



**SmartCow<sup>®</sup>**  
An AI Engineering Company

# Uranus User's Manual

Version 1, March 2023

# Copyright and legal statement

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# Declaration of conformity

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## **FCC**

This equipment has been tested and verified to comply with the limits for a Class A digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area (domestic environment) is likely to cause harmful interference, in which case the user will be required to correct the interference (take adequate measures) at their own expense.

## **CE**

The product described in this manual complies with all applicable European Union (CE) directives if it has a CE marking. For computer systems to remain CE compliant, only CE-compliant parts may be used. Maintaining CE compliance also requires proper cable and cabling techniques.

# Safety precautions

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Please read the following safety instructions carefully. It is advised that you keep this manual for future references.

- All cautions and warnings on the device should be noted.
- All cables and adapters supplied by SmartCow are certified and in accordance with the material safety laws and regulations of the country of sale. Do not use any cables or adapters not supplied by SmartCow to prevent system malfunction or fires.
- Make sure the power source matches the power rating of the device.
- Position the power cord so that people cannot step on it. Do not place anything over the power cord.
- Always completely disconnect the power before working on the system's hardware.
- No connections should be made when the system is powered as a sudden rush of power may damage sensitive electronic components.
- If the device is not to be used for a long time, disconnect it from the power supply to avoid damage by transient over-voltage.
- Always disconnect this device from any AC supply before cleaning.
- While cleaning, use a damp cloth instead of liquid or spray detergents.
- Make sure the device is installed near a power outlet and is easily accessible.
- Keep this device away from humidity.
- Place the device on a solid surface during installation to prevent falls.
- Do not cover the openings on the device to ensure optimal heat dissipation.
- Watch out for high temperatures when the system is running.
- Do not touch the heat sink or heat spreader when the system is running.
- Never pour any liquid into the openings. This could cause fire or electric shock.
- As most electronic components are sensitive to static electrical charge, be sure to ground yourself to prevent static charge when installing the internal components. Use a grounding wrist strap and contain all electronic components in any static-shielded containers.
- If any of the following situations arises, please contact our service personnel:
  - Damaged power cord or plug
  - Liquid intrusion to the device
  - Exposure to moisture
  - Device is not working as expected or in a manner as described in this manual
  - The device is dropped or damaged
  - Any obvious signs of damage displayed on the device
- Do not leave this device in an uncontrolled environment with temperatures beyond the device's permitted environment with temperatures (see specification) to prevent damage.
- RTC battery warnings
  - Use replacement batteries that comply with the recommended battery safeguards, especially for certain types of lithium batteries.
  - Do not dispose of batteries into a fire or oven, or crush them, as this can lead to an explosion.
  - Do not leave batteries in extremely hot environments, as this can cause flammable liquids or gases to leak and ignite.
  - Do not subject batteries to extremely low air pressures, as this may cause flammable liquids or gases to leak, resulting in an explosion.

# Warranty and RMA

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## Warranty Period

SmartCow warrants that products will be free from defects in material and workmanship for 2 years (24 months), beginning on the date of invoice by SmartCow. SmartCow will provide free of charge warranty coverage to all the products manufactured and sold in case the purchased product is proven defective in material or workmanship under normal use during the warranty period.

## Return Merchandise Authorization (RMA)

- Customers can claim RMA service by requesting “SmartCow RMA Service Form” from the account manager. After filling out the form, the account manager will reply with a corresponding RMA number.
- Customers must collect all the information about the problems encountered and note anything abnormal or, print out any on-screen messages, and describe the problems on the “SmartCow RMA Service Form” for the RMA number application process.
- Customers shall return the RMA to SmartCow within 7 working days after the RMA number was generated and enclose the “SmartCow RMA Service Form” with the returned packages.
- SmartCow has the right to refuse providing repair services for products no longer in warranty. If SmartCow chooses to provide repair services, the customer will be charged for the repair fees and component fees. Additionally, the needed repairing time depends on component acquisition.
- Any products returned by SmartCow to other locations besides the customers’ site will bear an extra charge and will be billed to the customer.

# RoHS compliance

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## **SmartCow RoHS environmental policy**

SmartCow is a global citizen for building digital infrastructure. We are committed to providing green products and services, which are compliant with European Union RoHS (Restriction on Use of Hazardous Substance in Electronic Equipment) directive 2011/65/EU and 2015/863, to be your trusted green partner and to protect our environment.

RoHS restricts the use of Lead (Pb) < 0.1% or 1,000ppm, Mercury (Hg) < 0.1% or 1,000ppm, Cadmium (Cd) < 0.01% or 100 ppm, Hexavalent Chromium (Cr6+) < 0.1% or 1,000ppm, Polybrominated biphenyls (PBB) < 0.1% or 1,000ppm, and Polybrominated diphenyl Ethers (PBDE) < 0.1% or 1,000ppm.

In order to meet the RoHS compliant directives, SmartCow has established an engineering and manufacturing task force to implement the introduction of green products. The task force will ensure that we follow the standard SmartCow development procedure and that all the new RoHS components and new manufacturing processes maintain the highest industry quality levels for which SmartCow is renowned.

The model selection criteria will be based on market demand. Vendors and suppliers will ensure that all designed components will be RoHS compliant.

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## Topics:

- [Features and key benefits of Uranus](#)
- [Specifications of Uranus](#)
- [Block diagram](#)
- [Layout](#)
- [I/O ports, pins, and switches](#)

Uranus is an AI edge fanless embedded system.

It is powered by the NVIDIA® Jetson™ NX, TX2 NX, or Nano modules. Uranus can run multiple neural networks and process multiple high-resolution images at the same time.

## 1.1 Features and key benefits of Uranus

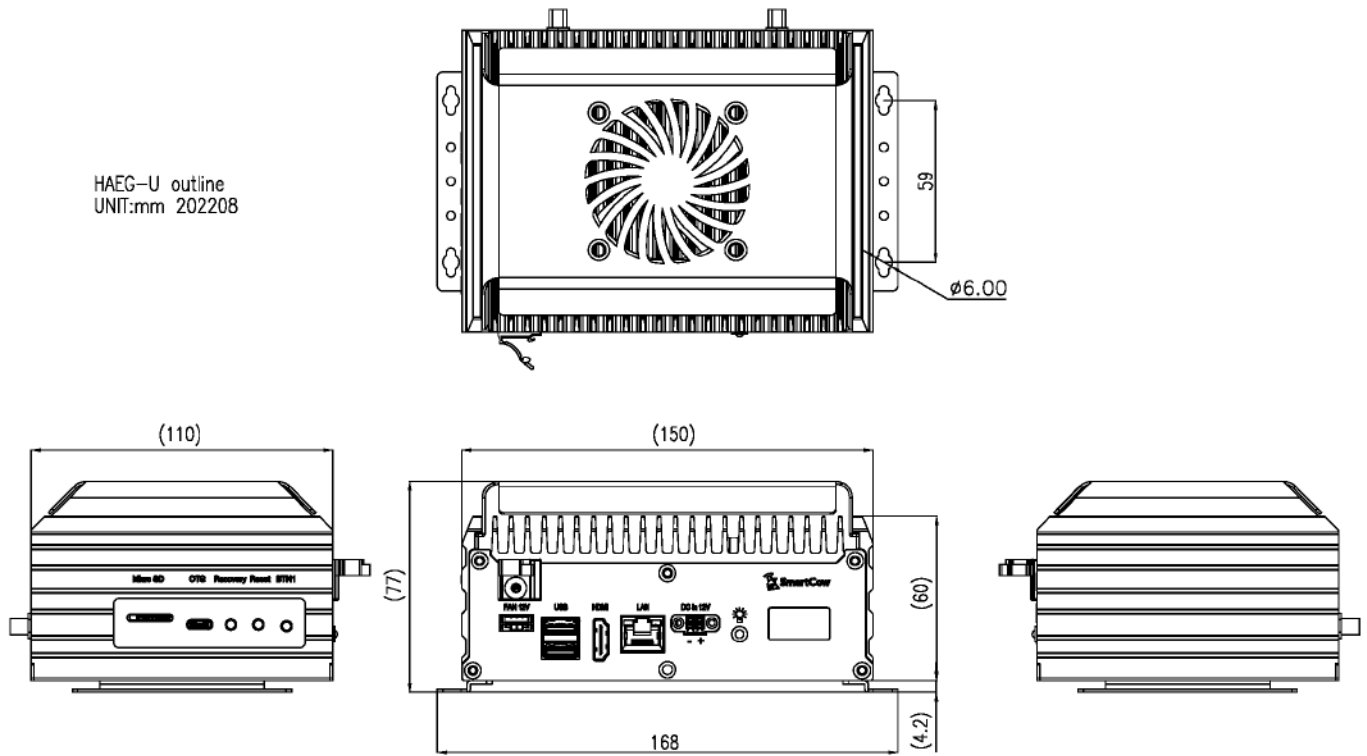
- Uranus has a compact and fanless design, so it is easy to deploy indoors and outdoors.
- It has a GPU-accelerated platform that is compatible with a range of modules (Xavier™ NX, TX2 NX, and Nano).
- As a lightweight all-in-one solution, Uranus is easy to deploy with minimal labor costs and fully-integrated hardware and software.
- It operates multiple neural networks and can process several high-resolution images concurrently.

## 1.2 Specifications of Uranus

General	Processor	NVIDIA Jetson Xavier NX 16GB/ TX2 NX/ Nano
	BSP	JetPack
	Power input	12V DC input with 2-pin Terminal block
	Certification	CE, FCC
Physical I/O	Display	1 x HDMI 2.0 Type A 1 x 0.96" OLED
	Ethernet	1 x RJ45 GbE (10/100/1000)
	Tact switch	1 x Recovery 1 x Reset 1 x GPIO
	USB	2 x USB3.2 Gen1 Type A (5Gbps total) 1 x USB2.0 Type C (OTG only)
	SD card	1 x micro SD
	4-pin header	1 x fan connector
	Power LED	1 x Power LED indicator
Expansion	Expansion slot	1 x Mini PCIe (USB2.0/SATA/PCIe) (full size/half size)
	SIM card	1 x Nano SIM slot
Environment	Operating temperature	-25°C - +60°C
	Storage temperature	-40°C - +85°C



HAEG-U outline  
UNIT:mm 202208



## 1.5 I/O ports, pins, and switches

The following photographs show where you can find the I/O ports, pins, and switches on Uranus.

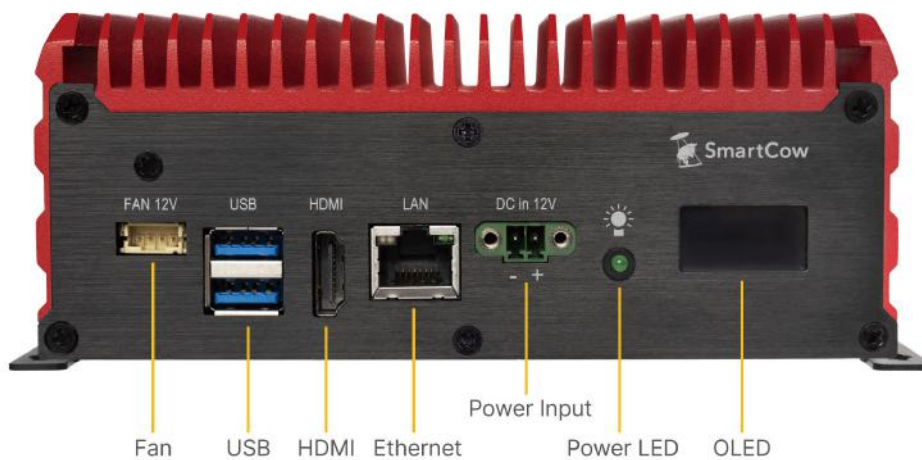
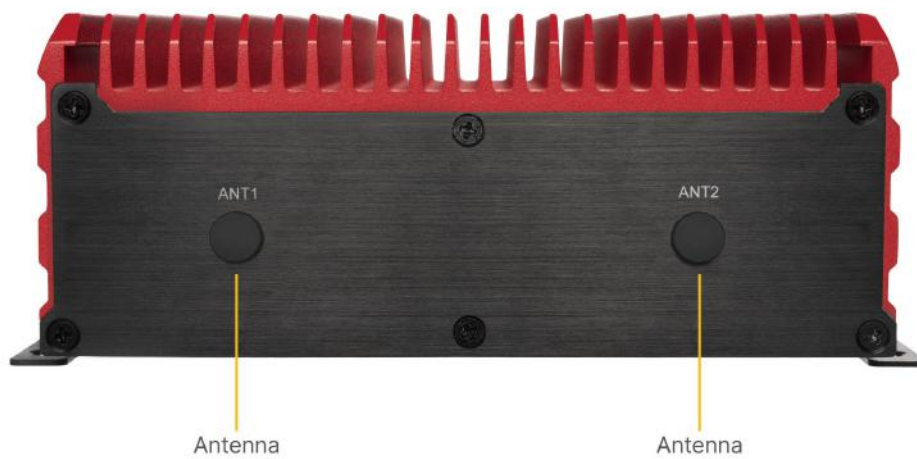
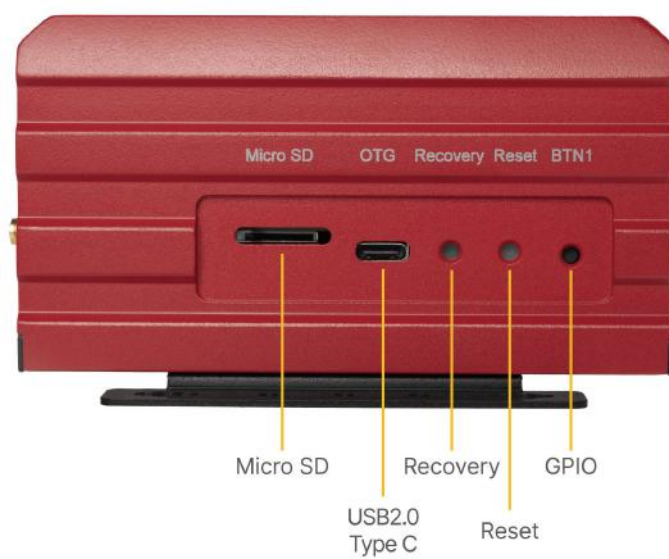


Figure 1: Front of Uranus



**Figure 2: Back of Uranus**



**Figure 3: Side of Uranus**

## Topics:

- [Uranus package contents](#)
- [Compatible Jetson modules](#)

These are the contents of the Uranus package, as well as the part numbers to use when ordering.

Model name	Description
HAEGU-XN16	AI embedded system with Jetson Xavier NX 16G, 12V DC, including 60W 12V adapter
HAEGU-TN04	AI embedded system with Jetson TX2 NX, 12V DC, including 60W 12V adapter
HAEGU-NN04	AI embedded system with Jetson Nano, 12V DC, including 60W 12V adapter

## 2.1 Uranus package contents

### Packaging list

Item	Description	Quantity
HAEGU	AI embedded system with NVIDIA Jetson module	1
Power adapter	DC 12V/5A, Terminal block	1
Screw	Mini PCIe screw	2
Standoff	Mini PCIe standoff	2

### Wall mount

Uranus comes with a wall mount bracket. To use the wall mount bracket, you need four M3 size screws that are at least 6mm in length. There is no installation height limit.

### Accessories list (optional)

Part number	Description
1Y0701800200LI	US power cord
1Y0701800100LI	EU power cord
51-U00000000004	Quectel EP06 Series (LTE Cat.6)
61-UAN00005RAR 1Y0801000010AR	LTE antenna and coaxial cable (Usage: 2)
51-U00000000000	mSATA 128G
51-U00000000005	JJPlus Wi-Fi module
61-UAN00003RAR 1Y0801000000AR	Wi-Fi antenna and coaxial cable (Usage: 2)
	Fan kit

## 2.2 Compatible Jetson modules

These are the Jetson modules that are compatible with Uranus.

	<b>Xavier NX 16GB</b>	<b>TX2 NX</b>	<b>Nano</b>
CPU	6-core NVIDIA Carmel ARM®v8.2 64-bit CPU 6MB L2 + 4MB L3 processor	Dual-Core NVIDIA Denver 2 64- Bit CPU Quad-Core Arm® Cortex®-A57 MPCore processor	Quad-core ARM Cortex-A57 MPCore processor
GPU	NVIDIA Volta™ architecture with 384 NVIDIA CUDA® cores and 48 Tensor cores	NVIDIA Pascal™ Architecture GPU with 256 CUDA cores	NVIDIA Maxwell architecture with 128 NVIDIA CUDA cores
Memory	16GB 128-bit LPDDR4x @ 59.7GB/s	4GB 128-bit LPDDR4 @ 51.2GBs	4GB 64-bit LPDDR4 @ 25.6GB/s
Storage	16GB eMMC 5.1		

## Topics:

- [Downloading the OLED demo files for Uranus](#)
- [Testing the OLED of Nano eMMC-based devices](#)
- [Testing the OLED of TX2 NX eMMC-based devices](#)
- [Testing the OLED of Xavier NX eMMC-based devices](#)

## About this task

### 3.1 Downloading the OLED demo files for Uranus

---

#### About this task

Before you begin OLED testing, download the OLED demo files.

#### Procedure

1. Download the zip folder containing the demo files using the following link.  
[https://smartcow-general-public.s3.us-east-2.amazonaws.com/BSPs/Gaia/oled\\_test.7z](https://smartcow-general-public.s3.us-east-2.amazonaws.com/BSPs/Gaia/oled_test.7z)
2. Extract the contents of the folder.
3. Follow the instructions to display an animated gif on your device.

### 3.2 Testing the OLED of Nano eMMC-based devices

---

#### Procedure

1. Download the luma example, and then run the following commands.

```
cd oled_test
```

```
git clone https://github.com/rm-hull/luma.examples.git
```

```
git clone --depth 1 --branch 3.8.1 https://github.com/rm-hull/luma.oled.git
```

```
git clone --depth 1 --branch 2.3.1 https://github.com/rm-hull/luma.core.git
```

```
sudo cp -r luma.oled/luma/ luma.examples/examples/
```

```
sudo cp -r luma.core/luma/core/ luma.examples/examples/luma/
```

```
sudo rm -r luma.oled/ luma.core/
```

2. Install the dependency by running the following commands.

```
sudo sed -i "s/#deb/deb/g" /etc/apt/sources.list.d/nvidia-l4t-apt-source.list
```

```
sudo apt update
```

```
sudo apt install python3-pip
```

```
sudo apt-get install libjpeg-dev zlib1g-dev libfreetype6-dev libavformat-dev libavdevice-dev
```

```
python3 -m pip install --upgrade setuptools
```

```
python3 -m pip install -r requirements.txt
```

```
sudo sed -i "s/deb/#deb/g" /etc/apt/sources.list.d/nvidia-l4t-apt-source.list
```

3. Change the settings by running these commands.

```
sudo cp animated_gif_sc.py luma.examples/examples/
```

```
sudo cp OLED-Welcome.gif luma.examples/examples/images/
```

```
sudo sed -i "/(128, 64): dict(multiplex=0x3F, displayclockdiv=0x80, compins=0x12),/a\ (128, 40): dict(multiplex=0x27, displayclockdiv=0x80, compins=0x12)," luma.examples/examples/luma/oled/device/__init__.py
```

4. Run the OLED.

```
cd luma.examples/
```

```
sudo python3 examples/animated_gif_sc.py --spi-port 1 --spi-device 1 --interface spi --gpio Jetson.GPIO --gpio-mode Jetson.GPIO.BOARD --gpio-data-command 32 --gpio-reset 31 --gpio-reset-hold-time 0.1 --width 128 --height 40
```



**Note:** To run scripts from the examples folder, you may need to manually install their dependencies.

## 3.3 Testing the OLED of TX2 NX eMMC-based devices

---

### Procedure

1. Download the luma example using the following commands.

```
cd oled_test
```

```
git clone https://github.com/rm-hull/luma.examples.git
```

```
git clone --depth 1 --branch 3.8.1 https://github.com/rm-hull/luma.oled.git
```

```
git clone --depth 1 --branch 2.3.1 https://github.com/rm-hull/luma.core.git
```

```
sudo cp -r luma.oled/luma/ luma.examples/examples/
```

```
sudo cp -r luma.core/luma/core/ luma.examples/examples/luma/
```

```
sudo rm -r luma.oled/ luma.core/
```

## 2. Install the dependency.

```
sudo sed -i "s/#deb/deb/g" /etc/apt/sources.list.d/nvidia-l4t-apt-source.list
```

```
sudo apt update
```

```
sudo apt install python3-pip
```

```
sudo apt-get install libjpeg-dev zlib1g-dev libfreetype6-dev libavformat-dev libavdevice-dev
```

```
python3 -m pip install --upgrade setuptools
```

```
python3 -m pip install -r requirements.txt
```

```
sudo sed -i "s/deb/#deb/g" /etc/apt/sources.list.d/nvidia-l4t-apt-source.list
```

## 3. Change the settings.

```
sudo cp animated_gif_sc.py luma.examples/examples/
```

```
sudo cp OLED-Welcome.gif luma.examples/examples/images/
```

```
sudo sed -i "/(128, 64): dict(multiplex=0x3F, displayclockdiv=0x80, compins=0x12),/a\ (128, 40): dict(multiplex=0x27, displayclockdiv=0x80, compins=0x12)," luma.examples/examples/luma/oled/device/__init__.py
```

## 4. Run the OLED.

```
cd luma.examples/
```

```
sudo python3 examples/animated_gif_sc.py --spi-port 1 --spi-device 0 --interface spi --gpio Jetson.GPIO --gpio-mode Jetson.GPIO.BOARD --gpio-data-command 32 --gpio-reset 31 --gpio-reset-hold-time 0.1 --width 128 --height 40
```



**Note:** To run scripts from the examples folder, you may need to manually install their dependencies.

## 3.4 Testing the OLED of Xavier NX eMMC-based devices

---

### Procedure

#### 1. Download the luma example using the following commands.

```
cd oled_test
```

```
git clone https://github.com/rm-hull/luma.examples.git
```

```
git clone --depth 1 --branch 3.8.1 https://github.com/rm-hull/luma.oled.git
```

```
git clone --depth 1 --branch 2.3.1 https://github.com/rm-hull/luma.core.git
```

```
sudo cp -r luma.oled/luma/ luma.examples/examples/
```

```
sudo cp -r luma.core/luma/core/ luma.examples/examples/luma/
```

```
sudo rm -r luma.oled/ luma.core/
```

## 2. Install the dependency.

```
sudo sed -i "s/#deb/deb/g" /etc/apt/sources.list.d/nvidia-l4t-apt-source.list
```

```
sudo apt update
```

```
sudo apt install python3-pip
```

```
sudo apt-get install libjpeg-dev zlib1g-dev libfreetype6-dev libavformat-dev libavdevice-dev
```

```
python3 -m pip install --upgrade setuptools
```

```
python3 -m pip install -r requirements.txt
```

```
sudo sed -i "s/deb/#deb/g" /etc/apt/sources.list.d/nvidia-l4t-apt-source.list
```

## 3. Change the settings.

```
sudo cp animated_gif_sc.py luma.examples/examples/
```

```
sudo cp OLED-Welcome.gif luma.examples/examples/images/
```

```
sudo sed -i "/(128, 64): dict(multiplex=0x3F, displayclockdiv=0x80, compins=0x12),/a\ (128, 40): dict(multiplex=0x27, displayclockdiv=0x80, compins=0x12)," luma.examples/examples/luma/oled/device/__init__.py
```

## 4. Run OLED.

```
cd luma.examples/
```

```
sudo python3 examples/animated_gif_sc.py --spi-port 2 --spi-device 0 --interface spi --gpio Jetson.GPIO --gpio-mode Jetson.GPIO.BOARD --gpio-data-command 32 --gpio-reset 31 --gpio-reset-hold-time 0.1 --width 128 --height 40
```



**Note:** To run scripts from the examples folder, you may need to manually install their dependencies.

## Topics:

- [Putting your device into recovery mode](#)
- [Flashing firmware for Nano eMMC](#)
- [Flashing firmware for TX2 NX eMMC](#)
- [Flashing firmware for Xavier NX eMMC](#)

## 4.1 Putting your device into recovery mode

---

There are two ways to set Uranus to recovery mode.

### Before you begin

- Prepare one available PC that can meet the basic Ubuntu 18.04 hardware requirements.
- Use a USB type A to USB type C cable to connect the USB-C socket on device and connect the USB-A to PC.

### Procedure

You can use one of the following methods to put your device into recovery mode.

- When the device is powered on, follow these steps.
  - a. Keep pressing the recovery button.
  - b. Press the reset button and then release it.
  - c. Release the recovery button.
- When the device is powered off, follow these steps.
  - a. Keep pressing the recovery button.
  - b. Power on the device.
  - c. Release the recovery button.

## 4.2 Flashing firmware for Nano eMMC

---

Follow these steps to flash the firmware for Nano eMMC-based devices.

### Procedure

1. Extract the SmartCow Board Support Package (BSP) image.

```
tar xvjf <SmartCow_BSP_image_file_name>
```

2. Change the current working directory to the directory named `mfi_jetson-nano-devkit-emmc`.

```
cd mfi_jetson-nano-devkit-emmc
```

3. Connect the Jetson board to a host computer and enter the RCM mode on that board.
4. Flash the firmware of the Jetson device running the following command.

```
sudo ./nvflash.sh
```

## 4.3 Flashing firmware for TX2 NX eMMC

---

Follow these steps to flash the firmware for TX2 NX eMMC-based devices.

### Procedure

1. Extract the SmartCow Board Support Package (BSP) image.

```
tar xvjf <SmartCow_BSP_image_file_name>
```

2. Change the current working directory to the directory named `mfi_jetson-xavier-nx-devkit-tx2-nx`.

```
cd mfi_jetson-xavier-nx-devkit-tx2-nx
```

3. Connect the Jetson board to a host computer and enter the RCM mode on that board.

4. Flash the firmware of the Jetson device running the following command.

```
sudo ./nvflash.sh
```

## 4.4 Flashing firmware for Xavier NX eMMC

---

Follow these steps to flash the firmware for Xavier NX eMMC-based devices.

### Procedure

1. Extract the SmartCow Board Support Package (BSP) image.

```
tar xvjf <SmartCow_BSP_image_file_name>
```

2. Change the current working directory to the directory named `mfi_jetson-xavier-nx-devkit-emmc`.

```
cd mfi_jetson-xavier-nx-devkit-emmc
```

3. Connect the Jetson board to a host computer and enter the RCM mode on that board.

4. Flash the firmware of the Jetson device running the following command.

```
sudo ./nvflash.sh
```

## (Optional) Installing the Uranus fan kit

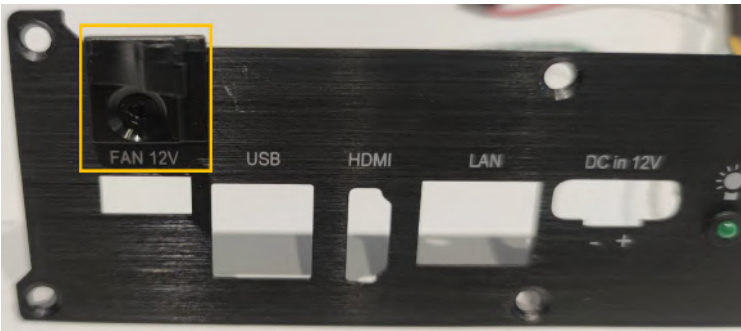
A

### Procedure

1. Remove the screws on the device as shown in the following figure.



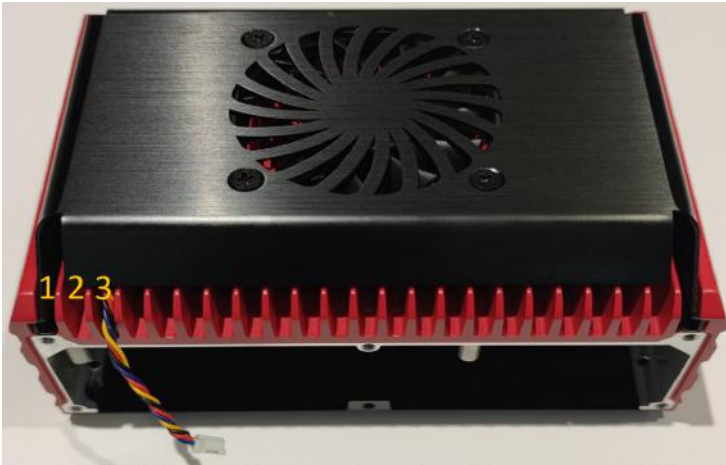
2. Lock the cable clip on the front panel.



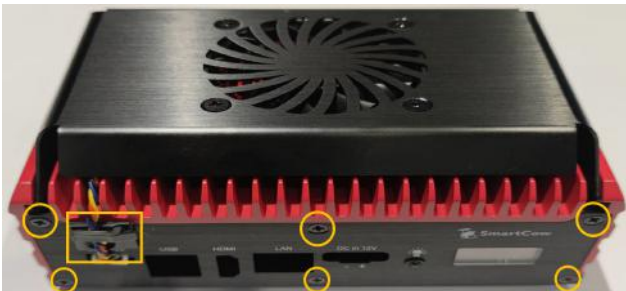
3. Move the wire to the left.  
Slide the kit from bottom to top into cover.



4. Put the wire into the third groove.



5. Put the front panel back.



6. Lock the screws, plug the wire into the fan connector, and buckle the cable clip.

## (Optional) Installing an mPCIe card into Uranus

## B

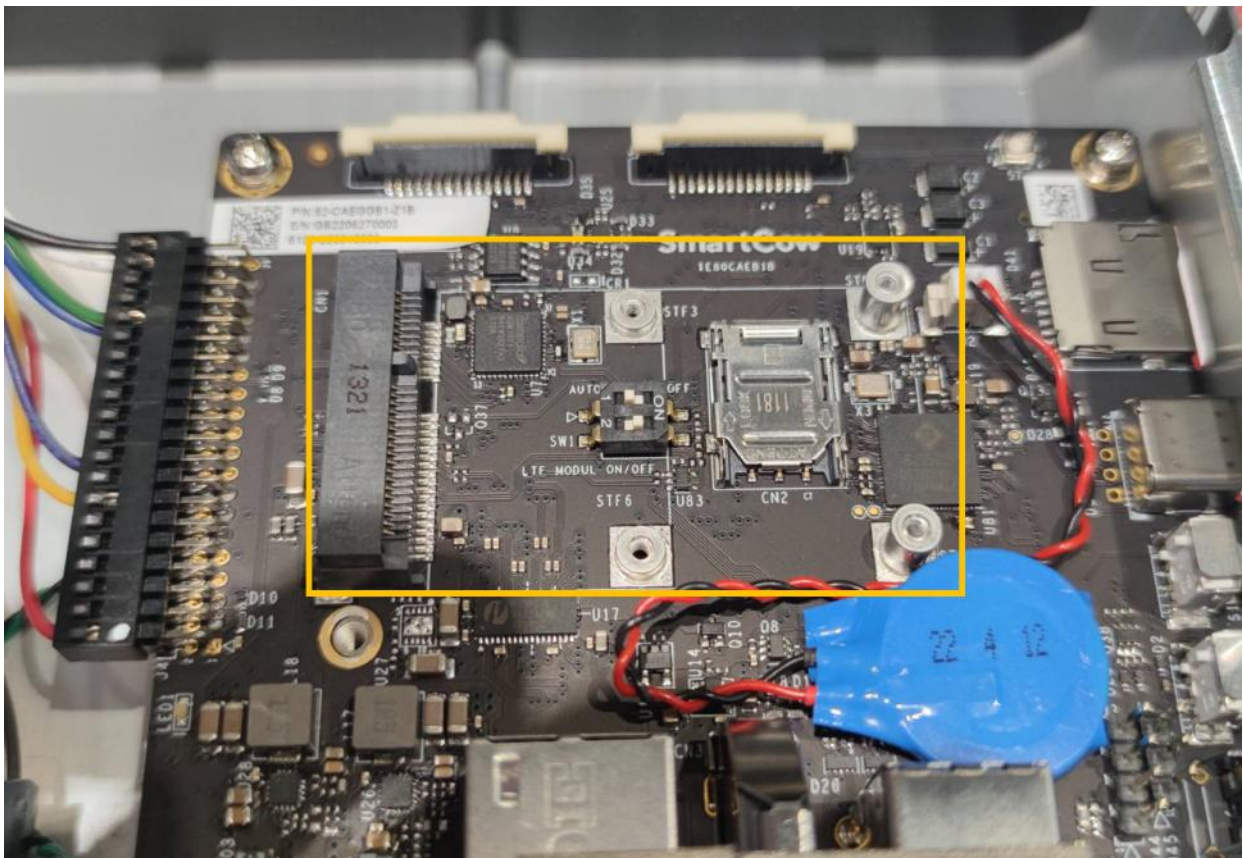
### Procedure

1. Remove the six screws to open the bottom plate, as shown in the following figures.



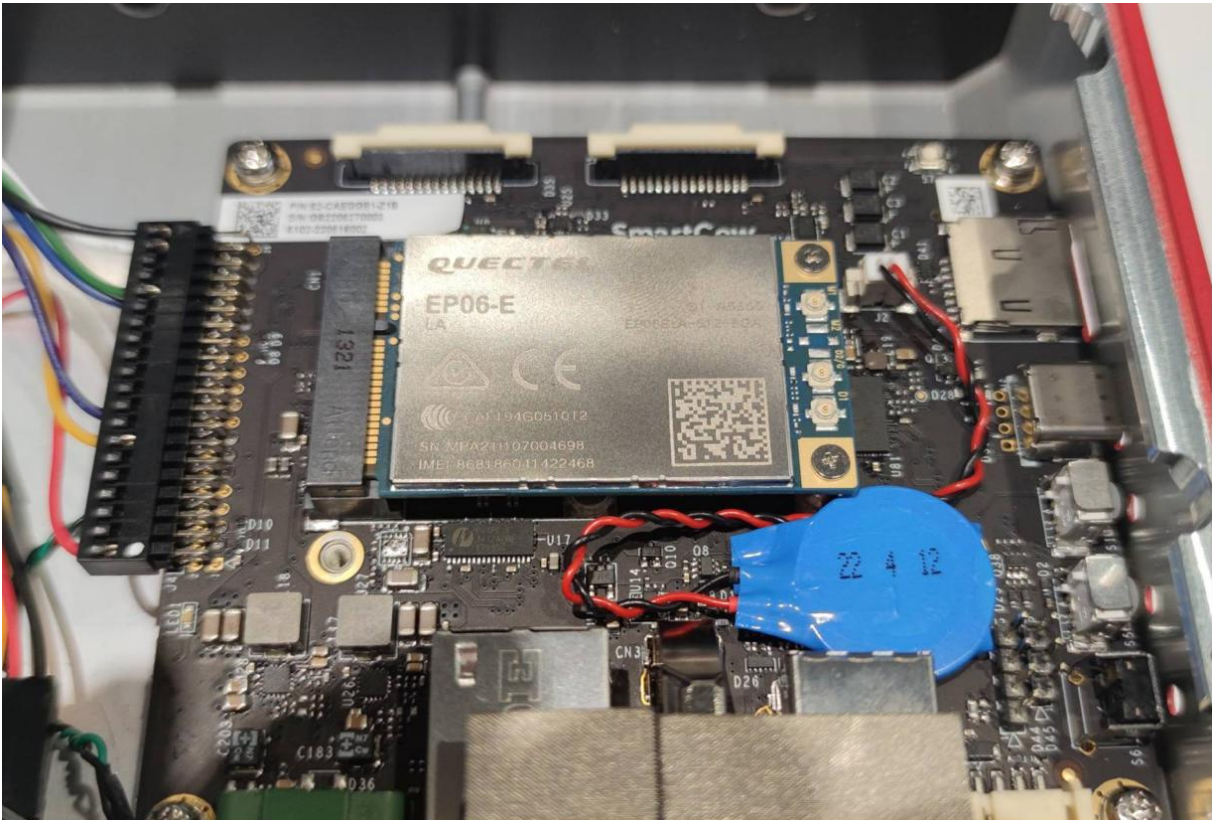
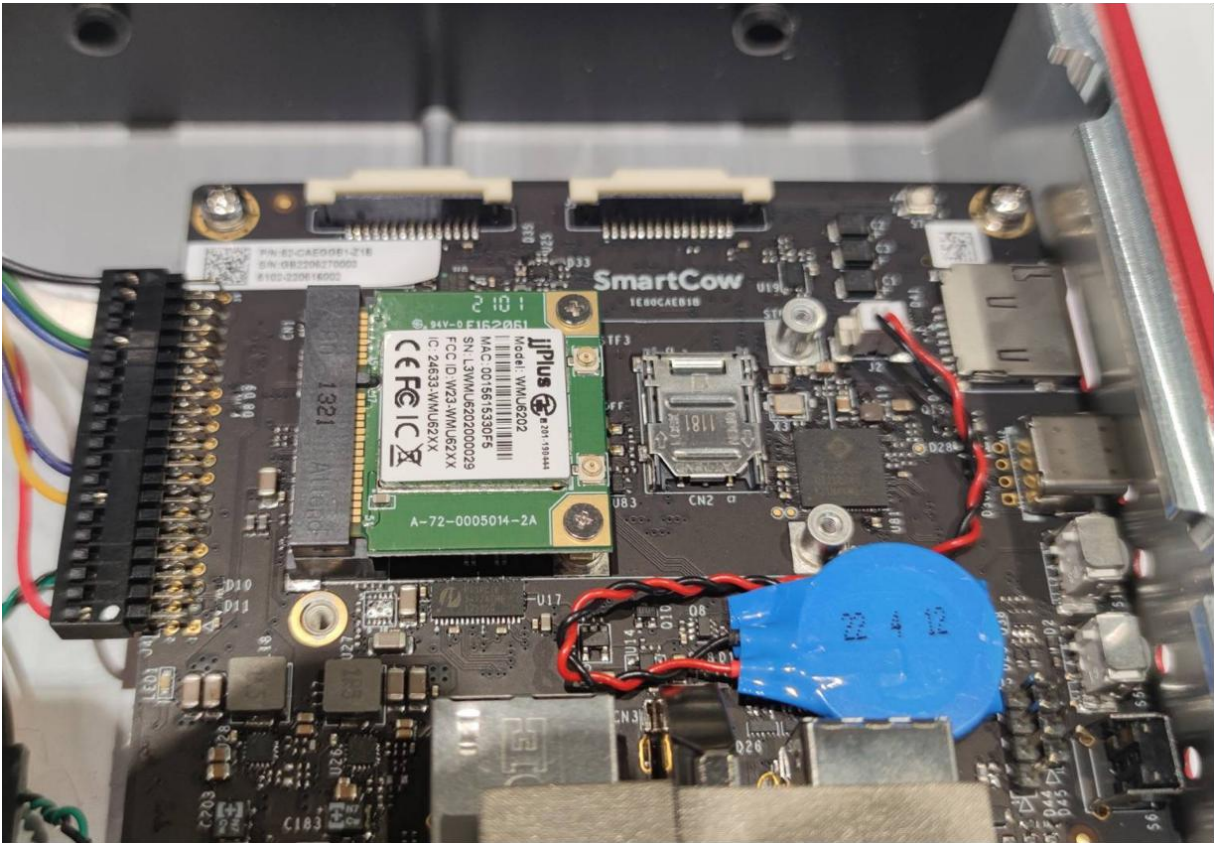


You can see the mPCIe slot.



2. Install a Wi-Fi module, LTE module, or mSATA.

(Optional) Installing an mPCIe card into Uranus





# Document control

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Document Version	Product Version	Release Date
1.0	1.0	2023-03-30