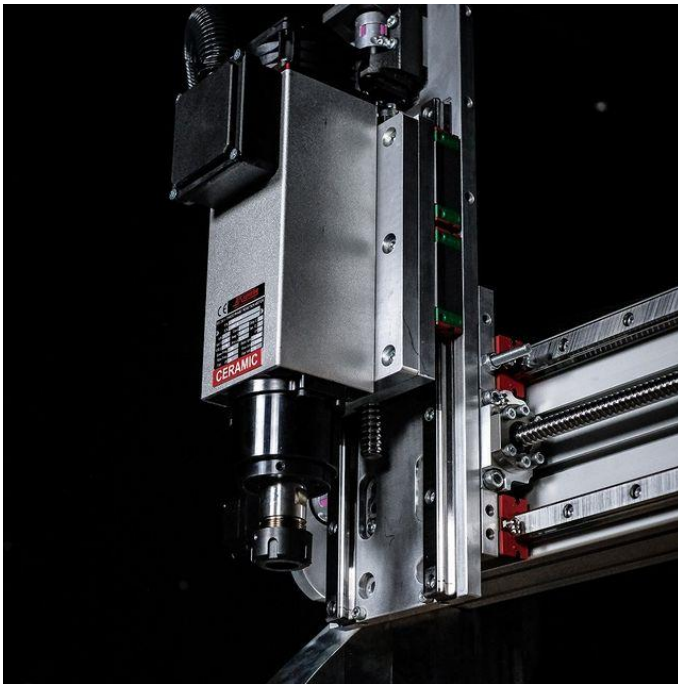


Section 1 – General Introduction to CNC



4.0 ROBOTICS

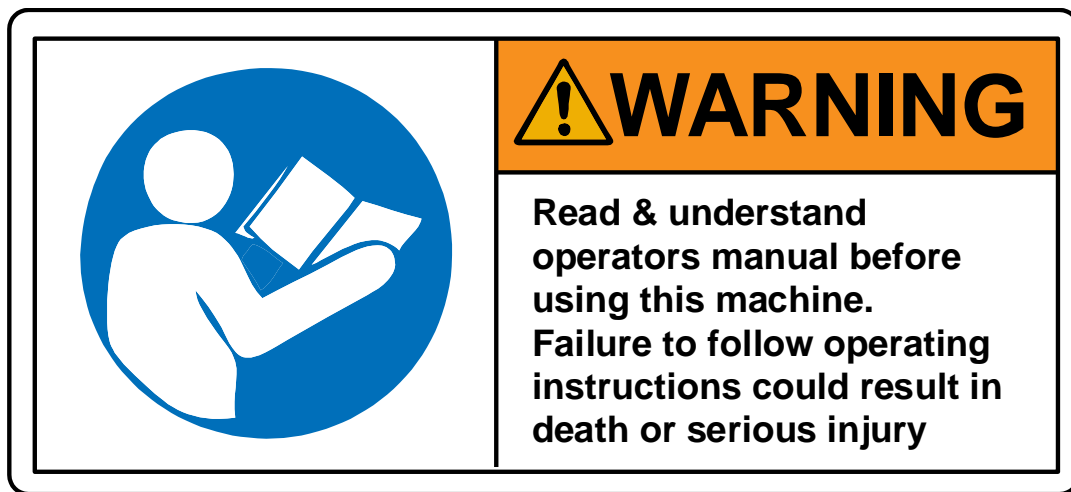


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Before using/powering on the machine, the device should be carefully checked to make sure all connections are secure and the device is technically sound.



**Ensure You understand
the safety considerations
of a machine provided
in the open configuration
without a safety
enclosure**



**Do NOT Interfere
with the machine
when under CNC
control**



**NEVER LEAVE
THE MACHINE
WORKING
UNATTENDED**

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1 INTRODUCTION

Thank you for purchasing your CNC system from BG Precision. This manual is a general introduction to CNC and is not specific to any one system in our range. Supplementary material will be provided specific to the machine make and model of which you have purchased.

Firstly, please inspect the machine and all components after delivery has been received. Please check and ensure all aspects of the machine and associated extra items are in good condition and there is no evidence of damage or wear to any components due to the shipping process.

Please ensure you read all the operational manuals for this CNC machine prior to attempting to use the system. Throughout this manual there are references to “A Trained Operator” or “Trained and Experienced personnel”. These are defined as follows:

All persons that use, or come into contact with the CNC system MUST:

- understand what a CNC router/mill/laser is and can do
- read and understood the content of this user manual prior to using the system
- be able to always exercise control of the CNC system
- follow all the guidelines presented including the use of appropriate PPE
- seek further instruction if anything is unclear
- be sure that you have understood these instructions completely

Responsibility of use or misuse belongs to the end user. BG Precision PTY LTD and its affiliates accept no responsibility for use or misuse by the user. If you may not be able to use this product properly, we recommend that you do not begin use or cease use immediately.

This manual was not intended to cover every facet of machine operation. This manual serves to provide the information needed to safely operate and maintain the CNC system. This manual has been designed to be used as an instruction tool as well as a reference tool for everyday work. Step by step instructions are provided where possible to help all levels of users understand the machine.

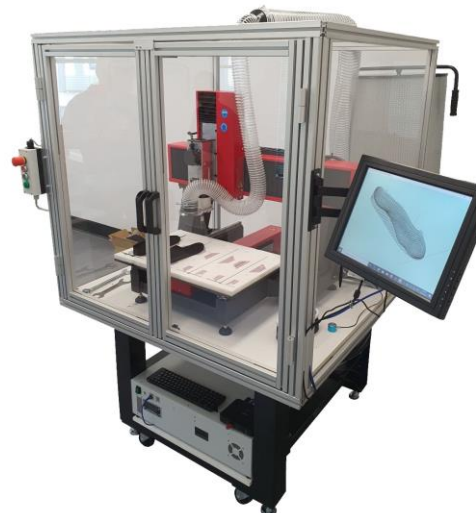
NOTE: Important aspects of machine use and best practice are highlighted and should be adopted where possible to maximise the machine tool life and performance. It is VERY IMPORTANT that all personnel read and understand the safety chapter BEFORE operating the machine. All Warning and Caution notices must be noted before interacting with the machine.

If there are any further questions or if anything is not clear, please contact us at info@bgprecision.com.au

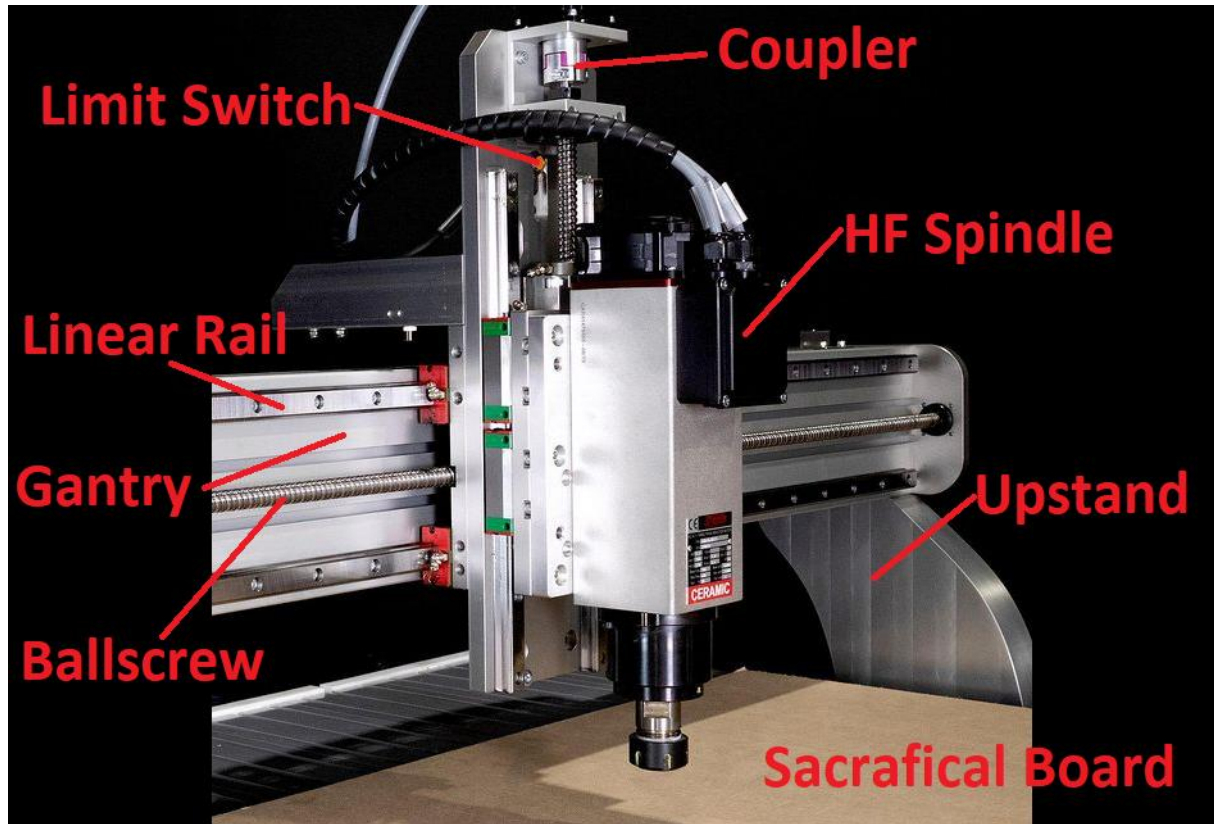
2 CNC MACHINE OVERVIEW

Broadly speaking a “CNC Router” is a computer-controlled machine that has a spindle mounted on it that holds a cutting tool (router bit). It is typically set up with 3 directions of movement referred to as the X, Y and Z axis. The position of the router is determined by a computer telling the motors mounted on each axis how much to move in each direction.

Using this method of positioning, any location within the machines work area (envelope) can be defined and the router can be moved within that space. As the machine is driven by a computer telling it where to move, the operator uses a software program to draw the shapes they want to cut and create the path that the machine will follow.



2.1 COMPONENT IDENTIFICATION



Component	Function
CNC Controller	The controller is the white control box that has the electronics necessary to move and manipulate the machine position and spindle speed. We utilize a Windows PC based controller called UCCNC
CNC Router	A computer-controlled machine for subtractive machining of non-ferrous materials such as wood, plastics, brass and aluminium
HF Spindle	All our machines are equipped with a High Frequency (HF) Spindle which has better power and torque characteristics than a single phase fixed frequency spindle such as a trim router or drill. There is a frequency inverter inside the CNC Controller that controls the spindle speed by varying the frequency from 0-400hz. There are three categories of spindle we use: MTC – Manual Tool Change QTC – Quick Tool Change ATC – Automatic Tool Change
Tslot Table and Sacrificial layer	Your work is usually placed on the bed of the CNC. Most our machines come with a T-Slot table which allows for multiple clamping methods such as T-slot clamps and T-nut inserts. It's a good idea to always use a sacrificial layer under the work piece you are machining. This is especially important when you are milling all the way through the material. 3-4-6mm MDF often works well. It saves you blemishing the T-slot Aluminium table. Often if you use a thick layer you can use a drill and screws to fix your work. Crude but functional.

Gantry	The gantry is what supports the spindle above the material and allows is CNC machine to transvers in the X direction.
Upstands	The Upstands support the gantry and are normally connected under the table via an undercarriage allowing the CNC machine to transverse in the Y direction
Linear rail	<p>The profiled linear rails are one of the best linear motion systems for machine accuracy.</p> <p>The coefficient of friction on linear guides is only a small fraction of what is created by traditional round guides and can take loads in all directions. With these features, our CNC machines achieve the highest level of system accuracy and greatly enhanced moving accuracy to allow quality surface finish when machining woods, plastics and alloys.</p>
Ballscrew	<p>Ball screws offer a high level of mechanical efficiency, can carry remarkably heavy loads and produce minimal friction. This is because they are designed with a nut in which ball bearings circulate. The ball bearings create a smooth gliding surface for the screw, thereby reducing friction and subsequently increasing the ball screw's lifespan.</p> <p>Motion on every axis of our CNC machines are controlled by high-precision ball screws. Their ability to create low internal friction, while withstanding high thrust loads at high rates of speed, is paramount to the accuracy of the CNC system</p>

2.2 KEY AREAS OF KNOWLEDGE

As with any subject, the more time you invest in learning about CNC and the related technologies, the more you will get from it. To achieve the best results, there are a few key areas which you should concentrate on:

1. Computer skills

One requirement common to all aspects of CNC work is how to use a computer to perform basic tasks. You will be working with computers and computer programs during almost all the steps of the process as you design your parts and need to understand basic operations such as starting and stopping programs, saving, copying and deleting files, finding files stored on your computer and installing programs and updates.

Your CNC machine is also run by a computer, this may be a standalone PC or a dedicated Control Box with PC built in.

By purchasing a CNC Machine, it is assumed a basic knowledge of computers and the Windows operating system, if you don't feel comfortable with your current computer skills or are new to running a PC then it would be well worth taking a basic course or buying a general guide to working with your PC.

2. Design & Toolpath Software

Before you can cut anything with a CNC, you need to first create the design layout that the machine is going to follow to cut the parts. The software you choose will play a significant role in successfully creating projects with your CNC. Simply put, the design software will allow you to transform "pencil and paper" ideas to a set of instructions used to run the machine. When done correctly, the end result will be a physical product you can touch and hold that has value and purpose and a great sense of achievement.

3. Operating and Maintaining your CNC Machine

If you currently own or use a CNC machine, you already know how important it is to keep it properly maintained and adjusted, to know and understand its limitations and how to set it up correctly to run a job.

If you don't own a machine yet, then it's important to spend time thinking about what you want your machine to be able to produce, this can eliminate a lot of future frustration. Cost will always be an important factor but realize that you need to balance that with capabilities, because nothing can be

more expensive than a machine that cannot do what you need. For example, if you want to cut large sheet goods then a desktop model will probably not be your best choice. However, if you only have room for a small machine this may be your only option and you need to understand its limitations on how large a part it can cut. Only you can determine what this balance will be for your situation and budget.

Some important considerations when researching the purchase of a machine or when looking at building one yourself include size, speed and accuracy and the technical support offered both before and after the purchase. As with software, the importance of a company's reputation, support, and an active website and/or forum cannot be understated.

Every CNC machine needs software to directly drive its movement; this is commonly referred to as the 'Control Software'. All machines sold by BG Precision utilise a Windows based control software called UCCNC.

4. Knowledge of Materials and Tooling

The user is responsible for defining the tool parameters in Vectric. One setting does not cover all toolpath operations. One setting does not cover all materials. The geometry you need is diameters and/or Angles and that is written on the tool label.

When it comes to obtaining the best possible results, you cannot forget the material you are working with or the tool you are using to cut it. The type of material will factor into every stage of the Project – from initial concept through final finishing.

The common materials people using CNC Routers work with include; wood, plastics, dense foam board and softer (non-ferrous) metals (brass, aluminium, etc.). If you are not already familiar with the type of material you want to use, there are many sources of information that can help you.

Typical questions you must answer for the type of material include proper tool (bit) selection, how fast you can move that tool through that material (Feed Rate and Plunge Rate), how much material you can remove at one time (Pass Depth and Cut Depth) and how fast the bit should be rotating (Spindle or Router speed). Typically suppliers of tooling offer information on the correct settings for the router bits they sell.

I recommend you read these two pages:

<https://docs.vectric.com/docs/V10.5/VCarveDesktop/ENU/Help/form/Tool%20Database/index.html>

<https://www.cnccookbook.com/feeds-speeds/>

3 SAFETY

The CNC Machine is an electrical appliance and precision machine. Protect yourself and your investment by reading and understand the entire owner's manual before attempting assembly or operation. Read and understand the warnings posted on the machine and in this manual. Failure to comply with all the warnings may cause serious personal injury or costly damage to your CNC machine.

This CNC machine is designed and intended for use by properly trained and experienced personnel only. If you are not familiar with the proper and safe operation of a CNC machine, do not use the CNC Machine until proper training and knowledge have been obtained.

Your CNC machine is intended for cutting wood, acrylics, wood-fibre composites, certain plastics and non-ferrous metals. Do not use this machine for other than its intended use. If used for other purposes, BG Precision/ disclaims any real or implied warranty and holds itself harmless from any injury that may result from that use.

3.1 MEANING OF THE RELATED SYMBOLS

DANGER

Symbols and texts, that are marked with the addition "DANGER", warn against a specific threatening/dangerous hazard (serious injury, long term damage, death)

Unconditional attention must be given to these references!

WARNING

Symbols and texts, that are marked with the addition "WARNING", warn against a possibly threatening danger (serious injury, long term damage, death)

Unconditional attention must be given to these references!

CAUTION

Symbols and texts, that are marked with the addition "CAUTION", warn against a possibly threatening danger (possible injuries, risk of damages)

Unconditional attention must be given to these references!



Where the manual refers with this symbol (shown left) it contains very important references. Compliance is unconditional in order to avoid damage to people and property.

Unconditional attention must be given to these references!



DANGER through electric shock.



DANGER through mechanical movements – danger of crushing and pinching



DANGER through uncontrolled movement / crashing and heavy loads.



DANGER spindle cutting edge



DANGER through trip hazard



READ THE MANUAL – and have the manual to hand at all times near the machining area.



LOOSE CLOTHING – Never wear loose clothing or jewellery near machine.



**Ear protection
must be worn**

WARNING – Ear protection must be worn



**Wear Face
Mask**

WARNING – Face mask must be worn



**Eye protection
must be worn**

WARNING – Eye Protection must be worn

3.2 WORKSHOP ENVIRONMENT

1. Ensure that the floor can bear the weight of the machine and work pieces mounted on it.
2. Keep the floor around the machine clean and free of scrap material, oil and grease.
3. Do not lean lumber or other heavy materials against the gantry, guide rails or table.
4. Support the weight of the dust hose attached to the dust shoe accessory to prevent the weight of the hose from dislodging the dust shoe. Ensure that there is enough slack in the dust collection hose to allow the spindle to cover the entire work area.
5. Locate the CNC Machine away from overhead pipes and plumbing fixtures to prevent condensation from dripping on to the spoil boards and control system components.
6. Locate the CNC Machine away from sinks, faucets or other water supplies or storage to prevent splash-out that can damage the spoil boards and control system components.
7. Provide adequate room between the CNC Machine and other machines in the shop to reduce the chance of accidental jarring when transporting lumber or other heavy materials through the shop and while materials are being worked on other machines.
8. Ensure adequate space between machines to allow for the possibility that the work piece will extend over the end of the CNC Machine table.
9. Store cutting tools in a dry location and prevent contact to preserve the cutting edges.



3.3 HEALTH AND SAFETY

10. Always wear approved personal health and safety equipment as indicated for the materials and type of operations that will be performed. These should include a dust mask, hearing protection, safety clothing, and safety glasses/face shield. Do not rely on prescription or over-the-counter eyeglasses; they are *not* safety glasses. Wear ear protectors (plugs or muffs) even during short periods of operation.



**Eye protection
must be worn**



**Ear protection
must be worn**



**Wear Face
Mask**

11. Before operating this machine, remove any hand, wrist, and neck jewellery and roll sleeves up past the elbows. Be sure to not wear loose clothing which may become caught in the machine and confine long hair.



- a. Non-slip footwear or anti-skid floor strips are recommended.
 - b. Wear protective hair covering to contain long hair.

12. Use a dust mask or other safeguards to avoid inhaling dust generated from material being cut. Install dust collection equipment consistent with shop ventilation practices. Remove dust and debris from the floor frequently to prevent slipping. Drilling, sawing, sanding or machining certain materials generates dust and other substances known to cause cancer. Certain materials also emit chemicals and must be dealt with accordingly.



13. In addition to other health hazards, dust from wood and other materials is flammable. Do not operate welding, wood burning, smelting, soldering or other high-heat tools on the CNC Machine table or vicinity.
14. Do not operate this machine while tired or under the influence of drugs, alcohol or any medication.

3.4 ELECTRICAL

15. Make certain the switch is in the OFF position before connecting the machine to the power supply.
16. Check all cords before each use. If damaged, replace immediately. Never use a tool with a damaged cord as it may result in serious injury or cause an electrical shock.





17. Make certain the machine is properly grounded and the circuit is protected with a fuse or circuit breaker in accordance with local codes. Install a separate circuit if necessary, to limit power loss when multiple machines in your shop are operating simultaneously. If necessary, place a cover on the outlet to prevent accidental disconnection.
18. Make all machine adjustments or maintenance with the machine unplugged from the power source.
19. Follow effective lockout procedures to reduce the risk from high voltage wires and components

and prevent intentional bypassing of safety controls and accidental operation.

20. Don't use in a damp or wet location, or expose to rain, fog or snow.
21. Keep the electrical cord away from sharp edges, heat or moving parts, and do not store materials on top of it. Position the cord so it will not become a tripping hazard.
22. While the use of an extension cord is discouraged, it is recognized that the wiring layout of the shop may not allow the placement of the CNC Machine directly next to an outlet. If it is necessary to use an extension cord, make sure the extension cord is in good condition, heavy enough to carry the current requirements, and installed to prevent a tripping hazard. An undersized cord will cause a reduction in voltage resulting in loss of power and overheating which may result in fire or electrical shock.

3.5 OTHER SAFEGUARDS

23. Remove and store adjusting keys and wrenches when finished with them and before turning on the power. If necessary, for visibility, apply safety markings to adjusting wrenches and keys.
24. Install safety guards consistent with general shop safety practices. Keep safety guards in place at all times when the machine is in use. If removed for maintenance purposes, use extreme caution and replace the guards immediately after completion of maintenance. 
25. Check damaged parts immediately. Before further use of the machine, a guard or other part that is damaged should be carefully checked to determine that it will operate properly and perform its intended function.
26. Keep visitors a safe distance from the work area. Keep children away.
27. Control liquids in your shop to limit the possibility of spillage that can damage the CNC which can cause damage or personal injury from electric shock or fire. 
Be careful with storage and use of cleaning fluids, finishes and solvents. Never use the table to apply or dry finishes.




3.6 MAINTENANCE

28. During any inspection or maintenance activity always ensure the machine is powered off and disconnected from the power supply.
29. Establish a weekly and monthly maintenance checklist and follow it diligently.
30. Routine maintenance should include periodic checks for alignment of moving parts, looseness or binding of moving parts, worn or bare wires, breakage of parts, skewed mounting and any other conditions that may affect its operation or cause injury. Analyse breakage or damage to

determine the cause and take appropriate remedial action.

31. Do not operate the CNC Machine if a component of the control system is damaged. It should be properly repaired or replaced before use.
32. Follow instructions for lubricating and changing accessories.
33. Store maintenance tools and supplies nearby, consistent with shop maintenance practices and resources.
34. Only use identical replacement parts, use of any other parts may create a hazard or cause product damage
35. All repairs whether electrical or mechanical, should be done by a qualified person.
36. NEVER manually force movement of the machine by hand even when machine is off.

3.7 OPERATIONAL PRACTICE

37. Never leave the machine running unattended. Always be in close reach of the emergency stop button. 
38. Turn the power off and do not leave the machine until it comes to a complete stop.
39. Always stay alert! Do not allow familiarity (gained from frequent use) to cause a careless mistake. ALWAYS REMEMBER a careless fraction of a second is sufficient to inflict serious injury.
40. Stay alert and exercise control. Watch what you are doing and use common sense. DO NOT operate tool when you are tired. DO NOT rush.
41. Avoid pinch points and entanglement hazards. Keep hands and clothing away from the ball screws, thrust bearings, gantry, guide rails and rotating cutting tool while in operation. 
42. Use the right tool at the correct speed and feed rate.
Do not force a tool or attachment to do a job for which it was not designed. The right tool will do the job better and more safely.
43. Do not touch a cutting tool immediately after use. It will be hot and may cause skin burns. Exercise caution when handling the collet and spindle nut if the cutting tool is hot. Keep a heavy glove or oven mitt on hand for the purpose. 
44. Do not lay a hot cutting tool on its side. Create a rack for cooling off hot cutting tools.
45. Use recommended accessories; improper accessories may be hazardous.
46. Do not use dull, gummy, or damaged cutting tools. Keep bits and other cutting tools clean and sharp for best and safest performance.

47. Turn off the machine before cleaning. Use a vacuum, brush or compressed air to remove chips or debris. Do not use hands.
48. Do not climb or stand on the machine. Serious personal injury and costly damage could occur if the machine tips over or the gantry is dislodged.
49. Remove loose items and unnecessary work pieces from the table before starting the machine.
50. Plan tool paths to make multiple passes rather than to take off a large amount of material at one time. This will reduce mechanical stress and heat on cutting tools.
51. Always secure a work piece to the spoil board using clamps, vacuum, or double-sided tape. If the work piece is mounted in a jig ensure that the fixture is securely held to the table. Never hold a work piece down by hand while operating.
52. Inspect the material of your work piece to detect any defects that may result in ejection of large pieces of scrap.
53. Make sure the work piece is free from nails, hardware, or other foreign objects.
54. After installing a cutting tool, make sure the collet is securely tightened. An unsecured cutting tool may fly loose from the collet and cause injury. Be sure that the adjusting wrenches have been removed and are secured before turning on the power.

3.8 GROUNDING INSTRUCTIONS:

This tool should be connected to a grounded metal permanent wiring system, or to a system having an equipment-grounding conductor. The CNC Machine control system assumes the ground pin on the AC controller box connection is connected to a grounded conductor.

3.9 STORAGE

In the case where the machines are stored and not used for extended periods of time (greater than 3 days) the machine must be placed in an atmosphere free from moisture and from excessive changes in temperature. The slides (more details in section **10**) must be kept clean and lubricated with light “3 in 1” oil. The ballscrews (more details in section **10**) must be lubricated with a grease gun using the greasing nipple.

4 LIABILITY AND GUARANTEE

All statements in these operating instructions serve the certain and undisturbed business of the CNC Machine.

The operating instructions are an important component of the machine, its safe use, and the long term reliability of the CNC Machine. These instructions must be read and studied carefully by ANY operator of the machine system before use.



Improper handling of the machine can lead to serious injury to the operator(s) and severe damage to the machine. The machine manufacturer and provider are not liable (except in the case of due negligence) for damage and injury due to improper handling and use of the CNC machine.

We the manufacturers and appointed agents reserve the right to make variations to the frame and components in the event of future developments.

5 WARRANTY

The machine system is guaranteed with a 12 month manufactures warranty from the date of delivery on site at the customer location. If you believe a part of the machine is defective under warranty, please contact the dealer you purchased from. If the machine was not purchased direct from BG Precision but an affiliated dealer, you must contact the dealer from whom you purchased the machine not BG Precision



The warranty covers all hardware aspects of the machine use within the 12 month warranty period **provided the machine operation and use meets the following requirements:**



- The machine is used by trained operators only. The use of the machine by untrained persons will **immediately void** the warranty as well as putting the machine and the untrained operator in serious risk of injury or damage.
- The machine is used within the application scope recommended/discussed. This will have been discussed with the customer during the enquiry. Machining of hard materials e.g. stainless steel or other hard metals will put the machine under excessive stress and load and will void the warranty. Section 6 outlines the scope of work that can be carried out on the CNC machine.
- The machine is maintained in the same state and configuration as when the machine was delivered / installed. Modifications effecting the safe operation of the machine will void the warranty.
- The environment where the machine is kept does not expose the machine to excessive moisture or thermal changes.
- The AC electrical supply to the machine is reliable and free from excessive noise – if necessary, a dedicated MCB/RCD switch may be required.
- The AC electrical system has a reliable and professionally installed earth connection.
- BG Precision must be notified in the case where a mist coolant system is to be run on the machine. Special precautions are needed, and the machine configuration will be different if mist coolant is to be used
- The machine is kept clean, free from build-up of materials on moving parts especially the linear slides, and generally in good condition. Excessive build-up of material around the spindle and the linear slide mechanisms of the CNC Machine frame can cause excessive loads in the drive system and damage to the machine drives.
- The maintenance of the ball screws is carried out periodically to ensure free unrestricted movement
- The linear slides are periodically cleaned, inspected and lubricated



- The cables to the machine, the power and communications are managed and protected. Damaged cables can cause short circuits and can damage the machine's sensitive electronics. Machine damage due to cable damage voids the warranty terms.
- Damage or failure of the machine, or part of the machine is reported to BG Precision immediately upon discovery of a problem.
- The machine is not modified from the factory configuration. This includes; mechanical configuration, electrical configuration and software configuration

5.1 WARRANTY REGARDING THE CONTROL PC

In the case *where BG Precision provide a PC for the CNC Machine operation* the Guarantee on the control PC will be in-line with the CNC Machine system.

In the case *where the customers control PC is used* BG Precision can take no responsibility for loss of functionality caused by subsequent failure of the customer's PC. In the case where BG Precision installs the machine on site, BG Precision will test the control PC to ensure it is suitable for controlling the CNC Machine system.

We can provide remote login and reconfiguration if the control PC goes down or has an issue. We recommend you purchase a fresh new control PC prior to the machine arrival and use this as the dedicated machine for the CNC system. A moderate spec Windows PC is sufficient for controlling the machine. Any extra/additional CAD packages you wish to run may require you to upgrade to a higher spec windows system.

A Laptop is fit for purpose and often the preferred unit to control the system – you as a machine operator need to consider how to manage the use of the control PC as it is important not to let the swarf and chips generated during the cutting process interfere with the PC's – for example - the keyboard etc.

6 RECOMMENDED USE

6.1 TYPICAL APPLICATION MATERIALS

The CNC Machine systems are suitable for milling, boring, engraving the following materials:

- Wood.
- Plastics.
- Aluminium and other NE metals (under certain very specific conditions)
- Fibre composites e.g. GFK or CFK (with specific attention to the dust generated from cutting)
- Foam (with specific attention to the dust generated from cutting)

The above list of materials is appropriate if the following conditions are met

- Appropriate tooling is used for the job requirement
- The tools have been installed correctly in the collet mounting system in the provided spindle.
Never use a tool outside of its operating parameters.
- The spindle speed and feed rate are appropriate for the job
- In the case where you are machining aluminium some extra care is required to maintain good chip development. If necessary, a cold airline will improve chip generation.
- Coolant may be required in some cases where aluminium is the main application. In the case where coolant is used the operator must pay close attention to manage the coolant run off.
- In all cases – especially where composites are machined – provision of adequate extraction systems to eliminate hazardous swarf, dust and particulates must be implemented. There must be systems in place to stop dust ingress into the machines running gear and spindle bearings

6.2 SPECIAL NOTE ON APPLICATION MATERIALS

If the CNC Machine system is used on materials outside of the scope of recommended use, then the warranty does not cover any issues caused by this incorrect machine usage.

7 SPECIAL NOTES ON CLAMPING

WARNING: Very important the work piece is clamped securely.



7.1 SHEET CLAMPING USING SUPPLIED CLAMPS WITH THE MACHINE

The T-slot bed provides several methods for clamping. The image below shows the typical method for clamping sheet work in small sizes to the T-slot table. The clamps can be used to clamp a variety of thicknesses up to 18mm MDF. There are other options available- please contact us for more information. It is very important the work is securely clamped as if the work hops during use and becomes loose – it is extremely dangerous.



Figure 1: Clamping methods – Sheet Clamping

7.2 CLAMP SETS FOR LARGER WORK PIECES

Another method of clamping is shown here in the image on the left using triangular brackets and fixing cantilever arms. These can work very effectively for larger pieces like the acetal part shown here in the image on the left. The advantage of this configuration is larger work pieces can be clamped securely. However you have to be careful as the larger the clamps you use, the more

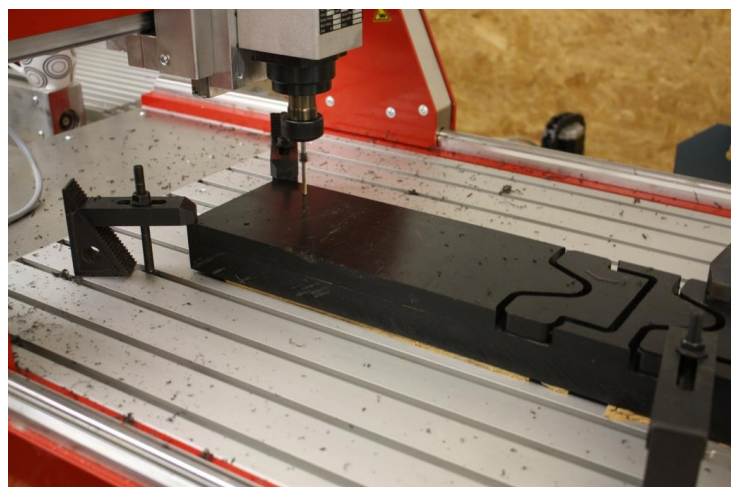


Figure 2: Clamping methods - Clamp Sets

you run the risk of crashing into the clamps during use. Always double check before you run your toolpath that the machine will not move itself to crash into the clamps.

7.3 SACRIFICIAL LAYERS

It's a good idea to always use a sacrificial layer under the work piece you are machining. This is especially important when you are milling all the way through the material. 3-4-6mm MDF often works well. It saves you blemishing the T-slot Aluminium table. Often if you use a thick layer you can use a drill and screws to fix your work. Crude but functional.

7.4 SPRAY ADHESIVE



Spray adhesive, especially 3M photo mount spray is a very useful additional method of clamping. For example a piece of MDF can be clamped to a sacrificial layer of MDF with just the spray adhesive. You have to play with trial and error to find the optimal machining conditions as the spray adhesive is not as strong as the other clamping methods – but can still be VERY effective. For example, when machining letters out of MDF or plywood the addition of spray adhesive as well as the clamps can help prevent the cutout shapes from “hopping” on the bed. For larger pieces this is especially helpful. The reason for this is that it makes sure that the work piece sits flush to the top surface on all areas. Sometimes when clamping larger sheets – the middle of the sheet can rise slightly when clamped at the edges. The spray adhesive does a great job of keeping everything flat and true. Light sanding afterwards gets rid of the adhesive. Trial and error is the best method to approach.

7.5 CLAMPING CONSIDERATIONS

It's very important that whatever clamping approach you use that you proceed with caution. This is especially important when your experiment with new methods. Work coming loose when you are machining is extremely difficult.



8 ELECTRICAL CONNECTIONS

All Electrical connections must be performed by a qualified electrical and follow any local codes and ordinances. Failure to comply may result in serious injury.

Electrical connections that are improperly installed or are outside operational specifications may cause machine damage and void any warranties that are in place.



Figure 3: Standard AUS plug

All our CNC machines are rated for 220V +/-10% having an operational range of 200-240V unless otherwise stated. The machines come pre-wired with a 10 AMP Australian 3 pin plug for use on a circuit with a grounded outlet as pictured. It is recommended that these machines be connected to a dedicated 10-amp circuit.

If the machine must be reconnected for use with a different type of electric circuit, the connection must be done by qualified person(s), and must comply with all local codes and ordinances.

8.1 GROUNDING INSTRUCTIONS:

CNC machines must be grounded. This grounding provides a path of least resistance for electrical current, which during a malfunction will reduce the risk of electrical shock.

All CNC machines are equipped with an electrical cord with grounding conductor and plug. The plug must be used with a matching outlet that is properly installed and grounded in accordance with local codes and ordinances.

These plugs must not be modified, if a matching outlet is need, one must be installed by a qualified electrician.

Improper installation may result in electrical shock.

If grounding instructions are not completely understood or if in doubt as to whether the machine is properly grounded, a qualified electrician should be consulted.



8.2 EXTENSION LEADS:

The use of extension cords should be discouraged. It is recommended to place the machines as near to the power source as possible.

If an extension cord is necessary, make sure any cord used is in good conditions. Worn or damaged cords should be replaced immediately.

When using an extension cord, be sure to use one that is heavy enough to carry the required current and use only 3-wire extension cords that feature the correct 3-prong grounding plugs and 3-pole receptacles.

An undersized cord will cause a drop-in line voltage resulting in loss of power, overheating and runs the risk of fire.

9 POWER MANAGEMENT OF LAPTOP/PC

It is very important that you disable all screen savers and any temporary shutdown present on your window system. Automatic restarts, updates, screen savers, power save modes etc etc. These can all cause the USB/Ethernet communication to be lost between your machine and control PC. This usually results in lost work.

As the figure show – disable the **Display Dim**, **Turn off Display** and **Sleep functions** when the laptop is plugged in.

Change settings for the plan: Balanced

Choose the sleep and display settings that you want your computer to use.

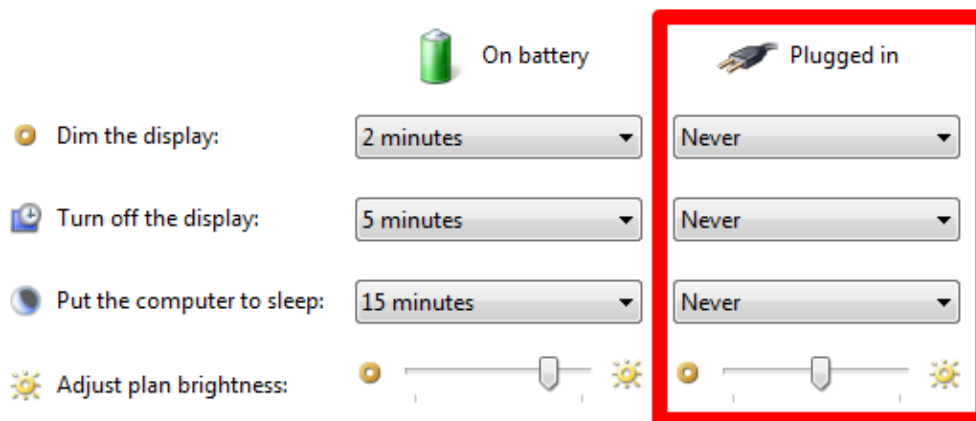


Figure 4: Power Management of Laptop/PC

10MAINTENANCE

10.1 GENERAL MAINTENANCE

Best practice with machine tools is to keep the machines in a dry, clean, free from dirt and debris environment.

To ensure proper machine operation, it is regularly recommended that the prismatic guides and rolled ball-screws on all axes are wiped clean with a rag to show a little shine by cleaning away the shop grime. You should then lubricate with a light machine oil lubricant (such as 3-IN-ONE oil). Figure 6 shows the X axis rails and ballscrew. The Z and Y axes have the same components. Failure to do this can result in poor performance and in extreme cases, cause surface corrosion or pitting of the hardened steel linear rails. We do not recommend you try to remove surface corrosion if it gets to this stage as this may further reduce the performance of the linear guides.



Figure 5: Recommended lubricating oil



Figure 6: Weekly (best case daily) cleaning and application of light oil externally to screws and rails with cloth and light oil.

The ballscrews also have grease nipples on them. Every 1000 hours or every year these can be packed with suitable grease for optimal operation – See Figure 7 for the recommended grease specification.



Figure 7: Recommended grease for the ballscrews when greasing via the grease nipple

10.2 ROUTINE CHECKS: (PERFORMED DAILY WITH MACHINE USE)

1. Wipe the ball-screws and prismatic guides clean and dust free.
2. Apply light machine oil to ball-screws and prismatic guides using a clean lint free cloth. Move the machine through travel limits to properly disperse lubricant using UCCNC.
3. Check cutting tool edges for chips and/or dullness.
4. Generally, inspect the machine for any damage.
5. Verify that the Spindle and Collet Nut threads are clean of debris and undamaged.
6. Check coolant levels in reservoir.
7. Verify that the dust extractor is free of blockages.
8. Check that all electrical connectors are fitted correctly and are not loose.

10.3 COLLET MAINTENANCE

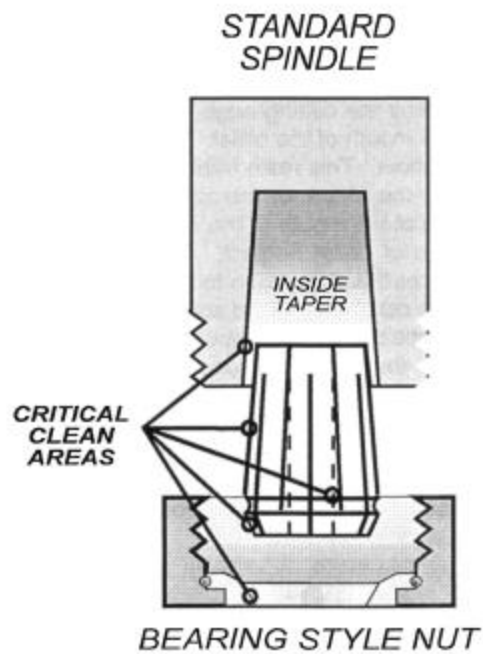
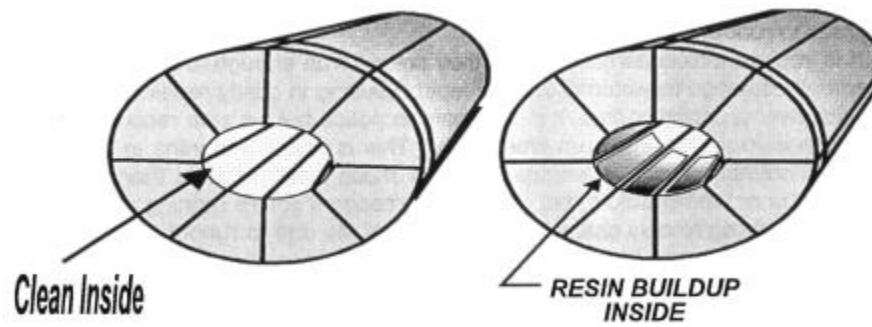
Heat is the biggest enemy of the tool and the initial transfer of heat is from the tool to the collet. Collets are manufactured from spring steel and over a period of time, heat and usage causes them to lose elasticity. This hardening process makes tightening of the collet more difficult thus causing uneven gripping and ultimately tool runout.

It is important to understand when hardened collets are not replaced; over tightening will eventually damage the internal spindle taper resulting in costly repairs. This process occurs gradually over a period of time and is difficult to diagnose. A practical recommendation for collet life is in the 400-600 run time hours. This is about 3 months in a normal two-shift operation. If collets are not changed, they will eventually become brittle enough to crack or break and permanently damage the spindle. Preventative maintenance is much cheaper than this costly alternative. Timely collet replacement is important, but cleaning the collet, along with the collet nut, toolholder taper, and inside spindle taper each time the tools are changed is equally important.

As material is routed, whether it be wood, plastic, aluminum, or man-made board, the chips carry many resins migrating up the slits in the collet and depositing onto the inside of the collet ears (usually nearest the mouth of the collet). The resin acts as pressure points gripping the tool tighter at the mouth of the collet. These pressure points often distort the grip on the tool creating runout. This resin heats up as the tool does and actually transfers onto the shank of the tool almost adhering the tool into the collet. Many times the tell tale sign of this transfer is brown marks at the mouth of the collet contact on the shank. These marks are a strong signal of collet neglect and the necessity to institute a collet maintenance procedure.

To prevent this problem, the resin must be removed from all surfaces using a non-abrasive brush. Make sure that all surfaces including outside and inside collet and inside spindle taper are thoroughly clean and dry before reassembling.

Also, the collet nut should be cleaned of resin and chip buildup and regularly replaced to insure the integrity of the whole collet system. It is important to point out that simply blowing out the collets or soaking them overnight in a thinner does not rid collets of resin buildup. In fact, the latter procedure can prove to be hazardous. Do not use a petroleum-based lubricant for cleaning, as it will only act as a magnet for all of the dirt and dust by the residue it leaves behind.



10.4 AIR COOLED SPINDLES ONLY

If your CNC routers come with an air-cooled spindle, keep the cooling fan free from any blockages so that nothing is disrupting airflow. Be sure to wipe down the area around the fan on the top of the spindle encasement to remove any dust after every use. You can also use a vacuum or air compressor to remove dust from the local area.

10.5 WATER COOLED SPINDLE ONLY - COOLING SYSTEM FLUSH/REFILL:

On CNC routers with the liquid cooled spindle, every 4-6 months the electro spindle cooling system should be flushed and refilled to guarantee that the coolant is fresh and able to perform optimally.

The cooling system consists of a clear reservoir/pump assembly.

The cooling system consists of a clear reservoir/pump assembly.

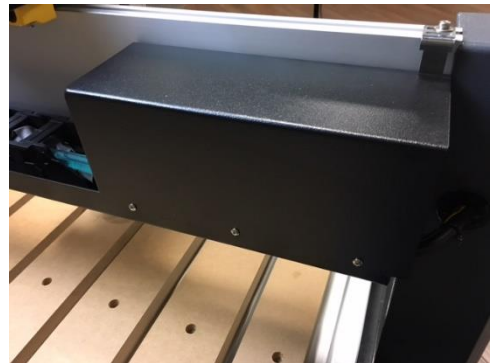



Figure 8: Cooling system is under cover on back of bridge

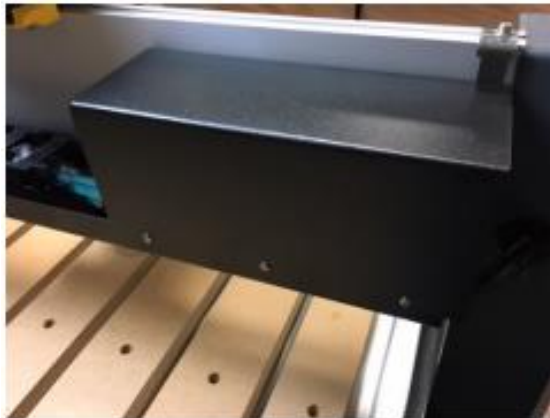
To flush this system, it is recommended that users acquire:

1. A small section of 5mm tubing.
2. Empty container used to catch old fluid.
3. Container of distilled water (to flush).
4. Standard Radiator Coolant PREMIXED.

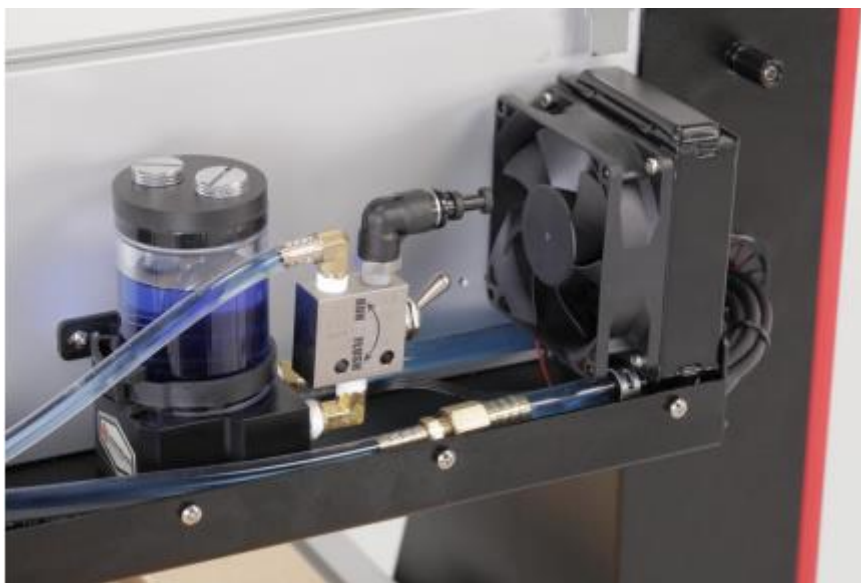
	<p>Distilled Water Example: Available from Supercheap Auto for \$7.99</p> <p>Clickable Link: SCA Demineralised Water 5 Litre Supercheap Auto</p>
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	<p>Radiator Coolant Premix Example: Available from Supercheap auto for \$9.99</p> <p>Clickable Link: SCA Standard Radiator Coolant 5 Litre Supercheap Auto</p>
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First, locate the cooling system which can be found on the rear side of the gantry. Uncover the cooling system by removing the 3-screws which hold the black cover in place.



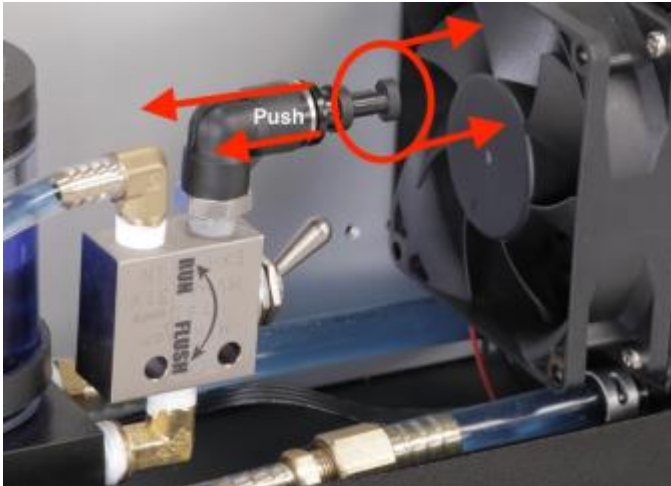
Once the cover is removed, notice the cooling pump/reservoir, as seen here:



The output from the pump is going directly into a new purge valve. From there the fluid travels up the wire chain to the spindle then back through the radiator to the pump through the return tube.

To flush the system, removing all the old coolant and preparing for the new fluids:

1. You may want to cover your MDF Spoilboard to prevent any liquid spills soaking in.
2. Remove the black plug from the purge valve. The black collar attached to the elbow will need to be pressed in while you pull the black plug out, as seen here:



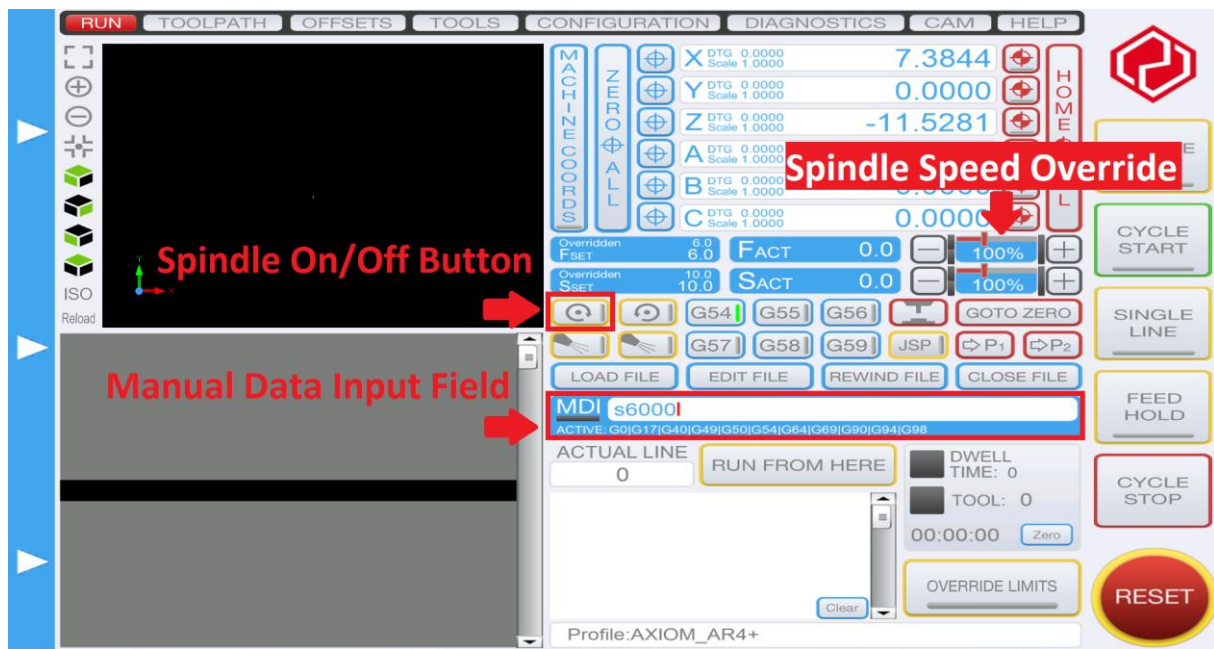
3. Attach a short section of tubing to that same fitting and run it to an empty container. If you do not have any tubing this is the location of which the coolant will flush out from so you will need to get your empty container close to avoid any mess.
4. Move the toggle switch to the (Flush) position.

Make sure the spindle RPM is turned to Zero (F0.00). To set the spindle speed manually in revolutions per minute (rpm) you can type "S" for Spindle speed and the value you want to set the speed in RPM into the MDI (Manual Data Input) on the UCCNC faceplate.

Type "S0" into the MDI and press enter.

Refer to section 8.5 *Setting Spindle RPM* on the main user manual if you don't know how to do this.

Then use the manual spindle on/off button as seen on the face plate here:



While the pump is running pour the distilled water into the top of the reservoir. This will cause the pump to draw up the distilled water (Flush) and push out the old fluids and water through the other line.

Once the coolant has been flushed from the system, press the ON/OFF button again to stop the pump.

Next, replace the distilled water (Flush) with the new coolant, by repeating the above purge steps.

Once all the distilled water (Flush) has been removed from the system and replaced with the proper coolant, stop the pump by pressing the ON/OFF button on the controller and move the toggle switch back to the run position.

Remove the temporary section of tube used for flushing and reconnect the black plug.

Continue to fill the reservoir with the proper coolant filling the tank and turn the spindle on by pressing the SPINDLE button on the controller.

With the pump running top off the tank to approximately $\frac{3}{4}$ full, using the remaining coolant.

When finished, be sure to reinstall the pump cap and turn the spindle off using the SPINDLE button on the controller.