

Aus3D Prusa Mendel i3 Kit

Electronics Assembly Instructions

Note: At this time a graphical guide for the final installation of electrical components has not been completed. The following instructions will walk you through completing the setup of your printer.

Section 1 - Electrical

1. Complete frame construction – see “instructionsV1.pdf”.
2. Install the power supply unit (PSU). The PSU mounts to the left side of the frame, and uses 4 M3 screws. Make sure to use the plastic spacers included - the screws shouldn't go too far (more than 3-4mm) inside the PSU. The electrical connections should face downwards to make for neater cabling.
3. Install the Melzi control board. The control board mounts to the right side of the frame. Plastic spacers are included in each kit, place spacers between the board and the frame before screwing it in place. Mount the control board so that the USB and microSD connections are near the top.
4. Install the cable that carries power from the PSU to the control board. This is a 2-core cable (usually red and black). On the control board, the cable wires into the terminal marked “POWER”. The upper connection (near “HOTBED”) is negative, the lower connection (near “E-MOTOR”) is positive.

On the PSU the red wire should go to any of the DC Output terminals marked positive, and the black to any marked negative. All the positive terminals are identical, and all the negative terminals are identical – there is no preference where the wires connect, but keeping them further apart may reduce the risk of an accidental short.

5. Wire the motors to the control board. There are two different sets of coloured wires that the motors may have. Depending which colours are present, wire the motor cables in the following order (top-to-bottom):

Black, Green, Blue, Red

or

Yellow, Blue, Green, Red

Motors wired incorrectly may move in reverse, or not move at all. However, there is no risk of damaging the motors due to incorrect wiring order.

If a motor runs in reverse, switch the first (or last, but not both) two wires around (e.g. swap black and green, or yellow and blue).

Because there are two motors for the Z axis, they will both need to be wired into the same terminals. Twisting the ends of the wires (e.g. both sets of red, etc.) together may make this easier.

6. Install the heated bed. Use 4 longer M3 screws (20-24mm), a washer on top of the bed, a spring (not washer, full spring) in between the bed and the bed support plate, and a washer and nut beneath the bed support plate.

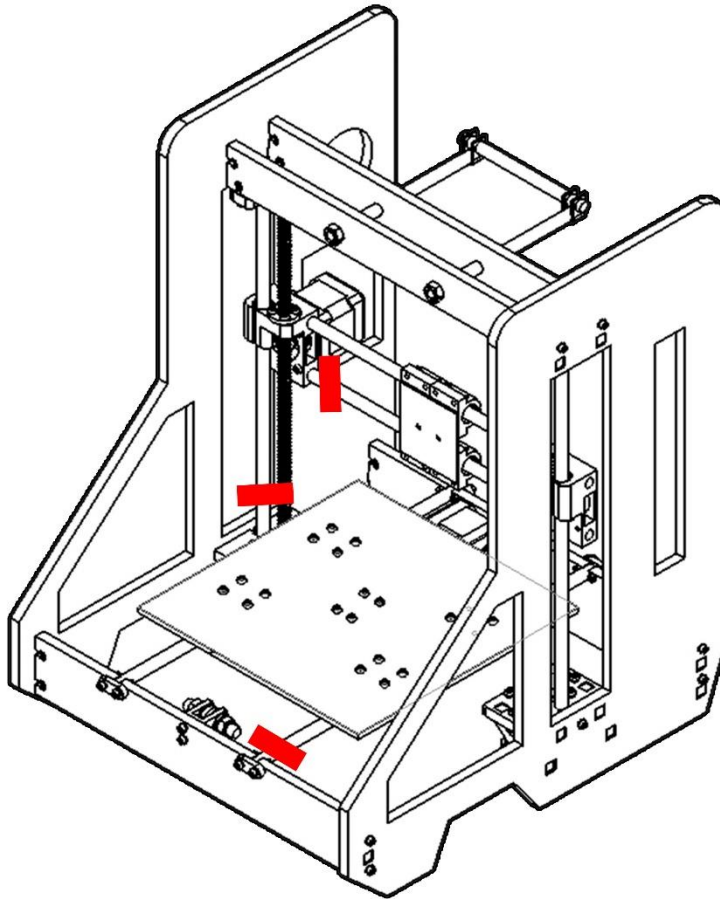
These screws can be adjusted to raise or lower each corner of the bed in order to get it level. The springs provide some protection should the hot-end crash into the print bed.

The power cable going to the heated bed (thicker wires) connects to the “HOTBED” terminal on the control board. Polarity matters, follow the convention established for the “POWER” terminal – the wire nearest “POWER” should be positive.

The two white wires from the heated bed are wired to the thermistor, and connect to the “BTEMP” terminal. Polarity does not matter.

To level the heated bed, move the extruder down until the nozzle is a paper’s width from the bed surface. Now, move the extruder from left to right and verify that the distance remains constant. Adjust if necessary. Move the printer bed back and forth, again, monitor the distance and adjust if necessary.

7. Wire the extruder (motor should already be done. If not, do it first). The white wires (thermistor) connect to “ETEMP”, polarity does not matter. The red wires (heating element) connect to “HOTEND”. Again, polarity does not matter. The fan wires connect to “FAN”, and polarity matters. The positive wire is near “HOTEND”.
8. Now it is time to install and wire up the endstops (microswitches). Included are three plastic clips that the endstops will screw onto. The clips will hold the endstops onto 8mm smooth rod, and should be tightened in place securely. Below is a diagram of endstop placement:



Verify that each switch will make contact with the moving components. The X endstop should be pressed by the extruder carriage, the Y endstop should be pressed by the printer bed, and the Z endstop should be pressed by the X motor mount.

Wire the endstops to the control board. Polarity does not matter. Endstops are marked "XSTOP", "YSTOP" and "ZSTOP".

9. Wire the included mains-lead to the PSU. **For safety, ensure the cable is NOT connected to mains power while doing this step.**

AU mains colour coding is as follows:

NEUTRAL – Black or Blue

LINE/ACTIVE – Red or Brown

EARTH – Green or Yellow

The PSU should have three terminals for the mains connection (AC Input), marked L, N and GND (or GND symbol, \perp).

Once the wires are securely in place, the cable may be plugged into mains power.

Section 2 – Software / Firmware

1. Download the Arduino IDE (version 1.0.5 recommended) from:
<http://arduino.cc/en/Main/Software>
2. Download the “Sanguino” folder from <https://github.com/reprappro/Marlin>. To do this, use the “Download Zip” button on the right of the page, and extract the “sanguino” folder somewhere you can find it.

Place the “sanguino” folder into Arduino hardware folder. On Windows, this is found at: C:\Users\USERNAME\Documents\Arduino\hardware

This should make the new structure

C:\Users\USERNAME\Documents\Arduino\hardware\sanguino

3. Turn the power to the printer (mains power) on, and connect the USB cable between the printer and your computer. Your computer should automatically download and install the appropriate drivers. If not, drivers can be found on this USB.
4. Download the Aus3D customised firmware from <https://github.com/Aus3D/Prusai3>. Use the “Download ZIP” button as before. Extract the files, and open “Marlin.ino” with the Arduino software.
5. In the Arduino software, select the open file “Configuration.h” from the top bar of open files. The following lines will need to be adjusted later to properly calibrate distances:

```
// default settings
```

```
#define DEFAULT_AXIS_STEPS_PER_UNIT {78.7402,78.7402,200.0*8/3,760*1.1}
```

```
#define DEFAULT_MAX_FEEDRATE {500, 500, 5, 25} // (mm/sec)
```

```
#define DEFAULT_MAX_ACCELERATION {9000,9000,100,10000}
```

6. In the Arduino software, select “Tools”>”Board”>”Melzi 1284p 16mhz”. Select “Tools”>”Serial Port”, and select the highest-numbered COM port.
7. Press the “Upload” (play) button to upload the firmware to the board. It may take a minute, but there should be a message informing you of a successful upload in the bottom terminal window. If there is not:
 - a. Double check the COM port. Verify this is the correct COM port by opening device manager and looking for Melzi. Alternatively, unplug the board to see which COM port disappears.
 - b. If problems persist, unplug the USB cable, wait a few seconds, and plug it back in. Select the correct COM port and try again.
 - c. Sometimes pressing the “Reset” button on the Melzi board before / during the start of the upload can help resolve issues.
8. Download the latest version of Printron (or use the copy provided on the USB) and extract the software. Open “Pronterface”.

9. In Pronterface, set the Port to the known COM port, and the number (BAUD rate) to 115200 (which was pre-set in the firmware we uploaded). Press connect, and after a moment the console window in Pronterface should report success.
10. Position the extruder (by hand) in the middle of the X axis, so that if it moves the wrong way nothing will be damaged. Then, in Pronterface, use either the + or – X button to move the axis. Move the axis in short motions at first, until you are sure it is moving correctly. Do not move the axis far enough to crash into the frame.
11. Perform the same check for the Y and Z axis. They should each move as told. If any of the axis seem to move in the wrong direction, you can either switch the motor wires (as discussed previously) or change the firmware line (select appropriate axis, change false->>true or vice-versa):

```
#define INVERT_X_DIR false
```

12. Now, test that the X axis homes correctly. Be ready to unplug mains power quickly, if something goes wrong here the printer will make an unpleasant sound – but it shouldn't be damaged.

Move the extruder to the middle of the axis (electronically), and then press the X home button (X with a house). The carriage should move towards the switch, and once it presses the switch, it should stop moving.

If the axis moves the wrong way (away from the switch), verify:

- Where the switch was placed, relative to the diagram previously.
- That the motor moves in the correct direction under manual control.

If the axis does not stop, verify:

- That the carriage physically presses the switch on contact.
- That the switch is wired to the control board correctly.

13. Repeat these checks for the Y and Z axes. Again, be prepared to unplug the printer if something goes wrong.
14. Once each endstop has been tested and confirmed working, you may home all three axes. Press the home button without a letter – first the X axis will home, then Y, and then Z. This will happen automatically at the start of every print, so verify that no cables are going to get caught or stuck during this motion.
15. When an axis is homed, software defined limits are placed at the opposite end of the axis. The firmware included comes with limits of 150mm for the X any Y axis, and 180mm for the Z axis. **Be ready with the power switch just in case!** Verify that these limits are working by telling the software to move an axis repeatedly away from the endstop. Before the axis reaches the end, it should stop automatically, and not move any further.

These limits are pre-set as safe limits for getting setup and testing. To change these limits, edit the following lines in the firmware:

```
// Travel limits after homing
#define X_MAX_POS 150
#define X_MIN_POS 0
#define Y_MAX_POS 150
#define Y_MIN_POS 0
#define Z_MAX_POS 180
#define Z_MIN_POS 0
```

16. Verify that the thermistors are operating correctly. The “Check Temp” button should return the temperature for the extruder and the bed.
17. Verify that the extruder and bed can both heat up correctly. Set the temperature to a full integer (60 for bed, 180 for extruder are common numbers for PLA) and press “Set”. You should see the temperature reach these numbers over a few minutes.

Do not touch the hotend while it is heating up! The heated bed gets toasty too!

18. Once at temperature, carefully feed some PLA filament through the extruder and into the hotend. Once the filament is correctly placed, and there is a gap between the nozzle and the bed (raise the Z axis), press “Extrude”. The extruder motor should activate and push the filament into the hot-end.

You may need to press the button several times (or adjust the extrude length) before any filament comes out the nozzle. If the motor spins the wrong way, see previous info regarding reversing the motors.

Note: Pronterface will for some reason return an error message if the extruded length or rate are decimal values – ensure they are integer numbers with no decimal point.

19. Congratulations – at this stage, everything should be working and you should be ready to do a test print – and start calibrating! Calibration is far too broad a topic to be encompassed in this guide – an excellent starting point is the following wiki page:

<http://reprap.org/wiki/Calibration>

Finally, if you are stuck and need assistance, please contact me via chris@aus3d.com.au.