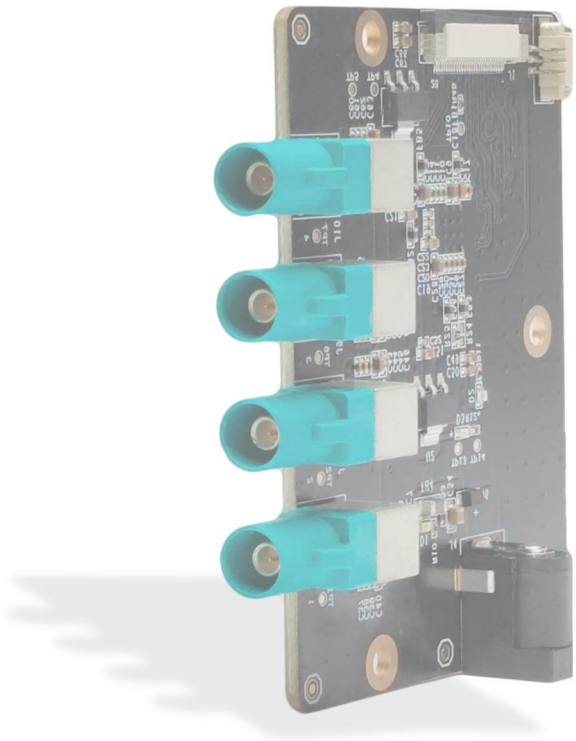
User manual

SG4A-ORIN-GMSL2



Version 1.0

Disclaimers

SENSING reserves the **right to** edit/modify this document without any prior notice.

Catalogue

Document Revision of curriculum vitae

Rev Document version number	Date Date of revision	Description Description	Author Author
V1.0	2023/03/28	Initial release	Research and Development

Safety warnings and precautions for use

- **Safety instructions**

Before using this product, you must first consult this document to gain an initial understanding of the product and follow the safety instructions in the product's user manual to ensure your personal safety and to avoid damage to the equipment. The manufacturer is not responsible for any problems with the equipment or the safety of your life and property caused by its incorrect operation.

- **Supply voltage**

12V DC input power to the adapter; current: 3A or more

- **Environmental requirements:**

Operating temperature: -20°C - 85°C

Ventilation requirements: The area around the installation of the calculation platform must be well ventilated.

- **Grounding requirements**

The power supply of the power adapter must be well earthed, in special scenarios it is necessary to install an earth screw to earth.

- **Static Protection**

Electronic components and circuits are sensitive to electrostatic discharge. Although we design our circuit board card products with anti-static protection for the main

interfaces on the board, it is difficult to achieve anti-static safety protection for all components and circuits. It is therefore advisable to observe anti-static safety measures when handling any circuit board components. ESD safety measures include, but are not limited to, the following:

- The box should be placed in an anti-static bag during transport and storage until the installation is deployed before taking this adapter board;
- The static electricity stored in the body should be discharged before the body comes into contact with the box: wear a discharge grounding wristband;
- Operate the box only within the safe area of the static discharge point;
- Avoid moving boxes in carpeted areas.

Explanation of nouns

POC	Power Over Coax
GMSL	Gigabit Multimedia Serial Links
FPDLINK	Flat Panel Display Link
SerDes	Serializer and Deserializer
D-PHY	The original version of the MIPI D-PHY was designed for

	500Mbits/s, while D is 500 in Roman numerals (Latin numerals), and C and M are 100 and 1000 in Roman numerals respectively, i.e. C and M in C-PHY and M-PHY.
C-PHY	C-PHYs may be used in channel-limited applications, hence the use of the character "C", 3-Phase symbol encoding technology, which allows each symbol to 2.28bits of data per symbol, 2.27 times more efficient than D-PHY using a 5-input transmission

Chapter 1 Introduction to the SG4A-ORIN-GMSL2 adapter board

The SG4A-ORIN-GMSL2 adapter board, which allows up to 16 cameras to be connected to the Jetson AGX Orin/Xavier module, is fully compatible with the NVIDIA Jetson AGX Orin/Xavier Development Kit. As there are many different types of GMSL cameras available, the adapter board can be adaptively operated at different frequencies i.e. it is compatible with both GMSL1 and GMSL2 protocol interfaces through software configuration. The GMSL camera is powered by PoC (Power over Coax), so all data, control signals and power are sent over a 50 Ohm coaxial cable, making the camera's cable routing flexible and easy to install in automotive applications. As the 120Pin connector on the NVIDIA Jetson AGX Orin/Xavier development kit does not provide the required voltage for the camera, the adapter board has a hot-swappable 12V power external connector.

1.1 SG4A-ORIN-GMSL2 Adapter plate function

- Compatible with official kits

  Support for NVIDIA Jetson AGX Orin/Xavier Development Kit
- Compatible with different versions of NVIDIA JetPack SDK

  Jetpack 5.0.1, L4T r34.1.1 and above
- Supports up to 16 GMSL cameras

Each SG4A-ORIN-GMSL2 single board has a built-in Maxim MAX96712, which supports 4*GMSL2 cameras and can be connected to a total of 4 SG4A-ORIN-GMSL2s, expanding to a maximum of 16 channels

- Support for synchronous triggering

  Support for external trigger signals for camera synchronisation

- Cameras can transmit up to 15 metres

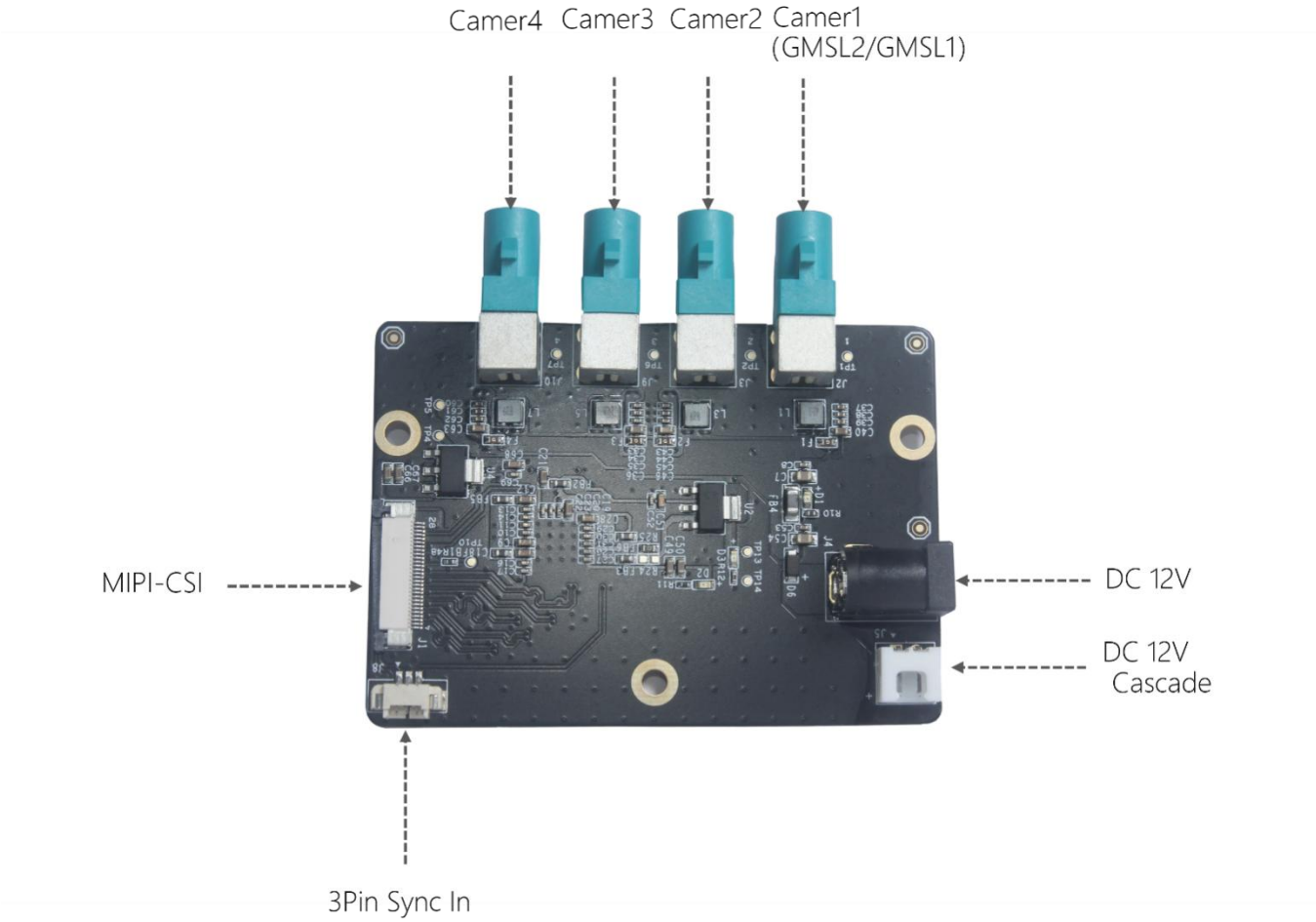
  By using the GMSL protocol for cameras, you can support stable and reliable transmission of cameras over long distances, with a maximum distance support of 15 metres. The use of Moriyun repeaters allows for the extension of: https://www.sensing-world.com/gmslzjq

1.2 SG4A-ORIN-GMSL2 Adapter Plate Specification

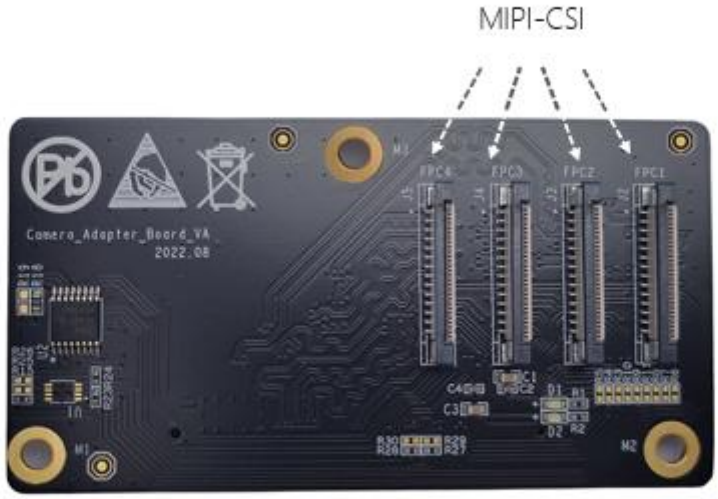
Model / Model	SG4A-ORIN-GMSL2
Dimension	73.66mm*53.34mm
Weight	<50g
Connectors / Connector	MIPI CSI-2
Camera input / Camera input	Camera*4(GMSL2/GMSL1)
Trigger In / Trigger In	3Pin Sync In
Deserializer / Deserializer	MAX96712GTB
Camera Connector / Camera	Fakra Z Code

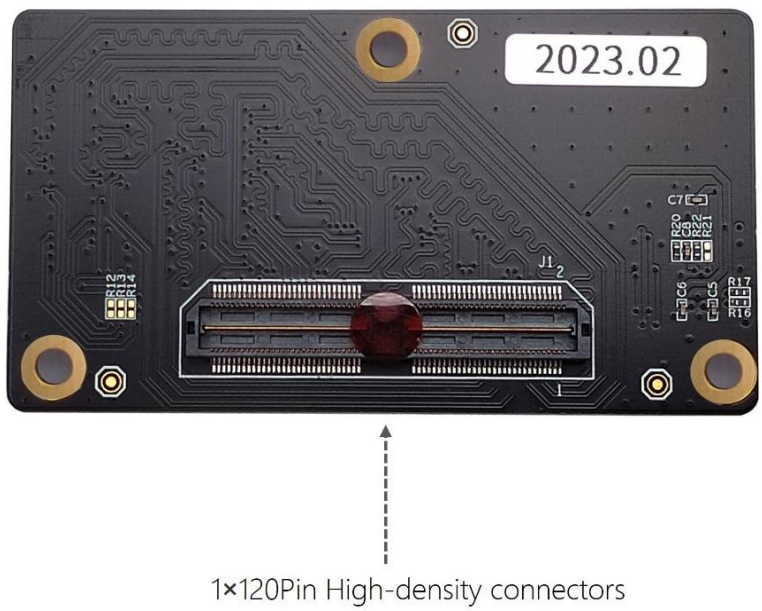
Connector	
POC Power Supply / POC Power Supply	DC 8-16V
DC Power Supply / DC Power Supply	DC 12V
Operating Temperature / Operating Conditions	-20°C to +85°C
Adaptation kit	Jetson AGX Orin/Xavier
with adapter plate / collocation	SG4A-NVKit-MIPI Adapter board

- SG4A-ORIN-GMSL2 Interface diagram of the adapter board



- SG4A-NVKit-MIPI adapter board interface diagram


MIPI-CSI
FPC4
FPC3
FPC2
FPC1
Camera_Adapter_Board_VA
2022.08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1×120Pin High-density connectors

Chapter 2 SG4A-ORIN-GMSL2 Instructions for using the adapter plate

2.1 Setting up the environment

Reference link to Nvidia's official website:

Software Setup

https://developer.nvidia.com/embedded/learn/jetson-agx-orin-devkit-user-guide/two_ways_to_set_up_software.html

To Flash the Jetson Developer Kit Operating Software

https://docs.nvidia.com/jetson/archives/r35.1/DeveloperGuide/text/IN/QuickStart.html#to-flash-the-jetson-developer-kit-operating- software

The driver package for the SG4A-ORIN-GMSL2 adapter board is developed on a specific Jetson Linux version and you need to make sure the Jetson Linux version matches before installing the driver. If it does not match, you need to re-flash the system, otherwise the system will not boot after installing the driver. NVIDIA Jetson AGX Orin/Xavier supports two types of flashes using SDK Manager and Flash.sh script.

Preparation required:

- NVIDIA Jetson AGX Orin/Xavier Development Kit
- Computer with Ubuntu 18.04/20.04s 1

- USB TYPE-C data cable 1pc

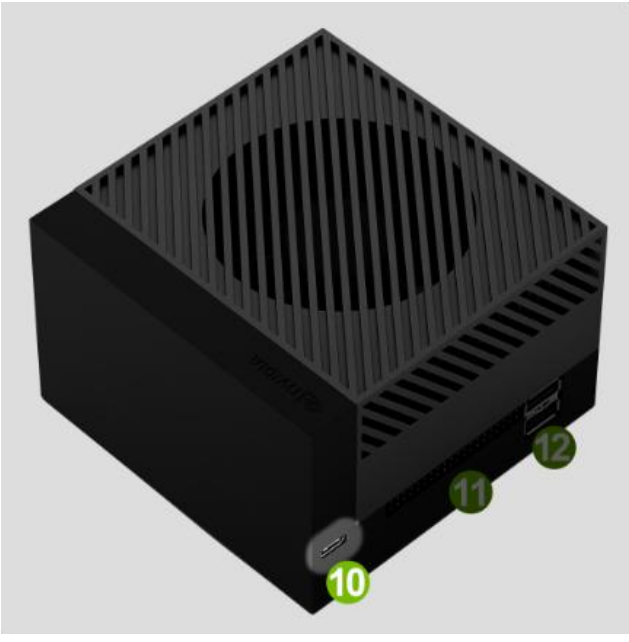
2.1.1 Set RECOVERY download mode

The Nvidia Jetson platform software is upgraded via the USB interface and the Jetson device needs to be put into Recovery mode before the upgrade can take place, which includes the Kernel Kernel, the file system RootFS, the JetPack SDK and more.

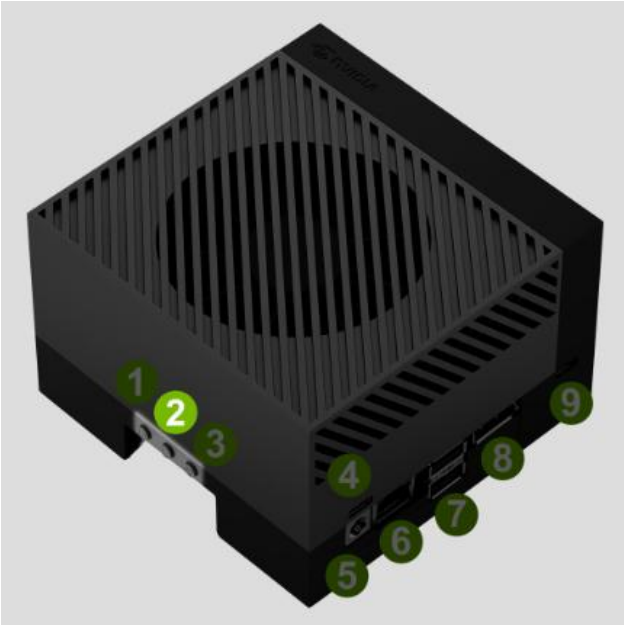
To enter Recovery download mode in the off state, proceed as follows:

(1) Connecting a USB TYPE-C cable

Use a USB TYPE-C cable to connect the Jetson device to the Ubuntu Host, one end to the TYPE-C port of the Jetson device⑩ and the other end to the USB port of the Ubuntu Host



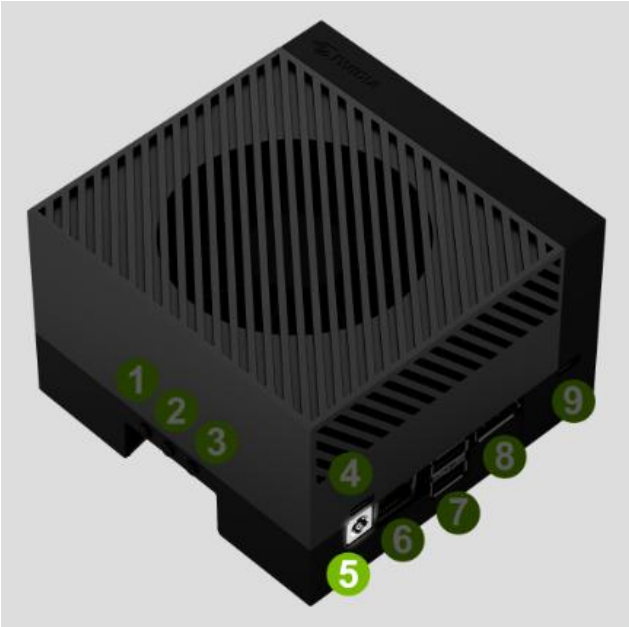
(2) Press and hold the Force Recovery button at② and do not release it yet



(3) Access to power

Can be connected to the power supply using the Type-C connector ④

Can also be connected to the power supply using the DC interface ⑤



(4) If the white LED⑥ does not light up, press and hold the power on button① to switch on

(5) Wait for more than 5s and release all buttons to enter Recovery download mode

You can run the command lsusb on the Ubuntu Host to check for NVIDIA Corp. APX devices to confirm that the Jetson device has successfully entered Recovery download mode.

```
sensing@ubuntu:~$ lsusb
Bus 004 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 003 Device 004: ID 0e0f:0002 VMware, Inc. Virtual USB Hub
Bus 003 Device 003: ID 0e0f:0002 VMware, Inc. Virtual USB Hub
Bus 003 Device 005: ID 0955:7023 NVIDIA Corp. APX
Bus 003 Device 002: ID 0e0f:0003 VMware, Inc. Virtual Mouse
Bus 003 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 002 Device 003: ID 0e0f:0002 VMware, Inc. Virtual USB Hub
Bus 002 Device 002: ID 0e0f:0008 VMware, Inc. Virtual Bluetooth Adapter
Bus 002 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
sensing@ubuntu:~$
```

2.1.2 Use the SDK Manager to brush your phone

(1) Download SDK Manager

Download the latest SDK Manager from the official website and select the .deb format for Ubuntu.

https://developer.nvidia.com/nvidia-sdk-manager

Once downloaded, copy it to the working directory of your Ubuntu Host and install it.

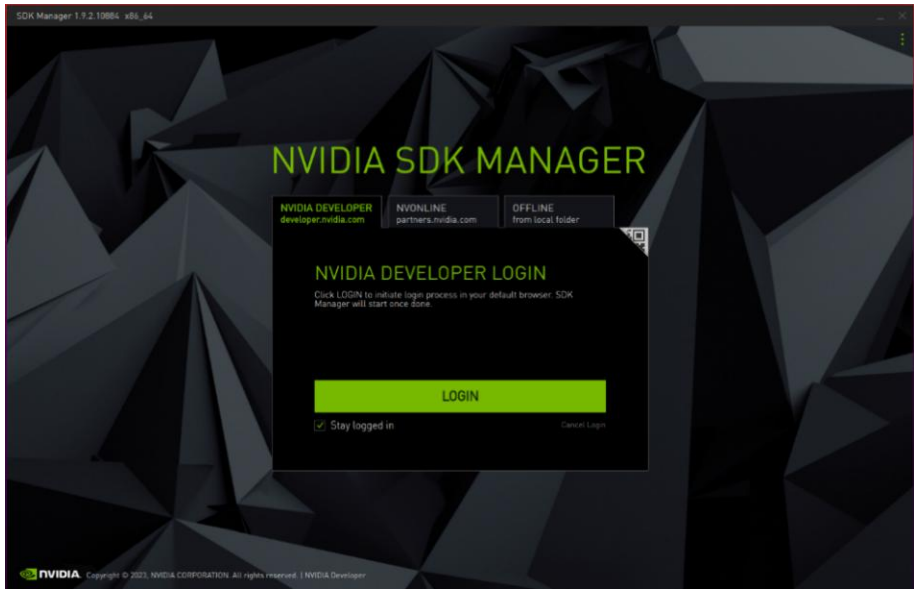
```
$ sudo apt install . /sdkmanager_1.9.2-10884_amd64.deb
```

(2) Run SDK Manager

Before running the SDK Manager, please refer to section 2.1.1 Setting up RECOVERY download mode to put the Jetson device into Recovery download mode. Find and click on the "SDKManager" icon in the application to run the SDK Manager, or run it from the terminal with the following command.

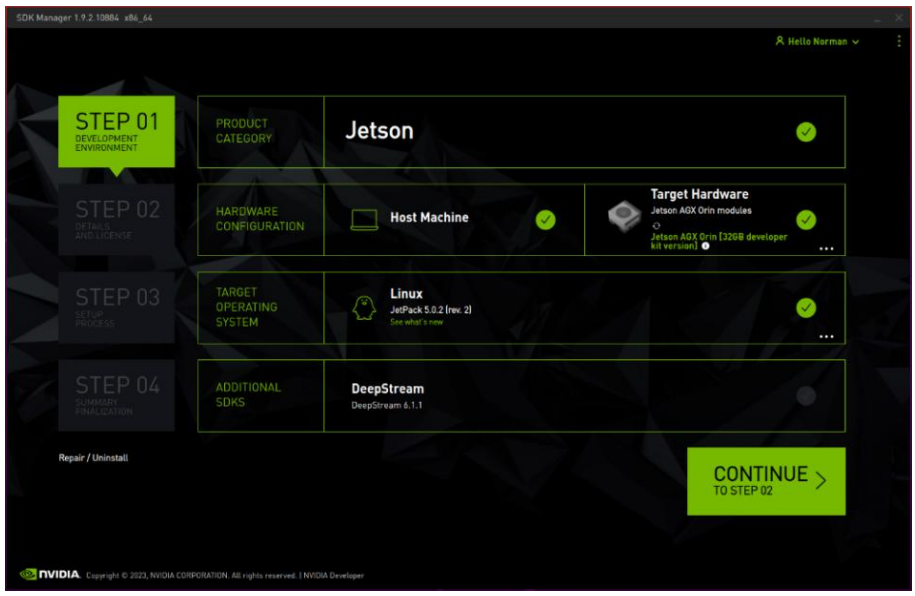
```
$ sdkmanager
```

Once launched, you will need to log in with your account, if you don't already have one, you can register for a developer account.

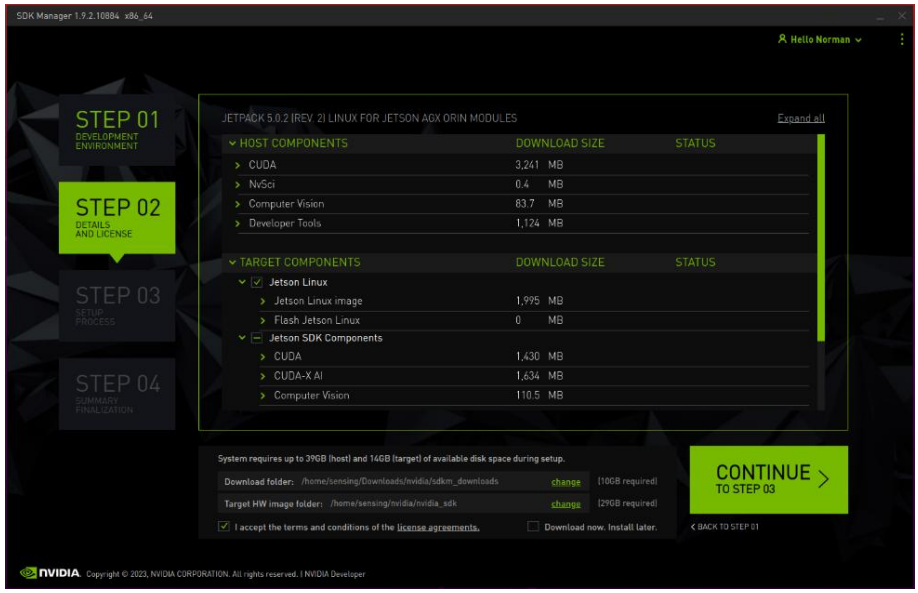


(3) Refresh

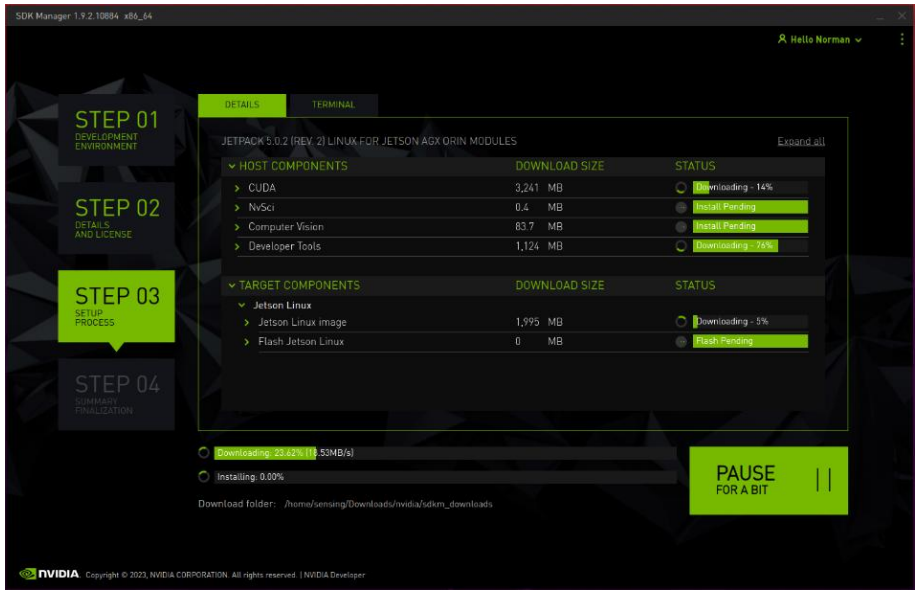
STEP 01: Automatically identify the Jetson device, select the JetPack version to match the Jetson Linux version required by the driver package, here JetPack 5.0.2 (Jetson Linux 35.1) is used as an example. Note that if there is no matching version, you need to use the Flash.sh script brushing method instead.



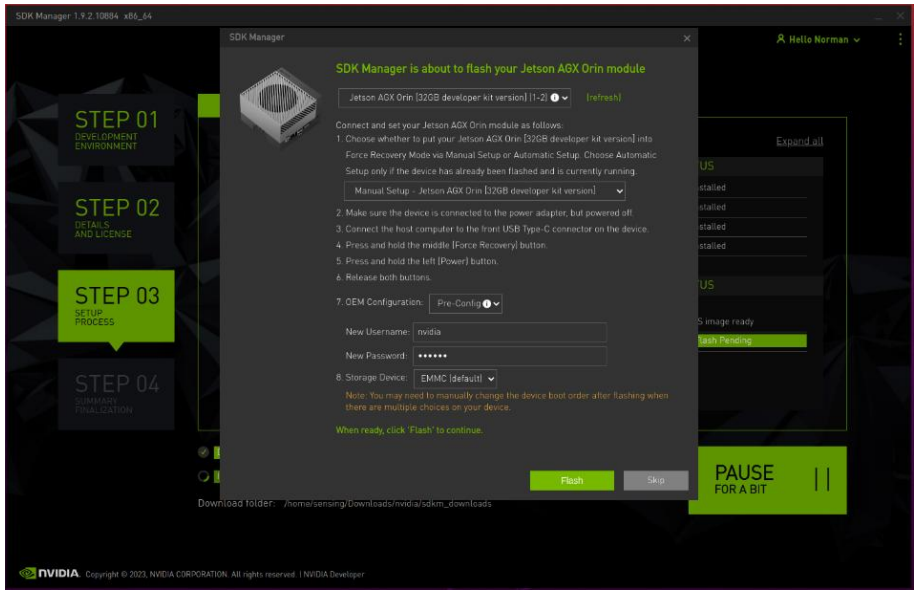
STEP 02: Select the components to be installed according to your needs

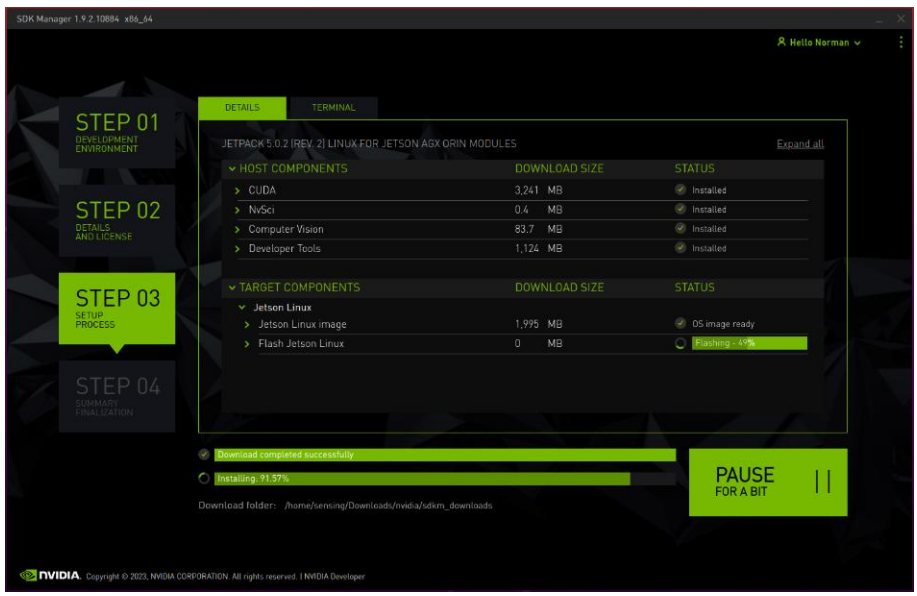


STEP 03: Download and Installation

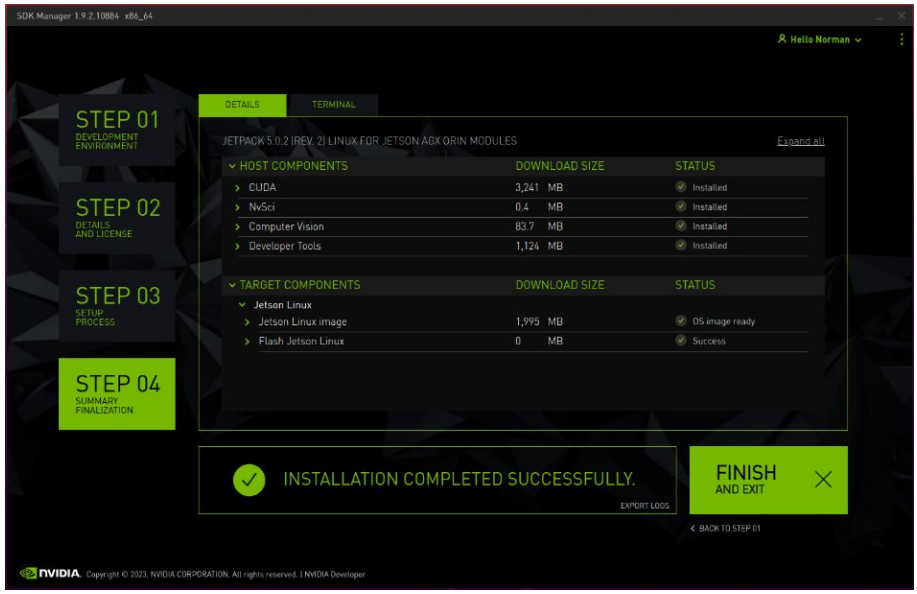


As the Jetson device is already in Recovery mode, here select Manual Setup, and set a new username and password.





STEP 04: Installation complete



Once the swipe is complete, the Jetson device automatically boots into the Linux desktop.

2.1.3 Use the flash.sh script to flush the machine

(1) Download the brush package

https://developer.nvidia.com/embedded/jetson-linux

Depending on the driver version, select the corresponding Jetson Linux version, here JetPack 5.0.2 (Jetson Linux 35.1) is used as an example.

Downloads and Links

	Jetson Orin modules and developer kit	Jetson Xavier modules and developer kits
DRIVERS	Driver Package (BSP)	
	Sample Root Filesystem	
SOURCES	Driver Package (BSP) Sources	
	Sample Root Filesystem Sources	
	Sensor Processing Engine Sources	
DOCS	Jetson AGX Orin Developer Kit User Guide	Jetson AGX Xavier Developer Kit User Guide Jetson AGX Xavier Platform Adaptation Guide
	Release Notes	
	Jetson Linux Developer Guide (online version) Jetson Linux Developer Guide (downloadable version)	
	Software License Agreement	
	Jetson Linux API Reference (formerly named Multimedia API Reference)	
	nvbuf_utils to NvUtils Migration Guide	

Click on Driver Package to download to get Jetson_Linux_R35.1.0_aarch64.tbz2

Click on Sample Root Filesystem to download Tegra_Linux_Sample-Root-Filesystem_R35.1.0_aarch64. tbz2 and copy it to the working directory of your Ubuntu Host.

```
sensing@ubuntu:~/nvidia$ ls
Jetson_Linux_R35.1.0_aarch64.tbz2
Tegra_Linux_Sample-Root-Filesystem_R35.1.0_aarch64.tbz2
sensing@ubuntu:~/nvidia$
```

(2) Unzip and install the brush package

Unzip the package, note that the filesystem needs to be extracted to the Linux_for_Tegr a/rootfs directory via sudo.

```
$ tar -jxvf Jetson_Linux_R35.1.0_aarch64.tbz2
$ sudo tar -jxvf Tegra_Linux_Sample-Root-Filesystem_R35.1.0_aarch64.tbz2 -C Linux_for_Tegr a/rootfs/
```

Execute the apply_binaries.sh script

```
$ cd Linux_for_Tegra/
$ sudo . /apply_binaries.sh
```

```
Setting up nvidia-l4t-initrd (35.1.0-20220810203728) ...
Pre-installing initrd package, skip flashing
Setting up nvidia-l4t-jetson-io (35.1.0-20220810203728) ...
Setting up nvidia-l4t-multimedia (35.1.0-20220810203728) ...
Setting up nvidia-l4t-pva (35.1.0-20220810203728) ...
Setting up nvidia-l4t-vulkan-sc-samples (35.1.0-20220810203728) ...
Setting up nvidia-l4t-weston (35.1.0-20220810203728) ...
Setting up nvidia-l4t-display-kernel (5.10.104-tegra-35.1.0-20220810203728) ...
Setting up nvidia-l4t-camera (35.1.0-20220810203728) ...
Setting up nvidia-l4t-graphics-demos (35.1.0-20220810203728) ...
Setting up nvidia-l4t-gstreamer (35.1.0-20220810203728) ...
Processing triggers for nvidia-l4t-kernel (5.10.104-tegra-35.1.0-20220810203728)
 ...
Processing triggers for libc-bin (2.31-0ubuntu9.9) ...
/home/sensing/nvidia/Linux_for_Tegra
Removing QEMU binary from rootfs
Removing stashed Debian packages from rootfs
L4T BSP package installation completed!
Disabling NetworkManager-wait-online.service
Disable the ondemand service by changing the runlevels to 'K'
Success!
```

Note: If an error is reported during the execution of this script, follow the prompts to install the appropriate dependency package.

(3) Refresh

Refer to section "2.1.1 Setting up Recovery Download Mode" to put the Jetson device into Recovery download mode. After confirming that the device is recognized with the lsusb command, execute the following command to refresh the device.

```
$ sudo . /flash.sh jetson-agx-orin-devkit mmcblk0p1
```

```
[ 688.5490 ] Bootloader version 01.00.0000
[ 688.5808 ] Writing partition A_MEM_BCT with mem_coldboot_sigheader.bct.encrypt
 [ 243712 bytes ]
[ 688.5826 ] [.............................................] 100%
[ 691.6344 ] tegradevflash_v2 --write B_MEM_BCT mem_coldboot_sigheader.bct.encry
pt
[ 691.6494 ] Bootloader version 01.00.0000
[ 691.6854 ] Writing partition B_MEM_BCT with mem_coldboot_sigheader.bct.encrypt
 [ 243712 bytes ]
[ 691.6886 ] [.............................................] 100%
[ 694.7130 ] Flashing completed

[ 694.7228 ] Coldbooting the device
[ 694.7371 ] tegrarcm_v2 --chip 0x23 0 --ismb2
[ 694.7568 ] MB2 version 01.00.0000
[ 694.7947 ] Coldbooting the device
[ 694.7960 ] tegrarcm_v2 --chip 0x23 0 --reboot coldboot
[ 694.8031 ] MB2 version 01.00.0000
*** The target t186ref has been flashed successfully. ***
Reset the board to boot from internal eMMC.
```

After brushing, the Jetson device automatically reboots into the Linux system and follows the wizard to complete the configuration to access the desktop.

2.2 Driver installation and camera lighting

For a list of supported cameras and driver installation spotlights, please contact sales for a copy.

Contact us

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