

NAC-1000 USER

NVIDIA® Jetson Orin™ Embedded AI Computing System
IP66, 1 1000Base-T1 LAN, 4 M12 PoE+ GigE LAN, 8 GMSL2, 2 USB 3.1

Manual

Record of Revision

Version	Date	Page	Description	Remark
1.00	2025/12/09	All	Official Release	
1.10	2026/01/30	All	Update	

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CE The products 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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Order Information

Part Number	Platform	RAM	LAN	USB 3.1	Serial	Iso. CAN	Iso. DIO	PoE ⁺	GMSL	SIM	M.2
NAC-1000-R32	Jetson AGX Orin	32GB	5	2	1	2	12	4	8	2	4
NAC-1000-R64		64GB									

NVMe SSD List

Part Number	Description
S128	128GB NVMe SSD
S256	256GB NVMe SSD
S512	512GB NVMe SSD
S01T	1TB NVMe SSD

Optional Accessories

Part Number	Description
PWA-160WB-WT	160W, 24V, 85V AC to 264V AC Power Adapter with 3-pin Terminal Block, Wide Temperature -30°C to +70°C
PWA-180WB	180W, 24V, 90V AC to 264V AC Power Adapter with 3-pin Terminal Block
PWA-280WB-WT	280W, 24V, 85V AC to 264V AC Power Adapter with 3-pin Terminal Block, Wide Temperature -30°C to +70°C
GMSL Camera Kit	GMSL Camera with Fakra-Z connector
M.2 Storage Module	M.2 Key M/Key B PCIe Storage Module
5G Module	5G Module with Antenna
4G Module	4G/GPS Module with Antenna
RTK GPS Module	RTK GPS Module with Antenna
WiFi & Bluetooth	WiFi & Bluetooth Module with Antenna

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1

GENERAL INTRODUCTION

1.1 Overview

The Vecow NAC-1000 is powered by NVIDIA Jetson AGX Orin platform, featuring an Arm® Cortex®-A78AE CPU and an advanced NVIDIA Ampere architecture GPU with 64 Tensor Cores, delivering up to 275 TOPS of AI performance. The NAC-1000 fully supports NVIDIA Isaac Perception Software Stack for AI robot development on NVIDIA Isaac ROS, making it a high-performance, industry-leading platform for deploying and running robotics applications.

The NAC-1000 boasts a rugged design and supports high compute density with versatile I/O options, including 8 GMSL 1/2 automotive cameras, 2 USB 3.1 Gen 2 Type-C ports, 1 1000 Base-T1 GigE LAN port, 2 Isolated CAN Bus interfaces, 2 SIM card sockets, and 4 M12 GigE PoE⁺ LAN ports. With support for a wide 9V to 50V DC input range, an operating temperature from -40°C to 85°C, and software ignition control, the Vecow NAC-1000 is an ideal solution for AI-based robots, autonomous machines, construction robots, and other AI-driven edge computing applications.

Furthermore, the NAC-1000 supports the NVIDIA JetPack™ 6 software development kit, enhancing the Jetson platform's flexibility and scalability to accelerate AI application deployment.

1.2 Features

- Advanced NVIDIA® Jetson AGX Orin™ platform delivers up to 275 TOPS AI performance
- Based on NVIDIA Nova Orin™, fully supports NVIDIA Isaac™ Perceptor Software Stack for AI Robot Development on NVIDIA Isaac™ ROS
- Supports 8 GMSL 1/2 automotive cameras with Fakra-Z connectors
- 1 1000Base-T1 LAN, 4 M12 PoE+ GigE LAN
- Built-in Bosch 6-axis IMU, Altimeter, Magnetometer
- Supports multiple 5G/4G/WiFi/BT/LTE/GPRS/UMTS wireless connection
- IP66, DC 9V to 50V, Software Ignition Power Control

1.3 Product Specification

1.3.1 Specifications of NAC-1000

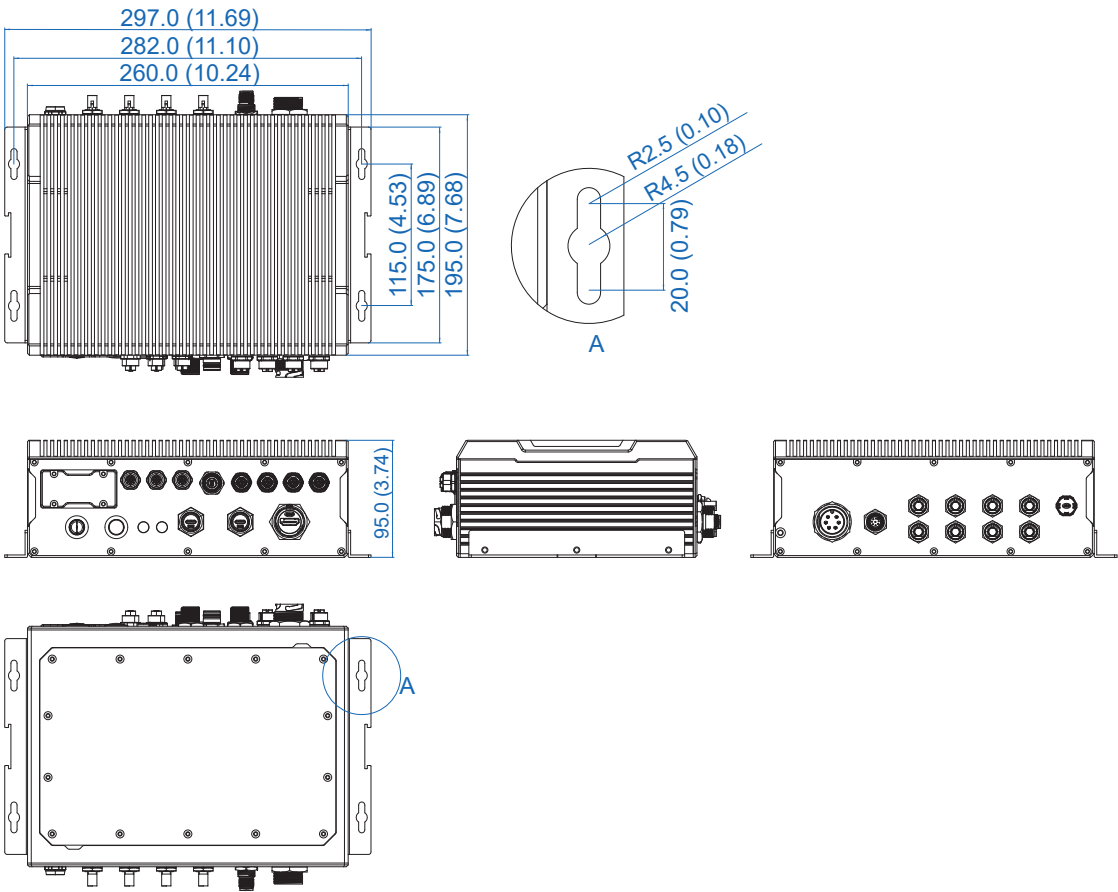
System	
CPU	NAC-1000-R32 : 8-core Arm [®] Cortex [®] -A78AE v8.2 64-bit CPU NAC-1000-R64 : 12-core Arm [®] Cortex [®] -A78AE v8.2 64-bit CPU
GPU	NAC-1000-R32 : 1792-core NVIDIA Ampere™ architecture GPU with 56 Tensor Cores NAC-1000-R64 : 2048-core NVIDIA Ampere™ architecture GPU with 64 Tensor Cores
DL Accelerator	2x NVDLA Engines
Memory	NAC-1000-R32 : 1 32GB LPDDR5 DRAM NAC-1000-R64 : 1 64GB LPDDR5 DRAM
OS	Linux Ubuntu 22.04 with NVIDIA JetPack 6
I/O Interface	
USB	2 USB 3.1 Gen 2 Type-C
Serial	1 M12 COM RS-232/422/485
CAN Bus	2 Isolated CAN Bus support Flexible Data-rate
DIO	12 Isolated DIO (6 DI, 6 DO)
Micro USB	• 1 Micro USB console debug port • 1 Micro USB OS flash port
Button	• 1 Power Button • 1 Force Recovery Button • 1 Reset Button
LED	Power, SSD
SIM	2 SIM Card Socket
Antenna	6 Antenna for 5G/WiFi/4G/LTE/GPRS/UMTS
Expansion	
PCIe	1 PCIe x8 Slot (by request)
M.2	• 1 M.2 Key B Socket (3042/3052, USB) • 1 M.2 Key B Socket (3042/3052, PCIe) • 1 M.2 Key E Socket (2230/3042, PCIe/USB/UART)
Graphics	
Interface	1 Digital Display, up to 4K60
Video Encode	NAC-1000-R32 : 1x 4K @60, 3x 4K @30, 6x 1080p @60 (HEVC) NAC-1000-R64 : 2x 4K @60, 4x 4K @30, 8x 1080p @60 (HEVC)
Video Decode	NAC-1000-R32 : 1x 8K @30, 4x 4K @30, 9x 1080p @60 (HEVC) NAC-1000-R64 : 1x 8K @30, 7x 4K @30, 11x 1080p @60 (HEVC)
Camera	
GMSL	8 Fakra-Z connectors for GMSL 1/2 automotive cameras

Sensor	
IMU	3-axis accelerometer and 3-axis gyroscope, I2C interface
Magnetometer	3-axis magnetic sensor, I2C interface
Altimeter	Absolute barometric pressure sensor, I2C interface
Storage	
M.2	2 M.2 Key M Socket (2280)
eMMC	1 eMMC 5.1, 64GB
SD	1 Micro SD (External)
Ethernet	
LAN 1	10/100/1000 Base-T1 Ethernet GigE LAN, SPE Connector
PoE⁺	
LAN 2	Intel I350 GigE IEEE 802.3at (25.5W/48V) PoE ⁺ LAN, M12 X-coded Connector
LAN 3	Intel I350 GigE IEEE 802.3at (25.5W/48V) PoE ⁺ LAN, M12 X-coded Connector
LAN 4	Intel I350 GigE IEEE 802.3at (25.5W/48V) PoE ⁺ LAN, M12 X-coded Connector
LAN 5	Intel I350 GigE IEEE 802.3at (25.5W/48V) PoE ⁺ LAN, M12 X-coded Connector
Power	
Power Input	DC 9V to 50V
Power Interface	6-pin M23 Connector
Ignition Control	16-mode Software Ignition Control
Others	
TPM	Infineon SLB9673 XU2.0 FW26.10, I2C Interface (Optional)
Mechanical	
Dimensions	260 mm x 195 mm x 95 mm (10.24"x 7.68" x 3.74")
Weight	5.5 kg (12.13 lb)
Mounting	Wallmount
Environment	
Operating Temperature	50W TDP with 60W PoE load : -25°C to 60°C (-13°F to 140°F) 50W TDP without PoE load : -25°C to 75°C (-13°F to 167°F)
Storage Temperature	-40°C to 85°C (-40°F to 185°F)
Humidity	5% to 95% Humidity, non-condensing
Relative Humidity	95% @ 75°C
Shock	Operating, MIL-STD-810H, Method 516.8, Procedure I
Vibration	Operating, MIL-STD-810H, Method 514.7, Procedure I, Category 4
EMC	CE, FCC, EN50155, EN50121-3-2, EN62368-1

*While using Camera, System(50W, Without PoE) Operating Temperature suggest -25°C to 65°C due to Camera limitation.

1.4 Mechanical Dimension

Unit : mm (inch)

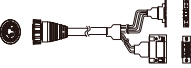


2

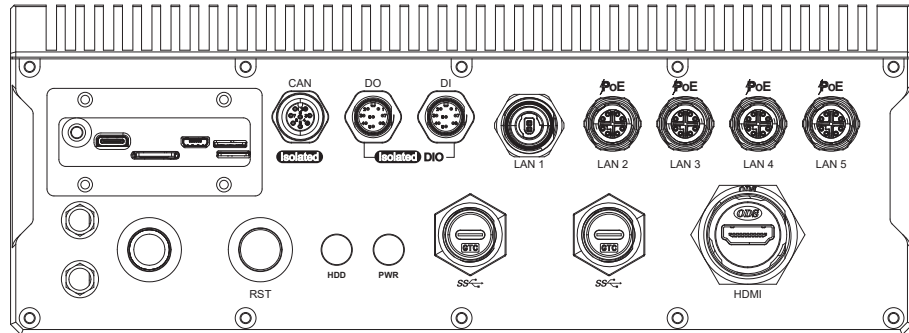
GETTING TO KNOW YOUR NAC-1000

2.1 Packing List

Item	Description	Qty
1	NAC-1000 Edge AI Computing System (According to the configuration of your order, NAC-1000 series may contain micro SD and M.2 modules. Please verify these items if necessary.)	1

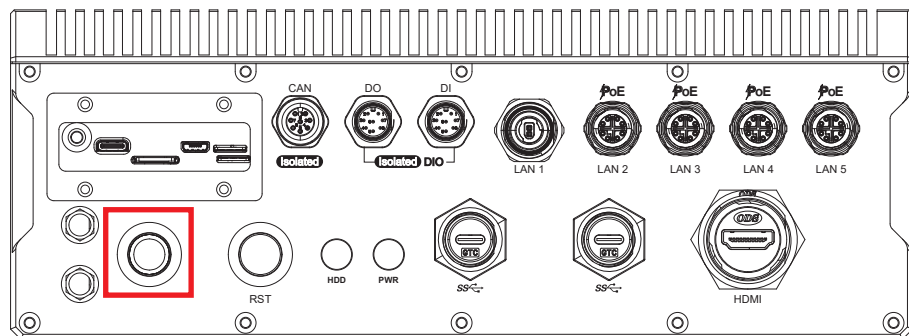
Item	Description	Outlook	Usage	P/N	Qty
1	Phillips NO.2 UNF#10-32T,6L		Wall Mount Bracket	53-I000510-000	6
2	Wall mount		Mount	62-00P0084-000	2
3	Foot Pad		Foot Pad	53-4000042-303	4
4	DC-in Cable with IGN		DC	61-1CB060Y-104	1
5	Terminal block 3-pin(7.62mm)		DC	51-2611R03-S1N	1
6	Terminal block 3-pin(5.0mm)		IGN	51-2411R03-S1K	1

2.2 Front Panel I/O & Functions



In Vecow NAC-1000 series, Most of the I/O connectors are located on the front panels. Most of the general connections to computer devices, such as Nano SIM , SD card, USB, LAN(M12 and SPE), CAN-FD port, DI/DO port, HDMI Port, Force Recovery USB ,Force Recovery button, Power Button ,Reset Button, indicators are place on the front panel.

2.2.1 Power Button



The Power Button is a non-latched switch used to control the system power. It also features a tri-color LED to indicate the system status. It is connected to CN3801 through power button cable.

To power on the system, press the power button and then the Blue LED is lightened.

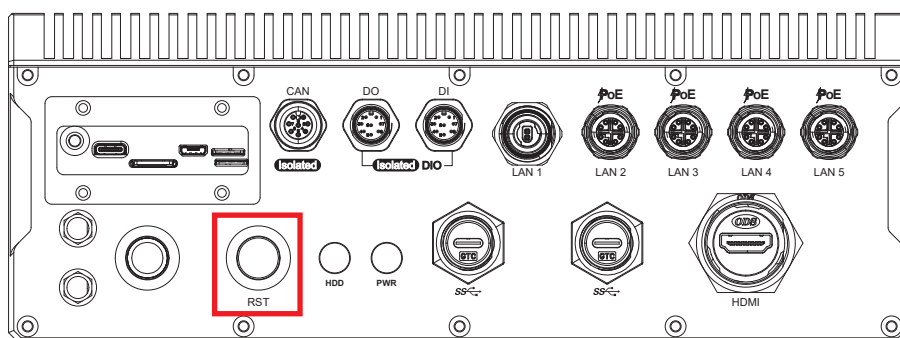
To power off the system, the Red LED of power button is lightened, you can either command shutdown by OS operation, or just simply press the power button.

To enter suspend mode, the Green LED of power button is lightened, you can command suspend by OS operation

And the LED action define is as below table :

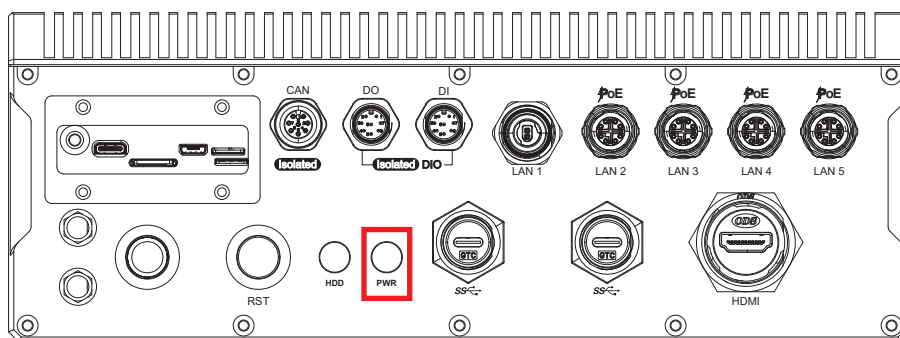
Mode	LED Color
Power on	Blue
Power off	Red
Suspend	Green

2.2.2 Reset Button



The button is connected to J3801 through reset button cable. If the system has error or frozen status, you can press Reset Button to restart, then the system will reboot OS.

2.2.3 PWR & Status LED Indicators

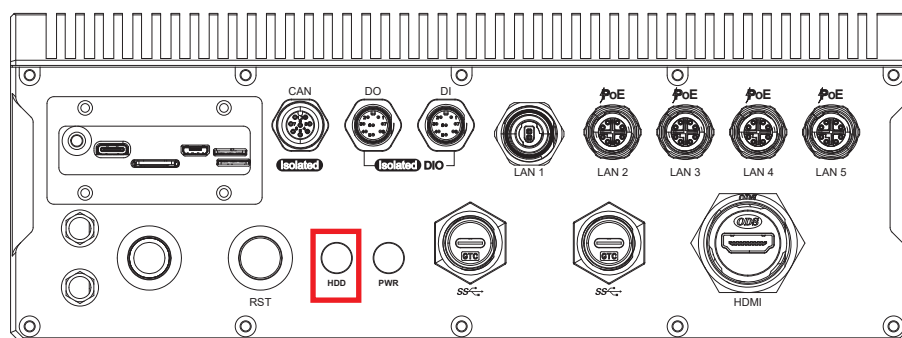


The Power LED is connected to PWR_LED3801 through LED cable.

The Power LED action define is as below table :

LED Color	System Status
Green (PWR LED)	+5V Power Ready

2.2.4 HDD & Status LED Indicators



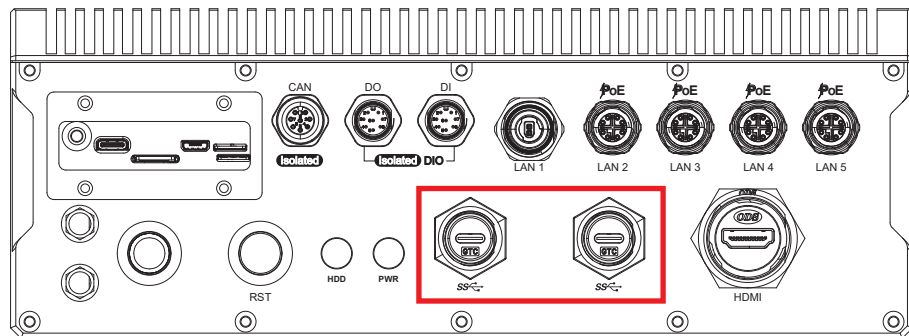
The HDD LED is connected to HDD_LED1002 through LED cable

It is presented with the storage active status. The HDD LED is presented with power of system is ready on normally.

The Power LED action define is as below table :

Mode	LED Status
Functional	On
Not functional	Off
In progress	Flashing

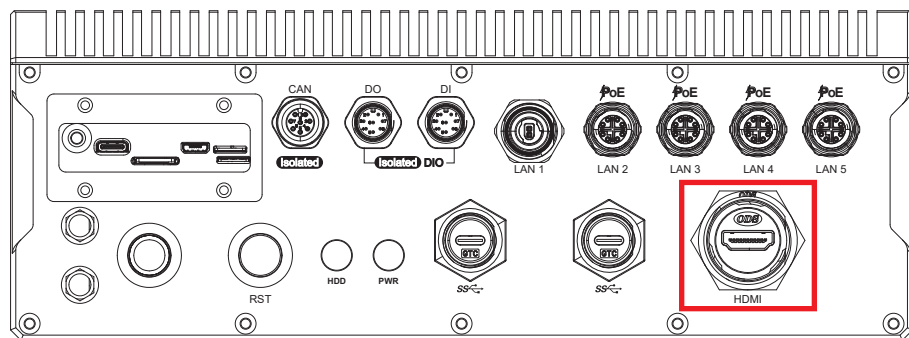
2.2.5 USB 3.2 Gen2



There are two USB 3.2 Connector connections available supporting up to 10Gb per second data rate in the front side of NAC-1000 series. It also compliant with the requirements of Super Speed+ (SS+), Super Speed (SS), high speed (HS), full speed (FS) and low speed (LS).

It is connected to MB Type-C Port through USB Type-C Cable.

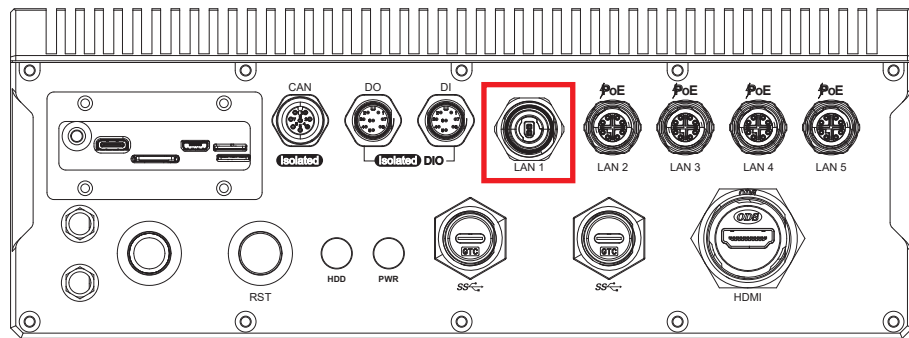
2.2.6 HDMI Port



The HDMI Port support HDMI V2.1 interface, connection supports up to Up to 3840 x 2160 @60Hz

It is connected to MB HDMI Port through HDMI Cable.

2.2.7 SPE Ethernet Port



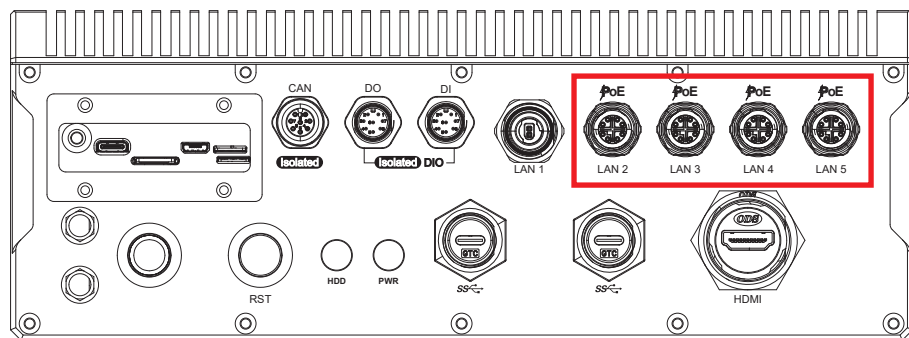
There is one 2-pin SPE jack on the front side of NAC-1000 series. It supports 1000BASE-T1 gigabit data signals over standard Ethernet SPE cable.

It uses the 88Q2220 IC to convert RGMII signals to standard Ethernet (MDI) signals.

The pin-outs of LAN1 is listed as follows :

	Pin No.	Definition
	1	MDI_P
	2	MDI_N

2.2.8 M12 Ethernet POE Port

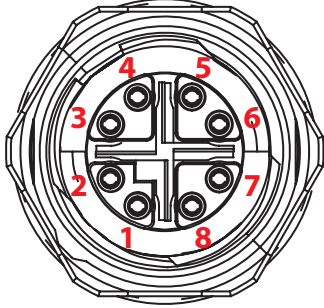


There are four 8-pin M12 X-Code jacks on the front side of NAC-1000 series. It supports IEEE 802.3at (POE⁺), Power over Ethernet (POE) connection delivering up to 25W/54V per port and 1000BASE-T gigabit data signals over standard Ethernet Cat 5/Cat 6 cable.

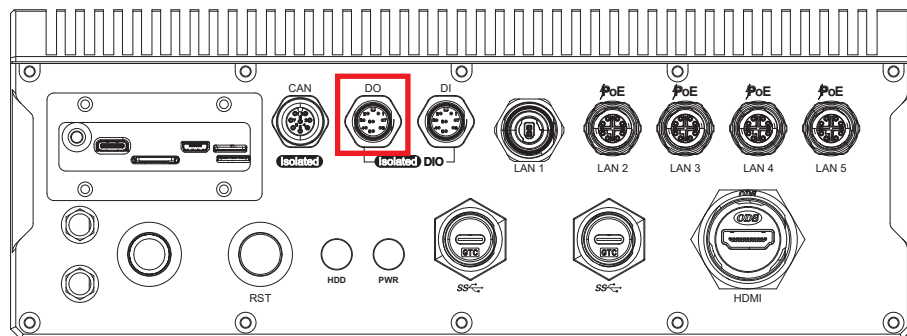
Each connection is connected by Intel® I350 Gigabit Ethernet controller and independent PCI express interface to connect with multi-core processor for network and data transmit optimization. Also, each POE function is powered by IP804AR controller. Only when POE port starts to supply power to power devices, the dedicated LED will be lightened.

PS. Suggest to use POE function when power input is over 24V.

The pin-outs of LAN2 to LAN5 are listed as follows :

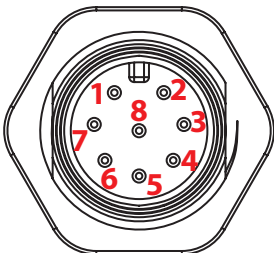
	Pin No.	Definition
	1	MDI1_P
	2	MDI1_N
	3	MDI2_P
	4	MDI2_N
	5	MDI4_P
	6	MDI4_N
	7	MDI3_N
	8	MDI3_P

2.2.9 M12 Isolated DO Port



There is one 8-pin M12 A-code jack with Isolated digital output(DO) on the front side of NAC-1000 series. DO support NPN(sink) and PNP(source) mode. Each digital output (DO) channel is equipped with an isolation chip and can be configured via a jumper to the DO.

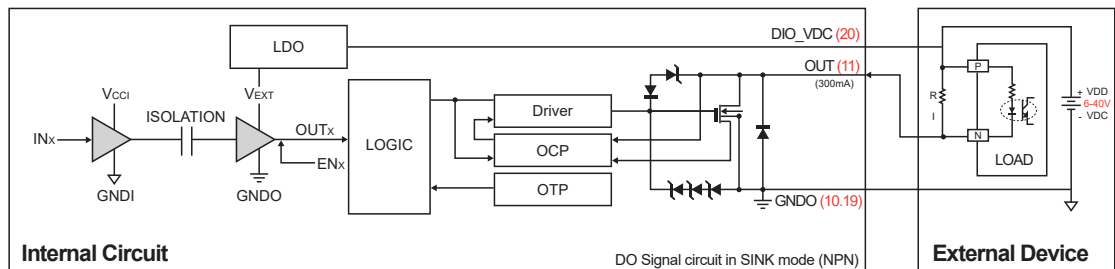
M12 A-code DO pin out is as below table :

	Pin No.	Definition	Pin No.	Definition
	1	EXT_OUT3	5	+VDIO_EXT
	2	EXT_OUT0	6	EXT_OUT5
	3	EXT_OUT1	7	EXT_OUT4
	4	EXT_OUT2	8	ISO_GND

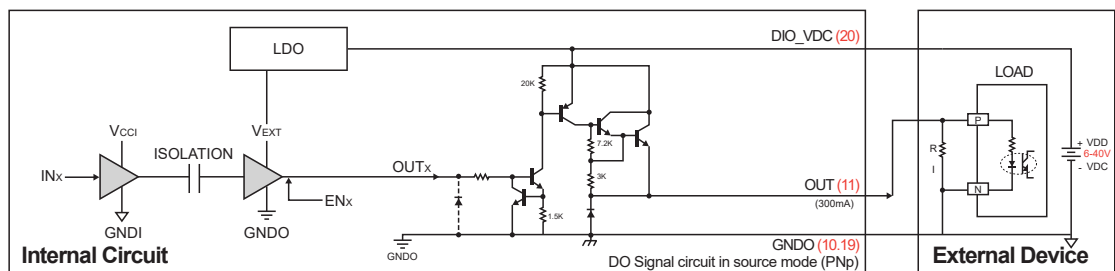
Notice : +VDIO_EXT is external 6~40VDC(NPN) or external 6~48VDC(PNP)

DO reference circuit :

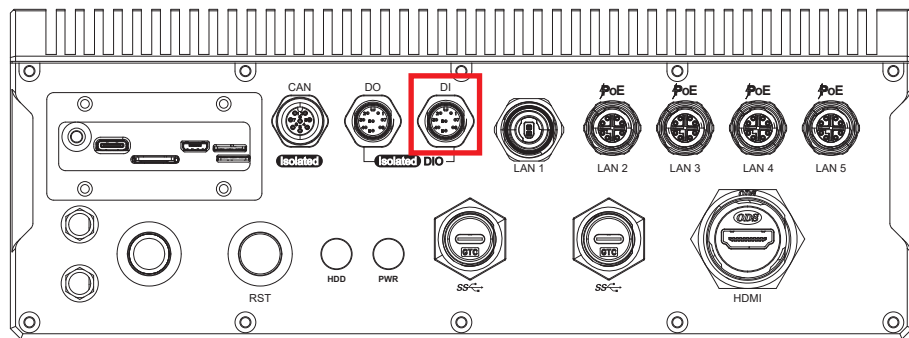
Sink Mode (NPN, Default)



Source (PNP)

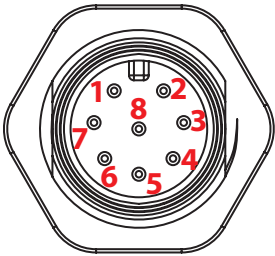


2.2.10 M12 Isolated DI Port



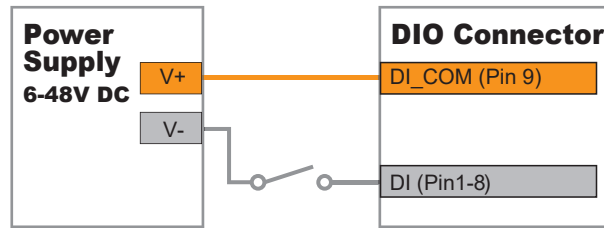
There is one 8-pin M12 A-code jack with Isolated digital input(DI) on the front side of NAC-1000 series. DI support NPN(sink) and PNP(source) mode. Each DI channel is equipped with a photo coupler for isolated protection.

M12 A-code DI pin out is as below table :

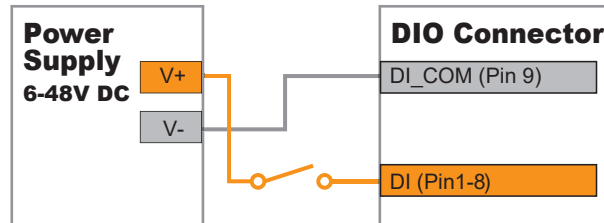
	Pin No.	Definition	Pin No.	Definition
	1	EXT_IN3	5	+VDI_COM
	2	EXT_IN0	6	EXT_IN5
	3	EXT_IN1	7	EXT_IN4
	4	EXT_IN2	8	ISO_GND

DI reference circuit :

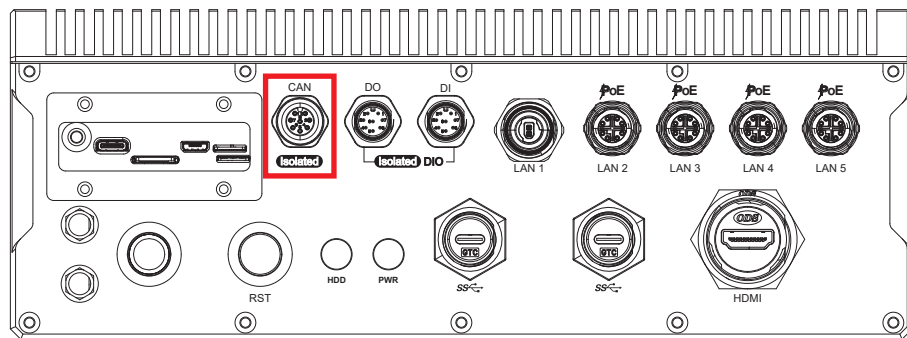
Sink Mode (NPN)



Source Mode (PNP)

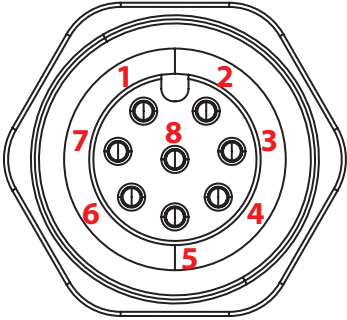


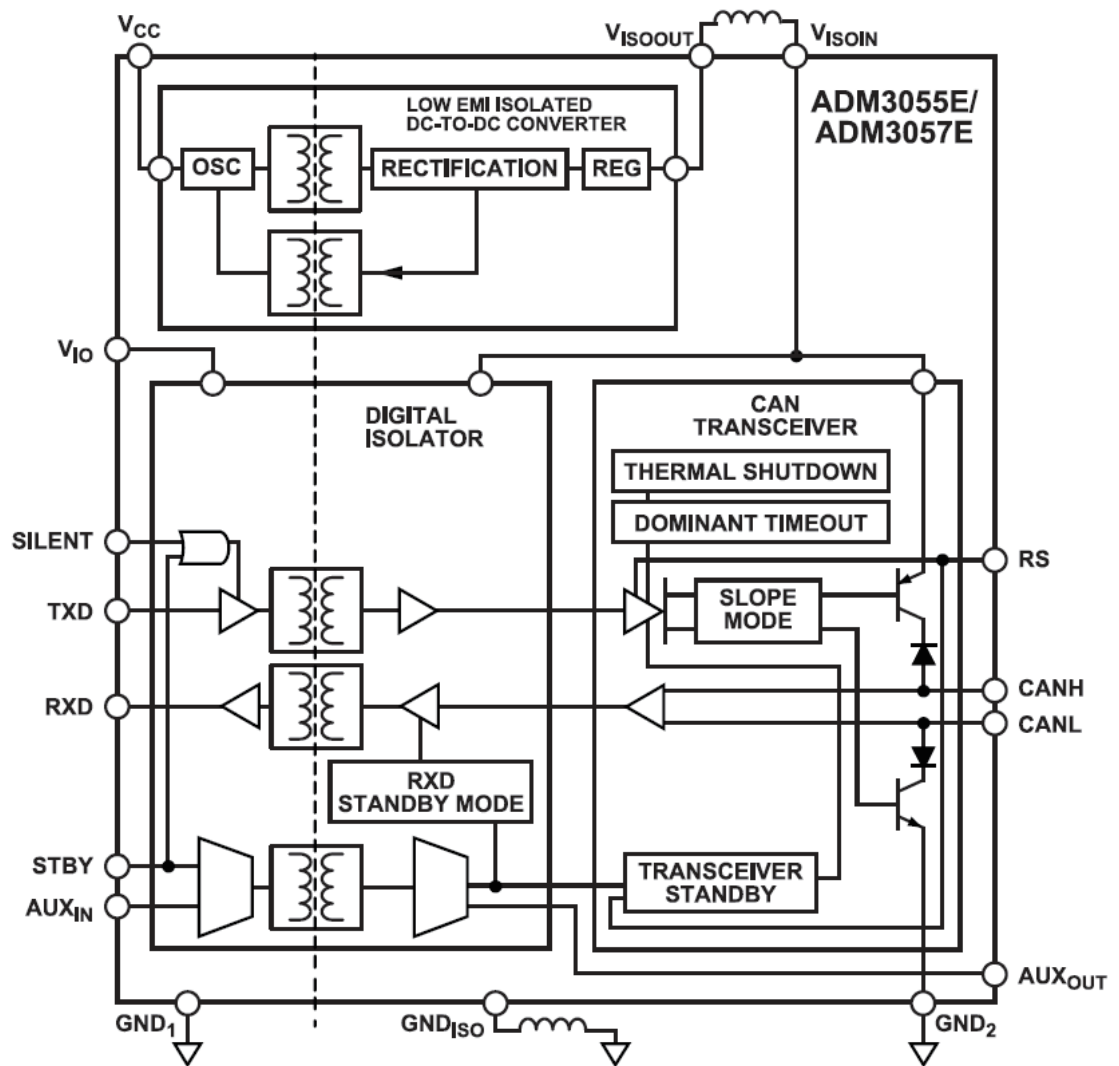
2.2.11 M12 Isolated CAN-FD Port



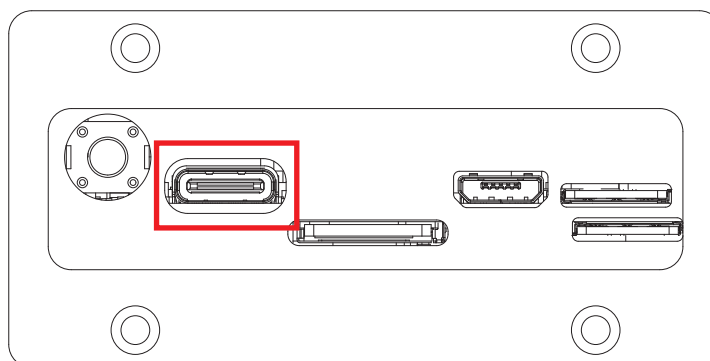
There is one 8-pin M12 A-code jack with two Isolated CAN-FD on the front side of NAC-1000 series.

M12 A-code CAN FD pin out is as below table :

	Pin No.	Definition
	1	CAN1_H
	2	CAN1_L
	3	CAN1_GND
	4	--
	5	CAN2_H
	6	CAN2_L
	7	CAN2_GND
	8	--



2.2.12 Recovery USB Type-C Port

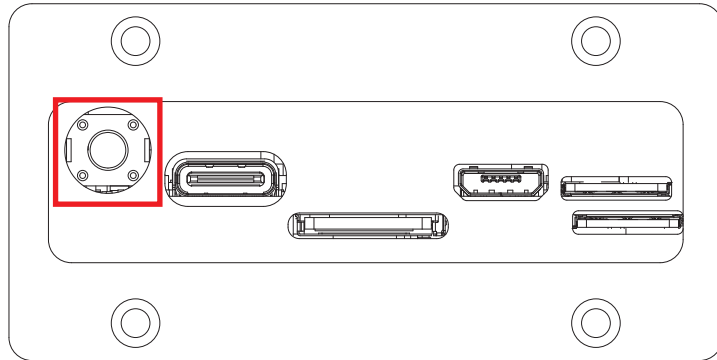


The NAC-1000 USB Recovery mode provides an alternate boot device (USB Type-C). In this mode, the system is connected to a host system and boots over USB. This is used when a new image needs to be flashed. USB must be available to use as USB Device for USB Recovery Mode.

Recovery USB pin out is as below table :

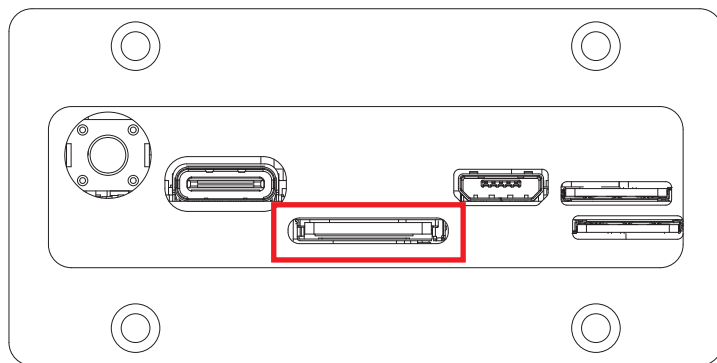
Pin No.	Definition	Pin No.	Definition
A1	GND	B1	GND
A2	USB3_DATA_TX1+	B2	USB3_DATA_TX2+
A3	USB3_DATA_TX1-	B3	USB3_DATA_TX2-
A4	+V5	B4	+V5
A5	CC1	B5	CC2
A6	USB2_DATA_D1+	B6	USB2_DATA_D2+
A7	USB2_DATA_D1-	B7	USB2_DATA_D2-
A8	NC	B8	NC
A9	+V5	B9	+V5
A10	USB3_DATA_RX2-	B10	USB3_DATA_RX1-
A11	USB3_DATA_RX2+	B11	USB3_DATA_RX1+
A12	GND	B12	GND

2.2.13 Force Recovery Button



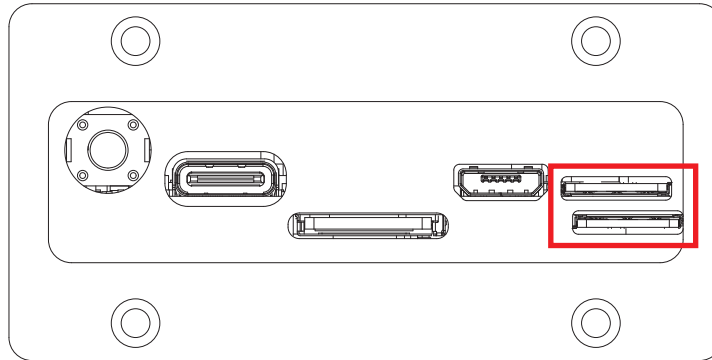
Press the Button enter Force Recovery Mode. Button is held down while either system is first powered on, or by pressing & releasing reset button while Recovery button is pressed.

2.2.14 Micro SD



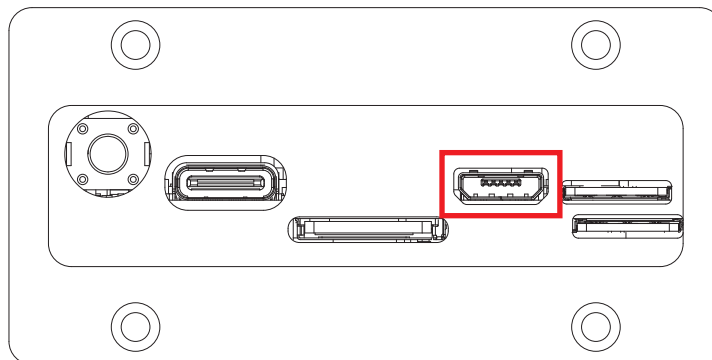
The external Micro SD card provides additional storage expansion. It is located behind the cover-plate on the front panel.

2.2.15 Two Nano SIM



The external Nano SIM card offers wireless communication capability by M.2 key B 4G/5G Card to the system. The SIM card located at the top is defined as SIM2 and communicates through the M.2 Key B Slot 2 interface. The SIM card located at the bottom is defined as SIM1 and communicates through the M.2 Key B Slot 1 interface.

2.2.16 Console Port



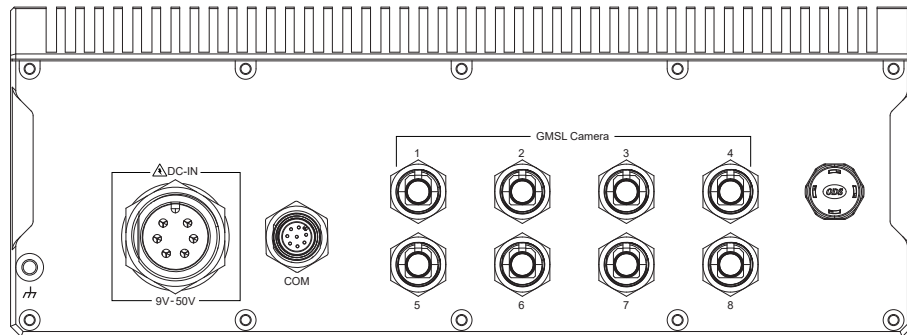
The Console Port connected by Micro USB connector is debug Port of system. It connects to the SOM serial console by USB to UART IC. It can be connected by USB (Type A to Micro USB Type) Cable to USB Port of PC, and execute terminal tool, then it will get the system status message.

The Console port and OOB UART share the same physical interface. Their function can be selected through the hardware switch SW702. By toggling this switch, users can choose whether the port operates as a Console interface or as an OOB UART interface.

Console Port Pin Out of Micro USB is as below table :

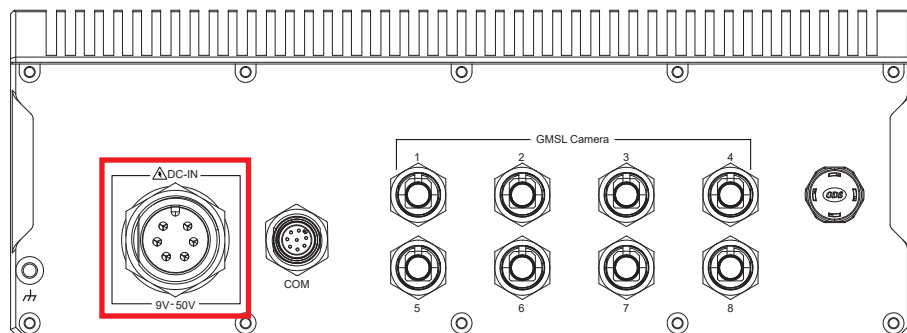
Pin No.	Function	Pin No.	Function
1	+V5	4	NC
2	USB_DATA-	5	GND
3	USB_DATA+		

2.3 Rear Panel I/O & Functions



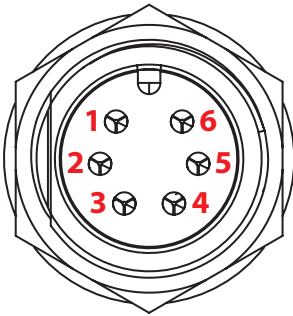
In Vecow NAC-1000 series, Most of the I/O connectors are located on the rear panels. Most of the general connections to computer devices, such as power input ,COM ,GMSL Camera are place on the rear panel

2.3.1 Power DC-IN Port

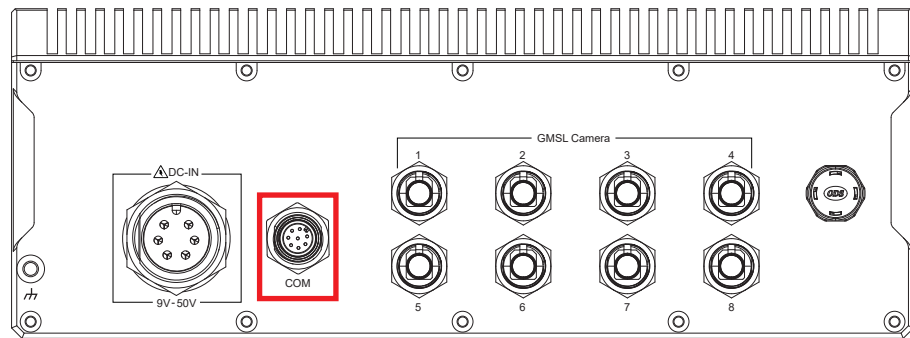


NAC-1000 supports 9V to 50V DC wide range power input by DC-IN port. And the port is connected to ATX Connector through Power DC-IN Cable.

The pin assignments of DC-IN port is listed in the following table :

	Pin No.	Definition
	1	GND
	2	GND
	3	IGN
	4	PWR_BTN
	5	VCC
	6	VCC

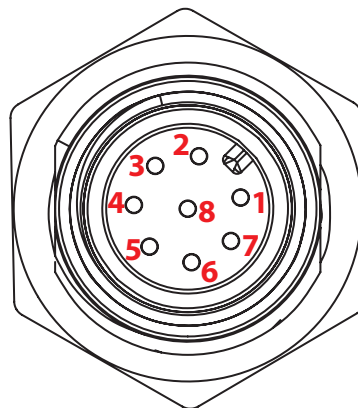
2.3.2 M12 COM Port



The M12 COM port is connected to JCOM3201 through COM cable.

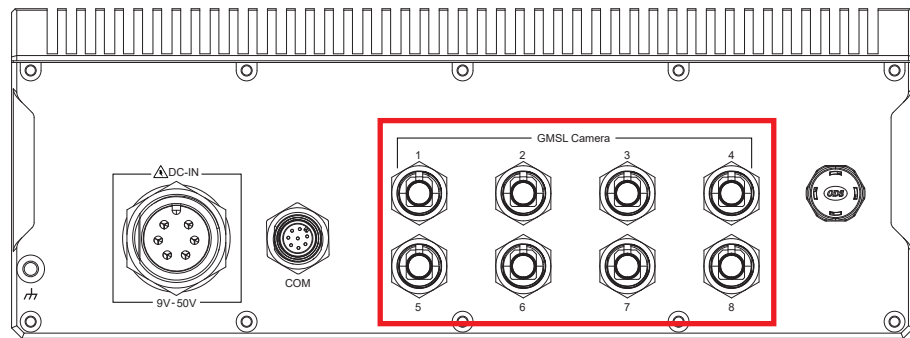
It can be configured for RS-232, RS-422, or RS-485 with auto flow control communication. The default definition of COM 1 is RS-232; if you want to use RS-422 or RS-485, you have to change COM mode by software.

The pin assignments of M12 COM port is listed in the following table :



Pin No.	RS232	RS422	RS485
1	-----	TXD-	DATA-
2	RXD	TXD+	DATA+
3	TXD	RXD+	-----
4	-----	RXD-	-----
5	-----	-----	-----
6	RTS	-----	-----
7	CTS	-----	-----
8	GND	GND	GND

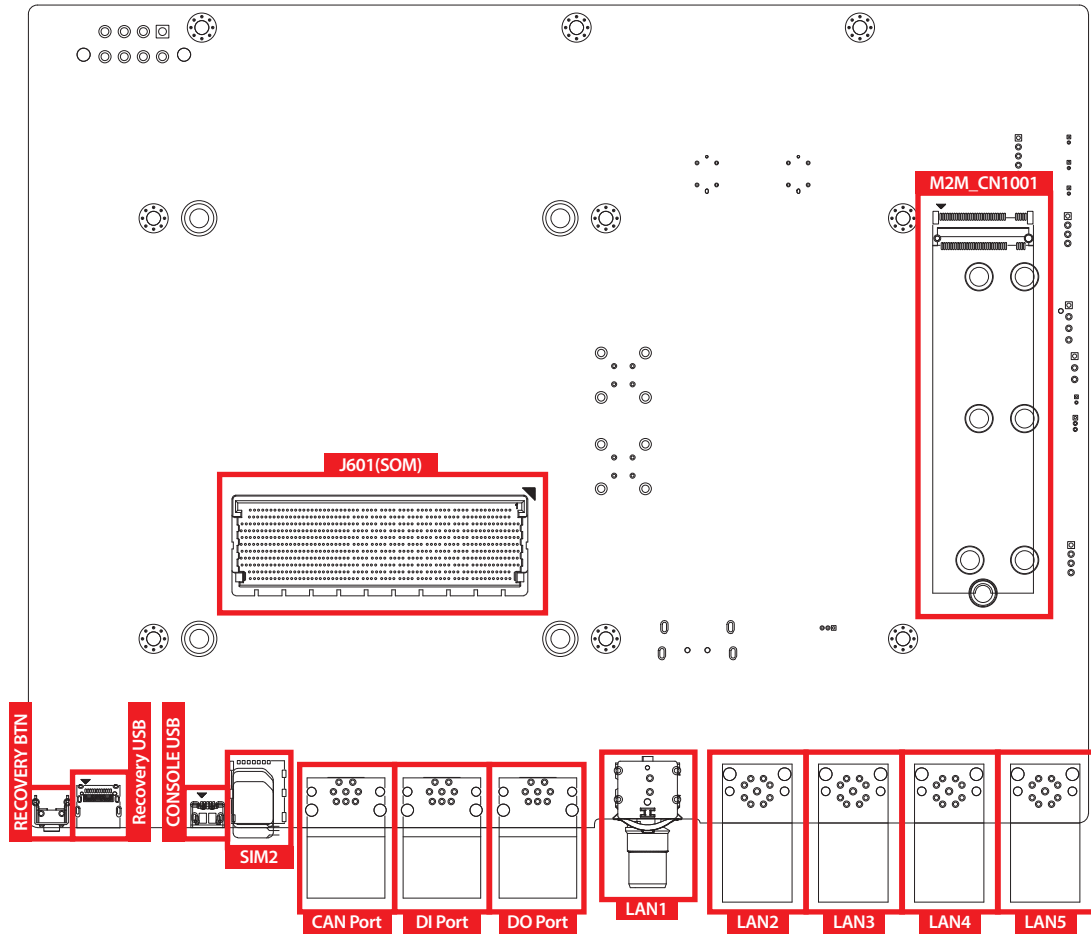
2.3.3 GMSL Camera Port



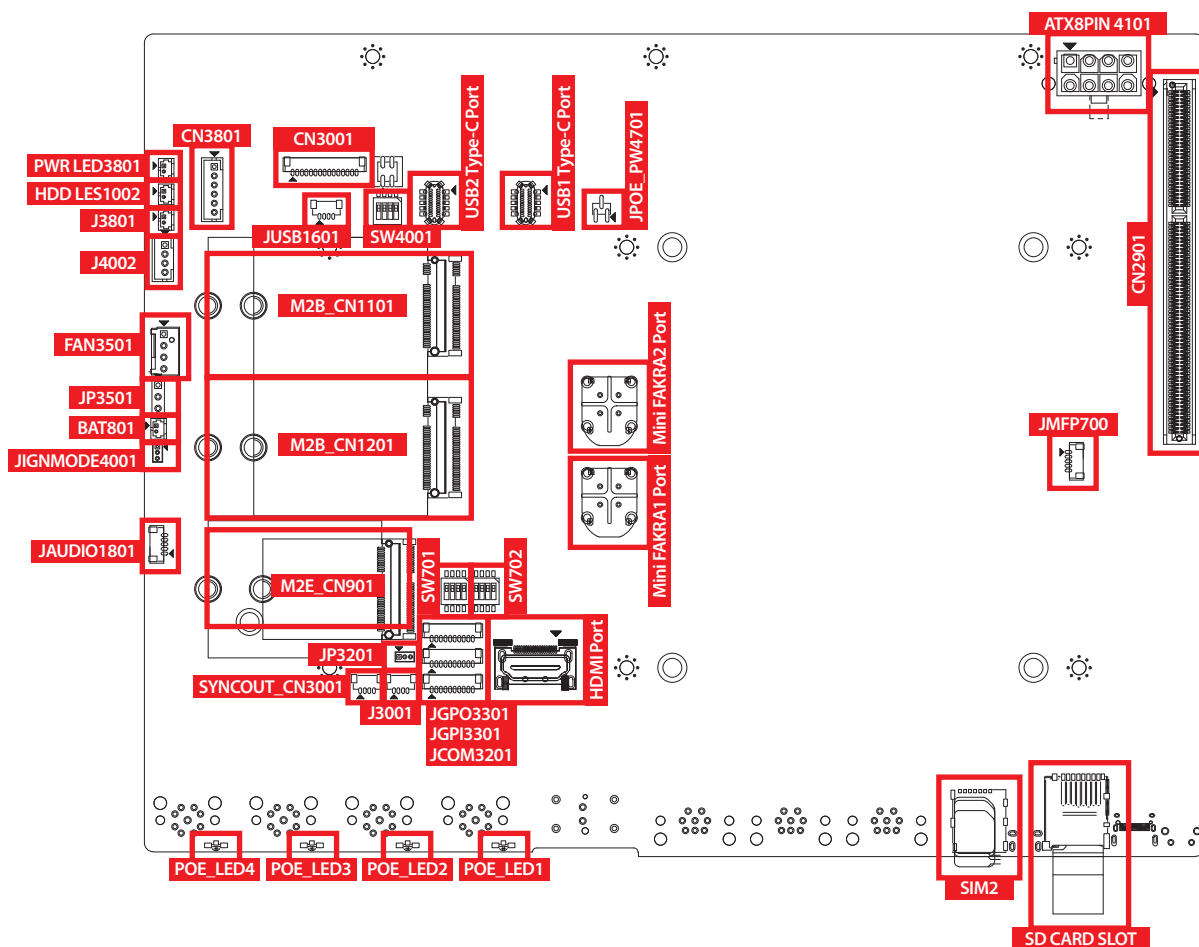
There are eight FAKRA connectors in the rear side of NAC-1000. NAC-1000 uses Mini FAKRA connectors and connects to each FAKRA through a one-to-four splitter jack and a 15-meter single coaxial cable. Using GMSL2(Gigabit Multimedia Serial Link) connections, the cameras are connected to a four-port deserializer. The output of the deserializer is MIPI CSI-2. Our GMSL design can support frame sync in default with 30Hz with 50% duty cycle.

2.4 Main Board Expansion Connectors

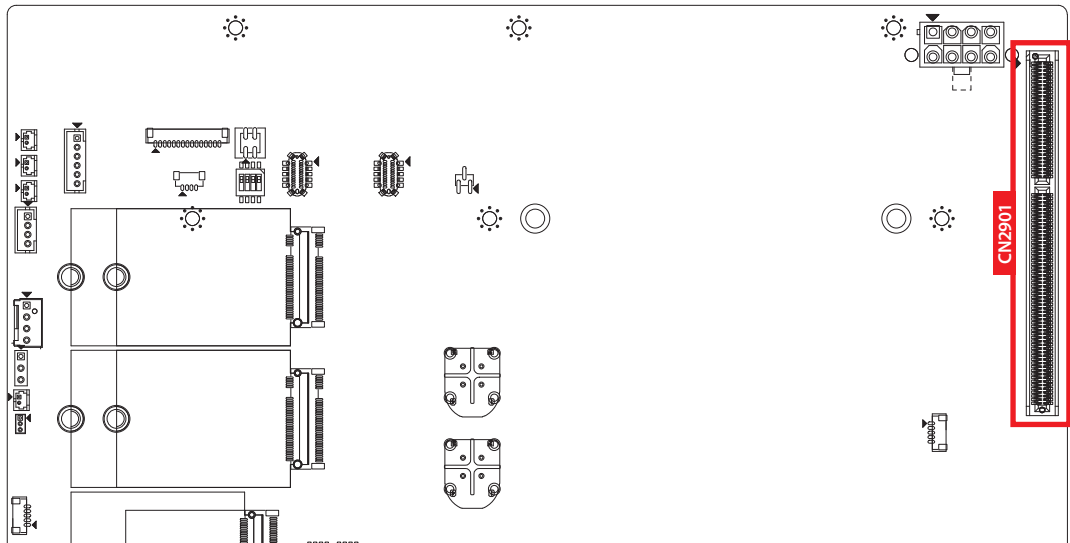
2.4.1 TOP View of MB



2.4.2 BOT View of MB

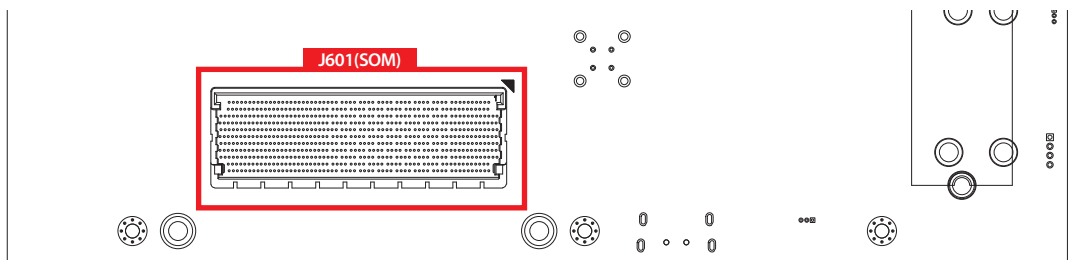


2.4.3 PEG(CN2901)



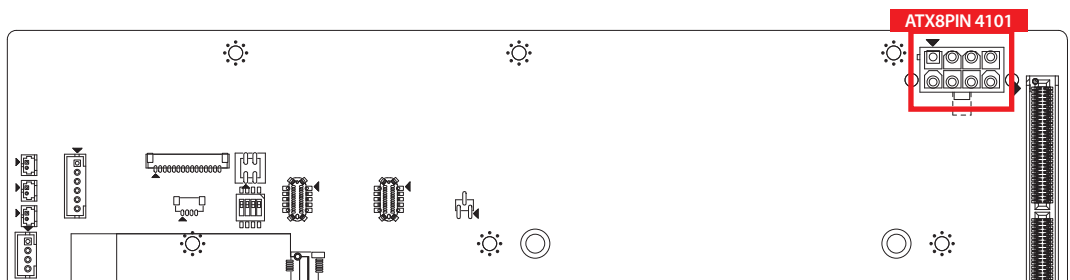
It uses PCIE GEN4 X8 to transfer data to PCIE card.

2.4.4 Jetson AGX Orin SOM Socket (J601)



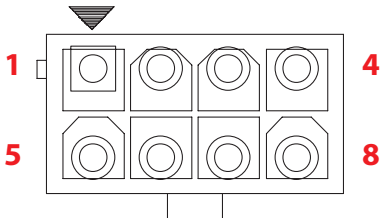
Connection to Jetson AGX Orin SOM.

2.4.5 ATX Power (ATX8PIN_4101)

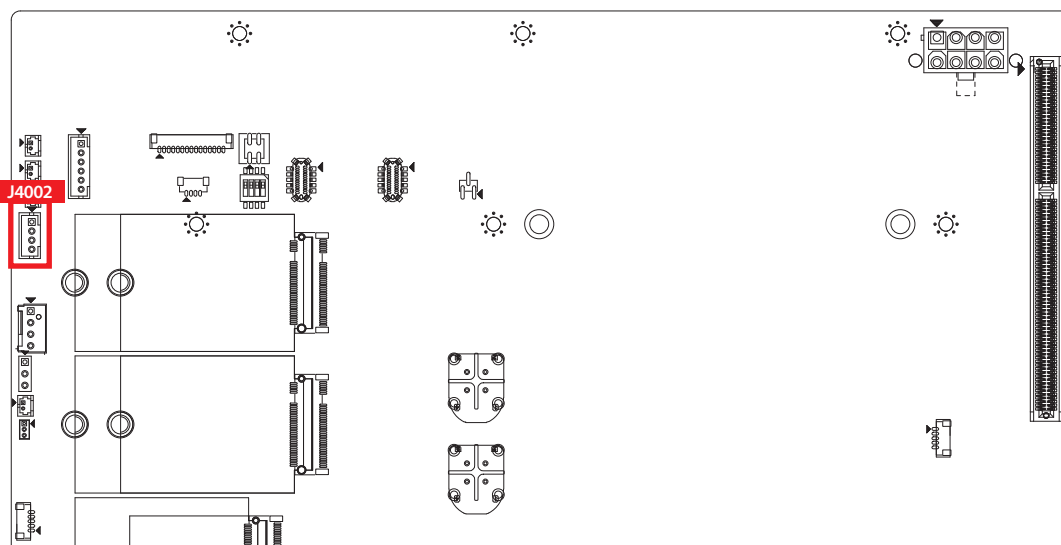


The ATX connector supplies 9–50 V DC power to the system motherboard through the DC-IN cable.

The pin assignments of ATX8PIN_4101 is listed in the following table :

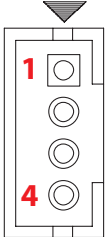
	Pin No.	Definition
	1	GND
	2	GND
	3	GND
	4	GND
	5	VDC_IN
	6	VDC_IN
	7	VDC_IN
	8	VDC_IN

2.4.6 Remote Control(J4002)

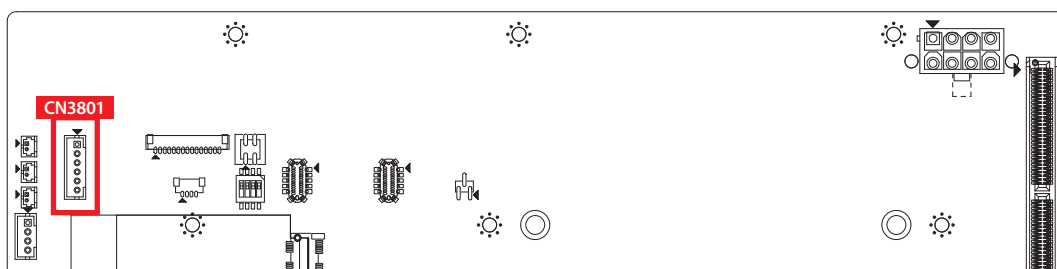


It can turn on or off the system power from 3-pin power-on/off Switch through DC-IN cable.

The pin assignments of J4002 is listed in the following table :

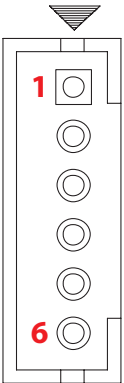
	Pin No.	Definition
	1	PWR_BTN
	2	GND
	3	IGNITION
	4	GND

2.4.7 Power Button(CN3801)

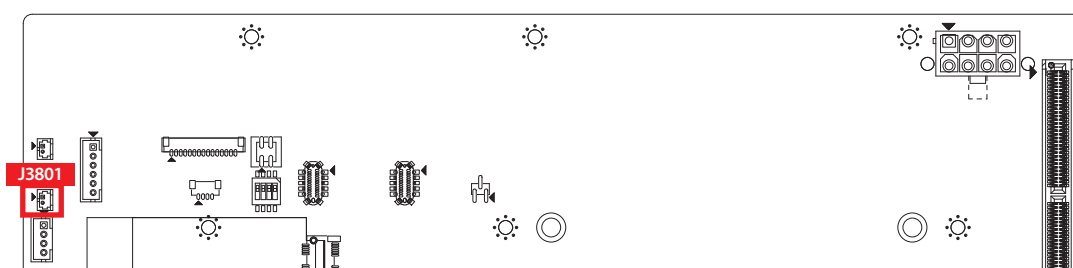


It can control the system power and features a tri-color LED to indicate the system status through power button cable.

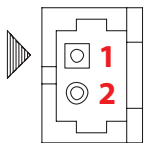
The pin assignments of CN3801 is listed in the following table :

	Pin No.	Definition
	1	PWR 5V
	2	Red LED
	3	Green LED
	4	Blue LED
	5	PWR BTN
	6	GND

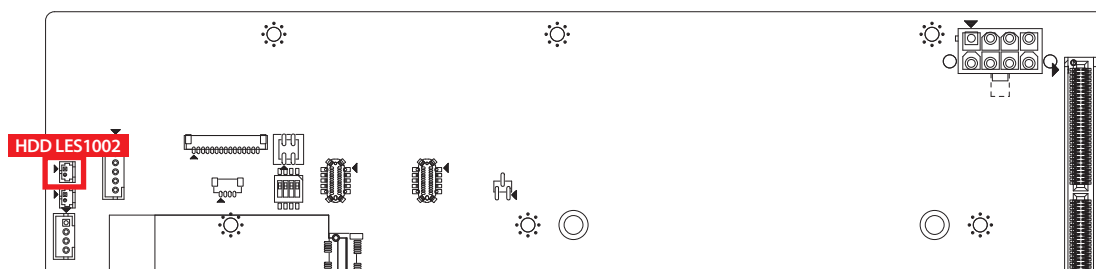
2.4.8 Reset Button (J3801)



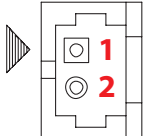
The pin assignments of J3801 is listed in the following table :

	Pin No.	Definition
	1	Reset BTN
	2	GND

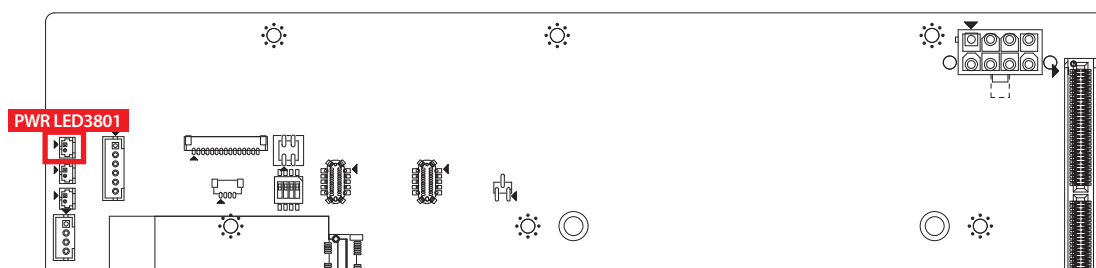
2.4.9 HDD LED(HDD_LED1002)



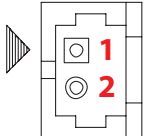
The pin assignments of HDD_LED1002 is listed in the following table :

	Pin No.	Definition
	1	HDD_LED_P
	2	HDD_LED_N

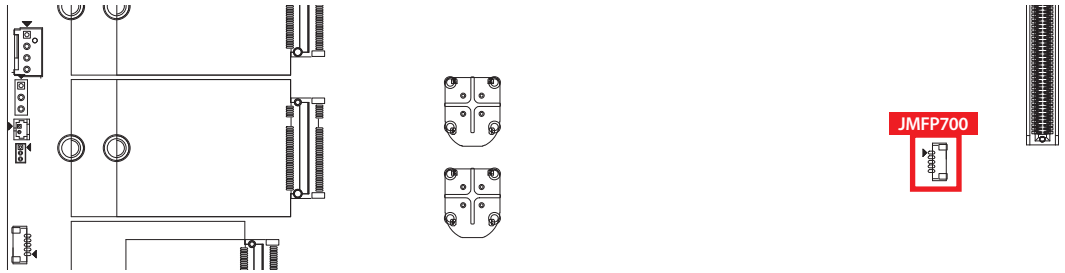
2.4.10 Power LED(PWR_LED3801)



The pin assignments of PWR_LED3801 is listed in the following table :

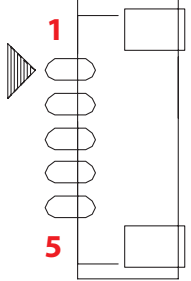
	Pin No.	Definition
	1	PWR 5V
	2	GND

2.4.11 Reserve Frame Sync(JMFP700)

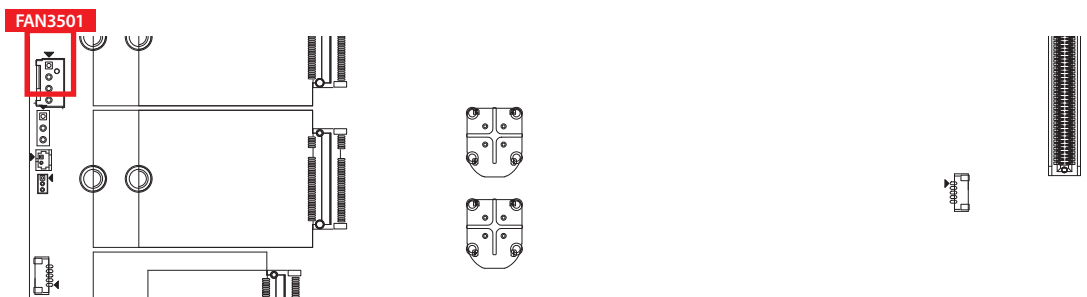


The Frame Sync allows an external device to control GMSL camera frame synchronization via GPIO, enabling precise alignment of frames across multiple cameras.

The pin assignments of JMFP700 is listed in the following table :

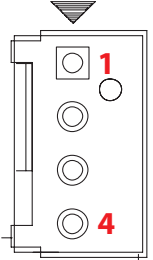
	Pin No.	Definition
	1	EX_FRSYNC
	2	NC
	3	NC
	4	NC
	5	GND

2.4.12 Fan(FAN3501)

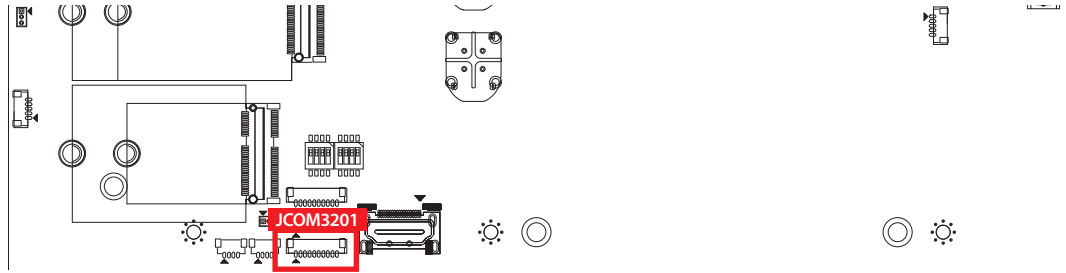


Fan power supports for additional thermal requirements.

The pin assignments of FAN3501 is listed in the following table :

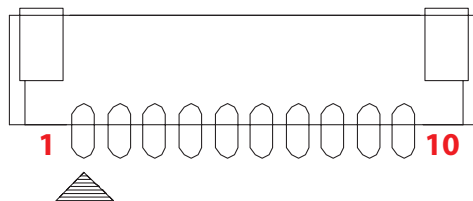
	Pin No.	Definition
	1	GND
	2	FAN_PWR
	3	FAN_TACH
	4	FAN_PWM Control

2.4.13 COM (JCOM3201)



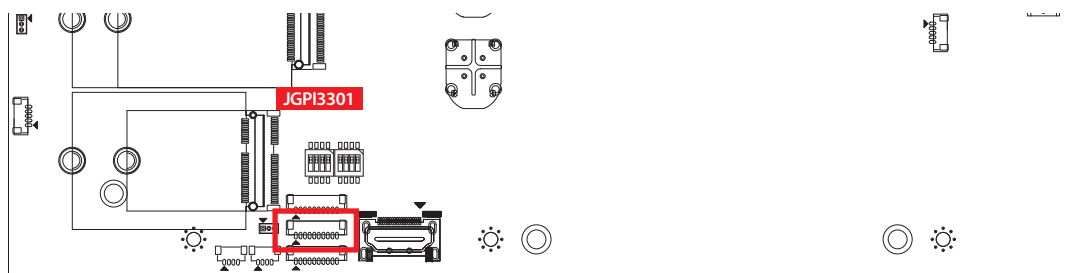
COM (JCOM3201) can be configured for RS-232, RS-422, or RS-485 with auto flow control communication. The default definition of COM is RS-232, if you want to change to RS-422 or RS-485, it must change COM mode by software.

The pin assignments of JCOM3201 is listed in the following table :



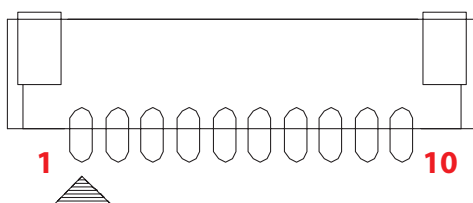
Pin No.	RS232	RS422	RS485
1	-----	-----	-----
2	GND	GND	GND
3	-----	-----	-----
4	-----	RXD-	-----
5	CTS	-----	-----
6	TXD	RXD+	-----
7	RTS	-----	-----
8	RXD	TXD+	DATA+
9	-----	-----	-----
10	-----	TXD-	DATA-

2.4.14 Reserve GPI(JGPI3301)



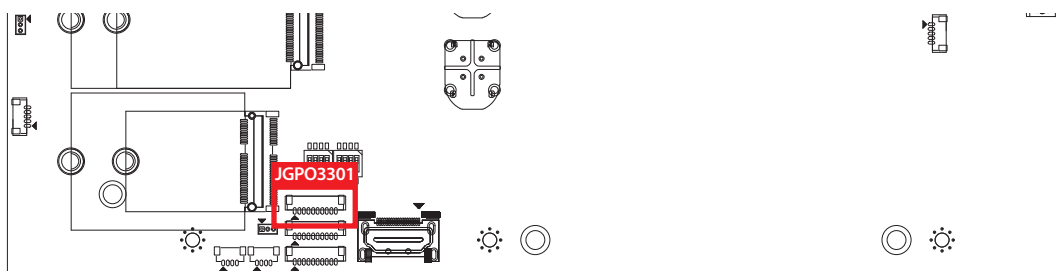
It includes 6 bit GPI with 3.3 power level, it can be set GPI mode what you want.

The pin assignments of JGPI3301 is listed in the following table :



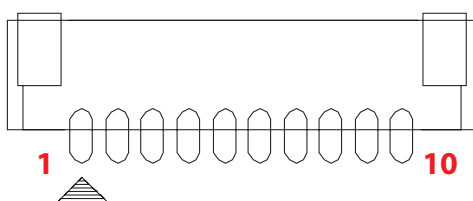
Pin No.	Definition	Pin No.	Definition
1	PWR 3.3V	6	GPI_4
2	GND	7	GPI_5
3	GPI_1	8	GPI_6
4	GPI_2	9	NC
5	GPI_3	10	NC

2.4.15 Reserve GPO(JGPO3301)



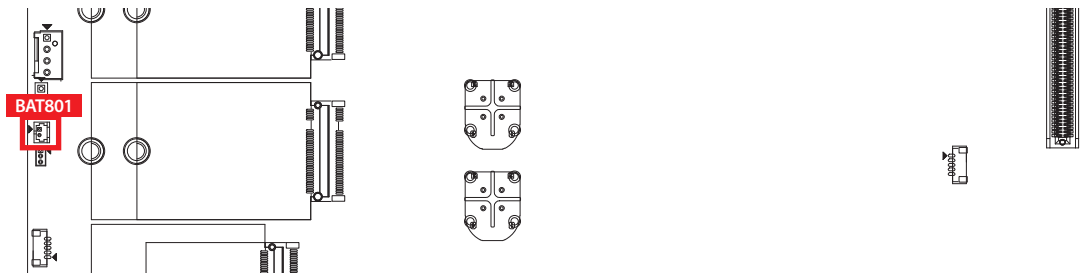
It includes 6 bit GPO with 3.3 power level, it can be set GPO mode what you want.

The pin assignments of JGPO3301 is listed in the following table :



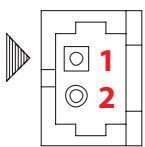
Pin No.	Definition	Pin No.	Definition
1	PWR 3.3V	6	GPO_4
2	GND	7	GPO_5
3	GPO_1	8	GPO_6
4	GPO_2	9	NC
5	GPO_3	10	NC

2.4.16 RTC Battery(BAT801)

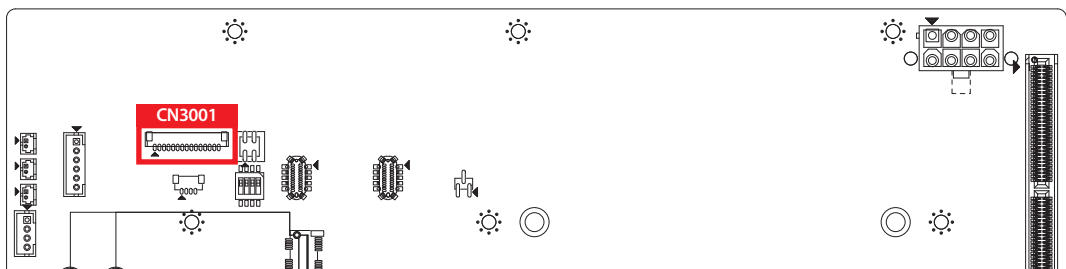


It is connected by CR2032 with cable supply power for RTC IC, if the battery is disconnected, the RTC function will not be work, and it will have a wrong time of OS.

The pin assignments of BAT801 is listed in the following table :

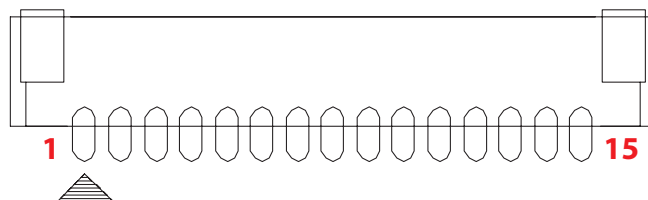
	Pin No.	Definition
	1	VRTC
	2	GND

2.4.17 OOB control(CN3001)



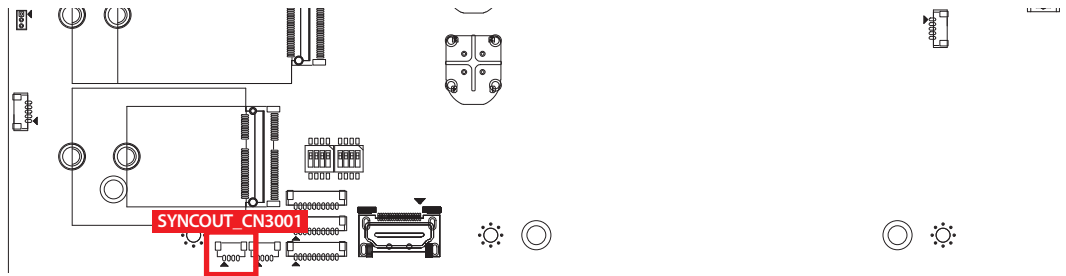
It is connected by OOB mother board, if you want to remote control the system function (Power on / reset or monitor).

The pin assignments of CN3001 is listed in the following table :



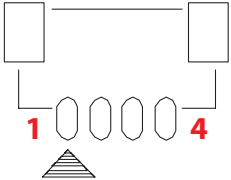
Pin No.	Definition	Pin No.	Definition	Pin No.	Definition
1	PWR 5V	6	GND	11	OOB_SDA
2	PWR 5V	7	OOB_RXD	12	GND
3	OOB_RESET	8	OOB_TXD	13	PSW_NU
4	GPIO0	9	GND	14	RST_SW
5	GPIO1	10	OOB_SCL	15	PWR_ONOFF_DET

2.4.18 Sync(SYNCOUT_CN3001)

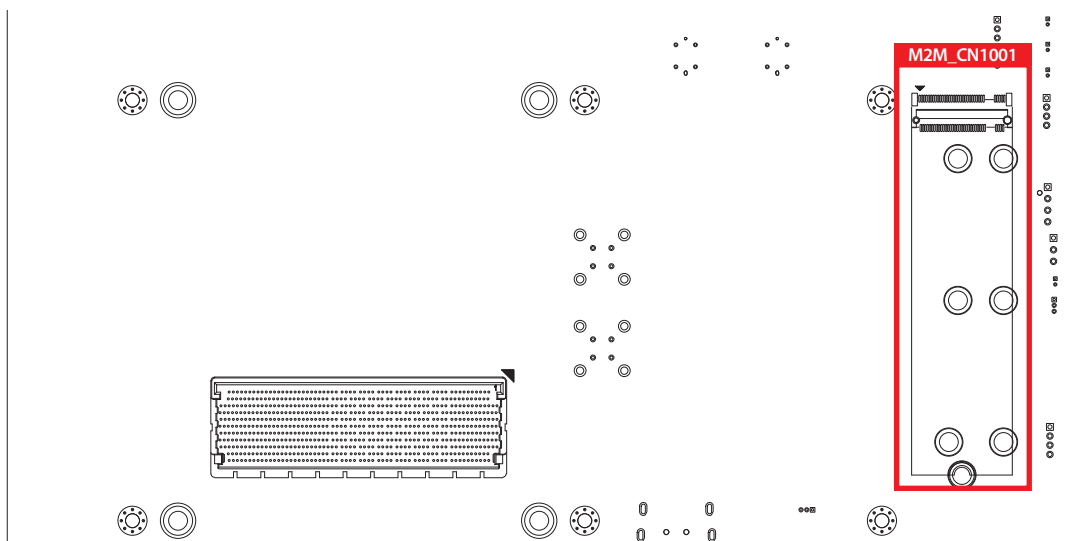


It supports to control the system by outside device.

The pin assignments of SYNCOUT_CN3001 is listed in the following table :

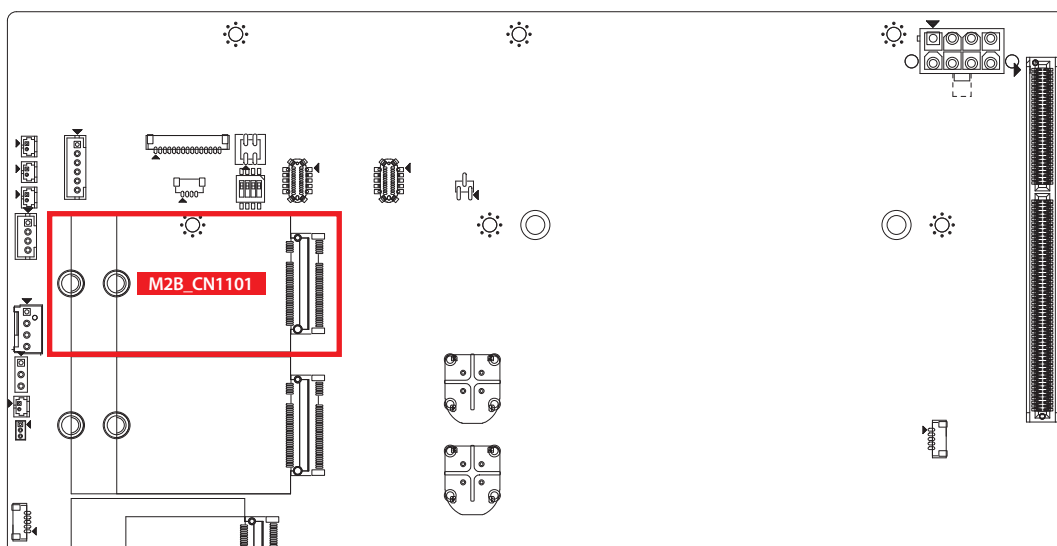
	Pin No.	Definition
	1	EXT_SYNC
	2	SYNC_UART_TX
	3	SYNC_UART_RX
	4	GND

2.4.19 M.2 Key M Slot(M2M_CN1)



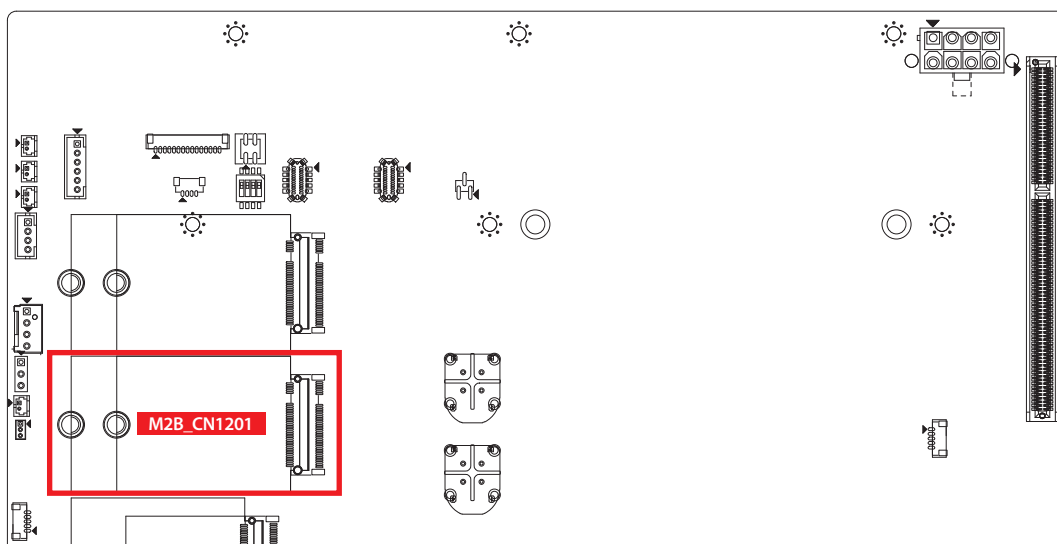
The M.2 key M is suitable for applications that use Host I/Fs supported PCIe Gen 4 x4, it can be plugged NVME Module card 2280 type.

2.4.20 M.2 key B Slot 1(M2B_CN1101)



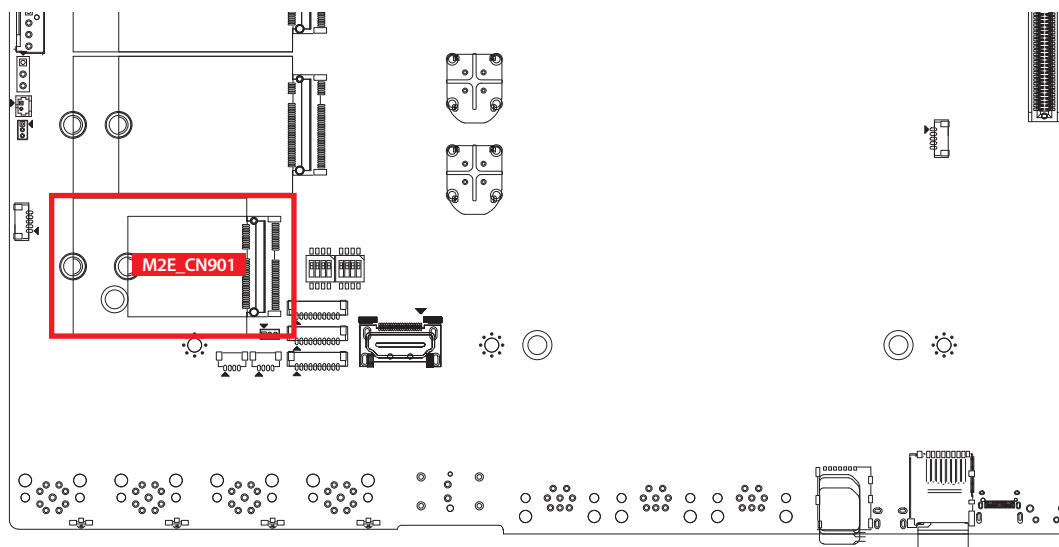
The M.2 key B is suitable for applications that use Host I/Fs supported PCIE GEN4 X1, it can be plugged including LTE/5G, NVME Module card 3042/3052 type.

2.4.21 M.2 key B Slot 2(M2B_CN1201)



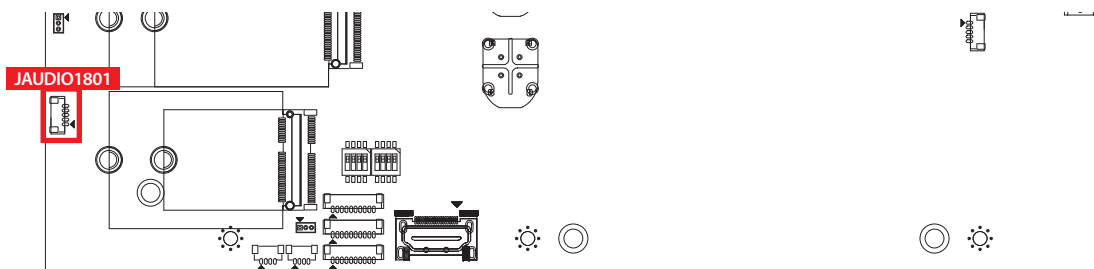
The M.2 key B is suitable for applications that use Host I/Fs supported USB 3.0, USB 2.0, it can be plugged including LTE/5G, NVME Module card 3042/3052 type.

2.4.22 M.2 key E Slot(M2E_CN901)



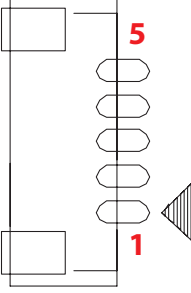
The M.2 key E is suitable for applications that use wireless connectivity including Wi-Fi, Bluetooth. Module card types include 2230/3042 type.

2.4.23 Line-out / Mic In (JAUDIO1801)

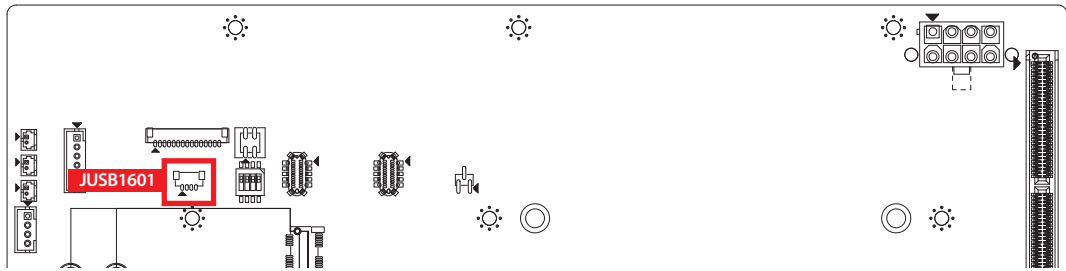


It is connected by Audio Jack Cable for Line-out and Mic In application.

The pin assignments of JAUDIO1801 is listed in the following table :

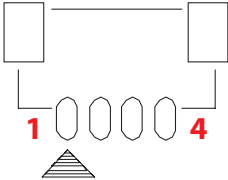
	Pin No.	Definition
	1	AUDIO_L
	2	AUDIO_R
	3	GND
	4	MIC_L
	5	MIC_R

2.4.24 Reserve USB 2.0 (JUSB1601)

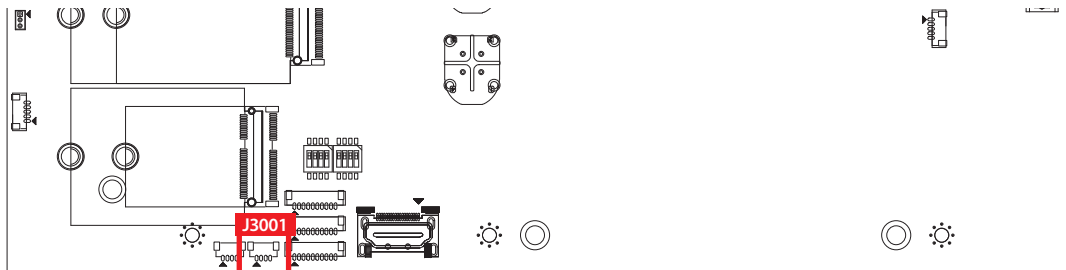


The USB 2.0 is reserve for other function.

The pin assignments of JUSB1601 is listed in the following table :

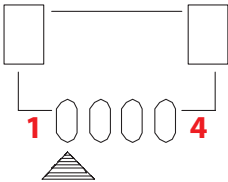
	Pin No.	Definition
	1	PWR 5V
	2	USB2_DM
	3	USB2_DP
	4	GND

2.4.25 Debug UART for OOB(J3001)



It is connected by OOB cable, it can transfer the debug UART signal to OOB, and it will monitor by Ethernet remote the system status. The UART Signal is switched by SW702.

The pin assignments of J3001 is listed in the following table :

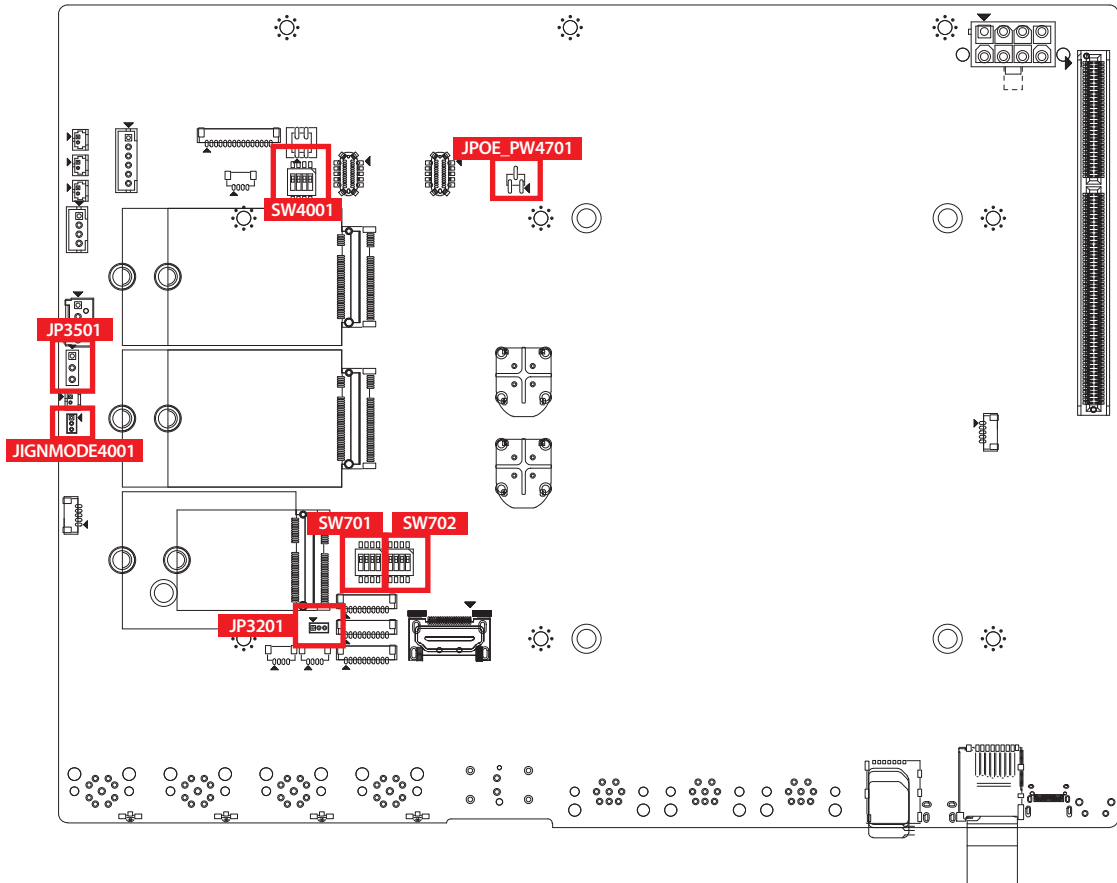
	Pin No.	Definition
	1	UART_TX
	2	UART_RX
	3	GND
	4	GND

2.5 Main Board Jumper / Switch Settings

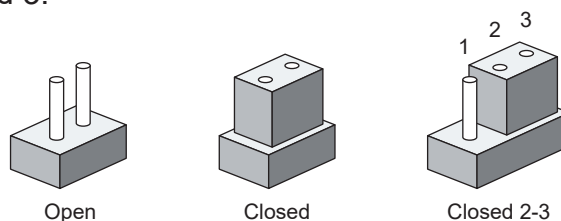
2.5.1 Board Top /Bottom View of NAC-1000 series Main Board with Jumper

There is no jumpers on the Top side of NAC-1000 series.

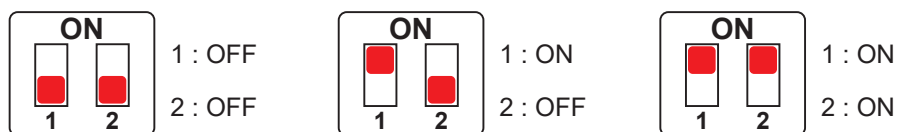
The figure below is the Bottom side of NAC-1000 series main board which is the main board. It shows the location of the jumpers.



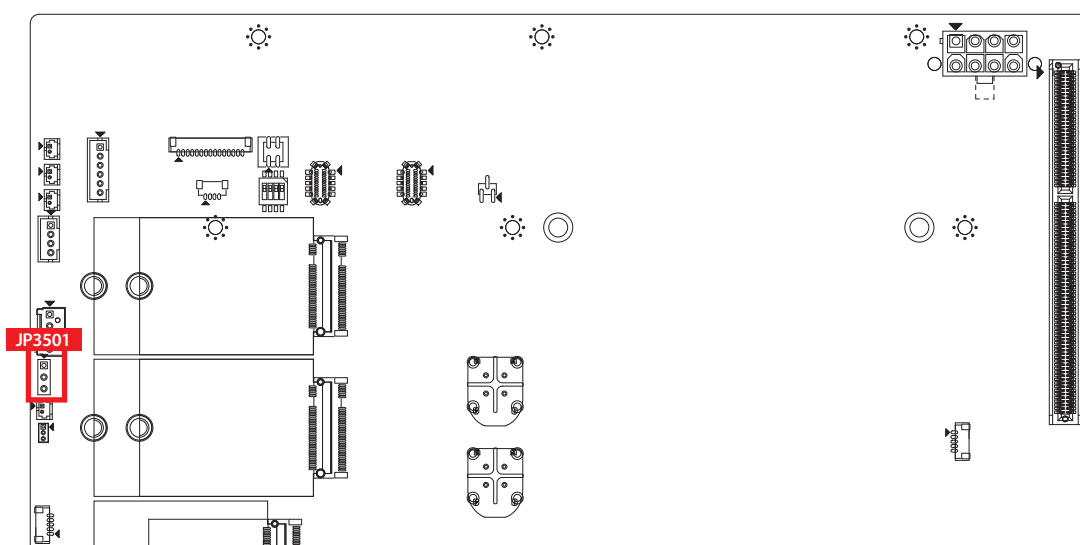
You may configure your card to match the needs of your application by setting jumpers. A jumper is a metal bridge used to close an electric circuit. It consists of two metal pins and a small metal clip (often protected by a plastic cover) that slides over the pins to connect them. To "close" a jumper, you connect the pins with the clip. To "open" a jumper, you remove the clip. Sometimes a jumper will have three pins, labeled 1, 2 and 3. In this case you would connect either pins 1 and 2, or 2 and 3.



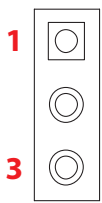
You may configure your card to match the needs of your application by DIP switch. As below show the DIP switch on and off.



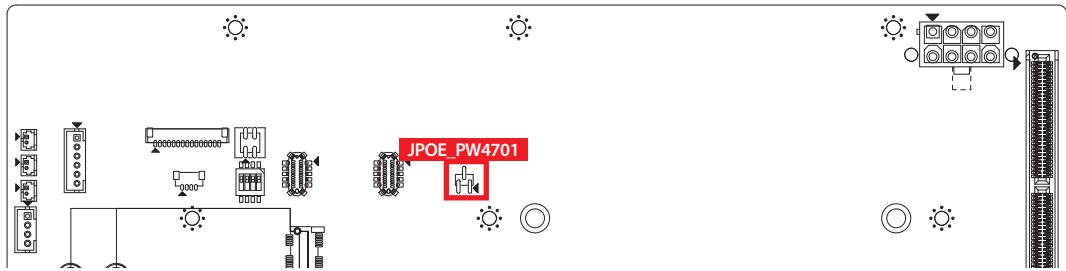
2.5.2 SOM FAN Operation Voltage Select (JP3501)



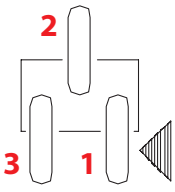
The pin assignments of JP3501 is listed in the following table :

	Pin No.	Definition
	1-2	FAN Operation Voltage 5V
	2-3	FAN Operation Voltage 12V(Default)

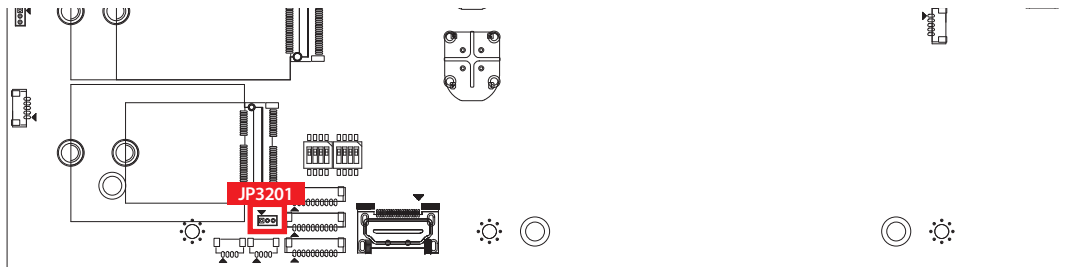
2.5.3 POE Power On Select Mode (JPOE_PWR4701)



The pin assignments of JPOE_PWR4701 is listed in the following table :

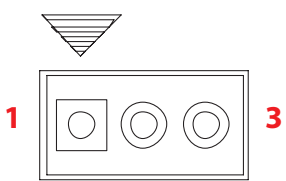
	Pin No.	Definition
	1-2	POE Power On by 3.3V_SB
	2-3	POE Power On by P3.3V(Default)

2.5.4 COM1 RS485 Mode Terminal resistance ON/OFF(JP3201)

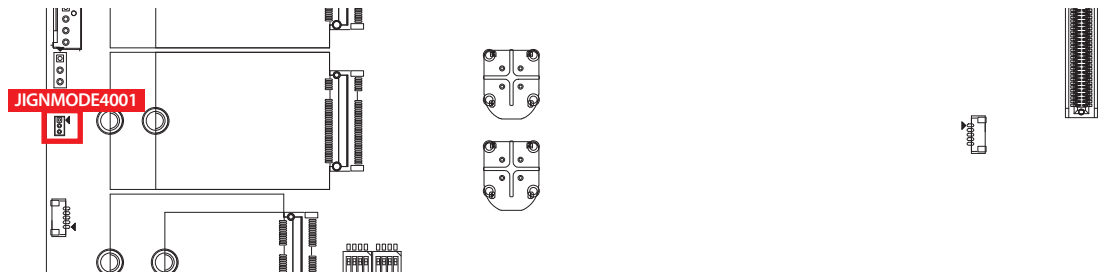


There is one Pin Header JP3201 to set terminal resistor (120Ω) ON/OFF of COM RS485 mode function.

The pin assignments JP3201 is listed in the following table :

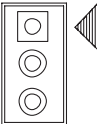
	Pin No.	Definition
	1-2	RS485 Mode Terminal resistance OFF (Default)
	2-3	RS485 Mode Terminal resistance ON

2.5.5 Ignition Mode Select(JIGNMODE4001)

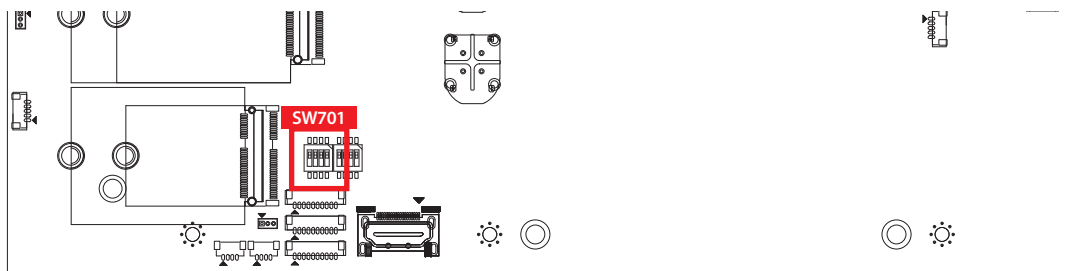


If the system use the ignition mode, the function can be changed by jumper setting. The default is H/W setting, it can be changed by software, but the jumper must be changed Pin 2-3 short.

The pin assignments JIGNMODE4001 is listed in the following table :

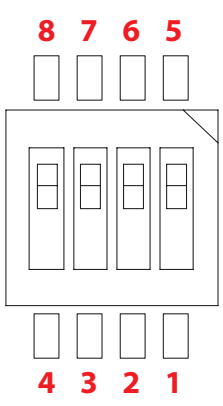
	Pin No.	Definition
	1-2	H/W MODE(Default)
	2-3	S/W MODE

2.5.6 OOB Control/SYNC(SW701)

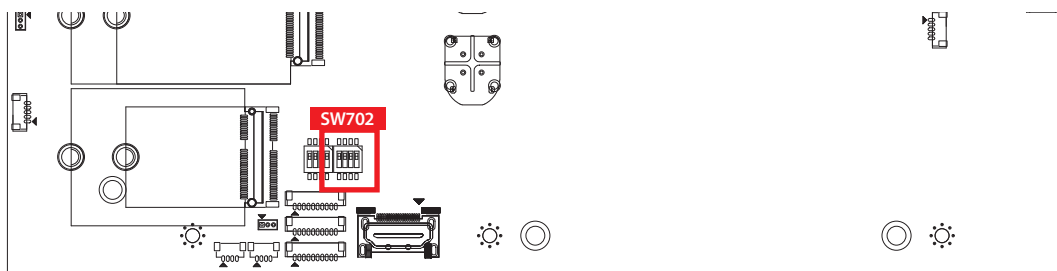


The control UART is connected to OOB module port, it can remote control system when the system is booted up. It also can be changed to SYNC when use control UART by outside device.

The pin assignments SW701 is listed in the following table :

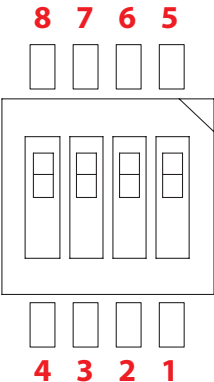
	Pin No.	Definition	Status	
	1	UART2_RXD	1 , 3 ON 2 , 4 OFF	OOB Control
	2	UART2_RXD	1 , 3 OFF 2 , 4 ON	Sync Control
	3	UART2_TXD		
	4	UART2_TXD		
	5	OOB_RXD		
	6	SYNC_RXD		
	7	OOB_TXD		
	8	SYNC_TXD		

2.5.7 Debug UART/OOB(SW702)



The debug UART is connected to console port (Micro USB), it can monitor what the system status is when the system is booted up. It also can be changed to OOB when use remote control by Ethernet.

The pin assignments SW702 is listed in the following table :

	Pin No.	Definition	Status	
	1	UART3_RXD	1 , 3 ON 2 , 4 OFF	OOB Remote CONSOLE
	2	UART3_RXD	1 , 3 OFF 2 , 4 ON	M-USB CONSOLE
	3	UART3_TXD		
	4	UART3_TXD		
	5	Remote_ Console_RXD		
	6	MICRO_B_ RXD		
	7	Remote_ Console_TXD		
	8	MICRO_B_ TXD		

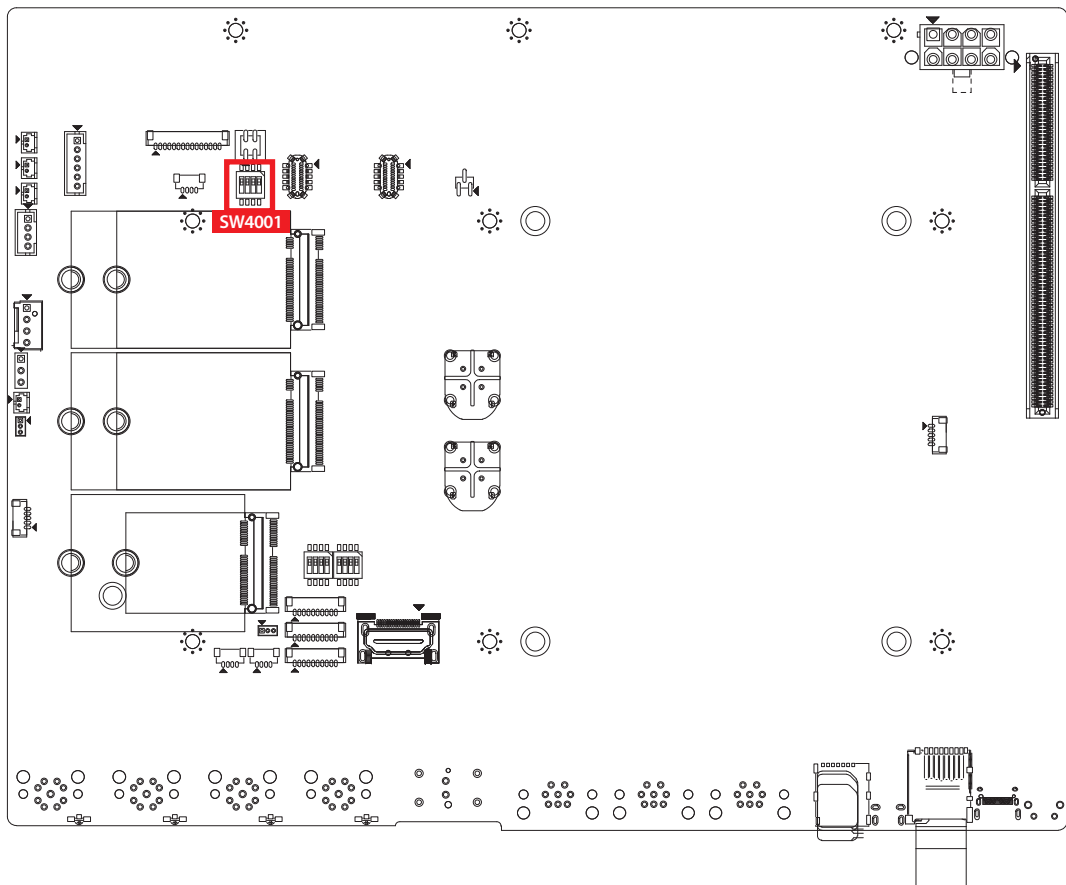
2.6 Ignition Control

NAC-1000 series provides ignition power control feature for in-vehicle applications. The built-in MCU monitors the ignition signal and turns on/off the system according to pre-defined on/off delay period.

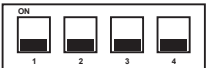
2.6.1 Adjust Ignition Control Modes

NAC-1000 series provides 16 modes of different power on/off delay periods adjustable via SW4001 switch. The default DIP switch is set to 0 in ATX power mode. When using the OOB function, the Ignition control function cannot be used at the same time.

SW4001 : Ignition Control



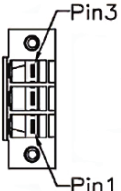
The modes are listed in below table :

Deep Switch Position	Power on delay	Power off delay	Switch Position
0	ATX mode (Default)		
1	No delay	10 seconds	
2	No delay	15 seconds	
3	No delay	20 seconds	
4	No delay	30 seconds	
5	No delay	60 seconds	
6	5 seconds	10 seconds	
7	5 seconds	30 seconds	
8	5 seconds	60 seconds	
9	5 seconds	90 seconds	
A	5 seconds	120 seconds	
B	10 seconds	10 seconds	
C	10 seconds	30 seconds	
D	10 seconds	60 seconds	
E	10 seconds	90 seconds	
F	AT mode		

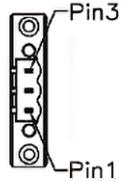
2.6.2 Ignition Control Wiring

To activate ignition control, you need to provide IGN signal via via the 3-pin pluggable terminal block from dc-in cable. Please find below the general wiring configuration.

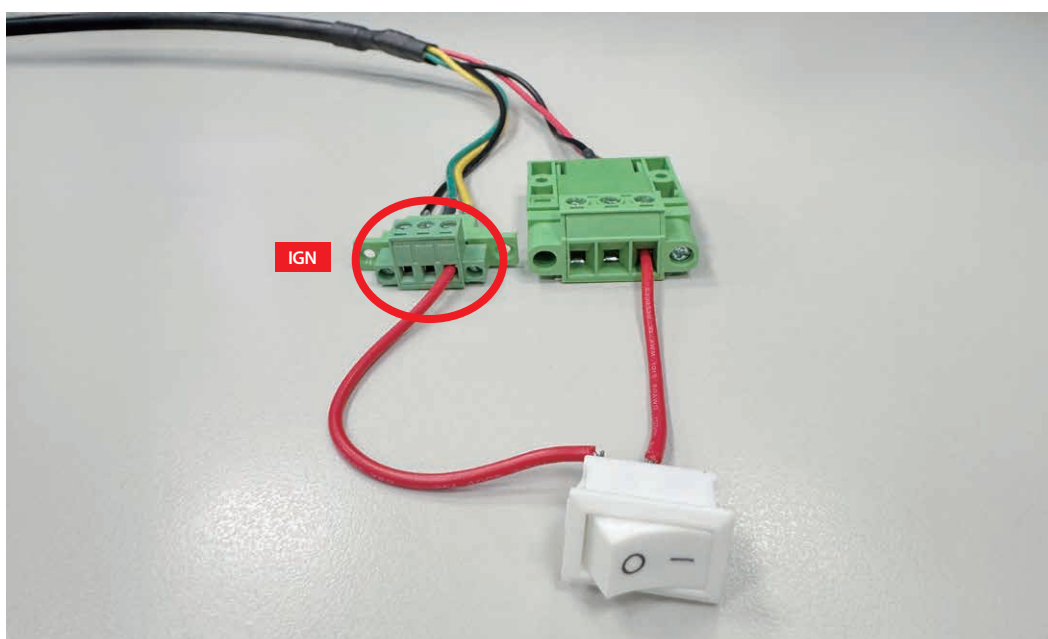
DC-IN CABLE Power jack pinout :

	Pin No.	Definition
	1	Chassis GND
	2	GND
	3	Power

DC-IN CABLE IGN jack pinout :

	Pin No.	Definition
	1	GND
	2	Power BTN
	3	IGN

For testing purpose, you can refer to the picture blow to simulate ignition signal input controlled by a latching switch.

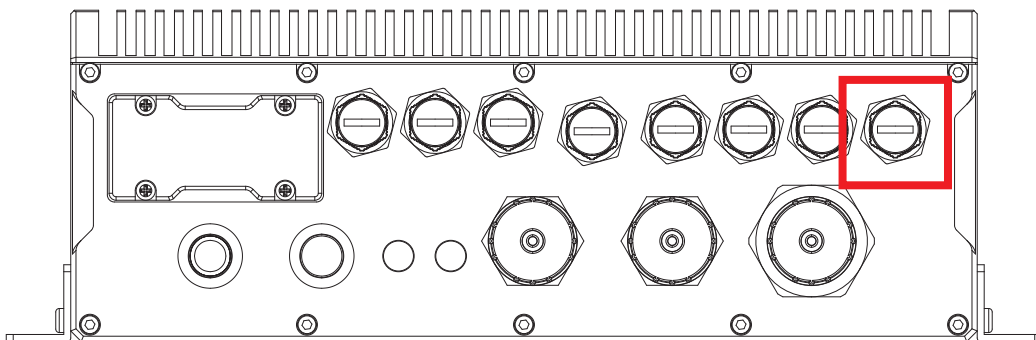


3

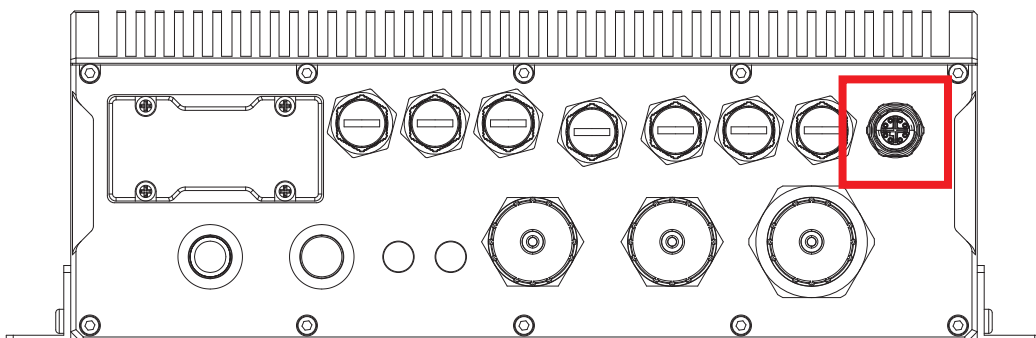
SYSTEM SETUP

3.1 How to Use Your NAC-1000

Step 1 Remove waterproof cap.



Step 2 Confirm connector pin defined.(Example LAN)



Step 3 Confirm wire.

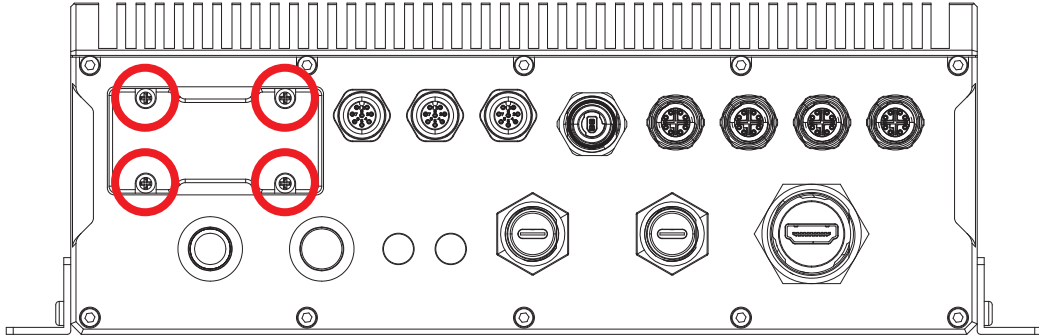


Step 4 Turn wire connector.



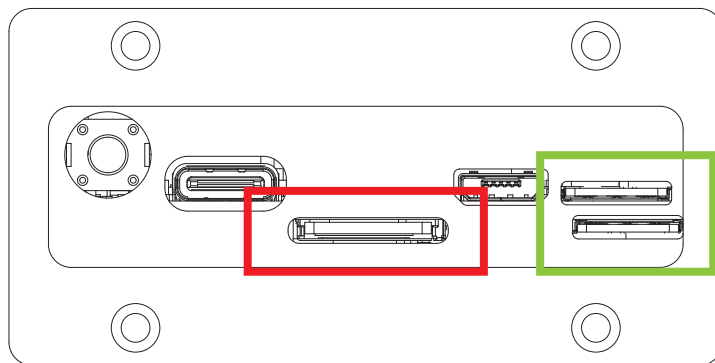
3.2 Installing Micro SD/SIM Card

Step 1 Remove four PH-M3x6L screws on SD/SIM cover.



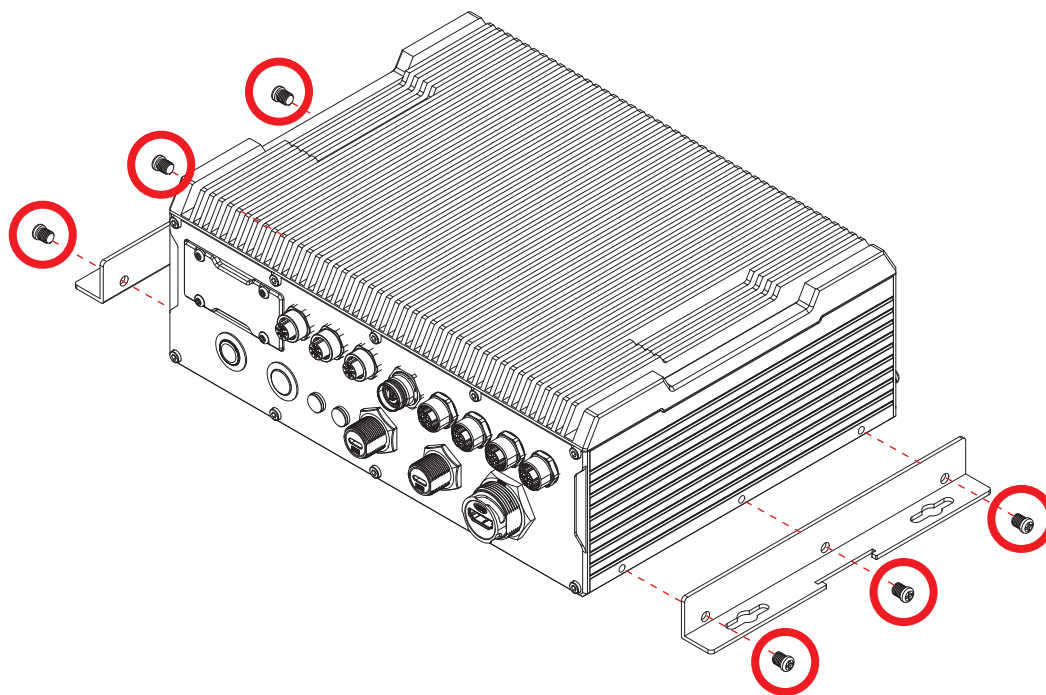
Step 2 Inserting Micro SD/SIM card.

(Red : Micro SD socket, Green : SIM socket)

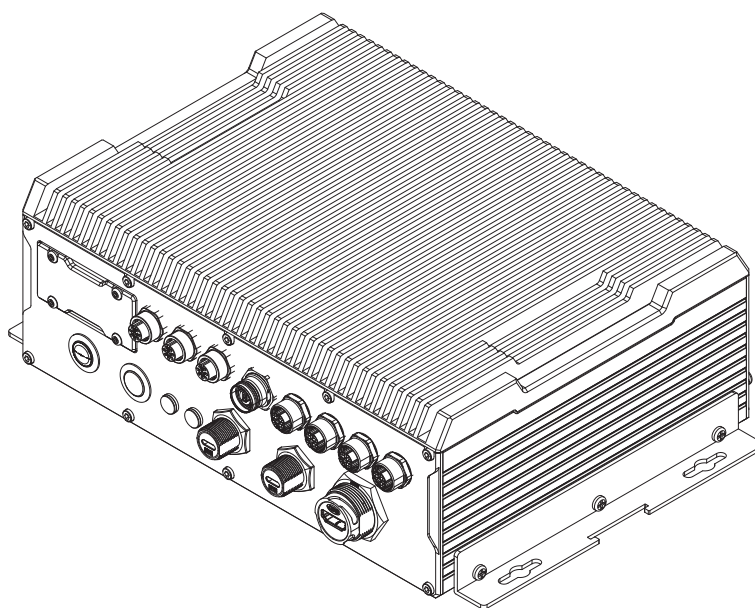


3.3 Mounting Your NAC-1000

Step 1 Fasten six PH-#10-32x6L screws.



Step 2 Finish



4

SOFTWARE SETUP

This section provides information regarding the peripherals and image flashing. Please note that this information may be outdated or incompatible with images of older versions. The documentation included with the image package contains version-matched information. If you encounter any issues, please reach out to support for help.

4.1 Peripheral Interface Guide

The directory `/opt/vecow/tools` contains the necessary instructions and scripts for utilizing the peripherals on the NAC-1000. A symbolic link, named `NAC1k-Tools`, is also provided in the home directory, pointing to the aforementioned location. This subsection replicates the contents of that directory. As mentioned in the preamble, the instructions provided herein may be obsolete or non-functional.

4.1.1 Cameras

As of the writing of this documentation, the NAC-1000 supports Leopard Imaging's Hawk and Owl cameras. Hawks must be connected to ports 1-4, whilst Owls to ports 5-8. To preview the image of these cameras, the following command can be invoked :

```
$ gst-launch-1.0 nvarguscamerasrc sensor-id=i ! nv3dsink
```

where $i = 0, 1, \dots, 11$.

By default, these cameras use internal frame synchronization. To activate external frame synchronization, simply open the device file `cdi_tsc`. When the device file is closed, it switches to internal frame synchronization automatically.

4.1.2 CAN Buses

The NAC-1000 features two CAN buses which are accessible through the network interface can0 and can1 with the Socket API. For example, the command :

```
$ sudo ip link set can0 up type can bitrate 1000000
```

configures the CAN interface can0 to operate at a bitrate of 1Mbps.

4.1.3 Serial port

The device node for the serial port COM is ttyTHS1. The port can be configured to use the RS-232, RS-422, or RS-485 standards by setting GPIO pins to values listed below.

Standard	PAC.02	PP.04
RS-232	1	0
RS-422	1	1
RS-485	0	1

For instance, to have COM operate in RS-485 mode, run :

```
$ sudo gpio set 0 140=0 96=1
```

4.1.4 Digital Input/Output Port

The mapping of DIO pins to GPIO pins is as follows.

Mode	PAD.00	PAD.01
NPN	1	0
PNP	0	1

The mapping of DIO pins to GPIO pins is as follows.

DIO	GPIO
EXT_IN0	PA.02
EXT_IN1	PAC.05
EXT_IN2	PAC.07
EXT_IN3	PQ.04
EXT_IN4	PN.02
EXT_IN5	PH.04
EXT_OUT0	PM.05
EXT_OUT1	PQ.01
EXT_OUT2	PH.07
EXT_OUT3	PI.00
EXT_OUT4	PI.01
EXT_OUT5	PI.02

4.1.5 Software Ignition Control

The behavior of ignition is managed by the MCU located on i2c bus 0 at address 0x48. To utilize software control for the behavior of ignition, one should change the JIGNMODE4001 jumper configuration to short pins 2 and 3, and then change to mode IGN by setting the registers at 0x18 and 0x29.

4.1.6 Bosch Sensors

The NAC-1000 is equipped with a BMI088, a BMM350, and a BMP581. These sensors can be accessed via the i2c bus 1 at address listed below

Sensor	Address
BMI088(ACCEL)	0x18
BMI088(GYRO)	0x68
BMM350	0x14
BMP581	0x46

4.2 Flash image to Your NAC-1000

4.2.1 How to Flash an Image to the NAC-1000

Before starting the flashing process, ensure that the NAC-1000 is turned off and disconnected from the power supply. You'll also need a host computer running Ubuntu 20.04 or later.

4.2.1.1 Prepare the Host Computer

Step 1 : Open a terminal on the host computer and temporarily disable the automount feature for new external storage devices. On most Debian-based Linux distributions, you can do this with the following command :

```
$ sudo systemctl stop udisks2.service
```

Step 2 : Ensure that the "nfs-kernel-server" service is running on the host computer by using this command :

```
$ sudo service nfs-kernel-server start
```

4.2.1.2 Download the OS Image File to the Host Computer

Step 1 : Download the image package. The file name will be similar to :

```
$ mfi_nac1000-610xxx-xx-p3701-xxg_ubtudsk.tzst
```

Step 2 : Verify the MD5 checksum using the following command :

```
$ md5sum -c ./mfi_nac1000-610xxx-xx-p3701-xxg_ubtudsk.tzst.md5sum
```

Step 3 : Extract the compressed image files by running one of the following commands :

```
$ sudo tar --zstd -xvpf mfi_nac1000-610xxx-xx-p3701-xxg_ubtudsk.tzst
```

or

```
$ zstd -d mfi_nac1000-*.tzst -c | sudo tar -xvpf -
```

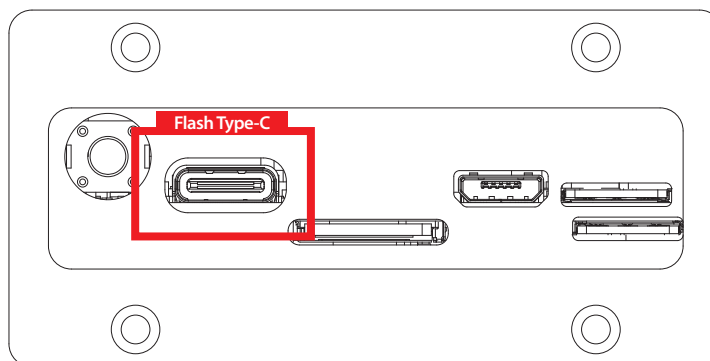
Step 4 : Navigate to the decompressed directory and run the script to install the necessary dependencies :

```
$ sudo ./l4t_flash_prerequisites.sh
```

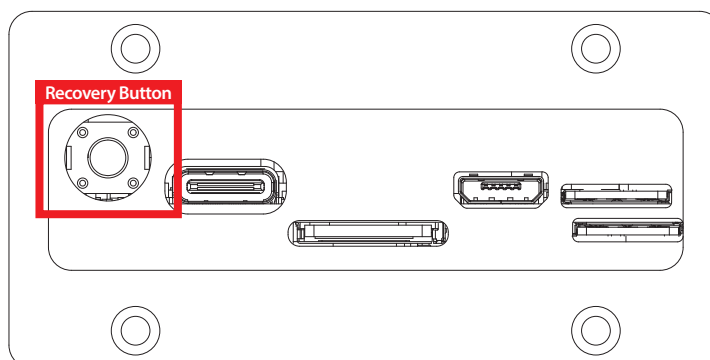
4.2.1.3 Connect the NAC-1000 to the host computer

Step 1 : Connect the power adapter to the NAC-1000, but do not turn it on yet.

Step 2 : Connect a Type-C USB cable to the “Flash” port on the NAC-1000, and connect the other end to an available USB port on the host computer. You can connect up to ten NAC-1000 devices in recovery mode to the host.



Step 3 : Press and hold the “Recovery” button on the NAC-1000.



Step 4 : While holding the “Recovery” button, power on the NAC-1000. Keep holding the “Recovery” button for at least two seconds, then release it.

Step 5 : With the device in recovery mode, run the following command on the host computer to check if the device is detected :

```
$ lsusb
```

You should see a USB device listed with the following information :

BUS XXX Device XXX: ID 0955:7023 Nvidia Corp. APX

4.2.1.4 Flash the Image to the NAC-1000

Step 1 : Open a terminal on the host computer and navigate to the directory where you extracted the package in Step 2-3.

Step 2 : Run the following command from the decompressed folder to flash the image. This process will take some time.

For booting the image from emmc storage:

```
$ sudo ./mfi_nacpltfs.flash --boot-dev emmc
```

For booting the image from nvme storage:

```
$ sudo ./mfi_nacpltfs.flash --boot-dev nvme
```

The default login credentials for accessing the system are :

User : nvidia

Password : nv1234



APPENDIX A : Power Consumption

Testing Board	NAC-1000
RAM	64 GB 128-bit LPDDR5
USB-1	USB Flash SanDisk 3.0 32GB
USB-2	USB Flash SanDisk 3.0 32GB
USB-3	LEXMA LK6550R
SD	ADATA Micro SD 32GB
Storage	64 GB eMMC 5.1
Storage	Kingston SNV2S M.2 M key 500G
Camera	Leopard LI-AR0234CS-STEREO-GMSL2 (HAWK)
Camera	Leopard LI-AR0234CS-GMSL2-OWL
PoE	PoE 100W
M.2 KEY B	Quectel EM060K
M.2 KEY E	Intel AX210NGW
LAN 1	1.0 Gbps
LAN 2	1.0 Gbps
LAN 3	1.0 Gbps
LAN 4	1.0 Gbps
LAN 5	1.0 Gbps
Graphics Output	HDMI
Power Plan	30W/MAXN
Power Source	Chroma 62006P-100-25
Test Program	Burn-in Test/Stress-ng Test

A.1 12-core Arm® Cortex®-A78AE v8.2 64-bit CPU, up to 2 GHz 2048-core NVIDIA Ampere™ GPU with 64 Tensor Cores (NAC-1000_30W)

Power on and boot to Ubuntu 22.04 LTS 64bit

CPU	Power Input	Ubuntu 22.04 LTS 64bit			
		idle status CPU		Run BurnInTest/Stress-ng Test with POE 100W	
		Max Current	Max Consumption	Max Current	Max Consumption
12-core Arm® Cortex®-A78AE v8.2 64-bit CPU, up to 2 GHz	9V	1.86A	16.72W	NA	NA
	12V	1.39A	16.70W	14.62A	175.57W
	24V	0.78A	18.80W	6.82A	163.86W
	36V	0.60A	21.44W	4.52A	162.77W
	50V	0.45A	22.6W	3.40A	169.89W

A.2 12-core Arm® Cortex®-A78AE v8.2 64-bit CPU, up to 2 GHz 2048-core NVIDIA Ampere™ GPU with 64 Tensor Cores (NAC-1000_MAXN)

Power on and boot to Ubuntu 22.04 LTS 64bit

CPU	Power Input	Ubuntu 22.04 LTS 64bit			
		idle status CPU		Run BurnInTest/Stress-ng Test with POE 100W	
		Max Current	Max Consumption	Max Current	Max Consumption
12-core Arm® Cortex®-A78AE v8.2 64-bit CPU, up to 2 GHz	9V	1.90A	17.11W	NA	NA
	12V	1.43A	17.16W	17.02A	204.37W
	24V	0.79A	18.92W	8.40A	201.54W
	36V	0.57A	20.71W	5.59A	201.32W
	50V	0.46A	23.03W	3.93A	196.47W

B

APPENDIX B : Supported Module List

B.1 Supported 5G/4G/GPS List

Type	Model	Support Standard
M.2 KEY B	Quectel RM520N	5G NR Sub-6GHz GPS/GLONASS/BeiDou/Galileo/QZSS
M.2 KEY B	Telit LN920A6	LTE Category 6 GPS/GLONASS/BeiDou/Galileo
M.2 KEY B	Quectel EM060K	LTE Category 6 GPS/GLONASS/BeiDou/Galileo
M.2 KEY B	Telit FN990	5G sub-6 FDD and TDD GPS/GLONASS/BeiDou/Galileo/QZSS
M.2 KEY E	ANAVS Mosaic-H	GPS/GLONASS/BeiDou/Galileo/QZSS

Note : Wireless module with antenna is by request. A customized chassis is needed.

B.2 Supported Wi-Fi/Bluetooth List

Type	Model	Support Standard
M.2 KEY E	Azurewave AW-CB375NF	IEEE 802.11ac/a/b/g/n/ac BT5.0
M.2 KEY E	SparkLAN WNFT-280AX(BT)	IEEE 802.11ac/a/b/g/n BT5.0
M.2 KEY E	Intel AX210NGW	IEEE 802.11a/b/e/g/h/i/k/n/r/u/v/w/ac/ax BT5.3

Note : Wireless module with antenna is by request. A customized chassis is needed.



For further support information, please visit www.vecow.com

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