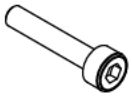
OpenStrain Bioreactor parts, assembly, and protocol

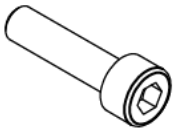
6 mm M3 Hex SHCS
Stainless Steel 316
QTY: 30

8 mm M3 Hex SHCS
Stainless Steel 316
QTY: 3

10 mm M3 Hex SHCS
Stainless Steel 316
QTY: 4



16 mm M3 Hex SHCS
Stainless Steel 316
QTY: 10



20 mm M5 Hex SHCS
Stainless Steel 316
QTY: 1

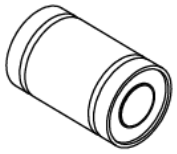
12 mm M5 BHCS
Stainless Steel 316
QTY: 16

M3 Nut
Stainless Steel 316
QTY: 2

1 x 9 x 20 mm
Spring
QTY: 1

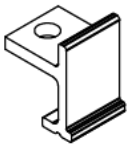
M3 Heat Insert
QTY: 32

M5 Heat Insert
QTY: 17



6 mm Linear Bearing
QTY: 2

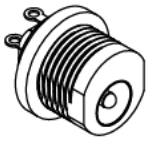
Well Clamp
QTY: 9



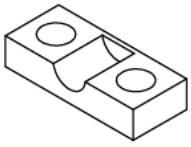
Pull Arm Clamp
QTY: 9

6 mm Well Key
QTY: 1

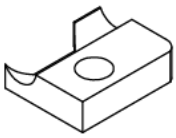
8 mm Arm Key
QTY: 1



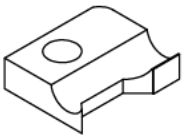
5.5 x 2.1 mm
DC Socket
QTY: 1



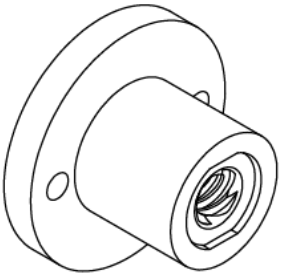
Smooth Shaft Clasp A
QTY: 2



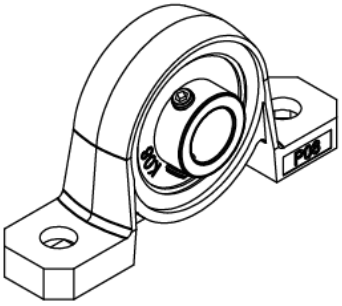
Smooth Shaft Clasp B
QTY: 1



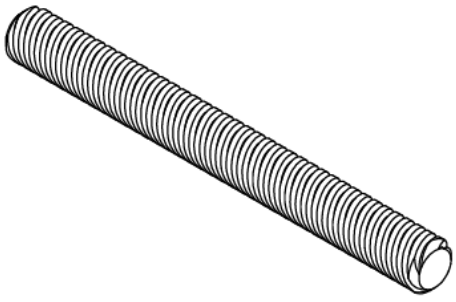
Smooth Shaft Clasp C
QTY: 1



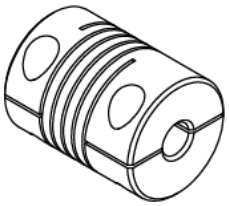
Type 2 ACME/TR8x8(P2)
Anti-Backlash Nut
QTY: 1



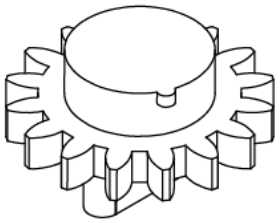
KP08 Pillow Block Mounted
Bearing
QTY: 1



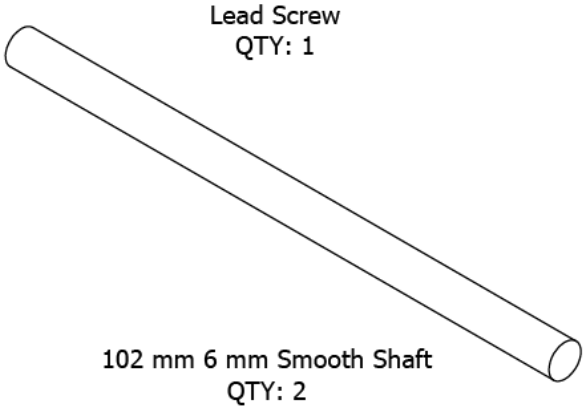
77.5 mm ACME TR8x8(P2)
Lead Screw
QTY: 1



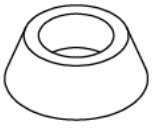
6.35 mm x 8 mm Flexible
Coupling
QTY: 1



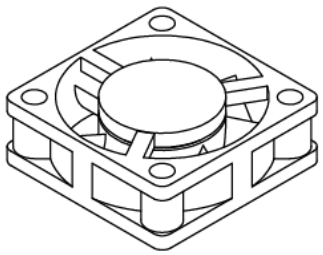
Spur Gear
QTY: 1



102 mm 6 mm Smooth Shaft
QTY: 2

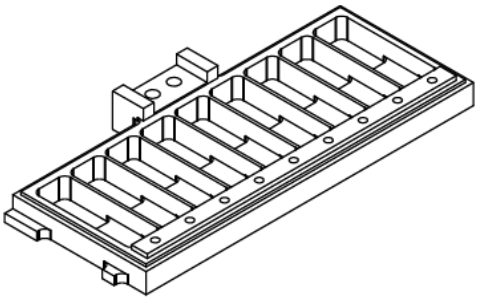


M5 Rubber Foot
QTY: 4

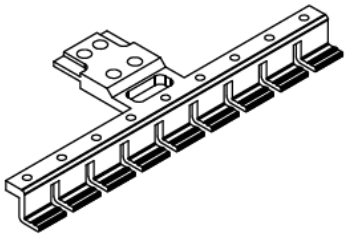


30x30x10 DC Fan
QTY: 1

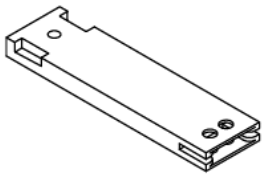
Designed by	Scale	Sheet
Matthias	1 : 1	1 / 3



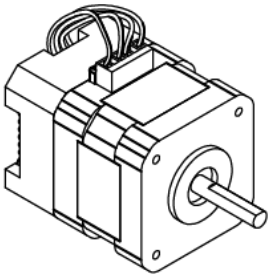
Well Plate
Stainless Steel 316
QTY: 1



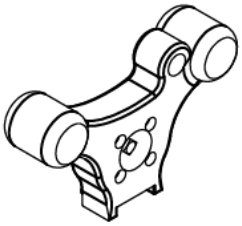
Pull Rake
Stainless Steel 316
QTY: 1



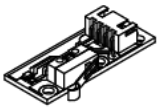
Pull Arm
QTY: 1



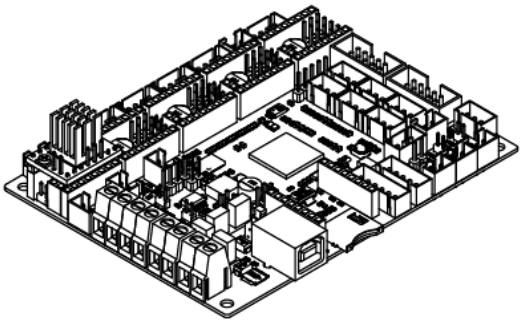
BTT S42C v1.1 42
Stepper Motor Closed Loop
QTY: 1



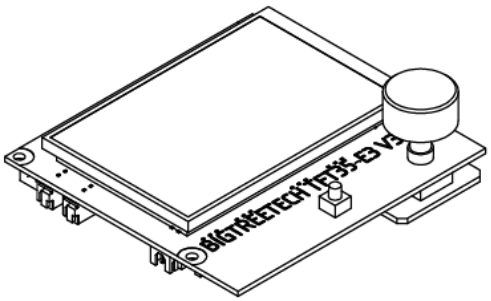
Linear Carriage
QTY: 1



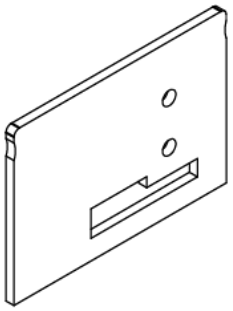
End Stop Switch
PCB Mounted
QTY: 1



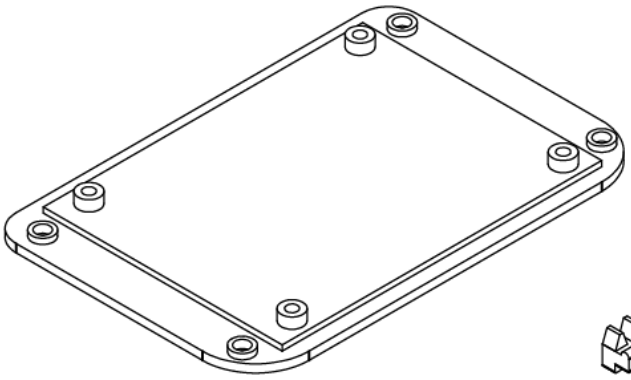
BTT SKR 3
Motherboard
QTY: 1



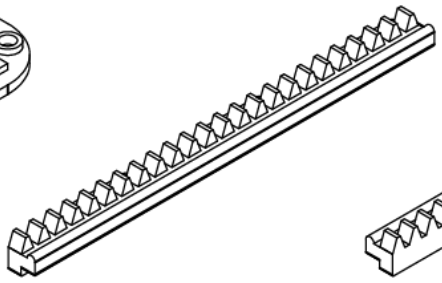
BTT TFT35 E3 v3.0.1
Touch Display
QTY: 1



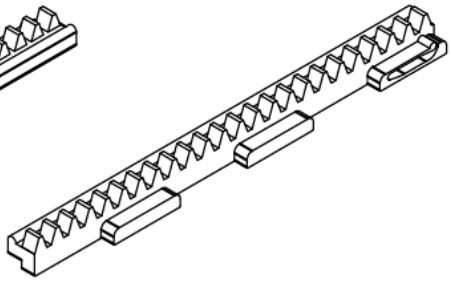
Motor Screen
Window
QTY: 1



Motherboard Base
QTY: 1



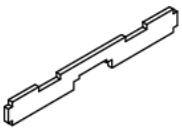
Rack A
QTY: 1



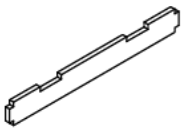
Rack B
QTY: 1

Designed by	Scale	Sheet
Matthias	1 : 2	2 / 3

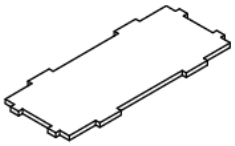
Well Lid Side
QTY: 2



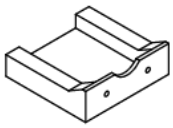
Well Lid Rear
QTY: 1



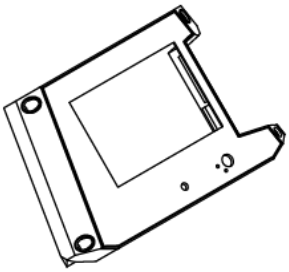
Well Lid Front
QTY: 1



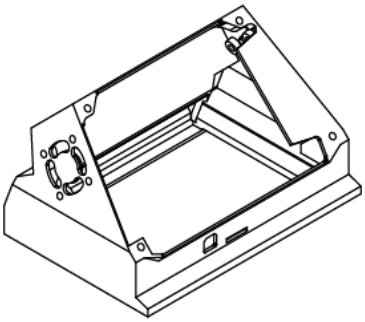
Well Lid Upper
QTY: 1



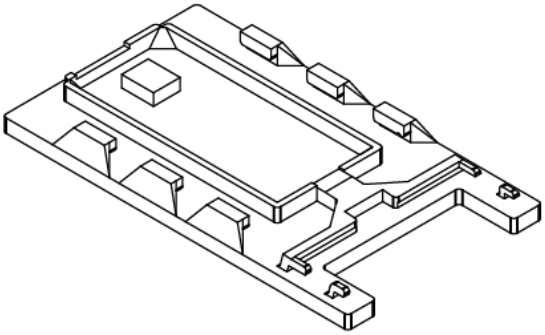
Motor Base
QTY: 1



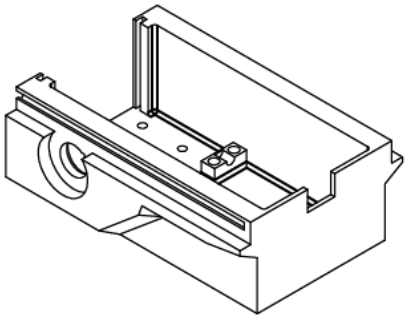
Control Unit Face
QTY: 1



Control Unit Base
QTY: 1



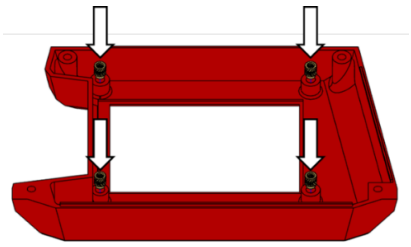
Drive Box Base
QTY: 1



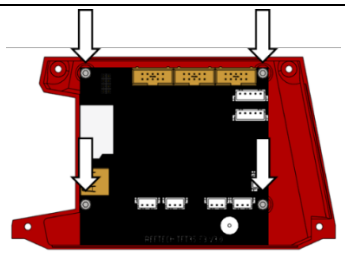
Drive Box
QTY: 1

Designed by	Scale	Sheet
Matthias	1 : 4	3 / 3

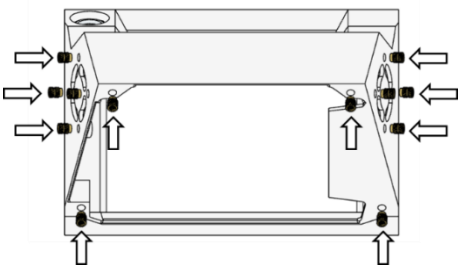
Bioreactor Control Unit Assembly



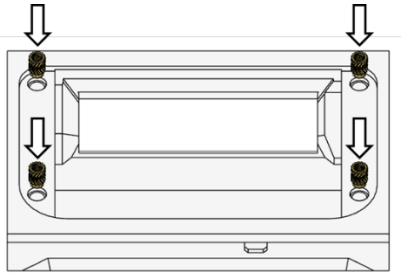
1. Install M3 heat inserts into control unit face.



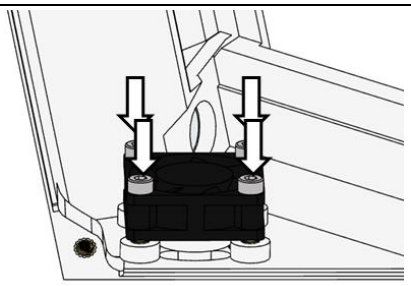
2. Secure BTT TFT35 E3 v3.0.1 display using 4x 6 mm M3 hex socket head cap screws (SHCS).



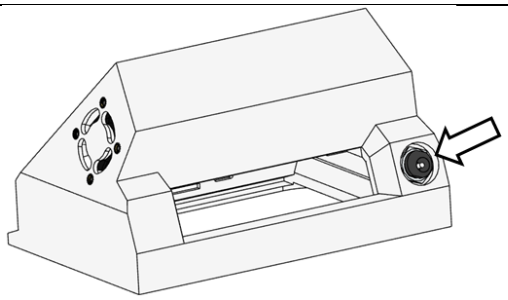
3. Install M3 heat inserts into control unit base.



4. Install M5 heat inserts into control unit base.

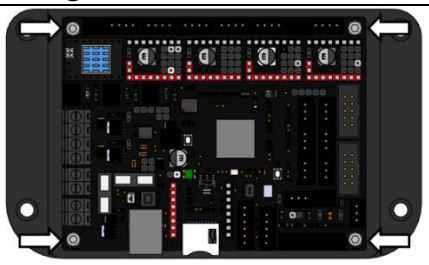


5. Secure both DC fans using 8x 16mm M3 hex SHCS. Ensure fan orientation vents air outwards.

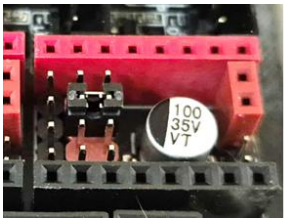


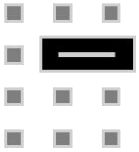
6. Solder leads to negative and positive terminals of DC power port. Install DC power port from within casing. Secure with nut on outside of casing.

7. Install M3 heat inserts into motherboard base.

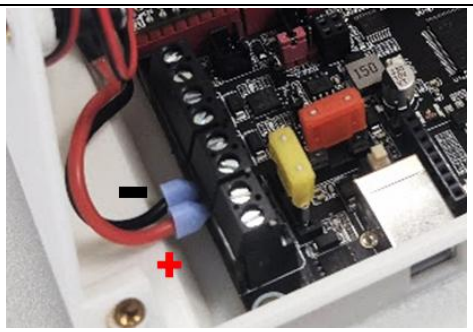


8. Secure BTT SKR3 motherboard as shown using 4x 6 mm M3 hex SHCS.

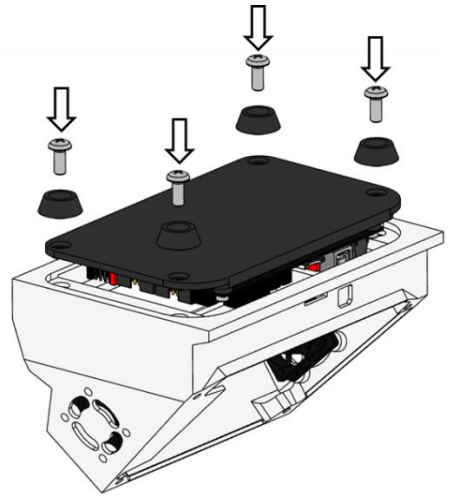




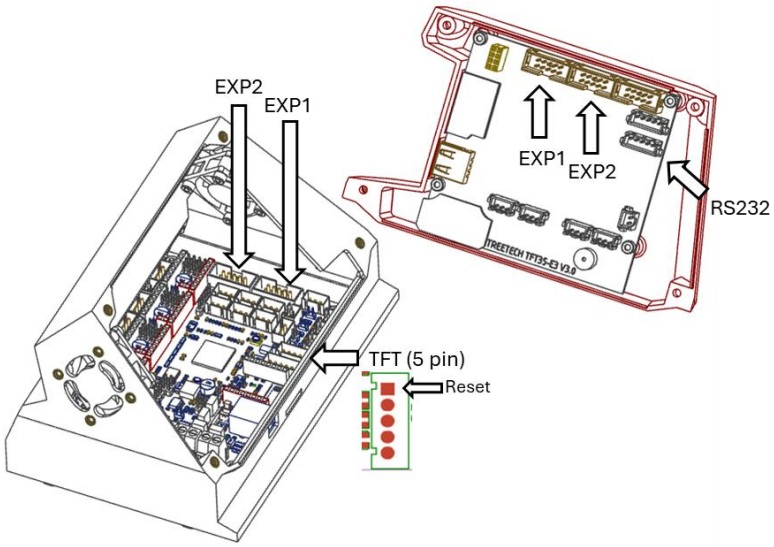
9. Remove/add jumpers to match above. Version B:



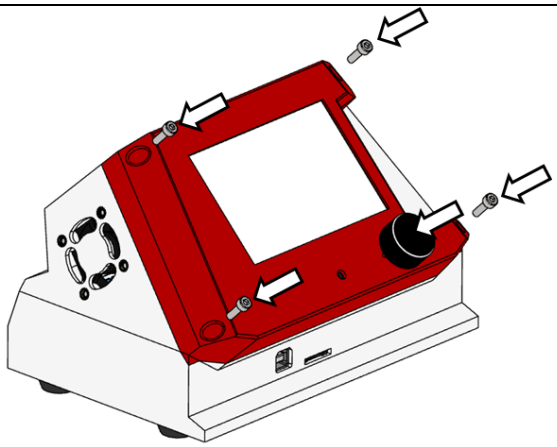
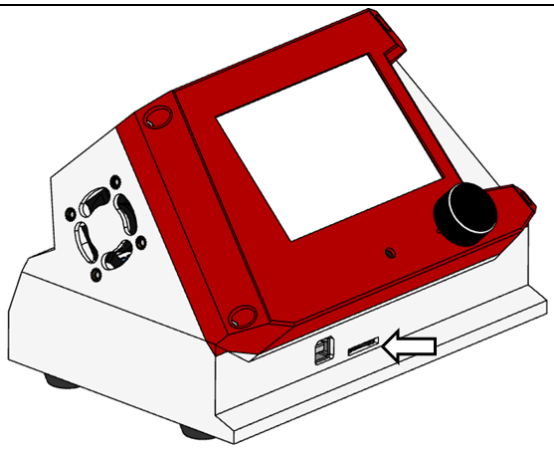
10. Insert and secure DC power leads to the SKR 3 power input terminals.



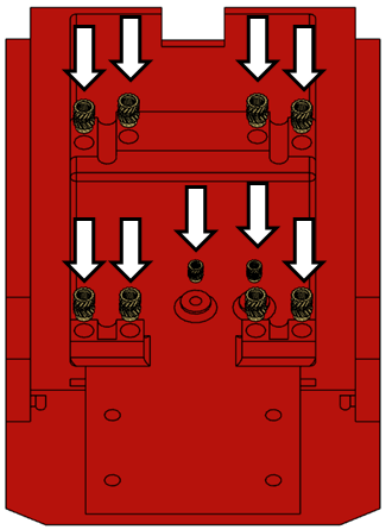
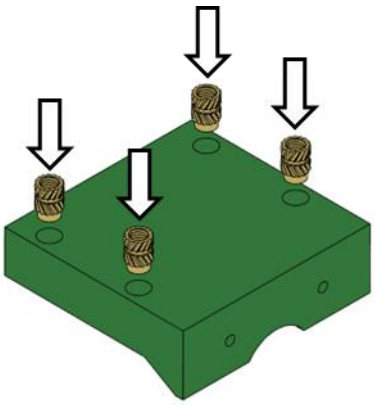
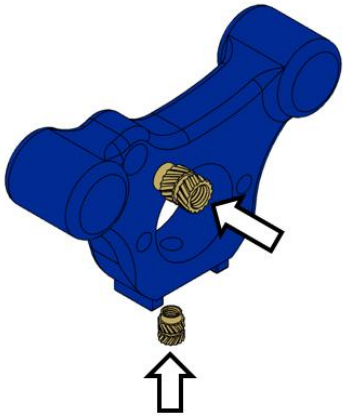
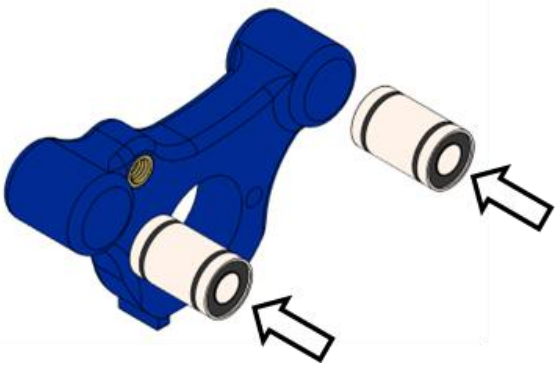
11. Secure motherboard base and rubber feet to control unit base using 4x 12 mm M5 button head cap screw (BHCS)

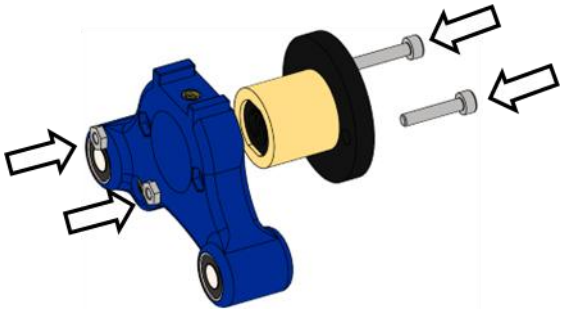


12. Use cables provided with BTT TFT35 display to connect EXP1 to EXP1, EXP2 to EXP2, and TFT to RS232. 5-pin TFT wire can be re-terminated with a 5-pin JST male header to ensure firm connection with motherboard. Ensure reset pin is attached appropriately.

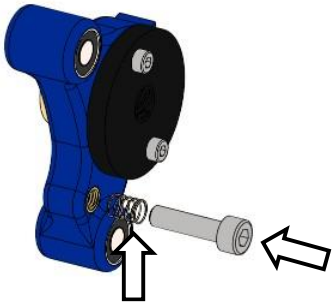
	
13. Attach rotary nob to TFT35 rotary encoder. Secure control unit face with 4x 10 mm M3 hex SHCS.	**14.** Install microSD card containing 'firmware.bin' from Printables online file storage (URL) to flash motherboard firmware on first boot. Power on control unit by connecting 24V 5A DC power supply.
The control unit are now assembled.	

Bioreactor Drive Unit Assembly

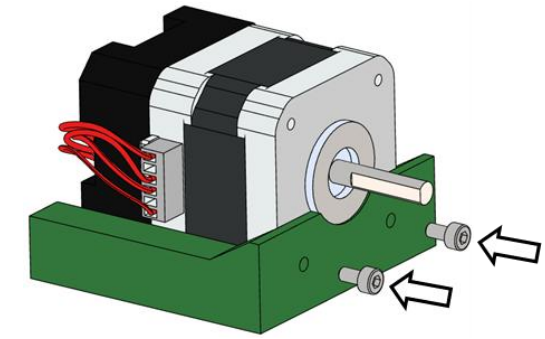
	
1. Install 8x M5 heat inserts and 2x M3 heat inserts into drive box.	**2.** Install M5 heat inserts into motor base plate.
	
3. Install 1x M5 heat insert and 1x short-style M3 heat insert into linear carriage.	**4.** Press fit 6mm linear bearings into linear carriage. Secure with super glue if necessary.



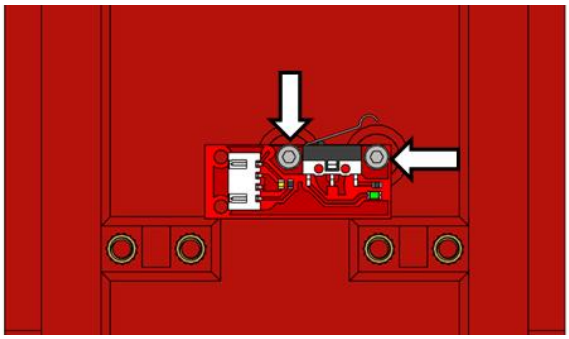
5. Secure lead nut using 2x M3 nuts and 2x 16 mm hex SHCS.



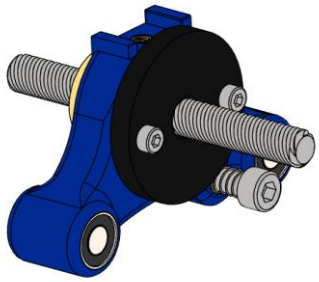
6. Install 20 mm M5 hex SHCS with spring into linear carriage such that the spring just starts to compress



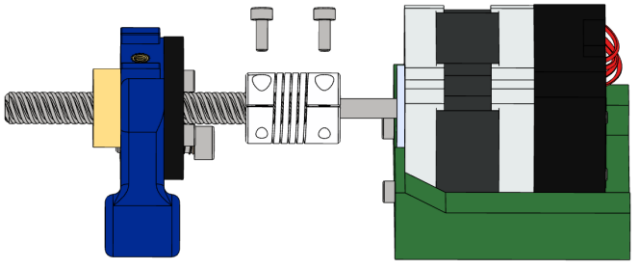
7. Secure the BTT S42C stepper motor to the motor plate using 2x 6 mm M3 hex SHCS. Match orientation to image above.



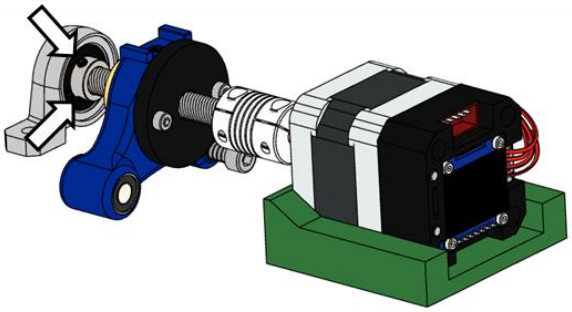
8. Attach the 3-lead limit switch wire to the limit switch. Secure the limit switch to the drive box with 2x 6 mm M3 hex SHCS.



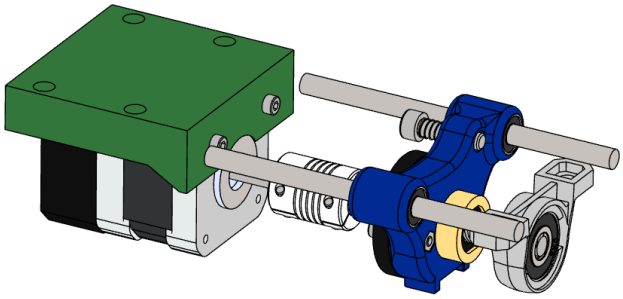
9. Twist the 8 mm ACME lead screw through the lead nut. Ensure the spring within the lead nut is under tension.



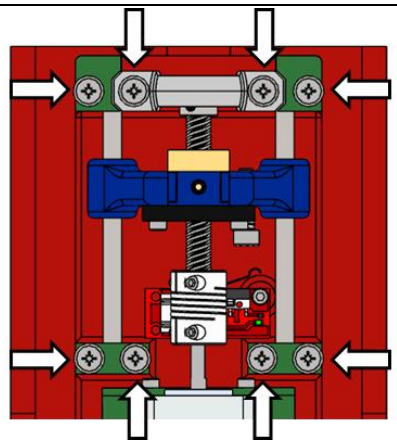
10. Attach the lead screw to the motor shaft using the flex coupling and 2x 8 mm M3 hex SHCS.



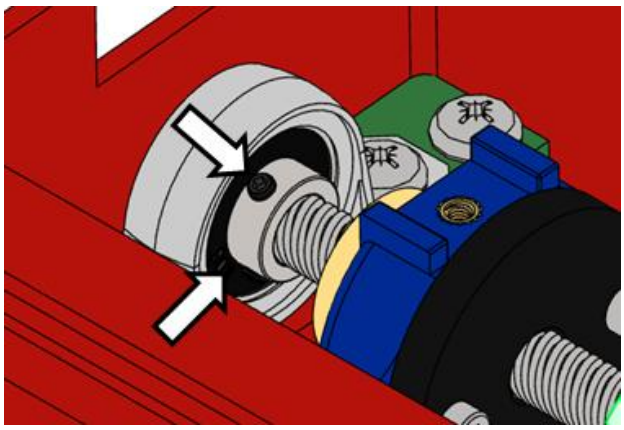
11. Place the pillow block bearing onto the free end of the lead screw, but do not fasten its internal grub screws yet.



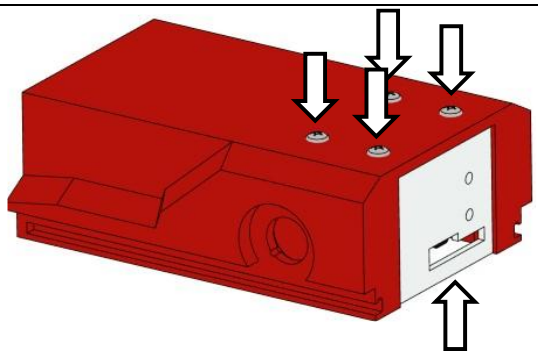
12. Slide the smooth rods through the linear bearings.



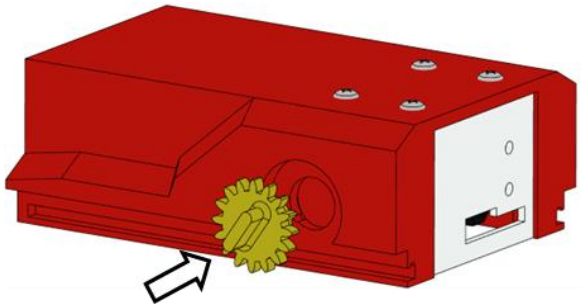
13. Secure the smooth rods and pillow block bearing to the drive box using Smooth Shaft Clasp A (2x), B, & C and with 8x 12 mm M5 BHCS.



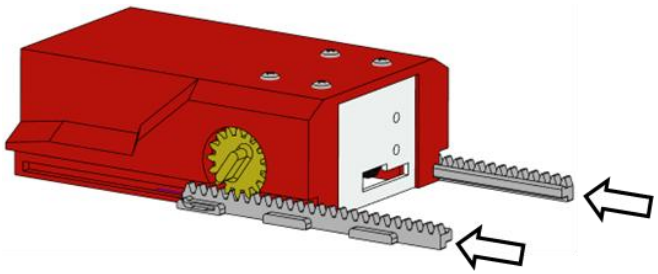
14. Secure the pillow block bearing to the lead screw by fastening its internal grub screws.



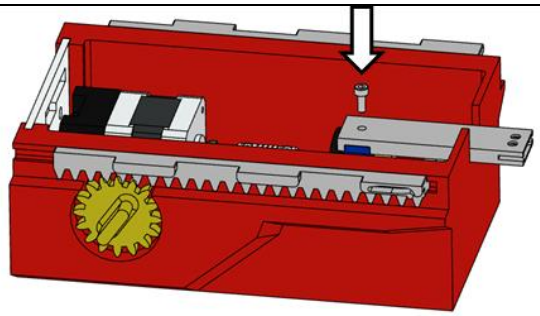
15. Secure the motor plate to the drive box using 4x 12 mm M5 BHCS. Slide motor window into the back of the drive box.



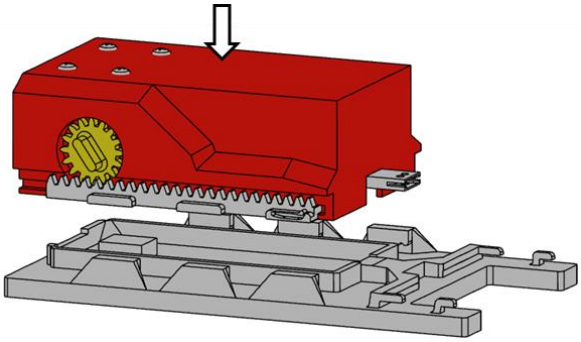
16. Install the spur gears into both sides of the drive box.



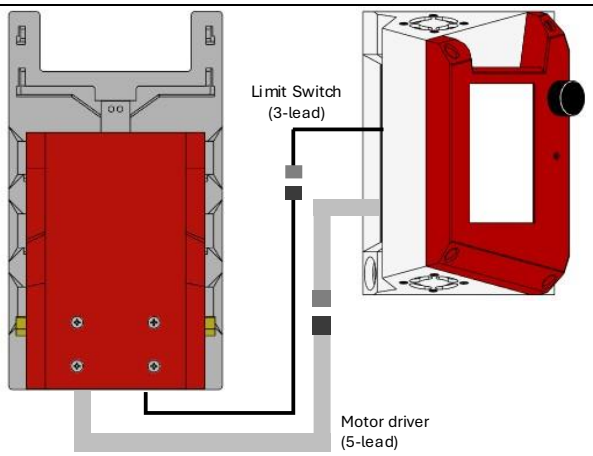
17. Slide Rack A & B down rails on drive box.



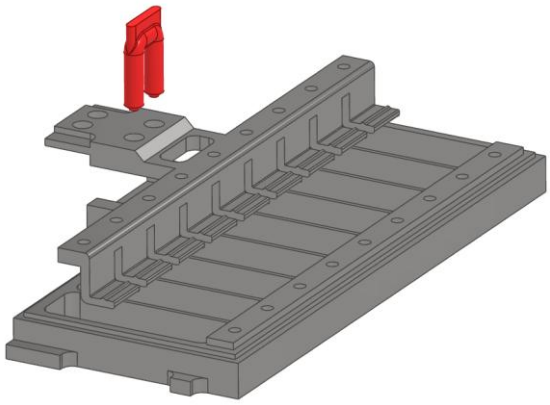
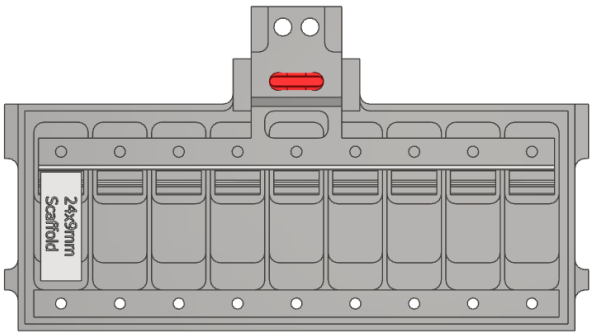
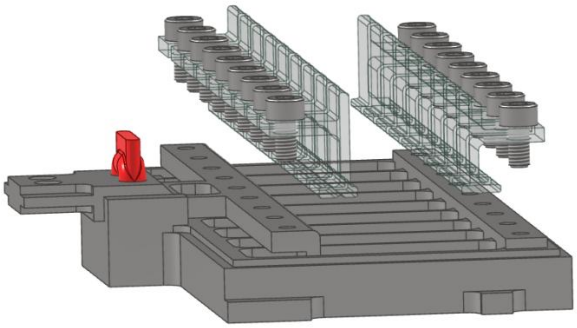
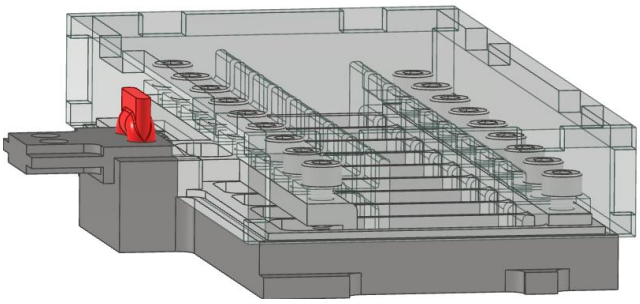
18. Install M5 heat inserts into control unit base.



19. Place drive box assembly onto drive plate and secure by turning spur gears.



20. Connect motor to X driver input on motherboard and limit switch to x-lim input on motherboard. Attach extension leads on motherboard side of each cable. Use Y and Z for 2nd and 3rd bioreactors.

Loading the well plate assembly	
 **1.** Place pull rake into well plate and secure position with 8 mm well key.	 **2.** Place scaffold into well.
 **3.** Position 6mm M3 hex SHC screws in pull rake clamps and well clamps, then secure to pull rake and well plate.	 **4.** Enclose well plate assembly with acrylic well lid.
The drive unit and well plate are now assembled.	