



The Opt Lasers PLH3D 6-watt laser

Laser Setup Instructions for Engraving and Cutting on the Acorn Centroid 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.

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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](#).

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.

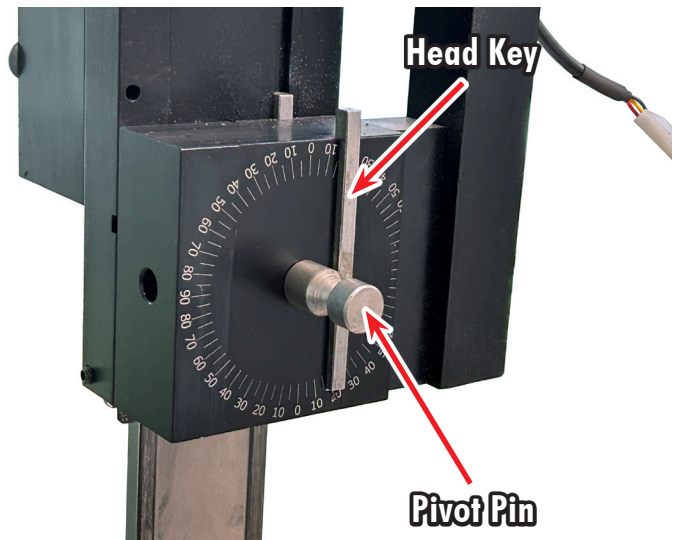


FIGURE 1— The headstock, motor, and speed control removed from the column saddle.

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 2).

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 Acorn Centroid Controller

The following text covers the connection and configuration information for an Acorn controller to the Sherline driver box (P/N 8760) for Opt Lasers. You will need to remap the 25-pin connector on the Acorn controller to match the Sherline driver box.

NOTE: The Acorn DB25 male port can be remapped to match the Sherline Driver (8760) DB25 female port (see Figure 4 and the associated table).

Acorn controller DB25 male

Sherline 8760 driver DB 25 female

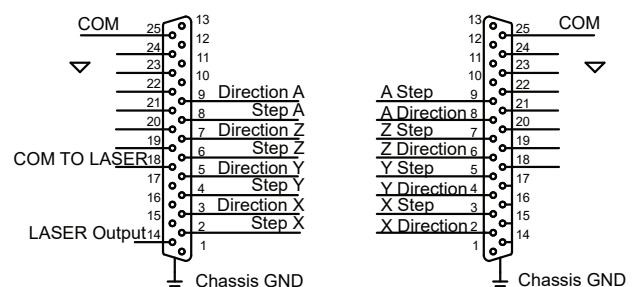


FIGURE 4: The remapped DB25 male pins to the DB 25 female connections.

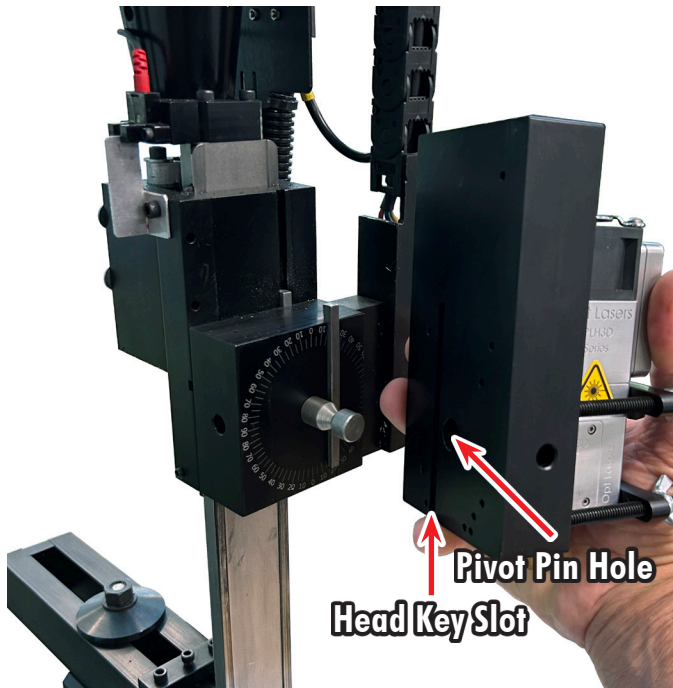


FIGURE 2—Align the head key slot and pivot pin hole on the back of the laser mount to the head key and the pivot pin on the column saddle.

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

1. Pins 1,10,11,12,13,15,16,17 are not connected
2. Pin 14 is the laser output from the Acorn Controller to the PLH3D-CNC Adapter
3. Pin 18 is the laser command output from the Acorn Controller to the PLH3D-CNC Adapter
4. Pins 19 thru 25 are not connected between the DB25 male and DB25 female

Acorn to Driver Box Connection Table

From Acorn Controller	Axis	To 8760 Driver Box
PIN 1	Not Used	PIN 1
PIN 2	Direction X	PIN 2 Direction
PIN 3	Step X	PIN 3 Step
PIN 4	Direction Y	PIN 4 Direction
PIN 5	Step Y	PIN 5 Step
PIN 6	Direction Z	PIN 6 Direction
PIN 7	Step Z	PIN 7 Step
PIN 8	Direction A	PIN 8 Direction
PIN 9	Step A	PIN 9 Step
PIN 10	N/C	PIN 10
PIN 11	N/C	PIN 11
PIN 12	N/C	PIN 12
PIN 13	N/C	PIN 13
PIN 14	Laser	PIN 14 (laser PWM)
PIN 15	N/C	PIN 15
PIN 16	N/C	PIN 16
PIN 17	N/C	PIN 17
PIN 18	COM	PIN 18 (laser ground)
PIN 19	COM	PIN 19
PIN 20	COM	PIN 20
PIN 21	COM	PIN 21
PIN 22	COM	PIN 22
PIN 23	COM	PIN 23
PIN 24	COM	PIN 24
PIN 25	COM	PIN 25

Limit Switches

You will need three homing switches for each axis on your CNC mill (four if you are using a rotary table).

Setting up a Laser to Use with Acorn Centroid

You will use the Primary System-Axis Drive Type screen within the Mill CNC Centroid Configuration Wizard to set up your mill for use with a laser (see Figure 5). This screen lets you manage, select, and even create “drive types.” A “drive type” is a pre-set configuration for a given make and model of axis motor drive. The drive type was created to make configuration of the Acorn system easy with its

matching schematic. Select the drive type and wire the system according to the match schematics.

By default, a new installation of CNC12 will default to “Bench Test ‘Screw Terminal’” as the drive type. This is fine for communication bench testing the Acorn with no axis drives connected. After passing that test, choose the drive type that matches the axis motor drives that are being employed, click on a drive type and click “Load Drive.”

As a convenience, this will pre-populate the IO map and some other screens of the Wizard that match the corresponding Acorn-to-axis drive schematic. The matching schematics are here; use them when wiring the control for the particular drive type being used.

The Acorn Schematic is found in the [All Acorn Documentation thread](#) found here.

NOTE: While we have tested and provided many different proven Acorn-to-axis drive schematics and schematics and Wizard drive types to make hookup simple and easy, when using an axis drive that is not on the list pick one that is close and use that and/or even modify the drive type and save it as a custom. You can even export the custom drive type and import it on another system.

Configuring Acorn Centroid for Use with a Laser

You will use the Acorn CNC mill software to create a new software configuration. Use the “Create new...” button to set up a “Custom” Drive type with currently selected settings in the Wizard (see Figure 5).

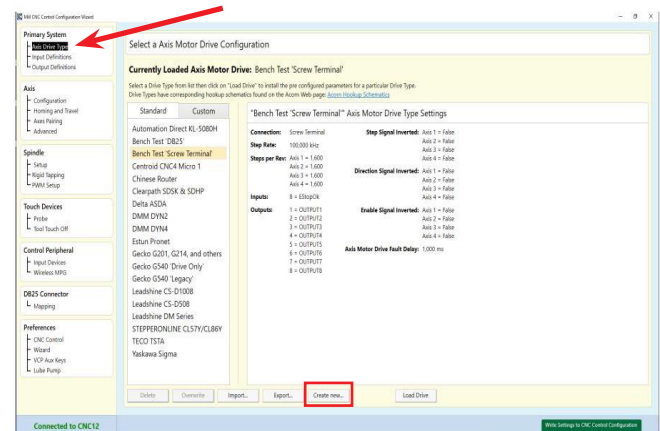


FIGURE 5—The red arrow shows the “Primary System-Axis Drive Type” menu selection. The red rectangle shows the location of the “Create new...” button.

These drive types can be exported and imported using the available buttons on the screen. Step and direction signals will be present on the Acorn regardless of the drive type selected. However, it is best if you create a drive type that closely matches the drives you are using. You can then work your way down through the Wizard tree to tailor the control to your application.

IMPORTANT: When completing any or ALL changes in the Wizard pages, you must click “Write Settings to CNC Control Configuration” for the changes to take effect. Follow any on screen prompts to complete the changes.

MILL CNC Control Configuration Wizard

Primary System

- Axis Drive Type
- Input Definitions
- Output Definitions

Axis

- Configuration
- Homing and Travel
- Axis Pairs
- Advanced

Spindle

- Setup
- Rigid Tapping
- PWM Setup

Touch Devices

- Probe
- Tool Touch Off

Control Peripheral

- Input Devices
- Wireless MPG

DB25 Connector

Select an Axis Motor Drive Configuration

Currently Loaded Axis Motor Drive: sherline 5800 LS

Select a Drive Type from list then click on "Load Drive" to install the pre configured parameters for a particular Drive Type. Drive Types have corresponding hookup schematics found on the Acorn Web page: [Acorn Hookup Schematics](#)

Standard Custom

sherline 5800 LS

sherline close loop .050
 sherline close loop 1mm
 sherline close loop 2.0 mm
 Sherline gecko driver

***sherline 5800 LS* Axis Motor Drive Type Settings**

Connection: Screw Terminal

Step Rate: 100,000 KHz

Steps per Rev: Axis 1 = 800
 Axis 2 = 800
 Axis 3 = 800
 Axis 4 = 800

Inputs: 1 = FirstAxisHomeOK
 2 = SecondAxisHomeOK
 3 = ThirdAxisHomeOK
 8 = EStopOK

Outputs: 1 = NoFaultOut
 2 = PWM Output
 4 = LaserEnable
 7 = LaserReset

Step Signal Inverted: Axis 1 = False
 Axis 2 = False
 Axis 3 = False
 Axis 4 = False

Direction Signal Inverted: Axis 1 = False
 Axis 2 = False
 Axis 3 = False
 Axis 4 = False

Enable Signal Inverted: Axis 1 = False
 Axis 2 = False
 Axis 3 = False
 Axis 4 = False

Axis Motor Drive Fault Delay: 1,000 ms

Delete Overwrite Import... Export... Create new... Load Drive

Connected to CNC12

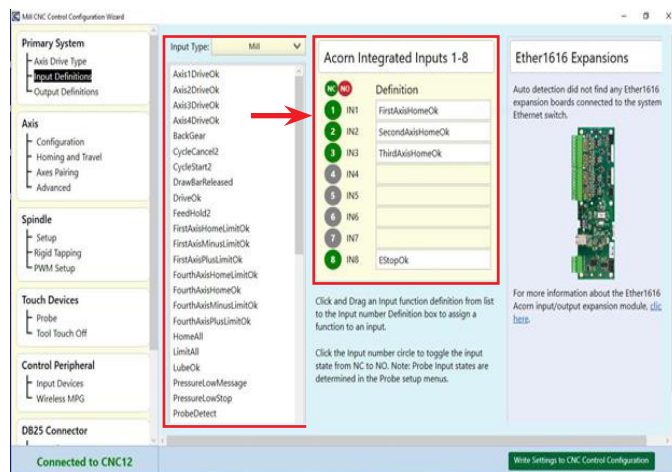
Write Settings to CNC Control Configuration

Primary System Input Definitions

[illegible]

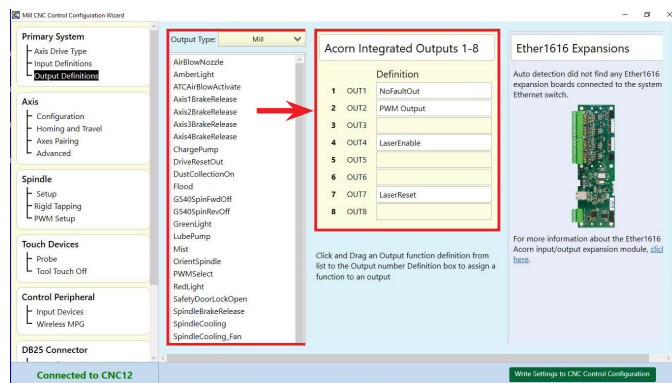
```
X-Axis=IN1
Y-Axis=IN2
Z-Axis=IN3
E-Stop=IN8
```

NOTE: The 4th-axis is for a rotary table. In this example, you don't need this connection. Please see the Acorn-to-Sherline wiring diagram on the last page for a full review of the connections.



Primary System Output Definitions

1. To define an Output, select a function from the Output Type list and drag and drop it to the Output Definition box.
2. Remove an Output Definition by clicking on it and dragging it back to the Output Type list.



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Axis Configuration

Here is where you set your axis parameters (see Figure 10).

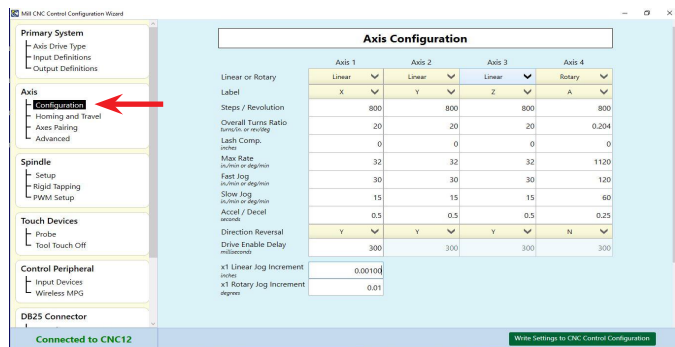


FIGURE 10—The red arrow shows the “Axis-Configuration” menu selection.

1. The steps/revolution row is 800 steps (because sherline 8760 driver box is 1/4 micro stepping 1/8 deg /360=200 steps * 4(1/4 micro stepping) = 800 steps per REV
2. Over all turns- in this row 20 turns per inch 1/4-20 lead screw(1 inch/20turns = .050 per turn of hand wheel ,The Acorn software requires this data is expressed as number of turns.
3. Max feed rate: for the Sherline driver box (P/N 8760), the maximum feed rate is 32 IMP.
4. Fast jog (also known as rapid) 30 IMP, slow jog is 15 IMP (note both max feed rate and fast jog setting are before the stepper will skip)
5. Accel/Decel: this setting is how fast, in seconds, it takes to get up to max feed rate as stated in the G-code program and how long it takes to slow down.

Axis (Homing and Travel)

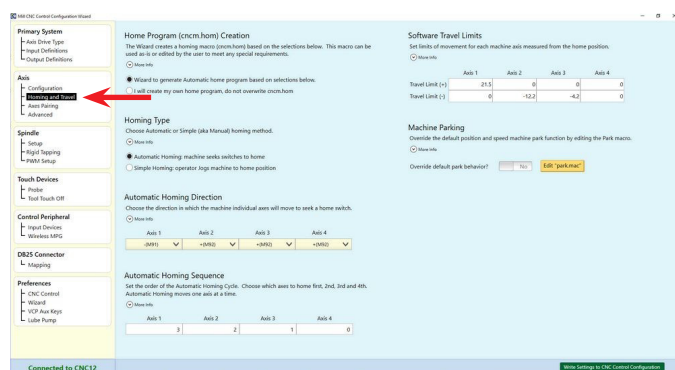


FIGURE 11—The red arrow shows the “Axis-Homing and Travel” menu selection.

In this screen, you will setup how the machine will:

1. Home
2. The directions in which it will Home
3. Software Travel Limits

HOME PROGRAM:

CNC12 generates a .HOM file automatically. IF you have a custom .HOM file, then change Home file to: “Custom User Defined”. Otherwise leave it to the default of Wizard Generated. A “.home” file is simply a G-code program that defines how the machine will “home out” based on the selections made in this menu.

HOMING TYPE:

- Select “Simple Homing” if the machine uses no home switches. Simple Home means that the operator will simply jog the machine to the desired home position and then press cycle start to set home at that position.
- Select “Home to Switch” if the machine is equipped with home switches.
- Selecting “Automatic Homing” will display additional homing options for Automatic Homing.

HOMING DIRECTION:

- If the machine axis must move in the positive direction to seek the home switch, then use + (M92).
- If it must move in the negative direction to seek the home switch, then use – (M91).
- Set Homing Direction for each axis.

HOMING SEQUENCE:

- Sets the order in which the axis is homed.
- By default, the order is 3rd-axis, 2nd-axis, 1st-axis, and 4th-axis in sequence. This is important: Generally you want to move the cutter away from the table first. So typically the Z-axis is first, followed by the Y-axis and then the X-axis last. IF the machine is equipped with a rotary axis, and it has a home switch that will be last to home.

SOFTWARE TRAVEL LIMITS:

Travel limits are used so that CNC12 knows the usable work envelope of the machine tool use of software travel limits is strongly suggested in all cases (whether you are using home switches and or limit switches in any combination).

- Travel Limit (+) is used if the home switch is on the NEGATIVE end of the axis. The value entered here would be a positive number. This number is the distance between the home switch and the other end of the axis travel, typically just shy of hitting a hard stop.
- Travel Limit (-) is used if the home switch is on the POSITIVE end of the axis. The value here would be a negative number. This number is the distance between the home switch and the other end of the axis travel, typically just shy of hitting a hard stop.

For example, the home switch is on the Y Positive end of the travel and there is 12.2” of travel on Y. The value entered would be -12.2.

PWM Output for Spindles and Lasers

The Acorn PWM can be used to command a Laser and/or a PWM Spindle Drive and use the G-code “S function”

(**NOTE:** PWM output is not to be confused with 0-10 s command analog output which is used with VFDs to control 3 phase spindle motors, which has its own dedicated output on H8.)

FIGURE 12—The Wizard PWM Setup menu.

PWM SETUP

- PWM enables
- Base Frequency (HZ)
- PWM Command Range 0-100 or 0-1000 this divides up the laser power or spindle RPM by 100 or 1000 increments. For example: AN command of S1000 would result in max laser power or 100%, max spindle RPM when 0-1000 range is selected.
- PWM Minimum S command power level to start Laser
- Inverse Output

PWM OUTPUT FOR LASERS

- 5-volt PWM output signal is on DB25 pin# 14
- DB25 pin# 14 is Output 2
- PWM is based on 0-100 OR 0-1000 S command. User selects range 0-100 or 0-1000 in Acorn Wizard.
- PWM Velocity modulation feature adjusts the PWM output based on velocity of the machine tool so overturning is avoided in the corners or turn around. G37 is used to turn ON and OFF PWM Velocity Modulation.
G37 ON = PWM VM ON, G37 OFF = PWM VM OFF
- M37 turns ON Laser Output, M38 Turns Laser output OFF: M37 will activate Laser Enable, Laser Reset, and PWM Select. After .5s will turn off Laser Reset. At this point, the laser controller will look at the PWM signal from OUTPUT2.

- M38 will wait 30s to allows laser controller to cool, then performs a M95 /37 /38 to turn off both Laser Enable and PW Select.
- Simple PWM controls are located in the Acorn Wizard. In addition to “manual PWM controls”, preset buttons

EXAMPLE Program

HEADER

G21 ; select metric units

G90 ; absolute positioning

G0 X0 Y0 ; rapid to X0Y0

Z0 ; Move to Z zero

G37 ON ; Auto Laser power Velocity Modulation ON

M3S0 ; Laser power off

M37 ; Laser on

Not used in this example MULTIPLE PASSES

;(Uncomment if you want to sink Z-axis)

;G91 (use relative coordinates)

;G0 Z-1 (sinks the Z-axis, 1mm)

;G90 (use absolute coordinates)

FOOTER

S0

G90 ; Absolute positioning

M38 ; Laser cool down time

;END

Sample G code

G21 ; select metric units

G90 ; absolute positioning

G0 X0 Y0 ; rapid to X0Y0

G37 ON ; PWM Laser Power Velocity Modulation ON

M3S0 ; Laser power off

M37 ; Laser on

G0 X-74 Y-36.5 M3 S0 F2000 ;for the G0 move the laser must be turned off with M3 S0 were S0 is the percentage of laser power)

G1 X-73.833 S207 ;after turning the laser power to (S0) the laser is turned back on at a precentage of power (Sxxx)

X-73.667 S203

X-73.333 S201

X-73.167 S203

X-73 S209

X-72.667 S213

X-72.5 S211

X-72.333 S215
 X-72.167 S217
 X-71.833 S215
 X-71.667 S213
 X-71.5 S205
 X-71.333 S211
 X-71.167 S207
 X-71 S200
 X-70.667 S203
 X-70.5 S196
 X-70.333 S190
 X-70.167 S192
 X-70 S194
 X-69.333 S200
 X-69.167 S198
 X-69 S196
 X-68.833 S198
 X-68.667 S203
 X-68.5 S207
 X-68.333 S205

Creating and Running Programs with the Acorn Controller and the OPT Laser

Starting the Acorn Controller

Turn on the power to the Acorn controller, then turn on the power to the driver box (8760).

Start the Acorn CNC12 software. At the first screen, you will need to check that the E-stop is not engaged or tripped (as you see the reset button is tripped) by clicking on the reset icon (see Figure 13, red box).

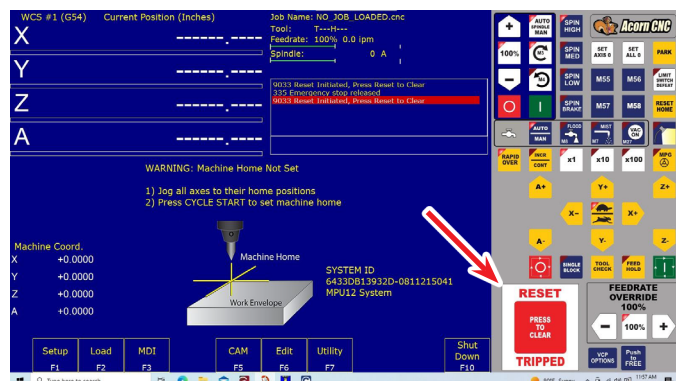


FIGURE 13—The red arrow is showing the Reset button.

After clicking on the reset icon, you will see message 4032 Reset Cleared (see Figure 14, in green), and the reset icon states OK.

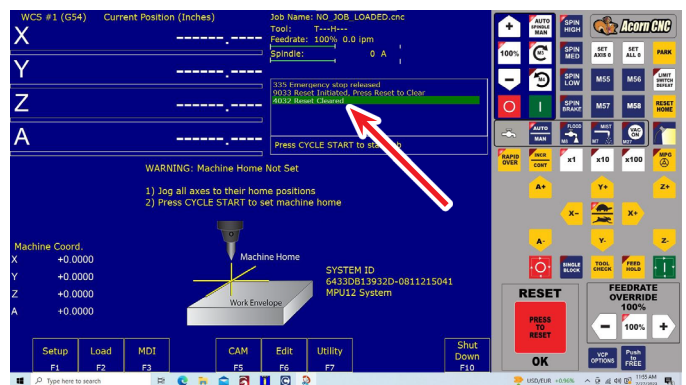


FIGURE 14—The green code line shows the message 4032 Reset Cleared.

Homing the Machine

The machine needs to be homed; there are two types of actions.

1. If the machine is not setup for homing switches, then move the machine to the X, Y, and Z start points and press the Cycle Start icon (see Figure 15, green button). At this point, the machine table will not move but the software DRO is reset to zero and the machine is ready to run the engraving.

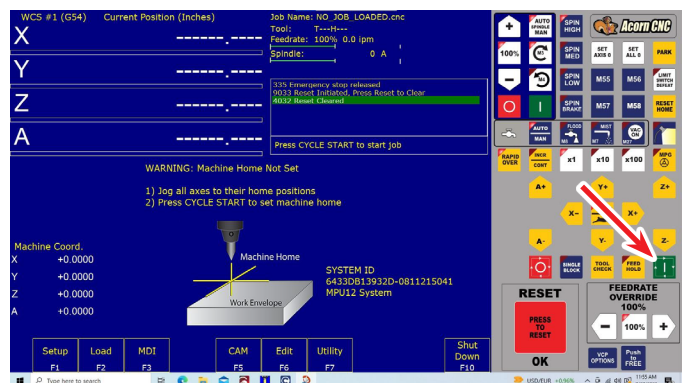


FIGURE 15—The red arrow is pointing to the location of the Cycle Start icon.

2. Load the program: Click on Load (F2). Then go to where you have your program and select it and click on open (see Figure 16).

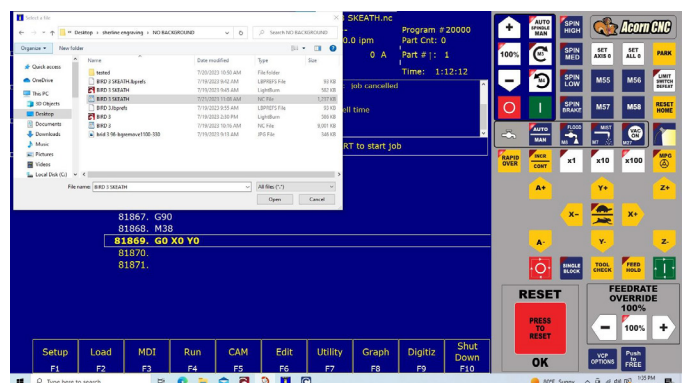


FIGURE 16

- Next, click on Run (F4), then click on Cycle Start (see Figure 17, green button). The next screen shows the software counting lines as the G-code is loaded to memory.

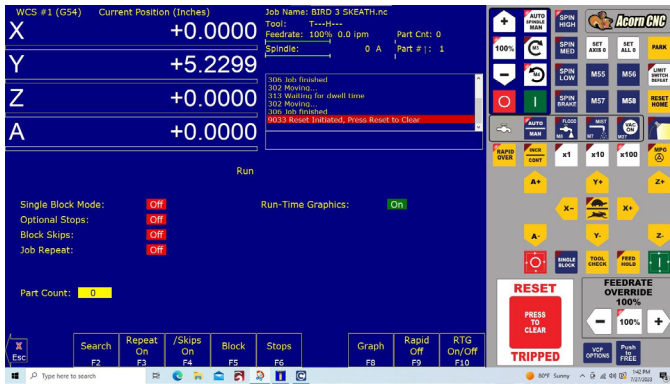


FIGURE 17

- The picture you see on screen is a representation of the engraving (see Figure 18).

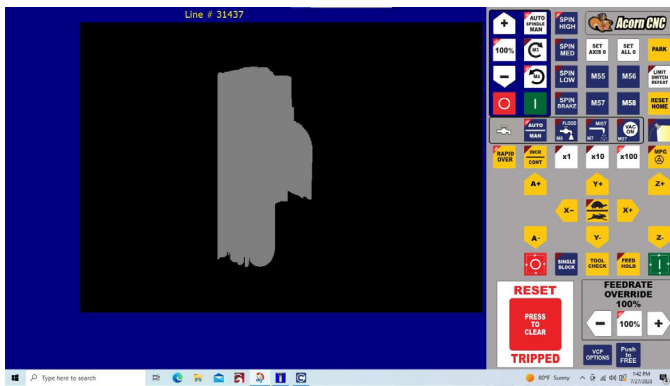


FIGURE 18

- When the G-code program is loaded, the program will begin to run (see Figure 19).

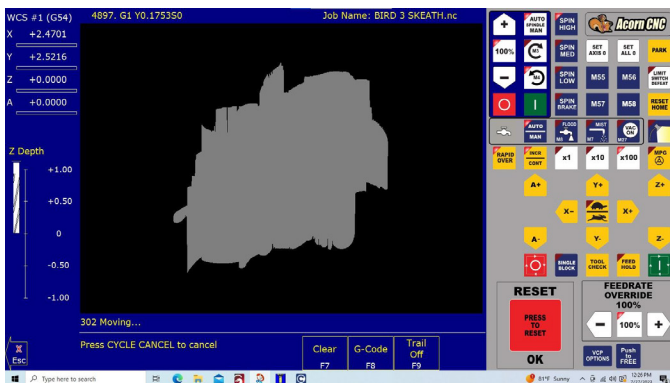


FIGURE 19

Thank you,
Sherline Products

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

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.

