

# C-Beam Machine

## Electrical Assembly Instructions





# Table of Contents

<b>1.0</b>	<b>Getting Started</b>	<b>2</b>
1.1	About The Kit	3
1.2	Check Product Contents	3
1.3	Tools Required	3
1.4	Notes on Assembly	4
<b>2.0</b>	<b>Power Supply Assembly</b>	<b>5</b>
2.1	Output	6
2.1.1	Securing XT60-Male Outputs .....	6
2.1.2	Inserting LED-Volt-Meter .....	7
2.2	Input	8
2.2.1	IEC-Inlet Wires .....	8
2.2.2	Attaching IEC-Inlet.....	9
2.3	Connecting PSU-Cover	10
2.3.1	Connecting Wires.....	10
2.3.2	Attaching PSU-Cover .....	12
2.3.3	Testing .....	13
2.3.4	Mounting .....	14
<b>3.0</b>	<b>CNC xPro Assembly</b>	<b>15</b>
3.0.1	Terminal-Block Attachment.....	16
3.0.2	Fan Mount Assembly.....	17
3.0.3	Attaching The CNC-xPro .....	18
3.0.4	Fans Wiring .....	19
3.0.5	Mounting the CNC-xPro Assembly.....	20
<b>4.0</b>	<b>Wiring &amp; Commissioning</b>	<b>22</b>
4.1	CNC-xPro Wiring	23
4.1.1	Wiring Mounts .....	23
4.1.2	Wire Routing .....	24
4.1.3	Connecting the CNC-xPro .....	26
4.2	Software & Machine Settings	27
4.2.1	Installing Universal G-Code Sender (UGS) .....	27
4.2.2	Configuring The Firmware .....	28
4.3	Testing	29
4.4	Complete	31
<b>5.0</b>	<b>Appendix</b>	<b>33</b>
5.1	Appendix A - Kit Contents	34
<b>6.0</b>	<b>Appendix B</b>	<b>39</b>
6.1	Recommended GRBL Settings	40

# 1.0 Getting Started

## **1.1 About The Kit**

The C-Beam Machine is a perfect Hobby CNC to manufacturer custom plates out of wood, plastics, or even aluminum. In many projects it happens, that an off the shelf plate does not suit your needs, a C-Beam machine is the solution to this problem. A C-Beam Machine offers the freedom to create the custom plates you need, right away, no long waits, no extortionate prices.

Instructions to build the mechanical portion of the machine can be found by watching this video: <https://www.youtube.com/watch?v=HVR8pABCHXI>

This manual mainly covers the electrical setup of the machine. Ideally, this kit should be started straight after completing the mechanical assembly. This kit aims to provide you with what you need to turn the mechanical kit into a working moving machine. To go from this kit to a machine which can begin cutting, you will need a router and a spoiler board with a system to mount the workpiece that you wish to cut.

The C-Beam machine has a very large community of users, who can mostly be found at <http://openbuilds.com>. It is free to sign up to this community and it will allow you to share your builds, interact with other members, and download useful community created resources. There is a specific build thread for the C-Beam Machine, and we would love to see your machines and what you make with them: <http://openbuilds.com/builds/c-beam<sup>TM</sup>-machine-plate-maker.2020/>

## **1.2 Check Product Contents**

Apart from the mechanical portion, when you receive your kit, the first thing you should do is to 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](mailto: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**

The assembly has been split into 4 sections: Power Supply Assembly, 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.

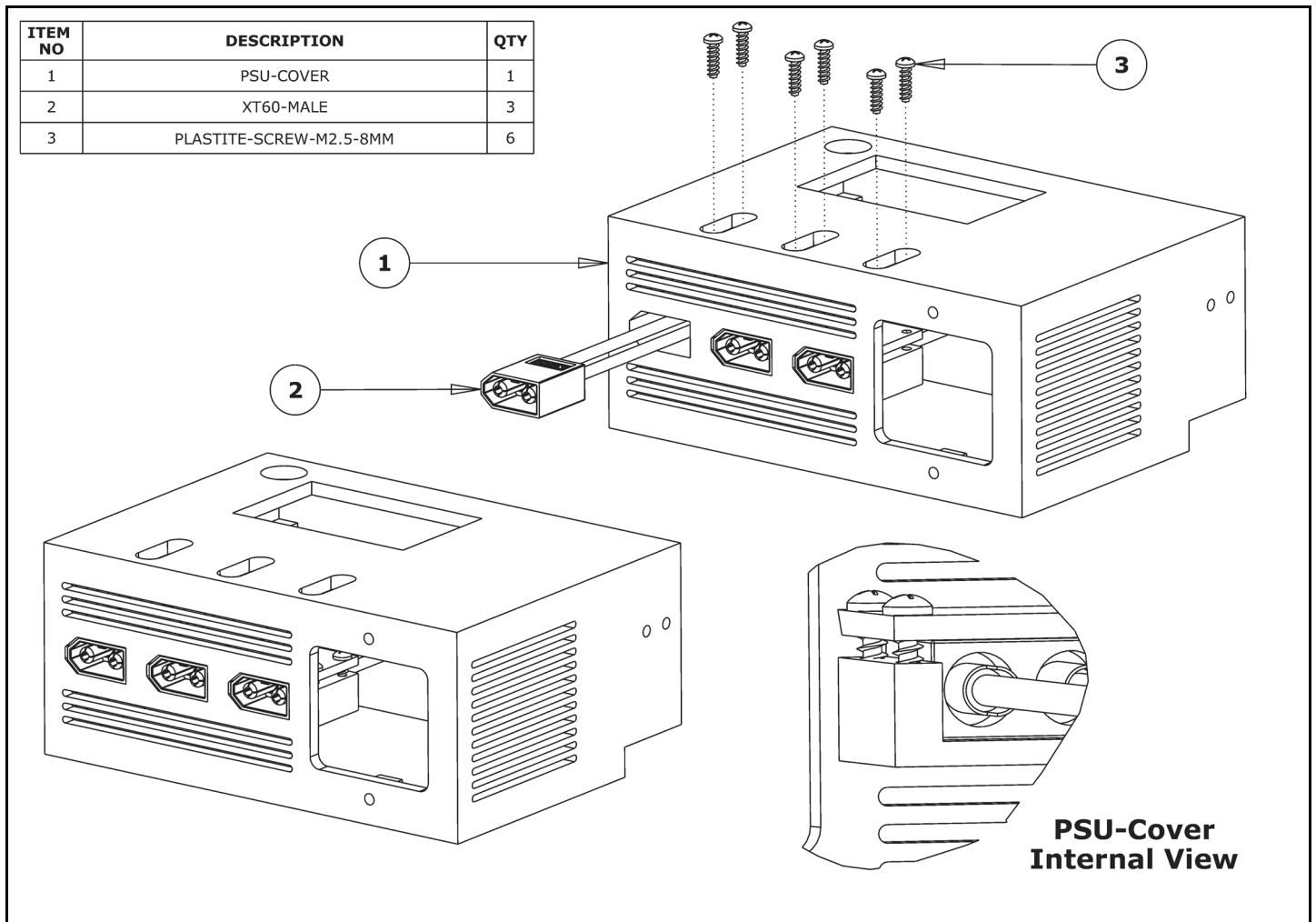
The polarity is indicated by the color of the wire, not by the color of the connectors at each end. A positive wire is red or brown, negative is black, and earth is green and yellow.

The controller is sensitive to electrical interference. Therefore we are now providing an interference kit with machine to reduce this. In this kit ferrite beads are provided. Clip the Motor-Ferrite's on the motor wires as close as possible to the CNC-xPro. Clip the PSU-Output-Ferrite's on the PSU-Output-Power-Cable as close as possible to the 24V-360W-Power-Supply. And the Router-Ferrite, as close as to your router as possible.

# 2.0 POWER SUPPLY ASSEMBLY

## 2.1 Output

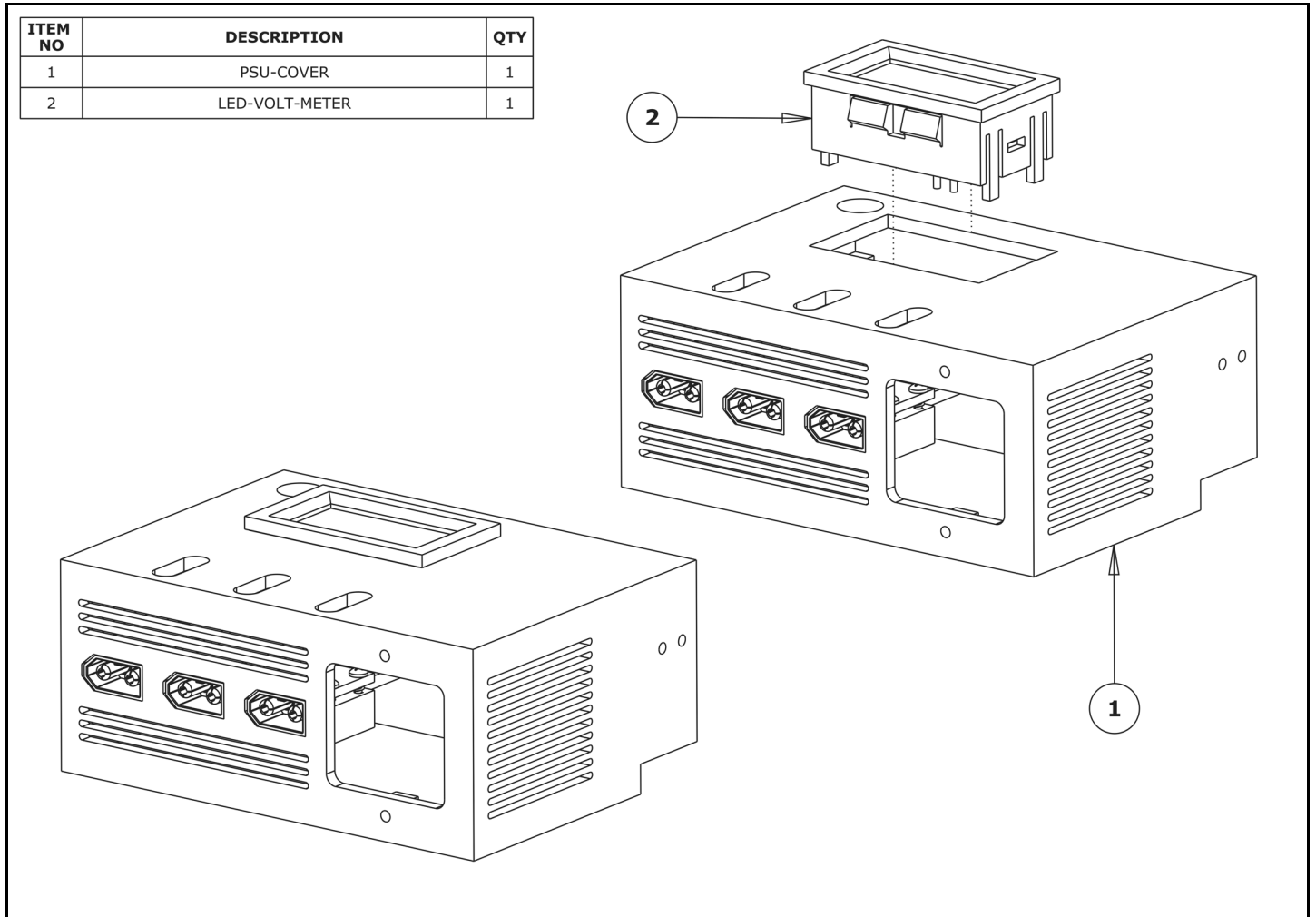
### 2.1.1 Securing XT60-Male Outputs



- A.** Insert the XT60-Male connectors into the provided insets on the PSU-Cover. They should sit flush with the front of the PSU-Cover. Completion of this kit only requires 2 x XT60-Male connectors. The left-most XT60-Male connector is not needed for the operation of this machine, but is included so you have the option to add additional accessories. For safety reasons, if you do not intend to use it, do not attach it to the PSU-Cover, and leave that inset empty.
- B.** Secure each 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.



## 2.1.2 Inserting LED-Volt-Meter

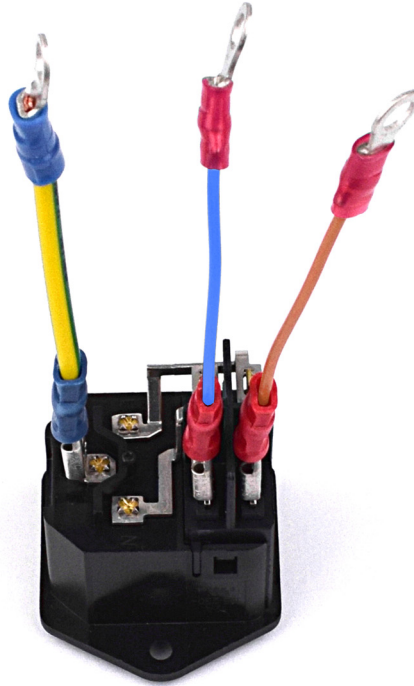


- A.** Gently push the LED-Volt-Meter into the provided gap on the top of the PSU Cover. The wires on the LED-Volt-Meter should be oriented to the front of the PSU-Cover.

## **2.2 Input**

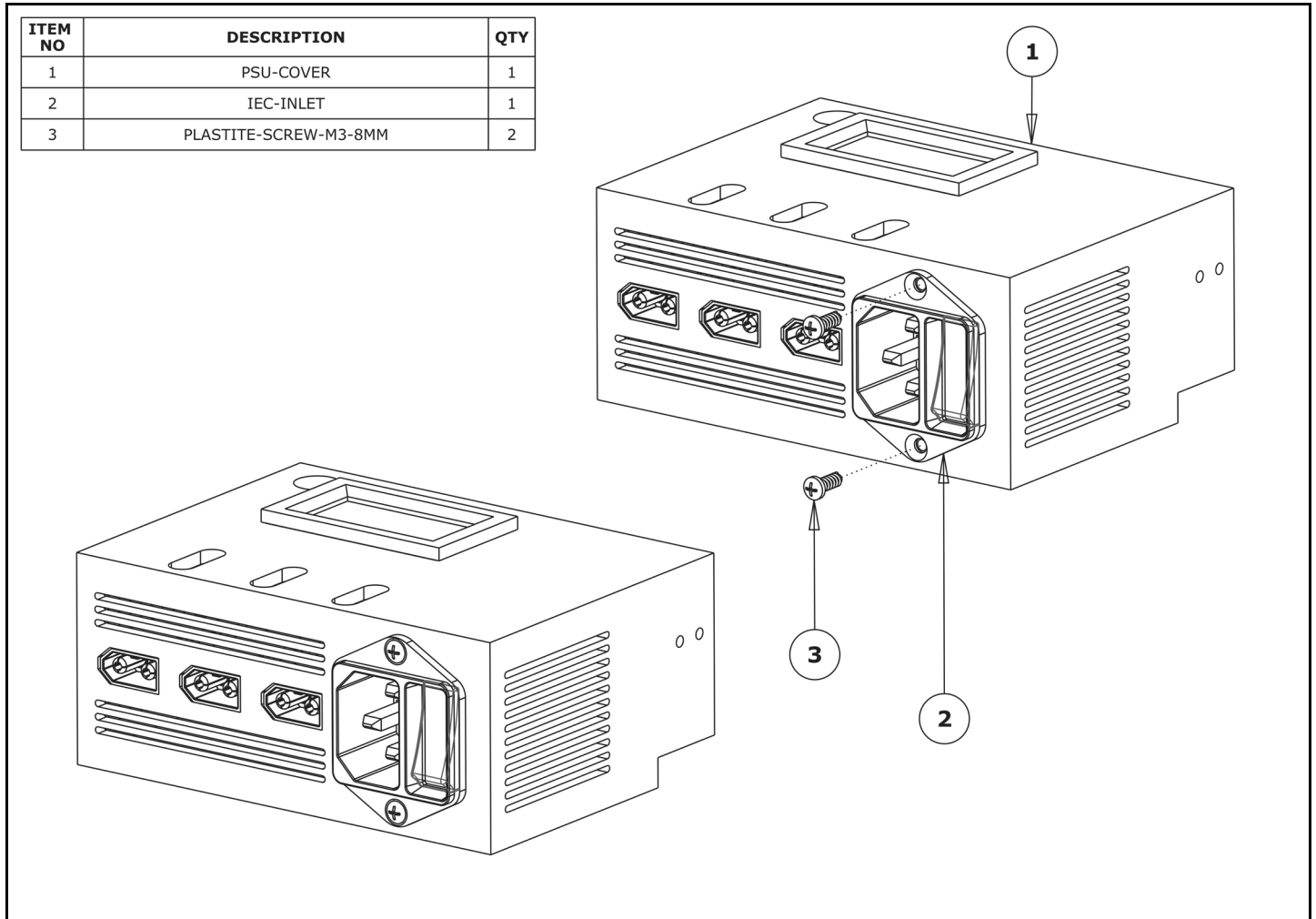
### **2.2.1 IEC-Inlet Wires**

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.

## 2.2.2 Attaching IEC-Inlet

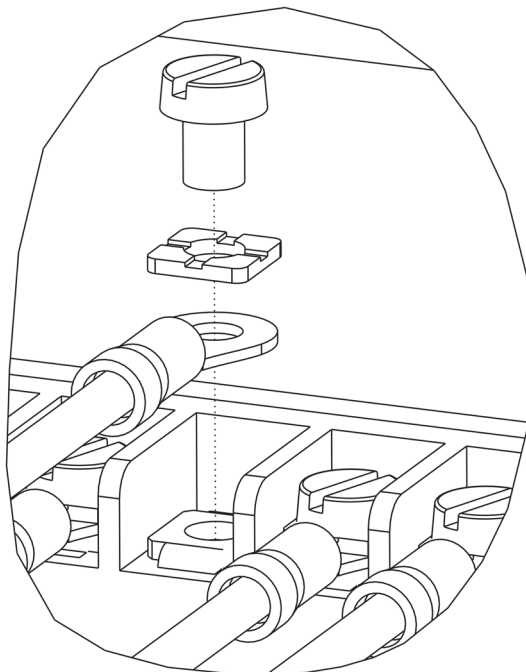
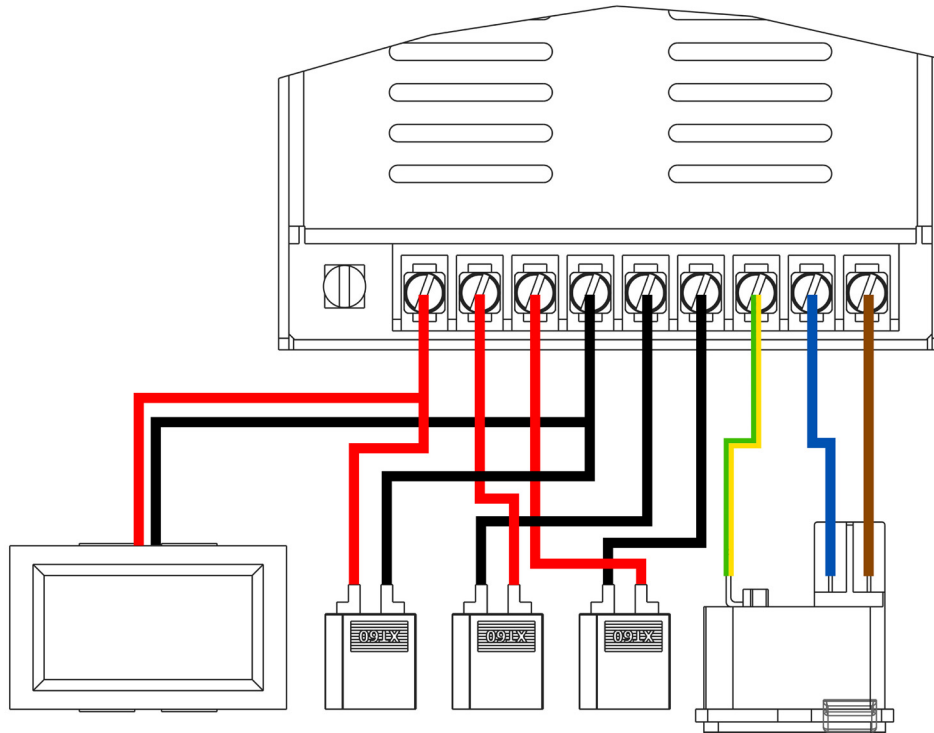


- A.** Secure the assembled IEC-Inlet to the PSU-Cover using 2 x Plastite-Screw-M3-8mm. Ensure the switch is on the right hand side.

## **2.3 Connecting PSU-Cover**

### **2.3.1 Connecting Wires**

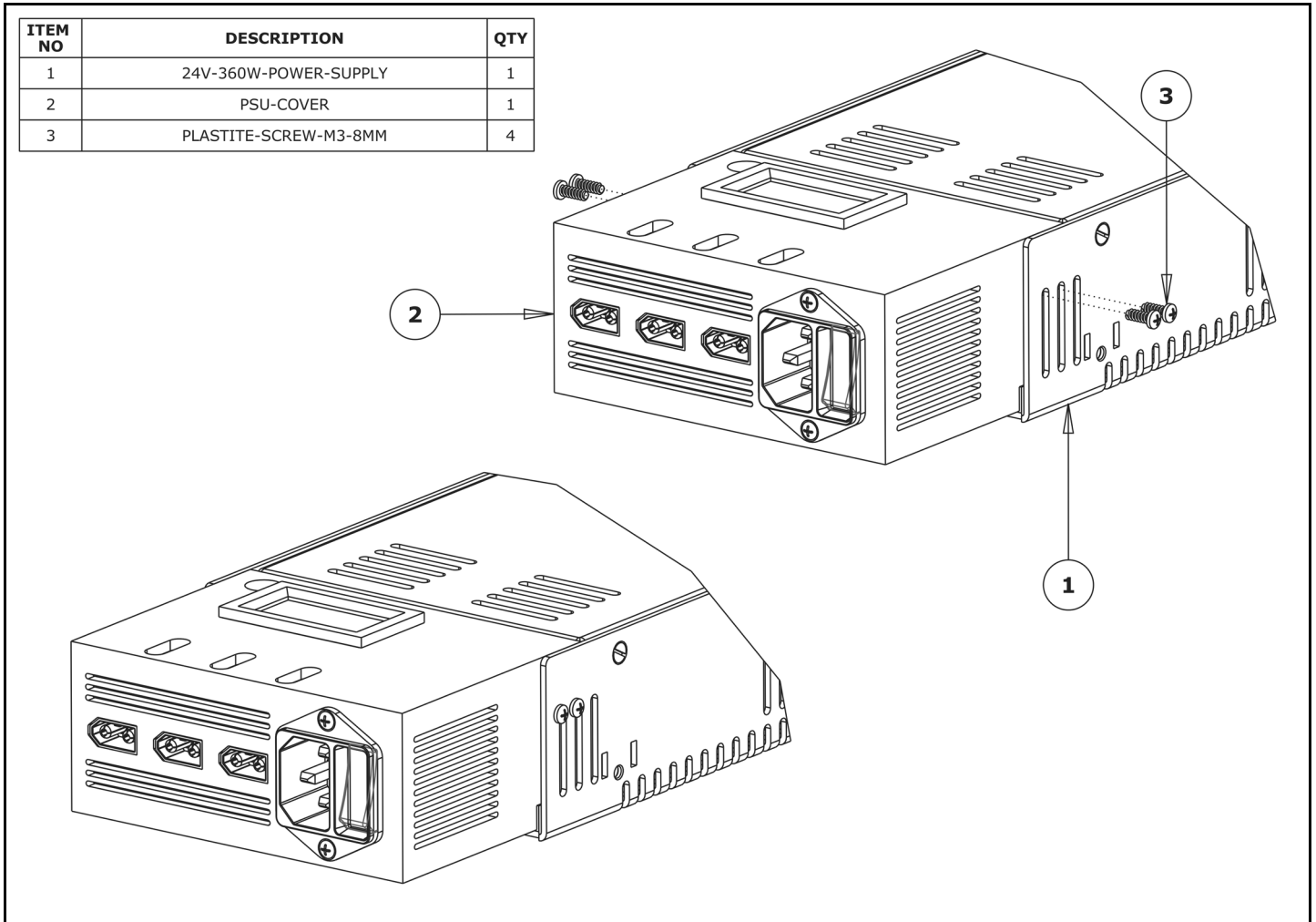
ITEM NO	DESCRIPTION	QTY
1	24V-360W-POWER-SUPPLY	1
2	PSU-COVER	1



**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 right and center XT60-Male connectors 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.** If you did not attach the left-most XT60-Male connector to the PSU-Cover, then only connect the LED-Volt-Meter to the last empty output terminals. If you intend to use a third XT60-Male connector, then it must also be connected with the LED-Volt-Meter to the same terminal points on the 24V-360W-Power-Supply. This simply involves screwing through two ring terminals (instead of one) and ensuring they are of the same polarity. The top ring terminal will have to be folded up in order to clear the plastic sleeve on the lower one.
- 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.

### 2.3.2 Attaching PSU-Cover



- 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.

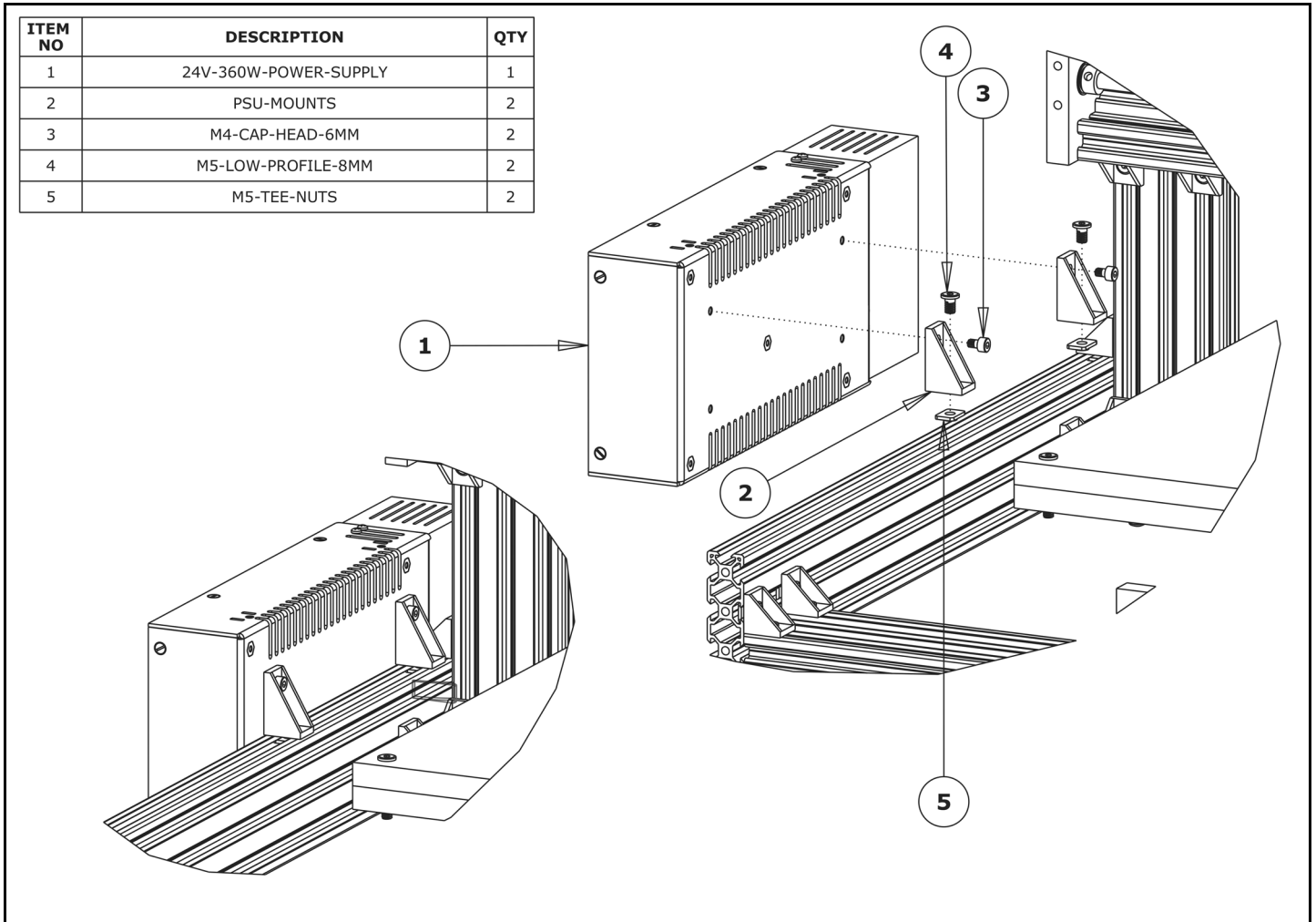
### 2.3.3 Testing

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.
- 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, the 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.

## 2.3.4 Mounting

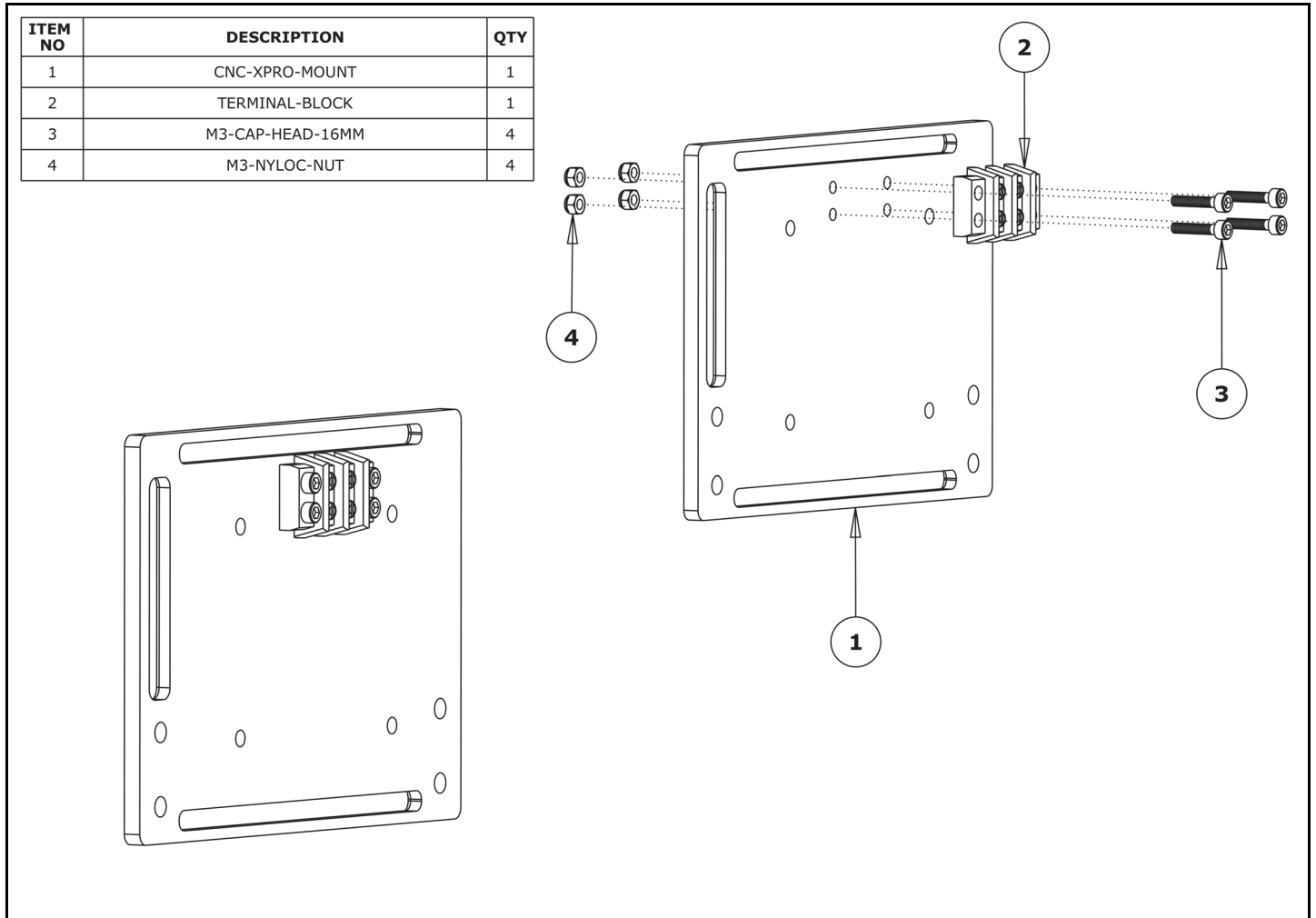


- A.** In the orientation above attach 2 x PSU-Mounts to the 24-360W-Power-Supply using 2 x M4-Cap-Head-6mm Bolts. The longest side of each PSU-Mount goes against the 24-360W-Power-Supply.
- B.** Bring the 24-360W-Power-Supply to the rear left of the C-Beam Machine, and secure it through the PSU-Mounts to the top of the V-Slot-2060-500mm using 2 x M5-Low-Profile-8mm Bolts, and 2 x M5-Tee-Nuts, these have to be inserted from the end of the extrusion.



# 3.0 CNC XPRO Assembly

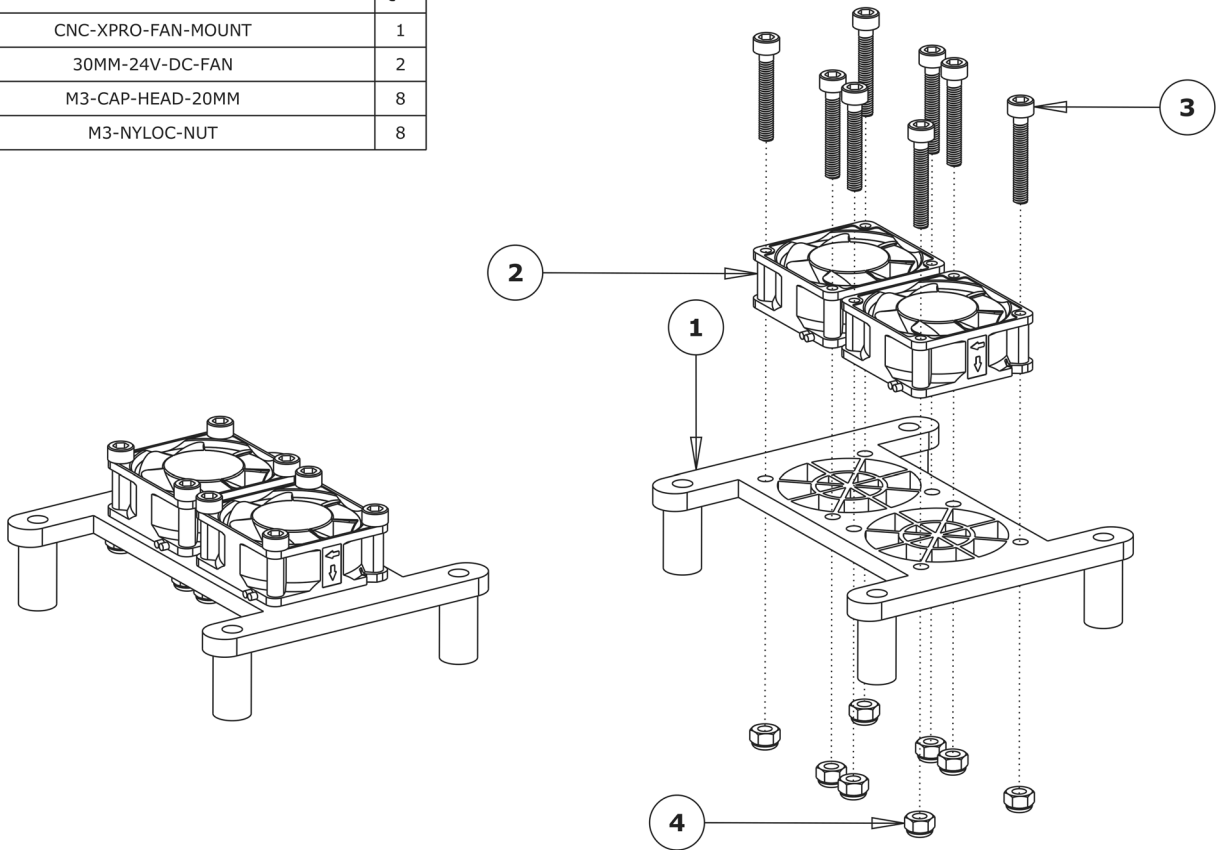
### 3.0.1 Terminal-Block Attachment



- A.** Attach the Terminal-Block to the CNC-xPro-Mount using 4 x M3-Cap-Head-16mm Bolts. Tighten the M3-Cap-Head-16mm Bolts to M3-Nyloc-Nuts on the other side of the CNC-xPro-Mount. Double check that the Terminal-Block is mounted to the correct side of the CNC-xPro-Mount.

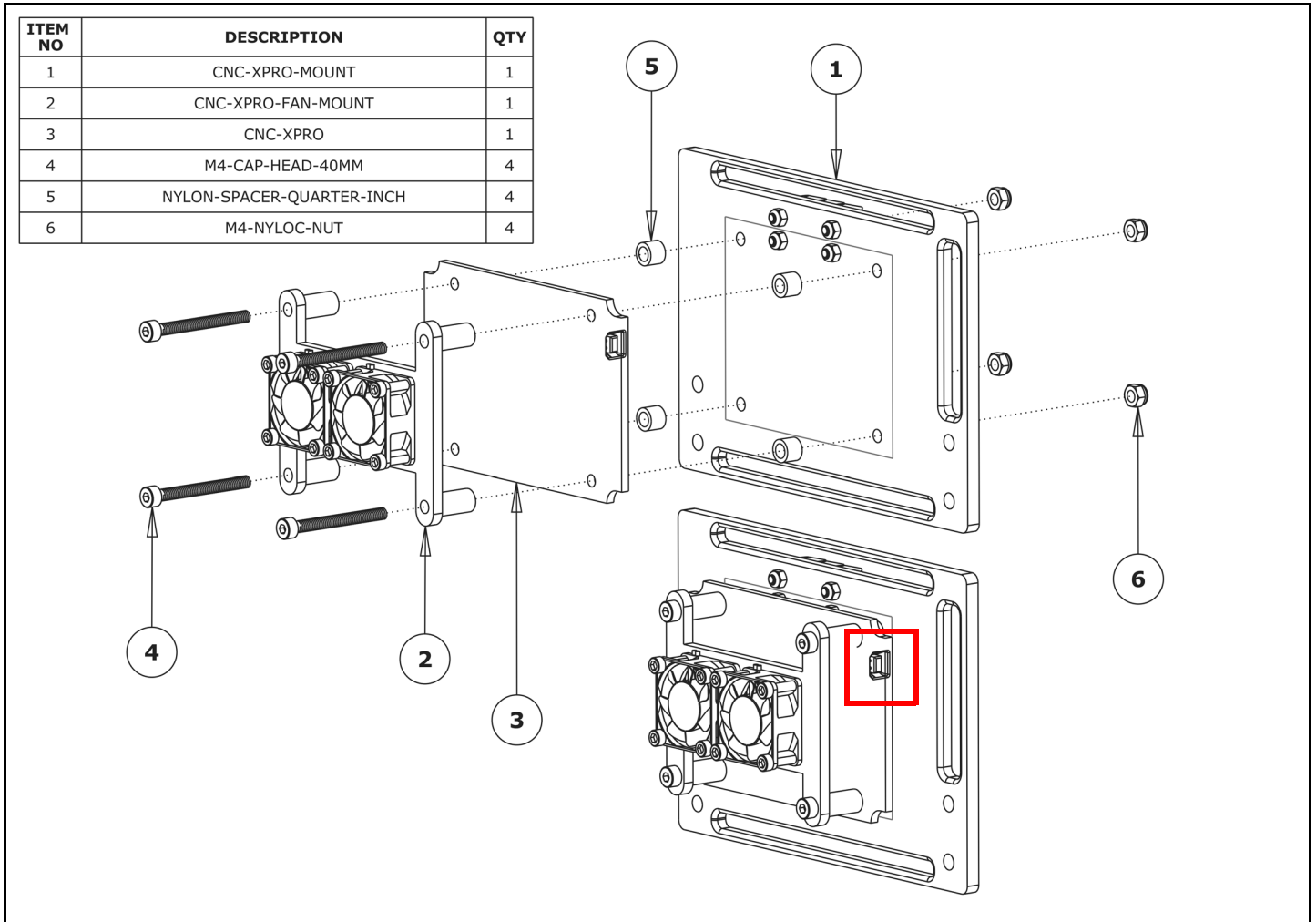
### 3.0.2 Fan Mount Assembly

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



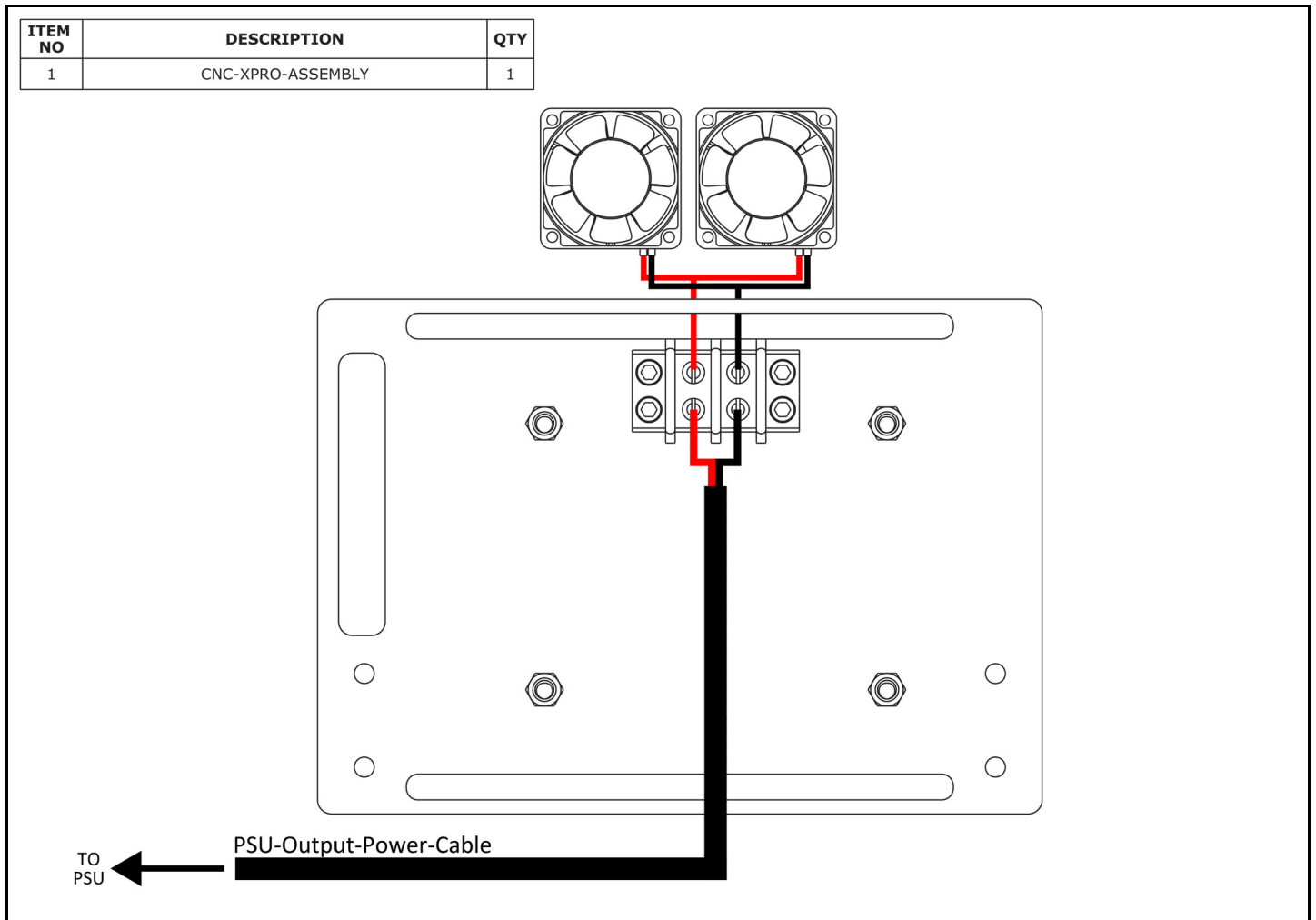
- A.** Attach 2 x 30mm-24V-DC-Fans to the CNC-xPro-Fan-Mount using 8 x M3-Cap-Head-20mm bolts and 8 x M3-Nyloc-Nuts. Ensure that the 30mm-24V-DC-Fans are blowing downward by ensuring that the side of the fan which the wires sit on is against the CNC-xPro-Fan-Mount. Make sure that the power wires on the 30mm-24V-DC-Fans are both on the same side of the CNC-xPro-Fan-Mount.

### 3.0.3 Attaching The CNC-xPro



- A.** 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 and tighten each bolt into a M4-Nyloc-Nut. The CNC-xPro-Fan-Mount should be orientated so the power wires are on the same side as the Terminal-Block. The CNC-xPro should be orientated so the USB terminal is in the same position as shown by the red square above.

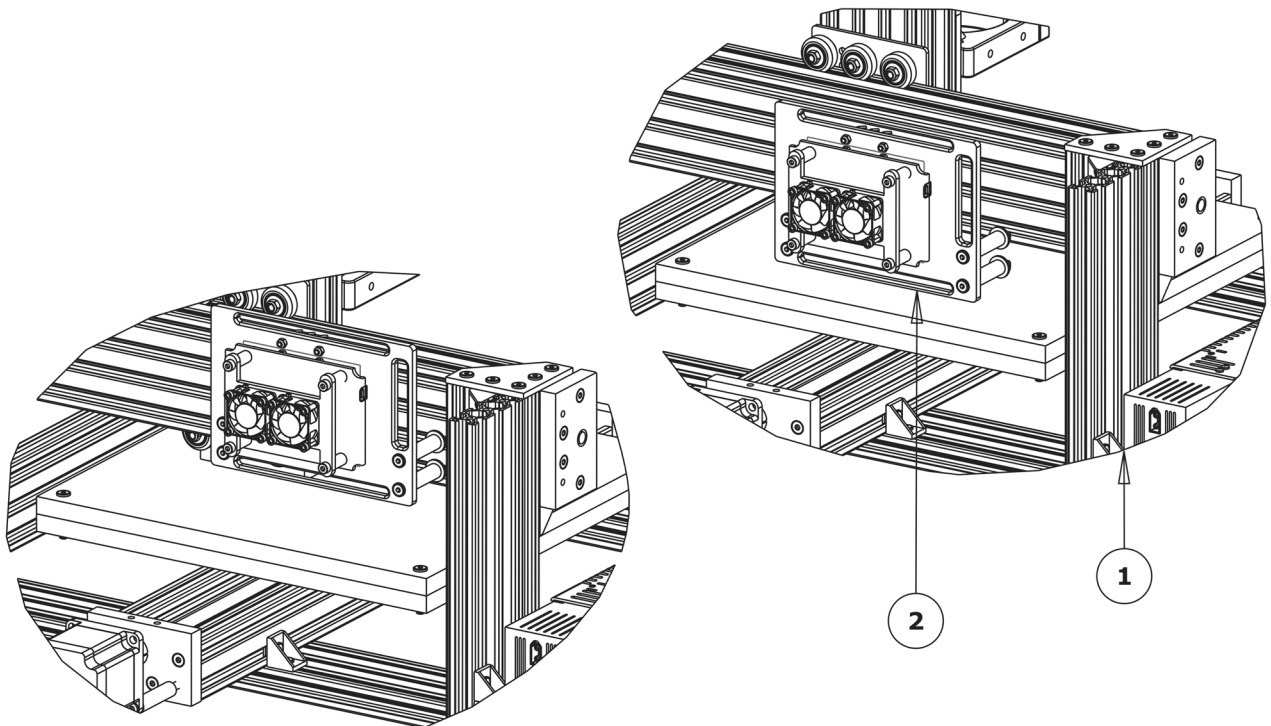
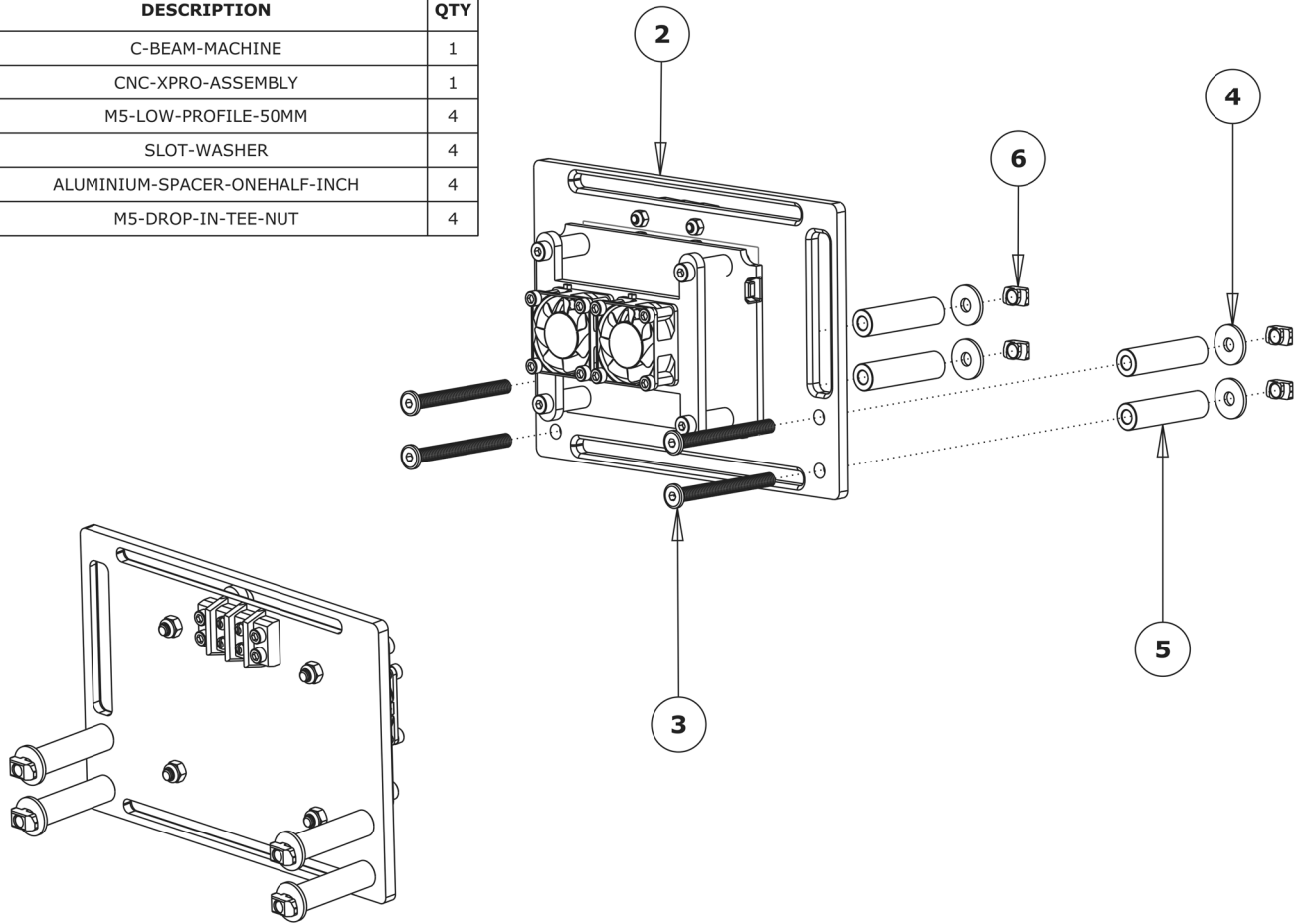
### 3.0.4 Fans Wiring



- A.** Locate both red wires coming from the two 30mm-24V-DC-30mm-Fans, and strip approximately 20mm of sheaving. Twist the two exposed copper cores together to form one.
- B.** Connect the red wires from the 30mm-24V-DC-30mm-Fans to the Terminal-Block, as shown above. To connect a wire, unscrew the respective screw from the Terminal-Block. Bend the exposed copper core of the wire around the screw. Screw the screw back into the Terminal-Block.
- C.** Repeat Step A & B for the two black wires of the 30mm-24V-DC-30mm-Fans.
- D.** With one of the PSU-Output-Power-Cables that was put into position in Step 2.3.2, strip back approximately 50mm of the black sheaving from the bare end to expose the red and black wires underneath. Strip back approximately 20mm of the sheaving from the red and black wires to expose the copper core underneath. Connect these wires to the Terminal-Block as in Step B.

### 3.0.5 Mounting the CNC-xPro Assembly

ITEM NO	DESCRIPTION	QTY
1	C-BEAM-MACHINE	1
2	CNC-XPRO-ASSEMBLY	1
3	M5-LOW-PROFILE-50MM	4
4	SLOT-WASHER	4
5	ALUMINIUM-SPACER-ONEHALF-INCH	4
6	M5-DROP-IN-TEE-NUT	4



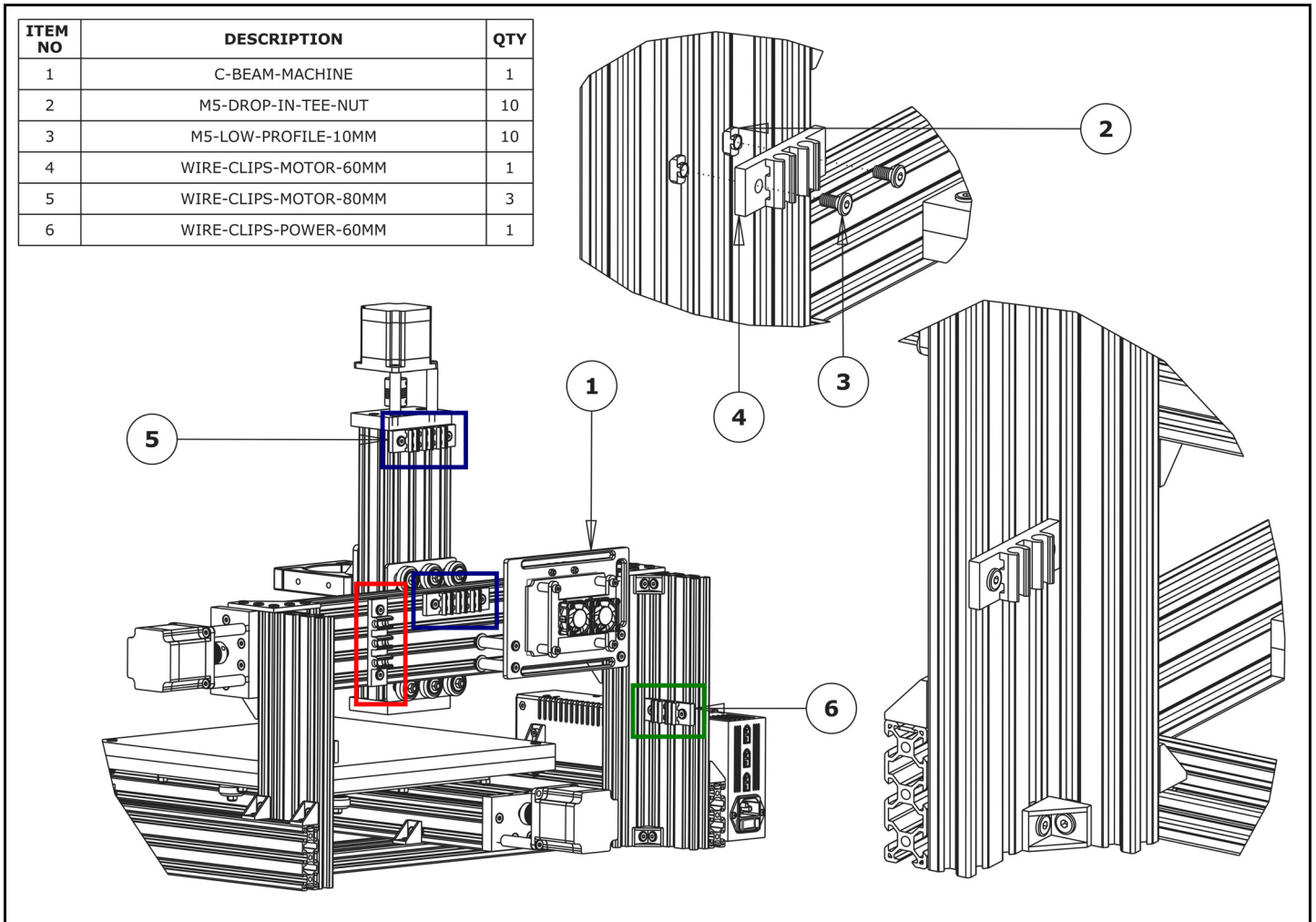
- A.** Insert 4 x M5-Low-Profile-50mm bolts through each mounting hole on the CNC-xPro-Mount.
- B.** On to each M5-Low-Profile-50mm bolt slide an Aluminium-Spacer-40mm and a Slot-Washer. The rounded face of the Slot-Washer should be flush against the Aluminium-Spacer-40mm.
- C.** On to the end of each M5-Low-Profile-50mm bolt, slightly thread a M5-Drop-In-Tee-Nut.
- D.** Bring the CNC-xPro-Assembly to the back of the C-Beam-Machine-Gantry, and align the M5-Low-Profile-50mm bolt assemblies from Step A/B/C with the back bottom two slots on the C-Beam-Machine-Gantry.
- E.** With the M5-Low-Profile-50mm bolt assemblies aligned, mate the CNC-xPro-Assembly with the slots. It should be towards the right hand side of the C-Beam-Machine-Gantry (If looking from the back), as seen in the images above.
- 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.

# 4.0 Wiring & Commissioning



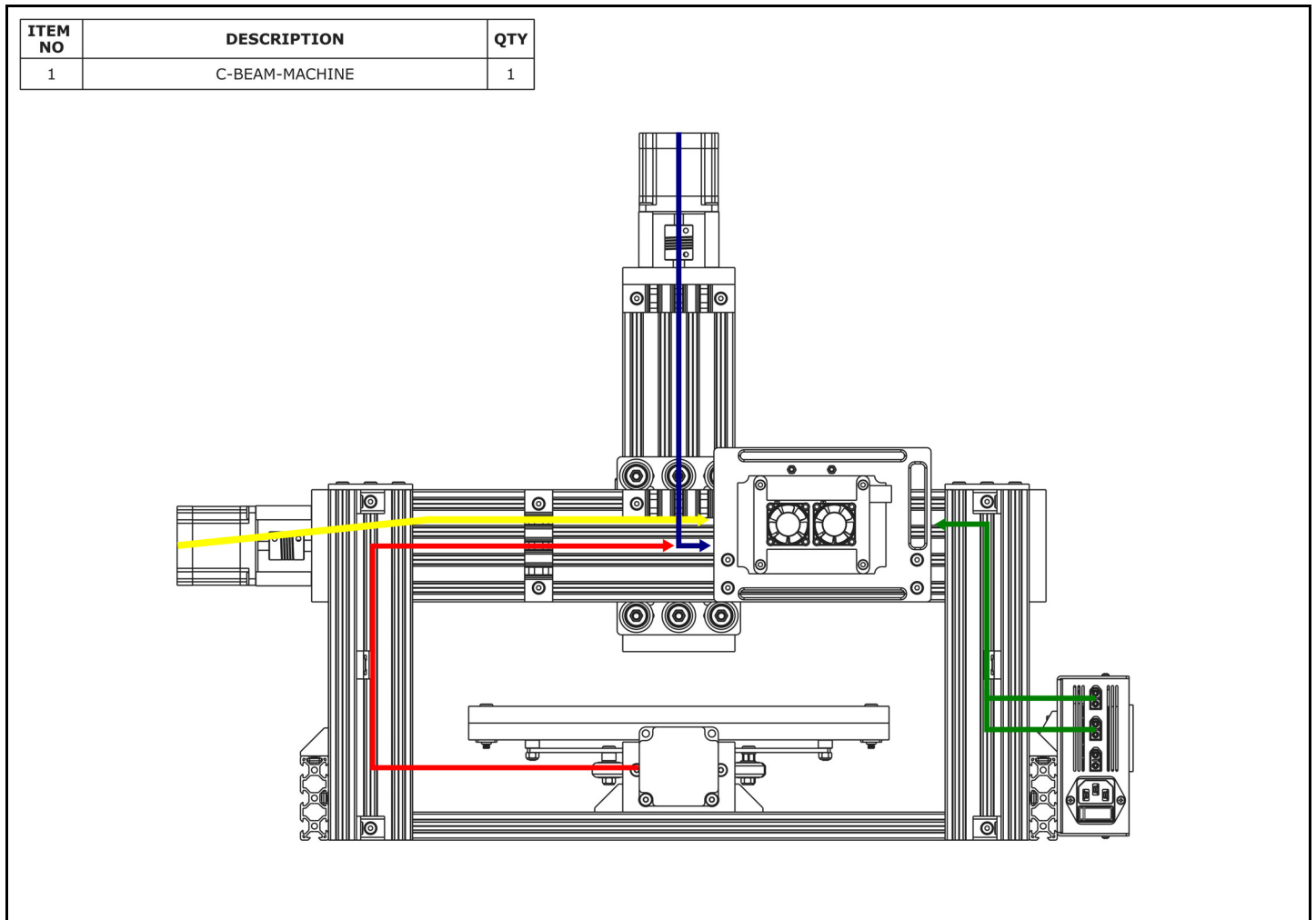
## 4.1 CNC-xPro Wiring

### 4.1.1 Wiring Mounts



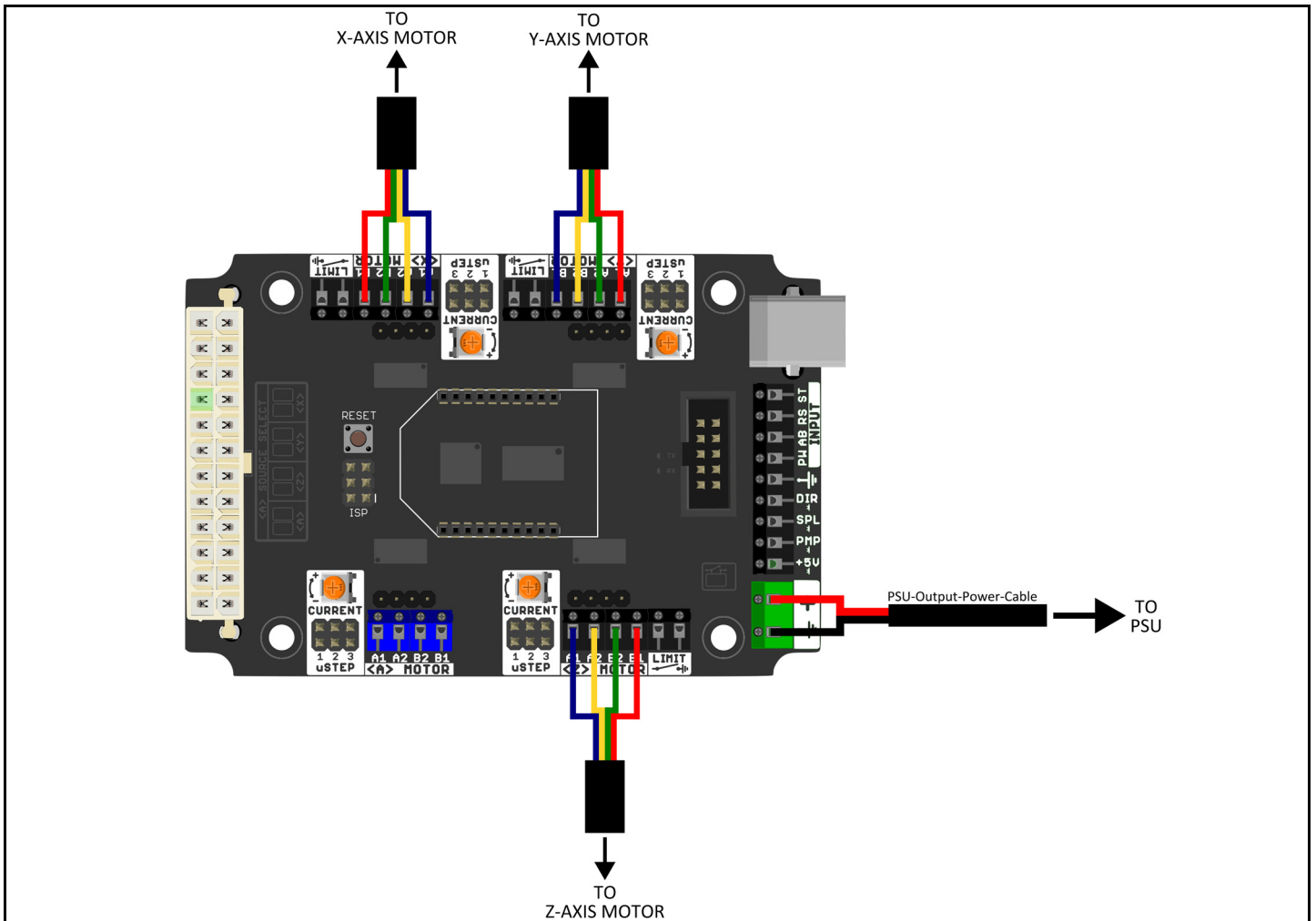
- A.** Mount a Wire-Clips-Motor-60mm to the inside of the left hand pillar (If looking from the back). Use 2 x M5-Drop-In-Tee-Nuts and 2 x M5-Low-Profile-10mm Bolts. The Wire-Clips-Motor-60mm should be half way up the pillar.
- B.** Repeat Step A for a Wire-Clips-Motor-80mm, shown in the Red Square above.
- C.** Repeat Step A for a Wire-Clips-Power-60mm, shown in the Green Square above.
- D.** Repeat Step A for 2 x Wire-Clips-Motor-80mm, shown in the Blue Squares above.

## 4.1.2 Wire Routing



- A.** The following steps are all as if looking from the back of the C-Beam-Machine. Bring the X-Axis motor wire around the left column, and along the back of the C-Beam-Machine-Gantry towards the CNC-xPro. Clip it into the top position of the Wire-Clips-Motor-80mm, it can be secured using 2 x Cable-Tie-Small going around the wire and through the slots of the clip.
- B.** Bring the Y-Axis motor wire towards the left column, take it up the column, and clip it into the left slot of Wire-Clips-Motor-60mm and secure it using 2 x Cable-Tie-Small. Next, take it along the back of the C-Beam-Machine-Gantry towards the CNC-xPro. Clip it into the middle position of the Wire-Clips-Motor-80mm, it can be secured using 2 x Cable-Tie-Small.
- C.** Bring the Z-Axis motor down the Z-Axis actuator, and clip it into the Wire-Clips-Motor-80mm that is on the Z-Axis actuator. Secure it using 2 x Cable-Tie-Small. Next clip it into the Wire-Clips-Motor-80mm that is on the C-Beam-Machine-Gantry, making sure there is enough slack for the left and right motion of the X-Axis Actuator. Secure it using 2 x Cable-Tie-Small.
- D.** Plug two PSU-Output-Power-Cables (One of which is already connected to the Terminal-Block) into the XT60-Male Outputs on the assembled 24V-360W-Power-Supply. Bring them up the right hand column towards the CNC-xPro. Secure them both to the Wire-Clips-Power-60mm.
- E.** The spare position on the Wire-Clips-Motor-60mm and Wire-Clips-Motor-80mm's can be used for the router wire, or any other wire you need to safely secure.

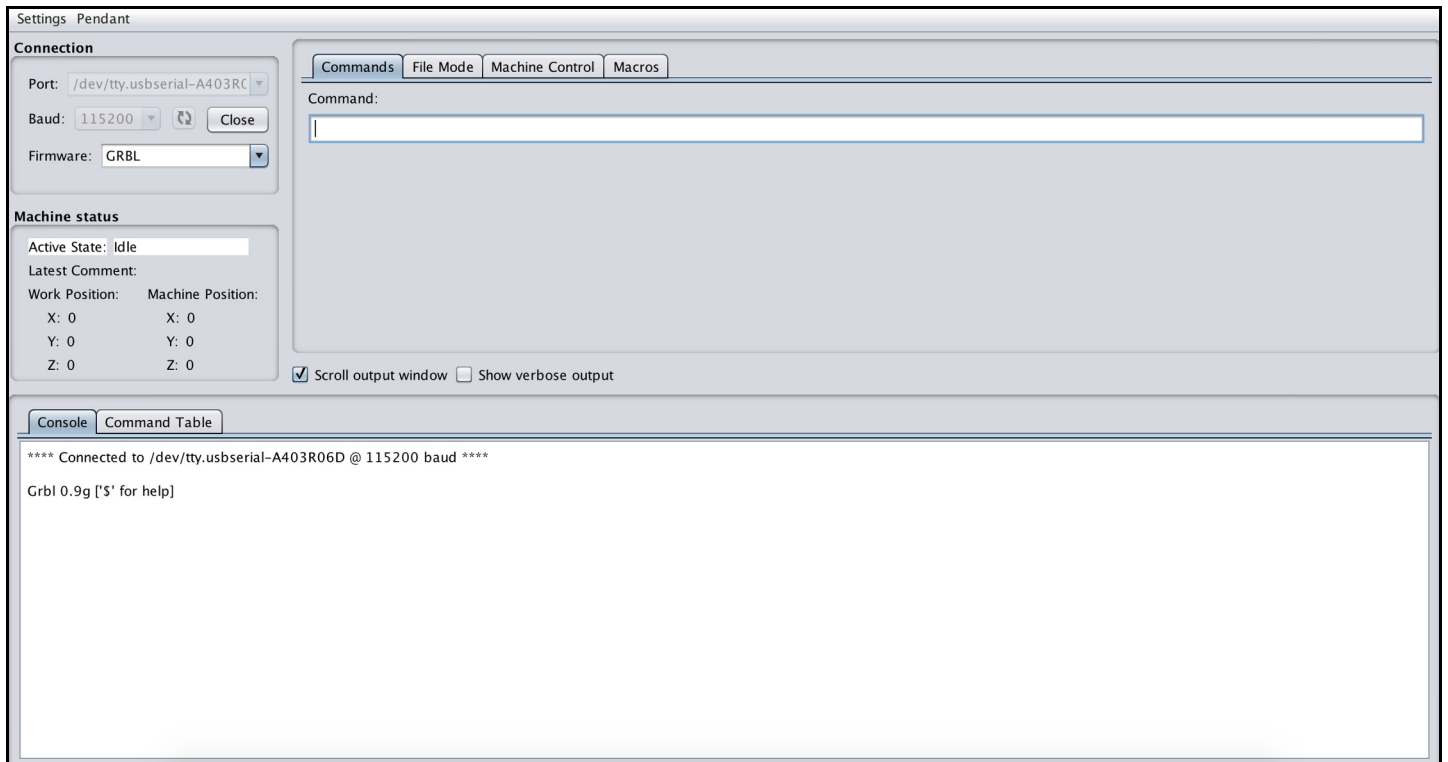
### 4.1.3 Connecting the CNC-xPro



- A.** Following the wiring diagram above, strip and connect the second PSU-Output-Power-Cable to the power input terminal on the CNC-xPro.
- B.** Connect the 3 x NEMA23-Stepper-Motors to the CNC-xPro as shown above. Take note of the order of the wire colours.
- C.** 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>

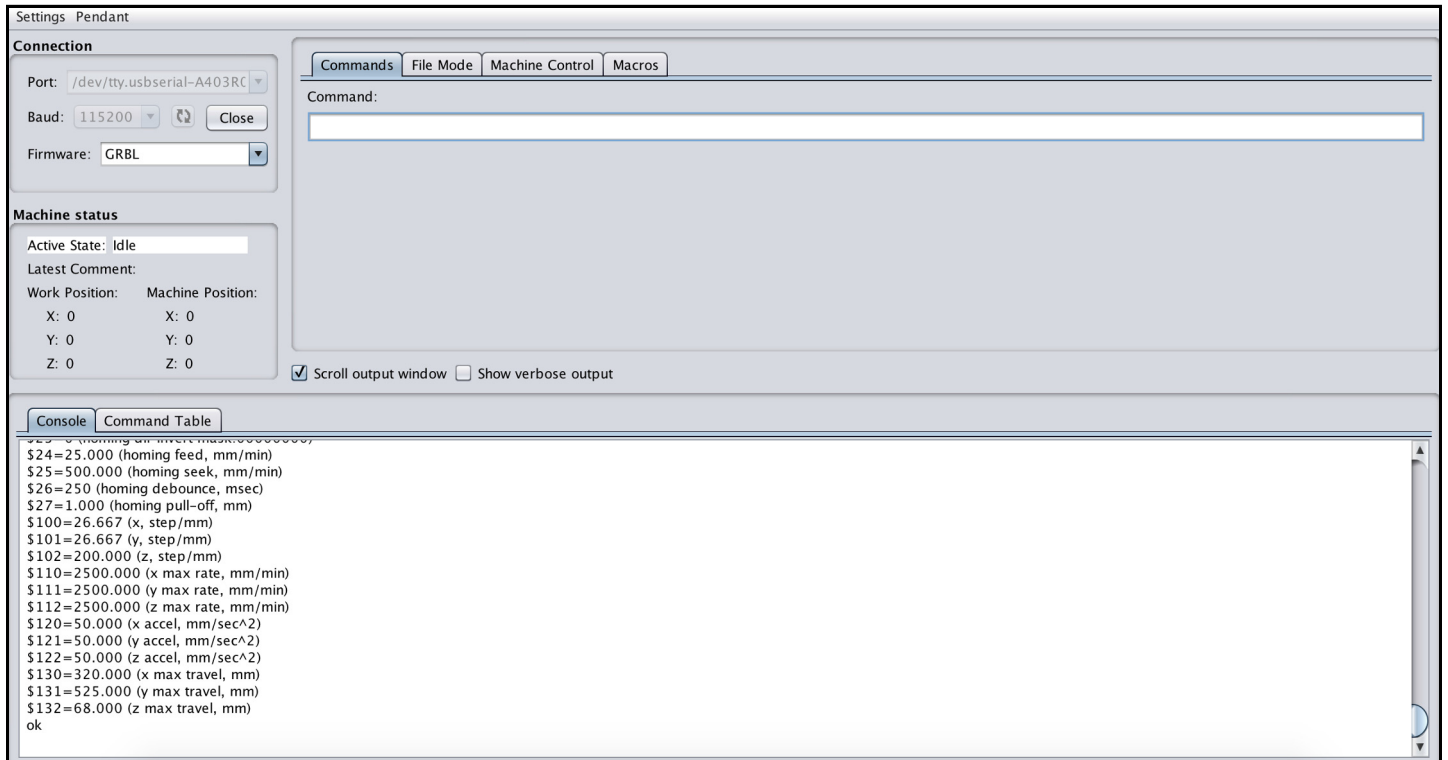
## 4.2 Software & Machine Settings

### 4.2.1 Installing Universal G-Code Sender (UGS)



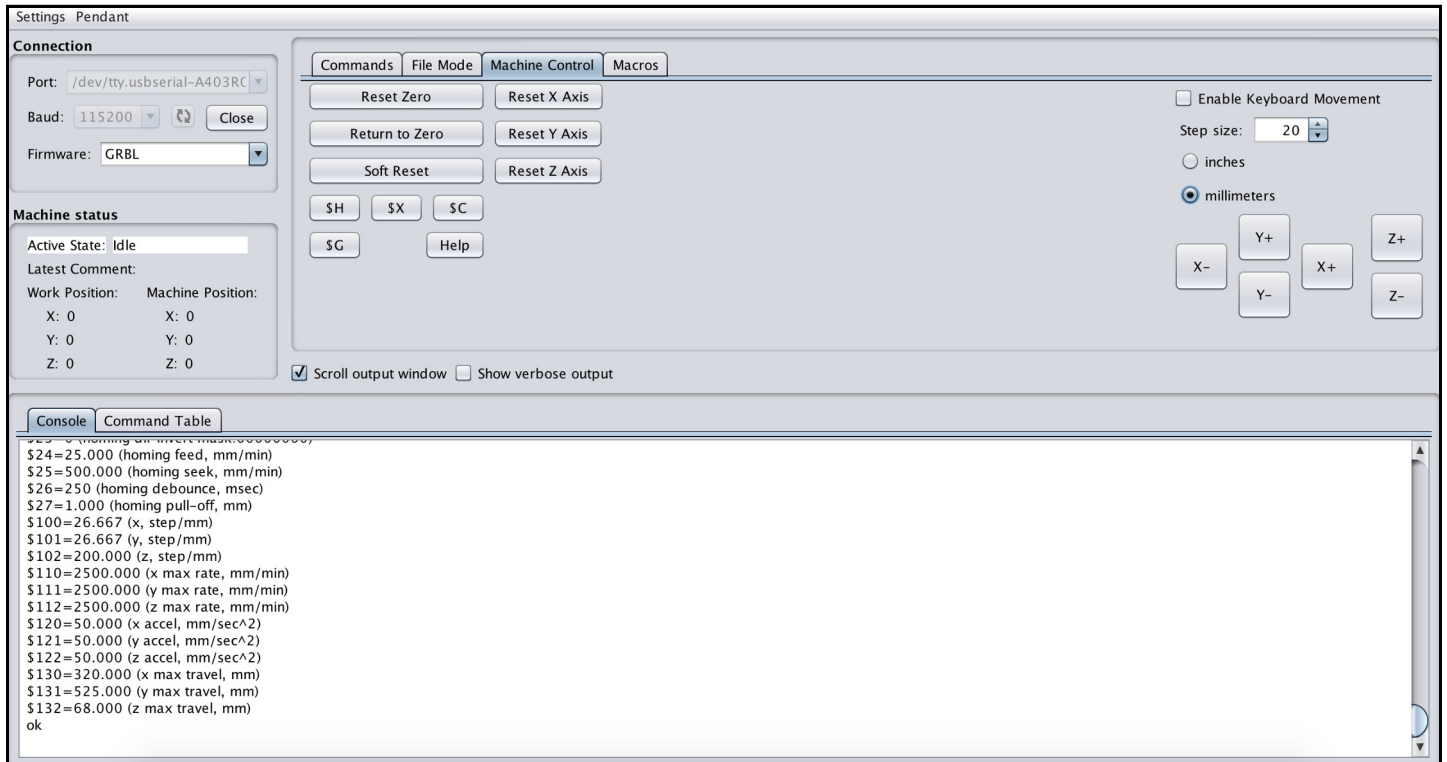
- A.** Universal G-Code Sender (UGS) is a simple Java-based cross platform G-Code sender. Download the latest 2.0 nightly build from: <https://github.com/winder/Universal-G-Code-Sender>
- B.** Unzip the folder to a location of your choosing.
- C.** Run the file named 'UniversalGcodeSender.jar' and UGS 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.
- 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, it should look similar to what is selected in the image above. Once found click 'Open' and UGS should successfully connect to the CNC-xPro. The Console output will show information similar to the above.

## 4.2.2 Configuring The Firmware



- A.** Under the Command heading there is a text input field 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. As can be seen, the default settings do not match what we recommend. 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, 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.
- C.** If interested, it is a good idea to read the GRBL Firmware Wiki for more in-depth information: <https://github.com/grbl/grbl/wiki>

## 4.3 Testing

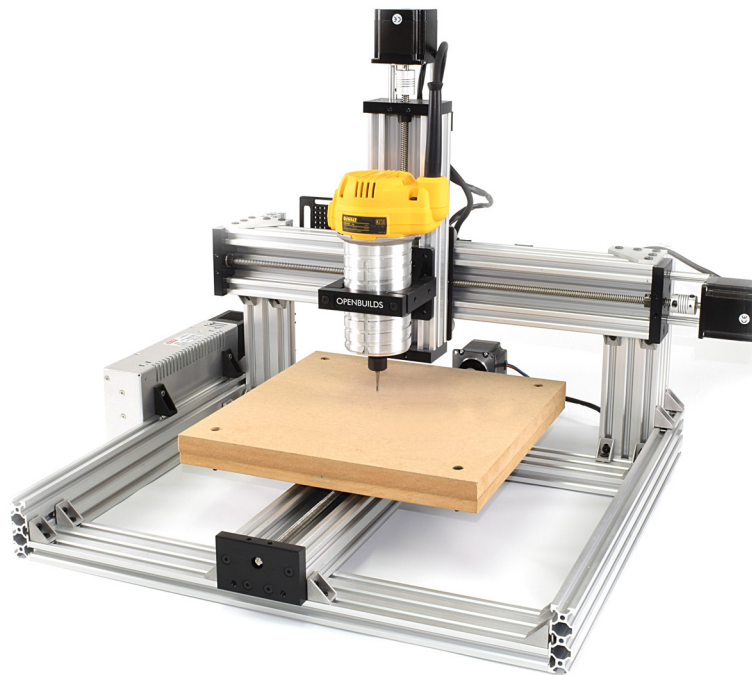


- A. To begin testing, disconnect from the CNC-xPro, and move the machine by hand so that it is in the middle of it's max travel on all axes.
- B. Switch on the 24V-360W-Power-Supply, and the 2 x 30mm-24V-DC-Fan's should activate. If they do not activate, check the wiring in Step 3.0.4.
- C. Reconnect to the CNC-xPro in UGS. 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. The default positions should work fine, but they can be adjusted to increase/decrease motor torque or quiet motor motion. If in Step D below the motors don't move, first check the wiring in Step 4.1.3. If that isn't the issue, then slightly increase the motor current in 1/8th turns.
- D. Looking from the front of the machine, the correct axes machine motion is: X-Axis positive to the right, Y-Axis positive going away, Z-Axis positive going up. 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 'Step size' to 20 and select 'millimeters'. Press the 'X+' button to jog the machine in the positive X direction, and the carriage should move to the right. Press 'Y+' and the gantry should move away. Press 'Z+' the Z-Axis should go up.
- E. If in Step C any of the axes have moved in the opposite directions than should be expected, turn off machine and disconnect from the CNC-xPro. To correct this issue, locate the motor wire for the axis that is incorrect and flip the wire colour order on the CNC-xPro. Repeat Steps B, C & D to retest the machine.
- F. Once the motor directions are correct, use the jog controls in UGS to check that the machine can move through the whole distance of its travels on all axes. If this is unsuccessful, first check that the ACME-Lead-Screw are attached correctly, aligned, and not binding. If the assembly is correct, it may be that the drivers on the CNC-xPro are overheating, so try decreasing the current in 1/8th turns.

**G.** Testing of the machine is now complete. Any excess wire can be bundled behind the CNC-xPro-Mount, or shortened to the correct length.

A final note, the controller is sensitive to electrical interference. Therefore we are now providing an interference kit with machine to reduce this. In this kit ferrite beads are provided. Clip the Motor-Ferrite's on the motor wires as close as possible to the CNC-xPro. Clip the PSU-Output-Ferrite's on the PSU-Output-Power-Cable as close as possible to the 24V-360W-Power-Supply. And the Router-Ferrite, as close as to your router as possible. Furthermore if you have a dust extraction system, we recommended grounding the extraction hose along its length using a metal strip.

## 4.4 Complete



Congratulations! You have completed the Assembly of the C-Beam-Machine, 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.** With this electronic kit we have decided not to include end-stops. This means that when creating your G-Code files 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 position the machine to the same upper front left corner set in the CAM package.
- C.** In the 'Machine Control' tab press 'Reset Zero'. This is a crucial step, and must not be forgotten when not using end-stops.
- 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.

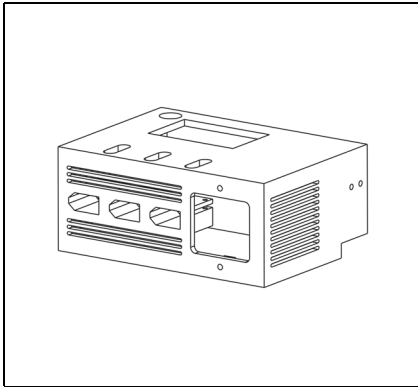


# 5.0 Appendix

# 5.1 Appendix A - Kit Contents

## Power Supply Assembly

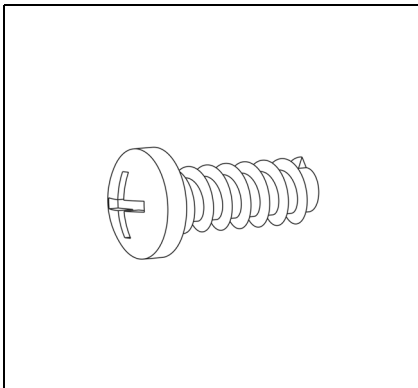
1 x PSU-Cover



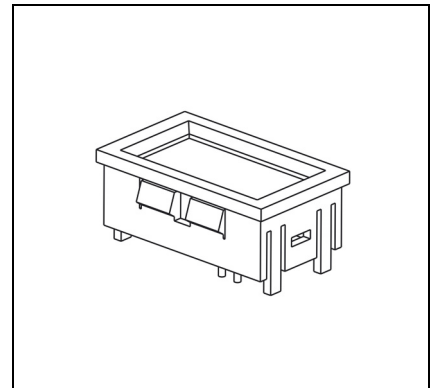
3 x XT60-Male



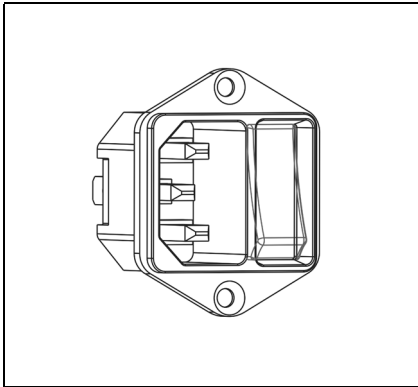
Plastite-Screws:  
6 x M3-8mm  
6 x M2.5 x 8mm



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



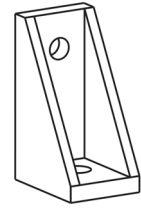
1 x Mains-Cable



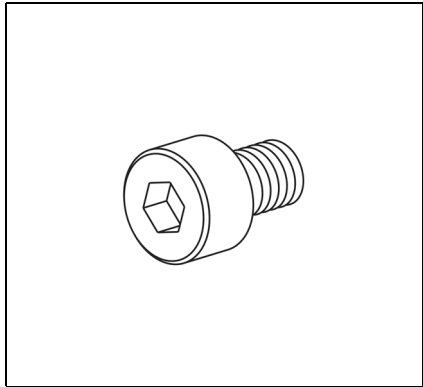
3 x PSU-Output-  
Power-Cable



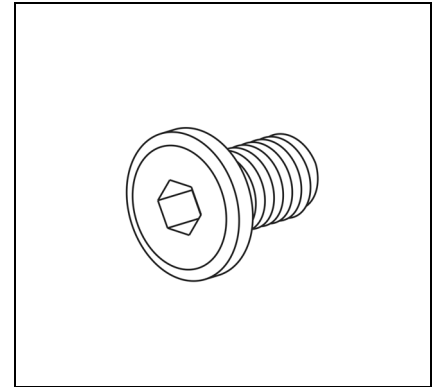
2 x PSU-Mounts



2 x M4-Cap-Head-  
6mm

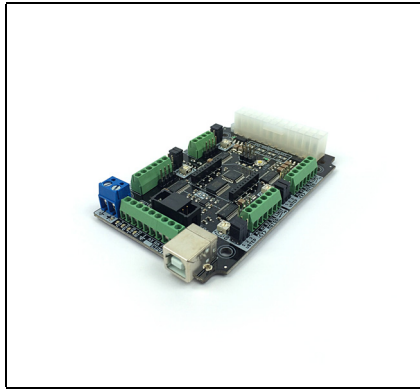


2 x M5-Low-Profile-  
8mm

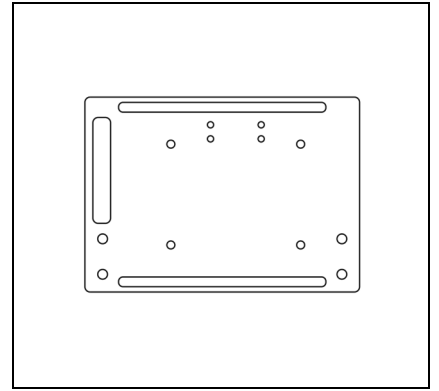


# CNC-xPro Assembly

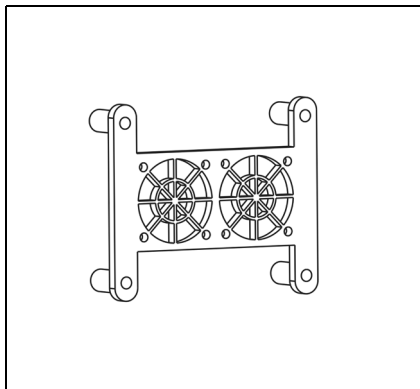
1 x CNC-xPro



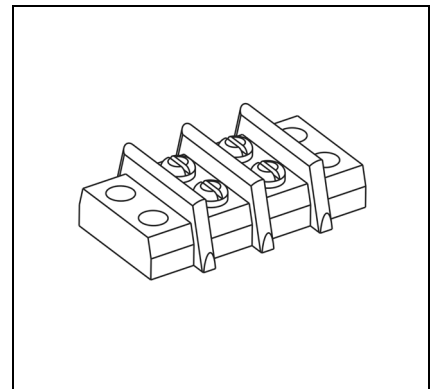
1 x CNC-xPro-Mount



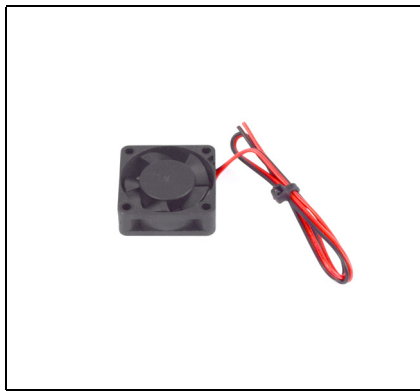
1 x CNC-xPro-Fan-Mount



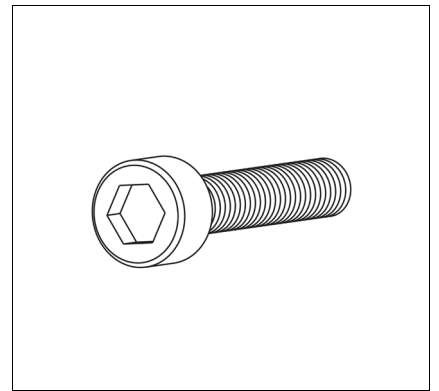
1 x Terminal-Block



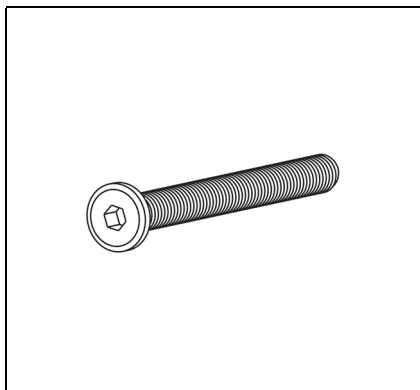
2 x 30mm-24V-DC-Fan



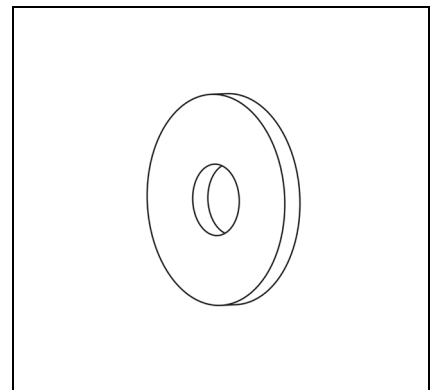
Cap-Head:  
4 x M3-16mm  
8 x M3-20mm  
4 x M4-40mm



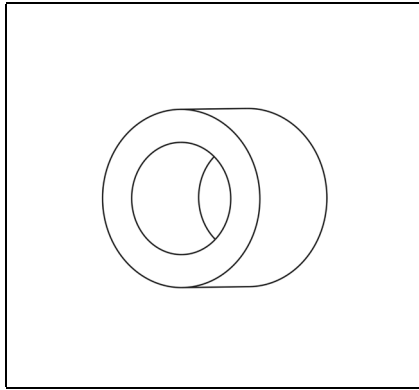
10 x M5-Low-Profile-10mm  
4 x M3-16mm



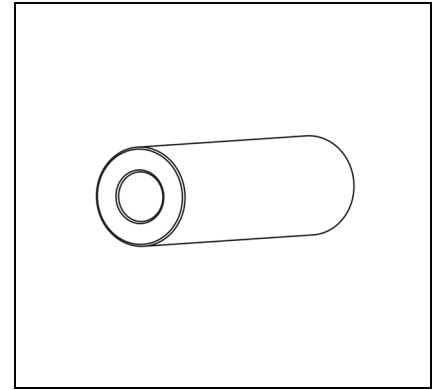
4 x Slot-Washer



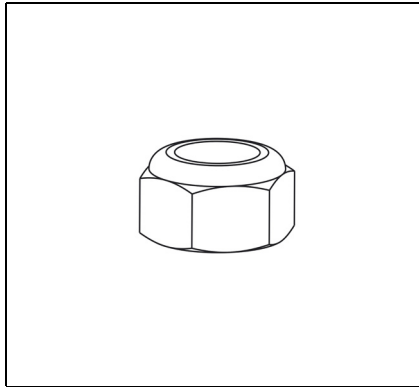
4 x Nylon-Spacer-Quarter-Inch



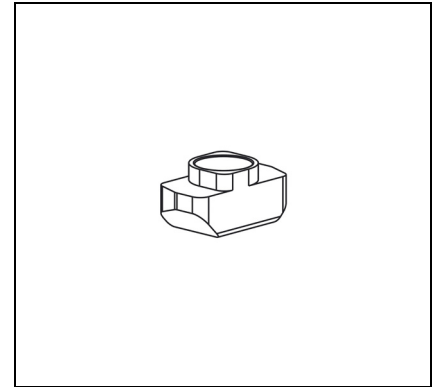
4 x Aluminium-Spacer-OneHalf-Inch



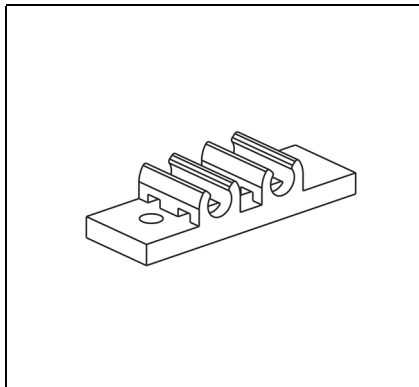
Nyloc-Nuts:  
12 x M3  
4 x M4



14 x M5-Drop-In-Tee-Nut



Wire-Clips:  
1 x Motor-60mm  
3 x Motor-80mm  
1 x Power-60mm



Cable-Ties:  
25 x Small  
25 x Large



## **Misc**

1 x Ceramic-Screw-Driver



1 x USB-Cable



# 6.0 Appendix B

## **6.1 Recommended GRBL Settings**

The settings below are for a CNC-xPro set at 1/8 micro stepping.

```
$0=10 (step pulse, usec)
$1=255 (step idle delay, msec)
$2=0 (step port invert mask:00000000)
$3=6 (dir port invert mask:00000110)
$4=1 (step enable invert, bool)
$5=0 (limit pins invert, bool)
$6=0 (probe pin invert, bool)
$10=1 (status report mask:00000011)
$11=0.020 (junction deviation, mm)
$12=0.002 (arc tolerance, mm)
$13=0 (report inches, bool)
$20=0 (soft limits, bool)
$21=0 (hard limits, bool)
$22=0 (homing cycle, bool)
$23=0 (homing dir invert mask:00000001)
$24=2000.000 (homing feed, mm/min)
$25=1000.000 (homing seek, mm/min)
$26=250 (homing debounce, msec)
$27=1.000 (homing pull-off, mm)
$100=200.000 (x, step/mm)
$101=200.000 (y, step/mm)
$102=200.000 (z, step/mm)
$110=2000 (x max rate, mm/min) (Go upto 7500)
$111=2000 (y max rate, mm/min) (Go upto 7500)
$112=2000 (z max rate, mm/min) (Go upto 1500)
$120=100.000 (x accel, mm/sec^2)
$121=100.000 (y accel, mm/sec^2)
$122=100.000 (z accel, mm/sec^2)
$130=270.000 (x max travel, mm)
$131=270.000 (y max travel, mm)
$132=80.000 (z max travel, mm)
```