Application Notes

Getting Started Guide
NVIDIA® Jetson Orin™ Reference Design

2 Channel MIPI CSI-2 Carrier Board With Jetson Orin NX SoM | CBM-NVA-ONX-16-128-V2

THE IMAGINGSOURCE
TECHNOLOGY BASED ON STANDARDS

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1. General Information

This application note describes how to get started with the 2-Channel MIPI CSI-2 Carrier Board with Jetson Orin NX 16 GB SoM, Part-No. CBM-NVA-ONX-16-128-V2.

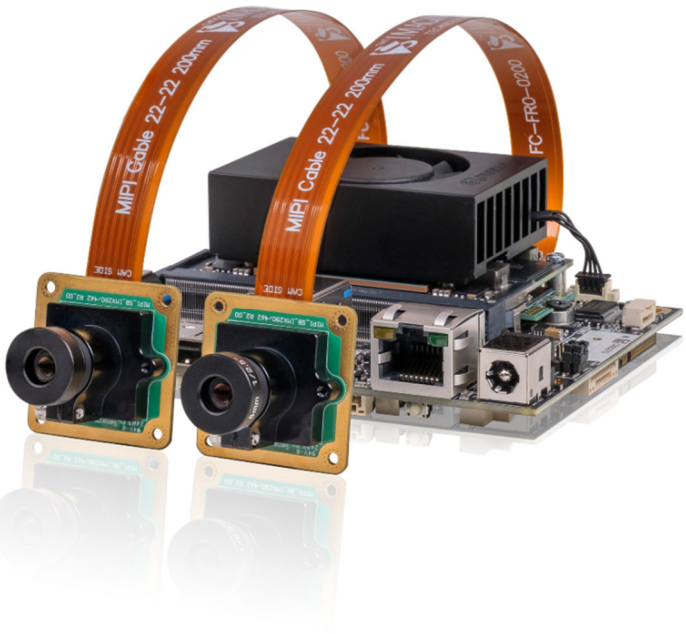


Figure 1: NVIDIA Jetson Orin Reference Design, 2-Channel MIPI CSI-2 Carrier Board with Jetson Orin NX 16 GB SoM and two MIPI CSI-2 cameras.

1.1 Cautions

	DO NOT UPGRADE YOUR SYSTEM If you upgrade your system, e.g., by executing: *#sudo apt-get dist upgrade* this may brick some board functionality and some interfaces may not work correctly anymore. The cameras and carrier board drivers depend on the installed kernel and bootloader versions. Upgrading them to incompatible versions may render the system unusable. In this case, the carrier board may need to be returned per RMA to The Imaging Source.



DO NOT INSTALL NEW JETPACK

If you install a new JetPack version, The Imaging Source MIPI CSI-2 cameras will not work anymore.



MIPI CSI-2, GMSL2, FPD-LINK III CAMERAS HANDLING

Connect MIPI-based cameras ONLY when the system is powered off.

Make sure to unplug the power supply and any USB or GigE cables before connecting or re-connecting MIPI-based cameras.
Otherwise, the cameras may be damaged, may not be detected, or may not work properly.



MICRO-USB PORT USE

If you plug a cable into the Micro-USB port, the board will not boot.

The Micro-USB port must only be used for Flash or Recovery. This procedure is not covered by this document.



LOGIN DATA

To login on Linux, use the following data:

- Login: **nvidia**
- Password: **jetson**

1.2 Hardware

The procedures described in this document assume that you are using the following hardware components, which are included in this Reference Design:

- Carrier board with 2-channel MIPI CSI-2, i.e., JNX42:
  - Note: 4-channel MIPI CSI-2 board is available upon request.
- NVIDIA Orin NX System on Module with 16 GB RAM:
  - Note: Orin Nano SoM and different RAM sizes are available upon request.
- SSD 128 GB
- NVIDIA heatsink and fan
- Power supply 12V/40W (FSP) incl. power cable (EU version)
- 1x DMM 36SX462-ML, 36S MIPI CSI-2 monochrome camera
- 1x DFM 36SX462-ML, 36S MIPI CSI-2 color camera
- 2x TLH 10-M lens holders
- 1x TBL 8 C, M12 lens with IR-cut filter
- 1x TBL 8, M12 lens
- 2x CA-FPC-22P-22P/0.20 cables

1.2.1 Hardware Configurations

The following SoM, RAM and carrier board configurations with different number of MIPI CSI-2 ports are available on request:

Product ID	SoM / RAM	No. CSI-2 Ports
CBM-NVA-ONX-16-128-V2-M2	Orin NX 16 GB	2
CBM-NVA-ONX-8-128-V2-M2	Orin NX 8 GB	2
CBM-NVA-ONA-8-128-V2-M2	Orin Nano 8 GB	2
CBM-NVA-ONA-4-128-V2-M2	Orin Nano 4 GB	2
CBM-NVA-ONX-16-128-V4-M2	Orin NX 16 GB	4
CBM-NVA-ONX-8-128-V4-M2	Orin NX 8 GB	4
CBM-NVA-ONA-8-128-V4-M2	Orin Nano 8 GB	4
CBM-NVA-ONA-4-128-V4-M2	Orin Nano 4 GB	4



Note

The above-mentioned hardware configurations do not include any cameras, lenses, lens mount holders, or cables. They must be ordered separately.

The SoMs are delivered with pre-installed software as described in Chapter 1.3.

1.2.2 Deserializer Boards

In addition to 36S MIPI CSI-2 cameras, Acuva GMSL2 IP67 cameras and 36C FPD-Link III board-level and IP67 cameras can be operated by means of deserializer boards, too:

- MDSER-GMSL2-4CH – a 4-channel GMSL2 deserializer board for operation of up to four Acuva GMSL2 cameras.
- MDSER-FPD3-4CH – a 4-channel FPD-Link III deserializer board for operation of up to four 36C FPD-Link III cameras.

For detailed assembly instructions refer to Chapter 2.
For more information about the deserializer boards, refer to:

https://www.theimagingsource.com/en-de/embedded/deserializer/gmsl2-fpd-link-iii/

1.3 Software

For your convenience, some software packages have been pre-installed:

- JetPack 6.2.
- The Imaging Source MIPI drivers, e.g., “theimagingsource-drivers_rxxxx.deb”:
  - Drivers required to operate different MIPI-based cameras, incl. GMSL2 and FPD-Link III cameras and carrier boards.
- Latest version of Imaging Control IC4 GenTL Driver for Jetson MIPI, e.g., “ic4-gentl-driver-jetson-mipi_1.0.0.189_arm64.deb” or newer:
  - The GenTL Driver for Jetson MIPI is required when using the Imaging Control IC4 SDK and IC Capture.
- Latest version of Imaging Control IC4 SDK, e.g., “ic4_1.5.3.3316_arm64.tar” or newer:
  - The IC4 SDK includes “ic4src” – a GStreamer camera source for straightforward image acquisition.
- Latest version of IC Capture, e.g., “ic-capture_4.2.0.811_arm64.tar” or newer:
  - IC Capture is an End User GUI viewer tool for straightforward camera evaluation.
- Latest versions of the GenTL Producer for GigE Vision and USB3 Vision Cameras.
  - For more information refer to The Imaging Source’s website: https://www.theimagingsource.com/en-de/support/download/

Note

The 'First-Time-Installation Package' is stored under /usr/local/first_time_setup

which includes the above-mentioned packages.
You may also use them in the event that re-installation is necessary.

2. Assembling the Hardware

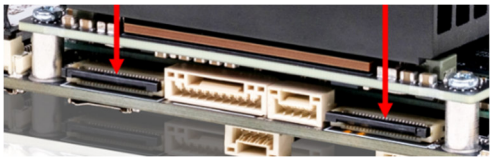
The procedures described in this chapter should be followed to ensure the best first-time experience with this reference design.

1. Begin by screwing the TBL 8 C lens (for use with the color camera) and the TBL 8 lens (for use with the monochrome camera) into the TLH 10-M lens mount holders.



2. Mount the TLH 10-M lens mount holders to the two DxM 36SX462-ML cameras. In order to achieve true color fidelity, make sure to use the TBL 8 C lens with the DFM 36SX462-ML color camera.

3. Connect the CA-FFC-22P/0.3m cables to the two black MIPI CSI-2 22-pin connectors. These are located beneath the heat sink/fan assembly, directly under the SoM (please see image below):



   a. To do so, unlock the black clips of the MIPI CSI-2 22-pin connectors by pulling them up.

   b. Insert one end of the first FFC cable, labeled 'CPU SIDE,' into the connector with 22 pins facing downward. Then, secure the cable by locking the black clips in place.

   c. Repeat the same procedure with the second FFC cable.

	**MIPI CSI-2 CABLE “CPU SIDE”** Pay attention to the lettering on the MIPI CSI-2 cable. Ensure that the cable end with the inscription “CPU SIDE” is plugged into the SoM. Otherwise, the carrier board may be damaged or behave erratically, e.g., you may not get an HDMI signal or may experience booting issues.



4. Connect the other ends of the FFC cables to the DxM 36SX462-ML cameras (please see image below).

	MIPI CSI-2 CABLE “CAM SIDE” Pay attention on the lettering of the MIPI CSI-2 cable. Ensure that the cable end with the inscription “CAM SIDE” is affixed to the camera. Otherwise, the carrier board may be damaged or behave erratically, e.g., you may not get an HDMI signal or may experience booting issues.



5. Connect a USB mouse and a USB keyboard to the two horizontal USB3 ports:
   a. Note: No mouse and keyboard are included in this reference design kit.
6. Connect the HDMI cable to the HDMI port of the reference design, and the other end to a monitor (HD resolution or higher is recommended):
   a. Note: No HDMI cable and no monitor are included in this reference design kit.
7. Take the power supply 12V/40W (FSP) and the power cable and first connect it to a wall socket.
   Then connect it to the reference design to supply power to the board.

MIPI CSI-2 CAMERAS HANDLING

Connect MIPI-based cameras ONLY when the system is powered off.

Make sure to unplug the power supply and any USB or GigE cables before connecting or re-connecting MIPI-based cameras.
Otherwise, the cameras may be damaged, may not be detected, or may not work properly.

2.1 Assembling of Deserializer Boards

The procedures described in this chapter assume that you are using one of the Reference Design Hardware Configurations with two MIPI CSI-2 ports (JNX42) as described in Chapter 1.2.1.

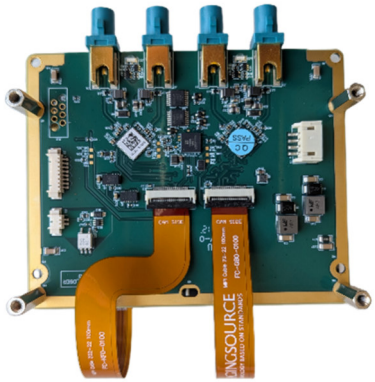
We also assume that you are using Acuva GMSL2 or 36C FPD-Link III cameras in combination with one of the deserializer boards described in Chapter 1.2.2.

Using a Reference Design Hardware Configuration with four MIPI CSI-2 ports (JNX40) is not supported and is technically not feasible, because of the limited CSI-2 bandwidth.

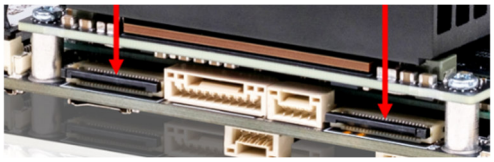
1. Make sure the Reference Design is powered off.
2. Connect the two FFC 100mm cables to the Deserializer Board according to the image below.

MIPI CSI-2 CABLE “CAM SIDE”

Pay attention to the lettering of the MIPI CSI-2 cable. Ensure that the cable end with the inscription “CAM SIDE” is affixed to the deserializer board.



3. Connect the other ends of the FFC cables to the two black MIPI CSI-2 22-pin connectors. These are located beneath the heat sink/fan assembly, directly under the SoM (see image below):



i. To do so, unlock the black clips of the MIPI CSI-2 22-pin connectors by pulling them up.

ii. Insert one end of the first FFC cable, labeled 'CPU SIDE,' into the connector with 22 pins facing downward. Then, secure the cable by locking the black clips in place.

4. Repeat the same procedure with the second FFC cable.

MIPI CSI-2 CABLE “CPU SIDE”

Pay attention to the lettering on the MIPI CSI-2 cable. Ensure that the cable end with the inscription “CPU SIDE” is plugged into the SoM.

Otherwise, the carrier board may be damaged or behave erratically, e.g., you may not get an HDMI signal or may experience booting issues.

5. Use the included Y-cable to provide power from the carrier board to the deserializer board.

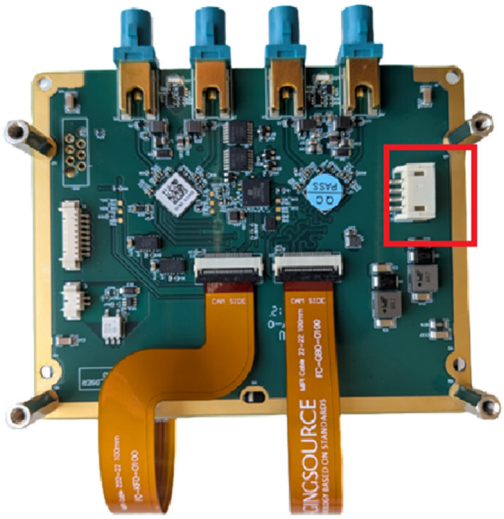




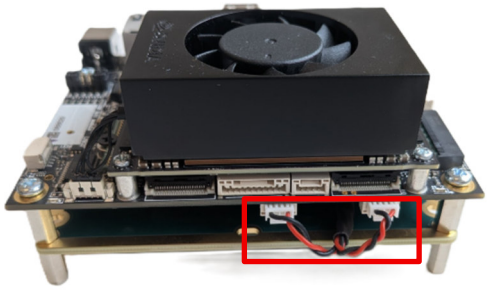
6. Connect the single-ended 4-pin connector of the Y-cable to the J1 Power Connector of the deserializer board according to the image below.

Technical Reference Manual for Deserializer Board

For more information about dimensions, electrical specifications, etc., refer to the Technical Reference Manual of the respective deserializer board: https://www.theimagingsource.com/en-de/embedded/deserializer/gmsl2-fpd-link-iii/



7. Connect the two connectors of the Y-cable to J29 (I2C) and J35 (CAN) of the carrier board.



POWER CONNECTORS

In case that one of the connectors J29 or J35 is required for another purpose, J8 (USB2 shared with M2) can be used instead.
In each case, only the following pins are used:

- Pin 1: +5 V (max. 1 A, no current limiter)
- Pin 4: GND

Note:
No other connectors on the carrier board can be used for powering the deserializer board.

8. Connect the Acuva GMSL2 or 36C FPD-Link III cameras to the deserializer board via supported FAKRA coaxial cables.

	**FAKRA Coaxial Cables** For best performance and to ensure IP67 protection, it is recommended to use the FAKRA coaxial cables provided by The Imaging Source Europe GmbH. For more information refer to TIS's accessory website: https://www.theimagingsource.com/en-de/product/accessory/

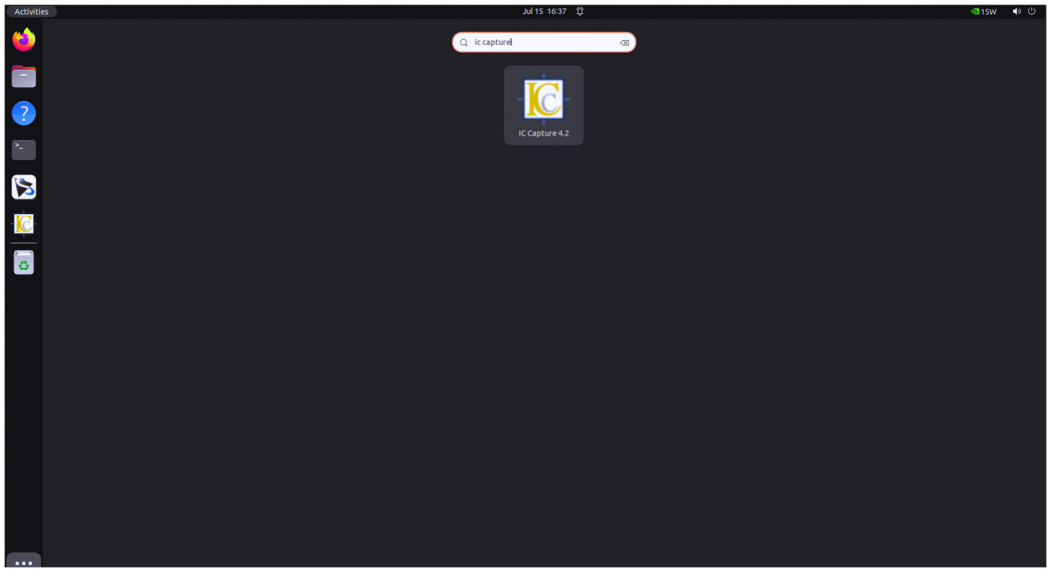
9. Power up the Reference Design.

3. Image Acquisition

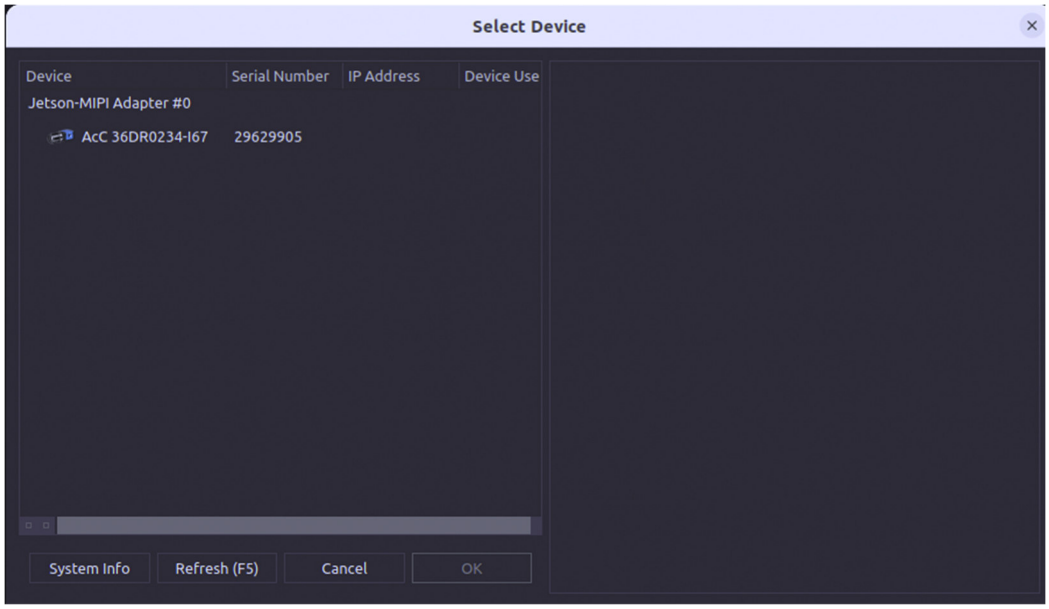
3.1 Using ‘IC Capture’

The easiest way to start with image acquisition and image display is by using the GUI application IC Capture which is provided together with the pre-installed IC Imaging Control 4 SDK.

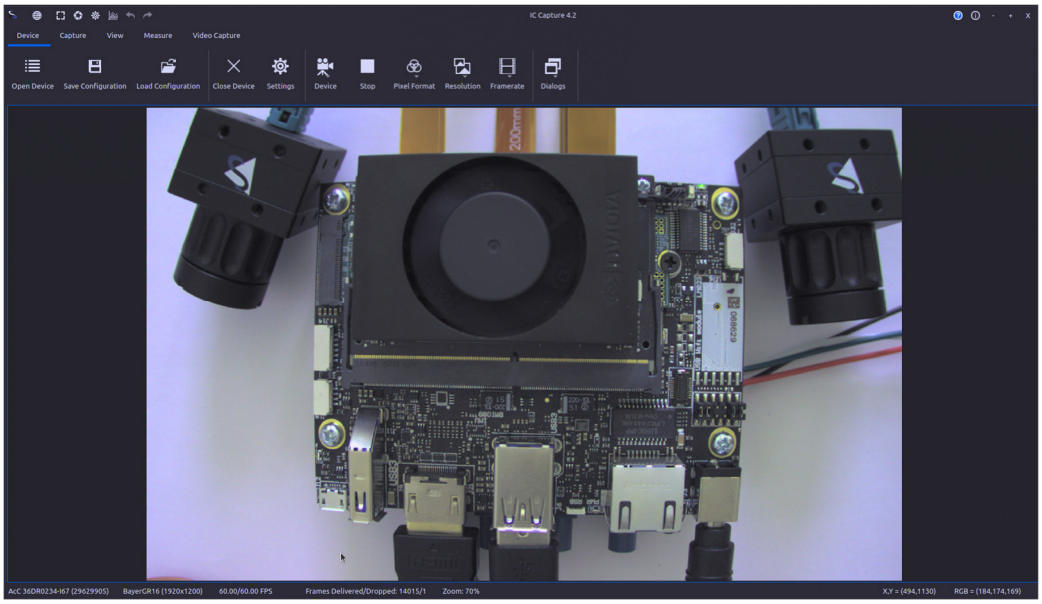
To launch IC Capture go to *Show Applications* > type in *IC Capture* in the search bar and select IC Capture x.x to launch it:



Select one of the cameras to start image acquisition:



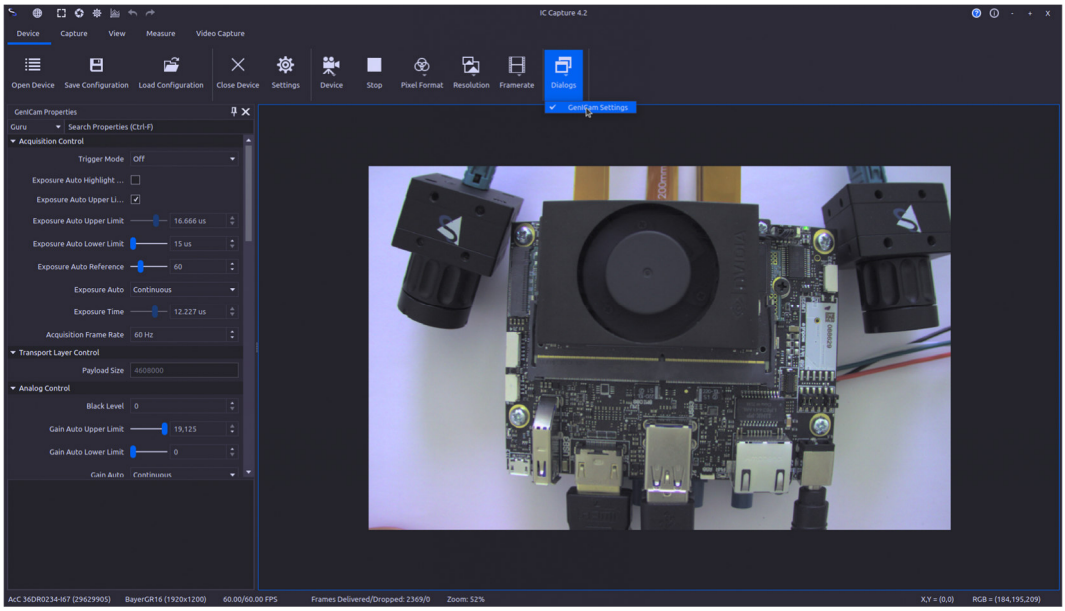
and launch image display:



Note

IC Capture offers advanced image enhancement functionalities, e.g., auto-exposure, auto-gain, saturation, hue, sharpness, tone-mapping, etc., which are performed on the CPU and may cause higher CPU load.

From the *Dialogs* menu select *GenICam Settings* then chose *Guru* under *GenICam Properties* to gain full access to all camera and software functions:



3.2 Using IC4 SDK Examples

The Imaging Control IC4 SDK provides different SDK examples for the programming languages C, C++, .NET and Python.

You can find them on GitHub:

https://github.com/TheImagingSource/ic4-examples

The SDK documentation for the different APIs is available here:

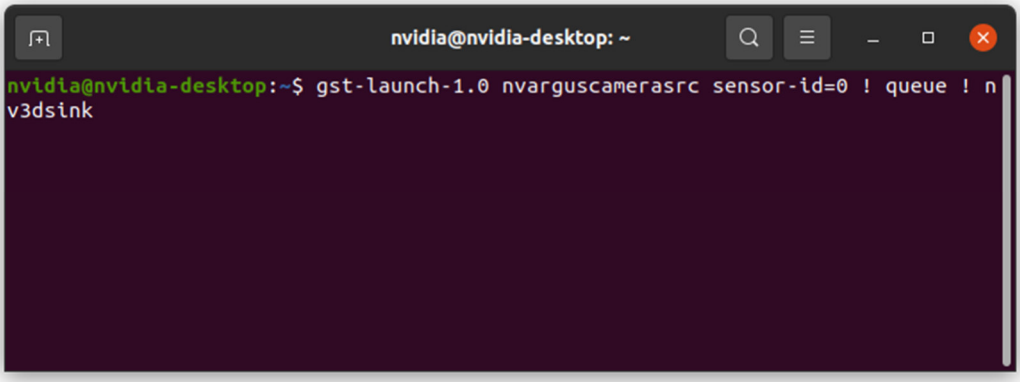
- C API:
  https://www.theimagingsource.com/en-us/documentation/ic4c/index.html
- C++ API:
  https://www.theimagingsource.com/en-us/documentation/ic4cpp/index.html
- .NET API:
  https://www.theimagingsource.com/en-us/documentation/ic4dotnet/articles/intro.html
- Python:
  https://www.theimagingsource.com/en-us/documentation/ic4python/index.html

3.3 Using GStreamer

To launch native image acquisition via GStreamer, type in the following commands in a terminal:

For camera '0':

#gst-launch-1.0 nvarguscamerasrc sensor-id=0 ! queue ! nv3dsink



This will start image acquisition on camera ‘0’ and launch a display window:



For camera '1':

#gst-launch-1.0 nvarguscamerasrc sensor-id=0 ! queue ! nv3dsink

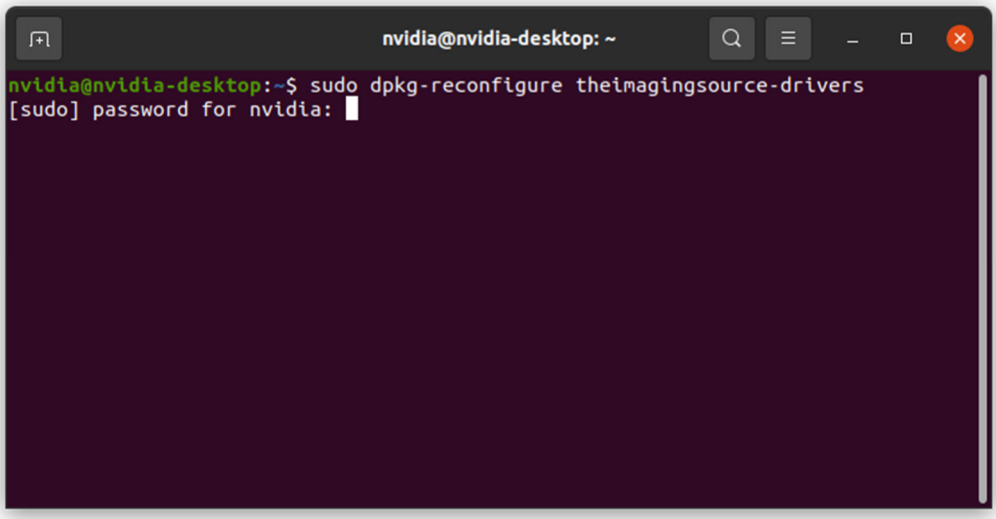
	Note The proper configuration and use of GStreamer is not covered by this document.

4. Driver Configuration

If you would like to use a camera model other than the ones included with this reference design, you must reconfigure the camera drivers and reboot the system.

To do so, execute the following command in a terminal:

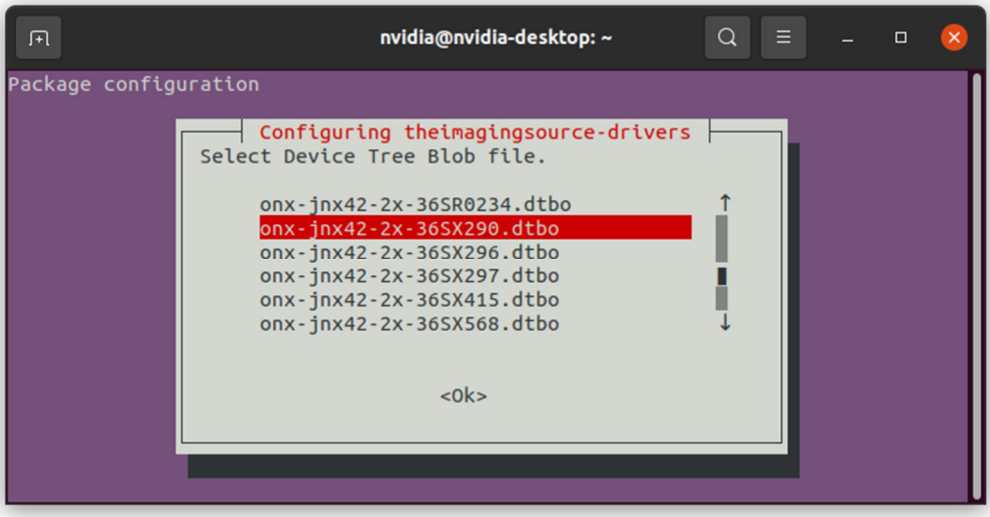
#sudo dpkg-reconfigure theimagingsource-drivers



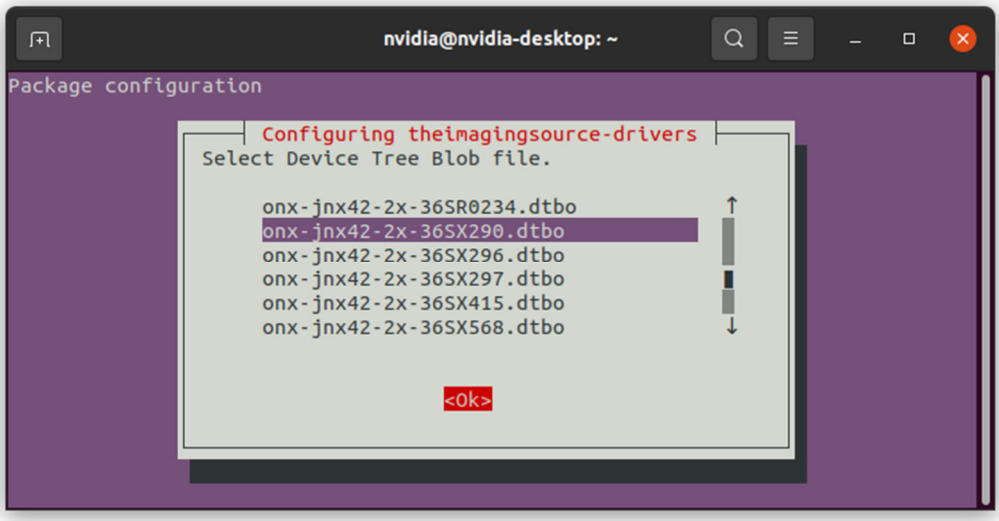
Confirm to continue:



Select the correct camera model (e.g., 36SX290) and carrier board model (e.g., onx-jnx42):



Use the *Tab* key to select *Ok* and confirm your choice:



Confirm to make the current selection the default one:



Reboot the system to apply the changes, e.g.:

#sudo reboot

	Note If you do not reconfigure the drivers to match your camera model, the camera may not be detected or may not work properly. If you do not reboot the board after reconfiguring the driver, the changes will not take effect. **Always unplug the power supply from the board before changing the cameras.**

5. Documentation

Refer to the following documentation:

- To find the Technical Reference Manuals for 36S MIPI CSI-2 cameras, refer to: https://www.theimagingsource.com/en-de/embedded/mipi-csi-2/36s/
- To find the Technical Reference Manuals for Acuva GMSL2 IP67 cameras, refer to: https://www.theimagingsource.com/en-de/embedded/gmsl2/acuva/
- To find the Technical Reference Manuals for 36C FPD-Link III cameras, refer to: https://www.theimagingsource.com/en-de/embedded/fpd-link-iii/
- To find the Technical Reference Manuals for the MDSER-GMSL2-4CH and MDSER-FPD3-4CH deserializer boards, refer to: https://www.theimagingsource.com/en-de/embedded/deserializer/gmsl2-fpd-link-iii/
- To find online documentation, e.g., Technical Reference Manual for the NVIDIA Orin Reference Design / carrier board(s), refer to: https://www.theimagingsource.com/en-de/embedded/kit/jetson-orin/
- To find the MIPI driver online documentation, refer to: https://www.theimagingsource.com/en-us/documentation/theimagingsourcedriversjp6/
- For FAQs or Support refer to: https://www.theimagingsource.com/support/

Revision History

Document Number	Date	Changes
AN20250208-01	08 February 2025	Initial release version of this document.
AN20250208-02	05 June 2025	The following changes have been made: ▪ Chapter 1.2: Updated cable type, i.e., CA-FPC-22P-22P/0.20 ▪ Added Chapter 1.2.1. ▪ Chapter 1.3: Updated JetPack version to JetPack 6.2.
AN20250208-03	15 July 2026	The following changes have been made: ▪ Added Chapter 1.2.2 Deserializer Boards ▪ Update Chapter 1.3 Software ▪ Added Chapter 2.1 Assembling of Deserializer Boards ▪ Updated Chapter 3 Image Acquisition ▪ Updated Chapter 5 Documentation

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All weights and dimensions are approximate. Unless otherwise specified, lenses shown in camera product images are not included with the cameras.