

## Heavy Mill Build Guide



# Table of Contents

Who is this Guide For?	3
Precautions & Electrical Risk	4
Kit Contents	5
Aluminium Extrusions	6
Linear Motion	7
Hardware	8
Other Parts	9
What You'll Need	10
Electronic Components	11
Variable Frequency/Speed Drive (VFD / VSD)	12
Assembling Your Heavy Mill	13
Pre-Build Notes	14
Base Construction	15
Base Construction Continued	16
X/Z Axis Setup	17
X/Z Axis Setup Continued	18
X-Axis Linear Rails	19
Y-Plate Explosion	20
Y End Plate, Pulley Plate, Stepper Plate and Stepper Motor installation	21
X Motor Plate	22
X Motor Plate Continued	22
X Pulley Plate	22
X Motor Plate	23
Limit Switches	24
Limit Switches	24
Tightening Up X Bearings and Bearing Rails	25
Installing Belt Clamps and Belts	26
Installing Belt Clamps and Belts Continued	27
Wiring and Plumbing	28
Limit Switch Termination	29
Stepper Motors	30
Enclosure Layout	31
Enclosure Layout Continued	32
Enclosure Layout Images	33
What to Expect From Your New Heavy Mill	34
Get in Touch	35

# Who is This Guide For?

"The best way to put the Heavy Mill together is to allow for several days to build, tune and get to know the machinery before use.

Milling has always been a popular hobby with those who are passionate about wood and metalworking, but in recent years, there's been a raft of amateur hobbyists showing an interest in having a go too!

Don't rush, take your time and enjoy the build."

*Ryan & Ben*



Please note this is **not** an appliance – it is an industrial tool, so careful consideration must be adhered to, while building and using the machine, so it's important to remember:

- *The construction and use of this machine pose many risks to your safety, so carefully planning your build is crucial.*
- *The Heavy Mill should never be left running unintended.*
- *Loose clothing/hair etc should be secured correctly before operating the machine.*
- *Get used to wearing goggles when around the machine. Milling bits and debris can and do get discarded by the machine.*
- *You'll need plenty of room to move and construct the machine, many of our customers choose to build specialised craft spaces in sheds and garages.*
- *In fact, sheds and garages are ideal locations for your equipment to ensure the noise isn't likely to disturb anyone.*
- *Although the machine is portable, it's a good idea to store the machine in a space where there's enough room to run it efficiently.*

## Precautions

## Electrical Risk

VFD (Variable Frequency Drive) varies the frequency of the output from the 50hz to within a range of 0-400HZ in order to control the pace of the spindle on the machine.

The VFD, and power supplies, as with any electrical item, can be dangerous when not managed correctly, remember:

- *Only a licensed electrician should ever commission these items.*
- *The items should be enclosed in a grounded or otherwise appropriate enclosure and kept clean and in good working order while avoiding excess moisture.*
- *The machine should be installed on a circuit that is protected by an RCD and breaker*



UK: 01733 590 191

info@3dtek.xyz

3dtek.xyz

AUS: +61 410 730 128

support@3dtek.xyz

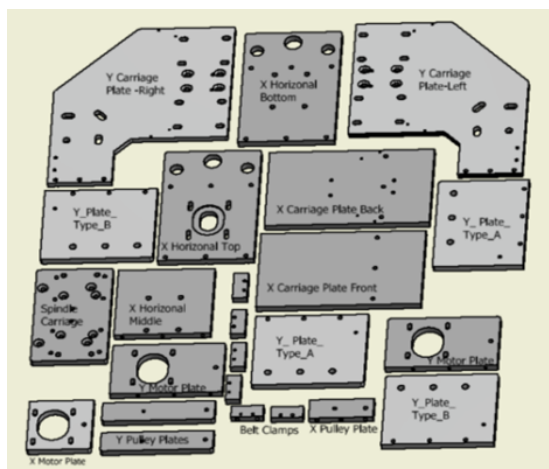
Contents within the kits will differ depending on the options selected at the time of purchase.

## Kit Contents

The basic kit includes:

### Anodized Plates

Plate	Description	Qty
SCP	Spindle Carriage	1
YPA	Y_Plate_Type_A	2
YPB	Y_Plate_Type_B	2
XHP_Top	X Horizontal Top	1
XVP_Front	X Carriage Plate Vertical Front	1
XVP_Back	X Carriage Plate Vertical Back	1
XHP_Bot	X Horizontal Bottom	1
XHP_Mid	X Horizontal Mid	1
XMP	X Motor Plate	1
YMP	Y Motor Plate	2
XPP	X Pulley Plate	1
YPP	Y Pulley Plate	2
BCT	Belt Clamp Top	3
BCB	Belt Clamp Bottom	3
YCP	Y Carriage Plate Left	1
YCP	Y Carriage Plate Right	1
YCP	Z Motor Mount	1



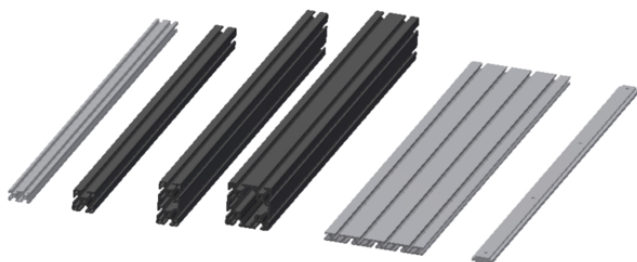
UK: 01733 590 191

info@3dtek.xyz

3dtek.xyz

AUS: +61 410 730 128

support@3dtek.xyz



# Aluminium Extrusions

Part	Description	1000mm Qty	1500mm Qty
<b>4040 Rail</b>	4040 Rail – Base Structure	4	6
<b>X-Axis Rail</b>	8080 – Tapped Both Ends M8 * 15mm	1	1
<b>Y-Axis Rails</b>	40120 – Tapped Both Ends M8 * 15mm + Drilled & Counterbored holes.	2	2
<b>XDGRail</b>	X-Axis Drag Chain Support Rail 2040 T Slot	1	1
<b>YDGRail</b>	Y-Axis Drag Chain Support Rail 2040 T-slot	1	1

If you chose the T-Slot bed option, you'll find the following within your kit:

Part	Description	1000mm Qty	1500mm Qty
<b>Bed T-slot</b>	15180 – T-slot Bed Extrusion – If bed option is taken	3	5
<b>Bed T-slot Left Side</b>	15180 – 4-6 holes – if bed option taken	1	1
<b>Bed T-slot Right Side</b>	15180 – 4-6 holes – if bed option taken	1	1
<b>T-Slot Tee Extrusion</b>	T-Slot Connectors – if bed option taken	4	6
<b>Water Block Strip</b>	12x3 MM Alloy Flat Bar strip – if bed option taken	1	1



UK: 01733 590 191

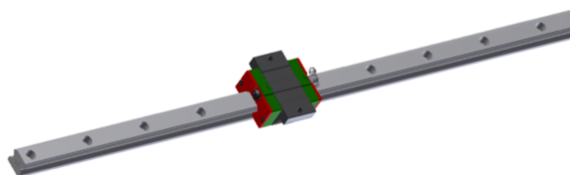
info@3dtek.xyz

3dtek.xyz

AUS: +61 410 730 128

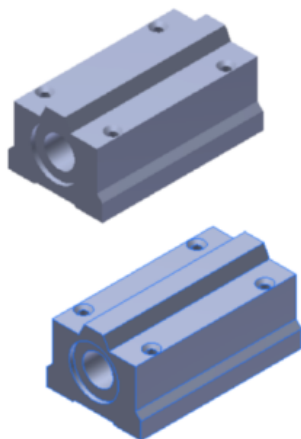
support@3dtek.xyz

# Linear Motion



Part	Description	1000mm Qty	1500mm Qty
HGW20	HGW20CC Linear Bearing Blocks	6	6
HG20	Linear Rail – ~990 / ~1490 mm	2	2
HG20	Linear Rail – ~1100 / ~1490 mm	2	2

Part	Description	1000mm Qty	1500mm Qty
HSS	16mm hardened Steel Shaft 225mm	2	2
PB	Pillow Bearing Blocks SC16LUU	2	2



Part/Purpose	Label Code	Qty
Securing Z Pulley on Acme Thread	M8 Flanged Nut	1
8MM Steel Spacer sits below pulley on Z Acme	8 mm Spacer	1
Idler Pulley Spacer 5mm Bore (one inside, one outside Idler)	3 mm Spacer	6
Z-Axis Lead Nut	Lead Nut	1
X & Y Limit switches	M3 Nylock Nut	8
X & Y Limit switches	M3 Washer	8
Shaft Grubs Screws	M3x10 BHCS	4
Z Limit Switch	M3x16 SHCS	2
X & Y Limit switches	M3x25 SHCS	8
Drag Chain to Drag Chain Support Extrusion	M4 Tee Nut	4
Drag Chain to Drag Chain Support Extrusion	M4x10-12 SFHCS	4
Drag Chain Mounts	M5x12 BHCS	4
Belt Clamp Top	M4x25 SHCS	6
Stepper Motors	M5 Nylock Nut	24
Stepper Motors	M5 Star Washer	16
Stepper Motors	M5 Washer	16
Y Stepper Motors	M5x25 SHCS	8
Z Motor Mounting	M5x16 BHCS	12
Securing Bearing Rail, X Stepper Motor	M5x20 SHCS	104
Bolting together all other plate hardware	M5x20 FSHCS	28
Motor Plates, Pulley Plates	M5x20 FSHCS	18
Belt Clamp Bottom	M5x25 BHCS	6
Idler Pulley Axels	M5x30 BHCS	3
Y-Axis Limit Switch Triggers	M5x40 BHCS	2
X-Axis Limit Switch Triggers	M5x70 SHCS	2
Bearings in Y-Axis	M6 Spring Washer	16
Bearings in Y-Axis	M6 Star Washer	16
Bearings in Y-Axis	M6x20 SHCS	20
Bearings in X-Axis Plates	M6x20 FSHCS	8
Securing Wasteboard	M6 Tee Nut	30
Spindle Clamp Bolts	M6x50 SHCS	4
Y Plates to X-Axis Extrusion / End Plates to Y Extrusion, Spindle Mount	M8 Spring Washer	24
Y Plates to X-Axis Extrusion / End Plates to Y Extrusion, Spindle Mount	M8 Star Washer	24
Y Plates to X-Axis Extrusion / End Plates to Y Extrusion, Spindle Mount	M8x25 SHCS-	24
Securing Y Rails to Base	M8x40 SHCS	12



## Other Parts

Part	Description	1000mm Qty	1500mm Qty
<b>T5B10</b>	T5_Delrin Idler	3	3
<b>DC</b>	Drag Chain / m	3	3
<b>Z ACME</b>	Z-Axis Acme Thread 202mm	1	1
<b>T5P10</b>	T5 Pulley 10-15 tooth with flange	4	4
<b>T5P20</b>	T5 Pulley 20-24 tooth with flange	1	1
<b>FB</b>	Flanged Bearing	2	2
<b>CN</b>	Coolant Nozzle (T-slot Bed Option Only)	1	1
<b>MBC</b>	Misumi Black Cap 2040	4	4
<b>Gusset Set for 4040</b>	Set of 8 Gussets	1	1
<b>Spindle</b>	None, 800W, 1.5 KW, 2.2kw as per option selected	1	1
<b>Spindle Mount</b>	80mm Spindle Mounts if spindle option selected	1	1
<b>NEMA23_76</b>	Stepper Motors Nema 23 – 76mm Single Shaft	4	4
<b>CP</b>	Coolant Pump (Qty 2 if T-slot bed option is taken)	1	1
<b>Belt</b>	AT5 Open Belt – meters	7.5	10
<b>Belt</b>	AT5 Closed Loop Belt	1	1
<b>DT</b>	Drip Tray – (With T-slot Bed Option)	990	1400
<b>DCB</b>	Drag Chain Brackets2	2	2

- *A soldering iron – we'd recommend X-Tronic, Hakko or Vastar.*
- *Basic hand tools, such as screwdrivers, a drill and a range of spanners.*
- *If you've chosen the T-slot Bed variation, you'll need a few tubes of plastic silicone, which is the same stuff you use to seal around the edge of a bath or sink – it's easy to get hold of from the likes of Screw Fix, B&Q or even places like B&M and The Range.*
- *Support from a trusted, qualified electrician to commission the 240V components.*

**What You'll Need to  
Complete Your Build**



UK: 01733 590 191

[info@3dtek.xyz](mailto:info@3dtek.xyz)

[3dtek.xyz](http://3dtek.xyz)

AUS: +61 410 730 128

[support@3dtek.xyz](mailto:support@3dtek.xyz)

Depending on the options you chose at the point of purchase the electronics kit may include one of the following:

- *GRBL AIO and associated connectors*
- *Masso Controller and associated connectors*
- *Gecko G540 Driver Board and associated connectors.*

## Electronic Components

All kits include the following electronic parts:

Description	Qty
Electronics Enclosure	1
Neutrik PowerCon Plug & Socket	1
Din Rail	1
12V Power Supply	1
12V Fan & 2 * Dust Filter	1
Cable Ties & Sticky Mounts	Assorted
DC PSU Cable	1m
2.5mm AC Power Cable Red, Black, Green	1m
Wiring harness Motors	4
X&Y limit cables Harness	2
Z limit cable Harness	1
Emergencies stop switch	1
Large cable gland	2
Medium cable gland	2
Small cable gland	2
Cable Sock	5
Large Cable Sock	10m
Medium Cable Sock	2m
Small Cable Sock	2m
Variable Frequency/Speed Drive / (With Spindle Option Only)	0/1
12V Bilge Pump (Water Cooled Spindles Only)	0/1
2 x DC Power supplies, electronics option dependant	2
Shielded 4 Core VFD Spindle Cable	7m



UK: 01733 590 191

info@3dtek.xyz

3dtek.xyz

AUS: +61 410 730 128

support@3dtek.xyz

As we mentioned previously, your inverter must be installed by a fully accredited licensed electrician – who must ensure:

- *The inverter has a ground connection.*
- *If you've purchased a water-cooled model, the electrician should set up the coolant pump to prevent the premature wear of the spindle.*
- *The VFD parameters are set up correctly before the spindle is run.*
- *That there is no polarity to the connections on the spindle. Active outputs from the VFD connect to any of pins one, two or three. You need your spindles to be running clockwise, if the spindle is not doing so, any two of the active spindles can be swapped at either end, although the ground line to pin four needs to remain connected at all times.*
- *This machine is noisy, so a shielded cable is provided to prevent interference with the signal lines of the limit switch.*
- *The VFD front panel can be removed a network cable can mount the control panel in the most convenient place.*

## Variable Frequency/Speed Drive (VFD / VSD)



UK: 01733 590 191

info@3dtek.xyz

3dtek.xyz

AUS: +61 410 730 128

support@3dtek.xyz

When assembling your Heavy Mill, it is not always necessary to do so in a specific order.

However, if at any point you find the build difficult, you can always join our Facebook group.

We have an active community of experts and newbies alike to share knowledge and swap stories.

## Assembling Your Heavy Mill

As a rule of thumb with just about anything you build, if it fits, it's the correct bolt, nut or screw.

Included in your kit, there will be several different kinds of washer, which offer support to various parts of the machinery:

· *The spring washers will help to maintain pressure on the joint, thereby reducing vibration.*

· *The star washers keep the assembly in a position where bolts can be in a slot rather than a hole.*

*There are quite a few spares included, so don't panic if you have washers and nowhere to put them.*

It's incredibly important to seek the support of a qualified and trusted electrician for commissioning.

The VFD cable supplied in your kit is an important part. Although it's difficult to make use of such a thick cable, it has been designed to be robust and should not be substituted in any circumstance.

## Electronics



UK: 01733 590 191

info@3dtek.xyz

3dtek.xyz

AUS: +61 410 730 128

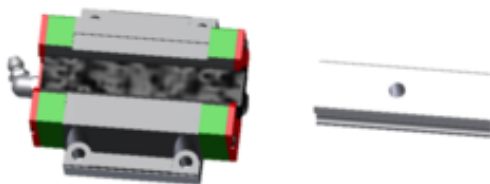
support@3dtek.xyz

## Pre-Build Notes

The Linear Bearing blocks used on the X & Y axis must be installed very carefully.

There is a small black spacer inserted into the bearing, which should not be taken out – doing so will release all the balls.

Also, never remove the black spacer strip unless there's a rail that will be put in to take its place.

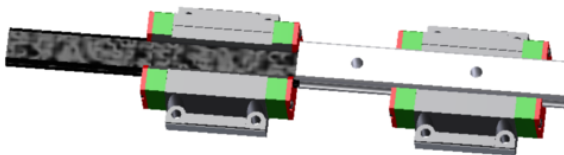


The tolerances of these bearings designed to be tight. However, when two bearing blocks must be used together the bolts securing each block mustn't be tightened too much; they should be kept loose.

If the bolts are too tight and there is no room for movement in the alignment of each of the blocks, the rail will be unable to slide through both blocks.

In the image below, you'll see that the rail is attempting to enter the second block – this needs to be either exactly aligned or kept loose. Otherwise, you will need to back the spacers out and realign them.

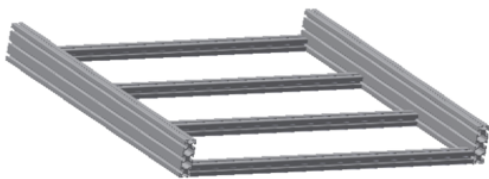
And it can be tricky to feed the spacers back into the blocks while retrieving a heavy rail out of the block.



The Heavy Mill base consists of 4 to 6 x 40\*40 cross extrusions and 2 x 40\*120 Y Extrusions.

## Base Construction

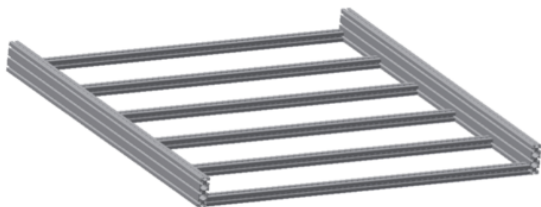
### 1000mm:



#### Parts List for 1000mm Base:

- 4 x 40\*40 Base Supports
  - 2 x 40\*120 Y Rails
  - 8 x M8\*40mm SHCS
- 4 x T-Slot Connectors (With T-slot Base option only)
  - 20 x m6 Tee Nut (With T-slot Base option only)
  - 20 x M6x25 FHCS (With T-slot Base option only)

### 1500mm:

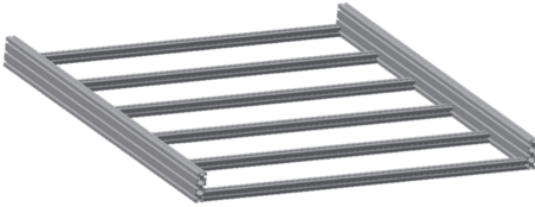


#### Parts List for 1500mm Base

- 6 x 40\*40 Base Supports
  - 2 x 40\*120 Y Rails
  - 12 x M8\*40mm SHCS
- 6 x T-Slot Connector (With T-slot Base option only)
  - 30 x m6 Tee Nut (With T-slot Base option only)
  - 30 x M6x25 FHCS (With T-slot Base option only)

**Custom Size Heavy  
Mills: \***

**Base Construction**



**Parts List for Custom Base**

- *Custom qty of 40\*40 Base Supports.*

- *2 x 40\*120 Y Rails.*

- *Gussets for base construction.*

- *\*Custom Heavy Mill Sizes ship with a custom qty of 90 Degree Gussets rather than M8 bolts for assembly.*

- *4040 Base supports to be set with even spacing along Y Rails.*



# X/Z Axis Setup

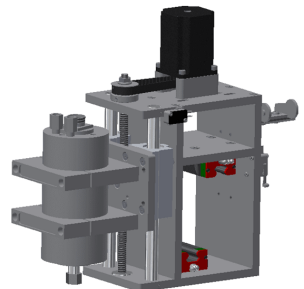
## X/Z Axis Parts

Part Description	Quantity
HGW20CC Linear Bearing Blocks	2
Hardened Steel Shaft	2
X Carriage Vertical Front	1
X Carriage Vertical Back	1
M5x20 FSHCS	32
Flanged Bearing	2
Z-Axis Acme Thread	1
AT5 Belt Loop	1
Limit Switch with Lever	2
Limit Switch No Lever	1
Belt Clamp Bottom	1
Belt Clamp Top	1
M4x25 SHCS	2
X Carriage Horizontal Mid	1
X Carriage Horizontal Bottom	1
M6x20 FSHCS	12
Drag Chain Bracket	1
M5x12 BHCS	2
M3x25 SHCS	4
M3x16 SHCS	2
X Carriage Horizontal Top	1
NEMA 23 Stepper Motor	1
8MM Steel Spacer for Acme Pulley	1
Z Motor Mount	1
Pillow Block Bearings SC16LUU	2
Spindle	1
Z-Axis Lead Nut	1
Spindle Mount Front	2
Spindle Mount Back	2
Spindle Carriage Plate	1
M5x16 SHCS	8
M8 Flanged Nut	1
Drag Chain end link	1
AT5 Pulley 10	1
AT5 Pulley 20	1
Pulley Grub Screws	4
M3x10 BHCS	4
M4x10 SFHCS	2
M5x25 BHCS	2

## Notes:

# X/Z Axis Setup

- *Don't remove the black tabs from inside the bearing blocks themselves.*
  - *The bearing blocks are not designed to directly sit in line with each other, one is supposed to be offset.*
- *There are three horizontal plates and two verticals.*
  - *All plate screws are countersunk M5 \* 20's*
- *The HGW20 bearing blocks take M6 countersinks (leave them loose)*
- *Make sure you install the flanged bearings, acme thread, hardened shafts and pillow block bearings at this time so that it doesn't have to come apart during the installation of the Z-Axis.*
- *The tolerance of the 6 holes for the shafts and flanged bearings is very tight, which means you might have to lightly sand the inside of each hole with some emery cloth to install the shafts and bearings.*
- *The star washers will help the Z motor grip in its slots, install at the closest point to the front, put on AT5 closed belt on then pull back tight and lock-off nuts.*
- *Once complete you can add the Z-Axis parts as well as the main X 8080 rail.*



- *When you install the linear rails, note that they are intended to be offset.*
- *Do not install the green dust plugs into the bearing rails – this job must leave this until the end of the build.*
- *Again, be sure not to tighten any bearing rail bolts until the X-axis belts are exactly lined up.*

## X-Axis Linear Rails

- *The other two 20mm Linear rails should be installed in the topmost channel of the main Y rails in the base frame using the tee nut bars and M5x20 SHCS as per the X-Axis previously completed.*
- *Once again, leave all bolts loose, tightening only enough to make sure that bolt heads are not sitting proud of the rail which will cause them to foul a bearing once they slide along the rail.*
- *Don't tighten any bolts within the bearing blocks – remember, must remain loose for alignment.*
- *Be cautious when installing bearing blocks, they should be on the opposite side of the three vertical countersinks on the top of the Y plates.*
- *Provided are M6 star and spring washers for the 20mm HGW20 bearing blocks. If using both, the star washers should be flat against the alloy plate and the split washer against the head of the bolt.*
- *Don't remove the black bearing keepers from the bearing blocks yourself, these will be forced out when pushing the bearing onto the rail.*

## Y Plates Build and Gantry Installation



There are two methods for getting the gantry installed.  
The best method will depend on if you have a second person available to help.

### **Method 1: Solo**

Whilst by no means an easy feat, one single person can install the gantry by first sliding the lone Y plate assemblies onto the Y-axis bearing rails and then lifting and chocking the gantry X rail (with X/Z axis present) into place.

### **Method 2: Two People**

The Y plate assemblies can first be attached to the gantry X Rail (with X/Z Axis also present) and then the entire assembly lifted and slid onto the awaiting Y bearing rails.  
Be sure to leave the 16 \* M6x20 SHCS very loose.

## Y Plate Explosion

## Install Y Bearing Rails

- *Place T nut bar behind the bearing rail and very loosely screw in the m5x20 SHCS.*
- *Slide entire bearing rail into Y-axis (found at the top of the 3 Tee Slots).*
- *Lift the bearing rail high in the t-slot while tightening up the M5x20 SHCS.*
- *Once again, do not install green dust plugs at this time.*



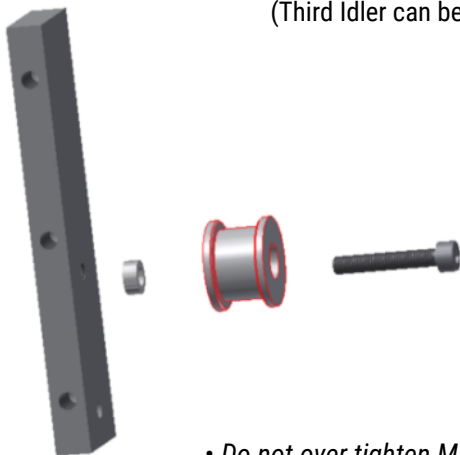
- *Idler pulley plates and motor plates come with an extra hole for a screw that holds the drag chain support extrusions, these are installed with the hole at the bottom.*
- *There are 4 Y end plates, 2 A-Type and 2 B-Type. They differ only in that the side that they are countersunk and the placement of the single-threaded hole.*
- *The two A-type's should be installed diagonally opposite each other, the same goes for the two B-type plates.*

## Y End Plate, Pulley Plate, Stepper Plate and Stepper Motor installation

Install Idler Bearings with spacer x 3  
(Only 2 required for Y-Axis)



Attach Idler to 2 x Y Idler Pulley Plates using M5x30 BHCS.  
(Third Idler can be put aside for now)



- *Do not over tighten M5x20 SFHCS (8)*
- *The smaller opening of the Idler pulley is oriented towards the head of the M5x30.*

- *X Motor requires 20mm SHCS screws, not 25mm as previously used on Y, Z, and A motors.*
- *Depending on the installation, some may require substitution for M5x16.*
- *Install motor in the position that slots closest to the centre of the machine.*

## X Motor Plate

- *Do not over tighten M5x20 SFHCS.*

- *Again, some installations may require substitution for M5x16.*

- *You will need to break and join your drag chain to achieve the desired length, while considering bend radius.*

- *Ensure when setting the X drag chain length, that the drag chain is not long enough to foul the X idler pulley plate when the X carriage comes to the end of its run.*

- *One male and one female drag chain end are required for each part of the chain.*

- *4 \* M4x12 SFHCS / BHCS Secure the drag chain ends to the mounts.*

- *4 \* M4x8 SFHCS secure the other ends to the drag chain support extrusions using m4 T-Nuts.*

## X Pulley Plate

- *X Motor requires 20mm SHCS screws, not 25mm as previously used on Y, Z, and A motors.*
- *Depending on the installation, some may require substitution for M5x16.*
- *Install motor in the position that slots closest to the centre of the machine.*

## X Motor Plate

- *Do not over tighten M5x20 SFHCS.*

- *Again, some installations may require substitution for M5x16.*

- *You will need to break and join your drag chain to achieve the desired length, while considering bend radius.*

- *Ensure when setting the X drag chain length, that the drag chain is not long enough to foul the X idler pulley plate when the X carriage comes to the end of its run.*

- *One male and one female drag chain end are required for each part of the chain.*

- *4 \* M4x12 SFHCS / BHCS Secure the drag chain ends to the mounts.*

- *4 \* M4x8 SFHCS secure the other ends to the drag chain support extrusions using m4 T-Nuts.*

## X Pulley Plate

• One limits switch has no lever; this is designed for the Z-axis – it's triggered by the pillow block bearing case.

• The limit switch mounting holes are now tapped m3, so no washer and nut are needed.

## Limit Switches

Parts	Description	Qty
LMS	Limit Switches	5
Y-Axis Limit Switches	M3 x 25mm Socket Head Cap Screws	4
X-Axis Limit Switches	M3 x 25mm Socket Head Cap Screws	4
Z-Axis Limit Switch	M3 x 16mm Socket Head Cap Screws	2

The limit switches are fouled by screws inserted into the Y Gantry plates and the Y End Plates. They can be screwed in and out to eventually set the machines home and the extent of travel.

The Y-axis bearing rails are to be pulled as high as they can be in the Y rail slots and screwed to a reasonable tightness. That said, do not over tighten the bolts, they are only threaded into a thin alloy tee nutbar, so they won't require much elbow grease.

There are a lot of these bolts all pulling the Tee nut bar into contact with the inner surface of the t-slot. It's this friction that holds the rail into place without overtightening the bolts.

Similarly, pull the gantry high when tightening the bolts in the Y carriage plates bearings. The 8 bolts going into the 2 bearings on each side of the gantry, are to be as low as possible in the slots on the Y carriage plates.

## Limit Switch Triggers



Push the X carriage to one side of the machine and then tighten the 8 bearing block bolts in the X Carriage.

## Tightening Up X Bearings and Bearing Rails

When loose, the X-axis bearing rails should have some play in the T-slot. They are designed to be moved forward and backwards by around 5mm. Pull the X carriage towards the front of the machine so that it pulls the X bearing rails forward in the t-slot they are secured to.

Starting from one end move along the TOP rail (only) securing each screw in the rail. As per the Y bearing rail, no need to over tighten these screws.

Continue pulling forward on the X Carriage and bearings so that they are positioned facing the front of the machine.

Then work back the other way, tightening the underside bearing rail screws as you do so. Again, keep the carriage close which is all the more important this time.

## Installing Belt Clamps and Belts

- Pull the motors towards their mounting slots in the centre of the machine and tighten up.
- Leave the top belt clamp top loose-fitting with at least 5mm so that you can fit a doubled over belt into it.
- Back off the screws holding the pulley, so the plate is loose with a good 3-5mm of play.
- The belt will be in your cut as a single length, it will need to be cut into three equal pieces.
- The belt loops around both the motor pulley and the idler pulley. It meets at the belt clamp and crosses with the belt coming from the motor end on top.
- Install the belt with a little slack, when the pulley plate screws are tightened tension will pull onto the belt.
- Slide the carriage from end to end to ensure that the belt does not try to run off the motor pulley or the idler pulley. The depth that the motor's pulley is inserted on to the shaft and that the belt is pushed into the clamp may need adjustment. The idler has no adjustment and so will set the standard.

Parts	Description	1000mm Qty	1500mm Qty
BCT	BeltClamp_Top	3	3
BCB	BeltClamp_Bottom	3	3
Belt Clamp Bottom and Stepper Motors	M5 x 25 Button Head Cap Screws	6	6
Belt Clamp Top	M4 x 25mm Socket Head Cap Screws	6	6
Belt	Open Loop Belt – meters	7.5	10
Belt	<a href="#">Closed-loop</a> 275mm T5 Belt	1	1

## Installing Belt Clamps and Belts

- *When retightening the pulley plate take note of the belt tension. It should not be firm when the pulley plate gap is closed back up. It's a bit difficult to measure so a good test is to pull the gantry forward, so the front of the Y carriage plate is 300mm from the front of the machine then sit a 600g weight (a full 375mm bottle of beer) on the top of the belt in front of the carriage. It should deflect by around 3mm or so. Any tighter and there is a risk of snapping stepper motor shafts, looser and you may end up tightening it later. If you do break something, we will replace it without charge once, with the experience, it wouldn't happen twice.*
- *You may need to back off the pulley plate and belt clamp top plate to readjust the belt length/tension several times before being happy.*
- *The belt clamp top does not need to compress the belt much to gain a very good grip. Don't overtighten as it's difficult to remove later. Always install and remove the belt clamp top by turning each screw a little bit at a time. Tightening or loosening one bolt by much more than the other leads to the other getting jammed due to the expanding force of the compressed belt in the clamp. If this happens, squeeze the top and bottom of the clamp together with a pair of plumber's grips / large set of pliers/vice grips etc, or tap the top plate gently with a hammer.*
- *Trim the belt back to no more than 20mm extending from each side of the clamp. It's very difficult to cut due to the metal radials.*

## Wiring and Plumbing

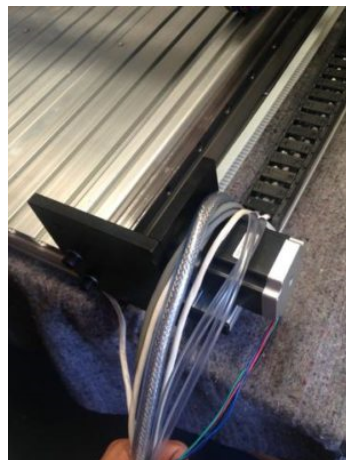
- *There are two sets of drag chain. One running with the X-Axis and One Running with the Y.*
- *All cables running through the X must also travel through the Y chain.*
- *You can remove one end of each drag chain and lay it flat to work in cables or more simply remove all the underside clips of the chain and lay through the entire wire bundle as one.*
- *Avoid drawing wires through if possible as they can wrap around each other – opening all the links and laying cable in works best and enables the removal or repositioning of a single cable if necessary, later.*

Parts	Description	1000mm Qty	1500mm Qty
<b>VFD Cbl</b>	Shielded 4 Core VFD Spindle Cable	5	7
	Stepper Wire Harness	4	4
	Limit Switch Harness	3	3
<b>Hose</b>	5mm Water line hose – water-cooled only	2x5m	2x5m

### Y-Axis Notes

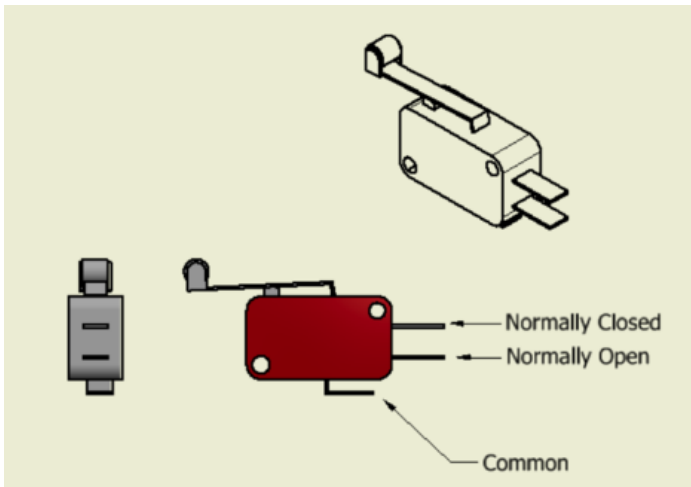
The furthest Y cable (away from the Y cable drag chain) runs down the back of the machine in the T slot of the back support 4040 base extrusion.

All Cables feeding the machine will end up exiting the Y drag chain at the back of the machine. (Other than the two Y motors which never enter the drag chains.)



## Limit Switch Termination

- *The limit switches have 3 terminals. Common, Normally Open, Normally Closed*
- *Generally, we use the common and normally open which are the terminal on the side and the closest terminal to the one on the side.*
- *Each switch needs two wires, if necessary, the common can be shared between any of the switches.*



From each switch, one wire goes to the common and one wire to the Normally Open.

There are 4 Wires on each stepper motor.

- *The Stepper motors have two coils, and two pairs.*
- *If the wires of any one or more pair are touching each other, the motor will act as a brake and be hard to spin by hand. In this way it's possible to identify the pairs if you touch any two wires together and the motor doesn't become hard to spin, those two are not a pair. When you find a combination of two wires that when joined make the motor difficult to spin, that's a pair – and by default, the other two are the second pair.*
- *The pairs are Red/Blue and Green/Black.*
- *Once connected – To identify in the mass of wires coming off the machine which wires are for which motor you can short out one of the pairs and see which axis becomes difficult to move, then mark this wire so it can be identified when you come to wiring your controller.*

## Stepper Motors

Depending on the electronics options selected there will be different items supplied with the electronics enclosure.

**PLEASE NOTE:**

**There are by necessity several 240V components in this system that are to be commissioned by a licensed electrician.**

**3DTek cannot stop you from commissioning these parts yourself and hope that you can consider your own and the safety of everyone who may come into contact with this system now and in the future by organising a licensed electrician for what should be 1 to 1.5 hours of time to wire up the system for you.**

**3DTek will, by arrangement, be ready and awaiting a call during the time your electrician is booked to ensure that the commissioning does not cost you any more than it has to in tradesman's fees.**

All Kits will include:

- *Large Plastic Enclosure with hinged lid & metal enclosure + Hardware for mounting*
- *Neutrik Power input Plug and Socket + Hardware for mounting*
- *Fan + Mounting Hardware (Please see the sticker on the fan for appropriate supply voltage)*
- *2 Fan Filters + Mounting Hardware*
- *At least one power supply*
- *~300mm of Din Rail*
- *Some cable management – cable ties and sticky mounts*
- *Cable Glands for cable entry*

Enclosure Layout



UK: 01733 590 191

AUS: +61 410 730 128

info@3dtek.xyz

support@3dtek.xyz

3dtek.xyz

There is no right or wrong way of laying out and wiring the enclosure.

See a mock-up photo of a suggested layout on the proceeding pages. You can lay it out however you prefer, however there are some points to note when making these decisions:

## Enclosure Layout

- *VFD Output, and to some extent AC/DC power supplies & the USB/VGA do not play nice. In placing the AIO/MassO board or any USB/VGA device with its USB connector to the bottom left of the enclosure and the VFD and VFD output cable in as far to the opposing corner as possible we lessen the likelihood of USB disconnections that can be caused by the interaction between USB and the VFD.*
- *The Fan is blowing into the enclosure beside the motor driver which is the main heat-generating source. This would be the AIO, Gecko or similar. The flow of the fan is towards the sticker so have the sticker pointing in. The fan filter goes on the outside of the enclosure and the fan on the inside.*
- *Use a hole saw that is as close to the size of the fan blades as possible to drill the fan hole. A hole as little as 10mm diameter less than the fan blades can reduce 50% of the flow.*
- *The Exhaust filter is placed directly across from the inlet. This could be anywhere but helps to ensure air is travelling directly across the motor drivers. There is enough air exchange in the enclosure that it is not particularly important and does not need to blow over the PSU's or VFD.*
- *The exhaust filter is necessary only as when the machine is off there is no positive pressure and so dust from other works in the area can invade.*
- *If using a USB control system (AIO, GRBL + Gecko) the USB lead can exit the enclosure through one of the medium size glands. You will need to heat shrink or wrap with tape the cable to increase its girth so that the gland will grip it.*
- *The USB and the VFD cable are the two to keep very separate! So, when these two leads exit the enclosure, the VFD cable should head off the machine and the USB lead in the opposite direction and should never cross paths. These Invertek VFD's are very high quality and don't generally cause trouble – VFD's are by nature are noisy though this is the primary consideration for wiring layout.*



UK: 01733 590 191

info@3dtek.xyz

3dtek.xyz

AUS: +61 410 730 128

support@3dtek.xyz



## Enclosure Layout



Congratulations on building your very own  
Heavy Mill!

The beauty of the Heavy Mill is its sheer versatility since it can be used to cut foams, timber, plastics, soft metals such as aluminium, brass and bronze, and hybrid materials.

The performance of the Heavy Mill is designed to compete against costly CNC Routers, while still retaining portability and ease of use.

## What to Expect From Your New Heavy Mill

Mills are especially effective at making patterns and shapes that just aren't possible with standard hand tools, some common items you can make with your mill, include:

- *Tools.*
- *Jewellery.*
- *Wood or metal art.*
- *Clocks and mechanisms.*
  - *Toys.*
- *Instruments.*
- *Ornaments.*

The world truly is your oyster, particularly since we're always working on upgrades and new modifications to enhance your Heavy Mill experience.

In fact, you can even design and manufacturer upgrades for the machine with the mill itself!



UK: 01733 590 191

info@3dtek.xyz

3dtek.xyz

AUS: +61 410 730 128

support@3dtek.xyz

# Get in Touch

If you require any more information on the heavy mill,  
you'd like to hear more about any of our other products  
or you'd like to get involved with our thriving Facebook  
community, contact us or check out our FAQ's:

[www.3dtek.xyz/contact-us](http://www.3dtek.xyz/contact-us)  
[www.3dtek.xyz/faq](http://www.3dtek.xyz/faq)  
[www.facebook.com/groups/3dtekusers](http://www.facebook.com/groups/3dtekusers)

Facebook: @3DTek.xyz  
Instagram: 3DTEK  
LinkedIn: 3dtek-cnc  
YouTube: 3DTek

UK: 01733 590 191

AUS: +61 410 730 128

[info@3dtek.xyz](mailto:info@3dtek.xyz)

[3dtek.xyz](http://3dtek.xyz)  
[support@3dtek.xyz](mailto:support@3dtek.xyz)

