Product Document

Published by
ams OSRAM Group

User Guide

UG000473

JetCis_130

User Guide

EVK with NVIDIA Jetson

v2-01 • 2020-Aug-10

Content Guide

1 Introduction

This is a user guide about the JetCis_130 which is a platform to evaluate the Mira130 sensor. The kit is built on top of an NVIDIA Jetson developer kit. The purpose of this guide is not to explain the sensor functionality, nor will it replace the NVIDIA Jetson manual. For that purpose, please refer to the appropriate datasheet/manual. The goal of this document is to get started quickly with this evaluation kit, to connect the camera board to the NVIDIA Jetson, to explain the GUI and how to take pictures with the kit. The EVK does not need an external computer to be operated, instead the NVIDIA Jetson runs GNU/Linux Ubuntu.

1.1 Kit Content

The kit contains:

- NVIDIA Jetson TX2 or NVIDIA Jetson Nano
- Interposer board (only applicable for NVIDIA Jetson TX2)
- Sensor board with lens, lens holder, VCSEL
- Connector cable for sensor board
- Tripod with adaptor for sensor board mounting
- Power supply EU/UK
- Flash drive with documentation
- HDMI cable

1.2 Ordering Information

Ordering Code	Description
JetCis_130_EK	JetCis_130

2 Getting Started

First, check if all items listed in the previous chapter are in the box.

Add the following additional items to get started:

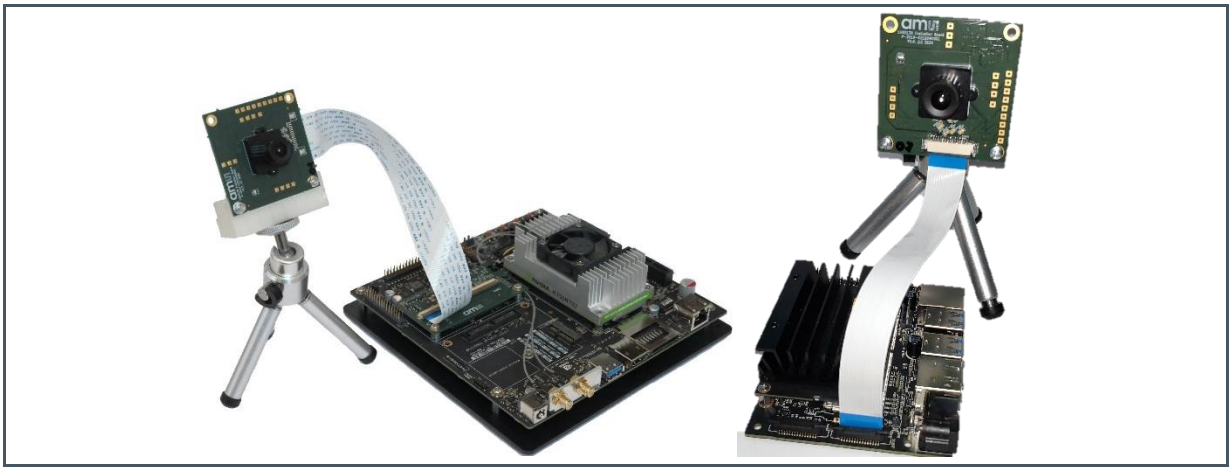
- HDMI monitor
- USB keyboard
- USB mouse
- Power outlet
- Only for the US: a power adapter cable

Carefully follow all the steps in the next chapter. Make sure the power supply is not yet connected before booting. Always make sure the power adapter is disconnected when connecting or disconnecting any other hardware.

CAUTION

1. Do not connect or disconnect the sensor and interposer boards while the system is powered on. This could cause short circuits and may damage the system.
2. Do not put anything on top of the Jetson board as this might cause short circuits.

Figure 1:
Global Setup Overview of the JetCis TX2 Evaluation Kit and the JetCis Nano Evaluation Kit



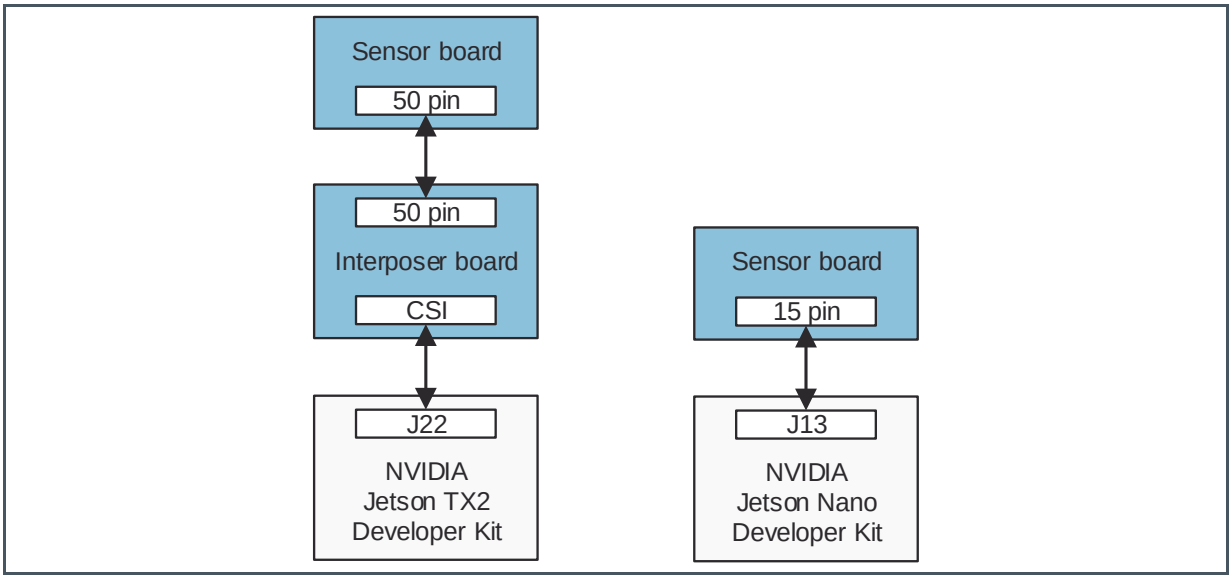
3 Hardware Description

The hardware contains as embedded computing platform an NVIDIA Jetson TX2 or NVIDIA Jetson Nano. Based on these two options, the hardware will vary slightly. This chapter describes the process of setting up the hardware.

3.1 Hardware Architecture

The difference between the two options is shown in the figure below. The NVIDIA Jetson TX2 requires an interposer board to connect to the sensor board, which contains the sensor. When the EVK consist of the NVIDIA Jetson Nano, it does not need the interposer board any longer and only a flex cable connects the sensor board is directly to the NVIDIA system.

Figure 2:
Possible Variations of the EVK



3.2 Sensor Board and Tripod Mounting

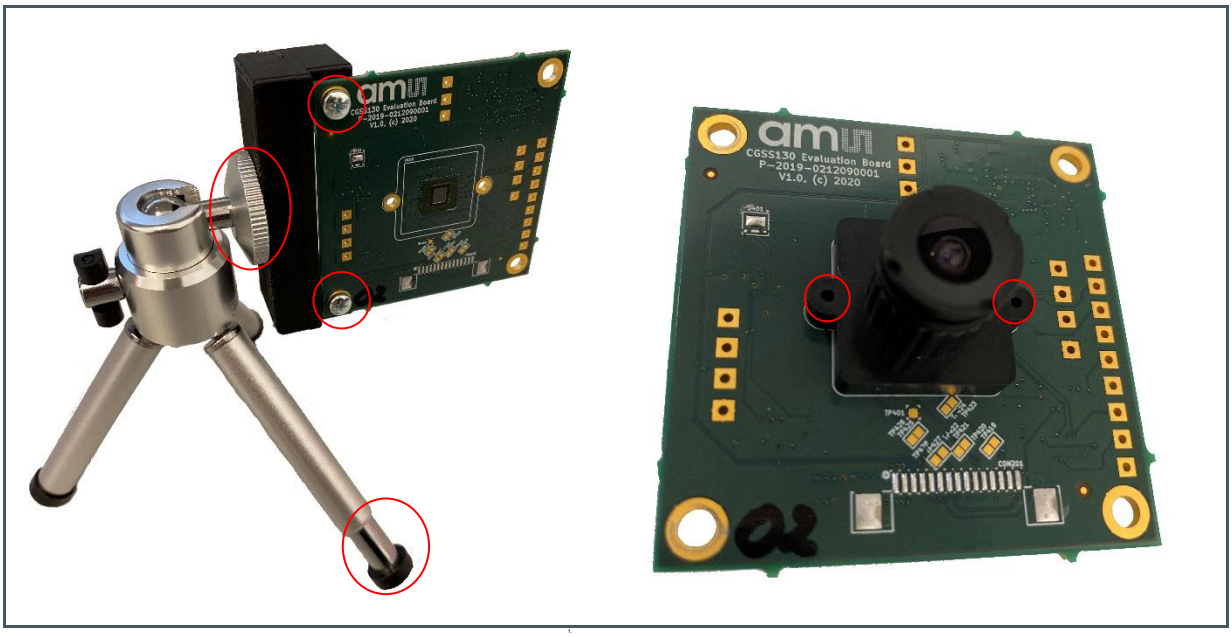
The sensor board contains the image sensor itself, as well as a power management integrated circuit (PMIC). This PMIC generates the required voltages for the image sensor. The sensor board also consists of a VCSEL flood illuminator to demonstrate the performance in NIR lighting. The software controls the illuminator and PMIC via commands. In addition, the board features various test pads for measurements. For the description of the test pads, refer to Chapter 6.1.

Mounting holes are present on the sensor board to connect a tripod mount to the tripod, see Figure 3. There is the possibility to extend the legs of the tripod. Besides those holes, there are also mounting holes for the lens holder to add a lens. Out of the box, the lens holder is already screwed onto the sensor board including the S-mount lens. The lens can be screwed out of the lens holder in case the user wants to do specific measurements without a lens. To focus the lens, simply rotate until the image is sharp.

Attaching the tripod:

- Mount the sensor board onto the black tripod adapter mount with the provided screws.
- Screw the tripod in the black adapter mount.
- Extend the tripod legs to the desired length.

Figure 3:
Mounting Holes: Tripod (left); Lens (right)



3.3 Interposer Board (TX2 only)

The interposer board makes the connection possible between the sensor board and the NVIDIA Jetson TX2. Both boards are linked to each other by using a flex cable. This is illustrated in Figure 4. The electrical components mounted on the interposer board are not being used, but were provided as a backup solution or as an alternative for the PMIC on the sensor board. Also on this board, test pads are provided. Refer to chapter 6.2 for a complete description.

Connecting the interposer board with the sensor board:

- Open the connector on both boards carefully.
- Insert the end of the flat ribbon cable, with the exposed metal side facing down, into the slot between the connector clip and the base. Insert the cable straight and as far into the connector clip as it can go.
- Close the connector on both ends.

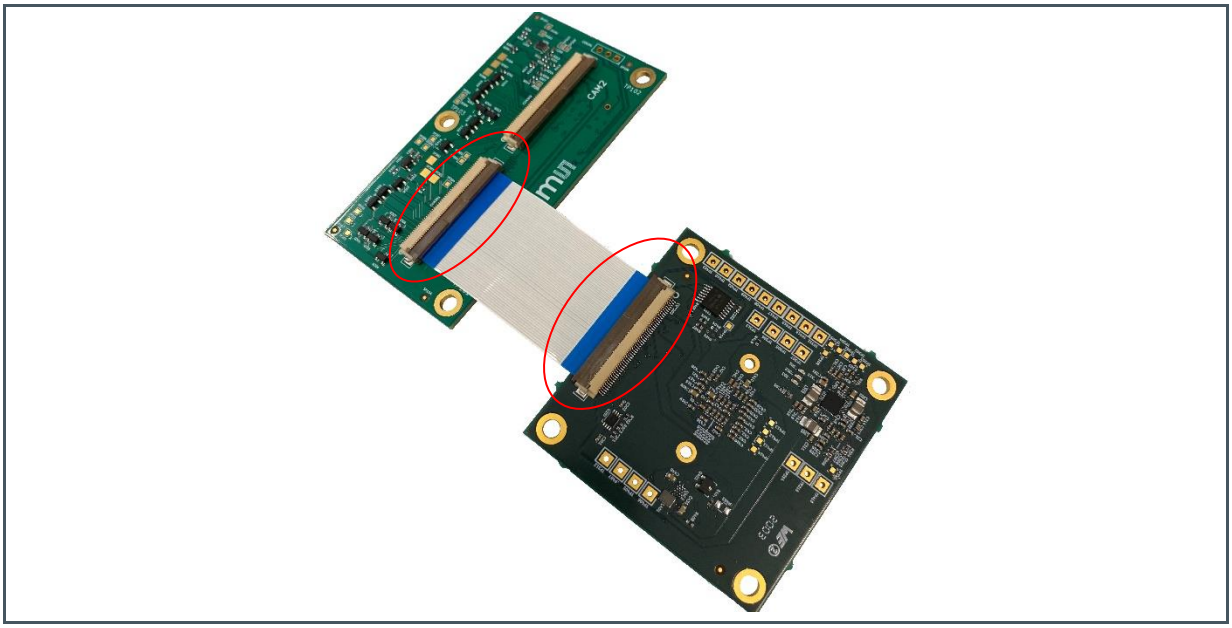
CAUTION

Do not apply force when opening/closing the clip of the connector. Make sure the flex cable is perfectly aligned with the connector when closing it.

Information

The interposer board is capable of connecting two sensor boards, for dual camera operation.

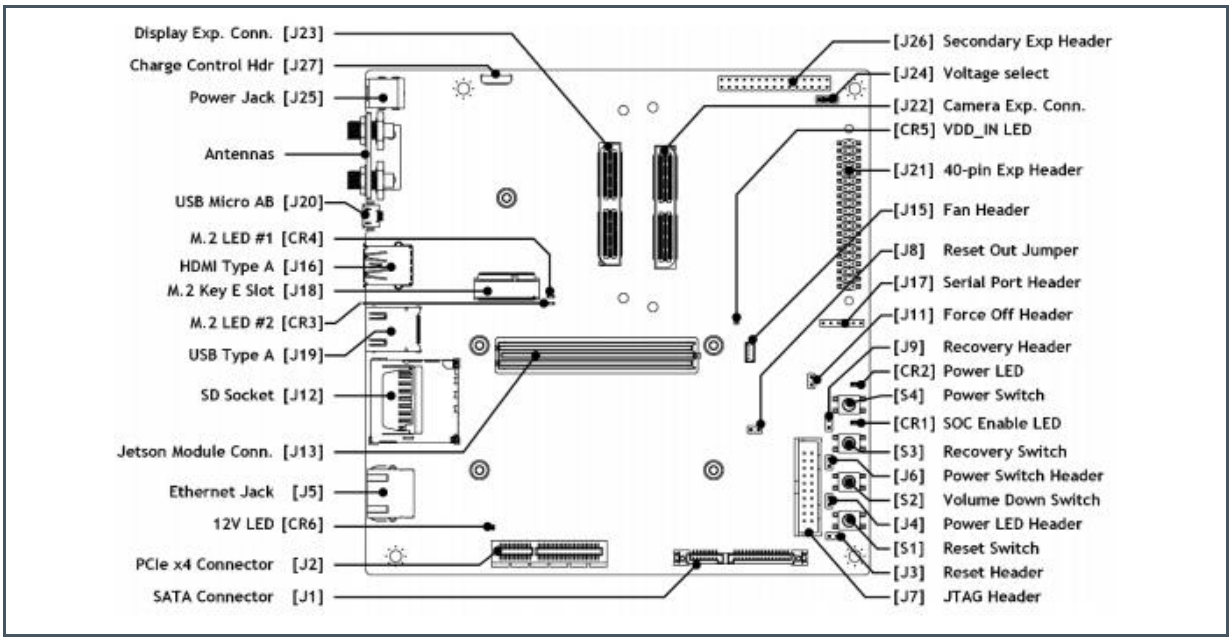
Figure 4:
Connector Cable



3.4 NVIDIA Jetson TX2

This section is applicable when the EVK consists of the NVIDIA Jetson TX2. All the hardware connectors are depicted in Figure 5. For more information, consult the NVIDIA Jetson TX2 manual.

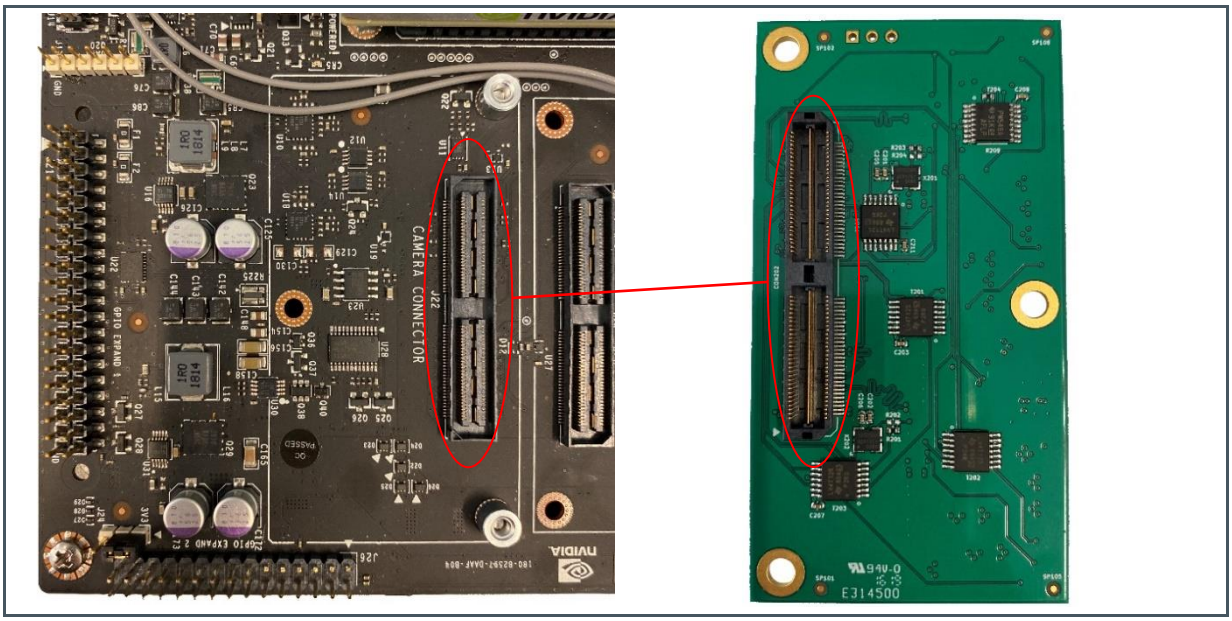
Figure 5:
NVIDIA Jetson TX2 Revision B02/04



Connecting the interposer to the NVIDIA Jetson TX2:

- Plug in the interposer board connector in J22 on the NVIDIA Jetson TX2 as on Figure 6.

Figure 6:
Connect Interposer Board with NVIDIA Jetson TX2



3.4.1 Connecting Other Hardware

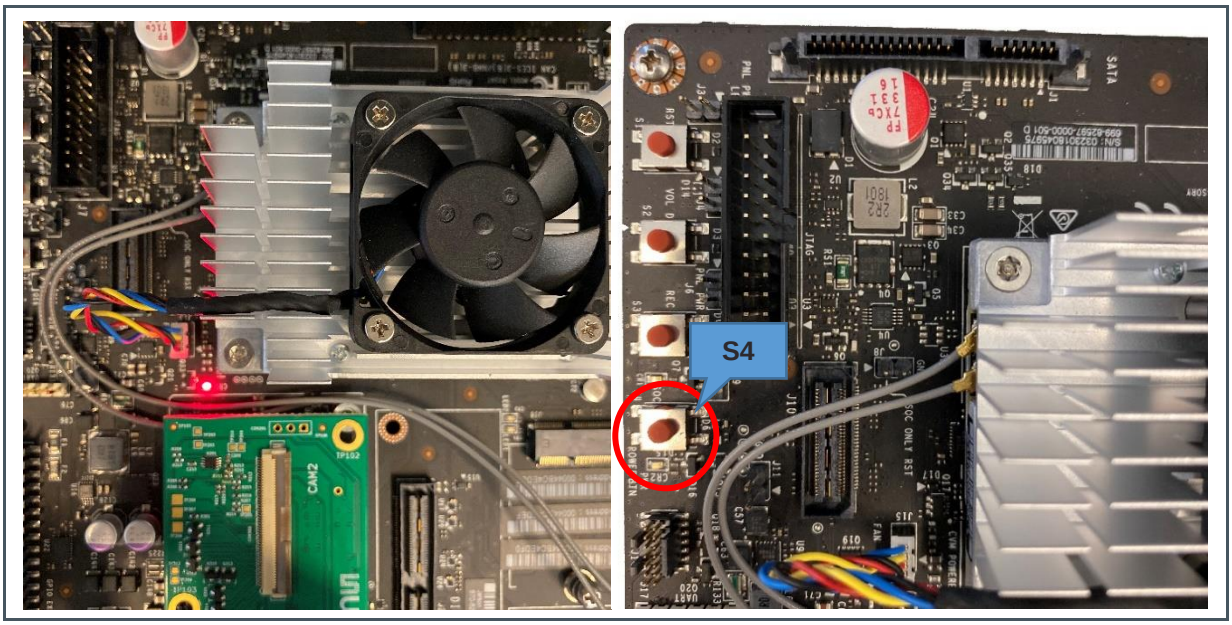
The EVK does not include a keyboard, mouse and display. The user can use his own hardware instead. The kit features a USB port and a mini USB port with an adapter. This way, two USB ports are available, which can be used for keyboard and mouse. Next, there is an HDMI port available for a display. For the internet connection, either Wi-Fi or Ethernet LAN is available.

- Connect other hardware such as monitor, keyboard, mouse

3.4.2 Power-Up the System

- When everything is connected, plug in the AC power.
- An LED will light up and now the button S4 needs to be pressed for about 1 second to start the system.
- On the connected display, the NVIDIA logo will appear after some displayed code.

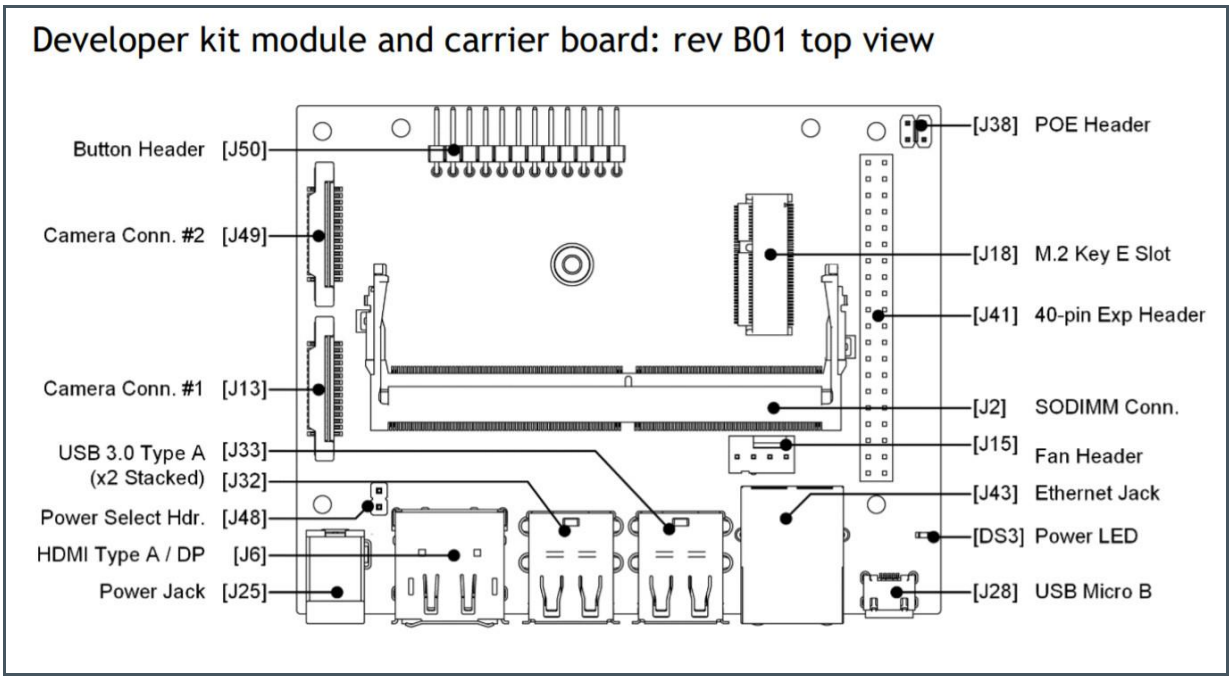
Figure 7:
Power LED (left); Power Button (right)



3.5 NVIDIA Jetson Nano

3.5.1 Schematic View

Figure 8:
Schematic Overview of the Jetson Nano Connections



3.5.2 Connecting the Hardware

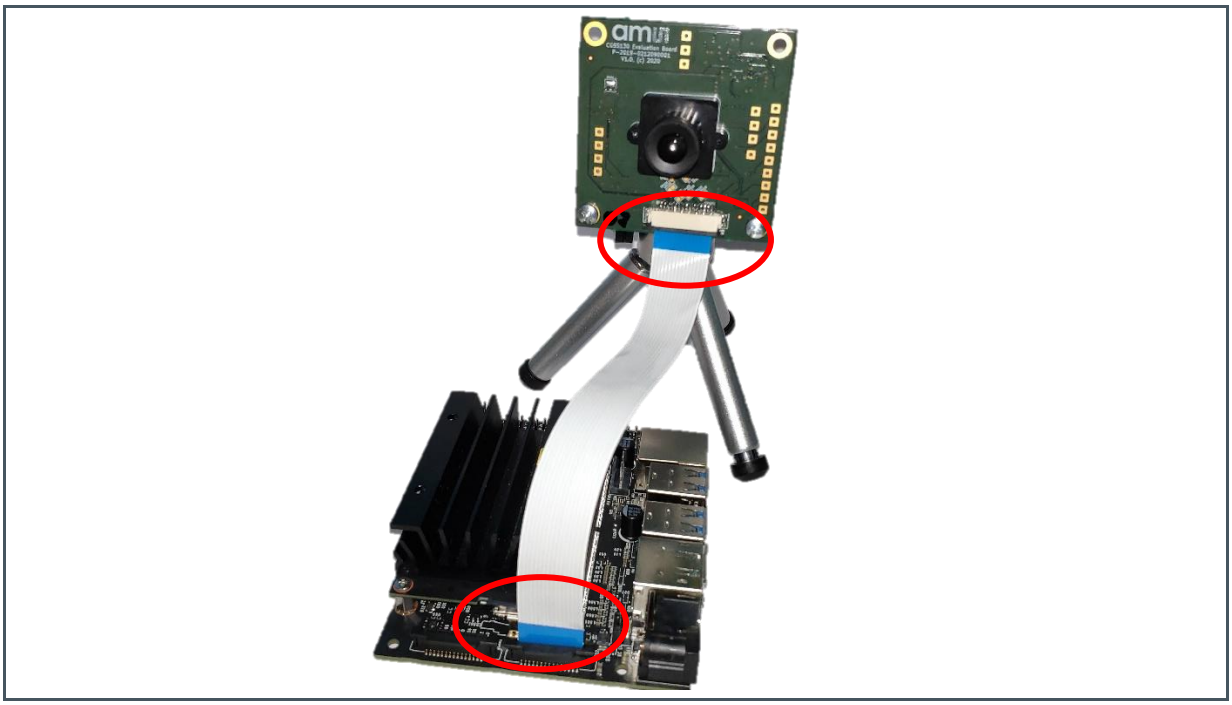
Connecting the Jetson Nano to the sensor board is done by opening the connectors both on the sensor board and on the Jetson Nano board. Make sure to insert the cable in the CAM0 port on the right. Insert the flex cable as depicted on Figure 9.

› Connect the Nano to the sensor board using the flex cable

The EVK does not include a keyboard, mouse and display. The user can use his own hardware instead. The kit features a USB port and a mini USB port with an adapter. This way, two USB ports are available, which can be used for keyboard and mouse. Next, there is an HDMI port available for a display. For the internet connection, either Wi-Fi or Ethernet LAN is available.

› Connect other hardware such as monitor, keyboard, mouse

Figure 9:
Jetson Nano Connections



3.5.3 Powering Up the System

The Jetson Nano does not have a power button. To power on the system, plug in the micro usb cable in the appropriate connector. The system will then boot up.

- Plug in the microUSB power supply

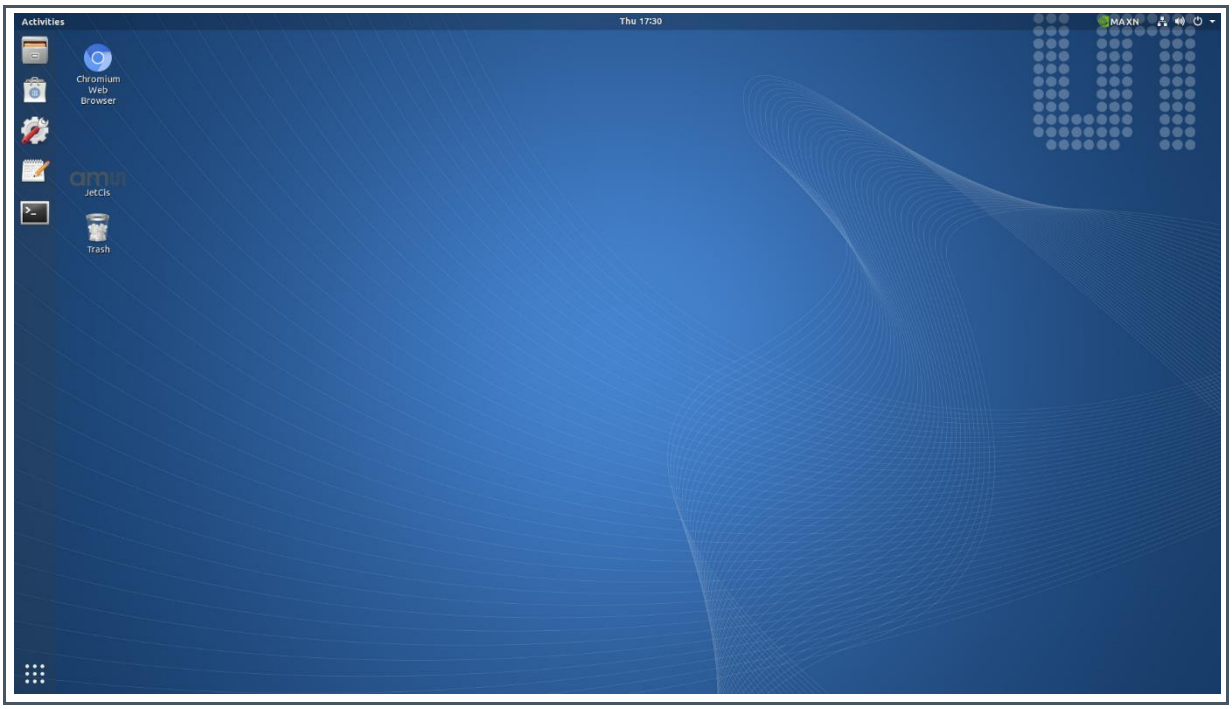
4 Software Description

This chapter will explain how to use the graphical user interface of the EVK. Before proceeding to this step, check if the system is powered on, and the login screen appears.

4.1 The Ubuntu Desktop

After booting, a desktop will appear. On the left, there is he sidebar, with various useful applications such as a file browser, a text editor, an internet browser, a terminal and a system settings shortcut.

Figure 10:
Desktop/Main Screen



4.1.1 Configuring the Screen Resolution

For an optimal experience, the resolution of the system should match the resolution of the connected monitor. To change the resolution, press Start key, Win key or ALT + F1 + Enter on your keyboard and search for Displays. There you should find an option to adjust the display resolution and scaling options.

4.1.2 Configuring the Keyboard Layout

In the status bar on the top right, next to the volume icon, the present keyboard layout is shown. By default, it is set to US QWERTY.

4.1.3 Connecting to a Network

As shown in the figure below, the system will enable the Wi-Fi or wired connection chosen in the internet menu. Pressing the Wi-Fi symbol or the two arrows in the status bar on the top right gives this menu.

The Jetson Nano only supports wired network connections.

Figure 11:
Network Connection Screen

4.2 JetCis Viewer

4.2.1 Starting the GUI

On the desktop, there is a shortcut called JetCis viewer. Double click the icon to open the GUI software. A dialog shown in Figure 12 will pop up to ask for the user password. Give the following credentials whenever a pop up dialog appears, the screen is locked or sudo is used in a terminal:

```
User: jetcis
Password: jetcis
```

Hence, the application has root permission to modify the system. It can now change the driver to allow compatibility with different sensors and bit modes. A GUI shown in Figure 13 will appear.

Figure 12:
A Dialog Prompt for Credentials.

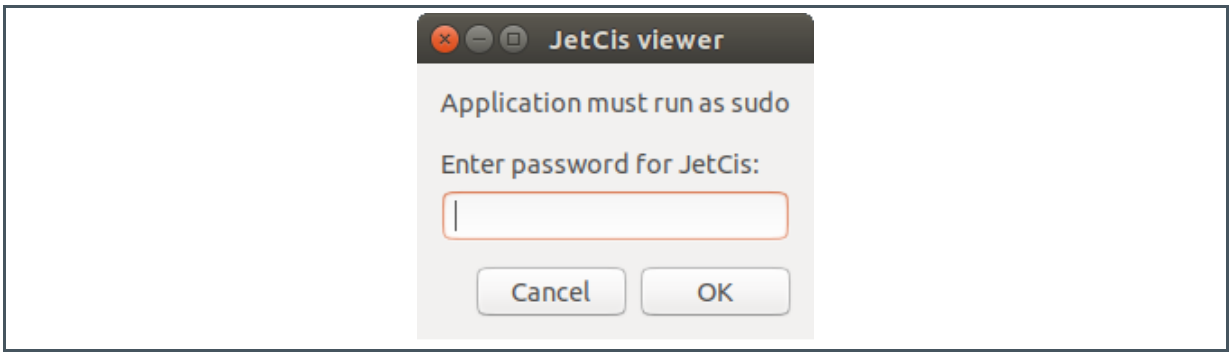
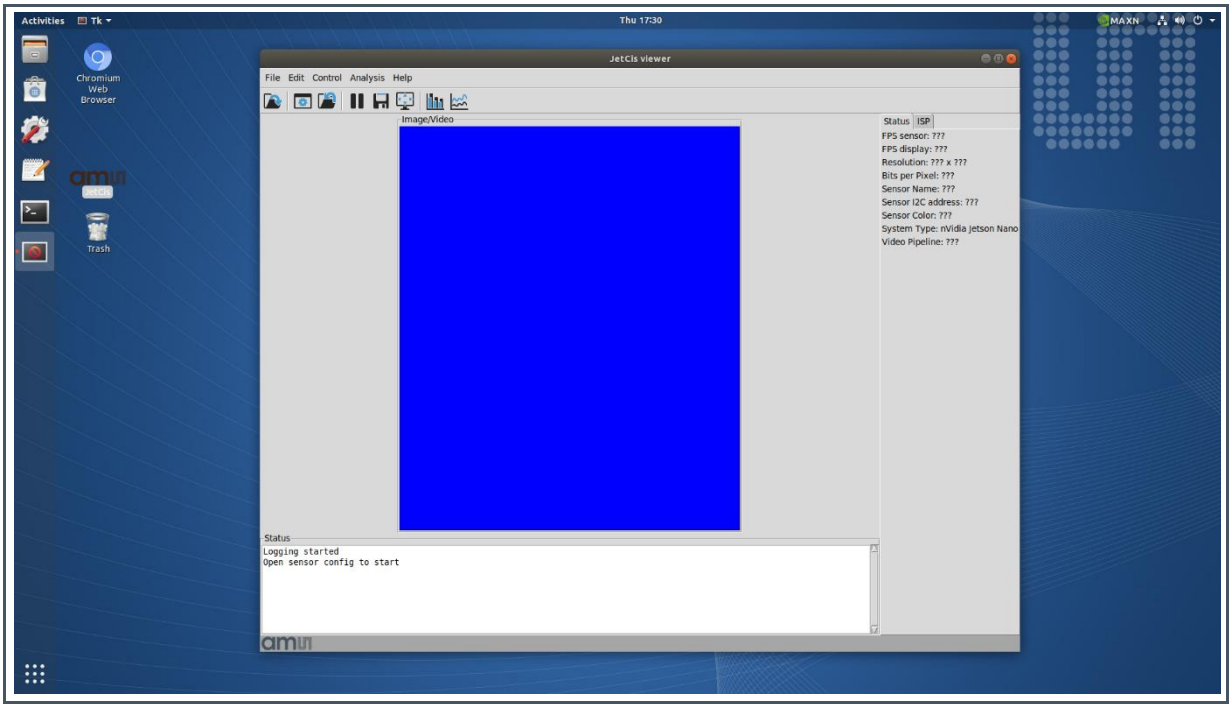


Figure 13:
JetCis Viewer



4.2.2 Loading a Configuration File

The next step is to select the appropriate configuration file that matches the sensor board.

Now press File -> Open Sensor Configuration and select the desired configuration file in the directory /home/jetcis/JetCis/sensor. Make sure the connected sensor board matches the configuration file.

Different bit modes such as 8-bit and 10-bit modes are available. Click open to load all the registers and GUI configurations. When the register upload is finished, a live image will appear.

Figure 14:
Select the Appropriate Configuration File

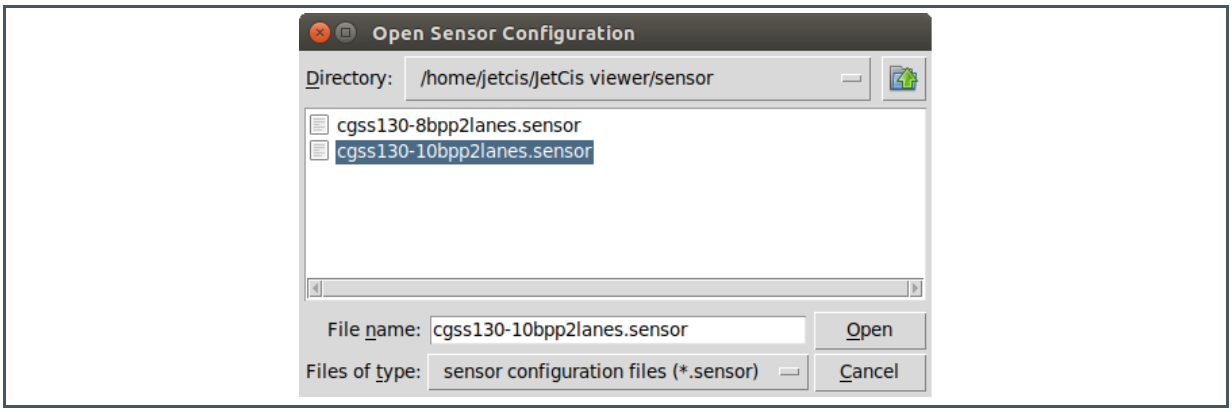
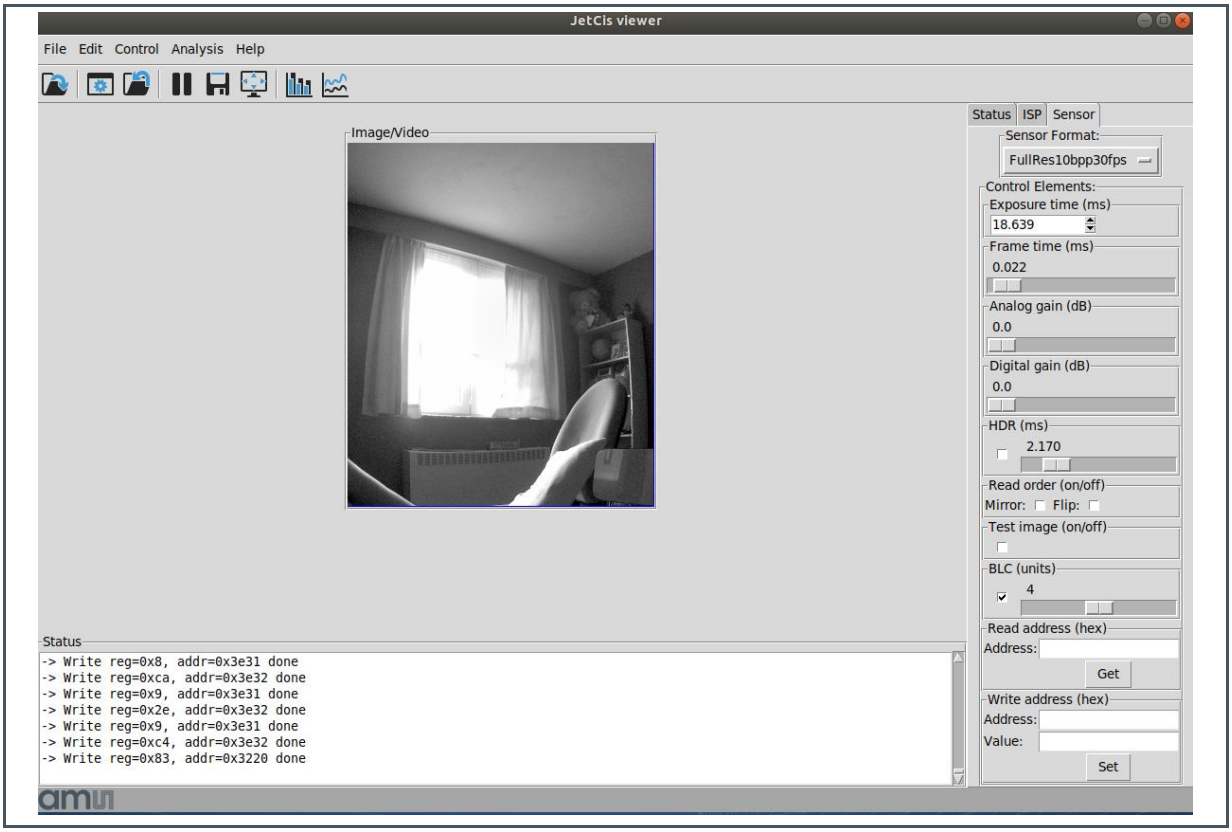


Figure 15:
Live Image



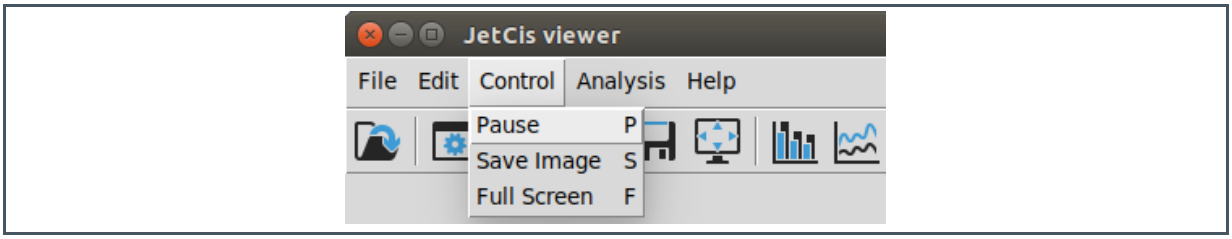
4.2.3 GUI Features

The GUI contains different features as seen in Figure 15. In this section, a detailed overview is given for each of the areas in the window.

Menu Bar

On top of the window, several actions can be selected by pressing the buttons in the menu bar. For some actions, a shortcut key exists. This is written on the right, e.g. F to toggle full screen.

Figure 16:
Menu Bar



Toolbar

Below the menu bar, the toolbar is present. The meaning of the different icons are from left to right:

- Open a sensor configuration file (see tooltip when hovering the pointer)
- Save GUI settings
- Open GUI settings
- Play/pause the live stream
- Save the presented images
- Enable full screen
- Open the histogram view
- Open the waveform view

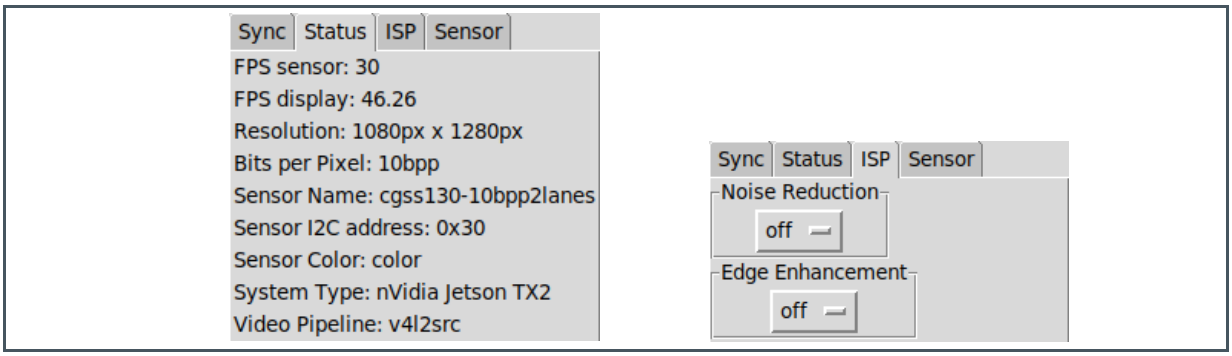
Figure 17:
Toolbar

Widgets

On the right of the window, widget are shown. This contains four tabs:

- Sync: set the signal for external triggering mode, see Figure 13
- Status: sensor live information, see figure below
- ISP: image signal processing, see figure below
- Sensor: control to change sensor parameters, see Figure 15

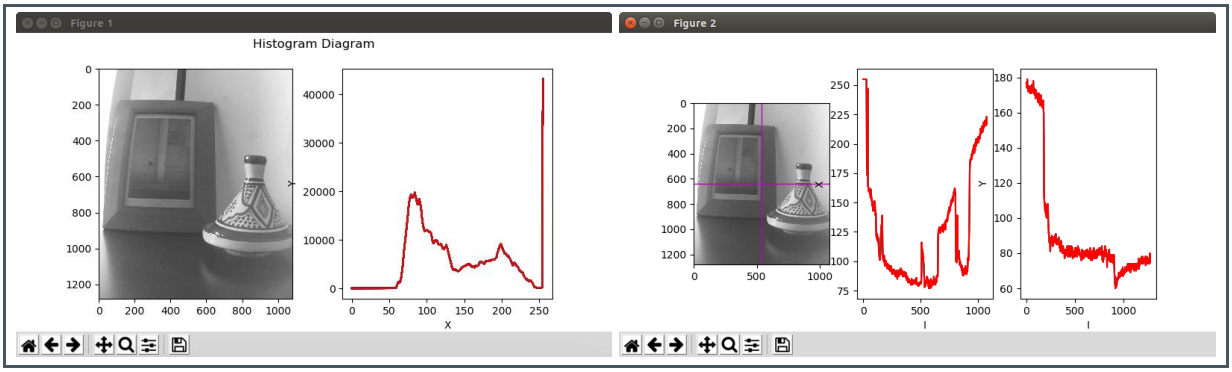
Figure 18:
Status and ISP Tab



Waveform and Histogram

Two image analysis tool are implemented in the GUI. These are a histogram and a row/column profile of the image. This is illustrated in the figure below. The plots are a live view of the presented image and can be modified with the buttons on the bottom of the window. To zoom in on the image, go to the main window again and scroll on the live image. Hence, the plot will be updated. Note that drawing the plot will reduce the framerate, so it is better to pause the image when displaying the histogram.

Figure 19:
Waveform and Histogram

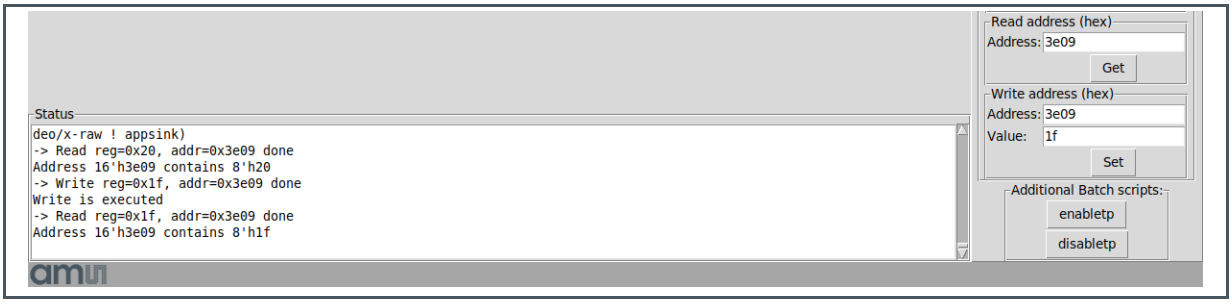


4.2.4 Read/Write Registers with the GUI

On the right side, it is possible to enter an address in the ‘Read’ section. Press GET to readout the value from the register. The output will be shown in the Status window at the bottom.

To write a register, enter address and value in the appropriate fields. Press the SET button to write. Note that all addresses and values should be written in a hexadecimal notation, for example, ‘3e09’ can be entered.

Figure 20:
Read and Write Registers with the GUI



4.2.5 Save and View Images

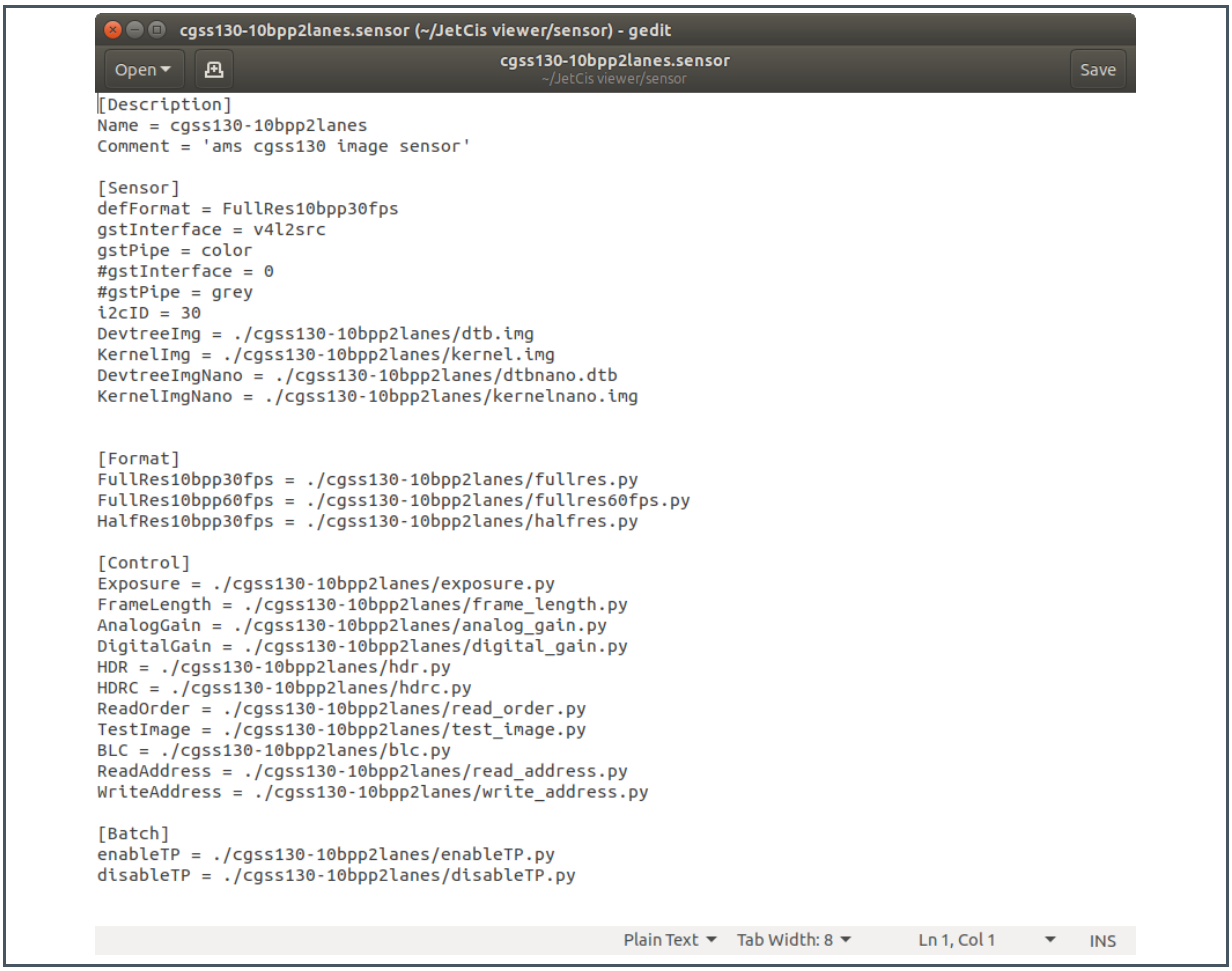
As explained in the previous chapter, images can be saved in a preferred directory on the file system. The GUI shows the JPEG images. However, RAW images can be viewed with a specialized RAW-viewer such as ImageJ. Both image formats will be saved.

4.2.6 Adding Widgets to the GUI (advanced users)

To automate a specific setting, a widget can be added to the GUI. To add a widget to the GUI, select first the directory specific to the sensor and bit /home/jetcis/JetCis viewer/mira130-10bpp2lanes where all the other descriptions of the already present widgets are located. Here, select a random python file or one that contains settings which are close to what is desired. Copy and paste the file in the same directory and change the filename. This file will contain the functionality of the widget.

When the file is created, go to the directory /home/jetcis/JetCis viewer/sensor. Here, the configuration files of the sensors are stored. Open the file mira130-10bpp2lanes.sensor with a text editor, e.g. gedit or Vim. In this file, specify under [Control] the path of the python file made earlier to add the widget to the GUI.

Figure 21:
Add Python File to Configuration File



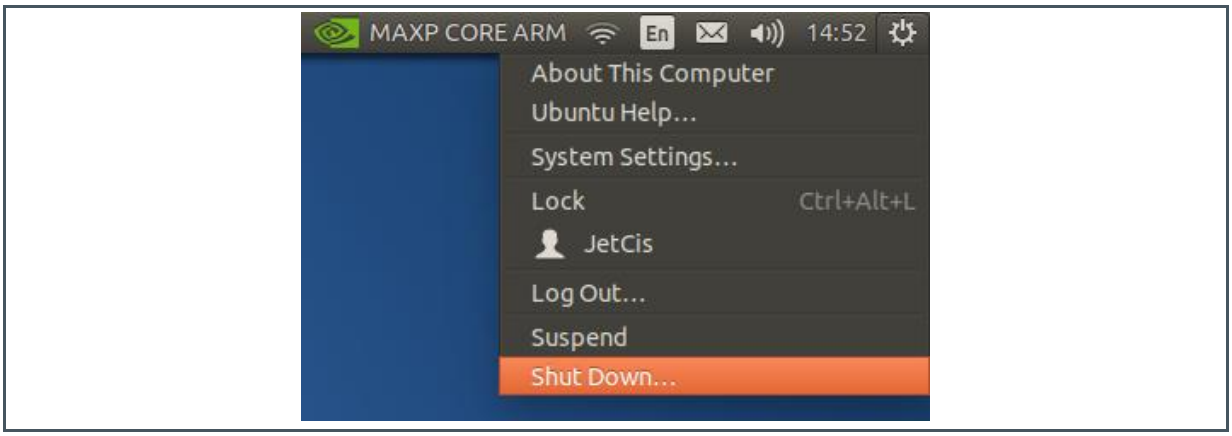
In the created python file, you need to have at least the function controlInit() and controlSet(). Those are normally present because a file was copied. In controlInit(), change the name and other settings. The types where you can choose from are slider, list, checkbutton, text_entry_read, text_entry_write, checkbutton_and_slider and two_checkbuttons. In controlSet(), specify what will happen when the widget is changed by e.g. moving a slider or pressing a button.

Figure 22:
Example Code of the Digital Gain Slider

4.3 Shutting Down the System

Click the top right icon in the status bar, and click shutdown. The system will turn off. Now it is safe to plug or unplug the interposer/sensor boards.

Figure 23:
Shut Down Screen



5 Resolving Common Problems

This chapter explains how to resolve the most common issues.

Figure 24:
Common Issues

Issue	Solution/Suggestion
The system is not booting	Make sure the power supply is plugged in the wall socket and in the NVIDIA Jetson. Make sure the red POWER LED is on after pressing the power button.
Display remains blank	Make sure the HDMI cable is plugged in and the correct input source is selected on the monitor. Also, make sure the POWER LED is on.
No image in the GUI	Turn off the system. Make sure the flat cable is properly connected to the board on both sides. Turn on the system.
The image is not sharp	Rotate the lens to focus.

6 Appendix

6.1 Test Pads of the Sensor Board

On the PCB, there are several test pads provided. A detailed description of the test pads is given in the table below.

Figure 25:
Test Pads of Sensor Board

Number	Description	IC
101	Ground	
102	Ground	
103	Ground	
104	Ground	
301	Active low, debounced power-on input or power-request input to start power-up sequencing	PMIC
302	Powerhold; enable input	PMIC
303	Sleep mode input or CLK request input	PMIC
304	Interrupt output	PMIC
305	2.5 V analog power supply AVDD	PMIC/Sensor
306	1.2 V digital power supply DVDD	PMIC/Sensor
307	1.8 V digital power supply DOVDD	PMIC/Sensor
308	3.3 V digital power supply load switch	PMIC
309	Digital input that defines whether SPI or I^2C and GPIOs is available	PMIC
310	2.8 V digital power supply	PMIC
311	Power supply 3.3 V	
312	Ground	
313	Ground	
314	Output voltage LDO	PMIC
315	Output voltage LDO	PMIC
401	Ground	
402	External triggering of HDR short exposure	Sensor
403	External triggering of HDR long exposure/SYNC	Sensor
404	Clock input	Sensor
405	I^2C data line (open drain)	Sensor
406	I^2C clock	Sensor
407	LED strobe signal	Sensor
408	I^2C device ID 1	Sensor
409	I^2C device ID 0	Sensor
410	XSHUTDOWN signal input (internal pull-up, active low)	Sensor

Number	Description	IC
411	Internal reference voltage	Sensor
412	Internal reference voltage	Sensor
413	Internal reference voltage	Sensor
414	Internal reference voltage	Sensor
415	TM	Sensor
416	GPIO	Sensor
417	ATM	Sensor
418	Ground	Sensor
419	MIPI data 0 negative	Sensor
420	MIPI data 0 positive	Sensor
421	MIPI data 1 negative	Sensor
422	MIPI data 1 positive	Sensor
423	MIPI data 2 negative	Sensor
424	MIPI data 2 positive	Sensor
425	MIPI data 3 negative	Sensor
426	MIPI data 3 positive	Sensor
427	MIPI data clock negative	Sensor
428	MIPI data clock positive	Sensor

6.2 Test Pad Description of the Interposer Board

On the PCB, there are several test pads including their name. A detailed description of the test pads is given in the table below.

Figure 26:
Test Pads

Number	Description
101	Ground
102	Ground
103	Ground
201	Camera 0 power down sensor
202	Camera 1 power down sensor
203	Camera vertical sync
204	Camera 0 clock input
205	Camera 1 clock input
206	Ground
207	Power supply 3.3 V
208	Power supply 5.0 V

Number	Description
209	Output power supply buffer gate
210	Output power supply buffer gate
301	Camera 0 I^2C device ID 0
302	Camera 0 PMIC GPIO
303	Camera 0 I^2C device ID 1
304	Camera 0 DIN B-
305	Camera 0 DIN B+
306	Camera 1 PMIC GPIO
307	Camera 1 I^2C device ID 1
308	Camera 1 I^2C device ID 0
309	Camera 1 DIN B+
310	Camera 1 DIN B-
311	Camera 0 LED strobe
312	Camera 1 LED strobe

7 Revision Information

Changes from previous version to current revision v2-01	Page
Update folder structure according to new revision	

- Page and figure numbers for the previous version may differ from page and figure numbers in the current revision.
- Correction of typographical errors is not explicitly mentioned.

8 Legal Information

Copyrights & Disclaimer

Demo Kits, Evaluation Kits and Reference Designs are provided to recipient on an “as is” basis for demonstration and evaluation purposes only and are not considered to be finished end-products intended and fit for general consumer use, commercial applications and applications with special requirements such as but not limited to medical equipment or automotive applications. Demo Kits, Evaluation Kits and Reference Designs have not been tested for compliance with electromagnetic compatibility (EMC) standards and directives, unless otherwise specified. Demo Kits, Evaluation Kits and Reference Designs shall be used by qualified personnel only.

ams AG reserves the right to change functionality and price of Demo Kits, Evaluation Kits and Reference Designs at any time and without notice.

Any express or implied warranties, including, but not limited to the implied warranties of merchantability and fitness for a particular purpose are disclaimed. Any claims and demands and any direct, indirect, incidental, special, exemplary or consequential damages arising from the inadequacy of the provided Demo Kits, Evaluation Kits and Reference Designs or incurred losses of any kind (e.g. loss of use, data or profits or business interruption however caused) as a consequence of their use are excluded.

ams AG shall not be liable to recipient or any third party for any damages, including but not limited to personal injury, property damage, loss of profits, loss of use, interruption of business or indirect, special, incidental or consequential damages, of any kind, in connection with or arising out of the furnishing, performance or use of the technical data herein. No obligation or liability to recipient or any third party shall arise or flow out of ams AG rendering of technical or other services.

RoHS Compliant & ams Green Statement

RoHS Compliant: The term RoHS compliant means that ams AG products fully comply with current RoHS directives. Our semiconductor products do not contain any chemicals for all 6 substance categories plus additional 4 substance categories (per amendment EU 2015/863), including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, RoHS compliant products are suitable for use in specified lead-free processes.

ams Green (RoHS compliant and no Sb/Br/Cl): ams Green defines that in addition to RoHS compliance, our products are free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material) and do not contain Chlorine (Cl not exceed 0.1% by weight in homogeneous material).

Important Information: The information provided in this statement represents ams AG knowledge and belief as of the date that it is provided. ams AG bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. ams AG has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. ams AG and ams AG suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

Headquarters
ams AG
Tobelbader Strasse 30
8141 Premstaetten
Austria, Europe
Tel: +43 (0) 3136 500 0

Please visit our website at www.ams.com
Buy our products or get free samples online at www.ams.com/Products
Technical Support is available at www.ams.com/Technical-Support
Provide feedback about this document at www.ams.com/Document-Feedback
For sales offices, distributors and representatives go to www.ams.com/Contact
For further information and requests, e-mail us at ams_sales@ams.com