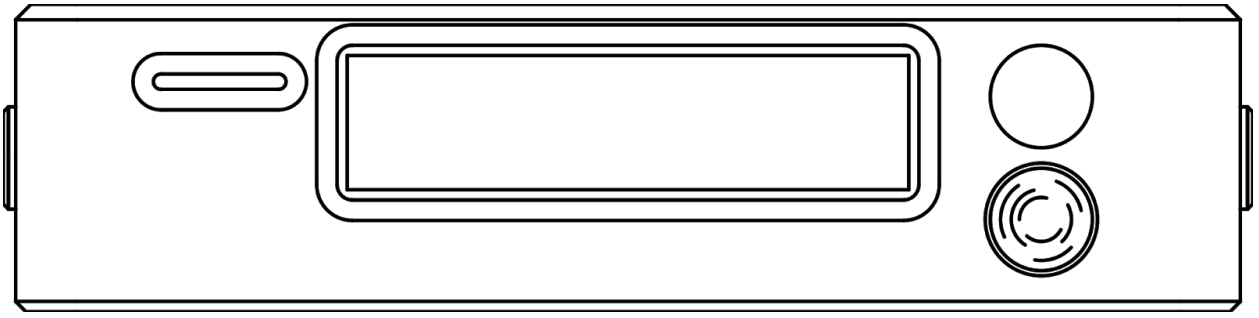
DIGITAL CAMERA SYSTEMS



# LDT-R1 User Manual

**24/01/2020**

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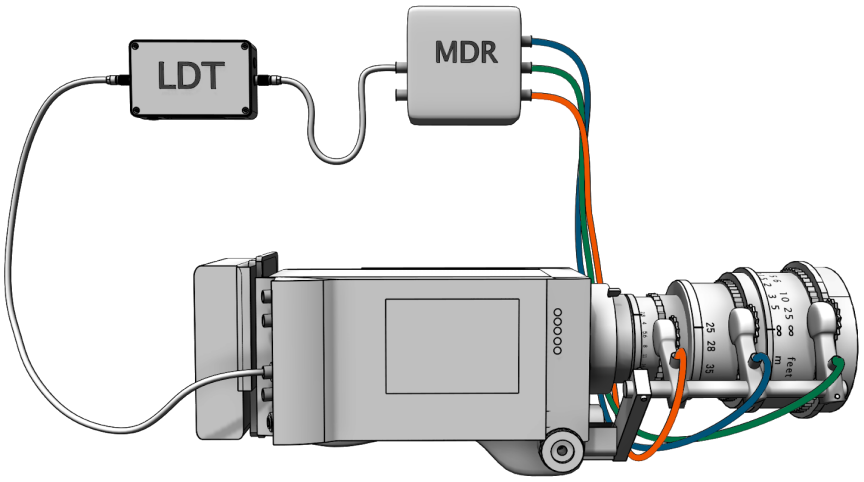
# Introduction

Digital Camera Systems LDT-R1 is a lens encoding system for the RED Family, Panavision DXL, Sony Venice and film cameras.

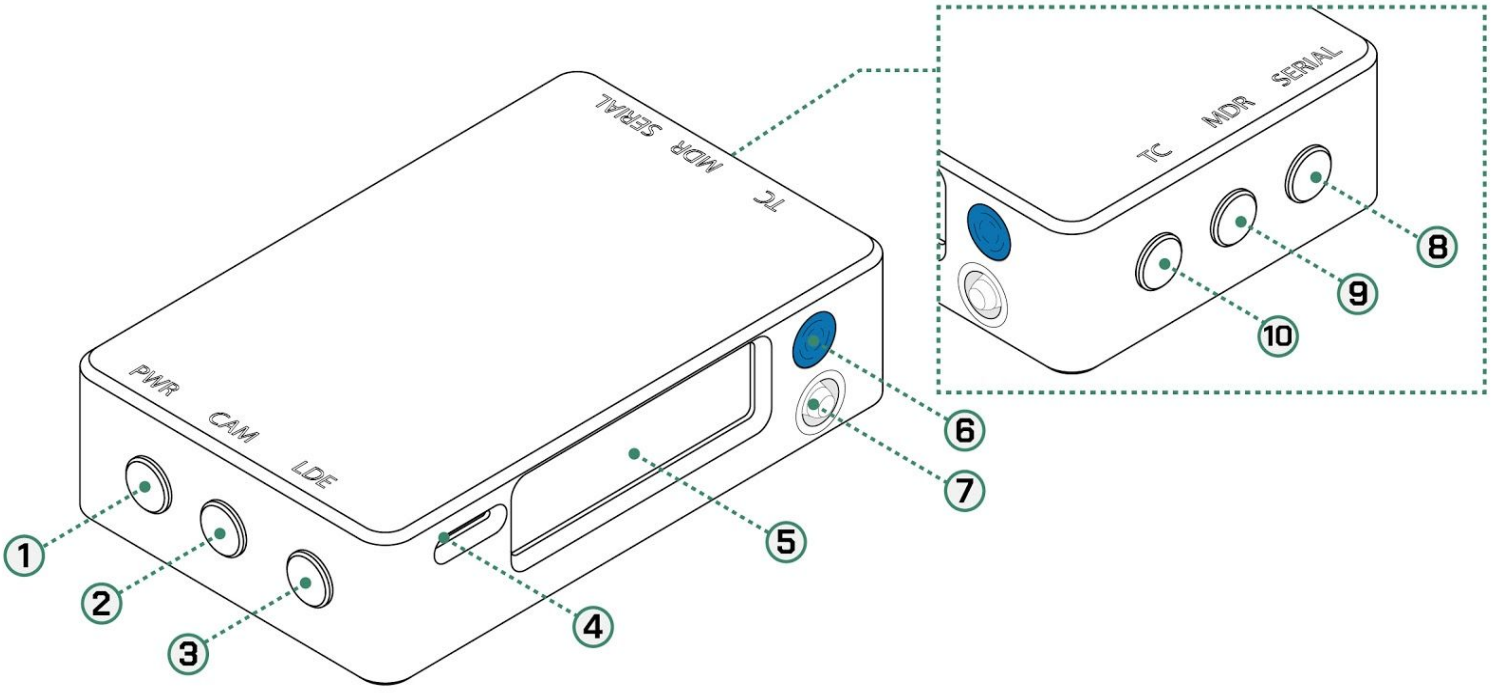
It reads the Focus, Iris and Zoom motor movements from a FIZ motor controller unit and translates this information into compatible data for the host camera.

Metadata can be written directly into the raw camera files in real time (injection recording) or recorded onto a MicroSD card (Internal SD recording).

This manual is divided into two main sections depending on how the metadata is being recorded. Please go to the appropriate chapters.




## LDT-R1 Components




| | | | |
|---|---|---|---|
| 1 | Power - 6-pin 0B Lemo | 6 | Back Button |

| | | | |
|---|---|---|---|
| 2 | Camera - 4-pin 0B Lemo | 7 | Joystick |
| 3 | LDE - 12-pin S103 Fischer | 8 | Serial - 4-pin 0B Lemo |
| 4 | Memory slot for MicroSD Card | 9 | MDR - 4-pin 0B Lemo |
| 5 | LCD Screen | 10 | Timecode - 5-pin 0B Lemo |

## Physical Connections

| Name | Type | Description | Cable Codes |
|---|---|---|---|
| PWR | 6-pin 0B Lemo | Power and Shutter Pulse/Rec Tally connector | RUNA, RUNPV, RUNPVY, RUNV, PWRA, PWRC |
| CAM | 4-pin 0B Lemo | Digital camera connection port | DXL, RED, C/i T |
| LDE | 12-pin S103 Fischer | Lens data encoder connection port for LDT-E1 and Arri LDE-1 | LDE, LDE-1 embedded cable |
| TC | 5-pin 0B Lemo | Timecode input port | TCD, TCDYA, TCDYB, TCDYC |
| MDR | 4-pin 0B Lemo | Preston MDR Serial connection port | MDR, MDRP |
| SERIAL | 4-pin 0B Lemo | Serial passthrough connection port | CT |

## Cable Types and Codes

All DCS cables are categorized using a code and a bend relief color for each of the cable types. Cables have two default lengths, 12 or 18 inches and the connector type can be straight (S), right angle (R), or anglissimo (O). Custom cables can be made upon request.

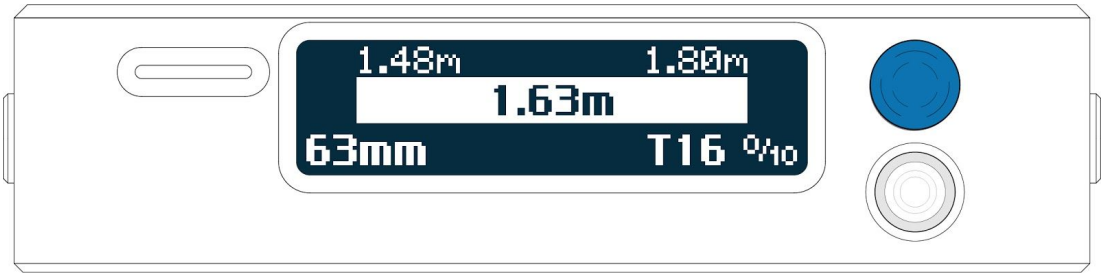
| Code | Bend Relief Color | Type<br><br>Port Name | LDT-R1 Rec Mode | Description |
|---|---|---|---|---|
| RUNA | Gray | 6-pin 0B Lemo to 3-pin S102 Fischer<br><br>PWR | Film, MicroSD Card | RUNA connects the LDT-R1 PWR port to a 3-pin RS socket that provides shutter pulse and power for the unit. If LDT-R1 Rec Mode is set to Injection Recording, RUNA can be used as a power cable. |
| RUNPV | Gray | 6-pin 0B Lemo to 10-pin 2S Lemo<br><br>PWR | Film, SD card | RUNPV connects the LDT-R1 PWR port to a Panavision Millennium XL2 or other Panavision film cameras. The 10-pin socket on the camera provides shutter pulse and power for the LDT-R1. If the shutter pulse is sent to the camera from a Preston MDR, a Panavison 10-pin splitter box must be used on the camera end. |
| RUNPVY | Gray | 6-pin 0B Lemo to 10-pin S2 Lemo and 10-pin 1B Lemo<br><br>PWR | Film, SD card | RUNPVY is a Y cable. It is the same as the RUNPV, but it also connects the 10-pin socket on the camera to a Preston MDR-3 and MDR-4. This lets the shutter pulse travel from the MDR-3 to the camera and LDT-R1 without using a Panavison 10-pin splitter box. |
| RUNV | Gray | 6-pin 0B Lemo to | Venice, SD | RUNV connects the |

| | | | | |
|---|---|---|---|---|
| | | 4-pin Hirose<br><br>PWR | card | LDT-R1 PWR port to the 4-pin Hirose socket of the Sony Venice that provides record tally and power for the unit. |
| PWRA | Black | 6-pin 0B Lemo to 2-pin 0B Lemo<br><br>PWR | RED ET, DXL ET, Any Cam Cooke /i | PWRA provides power to the LDT-R1 from a 2-pin 0B Lemo 12v power source. |
| PWRC | Black | 6-pin 0B Lemo to 3-pin S102 Fischer<br><br>PWR | RED ET, DXL ET, Any Cam Cooke /i | PWRC provides power to the LDT-R1 from a 3-pin S102 Fischer 24v power source. |
| DXL | Gray | 4-pin 0B Lemo to 7-pin 1B Lemo<br><br>CAM | DXL, Element Technica | DXL cable connects the LDT-R1 to a Panavision DXL. It injects the encoded data into the RAW file. |
| RED | Gray | 4-pin 0B Lemo to 4-pin 00 Lemo<br><br>CAM | RED, Element Technica | RED cable connects the LDT-R1 to a RED camera. It injects the encoded data into the RAW file. |
| C/i T | Gray | 4-pin 0B Lemo to 4-pin 0B Lemo | Any Cam, Cooke /i | C/i T cable connects the LDT-R1 to any camera that supports the Cooke/i protocol e.g. Sony Venice. It injects the encoded data into the RAW file. |
| LDE | Green | 12-pin S103 Fischer to 6-pin 0B Lemo<br><br>LDE | Any Mode | LDE cable connects the LDT-E1 to the LDT-R1. |
| TCD | Brown | 5-pin 0B Lemo to 5-pin 0B Lemo | Film, SD card | TCD sends the timecode signal from a timecode generator to |

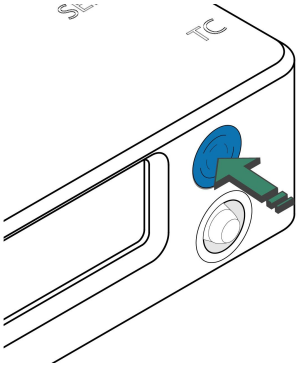
| | | | | |
|---|---|---|---|---|
| | | TC | | the LDT-R1. |
| TCDYA | Brown | 5-pin 0B Lemo to 5-pin 0B Lemo & 5-pin 0B Lemo<br><br>TC | Film, SD card, RED SD card | TCDYA sends the timecode signal from a timecode generator to the LDT-R1 and another device, for example, the Panavision DXL. |
| TCDYB | Brown | 5-pin 0B Lemo to 5-pin 0B Lemo & BNC<br><br>TC | RED SD card | TCDYB sends the timecode signal from a timecode generator to the LDT-R1 and a RED camera with a BNC timecode input connector. |
| TCDYC | Brown | 5-pin 0B Lemo to 5-pin 0B Lemo & RED Sync<br><br>TC | RED SD card | TCDYC sends a timecode signal from a timecode generator to the LDT-R1 and a RED camera with a Sync timecode input connector. |
| MDR | Blue | 4-pin 0B Lemo to 4-pin 0B Lemo<br><br>MDR | Any Mode | MDR cable connects the LDT-R1 to a Preston MDR 2 or 3 serial port. |
| MDRP | Blue | 4-pin 0B Lemo to 4-pin 0B Lemo<br><br>MDR | Any Mode | MDRP cable connects the LDT-R1 to a Preston MDR 2 or 3 serial port. Also provides power. |
| CT | Orange | 4-pin 0B Lemo to 6-pin 1B Lemo<br><br>SERIAL | Any Mode | CT cable connects the Preston MDR 2 or 3 serial port with a CineTape. This cable connects to the LDT-R1 Serial connector if the Preston MDR serial ports are in use. |

# Navigating Menus

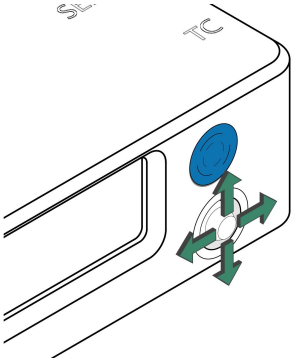
The LDT-R1 is equipped with one button and a joystick.



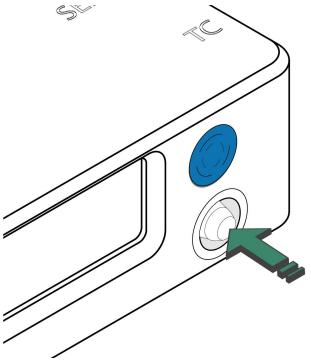

The blue button is the back button



The joystick is used to navigate the menus (up, down, left and right).



Press the joystick in to access the Menu or select an option.



Full menu structure can be found in Appendix 1: Menu Structure

## Flipping GUI

If, for rigging purposes, the LDT-R1 requires to be rigged upside down, the GUI can be flipped.

Choose: Menu > Settings > Advanced > Flip GUI > Yes.

## Homepage functions

The homepage comes up when the LDT-R1 powers up. There are four pages.
**Note:** Depending on the REC Mode selected, the homepage layout differs.

System Status
This page is to check the status of the SD Card and the Preston Connections


Selected lens
Once a lens is loaded, it will be possible to check the lens details here


Lens details
Once a lens is encoded the screen will display a real time readout of the three axis'. Push the back button to switch between units measured (feet/metres),


Motor Status
From this page the motor connection can be checked.
None: No motor detected
Caling: Motor is calibrating
OK: Motor is ready


On the homepage: joystick Up/Down controls the brightness of the LDT-R1 screen.

# Firmware update

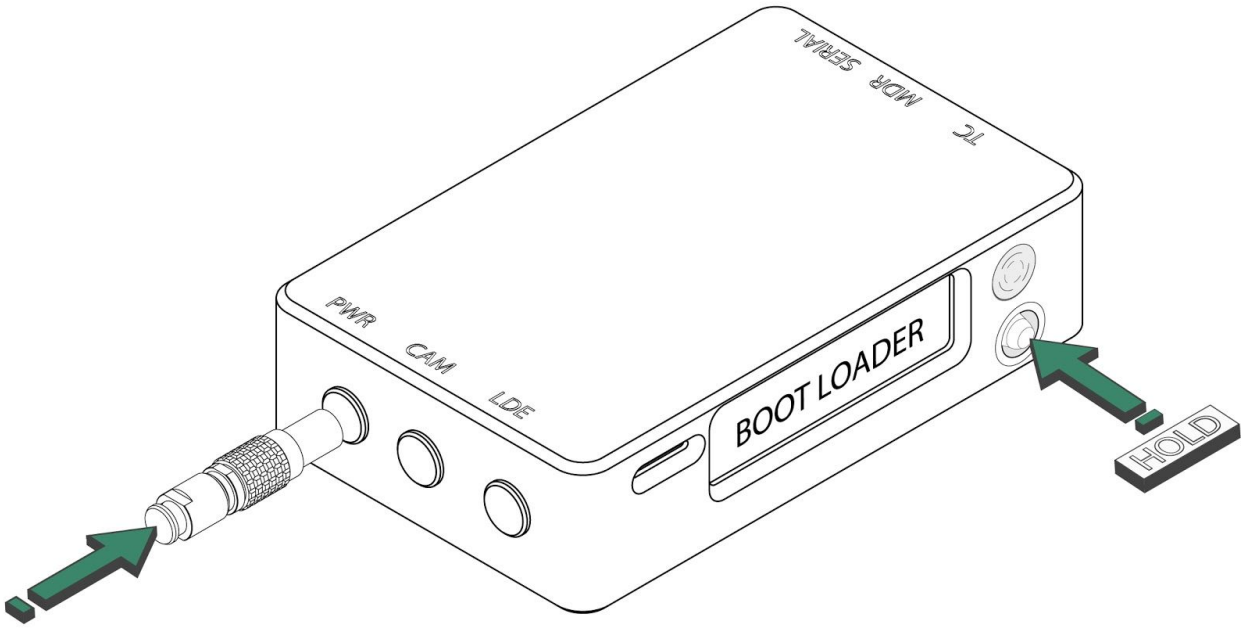
We ship our units with the latest firmware, but we are constantly working on new features and fixes, so it is highly recommended that you check the firmware is up to date before starting.

In order to update the LDT-R1 firmware:

On a computer:

- Download the latest firmware from [www.dcs.film/downloads](www.dcs.film/downloads),
- Remove the MicroSD Card from the LDT-R1 and insert it into the computer,
    - If you are using a brand new MicroSD card format it FAT32,
- Create a folder called ‘FIRMWARE’ on the MicroSD card,
- Copy the firmware into the ‘FIRMWARE’ folder,
- Eject the MicroSD card.

On the LDT-R1:




- Switch off the unit,
- Insert the MicroSD card back into the LDT-R1,

- Push and hold the joystick when powering up the LDT-R1,
- This will take you into the firmware update mode,
- Select the firmware file from the list,
- Press the joystick in to run the update,
- When firmware is updated, reboot the unit by unplugging and replugging the power cable.

For further support, contact our team at info@dcs.film.

# Setting up the Preston MDR

The Preston MDR 3 must be running firmware 1.17 or later. Please update your MDR 3 first. In case of using MDR 2 or MDR 4 please contact DCS support for more information and supported firmware versions.

Setup the Focus / Iris / Zoom direction for natural use on the Preston. If you are using a separate iris handset then connect this now and ensure the direction of the preston motors are correct. Do the same for Zoom demand.

# Injection Recording

Refer to this section if you are recording data externally from the LDT-R1. This mode is only available for digital cameras

In this chapter you can find details on how to set up a camera in order to record metadata into the raw file headers, depending on the system you are running.

## Red Camera Family

### Setting up the Camera

- First of all, make sure the camera is running firmware 7.0.2 or later,
- Connect the RED Touch to access all of the camera settings,

### Enabling ET Protocol

In order to enable the LDT-R1 to talk to the camera and to write and display lens metadata, the ET Protocol must be selected:

- From the LCD choose: Menu > Setting > Setup > Communication > Serial,
- From the Ctrl Protocol select: Element Technica

### Disabling the Lens Mount

To avoid lenses interfering with the LDT, the smart lens mount needs to be disabled:

- From the LCD choose: Menu > Setting > Setup > Lens,
- Disable lens mount.

Don’t worry if the menu is grayed out. This means a smart lens mount is not fitted to the camera.

### Overlay Lens Data on a Monitor

In order to display lens data as an overlay on an SDI monitor, do the following:

- Copy the provided ‘overlay’ folder into a fresh REDMAG,
- Load the camera mag into the camera,
- Choose Menu > Settings > Display > Monitor Control > Overlays,
- Move the On Media DCS overlay to In Camera,
- Choose Menu > Settings > Display > Monitor Control > Monitor Setup,
- Select HD-SDI from the top left dropdown menu,
- On Overlay choose DCS.

## Rigging the LDT-R1

- Connect the MDR to the LDT-R1 MDR port with the MDR (blue) cable,
- Connect the camera CTRL port to the LDT-R1 CAM port with the RED (gray) cable.

## Setting up the LDT-R1

Push the joystick in to enter the menu, use the back button to go back.

- Power the LDT-R1 with the PWRA or PWRC cable to a 2-pin or Dtap power source,
- Choose Menu > Settings > Data source > Local;
- Choose Menu > Settings> Recording Mode > RED, Element Tech.

# Panavision DXL

## Setting up the Camera

- First of all, make sure the camera is running firmware 1.012 or later (contact Panavision for further information),
- Use the side panel to access all camera settings.

### Enabling ET Protocol

In order to enable the LDT-R1 to talk to the camera and to write and display lens metadata, the ET Protocol must be selected:

- From the side panel choose: Menu > Network > Serial,
- From Ctrl Protocol select ‘Element Technica’.

### Disabling the Lens Mount

To avoid lenses interfering with the LDT, the lens mount needs to be disabled:

- From the LCD choose Menu > Setting > Setup > Lens,
- Disable lens mount.

Don’t worry if the menu is grayed out. It means a smart lens mount is not fitted to the camera.

### Overlay Lens Data on a Monitor

In order to display lens data as an overlay on an SDI monitor, do the following:

- Copy the provided ‘overlay’ folder into a fresh REDMAG,
- Load the camera mag into the camera,
- Choose Menu > Monitoring > Overlay Import/Export > On Media,
- Select DCS overlay and Import,
- Go back to Overlay Import/Export, choose In Camera,
- Select DCS overlay,
- Choose Menu > Monitoring > Monitor Preferences,
- Select where you would like to output the overlay metadata. E.g. SDI 1,
- On Overlay choose DCS.

## Rigging the LDT-R1

- Connect the MDR to the LDT-R1 MDR port with the MDR (blue) cable
- Connect the camera AUX port to the LDT-R1 CAM port with the DXL (gray) cable.

### Setting up the LDT-R1

Push the joystick in to enter the menu, use the back button to go back:

- Power the LDT-R1 with the PWRA or PWRC cable to a 2-pin or Dtap power source,
- Choose Menu > Settings > Data source > Local,
- Choose Menu > Settings> Recording Mode > DXL, Element Tech.

## Sony Venice

### Setting up the Camera

Sony Venice does not require any setting up to accept the Cooke /i information coming from the 4-pin LEMO installed on the lens mount.

#### Overlay Lens Data on a monitor

In order to display lens data as overlay on a SDI monitor, do the following:

- Choose Menu > Monitoring,
- Select the desired SDI output,
- Press down the control knob and select Setup,
- Navigate to Lens Status and check Info,
- Choose the desired unit of measurement, the default is feet.

### Rigging the LDT-R1

- Connect the MDR to the LDT-R1 MDR port with the MDR (blue) cable,
- Use the Cooke/i (yellow) cable to connect the Sony Venice’s lens mount to the LDT-R1 CAM port,
- Power the LDT-R1 using the PWRA or PWRC cable to a 2-pin or Dtap power source.

### Setting up the LTD-R1

Push the joystick in to enter the menu, use the back button to go back

- Choose Menu > Settings > Data source > Local
- Choose Menu > Settings> Recording Mode > Cooke /i

# Internal Recording

Refer to this section if you are recording data in the LDT-R1. This mode is available for all types of cameras. LDT-R1 requires shutter pulse or record tally from the

camera in order to start recording data. External timecode must be provided to the LDT-R1. Encoding data is recorded on the MicroSD card.

Please make sure to backup the MicroSD data on a computer after each shooting day in order to avoid data loss.

## Recording Format

Frame by frame (FbF) data is recorded onto the MicroSD card's CLIPS folder, as a CSV file type. Everytime the camera runs, a new CSV file is created.

The CSV file is matched to the timecode. A new line gets created at every timecode interval.

Read '*Appendix 2: Internal Recording - CSV File Structure*' to learn more about it.

## Setting up the LTD-R1

Select the desired projects FPS.

- Choose Menu > Settings> Project FPS;
  (23.98FPS, 24FPS, 25FPS, 29.97FPS, 30FPS)

Project FPS must match Timecode FPS.

If running multiple LDT-R1s at once, setting the corresponding camera index is advised.

- Choose Menu > Settings> Camera index > A, B, C, ...

Camera roll can also be set. Updating the camera roll to the corresponding roll loaded on the camera will help to keep track of the data. On a shoot with frequent reloads we sometimes recommend you set this per day instead so A001 would be left for the entire shoot day on A1.

- Choose Menu > Settings> Roll > 001, 002, 003, ...

# Arri Film cameras

## Rigging the Camera and LDT-R1

Arri film cameras are equipped with a 3-pin RS power out which provides power and shutter pulse for the LDT-R1.

- Connect the MDR to the LDT-R1 MDR port with the MDR (blue) cable,
- Connect the RS port on the camera to the LDT-R1 PWR with the RUNA (grey) cable.

## Setting up the LTD-R1

Push the joystick in to enter the menu, use the back button to go back.

- Choose Menu > Settings > Data source > Local,
- Choose Menu > Settings> Recording Mode > Film, SD card.

# Panavision Film Camera

## Rigging the Camera and LDT-R1

Panavision XL2 cameras are equipped with a 10-pin Lemo connector which provides power and shutter pulse for the LDT-R1.

- Connect the MDR to the LDT-R1 MDR port with the MDR (blue) cable,
- Use the RUNPVY (gray) cable to connect the 10-Pin Lemo on the camera to the LDT-R1 PWR and to the Preston MDR-3 Camera port. This cable allows the shutter pulse to travel from the MDR-3 to the camera and to the LDT-R1.

Alternatively, Panavision provides a splitter box to duplicate the 10-pin lemo on the camera. If available, use the RUNPV (gray) cable to connect the 10-Pin Lemo on the camera to the LDT-R1 PWR. Plug the MDR 3 as per usual.

## Setting up the LTD-R1

Push the joystick in to enter the menu, use the back button to go back.

- Choose Menu > Settings > Data source > Local,
- Choose Menu > Settings > Recording Mode > Film, SD card.

# RED Family

DCS always advise to use injection recording on RED cameras. However, if the production requires frame by frame data to be recorded internally on the SD card of the LDT-R1 follow the procedure below:

## Setting up the Camera

RED cameras can send out Rec Tally from the CTRL port. In order to allow the LDT-R1 to receive a recording signal from the camera and to write metadata, the RED Command Protocol must be enabled.

- Connect the RED Touch to access all of the camera settings,
- From the LCD choose: Menu > Setting > Setup > Communication > Serial,
- From the Ctrl Protocol select: RED Command Protocol.

## Rigging up the LDT-R1

- Connect the MDR to the LDT-R1 MDR port with the MDR (blue) cable,
- Connect the camera CTRL port to the LDT-R1 port with the RED (gray) cable.

## Setting up the LTD-R1

Push the joystick in to enter the menu, use the back button to go back.

- Power the LDT-R1 with the PWRA or PWRC cable to a 2-pin or Dtap power source,
- Choose Menu > Settings > Data source > Local,
- Choose Menu > Settings > Recording Mode > RED, SD card.

# Panavision DXL

DCS always advise to use injection recording on the Panavision DXL camera. However, if the production requires frame by frame data to be recorded internally on the SD card of the LDT-R1 follow the procedure below:

## Rigging the Camera and LDT-R1

The Panavision DXL is equipped with a 3-pin RS AUX power out which provides power and shutter pulse for the LDT-R1.

- Plug the RUNA cable (gray) from the POWER port on the LDT-R1 to any of the 24v RS ports on the Panavision DXL,
- Connect the MDR to the LDT-R1 MDR port with the MDR (blue) cable,

- Connect the RS port on the camera to the LDT-R1 PWR with the RUNA (grey) cable.

### Setting up the LTD-R1

Push the joystick in to enter the menu, use the back button to go back.

- Choose Menu > Settings > Data source > Local,
- Choose Menu > Settings > Recording Mode > Film, SD card.

## Sony Venice

DCS always advise to use injection recording on the Sony Venice camera. However, if the production requires frame by frame data to be recorded internally on the SD card of the LDT-R1 follow the procedure below:

### Rigging the Camera and LDT-R1

Sony Venice is equipped with a 4-Pin Hirose connector which provides power and record tally for the LDT-R1.

- Connect the MDR to the LDT-R1 MDR port with the MDR (blue) cable,
- Connect the Hirose on the camera to the LDT-R1 PWR with the RUNV (grey) cable.

### Setting up the LTD-R1

Push the joystick in to enter the menu, use the back button to go back.

- Choose Menu > Settings > Data source > Local,
- Choose Menu > Settings > Recording Mode > Venice, SD card.

# Programming a New Lens Table

Creating a lens table is essential to the encoding process. It requires inputting the relevant lens information (lens name, brand, serial number etc.) and then inputting all of the marks from the axis' (focus/iris/zoom) for each lens. The following guide explains this process.

## Lens Table General Settings

Before creating the first lens table, please review and adjust the following settings accordingly:

### Data Source

Data source should always be set to Local Table.  If for some reason it has been set to Pull from Remote please change it back to Local Table. Pull from remote is an advanced feature and should only be used when advised by someone from DCS.
Menu > Settings > Advanced > Data Source > Local table / Pull From Remote

### Auto Lens Select

If enabled, Auto Lens Select will automatically change the lens on the LDT-R1 when the F-Map is changed on the Preston Hand Unit 3 (HU3).

Lens details can be manually added (F-Map OFF), however the LDT-R1 can pull the lens details from the Preston HU3 library to streamline this process and keep the naming convention for the lens tables consistent with what is in use on the HU3 (F-Map ON). Go to the 'Using Auto Lens Select and F-Map' chapter for further information regarding using this system during the show.

## Using Auto Lens Select and F-Map

Depending on the focus puller's needs, the LDT-R1 has two modes on which a lens can be loaded during the day and encoded in the unit. This will dictate how a lens is encoded and the interaction with the LDT-R1 during the day.

Auto Lens Select automatically changes the lens on the LDT-R1 when the lens is changed on the Preston HU3. In order to use Auto Lens Select, the Focus Puller must use F-Mapping on the Preston HU3 and MDR-3.

There is no need for F-mapping to stay on during a shot, and can be turned off right after the lens is loaded; the selected lens will stay loaded on the LDT-R1 till a new lens is selected on the Preston HU3. In fact, the only details required from the F-Map by the R1 are the brand, name, focal length, serial number and type of the lens. As the lens tables are created on the R1 the F-Map lens tables only need to be partially completed.

When creating a new lens table, by selecting the desired lens on the Preston HU3, this will auto-populate the lens brand, lens name, lens type, focal length and serial number to the LDT-R1.

If F-Map is disabled, when creating a new lens table on the LDT-R1, the lens brand, lens name, lens type, focal length and serial number needs to be manually entered. When a lens is changed on the camera, the new lens needs to be manually selected on the LDT-R1.

Preston HU3 lens tables can be exchanged between other Preston HU3s by using the Preston dongle and mobile app. Please visit the Preston website for more information.

## Adding a New Lens with using F-Map

Mount a new lens to the camera. On the Preston MDR press the calibrate button. This will calibrate the LDT-R1 as well. Once calibration finishes, on the Preston HU3 create a new F-Map of the lens attached to the camera. If the lens has already been F-Mapped, select it on the Preston HU3. In the LDT-R1 menu:

- Choose: Menu > Add Lens.

The LDT-R1 will display a message with the name of the lens. If the lens name matches the lens mounted on the camera and the one loaded on the Preston HU3, press ‘ACCEPT’ to proceed.


Lens details will auto-populate. Proceed to ‘Creating a New Lens Table’ chapter.

## Adding a New Lens without using F-Map

Mount a new lens to the camera. On the Preston MDR press the calibrate button. This will calibrate the LDT-R1 as well. Once calibration finishes, from LDT-R1 menu:

- Choose: Menu > Add Lens.

Select an existing brand from the list, or input a new one if it isn’t listed.

To add a new brand, use the joystick up/down to scroll through the available characters. One click for a single increment, hold for rapid scroll. Click right to type the next character.


Once complete, press the back button to go back to the brand list and select one to proceed.

Select Prime or Zoom accordingly to the mounted lens on the camera.


Select an existing lens or add a new lens name if it isn't listed.


To add a new lens name, use the joystick up/down to scroll through the available characters. One click for a single increment, hold for rapid scroll. Click right to type the next character.


Once complete, press the back button to go back to the brand list and select one to proceed.

Add a new focal length or focal range depending on the mounted lens on the camera.


Type the new focal length or focale range. Use the joystick up/down to scroll through the numbers. One click for a single increment, hold for rapid scroll.

If it is a zoom lens, click right to finish typing the focal range.


Once  the focal length or focale range is entered, press the back button to go back to the focal range list and select one to proceed.


Enter a new lens serial number. use the joystick up/down to scroll through the available characters. One click for a single increment, hold for rapid scroll. Click right to type the next character.


Once the serial number is entered, press the back button to proceed.

## Creating a New Lens Table

Mapping a new lens table is crucial to ensuring that the data encoded throughout the production is precise.

When mapping a lens, a methodical process needs to be adopted on both the remote lens control side and on the LDT-R1 side. As standard practice, DCS suggests to enter a mark point on the LDT-R1 for each engraved mark and let the LDT-R1 interpolate the rest of the data.

Ensure that the lens calibration happens without any motor slip. When moving the lens axis with a remote handset, mark alignment should always be achieved from the same direction to avoid slack on the lens.

In order to retain the full precision of the focus knob, we recommend turning off F-Mapping during the creation of new lens tables.

## Initial Check

Establish which direction will be used on the Preston HU3 and on the Single Channel Handset (SCH) for the run of show (close focus, infinity, wide open iris, close iris, wide zoom, tight zoom). DCS suggests keeping it consistent throughout the whole set of lenses.
Do not move Preston Motors or change direction while encoding the lenses unless required by rigging purpose.

As a general practice, when mapping a lens on the LDT-R1, always keep close focus on the left, wide open iris on the left and wide zoom on the left. An example below.


Make sure to never change the F-Map on the Preston HU3 while mapping a lens on the LDT-R1.

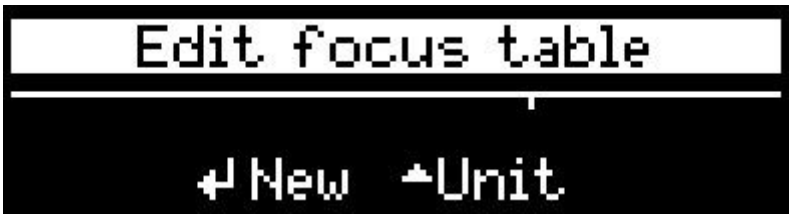
**Note:** Please check the motor direction on the LDT-R1 is on Normal before proceeding.
Choose: Menu > Motor direction. More information regarding motor direction at chapter ‘Chaining the Motor Direction’.

## Mapping a Lens Table

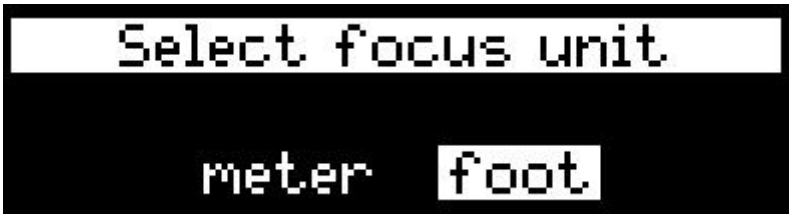
Once all the lens information is entered, select either ‘Focus’, ‘Iris’ or ‘‘Zoom’ (if a Zoom lens is being used) axis to start mapping the lens.


### Mapping The Focus Axis

Use the Preston focus knob to move through the span of the axis, the dot on the LDT-R1 display will move along the horizontal line. Ensure the dot reaches each end of the line.  If not, check if there were any slips during calibration or disable F-Map on Preston HU3.



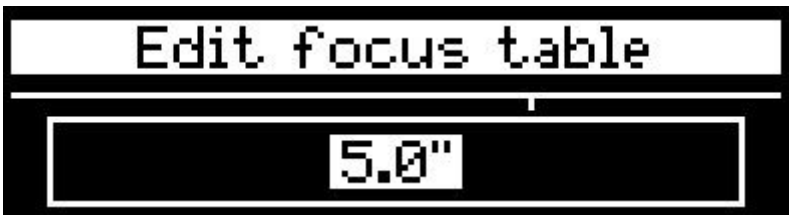

Set the units of measurement for focus by pushing the joystick UP. Choose metres or feet.




Set the lens to the closest focus mark.

On the LDT-R1 press the joystick to enter the first mark, a pop up window will ask you to select the focus value.
Use the joystick to select the required value:

- LEFT/RIGHT moves between pre-populated numbers: (0’ 1”, 3’ 0”, 10’ 0”, 30’ 0”, 100’ 0”, INF);
- UP/DOWN for fine adjustments.



Push the joystick to confirm selection.


Proceed for each desired engraved focus mark.

Once completed, push the back button to go back to the Edit Lens Table menu.


### Mapping the Iris Axis

Use the Preston HU3 slider or Preston SCH to move through the span of the iris axis, the dot on the LDT-R1 display will move along the horizontal line. Ensure the dot reaches each end of the line. If not, check if there were any slips during calibration.

**Note:** If a Single channel iris handset is being used we strongly recommend you use it to make the maps.

Set the lens to wide open.

On the LDT-R1 press the joystick to enter the first mark.

A pop-up window will ask you to select the T-Stop value, use the joystick to select the required value:

- LEFT/RIGHT moves between stops: (T0.7, T1, T1.4, T2, T2.8, T4, T5.6, T8, T11, T16, T22, 32, T45, T64, T90);
- UP/DOWN for fine adjustments,

Push the joystick to confirm selection.

Proceed for each desired engraved iris mark.

Once completed, push the back button to go back to the Edit Lens Table menu.

### Mapping the Zoom Axis

Use the Preston Microforce to move through the span of the axis, the dot on the LDT-R1 display will move along the horizontal line. Ensure the dot reaches each end of the line. If not, check if there were any slips during calibration.

A map can be created without the Microforce but it's very important that the Zoom Direction has been checked before you make the map, so we would recommend using the Microforce.

Set the lens to wide zoom.

On the LDT-R1 press the joystick to enter the first mark.

A pop-up window will ask you to select the zoom value, use the joystick to select the required one:

- LEFT/RIGHT to increase/decrease by 10mm,
- UP/DOWN for fine adjustments.

Push the joystick to confirm selection.

Proceed for each desired engraved zoom mark.

Once completed, push the back button to go back to the Edit Lens Table menu.

## Testing the Lens Table

Prior to saving the lens map we suggest testing its accuracy.  This can be done by pushing down the joystick when in one of the axes to enter the test window. Compare what is displayed here with the engraved marks on the lens to ensure the table is accurate.


Press the back button to go back.

## Saving a Lens Table

Once all the required values have been encoded, click on ‘SAVE’ to save the lens table.

A message will prompt upon successful completion.


# Edit a Lens Table

A lens table can be edited. New points can be added, existing points can be removed or a lens table can be permanently flipped.

Choose: Menu > Edit Lens.

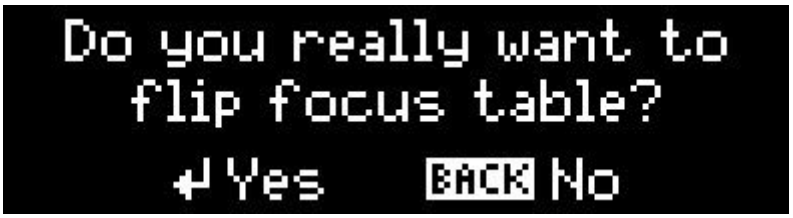
## Deleting a Point

If a point gets added by mistake or needs repositioning it can be removed.
In order to delete an existing point push the joystick to the left. Move the controller to the desired point. Push the joystick to remove the point.


Press the back button to go back.

## Flipping a Lens Table

If an axis map needs to be permanently reversed push the joystick to the right, then push the joystick to confirm.




If a map needs to be temporarily reversed we suggest to reverse the direction of the motor in the Main Menu > Motor direction.

# Using a Lens Data Encoder

Usually camera operators like to have a manual control of zoom instead of controlling it by using a motor. A lens enoder can be used instead in order to avoid the friction of a motor, allowing the axis to spin free and be able to achieve valuable encoding data.
DCS provides a lens data encoder called LDT-E1 alternatively a Arri LDE-1 can be used. Both of these solutions are plug and play, there is no need of creating a new or separate lens table to work for the LDE.

Note: the motor might need to reverse direction: please go to ‘Changing the Motors direction’ chapter.

## Setting the axis for the Encoder

You must select the axis the LDT-E1/LDE-1 is set to. Can be bound to a specific axis.
Choose: Menu > Settings > LDE Axis to change;
Choose on which axis the LDE needs to be bound to between focus, iris or zoom.

Note: On the LDE-E1, the physical button where to choose the bounding axis is disbale on the LDT-R1. Please use the menu as described above.

# Changing the Motors direction

If for rigging purpose a lens motor or lens encoder need to be reversed choose: Menu > Motor direction > Reverse.

# Transferring Lens Maps between LDT-R1 Units

If multiple LDT-R1s need to use the same lens tables, the LENSDATA file can be copied onto the root of each MicroSD card and the LDT-R1 will automatically read them.

**Note:** Backup the LENSDATA file on the MicroSD card to avoid data loss in case of corruption.

# Lens Database

If the user decides to not use F-Map the lens database can be organised as a list or as folders.

- List: LDT-R1 display.
- Folder: LDT-R1 creates a folder structure based on lens brand, type and a single file for each lens in the root of the MicroSD card.
  DCS suggests using Folder mode.

# Shooting a Test

When shooting test footage, allow approximately one hour per camera type being used on the production. A test will involve recording the metadata (internally or injected) with a camera and recording a separate feed from the camera with an overlay to verify the data is correct at the final stage of the test. We recommend using a zoom lens (if any are being used during the shoot) in order to check all three axes.

To do a test:

- Encode a lens and test it (see “Programming a New Lens Table”),
- Shoot test footage in camera and record separate overlay feed at the same time,
- Extract the CSV if using injection recording (see relevant camera in Appendix 5),
- Merge the CSV files to the EXR,

Compare the metadata of the EXR file to the overlay footage.

# Appendix 1: Menu Structure

- Select Lens
- Calibrate
- Settings

- LDE bound to (this is used for selecting the axis for a free wheel encoder e.g. for hand zooms)
  - None
  - Zoom
  - Focus
  - Iris
- Camera index (only in SD mode)
  - A-Z
- Roll (only in SD mode)
  - 001-999
- Project FPS (only in SD mode)
  - 23.98
  - 24
  - 25
  - 29.97
  - 30
- Auto lens select (this tells the LDT what lens is loaded from the preston)
  - Off (use this if the focus puller is not using F-Mapping)
  - On (use this if the focus puller is using F-Mapping)
- Circle of conf. (only used for calculating the Depth of Field)
  - 0.013
  - 0.015
  - 0.02
  - 0.025
  - 0.03
  - 0.035
  - 0.04
  - 0.045
  - 0.05
- Rec mode
  - Film, SD card
  - DXL, Element tech.
  - RED, Element tech.
  - RED, SD card
  - Cooke /i
  - Venice, SD card
- Advanced
  - Data Source
    - Local table (for normal operation)

                - Pull from Remote (special operation only. Only choose this option if instructed to do so by a member of the DCS team)
            - Lens Database
                - List
                - Folder
            - Flip GUI
                - No
                - Yes
- Motor direction
    - Focus
        - Normal
        - Reverse
    - Iris
        - Normal
        - Reverse
    - Zoom
        - Normal
        - Reverse
- Add Lens
- Edit Lens
- Info

-

# Appendix 2: Error Codes

| | |
|---|---|
| (-1) | Internal software error |
| (-2) | No card inserted |
| (-4) | SD status error |
| (-5) | SD data error |
| (-6) | Card changed |
| (-7) | No MBR found |
| (-8) | No FAT fs found |
| (-9) | Wrong FAT chain or wrong B/S entry in PBS |
| (-10) | Unknown partition type |
| (-11) | Partition addressing error |
| (-12) | No free file descriptor |
| (-14) | Bad file name |

| | |
|---|---|
| (-15) | Not a directory |
| (-16) | Not a file |
| (-17) | Not found |
| (-18) | SD card command CRC error |
| (-19) | SD card command timeout error |
| (-20) | SD interface IRQ error |
| (-22) | Write protected |
| (-23) | Card write time out |
| (-24) | Card full |
| (-25) | Wrong file descriptor index |
| (-26) | Invalid parameter |
| (-28) | No such file |
| (-29) | File exists |
| (-30) | FAT12/FAT16 root directory full |
| (-31) | DMA failure |
| (-32) | LENSDATA file format error |
| (-33) | Out of memory |
| (-34) | F, I or Z table duplicated |
| (-35) | F, I or Z table missing |

# Appendix 3: Changelog

1.xx
HW=1 (PCB V1.0), no LDE

2.00 - 2019.01.30
HW=2 (PCB V1.1), with LDE, RED/FILM, overlay, SD recording

2.01 - Test version only

2.02 - 2019.04.17
Menu->Settings->Rec mode
FILM SD - shutter starts recording to SD
RED SD  - RED RCP starts recording to SD
RED ET  - RED Element Technika data transfer with 25fps
In FILM SD mode on the main screen (focus and DoF) the back button starts recording (hold for 3sec)
Project FPS selectable
INT TC GEN
Modified clip file
MDR-3 Lens name grab bug fixes

0.5mm step zoom selection up to 50mm

2.03 - 2019.04.18
~50 fps Preston query
Clip file format changes

2.04 - 2019.05.08
New MDR-3 calibration problem workaround
Zoom position selection in correct range

2.05 - 2019.05.15
Cooke /i support (tested on Venice only)

2.06 - 2019.05.27
Cooke /i modifications for LDT-C1
Selectable LDE axis
Works with incomplete lens tables

2.07 - 2019.07.04
Add lens offers selected lens on HU3
Settings -> Auto lens select changes lens table when lens changed on HU3

2.08 - 2019.07.31
Cinetape bugfix

2.09 - 2019.09.11
Venice Tally input support (HW interface needed)
Light Ranger support
RED ET focus bugfix

2.10 - 2019.11.12
Venice SD mode Settings menu fixed
?Preston port "ss" command goes diagnostics mode?

2.11 - 2020.01.23
Default focus unit: imperial
Focus under 2' in inches
Iris input (U/D) in 0.1 increments between 0.7-8.0 and 1 above 8 (L/R full stop)

2.12 - 2020.01.30
PCB V1.3 support: Direct Venice Tally input, F/I/Z LDE detection

Motor status shows LDE icon
DXL2 Element Technika Iris Bug workaround (10x value)

2.13 - 2020.02.12
Flip direction in table edit
Enhanced SAVE in table edit
Delete lens
Selectable Folders/List lens select method for Select, Edit and Delete lens
Modified Preston lens sn processing (space dropping)
DXL2 Element Technika Iris Bug workaround (10x value)

2.14 - 2020.03.09
"Rec mode" changed to "MODE"
Added "DXL ET" mode
Added "Flip GUI"

2.15 - 2020.03.13
* not tested on PCB 1.2 *
Added "Advanced settings" menu
-Data source
-Lens database
-Flip GUI

# Appendix 4: Internal Recording - CSV File Structure

Frame by frame (FbF) data is recorded onto the MicroSD card's CLIPS folder as a CSV file type. Everytime the camera runs, a new CSV file is created.

The CSV file is matched to the timecode. A new line gets created at every timecode interval. A frame count number runs alongside the timecode, starting at 1 for every new file.

## CSV File Naming Convention

CSV file names are made up of 8 characters. Eg. A001C001:

- The first character is the camera index;
- The next three characters are the camera roll;
- The next four characters are the clip number.

In order to set the camera index choose:
Menu > Settings> Camera index

And input the desired camera index

In order to set the camera roll choose:
Menu > Settings> Roll

And input the desired roll number.

Clip number is a three digit incremental number.

## CSV File Composition

The CSV file uses tab delimited format and is composed of:

- A header section, which lists:
    - The encoder type and serial number;
    - Clip name;
    - Project FPS;
    - Lens name;
    - Lens serial;
- A column section, which list:
    - Frame count: an incremental number, one increment per frame;
    - Timecode: it prints the timecode provided at that moment in time;
    - Focus: in brackets (in) or (m) depending on the unit chosen during the lens table creation. Data is expressed with one digit decimal point. Infinity is expressed with this value: 42273300.2.
    - Iris: expressed in T-Stops with one digit decimal point;
    - Focal length: Data is expressed in meters with one digit decimal point.
    - Iris: expressed in T-Stops with one digit decimal point;
    - RAW focus
    - RAW iris
    - RAW zoom
- A data section: in this sec

```
Heading
FIELD_DELIM    TABS
CREATOR LDT-R1 SW:2.12 S/N:14
CLIP    T008C001
PROJ FPS       24
LENS    Panavision Primo Zoom 17-75mm
LENS SERIAL    113
RAW RANGE      0-65535

Column
```

```
Frame count    Timecode      Focus (in)    Iris    Focal length (mm)    RAW focus     RAW iris      RAW zoom

Data
     1 11:49:39:20    67.6    11.0    31.2    31099   45899   37546
```

# Appendix 5: Injection Recoding - Extracting data from RAW footage

FbF data are extracted differently depending on the digital camera used.

## Red Camera Family & Panavision DXL

The name of the CSV file is the name of the clip.

The CSV file is a comma delimited type of file. Follow a list of only column header that concern LDT-R1 or where the LDT-R1's data get phrased:

- FrameNo: incremental number, one increment per frame;
- Timecode: it prints the timecode of the camera at that moment in time;
- Aperture: expressed in T-Stops with six digit decimal point;
- Focus Distance: how INF is expressed
- Focal Length:

```
FrameNo,Timecode,Aperture,Focus Distance,Focal Length,Acceleration X,Acceleration Y,Acceleration Z,Rotation X,Rotation Y,Rotation Z,Cooke Metadata
0,16:29:50:14,3.800000,6166,18,-0.319000,-0.015000,0.953000,0.000000,1.799000,-2.099000,
```

## How to extract FbF data on RED camera

REDLINE is required in order to extract frame by frame data from R3D footage.
REDCINE-X Pro also contain REDLINE and it can be downloaded from RED website:
https://www.red.com/downloads

On Terminal use the following command:
REDline --i /Path/To/Clip_001.R3D --useMeta --printMeta 5 > /Path/to/Export.csv

Where '/Path/To/Clip_001.R3D' is the source and '/Path/to/Export.csv' is the destination path.

# Sony Venice

The name of the CSV file is the name of the clip.

The CSV file is a tab delimited type of file. Follow a list of only column header that concern LDT-R1 or where the LDT-R1's data get phrased:

- Index: incremental number, one increment per frame;
- Timecode: it prints the timecode of the camera at that moment in time;
- Focus Distance(mm): data are expressed in millimeter, infinity is expressed with 'inf';
- Aperture Value: expressed in T-Stops with two digits decimal point;
-

```
Index  Timecode       Calibration    Focus Distance(mm)    Aperture Value Aperture Ring T Stop Integer Aperture Ring T
Stop Fraction(+ n/10) Current Focal Length(mm)     Hyperfocal Distance(mm)      Near Focus Distance(mm)      Far
Focus Distance(mm)    Horizontal Field of View(deg)Entrance Pupil Position(mm)  Normalised Zoom Value Lens Serial
Number Cooke Protocol User Metadata Lens Attributes
1      06:56:38:09    0      498.0  2.06   2.0    1      0      51103.0494.0  502.0  27.1   56.0   0.000  50-1089M
```

## How to extract FbF data on Sony Venice

Sony Raw Viewer is required in order to extract frame by frame data from Sony Venice footage. It can be downloaded from Sony website: https://www.sonycreativesoftware.com/rawviewer

On Raw Viewer go to the Export Tab, from format choose: CSV (Cooke Lens Meta)