BitRunner V2 Quick-Start Guide

The Carbide 3D BitRunner V2 automates your router's on/off functionality in Carbide Motion. No more reaching into the work envelope with a moving end mill. Now you can power down your router with the touch of a button—allowing you to perform tool changes quickly and safely. Use the BitRunner V2 in conjunction with the BitSetter and BitZero to automate your cutting process even more.

BitRunner V2 comes in deluxe and standard versions. While both versions have the same functionality, the deluxe version comes with an EMI filter not included in the standard.

Shapeoko Pro, Shapeoko 4, and Shapeoko 3 models that shipped with the Z-Plus as standard equipment are ready for BitRunner V2 right out of the box. Users with Shapeoko 3 models with Carbide Motion boards 2.3 and earlier (machines purchased before Black Friday 2019) will need to have purchased a new "Carbide Motion PCB – with Enclosure" at checkout. See Install a New Carbide Motion Board (v2.3 or earlier).

We're here to help! If you encounter any issues while setting up or using your BitRunner V2, please contact the Carbide 3D support team at: support@carbide3d.com.

Important Software Information

You must run Carbide Motion 4 or later with the BitRunner V2. Download the most recent version of Carbide Motion from: carbide3d.com/carbidemotion/download/.

Do Not Connect to Ethernet-Enabled Devices

While an Ethernet cable is used to connect the control pendant to the BitRunner V2, the BitRunner V2 is NOT an Ethernet device.

> **WARNING:** Do not attempt to connect the BitRunner V2 or control pendant to any Ethernet-enabled devices such as a modem or internet router.

Setting Up the BitRunner V2

1.1 Review BitRunner V2 Kit Contents

Figure 1

Item	Description	Qty	Note
A	BitRunner V2 (Deluxe or Standard)	1	BitRunner V2 enclosure and attached power cords
B	Control Pendant	1	Enable/disable the BitRunner V2
C	Logic Cable	1	Connects the BitRunner V2 to the controller
D	Ethernet Cable	1	Connects the BitRunner V2 to the control pendant
E	Grounding Cable	1	Attaches to spindle mount to ground the spindle

1.2 Install a New Carbide Motion Board (v2.3 or earlier)

If you have an older Carbide Motion board (2.3 or earlier), you should have purchased a new Carbide Motion PCB and enclosure with your BitRunner V2. Before setting up the BitRunner V2, you will need to install the new controller:

1. Power off the machine.
2. Disconnect the power and USB cables, and all of the motor cables and homing switches from the board.
3. Remove your old controller from the machine.
4. Install the new controller. The USB and power ports face the back of the machine.
5. Reconnect the motor, homing switch, power, and USB cables.

1.3 Connect the BitRunner V2 to the Controller

The BitRunner V2 is designed to lay flat on the ground near your work table and electrical outlet.

The 6-pin male-to-female logic cable connects the BitRunner V2 to the Shapeoko controller. The male end of the cable plugs into the BitRunner V2 and the female end plugs into the controller.

WARNING: Be careful when plugging in the logic cable. The connectors are polarized and MUST be inserted properly. While the cable has reverse voltage protection to prevent damage to the controller and BitRunner V2, the BitRunner V2 will not work unless cable is correctly plugged in.

NOTE: Avoid kinking the cable and ensure it will not be snagged or pinched by any moving parts.

1.3.1 Connect the Male End to the BitRunner V2

1. Plug the male end of the logic cable into the 6-pin female port on the top of the BitRunner V2. See *Figure 2*.

    a. The black plastic latch on the side of the connector faces **RIGHT**.

    b. Make sure the connector is fully seated. You will hear the latch click into place.

Figure 2

WARNING: There is a small triangular-shaped peg on one side of the female connector which must face **OUT**. The peg is quite small but you will be able to feel it easily with your fingers.

The logic cable has reverse-voltage protection to prevent damage to the controller and BitRunner V2 in the event it is incorrectly plugged in. **However, if the cable is plugged in incorrectly, the BitRunner V2 will not operate.**

1. Plug the cable's female end into the 6-pin male BitRunner V2 connector protruding from the front-end of the controller. See *Figure 3.*

    a. The small triangular peg faces **OUT** (away from the rail).

    b. The connector fits tightly. Press in and down to get it to seat fully.
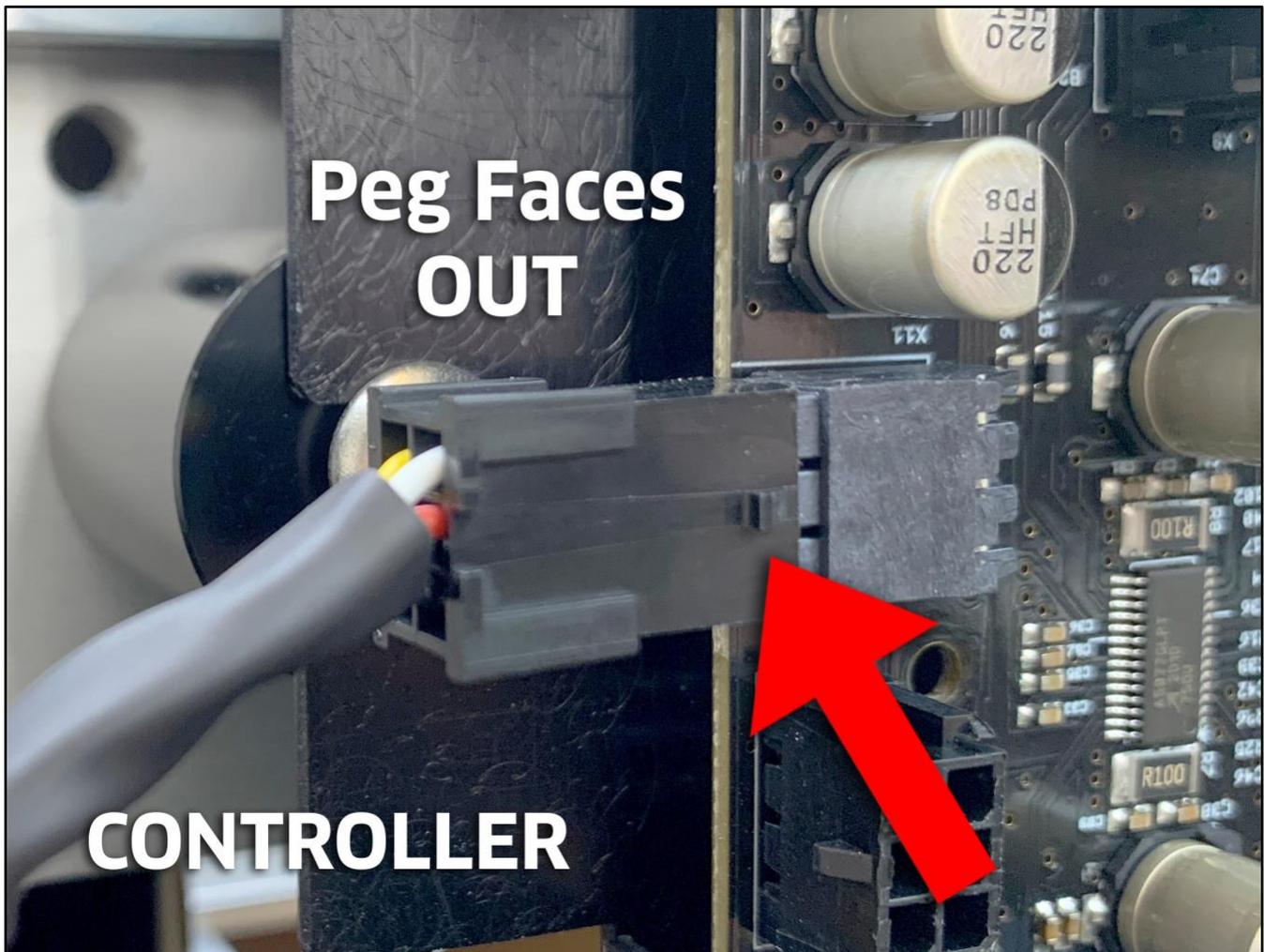

Figure 3

1.4   Connect the BitRunner V2 to the Control Pendant

Use the flat black Ethernet cable to connect the BitRunner V2 to the control pendant. The two ends of the cable are interchangeable. See *Figure 4.*

1.   Plug one end of the Ethernet cable into the Ethernet jack on the control pendant.

     a.   The clear latch and black strain-relief boot face up.

     b.   Press firmly to fully seat the connector. You will hear the latch click into place.

Figure 4

2. Plug the other end of the Ethernet cable into the jack on the top of the BitRunner V2. See *Figure 5.*
   a. The clear latch and black strain-relief boot face **LEFT**.
   b. Press firmly to fully seat the connector. You will hear the latch click into place.

Figure 5

1.5 Connect the BitRunner V2 to the Router and Power

1. Plug the spindle/router power cord into the short female power cable on the left side of the BitRunner V2.
2. Plug the longer male power cable into a wall outlet.

1.6 Attach the Grounding Cable to the Spindle Mount (Optional)

> **NOTE:** We recommend using the included grounding cable to ground the spindle/router in case of static discharge or electromagnetic interference (EMI). We especially recommend grounding the spindle during the winter, or in very dry or EMI-noise-heavy environments.

To attach the grounding cable:

1. Insert the banana plug into the round port on the top of the BitRunner V2. See *Figure 6.*

Figure 6

2. Use an M5 screw to secure the ring terminal end of the grounding cable to one of the two M5 holes on the left side of the spindle mount. See *Figure 7.*

3. Use a couple of zip ties to secure the grounding cable. Make sure the cable is secured where it will not get in the way of the machine's movements.
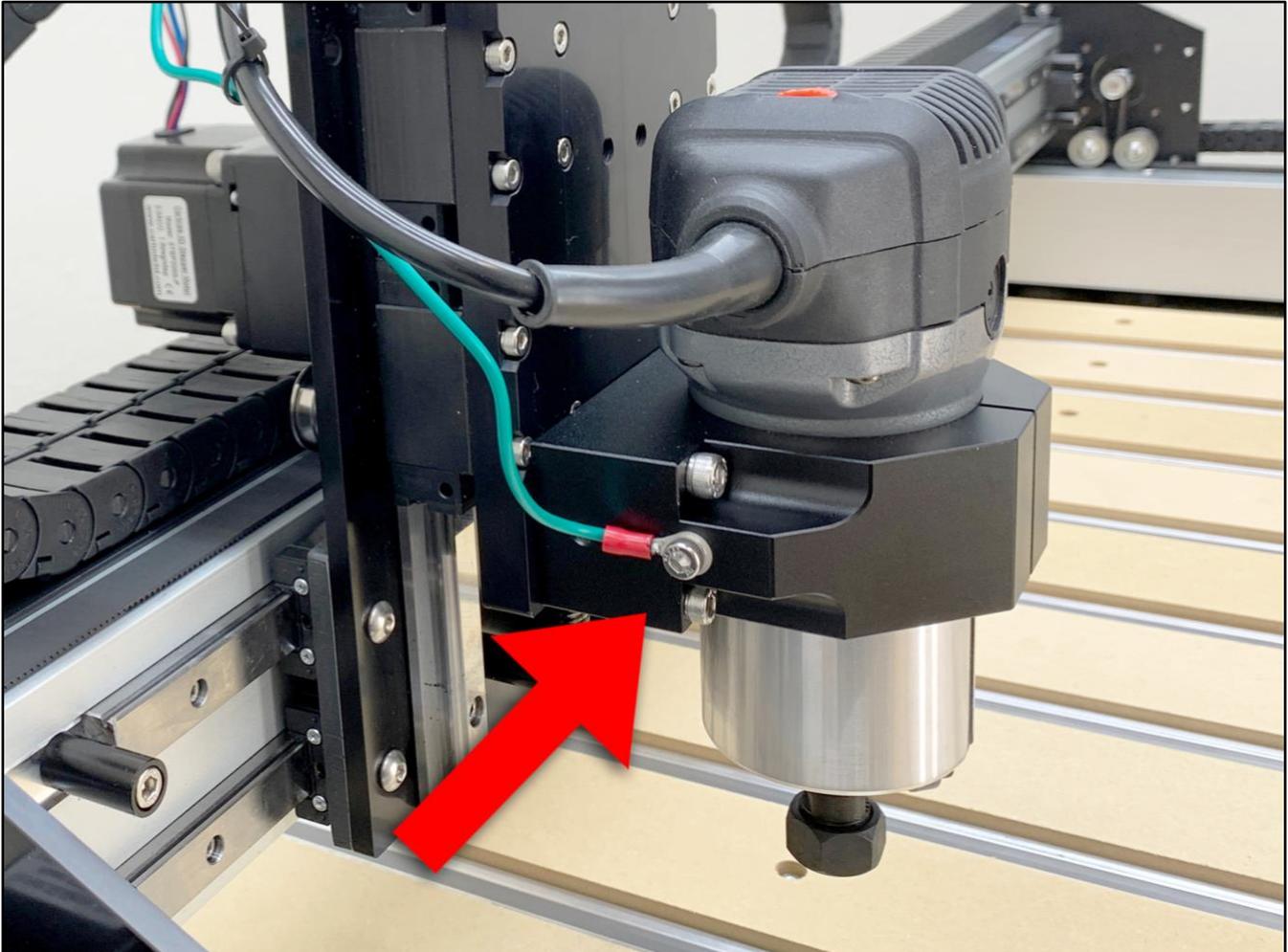

Figure 7

1.7 Upgrade Carbide Motion

The BitRunner V2 requires at least Carbide Motion 4.

1. Check for the build number in the bottom-left corner of Carbide Motion. Build numbers higher than 400 do not need to be upgraded.

2. If you have an older version, download the most recent version of Carbide Motion from carbide3d.com/carbidemotion/download and install it to your computer.

Using the BitRunner V2

2.1 Enable/Disable the BitRunner V2

The BitRunner V2 is enabled and disabled via the control pendant.

To enable the BitRunner V2:

1. Press the control pendant button to supply power to the router. The red button LED will turn ON. See *Figure 8*.

Figure 8

To disable the BitRunner V2:

2. Press the control pendant button again to cut power to the router. The button LED will turn OFF.

2.2   Install an End Mill

WARNING: For safety, it is best practice when installing an end mill or performing tool changes to first disable the BitRunner V2 via the control pendant, then to power off the router.

1. Press the control pendant button to disable the BitRunner V2 (button LED will be OFF).
2. Flip the power switch on the router to the OFF position.
3. Install the end mill.

2.3   Run the Project G-code

1. Flip the power switch on the router to the ON position.
2. Press the button on the control pendant to enable the BitRunner V2.
3. Load the G-code (.nc file) in Carbide Motion.

The G-code (or absence thereof) determines when BitRunner V2 cuts or supplies power to the router. If there is no G-code/.nc file being executed in Carbide Motion, then no power is supplied to the router. The G-code also triggers alert boxes to open in Carbide Motion which let you know when it's time to change the end mill, what RPM to set the spindle to, etc.

When G-code is executed in Carbide Motion, specific commands will determine if power is on or off:

- An **M3 S** command of 1000 or greater (1000 is the RPM) automatically turns the router on. M3 S2800 is an example M3 S command. Alternately, you might see commands written like this: M3S2800.
- An **M5** command turns the router off.
- An **M6** command indicates a tool change.

NOTE: If you're using Carbide Create to design your project, all of the G-code commands for tool change and spindle control are baked in; so, there's no need to change anything.

2.4 Perform Tool Changes

WARNING: For safety, it is best practice when installing an end mill or performing tool changes to first disable the BitRunner V2 via the control pendant, then to power off the router.

1. When the G-code reaches a tool-change command (M6) Carbide Motion will pause the job, cut power to the router, and alert you that it's time to change the tool.

2. Press the control pendant button to disable the BitRunner V2 (button LED will turn off).

3. Flip the power switch on the router to the OFF position.

4. Change the end mill.

5. Flip the power switch on the router to the ON position.

6. Press the control pendant button again to re-enable the BitRunner V2 (button LED will turn on).

7. In Carbide Motion, click the **Resume button** to resume cutting. Carbide Motion will continue cutting until it's time to perform another tool change, load the next G-code file, or until the project is done. See *Figure 9*.
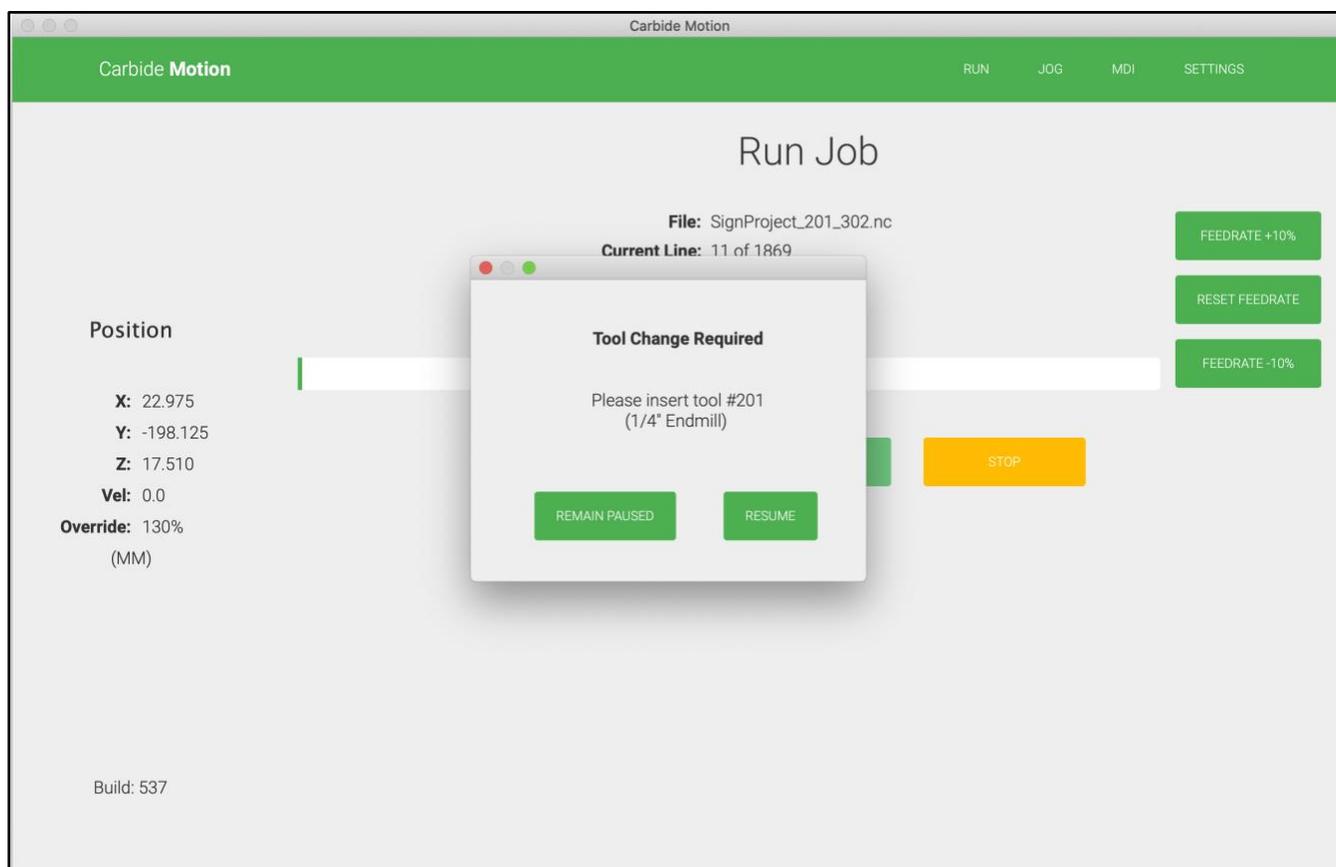

Figure 9

Troubleshooting and Maintenance

3.1 Troubleshooting Guide

BitRunner V2 will not turn on.	BitRunner V2 is not enabled	Press the control pendant button to enable the BitRunner V2.
	BitRunner V2 is not plugged into power.	Ensure BitRunner V2 is plugged into a power outlet.
	Cables are not correctly plugged in.	Ensure all cables are correctly connected. In particular, check correct connection of the logic cable at the Shapeoko controller.
BitRunner V2 stopped working suddenly.	The fuse may have blown if: • You know the G-code is good • Control pendant LED still lights up. The fuse can blow if the router shorts or if there is a short in your home.	Replace the old fuse with a new 15A 250V 5×20mm fuse. See Replacing the Fuse below.

3.2   Maintenance

Check the top of the BitRunner V2 for dust accumulation periodically, and vacuum when necessary.

3.3   Replacing the Fuse

The fuse may have blown if you know the G-code is good and the control pendant LED still lights up, but the BitRunner V2 has stopped working.

1. Unplug the BitRunner V2 from the power source and unplug all cables on the top of the device.
2. Use a 2.5mm hex key to remove the four FHS securing the back panel.
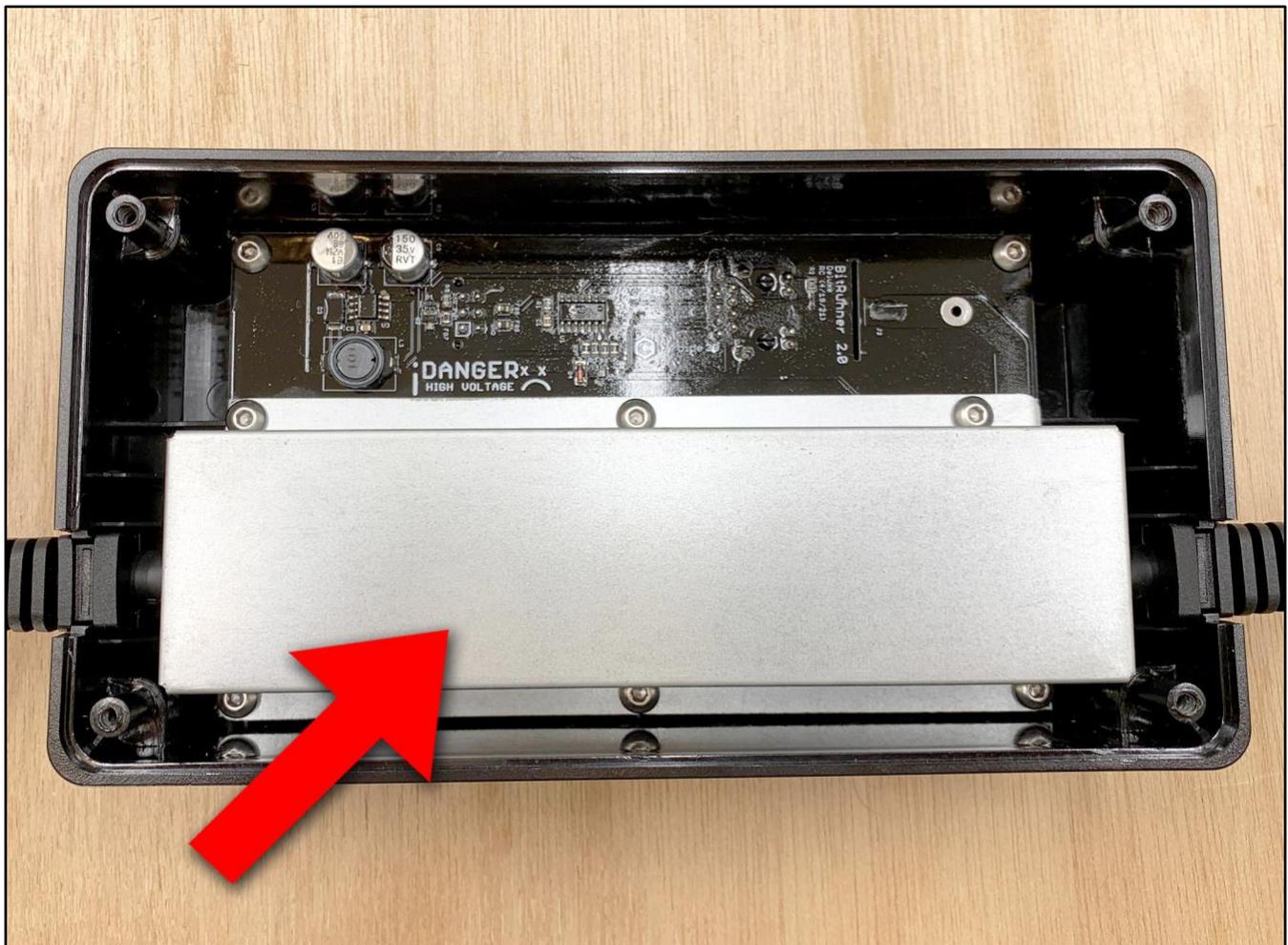3. Use a 2.5 mm hex key to remove the six BHCS securing the metal EMI shield. See *Figure 10*.

Figure 10

4. Use a small flathead screwdriver to carefully pry open the lid of the small black fuse box. See *Figure 11*.

     a. Pry from the left side of the fuse box, near the "B" embossed on the lid.
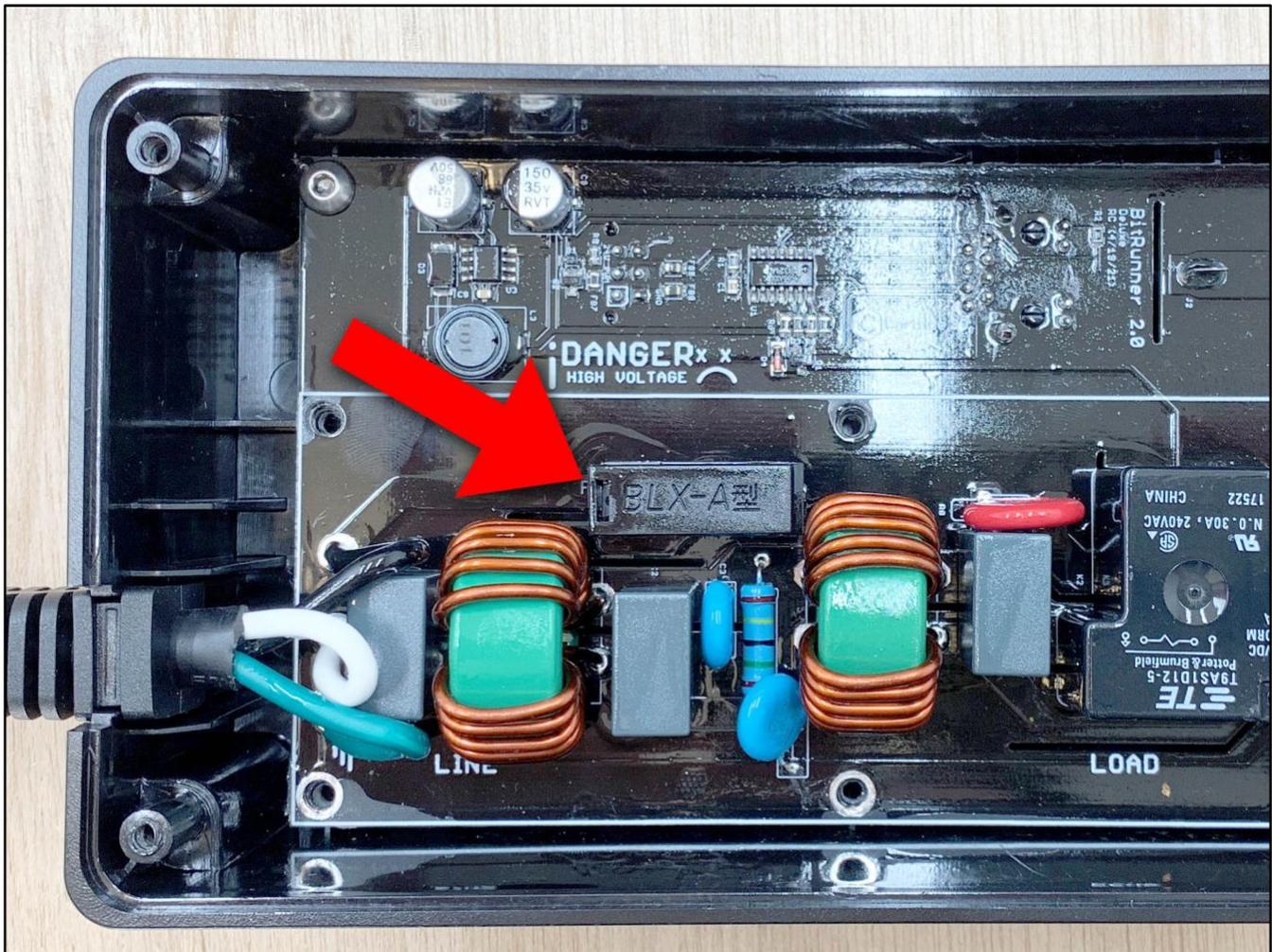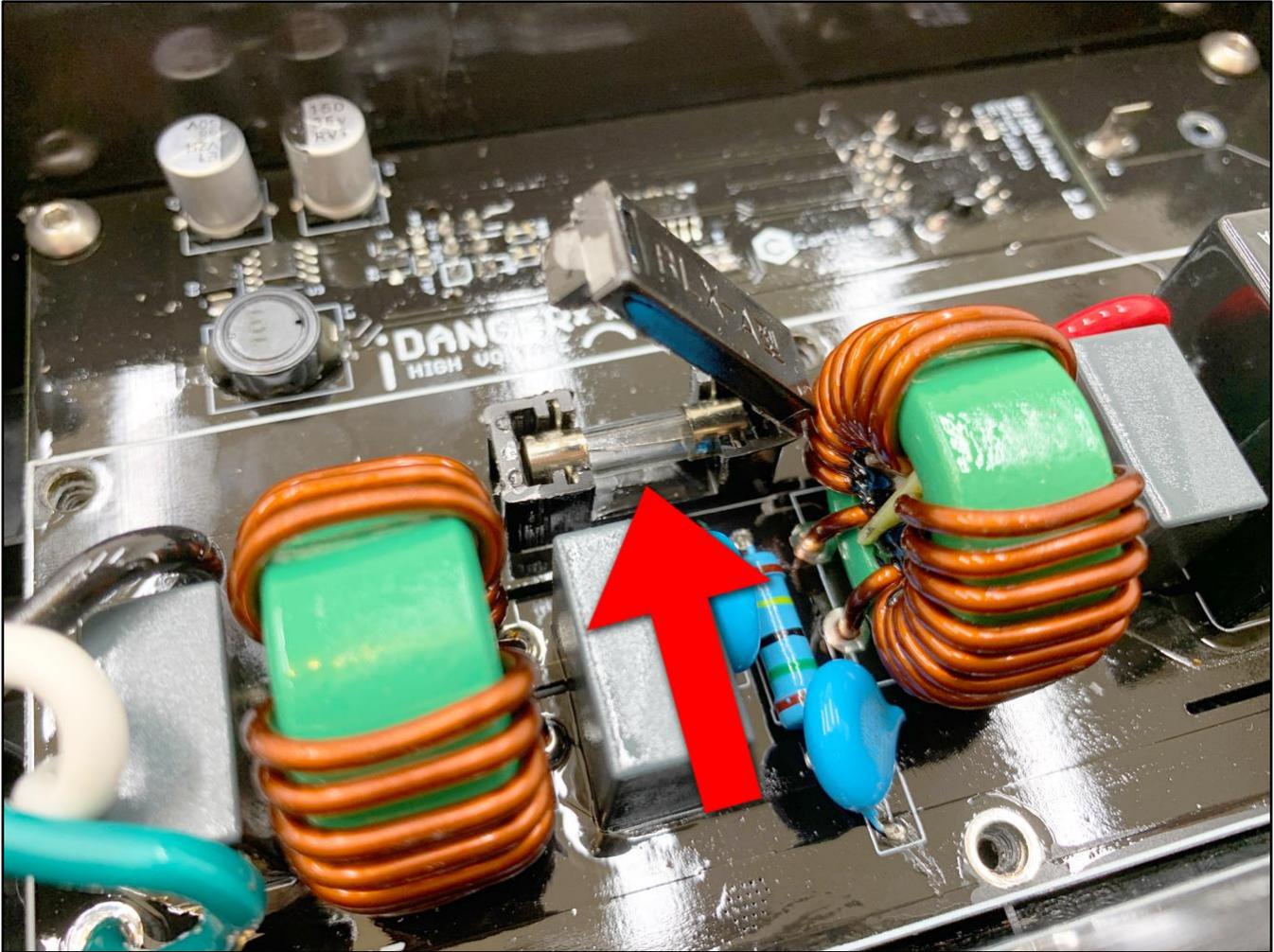

Figure 11

NOTE: Figure 11 shows the deluxe BitRunner V2. The standard version will not have the large coils under the metal EMI shield.

5. Use your finger or a small flathead screwdriver to carefully remove the fuse. See *Figure 12*.

Figure 12

6. Insert a new 15A 250V 5×20mm fuse.
7. Replace the metal EMI shield.
8. Replace the back panel of the BitRunner V2.