The Opt Lasers PLH3D 6-watt laser

**SHERLINE
PRODUCTS**

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Laser Setup Instructions for Engraving and Cutting on the MASSO Touch Controller

> ⚠️ **SAFETY WARNING:** You must use a quality pair of laser safety glasses when operating a laser. Wear safety glasses suitable for the type of laser you are using.

> ℹ️ **INFORMATION:** Laser engraving/cutting is only available in MASSO G3 and MASSO Touch software versions with the Multi-Head feature. Available in version 4.02.77b onwards.

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Setting up a Laser for Engraving and Cutting

For complete assembly and mounting instructions of the Laser Mount (P/N 8955), [CLICK HERE](#).

Preparing the Accu-Pro Mill for Use with a Laser

The motor and speed-control unit on an Accu-Pro mill is connected directly to the MASSO G3 Touch Controller. In order to use a laser with the Accu-Pro mill, you need to remove the headstock/motor/speed-control unit from the mill. This is not a straightforward operation. In order to remove the existing headstock/motor/speed-control unit, you must add cable connectors that will allow you to remove the headstock from the machine. You have the following options:

1. **Option 1:** If you already own an Accu-Pro mill:

   A. You must cut the wire shown in Figure 1.

FIGURE 1—Cut the wire indicated by the red arrow.

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10/24/23

B. Remove the shrink wrap around the large wire to expose the two separate wire connectors for the motor and the speed-control unit.

C. Add cable connectors to each end of the motor and speed-control wires as seen in Figures 2 and 3. You can also use "bullet type, butt-crimp terminals" as seen in Figure 4.*

*CAUTION: Regardless of which type of connector you choose, the wires must match. If the wires are connected wrong, there will be damage to the motor or the control.
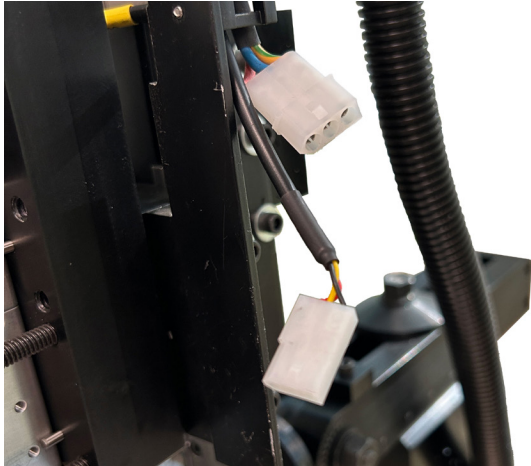

FIGURE 2—Wires with connectors leading to the MASSO Touch Controller.

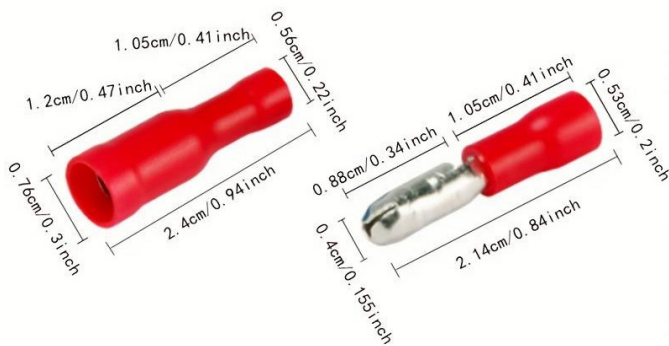*FIGURE 3—Wires with connectors leading out of the motor and speed-control unit.*

FIGURE 4—An example of bullet connectors shown for reference.

2. **Option 2:** If you are purchasing an Accu-Pro mill for use with a laser, you can have Sherline install the connectors for an installation fee. Contact sherline@sherline.com for pricing.

Installing the Laser Mount on the Mill Column

1. Remove the headstock, motor, and speed control by loosening the set screw on the side of the headstock. Then pull the entire assembly forward to remove it from the pivot pin.

2. Once the headstock is removed, clean the face of the column saddle so it is free of any chips. Replace the head key into the head key slot in the saddle.
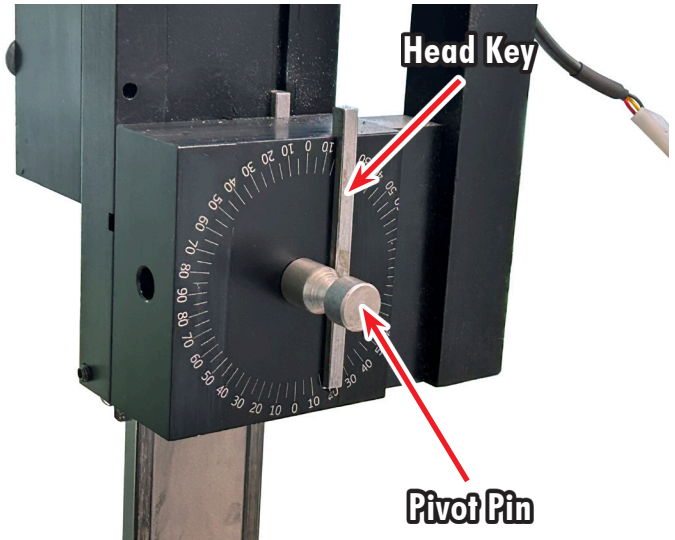

FIGURE 5— The headstock, motor, and speed control removed from the column saddle.

3. With the laser either mounted or unmounted to the laser mount, hold the laser mount with the pivot pin hole and head key slot orientated towards the column saddle (see Figure 6).
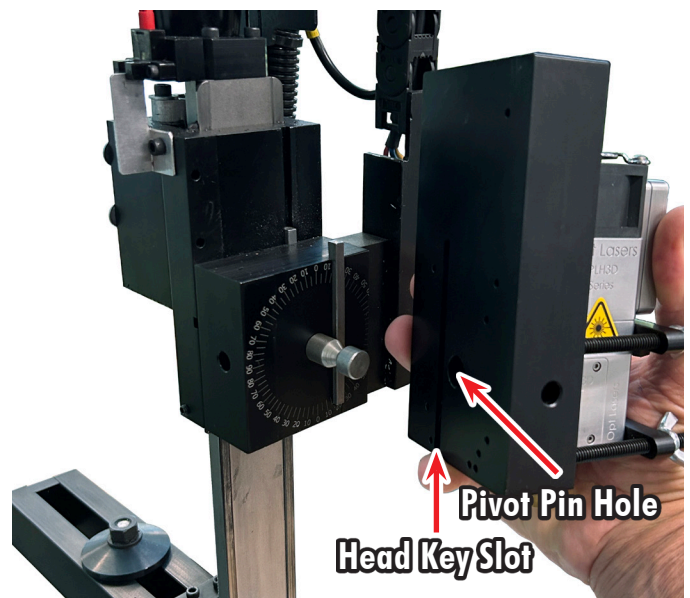

FIGURE 6—Align the head key slot and pivot pin hole on the back of the laser mount to the head key and the pivot pin on the column saddle.

4. Place the pivot pin into the 1/2" hole on the laser mount. Then slowly push the laser mount onto the pivot pin and onto the head key. The laser mount should push on until it is flush with the face of the column saddle. Once the laser mount is flush with the face of the column saddle, tighten the set screw on the side of the laser mount. When the set screw makes contact with the pivot pin, it will pull the laser mount down securely against the face of the column saddle and lock it in place.
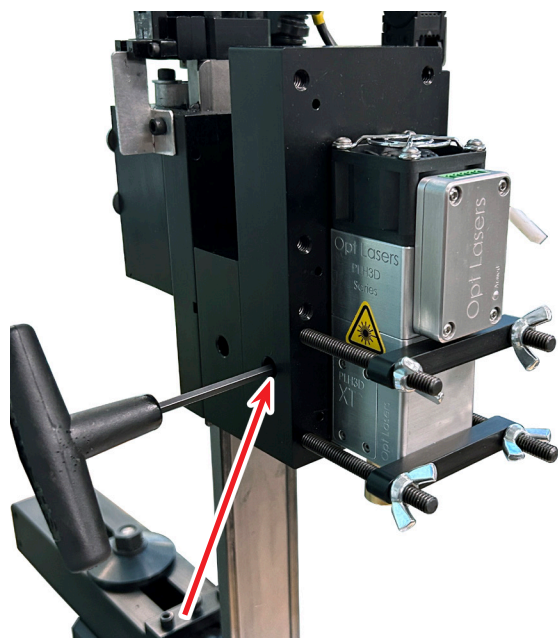

FIGURE 7—The red arrow points to the access hole for the laser mount set screw.

Installing a Laser

Sherline Products does not sell lasers. We sell the laser mount. You can purchase a laser from several laser manufacturers. We tested our laser mount with a few different lasers and found the Opt Lasers PLH3D to be the best value for the money and have the best customer service. The Opt Lasers package has everything you need to get started (Ultra-HD High-Performance Universal CNC Laser Upgrade Kit-optlasers.com).

Information on the laser used in testing, can be found here: Opt Lasers

Connect an Opt Lasers PLH3D

This section shows how the PLH3D 6-watt laser with CNC adapter was connected to MASSO for our laser testing.

The kit comes with the PLH3D laser, a CNC adapter, and all cables necessary to connect it to the MASSO CNC Controller, as well as a pair of safety glasses suitable for use with the laser. Only two wires need to be connected to get the laser up and running.

The PLH3D CNC Adapter provided with the kit is an interface between the laser and MASSO, which has various safety interlocks. These can be used to help ensure that the laser can be locked when not in use to prevent unauthorized use and provides other safety features, such as a place to connect the Emergency stop.

Connecting the OPT Laser to the MASSO Touch Controller

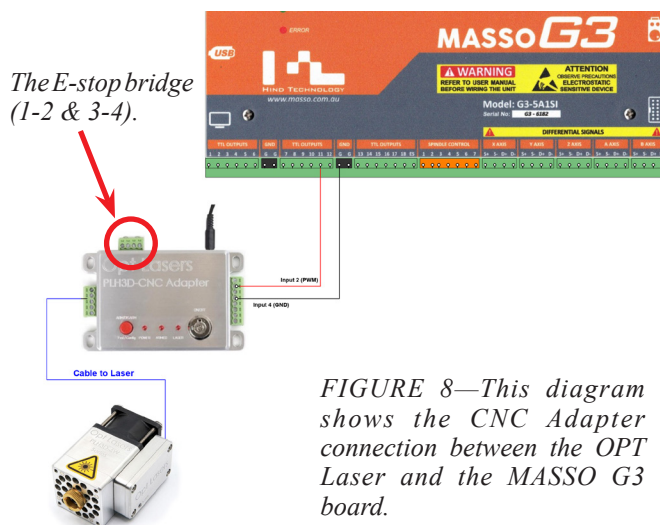*The E-stop bridge (1-2 & 3-4).*

FIGURE 8—This diagram shows the CNC Adapter connection between the OPT Laser and the MASSO G3 board.

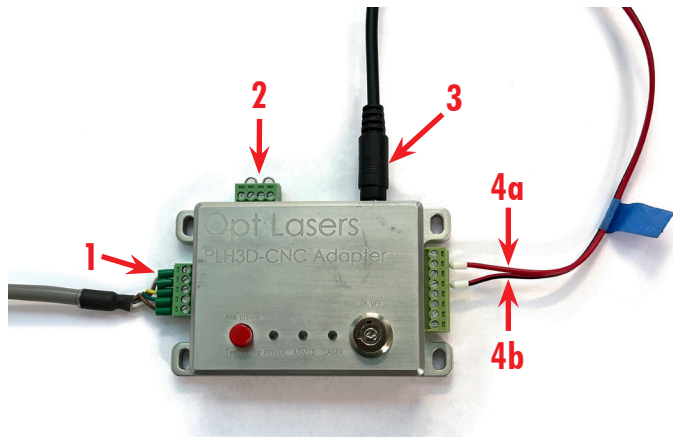The following photo shows the different connections on the Opt Lasers PLH3D-CNC Adapter (see Figure 9).

FIGURE 9
1. *5-wire connector on left goes to the laser.*
2. *Bridge the 1-2 and the 3-4 on the E-stop connector.*
3. *Power supply.*
4a. *#2 Red goes to #11 Red on the G3 board.*
4b. *#4 Black goes to Ground on the G3 board.*

Use the legend above to connect the wires from the CNC adapter to the MASSO G3 Touch Controller.

NOTE: The E-stop that is on the MASSO Touch controller stops all functions, thereby turning any signal to the laser off. Because of this, we do not make a connection to the E-stop connector on the OPT laser. Instead, we bridge the four points on the connector (see Figure 10).
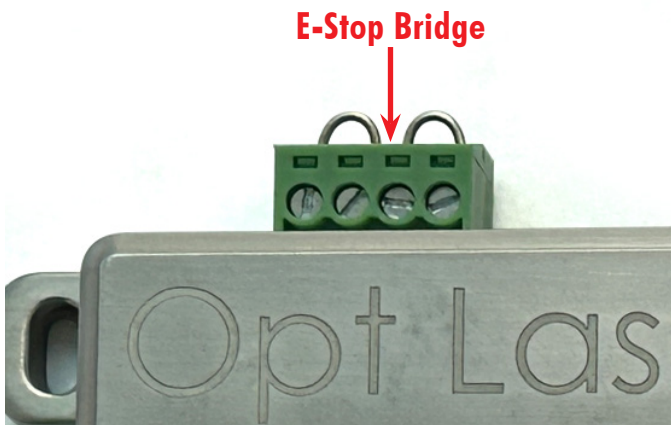
E-Stop Bridge

FIGURE 10—Close-up of the E-stop bridge.

The #11 Red and Ground Black are connected to #2 Red and #4 Black, respectively, on the PLH3D-CNC Adapter (see Figures 11 & 12).
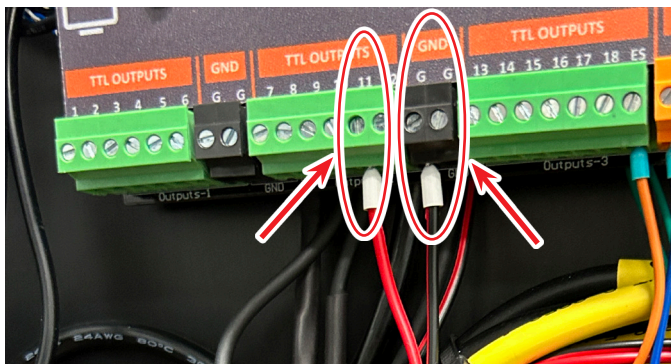

FIGURE 11—G3 board connections: Plug the red wire into the #11 TTL Output and plug the black wire into the Ground.

NOTE: The wire connection shown in Figure 12 is for customers who already own a MASSO controller. If you purchase a new controller from Sherline, these connections have already been made and the two-wire cable is one of the cables coming out of the back of the controller (see Figure 12 showing the cable connected to the OPT connector).
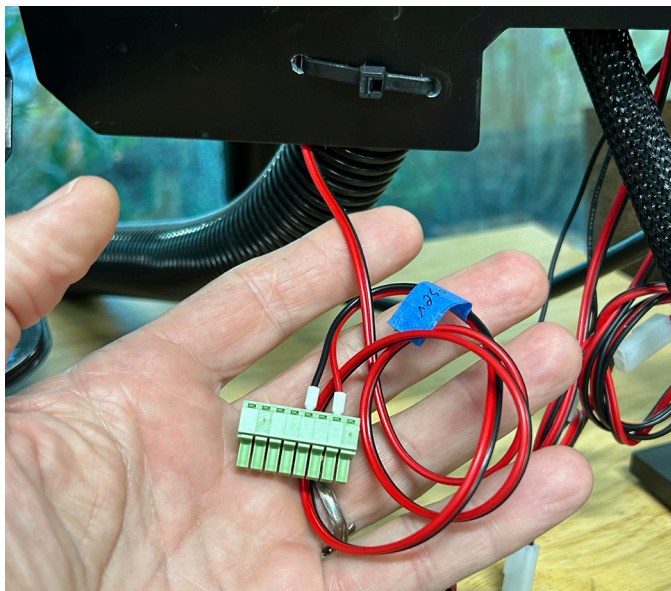

FIGURE 12—The #2 Red and #4 Black wires on the PLH3D-CNC Adapter.

Programming the CNC Adapter

The CNC adapter can be configured in many ways and needs to be set correctly to work with MASSO.

You will see the configured mode whenever you turn the laser on in the first second before the Power LED turns on.

The CNC adapter is correct if you see the Laser LED come on by itself before the Power LED turns on (see Figure 13).

FIGURE 13—This is what you see when you turn the Laser on. Note that the Laser LED is lit before the Power LED.

Instructions on setting the CNC Adapter can be found on the Opt Lasers Site: CNC Adapter Manual

Connecting Other Lasers

How you connect your laser will depend on what type of laser you have and its interface.

Please note the 5.6K resistor installed between the PWM output and MASSO GND. This is important and must be installed for correct PWM operation on all laser installations.

The connections shown below are for demonstration purposes only. Please consult the user manual that came with your laser to establish the correct connection.

MASSO uses TTL only and controls the power of the laser using PWM. (Pulse Width Modulation)

Hardware Requirements

- Any laser with a TTL PWM input.
- Safety glasses suitable for the laser you are using.

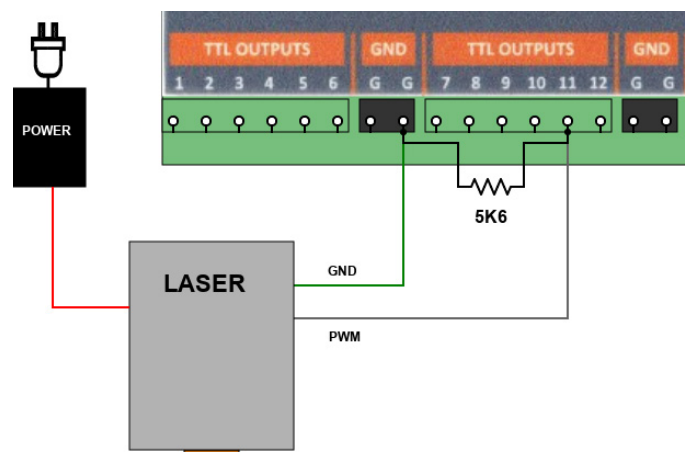### MASSO TTL Output

- Laser on 5 volt
- Laser off 0 volt

FIGURE 14

Installing the PWM Grounding Resistor

- The 5.6K resistor installed between the PWM output and MASSO GND is important and must be installed on all lasers that do not include a built in pull down resistor. This is needed for correct PWM operation.

  NOTE: The grounding resistor is not needed with OPT Lasers.

- If you are unsure if your laser has a pull down resistor there is no disadvantage in adding the resistor.

- The resistor can be installed at the laser or directly on MASSO as shown below.

- It is a good idea to insulate any resistor mounted in this manner to avoid accidental contacts. Here it has been put into clear heat shrink (see Figure 15).
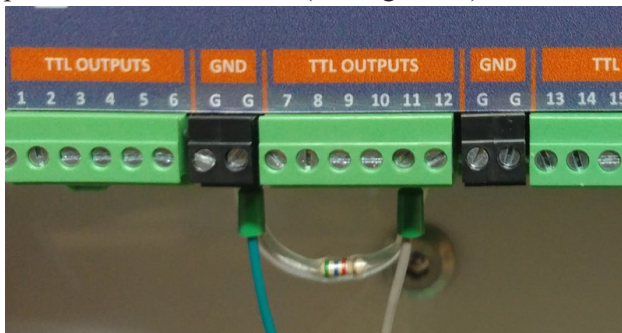

FIGURE 15—Resistor with heat shrink installed on MASSO

Setting up a Laser to Use with MASSO

This feature allows you to add a laser to MASSO to use for engraving or cutting as required.

MASSO can turn the laser on and off as well as control the power of the laser using PWM (**P**ulse **W**idth **M**odulation).

This allows the laser to be used for cutting, general line engraving, dithered, and grayscale engraving.

When working with grayscale engraving, MASSO can display the image by using the Depth Map feature.
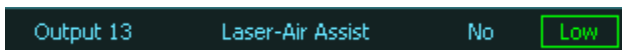
Configuring MASSO

- Configure MASSO output 11 for the LASER Engraving/Cutting output as shown.
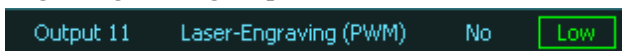
- No other output can be used for this function as it includes special hardware to output a PWM signal.

- An output can be assigned to move the laser into position when laser is selected.
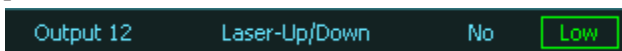
- An output can be assigned for Air Assist as required.

- Go to the Multi-Head setting page and select Laser Engraving/Cutting (see Figure 17).
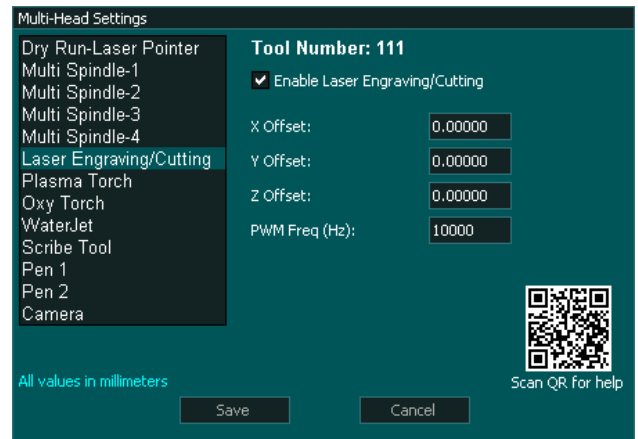
- Check the box for Enable Laser Engraving/Cutting.

FIGURE 16—The Multi-Head Settings dialog box.

- Set the PWM Frequency for your laser. It is recommended that you select a value of 10Khz though this will depend on the power of your laser and the maximum feed rate you which it will be moving. Since power is controlled by turning the laser on and off very rapidly, if you have a low PWM frequency and move quickly you could get a line that has areas where the laser was on or off - - - - - - - - A frequency of 10Khz should be a good balance.

- PWM can be set between 4Khz and 60Khz.

- X,Y, and Z offset is the distance from the Main spindle or other Main tool if using Waterjet or Plasma. This can be measured zeroing the DROs, making a spot with the laser and then jog the main spindle over to the center of the spot and reading off the X Y Y coordinates on the DROs. These will be your offsets. The Z offset will be determined by the focus point of your laser offset to the Z zero point of your spindle tool. It would not be uncommon to leave the Z offset set to 0 and to manually zero the laser when doing the job. Offsets are only needed when switching between the laser and other tools and only if they are part of the same G-code file.

- Configuration complete.

Displaying Laser Grayscale Engravings

- For a grayscale engraving to be able to be viewed as grayscale, the G-code file must include T111 M06 at the start of the file or the Depth Map view will be blank.

- To change between 2D View and Depth Map view, press the button at the top right of the display area (see Figures 17 & 18).
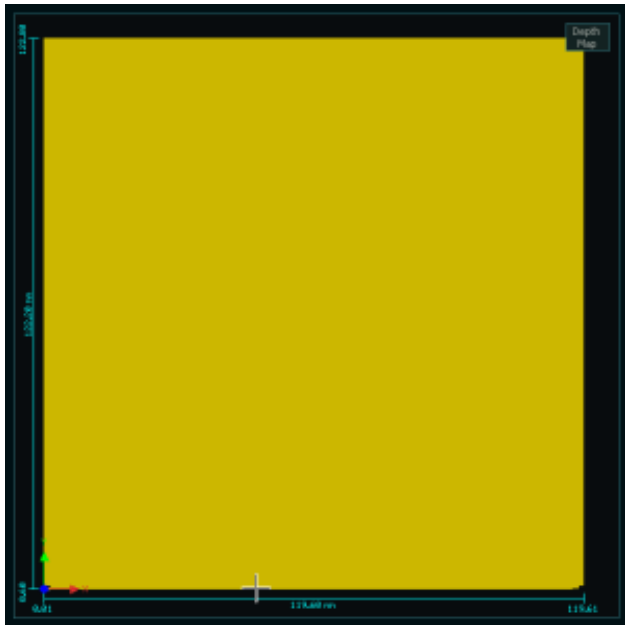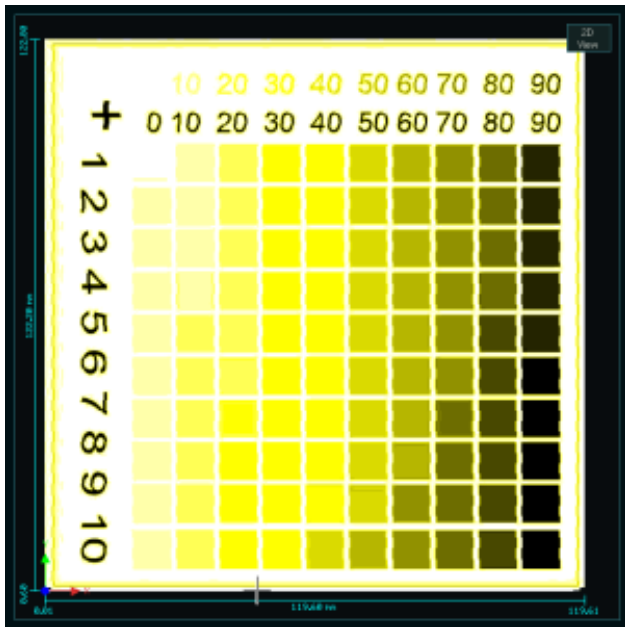
FIGURE 17—2D View

FIGURE 18—Depth Map View

- When the Laser Tool 111 is selected, the display automatically changes to show laser related information.
- This will display the Tool number 111
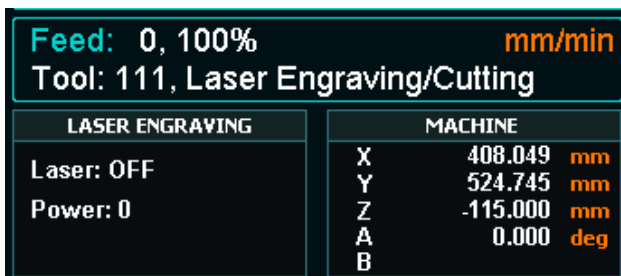- Laser On/Off status
- Laser Power

FIGURE 19—LASER Status screen

Syntax and Parameters

- **T111** – The laser is defined as Tool 111 and cannot be changed. To change to Laser Mode, you need to load Tool 111.
- **M03** – Turn the laser on. This turns the Laser Engraving/Cutting output on with 0 intensity.
- **S** – This controls the Laser PWM using any number from 0 to 1,000. 0 is 0% and 1,000 is 100% power. The S command must be included with a G1 and is synchronized with motion.
- **M05** – This turns the laser off.

EXAMPLE Program

```
N10 T111 M06
N20 S0 M03
N30 G00 X0 Y0
N40 G01 X100 Y0 F600 S350
N50 G01 X100 Y100
N60 G01 X0 Y0 S0
N70 M05
```

EXAMPLE Program Description

- N10 – Load Laser Tool 111
- N20 – Turn laser on at 0% PWM
- N30 – Rapid Move to X0 Y0
- N40 – Move to X100 Y0 at a feed rate of 600 with laser intensity of 35% PWM
- N50 – Move to X100 Y100 at a feed rate of 600 with laser intensity of 35% PWM
- N60 – Move to X0 Y0 at a feed rate of 600 with laser intensity of 0% PWM (off)
- N70 – Turn laser off

Generating G-code

MASSO Laser G-code requirements are compatible with many GRBL G-code softwares.

One of the best laser software options is Lightburn, which allows you to engrave photos, line drawings, and cut parts as needed (see page 6 for setting up Lightburn).

To see how to set up LightBurn for MASSO Laser, please following link: <u>Setting up Lightburn</u>

Notes on G-code Format

- You must include **T111 M06** at the start of the G-code file or the Depth map view will be blank.
- The **S** command can be on a line of its own before the move or it can be on the same line as the Move.
- The **S** command ranges 0 - 1,000 so to know what percentage of total laser power you have set divide the **S** value by 10.
- The **S** command is not actioned until there is an Axis move.

Laser Safety Glasses

A quality pair of safety glasses is the most important part of any laser. Unlike other CNC tools, a laser can cause serious eye damage from a distance in normal use.

Laser safety glasses are a must and can help reduce the probability of light entering the user's eye from a diffusely, backscattered laser light.

Use quality safety laser glasses suitable for the laser that you are using.

You only get one pair of eyes and they don't grow back.

FIGURE 20

NOTE: For all other laser connection information, contact MASSO.com.au, or go to this link (Installing an Opt Lasers (masso.com.au))

Opt Lasers Website

If you need more information about Opt Lasers, or if you are having any problems with the laser, please contact Opt Lasers directly at: optlasers.com

Thank you,
Sherline Products

Setting up Lightburn

> ℹ **INFORMATION:** Laser engraving/cutting is only available in MASSO G3 and MASSO Touch software versions with the Multi-Head feature. Available in version 4.02.77b onwards

What is Lightburn?

Lightburn is a software package designed to be used with Lasers of all types and can be used with CNC machines.

It has a free trial that allows you to test it with your machine before purchasing. Click the following link: Lightburn

With Lightburn, you can design, edit, and create G-code that you can send to your MASSO CNC controller.

It is a very powerful software that can be used with Windows, Mac OS, and Linux.

When you are happy that the software is what you want, you will need to purchase a license for the G-code version of Lightburn software.

This document does not seek to teach you how to use Lightburn but how to set it up to use with MASSO.

Lightburn assumes that you are using a Diode Laser.

Configure Lightburn to Use with MASSO

Step 1: Select the right Machine type.

When you first open Lightburn, it will ask you to select your device.

- Click on **Create Manually**.
- Select **GRBL-M3 (1.1e or earlier)** and click **Next**.
- Select **Serial/USB** and click **Next**.
- Enter the X and Y axis length for your machine and click **Next**.
- Turn off Auto "home" your Laser, (switch will be brown when off), and click **Next**.
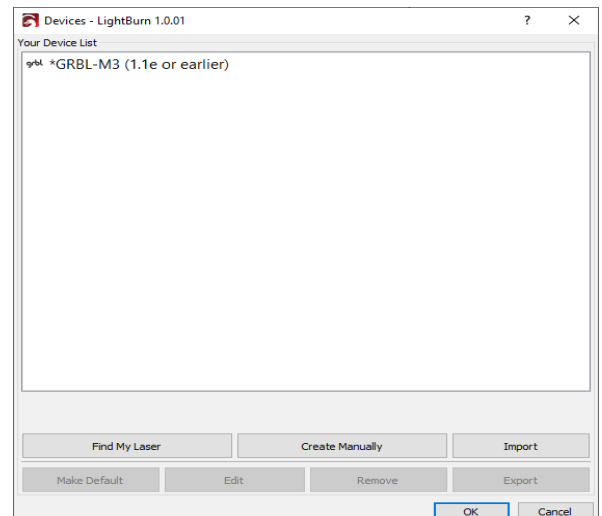- Click **Finish**.

FIGURE 21—You will see this dialog box at the completion of Step 1.

Step 2: ⚙ General Settings

- Find the ⚙ symbol along the top line and click on it.
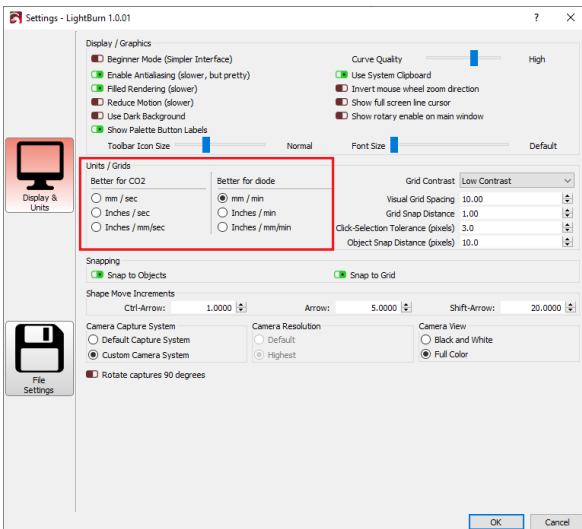- Under Unit/Grids, select **mm/min** or **Inches/min** as required.
- Click OK

FIGURE 22—The completed General Settings dialog box. The Unit/Grid section is outlined in red for reference.

Step 3: 🔧 Device Settings, Basic Settings tab

- Find the 🔧 symbol along the top line and click on it.
- Under the Basic settings tab select **M8** for Air Assist.
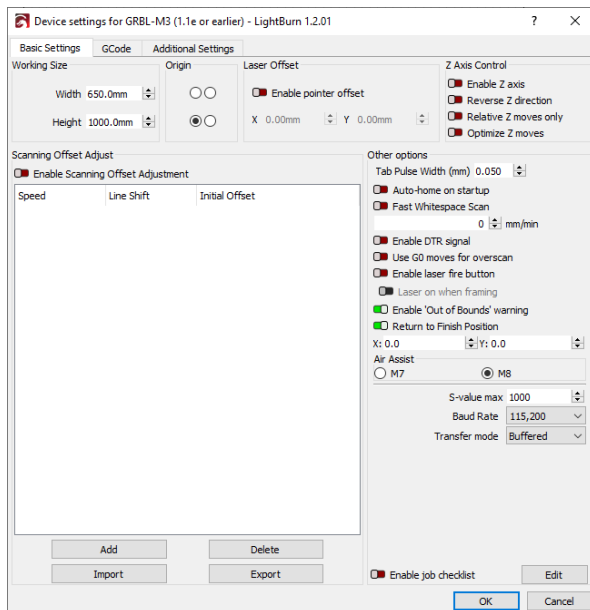- Set the **S-value** max to 1,000.

FIGURE 23—The completed Basic Settings dialog tab.

Step 4: 🔧 Device Settings, G-code Tab

- Find the 🔧 symbol along the top line and click on it.
- Under Start G-code enter the following:
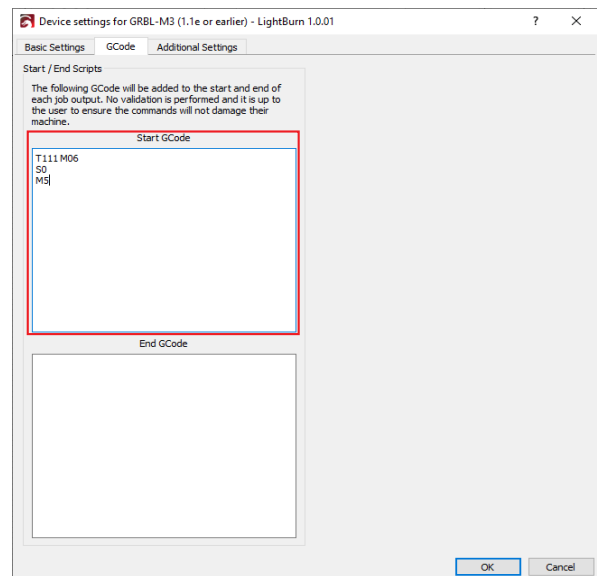
  T111 M06

  S0

  M5

- Click OK.

FIGURE 24—he completed G-code dialog tab. The Start G-code section is outlined in red for reference.

Lightburn configuration is now complete.

Outputting G-code

While there are many settings that you can use, the steps above are the minimum needed to get up and running.

- Once you have created your project, select Save G-code to output your file.
- Remember to add .nc at the end of your file name.
- Ensure that you have selected GRBL-M3 (1.1e or earlier) for your device when saving to ensure it outputs the correct G-code format. This is only a problem if you set up more than one device.
- Ignore the disconnected message on screen as it only applies when the Laser is connected directly to Lightburn.
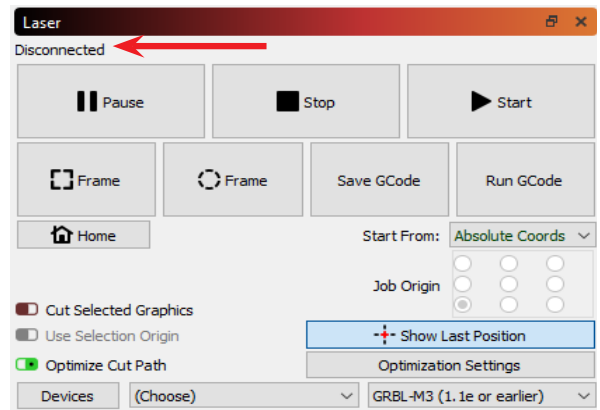

FIGURE 25—The red arrow shows the "Disconnected" message.

Overscanning

Overscanning is an important feature then engraving photos or shading an object. It allows the Laser to move past the end of the object you are engraving.

Overscanning is necessary to overcome acceleration and deceleration. Without overscanning, the laser would slow

down as it nears the end of the engraved area. However, because the laser is still turned on, the area of acceleration or deceleration will get darker burning because the laser is moving slower in that area. This causes a fringing effect on your engraving.

By using overscanning on your layer, the laser will move past the end of the engraving and turn the laser off then decelerate.

Likewise, when accelerating, it will start outside the engraving and turn on when it reaches the correct position. This allows the Laser to reach the correct speed before turning on.

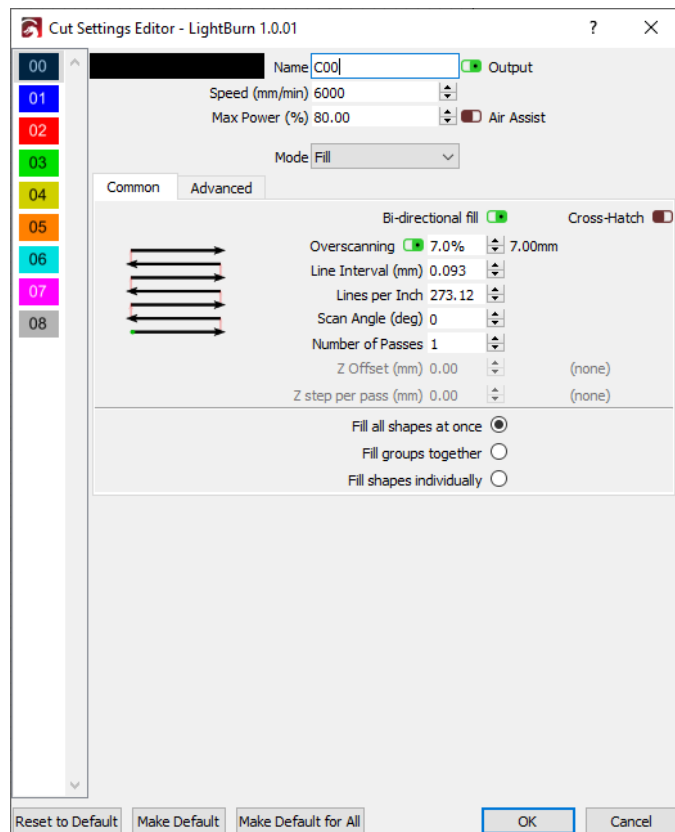The faster you move the longer overscanning will need to be.

FIGURE 26—The Overscanning dialog box.

Opt Lasers Website

If you need more information about Opt Lasers, or if you are having any problems with the laser, please contact Opt Lasers directly at: optlasers.com

Thank you,
Sherline Products Inc.