celepixel

CeleX-5 SDK User Manual

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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:

Driver/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. 2-1.

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

(3) Click "**Install Driver**" or "**Reinstall Driver**" (Fig. 2-4) to install the driver. After the installation is successful, Figure 2-5 will be shown.

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

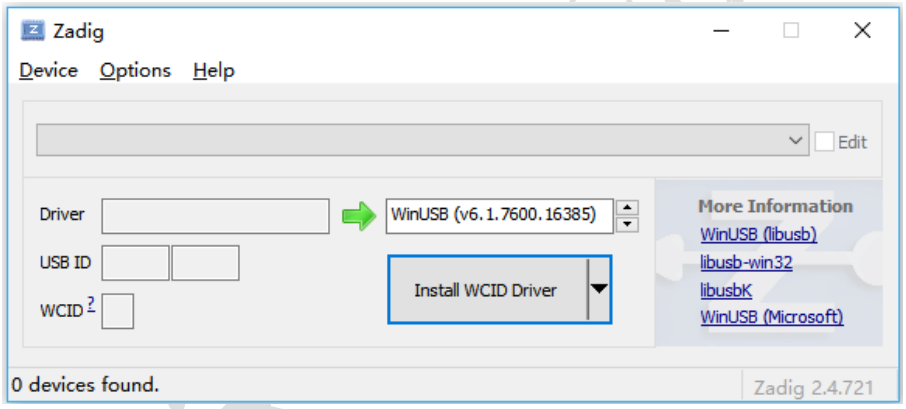


Fig. 2-1

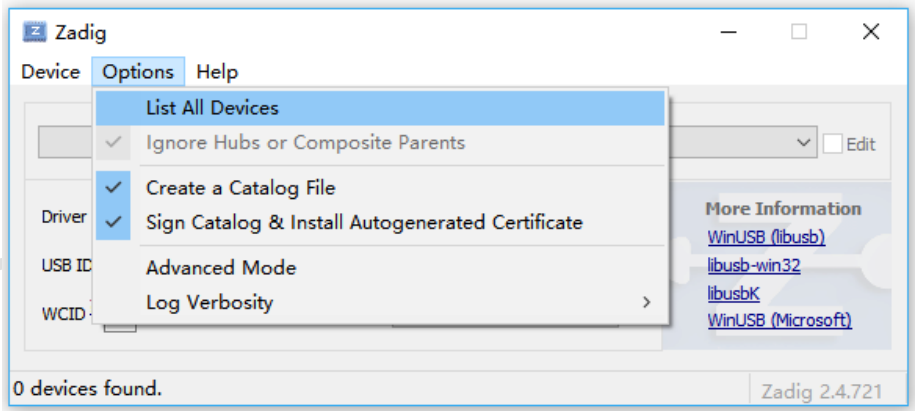


Fig. 2-2

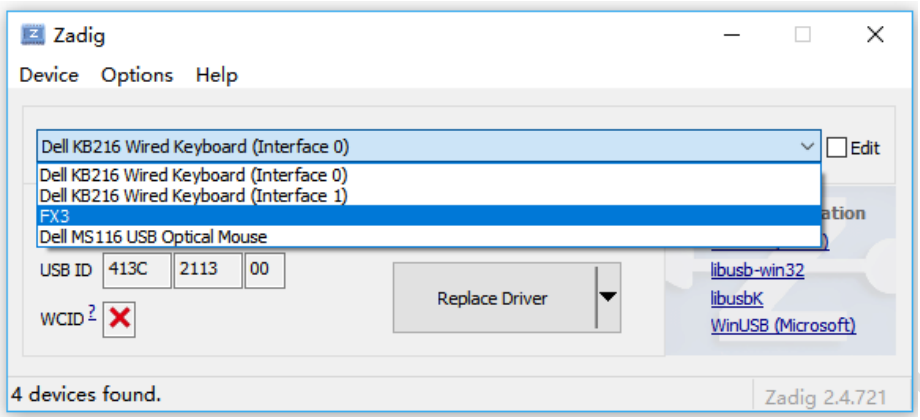


Fig. 2-3

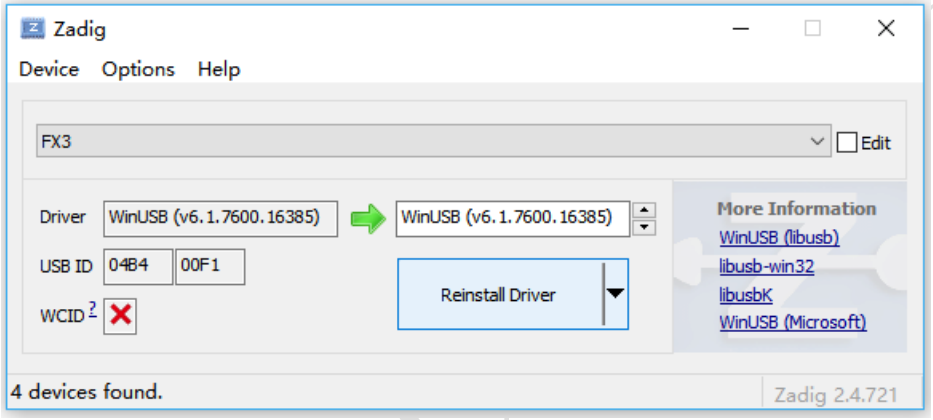


Fig. 2-4

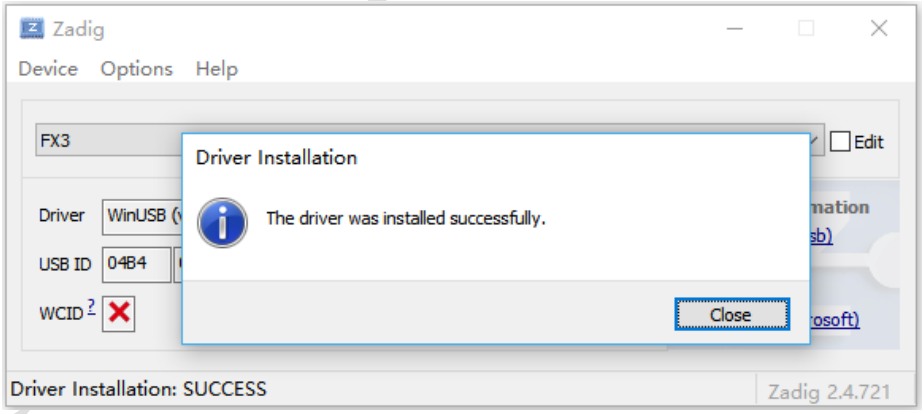


Fig. 2-5

1.1.2 Linux

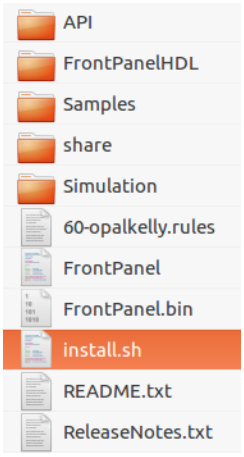
Please install the driver from following folder:

Driver/Linux

You can choose one of these drivers to install according to the platform system.

For Ubuntu 16.04LTS-x64, choose *FrontPanel-Ubuntu12.04LTS-x64-4.5.5.tar.gz*, after extracting,

users will see the following five files:



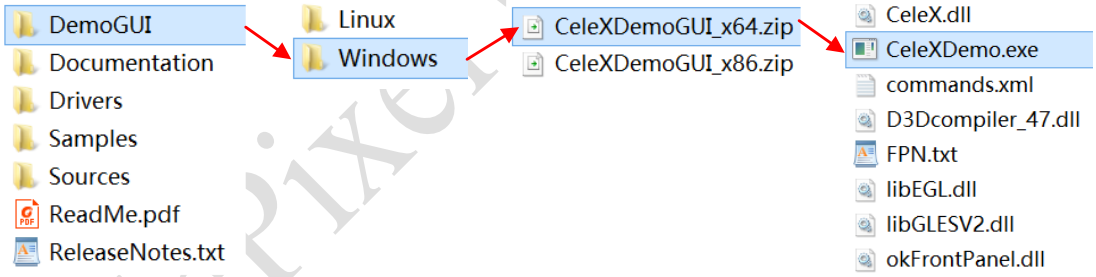
Open the terminal, enter the directory where install.sh is located, and input the following command to install the driver:

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

1.2 Run CeleX Demo GUI

1.2.1 Windows

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

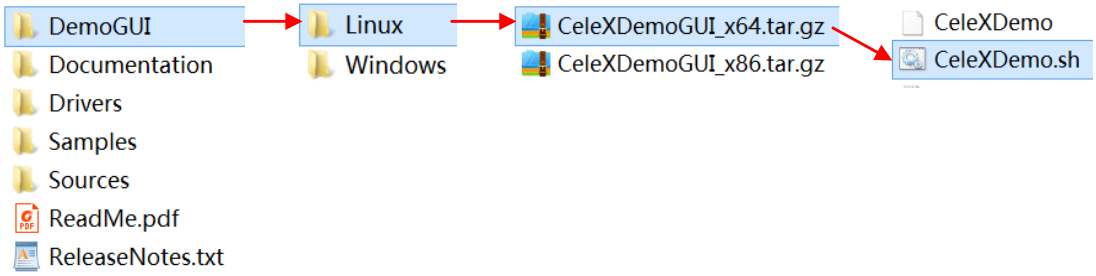


Double-click "CeleXDemo.exe" to open the CeleX-5 Demo GUI, as shown in Figure 3-2 in Chapter 2.

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.

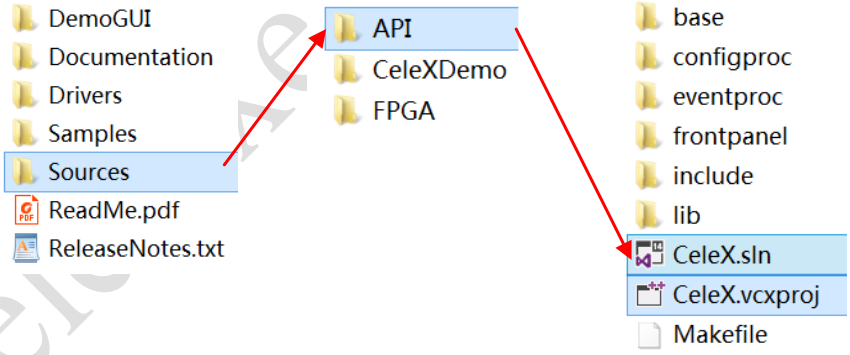
```
$ sh CeleXDemo.sh
```

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.

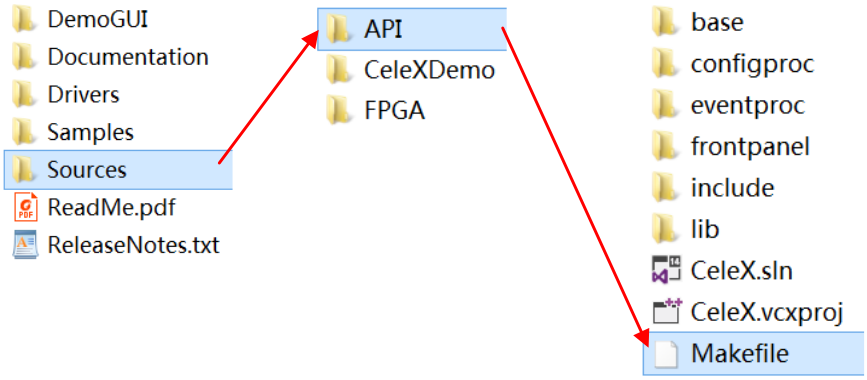
1.3.1 Windows

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*.



1.3.2 Linux

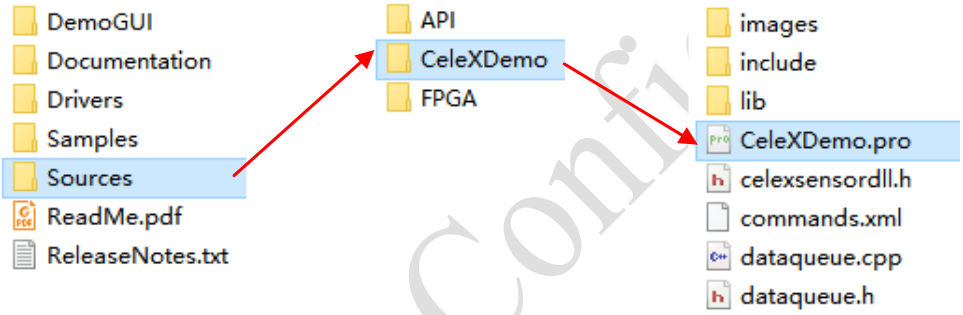
On the Linux platform, a Makefile is provided to compile the source code, and the shared library (libCeleX.so) will be generated in the current directory.



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*.

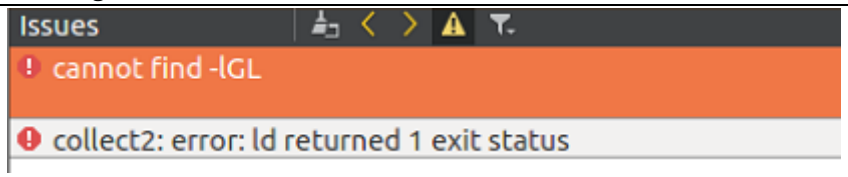
```
win32 {
    INCLUDEPATH += D:/opencv/build/include \
                   D:/Program Files/opencv/build/include/opencv \
                   D:/Program Files/opencv/build/include/opencv2
}
else {

    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
}
```

Problems that may occur during compilation (Linux):

Cannot find -lGL



Solution:

sudo apt-get install libgl1-mesa-dev

Udev Errors

1.5 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.

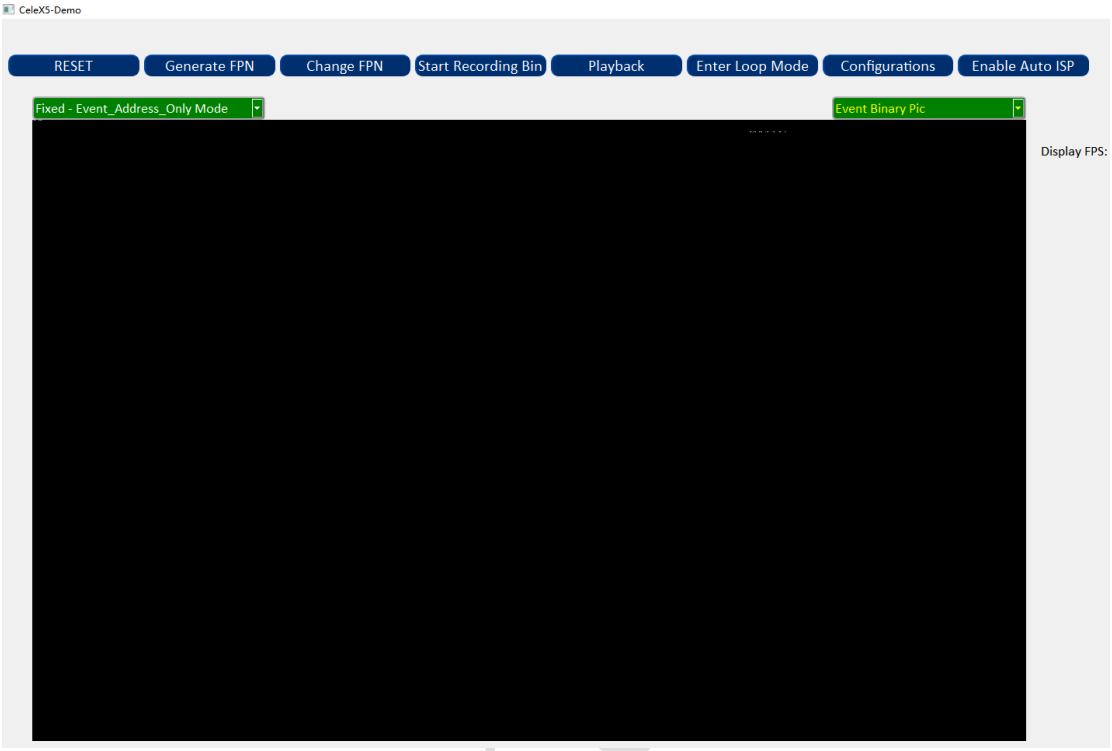


Fig. 2-1

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

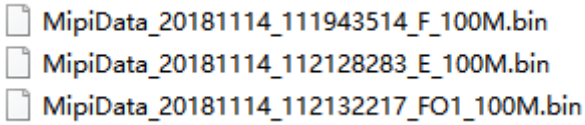
2.2 Record Raw Data of Sensor (Bin Files)

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)

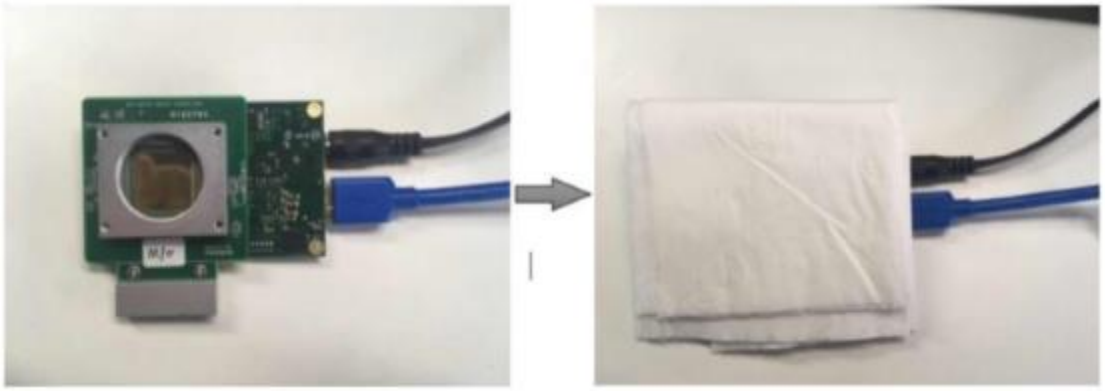
Click the "***Playback***" button to select a bin file to play, the image displayed in the interface is related to the Sensor mode when you record the bin data.

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.txt file in assigned direction after FPN file was successfully generated.

5) It will automatically use the new generated FPN file after restarting the GUI terminal. You should be able to see the differences of image quality then.