

CA378-AOIS for TinkerBoard Software Setup Guide

Version 1.0.0

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

Date	Version	Comment
2019/10/25	v1.0.0	Initial Release

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1. Notes

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

Hardware :TinkerBoard

OS :TinkerOS Debian9 v2.0.8

CSI Hardware :CenturyArks CA378-AOIS(Sony IMX378)

2. Environment configuration

There are two types of environment construction procedures.

1: Procedure for using kernel, driver and software installed TinkerOS image.

2: Manual installation procedure of kernel, driver and demo software.

2.1. Procedure for using kernel, driver and software installed TinkerOS image.

OS: TinkerOS Debian9 v2.0.8(Kernel v4.4.132)

Demo soft: v1.0.0

(1-1) Please download the following image.

https://www.centuryarks.com/images/product/sensor/2019-10-25-tinkeros-v1.0.0_CA378-AOIS.zip

(1-2) Write the image file to the SD card. For windows win32diskimager, for Linux balenaEtcher.

(1-3) Start Tinker board.

ID: linaro

PASSWORD: linaro

(1-4) This image file contains the kernel, drivers, and demo software, so the steps up to Chapter 4 are not necessary.

2. Environment configuration

2.2. Manual installation procedure of kernel, driver and demo software.

(2-1) Download and write TinkerOS image to SD card.

https://github.com/TinkerBoard/debian_kernel/releases/download/2.0.8/20181023-tinker-board-linaro-stretch-alip-v2.0.8.img.zip

(2-2) Start Tinker board.

ID:linaro

PASSWORD:linaro

3. Driver install

- Prerequisites

1. Prepare kernel source
2. Build and install new Linux kernel

Step 1. Prepare kernel source

Download the attached file to home directory on Tinker board and run the following command.

[https://github.com/centuryarks/CA378-AOIS/releases/download/TINKER_v1.0.0_v4.4.132\(Debian9_v2.0.8\)/CA378_v1.0.0_TinkerOS_Debian_v2.0.8_src_build.tar.gz](https://github.com/centuryarks/CA378-AOIS/releases/download/TINKER_v1.0.0_v4.4.132(Debian9_v2.0.8)/CA378_v1.0.0_TinkerOS_Debian_v2.0.8_src_build.tar.gz)

```
# tar -zxvf CA378_v1.0.0_TinkerOS_Debian9_v2.0.8_src_build.tar.gz
# cd CA378_v1.0.0_TinkerOS_Debian9_v2.0.8_src_build
# ./PrepareKernelSources.sh
```

Step 2. Build and install new Linux kernel

Build and install kernel module with the following command

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

Reboot

```
# sudo reboot
```

4. Software install

Please install by the following procedure.

- Installation procedure

1. Download “demo_v1.0.0_tinker.tar.gz” from the following site.

[https://github.com/centuryarks/Sample/releases/download/TINKER_v1.0.0_v4.4.132\(Debian9_v2.0.8\)/demo_v1.0.0_tinker.tar.gz](https://github.com/centuryarks/Sample/releases/download/TINKER_v1.0.0_v4.4.132(Debian9_v2.0.8)/demo_v1.0.0_tinker.tar.gz)

```
# wget --no-check-certificate ¥  
“https://github.com/centuryarks/Sample/releases/download/TINKER_v1.0.0_v4.4.132(Debian9_v2.0.8)/demo_v1.0.0_tinker.tar.gz”
```

2. Unzip “demo_v1.0.0_tinker.tar.gz” file.

```
# tar -zxvf demo_v1.0.0_tinker.tar.gz
```

3. Execute “Install.sh” in the extracted folder.

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

4. A shortcut is created on the desktop.

DEMO



5. Demonstration functions

5.1. Focus & OIS

5.2. 4K3K-resolution(12Mpixel) still image capturing

5.3. Capture image

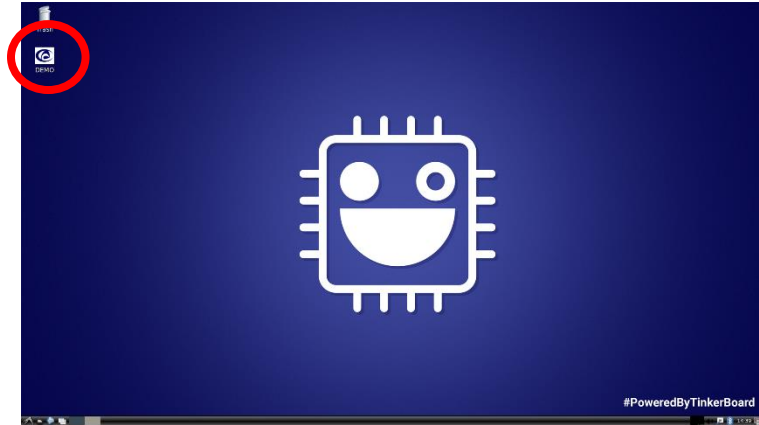
5.4. Movie recording

5.5. Build demo software

5.1. Focus & OIS

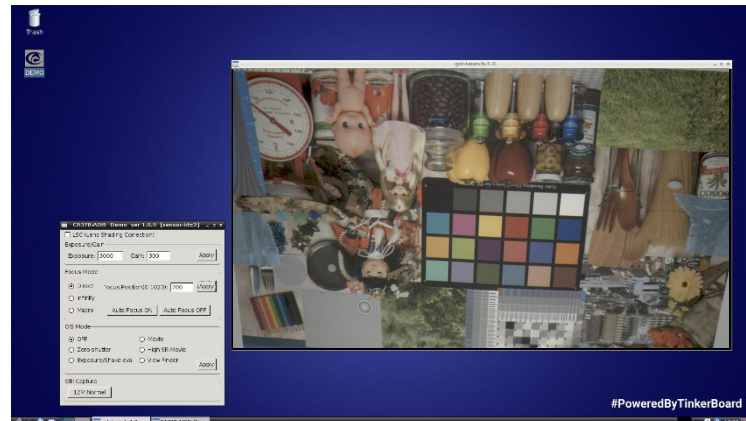
Procedure of starting Focus & OIS:

1. Click "DEMO" on the desktop.



2. Please change the distance of the object, or move the camera, confirm the function.

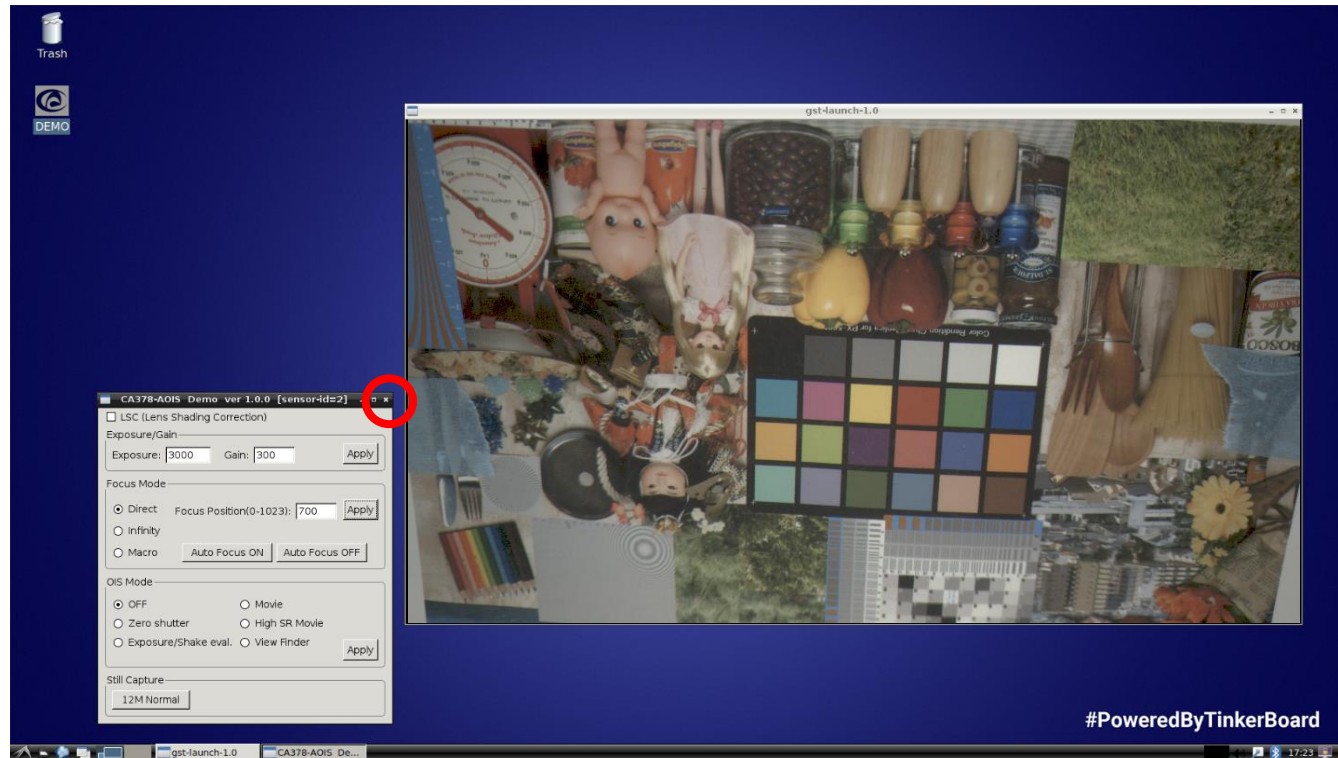
* For details of functions, refer to page 12.



5.1. Focus & OIS

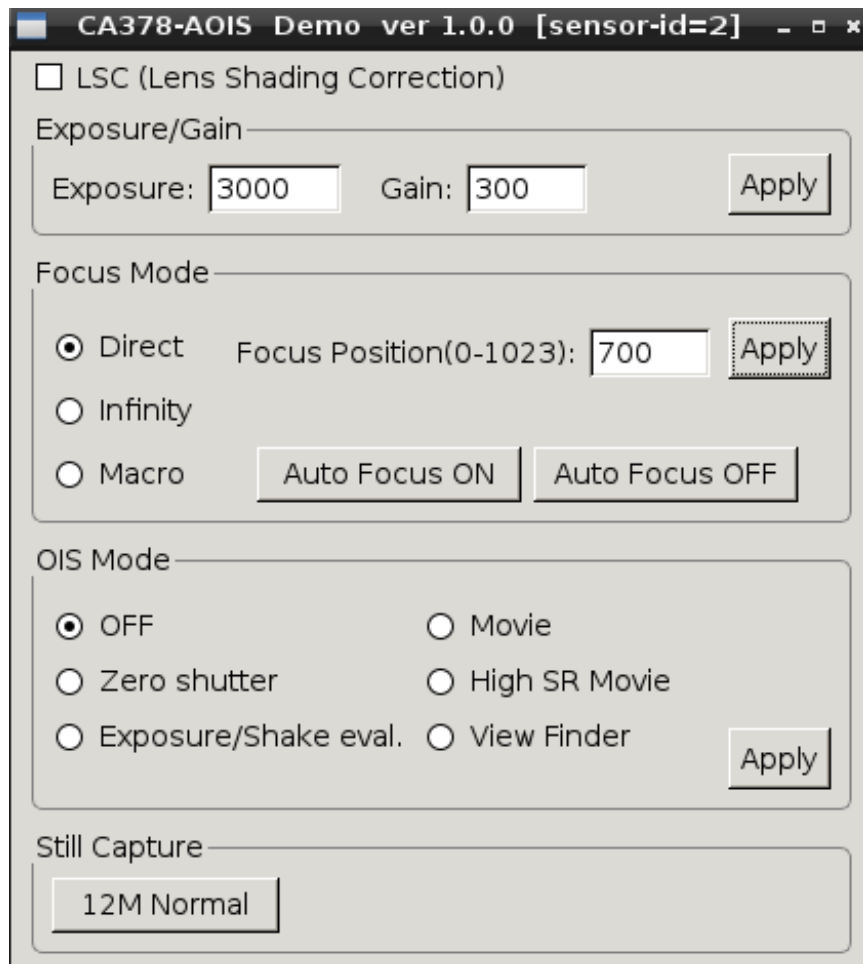
Procedure of finishing Focus & OIS:

1. Click the [x]



5.1. Focus & OIS

The following section describes each function of Focus & OIS.



CA378-AOIS Demo ver 1.0.0 [sensor-id=2]

☐ LSC (Lens Shading Correction)

Exposure/Gain

Exposure: Gain:

Focus Mode

☒ Direct Focus Position(0-1023):

☐ Infinity

☐ Macro

OIS Mode

☒ OFF ☐ Movie

☐ Zero shutter ☐ High SR Movie

☐ Exposure/Shake eval. ☐ View Finder

Still Capture

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.

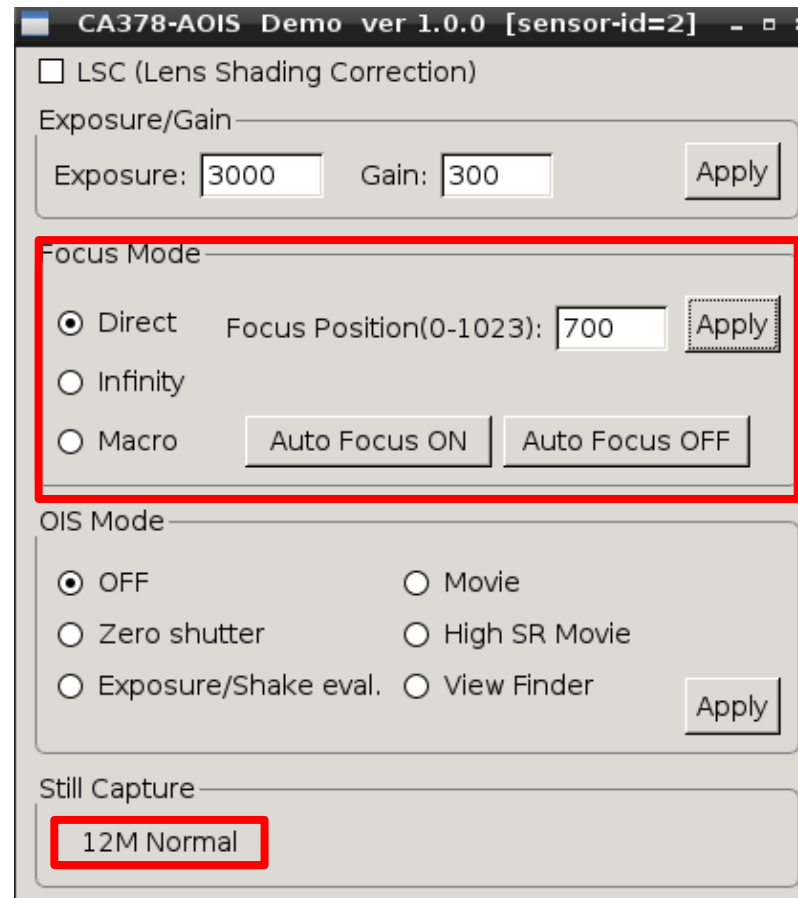
5.2. 12Mpixel still image capturing

Procedure of capturing 12Mpixel still image:

1. Adjust the focus.

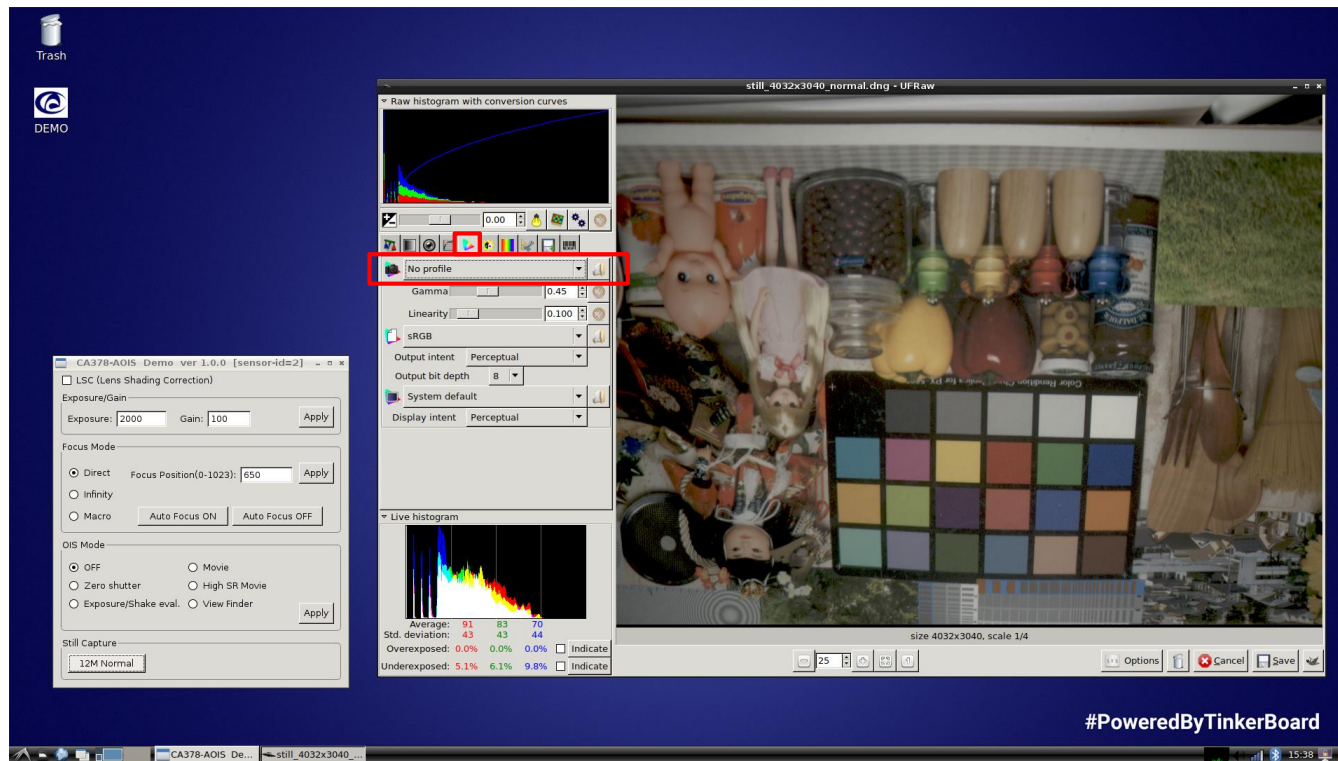
(It is useful to turn on Auto Focus and turn Auto Focus OFF when focus is on)

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

```
stillCapture12M_Normal.sh
#!/bin/sh
cd /home/linaro/demo
#W=1920
#H=1080
#media-ctl -d /dev/media0 --set-v4l2 "imx378 2-001a":0[fmt:SBGGR10/1920x1080]'
#media-ctl -d /dev/media0 --set-v4l2 "rkisp1-isp-subdev":0[fmt:SBGGR10/1920x1080]' #sink
#media-ctl -d /dev/media0 --set-v4l2 "rkisp1-isp-subdev":0[fmt:SBGGR10/1920x1080]' --set
#media-ctl -d /dev/media0 --set-v4l2 "rkisp1-isp-subdev":2[fmt:SBGGR10/1920x1080]' #sour
#media-ctl -d /dev/media0 --set-v4l2 "rkisp1-isp-subdev":2[fmt:SBGGR10/1920x1080]' --set
#W=3840
#H=2160
#media-ctl -d /dev/media0 --set-v4l2 "imx378 2-001a":0[fmt:SBGGR10/3840x2160]'
#media-ctl -d /dev/media0 --set-v4l2 "rkisp1-isp-subdev":0[fmt:SBGGR10/3840x2160]' #sink
#media-ctl -d /dev/media0 --set-v4l2 "rkisp1-isp-subdev":0[fmt:SBGGR10/3840x2160]' --set
#media-ctl -d /dev/media0 --set-v4l2 "rkisp1-isp-subdev":2[fmt:SBGGR10/3840x2160]' #sour
#media-ctl -d /dev/media0 --set-v4l2 "rkisp1-isp-subdev":2[fmt:SBGGR10/3840x2160]' --set
#W=4032
#H=3040
#media-ctl -d /dev/media0 --set-v4l2 "imx378 2-001a":0[fmt:SBGGR10_1X10/4032x3040]'
#media-ctl -d /dev/media0 --set-v4l2 "rkisp1-isp-subdev":0[fmt:SBGGR10_1X10/4032x3040]' #
#media-ctl -d /dev/media0 --set-v4l2 "rkisp1-isp-subdev":0[fmt:SBGGR10_1X10/4032x3040]' -
#media-ctl -d /dev/media0 --set-v4l2 "rkisp1-isp-subdev":2[fmt:SBGGR10_1X10/4032x3040]' #
#media-ctl -d /dev/media0 --set-v4l2 "rkisp1-isp-subdev":2[fmt:SBGGR10_1X10/4032x3040]' -
filename=still ${W}x${H}_normal
v4l2-ctl -d /dev/video1 --set-ctrl exposure=${2} --set-ctrl gain=${3} --set-selection=target
./bin/raw2dng -i $filename.raw -o $filename.dng -w ${W} -h ${H} -bit 10 -gain 1.0 1.0 1.0
ufraw $filename.dng
```

Capture command

```
# v4l2-ctl -d /dev/video1
--set-ctrl exposure=2000
--set-ctrl gain=200
--set-selection=target=crop,top=0,left=0,width=4032,height=3040
--set-fmt-video=width=4032,height=3040,pixelformat=BG10
--stream-mmap=8 --stream-to=temp.raw --stream-count=1
```

Setting	Parameter
4032x3040	Width=4032, Height=3040
3840x2160	Width=3840, Height=2160
1920x1080	Width=1920, Height=1080

5.4. Movie recording

Secure recording memory area

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

Movie capture(mp4)

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

Movie viewer(mp4)

```
# cd ~/demo/script/  
# mplayer -fps 1 /mnt/ram/VGA.mp4
```


5.5. Build demo software

Procedure of build software

```
# cd ~/demo/src/  
# ./MakeDomo.sh  
# mv GUI/DemoGUI /home/linaro/demo/bin
```

✕If an error occurs with qmake, install it with the following command.

```
# sudo apt install qt4-default
```

Appendix

A.1. About the directory structure

The following section describes the directory structure of the software.

```
demo
├── appicon.png
├── Install.sh
├── bin
│   ├── demo.ini
│   ├── DemoGUI
│   ├── raw2dng
│   └── raw2hdr
├── script
│   ├── capture_VGA.sh
│   ├── demo.sh
│   ├── IMX378_1022.xml
│   ├── preview.sh
│   ├── ramdisk.sh
│   ├── stillCapture12M_Normal.sh
│   ├── test_camera_1920.sh
│   ├── test_camera_3840.sh
│   └── test_camera_4032.sh
├── src
│   ├── GUI
│   │   ├── af_control.c
│   │   ├── af_control.h
│   │   ├── communication.h
│   │   ├── communication_tinker.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
│   │   ├── libtiff.patch
│   │   ├── Makefile
│   │   ├── raw2dng.c
│   │   ├── raw2hdr.c
│   │   └── tools.h
│   └── MakeDemo.sh
```

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.

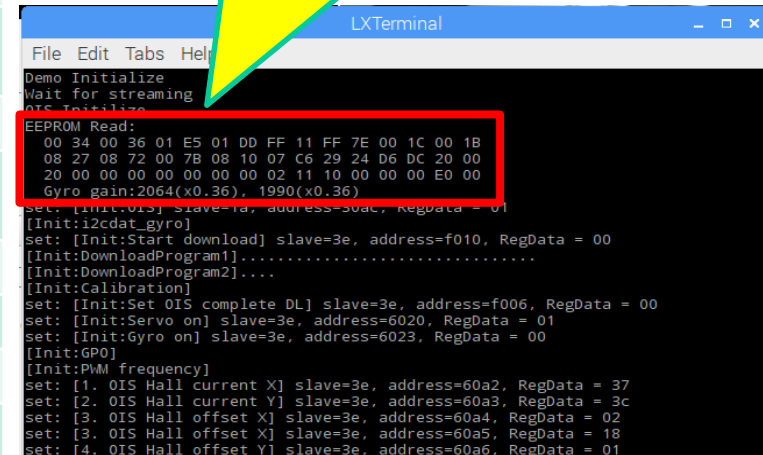
A.2. About the setting file

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

```
# DEMO Setting
preview = /home/linaro/demo/script/preview.sh
stillCapture12M_Normal = /home/linaro/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.



```
LXTerminal
File Edit Tabs Help
Demo Initialize
Wait for streaming
OIS Initialize
EEPROM Read:
00 34 00 36 01 E5 01 DD FF 11 FF 7E 00 1C 00 1B
08 27 08 72 00 78 08 10 07 C6 29 24 D6 DC 20 00
20 00 00 00 00 00 00 02 11 10 00 00 00 E0 00
Gyro_gain:2064(x0.36), 1990(x0.36)
set: [Init:OIS] slave=3e, address=30ac, RegData = 01
[Init:i2cdat_gyro]
set: [Init:Start download] slave=3e, address=f010, RegData = 00
[Init:DownloadProgram1].....
[Init:DownloadProgram2]....
[Init:Calibration]
set: [Init:Set OIS complete DL] slave=3e, address=f006, RegData = 00
set: [Init:Servo on] slave=3e, address=6020, RegData = 01
set: [Init:Gyro on] slave=3e, address=6023, RegData = 00
[Init:GPO]
[Init:PMM frequency]
set: [1. OIS Hall current X] slave=3e, address=60a2, RegData = 37
set: [2. OIS Hall current Y] slave=3e, address=60a3, RegData = 3c
set: [3. OIS Hall offset X] slave=3e, address=60a4, RegData = 02
set: [3. OIS Hall offset X] slave=3e, address=60a5, RegData = 18
set: [4. OIS Hall offset Y] slave=3e, address=60a6, RegData = 01
```