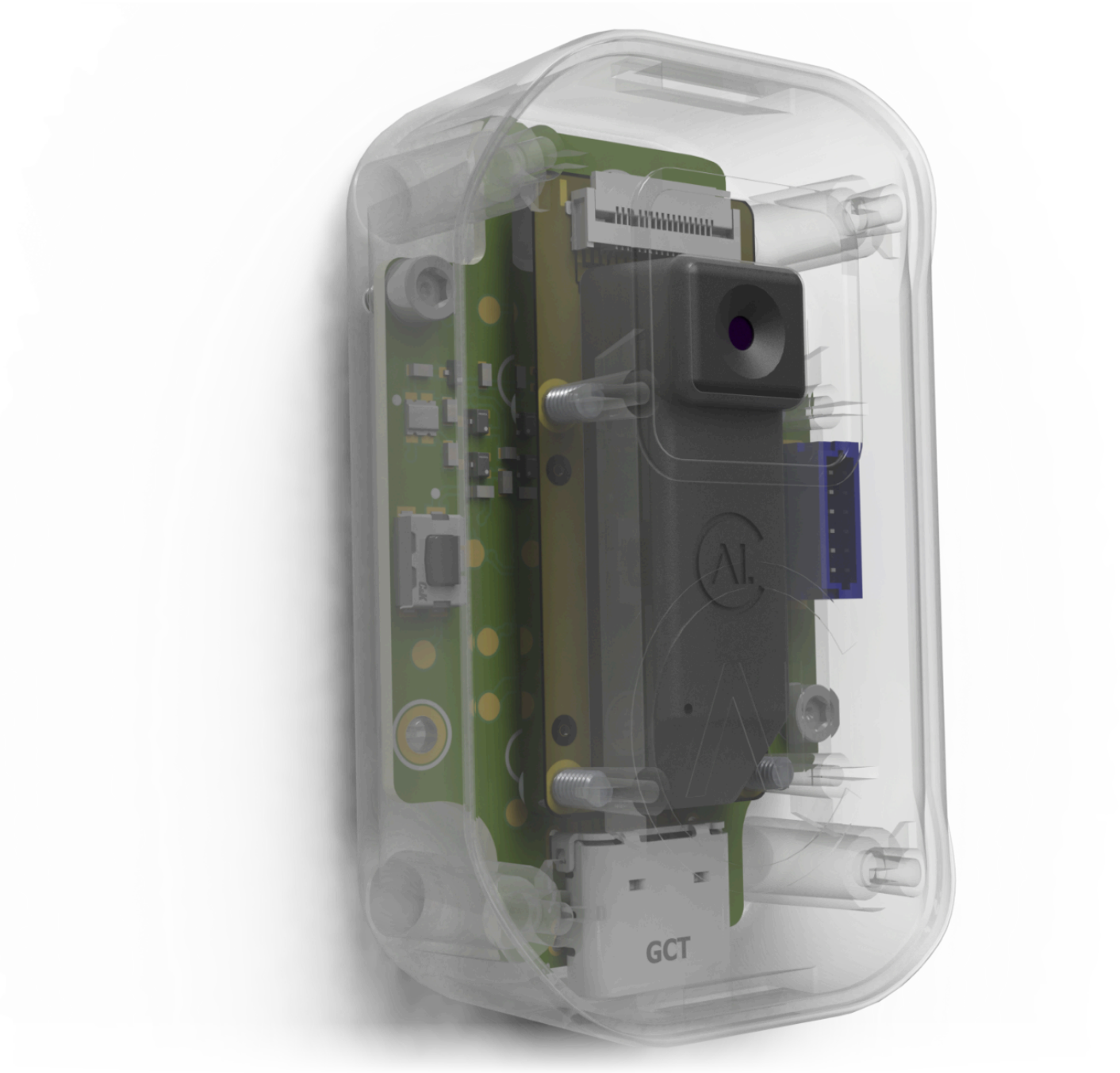
Calumino CaliVision

User Manual



Please contact support@calumino.com for more information

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1 Introduction

Calumino's CaliVision application enables users to visualize real-time thermal imagery from CTS sensors via the EVK, evaluate people-counting accuracy with CV overlay, record sensor data, and update device firmware.

CaliVision is a cross-platform desktop application supporting Windows and Linux.

CaliVision enables users to:

- Visualize real-time thermal imagery from CTS sensors via the EVK.
- Evaluate people-counting accuracy with CV overlay.
- Update the firmware binary on the EVK.
- Record sensor data (thermal, CV, and metadata) for offline analysis.
- Switch between thermal stream modes.

Future updates to the application will enable the following:

- Configure and test application-specific features: door counting, occupancy zones, exclusion zones, and regions of interest (ROI) for industrial monitoring.
- Export time-series data for integration with external tools.

1.1 Handling Instructions

The thermal sensor incorporates precision-engineered cantilevered mirrors. While the sensor is designed to withstand standard handling, care should be taken to avoid excessive shock or impact, which may affect its operational integrity. To ensure the device maintains its calibration accuracy and continues performing optimally, ensure it is handled with care.

2 Quick Setup Guide

The steps below can be followed to get the EVK up and running.

1. Navigate to the SharePoint link provided by the Calumino team and download the latest version of the CaliVision application for your platform (Windows or Linux).
2. Unzip/extract the downloaded folder.
3. Run any required software pre-requisite steps (see Section 5.1).
4. Double-click on the CaliVision executable.
5. Connect your EVK to the computer via USB.
6. Locate and press the **Connect** button on the left of the window.

3 Basic Operation

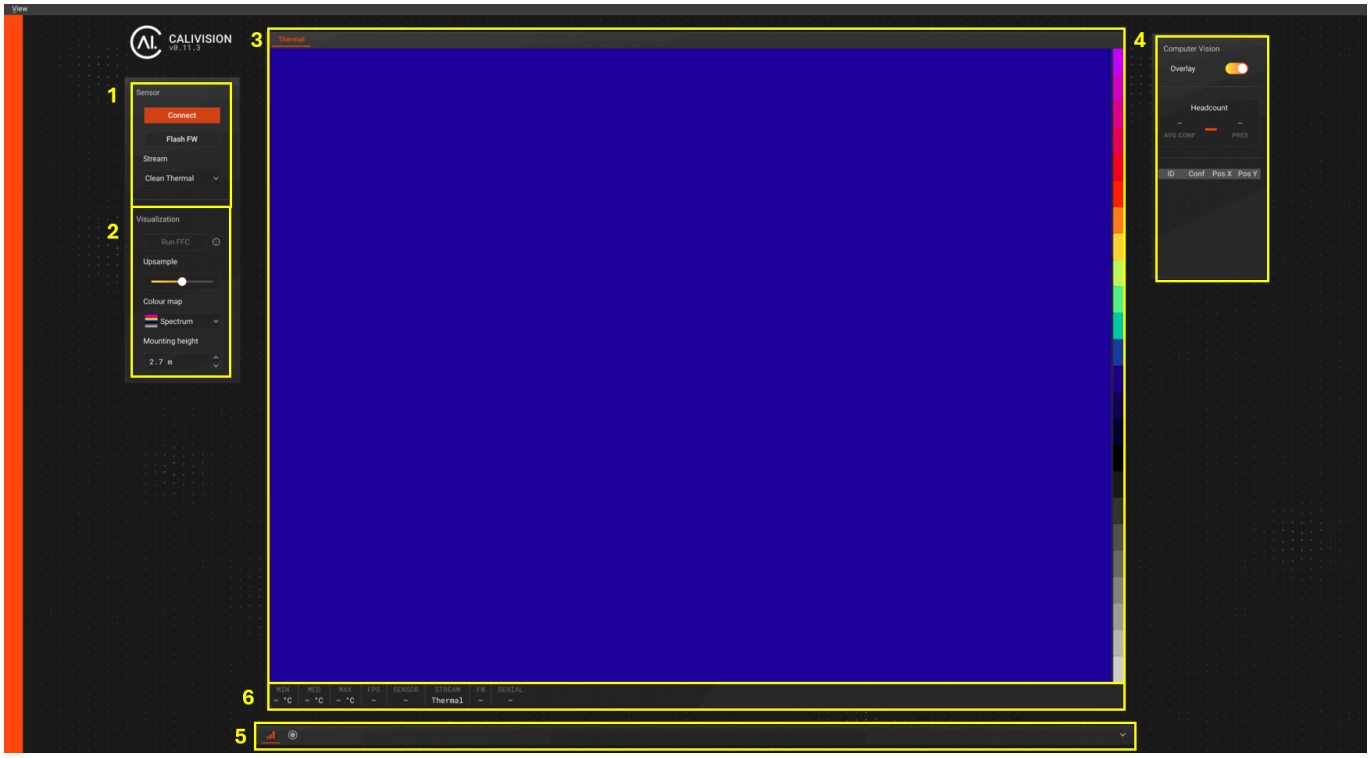

Figure 1 – CaliVision (No sensor connected)

The CaliVision application is broken up into the following main sections:

1. **Sensor operations**, including connecting, disconnecting, updating firmware, selecting the thermal stream, and recording sensor data.
2. **Visualisation settings**, including updating the background reference image (FFC), upsampling the thermal image, changing the colour map, and configuring the sensor mounting height.
3. **The Thermal visualisation**, including the colour map scale bar and a hover tooltip showing pixel coordinates and temperature.
4. **Computer Vision (CV) information**, including the option to overlay detections on the thermal visualisation, the total headcount, average detection confidence, and longest presence duration.
5. **Bottom panels** - a tabbed area containing the **Plot** panel (time-series charts for Headcount or Global Temperature) and the **Record** panel (recording controls and session metadata).
6. **Stats bar** - a footer displaying real-time statistics: minimum, median, and maximum temperatures, frames per second, sensor resolution, active stream, firmware version, and device serial number.

3.1 Sensor Operations

Connecting/Disconnecting

A device can be connected and disconnected from the application via the **Connect/Disconnect** button. A device must be connected before the visualisation will begin. When connecting, the button text changes to “Connecting…” and reverts to “Disconnect” once the connection is established.

Stream Selection

The stream selector drop-down allows users to choose between available thermal stream modes:

- **Clean Thermal** - the default stream; provides spatially smoothed thermal data.
- **Thermal (smoothed)** - an alternative thermal stream presentation.

The active stream is reflected in the stats bar at the bottom of the window. The stream selector is disabled during recording.

Flashing Firmware

The firmware running on the hardware can be updated using the **Flash FW** button.

Once pressed, a file explorer window will appear, allowing the user to select the firmware binary from their system. Once selected, the button transitions to a progress bar displaying the flash percentage (e.g. “Flashing: 45%”), allowing the user to monitor the process. If a device is currently connected, it will be automatically disconnected before flashing begins.

Upon successful completion the button displays “Flash complete” and the application will automatically attempt to reconnect to the device after a short delay. If the flash fails, the button displays “Flash failed”. Ensure only officially distributed Calumino binaries are flashed.

Recording

The CaliVision application includes the ability to record sensor data to HDF5 (`.h5`) files. The recording controls are located in the **Record** tab at the bottom of the window.

For a complete customer workflow (including delay, trim, metadata, and save), see the **Recording Data Capture** section.

Starting a Recording

Press the **Record** button to begin. A file dialog will appear, allowing you to choose the save location and filename. A pre-recording dialog is then presented where session metadata can be entered, including:

- Site name, room, and environment description
- Sensor mounting angle and ceiling height
- Scenario identifier and notes

An optional countdown delay can be configured before recording begins.

During Recording

While recording is active, a live frame counter is displayed. The stream selector is locked to prevent stream changes during capture.

Stopping and Saving

Press **Stop** to end the recording. A post-recording dialog allows you to review and edit the session metadata before saving. An optional trim control allows removing a specified number of seconds from the end of the recording.

Recorded Data

The following data is included in the `.h5` file:

- **Thermal stream** - thermal frames with frame IDs and timestamps
- **Computer Vision Data:**
  - Headcounts per frame
  - Confidence levels
  - Entity information such as position and velocity
- Calibration information (including FFC data if applied)
- Sensor metadata - device serial number, firmware version, calibration date, etc.
- Session metadata - site, room, mounting configuration, and scenario information

3.2 Visualisation Settings

Flat Field Correction (FFC)

An FFC is a quick calibration step that helps your sensor produce a cleaner, more accurate thermal image. Over time and with changes in ambient conditions, small variations can develop between individual pixels, which may appear as faint patterns or uneven backgrounds in the image. Running an FFC allows the system to reset its baseline using a uniform scene, ensuring that the background looks even and that real temperature differences stand out clearly. This improves image quality, temperature consistency, and the reliability of any analytics that rely on the thermal data.

An FFC can be performed by placing a flat object, uniform in temperature and material in front of the sensor, at a distance of approximately 5mm (ensuring the entire FOV is covered) and pressing the **Run FFC** button. A progress indicator shows the capture progress (e.g. “Capturing: 60%”). Once complete, the button text changes to “Re-run FFC”, indicating that a correction has been applied.

FFC calibration data is automatically saved per device and persists across sessions. When reconnecting the same sensor, the previously captured FFC is automatically restored.

Upsampling

The thermal visualisation can be upsampled using the three-position slider:

- **Off** - native sensor resolution (no upsampling)
- **2×** - doubles the displayed resolution
- **4×** - quadruples the displayed resolution

Thermal image upsampling is a visual enhancement that makes the thermal image appear smoother and easier to interpret by increasing the number of displayed pixels using interpolation. It works by estimating intermediate values between the sensor's original pixels, which can improve perceived clarity and make shapes or temperature patterns easier to see. Importantly, upsampling does not increase the true resolution of the sensor or reveal additional thermal detail. The underlying thermal data and accuracy remain unchanged. Upsampling only affects how the image is displayed to the user.

Colour Map

The thermal visualisation can be displayed in multiple colour maps, selectable via the drop-down menu. Each colour map is previewed with a colour swatch icon beside its name:

- **Spectrum** (default) - a multi-colour gradient.
- **Turbo** - a perceptually uniform colour gradient.

Mounting Height

The mounting height spinner allows the user to specify the height at which the sensor is mounted, in metres. The range is 1.5 m to 5.0 m (adjustable in 0.1 m increments). This value is recorded in the session metadata when recording sensor data.

3.3 Thermal Visualisation

The main element of the application is the thermal visualisation, which occupies the centre of the window. It displays the live thermal image from the sensor, rendered using the selected colour map.

Colour Map Scale Bar

A vertical colour map scale bar is displayed alongside the right edge of the thermal image. It shows 24 discrete colour segments from hot (top) to cold (bottom), providing a visual reference for the temperature-to-colour mapping currently in use.

Hover Tooltip

Hovering over the thermal image displays a tooltip showing the normalised pixel coordinates and the temperature at that point in degrees Celsius. The tooltip appears after a short delay and updates in real time as the cursor moves.

Rotation

The thermal image can be rotated in 90° increments using the **View → Thermal → Rotate CW** menu item or the keyboard shortcut **Ctrl+R**. The rotation cycles through 0°, 90°, 180°, and 270°. The overlay and hover tooltip coordinates are adjusted to match the current rotation.

3.4 Computer Vision Information

The Computer Vision (CV) panel is located on the right side of the window. It displays real-time people-counting analytics from the sensor's on-board CV algorithm.

Overlay

The **Overlay** toggle allows the user to enable the CV outputs (people detection locations) onto the thermal visualisation. Each detected person is marked with a crosshair reticle and their tracking ID is displayed below the crosshair.

Headcount

The headcount is displayed as a large central number in the CV panel, indicating the total number of people currently detected in the field of view (FoV).

Average Confidence

The average confidence score across all current detections is displayed to the left of the headcount. This value (ranging from 0 to 1) indicates the overall confidence the CV algorithm has in its detections.

Presence

The longest continuous presence duration of any tracked entity is displayed to the right of the headcount (e.g. "1m 23s").

Detections Table

Below the headcount display, a table lists each detected entity with the following columns:

- **ID** - The tracking identifier allocated to each detected person. If a person leaves the FoV and returns, they may receive a different ID.
- **Conf** - The confidence level (0 to 1) of the detection.
- **Pos X** - The horizontal position of the detection, normalised between 0 and 1.
- **Pos Y** - The vertical position of the detection, normalised between 0 and 1.

A value of (0.50, 0.50) represents the centre of the FoV.

3.5 Plotting

The **Plot** tab in the bottom panel provides time-series charting with two modes, selectable via a drop-down menu. Individual data series in the legend can be clicked to toggle their visibility.

Headcount

When the drop-down is set to “Head Count”, the plot displays a time series of the total headcount within the FoV.

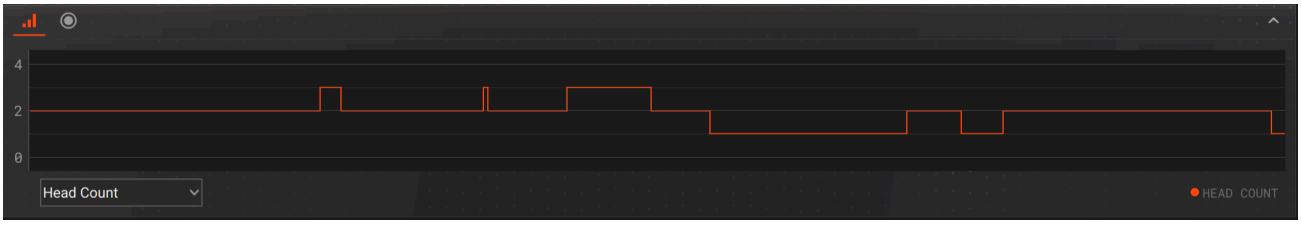

Figure 2 – Time series plot of Head Count

Temperature

When the drop-down is set to “Global Temperature”, the plot displays a time series of the maximum (red), median (yellow), and minimum (blue) pixel temperatures within the FoV.

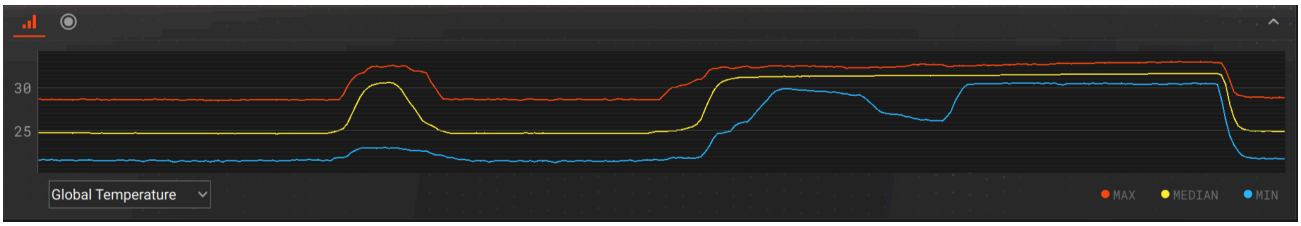

Figure 3 – Time series plot of Global Temperature

3.6 Stats Bar

The stats bar is a horizontal footer displayed beneath the thermal visualisation. It provides at-a-glance information about the current session:

Item	Description
MIN	Minimum pixel temperature in the current frame (°C)
MED	Median pixel temperature in the current frame (°C)
MAX	Maximum pixel temperature in the current frame (°C)
FPS	Current frame rate
SENSOR	Sensor resolution (e.g. 20×15)

Item	Description
STREAM	Name of the active thermal stream
FW	Firmware version running on the device
SERIAL	Device serial number

3.7 Keyboard Shortcuts

The following keyboard shortcuts are available:

Shortcut	Action
Ctrl + =	Increase UI scale
Ctrl + –	Decrease UI scale
Ctrl + 0	Reset UI scale to 100%
Ctrl + R	Rotate thermal image 90° clockwise

UI scale adjustments are also available from the **View → Scale** menu, which displays the current scale percentage.

4 Recording Data Capture

This section describes the end-to-end customer workflow for recording thermal and computer vision data in CaliVision.

4.1 Record Panel Overview

All recording actions are performed from the **Record** tab in the bottom panel. The panel provides:

- **Record** button - starts a new recording session.
- **Stop** button - ends active capture.
- **Save** action flow - finalises and writes the `.h5` file.
- **Delay** control - optional countdown before recording starts.
- **Trim** control - optional removal of a short segment from the end before save.
- Session metadata editor - site, room, mounting, scenario, and notes fields.

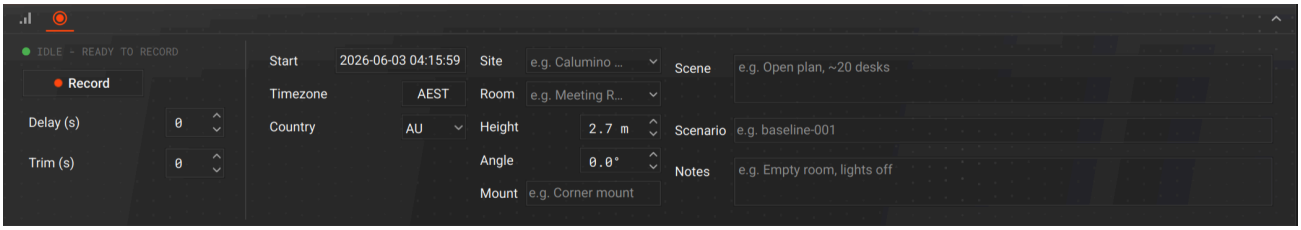

Figure 4 – Record tab with start/stop workflow and session metadata entry

4.2 Customer Recording Workflow

1. Start Recording

1. Connect the EVK and confirm live thermal data is visible.
2. Open the **Record** tab.
3. Press **Record** and choose a filename/location for the output `.h5` file.
4. Complete the pre-recording metadata dialog.
5. If a delay is configured, wait for the countdown to reach zero.

2. Monitor During Capture

While recording is active:

- A frame counter indicates capture progress.
- Stream selection is locked to keep the recording consistent.
- Live thermal and CV displays continue to update in real time.

3. Stop and Save

1. Press **Stop** to end capture.
2. Review and update metadata in the post-recording dialog.
3. Apply optional trim (seconds from the end), if required.
4. Save to finalise the recording file.

4.3 What Is Saved

Each recording stores:

- Thermal frames with frame IDs and timestamps.
- CV outputs (headcount, confidence, tracked entity data).
- Device/sensor metadata (serial, firmware, calibration information).
- Session metadata entered by the user (site, room, mounting, scenario, notes).

4.4 Recording Best Practices

- Keep USB and power connections stable for the entire recording.
- Set metadata before capture starts to improve traceability.
- Use delay for staged scenarios where people enter after capture starts.
- Use trim to remove brief setup movement at the end of a session.

5 Troubleshooting Guide

5.1 Software Pre-requisites

CaliVision is supported on Windows and Linux. The following are general recommendations for using the EVK:

- If the application is installed on a laptop, please ensure that the computer remains plugged into power throughout the entire time you are using the application.
- Linux builds currently require a distribution with glibc 2.39 or later due to runtime requirements.
- On Linux, the distributed FTDI driver archive and installer script must be run before first use so the FT4222 USB bridge can be recognised.
- On Windows, the FTDI device driver may need to be installed manually (see below).

Linux First-Run Setup (USB Recognition)

For Linux distributions meeting the runtime requirement above:

1. Ensure the packaged files `install_ft4222_linux.sh` and `libftd2xx-linux-x86_64-1.4.34.tgz` are in the same folder as the CaliVision executable.
2. Open a terminal in that folder.
3. Run:

```
sudo bash ./install_ft4222_linux.sh
```

The script installs the bundled FTDI runtime, writes udev permissions for FT4222, and applies executable permissions to the CaliVision binaries in that folder. Reconnect the USB device after setup if it was already plugged in.

5.2 I am having issues connecting to the device

Possible cause: The correct device driver is not yet installed (Windows only).

Solution: Download the driver from the "Drivers.zip" folder from the SharePoint. Once downloaded, extract the contents. Right click on the `ftdibus.inf` file and select install. Repeat this procedure for `ftdiport.inf`. Restart your computer and attempt to connect to the device through the visualisation application again.

5.3 The device is not detected after flashing firmware

Possible cause: The device is still rebooting after a firmware update.

Solution: After flashing, the device requires several seconds to reboot. The application will automatically attempt to reconnect. If the device does not appear after approximately 15 seconds, disconnect and reconnect the USB cable, then press **Connect**.

6 Revision History

Revision	Date	Change
02	04/06/2026	Added Linux runtime baseline (Ubuntu 24.04+) and first-run bundled FTDI setup instructions for USB recognition
01	03/06/2026	Updated for v0.11 - stream selection, recording workflow with session metadata, stats bar, hover tooltip, rotation, UI scaling, keyboard shortcuts, cross-platform support, expanded CV panel information
00	29/05/2026	Initial release