# Polaris 600/700/800 Turbo EFI Control Box Instructions (Universal Harness)

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 universal harness
___1 Pressure Transducer
___1 mounting bracket for transducer
___10 red butt-splices (2 is spares)
___3 blue butt-splices (1 is spare)
___1 battery connector
___1 jumper connector

## 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 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 reduce fuel or increase fuel amounts for certain rpm ranges and load conditions. This is done by changing its fuel adjustment settings by using the buttons 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! Use of an Air/Fuel Guage and plug readings are highly recommended when tuning.

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**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 **Dielectric Grease** on all connections to help prevent corrosion on the terminals.

**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 will 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.

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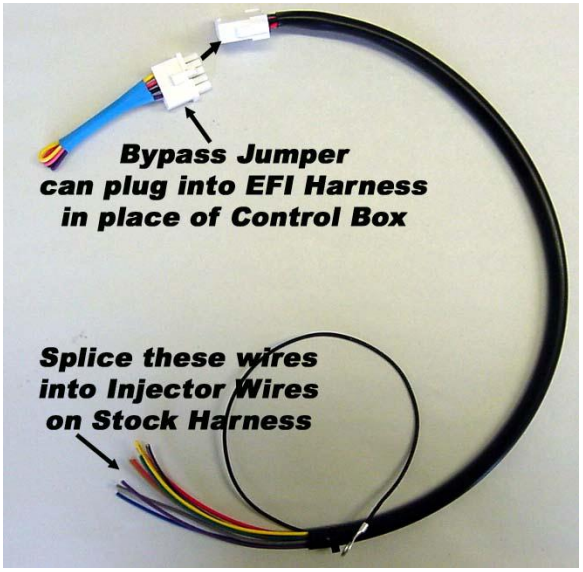
## II. Control Box Harness Connectors

There are two 10-pin connectors at the end of the black cable on the control box. One is for the EFI wiring harness and the other is for the transducer harness. These two connectors are keyed (male/female) so only the correct harness will fit into the correct plug-in.

**Note:** Use **Dielectric Grease** on all plug connections to help prevent corrosion on the terminals.

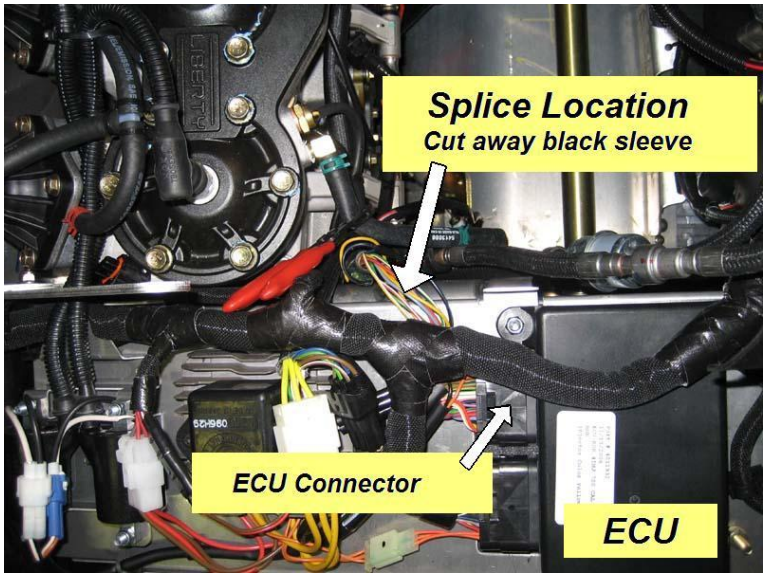



The Control Box EFI harness will need to be spliced into your sled's harness as follows:

1. Locate the fuel injector harness (see photo). This harness comes from the smaller (26-pin) ECU connector. Cut away several inches of the black sleeve around the harness as shown.

2. Determine where the control box will be mounted and how the harness will be routed. Route the harness so the wires end up near the sled's fuel injector harness. Be sure to route the harness away from hot areas and moving parts.

3. If the sleeve over the EFI harness wires is too long, mark a cutting location, pull the sleeve off the wires, cut it to length, and reinstall it over the wires.




Note on using the supplied Crimp/Heat-shrink connectors:

The supplied Crimp/Heat-Shrink Connectors, if installed correctly, will provide a reliable connection. After the wires are cut and the insulation is stripped, the connector is crimped onto the wires. The connector is then sealed by the heat-shrinking process (adhesive inside the connector will melt and seal out moisture). Proper crimping and sealing is critical to the reliability of these connectors. When crimping, be sure to use the correct crimping tool. DO NOT USE A CRIMPER THAT PUNCHES INTO THE INSULATION. After crimping, pull on the wires to be sure they are securely crimped. Then apply heat to shrink the connector's insulation tightly around the wires. See example in photo.

4. Power wire:

   Use the blue Crimp/Heat-Shrink Connector to attach the **Red** power wire to the **Red/Blue** wire on the sled's harness. Cut one of the **Red/Blue** wires on the sled's harness (there are 2 of these, doesn't matter which one), leave enough working room on both ends. Cut the **Red wire** on the Boondocker EFI harness to length, but leave a little extra length. Strip the insulation from these three wires about 1/4" from the end. Twist together the **Red** and one **Red/Blue** wire, insert into one end of the Crimp/Heat-Shrink Connector and crimp. Insert the other **Red/Blue** wire into the other end of the connector and crimp.

| **Boondocker EFI Harness** | **Sled Injector Harness** |
|---|---|
| **Red** | **Red/Blue** |

5. Injector wires:

| **Boondocker EFI Harness** | **Sled Injector Harness** |
|---|---|
| **Yellow** | **Yellow** on **ECU** side |
| **Tan** | **Yellow** on **Injector** side |
| **Green** | **Green** on **ECU** side |
| **Brown** | **Green** on **Injector** side |
| **Blue** | **Yellow/White** on **ECU** side |
| **Violet** | **Yellow/White** on **Injector** side |
| **Pink** | **Green/White** on **ECU** side |
| **Gray** | **Green/White** on **Injector** side |

Note: There are 2 yellow wires on the 26-pin connector. Be sure to use the yellow wire in **position 6** on the 26-pin ECU connector.

   a. Cut the injector wires (yellow, green, etc) leaving enough working room on both ends. Strip these wires about 3/16".

   b. Cut the EFI harness wires (yellow, tan, green, etc) to length, leaving a little extra length. Strip these to about 3/16".

   c. Note that four of the injector harness wires go to the ECU and four go to the Injectors, be sure to re-verify if you are connecting to the ECU-side or Injector-side. Use the red Crimp/Heat-Shrink Connectors to connect to the wires as listed above.

6. TPS wire: If installing a nitrous kit, use the white wire on the N2O harness, otherwise, use the white wire on the supplied TPS connector.

| **Boondocker EFI Harness** | **Sled Injector Harness** |
|---|---|
| **White** | **Light Blue** |

   Use the blue Crimp/Heat-Shrink Connector to attach the **White** TPS wire to the **Light Blue** wire on the sled's harness. Cut the **Light Blue** wire on the sled's harness, leave enough working room on both ends. Cut the **White** wire on the Boondocker TPS/N2O harness to length, but leave a little extra length. Strip the insulation from these three wires about 1/4" from the end. Twist together the **White** and one **Light Blue** wire, insert into one end of the Crimp/Heat-Shrink Connector and crimp. Insert the other **Light Blue** wire into the other end of the connector and crimp.


7. Connect the EFI harness ground eyelet (black wire) to the grounding stud next to ECU as shown in the picture. If necessary, cut a slit in the sleeving of the EFI harness to allow this to reach. This connection must be made to **chassis ground**, not the engine ground! A good ground connection is extremely important!

8. Heat shrink all the splice connectors.

9. Double check the harness routing to be sure it is away from hot areas and moving parts. Use zip ties to secure it. Use reflective heat tape if the harness must be routed near hot items such as the exhaust.

## III. Control Box Mounting Locations

The Control Box can be mounted under the hood, on the dash, or on the handlebar riser 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 coils.

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

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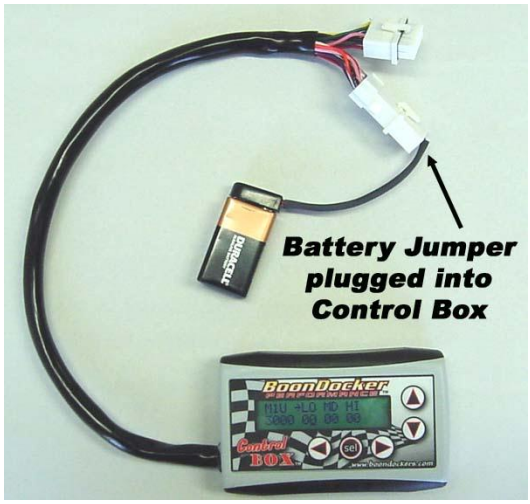
## IV. Battery / Jumper Connectors




Two jumpers are supplied with 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 Connector** in order to operate the box without the sled running.

### 2. Jumper Bypass Connector

The Jumper/Bypass connector can 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.

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## V. 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 and when the engine is running. Up to 5 different maps are stored in the box (currently all with zero values). The box will remember what map was last selected and what its settings are – you do not need to do anything to save a map.

### 1. 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:

```
Polaris 700Turbo
Ver:5.1
```

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

**`Polaris700`** Sled model. This box is designed for the Polaris 700 Turbo. Boxes for other sleds will have other lettering.

**`Ver:5.1`** This is the software version of the box. The box can be reprogrammed only by sending the box back to Boondocker

## 2. 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.
**Stats** Display runtime data, captured data, and recorded maximum data.
**N2O** Menus for optional Boondocker Nitrous kit.
**Map** Go to the **Map** menu.

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

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# 3. Fuel Adjust Menus

This selection is used to make fuel adjustments. There are up to seven **Fuel** adjust screens (examples shown below). Fuel screen1 will be displayed after moving the cursor to the **Fuel** selection on the **Main Menu** and pressing the **"SEL"** button.

Go to the next screen by pressing the "**SEL**" button. After pressing the "**SEL**" on the last **Fuel** adjust screen, you will return to the Main Menu. Use the **Left/Right Arrow** keys to switch between settings. Use the **Up/Down Arrow** keys to change the setting values. Sample **Fuel** adjust screens are shown below (actual rpm settings and number of screens may be different for your model).

**Fuel** screen1:
```
M1L  LO MD N2 DL
3000 00 00 00 00
```

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

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

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

**Fuel** screen5:
```
M1L  LO MD HI tr
8400 00 00 00 00
```

**Fuel** screen6:
```
M1L  -4 -2  0 +1
TboL 00 00 00 00
```

**Fuel** screen7:
```
M1L   2  3 12 18
TboH 00 00 00 00
```

**Fuel** screen8:
```
M1L  AM DR Sens
ACEL 00 00 00
```

The control box allows fuel adjustments to be made according to the following two factors: RPM and Engine Load.

**RPM Regions:**
Up to seven RPM regions are pre-programmed in the control box which allows fuel adjustments to be made at specific RPM settings. Whenever the engine RPMs are between these specific regions, the fuel adjustment will be the result of the adjacent RPM fuel settings blended together. For example, the fuel setting at 5000 RPM is centered at 5000 RPM, but this value also has an effect on fuel whenever RPMs are above 3000 RPM and below 6700 RPM (the two adjacent settings for this example). Suppose the 3000 fuel setting is at "4" and the 5000 fuel setting is at "8", so if engine rpms are at 4000 the actual fuel adjustment made will be ½ of "4" and ½ of "8" which is "6".

**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 (idel) 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.

## 3.1 Fuel Screens (RPM Adjustments)

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

Below is a description for each field show in the above sample screen:

**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 Load/Copy sections 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. There can be from 3 to as many as 7 rpm regions depending on the program version. The effect of the 3000rpm setting tapers off until 5000rpm, while the effect of the 5000rpm setting ramps up as rpms go towards 5000. The other regions work similar to this.

**LO / MD / HI** These are the engine Load settings for each RPM region. 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

**tr** This adjustment is to **Trim** the **PTO cylinder**. This is used to add or subtract fuel on the PTO 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 (mag) 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 (such as incorrect harness connections to the PTO cylinder).

**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 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. 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 readings, and fuel pressure when running with engine mods that require a lot of additional fuel!

## 3.3 Boost Screens (PSI Adjustments):

These menus adjust the fuel according to the pressure transducer. Fuel can be added or subtracted as follows:

**Turbo Low:**

```
M1L  -4 -2  0 +1
TboL 00 00 00 00
```

-4: fuel adjustment when pressure is below -4 in Hg (normal idle) to -2 in Hg.
-2: fuel adjustment when pressure is between -2 and 0 in Hg
0 : fuel adjustment is centered at 0 psi.
1 : fuel adjustment is centered at 1 psi.

**Turbo High:**

```
M1L  +2 +3 12 18
TboH 00 00 00 00
```

2: fuel adjustment is centered at 2 psi. If pressure is below 2, fuel is blended with 1psi setting. If pressure is above 2, fuel is blended with 3psi setting.
3: fuel adjustment is centered at 3 psi.
12: fuel adjustment is centered at 12 psi.
18: fuel adjustment is centered at 18 psi. If pressure is below 18psi, fuel is blended with 12psi setting. If pressure goes above 18psi, fuel is kept at this setting.

**Note: Be sure to add numbers to the higher boost settings even if you are not operating at higher boost.** For example, if the setting at 18 is set to 0 and your boost starts to go above 12, the fuel that is being added will drop to zero as boost reaches 18psi.

Adjustments can be quickly made to each region in order to provide an optimal fuel curve based on boost.

The negative and low pressure settings (-4, -2, 0, 1, 3) can be used to fine-tune the fuel before and after positive boost is reached.

## 3.3 Fuel Screen (ACEL Adjustment)

```
M1U →AM DR Sens
ACEL 00 00 00
```

This is the last screen displayed when in the Fuel menus. This screen is used to control fuel when the control box senses acceleration (like an accelerator pump). Below is a description for each field show in the above screen:

**M1U** This displays current map that is being used – in this case, **M1** stands for **Map1**

**AM** This displays the **Amount** of fuel to be added (if number is positive) or subtracted (if number is negative) during Acceleration. This fuel amount will be summed with any other current fuel modifications being made by the Control Box. This means during acceleration the final fuel adjustment amount will be the amount due to the Control Box RPM and/or Nitrous settings in *addition* to the AM fuel setting.

**DR** This displays the **Duration** in engine cycles that the fuel shown in AM will modify the existing fuel during Acceleration. The accelerator pump feature will be turned off if this value is zero and no fuel adjustments will be made. The Acceleration fuel adjustment will be turned off whenever deceleration is detected (throttle is backed off) regardless of the DR value.

**Sens** This displays the **Sensitivity** that is used to detect engine acceleration. Higher numbers make this **Less** sensitive. Do not use zero, or acceleration will be on all the time! Suggested values are between 6 and 20, start with a value between 8 and 10.

Note: The **Stats** Screen will display an "A" and a solid block on the right-side of the screen to indicate when the Accelerator pump feature is active as shown:

**Stats Screen indicating Acceleration:**

```
Run 35/40    10   ■
 5500 MD■■■      A
```

---

# 4. 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 (**Map1**-**Map5**) are available.

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

## 4.1 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.

## 4.2 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.

### 4.3 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.

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## 5. 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.

### 5.1 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 10.2NA
 5500 MD███   10
```

**1st line**

| | |
|---|---|
| **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 |
| **N** | If "N" displayed, Nitrous is on |
| **A** | If "A" displayed, Accelerator Pump Fuel adjustment is on |

**2nd line**

| | |
|---|---|
| **5500** | Engine RPM |
| **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 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. Note: The Button Mode can also be configured to Capture the Status screen Press **SEL** to go to the next screen: **Stats: MAX**.

## 5.2 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**.

## 5.3 Stats: PSI

This menu displays nitrous and TPS information.

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

| | | |
|---|---|---|
| **MAX** | **12.2** | This is the **average** maximum boost amount measured in psi. The boost is averaged during a 1 second window in order to filter out boost spikes. This value should be very close to the actual sustained boost. If the display shows "XX.X", the boost value has exceeded the valid range. |
| **Peak** | **13.4** | This is the peak boost value. This is usually higher than the Max boost value by 1 to 2 psi due to spikes on the boost pressure. If the display shows "XX.X", the boost value has exceeded the valid range. |
| **Clr** | **Y N** | Selecting **Y** will clear the save PSI Max/Peak values. Use any arrow key to select **Y** or **N**. Pressing "**SEL**" takes you to the **Main Menu**. |

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# VI. Nitrous Menus

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

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

| | | |
|---|---|---|
| **Fuel** | **040** | **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:** This is the amount of fuel that will be added during nitrous use or when the button is activated (see Btn settings).

**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**.

---

# VII. Turbo EFI Tuning

## Fuel Requirements:

**Race gas MUST be used**, even for low boost! Detonation will quickly destroy your engine! (see topic in Tuning Tips)

**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 octane than other comparable fuels**. Other suggested brands include Unical, Rockett Brand, F&L Racing Fuel, and Trick racing gas. Always use fresh fuel from a sealed barrel.

## Spark Plug Gap:

Use new spark plugs and reduce the gap to .018" - .020". Carry extra plugs – leaded fuel and boost are hard on spark plugs!

## Recommended Control Box Settings:

Call Boondocker for suggested starting numbers.

## 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 starts to close off). Make sure the engine is tuned properly before increasing the boost and watch closely for proper fuel mixture and detonation (see topic in Tuning Tips).

## 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 and are recommended, 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. Typical EGT temps can be between 1250 – 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). 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! As oxygen is added, the flame gets hotter to a certain point, then too much air can can gradually cool things off.

| | |
|---|---|
| **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. Stock timing seems to work best for this turbo. |
| Fuel | Different fuels have different specific gravities (densities) and other characteristics which can affect your mixture requirements from one fuel to another – be aware of this if you change fuels**.** Oxygenated fuel will run leaner than non-oxygenated fuel and is not recommended. |
| 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. Troubleshooting

## 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 on during power up, the button will be disabled and the following message will be displayed until a button is pressed:

```
Button is Stuck!
```

If this condition occurs, the Control Box will still function and adjust fuel properly. The Control Box can be sent back to Boondocker to be serviced.

## 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 following error messages.

| | |
|---|---|
| `Injector 1 Fault` | No signal detected on the MAG side lower injector (yellow wire). |
| `Injector 2 Fault` | No signal detected on the PTO side lower injector (green wire). |
| `Injector 3 Fault` | No signal detected on the MAG side upper injector (yellow/white wire). |
| `Injector 4 Fault` | No signal detected on the PTO side upper injector (green/white wire). |
| `Injector x Fault` | An error occurred that did not get cleared (by pressing any button) before the engine was started again. |

If any of these conditions occur, the Control Box will still try to function and adjust fuel properly. Contact Boondocker to determine if the Control Box and harness need to be sent back to be serviced.

## Other Issues

**Engine runs erratic:**

1. Verify that the EFI Harness Ground Wire has a good connection.
2. 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.

3. Unplug the EFI harness and plug original harness back into the injectors and verify that the sled runs OK (test can only be done at low rpms before boost comes on).

4. If problem only occurs with Control Box plugged in, change all fuel adjustment settings to 0 and see if problem persists.

5. 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.

| | |
|---|---|
| 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. |

## 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.