Neousys Technology Inc.

NRU-230V-AWP Series

NRU-240S-AWP Series

User Manual

Revision 1.0

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Legal Information

All Neousys Technology Inc. products shall be subject to the latest Standard Warranty Policy

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Before installing any software, applications or components provided by a third party, customer should ensure that they are compatible and interoperable with Neousys Technology Inc. product by checking in advance with Neousys Technology Inc.. Customer is solely responsible for ensuring the compatibility and interoperability of the third party's products. Customer is further solely responsible for ensuring its systems, software, and data are adequately backed up as a precaution against possible failures, alternation, or loss.

For questions in regards to hardware/ software compatibility, customers should contact Neousys Technology Inc. sales representative or technical support.

To the extent permitted by applicable laws, Neousys Technology Inc. shall NOT be responsible for any interoperability or compatibility issues that may arise when (1) products, software, or options not certified and supported; (2) configurations not certified and supported are used; (3) parts intended for one system is installed in another system of different make or model.

Contact Information

Headquarters **(Taipei, Taiwan)**	**Neousys Technology Inc.** 15F, No.868-3, Zhongzheng Rd., Zhonghe Dist., New Taipei City, 23586, Taiwan Tel: +886-2-2223-6182 Fax: +886-2-2223-6183 Email, Website
Americas **(Illinois, USA)**	**Neousys Technology America Inc.** 3384 Commercial Avenue, Northbrook, IL 60062, USA Tel: +1-847-656-3298 Email, Website
China	**Neousys Technology China Co., Ltd.** Room 612, Building 32, Guiping Road 680, Shanghai Tel: +86-2161155366 Email, Website

Declaration of Conformity

FCC

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the 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 instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

CE

The product(s) 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.

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Safety Precautions

- Read these instructions carefully before you install, operate, or transport the system.
- Install the system or DIN rail associated with, at a sturdy location
- Install the power socket outlet near the system where it is easily accessible
- Secure each system module(s) using its retaining screws
- Place power cords and other connection cables away from foot traffic. Do not place items over power cords and make sure they do not rest against data cables
- Shutdown, disconnect all cables from the system and ground yourself before touching internal modules
- Ensure that the correct power range is being used before powering the device
- Should a module fail, arrange for a replacement as soon as possible to minimize down-time
- By means of a power cord connected to a socket-outlet with earthing connection
- This product is intended to be supplied by a Listed Power Adapter or DC power source, rated up to 5000m altitude operation. If further assistance is required, please contact Neousys Technology
- If the system is not going to be used for a long time, disconnect it from mains (power socket) to avoid transient over-voltage

Battery Warning

- Batteries are at risk of exploding if incorrectly installed.
- Do not attempt to recharge, force open, or heat the battery.
- Replace the battery only with the same or equivalent type recommended by the manufacturer.

Service and Maintenance

- ONLY qualified personnel should service the system
- Shutdown the system, disconnect the power cord and all other connections before servicing the system
- When replacing/ installing additional components (expansion card, memory module, etc.), insert them as gently as possible while assuring proper connector engagement

ESD Precautions

- Handle add-on module, motherboard by their retention screws or the module's frame/ heat sink. Avoid touching the PCB circuit board or add-on module connector pins
- Use a grounded wrist strap and an anti-static work pad to discharge static electricity when installing or maintaining the system
- Avoid dust, debris, carpets, plastic, vinyl and 8tyrofoam in your work area.
- Do not remove any module or component from its anti-static bag before installation

Restricted Access Location

The controller is intended for installation only in certain environments where both of the following conditions apply:

- Access can only be gained by QUALIFIED SERVICE PERSONNEL who have been instructed on the reasons for restrictions applied to the location and any precautions that shall be taken
- Access is through the use of a TOOL, lock and key, or other means of security, and is controlled by the authority responsible for the location

About This Manual

This manual introduces and demonstrates installation procedures of Neousys NRU-230V-AWP/ NRU-240S-AWP systems featuring NVIDIA® Jetson AGX Orin™ platform. The manual also demonstrates the system's general installation procedures.

Revision History

Version	Date	Description
1.0	Jun. 2024	Initial release

1 Introduction

NRU-230V-AWP/ NRU-240S-AWP are rugged, IP66 waterproof NVIDIA® Jetson AGX Orin computers targeting edge AI applications for harsh environments, ranging from roadside, food & chemical factories, mining, construction, agriculture, or harbor. It aims to redefine rugged Edge AI with waterproof features at an affordable cost through its streamlined mechanical design, standardized cable kit, and carefully selected waterproof connectors.

NRU-230V-AWP/ NRU-240S-AWP front panel

NRU-230V-AWP back panel

Powered by NVIDIA® Jetson AGX Orin, the systems offer up to 275 sparse TOPS (INT8) AI inference and can transcode up to twenty-two 1080P video streams simultaneously. To meet versatile camera requirements for vision-based AI applications, NRU-230V-AWP not only offers 4x waterproof M12 PoE+ GbE ports for industrial GigE cameras or IP cameras, but it also provides 8x waterproof GMSL2 FAKRA ports for automotive cameras or industrial stereo cameras. Additionally, the waterproof Type-C connector provides 4K DisplayPort output for ADAS applications involving real-time surround-view awareness. A waterproof 10GbE port is also provided for high-speed data communication.

For in-vehicle deployment, NRU-230V-AWP is equipped with an 8V to 48V wide DC input range, ignition power control, 2x isolated CAN bus ports, 1x RS232 port, and 1x isolated RS485 port. It also features two mini-PCIe sockets for CAN/ COM/ WiFi modules and one M.2 B-key socket for 4G LTE/ 5G NR mobile communication module. In terms of storage, NRU-230V-AWP comes with 64GB eMMC on the Orin module and an M.2 2280 NVMe socket for fast SSD read/write speeds, along with two internal 2.5" SSD slots for storage expansion. Lastly, NRU-230V-AWP comes with a system monitoring port to report the latest power, thermal, and Jetson status via an onboard automotive-grade MCU for potential functional safety system design.

The integration of IP66 waterproof capability, AGX Orin AI performance, and rich onboard IO strikes a sweet spot between ruggedness, performance, and cost. It is an ideal waterproof edge AI platform for industrial vehicles, outdoor AMR, edge inspection, and roadside.

1.1 NRU-230V-AWP Specifications

System Core	
Processor	NVIDIA® Jetson AGX Orin™ System-on-Module (SOM), comprising NVIDIA® Ampere GPU and Arm Cortex-A78AE CPU
Memory	32GB/ 64GB LPDDR5 (JAO 32GB/ JAO64GB) @ 3200 MHz on SOM
eMMC	64GB eMMC 5.1 on SOM
Panel I/O Interface	
GMSL Camera	8x GMSL2 FAKRA Z connectors Configuration A. 8x AC-IMX390 (2MP@30FPS) Configuration B. 8x AC-ISX031 (3MP@30FPS) Configuration C. 8x AC-IMX490 (5MP@30FPS)
Ethernet port	Ports 1 to 4: Gigabit Ethernet ports by Intel® I350 via M12 X-coded 8-pin connector Port 5: 10 Gigabit Ethernet port via M12 X-coded 8-pin connector
PoE Capability	IEEE 802.3at PoE+ PSE for ports 1 to 4 (maximum 100W total power budget)
USB2.0	2x USB 2.0 ports via M12 A-coded 8-pin connector
USB3.2 + Video Port	1x waterproof USB Type C (USB3.2 Gen 1 and 1x DisplayPort, supporting 3840x2160 @ 60Hz)
Serial Port + DO	1x isolated RS-485, 1x RS-232, and 1x isolated DO via M12 A-coded 8-pin connector
CAN bus + DI	2x isolated CAN 2.0, and 1x isolated DI (GPS PPS input) via M12 A-coded 8-pin connector
System Monitoring	1x isolated CAN 2.0 port and 1x isolated DO via M12 A-coded 8-pin connector by automotive-grade MCU
Internal I/O Interface	
Mini PCI Express	1x full-size mini PCI Express socket (PCIe + USB 2.0) for WiFi 6, or CAN modules 1x full-size mini PCI Express socket (USB 2.0) for GNSS or 4G LTE modules
M.2	1x M.2 3042/3052 B key (USB 3.2 Gen 1 + USB 2.0) for 4G/5G module with dual SIM support
Storage Interface	
SATA	2x internal SATA ports for 2.5” HDD/ SSD installation

M.2 NVMe	1x M.2 2280 M key socket (PCIe Gen4x2) for NVMe SSD
Power Supply	
DC Input	8V to 48V DC input and ignition power control via M12 L-coded, 5-pin connector*
Mechanical	
Dimension	225 mm (W) x 195 mm (D) x 89 mm (H)
Weight	4.4kg (excluding wall-mount bracket)
Mounting	Wall-mount bracket (standard)
Environmental	
Operating Temperature	-25°C to 70°C (30W TDP mode, without 10GbE transmission and PoE Load) ** -25°C to 60°C (30W TDP mode, with full function)
	With full CPU+GPU stressing: 1.NRU-230V-AWP non-throttling at 65C with 30W TDP mode 2.NRU-230V-AWP non-throttling at 55C with 60W TDP mode (JAO64 MAXN)
Storage Temperature	-40°C to 85°C
Humidity	10% to 90%, non-condensing
Vibration	Operating, MIL-STD-810H, Method 514.8, Category 4
Shock	Operating, MIL-STD-810H, Method 516.8, Procedure I
EMC	CE/FCC Class A, according to EN 55032 & EN 55035 EN 50121-3 (EN 50155:2017, Clause 13.4.8)

** The maximum current of each pin is 16A.*

*** For sub-zero and over 60°C operating temperature, a wide temperature Solid State Disk (SSD) is required.*

1.2 NRU-240S-AWP Specifications

System Core	
Processor	NVIDIA® Jetson AGX Orin™ System-on-Module (SOM), comprising NVIDIA® Ampere GPU and Arm Cortex-A78AE CPU
Memory	32GB/ 64GB LPDDR5 (JAO 32GB/ JAO64GB) @ 3200 MHz on SOM
eMMC	64GB eMMC 5.1 on SOM
Panel I/O Interface	
Ethernet port	Ports 1 to 4: Gigabit Ethernet ports by Intel® I350 via M12 X-coded 8-pin connector Port 5: 10 Gigabit Ethernet port via M12 X-coded 8-pin connector
PoE Capability	IEEE 802.3at PoE+ PSE for ports 1 to 4 (maximum 100W total power budget)
USB2.0	2x USB 2.0 ports via M12 A-coded 8-pin connector
USB3.2 + Video Port	1x waterproof USB Type C (USB3.2 Gen 1 and 1x DisplayPort, supporting 3840x2160 @ 60Hz)
Serial Port + DO	1x isolated RS-485, 1x RS-232, and 1x isolated DO via M12 A-coded 8-pin connector
CAN bus + DI	2x isolated CAN 2.0, and 1x isolated DI (GPS PPS input) via M12 A-coded 8-pin connector
System Monitoring	1x isolated CAN 2.0 port and 1x isolated DO via M12 A-coded 8-pin connector by automotive-grade MCU
Internal I/O Interface	
Mini PCI Express	1x full-size mini PCI Express socket (PCIe + USB 2.0) for WiFi 6, or CAN modules 1x full-size mini PCI Express socket (USB 2.0) for GNSS or 4G LTE modules
M.2	1x M.2 3042/3052 B key (USB 3.2 Gen 1 + USB 2.0) for 4G/5G module with dual SIM support
Storage Interface	
SATA	2x internal SATA ports for 2.5” HDD/ SSD installation
M.2 NVMe	1x M.2 2280 M key socket (PCIe Gen4 x2) for NVMe SSD
Power Supply	
DC Input	8V to 48V DC input and ignition power control via M12 L-coded, 5-pin connector*

Mechanical	
Dimension	225 mm (W) x 195 mm (D) x 89 mm (H)
Weight	4.4kg (excluding wall-mount bracket)
Mounting	Wall-mount bracket (standard)
Environmental	
Operating Temperature	-25°C to 70°C (30W TDP mode, without 10GbE transmission and PoE Load) ** -25°C to 60°C (30W TDP mode, with full function)
	With full CPU+GPU stressing: 1.NRU-230V-AWP non-throttling at 65C with 30W TDP mode 2.NRU-230V-AWP non-throttling at 55C with 60W TDP mode (JAO64 MAXN)
Storage Temperature	-40°C to 85°C
Humidity	10% to 90%, non-condensing
Vibration	Operating, MIL-STD-810H, Method 514.8, Category 4
Shock	Operating, MIL-STD-810H, Method 516.8, Procedure I
EMC	CE/FCC Class A, according to EN 55032 & EN 55035 EN 50121-3 (EN 50155:2017, Clause 13.4.8)

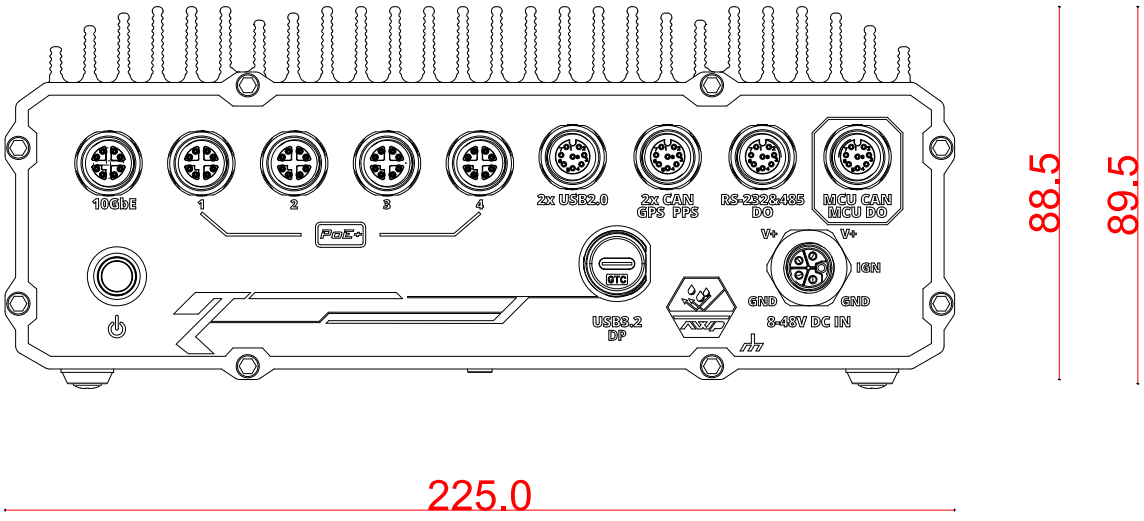
** The maximum current of each pin is 16A.*

*** For sub-zero and over 60°C operating temperature, a wide temperature Solid State Disk (SSD) is required.*

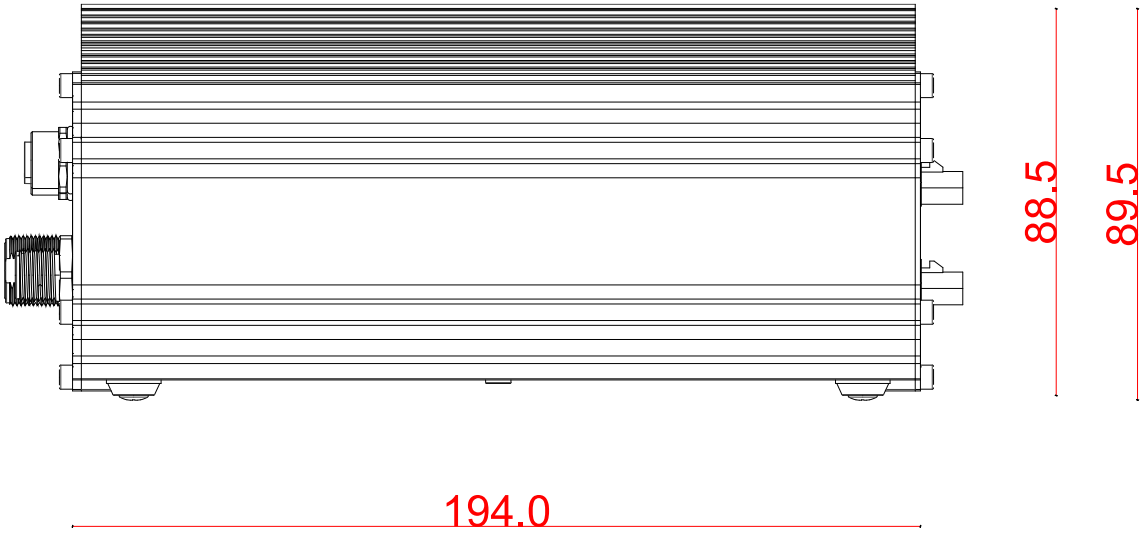
1.3 Dimension of NRU-230V-AWP/ NRU-240S-AWP

> NOTE
>
> *All measurements are in millimeters (mm).*
>
> *NRU-230V-AWP and NRU-240S-AWP share the same dimensions, therefore NRU-230V-AWP will be used for demonstration purposes.*

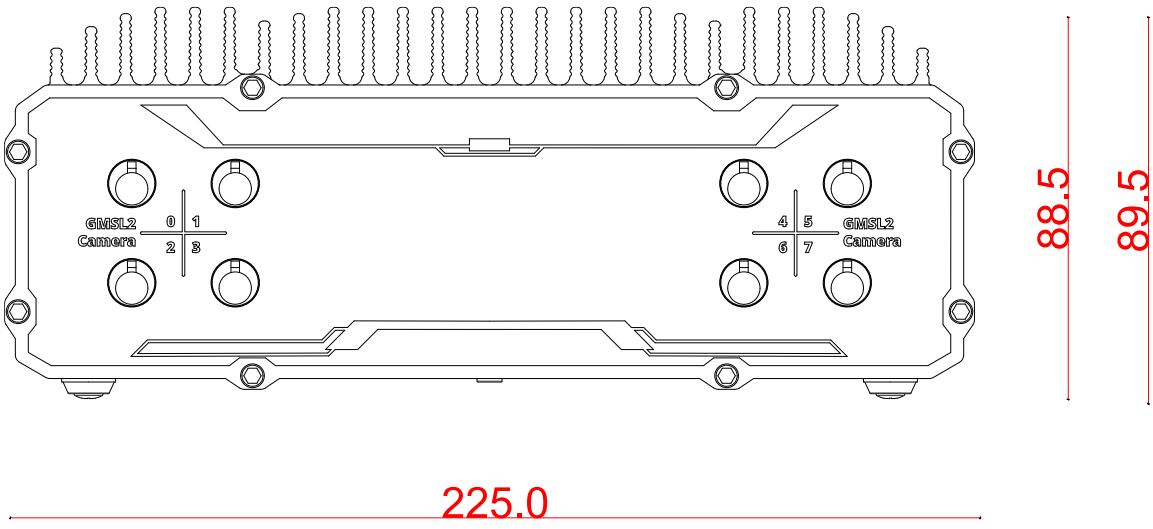
1.3.1 Front Panel View



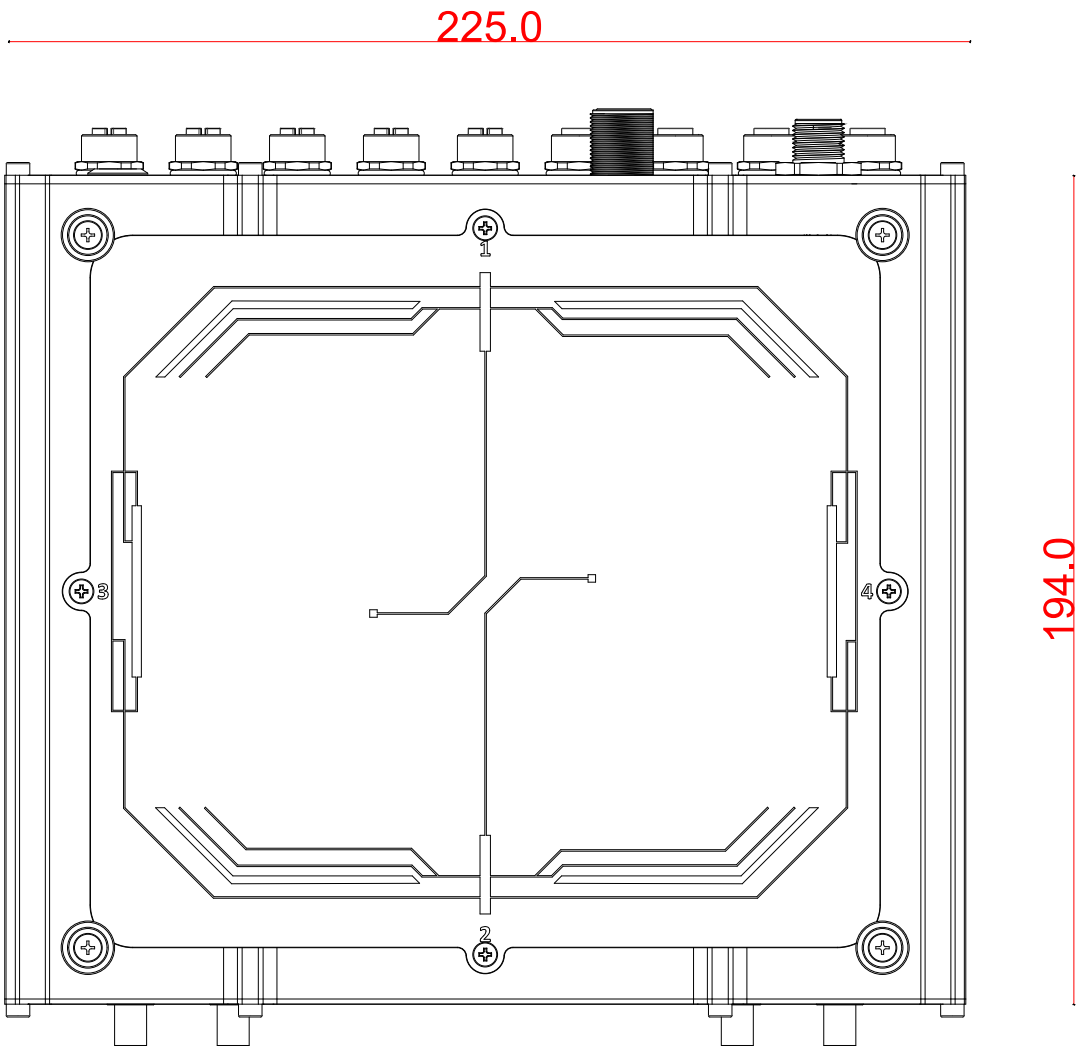
1.3.2 Side Panel View



1.3.3 Rear Panel View



1.3.4 Bottom View



2 System Overview

Upon receiving and unpacking your system, please check immediately if the package contains all the items listed in the following table. If any item(s) are missing or damaged, please contact your local dealer or Neousys Technology.

2.1 NRU-230V-AWP Packing List

Item	Description	Qty
1	NRU-230V-AWP (If you ordered SSD/ HDD or add-on module, please verify these items)	1
2	Accessory box, which contains ● Screw pack ● Wall mount bracket ● 15cm SATA 7P+4P to SATA 22P cable ● 180cm M12 L-coded 5P cable for DC input and ignition power control ● 2-pole inline splicing connecter w/lever	 1 2 2 1 5

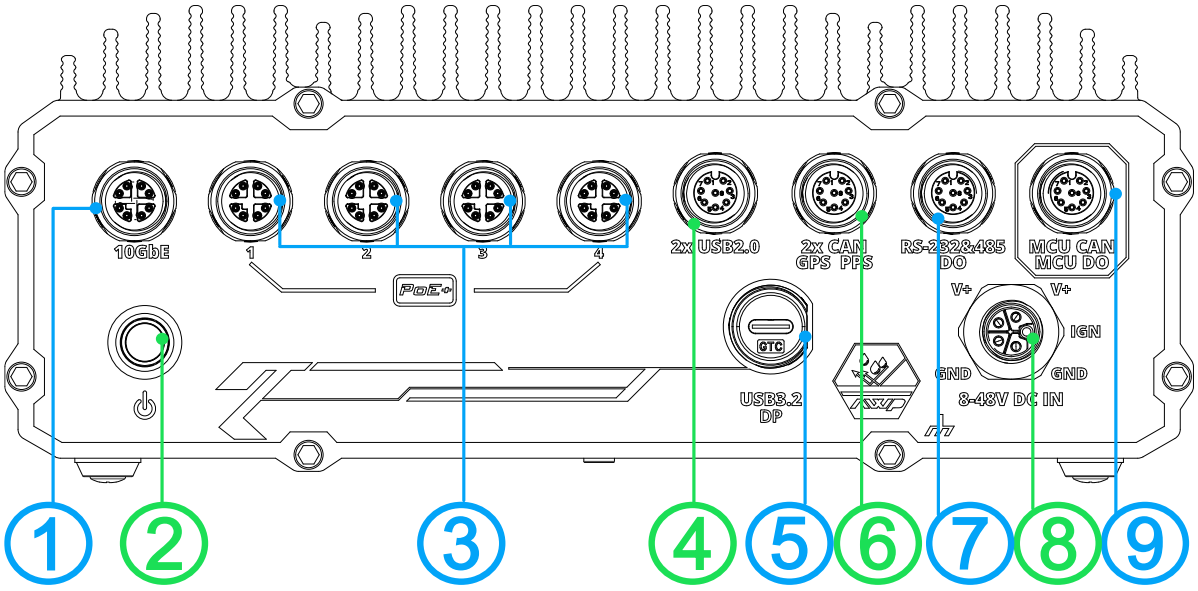
2.2 NRU-240S-AWP Packing List

Item	Description	Qty
1	NRU-240S-AWP (If you ordered SSD/ HDD or add-on module, please verify these items)	1
2	Accessory box, which contains ● Screw pack ● Wall mount bracket ● 15cm SATA 7P+4P to SATA 22P cable ● 180cm M12 L-coded 5P cable for DC input and ignition power control ● 2-pole inline splicing connecter w/lever	 1 2 2 1 5

2.3 NRU-230V-AWP/ NRU-240S-AWP Series Front Panel

> NOTE
>
> *NRU-230V-AWP and NRU-240S-AWP share the same front panel I/Os.*

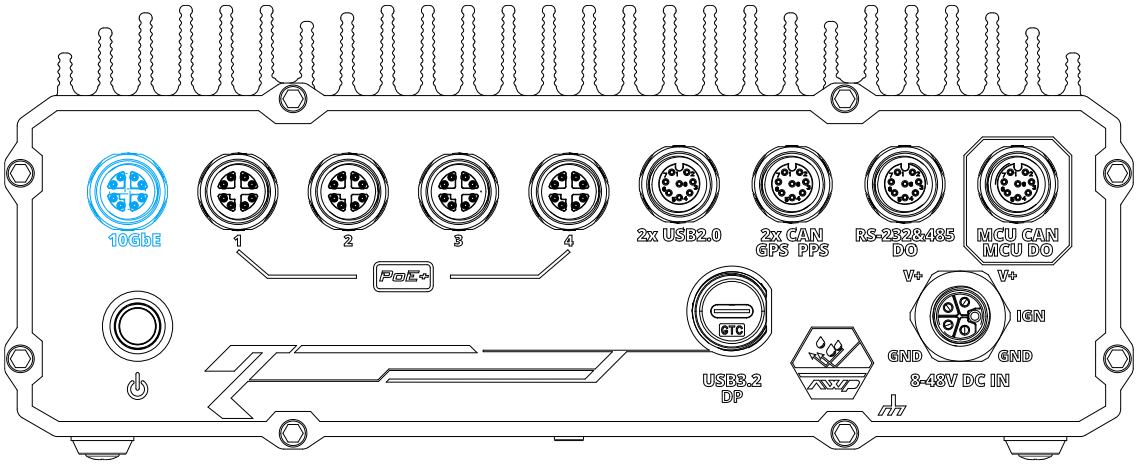
The front panel of the system features M12 ports such as 10GbE, IEEE 802.3at PoE+, USB2.0, CAN GPS PPS, COM, isolated CAN/ DO by automotive-grade MCU, wide range 8V to 48V, ignition power control.



No.	Item	Description
1	M12 X-coded 10Gb Ethernet	The 10GbE port is backwards compatible with 5Gb, 2.5Gb, and GbE connections.
2	Power button	Use this button to turn on or force power off the system.
3	M12 X-coded Power over Ethernet (PoE+)	The M12 X-coded Power over Ethernet ports (IEEE 802.3at PoE+ PSE) provide both data connection and electric power to devices (eg. IP camera), and offers a total power budget of 100W.
4	M12 A-coded USB2.0	The M12 A-coded USB 2.0 port is backward-compatible with USB 1.1 / 1.0.
5	Type-C USB or DisplayPort	Type-C USB 3.2 Gen1x1 (5Gbps) port, and supports alternative mode for DisplayPort
6	M12 A-coded CAN & DI (GPS PPS)	2x isolated CAN 2.0, and 1x isolated DI (GPS PPS input)
7	M12 A-coded Serial port & DO	1x isolated RS-485, 1x RS-232, and 1x isolated DO

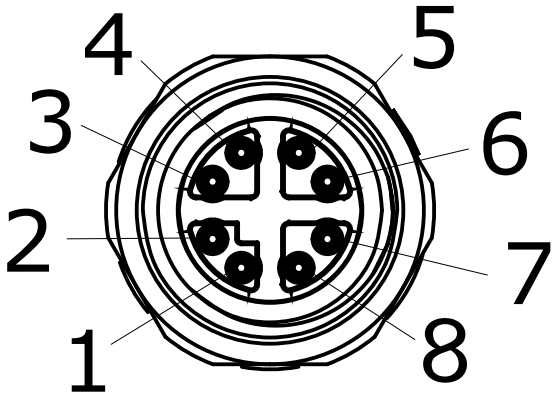
8	M12 L-coded DC input with ignition power control	8V to 48V DC input and ignition power control
9	M12 A-coded MCU CAN/ DO	Automotive-grade MCU with isolated CAN2.0 and isolated DO

2.3.1 M12 X-coded 10Gb Ethernet



The system offers one 10Gb Ethernet port, implemented via M12 X-coded connector using Marvell® AQC113 controller on the front panel. The port is backwards compatible with 5Gb, 2.5Gb, and Gb Ethernet connections.

Connector Pin Definition

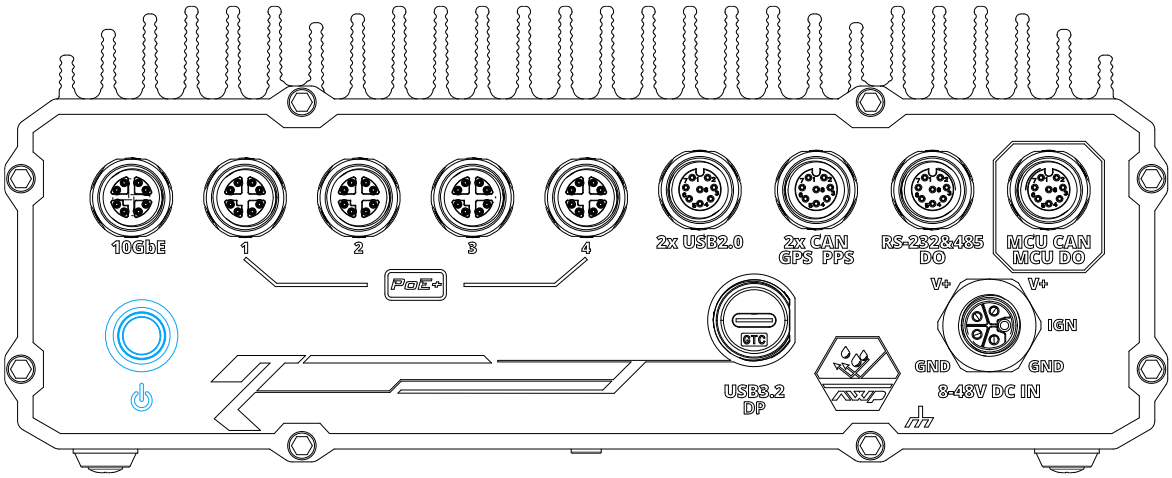


Panel side

Cable connector end

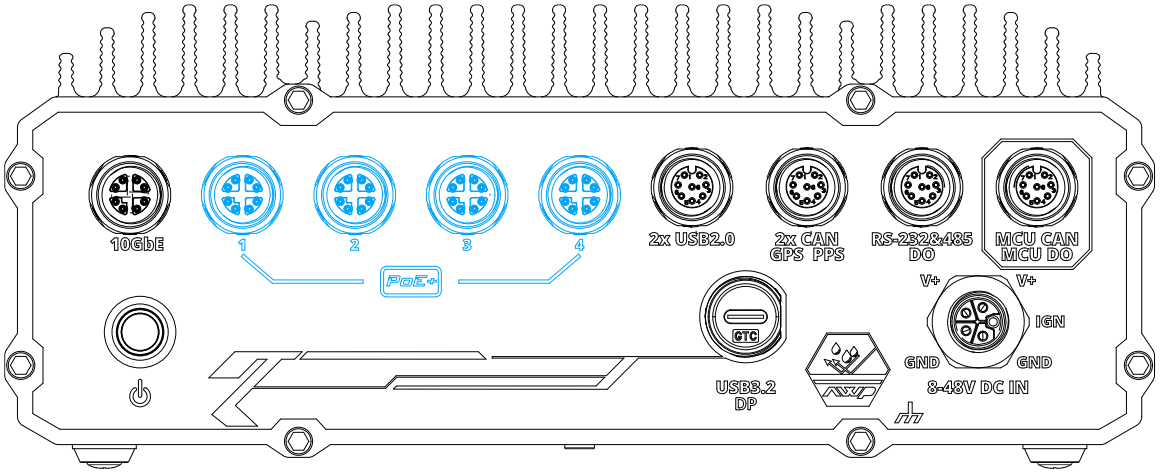
Signal	M12 panel side	M12 cable connector	Wire color
LAN P0	1	1	
LAN N0	2	2	
LAN P1	3	3	
LAN N1	4	4	
LAN P3	5	5	
LAN N3	6	6	
LAN N2	7	7	
LAN P2	8	8	

2.3.2 Power Button



The power button is a non-latched switch for ATX mode on/off operation. Press to turn on the system, and to turn off, you can either issue a shutdown command in the OS, or just press the power button. In case of system halts, you can press and hold the power button for 5 seconds to force-shutdown the system. Please note that there is a 5 seconds interval between two on/off operations (i.e. once turning off the system, you will need to wait for 5 seconds to initiate another power-on operation).

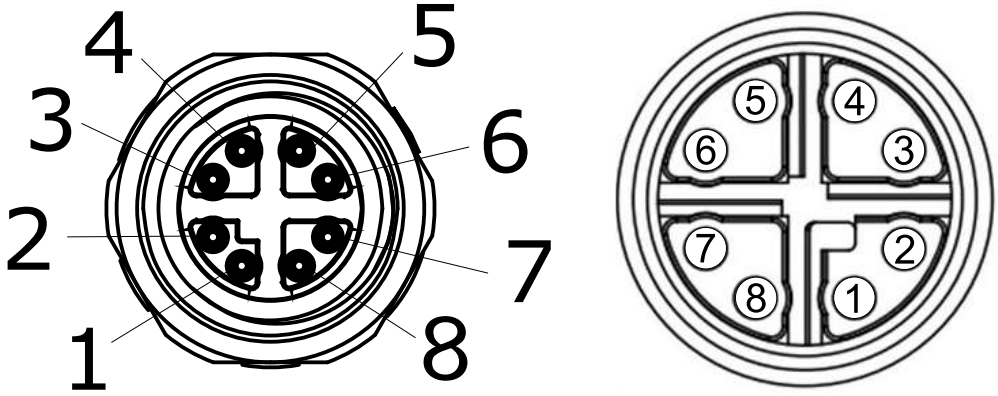
2.3.3 IEEE802.3at Power Over Ethernet



The system offers GbE with PoE+ via M12 X-coded connectors on the front panel.

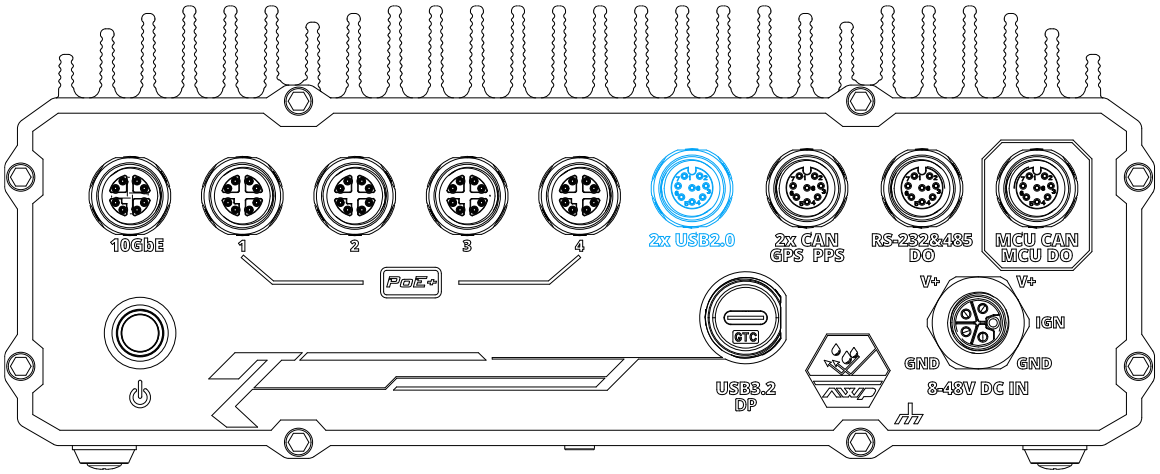
Power over Ethernet (PoE) supplies electrical power and data on a CAT-5/CAT-6 Ethernet cable. Acting as a PoE PSE (Power Sourcing Equipment), compliant with IEEE 802.3at, each PoE port delivers up to 25.5W to a Powered Device (PD). PoE can automatically detect and determine if the connected device requires power or not, so it is compatible with standard Ethernet devices as well.

Connector Pin Definition



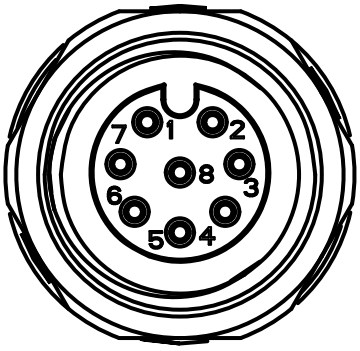
Panel side		Cable connector end	
Signal	**M12 panel side**	**M12 cable connector end**	**Wire color**
LAN P0	1	1	
LAN N0	2	2	
LAN P1	3	3	
LAN N1	4	4	
LAN P3	5	5	
LAN N3	6	6	
LAN N2	7	7	
LAN P2	8	8	

2.3.4 USB2.0 Port

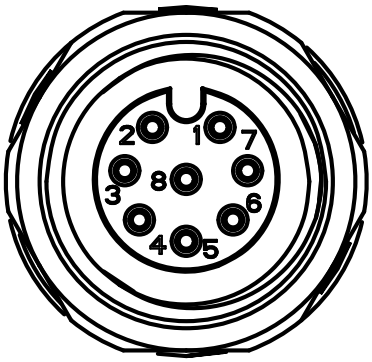


The USB2.0 ports are backward compatible with USB 1.1 and USB 1.0 devices.

Connector Pin Definition



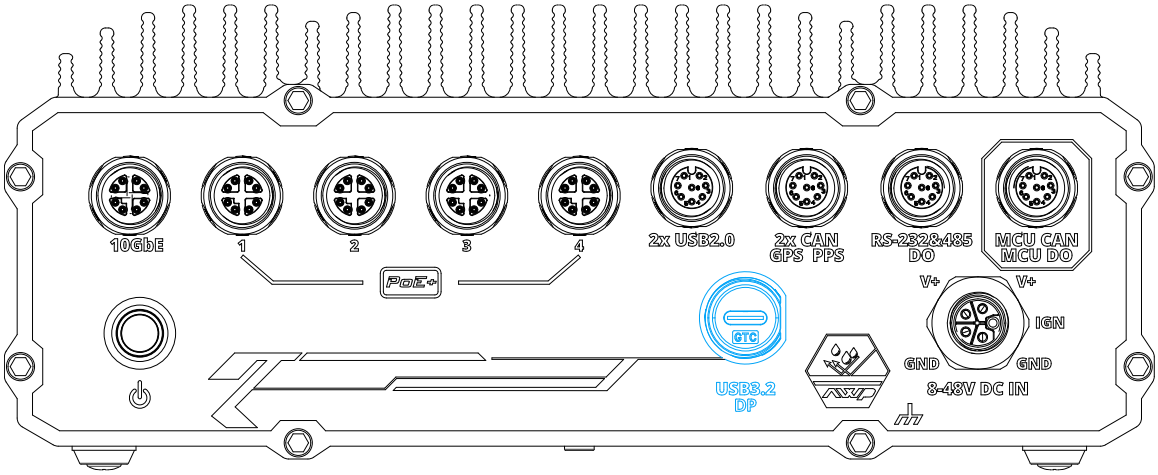
Panel side



Cable connector end

Signal	M12 panel side	M12 cable connector end	Wire color
USB0_DATA+	1	1	
USB0_DATA-	2	2	
USB0_VCC	3	3	
USB0_GND	4	4	
USB1_GND	5	5	
USB1_VCC	6	6	
USB1_DATA-	7	7	
USB1_DATA+	8	8	

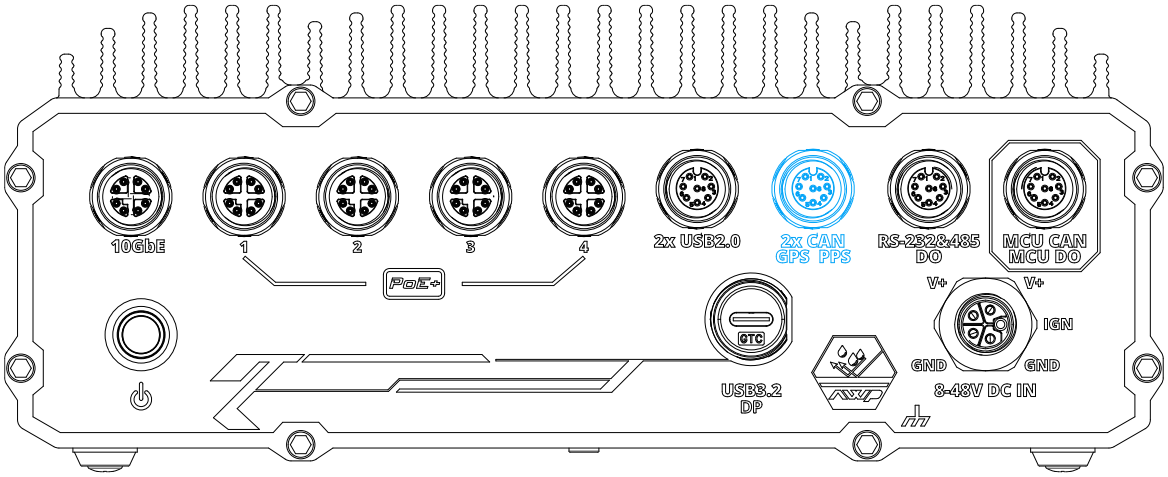
2.3.5 Type-C USB3.2 Gen 1 or Alternative DisplayPort



The system's USB 3.2 Gen1x1 type-C port offers up to 5Gbps of data transfer bandwidth. The port is backward compatible with USB3.2 Gen.1 USB 2.0, USB 1.1 and USB 1.0 devices via a USB hub (not included) to connect to external devices.

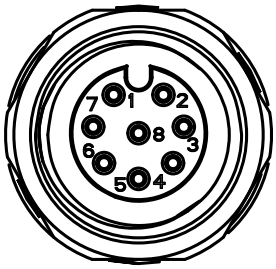
The USB Type-C port can also be used alternatively for DisplayPort output to support resolutions up to 3840 x 2160 (4K). Or by plugging in a USB Type-C hub, you may use USB and DisplayPort simultaneously.

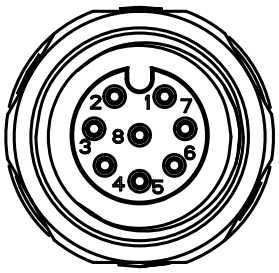
2.3.6 Isolated CAN 2.0 & Isolated Digital Input (GPS PPS)

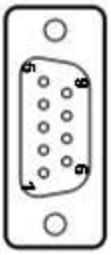


The connector has two isolated CAN buses and a GPS PPS input signal. The CAN bus is a robust industrial bus with a pair of differential signals and is commonly used in various industrial and in-vehicle applications. The system is equipped with two CAN bus ports. The CAN bus port supports CAN2.0A and CAN2.0B with a default speed of 500 kbps. To change the CAN bus termination, please refer to the internal 4-pin DIP switch.

The GPS PPS input aims to receive the PPS signal from an external GPS module. With the NMEA data and the GPS PPS from the external GPS module, the system will be synchronized with GPS time. Please refer to the following table for information on wiring and programming the isolated DIO channels.

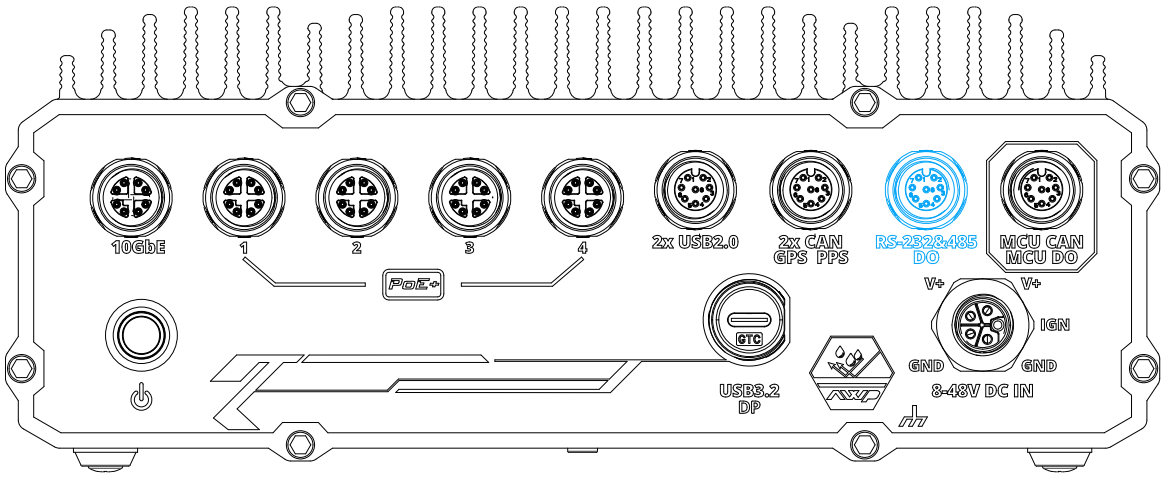




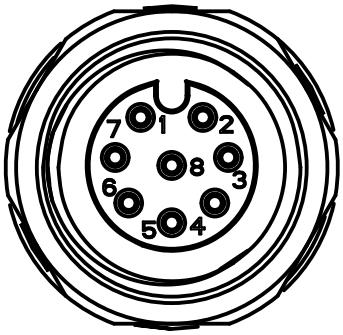


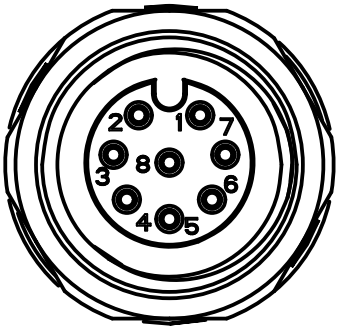
M12 Panel side		M12 Cable end	DB9 end	Signal
Signal	**M12 panel pin**	**M12 cable pin**	**COM pin**	
CAN0_H	1	1	3	CAN1
CAN0_GND	2	2	2	
CAN0_L	3	3	5	
GPS_PPS_H	4	4	Open Wire_Red	GPS PPS
GPS_PPS_L	5	5	Open Wire_Black	
CAN1_L	6	6	5	CAN2
CAN1_GND	7	7	2	
CAN1_H	8	8	3	

2.3.7 RS-232, 485 and DO



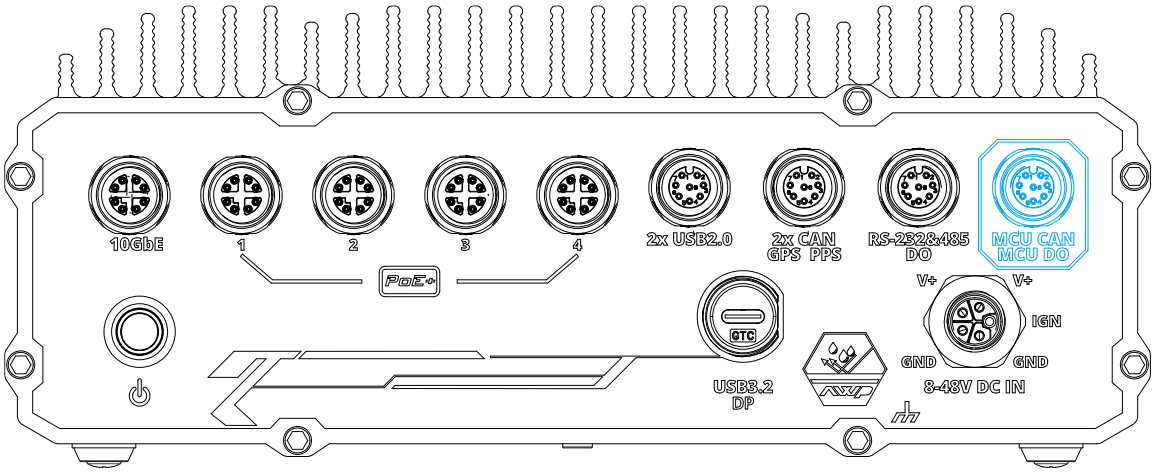
Connector Pin Definition

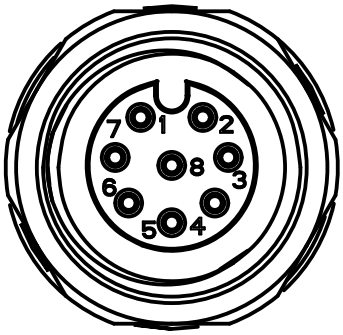


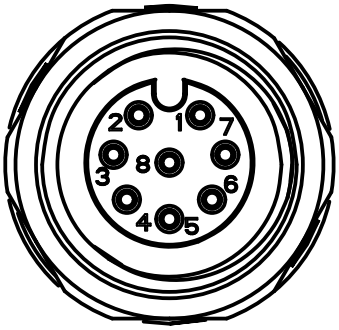


M12 panel side	Signal	M12 cable connector end
1	RS485_DATA-	P3_Pin 3
2	RS485_DATA+	P3_Pin 2
3	RS485_GND	P3_pin 5
4	DO_H	Open Wire_Red
5	DO-L	Open Wire_Black
6	RS232_GND	P4_Pin 5
7	RS232_RX	P4_Pin 2
8	RS232_TX	P4_Pin 3

2.3.8 MCU CAN/ MCU DO



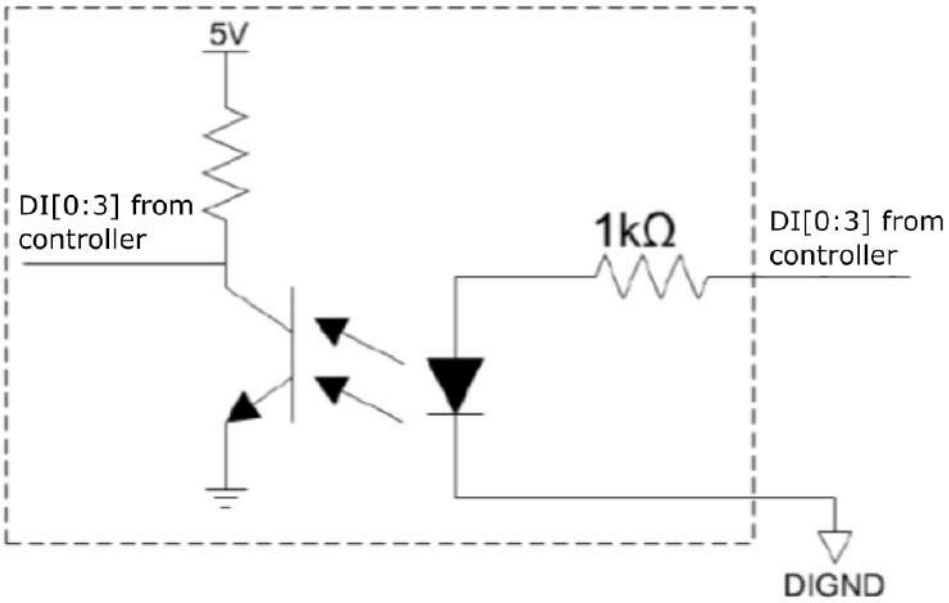




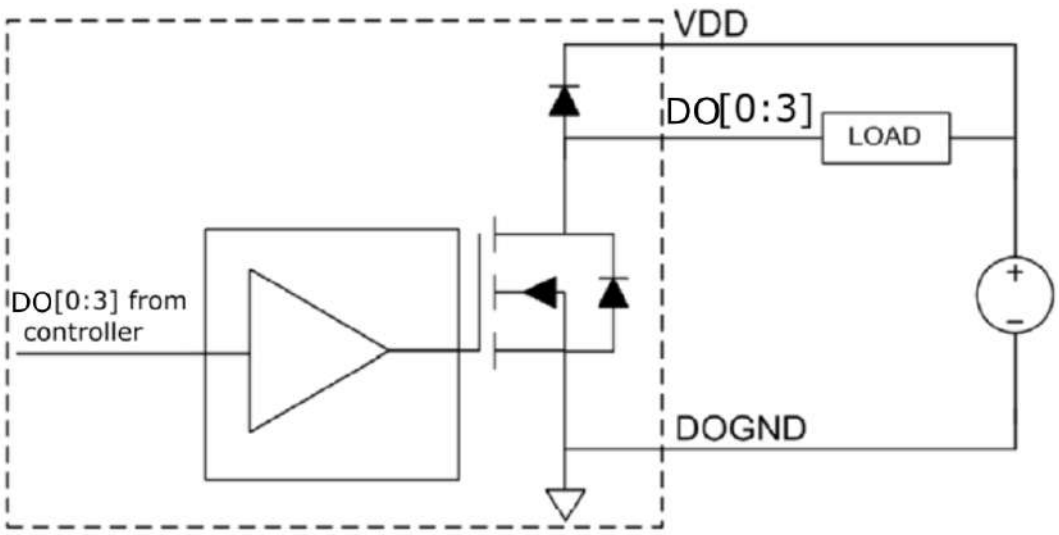
M12 panel side	Signal	M12 cable connector end
1	MCU_CAN_H	P3_Pin 3
2	MCU_CAN_GND	P3_Pin 2
3	MCU_CAN_L	P3_pin 5
4	MCU_DO_H	Open Wire_Red
5	MCU_DO_L	Open Wire_Black
6	NC	x
7	NC	x
8	NC	x

Wiring for DIO

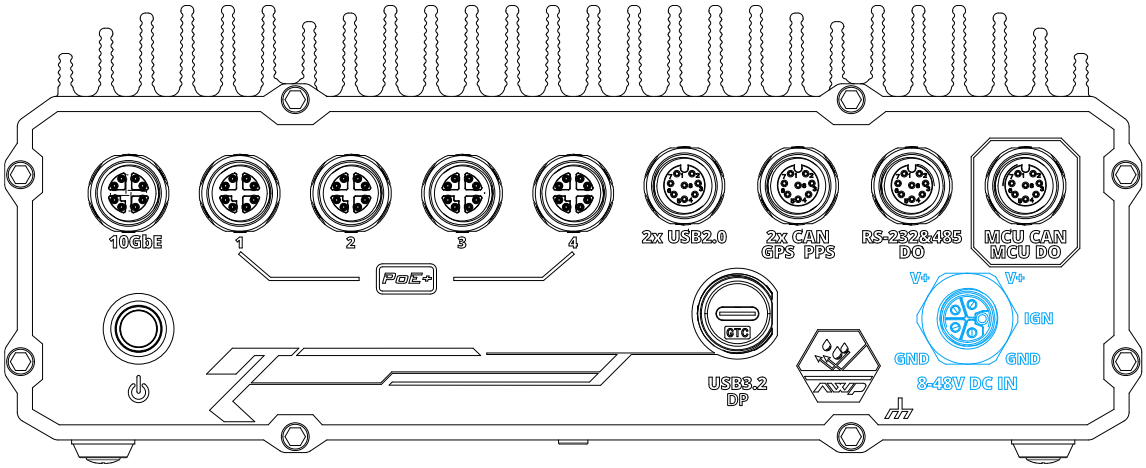
The digital input function is implemented using a photo-coupler with an internally series-connected 1kΩ resistor. You need to provide a voltage to specify the logic high/low state. The input voltage for logic high is 5~24V, and the input voltage for logic low is 0~1.5V.



The digital output function is implemented using Power MOSFET + Analog Device iCoupler® component. The DO channels are configured as NO (normally-open) configuration. When you turn on the system, all DO channels have a deterministic state of logic 0 (circuit disconnected from GND return). When logic 1 is specified, MOSFET is activated and GND return path is established. The digital output function on the system supports sinking current connection. The following diagrams are the suggested wiring for DO:



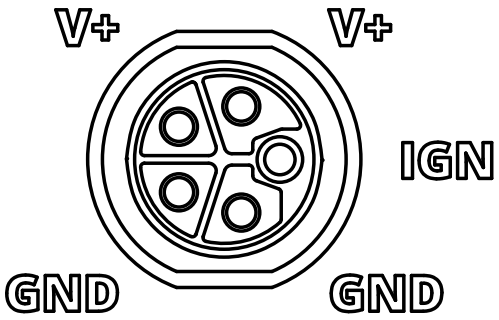
2.3.9 DC-in Connector



The system accepts a wide range of DC power input from 8V to 48V with reverse polarity protection via a M12 L-coded connector. The M12 L-coded connectors offer COTS availability and ultra-rugged connection reliability when wiring DC power.

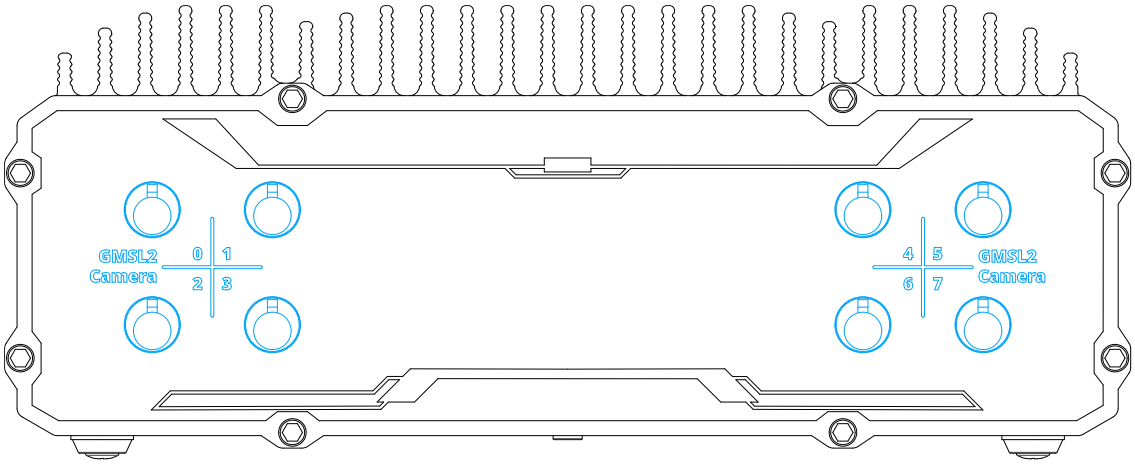
> **WARNING**
>
> *Please make sure the voltage of DC power is correct before you connect it to the system. Supplying a voltage over 48V will damage the system.*

Connector Pin Definition



Signal	Wire color
V+	
V+	
GND	
GND	
IGN	

2.3.10 FAKRA Z Connector for GMSL2 Camera (NRU-230V-AWP Only)



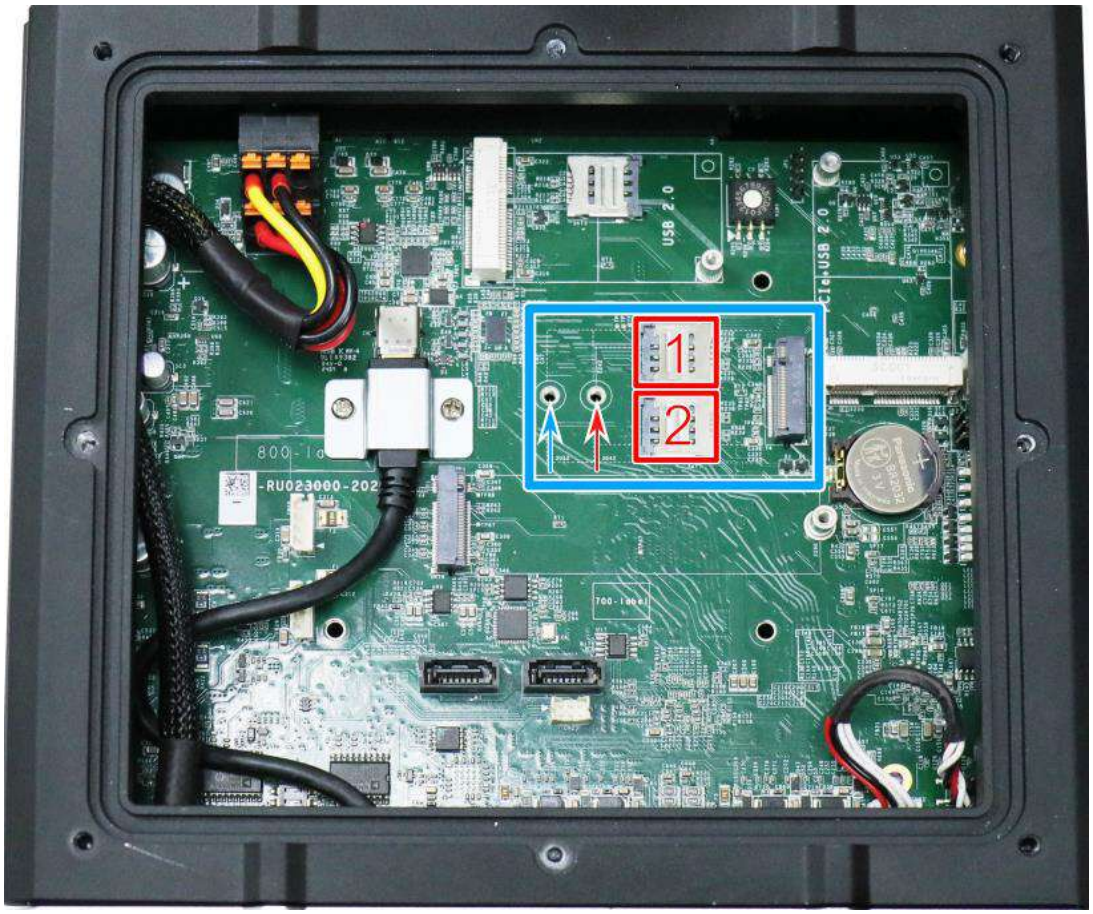
Fachkreis Automobil (FAKRA) connector is a German standard for SubMiniature version B based automotive-grade connectors. There are eight FAKRA Z connectors on the rear panel side to connect to automotive GMSL2 cameras.

Due to their advanced features such as IP67 waterproof, high dynamic range (120dB HDR), auto white balance (AWB), and LED flicker mitigation (LFM), automotive GMSL2 cameras are ideal for autonomous vehicle applications.

2.4 Internal I/O

The system's internal I/O connectors consist of an M.2 B key slot for 5G/4G wireless communication module, two mini PCIe slots for wireless or storage modules, one M.2 M key for NVMe installation, and two 2.5" SATA SSD storage.

2.4.1 M.2 B Key 3042/ 3052 & SIM Slots

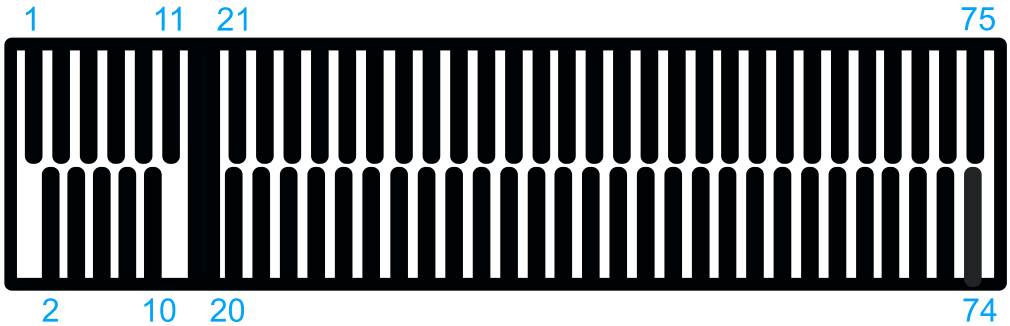


The system has an M.2 3042/ 3052 slot (indicated in **blue rectangle**) with dual SIM slots (indicated in **red rectangle**) supporting 5G/ 4G. A copper standoff is provided for you to secure onto the motherboard into the **red arrow** location for an M.2 2242/ 3042 module, or into the **blue arrow** location for an M.2 3052 module. By installing a 5G or 4G M.2 module and SIM card, you can access the internet via the provider's network.

NOTE

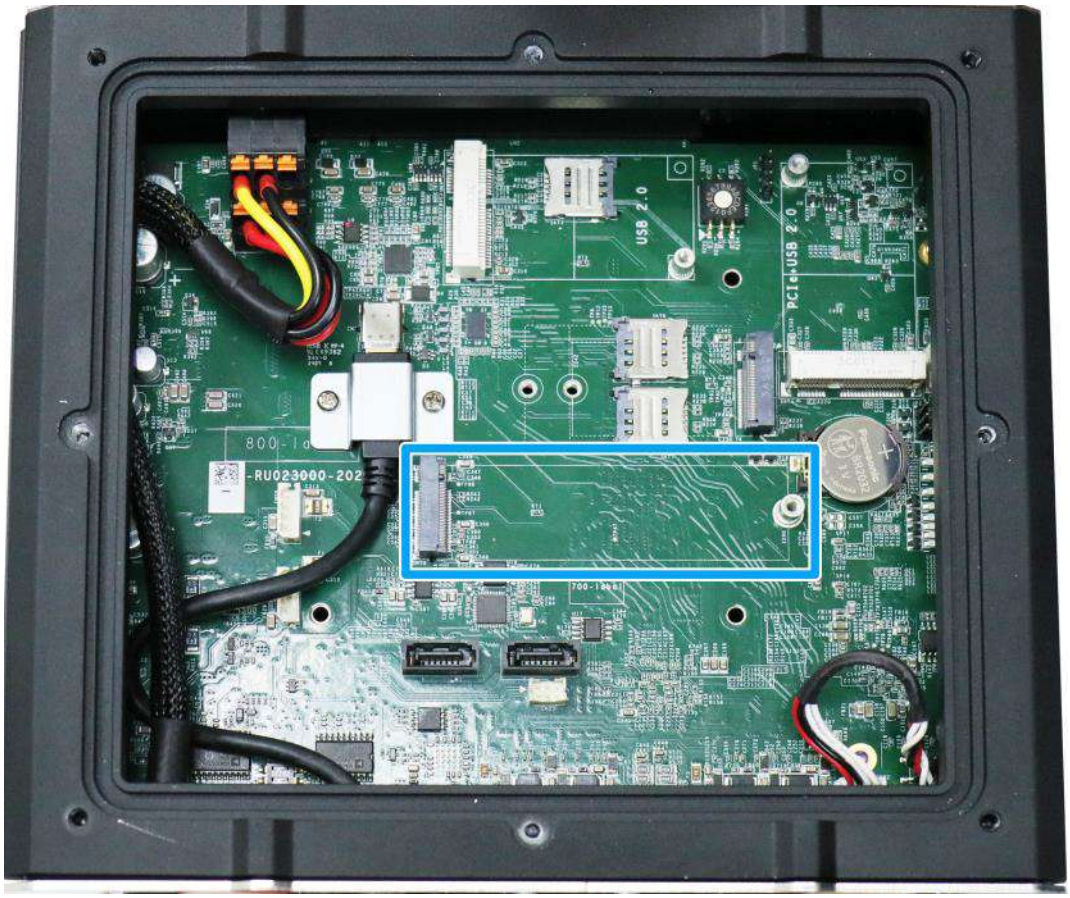
If the module is installed after the initial purchase, you may need to contact Neousys Technology or an authorized distributor for a customized panel with the required number of waterproof SMA antenna holes.

M.2 (B Key) Slot Pin Definition



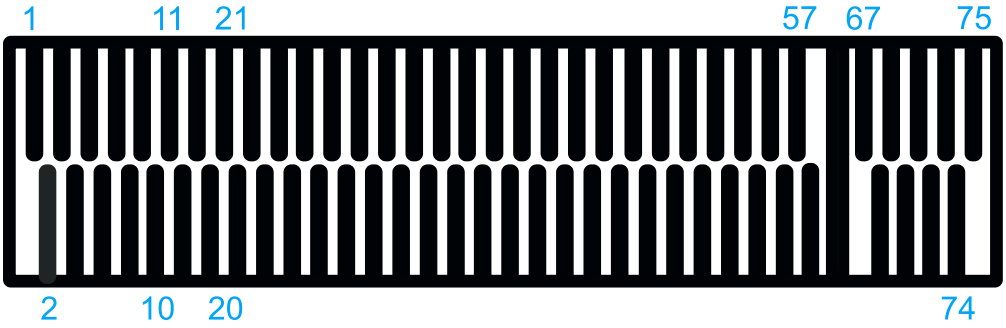
Pin #	Signal	Pin #	Signal
1	-	**2**	+3V3
3	GND	**4**	+3V3
5	GND	**6**	-
7	USB_D+	**8**	-
9	USB_D-	**10**	-
11	GND		
Mechanical Key			
21	-	**20**	-
23	-	**22**	-
25	-	**24**	-
27	GND	**26**	-
29	USB3.0-RX-	**28**	-
31	USB3.0-RX+	**30**	UIM1-RESET
33	GND	**32**	UIM1-CLK
35	USB3.0-TX-	**34**	UIM1-DATA
37	USB3.0-TX+	**36**	UIM1-PWR
39	GND	**38**	-
41	-	**40**	-
43	-	**42**	UIM2-DATA
45	GND	**44**	UIM2-CLK
47	-	**46**	UIM2-RST
49	-	**48**	UIM2-PWR
51	GND	**50**	PERST_N
53	-	**52**	-
55	-	**54**	-
57	GND	**56**	-
59	-	**58**	-
61	-	**60**	-
63	-	**62**	-
65	-	**64**	-
67	RESET_N	**66**	-
69	-	**68**	-
71	GND	**70**	+3V3
73	GND	**72**	+3V3
75	-	**74**	+3V3

2.4.2 M.2 2280 (M Key) for NVMe SSD



The system has a Gen4 x2 PCIe M.2 2280 slot for you to install an NVMe SSD. The M.2 NVMe SSD offers significantly better system performances when compared to a 2.5” SSD.

M.2 (M Key) Slot Pin Definition



Pin #	Signal	Pin #	Signal
1	GND	**2**	+3V3
3	GND	**4**	+3V3
5	PERN3	**6**	-
7	PERP3	**8**	-
9	GND	**10**	-
11	PETN3	**12**	+3V3
13	PETP3	**14**	+3V3
15	GND	**16**	+3V3
17	PERN2	**18**	+3V3
19	PERP2	**20**	-
21	GND	**22**	-
23	PETN2	**24**	-
25	PETP2	**26**	-
27	GND	**28**	-
29	PERN1	**30**	-
31	PERP1	**32**	-
33	GND	**34**	-
35	PETN1	**36**	-
37	PETP1	**38**	-
39	GND	**40**	-
41	PERn0	**42**	-
43	PERp0	**44**	-
45	GND	**46**	-
47	PETn0	**48**	-
49	PETp0	**50**	PERST_N
51	GND	**52**	CLKREQ
53	REFCLKN	**54**	-
55	REFCLKP	**56**	-
57	GND	**58**	-
Mechanical Key			
67	-	**68**	-
69	-	**70**	+3V3
71	GND	**72**	+3V3
73	GND	**74**	+3V3
75	GND		

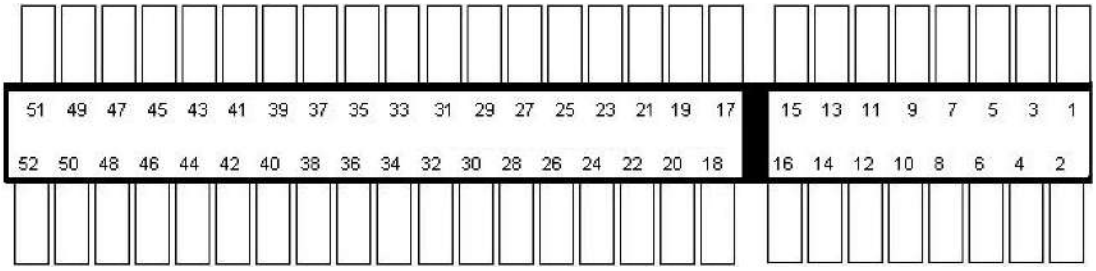
2.4.3 mini-PCIe Slot (PCIe and USB2.0 Signal)

The mini-PCIe socket (in **blue**) accepts off-the-shelf mini-PCIe modules. You can add additional features to your system such as WiFi, GPS, etc.

NOTE

If the module is installed after the initial purchase, you may need to contact Neousys Technology or an authorized distributor for a customized panel with the required number of waterproof SMA antenna holes.

mini-PCIe Pin Definition



Pin #	Signal	Pin #	Signal
1	-	2	+3.3V
3	-	4	GND
5	-	6	+1.5V
7	-	8	UIM_PWR
9	GND	10	UIM_DATA
11	REFCLK-	12	UIM_CLK
13	REFCLK+	14	UIM_RST
15	GND	16	UIM_SPU
Mechanical Key			
17	-	18	GND
19	-	20	-
21	GND	22	PERST#
23	PERn0	24	+3.3V
25	PERp0	26	GND
27	GND	28	+1.5V
29	GND	30	-
31	PETn0	32	-
33	PETp0	34	GND
35	GND	36	USB_D-
37	GND	38	USB_D+
39	+3.3V	40	GND
41	+3.3V	42	-
43	GND	44	-
45	-	46	-
47	-	48	+1.5V
49	-	50	GND
51	-	52	+3.3V

WARNING

Some off-the-shelf mini-PCIe 4G modules are not compliant to standard mini-PCIe interface. They use 1.8V I/O signals instead of standard 3.3V I/O and may have signal conflict. Please consult with Neousys for compatibility when in doubt!

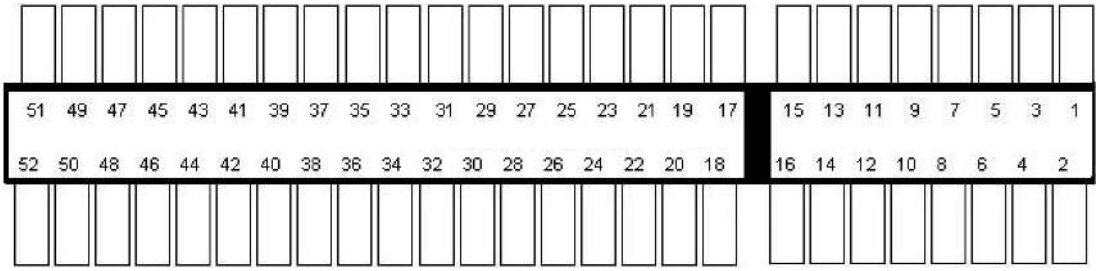
2.4.4 mini-PCIe Slot and SIM (USB 2.0 Signal Only)

There is a full-size USB2.0 signal only mini-PCIe socket (indicated in **blue**) for better compatibility with off-the-shelf mini-PCIe wireless modules. For customers who want to install a mini-PCIe wireless module, please take advantage of the mini-PCIe socket, SIM card slot (indicated in **red**) and the antenna openings on the panels.

NOTE

If the module is installed after the initial purchase, you may need to contact Neousys Technology or an authorized distributor for a customized panel with the required number of waterproof SMA antenna holes.

mini-PCIe Pin Definition



Pin #	Signal	Pin #	Signal
1	-	2	+3.3V
3	-	4	GND
5	-	6	+1.5V
7	CLKREQ#	8	-
9	GND	10	-
11	-	12	-
13	-	14	-
15	GND	16	-
Mechanical Key			
17	-	18	GND
19	-	20	-
21	GND	22	PERST#
23	-	24	+3.3V
25	-	26	GND
27	GND	28	+1.5V
29	GND	30	-
31	-	32	-
33	-	34	GND
35	GND	36	USB_D-
37	GND	38	USB_D+
39	+3.3V	40	GND
41	+3.3V	42	-
43	GND	44	-
45	-	46	-
47	-	48	+1.5V
49	-	50	GND
51	-	52	+3.3V

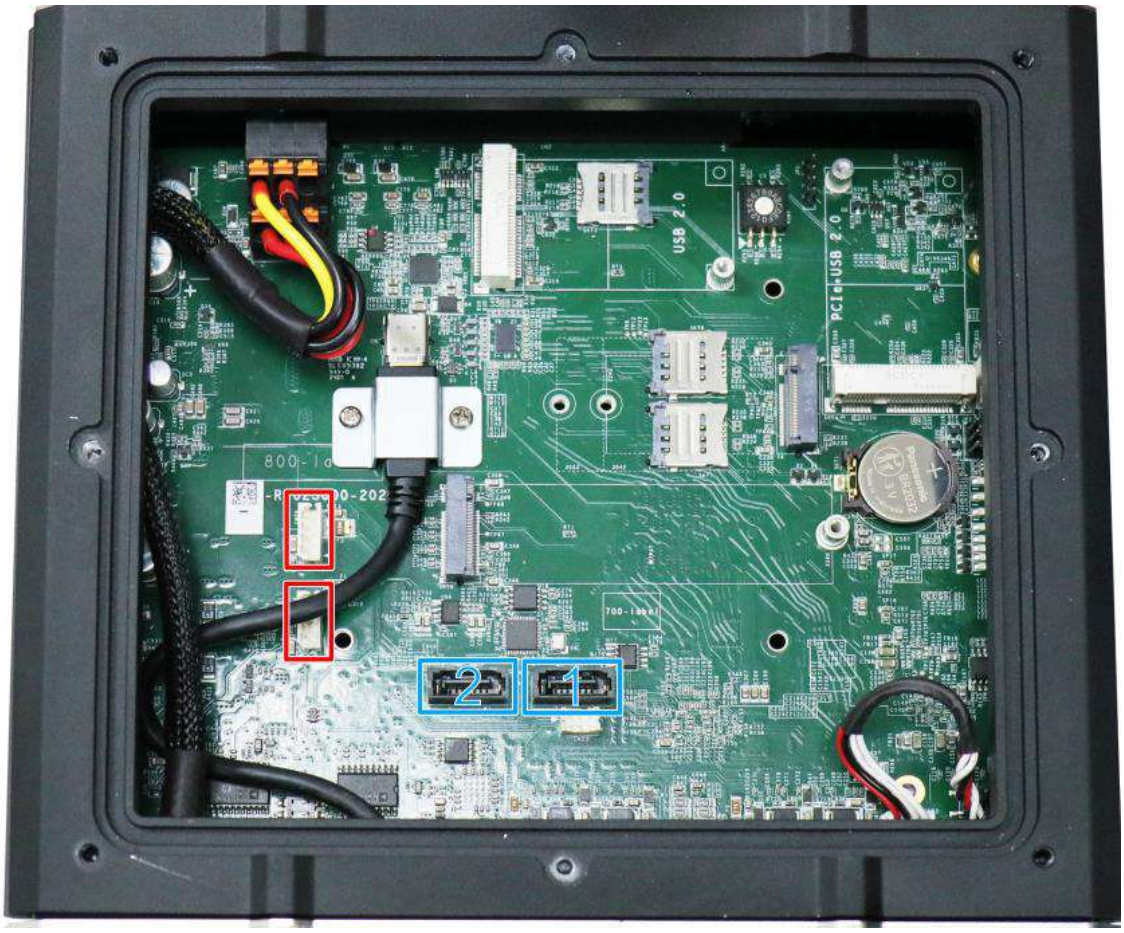
2.4.5 DIP Switch for COM/ CAN bus Port Configuration

The system's COM/ CAN bus ports are implemented via the NVIDIA Jetson module and can provide up to 115200 bps baud rate.

The ports can be configured by adjusting the DIP switch. The following table describes the pin configuration and their definitions.

DIP position / DIP number	On	Off
1	Enable CAN0 Termination	Disable CAN0 Termination
2	Enable CAN1 Termination	Disable CAN1 Termination
3	Enable RS485 Termination	Disable RS485 Termination
4	Enable Auto Power On	Disable Auto Power On

2.4.6 SATA Ports



The system has two SATA ports which support SATA signals. Each SATA port (indicated in **blue**) features a SATA and power connector (indicated in **red**). Standard SATA/ power connectors are provided with the system.

3 System Installation

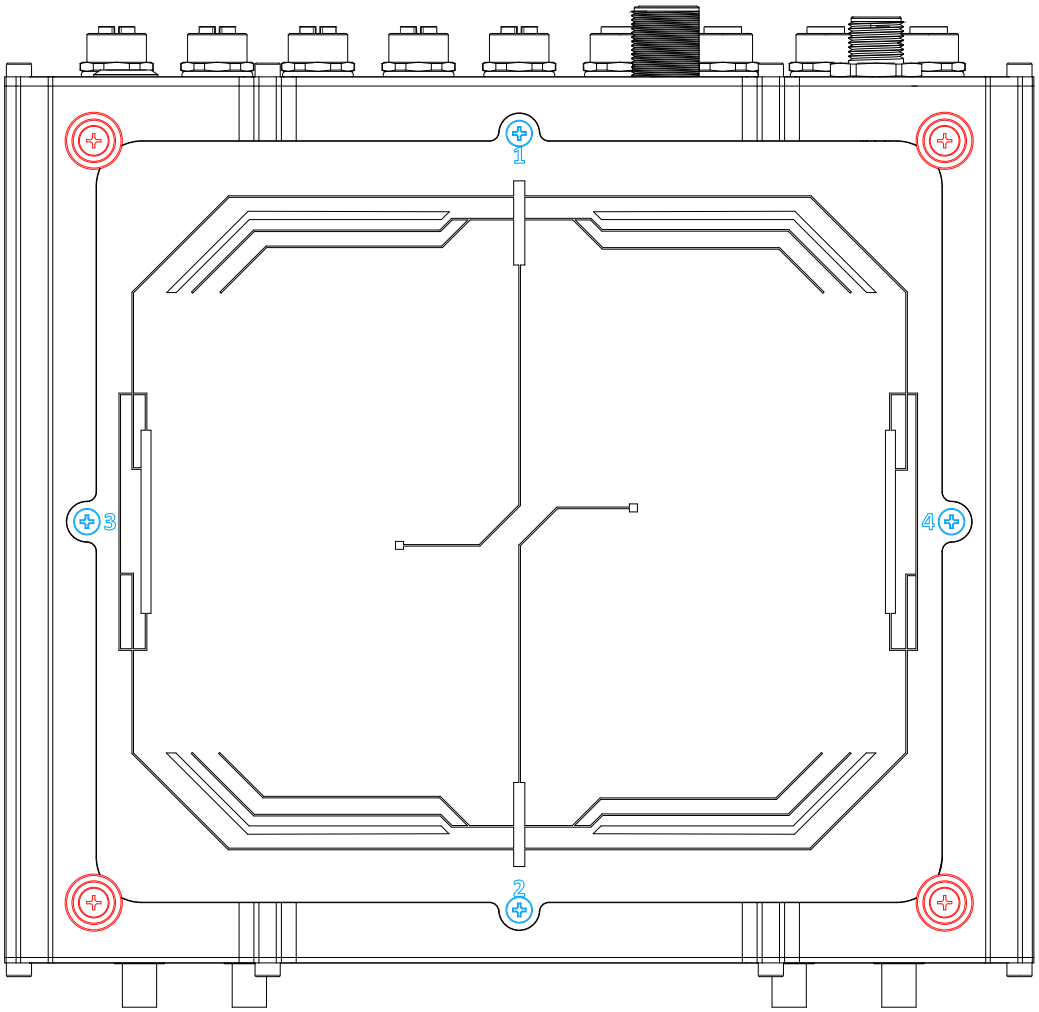
Before disassembling the system enclosure and installing components and modules, please make sure you have done the following:

- It is recommended that only qualified service personnel should install and service this product to avoid injury or damage to the system.
- Please observe all ESD procedures at all times to avoid damaging the equipment.
- Before disassembling your system, please make sure you have the module/ component you wish to install at hand and have all the necessary tools.
- Before disassembling your system, please make sure the system has powered off, all cables and antenna (power, video, data, etc.) are disconnected.
- Place the system on a flat and sturdy surface (remove from mounts or out of server cabinets) before proceeding with the installation/ replacement procedure.

3.1 Disassembling the System Enclosure

To install internal components such as M.2 SSD or mini-PCIe module, you need to disassemble the system enclosure. Please refer to the following procedure:

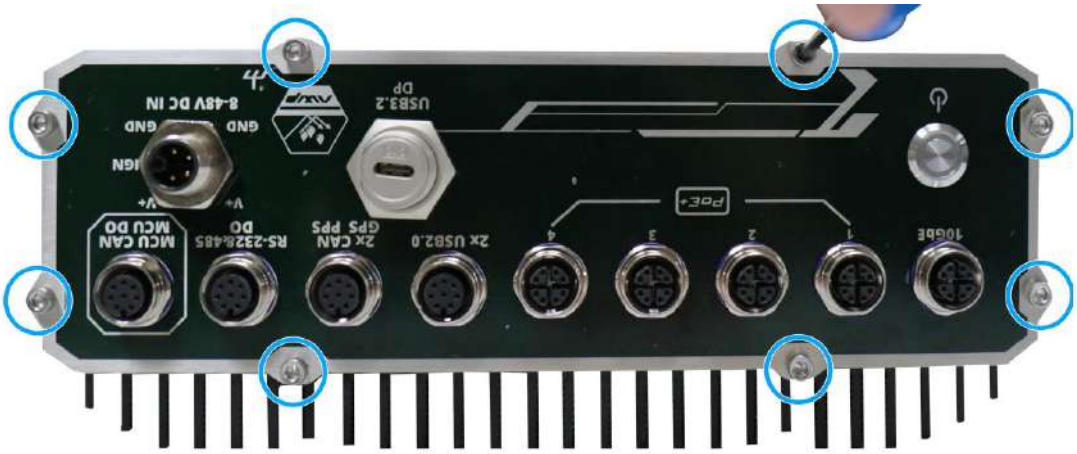
1. Turn the system upside-down and remove the screws indicated **blue** and **red** (with rubber stand).



2. Gently lift the bottom panel open to access the internal expansion slots

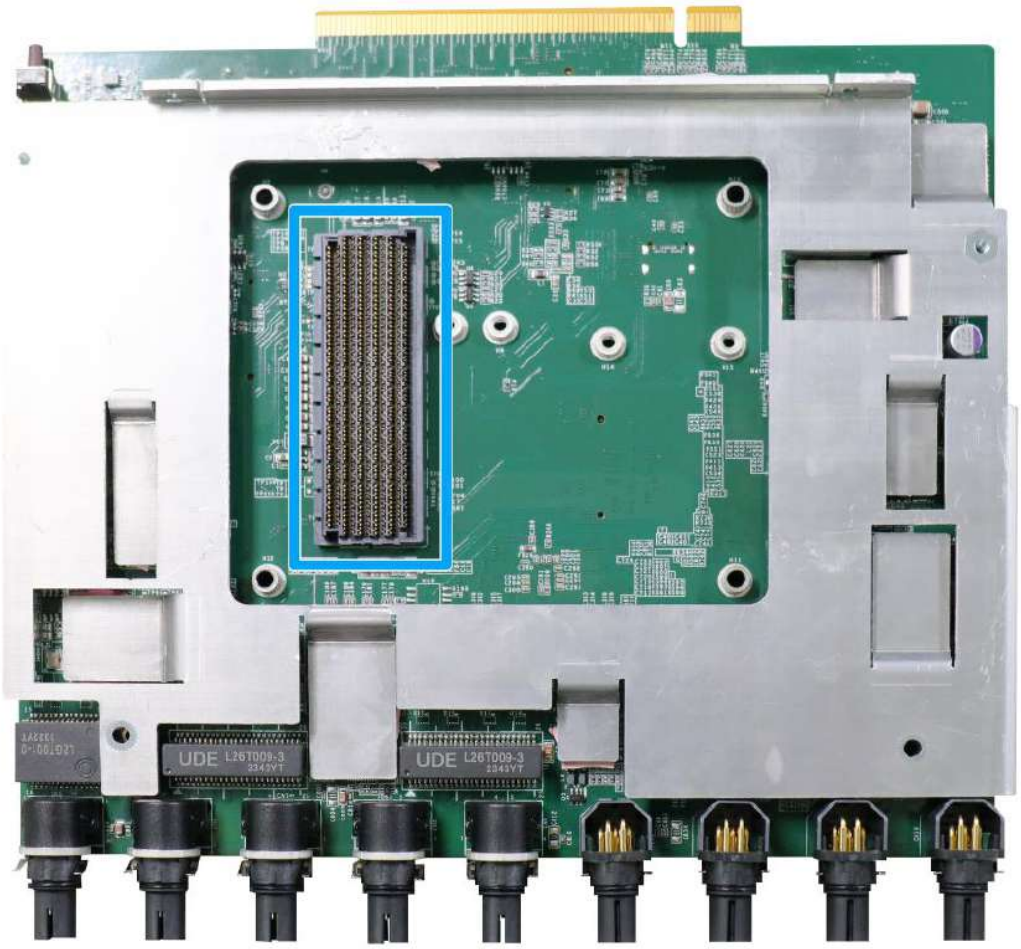
3. Remove the screws securing the heatsink on the motherboard.

4. Remove the screws indicated on the I/O panel.



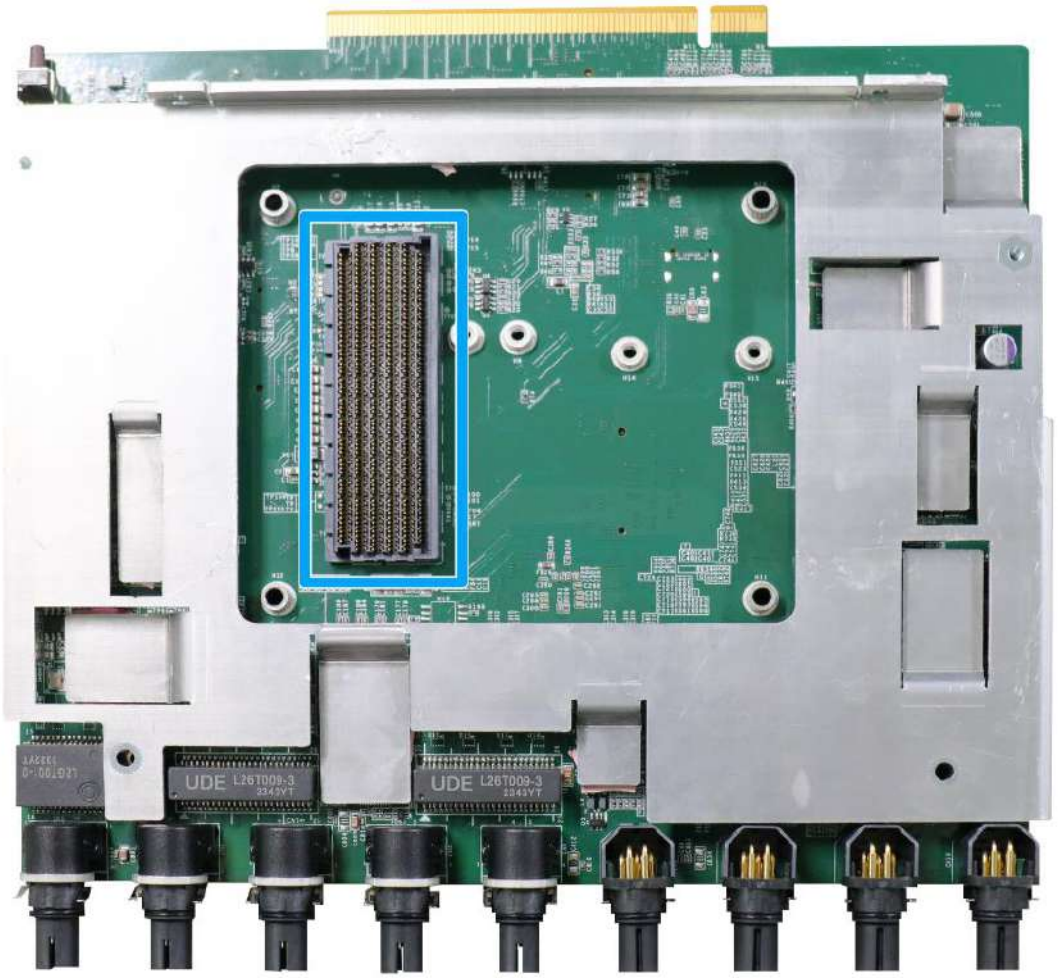
5. Gently slide the motherboard out of the enclosure.

6. Turn the motherboard upside-down to access the NVIDIA® Jetson AGX Orin™ SoM's 699-pin interface connector.



3.2 Installing Internal Components

3.2.1 NVIDIA® Jetson AGX Orin™ SoM Installation

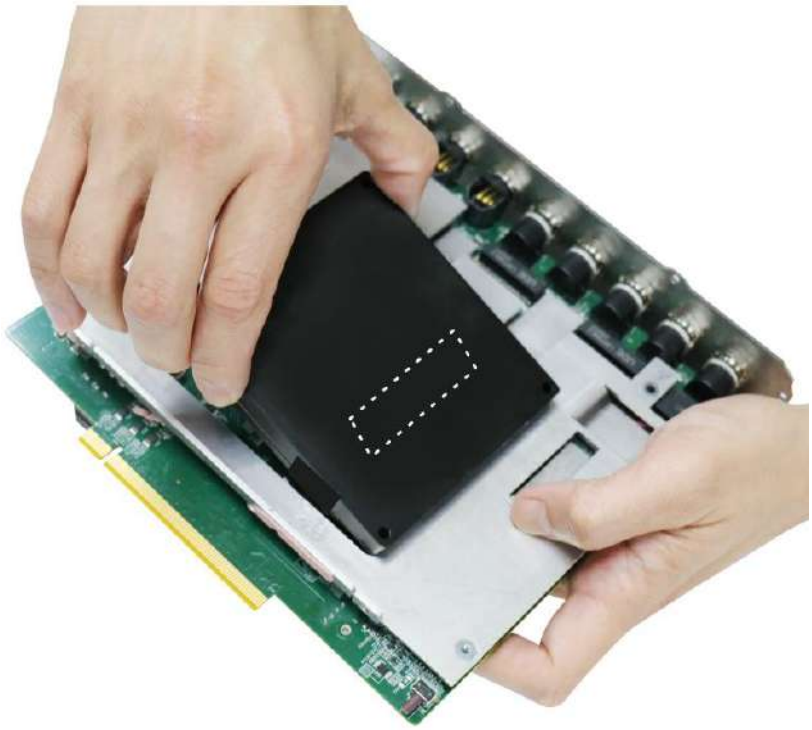


The system has a dedicated 699-pin interface for NVIDIA® Jetson AGX Orin™, please refer to the following instructions for installation.

1. Please refer to the section Disassemble the system enclosure.

2. Simply match the SoM's pin connector end to the motherboard, lower and push firmly into the motherboard until you hear a "click" sound.

3. If you need separate the SoM from the motherboard, place fingers on the SoM's non-connector end, gently lift to un-clip the SoM off from the interface (indicated by the white dotted lines).

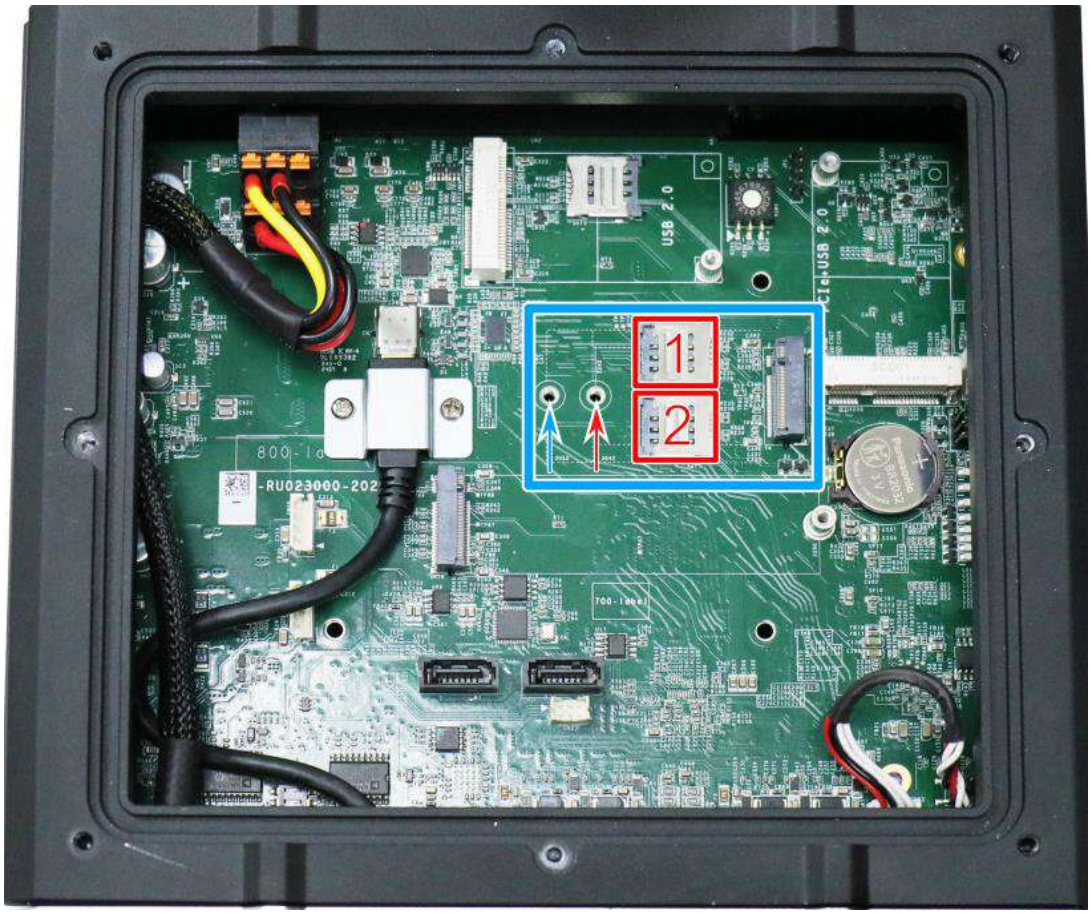


4. Reinstall the system enclosure.

If you need to install other components, please refer to respective sections.

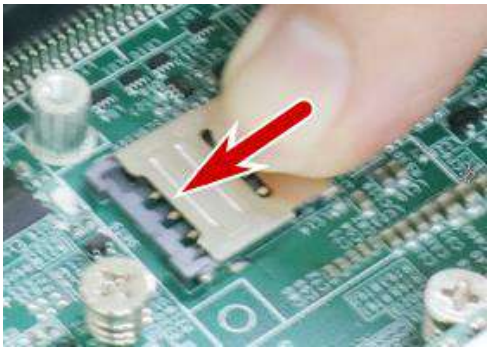
3.2.2 M.2 B Key 3042/ 3052 & SIM Card Installation

The system has an M.2 2242/ 3042/ 3052 slot (indicated in **blue rectangle**) with dual SIM slots (indicated in **red rectangle**) supporting 5G/ 4G. A copper standoff is provided for you to secure onto the motherboard into the **red arrow** location for an M.2 2242/ 3042 module, or into the **blue arrow** location for an M.2 3052 module.



To install an M.2 3042/ 3052 module, please refer to the following procedure:

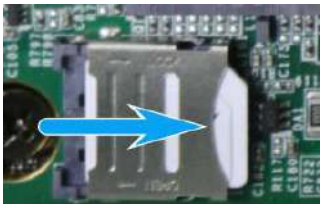
1. Disassemble the system enclosure.
2. Locate the M.2 B key slot indicated in **blue** and the SIM card slots indicated in **red**.
3. If you are installing a 5G/ 4G wireless module that requires a SIM card, please install the SIM card first by pushing the SIM slot holder in the direction shown and flip open the holder to place the SIM into the slot. Otherwise go to the next step.



Push SIM holder

Flip open the holder and place SIM

4. Flip the holder back onto the SIM card and push in the direction shown to lock-in the SIM card into the slot.



5. Insert the M.2 B key module on a 45 degree angle and secure with a screw. To open the SIM slot, slide the micro SIM cover in the direction shown and flip open the slot.

Insert on a 45° angle

Secure with a M2.5 P-head screw

6. To install the antenna onto the system enclosure, clip on the IPEX-to-SMA cable to the module and secure the antenna to the side panel (refer to the module's manual for clip-on connection).

Clip on the IPEX-to-SMA cable

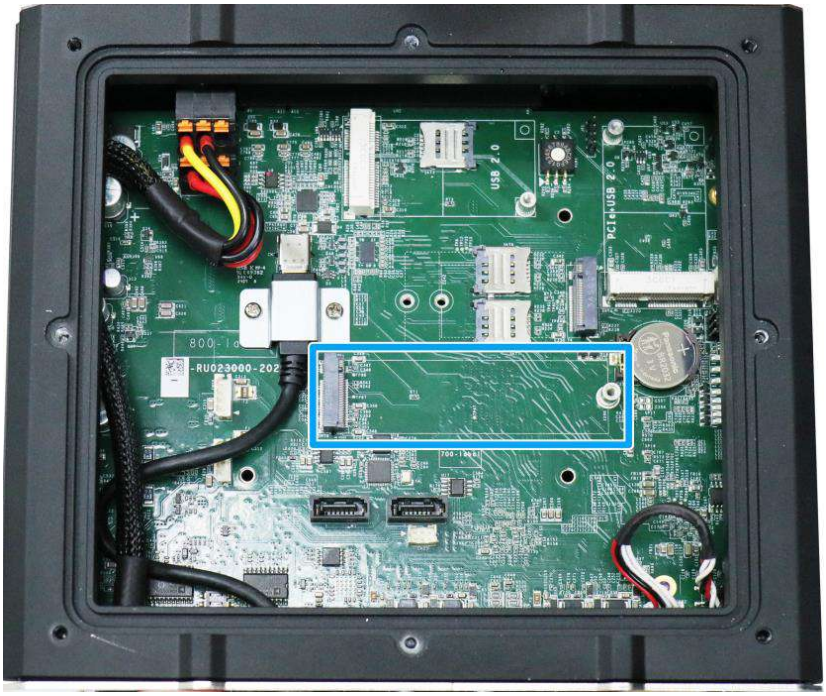
> NOTE
>
> *If the module is installed after initial purchase, you may need to return the unit to Neousys Technology or an authorized SEMIL distributor for SMA antenna installation.*

7. Reinstall the system enclosure.

If you need to install other components, please refer to respective sections.

3.2.3 M.2 2280 M Key NVMe SSD Installation

The system has a Gen4 x2 PCIe M.2 2280 slot for you to install an NVMe SSD. To install the NVMe SSD, please refer to the following procedure.



1. Please refer to the section Disassemble the system enclosure.
2. Insert the module on a 45° angle.

3. Gently press down and secure the module with an M2.5 P-head screw.

4. Remove the thermal pad’s protective film at the bottom of the enclosure panel for the NVMe module.

5. Reinstall the enclosure when done.

   If you need to install other components, please refer to respective sections.

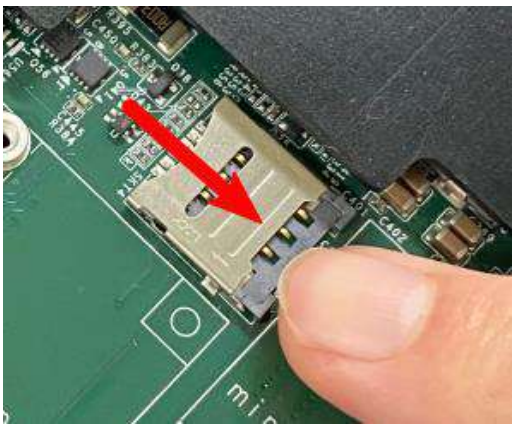
3.2.4 mini-PCIe Module Installation

The system comes with two mini-PCIe sockets. The socket that only has USB2.0 signal also comes with a SIM card slot

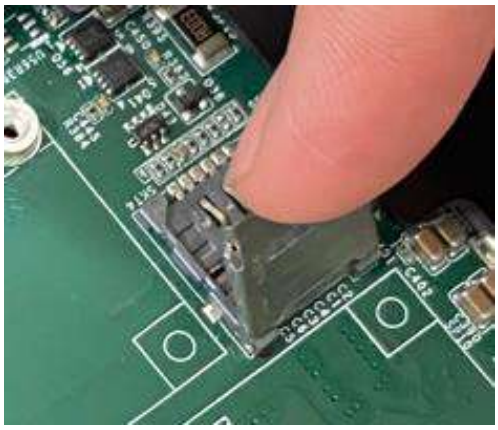
There are two mini-PCIe slots on the main board. Please follow the procedures for installation.

1. Please refer to the section Disassemble the system enclosure.

2. If you are installing a mini-PCIe module with 4G/ 3G that requires a SIM card, please install the SIM card first. Otherwise go to the next step. To install the SIM card, push the SIM slot holder in the direction shown and flip open the holder to place the SIM into the slot.



Push the SIM holder in the direction shown



Flip open the holder

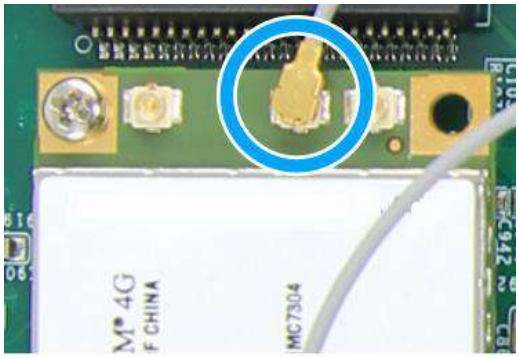
3. Flip the holder back onto the SIM card and push in the direction shown to lock-in the SIM card into the slot.

4. To install, insert the gold finger end of the mini-PCIe card on a 45 degree angle into the slot, gently push the other end of the mini-PCIe onto the motherboard and secure it a screw.

Insert at 45° angle

Secure the card with a screw

5. To install the antenna onto the system enclosure, clip on the IPEX-to-SMA cable to the module and secure the antenna to the side panel (refer to the module's manual for clip-on connection).



Clip on the IPEX-to-SMA cable

> NOTE
>
> *If the module is installed after initial purchase, you may need to return the unit to Neousys Technology or an authorized SEMIL distributor for SMA antenna installation.*

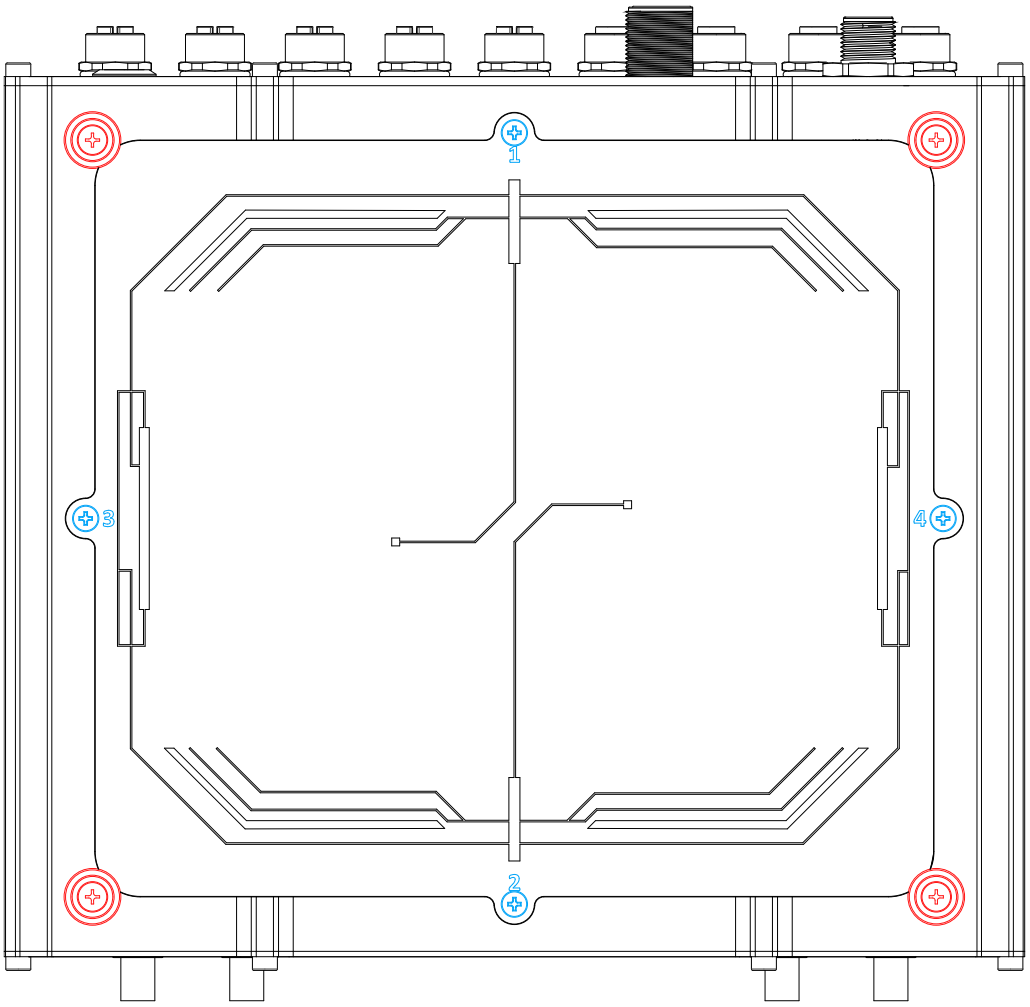
6. Reinstall the enclosure when done.

   If you need to install other components, please refer to respective sections.

3.2.5 Installing 2.5” HDD/ SSD

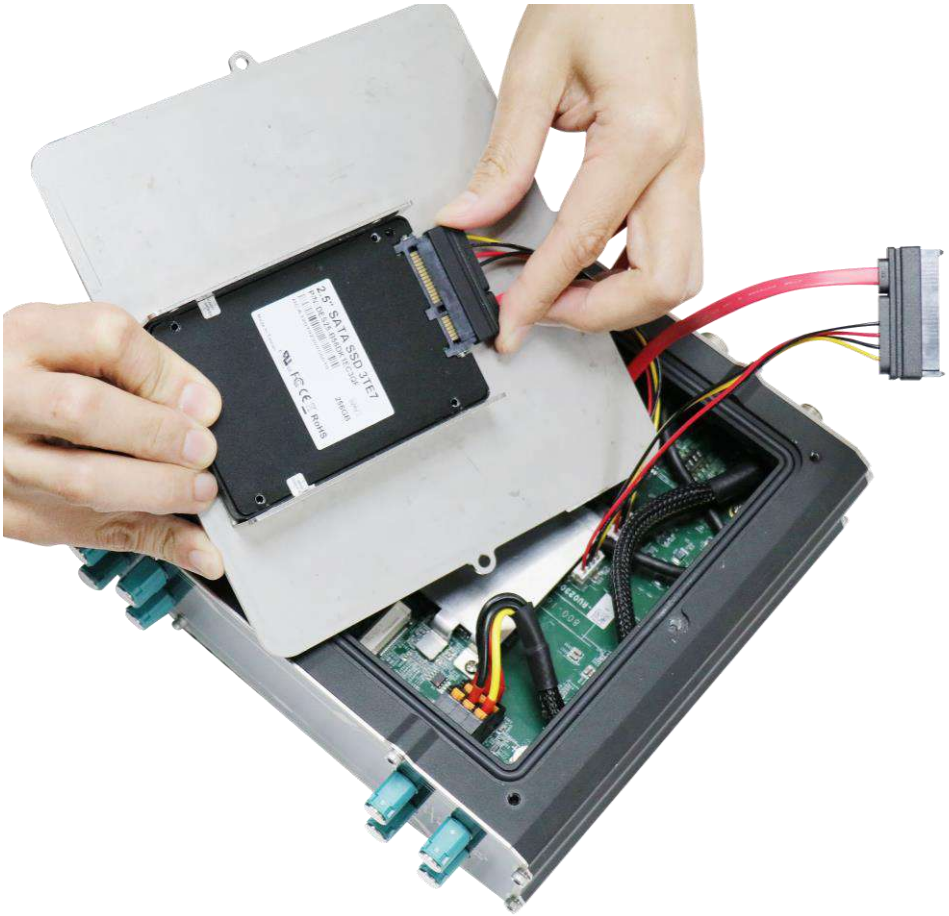
There are two HDD/SSD slots on the inside of enclosure’s bottom panel. Please follow the procedures for installation.

1. Remove bottom panel screws indicated.



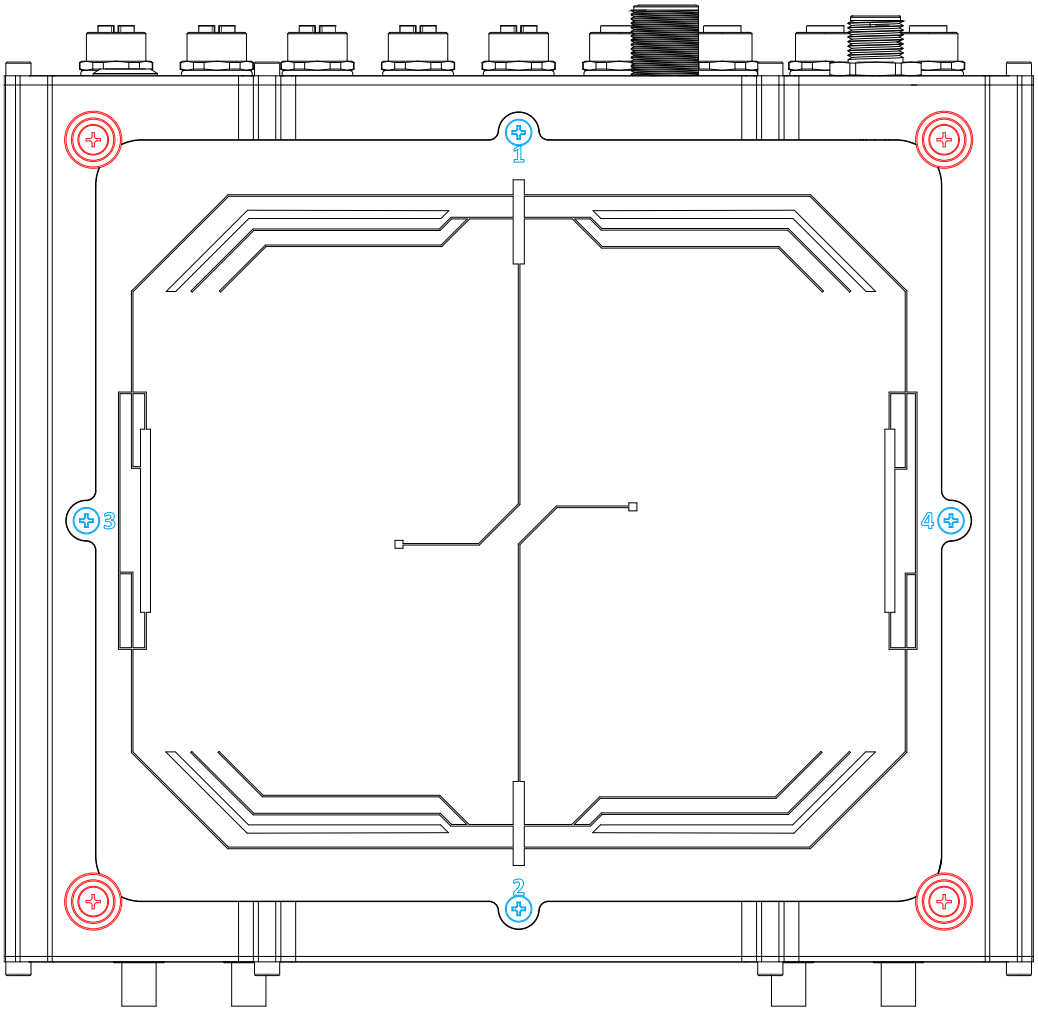
2. Place a 2.5” HDD/ SSD into the drive mount and secure with four screws (indicated by arrows). Note the orientation of the drive’s connector with respect to the panel.

3. Connect the SATA cable to the connector.



4. If you need to install the other HDD/ SSD, please repeat previous steps.

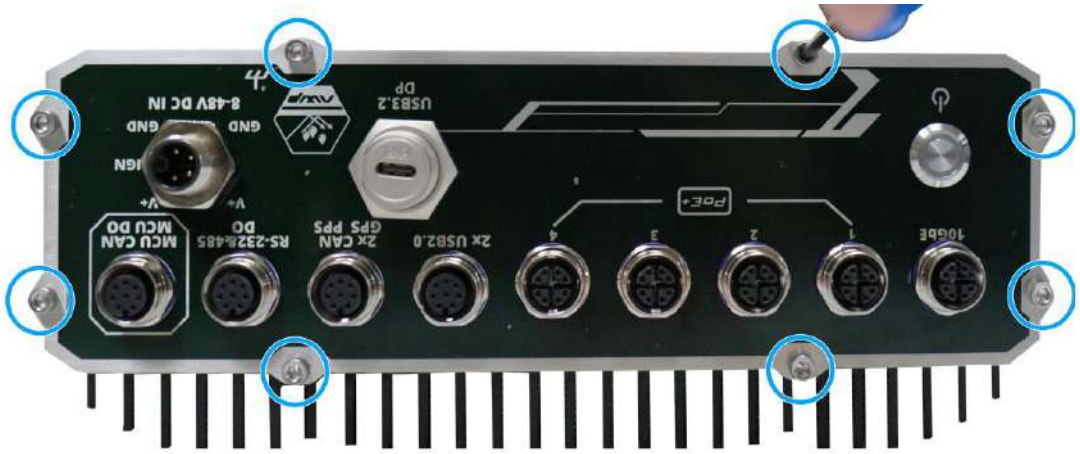
5. Place the panel back onto the enclosure, and secure the indicated screws (**blue**) at a torque range of 6.3 – 7.7kgf-cm in ascending order to complete the installation procedure.



3.3 Installing the System Enclosure

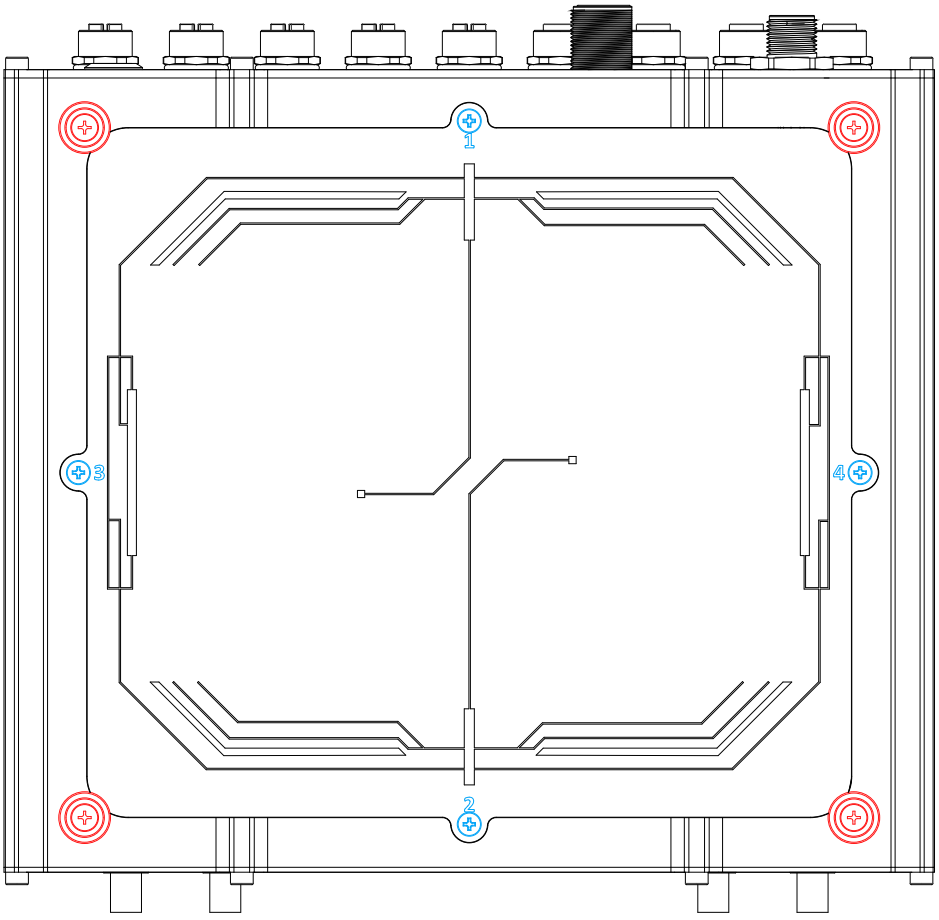
1. Gently slide the motherboard back into the enclosure, make sure the goldfingers (indicated in **red**) are inserted properly into the slot (indicated in **blue**).

2. Secure the hex bolt screws indicated on the I/O panel.



3. Place the bottom panel back onto the system.

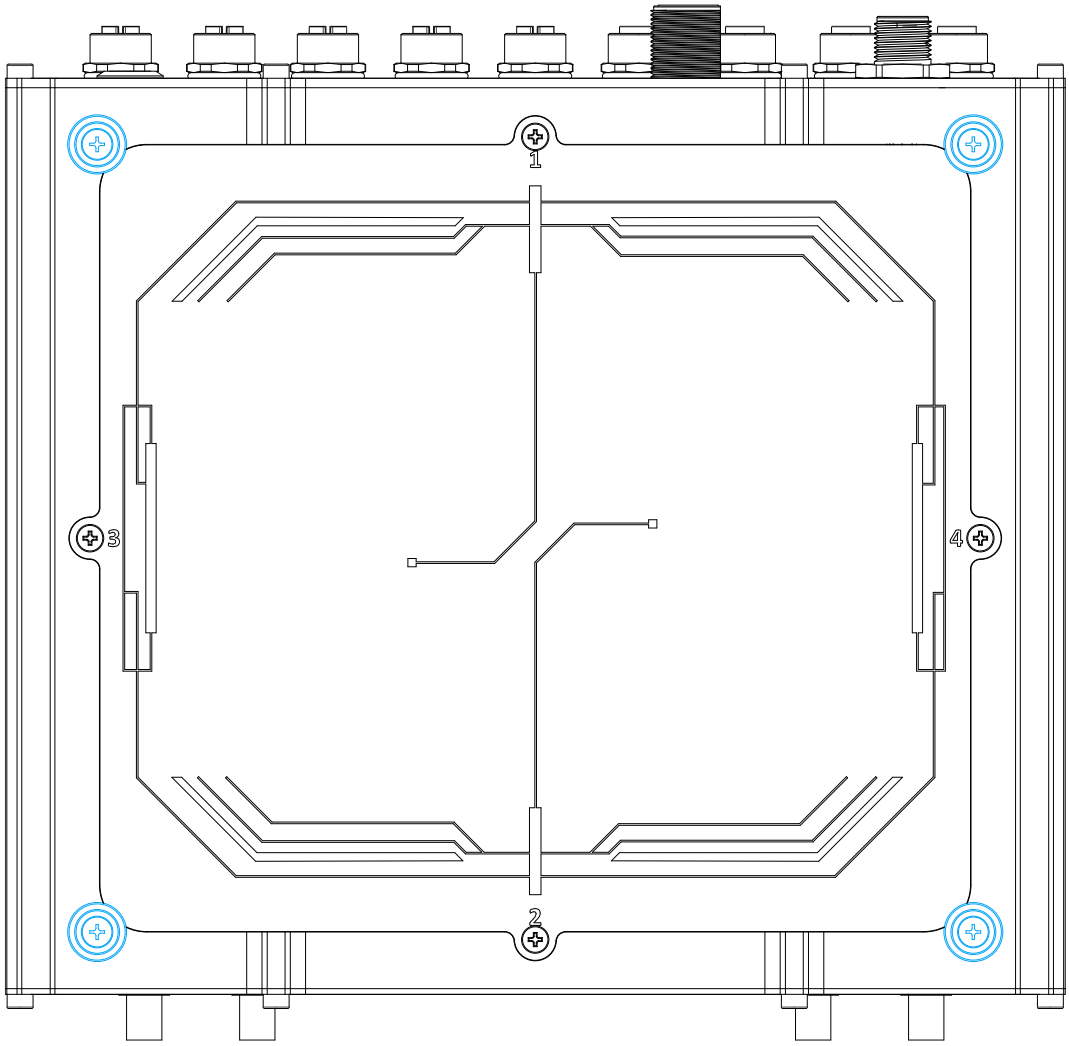
4. Place the panel back onto the enclosure, and secure the indicated screws (**blue**) at a torque range of 6.3 – 7.7kgf-cm in ascending order to complete the installation procedure.



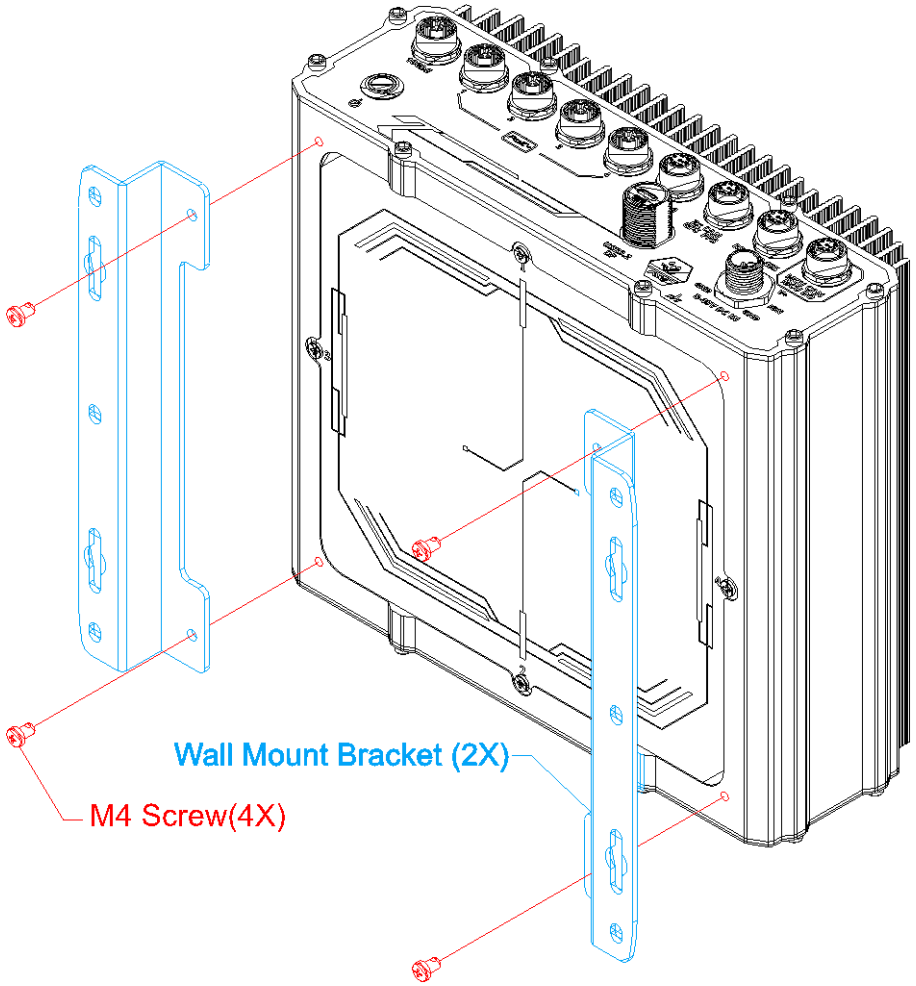
3.4 Wall Mount Bracket Installation

To install the wall mount bracket for the system, please refer to the following instructions.

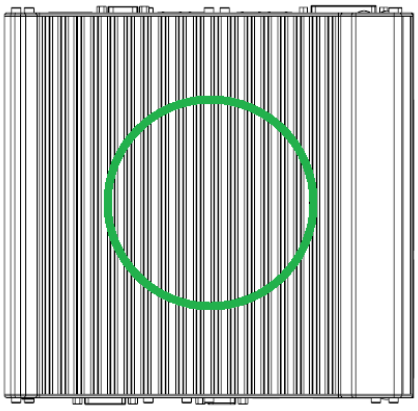
1. To install the damping bracket, please remove the four rubber stands at the bottom of the enclosure.

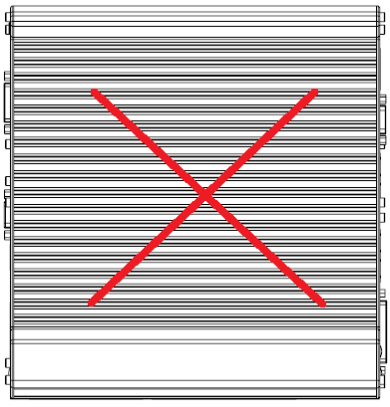


2. Take out the wall mount bracket (in **blue**) and four M4 screws (in **red**) out of the accessory box and fix the wall mount bracket to the bottom of the system enclosure.



3. Place the system on a flat surface portion of the wall and secure it with four (4) M4 screws. When wall mounting, place the heatsink fins perpendicular to the ground for better heat dissipation efficiency.

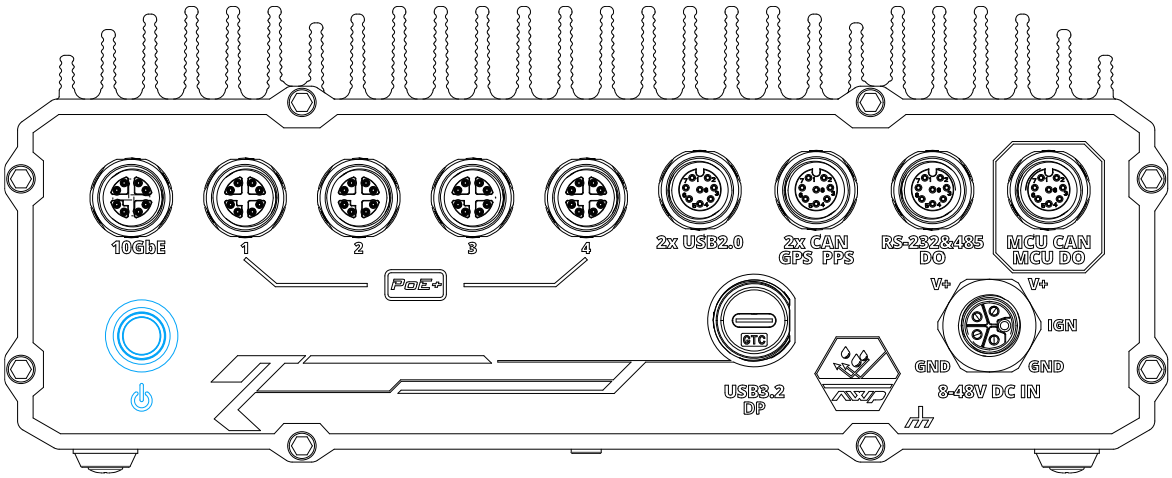




3.5 Powering On the System

3.5.1 Powering On Using the Power Button

This is the simplest way to turn on your system. The power button on the side panel is a non-latched switch and behaves as the ATX-mode on/off control. With DC power connected, pushing the power button will turn on the system and the PWR LED indicator will light up. Pushing the button when system is on will turn off the system. If your operating system supports ATX power mode, pushing the power button while the system is in operation will result in a pre-defined system behavior, such as shutdown or hibernation.

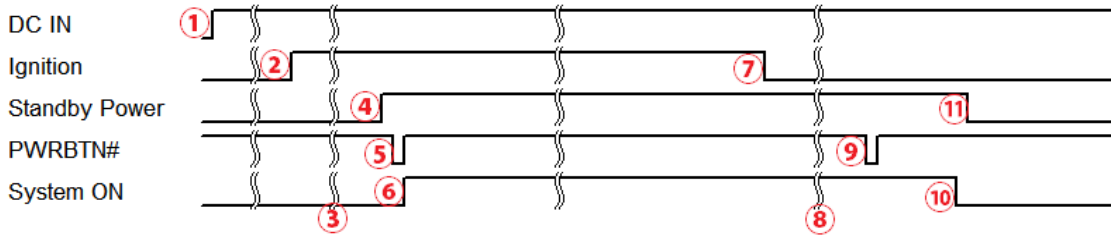


4 Ignition Power Control

The ignition power control module for in-vehicle applications is an MCU-based implementation that monitors the ignition signal and reacts to turn on/off the system according to predefined on/off delay. Its built-in algorithm supports other features such as ultra-low power standby, battery-low protection, system hard-off, etc. In this section, we'll illustrate the principle of ignition power control and operation modes.

4.1 Principles of Ignition Power Control

The concept of ignition power control module is to control the timing correlation between ignition signal and system power status. A typical timing correlation is described in following diagram.



1. When DC power is supplied to the system, MCU starts to periodically detect ignition signal. Note that only MCU is working at this moment and the overall power consumption is less than 2 mW.
2. Ignition signal is active (both 12VDC and 24VDC ignition signals are accepted).
3. MCU starts to count a pre-defined power-on delay.
4. Once power-on delay expired, MCU turns on necessary standby power for the system (3.3VSB & 5VSB).
5. A PWRBTN# pulse is then issued to turn on the system (equivalent to one pressing the power button on the front panel).
6. The system is booting and becomes operational.
7. After a period of time, the ignition signal becomes inactive.
8. MCU starts to count a pre-defined power-off delay.
9. Once power-off delay expired, another PWRBTN# pulse is issued to perform a soft-off for the system (ex. a normal shutdown process for Windows system).
10. The system is completely shut down.
11. As MCU detects system is off, it turns off the standby power for the system, and operates in low power mode again (< 2mW power consumption).

4.1.1 Additional Features of Ignition Power Control

In addition to the typical timing correlation, the ignition power control module offers additional features to provide additional reliability for in-vehicle applications.

- **Low battery detection**

  The ignition power control module continuously monitors the voltage of DC input when the system is operational. If input voltage is less than 11V (for 12VDC input) or less than 22V (for 24VDC input) over a 60-second duration, it will shut down the system automatically.

- **Guarded power-on/ power-off delay duration**

  If ignition signal goes inactive during the power-on delay duration, the ignition power control module will cancel the power-on delay process and go back to idle status. Likewise if ignition signal goes active during the power-off delay duration, the ignition power control module will cancel the power-off delay process and keep the system running.

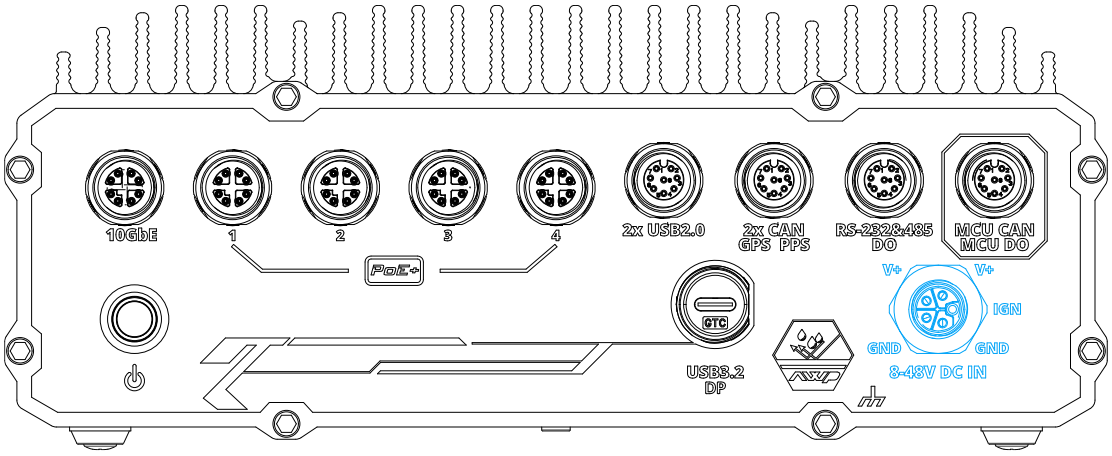
- **System hard-off**

  In some cases, system may fail to shutdown via a soft-off operation due to system/ application halts. The ignition power control module offers a mechanism called “hard-off” to handle this unexpected condition. By detecting the system status, it can determine whether the system is shutting down normally. If not, the ignition power control module will force cut-off the system power 10 minutes after the power-off delay duration.

- **Smart off-delay**

  The ignition power control module offers two modes (mode 13 & mode 14) which have very long power-off delay duration for applications require additional off-line time to process after the vehicle has stopped. In these two modes, the ignition power control module will automatically detect the system status during the power-off delay duration. If the system has shutdown (by the application software) prior to power-off delay expiring, it will cut off the system power immediately to prevent further battery consumption.

4.1.2 Wiring Ignition Signal

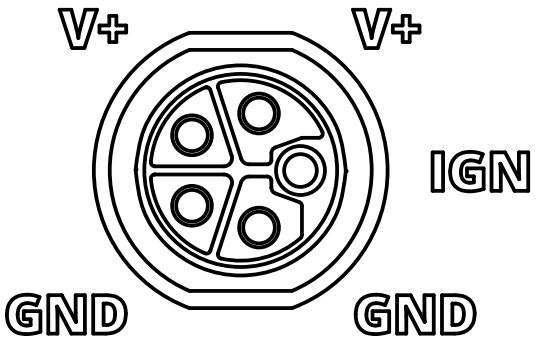


To have ignition power control for in-vehicle usage, you need to supply IGN signal to the system. The IGN input is located on the M12 L-coded 5-pin connector (shared with DC power input). For in-vehicle ignition control wiring, please do the following:

1. Connect car Battery + line (12V for sedan, 24V for bus/ truck) to V+.
2. Connect car Battery -/ GND line to GND.
3. Connect ACC line to IGN.

> **WARNING**
>
> *Please make sure the voltage of DC power is correct before you connect it to the system.*
> *Supplying a voltage over 48V will damage the system.*
> *Please make sure your DC power source and IGN signal share the same ground.*

Connector Pin Definition



Signal	Wire color
V+	
V+	
GND	
GND	
IGN	

4.1.3 Operation Modes of Ignition Power Control

You can use the rotary switch to configure the operation mode. The system offers 16 (0~15) operation modes with different power-on/power-off delay configurations. Please refer to the section "Disassembling the system" to gain access to the rotary switch.

- **Mode 0**

  Mode 0 is the ATX mode without power-on and power-off delay. User can only use the power button on the front panel to turn on or turn off the system.

Mode	Power-on Delay	Power-off Delay	Hard-off Timeout
0	N/A	N/A	N/A

- **Mode 1**

  Mode 1 is AT mode without power-on and power-off delay. The system automatically turns on when DC power is applied. A retry mechanism is designed to repeat the power-on cycle if the system fails to boot up.

Mode	Power-on Delay	Power-off Delay	Hard-off Timeout
1	N/A	N/A	N/A

- **Mode 2**

  Mode 2 is designed to have a very minor power on/ off delay of 160ms for applications that requires the system to start up almost at the same as the rest of the equipment it is working in collaboration with.

Mode	Power-on Delay	Power-off Delay	Hard-off Timeout
2	160ms	160ms	10 minutes

- **Mode 3 ~ Mode 12**

  Mode 3 ~ Mode 12 have various power-on delay and power-off delay. Each mode supports a hard-off timeout of 10 minutes.

Mode	Power-on Delay	Power-off Delay	Hard-off Timeout
3	10 seconds	10 seconds	10 minutes
4	10 seconds	1 minute	10 minutes
5	10 seconds	5 minutes	10 minutes
6	30 seconds	1 minute	10 minutes
7	30 seconds	5 minutes	10 minutes
8	30 seconds	10 minutes	10 minutes
9	3 minutes	1 minute	10 minutes
10 (A)	3 minutes	10 minutes	10 minutes
11 (B)	3 minutes	30 minutes	10 minutes
12 (C)	10 minutes	30 minutes	10 minutes

- **Mode 13 (D) / Mode 14 (E)**

  Mode 13 and Mode 14 are ignition power control modes with very long power-off delay. Both modes support the feature of “smart off-delay”, which automatically detect system status during power-off delay duration and cut off system power if system is off in prior to power-off delay expired.

Mode	Power-on Delay	Power-off Delay	Hard-off Timeout
13 (D)	30 seconds	2 hours	10 minutes
14 (E)	3 minutes	2 hours	10 minutes

- **Mode 15 (F)**

  Mode 15 is reserved.

5 Reflashing the NRU System

NRU series is shipped with JetPack installed as a turnkey solution. If you are familiar and experienced with the platform, you can skip this section and start your development.

Please refer to this link on how to reflash/ backup/ restore the NRU series with either NVIDIA's official JetPack or from the pre-built system image by Neousys.