

# FabLight 1500/3000/4500

## Operator's Manual



Version 3.0 — March 19, 2019



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# 1. Introduction

The FabLight is a laser cutter manufactured by 3D Fab Light, Inc., in Oakland, CA. It is designed to safely cut both metal sheets and tubes in a compact footprint. It can also engrave these materials.

The FabLight uses a Fiber Laser, which can output pulses between 1,500W to 4,500W, depending on the model. The cutting area is 50" x 25", and the rotary fits tubes up to 2" diameter and up to 52" long. A Capacitive Head Sensor (CHS) maintains a constant gap between the Cutting Head and the metal to cut.

It can cut and engrave steel, stainless steel, aluminum, brass, bronze, copper, and titanium. Cut quality and speed depend on the material thickness, and the laser power.

**IMPORTANT:** Read and understand this manual thoroughly before operating the FabLight. Optical, electrical and mechanical hazards exist. Only users who are properly trained and authorized should operate the machine.

Bed size	50" x 25"
Max tube size	52" long, 2" diameter
Laser	150W/300W/450W continuous, 1500W/3000W/4500W pulsed
Input voltage	110V 65Hz single-phase outlet
Assist gas	175 PSI Compressed gas (max) (300 psi with high pressure option)
Materials	Steel, Stainless Steel, Aluminum, Copper, Brass, Titanium
Focusing	Motorized focus lens with capacitive height sensor
Cooling	Air cooled
Safety	Class 1 safety enclosure. No eyewear required.
Exhaust	Remote switching for Dust Collector. 15 Amp max.

## 2. Safety & Compliance

### 2.1. Certification

The FabLight is a Class I laser product and complies with 21 CFR Chapter 1, E Subchapter J. These safety standards have been established by the US Food and Drug Administration, Center for Devices and Radiological Health (CDRH). The FabLight complies with all CDRH standards for Class I systems including labeling, protective housings, and safety interlocks. For more information on laser safety standards refer to Regulatory Requirements for Laser Product Manufacturers or American National Standard for Safe Use of Lasers (ANSI Z136.1). Both publications are available from the Laser Institute of America, 13501 Ingenuity Drive, Suite 128, Orlando, FL 32826. Phone: (800) 345-2737. [www.lia.org](http://www.lia.org)

### 2.2. Laser Safety

The safety enclosures and interlocks of the FabLight prevent the user from being exposed to direct or indirect laser radiation during normal operation or maintenance of the machine. Under no circumstances should these interlocks be defeated or bypassed. The laser used inside the system can be extremely dangerous. Direct eye contact with the laser beam can cause serious damage or blindness. Direct skin exposure to the laser beam can cause serious burns. There are no user serviceable parts in the laser system. Servicing, adjustment or replacement of the fiber laser, power supplies or other components should only be performed by factory trained and authorized technicians. Laser safety labeling is described below.

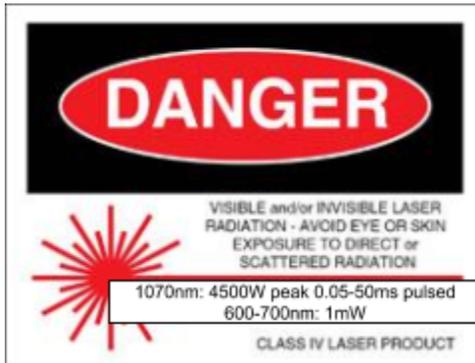
#### 2.2.1. Certification & Identification Label

Located on the right side, back edge of the FabLight.

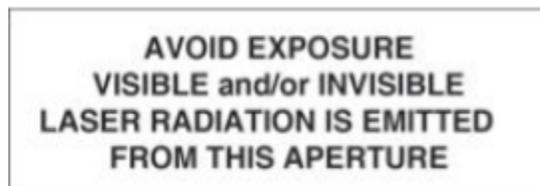


### 2.2.2. Warning Logotype & Aperture Label

These labels are located behind each of the two non-interlocked Side Service Panels, visible after panel removal. It includes information about the peak power of the two laser sources, one visible (red pointing diode between 600-700 nm), the other invisible (fiber laser at 1070 nm).



On the cutting head is this label, warning about exposure from the cutting head aperture.



### 2.2.3. Non-Interlocked Protective Housings

One label is located above each of the two side service panels that require screws to be turned for removal. The labels are visible both during and after panel removal.



### 2.2.4. Defeatable Interlocked Protective Housings

This label is near the Front Door, which has a defeatable but automatically resetting interlock switch. The label is next to the door, leaving it visible even with the door open.



## 2.3. Electrical Safety

**DANGER:** Lethal voltages exist inside the machine. Do not tamper with or bypass safety interlocks. Disconnect power to the machine before removing any service enclosures.

## 2.4. Mechanical Safety

**DANGER:** Moving parts inside the machine can cause bodily harm. Many components move at high speed and have potentially lethal force. Do not tamper with or bypass safety interlocks. Disconnect power to the machine before servicing any mechanical components.

## 2.5. Ventilation Safety

Laser cutting or engraving of many materials can create hazardous fumes. These fumes may be dangerous to breathe and can damage the FabLight. Consult Manufacturer's Safety Data Sheets (MSDS) for all materials before laser cutting.

The user of the FabLight is responsible for exhaust ventilation and removing cutting fumes from the working area. Before operating the FabLight, make sure that an exhaust system is installed, connected and working properly.

The user of the FabLight is also responsible for making sure that the output from the ventilation system complies with local air quality or other regulatory standards.

**CAUTION:** Laser cutting can create dangerous or lethal fumes. Make sure a ventilation system is in place and working properly before operating the FabLight.

## 2.6. Assist Gas Safety

**DANGER:** All gasses supplied to the FabLight must be dry and oil-free. If oil is introduced into the system, there is a risk of explosion if the system is later used with oxygen.

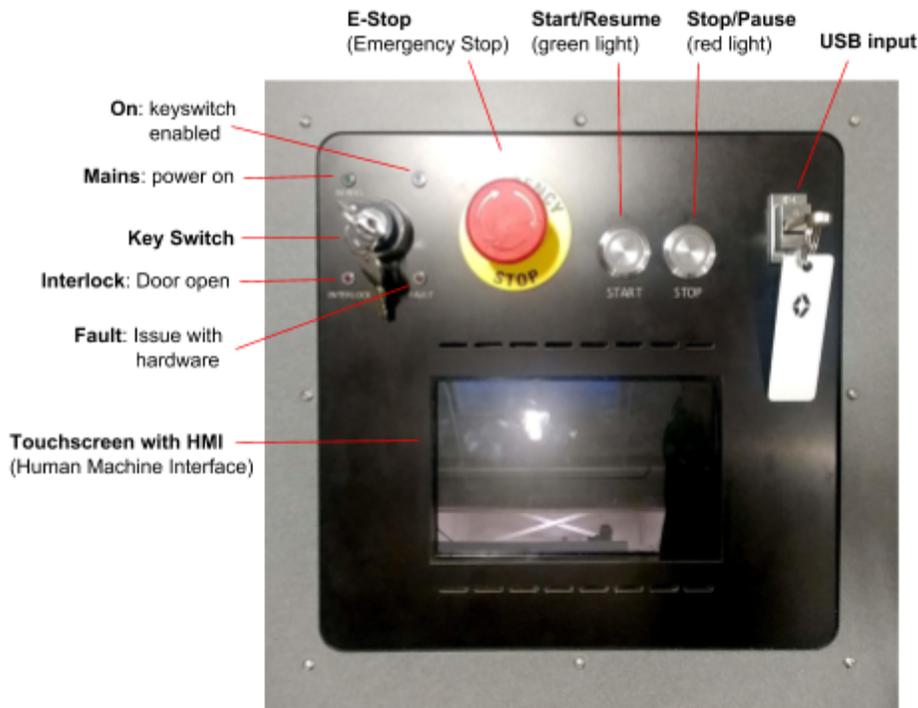
**CAUTION:** Compressed gasses can cause gas embolisms. Do not place fingers near or under the gas nozzle when assist gas is on.

### 3. System Features

This section describes the major features of the FabLight.

#### 3.1. I/O Control Panel

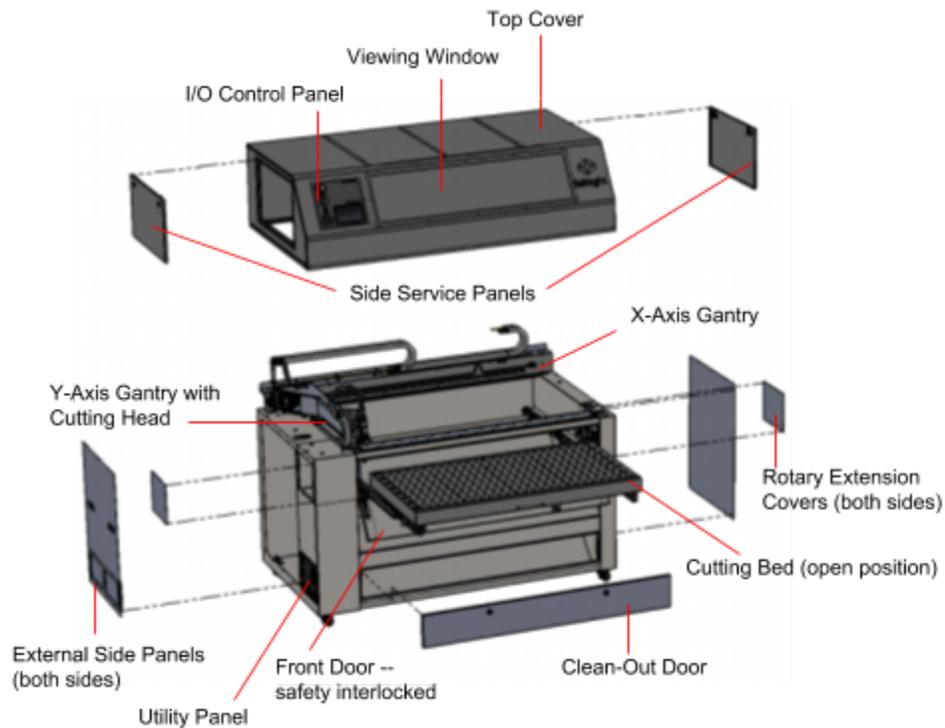
The I/O Control Panel contains the controls for operating the machine. This includes a keyswitch, emergency stop button, start and stop buttons, and indicator lights. It also has a touchscreen for loading files, controlling the motion, and starting and stopping jobs. It is mounted on the left side, in the Top Cover.



Light on panel	Description
MAINS	Machine receiving mains power.
ON	E-Stop is disengaged, and Key Switch has been turned.
FAULT	Machine encountered a fault. Motion halted. Check touchscreen for error message. If necessary, view section “7. Troubleshooting” of this manual.
INTERLOCK	Interlock is active. This light is on when the Front Door is open.
GREEN START	See section “6. Operation” of this manual.
RED STOP	See section “6. Operation” of this manual.

## 3.2. Top Cover

The Top Cover consists of a transparent plastic window that prevents any scattered laser radiation from escaping the cutting area. The window is designed to absorb the laser wavelengths. The Cover also houses the Side Service Panels and I/O Panel. The Top Cover should not be removed.



## 3.3. Side Service Panels

**DANGER:** Do not operate laser with service panels removed.

There are two Side Service Panels that mount in the Top Cover, and can only be removed with a wrench -- they are not safety interlocked. These panels should not be removed during normal operation, but can be removed for maintenance such as cleaning, changing a window, or centering the nozzle.

## 3.4. Front Door - Safety Interlocked

The Front Drawer opens to allow metal to be placed on the Cutting Bed, or to load tubes in the Rotary. When closed, the Front Drawer mates with the chassis and is safety interlocked. The laser cannot be turned on when the Front Drawer is open.

### 3.5. Clean-Out Door

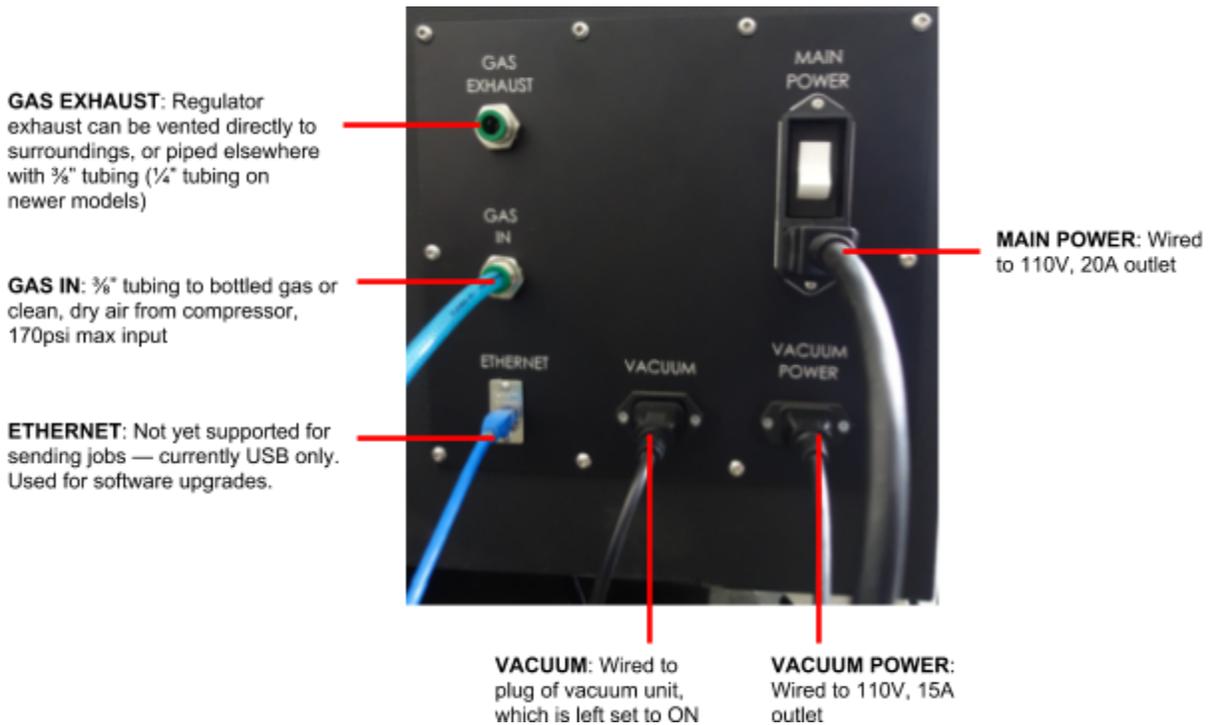
**DANGER:** Do not operate laser with Clean-Out Door removed.

The Clean-Out Door opens to allow recovery of any parts that may have fallen, as well as debris from cutting. The Clean-Out Door mates with the chassis. It must be opened with a wrench, and is not safety interlocked. The laser can be turned on when the Clean-Out Door is open.

### 3.6. Utility Panel

The Utility Panel is located on the left side of the Fablight, on the lower, front corner. It contains the Main Power Switch and Circuit Breaker. This power switch disconnects all internal power to the machine. It also includes:

- One Ethernet port
- Two plugs for the Exhaust Power Plugs (one to the wall outlet, one to the vacuum)
- Two  $\frac{3}{8}$ " tubing connectors, for taking in compressed gas, and another for exhausting the regulator to outside the machine.

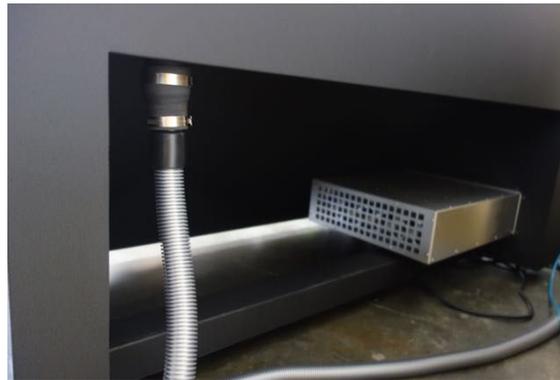


**WARNING:** Do not hook up input compressed gas to the GAS EXHAUST bulkhead -- only to the GAS IN bulkhead. The GAS EXHAUST is only there to vent the computer-controlled regulator inside, and hooking up pressurized gas to it can damage the regulator.

**NOTE:** Newer FabLight models use a ¼" port for the exhaust, to eliminate this issue.

### 3.7. Exhaust Connection

There is one exhaust connection accessible behind the machine, on the rear side, under the cutting area. It must be connected to an external ventilation or air filtering system. This ventilates fumes from the cutting area. One end of a HEPA-filter equipped vacuum can be connected by pressing it into the coupler. See figure below.



### 3.8. Cutting Bed

The Cutting Bed is mounted in the drawer. This is where sheet metal is loaded and cut. The cutting bed has two positions: in the middle position for sheet cutting, and pushed all the way back for tube cutting.

### 3.9. Rotary Axis

The Rotary Axis for tube cutting is located in the front of the drawer. This is where tubes are loaded. The rotary chucks are located in the front of the machine, just behind the door to the left and right.

On both sides of the machine are Rotary Extension Covers. These allow future upgrades to an add-on extension that allows 10-foot tubes to be cut on FabLight. Do not remove these covers.

### 3.10. Cutting Head

The Cutting Head is where the Fiber Laser is connected. It contains optics for collimating and focusing the laser beam, and electronics for the Capacitive Head Sensor that maintains a constant cutting distance between the Cutting Head and the metal being cut. A stepper motor

controls the Z-Axis height. The Cutting Head also has an inlet for the Assist Gas being used for cutting.

### 3.11. Y-Axis Gantry

The Cutting Head is mounted on the Y-Axis Gantry, which travels the full length of the machine. A high-precision motor controls the motion of the Cutting Head along the axis. The Y-Axis is mounted to the X-Axis Gantry by a rail system on one side, and is simply supported by a bearing on the other side.

### 3.12. X-Axis Gantry

The X-Axis Gantry is fixed, with the Y-Axis running along it. A precision motor controls the motion of the Y-Axis.

### 3.13. Fiber Laser

The Fiber Laser is mounted, along with the control electronics, in the Left Side Bay of the machine. The laser light is provided by diodes, which passes through a gain fiber inside the main laser housing in the bay, and is then delivered to the cutting head through a fiber optic cable that runs along the X-axis and Y-Axis. The delivery fiber is fixed in position, and should under no circumstances be removed except by trained technicians.

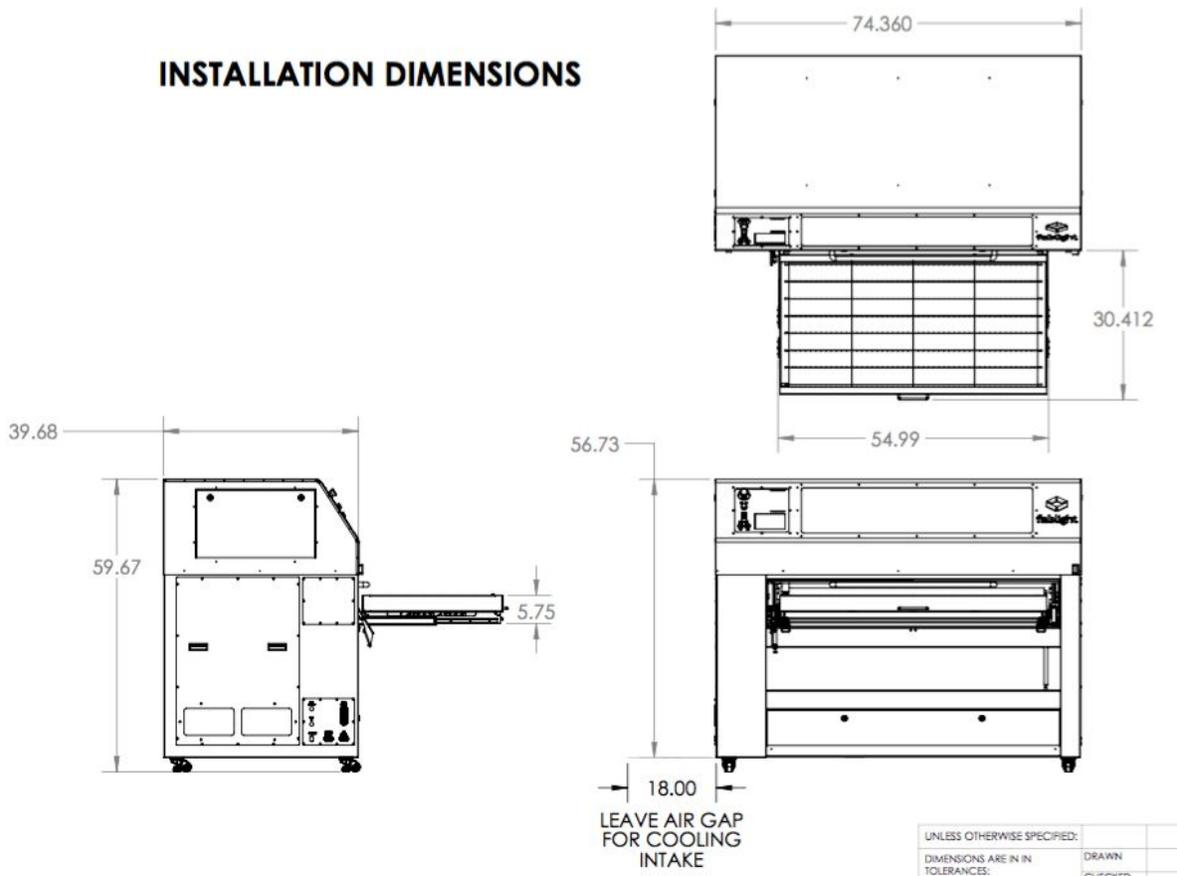
The laser extends out into the back of the machine in a metal enclosure. It should not be covered with anything, and there should be enough space on the side of the machine to permit airflow through the vent. If blocked, the laser will overheat and shut down for safety. It will need to cool before it can be used again.

# 4. Installation

## 4.1. Space Requirements

The FabLight requires a smooth, flat surface that is free from excessive vibration. The machine is mounted on casters, with screw-down feet for preventing the machine from moving once located. The feet can be tightened down or raised up using the 7mm hex head in the top of the shaft. Remove the two External Side Panels to access the hex head. Once the feet are set, they can be locked in place by screwing down the nut on the shaft of the foot.

The FabLight requires a minimum of 18" clearance on the left and right sides of the machine to allow access to the Service Panels, as well as to allow airflow to the laser. Another 18" clearance is recommended on the right side for accessing the Side Service Panel, though service should not often be needed. It also requires 31" of space in front of the machine for fully pulling out the cutting drawer. The back of the machine can be pushed up next to a wall.



The Exhaust Duct connects to the FabLight on the right, rear edge of the machine. All other utilities (AC power, air, external data cable) connect through the Utility Panel, shown below, on the left side of the machine.



## 4.2. Electrical Requirements

AC Power is connected to the FabLight on the left side of the machine, through a plug on the Utility Panel, just below the large white main on/off switch. In the U.S., the FabLight requires a 110VAC, 60Hz, 20 Amp circuit. If you have purchased the machine for use outside the U.S., it should be configured for either 110VAC or 220VAC, depending on the country.

Using the provided dust collector requires a second 110VAC, 60Hz, 15A circuit. See section “4.4. Exhaust” below.

**NOTE:** For all three models (FabLight 1500, 3000, and 4500), TWO circuits are required: a 20A circuit for the FabLight, and a 15A circuit for the supplied dust collector.

## 4.3. Cooling

All components of the FabLight, including the laser, are air cooled. No separate external cooling system is required. The laser should be operated in an air conditioned room that maintains the humidity below 90%, and the air temperature at 77°F (25°C). Operating the laser above this humidity or temperature may reduce its performance.

**CAUTION:** At least 18" of space is required next to the left side of the machine to allow for proper air cooling of the laser. See Space Requirements above.

## 4.4. Exhaust

The FabLight requires an external ventilation fan or air filtration system. This exhaust can be connected to the machine through the port provided on the rear side of the machine. A dust collector with a HEPA filter can be connected to the port through an adapter, and the dust collector can be plugged directly into the machine to be turned on and off as the machine cuts.

A dust collector/vacuum with a HEPA filter is provided with the FabLight. Using it requires a second 110VAC, 60Hz, 15 Amp circuit. The FabLight uses a relay to turn the vacuum on and off, but the vacuum stays on and plugged into the wall.

Two cables are provided to plug into the two ports labeled on the Utility Panel:

- **VACUUM port:** a C14 to U.S. receptacle (NEMA 5-15R) cable for the vacuum to plug into.
- **VACUUM POWER port:** an IEC-320 C13 to U.S. plug (NEMA 5-15P) cable for plugging into the WALL.

**CAUTION:** The NEMA 5-15P is rated for 20A, but is provided as a “regular” U.S. plug for convenience, instead of the 20A plug (NEMA 5-20P) that goes into 20A outlets. Plug the machine into a 20A outlet to prevent the breaker from tripping.

To power the dust collector, there are two wires provided with the machine that plug into the Utility Panel. One connects into the VACUUM port, and this exposes a socket that the dust collector can be plugged into directly and left in the “On” position. The other connects into the VACUUM POWER port, and this is plugged into a 15 Amp wall outlet.

**NOTE:** For all three models (FabLight 1500, 3000, and 4500), TWO circuits are required: a 20A circuit for the FabLight, and a 15A circuit for the supplied dust collector.

Instead of a dust collector, another HEPA filter filtration system, or an external ventilation system, can be used. To connect directly to the machine, plug a ¼” OD hose into the push-to-connect Gas Exhaust bulkhead located on left side of the ports panel. Contact 3D Fab Light with questions about how to set up that system.

## 4.5. Assist Gas

The FabLight requires compressed gas to assist in cutting metal. Many metals will cut using compressed shop air that is clean (oil-free) and dry (moisture-free). Inert gases, such as nitrogen or argon, can be used to reduce edge burning for some metals. Oxygen can help speed up cutting of some metals.

**DANGER:** All gas supplied to the FabLight must be dry and oil-free. Moisture in the system can damage the optics, and oil can introduce a risk of explosion if later cutting with oxygen.

The gas supply is connected through a 3/8" push-to-connect bulkhead labeled GAS IN on the right side, rear of the machine. It flows to an internal regulator, and then to the Cutting Head.

**NOTE:** 150 psi or greater is recommended if possible. Lower pressures will work, but may result in not being able to cut as thick or as well as with higher pressures. A minimum of at least 110 psi is strongly recommended.

There are two types of regulators that ship with the FabLight:

- Standard Regulator (included)
  - Input: 174 psi (1.2MPa, 12bar)
  - Output: 145 psi (1.0MPa, 10bar)
- High Pressure Regulator (upgrade)
  - Input: 725 psi (5 MPa, 50bar)
  - Output: 435 psi (3 MPa, 30bar). Note that we limit it to 250psi output to protect the fittings and hoses.

The hose connector fittings are all rated to 300 psi, and the hoses themselves are either:

- Blue (200 psi, 1.38MPa, 13.8bar)
- Green: 300 psi (2MPa, 20bar)

The High Pressure Regulator can still be used if you have a Blue hose, but you will be limited to 200 psi. It is not simple to change out the hose, but it is possible.

There is a GAS EXHAUST bulkhead that connects to the regulator. This is to provide a path for vented gas from the regulator to the outside.

Feel free to contact 3D Fab Light to request more detailed guidance on how to set up your compression system.

## 4.6. Computer

There is an embedded computer on FabLight for uploading cut files and controlling the machine. Files are uploaded using a USB thumb drive.

**NOTE:** Files cannot yet be uploaded through the ETHERNET port on the Utility Panel.

## 5. Machine Controls

### 5.1. System Power

The Main Power Switch is on the Utility Panel, found on the left, lower front corner of the machine.

### 5.2. I/O Panel

When the Main Power Switch is on, the MAINS LED will light on the I/O panel. If the Emergency Stop (E-Stop) button is disengaged (rotate clockwise to check and release), the Key Switch needs to be turned clockwise momentarily to power the rest of the system. The ON LED will come on, as will the light inside the top cover, and the embedded touchscreen. The motors will also turn on. The laser will NOT be powered at this point -- that only happens when running a job.

### 5.3. Emergency Stop Button

Pressing this large red button IMMEDIATELY shuts off AC power to the functional part of machine. The button must be released and the key turned again to operate the FabLight (rotate clockwise). Note that with the E-stop pressed but the Main Power Switch still on, there will still be power into the machine.

**CAUTION:** Do not remove any panels for service without turning off the Main Power Switch and Circuit Breaker. The E-Stop does not disable Mains to the machine, but the machine will no longer be "On" and ready to run a job.

### 5.4. Touchscreen Interface

The Touchscreen presents a Human-Machine Interface (HMI) for uploading jobs to the machine. See chapter "6. Operation" for more on using the Touchscreen Interface.

## 6. Operation

### 6.1. Turn on the Machine

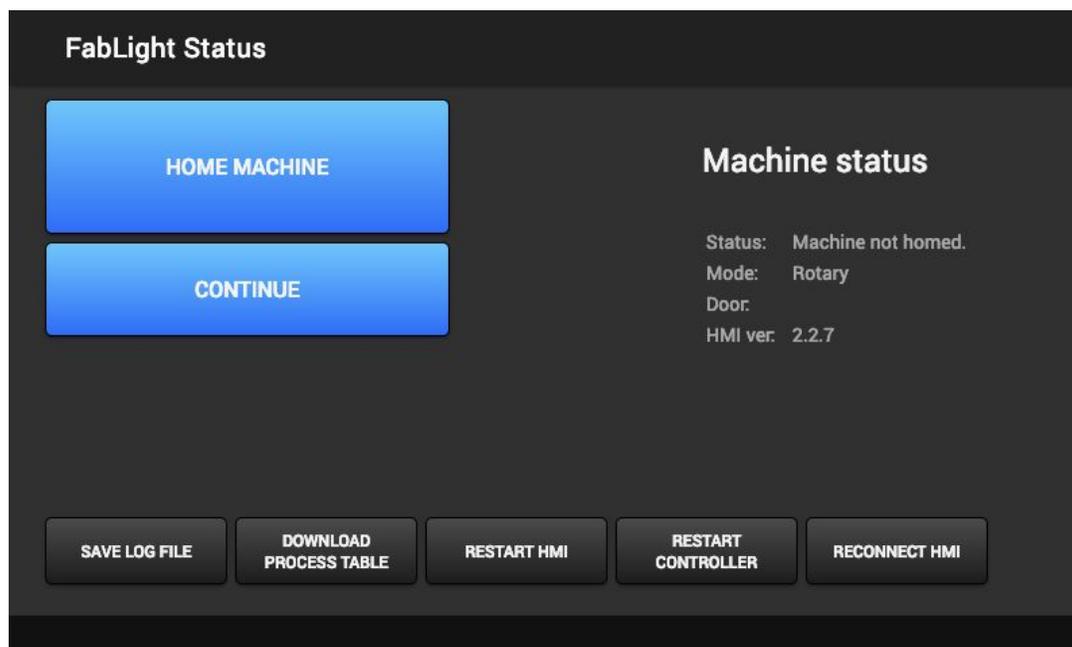
If the green MAINS light is not on, turn on the main switch on the Utility Panel located on the left side of the machine. If that doesn't work, check that the cable directly below the switch is plugged into a 115V, 20A outlet. The Touchscreen will also turn on and launch the Human-Machine Interface (HMI).

Release the Emergency-Stop (E-Stop) switch by rotating it clockwise. This will disengage it. Then turn the Key Switch clockwise momentarily and release it. The green ON light should turn on, as well as the interior light in the cutting area.

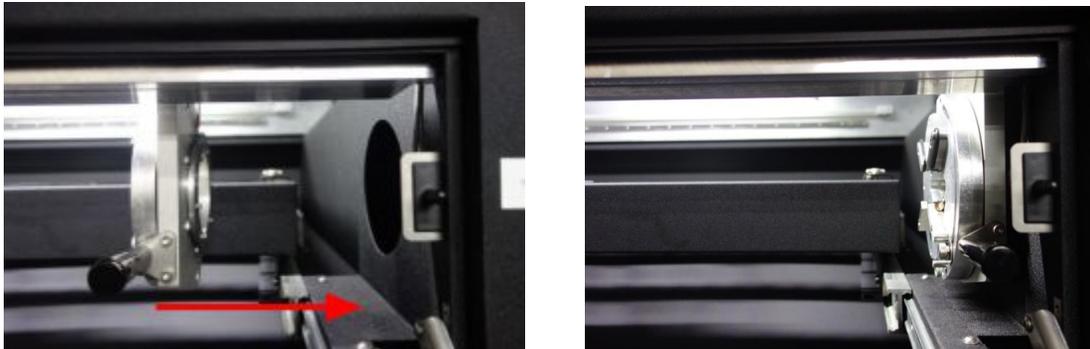
### 6.2. Home the Machine

When the machine first starts, it does not know where the cutting head is. The machine must go through a homing routine before any jobs can be run. The machine usually only needs to be rehommed when it is first turned on, or after the E-Stop is pressed.

When the HMI touch screen turns on it will state "Status: Machine not homed." You must press HOME MACHINE for all 6 axes to run through their homing routines. Once that is complete and the status updates to "Machine is homed", press CONTINUE to begin using the machine.



If your machine has a rotary you may encounter two homing errors. If the touchscreen says, “Idler not homed. Move idler to home”, open the door and move the idler all the way to the right. There is a sensor that detects when the idler is in its home position.



Move idler from not-in-home-position all the way to the right.

Once the idler is in the home position, close the message and repress HOME THE MACHINE. If you encounter an error message saying that the rotary is locked; simply pull out the red pin, close the message, and repress HOME THE MACHINE.

## 6.3. Loading Material

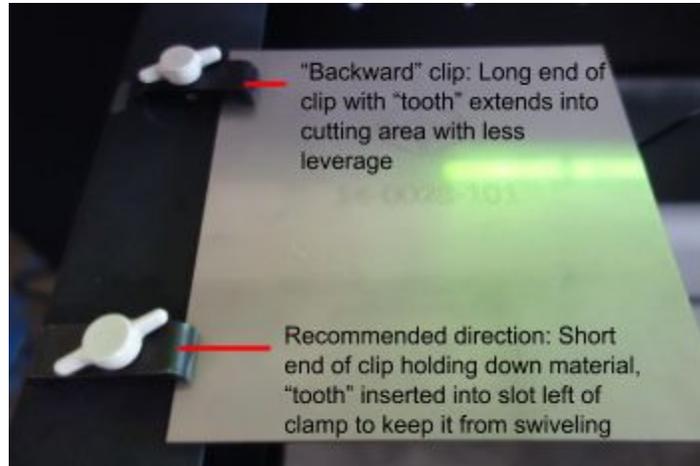
Open the Front Door and load a tube or plate.

**CAUTION:** Metal should be free of oil, paint, adhesives, or other residues before cutting. If these substances are present during cutting, they can be burned by the laser and can cause damage to the optics in the cutting head.

### 6.3.1. Loading Sheet Metal

For sheet metal, use the thumb screws and clips to hold down the sheets along the left or right side of the drawer.

If you look at the image below, the bottom clip is the recommended position, with the short end of the clip holding the material. This puts the clip out of the cutting area of the pallet, and also provides more leverage for holding the material down.

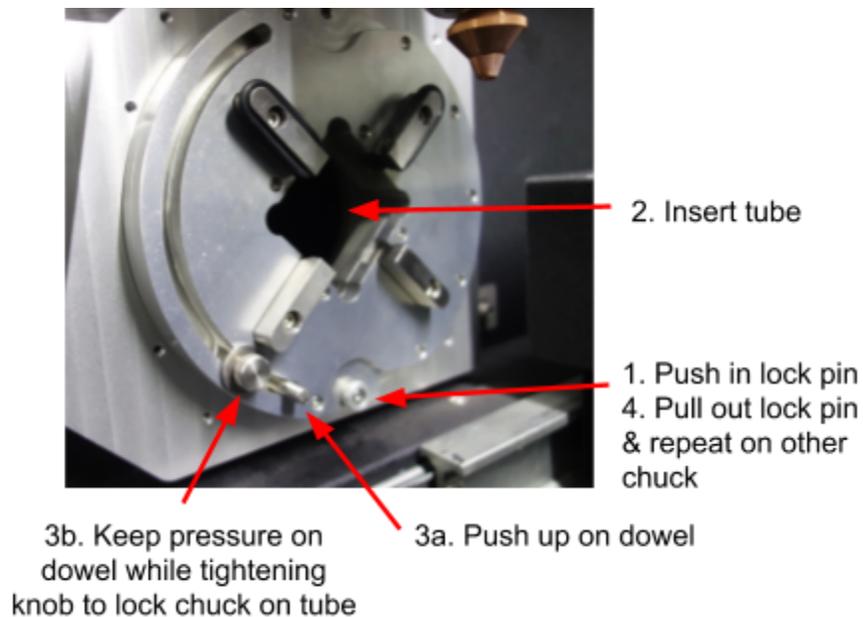


### 6.3.2. Loading Round and Square Tubes

To load a tube, the pallet must first be pushed to the rotary position toward the back of the machine. After that, the tube is loaded into the two chucks on the left and right sides, just behind the door. The image below shows the five steps involved in securing the chuck. The same procedure is done on both chucks.

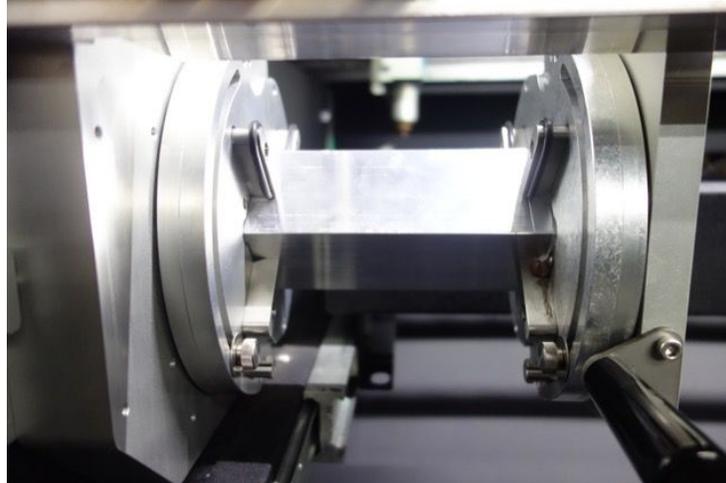
The idler chuck on the right should be loaded first, followed by the drive chuck on the left. See the image below for step-by-step instructions for loading the chuck and securing the tube.

**NOTE:** After securing both chucks, remember to pull both lock pins out. If you forget, the machine will remind you before cutting a tube.



**WARNING:** You must keep pressure (push up) on the dowel until the knob has been tightened, otherwise the chucks will be locked loosely around the tube, which can cause the tube to slip during job rotation.

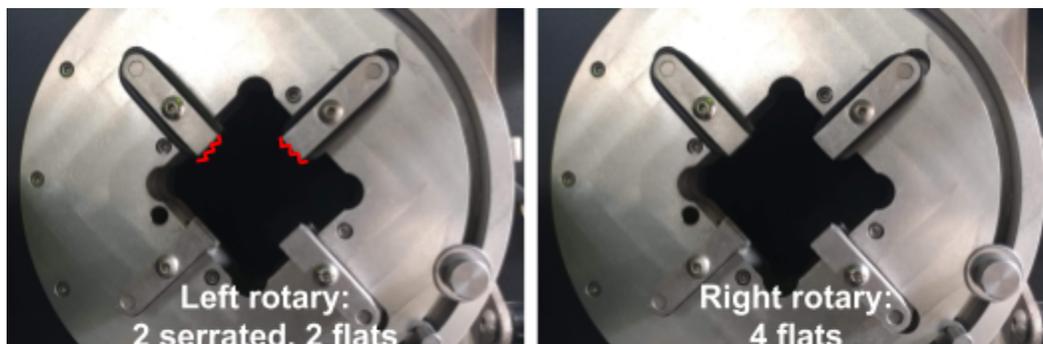
The chucks can accommodate tubes between 0.5” and 2” in outer diameter for all tube shapes (round, square, rectangle). This is what a 2” square tube looks like when loaded:



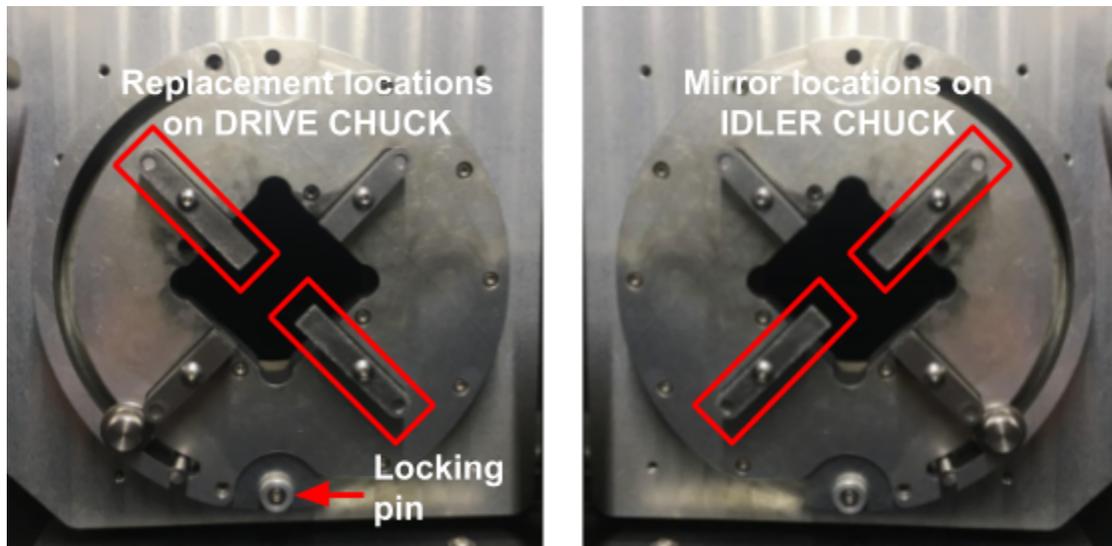
### 6.3.3. Switching Jaws for Rectangle Tubes

The FabLight ships with default jaws that are equal in size and accommodate round and square tube shapes. If you want to load a rectangle-shaped tube, you will 4 longer jaws to switch in as pairs on each rotary chuck. Refer to section “10. Service Through Freshdesk” for information on contacting us. Once you have received the long jaws, follow the steps below to switch tube shape modes:

1. In the default Round and Square mode, the drive chuck (left rotary) will have 2 serrated jaws at the top with O-rings, and 2 flat jaws at the bottom. The idler chuck (right rotary) will have 4 flat jaws with 2 O-rings at the top. This is how you should reset the jaws when switching out of Rectangular mode.



2. To switch into Rectangular tube mode, get the four long jaws and a 5/64" allen key. Pay attention to the location the long jaws must go in on both chucks.

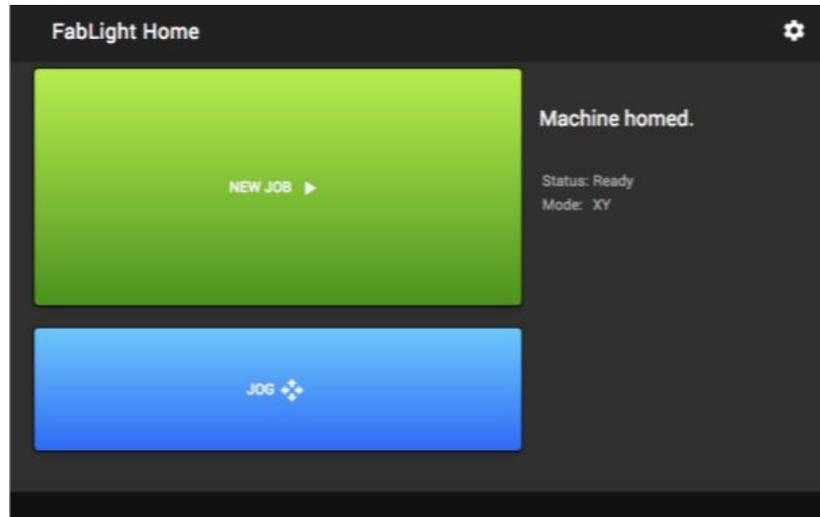


3. Push in the locking pin at the bottom of the chuck. Use the allen key to remove the screws holding in the default mode jaws that are in the replacement locations.
4. Wiggle those jaws loose from their pins and set them aside.
5. Switch the O-ring that is no longer held back by a top short jaw to a remaining bottom short jaw.
6. Tighten the long jaws in the now empty locations.
7. Repeat on idler rotary chuck to achieve the state shown in step 2 for both rotaries. They will be mirror images, with the front top and rear bottom chucks getting the extended jaws.
8. You can then load a rectangle tube that should clamp securely between the long and short jaws.
9. Do the above procedure in reverse to return to the default Round and Square jaws.

## 6.4. Setting Up the HMI

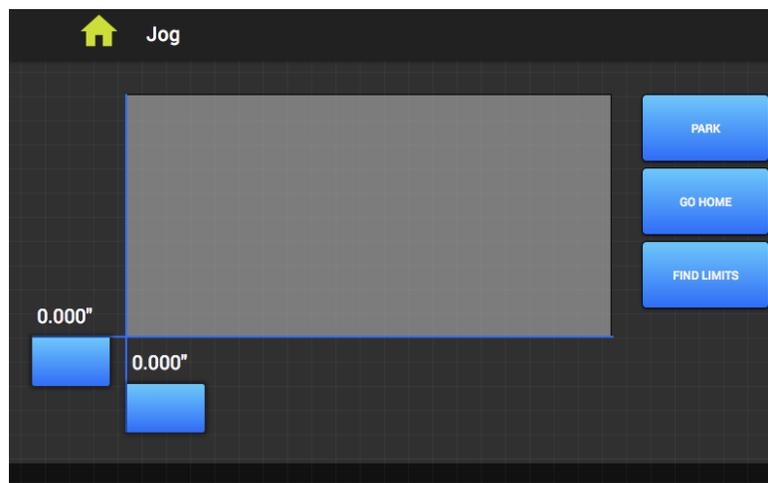
### 6.4.1. Home Page

The HMI's FabLight Home screen has two big buttons on the left (NEW JOB, JOG), and status on the right side. In the image below, the machine is homed, ready, and in XY (not rotary) mode.



### 6.4.2. Jog Page

Pressing the "JOG" button on the Home Page brings up the Jog Page. This page allows you to move the cutting head around in the X-Y plane as needed. Drag on the flags for the X and Y axes to set the position. The head will move when the flag is released. The measurement positions are shown, and change by 0.100" increments.



On the right are three buttons:

- PARK will move the cutting head to the back of the machine.
- GO HOME will move the cutting head to the last home position, which is the last job starting point.
- FIND LIMITS is used to re-home the machine back to the origin (0",0").

Double-tapping the flag for the X or Y axis brings up a number pad where you can type in that coordinate directly, as shown in this picture. This can be useful for fine adjustments, or for manual step-and-repeat.



### 6.4.3. Settings Page

From the Home page, pressing the gear icon  brings up the Settings Page. On the left side are the MACHINE GAS, MACHINE UNITS, and PROCESS TABLE MANAGEMENT sections. On the right side are UTILITY and ADVANCED sections.



### 6.4.3.1. Machine Gas

Here you can set the MACHINE GAS you will be using. If you select a different gas, the SAVE button will turn green, and you can press it to confirm your selection.

**NOTE:** This will change the processes the machine uses for cutting and engraving. Each gas has its own set of processes for each type of gas. Not all materials have settings for all gases.

When changing the gas, you can use the PURGE GAS button in two ways:

- **Removing hose:** If you can close the air source to the machine, then hit the PURGE GAS button, the air will be exhausted. Press it again if you need to purge more. Then you can easily push down the GAS IN bulkhead to free the hose for removal.
- **Purging with new gas:** After changing gas, say from air to nitrogen, flush the line by pressing PURGE GAS button.

### 6.4.3.2. Machine Units

This changes whether the jogging and process settings are displayed in millimeters or inches. If you switch units, the SAVE button will turn green, and you can press it to confirm your selection.

### 6.4.3.3. Process Table Management

This lists the database file (.db extension) that is being used. Note in the image above it says “Using FL4500\_database\_03132018\_in\_process\_12.db”. The .db file’s name starts with the FL4500.

If you press the “DOWNLOAD PROCESS TABLE” button and have a USB drive inserted, it will download the .db file and append “download\_YYYY\_MM\_DD” to the name according to the date on which you downloaded the database.

With a USB drive inserted, if you press the “UPLOAD PROCESS TABLE” button, you will see a screen that lists the available .db files to use from the root folder of your USB. From that list, you can select one and press SAVE.

**WARNING:** If you upload a database without first downloading the one already in use, the in use database will get overwritten and cannot be retrieved again. Be sure to download the existing database before uploading a new one.

### 6.4.3.4. Utility Section

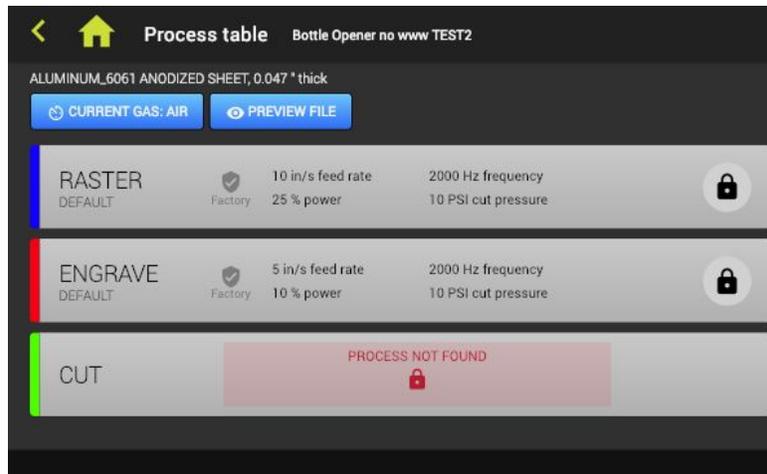
Press Purge Gas to empty the line (see section “6.4.3.1. Machine Gas” above). Press VACUUM ON to test whether the vacuum can be turned on by the machine.

### 6.4.3.5. Advanced Section

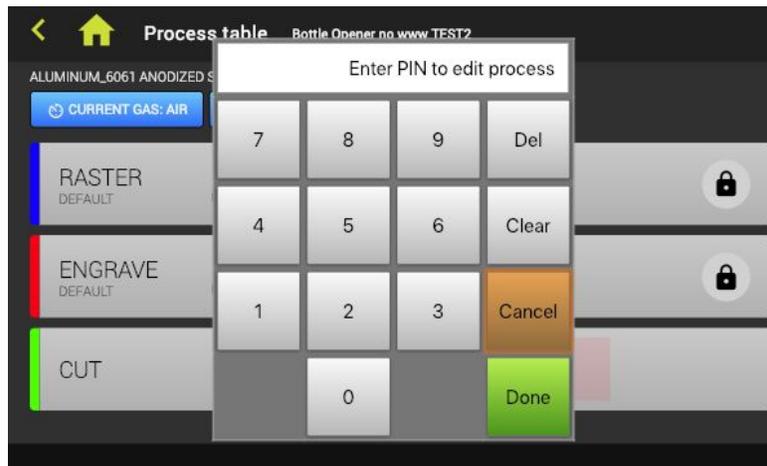
There are six buttons: ROTARY LEVELING, ROTARY CENTERING, FOCUS TEST, BEAM CENTERING, CHS INFO, and DOWNLOAD LOG. They are all described in section “9. Calibration Routines.”

### 6.4.5.6. Admin Password

If you are in a facility with multiple operators (such as a prototyping lab or school), you may want to limit access to changing the FabLight’s process database. As an administrator, you can set and enable a 4-digit PIN that must be entered if a regular user wants to change the process or create a new process. A “lock” icon appears wherever the process PIN must be entered. Once the PIN is entered, the process stays unlocked until a new job is loaded.



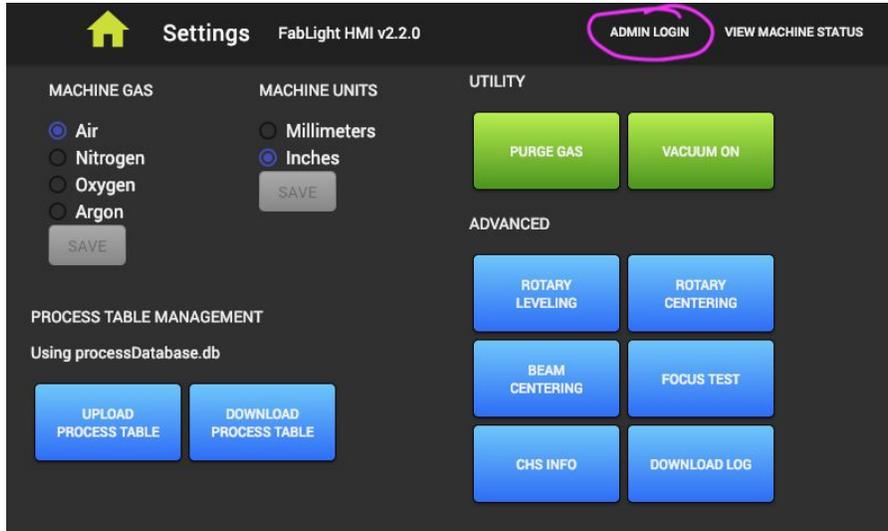
Process page screen with the PIN enabled. The user must enter in the PIN to create a new process or edit an existing process.



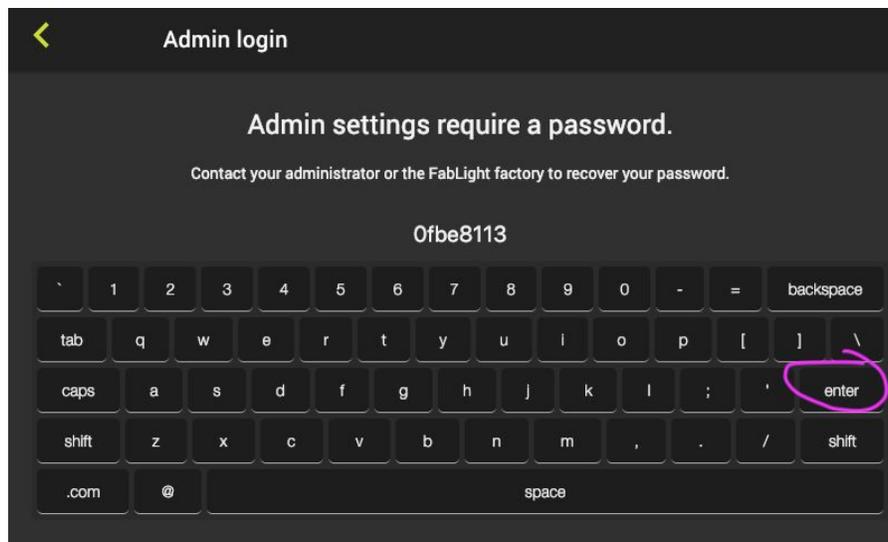
Clicking on the lock opens up a keypad to enter a PIN number.

To set the pin, you will need your FabLight's unique 8-character [a-z, 0-9] administrator password. Contact 3D Fab Light if you forgot your password or wish to reset it.

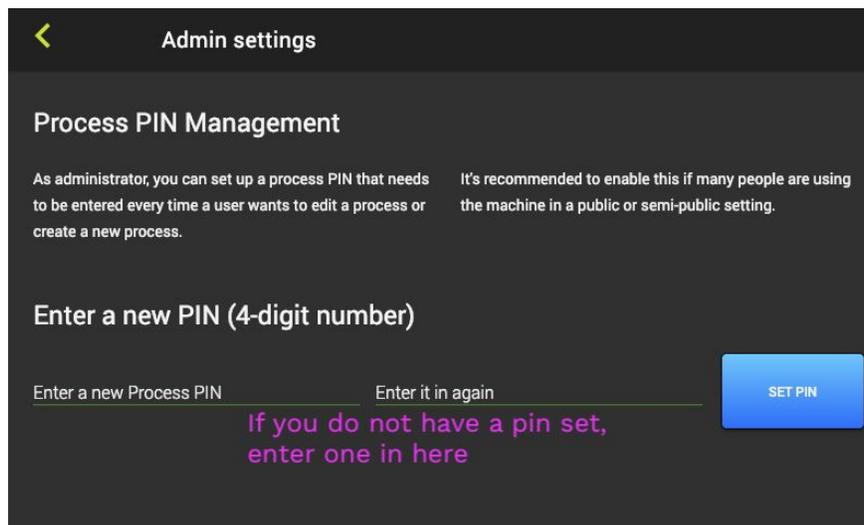
1. Go to the ADMIN LOGIN screen on the HMI.



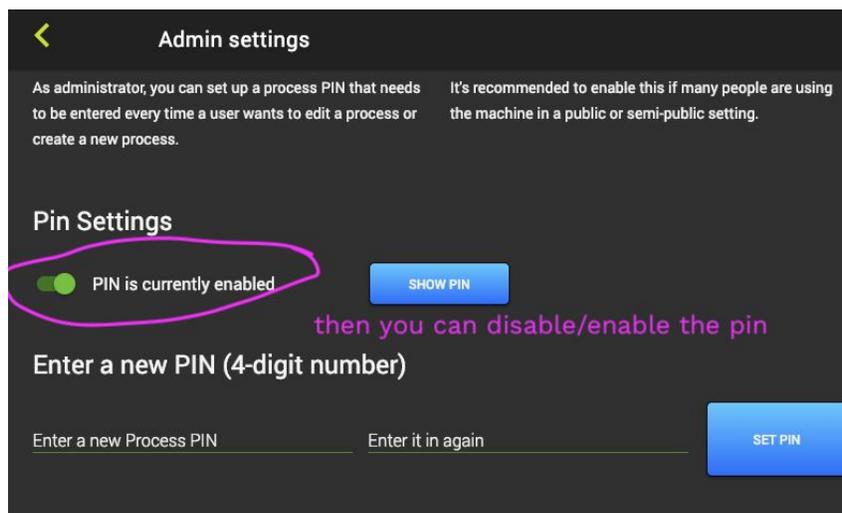
2. Type in your password and press enter.



3. From the admin settings page you can create a new PIN if you haven't already set one up.



4. You can also enable or disable the PIN number.



## 6.5. Loading a FAB File on the HMI

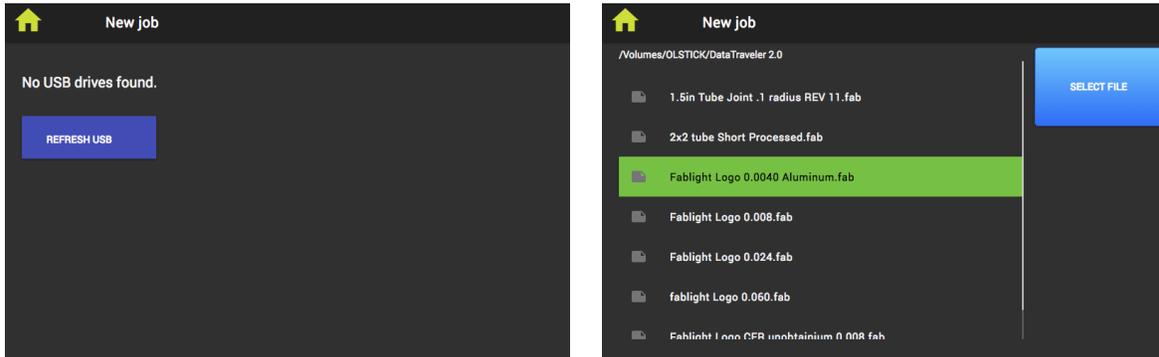
### 6.5.1. Open Job File

From the Home screen, press the New Job button to get a list of files on a USB flash drive.

**NOTE:** Jobs can currently only be loaded with a USB flash drive.

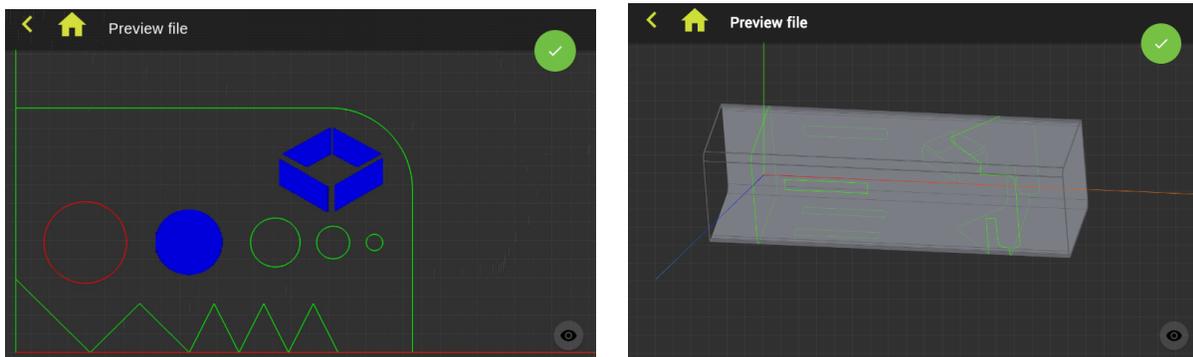
If there is no USB drive found, the screen below left shows the REFRESH USB button to press after putting one in. A list of FAB files created by FabCreator will appear on the screen, shown below right. (See FabCreator Manual for information on how to create FAB files.)

Scroll up or down to find a file to load, then press the name, followed by the SELECT FILE button on the right.



### 6.5.2. Preview File

Once selected, a preview of the file will appear on the screen. Both sheet and tube parts will be previewed (see images below left for sheet, right for tube). Green lines represent cut lines, red lines represent engrave lines, and blue filled shapes represent raster engraves. You can zoom in and out using a two-finger pinch, much like on a smartphone touchscreen. The eye logo in the lower right corner will reset the view. Press the green circle with a check to select file.



**NOTE:** Changes to the file must be made in FabCreator, the reloaded onto the HMI.

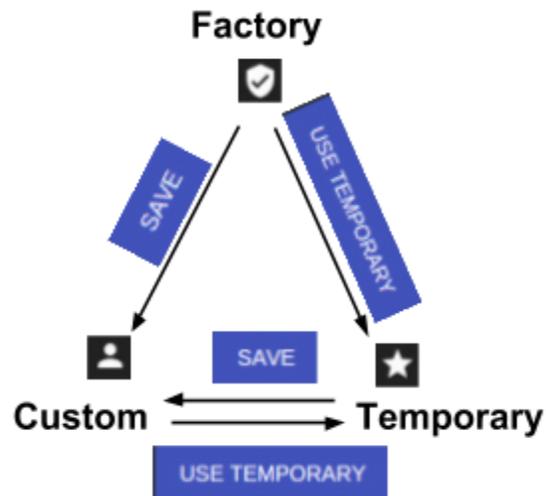
### 6.5.3. Process Table Overview

The Process Table is a collection of machine and laser settings optimized for the material being cut. Once the file is chosen, any processes in the Process Table associated with the material that was chosen in FabCreator will appear.

There are three categories of process:

- Factory: Protected process that can't be edited on HMI.
- Custom: Saved alternative process for that material.
- Temporary: One-time process for testing that can either be saved (if good), or will be overwritten the next time you go to the Home screen to load a new file.

The relationship between the three types is shown in the diagram. There is no way to overwrite a Factory process, but it can either be changed into a Temporary process, or a Custom alternative process can be saved.



Try not to mess with the Factory process too much or you can risk damage to the laser or machine. If you want help with cut quality or developing process for new materials, please contact 3D Fab Light.

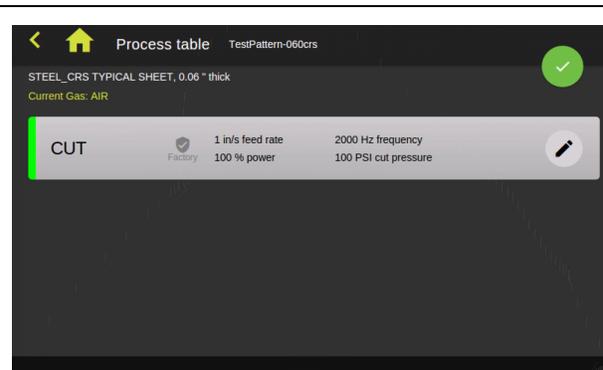
#### 6.5.4. Editing a Process

This screen shows a Factory process  for the CUT geometry in file "TestPattern-060crs". The material properties, as specified back in FabCreator when the FAB file was created, are:

- STEEL\_CRIS
- TYPICAL
- SHEET
- 0.06" thick

If everything looks good, press the green

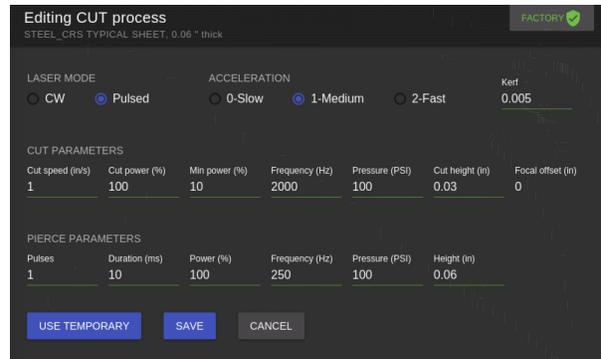
check  in the upper right to proceed.



To edit a process, press the pencil icon  on the right side of the process. This will open an EDITING screen. Press on any parameter to edit it.

To check if there are other saved processes, you can press the FACTORY button

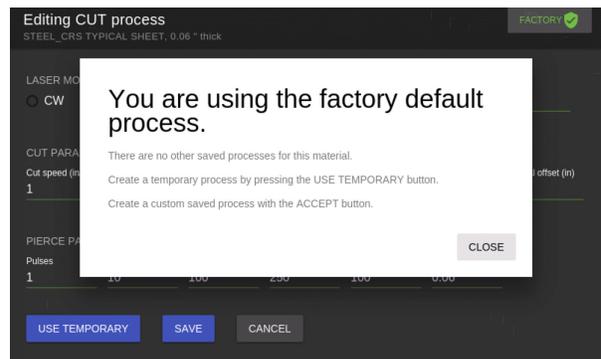
 in the upper right corner.



This will bring up an info window. It will list alternative processes, and remind you that:

- USE TEMPORARY will store it as a Temporary process.
- SAVE will save it as a Custom process.
- CANCEL leaves the process unchanged.

Hit CLOSE to go back to editing and make a choice.

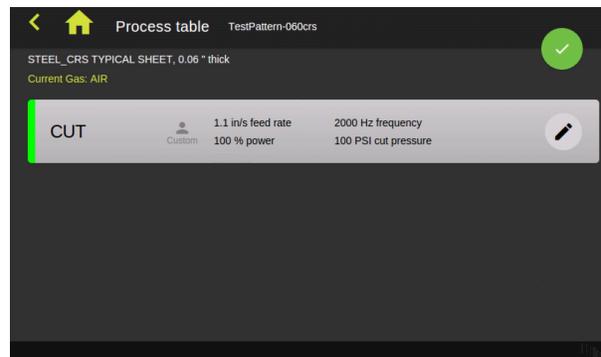


This example now has a Custom process

. To either restore the Factory process, or to use a Temporary process, press the

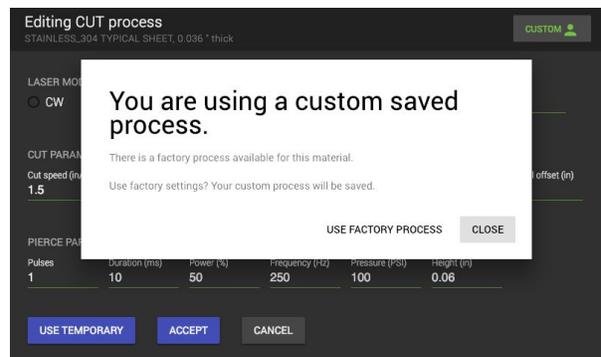
pencil icon  to get back to the EDITING screen, then press the CUSTOM button

 to get another info screen.



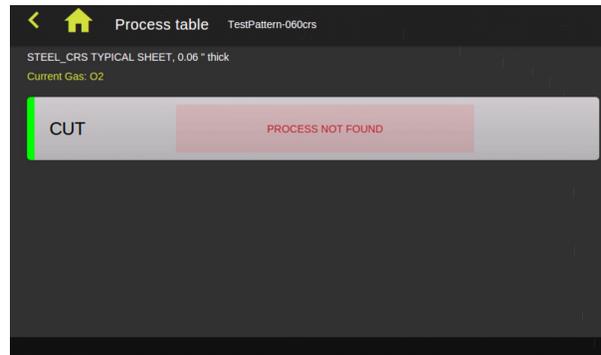
On this info screen, you can either press:

- CLOSE to keep using the CUSTOM process, or
- USE FACTORY PROCESS to restore the Factory process settings. The Custom process will still be saved.



## 6.5.5. Copying or Creating a Process

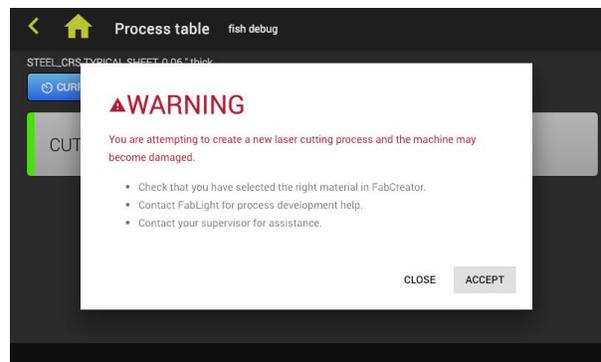
Some materials will not have a Factory process. In these cases, a red button that says “PROCESS NOT FOUND” will appear. Pressing that button will lead to a warning screen:



### “WARNING

You are attempting to create a new laser cutting process and the machine may become damaged.

- Check that you have selected the right material in FabCreator
- Contact FabLight for process development help
- Contact your supervisor for assistance.”



After that, you will either see this screen, which lets you copy:

- The same PROCESS (e.g. CUT)
- for the same MATERIAL (e.g. Stainless\_304),
- the same STOCK TYPE (e.g. tube),
- and the same GAS (e.g. Air).

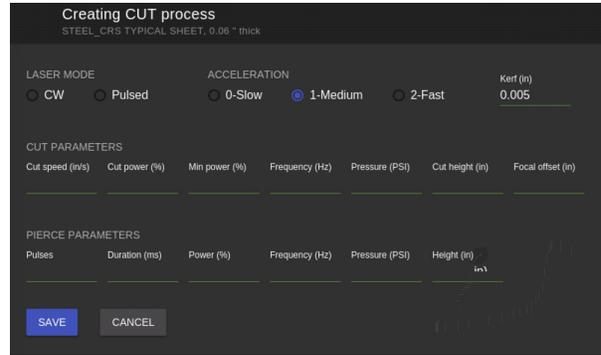
The goal is to help you pick processes that are similar to what you’re trying to cut.

Press SELECT to finish.



If no similar processes exist, you'll have to fill in the entire blank process table, as shown here on the CREATING edit screen.

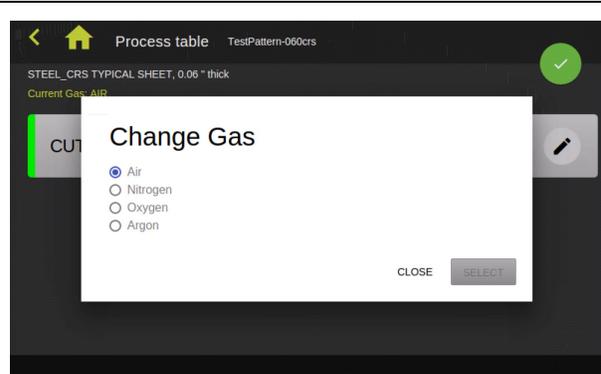
**NOTE:** You can contact 3D Fab Light for process development assistance as needed.



### 6.5.6. Changing Gas

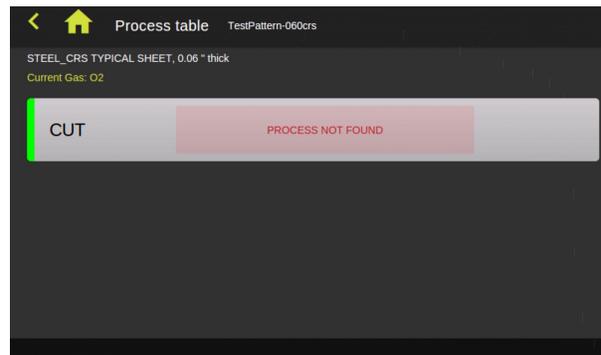
From the Process table page, if you press the Current Gas a window will appear to let you change the gas without having to go back to the Settings page.

**NOTE:** Selecting a new gas means that all of the processes change as well, and most materials don't have processes for all gases.



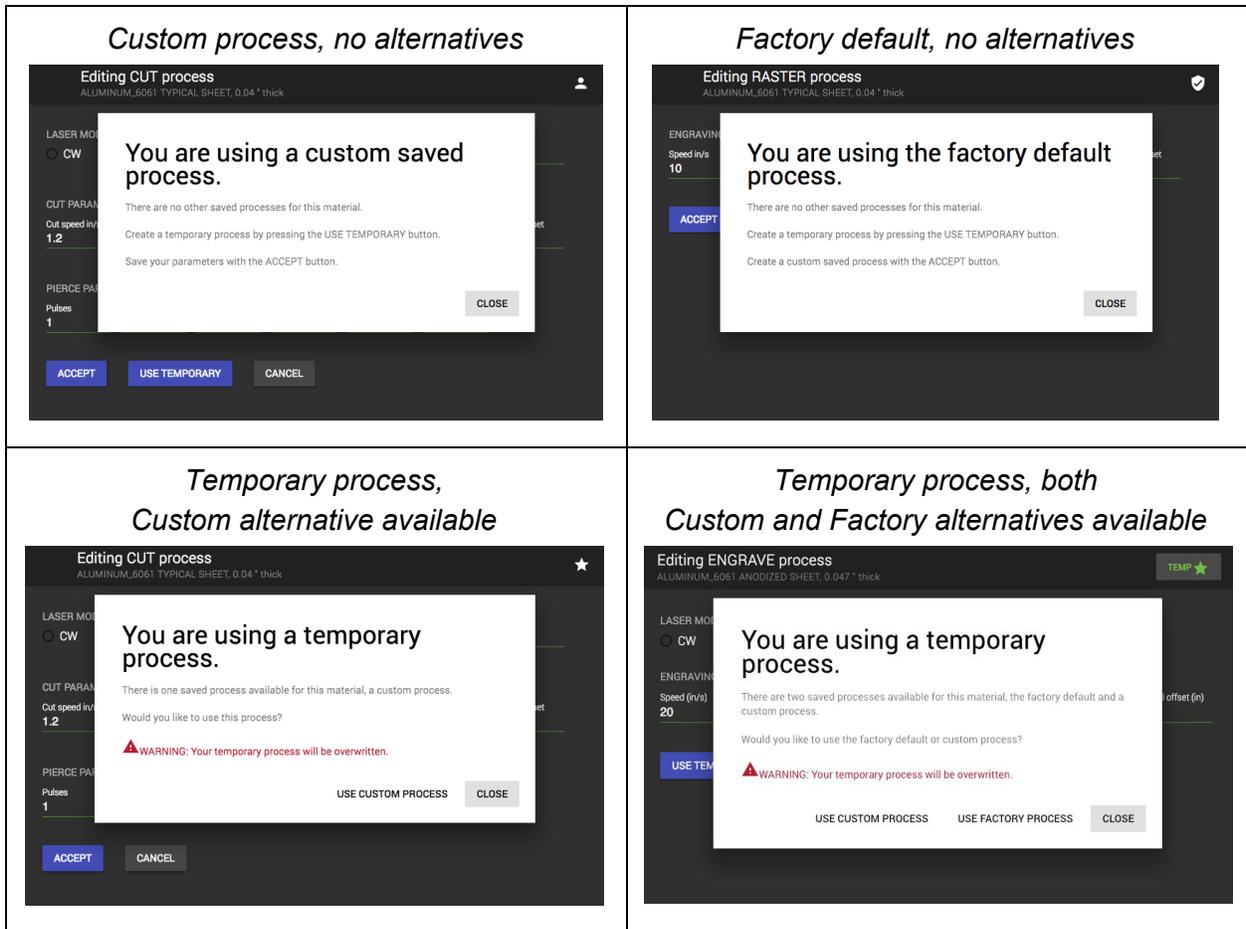
In this example, the Current Gas has been changed to O2 (Oxygen), and there is a red button that says "PROCESS NOT FOUND" for this gas and material.

See Copying and Creating a Process section above for instructions.

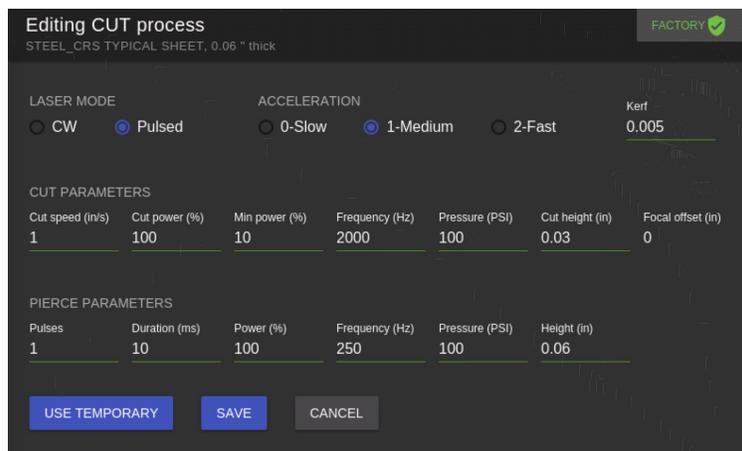


### 6.5.7. Switching Between Processes

There are a number of combinations of Factory, Custom, and Temporary processes that can exist for each material. Below are four examples of the info boxes that pops up when you press on the Factory, Custom, or Temporary button in the upper right corner of an EDITING screen. Note the choices available at the bottom of each info box.



### 6.5.8. Parameter Reference



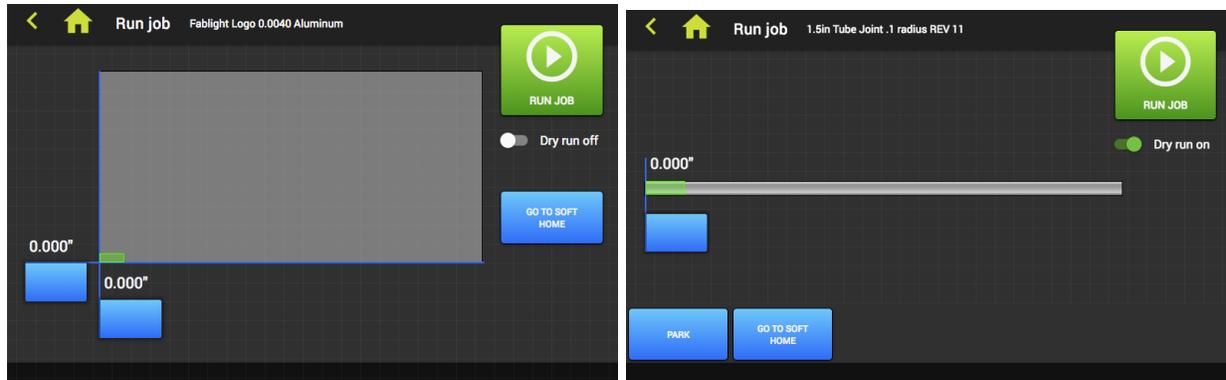
Parameter	Value	Description
<b>LASER MODE</b>		
Laser mode	CW or Pulsed	<p>CW - Continuous wave modulated (can use this for thin sheet metal)</p> <p>Pulsed - Pulsed modulated (use this most of the time)</p> <p>All process params for CUT have been tested with pulsed mode. CW (freq 2000) produces great cut surface quality, but has a large amount of dross. We have not found optimal parameters for thick materials in CW mode.</p> <p>CW is used by default for raster and cannot be changed. Engraving processes can use either pulsed or CW.</p>
<b>ACCELERATION</b>		
Acceleration*	0-Slow 1-Medium 2-Fast	Medium is default. Use slow for small parts or parts with fine features for best results.
Kerf	0.005 in	Default kerf set to 0.005in (0.127mm).
<b>CUT PARAMETERS</b>		
Cut speed	in/second or mm/sec	Slowing down and reducing power can reduce dross. Higher pressure can let you go faster.
Cut power	0-100%	Laser power. Linearity not tested.
Cut gas pressure	0-145 PSI	Varies based on the material, thickness, and cutting gas. Can be higher than 145 PSI with the High Pressure Regulator option.
Cut height	0.01 to 0.1in	<p>Distance of nozzle above the material during cutting.</p> <p>For a rotary job (square tube) the cut height should be greater than 0.030".</p> <p>For cutting sheets we recommend 0.01 to 0.03 in to get more gas flowing into the cut. Engraving can have a higher cut height since the gas pressure can be lower.</p>
Cut frequency	25-2000 Hz	Affects "dots-per-inch" and energy put into cut. Lower frequency has higher energy per pulse.
Focus offset	0	Changes the focal offset. Focus offset of 0 is calculated by the machine based on the cut height to be focused at the top of the material.
<b>Pierce parameters</b>		

Pierce pulses	1	How many times to pierce
Pierce power	0-100%	Laser power for pierce
Pierce pressure	145 psi	Pierce gas allows for material to be removed as laser heats it. In general, try not turn this below 110psi.
Pierce height	0.06 in	Do not change this value
Pierce frequency	25-2000 Hz	See cut frequency above
Pierce duration	10 ms	Time in milliseconds. We have found piercing under 20 ms is optimal for even the thickest metals.

## 6.6. Running the Job

### 6.6.1. Positioning the Bounding Box

The image below left shows the Run Job page for sheets, and below right shows it for tubes. The green rectangle represents the bounding box for the cut envelope of the job being processed, overlaid on full cutting area of the sheet and tube modes. The bounding box shows the maximum extent of material needed to cut the job.



When you reposition the job by dragging the flags associated with each axis, the output reading will change, and the bounding box will reposition. The cutting head will also move. When you run a job, this location will be set as the Soft Home. Pressing the button “GO TO SOFT HOME” will return to this position.

### 6.6.2. Viewing a Dry Run

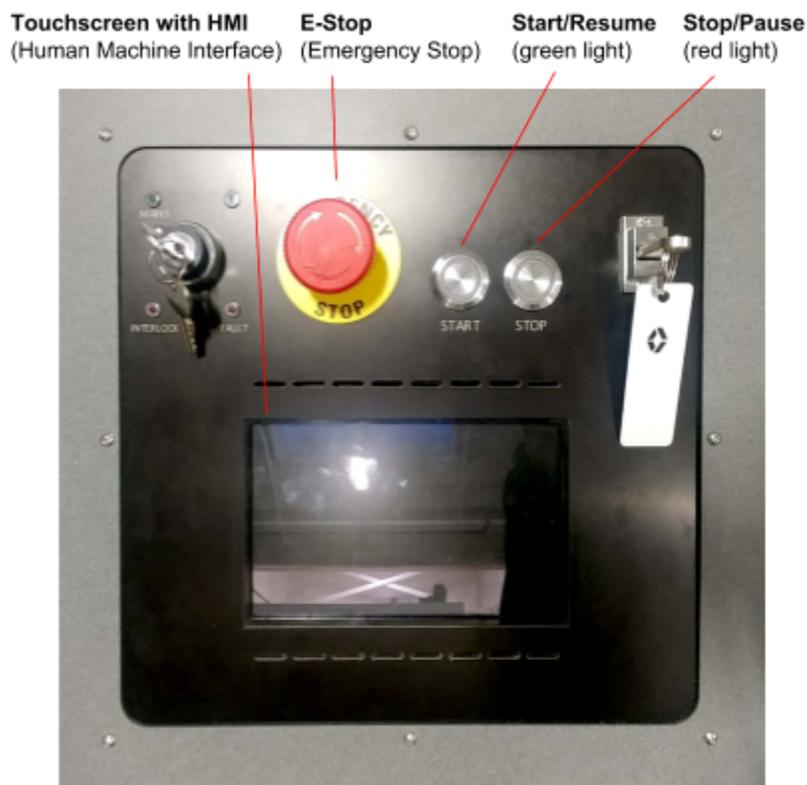
Once the job is positioned, it is possible to dry run the job. Press the “Dry run off” switch under the RUN JOB button, and it will move right, turn green, and say “Dry run on” (as in the above right tube cut screen). Dry run allows a job to be previewed by the cutting head, with the laser

power and gas pressure for all processes set to zero. The job will run with all other settings intact. To dry run, press the “RUN JOB” button. The START button on the I/O Panel will light up green and start flashing. Press the START button to begin the job.

To actually run the job with laser and gas on, make sure it's set to “Dry run off”, then press the “RUN JOB” button on the HMI and the green START button on the I/O Panel.

**NOTE:** The mechanical START button is meant as a failsafe against faults in the computer. It also prevents the machine from running without an operator present to make sure the job is properly set up.

### 6.6.3. Start, Pause, Resume, and Stop



During a job, the START button will be solid green, and the STOP button will be solid red.

To pause the job, press the STOP button once. Both buttons will be flashing.

To resume the job from pause, press the START button. Both buttons will return to solid lit.

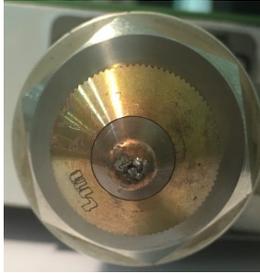
To cancel the job from pause, press the STOP button. Both buttons will go dark. The job must be restarted from the HMI.

The Start and Stop buttons will either be solid or flashing, depending on their function. See table below.

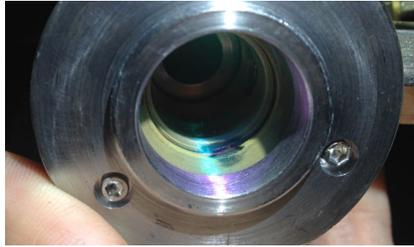
Action	Button state after action
Job sent to machine, ready to begin	Flashing Green Start Button.
<b>Start:</b> Press “flashing green START” to begin job	Both buttons solid
<b>Pause:</b> Press “solid red STOP” to pause running job	Both buttons flashing
<b>Resume:</b> Press “flashing green START” to resume paused job	Both buttons solid again
<b>End:</b> Press “solid red STOP” to end paused job	Both buttons off

# 7. Troubleshooting

## 7.1. HMI & On-Screen Notices

<p><b>White screen</b> (nothing shown)</p>	<p>Try rebooting the machine. If the white screen persists after restart, contact 3D Fab Light so we can update your program.</p>
<p><b>CHS Error</b> (many descriptions possible)</p>	<p>CHS sensor or calibration has failed for some reason. Verify the following and contact 3D Fab Light:</p> <ul style="list-style-type: none"> <li>• Calibration plate (if checking calibration) is grounded, clamped, and flat against the pallet.</li> <li>• Bed of the pallet (metal slats) is grounded</li> <li>• Nozzle tip is clean, wipe off slag (shown below) with Scotchbrite</li> </ul>  <ul style="list-style-type: none"> <li>• All cables on the cutting head are tight, especially the cable to the top of the focus box and the gold SMA connector.</li> </ul>
<p><b>Door is open.</b> Please close door [before running job] <i>or</i> Door opened while cutting, job will be aborted</p>	<p>The cutting head attempted to move but the door is open. Close the door and retry the motion.</p> <p>Interlock safety measure was triggered by opening the door during a job. Close the door and rerun the job.</p>
<p><b>Estop Relay Off</b></p>	<p>Machine failed to enable the motor drives when trying to find home. Contact 3D Fab Light as there may be a short.</p>
<p><b>Finding Limits...</b></p>	<p>The HMI is attempting to find machine limits. This is a normal message.</p>
<p><b>Homing Error</b> Idler not homed. Please move idler to home position before homing. <i>or</i> Move off [X/Y/Z/R] limit exceeded max distance.</p>	<p>Move the idler (right rotary chuck) all the way to the right to its home position.</p> <p>An axis limit switch requires servicing. Contact 3D Fab Light.</p>

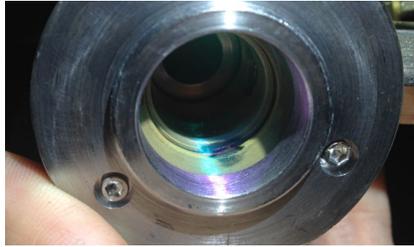
<b>Laser Error or Laser Warning</b> (many descriptions possible)	The laser has encountered an error or warning.. Please contact 3D Fab Light with the laser message.
<b>Laser Low Temperature</b> On reboot, fans will turn on to circulate warm air. Please close door and wait for laser to warm up before using. Current temperature is ____	The machine operates between 10°C and 50°C. Reboot main power for the machine fans to turn on. It can help speed up the process to also turn on the heater in your workspace. You will see an updated Laser Ready message when it has reached operable temperature.
<b>Limit Detect</b>	One of the axes ran into its limit switch. Try to re-home the machine. If homing is unable to complete, contact 3D Fab Light.
<b>Low Gas Pressure</b>	The gas pressure has dropped down too low for the current process. Make sure gas pressure into the machine is more than the requested gas pressure.
<b>Machine Error</b> Machine Not Homed!	The cutting head does not know where it is. Go to the Homepage on the HMI and home the machine.
<b>Machine Offline</b>	The HMI is not connected to the machine. Check the E-stop and key switch to make sure the machine is on and not just the Mains power. Hit the Restart HMI button if needed. If the problem persists after restart, contact 3D Fab Light so we can replace contaminated parts.
<b>Machine Paused</b>	The stop button was pressed on the machine.
<b>Motor Drive Fault</b>	An axis motor is obstructed or, if blinking red, needs to be repaired or replaced. If there is no light from the X or Y motors, the servo power supply box requires repair or replacement. Contact 3D Fab Light for repair and replacement services.
<b>No material loaded</b>	CHS has not detected any material above the cutting bed (for sheets) or between the rotaries (for tubes). Place material and set soft home to area over the material. Make sure there are no holes in the material within the cutting area and that the job fits entirely in the stock area.
<b>Nozzle off</b> Nozzle has broken away. Please re-affix nozzle	The nozzle on the cutting head has been knocked off. Reach for the nozzle as best you can where the cutting head is already stopped. (The cable that chains the nozzle to the cutting head is important for grounding and should be securely attached on both ends. If that cable breaks, contact us for a replacement). If the nozzle knocked off during a job while the laser was running, inspect the interior for any damage (burned gasket example below) before reattaching it. BE CAREFUL not to introduce any contaminants inside the nozzle body.



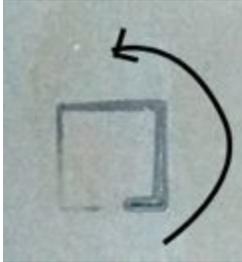
If there is no damage, reconnect the nozzle to the cutting head as best as you can (it is secured by magnets). Once the nozzle is no longer completely loose and dangling, jog the cutting head over to the right side of the machine. Open up the right side service panel and securely reinsert the nozzle fully into the cutting head as detailed below.



Face flat edge to green cover side of cutting head. Ensure nozzle is sitting properly and securely back in cutting head by giving it a test tug and twist, there should be no play.

	 <p>If there is no damage, reconnect the nozzle to the cutting head as best as you can (it is secured by magnets). Once the nozzle is no longer completely loose and dangling, jog the cutting head over to the right side of the machine. Open up the right side service panel and securely reinsert the nozzle fully into the cutting head as detailed below.</p>   <p>Face flat edge to green cover side of cutting head. Ensure nozzle is sitting properly and securely back in cutting head by giving it a test tug and twist, there should be no play.</p>
<p><b>Out Of Bounds</b> (various descriptions possible)</p>	<p>A move motion you are trying to make will be out of bounds in the X or Y, or will hit the idler. Verify the job is within the bounds of your stock material and, for tube jobs, does not overlap with the idler location.</p>
<p><b>Pallet Error</b> (various descriptions possible)</p>	<p>Verify the pallet is pulled in front for sheet jobs and stowed to the back for tube jobs. There are ridges built into the track to confirm the pallet is sitting in the right position for each mode.</p>
<p><b>Rotary Error</b> Please check locking pin</p>	<p>Remove the pins from the rotary and idler to enable free rotation.</p>
<p><b>Rotary Leveling or Rotary Centering</b> (many descriptions possible)</p>	<p>Rotary leveling or centering has failed for some reason. Verify that you have the correct 2in tube from the ship kit loaded, the CHS has been successfully calibrated, and the rotary drive has not faulted.</p>
<p><b>Tip Touch Pause</b> Too many tip touches, machine paused</p>	<p>The nozzle ran into an obstacle three times during a job. Check the nozzle tip is hand tight and nozzle body is properly seated in the cutting head. Clear the obstacle before restarting the job.</p>

## 7.2. Cutting Issues

Problem	Potential Causes	Solutions
Machine ran with “wrong” process: Cut instead of engraved, dry run instead of cut, etc.	Process mapping is incorrect.	Double check your process table. Make sure the assigned parameters in all processes are correct.
Job does not start	Drawer open. Machine out of bounds.	Close all drawers. Make sure machine is in correct mode. Make sure job fits in cutting bed area.
Job runs but machine does not cut	Dry run process selected.	Toggle dry run off. Check process table for assigned cut or engrave process.
Machine does not cut, no beam visible.	Nozzle is not centered, indicated by the red pointing diode (could occur after nozzle knock-off or optics replacement). Laser is not working.	See section “9.4. Beam Centering”  Determine if laser is operating or not by looking at the red pointing diode. If the beam is not visible, turn off machine, refer to Calibration - Beam Centering.
Cut does not go all the way through material	Wrong process selected. Cut speed too high. Gas pressure too low. Process table incorrect. Incorrect machine calibration. Cutting head or optics is dirty.	Select correct process. Reduce cut speed. Increase assist gas pressure up to 145 PSI. Verify process table is correct. Verify beam centering and focus test. Inspect nozzle tip (see below).
Machine loses cut 	Process table parameters incorrect. Cutting head or optics is dirty.	Verify cut process params including cut speed, cut height, and gas pressure. Check nozzle tip is clean, wipe off slag with Scotchbrite. Contact 3D Fab Light for further verification steps.
Machine does not cut, many sparks visible	Process table not set correctly. Cutting head or optics is dirty	Ensure correct focal offset, cut speed, cut height, and gas pressure in process table. Inspect nozzle tip (see above).

## 7.3. Mechanical Issues

Problem	Potential Causes	Solutions
Z Axis stuck at top of travel	Debris on Z axis sled Dusty Z axis bearings	Vacuum clean with soft-bristle attachment, then wipe down with shop towel.
Nozzle fails to recognize tip touches	CHS Calibration issues. If the nozzle hits material or is knocked-off, cables in the cutting head may have come loose.	Contact 3D Fab Light. Verify all cables on the cutting head are tight, especially the cable to the top of the focus box and the gold SMA connector. Contact 3D Fab Light if no obvious causes are found.
Gas Exhaust port is leaking or stuck in open position	The margin of supply pressed over the desired PSI is too low, or the regulated PSI limit is set too high, or there is debris caught in the valve.	Contact 3D Fab Light for guidance.

## 7.4. Design Software Issues

Problem	Potential Causes	Solutions
Import/Exporting .dxf files between FabCreator and Solidworks is altering the design	Software incompatibility.	Try using Draftsight and re-saving the DXF. Contact 3D Fab Light if that doesn't fix the issue.
Cannot nest parts in Solidworks	2D CAD programs are more compatible for nesting parts then importing into FabCreator.	Array parts in Autocad or Draftsight instead.
Cannot import .dxf file into FabCreator	If you see the message "Join Warning - file contains entity smaller than join tolerance", there may be unnoticed tiny polylines somewhere in the design.	Use the FabCreator parts tree to identify unwanted, small components.

## 8. Maintenance & Repairs

### 8.1. Preventative Maintenance

Just like any other machine tool, the FabLight must be cleaned regularly for optimal performance. Lack of regular preventative maintenance (PM) will lead to damaged machine components, a reduction in part quality, and machine downtime.

Cleaning the entire machine takes on average 10 minutes to complete and is easy to do with a single person. The basic recommended PM schedule is shown below; see section “8.3. Full PM Schedule” below for a detailed timeline chart to follow.

<b>Machine Usage</b>	<b>Cleaning Frequency</b>
4 or more hours per day	Daily
2 or less hours per day	At least once a week

Even if the machine does not appear to be dirty, over time metal particles can build up; for optimum machine performance you must adhere to the recommended PM schedule, even if the machine “does not appear to be dirty.” See the next page for section “8.2. Cleaning Tools Required” to get started.

## 8.2. Cleaning Tools Required

Tool	Frequency required	Notes
Vacuum	Regular (daily/weekly)	<p>A secondary vacuum should be purchased for ease of cleaning, especially for daily maintenance and heavy machine use.</p> <p>The machine comes with a dust collector for fine particles. This vacuum can be used for PM as well but it must be disconnected from the machine.</p> <p>We recommend the VacuMaid SR38 for cleaning, along with a telescoping attachment and soft brush attachment.</p> <p>VacuMaid SR38 (\$629.95)  <a href="https://vacumaid.com/product/sr38/">https://vacumaid.com/product/sr38/</a></p> <p>Bags can be purchased separately from the VacuMaid site or on Amazon.</p>
Telescoping attachment	Regular (daily/weekly)	These attachments come with the VacuMaid SR38, but can be purchased separately on the VacuMaid site.
Soft brush attachment	Regular (daily/weekly)	The brush must be SOFT, ideally made from a natural fiber. Cheaper, hard plastic brushes can potentially unseat cables and scratch the machine.
Microfiber cloth or microfiber duster	Regular (daily/weekly)	For keeping the window clean. Do NOT use paper towels or the vacuum brush on the window. It will permanently scratch it.
Clean shop towels	Regular (daily/weekly)	Used to clean encoder strips and cutting head.
WD-40	Quarterly	For keeping bearings lubricated and rails clean.

## 8.3. Full PM Schedule

Item No.	Activity	Light use (< 4 hours each day)					Heavy use (> 4 hours each day)					
		Per shift	Day	Week	Month	Quarter	Per shift	Day	Week	Month	Quarter	
<b>A. FabLight Machine</b>												
1	Clean the nozzle tip		Day				Shift					
2	Vacuum the machine interior, including the cover, gantries, and part slide			Week			Shift					
3	Wipe encoder strips			Week				Day				
4	Clean cutting head			Week				Day				
5	Check external air filter and empty if necessary (follow manufacturer's instructions)			Week				Day				
6	Empty dust collector				Month				Week			
7	Empty PM vacuum				Month				Week			
8	Clean green window with microfiber cloth				Month				Week			
9	Empty cleanout drawer				Month				Week			
10	Apply WD-40 to the rails					Quarter				Month		
11	Grease the drawer slides					Quarter					Quarter	
12	Inspect the cutting head window					Quarter				Month		
<b>B. Compressor - check manufacturer's instructions for specific PM schedule</b>												
1	Drain water from compressor tank		Day				Shift					
2	Drain dryer			Week								
3	Drain prefilter			Week								
4	Drain particulate filter	See manufacturer's PM guide										
5	Change compressor oil				Month							

## 8.4. Step By Step PM Guide (video)

[Click here](#) for a video tutorial of the entire FabLight cleaning procedure.

## 8.5. Step By Step PM Guide (photos)

[Click here](#) for a photo slideshow tutorial of the entire FabLight cleaning procedure.

## 8.6. Why the Machine Gets Dirty

The laser cutting process works by melting material with the laser and blowing it through the cut with an assist gas. This melt and blow process creates both fine vaporized metal particles and larger particles. The smaller airborne particles are removed by the dust collector, while the larger particles settle in the machine and must be cleaned out manually.

Most of the large particles are created during the pierce process which is the start of a cut. The pierce typically fires the laser at a high power. The laser melts the metal from the surface down into the material until it is melted all the way through, at which point the assist gas blows the metal through the back. The result is a hole punched through the material. During the first part of the pierce, metal particles splatter up above the material, and during the second part, metal particles are blown down into the machine.

The metal particles that remain in the machine vary depending on the type of metal cut. You may see:

Aluminum	White or light colored particles
Magnetite	Black particles
Oxides	Brown particles

The encoder strips in the machine are magnetic and attract magnetite. They are delicate and need to be wiped by hand, using clean shop towels.

## 8.7. ONLY WHEN NECESSARY: Laser Optic Window

The Laser Optic Window is a protective piece of glass housed in the breakaway nozzle of the cutting head. It is meant to protect the other optics in the Cutting Head. If it is damaged or dirty it must be changed. The replacement procedure should be done when necessary. Replacement windows cost around \$100. You can order them from [Thorlabs](#), or through 3D Fab Light. Detailed part number and instructions are provided below.

### 8.7.1. Window Replacement Notices

After replacing the Laser Optic Window, you must redo the Beam Centering.

**CAUTION:** Failure to maintain this optical component can lead to serious failure of other parts of the machine. If the FabLight is not cutting as well as it had been, stop using the FabLight and inspect the window.

**CAUTION:** You must wear gloves when handling the window to prevent contamination. Even with gloves, only touch the edges of the window and never the faces.

**DANGER:** Do not operate the laser with the Side Service Panel removed.

### 8.7.2. Window Replacement Instructions

#### Tools Needed:

- Thorlabs WG41050-C, 1" diameter Precision Window
- 5/64" Hex key
- 8mm hex key to open the side panel
- 5/16" midget wrench
- Gloves
- Clean shop towel
- Sharpie
- Painters tape

#### Access:

1. Jog the cutting head to the right side service panel (~46, ~12.5).
2. Press the E-stop to turn off the CHS power supply. The HMI will remain on but the light inside the machine should turn off.
3. Open the right side service panel with the 8mm hex wrench. The gantry will be free to move by hand to adjust for ease of access for the steps below.

#### Nozzle Removal:

1. Prepare a clean shop towel on a clean surface to rest the nozzle on after removal.
2. It is recommended to lay a big sheet at the right side of the machine pallet, to prevent the small screw you will remove from falling into the catch basin.

3. Access the cutting head through the service panel opening. With your palm around the nozzle body, carefully pull it free from the magnetic attachment to the cutting head box.



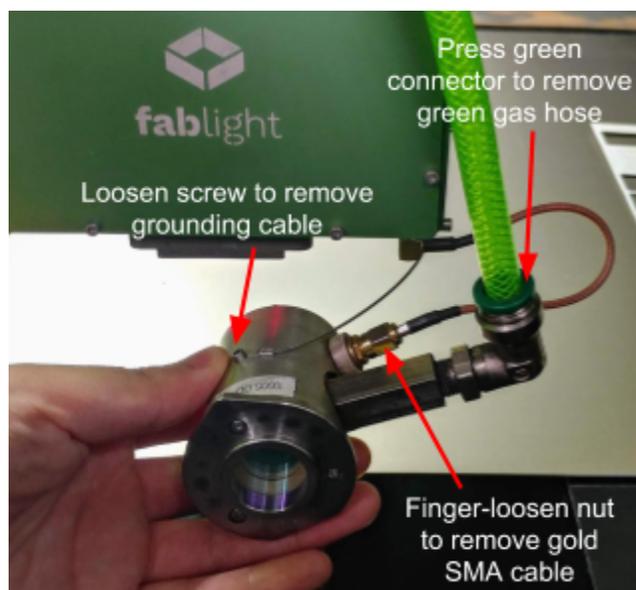
Grip firmly and pull more towards you than down.



Pull only as much as needed to detach the magnets, do not break the grounding cable!

**WARNING:** Be careful not to jerk the nozzle body sharply away from the cutting head box, as this can break the grounding cable connecting the two. Once removed, be careful not to touch or introduce new contaminants to the window. Preserve the original state of the damaged window as much as possible so 3D Fab Light can examine the damage during servicing.

4. Use a 5/64" hex wrench to remove the grounding cable from the back of the nozzle. Set aside the screw for reinstallation. If you lose the screw and need to replace it, it is a Socket Head Cap Screw 2-56 x .125".



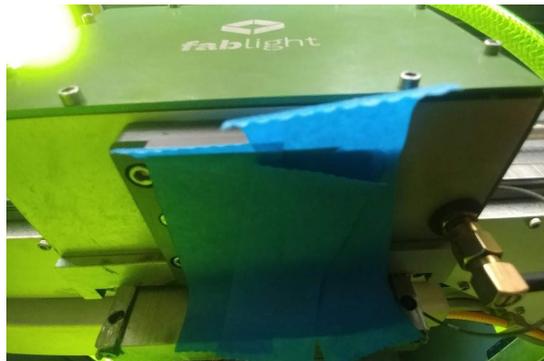
**NOTE:** Once the cable is disconnected from the nozzle, the nozzle should not be put down to hang by the green gas line or gold SMA connector. If you need to free both your hands, attach the nozzle back to the cutting head by making a loose connection to the magnets.

5. Remove the gas line by pressing down on the green SMC connector and pulling out the hose.
6. Remove the gold SMA cable by loosening the nut attached to the nozzle body. It should be installed only finger tight, but if you are unable to loosen the nut with your finger, use the 5/16" midget wrench.
7. The nozzle should now be free of any connections to the cutting head box. Set it down on the clean shop towel surface.



Nozzle removed from machine

8. Use painters tape to cover up the now exposed opening underneath the cutting head box to prevent contamination from getting inside.



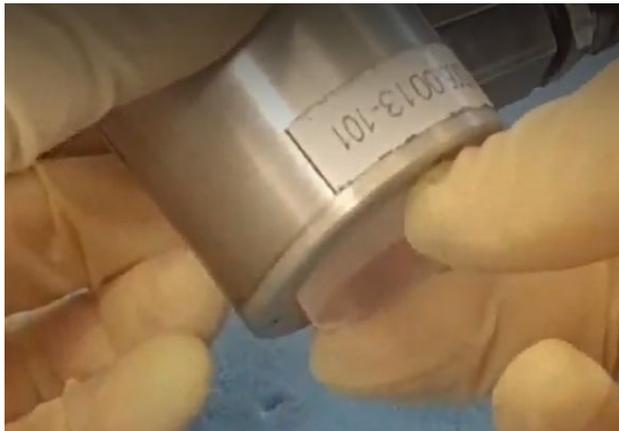
#### **Window Replacement:**

1. Put on your gloves.

2. Use the hex wrench to remove all of the screws on the bezel. Set the bezel down on the clean towel.



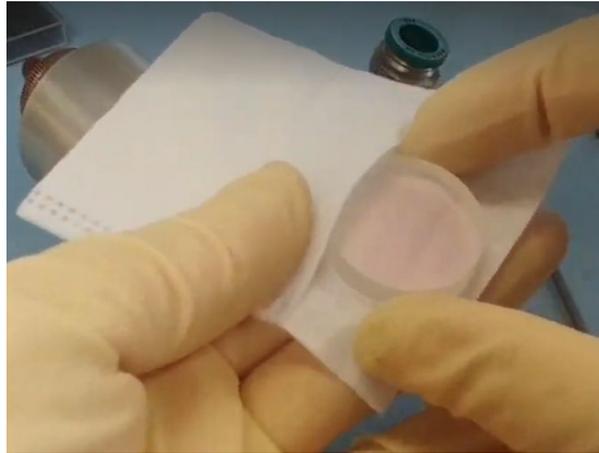
3. Remove the window by shaking the nozzle above the lens paper. If the window does not come out, gently extract it by holding it on the edges.



4. Using a sharpie, mark the EDGE of the window with an arrow to show which side was facing UP in the nozzle, exposed to you. The window can be installed either way but by marking the windows surface that faces up will help determine the source of contamination in the future. Set the damaged window down on the clean towel.



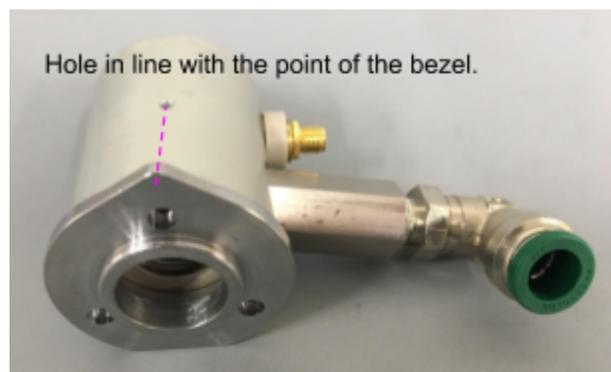
5. Open the replacement window package. Wearing gloves, grasp only the EDGES of the window to lift it out of its case. Do not touch the surfaces (top or bottom) of the window.



6. Hold the nozzle in one hand. Use your other hand - holding the window by the EDGES - to gently place the window into its seat in the nozzle. Make sure it is level. If it isn't, hold the nozzle upright and gently tap it on the table.



7. Place the bezel back on the nozzle.



**NOTE:** The bezel is shaped like a teardrop, with a point at one end, and a flat side at the other. The POINTED side must be aligned with the grounding cable screw hole in the body of the nozzle.

8. Replace the screws, using the hex wrench, to be barely-tight. Make sure that the bezel and window are flat and seated properly. Torque each screw to tighten them a little at a time for each screw to keep the bezel parallel with the top of the nozzle body. All the screws need to end up completely tight to insure the window is flat.

**NOTE:** The screws need to be snug but be careful to not over tighten as they are small screws and could strip. The bevel screws are not the same as the grounding cable screw, be sure to replace each to the right place. The grounding cable screw is smaller.

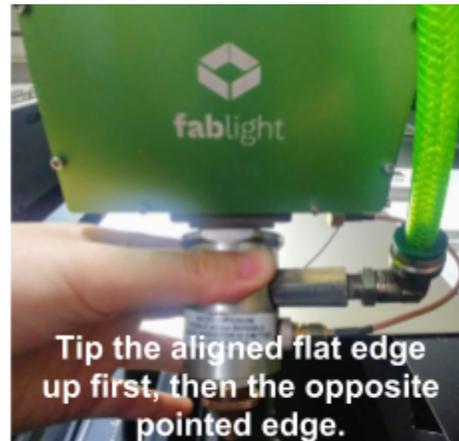
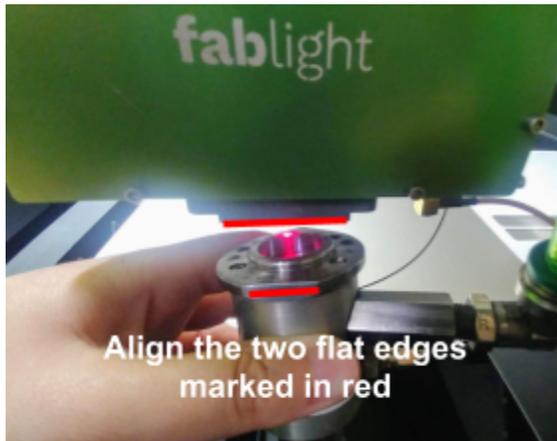
9. Place the old, damaged window in the Thor bag and box it up to send to 3D Fab Light for diagnosing.



#### **Reattach Nozzle:**

1. Access the cutting head again at the right side service panel opening. Reattach the grounding cable, gold SMA connector, and gas hose to the nozzle. The gold SMA connector nut should only be finger-tight, do not use a tool.
2. Remove the painters tape that was covering the opening at the bottom of the cutting head box.

3. Align the flat edge of the teardrop shaped bevel to the dark grey edge at the bottom of the cutting head box, on the side with the green cover.

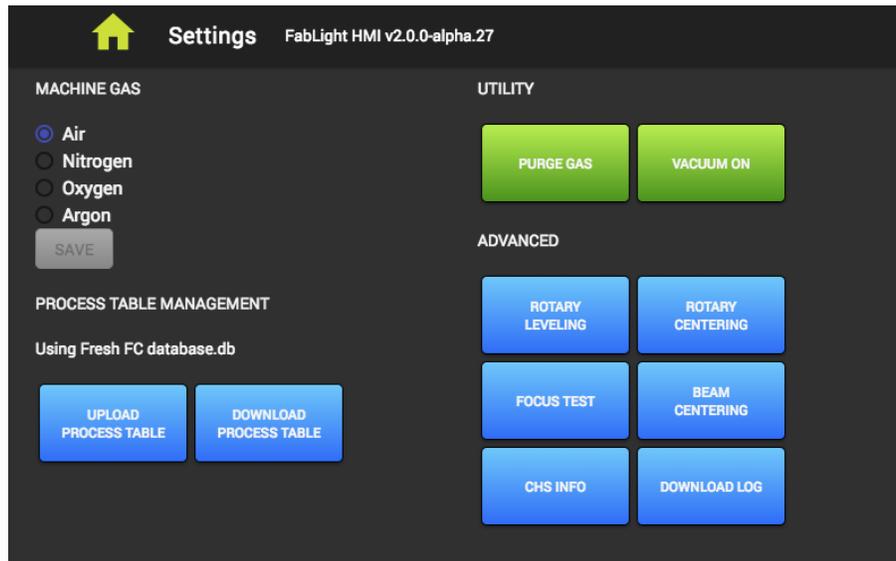


4. Keeping the flat end aligned, lift the pointed end of the teardrop bevel to also meet the magnets below the cutting head.
5. When the nozzle is properly seated back into the cutting head, you will hear and feel a *thunk*. Test out the seating by giving the nozzle a firm twist and tug, it should not rock at all.

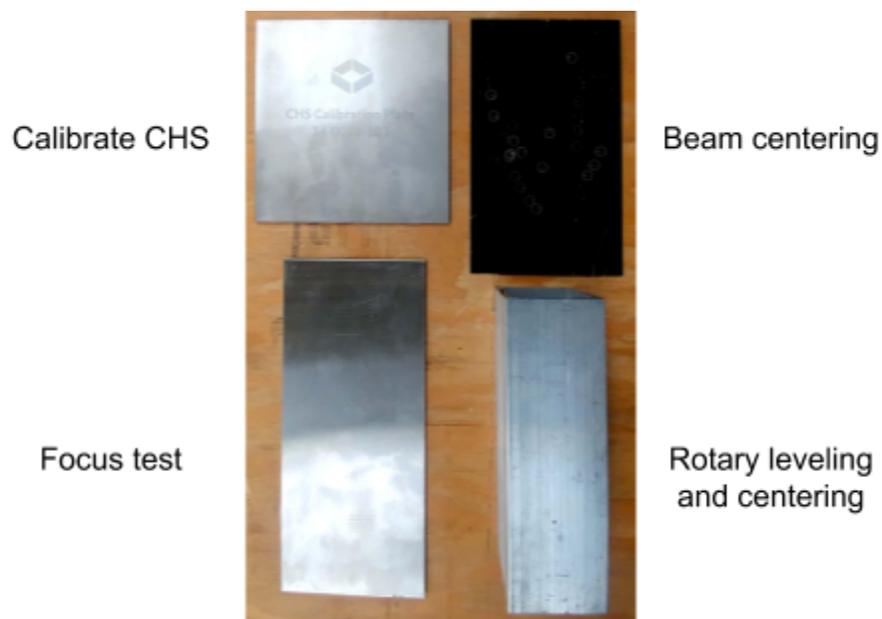
**WARNING:** You must calibrate for the new window. See section “9.4. Beam Centering.”

## 9. Calibration Routines

On the Settings Page there are six ADVANCED buttons: ROTARY LEVELING, ROTARY CENTERING, FOCUS TEST, BEAM CENTERING, CHS INFO and DOWNLOAD LOG.



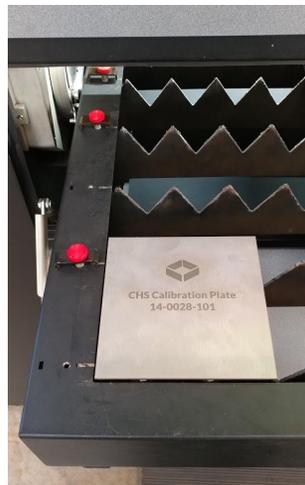
Four tools are provided in the ship kit that comes with the machine, for use with these routines. Shown below, they are a 0.090" stainless steel plate for CALIBRATE CHS, a 0.040" black anodized aluminum plate for BEAM CENTERING, another thin stainless steel sheet for FOCUS TEST, and a 2" square aluminum tube for ROTARY LEVELING and ROTARY CENTERING.



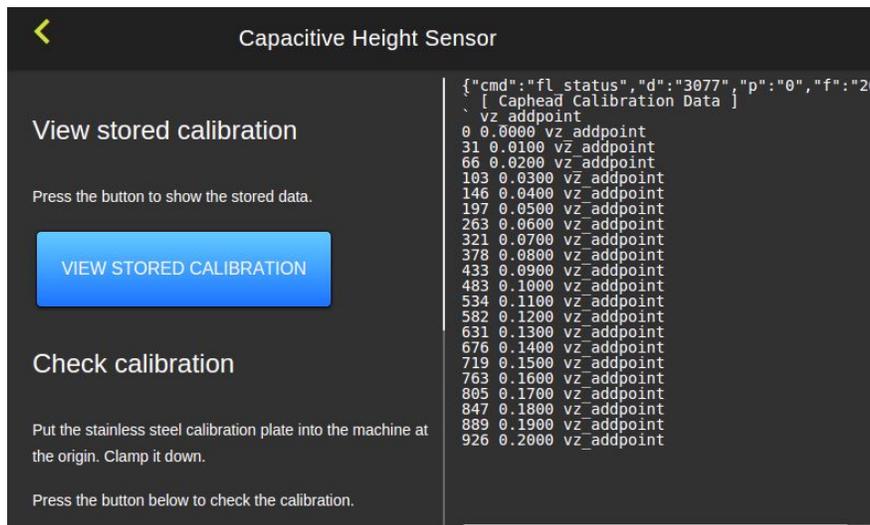
## 9.1. CHS Info

This routine should not be done often. Its need is indicated by Z-axis operation errors or notices on the HMI about CHS Calibration errors. The calibration should only be reset at the instruction of 3D Fab Light after sending us the information below, or after instructions to replace the cutting head.

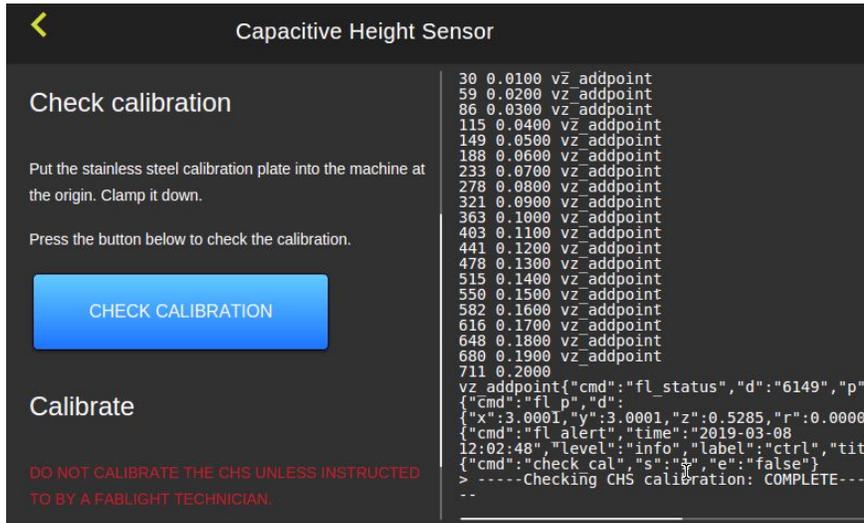
1. Place the provided calibration plate (or another piece of 0.090" stainless steel at least 4" x 4") at the origin (front-left corner of pallet). Do not clamp it down, it should be flat and heavy enough to weigh itself down firmly against the slats. Return the pallet to the sheet mode position and close the drawer.



2. Press CHS INFO on the Settings page. Hit VIEW STORED CALIBRATION to pull up current measurements in the log screen to the right. Take a photo of whole HMI screen.

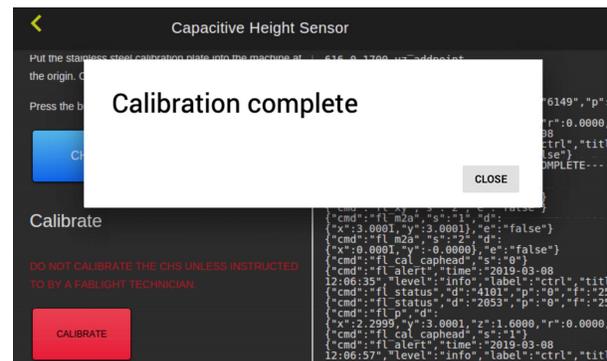
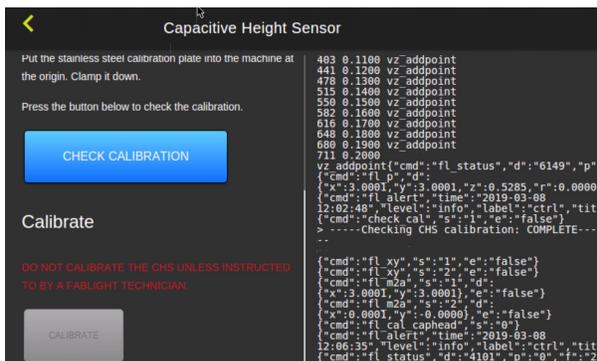


- Hit CHECK CALIBRATION, which will move the cutting head to (3,3) over the plate and automatically begin taking new measurements. The button will grey out while the routine is running and return to blue when the routine completes. Take a photo of the whole HMI screen when the new measurements has output to the log screen.



- Send both photos to 3D Fab Light and await instructions.

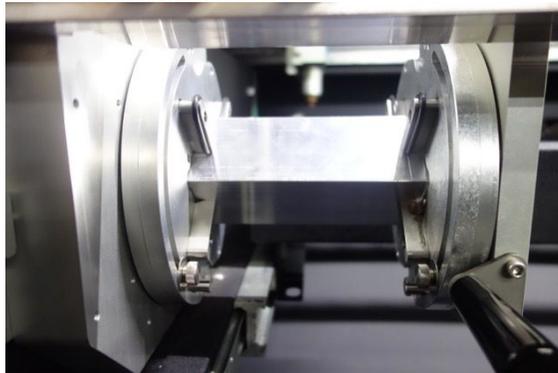
- ONLY IF INSTRUCTED:** If 3D Fab Light requests you recalibrate your CHS, clamp the .090" stainless calibration plate back at the origin and access the CHS Info page in HMI settings again. Press the red CALIBRATE button, the routine will begin automatically. While the routine is running, the button will grey out. When the routine is complete, a notice will pop up on the HMI.



## 9.2. Rotary Leveling

This routine should not need to be done often, if ever. One indication is if you can't insert the lock pin on the left chuck when the tube is parked (at 45-degrees). Another indication is that it is causing problems getting around the corners of square tubes.

Load the provided 2" square aluminum tube into both chucks as shown in the image below, and pull out both locking pins. Press ROTARY LEVELING on the Settings page to run the routine. The button will be greyed out while it is running and return to green when it automatically stops after completion.



## 9.3. Rotary Centering

This is another routine that should not need to be done often. One indications are that the machine is not cutting symmetrically on square tubes (Y-centering).

Load the provided 2" square aluminum tube into both chucks as shown in the image above, and pull out both locking pins. Press ROTARY CENTERING on the Settings page to run the routine. The button will be greyed out while it is running and return to green when it automatically stops after completion.

## 9.4. Beam Centering

This routine needs to be done after changing the window in the cutting head (see "ONLY WHEN NECESSARY: Laser Optic Window" section in Maintenance & Repairs above).

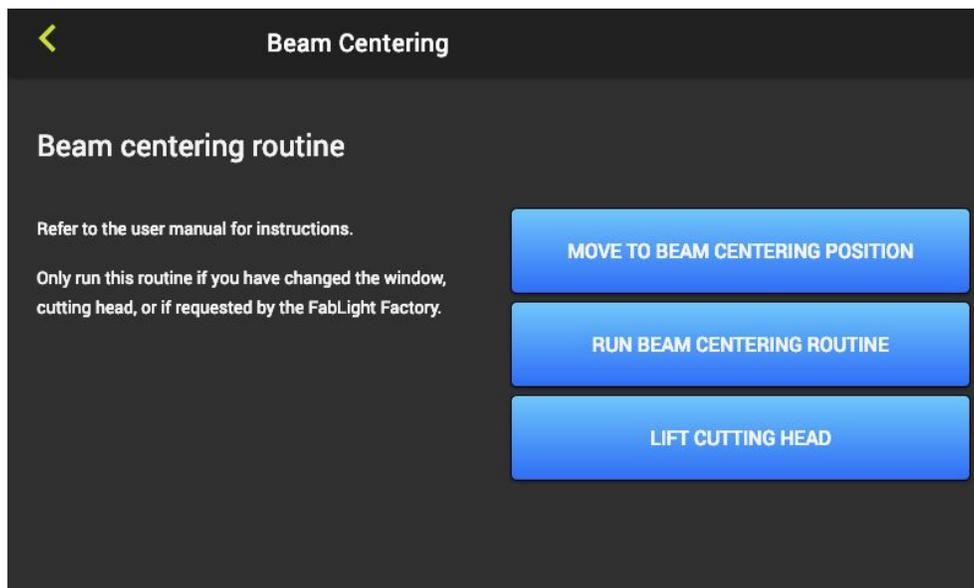
**DANGER:** Do not operate the laser with the Side Service Panel removed.

1. Open the right Side Service Panel.

2. Place a piece of black anodized aluminum on the center-right side of the pallet, oriented along the Y-axis and clamped down in two places.



3. Close the right Side Service Panel.
4. Press the button for BEAM CENTERING on the Settings page and then press MOVE TO BEAM CENTERING POSITION. The cutting head will jog over to the center-right (48, 12.5) of the machine. Verify the anodized plate is properly positioned underneath, then hit RUN BEAM CENTERING ROUTINE and press START when the button lights up green. The machine will engrave a circle on the plate and then center the nozzle over the origin of the circle.



5. Open the right Side Service Panel again, and look at where the circle is in relation to the nozzle. Try to look at it from both the front view (drawer side) and the side view (service

panel side) - a flashlight can help illuminate the interior. The circle should be PERFECTLY centered underneath the nozzle.



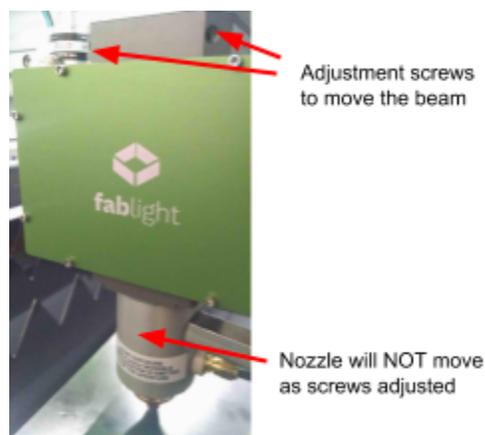
Nozzle off-center by a large amount



Nozzle centered correctly

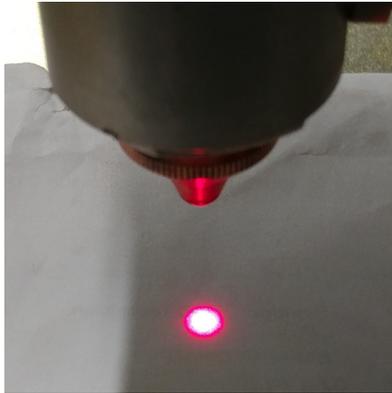
- Adjust the set screws above the cutting head with a 3/32" allen wrench as needed (see photo below). The two adjustment screws are opposed by spring pins, so that the next circle that is engraved moves out in the direction of the screw that is loosened. Tightening the screw has the opposite effect. The goal is to move the circle to be centered under the nozzle. In the example photo shown above, the circle needs to move to the right, so the set screw on the left would be tightened while the set screw on the right would be loosened by the same amount. To move the circle towards you (out toward the side panel) loosen both screws the same amount. To move the circle away from you (toward the inside of the machine) tighten both screws the same amount.

**NOTE:** The screws are VERY sensitive. Try to keep track of each fraction of a turn you make, since the nozzle will NOT move with the adjustment.

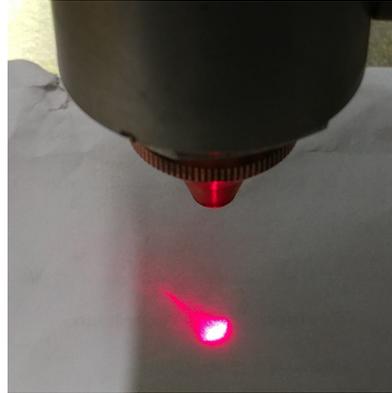


- Press LIFT CUTTING HEAD on the HMI and place a white piece of paper underneath the nozzle to check if the red pointing diode is still showing fully through the nozzle opening after set screw adjustments. Eclipsing of the red pointing diode indicates

improper set screw positions. This “**white paper test**” can be especially helpful for giving you an idea of how sensitive the screws are. LIFT CUTTING HEAD will also shift the cutting head position slightly in the negative Y, so that the next test circle does not overlap with the previous engrave.



Full, correct visibility of red pointing diode



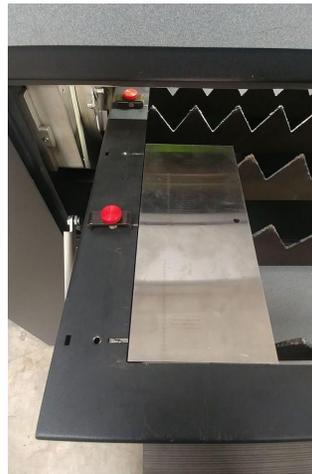
Eclipsed, incorrect visibility

8. **REMOVE THE WHITE PAPER** and close the Side Service Panel. Then hit RUN BEAM CENTERING ROUTINE, verify the nozzle is not above any previous circle engraves, and hit START when it lights up green. Repeat steps 5-8 as needed until the circle is completely centered underneath the nozzle from both front and side views with the red pointing diode fully visible.

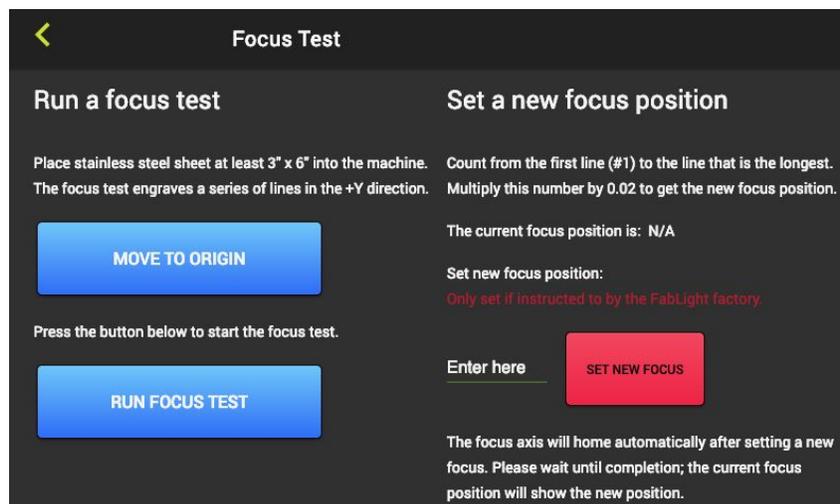
## 9.5. Focus Test

This test should only be performed after contacting customer service for more information. Its need is indicated by the machine cutting very well one day but not the next, and should not happen often, if ever.

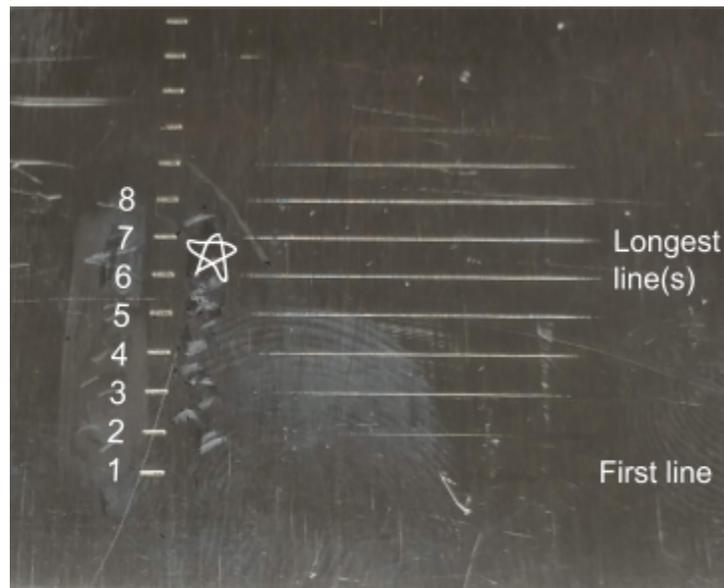
1. Place a flat sheet of stainless steel that is at least 3" x 6" at the origin (lower-left corner) of the pallet, oriented along the Y-axis. Do not clamp it down; it should be flat and heavy enough (at least 0.060" thick) to weigh itself down against the pallet slats.



2. Close the drawer, and make sure the assist gas is turned on / available.
3. Press the FOCUS TEST button on the Settings page. Press MOVE TO ORIGIN to home the cutting head. Press RUN FOCUS TEST, verify the cutting head is over the lower-left corner of the stainless plate, and then press the START button when it lights up green.



4. Wait until the focus test completes engraving two columns of lines. It will return to soft home after the first column and pause for a bit before starting the second column. Do not open the door until both columns are engraved, the cutting head has raised back up, and a notice pops up on the HMI notifying you that the test has been complete.
5. Remove the stainless plate and determine which line in the right column is the longest. A magnifying tool may be helpful. You are looking for the line longest in width, not anything else like darkness or thickness. In some cases, two consecutive lines may both be equally the longest.



6. Starting from the bottom-most hash mark being number one, count up to the row of your longest line(s).
7. Multiply the number you counted to by .02 to determine your new focus number. If two lines are equally the longest, multiply by the value halfway between. In the example photo above, the number counted to is 6.5, resulting in a new focus number of .13
8. If the new number does not match what your machine is currently set at, enter the new number and press the red SET NEW FOCUS button. The stored number will update momentarily.

## 10. Service Through Freshdesk

Freshdesk is our comprehensive platform for users to access software downloads and manuals, as well as submit service requests, technical questions, and feature suggestions. You can create an account here: <https://3dfabligh.freshdesk.com>. Once you have signed up for an account with your email, you can log into the platform to submit a ticket or email [service@3dfabligh.com](mailto:service@3dfabligh.com) to automatically open a ticket.

To reduce the time required to diagnose and solve a problem, please document as much information as possible in your ticket, such as:

- Material and thickness being cut
- Files being run (DXF, FAB, Solidworks)
- Settings being used (process table screenshot, gas, pressure reached)
- History of the problem (frequency of issue and application, conditions leading up to the issue, whether the machine has been paused in the issue state or switched to operating a different application)

The 3D Fab Light Support Team usually responds to tickets within the day. Visit our website to see our business and service hours: <https://www.3dfabligh.com/contact-us>

**CAUTION:** The FabLight contains very few user-serviceable parts. Tampering with the machine, especially the Fiber Laser itself, can void the warranty.

**WARNING:** The FabLight contains software and firmware. Tampering with any internal software may damage the machine and void the warranty.

# 11. Standard Warranty

Following are 3D Fab Light's standard warranty terms. However, the warranty terms for your systems may vary. Please refer to the signed Sales Quotation for actual warranty for your system.

**WARNING:** The FabLight is a high-precision industrial machine. Failure to adhere to the Preventative Maintenance guidelines detailed in section “8. Maintenance and Repairs” can lead to avoidable machine downtime or operation issues. Users are expected to contact 3D Fab Light as soon as possible for servicing support. Any unauthorized adjustments to machine hardware or software taken by the user without guidance and instruction from 3D Fab Light will result in out-of-warranty charges for any consequential Factory servicing needs. See section “10. Service Through Freshdesk” above for how to contact 3D Fab Light for service requests.

3D Fab Light, Inc. warrants items manufactured by it to be free from defects in materials and workmanship for a period of one year. This warranty applies only to the original Buyer, for equipment installed at the original location. Major subsystems manufactured by other companies (e.g. the laser system, motion controller) are covered only by their original manufacturer's warranty and 3D Fab Light does not make any warranty in respect to such items.

3D Fab Light's liability under valid warranty claims is limited to repair or replacement at 3D Fab Light's facility or Buyer's location at the discretion of 3D Fab Light. Buyers are responsible for any shipping charges, insurance, and travel expenses incurred by 3D Fab Light while providing warranty service. 3D Fab Light does not provide on-site service outside of the domestic United States.

Warranty claims must be made within 30 days of occurrence of the circumstances giving rise thereto. Such claims must be in writing and must fully disclose all related circumstances giving rise to the claim. Before any products are returned for warranty service, written authorization and written shipping instructions must be obtained from 3D Fab Light. Buyer shall be responsible for all shipment and related costs, as well as any damage due to improper packing or handling of products being returned for warranty service. 3D Fab Light reserves the right to reject any warranty claim for products that have been damaged in shipment or shipped by a non-acceptable means of transportation.

If it is found that products have been returned without cause, the Buyer will be responsible for all return shipping charges and may, at 3D Fab Light's sole discretion, incur charges for testing and examination.