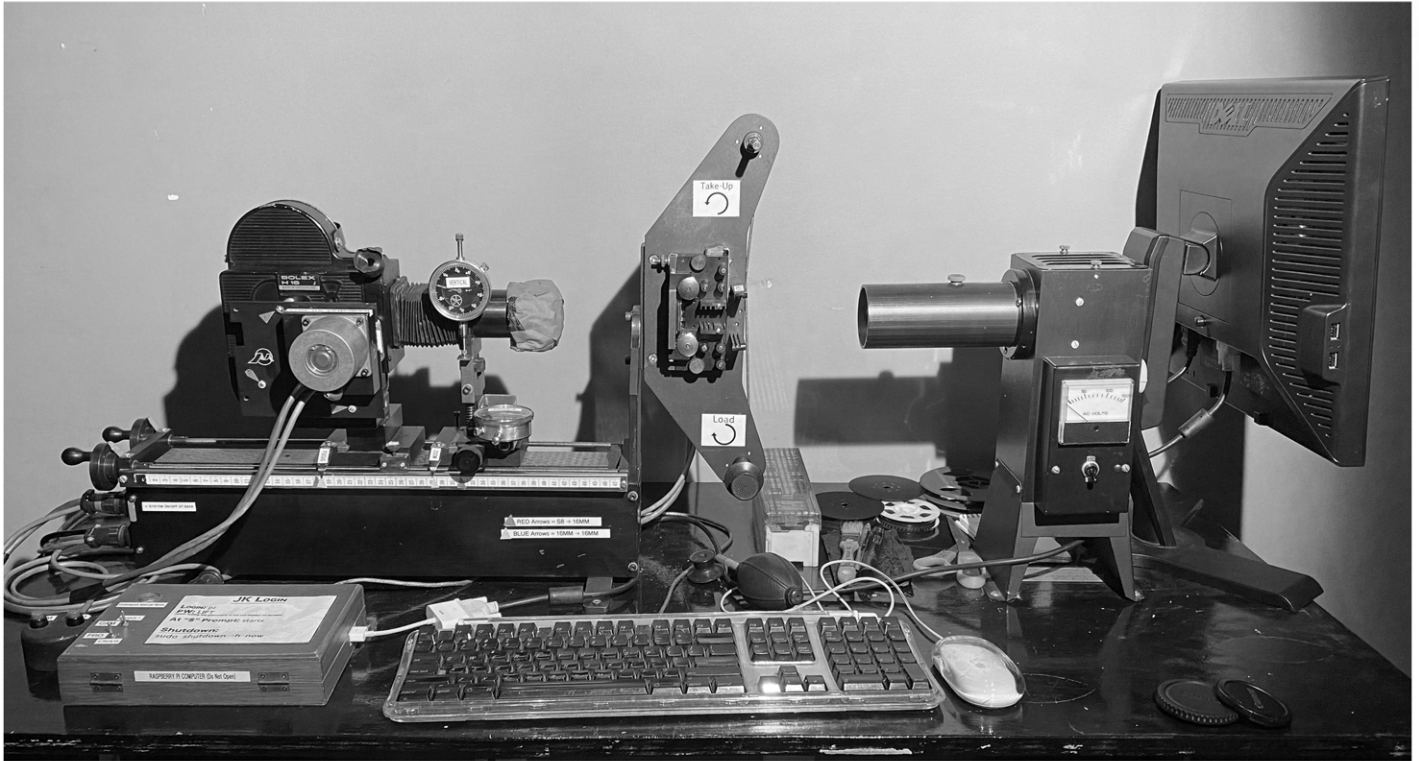# Introduction & Usage (What is a JK Optical Printer?)

"Optical printing is reprinting already filmed images onto film. It is a way to move one film size and/or type onto another. It is a way to change the speed of a series of images, including moving film that was shot at silent speed (18FPS) to sound speed (24FPS) so that it projects at the speed the original action took place. It is a way to preserve fragile images by transferring them onto new stock. It is a way to create superimpositions, dissolves, traveling mattes and other optical effects. Until the advent of digital effects and compositing it was used extensively in the mainstream film industry to create title sequences and a whole variety of optical and special effects." (Experimental Filmmaking by Kathryn Ramey)

The optical printer re-photographs developed film onto unexposed film stock. It's a very simple process that can be made incredibly complex depending on the result you're hoping to achieve!

At one end of the printer a light shines through a projector which has the developed film/print threaded up. This projects a frame into the lens of a camera at the other end of the printer which is loaded with fresh, unexposed film.

The optical printer is different from a contact printer which runs at a faster speed and has the developed film in direct contact with the unexposed film stock to create an exact print. The contact printer doesn't allow for as much experimentation and effects work as the optical printer.

The LIFT JK Printer can take Regular 8mm, Super 8, and 16mm film in the projector area using interchangeable gates, but can only take unexposed 16mm film in the Bolex.

The LIFT JK Printer has also been modified for use with a Raspberry Pi microcomputer, which allows for control of the camera and projector movements using a custom made software.

LIFT JK Optical Printer

16mm Bolex

Projector

Lamp

Monitor
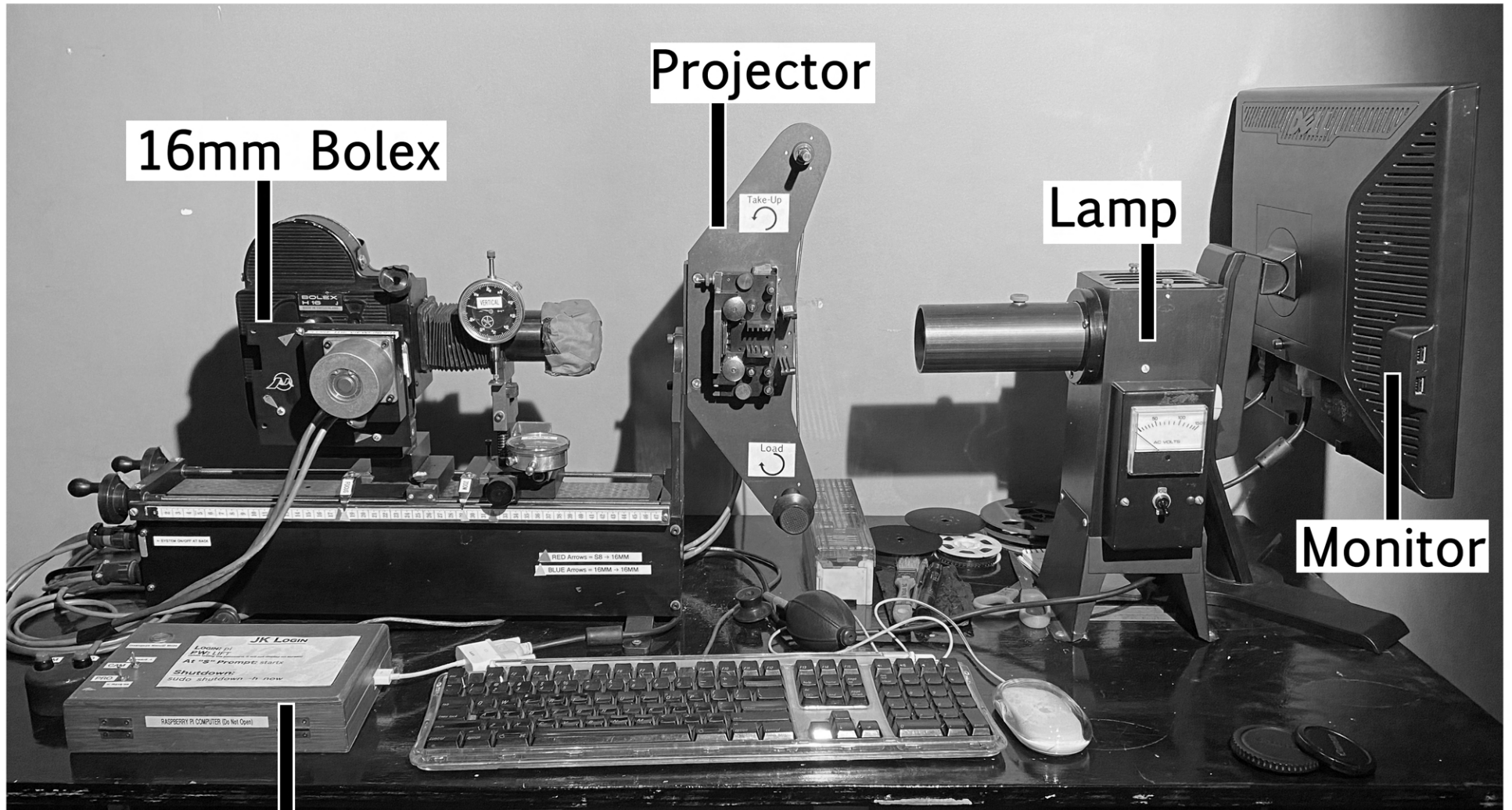
Raspberry Pi Computer

Getting Started

When preparing to work on a project involving the JK Optical Printer there are a few things that are best to keep in mind!

Do Exposure Tests! Doing a variety of tests with different ND filters, shutter speeds, etc and developing them (or taking them to the lab for processing) will save you an incredible amount of time (not to mention money) in comparison to simply guessing and hoping for the best.

That means that the process of working with the JK is going to take some time. It can be a little glitchy and there maybe times when something has to be redone. It is always best to monitor the machine as you run it, even though it might be tempting to punch in your numbers, hit RUN and step out for lunch!

There are different ways of prepping a roll of film for printing and you will likely decide what works best for yourself as you work on your project. Here are two suggestions:

- Isolate each shot you want to print on a seperate core. This will also mean threading the projector multiple times.
- Gang up all your desired shots onto 1 roll with leader separating the shots.

It is impossible to cover every way that an optical printer can be used because it changes depending on the results you're hoping to achieve with it! There is so much opportunity for experimentation with the printer that you will discover as you work with it.

This guide will help you to understand how to startup, load, run, focus, frame, and adjust the printer so that you can learn how to use it to create.

Table of Contents

Computer Startup

Our JK printer is controlled via a raspberry pi microcomputer which is contained in the wooden box on the desk. This system must be turned on in order to use the printer.

The software for this system has been custom programmed so you're very likely to encounter some glitches during use (refer to the Glitches section for more)

To get things started:

1. The Main ON/OFF Switch is located behind the Bolex on the base (Between cables)

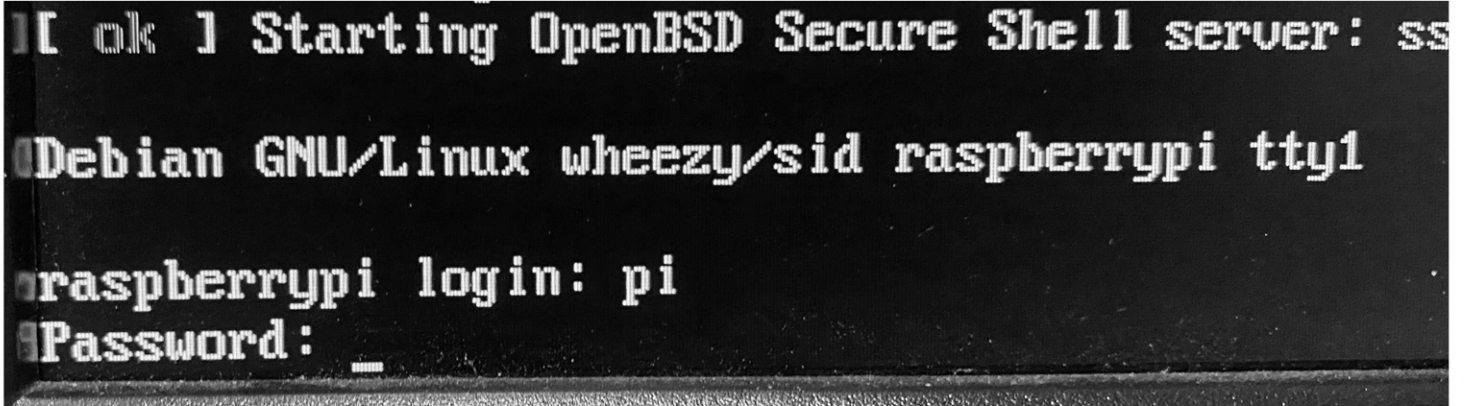2. Turn Monitor ON (power button in bottom right corner)
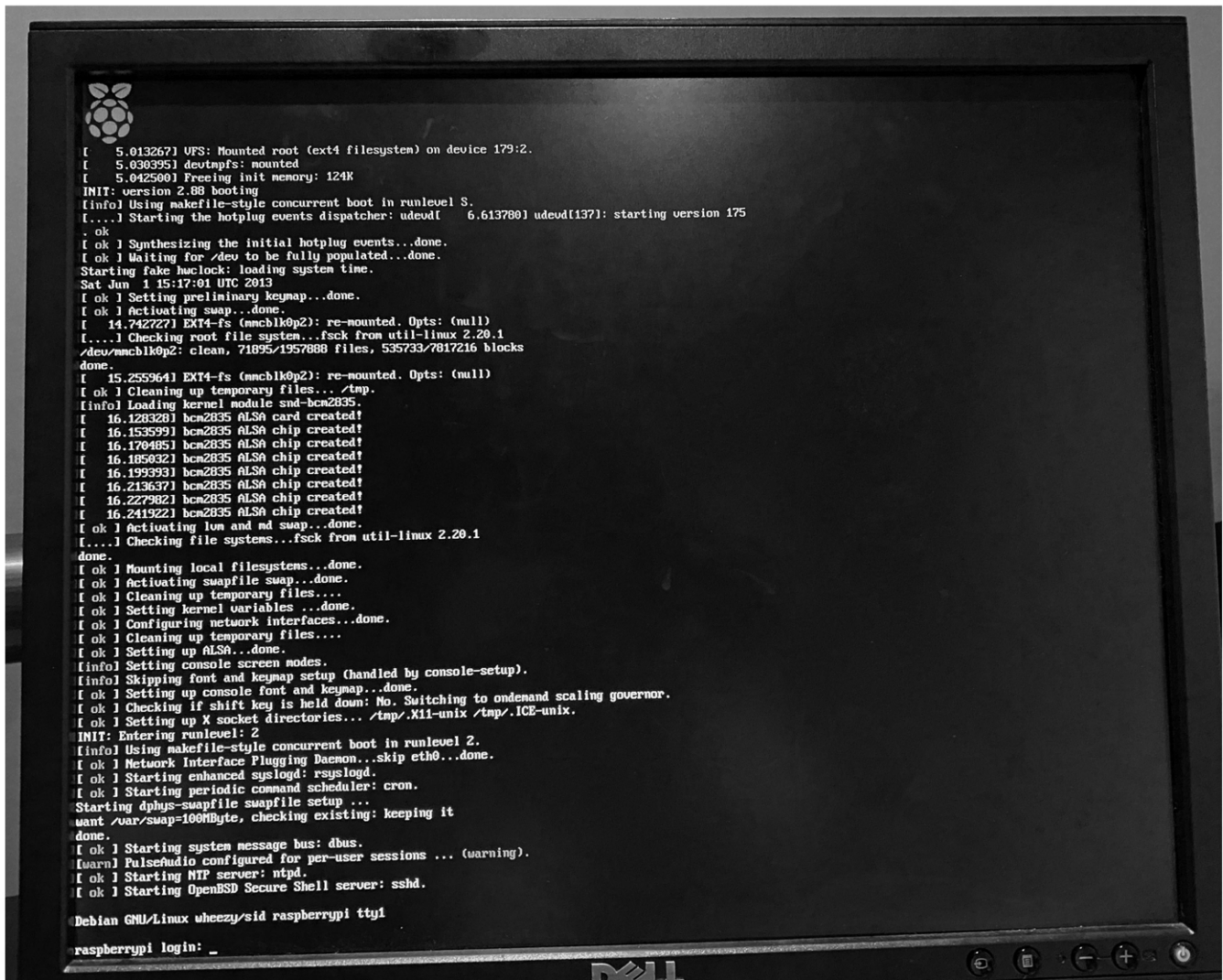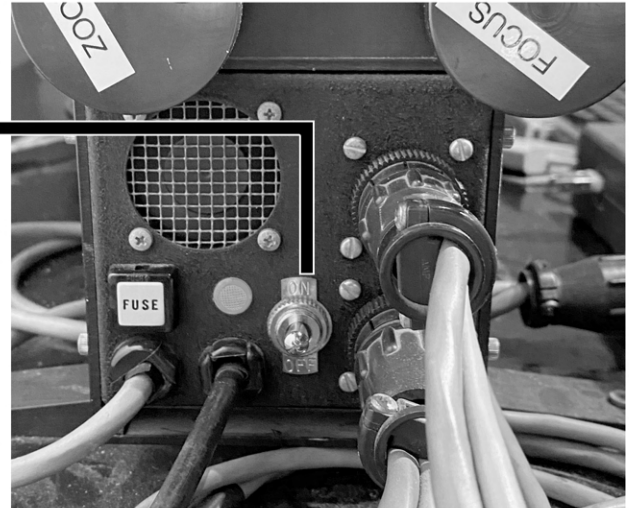
Computer Startup - Login

Once the wall of text on the monitor stops, you need to put in these login credentials:
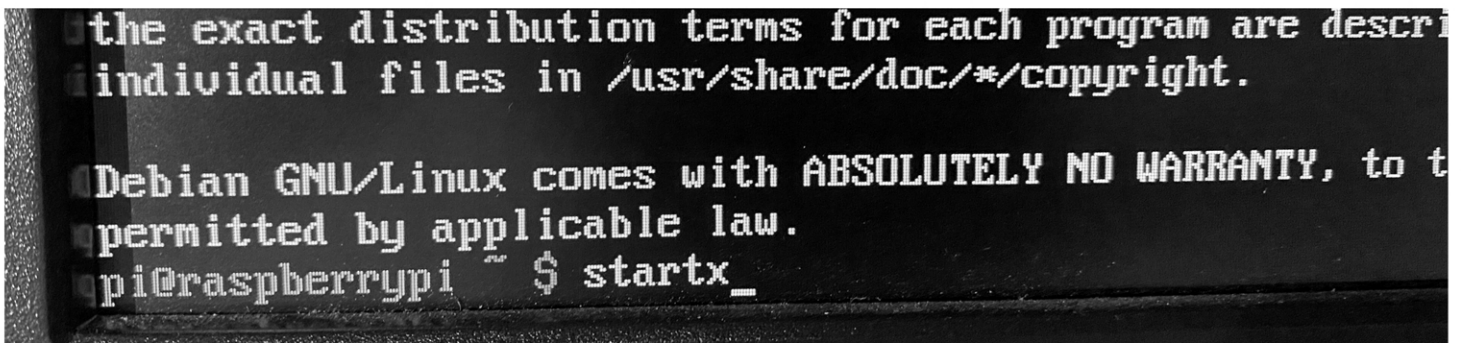
Raspberrypi login: **pi** (press Enter)

Password : **LIFT** (the text won't
show when typing. press Enter)

A New wall of text will appear! Once this stops again you'll need to tell the system to start by using this command:
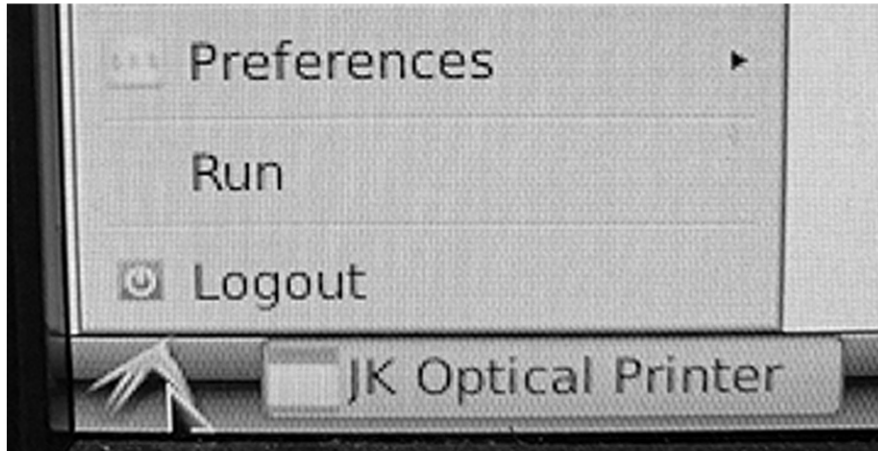
Pi@raspberrypi~$ **startx** (Press Enter)

If all goes well the computer will boot into a pretty standard looking desktop and you can get started!
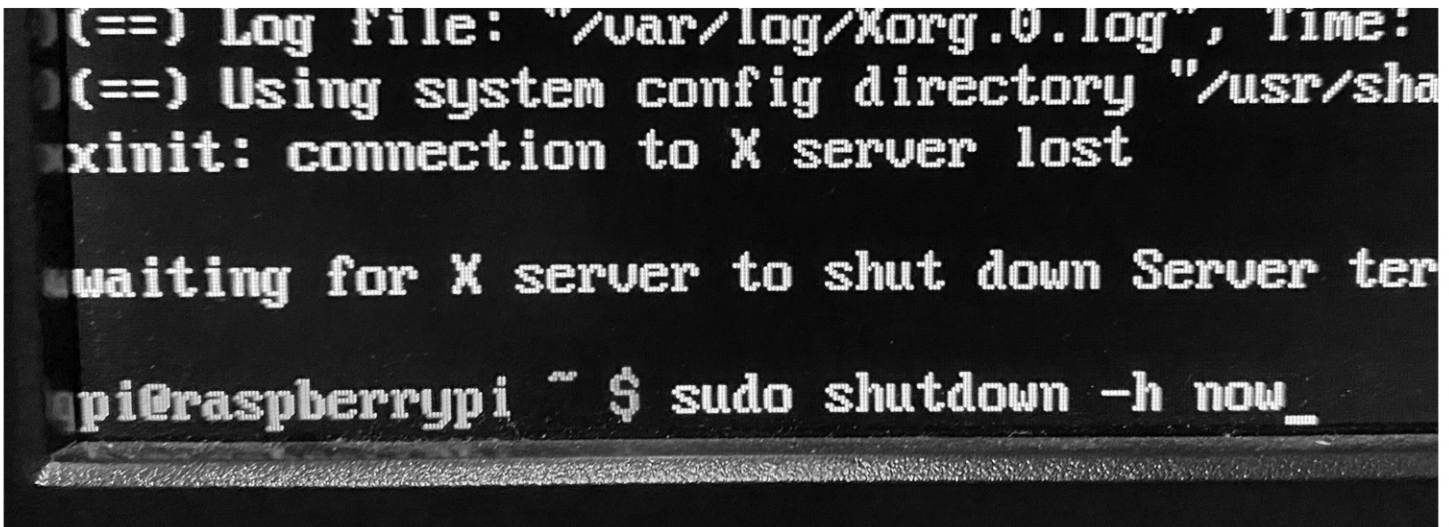
Computer Shutdown

For shutting the system down go to Logout in the start menu and click Logout.

The monitor will again show a wall of text. After this type:
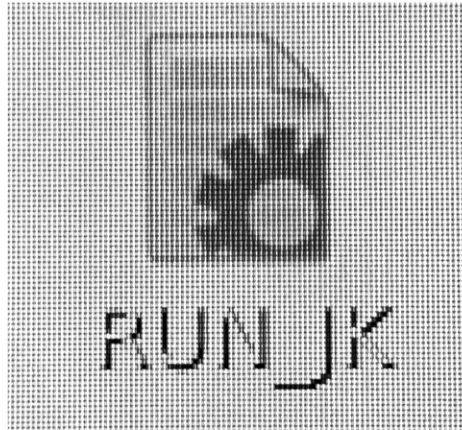
sudo shutdown -h now (Press Enter)

Do Not Forget:
1. Turn Off The Monitor
2. Turn Off The Main Power Switch

JK Printer Software - Startup

Once the computer is on and loaded up to the Desktop click the **Run_JK** file (that looks like a text document) to open the JK Printer software.

When it opens click **Execute** (not Execute in Terminal, even though that's outlined in red). This will bring up the program for controlling the functions of the printer.
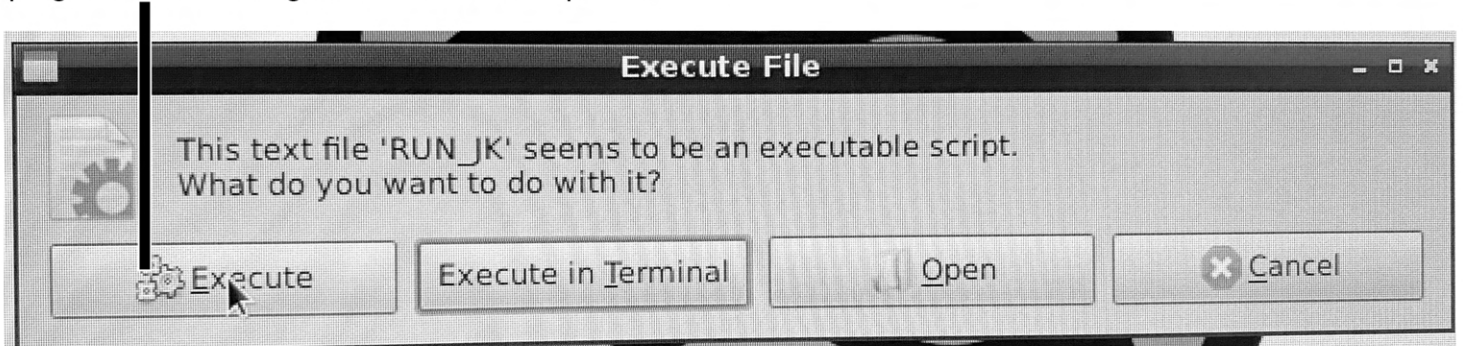
This will launch the JK Software that lets you control the printer and set it up to do a variety of things.
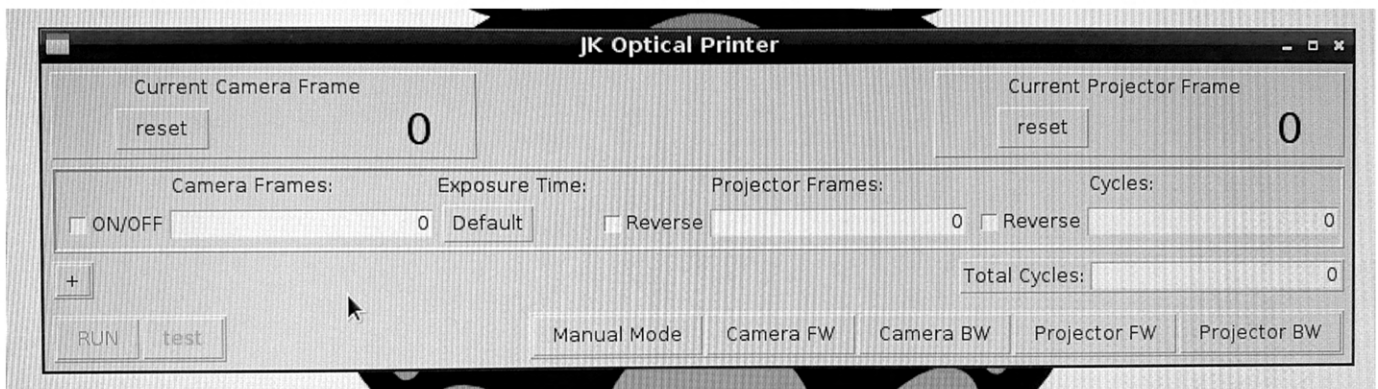
The program allows for:
- Tracking number of frames advanced in the camera
- Tracking number of frames advanced in the projector
- Controlling how many frames to advance in the camera
- Controlling whether camera moves the film forward or backward
- Controlling how many frames to advance in the projector
- Controlling whether the projector moves forward or backward
- Changing the exposure time of the camera
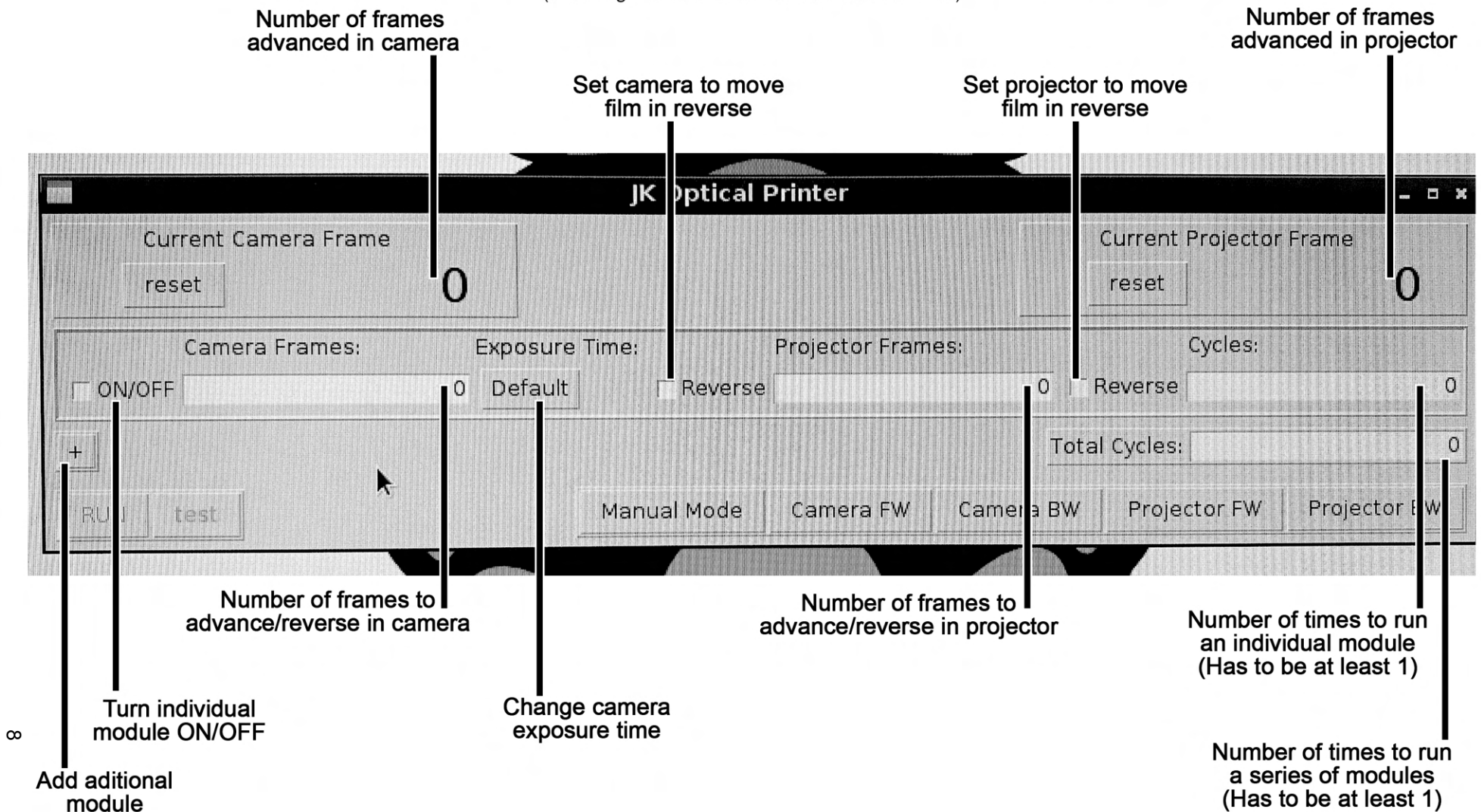- Switching to Manual Mode for use with controller on the desk

7

JK Printer Software

The JK program allows for control over the basic functions of the printer. Using this program you're able to have the printer do a single or a series of operations, depending on what you tell it to do by inputting various parameters.
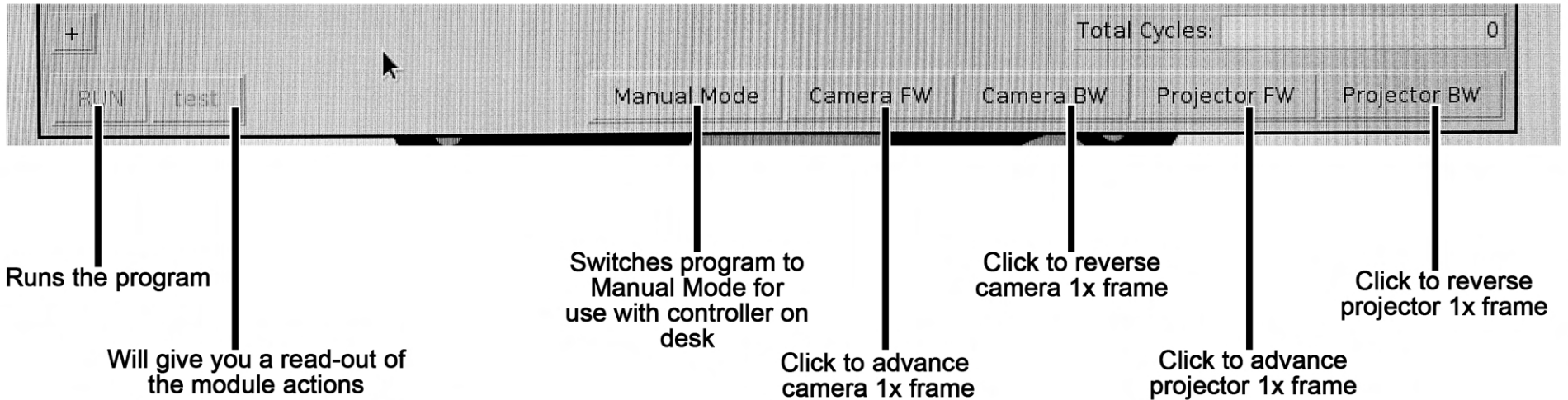
The program works by adding modules which allow you to tell the camera and projector what to do and how many times to do it. Each new module is another row in the program that can be set to run a certain amount of times. Modules can be run individually or in a series with other modules.

<u>Minimum number of cycles has to be 1 for anything to happen! For both individual Module lines and Total Cycles</u>

(The image below is of the software with 1 module)

Number of frames advanced in camera

Number of frames advanced in projector

Set camera to move film in reverse

Set projector to move film in reverse

Number of frames to advance/reverse in camera

Number of frames to advance/reverse in projector

Number of times to run an individual module (Has to be at least 1)

Turn individual module ON/OFF

Change camera exposure time

Add aditional module

Number of times to run a series of modules (Has to be at least 1)

8

JK Printer Software

| + | | | | Total Cycles: | | 0 |
| RUN | test | | Manual Mode | Camera FW | Camera BW | Projector FW | Projector BW |

Runs the program

Will give you a read-out of the module actions

Switches program to Manual Mode for use with controller on desk

Click to advance camera 1x frame

Click to reverse camera 1x frame

Click to advance projector 1x frame

Click to reverse projector 1x frame

Manual Mode

When the program is in manual mode it is controlled through the physical controls on the desk. Modules do not run in manual mode.

The two buttons labelled CAM and PRO are for controlling the movements of the Camera and the Projector. Each press will advance/reverse 1x frame at a time.

The controls on the Raspberry Pi box are for selecting the direction that the camera and projector move and for disengaging manual mode and returning to the software.

CAM   PRO

Disengage Manual Mode

Forward →

CAM ——— Camera Forward/Reverse

PRO ——— Projector Forward/Reverse

← Reverse

JK Printer Software
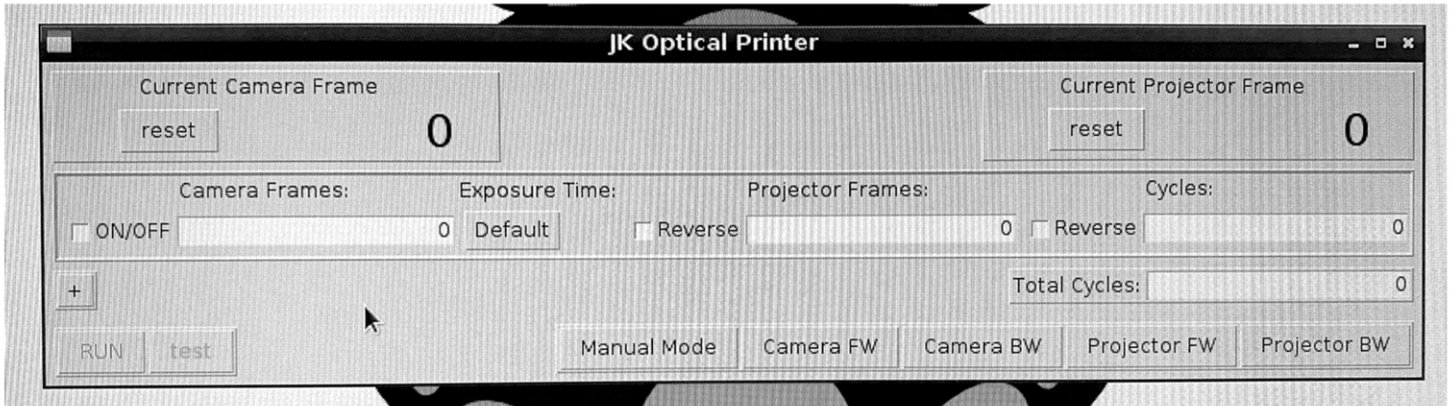
CURRENT CAMERA FRAME: will count up as you advance the camera. You can also reset this (with the rest button) to zero.

CURRENT PROJECTOR FRAME: Is the same as the camera frame counter, but for the advance of the film in the projector instead

CAMERA FRAMES: This is where you input the number of frames for the camera to advance and expose (can also go in reverse if box is checked)

PROJECTOR FRAMES: This is where you input the number of frames for the projector to advance (can also go in reverse if box is checked)

CYCLES: Is the total number of times that you want the action of that one module line to run for

ON/OFF: toggles whether a module is active

EXPOSURE TIME: Let's you adjust how long the shutter in the Bolex is open for.

+ BUTTON: will add a new module (row) that can be added onto the one above it.

TOTAL CYCLES: Determines how many times the entire stack of modules will run for. The modules will run from top to bottom and you can have your stack of modules run multiple times if you tell your total cycles to do so!

Minimum number of cycles has to be 1 for anything to happen! For both individual Module lines and Total Cycles

The module runs LEFT to RIGHT! Camera Advance/Expose first, followed by Projector Advance!

CAMERA FW / CAMERA BW: Advances camera forward or backward by 1 frame

PROJECTOR FW / PROJECTOR BW: Advances Projector forward or backward by 1 frame

RUN will run the modules that you have setup

TEST will give you a read-out of the module actions

MANUAL MODE: Switches control of the camera and projector from the program to the physical controller on the desk (wooden box and switch with 2 red buttons). Modules aren't running in manual mode!
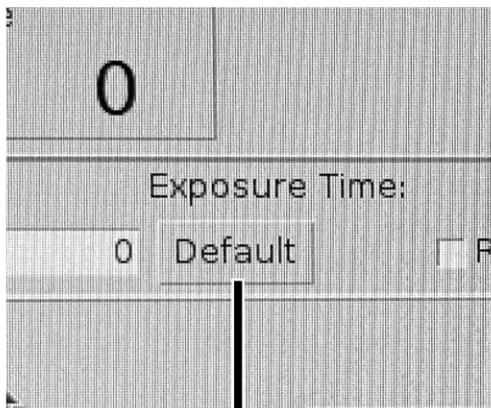
JK Printer Software - Exposure Time

The JK program also allows for control over the Bolex shutter. You can increase or decrease the amount of time that the shutter stays open during each exposure. This is selected through a drop down menu when the box below 'Exposure Time' is clicked.

On startup the **Exposure Time** will be set to **Default**. When changing the Exposure time you can choose from a variety of options ranging from fractions of a second all the way up to a 60 second exposure time.

On longer exposures you will be able to hear the shutter opening and then the shutter closing after the selected amount of time.
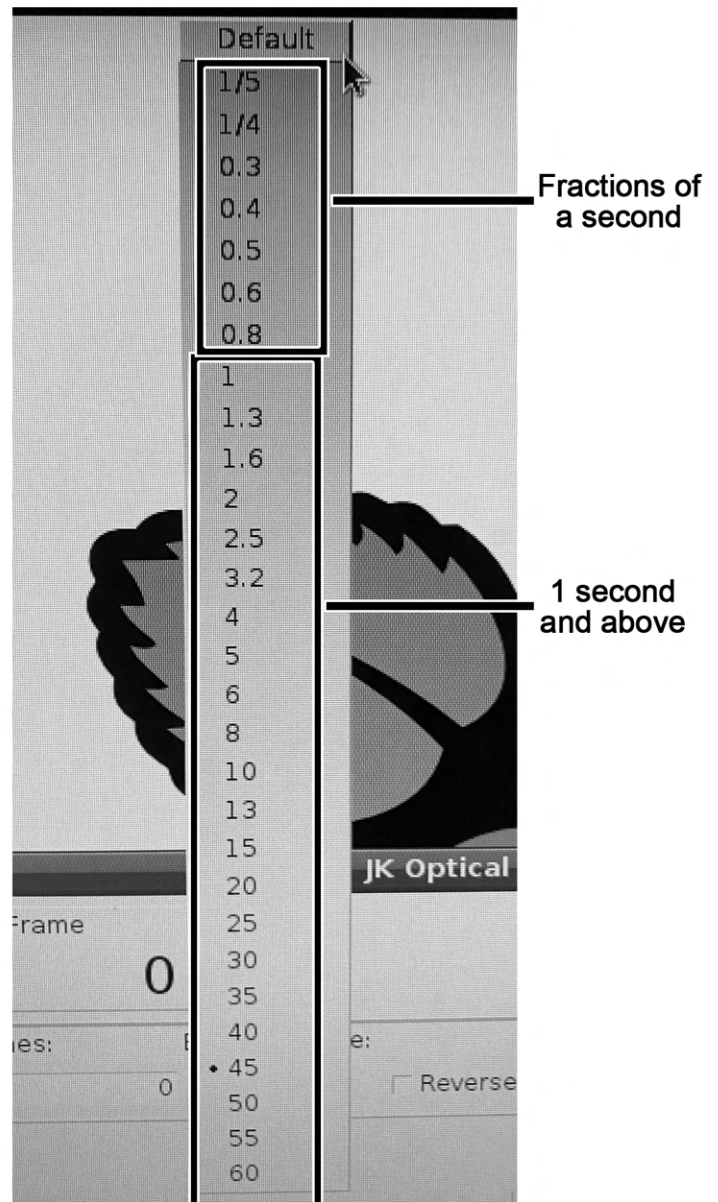
Changing your Exposure Time results in more or less light entering the camera! It's important to do exposure tests before diving into a project fully so that you can determine best results!

Exposure time is set to Default on startup
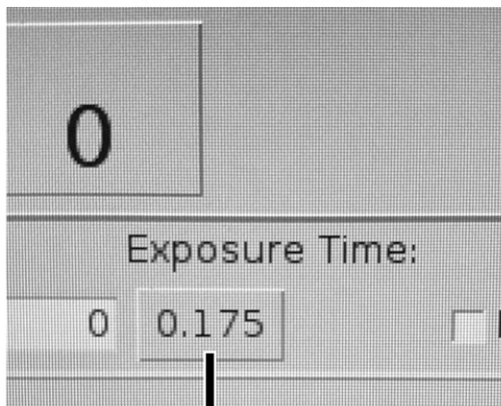
When selecting Default again from the drop down menu, it will now display the actual number instead (0.175)
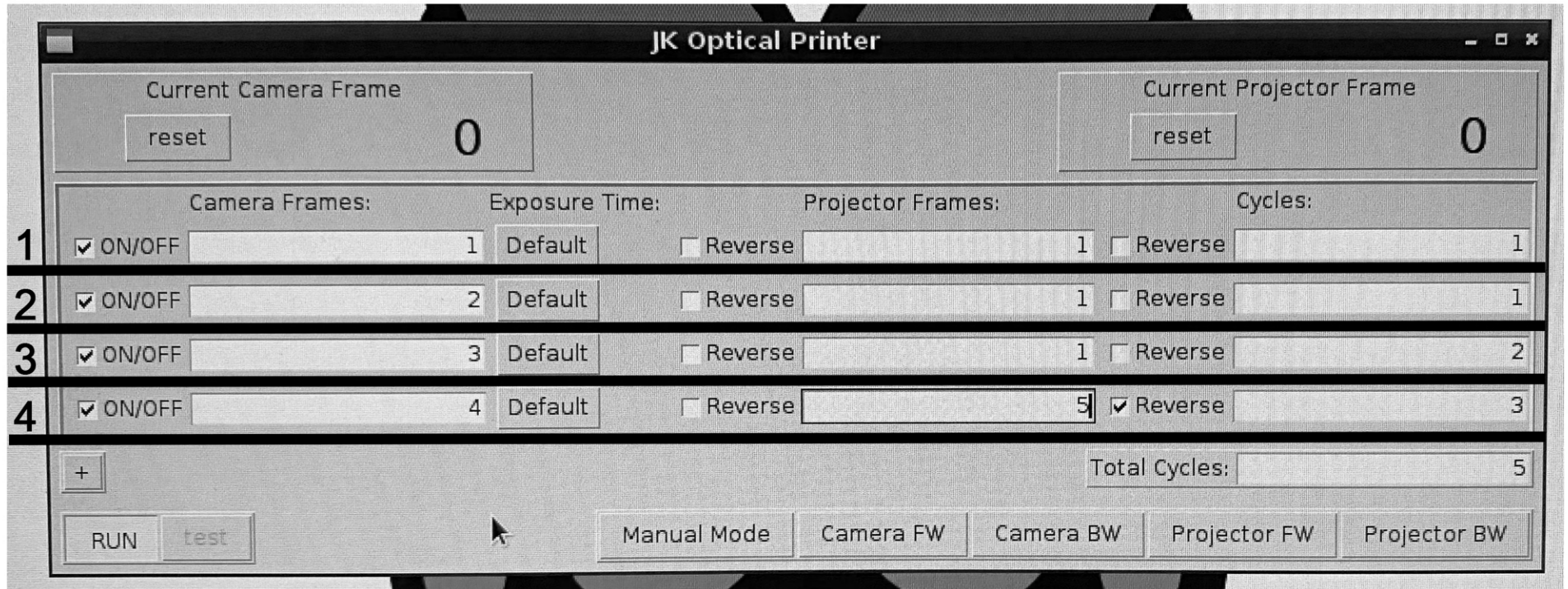

Fractions of a second

1 second and above

JK Printer Software - Module Example

The image below shows the program with 4x modules:

		Camera Frames:	Exposure Time:		Projector Frames:		Cycles:
1	☑ ON/OFF	1	Default	☐ Reverse	1	☐ Reverse	1
2	☑ ON/OFF	2	Default	☐ Reverse	1	☐ Reverse	1
3	☑ ON/OFF	3	Default	☐ Reverse	1	☐ Reverse	2
4	☑ ON/OFF	4	Default	☐ Reverse	5	☑ Reverse	3

JK Optical Printer — Current Camera Frame: reset — 0 — Current Projector Frame: reset — 0

Total Cycles: 5

RUN | test | Manual Mode | Camera FW | Camera BW | Projector FW | Projector BW

Module 1:
- Camera advances 1 frame forward
- Projector advances 1 frame forward
- This module runs 1 time

Module 2:
- Camera advances 2 frames forward
- Projector advances 1 frame forward
- This module runs 1 time

Module 3:
- Camera advances 3 frames forward
- Projector advances 1 frame forward
- This module runs 2 times

Module 4:
- Camera advances 4 frames forward
- Projector advances 5 frames in reverse
- This module runs 3 times

Total Cycles is 5 which means this entire
series of modules will repeat 5 times

JK Printer Lamp

Before turning on the light, turn the dimmer at the rear of the unit all the way down (counter clockwise until it stops). Then turn it on and bring the dimmer up slowly.

The Lamp is turned ON and OFF with a silver switch below the voltage meter. The Intensity of the light is controlled by a dimmer at the rear of the unit.


Bulb Access

Dimmer

Voltage Meter

ON/OFF
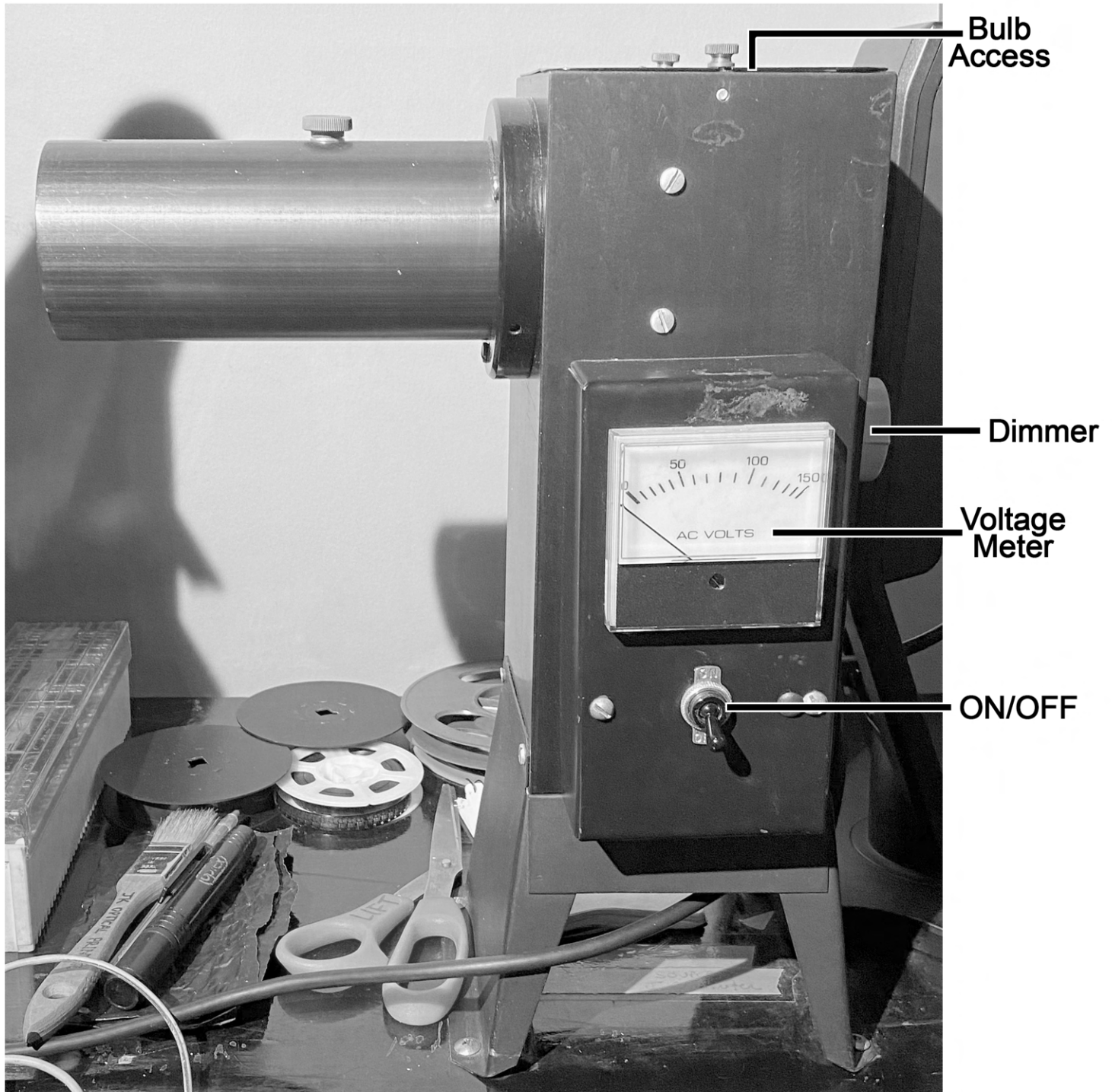
JK Printer Lamp

As you adjust the dimmer, the bulb's brightness will increase or decrease. There are two things to be aware of:
- The color of the bulb will change slightly as the brightness increases or decreases.
- The voltage also changes and this is reflected on the meter.

The Ideal voltage for the bulb is 80 on the dial (or straight up in a "12 o'clock" position). This brings the bulb to approximately the correct color temperature for working with TUNGSTEN color film.

Don't forget you can dim the bulb down when looking through the viewfinder of the camera to make framing and focusing easier!
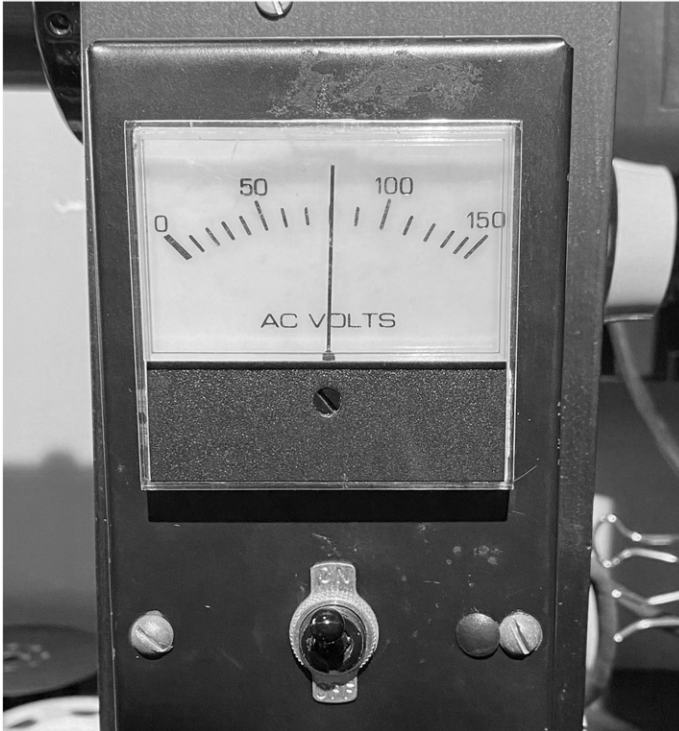
Meter on the lamp at 80. Indicating approximate TUNGSTEN color temperature
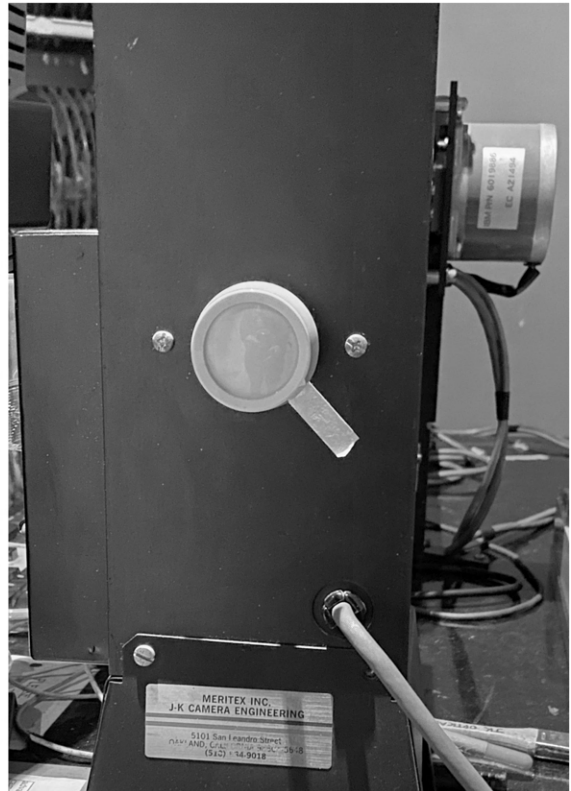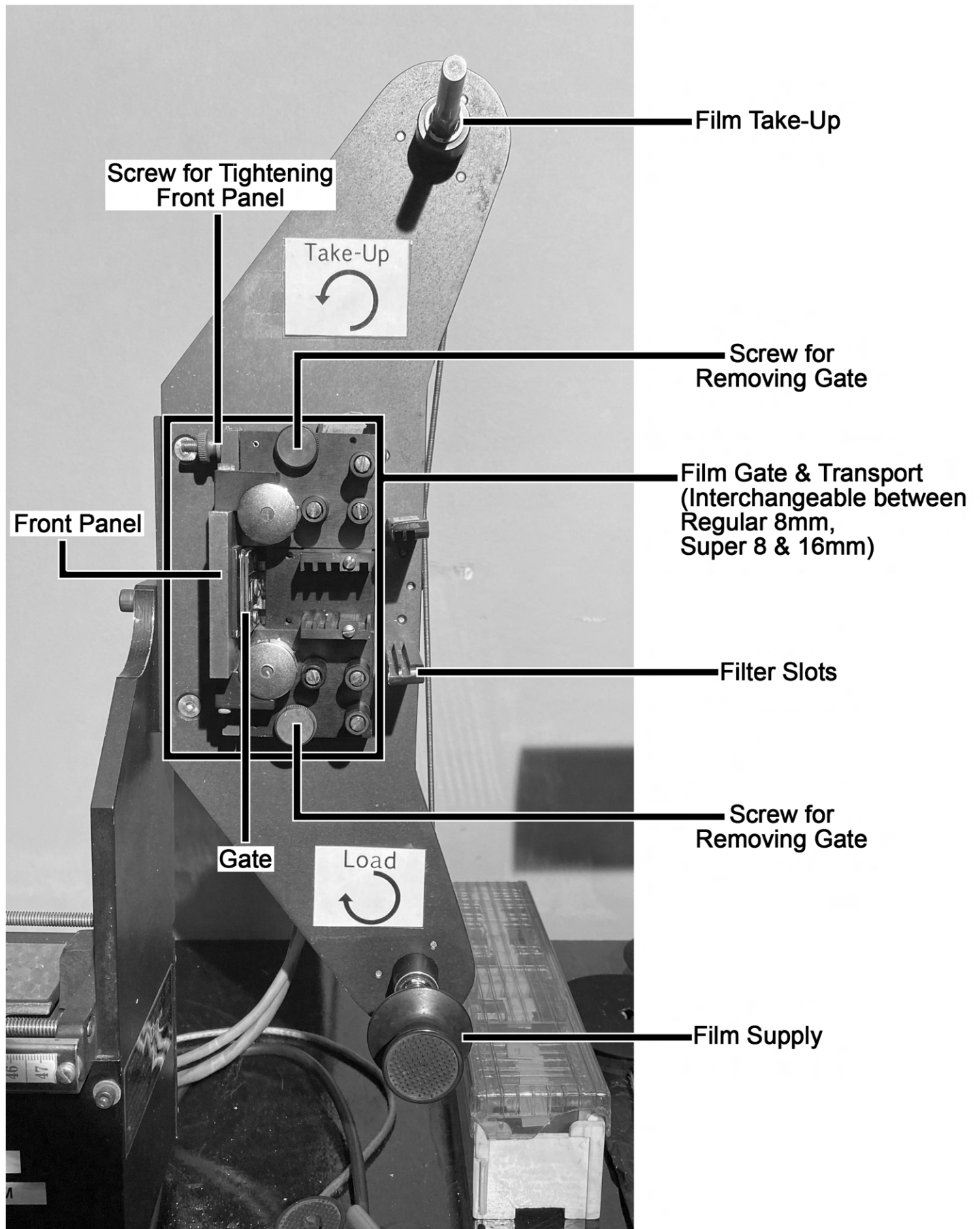

Dimmer at back of lamp

Lamp Bulb

The top panel of the lamp can be removed to access the lightbulb.

The JK Lamp takes an ELH 300w 120v bulb.

Consider supplying your own lightbulb for even more consistent results! This way only you use your bulb for the duration of your project.

JK Printer Projector

Film Take-Up

Screw for Tightening
Front Panel

Take-Up

Screw for
Removing Gate

Film Gate & Transport
(Interchangeable between
Regular 8mm,
Super 8 & 16mm)

Front Panel

Filter Slots

Screw for
Removing Gate

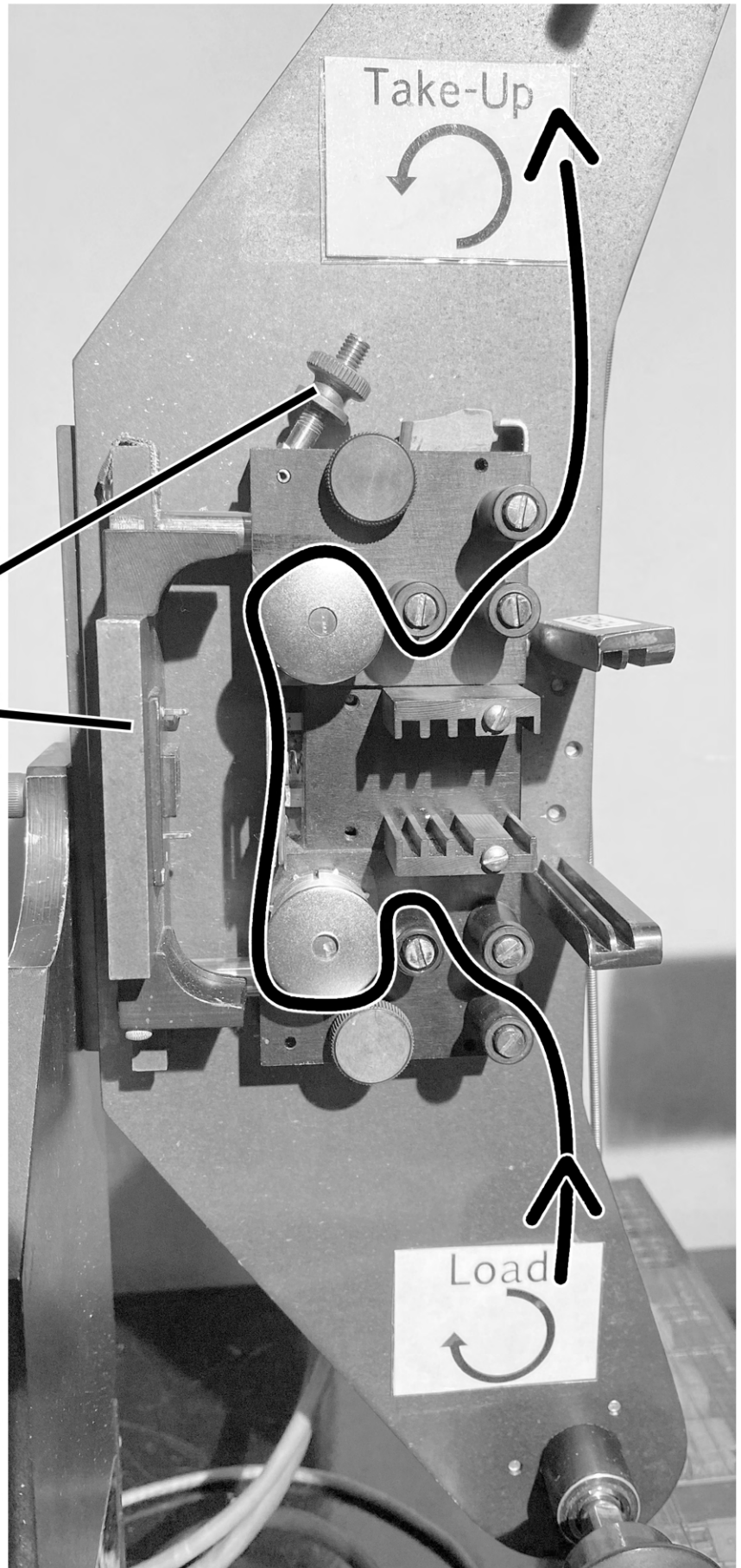Gate

Load

Film Supply

JK Printer Projector - Loading

The JK Projector is threaded from bottom to top. Your roll of film loads on the bottom is threaded through and onto a take up spool/reel at the top

The projector has interchangeable gates for Regular 8mm, Super 8, & 16mm.

The front panel of the gate slides in and out and is secured into place with a screw that drops into place and tightens. Have this open for loading and closed for use!
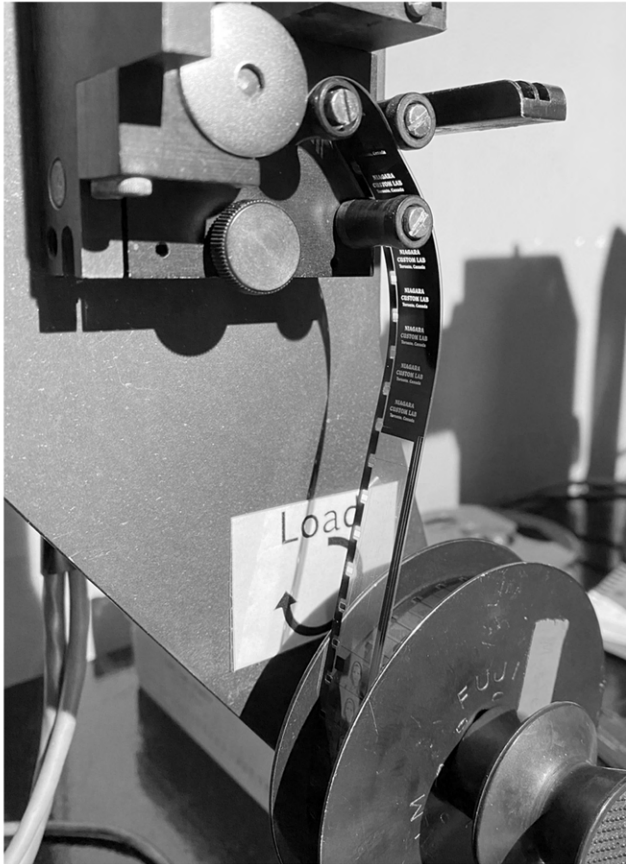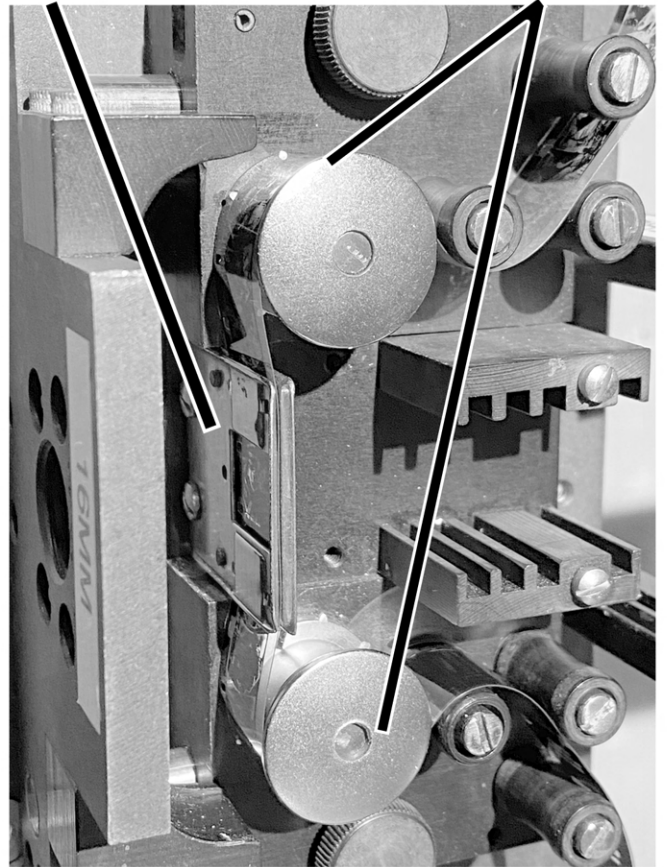
Take-Up
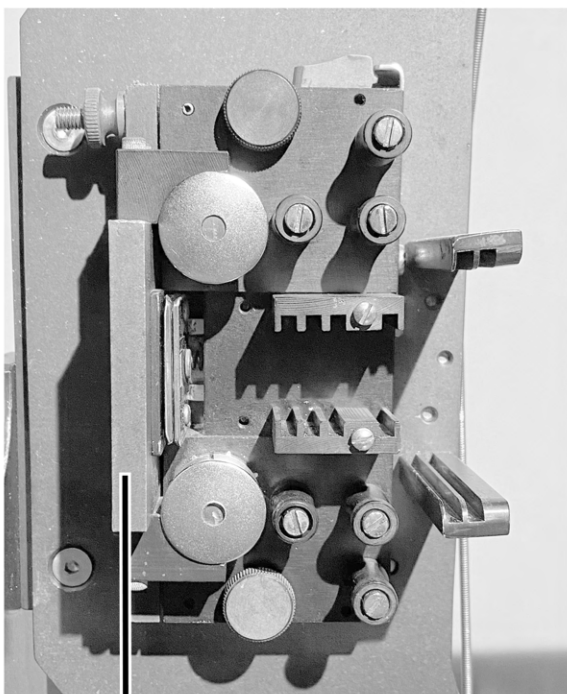
Load

Front panel closed

JK Printer Projector - Loading

The film feeds off the supply reel in a counter-clockwise direction.

Be sure to thread it in the gate and past both transport rollers.

Thread the film so that the image is in the orientation that you want to capture with the Bolex.

If you want the frame in a right-side up and non-flipped orientation:

From a camera original - emulsion of film is facing in on the roll (towards the bulb when threaded) with perfs on the side closest to the projector

From a print stock - emulsion of film is facing out on the roll (towards the gate) with the perfs on the side closest to the projector
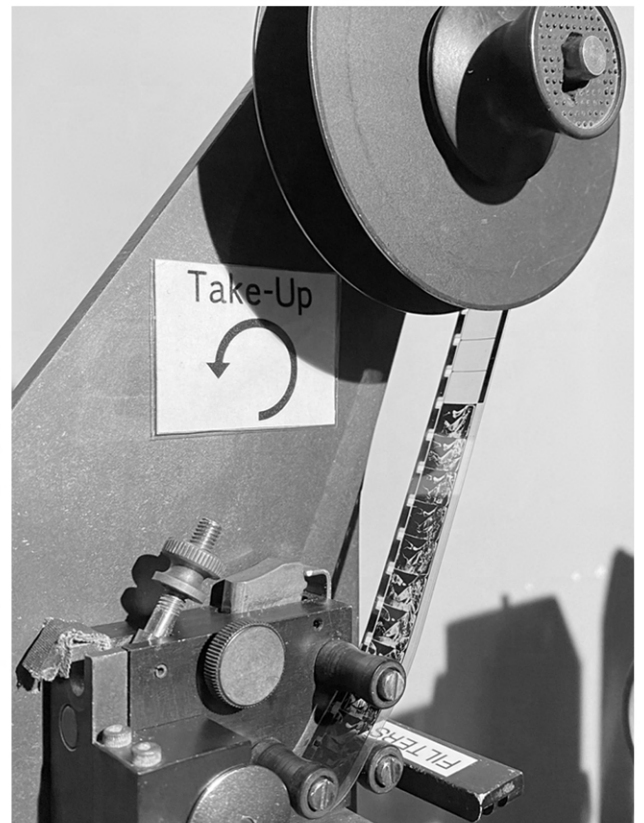
JK Printer Projector - Changing Gates

The JK Printer has 3 gates that can be used: Regular 8mm, Super 8, & 16mm. These gates live in labelled boxes under the JK Printer desk. The gates themselves are labelled with the format on the front panel.
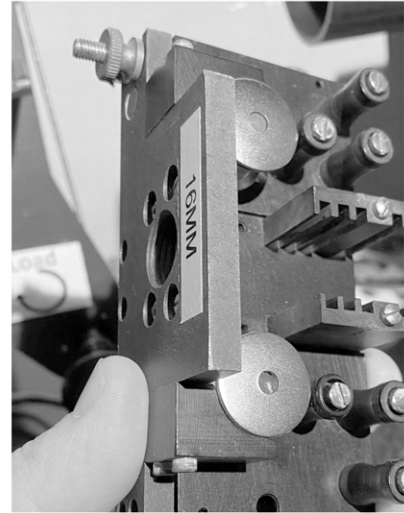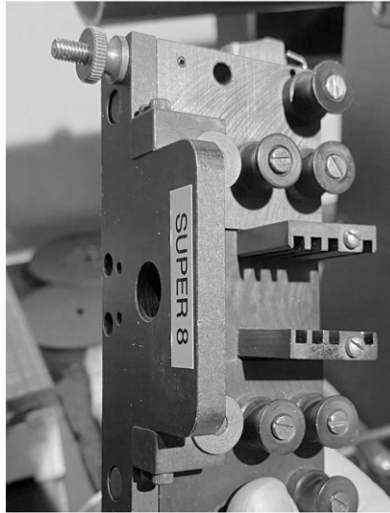

Removing A Gate

To remove a gate from the projector, unscrew the two screws holding the gate in place and gently pull it away from the projector.
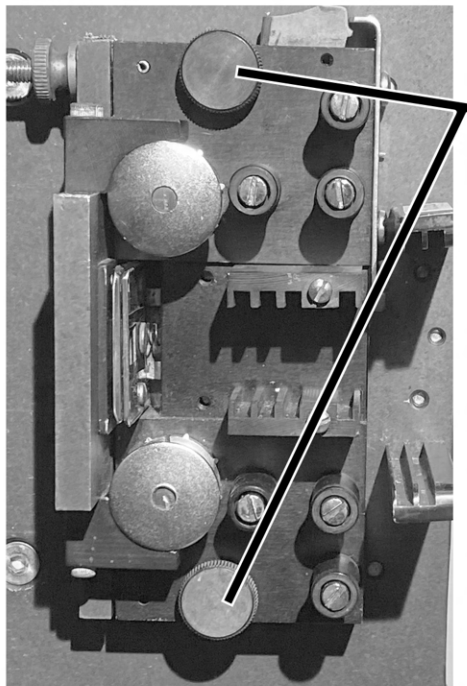
Attaching A Gate

The gate has two notched pegs at the back of the two transport rollers. These pegs need to line up with the two holes on the projector. The pegs can rotate freely if you need to adjust the alignment. Make sure the gate is sitting properly and screw the two screws (from above) back into place.

Line these up!
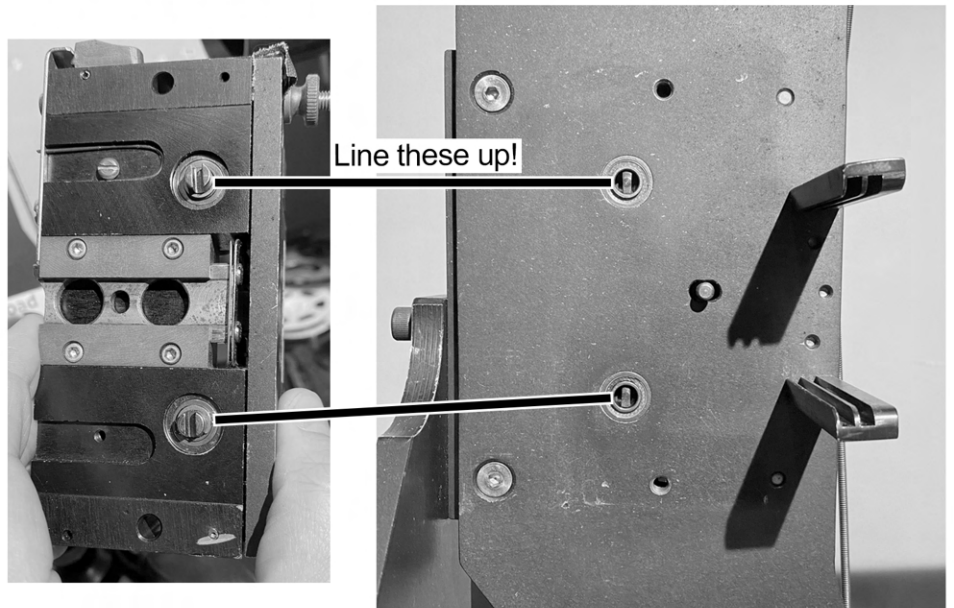
JK Printer Projector - Filters

The projector portion of the JK Printer has slots for filters which are located under the desk. There are a variety of ND (Neutral Density) filters and colored filters that can be used for controlling the amount of light, contrast, and color while doing your exposures.

Using ND filters is a good way of controlling light instead of changing the Exposure Time of the Bolex in the JK software.

Changing filters results in more or less light entering the camera! It's important to do exposure tests before diving into a project fully so that you can determine best results!
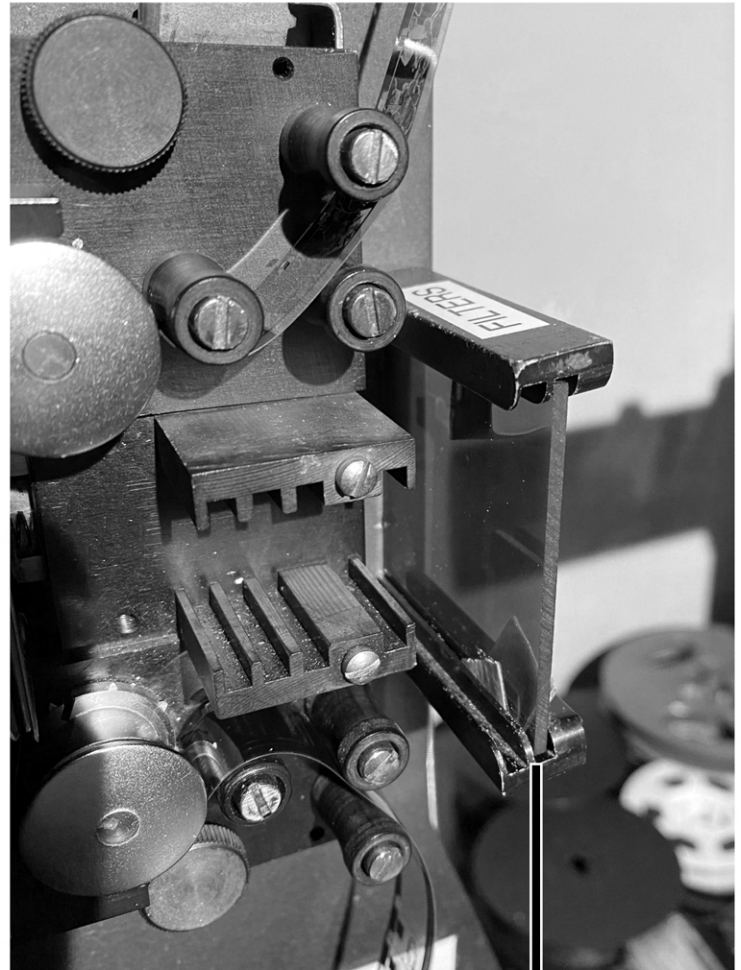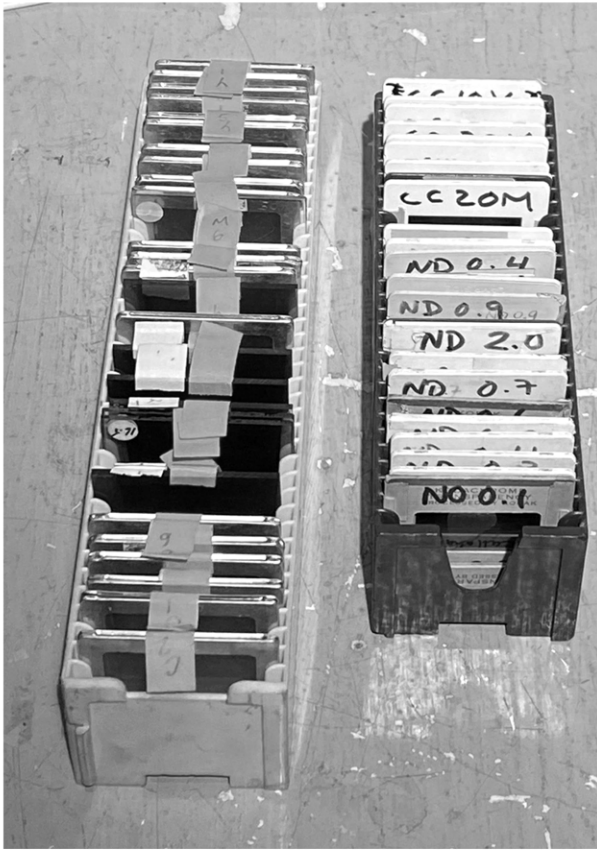
Filters are placed in these slots closest to the light source
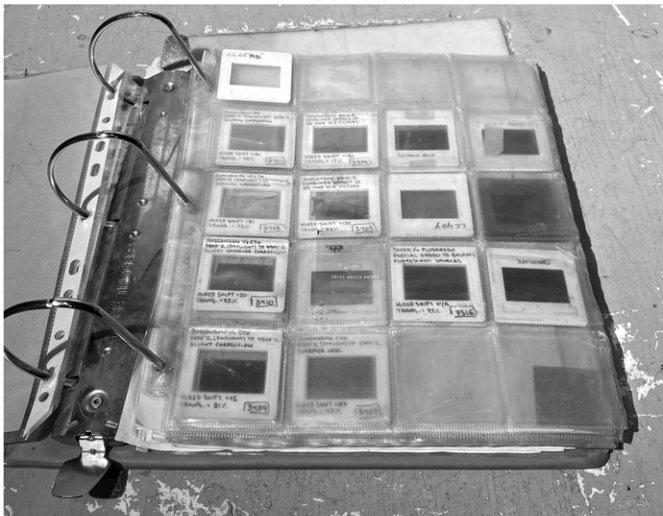
JK Printer Projector - Notes

The tension can be a little loose on the bottom of the projector resulting in some slack. You can wind your reel if this slack becomes too much.
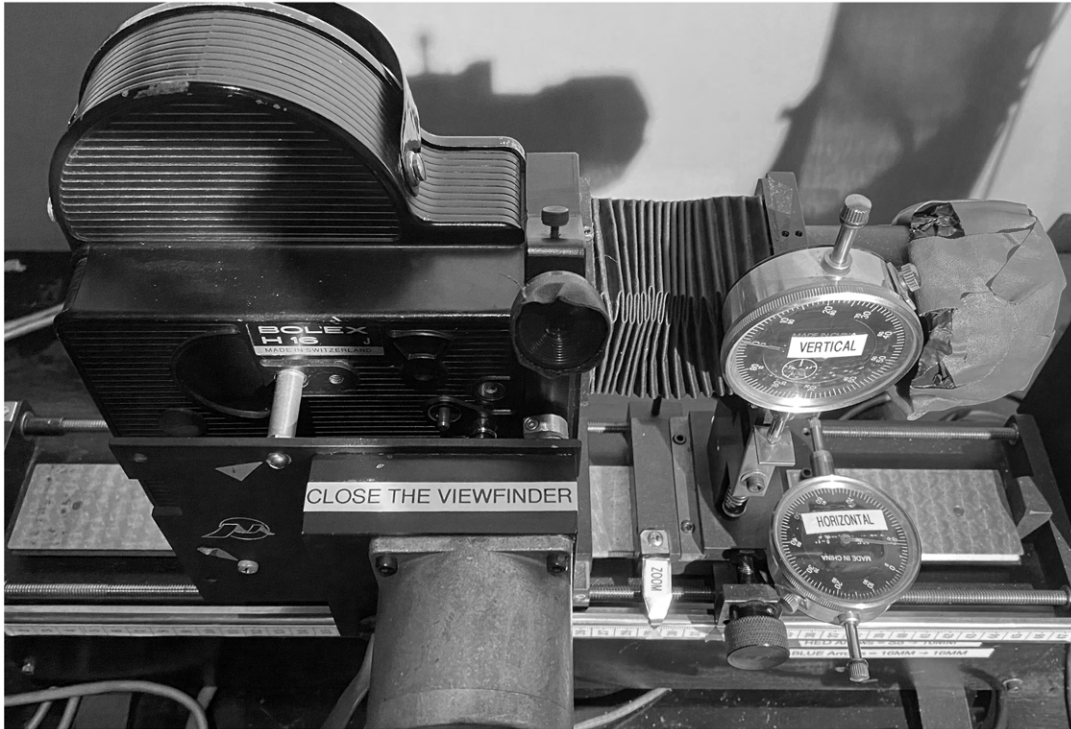

There are rubber stoppers and spacers on the desk to secure your film reel in place when loading the projector.
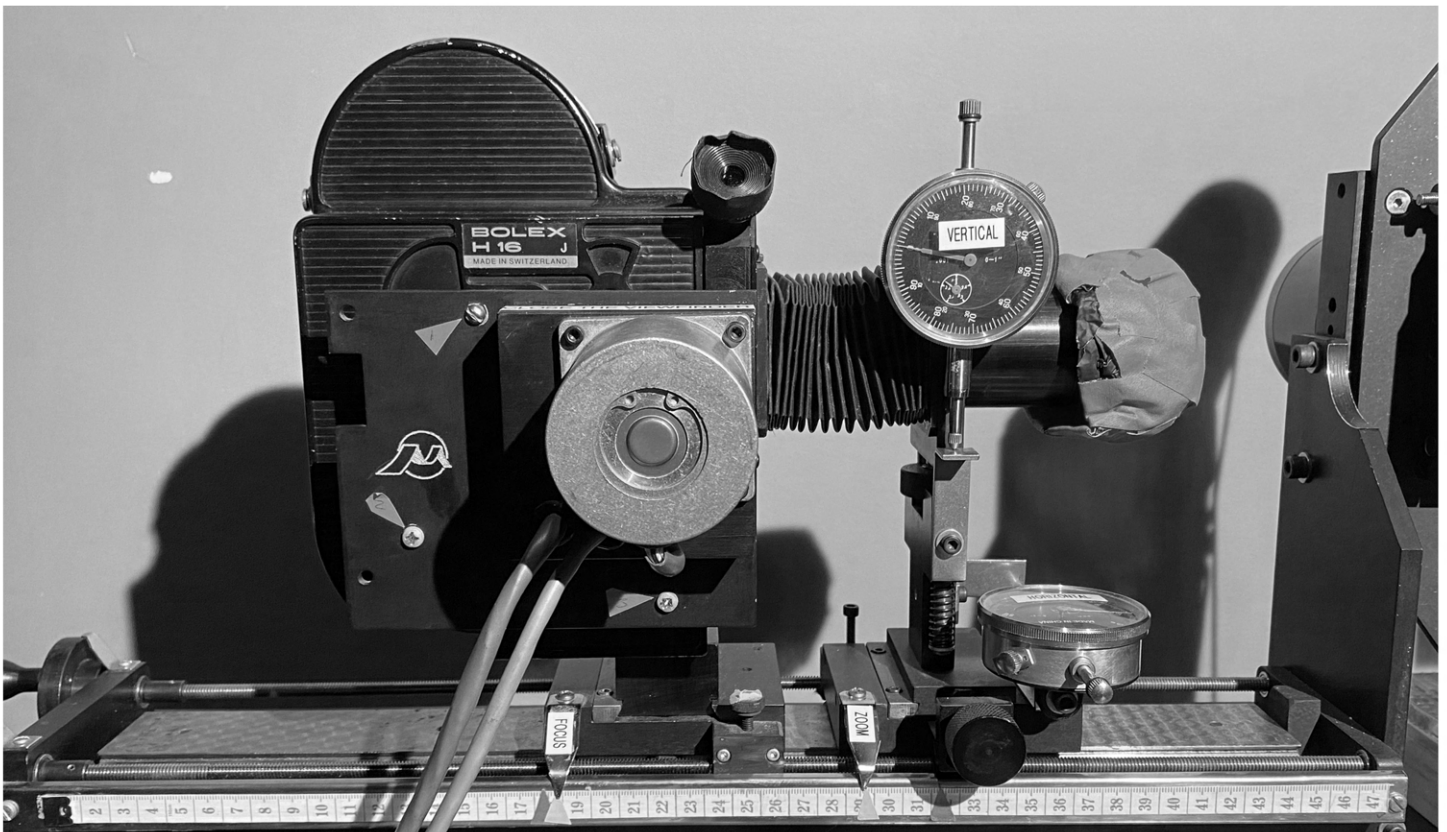
JK Printer Bolex

The Bolex is a special model that has a motor attached to it which we use to advance forward or in reverse, by one frame at a time and to control the exposure time of the shutter during those single frame movements.

The Bolex is outfitted with a lens attached to bellows at the front of the camera and the camera sits on a rail system which allows for movement of both the camera and the lens. The camera/lens can move forward and backward in relation to the film threaded up in the projector portion of the printer. Moving the camera/lens will adjust framing and focus.
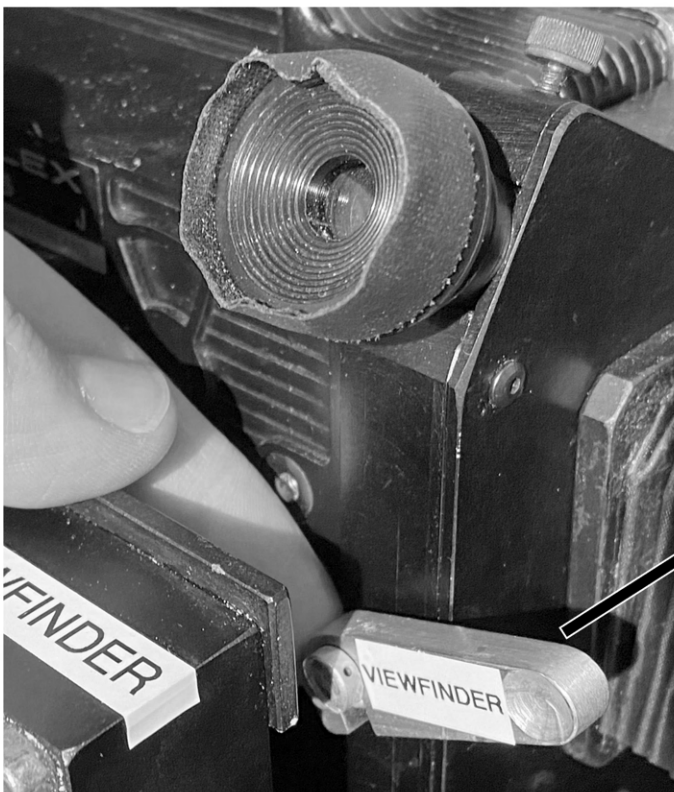
JK Printer Bolex - Viewfinder

This Bolex has a special viewfinder on it that you look through in order to focus and frame accurately. The viewfinder can be opened and closed with the silver switch below it.

The Viewfinder must be closed before beginning your exposures!

Silver switch will open or close the viewfinder.
PUSH IN to OPEN viewfinder
PULL OUT to CLOSE viewfinder

JK Printer Bolex - Loading

The Bolex on the JK Printer loads in the same fashion as any Bolex. Use 100ft rolls on daylight spools. The Bolex should have a takeup spool already inside.

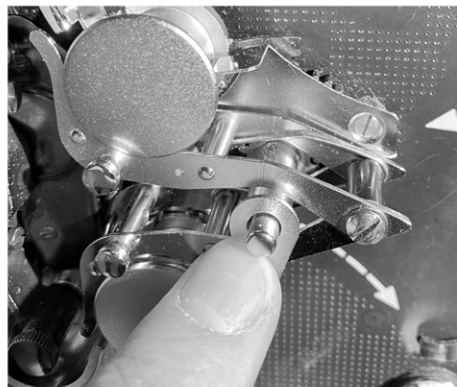Instead of winding the camera up to load the film, the JK computer software must be used. Either set the camera to advance a certain number of frames to load the film through or use the manual controller.
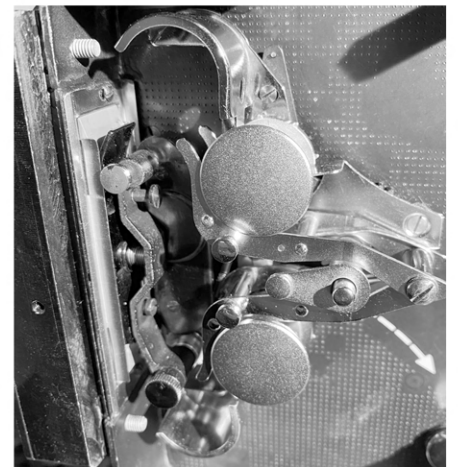

Be sure to close the loop former for loading and open it once the film is loaded (press the little button to release the guides)

Loop former closed

Loop former release

Loop former open

JK Printer Viewfinder

In the viewfinder of the Bolex is a crosshair which is your frame guide. The frame will be rotated as you look at it in the viewfinder, so the top of the frame will be on the right side of the viewfinder and the bottom of the frame is on the left side of the viewfinder.

As you move the camera and lens, you will be able to see the focus and framing adjust in the viewfinder.

The Viewfinder must be closed before beginning your exposures!

Dimming the light down makes it easier to look at your frame in the viewfinder, but be sure to readjust the light once you're done!
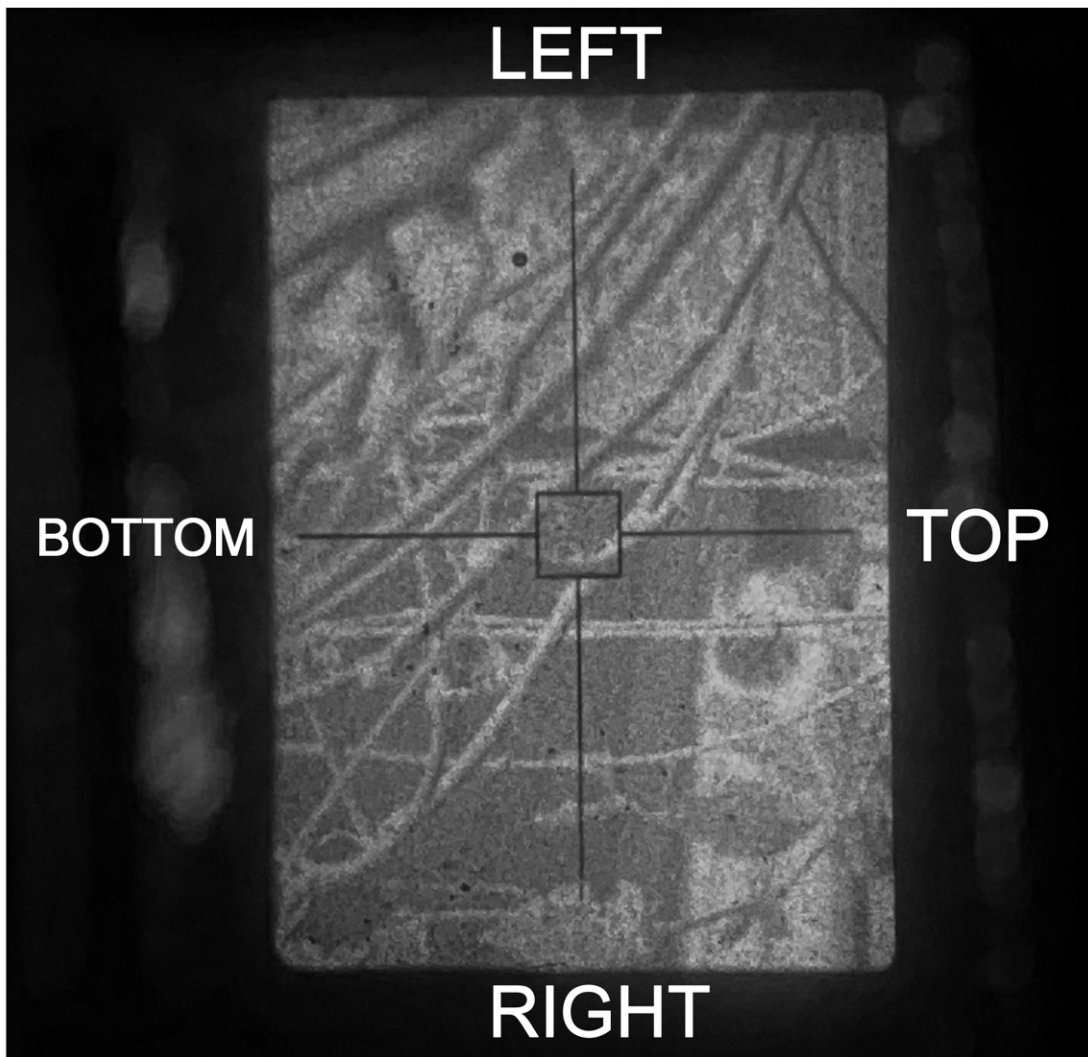
JK Printer Bolex - Movements

The Bolex and lens are on a rail which allows for them to be moved forward and backward. These movements will change the framing (zoom) and the focus of what the Bolex will capture. The controls for these movements are located at the back of the base and can be rotated clockwise or counterclockwise.
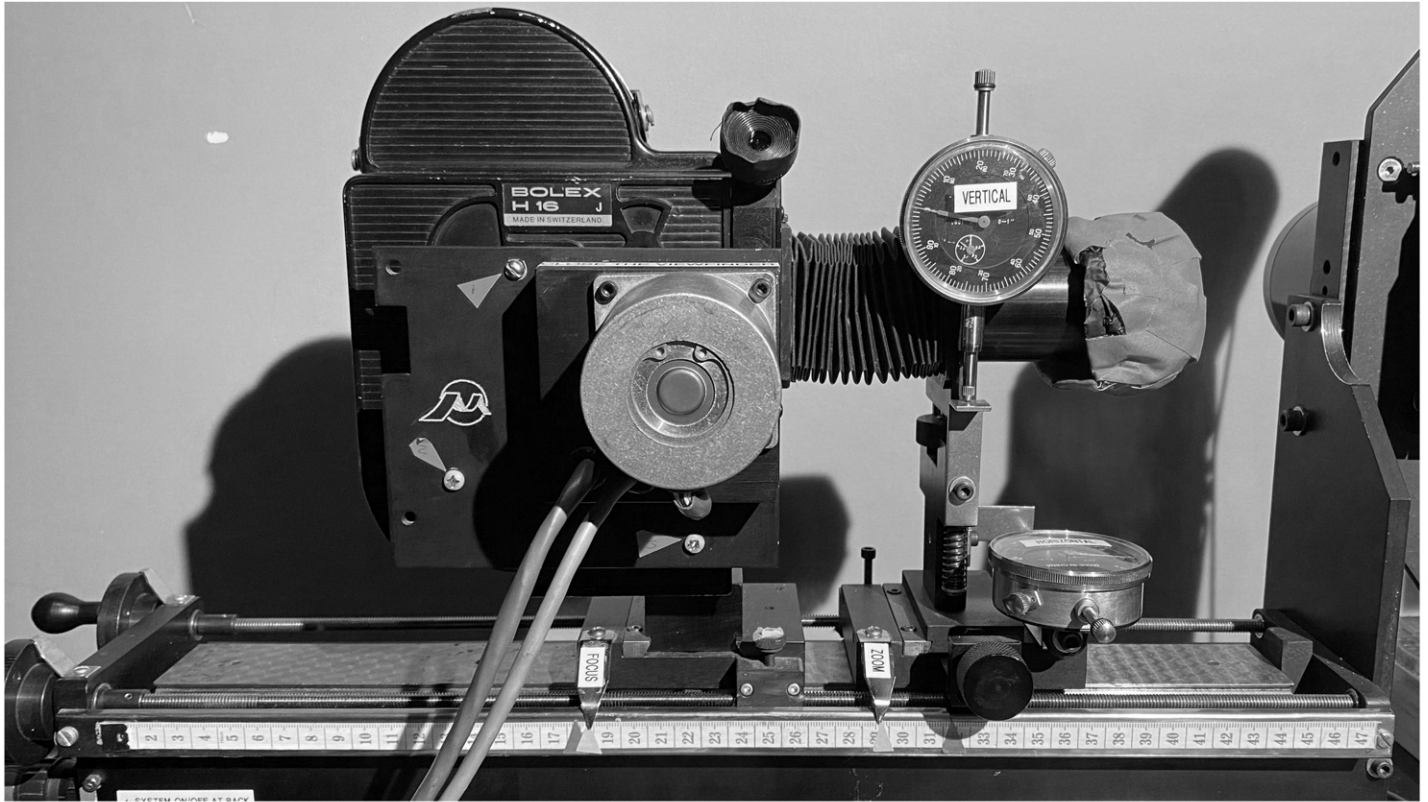
Control for moving lens forward or backward. This will change the size of the frame being captured from the projector
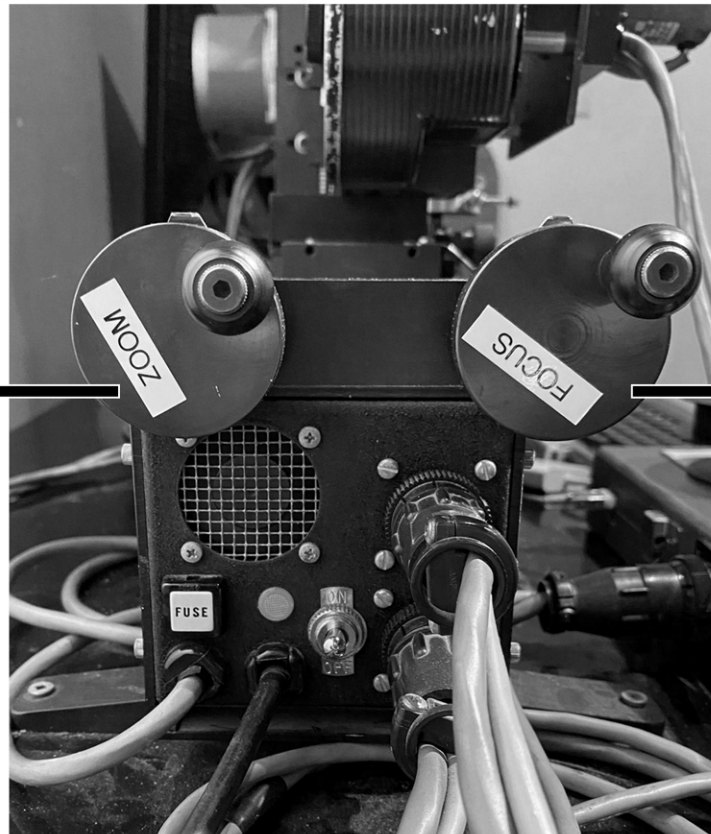
Control for moving camera forward or backward. This will change the focus of the frame being captured from the projector

JK Printer Bolex - Movements

On the rails are two indicators for the Bolex and the lens position so that you can do fine adjustments using the ruler on the base for reference.
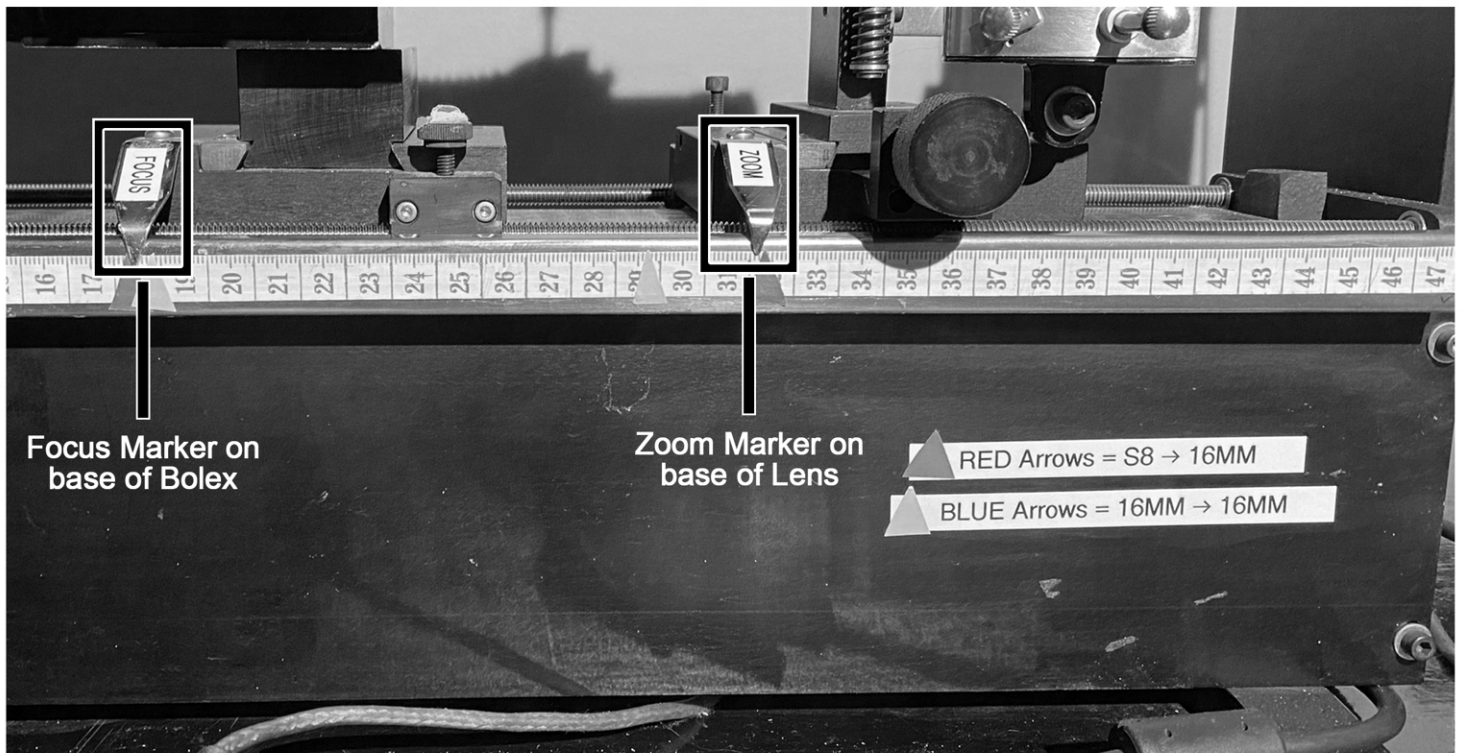

Focus Marker on base of Bolex

Zoom Marker on base of Lens

RED Arrows = S8 → 16MM

BLUE Arrows = 16MM → 16MM

There are also two sets of colored triangle tape markers on the ruler that are the approximate positions for when going from Super 8 (projected) to 16mm (in camera) OR from 16mm to 16mm. These markers are a basic reference and you can do further adjustment for your own project

RED Arrows = S8 → 16MM

BLUE Arrows = 16MM → 16MM

(This makes more sense when you're not looking at black and white pictures trust me)

JK Printer Bolex - Lens Movements

There are also controls for moving the lens horiztonally and vertically using knobs located below the lens. This allows for further manipulation for the framing of your image being captured by the Bolex.

The meters labelled 'Vertical' and 'Horizontal' can be used for positon reference.
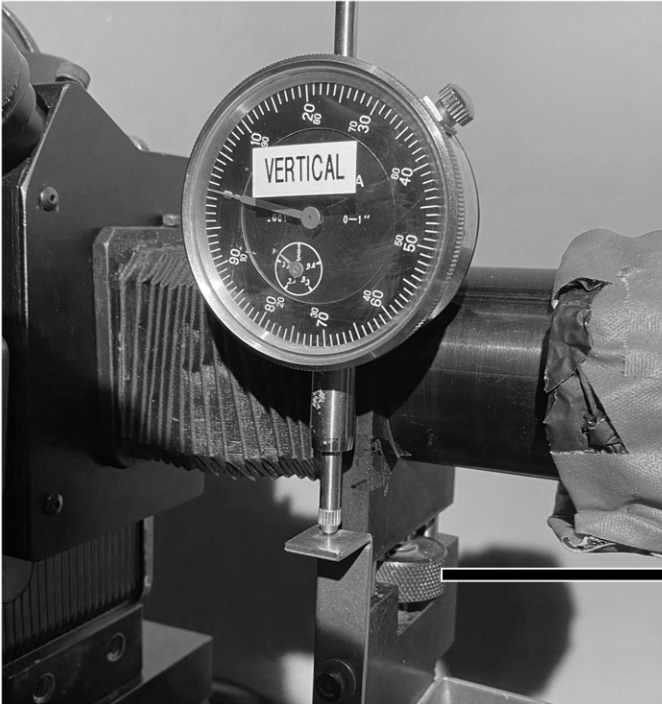
Knob for adjusting vertical position of lens
(knob maybe stiff)
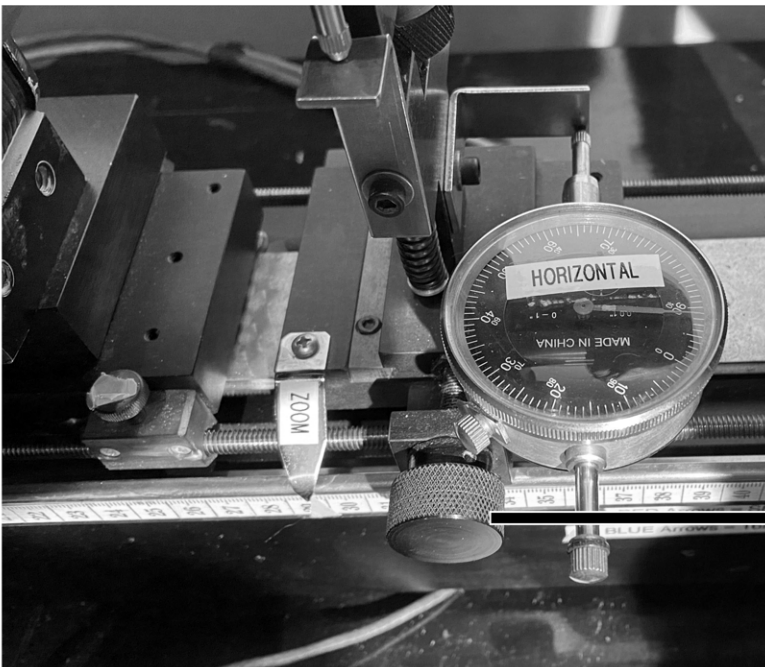
Knob for adjusting horizontal position of lens
(knob maybe stiff)

JK Printer Bolex - Lens

The aperture of the lens can also be adjusted using the ring at the front. The F-stops are viewable at the top of the lens.

Because the camera is capturing a frame from the projector, you do not have to worry too much about depth of field because it's flat. The sharpest results can be had from a lens when you avoid shooting completely wide open (F4 in this case).

JK Printer Exposure Notes

As covered in various sections of this guide the main ways of controlling your exposure when printing are:

1. **Filters in the projector**
   - Using ND and colored filters will allow you to control the amount of light. Finding the right combination of filters will take some trial and error!

2. **Light intensity**
   - The lamp is equipped with a dimmer that can be adjusted, but this will also shift the color temperature which is important to keep in mind

3. **Shutter speed of Bolex**
   - Using the software you can control how long the shutter in the Bolex stays open during each exposure

4. **Aperture of lens**
   - The aperture of the lens can be adjusted to different F-stops. A lens is usually sharpest around two stops below wide open (F8 in this case)

5. **ISO of film in Bolex**
   - Not always something that you can easily change depending on stock options that suite your project!

You will likely be choosing which factors to adjust based on your own workflow and project requirments, but it's good to understand your choices!

Ultimately it is best to do small tests for exposure by bracketing different settings and exposing a few frames at a time. Then you can do a quick development in the darkroom. If it requires stricter, more precise processing you can take it to the lab as well. This is going to save you a lot of guessing and time later on as you determine the proper exposure settings for your project.

You can utilize a light meter in front of the lens as a starting point, but still best to do exposure tests!

JK Printer Glitches

Because the JK runs off of a custom programmed software and combined with the age of the components, it isn't uncommon to encounter glitches when working with it. I've documented a few below.

When running the camera may skip an exposure. Be sure you're monitoring the printer while running as you'll be able to hear when the camera does something that it shouldn't.

Computer Startup

- On the startup screen (as you type in login/startup information) sometimes what is being typed will continously repeat. This may stop after a moment or you may need to restart.

- As noted in the startup section, when typing the password for login the text will not display on the screen.

JK Software

- If you're on Manual mode and then try to close the JK Optical Printer program it won't work. You have to exit manual mode and then close the program.

- If you make a module with a different exposure time (than the default one) and run that module, and then switch to Manual mode, the camera will still run at that set exposure time in Manual mode. To change the exposure time, you have to exit manual mode, adjust the exposure time in the module, run the module at least once again, then switch batch to manual mode for it to retain the new exposure time.

- If the software is on manual mode and the computer goes to sleep, when it wakes up the software will have glitched. To fix this, press the Red button to get out of manual mode and the software will fix itself.