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“The Way CNC Was Meant to Be”

Disclaimer

Thank you for purchasing a ShopSabre CNC Router machine. The following instructions should have you up and running within a few hours. Please read these instructions carefully, but remember if you have any trouble we are here to help.

Assembly services are available for a fee through ShopSabre CNC. To order assembly assistance, please call 1-800-493-6021 and speak with your sales person for additional details and pricing. We will schedule a ShopSabre technician to come to your facility as soon as possible. Scheduling is subject to technician’s current availability.

WARNING

WARNING

WARNING

WARNING

WARNING

The assemblies you are about to work with are very heavy (up to and including 6,500 pounds), and if not handled properly could cause injury, dismemberment, or possibly death. If you proceed to assemble your new ShopSabre CNC machine, you assume all responsibility and liability should there be injury of any kind or death. If you do not understand and agree with these disclaimers, please do not use this product and return all materials to the place of purchase.

These instructions are only meant as a guide, and are not the only method that may be used. If you feel there is a safer method, please use it. **Please use safety and caution as you proceed.**

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Chapter 1

Receiving, Installation, Power

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Receiving the Machine

Depending on your method of shipment your machine will arrive to you in two ways, on a flatbed truck or in an enclosed truck you will need a minimum 7,500-pound fork lift with at least 8' fork extensions.

Correct method of lifting off the flatbed



It is the purchaser's responsibility to examine all shipments from ShopSabre at time of receipt, note any damage on the Bill of Lading, and notify the carrier. Any damages not noted at time of receipt **will not be eligible for warranty or repair.**

Unloading the Machine

The machine will arrive either on a flatbed truck or a box truck on a pallet.



Remove the white wrap. **When receiving the machine please review the packing slip provided to make sure all the components are received.** All components will either be strapped to the machine bed, or under the machine (if your machine came on a pallet). In order to lift your machine off the pallet, you must first remove all bolts securing it to the pallet. After you have removed all bolts you will be able to lift the table off the pallet and set into place.

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Machine Placement and Leveling

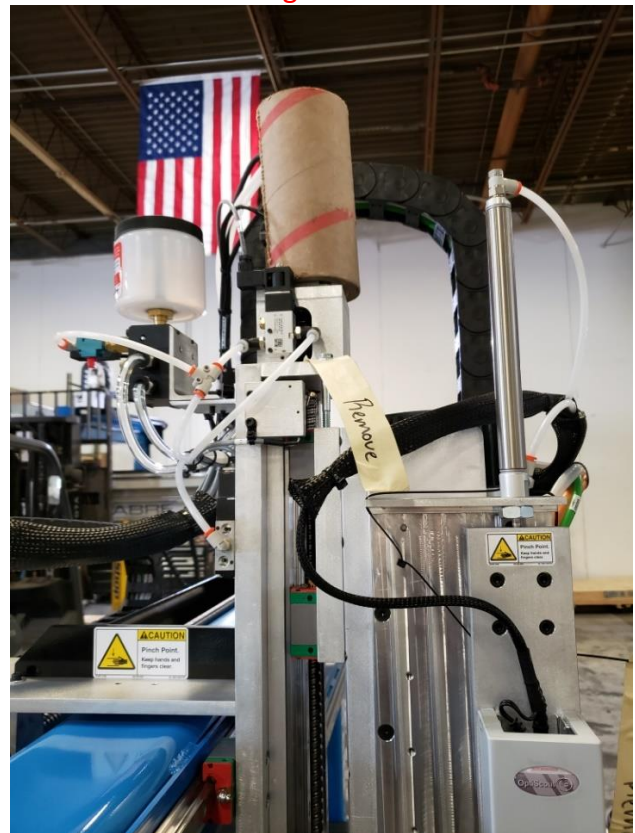
After you have lifted the machine off the pallet, it is time to place the machine in the designated area. **If you are unclear about machine placement please contact tech support at 1-800-493-6021 for advice about machine placement and room design.** Once in designated area the machine will need to be leveled. IS series machines use large bolts for feet, and all other machines use pads. These will be included in your packaging. 1A shows an example of foot bolts for an IS machine – the heads are generally placed up and they are threaded down into the legs. Figures 1B-1D show shipping bolts. The exact placement of these bolts may vary depending on machine model.

Figure 1A



Feet Are Located in Boxes

Figure 1B



Remove Bolt - Top of Z Axis

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Figure 1C



Remove Bolt - Under Gantry

Figure 1D



Sides of Table

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Control Box Computer Connection

If your machine is an “IS” series machine, you may skip this section.

Figure 2A shows an example of the back of your computer where you will need to attach a 37 Pin data cable. Figure 2B shows the appropriate port the 37-pin data cable should plug into on the computer. Take the other end of the data cable and plug it into the BLUE port on your computer. **Note: If you plug this connector into the wrong port your machine WILL NOT run.** (Most machines use only one data cable, in the blue port. However, if the control box on your table has two 37-pin ports, then both blue and black ports will be used). **Machines with a lot of included options may require two cables. If two were included with your machine, make sure both are installed in the appropriate locations.**

Figure 2A



Back Of Computer

Figure 2B



Correct Position

Note: With Windows 10, Microsoft has removed any way to turn off Windows Updates. This is unfortunate as Windows will not only randomly update but also randomly shut down the computer even if you are in the middle of a project and even if the machine is cutting. **We recommend you manually check for Windows Updates each morning before beginning work. If you do not, the machine could shut down during work. Not only will the machine stop cutting, but you will lose your zeros, your tool measures, and any other settings you’ve changed since the control screen was last opened.**

As an order of operations, we recommend first installing any updates, then opening WinCNC, then opening any other programs you want to use (Chrome, Vcarve, etc). In this way, WinCNC will have memory priority.

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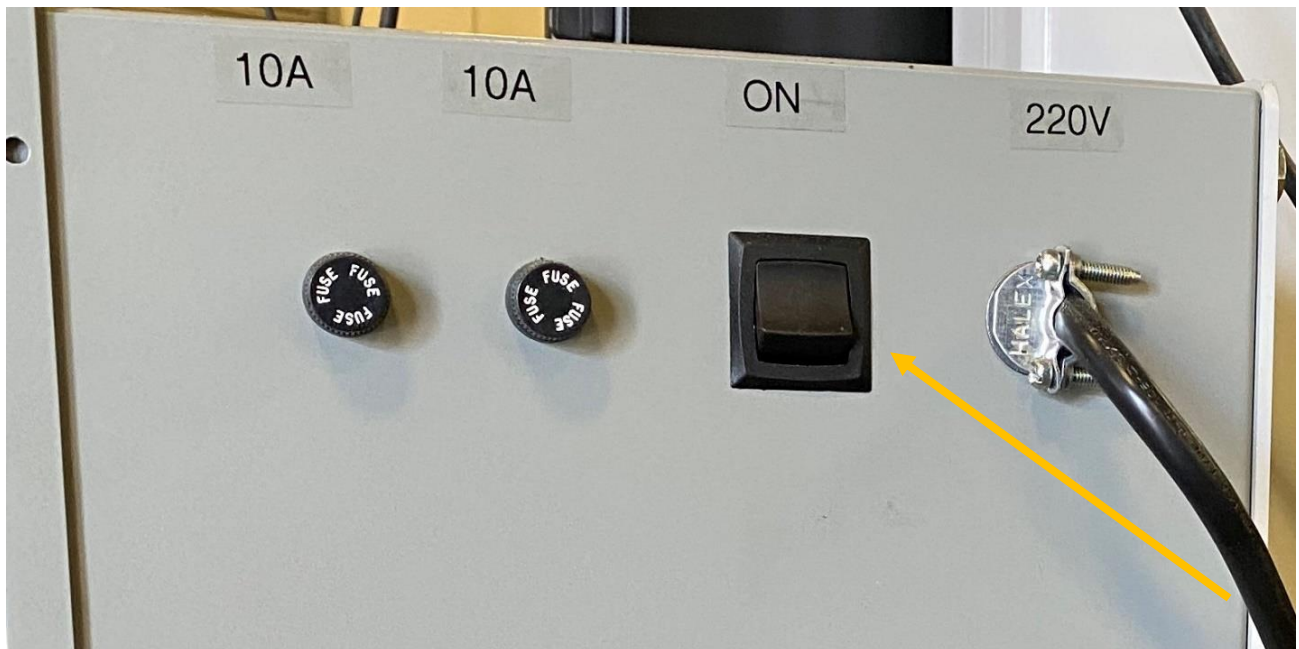
Computer Setup



If your machine is not an IS series router, ShopSabre recommends plugging the computer into a power strip (not provided) in order to protect against power surges, as we do not warranty internal device failures due to lightning strikes or other in-field electrical issues.

At this point, you are now ready to power up your machine. Plug your control box into the appropriate power. If your machine is not an IS series, power will either be 220-volt single phase, or standard 110 volt. Please refer back to your Sales Agreement for your machine power specs or to the following page. **If you are unclear about your machine specs, please contact tech support at 1-800-493-6021.** To power up your control box/stand there will be a switch located on the front or side.

Turn the switch the on, and also turn on your computer (for non-IS models) and monitor. When your computer finishes booting up and is at the Windows desktop you will see an icon labeled "ShopSabre Router"



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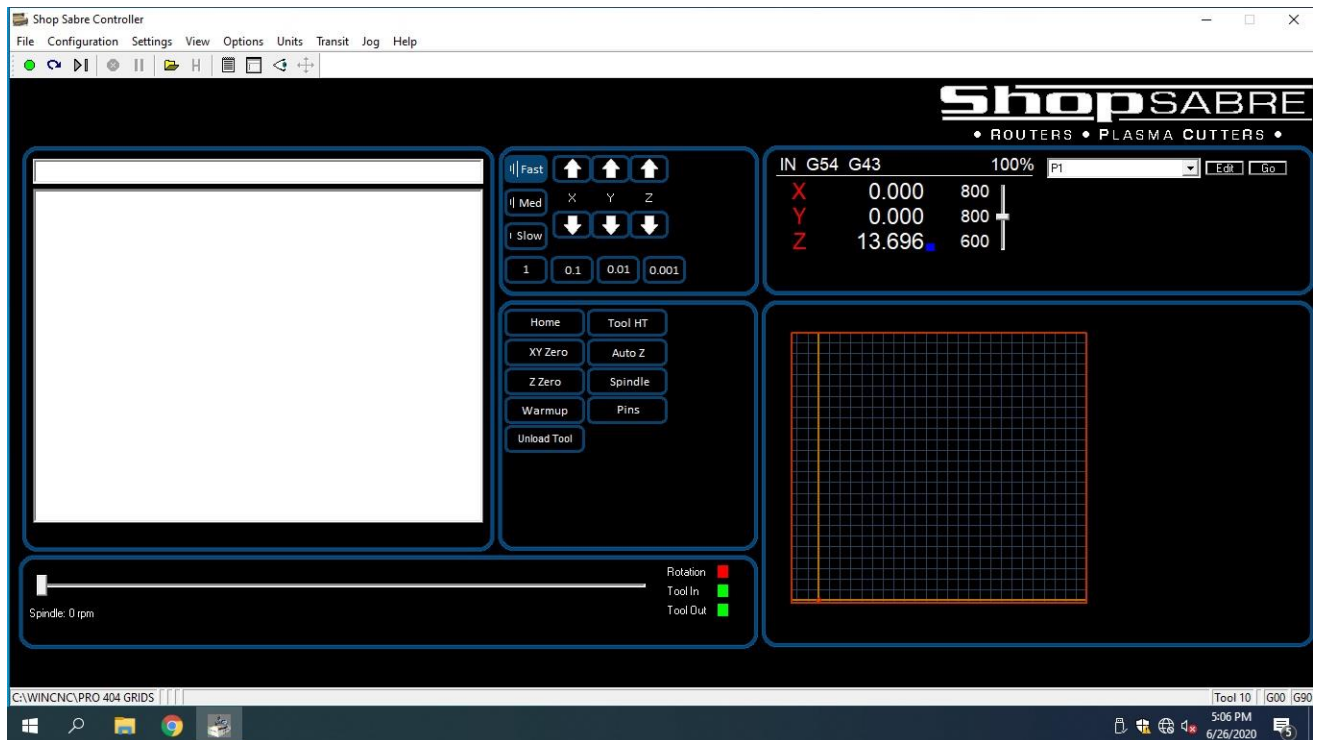
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If you purchased a combination table you will see two icons: one labeled ShopSabre Router and another labeled ShopSabre Plasma (or ShopSabre Oxy). Locate the appropriate icon and double click. The next screen that appears is your machine interface. **Figure 3C** shows an example of a router control screen. **If you purchased a touch-screen monitor there will also be a USB cable that needs to be connected between the monitor and computer to enable touch functionality.**

Figure 3C



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Machine Power

The following is a list of general plug types and power requirements your machine may need. If you have questions about the options you purchased or which plugs you may need, please contact your sales person. ALL ELECTRICAL WORK MUST BE PERFORMED BY A CERTIFIED ELECTRICIAN.

Model	Option	Plug
IS Series		
Wired for 208-240v Single Phase:		
	Control Box:	(Qty 1) NEMA L6-20 plug, 20 amps
	5 HP Spindle:	(Qty 1) NEMA L6-30 plug, 30 amps
	10 HP Spindle:	(Qty 1) Leviton 3763C plug, 41 amps max draw
Wired for 208-240v Three Phase:		
	Control Box:	(Qty 1) NEMA L15-20 plug, 20 amps
	5 HP Spindle:	(Qty 1) NEMA L15-30 plug, 30 amps
	10 HP Spindle:	(Qty 1) NEMA L15-30 plug, 30 amps
For Vacuum, Dust Collector see below		

Pro Series		
208-240v Single Phase:		
	Control Box:	(Qty 1) NEMA 6-20 plug, 20 amps
110v Single Phase:	PC + Monitor	(Qty 2) NEMA 5-15 plug, 15 amps
For VFD, Vacuum, Dust Collector see below		

RC Series + SS23 + Sidekick		
110v Single Phase:		
	Control Box:	(Qty 1) NEMA 5-15 plug, 15 amps
	Milwaukee option:	(Qty 1) NEMA 5-15 plug, 15 amps
	PC + Monitor	(Qty 2) NEMA 5-15 plug, 15 amps
For VFD, Vacuum, Dust Collector see below		

Continued on next page

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VFD for non-IS series machines:		
Must be hard-wired 208-240v only either Single or Three Phase	2, 4, or 5 HP, Single or Three Phase:	30-amp circuit
	9 or 10 HP, Three Phase:	30-amp circuit
	9 or 10 HP, Single Phase:	50-amp circuit; 41 amp max draw

Dust Collector: 208-240v only		
3HP Cyclone	Single Phase:	30-amp circuit; Plug not included. Recommend (Qty 1) NEMA L6-30 plug
2HP Shop Fox	Single Phase:	20-amp circuit; Plug not included. Recommended (Qty 1) NEMA 6-20 plug
3HP Shop Fox	Single Phase:	30-amp circuit; Plug not included. Recommended (Qty 1) NEMA 6-30 plug
5HP Grizzly	Single Phase:	Manufacturer recommended 40-amp circuit; Plug not included.

C-Aire Compressors	208/230 Volt	
(A050V060-1230) 60 Gallon	Single Phase 21/19.1 amps	30 Amp, Hard-wired
(A050V080-1230) 80 Gallon	Single Phase 21.0/19.0 amps	40 Amp, Hard-wired

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Vacuum Pumps:		
SHOPSABRE PUMPS		
ShopSabre F1	Single Phase:	(Qty 1), NEMA 6-15 plug, 15 amps
ShopSabre F4	Single Phase:	(Qty 1) NEMA 6-30 plug, 30 amps
FPZ PUMPS		
Motor starter or VFD required		
20 HP FPZ	Three Phase only:	Hard-wired; See Motor Data Sheet, Page 37
25 HP FPZ	Three Phase only:	Hard-wired; See Motor Data Sheet, Page 37
BECKER PUMPS		
Motor starter or VFD required		
9HP Becker	Single Phase w/Mitsubishi VFD:	Hard-wired, 45 amps running
12HP SK Becker	Single Phase w/Mitsubishi VFD:	Hard-wired, 55 amps running
18HP Becker	Single Phase w/Mitsubishi VFD:	Hard-wired, 85 amps running
9HP Becker	Three Phase:	Hard-wired, 28 amps running
12HP SK Becker	Three Phase:	Hard-wired 36 amps running
18HP Becker	Three Phase:	Hard-wired, 55 amps running

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Air Connection & Air Balancer Installation

If your machine requires compressed air, the air connection will be located on the left side of the machine (Figure 4C), usually on the middle or front leg. If you are unclear if your machine requires air please refer to your purchase agreement under air requirements or call your sales representative. **Note: If your machine requires air it needs a minimum of 95 PSI to operate. If the pressure drops below 95 it will likely require a homing operation. We recommend minimum 5 CFM at 100 PSI, and 105-125 PSI at the machine to avoid fluctuations that may trigger an abort. Pressure above 150 PSI will often cause problems changing tools.**

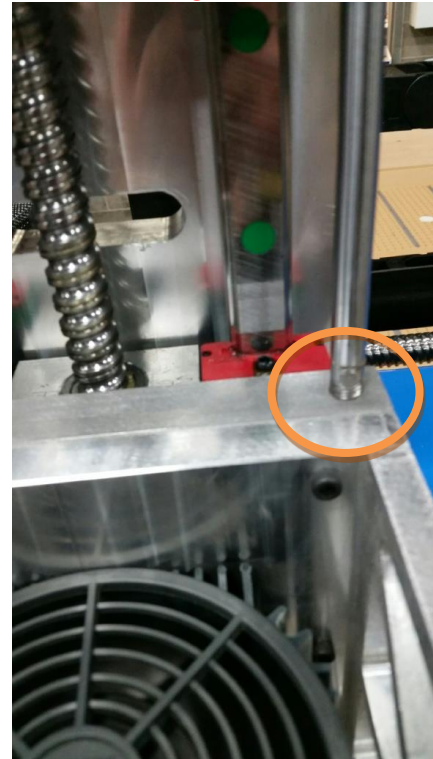
If your machine comes with an air balancer it is now time to install it. The balancer helps offset the weight of the spindle so the motor works less and stays cooler for longer life. It will also keep the head from dropping if power is turned off or lost due to an outage. If this is not installed properly the machine may periodically report a servo being offline due to the Z motor working too hard. Figures 3A and 3B show the proper installation of the air balancer to the top plate and the installation of the shaft to the bearing plate of the spindle. **Make sure the spindle is in the up position when tightening the nut.**

The air balancer requires two air lines (one for the top, one for the bottom). These air lines extend from the X-axis cable track behind the gantry and are labeled. The top hose is an exhaust and does not travel the entire length through track.

Figure 3A



Figure 3B



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Figure 3C



If you purchased an Automatic Tool Changing Spindle your machine air input will be similar to **Figure 4C**. Each gauge is set at the factory with the required PSI labeled on the gauge itself. Once you attach the required compressed air to your machine check to see if the gauges are at the correct setting as they may have moved during shipping.

Note: You must use a 5-micron water separator at the machine. If you do not use a water separator and water gets inside your system it **will cause damage, voiding your warranty.**

Also Note: A 5-micron filter is the minimum required. If your machine has a tool changing spindle, HSD requires ISO 8573-1 air quality with class 2 for solid particles ($< 1\mu\text{m}$), class 4 for humidity ($< 37.4^\circ\text{F}$), and class 3 for oil ($< 1\text{mg}/\text{m}^3$). A refrigerated air dryer or a desiccant filter are often necessary for humid areas to reach these standards. See their manual Section 4.4.1 for more details

Figure 4D



The machine requires an appropriate $\frac{1}{4}$ NPT air coupler for the manifold (**not included with machine**)



WARNING: All work must be performed by a qualified industrial electrician



VFD Installation

If you purchased an IS series machine, you may skip this section.

If you purchased a High Frequency Spindle, you will receive with your machine a Variable Frequency Drive (VFD). **Figure 5A** shows an example of what a common VFD looks like. This section of the manual should be performed by a qualified electrician. **If your VFD is wired incorrectly, your warranty will be void.**

Although some VFDs may have labels or stickers which reference removable jumpers, all VFDs will come configured from the factory. **Do not remove any jumpers.** If you have any questions about your machine specifications, please contact ShopSabre tech department at 1-800-493-6021.

Installing the motor wire to the VFD is very simple. All models of VFD will have U, V, W terminals for those wires. Locate the wire on your machine with labeled U, V, W and GND wires. Located on your VFD are three terminals labeled U, V, W and GND. Simply insert the appropriate wire and tighten the clamp using a Philips head screwdriver. Your electrician should also assist in this step. Please note that there is no ON/Off switch located on the VFD. Your electrician will need to install a power disconnect from your shop's electrical panel. Also note that your VFD is capable of running from **Single Phase** as well as **Three Phase** power. **Removing jumpers from the VFD will void your warranty.**

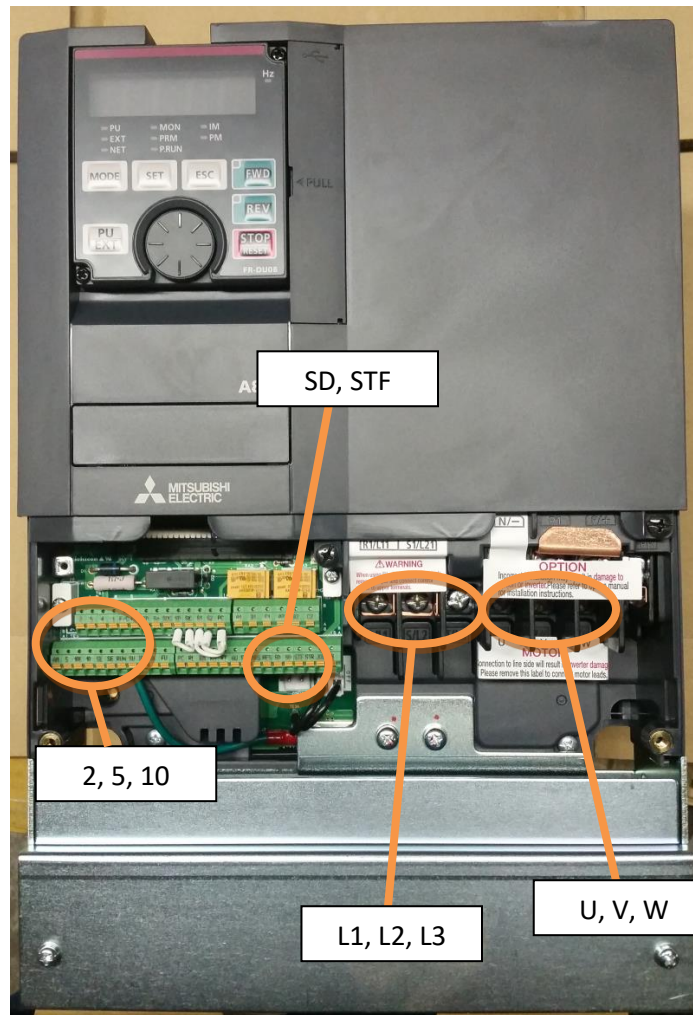
The VFD should be mounted on a wall near the machine where it can be easily accessed when needed.

From the spindle on the machine will be either an orange or gray wire that splits to three wires labeled U, V and W, and will also have two green/yellow wires that go to ground screws on the lower metal part of the VFD. These screws are often green.



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Figure 5A



This is an example of a common VFD. All VFDs will have L1, L2, L3 and U, V, W.

Note: Single phase input wiring connects to R/L1 and S/L2 only, and T/L3 will be empty. Three phase input to R/L1, S/L2, T/L3. There are **no neutrals** in this circuit. **Connecting a neutral wire in place of a phase wire or to any other terminal will damage the VFD and void your warranty.**

Vacuum Pumps

This section in your manual will assist you in the assembly and basic operation of your new vacuum hold down system.

- [Becker](#), Page 22
- [FPZ](#), Page 35
- [F4](#), Page 38

Your vacuum pump arrives to your facility separate from your table. When you receive your vacuum pump you must first verify the electrical setting to make sure pump is set to the correct voltage. If you wire your vacuum pump incorrectly you may overheat the pump and damage can occur. If your pump is wired incorrectly YOU WILL VOID YOUR WARRANTY. In the event of failure, the determination is made by FPZ and is final. If there is any cost involved in repair the customer will be held responsible.

If you have purchased an FPZ or Becker vacuum pump, we’ve included motor data sheets in their respective sections. You must consult your electrician for the proper electrical requirements for starting and running the vacuums. If you have questions about electrical requirements or setup, your electrician and/or FPZ and Becker tech support can provide the answers for your specific situation. ShopSabre cannot provide recommendations for electricians or electrical requirements.

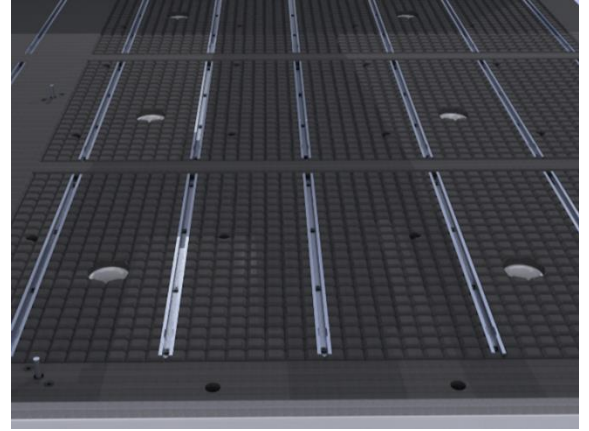
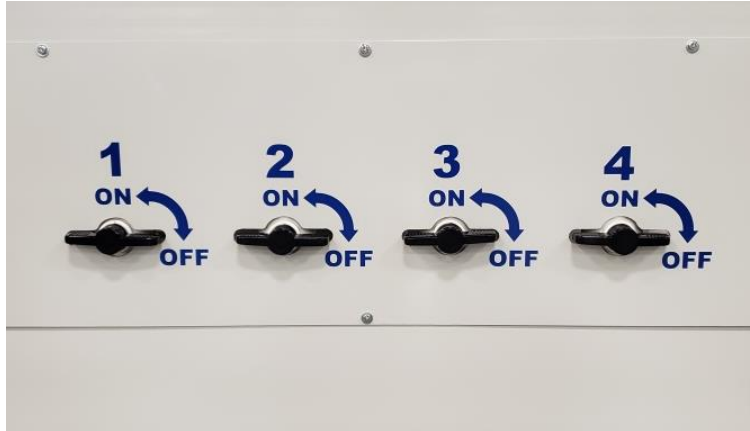
Both FPZ and Becker recommend a motor starter or VFD for their pumps. Consult your local industrial electrician or purchase a VFD from ShopSabre.

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If you purchased the vacuum option, the front of your machine will have four valves and a waffle grid. If you purchased the T-Slot upgrade, you will have a waffle grid and T-slots installed into the table top.



On a typical machine, the 4" vacuum line will be installed on the back of the machine. Please contact your sales representative for more information. If you purchased a vacuum from ShopSabre, your machine will arrive with all the plumbing pre-installed on the table. It is the customer's responsibility to plumb the machine to the vacuum. These next few steps will walk you through the process of connecting the vacuum.

Note: If you did not purchase a vacuum pump from ShopSabre, you will not receive any 4" pipe to connect between the machine and a pump.

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Becker Vacuum Pump

The Becker vacuum pumps which are sold with ShopSabre machines come in three varieties: 10HP (VTLF 2.250), 15HP (VTLF 2.400), and Duplex (VTLF 2.400\0-79). Pictured below is the 10HP. All three function similarly. The 10HP pump uses 2" PVC to a British Pipe Thread to NPT adapter (included from Becker). The 15HP and Duplex use 4" PVC. A 4" to 2" adapter is included with the piping provided by ShopSabre for 10HP pumps.



Becker vacuums have built-in filters. For setup, simply run the appropriate PVC from the CNC to the intake of the pump, and run power to the pump. Becker does recommend a motor starter. ShopSabre recommends consulting your electrician when choosing the starter appropriate for your local codes, environment and circumstances. **The Becker does have a maintenance schedule as detailed by the following pages. Every 40-200 hours the filters should be cleaned, and every 3000h it requires greasing and measuring the vanes in the pump. The following pages come directly from Becker's manuals.**

These pumps should not be turned on/off more than 6 times per hour maximum. We recommend leaving it on for the entire amount of time the machine is being used that day and turning the zone handles on/off when changing parts (shown at the beginning of the Vacuum Pump section).

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VTLF 2.250

Rotary vane vacuum pumps

- oil-free and air-cooled
- incl. integrated suction filter, vacuum relief valve and blow off valve

Drehschieber-Vakuumpumpen

- trockenlaufend und luftgekühlt
- inkl. integriertem Ansaugfilter, Vakuumsicherheitsventil und Abblaseventil

Pompes à vide à palettes

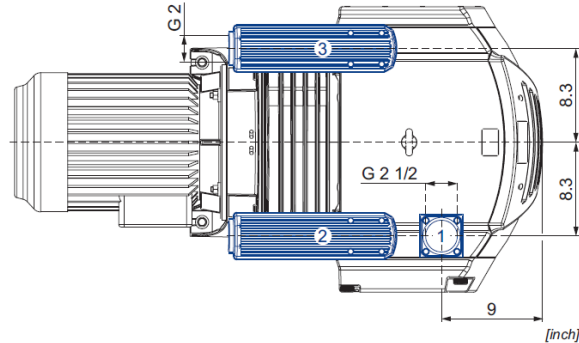
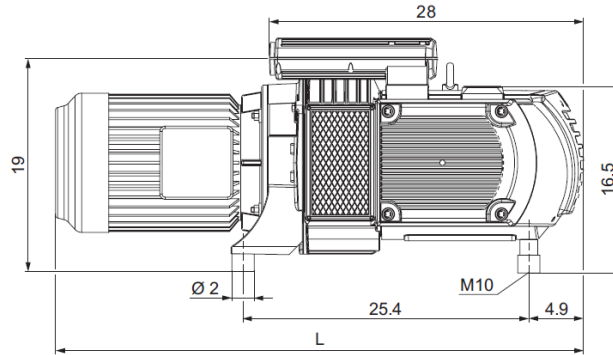
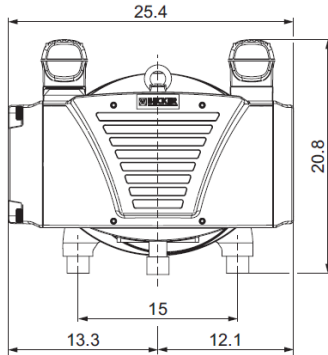
- fonctionnant à sec et refroidies par air
- incl. filtre d'aspiration intégré, soupape de sécurité vide et soupape d'échappement

Pompe per vuoto a palette

- funzionanti a secco e raffreddate ad aria
- incl. filtro di aspirazione integrato, valvola di sicurezza vuoto e valvola di sfogo

Bombas de vacío de paletas

- sin aceite y refrigerado por aire
- incl. filtro de aspiración integrado, válvula de seguridad de vacío y válvula de escape



- Vacuum connection
Sauganschluss
Raccord vide
Raccordo aspirazione
Conexión de vacío
- Vacuum relief valve with silencer
Vakuumsicherheitsventil mit Schalldämpfer
Soupape de sécurité vide avec silencieux
Valvola di sicurezza vuoto con silenziatore
Válvula de seguridad de vacío con silenciador
- Exhaust air silencer
Abblaseventil mit Schalldämpfer
Silencieux échappement d'air
Silenziatore scarico aria
Silenciador de escape de aire

CFM		in. HgV		lbs	dB(A) ¹⁾	
50 Hz	60 Hz	50 Hz	60 Hz		50 Hz	60 Hz
144	169	23.6	23.6	333 + (M)	77	79

(M)	50 Hz				60 Hz				lbs	No	L inch			
	hp	V	rpm	A	hp	V	rpm	A						
3~	7.4	Δ230/Y400	IE3	972	23.4/13.5	8.9	Δ265/Y460 Δ230/Y400	IE3 -	1170 1162	23.4/13.5 24.2/14.0	224.9	IP55 • ISO F • bimetal	42889622300003TA	45.1
3~	7.4	Δ400	IE3	976	13.5	8.9	Δ460 Δ400	IE3 -	1173 1160	13.6 14.3	235.9	IP55 • ISO F • bimetal	42889690300003TA	45.1
3~	-	-	-	-	-	8.9	YY230/Y460 YY208	IE3 -	1175 1159	27.8/13.9 28.1	235.9	UL (E235514) • CSA • CC (329B) IP55 • ISO F • bimetal	42989607300114TA	45.1
3~	7.4	Δ200/Y350	IE3	974	26.9/15.5	6.6	Δ220/Y380-400 Δ200/Y350	IE3 -	1168 1162	26.7/15.4-15.3 27.8/16.1	235.9	IP55 • ISO F • bimetal	42889653300003TA	45.1
3~	-	-	-	-	-	8.9	Δ400	IE3	1175	15.2	235.9	UL (E235514) • CSA • CC (329B) IP55 • ISO F • bimetal	42989654300114TA	45.1

- 1) DIN EN ISO 3744 (KpA = 3 dB(A)) interval of 39.4 inch, at medium load, both connection sides piped
DIN EN ISO 3744 (KpA = 3 dB(A)) Abstand von 39.4 inch, bei mittlerer Belastung, beide Seiten abgeleitet
DIN EN ISO 3744 (KpA = 3 dB(A)) intervalle de 39.4 inch, à régime moyen, avec dérivation des deux côtés
DIN EN ISO 3744 (KpA = 3 dB(A)) intervalo de 39.4 inch, a medio regime, entrambi i lati derivati
DIN EN ISO 3744 (KpA = 3 dB(A)) intervalo de 39.4 inch, en media carga, derivados de ambos lados
- Dimensions in inch
Maßangaben in inch
Mesures en inch
Misure in inch
Dimensiones en inch



Right of modification reserved
Änderungen vorbehalten
Sous réserve des modifications
Sotto riserva di modificazioni
Derecho a modificaciones reservado

30.10.2018

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VTLF 2.400

Rotary vane vacuum pumps

- oil-free and air-cooled
- incl. integrated suction filter, vacuum relief valve and blow off valve

Drehschieber-Vakuumpumpen

- trockenlaufend und luftgekühlt
- inkl. integriertem Ansaugfilter, Vakuumsicherheitsventil und Abblaseventil

Pompes à vide à palettes

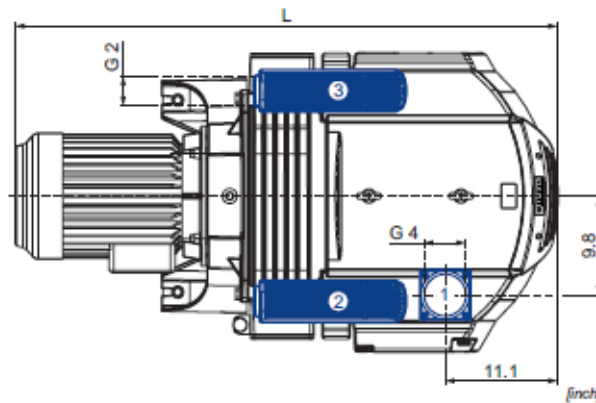
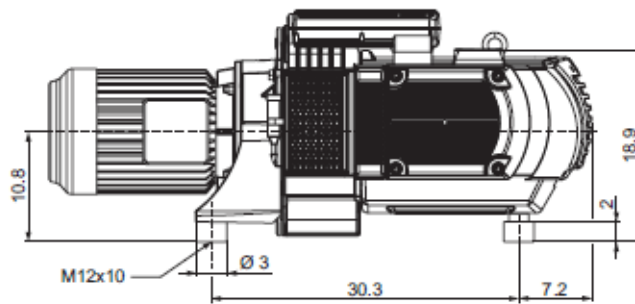
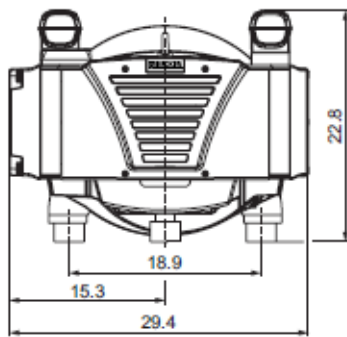
- fonctionnent à sec et refroidies par air
- incl. filtre d'aspiration intégré, soupape de sécurité vide et soupape d'échappement

Pompe per vuoto a palette

- funzionanti a secco e raffreddate ad aria
- incl. filtro di aspirazione integrato, valvola di sicurezza vuoto e valvola di sfogo

Bombas de vacío de paletas

- sin aceite y refrigerado por aire
- incl. filtro de aspiración integrado, válvula de seguridad de vacío y válvula de escape



- Vacuum connection
Sauganschluss
Raccord vide
Raccordo aspirazione
Conexión de vacío
- Vacuum relief valve with silencer
Vakuumsicherheitsventil mit Schalldämpfer
Soupape de sécurité vide avec silencieux
Valvola di sicurezza vuoto con silenziatore
Válvula de seguridad de vacío con silenciador
- Exhaust air silencer
Abblaseventil mit Schalldämpfer
Silencieux échappement d'air
Silenziatore scoppio aria
Silenciador de escape de aire

CFM		in. HgV		lbs	dB(A) ¹⁾	
50 Hz	60 Hz	50 Hz	60 Hz		50 Hz	60 Hz
230	270	23.6	23.6	546.8 + (M)	77	79
(M)	60 Hz				lbs	L (VTLF incl. motor)
hp	V	rpm	A		inch	
3~	208-230/460	880	42.9-38.8/19.4	NEMA • Iso F • IP 55	≈417.2	≈58.5
3~	YY230/460 IE3 YY208	881 876	51.4/25.7 54.6	UL (E235514) • CSA • CC329B Iso F • IP 55	≈403.5	≈60.8

1) DIN EN ISO 3744 (KpA = 3 dB(A)) interval of 39.4 inch, at medium load, both connection sides piped
 • Dimensions in inch
 DIN EN ISO 3744 (KpA = 3 dB(A)) Abstand von 39.4 inch, bei mittlerer Belastung, beide Seiten abgeleitet
 Maßangaben in inch
 DIN EN ISO 3744 (KpA = 3 dB(A)) intervalle de 39.4 inch, à régime moyen, avec dérivation des deux côtés
 Mesures en inch
 DIN EN ISO 3744 (KpA = 3 dB(A)) intervallo di 39.4 inch, a medio regime, entrambi i lati derivati
 Misure in inch
 DIN EN ISO 3744 (KpA = 3 dB(A)) intervalo de 39.4 inch, en media carga, derivados de ambos lados
 Dimensiones en inch

If



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 取扱説明書
 사용설명서
 使用说明书

VTLF 2.200
VTLF 2.250
VTLF 2.360

2006/42/EG



				mbar
				m ³ /h
<p>AIR</p>			<p>DIN EN ISO 3744</p> <p>L_{pA} = 75-80 dB(A) - 50Hz L_{pA} = 77-82 dB(A) - 60Hz K_{pA} = 3 dB(A)</p>	

<p>222-280 kg 490-617 lbs</p>	<p>A > 400mm A > 16"</p>	<p>> 5°C/41°F < 45°C/113°F</p>	<p>max. 90%</p>	<p>max. 800m</p>
<p>1</p>	<p>2</p>			

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3

4

5

BECKER		Mod.Nr. 300000X	END000X	CE
No. 13.300000X		3~Met. 30000000X	XX	
50 Hz	3000W	60 Hz	3000W	
3000-3000 / 3000-3000	V Δ / Y	3000-3000 / 3000-3000	V Δ / Y	
300-300 / 300-300	A	300-300 / 300-300	A	
cat. Y 0.300-0.300		cat. Y 0.300-0.300		
30000-30000 / 30000 / 30000	mm	30000-30000 / 30000 / 30000	mm	XX kg

6

7

8

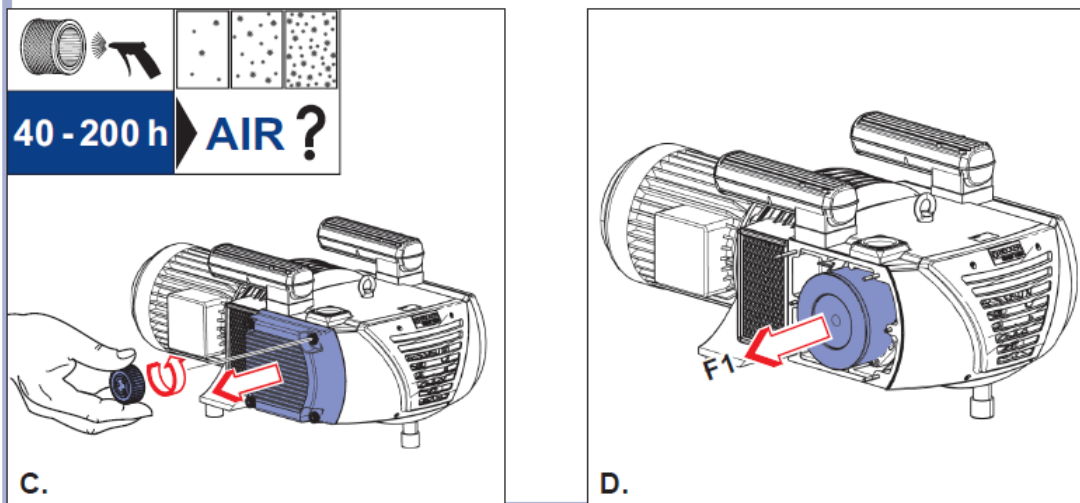
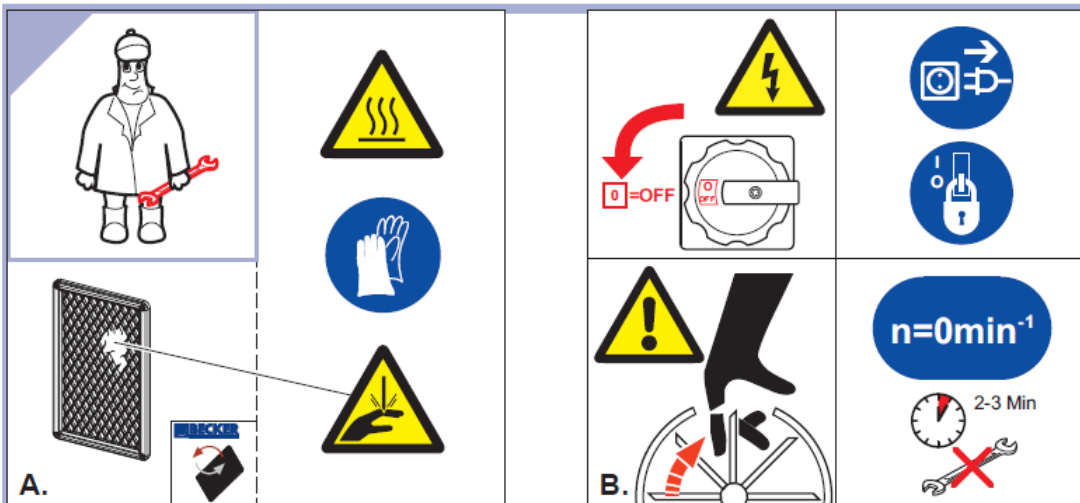
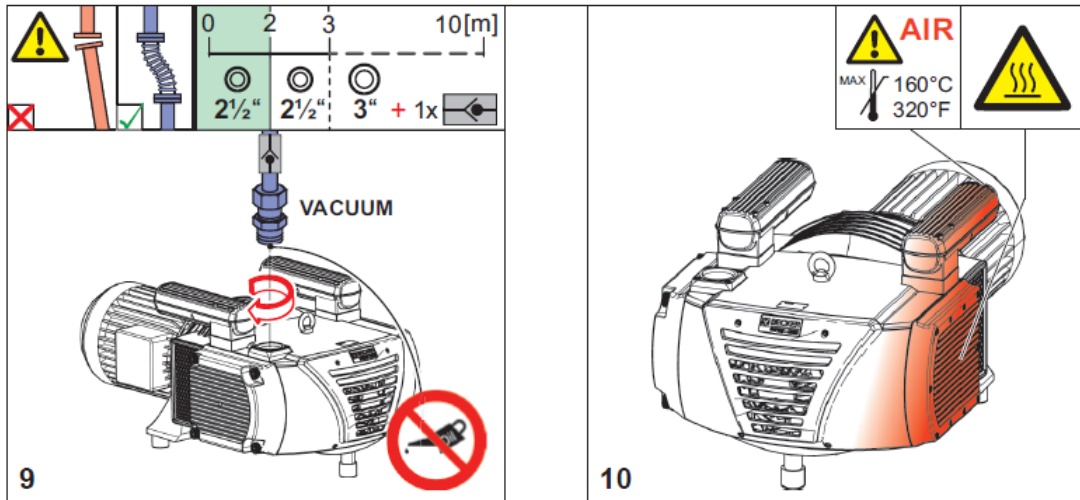
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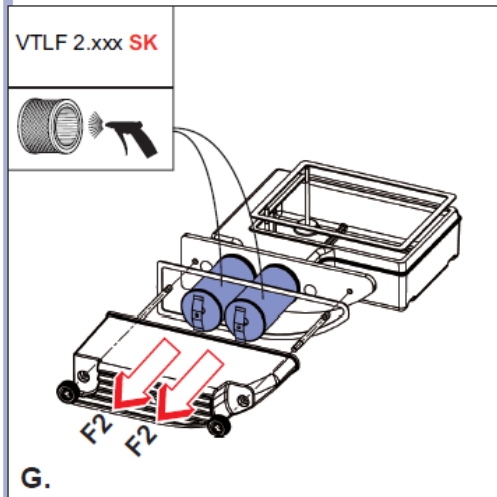
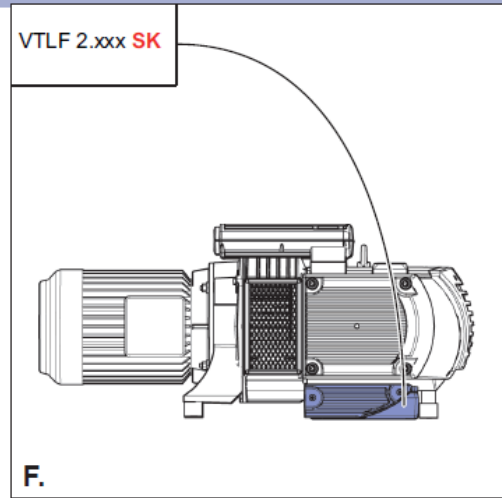
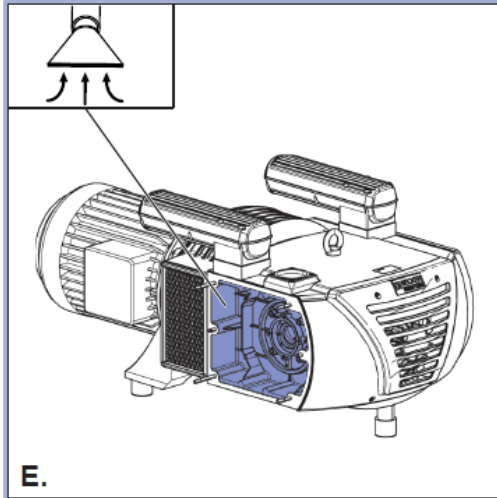
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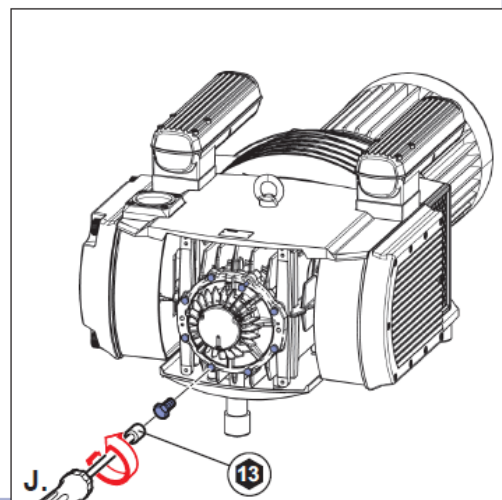
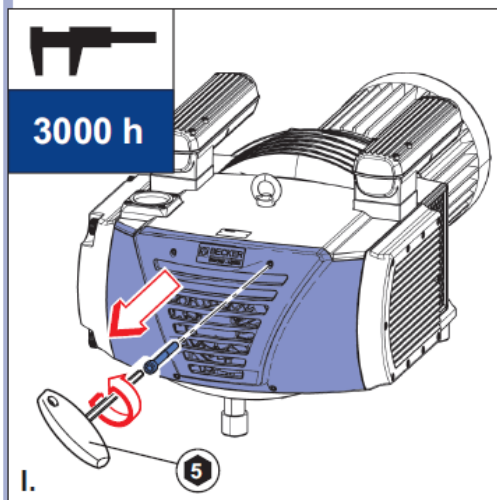
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F1: D: 218 mm
H: 122 mm
No.: 90951200000
F1: (polyester)
VTLF 2.xxx/6
No.: 90959600000
F2: D: 64 mm
H: 120 mm
2x No.: 90951000000

EN149 - FFP3
42 CFR 84 - N100



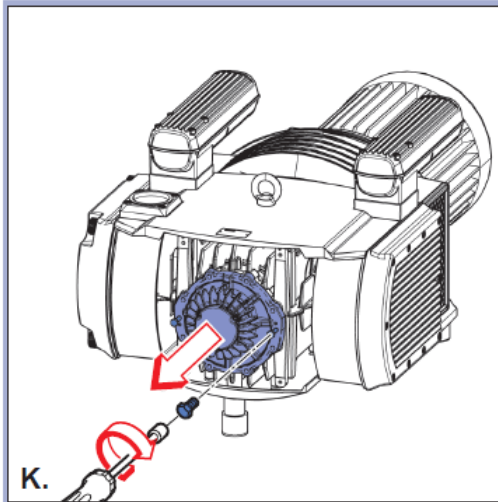
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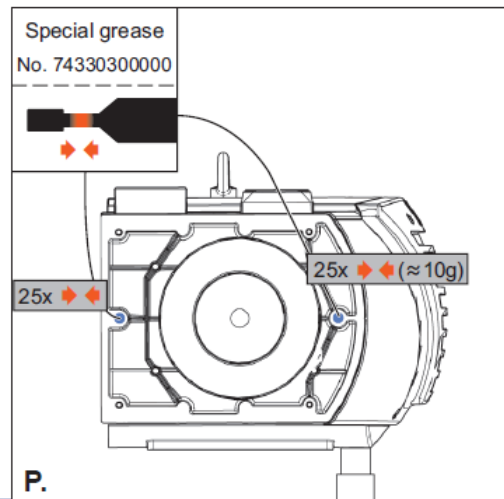
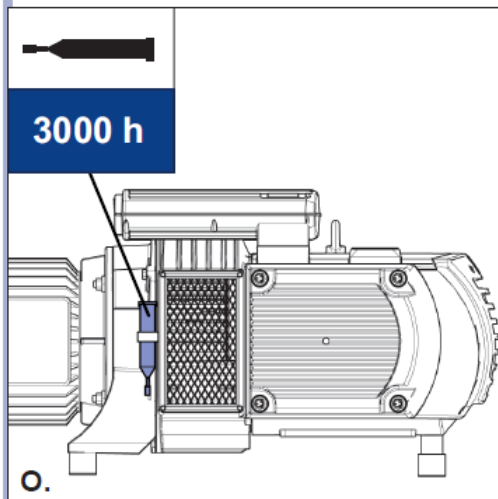
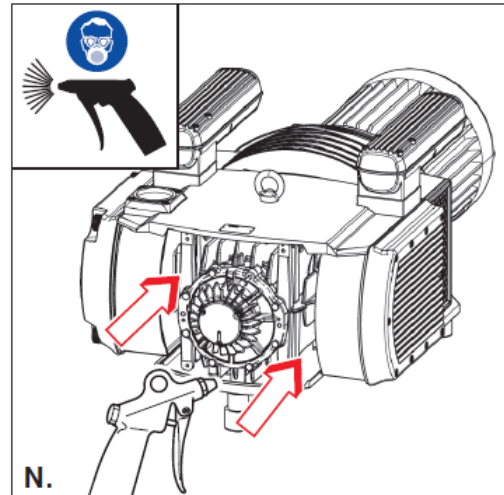
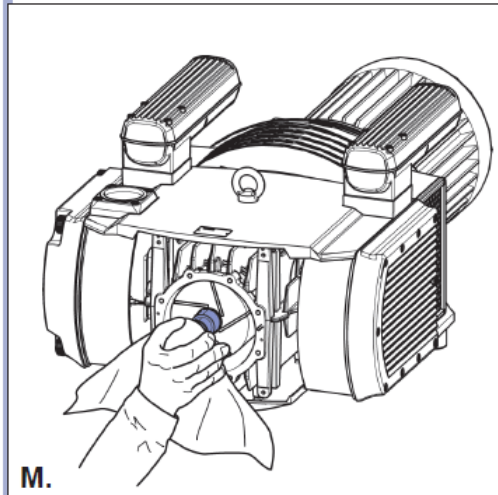
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	$A_{MAX} = 65\text{mm}$ $A_{MIN} = 41\text{mm}$
	$A < 41\text{mm}$
VTLF 2.200/2.250 → No. 90136701005 (SET) L. VTLF 2.360 → No. 90132500005 (SET)	



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info@becker-international.com



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VTLF 2.400
 VTLF 2.500

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					mbar
				L _{pA} = 77-79 dB(A) - 50Hz L _{pA} = 79-80 dB(A) - 60Hz K _{pA} = 3 dB(A)	

			350-370 kg 772-816 lbs	A > 400mm A > 16"				
MIN 2x				max. 90%				max. 800m

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6

BECKER		Mod.Nr. 300000	EN60000	CE
3-Phase 30000000				
50 Hz		3000W	60 Hz	3000W
300A-300 / 300A-300 V Δ / Y		300A-300 / 300A-300 V Δ / Y		
300A-300 A		300A-300 A		
EN61181-2:2011		EN61181-2:2011		
300A-3000 Int.		300A-3000 Int.		
			300 kg	

7

OPTIONAL

PTC Bi-metal Softstart

8

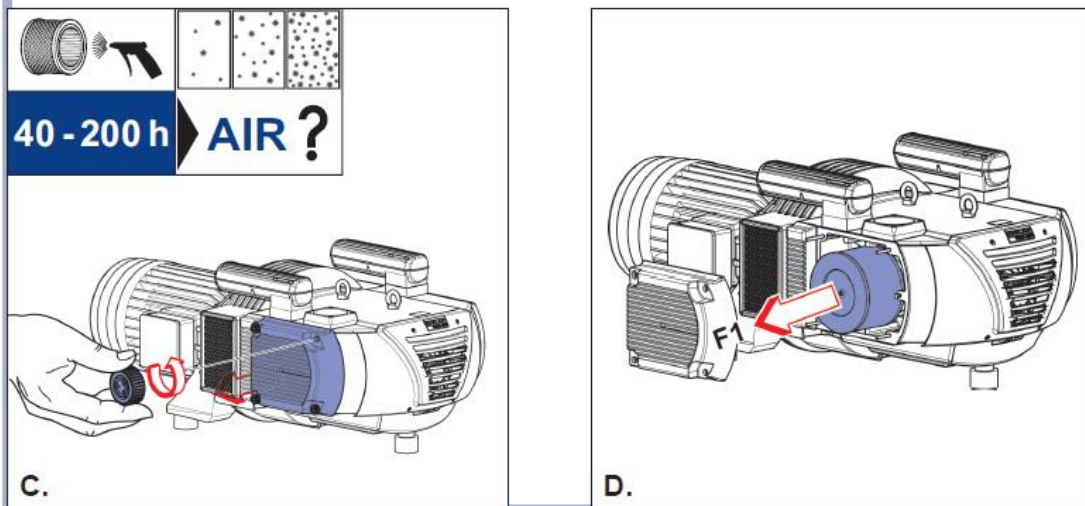
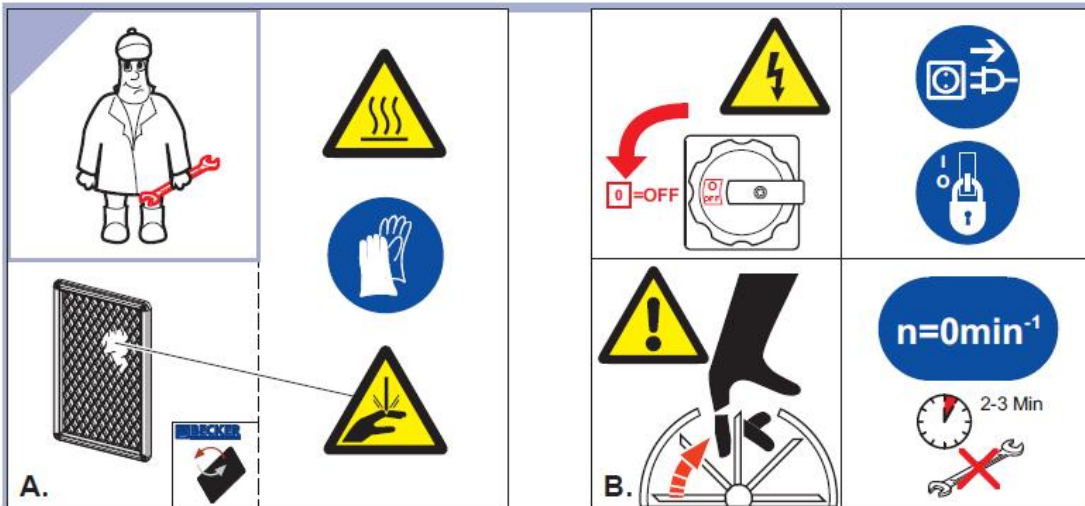
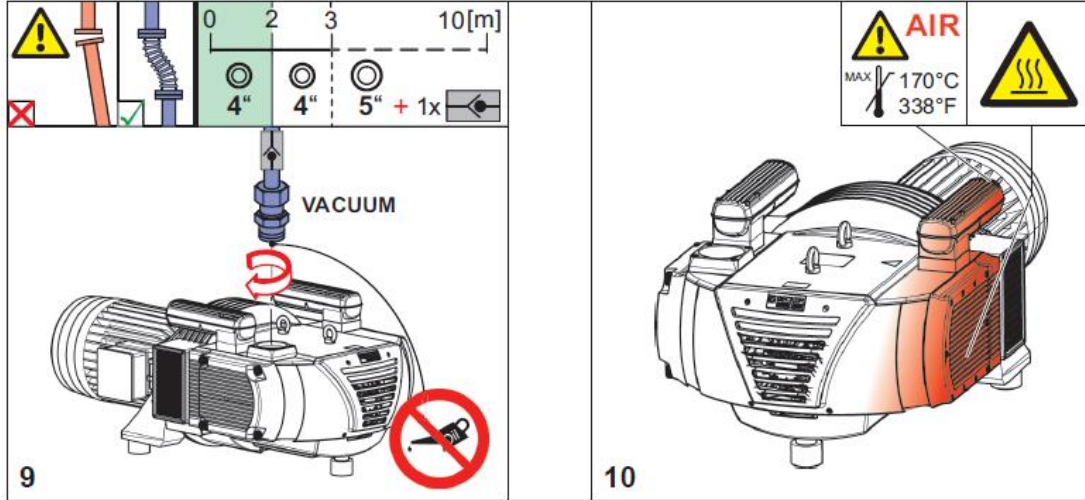
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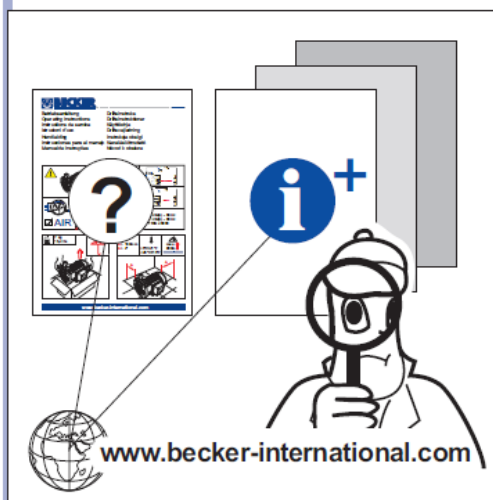
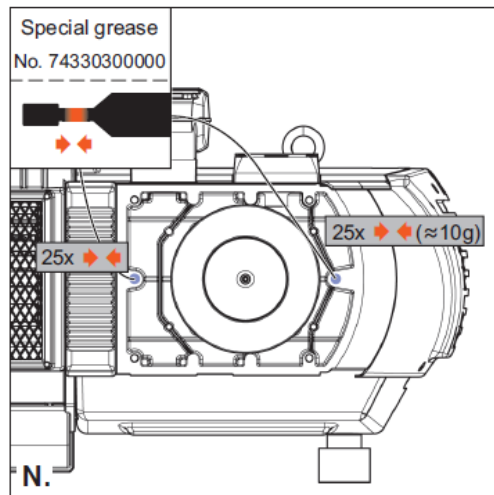
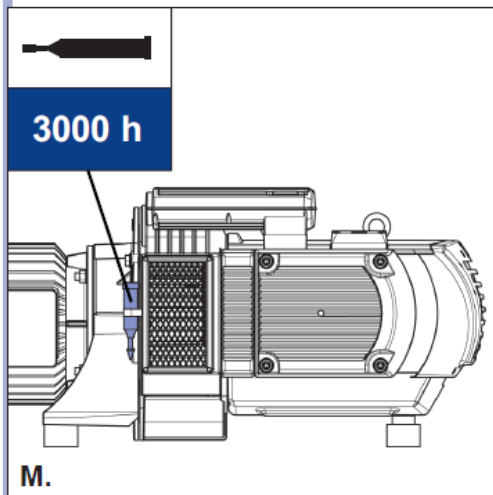
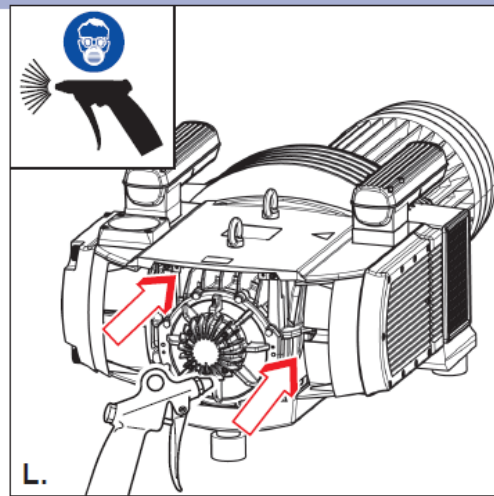
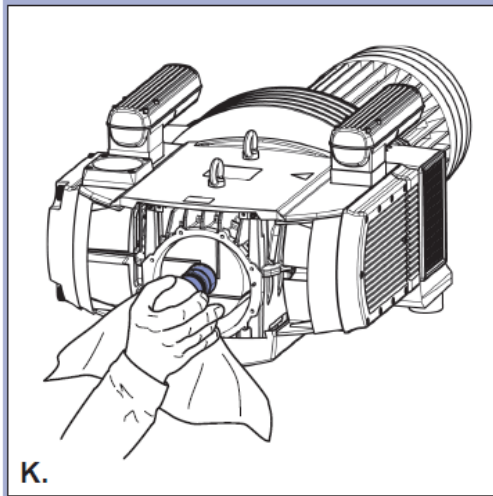
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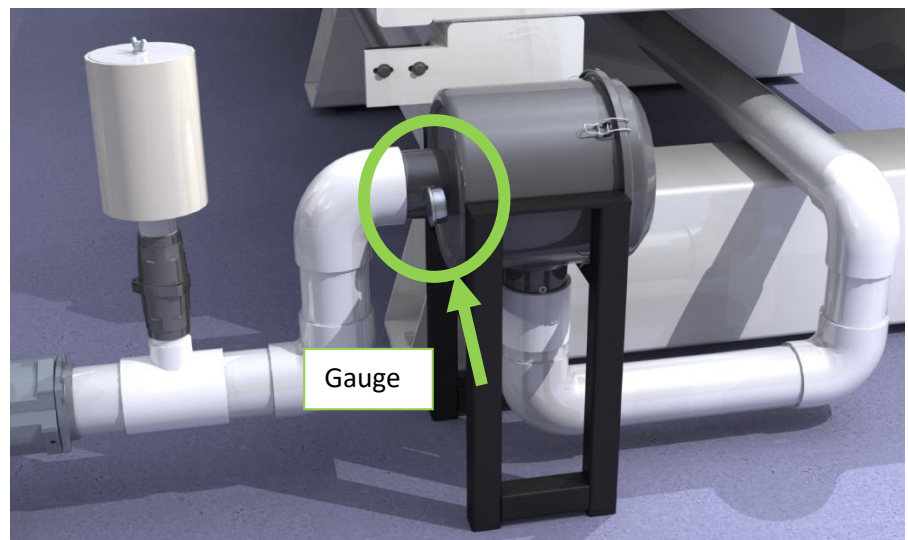
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FPZ Vacuum Pump

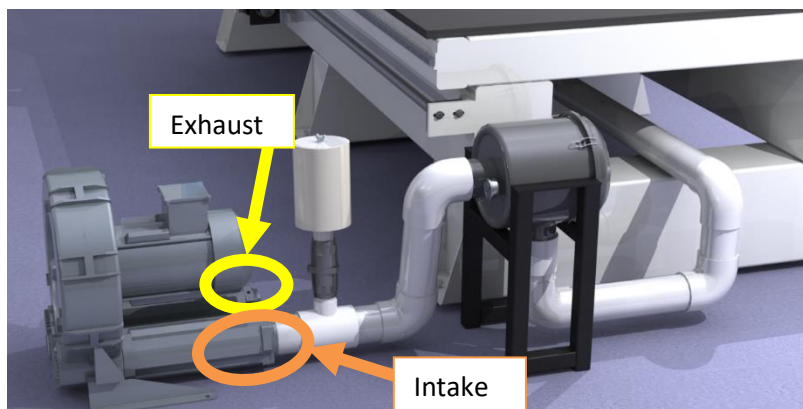
These pumps should not be turned on/off more than 6 times per hour maximum. We recommend leaving it on for the entire amount of time the machine is being used that day and turning the zone handles on/off when changing parts (shown at the beginning of the Vacuum Pump section). **Maximum ambient temperature during operation is 104°.**

The exhaust temperature for FPZ pumps is approximately ambient + 100°F. This will melt PVC. Do NOT use PVC as an exhaust pipe.

Make sure when installing the filter, you have the flow installed in the correct position. The arrows should be pointing towards the vacuum pump. You will need to install the supplied vacuum gauge in the correct position on the output side of the filter. Illustrated in the picture to the right is the correct position for the vacuum gauge for this filter.



Depending on the style and horsepower of the vacuum pump, your filter might look different. Below is a picture of a 20 HP FPZ vacuum.



This is a picture of the complete setup with a 20HP. Please contact your sales representative for specs.

On the 20HP pump the vacuum gauge will be installed on the *output* side of the filter.

Follow the yellow arrows on the pump for airflow direction.

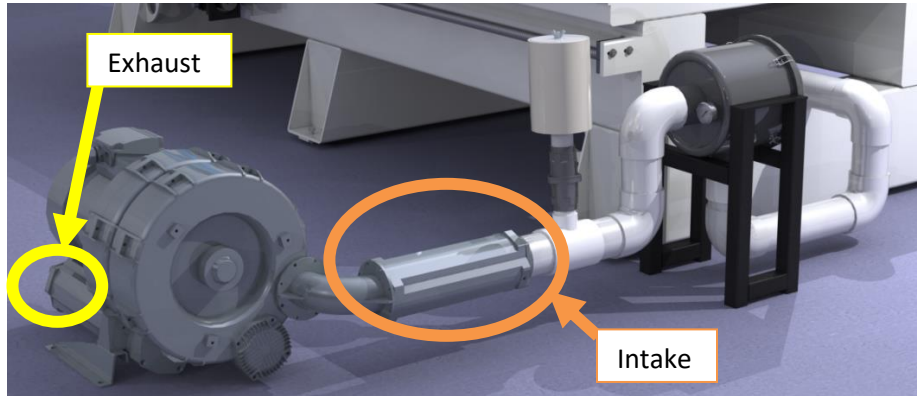
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Picture of a 25 HP FPZ below. Note the locations of the intake and exhaust. The intake can be rotated in 90° increments if necessary.



This is a picture of the complete setup with a 25HP. Please contact your sales representative for specs.

On the 25HP pump the vacuum gauge will be installed on the *output* side of the filter.

Follow the yellow arrows on the pump for airflow direction.

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FPZ, Inc
 150 N. Progress Drive
 Saukville, WI, 53080 - U.S.A.
 Tel. (262) 268-0180
 Fax (262) 268-0415
 E-mail usa@fpz.com

87

TECHNICAL Three Phase Electric Motors

SS 0904

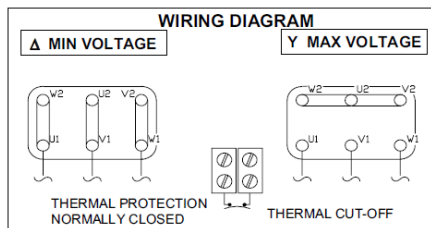
3-PHASE MOTOR

GENERAL SPECIFICATIONS:

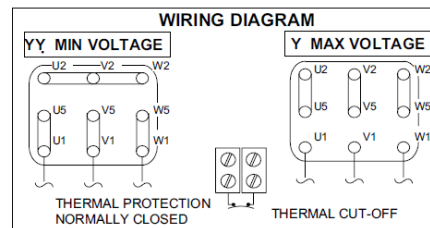
- 1- **Type:** 3-phase AC MOTOR - IEC 60034
- 2- **Marks:** cURus, CE
- 3- **Poles:** 2
- 4- **Frequency:** 60 Hz / 50 Hz
- 5- **Insulation Class:** F
- 6- **Enclosure:** TEFC
- 7- **Protection:** IP 55
- 8- **Thermal Protector:** KLIXON 150 °C
- 9- **Service Factor:** 1.15
- 10- **Max. Ambient:** 40°C
- 11- **Duty:** Cont.
- 12- **Construction:** Aluminium frame

POWER			60 HZ			50 HZ			STARTING CURRENT RATIO	CABLE ENTRY
HP	KW	SIZE	VOLTAGE	FLA 208 / 460	POWER FACTOR cos φ	VOLTAGE	FLA 230 / 400 (200 V)	POWER FACTOR cos φ		
0.33	0.25	63	208-230/460	1.5 / 0.7	0.75	230/400	1.4 / 0.8	0.70	3.9	M16
0.5	0.37	63	208-230/460	2.3 / 1.0	0.79	230/400	2.1 / 1.2	0.73	3.6	M16
0.75	0.55	71	208-230/460	2.7 / 1.2	0.85	230/400	2.6 / 1.5	0.78	3.8	M16
1	0.75	80	208-230/460	3.3 / 1.5	0.84	230/400	3.5 / 2.0	0.78	5.0	M20
1.5	1.1	80	208-230/460	5.0 / 2.3	0.86	230/400	4.5 / 2.6	0.82	5.6	M20
2	1.5	90	208-230/460	6.3 / 2.9	0.82	230/400	6.1 / 3.5	0.82	5.0	M20
3	2.2	90	208-230/460	9.0 / 4.1	0.87	230/400	8.5 / 4.9	0.81	7.1	M20
4	3.0	90	208-230/460	11.2 / 5.9	0.80	230/400	11.8 / 6.8	0.80	7.0	M20
		100	208-230/460	12.9 / 6.1	0.85	230/400	11.6 / 6.7	0.85	6.0	M25
5.5	4.0	100	208-230/460	17.5 / 8.1	0.88	230/400	14.0 / 8.1	0.88	6.2	M25
7.5	5.5	112	208-230/460	20.0 / 9.5	0.86	230/400	19.4 / 11.2	0.85	7.6	M25
		132	208-230/460	19.7 / 11.4	0.82	230/400	19.7 / 11.4	0.82	7.0	M32
10	7.5	112	208-230/460	26.0 / 12.5	0.88	230/400	25.6 / 14.8	0.87	8.2	M25
		132	208-230/460	26.5 / 15.3	0.87	230/400	26.5 / 15.3	0.87	6.4	M32
15	11.0	132	208-230/460	40.0 / 21.7	0.84	230/400	37.5 / 21.7	0.84	6.9	M32
20**	15.0	132**	208-230/460	54.0 / 26.0	0.86	200/400	(61.0) / 30.5	0.82	7.0	M32
		160	208-230/460	54.0 / 29.8	0.85	230/400	51.6 / 29.8	0.85	8.1	M40
25	18.5	160	208-230/460	63.0 / 34.8	0.87	230/400	60.0 / 34.8	0.87	8.5	M40

* FLA x Starting current ratio = starting current



6 LEADS MOTORS.
 208-230/460 V - 60 Hz
 230/400 V - 50 Hz



** 9 LEADS MOTOR. APPLICABLE TO 20hp SIZE 132
 208-230/460 V - 60 Hz
 200/400 V - 50 Hz

Specifications subject to change without notice. Alternate motor suppliers may be used.

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F4 Vacuum Pump

Thank you for purchasing your F4 vacuum hold down system. Please take a few minutes to read through this information. This system is very simple to set up and operate, however there are a few things to keep in mind during installation and operation.

Placement: Everyone's shop setup is different and the compact size of our systems allows for many different configurations. The switches are mounted on top of the machine and their location corresponds to the vacuum motors that they operate. You will need to have easy access to the top of the machine to operate the switches. **DO NOT** place the rear (non-manifold side) or sides of the machine tight against a wall, it will negatively affect the cooling of the vacuum motors. The rear and fan sides of the machine require a minimum clear space of 2 feet. The top of the machine **MUST** remain up or the internal valves will not operate correctly. The machine has adjustable feet and jam nuts to level and lock in the machine. If easy access to all sides of the machine is not possible you can simply separate the machine from the rest of the system at either the single 4" rubber boot or the multiple 2" rubber boots and move the machine for easy servicing. This machine needs to be installed in a space where the temperature does not change drastically and there is space for heat to dissipate. **DO NOT ENCLOSE THE MACHINE IN A SMALL SPACE.**

Plumbing the system: A good rule of thumb is the less length you use and fewer bends that you have to put into the system the better. The system comes with a manifold, to attach it simply loosen the hose clamps on the open end of the 2" rubber boots with a 5/16" nut driver and slide them onto the stubs that are located on the front of the machine and tighten them down. The manifold is symmetrical so it can be attached to the machine in either direction. After you run the 4" pipe from the manifold on your CNC machine simply loosen the 4" rubber boot on the vacuum system manifold with a 5/16" nut driver and slide it onto the pipe then tighten it down.

Wiring the system: It is recommended that a certified electrician run the circuit needed for the machine. The F4 requires a dedicated 30-amp 220/240-volt single phase circuit. **MAKE SURE** that there is nothing else wired into the circuit.

Operation: As mentioned above, the switches on the top of the machine control the vacuum motors. Each switch operates its own independent motor. The placement of the switches on top corresponds with which motor they operate. It is highly advised that you use a scrap/spoil board to prevent any foreign objects or debris from entering the vacuum system and the system be turned off if the scrap board is not being used. Make sure to cover your vacuum ports on your CNC table top if you are using T slots and clamps instead of a spoil board and vacuum hold down to prevent foreign objects from entering the vacuum system. To turn the system on simply press the green button on each of the switches that you would like to use. It does not matter which vacuum motor you choose to use or in what order you turn them on. It is advised to turn them on one at a time to prevent any power surging. The internal valves automatically open and close to regulate air flow. To turn them off simply push the red button. It is recommended that you figure out how many vacuum motors you want on before you start cutting. It is important that your shops ambient air temperature does not exceed **100 degrees F**. The machine will function above this temperature but this could negatively affect longevity. The fans are an important part of keeping the machine cool during operation and special care should be taken to make sure they are always operational and free of debris that could inhibit the fans operation.

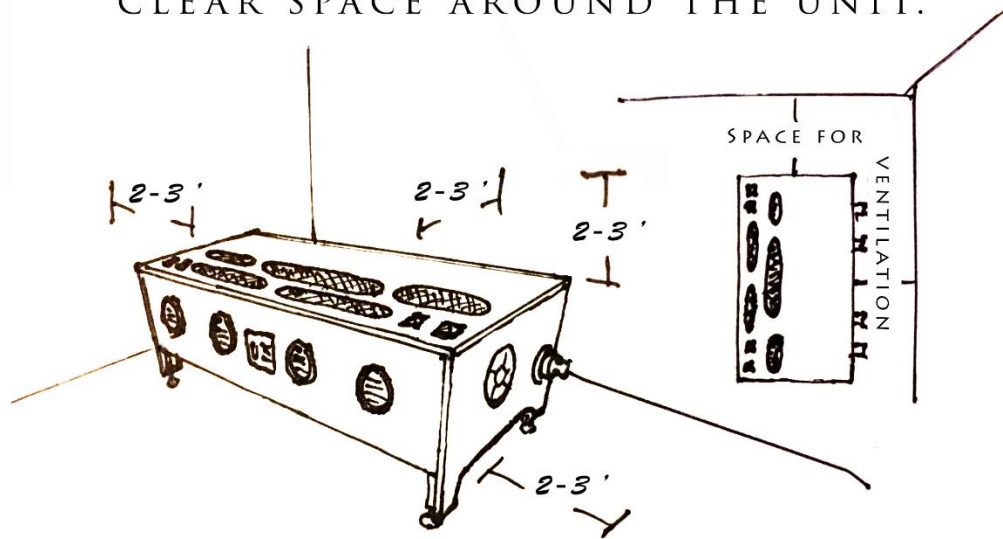
MORE IS NOT ALWAYS BETTER: Believe it or not, just because you have multiple vacuum motors does not mean that you should always use them. If you tend to cut full sheets that completely cover your spoil board it is very likely that you will only need to use one motor. Particularly if you are cutting large parts, leave a skin, cut non porous materials, or tape the edges of your spoil board. Make sure to only open the zone valves on your CNC machine that need to be open. If you cut smaller pieces, don't leave a skin, cut porous materials, and don't mask open areas or tape the edges of your spoil board, multiple vacuum motors will most likely need to be running. An easy way to tell how many vacuum motors you need on is to start with one motor and listen, then turn on a second one. If you hear a pulsing you should turn the additional motor off. If you do not hear pulsing after 2 motors are on you can continue to turn on additional motors and repeat the process. One thing to consider is that if you are not leaving a skin, or if you are machining away a lot of material on a porous sheet you will lose vacuum pressure as you run your part(s). In situations like this it is advised to start out with more vacuum motors than you need so that you still have correct hold down force at the end.

The following sheet also comes attached to all F4 boxes:

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INFORMATION:

WHEN SETTING UP YOUR NEW F4 LOCATION PLEASE REMEMBER TO LEAVE 2-3 FEET OF CLEAR SPACE AROUND THE UNIT.



THE F4 VACUUM SYSTEM MUST SIT ON THE LEVELING FEET TO OPERATE CORRECTLY.

THE SYSTEM PRODUCES HEAT WHEN RUNNING AND REQUIRES AIR FLOW TO COOL PROPERLY.

PLEASE CONSULT YOUR SHOP SABRE MANUAL BEFORE OPERATING.

THE MOTORS INSIDE YOUR F4 ARE BRUSHED MOTORS AND WILL NEED REPLACEMENT EVERY 1500+ HOURS OF SERVICE.

WE RECOMMEND CHECKING THE MOTOR BRUSHES EVERY 6 MONTHS OR 750 HOURS OF USE.

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The F4 system can run with anywhere from one to four motors active at a time. Often, customers will find sufficient hold-down power using only three or even two motors active. This will save time on brushes, as which motor(s) are active can be alternated, and allows the machine to continue running while motors are removed for brush changes. This also produces less noise. Using more motors does not increase the inches of mercury (inHg) that the vacuum can pull (the maximum force the pump can apply), but will increase the total air flow rate (CFM). If there are leaks around the spoil board or material sheet, material removed from the kerf, or large sheets with more surface area, then more flow from the vacuum can be desirable; although, ideally, leaks should be sealed.

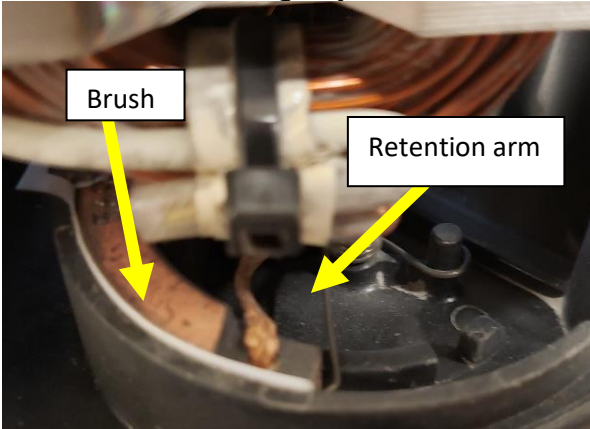
The F4 has four motors - each of which are brushed motors which **require changing brushes about every 1,500 hours and should be checked around 750 hours of use**. This will vary depending on the amount of use and the number of on/off cycles. To replace the brushes the rear panel of the F4 must be removed, as well as the individual motor covers. We recommend removing the entire motor during servicing for ease of access. Failure to replace brushes in a timely manner will cause motor damage that is not covered under warranty. New brushes can be purchased from the ShopSabre parts department. We have a video available that will walk through the process, which is available by going to <https://www.shopsabre.com/support/> and logging in to ShopSabre University. The password for the university access will change periodically and can be found by looking in the ShopSabre Router Facebook group in a comment to the rules section or by calling ShopSabre. The existing crimp connector must be cut, the magnet wires' insulation must be removed (scraping with an X-Acto knife works well) before crimping on the new brushes. Each motor has two brushes.



Step 1: Remove the motor from the machine.

Remove the casing from the motor by first removing these three screws.

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Step 2: Identify the brush and the retention arm.



Step 3: Move the retention arm back and lock it in place in the holding area.

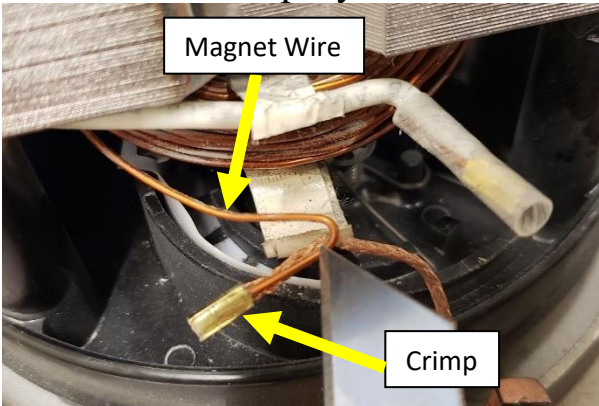


Step 4: Remove the brush, cut the zip tie and the tape.

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Step 5: Cut the existing crimp from the wire. This will most likely involve cutting the magnet wire itself.

Scrape the magnet wire around all sides until the coating is entirely removed in the area where the new crimp connector will be.

If this is not done correctly, the motor will not run. This is a critical step.

Replace the brush and re-crimp the new wire. Repeat on the other side of the motor for the second brush.

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- Changing Tools
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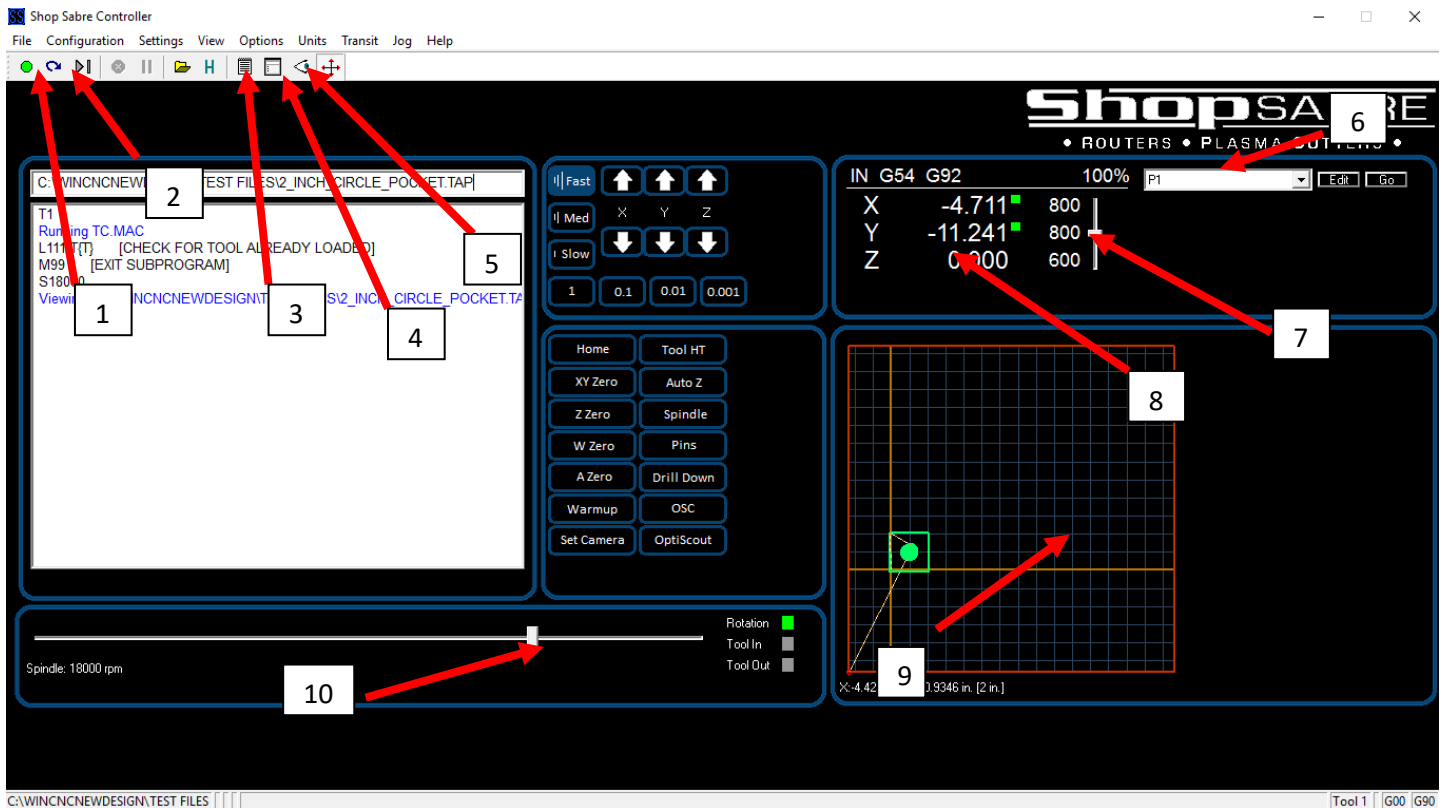
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Features of the ShopSabre Controller

1. Start Button - Starts and runs all programs
2. Restart Button – Restarts a program from where it was stopped
3. Edit Pad - Allows you to edit the G-Code
4. Simulation Button - Tell you what and where an error is in the G-Code
5. View Button - Will display the part on grid
6. Position Recorder - Allows you to save positions across the table
7. Feed Rate Override
8. Coordinates – If green squares are next to the coordinates, the coordinates are all relative to where you set your last XYZ zero. If no green squares or red squares, they are relative to the machine home position.
9. Preview window
10. Spindle RPM bar (optional)



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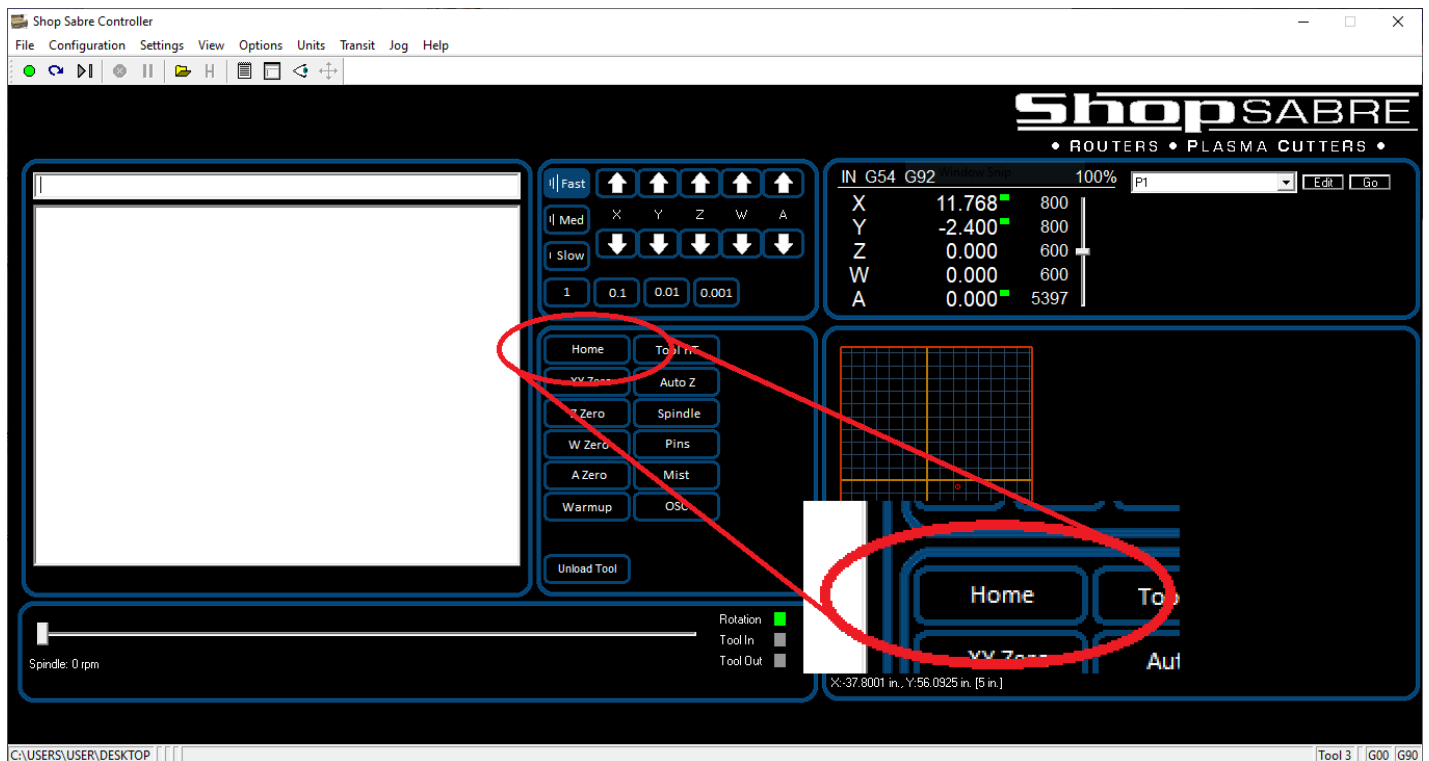
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Homing the Machine

Before the machine will operate it needs to find its home location. During the homing process it will move all axes until the limit switches are pressed. This allows the machine to locate where it is on the table. In **Figure 6A** it shows the "HOME" button on your CNC control screen. Mouse over to the "HOME" button and single click. At this time your machine will start moving into its "HOME" position which is located in the front left corner of the table. **Note: The front left corner is the default home position. The machine will always touch the switches in that corner, even if the work zero location has been changed.** Once the machine has reached its "HOME" position it is ready to start cutting.

The home position is not necessarily the same as the work zero position unless the pop-up pins are being used as a reference location. The work zero can be set anywhere on the table as needed. Homing the machine will *not* lose the work zeros.

Figure 6A



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Quick Keys



1. **Arrow Keys:** X/Y axis moves
2. **Page Up/Page Down:** Z axis up/down
3. **Home/End:** 4th axis rotation or W axis up down
4. **Tab Key:** Command/Job history window
5. **F1:** Help
6. **F2-F4:** Transit speeds: slow, medium, fast
7. **F5:** Clear screen
8. **F6-F9:** Jog increments: 0.001, 0.01, 0.1, 1
9. **Spacebar:** Pause a running program
10. **Insert/Delete:** Increase/decrease feed rate override by 1%
11. **Number Pad + and -:** Spindle speed increase/decrease. **Note:** If you have a J-Tech laser, + and - control the laser power. To change spindle speed with a J-Tech, hold shift while pressing + or -.

Loading Tools – ISO30 Automatic Tool Changer

At the end of the working day, always remove the tool-holder cone from the spindle, to avoid any problem of it sticking. Replace it with a clean tool-holder cone at room temperature, to protect the inside of the spindle from the outer environment.

ATC spindle purchases include ISO 30 tool cones ER 32 collets in various quantities depending on the order, a spanner wrench and chuck holder (Pictures displayed below).

A torque wrench is not required for this step. However, if one is present, we recommend 90 ft lbs. when tightening the nut.

ISO 30 Cone & Nut



ER 32 Collet



Spanner Wrench



Tool Chuck Holder



Note: The chuck holder will need to be secured to either the CNC table or on a work bench that will securely hold the chuck holder. Also note that if mounting the chuck holder to the CNC table make sure it will not interfere with the movement of the table.

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To change a bit, first need to put in the correct collet into the nut of the ISO 30 cone. Grab both the ER 32 collet and nut, and with mild force "click" the collet into place. Below, a picture illustrates what the nut should look like after having been correctly "clicked" into place. **Note: if this is not done correctly and the machine cuts with this collet out of place it WILL damage the cone, collet and/or spindle bearings and it WILL NOT be covered by your warranty.**

Once correctly clicked into place, hand-tighten the nut onto the ISO 30 cone. After having hand-tightened the nut into the collet, insert the ISO 30 cone into the chuck holder (Figure 7B) by pressing down on the black lever. When the cone is securely in the chuck holder release the button locking the cone into place. Take the spanner wrench and align the grooves in the wrench to the collet nut (Figure 7D). In a clockwise rotation tighten the collet nut with about 100 ft lbs of torque. The cone is now ready to be put into either the tool rack or into the spindle itself.

Figure 7A



Pictured: The wrong way to install a collet. Do NOT insert a bit before inserting the collet.

Figure 7B



Pictured: The right way to install a collet. Install the collet fully seated into the nut BEFORE installing the bit. Tightening is the last step. The following page shows this step by step.

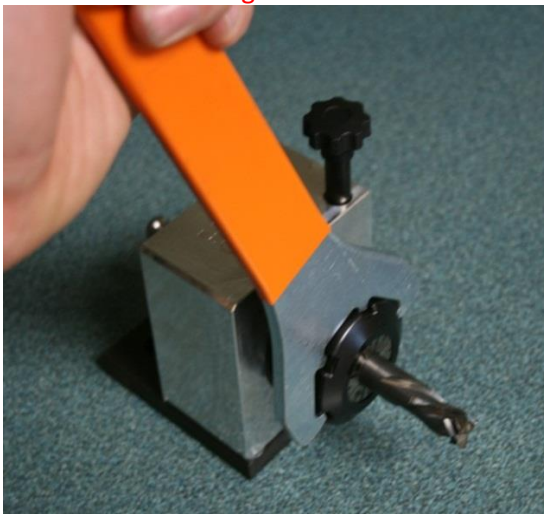
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Figure 7C



Figure 7D



HSD recommends a dry lubricant on the tool holders called LUSIN® PROTECT G 31 ANTI-CORROSIVE/LUBRICANT. Although not required, it can help to reduce rusting of the tool cones in humid environments.

Surface rust can also happen on tool cones if water is in the air lines. This can cause permanent damage to the spindle and tool holders. If water is in the air lines, purchase either a desiccant or refrigerated drying system sufficient to clear the humidity from the lines. Water damage can cause rust and will not be covered under warranty.

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Loading Tools – HSK Automatic Tool Changer

First, the bits must be loaded into their respective tool holders.

HSK Cone & Nut



ER 32 Collet



HSK Tool Chuck Holder



Spanner Wrench



Note: The chuck holder will need to be secured to either the CNC table or on a work bench that will securely hold the chuck holder. Also note that if you plan on mounting the chuck holder to the CNC table make sure it will not interfere with the movement of the table.

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To change a bit, first put in the correct collet into the nut of the HSK tool holder. Grab both the ER 32 collet and nut, and with mild force "click" the collet into place. This illustrates what the nut should look like after you have correctly "clicked" the collet into place. **Note: if this is not done correctly and the machine cuts with this collet out of place it WILL damage the cone, collet and/or spindle bearings and it WILL NOT be covered by your warranty.**

Once correctly clicked into place, hand-tighten the nut onto the HSK tool holder. After you have hand-tightened the nut into the collet, insert the HSK tool holder into the chuck holder by pressing down on the black lever. When the cone is securely in the chuck holder release the button locking the cone into place. Take the spanner wrench and align the grooves in the wrench to the collet nut. In a clockwise rotation tighten the collet nut with about 100 ft lbs of torque. The tool is now ready to be put into either the tool rack or into the spindle itself.



Pictured: The wrong way to install a collet. DO NOT insert a bit before inserting the collet.



Pictured: The right way to install a collet. Install the collet fully seated into the nut BEFORE installing the bit. Tightening is the last step. The following page shows this step by step.

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After the machine is homed it is now time to install tools into the rack.

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Collet Spindle - Changing Bits & Collets

If the machine has a collet spindle it includes two spanner wrenches and three ER 25 collets. If extra collets were purchased, they will also be shipped with the machine. (Pictures Below)

Collet & Collet Nut



Spanner Wrenches



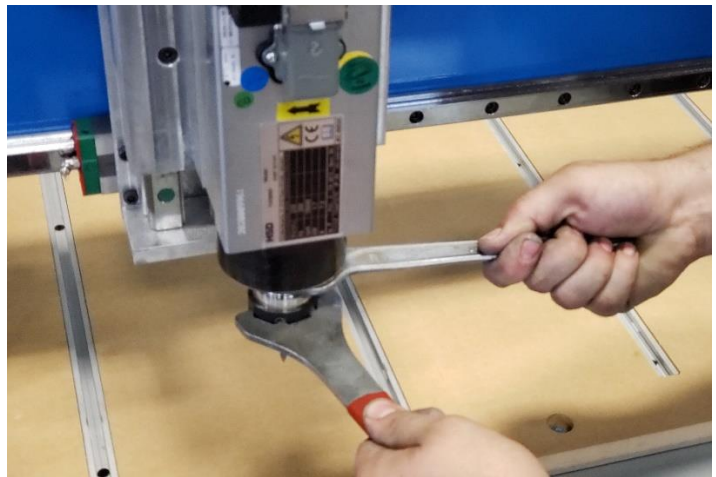
To change a bit, first put in the correct collet into the collet nut. (Figure 8A) Grab both the ER 25 collet and Nut and with mild force "click" the collet into place. In Figure 8A it illustrates what the nut should look like after correctly "clicking" the collet into place. **Note: if done incorrectly and the machine cuts with this collet out of place, it WILL damage you're the collet, nut and/or spindle bearings and it WILL NOT be covered under warranty.**

Once you have correctly clicked the collet into place you will need to load the collet into the spindle. To do this, hand-tighten the nut onto the spindle. At this point, you can insert the bit and finish tightening the nut. When the nut is tight use both spanner wrenches with about 20 pounds of force and tighten the collet to the spindle (Figure 8B)

Figure 8A



Figure 8B



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Quick-Change Spindle - Changing Tool Holders

If you do not have a quick-change collet spindle, please skip this section.

If the machine has a quick-change spindle, the bits and collets will change identically to the regular collet spindle in Section H. However, the quick-change spindle is designed to have bits pre-loaded in multiple tool holders and for those holders to be swapped-out. To install a tool holder, turn the gold ring on the spindle until you can see the set screw hole (circled in **9A**). Line up the tool holder set screw hole with the one on the spindle and insert the tool holder upward until feeling it seat into position in **figure 9A**. Insert the allen wrench and turn clockwise (**Figure 9B**). This should lock the holder into position within the spindle. To remove the holder, reverse this order. The tool holder will not drop out until the wrench is removed. Be aware that turning the wrench too far counter-clockwise will cause the wrench to stick inside until it is rotated slightly clockwise again.

Figure 9A



Figure 9B



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A Note Before Proceeding:

During automated processes such as tool changes and tool measures, aborting the operation will require the machine to be rehomed.

Changing Tools - Automatic Tool Changer

If the machine was purchased with an automatic tool changer (ATC), the machine will have a tool rack mounted on the side or on the back of the table (Figure 10c)

Note: The standard configuration for a tool rack will change depending on model of machine. The next steps are identical even if you special ordered a different tool rack configuration.

To automatically change a tool, in the input bar, type the letter "T" with the desired tool number after with no spaces (Figure 10A) At this point the machine will automatically move and change the tool and return to the last location. **Note:** In Figure 10B it shows the tool the machine thinks it has loaded in the spindle. Make sure this number matches what is actually in the spindle BEFORE you make a tool change. If the incorrect tool holder is in the spindle and you try to change tools automatically damage will occur.

To match the correct tool on the rack with the tool number on your ShopSabre screen, simply count from the front of the table to the back or left to right for Pro and IS series machines (Figure 10C). The position closest to the front (or left) of the table is tool number 1. **If the tool does not match**, hold the tool cone while pressing the green button located on the side of the spindle (Figure 10E). This will release the tool in the spindle. After the tool is released, put it in the correct position on the tool rack.

To insert a tool, simply put the cone in the spindle and, with constant upward force, press the green button to make the spindle grab the cone and pull it upwards, locking it into position. (Figure 10D)

Note: Do not stop or abort during a tool change operation. If a tool change is aborted, the machine may not recognize that it has picked up a new tool. If the tool in the spindle does not match what the software thinks is in the spindle the result may be damage to your machine during the next tool change operation or may result in a tool being dropped from height. If an abort must be performed, be sure to check that the tool it actually has is the same as the tool it thinks it has (circled in Figure 12B). The machine will require a homing operation if it is aborted during an automated process like changing tools.

If the machine has been aborted during a tool change operation, it will require rehomeing. If it is engaged with a tool in the rack, type in “m11c1” and press enter to open the jaws. Then rehome the machine. When it is done homing, type in “m12c1” and press enter to close the jaws. Make sure the control screen shows “No Tool” at the bottom right (Figure 10B). If not, manually load the indicated tool into the spindle jaws by using the green button on the side of the spindle.

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Figure 10A

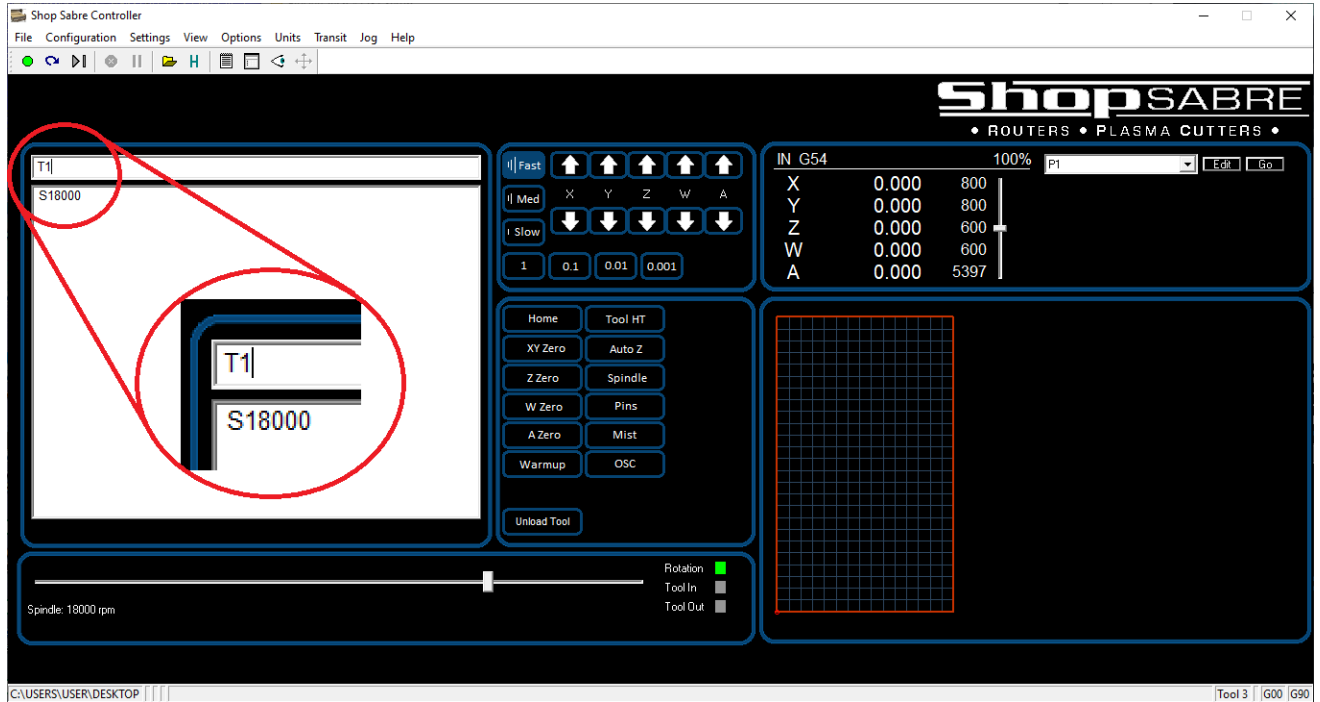
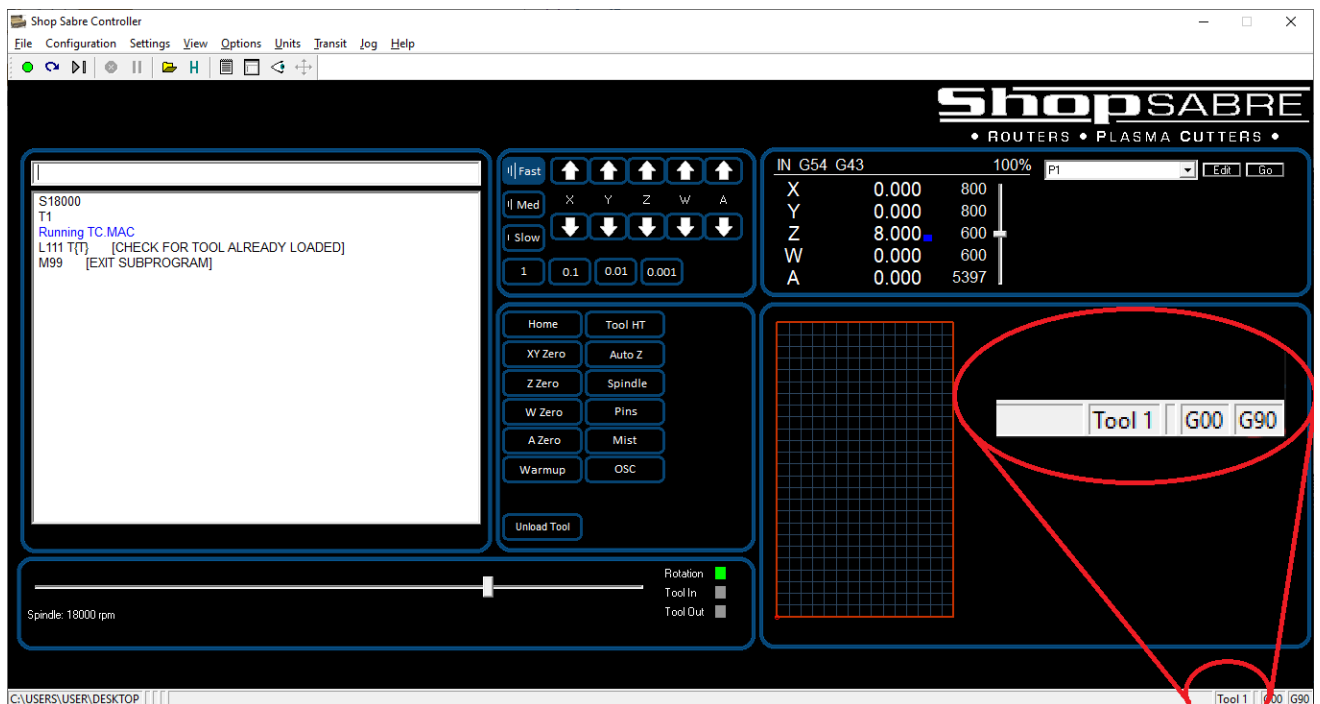


Figure 10B



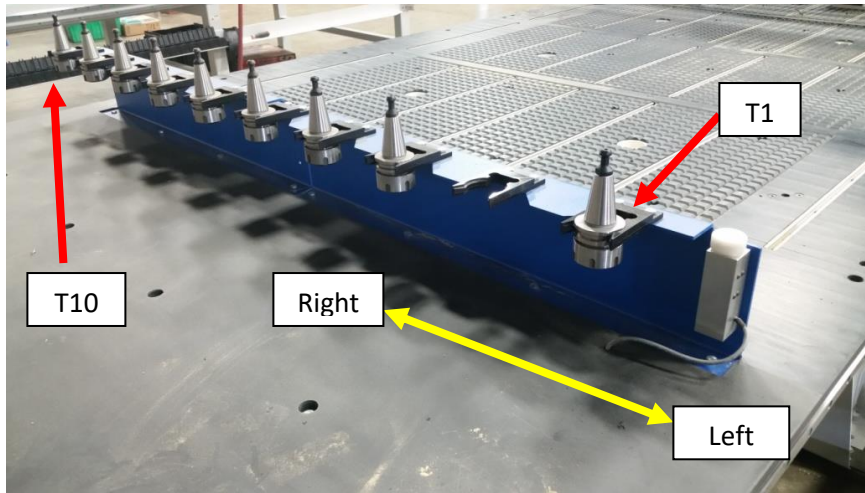
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Figure 10C



This picture is from the back of an IS series machine looking forward.

To unload a tool without grabbing a new tool, you **must** use the Unload Tool button on screen to remove a tool. This will unload the tool, move forward of the rack and close the jaws automatically. **Do not** use "T0". In addition to not automatically closing the jaws, **the T0 command will not grab the DustDock skirt, if you've purchased that option.** Remember, the machine always expects the dust skirt to be on the spindle.

Figure 10D

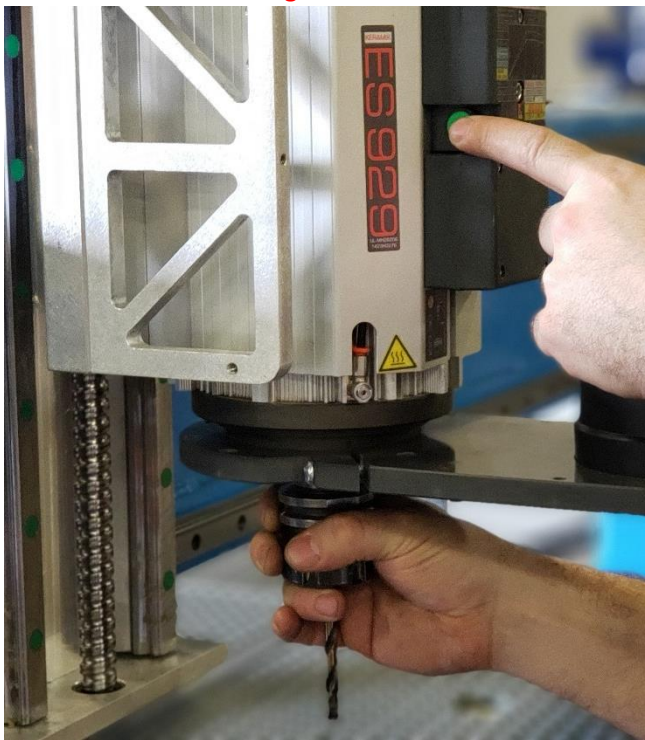


Figure 10E



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Measuring New Tools

If the machine has a tool measure switch you will either have a switch mounted to the tool changer tool rack for ATC, (Figure 11A), the by itself on the back of the machine for collet spindles (Figure 11B) or on the upright for RC machines. These next steps will show how to properly measure and store new cutting tools. (ATC steps on next page). **If you have a DustDock skirt (machines with the yellow DustDock arm) you will want to remove the skirt first.**

Figure 11A



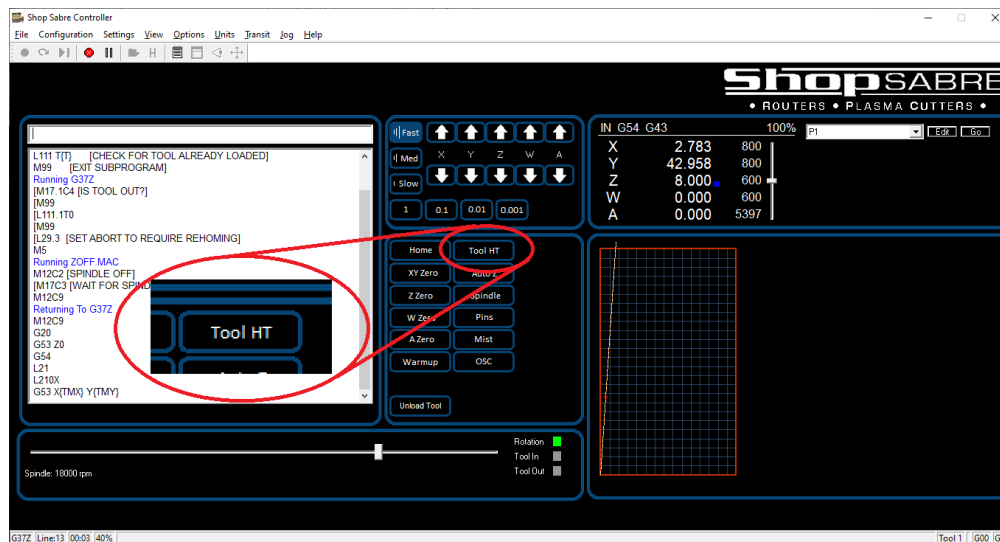
Figure 11B



To measure a tool, the tool must first be loaded in the spindle.

- On a collet spindle, insert the bit into the spindle (page 54).
- On a tool changer, command the machine to grab a tool (page 48)

Once the bit is properly inserted your new cutting bit, on your ShopSabre control screen find the button labeled "Tool HT" and single click this button. At this time the machine will automatically move over to the tool switch and touch off measuring and storing the new cutting bit.



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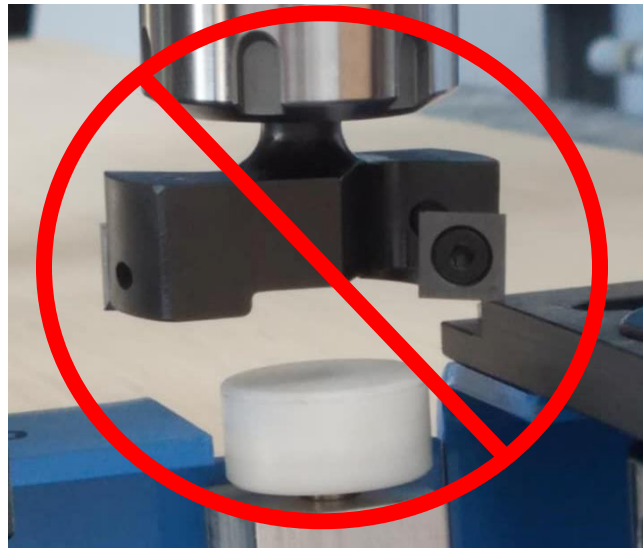
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If the machine has a collet spindle, this operation will need to be performed every time a new bit is inserted into the spindle. **Be sure to set the tool height before the first Z0 is set for cutting.** After that, simply do a tool height after each bit change. If these operations are done in reverse order, any subsequent tools will be cut at the wrong depth.



There are some bits that cannot be touched off on the tool measure switch due to their size or geometry. A spoil board cutter is a common example. **On a collet spindle**, the blades will simply miss the white pad all together. **On an ATC**, the blades can hit the tool forks and will cause a servo to go offline.



Because a spoil board cutter should *only* be used to flycut spoil boards, most customers do not keep it in their tool rack. Manually remove whichever bit the spindle already has and set it aside (do *not* put back in the rack by hand). Insert the spoil board cutter, and set your z0 like normal. If you get a Z low boundary error while trying to set the zero, move the bit farther out of the tool holder and try again. When done, replace the previous bit into the spindle.

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Automatic Spindle ON/OFF & Spindle Speed

If you ordered your machine with ATC (automatic spindle on/off) and spindle speed your machine will be controlled by the software. **Note: if you ordered a Milwaukee router, automatic spindle speed is not an option.** If you are unclear about your machine options please refer to your purchase agreement or call your sales representative

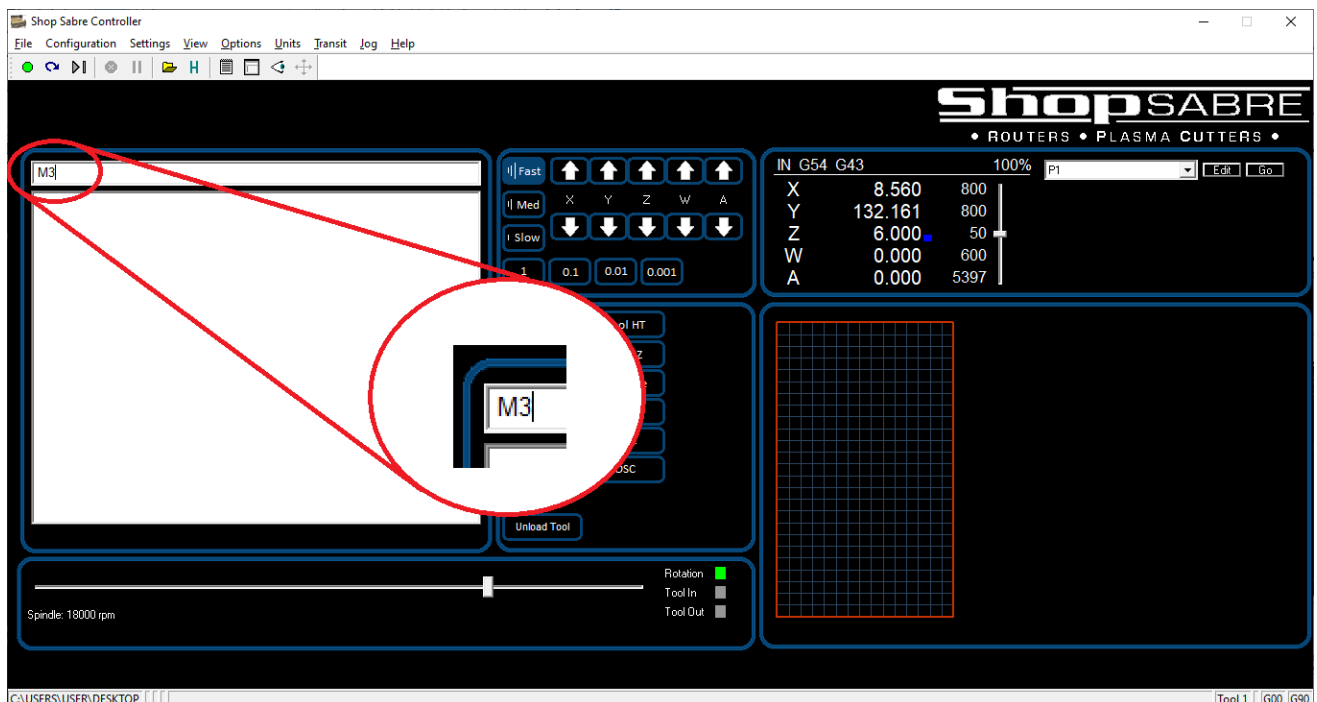
To change the spindle speed in the input bar type "S" and the desired speed with no spaces or drag the slide bar to the appropriate speed.

To turn your spindle on in the Input control bar type M3 (Figure 12A). (**Note: If no speed must be set first.**)

To turn your spindle off in the input control bar type M5 (Figure 12B)

Figure 12C shows an example of setting the spindle speed to 18,000 RPM **Note: you can change the spindle speed without the spindle being turned on.** Figure 12D shows an example of what the VFD should look like after setting the spindle speed. **Note: in Figure 12D this VFD is set to 18,000 RPM. Depending on model, the digital display on the VFD may not display the last digit.**

Figure 12A



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Figure 12B

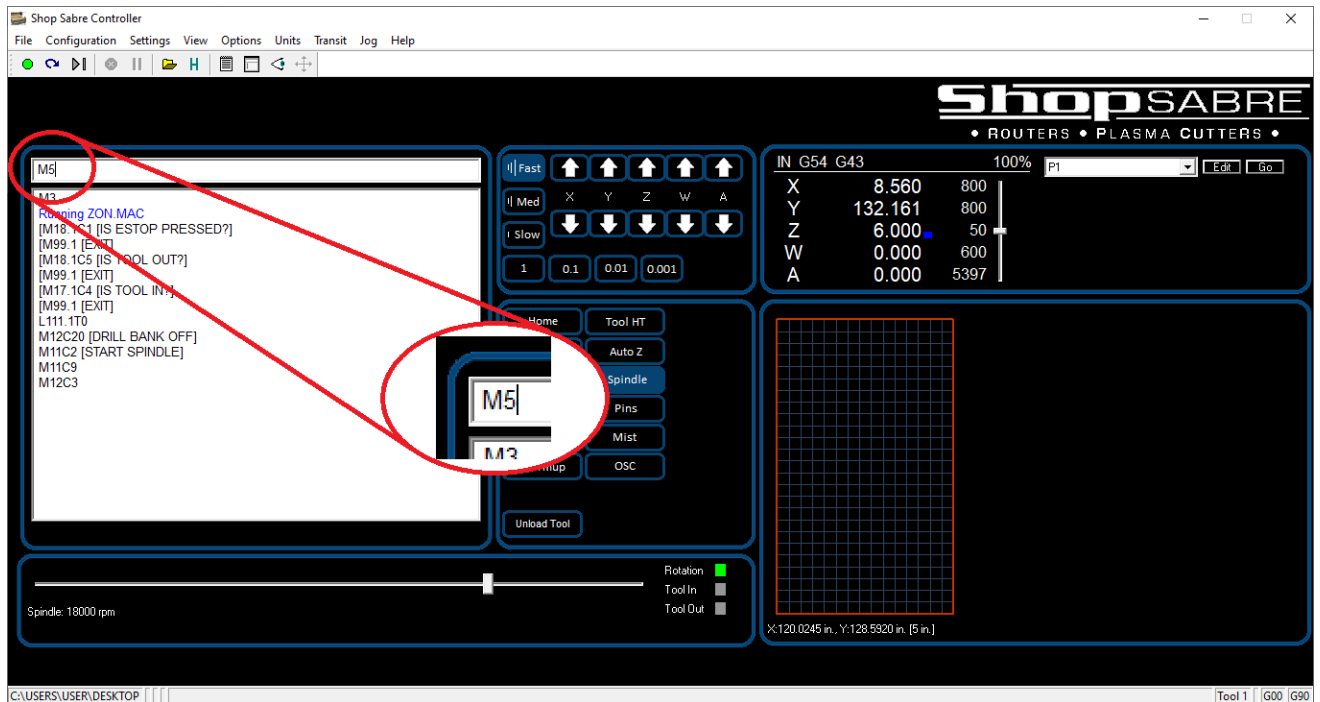
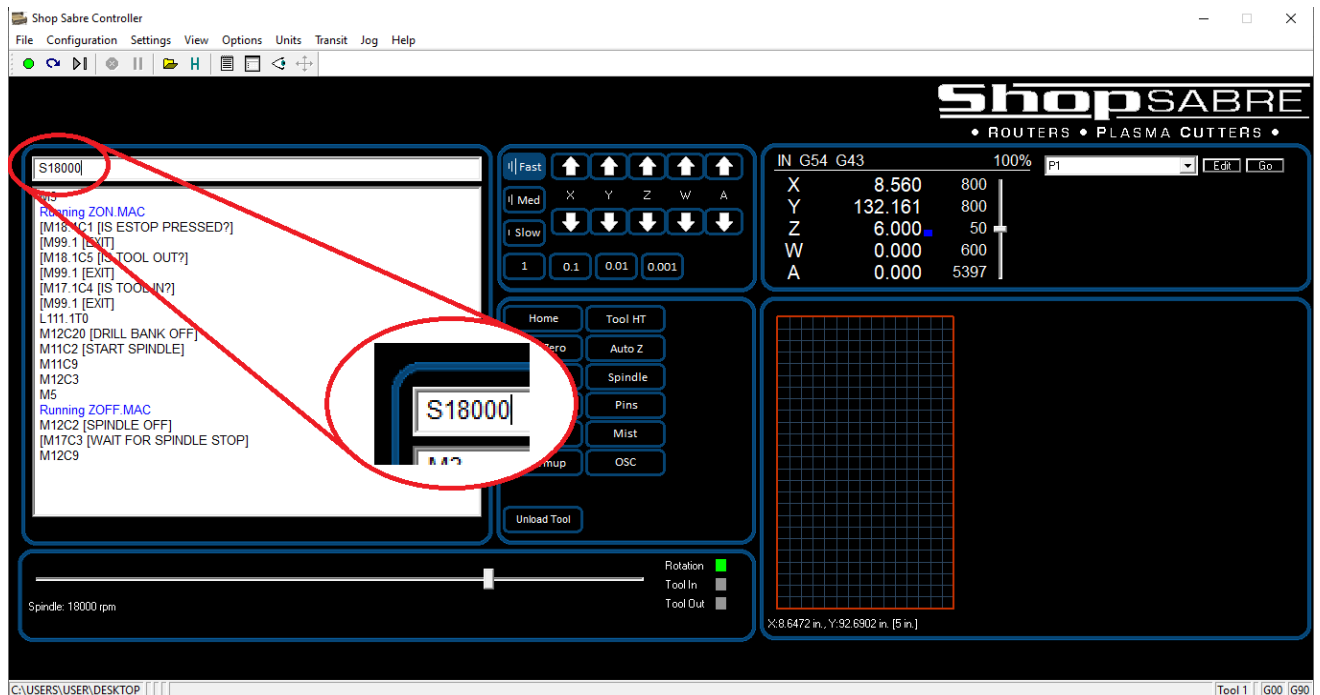


Figure 12C



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Figure 12D



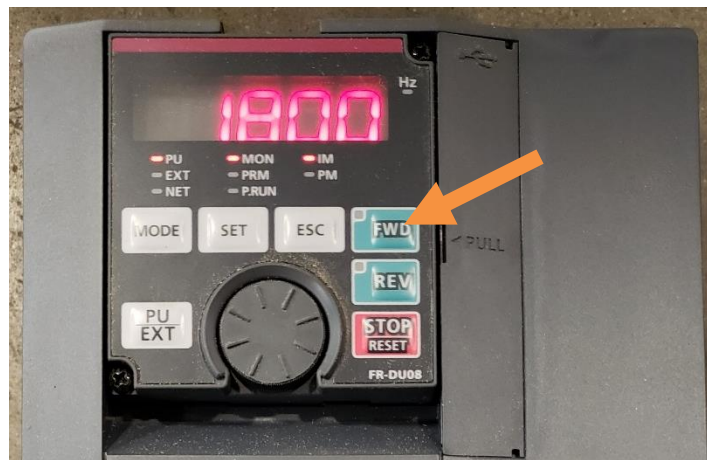
Mitsubishi VFDs have only 4-digits, so will display 18,000 RPM as “1800”.

Manual ON/OFF & Spindle Speed

If you have an ATC spindle or purchased automatic spindle on/off, please skip this section.

If the machine was not ordered with automatic spindle On/Off or spindle speed, the router or spindle will need to be turned on manually (please refer to the sales agreement to find out if the machine has spindle speed). To turn your spindle ON, press the FWD button located on the front panel of the VFD (Figure 13A). To turn your spindle OFF, press the STOP button located on the front panel of the VFD (Figure 13C). To set your spindle RPM, turn the dial located on the front of the VFD Clockwise to increase the speed and counter clockwise to decrease the speed. Once the desired speed is selected, press the SET button located on the front panel of the VFD (Figure 13B). Your exact model may vary.

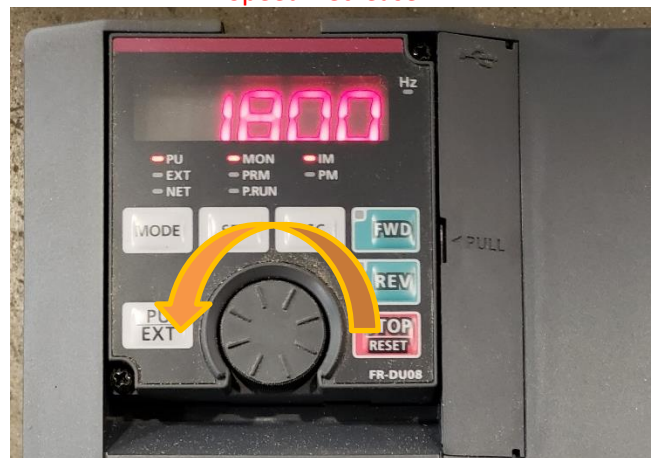
Figure 13A



Speed Increase



Speed Decrease



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Figure 13B

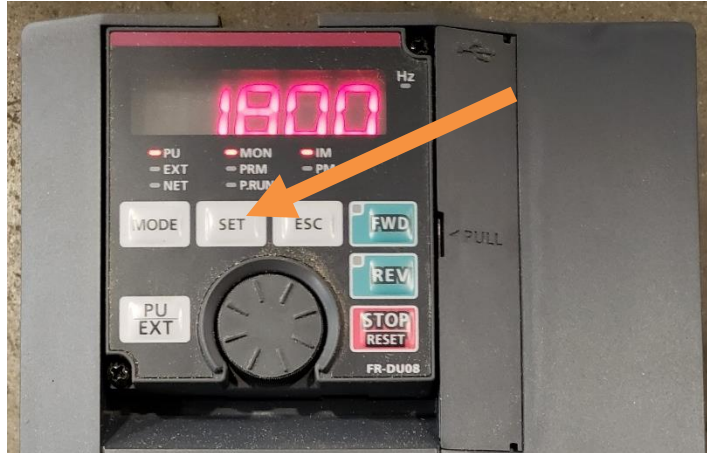
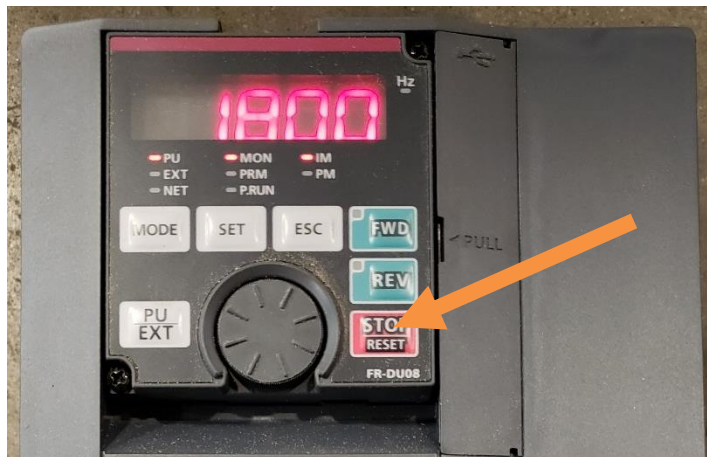


Figure 13C



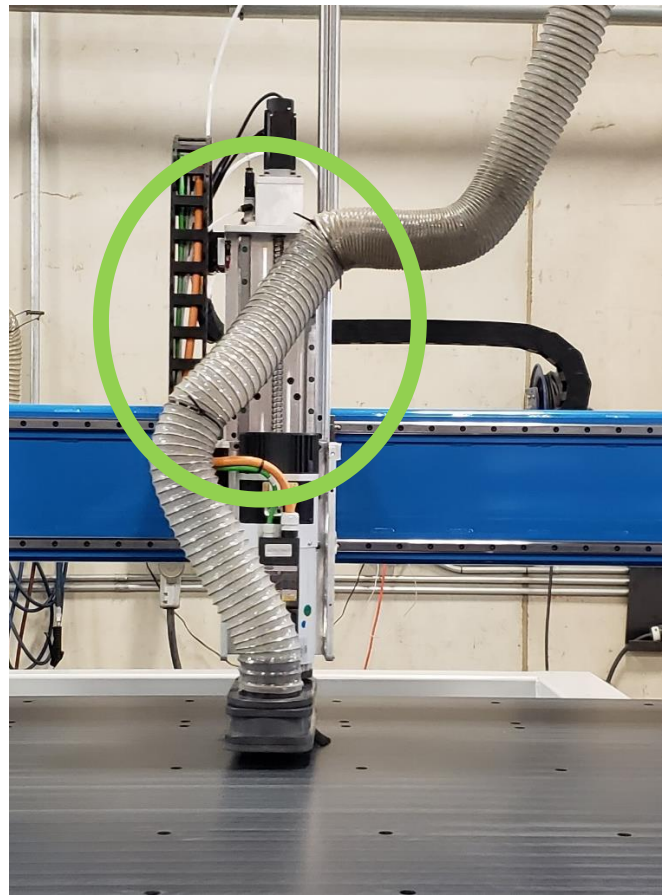
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Mounting the Dust Hose

There are two primary ways customers will mount the dust hose to the machine: hanging from the ceiling with enough slack for gantry movement and tying it to the cable track. If the second method is used, the placement of the hose is very important. In both cases, the hose needs to have a metal spiral (not plastic) and be grounded on both sides to the frame of the machine and the dust collector. See next page.

The wrong way: the dust hose will touch the X limit switch and cause the machine to be in the wrong position, or jam the hose and cause damage

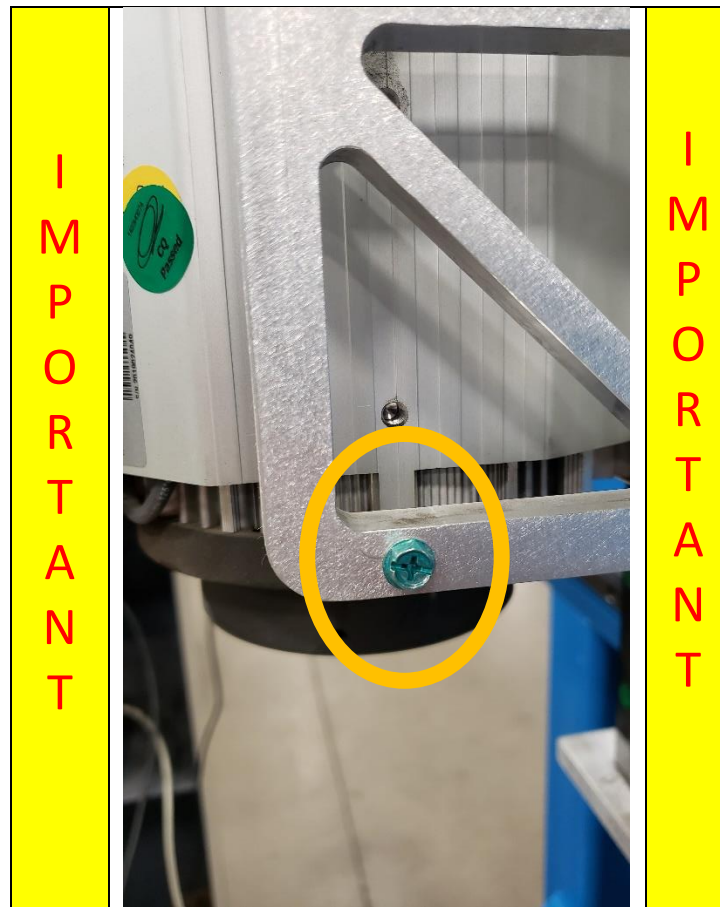
The right way: the dust hose is out of the way of any moving parts and has enough slack to extend the entire length of the Z travel without interference



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In order to avoid static buildup that can cause the machine to lose position over time, you must ground your dust collection hose. Your dust hose must have a *metal* reinforcement spiral. ShopSabre has provided a grounding bolt on the right spindle stiffener plate (circled in orange above). Strip the plastic on the hose back, crimp a wire to the reinforcement metal inside the hose, and run that wire to this bolt using a ring terminal.

Additionally, if any hard pipe is used make sure it is metal. PVC hose will hold static and can cause loss of position.

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DustDock Operation

If you do not have the DustDock, please skip this section.

If a DustDock was purchased with the machine it will come with the yellow DustDock arm pre-installed. For all machines *except* an IS612 this arm will extend beyond the front of the machine and requires additional clearance. An IS612 has a different style arm that is mounted on the tabletop at the back of the machine.

**Pro 404, 408, 510
IS408, 510**



IS612



During tool changes the machine will place the Super Spacer dust skirt into the DustDock, change tools, and come back to grab the skirt. This is all done automatically with no input required from the user. **Note: The dust skirt should always be installed on the spindle and never manually placed into the DustDock arm. If the skirt is removed from the spindle, replace it directly onto the spindle and not into the Dock.**

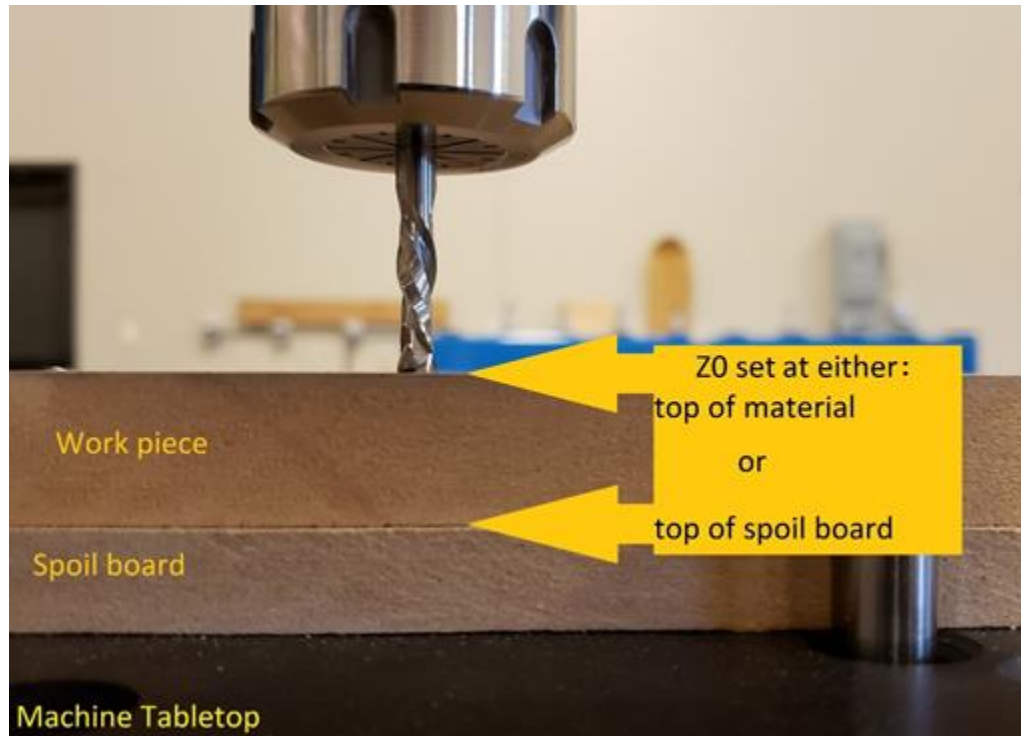
Also note: The DustDock is primarily designed for sheet goods. Running very long bits with very tall material may cause a collision between the two when the spindle moves to the DustDock height to return the skirt. If this affects you, you may wish to contact tech support.

It is also important to keep this arm level. If it gets bumped or hit it may shift up or down and the magnets of the dust skirt may not grab properly.

If this option was not purchased, it may be available as an in-field add-on to Pro and IS series machines. Not all machines are compatible with the DustDock. To discuss these options, please call our tech support department.

Making A Spoil Board

All machines come with a tabletop already installed from the factory. **This tabletop is NOT a cutting surface.** In fact, the machine has a software protection that will prevent any measured tool from cutting into this tabletop, and as a result it rarely needs to be replaced. In order to fully cut through the work piece, a 'spoil board' or 'waste board' will need to be installed underneath the work piece on top of the existing tabletop.



This spoil board will need to be 'flycut' or 'surfaced' first. This is important on every machine because it will make the surface flat for cutting. Additionally, for machines with vacuum hold down it will open up the pores of the material and should be done on both top and bottom sides of the board. This board does NOT need a grid or holes cut into it because the vacuum should pull straight through the board. For those with vacuum hold down, flip the board and repeat the process on the other side.

This means the material choice is important. Typically the MDF from a local lumber yard or big box store is sufficient. Often an LDF or Ultra-lite MDF, such as Trupan, works well.

ShopSabre has a video about creating the flycut program which can be found in the link below. It is a very simple program – make a rectangle and use a 'pocket' toolpath to cut 0.02" to 0.04" from each side. If there are any low spots in the board after cutting, lower the z0 to the new surface and run it again. See the next section for how to set the z zero.

https://www.youtube.com/watch?v=IYYhdjF8Jl8&ab_channel=ShopSabreCNC

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Typically this board should start at $\frac{3}{4}$ ". As the board gets cut up from cutting through parts, surface it down further until it reaches around $\frac{3}{8}$ ", at which point it should be replaced. As the board gets thinner it will have more of a tendency to curl. If this happens, flip it over and begin surfacing from the other side. If the curl is too extreme, where it will no longer sit flat, it is time to replace the board. This will often happen as humidity gets pulled out of the board by the vacuum.

There are reasons to choose both positions for Z0. Many materials have a nominal thickness but actually come in differently (i.e., MDF may say 0.75" but actually is 0.74 or 0.76 and can even vary across the sheet). Some materials can have 10% variations in thickness and still be within tolerance (i.e., 1" material could be 0.9" or 1.1" and still be considered good). Going from the top of material, z zero can be changed more easily and can also control the depth of cut from materials that may be different from their nominal thickness. Zero at the bottom of the material means more accurately cut through the part and less wear on the spoil board, and also accurately controlling the material remaining in a pocket regardless of the actual thickness of material. This is typically faster as well as z0 only needs to be set after the spoil board is planed. Most customers cutting in a production setting set z0 at the top of the spoil board.

Bit manufacturers make spoil board cutters – these are bits made specifically and *only* for this purpose. A spoil board cutter **should not** be used for anything else (pockets, dados, or flattening lumber). They are not designed to give a perfectly smooth cut. Every manufacturer rates them a little differently, but they typically have a maximum cut depth of 0.05" and 10k RPM maximum spindle speed. See [Common Bit Types](#) on page 131 for a picture of a Vortex 7025 spoil board cutter.

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Setting a Work Zero

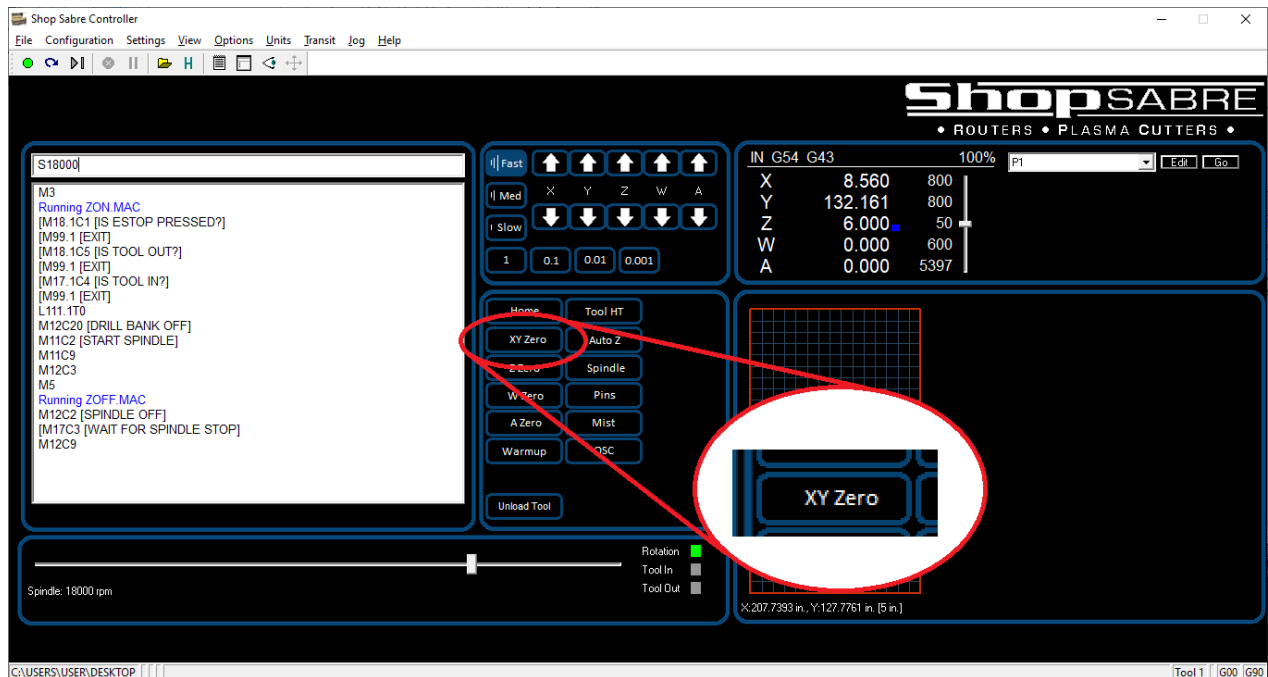
For more information on setting a work zero, watch our video on YouTube: [Setting a Work Zero](#)

Now it's time to set a working zero. Set the piece of scrap material on the table and move the machine so that the spindle is centered over the front left corner of the material (Figure 14A). On the control screen, single click the "XY Zero" Button (Figure 14B). You have now just set a temporary work position. Now bring down your z axis to the very top of the material and single click the "Z Zero" button. You now have set a temporary Z work position.

Figure 14A



Figure 14B



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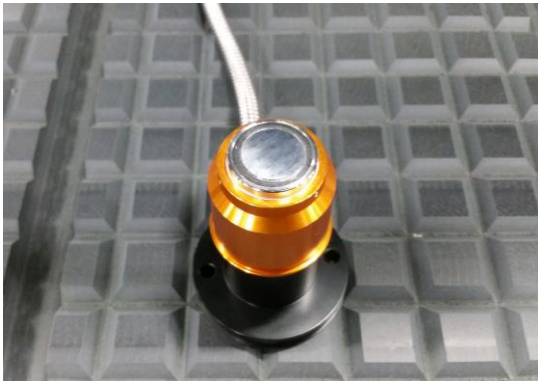
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Using the Material Height Touch Pad

For more information on Material Height Touch Pad, watch our video on YouTube: [Material Height Touch Pad](#)

If a material height touch pad was purchased, there will be a device similar to the picture on the left below, labeled "Current Generation". These next steps will teach you how to properly set up and use the touch pad. **The older Tormach touch pads (the black pad below) will require regular maintenance due to oxidation on the internal contacts. This should be done if you frequently receive errors such as "soft limit exceeded z+" or the z height is off by 1/8". Refer to the section on height pad maintenance for cleaning instructions.**

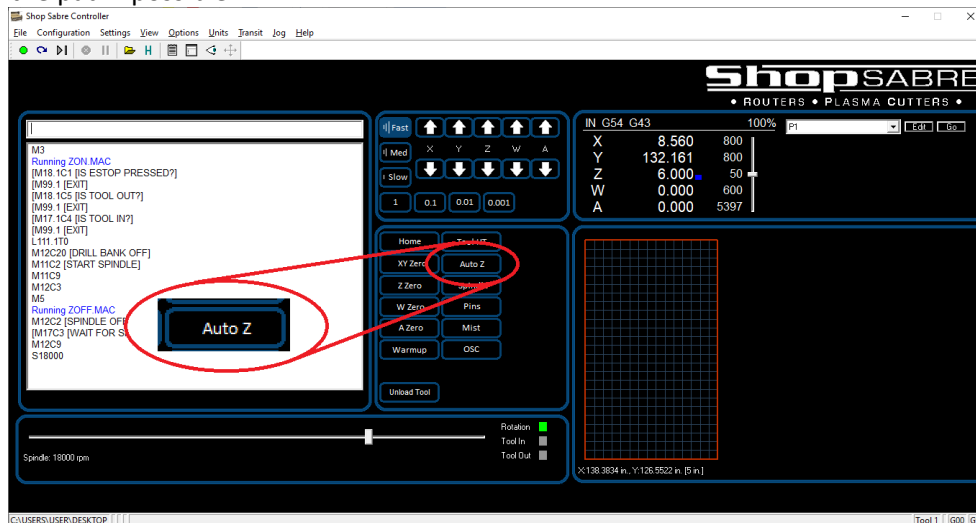


Current Generation



Last Generation

First, make sure the height pad is plugged into correct cable. This cable is near the spindle, either in the Z cable track or zip tied near the Z motor, depending on model and will be labeled "Height." The pad can be used anywhere on the table. Place the touch pad onto the surface where the Z0 should be located. Now with the arrow keys, jog the machine over to the touch pad (please refer to the section for quick keys.) Lower the Z axis down to about 1" over the touch pad. On ShopSabre screen locate and press the "AutoZ" button. At this time the Z axis will lower automatically, touching off the pad twice and storing the Z0 position. Try to get the bit in the middle of the pad if possible.



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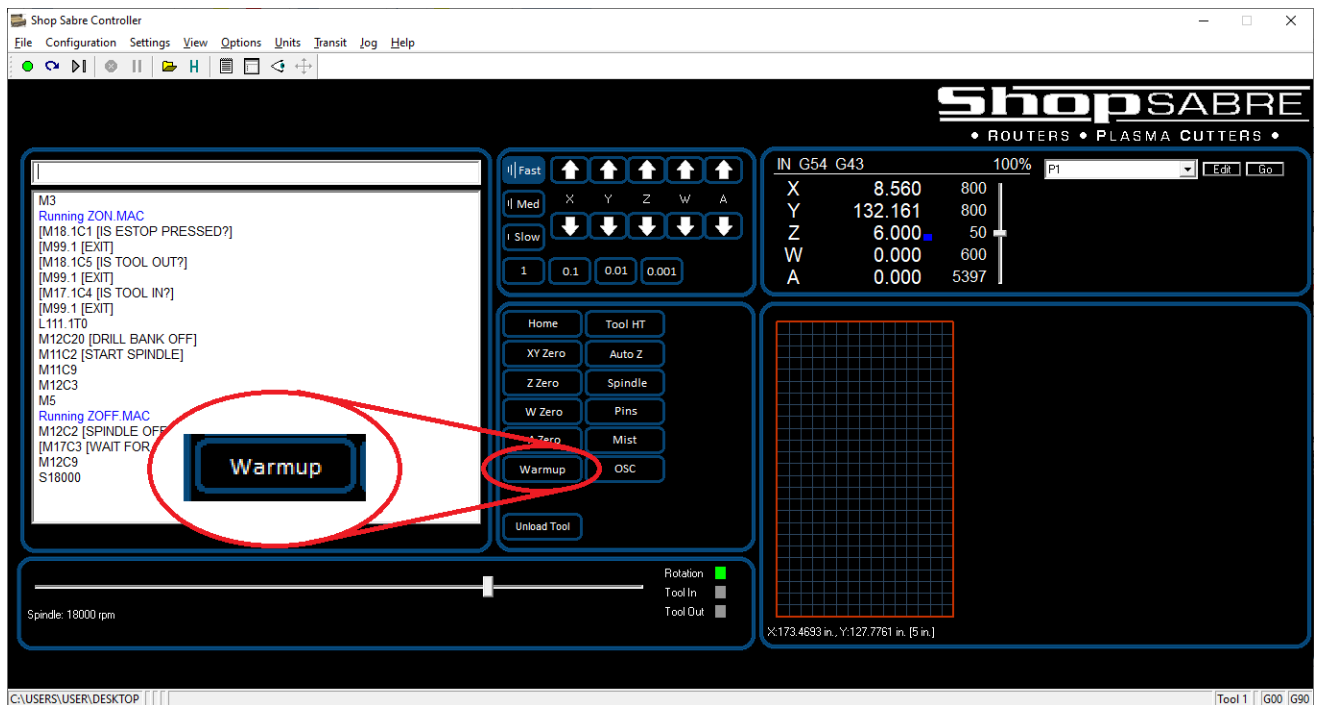
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Warmup

Note: If the machine has a Milwaukee router, skip this step.

All spindle machines will have a button labeled “Warmup”, which will move the spindle to the center of the table and run the spindle warmup procedure. This is an important process because the spindle bearings are ceramic and want to run warm for longer life.

During the warmup process, the spindle will run at 50% speed for 2minutes, 75% speed for 2 minutes, and 100% speed for 1 minute. On machines that have manual spindle speed control, set this RPM manually on the VFD. See the section on setting spindle speed on [page 64](#). Short breaks between cutting do not require another warmup session, but if the spindle has sat idle for 2 or 3 hours it’s a good idea to warm it up again. Due to the high spindle speed during this procedure, make sure whichever bit is in the spindle can handle 18-24,000 RPM.



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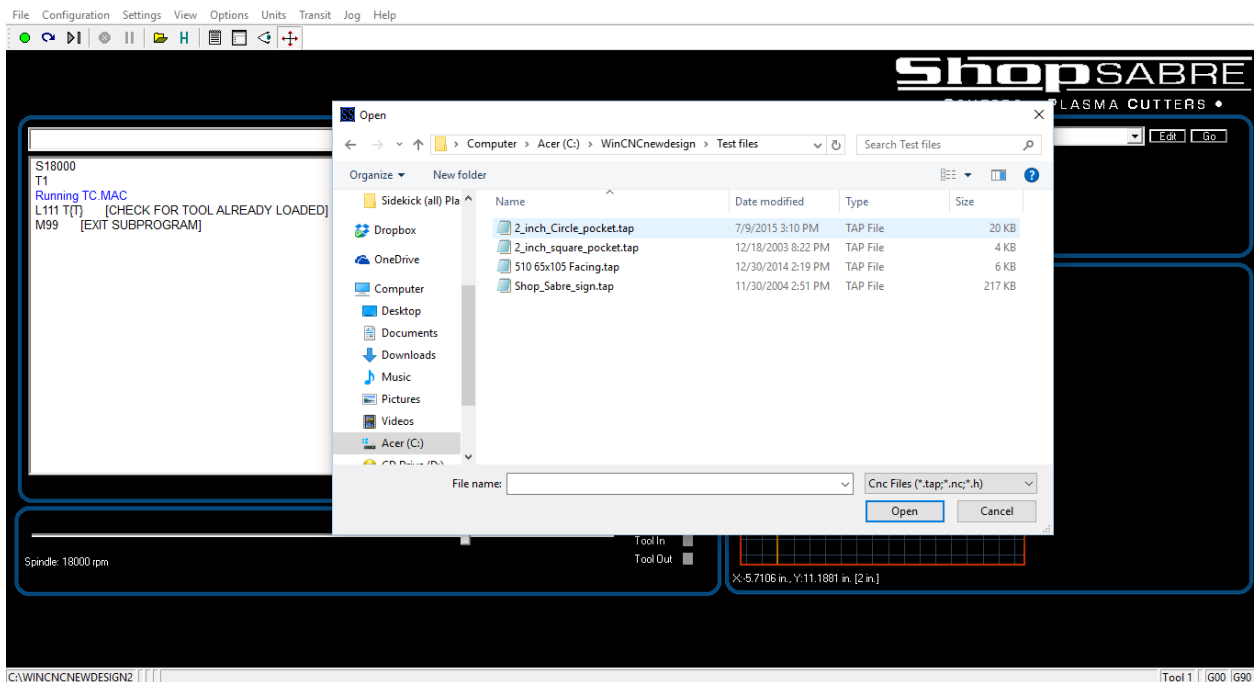
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Running a Demo Part

Note: When running cut files, you must first transfer them to the hard drive of the machine's computer and **do not** run them directly from a flash drive or network drive. The connections to those drives have proven to drop out randomly for short, unnoticeable periods of time. When cutting, those drops are long enough to cause the machine to cut incorrectly or stop cutting all together. It *is* OK to transfer them by those methods, but not to run directly.

Please Note: These demo files are not coded for automatic spindle on/off and you will have to manually turn on the spindle. If you do not manually turn on your spindle damage may occur to the cutting bit. After securely fastening a scrap piece to the table top and setting an XY and Z zero, it is time to open up the demo file located on the hard drive. On the ShopSabre controller screen click File and then open. Select the C: drive and open up the WinCNC folder. In the WinCNC folder will be another folder labeled "Test Files". Click the file labeled 2_inch_Circle_pocket.tap and click OK. The file name will appear in the command bar. Now at this point the XY and Z zeros have been set and the file is loaded. **Note:** turn on the spindle at this point.



The next step is to execute the file. There are two ways of doing this, by hitting the enter key on the keyboard or by single clicking the green button on the control screen. **Note:** To stop the machine at any time, hit the escape key on the keyboard, the red stop icon on the toolbar, or the emergency stop button. After the machine is finished cutting the demo part, turn off the spindle and remove the demo piece and inspect the part for straightness and cut quality. The machine has gone through many hours of testing at ShopSabre facility. However, shipping a machine across the continent or the ocean could cause some minor misalignment. If there are any issues please call our tech support line at 952-461-4570 or 1-800-493-6021.

If you need help or have questions throughout the process, contact our tech support team between the hours of 8am and 5pm CST at 1-800-493-6021 © ShopSabre CNC 8-23-2021

Digitizing Probe

If you do not have the digitizing probe, please skip this section.

For more information on the Digitizing Probe, watch our video on YouTube: [Digitizing Probe](#)

The digitizing probe is a cost-effective way of digitally copying a part. These next steps are a guide for how to effectively use the digitizing probe and copying a 3D part. Below is a picture of a digitizing probe correctly installed into a spindle. Your probe may vary in appearance. **Note: The operation of the probe is identical for all spindles. Tormach SPU-40 digitizing touch probes required regular maintenance due to oxidation on the internal contacts. This should be done if the machine frequently gives "probe stuck" errors. Refer to the section on probe maintenance for cleaning instructions on page 83.**



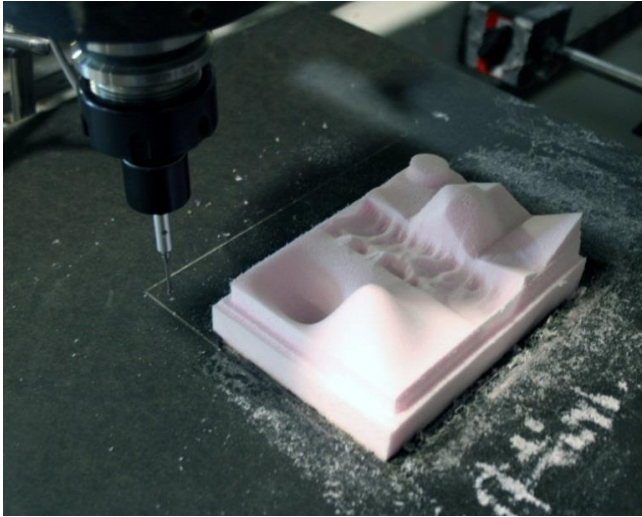
The next steps will walk through how to install the digital probe into a tool changing spindle. Refer back to the "Changing Tools" section for a collet spindle.

The probe option will include: either a 10mm or 3/8" collet (depending on model), digital probe and a 1" stylus with 4mm ball tip.



To correctly install the digitizing probe, first insert the provided collet into the collet nut. Next, take the digitizing probe, insert it into the collet and hand tighten the collet nut until the probe is secure. Use the provided spindle wrenches and tighten the collet nut. Make sure to plug in the probe to the cable labeled "Probe".

The digital probe is now ready to digitize the part. The next steps will walk through setting up the part and software.



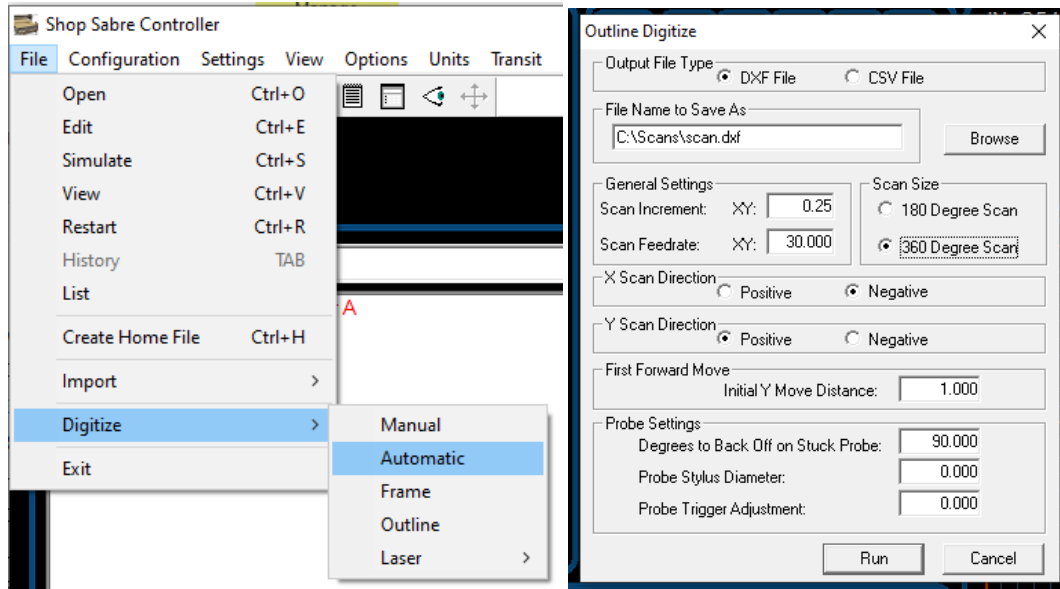
Before digitizing the part, first secure the part to the table top. This particular part was best secured using spray adhesive. If your machine was ordered with T-Slots or vacuum these may also be great ways to hold down the part. Keep in mind if using a vacuum, digitizing 3D parts will often take several hours.

Next, decide what type of scan to do; an outline scan, a 3D surface scan, or a laser scan. If the machine has a laser scanner, [please refer to that section](#) on page 94. For automatic scans, see page 77.

Outline scans will do exactly that – scan either the outside perimeter or the inside holes of a part. Scanning both inside and outside holes will require multiple scans. **DO NOT** change the XY zero or move the part between scans. Simple move from one to the next. Each file will create a DXF file. These files can be imported into most CAD/CAM programs successively to recreate the part in that software.

1. First, move the probe to the front center of the part
2. Move the probe tip slightly below the surface so it can touch around the entire perimeter of the part to be scanned-typically within 1” of the front of the part.
3. Set XY and Z zeros in that location. Do this only for the first scan. If doing multiple scans on the same part for inside holes and the perimeter then leave the XY zero in the first location.

4. Go to the File Menu and select "Digitize -> Outline"



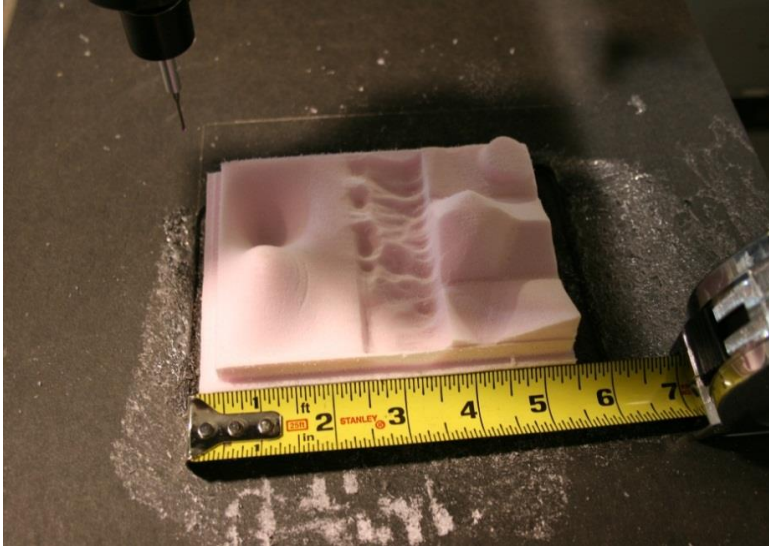
5. Select file type, and give the file a name. **Note: This name CANNOT have spaces in either the directory OR the name itself. Creating a new file in c:\scans is a great idea.**
6. Choose a scan increment. Typical scan increments range from 0.5" to 0.2". Going below 0.1" is likely to cause problems. Do this only if the part to be scanned has small details AND the building the machine is installed in is free of electrical noise. A feed rate of 30 IPM is typical. Higher feed rates and larger increments may reduce the quality of the scan.
7. Scan size of 360° is typical, but if the part can be mirrored left-to-right, choose 180° to save time
8. X Scan direction sets a clock-wise or counter-clockwise scan. Usually this will not affect the scan.
9. Set Y direction as positive
10. Initial move distance should be greater than the distance the probe is from the part. 1" is typical. If the probe does not touch the part within 1" it will shut down the scan.
11. Change probe stylus diameter to the size of the probe tip-typically 0.08 to 0.16". Measure this with a caliper.
12. Probe trigger adjustment is not required, but will add more accuracy. This is the amount of movement the probe tip needs before triggering a point. **This is not necessary**, but can add some accuracy. Typical values are around 0.008". If your part needs precision, talk to our tech support department about how best to determine this size.
13. Click "Run" and the probe will begin scanning. If the probe gives a "probe stuck" error or fails to scan, contact our tech support department for troubleshooting.

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Automatic scans require knowing the size of the area to be scanned. First, roughly measure the part.



The next step is to take rough measurements. This part is roughly 5.5" on the Y axis. Write this number down as it is needed when setting up the software.



Also write down the rough measurements on the X axis as well.

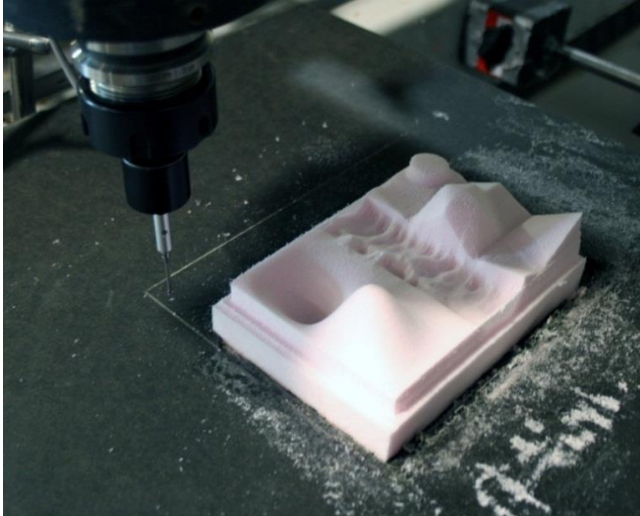
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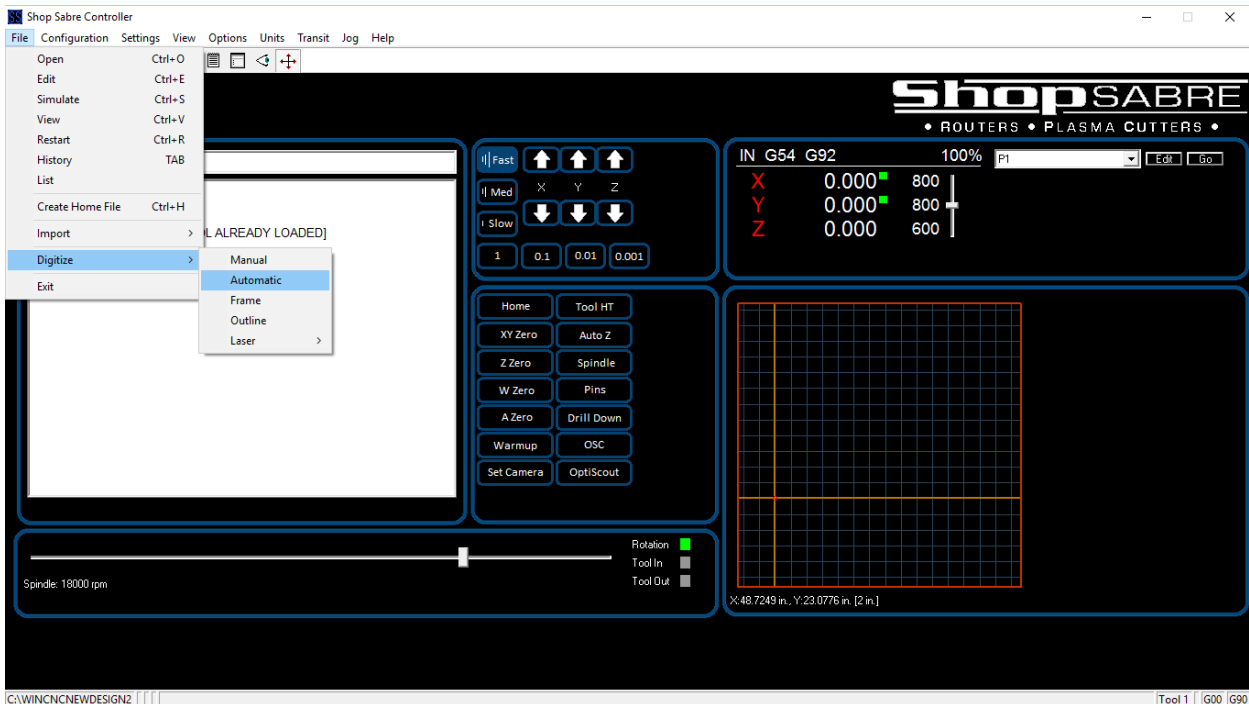
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After you have recorded the measurement on your part, get your probe into position and set a working zero. This will always be set at the front left of the part:



.25" away from the part on the Y axis. The digital probe is just above the table top surface. Locate on the ShopSabre control screen, the X, Y zero button and single click. Note: Please refer to [page 69](#) for setting a proper working zero.

On your control screen click on File -> Digitize-> Automatic.



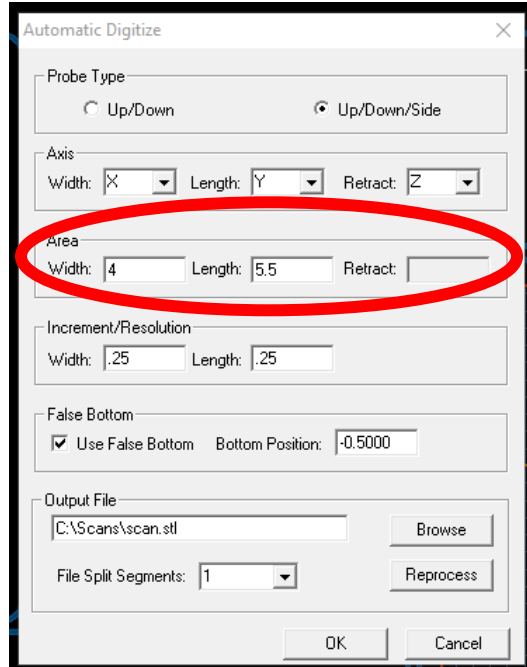
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After clicking on the Automatic button, this screen will pop up. In this screen, enter the measurements from the last step. Circled in red is where to enter your recorded measurements:



Circled in red is the input window for the resolution of the digitizer. With the standard digitizing stylus provided with the probe, 0.1” is the lowest feasible resolution, with 0.25” or higher being the recommended standard resolution. Going smaller may or may not result in frequent “probe stuck” errors depending on geometry and environmental conditions.

A false bottom is necessary if the probe cannot travel low enough to touch the bottom or if the bottom should not be scanned. The probe will travel down to this distance (from where the Z0 is set) and result in a flat bottom in the scan file.

Make sure to select the output location. We recommend “c:\scans”. This directory cannot have spaces.

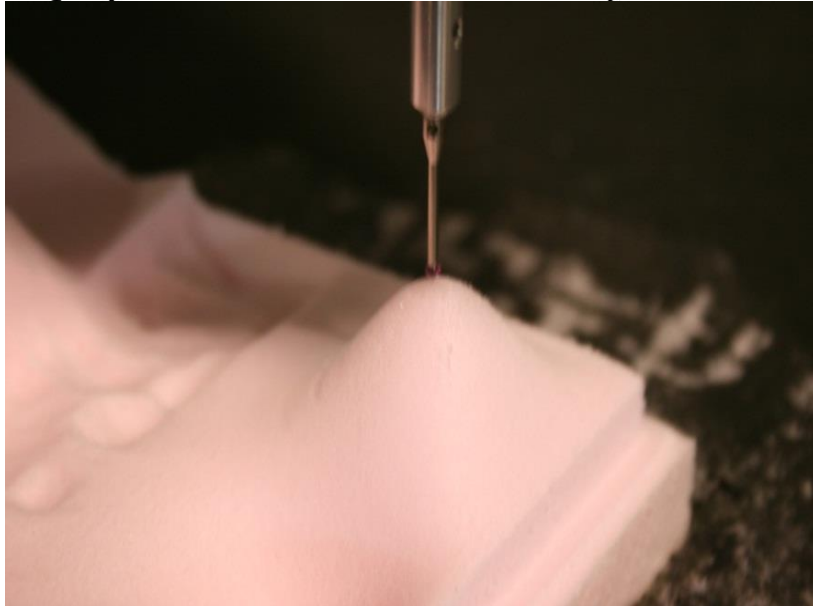
After all settings have been correctly entered, it’s time to start digitizing. Click the OK button on the Automatic Digitize screen and then click the run button on the ShopSabre control screen. **Note: For a list of quick keys please refer to Section B.** At this time your machine will automatically start moving and digitizing your part. Once the part is finished the 3D file will save automatically on your hard drive. This file can be opened in your provided CAM software. **Keep in mind, depending on scan size and resolution, this can take many hours.**

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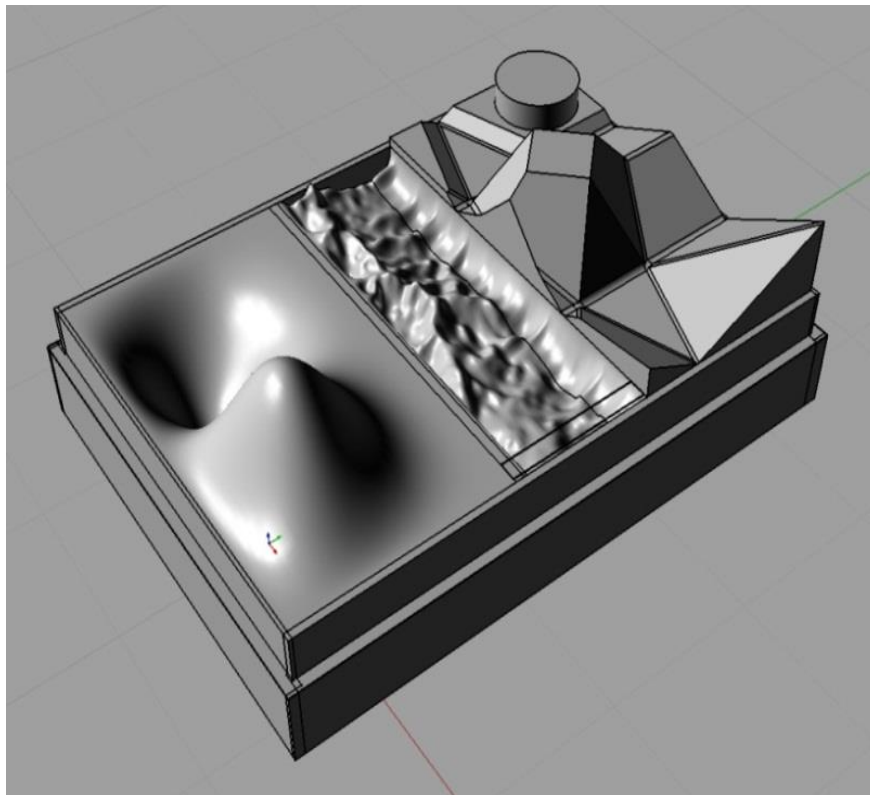
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Finished Digital File:



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Maintenance on Your Tormach Height Pad/Digital Probe

Note: These instructions come directly from Tormach for maintenance on your probe. If you have a different height pad you can skip this section.

Passive Probe Installation

Product Identification: Passive Probe w/ 10 mm Tormach Tooling System (TTS) Mount (PN 32309) and Passive Probe (PN 32310).

Purpose: The purpose of this document is to detail passive probe configuration, calibration, maintenance, and electrical connections for non-Tormach mills.

IMPORTANT! When using the probe, disable the spindle by turning the spindle lockout key on the operator panel to the Off position. On mills with an enclosure, open the spindle door to release the spindle door switch and stop motor function. Failure to do so may damage the probe.

PathPilot™ Configuration

For further information, refer to mill *Operator Manual* chapter 6, *PathPilot Interface*.

Calibration

The probe requires calibration to ensure that the center of the probe tip is located along the central axis of the mill spindle. For further information, refer to mill *Operator Manual* chapter 8, *Accessories*.

Maintenance

Over time, corrosion can build up on the contact surfaces of the passive probe. This can lead to inconsistent electrical resistance and faulty operation. To avoid potential problems, regularly clean probe contacts as indicated below:

1. Using a 2.5 mm hex wrench, remove three 3 mm Screws as shown in **Figure 1** and disassemble the passive probe (see **Figure 2**).



Figure 1



Figure 2



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NOTE: Corrosion problems usually start on the Contact Spokes of the Center Mandrel (see Figure 3 and inset).

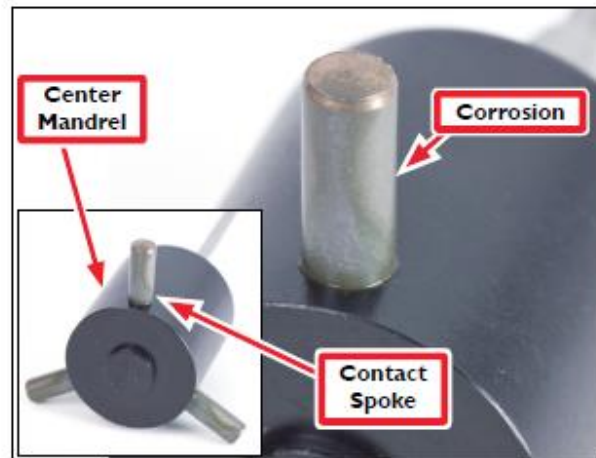


Figure 3

2. Using emery paper, Scotch-Brite™ or steel wool, clean the contacts. Use enough force to remove the corrosion, but be careful not to bend the Contact Spokes (see Figure 4 and inset).

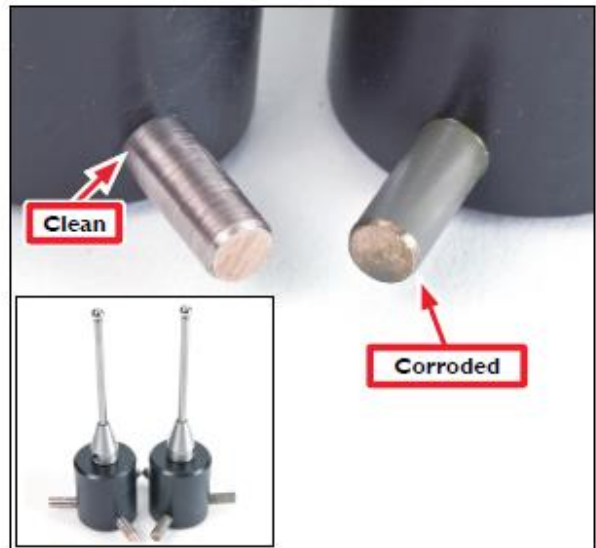


Figure 4

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- Using a corrosion inhibitor like LPS 1[®] Greaseless Lubricant or similar, wipe all contact surfaces clean (see Figure 5 and Figure 6).



Figure 5



Figure 6

- Re-assemble the probe; ensure the spring is correctly realigned (see Figure 7).



Figure 7

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Using the Multi-Drill Boring Block

If you do not have the boring block, please skip this section.



If you purchased a boring block, you will have a second vertical axis on the gantry and the control screen will include a "W" axis coordinate next to the XY and Z coordinates, as well as "W Zero", "Drill Down" and "Drill Bank Up" buttons.



Your CAM software will be responsible for outputting the correct g-code to run the drill. Typically, it will output a "G55" code to offset the drill to the correct location. This distance is based on the corner drill (#5). It will also output an "M3.2" to turn on the drills and an "M5" to turn it off. All drills will spin when turned on.

Drills alternate in their spin between clockwise and counterclockwise.

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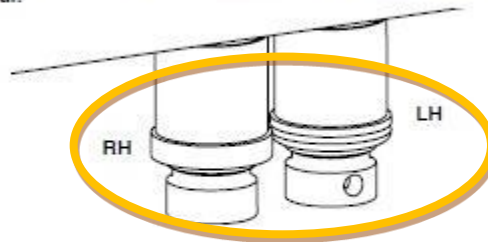
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"Drill Down" will extend drill #1 down to be used for setting W Zero. Drill Bank Up retracts ALL drill bits.

To tell the difference, look at the groove on the collar. Left-handed collars have a groove, where right-handed collars do not. Here is an excerpt from the HSD manual:

 Always check that the direction of rotation of the tool is the same as the spindle. The Right hand and Left hand rotating spindles differ by the presence of the groove on the collar.



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MC s.r.l. © - 0104H00gb.fm040605

The drill bits come in two colors: black bits are right-handed while orange bits are left-handed. **Note: You can change all bits to be whatever size drill you want, as long as the length is consistent. All nine drills MUST be the same length to function correctly.**

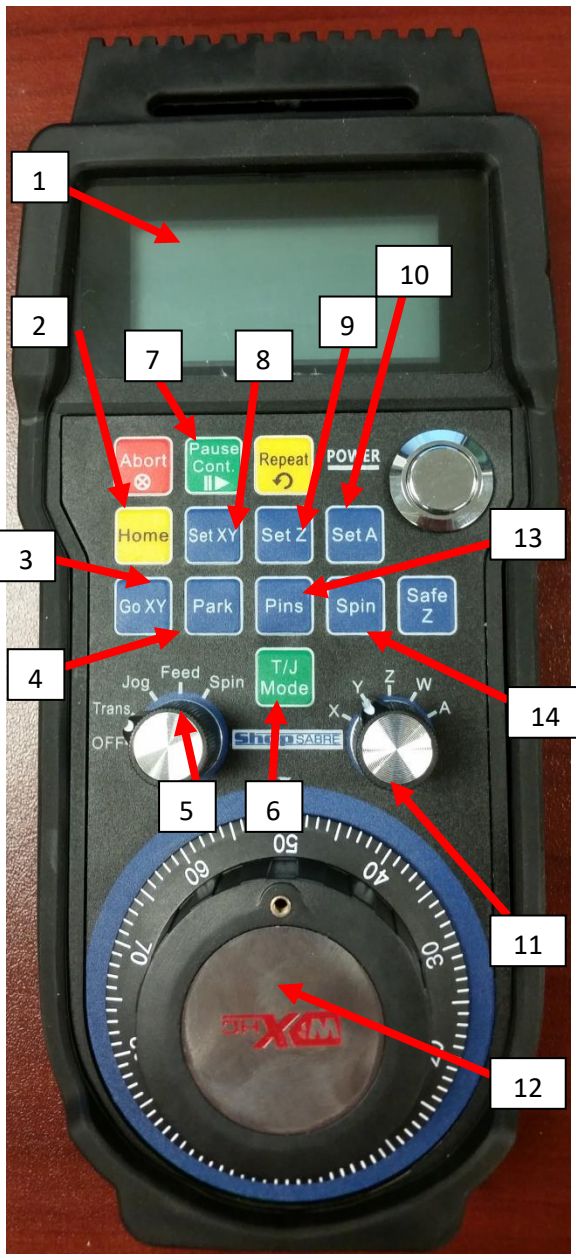


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Wireless Pendant

If you do not have the wireless pendant, please skip this section.

The ShopSabre controller is capable of utilizing a wireless pendant as an add-on option. This gives the operator the ability to be away from the keyboard and still jog the machine, set zeros, abort, and more. If you purchased this option, you must plug in the USB receiver for the pendant before turning on the ShopSabre control screen. If you have not purchased this option, it is available as an upgrade.



1. The pendant's screen will turn off after a time of not being used. This turns it back on
2. Homes the machine
3. Moves the machine to your current XY work zeros at rapid speed
4. Moves the machine to a user-changeable park position (uses P10 position and calls G53P10)
5. Cycles between Trans, Jog, Feed rate and spindle RPM changing
6. If #5 is on Trans, will cycle between Slow, Medium and Fast. If #5 on Jog, will cycle between 1", 0.1", 0.01", 0.001".
7. Starts, pauses, and un-pauses a file that has been opened from the computer.
8. Sets the current torch location as an XY work zero
9. Sets the current torch location as a Z work zero. This is unnecessary if the touch option is purchased.
10. If a second vertical axis (W) or indexer (A) axis exists, sets the current location as W or A work zero
11. Changing this dial will select which axis the Manual Pulse Generator (12) controls when turned.
12. Manual Pulse Generator. Turning this dial sends pulse signals to WinCNC. If #16 is set to X,Y,Z or A then turning the MPG will jog or transit that axis. If set to Spindle and the spindle speed option has been purchased it will change RPM. If set to Feed it will increase or decrease the feed rate override from 1% to 200% of programmed G1 feed rate.
13. If the pop-up reference pins options is purchased, this will trigger them
14. Turns the spindle(s) on/off

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Basic 4th Axis Setup

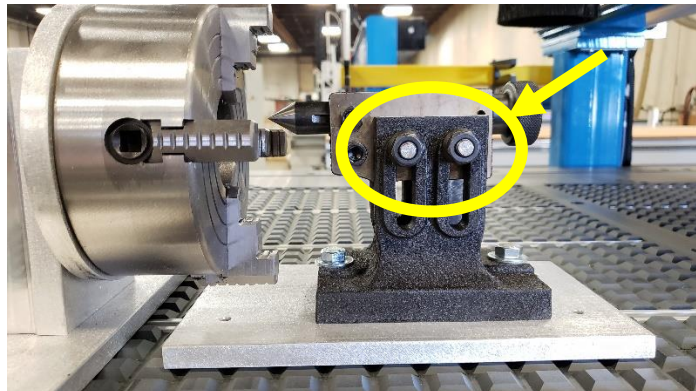
If you do not have the 4th axis, please skip this section.

Note: When plugging and unplugging the 4th axis to the machine, first verify that the control box is turned off to avoid damage to the drive or motor.

The ShopSabre 4th axis is designed to be mounted or bolted in many different ways and locations; however, the operations will remain the same. The 4th axis should be used as a rotary positioning system, meaning that the 4th axis should step to a position, use the x or y axis (depending on orientation) for the machining, then step again and repeat until the project is complete. **It is not designed to function as a lathe.**

The 4th axis aluminum base plate can be customized to fit your needs. I.e., Bolt holes, cam clamps, t-slots, etc. The head should be positioned over the top center of the stock that is to be cut. We recommend creating a small table which has t-slots cut into it and can be moved on and off the machine as a unit. This will mean the alignment will only need to be done one time and the small table can be bolted down to the machine in the same location every time.

First the chuck head and tailstock must be aligned. Decide whether to align with the X axis or the Y axis. In this example we have aligned it with the Y axis. Loosen the bolts that hold the tailstock in place and lower it to the appropriate height to be centered on the chuck.



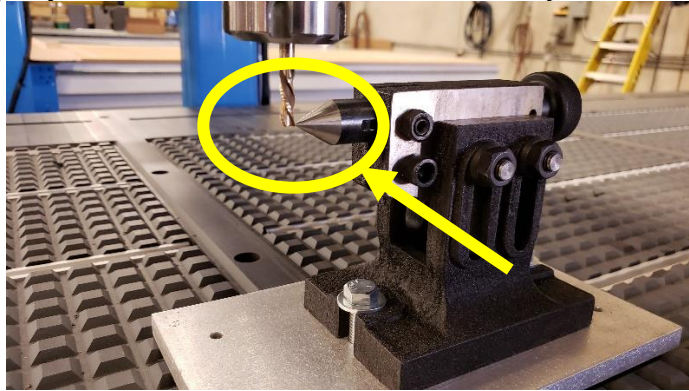
Once aligned, set the tailstock approximately in place based on the length of your material and align the spindle with it and secure the tailstock to the table. Once aligned, click the XY zero and Z zero buttons. We will change the Y zero again when the material is loaded.

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Move the spindle back near the chuck and center the chuck with the spindle (center in the X direction for this example). Next, insert the material into the chuck and center it. The 4th axis comes with a 4-jaw chuck for ease of grabbing both square and round tubing. It is possible to replace the chuck head with a third-party chuck (not supplied by ShopSabre) that has 3 jaws.



To rotate the A axis, use the home and end keys on the keyboard. Insert the material and move the spindle forward so the entire tool holder can clear the chuck and **click the XY zero button** again in this location.



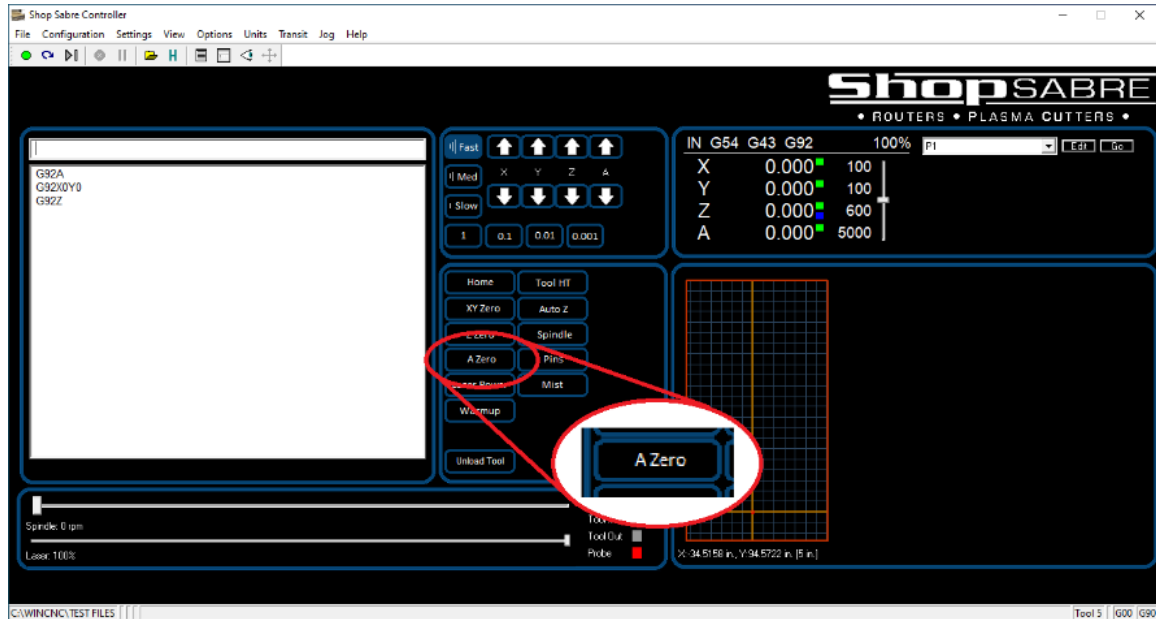
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Once the spindle is in the desired position, use the **"A Zero"** button that is found on the control screen.



The 4th axis is now set up to run a program.

When posting out of Vectric products you will want to select the ShopSabre X2A or Y2A depending which axis the stock is parallel to. If the stock is **parallel to the x axis you will select the Y2A post** and if it is **parallel to the y axis you will select the X2A**.

Note: When plugging and unplugging the 4th axis to the machine, first verify that the control box is turned off to avoid damage to the drive or motor.

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Unist Mist System

If you do not have the Unist mist system, please skip this section.

Note: Dust collection with aluminum requires a special dust collector that’s set up to contain explosions from metal dust. Also, a dust skirt will often cause aluminum chips to be dragged along the surface and scratch the material. For these reasons we do not recommend using a dust skirt while cutting aluminum.

If the machine has a mist system for cutting aluminum and other light, non-ferrous metals it will be mounted behind the gantry on Pro + IS machines.



This is NOT a flood-coolant system as may be seen in a milling machine. It is designed to spray a very light mist which immediately evaporates on contact with the hot cutting bit and there should be very little coolant involved. If pooling occurs on the part, reduce the flow rate of coolant using one of the settings below. This reduces the heat present in the bit and extends the life of the bit.

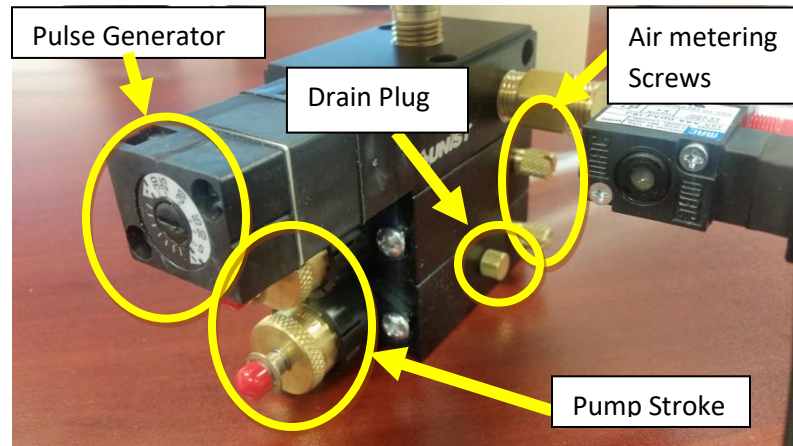
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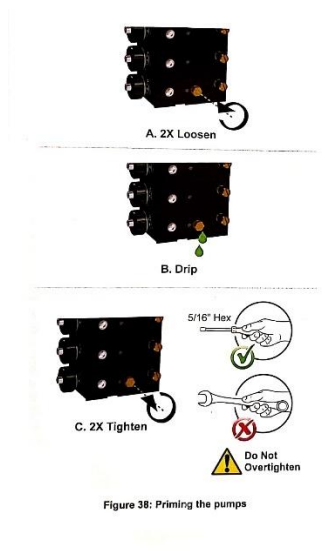
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Note: The Unist system comes with an easy-to-read instruction manual and we recommend reading it before using it. Here are the basics. There are three sets of dials and a drain the operator must be aware of:



- The pulse generator will change how frequently the mister pulses
- The pump stroke increases the amount of fluid per pump
- The air metering screws regulate the rate of air going through the system
- The drain plug is used to drain the system.

Per their manual, at full airflow the Unist will use about 8 CFM (4 per hose)



For the drain plug, per the Unist Coolubricator manual, **Do Not Overtighten** or it will break the knob.

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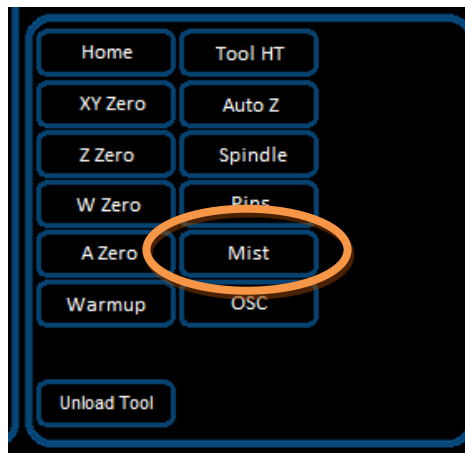
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Remove the dust skirt. **The mist system will not use a dust skirt.** Position the nozzles to point at the bit.



On screen you will have a mist button which will activate the mister. Press the button again when you want to deactivate the mister.



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Tangential Knife and Creasing Wheel

If you do not have an Ecomac tangential knife or creasing wheel, please skip this section.

Note: If using these options with OptiScout, see the OptiScout Addendum on page 118

The tangential knife can be used to cut a very thin kerf through soft, thin, or gummy materials that may otherwise pose a problem for a router bit. Vinyl, cardboard, foam, coroplast, leather and magnet material are common examples. It has the ability to oscillate to provide more cutting action for thicker materials like leather.

The creasing wheel allows small cuts or creases to be made in cardboard so it can be more easily folded.



First insert a blade into the knife and tighten the set screw to secure it. In the home position the blade will be parallel to the X axis. If a bit is loaded into the spindle, set your XY zero with the spindle as normal. If not, we can set the XY zero with the knife later.

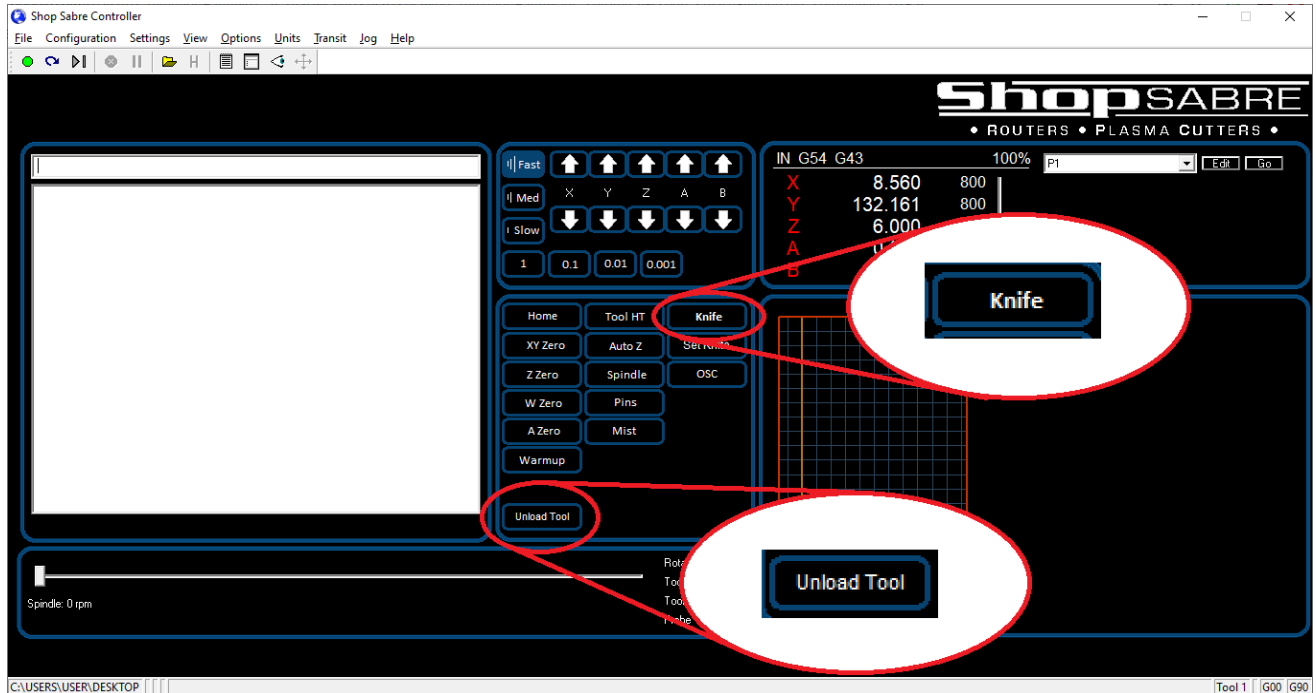
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Make sure any tools have been removed from the spindle by using the Unload Tool button on the control screen. Once unloaded, press the "Knife" button on screen to lower the knife below the spindle.



If the XY zero was not set previously, type in "G55" to the command bar. This will change the coordinates so the machine knows the offset between the spindle and knife. Then set the XY zero with the knife blade. The "G54" will change to a "G55". **It is important to know which mode it is in when you are setting an XY zero for both knife and router. Setting a zero with either cutting head in the wrong mode will result in the machine cutting in the wrong location.**



Lower the Z axis until the knife touches the spoil board (the knife will *always* run from the bottom of material). Then click the "Z Zero" button. If oscillation will be used, pull down on the shaft of the knife where the knife blade attaches to until it is fully extended and set the Z zero with the knife extended. **If z zero was not set this way while using both oscillation and a hard spoilboard it will impact the spoilboard during its oscillations and could break the knife. Cutting mats made for Ecocam knives may avoid this problem.**

From there run the file just like with a router. If the file is exported using the correct post processor ("ShopSABRE Knife Arc (inch)" in Vectric Vcarve and Aspire) it will automatically switch into and out of G55 mode. However, if aborted it may stay in G55 mode. If this is the case, enter "G54" into the command bar when ready to go back to router mode. The creasing wheel operates in the same way, except it does not have the oscillation capability.

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Laser Scanner

If you do not have the Optimet laser scanner, please skip this section.

The Optimet ConoPoint laser scanner can be used to scan in small or large parts at a high degree of accuracy.



However, there are some important restrictions. Using a laser means it needs a part that will not absorb light but also not reflect it like a mirror. As a result, covering the part that needs to be scanned with Magnaflux Developer powder or odorless spray foot powder (either must be a spray) will give the best results. Shiny or deep black surfaces may not yield a proper scan. This will be very dependent on, and will vary with, your material.

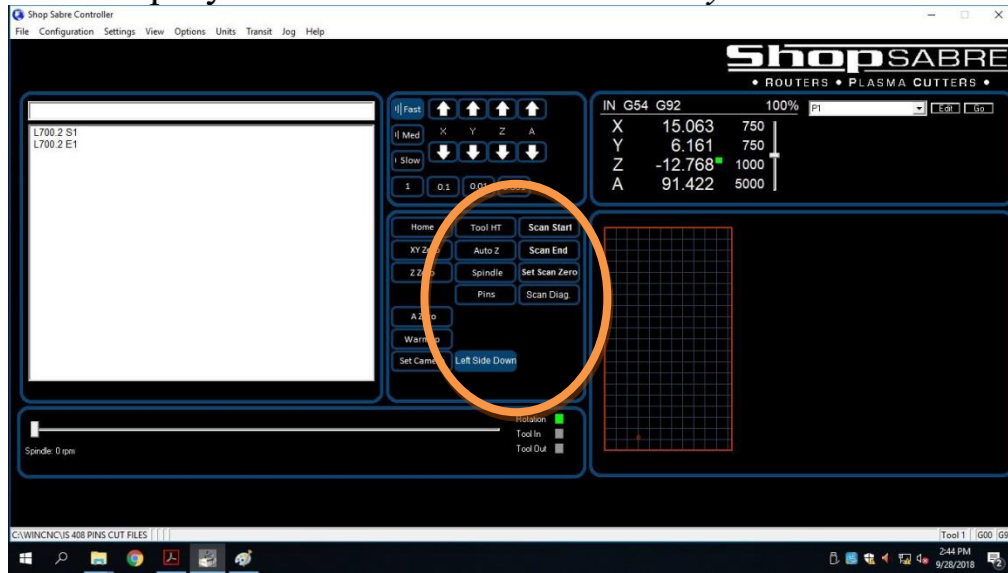
If you have a tool in the spindle, it is recommended that tool is removed before starting a laser scan. Once that is done, press the “Left Side Down” button. This will lower the scanner below the spindle.

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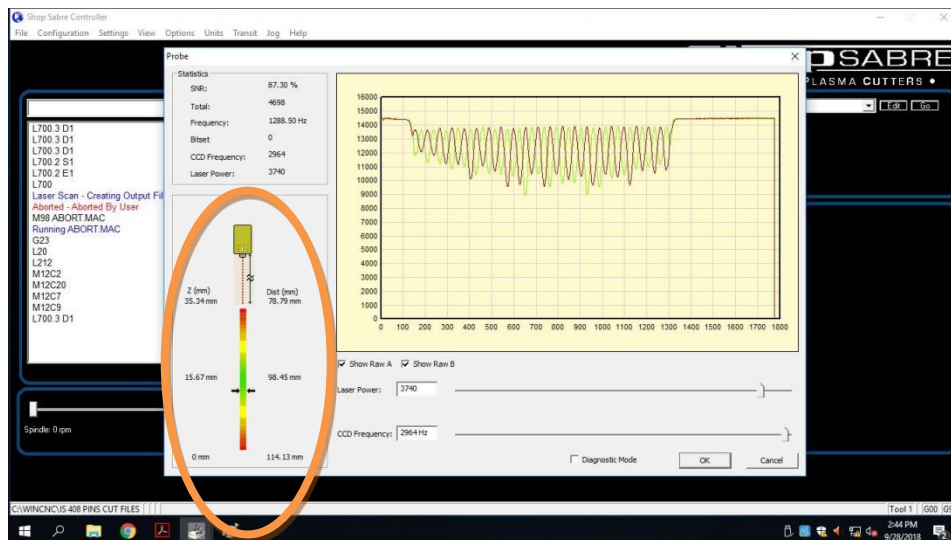
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Next, we want to outline the area of our scan. Move the laser dot to the front left corner of the area to scan and press the "Scan Start" button. You will see "L700.2 S1" appear in the command history as shown in the picture above. Move the laser dot to the back right corner of the area and press the "Scan End" button. "L700.2 E1" will appear in the history.

Pressing the "Scan Diag." box will open a diagnostic screen which you will use to set the proper height of the camera.



The circled feature in the above picture is the quality of the reflection the laser scanner is able to see. By moving the Z axis up and down on the machine it will change the focal point of the laser. Our goal is to get the arrows into the green color on this bar as shown above.

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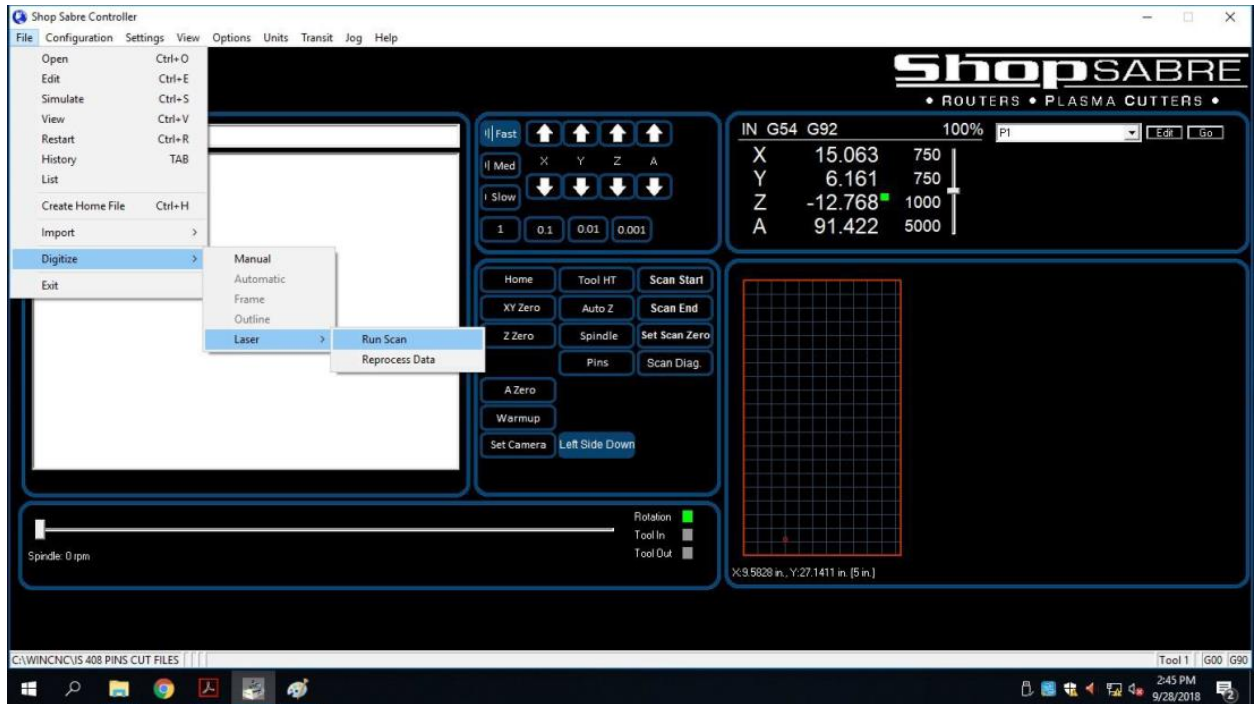
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When the arrows are in the center of the green section of the bar, we can hit the OK button and then press the “Set Scan Zero” button which will lock that in.

At this point, we want to actually run the scan. Go to the File menu, click Laser, and Run Scan.



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This will bring up a new dialog box:

Laser Scan Parameters

X Start: 11.9825

Y Start: 6.1613

X End: 15.0625

Y End: 6.1613

X Res.: 100

Y Res.: 100

Feed Rate: 750

CCD Freq.: 2964

Power (0-4095): 3740

Lens: 100mm

Show Probe Dialog

Directions: Uni-Directional

Type: Surface

Height Offset: 0.0000

Scan Data File Name: C:\WINCNC\SCAN.BIN

Start Scan Cancel

Here it shows the X and Y start and end points we just set. The CCD Frequency cannot be above 3000. As a result, we need to change the X and Y resolutions AND the Feed Rate until the CCD Frequency is near to but below 3000. Typically, this means X and Y resolutions around the 100-150 range, as shown above.

The Power number is set from the previous screen that was used to focus the camera in the green area. This can be turned down if the surface is more reflective than normal. However, there's no guarantee a reflective surface will be scanned, and they should be avoided.

The file name at the bottom should have no spaces and should be placed in a directory with no spaces. The C:\wincnc folder is a good place, or you may want to make a new one c:\wincnc\scans to keep them organized.

When this box has been set correctly press "Start Scan" and the machine will begin moving. It will create a .stl file that can be imported to many CAD/CAM systems.

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J-tech Laser Engraver

If your machine does not have a J-tech, skip this section.

ShopSabre machines can be purchased with a J-tech laser engraver from the factory. At this time it cannot be added in the field.



The J-tech must be installed and removed before and after each use and gets mounted on the side of the spindle. **It is critical to remove the unit before any tool changes are performed. Changing tools automatically with the laser attached will result in damage to the laser that is not covered under warranty.**

IS and Pro machines will have a mount on the spindle stiffener bracket on either the left or right side depending on configuration. This will be either a cap-head bolt or a thumb screw. The J-tech is mounted to a black plate with a bolt hole. The cable will plug in to a wire labeled “Laser”.

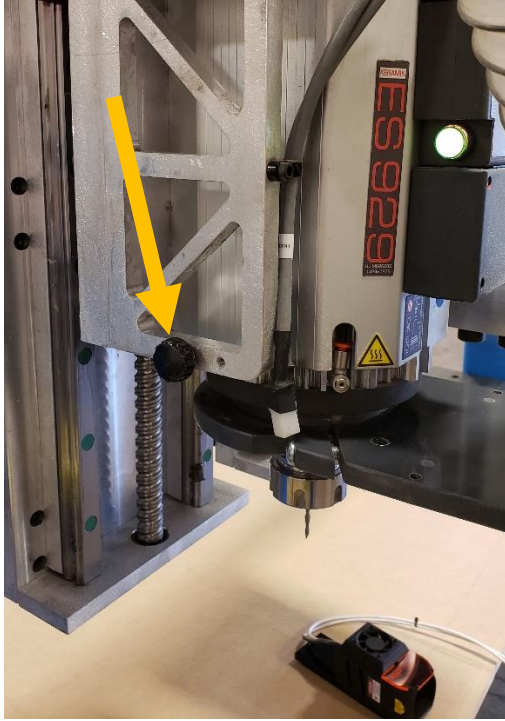
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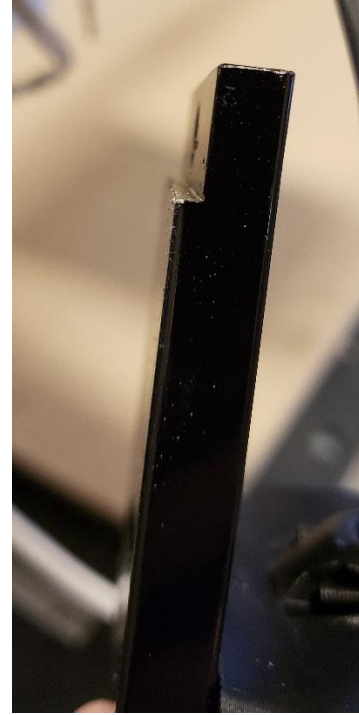
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Thumb screw



J-tech mounting plate



J-tech mounted



Laser plug



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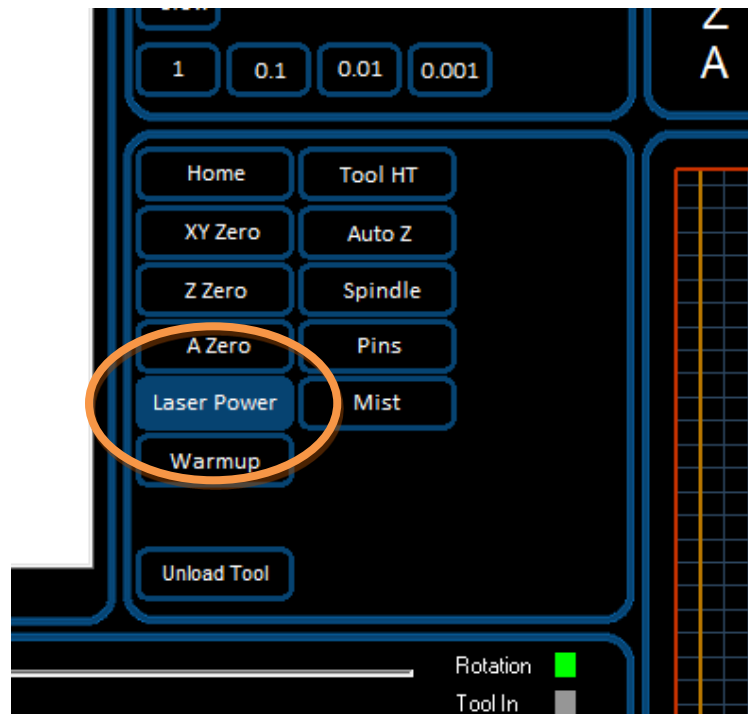
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To run the laser, first output a file from Vcarve with the correct post processor. There are two different post processors depending on whether or not you’ve purchased Vectric’s “Laser Module”. This is an add-on to Vectric Vcarve and Aspire. Engraving vector lines can be done without the laser module, but engraving pictures will require this addition. **Contact ShopSabre technical support for the correct post processor, since these are not included with Vcarve or Aspire.** Make sure to set the laser power appropriately (in the laser module). Without the laser module, the spindle speed acts as the laser power. Create a new endmill tool with the appropriate feed rates to engrave your material and set the spindle speed not exceed 100, as in 100%.



Once your file is made, set XY zero and Z zero for the laser, similar to how it would be done with a spindle. click the “Laser Power button” on screen. The laser *will not* come on at this point, and will only turn the dot on when the machine is in cutting motions. Then run the file.



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Opt Lasers Laser Engraver

If your machine does not have an Opt Lasers engraver, skip this section.

ShopSabre machines can be purchased with an Opt Lasers laser engraver from the factory. At this time it cannot be added in the field.

The Opt Lasers unit is mounted to a vertical plate that can slide up and out of the way of the spindle during routing operations. There is a magnetic cover over the electronics mounted to that plate. First, remove that cover. Make sure to set this in a place where it will not be lost, as the electronics underneath should be kept covered when not in use.



Then attach the laser unit. It is also magnetic and simply clips vertically onto that connection.



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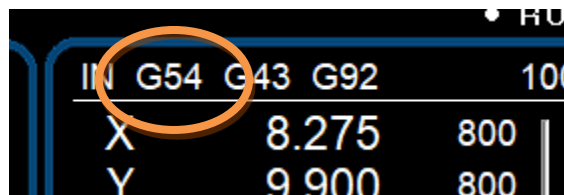
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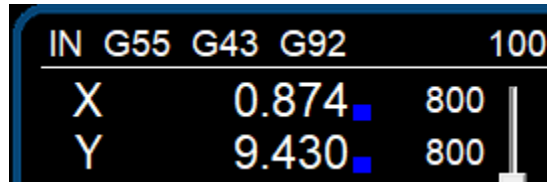


The machine is programmed with “G54” and “G55” offset modes. During normal cutting the controller should read “G54” above the coordinates:



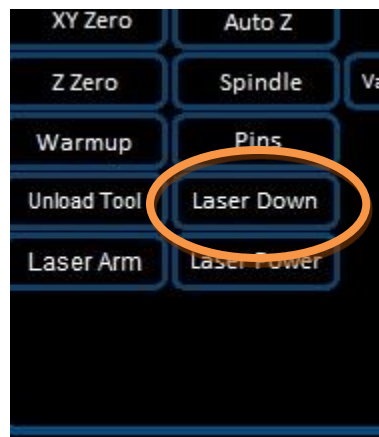
This is the mode the machine **must** be in while setting an XY zero using the spindle. While using the laser, the machine will instead be in “G55” mode. If the XY zero is set while in G55 mode the machine will offset the opposite direction and will not cut appropriately. If the machine is in the wrong mode, type in G54 to the command bar and press enter and the coordinate shift will happen. There will also be blue boxes next to the X and Y coordinates when this offset occurs.

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Once the XY zero has been set with the spindle, set the Z zero using a tool that is tool measured. **Note: the bit being used must be tool measured or the laser will move to the wrong vertical location and could crash.** Unload the bit from the spindle using the green button and set the tool holder aside. ShopSabre also recommends removing the dust skirt to avoid the bristles rubbing on the material.

On the control screen are three buttons: “Laser Down”, “Laser Arm”, and “Laser Power”. First, make sure the spindle is in the air and press the laser down button. The unit will extend downward below the bottom of the spindle and turn the button blue. During this process it will also switch from G54 to G55 mode automatically. Pressing the Laser Down button again will retract the laser assembly and also switch back to G54 mode for routing.



Next is a two-step procedure to ensure the operator is intending to use the laser. Before proceeding, make sure to read and understand these notes below.

Note: this 6w laser can burn and cut, and will cause eye damage. The shroud around the laser must be used at all times to prevent laser bounce which can cause damage and injury to those around the table or even passing by. Anyone in the vicinity of the laser should be wearing the appropriate protective goggles.

Also Note: surfaces cannot be shiny for use with this laser, as shiny surfaces can reflect either back to the lens itself, or to other areas of the room surrounding it. These reflected beams can stay focused for long distances and cause injury or damage to those around.

To arm the laser, press the “Laser arm” button.



This button will then turn blue complete the arming sequence. The final step is to press the “Laser Power” button. When this happens a red light on the side of the laser itself will light up and the cooling fan on top will turn on. It is normal for this fan to be loud, as it moves a high volume of air.



The Opt Lasers engraver is now armed and powered and prepared to cut. However, the laser light itself will not come on until a file with correct g-code is run. Typing in “Z0” and pressing enter will bring the laser down approximately 1/8” above the Z0 that was previously set with the spindle tool. This is the appropriate height for laser focus during normal operations. The XY coordinate shift has also occurred, and typing in “X0Y0” and pressing enter will command the machine to move the laser to the XY zero point. This is not required, however, as an appropriate g-code file will move the machine from wherever it is at the moment to the start point before firing the beam itself.

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The machine is now set up and ready to run a file. Load the file normally as when running a router program, preview it, and press enter to run. When the file is complete, turn off the Laser Armed button to remove power, and again press the Laser Down button to retract the laser and return to G54 mode. Place the bit back in the spindle and run any remaining router cuts, such as the profile cutout.

Outputting a file with Vcarve Pro:

After drawing your file with Vcarve, save the tap file from Vcarve with the correct post processor. There are two different post processors depending on whether or not you’ve purchased Vectric’s “Laser Module”. This is an add-on to version 10 of Vectric Vcarve and Aspire . Engraving vector lines can be done without the laser module, but engraving pictures will require this addition. **Contact ShopSabre technical support for the correct post processor, since these are not included with Vcarve or Aspire.** Make sure to set the laser power appropriately (in the laser module). Without the laser module, the spindle speed acts as the laser power. In that case, create a new endmill tool with the appropriate feed rates to engrave your material and set the spindle speed not exceed 100, as in 100%.



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Remote Tech Support using TeamViewer

If you need tech support, and the machine is connected to the internet, we can log in remotely to help. We install a program on the desktop called TeamViewer (**Figure 15A**).

When you open TeamViewer you will see two boxes that give “Your ID” and “Password” respectively (**Figure 15B**). Having those numbers ready can speed the process, as our techs will need these numbers in order to log in. If you do not have internet, this is not an option.

Figure 15A



The Icon for TeamViewer on the Windows 10 desktop

Figure 15B



Example of ID/Password. Sometimes this window opens behind other windows. Make sure to minimize other windows if you don't see it.

TeamViewer automatically fills in the ID and password, and may take a few moments to show up, especially if your internet is slow.

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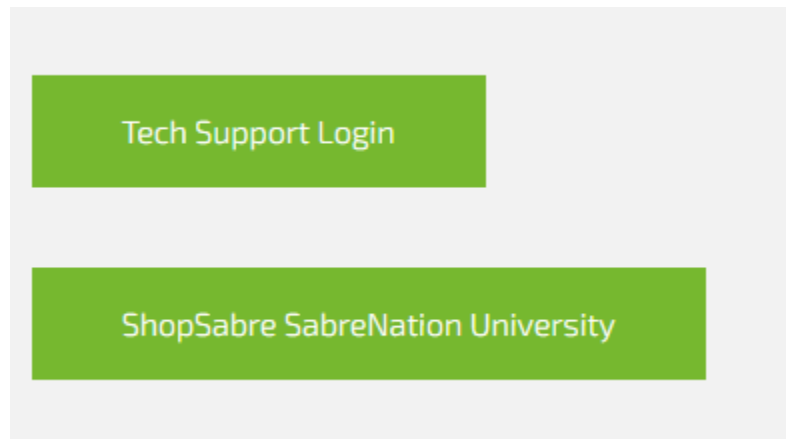
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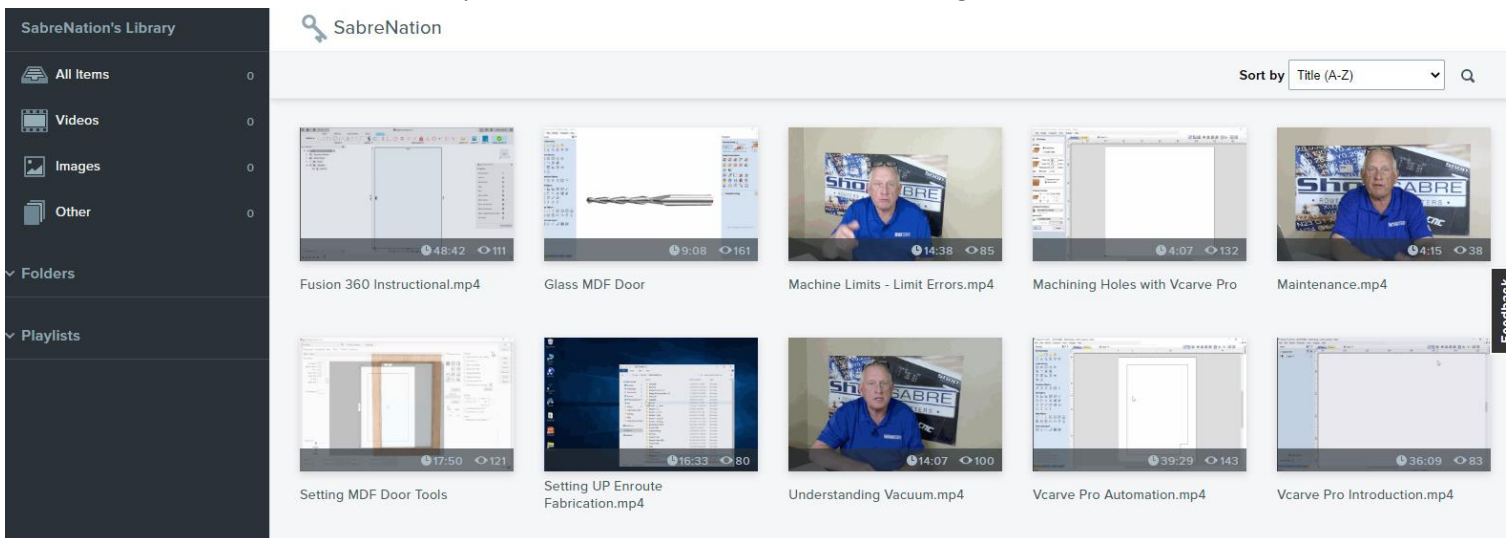
ShopSabre University

ShopSabre has created a portion of our website called "ShopSabre University". Go to <https://www.shopsabre.com/support/> and click on the big green button that says "ShopSabre SabreNation University."



The password will be changed periodically, and can be found either by calling or emailing ShopSabre's Customer Liaison, or by going to our Facebook group and looking in the comments to the rules.

Once inside, the video library can be accessed. RouterBob will add more videos as time allows. These will be more tutorial-focused and specific for our customers rather than the general YouTube audience.



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Lubrication

For long-term use of a linear motion system under normal conditions, good lubrication is a must. If lubricant is not used, rolling parts wear quickly, and the service life of the system is shortened considerably.

To simplify the lubrication requirements, we have the proper grease, grease gun and needle fitting available for purchase from ShopSabre. Give us a call at 800-493-6021. The kit includes three large grease tubes, a grease gun with flexible hose, and a needle fitting for all grease points.

There are 12 grease points for the linear bearings (examples shown on next page). Four blocks on the table rails (Y axis), four on the gantry rails (X axis) and four on the vertical axis rails (Z axis). **We recommend that every 40 - 60 hours of operation all blocks and ball nuts are greased.** The blocks take about 1 - 3 pumps on the grease gun. On Pro and IS series machines there are 4 ball nuts that must also be greased. On RC series machines there are linear racks that must be greased instead of ball screws. The linear bearings and ball nuts have circulating ball bearings inside of their blocks. If the machine is running rough, the proper fix will depend on the frequency of your greasing. If greasing the blocks is not fixing the rough travel it may be better to try degreasing with some WD-40 on the rails, running the machine in slow motion along its length of travel several times and wiping off the old grease that comes out. Then try running your parts without greasing to see if the quality has improved. Grease while in motion to distribute the grease throughout the bearing.

Each ball nut has a grease zerk on it. To grease the Z, find a slot at the top in the back. If the machine has ball screws on X and Y axes, the X axis is found on the back of the gantry. You may have to climb under the table to grease the Y axes. Run each axis to distribute the grease.

When greasing your machine, **it is required to** use the recommended grease SL3310 and proper needle-tip grease gun tip as shown in pictures below. Using an incompatible grease or fitting may cause damage and will not be covered under warranty. **Do not use a standard grease fitting.**

		
ATD-5016	Sta-Lube SL3310	Do not use a regular fitting

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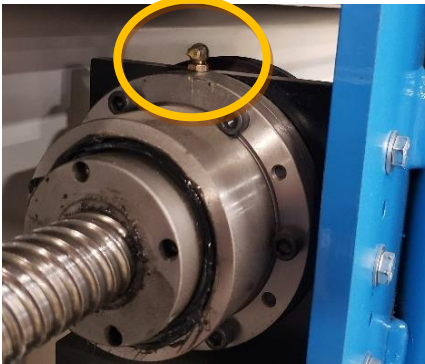
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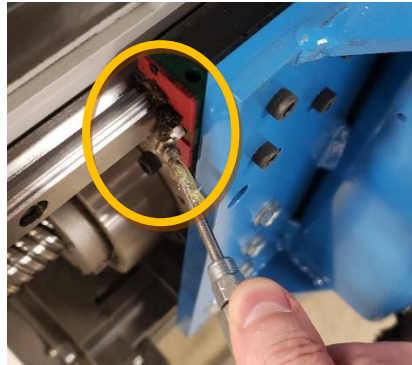
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The ATD-5016 will push up against the check valve at the end of the zerk. If seated correctly, grease will flow inside the bearing when pumped. If not seated properly, grease will exit between the needle and the zerk.

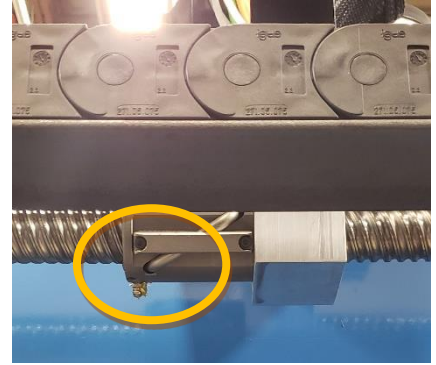
Y axis ball nuts on each Y ball screw



Y axis linear bearings on either side of the machine



X axis ball nut behind the gantry



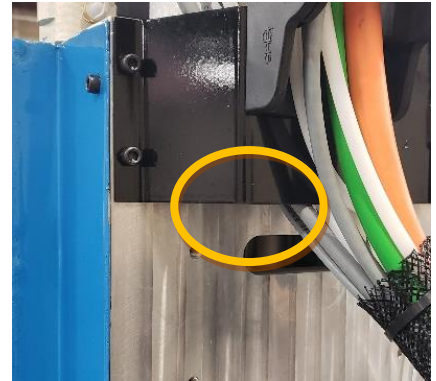
X axis linear bearings on the front of the gantry



Z axis linear bearings inside the spindle cover on both left and right sides of the Z assembly



Z axis ball nut accessed from behind the gantry



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Chapter 3

Vetric VCarve Pro

Section:

- A. [Starting A New File](#), Page 114
- B. [Applying Toolpaths](#), Page 115
- C. [Saving Your Toolpaths](#), Page 116

This is *not* a comprehensive tutorial on VCarve software. Although we do train on VCarve during our monthly training classes, we do not make VCarve and Vetric the best resource for information on their products. Vetric has dozens of tutorials and videos on the internet, and there are many more done by third parties. This is simply to give you the basics of starting a new file, applying a toolpath and saving a toolpath in a way that your ShopSabre router will recognize.

For more comprehensive tutorials:

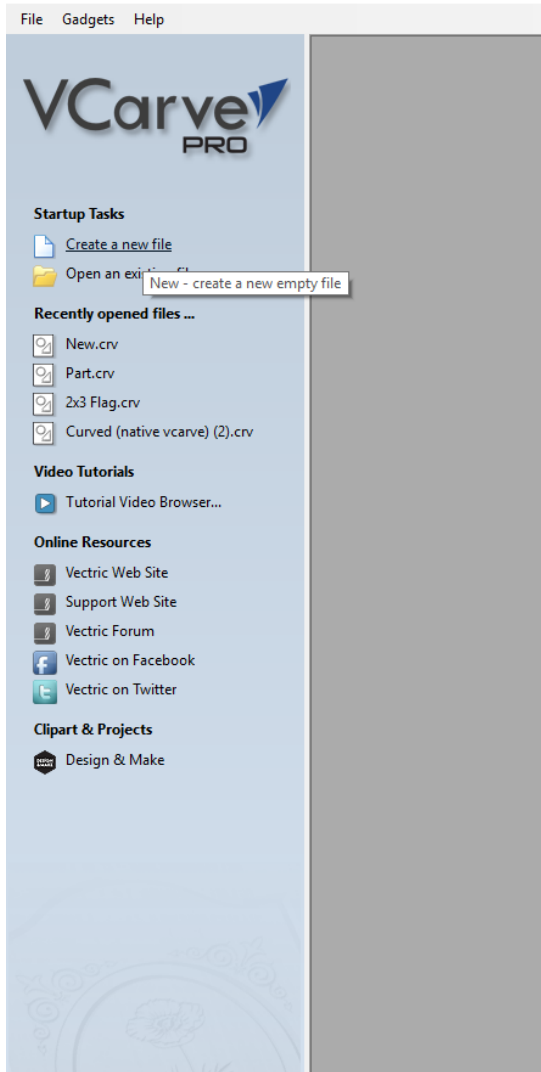
- Look at Vetric’s [website](#)
- Search for VCarve on YouTube
- Search through our SabreNation University (page 99).

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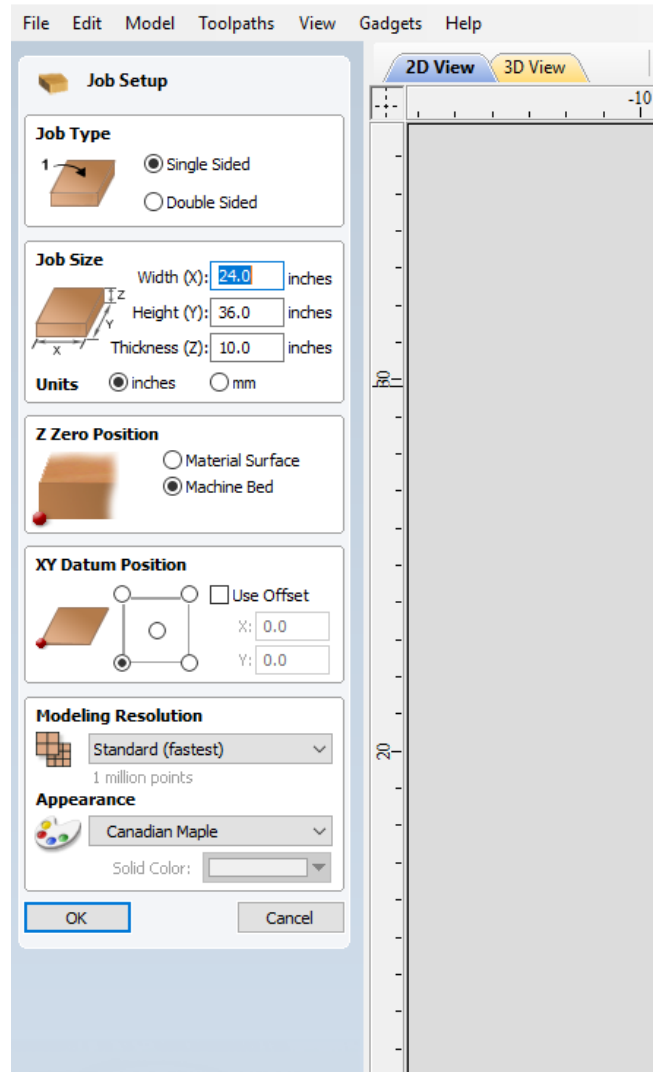
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Starting A New File



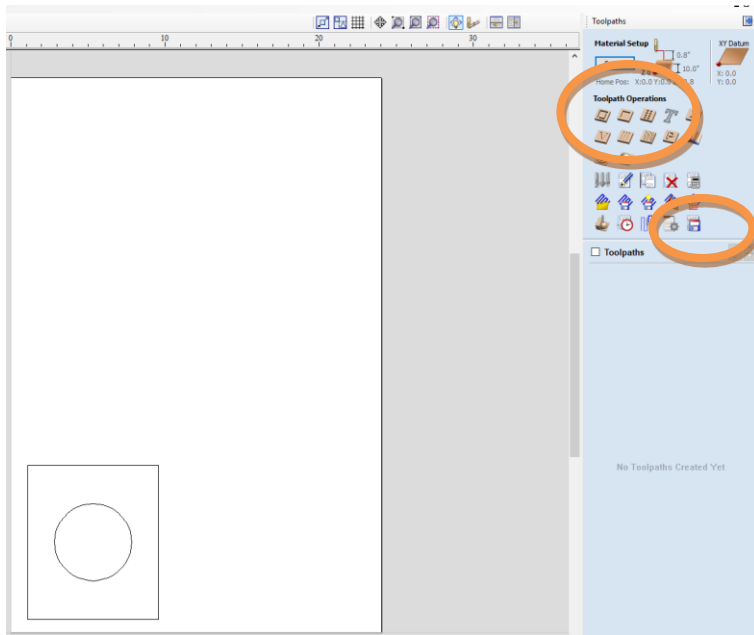
When starting Vectric Vcarve, you will start a new file by clicking on "Create a new file"



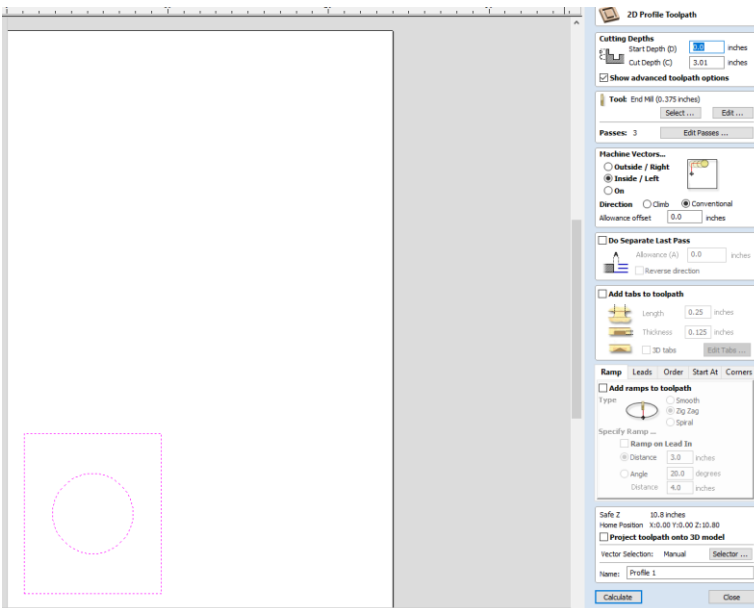
Job setup will appear. You will choose the size of your sheet, what units you will use, z zero position and xy zero position. These last two MUST MATCH where you set your zeros on your table or your part may not cut in the correct spot or may give a "Soft Limit" error.

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Applying Toolpaths



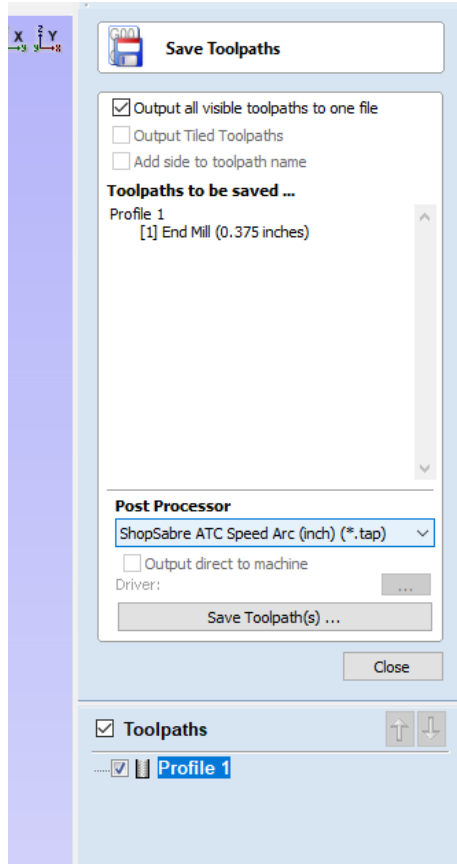
The right-hand toolpath menu gives you toolpath operations. The most common are the profile, pocket, and drilling (the first three icons under Toolpath Operations). Also showing the save toolpath button once the toolpath has been configured.



This shows the 2D profile toolpath. Change the settings to be appropriate for your job and click "calculate"

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Saving Your Toolpaths



In the Save Toolpath dialog box you will choose your post processor from the dropdown menu. Automatic Tool Changer machines should typically choose the “ShopSabre ATC Arc (inch)” unless you’re cutting your spoilboard. In that case, and for all non-tool changer machines, choose the “ShopSabre M5 Arcs (inch)” post processor.

Click “Save Toolpath(s)...” to save the .tap file that your machine will run.

You will also want to go to the “File” menu and click “Save” to save your .crv file. This file is necessary if you want to modify the drawing in the future, as .tap files cannot be modified by CAD programs.

ShopSabre VCarve Post Processor List

Below is a basic description of the Post Processors in Vectric and what they might be used for. If you have any questions, please contact our team to assure you are using the correct processor.

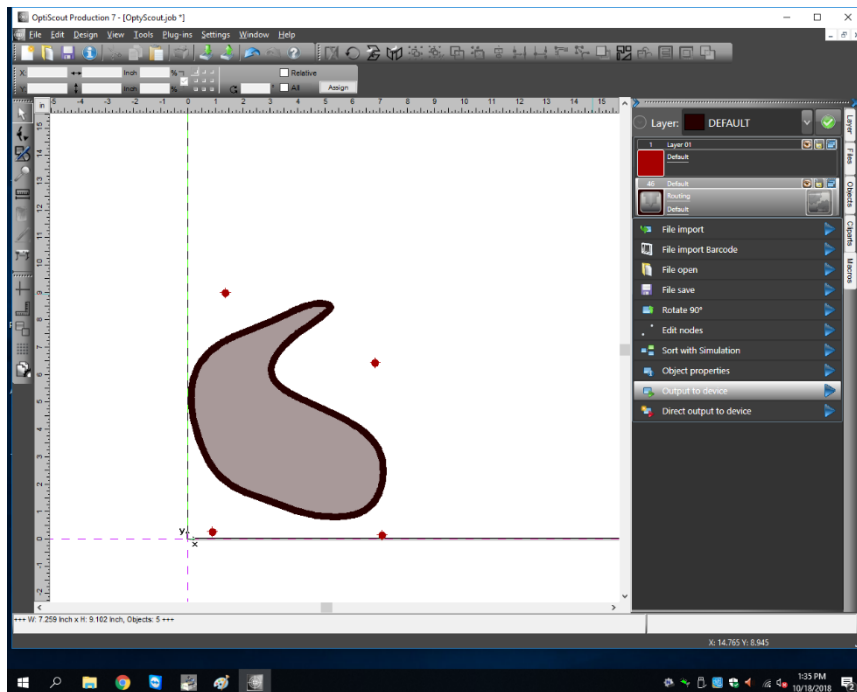
- **ShopSabre 4th Axis X2A (Inch)**
 - This Post is for the use with 4th Axis option orientated along the Y Axis converting the X Axis to Rotational – This Posts will output the measurement in Inches.
- **ShopSabre 4th Axis X2A TC (Inch)**
 - This Post is for the use with Auto Tool Changer machines using the 4th Axis option orientated along the Y Axis converting the X Axis to rotational. This Post will output the measurement in Inches.
- **ShopSabre 4th Axis Y2A (Inch)**
 - This Post is for the use with 4th Axis option orientated along the X Axis converting the Y Axis to Rotational – This Posts will output the measurement in Inches.
- **ShopSabre 4th Axis Y2A TC (Inch)**
 - This Post is for the use with Auto Tool Changer machines using the 4th Axis option orientated along the X Axis converting the Y Axis to rotational – This Post will output the measurement in Inches.
- **ShopSabre ATC Arc (Inch)**
 - This Post is for the use with Auto Tool Changer machines. This Post will output the measurement in Inches.
- **ShopSabre ATC Arc (MM)**
 - This Post is for the use with Auto Tool Changer machines. This Post will output the measurement in Millimeters.
- **ShopSabre Knife Arc (Inch)**
 - This Post is for the use with Tangential Knife optioned machines. This Post will output the measurement in Inches.
- **ShopSabre Mitsubishi ATC Arcs (Inch)**
 - This Post is for the use with Auto Tool Changer machines using the Mitsubishi Controller (IS-M Series). This Post will output the measurement in Inches.
- **ShopSabre M5 Arcs (Inch)**
 - This Post is for the use with Manual Change (Milwaukee and Non-ATC) machines. This Post will output the measurement in Inches.
 - **Note – This Post should also be used with Single Tool Output when not using the ATC System – (Example – Inserting Manual Spoil Board Cutter and Fly cutting a Surface)**
- **ShopSabre M5 Arcs (MM)**
 - This Post is for the use with Manual Change (Milwaukee and Non-ATC) machines. This Post will output the measurement in Millimeters.
 - **Note – This Post should also be used with Single Tool Output when not using the ATC System – (Example – Inserting Manual Spoil Board Cutter and Fly cutting a Surface)**
- **ShopSabre Plasma (Inch)**
 - This Post is for the use with ShopSabre CNC Plasma Cutting machines outputting in Inches of measurement.

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OptiScout Addendum

If you do not have the OptiScout camera system, please skip this section.

The OptiScout software and camera allow you to import a pre-made drawing with registration marks which you’ve created and printed using other software like Adobe Illustrator or CorelDraw, identify those registration marks with the camera, and automatically cut the shape with reduced user input. This print can be rotated and placed in almost any orientation on the table and the camera can automatically rotate the cut file that it creates after identifying these marks.



ShopSabre has pre-configured your machine so the offsets are measured and set correctly. OptiScout therefore already knows the distances between the spindle and the camera, as well as any other options you’ve purchased (tangential knife, creasing wheel, etc).

Each attachment has a slightly different procedure for setting up Z0 which is covered in this manual.

Before anything is cut, verify the camera is functional. First, inside the control cabinet we must verify that the coaxial video cable is plugged in to the camera capture device inside the control stand:

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On the left side is the USB cable that goes to the PC, and the right side is the video-in signal. This is done during testing at the ShopSabre facility and should already be complete, however it can be bumped around and come loose during shipping. If either of these are disconnected, reconnect them now.

Next, we must make sure the power on the top of the camera is lit up and that the lens cap is off the bottom of the camera.

Open the ShopSabre controller and home the machine. At this point, the machine could be used without OptiScout. We must first set our zeros for our attachments. When using OptiScout, these zeros should **ALWAYS** be set at the bottom of the material to be cut (top of your spoilboard). On the control screen you will see several buttons. Depending upon your purchased options you may have some or all of these buttons:



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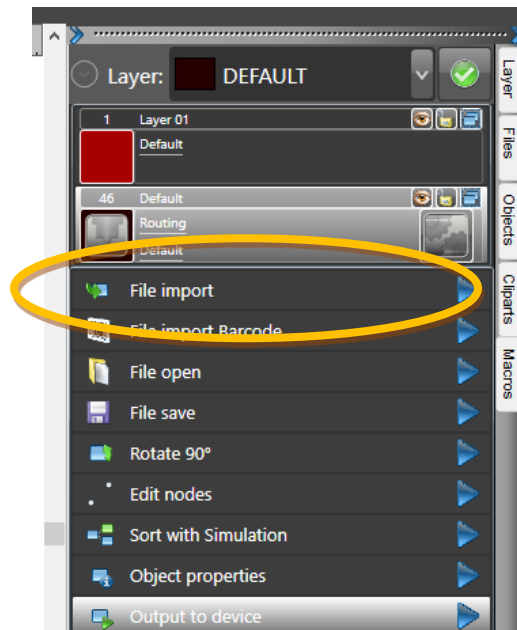
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Press the “Knife” button in the lower right corner of the above picture. This will lower the air cylinder for the knife attachment. Press the “Page Down” key on the keyboard until the knife is at the correct height for the Z zero. Once there, press the “Set Knife” button.

If you have a creasing wheel, raise the Z to the top of its travel, press the “Knife” button to retract the knife and press the “Creasing Wheel” to extend the wheel. Lower the Z until the wheel is at the appropriate height for z zero and press the “Set Creasing” button. Press it again to retract the wheel.

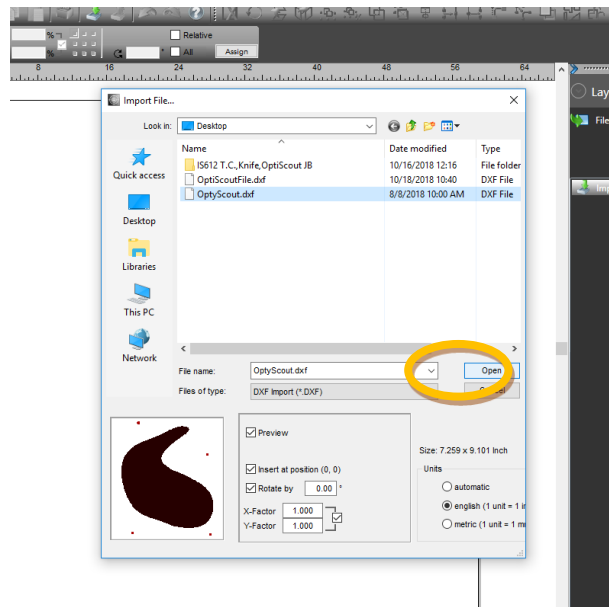
If you are cutting normal sheet goods you are now ready to use OptiScout. If your material is thicker than $\frac{3}{4}$ ” material, you will want to do the same procedure as above with the camera. This must be done to avoid a crash when the camera rapids across the material.

To use OptiScout, minimize the ShopSabre controller and open the program on the desktop of the computer labeled “OptiScout”. If a new file has not already appeared, start it from the File menu now. We are ready to import our drawing by pressing the blue triangle on the “File Import” button:



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This will open a dialog box to allow a file to be imported. Find the appropriate file, changing the file type if necessary, and click OK:



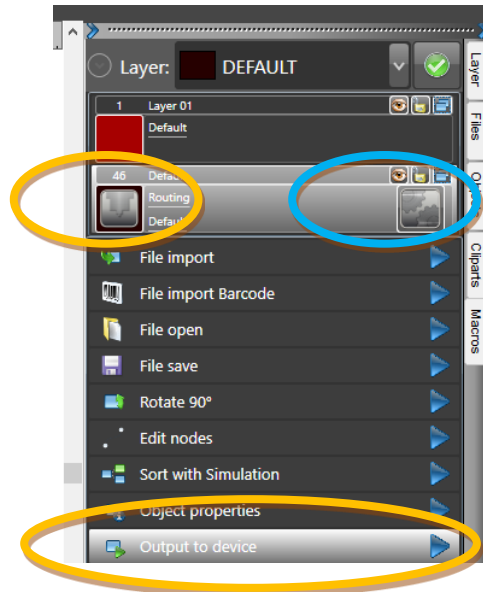
When the file has been imported it will appear as a drawing like below.

Note: If the registration marks have been drawn on a layer named "RegMark", OptiScout will automatically detect that layer as the registration mark layer and no further configuration needs to be done. We recommend this for all files to avoid confusion and increase ease of use.

The next step is to select your tool. Typically, only one tool will be used per file (only router, only tangential knife, etc). Although you can use multiple tools, OptiScout will not automatically create this and it will require going through these steps sequentially after each cut is made.

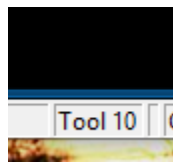
Our tool must be selected next. In the image below, click where it says "Routing" for a drop-down list of your available tools. Circled in blue is the configuration button. Pressing that will allow us to set the depth of cut, depth per pass, which tool number is used, RPM, and feed rate for both XY and Z axes. **Note:** The tool number is set by the material at the bottom of the configuration screen. Any changes made here will not persist between operations unless saved to a default profile and should be checked each time to make sure they are accurate. We have set the Knife to default to T31 and Wheel to T32. If you create a new material, which is rarely necessary, make sure these are correct before running.

Finally, we will press “Output to device” and it will open the OptiScout camera screen. Before the file is output, there are a few things of note:



If any tools are loaded into the spindle, it will immediately try to unload these tools. This will happen immediately and very quickly. **You cannot abort the program through the OptiScout software. If you need to stop for any reason, flip back to the ShopSabre controller, or use the e-stop button.**

Make sure the tool loaded in the spindle (if applicable) is the correct tool, and that the tool it thinks it has in the lower right corner of the screen is the same tool that’s actually in the spindle.



If you’re using the router, rather than knife or creasing wheel, we must do two things first:

1. Type in “G49” to the controller. This will remove our low boundary, allowing us to move the bit down to the spoil board
2. Type in “G37CAL” to the controller. This will set our Z Zero for OptiScout and do a tool measure on that tool. Once this is complete, we can run OptiScout like normal.

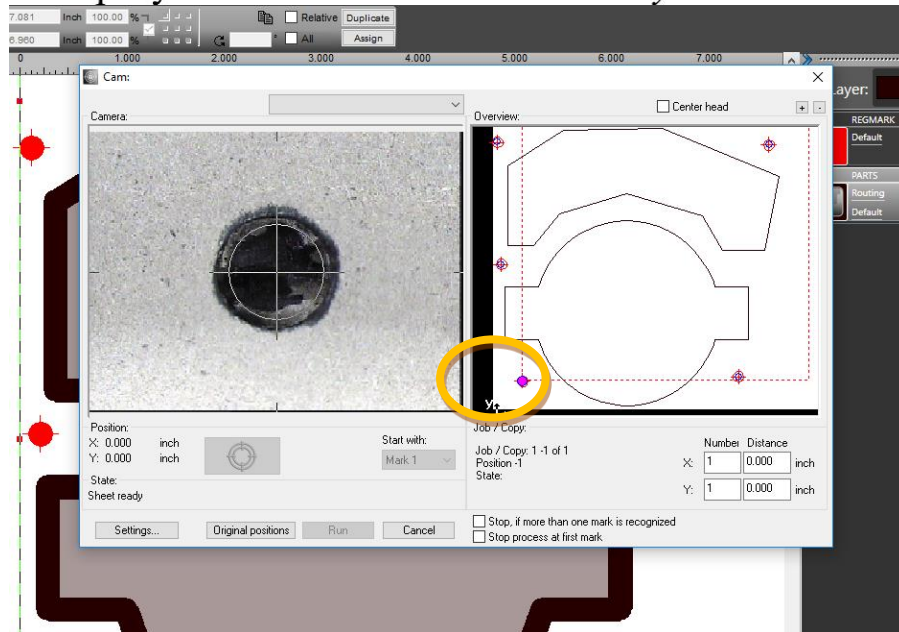
Once the tool has been placed in the rack, the gantry will move forward to the origin, drop the spindle and the camera and attempt to find the first registration mark. The one it’s looking for will be highlighted as shown below and the camera video feed will be displayed. If the video feed is not shown, see the end of this document for troubleshooting.

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A green circle will be displayed when it finds the circle. These registration marks are set to be $\frac{1}{4}$ " diameter. Using the incorrect size for registration marks will decrease the chance of success and it may not be able to discover them. If it is unsuccessful in locating the mark, it will release control to the user and you may drive the camera to center it on the registration mark. Either way, pressing the target button will attempt to lock in the circle as the coordinate.



Once successful, OptiScout will move the machine to the next location where it thinks a registration mark exists. Again, this may require manual intervention if the rotation of the print on the table is significant. After two registration marks it is typically able to calculate the locations of the rest and will automatically find them. If necessary, these can be found manually also.

After OptiScout has successfully found enough registration marks it will proceed to output a .tap file into the c:\wincnc directory and then command the controller to run this file. At this point one of several things may occur:

- The spindle will retract upwards
- The camera will retract
- An additional tool (knife, wheel, etc) may drop down
- The router may return to the tool rack to grab the bit that has been called in the OptiScout program

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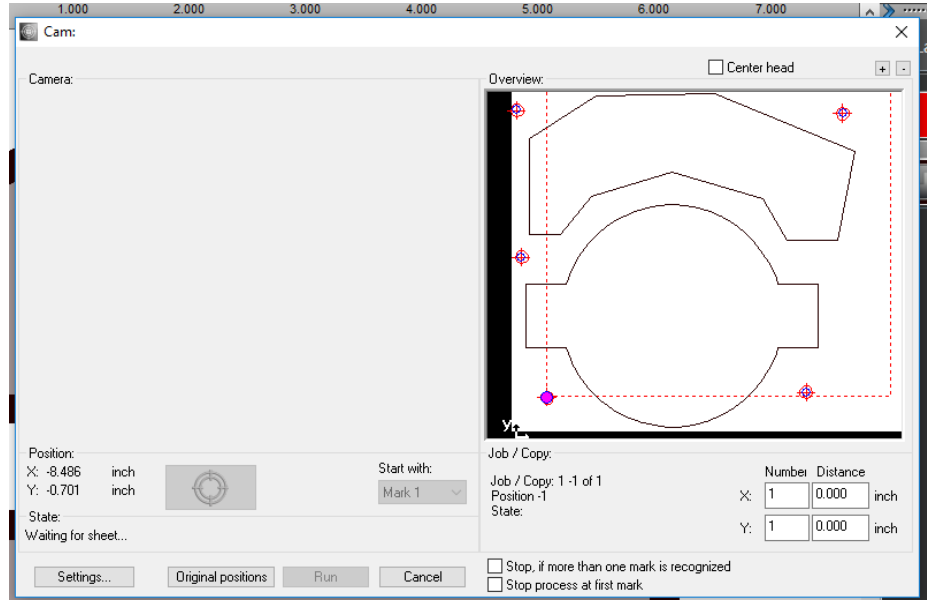
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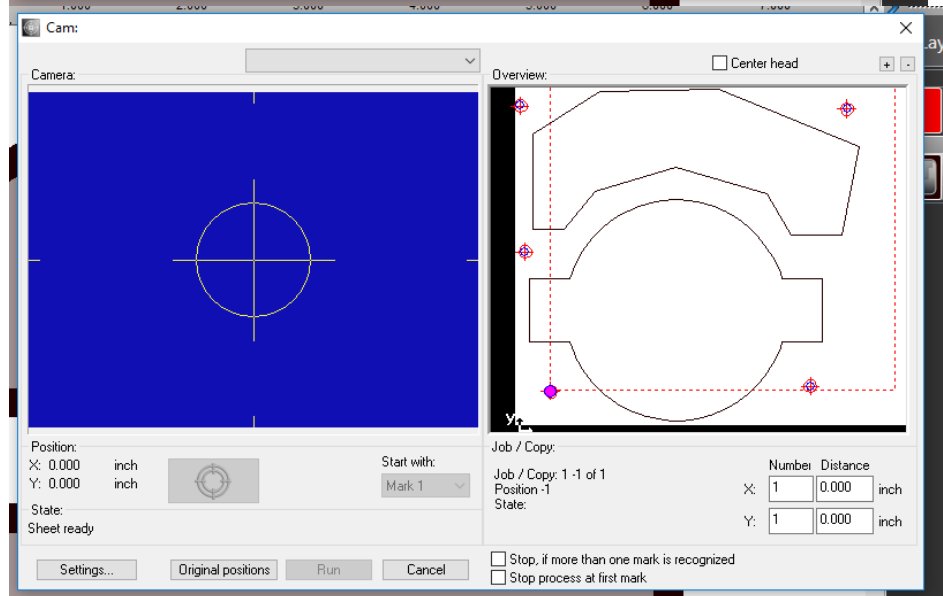
The machine will then proceed to move to the appropriate start point, drop the cutting tool, and run through the cut file. When it is finished it will raise the Z and the controller will indicate the file has been finished. Keep in mind, OptiScout may not automatically bring the controller to the front of the monitor and we recommend that operators of the machine watch the controller rather than the OptiScout screen in case an abort is required.

If the camera feed does not appear, the color of the screen will indicate the problem.

A gray/blank screen indicates the camera capture device has not been recognized. Typically, this means the USB cable is not plugged in on one or both sides, but could indicate the driver is uninstalled or not detected.



A blue screen indicates no video connection along the coaxial cable. The driver and capture device has been detected, but either the video cable is not connected or the camera does not have power. Check the light on the camera and the cable connection.



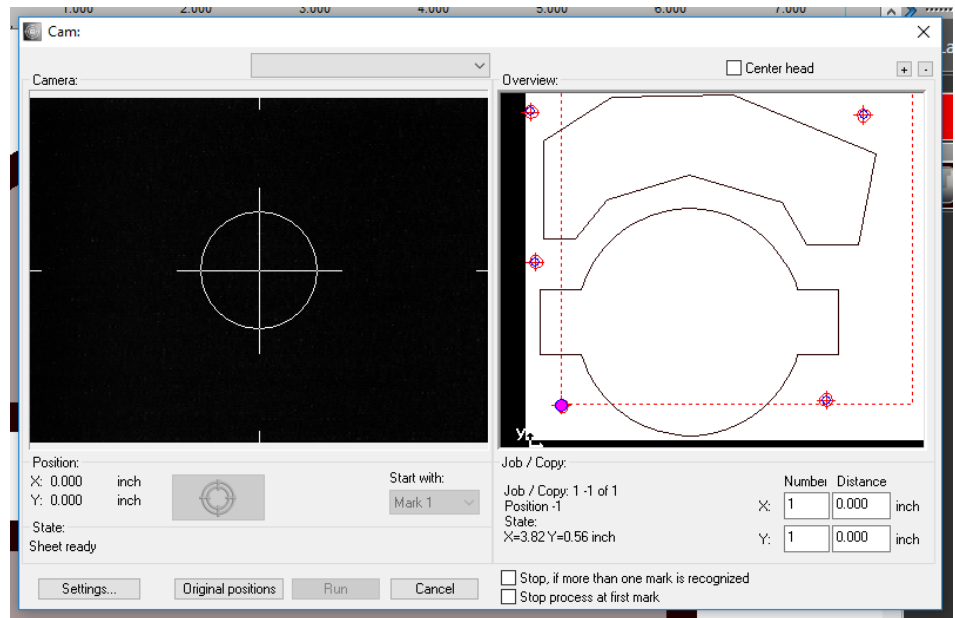
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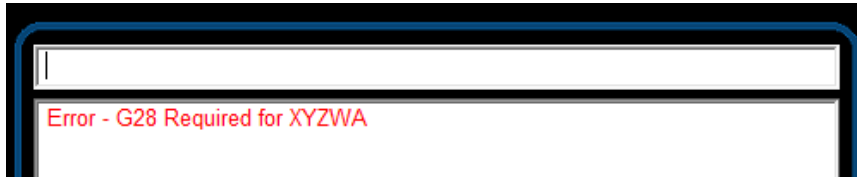
A black screen means the lens cap is on. Remove the cap from the camera and the video stream should be restored.



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Frequently Asked Questions

Q: My machine is telling me "G28 required"



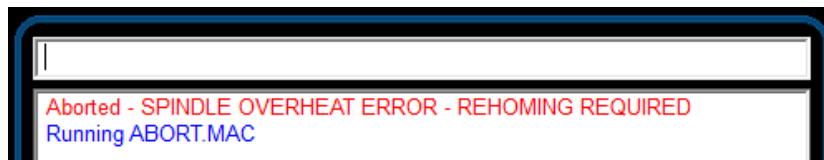
A: The machine needs to be homed before other operations can commence. If it gives this error after pressing the "home" button, it means there is another error. Pressing an arrow key on the keyboard to tell the machine to jog will often bring up the true error.

Q: I got an "Emergency Stop" error.



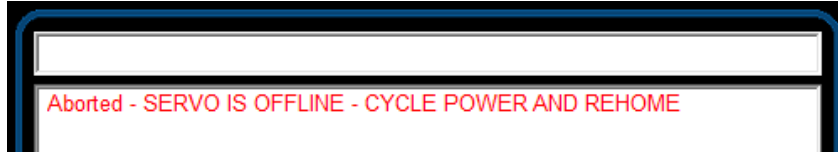
A: First check that the emergency stop button is pulled out. If not, twist the knob to release it. If it is pulled out, check the back of the computer to make sure you have the 37-pin cable from the control box plugged into the blue port. If this is correct, please call tech support.

Q: I got a "Spindle overheat, must rehome" error.



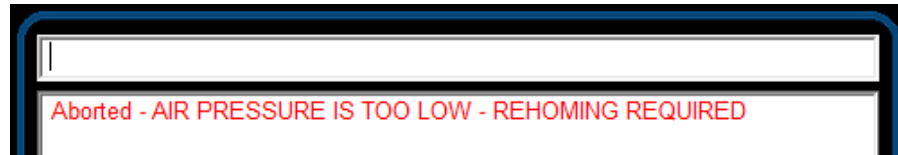
A: Check to make sure the 37-pin cable from the control box is plugged into the blue port on the back of the computer. If this is correct, then double-check to make sure the power switch is in the "ON" position. If so, check to see if the fan on the control box is spinning and that other components inside the box have lights. If not, the box is not receiving power. If components in the control box are receiving power, please call tech support.

Q: The machine stopped while cutting and gave a “Servo offline, cycle power and rehome” error.



A: If this is the first time it happened, simply cycle power and rehome the machine. If it happens again and you're not sure why the servo went offline, inside the control box each axis motor has its own amplifier drive. On one drive will be an alarm code. Look to see what this code is and call tech support before cycling power. We can use this code with what the machine was doing to better determine why it went offline.

Q: A “Low air pressure, cycle power and rehome” alarm appeared on screen



A: Automatic Tool Changing machines require 95 PSI minimum at all times to function properly, and we typically recommend 110-120 PSI so it won't error on minor fluctuations. If the pressure or CFM drop below minimums even for a fraction of a second the machine will trigger that alarm. This can be reduced or eliminated all together with the proper air pressure, CFM, and equipment that is capable of keeping up with these requirements. During tool change operations, 5 CFM is typical, with 1 CFM common during normal operation. The regulators on the side of the machine do not need adjustment, only the incoming air pressure to the machine from your compressor. A 3 to 5 HP compressor with a 60+ gallon tank and 3/8" air lines are usually sufficient. If there is a regulator in between the machine and the compressor try removing it and going directly between the two.

Q: The machine stopped and gave a “Soft limit exceeded y+” or another axis or direction (x-, x+, y-, z+, z-)



A: The controller software has calculated that the next move will take it beyond the cutting limits of the machine and has stopped itself to prevent damage. With an X or Y error, this typically means either the XY zero point needs to be moved or that the drawing is too large for the table (or both). Previewing the drawing in the preview window will often show it outside of the red box, indicating it is outside of the table’s cutting area. A “Z”-error means the spindle can’t move any lower, and your bit may need to be lowered in the collet or a longer tool cone ordered for the bit to reach the depth required. A “Z+” error generally indicates that some other problem occurred. Scrolling up in the g-code history will often show the first error that prompted the Z+ error – for instance a program telling the machine to lift too high.

Q: I received a “Low Boundary” error while cutting or jogging the machine

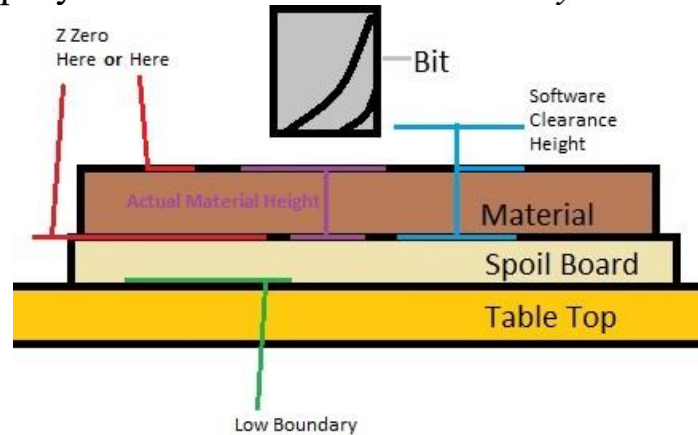


A: There is a limit that is set at the factory to protect the machine’s tabletop from bits cutting too low and damaging it. The most common cause of this is the current bit not being tool heighted before cutting. Press the “Tool HT” button on screen, then reset your Z Zero and try again. If it persists, the program is likely telling the machine to cut too deep. Check how deep your program is set to cut, and also whether the position of the Z0 in the file matches the position on the table (i.e., on top of material or top of spoil board).

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Q: After using the material height touch pad my machine is cutting 1/8" too high.

A: The inside of the height pad must be cleaned. The contacts may have oxidized from contact with air and the machine will think the pad is pressed when it's not. Refer to that section earlier in this manual for how to clean the pad.

Q: My tool changer is "leaking" air even when a tool is inside the spindle

A: This is normal. It uses around 1CFM to help reduce the amount dust and debris from entering the spindle from below.

Q: My dust dock skirt falls off when the machine tries to pick it up after a tool change

A: Usually one of two things has happened: either the magnets or peg holes are filled with debris where the two parts of the skirt can't lock together properly or the yellow Dock arm has fallen and is no longer level. Place a level on the arm and, if necessary, loosen one or both of the two bolts holding it to the machine, level the arm and tighten the bolts back down. The machine must also be leveled or the arm will not be parallel with the tabletop. Alternatively, if someone has moved the top mounting plate of the dust skirt to a different position vertically on the spindle the magnets may no longer be able to grip with full strength. If this last option is the case, contact tech support for help with changing the coordinates to the new position.

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Understanding Basic G-Code

This section is not a comprehensive list of g-codes or specifically how to code files. It’s simply a set of basic, common g-codes that your files will often contain. All spaces are ignored by the controller.

G0	Indicates a rapid move to a location (I.e., G0 X15 Y37 moves to those coordinates at rapid speed)
G1	Indicates a move at the specified feed rate which is usually indicated on the same line or an earlier line
G2 or G3	A smooth arc motion either clockwise or counterclockwise
G53	Calls for a rapid movement using absolute coordinates. The coordinates with G53 are based on the machine’s home location rather than a working zero.
G54, G55, G56, G57	An X or Y direction offset (or both). If your machine has multiple cutting heads, each one will have a position specified by one of these offset numbers. While setting an XY zero with one cutting head, make sure to be in the proper offset. For instance, if you have both a spindle and a tangential knife, you would make sure to be in G54 mode when using the spindle to set the XY zero.
G90	Sets the controller to absolute coordinate moves. Nearly every G-code file should begin with this. All subsequent G0, G1, G2 and G3 moves will be based on your XYZ zero point. (I.e., X2 moves it to 2 inches from 0. Another X2 would not move at all since it’s already at X2)
G91	Sets the controller to relative coordinate moves. All subsequent moves will be based on the current position of the spindle. (I.e., X2 moves 2 inches to the right of its current location. Another X2 moves 2 inches to the right again).
G92	Clears all working zeros
G92 X#Y#Z#	Sets a working zero that is # distance from the spindle’s current location. (I.e., G92 X0Y0 will set the current location as X0Y0, where G92 X5 will set the X zero to be 5 inches to the left of the current position and not change the Y zero)
M3	Turns the spindle on
M3.2	Turns the drill bank on if that option was purchased
M5	Turns all spindles off
G4x#	A G4 by itself will pause indefinitely while it waits for the user to hit the enter key. G4x# will pause for # seconds. For example, a warmup macro might do a G4x600, which pauses for 600 seconds (10 minutes) while the spindle spins.
S#####	Sets the RPM for the spindle if that option was purchased. (I.e, S18000 sets the spindle to 18,000 RPM). If this option was not purchased the controller will ignore this code.
F###	Sets the feed rate for all G1, G2, and G3 moves. Can be used at the end of a movement line (G1 X10 Y5 F100) or on a line by itself, before any G1 lines, calling out which axes to set (F350XY). XY feed speeds must be set separately from Z feed speeds. Using an F# on the end of a line with a X Y & Z movement will only set the feed rate for the Z axis.
M11C1	ATC spindle jaws open
M12C2	ATC spindle jaws closed

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Common Bit Types

All bits have a “chipload” which is literally the thickness of the slice it is cutting off of the material. This chipload goes into a formula with Spindle Speed, # of cutting edges, and feed rate:

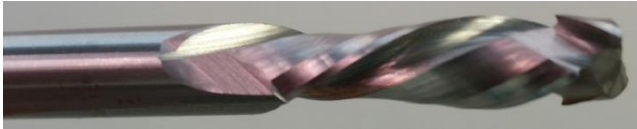
$$\text{Feed Rate} / (\text{RPM} \times \# \text{ flutes}) = \text{chipload}$$

Most manufacturers will provide a chipload chart which details what the expected chipload is for the bit. There are many calculators online and Vcarve Pro 10.0 or higher includes one in the tool database. Input the number of flutes and the desired RPM, then change the feed rate until the chipload is within the desired range.

Note: running a bit below its chipload will cause overheating of the bit, reduced tool life and possible burning of wood and melting of aluminum and plastics. Running a bit above its chipload will cause excessive force beyond what the bit is designed for and will likely break the tool. It is also important to take into consideration the torque curve of the spindle and how hard the bit will be pushed into material. Most spindles and routers have higher torque at higher RPM and can therefore be pushed harder without stalling at higher RPM.

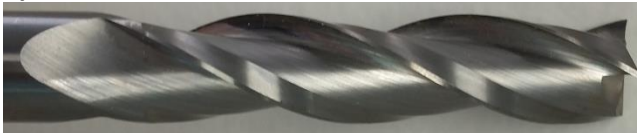
Below is a list of common bit types:

Compression



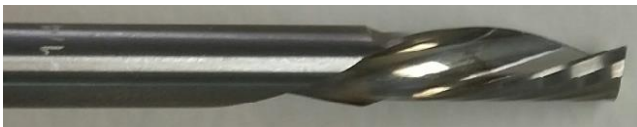
Compressions are every-day cutting bits. Normally used when you want a clean finish on both top and bottom surfaces and are cutting through the material in one pass at a high feed rate. **They must always be ramped-in during cutting, never plunge cut.**

Upcut



Upcuts are best for pulling material out of the kerf and giving a good bottom finish. Aluminum and plastics will always use an upcut made specifically for those materials. These bits almost always reduce hold down as they pull upwards on the part. They can be plunge-cut.

Downcut



Downcuts are used when a good finish on the top surface of the part is needed. They also tend to increase hold down as they put down force on the part. **They must always be ramped-in during cutting and cannot plunge-cut.**

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V-bit



Used primarily for v-carving and engraving, but can also be used for cutting very fine details with a shallow depth of cut. They can be plunge cut, but only for their shallow depth of cut.

Spoilboard Cutter



Spoilboard cutters are used only for quickly surfacing large material – usually the sacrificial board placed on top of the machine's tabletop but below your material. These are not used inside of a tool change rack, nor are they commonly used with any tool change operations. Typically used to cut 0.02"-0.06" per pass to flatten a board. Can be plunge cut but typically have a maximum cut depth of 1/8" or less.

Ball Nose



Used primarily for 3D work or creating channels with a rounded shape, especially for inserting gasketing. Can be plunge cut, but the geometry of each ball nose can be different and plunge rates may need to be reduced.

Tapered Ball Nose



Used primarily for 3D finishing work where very fine detail is necessary. The taper allows for fewer broken bits as the tool is stronger. Stepover of 1-3% is typical when finishing work needs to be minimized.

Drill



A normal drill bit used for plunge cutting holes of the identical size as the bit. Although typical drills want to spin at 2-3,000 RPM, most spindles must spin around 4-6,000 RPM due to torque limitations at low speed.

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ShopSabre CNC Warranty

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The liability of Numerically Automated Cutting Systems/DBA ShopSabre CNC under valid warranty claims is limited to repair or replacement of defective components at Numerically Automated Cutting Systems/DBA ShopSabre CNC discretion. In no way or any circumstance does this warranty cover or extend to incidental costs, loss of time, loss of revenues, and/or consequential damages.

Warranty does not cover customer caused damages; damages due to misuse, negligence or accident and/or installation and internal adjustments or modifications other than those stated in the "Installation and Operation" sections of operation manuals or without the express permission of Numerically Automated Cutting Systems/DBA ShopSabre CNC.

Onsite service is available where determined necessary with collaboration with ShopSabre Technical Support, in such case the Labor and parts costs are covered. Travel costs including hotel and meals are the customer's responsibility and charged at time of scheduling.

RETURNS AND ADJUSTMENTS

Equipment incorrectly ordered is subject to a 35% restocking charge. Merchandise that has been abused, mistreated, or shows signs of wear will not be accepted for return or credit. **No returns on Software (whether purchased or provided with a machine), whole machine units, custom or special orders. It is the customer's responsibility and risk to determine the suitability of a machine assembly or option to fit the needs or function required. No returns will be considered/accepted after 30 days.**

Numerically Automated Cutting Systems/DBA ShopSabre CNC will ship replacement/warranty parts via standard ground transportation. Expedited or overnight services are available at an additional cost.

Any product, component, or assembly returned for Any Reason shall be sent insured prepaid via the means of transportation specified by Numerically Automated Cutting Systems/DBA ShopSabre CNC. In all cases, Numerically Automated Cutting Systems/DBA ShopSabre CNC has sole responsibility for determining the cause and nature of failure, and Numerically Automated Cutting Systems/DBA ShopSabre CNC determination and any remedies with regard there to shall be final in all cases.

Warranty parts/components not returned within 5 business days will be charged in full to client. Outstanding balances may result in cancellation of further warranty and/or support until balance is cleared.

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SHIPPING DAMAGE

All shipping damage must be reported to **the shipping company** at the time of delivery and noted on paperwork before signing. If damage is discovered after the driver has left, you must contact the shipping company and file a report for the damages found. In both events, notify ShopSabre as soon as possible. We will try to assist you with a claim. The claim is between the customer and the shipping company unless otherwise stated in writing. All replacement parts will be billed to the customer and the shipping company will reimburse the customer directly for the parts. In the event that a ShopSabre technician is required, they will be billed at \$65 per hour plus travel expenses for each technician required.

EXCLUDED PRODUCTS

All laser optical components are specifically excluded from warranty.

All Consumables are specifically excluded from warranty.

All Software is specifically excluded from warranty.

WATER-COOLED AND AIR-OPERATED PRODUCTS

Numerically Automated Cutting Systems/DBA ShopSabre CNC does not warrant any of its water-cooled or air operated products against contingent or subsequent damage resulting from negligence in providing the required water-cooling or air pressure or from unexpected events which cause the required water-cooling or air pressure to be interrupted during operation of the equipment or from unacceptable water quality or air quality/volume/pressure. Warranty does NOT cover damages due to moisture in air operated items- ShopSabre does recommend use of appropriate air contamination removal.

TERMS

All payments are due 50% at the time of order and the final balance including shipping and handling prior to shipment whether for complete systems, subsystems, accessories, or parts orders. Numerically Operated Cutting Systems/DBA ShopSabre CNC will not extend credit.

SALES TAX

State Sales Tax will appear on all shipments to states in which ShopSabre CNC has economic nexus, unless a signed official state tax exemption certificate is furnished to Numerically Automated Cutting Systems/DBA ShopSabre CNC at time of purchase. ALL purchasers are responsible for payment of sales/use tax to their own state or local jurisdiction where applicable. Governing Law: The State of Minnesota is the jurisdiction and the governing law. No Taxes of any kind will be assumed covered unless otherwise stated in the order details.

SHIPPING/INSTALLATION

All Shipping will be facilitated through ShopSabre’s broker unless otherwise stated. ShopSabre will use best judgment when choosing the delivery method. Customer will be responsible for unloading and installation of equipment. ShopSabre will not provide unloading services unless otherwise stated in writing at the time of order. All machines will require proper equipment for unloading specified in user manual. It is the customer’s responsibility to have proper equipment for unloading, any cost associated with this equipment is customer responsibility. Freight deliveries are ONLY estimating, no guarantee is provided. ShopSabre does not recommend renting unloading equipment until confirmation phone call with carrier has taken place. Numerically Automated Cutting Systems/DBA ShopSabre CNC is not responsible for extra costs or losses that occur due to shipping delays. ShopSabre is not responsible for freight delays related to the chosen carrier, weather, or acts of God – Costs related to such delays are not Numerically Automated Cutting Systems/DBA ShopSabre CNC responsibility. If you require special delivery needs you must let ShopSabre know in writing prior to shipping. Extra costs may result from special shipping requirements and will not be covered by any promotions, sales, or discounts. ShopSabre reserves the right to charge storage fees as necessary for orders that are unable to be received within delivery window.

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Customers choosing to pick-up their own equipment must do so within 48 hours of completion or storage fees may apply. Customers picking up must provide flat trailer with no sides. Customers picking up will be responsible for providing necessary straps, tarps, and protection against damages. ShopSabre will not extend liability for customer pick-up and will not be responsible for damages related to travel.

ShopSabre is not responsible/liable for damages, losses, injury, or failures related to unloading the equipment or installation of the equipment. ShopSabre will not be responsible for equipment that is improperly installed. All Utilities should be installed to local code and inspected for safety by a professional prior to powering up. Numerically Automated Cutting Systems/DBA ShopSabre CNC does not extend liability for improper utility installation.

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