

# NRU-51V+ / NRU-51V

Rugged NVIDIA® Jetson Orin™ NX / Xavier™ NX GMSL2 Camera Sensor Hub for Autonomous Vehicles and Teleoperation



## Key Features

- Powered by NVIDIA® Jetson Orin™ NX or Xavier™ NX SOM bundled with JetPack 5.1.1
- Rugged -25°C to 60°C fanless operation
- Support 4x GMSL2 automotive cameras via FAKRA Z connectors
- 1x 10GBASE-T 10Gb and 1x 1GBASE-T 1Gb Ethernet port
- 2x mini-PCIe sockets for WiFi/ GNSS/ NVMe/ CAN modules
- 1x M.2 3042/ 3052 B key socket for 4G/ 5G mobile communication
- 1x isolated CAN 2.0, 1x configurable RS232/ 422/ 485 port, and 1x GPS PPS input
- 8V to 35V wide-range DC input with built-in ignition power control

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## Introduction

NRU-51V series is a rugged Jetson Orin™ NX / Xavier™ NX computer supporting GMSL2 cameras that can act either as a sensor hub or a perception unit for ADAS, teleoperation, autonomous mobile robots, and autonomous vehicles.

By supporting GMSL2 automotive cameras, they enable NRU-51V+ with greater vision capability by taking advantage of advanced features such as IP67 waterproof, high dynamic range (120dB HDR), auto white balance (AWB), and LED flicker mitigation (LFM). NRU-51V+ can obtain high-quality images with minimal latency regardless of lighting conditions, from bright sunny days to pitch-black nights. Moreover, it has a unique synchronization mechanism capable of acquiring images from four GMSL2 cameras simultaneously within microseconds channel-to-channel skew. It can further accept GPS PPS signal to align image data with LIDAR or synchronize cameras on other systems.

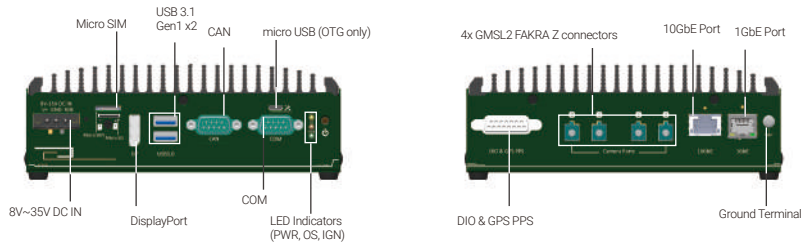
Thanks to the great power efficiency of NVIDIA® Jetson Orin NX™ NX SOM, NRU-51V+ delivers 100 TOPS inference performance in its 25W power package. Users can transfer raw camera images through its built-in 10GBASE-T Ethernet to another GPU server for perception processing, but also leverage its significant TOPS for real-time object or ROI detection. For teleoperation applications, users can utilize its hardware H.264/265 video codec, to encode video streams from four GMSL2 cameras in real-time and transmit the live video feed to a driver at a remote location via 5G telecommunication with minimum latency.

The combination of GMSL2 interface and Jetson Orin™ NX makes NRU-51V+ much more than just a simple edge AI computer. With greater vision brought by automotive cameras plus I/O interfaces such as 10GbE, CAN 2.0, and M.2 for 5G broadband, NRU-51V+ plays a central role in a moving platform, as a sensor hub for ADAS, a perception unit for AGV/ AMR, or a teleoperation controller for off-highway vehicles.

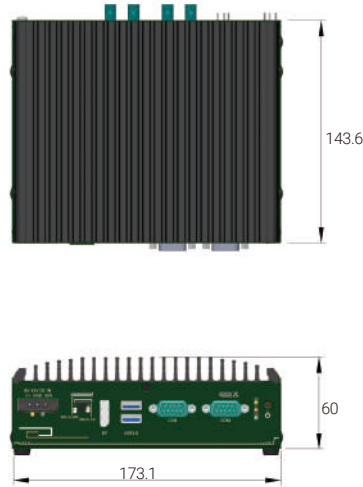
## Specifications

	NRU-51V+ JON8 / NRU-51V+ JON16	NRU-51V-NX8 / NRU-51V-NX16	NRU-51V+ JON8 / NRU-51V+ JON16	NRU-51V-NX8 / NRU-51V-NX16
<b>System Core</b>			<b>Power Supply</b>	
Processor	NVIDIA® Jetson Orin™ NX system-on-module (SOM), comprising NVIDIA® Ampere GPU and ARM Cortex CPU	NVIDIA® Jetson Xavier™ NX system-on-module (SOM), comprising NVIDIA® Volta GPU and Carmel CPU	DC Input	1x 3-pin pluggable terminal block for 8V to 35V DC input and ignition power control (V+/ GND/ IGN)
Memory	8GB/ 16GB LPDDR5 @ 3200 MHz on SOM	8GB/ 16GB LPDDR4x (Xavier NX 8GB/ 16GB) @ 1600/ 1866 MHz on SOM	<b>Mechanical</b>	
eMMC	N/A	16GB eMMC 5.1 on SOM	Dimension	173 mm (W) x 144 mm (D) x 60 mm (H)
Bundled JetPack Version	JetPack 5.1.1	JetPack 4.6.1	Weight	1.4kg
<b>Panel I/O Interface</b>			Mounting	Wall-mount bracket (optional)
GMSL2 Camera	4x GMSL2 FAKRA Z connectors, supporting 4x 1920x1080 @ 30 FPS camera input		<b>Environmental</b>	
Ethernet Port	1x 10GBASE-T 10GbE port with screw-lock 1x 1GBASE-T 1GbE port with screw-lock		Operating Temperature	With full CPU+GPU stressing: 1. NRU-51V+ non-throttling at 65C with 15W TDP mode (fanless) 2. NRU-51V+ non-throttling at 60C with Orin NX 16GB MAXN TDP mode (fanless)
USB	2x USB 3.1 Gen1 ports (total 5 Gbps shared with M.2 B key) 1x micro USB (OTG only)			-25°C to 60°C fanless operation (15W TDP mode)* -25°C to 70°C fanless operation (15W TDP mode, without 10GbE transmission)* -25°C to 70°C with optional fan kit (15W TDP mode)*
Video Port	1x DisplayPort, supporting 3840x2160 at 60Hz		Storage Temperature	-40°C to 85°C
Serial Port	1x hardware configurable RS-232/ 422/ 485 port		Humidity	10% to 90%, non-condensing
CAN Bus	1x isolated CAN 2.0 port		Vibration	Operating, MIL-STD-810H, Method 514.8, Category 4
Isolated DIO	1x GPS PPS input, 3-CH isolated DI and 4-CH isolated DO		Shock	Operating, MIL-STD-810H, Method 516.8, Procedure I
Ground Terminal	1x M4 ground terminal for chassis ESD shielding		EMC	CE/FCC Class A, according to EN 55032 & EN 55035
<b>Internal I/O Interface</b>			* For sub-zero and over 60°C operating temperature, a wide temperature SD card / NVMe is required.	
Mini PCI Express	<b>With Orin NX</b> 1x full-size mini PCI Express socket (PCIe + USB 2.0) for M.2 M 2242 NVMe with adapter for storage 1x full-size mini PCI Express socket (PCIe + USB 2.0) for GNSS, V2X, or CAN	<b>With Xavier NX</b> 1x full-size mini PCI Express socket (PCIe + USB 2.0) for WiFi, NVMe storage 1x full-size mini PCI Express socket (USB 2.0) for GNSS, V2X, or CAN		
M.2	1x 3042/3052 M.2 B key (USB 3.1 Gen 1 + USB 2.0) for 4G/5G module with dual SIM support (1x front-accessible, 1x internal)			

## Appearance



## Dimensions



## Ordering Information

Model No.	Product Description
<b>NRU-51V+-JON8</b>	Rugged NVIDIA® Jetson Orin™ NX(8GB) GMSL2 Camera Sensor Hub with 128GB M.2 2242 M NVMe
<b>NRU-51V+-JON16</b>	Rugged NVIDIA® Jetson Orin™ NX(16GB) GMSL2 Camera Sensor Hub with 128GB M.2 2242 M NVMe
<b>NRU-51V+-JONANO8</b>	Rugged NVIDIA® Jetson Orin™ Nano(8GB) GMSL2 Camera Sensor Hub with 128GB M.2 2242 M NVMe
<b>NRU-51V+-JONANO4</b>	Rugged NVIDIA® Jetson Orin™ Nano(4GB) GMSL2 Camera Sensor Hub with 128GB M.2 2242 M NVMe
<b>NRU-51V-NX8</b>	Rugged NVIDIA® Jetson Xavier™ NX(8GB) GMSL2 Camera Sensor Hub
<b>NRU-51V-NX16</b>	Rugged NVIDIA® Jetson Xavier™ NX(16GB) GMSL2 Camera Sensor Hub

## Optional Accessories

※ The NRU-51V+ is compatible with the Tier IV C1 series. For camera purchases, please contact Tier IV.

<b>AC-ISX031-H60</b>	Sony ISX031 CMOS sensor w/ built-in ISP; 1920x1536 @30fps, HFOV H63.9°; IP67+IP69K; -40°C to 85°C operating temperature; male FAKRA connector; active alignment; without lens cap	<b>AC-AR0233-H120</b>	Onsemi AR0233 CMOS sensor camera; 1920x1080 @ 30fps; LFM; HFOV 118°; IP67; -40°C to 85°C operating temperature; male FAKRA connector
<b>AC-ISX031-H120</b>	Sony ISX031 CMOS sensor w/ built-in ISP; 1920x1536 @30fps, HFOV H120.6°; IP67+IP69K; -40°C to 85°C operating temperature; male FAKRA connector; active alignment; without lens cap	<b>AC-AR0233-H190</b>	Onsemi AR0233 CMOS sensor camera; 1920x1080 @ 30fps; LFM; HFOV 196°; IP67; -40°C to 85°C operating temperature; male FAKRA connector; without lens cap
<b>AC-ISX031-H190</b>	Sony ISX031 CMOS sensor w/ built-in ISP; 1920x1536 @30fps, HFOV H195.9°; IP67+IP69K; -40°C to 85°C operating temperature; male FAKRA connector; active alignment; without lens cap	<b>AC-AR0233-H60-60FPS</b>	Onsemi AR0233 CMOS sensor camera; 1920x1080 @ 60fps; LFM; HFOV 60°; IP67; -40°C to 70°C operating temperature; male FAKRA connector
<b>AC-IMX390-H60</b>	Sony IMX390 CMOS sensor camera; 1920x1080 @ 30fps; LFM; HFOV 63.9°; IP67+IP69K; -40°C to 85°C operating temperature; male FAKRA connector; active alignment; without lens cap	<b>AC-AR0233-H120-60FPS</b>	Onsemi AR0233 CMOS sensor camera; 1920x1080 @ 60fps; LFM; HFOV 118°; IP67; -40°C to 70°C operating temperature; male FAKRA connector
<b>AC-IMX390-H120</b>	Sony IMX390 CMOS sensor camera; 1920x1080 @ 30fps; LFM; HFOV 120.6°; IP67+IP69K; -40°C to 85°C operating temperature; male FAKRA connector; active alignment; without lens cap	<b>AC-AR0233-H190-60FPS</b>	Onsemi AR0233 CMOS sensor camera; 1920x1080 @ 60fps; LFM; HFOV 196°; IP67; -40°C to 70°C operating temperature; male FAKRA connector; without lens cap
<b>AC-IMX390-H190</b>	Sony IMX390 CMOS sensor camera; 1920x1080 @ 30fps; LFM; HFOV 186°; IP67+IP69K; -40°C to 85°C operating temperature; male FAKRA connector; active alignment; without lens cap	<b>PA-60W-OW</b>	60W AC/ DC power adapter 12V/ 5A; cord end terminals for terminal block, operating temperature: -30 to 60°C
<b>AC-IMX490-H30</b>	Sony IMX490 CMOS sensor camera; 2880x1860 @30fps; LFM; HFOV 30.0°; IP67+IP69K; -40°C to 85°C operating temperature; male FAKRA connector; active alignment; without lens cap	<b>PA-120W-OW</b>	120W AC/ DC power adapter 20V/ 6A; 18AWG/ 120cm; cord end terminals for terminal block, operating temperature: -30 to 70°C
<b>AC-IMX490-H60</b>	Sony IMX490 CMOS sensor camera; 2880x1860 @30fps; LFM; HFOV 62.5°; IP67+IP69K; -40°C to 85°C operating temperature; male FAKRA connector; active alignment; without lens cap	<b>Wmkit-NRU-50</b>	Wall mount kit for NRU-50 series, including wall mount brackets and screws
<b>AC-IMX490-H120</b>	Sony IMX490 CMOS sensor camera; 2880x1860 @30fps; LFM; HFOV 120°; IP67+IP69K; -40°C to 85°C operating temperature; male FAKRA connector; active alignment; without lens cap	<b>AccsyBx-FAN-NRU-50</b>	Fan kit for NRU-50 series, including 92x92mm fan, fan frame, fan cable cover, and screws
<b>AC-AR0233-H60</b>	Onsemi AR0233 CMOS sensor camera; 1920x1080 @ 30fps; LFM; HFOV 60°; IP67; -40°C to 85°C operating temperature; male FAKRA connector	<b>Tpkit-NRU-50</b>	3 pcs of 30x30x2 mm thermal pad for mPCIe modules with the max component height between 1.3 mm and 2.4 mm, and M.2 B key modules with the max component height between 0.7 mm and 2.0 mm
		<b>FK-FF-CABLE-7M</b>	7M FAKRA cable for cameras with male FAKRA connector; the waterproof end is black
		<b>FK-FF-CABLE-15M</b>	15M FAKRA cable for cameras with male FAKRA connector; the waterproof end has heat shrink tube