

SMALL-GAUGE FILM MATERIALS

SCANNING PROTOCOL

(8mm, S8, 9.5mm, 16mm)

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Small-gauge film materials have many idiosyncratic aspects, both in their materiality and in the contexts in which their images are produced. These films were generally shot in contexts outside professional filmmaking practices, such as home movies, amateur films, and experimental or artists' films. Such film materials therefore constitute an irreplaceable representation of our film heritage, and provide an insight into our societies and the filmmaking process itself.

Small-gauge materials, usually made on acetate support, can reach a wide variety of preservation conditions and can present inventive and heterodox interventions (splicing, magnetic sound, camera processes). Due to the widespread use of reversible film stocks as well as these formats' low print runs, the vast majority of these materials will be considered preservation masters in themselves and will probably be the only existing physical supports for the images they contain. The film archive technician who handles these materials must know in detail the care each format calls for, since their small size makes them particularly fragile and susceptible to inappropriate use.

The digitization of small-gauge materials is a work process divided into different stages, with the aim of producing a series of digital files that faithfully mirror the original images. The concept of "fidelity" implies the simulation of photographic characteristics in order to reproduce an audiovisual experience as close as possible to the original material.

Although desirable, a photochemical conservation chain system for these materials is almost impossible, considering the difficulties in duplicating prints and the huge amount of existing titles. The digitization process in no way replaces a film preservation process, but it can allow access to the images without compromising the integrity of the original print.

This protocol document is designed for the digitization technician working with small-gauge film materials from an archival perspective. We have identified four stages in the digitization process (identification, material organization, capture, and post-production), and for each stage there are recommendations for the necessary equipment and a sequence of tasks. Issues relating to digital preservation, which should preferably rest with another archival technician, are not addressed in this document.

This protocol was drawn up in 2020 during an internship programme at the **Cinemateca Portuguesa-Museu do Cinema's ANIM** (National Archive of Moving Images) by Nerea Ganzarain and Carlos Saldaña, students of **Elías Querejeta Zine Eskola**. This work proposal has been specifically formulated for the Cinemateca Portuguesa and its MWA flashtransfer choice scanner with an Agiscan capture software suite, but may be adapted by other institutions.

1.

I D E N T I F I C A T I O N

At this stage, the archivist will assess the film materials, create a record entry in the archive collection database, and assign an acquisition code. The inspection of each item of material should result in the filling in of a registration form with all the required data for cataloguing (title, number of reels, length, emulsion, year, etc.), so as to simplify any technical procedure the materials may require later on.

WORKSPACE

Empty table, in a well-lit area and in a space with good ventilation.



MATERIAL

Light table

Flatbed film rewinder

Plastic film cans

Magnifying glass (minimum 8x magnification)

Nitrile gloves (for opening cans)

Clean cotton gloves

Film shrinkage electronic tester

A-D Strips [acid-detection strips]

Image reproduction equipment (camera, lighting, ruler)

Mask and protective goggles

1.1 PRELIMINARY STEPS

Cleaning up the workspace.

The work surface must be clean, as well as the tools for use. Use alcohol and a cotton cloth for cleaning.



Opening of cans.

In case of oxidation or the presence of mould in the can, the use of protection goggles and a mask is recommended to protect against gases and airborne particles. When opening a can, direct it to the opposite side of the body.

Arranging the film materials.

Materials will be sorted based on the original numbering, if any, or on material typology (according to formats and chronology).



pH measurement.

With acetate-based film materials, it is useful to know the extent of deterioration and the progression of Vinegar Syndrome. The result is important to take effective conservation measures. Insert an A-D Strip and check the pH level after 24 hours (according to A-D Strip instructions, the recommended minimum exposure of 24 hours is for films at room temperature).

1.2. FILM IDENTIFICATION AND RECORD

Photographic record of the film material.

It is advisable to photograph the film materials so as to document their condition upon arrival. Take a picture of the whole group of films in the same acquisition process, and then of each can and reel separately.



Identification

A record number should be assigned, and a registration form should be filled in for each item of film material. The technician should wear cotton gloves when making repairs or when in direct contact with materials. However, wearing gloves is not recommended whenever the film is running. Any damage or defect in the film can cause a glove to get caught and tear the material.

1.3 REPLACING THE CANS

Replacing and labelling cans.

The original container (can) should be replaced with a plastic one. The new container should be labelled as follows:

- Side sticker label (if there is more than one item, write on the label the first and last record numbers of the materials stored inside the same can)

- Top label (if there is more than one item, write on the label the first and last record numbers of the materials stored inside the same can)



Preservation of the original cans.

The original cans should be preserved and placed in a specified area in the archive. All notes or documentation relating to the deposit should also be collected and filed.

2.

P R E P A R A T I O N

2.1 PRELIMINARY STEPS

Acclimatization



When removed from the conservation vault, the film materials must be acclimated in an intermediate space for at least 48 hours before any handling.

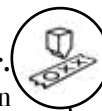


Cleaning up the workspace.

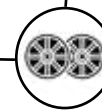
The work surface and tools for use must be clean, using alcohol and a cotton cloth.

2.2. REEL PREPARATION

Inspection and repair.



When moving the film to the capture reel, conduct an inspection of the material. Make sure to hold the film by the edges with your fingers. Stop the process to assess any irregularity that can be felt by touch; this is normally due to faulty splicing or film damage.



Setting up the different film materials on a reel for capture.

Materials should be sorted according to their format and record number. If they contain silent and sound material, it should be grouped in different reels, to facilitate capture.

During inspection, pay special attention to the integrity of the print. Check for dust, strange smell, and colour dye in the emulsion, damage in the perforations, elasticity of the support, and brittleness that can lead to tearing.

Check all splices, using cement or splicing tape to strengthen them if necessary. To do this, carefully press the splice to see if it holds. If not, the splice must be redone. All splicing should be redone or reinforced with tape.

Inspect every tear or initial tear originating from the edges of the film. In each case, assess the need for repair with splicing tape or Perf-fix (perforation repair) tape.

Pay special care when handling film with magnetic sound. If the film has been stored in a very damp environment, the magnetic coating can peel off and stick to the opposite layer of the film on the reel. To remove any trace of dirt, you should never use alcohol in this case, as it dissolves the magnetic tape.

Use cotton gloves exceptionally, only when handling materials that are new or free of mechanical damage. Avoid wearing gloves if the material presents a risk of damage or tearing. However, the use of gloves is recommended when repairing tears or splices. Make sure to tape the sides of the film down so it doesn't move on the table.

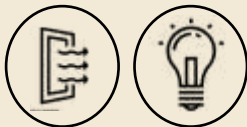
The different film materials should be assembled on each reel in sequential order (from start to finish or from finish to start) and in the same direction (they must not be in reverse order in relation to each other). If in good condition, the original film leaders (from the edges, outside leader – tail and foot) should not be removed.

When moving from one film material to another, a short length of neutral film strip (leader) should be added to mark the separation between the two. If present and in good condition, do not remove the original leaders. Using a marker pen, write on each intermediate “leader” strip the acquisition code, the record number, the title, and “START” or “FINISH”, near the beginning and end of each film.

Add at least 2 metres of “leader” strip at the beginning and end of the roll. Using a marker pen, write the acquisition's code, the roll number, the material numbers, and “START” or “FINISH”.

WORKSPACE

Empty table in a well-lit and ventilated area.



MATERIAL

- Light Table – Flatbed Film Rewinder
- Clean cotton gloves
- Magnifying glass
- Mask and goggles (in case of chemical application)
- Splicers.
- Reels
- White leaders
- Marker Pen
- Scissors
- Acid-free splicing tape
- Perf-fix tape 16mm
- Acetone
- Microfiber cloths
- Clean and lint-free cotton cloths
- Isopropanol 99.9%
- Eucalyptus Oil

2.3. ADDITIONAL INFORMATION.

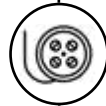
Cleaning.

With few exceptions, the material should not be cleaned from start to finish. Clean only the sections that are visibly and heavily soiled or mouldy.

To clean mould or dirt, apply isopropyl alcohol 99% (isopropanol) using a microfibre cloth and gently apply pressure to the film, while winding it just fast enough for the liquid to evaporate before the film reaches the reel. As the cloth accumulates dirt, make sure to alternate between the cloth's surfaces, and replace it when necessary. As mentioned above, do not use alcohol to clean film with magnetic sound, because it can dissolve the soundtrack coating.

Rewind

Rewind the film back onto the film reel, keeping a steady tension, without sudden speed changes. This is extremely important for a successful capture during scanning. Take care to keep the film's storage container clean.



DAMAGE	MODE OF ACTION	NOTES FOR DIGITIZATION
MECHANICAL DAMAGE	Acid-free splicing tape is used to repair tears and, whenever possible, should only be applied to the edges of the film and never in places where it can damage the image.	Scanning at slow speed, chance of frame loss or a break during scanning.
THIN SPLICING	Check each splice's integrity. If there are any weak splices, replace them with new ones using tape or acetone cement, depending on the type of splicing.	---
ABUNDANT DIRT	Cleaning (only when there is no magnetic soundtrack).	Clean the gate, light source, and all the reels after scanning.
MOULD AND FUNGI	Clean with isopropyl alcohol (if there is no magnetic strip). Use personal protection equipment.	Clean the gate, light source, and reels after scanning.
SCRATCHES, ABRASIONS AND BURNS	Do not intervene unless abrasion could affect film integrity. In that case, make a reversible repair.	---
VINEGAR SYNDROME	Separate from the rest of the materials, and if the film is too brittle, discard its digitization and improve its storage.	Colour may be degraded. Clean the scanner after digitization.
LOSS OF ELASTICITY	If it is too much, a hydration treatment can be carried out by dampening it in a paraffin-saturated environment. Discard the capture on the scanner in cases of extremely acute deterioration.	Sensitive material. Even when scanned at low speed, the film may break.
WAVY FILM / CUPPING	In cases of very serious distortion, discard the scan.	The image may ripple as it runs through the window.
COLOR DEGRADATION	---	Correct in post-production.
DAMAGE IN MAGNETIC SOUND STRIP	Never clean with alcohol, as it can dissolve the magnetic coating.	---

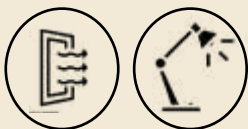
3.

CAPTURE

At this stage, the digitization technician will create digital image and sound files using the materials running through the scanner. The set of files obtained at this stage must meet uniform quality standards and allow for the subsequent digital reconstruction of the materials in their audiovisual integrity, from the first to the last frame.

WORKSPACE

A well-ventilated, dark place, with optional lighting near the scanner.



MATERIAL

- Scanner and accessories
- PC with external hard drive
- Clean cotton gloves
- Air blower (rubber-bulb squeeze type)
- Microfibre cloths
- Clean and lint-free cotton cloths
- Isopropyl alcohol (isopropanol) (99%)
- Reels 8mm, Super-8, 9.5mm, 16mm
- Splicers 8mm, Super-8, 9.5mm, 16mm
- Headphones

3.1 PRELIMINARY STEPS

Cleaning the scanner.

Before placing each roll of film in the scanner, it is essential to clean the equipment to avoid damaging or getting the film dirty as it runs through. Apply alcohol on a cloth and wipe the different parts of the gate and the reels through which the film will run. Before inserting the film, make sure the gate is clean by focusing the image signal in the gate's glass plate and checking for any dirt.



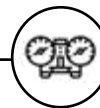
Storage for capture.

Before starting to scan a given set of film materials, make sure the computer equipment has enough free storage for the planned workload. At regular intervals, remove from the scanning equipment all files that have completed the digitization cycle.

3.2. PREPARING FOR SCANNING

Assembly of parts.

Set up the parts of the gate and the audio heads in the suitable way for scanning, according to the format of the film and the existence (or not) of a magnetic soundtrack.



Film loading.

Thread the film into the scanner following the explanatory scheme in the scanner's user manual. While performing this task, keep the scanner lens in an elevated position to avoid any unnecessary contact with it.

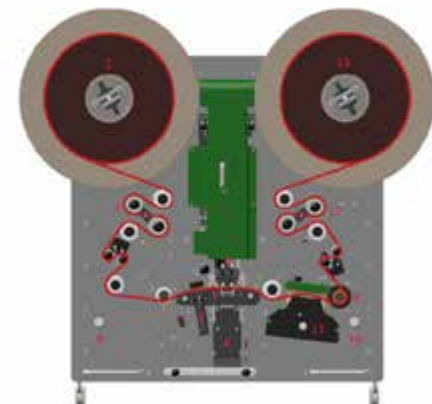
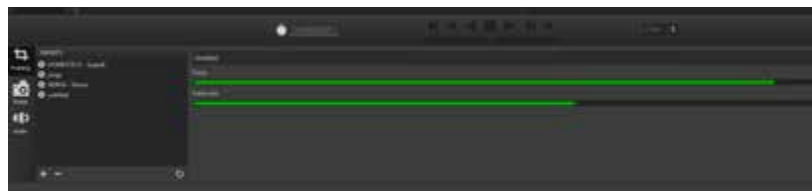
Framing, focusing and lighting before scanning.

Conduct a non-exhaustive preview of the material on the scanner, before proceeding with the scanning. Execute the following operations:



Setting the framing for capture

Take the top, bottom, left, and right edges of the frame as your reference, and if any of the edges extends beyond the perforation (such as in 9.5mm or Super-8 film), be sure to make the necessary adjustments to include the whole frame in the captured image.



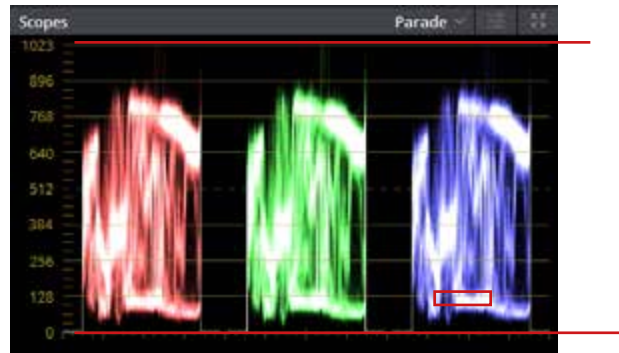
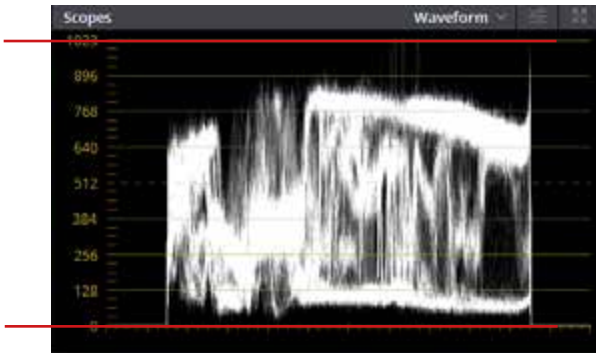


Setting the image's highlights and lowlights.

Taking the waveform/histogram as your measuring reference, make sure that the highest lights do not reach the top limit of your waveform, nor that the lowest signals reach the bottom limit of your waveform. Operating inside the range of your waveform, adjust the "Aperture" and "Light" controls, to get the widest signal possible. Avoid using "Video Gain" and any other setting that modulates the signal digitally.

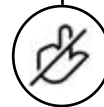
During the preview, the operator should stop at the brightest images (for instance, blown-out or clipped highlights) and the darkest images (underexposed, low-lit, or black frames) to adjust these same controls.

If there are any significant changes between film segments or sections, especially if they are marked by splices, emulsions, or film or camera changes, the operator should plan for interruptions during scanning, and define different capture settings for the different fragments.



Anticipate the impact of splicing or other material accidents during capture.

Splicing can affect the focus or framing of the scan. When there is an incident causing a frame shift that can be corrected in less than 15 frames, adjust and set the correction values and resume capture. If the incident affects the focus or causes a frame shift too difficult to address, stop the scan and restart using new settings.



Avoid color grading during capture.

Should you note dominant unbalanced colours, or significant shifts in the colour balance of the images, make note of them, but don't make any corrections until you have reached the colour grading stage in post-production.

Likewise, do not adjust black & white materials' saturation levels. Leave this until you have reached the colour grading stage in post-production.

Any inaccurate or unsuccessful corrections made during capture can compromise the final results and lead to the necessity for rescanning. Therefore, colour adjustments should remain neutral during capture

3.3. CAPTURE

Start and end of capture.

When capturing film material, the scan should start a little before the first frame and end a little after the last frame (excess frames will be removed in post-production).

When capturing several clips from the same material, the new recording should resume from a frame that has already been properly recorded in the previous capture (so the material can be edited together in post-production).

Capture speed.

Set the scanner capture speed to 10 fps. At this rate, you will ensure the scanner will not lose frames during capture due to storage saturation, and you will be able to react to any threading problems.

In the case of particularly fragile or deteriorated materials, it is advisable to slow down the capture speed even further.

Consistency in capture settings.

The light, colour, or focus settings should all remain unchanged during a single captured clip. To make adjustments to these parameters, stop the capture and start a new one.

Focus check.

The focus point must be checked before beginning the capture of each clip.

Cleaning check.

When the capture of each film in the same capture reel is finished, check for dirt in the gate. If there is any dirt, remove it with a rubber-bulb air blower.

3.4. MANAGING CAPTURE FILES

Naming and directory.

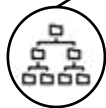
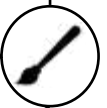
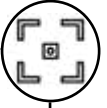
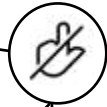
Each file must be named with the source film material's number. Different capture files (clips) for the same material should be marked with an ascending numerical sequence at the end of the file name.

All captures of the same acquisition process should be kept in a single folder, named with that same acquisition's code.

Backup and transport copy.

Upon concluding the captures of a given set of material, these should be written to an external hard drive so that the subsequent tasks can be carried out at a post-production work station.

The capture folder should always be kept as a backup in the scanner's computer equipment until the whole scanning process has been completed and validated.

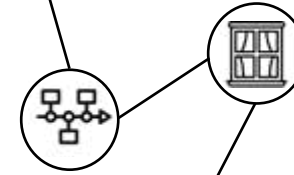
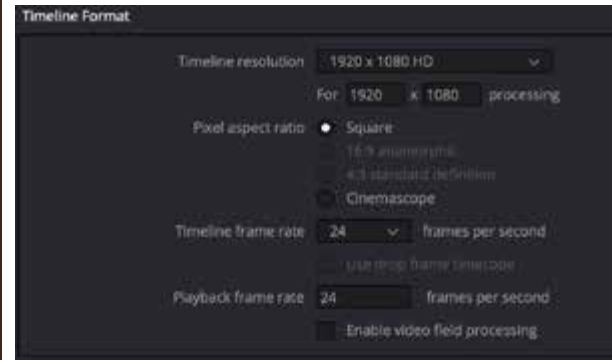


4.

P O S T - P R O D U C T I O N

4.1. PROJECT CREATION AND TIMELINE

In DaVinci Resolve you should create a project for the whole acquisition process, and, within the project, a timeline for each material. Each project and timeline will be identified with its corresponding code (acquisition code, material record number).



Selection of aspect ratio

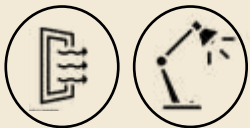
Although all timelines are set to a 1920x1080 HD delivery resolution, the image aspect ratio should match the aspect ratio set for each format's projection ratio. To do so, apply the corresponding mask to each timeline (in DaVinci Resolve, use the Timeline > Output Blanking tool). The mask must remain fixed and should be burned into the output files.

Generally speaking, the image ratio for each format is as follows:

- Super 8 mm. -- 1.37:1**
- 8 mm. -- 1.33:1**
- 9.5 mm. -- 1.31:1**
- 16 mm. -- 1.33:1**
- Super 16 mm. -- 1.66:1**

WORKSPACE

A well-ventilated, dark place, with optional lighting.



EQUIPMENT

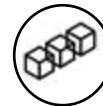
Software: Davinci Resolve. MediaInfo
Headphones

Editing the captured clips.

Validated captured clips for each material should be sequentially imported into the timelines.

If there are several clips, make the necessary cuts so that the clips can match the integrity of the material, without repeating or losing any images or frames.

Each timeline should start in the frame immediately before the first image of the film and end in the frame immediately after the last image of the film.



4.2. SCREENING AND VIEWING SPEED.

In the case of 8mm, Super-8, 9.5mm, and 16mm prints without magnetic soundtrack, it is crucial to carry out a survey and assess each film's correct viewing speed. In some cases, specific information about the film's frame rate might be available. In other cases, it is possible to know the camera model used during the shooting and thus limit the range of speed choices. In many other situations, operators won't have external information to help them determine the speed at which the film should run, and should decide according to their own criteria, taking the concept of the "natural movement" of people and filmed objects as reference.

The mezzanine files should always comply with the speed rate (fps) set by the operator; thus adjustments to the speed should be carried out in the timeline clips.

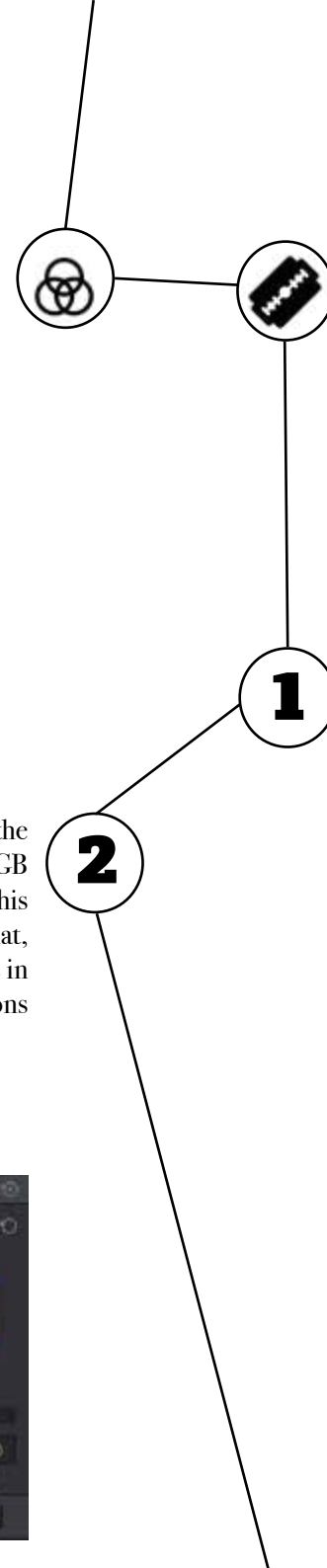
4.3. COLOR GRADING..

Colour grading is carried out on clips that can range from a single shot to the entire material. The operator should determine, according to the different chromatic values, which fragments should be given the same colour treatment and which fragments require a different treatment.

Factors such as emulsions, or film or camera changes within the same material, can serve as objective criteria for separating the clips.

Splitting the film into too many clips, due to indecision or to “be on the safe side”, can backfire, as it could make it more difficult to balance the different images accurately. You can always split the material into more sections if necessary during grading, so you should try to save on the number of clips at this stage.

2. In a second node, “Gamma” wheels or bars should be adjusted to correct the overall colour dominances. If the dominant colour corresponds to one of the RGB colours (red, green, blue), you should use Gamma wheels or bars to remove this dominance. Take as reference multiple images of the entire clip. It is possible that, having reached a satisfactory outcome for some sections of the clip, discrepancies in other fragments may occur. In this case, assess the need of grouping those sections into different clips or working towards finding suitable settings for both.

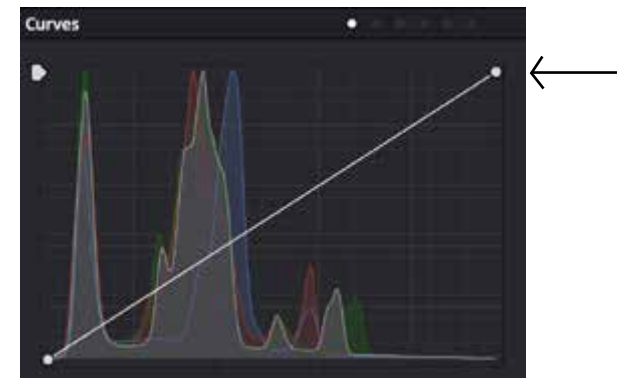


Grading of each clip.

In many digital colour grading software suites, corrections performed on a clip can be organized in a sequential structure of “nodes”, all of which can be deactivated, copied, or deleted. It is important that each correction, or each type of correction, is separated from the rest on a different node. This way the operator can have direct knowledge of the different corrections performed in each clip, thus streamlining the grading process.

The colour grading process can be covered in a basic two-node scheme:

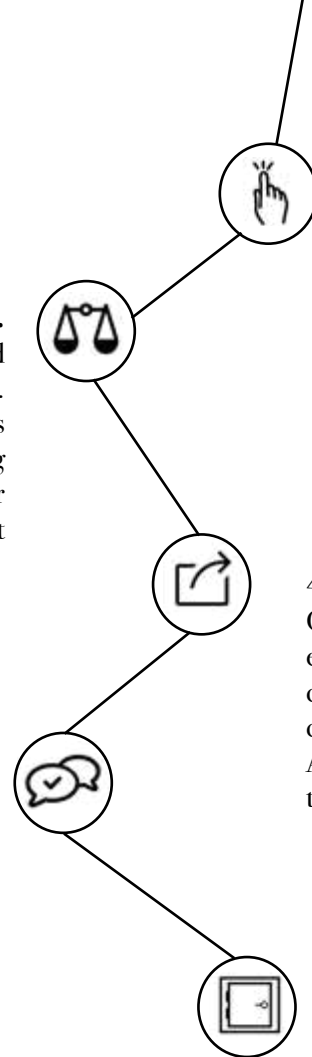
1. In a first node, a adjust “Gain” and “Lift” wheels or bars to set high and low brightness values respectively. Use the signal range along the waveform as reference, avoiding any loss or compression of information due to overexposure of highlights or underexposure of lowlights. Check the values in the brightest and darkest images of each clip, and make your adjustments accordingly. In this first step, the colour channels should be managed evenly, adjusting red, green, and blue values at the same time.



Color grading between clips.
Once the grading of each clip is completed, the operator should check for light and colour uniformity between the different clips. Check if peak levels of high and low beams in the different clips are inside the range of your waveform. Also check if, when moving from one clip to another, there is no significant change in colour values as a result of switching between two clips with distinct corrections. Check that your film feels balanced.

4.5 VALIDATION

The materials should be subject to quality control by a different archivist.



Add subsequent nodes to this basic scheme, depending on the material's requirements (e.g., adding saturation).

Colour grading can be performed on black & white materials (or material fragments) with a single node (the first of the two mentioned above). With a few exceptions, reduce to 0 (zero) the saturation of black & white images.

4.4. EXPORTING.

Once all post-production tasks are completed and examined, the following elements should be exported: a sequence of DPX files with the native image capture resolution, full aperture, without post-production or sizing, and the corresponding soundtracks in format WAV; a mezzanine file in Quicktime Apple ProRes 422HQ format, 1920x1080, with the speed rate (fps) set by the operator.

4.6 PREPARING FOR STORAGE

In the case of 16mm or 9.5mm films, the materials should be moved from the capture reel to the reels and cans they were in before Part 2 of this document.

In the case of 8mm or Super-8 films, it is better to leave them as they are (different short materials spliced together on the same reel).

In the case of 16mm and 9.5mm film materials, remove the leaders added during preparation and replace them with the original leaders. Use a cloth with isopropyl alcohol to wipe all markings added to the leaders during preparation. Store the removed leader in the workspace for reuse. For long-term storage the film should be wound with an even tension. This allows for more aeration of the film and prevents curling, crushing, and breakage that can occur when shrinkage builds up.

Film containers should not be completely airtight. Remember to close the container in the appropriate position when using perforated boxes.

