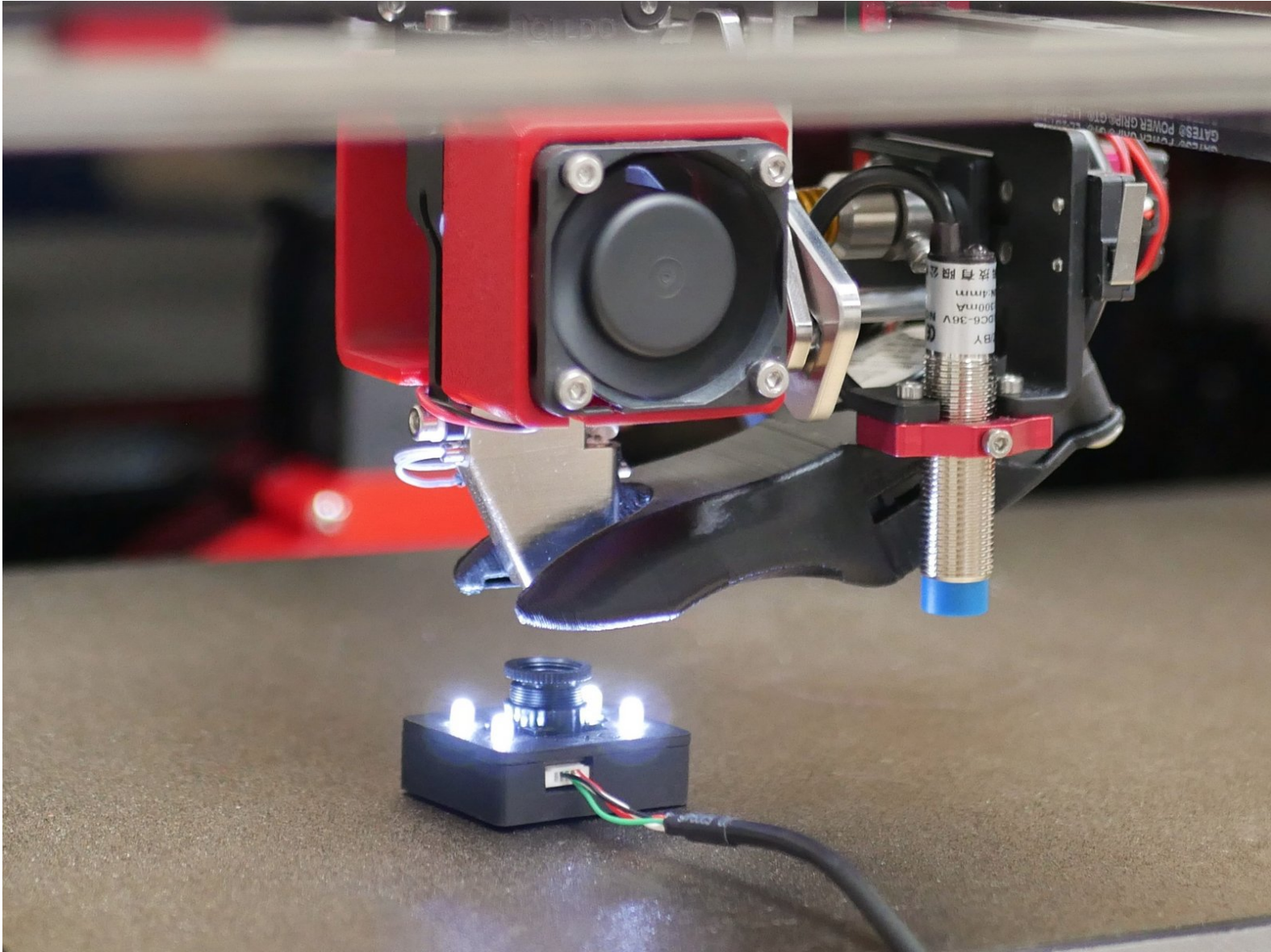


# Makertech

## Stage 09: Calibration

Written By: Makertech 3D

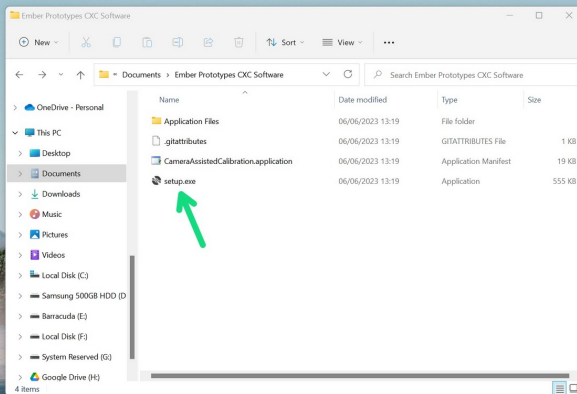


## Step 1 — CXC Calibration Tool



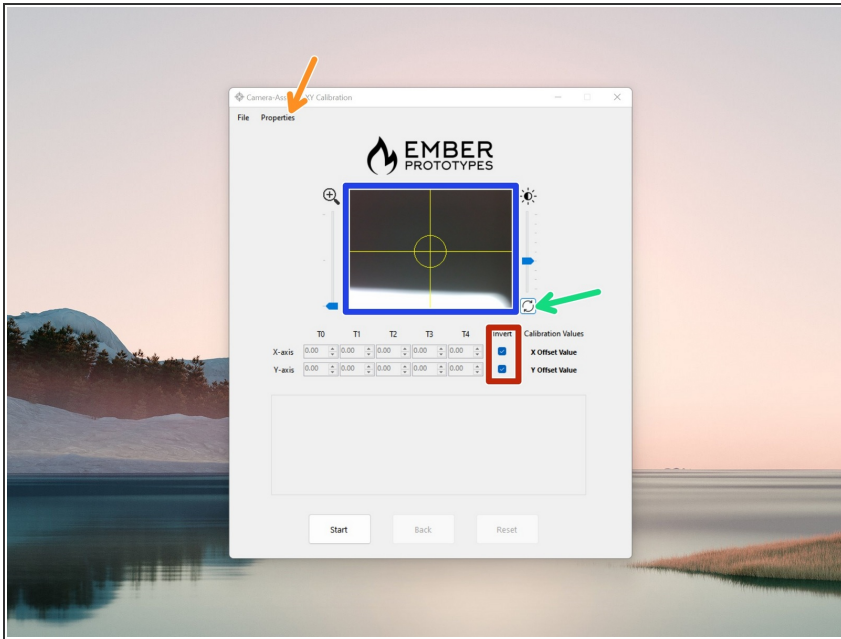
- ⓘ The Proforge 4 uses the CXC by Ember Prototypes to help calibrate the print heads. Learn more about the CXC [here](#).
- 📌 An auto-calibration tool that interfaces directly with your printer is also in the works, it is scheduled for release in February 2024.

## Step 2 — Software



- ⓘ The CXC software currently only runs on Windows machines.
- ⓘ Download the software [here](#).
- Unzip the file and run **setup.exe** file.
- 📌 A new cross-platform web app has been released and is available [here](#).

## Step 3 — Connecting the Camera



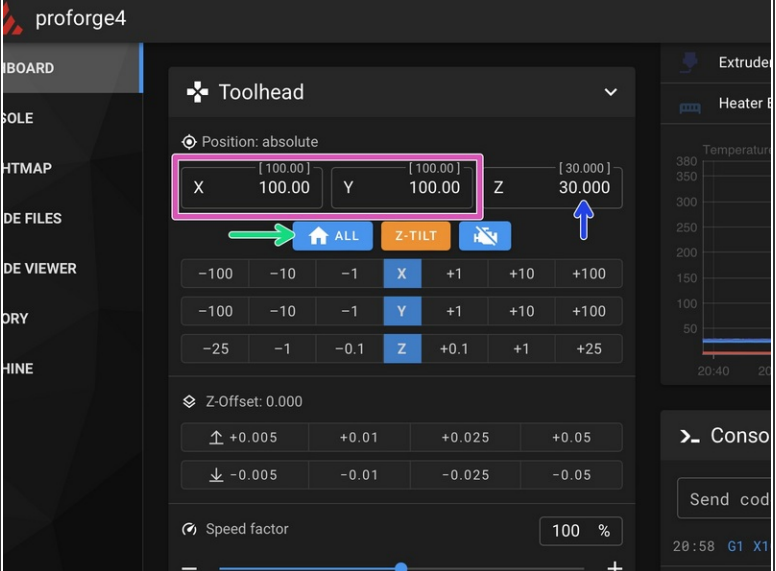
- ① Unpack the camera by taking it out of its anti-static packaging.
- ① Use the cable to connect the camera to your computer.
- When connected you should get a feed from the camera to the software like this.
- You may need to use the refresh button.
- In properties make sure that **Tool Changer** is selected.
- Make sure that both boxes for **invert** are checked.

## Step 4 — Setting Up Your Printer

```

29
30
31
32 # Tool Head X/Y Offsets:
33
34 # Tool Head 0:
35 # (0,0,0) - reference position
36
37 # Tool Head 1 Offset:
38 one_x_offset = 0
39 one_y_offset = 0
40
41 # Tool Head 2 Offset:
42 two_x_offset = 0
43 two_y_offset = 0
44
45 # Tool Head 3 Offset:
46 three_x_offset = 0
47 three_y_offset = 0

```

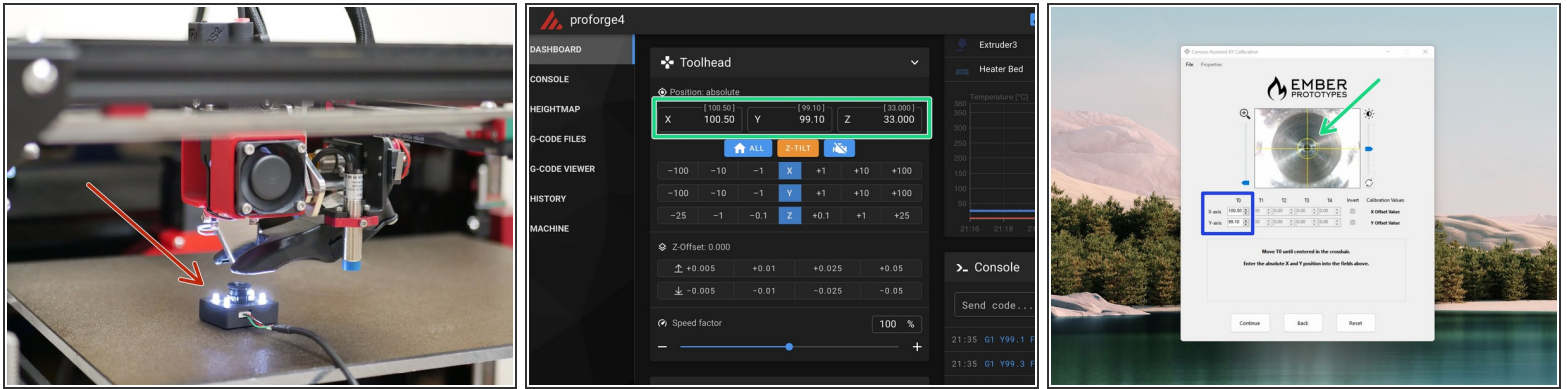


⚠ Before starting make sure that your print heads are clear of any filament ooze.

- Make sure that your current X/Y offset values are all set to 0. Double check this in the variable.cfg file.
- Home All.
- Lower the bed to 30mm.
- ① Select T0
- Move the print head to X/Y position (100, 100).

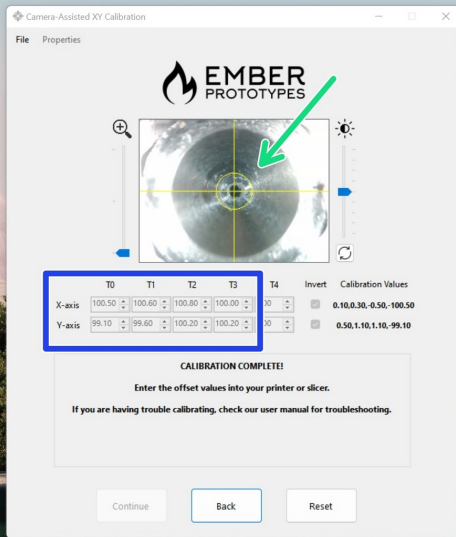


## Step 5 — T0



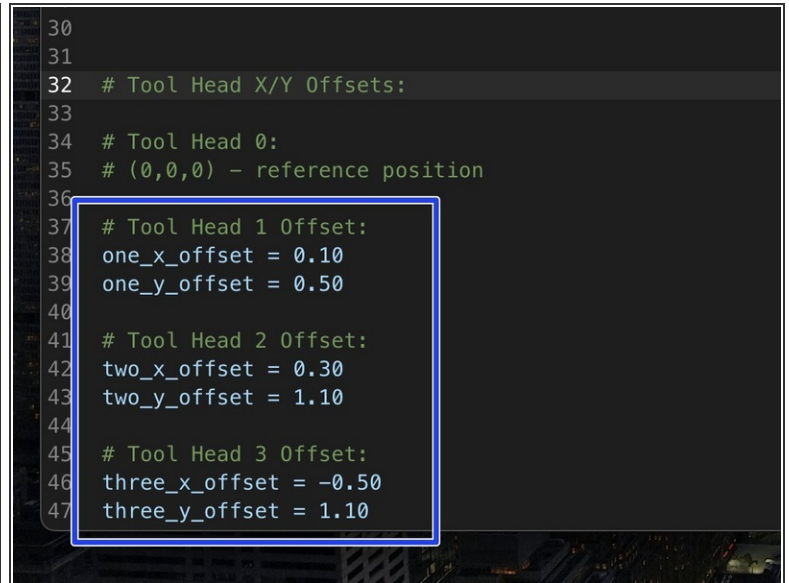
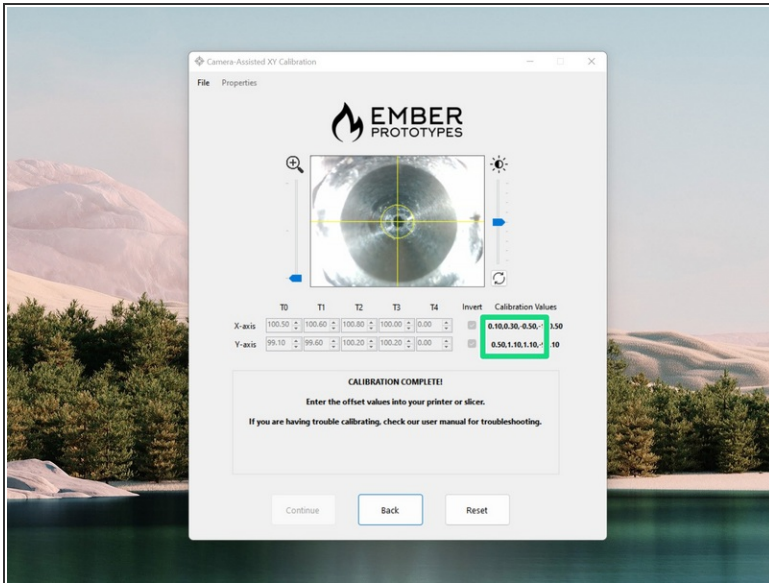
- Place the camera module onto the platform - the module has a magnet underneath it which will stick to the platform.
- ⚠ Do not place the module onto the bed whilst the bed is hot - this can cause damage to the module.
- ℹ Move the module to get it near to the centre of the print heads nozzle.
- Next move the print head using the controls in Mainsail until the centre of the nozzle comes into focus and also lines up with the cross hairs of the camera feed.
- ℹ When lined up hit start
- Enter these X/Y values into the software under the T0 column as shown.

## Step 6 — Remaining Print Heads



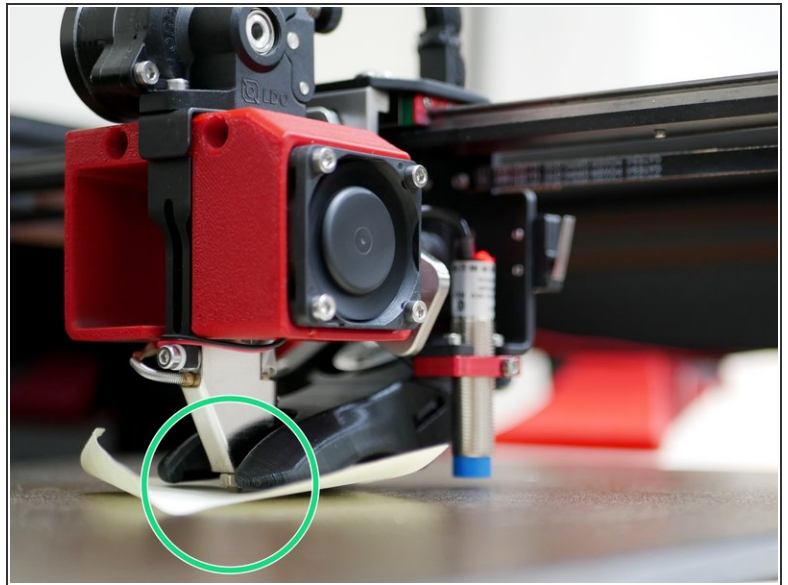
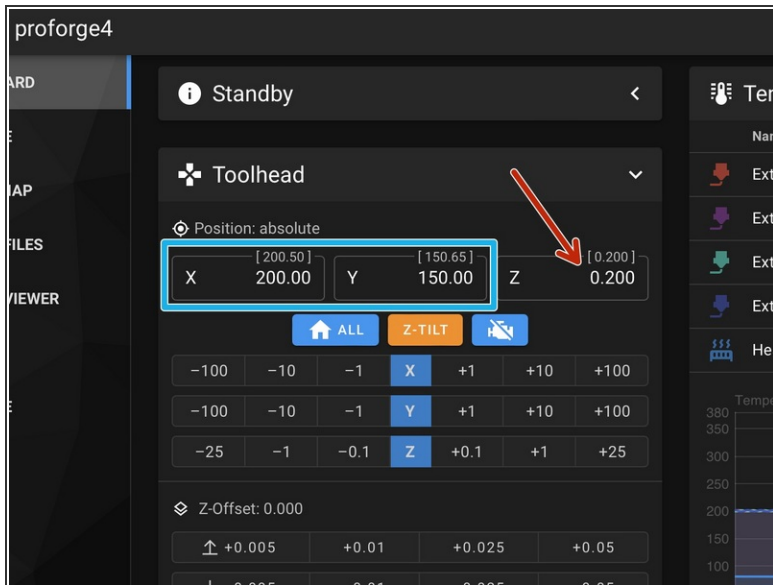
- ⚠ It's important when calibrating the remaining heads that the camera is not moved.
- ℹ Use the macro controls in Mainsail to dock T0 and select T1.
- Again use the controls in Mainsail to line the centre of the second print heads nozzle with the cross hairs on the software.
- ⚠ Don't forget to adjust the Z-value also, the bed is lowered by 1mm after each tool change.
- Enter the X/Y co-ordinates into the software.
- ★ Repeat this for the remaining print heads.

## Step 7 — X/Y Offsets



- With all of the X/Y values entered in hit finish to get your offset values.
- Enter these into the variables.cfg file.

## Step 8 — Print Head Z-Offsets



- ① With the offset for the first print head saved from [this step](#) in the previous stage continue with finding the offsets for the remaining print heads.
- ① Set the bed to 100C.
- ☑ The remaining Z-offsets are relative to the first print heads offset.
- ① Select the print head, T1.
- Move it to the centre of the build plate, co-ordinates (200, 150).
- Place a piece of paper between the nozzle and the platform. Move the platform up to the nozzle and stop once it grips the paper.
- Note the Z-position.
- ① Repeat this for any remaining print heads you have installed.



## Step 9 — Saving the Z-Offsets

```
18 three_x = 70
19 three_y = 296
20
21
22
23 # Tool Head Z Offsets:
24
25 one_z_offset = 0.1
26 two_z_offset = 0.2
27 three_z_offset = 0.2
28
29
30 |
31
32 # Tool Head X/Y Offsets:
33
34 # Tool Head 0:
35 # (0,0,0) - reference position
36
```

- Enter the Z-offsets that you collected from the previous step into the variable.cfg file.
  - T1 = one\_z\_offset
  - T2 = two\_z\_offset
  - T3 = three\_z\_offset