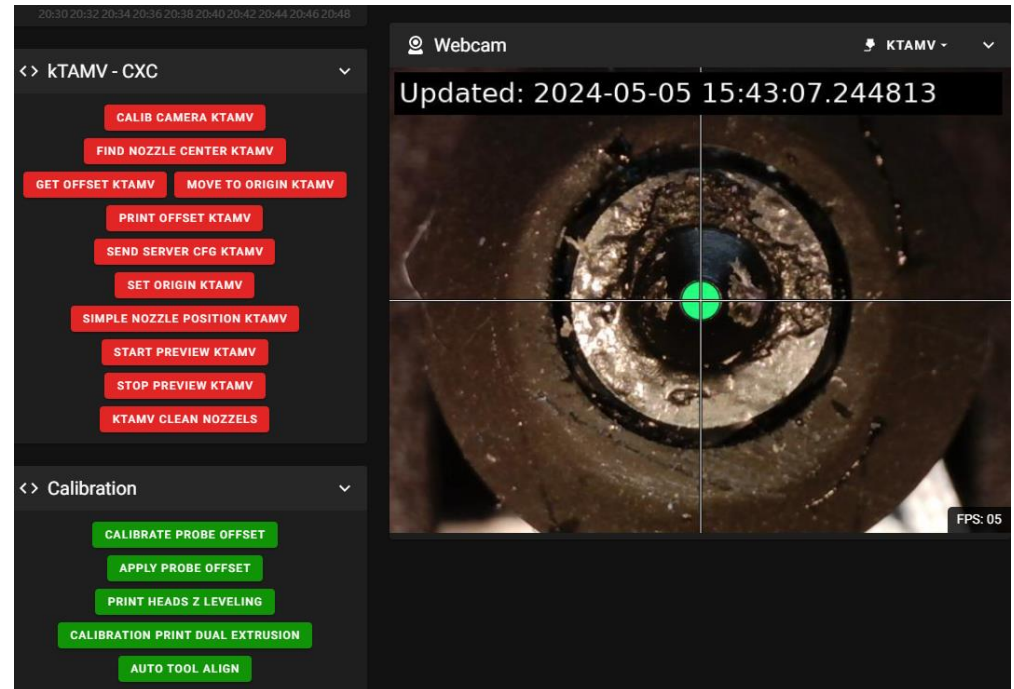




Klipper kTAMV with CXC-Camera

Marathon



Introduction

Credits:

- **CXC-Camera** → is an Assisted XY Calibration Tool from Ember Prototypes. It was designed to be as simple and universal as possible and meant to be used on 3D printers with multiple printing heads.
- **kTAMV** → is a Klipper Alignment Tool designed by Andrei Ignat. It works by using Machine Vision and it allows the fully automatic calibration of nozzle offsets.
- **This MOD** → takes these two great products and put them together in the Marathon ecosystem.

Why using **CXC-Camera** ?

Because ... it is small

... has LEDs

... has a magnet

... has an adjustable lens

... has a long USB cable attached

... already had one laying around (*as maybe some of you reading these rows also do*)

What this MOD actually is?

A highly precise and fully automatic calibration process for the XY offsets of the second printing head (TI) relative to the first one (TO).

...and what it is not?

It is not a very fast process, it requires 6 minutes and 20 seconds to complete the calibration. However, it is significantly faster than printing multiple test model iterations.

.... Can the calibration still be done manually?

Yes! There are only a few steps to follow. It is a process similar to what is required when using the original Windows App from Ember Prototypes.

Known Bugs & Todos:

~~- 'The Auto Tool Align' macro, when first used after a printer restart, is not aware of the Camera Calibration and Origin status, and it has to be restarted~~

- Sometimes the nozzle won't be recognized, and the macro has to be restarted.

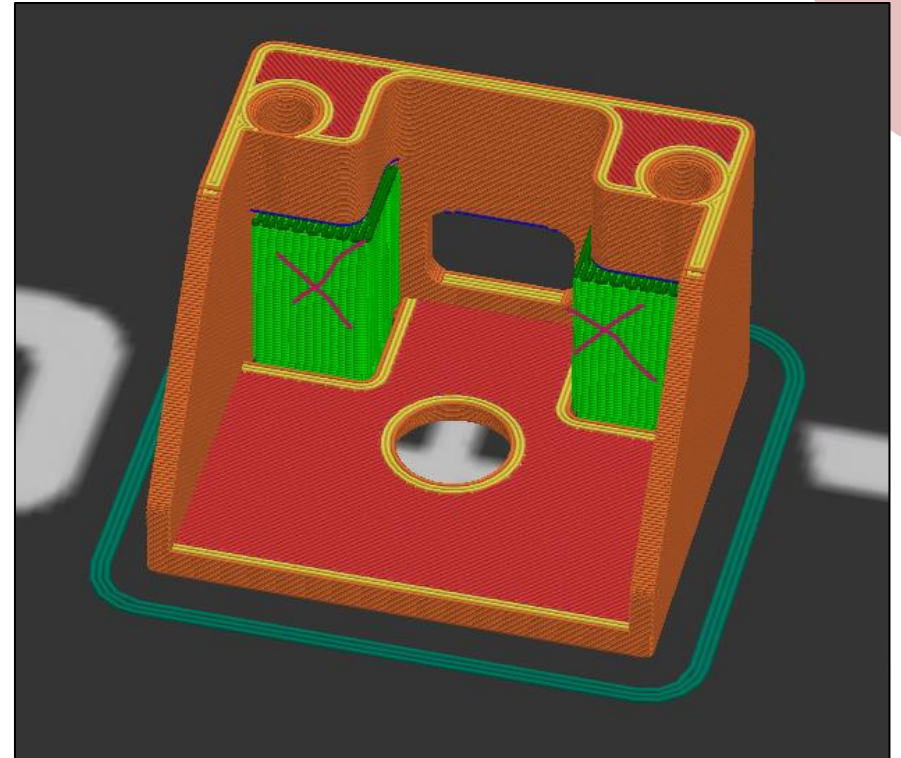
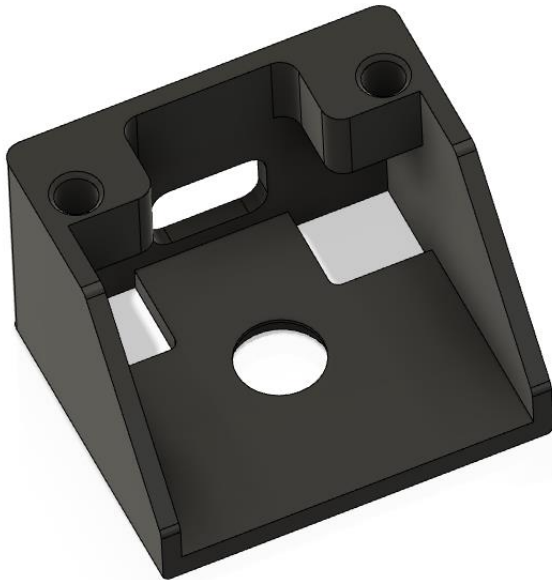
BOM

- 1x CXC-Camera → <https://www.emberprototypes.com/products/cxc>
- 2x M3-Inserts → <https://a.co/d/2GOOxsY>
- 1x Ø10x2mm Magnet → <https://a.co/d/6X9wvLV>
- 3x Zip ties

* The links are only for orientation; there are no affiliate links. You can purchase the hardware from wherever you like.

3d printed parts

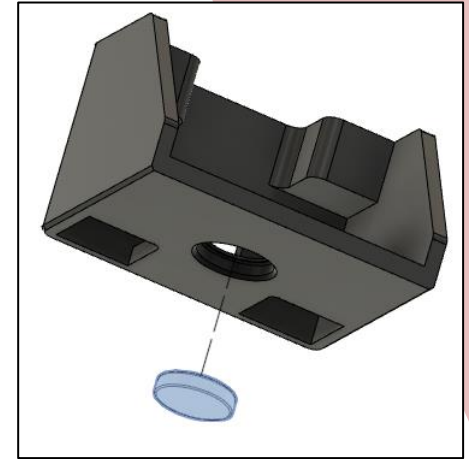
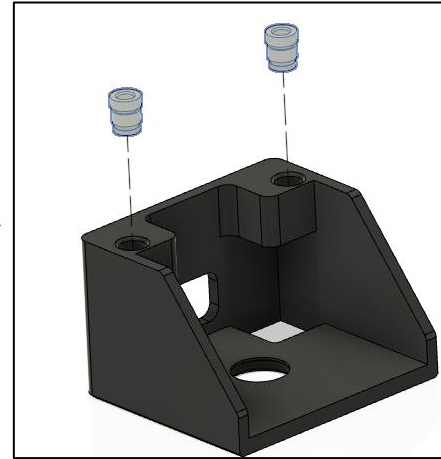
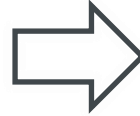
- 1x Bracket for CXC-Camera → **Print it out of a heat-resistant material (!)** with 30% infill and supports on the print bed only. After printing is completed, remove the support structures.



Prepare and Installation of the Bracket for the CXC-Camera

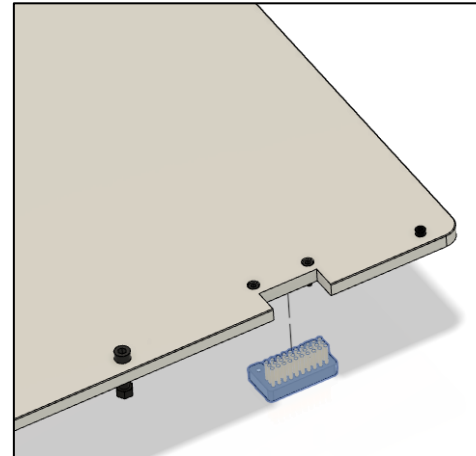
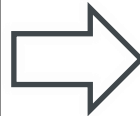
Install the two M3-Inserts and Ø10x2mm magnet as shown.

Make sure that the magnet orientation is such that it attracts the CXC-CAMERA !



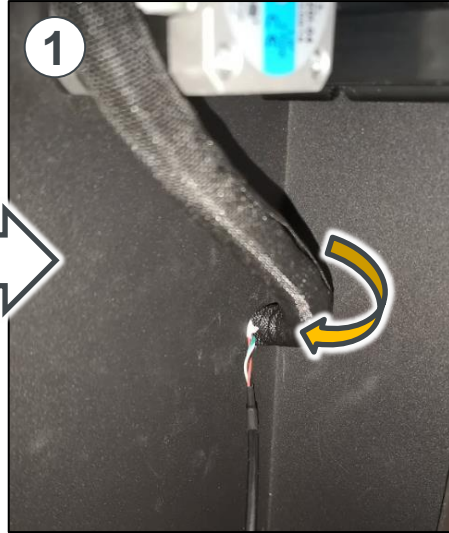
Remove the nozzle brush corresponding to T0 and install the Bracket for CXC-Camera in its place.

Recommendation: Keep the bed heated at 100°C for 10 minutes, and then retighten the screws holding the bracket.



Cable management for the CXC-Camera

Turn the printer on its side.
Carefully push the CXC-camera cable, with the small connector facing forward, along the T0-cable through the hole in the printer base. Around 450mm of CXC-camera cable have to be inside the printer chamber

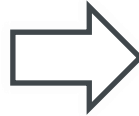


Between the edge of the cover beneath and printer base there are a few millimetres space. Gently push the cable thru that space inside the chamber where the electronics are found.



Cable management for the CXC-Camera

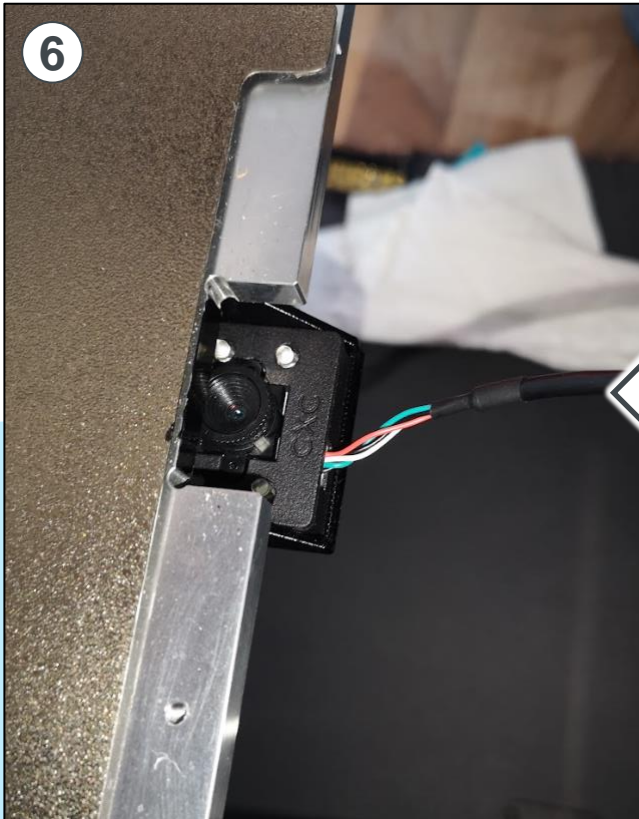
At the front of the printer, ensure that the cable length is sufficient to comfortably reach the USB port.



Use zip ties to secure the excess wire with the T0-cable together as shown.
Now, the printer can be placed back on its feet.

Cable management for the CXC-Camera

Inside the printer chamber, use a zip tie to fixate the CXC-Camera cable together with the T0-cable as shown.



Place the camera inside the bracket as indicated.

Ensure that the camera is pushed up to the back end of the bracket.

kTAMV Tool installation & Klipper configs

- Open a SSH-connection to your printer.
You can do that also from Windows Command Prompt by typing: **ssh biqu@<your printer IP>**
- The password is 'biqu' if you haven't change it.
- Type: **cd ~/ && git clone <https://github.com/TypQxQ/kTAMV.git> && bash ~/kTAMV/install.sh**
- The installation will start, some question have to be answered with 'yes'.
- During the installation your 'printer.cfg' and 'moonraker.conf' will be renamed and replaced by new ones.
- A new file, 'ktamv-macros.cfg' will be added during installation to your machine
- Now some CFGs specific for Marathon have to be added to your Machine:
 - Upload the provided 'ktamv_automation.cfg' and 'variables.cfg'
 - Replace the 'Marathon_Macros.cfg' and 'printer.cfg' (*The way the 'printer.cfg' resulting from the kTAMV installation is not okay, and some other settings have also been changed.*)
- kTAMV is collecting data for future development, if you want to opt out, type 'false' in the indicated field inside 'printer.cfg'.

```
Microsoft Windows [Version 10.0.19045.4291]
(c) Microsoft Corporation. All rights reserved.

C:\Users\marin>ssh biqu@192.168.178.42
biqu@192.168.178.42's password:


BTT-CB1

Welcome to BTT-CB1 2.3.2 Bullseye with Linux 5.16.17-sun50iw9

System load:  29%           Up time:           18 min
Memory usage: 27% of 986M   IP:             192.168.178.42
CPU temp:     45°C         Usage of /:      67% of 6.7G

[ 0 security updates available, 26 updates total: apt upgrade ]
Last check: 2024-05-06 17:17

Last login: Fri May 3 20:39:31 2024 from 192.168.178.28
biqu@Marathon:~$ cd ~/ && git clone https://github.com/TypQxQ/kTAMV.git && bash ~/kTAMV/install.sh
```



ktamv_automation
Marathon_Macros
printer
variables

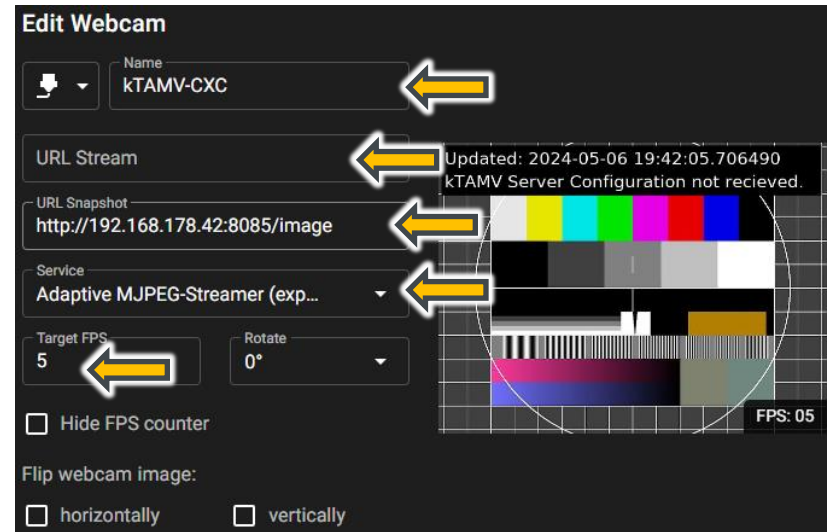
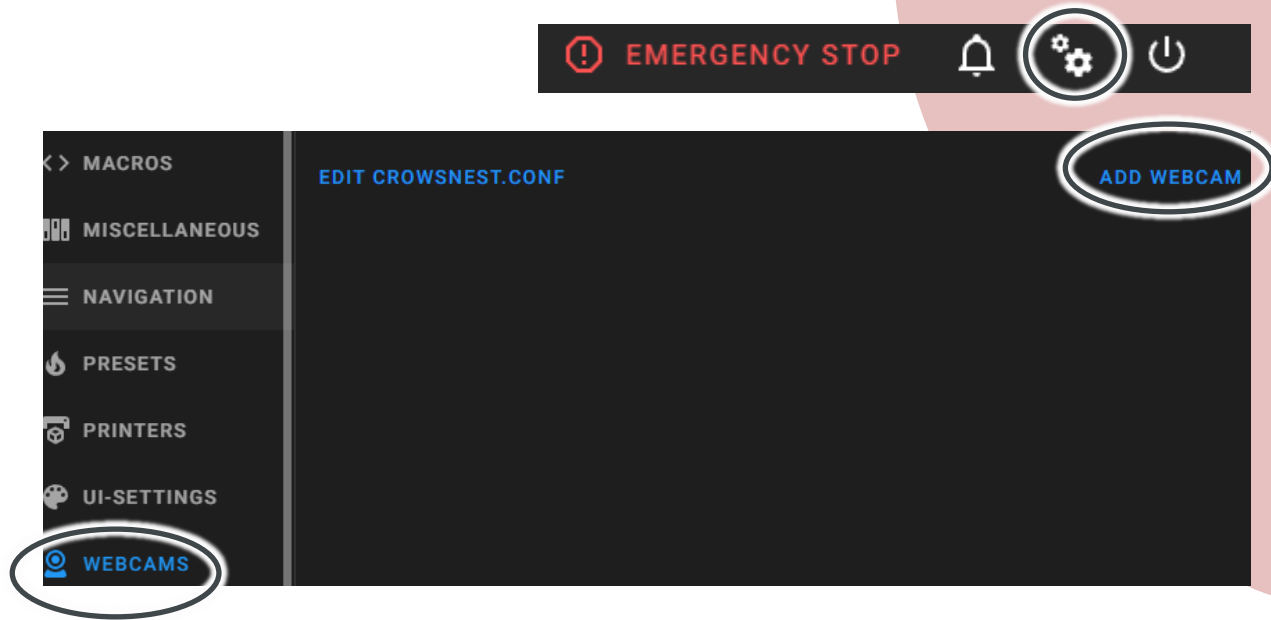
```
#####
# kTAMV
#####

[ktamv]
nozzle_cam_url: http://localhost/webcam/snapshot?max_delay=0
server_url: http://localhost:8085
move_speed: 5000
send_frame_to_cloud: true ←
detection_tolerance: 1

[include ktamv-macros.cfg]
[include ktamv_automation.cfg]
```

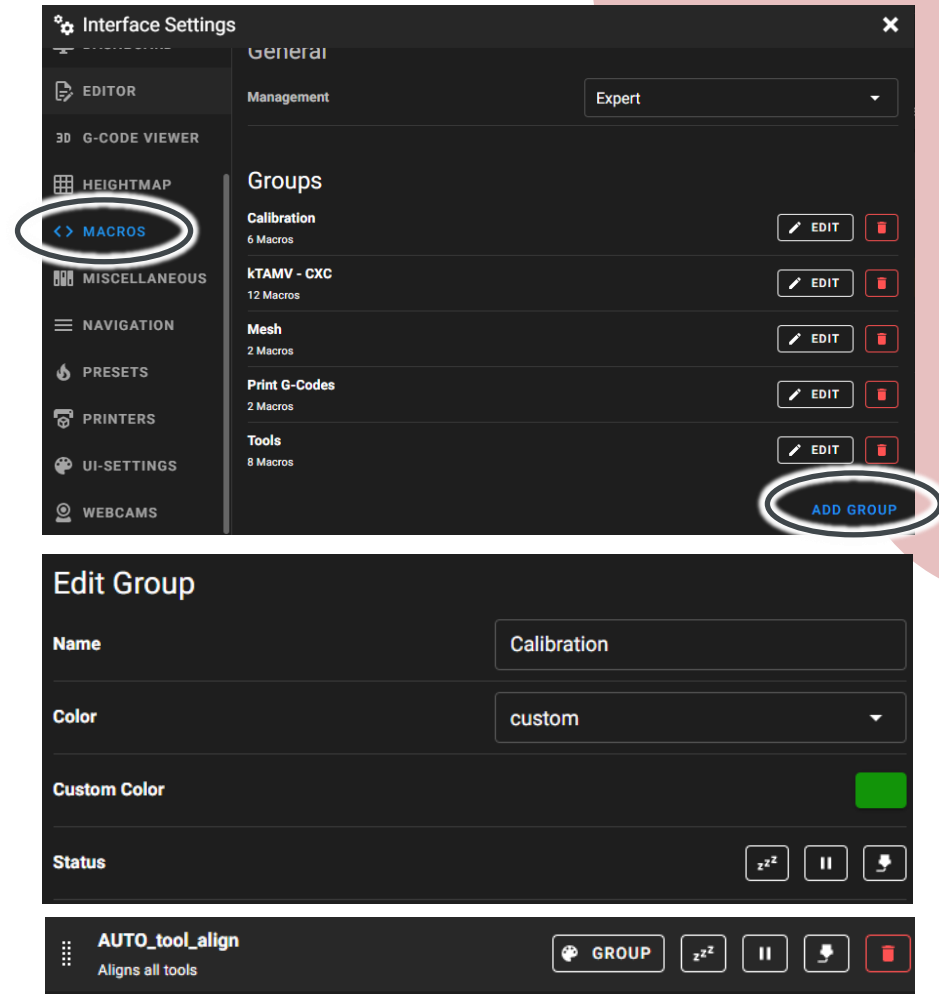
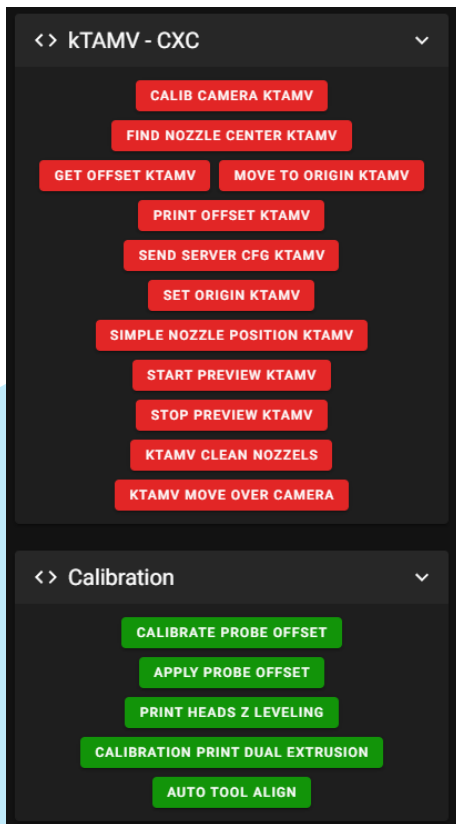

Camera installation in Mainsail

- Plug in the USB-connector from the camera
- Go to 'Interface Settings'
- Select 'WEBCAMS' menu
- Hit 'ADD WEBCAM'
- Name the Camera as you prefer
- Leave 'URL Stream' empty
- In 'URL Snapshot' type: **http://<your printer IP>:8085/image**
- For 'Service' use 'Adaptive MJPEG'
- 4-5 FPS are enough
- Power the printer OFF and then back ON from the button from behind.



kTAMV Macros

- Go to 'Interface Settings'
- Select 'MACROS' menu
- Hit 'ADD GROUP'
- Name the Group as you prefer
- Add all macros whose names contain 'ktamv' to the new group
- Select 'Edit' for the group 'Calibration' and add to it the 'AUTO_tool_align' macro



kTAMV Macros

SEND SERVER CFG KTAMV

It sends the camera configurations to the server where kTAMV runs

CALIB CAMERA KTAMV

It makes camera calibration, it determines the number of pixels per millimetre

FIND NOZZLE CENTER KTAMV

It finds the nozzle centre

SET ORIGIN KTAMV

It sets the origin to which the next tool/tools will be calibrated

START PREVIEW KTAMV

Turns the image on

STOP PREVIEW KTAMV

Turns the image off

MOVE TO ORIGIN KTAMV

Moves the selected tool to the last saved origin

GET OFFSET KTAMV

Measures the offsets of the selected tool relative to the saved origin

PRINT OFFSET KTAMV

It displays in the console the offsets that were just measured

SIMPLE NOZZLE POSITION KTAMV

Basically checks if the camera is able to recognize the nozzle

KTAMV CLEAN NOZZELS

Heats the nozzles and brush them (*Marathon specific Macro*)

KTAMV MOVE OVER CAMERA

Move the selected print head over the CXC-Camera (*Marathon specific Macro*)

AUTO TOOL ALIGN

It makes the whole determination of the T1 offsets relative to T0 automatically and saves the results in 'variables.cfg' (is an adaptation of 'ktamv_automation_example.cfg' Macro from kTAMV made for Marathon)

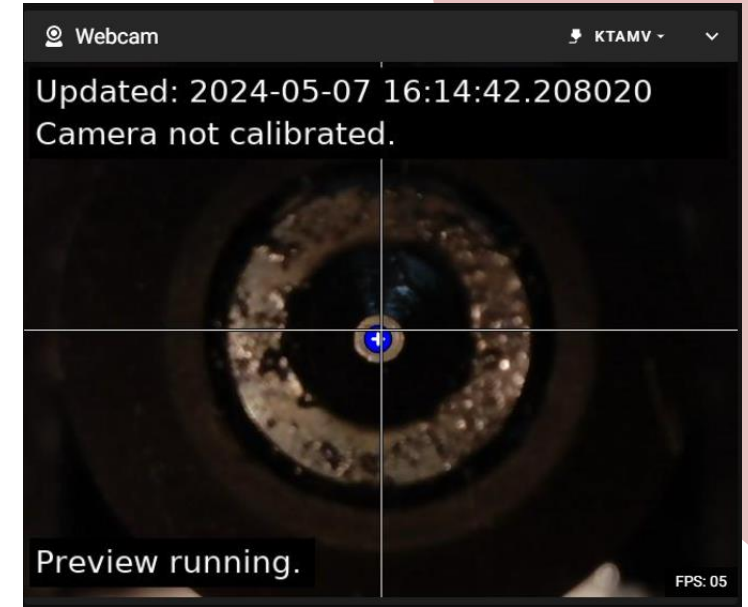
Adjust CXC Camera Lens

Before start measuring offsets the lens of CXC-Camera have to be adjusted:

- Move T0 over the camera with 'kTAMV MOVE OVER CAMERA' Macro
- Select 'KTAMV_SEND_SERVER_CFG' Macro
- Select 'KTAMV_START_PREVIEW' Macro
- Now the nozzle should be visible on the camera
- Gently adjust the lens until you get a clear image

That's it!

Integration of kTAMV with CXC-Camera is finished.



Thoughts and concerns ...

Exposure to heat → On Marathon, the CXC-Camera has no direct contact with the bed but is exposed to radiant heat emanating from it. Theoretically, cameras like the CXC should be fine up to 70°C. However, if there are concerns about heat exposure, when not in use, the camera can be parked somewhere away from the bed.



Constantly ON → "I have no data on whether keeping the camera constantly on would prematurely wear it out. However, if there are concerns about the effects on the camera from being constantly kept on, the USB connector can be unplugged and it can be parked aside, resting on a magnet.

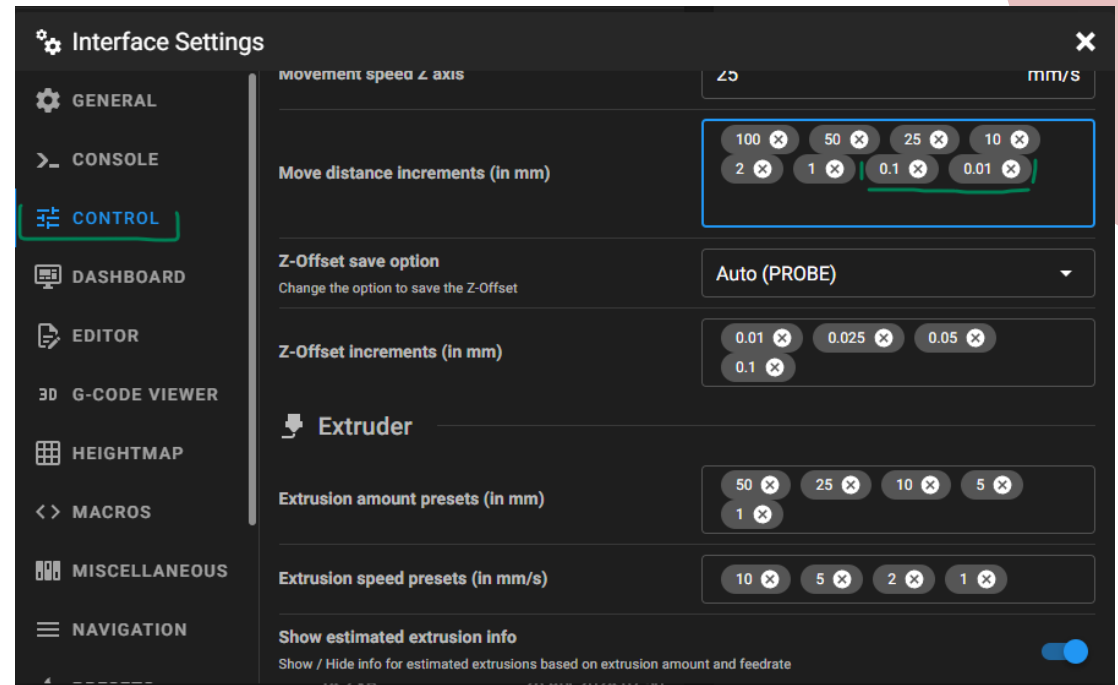
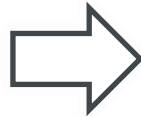


Measuring the Offsets manually

kTAMV is very particular and picky when it comes to the cleanliness of the nozzles. The nozzles have to be perfectly clean in order to be detected by the kTAMV.

The measuring of the XY offsets from T1 can also be done manually in a manner very similar to the original Windows app from Ember Prototypes.

Make sure that in interface you have small increments:

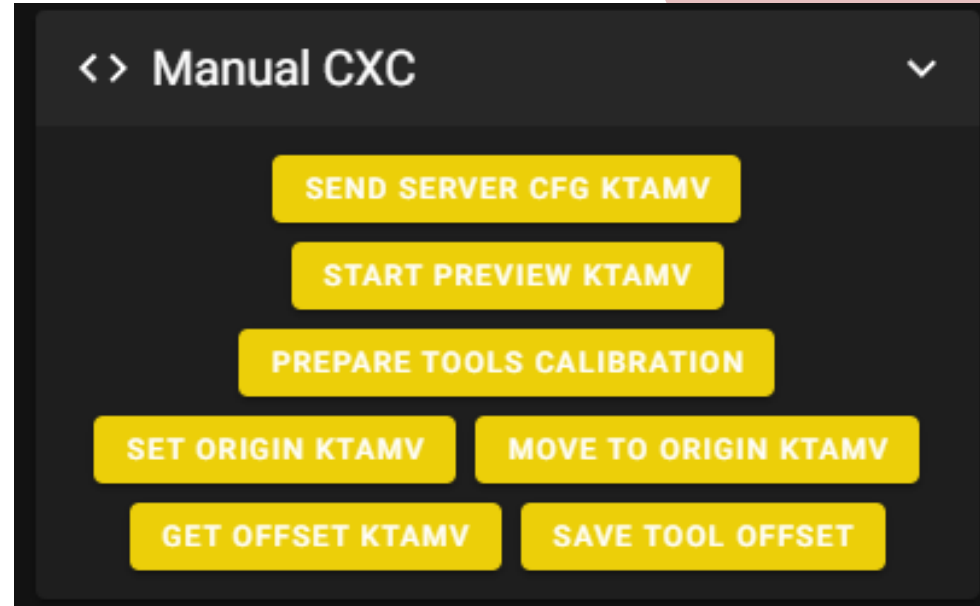


Measuring the Offsets manually

Make yourself an extra Macro Group like described.
Execute in order the following steps to measure manually the offsets from T1:

1. Execute '**SEND SERVER CFG KTAMV**' → it wakes up the kTAMV Server
2. Execute '**START PREVIEW KTAMV**' → it opens the camera
3. Execute '**PREPARE TOOLS CALIBRATIONS**' → it cleans the tools, deletes the old offsets and position T0 over the camera
4. Move T0 from the interface until it is perfectly centred to the camera
5. Execute '**SET ORIGIN KTAMV**' → it sets the origin to which the offsets from T1 will be measured
6. Select T1
7. Execute '**MOVE TO ORIGIN KTAMV**' → moves the selected tool to origin (in this case T1)
8. Move T1 from the interface until it is perfectly centred to the camera
9. Execute '**GET OFFSET KTAMV**' → it calculates the offsets of the current tool relative to the saved Origin
10. Execute '**SAVE TOOL OFFSET**' → it saves the offsets in '*variables.cfg*'

That is it !



Marathon

Happy printing!

**kTAMV Project:**

<https://github.com/TypQxQ/kTAMV.git>

CXC-Camera:

<https://www.emberprototypes.com/products/cxc>

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