TRAK® 3ntr 3D Printers

Maintenance & Troubleshooting Manual

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Covers Current Models:

- **3ntr A2**
- **3ntr A4**

TRAK MACHINE TOOLS

SOUTHWESTERN INDUSTRIES, INC.

2615 Homestead Place
Rancho Dominguez, CA 90220-5610 USA
T | 310.608.4422 | F | 310.764.2668
Service Department: 800.367.3165
e-mail: sales@trakmt.com | service@trakmt.com | web: www.trakmt.com

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TRAK Machine Tools
Southwestern Industries, Inc.
2615 Homestead Place
Rancho Dominguez, CA 90220
Phone 310-608-4422 Fax 310-764-2668
Service Department
Phone 800-367-3165 Fax 310-886-8029

Table of Contents

1.0 Introduction

This Maintenance Guide contains information to assist skilled and trained technicians in the maintenance, troubleshooting, and repair of the TRAK 3ntr 3D printers. It is far from complete; however, directly addresses the most commonly encountered issues that require maintenance, service, and/or troubleshooting with the TRAK 3NTR A2/A4 3D Printers.

Scope of the Maintenance Manual:

- Diagnostic Checklists/Flowcharts
- Repair Procedures
- Maintenance Procedures
- Upgrade Procedures

Although there is a Main Diagnostic Checklist available as a starting point for printer troubleshooting, this guide is most efficiently utilized browsing the table of contents to select the applicable Repair Procedures section content.

CAUTION - Information contained within this manual is a reminder for trained personnel only. This manual does NOT replace training – untrained personnel should not perform any maintenance on any 3ntr machinery even if dutifully following the procedures depicted into this document.

2.0 Safety

The safe set-up, calibration, and operation of your TRAK 3ntr 3D printer depends on its proper use and precautions taken by each operator. If these activities are performed incorrectly, there are risks, not limited to, electric shock, pinch/crush, burns, inhalation of fumes/debris that can cause serious injury or death.

NOTE – Southwestern Industries shall not be liable for damages resulting from mis-interpretation, misuse, error, and/or omission of the information contained within this manual.

Read and follow this Maintenance Guide. Understand the printer operation and safety precautions before setting up, calibrating, or operating the 3D printer.

- Always wear safety glasses and safety shoes.
- Always stop the printer before opening the access door and reaching into the printer.
- Always allow the printer, printer surface plate and workpiece to cool adequately before reaching into the printer.
- Have a qualified electrician make all electrical connections and cable wiring
- Never wear gloves, rings, watches, long sleeves, neckties, jewelry, or other loose items when operating the printer.

2.1 Safety Precautions

1) Do not operate this machine before reading and understanding all the available manuals.
2) Do not run this machine without knowing the function of every control key, button, knob, or handle. Ask your supervisor or a qualified instructor for help when needed.
3) Protect your eyes. Wear approved safety glasses (with side shields) at all times.
4) Allow the machine to cool before reaching into it for any reason. The printer bed, printer surface plate, printed part, extruders/nozzles, and other printer interior components can reach very high temperatures and cause serious burns.
5) Don't get caught in moving parts. Before operating this machine remove all jewelry including watches and rings, neckties, and any loose-fitting clothing.
6) Keep your hair away from moving parts. Wear adequate safety headgear.
7) Protect your feet. Wear safety shoes with oil-resistant, anti-skid soles, and steel toes.
8) Take off gloves before you start the machine. Gloves are easily caught in moving parts.
9) Remove all tools (wrenches, check keys, etc.) from the machine before you start. Loose items can become dangerous flying projectiles.
10) Never operate a 3D printer after consuming alcoholic beverages, or taking strong medication, or while using non-prescription drugs.
11) Protect your hands. Stop the printer bed movement and extruder translation mechanism:
    a. Before opening the printer access door
    b. Before reaching into the machine for any reason
    c. Before changing parts

d. Before removing the printer bed tray, printed parts, or filament debris
e. Before you make an adjustment to the extruder, nozzles or any interior mechanism.

12) Protect your eyes and the machine as well. Don't use a compressed air hose to remove the debris or clean the machine.

13) Stop and disconnect the machine before you perform maintenance and repair operations.

14) Keep work area well lighted. Ask for additional light if needed.

15) Do not lean on the machine while it is running.

16) Prevent slippage. Keep the work area dry and clean. Remove obstacles of any kind around the machine.

17) Avoid getting pinched in places where the printer bed or extruder arm movement can cause a crush or pinch injury

18) Do not operate the printer with the printer access door open or any of the windows or service access panels removed.

3.0 Maintenance

3.1 Check & Fill Coolant Level

The 3ntr printer is shipped with the coolant reservoir filled; however, check the coolant level before performing any calibration or test prints.

CAUTION – Printing with insufficient coolant will result in bad prints and in some cases may result in nozzle and/or extruder damage. Check and replace coolant on a weekly basis.

1) Locate the coolant filler cap on the top of the 3ntr printer.
2) Unscrew and inspect the coolant level. If lower ¼" below cap thread fill using the extra coolant (RED color) supplied with the printer. Use only factory approved coolant. Do not dilute.

Coolant Bottle and Printer Fill Cap

Proper Coolant Fill Level – ¼ Inch Below Cap Thread

3.2 Extruder Handling & Service

This section provides an overview of the Extruder assembly, provides detail instructions regarding handling the extruders, and provides instructions for assembling/disassembling the extruder as may be required for service or repair.

3.2.1 Extruder Overview

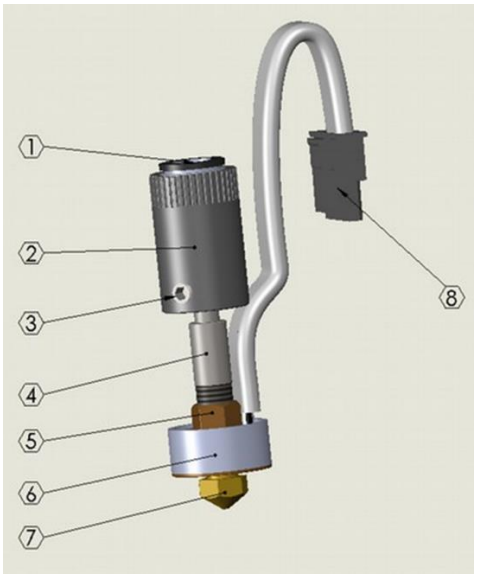
When looking at the image below we can find four main parts:

Tube adapter (2): is the round aluminum part that is used to hold the PTFE pipe that bring filament to the extruder. Pushing on collar (1) you can detach the PTFE piping. Set Screw (3)is used to secure the tube adapter on extruder – slightly tighten it (0.5Nm maximum)

Heat bridge (4): it's a carefully machined stainless-steel pipe that may be mounted upside down to get different thermal performances. Smooth outer surface must never be grabbed by vices or pincers.

Ceramic heater (6): the extruder heart, where the action is. We spent a lot of time improving it- use part (5) when assembling/disassembling an extruder

Nozzle (7): available on 0.3 / 0.4 / 0.6 / 0.8mm. Don't confuse our nozzle with cheap imports – ours have been engineered bot hat geometry and finish level to get you the maximum possible performances. Available also on anti-abrasion metal (0.4mm).



Extruder Components

3.2.2 Extruder Assembly Breakdown

Extruder Component Identification Guide

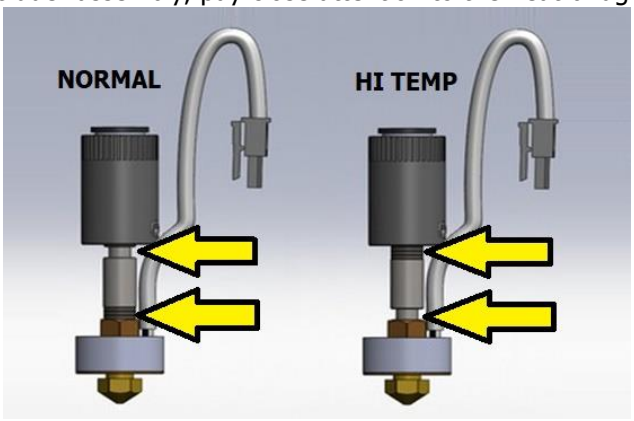
Assembly Breakdown

An extruder assembly consists of:

1. Print Head Connector
2. Thermocouple
3. Heater Wires
4. Bowden Tube Adapter
5. Heat Bridge
6. Ceramic Heater Assembly
7. Nozzle

3.2.3 Extruder Configurations – Normal/HI TEMP

When disassembling an extruder assembly, pay close attention to the heat bridge orientation.



Extruder Configuration ID Guide: Normal and HI TEMP

3.2.4 Handling Extruder Assemblies – Best Practices

Your 3NTR extruder assemblies do require some attention to handling to ensure a long service life.

This section provides guidance for handling extruders as applicable to nozzle changes, extruder disassembly, and any other maintenance service operation that requires handling the extruders.

3.2.5 Tools Required for Extruder Service

Tools for Extruder Service

Recommended tools:

- 2.5mm hex driver (Set included with printer)
- Stainless Steel wrench (Supplied with printer)
- 7 mm deep Socket (optional in Spares and Special Tools Kit)
- 0.5 mm feeler gauge (optional in Spares and Special Tools Kit, not shown)
- Dynamometric screwdriver with a setting of 1.3Nm (optional in Spares & Special Tools Kit, 2.5mm ¼" bit not shown)

3.2.6 Avoid Damaging the Ceramic Heater Assembly

IMPORTANT – At no time should there be clamping or twisting force on the ceramic heater assembly, thermocouple, and heater wires. Doing this will damage the ceramic heater assembly beyond repair and void your warranty.

Damaged Ceramic Heater from Applied Force

NOTE – In the photo of the Damaged Ceramic Heater, the ceramic is brittle, and once cracked, will loosen and further break down on each nozzle heat-up/ cool down cycle leading to rapid failure. To avoid this, the assembly is held together by opposing force that happens as the heat bridge is screwed into the nozzle, both into the ceramic heater assembly using the torque screwdriver.

3.2.7 Tool for Nozzle and Heat Bridge Service

Your printer comes supplied with a small, stainless steel wrench suitable for gripping the square surface provided. A 7mm deep socket is (included in the optional Tools & Spare Parts Kit) used to grip and secure the nozzle against the heat bridge at the correct torque value. 1.3Nm

Use opposing force only to secure assembly for use in the printer.

IMPORTANT - These are the only surfaces you should use force on when servicing an extruder.

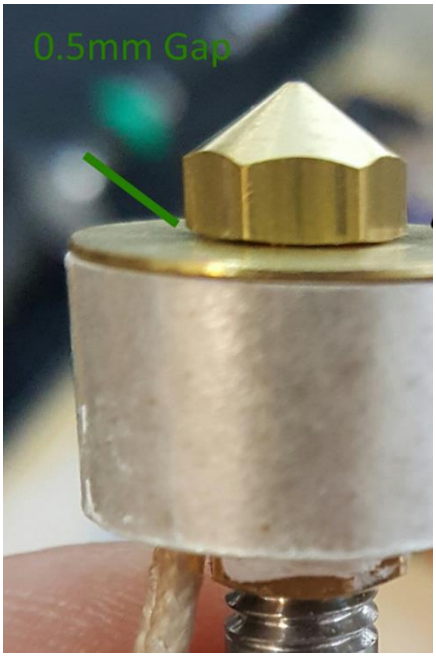
Custom Factory Supplied Tool for Gripping Square Surface

3.2.8 Nozzle and Ceramic Heater Assembly/Disassembly

A small .5 mm gap is needed between nozzle face and surface of ceramic heater assembly.

In addition, there is an order we find works best to avoid stress on the ceramic heater assembly.

1) Make sure assembly is cooled to room temperature to insure easy handling and disassembly.
2) For disassembly, use wrench on square surface of ceramic heater assembly and use socket on nozzle. Apply opposing force to loosen the two. Once free, both should be free to remove by hand. Never use pliers on the heat bridge.
3) For assembly, hand thread the nozzle close to .5mm gap. Follow that by hand threading the heat bridge until it stops against the nozzle. This gap is not critical. Just make sure it is there. Fit both wrench and socket on torque screwdriver, apply opposing force to secure them to one another at 1.3 Nm.

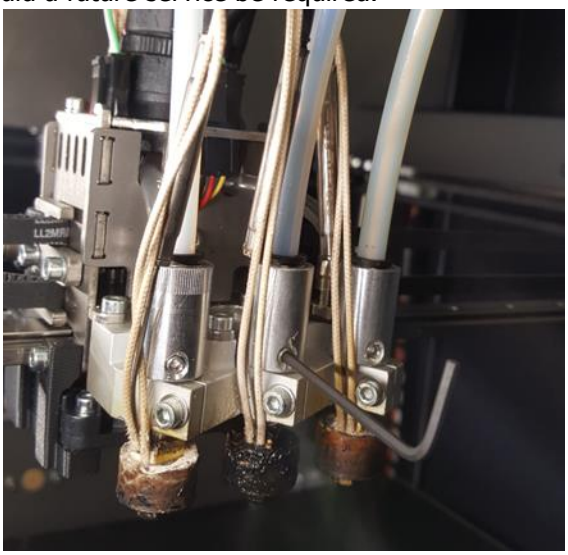


Gap Between Extruder Heater and Nozzle Shoulder

3.2.9 Other Extruder Handling Considerations

The most common cause of failure is excessive movement and or rough handling of thermocouple wiring and end connector. When assembling, avoid excessive forces on all wires and thermocouple. This is also true when mounting an extruder back into the printer head for printing.

One way to avoid excessive wire movement is to secure Bowden Tube Adapter into place with set screw exposed for easy access should a future service be required.



Using Set Screw to Secure Bowden Tube Adapter

Set Screw Positions must be reachable, but as close to aluminum block as position will allow without touching.

Set Screw Location

IMPORTANT – Avoid direct stress on thermocouple wire leading into ceramic heater. Sometimes a full disassembly of an extruder is required to clean trapped material. Before doing this, consider attempting both the short and long high heat clean procedure first.

3.3 Extruder Disassembly

This sections details disassembly of the extruder that may be required to remedy extruder performance issues, to replace a heater, or for nozzle service (off-machine)

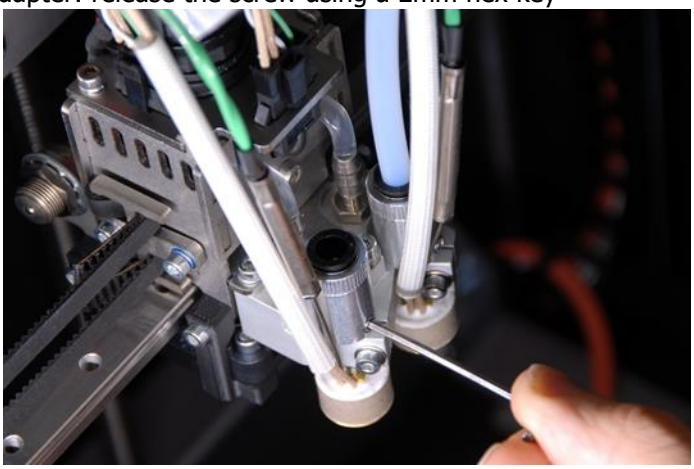
Before undertaking an Extruder Disassembly, be sure to review all the instruction regarding handling extruders. See Section Extruder Overview, Handling, & Service for details before proceeding.

CAUTION - NEVER, EVER bend wire and thermo couple probe entering the heater You may permanently damage the heater. If you pull or bend too much you may kill thermocouple or short power leads. In any case you are PERMANENTLY damaging the heater!

1) Do a Z homing then move plate to Z=190
2) Run a nozzle cleaning and leave the nozzle empty.
   See Section Clean Nozzles for Procedure.
3) Remove PTFE piping: push on collar with the supplied tool (or a 7mm key) while pushing in the pipe then pulling it away

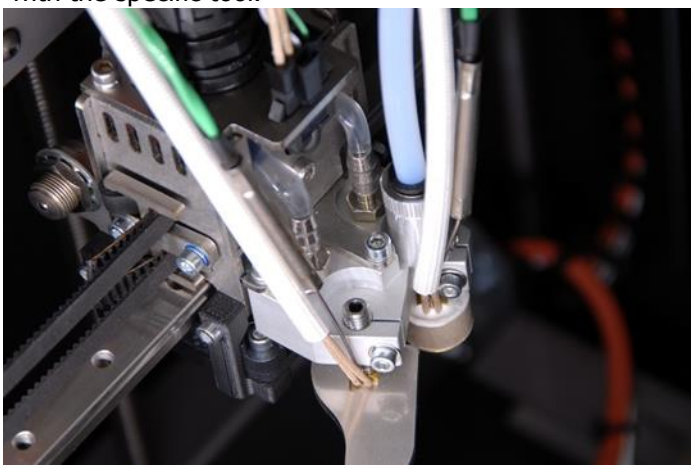
PTFE Tubing Removal

4) Remove tube adapter: release the screw using a 2mm hex key



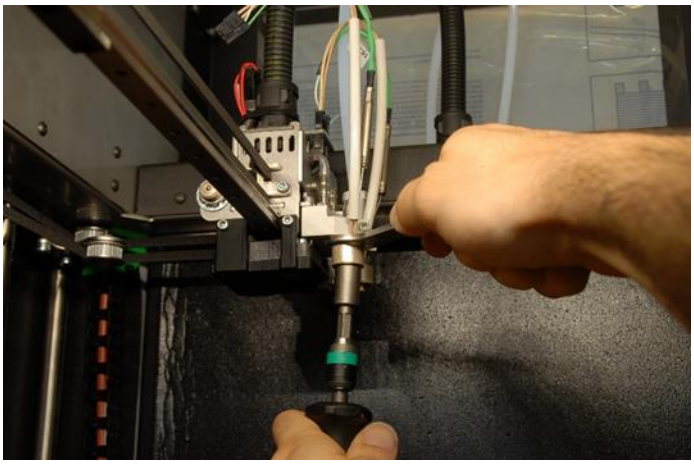
Release Tube Adapter Set Screw

5) Hold the heater with the specific tool.



Holding Heater with Specific Tool

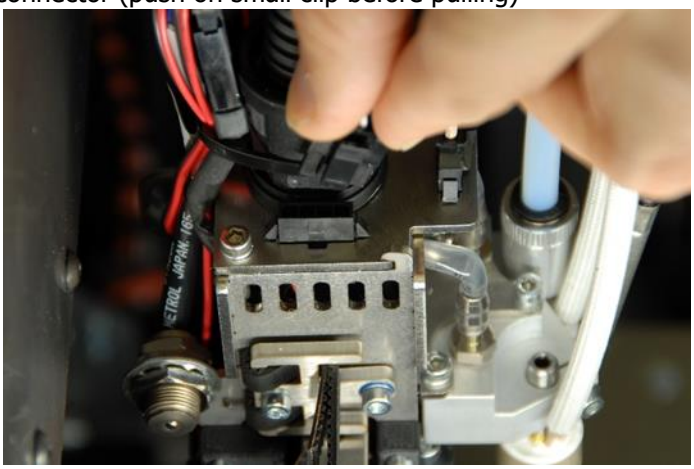
6) Remove nozzle (you can use dynamometric screwdriver)



Nozzle Removal and Tools

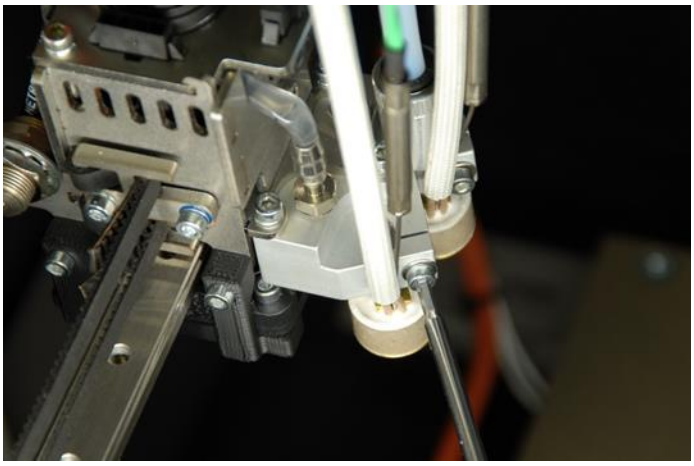
7) **IMPORTANT –** if nozzle should be locked on heater:
   a) run a filament change to heat up the extruder.
   b) wear protective gloves
   c) remove nozzle
   d) press emergency button to stop heating.
   e) Turn ON printer and WAIT for extruder to cool down before going on

8) Unplug heater connector (push on small clip before pulling)



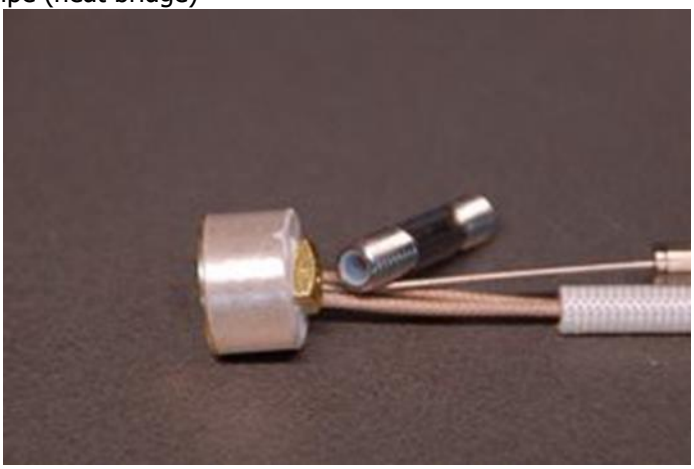
Unplug Heater Connector – Push on Clip Before Pulling Connector

9) Release set screw, remove extruder



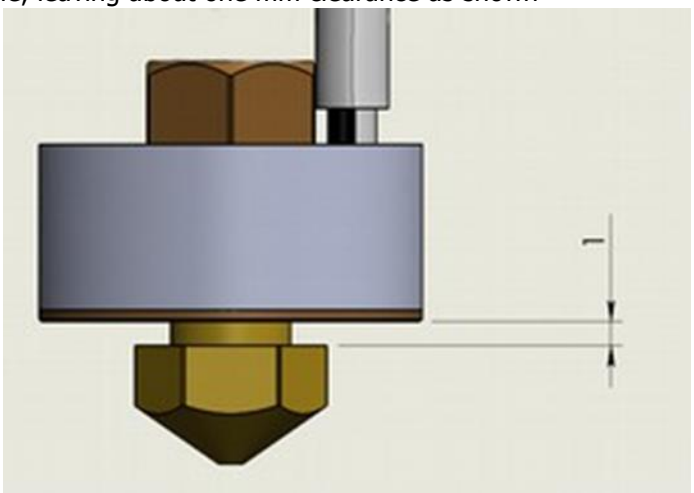
Release Extruder Set Screw

10) Remove steel pipe (heat bridge)



Heat Bridge Removed

11) Mount the nozzle, leaving about one mm clearance as shown

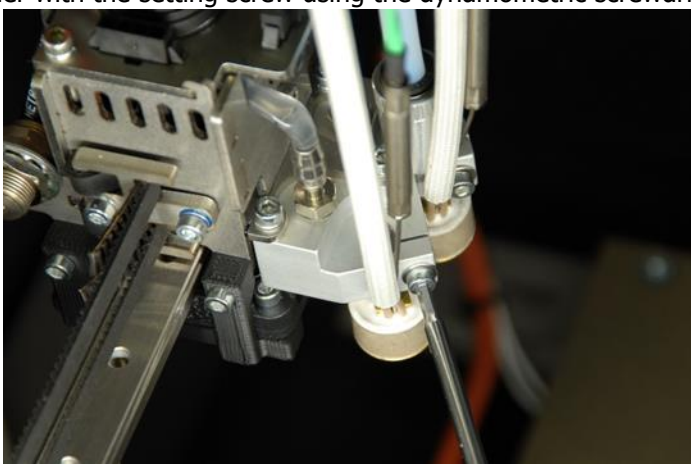


Nozzle Clearance Illustration

12) Mount the heat bridge with desired configuration (Normal or HI TEMP)

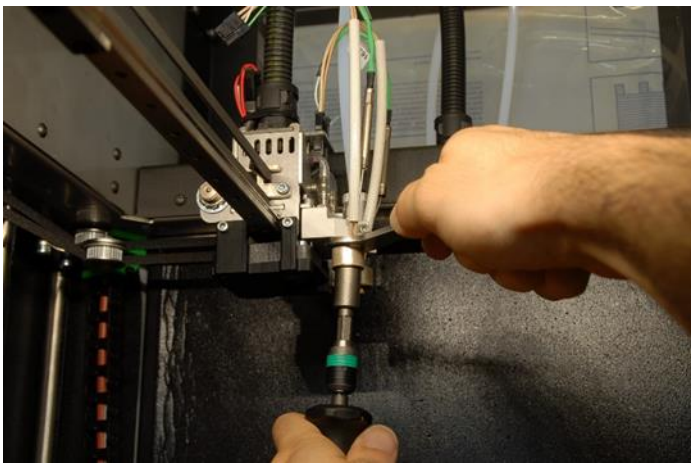
Extruder Heat Bridge

13) Lock the extruder with the setting screw using the dynamometric screwdriver (1.3 Nm)



Lock the Extruder Set Screw

14) Mount the tube adapter. Holding the heater with specific tool, lock the nozzle using the dynamometric screwdriver (1.3Nm)



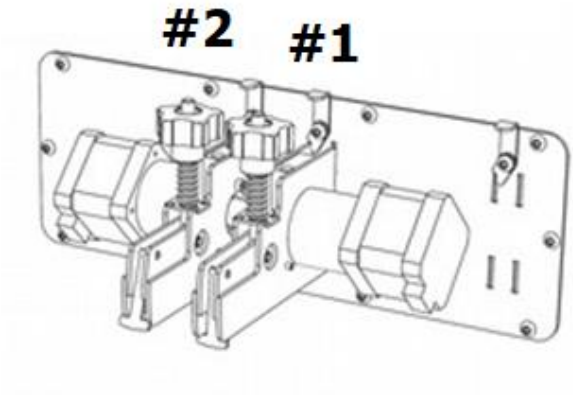
Holding Heater & Locking the Nozzle

15) Perform a Z nozzle alignment.
See Section Z Nozzle Comparison -3 Nozzles Relative Z Position Calibration for Procedure

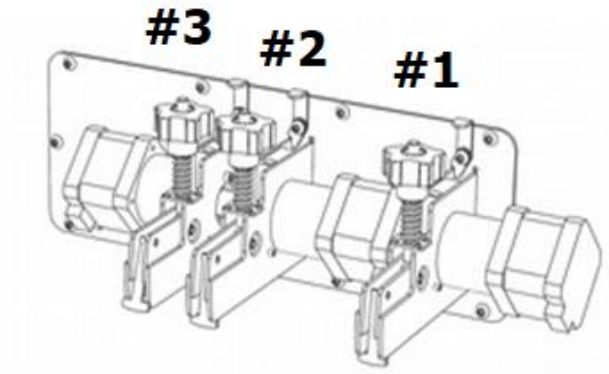
16) Plug in the PTFE piping, feed the filament.
17) Check XY alignment.
See Section XY Offset for Procedure.

3.4 Filament Feeder Installation

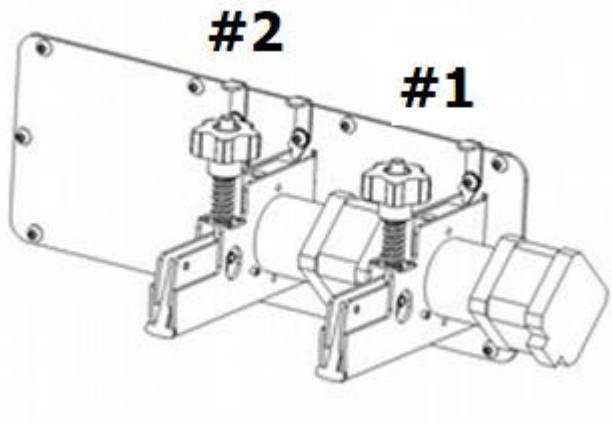
This section details the process to install the filament feeders to the printer. Each feeder has a specific position: refer to the illustrations applicable to your printer (below). If machine has three extruders, the longest pipe must go on the #1 feeder (the right most one, when looking from rear side).



Two Nozzle Feeder (A4)

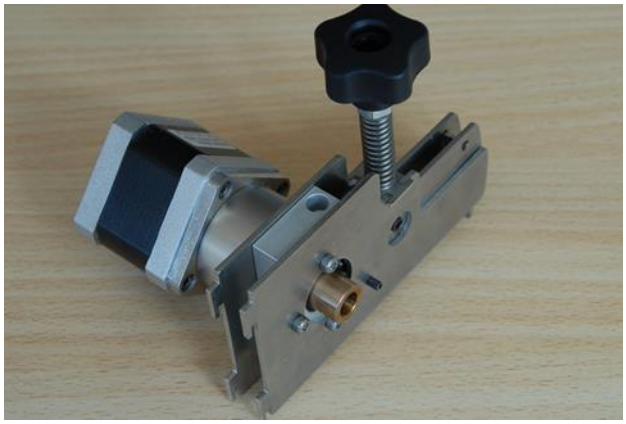


Three Nozzle Feeder (A2)



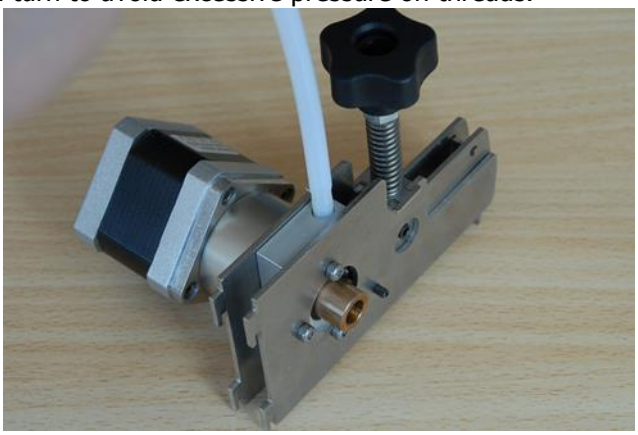
Two Nozzle Feeder (A2)

NOTE – Before fitting it on the printer, each filament feeder assembly must have its PTFE pipe fitted



Feeder Without PTFE Pipe

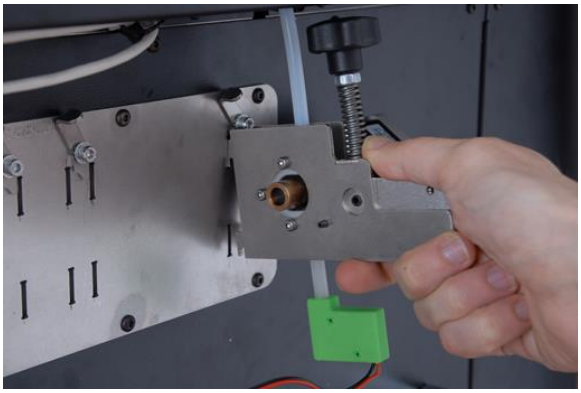
1) For each filament feeder: screw PTFE pipe on without forcing, until you can't turn it anymore, unscrew for half a turn to avoid excessive pressure on threads.



Fitting PTFE Pipe on Feeder

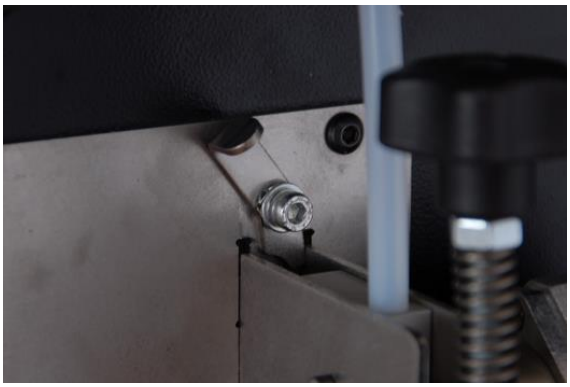
2) After fitting the PTFE pipe on each feeder, you can proceed to mount feeder on the machine routing the piping thru the ports just above each feeder.

Route Pipe Through Each Passage

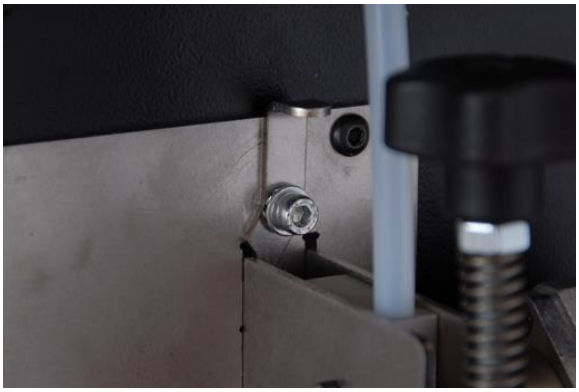


Engage Feeder Securely in Each Location

3) Mount all feeders, be sure that each feeder is fully engaged, pushing it downwards.
4) Secure each feeder with lock lever.



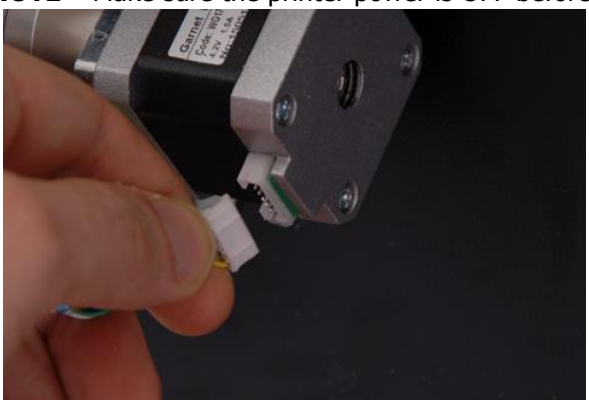
Feeder Lock Lever in Unlocked Position



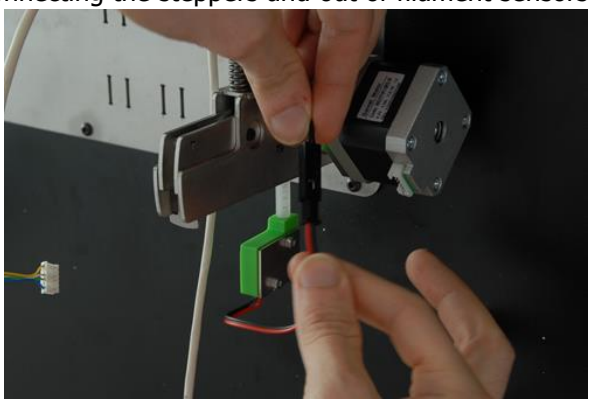
Feeder Lock Lever in Locked Position

5) Plug the electrical connectors. Feeder #1 (the rightmost one, when looking at the rear side). Its cable is longer as it can be used to drive the optional elastomer filament (SPFU) feeder

NOTE – Make sure the printer power is OFF before connecting the steppers and out of filament sensors



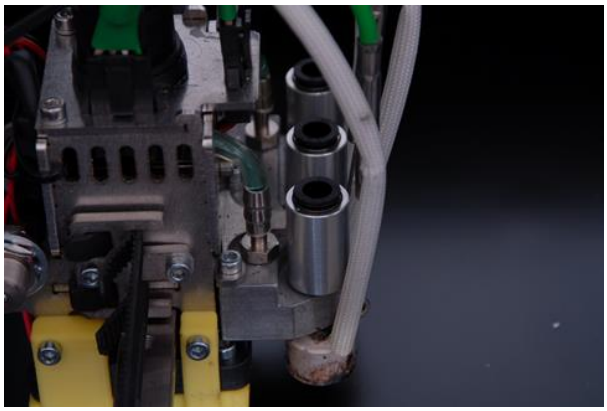
Stepper Motor Connector



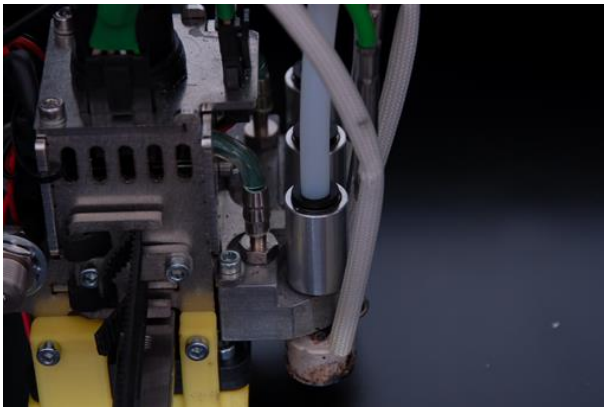
End of Spool Sensor Connector

6) Plug all extruder pipes, taking care not to tangle them.
   - When looking at machine LCD panel, forefront extruder is the #1, therefore must be connected with leftmost PTFE pipe.
   - To get full access to extruders you may want to lower the printing plate – see "LCD functions" manual section –and gently move the extruder holder assembly to a suitable position
   - Connection is simply obtained plugging the pipe and pushing fully inside into the pipe holder.

   NOTE – PTFE piping must not come off unless pushing on the small plastic collar. Be sure to have PTFE pushed all the way inside the holder.



Before plugging PTFE

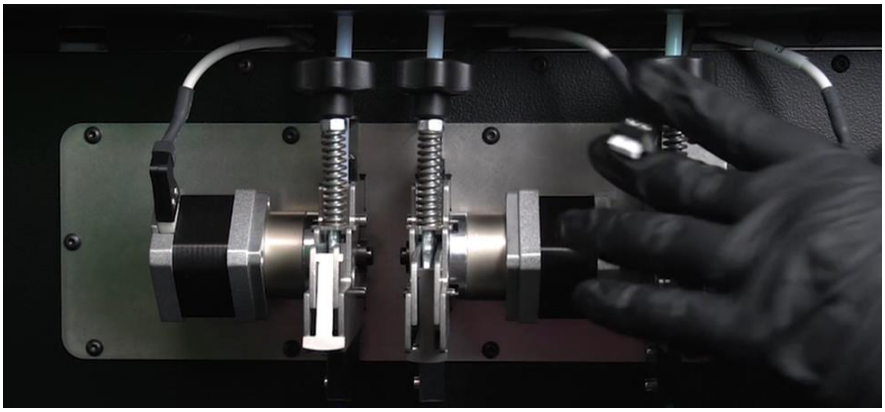


PTFE tubing plugged into #1

3.5 Feeder Roller Cleaning

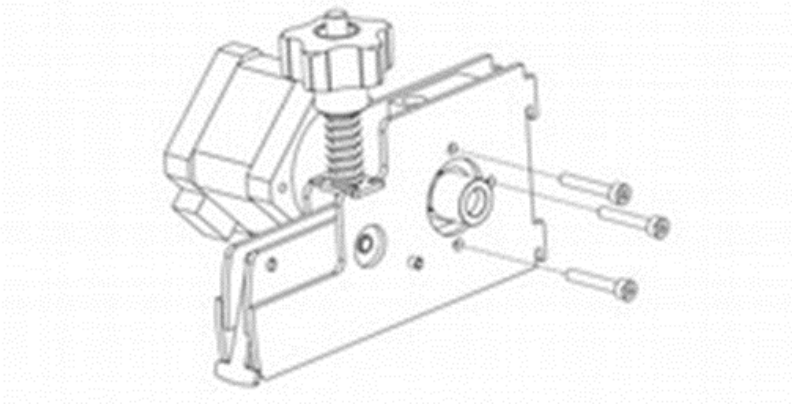
Routine cleaning may be performed simply blowing compressed air on the roller – use a compressed air can (you can find them at any general store, on office supplies shelves)

1) Remove filament from selected extruder using the Unload Filament Procedure
2) Turn off machine
3) Detach PTFE piping from extruder
4) Disconnect stepper cable (grab connector NOT the cable)



Disconnect Stepper Cable

5) Detach feeder assembly from printer
6) Unscrew the three bolts (as from picture) and detach gearbox



Filament Feeder Bolt Removal

7) Use a needle or a sharp pointed object to remove residual plastic from feeder roller – you may help yourself with compressed air

Saving Thermal Calibration

8) Rebuild everything and put the assembly back on printer.
9) Print a test part to verify.

3.6 Printer Firmware Update

This section details the process to update firmware for your printer. New firmware updates for your machine may improve performance or even add new features. Keep in touch with your TRAK 3ntr partner to keep your printer firmware up to date.

3.6.1 Check Firmware Version

To know what firmware version and machine type is running on your printer:

1) Connect to your printer, either directly (PC) or via print server.
2) Enable display of the communication log (PC) or use the console (print server)
3) Send the "M505" command to the printer

4) The machine will reply with a string like the following one:
   44321 29-3-16 Marlin KIMBRA – A.Cotronei – 3ntr
5) Meaning that your machine is type 44321 and firmware release date is March 29th, 2016.

   You will need the following files:
   - 44321_EN.hex if you want an English-speaking LCD interface
   - 44321_FR.hex if you want it in French
   - 44321_IT.hex if you want it in Italian

   NOTE - If your firmware is not responding at the M505 command, chances are that you are running a version that is way too old. Get in touch with your TRAK 3ntr partner or directly with TRAK customer service to learn about your machine upgrade policy.

3.6.2 Firmware Upgrade Process

Whatever is your preferred connection method (via PC or Print Server), you must follow few but fundamental steps:

1) Send M505 command to learn your machine firmware type
2) Send M218 command to get the XY offset of extruders – you may get different output according to firmware version

```
[...]
Send: M218
Recv: echo: Hotend offsets: 0.00,0.00 0.20,24.10 0.00,48.00 0.00,0.00
Recv: ok
[...]
```

M218 Output Example (XY Version)

```
20:52:07.237: Echo:Hotend offsets: 0.00,0.00,0.00 0.30,24.00,0.00 0.50,48.00,0.00 0.00,0.00,0.00
```

M218 Output Example XYZ Version

3) Send M518 command to get the thermal gain values of installed extruders

```
20:47:56.200: Echo:AD595 Offset & Gain
20:47:56.201: Echo:T0 Offset: 0.00, Gain: 0.96
20:47:56.203: Echo:T1 Offset: 0.00, Gain: 0.96
20:47:56.204: Echo:T2 Offset: 0.00, Gain: 0.96
20:47:56.206: Echo:T3 Offset: 0.00, Gain: 1.00
```

M518 Command Output Example

4) Load CLEANER firmware (whatever is your preferred method: PC or PRINT SERVER)
5) After one minute, load the required firmware version

6) Reload XY alignment parameters
   (in case of fig.58) M218T1X0,2 Y24,1 M218T2X0 Y48
   (in case of fig.59) M218T1 X0.3 Y24 M218T2 X0.5

7) Reload thermal gain values
   M518T0 G0,96
   M518T1 G0,96
   M518T2 G0,96

8) Permanently save the parameter settings
   M500

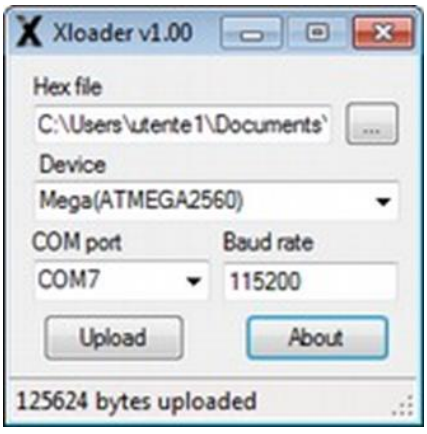
3.6.3 Firmware update – PC procedure

To perform any firmware update with your PC, you must have available:

- The XLOADER package, that can be easily obtained from many websites
- The CLEANER firmware
- The latest release of the firmware for your machine. The name must be equal to the first part of the M505 command result(see previous chapter) Be sure to have received the correct version for your machine and the cleaning program. Before starting the upgrade procedure, be sure to write down the output of the following commands:
- M218 (extruder offsets):to keep trace of nozzle displacements
- M518 (thermal gains): to get precise heating performances

Now you can start cleaning the machine memory:

1) Run XLOADER - Configuration should be automatically set at XLOADER start, except for the COM port on your PC –use the one you are already using to connect to printer.
2) Select the CLEANER.hex file to be loaded. Upload it to the printer clicking on the UPLOAD button. When done, power off printer, wait a few seconds then turn it on again.
3) Wait one minute for machine memory cleaning – no user intervention needed
4) Now use XLOADER again to load the desired firmware.
5) Quit XLOADER once firmware is uploaded.
6) Connect to the printer and re-write the M218 and M518 parameter THEN send an M500 to store them in the machine memory.
7) Now machine is ready to print!



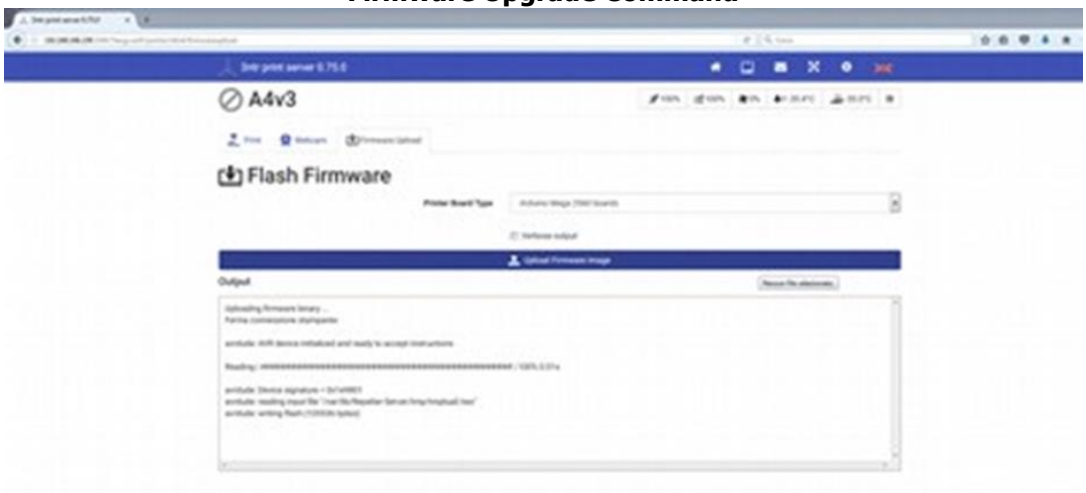
Xloader Tool

3.6.4 Firmware Update – Print Server Procedure

When using the print server, the firmware update procedure is faster and easier: just select the .HEX code to be uploaded. No software to install. Therefore, you can follow same procedure as for PC firmware upgrade, just using your browser instead of XLOADER.

Remember save configuration withM500, after restoring M218 and M518 parameters!

Firmware Upgrade Command



Flashing Firmware

3.7 MMS Firmware Update

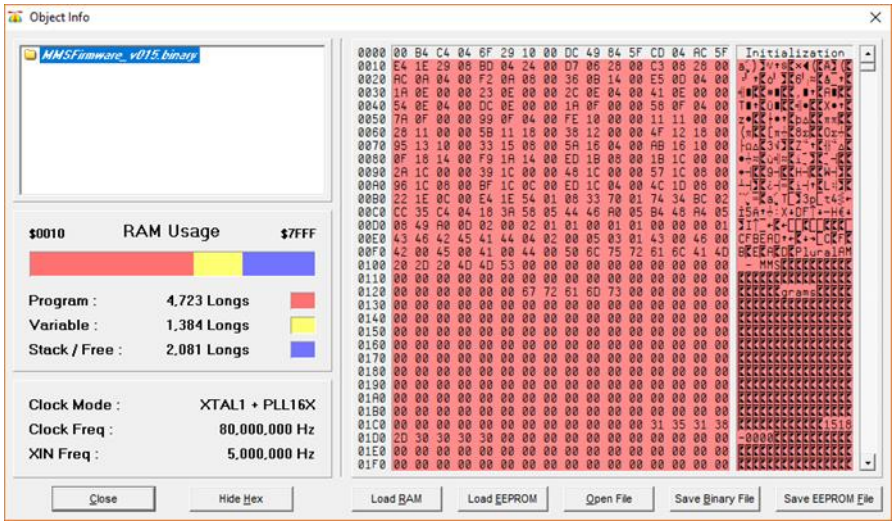
The MMS unit may require a firmware update. If needed, follow these instructions:

1) Download the Propeller tool here:
   https://www.parallax.com/downloads/propeller-tool-software-windows-spin-assembly

2) Download the correct MMS v1 or v2 firmware from these locations:
   V1 MMS: https://drive.google.com/open?id=1pUxs9JCG_5_Vx98I3TcFBbVnjrC76bYL
   V2 MMS: https://drive.google.com/open?id=1mn5ngnrCs-_OovshFR7_KruPsclqoziG

3) Connect the computer to the cabinet display via the USB cable inside the MMS (very short, may need a USB male-female extension cable).
   NOTE – You should see the cabinet's touchscreen power up when connected.

4) After installing the propeller tool and downloading the firmware, start the propeller tool, then click "open" under the file menu and select the binary firmware image (you may need to set file selection filter to "all"); then click the "Load EEPROM" button on the object info window that appears (middle button).

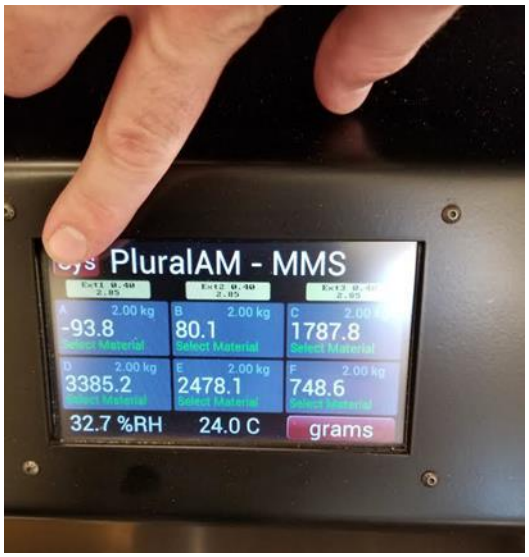


Updating MMS Firmware

5) Locate and copy the serial number from inside the cabinet (near the server power outlet)

MMS Unit Serial Number

6) Update the system id from the system menu on the touch screen (necessary to connect multiple mms cabinets to the same server).

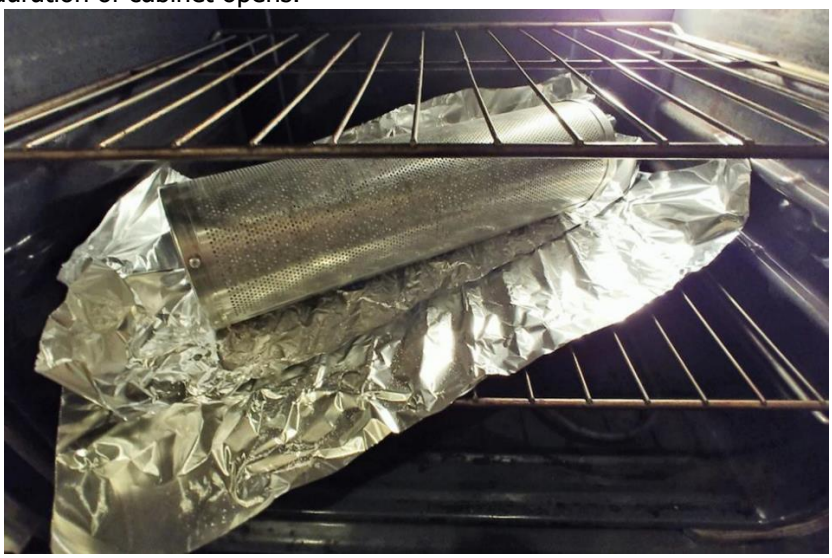


Sys button on MMS

Set Machine ID

3.8 Controlling Relative Humidity (RH) within MMS Cabinet

We have found that that with minimal cabinet openings the RH can be kept below 10% for one or more weeks at a time. You can choose how dry you want to keep the cabinet by determining when you exchange and dry the desiccant cylinders. Experience so far indicates that changing and drying the cylinders about once a month should keep the RH below 20% unless there are an unusual frequency and/or extended duration of cabinet opens.



Drying Desiccant Canister in Oven

The desiccant cannisters are renewable. Put a wet cannister in a conventional oven at 425° for 2.5 hours to renew it. A completely dried cylinder holds about 1 pound of water.
We dry ours in a home oven on layers of aluminum foil, then use multiple layers of foil to wrap the cylinder tightly to keep it dry until used.

4.0 Troubleshooting

This section provides troubleshooting assistance for commonly encountered problems. Browse the list to locate the specific problem/symptom, then review potential causes and perform the diagnostic/remedy actions as indicated. Use of the troubleshooting tables can save time and effort!

4.1 Troubleshooting Tables

Problem/Symptom: Little or No Extrusion	
Potential Cause	**Diagnostic/Remedy Actions**
Filament has quality issues (diameter is bigger than 3.1mm or smaller than2.6mm, polymer purity problems, filament is contaminated with powder/dust)	Check filament diameter, if needed discard the spool Check that filament is correctly wound on spool
Nozzle partially jammed	Clean nozzle with LCD function Replace Nozzle if cleaning unsuccessful
Dusty Contamination	Check that printer is not working into an excessively dusty environment
Wrong slicer settings for the filament (usually: extruder not hot enough, printing speed too fast)	Check your slicing setting, be sure to use right ones for current polymer
Dirty feeding roller	Clean the feeding roller
Insufficient feeding pressure	Increase feeding pressure (using the knob)
Extruder has electrical issues	Check the connector to be fully seated Check cable integrity You may want to change extruder for a new one Check M518 value
Feeding roller setting screw is loose	Tighten it using a 2mm hex key
Cooling system fault	Check liquid level Check radiator fans Wrong thermal calibration Check that recorded values are correctly matching the installed heaters
Nozzle is too close to plate	Perform Z calibration

Problem/Symptom: Part Won't Stick to the Plate	
Potential Cause	**Diagnostic/Remedy Actions**
Plate is dirty	Clean the plate using 90% or more isopropyl alcohol or just with warm water and soap (PA) to remove fingerprints, glue leftovers and other adhesion improvement substances
Z offset is too big.	Decrease Z offset setting in your slicer
First layer speed is too high.	Decrease first layer speed in your slicer settings
Polymer in use is not compatible with printing bed surface.	Change surface or use an adhesion improvement product (hairspray or any other product)
Printing plate is too cold.	Increase thermal settings (plate and heated chamber)
Part has very small "foot area" compared to height.	Decrease printing speed Increase layer thickness Enlarge support / use brim Check alternative part orientation
Be sure that door is closed	Close Door - if not, part may detach from plate and/or delaminate"

Problem/Symptom: Part Contamination – Lacks Color Separation	
Potential Cause	**Diagnostic/Remedy Actions**
Plate is dirty	Clean the plate using 90% or more isopropyl alcohol or just with warm water and soap (PA) to remove fingerprints, glue leftovers and other adhesion improvement substances
Extrusion temp is too high	When an extruder is deselected, if temperature is too high makes for longer liquid polymer state (aka: oozing) than flows out of nozzle due to gravity. Decrease printing and/or preheating temperature.
Print speed is too high	Residual nozzle pressure isn't neutralized with retraction. Slow down printing speed
No nozzle priming strategy enabled	Use one of the possible slicing solutions (prime pillar, wall, …) that let you keep a cleaner part
Bad Z nozzle leveling	Be sure to correctly perform the calibration of Z nozzle alignment
Bad XY nozzle alignment	Be sure to correctly perform the XY nozzle alignment

Problem/Symptom: Part Dimensional Issues – Big or Small	
Potential Cause	**Diagnostic/Remedy Actions**
Polymer has higher than expected shrinkage ratio	Increase your part size in slicing software Change polymer Lower printing temperature (if possible) Use part ventilation Use heated chamber

Problem/Symptom: Incomplete Print	
Potential Cause	**Diagnostic/Remedy Actions**
There is a vertical gap between part and nozzles	Nozzle jam: See Problem/Symptom Little or No Extrusion: Nozzle Jam.
Part is at nozzle level – If printing as a PC peripheral	Problem with USB connection (cable near electrical noise sources such as motors, power transformers...): change cable routing or buy a shielded one
system rebooted (i.e. OS or anti-virus update) or wrong power saving settings	Update/Correct
AC power interruption	Use an UPS suited for the printer power rating
Part is OK just up a certain quote then got a "hairball"	Part is too tall and thin – vibrates during printing process and breaks. Part detached from plate - Change part orientation in slicer software to make it steadier. Design some custom support into the 3d part mode

Problem/Symptom: Collision During Homing Axis: Doesn't Stop	
Potential Cause	**Diagnostic/Remedy Actions**
Problem with homing sensor (end stop) cabling	Be sure that end stops are not engaged. Send the M119 command: printer will answer with end stop status. Now push on each sensor, while sending the M119 command: the sensor status must correctly tell the status (ENGAGED). If not true, check sensor cabling and connectors (Y sensor has also a connector on the print head) on the motherboard.
Damaged endstop	If previous step doesn't give any result, the end stop may be faulty giving erratic output: replace it.
Firmware problem	If you just upgraded firmware, you may have loaded the wrong version for your printer. Get in touch with tech support.
Damaged motherboard	Motherboard may have a defective part (i.e.: cold solder joint). Needs to be replaced.

Problem/Symptom: Cold Nozzle with High Temp Readout (378°C)	
Potential Cause	**Diagnostic/Remedy Actions**
Defective thermocouple	Replace heater assembly
Bad connector	Replace heater assembly

Problem/Symptom: Machine is Stopped – MAXTEMP Displayed	
Potential Cause	**Diagnostic/Remedy Actions**
Defective electrical connection	Check connector integrity
Defective heater	Replace heater (or set thermal gain to 0.9 to temporary disable the error message – YOU CAN'T USE THIS EXTRUDER ANYWAY)"

Problem/Symptom: Molten Part/Falling Sides	
Potential Cause	**Diagnostic/Remedy Actions**
Problem with part cooling fan	Check fan connection. See if there is anything trapped inside fan. If needed, change fan.
Print speed is too low	Increase print speed
Extrusion temperature is too high	Decrease extrusion temperatures

Problem/Symptom: Can't Find Files on SD Card	
Potential Cause	**Diagnostic/Remedy Actions**
Printer SD Card hasn't been correctly seated in	Push the SD inside its socket
Defective SD card	Replace SD card – contact customer service to learn about the GCODE files that must be saved on SD card

Problem/Symptom: Squashed Printed Part/Jerky Z Movement	
Potential Cause	**Diagnostic/Remedy Actions**
Motherboard cooling fan is dead	Replace fan
Connector of one of z stepper is faulty or unplugged	Restore connection or change cable
Stepper / Gearbox moving z axis is faulty	Replace it

Problem/Symptom: Part Looks Shifted	
Potential Cause	**Diagnostic/Remedy Actions**
See Problem/Symptom Squashed Part/Jerky Z Plate Movement	
Wrong Z nozzle leveling	Do Z nozzle leveling

Problem/Symptom: No USB Connection, LCD not Lit	
Potential Cause	**Diagnostic/Remedy Actions**
The LED lights inside printer are on	Motherboard problem – probably a short on a fan or on an extruder
The LED lights inside the printer are off: Problem with main 24V power.	Contact tech support
The LED lights inside the printer are off: Tripped 220V fuse.	Contact tech support

Problem/Symptom: Sketchy Movement/ Axis won't Reverse Direction	
Potential Cause	**Diagnostic/Remedy Actions**
See Problem/Symptom Squashed Part/Jerky Z Plate Movement	

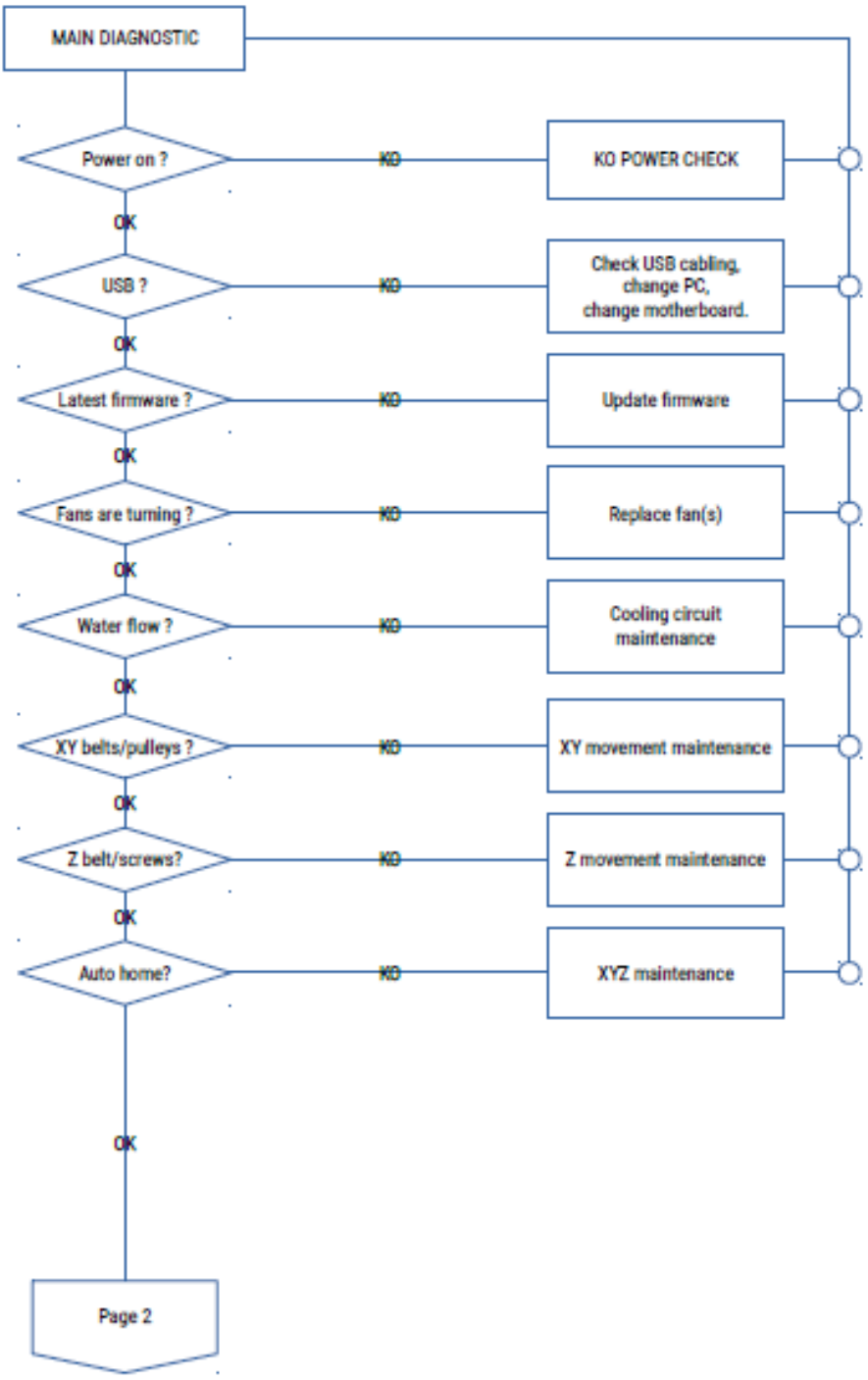
Problem/Symptom: Filament is Stuck into Bowden		
Potential Cause	**Scenario**	**Diagnostic/Remedy Actions**
Filament diameter is too big	ANY POLYMER	change spool
Excessive pressure on feeding roller: filament is squeezed	ANY POLYMER	relieve pressure
Using heated chamber: PLA will "inflate" when exposed to temps over 50-55°C	PLA	DON'T use heated chamber when using PLA

4.2 Useful G-Code Commands

Command	Printer Execution/What it Does
G1 X100 Y100 F9000	Move to X100 Y100 at 9000mm/min
G90	Absolute coordinate system
G91	Relative coordinate system
G92 E0	Set current axis position (in this case current extruder feeder filament position is set to zero)
M11	Enable/Disable filament sensor
M75	Start print timer
M77	Stop print timer
M104 T0 S215	Set extruder 0 temperature at 215°C , don't wait to reach it. If T0 is omitted, it's meant applied to current extruder
M106 Snnn	Set fan speed (nnn = 0..255). If no S option, then run at full speed.
M107	Turn off fan
M109 Sn M109 Rn	Set current extruder temperature, wait until you reach it S works while heating, R works for heating AND cooling.
M112	Emergency stop
M115	main parameters list (via USB)
M117 MESSAGE"xxxxx"	Display "xxxxxx" MESSAGE on LCD panel
M119	Show end stop status (via USB)
M140 S100	Set heated bed temp
M190 S100	Set heated bed temp and wait to reach it
M201 Xn Yn Zn En	Set max acceleration during print WARNING causes machine restart (if used to change extruder accel, is meant to current extruder, previously selected wit Tn)
M203 Xn Yn Zn En	Set maximum speed for selected axis
M206=& Xn Yn Zn	Set homing offset (default is zero)
M218 Tn Xn Yn	Sets nozzles offsets relative to extruder #1 Default distance (x,y) both for A2 e A4 is : 0,24 (T1) 0,48(T2)
M300 Sn Pn	Play a sound at S frequency and P duration (milliseconds)
M301 Tn Pn In Dn	Sets extruder (Tn) PID.
M302 Sn	Sets minimum extrusion temperature
M303 Tn Cn Sn	PID auto tuning for extruder E at Temperature S, taking C trials.
M400	Found values will not be stored. Use M500 to save them
M500	Finish all pending instructions
	Save parameters into EEPROM
M502	Reload default parameters from EEPROM
M503" "	Reload parameters saved from EEPROM
M518 T0 G0.95	Set extruder T0 gain
M600	Start filament change
M601	Save current position and park extruders
M602	Move extruders back to saved position
T0/T1/T2	Select extruder"

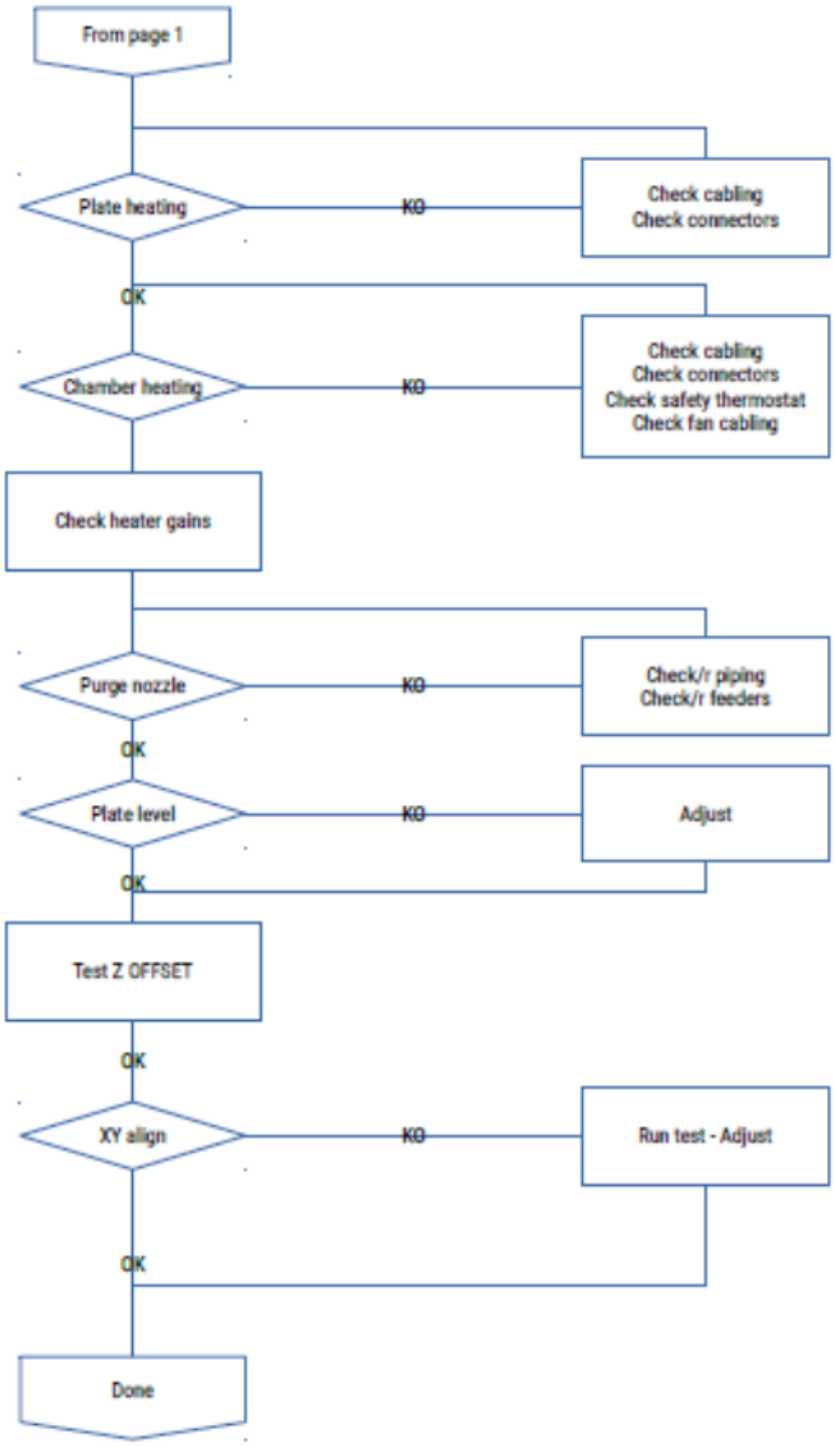
Table of Useful G-Code Commands

5.0 Main Diagnostic Checklist



4

Main Diagnostic Flowchart Page 1



Main Diagnostic Flowchart Page 2

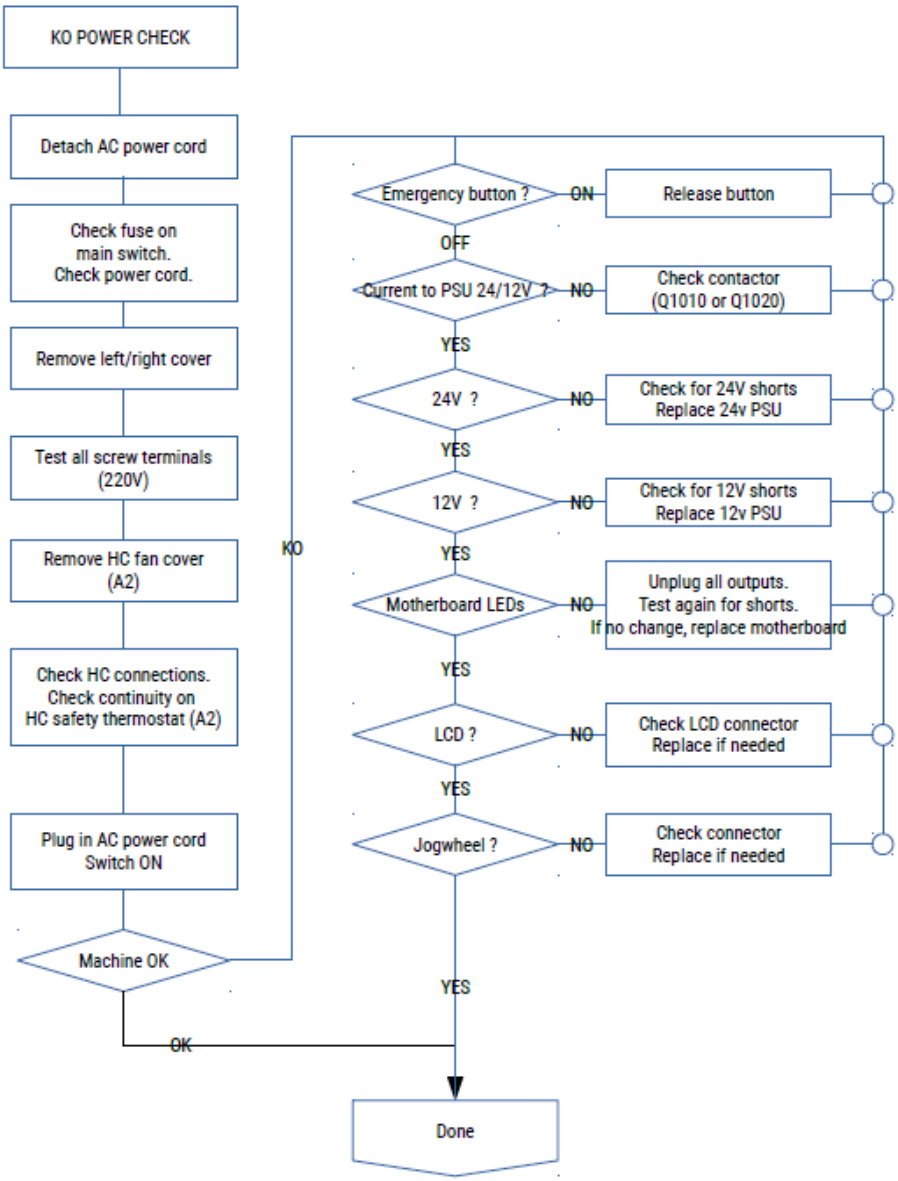
6.0 Repair Procedures

CAUTION - Always remove AC power cord before attempting any maintenance on heated chamber / plate or left part (AC power area) of the machine

CAUTION - The procedures are to be performed by trained personnel. If you didn't attend to 3ntr training procedures STOP NOW.

6.1 No Power

6.1.1 Diagnostic Flowchart



No Power Diagnostic Flowchart

6.1.2 No Power Check

Tools needed before undertaking this task:

Multimeter

Phillips Screwdriver

Hex Keys

1) Detach AC power cord

Detach Power Cord

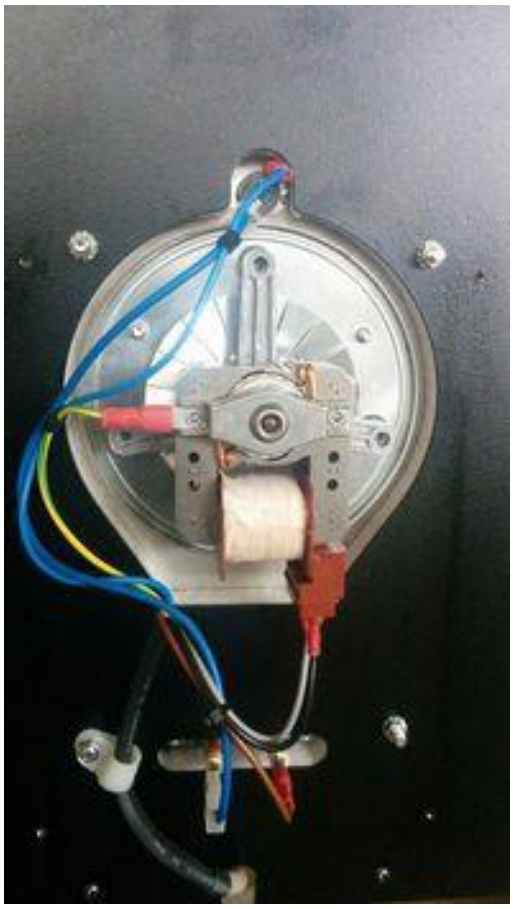
2) Check fuse on main switch. USE MULTIMETER TO CHECK.
   A good-looking fuse may be tripped anyway.

Checking Fuse on Main Switch

3) Check AC power cord – swap it with another one if possible
4) Test all AC screw terminals

Screw Terminals for Testing

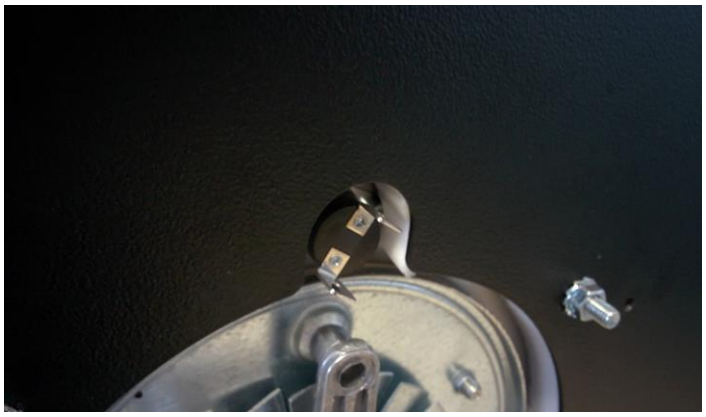
5) (A2) Remove HC fan cover



HC Fan Cover Removed

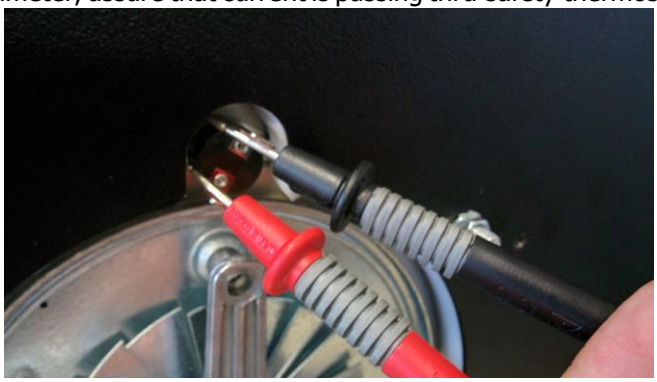
6) (A2) Check HC/FAN connections

7) (A2) Disconnect safety thermostat



Safety Thermostat

8) (A2) Using a multimeter, assure that current is passing thru safety thermostat



Checking Safety Thermostat Current

9) Plug in AC power cord. WARNING machine is powered on now
CAUTION - KEEP EVERYONE AWAY. Only trained maintenance people can be near the machine

Plug In Power Cord

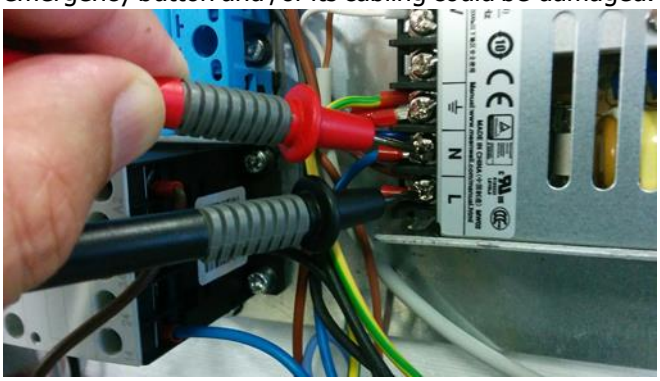
10) Turn on machine – IF STILL NO POWER, go on with this checklist

11) Check that EMERGENCY button is released

Release Emergency Button

12) Check that current is arriving on PSU AC screw terminals.

13) Check that AC tension is present on A1-A2 contactor terminals. If yes, contactor may be defective: replace it. If not, emergency button and /or its cabling could be damaged.

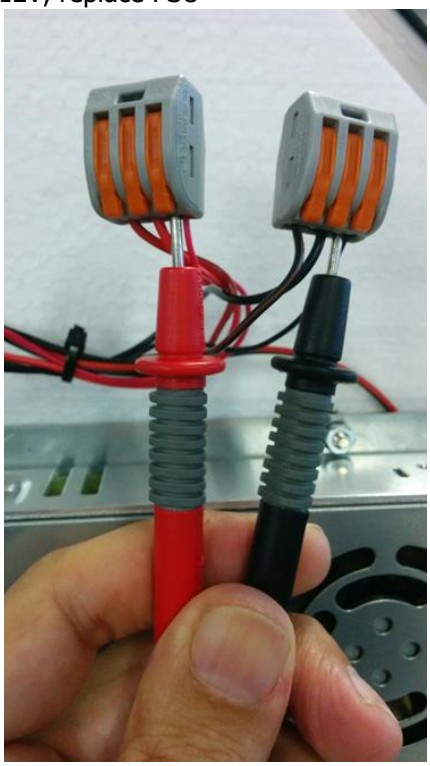


PSU AC Screw Terminal Current Check

14) Check that there is 24Vdc output on 24v PSU. If not, turn power off. Detach all 24V PSU outputs. Power on again. If still no 24V, replace PSU

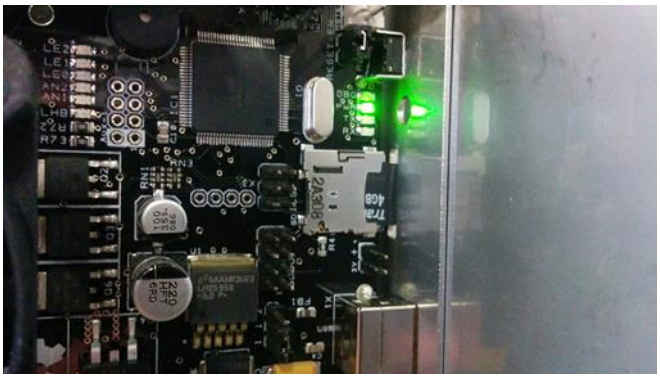
Check Output Voltage on PSU

15) Check that there is 12Vdc output on 12v PSU. If not, turn power off. Detach all 12V PSU outputs. Power on again. If still no 12V, replace PSU



Check PSU Output Voltage

16) Is the green LED lit on the motherboard?



Green LED on Motherboard

17) If LED is not lit, turn off printer. Check for shorts on Fans and heaters. If shorts are found, remove short. If no shorts are found replace motherboard

18) Is LCD lit? If not check cabling/connection – replace LCD if needed.

LCD Lit/Printer Ready

19) Is Jogwheel is working? If not check cabling/connection - replace jogwheel if needed.

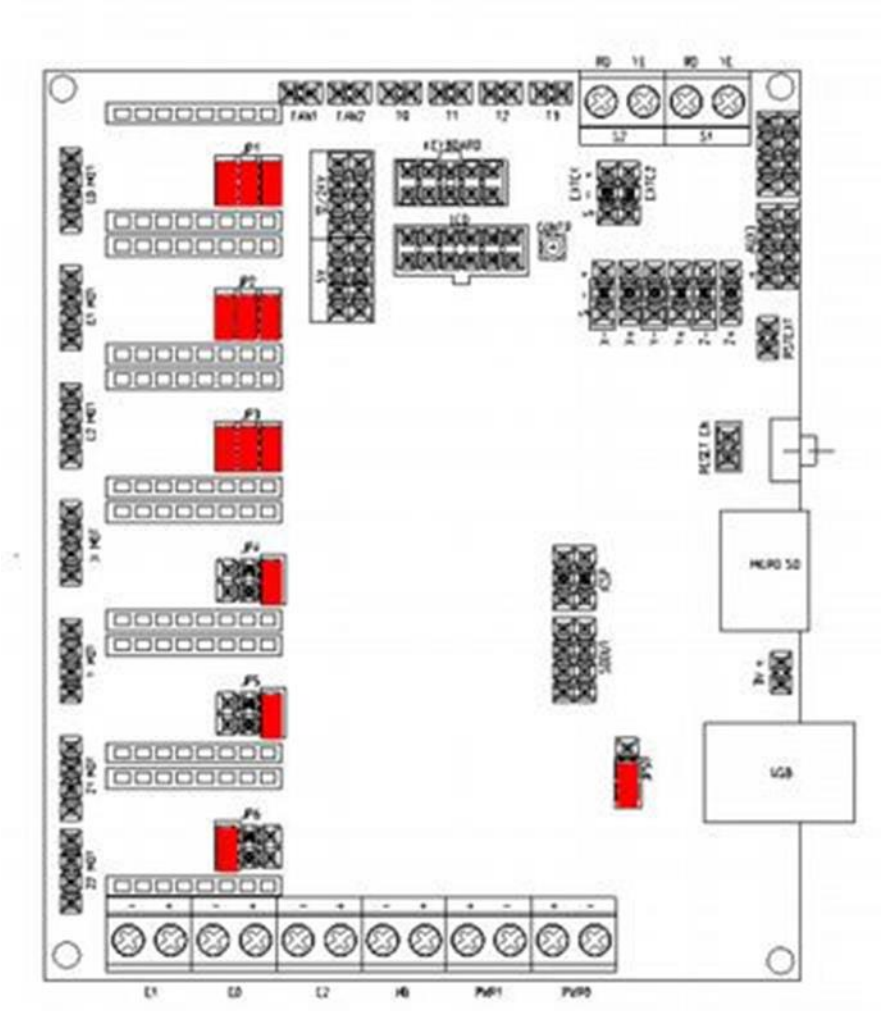
6.2 Fuse is Blown Repeatedly

1) Check fuse rating: on A4 must be 5A, on A2 must be 15A
2) Unplug machine, then check all screw terminals for AC voltage (SSR, PSUs, contactor)
3) Check that fuse holder is not ruined – replace it if needed (along with switch body)
4) Be sure that machine is using latest firmware (low power consumption)
5) If still having issues, be sure that AC power is within tolerance (230V or 110V +/- 5%)

6.3 Mother Board Cabling

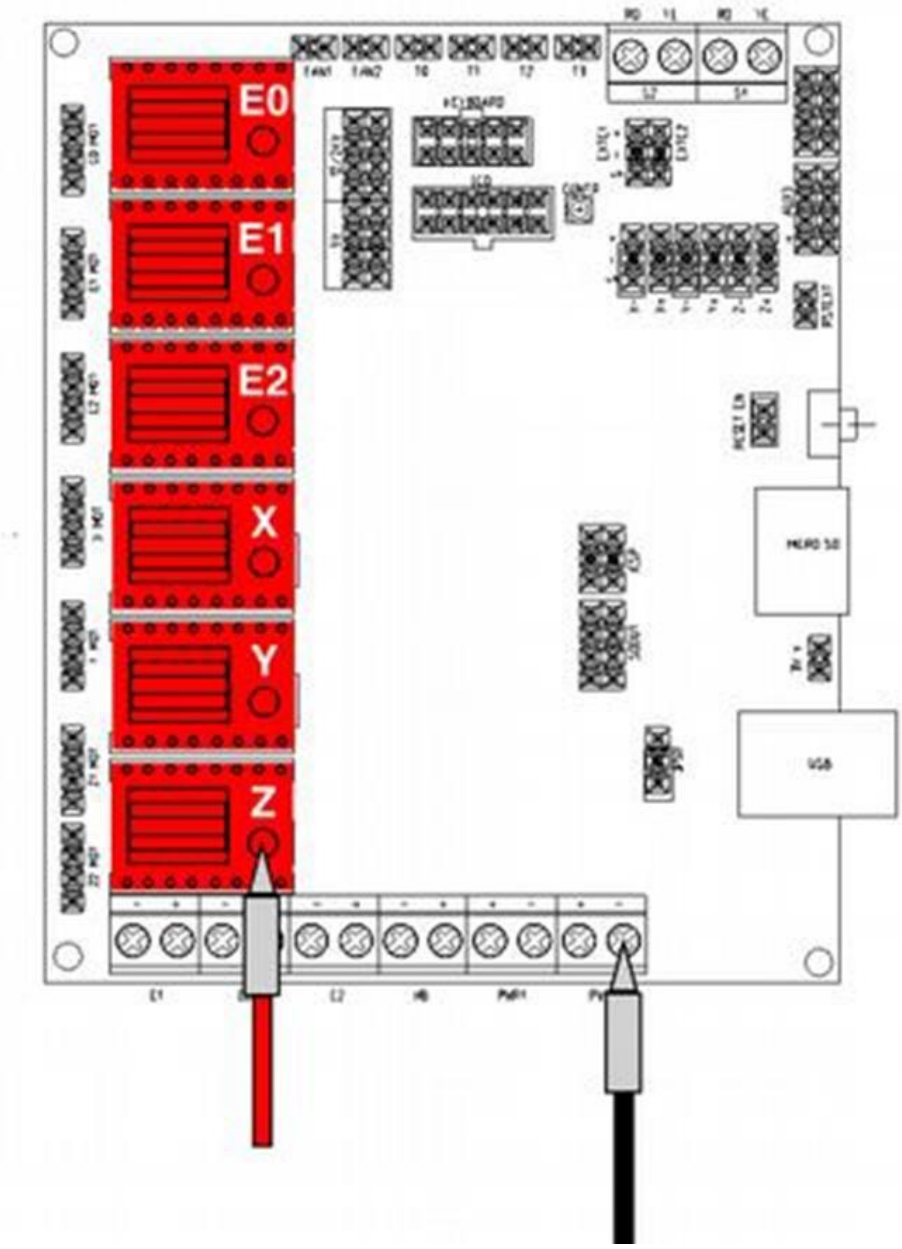
Motherboard is the brain of the machine: any problem here will be a problem for the entire machine. Therefore, be sure that motherboard is wired correctly, with no loose connector or any slack cable around.

1) Jumpers
   Jumpers are needed to set some hardware configurations. Be sure to set jumper position as in the following image:



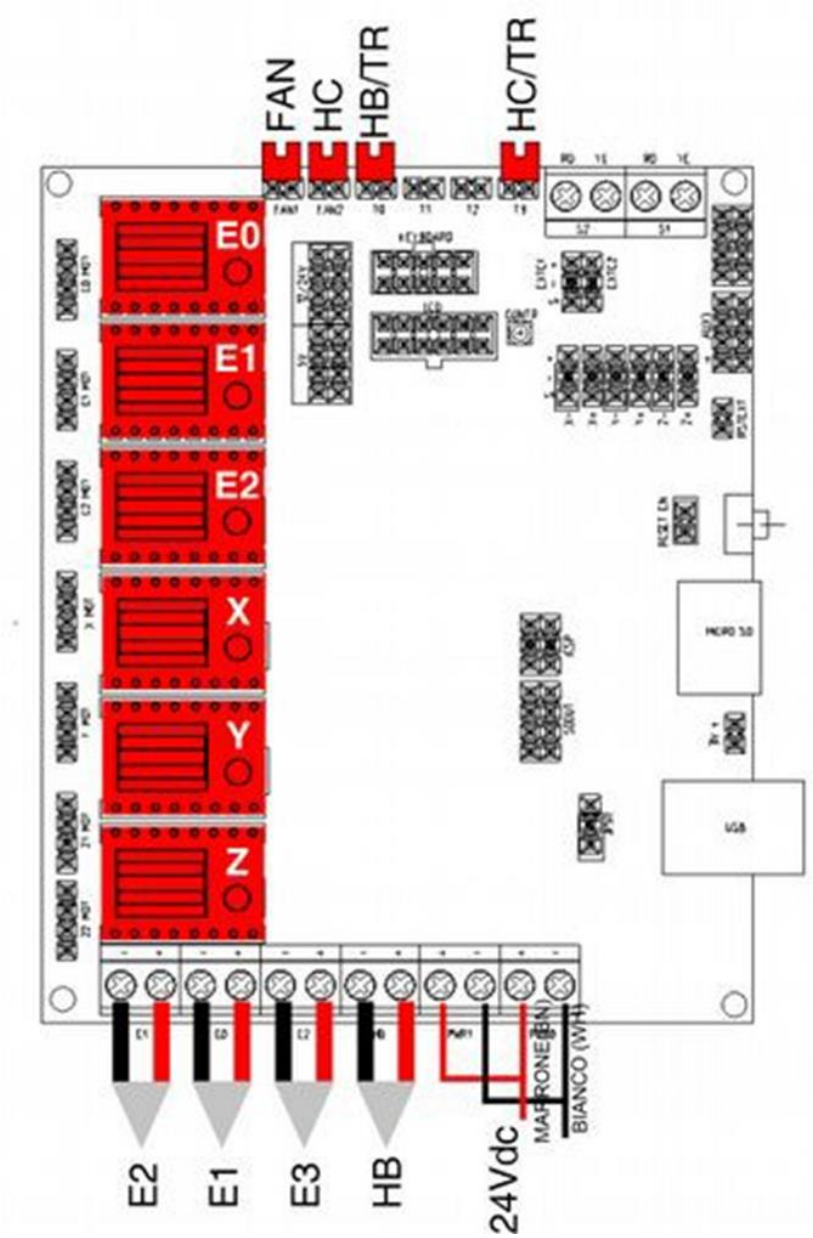
Motherboard Cabling

2) Drivers
   Drivers are the interface between the motherboard and the stepper motors that move XYZ and E axes. Care must be taken to seat them without bending pins and with the correct orientation (trimmer at right) To check current on each driver: put multimeter probes as shown below (black probe on "-" PWR screw, red probe on selected driver trimmer).



Drivers

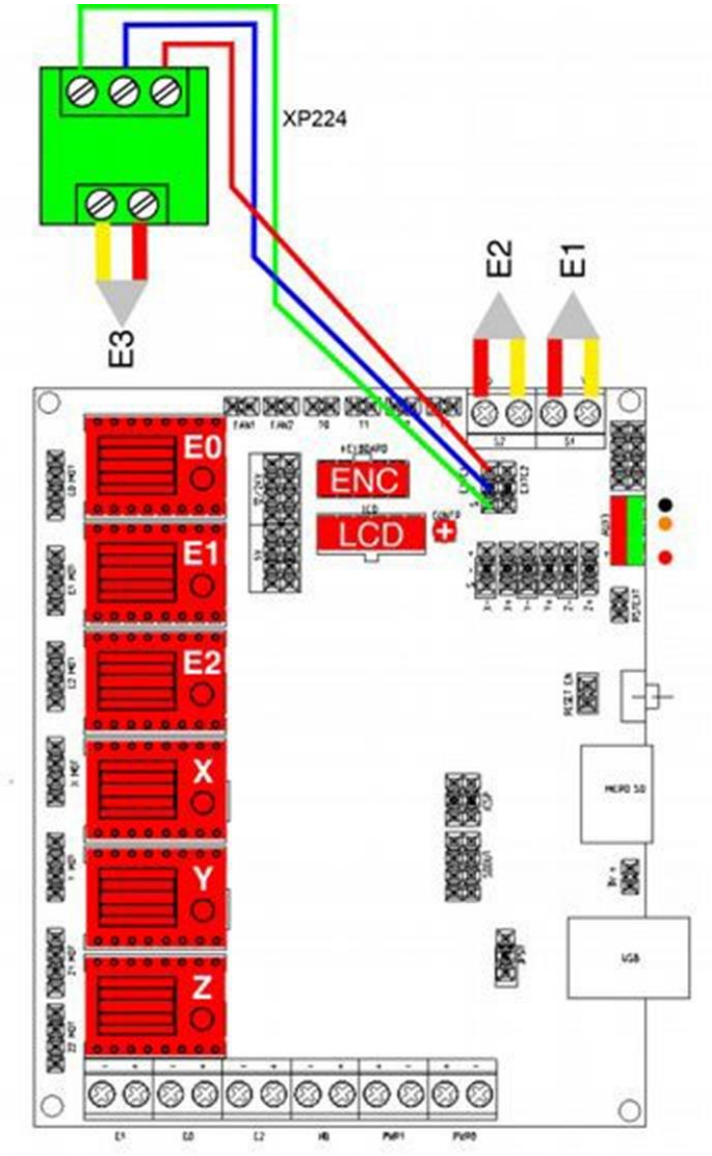
3) North and South Connections.
   24Vdc connectors are on the lower part of the motherboard.
   Fan/HC output and HB/HC temperature sensors are on the upper edge of the motherboard.



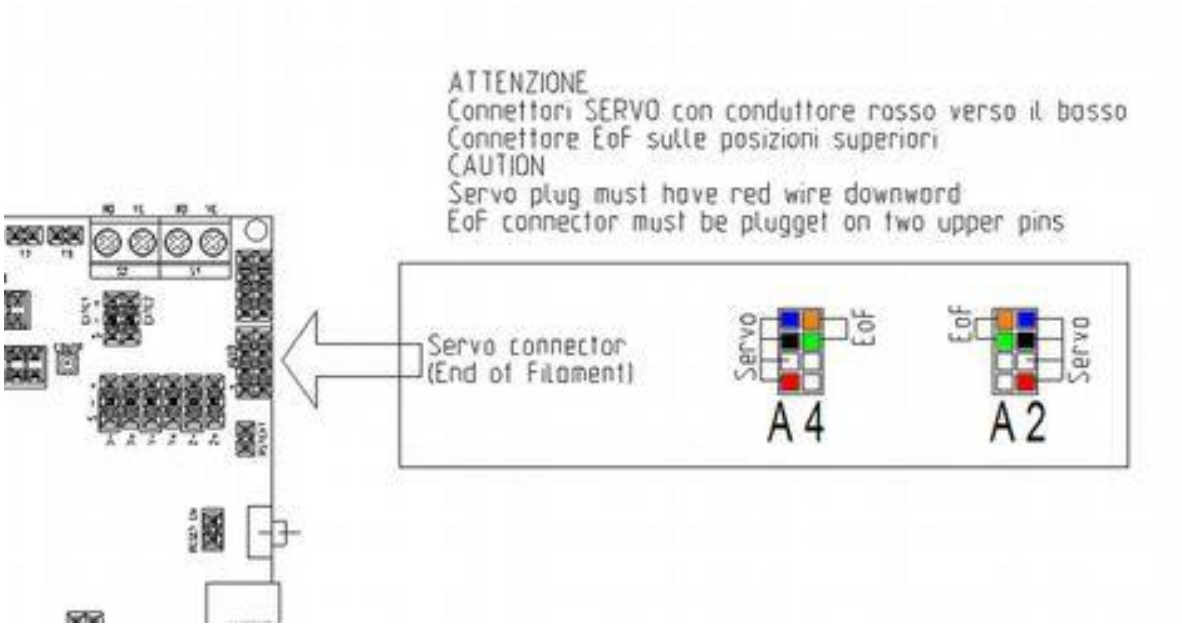
North/South Connectors

4) Thermocouples / servo / filament sensor / LCD / Jogwheel.
Thermocouples (E1 / E2 / E3) are used to precisely sense the temperature into the extruders. Servo connector is plugged top right (red position for A4, green position for A2). Filament sensor is plugged at the Black/yellow pins aside the servo connector (right for A4, left for A2).

CAUTION - BE ABSOLUTELY SURE NOT TO PLUG filament jumper on the lower pins (red dot near servo connector). Jogwheel connector goes (notch UP) on the ENC connector.
LCD goes (notch DOWN) on LCD connector. LCD contrast is set with the trimmer near the LCD socket.

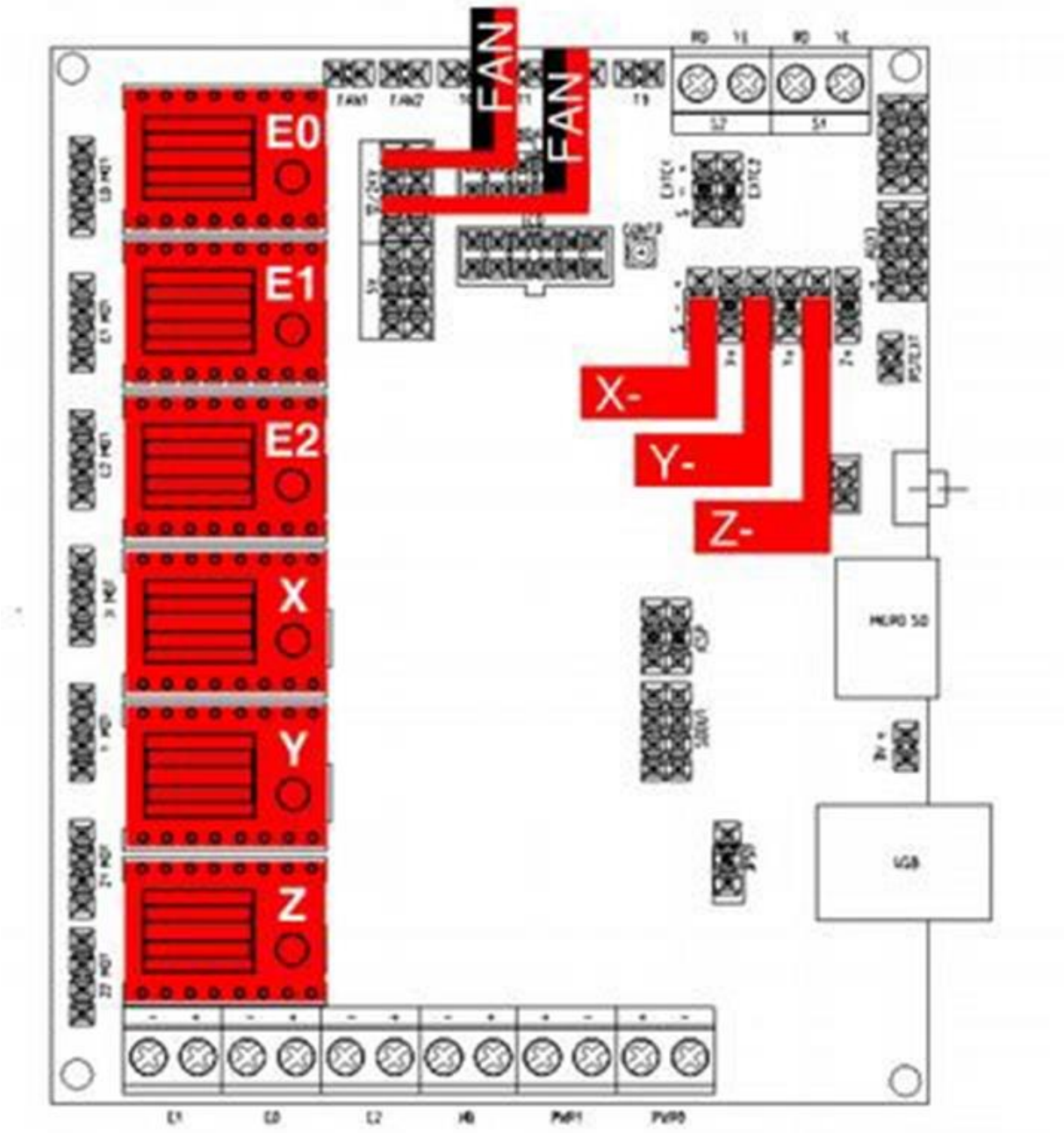


Thermocouple, servo, encoder, lcd, filament sensor



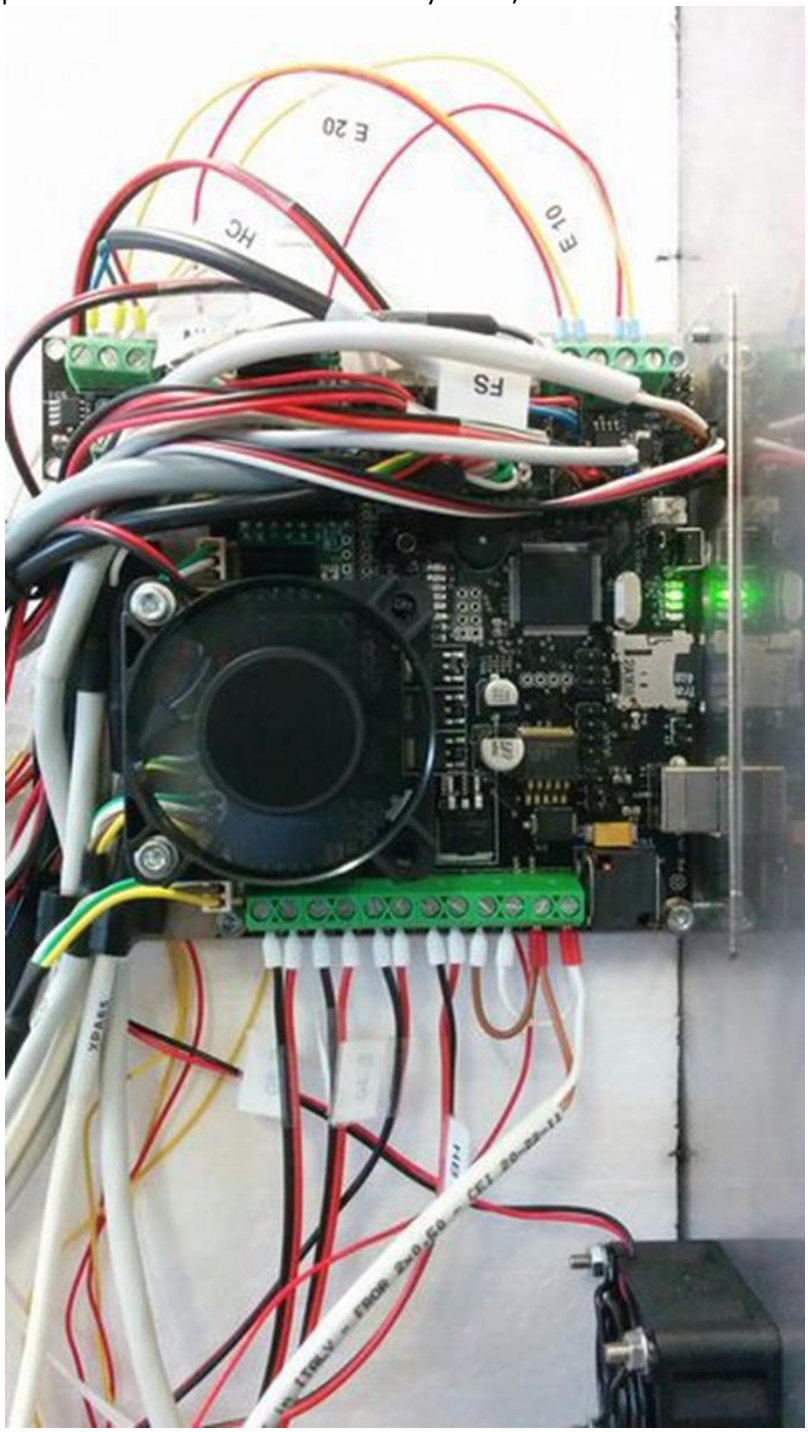
Servo and End of Filament Connections

5) Fan and Endstops
   Fan connection must be ALWAYS with the red lead on connector facing to the right.
   Fan connection socket: be sure to use the upper half of the socket (marked as 12/24V) as from following image. End stop must ALWAYS be connected on the two lower pins of the end stop socket.



Fan and End stops

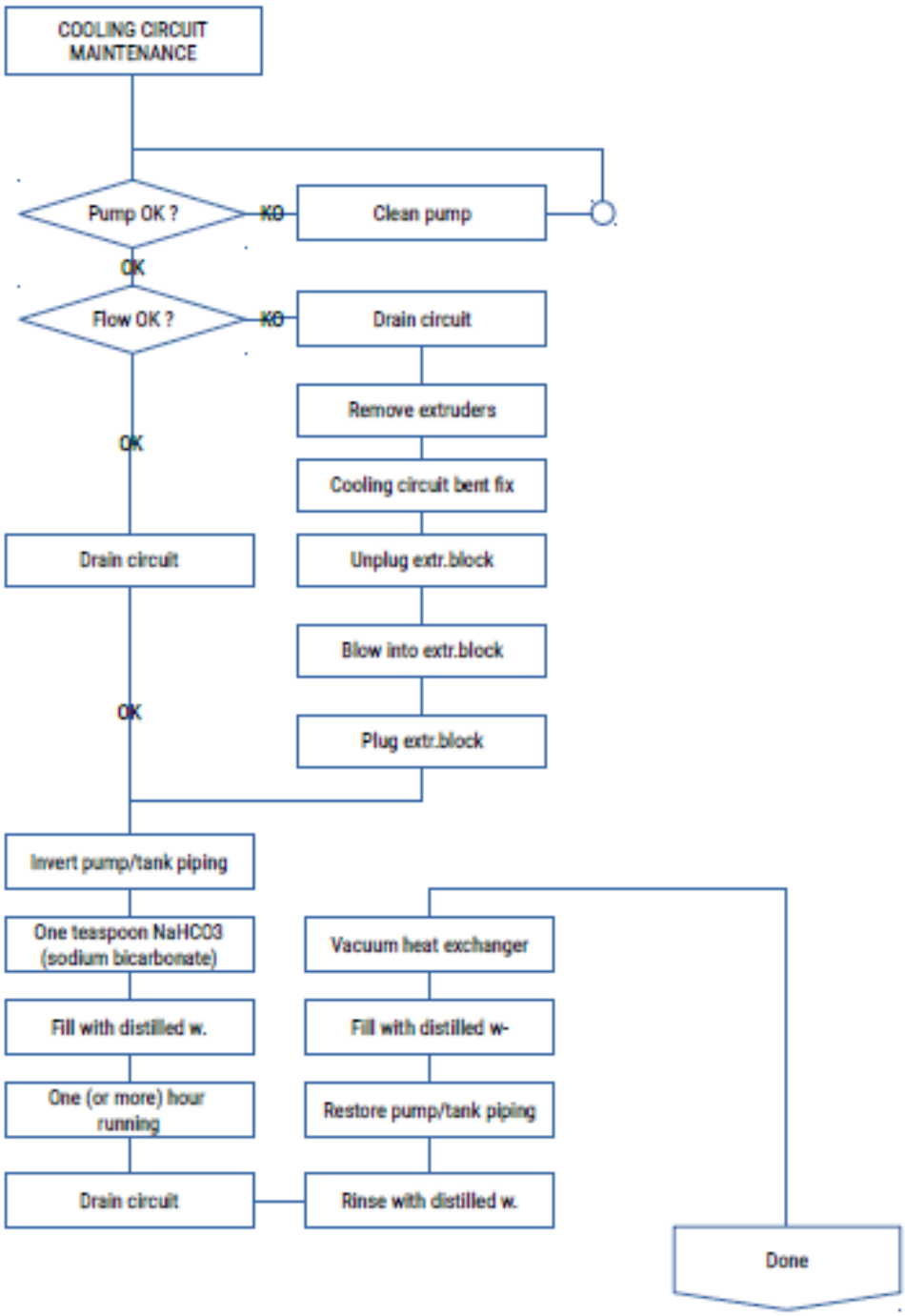
6) Correct Appearance. If motherboard is correctly wired, it should look like this:



Properly Cabled and Functioning Motherboard

6.4 Cooling Circuit

6.4.1 Maintenance Flow Chart



Cooling Circuit Maintenance Flow Chart

6.4.2 Cooling Circuit – Drain System

Tools needed before undertaking this task:

Filling Bottle

Distilled Water

Cellulose Rags/Towels

Empty Containers (Water Bottles Shown)

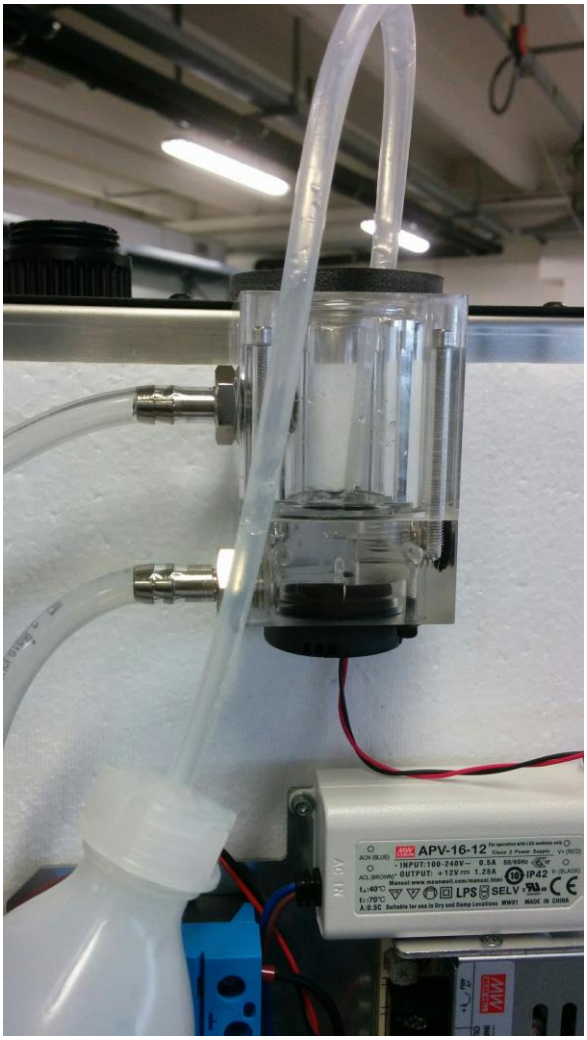
CAUTION - ALWAYS USE PUREST POSSIBLE DISTILLED WATER. Any other fluid will void warranty

1) Turn off printer, unplug power cord

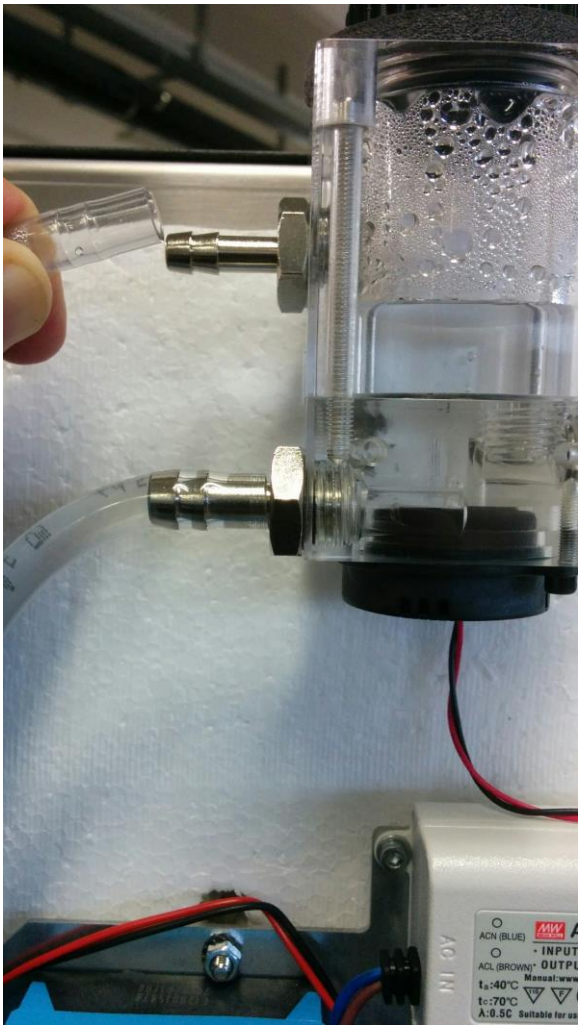
Unplug Power Cord

2) Gain access to the pump/reservoir assembly
3) Using the filling bottle, remove as much liquid you can from the reservoir

4) Unplug the inlet pipe to the reservoir

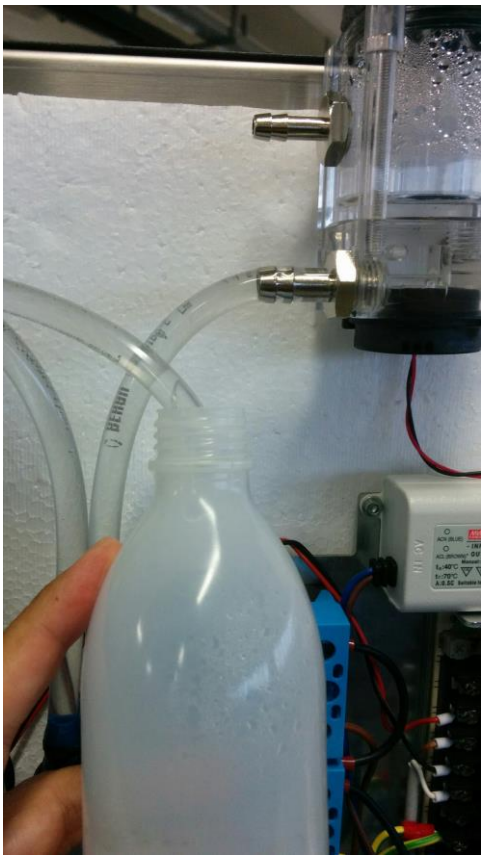


Removing Liquid from Reservoir



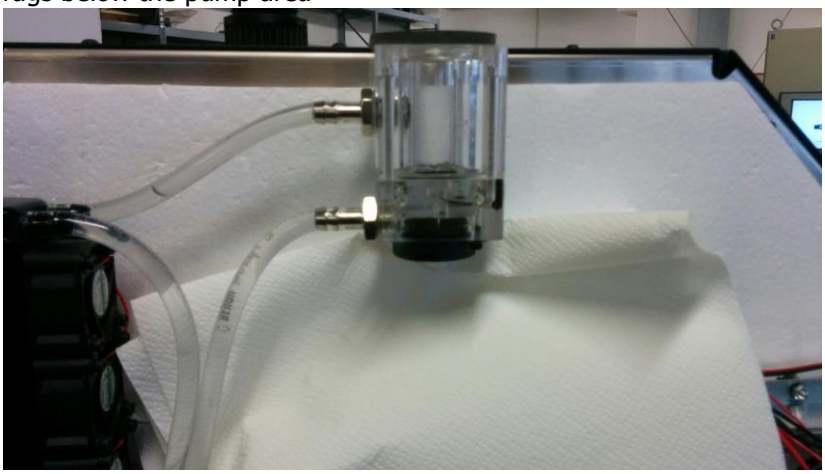
Unplug Inlet Pipe

5) Drain any liquid left in the circuit



Drain Remaining Liquid

6) Put some rags below the pump area



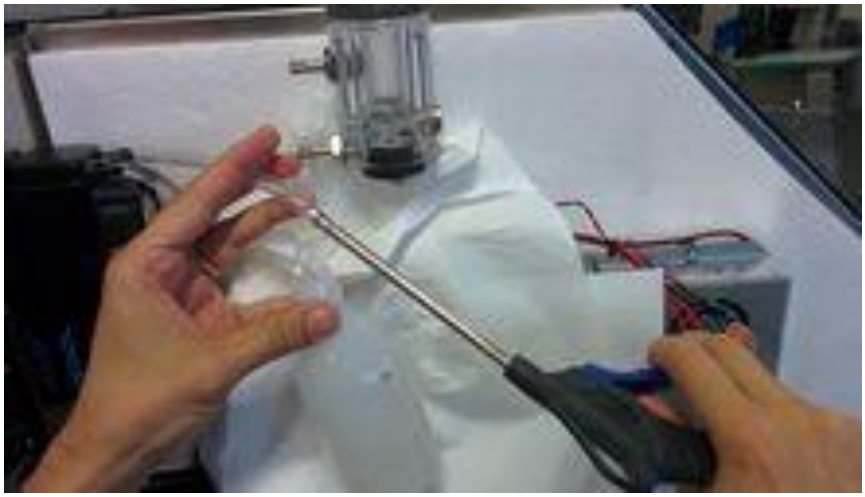
Rags Below Reservoir

7) Detach the outlet pipe

8) Put inlet pipe into a container to collect fluid during blowing

Detach Outlet Pipe

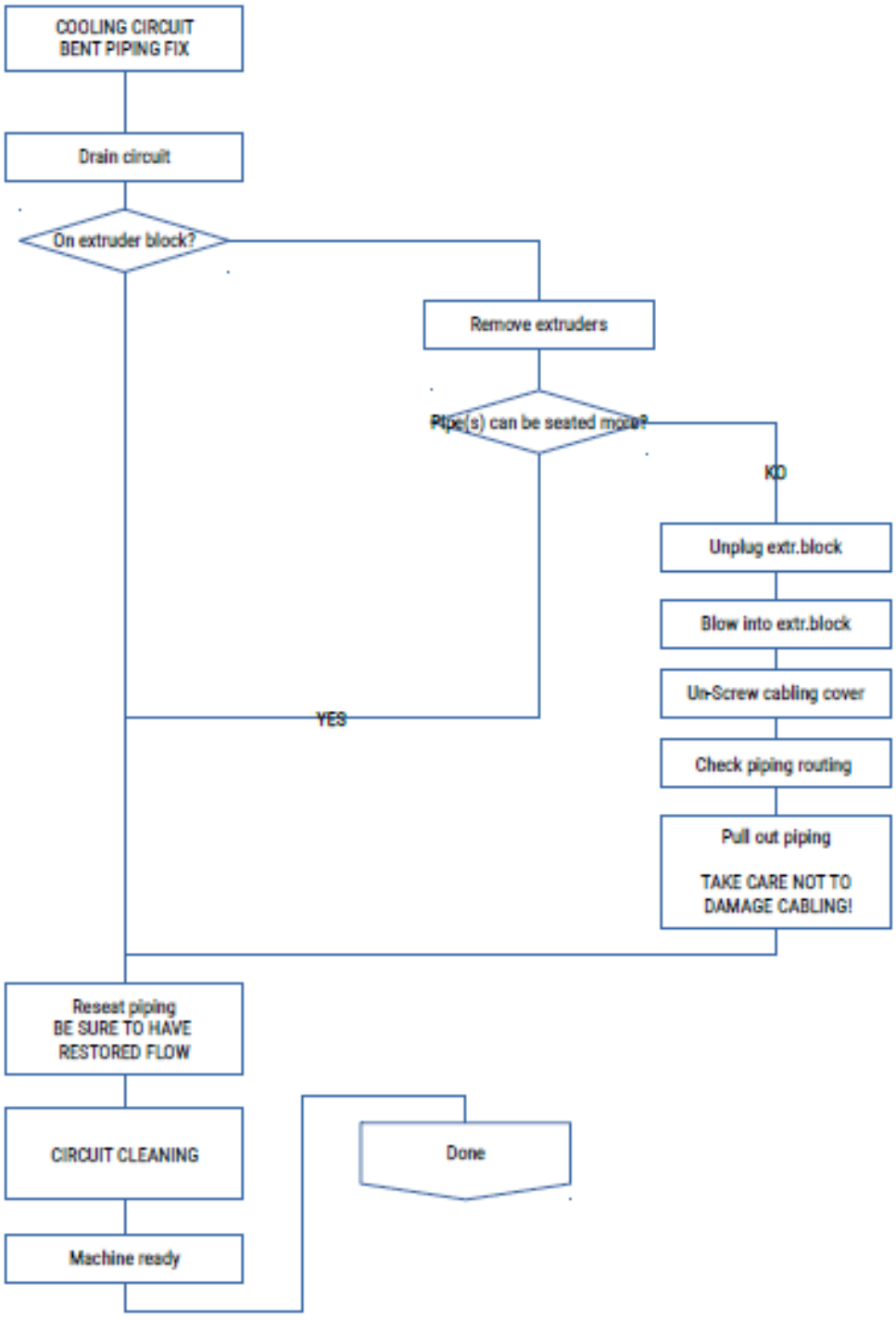
9) Blow (gently) with compressed air into outlet pipe. This way you will be able to drain any remains of liquid into the circuit



Blowing Compressed Air into Outlet Pipe

10) Machine ready!

6.4.3 Cooling Circuit – Fix Bent Piping



Cooling Circuit Bent Piping Diagnostic Flowchart

Tools needed before undertaking this task:

Compressed Air Gun

Hex Keys

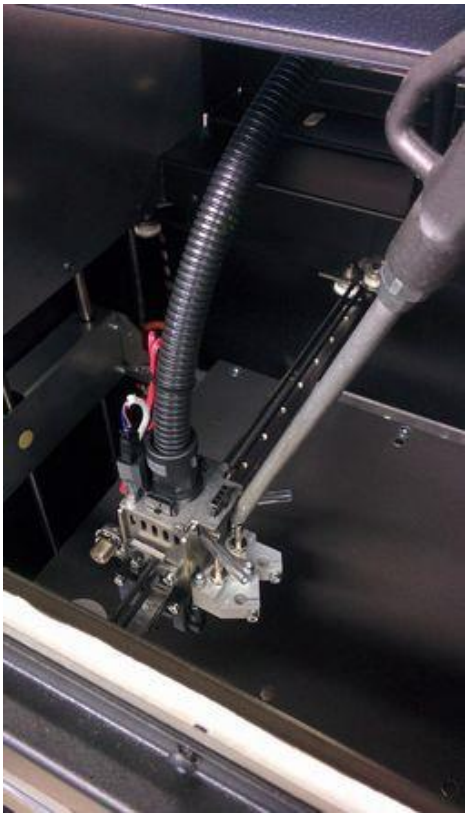
Bent circuit piping prevents correct flow of water cooling: correct flow must be restored to regain complete control of extrusionprocess.

If bend is happening anywhere in the printer BUT NOT at the extruder block:

1) Remove bend, re-seatpiping
2) Test water flow
3) Clean cooling circuit

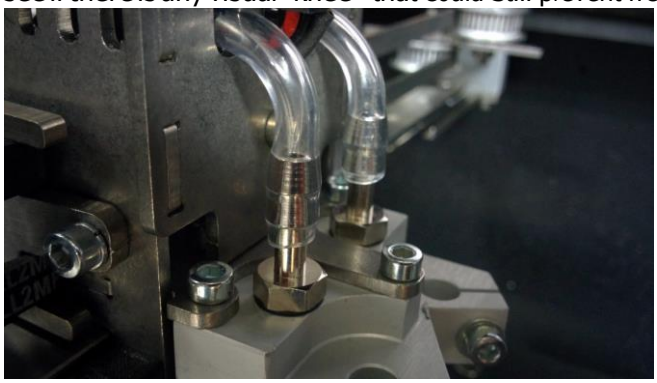
If bend is happening at the extruder block (WE ASSUME THAT MACHINE IS FULLY DRAINED):

1) Remove extruders
2) Detach piping (if pipes were fully seated, they will need to be shortened later on)



Top View of Extruders

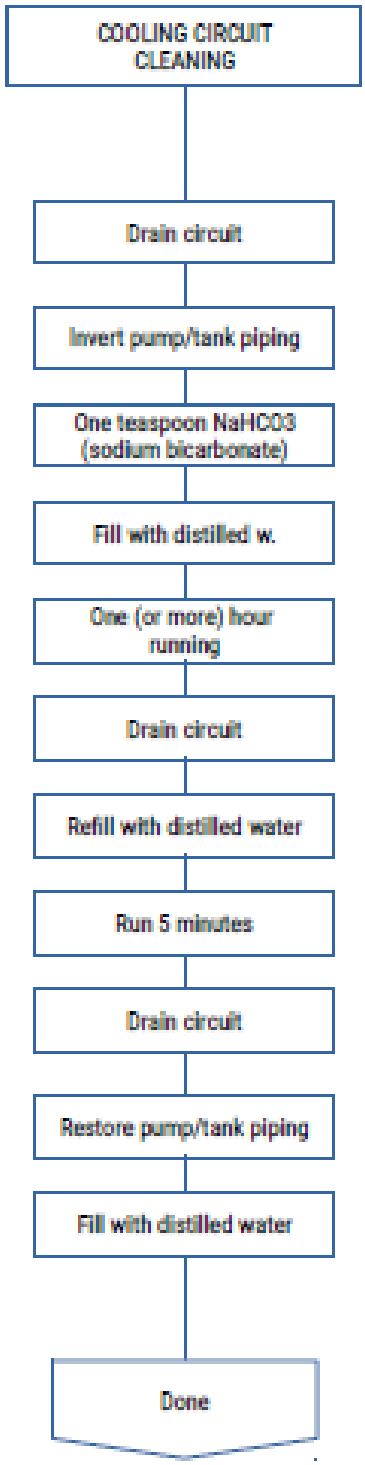
3) Blow inside extruder block water inlet/outlet (keep some towel upon block to avoid spreading water around)
4) If pipes were fully seated, shorten 5mm
5) Put back piping – see if there is any visual "knee" that could still prevent free flow of coolant.



Coolant Piping after Replacement

6) You may need to pull some piping
7) Clean cooling circuit

6.4.4 Cooling Circuit - Cleaning



Cooling Circuit Cleaning Flowchart

Tools needed before undertaking this task:

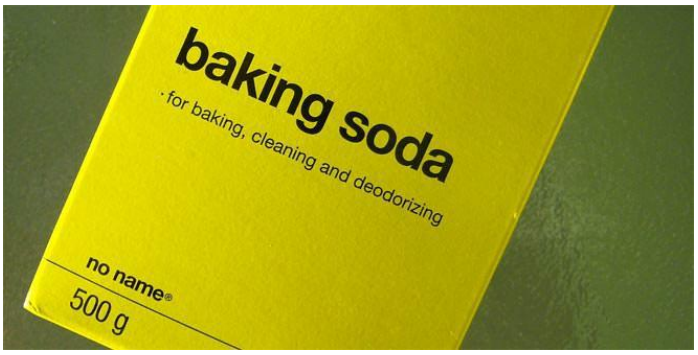
Filling Bottle

Distilled Water

Empty Containers

CAUTION - ALWAYS USE PUREST POSSIBLE DISTILLED WATER. Any other fluid will void warranty

Cellulose Rags/Towels



Baking Soda (Sodium Bicarbonate)

1) Power OFF and Unplug Printer

Unplug Printer

2) Completely drain machine
3) Invert inlet with outlet on pump/reservoir

Invert Inlet & Outlet on Pump/Reservoir

4) Put one teaspoon baking soda into reservoir
5) Fill reservoir with distilled water
6) Turn on machine
7) Don't let the level go too low on reservoir. Use emergency button to stop.
8) Once water level is steady on reservoir, let it run for 1-2 h
9) Completely drain machine
10) Refill with distilled water
11) Run for 5 minutes
12) Completely drain machine
13) Revert piping (inlet outlet) on pump/reservoir to original configuration.
14) Refill with printer cooling fluid (the red one)

6.4.5 Cooling Circuit – Pump Cleaning

This task is needed when pump is not turning (or it is turning at low speed)

Tools needed before undertaking this task: (other than the ones needed to drain machine)

Hex Keys

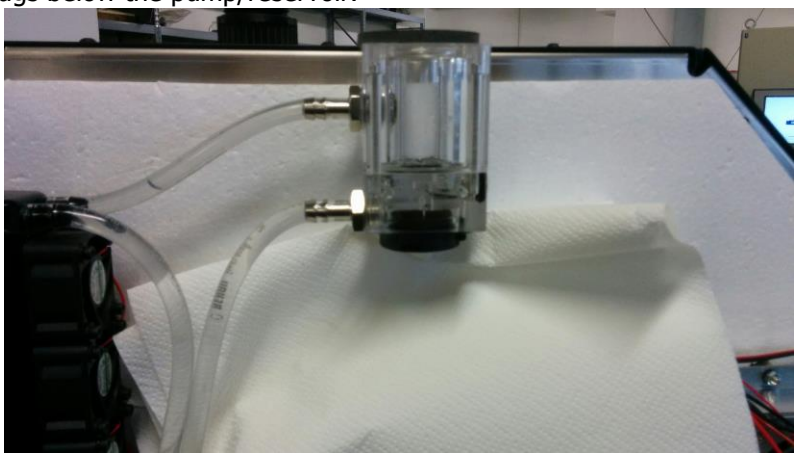
Cellulose Rags/Towels

1) Turn Printer OFF and remove AC Power.

Remove AC Power

2) Drain cooling circuit. Be sure to have completely drained the pump/reservoir.

3) Put some rags below the pump/reservoir.

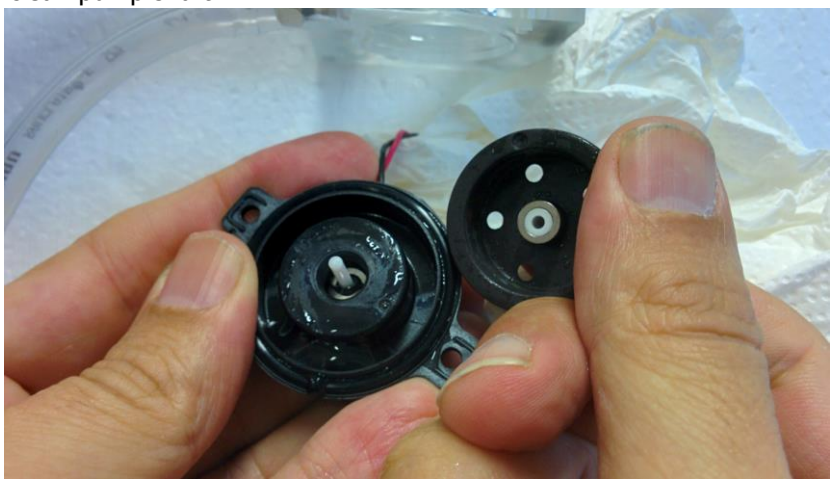


Place Rags below Pump/Reservoir

4) Remove the screws holding the pump against reservoir. As soon as screws are removed, use rags to absorb all water into pump housing.

Removing Pump/Reservoir Screws

5) Check for:
    - gasket /seal integrity
    - foreign part(s) on the pump impeller
    - clean pump shaft



Inspect Pump Components

6) Be sure that impeller is free to rotate on shaft

7) Clean the pump seal and the seal "landing zone" on reservoir- (on some pump version the white pin is not present)

Clean Pump Sealing Surfaces

8) Mount pump. Don't tighten screws
9) Turn on machine (DON'T refill circuit yet)
10) Tighten (gently) the pump screws until are tightened or pump stops running. In any case, never overtighten.

Refilling Reservoir

11) If pump is running, refill circuit and look for leaks. If pump is not running, check connection. Replace if connection is ok.

6.4.6 Printer Jams frequently – Cooling Circuit jammed

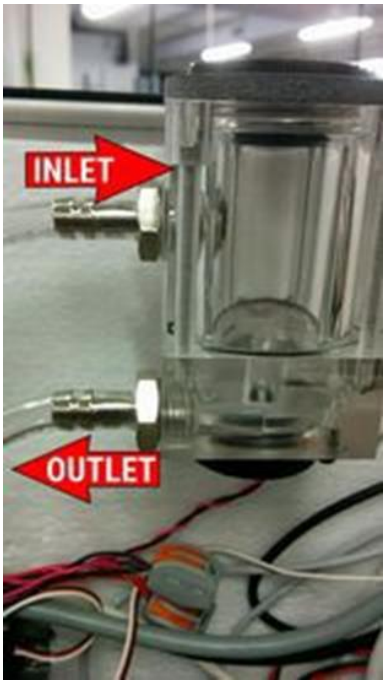
In case you are experiencing one of the following situations:

- SSU0 (or other low-temperature filament) is giving printing problems/jams into entry at upper part of the extruder
- Support polymer doesn't stick properly to raft/part
- You are unable to remove filament from extruders
- Plastic pipes entering/exiting the extruder holder block are showing some dark colored spots
- Plastic pipes entering/exiting the extruder holder block are showing some "cloudy" substances

Extruder with Jam on Entry

You should check the cooling system:

1) Turn power off and unplug printer from AC socket
2) Remove the panel covering the water reservoir/pump assembly (A2 is at left, A4 is at right)
3) Using suitable devices, completely empty the reservoir
4) Detach pump outlet (lower pipe) and place it into a 1-2 lt empty plastic bottle (keep a towel at hand to avoid any spill – if water leaks around, BE ABSOLUTELY SURE THAT EVERYTHING IS COMPLETELY DRY BEFORE POWERING ON MACHINE)
5) Detach inlet tube (it is the highest positioned pipe attached to the reservoir) and plug it into lower port (pump outlet)



Inlet/Outlet Identification on Coolant Reservoir

1) Fill the reservoir with tap water – don't reach the inlet port level (you could spill it into LIVE ELECTRICAL DEVICES LATER ON)
2) Turn on machine – pump will work in the opposite way it was working (possibly removing any obstruction into pipes) If there is no water flow, chances are that extruder holder block is jammed. Take the following extra steps:
    a. drain all the liquid from the cooling circuit
    b. remove all extruders from the machine
    c. unplug machine from AC power
    d. pull and detach piping entering the extruder block
    e. use compressed air to blow inside both entry points into extruder holder block
    f. when air is freely flowing in BOTH ports, re-connect piping to the extruder block and restart from #6 (fill reservoir)
    g. Keep adding water to the tank to the tank to get complete pipe cleaning
3) If water is still not flowing, turn power off – turn power on and:
    a. Check all piping that no sharp bends are obstructing flow
    b. Check that no pipe is being pinched by metal panels – remove all relevant panels to check piping
    c. Check that pipes into extruder holder assembly are not bent into connector area
    d. When water flow is steady (and works even when pump is powered off) let the circuit to completely drain
    e. Using DEMINERALIZED PURE WATER (same grade used for batteries) ll again the circuit and add until circuit is completely clean from any tap water residual
    f. Let the circuit to completely drain
    g. Turn power off and detach power cord
    h. Restore original piping condition (inlet and outlet connections)
    i. Fill system with de-mineralized water. Turn machine on
4) Tapping on inlet port, remove any air bubble trapped into heat exchanger – you must feel subtle pressure on inlet port flow entering the reservoir
5) Be sure that water level is OK

    NOTE - Using pure de-mineralized water is approved alternative to factory supplied blue tinted liquid.

Poor Cleaning Results Due to Cooling Problems

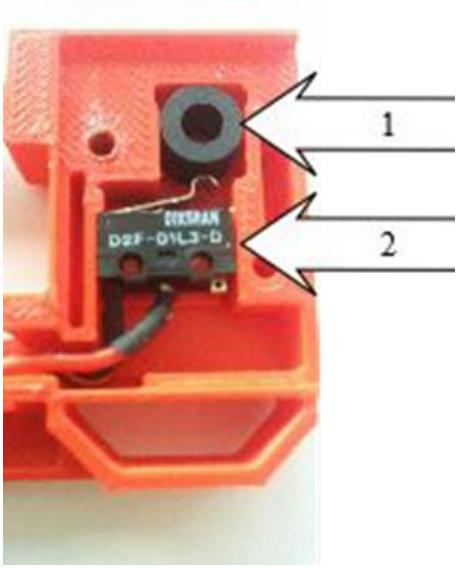
6.5 Feeder Assembly

6.5.1 Filament Sensor Doesn't Work/Works Intermittently

If the Filament Sensor doesn't work or works intermittently, perform these checks to determine one of the possible reasons:

1) Check the connector on motherboard
2) Check filament quality/diameter – thin ones may trigger sensor
3) Check the connectors on each filament sensor
4) Open each sensor
    - Clean from powder or any filament residual
    - Check that soldered on sensor (g.18 – 2) ends are OK
    - Plastic roller (g.18 - 1) is in place and free to move
    - Microswitch (g.18 – 2) is working OK

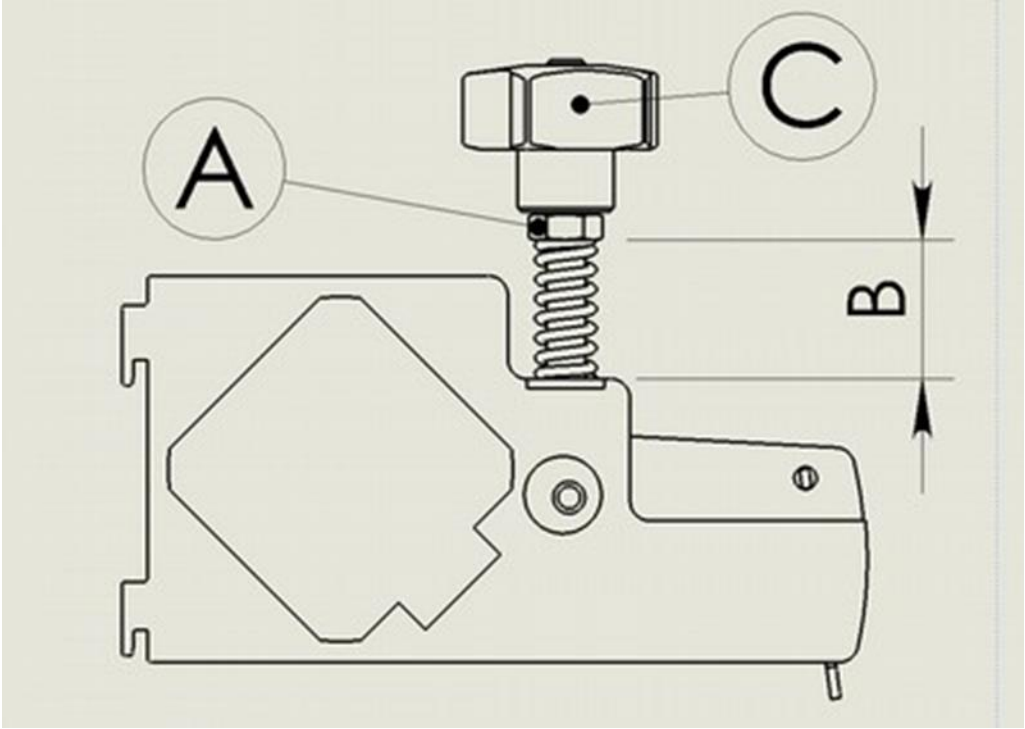
   If everything OK, put back cover on sensor(s)
5) G-code correctly enables the sensor (M11)
6) To validate installation:
    a. Be sure that ALL sensors have been fitted with filaments
    b. On two-nozzle machine: be sure that there is a jumper on the unused branch of cable assembly (you may need to open the cable cover inside heated chamber)
    c. Connect to machine (PC or print server)
    d. Send M119 command. Machine will reply with "filament_runout_pin: NOT TRIGGERED " if everything is OK.
    e. Remove a filament and again sending an M119 command you must get a "filament_runout_pin: TRIGGERED " reply.
    f. If not, check again connections



Filament Sensor

6.5.2 Feed Pressure – Check/Restore to Factory Default

Feed pressure is factory set and should never be changed.



Feed Pressure Adjustment Diagram

If you need to restore factory setting:

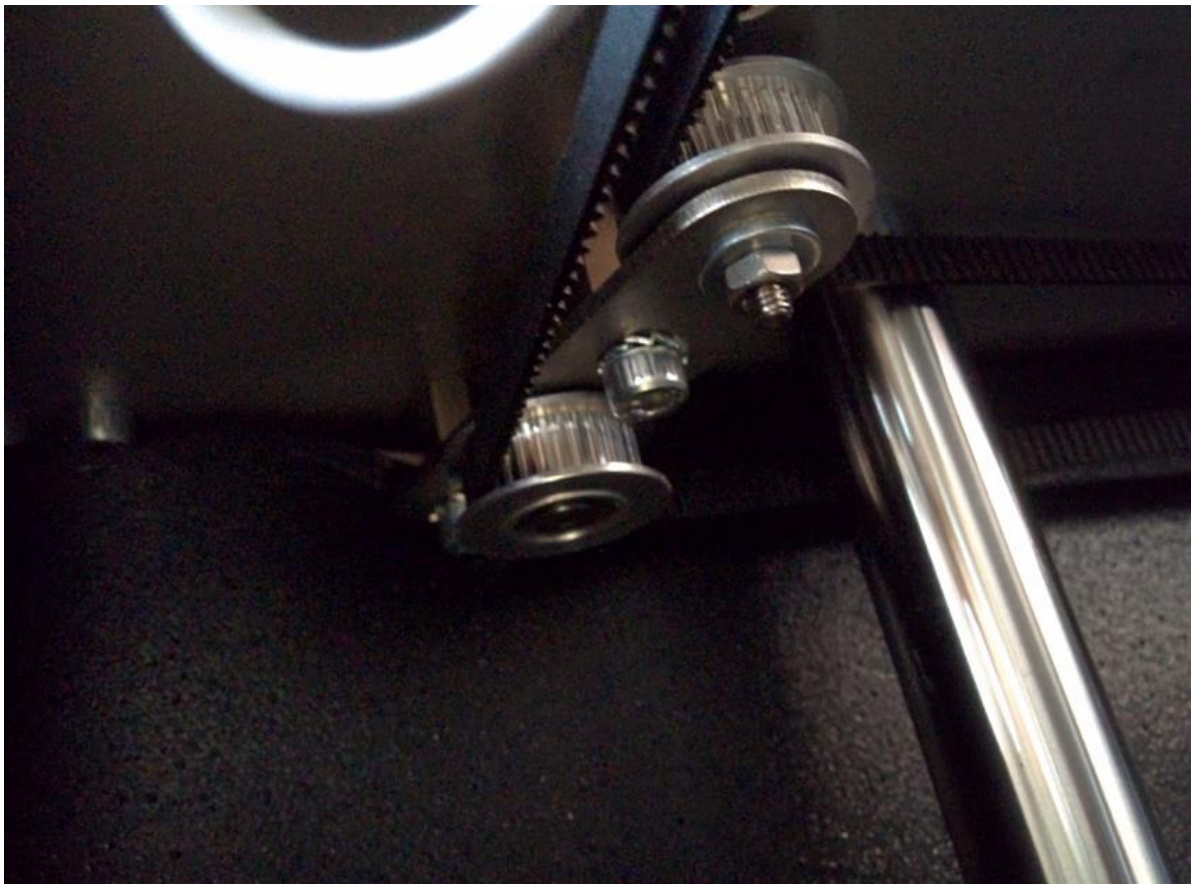
1) Release nut "A" with a 10mm spanner, holding "C" wheel.
2) Lock feeder into OPEN position, locking it into position as from above pic. 6.

NOTE - For older machines the position could be slightly different. Proof of good setting can be seen during printing process, when machine is repeatedly feeding and retracting – the lever shouldn't move – if you can see some fluctuation then the feeding roller is "chewing" the filament (showing that either pressure is too high, or filament is too soft).

6.6 Pulleys

It may happen that pulleys are getting loose or moving along the bearings, getting to touch supporting metal sheet. To check that pulleys are running OK:

1) Turn OFF machine, remove USB cable.
2) Grab extruder hold assembly and move it left/tight and back/forth. You must feel continuous friction, without any discontinuity.
3) Turn ON machine (to get LED lighting) and check pulleys clearance – you must be able to take a thin paper fragment between pulley and the supporting metal.
   NOTE - XY motors are strong enough to cope with some pulley friction.



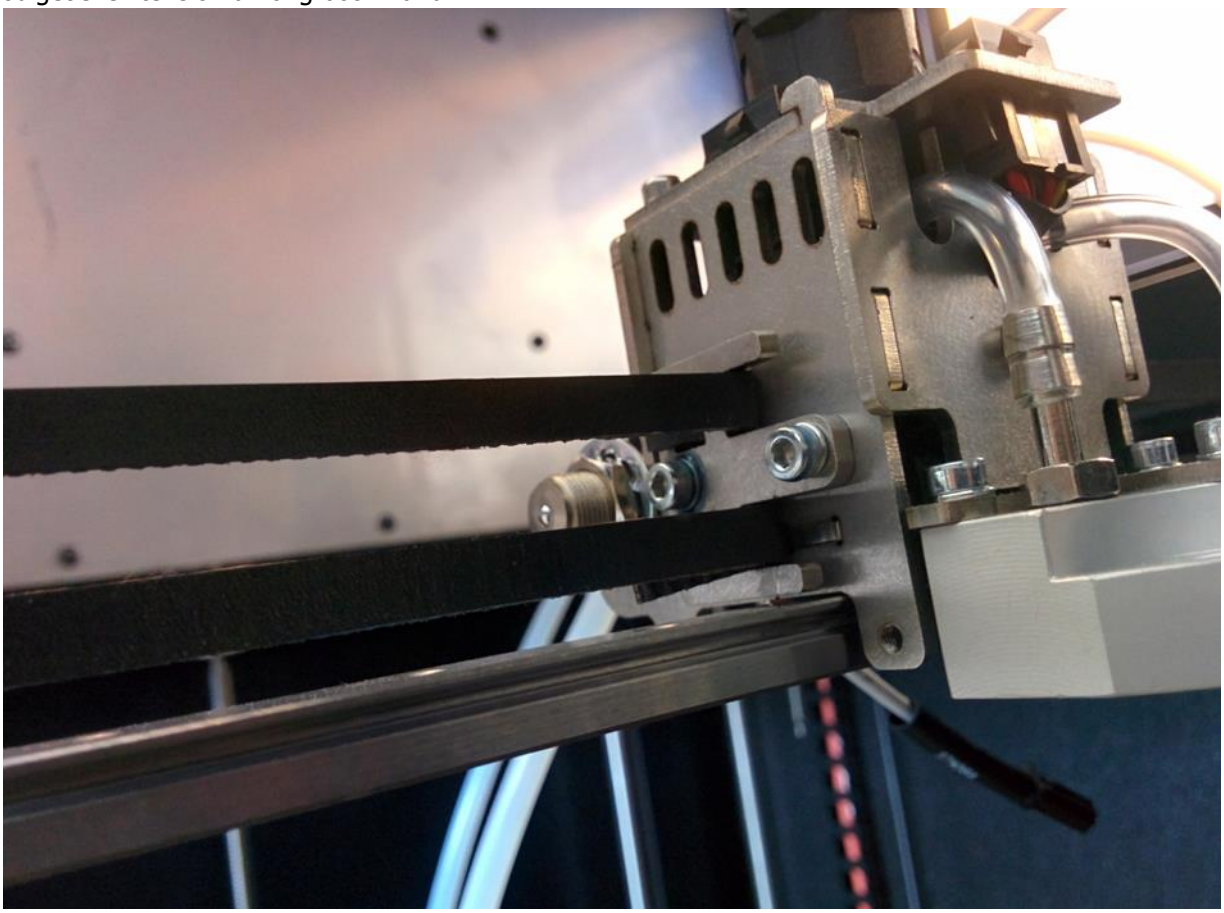
Pulleys

CAUTION - Moving the extruder holder around by hand may generate enough current to fry any USB device connected to the printer – be sure to unplug printer before attempting ANY manual movement.

6.7 Belt Tension

Upper and lower belts should have same tension. If you can feel notable difference, then you must correct situation.

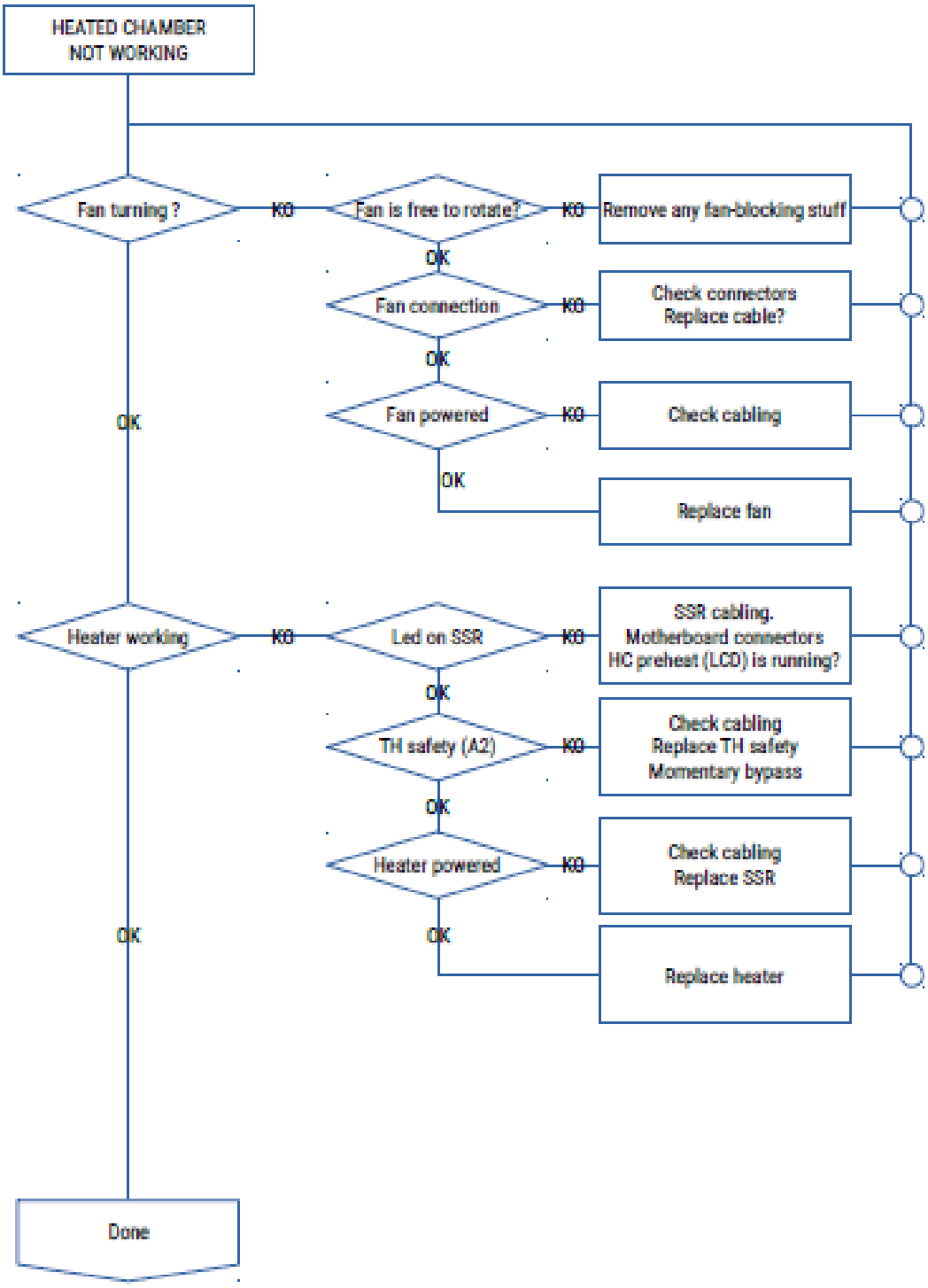
Loosen the nuts of the plate holding the X or Y motor – push (or pull it, if you removed the right cover) until you get even tension among both X and Y.



Belts – Check Tension

6.8 Heated Chamber

6.8.1 Diagnostic Flowchart



Fan Inlet

6.8.2 Heated Chamber Inspect & Repair

See Heated Chamber Diagnostic Flowchart Section 4.12 for troubleshooting guidance.

CAUTION - Failing to disconnect AC cord may expose to electric chock risk – DON'T run into any risk, ALWAYS FULLY DISCONNECT AC POWER WHEN SERVICING ANY AC DEVICE!!!! THESE PROCEDURE(S) are for trained electrical maintenance technicians: DON'T attempt if you lack proper training, tools and safety equipment. SEEK QUALIFIED HELP +or+ revert to 3ntr support before attempting ANY activity on LIVE AC powered parts.

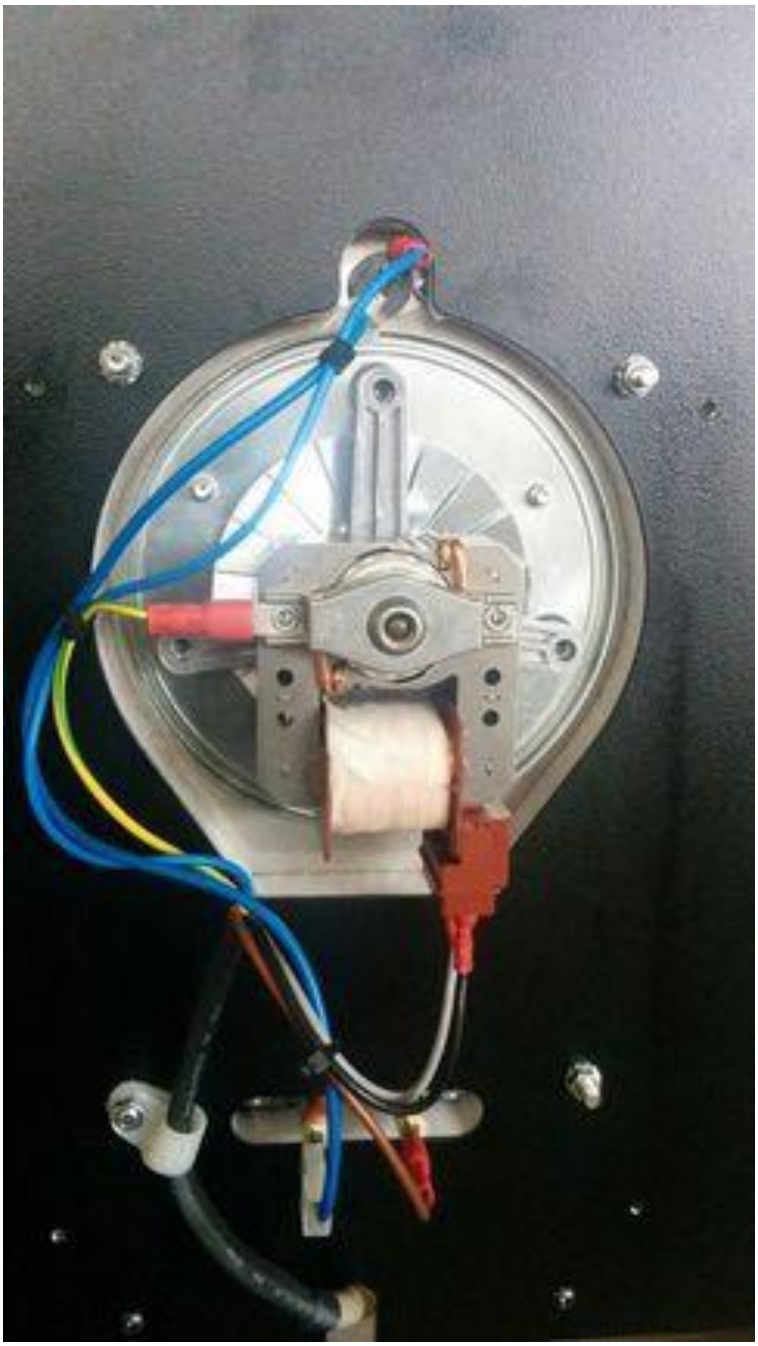
Fan is free to rotate:

- no debris inside fan housing
- no plastic "hairs" around
- turning fan by hand will get fan rotating alone for few seconds

Fan Inlet

Fan connection:

- Remove back HC cover (on A2)
- Remove back panel (on A4)
- All the connectors are securely engaged (A2)
- All screw terminals are securely tightened (A4)
- Pull gently to assess engagement
- Fully push inside to get seated connectors



Fan Connections (Cover Removed)

LED on Heated Chamber SSR

TH safety:

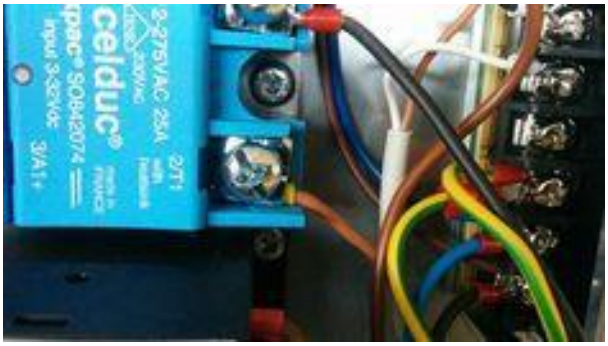
- check that connection is OK
- check TH is working (at room temperature, unplug both connectors entering the TH and using a multimeter you must read continuity)
- bypass the TH (detach the wire going from TH to the heater – plug the other one entering the TH directly to the heater)

TH Connections

SSR cabling: CORRECT CABLING (screw terminal holding just the metal tip of the lead)
NOTE - ALL leads entering the SSR must be checked

Correct SSR Cabling Connection

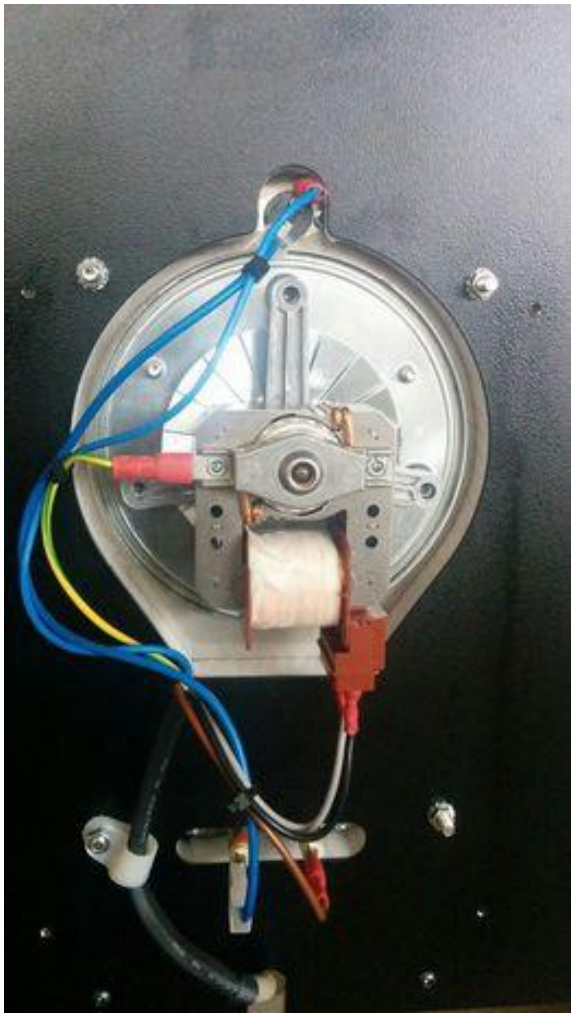
SSR cabling: WRONG CABLING (screw terminal holding the plastic part of the lead)



Incorrect SSR Cabling Connection

Heater Powered:

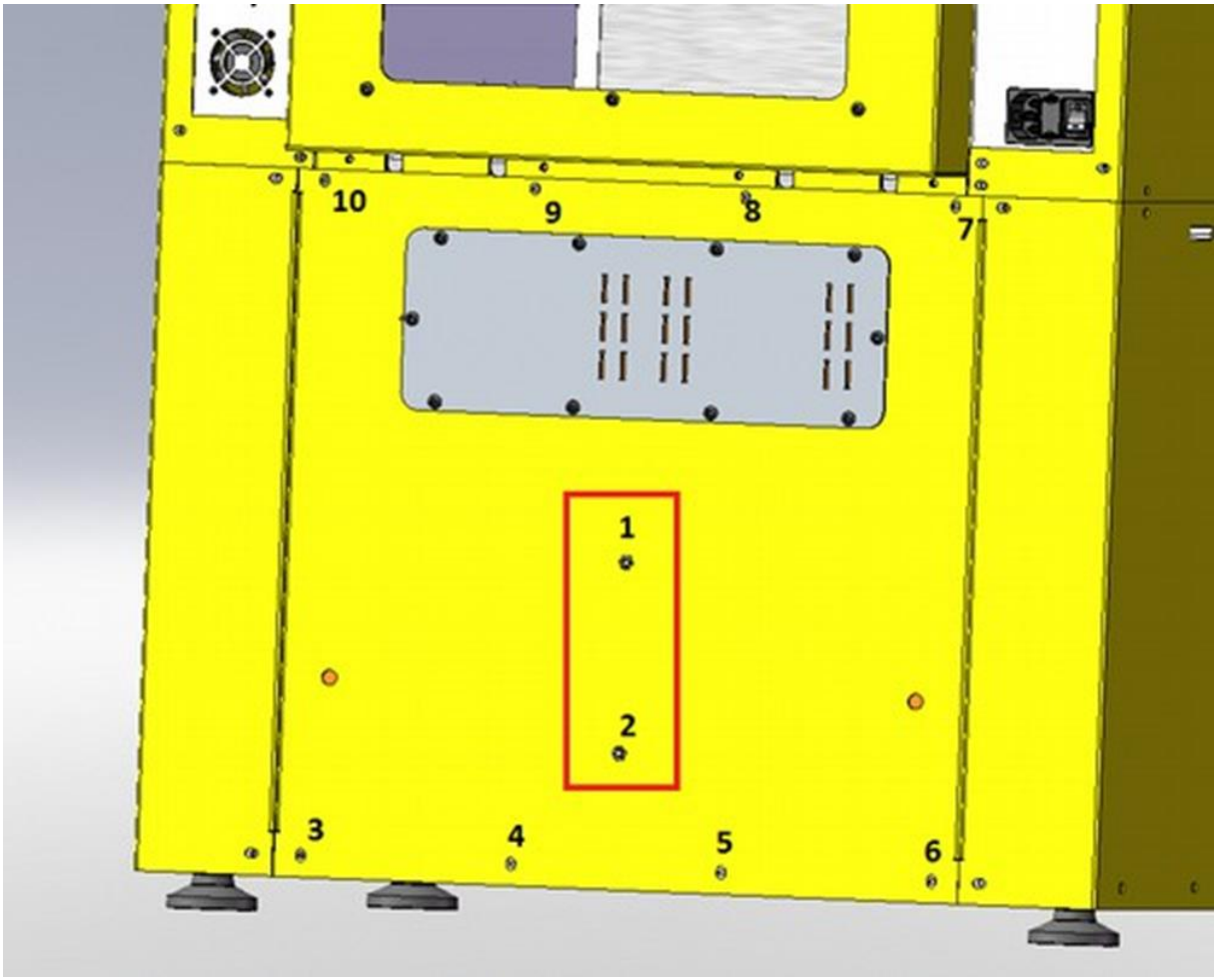
- Check that there is current arriving on the heater poles (fed by brown and blue leads in picture)
- If power is present on heater poles and still no heating, then replace heater.



Heater – Power and Current Checks

6.8.3 A4 Printer Heater Replacement

CAUTION - Power Down Printer, unplug machine and remove AC cord, BE ABSOLUTELY SURE THAT BY NO MEANS THERE IS AC POWER ARRIVING TO THE MACHINE.



Printer Rear Cover

1) Remove nuts 1-2 with an 8mm spanner
2) Remove screws 3-10 with a 2.5 mm hex key
3) Slowly open the rear cover, grab the heater/fan assembly from the inside (ask for help at this stage – if the fan/heater assembly falls on the printer bottom it may ruin the foam insulation)
4) Unscrew the fan leads – you may need to remove the plastic cover of the screw terminal. (for your convenience, you may want to completely detach the fan/heater assembly from the printer – be sure to take note of leads(cables) positions into screw terminals!)
5) Remove the fan using the 8mm nuts – four nuts total, two shown!
6) Replace with the new fan, be sure to mount it blowing toward the heater (notice the direction of arrow stamped on the fan)
7) Put back the four 8mm nuts
8) Restore electrical connections
9) Put back the heater/fan assembly on the rear cover

10) Put back the two remaining 8mm nuts to temporary secure the heater/fan assembly
11) mount the rear panel with the eight screws
12) tighten the two 8mm nuts
13) Check that no cable is to be seen inside the printer
14) Turn on the printer, see if fan is turning
15) Using repetier Host, turn on heated chamber, see if you get any heating. You may need to wait 5-10 minutes to see any T change

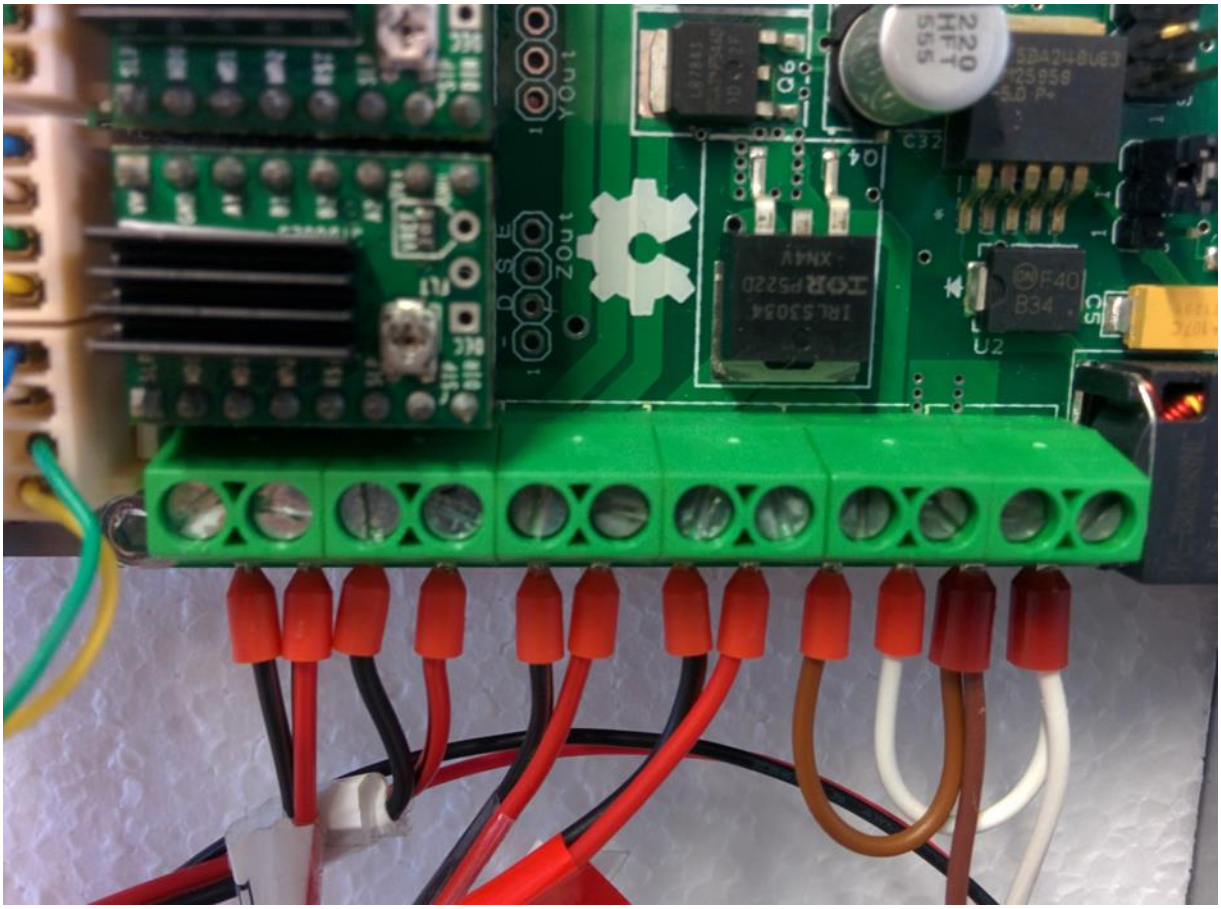
6.9 Motherboard

6.9.1 Screw Terminals - Tighten

Vibrations, extreme temperatures may loosen the screw terminals. This can lead to hard-to-diagnose problems: if you happen to get some weird problems hard to explain:

1) Turn OFF machine and unplug cord from AC socket
2) Remove relevant covers
3) Check screw terminals (with a fat tip screwdriver) being tightened correctly. Don't over tighten!

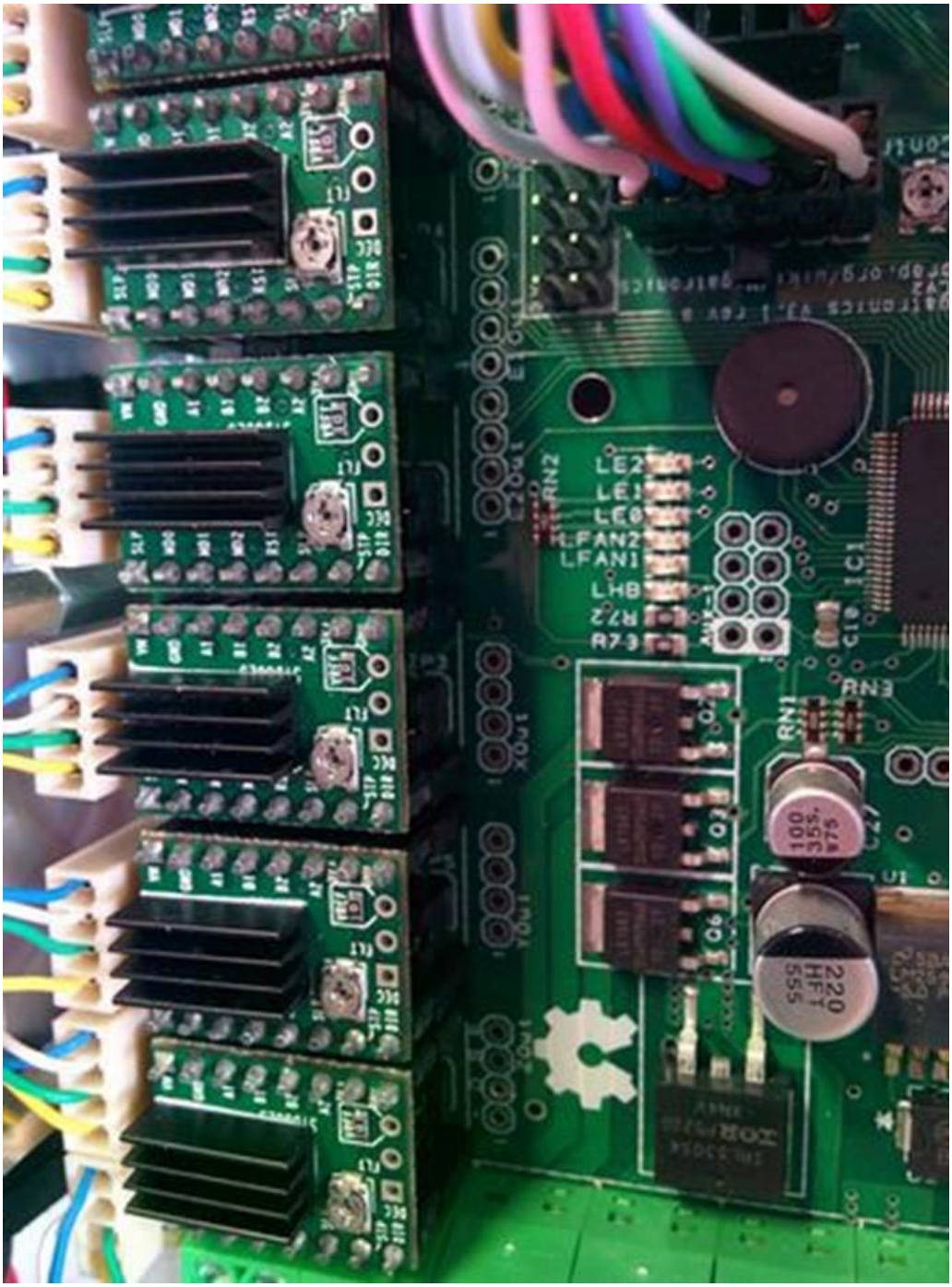
3ntr



Screw Terminals – Inspect Tightness

6.9.2 Stepper Heat Sinks – Cleaning

This is one of the printer areas most subject to dust accumulation.
NOTE - Clean this area with compressed air can. DON'T use industrial compressed air guns!



Stepper Heat Sinks

6.9.3 Motherboard (DC) Fans – Inspect

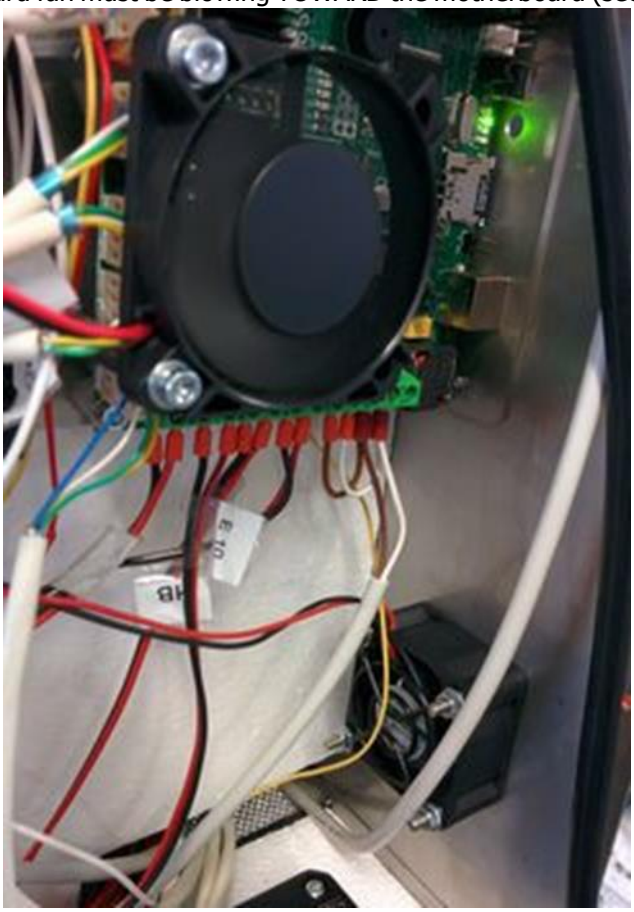
Any DC fan (the small black fans you see on heat exchanger/motherboard area/extruders) must always be running at 100% efficiency. Failing to comply with this requirement the printer may slowly fade into overheating or even more difficult problems to diagnose.

Therefore:

- Keep fans clear from cables or anything that can prevent fan rotation
- If fan is showing slow/irregular rotation immediately replace it.

Sunon fans have proved so far exceptionally reliable – usually the connections are to be blamed for malfunction, not the fan itself. Check that connection is working ok. In case of 1st gen printers (no Sunon fans) you may eventually want to replace with more reliable/newer parts.

IMPORTANT - Motherboard fan must be blowing TOWARD the motherboard (see pic)

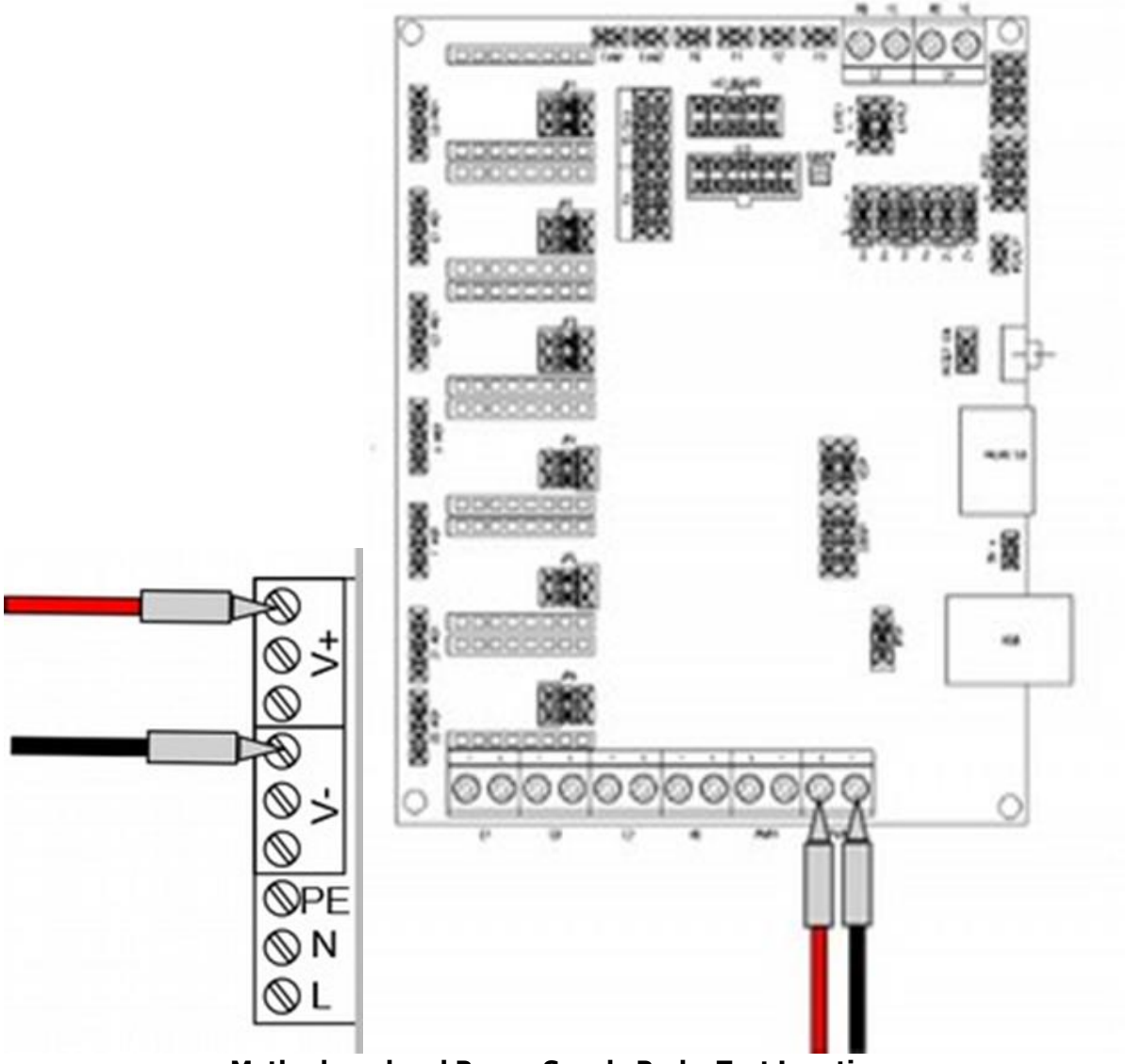


Motherboard Fan Working Correctly (Green LED)

6.9.4 DC Power Supply Test

Power supply is delivered to be feeding power at 24Vdc +/- 0.3V: you can test it with a multimeter on (+) and (-) poles of the power supply or on motherboard screw terminals. (as shown). Should you get out-of-tolerance reading, you can adjust it with the trimmer on power supply.

NOTE -This is a VERY RARE condition and you must report if you experience this – chances are your power supply is defective: perform repeat measurements during a few hours to assess part sanity.



Motherboard and Power Supply Probe Test Locations

6.10 Extruder Assembly

6.10.1 Extruder Gain – How to Find

The cornerstone of a good printing is control of temperature. Since 2016, all machines are delivered with calibrated heaters. If you can't tell the serial number of your heater(s) you can still compute the gain by yourself with this procedure:

1) Remove front panel to reach upper extruder area (tube adapters)
2) Move Z at 50
3) Bring extruders at middle, front area
4) Remove filament from selected extruder
5) Remove PTFE piping
6) Set gain to 1. Save configuration, using LCD functions.
7) Using Repetier Host (PC USB connection) or any browser (if you are using the print server option) set the desired extruder to 240° C
8) Manually feed some ABS filament and be sure to see some filament being extruded out of the nozzle
9) Remove filament, put the temperature probe fully down into the extruder
10) Let temperature to settle for one minute, then read the temperature on probe display
11) Gain value (n) is obtained with following formula:
    Ts = set temperature (240°C)
    Tr = temperature probe readout (I.e..: 232°C)
    n = Tr / Ts = 232 / 240 = 0,96
12) Set gain of selected extruder and save it using LCD function.

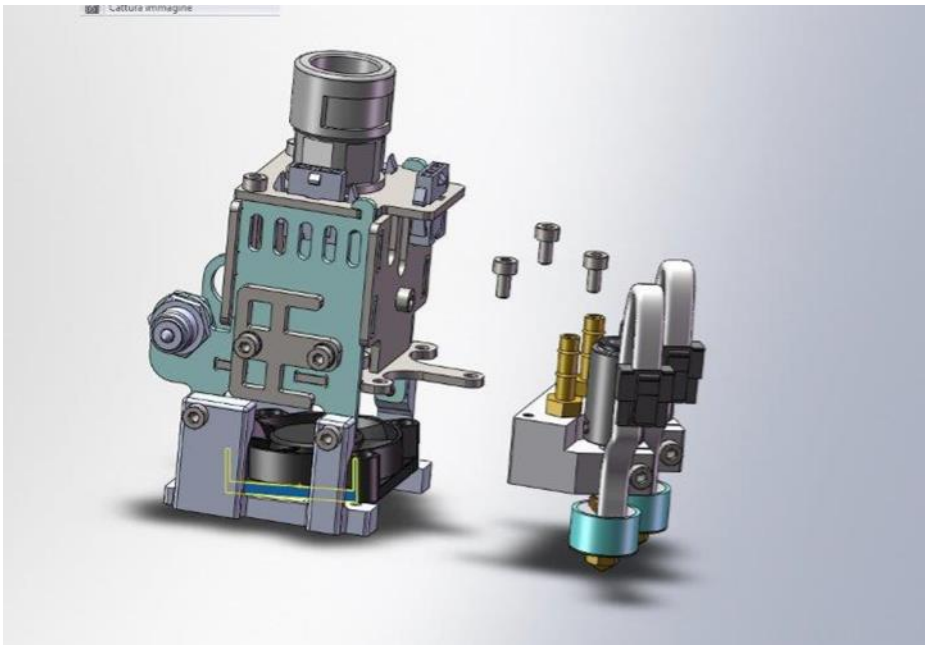
CAUTION - Use ONLY the probes and display supplied from 3ntr to avoid any malfunction

6.11 Print Head

6.11.1 Extruder Plate Change

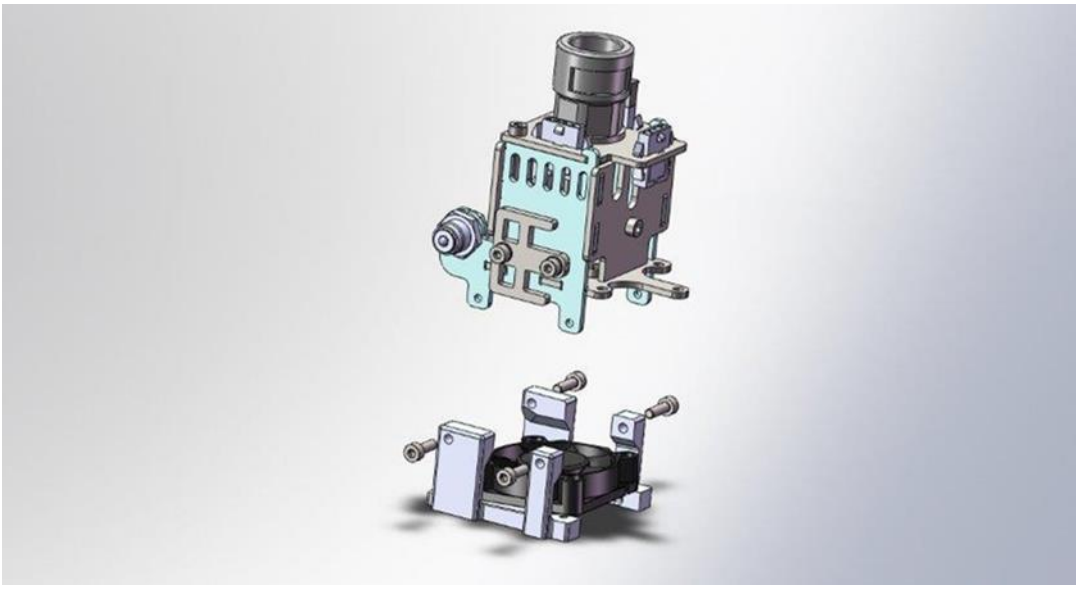
It may be required if you are updating an older machine to new standard or if the extruder assembly has been hit/damaged during Z plate lift (i.e.: faulty Z sensor/operator error)

1) Remove extruder cooling block



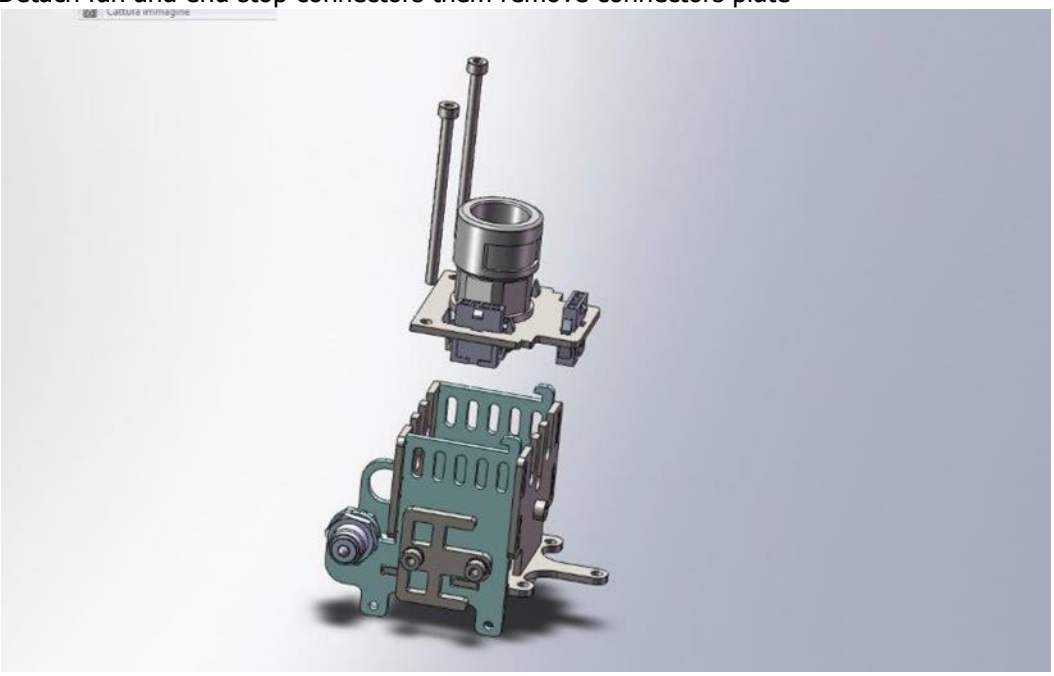
Remove Extruder Cooling Block

2) Remove fan holder



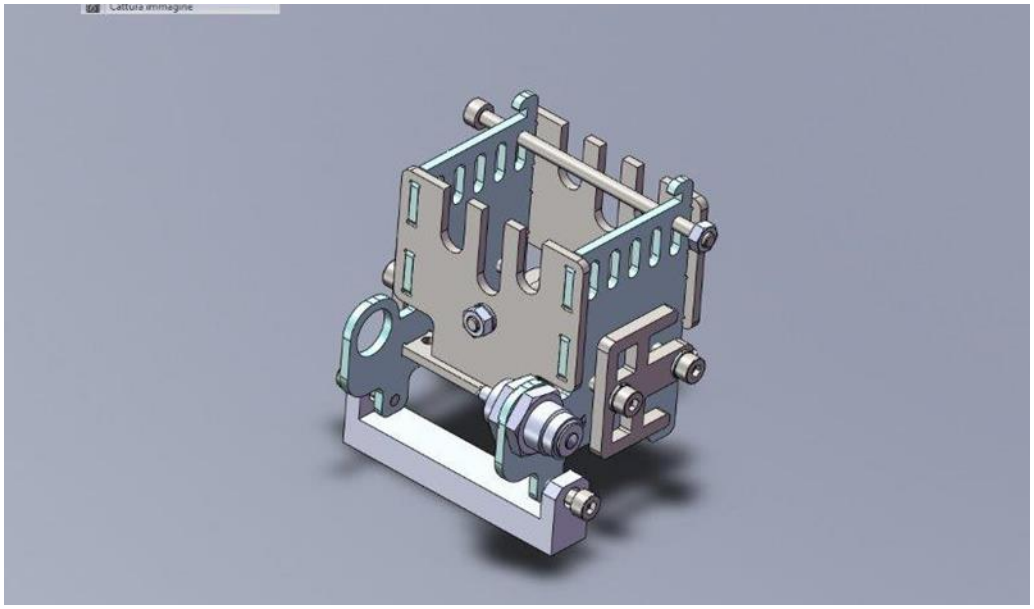
Remove Fan Holder

3) Detach fan and end stop connectors them remove connectors plate



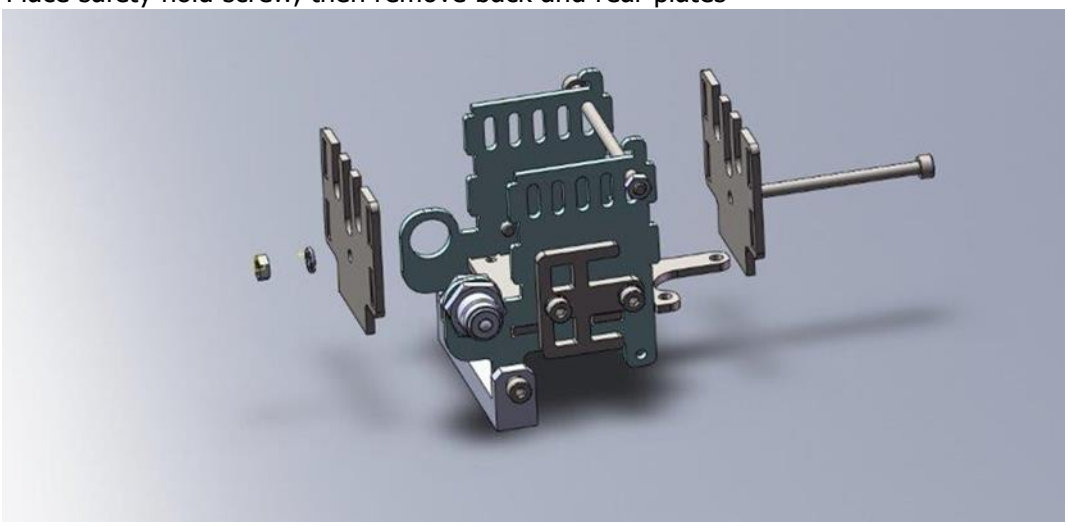
Detach Fan and End Stop Connectors/Plate

4) Place holder bracket



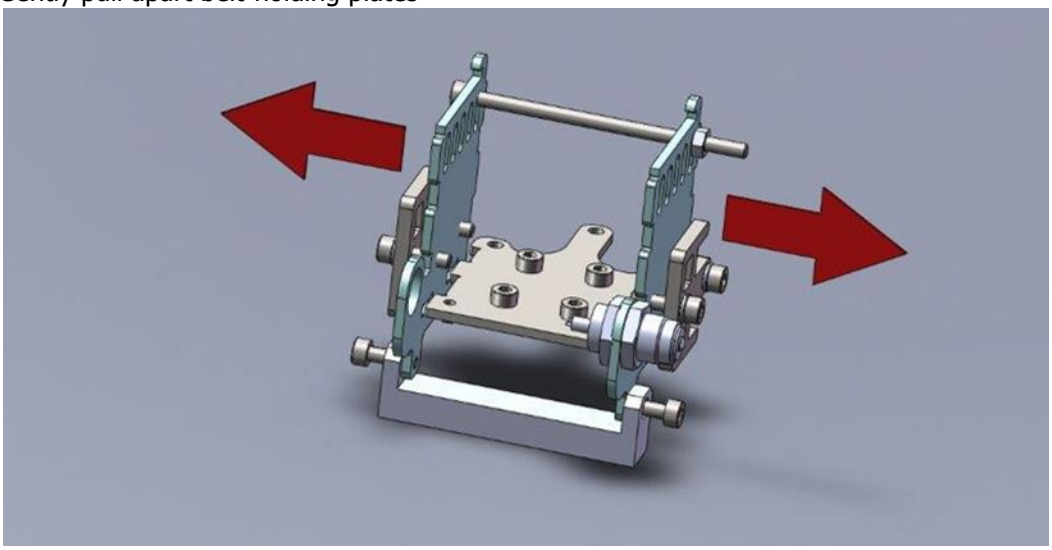
Place Holder Bracket

5) Place safety hold screw, then remove back and rear plates



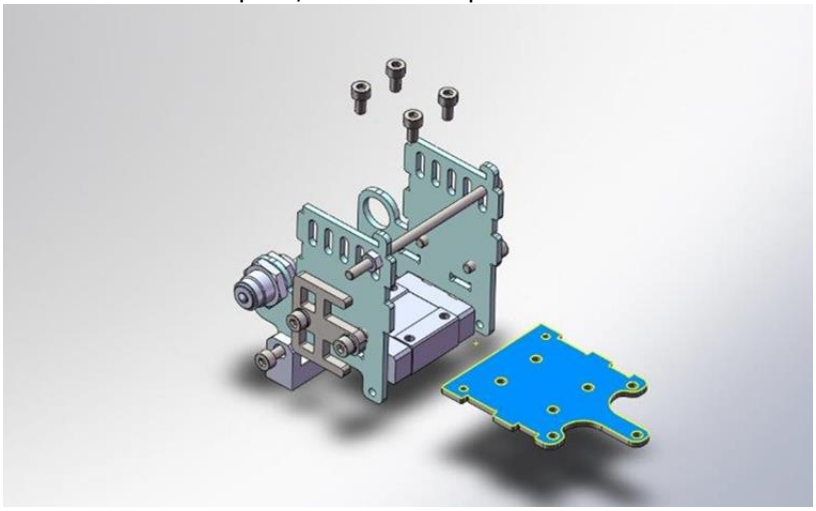
Place Safety Holder Screw, then Remove Back and Rear Plates

6) Gently pull apart belt-holding plates



Pulling Apart Belt Holding Plates

7) Replace extruder block holder plate, then reverse procedure to re-assemble



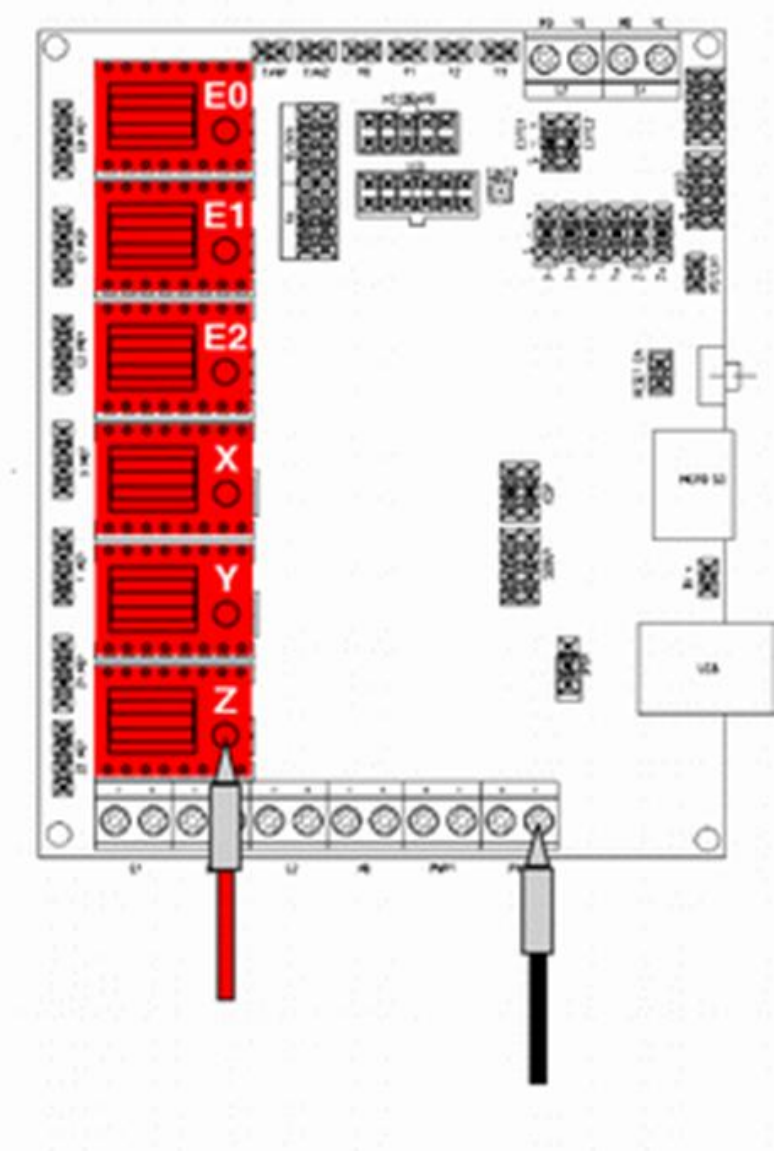
Extruder Block Holder Plate

6.12 Stepper

6.12.1 Current Setting (OLD Stepper Drivers)

Set multimeter on Vcc:

- Remove fan blowing on the motherboard to gain fully access to stepper drivers
- Black probe on extreme right PWR screw terminal (-)
- Red probe on driver trimmer (small screw-like metal device on top of stepper drivers)
- Readout on E0/E1/E2 = 0.45 V
- Readout on X / Y = 0.75V
- Readout on Z = 1.15V
- Put back the fan
- Check that all connectors are correctly and safely seated

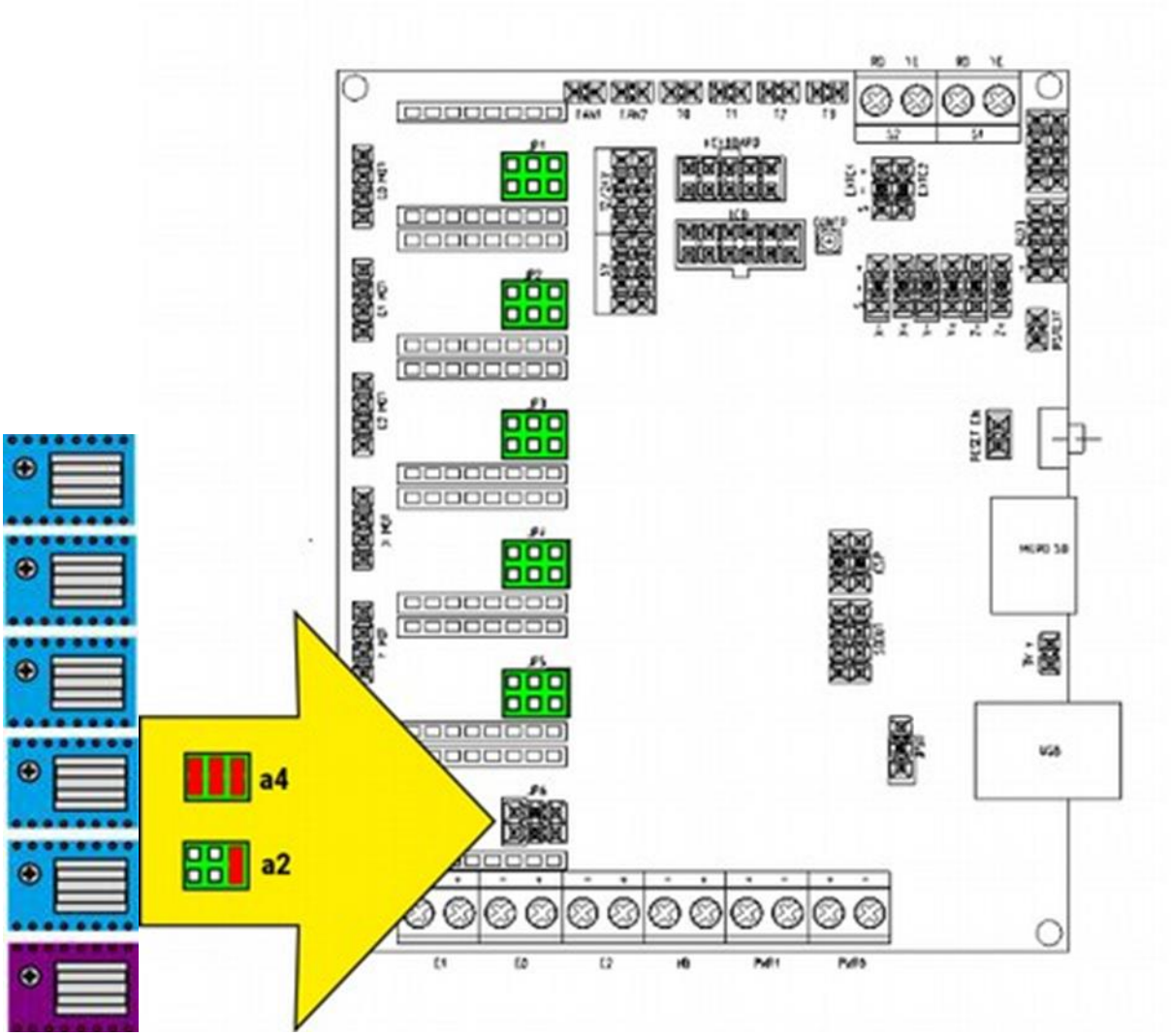


Multimeter Probe Placement

6.12.2 Stepper Current Settings (Silent Drivers)

Notice that jumper settings have changed (all removed except Z – see below). Procedure is as for old stepper drivers, values are changed as follow:

- Readout on E0/E1/E2 = 0.9 V
- Readout on X / Y = 1,4 V
- Readout on Z = 1.15 V

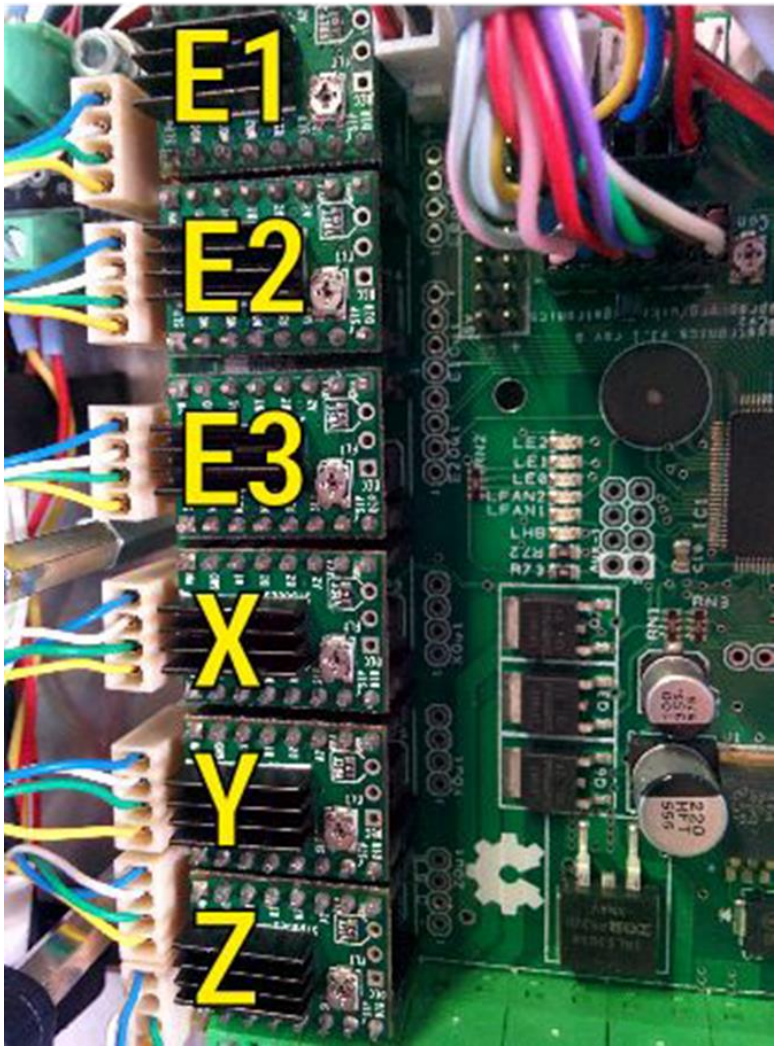


Silent Driver Jumper Settings

6.12.3 Stepper Driver Replacement

In case of faulty driver, you can easily replace it following this procedure:

1) Turn off power, be sure to remove cord from wall outlet
2) Remove right part machine cover, to gain access to motherboard area
3) Touch any bare metal part to discharge any static charge that could damage machine electronics
4) Remove the faulty driver – just grab it with your fingers. For X-Y-Z driver you must temporarily remove cooling fan.
5) Mount the new driver: be sure to have ALL PINS correctly seated and driver is following same orientation of the other ones.
6) Put back on the cooling fan.
7) Check that cabling and connector is OK.
8) Power up machine, test if relevant axis is moving OK.



Stepper Driver Identification

6.13 LCD Display

6.13.1 Malfunction – Weird Character Display

Several possibilities:

- LCD overheats due to poor airflow or missing insulation on the back panel.
- Check that all fans (heat exchanger and motherboard extraction) are working.
- Heat exchanger is clean, and air is correctly flowing
- Air can flow freely behind LCD
- Defective LCD – replace it
- Defective motherboard – replace it

6.13.2 Front Panel Removal

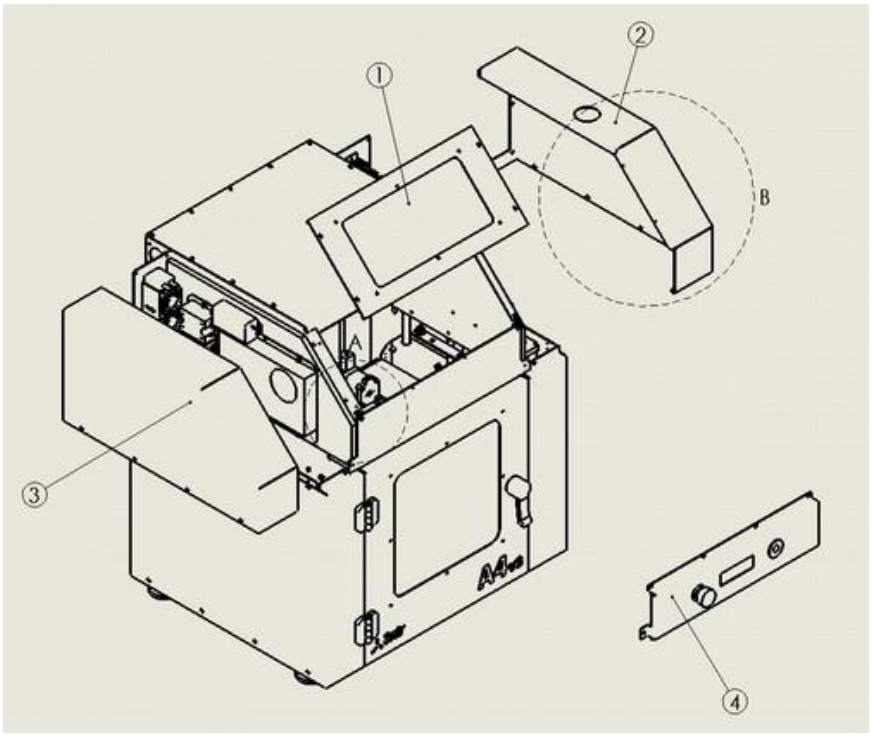
This procedure is valid for LCD / jogwheel / emergency button replacement as well.

SAFETY WARNING. CAUTION - BEFORE UNDERTAKING THE FOLLOWING PROCEDURE BE SURE TO PULL AC PLUG FROM WALL IN NO CASE MAINTENANCE HAS TO BE PERFORMED ON AN AC POWERED UNIT

Tools needed:

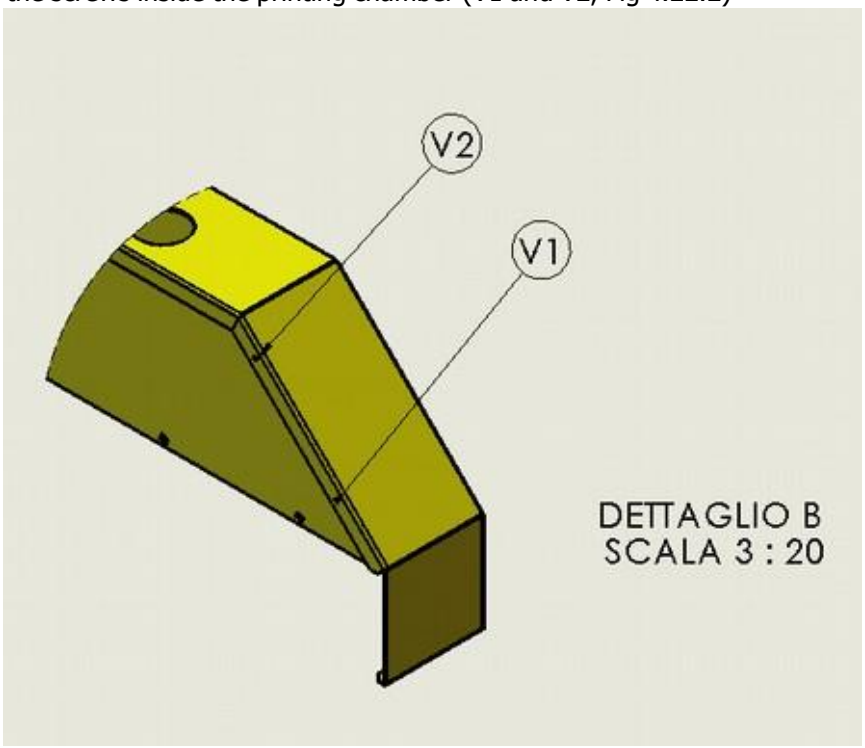
- 2.5mm hex key
- 5mm key
- UHU / PATTEX (or any solvent based general purpose glue)

1) Using the 2.5mm hex key remove the four screws holding the upper front panel (part 1 in Fig.4.22.1)
2) Remove the hex key holding the right cover (part 2 in Fig.4.22.1) – screws are both on right side and on machine rear



Panel Removal

3) Remove the screws inside the printing chamber (V1 and V2, Fig 4.22.2)



Right Cover Screw Locations

4) Right cover can be removed: gently lift it upwards to let it disengage from the water tank cap.

5) Same procedure applies to left cover (part 3 in Fig.4.22.1)
6) Remove the six screws holding the front panel assembly (part 4, Figure 4.22.1)
7) Open the printer door to get optimal clearance to remove front panel assembly.
8) Remove the selected part (LCD/Jogwheel/Emergency Button)

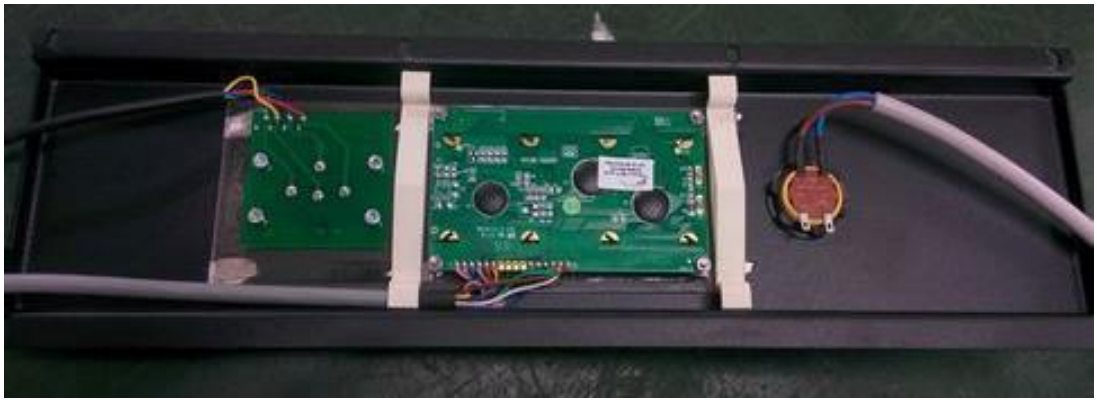


Figure 6.13.1 Rear View of Front Panel

9) Detach connector from motherboard (if LCD or jogwheel) or from safety relays (if emergency button)
10) Replace part
11) Restore electrical connection – jogwheel connector ("keyboard") notch is facing UP on the motherboard, while LCD connector notch is facing DOWN on the motherboard.
12) If clear Plexiglas plate holding the jogwheel and LCD is moving, secure it with a solvent based glue (such as UHU or PATTEX)
13) Put back front, right and left covers
14) Restore AC power, test machine emergency button / LCD / jogwheel to be OK

6.14 Print Server

6.14.1 Stops Working

One reason can be depleted memory due to too many video recordings.

Remedy:

1) Console access to print server (or SSH with putty)
2) Remove some videos (one directory each) into directory
   /var/lib/Repetier-Server/Printer/A2V2/time lapse or
   /var/lib/Repetier-Server/Printer/A4V3/time lapse
3) send the command
   sudo reboot
4) Server will reboot and regain control

6.14.2 Print Server – Lost Password

If you enabled access control on the print server but forgot your password, and there is not any other administrator account available, the only way out is deleting all user accounts.

1) Log on the print server using Putty
2) Stop the print server
   "sudo service repetierserver stop"
3) Delete the user database:
   "cd /"
   "cd var/lib/Repetier-Server/database"
   "rm user.sql"
4) Restart server to rebuild the user database (NOW ANYONE WILL BE ABLE TO LOGIN)
   "sudo service repetierserver start"

6.14.3 Print Server – Files Disappeared

This occurs if print server loses power when receiving a file.

To restore sanity:

1) Log into print server using Putty
2) Insert following command:
   "cd /"
   "cd var/lib/Repetier-Server/printer"
   "sudo mc"

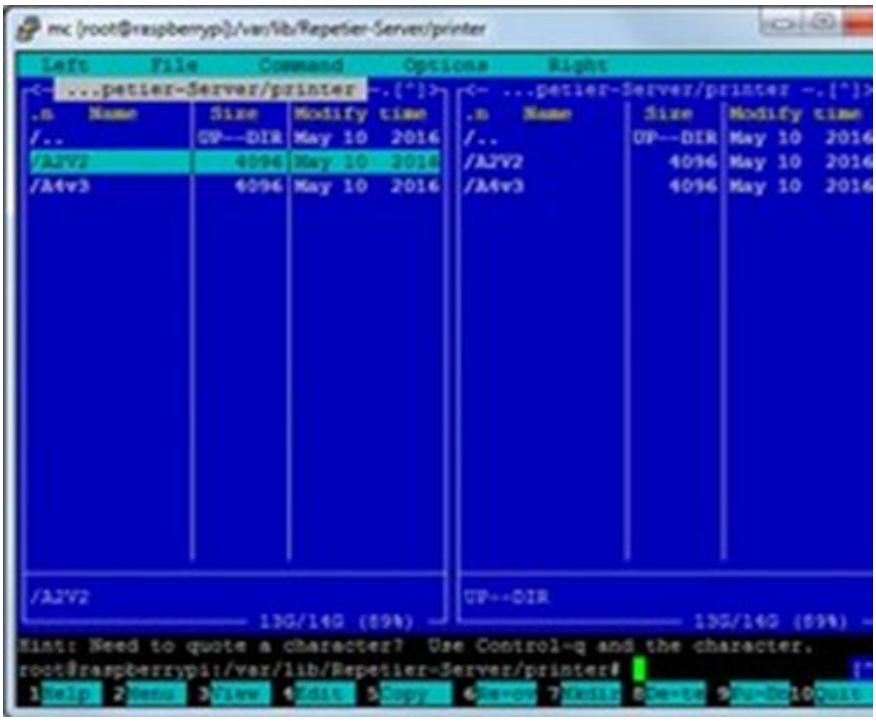


Figure 6.14.1 Screen After 'sudo mc"

3) You will be shown the printer names of active/defined models on your print server
4) Choose the directory of disappearing files.
5) Get into "jobs"directory.

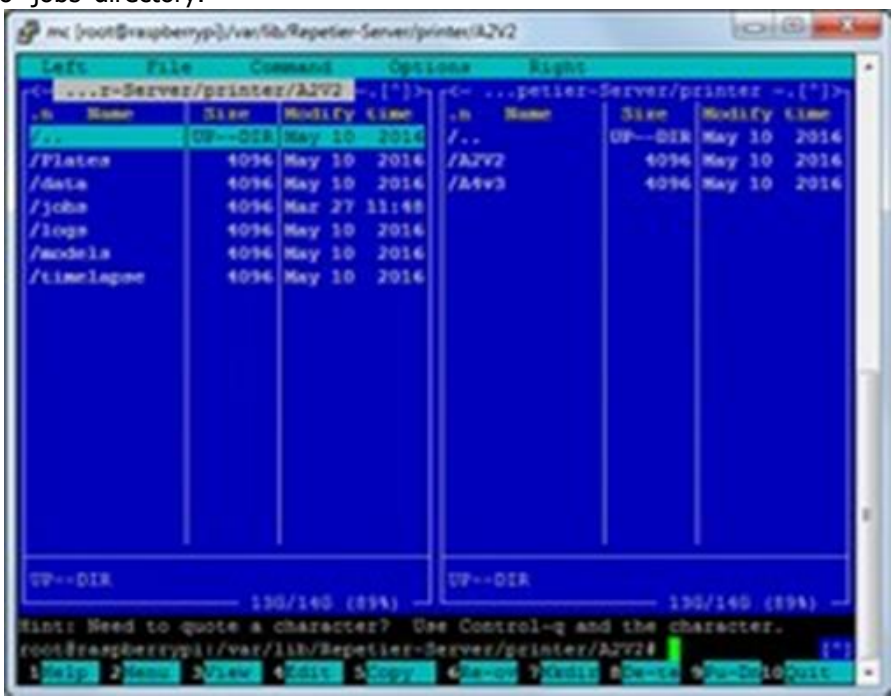


Figure 6.14.2 Jobs Directory

6) Delete the *.linfo le (the le ending with linfo) : move cursor over selected file then press F8
7) Press F10
   "sudo reboot" to restart.
8) System will rebuild itself and files will reappear.

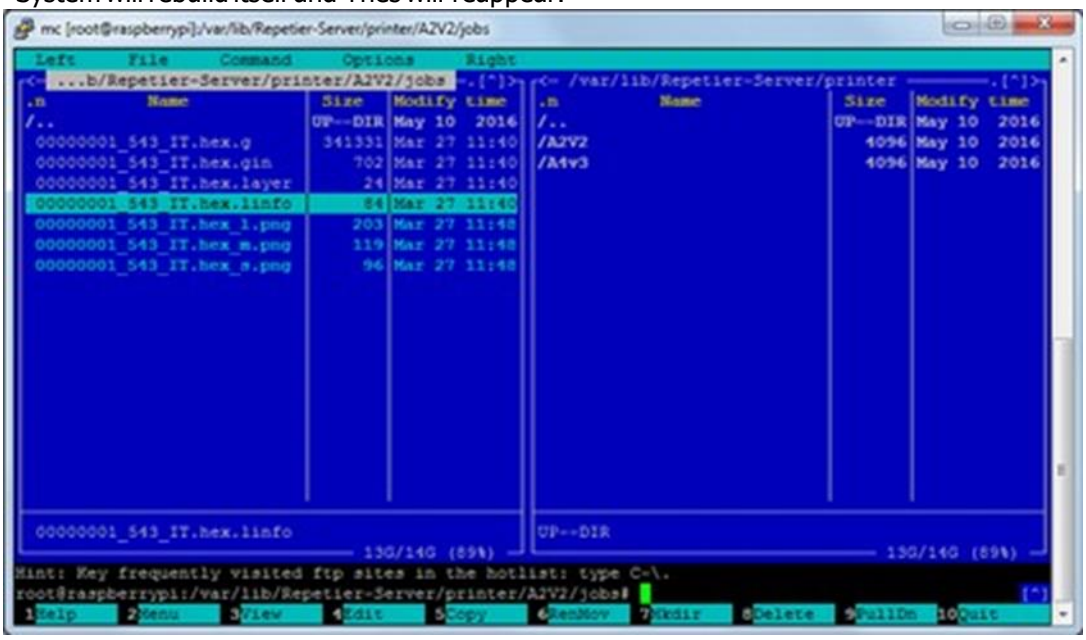


Figure 6.14.3 Screens After "sudo reboot"

6.14.4 Print Server – Files are Visible, but Won't Print

This has to do with some issues with files. Following the "disappeared files" procedure on previous chapter should fix it. If you still are not able to print, just delete all files (you will lose everything – gcodes and time lapses):

1) Log into print server using Putty
2) Insert following commands:
   "cd /"
   "cd var/lib/Repetier-Server/printer"
   "sudo mc"

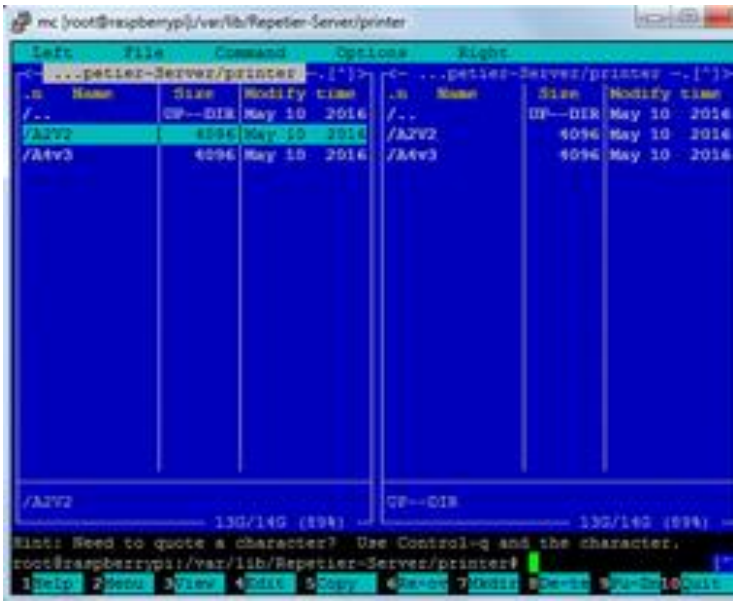


Figure 6.14.4 Files after "sudo mc"

3) You will be shown the printer names of active/defined models on your print server
4) Choose the directory of disappearing files
5) Get into "jobs" directory
6) Delete the *.linfo le (the file ending with linfo) : move cursor over selected file then press F8 delete all files into "models" and "timelapse" directories
7) Press F10 "sudo reboot" to restart.
   System will rebuild itself and files will reappear.

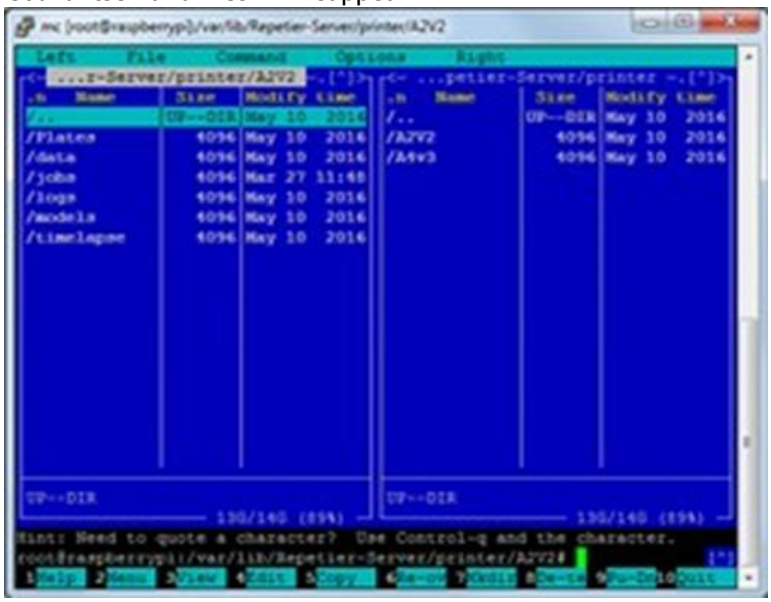


Figure 6.14.5 Files after System Rebuild

6.14.5 Print Server – Firmware won't flash anymore

For some reason, the permissions of the programs to be run to flash the firmware lost the original permissions. To restore them:

1) Log into print server using Putty
2) Insert following commands:
   "cd /"
   "cd /usr/local/Repetier-Server/modules/firmware/bin"
   "ls l" will give you the listing below. The left part of the listing MUST BE "rwxrwxrwx". If it is like that, then your print server install is OK. If not, go on reading

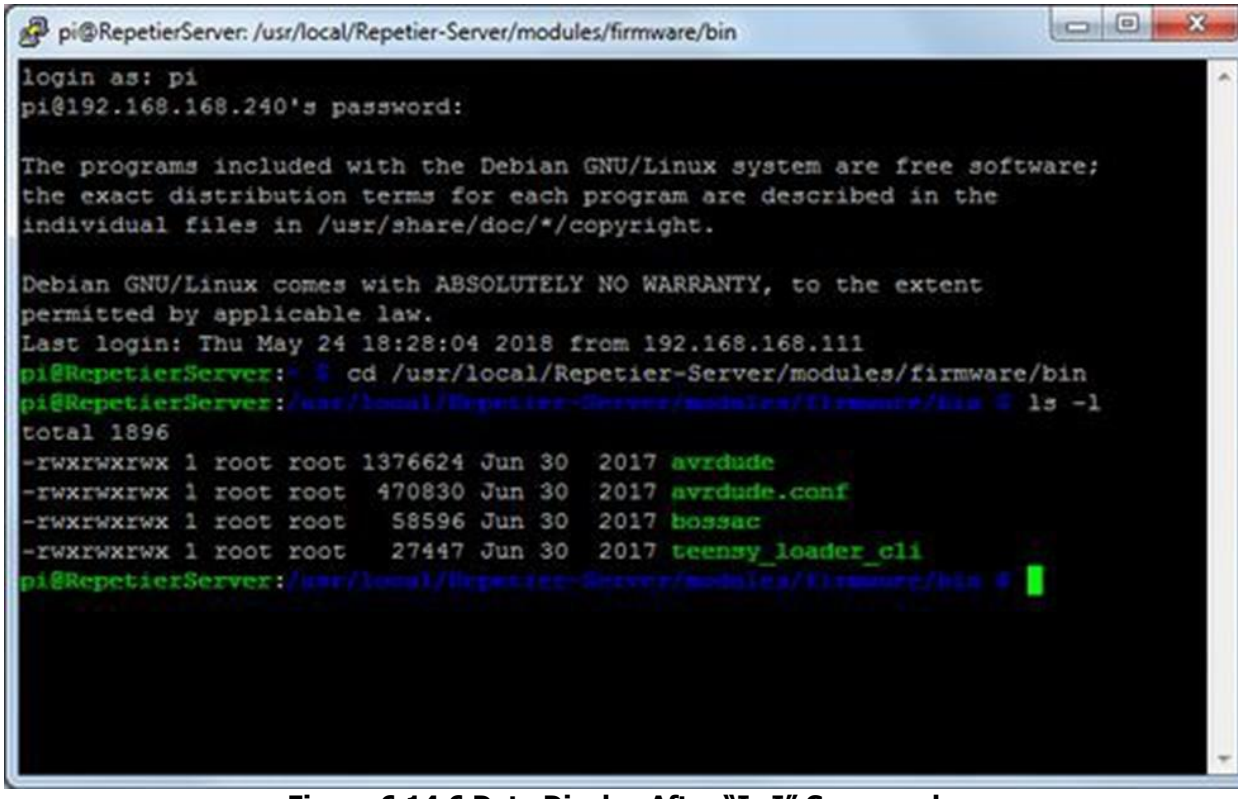


Figure 6.14.6 Data Display After "Is I" Command

3) "sudo chmod a+rwx *"
4) Logout. Try flashing again – it should be possible now

6.15 Z Axis

6.16 Print Looks Bad – Stripes

If you are experiencing horizontal banding or irregular horizontal stripes on your print, chances are that the Z movement has problems.

Figure 6.16.1 Horizontal Banding on Lower Portion (Motherboard Fan Unplugged)

Checklist (from most probable to the least possible chance):

- Unplugged or broken motherboard fan (not cooling the Z driver, it will overheat and not work constantly)
- Bottom synchronization belt too tightened – release it a bit
- Defective stepper driver (temporary test: swap the Z driver with extruder #3 or #2 –check power setting)
- Z screw movement is irregular: check coupling (screw-motor) and bearings (fully seated into bottom plate)
- Dirt trapped on screw nuts: remove any contamination and clean area. Use a clean cloth to remove any dirt traces from screws. This could be a symptom of hairspray (or any other aerosol contaminant) being used INSIDE the printer.
- Broken-defective Z leadscrews/nuts: dismount machine and inspect.
- Defective Z motor-gearbox
- Defective motor cabling (loose crimp)

6.16.1 Z Motor Replacement

CAUTION - Power OFF Printer, Unplug, and remove AC cord. BE ABSOLUTELY SURE THAT BY NO MEANS THERE IS AC POWER ARRIVING TO THE MACHINE

1) Remove front, left or right cover (depending on the stepper to be removed)
2) Unplug Z motor
3) Release all the screws from coupling between motor and Z screw. The coupling must disengage from Z screw during removal
4) Remove screws holding gearbox against machine chassis
5) If working on left side, you may want to remove the upper and right screws holding the electronics plate (letting you rotate it CCW) to get more space to lift and remove motor and gearbox assembly
6) Lift and remove gearbox
7) Note the distance between coupling and gearbox – you must maintain coupling on the new motor-gearbox assembly at the same distance
8) Mount the new gearbox/assembly on the machine
9) Push on the heated plate to be sure that it is fully seated on bottom bearings
10) Carefully tighten the screws holding the gearbox against machine chassis
11) Tighten coupling screws
12) Put electrical plate back into original position (if you moved it)
13) Plug electrical signal cable into gearbox
14) Turn on machine (BE CAREFUL NOT TO REACH live AC cabling area)
15) Move up and down (using LCD commands) the Z axis to test

6.17 Z Safety Switch

6.17.1 Installation/Calibration

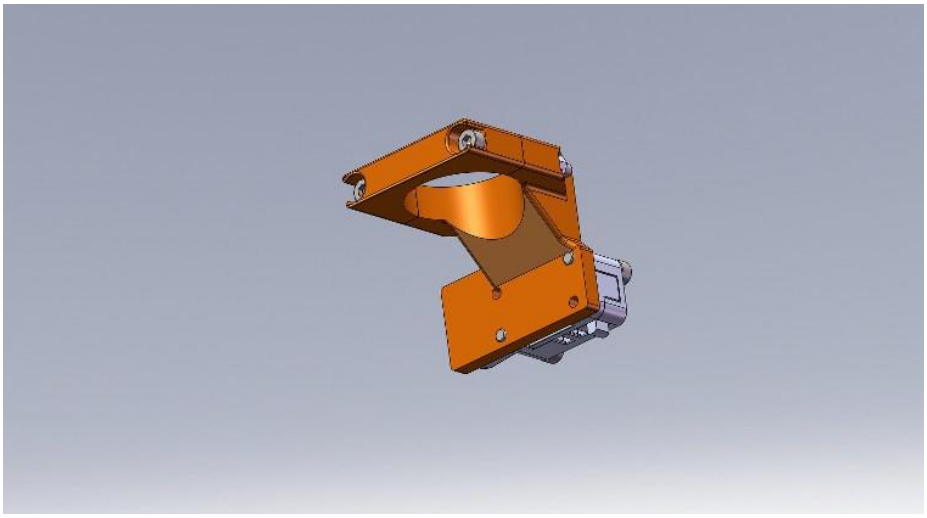


Figure 6.17.1 Z Safety Switch

1) Move plate (Z) down about to 60-80mm
2) Remove upper right cover (to gain access to motherboard)
3) Connect cable leads to (4) and (5)

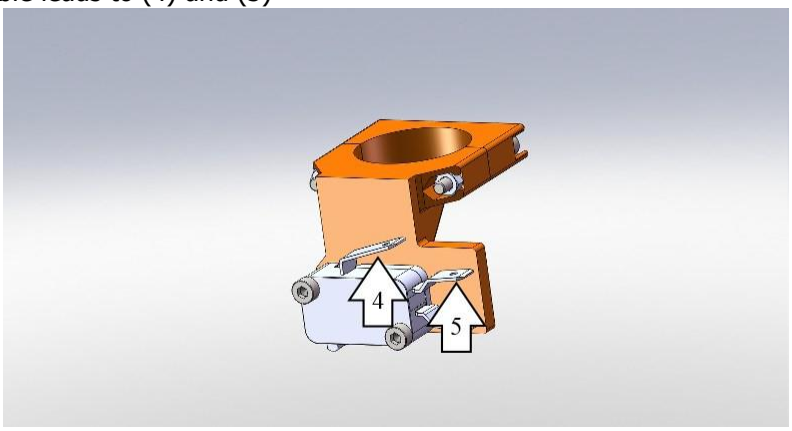


Figure 6.17.2 Cable Lead Connections

4) Fit safety switch on Z arm assembly as shown. Clamp part on Z assembly using screws (1) and (2)

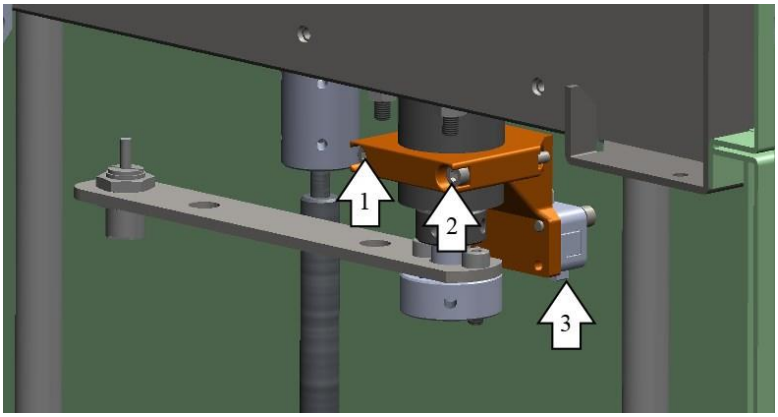


Figure 6.17.3 Safety Switch on Z Arm Assembly

5) Lock Z safety switch at highest position possible
6) Route Z safety switch cable along with existing Z sensor cable, until reaching the motherboard.
7) Connect Z safety switch to ZMAX pins (at the right of existing Z min switch)
8) From LCD menu, run the Z homing command. BE SURE THAT TRAY IS CORRECTLY PLACED INTO MACHINE
9) Move Z plate down 0.5mm
10) Release (1) and (2) screws, slide down sensor until tip (3) touches the Z holding part.
11) Lock safety switch into this position using screws (1) and (2)
12) Test Z homing with tray in place.
13) Z offset test print must confirm actual setting.
14) Test Z homing without tray in place: safety switch will cause homing to keep nozzles away from heated plate.

6.17.2 Z Safety Switch is triggered – machine is locked

This is an expected behavior to save machine from crashing plate against nozzles.

To regain control of the machine, lift the Z switch assembly (step #5 of Z switch mounting procedure) then check reason for triggering, that could be one of the following:

- Lack of printing tray
- Z arm servo KO
- Z arm sensor KO
- Part on plate preventing arm deployment

Once problem is fixed, perform Z safety switch calibration.

6.18 Heat Exchanger Cleaning

Even in case of setting, it's quite common to get airflow blocked by dust/hair/fibers that may bring serious trouble if routine cleaning is not performed.

Use a vacuum cleaner to remove any contaminant from heat exchanger inlet: NEVER blow air or compressed air onto heat exchanger surface from outside to inside – you may worsen situation blowing contaminants INSIDE the printer. You can do the opposite, blowing thru the radiator from inside the printer.

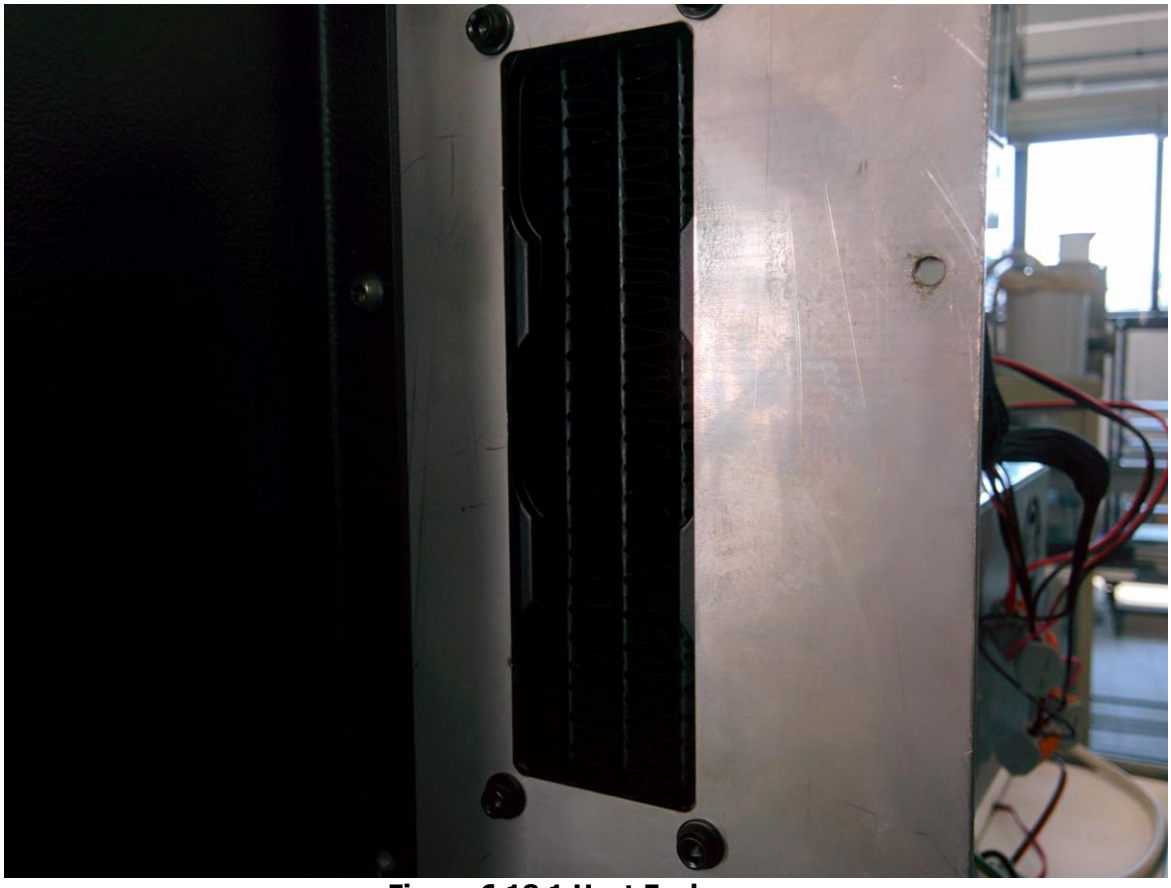


Figure 6.18.1 Heat Exchanger

6.19 Very High Temperature Hardware/Firmware Modification

Standard machines can reach 350°C: to get up to 450° you need to apply both hardware and firmware upgrade. Here is the procedure:

1) Turn OFF machine.
2) Gain access to the motherboard area – remove front and side panels.
3) Be sure to have at hand the thermocouple adapter and auxiliary power supply.

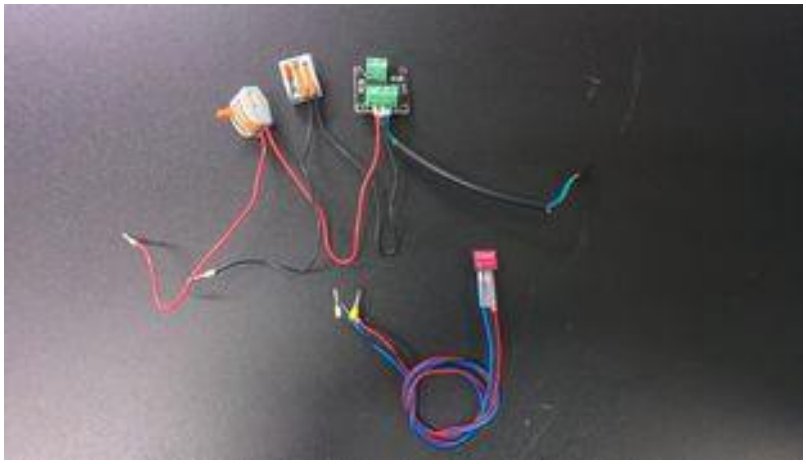


Figure 6.19.1 Power Supply and Thermocouple Adapter

4) Connect the thermocouple adapter:
    - There are two connectors on the motherboard – left is for #3 and right is for #2 (pictured is for #2).
    - Be absolutely sure that the RED lead (severed) is on the upper position. Failing to comply will fry the board.

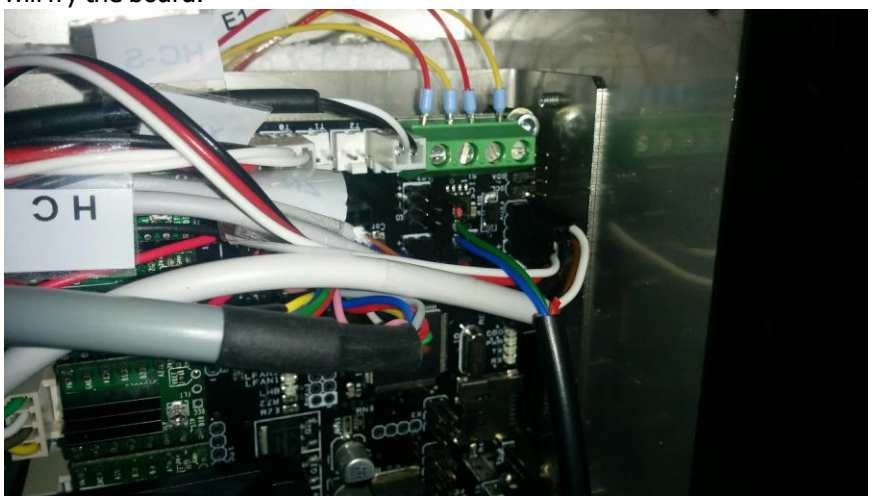


Figure 6.19.2 Thermocouple Adapter Connection

5) Remove thermocouple leads from motherboard

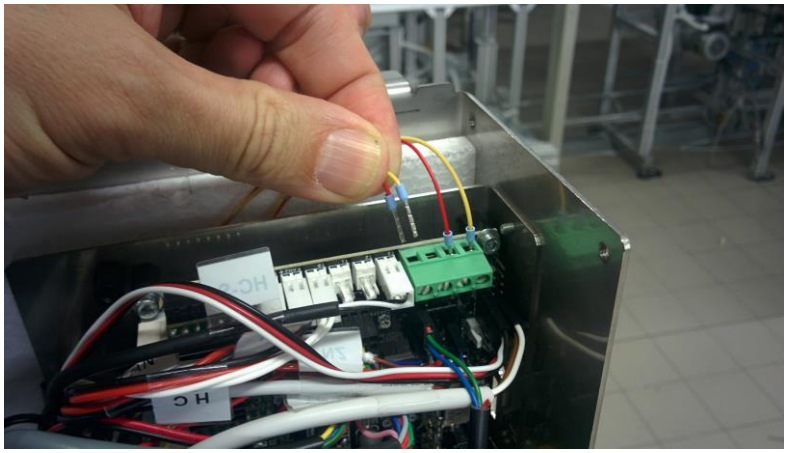


Figure 6.19.3 Removing Thermocouple Leads

6) Put the leads on thermocouple adapter

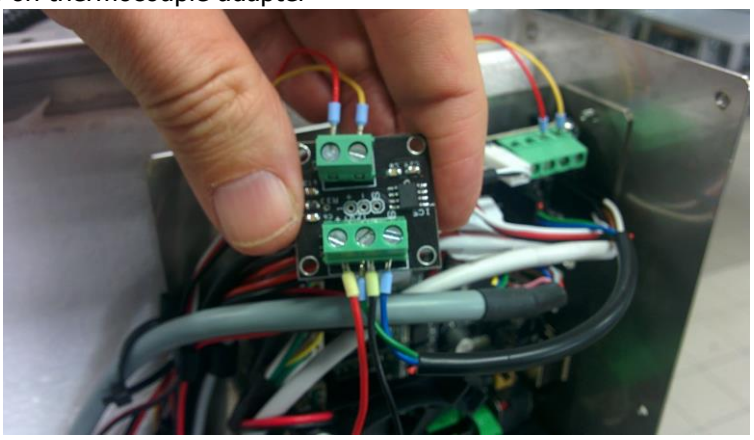


Figure 6.19.4 Connecting Thermocouple Leads to Adapter

7) Connect the (+) pole of the auxiliary power supply (blue lead) on the fourth terminal from right on the lower motherboard area

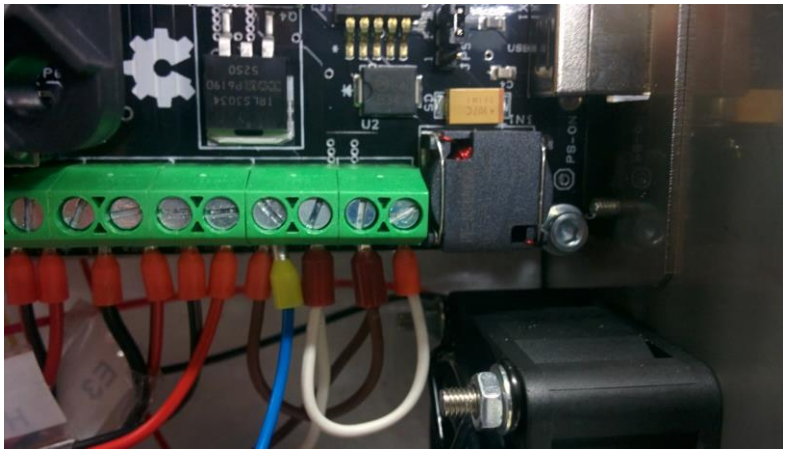


Figure 6.19.5 Auxiliary Power Supply Connection

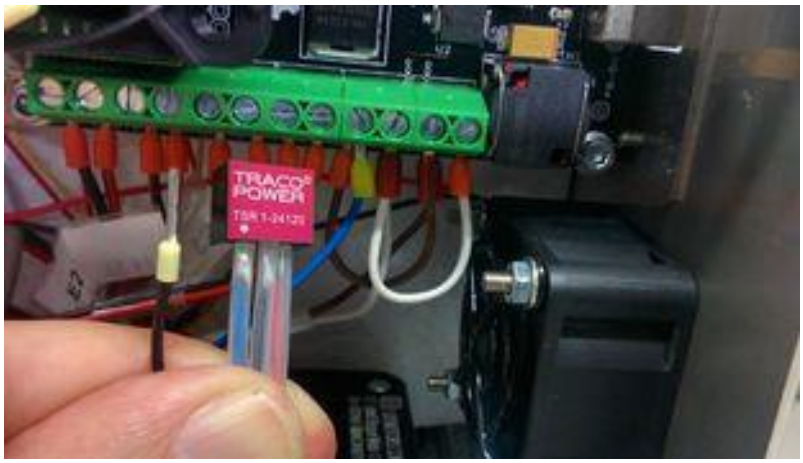


Figure 6.19.6 Auxiliary Power Supply

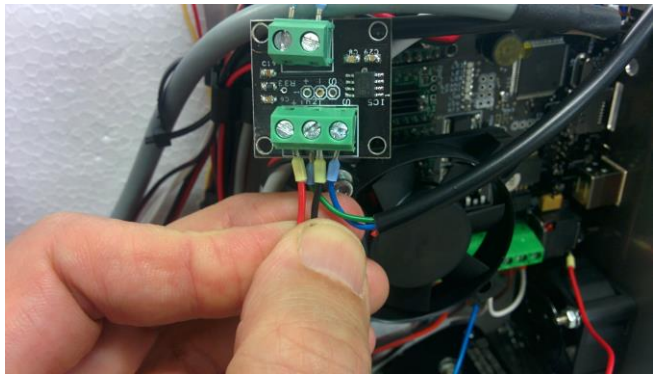


Figure 6.19.7 Connecting Leads from Auxiliary Power Supply

8) Connect leads from the auxiliary power supply:
   Red on the leftmost (must be the ONLY LEAD there)
   Black on the middle one (must be along with the lead going on the motherboard connectors

IMPORTANT: In case of upgrade of extruder #3, the existing red lead must be cut out from the cable going to the motherboard (as shown in the picture, near the thumb).

9) If you are applying above modification to #3 repeat above steps (be sure that motherboard connection is on the LEFT place)
10) If there is just one extruder affected by the modification, remove redundant wires as shown

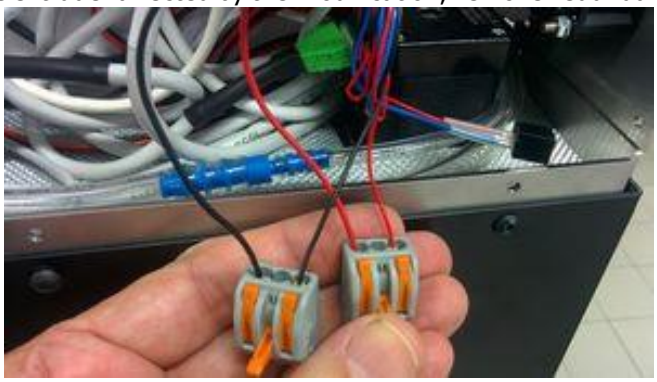


Figure 6.19.8 Removing Redundant Wires – Single Extruder Modification

11) Apply adequate firmware update: Be sure to run CLEANER firmware before loading the new HT one (failing to do so can get you into unpredictable behavior)

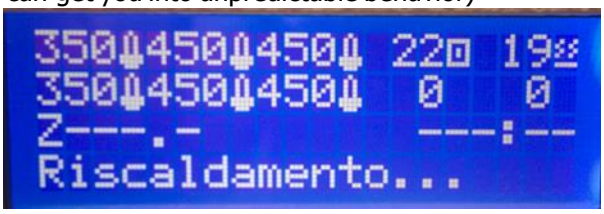


Figure 6.19.9 LCD Display During Firmware Update

6.20 X/Y/Z Axis Won't Move

If the selected axis doesn't move check as follow:

- Cable from motherboard to stepper motor is OK (fully seated and undamaged)
- Stepped motor driver is fully seated into motherboard
- (X or Y) pulley is firmly locked on motor shaft
- (Z) motherboard fan is running
- stepper driver current is OK

If above checks are OK, there are three possible reasons:

1) Faulty stepper driver: swap with a filament feeder driver (upper three topmost positions) and see if it moves. If yes, be sure to adjust current.
2) Faulty cable – try a temporary replacement with a spare cable (or get one temporary off the filament feeder)
3) Faulty stepper motor (VERY, VERY RARE): replace motor

6.21 Print Plate Repair Procedure

Before starting this procedure, you will need:

- A syringe with black glue
- Magnets to be glued
- Hardware tools to clean holes (le, sanding paper)
- Masking labels
- A printer of the same type for the plate being repaired (to later cure it)

Repair Procedure:

1) Clean the magnet hole on the printer plate
   - Clean any glue residual from the hole
   - Be sure that magnets have some clearance to let glue penetrate between carbon fiber and magnet walls – use a drill bit or a le to get to a bigger clearance if needed
   - Do not force the magnet into the hole
   - Be sure to remove any dust

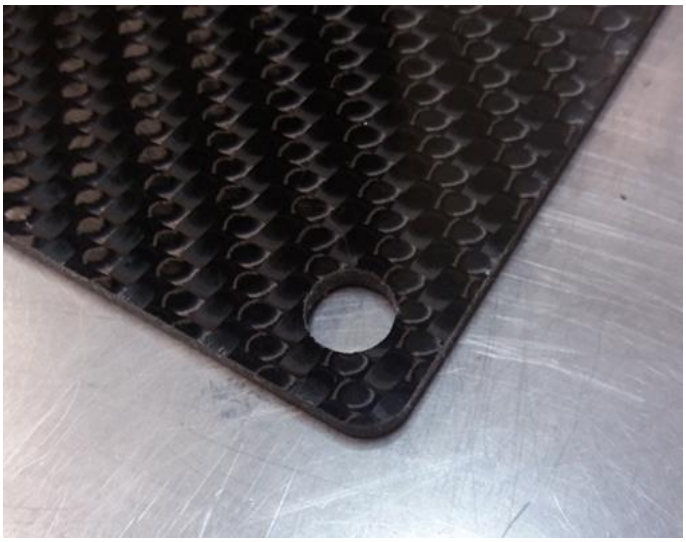


Figure 6.21.1 Printer Plate Corner Hole

2) Apply the masking label on the lower tray side (the one touching the hot plate)

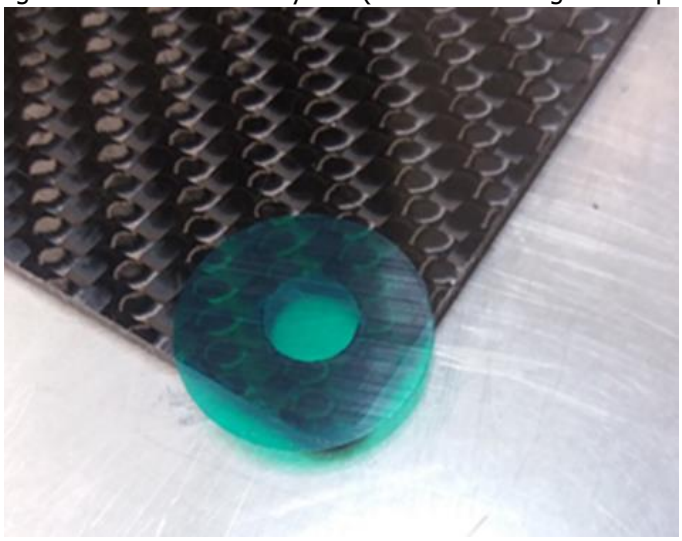


Figure 6.21.2 Masking Label on Lower Plate Side

3) Get the magnets. Let them stick to the hot plate (at room temperature – not to harm yourself)

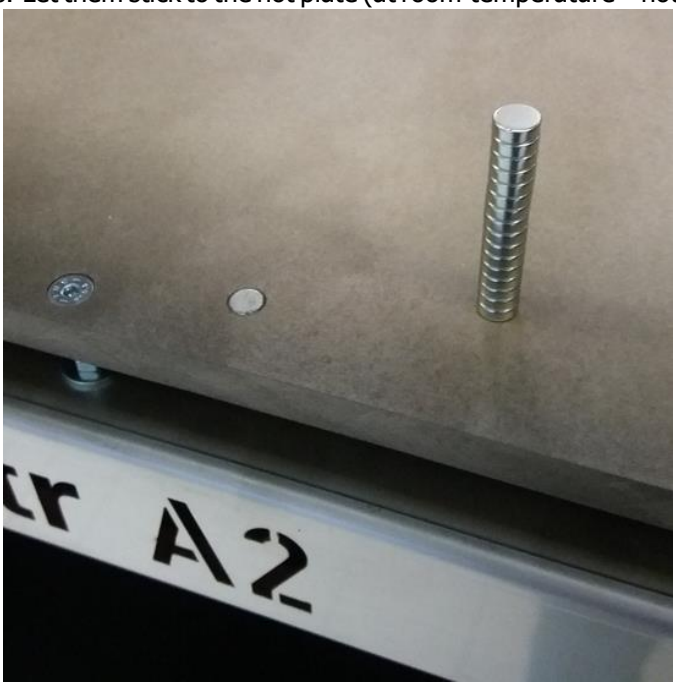


Figure 6.21.3 Magnet Stack

4) Mark the upper face of the magnet stack (while placed on hot plate magnet)

Figure 6.21.4 Mark the Magnet Stack

5) Place the magnet into the masked hole, marked side UP

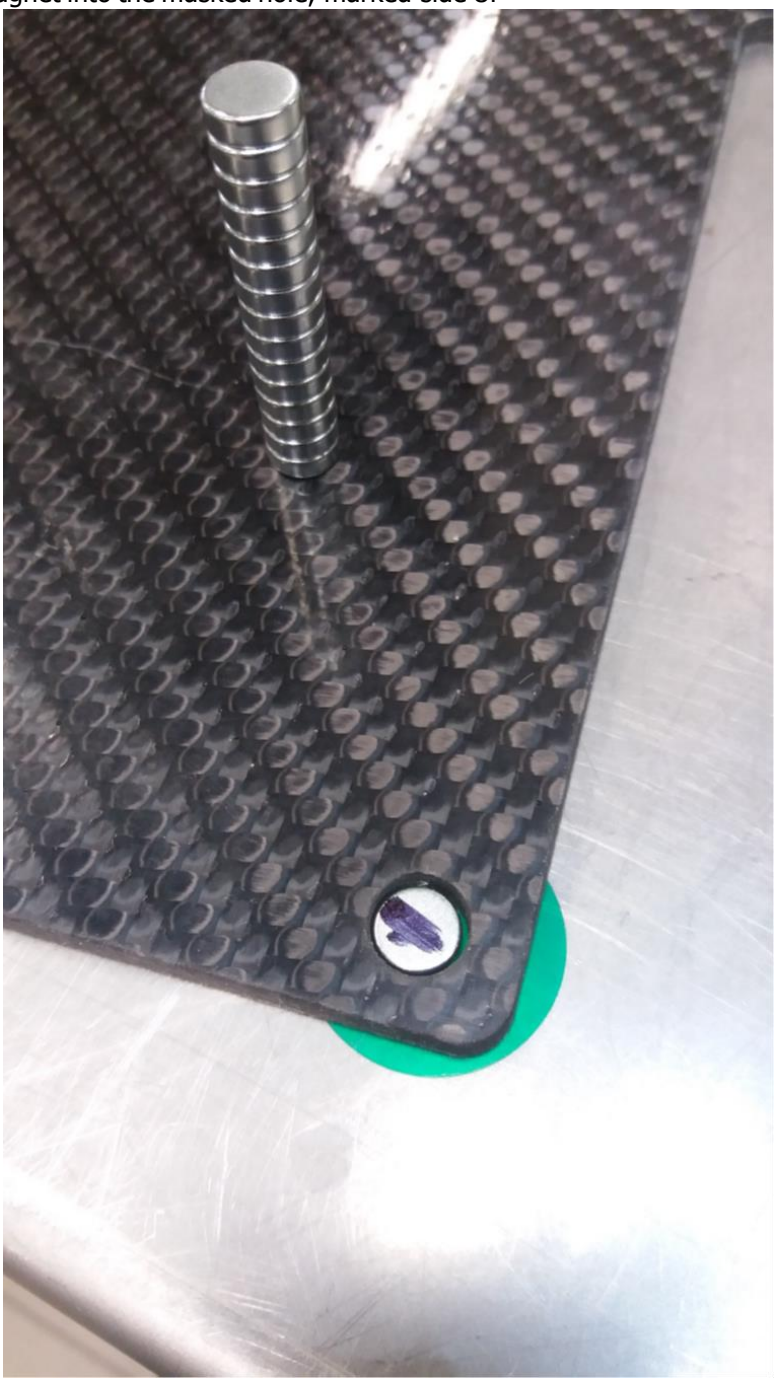


Figure 6.21.5 Magnet in Printer Plate Corner Hole

6) Set heated bed at 100° C. Wait for temperature to settle.
Be sure to have magnet away from any heated bed magnet

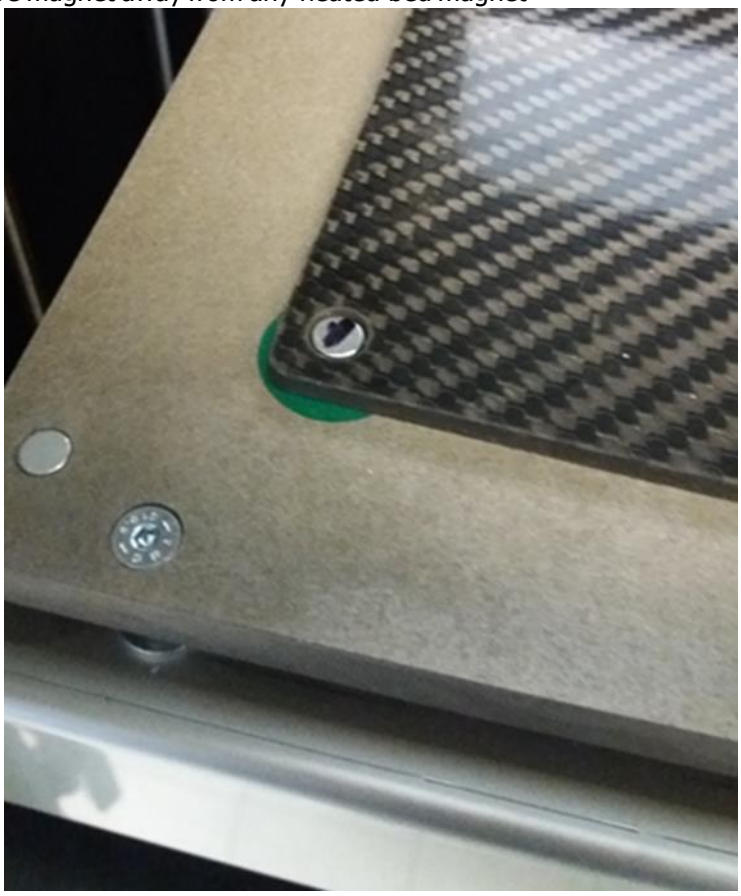


Figure 6.21.6 Plate with Magnet in Corner Hole on Heated Bed

7) Put a SMALL drop of glue on the magnet. Let it get warm and more fluid – it will penetrate the space between magnet and carbon plate.

8) Add glue drops until you coat the magnet. Don't exceed with glue – avoid getting a "bubble" that protrudes above plate level

NOTE - Be sure to keep the syringe with unused glue into a cold storage (fridge is OK)

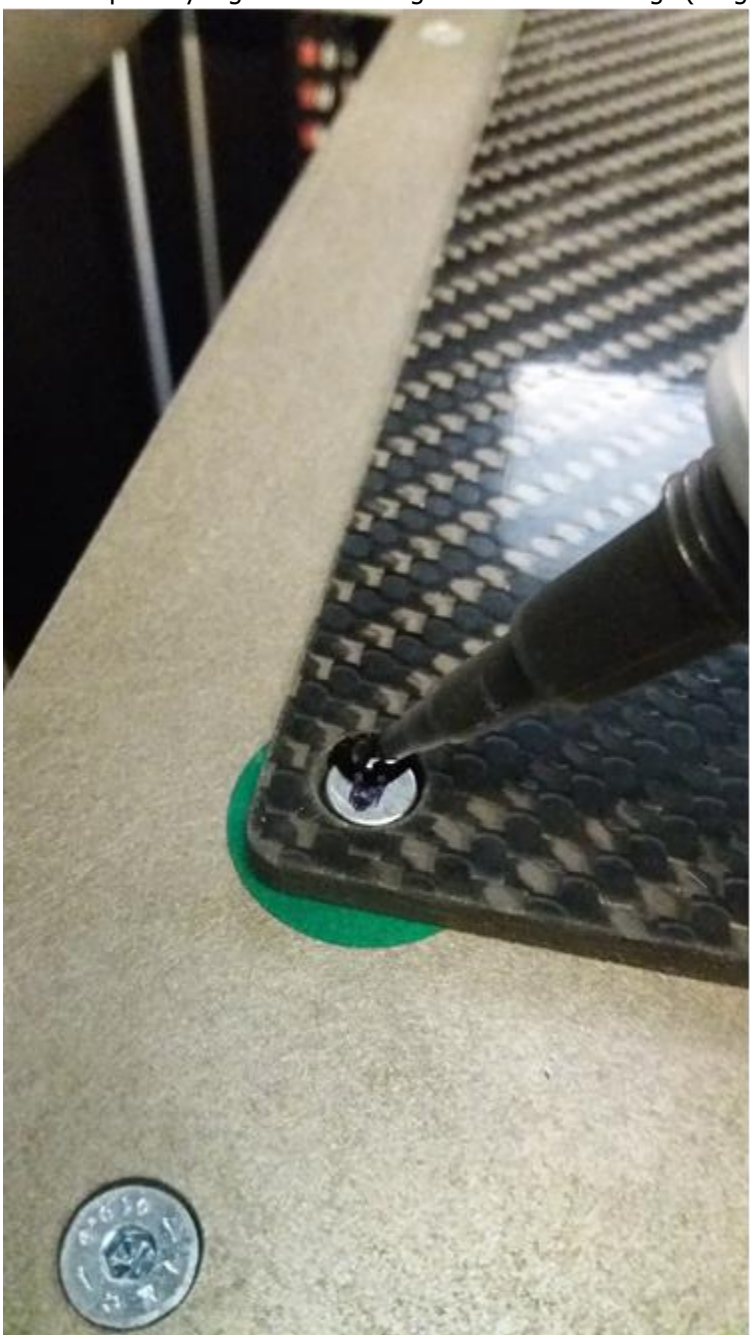


Figure 6.21.7 Applying Glue to Magnet

10) Inspect. This is how should be looking for a good quality job:
Glue is BELOW the plate level, yet you don't see it anymore the magnet surface

Figure 6.21.8 Completed Glue Application to Plate Magnet

11) Let it cure with supplied GCODE.
Just in case, below are the gcode program lines needed for curing:
M190 S100
M117 CURE 1
G4 S1800
M190 S120
M117 CURE 2
G4 S1800
M117 DONE
M190 S10

12) After curing, let plate cool down one hour before moving/using it.

13) Remove masking label before use!

6.22 Machine Packaging

Use the following images to properly re-package the printer before shipping.
CAUTION – Failure to place the printer on a suitable pallet and/or package the printer as shown can result in damage to the housing and mechanism.

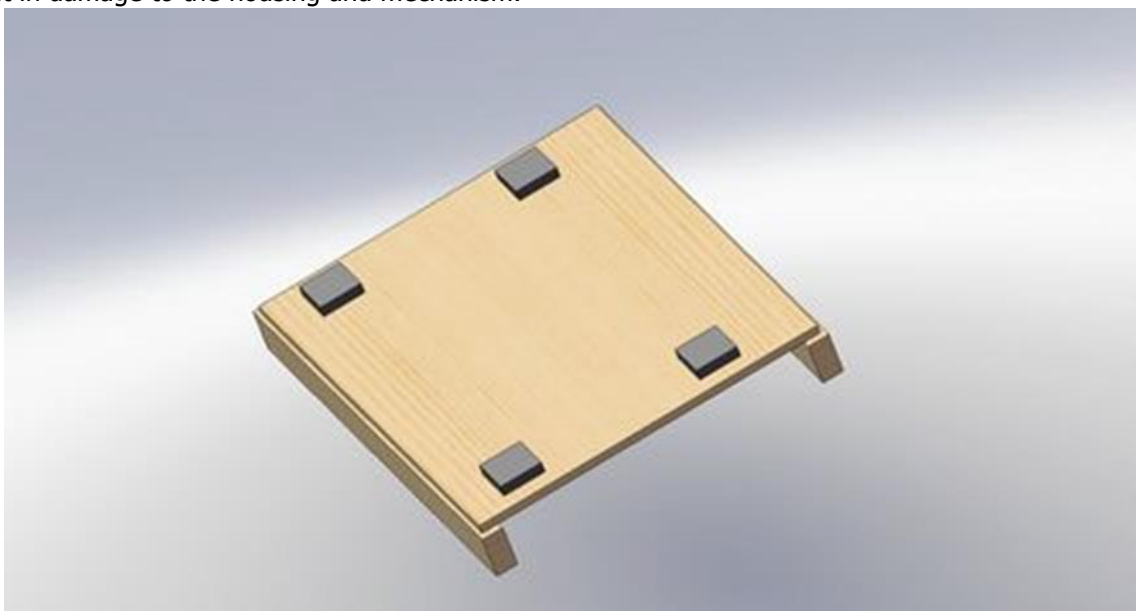


Figure 6.22.1 Printer Pallet with Pads

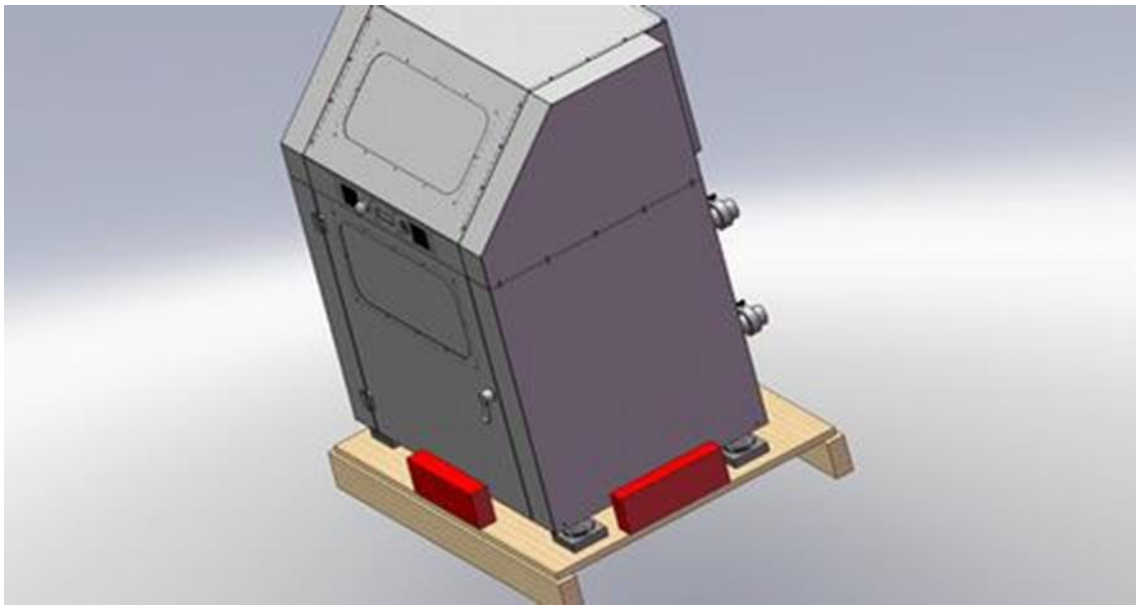


Figure 6.22.2 Printer on Pallet with Lower Side Blocks

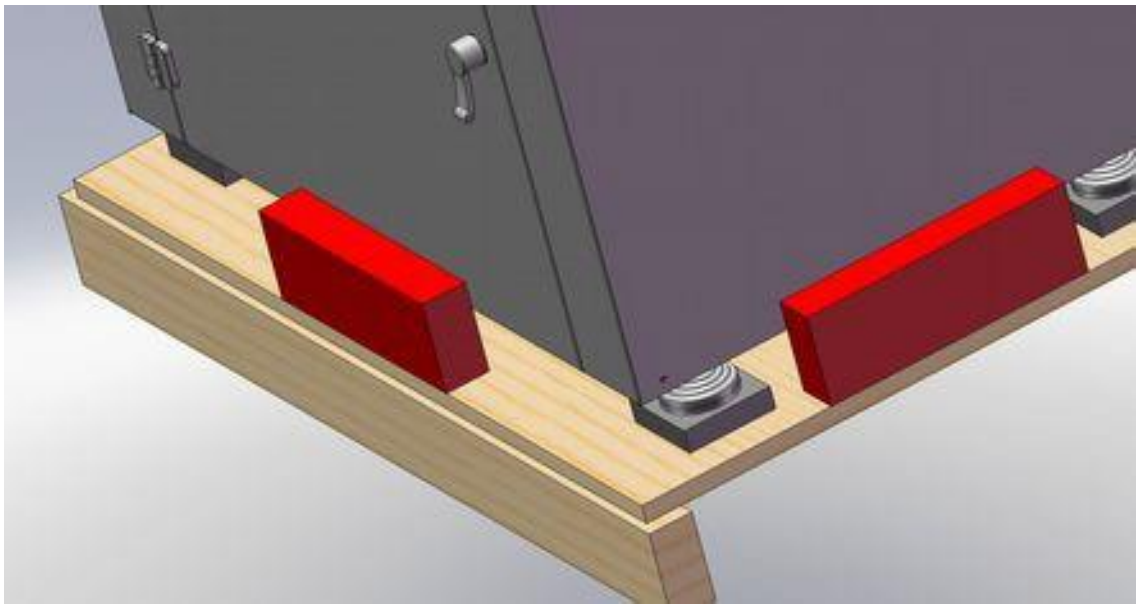


Figure 6.22.3 Pallet Detail – Side Blocks

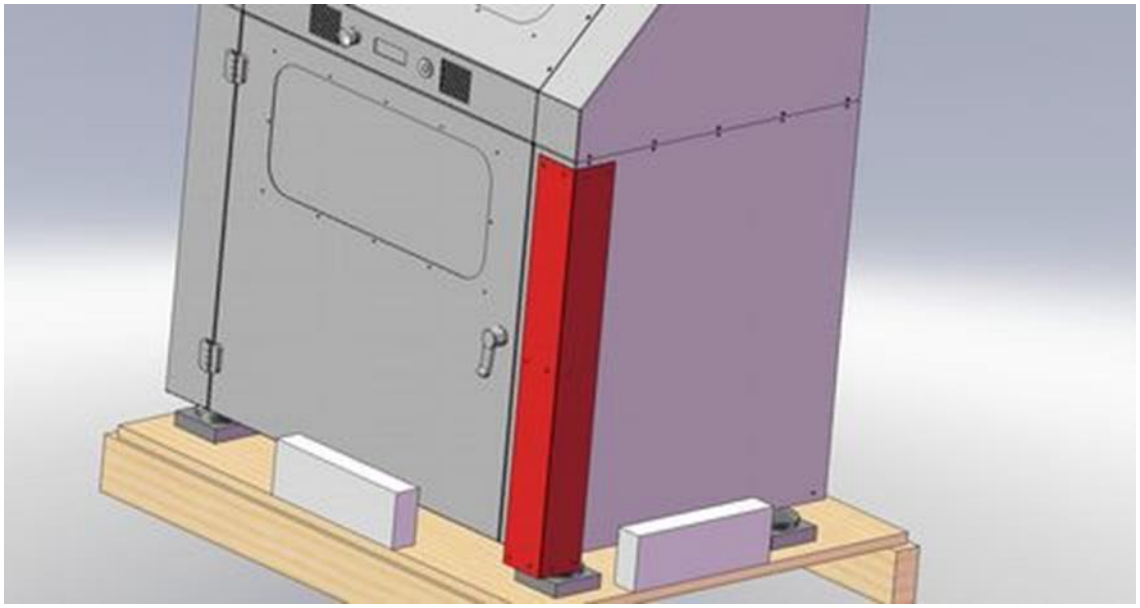


Figure 6.22.4 Printer Corner Protection

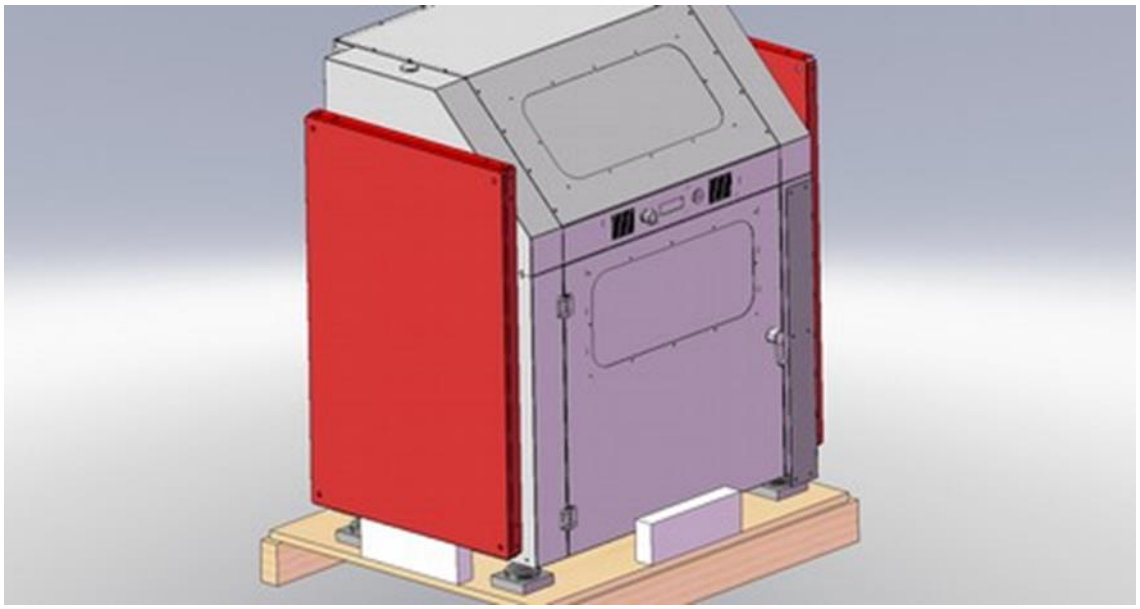


Figure 6.22.5 Printer Side Protection Padding

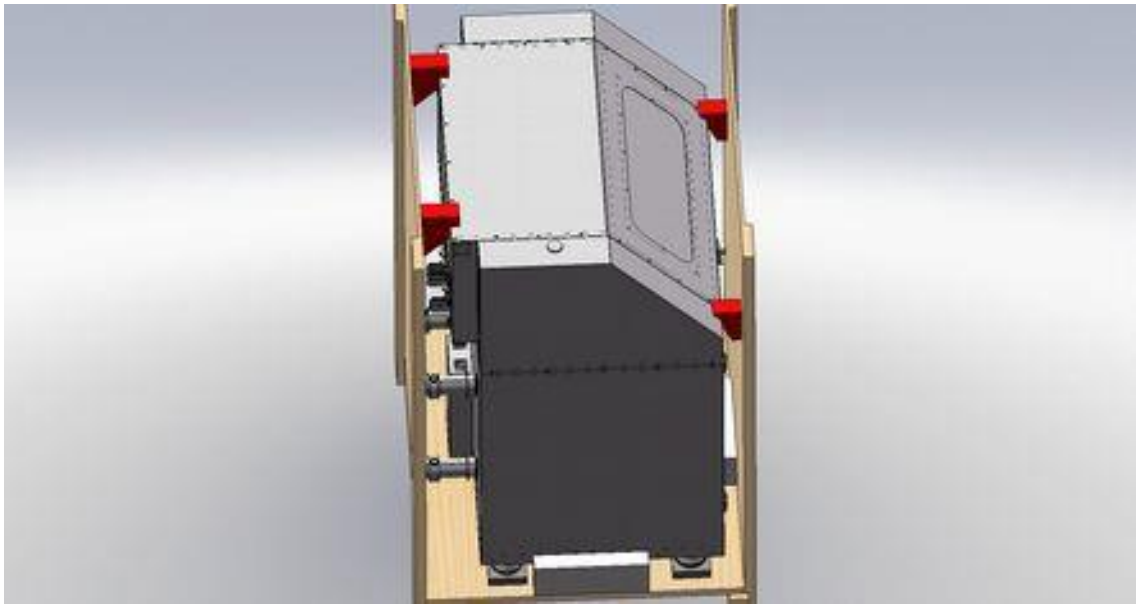


Figure 6.22.6 Front and Rear Printer Crate

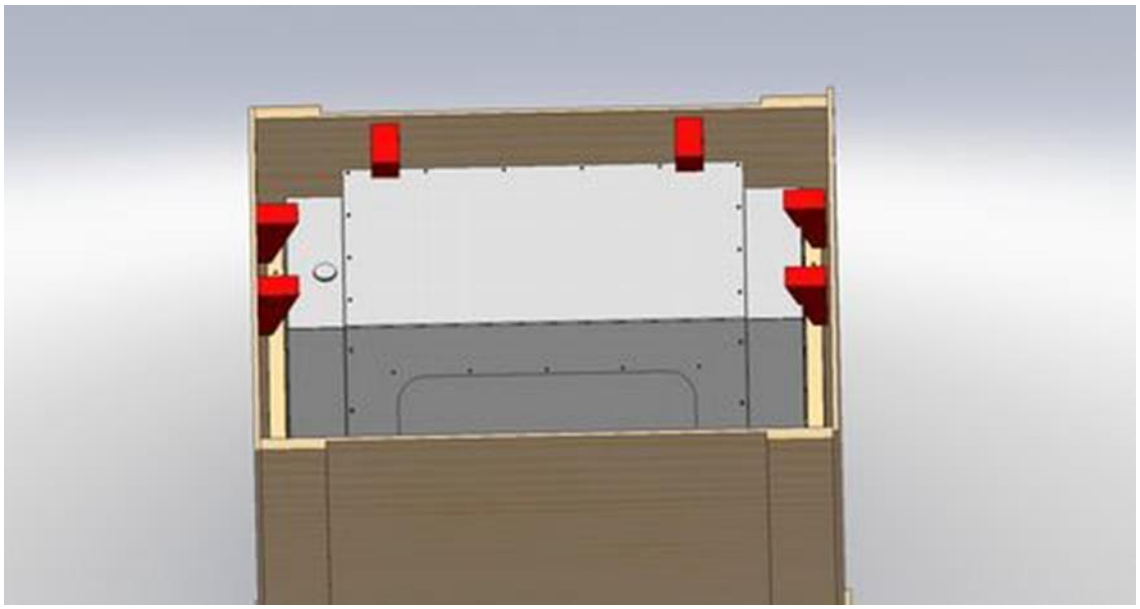


Figure 6.22.7 Printer Crate Sides and Top Padding

6.23 Appendix A – Testing for Shorts (Continuity)

You may want to be sure that current is flowing (i.e.: fuse) and sometimes you want to be sure it isn't (i.e.: between machine frame and any power lead). In both cases, you need a multimeter.

Let's see hot to test a fuse:
Set you multimeter into "continuity" mode.
Some models will also emit a sound when current can flow.

Figure 6.23.1 Multimeter Set to Continuity Mode

If you touch probes, display will change (and possibly hear a beep)

Figure 6.23.2 Checking Multimeter Function – Touch Probes

This fuse is blown. Discard it.

Figure 6.23.3 Multimeter Indicating Blown Fuse

This fuse is good – it works!

Figure 6.23.4 Multimeter Indicating Fuse OK

6.24 Appendix B – How to Test Voltage

You may test AC or DC voltage: be sure to switch multimeter to appropriate setting. In both case you must be careful with probes: Be sure that probes are touching just the test points – avoid touching any metal part of the machine. You may permanently damage machine parts.

If you are testing AC voltage be absolutely sure not to touch the metal tips of the probe while measuring **– DEATH RISK!**

Testing AC Voltage on Contactor Entry

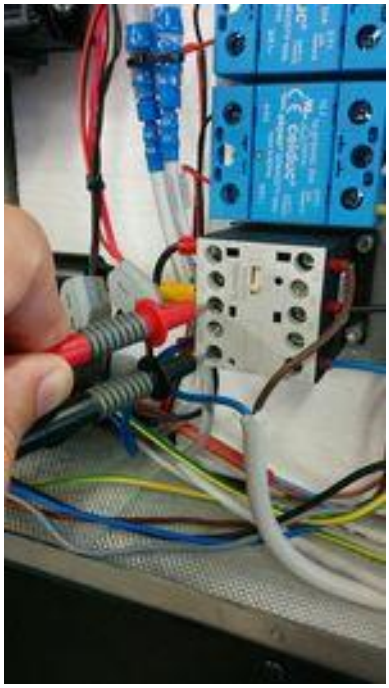


Figure 6.24.1 Testing AC Voltage on Contactor Entry

Multimeter set to measure AC voltage. 228 VAC present on entry.

Figure 6.24.2 Correct 228 VAC Entry – MM Set to AC

If you are measuring DC voltage, red lead goes onto (+) and black lead goes onto (-) points.
Testing 24Vdc output on PSU terminals

Figure 6.24.3 Testing 24V DC output on PSU Terminals

Multimeter set to measure DC voltage. PSU is correctly feeding 24.15 Vdc to the system.

Figure 6.24.4 Correct PSU DC Voltage Indicated on Multimeter

6.25 Appendix C: Changelog

Content from: 3ntr Industrial Grade 3D Printers: Maintenance Manual v 1.18

6-07-2017	v1.11: Added weird LCD behavior
10-07-2017	v1.12: Print server doesn't start prints
4-9-2017	v1.13: dead axis + dead cooling pics
18-9-2017	v1.14: Always check fuse with multimeter
30-10-2017	v1.15: Z safety switch
20-02-2018	v1.16: Silent stepper driver – tripped Z switch
24-05-2018	V1.18: Can't flash firmware – Z defects updated

TRAK Machine Tools
Southwestern Industries, Inc

TRAK Warranty Policy

Warranty

TRAK products are warranted to the original purchaser to be free from defects in workmanship and materials for the following periods:

Product	Warranty Period
New TRAK/ProtoTRAK	1 Year
New 3ntr	1 Year

The warranty period starts on the date of the invoice to the original purchaser from Southwestern Industries, Inc. (SWI) or their authorized distributor.

If a product, subsystem or component proves to be defective in workmanship and fails within the warranty period, it will be repaired or exchanged at our option for a properly functioning unit in similar or better condition. Such repairs or exchanges will be made FOB Factory/Los Angeles or the location of our nearest factory representative or authorized distributor.

Warranty Disclaimers

- This warranty is expressly in lieu of any other warranties, express or implied, including any implied warranty of merchantability or fitness for a particular purpose, and of any other obligations or liability on the part of TMT/SWI (or any producing entity, if different).
- Warranty repairs/exchanges do not cover incidental costs such as installation, labor, freight, etc.
- TMT/SWI is not responsible for consequential damages from use or misuse of any of its products.
- TRAK products are precision mechanical/electromechanical/electronic systems and must be given the reasonable care that these types of products require. Evidence that the product does not receive adequate Preventative Maintenance may invalidate the warranty. Excessive chips built up around ballscrews and way surfaces is an example of this evidence.
- Accidental damage, beyond the control of TMT/SWI, is not covered by the warranty. Thus, the warranty does not apply if a product has been abused, dropped, hit or disassembled.
- Improper installation by or at the direction of the customer in such a way that the product consequently fails, is considered to be beyond the control of the manufacturer and outside the scope of the warranty.
- Warranty does not cover wear items that are consumed under normal use of the product. These items include, but are not limited to: windows, bellows, wipers, filters, drawbars and belts.

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