celepixel

CeleX-5 SDK User Manual

CelePixel Technology Co. Ltd.

目录

1 User Steps of CeleX-5 SDK

1.1 Install MIPI to USB3.0 Driver

1.1.1 Windows

Please install the driver from following folder:

Drivers/Windows

Installation Steps:

(1) Connect the CeleX-5 Sensor to the PC via the USB cable, double-click "**zadig-2.4.exe**" to pop up the interface shown in Fig. 1-1.

(2) Select Options → List All Devices (Fig. 1-2), then select device FX3 (Fig. 1-3).

(3) Click "**Install Driver**" or "**Reinstall Driver**" (Fig. 1-4) to install the driver. After the installation is successful, Figure 1-5 will be shown.

Notes: The data cable must be connected to the USB 3.0 port on the PC.

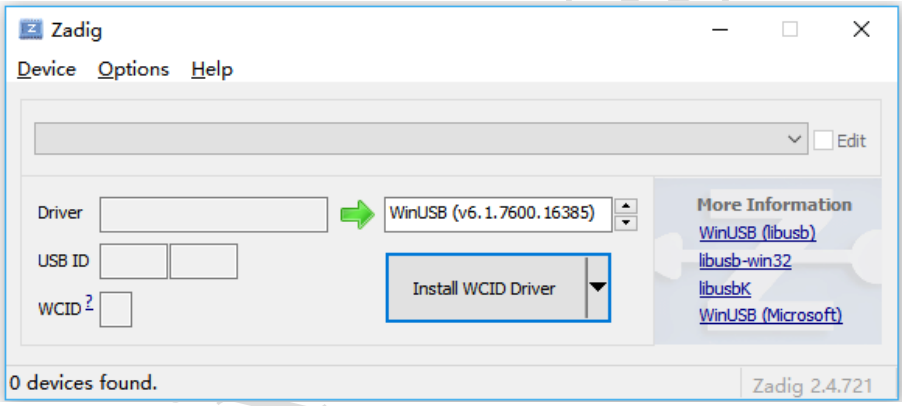


Fig. 1-1

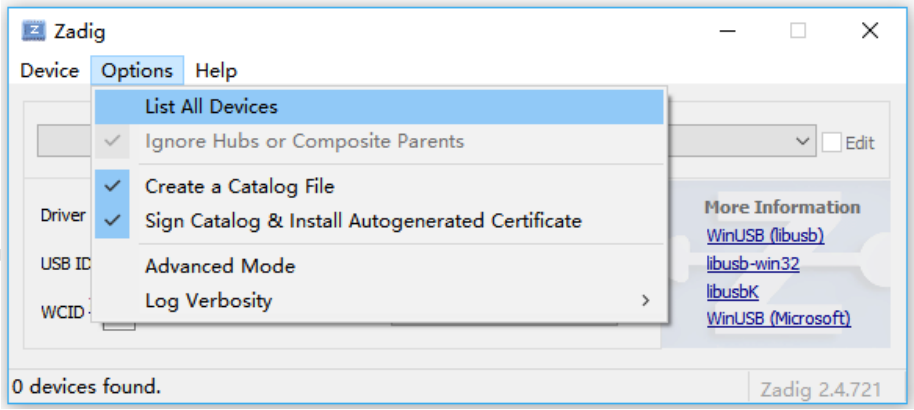


Fig. 1-2

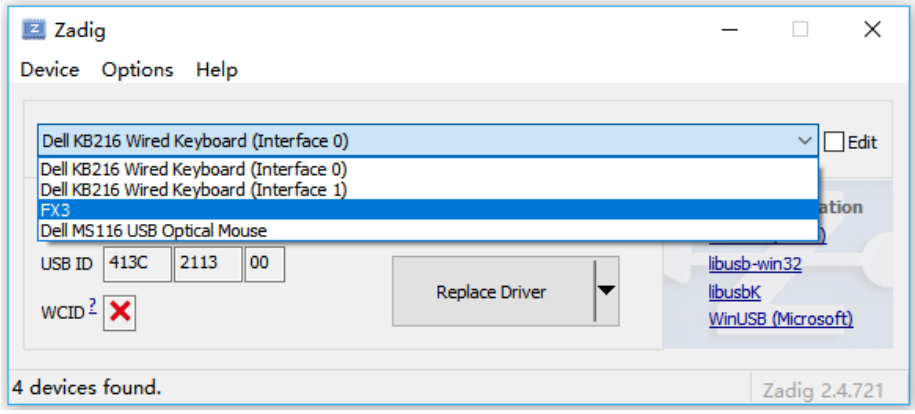


Fig. 1-3

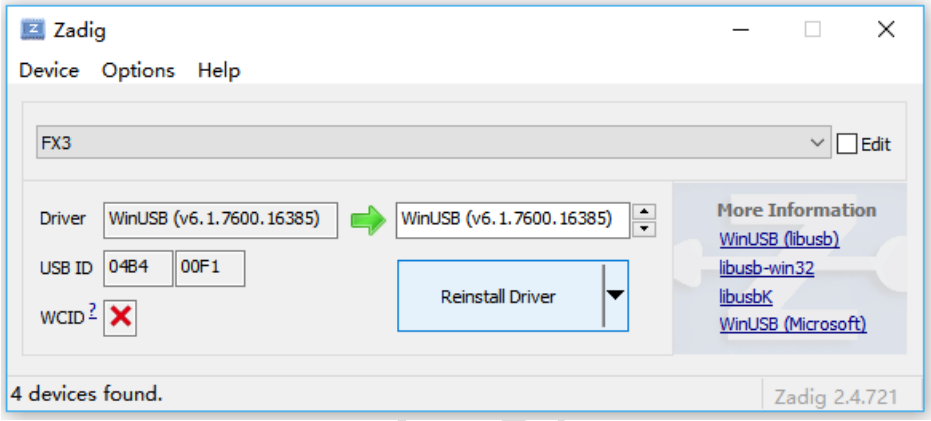


Fig. 1-4

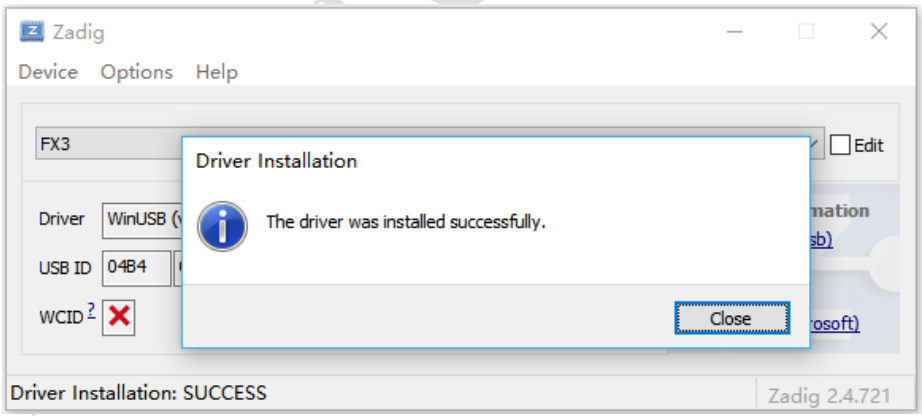


Fig. 1-5

1.1.2 Linux

Please install the driver from following folder:

Drivers/Linux

To install the driver for CeleX-5 Sensor on Linux，extract *CeleDriver-Ubuntu16.04LTS-x64.tar.gz*. after extracting, users will see the following two files:

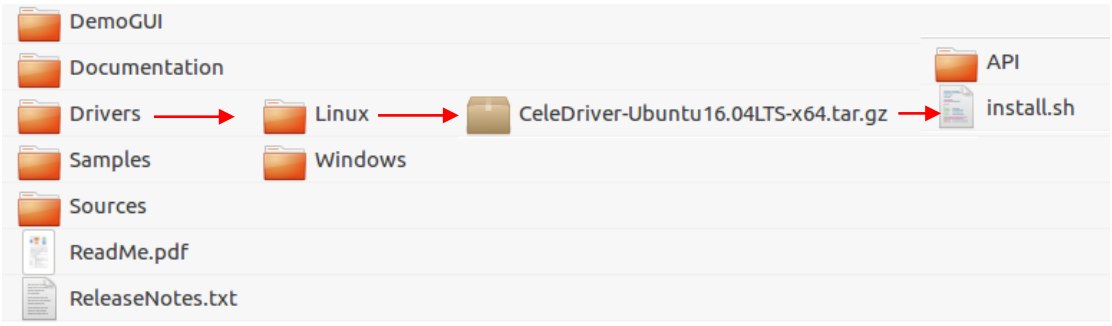


Fig. 1-6

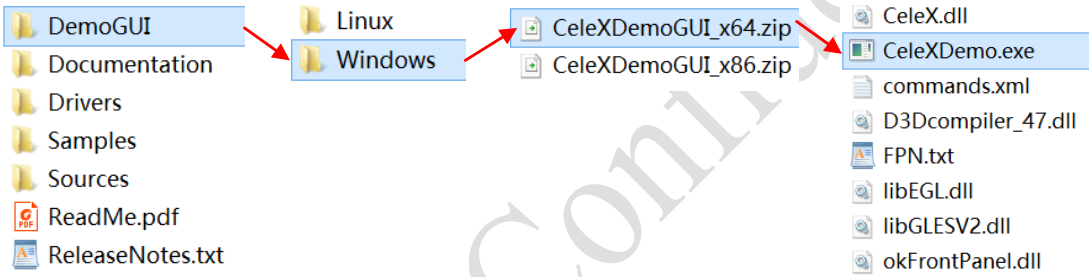
```
sudo sh ./install.sh
```

Fig. 1-7

1.2 Run CeleX Demo GUI

1.2.1 Windows

After installing the Driver, user could open the Demo GUI from following folder:

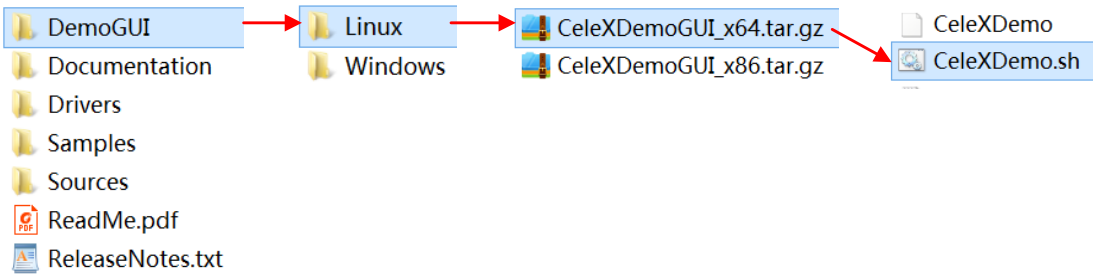


Double-click "CeleXDemo.exe" to open the CeleX-5 Demo GUI, as shown in Figure 2-2 in Chapter 2.

Note: If the software cannot be opened and some windows message box popped out saying some dynamic library files was missing, which may be caused by lacking of Visual C++ supporting package. You can install the "vc_redist.x86.exe" under the folder <*Drives/Windows*> and try it again, the software should be working properly.

1.2.2 Linux

After installing the Driver, user could open the Demo GUI from following folder:



Open a terminal and enter the following command to open the Demo GUI, as shown in Figure 2-

2 in Chapter 3.

```
$ sudo sh CeleXDemo.sh
```

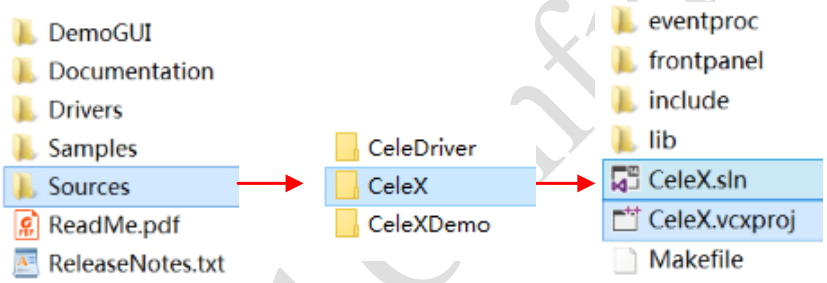
Note: Since we need to read and write the usb driver, we need to open the Demo with root privileges. Without the root permission, the usb device may fail to open.

1.3 Compile CeleX-5 Library Source Code

The OpenCV library (Version 3.3.0) is involved in the CeleX-5 API to develop some interfaces, so you need to install OpenCV and configure its development environment before compiling the source code of CeleX-5 library.

1.3.1 Windows

On the Windows platform, a VS2015 project file is provided to compile the source code, and the build library (CeleX.dll and CeleX.lib) will be imported into the directory *build/Windows*.



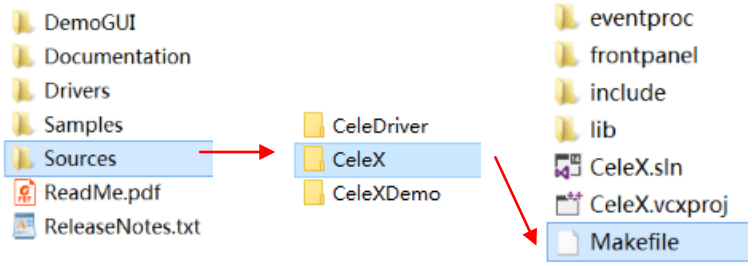
Note:

(1) You need to modify the settings of the OpenCV Include and Lib paths in the project properties. Otherwise, the compilation will fail because the OpenCV header files and libraries are not found.

(2) After the compilation is completed, a build/Windows directory will be automatically created in the directory where the project is located, and the compiled library files (CeleX.dll and CeleX.lib) will be automatically imported into this directory.

1.3.2 Linux

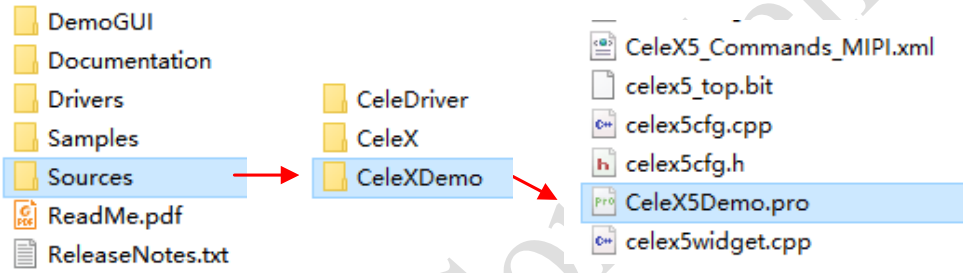
On the Linux platform, a Makefile is provided to compile the source code, and the shared library (libCeleX.so) will be generated in the current directory.



1.4 Compile Source Code of CeleX Demo GUI

Development Environment： Qt5.6.3 + OpenCV3.3.0

You could open the project in the following directory and compile it using Qt Creator easily.



Notes: It needs to modify the INCLUDEPATH and LIBS of OpenCV in the file *CeleXDemo.pro*.

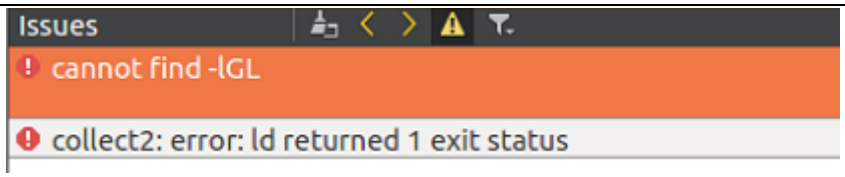
```
win32 {
    INCLUDEPATH += D:/opencv/build/include \
                   D:/Program Files/opencv/build/include/opencv \
                   D:/Program Files/opencv/build/include/opencv2
}
else {

    INCLUDEPATH += /usr/local/include \
                   /usr/local/include/opencv \
                   /usr/local/include/opencv2

    LIBS += /usr/local/lib/libopencv_highgui.so \
            /usr/local/lib/libopencv_core.so    \
            /usr/local/lib/libopencv_imgproc.so \
            /usr/local/lib/libopencv_videoio.so
}
```

Note: Problems that may occur during compilation (Linux):

(1) Cannot find -lGL

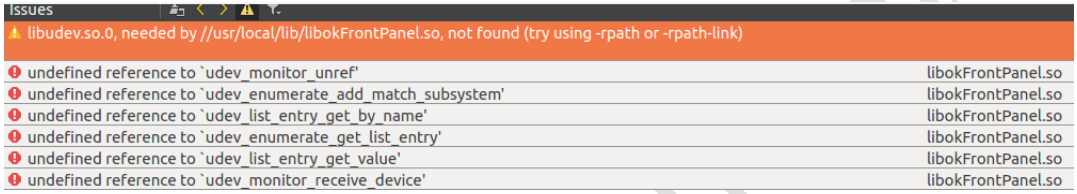


Solution:

sudo apt-get install libgl1-mesa-dev

(2) Udev Errors

Since FrontPanel SDK-v4.5.5 only supports Ubuntu12.04LTS version, the **USB device might not be recognized** when connecting with our Sensor, if you are using higher Ubuntu version. It is caused by the incompatible between "libudev" version used for FontPanel SDK-4.5.5 and Ubuntu14.04 or Ubuntu16.0.



Solution:

To install the corresponding Ubuntu12.04 library for libudev used, you can either download it from the following address, or from our Release directory < *Drivers/Linux/libudev* >.

download link:

https://ubuntu.pkgs.org/12.04/ubuntu-main-i386/libudev0_175-0ubuntu9_i386.deb.html

Name of installation file:

libudev0_175-0ubuntu9_i386.deb or libudev0_175-0ubuntu9_amd64.deb

Installation command:

sudo dpkg -i libudev0_175-0ubuntu9_i386.deb

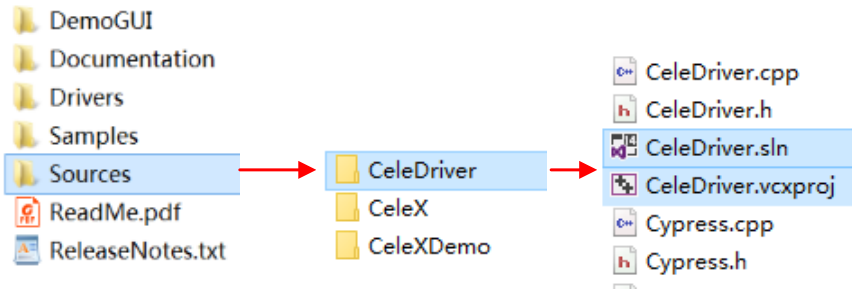
sudo dpkg -i libudev0_175-0ubuntu9_amd64.deb

1.5 Compile CeleX-5 Driver Source Code

The CeleX-5 Driver is used to obtain data on the USB side, and the SDK then acquires data through the CeleX-5 Driver for subsequent processing.

1.5.1 Windows

On the Windows platform, a VS2015 project file is provided to compile the source code. You can enter the Driver's Source Code directory by following the illustration below：

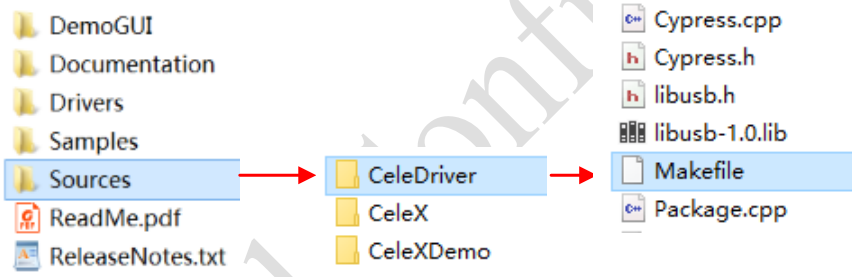


Note：

（1） After the compilation is completed, a build/Windows directory will be created automatically in the directory where the project is located. The compiled library files (CeleDriver.dll and CeleDriver.lib) will be automatically imported into this directory.

1.5.2 Linux

On the Linux platform, we provide a Makefile to compile the code, and the library file (libCeleDriver.so) will be generated in the current directory.



1.6 Generate FPN file

FPN (Fixed Pattern Noise) is the term given to a particular noise pattern on digital imaging sensors often noticeable during longer exposure shots where particular pixels are susceptible to giving brighter intensities above the general background noise. To get rid of FPN, we need to create FPN files for CeleX-5 Sensor. Each sensor requires its own FPN, and steps for generating FPN are illustrated in section 2.4.

2 The Functions of CeleX-5 Demo Kit GUI

If there is no sensor device connected, the interface screen is shown as Fig.2-1, when there is a sensor device connected, the interface screen is shown as Fig.2-2.

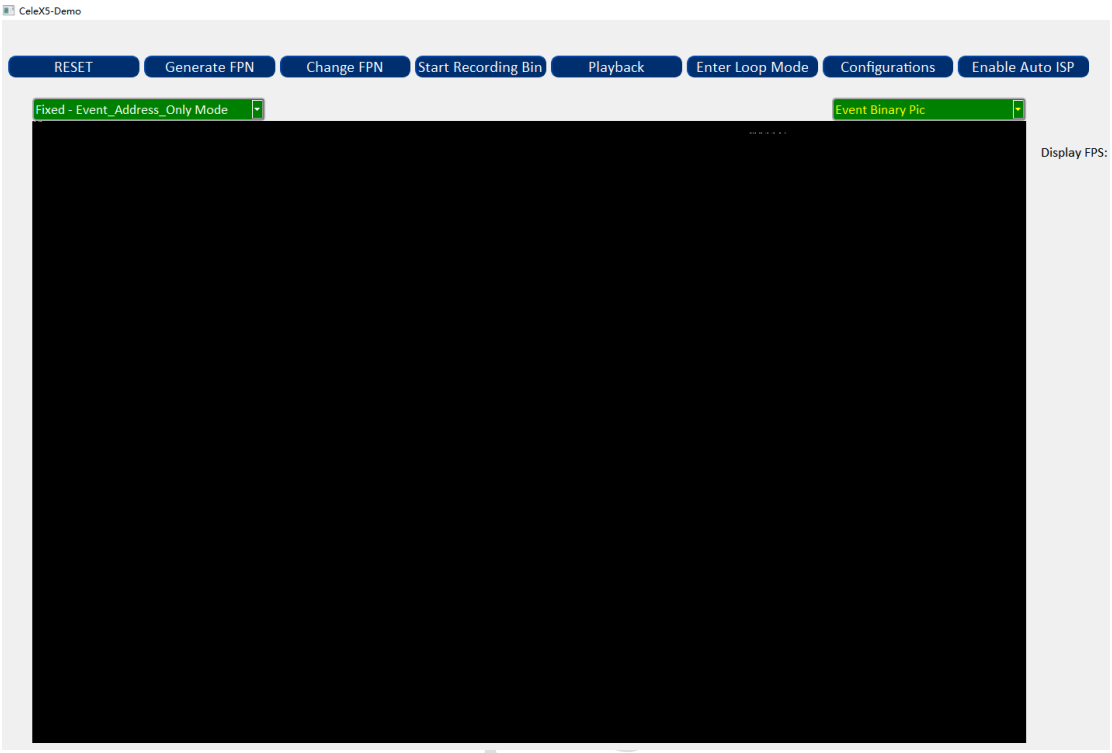


Fig. 2-1

Fig. 2-2

2.1 Change Sensor Mode

In the Fixed Mode, click the button "***Enter Loop Mode***" shown in Figure 2-3-1 to enter the Loop Mode. The images of *Loop Mode* are displayed as shown in Figure 2-4. Loop A is the first loop, its mode is *Full-frame Picture mode*, Loop B is the second loop, its mode is *Event mode*, and Loop C is the third loop, its mode is *Full-frame Optical-flow mode*.

In the Loop Mode, click the button "***Enter Fixed Mode***" shown in Figure 2-3-2 to switch to the Fixed mode (the default mode is *Event mode*).

Fig. 2-3-1

Fig. 2-3-2

Fig. 2-4 Sensor works in Event Mode

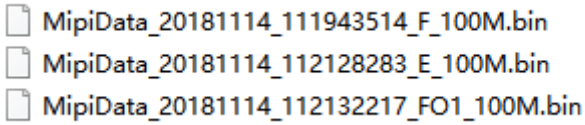
2.2 Record Raw Data of Sensor (Bin Files)

Click the "***Start Recording Bin***" button in Figure 2-5-1 to start recording bin data, then the text on the button will change to "***Stop Recording Bin***" as shown in Figure 2-5-2.

Click the "***Stop Recording Bin***" button to stop recording bin data. The recorded bin file will store

in the same directory as CeleXDemo.exe and is named in the form of

MipiData_YYYYMMDD_HHMMSSSSS_SensorMode_ClockRate.bin, as follow:



F: Full-frame Picture mode,

E: Event mode

FO1: Single Full-frame Optical-flow mode

100MHz: The operating frequency of the Sensor is 100MHz

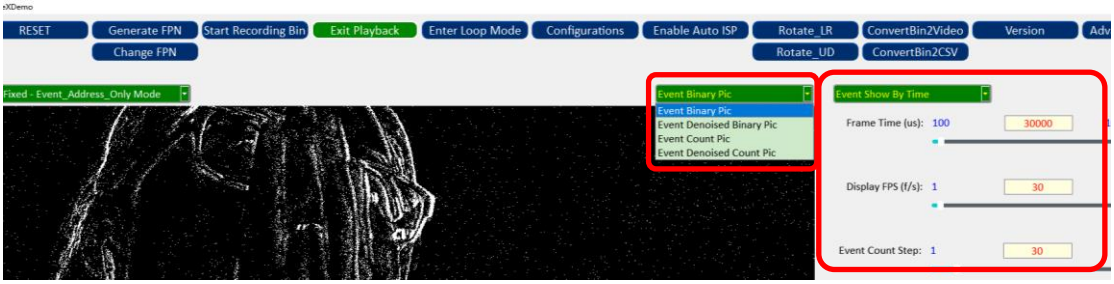
Fig. 2-5-1

Fig. 2-5-2

2.3 Playback Recorded Raw Data of Sensor (Bin Files)

Click the "***Playback***" button to select a bin file to play, the image displayed in the interface is related to the Sensor mode when you record the bin data.

You can select various Pic modes of the Bin file for display, and can select the display mode(show by time, show by count, show by row cycle) and set parameters such as Frame Time or Display FPS.

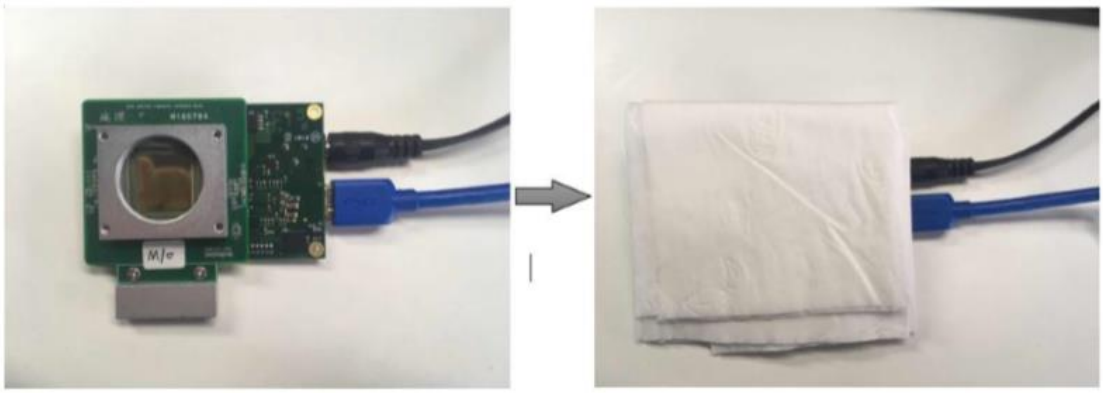


2.4 Generate FPN file

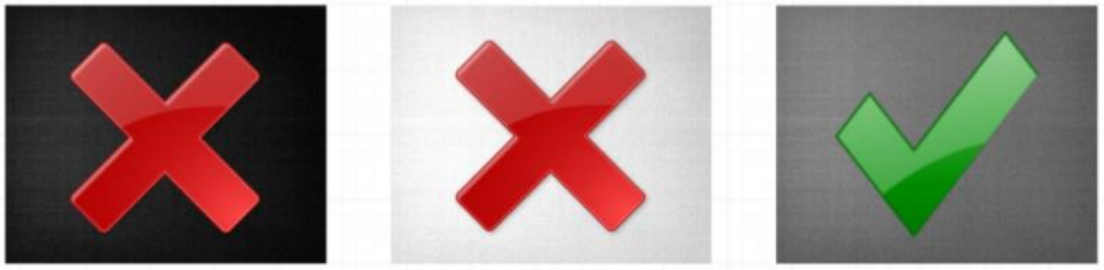
Each sensor requires its own FPN, and steps for generating FPN are illustrated as below:

1) Switch the Sensor operating mode into "Full-frame Picture Mode".

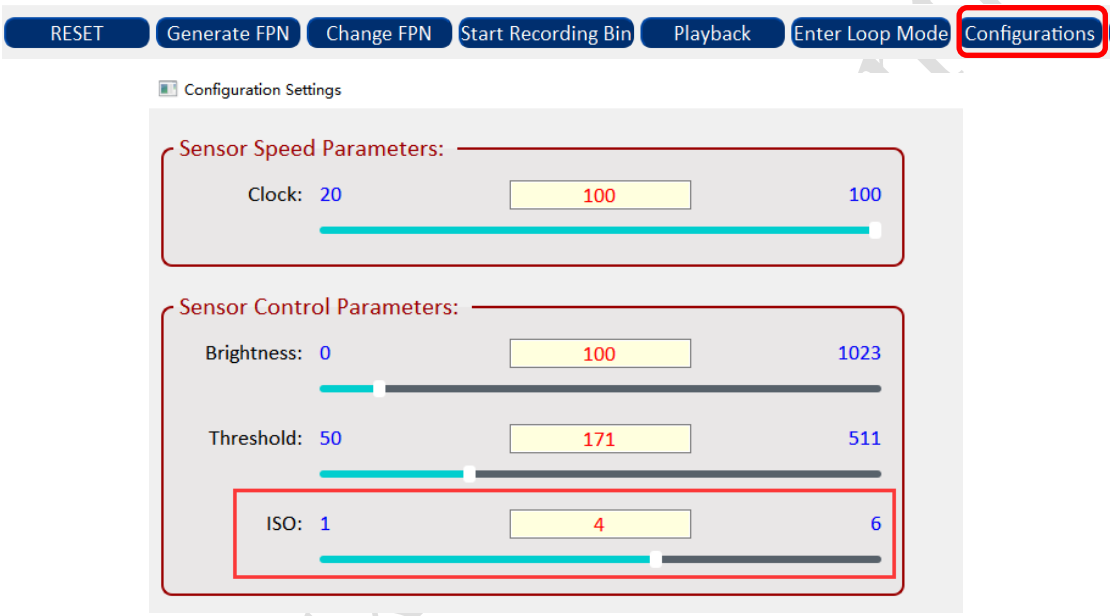
2) Since the FPN should be conducted under the condition of uniform illumination, we could use the way of removing optical lens and covering a piece of white paper (thin tissue or A4 paper) over the exposed Sensor. Make sure that paper completely covers the sensor and sheet is stationary. **NOTE: the effect will be better if you operate in natural light rather than the LED lamp.**



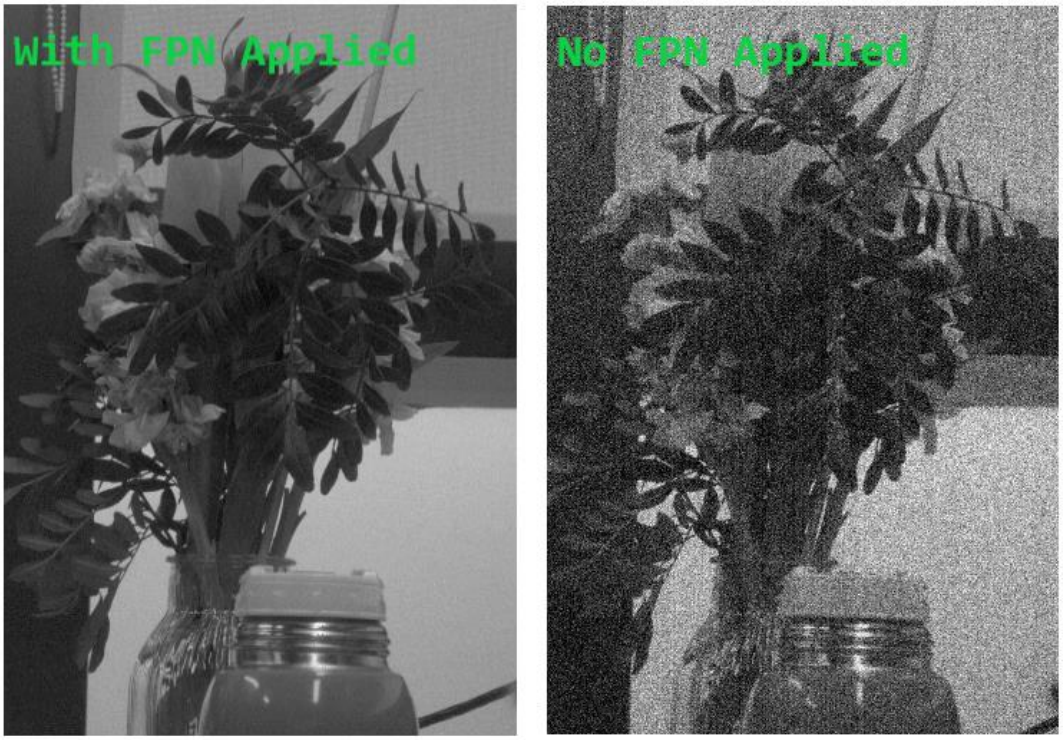
3) Before generating FPNs, please check the image screen and make sure it is normal, which is neither too dark nor too bright. Then, you could adjust the amount of paper over the Sensor or switch the “Brightness” slider in the GUI to change the luminance. **NOTE: the 3rd figure is the right luminance among the three figures below.**



4) Click the "***Generate FPN***" button in GUI. Then, you could see the FPN_3.txt file in assigned direction after FPN file was successfully generated. **Note: Different ISO levels correspond to different FPN files. ISO has a total of six levels. The default is the third level, which corresponds to the FPN_3.txt file. The user can obtain a brighter or darker image by adjusting the ISO level in the Configuration settings.**

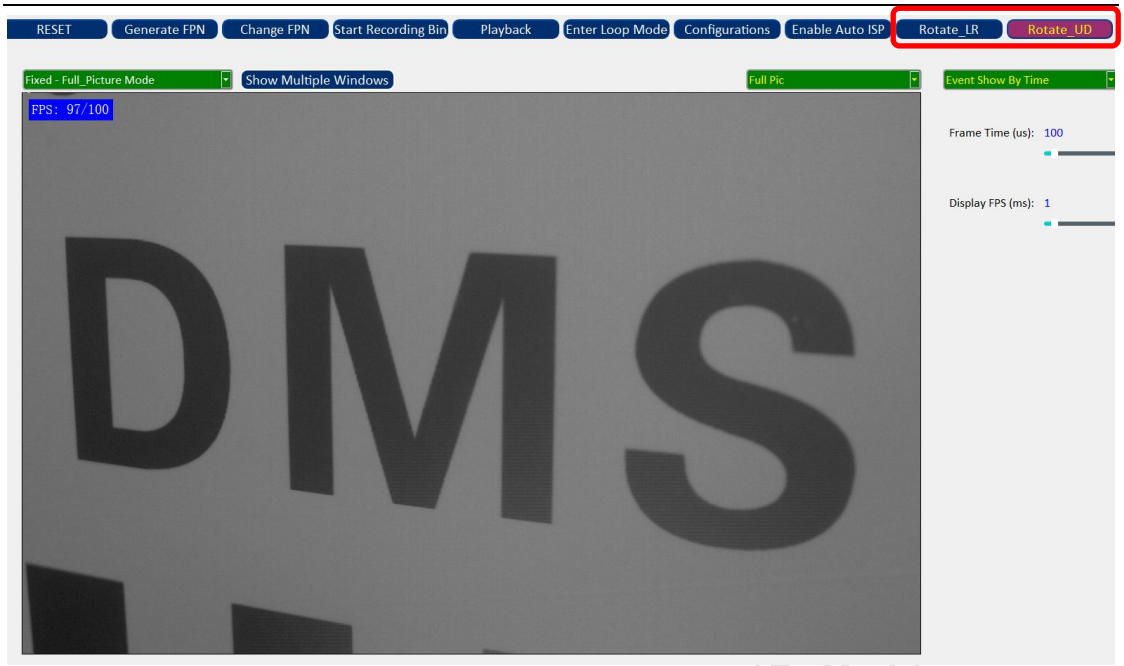


5) After generating the FPN file under the corresponding ISO settings, we can choose to switch to the corresponding FPN by clicking the "***Change FPN***" button. **Note: If the FPN file is generated according to the steps, but the image resolution is not improved after switching, check whether the current ISO corresponds to the FPN; check whether the selected FPN path contains the Chinese path.**



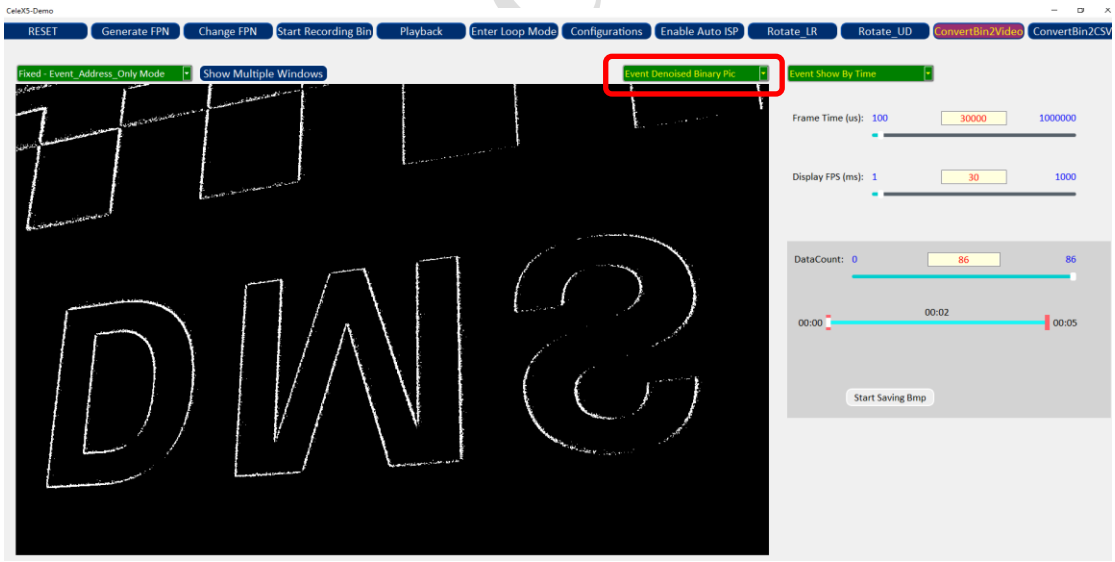
2.5 Flip image

Click the "***Rotate_LR***" or "***Rotate_UD***" button to flip the image left and right or up and down.



2.6 Convert bin to video

Click the "***ConvertBin2Video***" button, you can convert the recorded Bin file to a video file with the same name as the file. A video file in .mkv format is generated under Windows, and a video file in .mp4 format is generated under Linux. By selecting a different image format, you can convert the corresponding image format video of the Bin. For example, if you select the denoised image format, you can convert the Bin file of Event-Address_Only mode into the denoised image video.



2.7 Convert bin to CSV

Click the "***ConvertBin2CSV***" button to convert the recorded Bin file to a CSV file. For the Event-Address_Only mode, this file stores the Bin data as the Row, Colum, and TimeStamp information for the pixel. For Event-Intensity mode, this file stores Bin data as the Row, Colum, Intensity, Polarity, TimeStamp information for the pixel.

2.8 Advanced Settings

More advanced settings can be made by clicking the *"Advanced Settings"* button. When recording a Bin file, you can choose to turn off the screen display to ensure the integrity of the data (due to the time-consuming analysis of the data when displaying, it may result in data loss). Users can also set the "BinFile Time Duration" (in minutes) for recording each Bin file. Once the Bin file reaches the set length, the file will be saved automatically and a new file will be created.

When playing a Bin file, the user can save the picture at the same time. The interval for saving pictures can be adjusted by setting the "SavePic Count Interval" parameter (if the interval is set to 0, each frame will be saved; if the interval is set to 2, one image will be saved every 2).

In addition, a resolution setting is also available. The user can turn off the display of some lines by modifying the "Resolution Parameter". A detailed description of this feature can be found in the CeleX5_SDK_Reference documentation.