting the accelerator pump.

Accelerator Pump screen:

```
M1U  AM DR Sens
ACEL 00 00 08 .
```

Use the **Left/Right Arrow** keys to switch between factors. Use the **Up/Down Arrow** keys to change the value of each factor. Return to the **Main Menu** by pressing the "**SEL**" button.

Making Accelerator Pump adjustments

M1U This displays current map that is being used – in this case, **M1** stands for **Map1**, and **U** indicates the map is Unl**ocked** (changes are not allowed).

AM This is the **Amount** of fuel to inject for each intake cycle when the accelerator pump is required. Adjust the number appearing below **AM** to increase or decrease fuel quantity.

DR This is the **Duration** the pump is required. Adjust the number appearing below **DR** to set the desired duration in number of intake cycles.

Sens This is the **Sensitivity** setting. Adjust the number appearing below **Sens** to reflect how much change in load is required to activate the pump. A larger number means a larger change in injector duty cycle or throttle position is required to activate the pump (less sensitive). A smaller number increases the sensitivity as only a small change is required to activate the pump.

2. Map Menus

From the **Main Menu**, select **Map1U** to go to the **Map Menu** (shown below). This screen is used to **Load**/**Copy**/**Lock**/**Unlock** saved "maps" that contain fuel and N2O settings. Five maps can be used (**Map1**-**Map5**).

```
 Lock ULock Quit
→Load Copy  Quit
```


2.a Map: Load

When a new map is loaded, the current adjustment settings will be changed to the values from that map. To load a new **Map**, first move the cursor to select Load and press "**SEL**". The following **Load/Lock Menu** will be displayed:

```
Load 1 2 3 4 5→Q
Lock L U U U U Q
```

Load 1-5 Selects which map to load

Lock **L** = Locked, **U** = Unlocked, applied to the map number the **L** or **U** is under

Q Quits this menu

Use the **Up/Down** and **Left/Right Arrow** keys to move the cursor around. To load a new map, move the cursor to the desired map number and press "**SEL**." The map will be loaded and the **Main Menu** will be displayed. When a map is loaded, the **M*x*** (***x*** is the map number) that is displayed in the Main and Fuel menus will show the loaded map number as a reminder.

To quickly Lock or Unlock maps, move the cursor down to the **Lock** row, place the cursor under the **L** or **U** by the desired map number, and press "**SEL**" to change a **U** (Unlocked) to an **L** (Locked) or vice versa.

Select **Q** to Quit and return to the Main Menu.

2.b Map: Copy

To copy a map, first select **Copy** from the **Map Menu**. The following **Copy/Lock Menu** will be displayed:

```
Copy 1 2 3 4 5→Q
Lock L U U U U Q
```

Copy 1-5 Selects which map to copy the current map TO

Lock L = Locked, U = Unlocked

Q Quits this menu

This screen is used to save the CURRENT fuel adjustment map TO one of five available map locations. The map that is being copied TO must be Unlocked – otherwise a message will be displayed telling you that the map you selected cannot be overwritten.

Note: When a map is copied, the Control Box will load the map copied TO to be the new current map.

Use the **Up/Down** and **Left/Right Arrow** keys to move the cursor to the map number you want to copy TO and press "**SEL**". The following confirmation message will be displayed:

```
Overwrite Map A
With Map B? Y→N
```

"**A**" represents the map copied TO and "**B**" represents the current map to be copied FROM. If this is exactly what you intend, use the Left Arrow to underscore "**Y**" and press "**SEL**". Then the current map will be loaded into the selected map number, the selected map number will become the current map, and the Control Box will return to the Main Menu.

To quickly Lock or Unlock maps, move the cursor down to the **Lock** row, place the cursor under the **L** or **U** by the desired map number, and press "**SEL**" to change a **U** (Unlocked) to an **L** (Locked) or vice versa.

Select **Q** to Quit and return to the Main Menu.

2.c Map – Lock and ULock

Either **Lock** or **ULock (UnLock)** can be selected from the **Map Menu** to quickly lock or unlock the current map. Move the cursor to the desired selection and press "**SEL**". The box will return to the Main Menu and the current map will be locked or unlocked when **SEL** is pressed.

3. Stats Menus

This Control Box has a new feature that allows real-time data to be displayed and captured. This feature can be useful for tuning or for diagnostic purposes.

3.a Stats: RUN/CAPTURE

Selecting **Stats** from the Main Menu will first display the following screen with real "Run-time" data (current conditions):

```
Run 35/40 10.2 A
 5500 MD███    N
```

Run "Run" indicates display is in Run mode. If in capture mode, "Cap" will be displayed.

35 Input duty cycle in percent

40 Output duty cycle in percent

10.2 Current Boost Pressure

A If "A" is displayed, Accelerator Pump Fuel is being added

5500 RPM (note, if the engine is shut off, the last recorded RPM may be displayed)

MD Engine Load. **LO**, **MD**, or **HI** will be displayed.

███ These bars are a graphic display of **LO**, **MD**, or **HI** as shown below:

LO
MD ███
HI ██████

10 Current RPM-based fuel adjustment

Run/Capture mode:

Left-Arrow button : Sets **Capture Mode**, "**Cap**" will be displayed and the current data will be frozen on the display. The capture occurs on the display when the button is **released** (data will continue to be captured if the button is held down). It will stay in capture mode (data will remain frozen) until the **Right-Arrow** is pressed to return to **Run** mode or until the Control Box is re-powered. If the Stats menu is re-entered before the engine is shut off and the box is in Capture mode, the last captured data will be displayed.

Right-Arrow button : Clears capture mode (captured data will be lost!) and sets **Run mode**. "**Run**" will be displayed and real-time data will be displayed.
Press **SEL** to go to the next screen: **Stats: MAX**.

3.b Stats: MAX

Any button press from the Run screen will go to the next **Stats** screen which is the **Max** screen, displaying max RPM, Duty Cycle In from the sled's ECU, and Duty Cycle Out to the injectors.

```
MAX:DCIn/Out Clr
 5500 35/45  Y→N
```

MAX: 5500 Max rpm

DCIn 35 Max Duty Cycle Input from sled's ECU.

DCOut 45 Max Duty Cycle Output to the injectors.

These max values will be saved when the box is shut off so they will remain the next time this screen is displayed even if the box is re-powered. Peak values or "spikes" are filtered by finding the average during a certain time-window. Therefore, a maximum must be held for at least 1 second to be recorded and displayed properly.

Use the arrow keys to move the cursor between Y and N. Pressing **SEL** when the cursor is on **Y** will clear the max values. Pressing **SEL** when the cursor is on N takes you to the next screen: **Stats: N2O/TPS**.

3.c Stats: Boost Pressure

This menu displays boost pressure information.

```
PSI MAX Peak Clr
   12.2 13.4 Y→N
```

MAX **12.2** Maximum fuel adjustment during last nitrous activation (blacked out ▮▮▮ during nitrous activation). This can be cleared manually and is always clear upon next nitrous activation. This can be cleared manually and is always cleared upon next nitrous activation.

Peak **13.4** For systems without a N2O pressure regulator (**NON** in lower right-hand corner of **Startup Screen**), this displays current nitrous tank pressure. For systems using a N2O pressure regulator (**ADJ** or **FIX** in lower right-hand corner of **Startup Screen**), this shows the maximum nitrous pressure during the shot, where the pressure is measured after the solenoid valve.

Selecting **Y** will clear these saved values. Use any arrow key to select **Y** or **N**. Pressing "**SEL**" takes you to the **Main Menu**.

V. EFI Tuning Suggestions

Important: The Auxiliary Injector Test in Section II must successfully pass before running or tuning the sled!

Fuel requirements:

Race gas MUST be used, even for low boost! Detonation will quickly destroy your ingine! (See "Detonation" in "Tuning Tips" below.)

Sunoco 112 is recommended and has been determined to be adequate for boost levels up to 14psi. **VP fuel is not recommended – it has been found to have lower motor octane than other comparable fuels.** Other suggested brands include Unical, Rockett Brand, F&L Racing Fuel, Pure Purple, and Trick racing gas. Always use fresh fuel from a sealed barrel.

Spark Plug Gap:

Use new spark plugs and reduce the gap to 0.018" to 0.020". Carry extra plugs – leaded fuel and boost is hard on spark plugs.

Recommended Control Box Settings:

***** Please call Boondocker to receive the lates Fuel Setting information *****

The Control Box will not prevent a lean burn-down! You must take the proper tuning steps the same as if you were tuning a carburetor.

Each Fuel adjustment setting goes from –99 to 127. Positive numbers add fuel and negative numbers subtract fuel. This does not mean you have an effective range all the way to 127. You will max out the injector before this setting is reached! Your usable adjustment range (max value) is dependent on how much the ECU is already driving the injector, which will vary with load, RPM, temperature, elevation, and fuel pressure.

Boost controller:

It is recommended to start with the boost controller turned to the **lowest boost setting**. To find this starting point, remove the boost controller, loosen the knob all the way, blow through it while tightening the knob until you start to feel resistance (the valve stars to close off). Make sure the engine is tuned properly before increasing the boost and watch closely for proper fuel mixture and detonation (see topics under "Tuning Tips).

Maximum recommended boost is 12psi at 5000' altitude and 14psi if above 8000'.

Tuning Instruments:

Air/Fuel gauge:

A good wideband O2 gauge is highly recommended as an effective tuning tool. The sensor will have a limited lifespan due to exposure to pre-mix oil and leaded racegas, but in many cases it can last for a season and it is a very valuable tuning tool. If desired, after initial tuning is completed the probe may be removed to prolong its life.

Be aware that too rich a mixture can cause the gauge to read lean due to unburned fuel not being read by the gauge (the oxygen will produce a lean reading). Whenever the engine is decelerating, your A/F numbers will be lean - these readings can be ignored. However, whenever the throttle is being applied, pay attention to the readings!

Higher numbers are leaner (less fuel), lower numbers are richer (more fuel). A 14.7:1 ratio means all the available oxygen has combined with all the available fuel. Numbers from 11:1 to 13:1 generally produce the best power (extra fuel helps cooling and can help prevent detonation). A lower A/F ratio (10.8 to 11.2:1) is considered safer on a turbo since the extra fuel prevents heat build-up and helps prevent detonation. We recommend you find the lowest ratio where the sled still runs without being too rich.

EGTs:

Exhaust Gas Temperature gauges can also be an effective tuning tool, but they are not a substitute for reading spark plugs and piston wash and for a general feeling of how the engine runs. Use EGTs only as a backup to verify what you see. They can be misleading under certain conditions and safe readings can vary greatly from engine to engine depending on such things as probe placement, fuel, timing, pipe design, porting, etc. For this turbo, typical EGT temps seem to be around 1300 – 1325degF after a long pull.

Plug and Pipe Color:

Color will develop inside the pipe and on the plug after running a while which can be used to determine fuel mixture. A tan/cardboard brown color is desired. Light-gray is too lean, and dark brown is rich.

Tuning tips:

Important: Find the settings where your motor runs rich **before** you decide to go lean!

1. Tune with the engine and pipe at operating temperature. The sled's ECU will make adjustments as the engine warms up – you might think the engine needs leaner settings then later realize you are too lean once the engine warms up.

2. Use the **Load/Save Map** feature to quickly change and compare fuel settings when testing. This can also be useful for riding under different conditions. For example, changing elevations or temperatures may require different adjustments if the stock ECU does not compensate properly for your modifications. For drag racing, you might want to run richer settings for longer distances than you would for short distances.

3. One method for finding out where a fuel adjustment setting is effective, greatly increase only that setting. Run the engine to find out when it suddenly becomes too rich – this is where that setting is effective. Be careful – you can easily flood the motor, especially with LO load or low rpm settings. If this happens, to restart the engine you may have to pull several times with the throttle held wide open.

4. The **Stats Capture** feature can be used to determine RPM, and if the load setting is LO, MD, or HI. The nitrous button can be configured to capture these stats (see nitrous configuration section below). From the Main Menu, select **N2O**, set **Btn** to **CAP.** Whenever the button is pressed, the **Stats: Capture** screen will be displayed. The current stats will be captured when the button is released.

N2O Menu in "Capture" mode:

```
Fuel TPS RPM Btn
 040 OFF OFF→CAP
```


5. The nitrous handlebar button can be used to add or subtract a preset amount of fuel for interactive tuning purposes (see nitrous configuration section below). From the Main Menu, select **N2O**, set **RPM** and **TPS** to **OFF**, set **Btn** to **TUN** and adjust the fuel number as desired for the test (see example menu screen below). When the nitrous button is pressed, this amount of fuel will be added or subtracted immediately from the current settings for all rpms and all loads.

   N2O Menu in "TUNE" mode:

```
Fuel TPS RPM Btn
 040 OFF OFF→TUN
```

Also consider the following:

A/F Mixture — Generally EGT's get hotter as the motor gets lean, but too lean and the temps can actually drop! It's like turning the oxygen up too high on a torch – as oxygen is added, the flame gets hotter to a certain point, then gradually cools off until it becomes extinguished from too much oxygen.

Detonation — **Detonation often requires an experienced tuner to detect – in most instances it cannot be heard or noticed. Careful examination of the piston and sparkplug are required. Watch for melted sparkplug electrodes, speckling on the sparkplug insulator, or shiny or gray flakes on the electrode which could be melted aluminum from the piston. If possible, watch the crown of the piston (near exhaust port) for a pitted or sand-blasted look. EGT's can sometimes read low during detonation – heat is going into the cylinder and piston instead of out the pipe.**

Timing — Timing can affect the pipe temperature. Generally if the ignition is retarded, more heat will build up in the pipe. Too much advance may drop EGT temps, but increase cylinder temps.

Fuel — Different fuels have different densities and other characteristics which can affect your mixture and fuel requirements. Oxygenated fuel will run leaner. Octane rating is important for highly modified motors.

Lean spots — Sometimes a motor runs hot at certain rpms and throttle positions (usually in its mid-range) no matter what. The fuel adjustment settings can be used to richen this up, but the engine may quickly become too rich and run erratic. Under light load conditions you can sometimes get away with running hot for short periods of time. Under such conditions it is best to vary the throttle position often and not stay at one throttle setting for long durations.

VI. Nitrous Tuning (for optional Boondocker Nitrous kit)

Note: Be sure to make non-nitrous (RPM-based) tuning adjustments first. Once the nitrous tuning procedure has been done, any changes to the RPM fuel settings may affect nitrous fuel delivery. If this occurs, the nitrous tuning steps will need to be done again.

On the startup screen (displayed when first powered on), note the message in the lower right-hand corner.

ADJ – Configured for a nitrous system using an ADJustable or Fixed N2O pressure regulator.
FIX – Configured for a nitrous system using a FIXed N2O pressure regulator.
NON – Configured for a NON-regulated N2O system. **DO NOT USE WITH TURBO!**

Be sure that this description matches your actual nitrous system. Some internal settings and some user menus and settings are affected by this configuration. **Do not attempt to run a Regulated nitrous setup in NON mode!** Please call Boondocker if your setting is incorrect. If you do not have nitrous capability, then this configuration does not matter.

The fuel adjustment setting in the **N2O** menu is used to control how much fuel is added during nitrous use. The nitrous pressure transducer input is used to automatically scale the fuel adjustment up or down from this base setting according to nitrous pressure. However, you still must go through the nitrous tuning procedure before you can safely use nitrous.

Warning: Only adjust the control Box settings according to the steps below. The best way to tune an engine is with the use of an oxygen sensor and gauge (available from Boondocker). This adjustment process should only be performed by an experienced tuner. If you are not an experienced tuner, find someone who is. Remember, safety first!

The steps below should be performed with a full nitrous bottle. On systems without a nitrous pressure regulator, make sure the bottle is at proper operating temperature (70-90deg F) and pressure (700-1000psi). Make sure the engine is at normal operating temperature.

Do not exceed 2 seconds of nitrous use until the fuel adjustment is complete and correct.

1. First configure the nitrous system for Button use. The next chapter will describe different ways to configure your system for nitrous activation, but we're going to shortcut that for now.

   Select **N2O** from the **Main Menu**, move the cursor so it is under **Btn** and press the **Up Arrow** until **N2O**. Press "**SEL**" to return you to the **Main Menu**. Select **N2O** from the **Main Menu** again. Look at the **N2O Menu** to be sure that **TPS** and **RPM** are turned **OFF**.

   N2O Menu for Button Activation for initial Nitrous Tuning:

   ```
   Fuel TPS RPM Btn
   →050 OFF OFF N2O
   ```

2. Select **N2O** from the Main Menu.

   ```
   Fuel TPS RPM Btn
   →050 OFF OFF N2O
   ```

   Select Fuel. The following screen will appear:

   ```
   N2O Fuel   Delay
   →050         000
   ```

   Increase the nitrous **Fuel** adjustment setting until you notice a drop in the power increase when using nitrous. Oxygen, EGT, and rpm readings can be used to help determine when you are too rich. Be sure you have reached this point before proceeding. Note this adjustment setting.

3. Only after step 2 or 3 is complete, start reducing the **Fuel** setting. Continue reducing the **Fuel** setting until a maximum power increase is obtained. Again, note oxygen, EGT, and rpm readings, and do not exceed 2 seconds of nitrous use which is just sufficient to get a good reading. A useful technique is to accelerate, allow rpm to stabilize, apply nitrous, and notice maximum rpm, and if available, O2, and EGT readings.

4. If the **Fuel** is reduced but no power increase is noticed from the previous setting, this means you are lean. Note this adjustment setting.

5. Increase the **Fuel** setting back to where it was before no additional power increase was noted in step 4. This setting should be somewhere between the rich and lean settings. It is best to stay on the rich side.

6. After this adjustment is made, if the engine does not run perfectly smooth when using nitrous, do not use it! If the exhaust note does not sound clean, the cause is likely detonation, which can quickly destroy the engine. Use higher octane fuel, add more ignition retard, reduce the engine's compression, or reduce the amount of nitrous (see instructions for changing nozzles) before using nitrous again.

Note 1: The RPM and Nitrous fuel adjustments are summed. Therefore, any changes made to RPM fuel settings will affect the quantity of fuel delivered for nitrous. Therefore, for example, if the 7800 **HI** fuel setting is **decreased** by X amount, you need to **increase** the nitrous fuel setting by X amount in order to get the same total fuel delivery for nitrous.

Note 2: After initial tuning, any new performance enhancements to your engine will require re-tuning the EFI and nitrous fuel delivery.

Note 3: All nitrous fuel settings are stored in the same map as the RPM settings. All changes you make become part of the current map. The current map number is shown in the Main Menu.

VII. N2O System Configuration

A. N2O Configuration Options

There are seven ways to configure nitrous activation using one of more of the following inputs: button, throttle position (requires installation of Boondocker TPS kit), and rpm range. A brief description for each configuration is given below. More details can be found in sections B and C.

1. **Button only:** Pressing the momentary button activates the nitrous and releasing the button turns it off. The button can be configured to activate the nitrous regardless of TPS or RPM conditions.

2. **TPS (Throttle Position Sensor) only:** When the throttle is pressed beyond a point set by the user, nitrous is activated. Nitrous is deactivated when the throttle returns to a point below the chosen threshold.

3. **TPS and RPM:** When the RPM and TPS are within a range set by the user, nitrous will activate. Nitrous will turn off when the throttle is decreased (TPS is below the adjustable threshold) or when the RPM is out of the selected range (lower than Min or higher than Max).

4. **Button (N2O) or TPS:** The handlebar button can be used in combination with the TPS. In this way, either the throttle or the button can activate the nitrous. The button will always activate nitrous regardless of the TPS condition.

5. **Button (N2O) or TPS and RPM:** The handlebar button can be used in combination with the TPS and RPM range. In this way, either the throttle/RPM or the button can activate the nitrous. The button will always activate nitrous regardless of the TPS and RPM conditions.

6. **Button (ARM) and TPS:** The nitrous button input on the Control Box can be used to quickly arm and disarm nitrous capability. When armed (button input is on), the system can be configured to activate with TPS. Optionally, the handlebar button, which is momentary (only activated while pressed), can be replaced with a toggle, rocker, or slide switch so it remains in the on or off position (when not pressed).

7. **Button (ARM) and TPS and RPM:** Same as option 6 above except with RPM capability. When armed (button input is on), the system can be configured to activate with TPS and RPM.

B. N2O Configuration Procedure

Note: All nitrous configuration settings are stored in the same map as the EFI settings. All changes you make become part of the current map. The current map number is shown in the Main Menu.

From the **Main Menu**, select the **N2O** option. Below is a description of this menu:

```
Fuel TPS RPM Btn
→050 OFF OFF OFF
```

Fuel	050	**Fuel** setting during nitrous activation
TPS	OFF	Shows **TPS** mode is **OFF** or displays **TPS** trigger value
RPM	OFF	Shows whether **RPM** mode is **ON** or **OFF**
Btn	OFF	Displays button mode (described in detail below)

Fuel: The nitrous fuel adjustment tuning procedure is described above in **section VIII**.

Only a single fuel amount can be injected when nitrous is activated. Therefore, when using a turbo and nitrous, the nitrous pressure must be regulated. This is because there is no way to measure and adjust for nitrous pressure as it changes with temperature. If an adjustable regulator is used, your nitrous tuning will have to be changed every time you adjust the regulator. The simplest option is a fixed regulator. To select fuel parameters, move the cursor until it is under **Fuel** and press "**SEL**" or **Up** or **Down Arrow**. The following screen will appear:

```
N2OFuel    Delay
→030         000
```

N2OFuel N2O fuel setting. Amount of fuel added when nitrous is activated.

Delay Delay in number of engine cycles from when nitrous is activated to when fuel is delivered. Use this feature to reduce any bog that occurs due to fuel being delivered before nitrous arrives in the engine.

TPS: To select throttle-position triggering, move the cursor until it is under **TPS** and press "**SEL**", **Up** or **Down Arrow**. The following screen will appear:

```
TPS  N2O on if
→OFF  TPS > 200
```

TPS	**OFF**	Shows **TPS** mode is **OFF**.
200		TPS threshold value.

Under **TPS**, press the **Up or Down Arrow** to toggle the TPS mode **ON** or **OFF**.

Move the cursor right to the **200** setting, then use the **Up and Down Arrows** to select the trigger level. This number is set to near 200 at the factory. You can adjust it from 50 to 248. To choose your level, look at the third **Stats** screen. (Press "**SEL**" to get to the Main Menu, then select **Stats**, and press "**SEL**" until the third **Stats** screen appears – "**N2O"** is displayed in upper left-hand corner). With the sled on a test stand, quickly press the throttle fully and release it. Note the number under "**MxTP**" This is the maximum value your TPS will output. Let the engine idle, clear the **Stats** screen, and note the **MxTP** number, which is the minimum TPS output. Choose a number close to the maximum for full-throttle activation. If you choose a number too close to the maximum, it may sometimes fail to trigger. If you choose a number too low, it may trigger when only moderate acceleration is desired.

Press the "**SEL**" button to return to the **Main Menu**.

RPM: To select rpm triggering, move the cursor right until it is under **RPM** and press "**SEL**", **Up** or **Down Arrow**. The following screen will appear:

.

```
RPM  Min  Max
OFF← 5050 7550
```

RPM **OFF** Shows **RPM** mode is **OFF**.
5050 Min RPM threshold
7550 Max RPM threshold

Under **RPM**, press the up or down button to turn this mode ON or OFF.

Move the cursor right to adjust the **Minimum RPM** (nitrous will be on above this level) and the **Maximum RPM** (nitrous will turn off above this level).
Note: To use this mode, **TPS** must also be ON and the TPS trigger threshold set.

Press the "**SEL**" button to return to the **Main Menu**.

BTN: To select the button mode, move the cursor right until it is under **Btn**. Press the up or down key to select between the following five possible modes. The screen will change to the following:

OFF:

```
Description: Btn
Button Off :→OFF
```

This mode disables the handlebar button.

N2O:

```
Description: Btn
N2O + Fuel :→N2O
```

This mode adds nitrous and fuel when the button is pressed. When the button is pressed, nitrous will be activated regardless of the TPS or RPM settings.

TUN:

```
Description: Btn
Fuel only  :→TUN
```

When the handlebar button is pressed in **TUN** mode, only fuel is added. This is used to experiment with fuel addition and subtraction while riding. Press the button at a certain rpm or under a certain load to see whether your addition or subtraction is beneficial. This cannot be used in combination with N2O operation. Be sure **TPS** and **RPM** triggering are OFF when using this feature.

CAP:

```
Description: Btn
StatCapture:→CAP
```

In **CAP** mode, the handlebar button is used to capture current data. When pressed, the **Stats Capture** screen will be displayed and the data will be frozen when the button is released. After a capture, pressing the **Right-Arrow** button will erase the captured data and return to **Run** Mode.

ARM:

```
Description: Btn
On for N2O :→ARM
```

By using a pushbutton (momentary), toggle, rocker, or slide switch connected to the button input, the nitrous system can be armed or disarmed. When the switch is closed the system is armed and ready. Then, depending upon other configuration settings, either the **TPS** or **RPM** with **TPS** can activate the nitrous system. When the switch is open, the system is disarmed so neither **TPS** nor **RPM** will result in nitrous activation.

Nitrous activation idea: One way to use the button for nitrous activation and to have the RPM limiting feature (to prevent hitting the rev-limiter), set Btn to ARM, TPS to ON (with a low threshold), and RPM to ON (with desired Min/Max settings).

Press the **Left or Right Arrow** to return to the N2O menu or push the "**SEL**" button to return to the **Main Menu**.

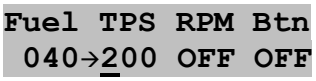
C. N2O Configuration Examples

The following are examples of settings to achieve the various nitrous triggering configurations described in Section A above:

1. **Button only:** Activate nitrous only when the button is pressed.

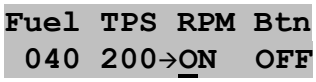
Set: TPS to OFF, RPM to OFF, and Btn to N2O.

2. **TPS only:** Activate nitrous only when the Throttle is pressed beyond a set level.



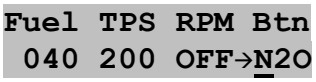
Set: TPS to ON (set the TPS threshold to the desired level), RPM to OFF, Btn to OFF.

3. **TPS and RPM only:** Activate nitrous only when the Throttle is pressed beyond a set level AND when RPMs are with a certain range.



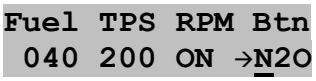
Set: TPS to ON (set TPS threshold to desired level), RPM to ON (set Min/Max to desired levels), Btn to OFF.

4. **Button (N2O) or TPS:** Activate nitrous when button is pressed or when Throttle is pressed beyond a set level.



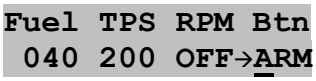
Set: TPS to ON (set TPS threshold to desired level), RPM to OFF, and Btn to N2O.

5. **Button (N2O) or TPS and RPM:** Activate nitrous when button is pressed or when Throttle is pressed beyond a set level AND the RPMs are within a certain range.



Set: TPS to ON (set TPS threshold to desired level), RPM to ON (set Min/Max values), and Btn to N2O.

6. **Button (ARM) and TPS:** Activate nitrous when button input is on (armed) AND Throttle is pressed beyond a set level.



Set: TPS to ON (set TPS threshold to desired level), RPM to OFF, and Btn to ARM.

7. **Button (ARM) and TPS and RPM:** Activate nitrous when button input is on (armed) AND Throttle is pressed beyond a set level AND the RPMs are within a certain range.

Set: TPS to ON (set TPS threshold to desired level), RPM to ON (set Min/Max values), and Btn to ARM.

D. N2O Pressure Transducer Faults

When the nitrous button is pressed, the Control Box first checks to make sure the readings from the pressure transducer are correct. One of the following two fault messages may be displayed. If a fault message is displayed, the nitrous solenoid will not operate and the message will remain displayed until any key is pressed to clear it or the engine is restarted.

```
ERROR: N2O press
too LOW!       .
```

This screen may appear if the pressure in the N2O tank is zero, the transducer is unplugged, or there is a wiring problem.

Important Note: If the bottle becomes empty, this message will be displayed and nitrous will be shut off to prevent extra fuel from being added without nitrous!

```
ERROR: N2O press
over 2000psi   .
```

This screen will appear if the pressure transducer senses a pressure above 1000psi for regulated systems or 2000psi for non-regulated systems.

VIII. Control Box Troubleshooting

A. Stuck Button

When the Control Box is first turned on, all buttons are checked to verify that a button is not stuck on. If a button is detected to be on during power up, the button will be disabled and the following message will be displayed until another button is pressed. To verify if a button really is stuck on, re-power the box without pressing any buttons.

```
Button is Stuck!
```

Note: A common problem is a **bad ground connection** on the sled causing the box to keep resetting itself. If a button is being pressed when this occurs, the "button stuck" message will be displayed. Start the sled without pressing a button and see if the message goes away. If it is not present, start looking for a disconnected ground on the sled (see Other Issues below).

If a button really is stuck on, the Control Box can still function and adjust fuel properly. The Control Box can be sent back to Boondocker to be serviced.

B. Injector Fault

The Control Box monitors the signals from the sled's ECU. If it detects signals on one set of wires but not the other, it will detect a fault on that injector and display one of the two error messages.

Injector 1 Fault!	Missing or bad signal detected on Injector #1 (yellow wire).
Injector 2 Fault!	Missing or bad signal detected on Injector #2 (green wire).
Injector 3 Fault!	Missing or bad signal detected on Injector #3 (blue wire).
Injector x Fault!	This means a previous injector fault has occurred which has not yet been cleared. (Press any button when error message is displayed to clear the fault)

If any of these conditions occur, the Control Box will still function and it will still try to make fuel adjustments, but the intermittent injector connection will need to be fixed. Contact Boondocker to determine if the Control Box and harness need to be sent back to be inspected or serviced.

Note 1: Injector errors that occur infrequently can be ignored since they are likely caused by sporadic electrical noise.

Note 2: It is possible for the sled to run but the wiring harness to be wrong – the box cannot make proper fuel adjustments. **If you see an injector error, first recheck the wire positions in the black connectors according to the tables in these instructions.**

C. Other Issues

Engine runs erratically:

1. Verify that the ground on the sled's harness has a good connection to the chassis.
2. Verify that the EFI Harness Ground Wire has a good connection.
3. Verify that all wiring is in good condition and that the wires have not pulled out of the terminals. To verify this, look inside each connector and verify that the terminal pins are all at the same height. If a terminal is starting to back out, it will appear to be lower in the connector, or the seal on the back-side will be protruding out farther than the rest.
4. Unplug the EFI harness and plug original harness back into the injectors and verify that the sled runs OK.
5. If problem only occurs with Control Box plugged in, change all fuel adjustment settings to 0 and see if problem persists.
6. Verify that the Control Box does not reset itself when the sled is running by doing the following:
    a. When the sled is first powered up, change the menu screen on the Control Box to one of the fuel adjust screens.
    b. Run the sled.
    c. Before shutting off the sled, verify that the screen is still on the same menu selection.
    d. If the startup screen is displayed (showing version number etc.), the box has reset itself. This is likely caused by bad voltage to the box due to an intermittent connection.
7. If necessary, the voltage supply to the box can be verified using a voltmeter. Probe from the Mag-side gray connector on the EFI harness where two red wires go to one connector terminal. Insert a small thin wire such as a paperclip or a small probe tip between the connector and the rubber seal in order to make contact with the terminal inside. Place the positive voltmeter probe here. Place the negative voltmeter probe on chassis ground. At idle the **DC voltage** should read around 12-14V.

Rough Idle: Idle adjustments are much more sensitive than other adjustments since the injectors are on for a very short duration. You may not be able to adjust your 3000 LO settings by very much.

LCD is dim:	If you are using a 9 volt battery to power the box when the sled is not running, your battery voltage is getting low – replace your battery. Extreme hot or cold temperatures may cause the LCD to not display properly.
LCD display is slow:	Cold weather conditions can make the LCD respond very slowly. The Control Box will still function OK. You can locate the box under the hood in order to provide heat so the LCD will display quicker.
Moisture on LCD:	Condensation is normal if the Control Box is quickly moved from a cold to a warm environment. In some cases, the Control Box enclosure may no longer be sealing properly. If such problems persist, contact Boondocker to determine if resealing the box is necessary.
Check Engine light:	Make sure the wires in the EFI harness are correct and check for a bad connection in the wiring harness. Recheck all connectors and be sure each is completely latched. Also inspect each wire to make sure there are no frayed, broken, or melted wires. Look at the seals on the back of each connector – if a pin has backed out, its wire seal will be protruding out of the connector more than the rest.

IX. Warranty, Terms & Conditions

Returned Goods – No merchandise will be accepted without prior approval. A RMA number (Return Merchandise Authorization) provided by Boondocker is required before a return will be accepted. A 20% handling and restocking charge will be applied to returned merchandise. No unauthorized returns will be accepted.

Limited Warranty – Boondocker warrants its product to the original purchaser against workmanship defects for a period of 90 days, commencing from the date of product delivery to the Consumer.

Maximum Liability – The maximum liability of Boondocker in connection with this warranty shall not under any circumstances exceed the price of the product claimed to be defective.