



## BoonDocker Polaris EFI Control Box Instructions

for software version 04e\_ or higher

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

### Kit Contents:

Quality check by:

- \_\_\_ 1 Control Box
- \_\_\_ 1 EFI harness
- \_\_\_ 1 battery/jumper connector
- \_\_\_ 2 velcro strips
- \_\_\_ 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](http://www.boondockers.com), select “SUPPORT” then select “PRODUCT REGISTRATION”. Please complete the on-line form. Be sure to enter the serial number (SN) that is displayed when the Control Box is first powered on (refer to instructions below).

### I. Theory of Operation:

The BoonDocker Control Box connects between the sled’s ECU (Electronic Control Unit) and the fuel injectors. It does not reprogram or interfere 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.

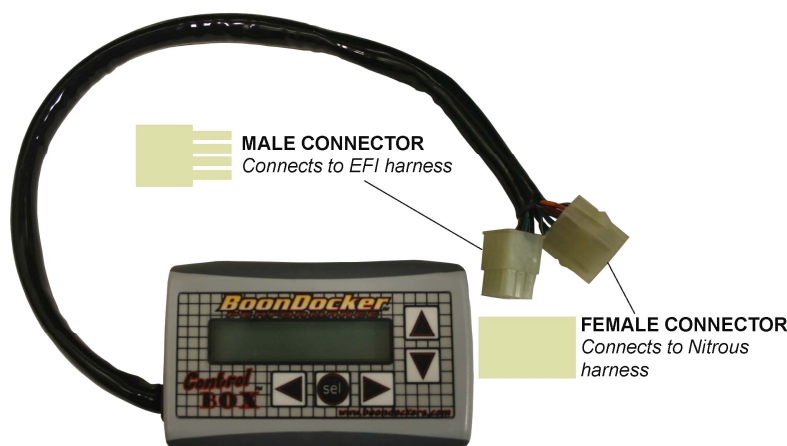
The Control Box can reduce fuel or increase fuel amounts for certain rpm ranges and load conditions by use of its keypad and LCD display. As with tuning a carburetor, it is possible to go too rich or too lean! **Note:** Be sure you know how to properly tune an engine before you adjust the fuel settings!

**Note:** Each Control Box is model specific and cannot be interchanged. For example, do not use a Control Box designed for a Polaris on an Arctic Cat.

### II. Control Box Harness Connectors

There are two connectors at the end of the black cable on the box as shown below. One is for the EFI wiring harness and the other is for the optional Nitrous wiring harness. These two connectors are keyed (male/female) so only the correct harness will fit into the correct plug-in (refer to picture).

**Note:** In order to prolong the life of the connectors, do not plug and un-plug the connectors more than necessary.



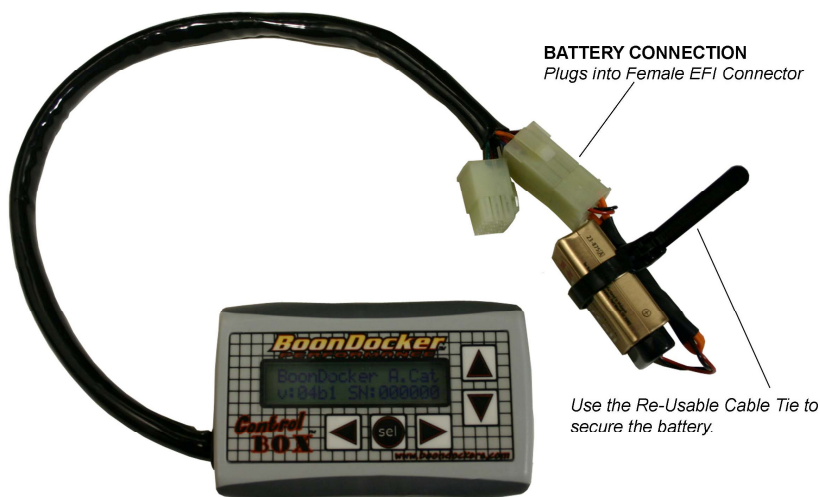
### III. Battery / Jumper Connector

The supplied Battery/Jumper Connector has a dual purpose. It can function as a battery connector in order to supply voltage to the Control Box when the engine is not running, and it can function as a jumper in order to bypass the Control Box.

#### 1. Battery Connector

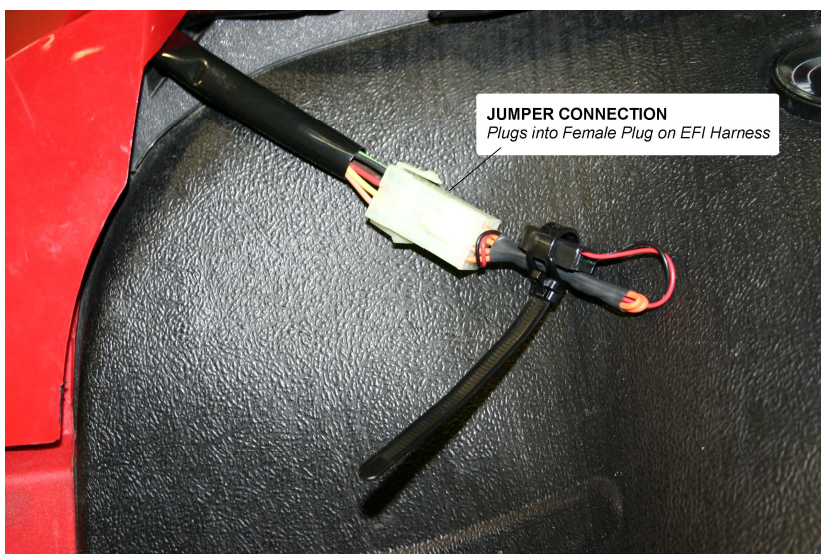
The Control Box is designed to operate without a battery – the box will turn itself on whenever power is applied for the fuel injectors. However, a 9-volt battery (not included) can be plugged into the box through the Control Box's connectors with the supplied **battery / jumper connector** in order to operate the box without the sled running. This battery connector plugs into the Control Box's nitrous connector (refer to picture below). Secure the battery to the connector with a zip tie in order to provide a strain relief for the 9-volt connector. The battery can also be secured to part of the harness if it is to be used on the sled while it is running.

The battery connector can be left plugged in during engine operation, but the nitrous harness (if used) cannot be plugged into the Control Box. The battery will eventually drain if left connected to the box, so it is best to disconnect the battery when not in use.



#### 2. Jumper Connector

The Battery/Jumper connector can also be used to bypass the Control Box in case the sled needs to be run without the Control Box. Disconnect the Control Box from the EFI harness and plug in the Jumper connector - the injectors are now connected directly to the sled's ECU.



## IV. EFI Wiring Harness

### Polaris EFI Harness

On the Polaris, each injector has a short (12") pigtail that goes to a connector. The EFI harness plugs into these connectors instead of the injectors themselves since engine removal is necessary to access the injectors. There are two connectors per cylinder. These injector connectors are located behind the engine under the jackshaft next to the tunnel.

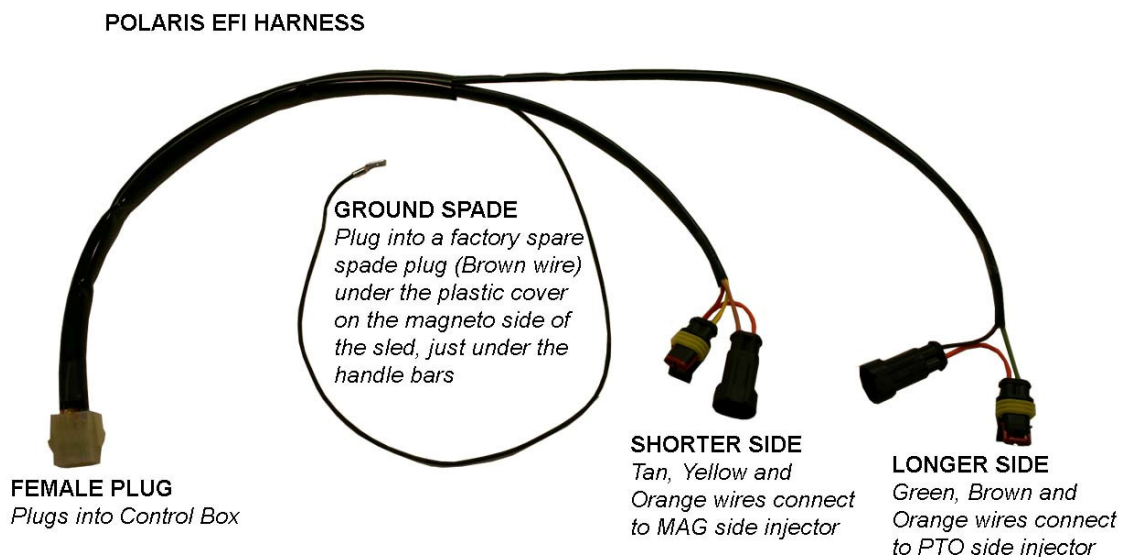
1. The PTO side injector connector is located down below the fuel pressure regulator. The EFI Harness connectors with the longer wires connect to the PTO injector connectors. Unplug the sled's connector and reconnect using the EFI harness connectors.
2. The MAG connector is located down between the oil reservoir and the coolant bottle. It is easier to see the injector plug-in on the mag side if you remove the exhaust and remove the support plate. If needed, you can also remove the brake caliper. It may also be helpful to pull up on the coolant lines and push them onto the cylinder - this will allow you to more easily see the connector. The EFI Harness connectors with the shorter wires connect to the Mag Injector connectors. Unplug the sled's connector and reconnect using the EFI harness connectors.

**It is very important that you insure the connector is plugged in correctly. You should hear it as well as feel it click in.**

*There is very little room. Most people can only fit one hand down in to plug in the injector. Place both parts of the connector in the palm of your hand and get them started. Then push together with your thumb while holding other end with your pinky finger.*

3. Run the wiring harness down along the oil/water bottle, along the side of the engine and across to the injector connectors.
4. The ground wire for the EFI harness will plug into a factory spare spade plug (**Brown wire**) under the plastic cover on the magneto side of the sled, just under the handle bars. The Acc power plug (**two pin, molded connector red and brown wires**) for the nitrous harness is also located in the same section of the factory wiring harness. It may be necessary to cut the factory zip-tie for the accessory plug to reach our nitrous harness.

**WARNING: Be sure to plug the ground into the BROWN WIRE-not the RED WIRE. This may cause the control box to short out and become defective.**



## V. Box Mounting Locations

The Control Box can be mounted under the hood, on the dash, or on the handlebars using the supplied Velcro strips. Before applying the adhesive strips, thoroughly clean each surface (rubbing alcohol works well). It is also best if each surface is room temperature.

If the box is mounted under the hood, keep the box away from excess heat (like the exhaust), and away from the ignition coil.

**Note:** The Control Box is designed to be splash-proof. Do not submerge or subject the box to high-pressure spray.



## VI. Control Box Menus

**Note:** *The buttons will become inactive whenever engine rpms are above 3500rpm.*

### A. Intro 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:

```
BoonDocker A.Cat
v:04b1 SN:000000
```

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

<b>A.Cat</b>	Sled model	This box is designed for an Arctic Cat. Boxes for other sleds will have other lettering. <b><u>Note:</u></b> <u>Be sure the Control Box is for your model of sled!</u>
<b>04b1</b>	Software Version	This is the software version of the box. The box can be reprogrammed only by sending the box back to Boondocker.
<b>000000</b>	Serial Number	Use this number when registering or identifying your box for technical assistance.

### B. Main Menu

The main menu is shown below:

```
→1-Fuel  3-Load
2-N2O    4-Copy
```

The current selection is shown by the right arrow and the cursor (underscore below the '1' above). 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.

## 1. Fuel Adjust Menu

This selection is used to make fuel adjustments. There are four screens (shown below). The first screen comes up after making this selection.

Go to the next screen by pressing the “sel” button. After pressing the “sel” on the 4<sup>th</sup> screen, you will return to the main menu. Use the **up/down** arrow keys to change the settings. Use the **left/right** arrow keys to switch between settings. The four fuel adjust screens are shown below.

Fuel screen1:    **M1L   LO MD HI tr**  
                          3000 00 00 00 00

Fuel screen3:    **M1L   LO MD HI tr**  
                          6700 00 00 00 00

Fuel screen2:    **M1L   LO MD HI tr**  
                          5000 00 00 00 00

Fuel screen4:    **M1L   LO MD HI tr**  
                          7800 00 00 00 00

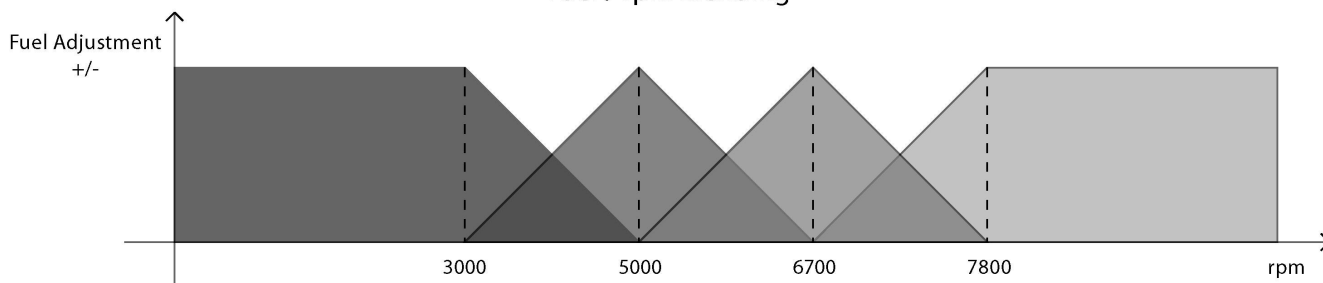
### Fuel Adjust Menu Description:

```
M1L →LO MD HI tr
3000 00 00 00 00
```

**M1L** This displays current map that is being used – in this case, **M1** stands for **Map1**. Five possible fuel maps can be used. The **L** indicates that this map is **Locked** – this means the settings cannot be changed (the up/down buttons have no effect). If 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 Load/Copy sections for more details.

**3000** This displays the rpm region for the fuel adjustments on this screen. For this example, this screen’s adjustments will be centered at 3000 rpm. There are 4 rpm regions. Each region is blended with the region below and the region above it as shown below. The effect of the 3000rpm adjustments taper off until 5000 rpms as shown.

Fuel / rpm Blending



**LO** This adjustment is for Low load conditions. This will affect throttle settings from 0 up to 1/4 or 1/3. For rpm region 3000, this adjustment will effect idle. For other rpm regions, this will affect deceleration and light load conditions. If this setting becomes too high, the engine may load up with fuel during deceleration.

**MD** This adjustment is for Medium (mid-range) load conditions. This will effect throttle settings from 1/4 up to 2/3 or 3/4. This will primarily effect medium load conditions.

**HI** This adjustment is for High load conditions. This will effect throttle settings from 2/3 or 3/4 to full open. This will affect high load conditions.

**tr** This adjustment is to Trim the **PTO cylinder** (**left-side cylinder** when sitting on the sled). This is used to add or subtract fuel on the left side if fine-tuning is desired. *The LO adjustment is not affected by the Trim value – trim is only used for the MD and HI settings.* It is best to tune the right cylinder first then make adjustments to the left (PTO) cylinder if necessary. If more than a small amount of adjustment is required (greater than plus or minus 7), check for other problems first.

**00** Each setting can go from –20 to 99. Refer to the tuning section below for tuning guidelines.

## 2. Nitrous Menu

This screen is used to make fuel adjustments for nitrous use and to display bottle pressure

Use the **up/down** arrow keys to change the settings, use the **left/right** arrow keys to switch between settings, and use the “**sel**” button to go back to the main menu.

```
M1L Fuel N2O 1050
42 40← ON psi
```

- M1L** This displays the current fuel map – **Map1**. The **L** indicates that this map is **Locked** and the settings cannot be changed. If a **U** is displayed, this means that the map is **Unlocked** and the settings can be changed. Refer to the Load/Copy sections for more details.
- Fuel 40** This is the Fuel adjustment for nitrous use. A default value of 40 is used – you must still adjust this value to properly tune for nitrous - refer to the Nitrous Tuning section for more details.
- 42** This is the **Compensated Fuel** amount that will be delivered when nitrous is used (N2O is ON). The bottle pressure input is used to adjust the Fuel adjustment (**40**) up or down.
- N2O** This shows the setting for the Nitrous Solenoid. This setting works as described below:
- N2O ON: The nitrous solenoid will turn on when the nitrous button is pressed. The adjusted fuel amount (compensated for bottle pressure) will be added.  
**Note:** fuel will not be added unless the engine is above 3500rpm. This allows you to test the nitrous circuit at idle without flooding the motor.
- N2O OFF: The nitrous solenoid will not turn on when the nitrous button is pressed. Fuel will be added according to the Fuel setting only (not the Compensated Fuel), and it will be added even if the engine is below 3500rpm. This can be used for tuning purposes – extra fuel can be added whenever the button is pressed.
- 1050** This is the nitrous bottle pressure in psi. If the nitrous pressure transducer is not connected to the Control Box, this could be a random value. **Note:** The nitrous pressure will not be updated if the engine is above 3500 rpm.



### 3. Load Map Menu

This screen is used to load a different Fuel adjustment map. It can also be used to lock and unlock each map. Five fuel adjustment maps can be loaded (Map 1-5). When a new map is loaded, the current adjustment settings will be changed to the values from that map.

When a map is loaded, the **Mx** (x is the map number) that is displayed in the Fuel and Nitrous menus will show the loaded map number as a reminder.

Use the **up/down** and **left/right** arrow keys to move the cursor around. If the cursor is over a number (1-5), the corresponding map will be loaded. If the cursor is placed over an **L** or **U**, the corresponding map's (1-5) lock/unlock status will be changed (from Locked to Unlocked or Unlocked to Locked). Select **Q** to Quit and return to the main menu.

```
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  
**Q**                Quits this menu

If a map number 1-5 is selected, the following screen will be displayed to confirm the Load operation (x=selected map):

```
Load Mapx?   Y →N
```

If an L or U is selected, the following screen will be displayed to confirm the Lock/Unlock operation (x=selected map):

```
Lock Mapx? Y →N   or   Unlock Mapx? Y →N
```

### 4. Copy Map 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. When a map is saved, **Mx** that is displayed in the Fuel and Nitrous menus will remain on the same map.

Use the **up/down** and **left/right** arrow keys to move the cursor around. If the cursor is over a number (1-5), the corresponding map will be loaded. If the cursor is placed over an **L** or **U**, the corresponding map's (1-5) lock/unlock status will be changed (from Locked to Unlocked or Unlocked to Locked). Select **Q** to Quit and return to the main menu.

```
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

If a map number 1-5 is selected, the following screen will be displayed to confirm the Load operation (x=selected map):

```
Copy TO Mapx?   Y →N
```

If an L or U is selected, the same screen as in the LOAD menu will be displayed to confirm the Lock/Unlock operation.

## VII. EFI Tuning

Each Fuel adjustment setting goes from -20 to 99. Positive numbers add fuel and negative numbers subtract fuel. The minimum is set to -20 so accidental adjustments beyond this value don't occur. However, this will not prevent a lean burndown! You must still take the proper tuning steps.

The maximum is set to 99. This does not mean you have an effective range all the way to 99 – you will likely max out the injector before this setting is reached. Your usable adjustment range (max value) is dependent on how long the ECU already has the injector on. This will vary depending on rpms, throttle setting, temps, and can be different from sled to sled even of the same model. There is no direct relation

Exhaust Gas Temperature gauges can be an effective tuning tool, but they are not a substitute for reading spark plugs and piston wash and feeling 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.

### 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. To find 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. To restart the engine you may have to pull several times with the throttle held wide open.
4. Set the N2O setting to OFF and use the nitrous button to add fuel interactively. When the nitrous button is pressed, the amount of fuel set in the nitrous menu will be added in addition to the fuel adjustments that are already made.

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  | EGT's can read low during detonation – heat is going into the cylinder and piston instead of out the pipe. Detonation often requires an experienced tuner to detect.  |
| 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. |



## VIII. Nitrous Tuning

The Fuel adjustment setting in the Nitrous 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 the amount of nitrous that is sprayed. However, you still must go through the nitrous tuning procedure before you can safely use nitrous.

The numbers for the nitrous fuel adjustment work the same as for the non-nitrous fuel adjustments. This can help to quickly get a baseline nitrous fuel setting if fuel adjustments are made after the nitrous has been adjusted. For example, if the 7800 HI fuel setting is **decreased** by X amount, you need to **increase** the nitrous fuel setting by X amount.

### **Warning: Only adjust the Control Box settings according to the steps below.**

The steps below should be done with a full nitrous bottle that is at the 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.**

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!

1. Increase the nitrous fuel adjustment setting on the Control Box until you notice a drop in the power increase when using nitrous. When this occurs, you are rich. Be sure you have reached this point before proceeding. Note this adjustment setting.
2. Only after step 1 is complete, start reducing the fuel setting. Continue reducing the fuel setting until a maximum power increase is obtained. This can be determined by noticing your maximum RPM.
3. If the fuel is reduced but no power increase is noticed from the previous setting, this means you are lean. Note this adjustment setting.
4. Increase the fuel setting back to where it was before no additional power increase was noted in step 3. This setting should be somewhere between the rich and lean settings. It is best to stay on the rich side.
5. 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 next section for changing nozzles) before using nitrous again.

## Pressure Transducer Faults

When the nitrous button is pressed, the Control Box 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.

**ERROR: N2O pres.  
transducer fault**

This screen may appear if the pressure transducer is unplugged or there is a wiring problem.

**ERROR: N2O pres.  
over 2000 psi**

This screen will appear if the pressure transducer senses a pressure above 2000psi. This may also occur if the pressure transducer is unplugged.

## IX. Troubleshooting

Engine runs erratic	<ol style="list-style-type: none"><li>1. Verify that the EFI Harness Ground Wire has a good connection.</li><li>2. Verify that all wiring is in good condition.</li><li>3. To determine if problem is with the Control Box, unplug the Control Box and install the jumper on the EFI harness.</li><li>4. If problem persists with Control Box unplugged and jumper installed, unplug the EFI harness and plug original harness back into the injectors.</li><li>5. If problem only occurs with Control Box plugged in, change all fuel adjustment settings to 0 and see if problem persists.</li></ol>
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, your battery voltage is getting low – replace your battery.
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. If there is excess moisture that does not go away, the box can be opened up and dried out. Note – there is a silica gel pack inside the box that will help absorb extra moisture.
Check Engine light	<ol style="list-style-type: none"><li>1. 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 or broken wires.</li><li>2. Fuel adjustment is too high. It is possible to increase the fuel adjustment so the injector is always on. Some ECU's check to make sure the injector is off before it drives the injector on again. A fault will be detected if this condition is not met.</li><li>3. Fuel adjustment is too low. If the fuel adjustment is set too low, the injector may not completely turn on. The ECU may detect this as a fault.</li></ol>

## X. 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.