CA378-AOIS for Jetson TX2 Software Setup Guide

Version 1.2.0

Dated: 2019/09/27

Home Page https://www.centuryarks.com/en/products/cm

History

Date	Version	Comment
2017/12/15	v1.0.0	Initial Release
2017/12/18	v1.0.1	"How to build sample code" added wget command "—no-check-certificate" added
2017/12/26	v1.0.2	Support 2 to 5 connected multiple cameras
2018/01/10	v1.0.3	Fixed installation problem
2019/09/27	v1.2.0	Support for Jetpack 4.2

Contents

1. Notes
2. Environment configuration
3. Driver install
4. Software install
5. Demonstration functions
  5.1. Focus & OIS
  5.2. 4K3K-resolution(12Mpixel) still image capturing
  5.3. Capture image
  5.4. Movie recording
Appendix
  A.1. Directory structure
  A.2. Setting file

1. Notes

This document is for building kernel directly on a running Jetson TX2 board and setup software.

Hardware :JetsonTX2
OS :Ubuntu 18.04 LTS – JetPack 4.2(L4T 32.1)
CSI Hardware :CenturyArks CA378-AOIS(Sony IMX378)

The environment in which each command is executed is shown below.
$...is executed on the host pc
#...is executed on the Jetson TX2

2. Environment configuration

★Before installing the CA 378-AOIS driver, please implement the following environment.

・Prerequisites
1. Installing Jetpack 4.2 on Host PC (Linux for Tegra R32.1)
2. Setting sudo permissions

Step 1. Install Jetpack 4.2 on Host PC
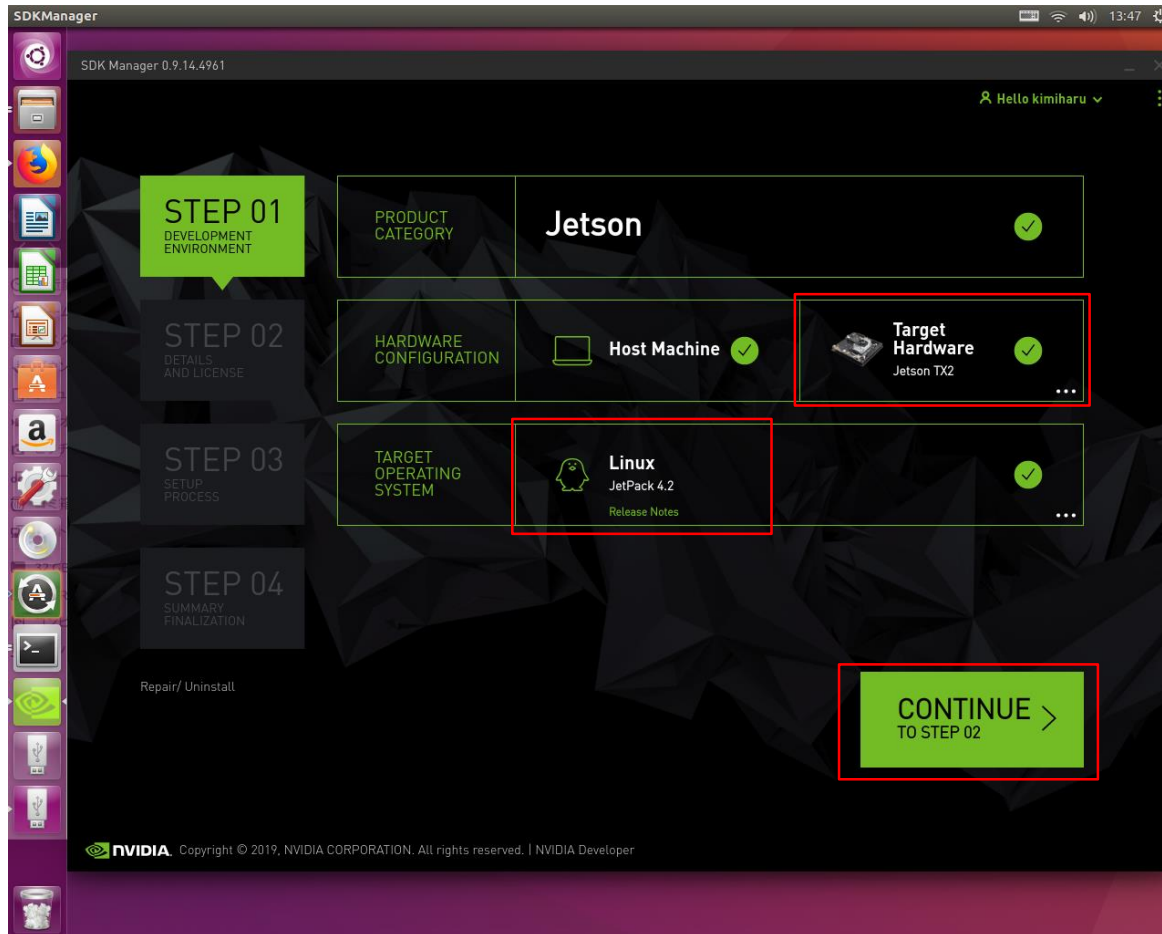
(1) Register as user at NVIDIA DEVELOPER site.
https://developer.nvidia.com

(2) Download and Install Nvidia SDK manager on host pc.
https://developer.nvidia.com/nvidia-sdk-manager

2. Environment configuration

(3) Set development environment on SDK Manager.
Target hardware is Jetson TX2(P3310), and target operating system is JetPack4.2.

2. Environment configuration

(4)Put the board into force USB Recovery Mode

1. Power down the device. If connected, remove the AC adapter from the device. The device must be powered OFF, and not in a suspend or sleep state.
2. Connect the Micro-B plug on the USB cable to the Recovery (USB Micro-B) Port on the device and the other end to an available USB port on the host PC.
3. Connect the power adapter to the device.
4. Press POWER button
5. Press and hold the RECOVERY FORCE (REC) button.
6. While pressing the RECOVERY FORCE button, press and release the RESET button.
7. Wait 2 seconds and release the RECOVERY FORCE button

(5) Set details and license on SDK Manager.
Check accept license and click continue to install the OS.
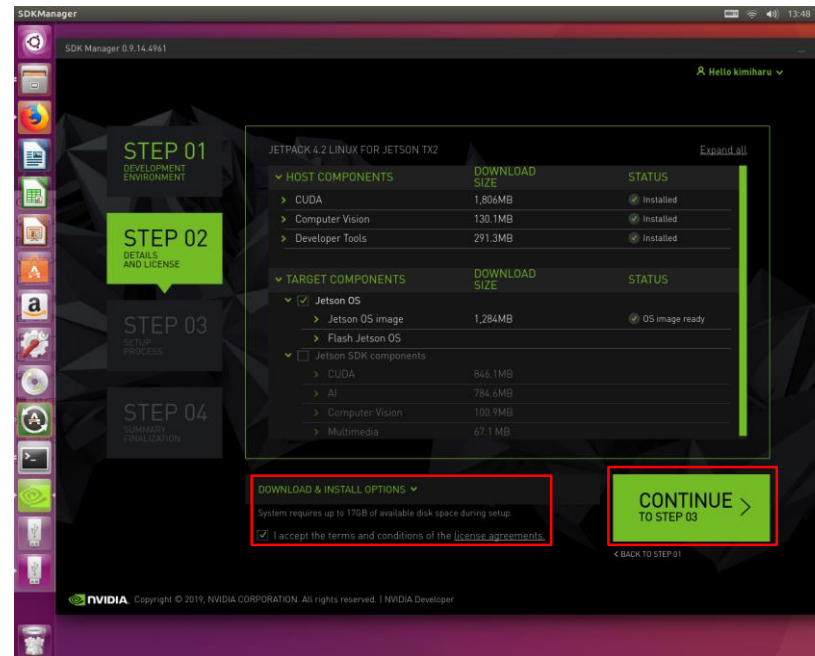
2. Environment configuration

(6) Start Jetson.
ID:nvidia
PASSWORD:nvidia

2. Environment configuration

Step 2. Setting sudo permissions

(1) Execute the following command.

```
# sudo visudo
```

(2) Add the following red line.

```
# User privilege specification
root    ALL=(ALL:ALL) ALL
nvidia  ALL=(ALL:ALL) ALL

# Members of the admin group may gain root privileges
%admin ALL=(ALL) ALL

# Allow members of group sudo to execute any command
%sudo   ALL=(ALL:ALL) ALL
%nvidia ALL=(ALL:ALL) NOPASSWD: ALL
```

(3) Reboot Jetson TX2.

```
# sudo reboot
```

3. Driver install

・Prerequisites
1. Prepare kernel source
2. Build and install new Linux kernel
3. Flash new Device Tree Binary(DTB)

Step 1. Prepare kernel source

Download the attached file to home directory on JetsonTX2 and run the following command.
https://github.com/centuryarks/CA378-
AOIS/releases/download/JSX2_v1.2.0_L4T32.1(Jetpack4.2)/CA378_2L_v1.2.0_Jetpack4.2_TX2_src_build.tar.gz

```
# tar -zxvf CA378_2L_v1.2.0_Jetpack4.2_TX2_src_build.tar.gz
# cd CA378_2L_v1.2.0_Jetpack4.2_TX2_src_build
# ./PrepareKernelSources.sh
```

3. Driver install

Step 2. Build and install new Linux kernel
Build and install kernel module with the following command

```
# ./BuildKernelSources.sh
```

Please enter the number of connected cameras.

```
# What is the number of camera connections? : 6
```

Please enter the number of framerate.

```
# What is the number of framerate for 4056x3040 ? (30/24/20/15/12/10/6/5) : 30
# What is the number of framerate for 3840x2160 ? (30/24/20/15/12/10) : 30
# What is the number of framerate for 1920x1080 ? (120/96/80/60/48/40/30) : 60
# What is the number of framerate for 640x480 ? (240/200/150/120/60) : 200
```

3. Driver install

Step 3. Flash new Device Tree Binary(DTB)

(1)Copy compiled dtb file to the host PC

```
$ cd ~/nvidia/nvidia_sdk/JetPack_4.2_Linux_P3310/Linux_for_Tegra/
$ sudo sshpass -p 'nvidia' scp -o StrictHostKeyChecking=no nvidia@192.168.xxx.xxx:/boot/*.dtb ./kernel/dtb/
$ nvidia@192.168.xxx.xxx is IP address on JetsonTX2.
$ sudo cp ./kernel/dtb/tegra186-quill-p3310-1000-c03-00-imx378.dtb ./kernel/dtb/tegra186-quill-p3310-1000-c03-00-base.dtb
```

(2)Put the board into force USB Recovery Mode

```
1.  Power down the device. If connected, remove the AC adapter from the device. The device must be powered OFF, and not
 in a suspend or sleep state.
2.  Connect the Micro-B plug on the USB cable to the Recovery (USB Micro-B) Port on the device and the other end to an
 available USB port on the host PC.
3.  Connect the power adapter to the device.
4.  Press POWER button
5.  Press and hold the RECOVERY FORCE (REC) button.
6.  While pressing the RECOVERY FORCE button, press and release the RESET button.
7.  Wait 2 seconds and release the RECOVERY FORCE button
```

3. Driver install

(3)Flash dtb partition
Replace this original DTB with your own build DTB

```
JetPack/4.2/64_TX2/Linux_for_Tegra/kernel/dtb/tegra186-quill-p3310-1000-c03-00-base.dtb
```

Flash

```
$ sudo ./flash.sh -r -k kernel-dtb jetson-tx2 mmcblk0p1
```

4. Software install

Please install by the following procedure.

· Installation procedure

1. Install package.

```
# sudo apt-get install v4l-utils ufraw –y
# sudo apt-get install libgstreamer1.0-0 gstreamer1.0-plugins-base gstreamer1.0-plugins-good gstreamer1.0-plugins-bad
gstreamer1.0-plugins-ugly gstreamer1.0-libav gstreamer1.0-doc gstreamer1.0-tools -y
```

2. Download " demo_v1.2.0_tx2.tar.gz " from the following site.
https://github.com/centuryarks/Sample/releases/download/JSX2_v1.2.0_L4T32.1(Jetpack4.2)/demo_v1.2.0_tx2.tar.gz

```
# wget --no-check-certificate ¥
   https://github.com/centuryarks/Sample/releases/download/JSX2_v1.2.0_L4T32.1(Jetpack4.2)/demo_v1.2.0_tx2.tar.gz
```

3. Unzip "demo_v1.2.0_tx2.tar.gz" file.

```
# tar -zxvf demo_v1.2.0_tx2.tar.gz
```

4. Execute "Install.sh" in the extracted folder.

```
# cd demo
# ./Install.sh
```

5. A shortcut is created on the desktop.(Once you launch the app, an icon will appear)
   DEMO

4. Software install

Jetson has a limiter of 120fps at isp when streaming.
When streaming at 120fps or higher, it is necessary to cancel the limiter.
Please cancel FPS limiter by the following procedure.

References
https://devtalk.nvidia.com/default/topic/1056210/jetson-nano/nvarguscamerasrc-frame-rate-limit/

1. Download library file.
https://devtalk.nvidia.com/cmd/default/download-comment-attachment/79559/

2. Unzip and copy file.

```
# tar –zxvf devtalk1056210_Jun26_v2.tar.gz
# cd devtalk1056210_Jun26_v2
# sudo cp libgstnvarguscamerasrc.so /usr/lib/aarch64-linux-gnu/gstreamer-1.0/libgstnvarguscamerasrc.so
```

5. Demonstration functions

5.1. Focus & OIS
5.2. 4K3K-resolution(12Mpixel) still image capturing
5.3. Capture image
5.4. Movie recording

5.1. Focus & OIS

Procedure of starting Focus & OIS:

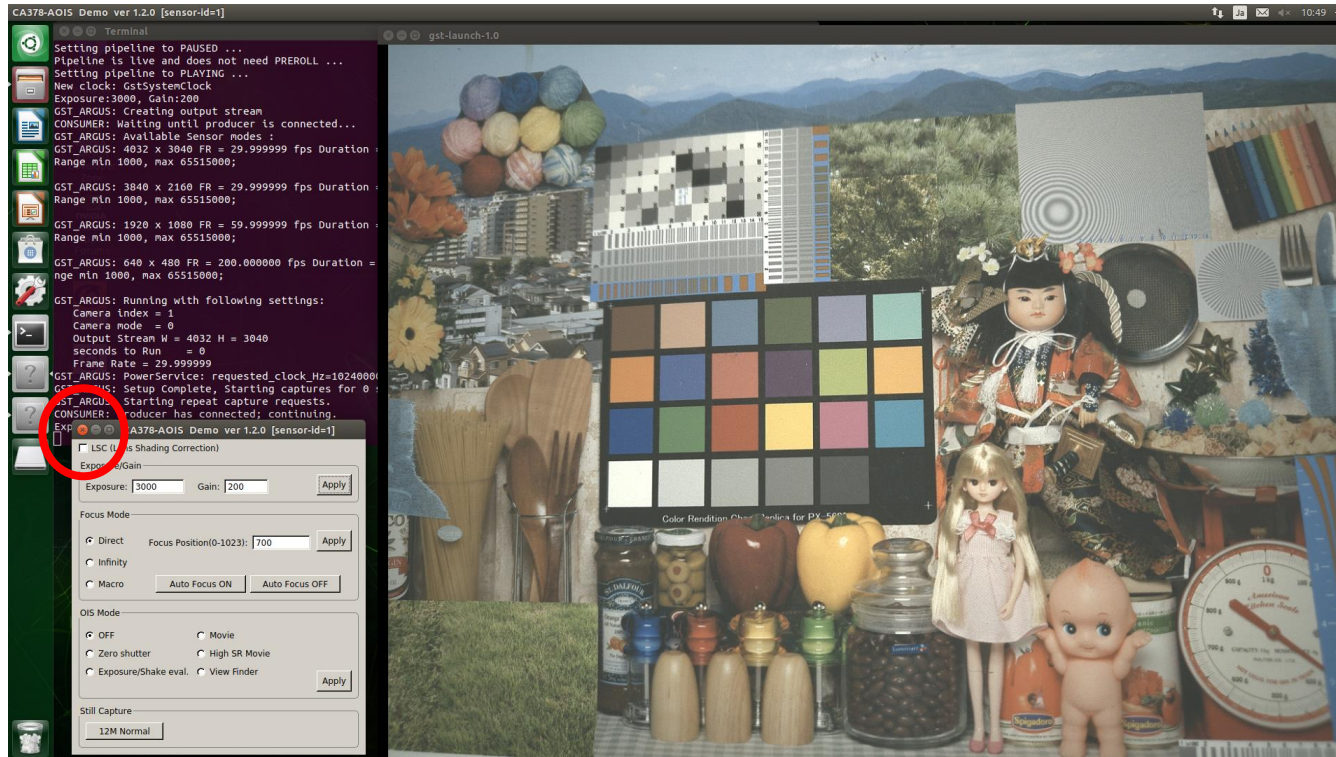1. Click "DEMO.desktop" on the desktop and click "Trust and Launch" on the dialog.

2. After a while the GUI screen will be displayed and the app icon changes.
3. Please change the distance of the object, or move the camera, confirm the function.
   * For details of functions, refer to page 19-20.
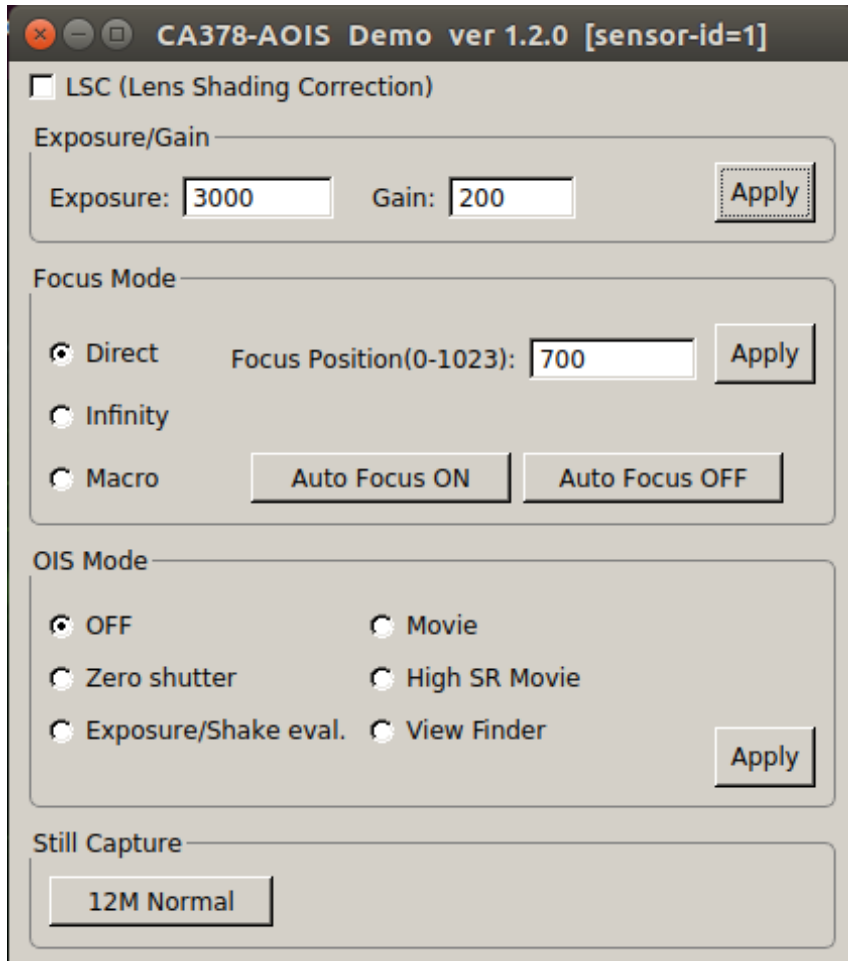
Procedure of finishing Focus & OIS:
1. Click the [x]

# 5.1. Focus & OIS

The following section describes each function of Focus & OIS.

Function	Description
LSC	Check to enable shading correction. ※ Theoretical values have been set.
Exposure/Gain	Exposure: Set the exposure time.(1-65515) Gain: Set the gain parameter.(100-2200) Apply: Apply the settings.
Focus Mode	Direct: Directly specify the focus position. Infinity: Set the focus position to infinity. Macro: Set the focus position to the short distance. Focus Position: Focus position. Apply: Apply the settings. Auto Focus ON: Enable auto focus. Auto Focus OFF: Disable auto focus. * Current debug control is for demo.
OIS Mode	OFF: Disable OIS. It corresponds to each OIS mode. 　Zero Shutter 　Exposure / Shake eval. 　Movie 　High SR Movie 　View Finder Apply: Apply the settings.
Still Capture	12M Normal: Capture 12Mpixel normal still image.

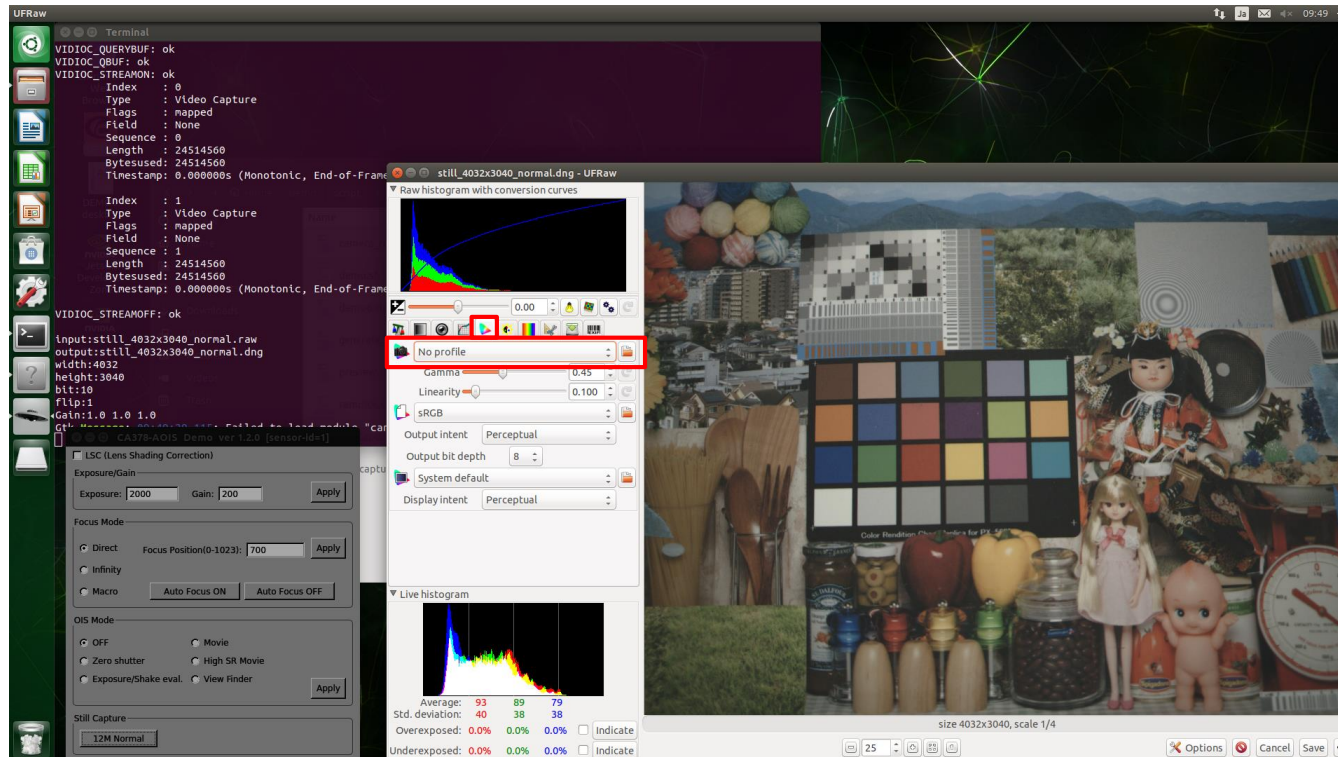# 5.2. 12Mpixel still image capturing

Procedure of capturing 12Mpixel still image:
1. Adjust the focus.
   (It is useful to turn on Auto Focus and turn Auto Focus OFF when focus is on)
2. Click the [12M Normal] button
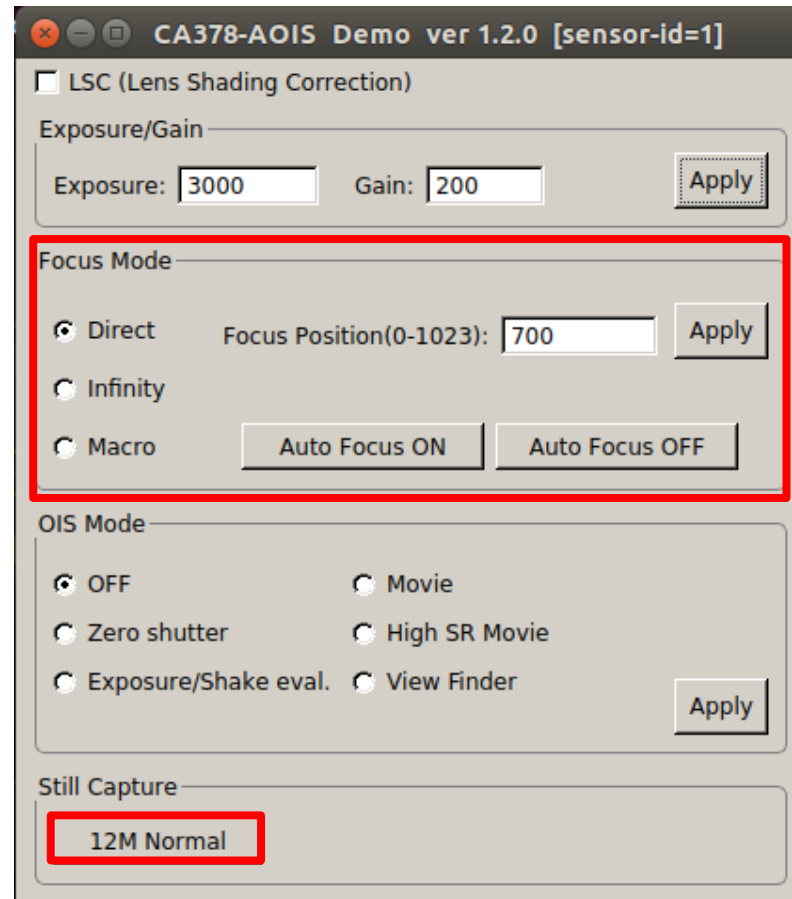
5.2. 12Mpixel still image capturing

3. Images can be captured in RAW and DNG format.
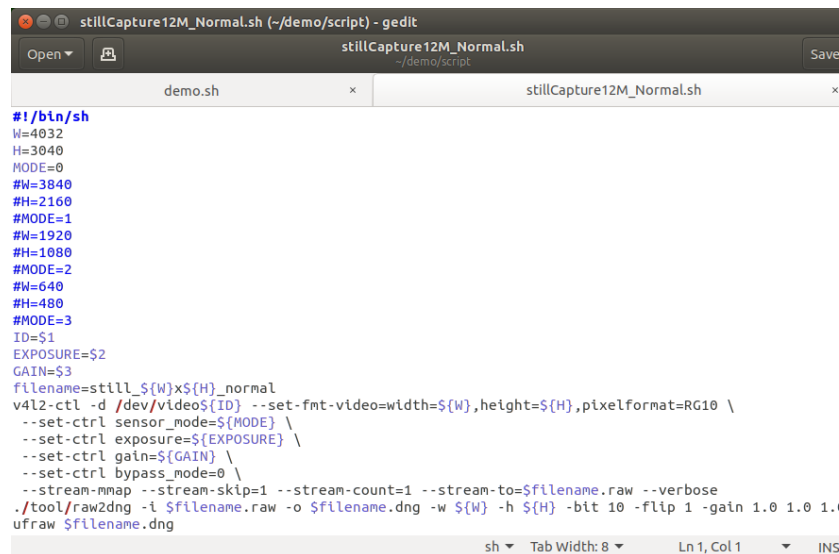4. Set the camera profile for color management to No profile.

5.3. Capture image

To capture an image by specifying the image size, change the Still script and press the app's capture button, or execute the capture command.

Still script
~/demo/script/stillCapture12M_Normal.sh

Capture command

```
#v4l2-ctl -d /dev/video0 --set-fmt-video=width=[Width],height=[Height],pixelformat=RG10 ¥
--set-ctrl sensor_mode=[Mode] ¥
--set-ctrl exposure=1000 ¥
--set-ctrl gain=200 ¥
--set-ctrl bypass_mode=0 ¥
--stream-mmap --stream-skip=1 --stream-count=1 --stream-to=image.raw --verbose
```

Setting	Parameter
4032x3040	Width=4032, Height=3040, Mode=0
3840x2160	Width=3840, Height=2160, Mode=1
1920x1080	Width=1920, Height=1080, Mode=2
640x480	Width=640, Height=480, Mode=3

5.4. Movie recording

Secure recording memory area

```
#cd ~/demo/script/
#./ramdisk.sh
```

Movie capture(yuv)

```
#cd ~/demo/script/
#./yuv_capture.sh /mnt/ram/test 0 4032 3040 30 60
```

Argument	Description
arg1	Movie file name
arg2	Sensor id(Specify 0)
arg3	Width
arg4	Height
arg5	Fps
arg6	Capture frame num

Movie viewer(yuv)

```
#cd ~/demo/script/
#./yuv_viewer.sh /mnt/ram/test0.yuv 4032 3040 30
```

Argument	Description
arg1	Movie file path
arg2	Width
arg3	Height
arg4	Fps

Appendix

CenturyArks Co., Ltd.

The following section describes the directory structure of the software.

```
demo
├──appicon.png
├──Install.sh
│
├──bin
│    demo.ini
│    DemoGUI
│    preview
│
├──script
│    demo.sh
│    demo6.sh
│    preview.sh
│    ramdisk.sh
│    stillCapture12M_Normal.sh
│    yuv_capture.sh
│    yuv_viewer.sh
│
├──src
│    af_control.c
│    af_control.h
│    communication.h
│    communication_jetson.c
│    debug_util.h
│    demo_control.c
│    demo_control.h
│    DemoGUI.pro
│    lsc_control.c
│    lsc_control.h
│    main.cpp
│    mainwindow.cpp
│    mainwindow.h
│    mainwindow.ui
│    Makefile
│    ois_control.c
│    ois_control.h
│    slave_address.h
│    types_util.h
│
└──tool
     Makefile
     preview.c
     raw2dng
     raw2dng.c
     raw2hdr
     raw2hdr.c
     tools.h
```

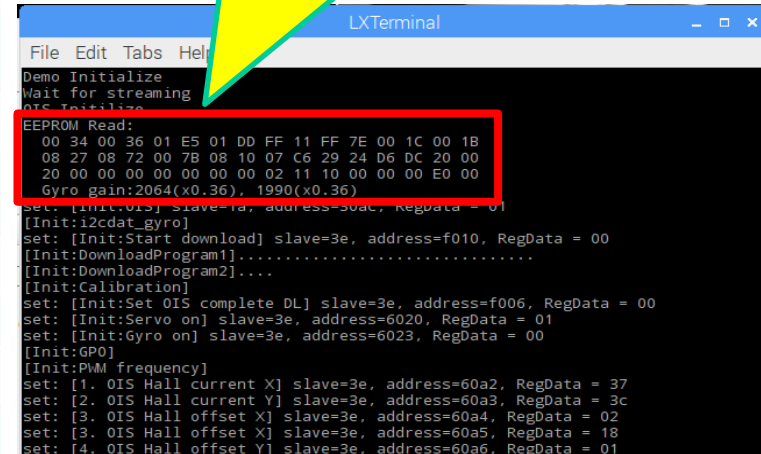| Function	Description
bin	DemoGUI: Demonstration software Demo.ini: Demonstration software setting file
script	Script files are described. It can be customized according to specifications. 　demo.sh 　preview.sh 　stillCapture12M_Normal.sh
src	It is a set of demo software source code.
tool	Image file conversion tools are described.

A.2. About the setting file

CenturyArks Co., Ltd.

The following section describes the "demo.ini" of the setting file.

```
# DEMO Setting
preview = /home/pi/demo/script/preview.sh
stillCapture12M_Normal = /home/pi/demo/script/stillCapture12M_Normal.sh
gyroGainRateX=1.00
gyroGainRateY=1.00
autoFocusGain=2.0
autoFocusConfidenceThreshold=10
autoFocusMoveLimit=100
AutoFocusAverageNum=1
Exposure=1000
Gain=200
```

Function	Description
preview	Script path for preview
stillCapture12M_Normal	Script path for capturing 12M normal still images
gyroGainRateX gyroGainRateY	It is valid only when OIS calibration result is written in EEPROM.
autoFocusGain	Adjust the autofocus gain.
autoFocusConfidenceThreshold	Specify the threshold value of the confidence level of Phase Difference.
autoFocusMoveLimit	Limit the amount of focus movement at one time.
AutoFocusAverageNum	Adjust the average amount of autofocus.
Exposure	Adjust the exposure time.
Gain	Adjust the gain.

If OIS calibration is already done,
The following log is output to Terminal.