bg precision

i2R CNC WITH UCCNC PC CONTROL

Imagination to Reality

CNC ROUTER USERS MANUAL

AXIOM® PRECISION

CNCdrive motion controls

Manufacturer:

Axiom Precision

Taiwan Axiom Dynamic

TAIWAN

Australia and New Zealand Agent

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Distributed by

Carbatec Group PTY LTD

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WARNING

**Read & understand operators manual before using this machine.
Failure to follow operating instructions could result in death or serious injury**
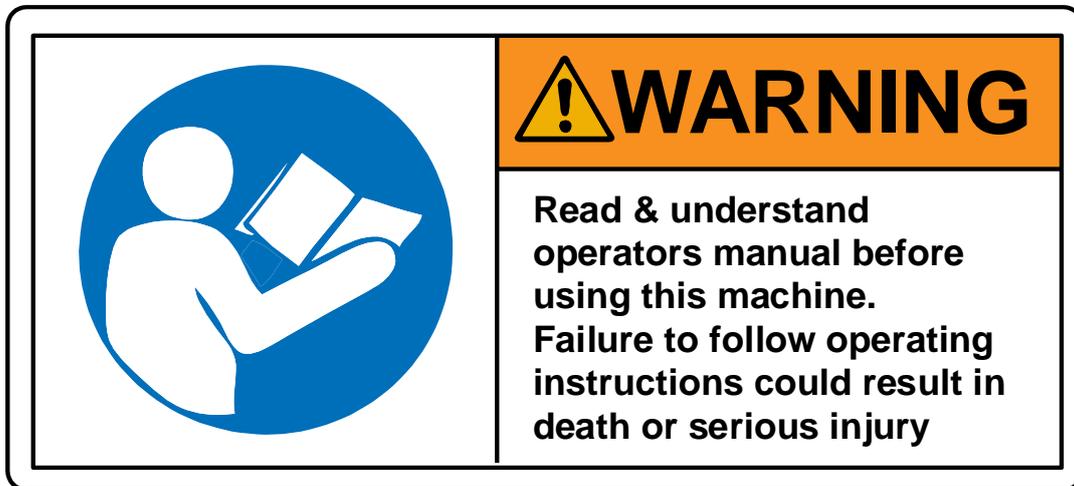
Before using/turning on the machine, the device should be carefully checked to make sure all connections are secure and the device is technically sound.

![bg precision logo]

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

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

⚠️ **NEVER LEAVE THE MACHINE WORKING UNATTENDED**

TABLE OF CONTENTS

1 INTRODUCTION

Thank you for purchasing your i2R CNC router system. Firstly, please inspect the machine and all components after deliver 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 the operational manuals for this i2R CNC router machine prior to attempting to use the system. Through-out this manual there are references to "A Trained Operator" or "Trained and Experienced personnel". These are defined as follows:

All persons that uses, or comes into contact with, the i2R CNC router system MUST:

- understand what a CNC router is and can do
- read and understood the content of this user manual prior to using the system
- be able to exercise control of the router system at all times
- 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 i2R CNC router 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 MACHINE OVERVIEW

2.1 COMPONENT IDENTIFICATION
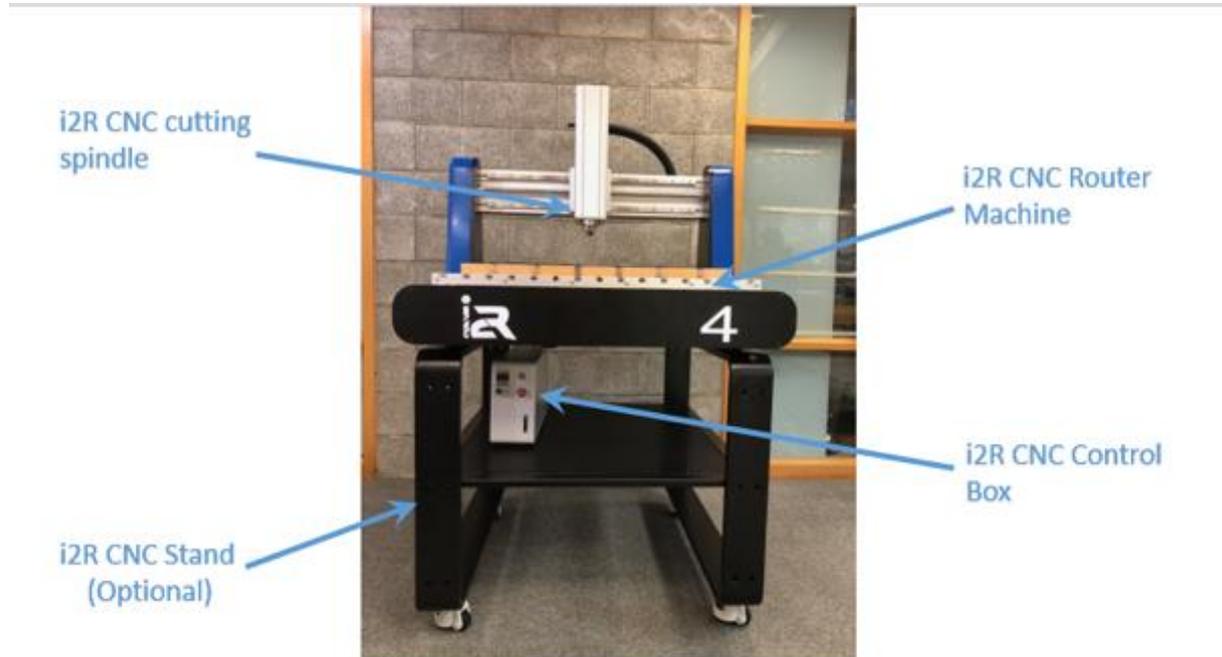
Component	Function
i2R controller	The i2R controller is the white control box that has the electronics necessary to move and manipulate the machine position and spindle speed
i2R CNC router main machine	This is the main machine XYZ carcass itself. This consist of 3 ballscrew driven axes on a steel frame
i2R main cutting spindle	The cutting spindle rotates and drives the cutting tool in the materials the CNC router is asked to cut and process
i2R Stand	The i2R stand is a steel stand that the machine can sit on (This is an optional extra)

3 SAFETY

The i2R CNC router 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. On i2R CNC router Basic models, before attaching a router, read and become thoroughly familiar with all the router manufacturer's operating and safety instructions. Failure to comply with all the warnings may cause serious personal injury or costly damage to your I2R CNC router.

This i2R CNC router 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 i2R CNC router until proper training and knowledge have been obtained.

Your i2R CNC router 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/i2R 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 of jewellery near machine.

Ear protection must be worn

WARNING – Ear protection must be worn

Wear Face Mask

WARNING – Face mast 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 i2R CNC router away from overhead pipes and plumbing fixtures to prevent condensation from dripping on to the spoil boards and control system components.

6. Locate the i2R CNC router 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 i2R CNC router 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 i2R CNC router 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 and budget. 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.

Wear Face Mask

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 i2R CNC router 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 i2R CNC router 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.

23. On i2R CNC router Basic models do not plug a router directly into a wall outlet. Connect it to the provided receptacle on the router table so that all machine movement can be regulated by the single controller.

3.5 OTHER SAFEGUARDS

24. 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.

25. 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.

26. 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.

27. Keep visitors a safe distance from the work area. Keep children away.

28. Control liquids in your shop to limit the possibility of spillage that can damage the i2R 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

29. During any inspection or maintenance activity always ensure the machine is powered off and disconnected from the power supply.

30. Establish a weekly and monthly maintenance checklist and follow it diligently.

31. 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.

32. Do not operate the i2R CNC router if a component of the control system is damaged. It should be properly repaired or replaced before use.

33. Follow instructions for lubricating and changing accessories.

34. Store maintenance tools and supplies nearby, consistent with shop maintenance practices and resources.

35. Only use identical replacement parts, use of any other parts may create a hazard or cause product damage

36. All repairs whether electrical or mechanical, should be done by a qualified person.

37. NEVER manually force movement of the machine by hand even when machine is off.

3.7 OPERATIONAL PRACTICE

38. Never leave the machine running unattended. Always be in close reach of the emergency stop button.

39. Turn the power off and do not leave the machine until it comes to a complete stop.

40. 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.

41. 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.

42. 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.

43. 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.

44. 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.

45. Do not lay a hot cutting tool on its side. Create a rack for cooling off hot cutting tools.

46. Use recommended accessories; improper accessories may be hazardous.

47. Do not use dull, gummy, or damaged cutting tools. Keep bits and other cutting tools clean and sharp for best and safest performance.

48. Turn off the machine before cleaning. Use a vacuum, brush or compressed air to

remove chips or debris. Do not use hands.

49. 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.

50. Remove loose items and unnecessary work pieces from the table before starting the machine.

51. 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.

52. 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.

53. Inspect the material of your work piece to detect any defects that may result in ejection of large pieces of scrap.

54. Make sure the work piece is free from nails, hardware, or other foreign objects.

55. 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 i2R CNC router 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 15) must be kept clean and light machine oil such as 3 in 1 applied. The ballscrews (more details in section 15) 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 Router.

The operating instructions are an important component of the machine, its safe use, and the long term reliability of the CNC router system. 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 router 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 warranty from the date of delivery on site at the customer location.

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 routers.

- 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 router 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 (see section 15)

- The linear slides are periodically cleaned, inspected and lubricated (see section 15)

- 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 include; 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 router operation* the Guarantee on the control PC will be in-line with the CNC router 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 were BG Precision installs the machine on site, BG Precision will test the control PC to ensure it is suitable for controlling the CNC router 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 i2R CNC router systems are suitable for routing, 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)

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 eliminated hazardous swarf, dust and particulates must be implemented.

6.2 SPECIAL NOTE ON APPLICATION MATERIALS

If the CNC router 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 MACHINE INSTALLATION

7.1 MACHINE INSTALLATION BY BG PRECISION DELIVERY VEHICLE

In the case where a machine is delivered by BG Precision directly to the customer then the following aspects must be considered

- Prior to delivery BG Precision must be notified of any narrow or difficult access areas to the position where the machine will be finally installed
- If any access points / hallways / gates etc are narrower / smaller / lower than normal and the machine has to go in at difficult / awkward angles, then BG Precision should be notified of such issues prior to delivery.
- It is important that sufficient man power / forklift is provided to allow easy movement of the machine into place
- If manually lifted, then 4 able bodied persons. 1 on each corner of the machine and the machine should be lifted without any cardboard underneath it.

Figure 1: i2R CNC with box cover removed and ready for lifting

7.2 MACHINE INSTALLATION BY FREIGHT

In the case where a machine is not delivered by BG Precision but is delivered by a third party then EXTRA care is needed to ensure the machine is handles correctly.

The machines are crated in cardboard covering.

Please mange the machines with extreme caution and only use forklifts to move the crated machines on their pallets. Figure 2 shows what 5 crated i2R looks like.

Figure 2: Scope of crated machine delivery

7.3 MACHINE ASSEMBLY ONCE DELIVERED

Failure to read and understand all the assembly and setup instructions before attempting assembly may result in serious injury.

Once you have verified the machine and their contents are 100% okay and damage free after transport then you can begin the setup process.

NOTE: in the case where BG Precision will visit and install machine, some (or all) of these tasks will be carried out by one of our installation engineers.

Packaging contents for the i2R CNC

Remove all contents from shipping boxes. Do not discard carton or packing material until assembly is complete. Accessories commonly ship inside machine or stand packaging and can be easily overlooked.
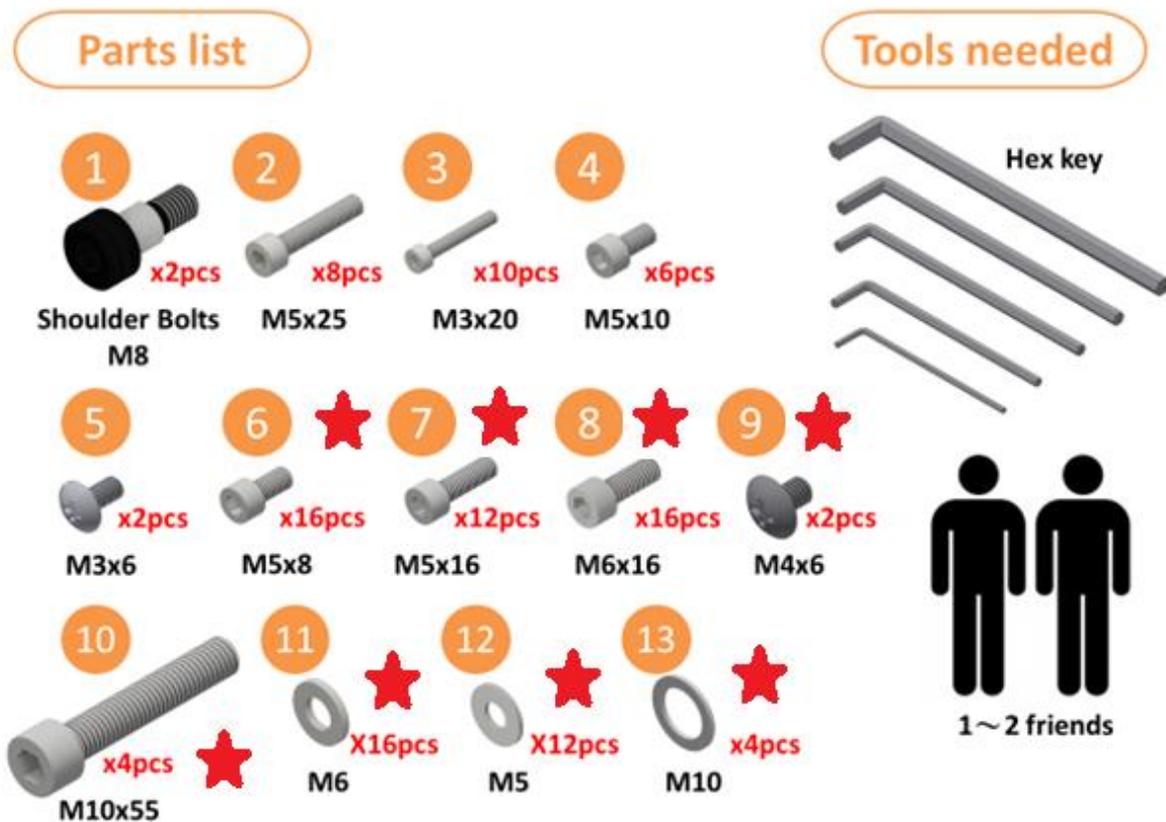

Tools required for assembly:

    #2 Philips-Screwdriver

   2.5mm, 4mm and 5mm Allen key

    Spirit Level

7.3.1 SETTING UP I2R STAND

The steel stand is an optional extra with the machine. If you have purchased this part, then please proceed through the assembly steps if not ignore items marked with red star and skip to section 0

Step 1

M5x8

Step 2

M6x16   M6
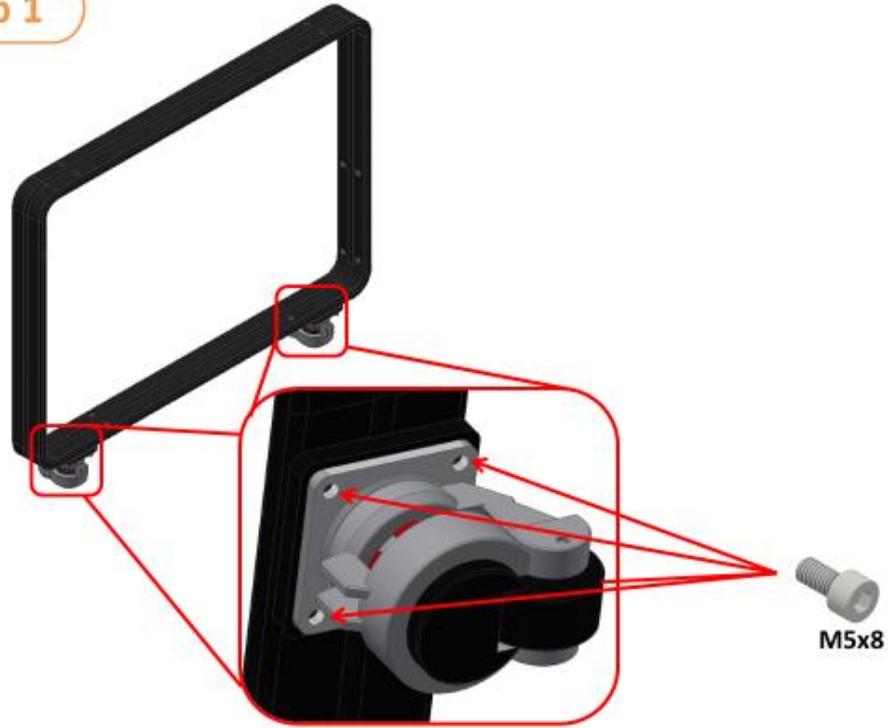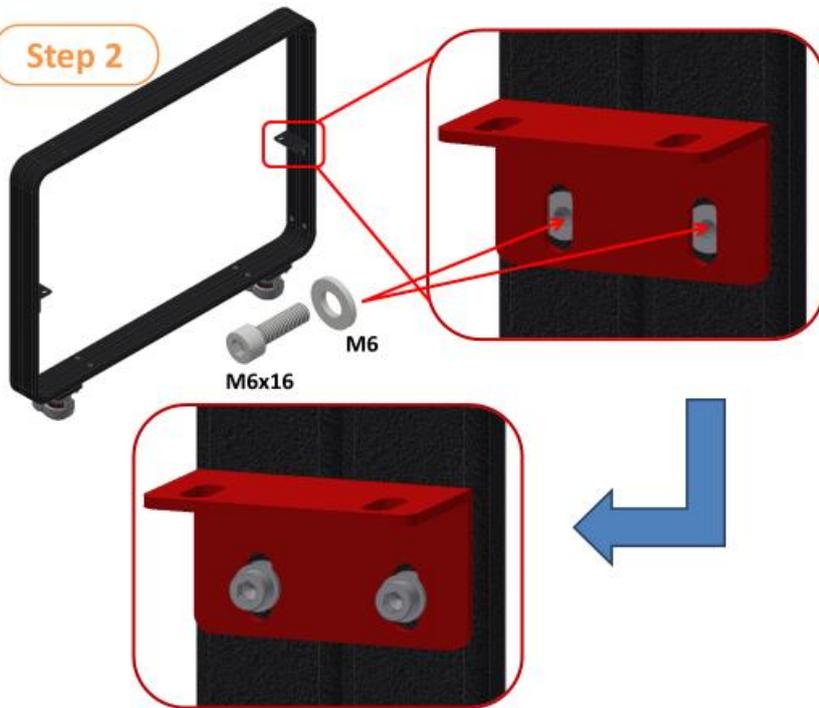
Notice

This side is backward

Step 3

M5x16

M5

M5

M5x16

**Step 4**

Step 5

M6

M6x16
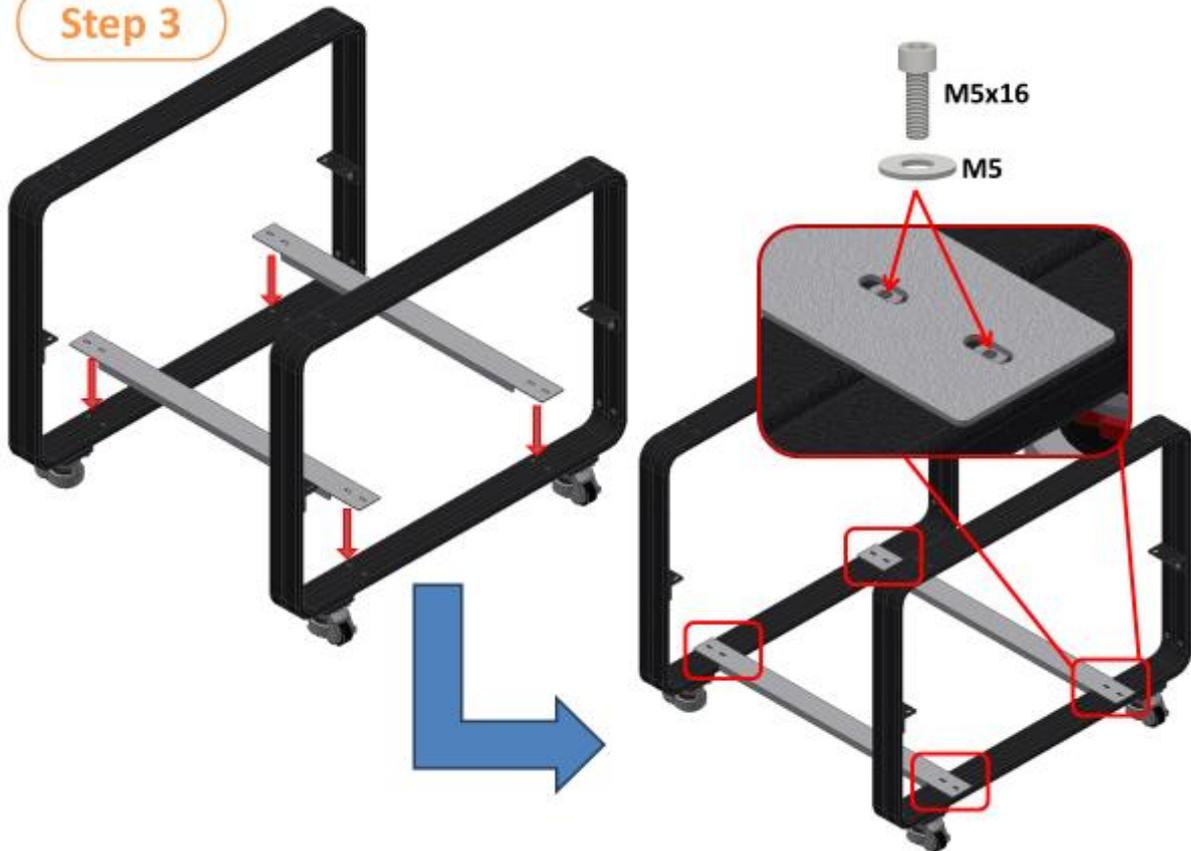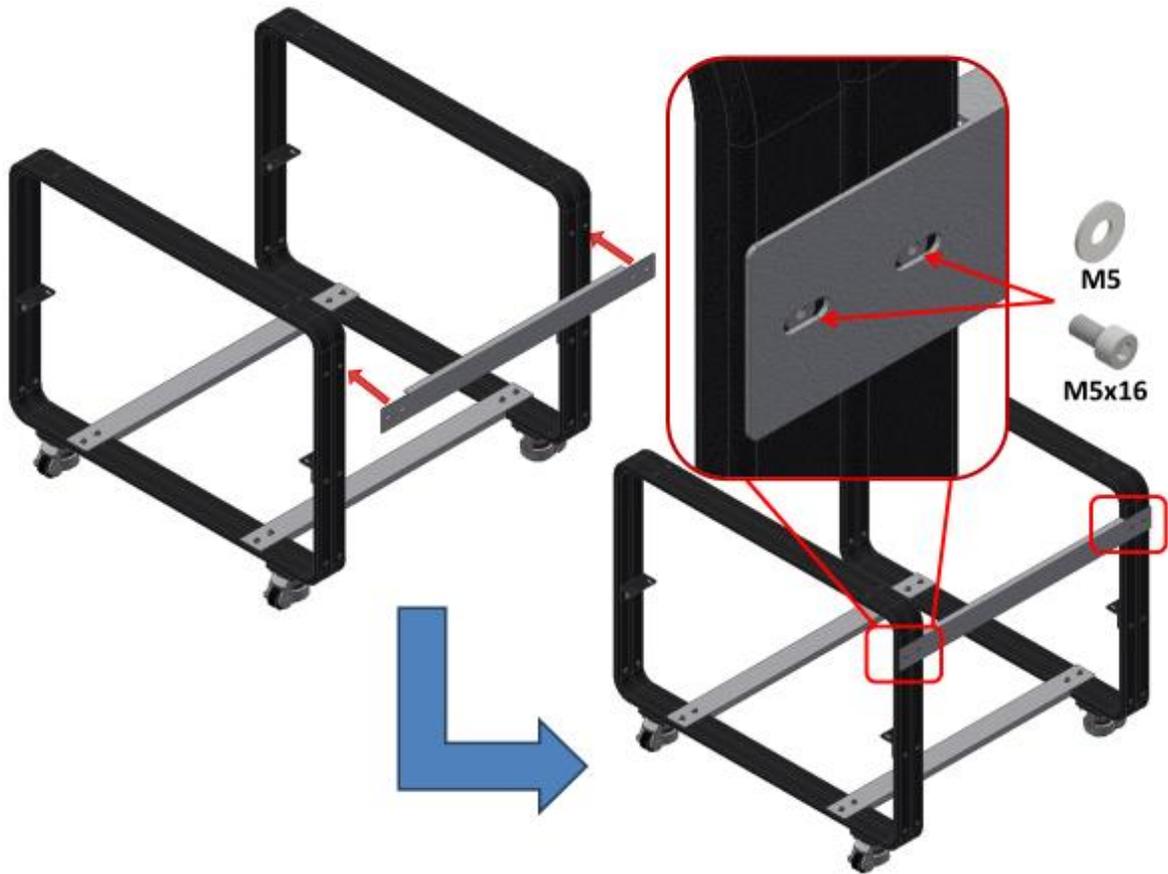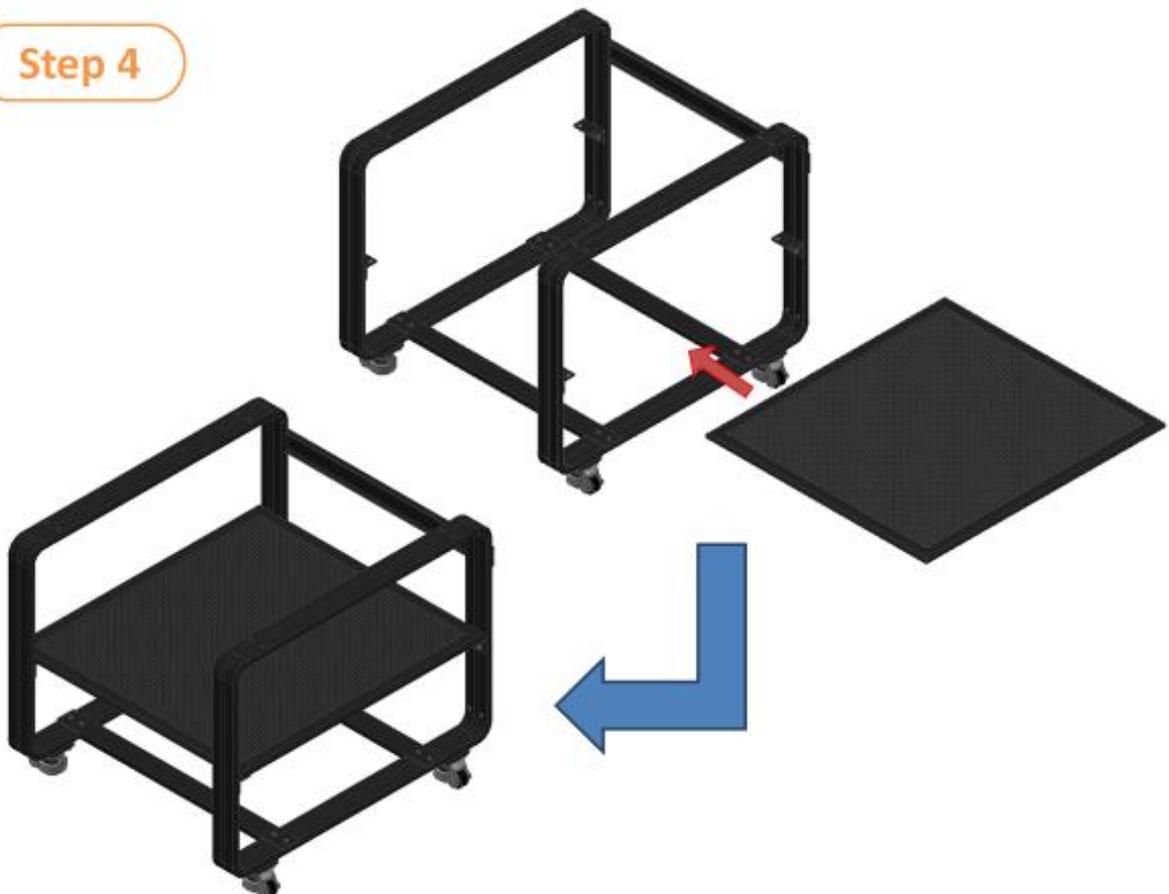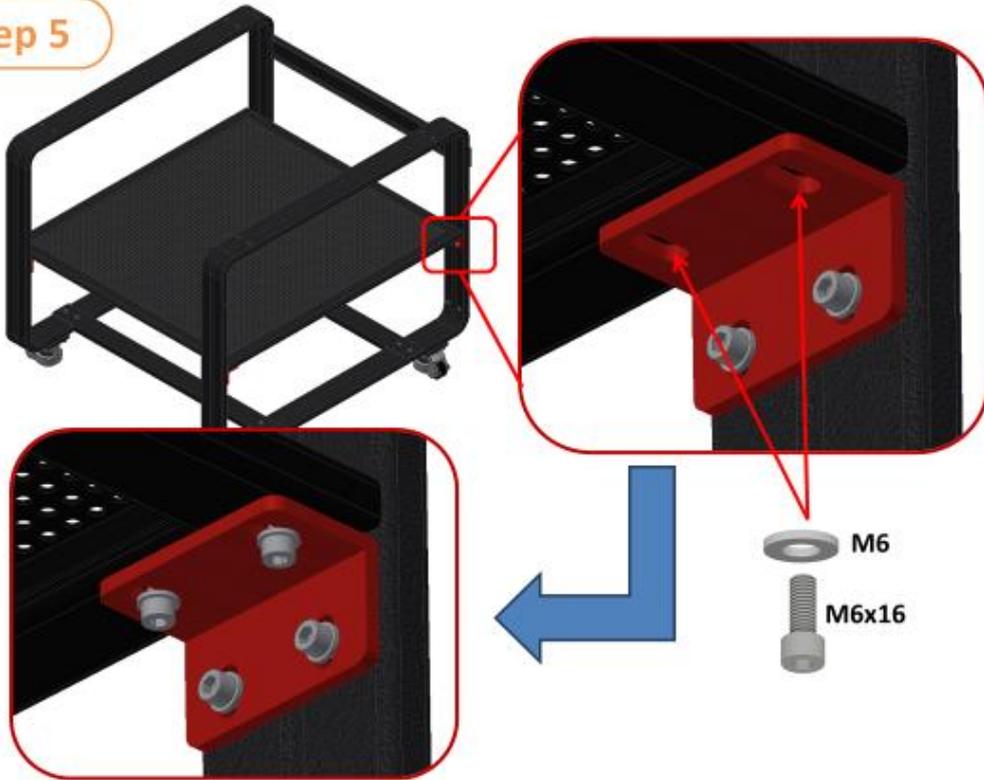
Step 6

M4x6
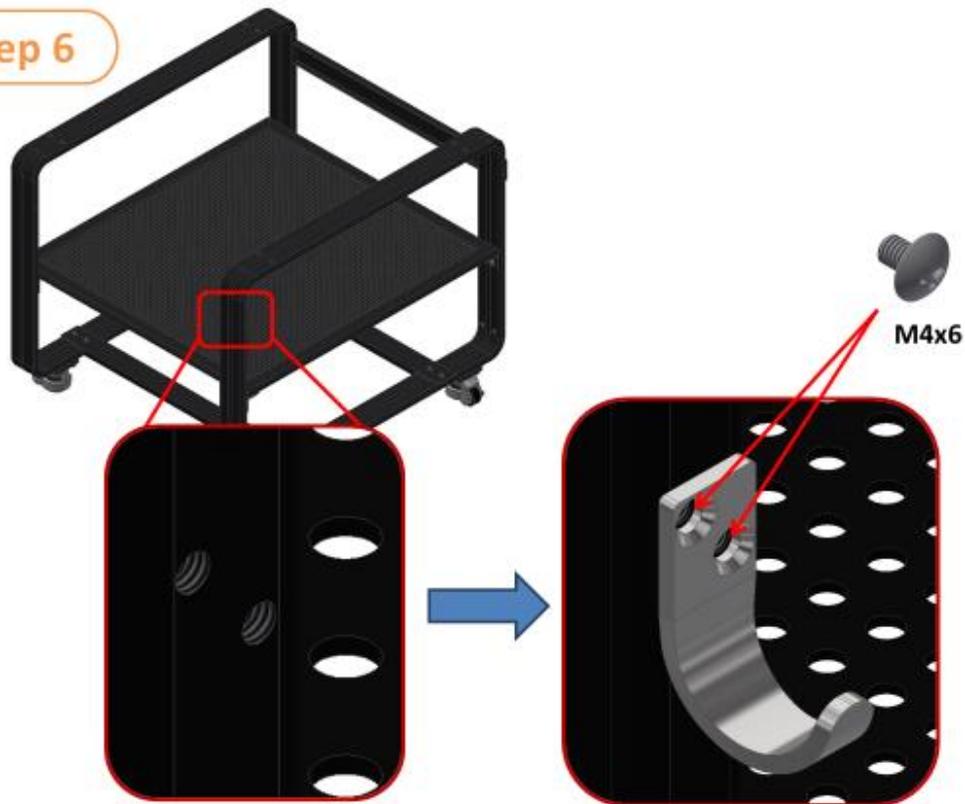
Step 7

Installing the router table on the Stand:

The CNC router table assembly is heavy. Please use a secure means and use caution when lifting onto the stand. At least 3-4 able bodies persons are needed to lift the machine onto the stand.

To avoid damage, be careful to never lift the router by the gantry. Always lift the router under the T-slot table or under the steel frame.

1- If using a forklift, keep forks under the steel frame to avoid damaging the wiring and mechanics of the machine.

    a. Place a scrap piece of lumber beneath the router assembly and carefully slide forks beneath the steel base.

7.3.2 SETTING UP THE I2R MACHINE

Step 1

1 insert to A
2 insert to B

Step 2

M5x10

M5x10
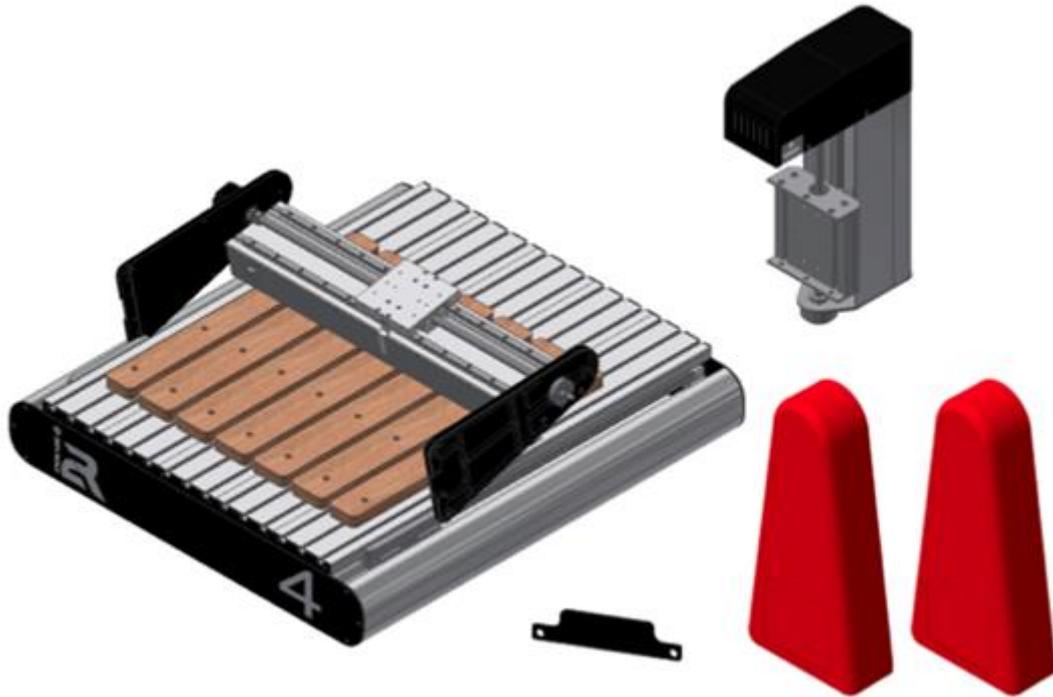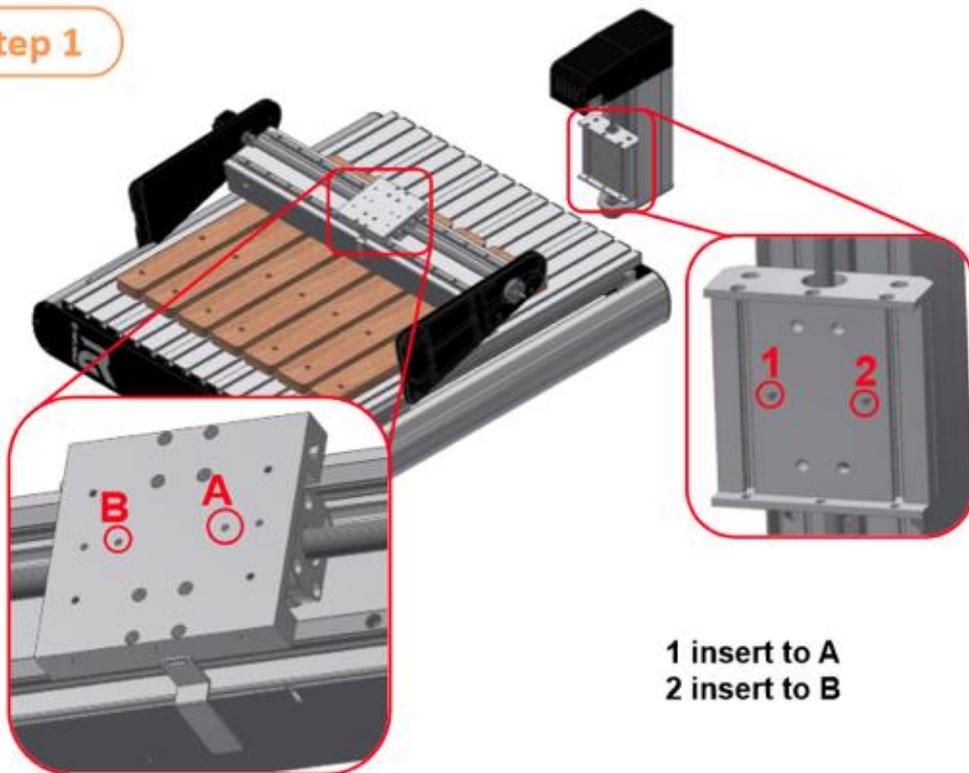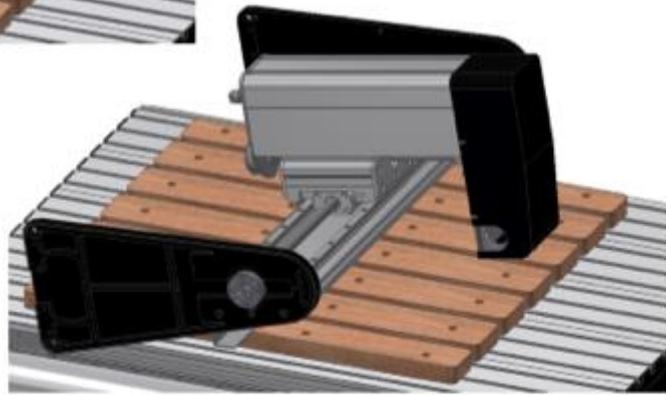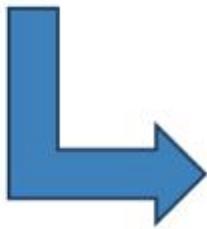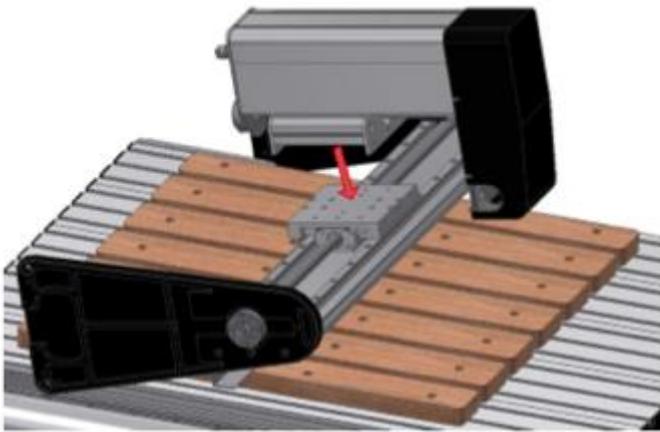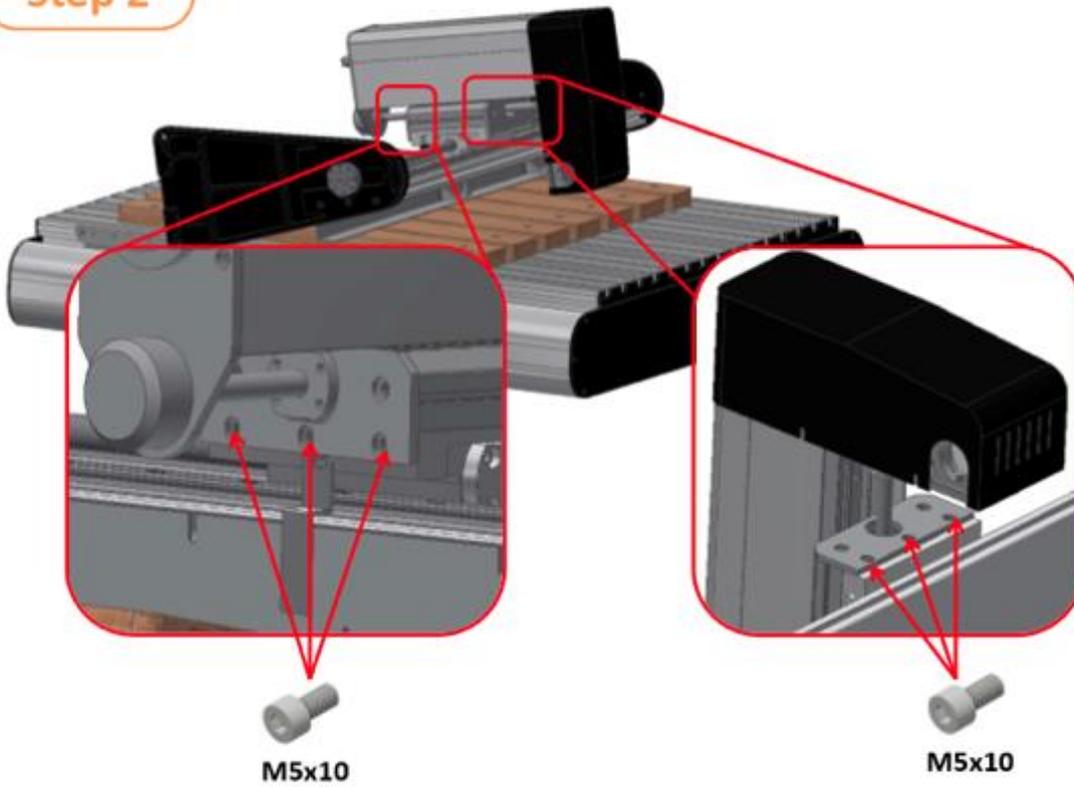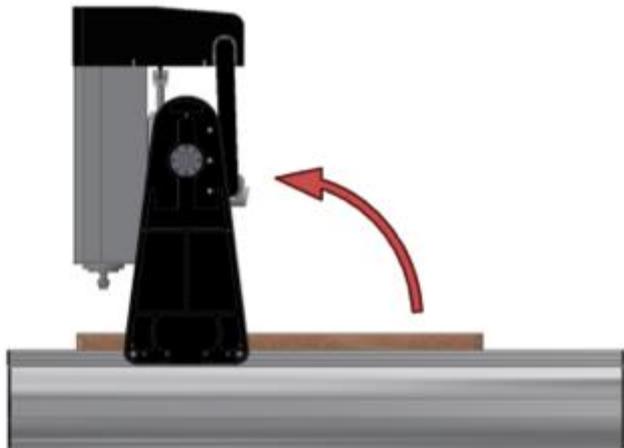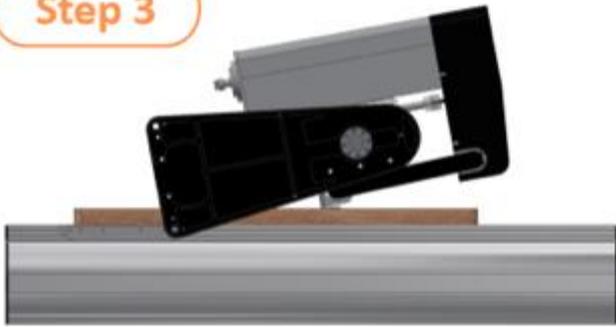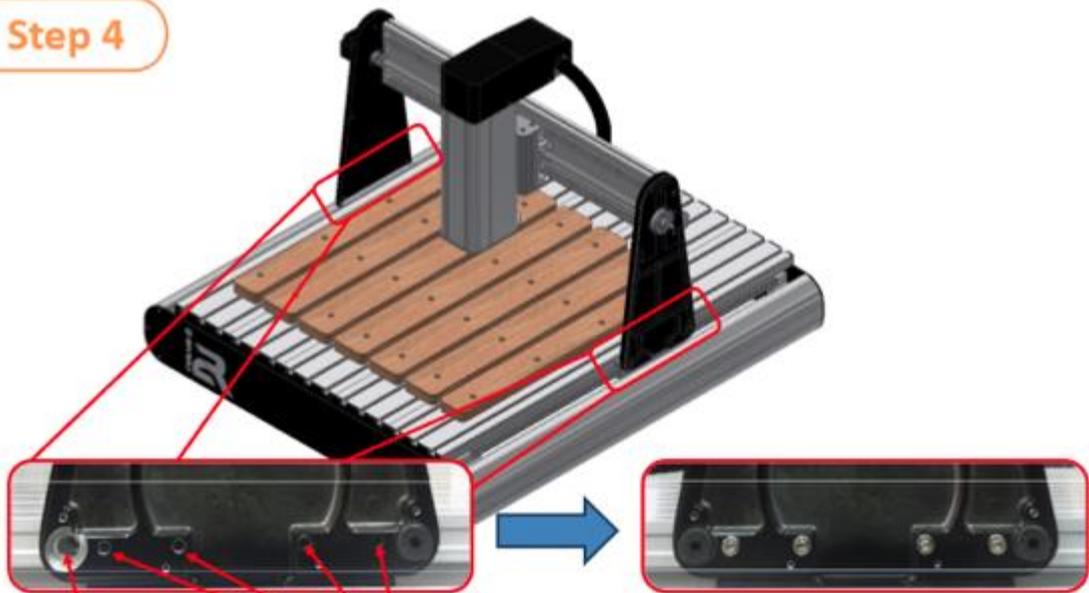
Step 3

Step 4

Shoulder Bolts-M8

M5x25

Step 5

M3x6
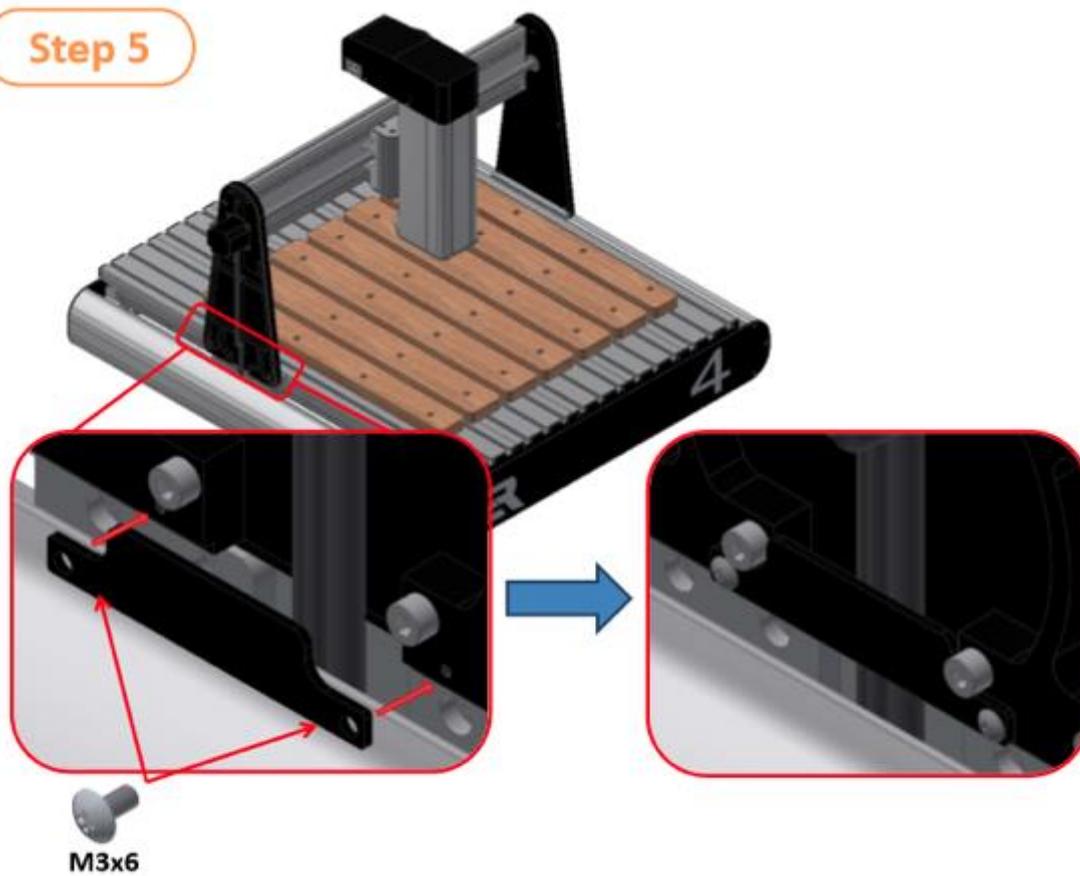
Step 6
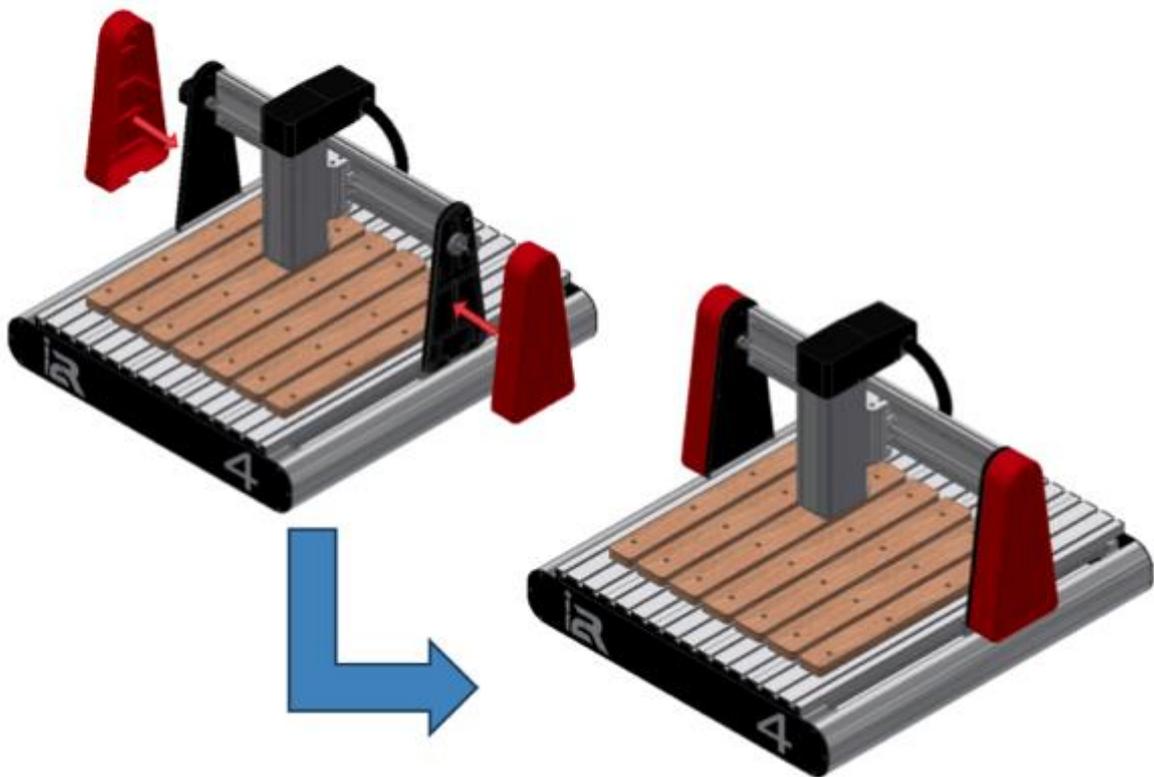
Step 7
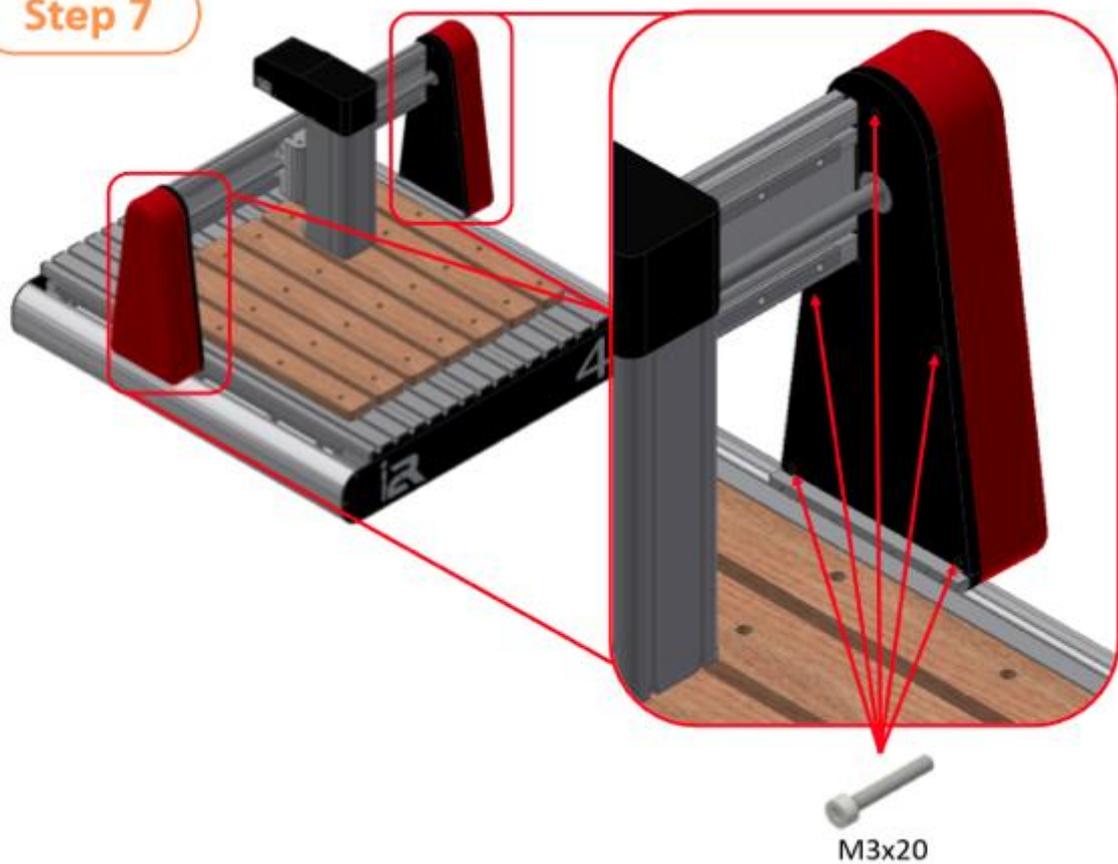
M3x20

7.3.3 COMBINE THE MACHINE AND STAND ASSEMBLY

Combine the machine assembly and stand

Step 1

Step 2

M10

M10x55
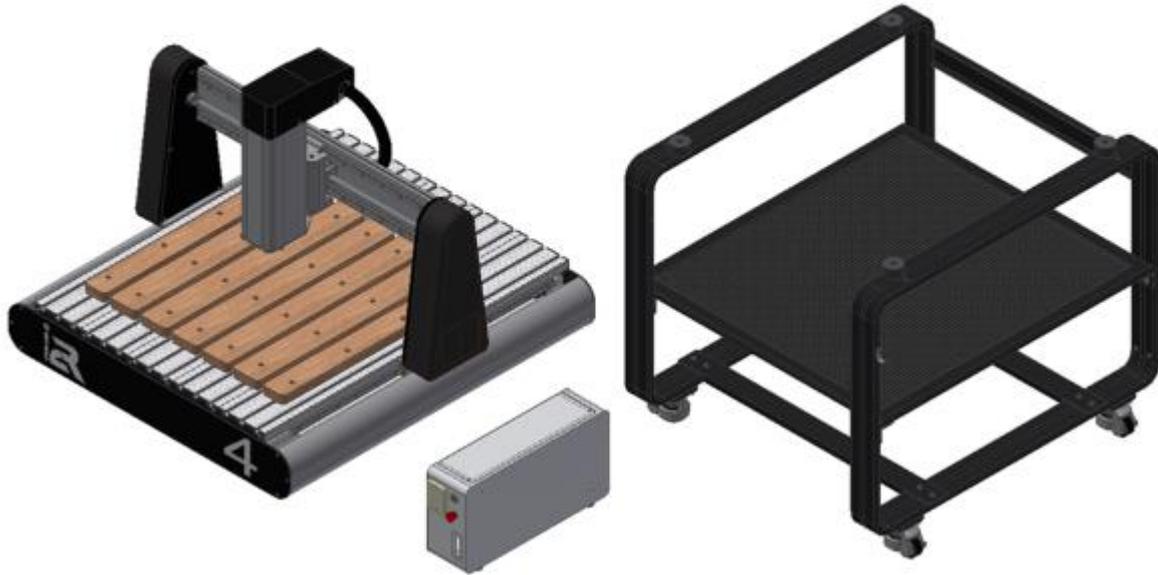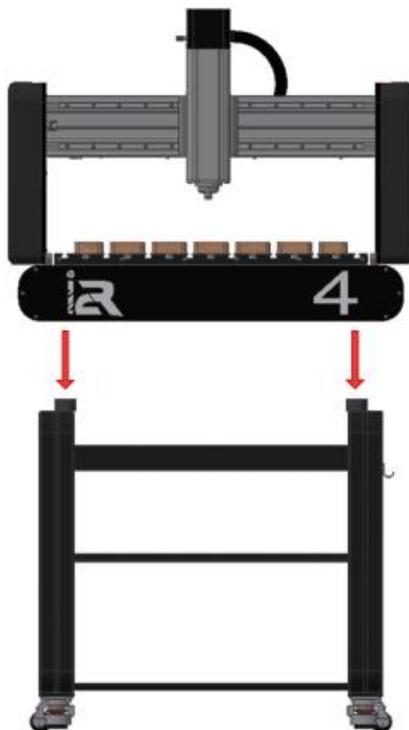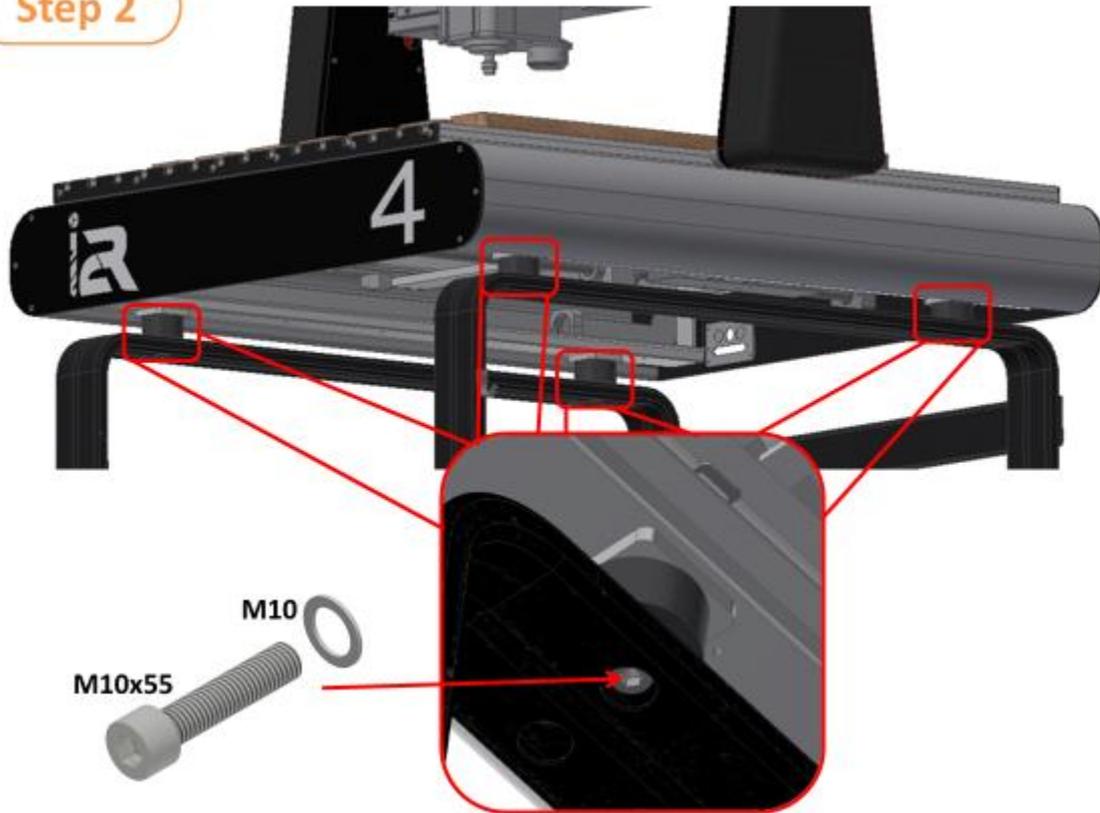
Step 3
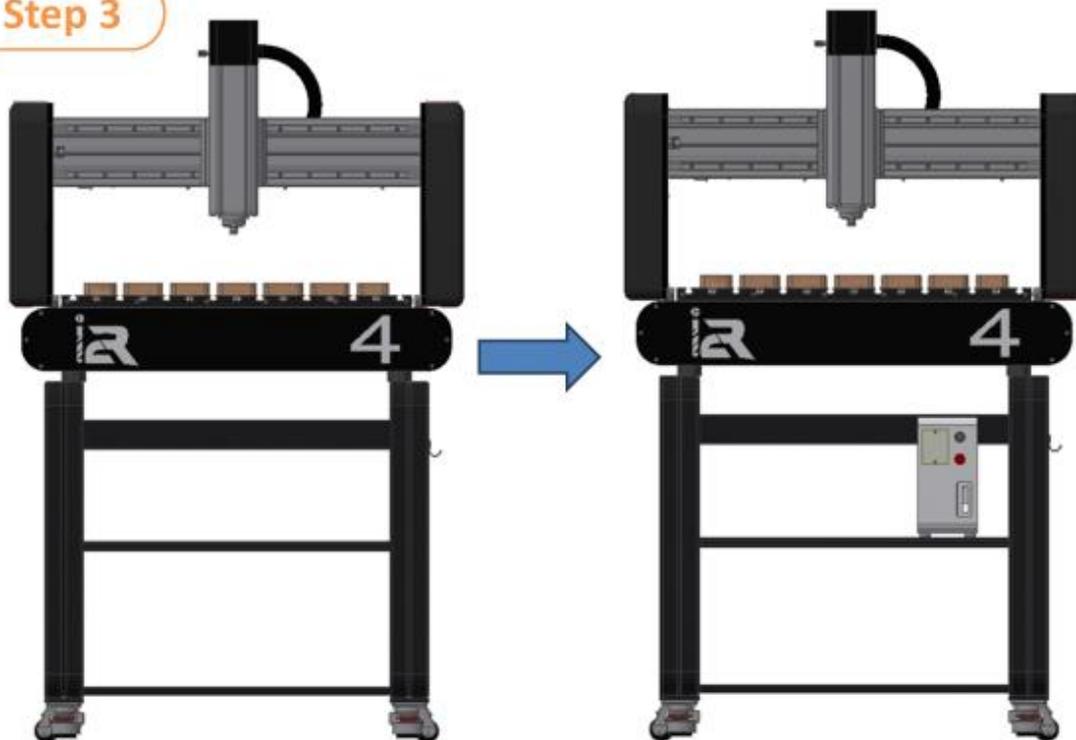
Step 4
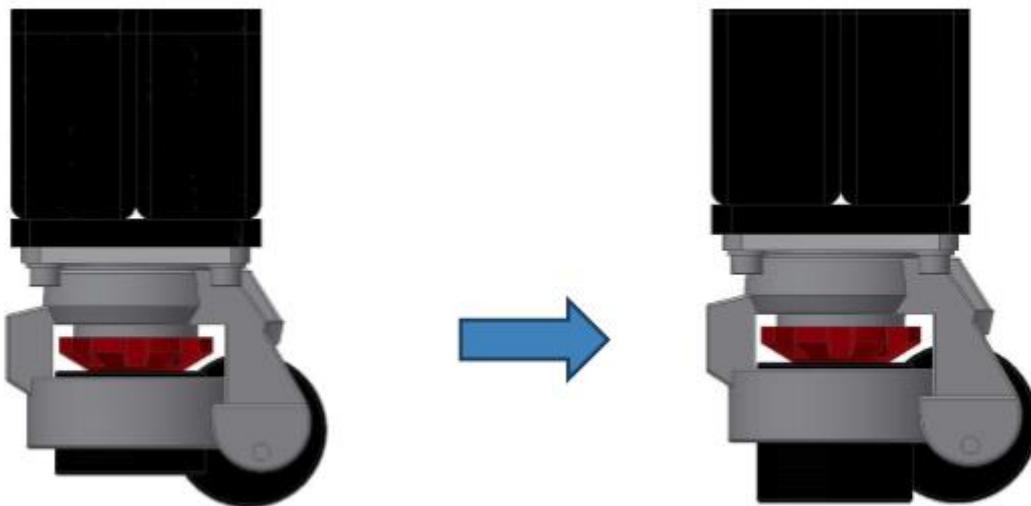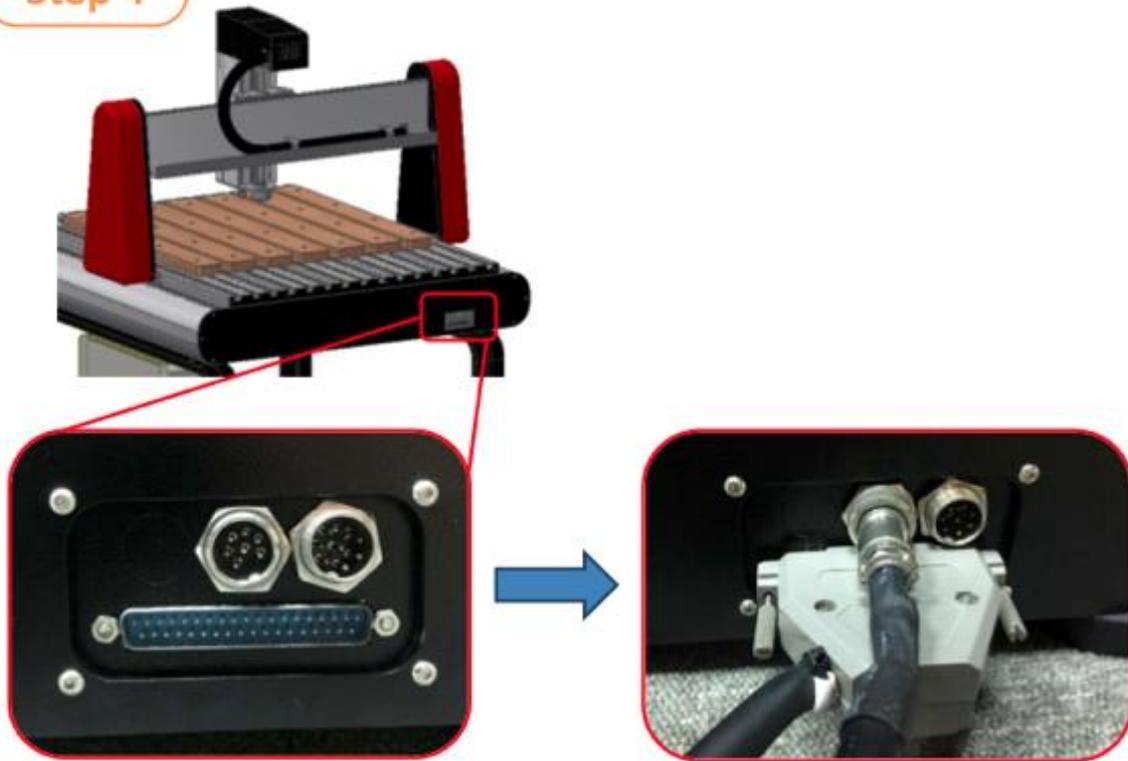
Move your CNC to the desired location, then turn the red gear and the anti-vibration pad until it makes contact with the floor. The caster wheel should be lifted and no longer touching the ground.

If you need to reposition your i2R, simply rotate the red gear in the opposite direction.

7.3.5 FINAL MECHANICAL SETUP PREPARATION

Once you have unpackaged your i2R CNC router and located it on a bench you have chosen or the i2R stand as per the above steps, it is time to connect the machine and control system together in preparation for first steps.

1) Locate it on a stable bench (as per the above steps)
2) Put the controller near the machine on the same bench (or under machine on i2R stand)
3) Locate and turn on laptop / PC to control machine next to the controller (see Figure 3)
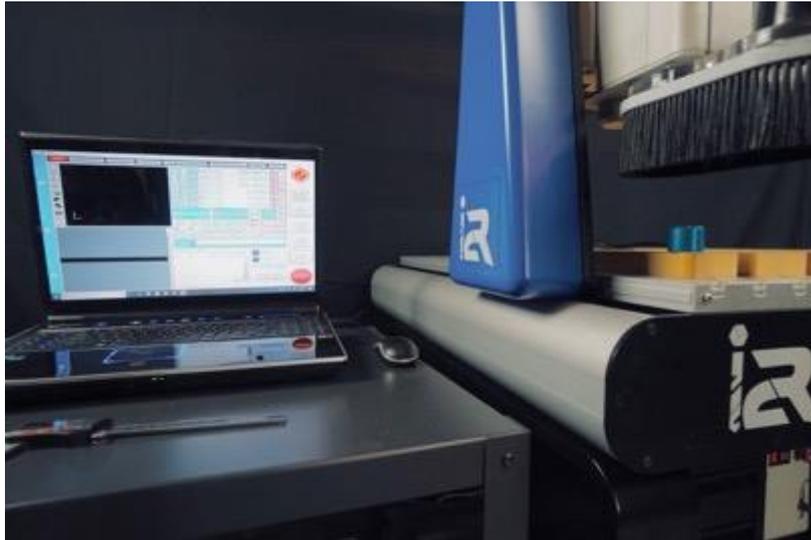
Figure 3: Locate control PC near to machine and control box

7.3.6 FIRST CONNECTION STEPS

The following steps should be carried out to ensure safe setup and operation of the machine. At all times inspect all connectors and anything you are handling for damage or any sign of mishandling. For more information on Electrical Connections refer to section 14.

Be sure to position the electrical cord through the back of the stand safely, so it will not be ran over by the castors and to prevent tripping hazards.

Figure 4: Cable summary out of control box

1) There will be 3 cables coming out of the control box (control box is identified in Figure 4).

- 2 cables will connect to the machine as shown in Figure 5
- Carefully seat these cables (there is only one correct way to seat connectors)
- Carefully tighten the connectors and careful not to cross thread the locking part of the connectors.

Figure 5: Connections to the back of the machine

2) Check the power button (shown in Figure 6) on the front of the controller box

- The power switch should be depressed with no light indicating it is powered OFF!

- NOTE Figure 6 shows switch in the OFF position
- Switch OFF before plugging into mains supply

Figure 6: Power button and estop on the controller

3) Plug in the 3-pin plug powering the control box into the AC wall socket outlet.

- Ensure the connection has RCD and standard domestic electrical protection installed
- Inspect the plug for any sign of damage
- Do not plug into a live socket
- Turn on AC power at the plug

4) Turn on the mains controller switch

- Figure 7 shows the Power button illuminated and on
- The switch should light up (you might hear a small clunk from motors engaging)
- You should see the Ethernet connector on the front of the white control box blink green.
- Connect the Ethernet port to the control PC (connection sequence not important)
- You are now ready to setup the UCCNC controller and run your i2R CNC router!

Figure 7: Push the power button and plug in Ethernet connector into PC and controller

8 i2R SETUP AND CONFIGURATION

This section of the manual is intended to show you how to configure your i2R CNC ROUTER machine to be controlled by UCCNC software. The UCCNC software is a full Gcode based machine controller and is therefore compatible with Gcode based CAM packages.

We support the UCCNC in conjunction with Vectric products. Cut2D and VcarvePro are the two most popular CAM packages we support. The combination of Cut2D/VcarvePro and the UCCNC is a very user friendly and powerful machine control package, whilst remaining easy to use.

Visit www.vectric.com where you can download Vectric CAM packages and run them in demo mode where you can test them out.

Please read this manual completely before using your i2R CNC ROUTER system with the UCCNC software.

To minimise the risk of injury and/or to prevent property damage, please only operate the machine and the associated control unit when you are sure that you have understood these instructions completely!

Should questions arise, please contact us.

Email: *info@bgprecision.com.au*
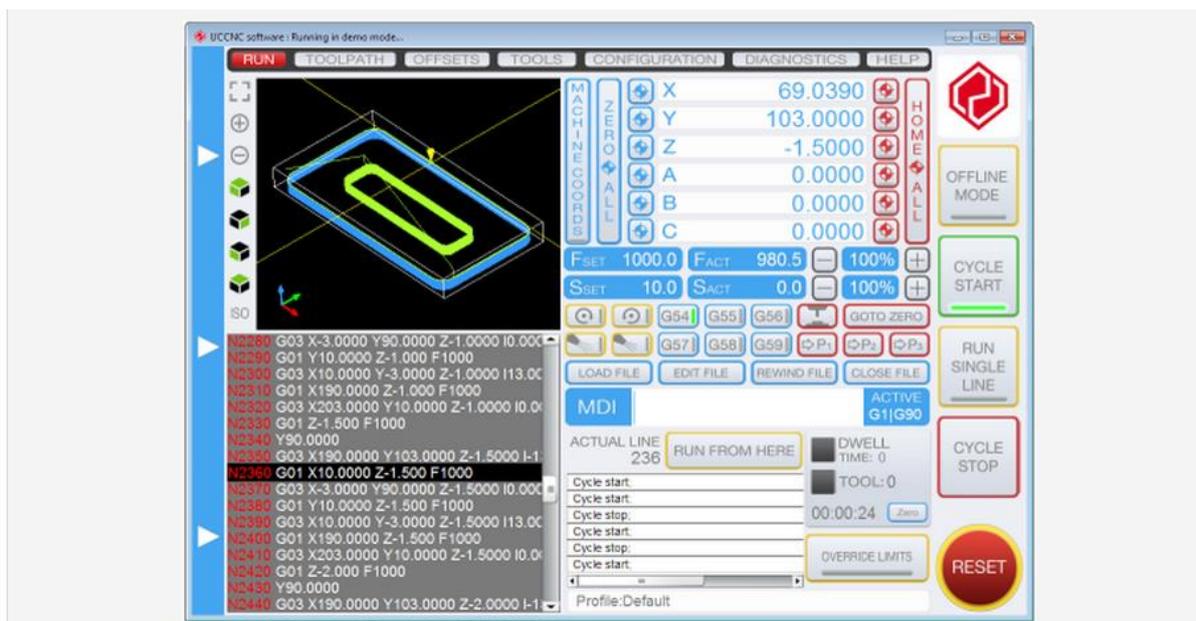
Figure 8: UCCNC controller main GUI

8.1 INITIAL MACHINE SETUP FOR UCCNC OPERATION

8.1.1 ITEMS REQUIRED FOR UCCNC OPERATION
You need to make sure you have the following items for using your i2R machine with UCCNC.

- i2R series CNC router
- UCCNC compatible controller
- Control PC with Ethernet port
- Control PC connected to the machine
- Machine controller on and powered up.

Figure 9: i2R series router sitting next to controller and PC

8.1.2 UCCNC SETUP PRECHECKS
This section assumes you have done the following

1) Securely located your machine on your workbench or i2R supplied stand
2) You have successfully connected your controller to your i2R machine
3) You have turned on the controller
4) You have a windows based laptop running beside the machine
5) You have connected the machine to the control computer using CAT5 Ethernet cable

You should have a set of files on a USB stick with all the installation steps. If not please contact us and we will send you an installer package.

8.2 UCCNC INSTALLATION AND BASIC OPERATION

The installer files (Figure 10) are all on your USB key or the link sent to you via email. Do not rush the installation. For the i2R Ethernet controller, no USB drivers are needed.

Please note some of the images may differ slightly due to variations in machine/models and due to constant update by ourselves or Windows.
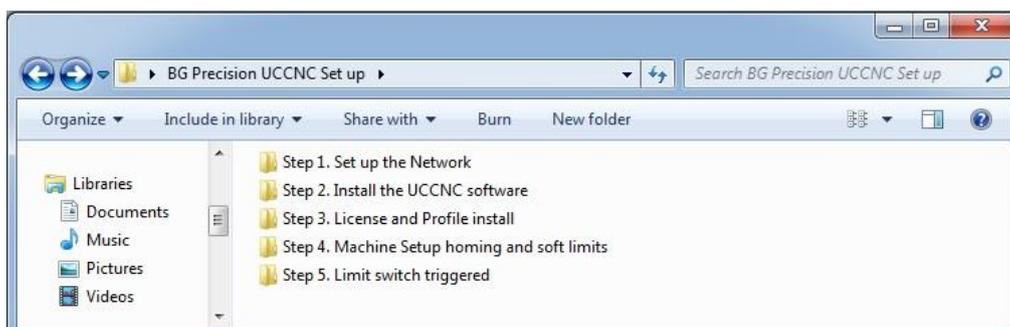
Figure 10: UCCNC Set-up files

8.2.1 STEP 1 SET UP THE NETWORK

Your UCCNC module in the i2R controller is an ethernet controller. Ethernet control is the most robust control for CNC applications. The controller requires IP address to be set on the local PC connected to the machine.

After following the steps outlined in section 8.1 above wait a few seconds to let the i2R Controller board to power up and to let the device identify itself on the network. The following instructions is based on direct connection to a LAN network card.

The below instruction can also be found in your installation folder under Step 1.
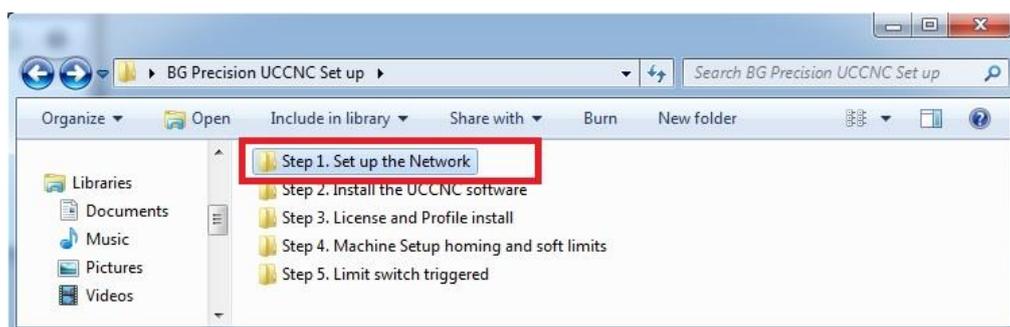
Figure 11: UCCNC Set-up, Step 1

Please refer to the AXBB Controller manual for more in-depth details. This manual is in the installation file set in the main folder.

1- In Windows click the Start menu, control panel and open the Network and Sharing centre. See Figure 12.
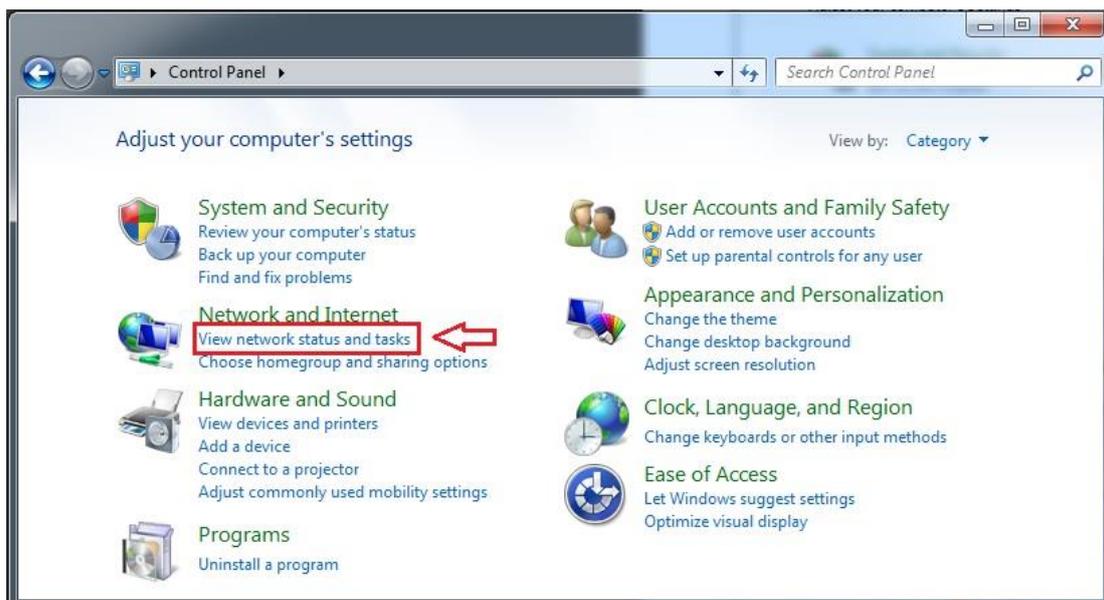
Figure 12: Windows Control Panel – Networks and sharing centre

2- Find the network connection in the non-identified connections list and click on its name. SeeFigure 13.
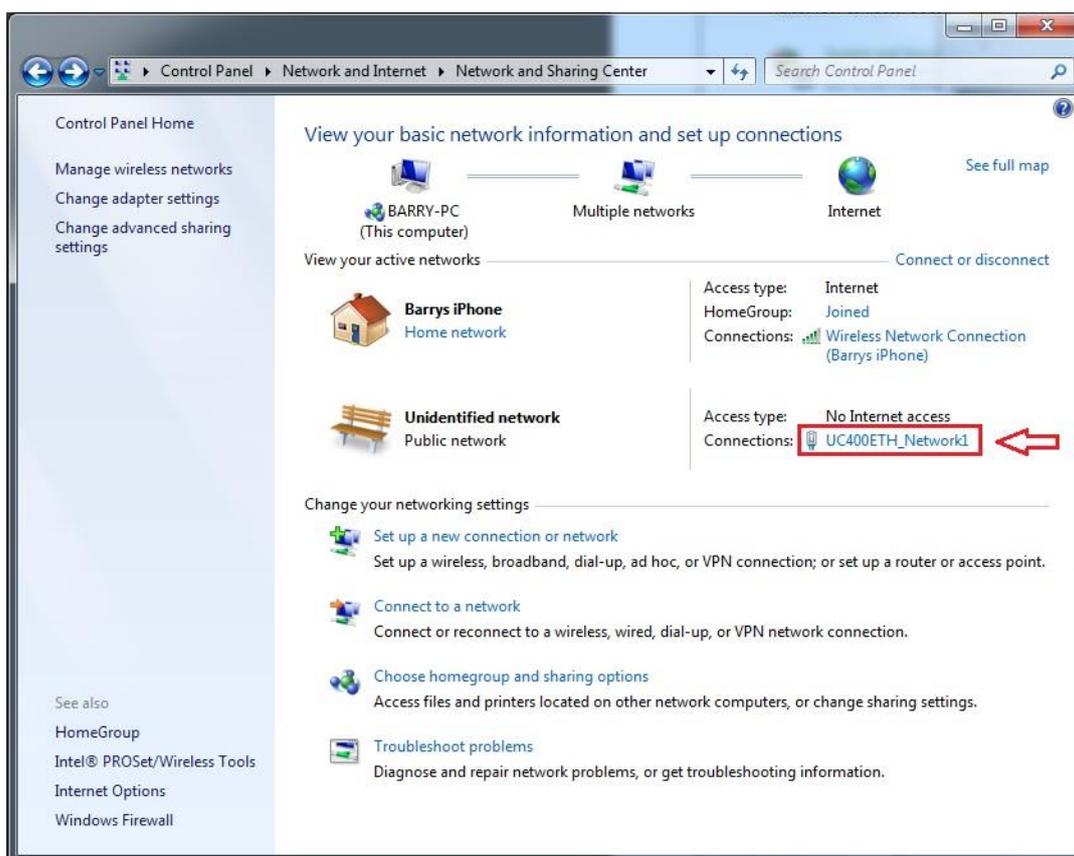
Figure 13: Networks and sharing centre - Non-Identified Connections

NOTE: That the network on the above and following print screen is already renamed to UC400ETH. By default the network will have a name local connection or similar.

3- Rename the connection by clicking the change adapter settings on the left side of the window. See Figure 14.
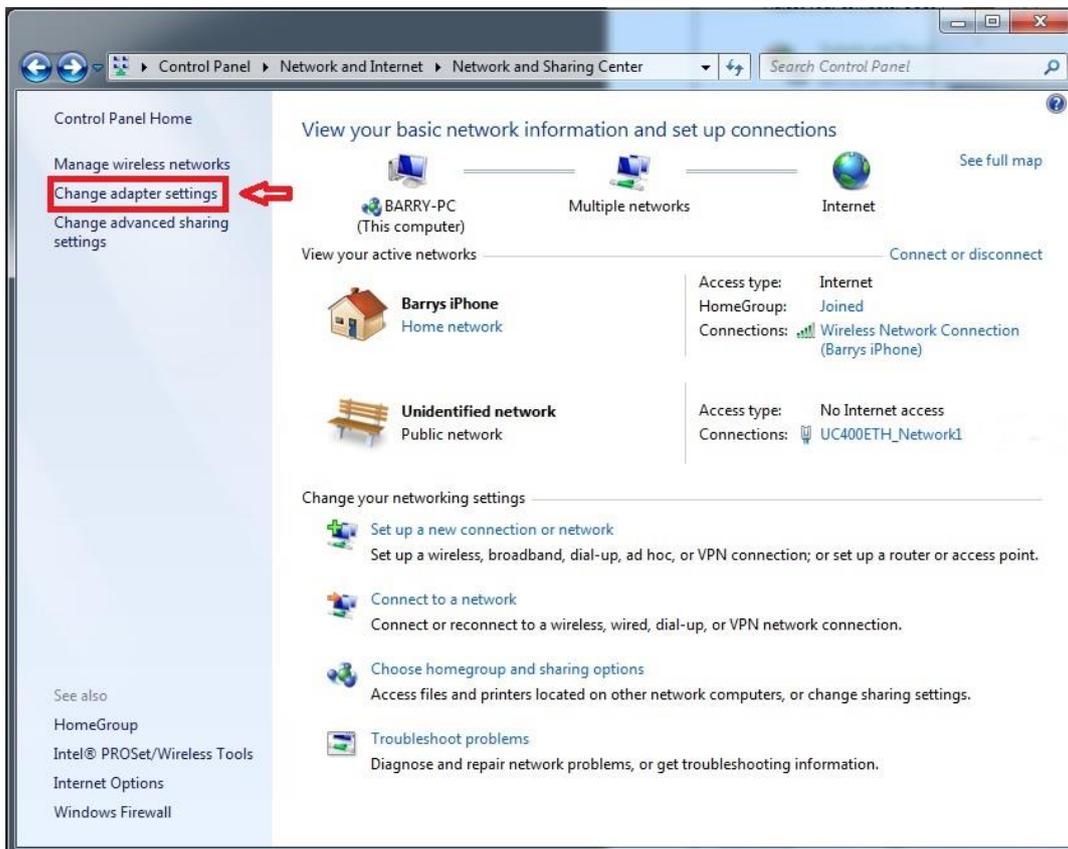
Figure 14: Networks and sharing centre – Change Adapter Settings

4- After left clicking on the Non-identified Network once click "rename this connection" and enter the new network name to help identify it later. (Suggestion: i2R CNC). See Figure 15

Figure 15: Rename this connection

5- After finding and optionally renaming the connection it is time to setup the network parameters. To setup the connection with direct cable connection click on the name of the connection and on the pop-up window press the Properties button. Please note that for this action to work the user must have administrator rights in the Windows account. See Figure 16.
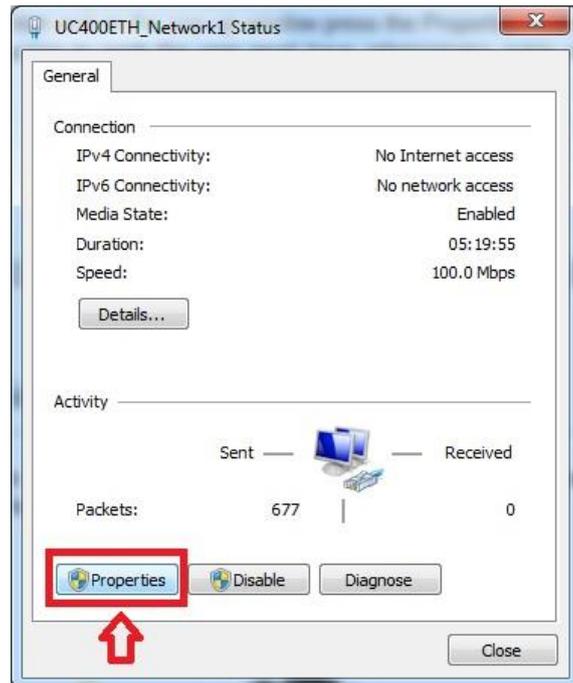
Figure 16: Network Properties

6- On the popup window find and select the 'Internet Protocol Version 4(TCP/IPv4)' row and click the Properties button. See Figure 17.
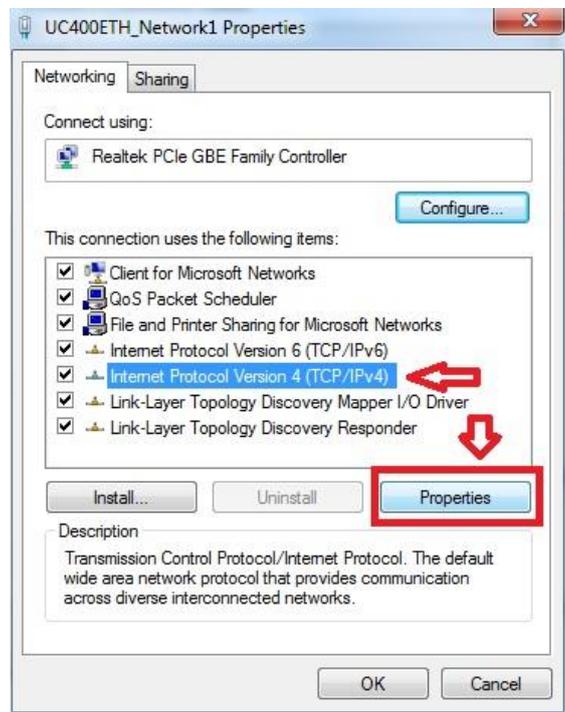
Figure 17: IPv4 Properties

7- On the pop up Internet Protocol Version 4((TCP/IPv4) properties window select the "Use the following IP address" option and fill in the IP address of the AXBB device and set the Subnet mask. The default IP address of the AXBB is 10.10.10.10 (this can be

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changed, refer to the AXBB manual for more details) and set the subnet mask to 255.255.255.0 value. Figure 18 shows the IPV4 network IP address that needs to be set.
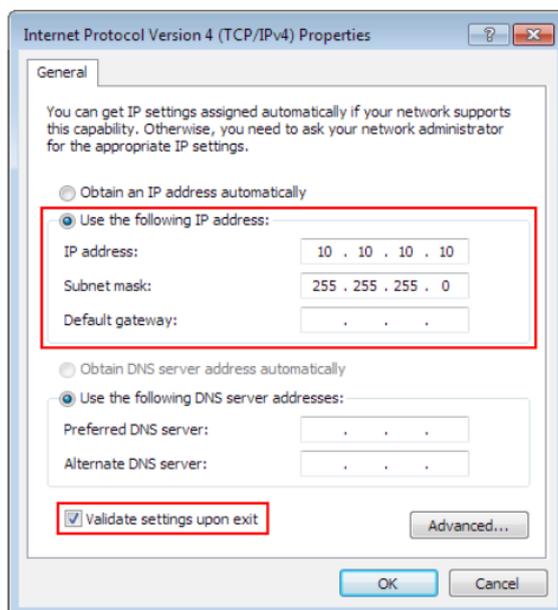
Figure 18: Network settings that need to be set prior to running the machine

After filling the values don't forget to set the 'Validate settings upon exit' checkbox to let the parameters validate automatically when closing the setup. Finally press OK to all the pop-up windows to exit the setup. Wait a few seconds to let Windows to update the settings in the LAN card.

8- To verify that the settings got validated open a command window with typing 'cmd' into the start menu and in the command window type 'ipconfig'. The result should look like as on the following image in Figure 19. Please note that the Ipv4 address of our adapter got the 10.10.10.10 value with a subnet mask of 255.255.255.0 value.
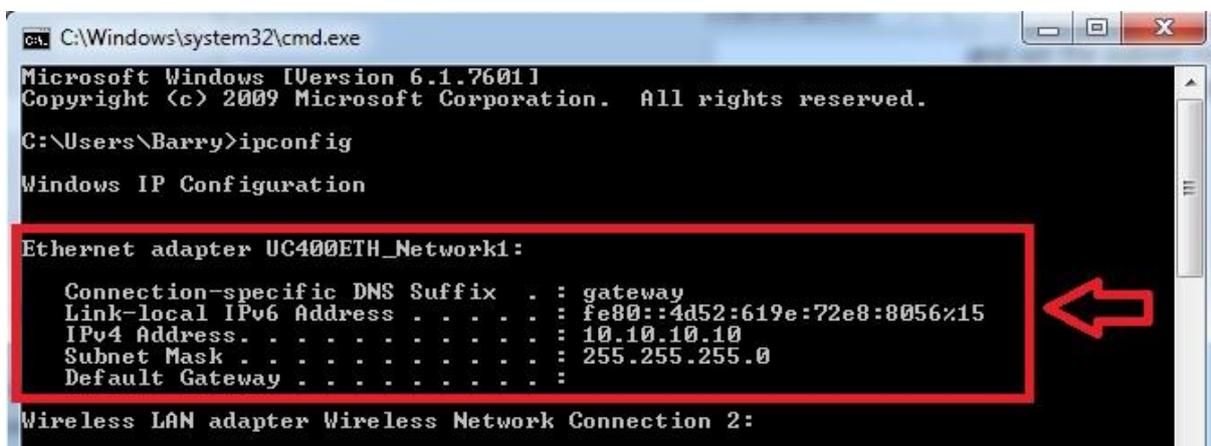
Figure 19: ipconfig settings confirmation

9- Once configured you can run the utility scanner to check the module is connecting to the machine okay. Refer to Figure 20

o The UCCNC utility checker is in the Cdrive/UCCNC/Util main folder.

o Open the utility checker and hit scan

o You should see your module number pop up on the screen

o If the device of interest does not show up in the list then check the network cable connections. Also check if the PC side network parameters are correct. Refer to AXBB manual on page 14 and 15 for more details.

NOTE: The UCCNC software needs to be installed on your PC first. Refer to steps in section 8.2.2
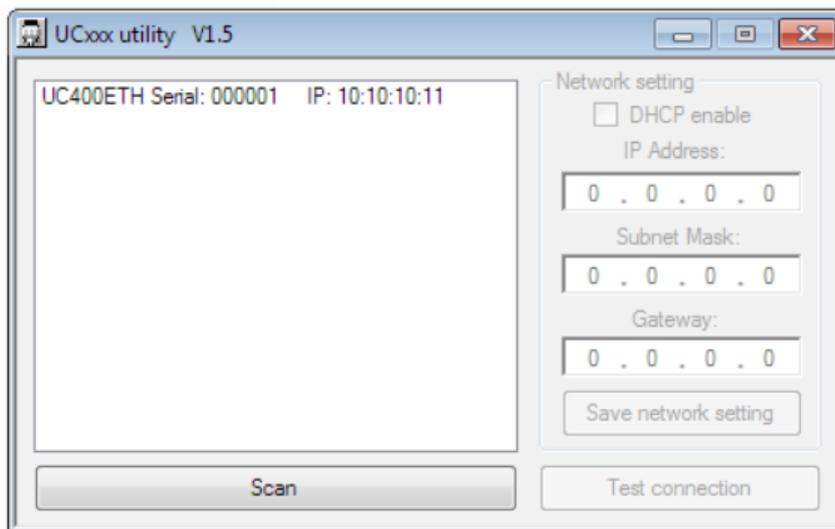
Figure 20: Utility scanner showing that the module is connecting okay with the computer

8.2.2 STEP 2 INSTALL THE UCCNC SOFTWARE

Once you have the module successfully connecting to the control computer you can now install the UCCNC software.

Open up STEP 2 from the installation folder and double click the installer Please refer to the **_Installing UCCNC Software_** PDF when installing. Depending on the PC certain steps during the installation (like USB drivers) can take some time.

1. _Enter the installation folder_
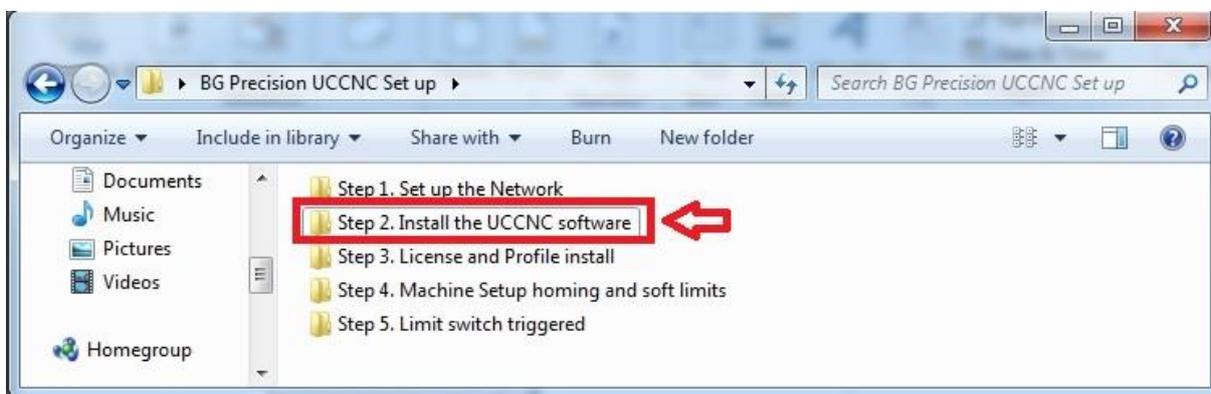
Figure 21: UCCNC Set-up, Step 2

2. _Run the installer (note the version in this manual may differ from the version in your installer)_
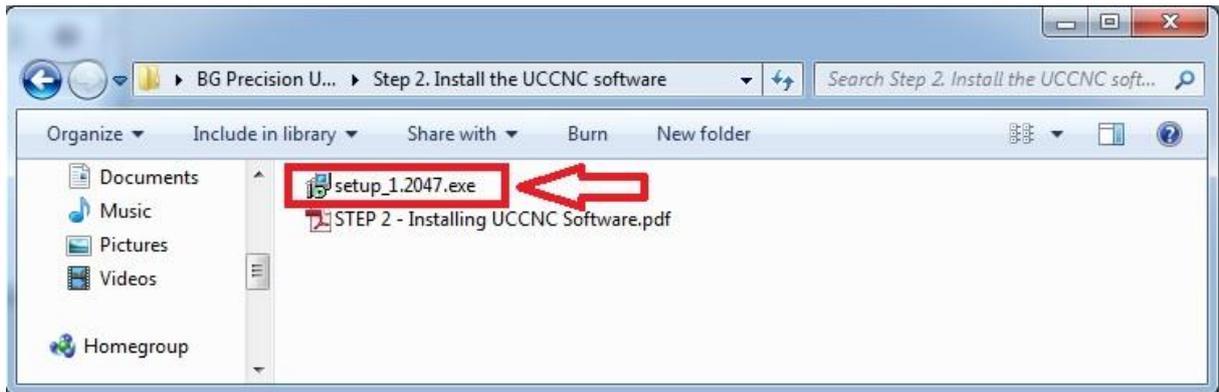
Figure 22: UCCNC Set-up exe

NOTE!!!!! The VERSION OF THE SOFTWARE MIGHT BE DIFFERENT IN YOUR INSTALLER

The latest version of the installer is always available on the CNC Drive website

http://www.cncdrive.com/UCCNC.html

Figure 23: UCCNC Software Downloads

8.2.3 STEP 3 UCCNC LICENSE AND PROFILE INSTALLER

The next step is to install the license for your AXBB controller and your machine parameters so the UCCNC can control your i2R system.

You will notice in the folder that there are files specific to your machine and also to a folder called "AXOIM_HF"

1. *Double click on Step 3. To open the profile and license installer*
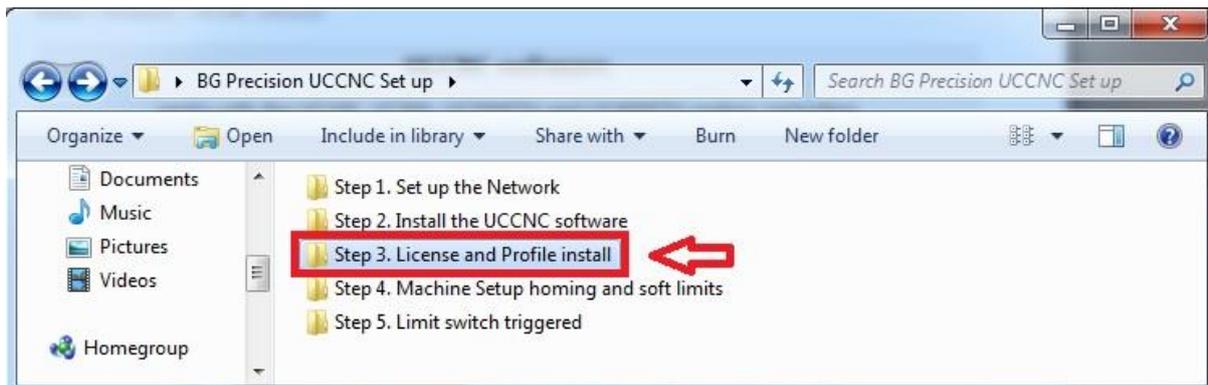
Figure 24: UCCNC Set-up, Step 3

2. _Click on the profile you wish to install for your machine._
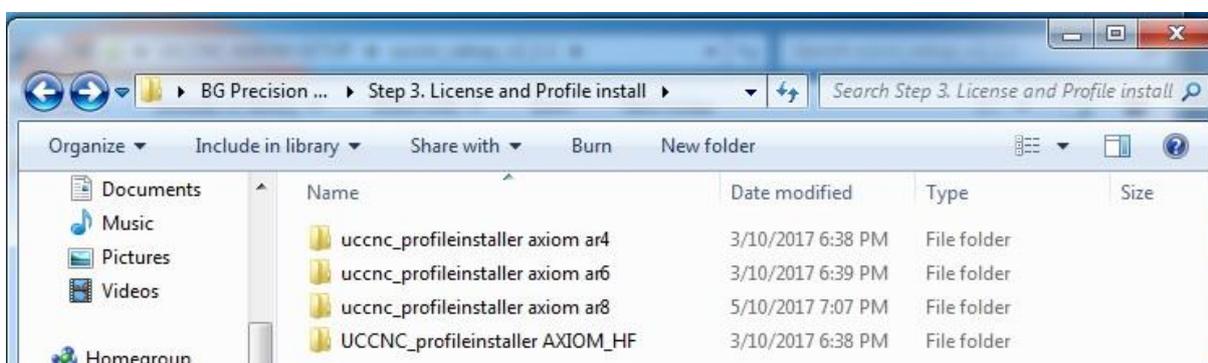
Figure 25: UCCNC profiles for selection

3. _Click the UCCNC_profile installer._

Figure 26: UCCNC Profile Run Me

When complete a pop up window will display the following:
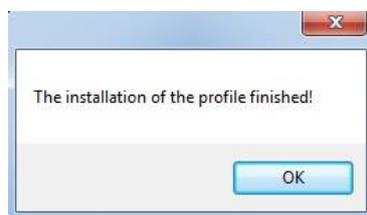
Figure 27: Installation of the profile finished!

4. There should now be a desktop shortcut for your i2R machine. All of the settings are now loaded and your machine is ready for full operation.

- NOTE!!!! When UCCNC installs for the first time there is a default shortcut always loaded to the desktop.

- VERY IMPORTANT you ether delete the generic shortcut or understand that it won't be the correct profile.

8.2.4 STEP 4_A MACHINE CONTROL WITH UCCNC

- Make sure your i2R machine is powered on

- Make sure your UC400ETH connection on front of control box is connected to the PC

- Make sure the emergency stop button on the front of the machine is released

- Make sure the green button on front of i2R controller is clockwise and green

- Make sure you have carried out all "setup operations from Step 1. Step 2. And Step 3
  Exactly.

  - Double click on the icon on your desktop that the profile installer created in Step 3.
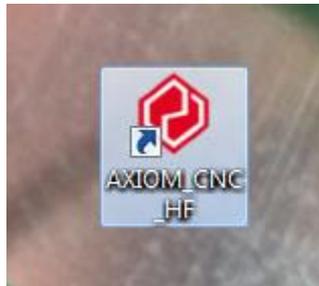
Figure 28: The UCCNC shortcut you should now have on the desktop

- The software should open and go straight to splash screen shown in Figure 29

Figure 29: UCCNC splash screen

- Note if you have installed the license file correctly you should not see any window pop up regarding the license when you open the program. Before you try to open the finally installed and validated UCCNC – make sure there are no currently open UCCNC windows.   When you have checked that there are no currently open UCCNC windows then attempt to open the UCCNC to test the installation has been successful.
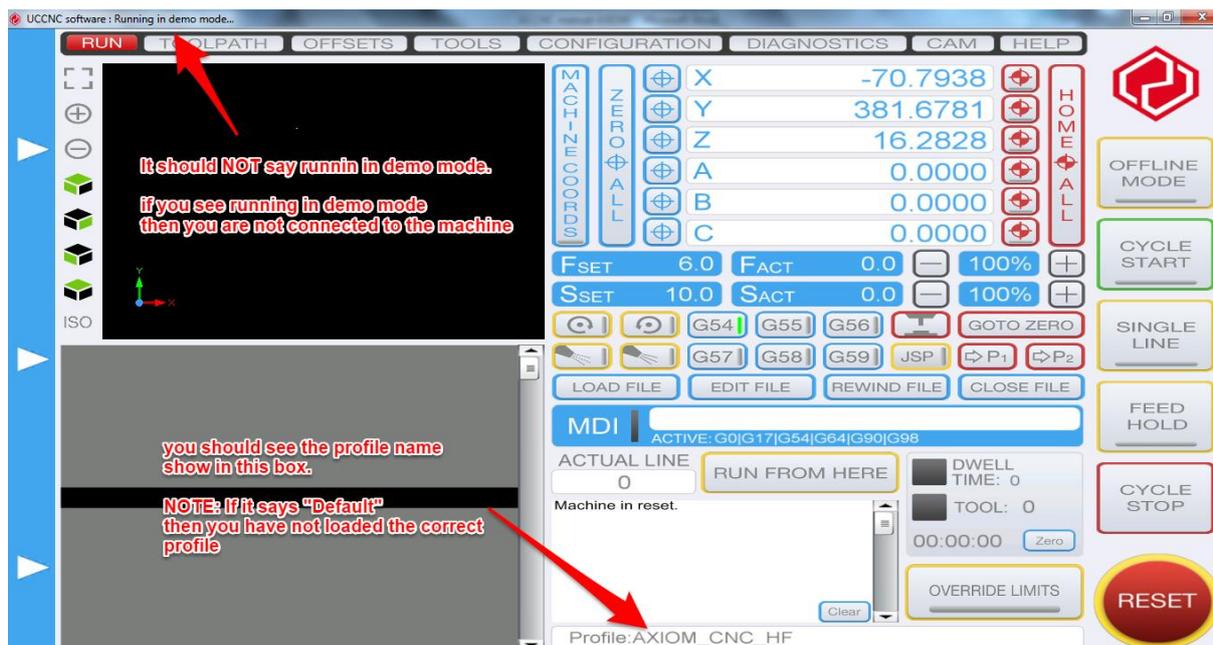
Figure 30: UCCNC main screen summary

- Figure 30 shows the main screen once you open the UCCNC controller.
    - NOTE – top left hand side. You should NOT see the text "Running in Demo mode" is should just say UCCNC software after the icon.
    - NOTE – In the profile summary box (next to red reset button) you should see the text "i2R_CNC_HF" showing you have loaded the correct profile.
- Hit the reset button (it should be flashing yellow and red and is shown in Figure 31). Once clicked it should remain solid red in colour. You should now be able to control the machine with your UCCNC software

NOTE – Whenever you are not directly interacting / controlling the machine you

must click the reset button, so the **button flashes red and yellow**. This is a safety procedure to make sure you don't accidentally turn on the spindle system.
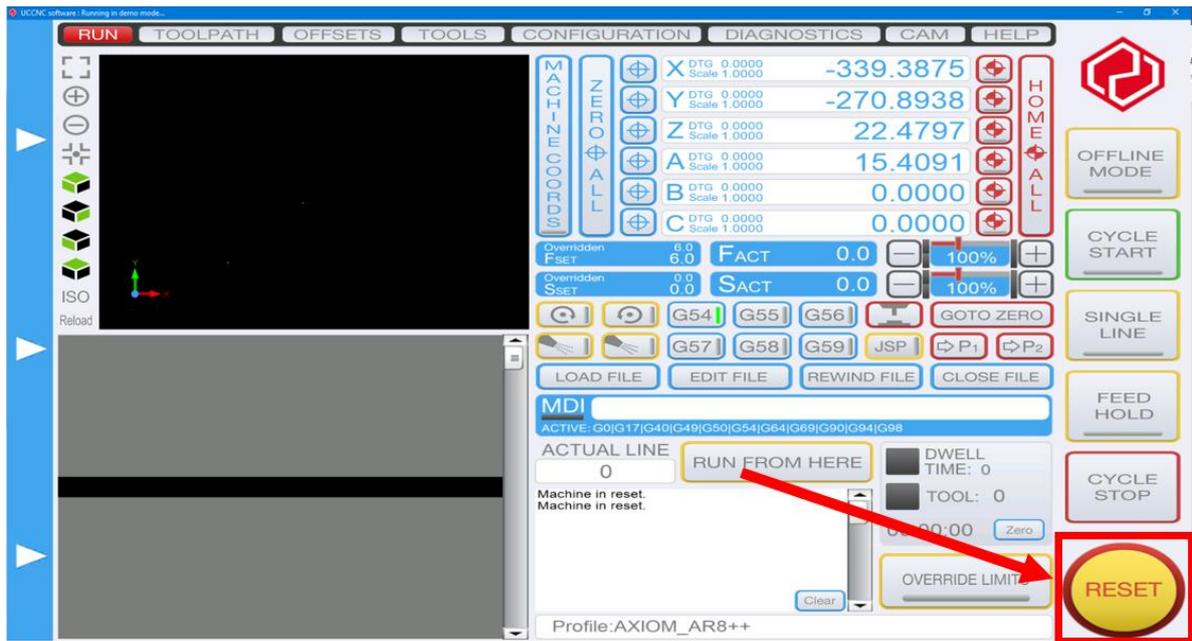
Figure 31: Reset button on UCCNC front panel

The UCCNC lets you jog the machine with the Keyboard in **Rapid** and **Slow** jog modes. The directions of movement are assigned as follows

- Right arrow key – jog X right / positive
- Left arrow key – jog X left / negative
- Up arrow key – Jog Y up / positive
- Down arrow key – Jog Y down / negative
- Page up – Z axis up / positive
- Page down – Z axis down / negative

○ Holding the "**Shift**" key while pressing the directions of movement keys will move the machine in rapid mode.
○ Releasing the **"Shift"** key will result in the slow jog motion
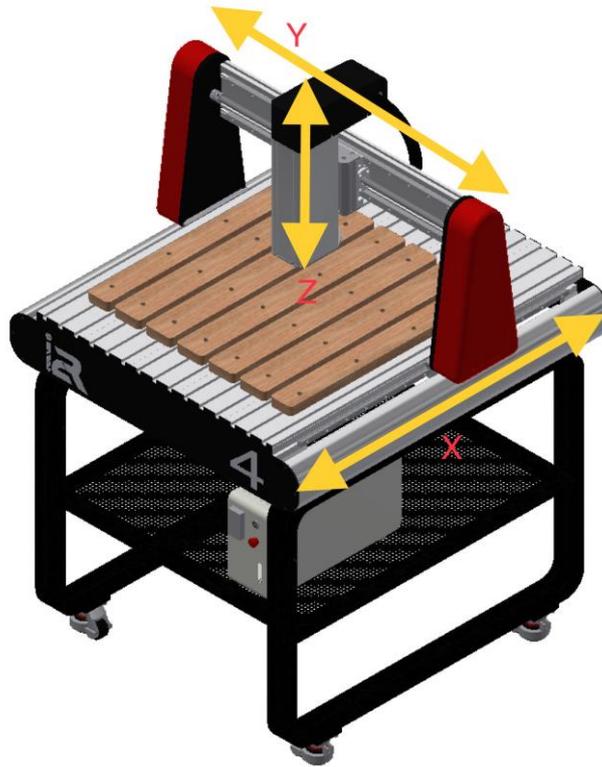
Figure 32: X - Y - Z Axis explained

Z positive move

Z negative move

Hold for Rapid Move

Y positive move

X positive move
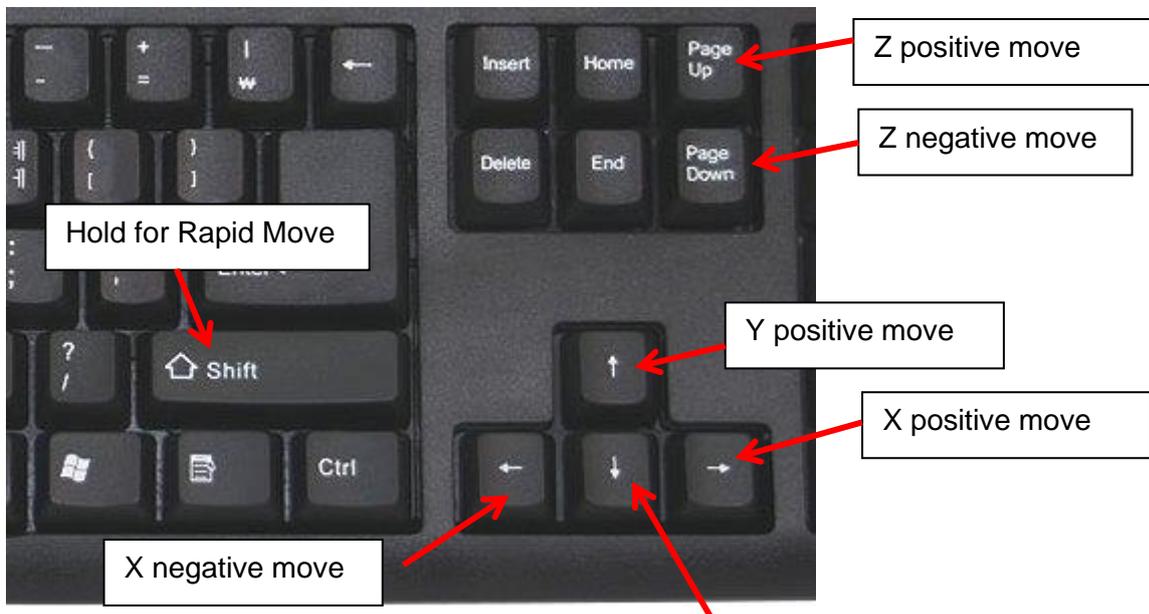
X negative move

Figure 33: UCCNC Keyboard commands

Y negative move

You can also control your machines movements via the UCCNC software interface on your PC. Hover your mouse over the left-hand side of the UCCNC interface for the movement controls menu to pop out. See Figure 34. For more details on the Jog Panel see section 9.3 Jogging the Machine.
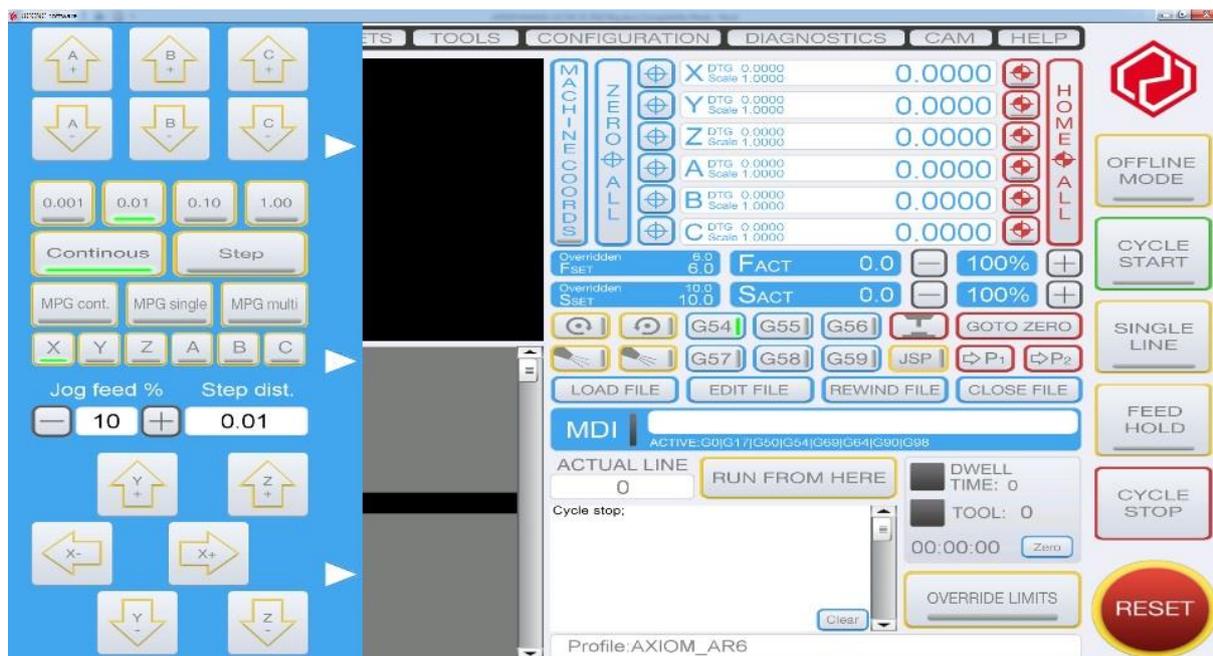
Figure 34: UCCNC screen interface movement controls

8.2.5 STEP 4_B MACHINE HOMING AND SOFT LIMITS

As discussed in Step 3, you are given the choice of configuring the machine with the soft limits enabled or with the general machine configuration.

Soft limits are software defined limits that can be enabled to prevent your machine from moving outside of its zone of movement (and crashing). In order for the soft limits to work you have to make sure you have loaded the correct profile for your machine (AR4, AR6, AR8) as the values are related to the geometry of the machines.

In order for this to work **_you must reference the machine each time the machine gets turned on_** to tell the software where the edges of the machine movement are each time. This can be done by using the "Home All" Command as you can see in Figure 35. The machine will move each axis until is hits that axis limit switch. It will then move away until the switch releases. This is how the software knows where the machine is relative to the limits switches. For the softlimits to work properly you must home the machine every time you turn the machine on.

This is not 100% required for use of the machine.

Crashing the machine will not do damage provided you press the emergency stop button shortly after. The stepper motors will simply "buzz" and the machine will not move.
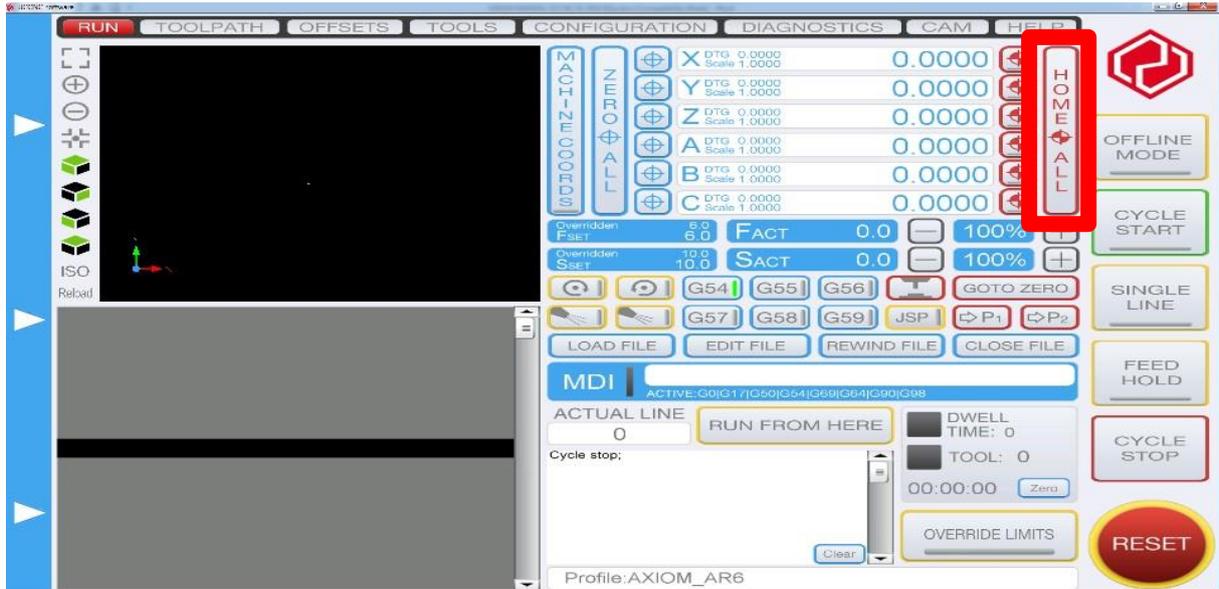
Figure 35: UCCNC Home All Command

8.2.6 STEP 5 LIMIT SWITCH TRIGGERED

Occasionally it is possible to jog the machine to the end of the machine travel such that a limit switch will be triggered. The software will now prevent you from controlling the machine. You will not be able to reset the software when the limit is triggered. When this happens, you must press the "OVERRIDE LIMITS" button in order to reset the machine. This can be done by using the "OVERRIDE LIMITS" Command as you can see in Figure 36. Once the "OVERRIDE LIMITS" button is pressed you can then click the reset button and regain control of the machine. Make sure you jog/move the machine AWAY from the limit switch. You will hear the switch release if you listen carefully. You are now back in the zone of operation for the machine and can continue.
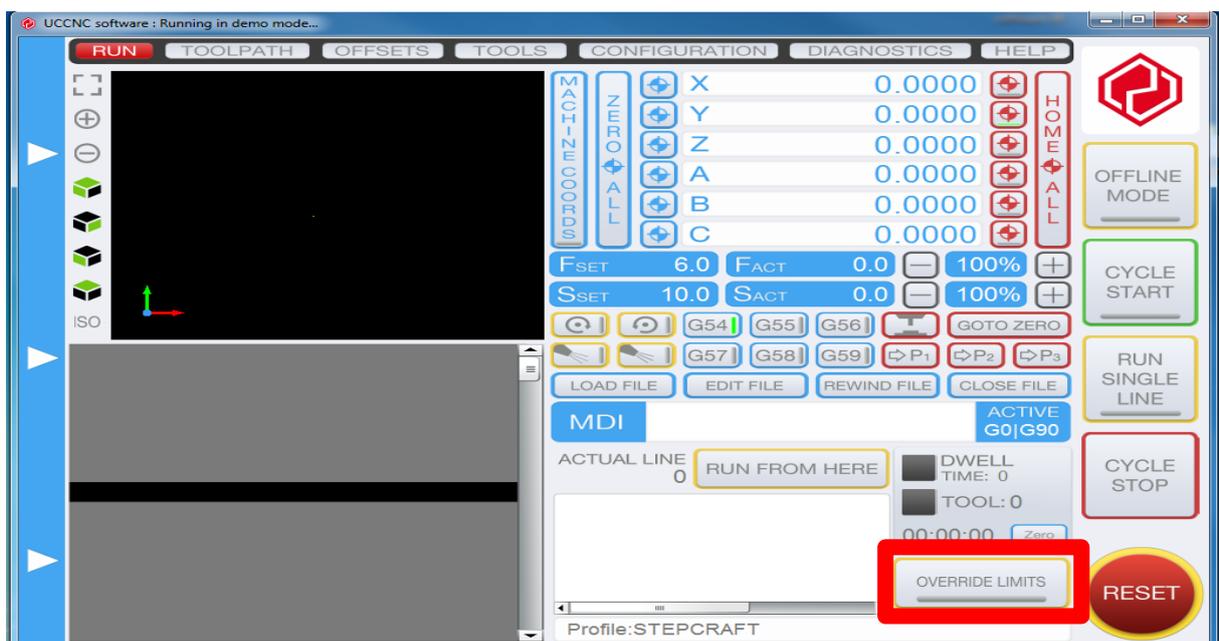
Figure 36: UCCNC Override Limits Command

8.3 SPINDLE SYSTEMS

DANGER Before you change the tool in the spindle and before you handle any of the spindle components in any way you must de-activate the spindle system to avoid accidental spindle start-up during handling.

The first stage in disabling the spindle system is to hit the reset button in UCCNC. This will de-activate the charge pump signal and will disengage a safety relay in the machine control electronics preventing unexpected start-up of the machine spindle.
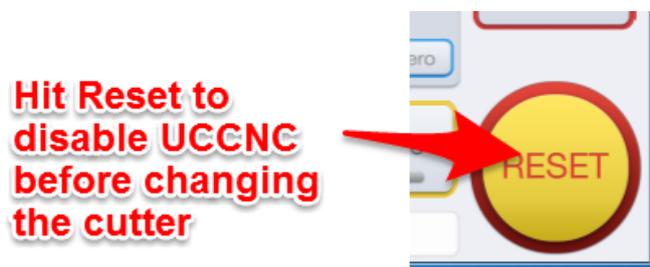
Figure 37: Reset to disable spindle relay

Further details on how to change tools and use the collet system are outlined in section 11.4 Load your tool.

8.4 SETTING SPINDLE RPM:

The i2R machines are equipped with a VFD invertor for spindle RPM control. This can be found on the front of the white control box.

On the UCCNC i2R machines the factory setting for spindle speed control is determined via UCCNC software or G-Gode (outputted by Vectric) only.

The buttons and the dial on the VFD, are intended to be used for programming only and cannot be used to set the spindle speeds.

The display shows the RPM in 60Hz frequency. This means that while the RPM is 0-24,000, the display will show 0-400. Each 100-displayed is equal to 6000RPM.

Delta VFD - RPM Values	
Frequency	RPM
250	15,000
267	16,000
283	17,000
300	18,000
317	19,000
333	20,000
350	21,000
367	22,000
383	23,000
400	24,000
Frequency equals desired RPM/60	

Figure 38: Delta VFD RPM Values

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.

For example, type S6000 and press enter to set the Spindle RPM to 6000

The spindle will turn at that speed when it has been programmed to start turning. It is OK to program an S word whether the spindle is turning or not. If the speed override switch is enabled and not set at 100%, the speed will be different from what is programmed. It is OK to program S0; the spindle will not turn if that is done. It is an error if:

• the S number is negative.

Note that the Spindle speed can be override in the 1-300% range using the + and – buttons in the spindle speed override DRO.

To manually start the spindle select the spindle On/Off Button as shown in Figure 39.
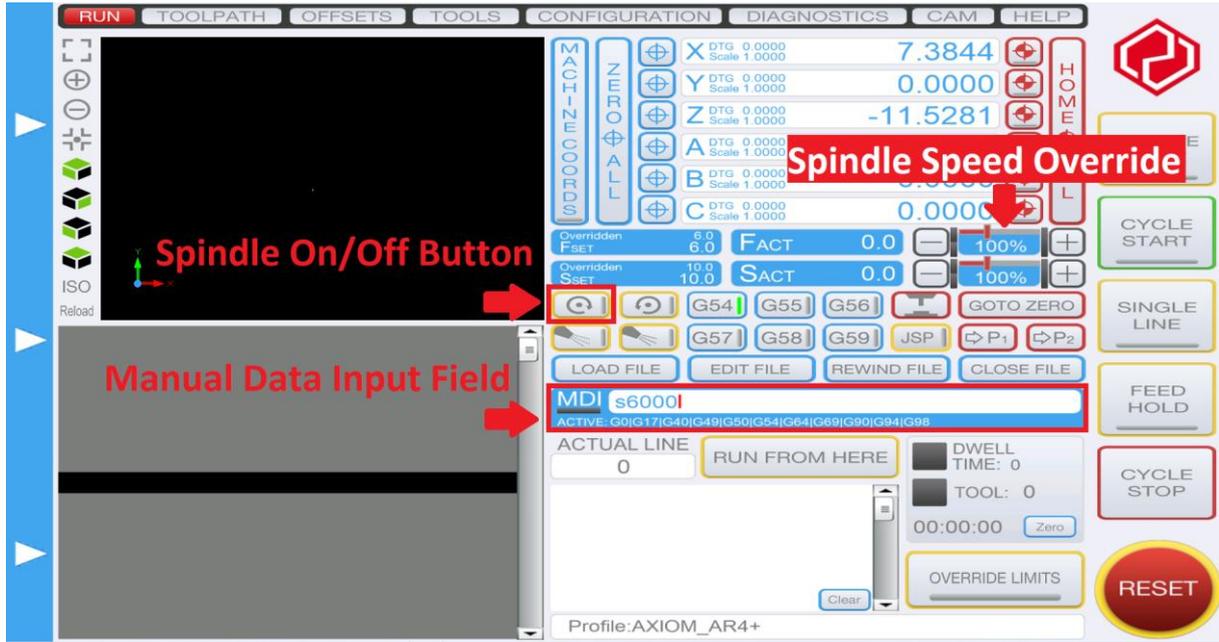
Figure 39: UCCNC Spindle Control

9 UCCNC ON SCREEN INTERFACE

Your UCCNC Profile for the i2R CNC machine comes with the UCCNC default screen set. The default screen set is the screen set file (.ssf) which the software installs by default. This screen set file contains components and graphics for a 6-axis machine controller. Print screens of this screen set are shown in this documentation. For more information on how to edit and customise the default screens please refer to the UCCNC user manual provided in your installation folders.

9.1 UCCNC PAGE TABS

The TAB pages on the default screen set are as follows:

9.1.1 RUN

This page is the main page of the screen, it contains the buttons to load, edit, run, close a G-code file. It also contains buttons to switch the spindle on/off, select the offset coordinate system. It contains a 3D toolpath viewer and a G-code viewer. On the top of the screen the 6 axis position DROs and actual and set feedrate, spindle set rotational speed and spindle actual rotational speed DROs are taking place. An MDI (manual data input field) is placed on the middle of the screen, this component allows a manual G-code input via the keyboard.

9.1.2 TOOLPATH

This page is to get a clearer view of the toolpath loaded into software. The page contains a large, high resolution 3D toolpath viewer and buttons to navigate, zoom and to have different viewing angles of the toolpath.

9.1.3 OFFSETS

This page contains the offset coordinate system parameters. The offset coordinate systems are on 6 sub TAB pages and are G54, G55, G56, G57, G58, G59 respectively. The actual offset coordinate system can be selected on the Run page. The offset values on the selected offset system is applied to the coordinate DROs of the machine and the name of the actual offset system is indicated in a label on this screen for example "Active fixture: G54" means that the G54 coordinate system is selected. Currently work offset is available for all the 6 axis and in addition a tool offset is available for the Z-axis. The offset numeric values are one by one all editable on the screen.

The current position which is the actual position of the machine can be offset with a single button press. Also the work offset can be cleared with one button and the tool offset can be cleared in a similar way with a single button press.

9.1.4 TOOLS (ONLY APPLICABLE TO AUTOMATIC TOOL CHANGE SPINDLES)

This page contains the tool offsets for the Z-axis, because as previously described tool offsets are currently only available for the Z-axis only. There are in total 96 pieces of tool offsets are available marked Tool#1 to Tool#96 on the screen. All tools can have its own tool length offset value. All tools numeric values are editable on the screen and the values can be saved to the profile file.

9.1.5 CONFIGURATION

This page is the most complex tab page, it contains several sub TAB pages and this page has all the software configuration parameters. We do not recommend you change any setting here. Your machine specific profile has been designed and tested to ensure your machine works how it was intended to.

9.1.6 DIAGNOSTICS TAB PAGE

This page shows data and feedback about the current job and the machine properties, like I/O and functions logic states. This page can be very useful when problem solving. We recommend you always check the current job properties prior to starting any job and ensure they are within your machining limits.

9.1.7 HELP TAP PAGE

This page lists the supported G and M and other codes with basic descriptions. Also, the motion controller device parameters and the license key validity can be read here.

9.2 OVERRIDING THE FEEDRATE AND THE SPINDLE SPEED

The programmed feedrate and spindle speed can be overridden any time, even when a code is executed and when a motion is in progress. Both properties can be overridden in the range of 0- 300% of the programmed value. The override feature is useful for example if the programmed feedrate is too slow or too fast and need to be adjusted, but the operator does not want to bother with regenerating the code with new feedrate values. The same is true for the spindle speed override, if the spindle speed is controlled from software then the programmed speed can be overridden on the fly which makes the system more comfortable for the operator and more productive saving lots of additional work and time.

To override the feedrate use the + and – buttons next to the feedrate and the spindle speed DROs. Pressing the plus button increases the value with +10% if the value is equal or above 10% and it increases +1% if the actual value is below 10%. Pressing the minus button decreases the value with 10% in case the current value is above 10% and decreases the value with 1% if the actual value is equal or below 10%.

If the feedrate override is set to 0% then the motion stops and stalls till the DRO value is changed to any higher value.
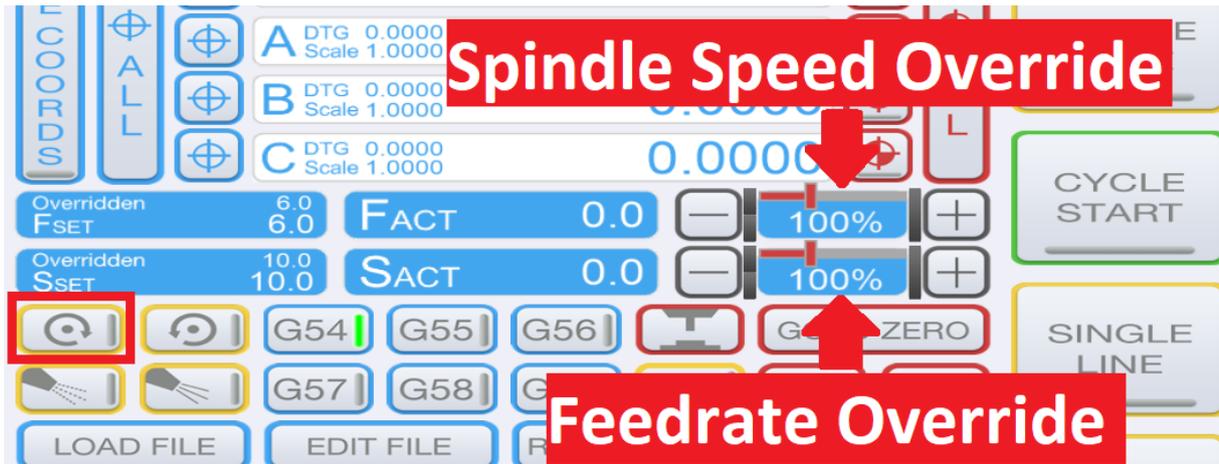
Figure 40: UCCNC Feedrate and Spindle Speed

9.3 JOGGING THE MACHINE

As well as using the keyboard commands as highlighted in 8.2.4 STEP 4_A Machine Control with UCCNC you can use an onscreen jog controller. The jog controller is used to move the machine manually by pressing screen buttons. Also, the manual pulse generator and the associated buttons can be found on this screen.

The jog panel is located on the very left side of the screen and on start-up this screen is hidden, only its right-side border is shown. Touching the panel's border with the mouse pointer makes the jog panel to pop and appear on the screen. The panel is not available when a motion is in progress, when the machine controller is busy executing commands.

There are + and – jog buttons on the jog panel, pressing these buttons all axis can be jogged to the negative and to the positive directions. The Jog feed sets the feedrate of the jog movements, the value is defined in percentage of the set maximum (G0) feedrate of the axis.

The mode of the jogging can be selected with buttons on the screen, there are continuous and stepping modes.

In continuous jogging mode the machine axis jogs while the jog button of the axis is being pressed and the jog finishes when the button gets released.

In step jogging mode the axis moves the selected distance for every jog button press. Currently there are 0.001, 0.01, 0.1 and 1 unit lengths are selectable.
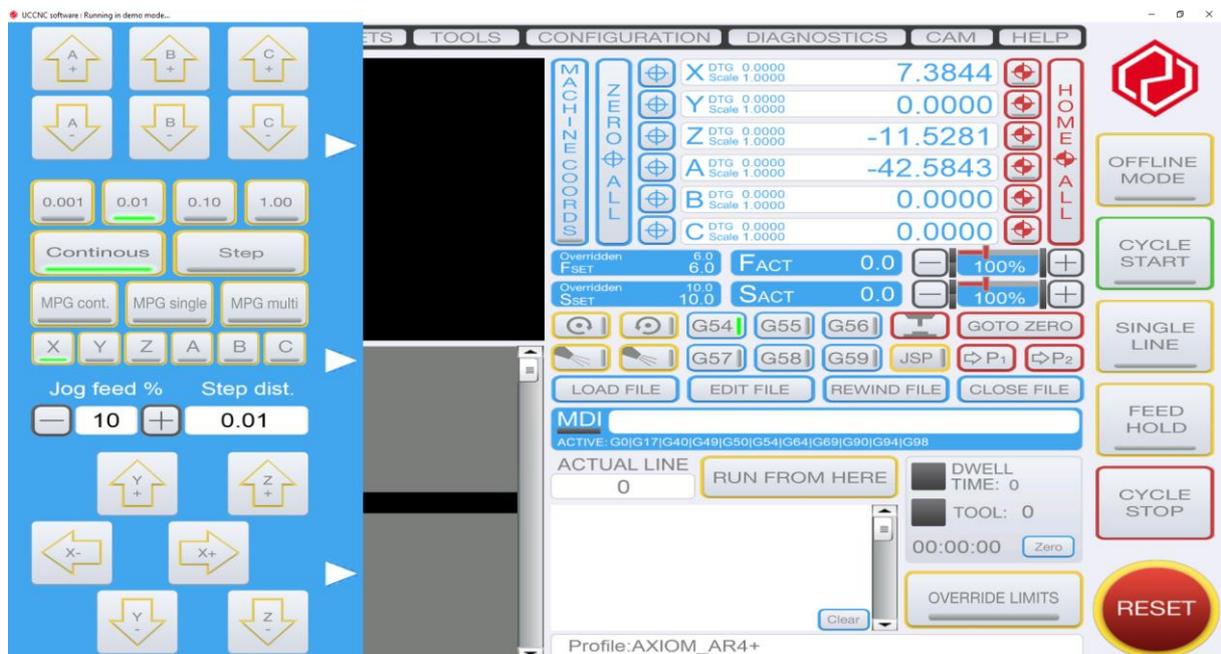
Figure 41: UCCNC Jog Controller

10 Cut2D/Vcarve/Aspire setup

We support UCCNC PC based control in conjunction with Vectric products. Cut2D and VCarve Pro are the two most popular CAM packages we support. The combination of Cut2D/VCarve Pro and the UCCNC is a very user friendly and powerful machine control package, whilst remaining easy to use.

Visit www.vectric.com where you can download trial versions of Vectric CAD/CAM packages and run them in demo mode where you can test them out.

10.1 Introduction and overview

Cut2D is a very popular CAM package and is very easy to use. Cut2D is very similar to VCarve Pro, however VCarve Pro has a lot more functionality (which is why it is more expensive). The best way to learn how to use Cut2D is to open the software and try to use it. You can see the live preview that gives you an idea of what the part will look like. You can also see the machine tool path overlaid also. Cut2D gives you a preview so you can check what your part will look like and check for mistakes.

In this section we are going to talk through cutting a basic job.
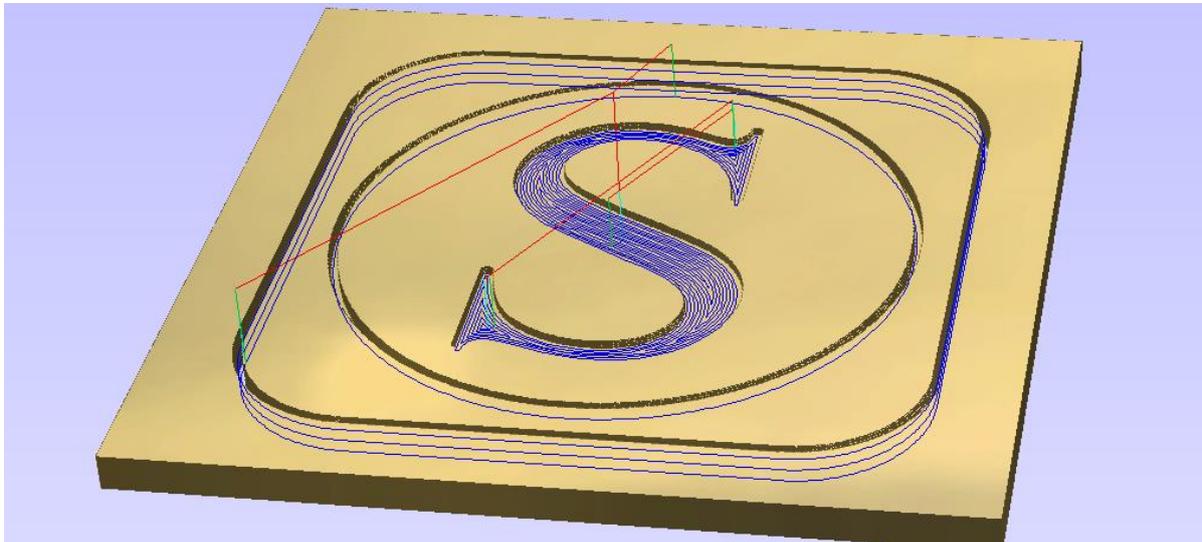
Figure 42: Vectric Screenshot

10.2 Vectric Software installation

When Vectric software is provided by BG Precision – the license number and user name specific to your machine should be on a sticker on the rear of the software case provided. If you purchased VCarve Pro or Cut2D from us and you do not have a case with a licence number – please let us know.

If you have purchased a digital copy of Vectric, BG Precision will provided you with an OEM license and a registration link. Please follow the link provided and you will be prompted to enter in your details associated with the purchase of this OEM license for updating in the Vectric Portal. Once complete and verified by Vectric (may take up to 24hrs on business days only) you will be set up with a V&CO account of which you will always have a digital copy of your Vectric Purchase, be prompted about updates and can use that profile to install your purchased Vectric software on other PCs.

If you purchase from Vectric directly, then Vectric will supply you with your software license key.

10.3 JOB SETUP - CAD

At this stage you need to create either a 2D design (Vectors), a 3D computer model (Components), or a combination of the two. This data will be used to calculate the paths the CNC will follow to cut the finished parts.

Depending on the reference material you have, you may start with a blank job and create everything within the software, or you may be importing information such as an image to trace or an existing 2D or 3D design supplied from another software package.

Once you have an idea of what you are trying to produce, the next step would be to start the software and setup a new project, followed by doing the actual CAD (design) work.

Next, we will talk about some of the important parameters in Vectric Job setup.
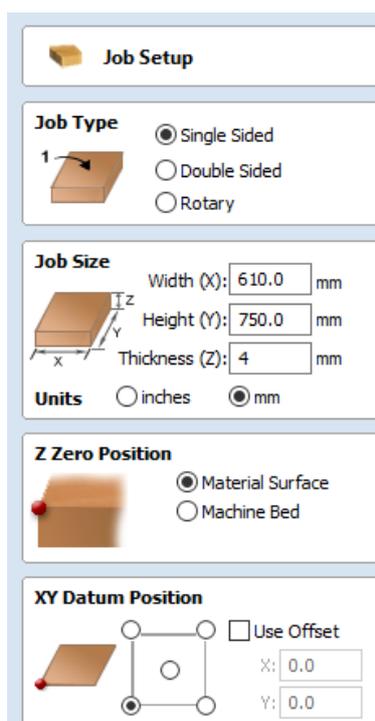
Figure 43: Vectric – Job Setup parameters on VCarve Pro

10.3.1   JOB SIZE

When setting Material Size, it can be the actual job size or just large enough to accommodate the job and space to cut it out. If you are going to be cutting your job from a much larger size of material than its actual size, then it is suggested for the design phase that you setup a material size just slightly larger than your job will be. You can either change this before calculating the toolpaths or simply position the XY Origin where you need it on the larger sheet of material.

Please ensure your units are set to "mm" as the post processor used and the i2R machine is calibrated in mm.

10.3.2   Z ORIGIN OR Z ZERO

The program gives you a choice between the top of the material or the bottom of the material as seen in Figure 43. It is easy to set your bit to the top of the material as the surface is fully exposed. For the bottom of the material if used, you will set the zero point to the bed of the machine, which is where the bottom of the material is sitting. For this reason, it is commonly just referred to as setting Z Zero to the machine bed which is the same as the bottom of the material.

If you zero on top of the material in Cut2D like in Figure 44 below– you need to zero the machine in the z-axis on top of the material also. This is where the tip of the cutting tool would touch the surface of the material.

If you have a sacrificial layer under your part to be machined (which you should) then cutting through deeper than the material thickness will ensure you cut all the way through around the entire perimeter and leave minimal finishing

10.3.3   X-Y ORIGIN OR XY DATUM POSITION

There are many considerations as you choose where to set the XY Origin. There is no right or wrong answer here as much of this is personal preference, but here are some considerations that may help for a specific project:

The programs give you 5 possible choices for this: The centre of the material or one of the 4 corners. Most projects tend to use either the centre or lower left corner, which agrees with how many of the CNC machines have been configured by the manufacturer. Again, this can be changed before the toolpaths are calculated. Many people like to design a project with the XY Origin at the centre but will then change it to the lower left before calculating the toolpaths.

Zeroing the job setup is important. You can see the faint cross hairs on the workpiece drawing as highlighted in Figure 44: Vectric - Job Set-up. The cross hairs appear in the centre of the work. This is because the X, Y origin is setup in the centre in the job setup in the left-hand side. You

can setup the job origin to be the bottom left for example. It is very important that you are consistent with the setup here in Cut2D and also with the machine.

If you zero in the middle in Cut2D like here – you need to zero the machine in the middle of the work.
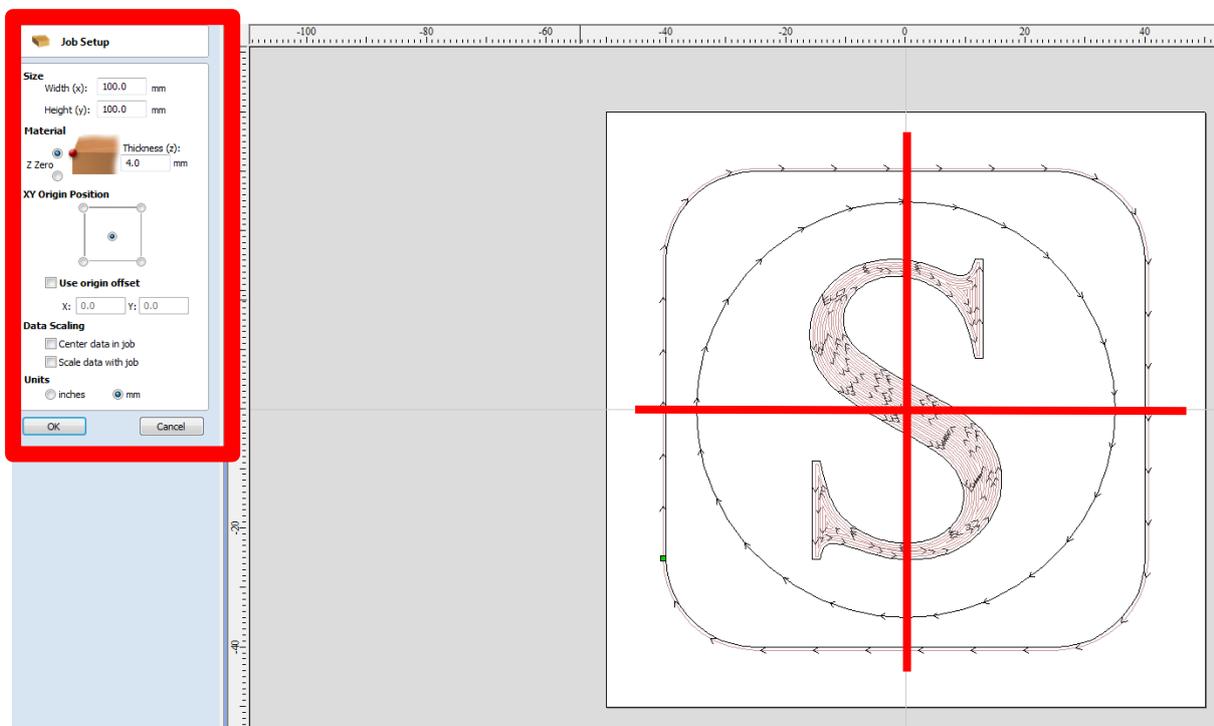
Figure 44: Vectric - Job Set-up

10.4 JOB SETUP – CAM

The first thing you need to do before you calculate any toolpaths is confirm your material setup and position, relative to how it will be set up on the machine itself. Although you will have previously made some choices on this when you setup the job for the design layout, you will need to double check they are still correct and potentially make changes based on things that may have evolved as you completed the design. For instance, if you set XY zero in the middle of the job for drawing, you may now decide to change this to one of the corners (typically lower left) for machining.

Once your material settings have been verified or edited, you are ready to start generating the Toolpaths. To do this you will run through this set of procedures.

10.4.1   TOOL SETUP

See Figure 45 below for the tool window that opens when you select the tool to use in cut2D/VcarvePro. Both Cut2D and VcarvePro allow you to build up a tool database. You can setup a tool for each materials/cutter combination. You can save tools for various jobs. As you

learn you will find some settings work better than others. When you find the sweet spot you can save the settings in the tool library.
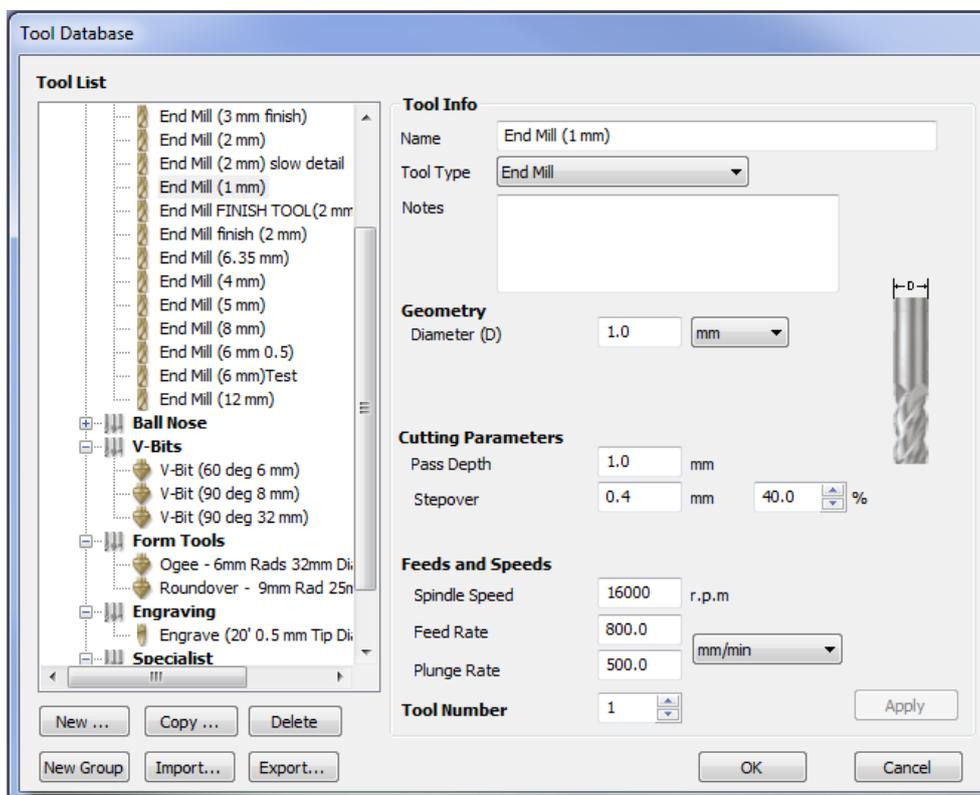
Figure 45: Vectric - Tool Database

NOTE: It is VERY important that you set your Feeds to be in **_mm/min_**
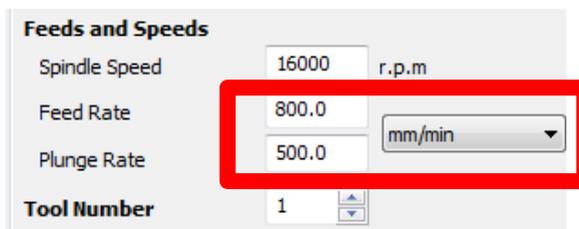
Figure 46: Vectric - Feeds and Speeds Settings

To help you with your settings they are explained as follows:

- **Name** – this is not important for the settings – but its good practice to name the tool to be descriptive of what is in the settings.

- **Tool Type** – this is important as it tells Vcarve what sort of tool you are using. This will affect the calculations and the live demo so always choose the same tool as you are using

- **Notes** – this field is useful for documenting specific outcomes or requirements needed when running with specific tools and settings. For example "make sure to clamp work piece well when running with these settings"

- **Diameter –** The diameter of the tool tells Cut2D how to approach tool radius compensation. If for examples you set the tool diameter to 4mm, Cut2D will then make the toolpath run 2mm outside the path you specify (if compensating for tool radius on the outside) to account for the tool geometry.

- **Pass Depth** – is the maximum depth that tool can go at once. If your cut depth is set at 5mm for example. And you are using a 1mm cutter. A good strategy would be to machine the 5mm in 1mm passes. Cut2D will then program the machine to cut down 1mm at a time down to the 5mm cut depth.

- **Stepover** – this setting is related to the pocketing function where you need to machine out a pocket and not just an outline/profile toolpath. The stepover controls how much overlap there is as the cutter pocket out the work.

- **Spindle speed** – Your spindle speed will be set on the dial on the front of the machine. If you look at the front of the controller you will see a small screen. This is the VFD screen and you can adjust the spindle speed. 0 = 0RPM. 400HZ - 24000RPM

- **Feed Rate** – this parameter is the speed of the machine when machining the work in the X and Y directions. The machine can rapid move at up to 5000mm/min. Typically machining speeds are at 700-2000mm/min. Stick to 1500 with a pass depth of 0.5mm or 1mm when you get started. You can build confidence and speed as you get used to using the machine. If your machine too fast the machine will stall and you will lose position. So tread carefully here.

- **Plunge rate** – is the same as the feed rate except it related to the Z direction. Typically milling cutters (like slot drills etc) prefer to mill in X and Y and are not as efficient in the Z / plunge direction. Keep this setting at 500mm/min or so as you get started.

10.4.2 TOOL RADIUS COMPENSATION

In order for Vcarve/Cut2D to carry out effective tool radius compensation (accounting for the fact that the tool has a diameter) *Make sure that when you select your tool:*

- You select the correct tool type – in this case an end mill. You will see an image of a tool sample on the right-hand side in the above below.

- Make sure you enter in the correct tool diameter. The tool diameter is the diameter of the "hole" or the width of the "channel" the tool will make in the work piece. One way to measure this (if not written on tool) is to slowly plunge the tool into a sample work piece – say MDF or plywood (jog only in Z and make sure the spindle is on). The circular hole the milling cutter makes in the work piece (ply or MDF) is the cutter diameter. You can now measure this with a ruler of calliper. NOTE it is best to specify the cutter diameter from the supplied cutter specifications.

- Take some notes for specific jobs. You might find the optimal settings for Perspex for example. It is a good idea to save a new tool with these settings so you always have this tool in your tool library for the next time.
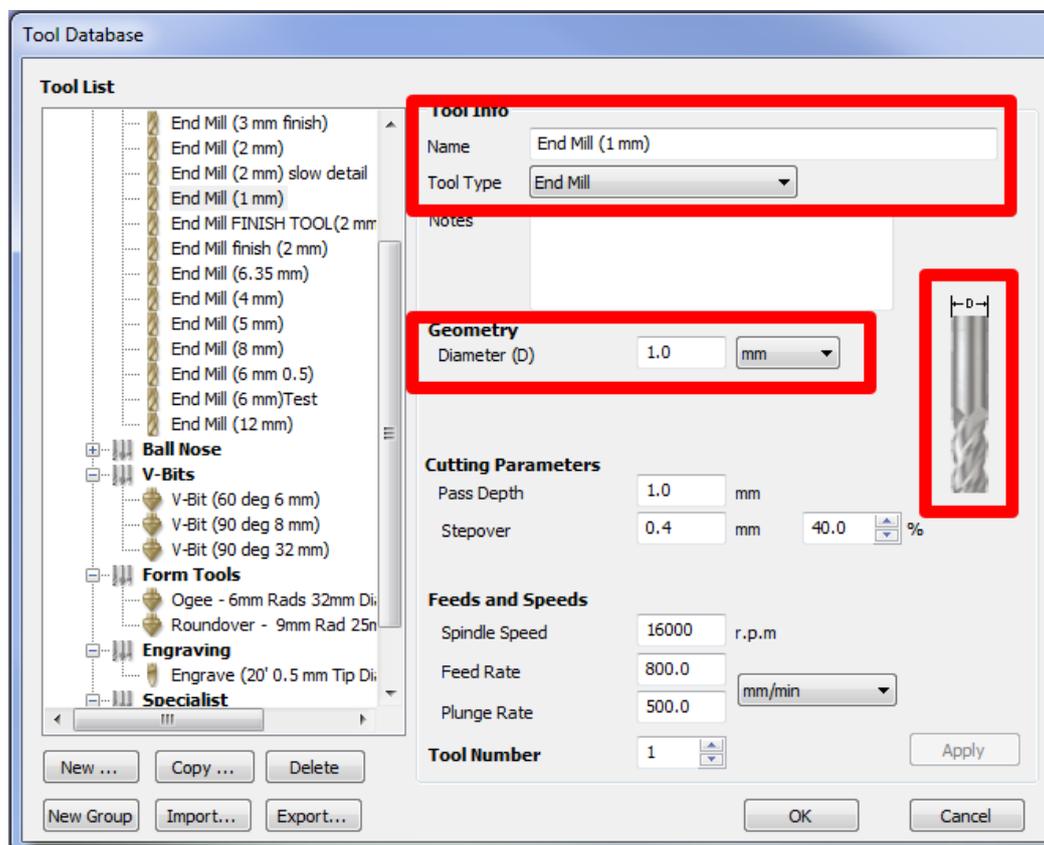
Figure 47: Vectric - Tool Database Parameters

Cutter Diameter

10.4.3 SELECT A TOOLPATH OPERATION

Profile, VCarve, Pocket are all examples of toolpaths. For example, a "VCarving" strategy can be used to engrave incised vector letters or a "Profile" strategy may be chosen to cut-out a vector shape. You will find good information on the different Toolpath types in the Help document and Reference Manual on Vectric. Each one has different applications, there are many examples within the video tutorials that cover all the main uses and some specialized functions.
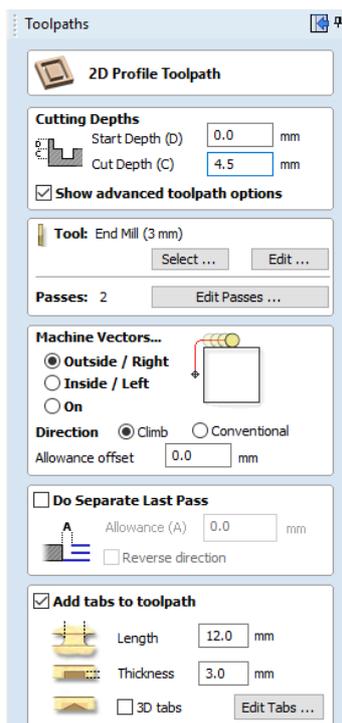
Figure 48: Vectric – Toolpath options

As we have set the thickness of the work to be 4mm (as per our plywood), and we set the cut depth of the final outline cut to be 4.5mm, Cut2D will give a warning. You can still proceed, it's simply telling you that you are going to machine deeper than your materials thickness.
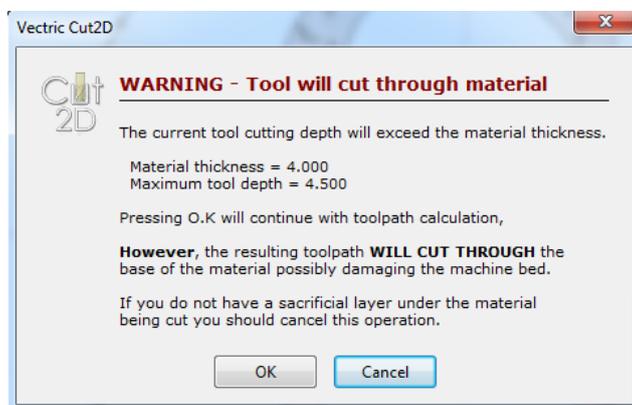
Figure 49: Vectric - Tool will cut through material warning

Each toolpath has options that can be set to customize it for a particular cut. These options vary and are dealt with in detail in the documentation and the tutorial videos. Some toolpaths have very few modifiers and some have a lot of additional choices depending on the type of cut and how much control the user may require over it. For instance, you may want to add "Tabs" to a toolpath where you are cutting out a job using a "Profile" toolpath strategy. That would let you specify the size and position of small pieces of material that leave the cut object still partially attached to the original stock to hold it in place while it is being machined. This is just one example of the way a toolpath can be adjusted. As a CNC is flexible enough to use in

many different applications and to cut a range of material it's important to have these options available when calculating different types of cut

10.4.4   SELECT A ROUTER BIT

Select a tool that will be best suited to machine the toolpath in the material you are using. Some toolpaths, by definition of what they do, are limited to the types of tools that can be assigned to them. For example, a VCarve toolpath can only use a V-Bit or Ball Nose tool. For each tool selected, you can 'Edit' the settings for that bit to exactly match the requirements for that project. A list of tools, their type, size and appropriate settings are remembered by the software and accessed from the "Tool Database". Tools can be added, edited and deleted to personalize this list to your specific needs. Over time this makes toolpath setup quicker and more accurate.

10.4.5   CALCULATE TOOLPATH AND PREVIEW

A powerful feature offered in all the Vectric programs is the Toolpath Preview; this allows you to accurately simulate the result of the toolpath on your computer screen in a virtual 3D piece of material.

Creating a simulation like this lets you check if the toolpath is correct based on the tool and settings you have chosen. If it does not look right in the preview, then it will not be right when you cut it. This feature helps you avoid costly mistakes, a few seconds at the computer can save hours at the machine, plus prevent damage, potential safety issues and a ruined project.

This function can also be used to generate realistic rendered images to show your customer exactly what the part will look like when its machined or even to use as images in promotional material to demonstrate the capabilities of what you make.

After you have created and calculated all the toolpaths and are happy with the Toolpath Preview, it is time to save them in the appropriate format for your CNC machine.

10.5 POST PROCESSOR

Part of the process requires you to export the toolpath from Cut2D/VcarvePro to a text file in order to import it into the machine. In order to do this, you must choose a post processor specific to your machine. In the case where you are using the i2R machine with either Mach3 or UCCNC you must select the "**Mach2/3 Arcs (mm)(*.txt)**" post processor. The drop-down menu in Vcarve/Cut2D has many post processor options as per Figure 50. Make sure choose the "**Mach2/3 Arcs (mm)(*.txt)**" in order to generate the toolpath to be compatible with the i2R machine and UCCNC.
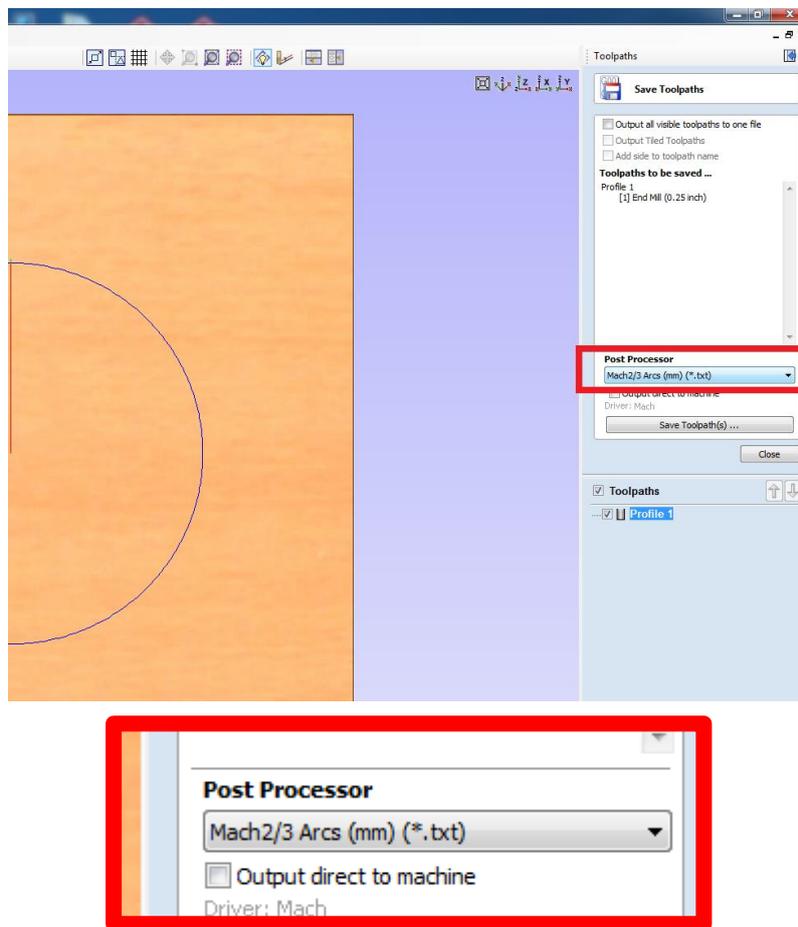
Figure 50: Vectric - Post Processor Selection

10.6 HELP AND SUPPORT FOR VECTRIC

Perhaps the most powerful tool for learning the Vectric products are the free video tutorials that are available for each program. You can find them on the Vectric Support Website: (www.support.vectric.com).

11 PART MACHINING AND UCCNC DETAILED OPERATION

The final stage is to machine your part and make some chips. To machine your part, we recommend you carry out the following steps in the following order:

11.1 HOME THE MACHINE

You must reference the machine each time the machine gets turned on or your start a fresh version of UCCNC to tell the software where the edges of the machine movement are each time. This can be done by using the "Home All" Command as you can see in Figure 51.
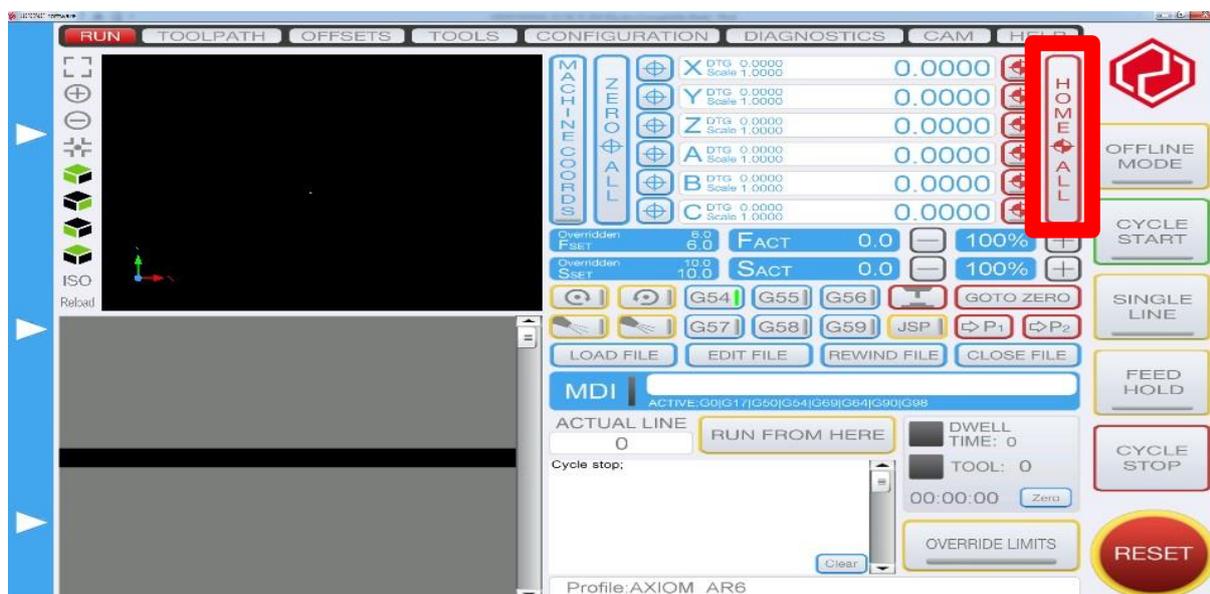
Figure 51: UCCNC Home All Command

This function aligns the software limits (or softlimits) for your machine with the actual working boundary on your table. For the softlimits to work properly you must home the machine every time you turn the machine on. Soft limits are explained in 8.2.5 STEP 4_B Machine Homing and Soft Limits.

11.2 LOAD YOUR GCODE FILE

The G-code file is generated from Cut2D/Vcarve and from there loaded into the UCCNC software
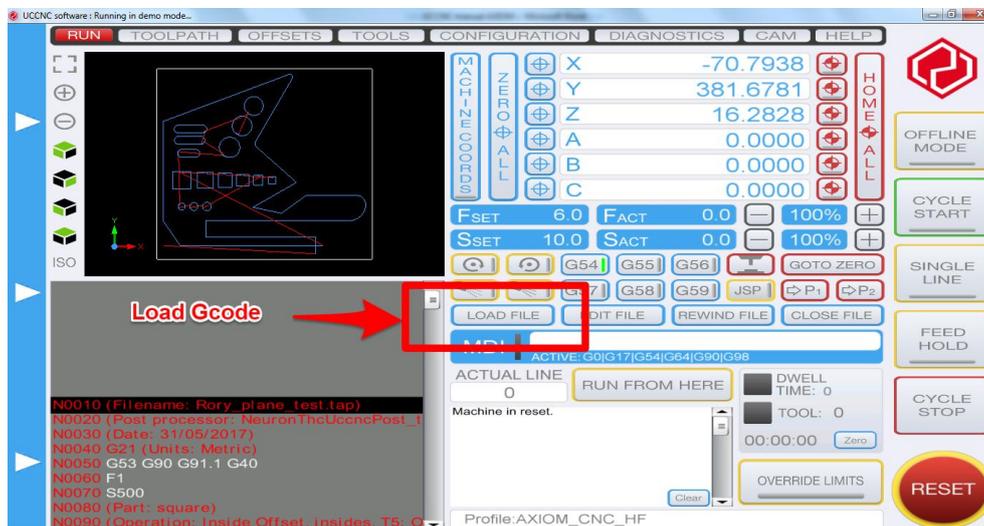
Figure 52: Load Gcode into UCCNC

11.3 CLAMP YOUR WORK PIECE TO THE MACHINE TABLE

WARNING: Very important the work piece is clamped securely. Refer Section 12 for more details

Figure 53: Clamping methods

11.4 LOAD YOUR TOOL AND SPECIAL NOTES ON COLLETS

Before loading any tool or touching the spindle refer to Figure 54 and press the reset button BEFORE attempting to change the tool.

Figure 54: Reset to disable spindle relay

DO NOT TOUCH the spindle unless the reset button is flashing red and yellow on UCCNC control interface on your PC.

The HF spindle use collets to load the cutters into the spindles. The HF spindle uses an ER20 collet system. You must disable the spindle system before you handle the collet mounting system by pressing the reset button on the UCCNC front panel.

Figure 55: HF ER20 Collets

The procedure for mounting the collets is important

- Choose the correct collet for your tool. Always stick to the cutter spec. If using a 3.175mm collet (1/8th inch) then use a 1/8th inch collet. Using the correct collet for your cutter will make safe tool mounting easier and safer.
- Make sure the collet and collet nut are clean and debris free
- Insert the collet into the collet nut until the collet seats. You should hear a "click". NOTE: if you mount a collet incorrectly into the spindle it will damage the collet.
- Mount the collet nut (now with seated collet) into the spindle head fixture and loosely tighten by hand only – just so the collet is on the threads of the spindle.
- Insert the tool you wish to use (NOTE: you should have pre- selected your collet size for your tool choice)
- Mount the tool so that you have enough tool stick out to carry out your machining operation.
- You must now lock the spindle head in order to tighten the collet nut
    - o On the HF spindle you must use the spanner to lock the head

- The collet nut can now be used to tighten the collet into the spindle head securing the cutter. The HF spindle needs a special ER20 collet spanner. (NOTE: be careful as you do this as you can slip and damage the cutter or cut/injure yourself. You will be exerting a tightening force with the locking spanner around and near a sharp cutter. So be careful!)

- Check the cutter is seated in the spindle and collet correctly by eye after you have installed the cutter and tightened the collet.
- Carry out steps in reverse to remove the cutter.
- Never use undersized tools for collets. Always use the correct collet for the correct tool
- Never us a tool beyond its recommended RPM.
- Always expect the unexpected.
- Take extra care when loading a tool and ensure the tool is mounted correctly prior to running a tool path and turning on the spindle.

11.5 SET X AND Y WORKING ORIGIN

Jog the machine such that the centre of the spindle is in line with the defined origin position you have set in the "Job Setup" in Vectric.
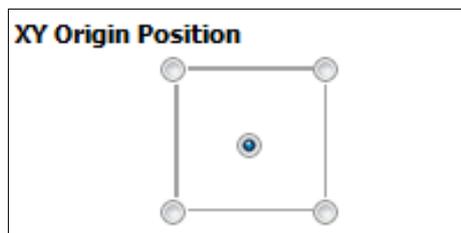
Figure 56: Vectric XY Origin

When in position you can select the set axis origin button for the applicable axis as below:

Figure 57: UCCNC Set workpiece origin button

11.6 SET Z WORKING ORIGIN

To set the z working origin, plug in the i2R Touch off puck provided with your machine into the back of the left side upright. Place the puck either on the material surface or the table surface as per your defined origin position you have set in the "Job Setup" in Vectric.

Figure 58: Vectric Z Zero Position

Jog the machine over the puck with your selected tool in place and run the auto touch off command ensuring you keep clear of machine at this point:

Figure 59: UCCNC AUTO Touch off button

The machine will automatically reduce the Z height until it touches the puck. When contact is made the machine will retract 10mm and set the Z working coordinate to 35. This takes into account that the puck is 25mm. The tip of your tool should now be 35mm from your required z origin position.

Please note this is an automatic operation and the machine will not stop until the cutting tool makes contact with the puck. To abort the operation hit "Cycle Stop" or the "Reset" button.

11.7 VERIFY THE WORKING AREA IS SUFFICIENT FOR MACHINING

With the live 3D toolpath viewer on UCCNC which can be found on the run tab or toolpath tab, you can see the current spindle location (yellow dot) with respect to the toolpath (blue line) you are about to cut.
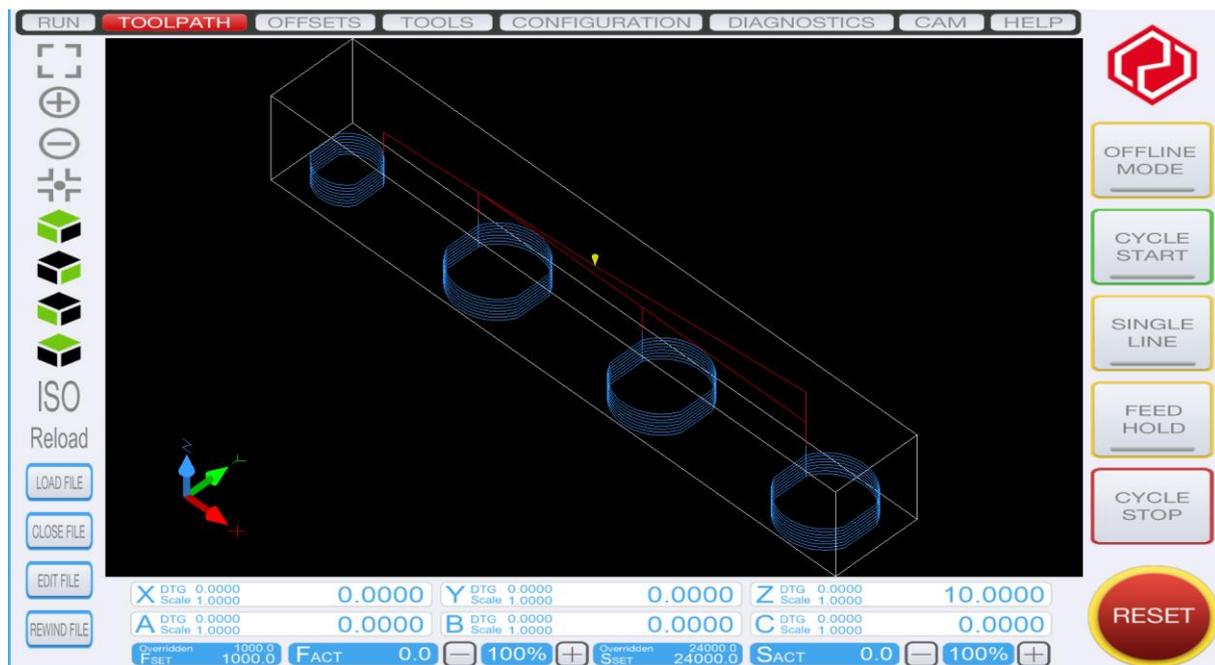
Figure 60: UCCNC Toolpath view

The red lines are rapid movements where the machine will move full speed prior to picking up your set federate in Vectric for machining. The white box is a boundary created by UCCNC and does not represent any part of the Vectric CAD/CAM setup. It signifies there is no movements outside this boundary.

Prior to starting your cycle, this is an opportunity to manually jog your machine within this boundary to ensure the following:

- Verify the working area is sufficient for machining
- Ensure there are no clamps or fixings in the boundary area
- Ensure the machine can travel within the boundary and the work doesn't extend the size of your machine
- Ensure the Material is large enough to be machined

11.8 REDUCE FEED RATE %

Prior to starting the cycle you can override and reduce the feed rate set in your G-Code by clicking the "-" button on the Fset line.

Figure 61: UCCNC Fset Override

This will slow the machine down giving you more reaction time if your set-up in incorrect for machining.

11.9 START CYCLE

Figure 62: UCCNC Cycle start

- Verify the working area is sufficient for machining
- Start Cycle
- **Observe and listen**

11.10 INCREASE FEED RATE %

After you have observed the start of your cycle and believe you set-up is correct and the machine is preforming appropriately, you can increase the feed rate set in your G-Code by clicking the "+" button on the Fset line.

Figure 63: UCCNC Fset Override

12 SPECIAL NOTES ON CLAMPING

WARNING: Very important the work piece is clamped securely.

12.1 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

Figure 64: Clamping methods – Sheet Clamping

hops during use and becomes loose – it is extremely dangerous.

12.2 CLAMP SETS FOR LARGER WORK PIECES

Figure 65: Clamping methods - Clamp Sets

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 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.

12.3 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.

12.4 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 is 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.

12.5 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.

13 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.
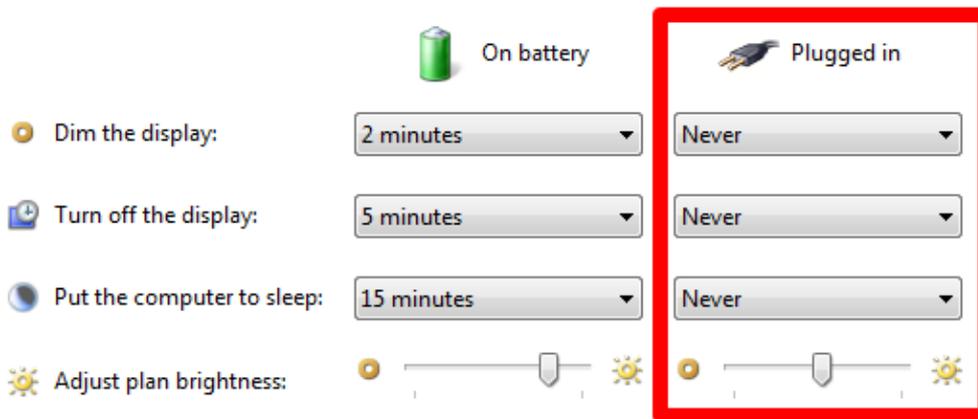
Figure 66: Power Management of Laptop/PC

14 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 67: Standard AUS plug

The **i2R** CNC machines are rated for 220V +/-10% having an operational range of 200-240V. 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.

14.1 GROUNDING INSTRUCTIONS:

i2R 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 i2R 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.

14.2 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.

It is recommended that if an extension cord must be used, it be a 10-12 gauge grounded-three wire cord of no more than 8-10 feet.

15 MAINTENANCE

15.1 GENERAL MAINTENANCE

Best practice with machine tools is to keep the machines clean and free from dirt and debris.

To ensure proper machine operation, it is recommended that the prismatic guides and rolled ball-screws on all axis are kept clean regularly wiped down with a light machine oil lubricant (such as 3-IN-ONE oil). Figure 68 shows the X axis rails and ballscrew. The Z and Y axes have the same components.

The ballscrews also have grease nipples on them. Every 1000 hours or every year these can be packed with standard grease for optimal operation – See Figure 69 for the recommended grease specification.

Figure 68: Weekly (best case daily) cleaning and application of light oil externally to screws and rails with cloth and light oil.

Figure 69: Recommended grease for the ballscrews when greasing via the grease nipple

15.2 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.
   a. Move the machine through travel limits to properly disperse lubricant.
3. Check cutting tool edges for chips and/or dullness.
4. Generally, inspect the machine for any damage.
5. Ensure that slots in the collets are free of sawdust and debris.
6. Verify that the dust extractor is free of blockages.
7. Check that all electrical connectors are fitted correctly and are not loose.

15.3 COOLING SYSTEM:

All i2R 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.

16 TECHNICAL SPECIFICATIONS

I2R: Imagination to Reality		4	6	8	
X Axis Travel	24" (600mm)	•	•	•	
Y Axis Travel	24" (610mm)	•			
	36" (915mm)		•		
	48" (1200mm)			•	
Z Axis Travel	4" (100mm)	•	•	•	
Table Work Area	37.28" x 28.39" (947mm x 720mm)	•			
	49.09"x 28.39" (1247mm x 720mm)		•		
	60.9" x 28.39" (1547mm x 720mm)			•	
Collet	ER11	•	•	•	
Collet Chuck	1/8"or ¼" (3mm or 6mm)	•	•	•	
High Speed Spindle	1.07 HP .8kW/6.5A Electro Spindle	•	•	•	
Spindle Speed	0~24000 RPM	•	•	•	
Rapid Feed Rate	200 IPM/ 5080 mm/min)	•	•	•	
Precision Linear Guide Rails	X/Y/Z Axis	•	•	•	
Precision Ball Screw	X/Y/Z Axis	•	•	•	
Power Requirements	115V, 50~60 Hz, 15 A Single Phase	•	•	•	
	220V, 50~60 Hz, 10A Single Phase				
Working Table	High Rigidity Interlocking Aluminium Extrusion	•	•	•	
	Integrated MDF Spoil Board	•	•	•	
Gantry Bridge	High Rigidity Aluminium Extrusion	•	•	•	
Gantry Support	Gravity Cast Aluminium Alloy	•	•	•	
Gantry Clearance	8.8" (224mm)	•	•	•	
Machine Base	Welded Structural Aluminium Frame	•	•	•	
Machine Footprint	27.16" x 26.31" (690mm x 670mm)	•			
	38.97" x 30" (990mm x 770mm)		•		
	47" x 30" (1197mm x 770mm)			•	
Required Floor Space	37.79" x 36.61" (690mm x 930mm)	•			
	50.98" x 37.36" (1295mm x 949mm)		•		
	62.79" x 37.36" (1595mm x 949mm)			•	
Max. Machine Height	31.37" (797mm)	•	•	•	
Machine Weight	176lbs (80kg)	•			
	209lbs (95kg)		•		
	242lbs (110kg)			•	
Tool Touch Off Puck	Standard Accessory	•	•	•	
Integrated Air Cooled System	Standard Accessory	•	•	•	
Controller Box and Software	UCCNC controller as standard	•	•	•	
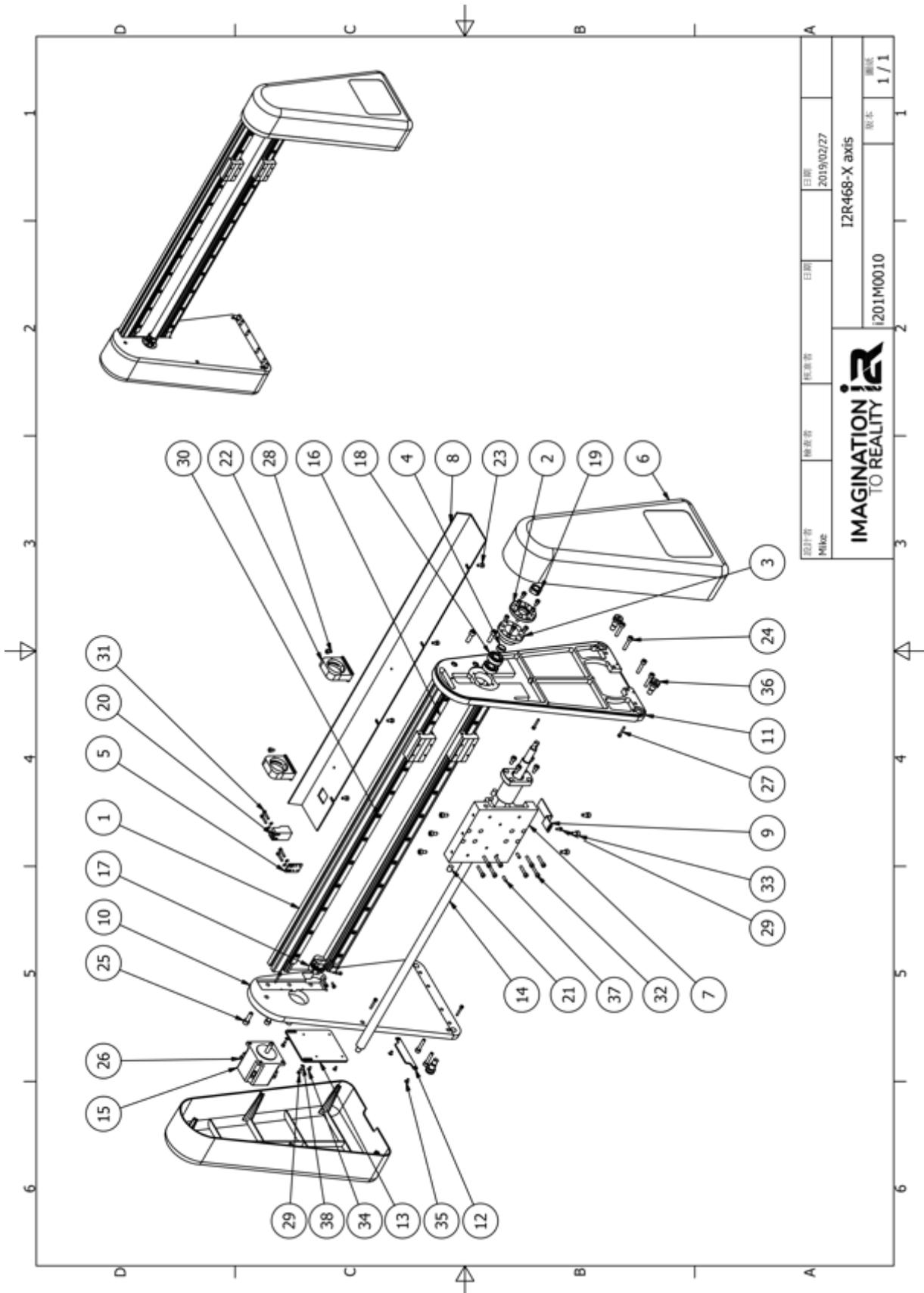
Material	Part number	Item name	Quantity	category
	I2R4 X axis			
	i201M0010	X-axis combination - i2R468		
1	AX0100042	X-axis aluminum extrusion	1	Components
2	AX0100131	Bearing cap	1	Components
3	AX0100151	Bearing housing	1	Components
4	AX0100191	Spacer	1	Components
5	AX0100222	Sensor matte	1	Components
6	i20101130	Vertical left and right shields (long version)	2	Components
7	i20101201	X-axis skateboard	1	Components
8	i20101221	Protective chain lower bracket	1	Components
9	i20101231	Sensor fixing plate	1	Components
10	i20101320	Left side panel	1	Components
11	i20101330	Right vertical board	1	Components
12	i20101750	Complete line plate	1	Components
13	i20101790	PCB fixing board	1	Components
14	AX0100070	X-axis screw	1	Components
	i201MH010	X-axis commercially available - i2R468		
15	TK266D-02A51	2-phase stepper motor 7.2w-2A 1.8 ohm	1	Components
16	STAF-BGXS15BN-1-700-NZ0-20-20	X-axis rail	2	Components
17	SQR20C	Coupling	1	Components
18	TPI-7001AHTP5	Oblique ball bearing	2	Components
19	BNR12	Anti-loose bearing nut - four angle type	1	Components
20	DA-1805NO	Square proximity switch	1	Components
21	CXHK8-10	Excellent glue	2	Components
22	N-TH-34B	Round tube holder (black)	2	Components
	i201S0010	X-axis screw package - i2R468		
23	M4 x8	Hexagon socket head cap screws	12	Screw package
24	M5 x 25	Hexagon socket head cap screws	8	Screw package
25	M6 x 20	Hexagon socket head cap screws	6	Screw package
26	M4 x 10	Hexagon socket head cap screws	4	Screw package
27	M3 x 20	Hexagon socket head cap screws	10	Screw package
28	M4 x 6	Hexagon socket head cap screws	2	Screw package
29	M3 x 8	Hexagon socket head cap screws	3	Screw package
30	M4 x 16	Hexagon socket head cap screws	24	Screw package
31	M3 x 16	Hexagon socket head cap screws	4	Screw package
32	M4 x 20	Hexagon socket head cap screws	8	Screw package
33	M5 x 10	Hexagon socket head cap screws	10	Screw package
34	M3 x 6	Semicircular head socket head cap screws	4	Screw package
35	M3x6	Round head Phillips	2	Screw package
36	MSBH10-10	Contour screw M8	4	Screw package
37	Pin4x10	Pin	2	Screw package
38	M3-flat washer	washer	6	Screw package
39	M4-20 type	Nut M4-20	4	Screw package
40	P4-M4	Nut P4M4	24	Screw package

B (1 : 4)

A (1 : 4)

	I2R4 Y 軸			
	i201M0020	Y-axis combination - i2R4		
1	AX0100124	Motor seat	1	Components
2	AX0100131	Bearing cap	1	Components
3	AX0100171	Y-axis bearing housing	1	Components
4	AX0100191	Spacer	1	Components
5	AX0100260	Sensor matte_B	1	Components
6	i20100141	Y-axis aluminum extrusion	5	Components
7	i20100160	Y-axis nut seat	1	Components
8	i20100181	Y-axis aluminum extrusion side cover	2	Components
9	i20101091	Y-axis aluminum extrusion side cover	2	Components
10	i20101151	Y-axis skateboard	1	Components
11	i20101211	Interface back cover	1	Components
12	i20101261	Y-axis aluminum extrusion front cover	1	Components
13	i20101272	Structural board (left)	1	Components
14	i20101281	Y-axis aluminum extrusion back cover	1	Components
15	i20101292	Structural board (right)	1	Components
16	i20101301	4040 aluminum extrusion frame	1	Components
17	i20101350	Skate fixing block	2	Components
18	i20101490	Y-axis bracketing fixed plate	1	Components
19	i20101760	Complete line plate	1	Components
20	AX0100540	24x24-MDF(EDGE)	2	Components
21	AX0100562	24x24-MDF	5	Components
22	AX0100200	Y-axis screw	1	Components
	i201MH020	Y-axis commercially available product - i2R4		
23	TROY_TK268D-02A51	2-phase stepper motor 9w-2A2.25 ohm	1	Components
24	STAF-BGXS15BN-2-820-NZ0-20-20_2x2	Y axis rail	2	Components
25	SQR20C(6.35.8)	Coupling	1	Components
26	TPI-7001AHTP5	Oblique ball bearing	2	Components
27	BNR12	Anti-loose bearing nut - four angle type	1	Components
28	DA-1805NO	Square proximity switch	1	Components
29	6901ZZ	Deep groove ball bearing	1	Components
30	STWN12	C buckle	1	Components
31	N-TH-34B	Round tube holder (black)	3	Components
32	CXHK8-10	Excellent glue	4	Components
	i201S0020	Y-axis screw package -i2R4		
33	M5 x 16	Hexagon socket head cap screws	6	Screw package
34	M3 x 20	Hexagon socket head cap screws	2	Screw package
35	M5 x 10	Hexagon socket head cap screws	12	Screw package
36	M4 x 6	Hexagon socket head cap screws	3	Screw package
37	M3 x 8	Hexagon socket head cap screws	4	Screw package
38	M3 x 6	Semicircular head socket head cap screws	4	Screw package
39	M4 x 12	Hexagon socket head cap screws	12	Screw package
40	M6 x 16	Hexagon socket head cap screws	6	Screw package
41	M6 x 35	Hexagon socket head cap screws	10	Screw package
42	M6 x 12	Hexagon socket head cap screws	8	Screw package
43	M4 x 20	Hexagon socket head cap screws	44	Screw package
44	M5 x 45	Hexagon socket head cap screws	2	Screw package
45	M5 x 20	Hexagon socket head cap screws	2	Screw package
46	M4 x8	Hexagon socket head cap screws	6	Screw package
47	M5 x 25	Hexagon socket head cap screws	2	Screw package
48	M6 x 25	Hexagon socket head cap screws	28	Screw package
49	M4 x 10	Hexagon socket head cap screws	9	Screw package
50	TRSS3-6	Round head Phillips	2	Screw package
51	M3-flat washer	washer	6	Screw package
52	P4-M4	Nut P4M4	29	Screw package
53	B4-M6	Nut P4M6	44	Screw package
54	Pin4x10	Pin	4	Screw package
55	M8 x 25	Hexagon socket head cap screws	4	Screw package
56	P4-M5	Nut P4M5	4	Screw package
57	Stop M4x4	Stop screw	1	Screw package
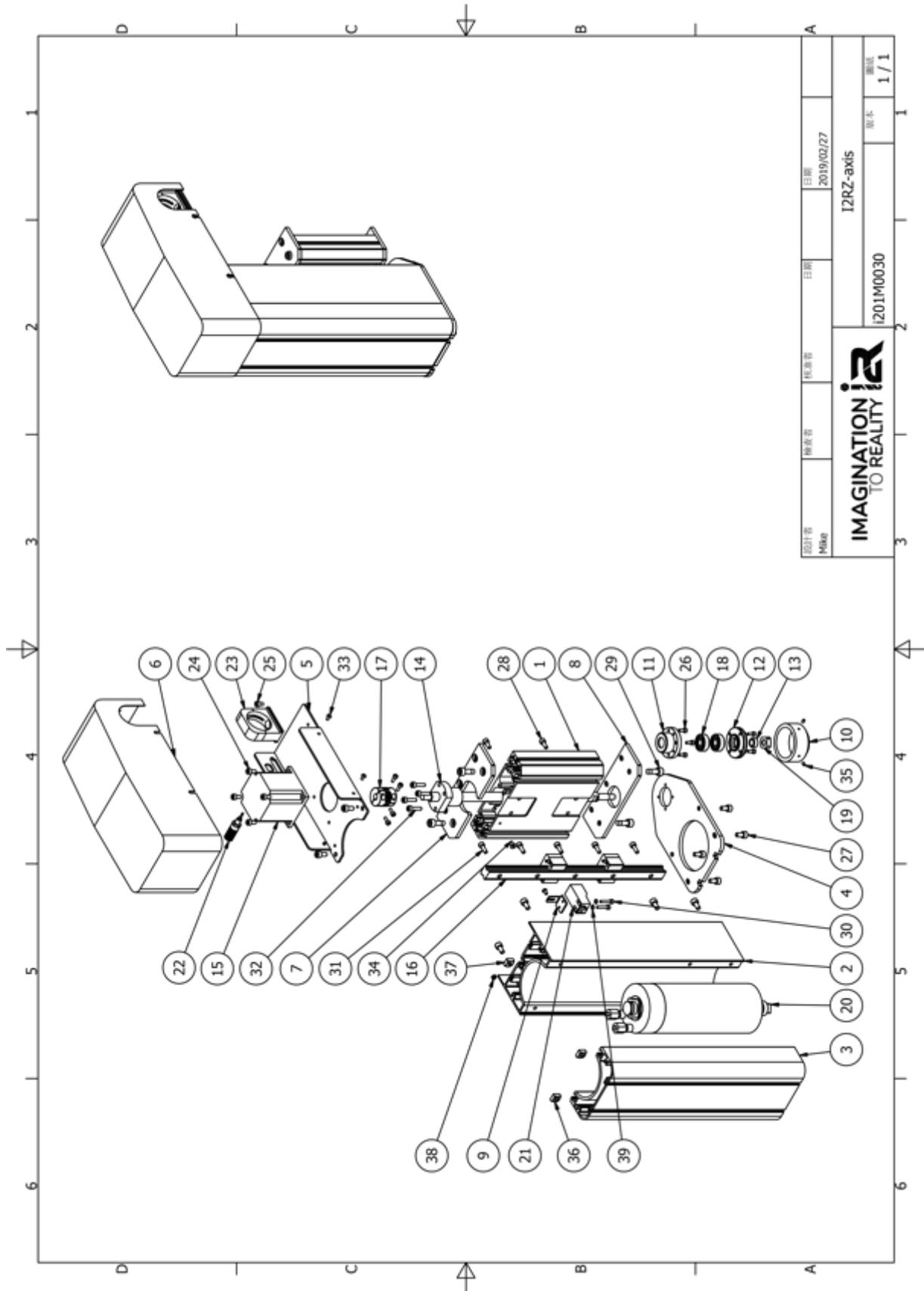
		I2R4 Z axis			
		i201M0030	Z axis combination - i2R468		
1	i20101021	Z-axis slide	1	Components
2	i20101171	Spindle holder-B	1	Components
3	i20101181	Spindle holder-A	1	Components
4	i20101032	Z-axis lower cover	1	Components
5	i20101191	Motor plate gold seat	1	Components
6	i20101102	X-axis linkage chain	1	Components
7	i20101050	Sliding block connection block - under	1	Components
8	i20101061	Sliding block connection block - on	1	Components
9	i20101070	Sensor fixing plate	1	Components
10	AX0300161	Bearing cover	1	Components
11	AX0300080	Bearing housing	1	Components
12	AX0300091	Bearing gland	1	Components
13	AX0300070	Spacer	1	Components
14	i20101040	Z axis_screw_304L	1	Components
	i201MH030	Z-axis commercially available - i2R468		
15	TK266D-02A51	2-phase stepper motor 9w-2A2.25 ohm	1	Components
16	OME-BGXS15BS-2-L280-20-20	Z axis rail _L280	1	Components
17	SQR20C(6.35.8)	Coupling SQR20C (6.35, 8)	1	Components
18	708A	Angled ball bearing (8x22x7t)	2	Components
19	BNR8	Anti-loose bearing nut - four angle type	1	Components
20	i20101780	Spindle _Ø65-V220/800W (Air cooled, 0.8KW 2.5A 220V)	1	Components
21	DA-1805NO	Square proximity switch	1	Components
22	N1535	Dr. Terminal Black (9404B)	1	Components
23	N-TH-34B	Round tube holder (black)	1	Components
	i201S0030	Z-axis screw package - i2R468		
24	M4 x8	Hexagon socket head cap screws	4	Screw package
25	M4 x 6	Hexagon socket head cap screws	1	Screw package
26	M3 x 8	Hexagon socket head cap screws	12	Screw package
27	M5 x 10	Hexagon socket head cap screws	12	Screw package
28	M4 x 10	Hexagon socket head cap screws	4	Screw package
29	M6 x 12	Hexagon socket head cap screws	4	Screw package
30	M3 x 16	Hexagon socket head cap screws	2	Screw package
31	M4 x 14	Hexagon socket head cap screws	5	Screw package
32	M4 x 16	Hexagon socket head cap screws	4	Screw package
33	M3 x 6	Hexagon socket head cap screws	5	Screw package
34	M4 x 8	Hexagon socket head cap screws	1	Screw package
35	Stop paying flat M3x4	Stop screw	2	Screw package
36	M3 (W5.5x2.4t)	Nut (W5.5)	1	Screw package
37	M3-flat washer	washer	2	Screw package
38	P4-M5	Nut P4M5	6	Screw package
39	P4-M4	Nut P4M4	5	Screw package
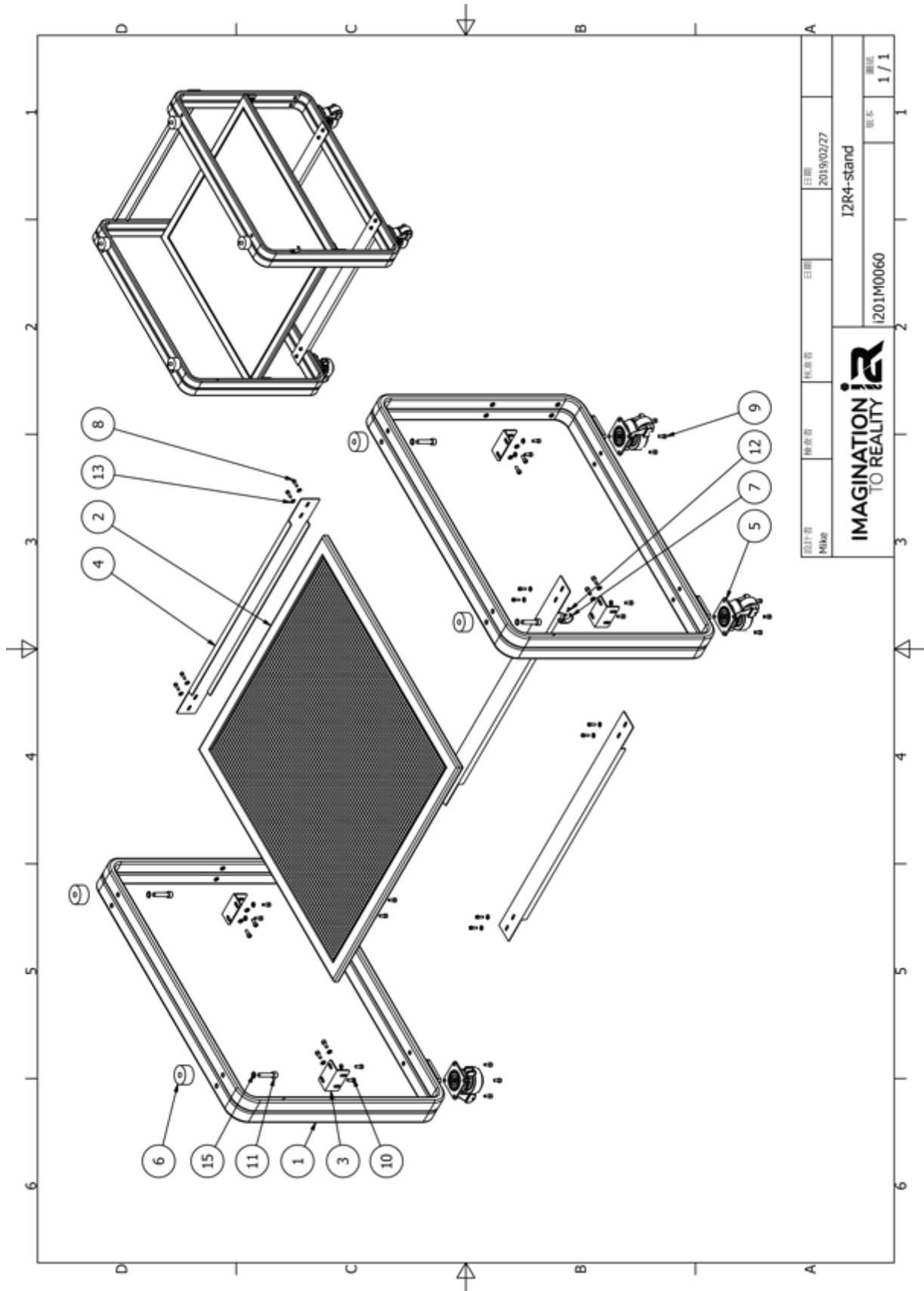
		I2R4 Stand			
	i201M0060	i2R4-Stand combination			
1	i20101243	Base STAND	2	Components
2	i20101252	Carrier board	1	Components
3	i20101740	Support plate	4	Components
4	i20101840	Base bracket	3	Components
5	FG-50F	Korean casters	4	Components
6	AX01C00044	Rubber shock pad -50Xd13X25t	4	Components
7	SDK-3016	3016 white iron hook	1	Components
	i201S0060	i2R468-Stand Screw Pack			
8	M5 x 16	Hexagon socket head cap screws	12	Screw package
9	M5 x 8	Hexagon socket head cap screws	16	Screw package
10	M6 x 16	Hexagon socket head cap screws	16	Screw package
11	M10 x 55	Hexagon socket head cap screws	4	Screw package
12	M4 x10	Hexagon socket head cap screws	2	Screw package
13	M5 washer	washer	12	Screw package
14	M6 washer	washer	24	Screw package
15	M10 small flat washer	washer	4	Screw package