WorkBee CNC

Full Kit Assembly Instructions

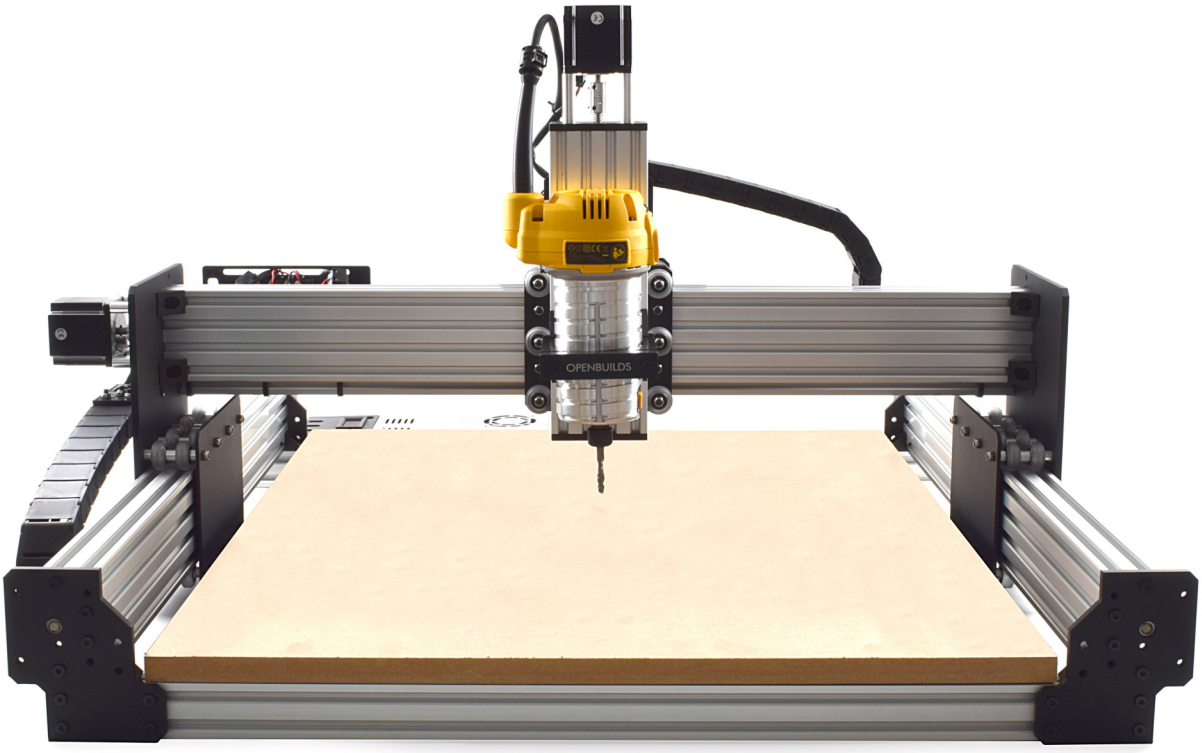


Table of Contents

1.0 Getting Started

1.1 About The Kit

This manual is for the full kit version of the WorkBee CNC Machine. Ideally, this manual should be started straight after completing the mechanical assembly. This manual will turn the mechanical portion of the WorkBee into a working moving machine.

Our WorkBee CNC Machine has a very large community of users, who can either be found at 'The WorkBee CNC Group' on Facebook/Google+, or http://openbuilds.com. Openbuilds It is free to sign up to this community and it will allow you to share your builds, interait with other members, and download useful community created resources. We have a specific build thread for the WorkBee, and we would love to see your machines and what you make with them: https://openbuilds.com/builds/workbee-cnc-machine.5626/.

1.2 Check Product Contents

When you receive your kit, the first thing you should do is check the contents against the list in Appendix A. The majority of the parts will be separated into boxes that correspond to the subsections in this manual. Additional spare small parts will be included. If anything is missing or damaged (or if you have any other problems) please contact us at sales@ooznest.co.uk and we will aim to resolve the issue as quickly as possible.

1.3 Tools Required

- The list below shows the main tools that will be required to complete this build:
- 2.5mm Allen Key
- 3.0mm Allen Key
- 4.0mm Allen Key
- 5.5mm Spanner
- 7.0mm Spanner
- 8.0mm Spanner
- Hammer
- Selection of Philips Screwdrivers
- Selection of Flathead Screwdrivers
- Tweezers
- Wire Cutters/Strippers

1.4 Notes on Assembly

This manual has been written for the construction of a 750 x 750mm screw driven version of the WorkBee. If you have a different version everything is exactly the same, with the exception of longer V-Slot extrusions and wire routing.

The assembly has been split into 5 sections: Drag Chains Assembly, Power Supply Assembly, Limit Switches & Wire Routing, CNC xPro Assembly, Wiring & Commissioning. To make locating parts quicker, leave the parts in the boxes they came in when carrying out the build.

It is recommended that you read through the whole manual before beginning the build in order to get a full picture of the assembly process. Before beginning each step, make sure you have studied the diagram and have the required parts in front of you. A PDF version of the manual is available on our website and this will allow you to zoom in on the diagrams if needed.

Be very careful to not over tighten the nuts and bolts on the plastic parts, otherwise they may crack. Everything should easily fit together, and so if it isn't, take a step back and re-read the instructions.

Assembly of this kit involves the use of electricity and therefore you should take appropriate precautions to ensure you are assembling the kit in a safe manner. When following wiring diagrams, double check that everything is connected correctly. Before carrying out any work on the electrics make sure that the machine is switched off.

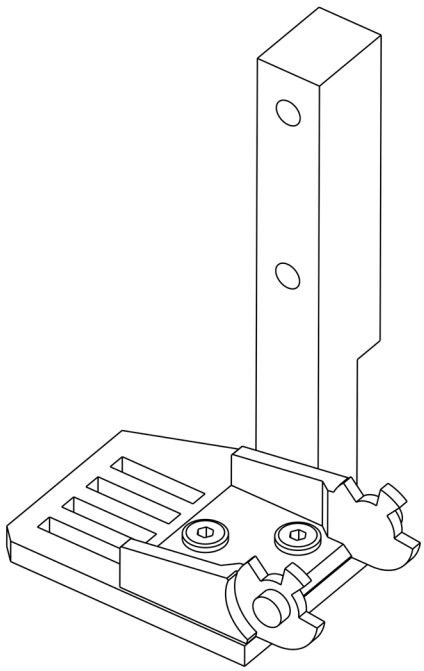
The polarity is indicated by the color of the wire, not by the color of the connectors at each end. For the AC IEC input, the live wire is brown, neutral blue, and earth is green and yellow. For the DC Wiring of the machine a positive wire is red, negative is black, and earth is green and yellow.

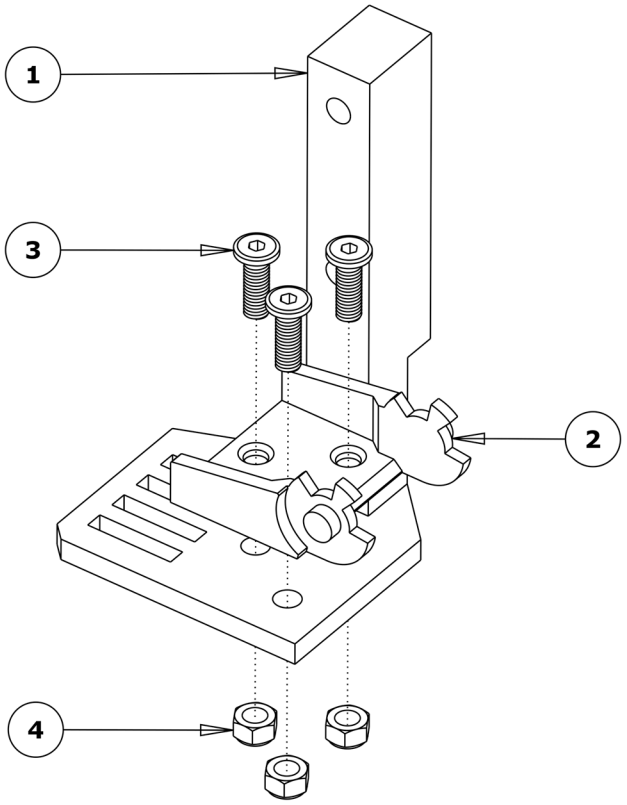
2.0 Drag Chains Assembly

2.1 Y-Axis

2.1.1 Y-Axis Fixed End Assembly

ITEM NO	DESCRIPTION	QTY
1	Y-DRAG-CHAIN-FIXED-END-MOUNT	1
2	DRAG-CHAIN-FIXED-END	1
3	M5-LOW-PROFILE-15MM	3
4	M5-NYLOC-NUT	3

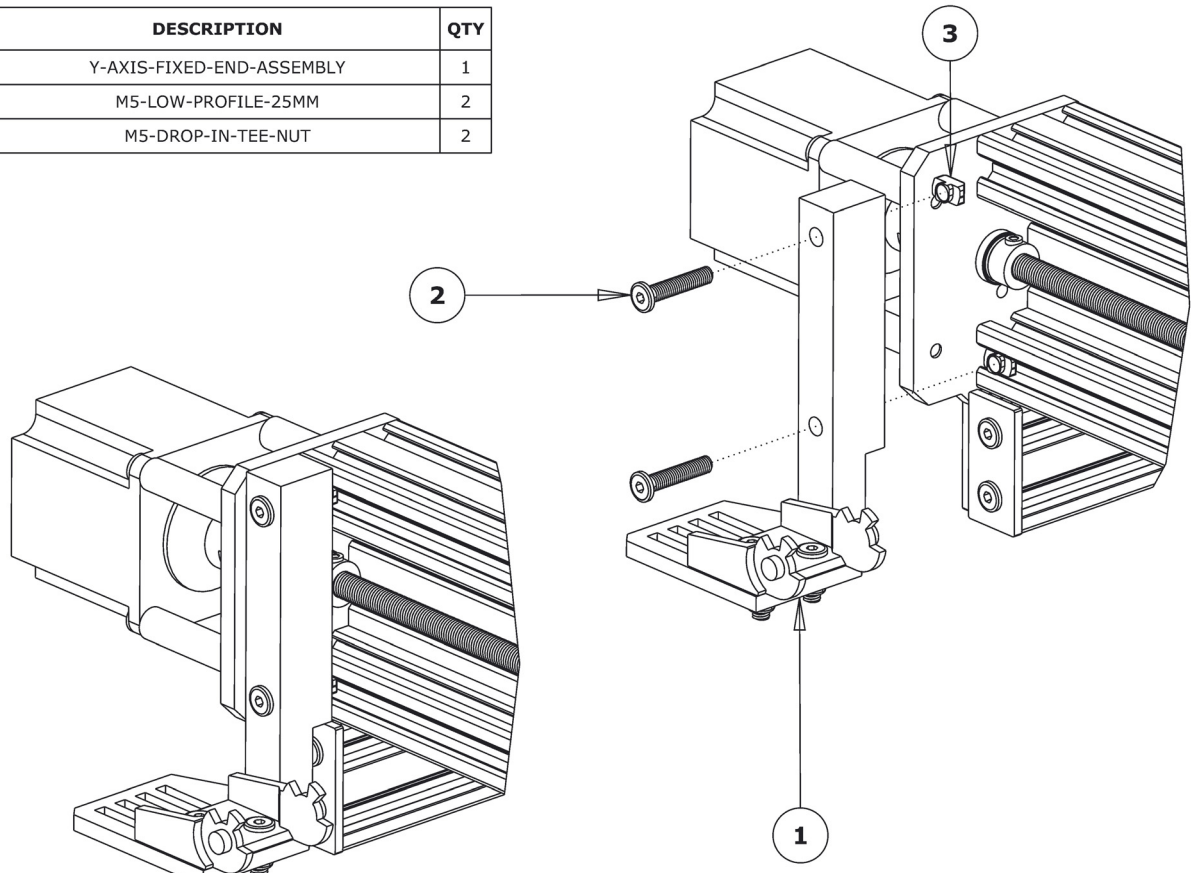




A. Attach a Drag-Chain-Fixed-End to the Y-Drag-Chain-Fixed-End-Mount in the orientation shown above, using 3 x M5-Low-Profile-15mm bolts and 3 x M5-Nyloc-Nut's.

2.1.2 Y-Axis Fixed End Mounting

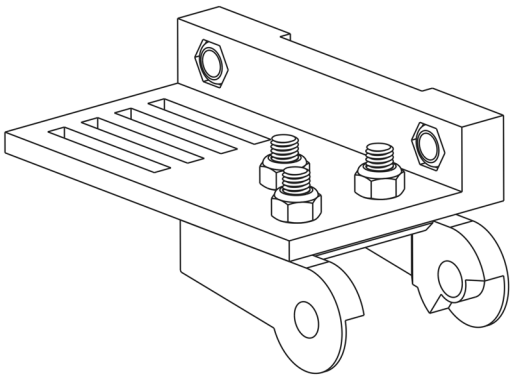
ITEM NO	DESCRIPTION	QTY
1	Y-AXIS-FIXED-END-ASSEMBLY	1
2	M5-LOW-PROFILE-25MM	2
3	M5-DROP-IN-TEE-NUT	2

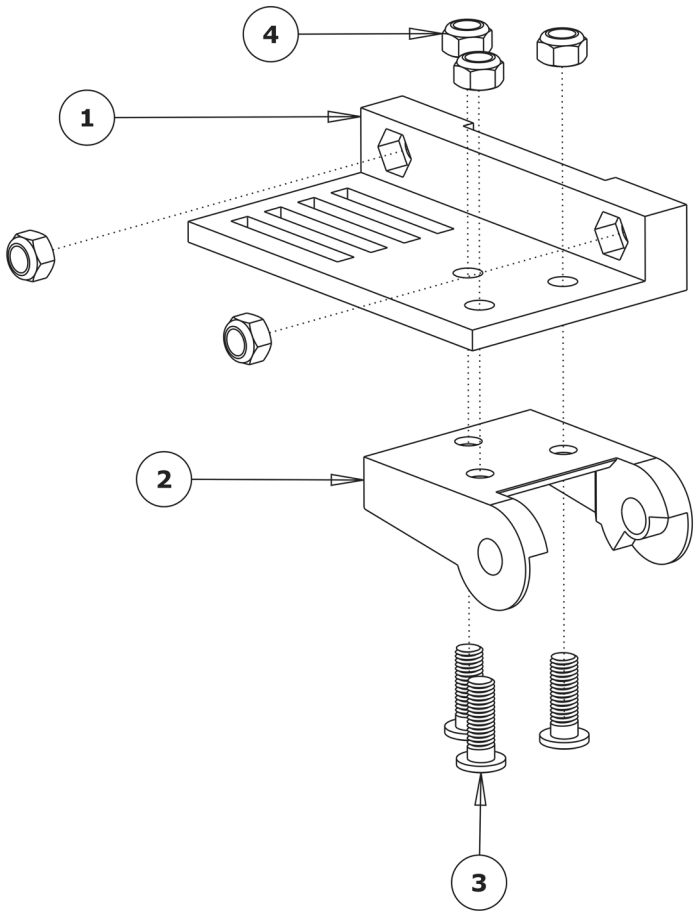


A. Position the Y-Axis-Fixed-End-Assembly to the back left corner of the WorkBee. It should be flush with the end of the C-Beam-750mm. Secure it using 2 x M5-Low-Profile-25mm bolts and 2 x M5-Drop-In-Tee-Nuts.

2.1.3 Y-Axis Moving End Assembly

ITEM NO	DESCRIPTION	QTY
1	Y-DRAG-CHAIN-MOVING-END-MOUNT	1
2	DRAG-CHAIN-MOVING-END	1
3	M5-LOW-PROFILE-15MM	3
4	M5-NYLOC-NUT	5



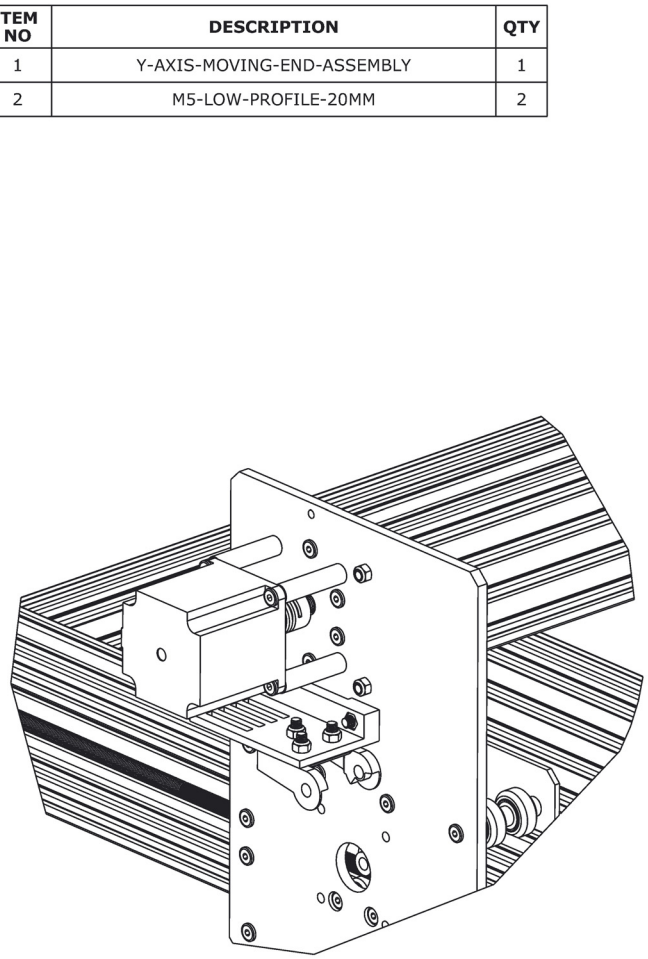


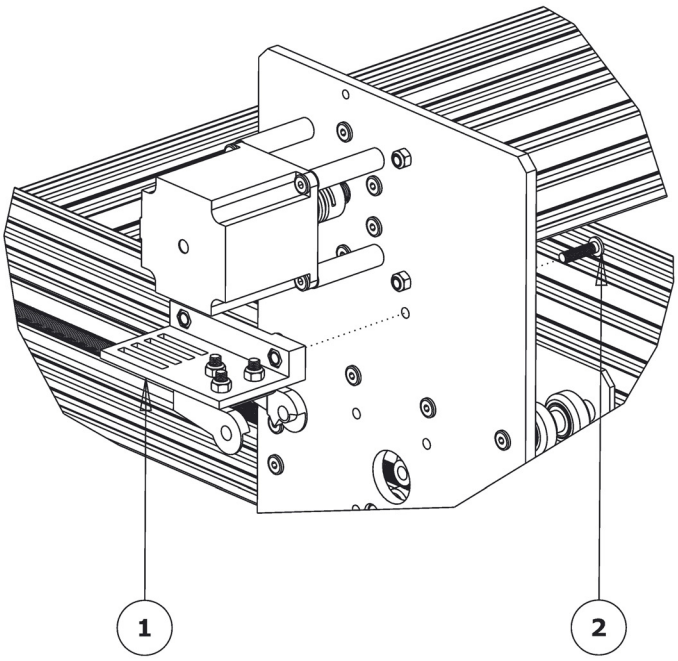
A. Insert 2 x M5-Nyloc-Nuts into the insets on the Y-Drag-Chain-Moving-End-Mount. They are a snug fit, so may require a light tap with a hammer.

B. Attach a Drag-Chain-Moving-End to the Y-Drag-Chain-Moving-End-Mount in the orientation shown above using 3 x M5-Low-Profile-15mm bolts and 3 x M5-Nyloc-Nuts.

2.1.4 Y-Axis Moving End Mounting

ITEM NO	DESCRIPTION	QTY
1	Y-AXIS-MOVING-END-ASSEMBLY	1
2	M5-LOW-PROFILE-20MM	2

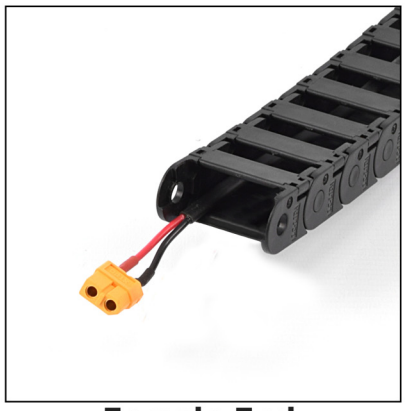




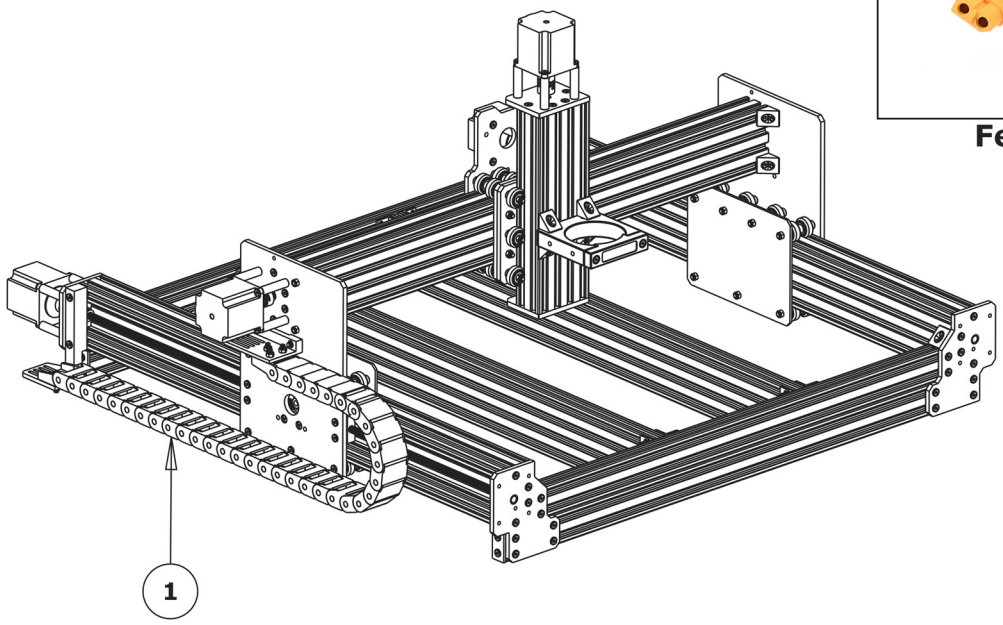
A. Secure the Y-Axis-Moving-End-Assembly using 2 x M5-Low-Profile-20mm bolts and the 2 x M5-Nyloc-Nuts already inserted into Y-Drag-Chain-Moving-End-Mount.

2.1.5 Y-Drag-Chain

ITEM NO	DESCRIPTION	QTY
1	Y-DRAG-CHAIN	1
2	PSU-OUTPUT-POWER-CABLE	1
3	LIMIT-SWITCH	1



Female End



A. Lay the Y-Drag-Chain flat on a table. Feed the PSU-Output-Power-Cable through the whole length of the Y-Drag-Chain. Ensure that the end with the XT60-Connector, is located at the female end of the Y-Drag-Chain (as shown above in the 'Female End' image).

B. If you have a screw driven WorkBee only feed two stepper motor wires through the Y-Drag-Chain. The end of the stepper motor wires with the black connector should be at the female end of the Y-Drain-Chain - same as Step A. Further to this, one of the stepper motor cables will be considerably longer than the other three - this cable should be one of the two which go inside the Y-Drag-Chain.

C. For all WorkBee Variants, feed the wires on a Limit-Switch, through the Y-Drag-Chain. The switch portion of the Limit-Switch should be at the female end of the Y-Drag-Chain.

D. Lay the Y-Drag-Chain flat along the left side of the WorkBee. The female end of the Y-Drag-Chain should be at the back of the machine, and the male end at the front.

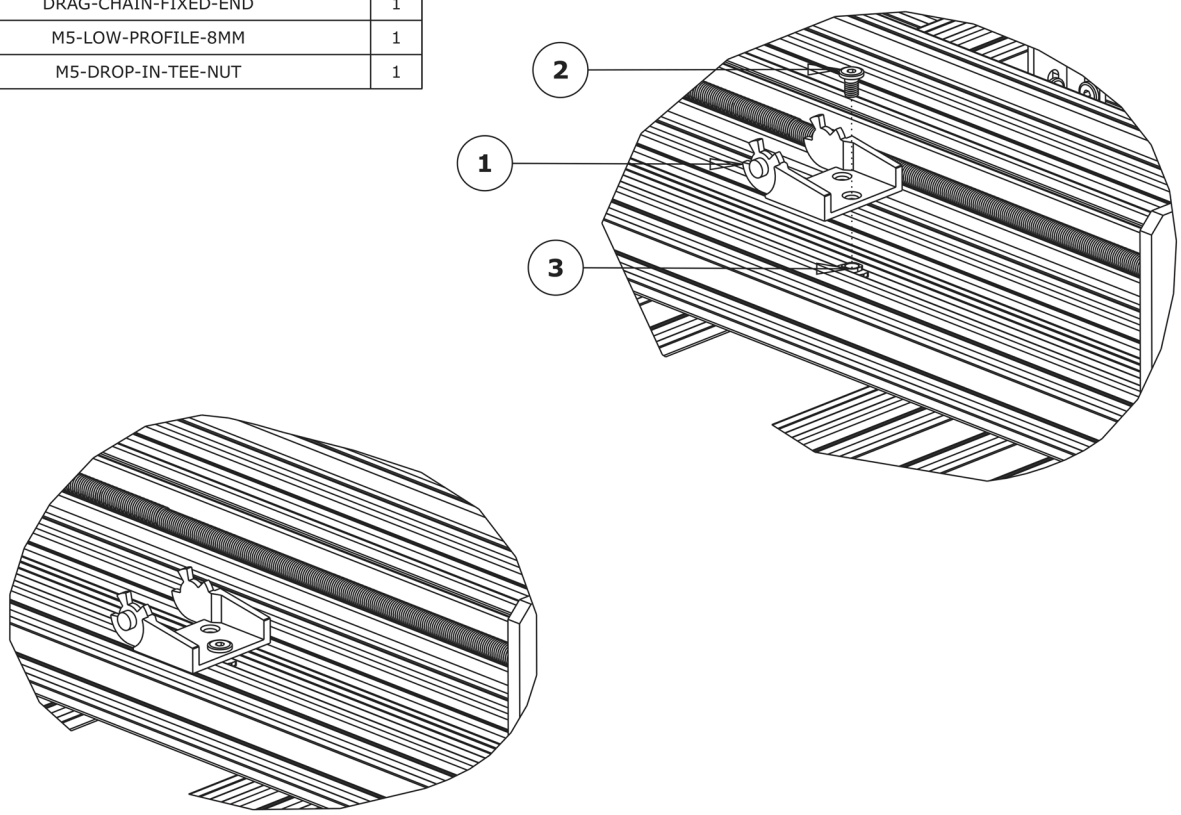
E. Attach the female end of the Y-Drag-Chain to the Drag-Chain-Fixed-End on the Y-Axis-Fixed-End-Assembly. It will take some force to click it into the Drag-Chain-Fixed-End.

F. Bring the male end of the Y-Drag-Chain to the Y-Axis-Moving-End-Assembly and attach it to the Drag-Chain-Moving-End. It will take some force to click it into the Drag-Chain-Moving-End.

2.2 X-Axis

2.2.1 X-Axis Fixed End Mounting

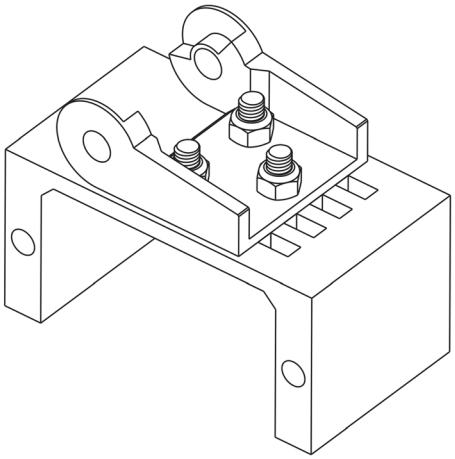
ITEM NO	DESCRIPTION	QTY
1	DRAG-CHAIN-FIXED-END	1
2	M5-LOW-PROFILE-8MM	1
3	M5-DROP-IN-TEE-NUT	1

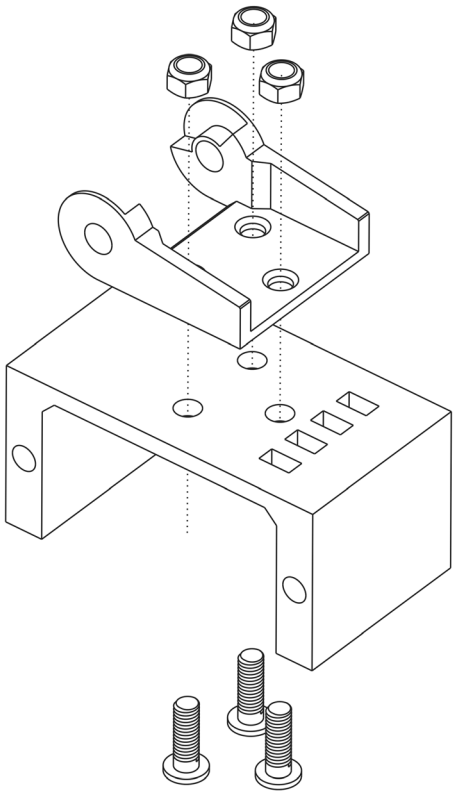


A. Attach a Drag-Chain-Fixed-End to the V-Slot-2040-750mm using an M5-Low-Profile-8mm and an M5-Drop-In-Tee-Nut. Ensure it is orientated as above; it should be located 150mm from right hand end of the V-Slot-2040-750mm if looking from the back. Ensure that it is parallel with the V-Slot-2040-750mm.

2.2.2 X-Axis Moving End Assembly

ITEM NO	DESCRIPTION	QTY
1	X-DRAG-CHAIN-MOVING-END-MOUNT	1
2	DRAG-CHAIN-MOVING-END	1
3	M5-LOW-PROFILE-15MM	3
4	M5-NYLOC-NUT	3

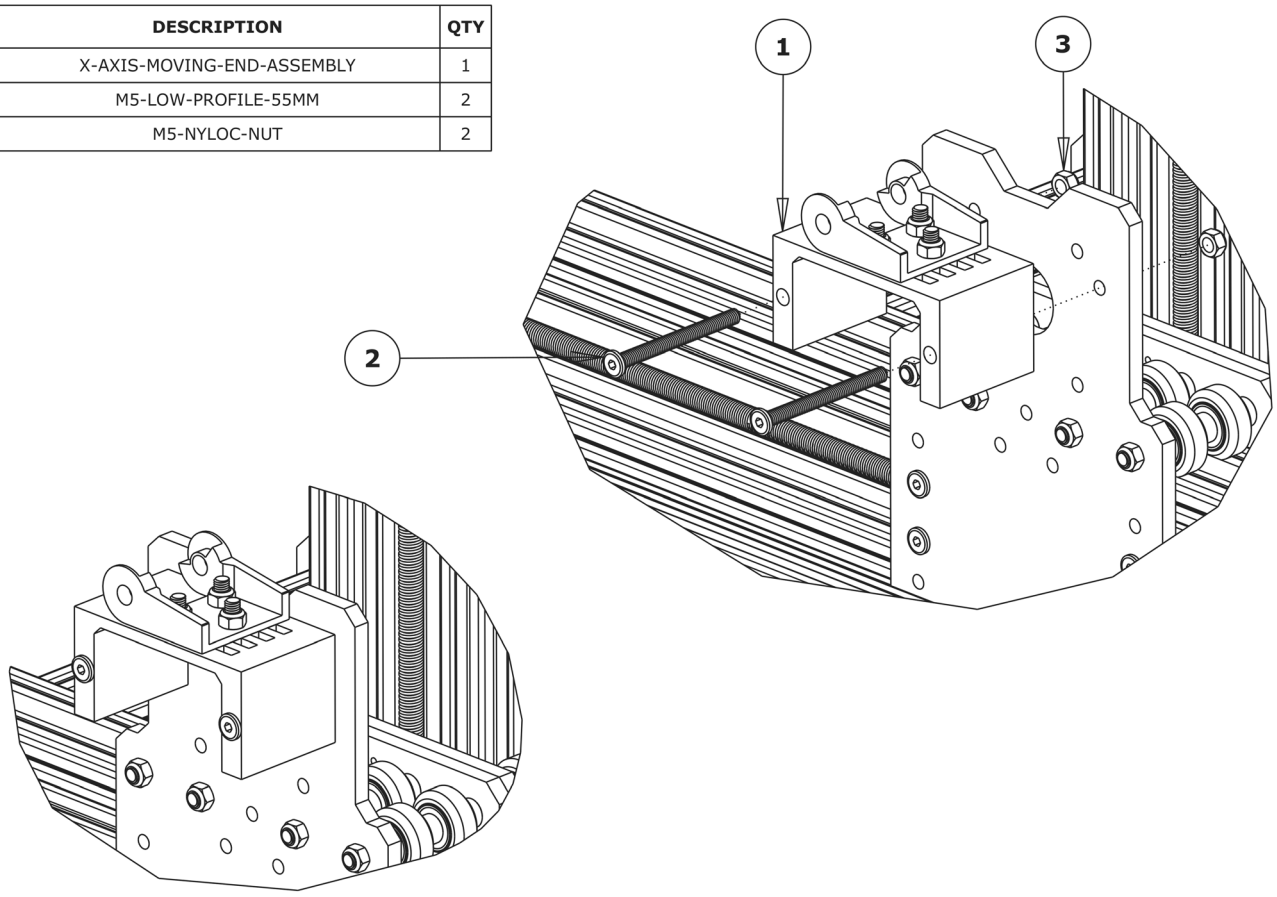




A. Attach a Drag-Chain-Moving-End to the X-Drag-Chain-Moving-End-Mount in the orientation shown above using 3 x M5-Low-Profile-15mm bolts and 3 x M5-Nyloc-Nuts.

2.2.3 X-Axis Moving End Mounting

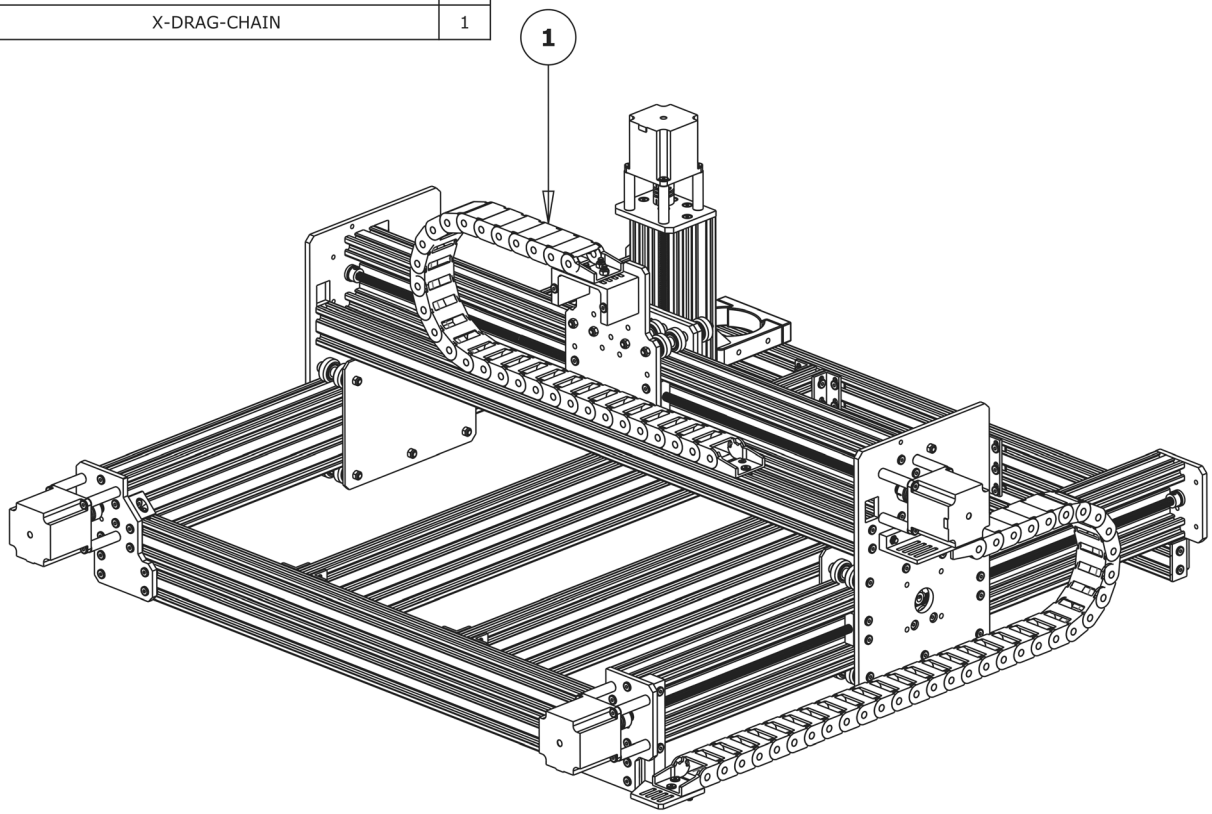
ITEM NO	DESCRIPTION	QTY
1	X-AXIS-MOVING-END-ASSEMBLY	1
2	M5-LOW-PROFILE-55MM	2
3	M5-NYLOC-NUT	2



A. Secure the X-Axis-Moving-End-Assembly to the X-Plate-Back using 2 x M5-Low-Profile-55mm bolts and 2 x M5-Nyloc-Nuts.

2.2.4 X-Drag-Chain

ITEM NO	DESCRIPTION	QTY
1	X-DRAG-CHAIN	1



A. Like in Section 2.1.5 lay the X-Drag-Chain flat on a table. If you have a screw driven WorkBee feed through one stepper motor wire. If you have a belt driven WorkBee feed through two. The end of the stepper motor wires with the black connectors should be at the male end of the X-Drag-Chain (opposite to Section 2.1.5).

B. Attach the female end of the X-Drag-Chain to the Drag-Chain-Fixed-End on the V-Slot-2040-750mm. It will take some force to click it into the Drag-Chain-Fixed-End.

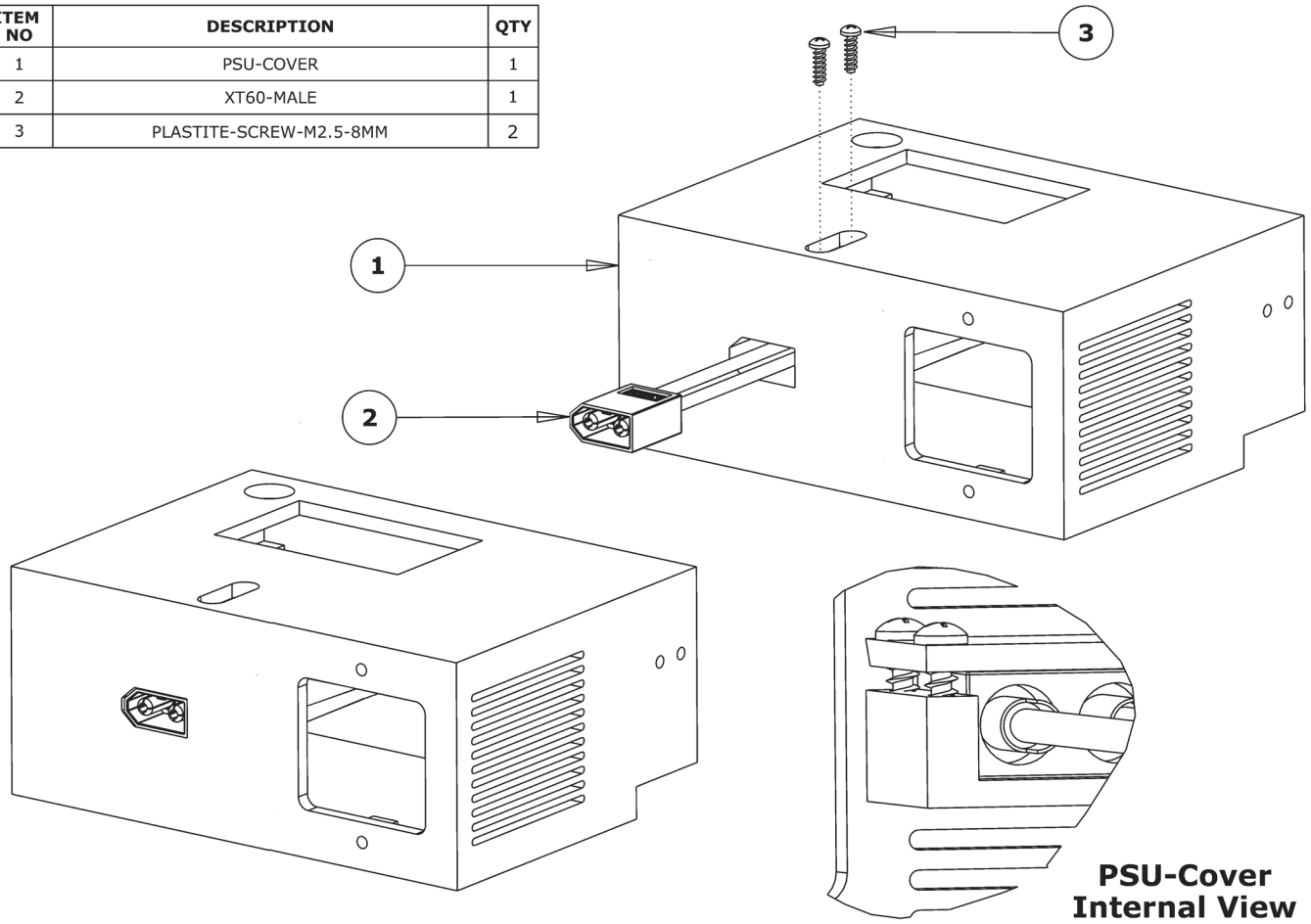
C. Bring the male end of the X-Drag-Chain up to the X-Axis-Moving-End-Assembly and attach it to the Drag-Chain-Moving-End. It will take some force to click it into the Drag-Chain-Moving-End.

3.0 Power Supply Assembly

3.1 Output

3.1.1 Securing XT60-Male Outputs

ITEM NO	DESCRIPTION	QTY
1	PSU-COVER	1
2	XT60-MALE	1
3	PLASTITE-SCREW-M2.5-8MM	2

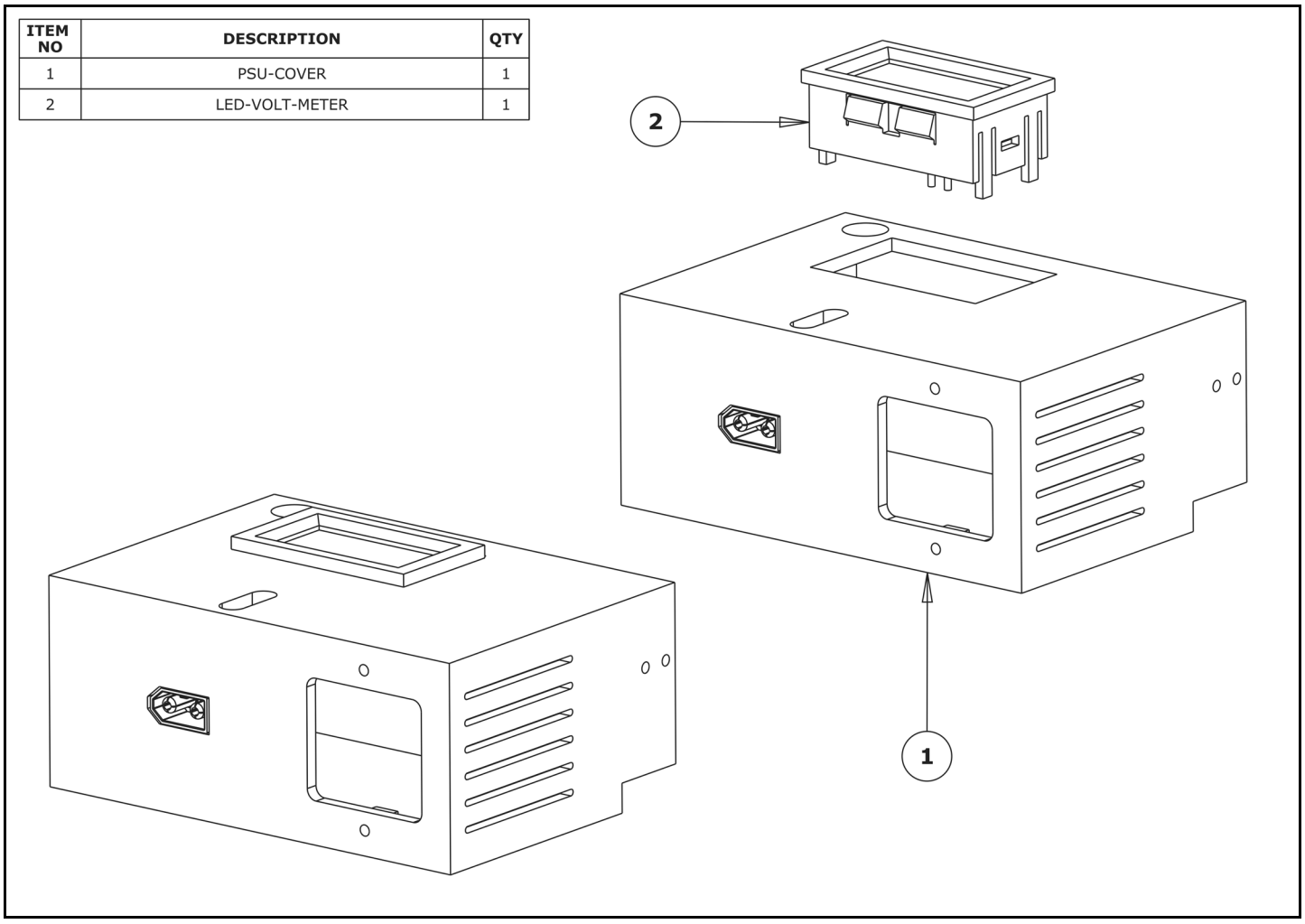


A. Insert the XT60-Male connectors into the provided inset on the PSU-Cover. it should sit flush with the front of the PSU-Cover.

B. Secure the XT-Male connector using 2 x Plastite-Screw-M2.5-8mm through the holes provided on the securing tab as seen on the internal view. When initially placing the screw, it is helpful to hold each screw in place using tweezers or long nose pliers.

3.1.2 Inserting LED-Volt-Meter

ITEM NO	DESCRIPTION	QTY
1	PSU-COVER	1
2	LED-VOLT-METER	1

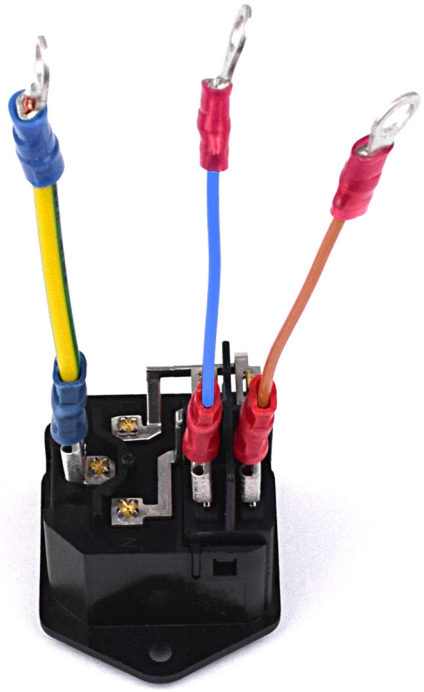


A. Gently push the LED-Volt-Meter into the provided gap on the top of the PSU Cover. The wires on the LED-Volt-Meter should be oriented to the front of the PSU-Cover.

3.2 Input

3.2.1 IEC-Inlet Wires

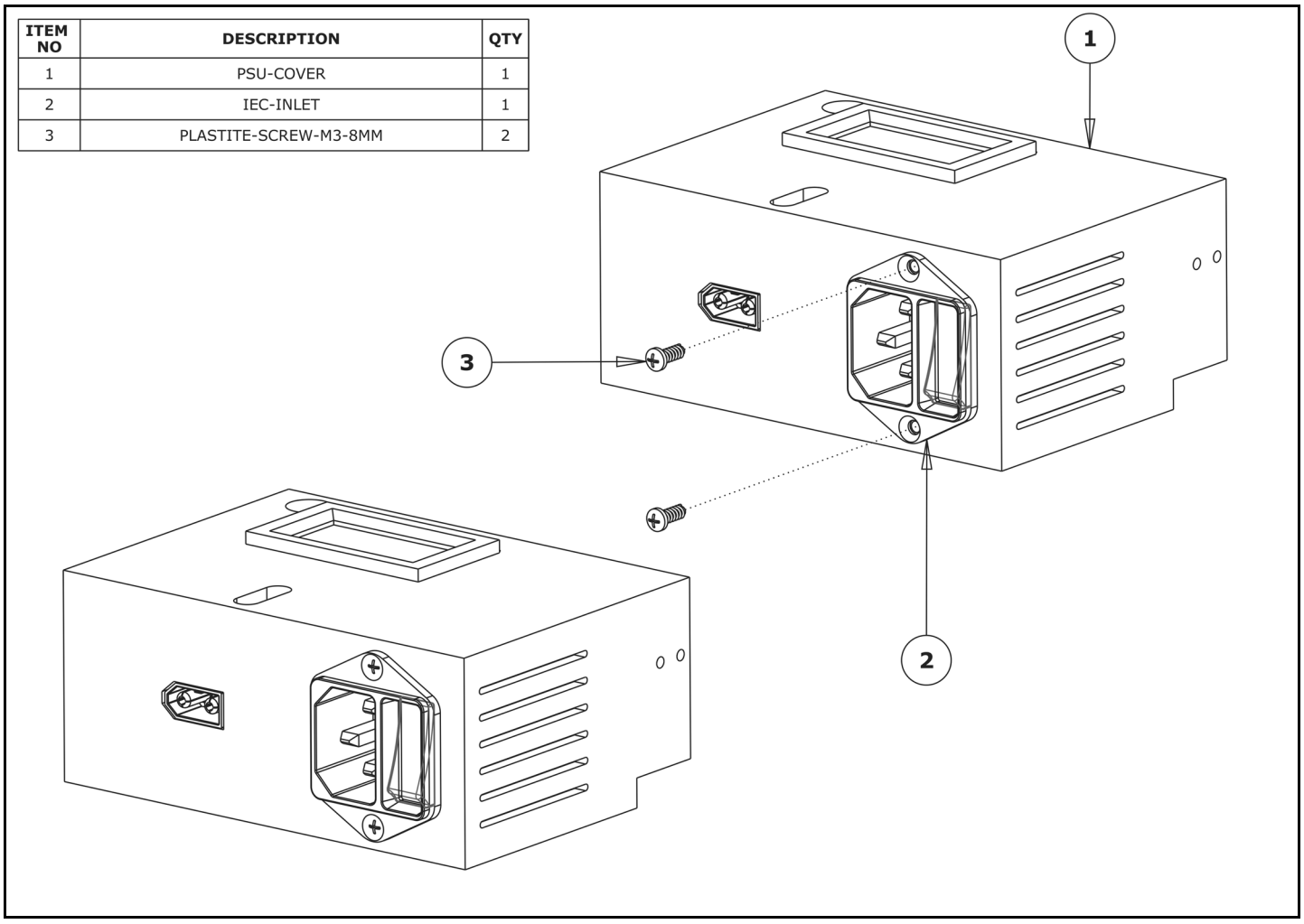
ITEM NO	DESCRIPTION	QTY
1	IEC-INLET	1
2	IEC-INLET-LIVE-WIRE	1
3	IEC-INLET-NEUTRAL-WIRE	1
4	IEC-INLET-EARTH-WIRE	1



A. Attach the receptacle end of the IEC-Inlet-Live-Wire, IEC-Inlet-Neutral-Wire & IEC-Inlet-Earth-Wire to their respective terminal tabs on the IEC-Inlet, as seen in the above image.

3.2.2 Attaching IEC-Inlet

ITEM NO	DESCRIPTION	QTY
1	PSU-COVER	1
2	IEC-INLET	1
3	PLASTITE-SCREW-M3-8MM	2

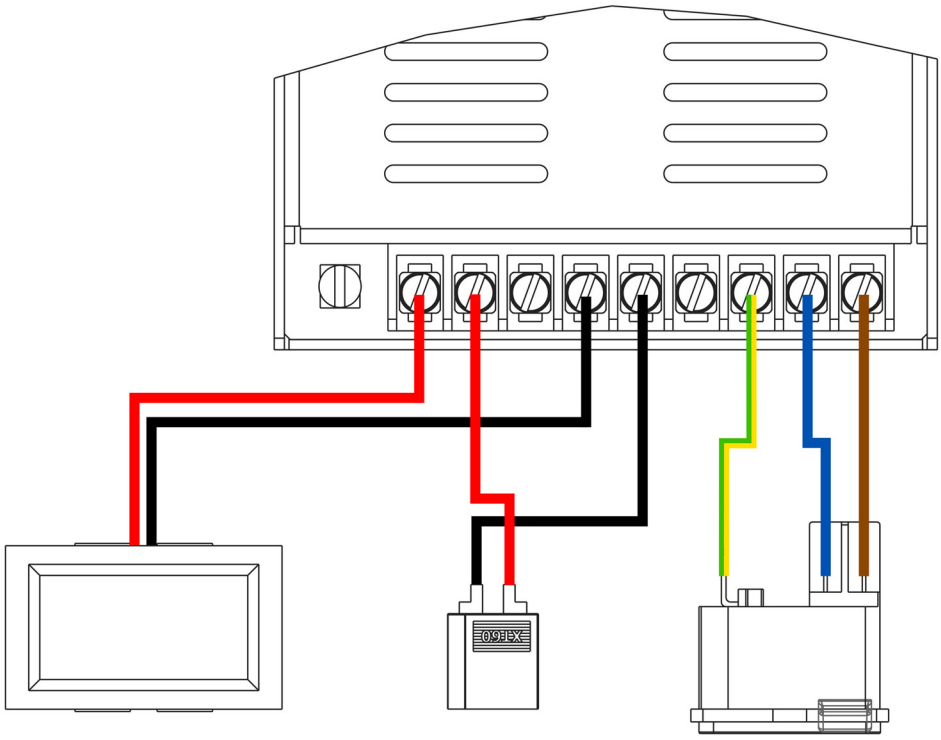


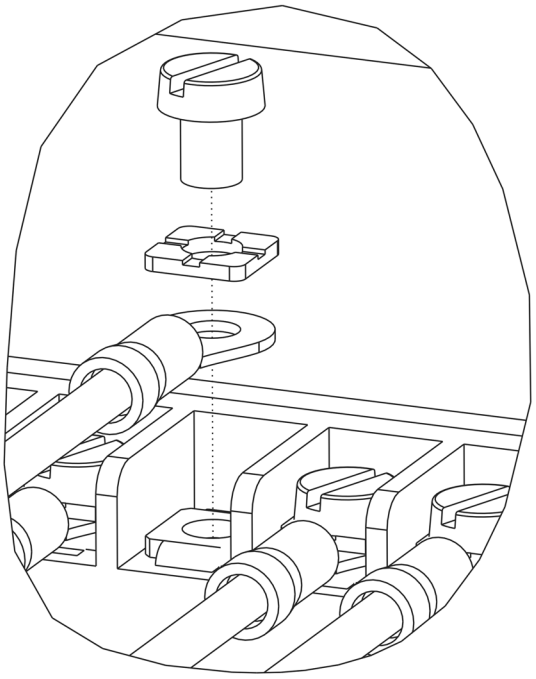
A. Secure the assembled IEC-Inlet to the PSU-Cover using 2 x Plastite-Screw-M3-8mm. Ensure the switch is on the right hand side.

3.3 Connecting PSU-Cover

3.3.1 Connecting Wires

ITEM NO	DESCRIPTION	QTY
1	24V-360W-POWER-SUPPLY	1
2	PSU-COVER	1





Ring Terminal Attachment

A. Bring the front of the 24V-360W-Power-Supply and PSU Cover close together.

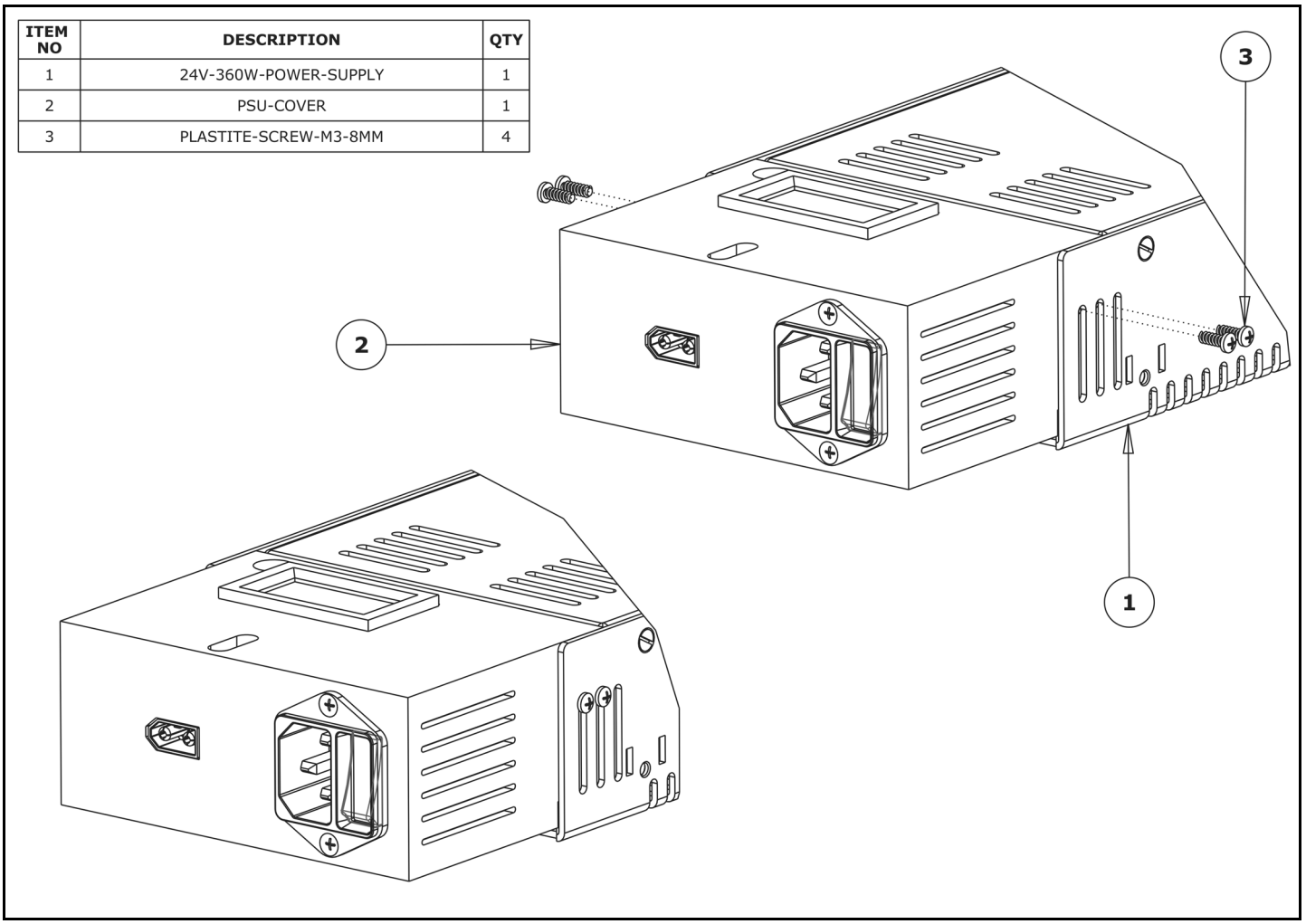
B. Following the wiring diagram, first connect both wires of the XT60-Male connector to the 24V-360W-Power-Supply. As seen on the ring terminal attachment view, the terminal screws on the 24V-360W-Power-Supply should first go through the terminal plate, then through the ring terminal on the wires, and then into the threaded hole on the 24V-360W-Power-Supply.

C. Then connect the LED-Volt-Meter to the output terminals.

D. Finally, connect the three IEC-Inlet wires to the 24V-360W-Power-Supply. The IEC-Inlet-Earth-Wire is very inflexible compared to the previous ones, so this wire may take some force to get into position.

3.3.2 Attaching PSU-Cover

ITEM NO	DESCRIPTION	QTY
1	24V-360W-POWER-SUPPLY	1
2	PSU-COVER	1
3	PLASTITE-SCREW-M3-8MM	4



A. Mate the PSU-Cover to the 24V-360W-Power-Supply. This may be very fiddly to initially get into position, so do take an extra bit of time to do so.

B. On each side, secure the PSU-Cover using two Plastite-Screw-M3-8mms. Go through the slots on the metal casing of the 24V-360W-Power-Supply, and then into the holes on the PSU-Cover.

3.3.3 Testing

ITEM NO	DESCRIPTION	QTY
1	24V-360W-POWER-SUPPLY	1
2	MAINS-CABLE	1

A. Insert the end of the Mains-Cable into the IEC-Inlet on the 24V-360W-Power-Supply. Check the switch on the side of the 24V-360W-Power-Supply is set to the supply voltage of your country.

B. Plug the Mains-Cable into a wall socket and switch it on. If the LED-Volt-Meter comes on, this indicates the 24V-360W-Power-Supply has power. If it doesn't come on, this is most likely because the switch on the IEC-Inlet is turned off; turn this on.

C. Once switched on, the LED-Volt-Meter should read 24.0. If it does not read 24.0, there is a screw through the hole towards the top left of the LCD can be used to adjust the voltage. Use a screwdriver to adjust the voltage to 24.0, and take caution to not touch any metal parts with the screwdriver.

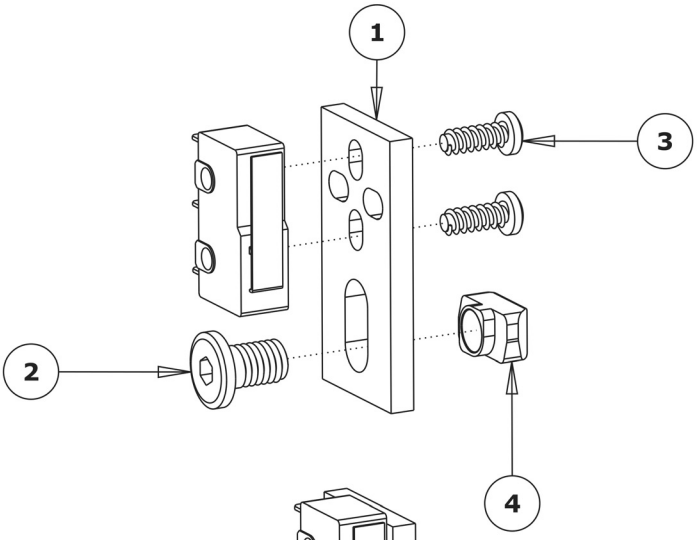
D. The Power Supply assembly is now complete and can be turned off and placed towards the back left of the machine near, the Y-Axis-Fixed-End-Assembly.

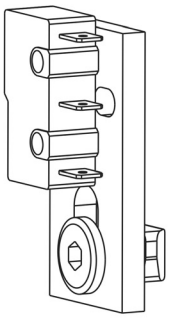
4.0 Limit Switches & Wire Routing

4.1 Limit Switches

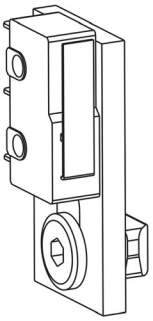
4.1.1 X & Y Limit Switches

ITEM NO	DESCRIPTION	QTY
1	LIMIT-SWITCH-PLATE	2
2	M5-LOW-PROFILE-8MM	2
3	PLASTITE-SCREW-M3-8MM	4
4	M5-DROP-IN-TEE-NUT	2

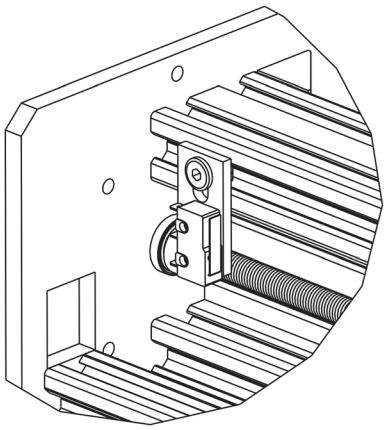




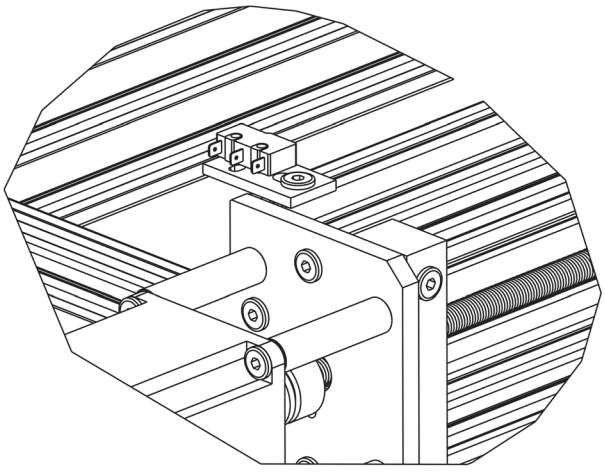
X-AXIS-LIMIT-SWITCH-ASSEMBLY



Y-AXIS-LIMIT-SWITCH-ASSEMBLY



X-Axis-Limit-Switch-Assembly Position



Y-Axis-Limit-Switch-Assembly Position

A. Carefully attach the Limit-Switch that was inserted in Section 2.1.5 to a Limit-Switch-Plate using 2 x Plastite-Screw-M3-8mms. The Plastite-Screw-M3-8mms self thread, the best technique is to screw in a couple of turns, then back out, and then back in a few more turns than last time, and so forth, until the Limit-Switch is firmly secured. Do not over tighten as you can shatter the switch. Make sure the Limit-Switch is orientated as the Y-Axis-Limit-Switch-Assembly above. Finally attach a M5-Low-Profile-8mm bolt, and on the end slightly thread a M5-Drop-In-Tee-Nut.

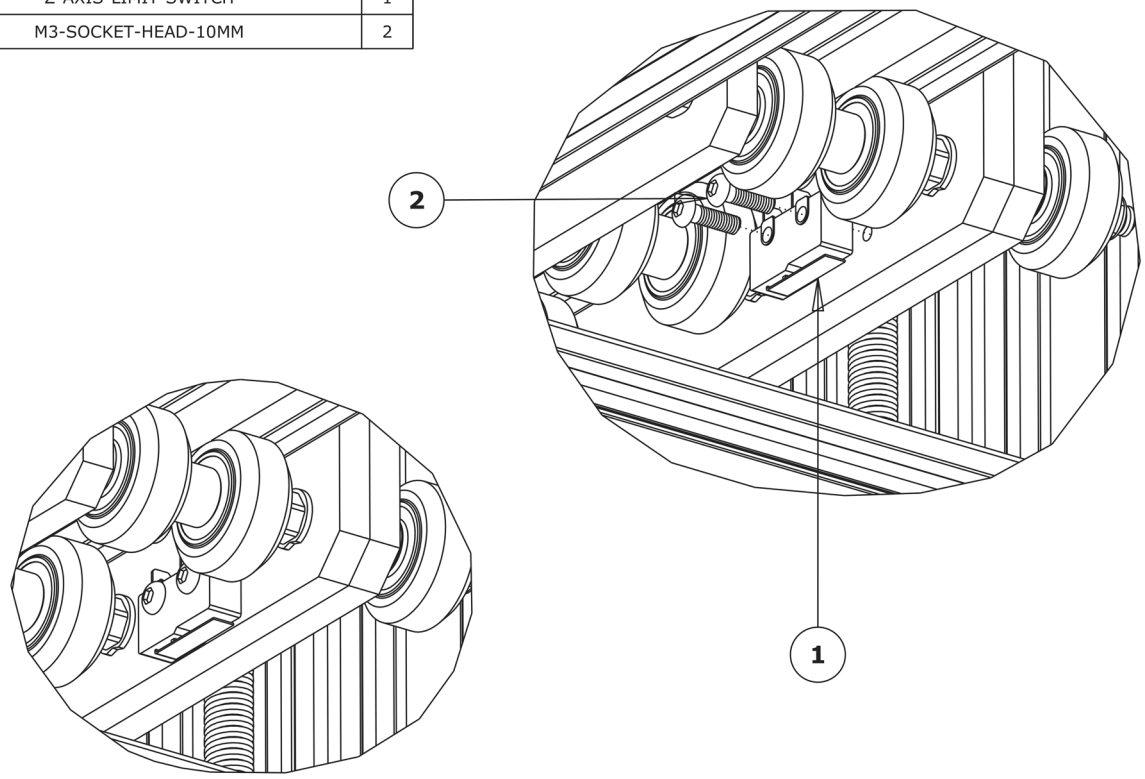
B. Repeat Step A for the last Limit-Switch, this one has not been inserted anywhere yet. Note the different orientation as seen in the X-Axis-Limit-Switch-Assembly above.

C. Attach the Y-Axis-Limit-Switch-Assembly to the left hand Y-Axis C-Beam extrusion (if looking from the front). It should be attached to the inner slot on the far end of the C-Beam extrusion. The distance between the Limit-Switch-Plate and the end of the extrusion should be 13mm.

D. Attach the X-Axis-Limit-Switch-Assembly to the back side of the X-Axis C-Beam extrusion. It should be attached to the top slot on the far left side (if looking from the back). The distance between the Limit-Switch-Plate and the end of the extrusion should be 10mm.

4.1.2 Z-Axis Limit Switch

ITEM NO	DESCRIPTION	QTY
1	Z-AXIS-LIMIT-SWITCH	1
2	M3-SOCKET-HEAD-10MM	2

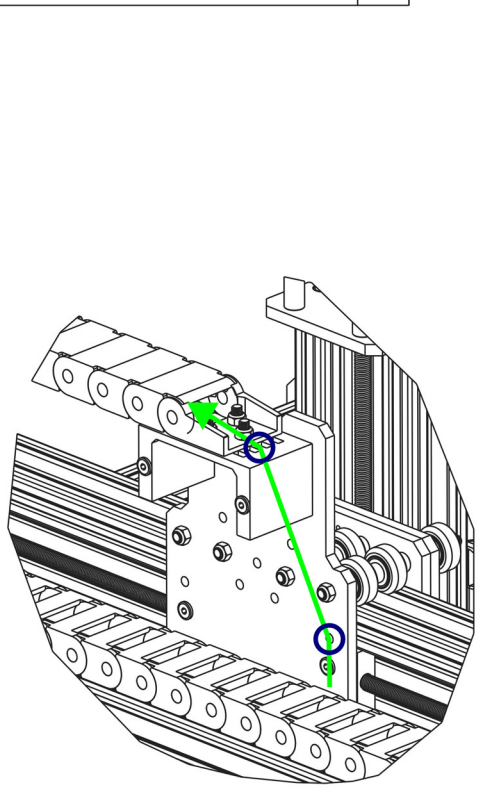


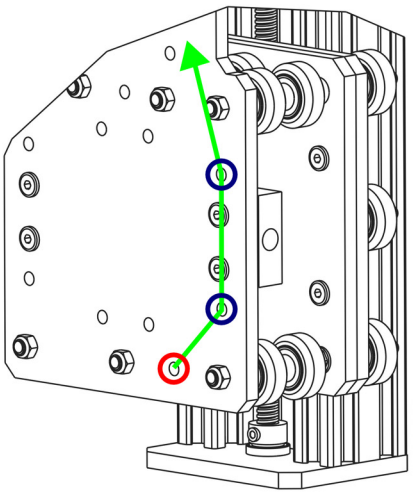
A. Attach the Z-Axis limit switch to the threaded holes on the X-Plate-Front using 2 x M3-Socket-Head-10mm bolts, in the orientation above. Do not over tighten as you can shatter the switch.

4.2 Wire Routing

4.2.1 Z-Axis Limit Switch Wiring

ITEM NO	DESCRIPTION	QTY
1	CABLE-TIE-SMALL	3

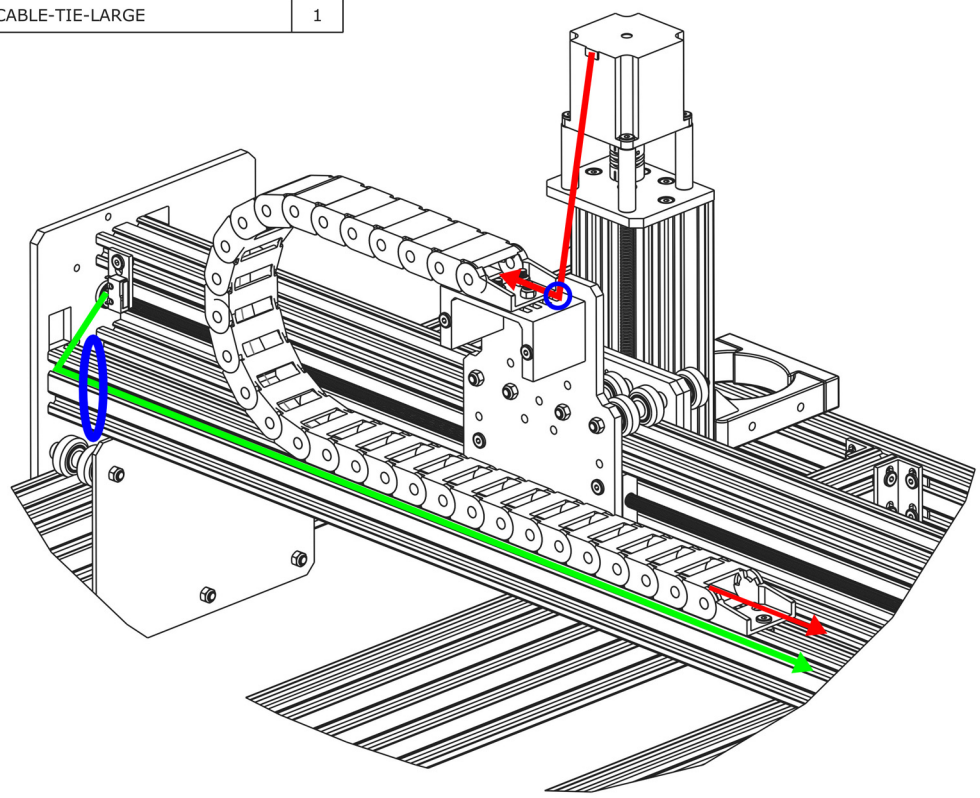




A. The Z-Limit-Switch sits in-between two sets of wheels. Directly opposite there is a hole. Feed the wires through this hole (Red circle above). Then as shown by the green line above bring the Z-Limit-Switch wires up the X-Plate-Back, and feed it through the X-Drag-Chain. Secure the wires using Cable-Tie-Smalls to the points marked with blue circles above. To stop it snagging on anything the wire should be pulled taught.

4.2.2 Screw Driven - Gantry Wire Routing

ITEM NO	DESCRIPTION	QTY
1	CABLE-TIE-SMALL	1
2	CABLE-TIE-LARGE	1

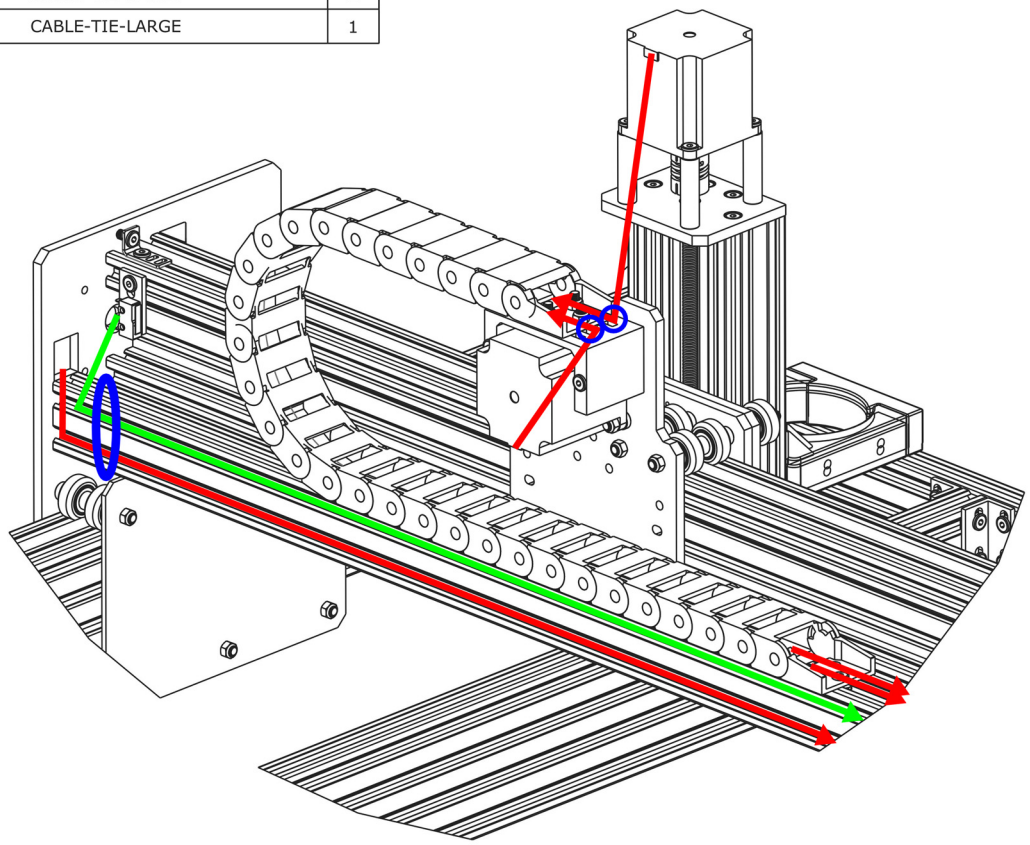


A. For the stepper motor wire that is inside the X-Drag-Chain, connect it to the pigtail on Z-Axis stepper motor. Making sure there is enough slack for the full travel of the Z-Axis, secure the wire to the X-Drag-Moving-End-Mount using a Cable-Tie-Small, shown by the small blue circle above.

B. The lead on the X-Axis limit switch should be secured to the V-Slot-2040-750mm using a Cable-Tie-Large at the position shown by the blue oval above. Then run the lead along to the other end of V-Slot-2040-750mm - it can be tucked into one of the slots.

4.2.3 Belt Driven - Gantry Wire Routing

ITEM NO	DESCRIPTION	QTY
1	CABLE-TIE-SMALL	2
2	CABLE-TIE-LARGE	1



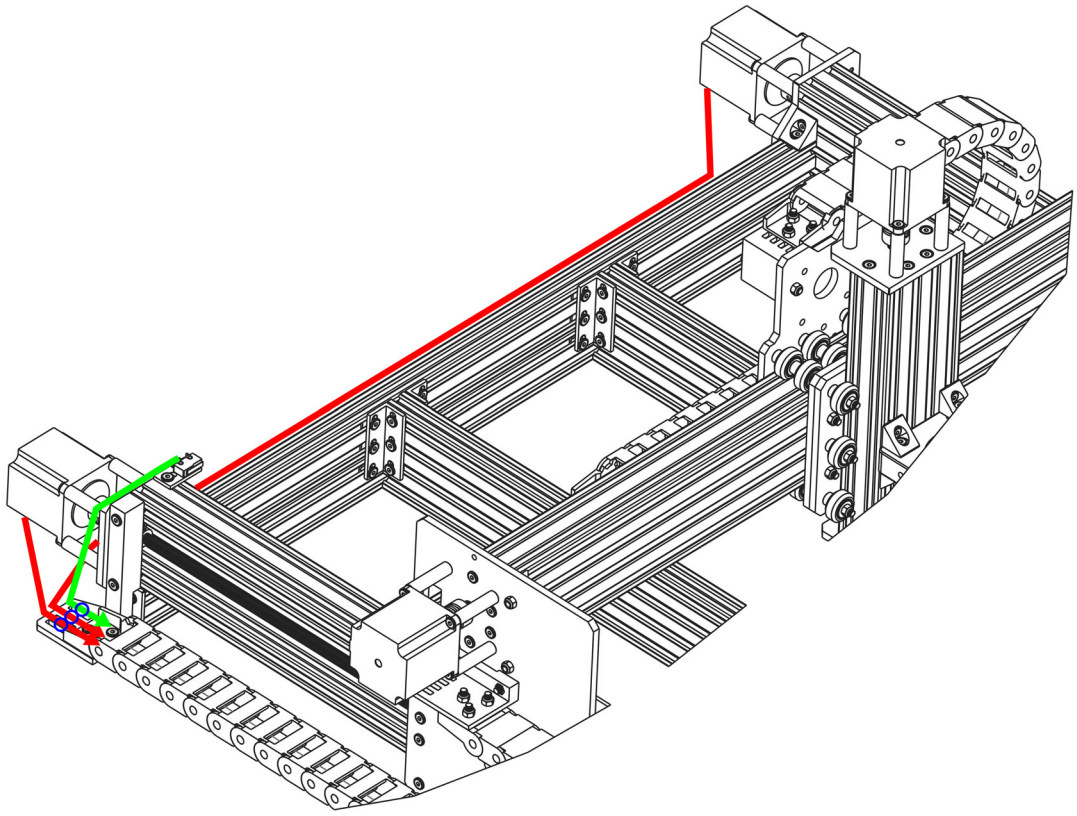
A. For one of the stepper motor wires that is inside the X-Drag-Chain, connect it to the pigtail on Z-Axis stepper motor. Making sure there is enough slack for the full travel of the Z-Axis, secure the wire to the X-Drag-Moving-End-Mount using a Cable-Tie-Small, shown by the small blue circle above.

B. For the second stepper motor wire connect it to the pigtail on the X-Axis stepper motor wire. Secure it to the X-Drag-Moving-End-Mount in a similar fashion as in Step A

C. Connect a stepper motor wire to the pigtail on the right hand Y-Axis stepper motor (as if looking from the front). Feed it through the square hole on the Y-Plate. The lead on the X-Axis limit switch and stepper motor wire should be secured to the V-Slot-2040-750mm using a Cable-Tie-Large at the position shown by the blue oval above. Then run the wires along to the other end of V-Slot-2040-750mm - they can be tucked into the slots.

4.2.4 Screw Driven - Y-Axis Wire Routing - Part 1

ITEM NO	DESCRIPTION	QTY
1	CABLE-TIE-SMALL	3



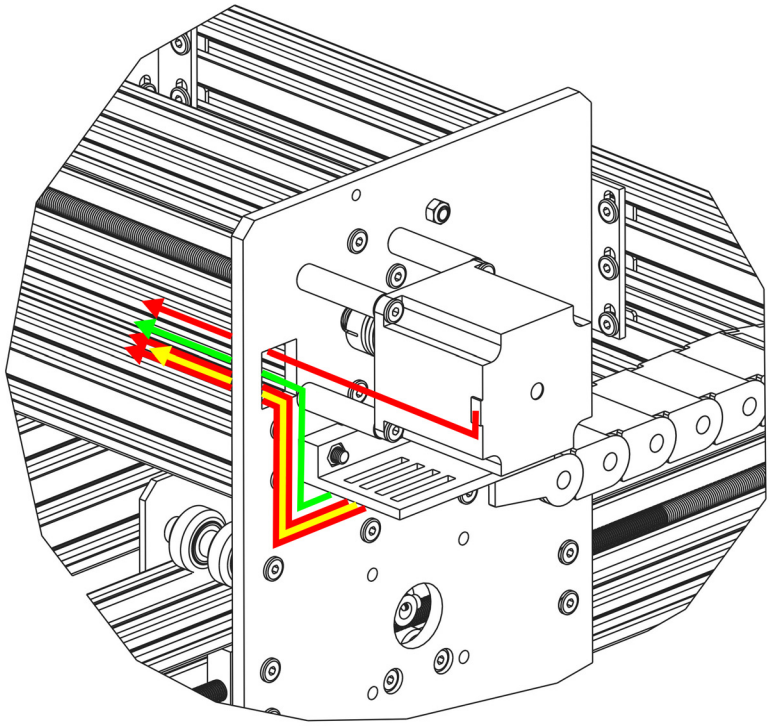
A. Connect the two stepper motor wires in the Y-Drag-Chain to the pigtails on the Y-Axis stepper motors. In Section 2.1.5 Step B, one of the stepper motor wires will be longer than the other, the longer wire should connect to the right hand stepper motor.

B. Secure the stepper motor wires to the Y-Axis-Fixed-End-Mount using Cable-Tie-Smalls. The wire for the right hand stepper motor can be tucked into a slot on one of the extrusions along the back.

C. Secure the lead on the Y-Axis limit switch to the Y-Axis-Fixed-End-Mount using a Cable-Tie-Small.

4.2.5 Screw Driven - Y-Axis Wire Routing - Part 2

ITEM NO	DESCRIPTION	QTY
1	CABLE-TIE-SMALL	5

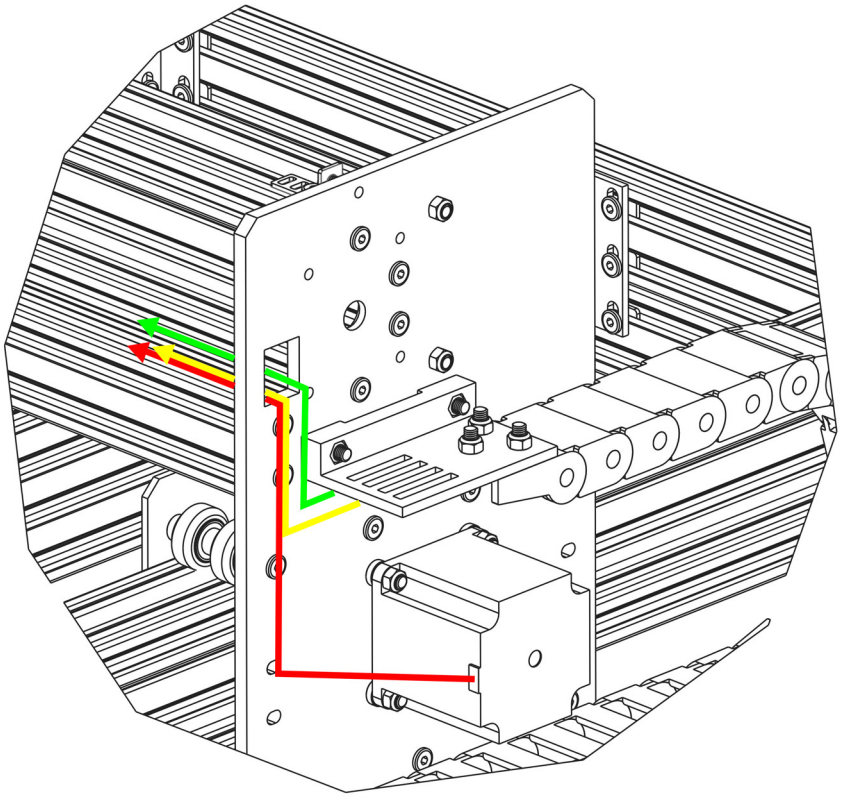


A. Connect a stepper motor wire to the pigtail on the X-Axis stepper motor and feed it through the square hole on the Y-Plate

B. Inside the Y-Drag-Chain there should be two stepper motor wires (red above), a power supply wire (yellow above), and a limit switch wire (green above). Feed all of these through the square hole on the Y-Plate. Remove any slack inside the Y-Drag-Chain, and then secure these 4 wires to the Y-Drag-Chain-Moving-End-Mount using Cable-Tie-Smalls.

4.2.6 Belt Driven - Y-Axis Wire Routing

ITEM NO	DESCRIPTION	QTY
1	CABLE-TIE-SMALL	3



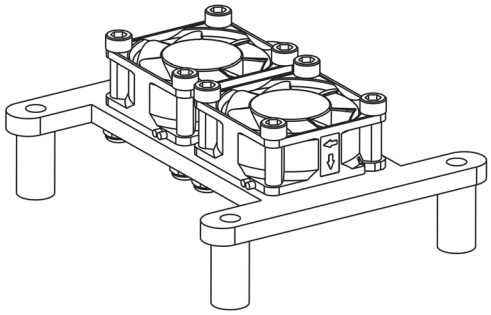
A. Connect a stepper motor wire to the pigtail on the left hand Y-Axis stepper motor (if looking from the front) and feed it through the square hole on the Y-Plate

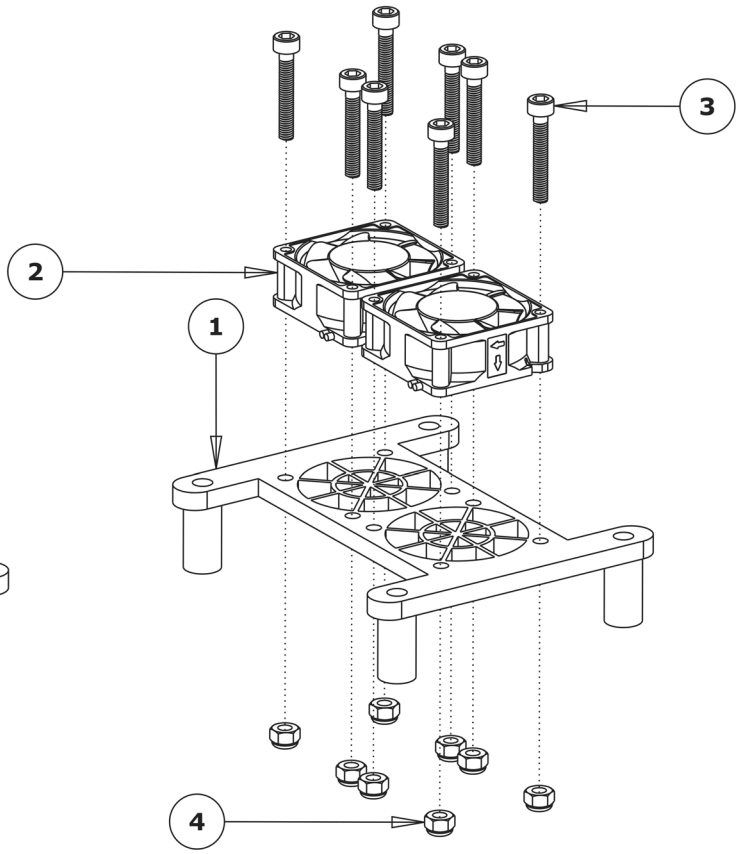
B. Inside the Y-Drag-Chain there should be a power supply wire (yellow above), and a limit switch wire (green above). Feed all of these through the square hole on the Y-Plate. Remove any slack inside the Y-Drag-Chain, and then secure these 2 wires to the Y-Drag-Chain-Moving-End-Mount using Cable-Tie-Smalls.

5.0 CNC xPro Assembly

5.0.1 Fan Mount Assembly

ITEM NO	DESCRIPTION	QTY
1	CNC-XPRO-FAN-MOUNT	1
2	DUAL-30MM-24V-DC-FAN	1
3	M3-CAP-HEAD-20MM	8
4	M3-NYLOC-NUT	8

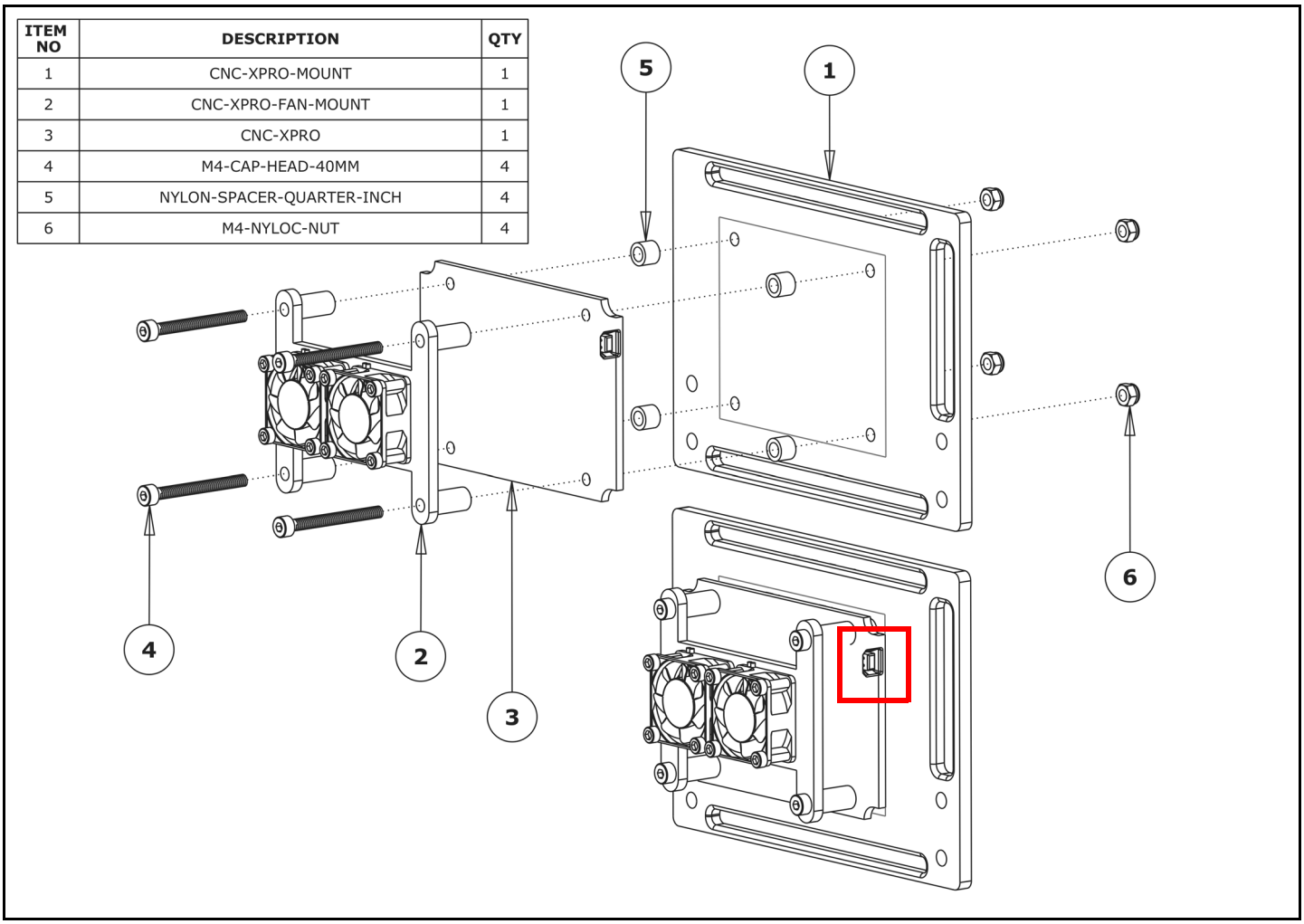




A. Attach the Dual-30mm-24V-DC-Fan to the CNC-xPro-Fan-Mount using 8 x M3-Cap-Head-20mm bolts and 8 x M3-Nyloc-Nuts. Ensure that the Dual-30mm-24V-DC-Fans are blowing downwards by ensuring that the side of the fan with the label on is against the CNC-xPro-Fan-Mount. Make sure that the power wires on the Dual-30mm-24V-DC-Fans are both on the same side of the CNC-xPro-Fan-Mount.

5.0.2 Attaching The CNC-xPro

ITEM NO	DESCRIPTION	QTY
1	CNC-XPRO-MOUNT	1
2	CNC-XPRO-FAN-MOUNT	1
3	CNC-XPRO	1
4	M4-CAP-HEAD-40MM	4
5	NYLON-SPACER-QUARTER-INCH	4
6	M4-NYLOC-NUT	4

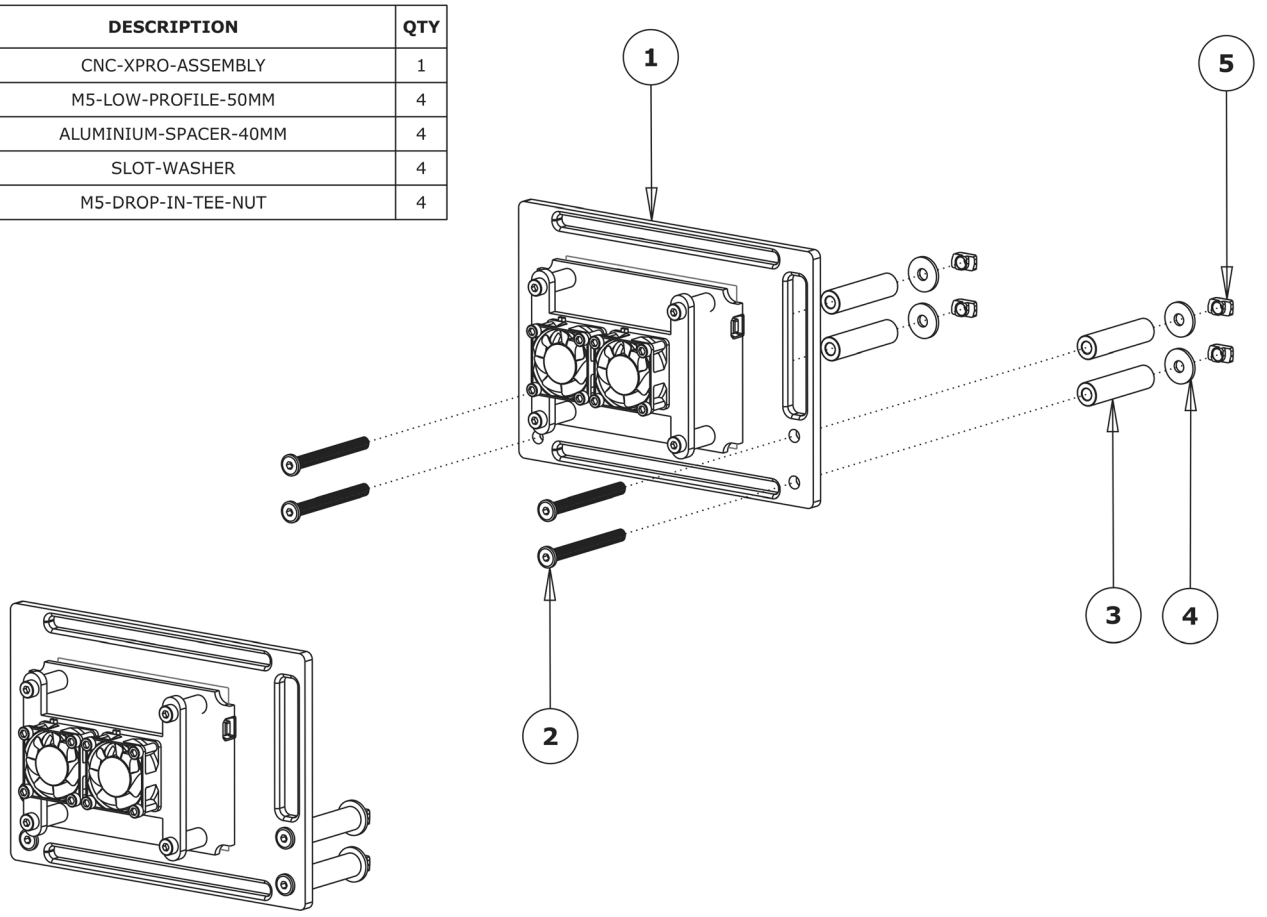


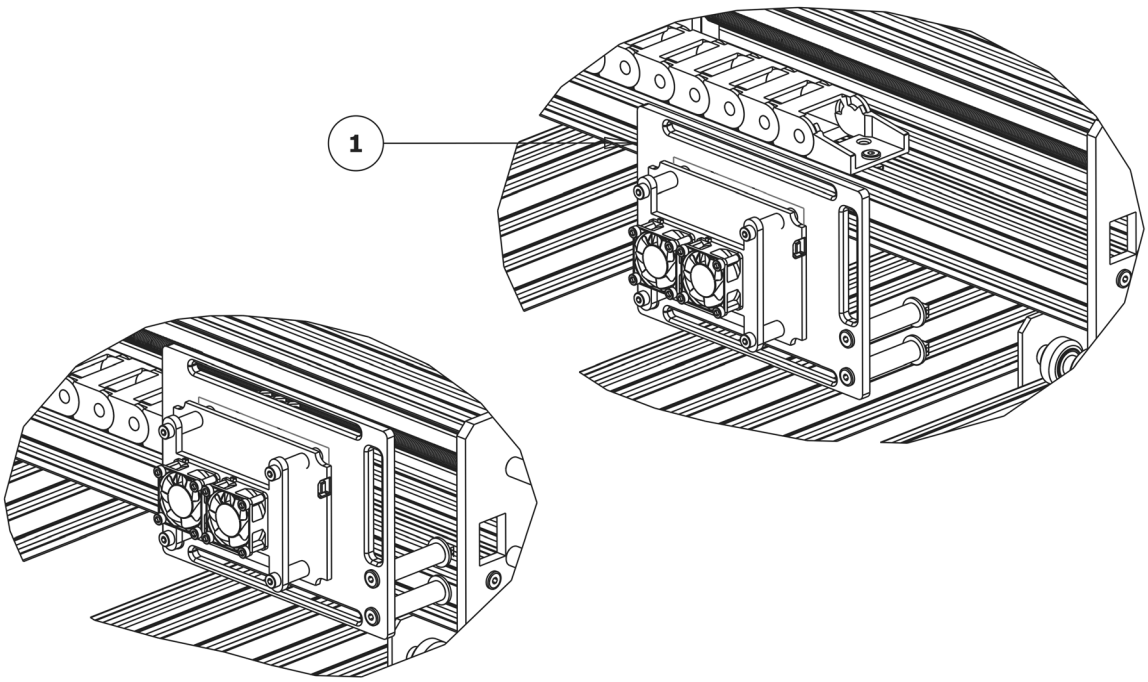
A. If you have purchased the bluetooth adaptor, now would be a good time to attach it to the CNC-xPro following the instructions on the pamphlet inside the bluetooth packet.

B. Insert 4 x M4-Cap-Head-40mm bolts through the previously assembled CNC-xPro-Fan-Mount, and then through the CNC-xPro and each through a Nylon-Spacer-Quarter-Inch. Finally, go through the CNC-xPro-Mount. While doing so plug the fans into the white 3 pin fan output header on the CNC-xPro. The CNC-xPro should be orientated so the USB terminal is in the same position as shown by the red square above. Secure the whole assembly using 4 x M4-Nyloc-Nuts.

5.0.3 Mounting the CNC-xPro Assembly

ITEM NO	DESCRIPTION	QTY
1	CNC-XPRO-ASSEMBLY	1
2	M5-LOW-PROFILE-50MM	4
3	ALUMINIUM-SPACER-40MM	4
4	SLOT-WASHER	4
5	M5-DROP-IN-TEE-NUT	4





A. Insert 4 x M5-Low-Profile-50mm bolts through each mounting hole on the CNC-xPro-Mount.

B. On to each M5-Low-Profile-50mm bolt slide an Aluminium-Onehalf-Inch and a Slot-Washer. The rounded face of the Slot-Washer should be flush against the Aluminium-Onehalf-Inch.

C. On to the end of each M5-Low-Profile-50mm bolt, slightly thread a M5-Drop-In-Tee-Nut.

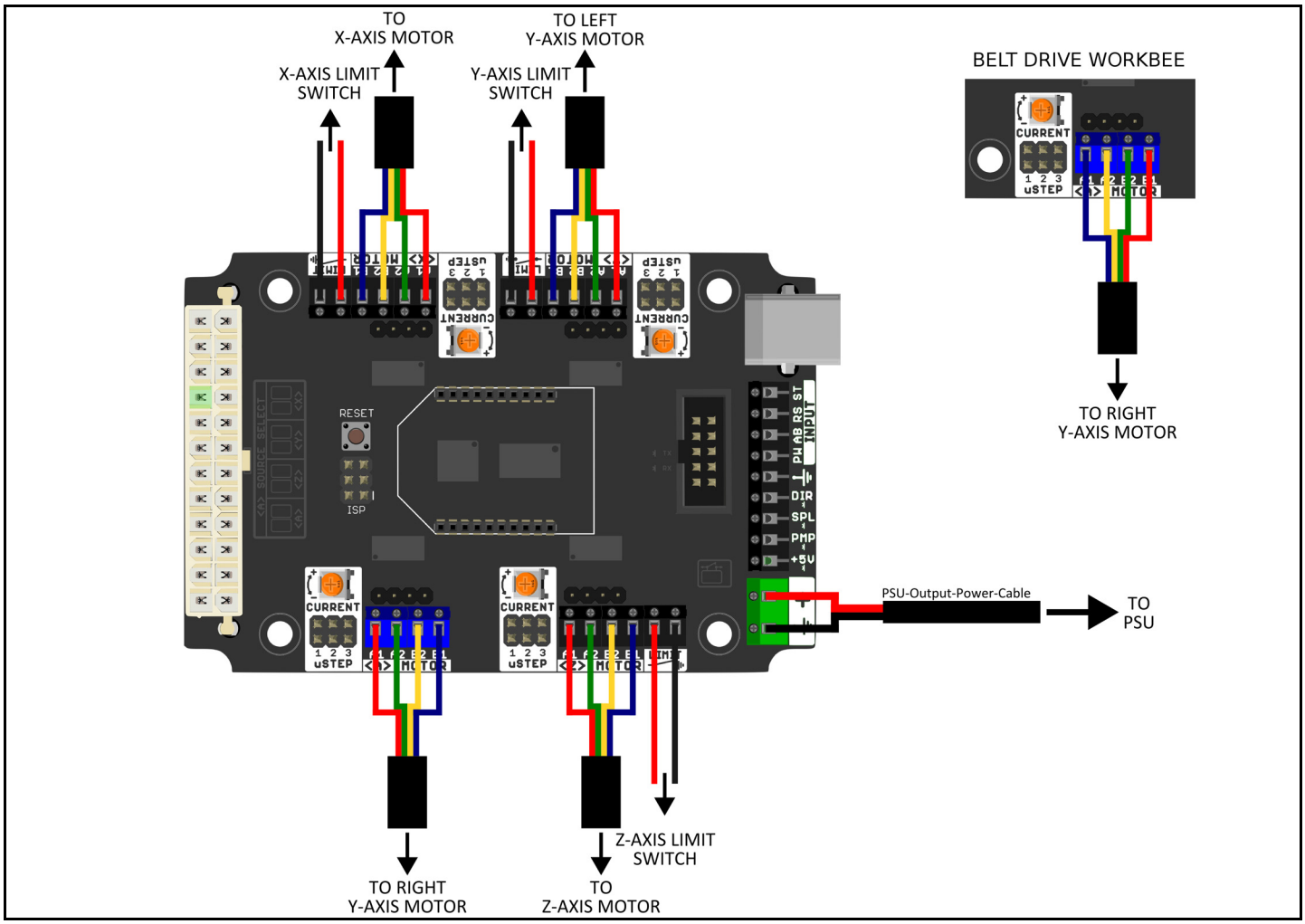
D. Bring the CNC-xPro-Assembly to the back of the WorkBee X-Gantry, and align the M5-Low-Profile-50mm bolt assemblies from Step A/B/C with the backward facing top and bottom slots on the V-Slot-2040-750mm.

E. With the M5-Low-Profile-50mm bolt assemblies aligned, mate the CNC-xPro-Assembly with the V-Slot-2040-750mm slots. It should be roughly 10mm from the end of V-Slot-2040-750mm.

F. Screw each M5-Low-Profile-50mm bolt to engage the M5-Drop-In-Tee-Nut with the slot. Fully tighten each M5-Low-Profile-50mm bolt.

6.0 Wiring & Commissioning

6.1 CNC-xPro Wiring



A. Following the wiring diagram above, strip and connect the second PSU-Output-Power-Cable to the power input terminal on the CNC-xPro. If you have the bluetooth adaptor also attach the provided capacitor, with the correct orientation with regards to the positive and negative side.

B. Connect the 4 x NEMA23-Stepper-Motors to the CNC-xPro as shown above. Take note of the order of the wire colours. For the belt drive version of the WorkBee notice that the colour order is reversed on the A driver (this is also true for a 1000x1500mm Belt & Screw drive WorkBee).

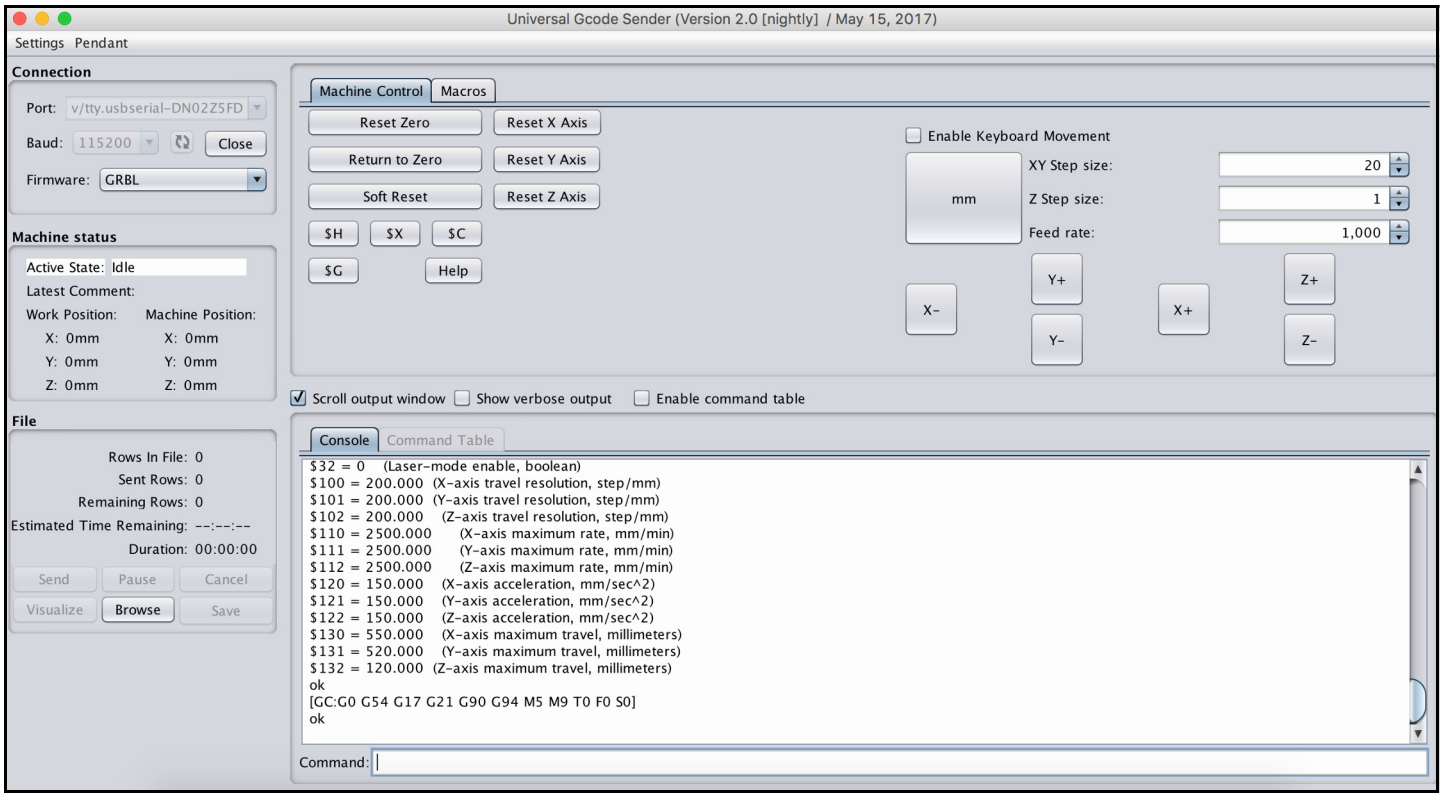
C. Wire in the 3 Limit-Switches, note the polarity of the wires in the image above.

D. Plug the PSU-Output-Power-Cable into the XT60-Male Output on the assembled 24V-360W-Power-Supply. Do not tidy up the wiring just yet, as this is best left until the machine has been fully checked to ensure that it is operating correctly.

E. If interested, it is a good idea to read the CNC-xPro Wiki for more in-depth information: https://github.com/Spark-Concepts/xPRO/wiki

6.2 Software & Machine Settings

6.2.1 Installing Universal G-Code Sender (UGS)



A. Universal G-Code Sender (UGS) is a simple Java-based cross platform G-Code sender. It requires the latest version of Java to be installed on your computer from https://java.com/en/download/ . Download UGS from the first Classic GUI link under the 'Nightly Builds' header from: https://winder.github.io/ugs_website/download/

B. Unzip the folder to a location of your choosing.

C. Run the file named 'UniversalGcodeSender.jar' and UGS should open and look similar to the above image.

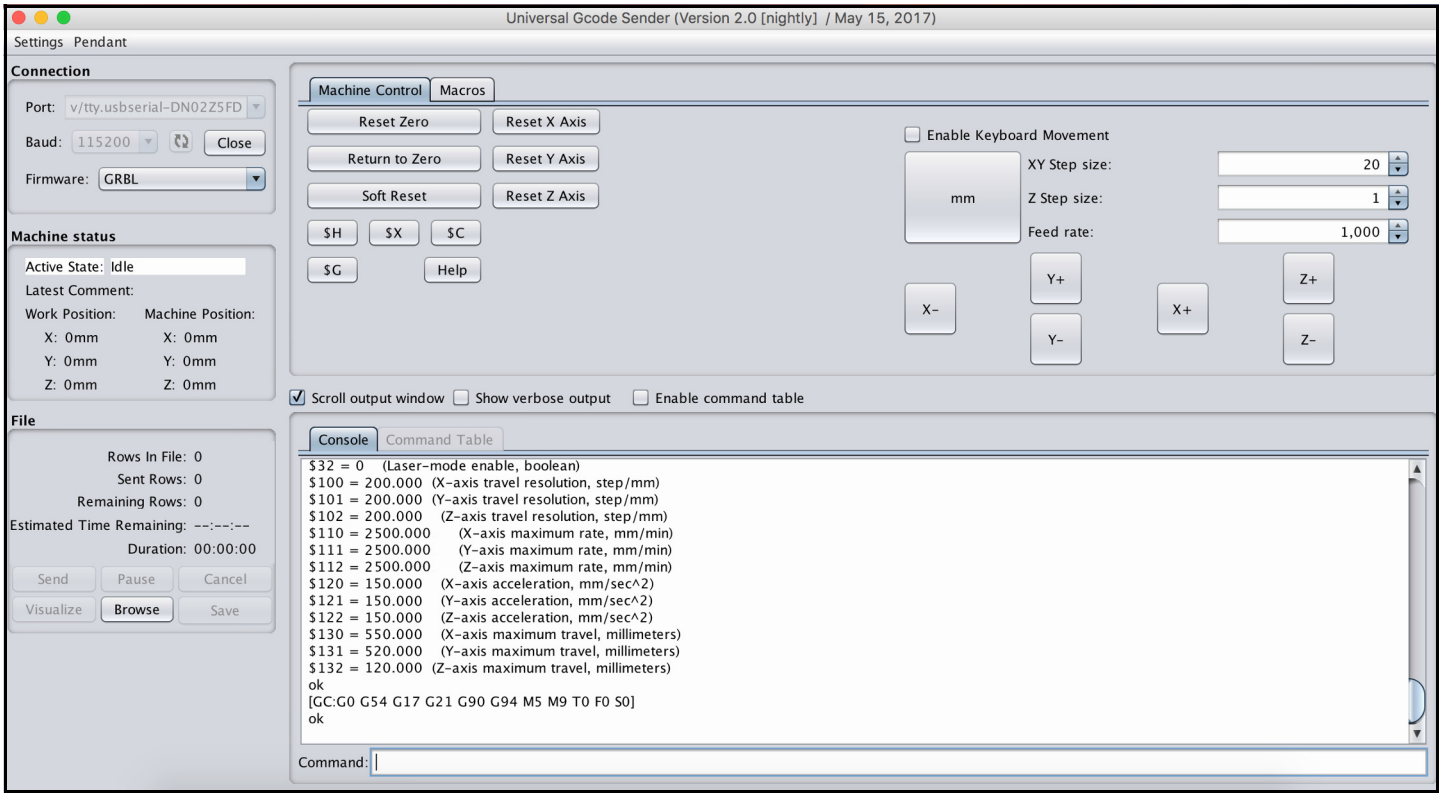
D. Download and install the appropriate drivers for the chip used on the CNC-xPro from: http://www.ftdichip.com/Drivers/VCP.htm. For Windows, under the comments section there is a link to an executable setup file.

E. Using the supplied USB-Cable, connect the CNC-xPro to your computer. It is recommended to get the WorkBee fully operating and multiple cuts completed under USB initially. Once everything is running correctly then use the bluetooth adaptor.

F. In UGS set the 'Baud' to '115200' and 'Firmware' to 'GRBL'. Press the refresh symbol.

G. On the 'Port' drop down list find the CNC-xPro, if on a Mac it should look similar to what is selected in the image above. If on a windows computer, it will show up as a COM port. Once found click 'Open' and UGS should successfully connect to the CNC-xPro. The Console output will show information similar to the above.

6.2.2 Configuring The Firmware



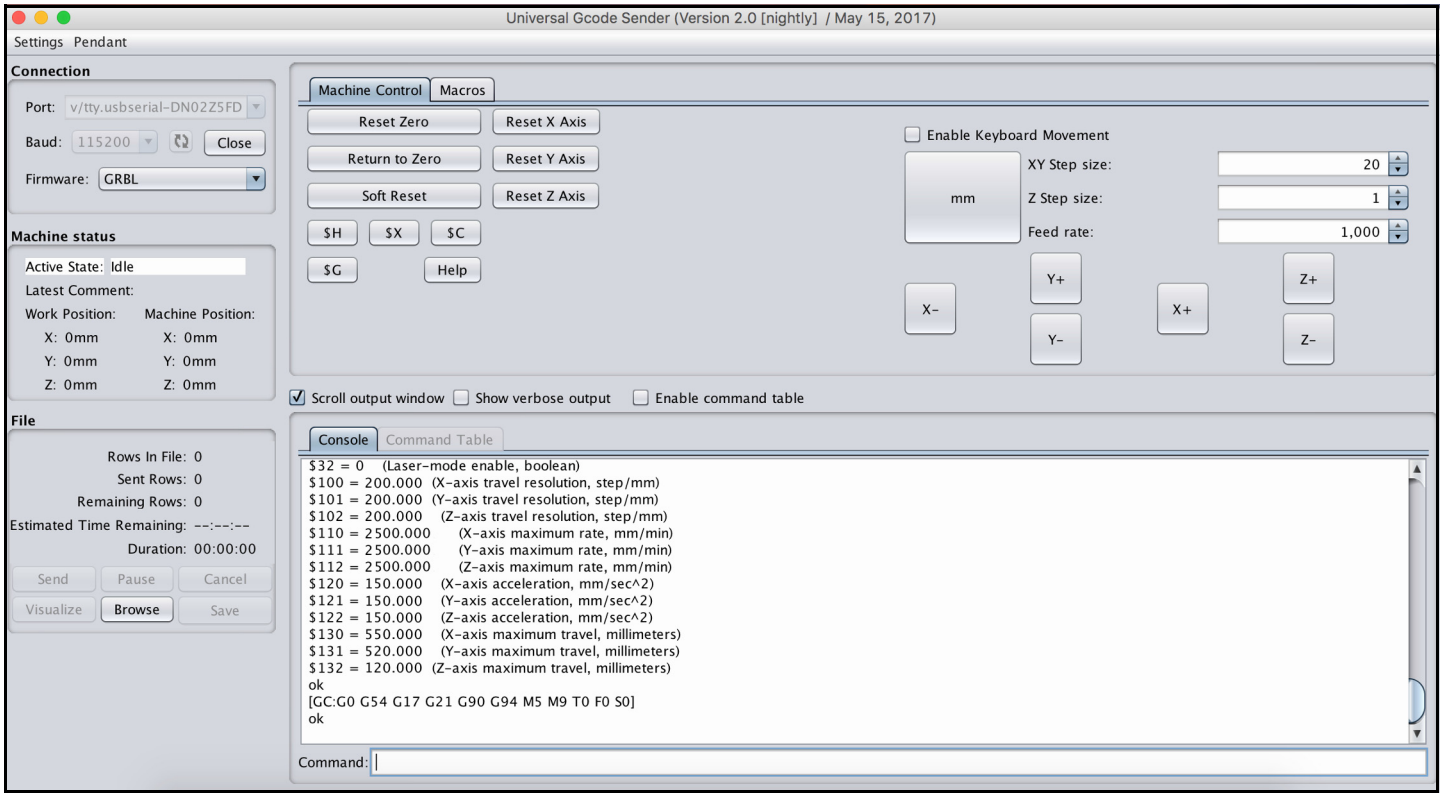
A. Under the large white console output, there is a text input area labeled 'Command:' where G-Code commands can be sent to the CNC-xPro. To bring up the current firmware settings type '$$' and press enter.

B. In Appendix B we have provided a set of recommended settings for each drive version of the WorkBee. Each setting has an id number and a value, and in order to change a setting to a new value, enter $id = new value. For instance, if setting number 100 is incorrect when compared to Appendix B, correct it by entering $100 = 200. Do this for all the settings in Appendix B, choosing the list that is appropriate for the drive of machine you have.

C. Setting number 130 and 131 will depend on the size of the machine you have. The values to enter here should be 200mm less than your X-Axis size and 230mm less than your Y-Axis size. For instance, on a 750x750mm machine the values for 130 and 131 should be 550 and 520 respectively.

D. If interested, it is a good idea to read the GRBL Firmware Wiki for more in-depth information: https://github.com/grbl/grbl/wiki

6.3 Testing



A. Next to each driver on the CNC-xPro, there is a current control pot, and these can be adjusted using the Ceramic-Screwdriver. Rotate clockwise to increase the current, and anti-clockwise to decrease. Turn each one clockwise until it stops, and then back 1/4 of a full turn. This is the ideal setting for the drivers.

B. Switch on the 24V-360W-Power-Supply, and the Dual-30mm-24V-DC-Fan should activate.

C. Looking from the front of the machine, the correct axes machine motion is: X-Axis negative to the left, Y-Axis negative towards the front, Z-Axis negative going down. To test this in UGS, click on the 'Machine Control' tab on the top bar. On the right hand side there are jog controls. Set the 'XY Step size' to 20, 'Z Step size' to 1, 'Feed Rate' to 1000 and select 'millimeters'. Press the 'X-' button to jog the machine in the negative X direction, and the carriage should move to the left. Press 'Y-' and the gantry should move towards the front. Press 'Z-' the Z-Axis should go down.

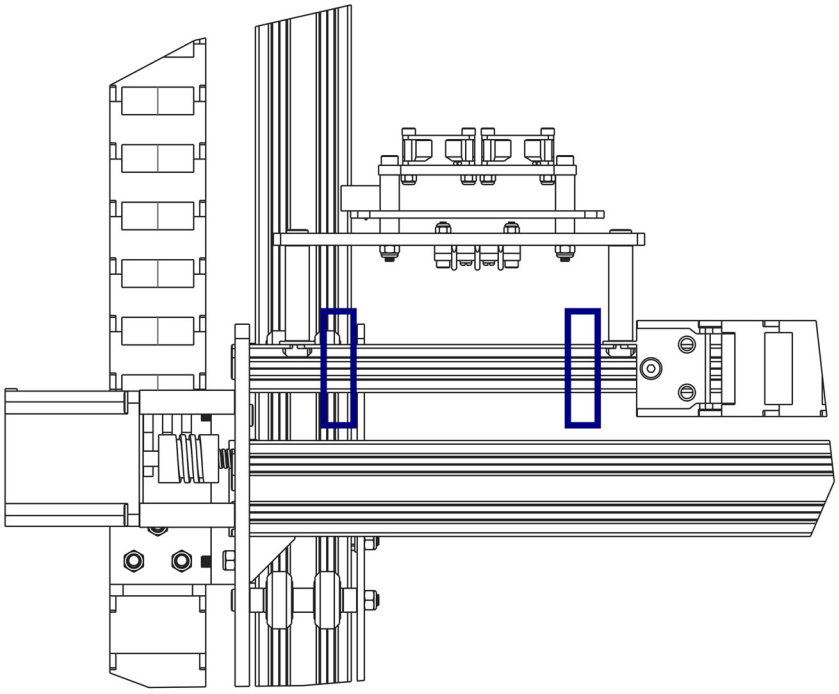
D. If in Step C any of the axes have moved in the opposite directions than should be expected, then the appropriate driver direction needs inverting. The $3 Direction Port Invert setting can be used to correct this issue, this is set by using the table in Appendix B section 2. For instance for a screw drive machine $3 currently is set at 2, setting $3 = 3, would invert the X Axis direction, but leave all the others as they are. Change $3 to the appropriate setting to get all the axes moving in the correct direction.

E. Next the homing cycle needs to be checked, the correct home position is the back right hand corner of the machine. Press the button labeled '$H', this is the Home button. The machine should first move positive upwards, and seek the Z limit switch. Once it has located the Z limit switch, the X-Axis should begin homing to the right, and the Y-Axis should begin homing to the back. Once the machine has located all 3 limit switches, it should pull off them by 3mm. If the machine homes in the incorrect direction on any of the axes, change setting $23 using Appendix B section 2 in the same fashion as Step D. If the machine fails to stop at any of the limit switches check that they are wired correctly according to Section 6.1

F. Testing of the machine is now complete.

6.4 Wire Tidying

ITEM NO	DESCRIPTION	QTY
1	CABLE-TIE-SMALL	2
2	CABLE-TIE-LARGE	2



A. Once the machine is operating correctly, using a Cable-Tie-Large secure the wires in Section 4.2.2 or 4.2.3 to the V-Slot-2040-750mm at the position shown by the right hand rectangle above. One at a time, the wires can be disconnected from the CNC-xPro and trimmed to the correct length.

B. Any excess wire in the PSU-Output-Power-Cable should be pulled out at the 24V-360W-Power-Supply end and bundled using a Cable-Tie-Large. Use 2 x Cable-Tie-Smalls secure the PSU-Output-Power-Cable to the slotted holes on the Y-Drag-Chain-Fixed-End-Mount.

C. Using a Cable-Tie-Large secure the wires in Section 4.2.5 or 4.2.6, and the PSU-Output-Power-Cable to the V-Slot-2040-750mm at the position shown by the left hand rectangle above. One at a time, the wires can be disconnected from the CNC-xPro and trimmed to the correct length.

6.5 Complete

Congratulations! You have completed the Full Kit Assembly of the WorkBee, and we hope you have enjoyed the build. Below are some general pointers meant to guide you in the correct direction when using the machine with UGS.

A. In your CAM package it is recommended that you set the working area to the same size as your intended work piece, and set the zero position to the upper front left corner of the work piece. Export the G-Code file with a GRBL post processor. If a GRBL post processor isn't available, select a standard G-Code file with no post processor and no arcs.

B. In UGS home the machine, and then use the jog commands to position the tip of the cutter to the same zero position set in the CAM package.

C. In the 'Machine Control' tab press 'Reset Zero'. This is a crucial step, and must not be forgotten. This will set the work coordinates to zero, if you need to re-home the machine for any reason, and press 'Return to Zero' it will return to this position.

D. Load your G-Code file in the 'File-Mode' tab. Press 'Send' to begin the file.

E. It is highly recommended that you use a pen in place of a spindle when first using the machine, and have a piece of paper as the work piece. This allows you to get used to the machine in a safe manor. To prevent crushing the pen, work on only one plane in your CAM package and have no negative Z Movements.

F. Some general pointers - avoid at all times moving the machine around by hand, doing this can damage the controller or reset settings. Always plug the machine in via USB and connecting in UGS, before powering it on. Keep the USB Cable and Spindle out of

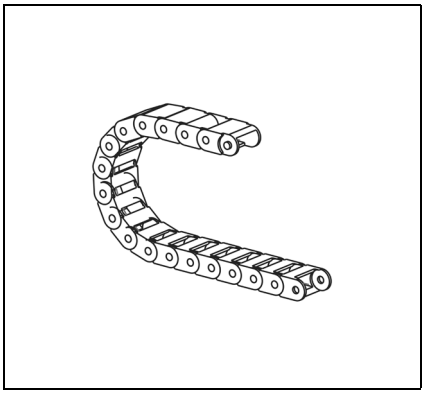
the cable carriers where possible. If you are having issues, please read through Appendix C before contacting us.

7.0 Appendix

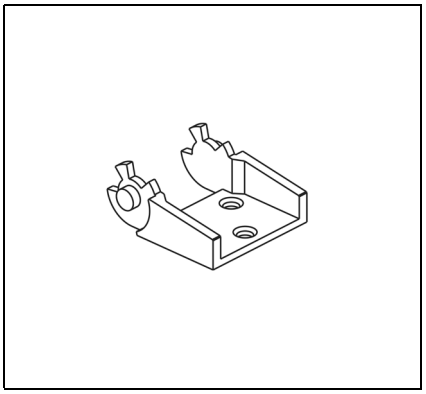
7.1 Appendix A - Kit Contents

Drag Chains Assembly

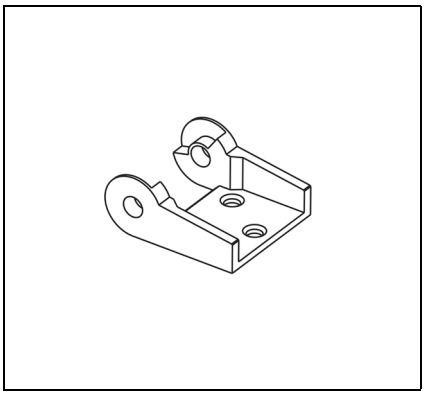
1 x X-Drag-Chain
1 x Y-Drag-Chain



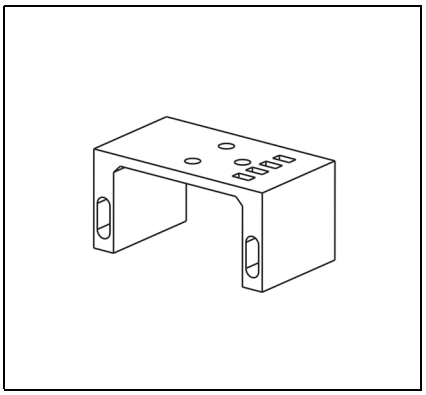
2 x Drag-Chain-Fixed-End



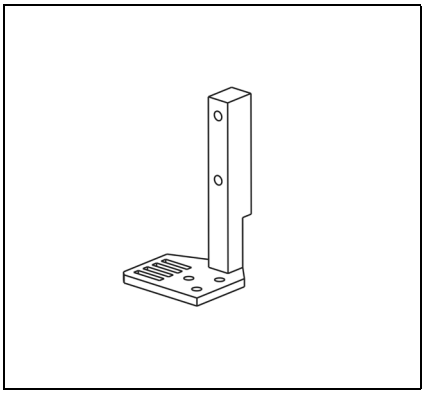
2 x Drag-Chain-Moving-End



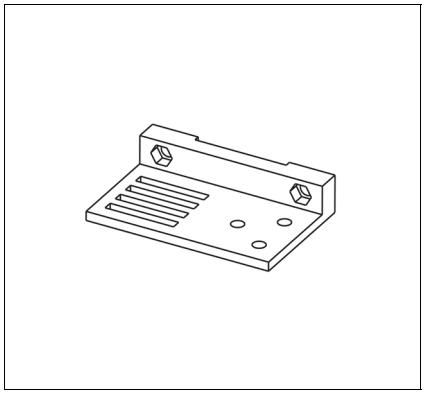
1 x X-Drag-Chain-Moving-End-Mount



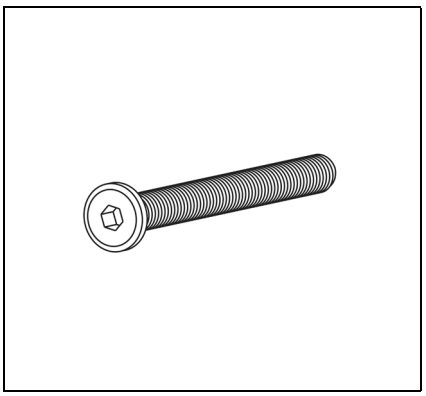
1 x Y-Drag-Chain-Fixed-End-Mount



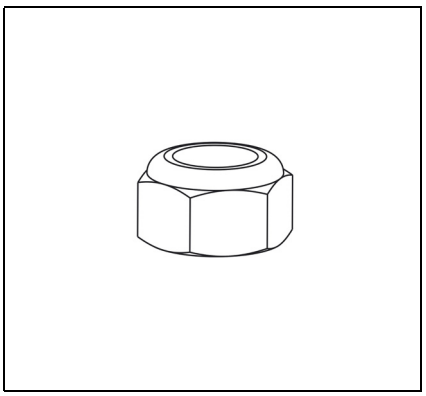
1 x Y-Drag-Chain-Moving-End-Mount



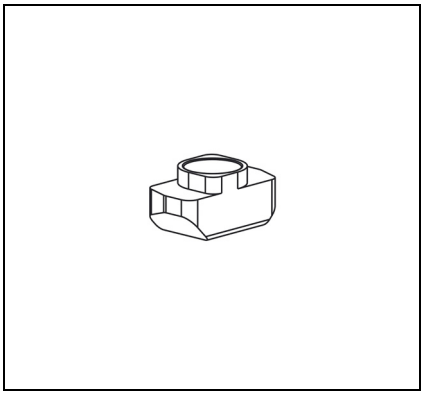
M5-Low-Profile:
1 x 8mm
9 x 15mm
2 x 20mm
2 x 25mm
2 x 55mm



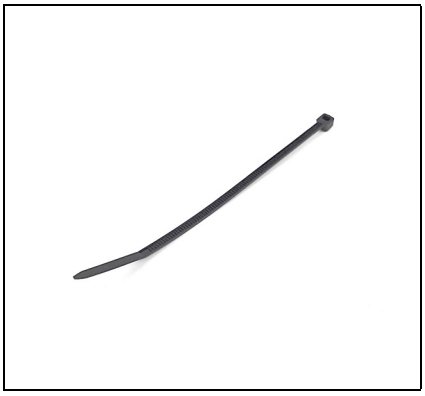
13 x M5-Nyloc-Nut



3 x M5-Drop-In-Tee-Nut

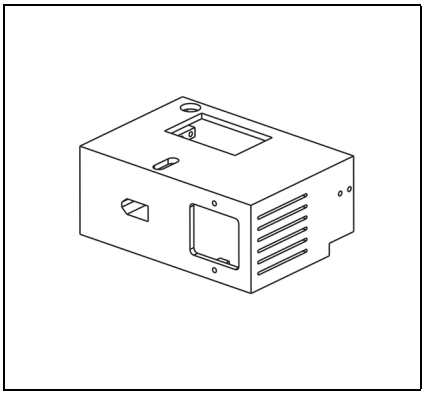


Cable-Tie:
25 x Small
25 x Large

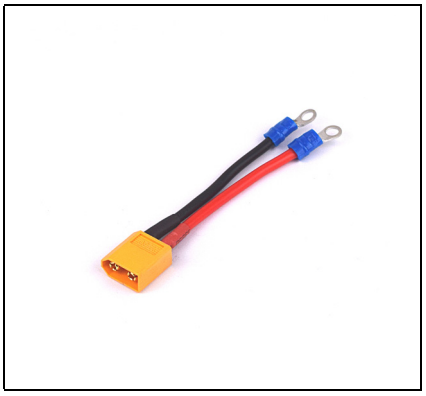


Power Supply Assembly

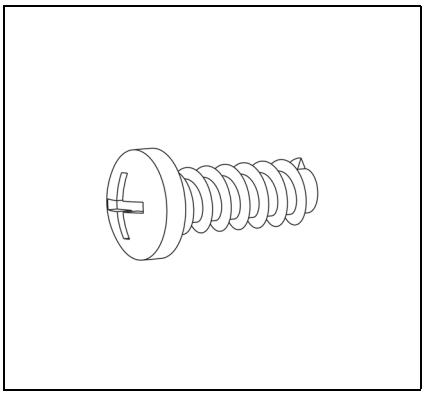
1 x PSU-Cover



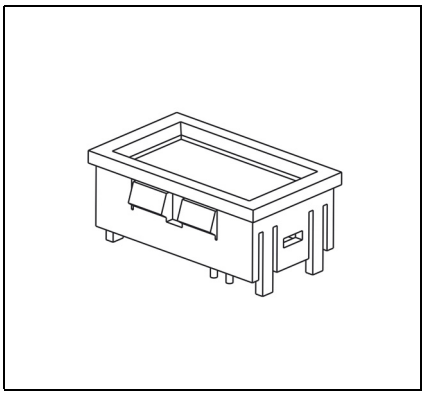
1 x XT60-Male



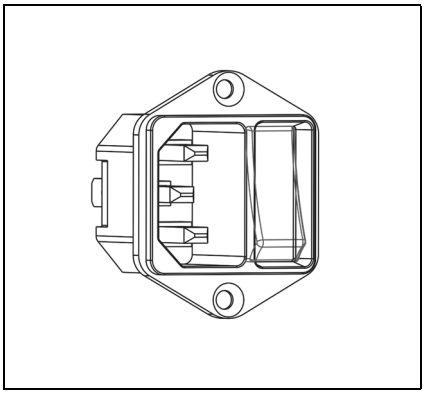
Plastite-Screws:
6 x M3-8mm
2 x M2.5 x 8mm



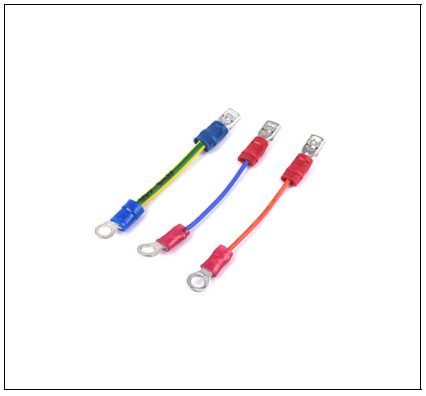
1 x LED-Volt-Meter



1 x IEC-Inlet



IEC-Inlet-Wires:
1 x Live
1 x Neutral
1 x Earth



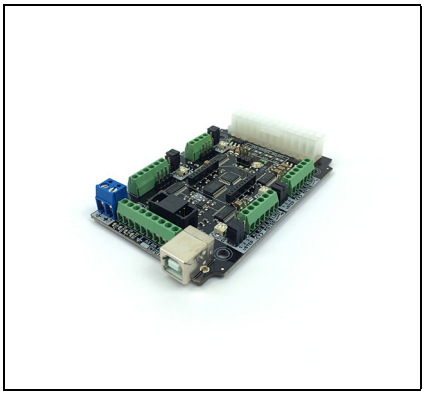
1 x 24V-360W-Power-Supply

1 x Mains-Cable

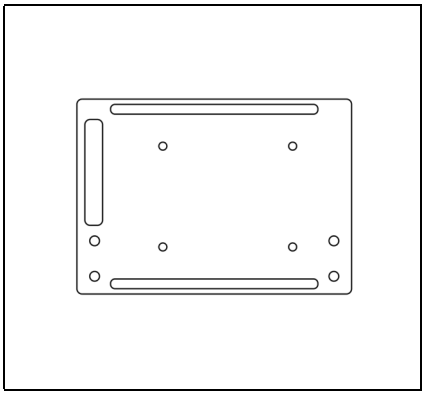
1 x PSU-Output-Power-Cable

CNC-xPro Assembly

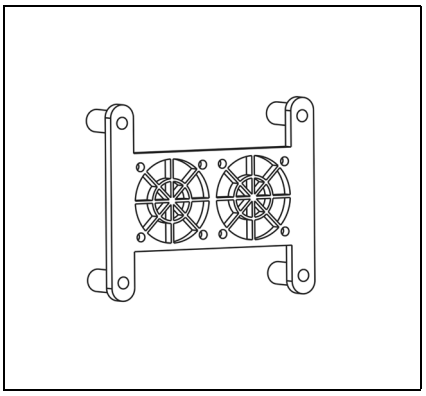
1 x CNC-xPro



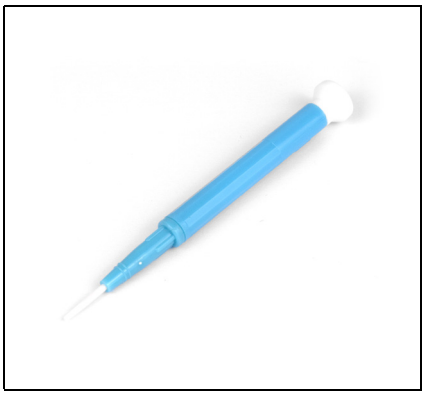
1 x CNC-xPro-Mount



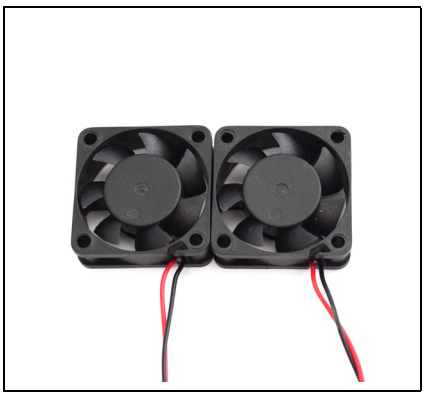
1 x CNC-xPro-Fan-Mount



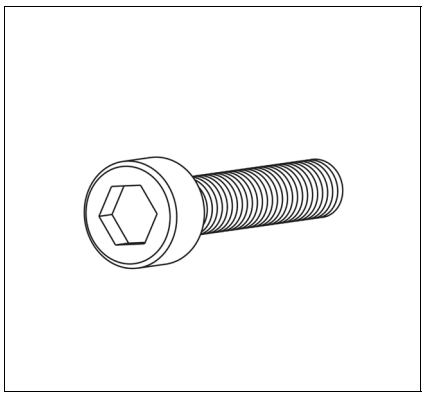
1 x Ceramic-Screw-Driver



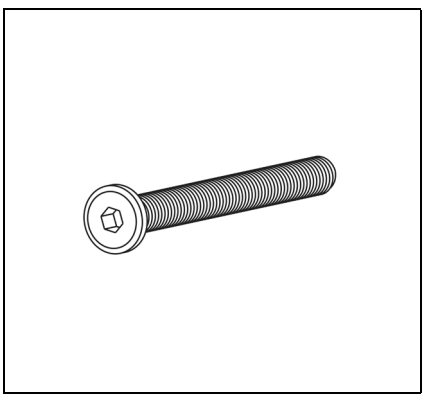
1 x Dual-30mm-24V-DC-Fan



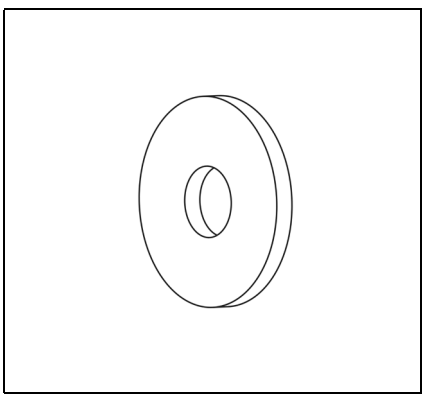
Cap-Head:
8 x M3-20mm
4 x M4-40mm



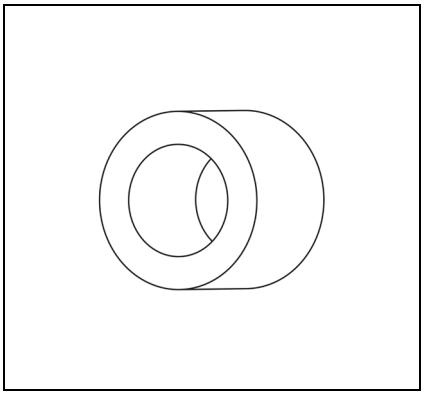
4 x M5-Low-Profile-50mm



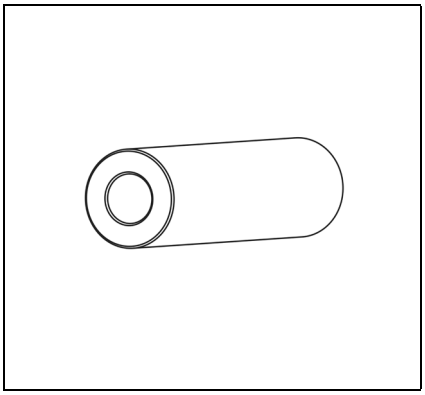
4 x Slot-Washer



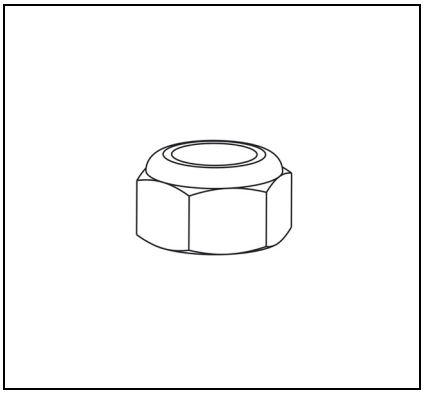
4 x Nylon-Spacer-Quarter-Inch



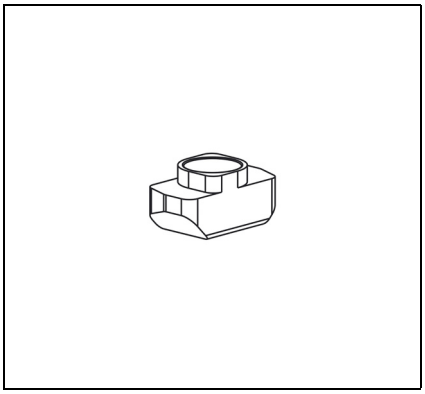
4 x Aluminium-Spacer-OneHalf-Ince



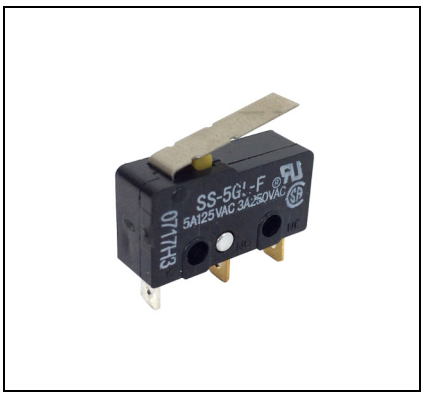
Nyloc-Nuts:
8 x M3
4 x M4



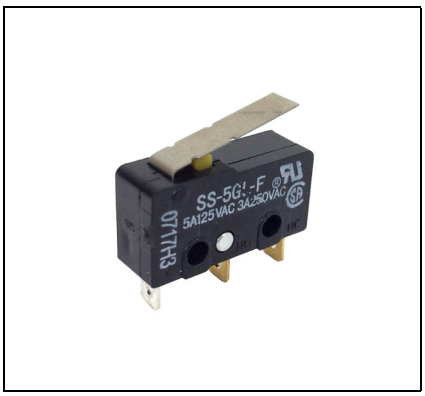
6 x M5-Drop-In-Tee-Nut



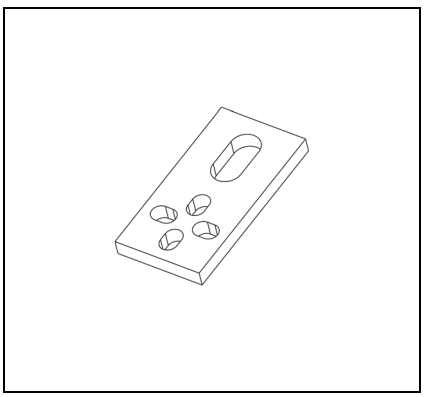
2 x Limit-Switch



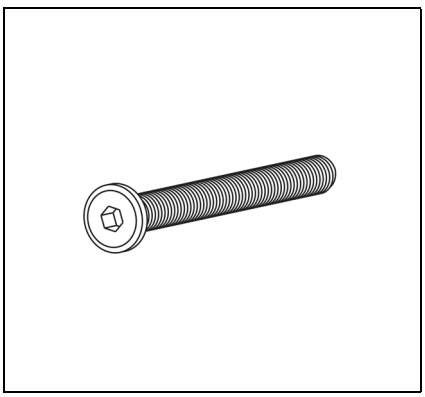
1 x Z-Axis-Limit-Switch (They are the same as the Limit-Switch except the holes are larger)



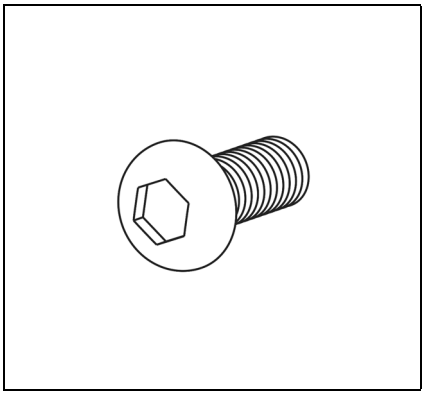
2 x Limit-Switch-Plate



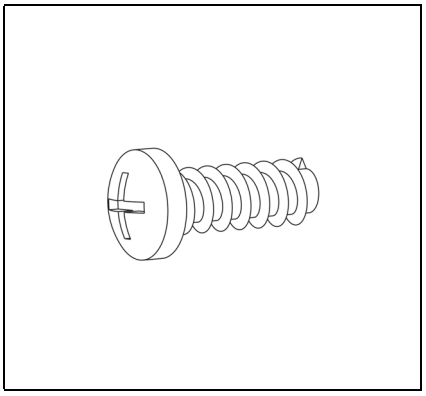
2 x M5-Low-Profile-8mm



2 x M3-Socket-Head-10mm



4 x Plastite-Screw-M3-8mm



1 x USB-Cable

8.0 Appendix B

8.1 Recommended GRBL Settings

The settings below are for a belt driven WorkBee.

```
$0 = 10 (step pulse, usec)
$1 = 255 (step idle delay, msec)
$2 = 0 (step port invert mask:00000000)
$3 = 3 (dir port invert mask:00000011)
$4 = 1 (step enable invert, bool)
$5 = 0 (limit pins invert, bool)
$6 = 0 (probe pin invert, bool)
$10 = 1 (status report mask:00000001)
$11 = 0.020 (junction deviation, mm)
$12 = 0.002 (arc tolerance, mm)
$13 = 0 (report inches, bool)
$20 = 1 (soft limits, bool)
$21 = 0 (hard limits, bool)
$22 = 1 (homing cycle, bool)
$23 = 0 (homing dir invert mask:00000000)
$24 = 100.000 (homing feed, mm/min)
$25 = 1000.000 (homing seek, mm/min)
$26 = 250 (homing debounce, msec)
$27 = 3.000 (homing pull-off, mm)
$30 = 1000 (Maximum spindle speed, RPM)
$31 = 0 (Minimum spindle speed, RPM)
$32 = 0 (Laser-mode enable, boolean)
$100 = 26.667 (x, step/mm)
$101 = 26.667 (y, step/mm)
$102 = 200.000 (z, step/mm)
$110 = 10000 (x max rate, mm/min)
$111 = 10000 (y max rate, mm/min)
$112 = 2500  (z max rate, mm/min)
$120 = 150.000 (x accel, mm/sec^2)
$121 = 150.000 (y accel, mm/sec^2)
$122 = 150.000 (z accel, mm/sec^2)
$130 = 550.000 (x max travel, mm)
$131 = 520.000 (y max travel, mm)
$132 = 120.000 (z max travel, mm)
```

The settings below are for a screw driven WorkBee.

```
$0 = 10 (step pulse, usec)
$1 = 255 (step idle delay, msec)
$2 = 0 (step port invert mask:00000000)
$3 = 2 (dir port invert mask:00000010)
$4 = 1 (step enable invert, bool)
$5 = 0 (limit pins invert, bool)
$6 = 0 (probe pin invert, bool)
$10 = 1 (status report mask:00000001)
$11 = 0.020 (junction deviation, mm)
$12 = 0.002 (arc tolerance, mm)
$13 = 0 (report inches, bool)
$20 = 1 (soft limits, bool)
$21 = 0 (hard limits, bool)
$22 = 1 (homing cycle, bool)
$23 = 0 (homing dir invert mask:00000000)
$24 = 100.000 (homing feed, mm/min)
$25 = 1000.000 (homing seek, mm/min)
$26 = 250 (homing debounce, msec)
$27 = 3.000 (homing pull-off, mm)
$30 = 1000 (Maximum spindle speed, RPM)
$31 = 0 (Minimum spindle speed, RPM)
$32 = 0 (Laser-mode enable, boolean)
$100 = 200.000 (x, step/mm)
$101 = 200.000 (y, step/mm)
$102 = 200.000 (z, step/mm)
$110 = 2500 (x max rate, mm/min)
$111 = 2500 (y max rate, mm/min)
$112 = 2500 (z max rate, mm/min)
$120 = 150.000 (x accel, mm/sec^2)
$121 = 150.000 (y accel, mm/sec^2)
$122 = 150.000 (z accel, mm/sec^2)
$130 = 550.000 (x max travel, mm)
$131 = 520.000 (y max travel, mm)
$132 = 120.000 (z max travel, mm)
```

The settings below are for a belt & screw driven WorkBee.

```
$0 = 10 (step pulse, usec)
$1 = 255 (step idle delay, msec)
$2 = 0 (step port invert mask:00000000)
$3 = 2 (dir port invert mask:00000010)
$4 = 1 (step enable invert, bool)
$5 = 0 (limit pins invert, bool)
$6 = 0 (probe pin invert, bool)
$10 = 1 (status report mask:00000001)
$11 = 0.020 (junction deviation, mm)
$12 = 0.002 (arc tolerance, mm)
$13 = 0 (report inches, bool)
$20 = 1 (soft limits, bool)
$21 = 0 (hard limits, bool)
$22 = 1 (homing cycle, bool)
$23 = 0 (homing dir invert mask:00000000)
$24 = 100.000 (homing feed, mm/min)
$25 = 1000.000 (homing seek, mm/min)
$26 = 250 (homing debounce, msec)
$27 = 3.000 (homing pull-off, mm)
$30 = 1000 (Maximum spindle speed, RPM)
$31 = 0 (Minimum spindle speed, RPM)
$32 = 0 (Laser-mode enable, boolean)
$100 = 200.000 (x, step/mm)
$101 = 26.667 (y, step/mm)
$102 = 200.000 (z, step/mm)
$110 = 2500 (x max rate, mm/min) (Go upto 7500)
$111 = 10000 (y max rate, mm/min) (Go upto 7500)
$112 = 2500  (z max rate, mm/min) (Go upto 1500)
$120 = 150.000 (x accel, mm/sec^2)
$121 = 150.000 (y accel, mm/sec^2)
$122 = 150.000 (z accel, mm/sec^2)
$130 = 800.000 (x max travel, mm)
$131 = 1270.000 (y max travel, mm)
$132 = 120.000 (z max travel, mm)
```

8.2 Invert Mask Table

Setting Value	Mask	Invert X	Invert Y	Invert Z
0	00000000	N	N	N
1	00000001	Y	N	N
2	00000010	N	Y	N
3	00000011	Y	Y	N
4	00000100	N	N	Y
5	00000101	Y	N	Y
6	00000110	N	Y	Y
7	00000111	Y	Y	Y

9.0 Appendix C

9.1 Common Trouble Shooting Questions

The problems and answers below are the most common issues that we have received in our experience. If you are having an issue, before contacting us, we recommend reading through this beforehand.

Problem - LED Volt Meter is not displaying anything.

Check it is wired correctly - if it is wired correctly please email us asking for a replacement and one will be sent out right away.

Problem - The voltage drops on the LED Volt Meter when turning on the machine.

There is a switch on the side the power supply to change the input voltage. Make sure this is set to match your countries voltage supply.

Problem - Motors are not moving when issuing a jog command.

Check $4 = 1.

Problem - A motor is juddering, but not turning.

This is mostly due to either the motor being wired in an incorrect color order, or there is a loose wire connection.

Problem - When issuing a Y-Axis jog command, it just vibrates but doesn't move.

This is a common error on a belt drive machine, as the motors have to be turning in opposite directions. Go back through section 6.1, and specifically look at the top right of the image regarding belt drive wiring.

Problem - Soft limit errors every time when running a file.

Check $130, $131, & $132 are set to the correct value for your size machine. Make sure the CAM program is setup in millimeters. Make sure that work zero is set in a position which allows for enough travel on each axis to complete the job. Most CAM programs have a safe Z Height setting, so make sure there is also enough positive Z travel from work zero to accommodate this. Wherever the zero position is set in the CAM program, you need to home the machine and then move the tip of the cutter to this position, and press the 'Reset Zero' button

Problem - When cutting, circles are not circle.

This is most likely because either a coupler or pulley is slipping on the motor shaft. Check screws are tight, and one of them is on the flat portion of the motor shaft.

Problem - Machine goes randomly off course mid job or machine stops.

Electrical interference is a common cause of this problem. Make sure the USB & router cable are outside the drag chains, and sleep/low power mode is turned off on the computer. Carry out a long dummy run with a pen (i.e no router and no dust extraction) and see if the problem persists. If it still persists, try another computer.

Problem - Machine was working correctly, now suddenly behaving strangely.

Sometimes the $$ settings can change value, this usually happens if the machine is moved around by hand. Re-check all $$ values to make sure they are set correctly.

Problem - Can’t connect to CNC xPro/GRBL is not loading.

First try another USB Cable. Then try another computer. The last thing to try is resetting the firmware on the controller. To do this download the Arduino IDE: https://www.arduino.cc/en/Main/Software

Connect the CNC xPro via USB and make sure Universal G-Code sender is closed. Open the Arduino IDE. In the Arduino IDE set Tools > Board to ‘Arduino/Genuino Uno’. Set Tools > Port to the port the CNC xPro is connected to. Set Tools > Programmer to ‘AVRISP mkII’

Open Files > Examples > EEPROM > eeprom_clear and then click the upload button (Second button in from the left, is a arrow pointing to the right) if this gives an error please contact us. If you get the ‘Done uploading message’ follow these steps to upload GRBL: https://github.com/grbl/grbl/wiki/Compiling-Grbl

10.0 Appendix D

10.1 Appendix D - Critical Machine Sizes

The table below shows the critical dimensions for the WorkBee CNC Machine.

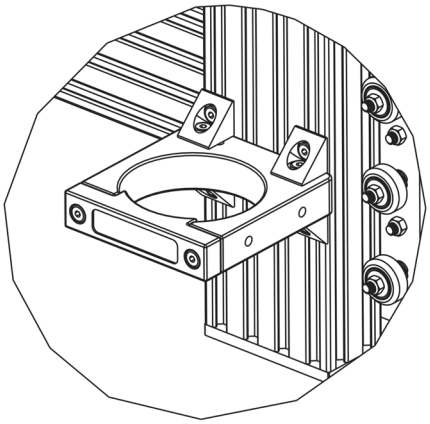
- Machine size is equal to the C-Beam extrusions lengths that make up the frame.
- Working area is the maximum workable area.
- Spoilerboard size is the maximum size of the spoilerboard.
- Footprint is equal to the minimum table size that is required for the WorkBee to sit on.
- The WorkBee requires a physical volume which is greater than the footprint. This is the overall machine volume. This is equal to the minimum physical space which is needed.

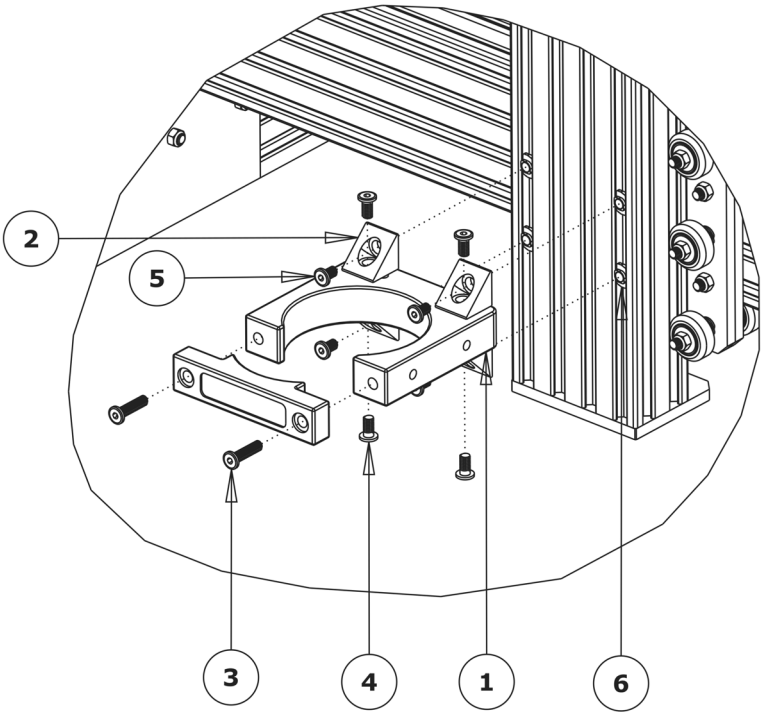
Machine Size	Working Area (X x Ymm)	Spoilerboard Size (X x Ymm)	Footprint (X x Ymm)	Overall Machine Volume (X x Y x Zmm)
750 x 750mm Belt Drive	550 x 520mm	620 x 750mm	810 x 790mm	880 x 860 x 510mm
750 x 750mm Screw Drive	550 x 520mm	620 x 750mm	810 x 790mm	895 x 875 x 510mm
750 x 1000mm Belt Drive	550 x 770mm	620 x 1000mm	810 x 1040mm	880 x 1110 x 510mm
750 x 1000mm Screw Drive	550 x 770mm	620 x 1000mm	810 x 1040mm	895 x 1125 x 510mm
1000 x 1000mm Belt Drive	800 x 770mm	870 x 1000mm	1060 x 1040mm	1130 x 1110 x 510mm
1000 x 1000mm Screw Drive	800 x 770mm	870 x 1000mm	1060 x 1040mm	1145 x 1125 x 510mm
1000 x 1500mm Belt Drive	800 x 1270mm	870 x 1500mm	1060 x 1540mm	1130 x 1610 x 510mm
1000 x 1500mm Belt & Screw Drive	800 x 1270mm	870 x 1500mm	1060 x 1540mm	1170 x 1610 x 510mm
1500 x 1500mm Belt Drive	1300 x 1270mm	1370 x 1500mm	1560 x 1540mm	1630 x 1610 x 510mm

11.0 Appendix E

11.1 Appendix E - Router Mount Assembly

ITEM NO	DESCRIPTION	QTY
1	ROUTER-MOUNT	1
2	ANGLE-CORNER	4
3	M5-LOW-PROFILE-20MM	2
4	M5-LOW-PROFILE-10MM	4
5	M5-LOW-PROFILE-8MM	4
6	M5-DROP-IN-TEE-NUT	4





A. On the outer most holes on the Router-Mount attach 4 x Angle-Corners using 4 x M5-Low-Profile-10mm Bolts. Make sure the angle corners are flush with the back of the Router-Mount.

B. Attach the Router-Mount to the Z-Axis extrusions using 4 x M5-Low-Profile-8mm Bolts and 4 x M5-Drop-In-Tee-Nuts. Make sure the Router-Mount is perpendicular to the extrusion. The Router-Mount position depends on what jobs you are planning to do, however 1/3 of the way up the extrusion is a good position for normal work.

C. Clamp the router inside the Router-Mount using the front plate and two M5-Low-Profile-20mm Bolts.