Laser GRBL tutorial

1. Preparation

 Complete the assembly of the engraving machine correctly

 The software supports the computer system Windows xp, 7, 8, 10, 11 systems, other systems please use lightburn or laserweb software

 Successfully install the drivers and software required for the communication between the computer and the engraving machine (CH340/STM32, etc.)

 Connect the engraving machine to the power supply and the computer

2. Software description

LaserGRBL is one of the best Windows software for image laser engraving. LaserGRBL is able to load any image, picture and logo and send it to your laser engraver with just a few clicks. You can go to the software official website to download the latest version and learn about software related information: https://lasergrbl.com/

LaserGRBL has limitations in cutting. If you do not require high precision for cutting, you can use image to vectorization for cutting. If you need a precise route, it is recommended that you use other software to complete the engraving file and save it as g-code Or a file import operation that grbl software can recognize.

3. Use of GRBL software

 Turn on the black power switch on the control board of the engraving machine, and use the data cable attached to the machine to connect the control board to the computer. To install the driver, please refer to the installation instructions in the driver folder. In the manager, you can see the com port corresponding to the engraving machine. If the com port is not displayed in the device manager, it proves that the driver has not been successfully installed. At this time, the engraving machine cannot communicate with the computer.
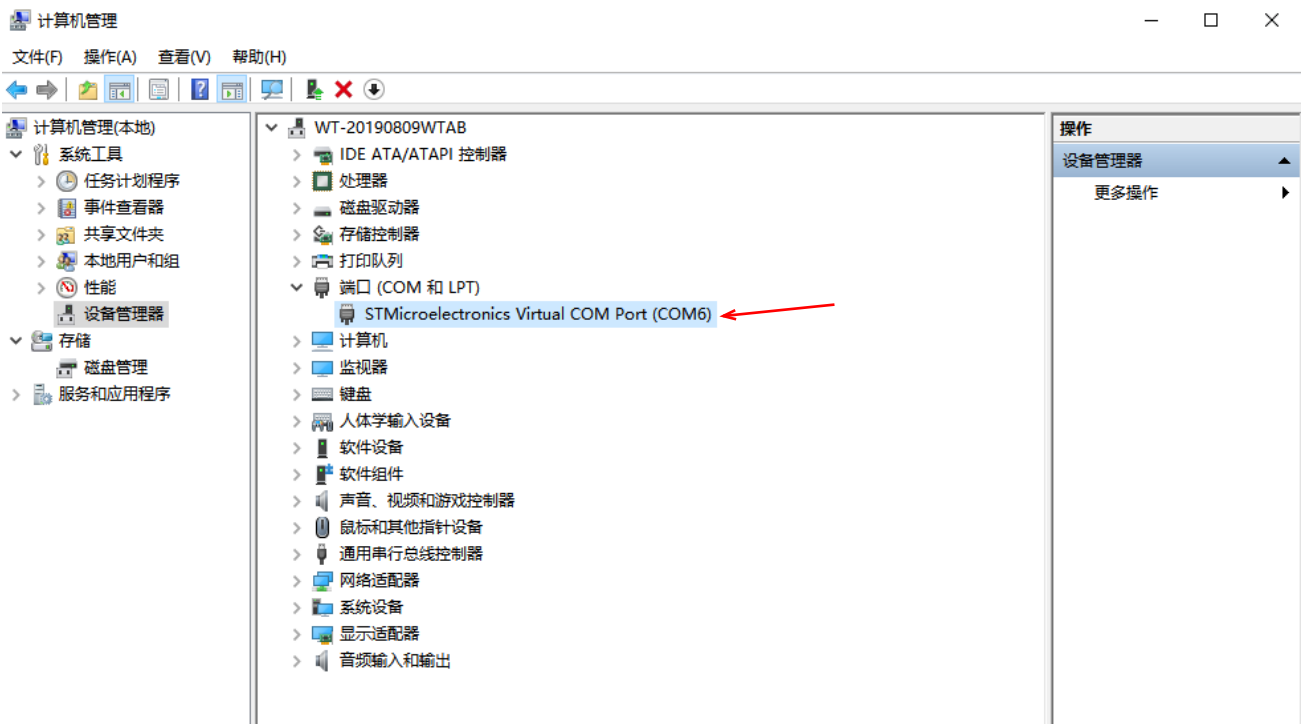
 Open the laser grbl software program, select the corresponding port of the engraving machine, set the baud rate to 115200, click the lightning button behind the baud rate to successfully connect to the engraving machine and communicate with the engraving machine. The following is a detailed explanation of the functions of the commonly used buttons in the software interface
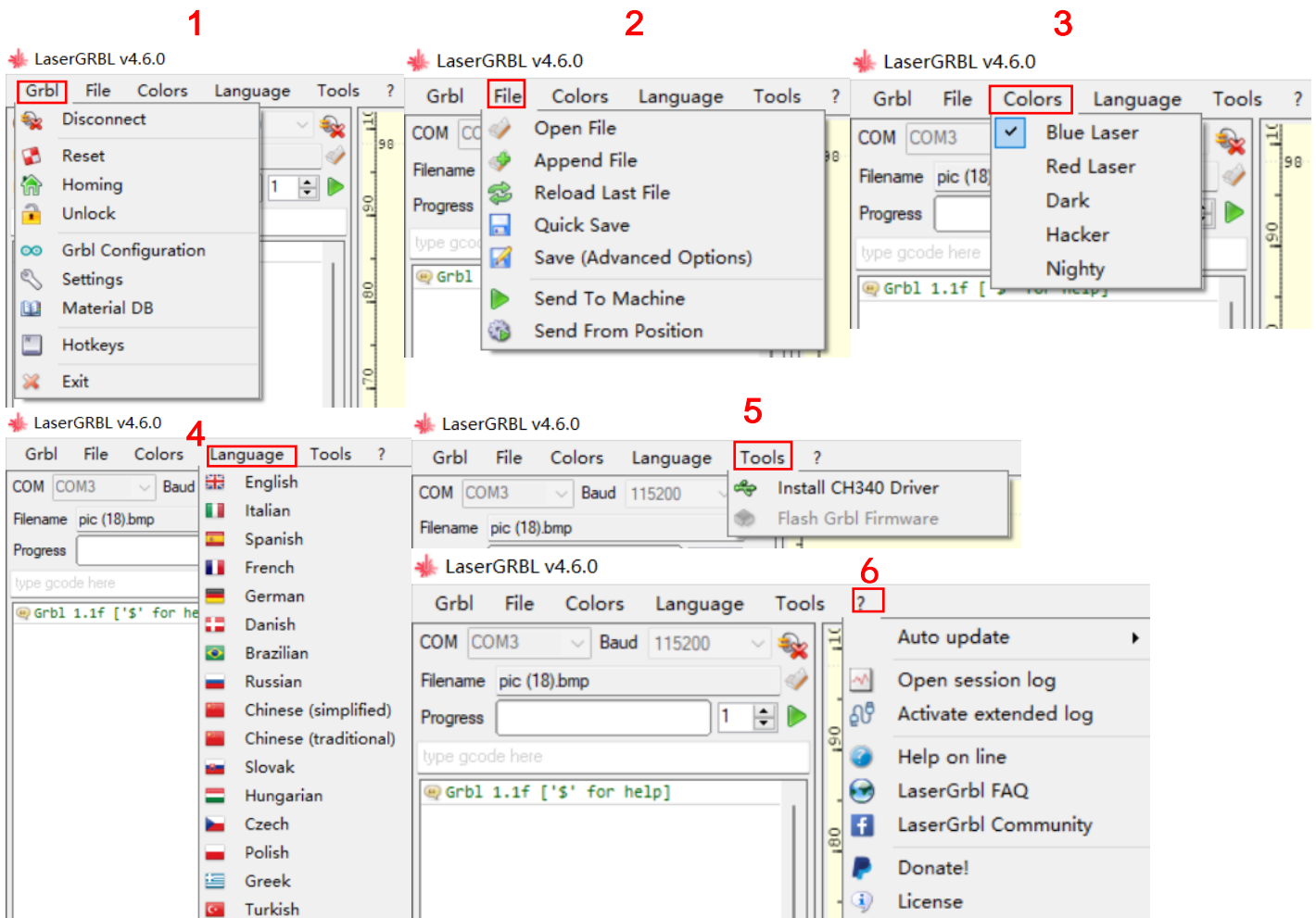
1 Grbl

Disconnect: connect/disconnect the engraving machine equipment

Reset: soft reset, clear running records, abnormal status, etc.

Homing: make the x and y axes of the engraving machine run to the lower left corner of the engraving machine to the top corner of the lower left corner of the machine, stop running and set the position as the coordinate zero point x = 0, y = 0 (engraving with x, y axis limiters machine is suitable for this function)

Unlock: When the x or y axis of the engraving machine touches the limiter or the alarm on the control panel is triggered, the machine will stop running and sound the alarm and lock the control panel. At this time, you need to press the reset button of the control panel to cancel the alarm sound , And then click the unlock button on GRBL to unlock the control panel of the engraving machine to allow the machine to work again

GRBL configuration: Regarding the parameter configuration of the control panel of the engraving machine, senior technical personnel can open the adjustment parameters, and generally do not need to adjust by default

2 files

Open file: open the file we need to engrave (support *.nc;*.cnc;*.tap;*.gcode;*.ngc,*.bmp;*.png;*.jpg;*.gif;*.svg)

Add file: When we open an engraving file, we can click this button to add a file to make multiple files overlap the engraving

Reload the last file: After we set the pattern engraving parameters, if you are not satisfied with the engraving parameters set last time, you can click to reload the last file to modify based on the parameters set last time
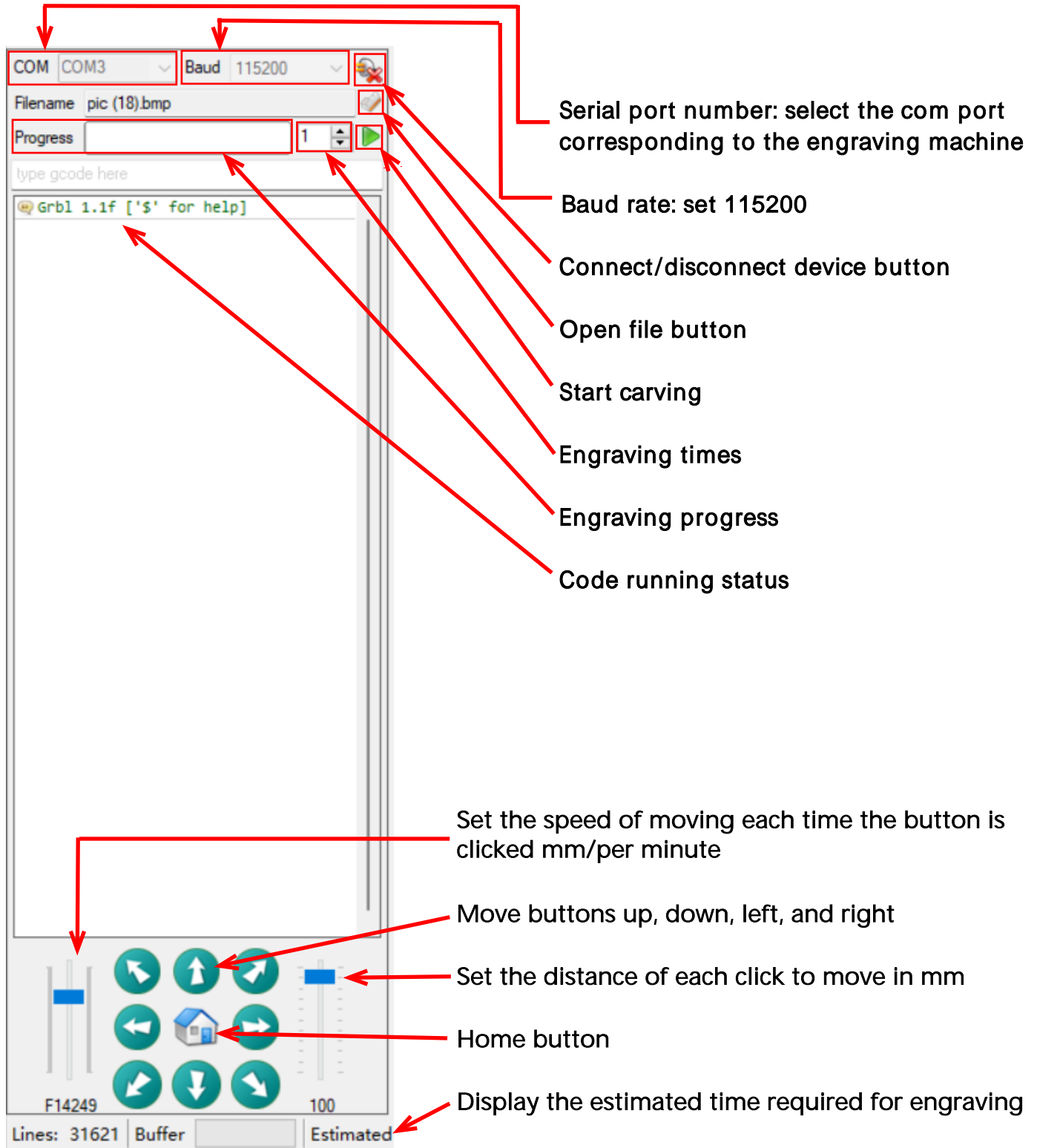
Save(advanced options): When we modify the parameters for many times and the engraving effect is satisfactory, we can click Save Program to save the file as a code file. Next time, we can directly open the file for engraving. You don't need to set the parameters again, and you can also save the file. Import files into the offline controller for offline work
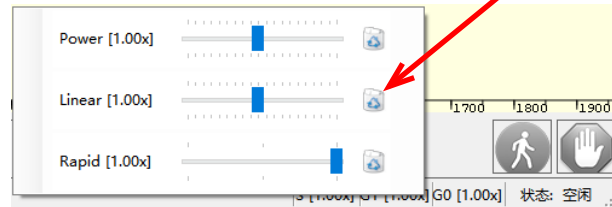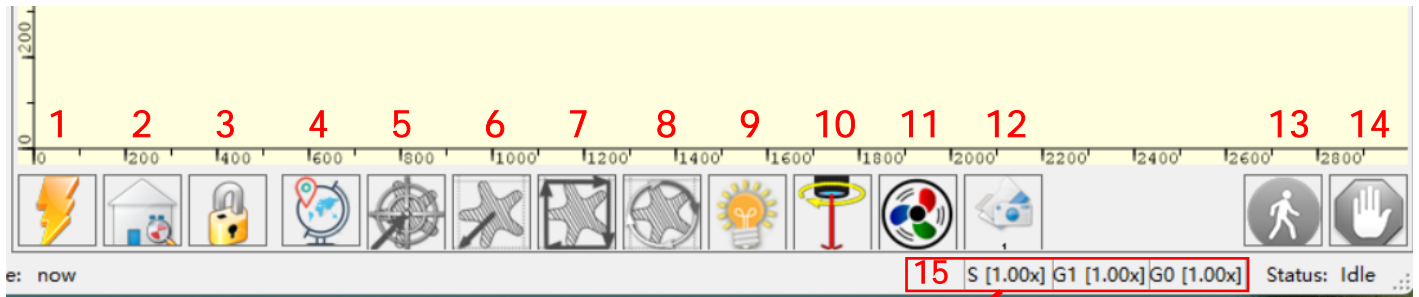
3 colors It needs to be changed when using different laser light, the default is blue light, generally no need to set

4 languages The GRBL software can be switched to different languages, the default is the language set by the computer .

5 Tools: You can quickly install the 340 driver, the old engraving machine is more convenient to use this function6?

More: You can visit the official website of the software from here to get more information and software related information

Serial port number: select the com port corresponding to the engraving machine

Baud rate: set 115200

Connect/disconnect device button

Open file button

Start carving

Engraving times

Engraving progress

Code running status

Set the speed of moving each time the button is clicked mm/per minute

Move buttons up, down, left, and right

Set the distance of each click to move in mm

Home button

Display the estimated time required for engraving

COM COM3 | Baud 115200

Filename pic (18).bmp

Progress 1

type gcode here

Grbl 1.1f ['$' for help]

F14249 100

Lines: 31621 | Buffer | Estimated

1 Reset: soft reset, clear running records, abnormal status, etc.

2 Homing: make the x and y axes of the engraving machine run to the lower left corner of the engraving machine to the top corner of the lower left corner of the machine, stop running and set the position as the coordinate zero point x = 0, y = 0 (engraving with x, y axis limiters machine is suitable for this function)

3 Engraving machine unlock button

4 Set the starting point of engraving

5 Move to the center of the frame

6 Move to the lower left corner

7 Engraving pattern border preview

8 Round border preview

9 Turn on the laser

10 Turn on the laser focus

11 Turn on/off the fan

12 Custom buttons (editable code to realize functions)

13 Continue engraving button

14 Stop engraving button

15 After clicking, there will be three pullable progress bars, power=laser power, linear= engraving density, rapid=engraving speed, use this function to freely adjust these three engraving parameters in the engraving pattern of the engraving machine
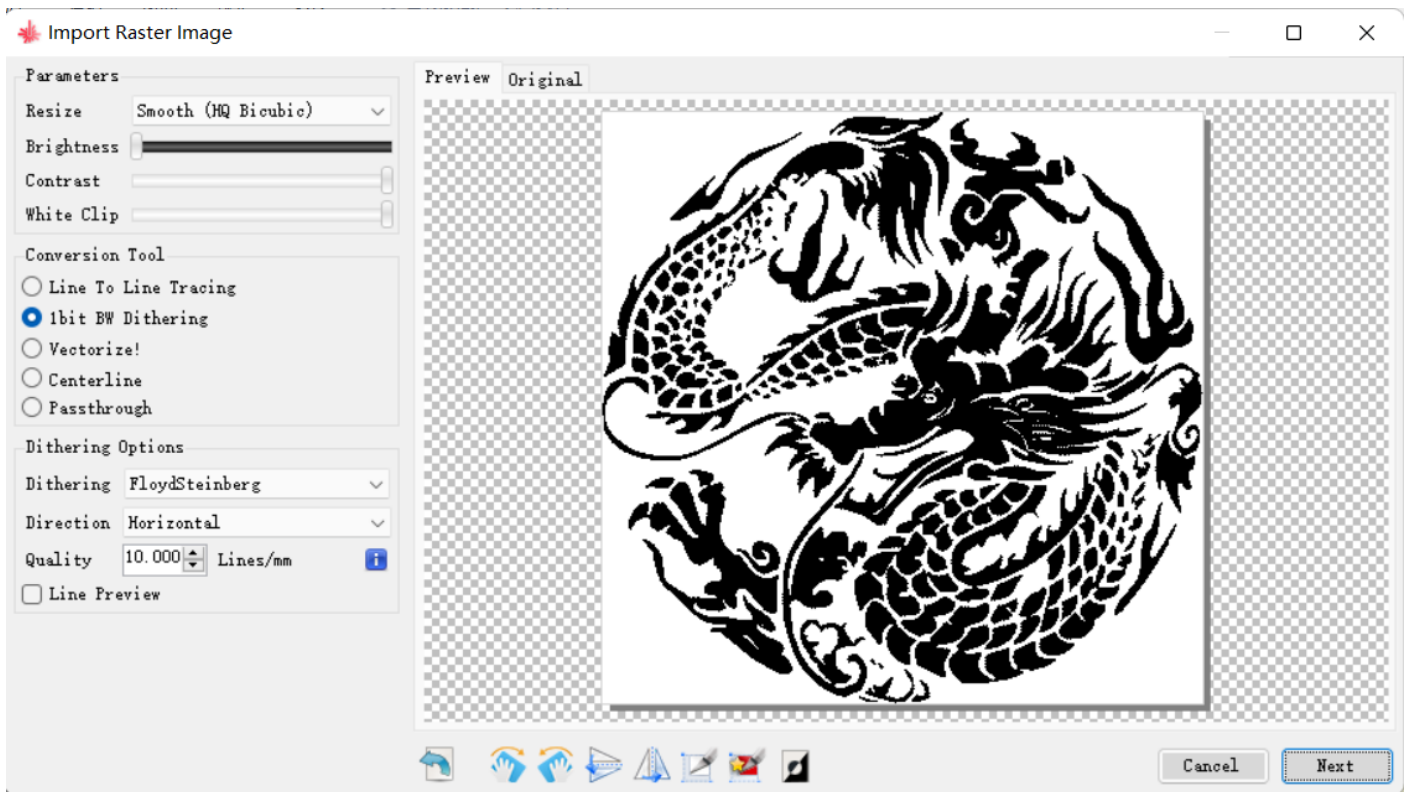
Input raster image

Parameter interface

1 Resize: Smooth (HQ Bicubic)-smoothing mode, which makes the edges of the picture slightly smooth, Sharp (Neares Neighbor)-sharpening mode, which makes the edges of the picture sharper, generally the default smoothing mode is fine

2 Brightness: adjust the brightness of the picture

3 Contrast: adjust picture contrast

4 White limit: limit the white part of the picture

5 Black and white: accentuate the black/white color

Conversion tool

1 Line-to-line tracking: Divide the picture into multiple lines to carve out, and use multiple lines to form the picture

2 1bit BW dithering: divide the picture into multiple pixels for engraving

3 Vectorization: Convert the edge of the picture into lines, engrave the outline of the picture, often used for cutting

4 centerline: centerline carving, transforming the picture into a bone shape

5 Passthorugh: direct engraving, engraving the original picture of the picture, without any processing, generally suitable for black and white photos such as stick figures

Picture interface

1 Preview: you can preview the effects that can be carved out by different parameters

2 Original: The original picture of the picture, showing the original picture of the picture, which can be compared with the preview

Functional area
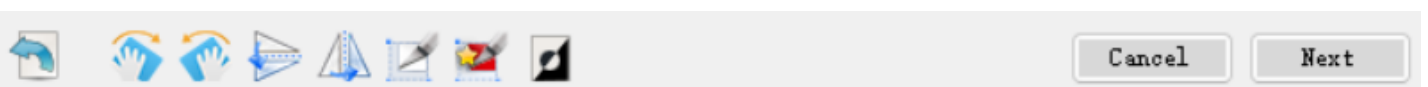
1 Restore all changes and restore the original image

2 Rotate the picture 90° clockwise

3 Rotate the picture 90° counterclockwise

4 Flip the picture horizontally

5 Flip the picture vertically

6 Crop the picture

7 Intelligently cut the picture, it will cut off the white part of the picture edge that cannot be engraved with the color.

8 Reverse the color, reverse the black and white
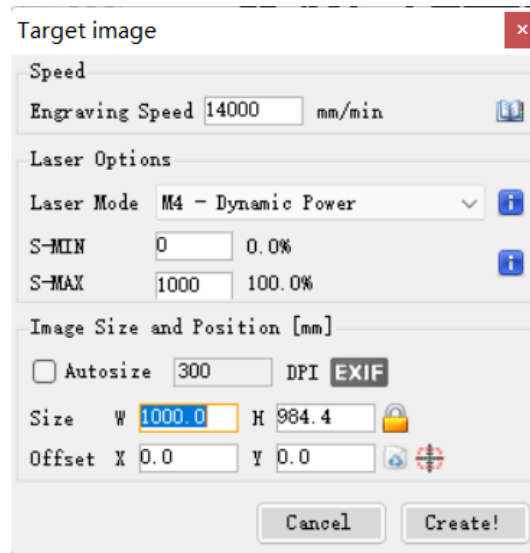
Target image

Speed-Engraving Speed: adjust the speed of engraving images, mm per minute, please refer to the laser instruction manual for adjustment parameters

Laser option-Laser Mode: M3 constant laser power mode, constant laser power mode simply maintains the programmed laser power, regardless of whether the machine is moving, accelerating or stopping. This provides better control over the state of the laser. This can lead to more consistent cuts of more difficult materials.

M4 dynamic laser power mode. When performing engraving work, the laser head must continuously accelerate and decelerate to follow direction changes. In M3 mode, this will cause more severe burns and slow down the laser speed.

The engraving effect of M3 mode is that the engraving marks are shallow in the middle, and the engraving marks on the left and right sides are deep. The engraving effect of M4 mode is the same as that in the preview. Generally, the engraving in M4 mode is selected.

Minimum S value Maximum S value: Adjust the power range of laser engraving patterns, S0-S1000=0%-100%, generally the minimum value is set to 0, and the maximum value is set to 1000. When engraving paper and other materials that are easy to engrave , You can appropriately reduce the maximum S value, for example, set it to S=500.

Image size and position

Automatically adjust size: After checking this option, you can adjust the image DPI value. The larger the DPI value, the smaller the engraving image size, and the smaller the DPI value, the larger the engraving image size. This setting is generally not used.

Size: W-adjust the width of the picture, H-adjust the height of the picture, the unit is mm.

Offset: X-the distance of the engraved image from the starting point X axis, Y-the distance of the engraved image from the starting point Y axis, in mm.

The small button behind the offset parameter: 1-return to zero offset value, 2-automatic offset, the starting point of the engraving coordinate is the image center point.

Laser GRBL operation demonstration

1: Use the data cable to connect the engraving machine to the computer usb socket, turn on the control panel switch of the engraving machine, and power on the machine. At this time, we can see the corresponding com port of the engraving machine in the computer device manager.
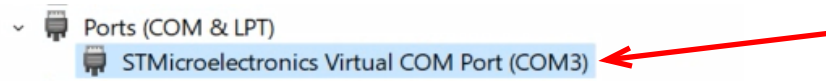

2: Open the laser grbl software, select the corresponding com port of the engraving machine, and click connect.


3: Click the file option at the top of the software, choose to open the file, select the pattern or code file we want to engrave, or directly drag the file that needs to be engraved into the grbl software.

4: After opening the picture file, you can adjust the parameters of the engraving pattern. If it is a code file, the parameters are generally set. You don't need to make adjustments. Set the engraving origin directly. After previewing, you can start engraving without any problems.
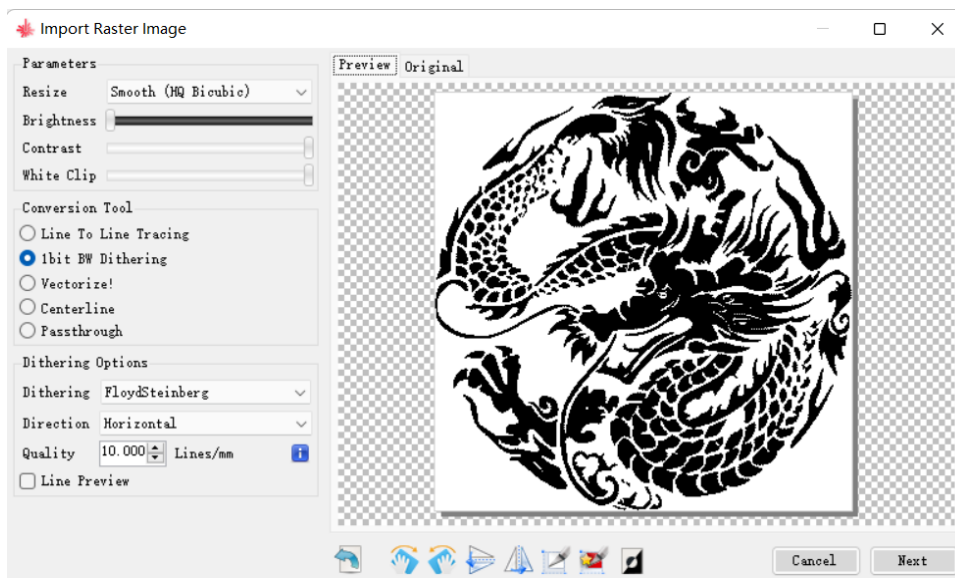

5: After adjusting the color of the picture and the engraving method, click Next to start setting the engraving speed, laser power range, engraving pattern size and other parameters. After the setting is complete, click Create
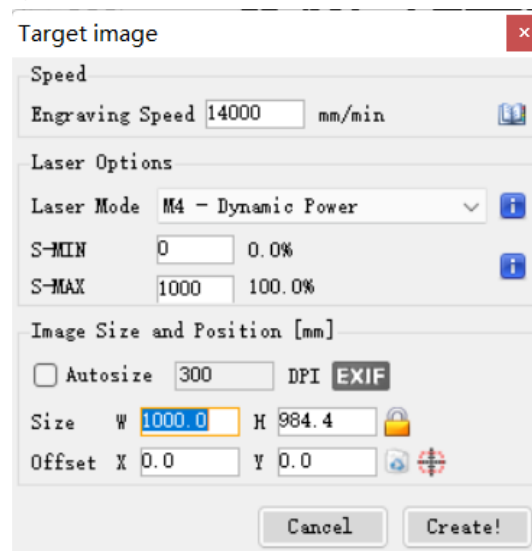
6: After completing the pattern engraving parameter setting, we need to focus the laser. Please refer to the previous description for the focusing method. The engraving material should be as flat as possible.

7: After focusing, we start to move the laser position to the starting point of engraving we need (the engraving pattern usually starts from the lower left corner, so generally move the laser to the lower left corner of the material), after moving to the starting point we need to set, click 2 to set the origin Button to set this position as the starting point of pattern engraving, click 3 to preview the engraving, after the preview is complete, click to start engraving
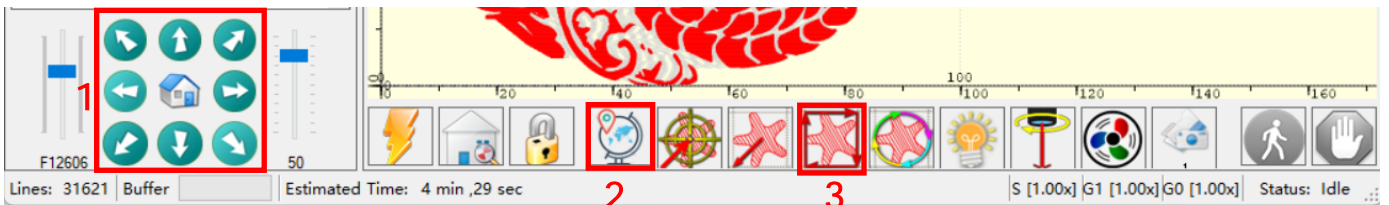
8: Set the number of times of engraving. The default is once. Click the start button to start engraving. You can also adjust if the laser power or engraving speed is not suitable during the engraving process.

9: After many times of engraving and adjusting the best parameters, we can click on the file and click on save program to save the engraving parameters as code format. Next time engraving, we can directly open the code file to start engraving (the engraving pattern size, speed, power and other parameters are Set when saving)
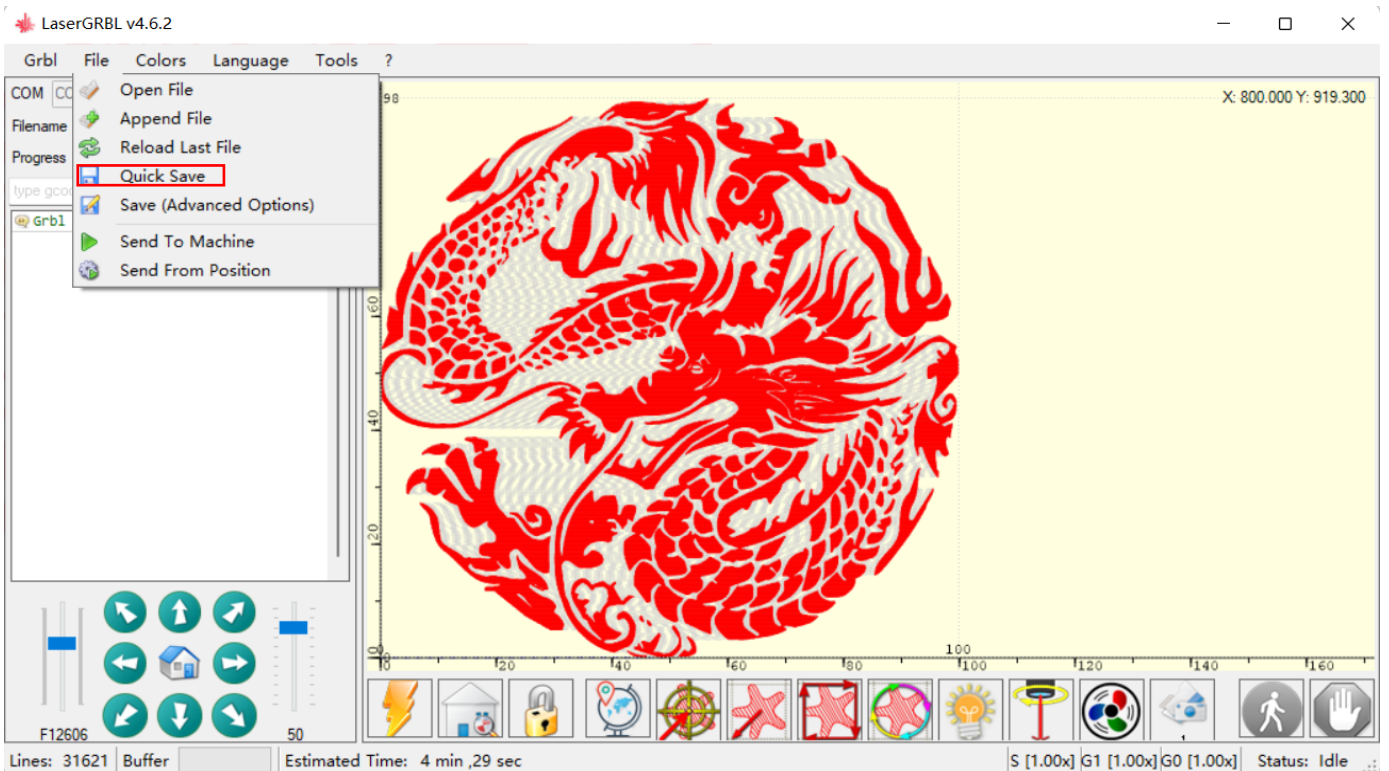
For more information, please visit GRBL software official website or Facebook community for reading and learning: https://lasergrbl.com/

Import custom buttons: Right-click on the blank space "Import custom buttons", open the provided U disk data, find the "CustomButtons (function button optimization)" file in the "lasergrbl (laser grbl laser engraving software)" folder and open it , the pop-up window appears and click Yes. For advanced use of custom buttons, please visit https://lasergrbl.com/usage/custom-buttons/ for learning.
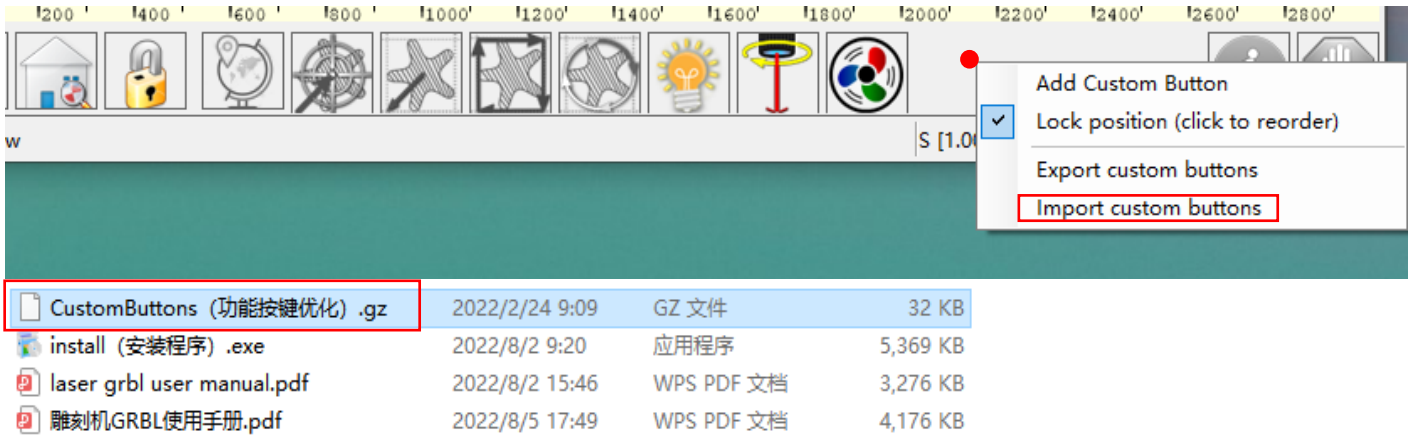
Attachment 1: Explanation of Control Board Interface Definition

2 Aixs 2.0

Labels:
- 12V GND PWM / Laser / GND 5V PWM
- GND 12V / Laser Laser / GND PWM
- 1A 1B 2A 2B / Y2 Axis / -LSR 12V
- 1A 1B 2A 2B / Y1 Axis / 1A 1B 2A 2B
- X Axis
- 5V / 12V / Y2 / Y1 / X
- USB
- DC 12V
- OffLine

Rx	nc
Tx	RST
GND	GND
5V	5V

2 Aixs 4.0

Labels:
- Reset
- Buzzer
- Power interface 12V 5A / 12V 5A
- USB interface / USB
- 12V Switch
- OffLine

5V	5V
GND	GND
RST	Tx
nc	Rx

- 1A 1B 2A 2B / X Axis / 1A 1B 2A 2B — X
- Y1 Axis — Y1
- 1A 1B 2A 2B / Y2 Axis / 1A 1B 2A 2B — Y2
- X Limit — X
- 1A 1B 2A 2B / Y Limit / Laser — Y

Attachment 2: Explanation of detailed parameter definition of control board grbl configuration

Open the laser grbl software to connect to the engraving machine, open the grbl option in the upper left corner, and open the grbl configuration. You can modify the configuration file of the control panel (such as acceleration, running direction, etc.) according to your needs. Click to write, close the window to test

Warning: If you do not understand these configuration files, please do not change the data in them

#	参数	值	单位	描述
$0	Step pulse time	10	microseconds	Sets time length per step. Minimum 3usec.
$0	步进脉冲时间	10	微秒	步进脉冲时间(us，不得低于3微秒，推荐10微秒)
$1	Step idle delay	25	milliseconds	Sets a short hold delay when stopping to let dynamics settle before disabling steppers. Value 255 keeps motors enabled with no delay.
$1	步进空闲延迟	25	毫秒	步进空闲延时(毫秒,当完成了一次运动到停止时，Grbl都会延迟这个数值的时间使步进脉冲无效，设置255始终有效)
$2	Step pulse invert	0	mask	Inverts the step signal. Set axis bit to invert (00000ZYX).
$2	步进脉冲颠倒	0	掩码	反转步进信号。设置轴位反转（00000ZYX） 。
$3	Step direction invert	6	mask	Inverts the direction signal. Set axis bit to invert (00000ZYX).
$3	方向颠倒接口	6	掩码	反转方向信号。设置轴位反转（00000ZYX） 。
$4	Invert step enable pin	0	boolean	Inverts the stepper driver enable pin signal.
$4	步进使能翻转	0	布尔值	反转步进驱动器使能引脚信号。
$5	Invert limit pins	0	boolean	Inverts the all of the limit input pins.
$5	限位引脚翻转	0	布尔值	反转所有限制输入引脚。
$6	Invert probe pin	0	boolean	Inverts the probe input pin signal.
$6	探测引脚翻转	0	布尔值	反转探头输入引脚信号
$10	Status report options	1	mask	Alters data included in status reports.
$10	状态报告	1	掩码	更改状态报告中包含的数据。
$11	Junction deviation	1	millimeters	Sets how fast Grbl travels through consecutive motions. Lower value slows it down.
$11	节点偏差	1	毫米	设置 Grbl 通过连续运动的速度。较低的值会减慢速度。
$12	Arc tolerance	0.0002	millimeters	Sets the G2 and G3 arc tracing accuracy based on radial error. Beware: A very small value may effect performance.
$12	圆弧公差	0.0002	毫米	根据径向误差设置 G2 和 G3 圆弧跟踪精度。注意：非常小的值可能会影响性能。
$13	Report in inches	0	boolean	Enables inch units when returning any position and rate value that is not a settings value.
$13	位置坐标单位设置	0	布尔值	返回任何不是设置值的位置和速率值时启用英寸单位。
$20	Soft limits enable	0	boolean	Enables soft limits checks within machine travel and sets alarm when exceeded. Requires homing.
$20	启用软限位，超出限制后报警	0	布尔值	启用机器行程内的软限制检查，并在超出时设置警报。需要归位。
$21	Hard limits enable	1	boolean	Enables hard limits. Immediately halts motion and throws an alarm when switch is triggered.
$21	启用硬限位，触发后停止运动并报警	1	布尔值	启用硬限制。触发开关时立即停止运动并发出警报。
$22	Homing cycle enable	1	boolean	Enables homing cycle. Requires limit switches on all axes.
$22	归为使能位	1	布尔值	启用归位循环。所有轴都需要限位开关。
$23	Homing direction invert	7	mask	Homing searches for a switch in the positive direction. Set axis bit (00000ZYX) to search in negative direction.
$23	复位方向翻转	7	掩码	归位搜索正方向的开关。设置轴位（00000ZYX）以负方向搜索。
$24	Homing locate feed rate	25	mm/min	Feed rate to slowly engage limit switch to determine its location accurately.
$24	复位寻找速度	25	毫米/分钟	复位寻找速度(以高进给速度去寻找限位开关，再以慢速度移动到零点，这个参数就是慢速度)
$25	Homing search seek rate	500	mm/min	Seek rate to quickly find the limit switch before the slower locating phase.
$25	复位给进速度	500	毫米/分钟	寻找速度以在较慢的定位阶段之前快速找到限位开关。
$26	Homing switch debounce delay	250	milliseconds	Sets a short delay between phases of homing cycle to let a switch debounce.
$26	复位消抖	250	毫秒	在归位周期的各个阶段之间设置一个短暂的延迟，以让开关去抖动。
$27	Homing switch pull-off distance	2	millimeters	Retract distance after triggering switch to disengage it. Homing will fail if switch isn't cleared.
$27	复位返回行程	2	毫米	触发开关后缩回距离以使其脱离。如果未清除开关，则归位将失败。
$30	Maximum spindle speed	1000	RPM	Maximum spindle speed. Sets PWM to 100% duty cycle.
$30	最大主轴转速，rmp	1000	转速	最大主轴转速。将 PWM 设置为 100% 占空比
$31	Minimum spindle speed	0	RPM	Minimum spindle speed. Sets PWM to 0.4% or lowest duty cycle.
$31	最小主轴转速，rmp	0	转速	最低主轴转速。将 PWM 设置为 0.4% 或最低占空比。
$32	Laser-mode enable	0	boolean	Enables laser mode. Consecutive G1/2/3 commands will not halt when spindle speed is changed.
$32	激光模式	0	布尔值	启用激光模式。改变主轴转速时，连续的 G1/2/3 指令不会停止。
$100	X-axis travel resolution	80	step/mm	X-axis travel resolution in steps per millimeter.
$100	X轴多少脉冲—毫米	80	步长/毫米	X 轴移动分辨率，以每毫米步数为单位。
$101	Y-axis travel resolution	800	step/mm	Y-axis travel resolution in steps per millimeter.
$101	X轴多少脉冲—毫米	800	步长/毫米	Y 轴移动分辨率，以每毫米步数为单位。
$102	Z-axis travel resolution	800	step/mm	Z-axis travel resolution in steps per millimeter.
$102	Z轴多少脉冲—毫米	800	步长/毫米	Z 轴移动分辨率，以每毫米步数为单位。
$110	X-axis maximum rate	20000	mm/min	X-axis maximum rate. Used as G0 rapid rate.
$110	X轴最大速度	20000	毫米/分钟	X轴最大速度(这也是G0的进给速度)
$111	Y-axis maximum rate	20000	mm/min	Y-axis maximum rate. Used as G0 rapid rate.
$111	Y轴最大速度	20000	毫米/分钟	Y轴最大速度(这也是G0的进给速度)
$112	Z-axis maximum rate	20000	mm/min	Z-axis maximum rate. Used as G0 rapid rate.
$112	Z轴最大速度	20000	毫米/分钟	Z轴最大速度(这也是G0的进给速度)
$120	X-axis acceleration	500	mm/sec^2	X-axis acceleration. Used for motion planning to not exceed motor torque and lose steps.
$120	X轴的加速度	500	毫米/秒^2	X轴加速度。用于不超过电机扭矩和失步的运动规划。
$121	Y-axis acceleration	20	mm/sec^2	Y-axis acceleration. Used for motion planning to not exceed motor torque and lose steps.
$121	Y轴的加速度	20	毫米/秒^2	Y轴加速度。用于不超过电机扭矩和失步的运动规划。
$122	Z-axis acceleration	20	mm/sec^2	Z-axis acceleration. Used for motion planning to not exceed motor torque and lose steps.
$122	Z轴的加速度	20	毫米/秒^2	Z轴加速度。用于不超过电机扭矩和失步的运动规划。
$130	X-axis maximum travel	500	millimeters	Maximum X-axis travel distance from homing switch. Determines valid machine space for soft-limits and homing search distances.
$130	X轴的最大行程	500	毫米	距归位开关的最大 X 轴行程距离。确定软限制和归位搜索距离的有效机器空间。
$131	Y-axis maximum travel	200	millimeters	Maximum Y-axis travel distance from homing switch. Determines valid machine space for soft-limits and homing search distances.
$131	Y轴的最大行程	200	毫米	距归位开关的最大 Y 轴行程距离。确定软限制和归位搜索距离的有效机器空间。
$132	Z-axis maximum travel	200	millimeters	Maximum Z-axis travel distance from homing switch. Determines valid machine space for soft-limits and homing search distances.
$132	Z轴的最大行程	200	毫米	离归位开关的最大 Z 轴行程距离。确定软限制和归位搜索距离的有效机器空间。