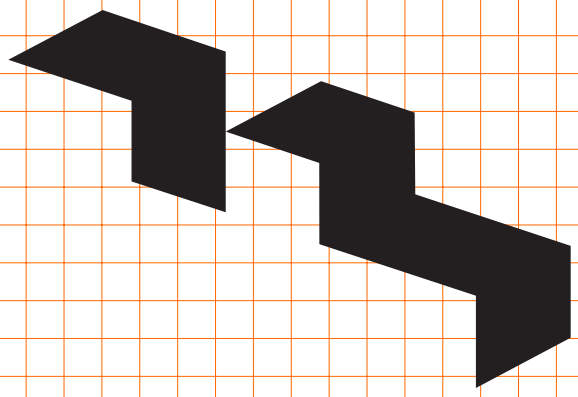


USER MANUAL
FILMFABRIEK
HDS+ FILMSCANNER

CONGRATULATIONS
WITH YOUR FILMFABRIEK SCANNER

Version: April 2018
Contact: support@filmfabriek.nl

USER MANUAL
FILMFABRIEK
HDS+ FILMSCANNER

CONTENTS

INTRODUCTION

Congratulations with your Filmfabriek HDS+ Scanner! With this scanner, you will be able to scan and digitize any film from 8 to 16 millimeters. In this user manual, we will discuss the basics of your scanner and the included Cine2Digits software. After reading this manual, you will be able to choose the correct settings for your film and digitize your material. We are proud of our products and we sincerely hope that you will enjoy your Filmfabriek scanner.

GETTING STARTED

UNPACKING & INSTALLING THE FILMSCANNER

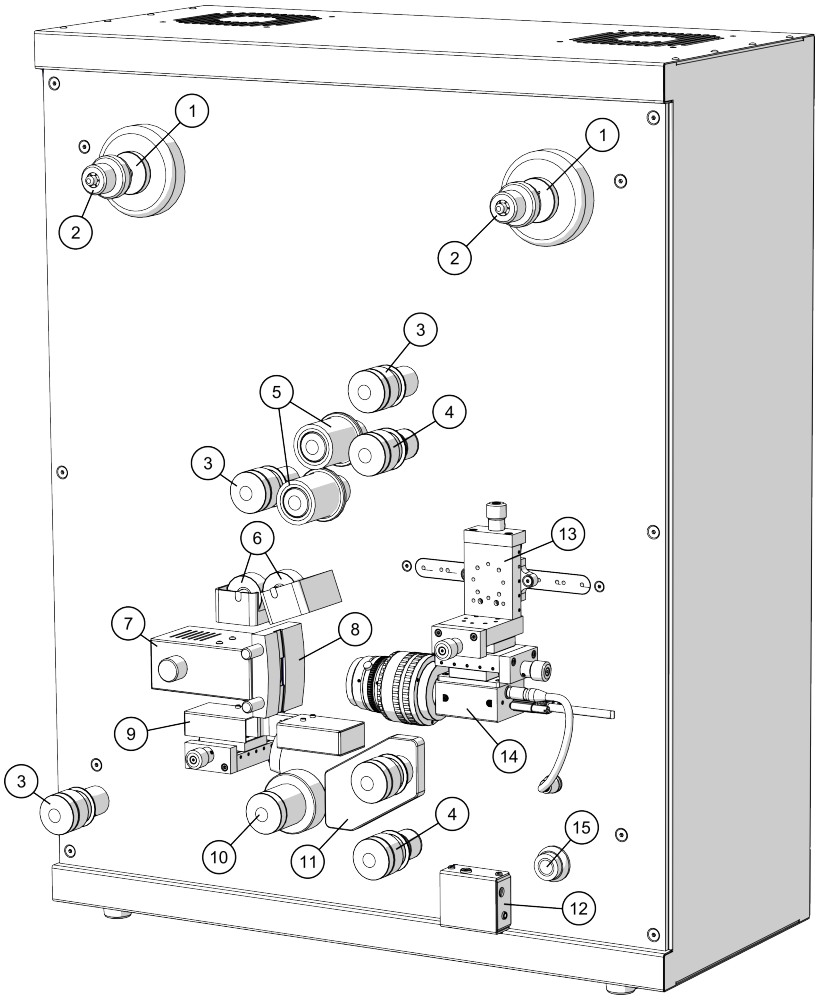
UNPACKING

Remove the screws from the top of the box. Also, remove the screws from the front of the box. Lift the scanner out of the box. Please do this with 2 persons and use proper lifting methods. Place the film scanner on a table. Open the box with the camera, cables and accessories. If you order a pre-installed workstation, unpack this and set it up close to the scanner.

INSTALLING THE CAMERA AND OTHER ITEMS

During transport, the camera, film gate and rollers are removed for safe transportation. For first use, these parts should be reinstalled.

STANDARD CONFIGURATION OF HDS+ FILMSCANNER

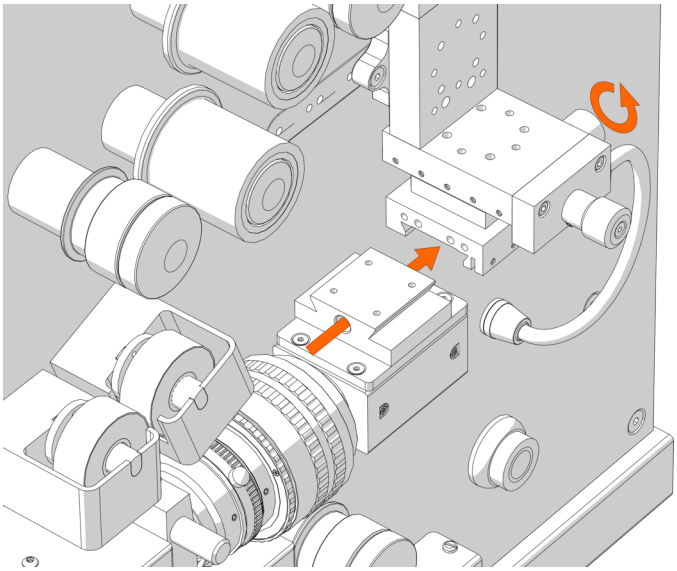


| 1. Film reel axle | 2. Lock nut | 3. Film guide roller | 4. Film tension sensor | 5. Particle Transfer Roller | 6. Wetgate roller | 7. LED Light source | 8. Film gate | 9. Sprocket hole detector | 10. Capstan roller | 11. Mounting location for sound heads | 12. Sound head amplifier | 13. Camera position adjustment tables | 14. Camera and lens assembly | 15. Power button

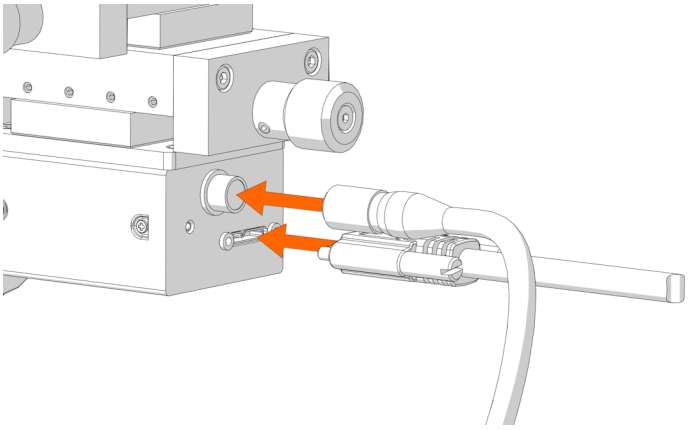
SETTING UP THE FILMSCANNER

INSTALL CAMERA

Slide the camera and lens assembly in the dovetail guide. Push until the slide touches the spindle, then turn the focus adjustment screw clockwise whilst still gently pushing on the camera. Assist the movement until the spindle grips the camera and lens assembly. Now rotate the adjustment screw until the entire dovetail slide of the camera is inserted in the guide table.

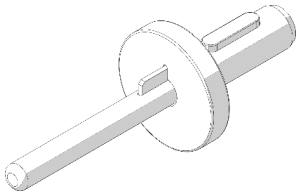


When the camera is inserted in the mount, connect the trigger cable and USB cable. Do not use a screwdriver to fasten the screws on the USB cable, as this can damage the connector in the camera. Only tighten the screws by hand.

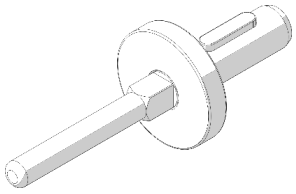


FILM REEL AXLES

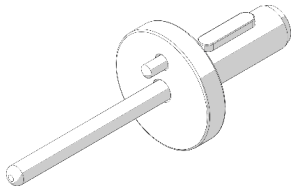
The scanner uses three different types of film axles to be compatible with most of the reels used in the industry. The Regular 8 axle, 16mm axle and Super 8 adapter come as standard with the scanner.



| Regular 8 axle

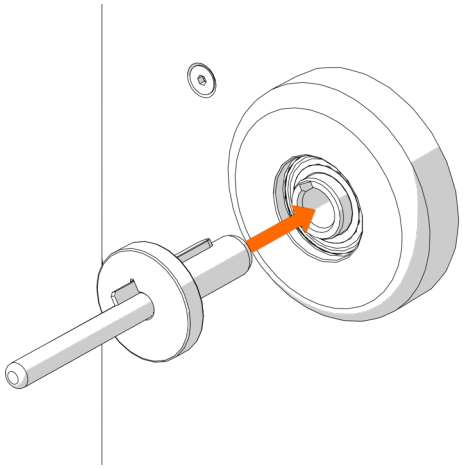


| 16mm / Super 8 (with adapter)



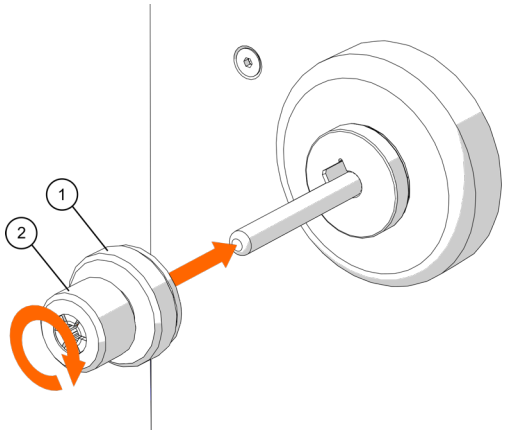
| 9.5mm Pathé axle

The axles are mounted in the hubs on the scanner by aligning the keyway and inserting in the hollow shaft. The axles are retained by a magnet.



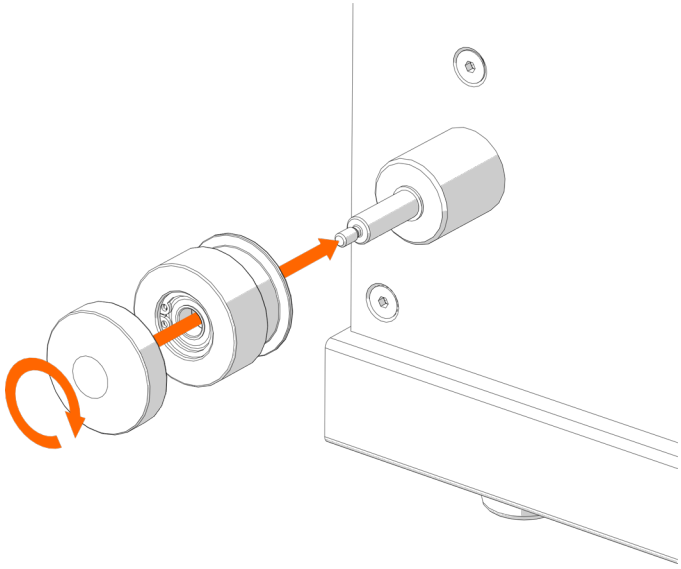
LOCK NUT

The lock nut holds the reels in place on the axle. To place the nut: hold the larger part (**1**) and loosen (**2**) half a turn. Slide the nut on the axle and whilst pressing the nut firmly against the reel, hand tighten (**2**) while holding (**1**) stationary.



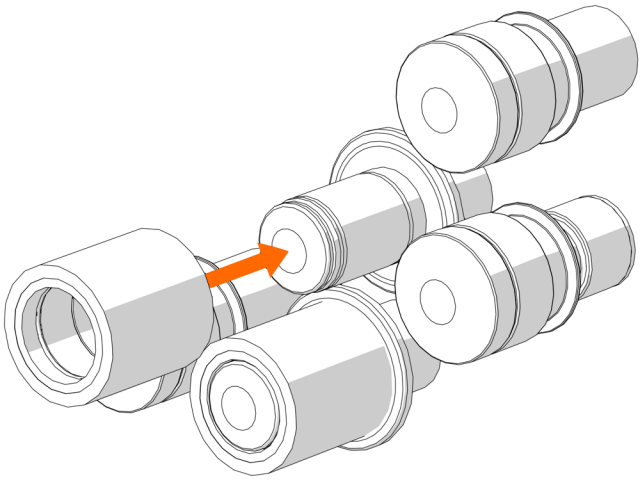
FILM GUIDE ROLLER

The film guide rollers are mounted on the axles by unscrewing the cap nuts as shown below. The rollers are correctly installed when the smaller edge is facing towards the scanner.



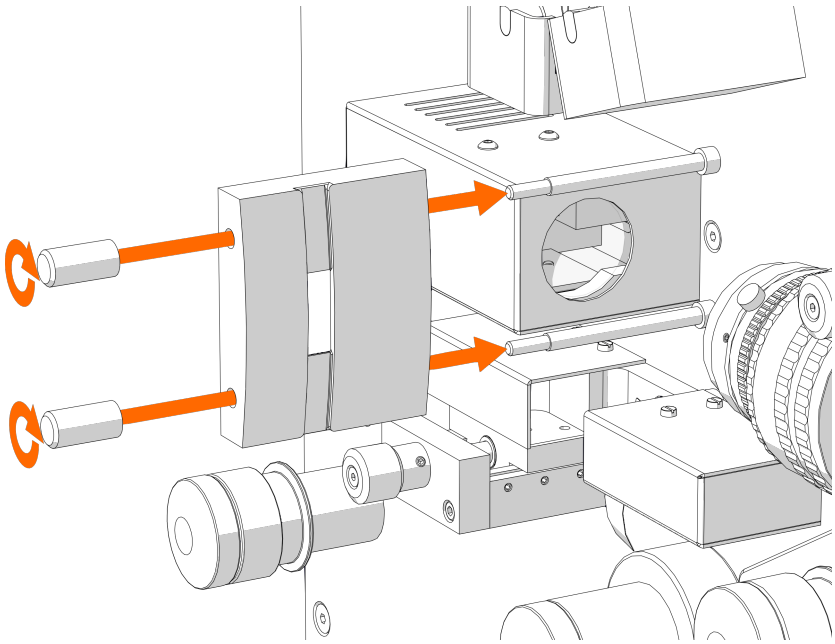
PARTICLE TRANSFER ROLLERS

The PTR (Particle Transfer Roller) can be mounted by sliding them on the designated axles. They are held in place by O-rings. The rollers do not have a specific orientation, they can be used either way around.



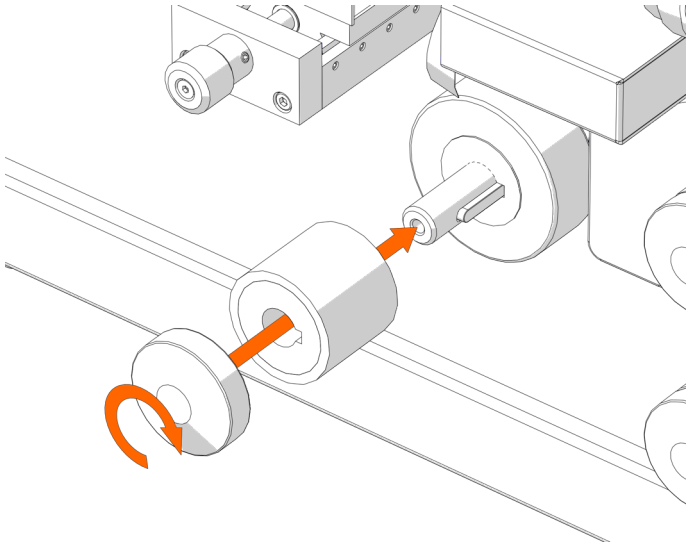
FILM GATE

The gate is placed on the axles with the countersunk holes in the gate facing towards the scanner. After placing the gate tighten the cap nuts by hand.



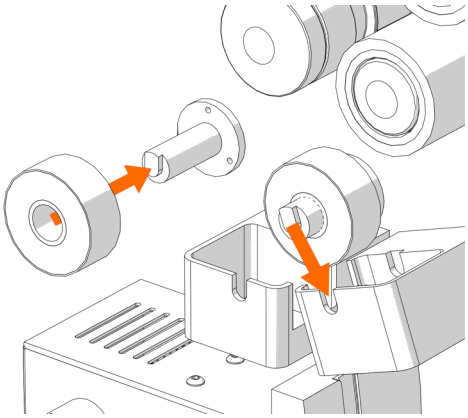
CAPSTAN ROLLER

The capstan is installed on the scanner by aligning the keyway between the axle and the roller and sliding the roller on the shaft. To lock the roller in place a cap nut is provided. The procedure is shown in the following illustration.



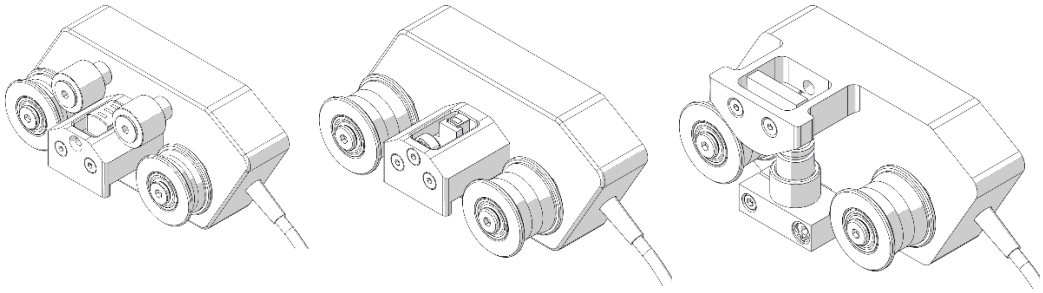
WETGATE ROLLERS

The wetgate rollers are slid onto the axles and are held in place by friction. The rollers with axles can be dropped in the slotted holders on the scanner's front panel.



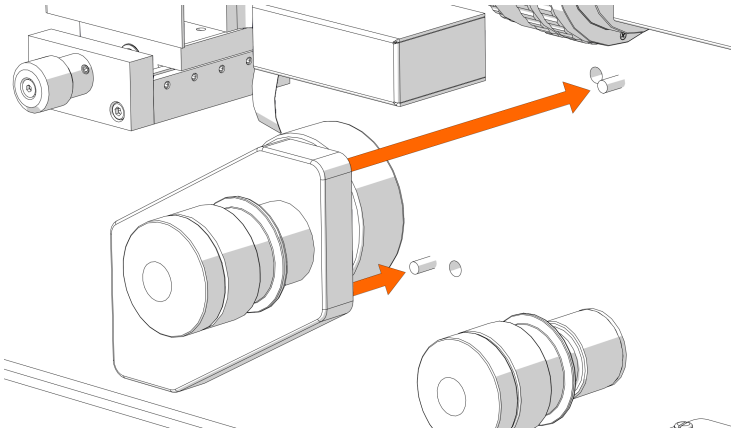
MOUNTING SOUND HEADS

By default the scanner is fitted with a guide roller plate (no sound head), used for scanning silent films. The guide roller plate can be swapped for a soundhead. The following soundheads are available for your scanner

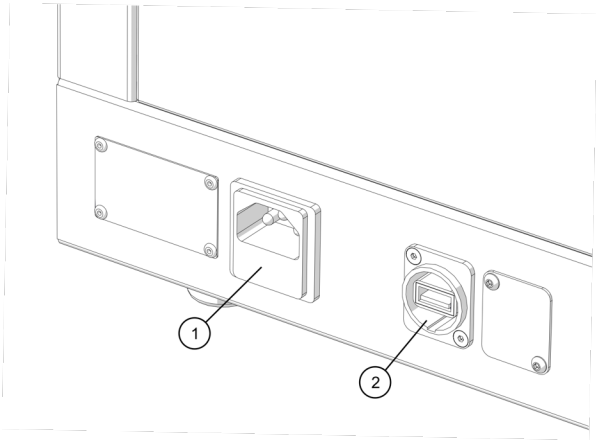


| 8mm magnetic | 16mm magnetic | 16mm optical

The soundheads are attached to the scanner with magnets. To mount them, slide them in a straight motion on the guide pins.



CONNECTING THE FILMSCANNER



| **1.** Power to socket | **2.** USB 2.0 to computer

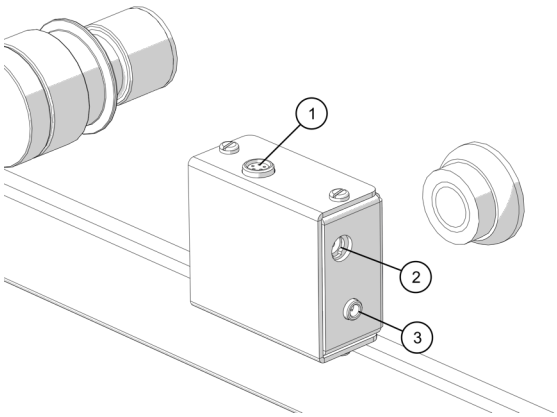
Connect the USB 2.0 cable to the scanner and the computer. Tip: first use the USB 2.0 connectors of the computer (black ones). If you only have USB 3.0 connectors (blue) left, use these.

Connect the power cable to the scanner and plug it into to power socket. Only use a grounded power socket with the scanner.

Connect the ShuttleXpress desktop controller to a USB 2.0 connector of the computer.

The USB 3.1 cable of the camera must be connected to at least USB 3.1 port to be able to reach sufficient transfer speeds. For highest speed and reliability it is advised is to connect the camera to a dedicated USB 3.1 gen2 PCI/e adapter card.

AUDIO CONNECTIONS

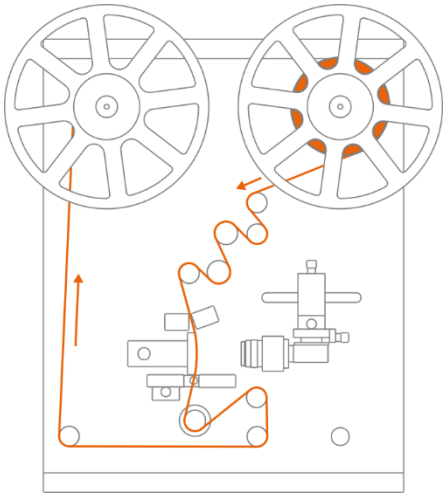


| **1.** Sound head | **2.** Power adapter | **3.** 3.5mm jack analog output

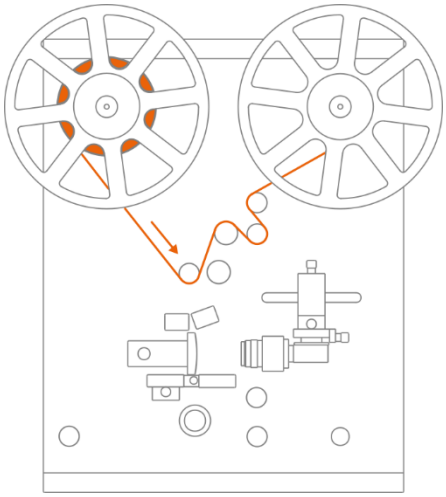
The audio output of the amplifier is an analog signal at line-in level. This output is connected to a Focusrite USB audio interface. Use the provided 3.5mm jack to 2x 6.35 jack cable to connect to the front panel inputs. Set the toggle switches to line. The Focusrite must be connected to at least a USB 3.0 port on the workstation.

LACING FILM

The scanner has the supply reel on the right side, the take-up reel on the left side. Two film paths are distinguished, one for play and reverse play the other one for fast rewinding or fast forward. In both configurations the rotating directions for the reel motors can be set for A and B wind. The default winding setting is A-wind for both reels.



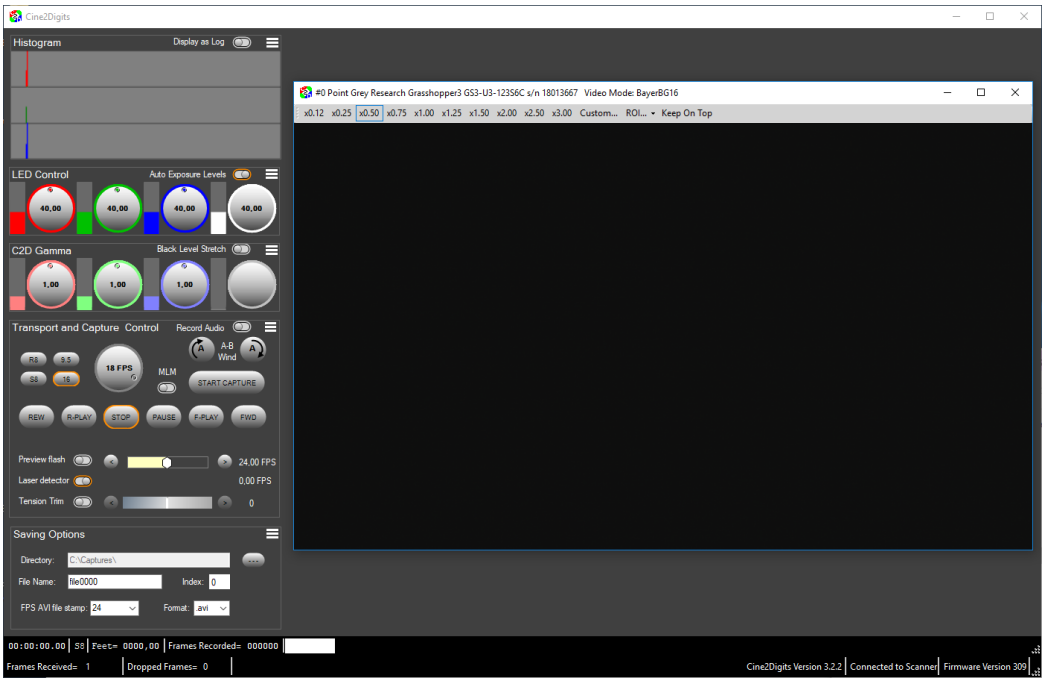
| Play and reverse (A | A wind)



| Fast forward/rewind (A | A wind)

CAPTURING FILM WITH CINE2DIGITS

The scanner is controlled with the Cine2Digits application. This application controls the transport as well as the capture and lighting controls.



FILM TRANSPORT

The film transport controls are found in the film transport control widget. The play, reverse play and pause buttons are used with the film laced in the play / reverse play configuration. The rewind and fast forward buttons are used in the fast forward / rewind configuration. The stop button works in both configurations.

Play / reverse

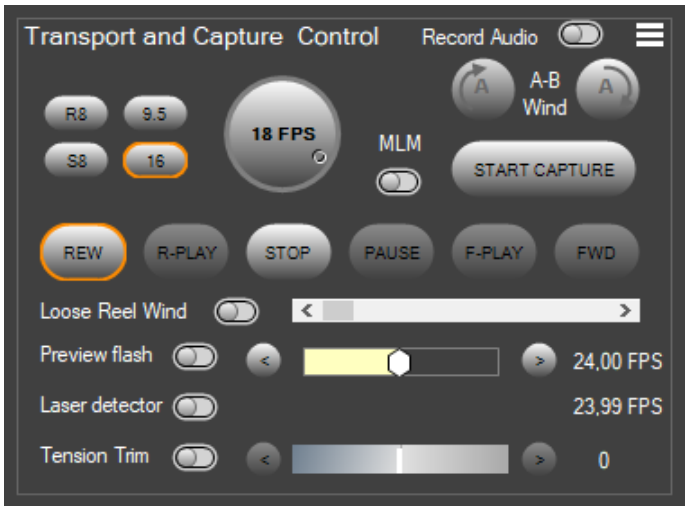
To start the transport, first in the top left corner select the film type that is loaded on the scanner. The film scanner, having a capstan driven transport means that the transport can only run when there is tension on the film. When clicking the play button the film will be tensioned. When the correct tension is reached the capstan will drive the film at the selected FPS. The FPS can be changed by placing the mouse cursor on the dial and using your scroll wheel. The FPS can be adjusted before the

transport is started, as well as when the transport is running. The pause button will stop the transport whilst the film will remain tensioned, the stop button will stop the transport and release tension. When the pause button is pressed from an untensioned state, the scanner will tension the film.

The tension sensors must be calibrated before first use. See section: Calibration Procedures.

Fast rewind / fast forward

With the film laced in the rewind configuration the film can be quickly rewound or fast forwarded to an empty reel. When clicking the rewind button slight tension is put on the film. On the screen a slider controlling the rewind speed appears.



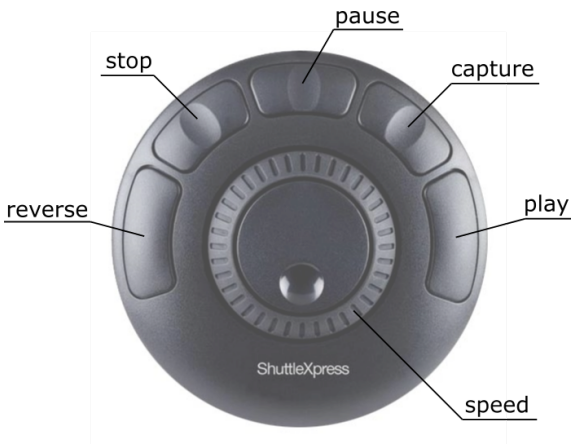
The upper tension sensor on the scanner is used to check for tension during the winding process. If no tension is detected the motors are stopped, this will be the case when the film has ended or in case the film breaks during winding. If a very loose wound film needs to be spooled on an empty reel, one can use the Loose Reel Wind option, this disables the tension check such that back tension can be manually applied.

Tension trim

The filmscanner will regulate the motors in order to keep the film tension constant during scanning. The operator can alter the default tension with the tension trim setting. For fragile film the tension can be lowered. If the tension is set too low there exists a risk that the capstan will lose grip on the film and will slip. If this happens, increase the tension. When working with warped material, the tension can be increased, this can help flatten the image in the gate.

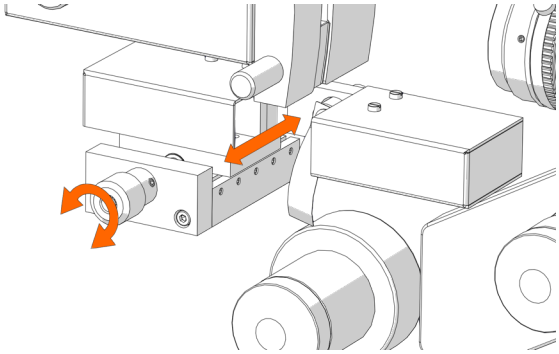
Contour ShuttleXpress

Besides the on-screen controls, the transport and capturing can also be controlled using the provided desktop controller. The following functions are assigned to the buttons



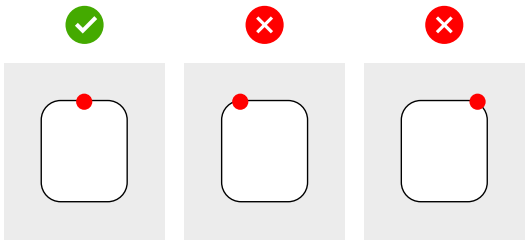
SPROCKET HOLE DETECTOR

The scanner is a frame-by-frame filmscanner. This means that an image is grabbed as soon as a sprocket hole is detected. The position of the sprocket holes differ for the various film formats, therefore it is important to correctly adjust the detector. The position of the detector can be adjusted by rotating the adjustment knob.



The following procedure can be used for establishing the correct alignment:

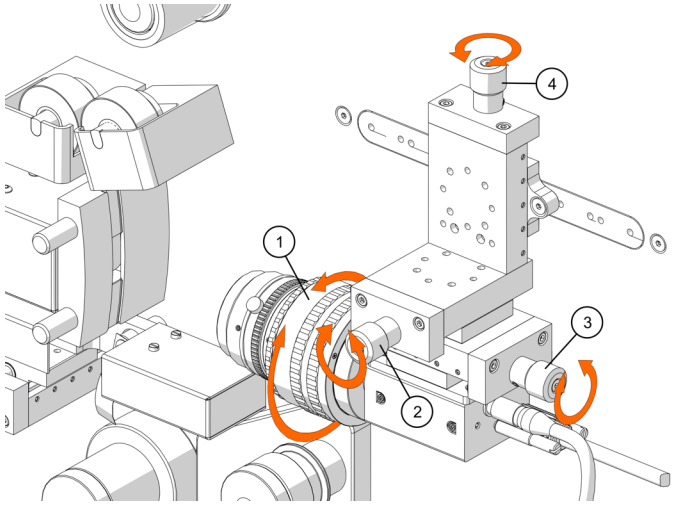
Start the transport at any arbitrary speed. Align the detector by eye such that the LED starts flashing, and images are shown on the screen. Rotate the knob clockwise until the LED stops flashing. Slowly turn counter-clockwise whilst counting the number of turns. Keep rotating counter-clockwise until the LED stops flashing again. At that point turn half the number of counted turns clockwise. Now the laser is centered in the sprocket.



The sprocket detector must be calibrated before first use. See section: Calibration Procedures.

FOCUSING AND FRAMING THE IMAGE

For focusing and framing the image it is important that the film is tensioned on the scanner. The Filmfabriek scanner allows to adjust the camera with full freedom of frame. This means that the operator can setup the system to capture exactly the area of the frame that is of interest with any available resolution of the camera.



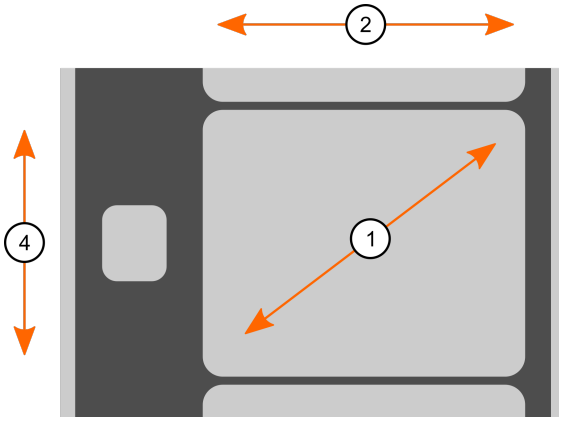
Focusing

In the transport control widget, use the pause button to tension the film. Disable the sprocket hole detector and enable the preview flash. The LED and camera will now produce images at a fixed rate. The FPS can be adjusted with the slider.

Using the rear adjustment knob (**3**) on the back of the camera the image can be focused. Tip: click on x2.00 to magnify the image and focus on the emulsion of the film.

Framing the image

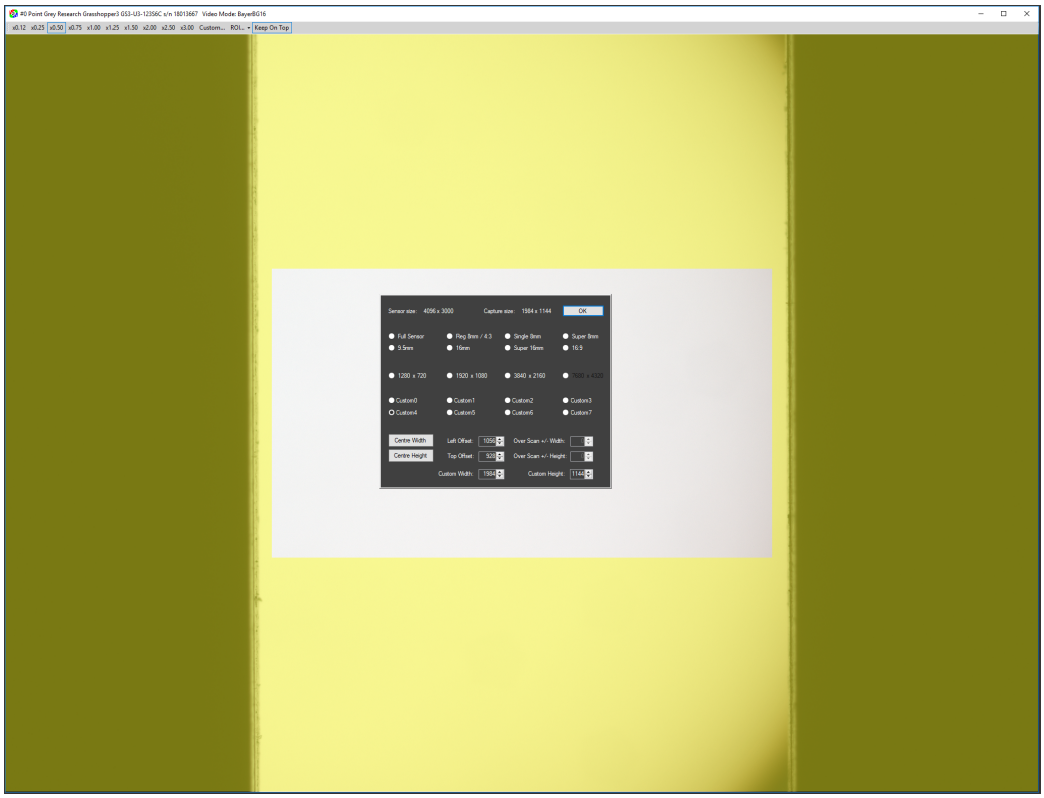
Using the camera and lens adjusters the amount of zoom (**1**), horizontal (**2**) and vertical position (**4**) can be adjusted. Note: the camera triggering is synchronized with the film transport, therefore only adjust the vertical position of the image when the transport is running.



Changing the capture resolution

To change the capture resolution, under the transport and capture control options go to “format”. The transport and capture control settings are accessed by clicking the icon with three lines in the top right corner of the widget.

The camera view now displays the full sensor view. The yellow area indicates the area the will be cropped.

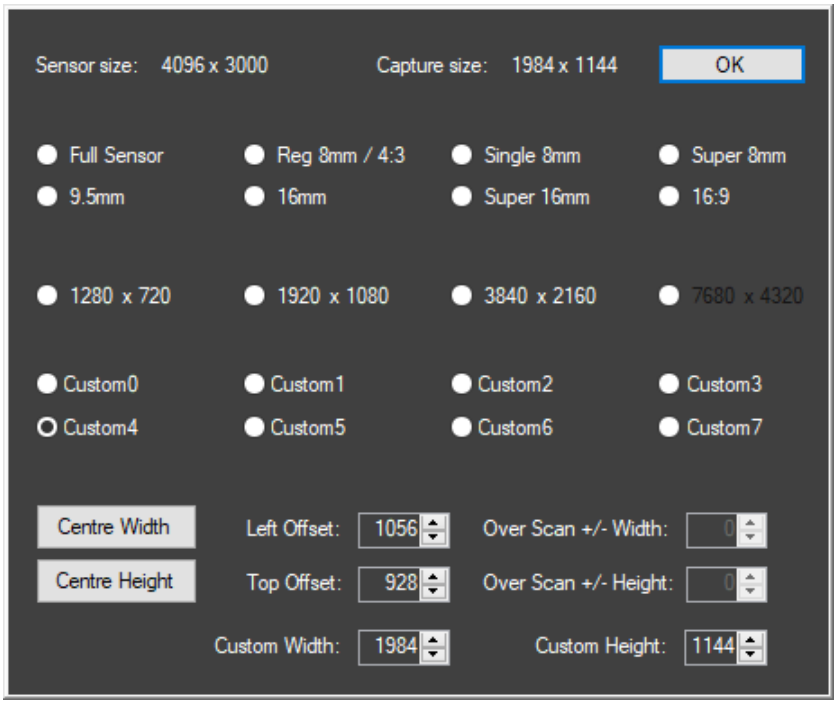


The top of the menu shows the maximum resolution of the sensor and the currently set capture size. Different film presets can be selected. These presets are based on the aspect ratio of the specific film type, mapped to the maximum supported resolution of the camera.

Below that there is a row of preset resolutions for HD-ready, FHD, 4K and 8K[1]

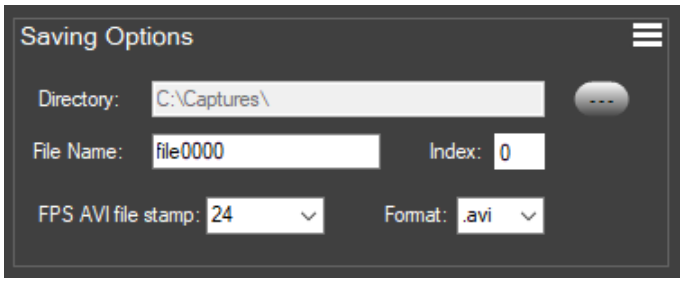
Furthermore, 8 custom presets can be created. In order to create a preset, select one of the preset slots. Select the custom desired vertical and horizontal resolution. Tip: Lenses exhibit their best sharpness in the center. Use the centre-width and centre-height buttons to center the selected resolution.
To name a preset: double click the text and type a new name. The name and preset resolution will be stored when the menu is closed.

[1] Currently not supported



SAVING AND CAPTURING FILM

The file format and location is set in the Saving options menu.



The scanner is able to capture film in the following file formats

Extension	*Color bit-depth*	*Audio*
.avi	8-bit	Yes
.tiff	12-bit	No
.dpx	10-bit log	No
.bmp	8-bit	No
.jpeg	8-bit	No

Index

The index is a number added to the file name. This number is incremented each time a capture is started. This to prevent overwriting existing files. The counter is reset to 0 by double clicking it, but will still skip over any existing saved files with the same index.

FPS AVI stamp

When scanning to an .avi file format it is required to set the FPS stamp[2]. The frame rate stamp tells a video player application at what speed to replay the captured file and should be the rate the film was created at, not necessarily the rate the film is scanned at.

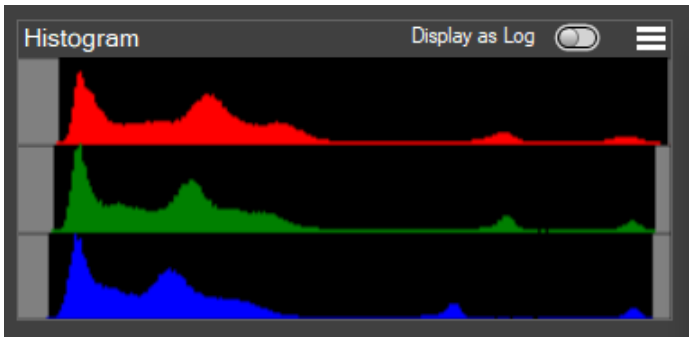
Capture

To start the capture use the “Start Capture” button in the transport and capture control widget.

The capture is stopped when the button is pressed again, or when the stop button is pressed.

LED CONTROL

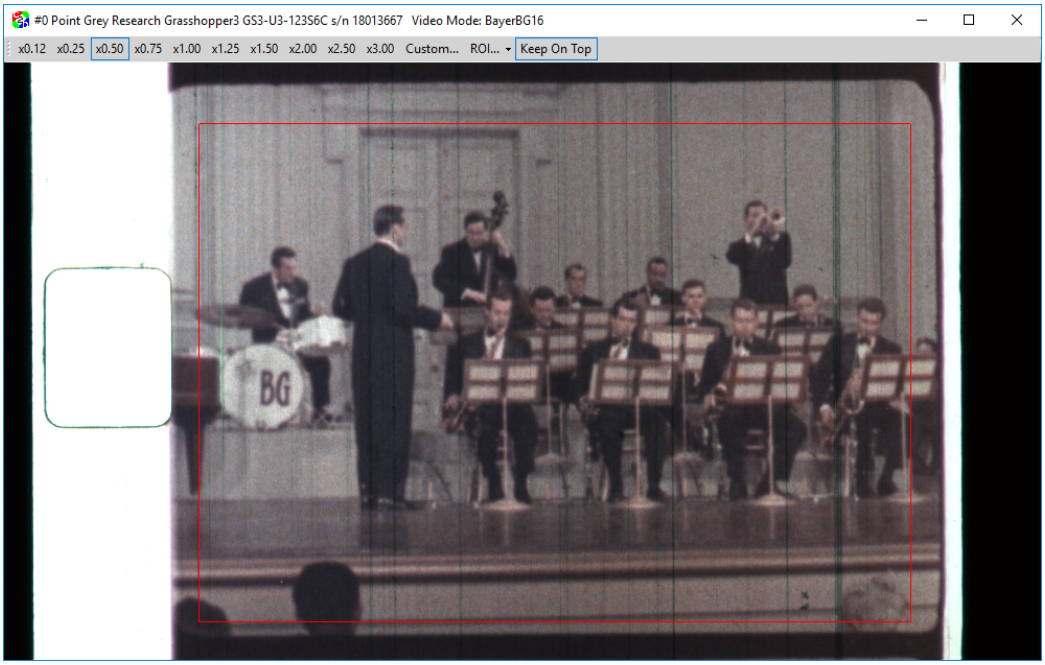
Cine2Digits is designed to make optimal use of the dynamic range of the digital sensor. This is done by controlling the LED light source to maximize the individual RGB channel exposures on the sensor whilst preventing under and over-exposures. The histogram displays the exposures of the RGB channels of the camera.



Region of Interest

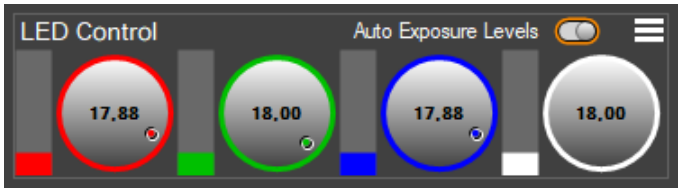
The area in which the exposures are monitored is indicated by the Region of Interest (ROI). This area can be shown by clicking the ROI button in the camera view window and select “show ROI”. The ROI is by default set to 80% of the area of the camera. The ROI can be moved or resized as required. The ROI is always active, regardless whether it is displayed as an overlay or not. The lines of the red rectangle will not be saved during capture.

[2] When working with audio the FPS stamp does not have an effect. See section: Capturing with audio.



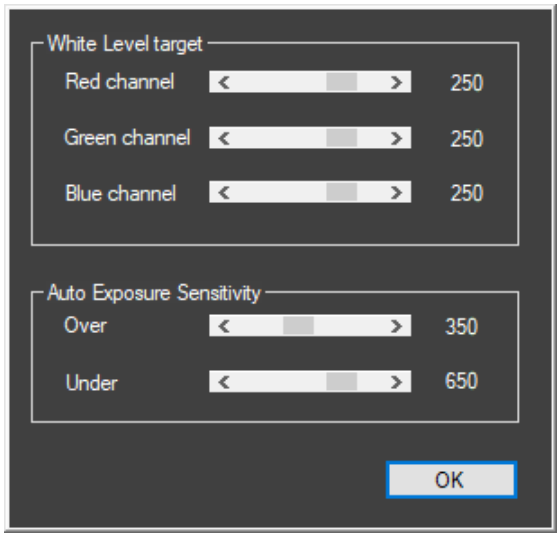
Autolevels

The previous described capturing method where the exposures are controlled automatically is called autolevels. The operator can opt for disabling the autolevels to manually dial in the desired exposure.



The LED control widget features four dials. The values can be changed with the cursor on the dial and using the scroll wheel on the mouse. The white dial will move all three colour channels together. Scrolling with the cursor above the bar left of the dial will move the value with large steps, the cursor on the dial will allow for more precise control.

In the LED Control options the autolevels sensitivity can be adjusted for under and over exposures. The default values are 350 for over-exposure sensitivity and 650 for under-exposure sensitivity.

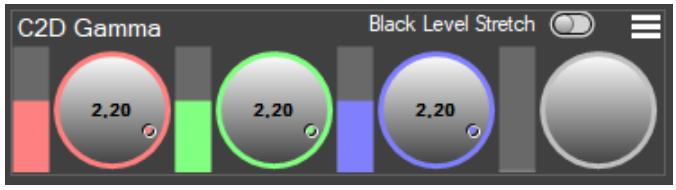


The over-exposure sensitivity determines the amount the exposure is reduced when over-exposure is detected within the ROI. Increasing the value will result in larger changes in frame-to-frame exposure. With larger steps the correct exposure will be reached quicker, but with the risk of over-shooting. Setting the value too-high will cause the behavior to become unstable, this will be indicated with the number changing colour to red. Inversely the behavior of the under-exposure cases can be adjusted.

The RGB white level target values are used by the AutoLevels feature for setting the white level exposure. It is advised to set these a little bit below the 255 clipping level. They can be adjusted individually if it required to create small tint to the white. E.g. RGB values of 250, 245 and 245 respectively will give a small red tint.

Gamma control

During capturing, a gamma correction can be applied to the image. Gamma corrections can also be applied during post processing, but applying them in C2D will ensure that a correction is done at the highest bit-level possible. For example, if a capture is done in .avi file format, the camera on the scanner having a 12-bit sensor, the gamma is applied in the 12-bit colour space before the data is downsampled to 8-bit and stored in the avi file. If the gamma correction was done in post, the correction had been done in the 8-bit colour space, increasing the risk of colour banding.



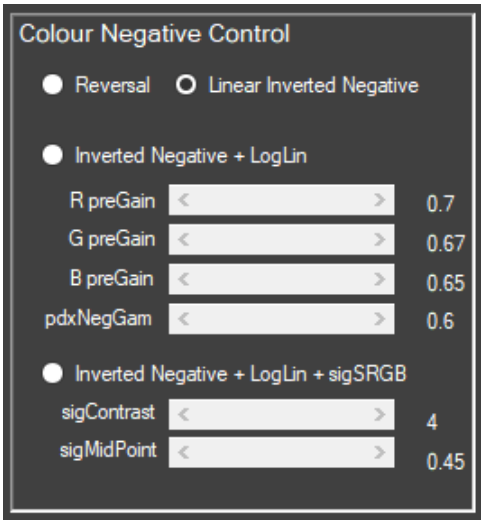
Besides an overall RGB gamma, there is also a black level stretch option. This option stretches the image to produce darker blacks with high setting of gamma levels.

Lens aperture

The autolevels function will increase exposure for dark scenes, or decrease the exposure when the scene is lighter. The LED exposure range for all three channels is from 10-300. For most of the scenes this range is more than sufficient. In the scenes where this is not the case, the effective range can be extended by adjusting the aperture of the lens. By default the aperture of the lens is set between 3 and 4. This is the aperture where the lens has its optimum with respect to sharpness. When the dials reach values of 300, the aperture can be opened to allow for more light to reach the sensor. The lower the number on the lens, the wider open the aperture. Inversely the same can be done for really light scenes in the film.

Scanning negative film

The scanner has the ability to work with negative film. This option can be selected in the Transport and Capture control options. When the negative button is toggled, the colors are inverted and additional colour controls pop-up. The LED autolevels are disabled when scanning negative film, manual setting of the correct exposure is required.



The Colour Negative Control menu allows the operator to dial in a more accurate LUT for negative scanning. The LUT is used for gamma processing, meaning that these settings will not affect the LED's. Similar to setting the gamma in C2D, the LUT is applied at the highest bit-depth the camera will allow.

CAPTURING WITH AUDIO

The scanner being a frame-by-frame filmscanner, the audio is captured separately from the images. When scanning with audio, the only file format supporting both audio and video is .avi. When scanning in .avi with the option “capture audio” enabled the framerate stamp set in the Saving Options menu is ignored. Instead, the average framerate of the transport during recording is used as a framerate stamp. The average framerate is determined by the sprocket hole detector. Because of this, it is important to only start the capture when the transport is at a constant speed. When scanning to an image sequence format, audio can be captured by using a separate audio capture application. The correct way-of-working with audio scans comprises of the following steps:

1. Lace the film
2. Set the record audio button to enable
3. Start the transport
4. When the transport reached a constant speed: start capture
5. Press stop capture to stop recording and keep the transport running
   Or
6. Press stop. The capture is stopped and the transport is stopped.

The position of the 16mm optical head is 16 frames from the gate, the position of the 16mm magnetic head is 18 frames from the gate. The 8mm magnetic head is 51 frames from the gate. For films with Super 8 audio the sound is 18 frames in advance of the image. On the scanner this results in a difference of 33 frames between the recorded audio and the displayed image. This results in an audio delay during playback of the film of 2.069, 1.839 and 1.379 seconds for 16, 18 and 24fps respectively. These delays can be corrected in post.

CAPTURING WITH WETGATE

Wetgate technology makes it possible to remove scratches and dirt from the film. Scratches in film divert the light away from the camera, resulting in dark lines in the image. Temporarily filling the scratches with a transparent fluid, the light will not be diverted, making the scratches not appear as dark lines in the frame. This greatly enhances the quality of the scan.

SCANNING PROCEDURE

The fluid we advise to use for wetgate scanning is isopropyl alcohol (>99,8%). This can be bought in most electronics and hardware stores. Use proper ventilation when scanning wetgate. Make sure you comply with all applicable local health and safety regulations when working with isopropyl alcohol.

1. Insert the wetgate rollers on the scanner
2. The rollers should not spin. If they spin on the shaft, secure them with a needle
3. Use a squeeze bottle to apply a small amount fluid on both the rollers
4. The rollers should be wet, but not so much that the containers beneath the rollers are filled with fluid. After lifting the rollers, the containers should be dry.
5. The fluid should be completely evaporated before the film is wound on the take-up reel. This affects the scanning speed: 6 FPS for 16mm film and 12 FPS for 8mm. These speeds are an indication, depending on the temperature and humidity of the environment the scanner is used in.

MAINTENANCE

The scanner is constructed in such a way that it requires only a minimum of maintenance. The keep the scanner in optimum condition: keep the scanner clean and free of dust.

REGULAR CLEANING OF THE SCANNER

On a daily basis remove the dust on the scanner. Removing dust works best by using compressed air, either from a compressor or and air-duster. While dusting, remove the film gate to remove dust on the light source. For cleaning the remainder of the scanner use a lint-free cloth and standard cleaning agent. The film residue from the gate and guide rollers can be cleaned off using a cloth with some isopropyl alcohol.

Cleaning of PTR's and capstan

The PTR's and capstan should be cleared of dust between each scanning job. This can be done by rolling the PTR/Capstan over a piece of tape with the sticky side up. Clear packing tape works well for this. It is advised to do a more thorough cleaning of the rollers once a week. For this type of cleaning use warm water with a mild detergent, preferably dish soap. Clean the rollers by hand and rinse off the detergent. Let to rollers dry before using them on the scanner.

Removing dust from light source

If dust particles remain visible after cleaning the light source, the light source can be partially dis-assembled for a more thorough cleaning:

1. Remove the cap nut from the light source
2. Carefully slide the housing away from the scanner
3. Remove the LED panel an leave it attached to the power cable on the scanner
4. Remove the light diffusor panel
5. Clean the diffusor and condenser lens with a lint-free cloth and lens cleaning agent. Be careful not to use paper for lens cleaning as this can scratch the surface
6. Reassemble the light source.

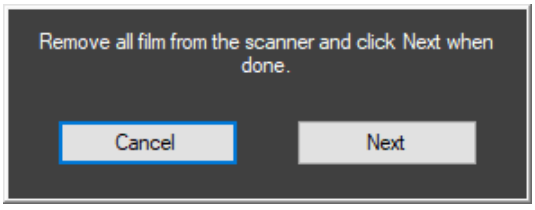
CALIBRATION PROCEDURES

Tension sensor calibration

Calibrating the tension sensors ensure that they provide the correct reading of film tension. The procedure is carried out using the provided calibration reel set.

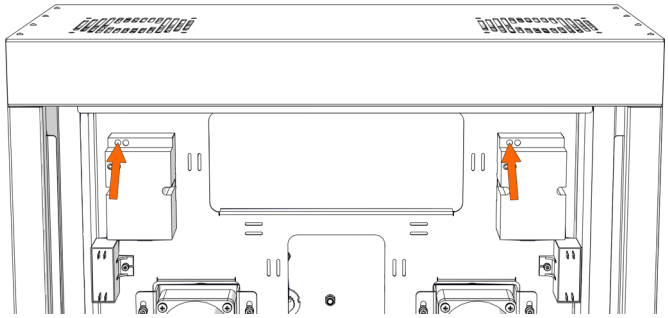
Before starting the calibration routine, configure the scanner with 8mm guide rollers and without a soundhead.

Go to the transport settings menu and click on calibrate. Follow the provided on screen instructions:



Reel motor adjustment

In case reel motor offset adjustment in needed in the tension procedure, backside access to the scanner is needed. Open the back panel with the provided key, with a Philips head screwdriver (PH0) tune the potentiometers labeled “adjust” on the motorcontrollers. Only calibrate the offset during the calibration routine of the tension sensors. Adjust the offset such that the motors just start spinning.

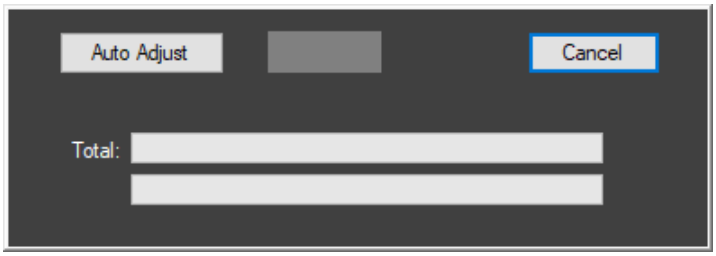


LED calibration

LED calibration is needed to allow the RGB exposure times to be approximately the same for a correctly balanced film. This calibration is run before shipping the scanner, and is not needed to be repeated.

The procedure is carried out as following:

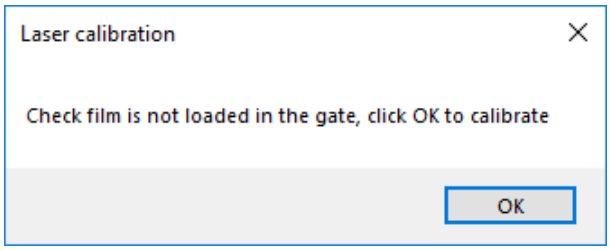
- Remove gate
- Set camera resolution to full sensor
- Frame image such that an even white image is displayed
- Set the aperture of the lens between 3 and 4
- Start LED calibration: go to Transport and Capture Control options, select “Calibrate LED’s”
- Click on Auto adjust to start the procedure



- Close the aperture when the on screen instructions ask for this
- LED’s are now calibrated

Laser calibration

The laser used in the sprocket detector can reduce in brightness over time. This is normal behavior for lasers. To compensate for this, it is recommended to calibrate the laser once a month or when sprocket hole detection issues occur. Before starting the procedure, remove the film from in between the sprocket detector. Go to the Transport and Capture control options and select “Calibrate laser”



If no film is in the laser beam, click OK to do the calibration.

FILMFABRIEK