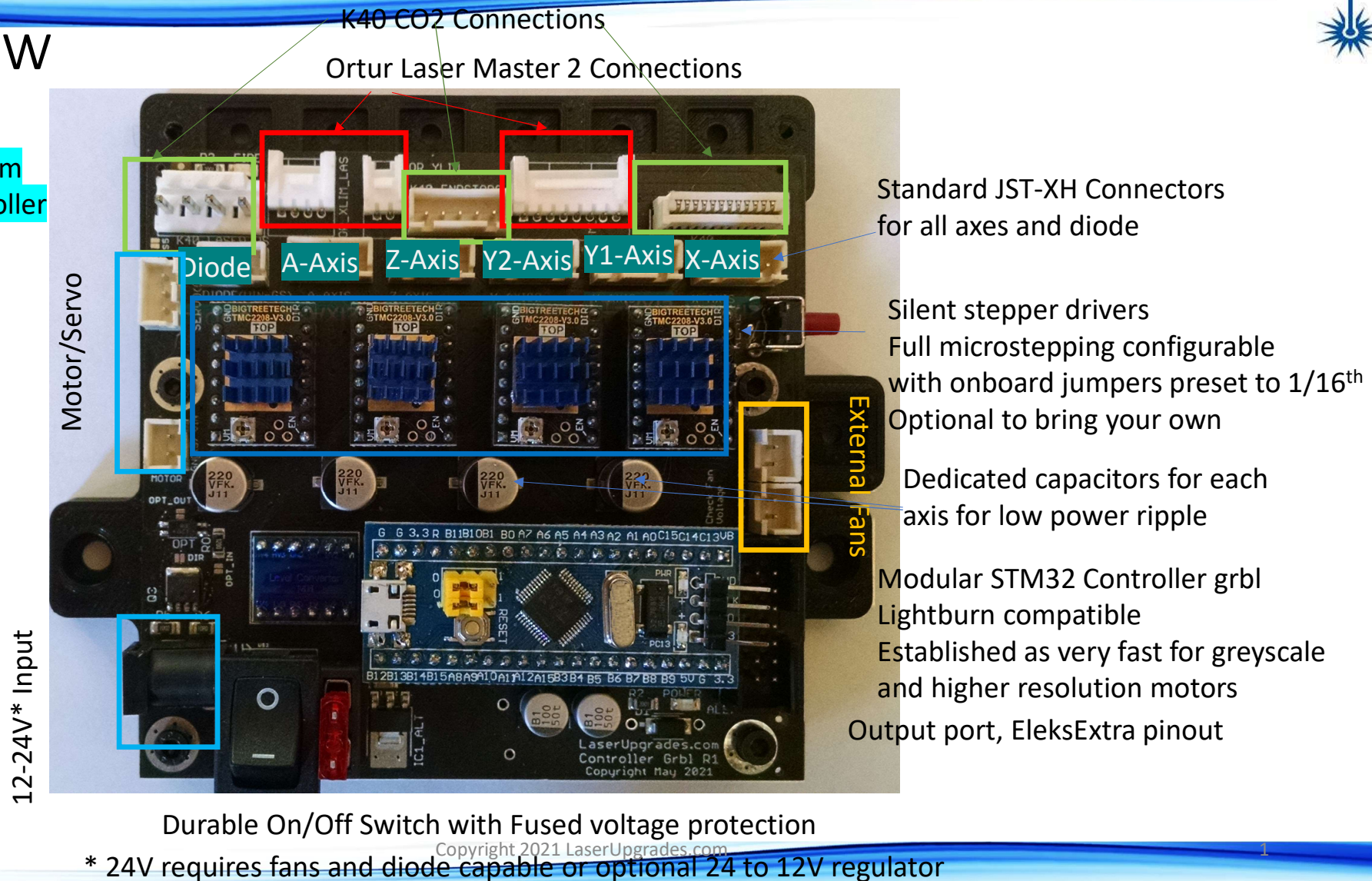




Overview

Black-n-Blue 2
LaserUpgrades.com
Laser GRBL Controller



11/5/2021



Feature Comparison

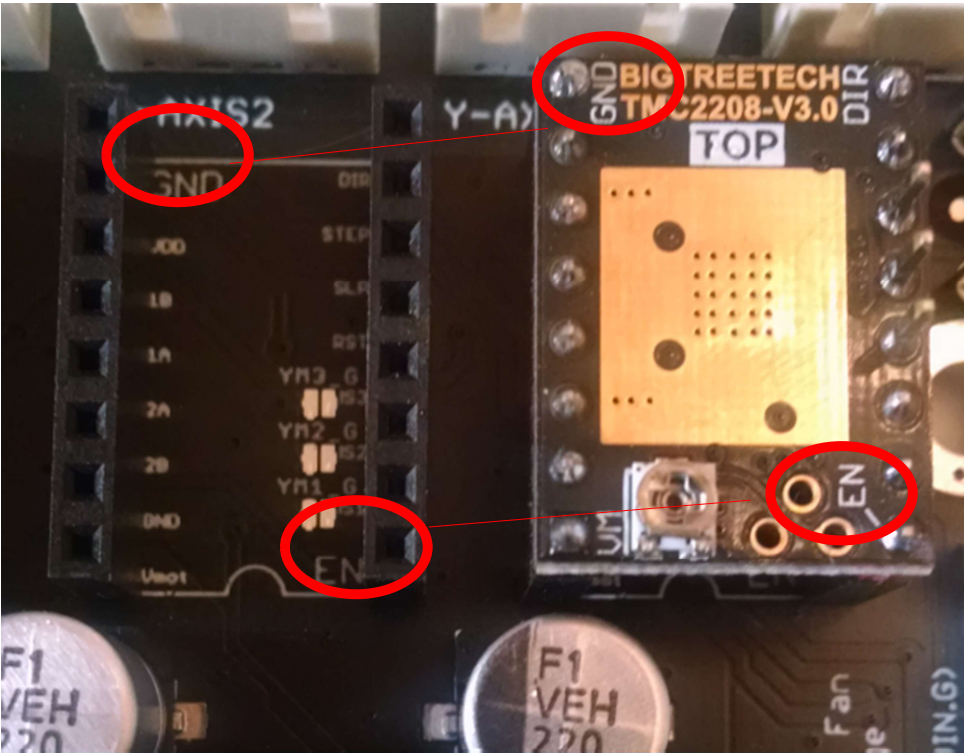
	8 Bit Nano	Black-N-Blue Nano	Ortur LM 2	Ortur LM Pro	LaserUpgrades grbl	Benefits
Processor	8 Bit	32 bit	32 bit	32 bit	32 bit	Faster Processing with 32bit
Speed	16MHz	72MHz	72MHz	72MHz	72MHz	Faster Processing with higher frequency.
High Resolution, greyscale	No	Yes	Yes	Yes	Yes	Highest resolution is with greyscale
Axes	3	4	2*	2*	4	2 axes is bare minimum
Extra Axes for Rotary	Yes	Yes	No	Yes	Yes	\$45 adapter is available for Ortur
Runtime configurable PwM	No	Yes	No	Yes	Yes	Can tune to account for laser/material response
Laser PwM/TTL Output	Yes	Yes	No (3.3V only)	No (3.3V only)	Yes	Can account for laser modules that are not TTL/PwM
Laser PwM Isolated Output	No	No	No	No	Yes***	Can be made immune to power supply noise such as C02
Silent Steppers	Yes	Yes	No	No	Yes	Seriously this should be standard equipment
External Drivers (optional)	?	Yes	No	No	Yes	Enables high power steppers for CNC or high speed, high torque applications needing >2.1A
Max Driver Voltage	12V	12V	12V	24V**	24V**	Enables high power steppers for CNC or high speed, high torque applications needing up to 2.1A
Configurable Driver Microstepping Jumpers	NA	NA	No	No	Yes	Enables up to 1/256 microstepping (impacts torque)
Dual Y Axis	Yes	Yes	No	No	Yes	Higher quality due to consistent movement of both sides of gantry
x, y, z, and Rotary or Lift	No	No	No	No	Yes	1 controller to rule them all
Dedicated Motor Capacitors per axis for low ripple	No	No	No	No	Yes	Less variation of movement accuracy due to burst requirements of steppers
Dual Fan Ports	No	No	No	No	Yes	Enables cooling fan for board and air assist
High Endurance off Switch	No	No	NA	NA	Yes	Ensures no flaky push button degradation over time
Fused Input, Voltage protection	No	No	No	No	Yes	Car fuse is easier to replace than electronics, Ramps style
Multiple 5V Outputs (air assist, buzzer, mist, coolant, e	Yes	Yes	No	No	Yes	Enables many custom implementations, gCode driven in Lightburn

* 3rd axis may be present, but not populated

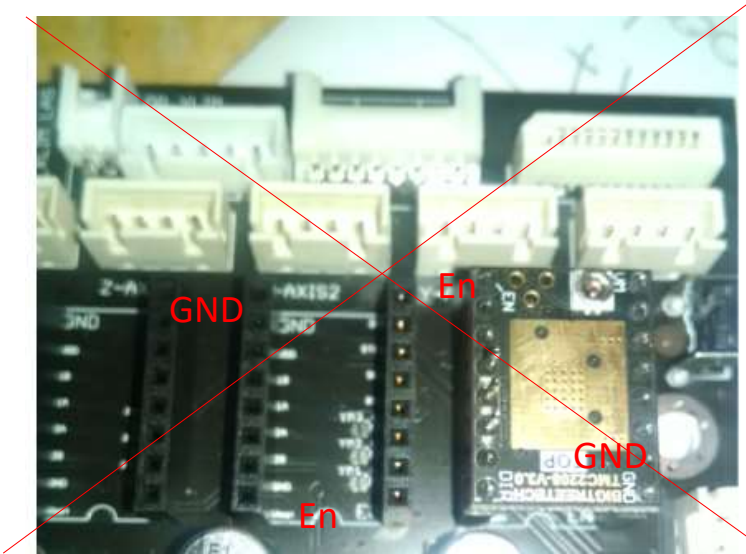
** Requires 24V diodes and 24V fans. Optional circuit is built into LaserUpgrades grbl to accomodate 12V to fans/diode up to 3A with 24V input



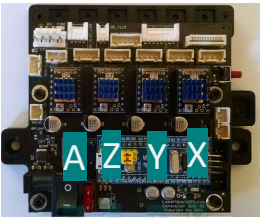
Section 1: General Setup
Step 1: TMC Silent Driver Installation



Correct – Driver is installed properly
All pins line up and silkscreen labels line up



Wrong – Driver is installed 180degrees out
Will blow up all drivers and possibly board

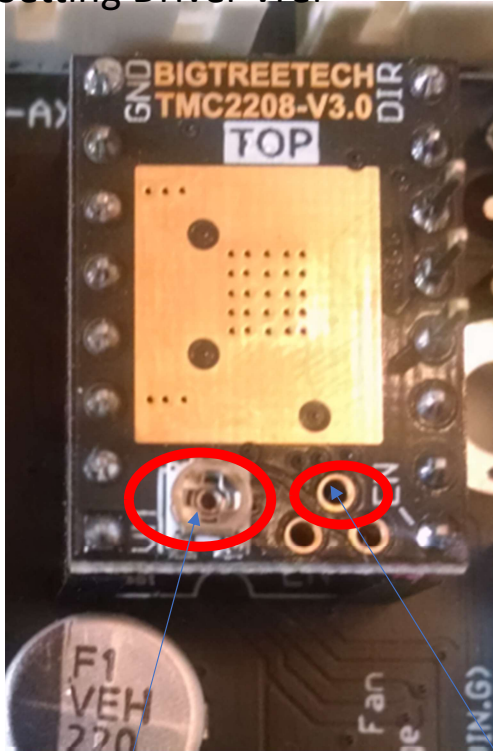


Stepper Axes



Section 1: General Setup

Step 2: Setting Driver Vref



Measure Voltage on these 2 locations

1. Measure voltage on 2 locations shown. For TMC drivers $V_{ref} = I_{max}$.
2. Adjust potentiometer- clockwise reduces V_{ref}
3. Set $V_{ref} = 0.8V$ (0.8A) for X, Z, A axis (assumes 0.9deg, 0.9A steppers)
4. Dual Y Axis setup- Set $V_{ref} = 1.1V$ (1.1A) for Y axis
5. Single Y Axis setup- Set $V_{ref} = 0.8V$ (0.8A) for Y axis
6. More current is not better, I've seen bad results if the steppers cannot manage the heat or the drivers get overheated and lock up.
7. Install blue heatsink- these do not travel well, so these heatsinks are not installed when you get them (see below)

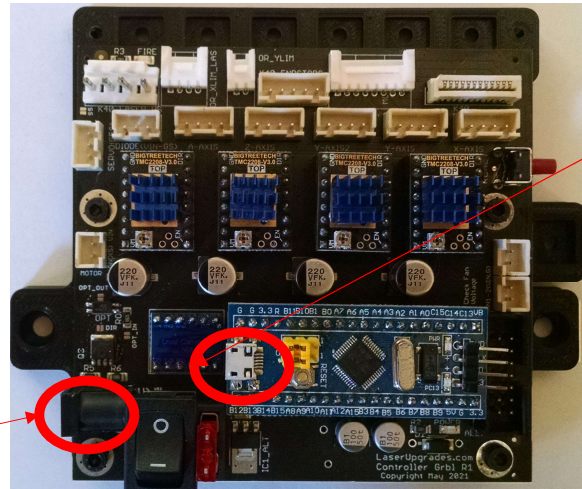


Peel off Plastic Liner
Install Blue Heatsink



Section 1: General Setup

Step 3: Power and Computer Connections



MicroUSB to computer

Shielded with Ferrite Micro USB cable
I have verified this cable works perfectly even
at 15feet (5m)

https://www.amazon.com/Monoprice-USB-2-0-Cable-Type/dp/B002KL5BLK/ref=sr_1_3?crd=L920742AH0YC

12V Ortur 3 prong power supply
If your Ortur power supply is 2
prong, use Amazon link below.

12V 6A 3 Prong Power Supply- or equivalent for Europe/other
Must have a 2.1x5.5mm connector

<https://www.amazon.com/Superpower-Supply-Adapter-Converter-Regulator/dp/B01CYIFOCE>

24V 6A Power Supply
K40 only

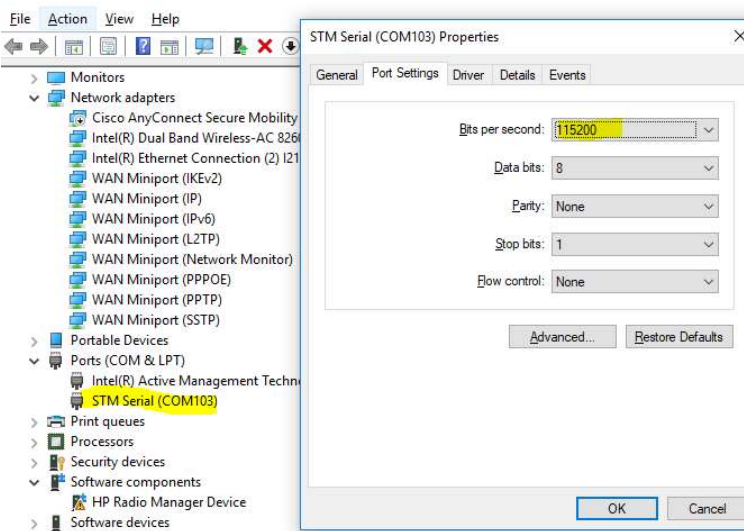
If 24V power used on Diode machine, you must have
separate supply for both diode and fan or
24V capable both diode and fan

<https://www.amazon.com/Auplf-Supply-Adapter-100-240V-Cameras/dp/B088897J2D/>



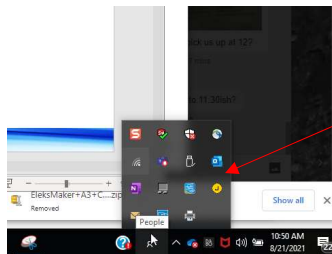
Section 1: General Setup

Step 4: Windows Driver Setup



1. Plug in USB cable to computer and flip power switch (power LED will be lit) You should hear a ring in windows indicating a new device is detected
2. Go to Windows Device Manager- you should see STM device
3. If you see the STM Serial Device in the Ports section- double click it and set the port to 115200 bits/sec
4. If you don't see a STM Serial Device in the Ports section- you should see an unknown device. Usually Windows will automatically detect the device and download the driver. There is usually an indicator in the notifications section of windows (bottom right).
5. If windows cannot find the driver after completing a search (more likely with Window 7 than Win10). Install the Virtual Com Port Driver
6. Failure to see the device at all indicates a cable, computer or controller issue. Contact LaserUpgrades.com to resolve.

Note in this case COM103 is used, this is needed for Lightburn setup

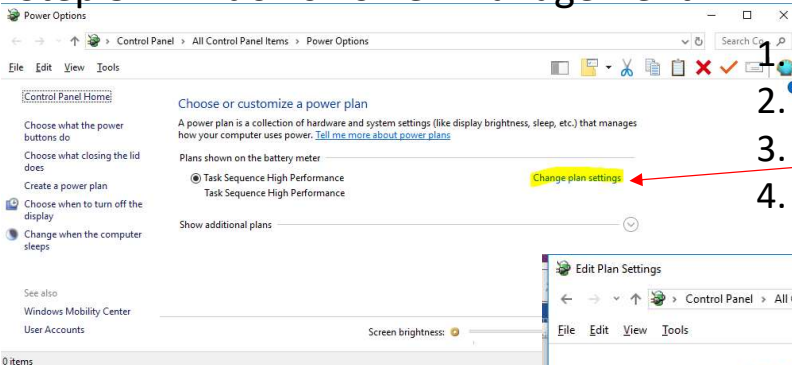


STM 32 Virtual Com Port Driver (also found on LaserUpgrades.com in faq section)
https://4d645df3-a99e-41e8-9e92-341c3f4f6151.filesusr.com/archives/2261d8_953f8470f068d29ab17123c8b2256aa.zip?dn=en.stsw-stem32102%20driver.zip

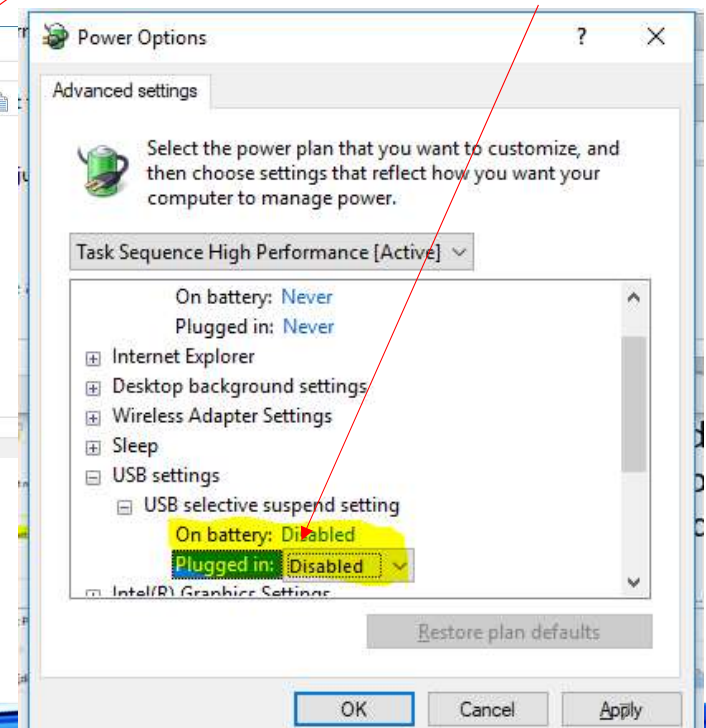
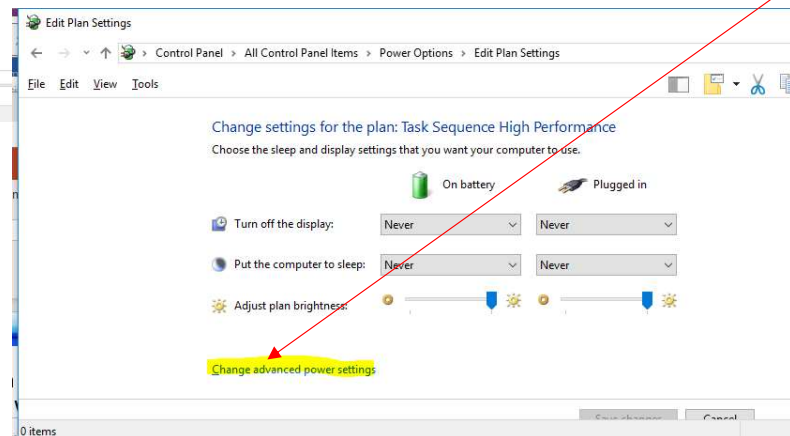


Section 1: General Setup

Step 5: Windows Power Management



1. In the Windows search window type "Power Options"
2. In the Power Options window Click "Change Plan Settings"
3. In the Edit Plan Setting window Click "Change advanced power settings"
4. In Advanced Setting window expand USB settings and **disable selective suspend**

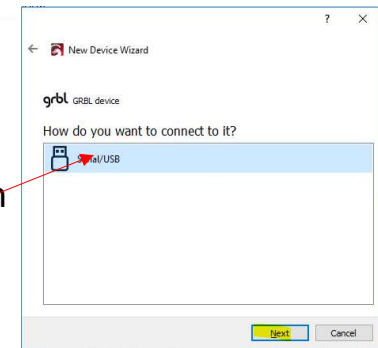
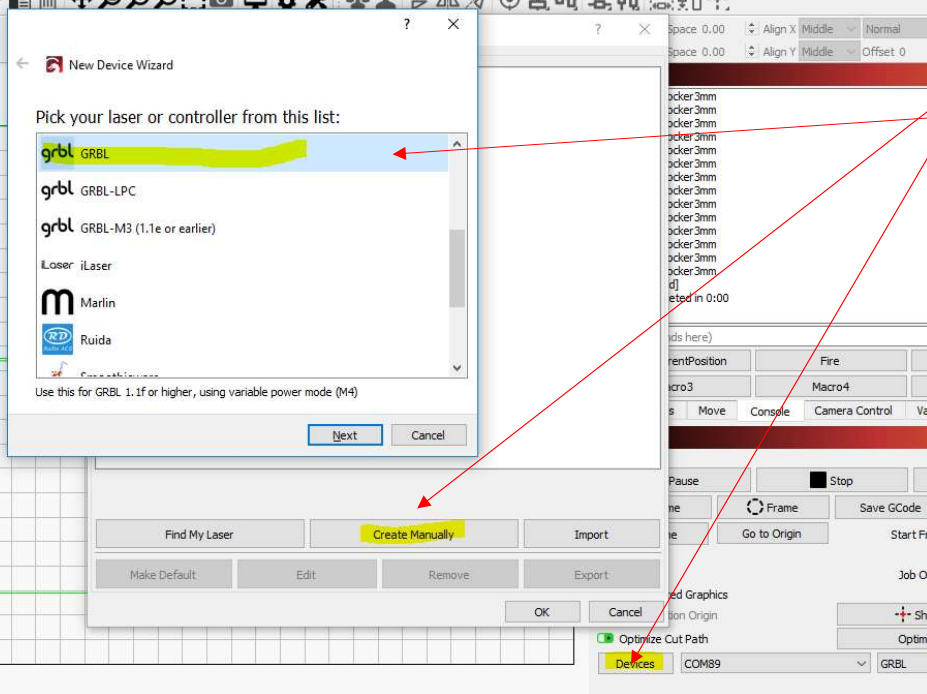




Section 1: General Setup

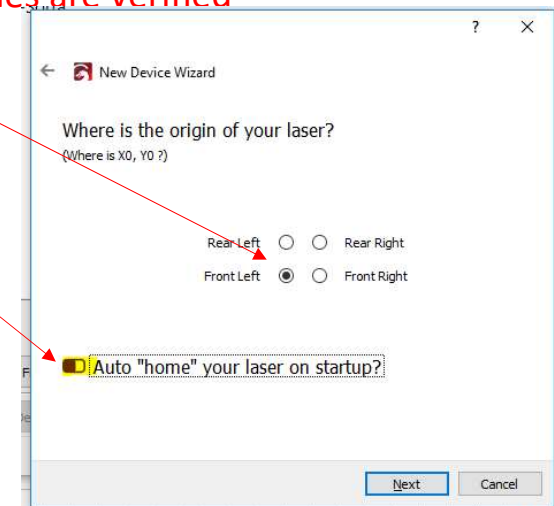
Step 6: Lightburn Setup Part 1- Device Setup

1. In Lightburn Laser Console
2. Left Click the Devices Button
3. Create Manually
4. Select grbl
5. Use USB/Serial
6. Name the device and Give it a machine size (300x300 for Eleksmaker, 400 x430 for Ortur, 300x200 for K40)
7. Give it an origin (Rear left for K40/Eleks, Front Left for Ortur)
8. Turn off auto home- this will be set up later with machine specific section when switches are verified
9. Finish

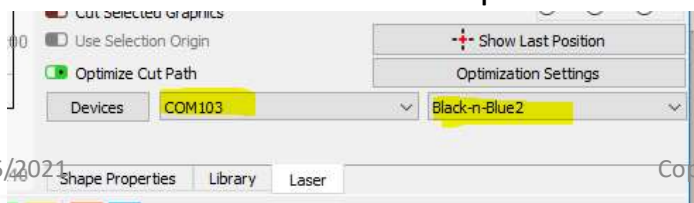


What would you like to call it?
(If you have more than one, use this to tell them apart)
Black-n-Blue

What are the dimensions of the work area?
(The lengths, in mm, of the X and Y axis of your laser)
X Axis Length: 300 mm Y Axis Length: 300 mm



10. In Laser Console Select the COM port and Device



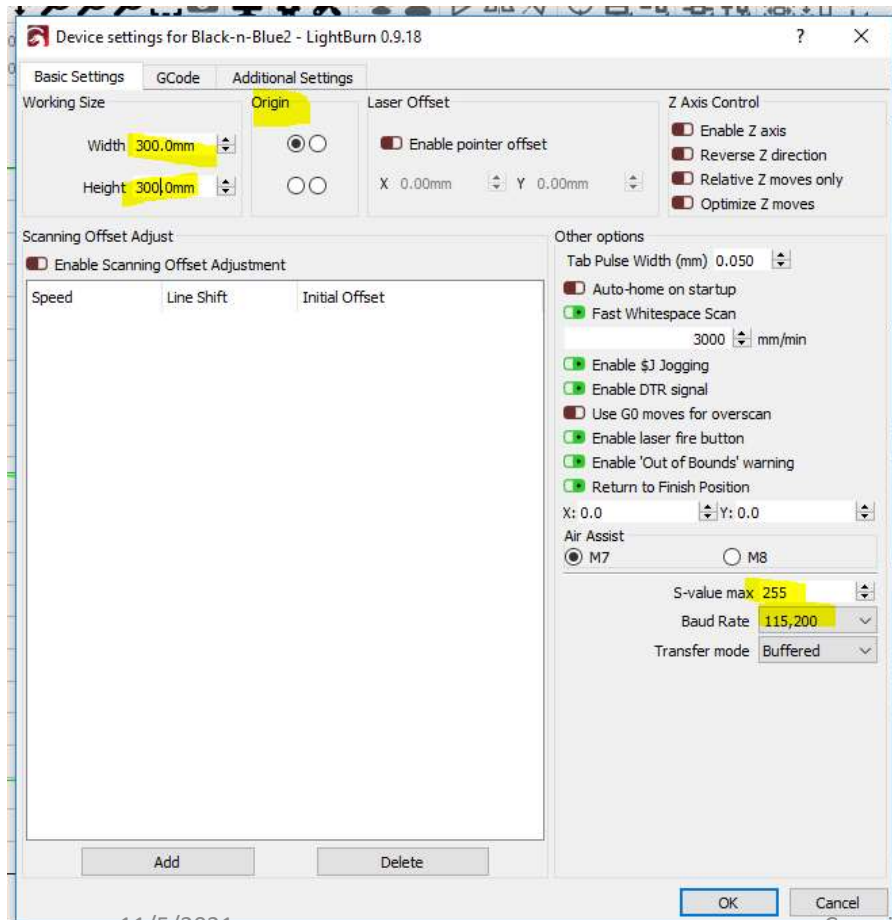
11/5/2021

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Section 1: General Setup

Step 7: Lightburn Setup Part 2- Device Settings



1. In Lightburn Edit Menu -> Device Settings
2. Match Settings as shown to the left, these are the main settings required to get up and running
3. Working Size and Origin can be reset here
(300x300 for Eleksmaker, 400 x430 for Ortur, 300x200 for K40)
4. Give it an origin (Rear left for K40/Eleks, Front Left for Ortur)
5. Note that Baud Rate matches settings in Device manager for the Com port
6. Make sure S-value max matches \$30 grbl settings
Default is 1000 for Ortur and 255 for others (Eleks, K40)
This setting is not relevant as long as S-value max and \$30 match



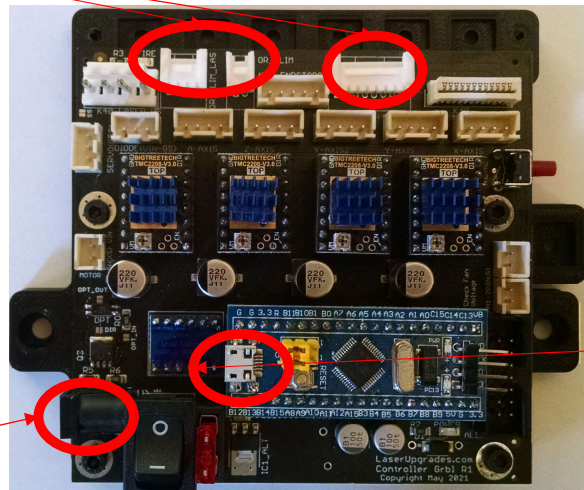
Section 2: Connections

Part 1: Black-n-Blue 2 Motherboard, TMC Silent Drivers and Stock Ortur Motors and Stock Ortur Harness

This is specific to Ortur using Stock motors and stock Harness

1. Mount the board in a safe place
2. Plug in the 3 wires as shown below- yes, plug and play!

Ortur Harness



MicroUSB to computer
Explained in General setup

12V Ortur 3 prong power supply
Explained in General Setup

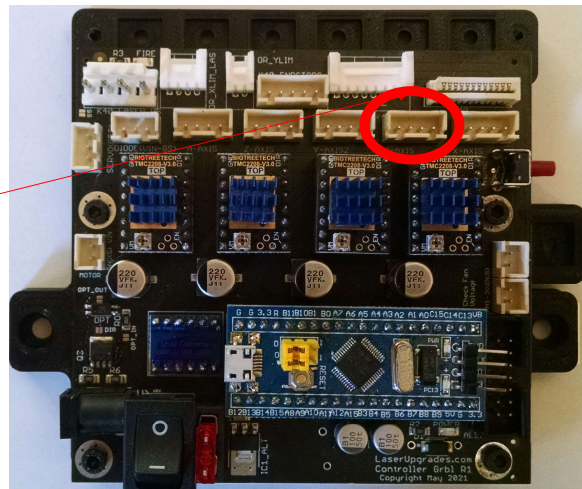


Section 2: Connections

Part 2: Black-n-Blue 2 Motherboard, TMC Silent Drivers and **High Resolution** Motors and Stock Ortur Harness

This is specific to Ortur using 0.9deg High Resolution Motors and stock Harness + Dual Y steppers

1. Same as section 2, part 1
2. Wire stepper motors to cables color for color (blue to blue, black to black, etc)
3. Plug Extra Y cable into Y1 (skip step if using single Y motor)
4. Set \$3=1 (typically \$3=3)



Y1 for Extra 4 pin
cable for Second Y

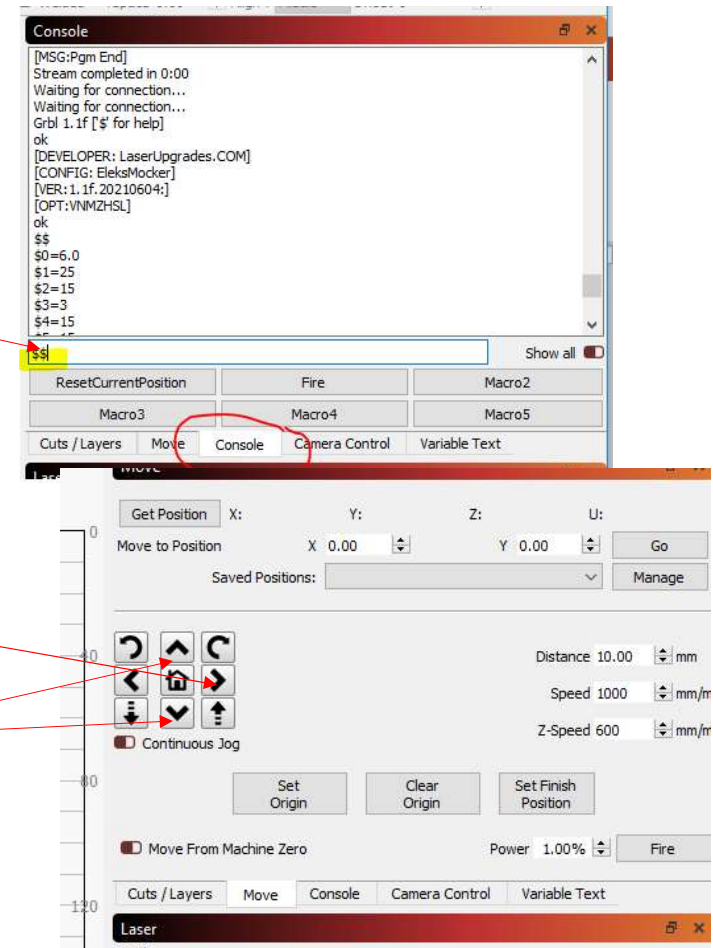


Section 3: Black-n-Blue 2 Motherboard, All Machines

Part 1: Lightburn Detailed Setup verify movement direction

This is generic to all machines

1. Default settings are built into the firmware
2. \$ commands are typed directly in the Lightburn Command Console
3. \$rst=* resets to defaults, \$\$ lists current settings
4. Move the gantry slowly by hand to the middle of the machine-
Lightburn will not allow negative jogging, the position of the gantry when you reset is 0,0
5. Reset the using the reset button (this resets the origin to where the gantry is)
6. Go to the Move Console and Jog in positive X (to the right), verify movement. If it moves in wrong direction adjust \$3, (if $\$3 > 2$, subtract 1 from \$3 if $\$3 < 2$, add 1 to \$3). After updating \$3, verify movement after adjustment by jogging in positive X
7. In the Move Console and Jog in positive Y. If Origin is rear left it will be down arrow, if Origin is front left it will be up arrow. If it moves in wrong direction adjust \$3, (if $\$3 > 1$ you will subtract subtract 2 from \$3, if $\$3 \leq 1$ you will add 2 to \$3). Verify movement after adjustment by jogging in positive Y



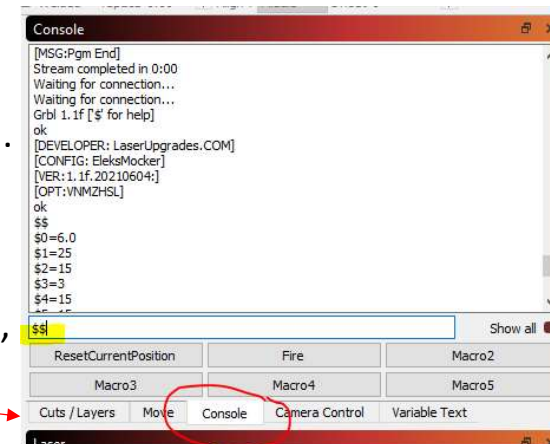


Section 3: Black-n-Blue 2 Motherboard, All Machines

Part 2: Lightburn Detailed Setup verify homing and limits

This is generic to all machines

1. Most machines have limits switches with NO configuration- NO is assumed except for K40. NO means the pins are normally open, when the switch is triggered it is shorted to ground.
2. Start setup with $\$22=0$ (homing cycle off)
3. $\$5=15$ is used for Eleksmaker and Ortur, $\$5=12$ is for K40
4. $\$21$ should be set to 1 to test limit switch operation (keep homing cycle off $\$22=0$).
5. By hand trigger each switch verify that grbl shows an alarm, if all switches are not working, resolve wiring
6. After verifying switches are operational, check X direction by typing $\$hx$ in the console command line. If it moves in the wrong X direction, trigger the X limit switch by hand and adjust $\$23$. If $\$23 > 2$, subtract 1 from $\$23$. If $\$23 < 2$, add 1 to $\$23$. After adjusting $\$23$ verify using $\$hx$ command.
7. Check Y direction by typing $\$hy$. If it moves in the wrong Y direction, trigger the Y limit switch by hand and adjust $\$23$. if $\$23 > 1$ you will subtract subtract 2 from $\$23$, if $\$23 \leq 1$ you will add 2 to $\$23$.
8. Set $\$25=3000$ (mm/min), this will speed homing up now that homing is working properly
9. Set soft limits by setting $\$20=1$, this means that the controller will not allow movement to exceed the machine size set in $\$130$ and $\$131$. If steps are missed the controller will not protect against damage, this is why hard limits are preferred and hard limits can be wired in parallel for NO configs.



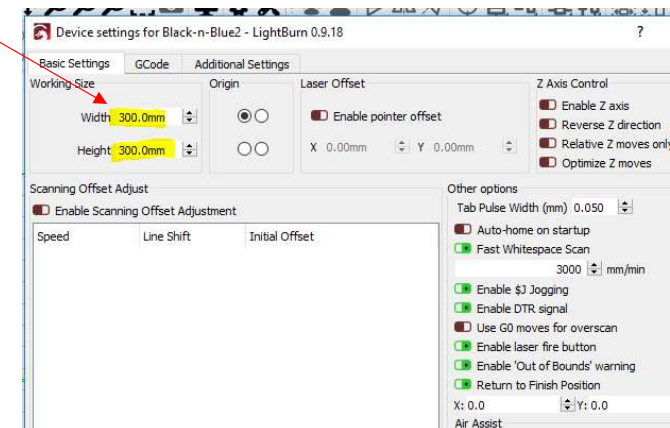
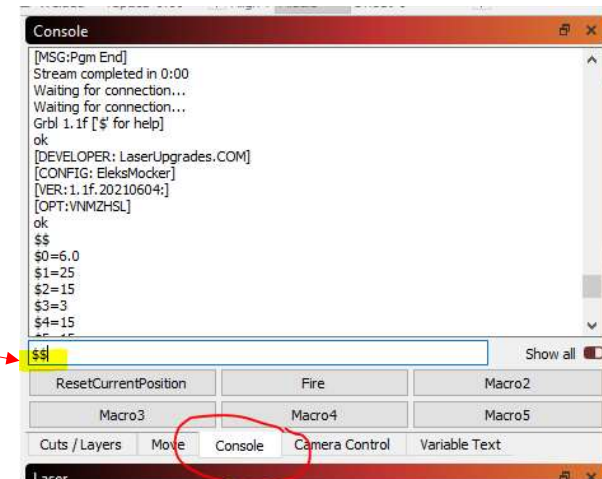


Section 3: Black-n-Blue 2 Motherboard, All Machines

Part 3: Machine Size and PWM

This is generic to all machines

1. In Lightburn console type \$\$
2. Set \$130 to machine size X (type \$130=300 for example), and \$131 to machine size Y
3. In Lightburn Edit Menu -> Device Settings. Set Machine Working size to match those set for \$130 and \$131
4. Set \$33 to PWM frequency in Hz, Defaults are recommended. 25000Hz is default for K40- this can be tuned





Section 4: Black-n-Blue 2 Motherboard, All Machines

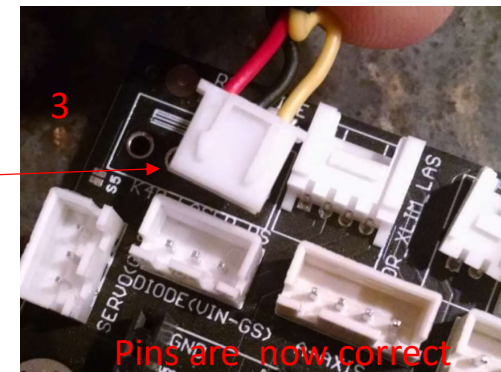
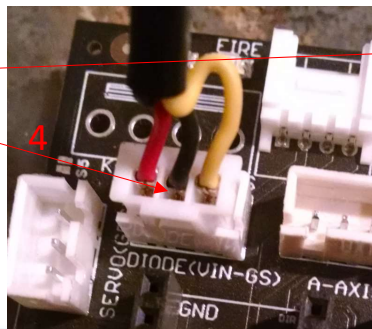
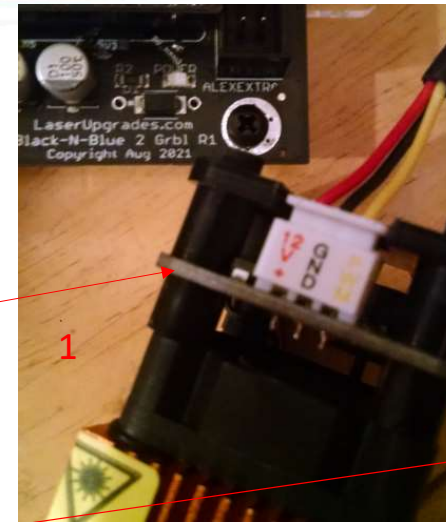
Part 1: Diode Connections

Reminder only connect a diode capable of the Voltage you have on your power supply.

Do not use a 24V power supply and expect it to power a 12V diode, it will blow it up.

Most diodes are 12V

1. Plug in cable to diode module making sure the other end of the cable is not installed on the Black-n-Blue 2. Many use the convention of Red=Power, Black=Ground, Yellow=PWM or Signal. If this convention is not used follow the markings on the diode module
2. Verify Order of wiring at Motherboard side, this is labeled on the Black-n-Blue 2 as "DIODE(VIN-GS)" This means the wires are Power, Ground, Signal or (Red, Black, Yellow). This example cable (Oxlasers) is not pinned correctly
3. Swap pins.
4. Install





Section 4: Black-n-Blue Nano, All Machines

Part 1: installing the nano

1. The USB of the nano is oriented in the same direction as the 8bit nano
2. With USB disconnected and the board power plug removed you'll remove the 8bit nano and plug the Black-n-Blue Nano in the same socket making sure all the pins are properly seated.
3. After verifying proper placement in socket, you can insert the micro USB cable into the Black-n-Blue Nano and power up the board.

1

