Hawkeye User Manual

Introduction

This is a modification kit for the Wolverine telecine machine. The kit is based on a new controller board and a new camera. It is designed to replace the stock Wolverine controller with much improved video quality.

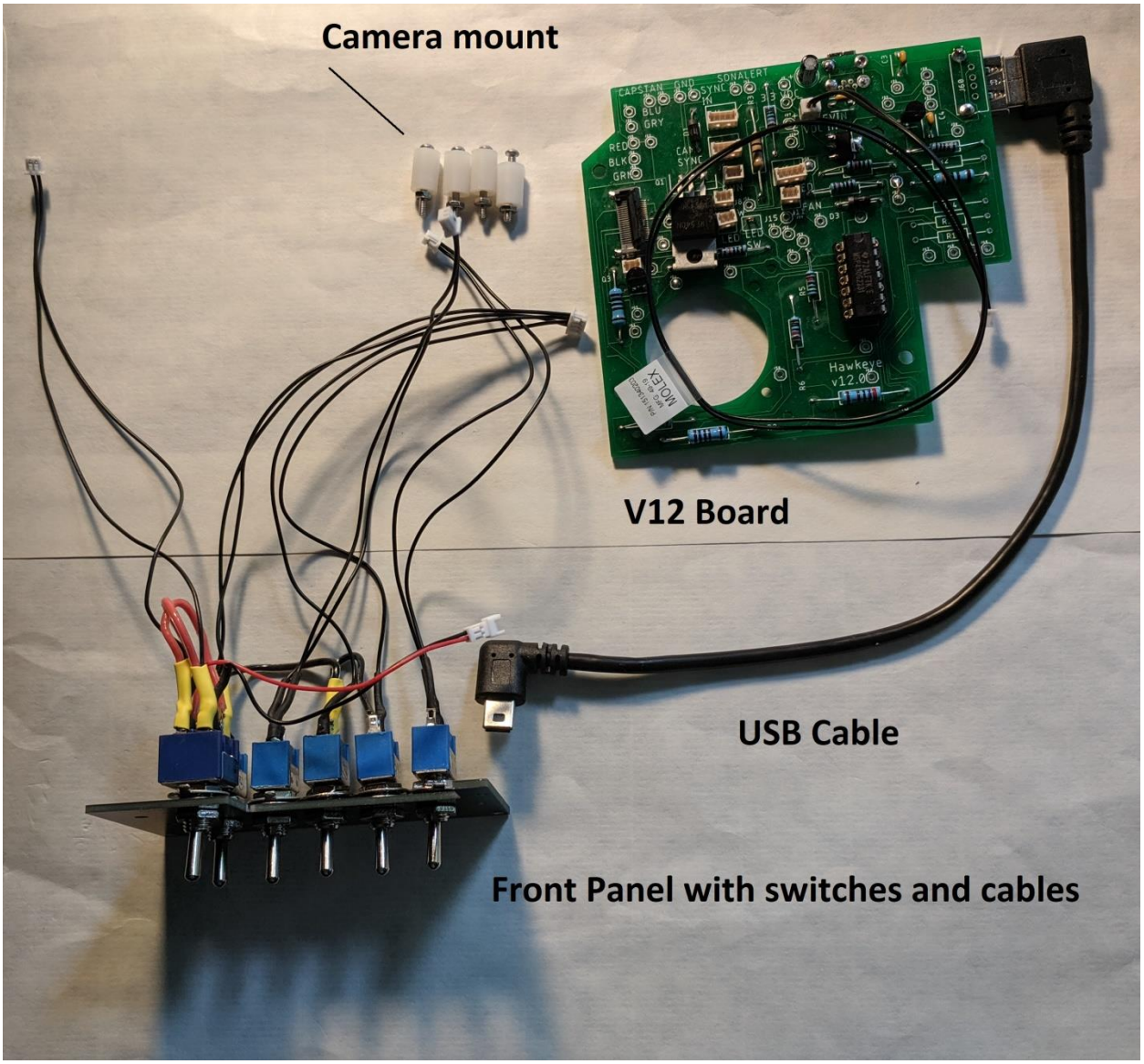
The controller and camera shipped by Wolverine captures the 8mm movie as an MP4 stream and very little control is given to the user. Most common complaint is high compression and digital effects that can be very bothersome to some users.

This new board can be combined with the camera (camera not included) and lens that captures the movie as a sequence of images into the laptop and it allows the user full control of image and stream parameters.

What is included with the kit

The kit contains the following components:

Ux226



The kit does not include the camera, the lens and the lens mount. All other components required for completely functioning unit are provided with the kit.

Note: The capstan is not included. The capstan can provide an alert when the film gets stuck due to damaged perforations, or optionally it can actively try to pull the film out of the jam.

Camera Information

The kit works with the following camera models:

DFM 72BUC02-ML

DFM 37UX226-ML

The two cameras are similar with the UX226 providing higher resolution capability and somewhat better color tones especially in the dark areas. The kit provides the standoffs for the BUC02 model only and different standoffs may be required for the UX226 but the mounting holes have the same spacing.

Here is a chart showing what standoffs are required for the two cameras and different resolutions and 12mm and 16mm lenses:

DFM72BUC02-ML

Lens Calculator	12mm	16mm
B	36.67329545	40.77005348
a	17.83626943	26.33506045
d=a+b	54.50956488	67.10511392
sensor to top of the lens distance		31.33506045
film to hawkeye board distance (see image)	47.5	47.5
F	12	16
Spacers required	7.009564885	19.60511392
Resolution needed horizontal	1280	1700
Resolution needed vertical	1024	1299
Pixel dim [mm]	0.0022	0.0022
Image Horizontal	2.816	3.74
Image Vertical	2.2528	2.8578
Super8 frame [4.01 x 5.79]		
Super8 Horizontal	5.79	5.79
Super 8 Vertical	4.01	4.01
Magnification required for 1280x1024 pixels	0.486355786	0.645941278

The BUC02 works best with the 3/8” spacers (9.5mm) when a 12 mm lens is used. Going with shorter spacers will produce higher pixel resolution but will result is soft corners.

It is possible to get a better resolution and better focus with the 16mm lens and 20mm spacers.

DFM 37UX226-ML

Lens Calculator	16mm	16mm	16mm
B	55.12162162	47.2972973	41.03784
a	22.54369603	24.17962003	26.22453
d=a+b	77.66531765	71.47691733	67.26236
	27.54369603	29.17962003	31.22453
film to hawkeye board distance (see image)	47.5	47.5	47.5
F	16	16	16
Spacers required -subtracted 5.5mm for holder	24.66531765	18.47691733	14.26236
Resolution needed horizontal	1280	1600	2000
Resolution needed vertical	1024	1200	1500
Pixel dim [mm]	0.00185	0.00185	0.00185
Image Horizontal	2.368	2.96	3.7
Image Vertical	1.8944	2.22	2.775
Super8 frame [4.01 x 5.79]			
Super8 Horizontal	5.79	5.79	5.79
Super 8 Vertical	4.01	4.01	4.01
Magnification required for 1280x1024 pixels	0.408981002	0.511226252	0.639033

Note that all resolutions are not available. Currently only the low and high resolutions were tested. The medium resolution with 18.5mm spacers is hard to set up because the lens has to be extended beyond the holder length. If a holder extender is added, the lens hits the bottom of the extender (dead spot). The high resolution with 14.5 mm spacers is achievable but the corners become a bit soft (barely noticeable). The problem with the high resolution is the space used on the hard disk and the post process becomes very slow.

The low resolution with 24.5mm spacers is a good choice. The pixel resolution is still comparable to Wolverine and the whole frame is in very sharp focus. The post-processing time is acceptable.

The cameras can be ordered from:

https://www.theimagingsource.com/

or:

https://www.oemcameras.com/

When ordering, make sure to include the 12mm f2.8 lens and the lens mount if you plan to use the 12mm lens.

If the 16mm lens is to be used then order the cameras without the lens. For the BUC02 you will still need the M12 holder. You may need to get a quite from the supplier for that. For the UX226 order the camera only without the lens but make sure to include the lens holder.

Here is an example quote from IS:

Item	Qty.	Product Description	Unit Price	Total Price
DFM 37UX226-ML	1	The Imaging Source board camera, color, USB 3.1, 1/1.7" Sony STARVIS IMX226, rolling shutter, resolution 4000x3000, WITHOUT lens, lens mount and cables	USD 329.00	USD 329.00
TLH 10-29.29s	1	Lens holder for the The Imaging Source 37 board cameras series, thread 12x0.5 mm, fixing screw, tube length 10 mm	USD 25.80	USD 25.80

USD 354.80

Shipping & Handling: $25 FedEx ground for domestic shipment
***Shipping cost will vary due to package weight and value of goods ***

Terms of Payment: Credit card (Amex, Visa, MasterCard), wire transfer, EFT
Delivery Time: Upon confirmation of receipt of payment
Quote Validity: 30 days

You can get the 16mm lens from the following source:

https://www.aico-lens.com/product/16mm-f2-2-f5-6-f8-10mp-m12-cctv-board-4k-macro-lens-ach1622mac/

You will have to request a quote from the supplier. They will ask you for the application details. You can send the following info or something similar to it:

==========

The name of the business is:
Name of your small business or say for personal use

Here is the camera specs:
sensor size 2/3"
resolution, 10MP
focal length 16mm

F no 5.6
D/H/V of object 5.79x401mm D = 7.04
FOV - should be able to cover 80% of sensor based on the above specs for object size and sensor.
The sensor used is Sony IMX226CQJ
==========

Also make sure that you have the right usb cable for camera-laptop connection. Check the camera website for cable recommendations.

It should be also noted that some of the camera spacers may require installation of the lens holder extension:

https://www.amazon.com/Universal-Lens-Extension-Metal-Camera/dp/B07JJ7S3ZP/

The extension is required because the stock holder may not be long enough for proper focus.

Once you receive the camera, download IC Capture software from:
https://www.theimagingsource.com/products/board-cameras/usb-2.0-color/dfm72buc02ml/

Connect the camera to your laptop and test it using the IC Capture software.

Wolverine Disassembly Instructions

Before the kit installation the original controller and camera have to be removed from the unit. Carefully read the following instructions.

Word of advice:

Follow the instructions carefully and do not apply force to any parts during disassembly. Pay attention to fragile small connectors and ribbon cables. Use the right size screwdriver to avoid stripping the screw heads. Make sure the power is disconnected and the SD card is out. Avoid touching the lubricated parts.

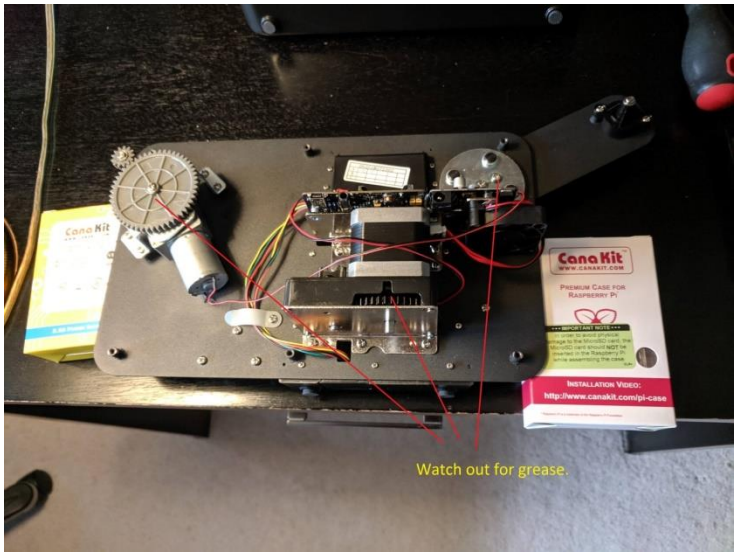
Disconnect power, Remove SD card and film reels.

Set the unit on a table with enough work space around it.

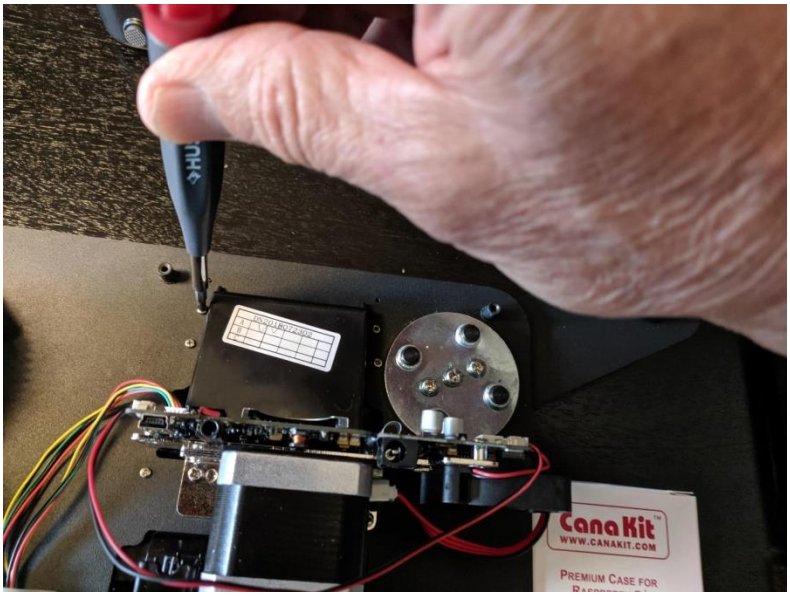
Make sure SD card is out and power disconnected.

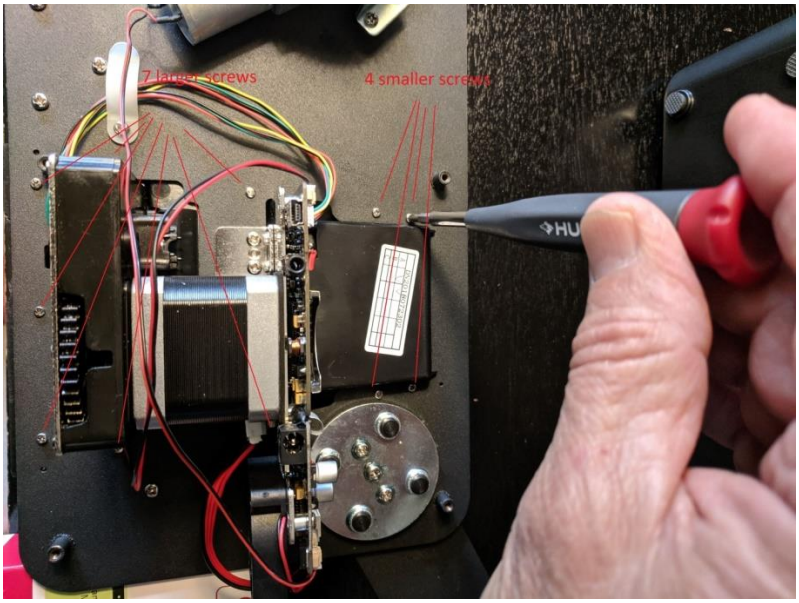
Lay the unit face down on the table. Add support to the sides by using empty boxes of right size or similar support. Remove 6 cover screws (the number of screws varies depending on the model). Set the screws on the side in a small container and mark them up. It is important not to mix up the screws because other unit components use the same thread screws but different sizes.

Remove the cover. Observe the greasy areas and avoid touching them.

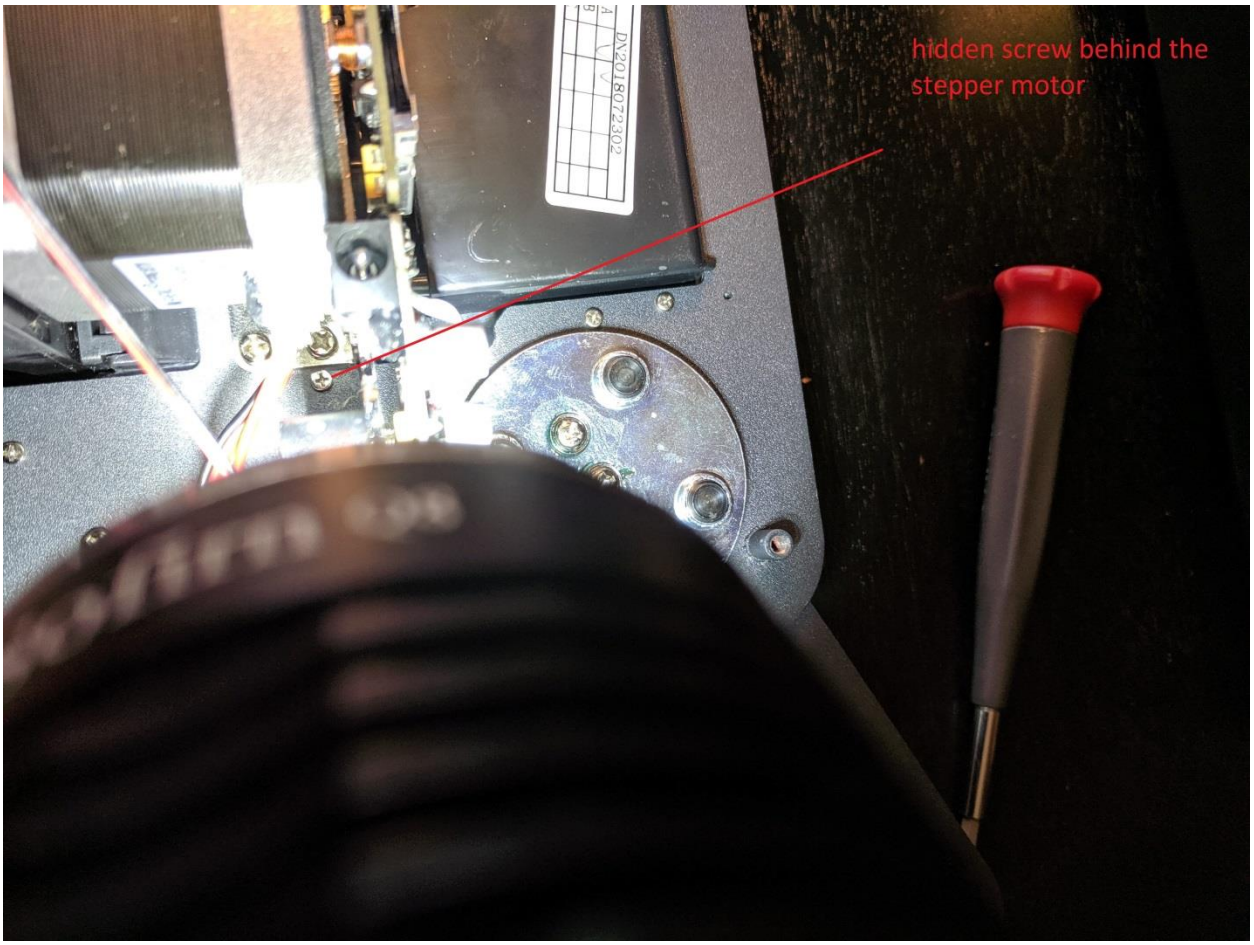


Remove the front cover screws. There are 11 of them, 4 for the top part. These are smaller screws and 7 for the bottom part. Make sure not to mix them.





One of the larger screws is hidden beside the stepper. Don’t forget that one.

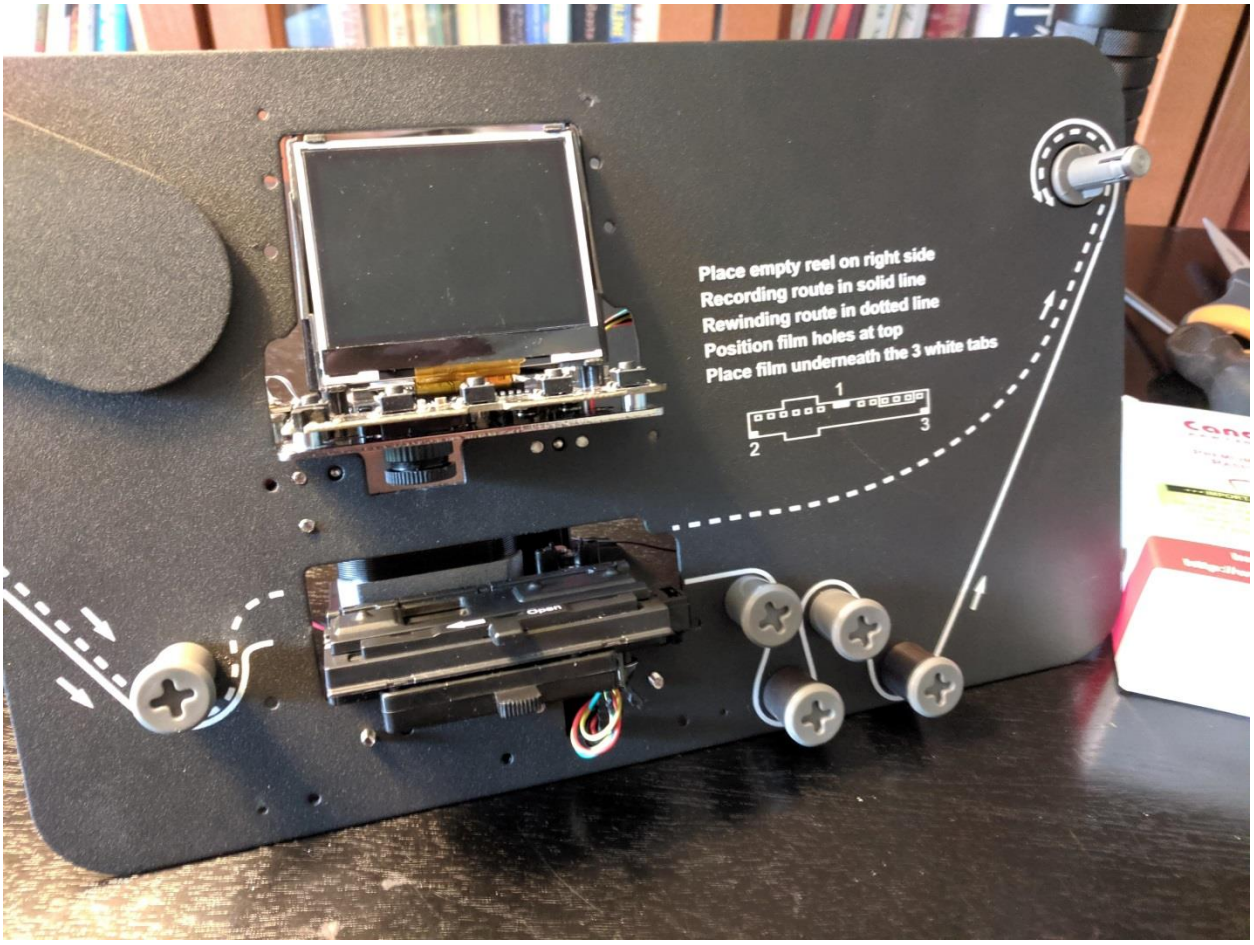


Store the screws a container, or a jar or whatever. It is easy to lose them.

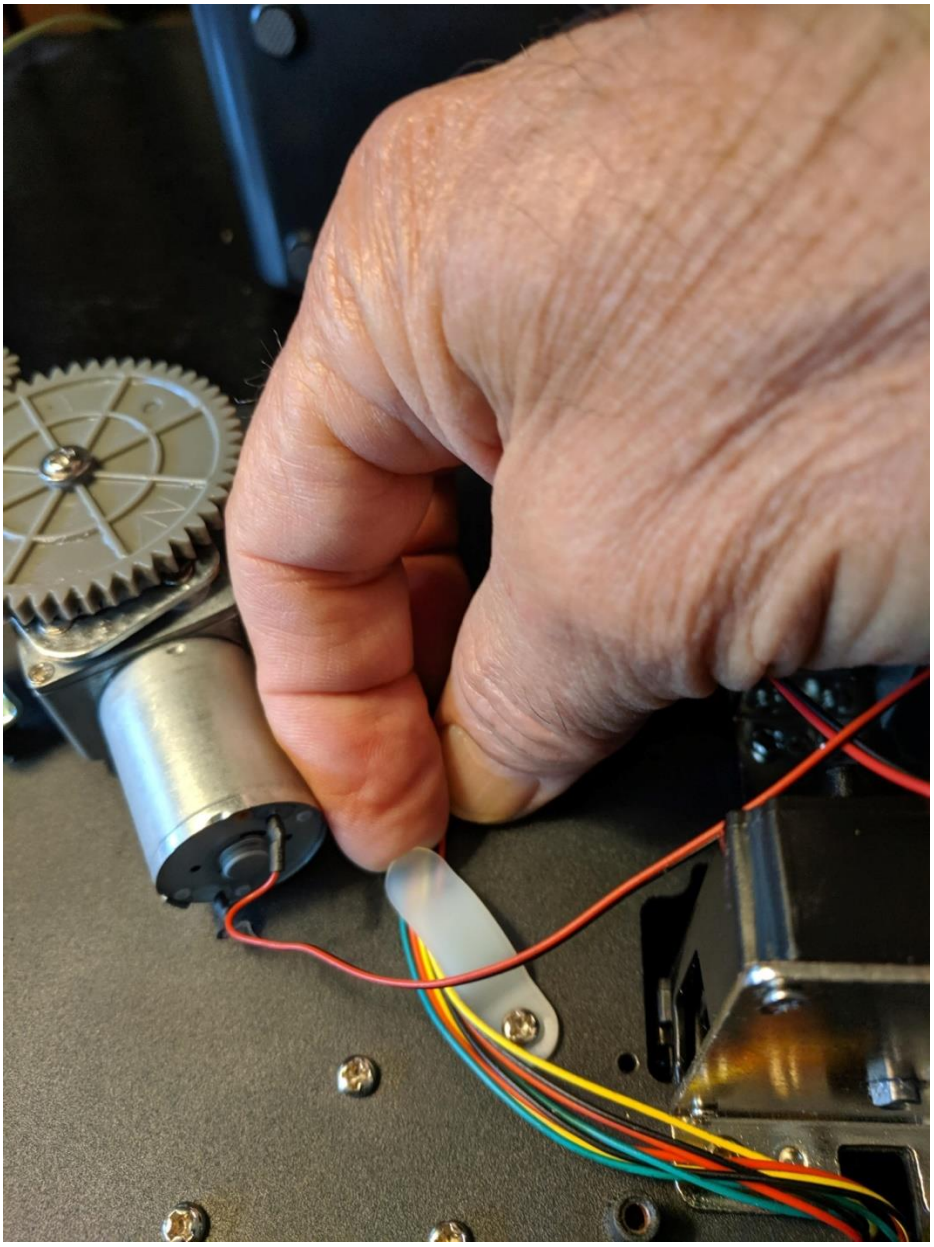
Set the unit upright and leave it supported by the stepper motor bottom Make sure not to touch the stepper gear. It has grease on it.

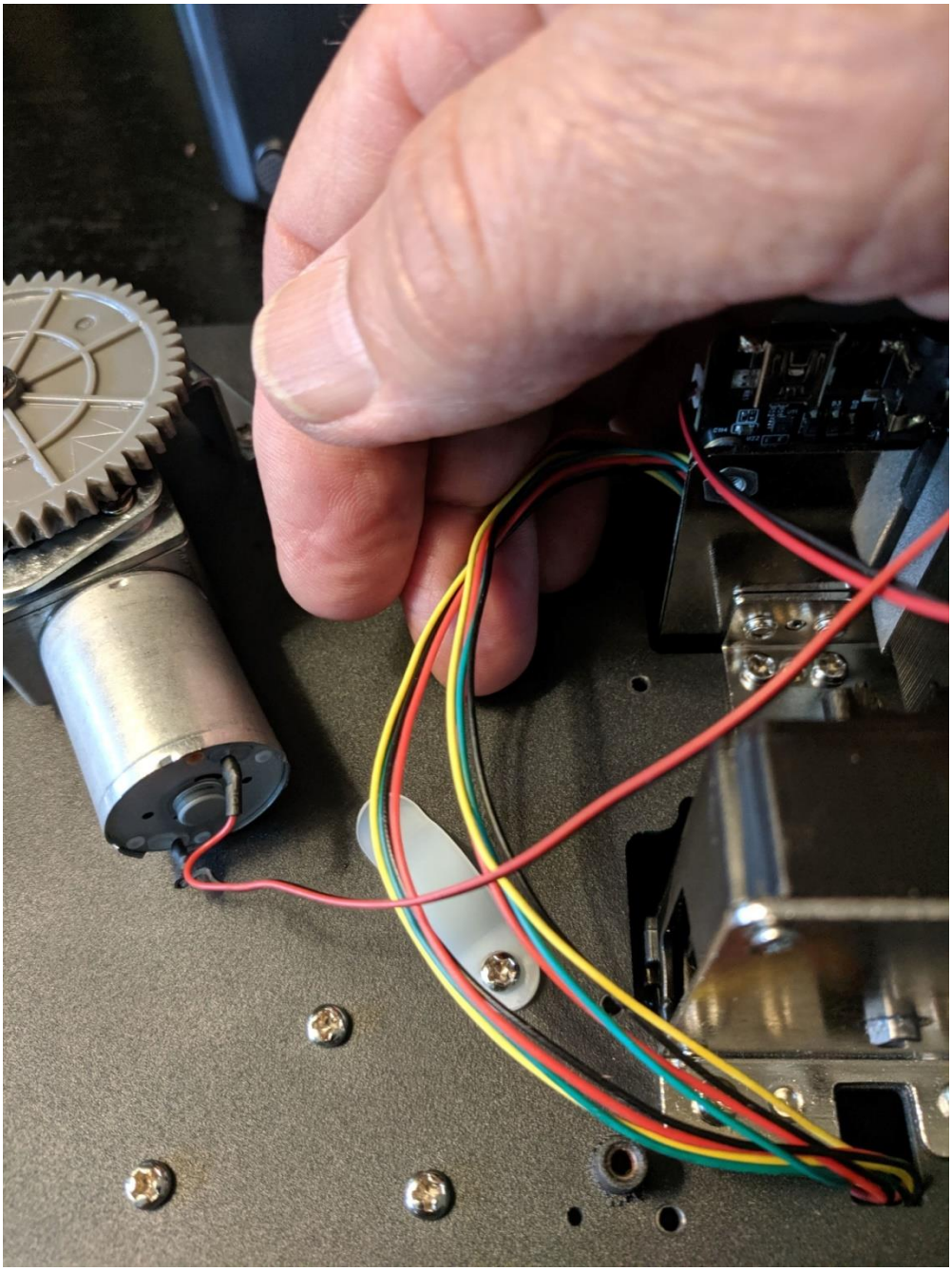
Grab the plastic front cover as shown and slightly push upwards and wiggle it out. DO NOT USE FORCE. It may take some time but it will come out. If it does not, make sure that all 11 screws have been removed.

The picture shows the front of the unit with the cover removed.

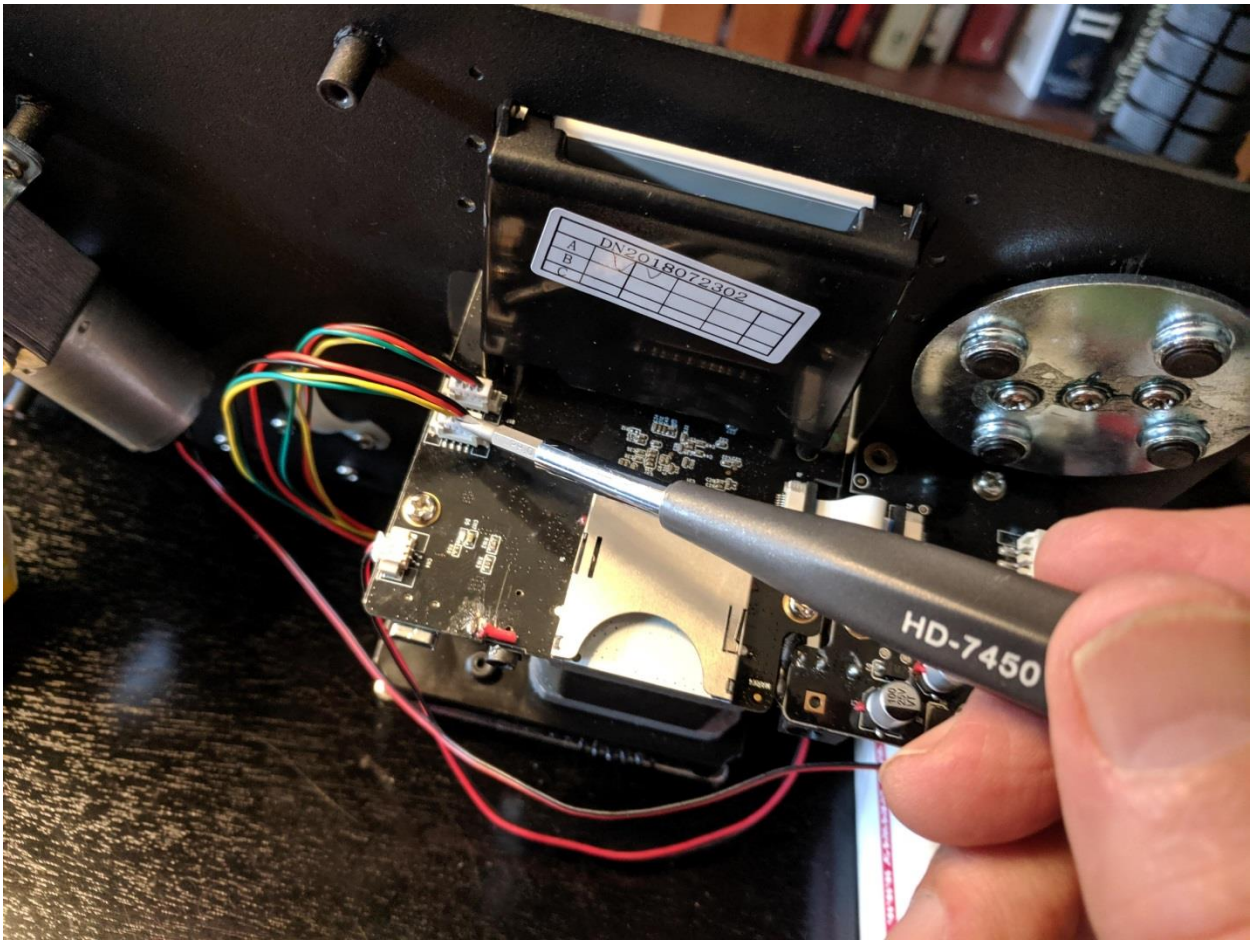


Slide the sync and S8/R8 switch cables from underneath the retainer clip.



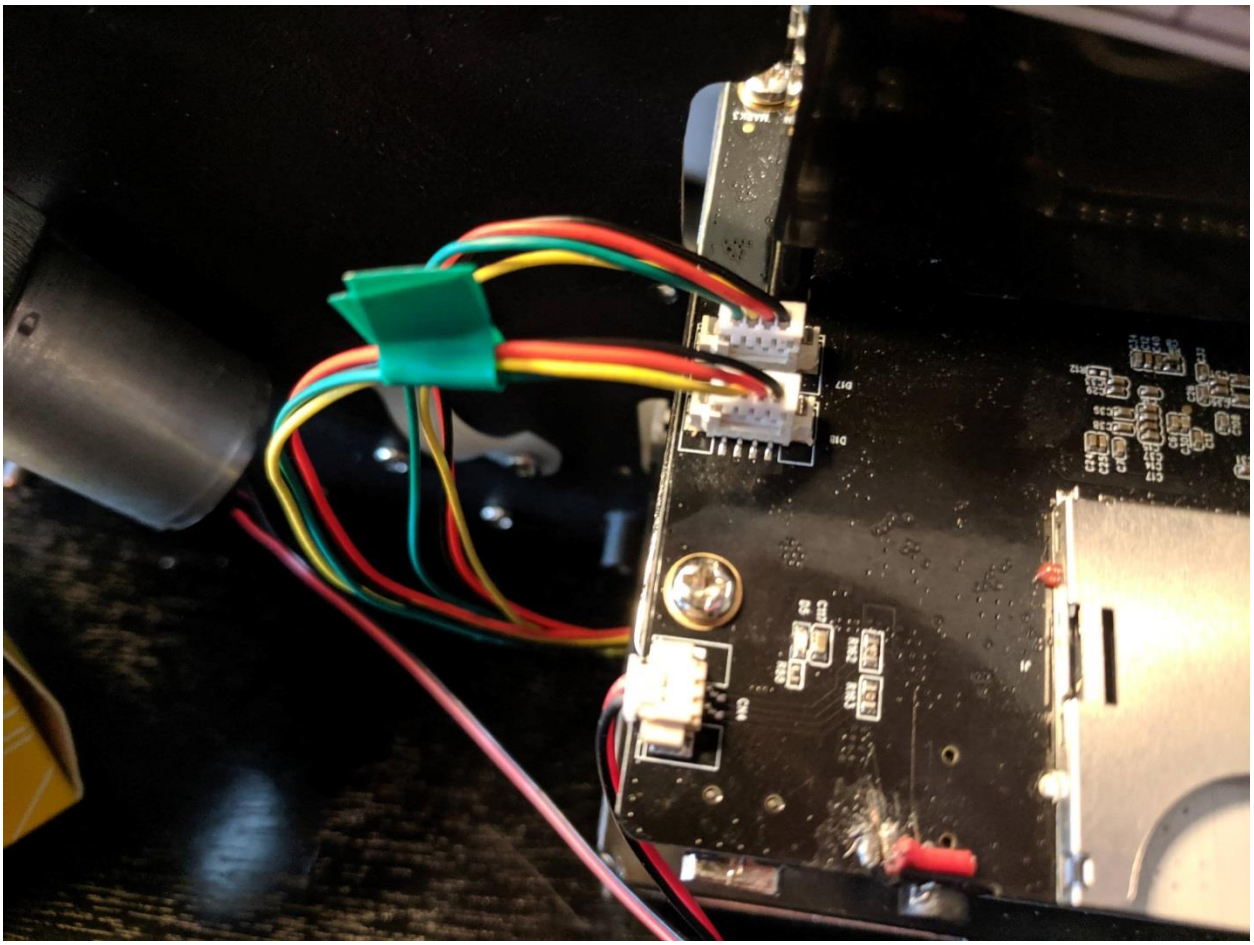


Disconnect sync and super 8 switch cables from the main board.

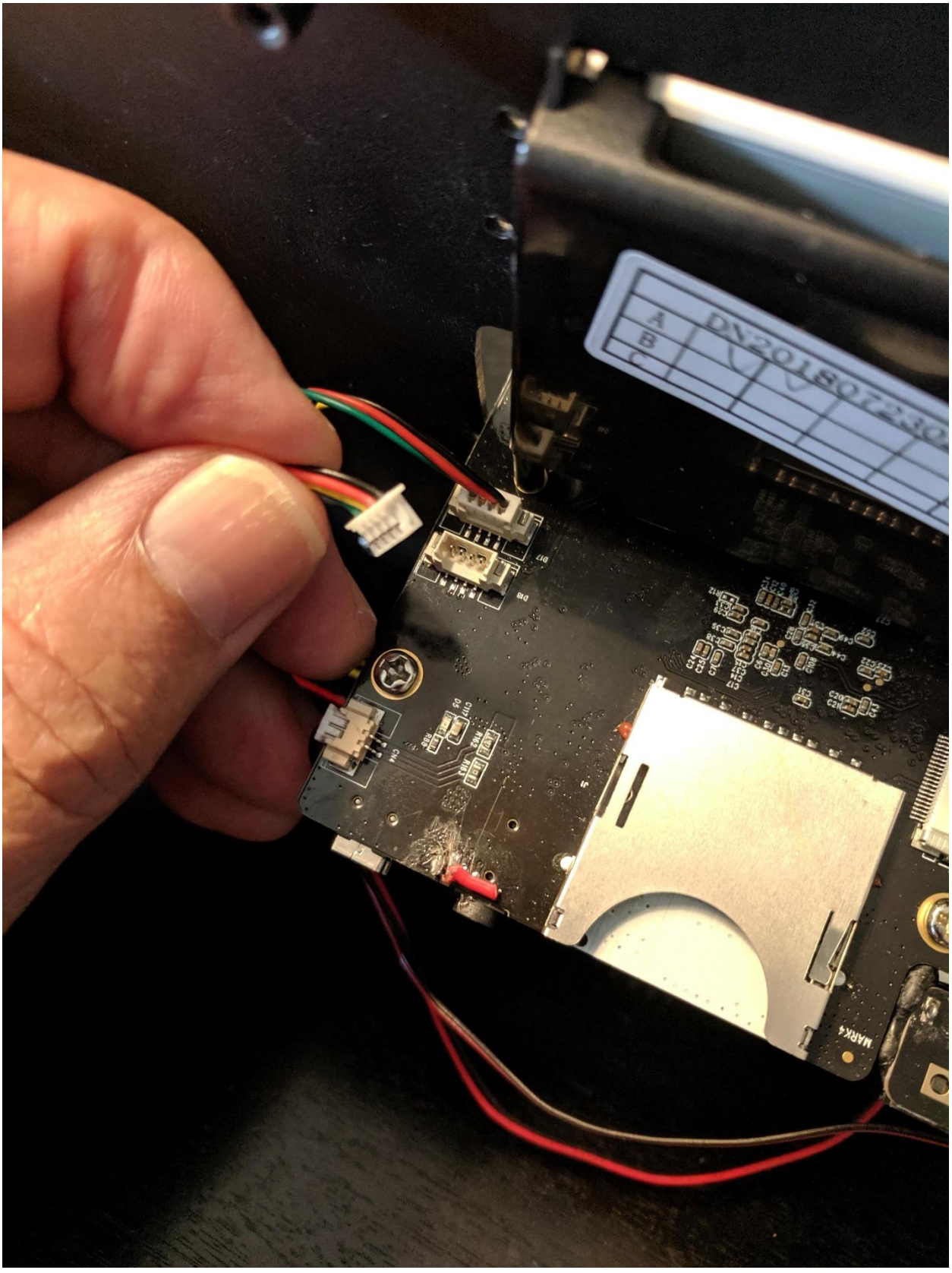


The connectors are interchangeable so make sure to mark one of the cables. The one towards the front of the unit (that does not have the green tape on it) is the sync cable that you will need later. The cable tagged with the green tape (I added the green tape) is from the R8/S8 switch and is not required for the

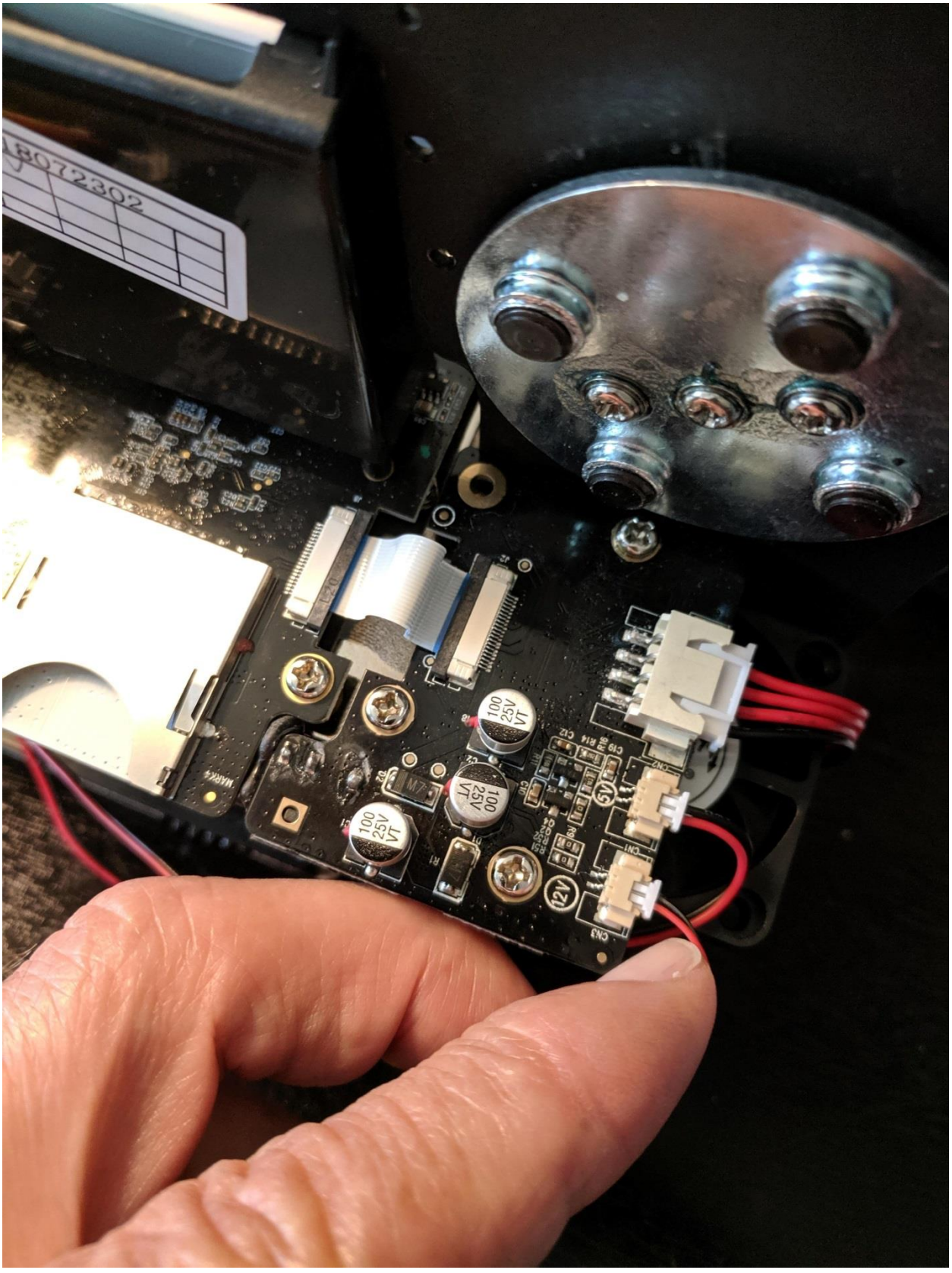
new board. Wiggle the connectors out. Do not pull hard.



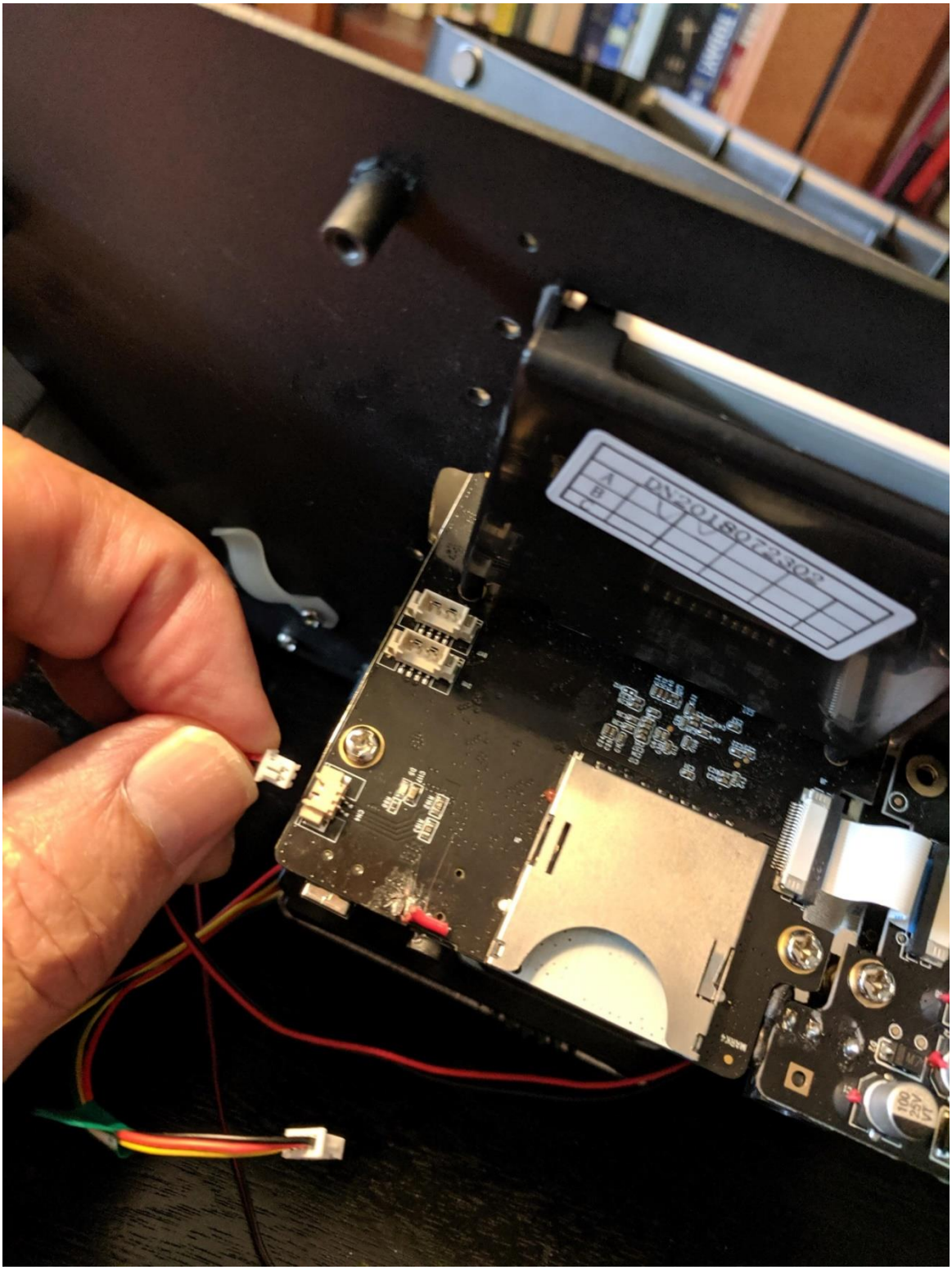

A
B
C


A
B
C
MARK4

Remove the fan connector from the power supply. Tag this cable because you will be connecting it to the adapter cable provided and then to the new controller. Leave the takeup motor connector connected for now..


100
25V
VT
100
25V
VT
100
25V
VT
5V
12V

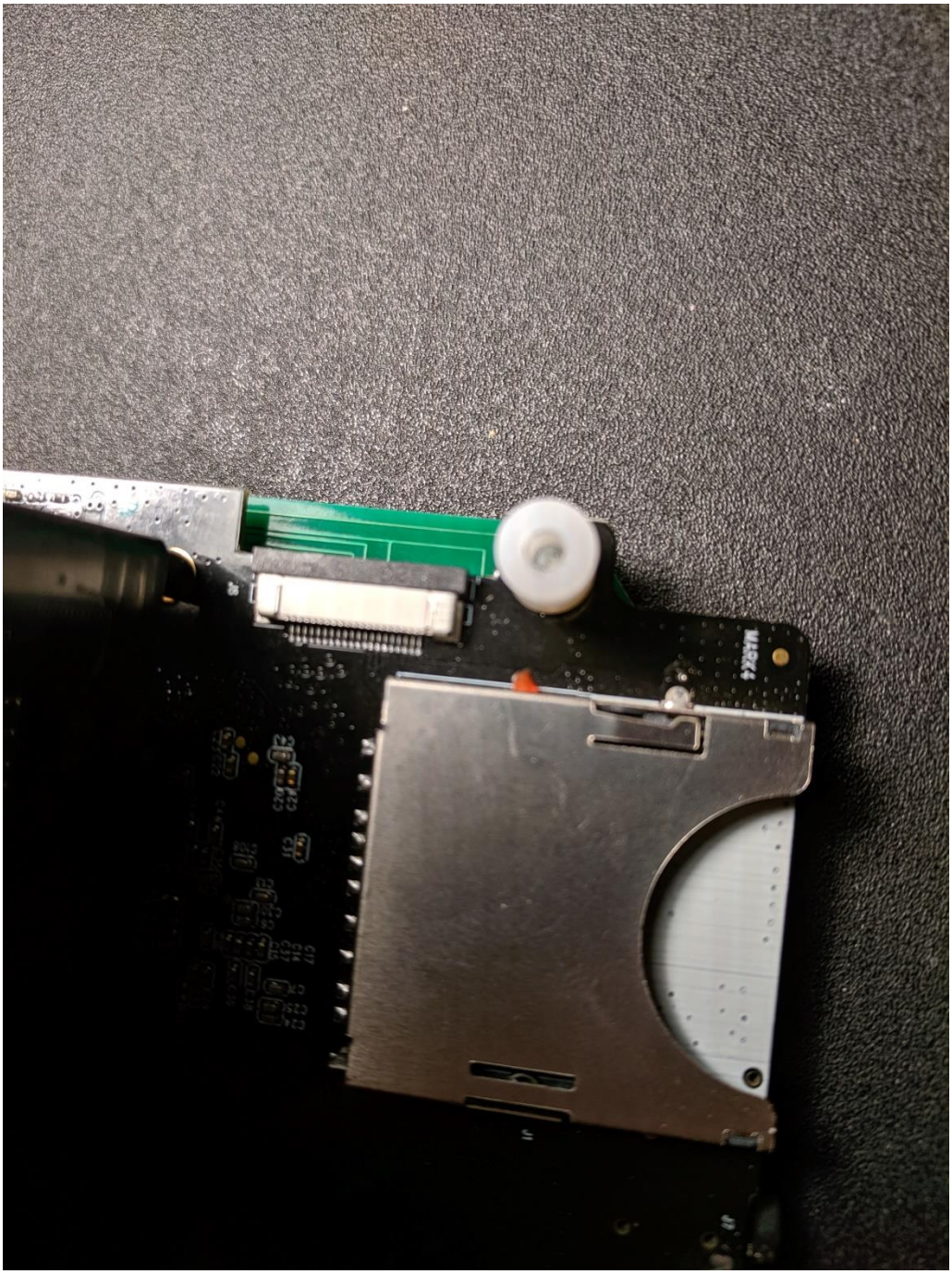
Disconnect the LED connector as shown. You will be connecting this connector to the new board. Put a tag on it.



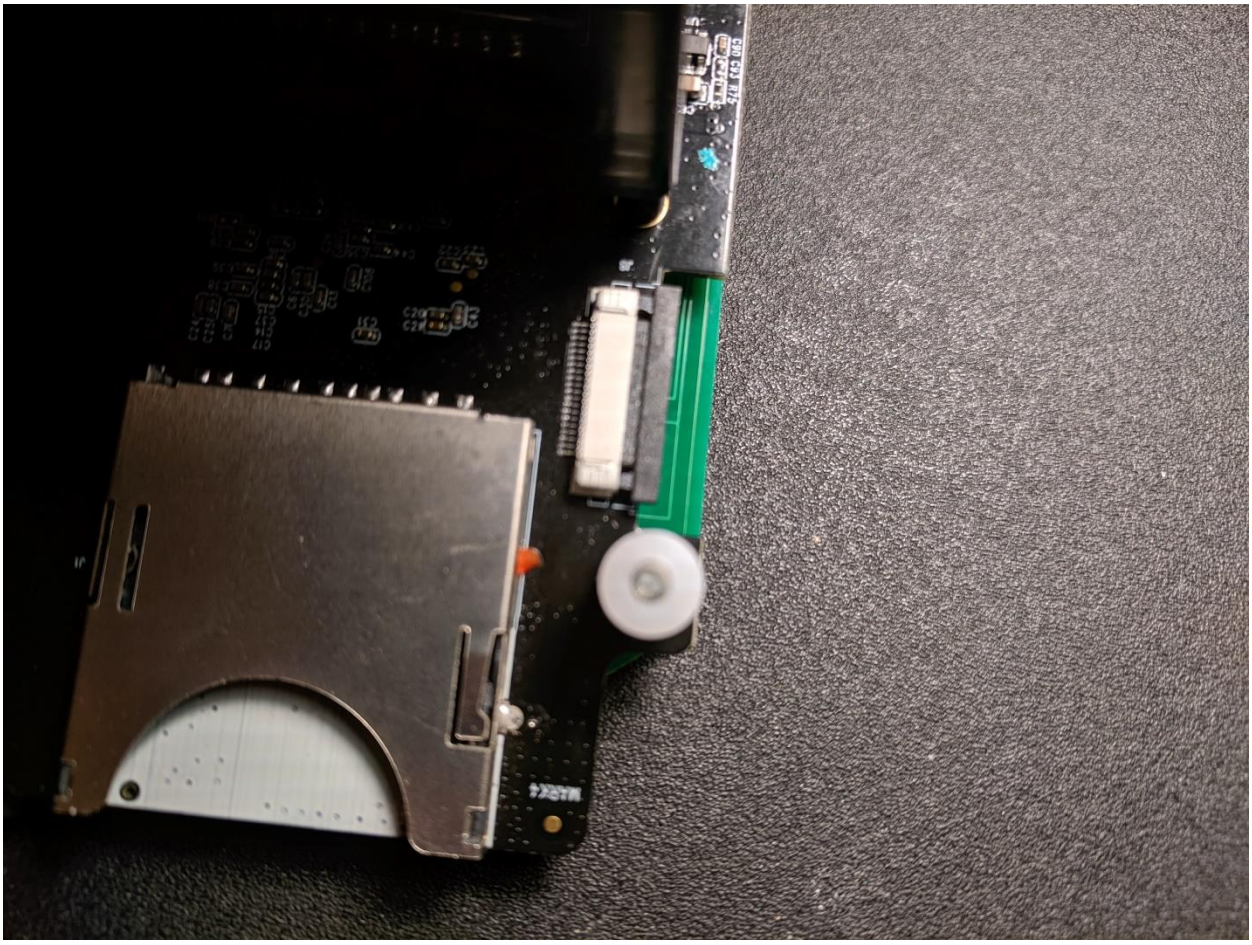
Disconnect the flex connector that connects the controller to the power supply. Be careful with this connector because it can break easily. Do not apply any excessive force.

The flex connector on the controller side has to be “unlocked”. You can do that by pushing the black tabs horizontally towards the power supply. The lock lever will slide out a bit leaving a small gap between the lever and the connector. Once done the cable will become loose and can slide out.

Here is the picture showing the locked connector.

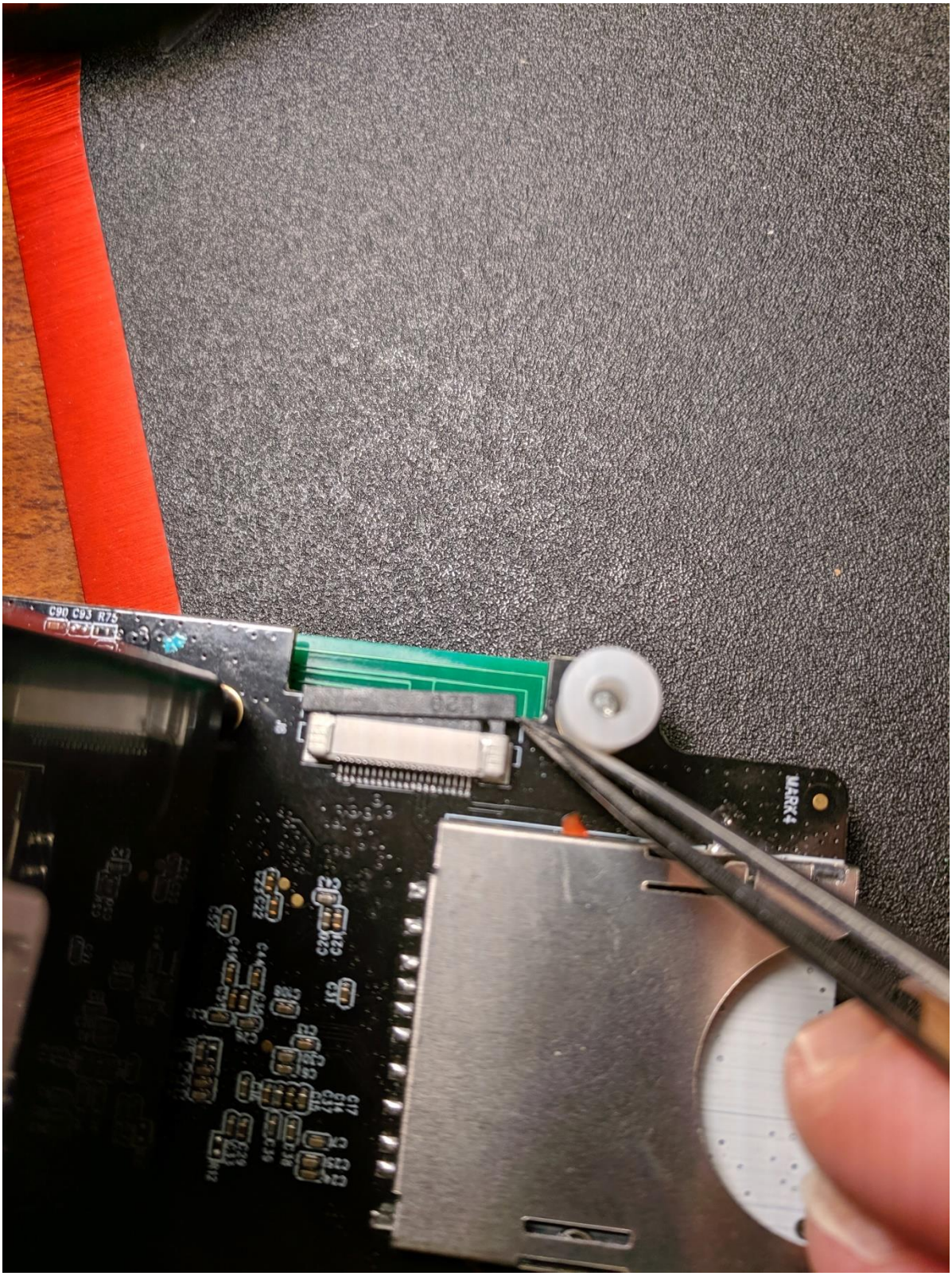


And here is the picture of unlocked connector:

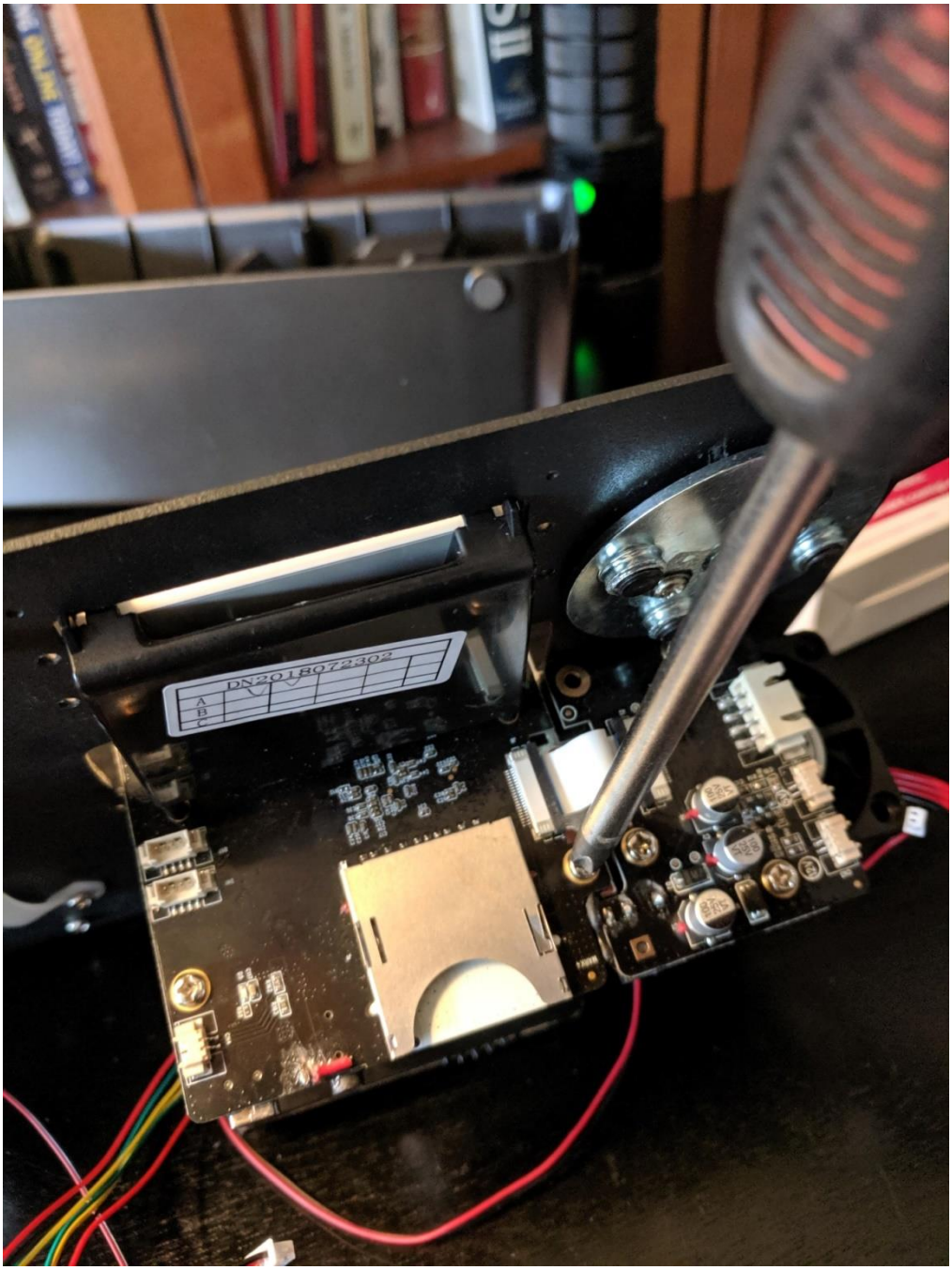


:

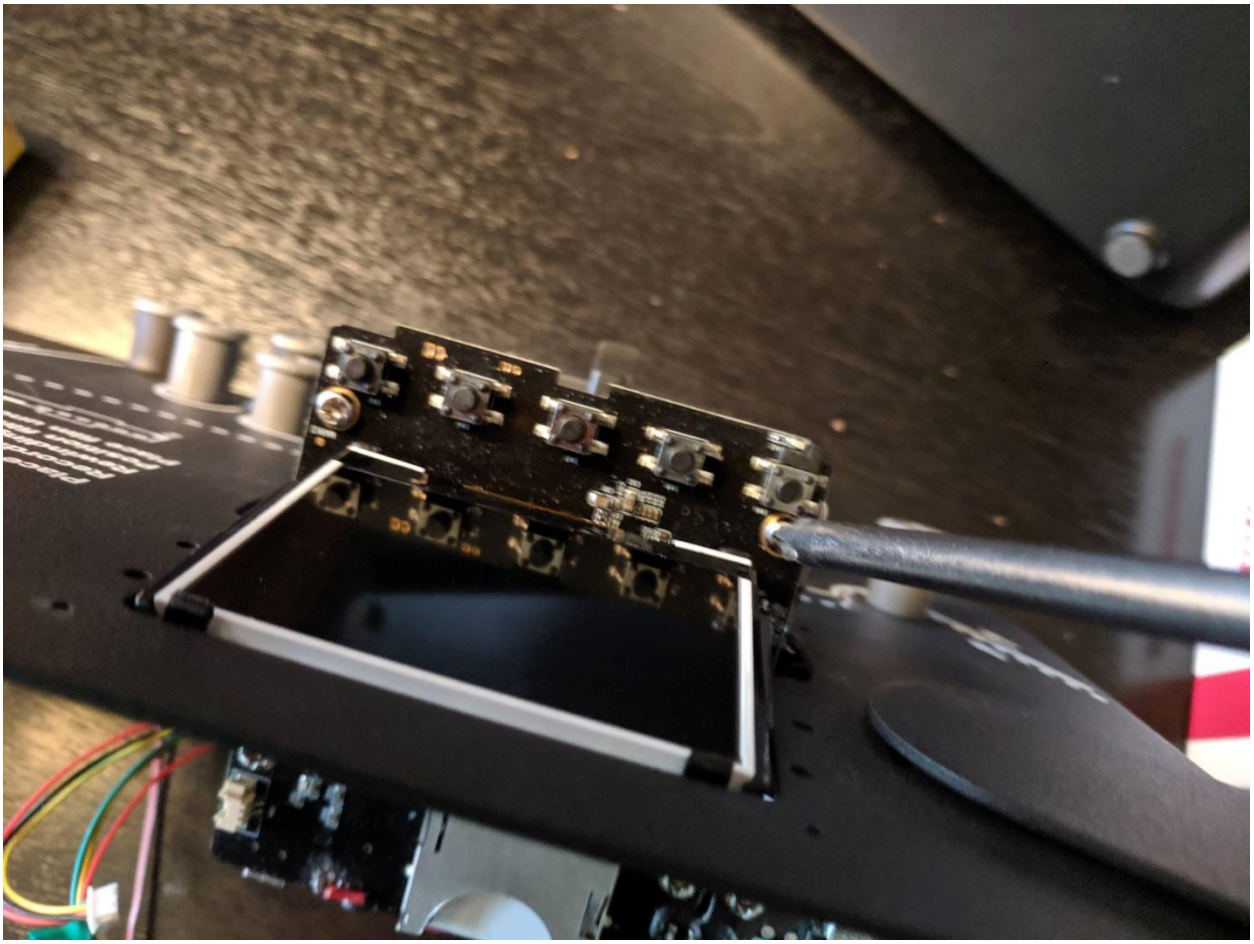
Here is the picture of the connector being unlocked:



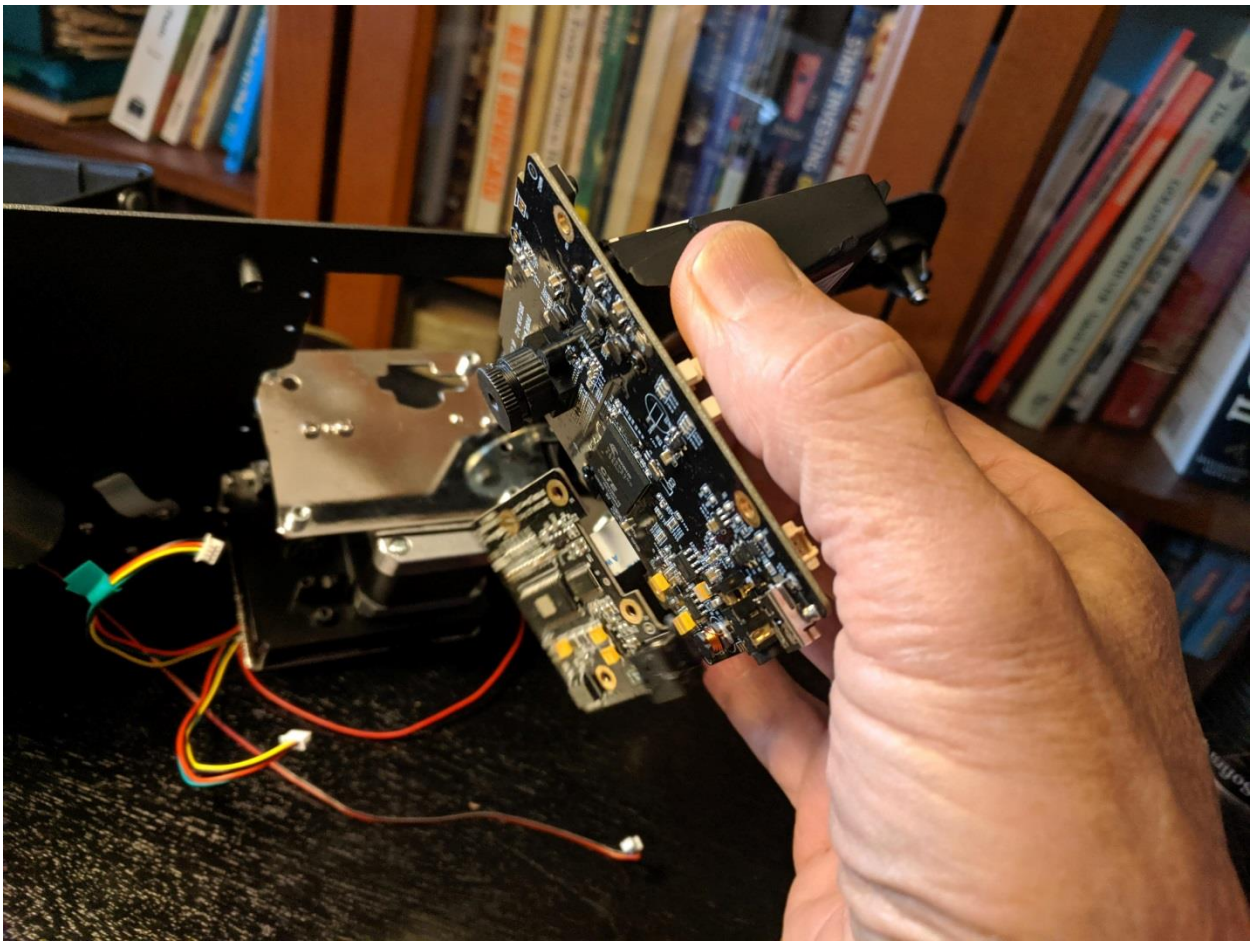
Remove the four controller board screws. Do not remove the power board screws.

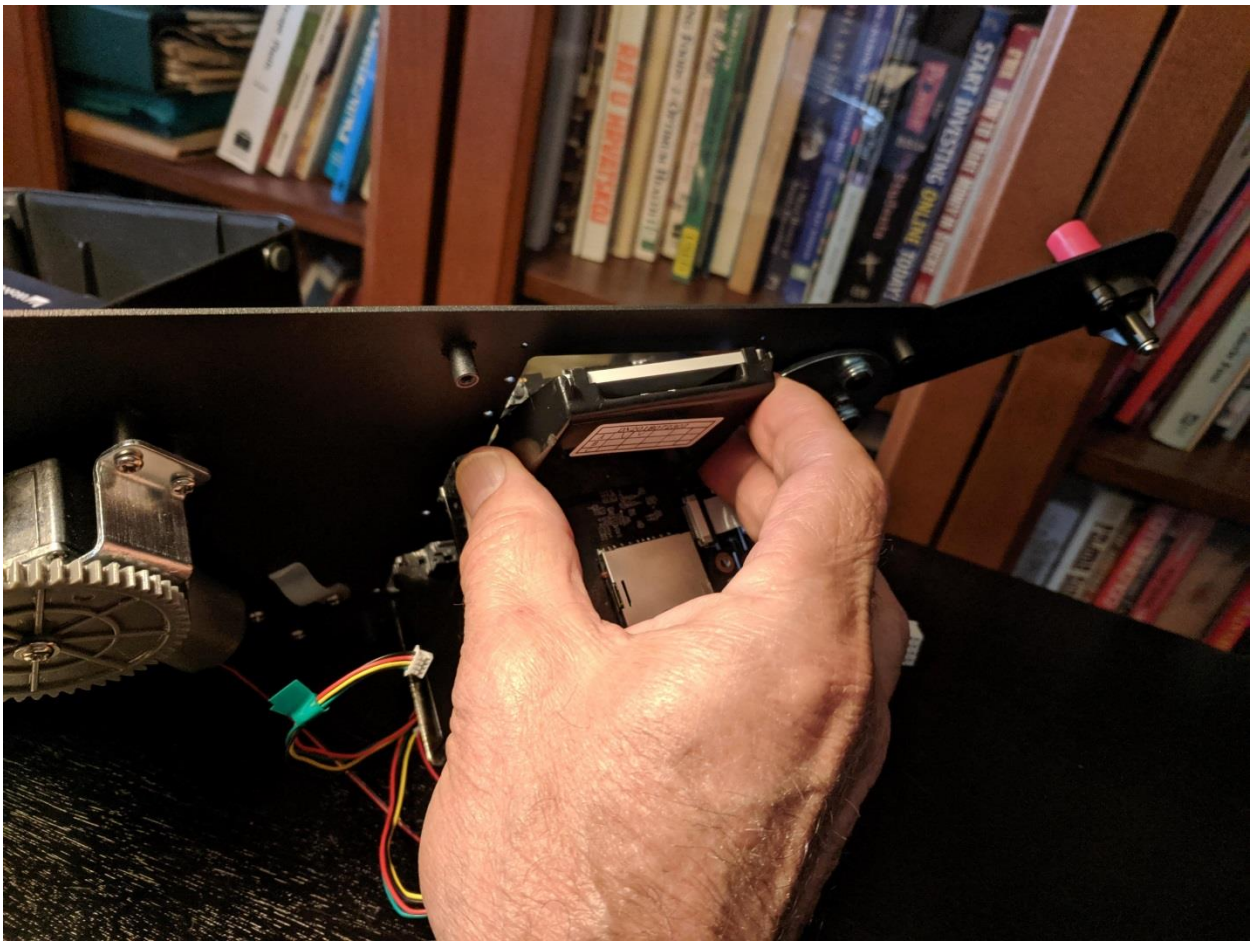


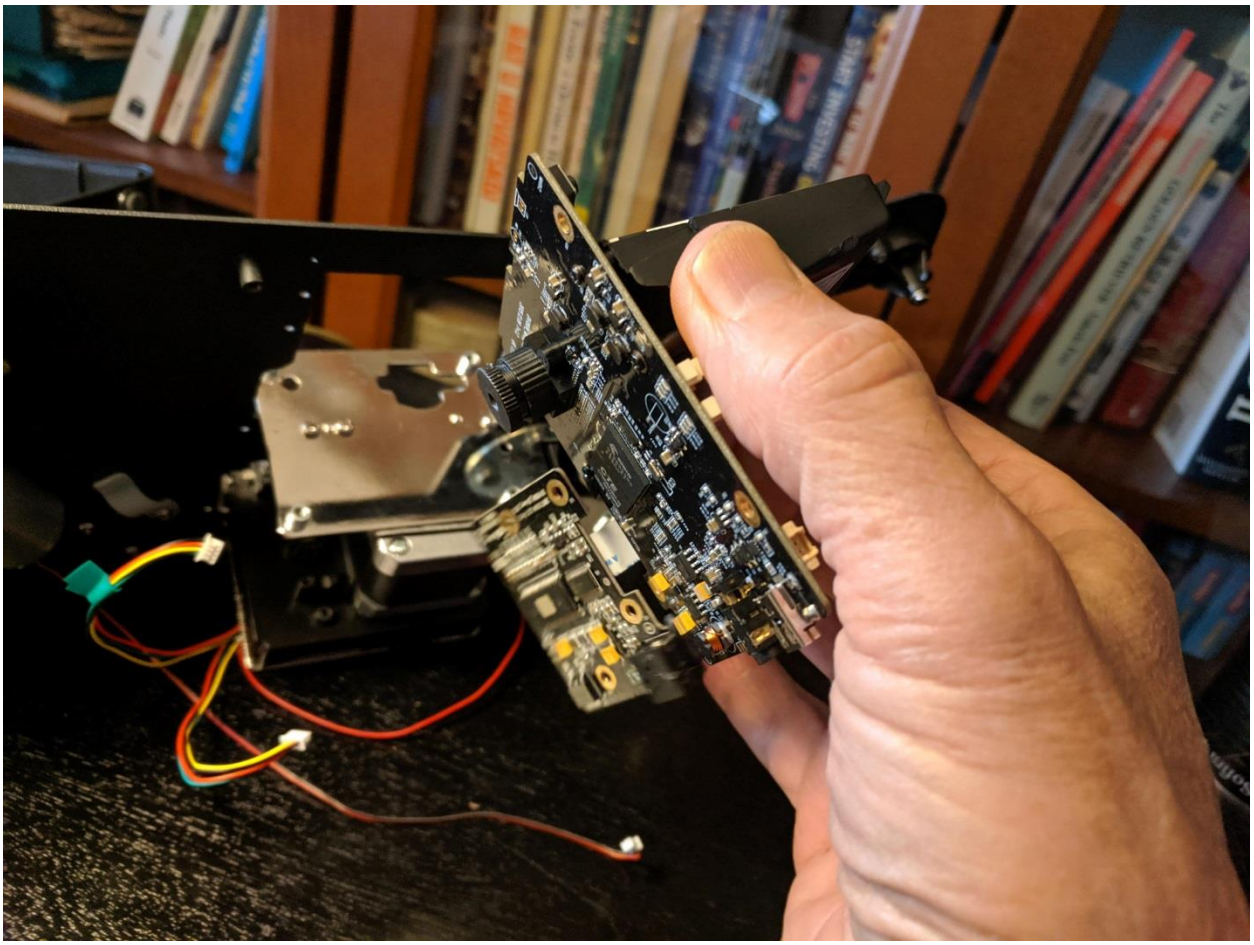
Two of the board screws are at the front.



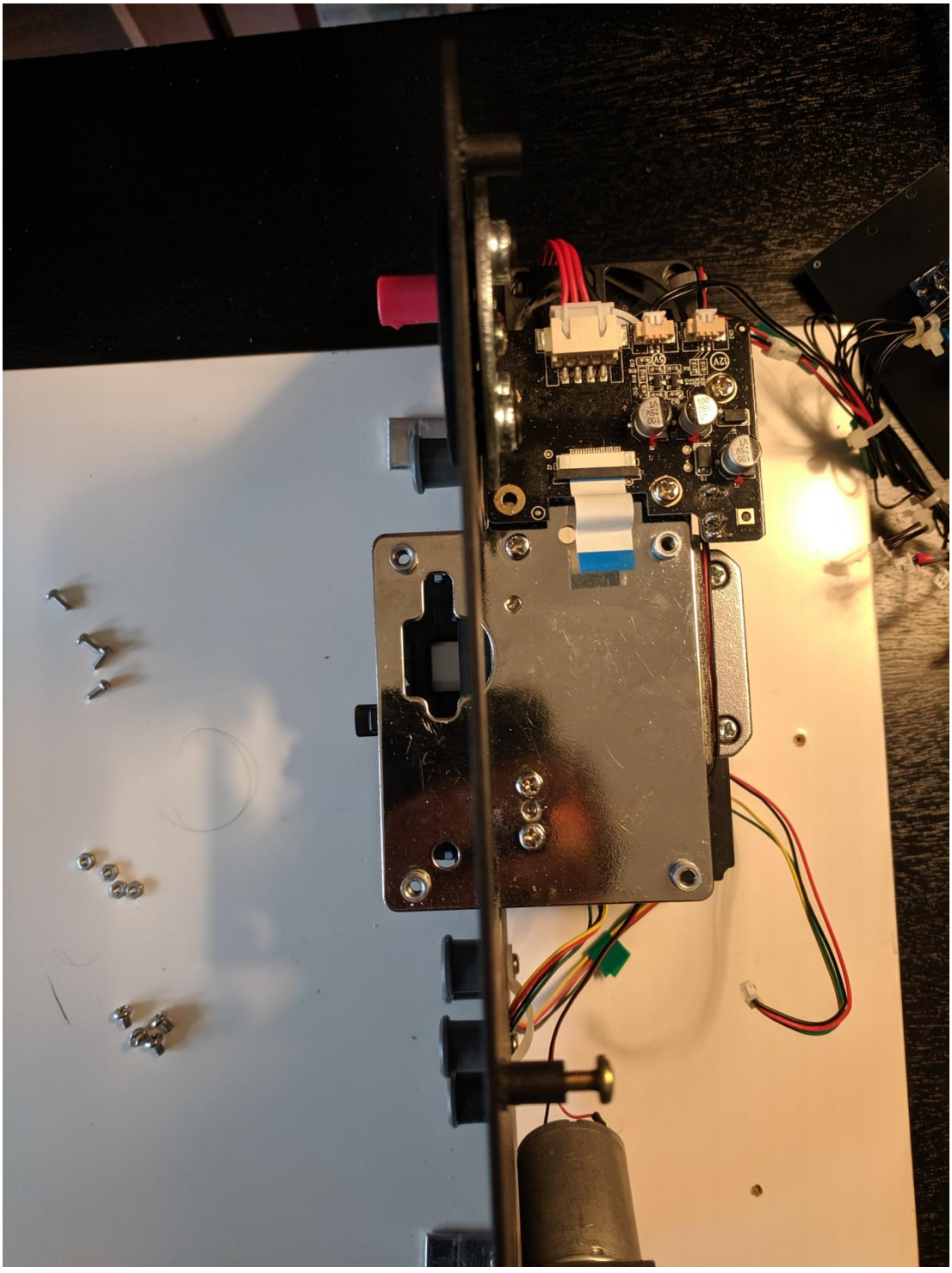
Wiggle the controller board up. Make sure there are no cables in the way. Be careful not to damage the power board ribbon cable.




START INVESTING ONLINE TODAY

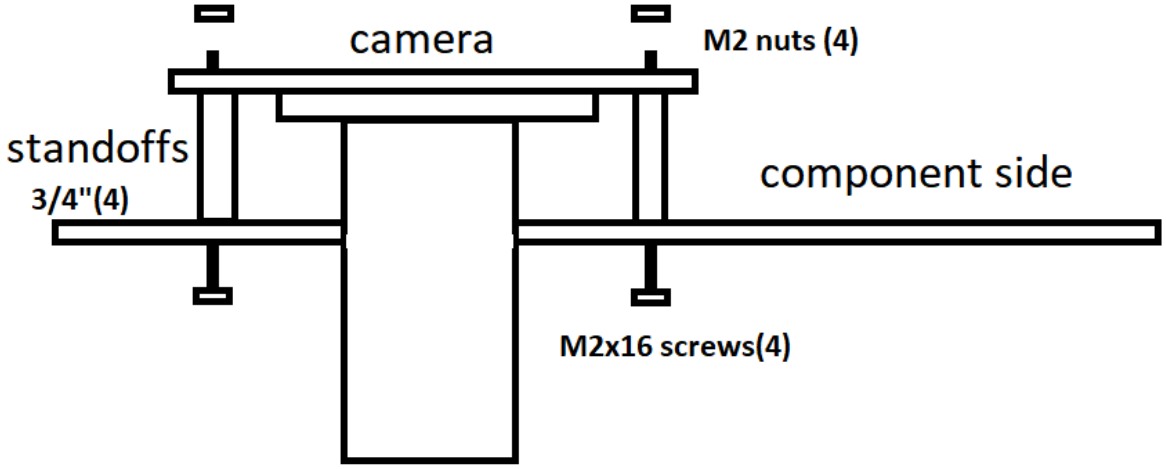


Now you are ready to mount the new camera.



Mounting of new controller and camera

Mount the BUC02 camera onto the new controller.



This is the standard mounting with the 3/8” spacers.

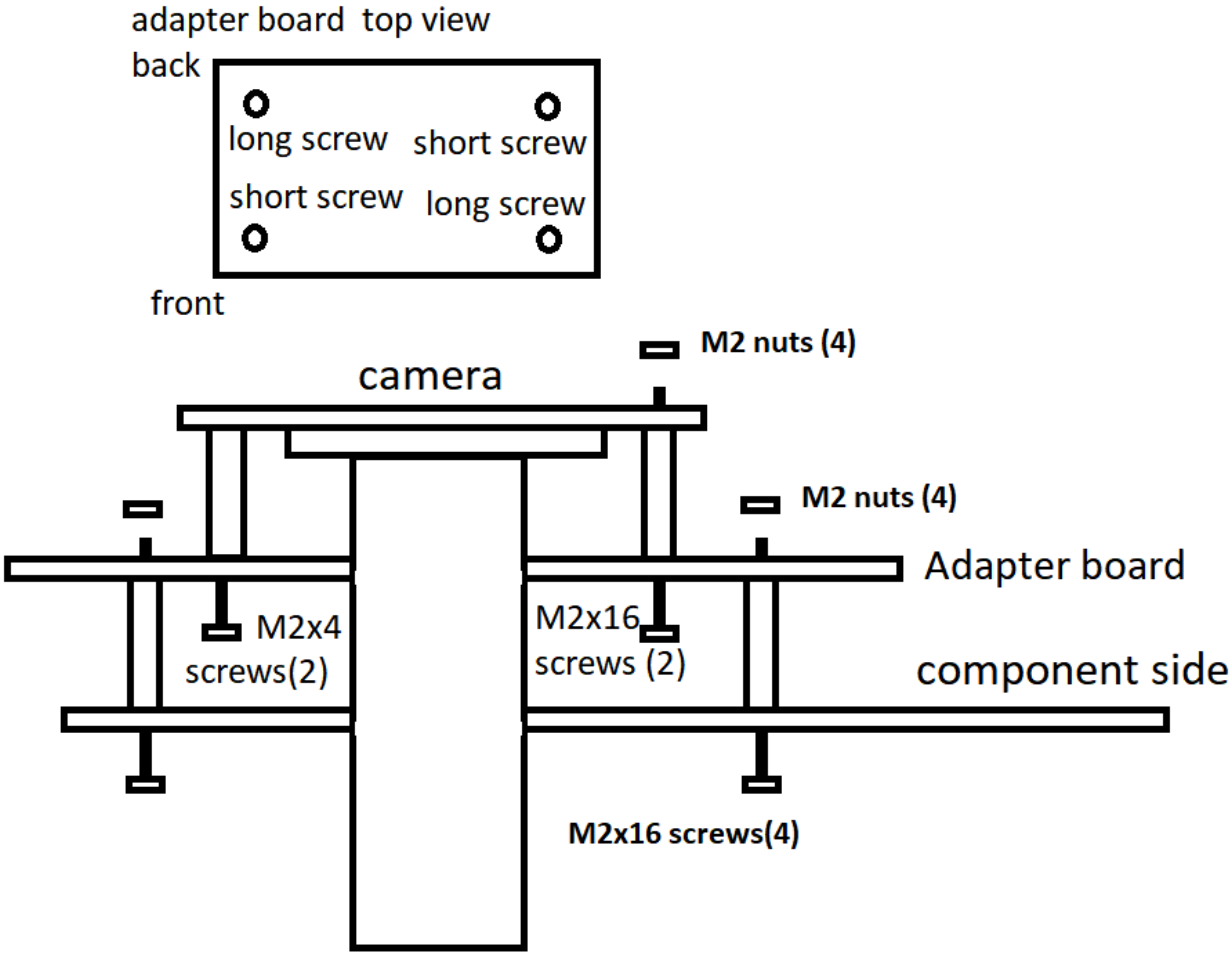
The Hawkeye kit provides the mounting for the BUC02 camera with the 12mm lens. If the UX226 camera or UX178 are used, or if 16mm lens is used then the spacer selection will depend on the desired resolution as per the two tables.

DFM72BUC02-ML

Lens Calculator	12mm	16mm
B	36.67329545	40.77005348
a	17.83626943	26.33506045
d=a+b	54.50956488	67.10511392
sensor to top of the lens distance		31.33506045
film to hawkeye board distance (see image)	47.5	47.5
F	12	16
Spacers required	7.009564885	19.60511392
Resolution needed horizontal	1280	1700
Resolution needed vertical	1024	1299
Pixel dim [mm]	0.0022	0.0022
Image Horizontal	2.816	3.74
Image Vertical	2.2528	2.8578
Super8 frame [4.01 x 5.79]		
Super8 Horizontal	5.79	5.79
Super 8 Vertical	4.01	4.01
Magnification required for 1280x1024 pixels	0.486355786	0.645941278

It is possible to get a very high resolution with the BUC02 using the 16mm lens and 20 mm spacers. The uncropped resolution is 2048x1536. Again here the corners can go a bit soft possibly when checked on a good quality large monitor. The disadvantage of high pixel resolution is the disk space and post processing time. It should be also mentioned that the camera alignment becomes difficult and it will be really hard to find the alignment that can shoot both film formats.

An adapter board can be used to facilitate the alignment. Two types are available, one for the S8 and one for the R8 film.



One set of spacers can be 10mm and the other 8mm. The adapter board thickness is 1.5mm giving the total spacing of 19.5mm which is close enough to 20mm.

DFM 37UX226-ML

Lens Calculator	16mm	16mm	16mm
B	55.12162162	47.2972973	41.03784
a	22.54369603	24.17962003	26.22453
d=a+b	77.66531765	71.47691733	67.26236
	27.54369603	29.17962003	31.22453
film to hawkeye board distance (see image)	47.5	47.5	47.5
F	16	16	16
Spacers required - subtract 5.5mm for holder	24.66531765	18.47691733	14.26236
Resolution needed horizontal	1280	1600	2000
Resolution needed vertical	1024	1200	1500
Pixel dim [mm]	0.00185	0.00185	0.00185
Image Horizontal	2.368	2.96	3.7
Image Vertical	1.8944	2.22	2.775
Super8 frame [4.01 x 5.79]			
Super8 Horizontal	5.79	5.79	5.79
Super 8 Vertical	4.01	4.01	4.01
Magnification required for 1280x1024 pixels	0.408981002	0.511226252	0.639033

For UX178 and UX226 cameras and 16mm lens an adapter board can be used for improved resolution.

For the low and high resolution use the adapter board with the following spacer combinations

Low Resolution (1440x1080)

Bottom spacers 8 mm

Top spacers 15 mm

Board thickness 1.5 mm

Total spacing 24.5mm

High Resolution (2560x1920)

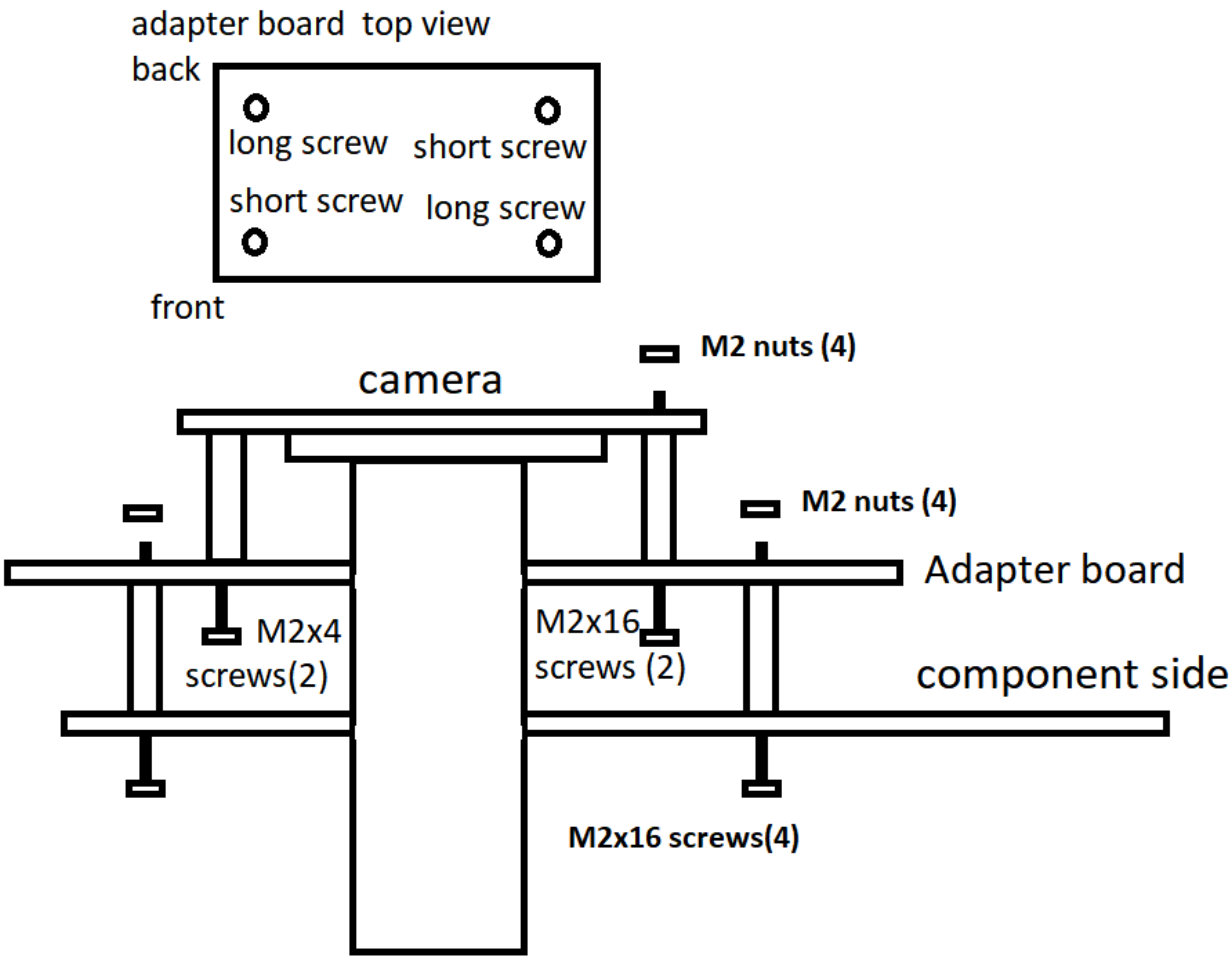
Bottom spacers 8 mm

Top spacers 5 mm

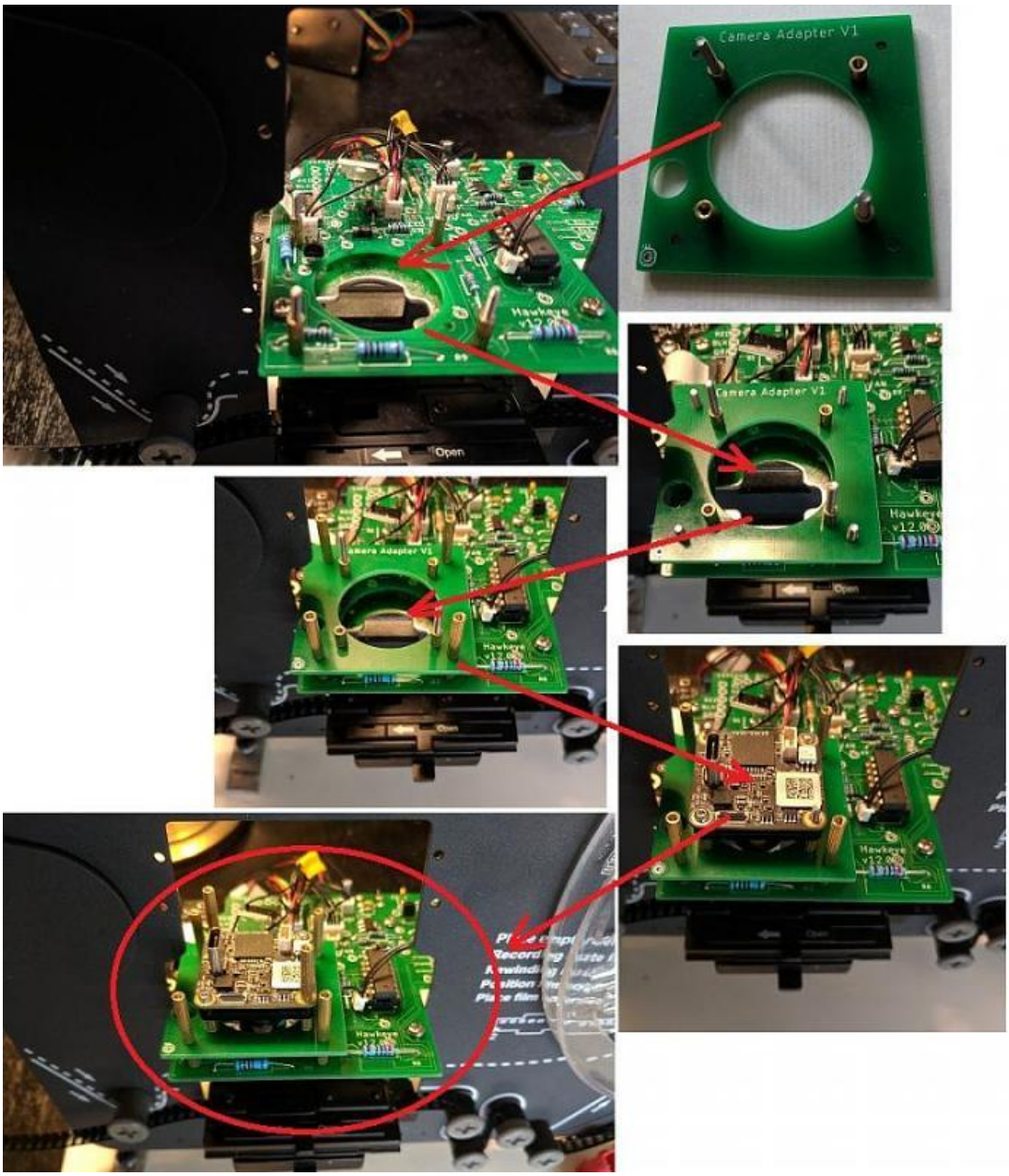
Board thickness 1.5 mm

Total spacing 14.5mm

Here is the mounting detail for the adapter board.



And here is the installation outline.



Note that there are two versions of the board:

V1 – for S8 film

V2 – for R8 film

Also note that the Hawkeye board can be installed onto the machine with the first set of spacers as shown in the picture. Then add the V1 or V2 board as required. Then add the camera. You may want to use the M2 spacers instead of the nuts to facilitate adapter board swapping when switching between the film formats.

Slide the board with the camera into the old board location taking care not to damage the flex cable coming from the power supply.

Once the board is roughly in its place, connect the flex connector from the power supply. Make sure the new controller cable release tab is up and the flex is seated properly in the connector. Then push on the tab. It will swing down and click into its lock position. Align the board with the mounting posts and install the mounting screws. Do not tighten the screws because the camera has to be aligned prior to that.

The gerber files for the boards are available here:

https://drive.google.com/drive/folders/1LDImmrMqqNCJVNDKjecCZIyow0tB8rV1?usp=sharing

Camera USB2 Connection

The BUC02 camera uses a USB2 cable. The Hawkeye kit provides the usb interconnect. Connect the USB patch cable provided in the kit to the camera. The USB mini connector from the cable goes into the camera and the USB A connector to the board A receptacle.

Use a longer USB type A to mini cable to connect the Hawkeye to the PC. Almost any type A to mini cable should work.

Camera USB3 Connection

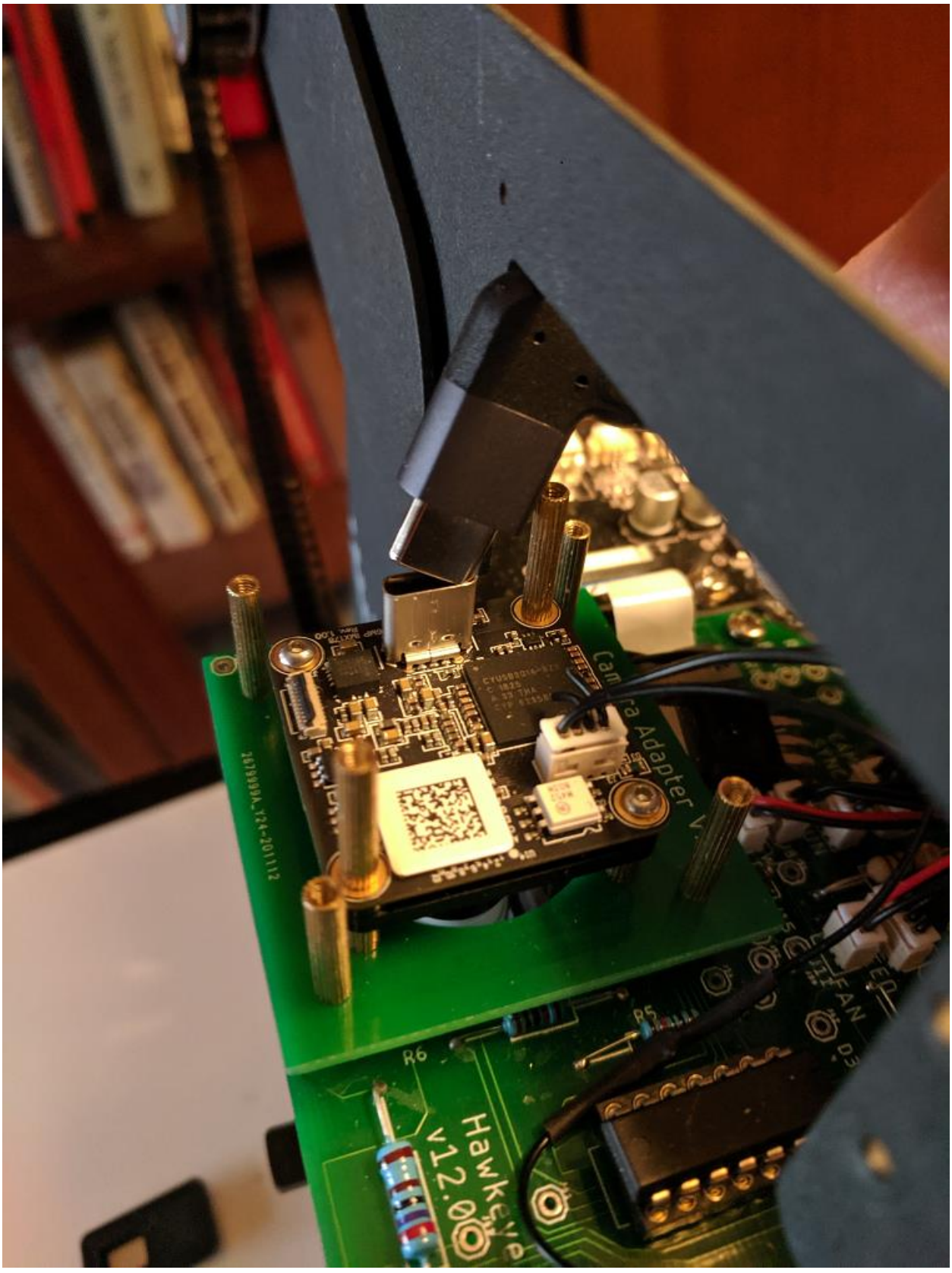
UX178 and UX226 are USB3 cameras. At this time the kit does not provide for interconnect through the Hawkeye board.

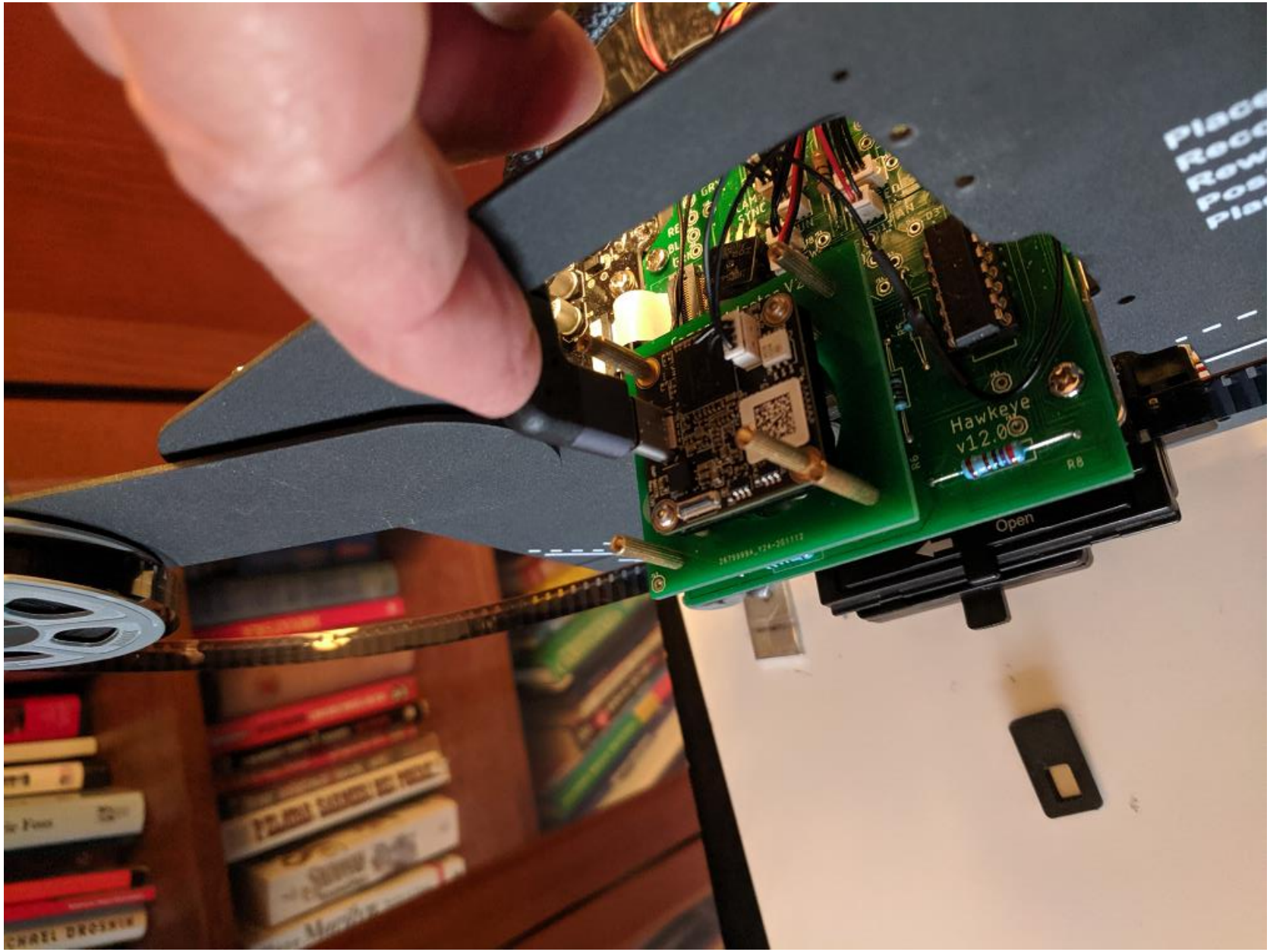
One possible solution is to get the extension cable such as:

https://www.amazon.com/gp/product/B08CZBGFM8/

Drill a hole large enough in the back cover to route the type c connector through. Connect the type c connector to the camera and type A to the PC and that is it.

It is to be noted that with the camera mounted on the adapter board it sits up pretty high and may not allow for easy access to the USB connector. The workaround is to bring in the connector from the back and tilt it backwards. Slide the connector in enough to get some clearance from the top and then tilt it forward so that it is straight up and then push it in.

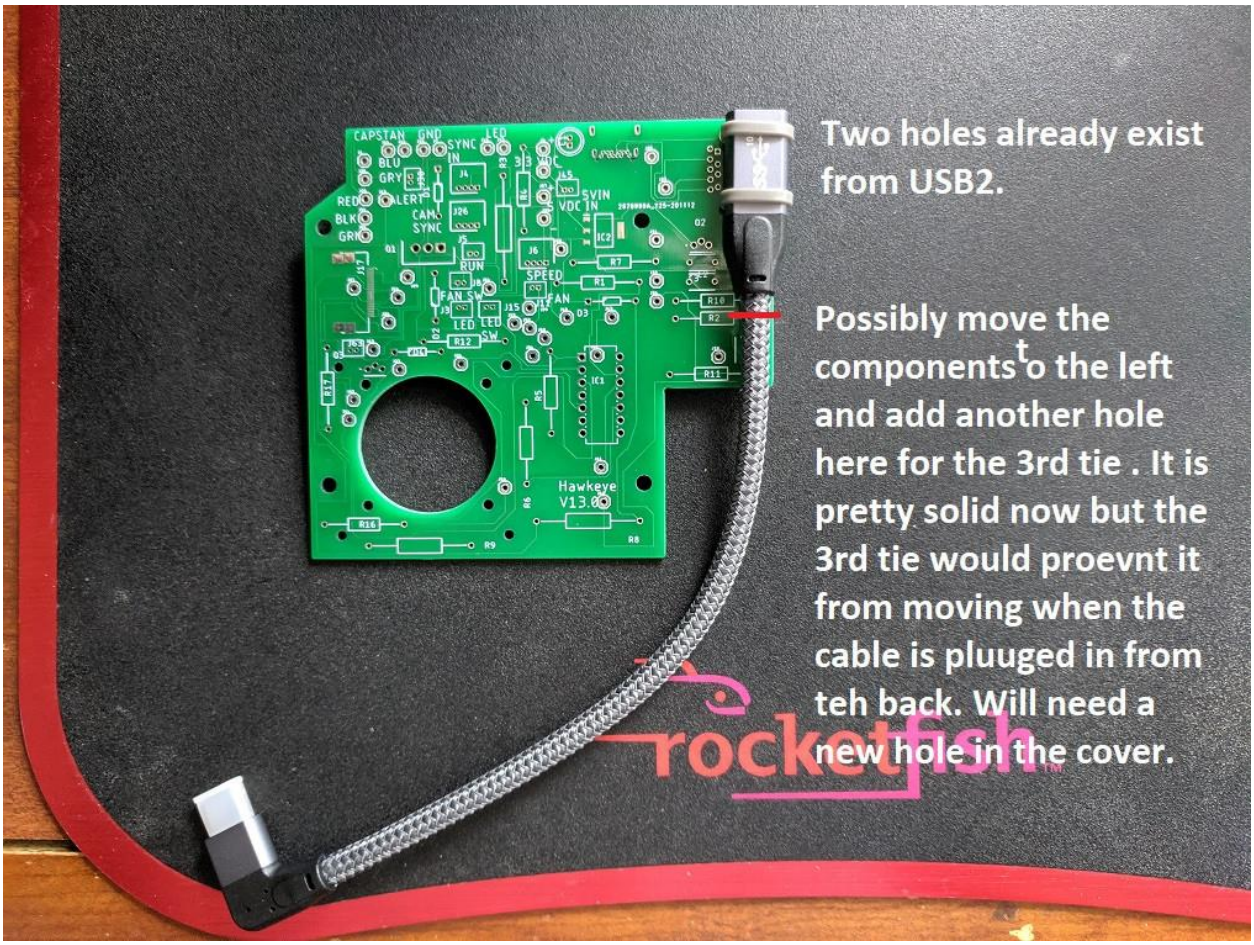

Hawkeye
v12.00
R6
R5

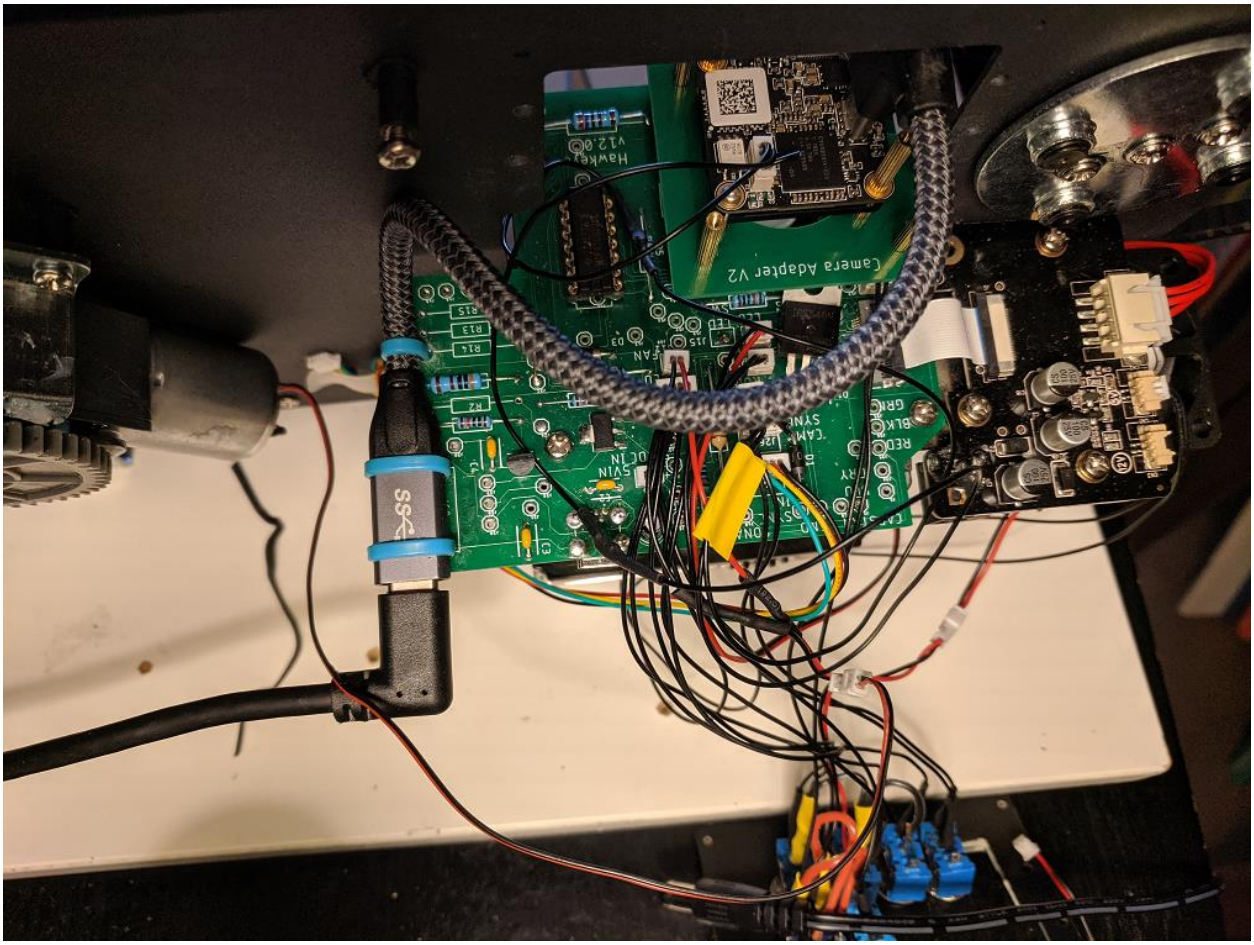

Hawkeye
v12.0
Open

Another, better solution is to use a patch cable.

https://www.amazon.com/gp/product/B08DY3YVLQ/

Mount the cable as shown:



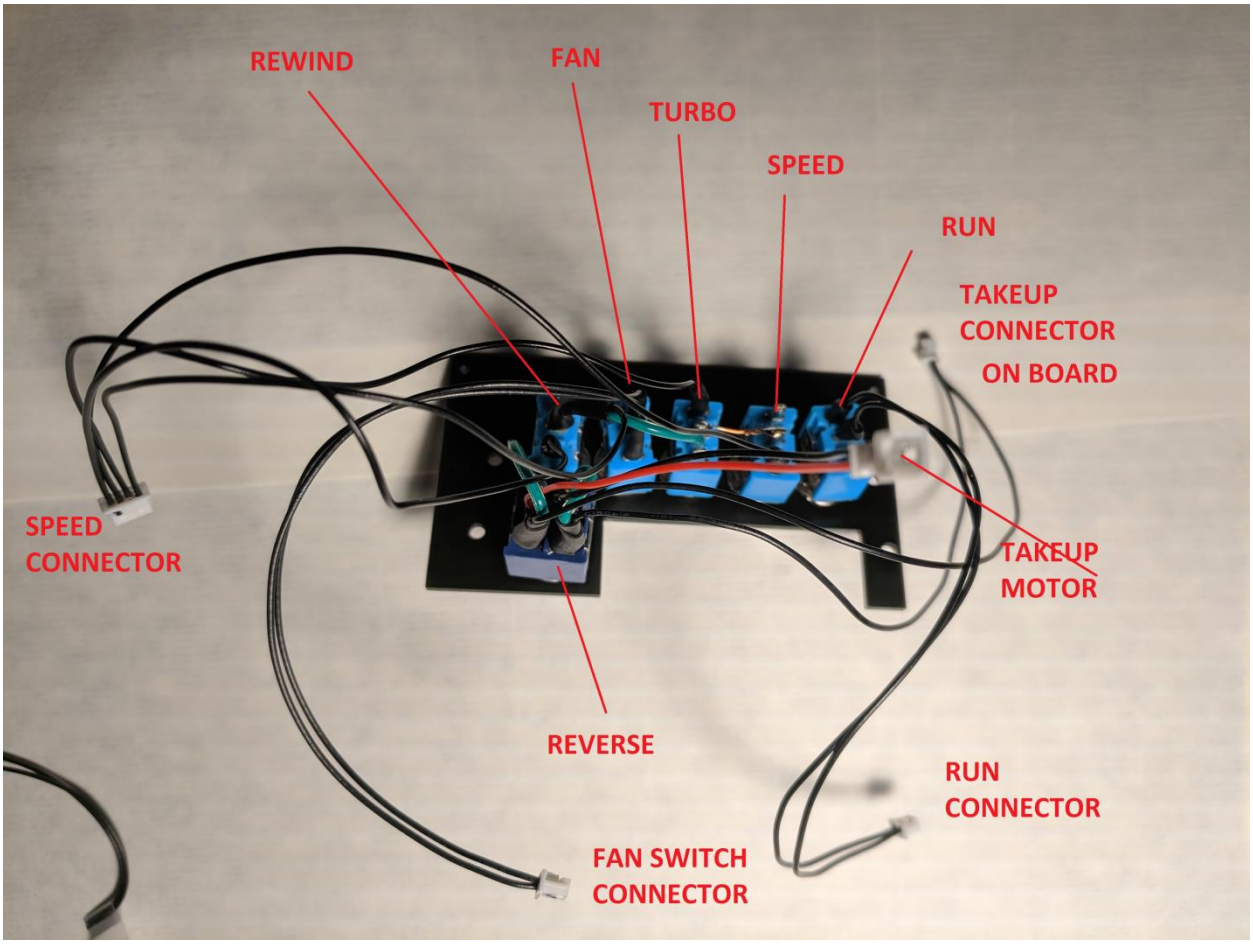


You will have to mark up the back cover to provide the access hole for USB3. The easiest way is to do that is to attach the back cover with two screws only and then through the opening in the front mark up where the connector goes. Remove the cover and make a cutout of right size.

Connect Switches

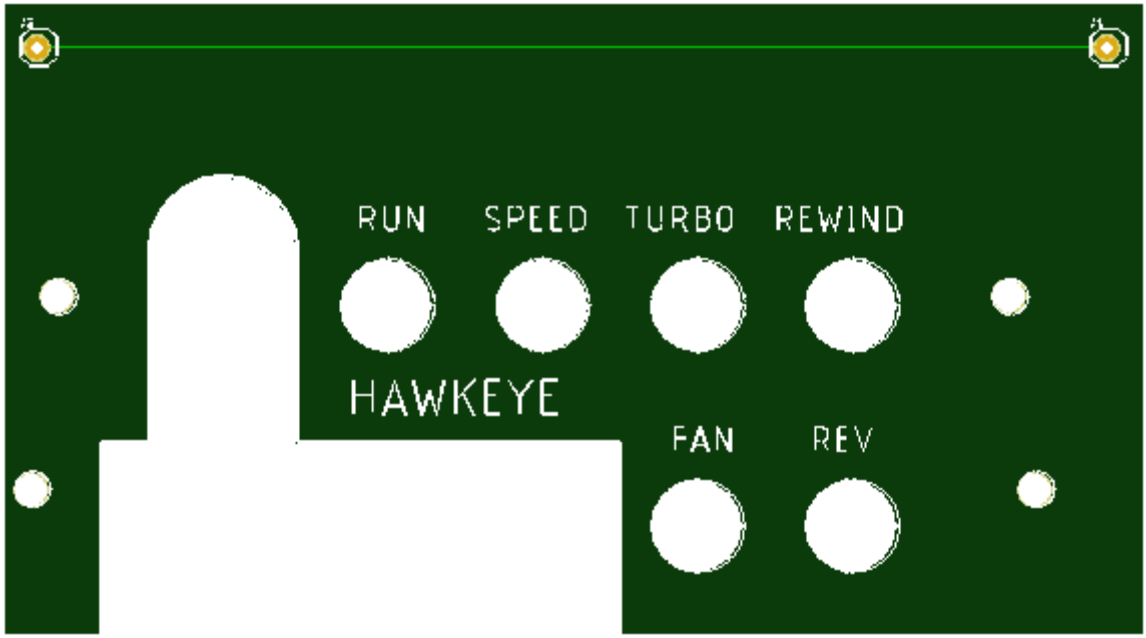
The switches are provided with the connectors already attached to them. Be careful handling them because the wires are pretty fragile and break easily.

Here is the picture with all the switches shown.

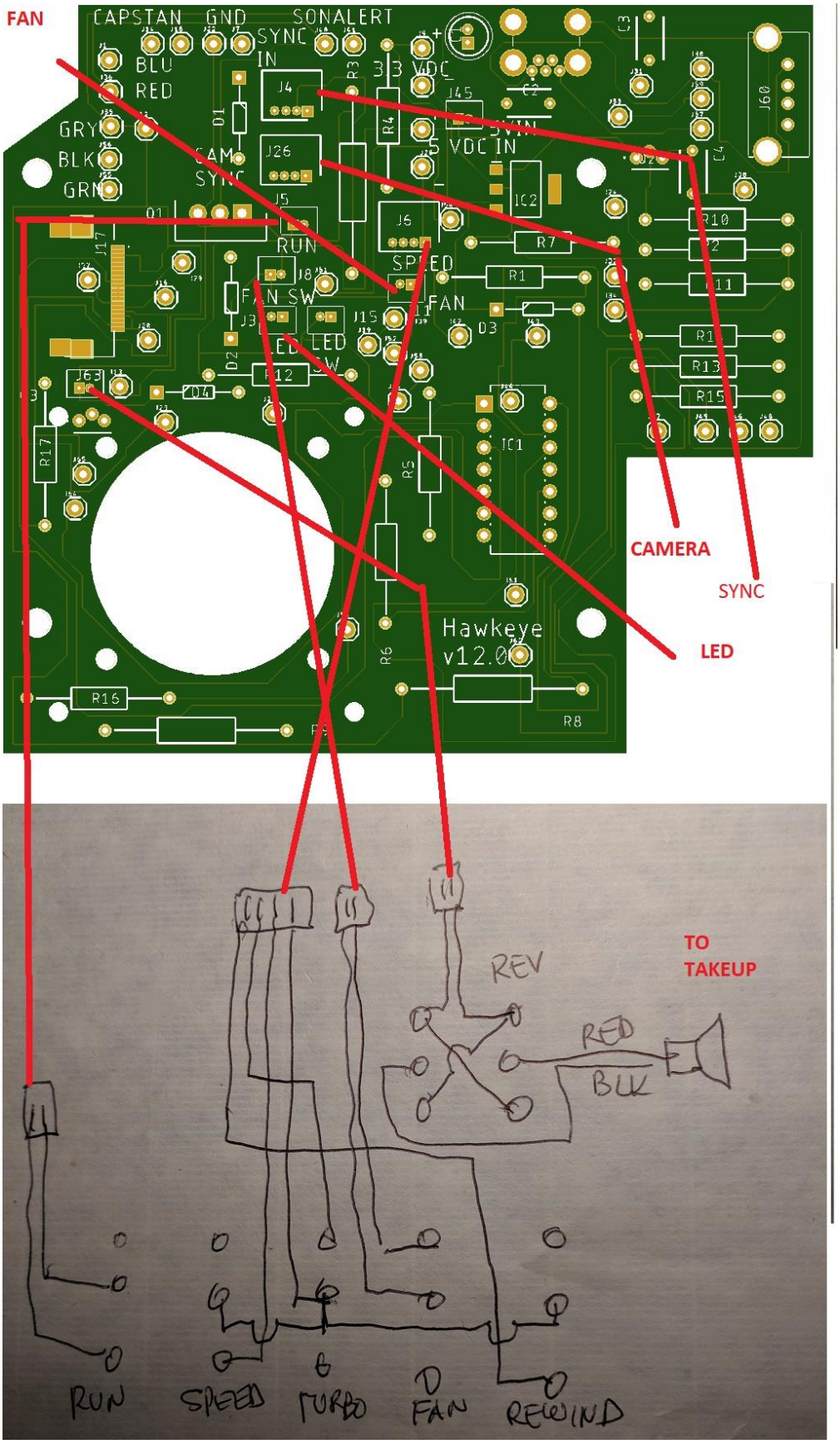


Mount the front panel using the small #2 screws and nuts provided and connect the switch connectors to the board using the picture below as a guide. Once done, harness the wires together and tie them with small plastic ties so that they do not interfere with any other components of the unit and moving parts.

Note: For high resolution camera mount using the adapter board a different panel is required. The new panel has a provision for the USB connector since the camera sits pretty high from the board.



The switch interconnect will be the same as with the old panel except that the switch locations are different.


FAN
CAPSTAN
GND
SONALERT
SYNC IN
BLU
RED
GRY
BLK
GRN
3.3 VDC
5 VDC IN
RUN
SPEED
FAN SW
FAN
LED
LED SW
Hawkeye
v12.0
CAMERA
SYNC
LED
TO TAKEUP
REV
RED
BLK
RUN
SPEED
TURBO
FAN
REWIND

Camera Frame Sync cable

The kit is shipped with the camera cable attached to the board. It uses two 4-pin connectors on each end. Connect the loose end to the camera sync connector.

In case the cable gets disconnected use the picture below as a guide. Do not reverse the cable.

The cable is shown in the picture below.

Note: The cable is for the BUC02 camera. For UX226 the wires have to be reversed by cutting the cable in the center and swapping the wires. Solder the wires and protect them with the electrical tape. If you do not have a soldering iron then connect the stripped opposite ends by wrapping them around each other and then use the electrical tape to protect them.

Connect the tagged side to the camera and the other side to the board CAM SYNC. Do not switch them around because it will cause the 3.3V supply short. The 3.3V regulator has a protection circuit but still it is not a good idea to do so. If the film gate LED is off the first time you power the board up then check this cable if it was properly connected.

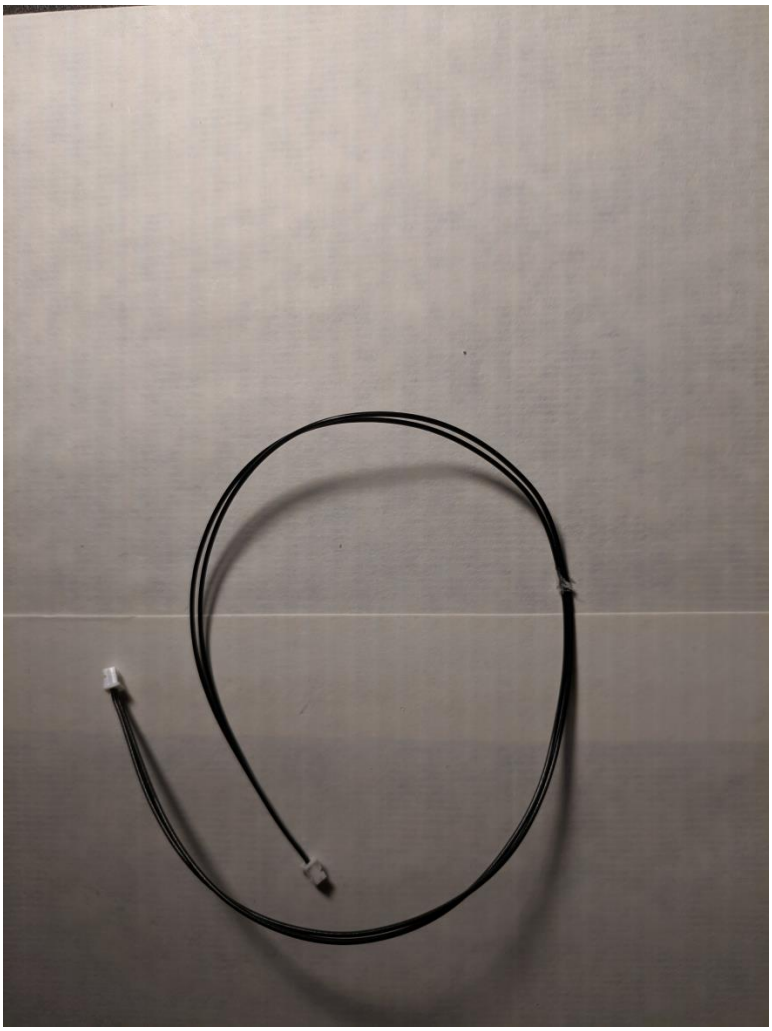
LED connection

Connect the LED cable that you tagged before to the board LED connector.

5V Connection

There is an extra 2 pin cable provided (It is shipped attached to the board). It has 2 pin picoblade connectors on both sides. Plug one side to the power supply 5V connector (that is where the fan was originally plugged in), and the other side to the 5VIN connector on the board. Swapping the ends is ok either way.

Note: The kit is shipped with the 5V cable already attached to the board.



Test

Plug the AC adapter DC output plug into the power supply. The LED should turn on. If it does not turn on then there is an issue with the 3.3V supply. Check the voltage on 3.3VDC test terminals. If it is zero, check the camera sync connector for proper connection. Unplug it and check again if the LED turns on.

If it does then the cable is reversed.

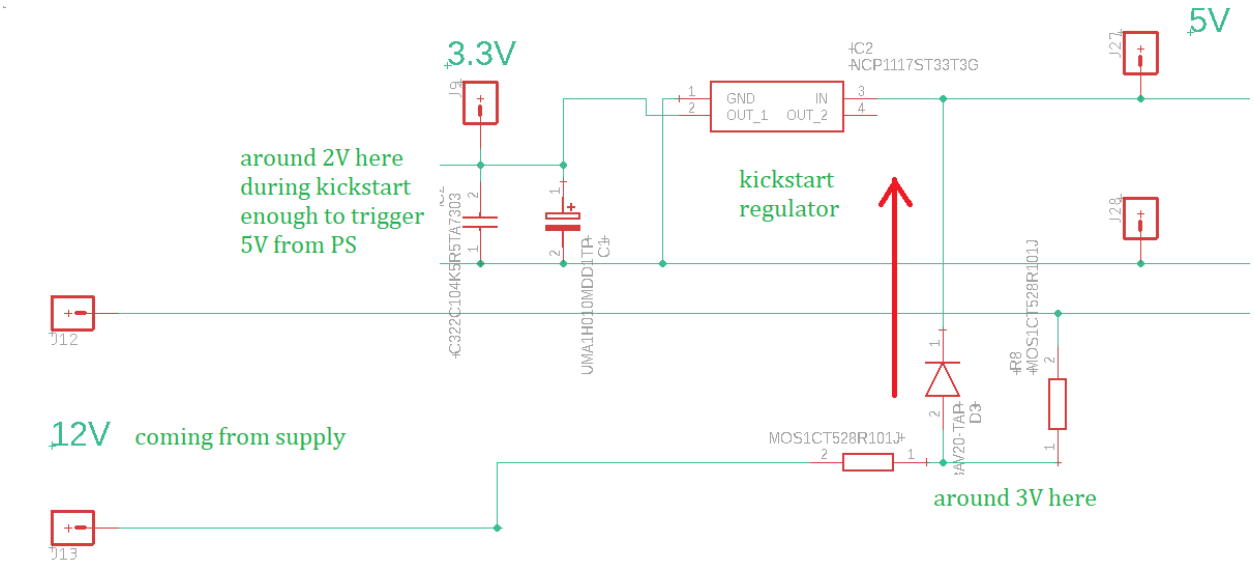
If it still does not turn on and the 3.3V reads zero, then check the voltage on terminals J12 and ground. J12 is close to the big mosfet transistor on the left side. If the reading is zero, then there is an issue with the flex connector. Check if connected properly. Also check the DC supply from the AC adapter. It should read 12V. The 12V is then routed to J12 through the flex connector pin 18.

If the 3.3V reads around 2V then check the 5V test terminals. If 5V is not there then the cable from the 5V output on the power supply may not be connected.

If 5V is there then the 3.3V regulator Q1 may be at fault or there may be a short on the 3.3V rail to ground. Check the solder connections and re-solder if necessary. Ultimately, replace the regulator or fix the short.

Another possibility may be in the bootstrap circuit. Here is the bootstrap description.

The 5V is supplied by the power supply. But you have to tell the supply to provide it by setting pin11 of J17 to 3.3V. But since the 5V is not there on power up, the 3,3V is not there either
because it is derived from 5V. So now since the 3.3V is not there, there is no way of setting pin11 to 3.3V - so we have a catch 22 situation.
The bootstrap cct was added to fix this problem. The 12V is there on power up. I used a resistor divider to provide around 3V to the 3.3V regulator. The regulator output is sufficient to pull up pin11 high enough to get the power supply to turn on the 5V rail.
The regulator gets the 5V and the bootstrap gets turned off because the diode gets reverse biased.



The boostrap may not start up if there is an excessive drain on the 3.3V line such as blown Wolverine frame sync device. Keep disconnecting the cables for the Hawkeye board and see if a particular cable causes the issue and then check the devices attached to that cable.

Make sure the fan is off. It could sometimes cause 5V startup issue.

If the LED turns on, precede with the other tests.

Turn the ON switch on. The stepper motor should start running. Make sure that the speed switch works.

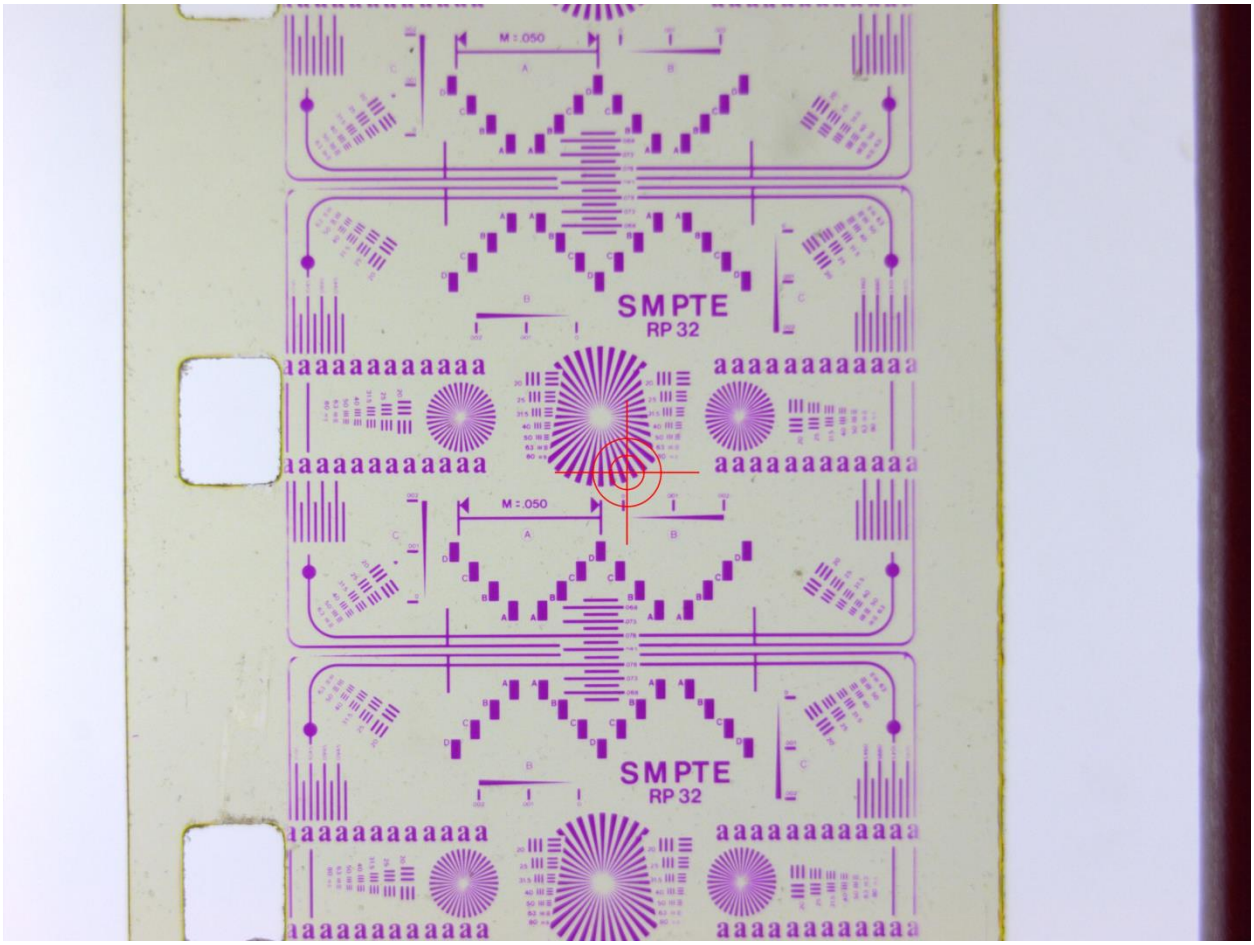
Here is the function table for the switches

Run	Speed	Turbo	Rewind	Mode
Off			Off	Off
Off			On	Rewind
On	Low	Off	Off	0.5 FPS HDR
On	Low	On	Off	1 FPS HDR
On	Hi	Off	Off	1 FPS
On	Hi	On	Off	2 FPS
On	Low	Off	On	0.5 FPS HDR + Capstan
On	Low	On	On	1 FPS HDR + Capstan
On	Hi	Off	On	1 FPS will add capstan
On	Hi	On	On	2 FPS will add capstan

Turn the fan switch on and make sure the fan runs.

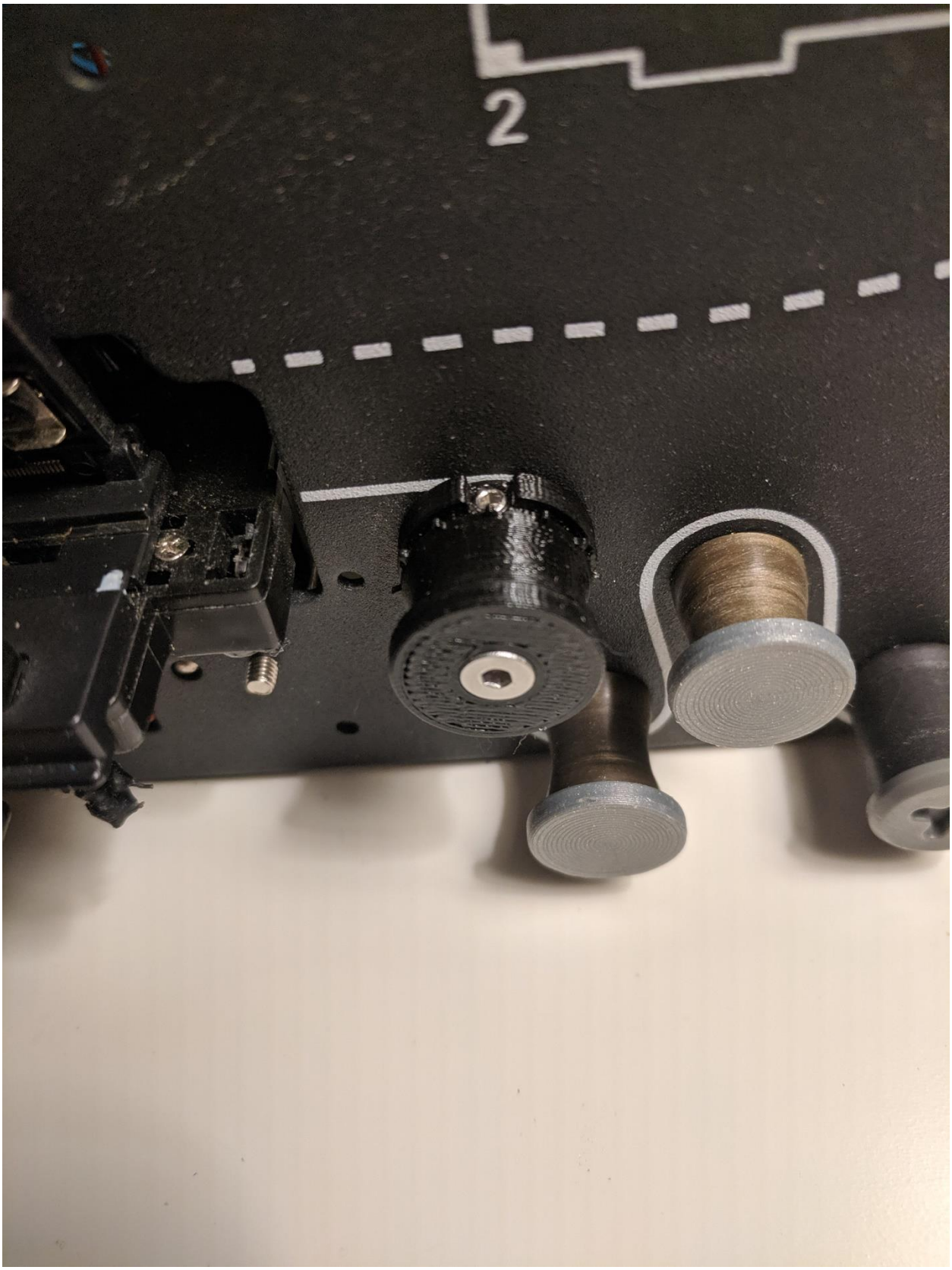
Connect the camera USB cable to your PC and run IC MEASURE. IC MEASURE is very similar to IC CAPTURE except that it has a marker in the center allowing for easier camera alignment.

Here is the IC MEASURE screen shot:



Move the board around until the marker is close to the center of the film. Also make sure that the frame is not tilted. When done tighten the mounting screws. Adjust the camera focus. It is to be noted that even if the run switch is off the LED stays on so that the camera adjustments can be done with a stationary frame.

Capstan Installation


2

It is to be noted that the capstan is not essential for Hawkeye operation. If however you have lots of reels with damaged perforations, capstan can help.

The capstan consists of a special pulley that replaces one of the Wolverine pulleys and it is attached to a small DC motor with the encoder capability. As the film advances the capstan pulley rotates causing the capstan motor to free run which causes the encoder to generate the pulses. The Hawkeye controller detects the pulses and it will not do anything as long as the pulses are detected.

If the film stops due to damaged perforations, the pulses generation stops and the controller detects that. The controller then sends the 12V pulse to the motor to pull the damaged part of the film through. It also generates and alert. If the film motion resumes, the capstan returns back to the normal mode of operation. But if the film is still stuck the controller shuts the stepper motor down for a short interval and will retry to pull the film out again and so on until the stuck film is cleared.

If the film is stuck so bad that the capstan cannot even budge it then the alert will stay on and the stepped will stay shut down.

It is to be noted that some users prefer to unjam the film manually but still prefer to get the alert and want the stepper to stop when the jam is detected. This can be accomplished by installing a switch in series with the motor power lead (white or gray lead).

Additionally, if the monitor function is required only, the capstan pulley does not have to have cogs but a smooth pulley can be used instead. This is important because getting a good quality cogged wheel 3D print is pretty hard, whereas a smooth pulley is very easy.

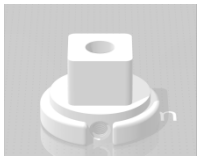
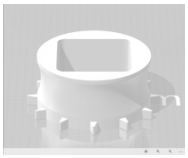
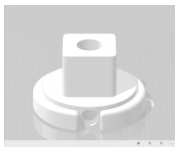
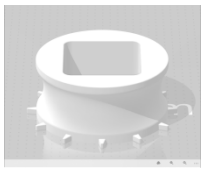
Capstan Installation

The first thing to do is to decide what type of capstan you need.

1. Automatic unjamming
2. Manual unjamming with alert

Automatic Mode Parts

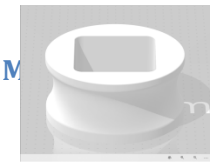
Pulley Parts:

	R8 hub	https://drive.google.com/file/d/1wv_rOFbeeIhEBtstLm-h_0PU1-Ujbhmg/view?usp=sh
	R8 front	https://drive.google.com/file/d/1YhGxHwu0-r1Wz7Mk0DhmGL8zh6gCHRZ3/view?usp
	R8 Cog Pulley	https://drive.google.com/file/d/1A_v_fAPjEXwYJhPQnN2wW-8Dnw124sNz/view?usp=
	S8 hub	https://drive.google.com/file/d/1-Epj_HfUMwiK5CtU6UeqsiEyX6ZgBh7_/view?usp=sh
	S8 front	https://drive.google.com/file/d/1aqXCiQzx7mYe-xKlunNAeTr1MXcCbbXL/view?usp=s
	S8 Cog Pulley	https://drive.google.com/file/d/1DFopyY29JMxzE5ZXZBYmSrqwBzyuFPan/view?usp=s

Manual Mode Parts

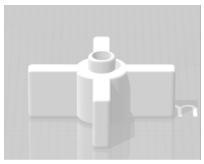
For manual mode, cogged pulleys are replaced by a smooth pulley that fits both film formats. The smooth pulley can be used for monitor mode i.e. it can detect the film motion but it cannot actively pull the film because it does not have cogs to engage the film perforations. The takeup reel force combined with the film friction is sufficient however to rotate the pulley as the film moves thus enabling the monitor function.

Smooth Pulley https://drive.google.com/file/d/1dJGbA3UlCumI3IwbR-NTgUOiU4M94-5z/view?usp=s

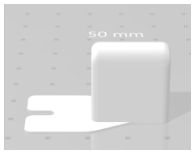


M

Motor Bracket 3rd pos https://drive.google.com/file/d/1AQr0eZubdVeS39KJARbJTFPdvaJTT3tn/view?usp=s

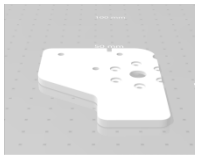


Motor Centering https://drive.google.com/file/d/1t6oIKSNuz-iP6QYuDmT6ImDoZs4URW55/view?usp



Motor Gauge https://drive.google.com/file/d/1Zdk10kKwOuad1SExkiAeisJlJ-2ZjlfX/view?usp=shari

Clamp https://drive.google.com/file/d/1UIT5eq-jXsvA6Vmv_gxsIXsb1kwkmOoV/view?usp=



Motor Bracket 1st pos https://drive.google.com/file/d/1hpomsBqlbpO4XxH56jx7xQIfbmB0-mTh/view?usp=

Motor Assembly

Remove the motor cable from the motor by unplugging the connector.

Use one of the motor brackets, either the one for the 1st position of the 3rd position. The first position is used for active mode capstan and the 3rd for the monitor mode.

You can get the motor from Amazon.

https://www.amazon.com/gp/product/B077SY212B/

You will also need the M2.5x3.5 screws.

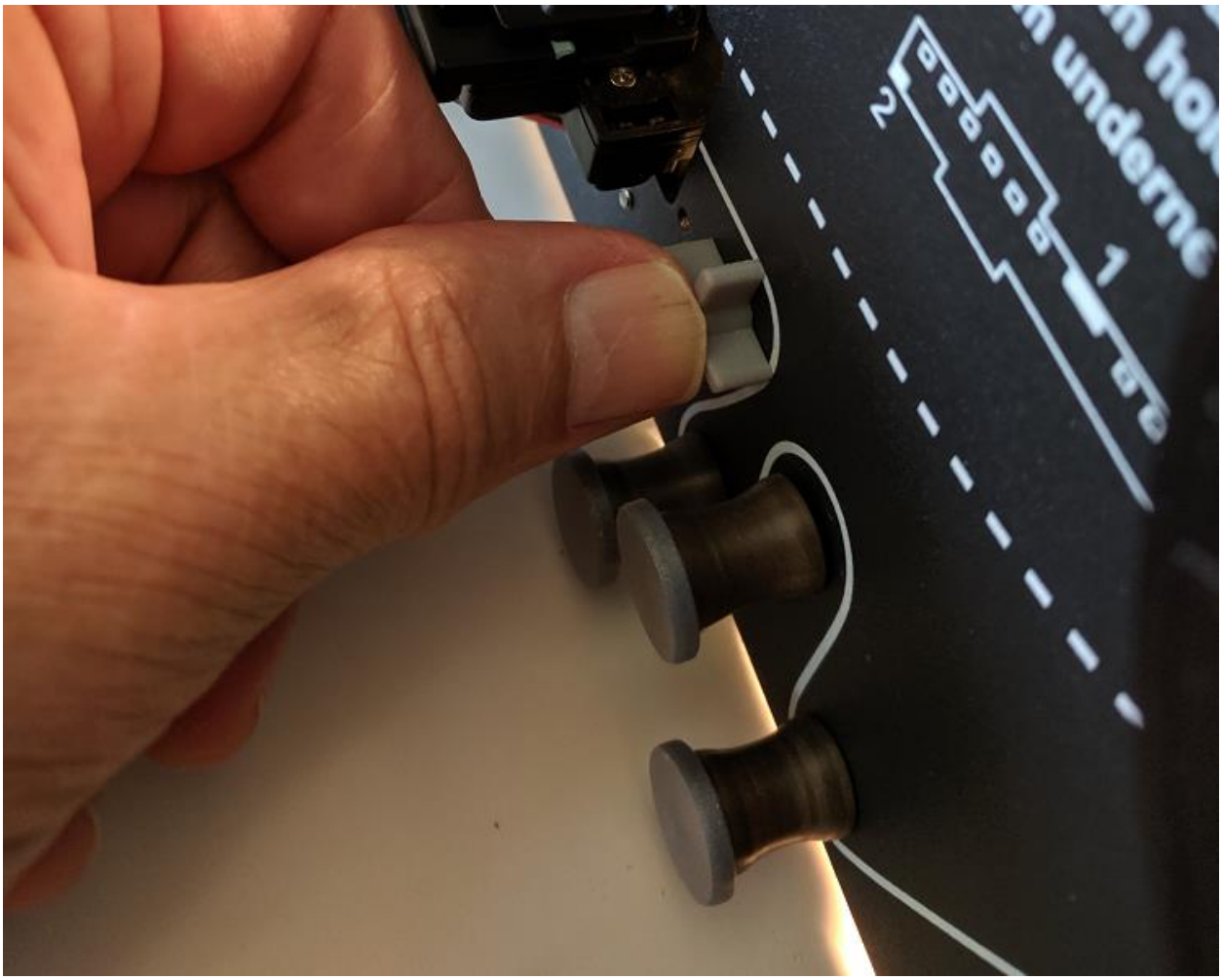
https://www.amazon.com/gp/product/B075C6C4YR/

Mount the motor onto the bracket using two M2.5x3.5 screws.

Remove all pulleys from the unit by undoing the screws at the back.

Mount the motor with the bracket from the back and attach 3 pulleys back but do not tighten the screws.

Use the motor alignment tool to make sure the shaft is centered in the hole then tighten all screws (do not apply too much torque – just snug).

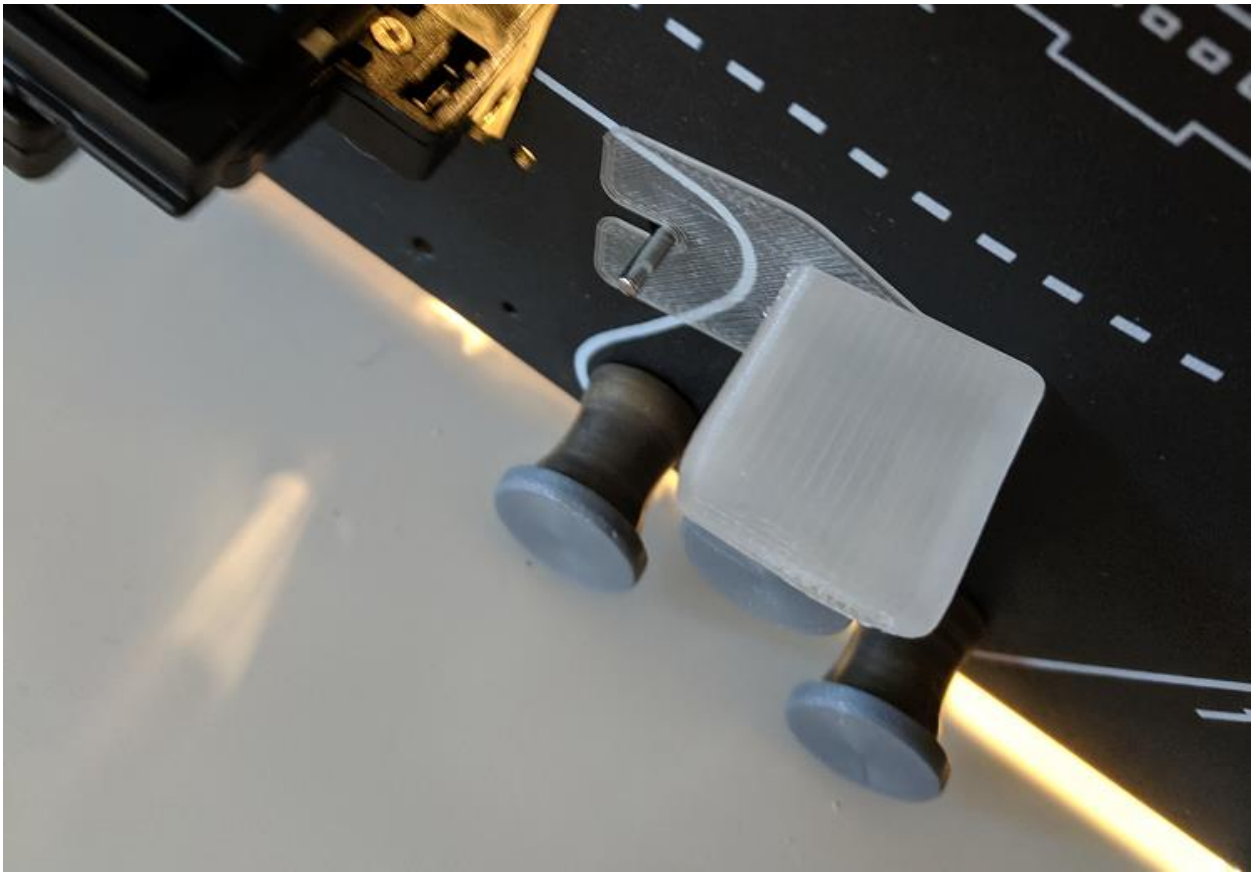


In order to make the capstan hub more stable it is advisable to use the brass tube over the shaft.

https://www.amazon.com/uxcell-Length-Thickness-Seamless-Straight/dp/B07Z989K2S/

Remove any burrs from the tube end. The burrs or deformation of at the end of the tube will make it hard to be slid over the shaft. Slide the tube over the motor shaft and cut the excess off. The hub center hole may have to be opened up a bit by using a 1/8” drill bit.

Use the motor gauge tool and slide the capstan hub over the shaft.

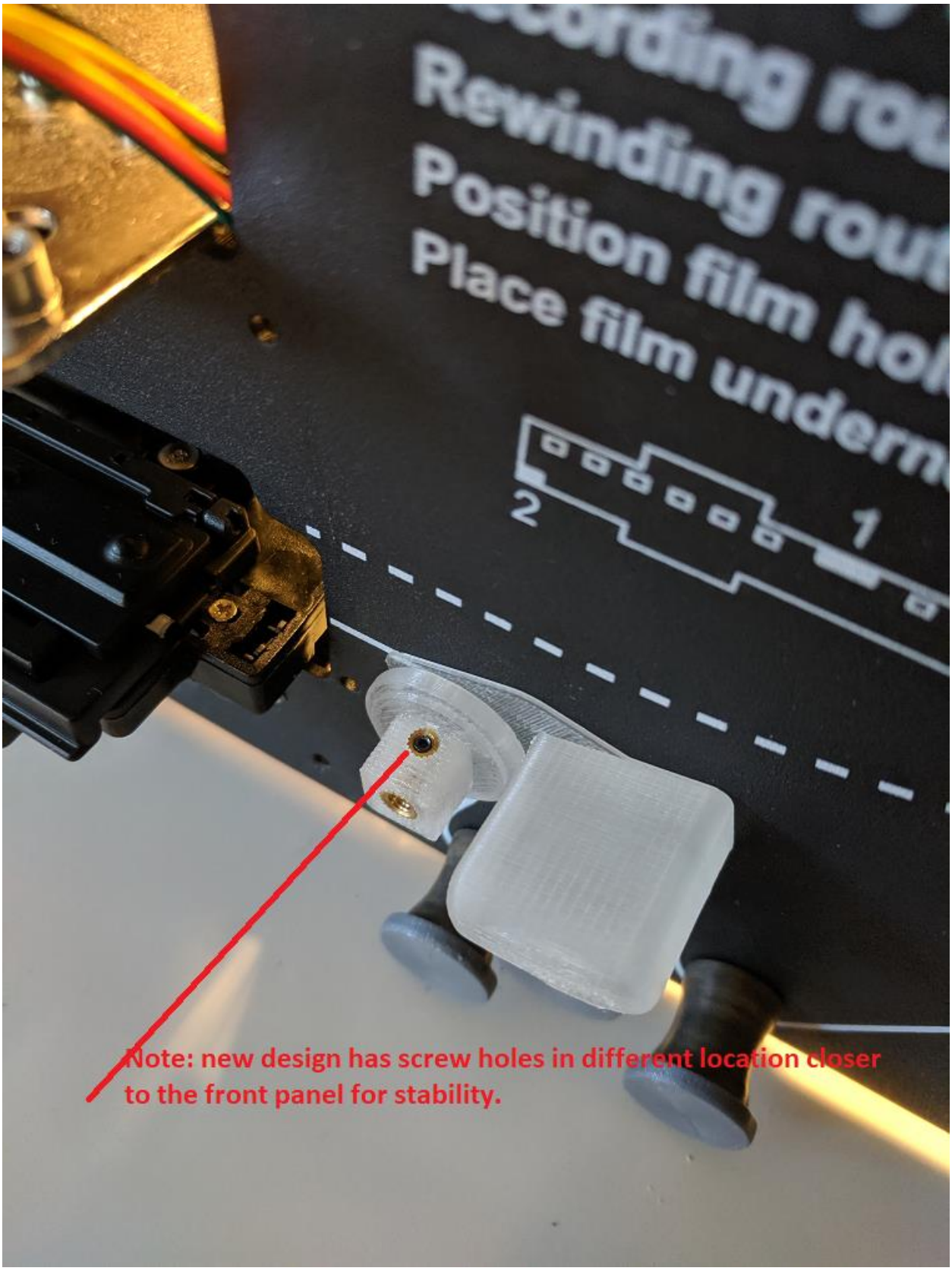


The gauge keeps the spacing between the capstan hub and the front panel. Without it the hub could bind during rotation.

Use qty 2 set screws to secure the hub.

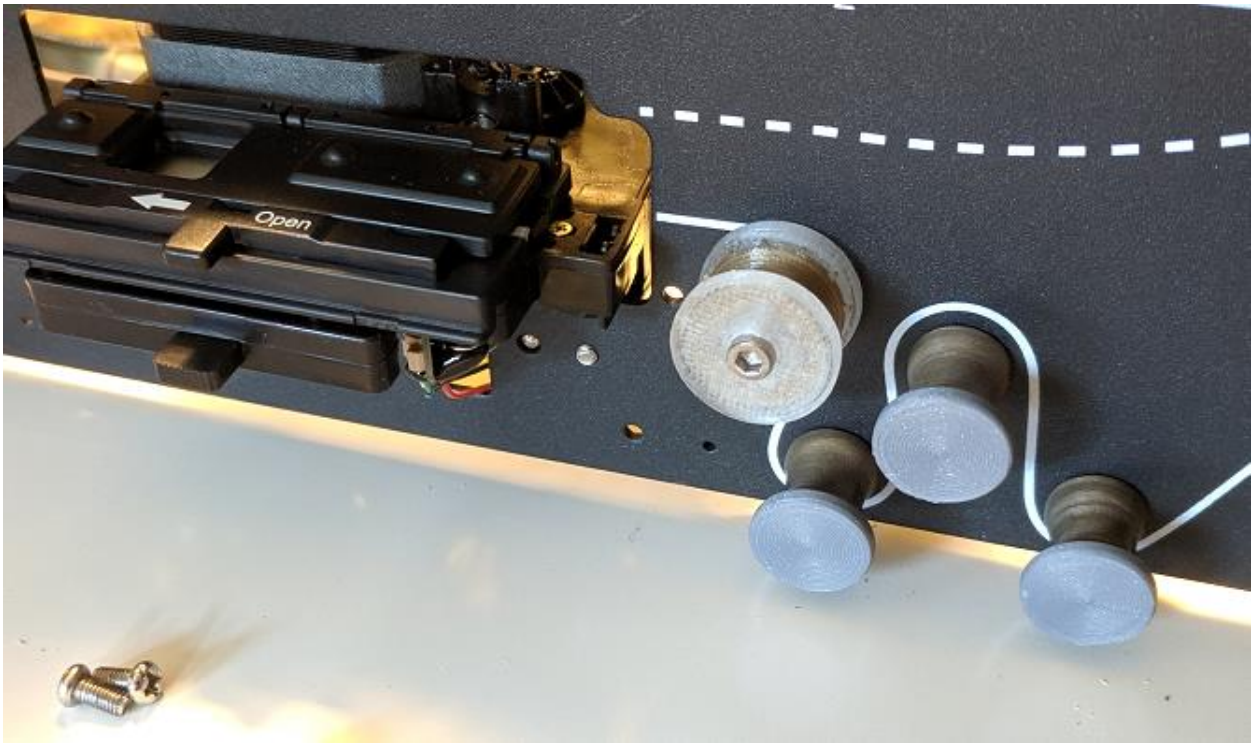
https://www.amazon.com/M2-5x6mm-Screws-Stainless-Socket-M2-5x6/dp/B07XWW64Z4/

Tighten both screws evenly so that the hub sits straight on the shaft. If the hub is crooked and in the first position it could cause film wobble.


Rewinding
Position film
Place film
2
1
Note: new design has screw holes in different location closer to the front panel for stability.

Attach the front cover by using the M3x6 screw.

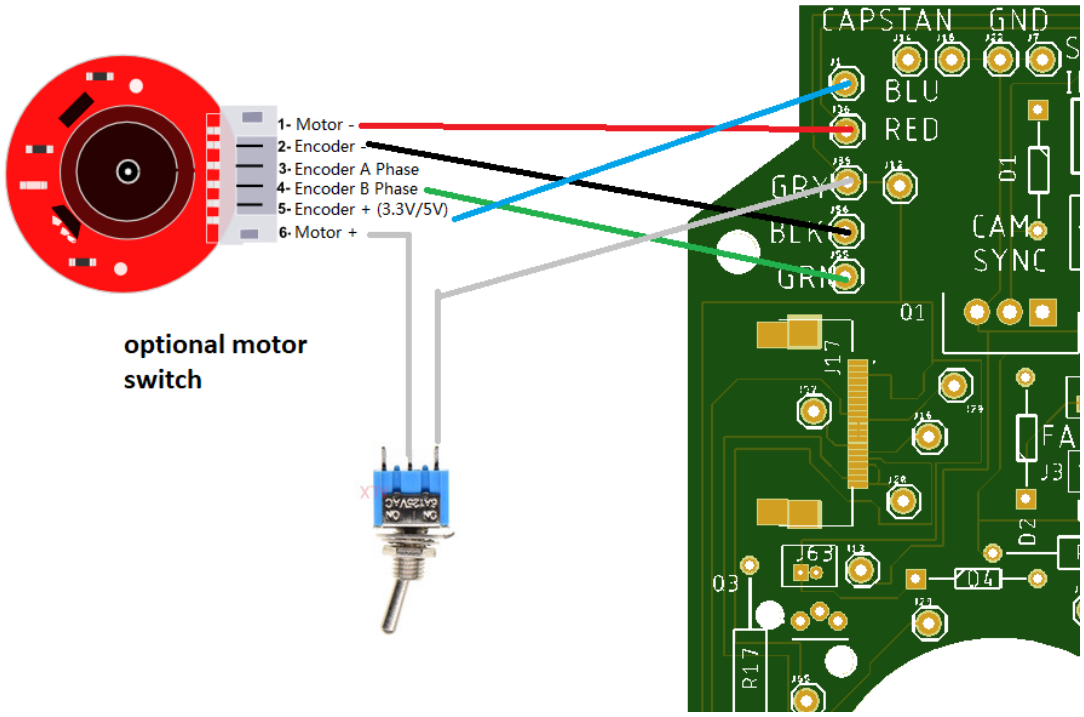
https://www.amazon.com/gp/product/B07D5V2MLP/



Wiring the Capstan Cable

Use the following diagram as a guideline for the capstan wiring installation. It is to be noted that in some kits the capstan wiring may already be soldered to the Hawkeye board in which case all that you have to do is to plug the connector into the motor.

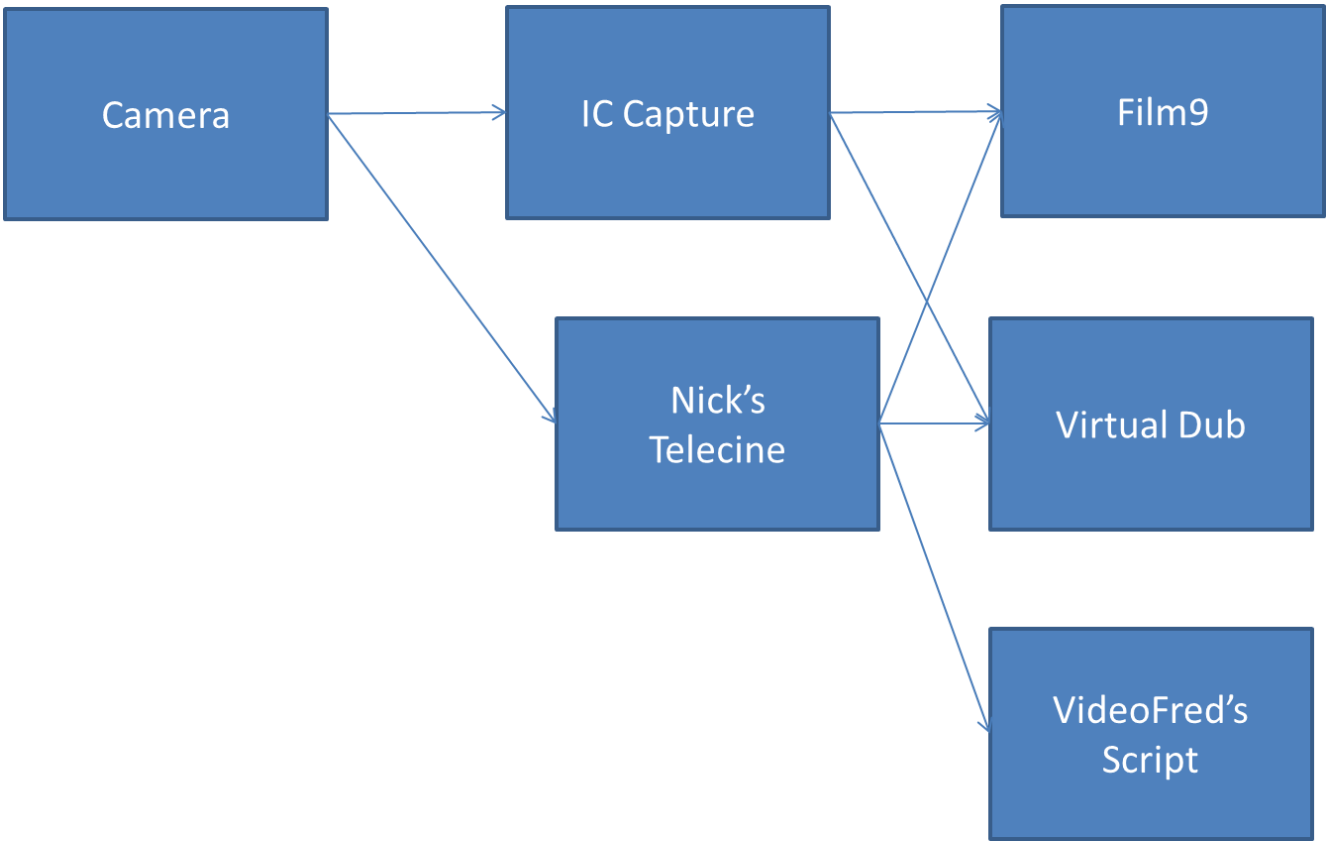
If the cable is not soldered to the board then you will have to solder it by following the diagram below.



Hawkeye Film Scan Procedure

Overview

The procedure is outlined below:



The best results so far were obtained by using the IC Capture and then with Virtual Dub and VideoFred script option 4.

Listed here are programs used and some other used for experimenting.

The IC Capture program can be obtained from the following link:

https://www.theimagingsource.com/support/downloads-for-windows/end-user-software/iccapture/

VideoFred's script plus VirtualDub2 – Stan's version:

https://drive.google.com/open?id=1ICS4yfdq11s3UVfLaKwdj7SDPLWskHyt

Fred's Script link:

https://forum.doom9.org/showthread.php?t=144271

VirtualDub2

https://sourceforge.net/projects/vdfiltermod/

As the picture shows, there are many combinations and lots more available. In here we will cover the process with Virtual Dub and VideoFred script only.

First Step First

It is assumed that the Hawkeye board is installed and working. If not, follow the installation instructions in the installation section of this manual.

Connect the camera usb to the camera and the PC.

Run IC Capture in the PC and proceed with the settings.

IC Capture Settings

Three camera models are used with Hawkeye:

DFM72BUC02

DFM37UX226

DFM37UX178

The UX226 and UX178 have higher resolution and a bit nicer color tones. The shadows have a bit more details and do not have the red tinge like with BUC02. Other than that the two cameras are similar.

One more note, the UX226 and UX178 are USB3 cameras are can run higher resolution at faster scan rates.

Note: The settings are very similar but there are a few differences listed here:

UX226 exceptions:

White Balance:

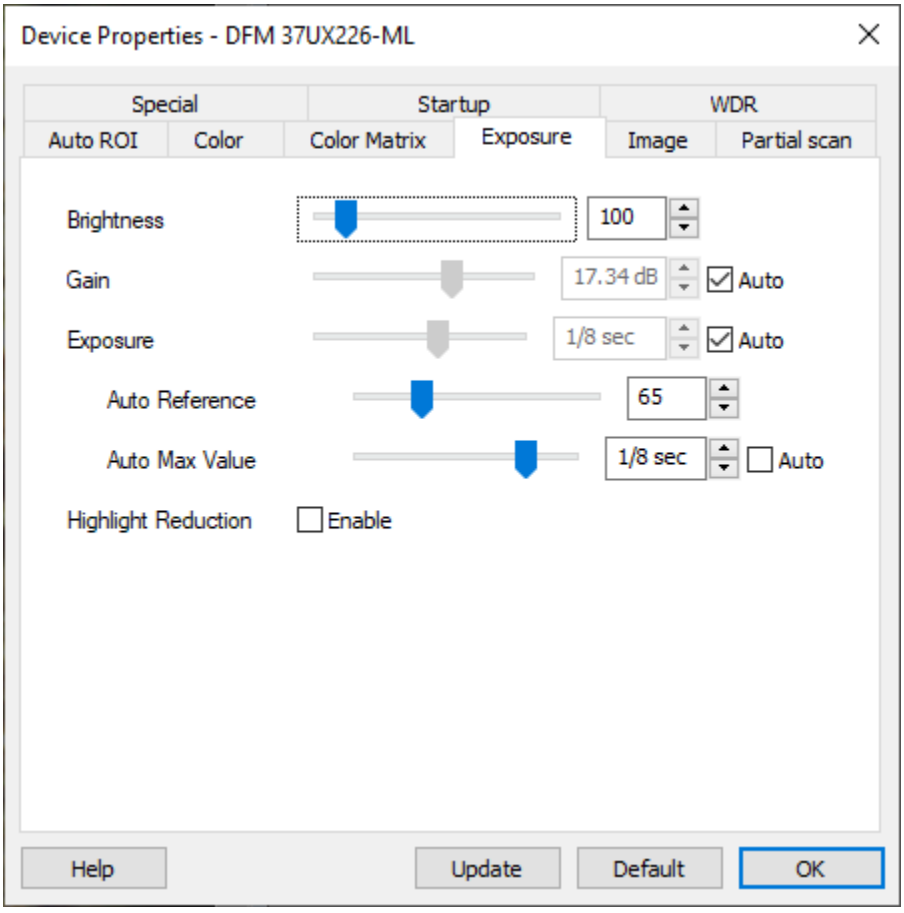
R = 3.17

G = 1.09

B = 1.00

In order to be able to scan at 1 FPS with this camera the exposure has to be tuned for higher speed.

Here are the settings:



WDR should be turned on but does not have additional settings like the BUC02.

End of UX226 exceptions:

UX178 Exceptions

White Balance:

R = 2.73

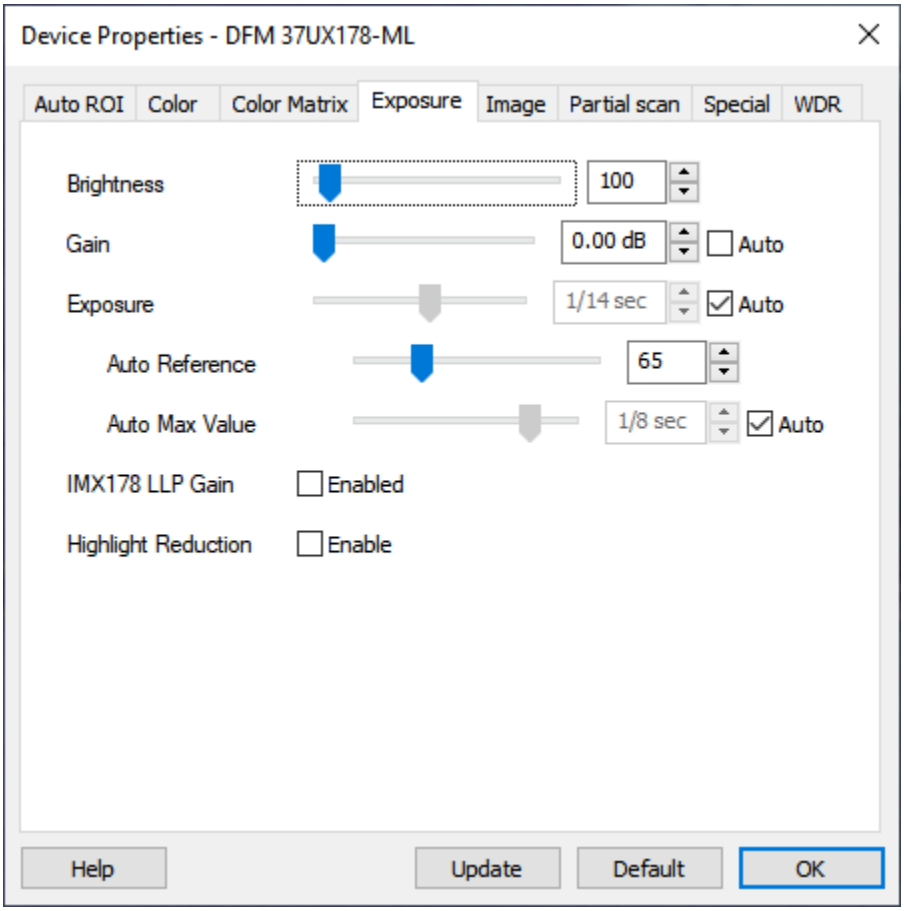
G = 1.13

B = 1.00

WDR should be turned on but does not have additional settings like the BUC02.

Another setting that is different is how the frame rate (FPS) is adusted.

The picture below shows the exposure screen:



The Auto Reference is similar to the BUC02. It determines how bright the image will be in auto exposure mode. Usually around 65 is a pretty good setting. But if the film is darker the exposure time could become very long and will push the exposure time very high and will cause overlap with the next frame. This will then results in smudged image (exposure catching up with the film advance).

The Auto Max Value if checked mitigates this issue. If the image is very dark, it will limit the exposure so that the FPS setting from the top menu is still maintained.

For example, if the scan is running at 2 frames per second (RUN, SPEED, TURBO ON) and resolution set to 2048x1536, then the FPS on the top should be set to 8 or close to that.

If it is set to higher than that, then with the Auto Max Value checked, the brightness limiter will make the image darker (faster exposure) trying to maintain that higher FPS setting.

If it is set to lower than 8, then the image will be brighter but the exposure can exceed the limit and the smear may occur. So setting the FPS to 8 is a pretty good compromise but some experimentation is recommended to get a decent bright image without smearing.

Obviously, if the film is very dark and none of the settings work, then a lower scan rate will fix that, but the scanning process will take longer.

End of UX178 exceptions.

Set resolution to 1280x1024.

Here is the summary of IC Capture settings. Try the settings first and if not happy with the result follow the detailed procedure below to tweak the settings.

- Color
  Saturation = 59
  White Balance Auto = off
  White R = 96
  White G = 64
  White B = 65
  Color Enh = off

- Exposure
  Exposure Auto = on
  Auto Reference = 84 (INCREASE THIS IF FRAMES TOO DARK)
  Highlight Reduction = not set

- Image
  Sharpness = 0 (SET AS REQUIRED – SET to 0 IF SHARPENING DONE IN POSTPROCESS)
  Gamma = 80
  Denoise = 0

- Partial Scan - set as required to center the frame

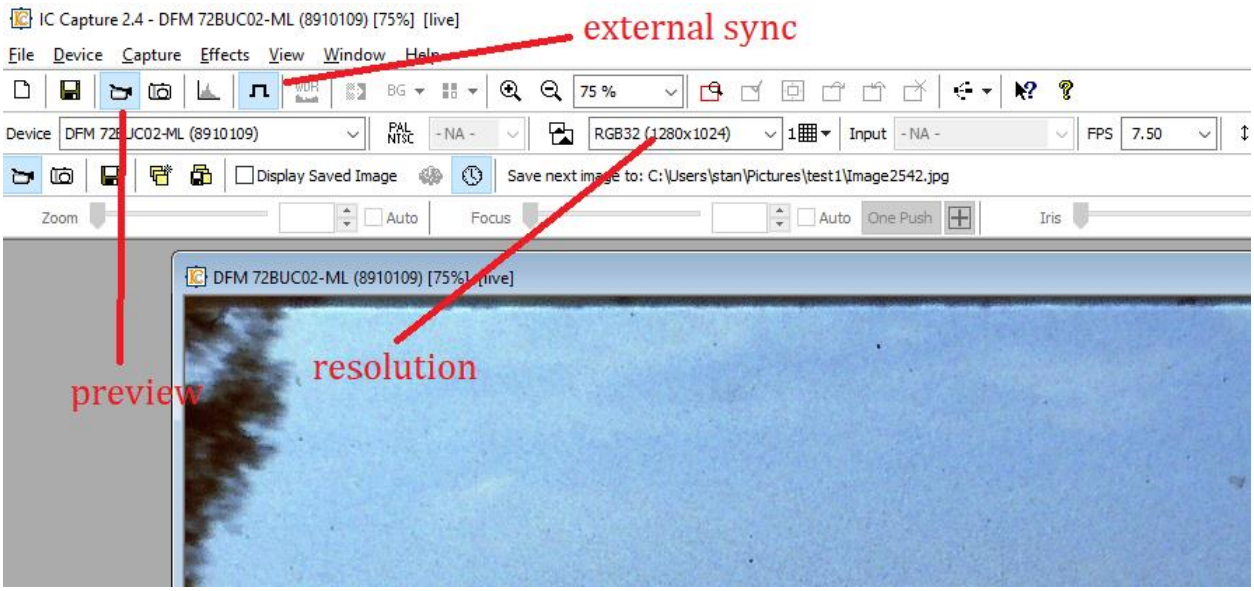
- WDR
  Tone Mapping = on
  Intensity = -1.76
  Global = 0
  a = 3.28
  b = -0.24

c = 0.30
lum_avg = 0.35

Save settings.

Resolution, external sync and preview

The first thing is to set the resolution to 1280x1024.



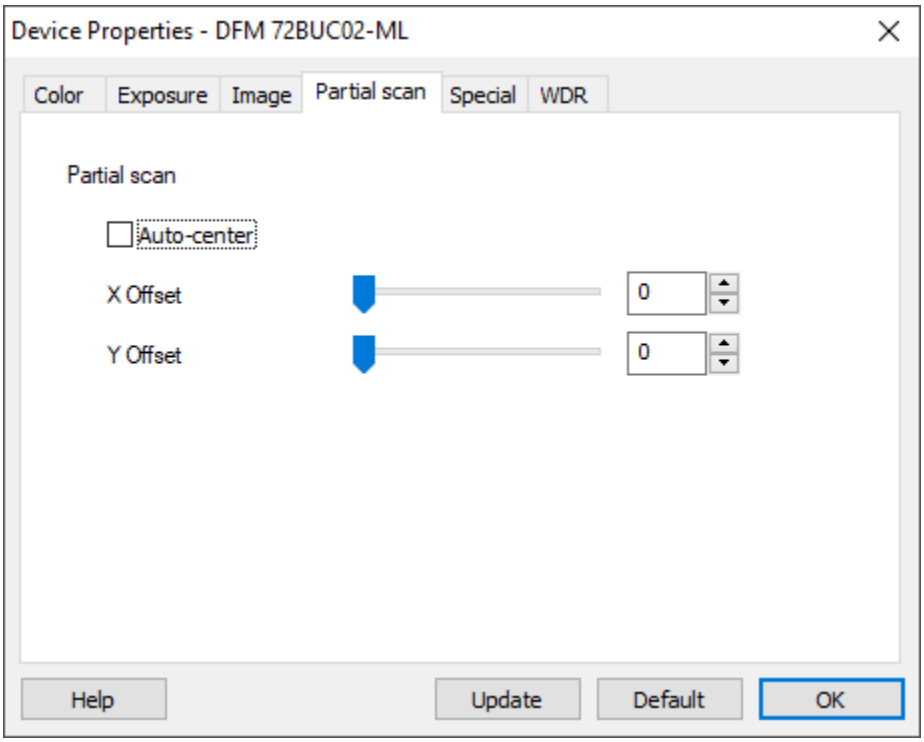
Turn external sync off and turn on preview.

Set resolution to 1280x1024

Set Partial Scan

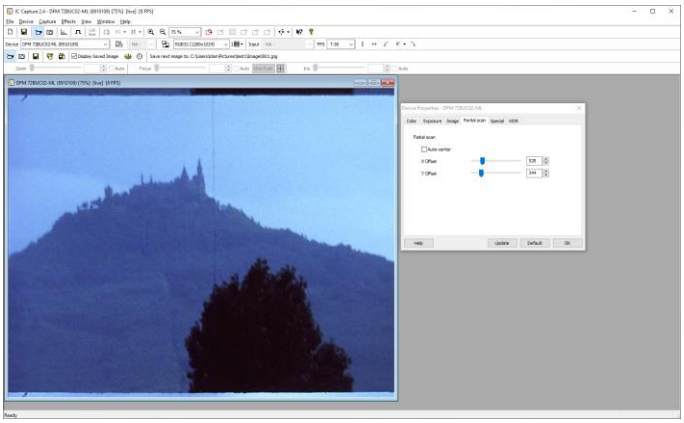
Click on Device menu and then select Properties.

A new window will open up:



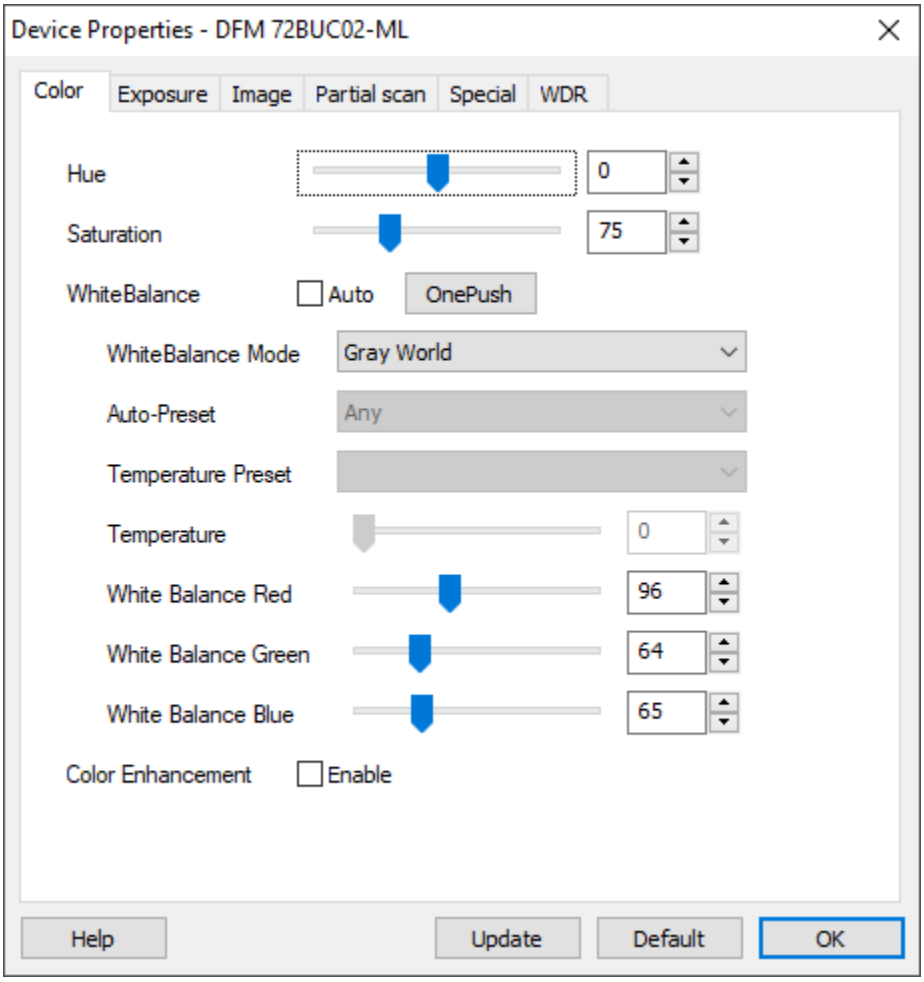
Make sure Auto-center is un-checked.

Adjust X offset and Y offset until the frame is centered properly. Since the frame is a bit smaller vertically than the window, some rollover will show on the top and bottom. This can be removed during post-processing.



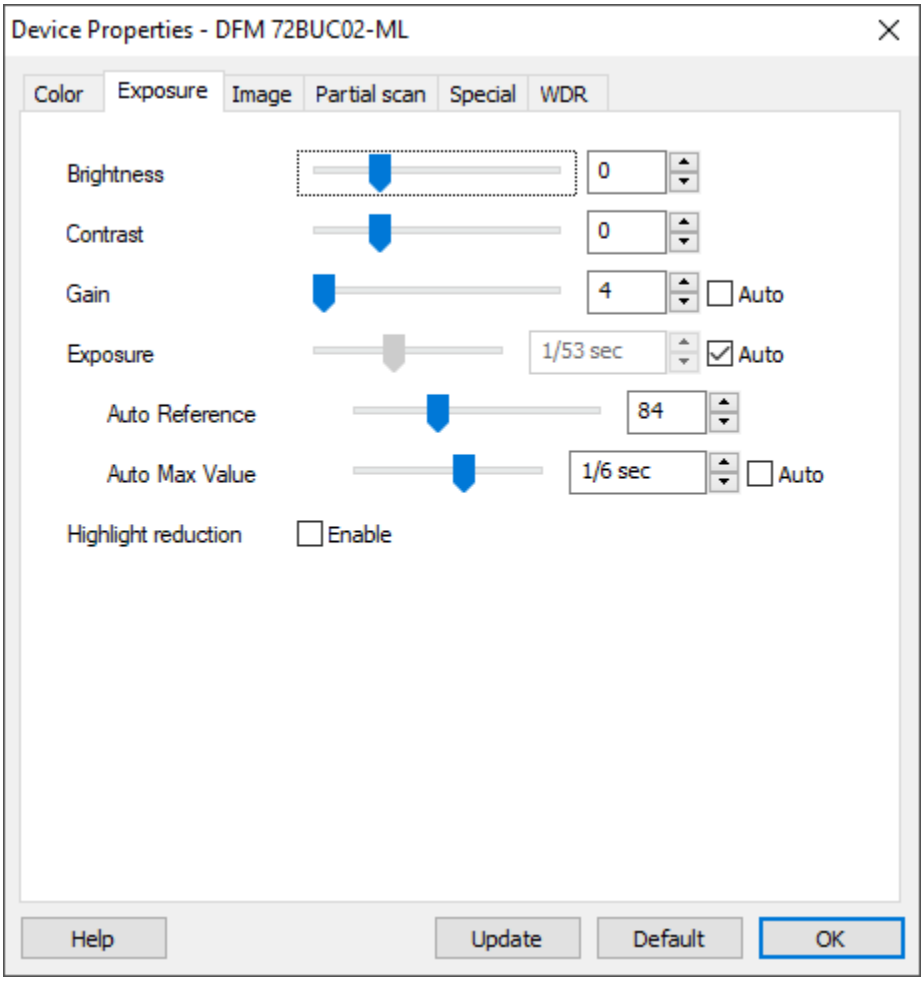
Color Adjustment

Click on the Color Tab and adjust as shown:



Exposure

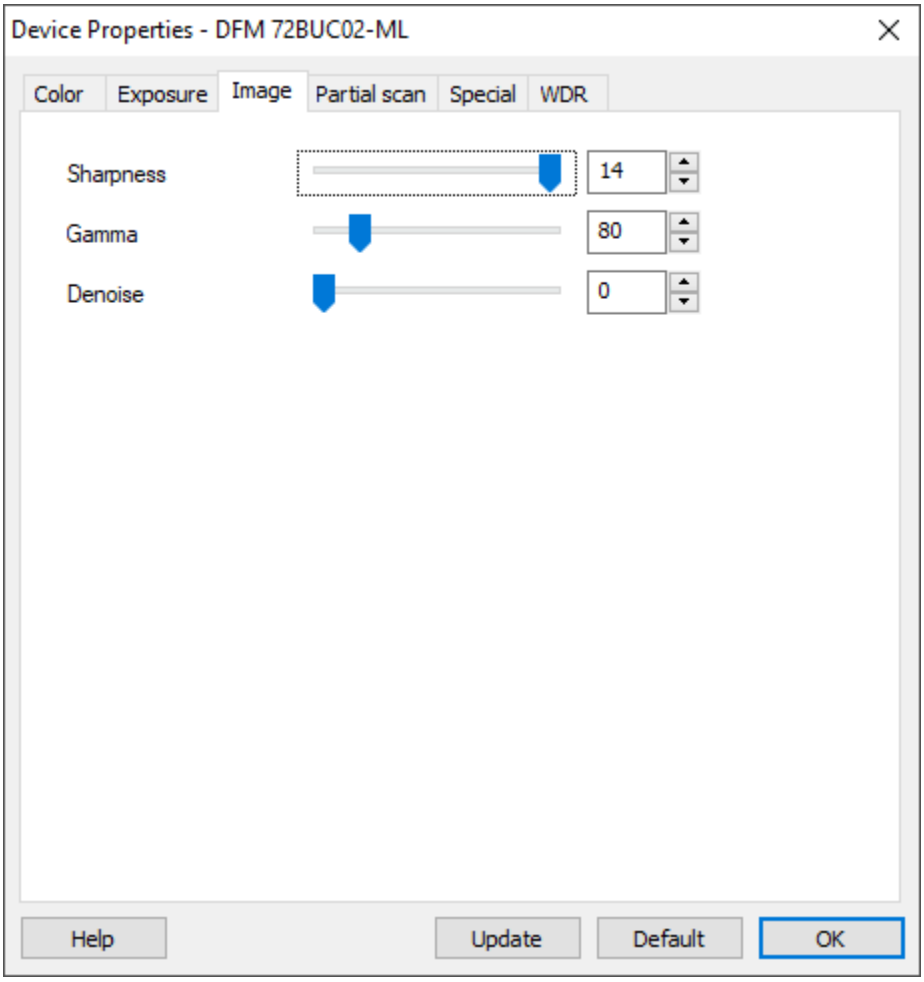
Set as shown:



The Auto Reference setting will impact the average brightness. If a particular scene is difficult and the auto setting is not very good you can change the setting on a fly. Stop the scanner and adjust and then just continue. There will be no break in the images.

Image

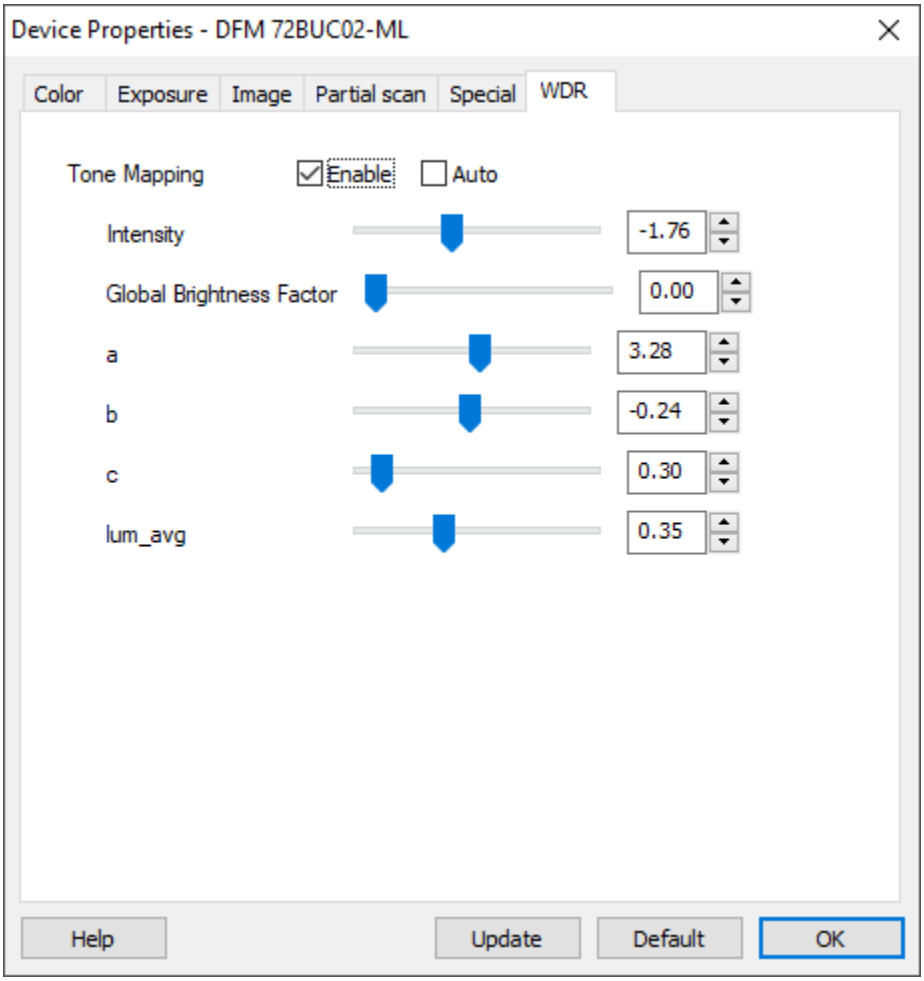
Set as shown:



Set sharpness to 14 if this is a quick scan with no post-processing. Otherwise, set it to 0, and readjust during post-processing.

Gamma is important to keep the balance between the dark and bright areas. It is better to set it here than during post-processing. Make sure WDR is turned on. Otherwise the images will look washed out.

WDR

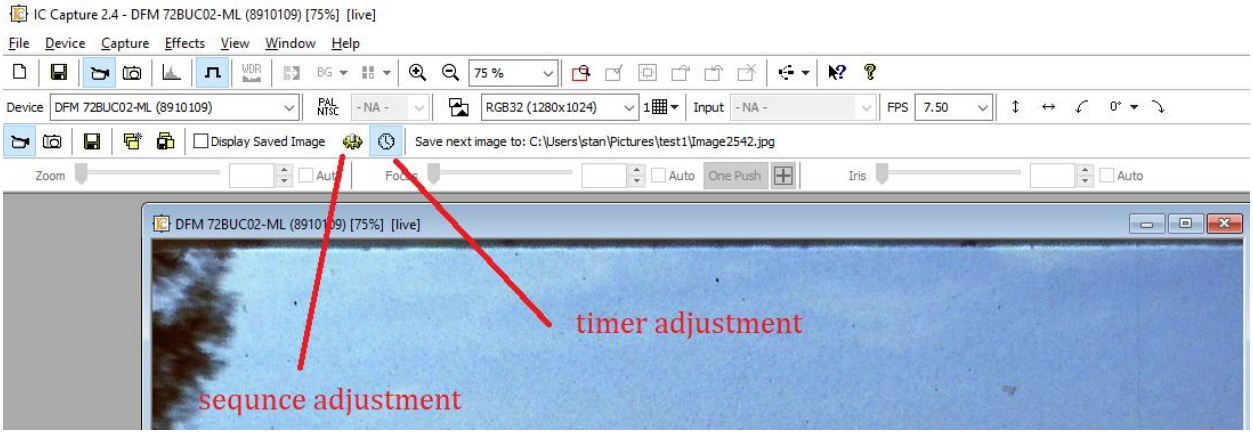


This is the Wide Dynamic Range settings. The chip has a 12bit A/D converter and the camera output is 8. So the 12 bit input has to be compressed into 8 bits. The camera firmware has a smart way of doing this compression. It drops out the bits that are less relevant to the quality of the image.

You can reset these values by picking up nice open scenery with lots of dark and bright areas, such as the blue sky, tree and building deep shadows. Then, turn auto-brightness off and turn the WDR auto on for several seconds to let it do its thing and then turn WDR auto to off, and auto-brightness back to on.

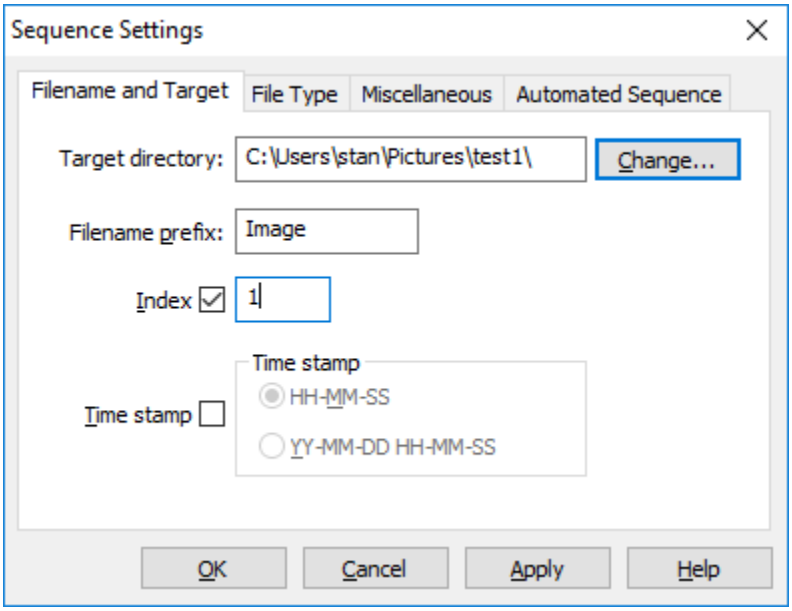
BTW – WDR will make the image more defined because the gamma setting of 80 makes it somewhat dull.

Sequence and timer adjustment



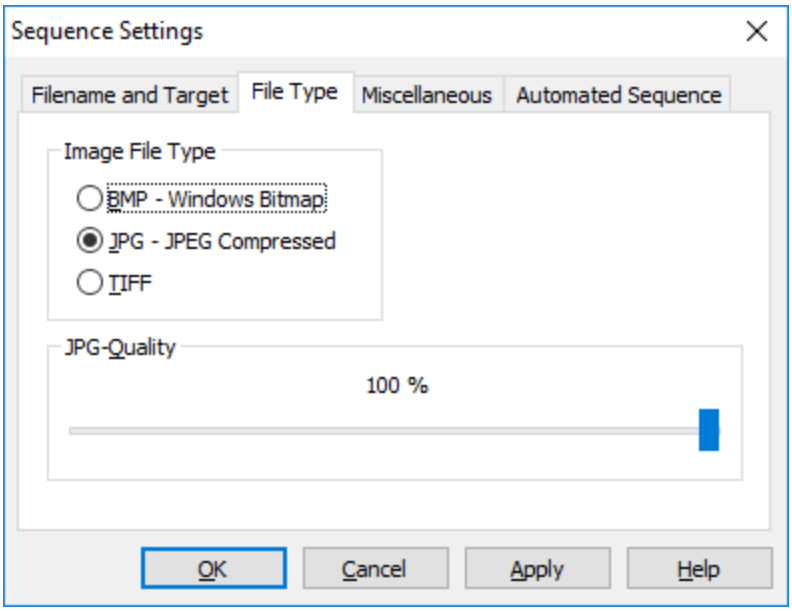
Click the sequence button:

Filename tab



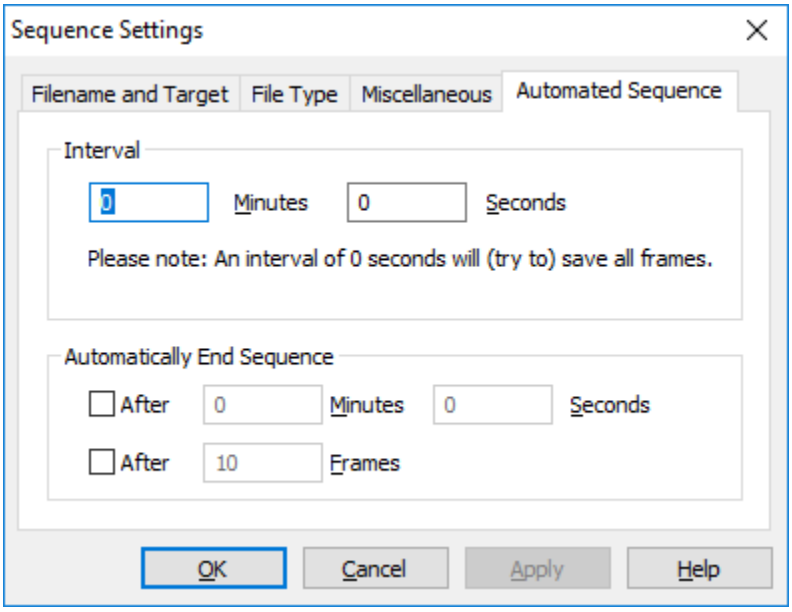
Set the destination folder path for the capture and sequence number and file name prefix as required.

Select File Type tab:



Select the type that you prefer. Jpg lower quality but less storage space required etc… If VideoFred is used, make sure to use tiff files. It will make a big difference in the end. BTW – you can spool the tiff files onto external drive if your machine is fast enough.

Select automated sequence:

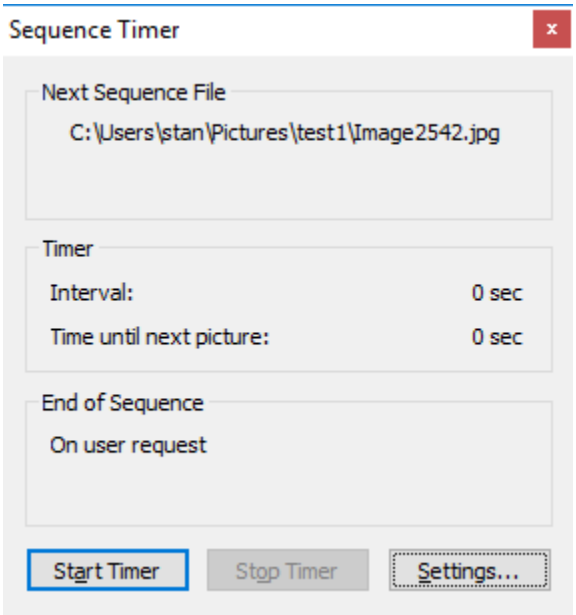


Make sure the interval is 0 minutes and 0 seconds.

Press OK button when done. The window will close.

Turn on external sync. If you do not proceed with the timer and start it the capture folder will be flooded with images. So, always make sure that the external sync is on before you start the timer.

Press the timer button:



Press start timer.

Start the capture by turning the Hawkeye run switch on. The machine will start capturing the images in the destination folder one every two seconds.

The destination folder will contain all of the images. These can be post-processed by Film9:

Create avi file with VideoFred (Virtual Dub2)

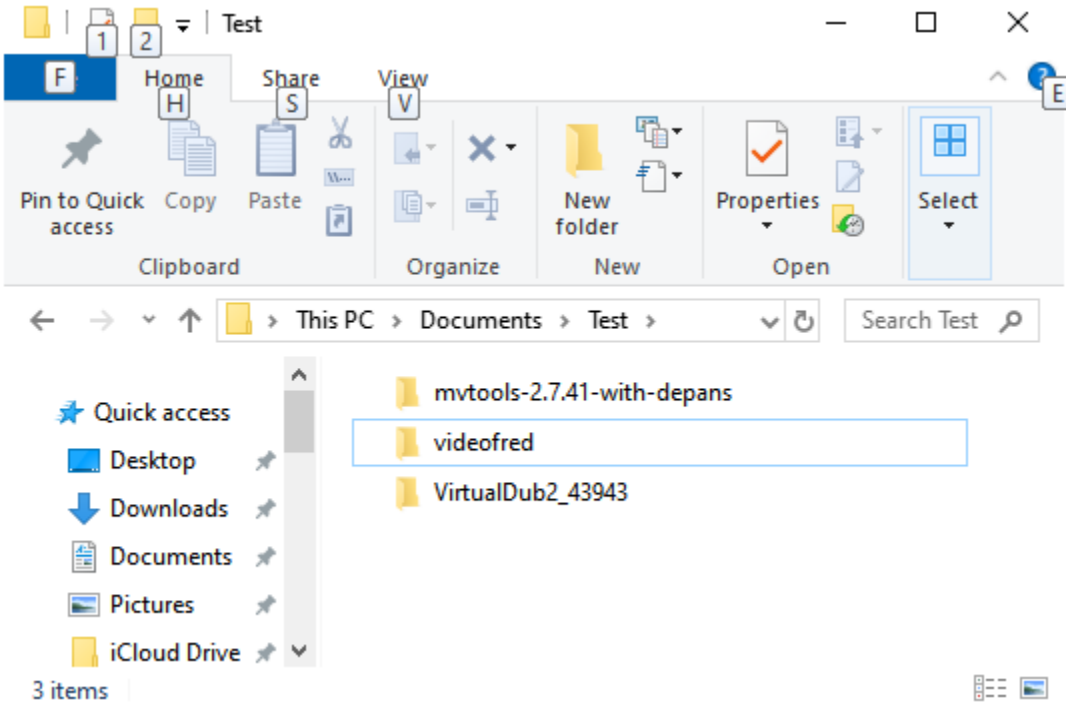
Download the zip file:

https://drive.google.com/open?id=1ICS4yfdq11s3UVfLaKwdj7SDPLWskHyt

Extract the zip in your download files folder. You will see Postprocess folder there once the unzip is done.

Move the Postprocess folder somewhere into a work directory on your machine.

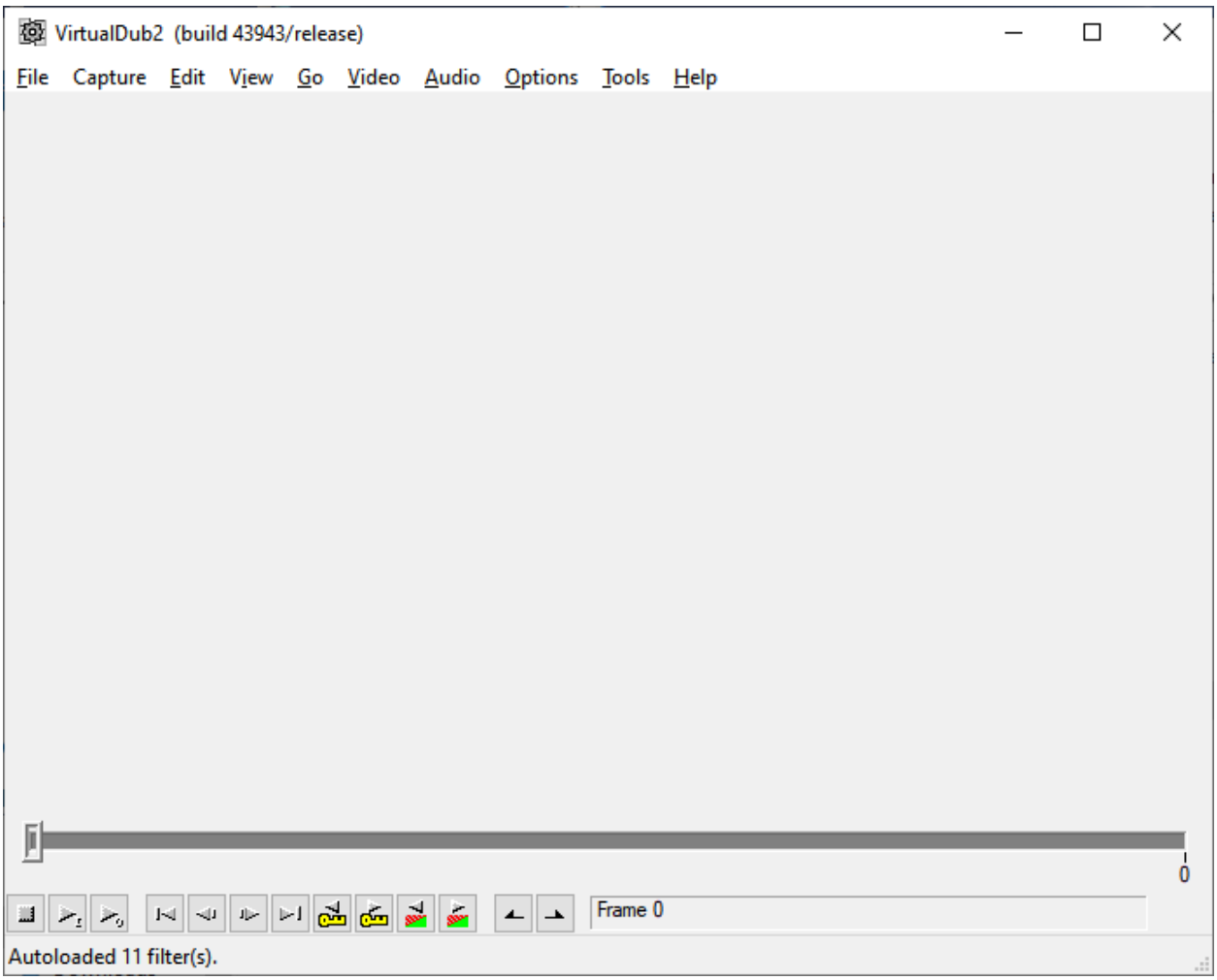
Open up the Postprocess folder. Should see the following directories there:



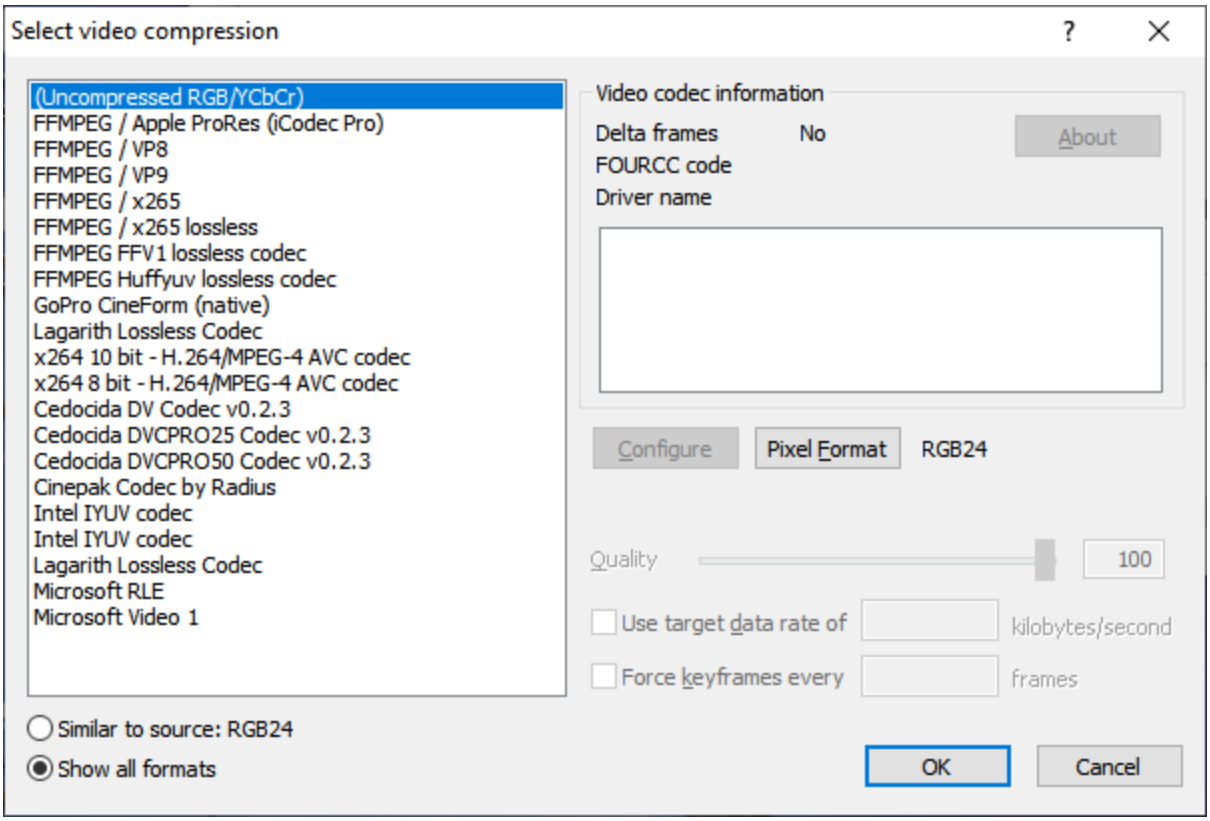
Go into VirtualDub2_43943

Double click on VirtualDub.exe.

VirtualDub2 will open.

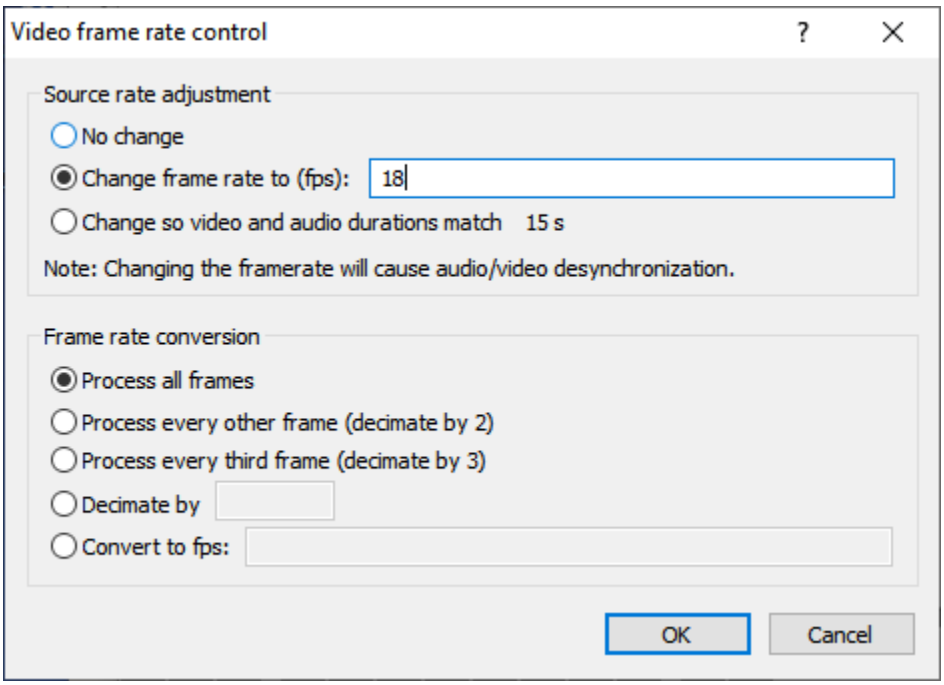


Click on the video tab and compression.



Make sure that Uncompressed is selected. Click OK.

Click on Video tab and then frame rate.



Set frame rate as required. I use 18 fls.

Click OK.

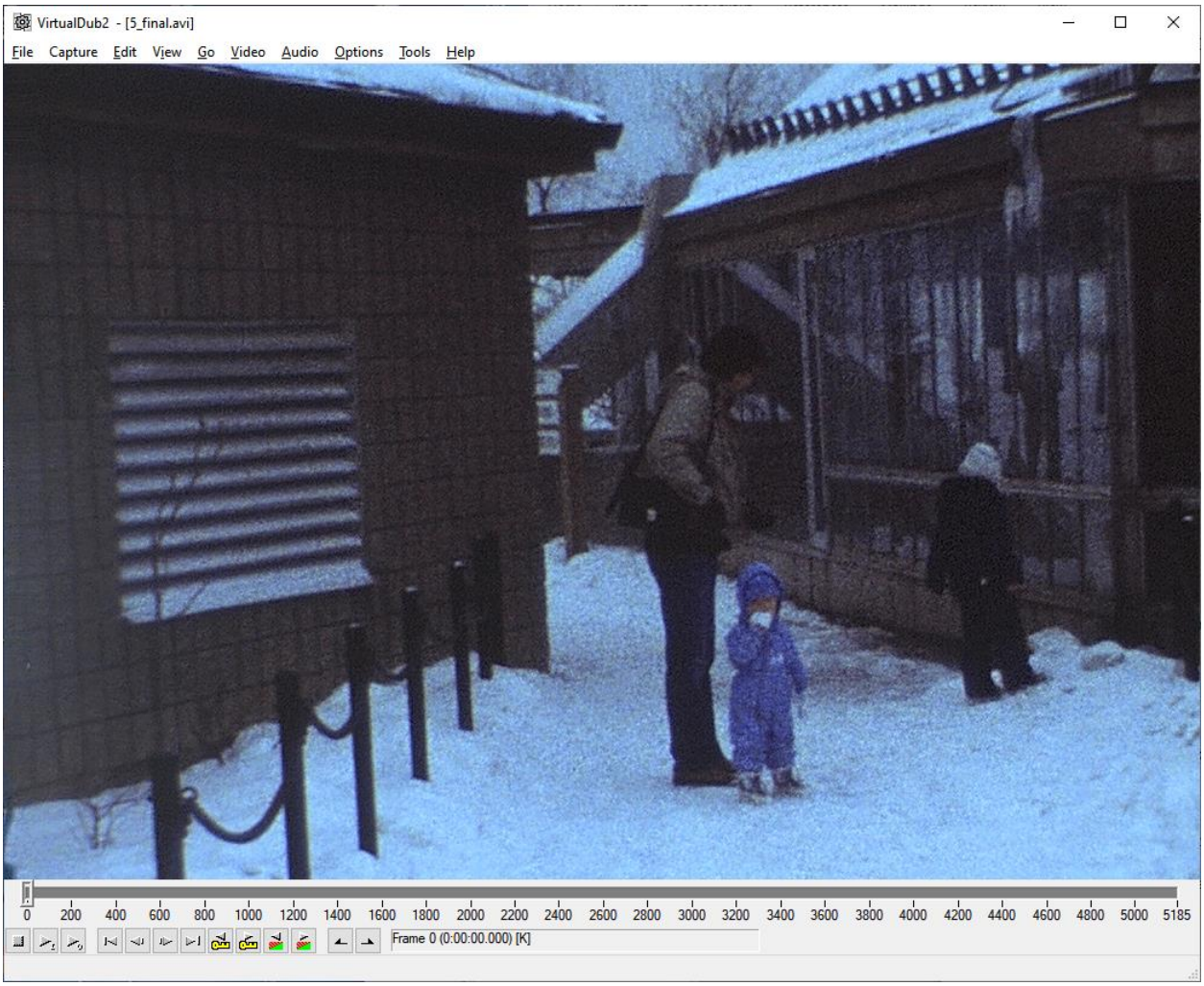
Next create a raw video from tiff images.

In VirtualDub click on Fle then

Open Video File

Open the first picture in the tiff series of pictures.

VirtualDub will create a video automatically from the series. Make sure that you have consecutive numbers in the series.



Then just save the file into you work directory and call it something something raw.

This is a raw unprocessed file. It is large and you can play it in VirtualDub or some other player but it will be choppy.

Next, close the file in VirtualDub by clicking File and then Close video file. Do not exit VirtualDub. Leave it there.

Now, go into the following directory:

Postprocess\videofred\20)Film_Restoring_vs_06_2012\scripts

Open up option4.avs file with a text editor (notepad is fine).

You have to change only one thing there:

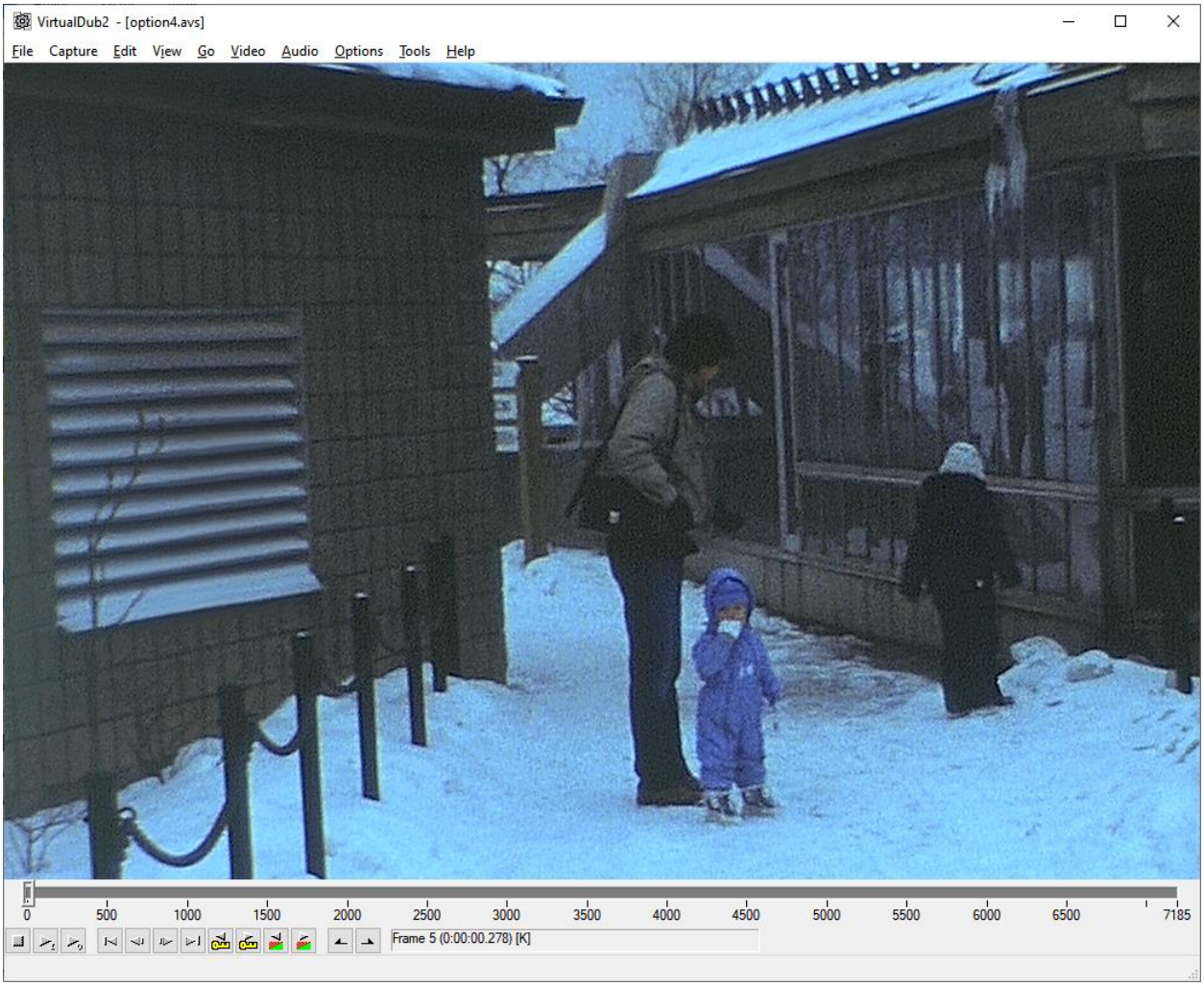
```
# 8mm film restoration script by videoFred.
# www.super-8.be
# info@super-8.be

# version 01.A with frame interpolation
# release date: june 20, 2012
#=============================================================================================

# august 2010: added removerdirtMC() as suggested by John Meyer
# october 2010: auto sharpening parameters

# march 2011: new autolevels.dll by Jim Battle
# www.thebattles.net/video/autolevels.html

# june 2012: improved stabilisation


#=============================================================================================

# cleaning, degraining, resizing, stabilizing, sharpening, auto-levels and auto-white balance.
#=============================================================================================


#film= "C:\Users\stan\Documents\8mm_video_transfer\Wolverine\Videos\Hawkeye\test11.avi"
# source clip, you must specify the full path here
#film= "D:\Hawkeye\video\canada_raw.avi"  # source clip, you must specify the full path here
#film= "C:\Users\stan\Documents\8mm_video_transfer\stan_8mm\4a.avi"

film= "E:\Hawkeye\canada\12_raw.avi"
```

Change the path to the raw file that you just saved whether it is on your local drive or external drive.

Save the avs file.

Now, go back to the WirtualDub program and click on File and then Open Video Fle and point to the avi file that you just saved.

In a few seconds VirtualDub will display the video.



If you get the removegrain.dll error then you probably do not have Microsoft tools runtime library installed on your machine.

Try downloading the runtime from here (will need an account to download). If you are concern that the library may cause other issues with the computer than skip this step.

https://www.wincert.net/forum/topic/9790-aio-microsoft-visual-bcfj-redistributable-x86x64/

Try this instead

Use the script debugger (AVSMeter). Download it from here (7z version):

https://www.videohelp.com/software/AVSMeter

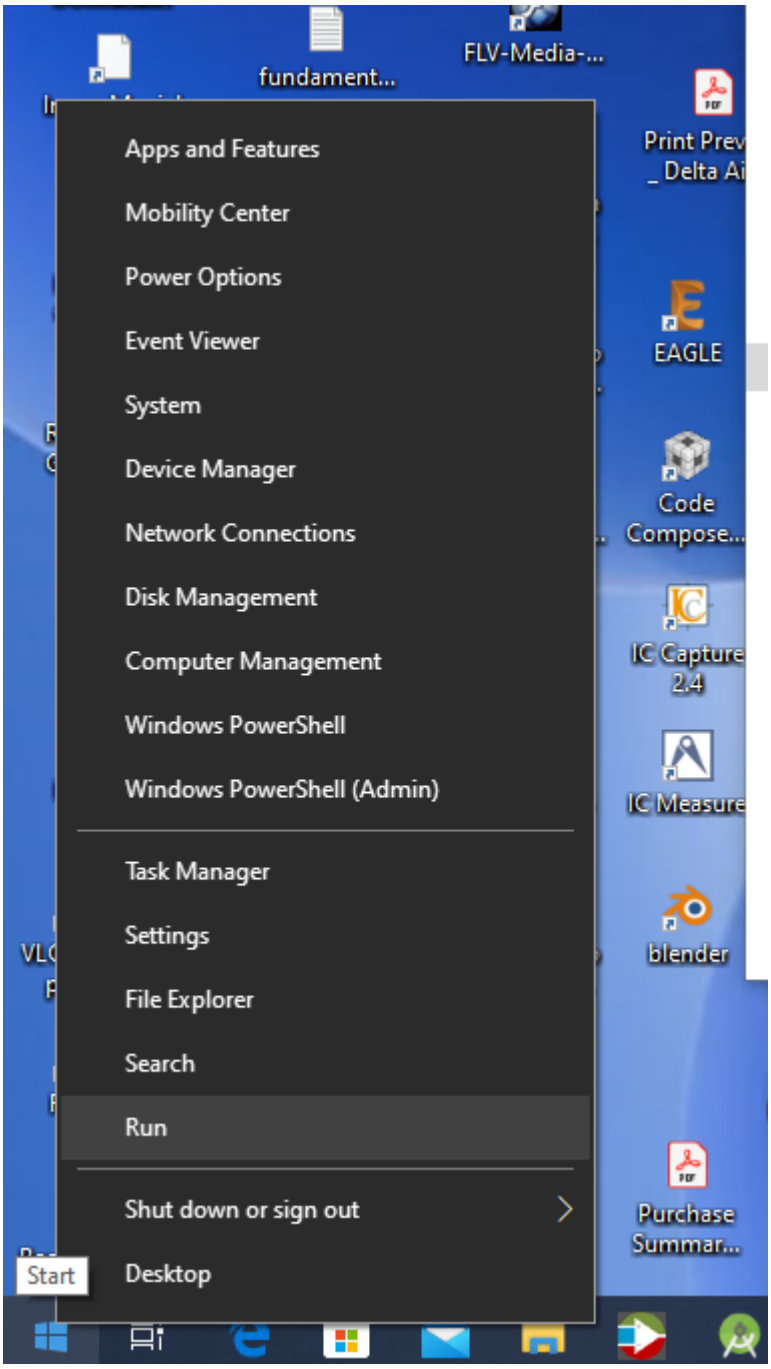
Or from here (zip version)

https://drive.google.com/open?id=1nTX_CwFATOgckPw0Upf7jWg6jWbTissD

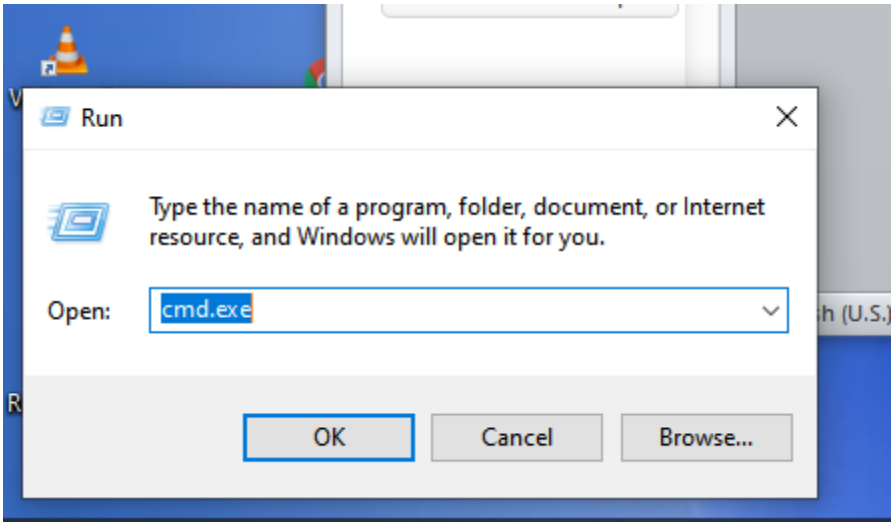
Save it in your Postprocess dir. Unzip and go into it with the explorer. Copy

AVSMeter.exe into your VideoFred scripts directory.

Open up dos shell by right clicking on the start button and hitting the run.

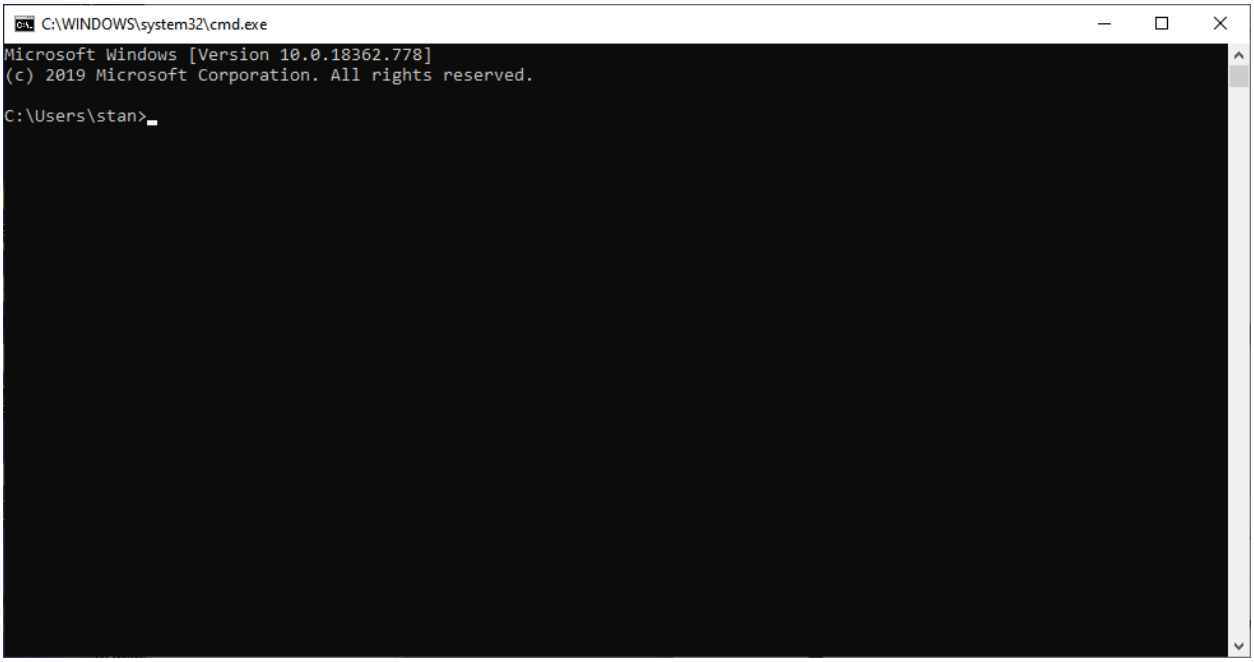


You will get the following:



Type in cmd.exe and then hit the OK button.

The command shell opens up.

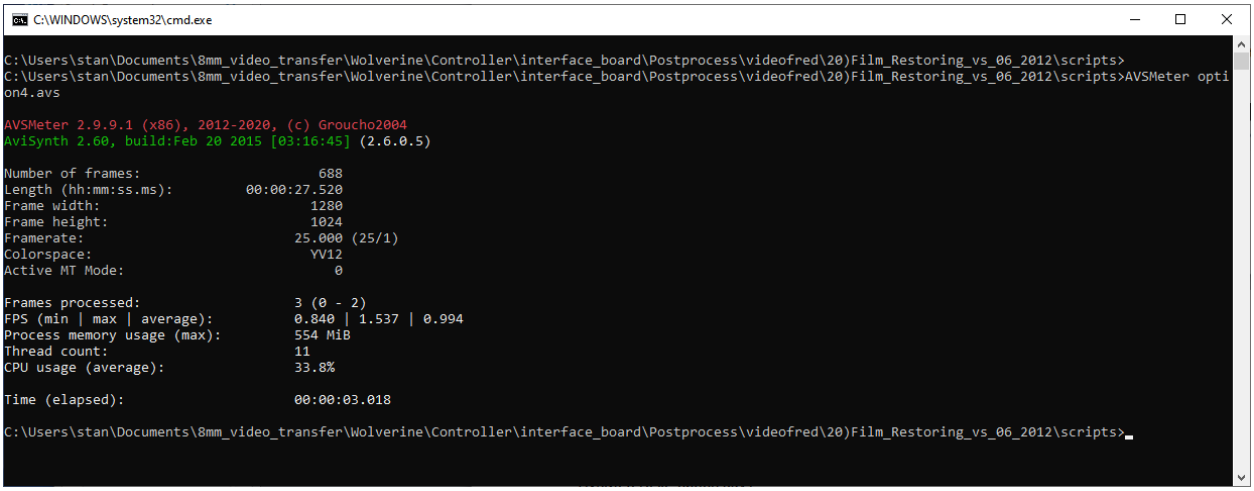


In the shell change the directory to your VideoFred scripts dir. For example, on my machine, I type in the following.

Then type in the following command in the shell:

AVSMeter.exe option4.avs

Should see the debug report.



If there are DLLs missing the report will show that.

After finding what is missing, get the components from the internet or contact me at:

sjelavic123@gmail.com and I will send you zipped DLLs.

Install the DLLs in your scripts directory and that should fix the issue.

Now you can save the file and it will be cropped, denoised and interpolated.

One more important note. It is not a good idea to save it in uncompressed format. So, in VirtualDub click on Video then Compression and select the compression type. I like Logarith but you may want a different one, whatever suits your needs.

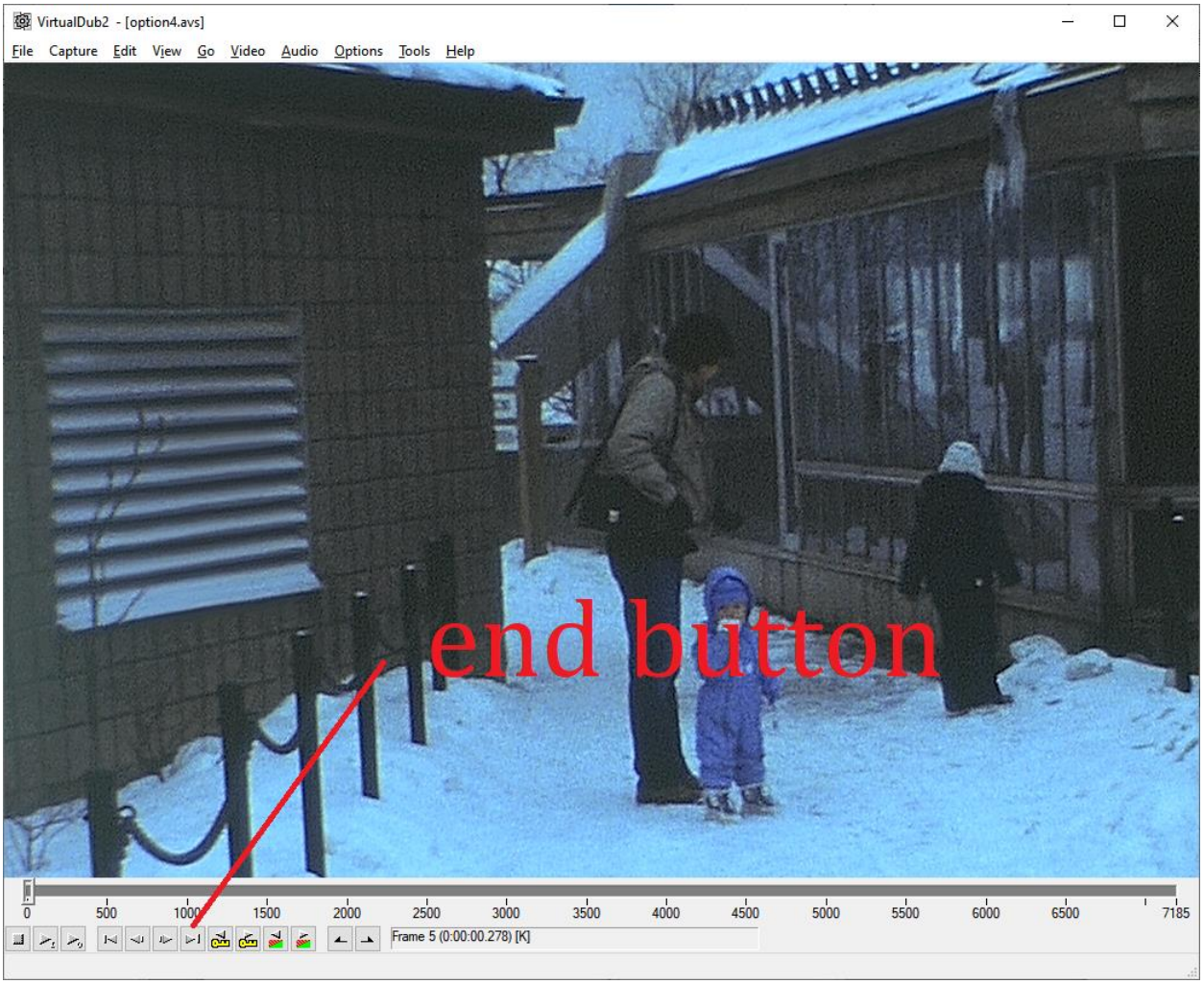
One more note. Option4.avs sets the final frame rate to 25 FPS. You can change that to whatever you want.

```
#PARAMETERS
#-------------------------------------------------------------------------------------------------------
----------------------------
result="result4" # specify the wanted output here

trim_begin=2  trim_end=10  play_speed=18   #trim frames and play speed (PAL: 16.6666 or 18.75)

numerator= 25  #numerator for the interpolator (final frame rate)
denumerator= 1 #denumerator  example: 60000/1001= 59.94fps
```

And that is it. Save the file and call it final something something.

VirtualDub can also be used to concatenate the clips. For that, save the processed clips in raw format.

Open the first clip in VirtualDub and move the end of the clip by clicking the end button.



Then click on File then Append Video segment. Hit again end button (do not forget that) then append next clip and so on until the last clip is in. Then set the compression and save the final video.

And that is it.

Run virtual dub. Make sure the compression is set to no compression in video tab. Also set the desired frame rate in video tab.

Open up the first image and save the video avi to the destination folder.

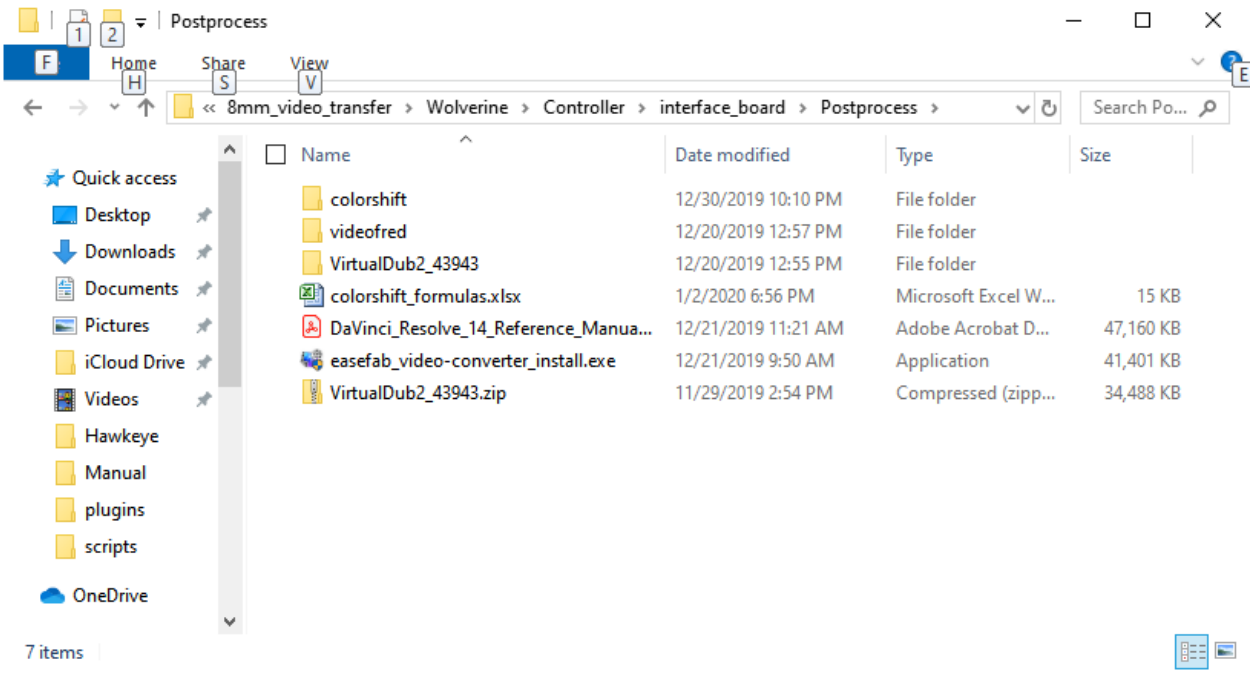
VideoFRed's Script (This runs with VirtualDub2)

Download the zip file from:

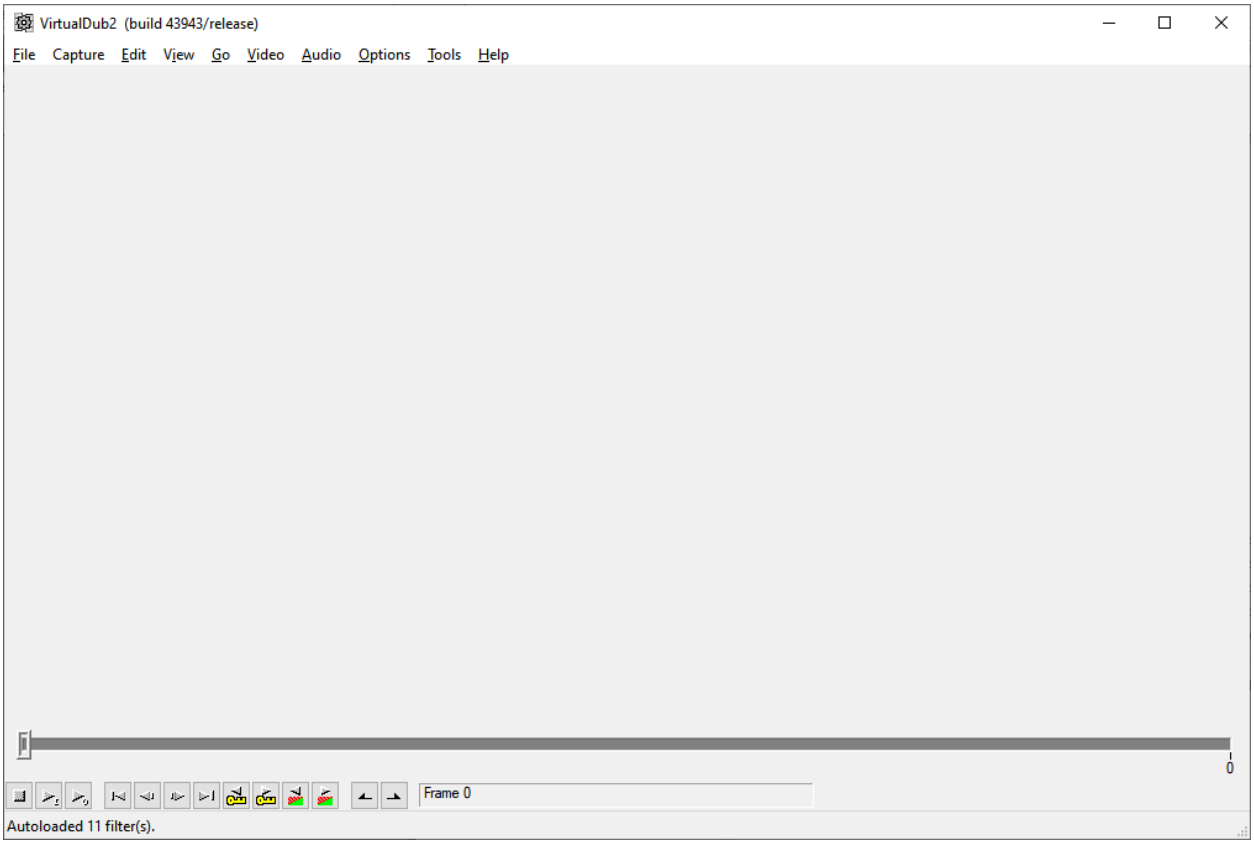
https://drive.google.com/open?id=1ICS4yfdq11s3UVfLaKwdj7SDPLWskHyt

Unzip the file into a work folder.

The folder has the following structure:



The VirtualDub2_4393 folder contains VirtualDub and that is first to be run.



The next thing is to set up the script.

Go into:

videofred\20)Film_Restoring_vs_06_2012\scripts

Open up option4.avs in text editor.

Change the video file path to correspond to the avi file that you saved in the previous steps.

Example:

film= "C:\Users\stan\Documents\8mm_video_transfer\Wolverine\Videos\Hawkeye\telecine4.avi"

Next, change the following line:

result="result8" # specify the wanted output here

For side by side preview:

result="resultS4"

And for the final video:

result="result4"

Also change the red and blue color settings:

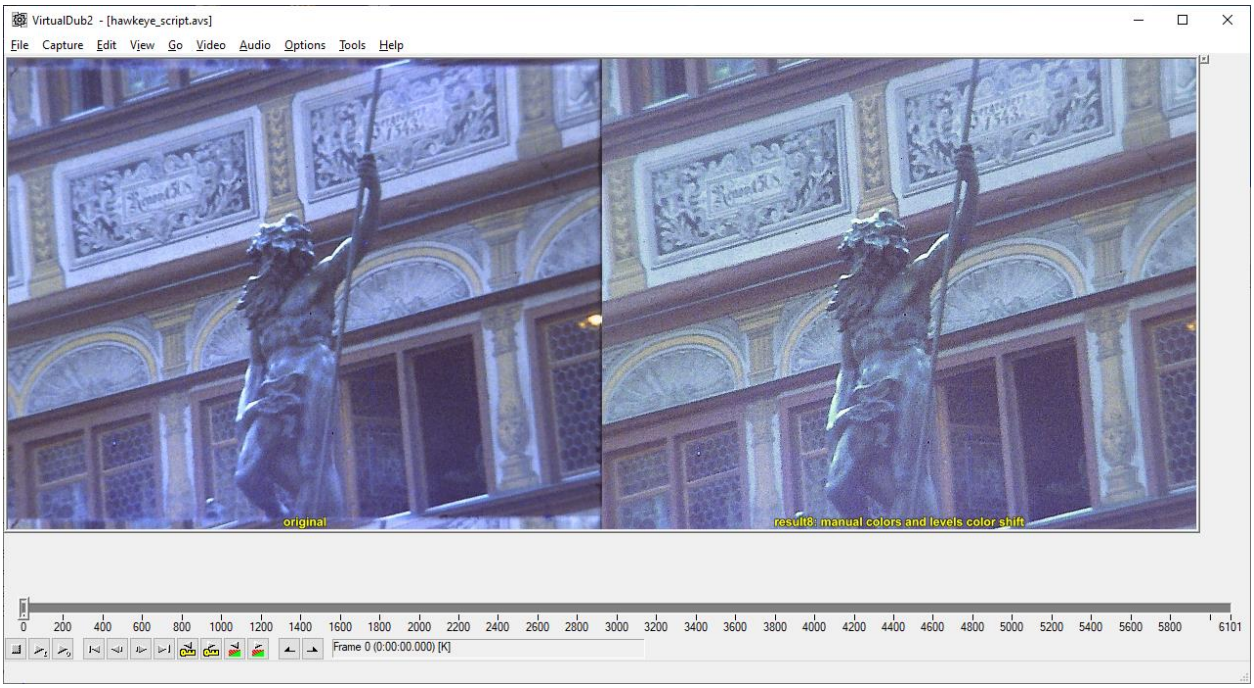
blue= -1 red= -4.5 #manual color adjustment, when returning result3 or result4. Values can be positive or negative

This makes the blue somewhat closer to real blue color, especially the color of the sky.

How to run the script

In VirtualDub2 click on File in the top menu and open up hawkeye.avs script.

The input and output vide will be presented side by side.



You can play the video, stop it etc.

You can also change the script and reload the video and observe the results of your change.

Once done, change the script for final video. Load the video and then save it in whatever format is suitable for you. Note that you can also change the compression in the video menu. It is recommended to use a lossless codec.

Hawkeye 2-exposure HDR

Required Support Software

Download:

https://www.theimagingsource.com/support/downloads-for-windows/software-development-kits-sdks/icimagingcontrolcsharp/

Once downloaded, run the .exe file for install the TIS components.

Download Hawkeye HDR app:

https://github.com/vintagefilmography/hdr

HDR Windows software for Hawkeye

Note: Hawkeye board V12 or higher and MSP FW mod are required for proper HDR operation to provide two camera triggers for a single external trigger.

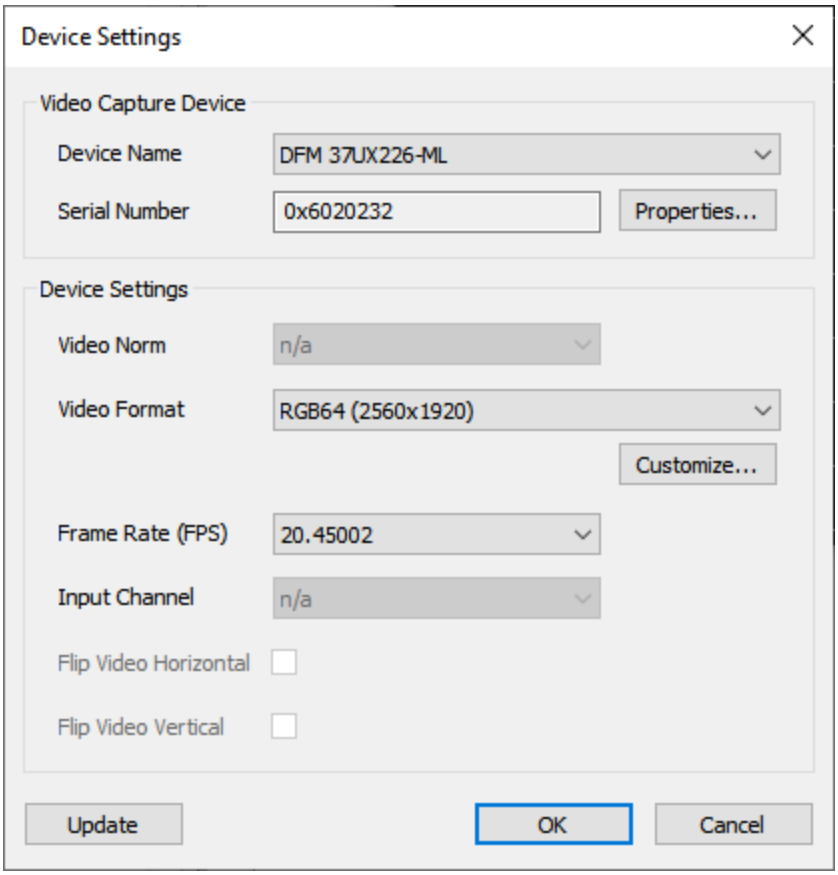
This is the windows software that runs hdr on the Wolverine scanner that has the Hawkeye mod. The software is written in Visual Basic and it connects to the camera and waits for the image ready event. After the event is received the sw stores the first image and lowers the camera exposure for the second image. When the second event is received it stores the second image. The process then repeats. The hawkeye MSP430 firmware has a mod to trigger the camera twice for each external trigger.

To run the sw go to the .../bin/Release dir and run the hdr1.exe file.

If you run into DLL issues, make sure that the TIS setup has been run as instructed above.

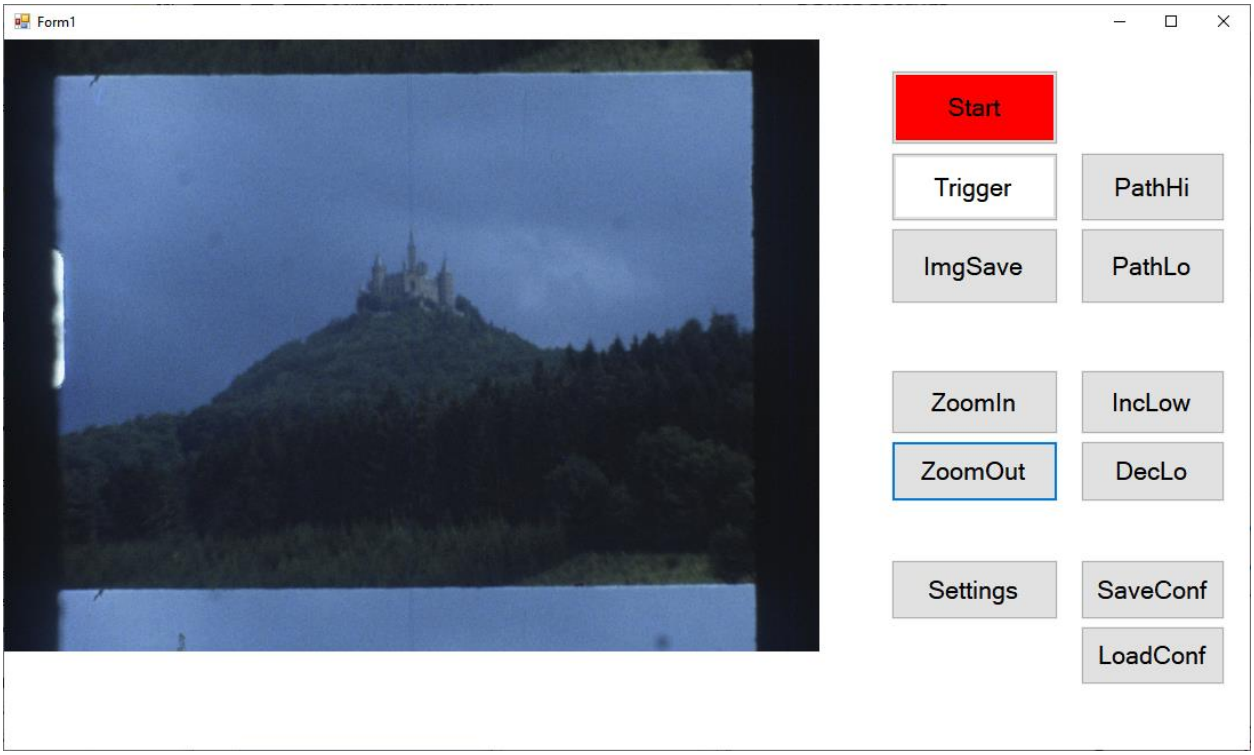
Ypua lso may want to install the Visual Studio 2019 community free version just to make sure that there are no DLL incompatibilities.

The Device Settings window will pop up.



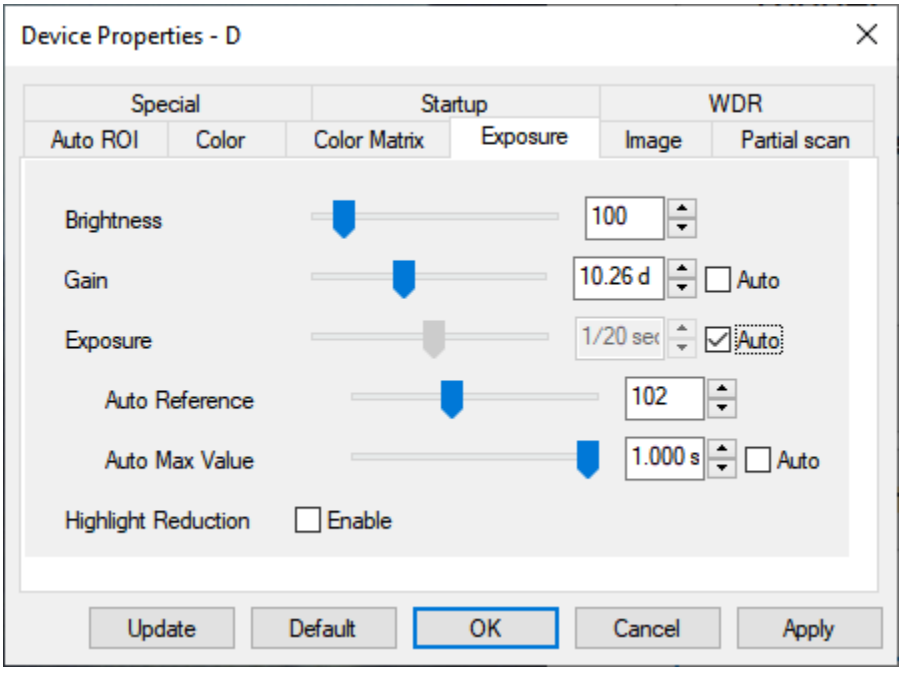
Make sure to set the highest FPS possible.

Click OK. A new window will open.



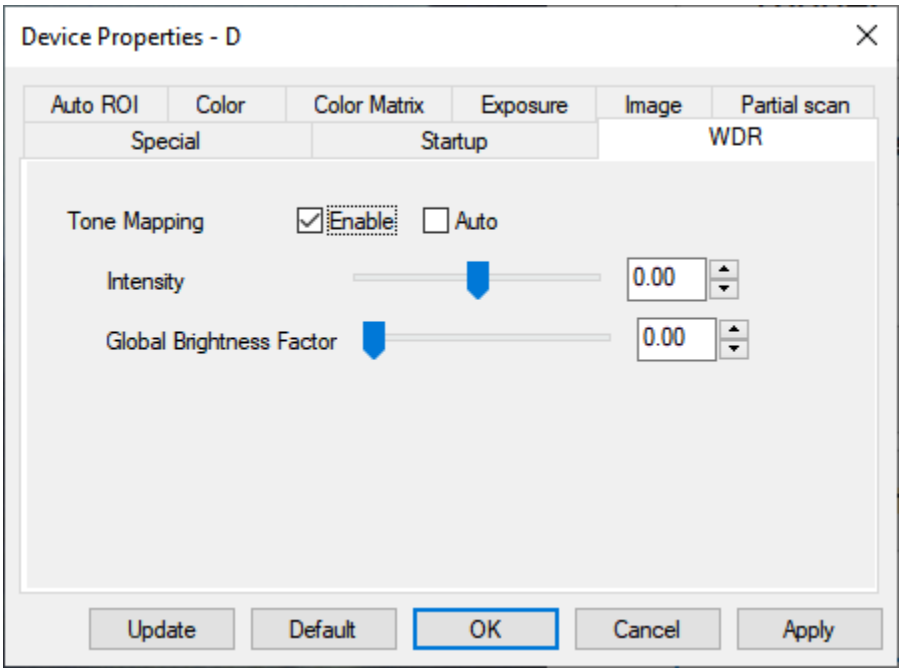
Toggle the Trigger button to make sure the trigger is not on and then click the Start button. The camera preview preview should get displayed. Click on ZoomOut to be able to see the whole frame.

Click on the settings button.

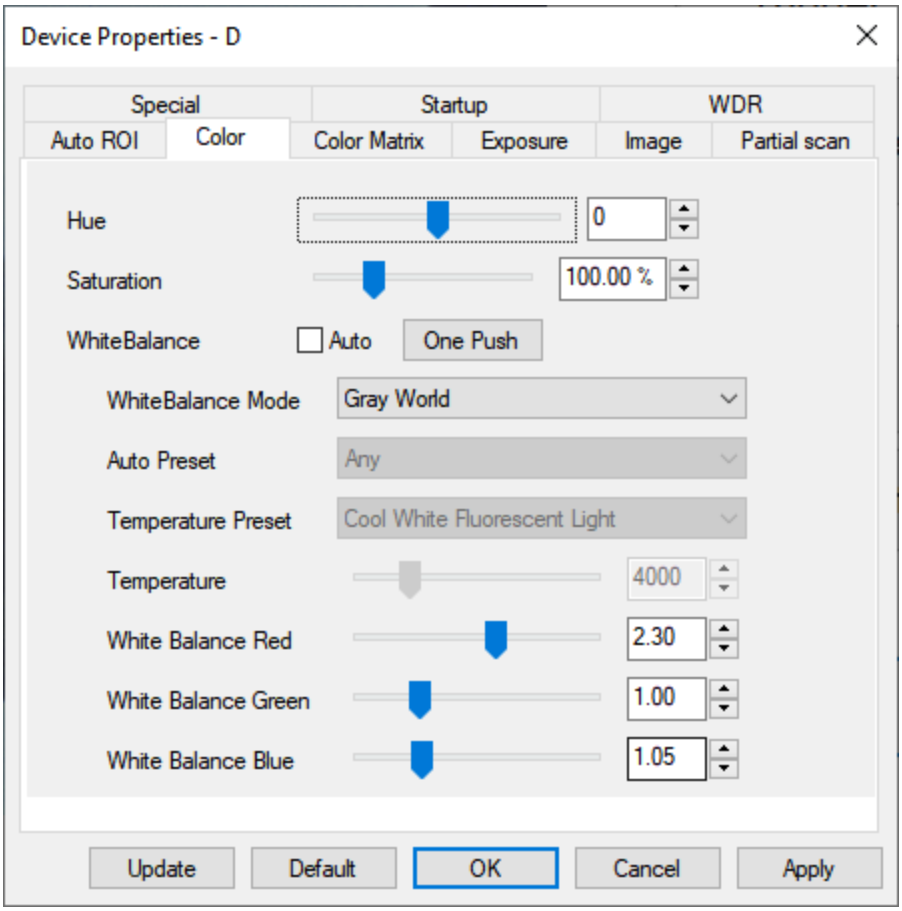


Shown above are recommended settings but ultimately you will want to tweak them to best fit your scan.

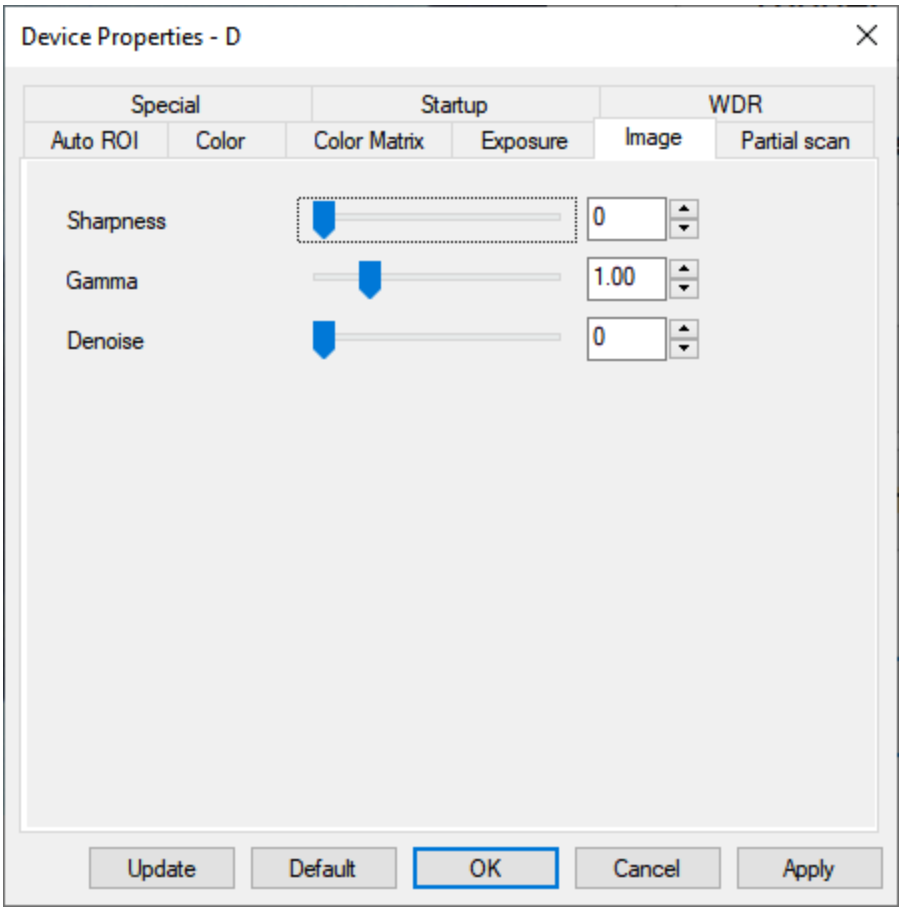
Make sure WDR is on:



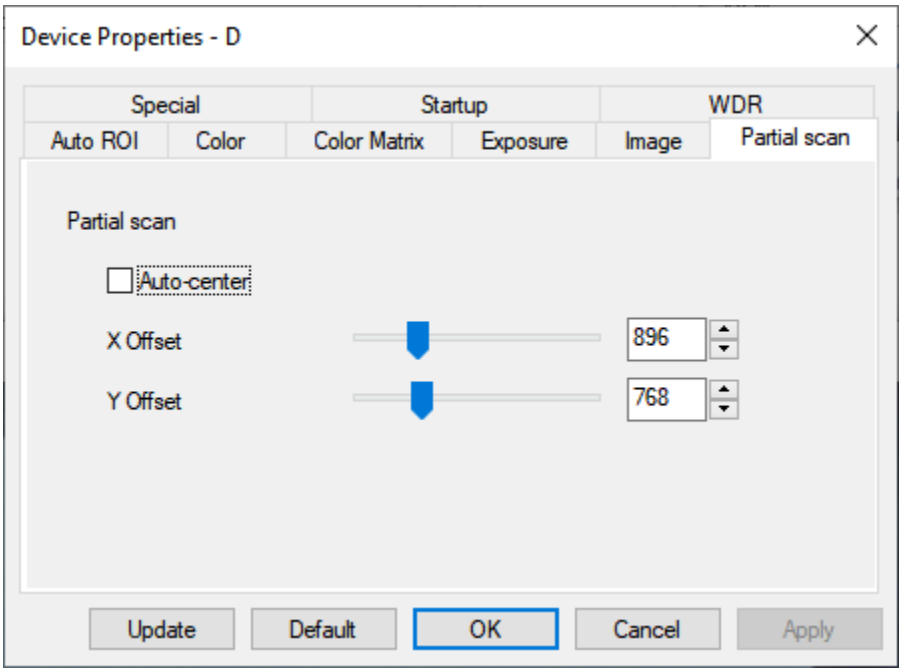
White balance on manual:

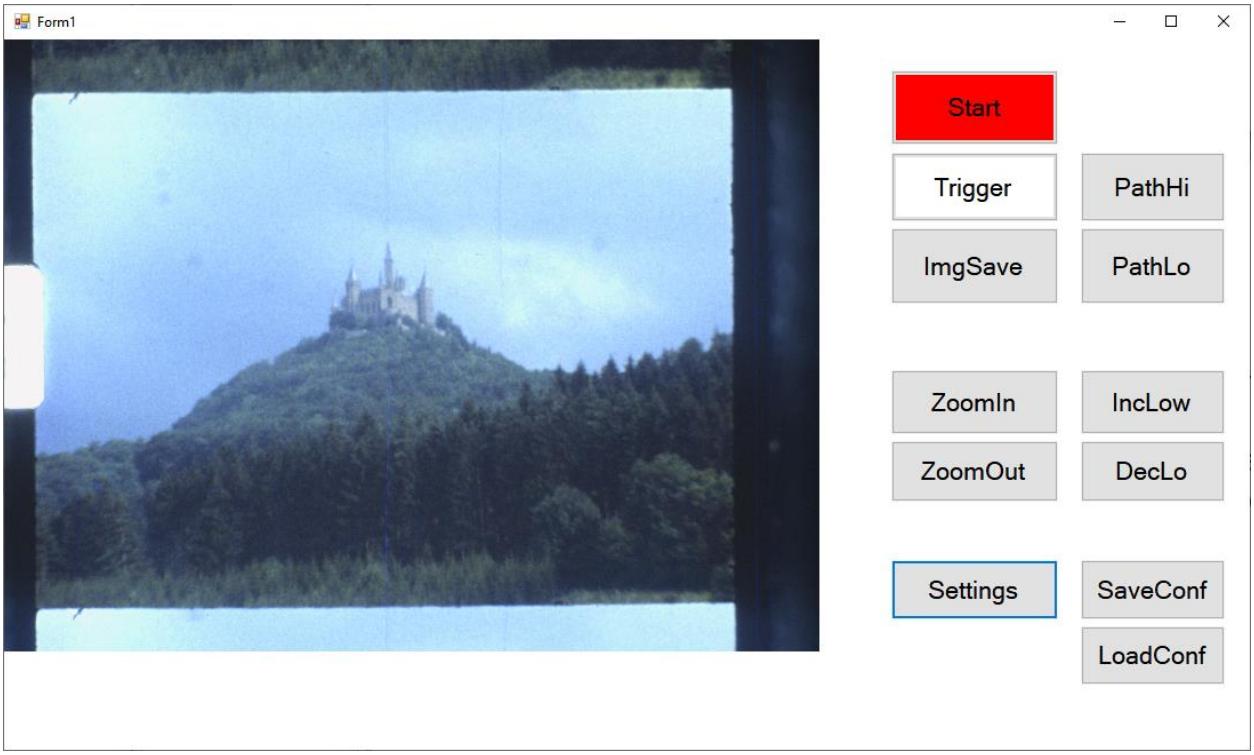

Device Properties - D
Special
Startup
WDR
Auto ROI
Color
Color Matrix
Exposure
Image
Partial scan
Hue
0
Saturation
100.00 %
WhiteBalance
Auto
One Push
WhiteBalance Mode
Gray World
Auto Preset
Any
Temperature Preset
Cool White Fluorescent Light
Temperature
4000
White Balance Red
2.30
White Balance Green
1.00
White Balance Blue
1.05
Update
Default
OK
Cancel
Apply

No gamma:



Adjust Partial Scan for best image fit:





Now, click on PathHi and PathLo to set the paths for your hi and low exposure images.

Click on IncLo a few times so that it is set to 2 or 3. That means that the lo exposure will be 2 or 3 stops below the hi. You can always go the other way by hittng the DecLo button.

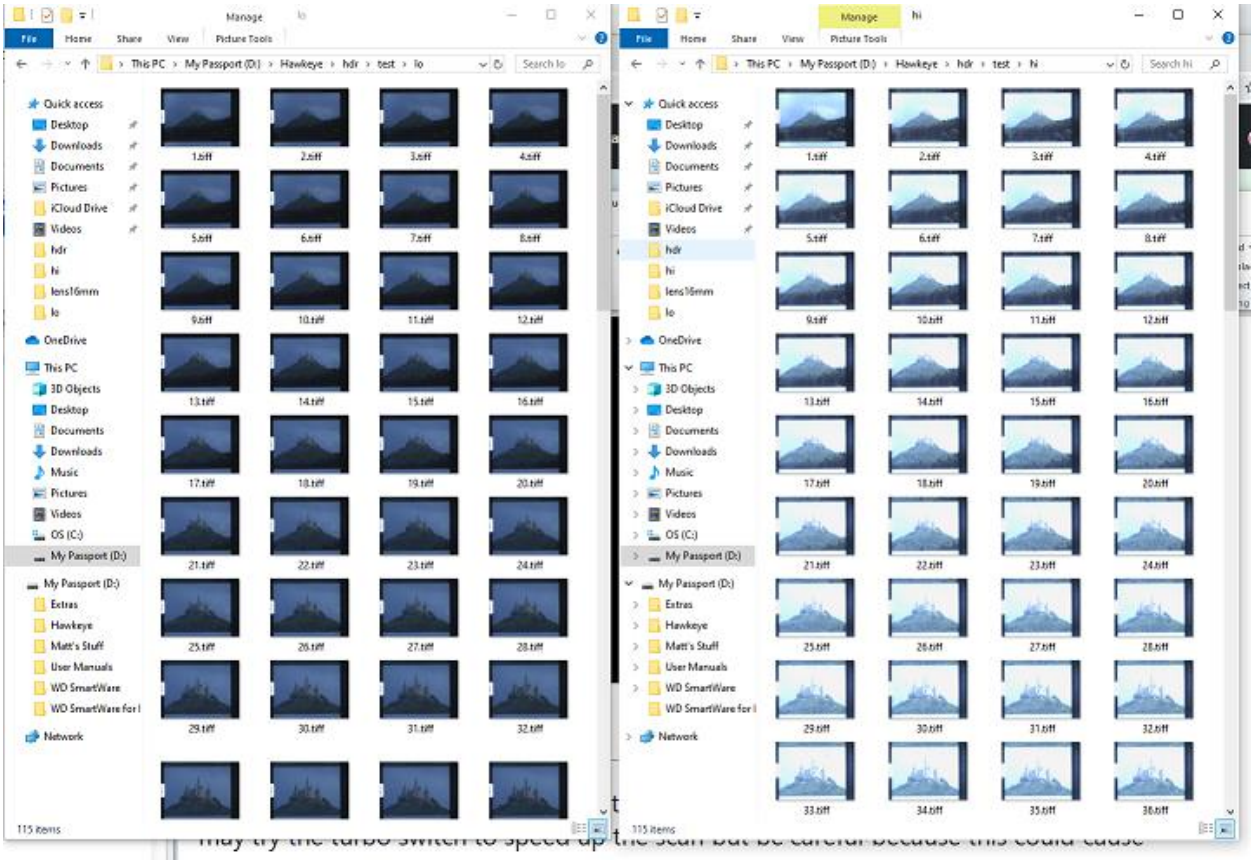
Turn the Start Button Off.

Turn on the Trigger button, Save button and Start button in that order.

The Image should go black.

Now you are ready to do the scan. Set the Hawkeye to slow speed to turn on HDR. You may try the turbo switch to speed up the scan but be careful because this could cause missed frames and the HDR exposures to go out of sequence.

Once done, you should have two directories with a bunch of images



Download enblend/enfuse from:

http://enblend.sourceforge.net/enfuse.doc/enfuse_4.2.xhtml/enfuse.html

Copy it from your download dir to your hdr work dir.

Create the following dos script and name it hdr.bat or enfuse.bat or something similar.

```
SET Input_PATCH1=D:\Hawkeye\hdr\hi

SET Input_PATCH2=D:\hawkeye\hdr\lo

SET OUTPUT_PATCH=D:\hawkeye\hdr\out

SET start=1

SET end=1000

FOR /L %%i IN (%start%,1,%end%) DO (CALL :loopbody %%i)

GOTO :eof

:loopbody

enfuse.exe --soft-mask --exposure-weight=1.0 --saturation-weight=0.2 --contrast-weight=0.0 --entropy-weight=0.0 --exposure-optimum=0.4 --exposure-width=0.2 -v -o "%OUTPUT_PATCH%\%1.tiff" "%Input_PATCH1%\%1.tiff" "%Input_PATCH2%\%1.tiff"
GOTO :eof
```

Edit the script path names as required. The combined files will be in the out dir.

Before you run the bat file make sure that enfuse.exe and vcomp140.dll are copied over from the enfuse bin directory to the directory where the batch file is located.
And that should be it. Run the bat file.

The images on the out dir will be an HDR blend of high and low exposure providing details for the bright and dark areas.