

Standard Operating Procedure (SOP)

Camera capture tool

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Purpose: Guide for operating the camera recording tool with synchronisation of electrophysiological data

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1. Overview

This tool captures synchronized video from a FLIR/BlackFly camera with GPIO strobe control, real-time preview, and automated video encoding. All recordings are saved with timing metadata for precise synchronization analysis.

2. Safety and Precautions

⚠ Before starting:

- Ensure the camera is properly connected via USB 3.0
 - Ensure the GPIO cable is also connected
 - Verify adequate disk space (approximately 1 GB per minute at 50 Hz)
 - Do not disconnect the camera during recording
 - Make sure SpinView is closed before starting recording
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3. Pre-Operation Setup

3.1 System Configuration

1. Open configuration file (`config.py`)

2. Verify settings:

- `VENV_PATH`: Path to Python virtual environment (or `None` if system Python has all required packages)
- `DEFAULT_SAVE_PATH`: Directory where recordings will be saved
- `DEFAULT_FRAMERATE`: Expected camera frame rate (Hz). Must match SpinView
- `DEFAULT_LINE`: GPIO line for strobe output (1 or 2). Depends on your setup. Use 1 for Axona, 2 for OpenEphys
- `CHUNK_DURATION_S`: Video chunk size in seconds (default: 10). Likely no need to edit.
- `BUFFER_MULTIPLIER`: Memory buffer size (increase if disk is slow). Likely no need to edit.
- `JPEG_QUALITY`: Image quality 0-100 (default: 85). Likely no need to edit.

3. Save changes if any settings were modified

3.2 Camera Configuration (SpinView)

Before using this tool, configure the camera in SpinView:

1. Set desired frame rate (e.g., 50 Hz)
 2. Set the resolution as desired
 3. Crop the image as wanted
 4. **Close SpinView**
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4. Operating Procedures

4.1 Starting a Recording Session

Method 1: Quick Start (Default Settings)

1. Double-click `start_recording.bat`
2. Wait for camera initialization (3-5 seconds)
3. Live preview window appears showing camera feed
4. Console displays: `Press ENTER to START recording`

Method 2: Custom Parameters

1. Open Command Prompt or PowerShell
2. Navigate to tool directory
3. Run with desired options (see section 5 for arguments):

```
start_recording.bat --duration 30 --framerate 50
```

Method 3: If the .bat script does not work

1. Open Command Prompt or PowerShell
2. Navigate to tool directory
3. Run with desired options:

```
python camera_capture_tool\src\main_recorder.py --duration 30 --framerate 50
```

4. You may need to activate a virtual environment first, or select the correct version of python

4.2 Recording Process

1. Open the video capture tool — preview Phase

- Live video preview appears (unless `--nolive` specified)
- Verify camera is showing correct view
- Adjust positioning/focus if needed

- Opening the program before starting the ephys recording ensures that the GPIO is set to the correct mode (constant value).

2. Start Ephys recording

- It is crucial for synchronisation that the ephys recording is started *before* the video recording
- The video recording is considered started when the **ENTER** key is pressed and frames get acquired, not when opening the program.

3. Start video recording

- Press **ENTER** in the console window
- GPIO strobe activates
- Console displays: "Acquisition is running"
- Lag counter shows buffer status: **Lag: X/Y frames | Time: Zs**

4. During Recording

- Monitor lag counter (should stay near 0)
- If lag increases significantly (> 10% of buffer), recording may be too fast for disk
- If lag gets close to the buffer size (Y), the storage disk is getting overloaded and the recording will likely crash.
- Simple solutions are to reduce resolution, increase frame compression (lower value for **JPEG_QUALITY** in **config.py**), reduce framerate, and check that no other program overloads the storage disk. Also consider using the **--sequential** mode.
- The video feedback may look a bit slow. This is normal, the displayed framerate is capped at 15 Hz maximum for optimisation purposes. If your **--framerate** value is higher, final video will be smoother.

5. Stop video recording

- For accurate synchronisation, it is crucial that the video recording is stopped *before* the ephys.
- **Manual stop:** Press **ENTER** in console
- **Automatic stop:** Wait for specified duration to elapse. Pressing **ENTER** will cause an anticipated ending of the recording.
- GPIO strobe deactivates
- Message displays: "Acquisition complete"

6. Stop Ephys recording

- Only after the camera recording has been stopped, which deactivates the GPIO strobe, can the ephys recording end.
- Remember to write down which video recording corresponds to your ephys session.

4.3 Post-Recording Processing

Automatic steps (no user input required):

1. Frame saving completes
2. Video chunks are encoded (if video generation enabled)
3. Final video is assembled

4. Timing metadata is saved to CSV file
5. Frame files are deleted (unless `--output both` or `--output frames` specified)
6. Console displays: "Recording complete!"

Press any key to close the program.

5. Command-Line Options

Option	Values	Default	Description
<code>--duration</code>	Number (seconds)	None	Auto-stop after specified time. Useful to make sure the video finishes before ephys
<code>--framerate</code>	Number (Hz)	50	Expected camera frame rate, must match the settings from SpinView
<code>--save_path</code>	Path string	<code>~/Documents/flea3_recordings</code>	Recording destination
<code>--line</code>	1 or 2	2	GPIO line for strobe output. For Axona recordings, use 1. For OpenEphys recordings, use 2
<code>--output</code>	<code>video</code> , <code>frames</code> , <code>both</code>	<code>video</code>	<code>video</code> =MP4 only; <code>frames</code> =raw frames only; <code>both</code> =MP4+frames. Useful if you are not sure about the compression quality.
<code>--sequential</code>	Flag	Off	Disable concurrent video rendering. All the rendering will happen at the end. Slow, but more reliable and reduce disk usage.
<code>--nolive</code>	Flag	Off	Disable live preview window
<code>--debug</code>	Flag	Off	Enable debug messages

Examples:

```
# 30-second recording at 50 Hz, save only video
start_recording.bat --duration 30 --framerate 50

# Continuous recording until manual stop, keep frame files
start_recording.bat --output both

# Save only frames, no video encoding
start_recording.bat --duration 10 --output frames

# Recording without live preview (better performance)
start_recording.bat --duration 60 --nolive
```

6. Output Files

Each recording session creates:

6.1 Directory Structure

```
~/Documents/flea3_recordings/
├── VIDEO_YYYYMMDD-HHMMSS/
│   ├── VIDEO_YYYYMMDD-HHMMSS.mp4      (if --output video or both)
│   ├── VIDEO_YYYYMMDD-HHMMSS.csv      (timing and metadata)
│   └── frames/                          (if --output frames or both)
│       ├── frame_0000000.jpg
│       ├── frame_0000001.jpg
│       └── ...
```

6.2 CSV Metadata File

The `.csv` file contains:

- **Timing data:** Precise timestamps for synchronization
 - `t_first_frame`: First frame capture time
 - `t_last_frame`: Last frame capture time
 - `t_set_line_exposure`: GPIO strobe ON time
 - `t_set_line_constant`: GPIO strobe OFF time
- **Configuration parameters:** All settings used for the recording
 - `duration_s, framerate_hz, gpio_line`
 - `generate_video, keep_frames, concurrent_render`
 - `live_video, debug_mode`
 - `chunk_duration_s, buffer_multiplier, jpeg_quality`

Use case: This metadata ensures full reproducibility and enables precise synchronization with external devices.

7. Troubleshooting

7.1 Frame Rate Warnings

If console displays:

```
[ERROR] Estimated frame rate (X Hz) differs from expected (Y Hz) by more than 1 Hz
```

Actions:

- 1. Frames are saved but video won't be generated (safety feature)
- 2. Check camera configuration in SpinView
- 3. Verify `--framerate` matches camera settings
- 4. Review system performance (CPU/disk usage)

7.2 Buffer Overflow

If lag counter approaches buffer size:

Lag: 950/1000 frames | Time: 25.3s

Actions:

- 1. Current recording will complete safely (buffer has headroom)
- 2. For future recordings, increase `BUFFER_MULTIPLIER` in config.py
- 3. Consider: faster storage device, lower JPEG quality, or slower frame rate

Revision History

Version	Date	Changes	Author
1.0	2026-01-19	Initial SOP creation	-