Raptor 700 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 with 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,** 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 engine'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.

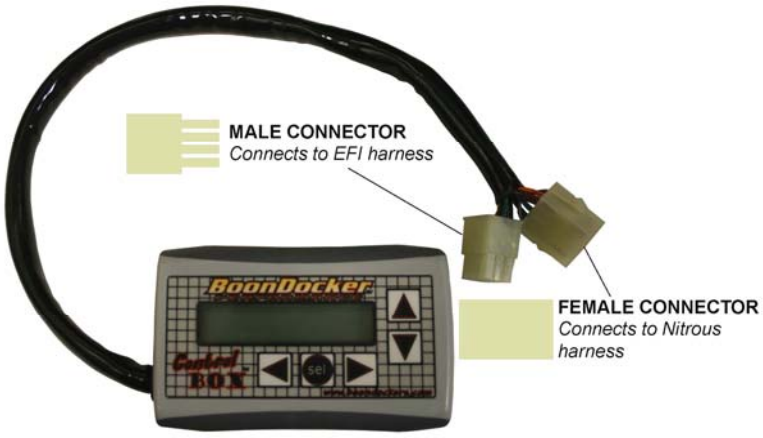
IMPORTANT NOTES:

Note 1: Avoid exposing the Control Box to environments where **static charges** may exist. For example, quickly removing a cover from the atv in a dry environment can create a static spark that will damage the box.

Note 2: 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.

Note3: We recommend using **Dielectric Grease** on all connections to help prevent corrosion on the terminals.

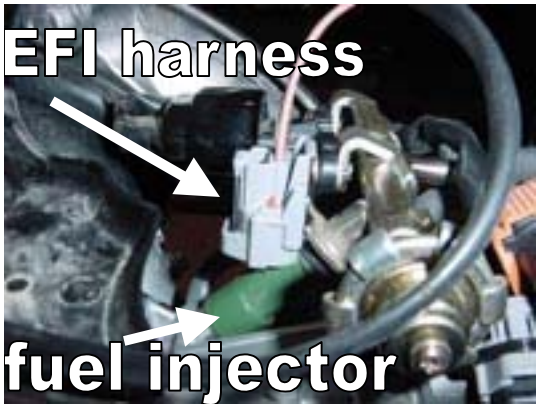
II. Wiring:

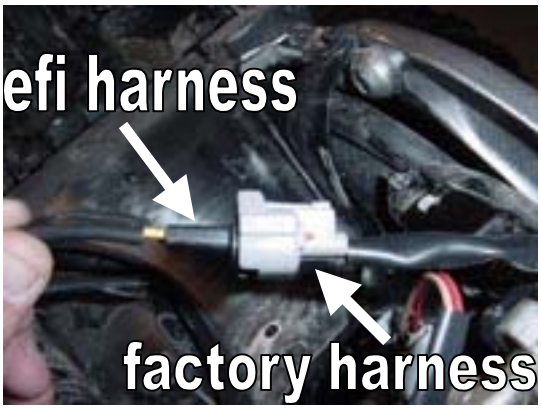


A. Injector wiring:
The Control Box EFI wiring harness plugs in between the stock injector connector and the injector itself. Starting by unplugging the factory connector from the fuel injector. Then plug the boondocker injection harness on to the fuel injector and into the factory connector.

The white connector connects to the Control Box.

You can locate the fuel injector by removing front plastics and fuel tank

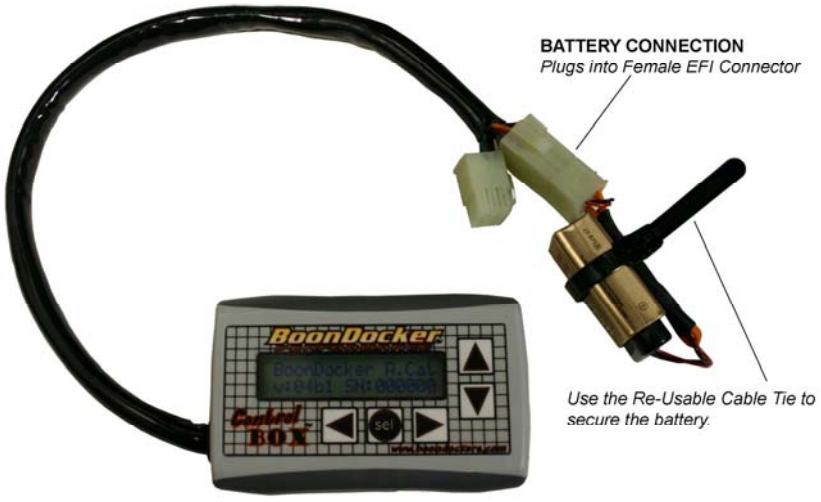




B. Jumper/Battery Connector
The jumper can be used in one of the following two ways:

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 injector harness (9-volt battery is not required). This bypasses the Control Box to allow the engine's ECU to directly drive the injectors. <u>This is for emergency or diagnostic use only!</u>



III. Control Box Mounting Location

The best location for the Control Box is either the left front fender or mounted on the flat spot on top of the fuel tank behind gas cap.

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 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.

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 Raptr
v:49bR SN:000000
```

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

Raptr	Model	This box is designed for the Raptor. Boxes for other models will have other lettering.
49bR	Sofware Version	This is the software version of the box. The box can be reprogrammed only by sending the box back to Boondocker.
000000	Serial Number	Use this number when registering or identifying your box for technical assistance.

B. Main Menu

Press any button from the Intro Screen to get to the Main Menu.

```
→1-Fuel  3-Load
 2-PSI   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 seven 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 4th 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 seven fuel adjust screens are shown below.

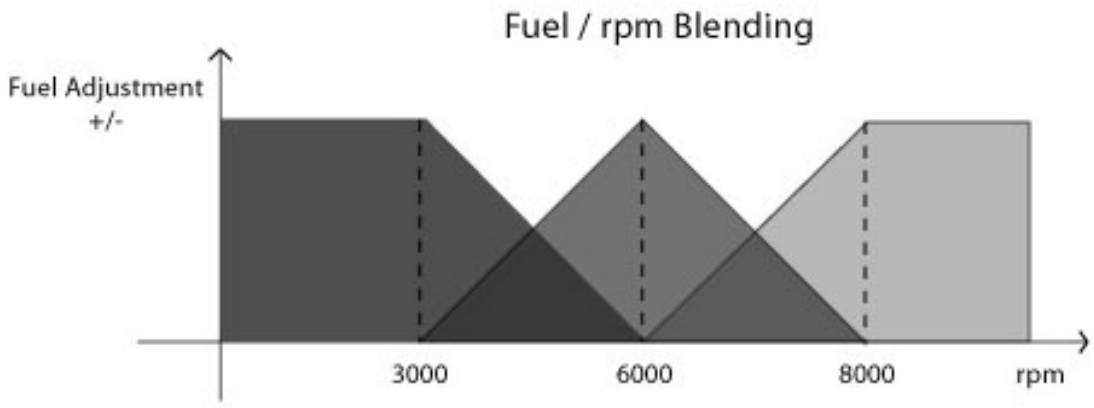
Fuel screen1:
```
M1L  LO MD HI
3000 00 00 00
```

Fuel screen2:
```
M1L  LO MD HI
6000 00 00 00
```

Fuel screen3:
```
M1L  LO MD HI
8000 00 00 00
```

Fuel screen4:
```
M1L  AM DR
ACEL 00 00
```

The fuel adjustment rpm ranges are blended as shown in the picture below. This allows for a broader range of adjustments with fewer steps. Each rpm adjustment setting centered at a particular value: 3000, 6000, 8500, 10500 rpms. Each region is blended with the region below and the region above it as shown. For example, if the rpms are at 4500, the adjustment value used will be half the value of the 3000 setting plus half the value of the 6000 setting.



Screen 1 (rpm adjustment)

```
M1U  LO MD HI
3000 00 00 00
```
M1U = Map 1, Unlocked

This menu's fuel adjustments are effective from idle to 3000 rpm. Above 3000 rpm, the fuel adjustment will be blended with the 6000 rpm adjustment.

LO, MD, HI adjustments are used according to throttle position. LO is active when throttle is closed to ¼ open. MD is active when throttle is between ¼ to 3/4. HI is active when throttle is 3/4 to full open.

Screen 2 (rpm adjustment)

```
M1U  LO MD HI
6000 00 00 00
```

This menu's fuel adjustments are centered at 6000 rpms and are blended with the 3000 setting below 6000 and blended with the 8500 settings above 6000 rpm.

Screen 3 (rpm adjustment)

```
M1U  LO MD HI
8000 00 00 00
```

This menu's fuel adjustments are centered at 8000 rpms and are blended with the adjacent settings above or below 8500 rpms.

Screen 4 (Acceleration enrichment)

```
M1U  AM DR
ACEL 00 00
```

This menu adjusts the fuel during acceleration. Fuel can be added or subtracted as follows:

AM: Amount of Fuel, can be "+" or "–" value.

DR: Duration - number of injection cycles to adjust fuel (0 = original acceleration fuel, 1 = adjust fuel for one cycle, etc.)

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 **M*x*** (***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.

Note: When a map is saved, the box will remain on the current map ("**Mx"** that is displayed in the Fuel and Nitrous menus will remain the same as before).

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
```

VII. EFI Tuning

Each Fuel adjustment setting goes from –99 to 99. Positive numbers add fuel and negative numbers subtract fuel. The Control Box will not prevent a lean burndown! You must take the proper tuning steps the same as if you were tuning a carburetor..

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 engine to engine 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 at operating temperature. The engine'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 Gauge — Observe readings during steady throttle and acceleration. Deceleration conditions will always be lean since fuel is greatly reduced by the engine's ECU. Optimum ratio for best horsepower is between 12:1 and 13:1.

Generally an Air Fuel mixture gauge will show richer (lower ratio) as the fuel is reduced. Sometimes the gauge will show lean if too much fuel is used – the fuel goes out the exhaust unburned and cannot be detected by the sensor causing it to show a lean reading.

Fuel — When running high compression or nitrous, you must watch fuel octane carefully. Octane requirements are determined by engine compression (higher compression requires more octane), ignition timing (retarded timing can tolerate less octane), and camshaft profile.

Different fuels can have different densities and other characteristics which can affect your mixture and fuel requirements. Oxygenated fuel will run leaner! Pay attention when changing fuels – you may have to retune!

Detonation — Detonation will quickly destroy an engine! Detonation can sometimes be heard as a knocking sound in the engine – stop immediately and either add more fuel, increase your fuel octane, or retard your timing.

Detonation often causes the edges on the crown on the piston to have a sandblasted look. The sparkplugs sometimes show a peppered look with small specks of aluminum on the insulator. Detonation is not always noticeable and may require an experienced tuner to detect.

VIII. Nitrous Tuning (for optional nitrous kit)

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

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!
```

The nitrous button is also checked. If the nitrous button is on during power-up, the nitrous button is disabled and the following message will be displayed until a button is pressed:

```
N2O button stuck
```

If either of these conditions persists, the Control Box will need 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, connectors, and terminals are in good condition. Look inside each square 12-position connector and verify that all terminal pins are at the same height in case a terminal is starting to back out. 3. To determine if problem is with the Control Box, unplug the Control Box and install the jumper on the EFI harness (do not install jumper on Control Box). 4. If problem only occurs with Control Box plugged in, change all fuel adjustment settings to 0, plug in Control Box and see if problem persists. 5. If problem persists with Control Box unplugged and jumper installed, unplug the EFI harness and plug original harness back into the injectors to verify the harness is still ok.
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. Moisture will disappear once the box has warmed up.
Check Engine light	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. 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.

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.

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.