CA378-AOIS for Raspberry Pi 4 Software Setup Guide

Version 1.0.0

Dated: 2023/06/22

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

History

CenturyArks Co., Ltd.

Date	Version	Comment
2023/06/22	v1.0.0	Initial Release

Contents

1. Environment configuration

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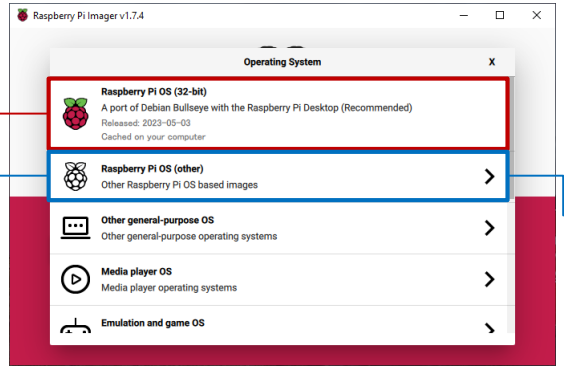
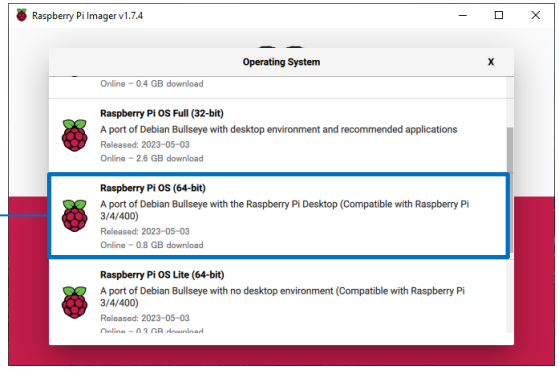
1.1. Environment setup

Raspberry Pi 4 Model B
- Raspberry Pi OS with desktop
- Release date: May 3rd 2023
- System: 32-bit
  64-bit
- Kernel version: 6.1
- Debian version: 11 (bullseye)





(1-1) Install Raspberry Pi OS using Raspberry Pi Imager.
https://www.raspberrypi.com/software/

(1-2) Follow the Installing the Operating System.
https://www.raspberrypi.com/documentation/computers/getting-started.html

(1-3) Insert the Micro SD card into the Raspberry Pi 4 Model B and boot.

1. Environment configuration

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* Since the architecture and bitness do not match, please follow the steps below for a 32-bit OS.

Add the following line to the end of the /boot/config.txt file.

```
arm_64bit=0
```

Restart with the following command after setting.

```
$ sudo reboot
```

Before execution

```
$ arch
aarch64
$ getconf LONG_BIT
32
```

After execution

```
$ arch
armv7l
$ getconf LONG_BIT
32
```

1. Environment configuration

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(2-1) Extract the setup script to your home directory.

```
$ tar zxvf demo_v1.0.0_pi4_setup_script.tar.gz
$ cd demo_v1.0.0_pi4_setup_script
```

(2-2) Run the setup script as follows.
Reboot after running.

```
$ ./setup.sh
```

Setup contents

- Install WiringPi(Library for controlling GPIO).
- Install demo software.
- Download, patch and build the kernel of the 1.20230405 branch.
- Edit the /boot/config.txt file.

2. Demonstration functions

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2.1. Focus & OIS & Camera control
2.2. Still image capturing

3.1. Focus & OIS & Camera control

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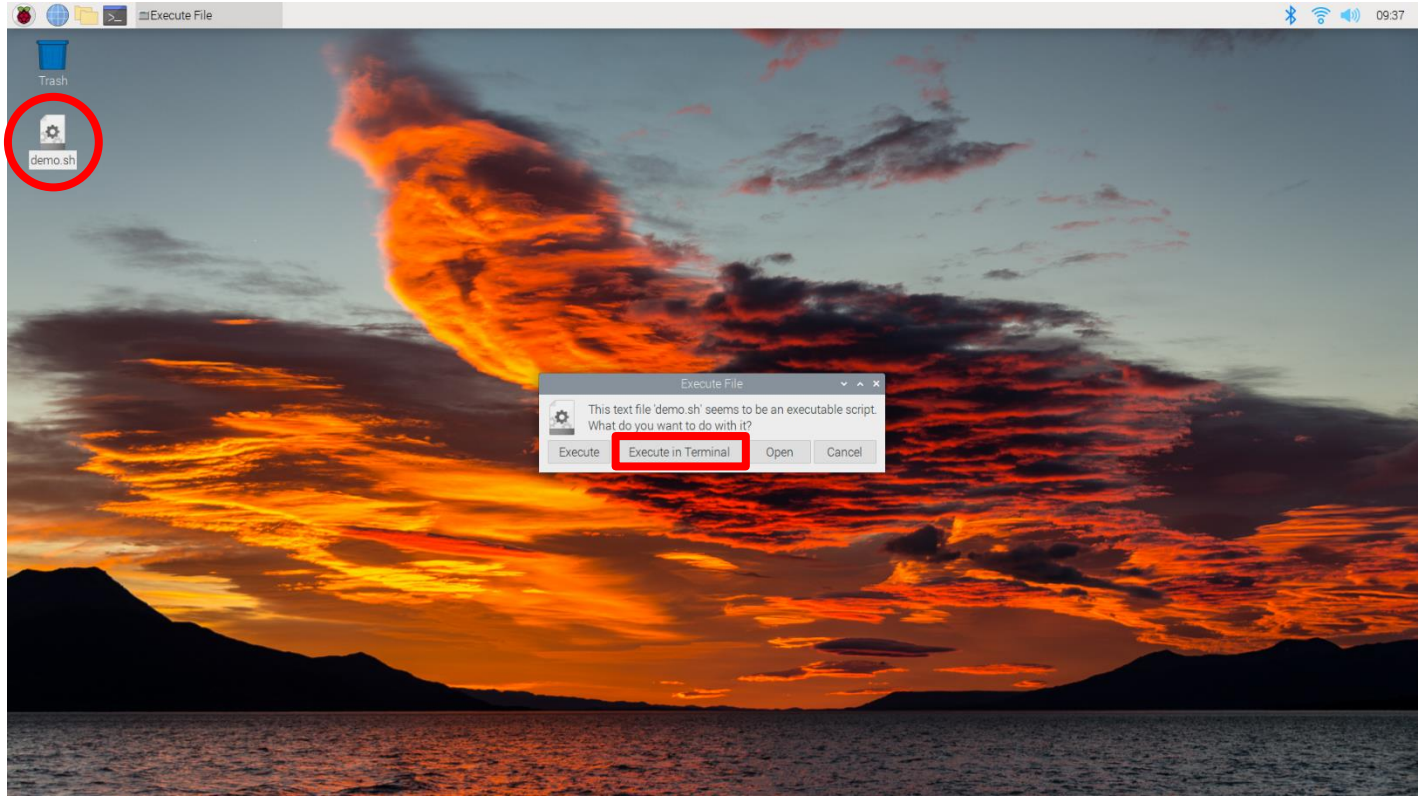
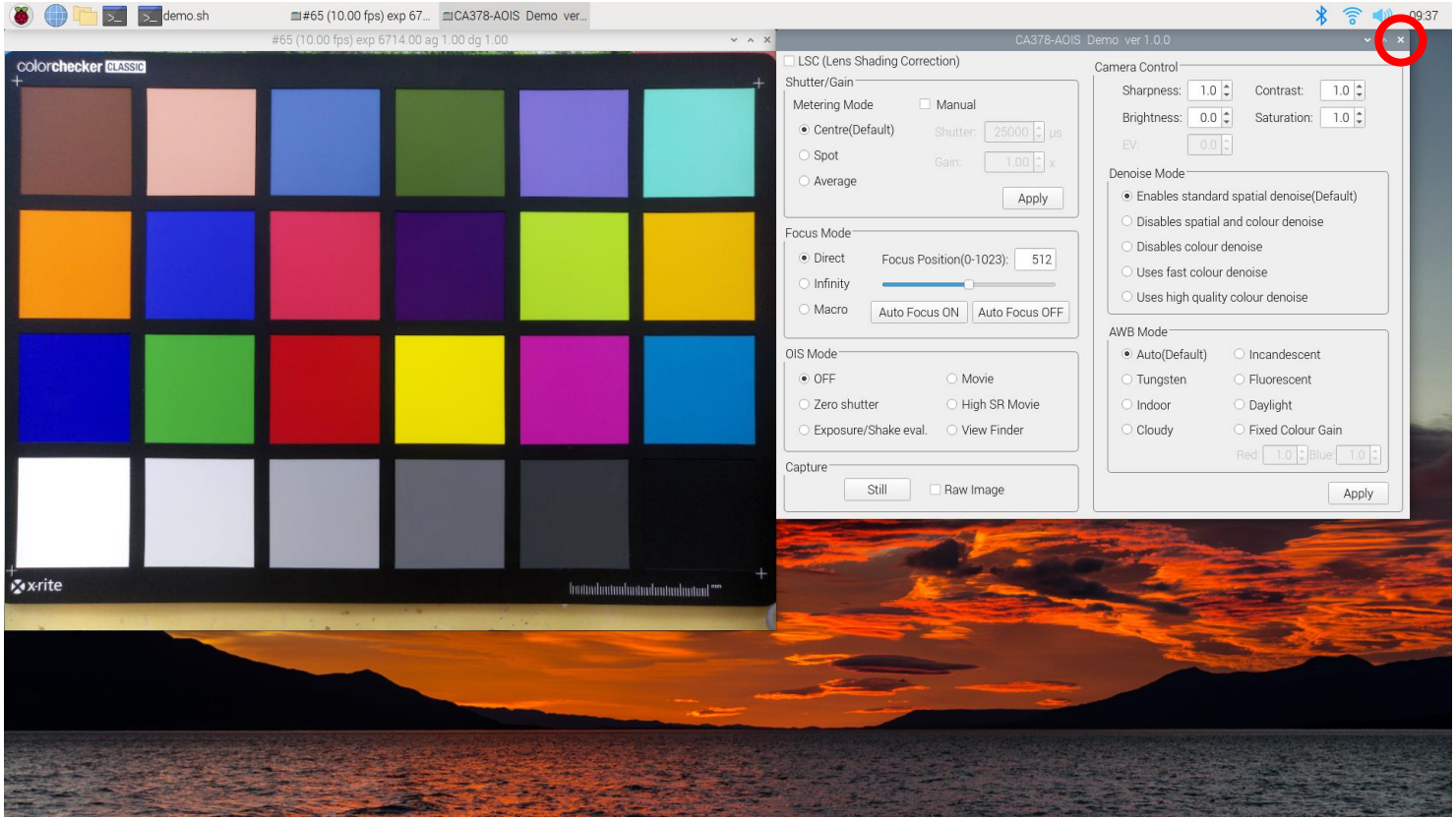
Procedure of starting Focus & OIS:
1. Click "demo.sh" on the desktop.
2. Click [Execute in Terminal].
3. After a while the GUI screen will be displayed.
4. Please change the distance of the object, or move the camera, confirm the function.
   * For details of functions, refer to page 10-12.



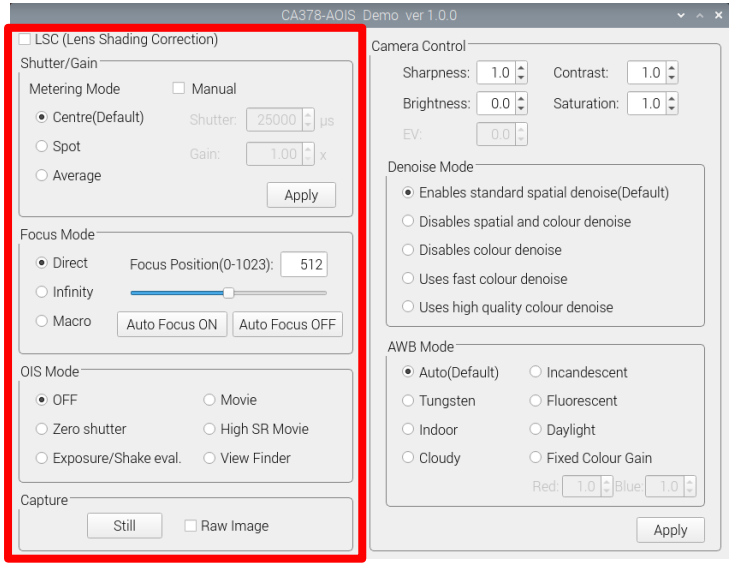
3.1. Focus & OIS & Camera control

Procedure of finishing Focus & OIS:
1. Click the [x]



3.1. Focus & OIS & Camera control

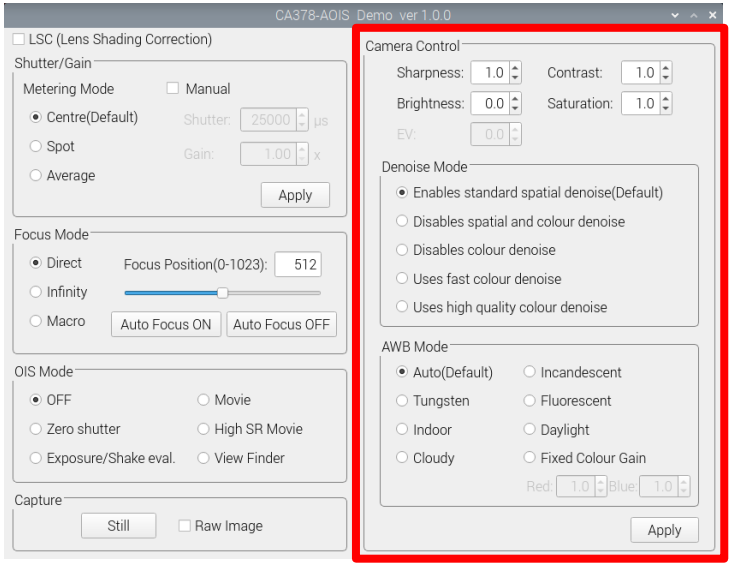
The following section describes each function of Focus & OIS.



Function	Description
LSC	Check to enable shading correction. ※ Theoretical values have been set.
Shutter/Gain	Metering Mode: Select the Sets the metering mode of the AEC/AGC algorithm. Shutter: Specify the shutter speed (microseconds). The maximum value depends on the length of frame. Gain: Specify the combined analogue and digital gains. * It may not match the value specified in the libcamera-apps command line option.
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. 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
Capture	Still: Capture normal still image (JPEG format). Raw Image: Save a raw Bayer file in DNG format alongside the usual output image.

3.1. Focus & OIS & Camera control

The following section describes each function of Camera control.



Function	Description
Sharpness	The given number adjusts the image sharpness.
Contrast	The given number adjusts the image contrast.
Brightness	The given number adjusts the image brightness.
Saturation	The given number adjusts the colour saturation.
EV	Sets the EV compensation of the image in units of stops, in the range -10 to 10.
Denoise Mode	Select the denoise mode. It corresponds to each denoise mode. Enables standard spatial denoise. It uses extra fast colour denoise for video, and high quality colour denoise for stills capture. Preview does not enable any extra colour denoise at all. Disables spatial and colour denoise. Disables colour denoise. Uses fast color denoise. Uses high quality colour denoise.
AWB Mode	Select the AWB mode. This option sets the AWB algorithm into the named AWB mode. If you select Fixed colour gain, specify the red and blue gains.

* The shutter/gain and camera control functions each correspond to libcamera-apps command line options.
https://www.raspberrypi.com/documentation/computers/camera_software.html#camera-control

3.1. Focus & OIS & Camera control

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Description of the script file:
It describes about the “script/preview.sh".

```
#!/bin/sh
cd /home/pi/demo
libcamera-hello -t 0 --viewfinder-width ${1} --viewfinder-height ${2} --framerate ${3} --tuning-file ${4} ${5}
```

libcamera-hello
https://www.raspberrypi.com/documentation/computers/camera_software.html#libcamera-hello

Option	Description
-t or --timeout	Delay before application stops automatically <milliseconds> The value zero causes the application to run indefinitely.
--viewfinder-width ${1}*	Capture image width
--viewfinder-height ${2}*	Capture image height
--framerate ${3}*	Frame rate
--tuning-file ${4}	Tuning file (json format) specified in the demo.ini configuration file
${5}	Options set with values selected/entered in the GUI

https://www.raspberrypi.com/documentation/computers/camera_software.html#common-command-line-options

* The argument of the script file will be the argument specified in demo.sh.

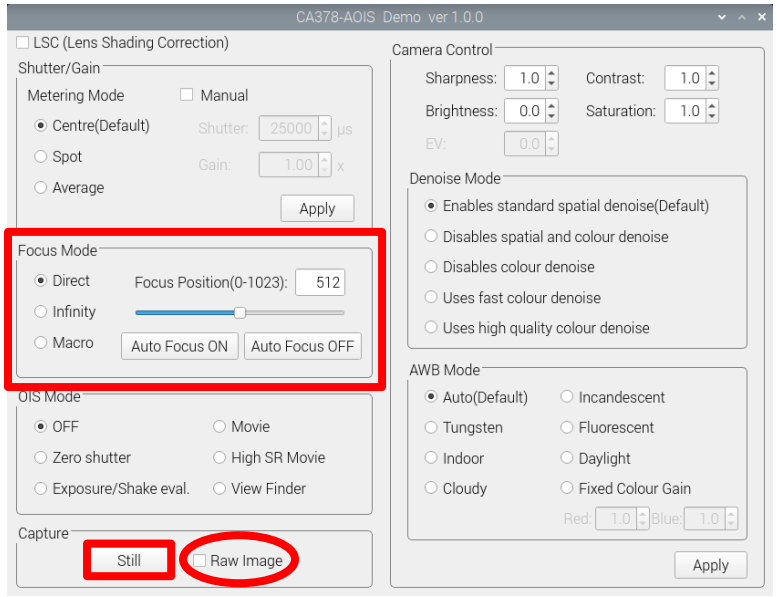
```
#!/bin/sh
cd /home/pi/demo
./bin/DemoGUI -w 4056 -h 3040 -fps 10
```

The following Bayer modes are currently available:
4056x3040 12-bit @ 10fps
2028x1520 12-bit (binned) @ 40fps
2028x1050 12-bit (cropped/binned) @ 50fps

3.2. Still image capturing

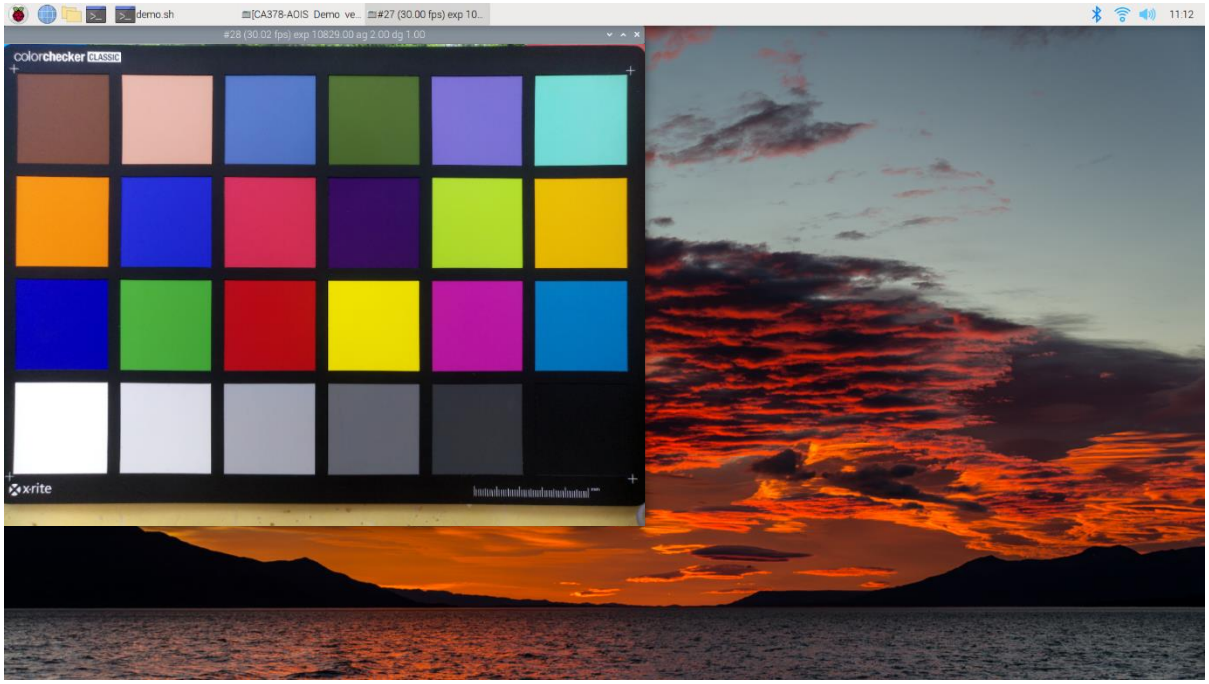
Procedure of capturing still image:

1. Adjust the focus.
   (It is useful to turn on Auto Focus and turn Auto Focus OFF when focus is on)
2. Click the [Still] button
   If you want to save a Raw image (DNG format) at the same time, check the [Raw Image] checkbox.



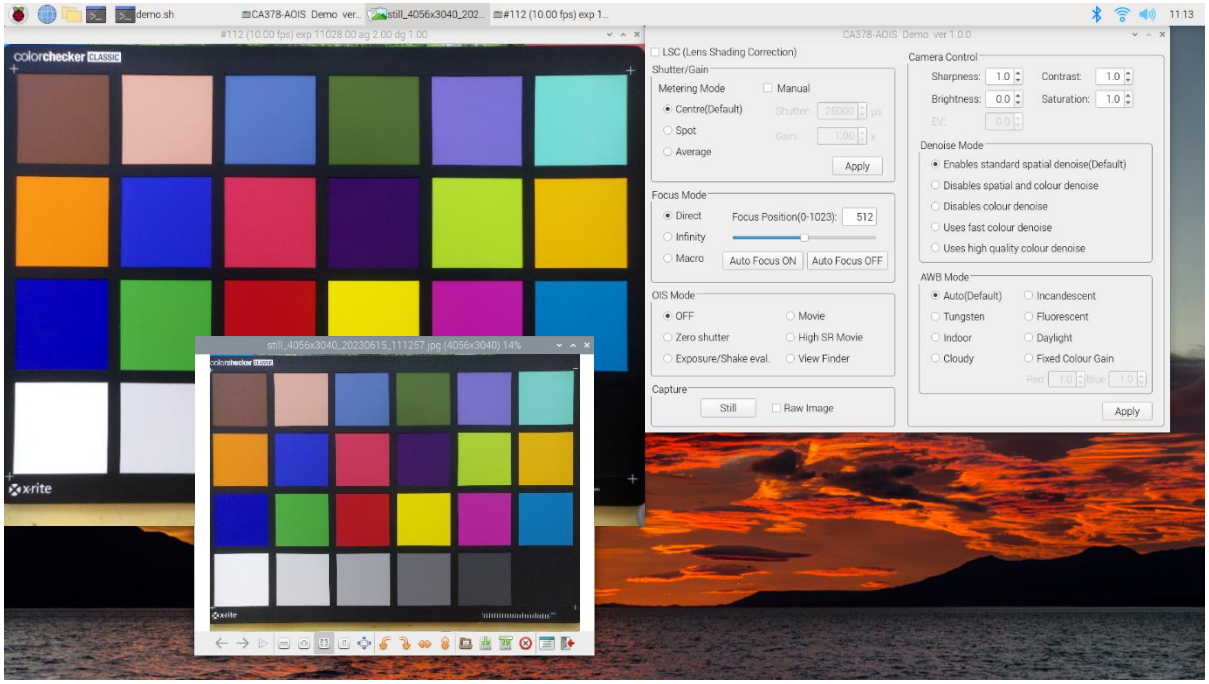
3.2. Still image capturing

3. Wait until the still image capturing is finished.

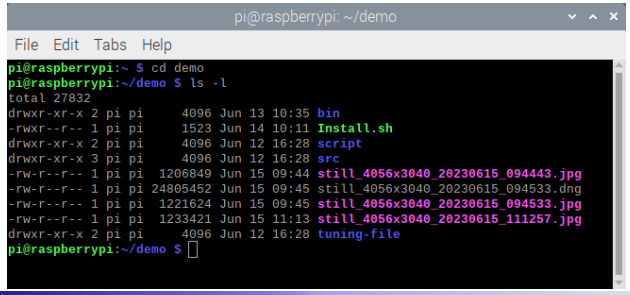


3.2. Still image capturing

4. When the still image capturing is finished, the preview display is restored.



5. Still images are saved in the demo directory.



3.2. Still image capturing

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Description of the script file:
It describes about the “script/stillCapture.sh".

```
#!/bin/sh
cd /home/pi/demo
DATETIME=`date "+%Y%m%d_%H%M%S"`
FILENAME=still_${1}x${2}_${DATETIME}
libcamera-still --width ${1} --height ${2} -o ${FILENAME}.jpg --tuning-file ${3} ${4}
gpicview ${FILENAME}.jpg &
```

libcamera-still
https://www.raspberrypi.com/documentation/computers/camera_software.html#libcamera-still

Option	Description
--width ${1}*	Capture image width
--height ${2}*	Capture image height
-o or –output	Output file name
--tuning-file ${3}	Tuning file (json format) specified in the demo.ini configuration file
${4}	Options set with values selected/entered in the GUI

https://www.raspberrypi.com/documentation/computers/camera_software.html#common-command-line-options

* The argument of the script file will be the argument specified in demo.sh.

```
#!/bin/sh
cd /home/pi/demo
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The following Bayer modes are currently available:
4056x3040 12-bit @ 10fps
2028x1520 12-bit (binned) @ 40fps
2028x1050 12-bit (cropped/binned) @ 50fps

Appendix

A.1. About the directory structure

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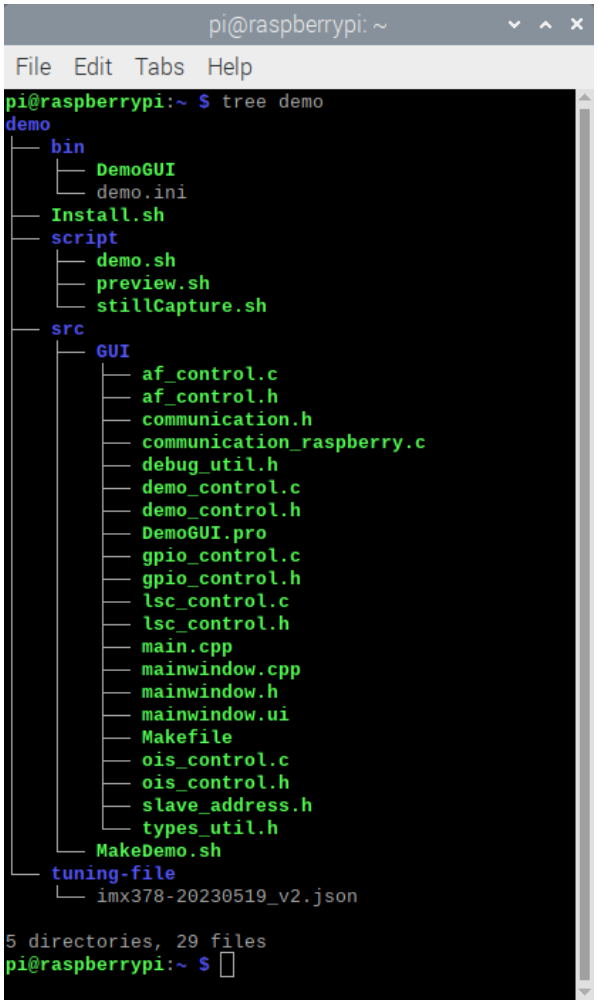
The following section describes the directory structure of the software.



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 stillCapture.sh
src	It is a set of demo software source code.
tuning-file	It is a tuning file (json format).

https://www.raspberrypi.com/documentation/computers/camera_software.html#the-camera-tuning-file

A.2. About the setting file

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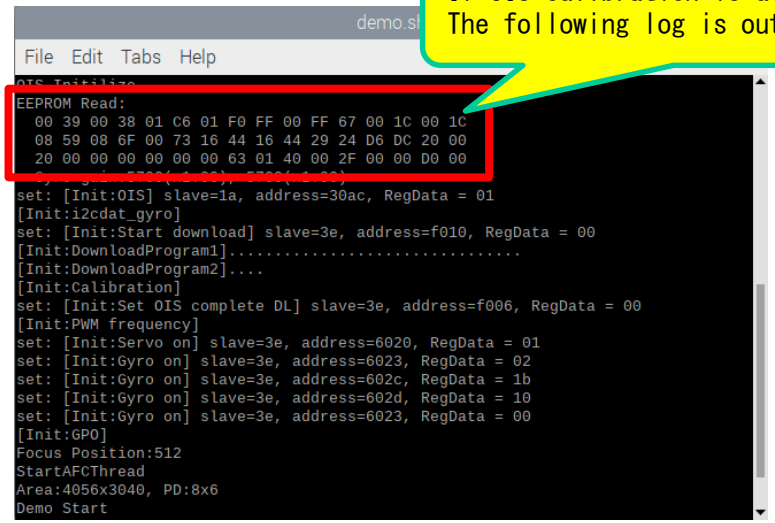
The following section describes the "demo.ini" of the setting file.

```
# DEMO Setting
preview=/home/pi/demo/script/preview.sh
stillCapture=/home/pi/demo/script/stillCapture.sh
tuning-file=/home/pi/demo/tuning-file/imx378-20230519_v2.json
gyroGainRateX=1.00
gyroGainRateY=1.00
autoFocusGain=2.0
autoFocusConfidenceThreshold=10
autoFocusMoveLimit=100
autoFocusFrameSyncMode=1
gain=1.0
shutter=20000
FocusControlMode=0
UseCenter4PointsOfPDdata=1
```

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



Function	Description
preview	Script path for preview
stillCapture	Script path for capturing still images
tuning-file	Tuning file (json format) path
gyroGainRateX gyroGainRateY	It is valid only when OIS calibration result is written in EEPROM. Currently, since the value of Gyro gain is too effective, the rate is adjusted.
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.
autoFocusFrameSyncMode	0: Frame async 1: Frame sync(Use XVS/GPIO)*
gain	Specify the combined analogue and digital gains.
shutter	Specify the shutter speed.
FocusControlMode	0 : CLAF Calibration mode 1 : CLAF Servo ON(for CA378-AOIS-C)
UseCenter4PointsOfPDdata	0: Read all PD data 1: Read PD data at the center 4 points

* A wire connection to GPIO is required hen synchronizing to the XVS signal.