Dropping frames

About this book

SilkyEvCam BothView comes with a Python-based sample code（viewer）. Frame drop may occur in MP4 files on the frame camera during recording operation. This document explains the causes of this phenomenon and how to respond with it.

Structure of this document

This document includes the following.

1. Causes of the dropping
2. Frame drop when output from the frame camera
3. Frame drop when creating of MP4 file
4. Additional information for MP4 file creation
5. How to respond to frame dropping
6. How to set frame rate

Dropping frames

1. Causes of the dropping

Frame drop in MP4 files may occur in two places in the sample code.

- When output from the frame camera
- When creating of MP4 file

In either case, frame drop occurs when the frame rate set on the frame camera exceeds the processing capacity of the PC. The following section describes how to check for each occurrence. (However, it is unlikely that frame drop will occur when creating MP4 files. The reason will be explained later.)

2. Frame drop when output from the frame camera

The sample code outputs a log text file showing frame drops during output from the frame camera. This allows to detect which frames were dropped.

Log file name: recording_[YYYYMMDD_hhmmss_sss]_lost-cam-frame.txt

[Note] The highlighted part is the same as the other recorded file names.

[Note] If no frame drop occurs, this file will not be created.

As shown in the screenshot below, the log file outputs drop frame information on a line-by-line basis.

[Note] The frame ID starts from 0.

[Note] In most cases, the status is "Incomplete". There are two other types of status, but they are rarely used because the conditions under which they occur are limited.

Reference:

https://docs.alliedvision.com/Vimba_X/VmbPy_Function_Reference/Frame.html?utm_source=chatgpt.com#vmbpy.FrameStatus

```
Missing frame... frame info: Frame(id=422, status=FrameStatus.Incomplete, buffer=0x7f1001f6e910)
Missing frame... frame info: Frame(id=423, status=FrameStatus.Incomplete, buffer=0x7f10021ad520)
Missing frame... frame info: Frame(id=424, status=FrameStatus.Incomplete, buffer=0x7f10023ec130)
Missing frame... frame info: Frame(id=425, status=FrameStatus.Incomplete, buffer=0x7f100262ad40)
Missing frame... frame info: Frame(id=426, status=FrameStatus.Incomplete, buffer=0x7f1002869950)
Missing frame... frame info: Frame(id=431, status=FrameStatus.Incomplete, buffer=0x7f1003164990)
Missing frame... frame info: Frame(id=432, status=FrameStatus.Incomplete, buffer=0x7f10033a35a0)
Missing frame... frame info: Frame(id=433, status=FrameStatus.Incomplete, buffer=0x7f10035e21b0)
Missing frame... frame info: Frame(id=437, status=FrameStatus.Incomplete, buffer=0x7f1003c9e5e0)
Missing frame... frame info: Frame(id=438, status=FrameStatus.Incomplete, buffer=0x7f1004000030)
Missing frame... frame info: Frame(id=439, status=FrameStatus.Incomplete, buffer=0x7f100423ec40)
```

3. Frame drop when creating of MP4 file

In the ffmpeg encoding log when creating MP4, the number of drop frames is output as final (or intermediate) information, but the specific IDs of the drop frames are not output. Therefore, the sample code only outputs the final statistical information log.

Log file name: recording_[YYYYMMDD_hhmmss_sss]_ffmpeg-final-stats.txt

[Note] The highlighted part is the same as the other recorded file names.

[Note] This file will be created even if no frame drop occurs.

As shown in the screenshot below, the final information of the encoding process are displayed in a single line.

```
[ffmpeg log] frame= 1220 fps= 60 q=25.0 Lsize=    46826kB time=00:00:20.32 bitrate=18877.8kbits/s speed=   1x
```

- frame=n   Total number of frames output
- fps=n   Average encoding speed
- q=n   Quantization parameter
  (image quality index; lower values indicate higher image quality)
- Lsize=nKiB   Output file size
- time=HH:MM:SS.ff   Output video length
- bitrate=n.kbits/s   Average bit rate (data volume per second)
- speed=n.nnnx   Processing speed (real-time ratio)

As shown in the screenshot below, If frame drop occurs, "drop=number of drop frames" will be displayed.

```
[ffmpeg log] frame=  431 fps= 25 q=41.0 Lsize=    3028kB time=00:00:17.36 bitrate=1428.8kbits/s dup=0 drop=569 speed=   1x
```

4. Additional information for MP4 file creation

Here, we will explain why frame drop is unlikely to occur when creating MP4 files.

In the sample code, "passthrough" is specified for "vsync," one of the parameters used in the ffmpeg encoding process.

```python
ffmpeg_process = (
    ffmpeg
    .input('pipe:', format='rawvideo', pix_fmt='bgr24',
           s='{}x{}'.format(img_w, img_h), use_wallclock_as_timestamps=1, fflags='+genpts')
    .crop(g_value.img_trim_offset_x, g_value.img_trim_offset_y, g_value.img_trim_width, g_value.img_trim_height)
    .output(file_path, pix_fmt='yuv420p', vcodec=v_codec, vsync='passthrough',
            preset='ultrafast', bf='0', tune='zerolatency', loglevel="info", stats=None)  # loglevel-default:info
    .run_async(pipe_stdin=True, pipe_stderr=True, overwrite_output=True)  # Display log on Text
)
```

This setting accepts all input frames. Therefore, unlike other settings such as "cfr (constant frame rate)" and "vfr (variable frame rate)," frames are not deleted due to encode processing capacity or synchronization issues.

This makes encoding processing delays more likely to occur. However, even before that, it is likely that frame drops will occur at the "when output from the frame camera".

5. How to respond to frame dropping

If frame drop occurs "when output from the frame camera" or "when creating of MP4 file", it is likely due to insufficient PC processing resources, so the frame rate needs to be reviewed.

If frame drop occurs only during "when output from the frame camera", it is possible to synchronize event data with the remaining frames by matching the remaining frames with the corresponding external event triggers. [Note] Even if frame drop occurs, the frame camera trigger signal is output.

If frame drop occurs "when creating of MP4 file", check the "speed" value in the log file. If it is 0.99x or higher, it is almost identical to real time (1.0x) and there is no major issue.
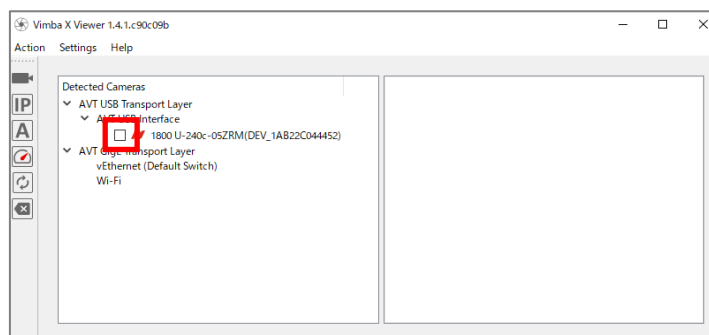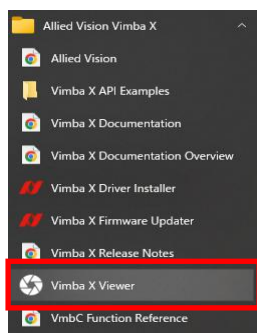
On the other hand, if the "speed" value is 0.90x or less, and it is clear that the processing speed cannot keep up with the input buffer, it is likely due to insufficient PC processing resources, so the frame rate needs to be reviewed. (Frame drop may not occur if the recording time is short. However, if recording continues for a long time, a buffer overflow will eventually occur, resulting in frame drop.)

6. How to set frame rate

The sample code set includes a file called "settings.xml" that describes the frame camera settings. Change the settings as needed. The following explains how to make changes.

1. Start Vimba X Viewer

   Connect BothView to your PC and launch "Vimba X Viewer".

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2. Load the setting file

Once Vimba X Viewer has launched, click the [Camera]-[Loading Camera Settings] at the menu bar, select the existing setting file (settings.xml) in the config folder of the sample code, and load it.
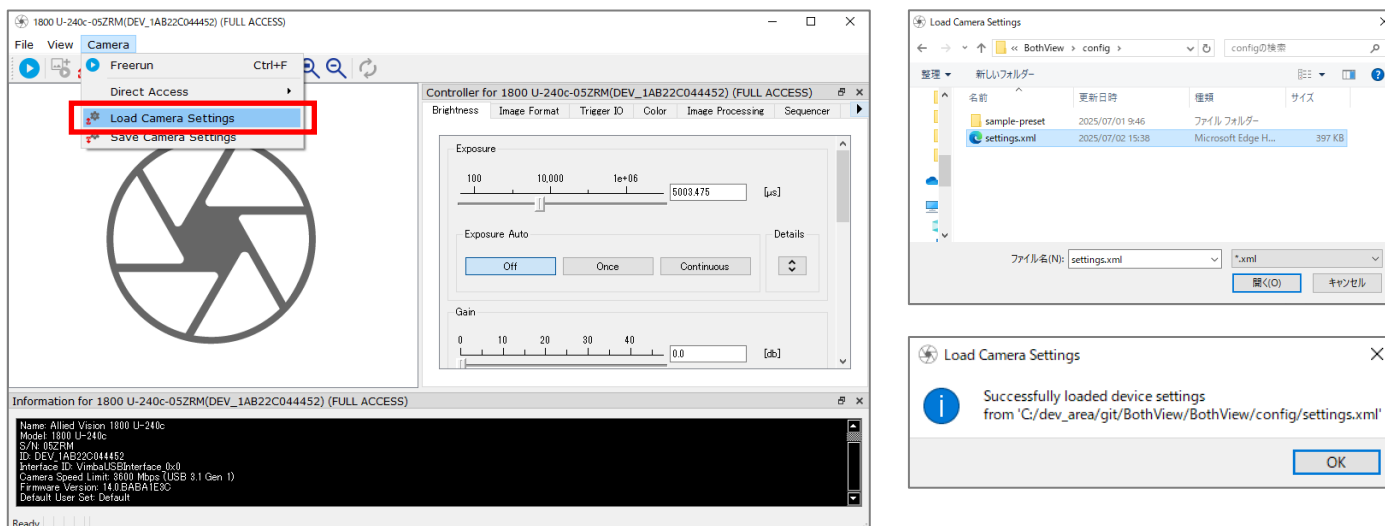
3. Change the exposure time

Increase the "Exposure" value in the [Brightness] tab on the right pane.

The default setting is 15,006.32 μs for exposure time, which corresponds to 60 fps. Readout and overhead (idle) have been subtracted from this value.
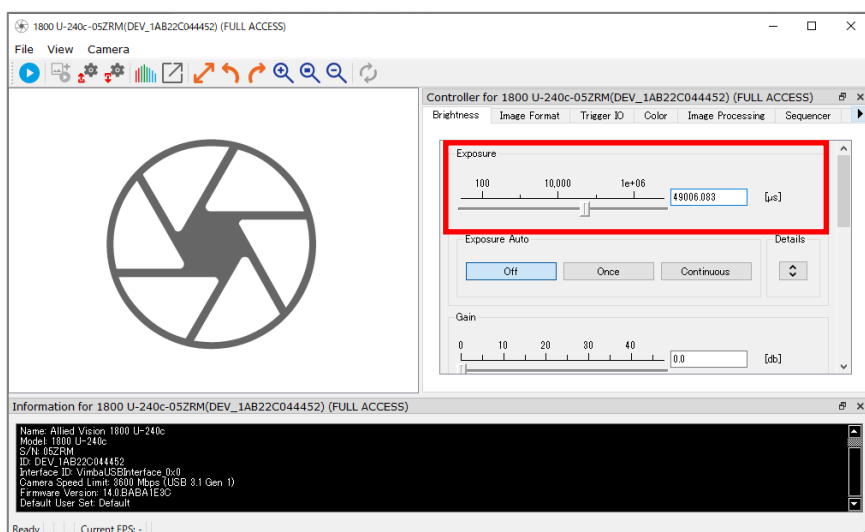
Reference:
https://cdn.alliedvision.com/fileadmin/content/documents/products/cameras/Alvium_USB/techman/Alvium-USB-Cameras_User-Guide.pdf

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4. Change the frame rate (Acquisition Frame Rate)

Enter "Acquisition Frame Rate" in [Filter pattern] in the [All] tab in the right pane and press the [Search] button. Click value for "Acquisition Frame Rate" in the list to display the setting window, then decrease the value.
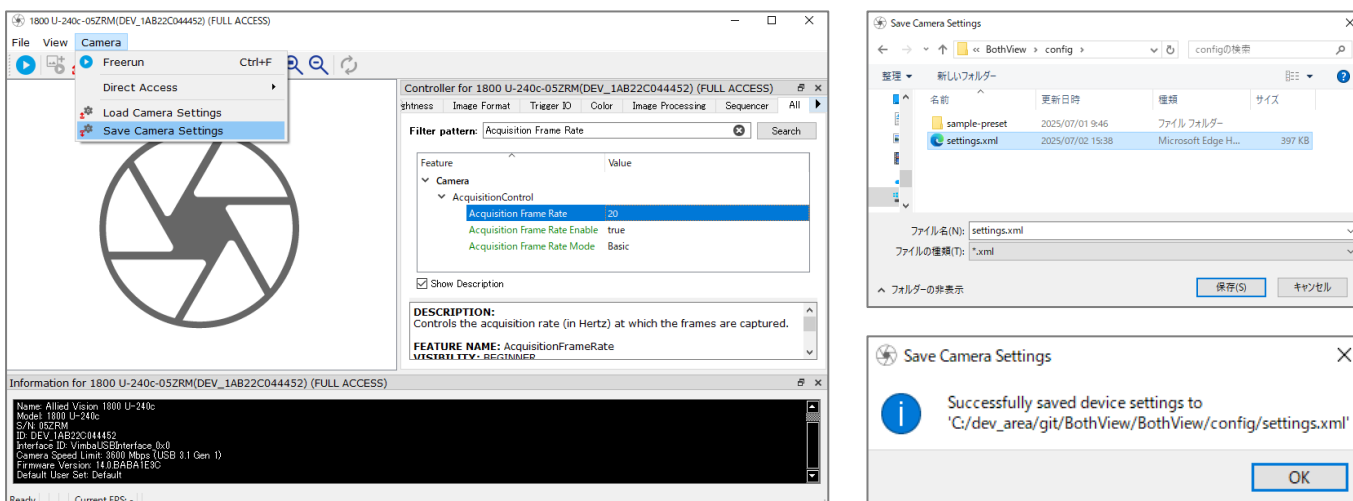
[Note] Exposure time takes priority over frame rate (Acquisition Frame Rate).

If the exposure time is longer than the reciprocal of the frame rate (i.e., the time available for one frame), the actual frame rate will automatically decrease accordingly.
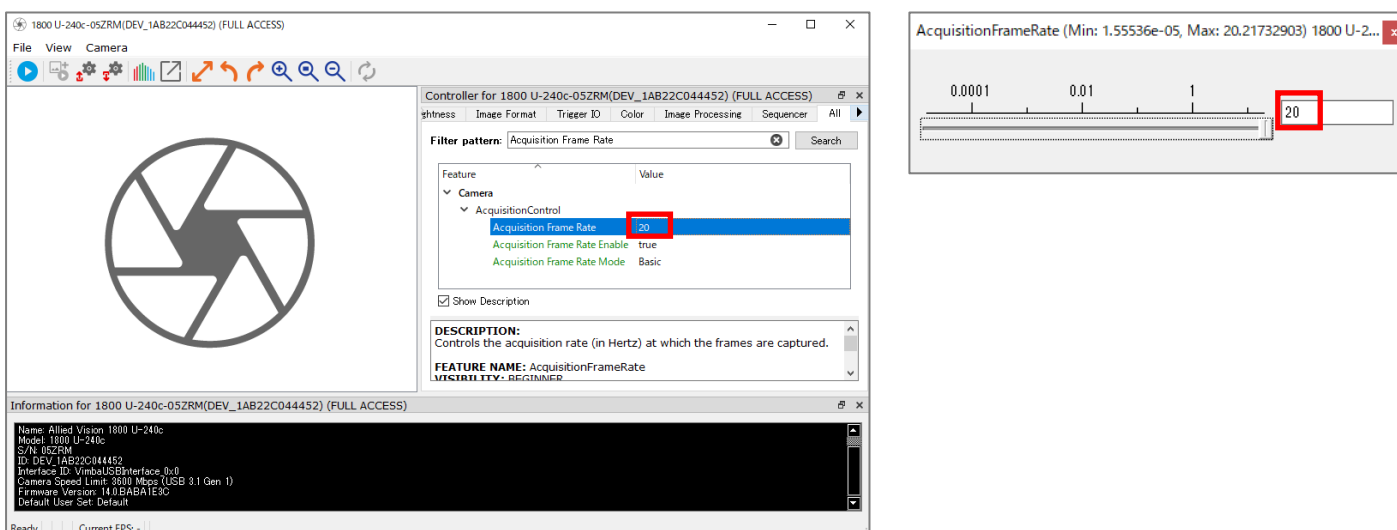
5. Save the setting file

Click the [Camera]-[Saving Camera Settings] at the menu bar, and save it. Be sure to stop streaming from the camera before saving.

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6. How to set frame rate

6. Confirm operation with sample code

Start the sample code and record the subject. Check the contents of the log files to confirm that there is no frame drop.

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