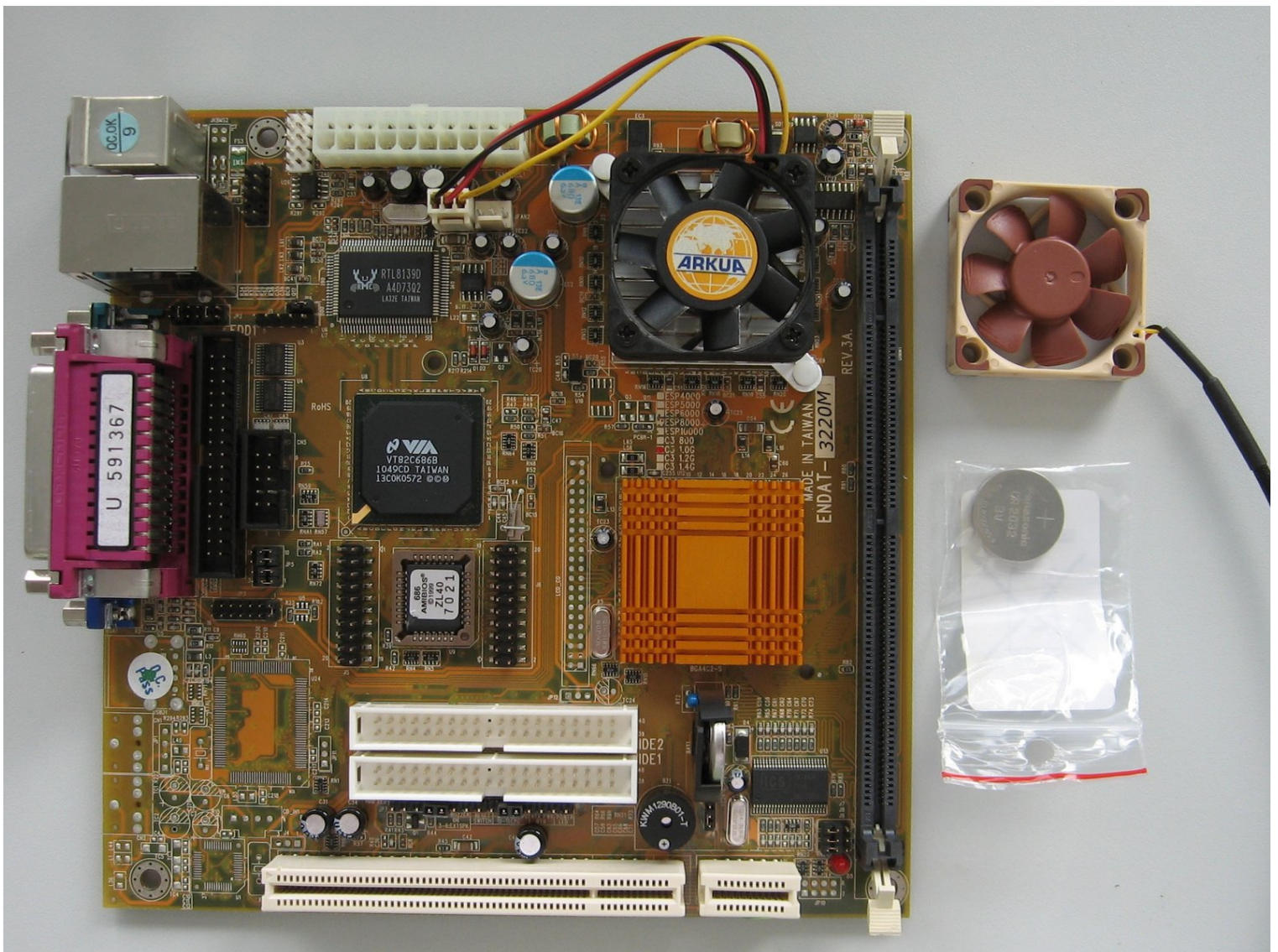


ZPrinter 650 Mainboard Replacement

If you own a ZPrinter 650 color powder 3D...

Written By: Pavel Hanak



INTRODUCTION

If you own a ZPrinter 650 color powder 3D printer, you may have experienced issues with the large electronics module, which is prone to failures. Unfortunately, replacement modules can be incredibly expensive, costing around \$5000 USD in 2015. To make matters worse, the original producer, Z Corporation, no longer provides spare parts for older printers manufactured before 2012 since they were acquired by 3D Systems.

However, there is a solution to this problem. After conducting some research, I found that the main reason for these failures is due to a small, embedded PC mainboard that is based on the VIA C3 processor. The Taiwanese factory that produced the board seems to have used an inadequate CPU fan, which causes the CPU to burn out when it stops working. In some instances, the fan has failed after only two months.

While the CPU cannot be replaced as it is soldered to the board, it is possible to purchase a new mainboard. The replacement part has the **part number ENDAT-3220M** and can often be found on sites such as eBay or PC surplus stores. Keep in mind that other Z Corporation printers also use this mainboard, such as the ZPrinter 450 and ZPrinter 250, but it may depend on the production year or revision of the printer. Therefore, **I recommend disassembling the printer and checking the actual mainboard type before purchasing a replacement.** With these steps, you can save yourself a significant amount of money and get your 3D printer back up and running in no time.

Disclaimer

This repair should be performed only by **skilled technicians only!** Moreover, it includes manipulation with very sensitive electronic components, thus proper ESD precautions must be met!



TOOLS:

- Phillips #1 Screwdriver (1)
- PS/2 keyboard (1)
- External Monitor with VGA input (1)
- Cut-Resistant ESD Gloves (1)
- Anti-Static Wrist Strap (1)



PARTS:

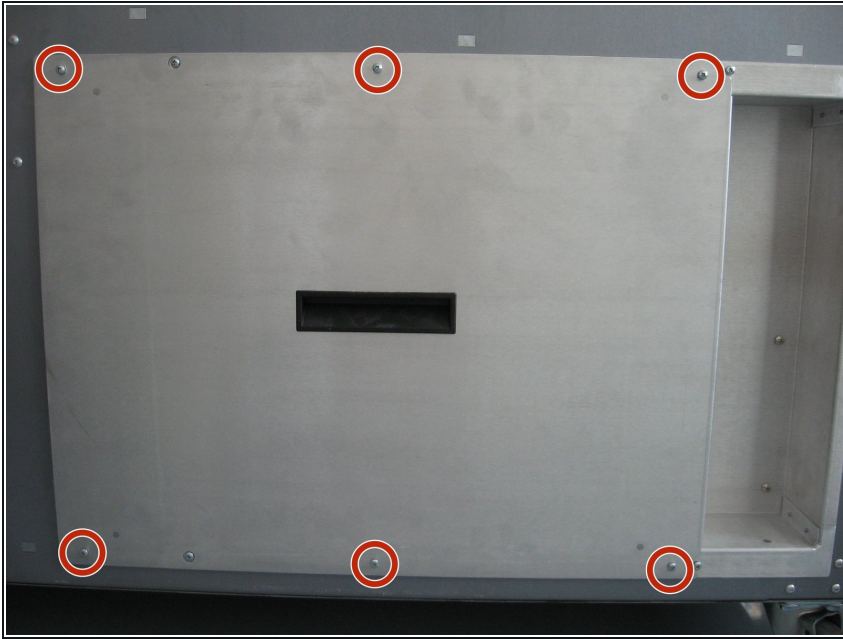
- ENDAT-3220M mainboard (1)
- CR2032 Lithium Battery (1)
- Zip Ties (1)
- 40x10mm 12V 3-Pin Fan (1)

Step 1 — Confirm Mainboard Failure, Part 1



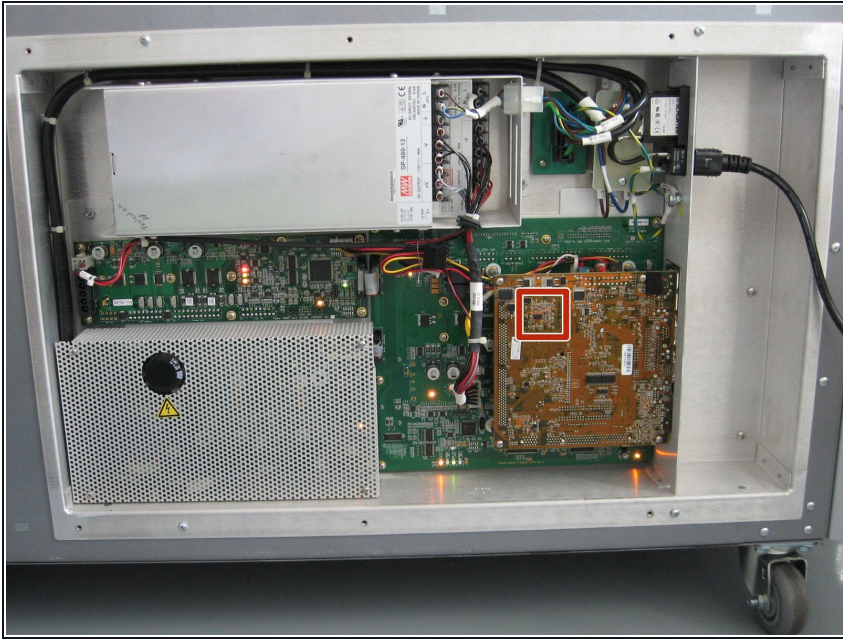
- Before replacing the mainboard, it is important to thoroughly troubleshoot the problem to ensure that it's the source of the issue.
- Normally, the mainboard produces a short beep about 10 seconds after powerup. If it doesn't beep, then it's probably dead.
- If the printer produces multiple or repeated beeps, it is a sign that the mainboard is likely functional, but there may be another component that has failed, such as a dead CMOS battery or bad memory.
 - ⓘ Refer to Step 8 for further diagnosis.
- Another indication is the front display - If all pixels remain black, it may be an indication that the mainboard is dead. If the display does not light up at all, like in the photo, it may be a sign of a different issue, such as a dead power supply for the electronics module.

Step 2 — Remove the Cover of the Electronics Module



- Power down the printer and disconnect all cables from the electronics module on the back.
- Remove the cover by unscrewing the 6 screws and setting it aside.
- ⓘ You do not need to remove the entire electronics module from the printer, only its cover. Remove only the screws indicated in the photo to access the mainboard.

Step 3 — Confirm Mainboard Failure, Part 2

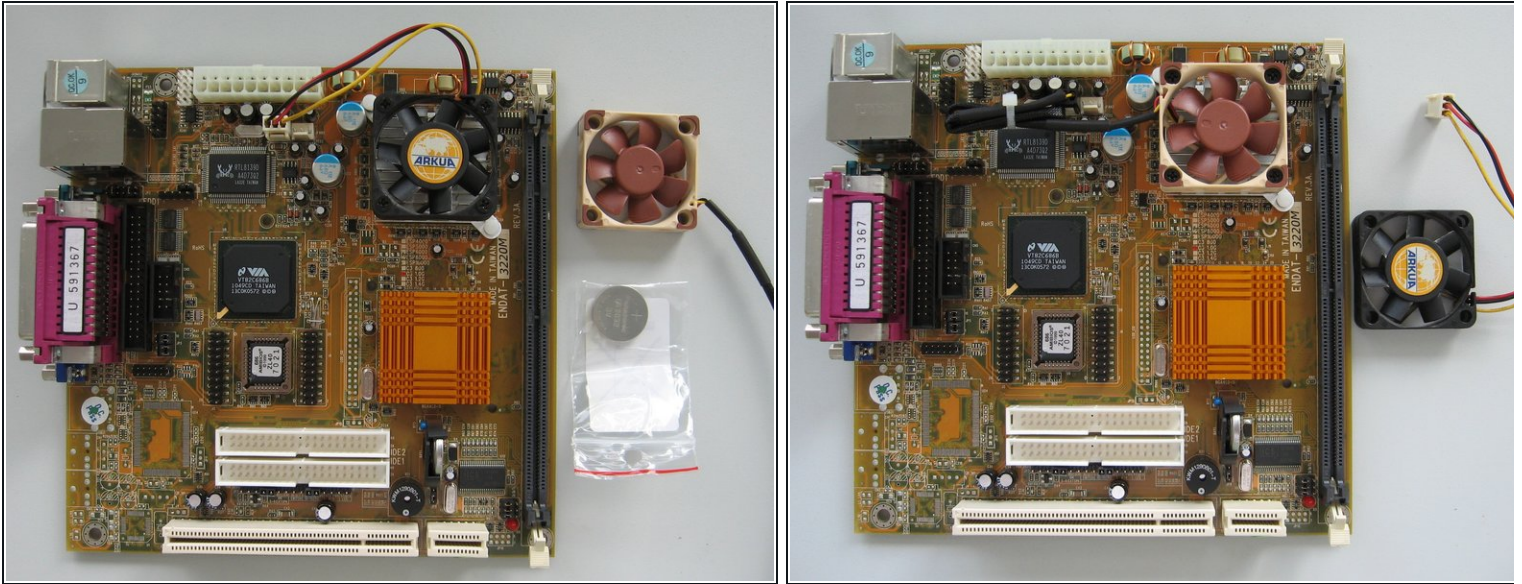


- After powering up the printer, allow it to run for at least 10 minutes. Check the temperature of the board on the back side of the CPU (marked red). If it is hot ($> 50^{\circ}\text{C}$), this may indicate a burnt-out CPU.
- Additionally, you can check if the original CPU fan is functional. If it does not work, this may also indicate a burnt-out CPU. Refer to Step 9 for further instructions on how to check.

⚠ Caution: The power inlet and wires are located above the mainboard. Be sure to exercise caution and take necessary safety precautions to avoid the risk of electric shock.

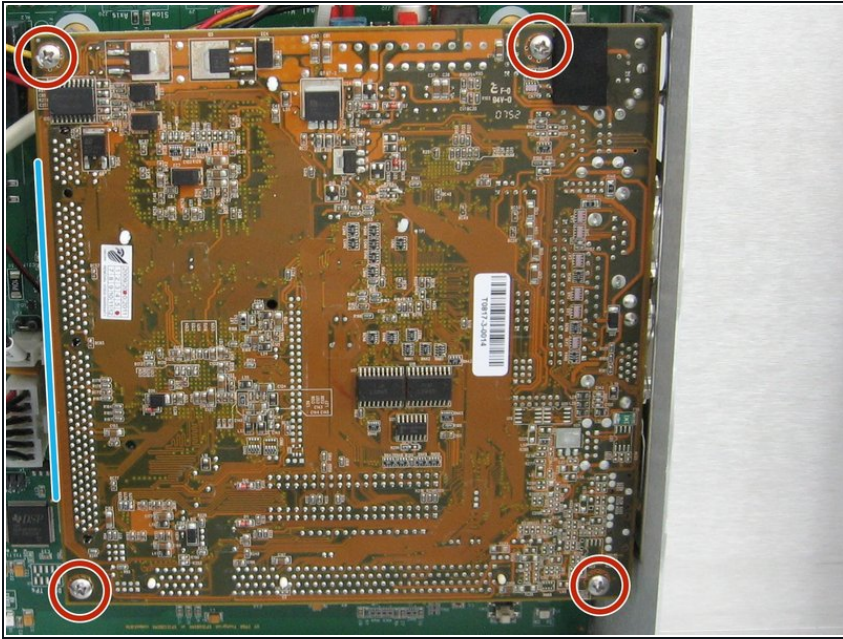
i The photo shows the status LEDs of a properly functioning printer, which may be useful for diagnostics if your printer is experiencing a different issue.

Step 4 — Prepare the New Mainboard for Installation



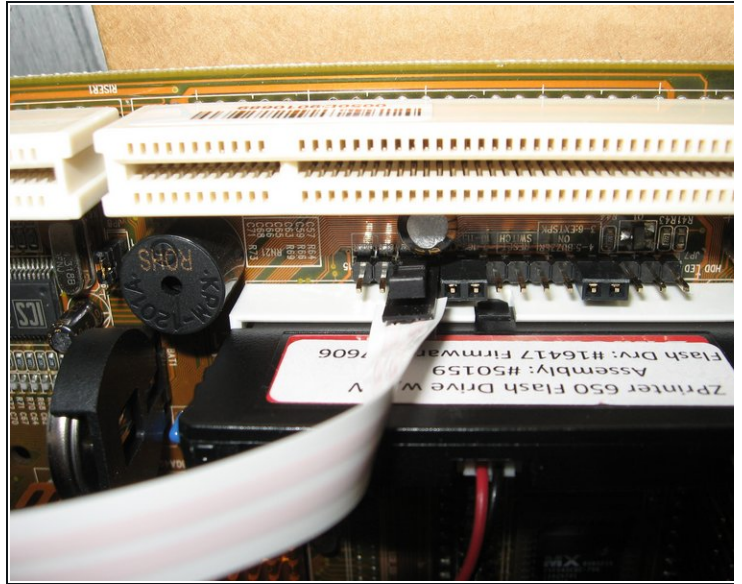
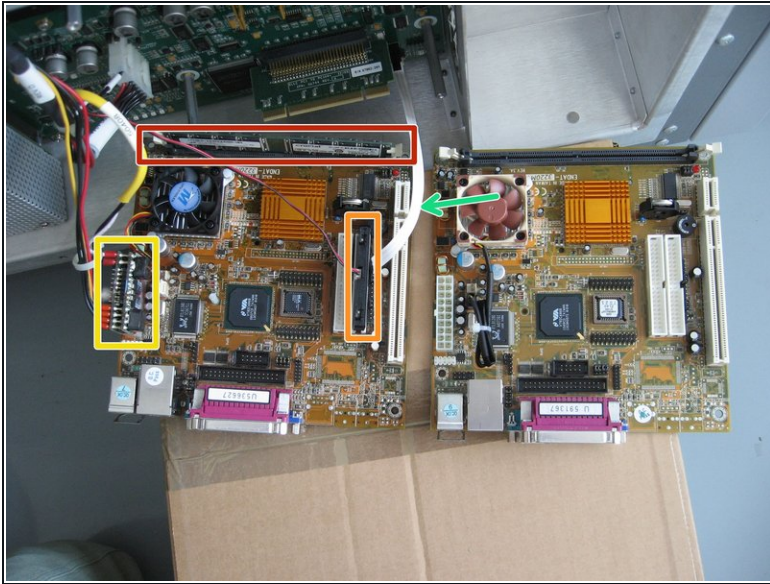
- Once you have confirmed that you have a faulty mainboard and purchased a replacement, you need to prepare it before installation.
 - Begin by replacing the original fan as a preventative measure to avoid future issues. **Use the best fluid dynamic bearing fan you can find**, such as the Noctua NF-A4x10 FLX featured in the photo. Any other high quality 40x40x10 mm fan with a 12V 3-pin connector will work as well. Don't forget to connect the fan cable.
 - Next, replace the original CMOS battery (CR2032 type) as a preventative measure, as the mainboard may have been in a warehouse for eight or more years, causing the original battery to die.
- ⚠ Caution:** Be aware that some variants of the mainboard do not come equipped with a CPU fan. If this is the case, you **must** add a fan to prevent the CPU from overheating and burning out.
- i** Mainboards produced at different times may use different screws for the CPU fan, which may present some difficulties during installation. If necessary, purchase 2.5x15 mm wood screws or M2.5x15 screws with washers.

Step 5 — Remove the Original Mainboard from the Printer



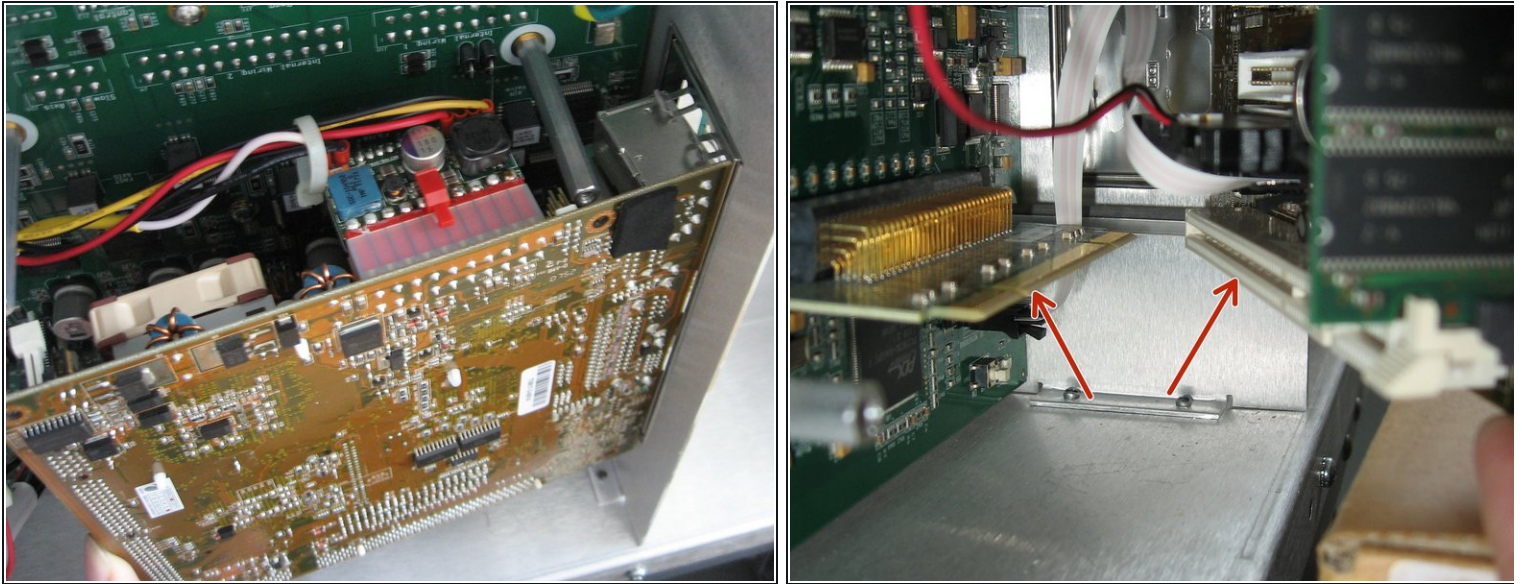
- Before removing the mainboard, unplug all cables from the printer and remove the 4 screws as indicated in the photo.
- Gently pull on the left vertical edge of the mainboard, being mindful of the resistance that you will feel as a PCI riser card disconnects (see Step 7 for more details).

Step 6 — Transfer Components to the New Mainboard



- Place a pedestal on the ground to support the original mainboard while you work on it; a cardboard box works well.
 - Review all the components that you need to move to the new mainboard:
 - DDR memory stick
 - Small Parallel ATA solid state hard drive
 - Power supply converter and connector
 - White ribbon cable for the "power button" header
- ⚠ It's important to connect the white flat cable exactly as shown in the second photo, otherwise the printer signal will not be able to boot up the mainboard. Also, ensure that you put the hard drive into the correct PATA slot.
- ⓘ If you can, make a backup of the drive (see Step 8 as to why). You will need another PC with a PATA adapter and imaging software for this task because there are several different partitions on it. The drive is powered via thin cable from Molex connector, so you will need to borrow it from the printer. The drive has 64 MB capacity.

Step 7 — Install the New Mainboard into the Printer



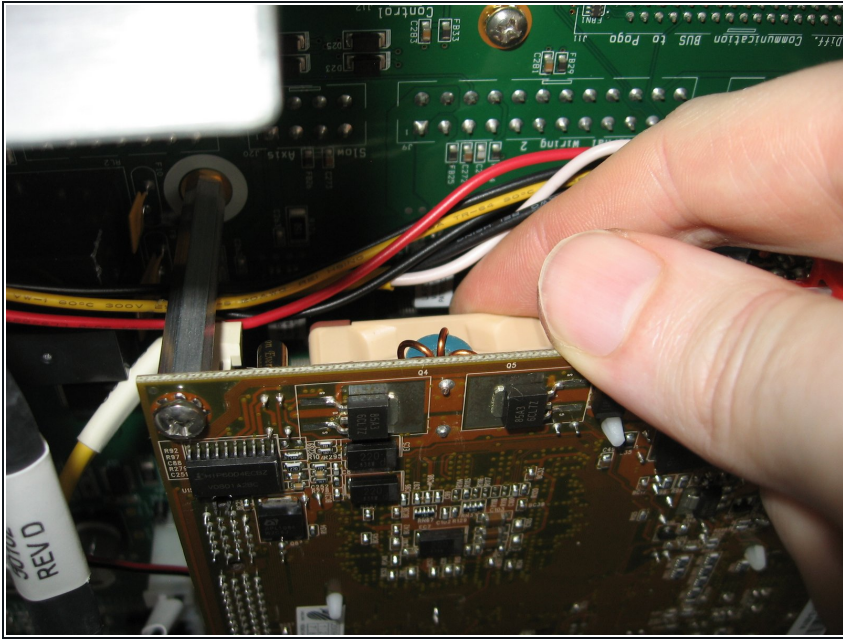
- This part is a bit tricky, because you need to connect the mainboard onto PCI riser card as you slide it in.
- Begin by placing the mainboard connectors onto the I/O shield at an angle, as shown in the first photo.
- Gently push the left edge of the board and verify that the riser card is properly mating with the PCI slot, indicated by green arrows in the second photo.
- If everything looks good, push the mainboard all the way onto the hexagonal mounting posts and secure it in place with screws

Step 8 — Test the Printer for Standalone Functionality




- Before connecting the Ethernet cable, test if the new mainboard has resolved the issue that caused the fault.
⚠ Do not connect Ethernet cable at this point, otherwise the printer will not boot.
- Connect a PS/2 keyboard and a VGA monitor to the mainboard. Plug in the power cord of the printer and turn it on. The mainboard should beep and show the BIOS logo. It may stop and report corrupted CMOS settings due to the battery replacement in Step 4.
- Enter the BIOS by pressing the Delete or F1 key and choose to Save settings, as shown in the second photo. This will save default CMOS settings and the mainboard will reboot itself. It should then boot into the printer firmware, with an ASCII GUI similar to the third photo. The small display at the front of the printer should also function now.
- ① If you encounter any issues, troubleshoot as you would with a regular PC. Check for loose cables/connectors, improperly seated components, faulty power supply, faulty memory, BIOS errors, etc.
- ① The worst problem would be a faulty storage drive since it stores calibration data for valves, rollers, and other mechanical components which were uniquely tuned in the factory. If you need my HDD image from one Zprinter 650 in Acronis, contact me, but keep in mind that it probably won't work well with another printer.

Step 9 — Verify Proper Fan Operation



- After the printer is running, confirm that the new CPU fan is mounted and plugged in correctly. You can check if it is rotating by using a small mirror or by carefully feeling it with your finger, as shown in the photo.
- Tie up nearby cables to prevent them from moving and blocking the fan.

 **Caution:** The power inlet and wires are located above the mainboard. Be sure to exercise caution and take necessary safety precautions to avoid the risk of electric shock.

Step 10 — Configure BIOS Settings, Part 1



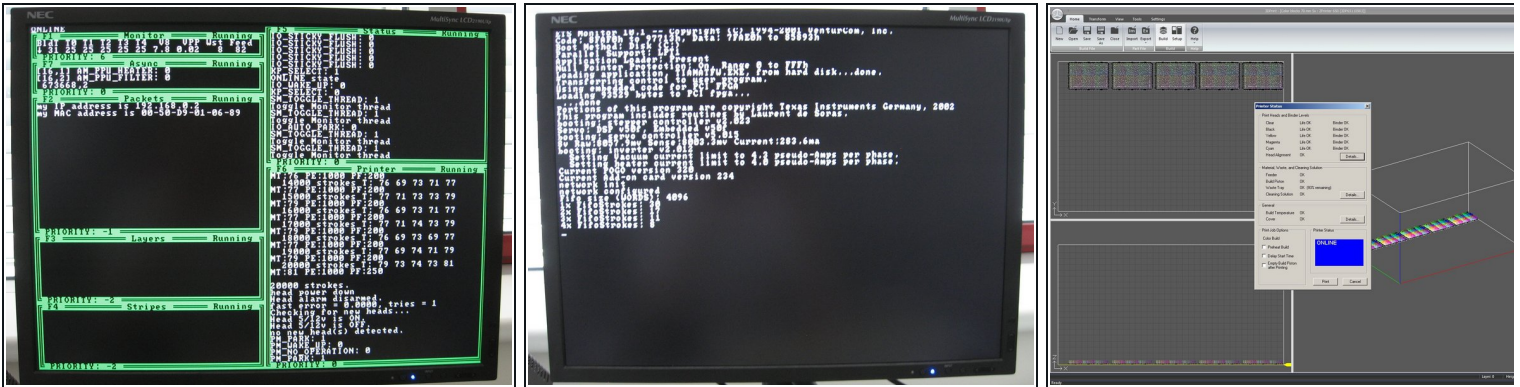
- To prevent the printer firmware from freezing when you connect the Ethernet cable, you must adjust some settings in the BIOS. Specifically, you need to disable certain onboard devices to avoid IRQ conflicts. Since the firmware runs on FreeDOS, which is not a Plug and Play OS, these adjustments are necessary.
- While I do not recall the exact settings that need to be changed, I have taken photos of a working printer that can serve as a template.
- ① Update as of 2022: I have set up a printer with a dead CMOS battery and found that you must set "Floppy Drive A" to "Not Installed".

Step 11 — Configure BIOS Settings, Part 2



- iFixit limits the number of photos per step to three, as such I had to split the BIOS settings into two steps. Notably, the Peripheral Setup setting is likely the most crucial.
- ☑ Once you have adjusted the necessary settings, remember to save them before allowing the printer to boot into its ASCII GUI.
- 📄 Update as of 2022: I recently configured a printer with a dead CMOS battery and found that you must set "Onboard FDC" to "Disabled".

Step 12 — Test Printer for Networked Functionality



- Connect the Ethernet cable to the printer and observe the ASCII GUI. Normally, some values change every second and should continue to do so after you plug in the cable. If the firmware freezes, double-check the BIOS settings.
- ❗ During boot, the firmware displays various information (as shown in the second photo). If the printer consistently freezes at a particular stage upon rebooting, that may be the issue. Unfortunately, the only way to reboot from frozen firmware is to turn the printer off and on again.
- The printer should now function correctly. You should be able to connect to it immediately with ZPrint or 3DPrint software because all settings were saved on its internal HDD. Keep in mind that the new mainboard has a different MAC address, so network configuration changes may be necessary in your institution/workplace.

Finally, you should turn off the printer, disconnect all cables and put back cover on the electronics module. That completes the repair.