ROScube-Pico NPN Series

User's Manual

NVIDIA® Jetson Nano™ / Xavier™ NX SOM-based platform for rapid development and deployment of ROS and AI applications



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Leading **EDGE COMPUTING**

Preface

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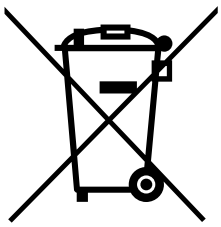
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Revision History

Revision	Description	Date	By
1.0	Initial release	2022-03-29	JC

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1 Introduction

ADLINK's ROScube-Pico NPN Series is a ROS 2 enabled robotic controller powered by the NVIDIA® Jetson Nano™ or Xavier™ NX system-on-module (SOM). ROSCube Pico supports a full complement of resources developed with the NVIDIA JetPack SDK and ADLINK's Neuron SDK, and is specifically suited for robotic applications demanding high-AI computing with minimal power consumption.

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2 Specifications

2.1 Product Specifications

ROScube Pico NPN	NVIDIA® Jetson Nano™	NVIDIA® Jetson Xavier™ NX
Model Name	**NPN-1B**	**NPN-2B**
System-on-Module (SOM)		
Module	NVIDIA Jetson Nano Module	NVIDIA Jetson Xavier NX module
CPU	Quad-core ARM Cortex-A57 MPCore processor	6-core NVIDIA Carmel ARM v8.2 64-bit CPU 6MB L2 + 4MB L3
CPU Max Frequency	1.43GHz	Power Modes (S/W controllable by user): 2-core @ 1.5GHz, 10W 4-core @ 1.2GHz, 10W 2-core @ 1.9GHz, 15W 4-core @ 1.4GHz, 15W 6 core @ 1.4GHz, 15W
GPU	NVIDIA Maxwell architecture with 128 NVIDIA CUDA® cores	384-core NVIDIA Volta GPU with 48 Tensor Cores
GPU Max Frequency	921MHz	800MHz @10W 1100MHz @ 15W
Memory	4GB 64-bit LPDDR4 @ 1600MHz 25.6GB/s	8GB 128 bit LPDDR4x @ 1600MHz 51.2GB/s
eMMC	16GB eMMC 5.1 on module	
AI Performance	N/A	14 TOPS @10W 21 TOPS @15W
Front Panel I/O Interfaces		
Display	1x HDMI 2.0 port	
Ethernet	4x Gigabit Ethernet ports	
USB 3.1 Gen1	4x USB3.0 Type A ports (2x with lockable connectors)	
Micro-USB	1x Micro-USB port for OTG/debugging and recovery	
Internal I/O Connectors		
MRAA 40-Pin Header	2x I^2C, 7x GPIO, 1x SPI, 1x UART,10x PWM (These signals are connected to the DB-37 connector. Refer to 3.5 Multi-I/O Connector (DB-37) for pin definition.)	
microSD Card Slot	1x microSD card slot	
M.2 Slot	1x M.2 Key E for Wi-Fi module 1x M.2 2242 Key M for NVMe SSD (NPN-2B only)	
CANbus	1x 3-pin header (Connected to the DB-37 connector. Refer to 3.5 Multi-I/O Connector (DB-37) for pin definition.)	
LED Indicators (board only)	Power (green) Standby (blue) SD Card (green) NVMe Module (amber)	
Power Management Signals	1x power button, 1x system reset, 1x force recovery, 1x power-on LED (for extending functionality to robots)	
RTC	CR2032 3V Li VARTA battery	

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ROScube Pico NPN	NVIDIA® Jetson Nano™	NVIDIA® Jetson Xavier™ NX
Model Name	**NPN-1B**	**NPN-2B**
Side Panel I/O Interfaces		
Multi-IO Connector (DB-37)	2x UART, 2x I^2C, 1x SPI, 1x CANbus (NPN-2B only), 5x GPIO, 1x extended power on/off, 1x extended SYS reset, 1x extended force recovery	
Audio In/Out	1x 3.5mm stereo line-out jack	
Sensors		
IMU	1x BMI160 (3-axis gyroscope, 3-axis accelerometer)	
Power Requirements		
Power Buttons	1x power on/off button, 1x reset button	
DC Power Input	8-20 VDC (+/- 10%)	
AC/DC Power Adapter	90W adapter, 19V/4.74A DC jack (optional, see ordering information)	
Mechanical		
Dimensions (W x D x H)	140 x 110 x 63.3 mm (5.5 x 4.33 x 2.49 in.)	140 x 110 x 63.3 mm (5.5 x 4.33 x 2.49 in.)
Weight	1035 g	1035 g
Mounting	Wall mount kit	
Environmental		
Operating Temperature (with 0.6m/s airflow)	-20°C to 50°C	-20°C to 50°C
Operating Humidity	Approx. 95% @40℃ (non-condensing)	
Storage Temperature	-40°C to 85°C	
Altitude	Up to 2000 m	
EMI	CE & FCC Class B with validated AC/DC adapter (EN61000-6-4/-2)	
EMS	IEC 61000-4-2 (ESD, contact: ±8kV, air: ±15kV) IEC 61000-4-3 (RS, 10V/m from 80-1000MHz, 3V/m from 1400-2000MHz, 1V/m from 2000-2700MHz, 1kHZ sine wave, 80% AM) IEC 61000-4-4 (EFT, ±2kV at 5KHz on power port, ±1kV at 5KHz on signal port) IEC 61000-4-5 (Surge, ±2kV line to earth CM on power port, ±1kV line to earth CM on signal port) IEC 61000-4-6 (CS, 10Vrms with 1kHz sine wave, 80% AM from 0.15MHz-80MHz) IEC 61000-4-8 (power-frequency magnetic fields) IEC 61000-4-11 (voltage DIPs & voltage interruptions)	
Vibration	IEC60068-2-6: 3G, 10-500Hz, 3 axes total, non-operational IEC60068-2-64: 1Grms, 10-500Hz, 1 hour/axis, operational	
Shock	IEC-60068-2-27 Operating 50G, half sine 11 ms duration	
Safety	62368 LVD	
Software		
Environment	Ubuntu 18.04 L4T (support for 32.4.3 and onwards)	
Middleware	ROS/ROS 2	
SDK	ADLINK Neuron SDK	

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2.2 Packing List

Controller	1x ROSCube Pico Nano or Xavier NX
Power Transfer Cable	1x Dinkel 2-pin to DC plug cable
Wall Mount kit	2x wall mount brackets

2.3 Optional Accessories

M.2 NVMe SSD	M.2 2242 NVMe SSD 256GB, Transcend TS256GMTE452T, for NPN-2B only (P/N: 29-46N00-6100)
Wi-Fi Module	Intel® Wireless-AC 9260 M.2 2230, Dual-Band 2x2 Wi-Fi + Bluetooth 5 Kit (P/N: 91-95266-0010)
AC/DC Adapter	90W, 90-264VAC to 19V DC power adapter (P/N: 31-62137-0000) (board version comes with 60W adapter by default)

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2.4 Mechanical Dimensions

All dimensions shown in millimeters

2.4.1 External Dimensions

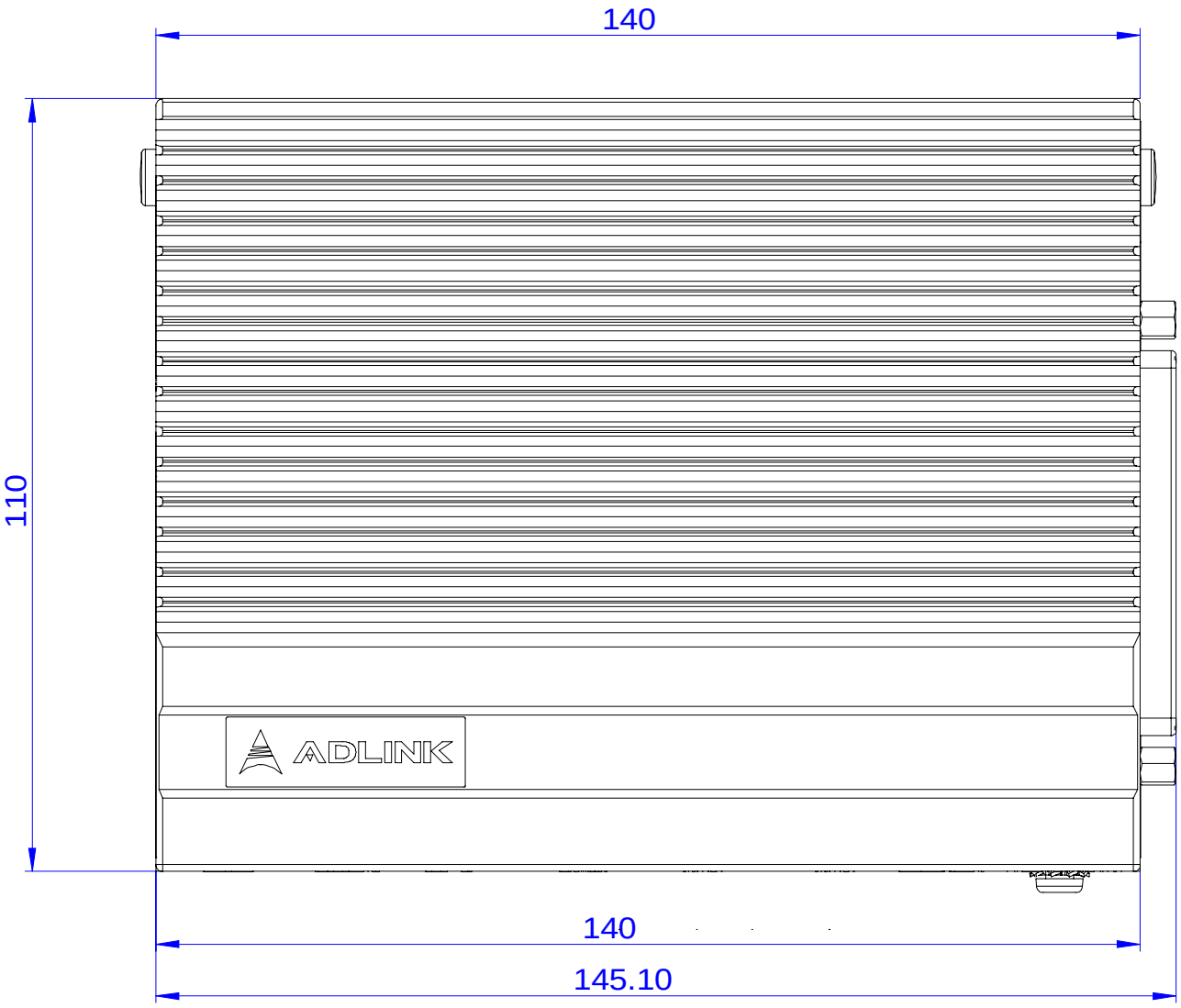


Figure 1: Box Dimensions (top view)

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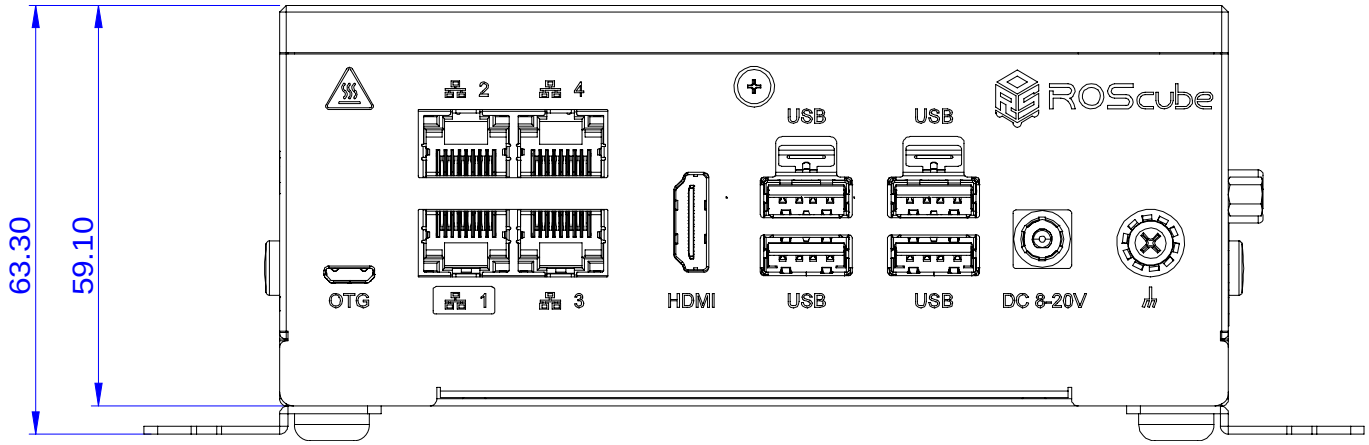


Figure 2: Box Dimensions (front view)

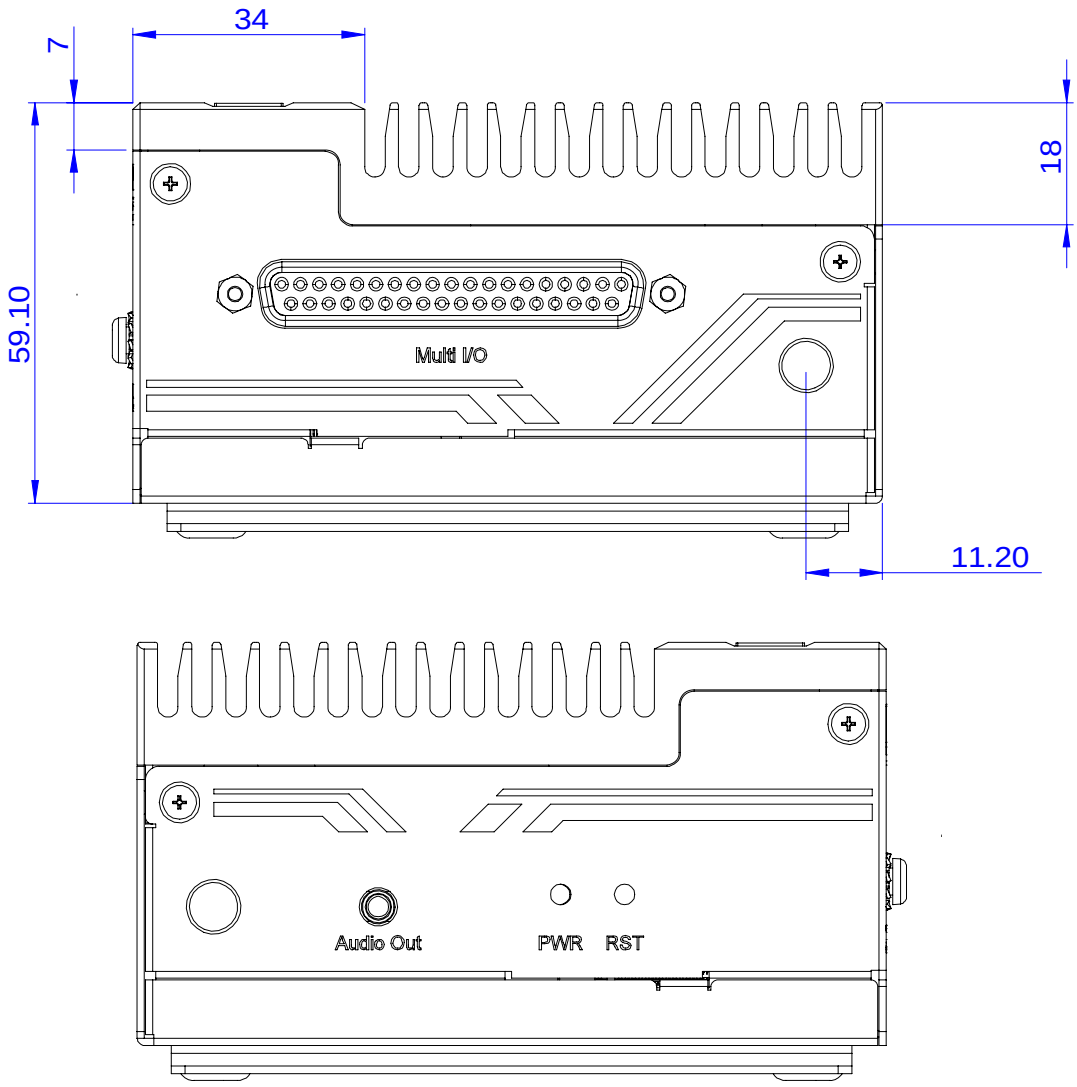


Figure 3: Box Dimensions (side view)

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2.4.2 Board Dimensions

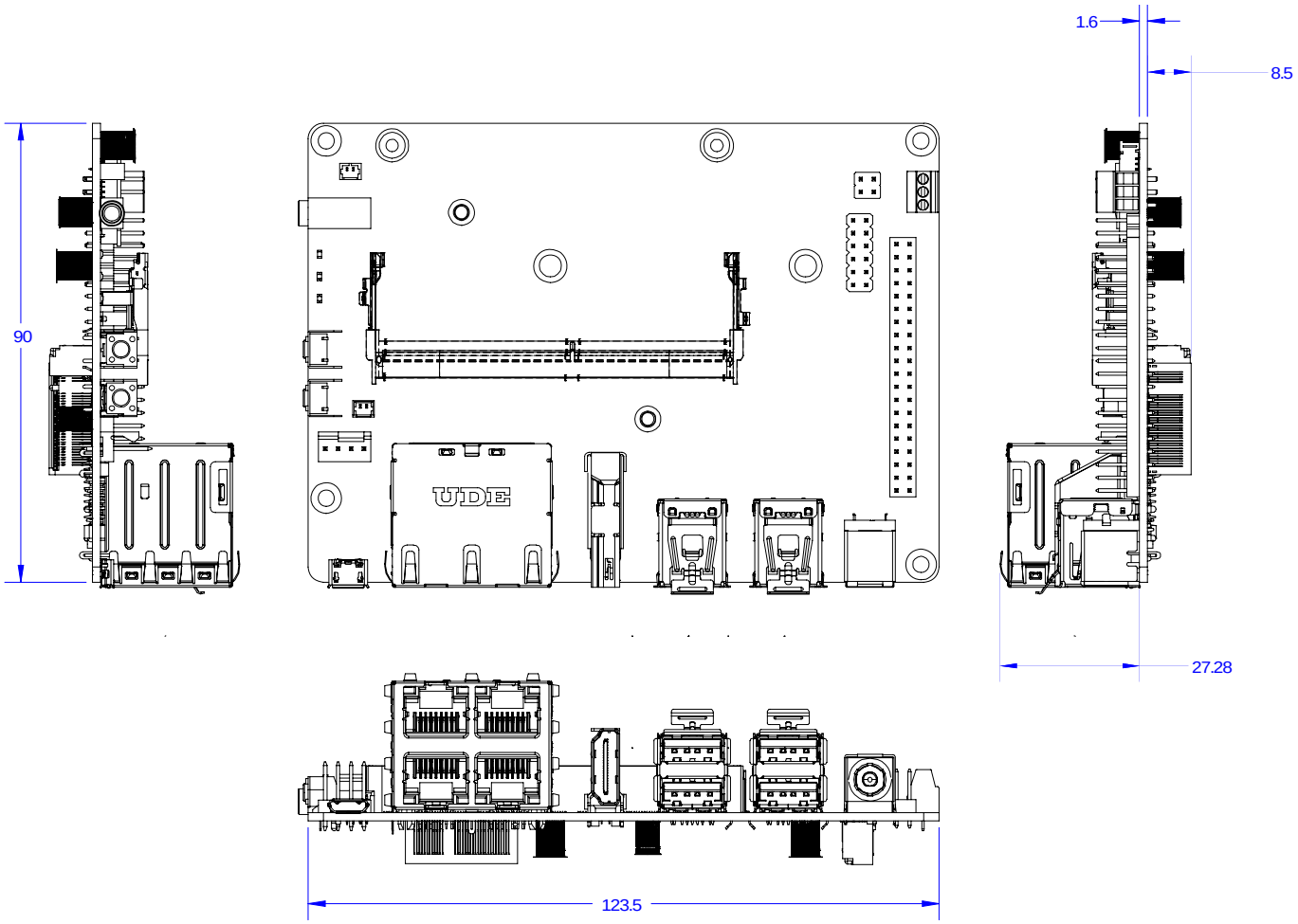


Figure 4: Board Dimensions

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2.5 System Layout

2.5.1 External Connector Locations

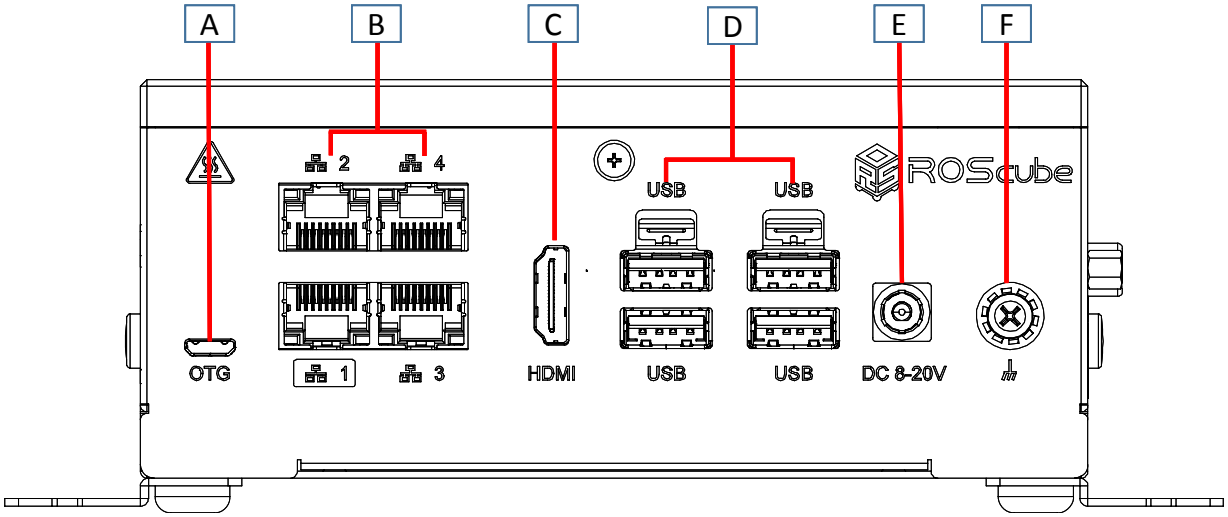


Figure 5: Front Panel I/O

A	USB 2.0 OTG port x1	D	USB 3.0 Type-A ports x4 (2x with lockable connectors)
B	Gigabit Ethernet ports x4	E	DC 8–20V x1
C	HDMI 2.0 port x1	F	Ground Screw x1

Table 1: Front Panel I/O Legend

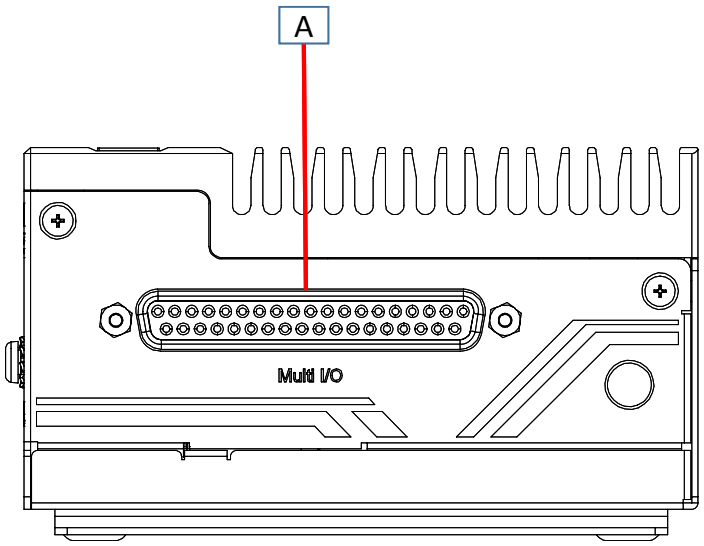


Figure 6: Right Side Panel I/O

A	Multi-I/O Connector (DB-37)

Table 2: Right Side Panel I/O Legend

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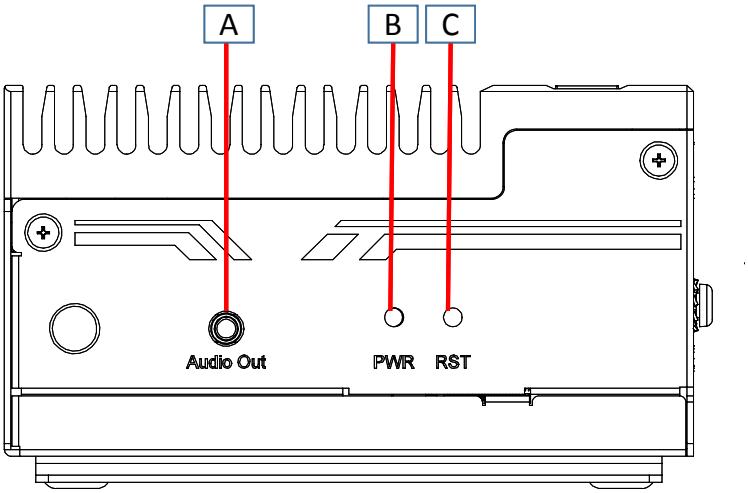


Figure 7: Left Side Panel I/O

A	Audio Out x1
B	Reset button x1
C	Power button x1

Table 3: Left Side Panel I/O Legend

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2.5.2 Carrier Board Connector Locations

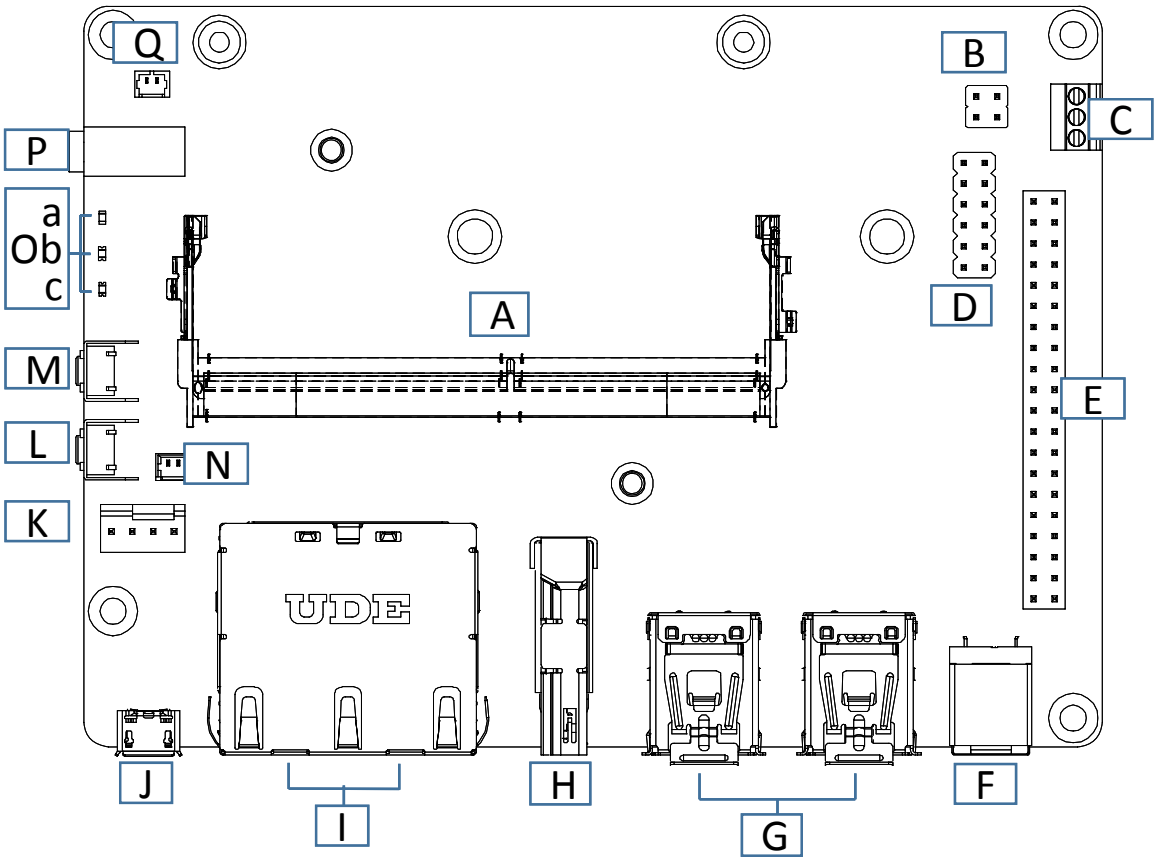


Figure 8: Carrier Board Connectors (top)

A	DDR4 SODIMM socket for NVIDIA Jetson module	**G**	USB 3.1 ports (4x)	**M**	Power button
B	CAN bus jumper header, (reserved - do not change settings - NPN-2B only)	**H**	HDMI 2.0 connector	**N**	RTC battery pin header (battery is glued to back of GbE ports)
C	CAN bus pin header for DB-37 connector TX/RX control (NPN-2B only)	**I**	Gigabit Ethernet ports (4x)	**O**	a – Standby LED (blue) b – Power LED (green) c – SD Card LED (green)
D	Power management pin header	**J**	Micro-B USB 2.0 OTG port	**P**	Audio Jack
E	MRAA connector (2x20 pin) for DB-37 connector	**K**	Fan header (5V)	**Q**	Microphone connector (mono)
F	DC power jack	**L**	Reset button		

Table 4: Carrier Board Connector Legend (top)

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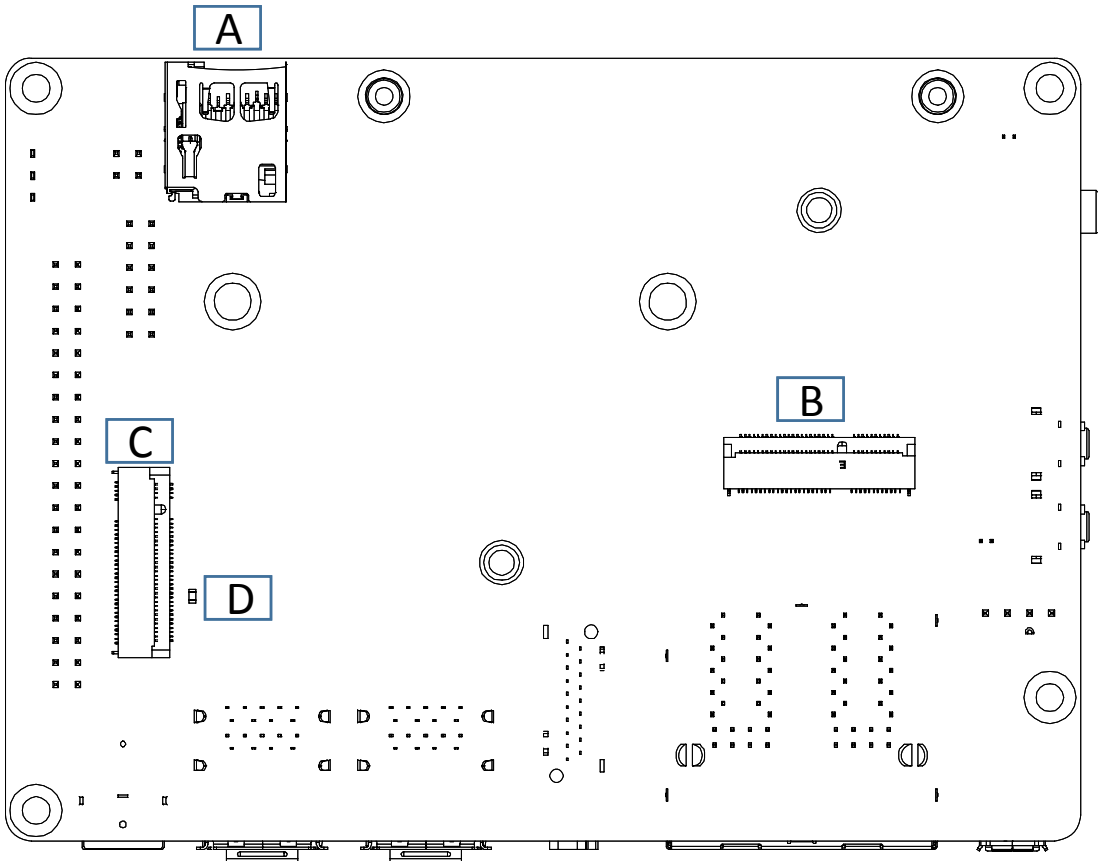


Figure 9: Carrier Board Connectors (bottom)

A	microSD slot	**C**	M.2 2242 Key M socket for NVMe module (NPN-2B only
B	M.2 2230 Key E socket for Wi-Fi/Bluetooth module	**D**	NVMe module LED (amber)

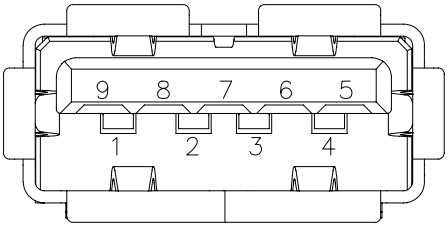
Table 5: Carrier Board Connector Legend (bottom)

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3 Pinouts and Signal Descriptions

3.1 USB 3.1 Ports

The ROScube Pico provides 4x USB 3.1 Gen1 (2 standard, 2 lockable) via hub controller.



Pin	Signal
1	+V5P0_USB
2	U2_ CN_D_N
3	U2_ CN_D_P
4	GND
5	U3_ CNRX_N
6	U3_ CNRX_P
7	GND
8	U3_ CNTX_N
9	U3_ CNTX_P

Table 6: USB 3.1 Pin Definition

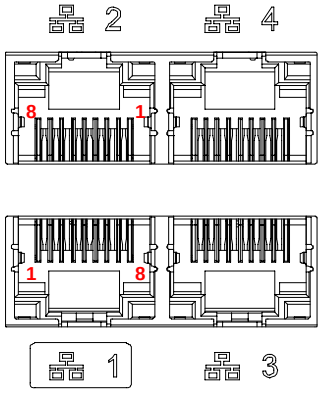
USB 3.1 Port Type A
Speed: 5 Gbps Color: Blue Voltage: 5 V Current: 900 mA Inrush current: 100 mA or 44 Ohm || 10 µF Protection: TPS2553, 910 mA min., 1010 mA max.

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3.2 Gigabit Ethernet Ports

Four Gigabit Ethernet ports are located on the front panel. LAN 1 is provided by the Jetson module, LAN 2/3/4 are each provided by a USB-to-LAN Bridge (LAN7800).

- Compliant with IEEE 802.3az Energy Efficient Ethernet
- Compliant with IEEE 802.3 Ethernet
- Compliant with IEEE 802.3u Fast Ethernet
- Compliant with IEEE 802.3ab
- Compliant with IEEE 802.3az Energy Efficient Ethernet Task Force
- Supports IEEE 802.1q VLAN tagging
- Support for frame of up to 9KB



Pin	10BASE-T/ 100BASE-TX	1000BASE-T
1	TX+	LAN_TX0+
2	TX-	LAN_TX0-
3	RX+	LAN_TX1+
4	—	LAN_TX2+
5	—	LAN_TX2-
6	RX-	LAN_TX1-
7	—	LAN_TX3+
8	—	LAN_TX3-

Table 7: Ethernet Port Pin Definitions

LED Function	Status	Description
Active/Link (Amber)	Off	Ethernet Port is disconnected
	Blinking	Ethernet port is connected and active
Speed (Green)	Off	10Mbps
	Off	100Mbps
	On	1000Mbps

Table 8: Ethernet Port LED Indicators

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Notes:

- LAN 1 MAC address is defined by NVIDIA module. LAN 2, LAN 3, and LAN 4 have MAC addresses provided by ADLINK.
- During boot up, the activity LED on LAN1 will light up for a few seconds, even if the port is not connected. This is normal behavior and does not affect the function of this product.
- The number of the LAN ports on the front I/O panel does not correspond to the number of the Ethernet connection displayed by the operating system. The operating system will number the connections in the order they are made, regardless of the port numbers on the panel.

3.2.1 Uplink and Downlink Limitations

LAN 2, LAN 3, LAN 4, and 4 USB 3.0 ports all share the same USB hub that connects to the NVIDIA Jetson Nano/Xavier module. The total available downlink bandwidth is 5 Gbps, which is shared among LAN 2, LAN 3, LAN 4, and 4 USB 3.0 ports. The total available uplink bandwidth is 5 Gbps, which is also shared among these 7 ports. The maximum uplink and downlink capacity for one LAN port is 1,000 Mbps, and for one USB 3.0 port is 5 Gbps. When LAN 2, LAN 3, LAN 4, and 4 USB 3.0 ports are all uploading or downloading data at the same time, each port will try to upload and download data at maximum capacity. This may result in lost packets, connection time-outs, and missing USB devices. It is suggested that the users avoid using these ports in situations that will lead to combined uplink and downlink requirements of over 5 Gbps.

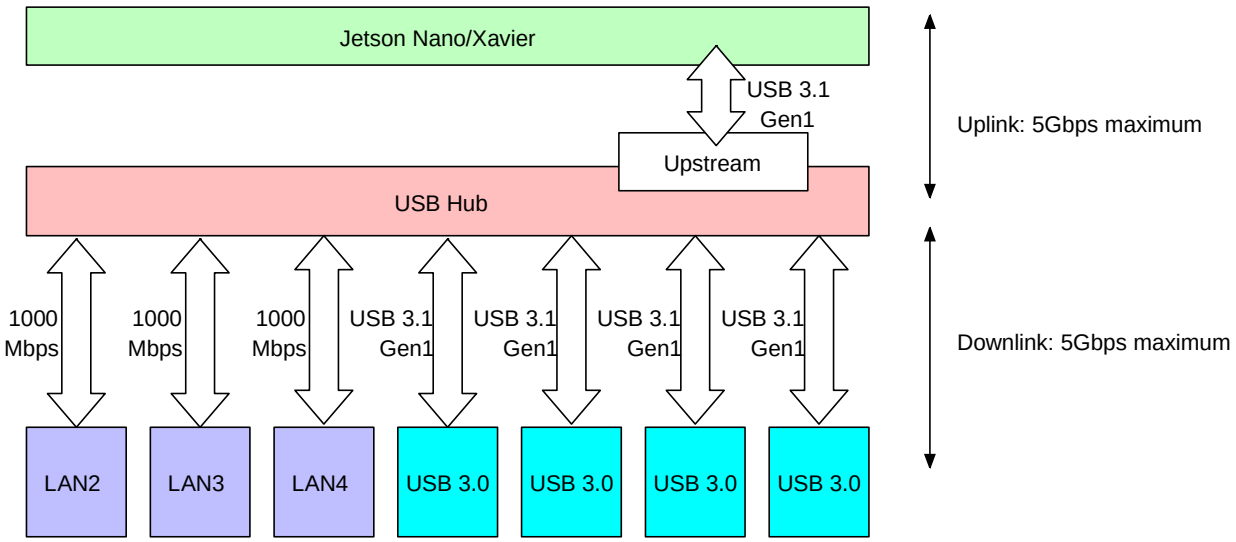
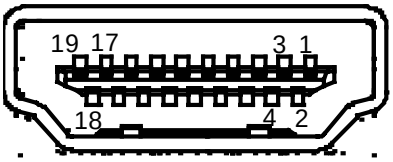


Figure 10: Ethernet and USB Hub Configuration

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3.3 HDMI Connector

The ROSCube Pico provides one HDMI interface. It consists of an upright standard HDMI connector. The pin definition is as follows:

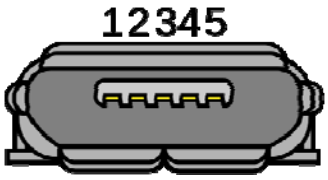


Pin	Signal	Pin	Signal
1	HDMI1_D2_CN_P	11	GND
2	GND	12	HDMI1_CK_CN_N
3	HDMI1_D2_CN_N	13	HDMI1_CN_CEC
4	HDMI1_D1_CN_P	14	
5	GND	15	HDMI1_CN_SCL
6	HDMI1_D1_CN_N	16	HDMI1_CN_SDA
7	HDMI1_D0_CN_P	17	GND
8	GND	18	+V5P0_HDMI
9	HDMI1_D0_CN_N	19	HDMI1_CN_HPD
10	HDMI1_CK_CN_P	20…23 (Shell)	GND

Table 9: HDMI Pin Definition

3.4 Micro USB 2.0 OTG Connector

The ROScube Pico equipped with one Micro USB 2.0 OTG Connector.



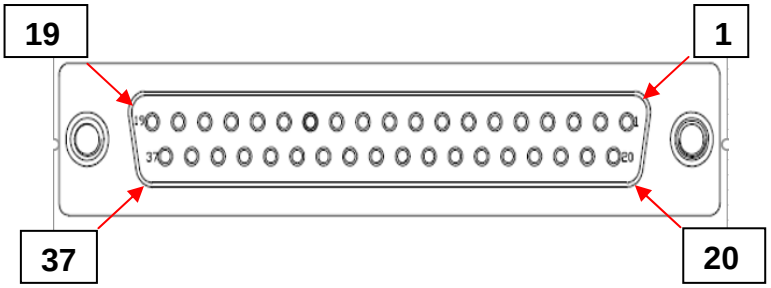
Pin	Signal
1	+V5P0_USB0
2	U2_USB0_CN_N
3	U2_USB0_CN_P
4	USB0_ID
5	GND

Table 10: Micro USB 2.0 OTG Pin Definition

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3.5 Multi-I/O Connector (DB-37)

The ROScube Pico have a rich I/O for autonomous, provide UART x2, I2C x2, SPI x1, CANbus x1 (NPN-2B only), PWM x5, 1x extended power on/off x1, extended SYS reset x1,extended force recovery x1.



Pin	Signal	Voltage	Pin	Signal	Voltage
1	PWR_BTN#	5.0 V	20	GND	
2	GND		21	CAN_L	5.0 V
3	FORCE_RECOVERY	1.8 V	22	CAN_H	5.0 V
4	GND		23	GND	
5	SYS_RST	1.8 V	24	GPIO7_PWM	3.3 V
6	GND		25	GPIO6_PWM	3.3 V
7	UART2_TX	3.3 V	26	GPIO5_PWM	3.3 V
8	UART2_RX	3.3 V	27	GPIO4_PWM	3.3 V
9	GND		28	GPIO3_PWM	3.3 V
10	I2C0_SCL	3.3 V	29	GND	
11	I2C0_SDA	3.3 V	30	SPI_CLK	3.3 V
12	SPI0_CS1	3.3 V	31	MISO0	3.3 V
13	SPI0_CS0	3.3 V	32	MOSI0	3.3 V
14	GND		33	3V3	3.3 V (output, 150 mA combined)
15	UART0_RX	3.3 V	34	GND	
16	UART0_TX	3.3 V	35	I2C1_SCL	3.3 V
17	GND		36	I2C1_SDA	3.3 V
18	V5	5.0 V (output, 150 mA combined)	37	3V3	3.3 V (output, 150 mA combined)
19	V5	5.0 V (output, 150 mA combined)			

Table 11: Multi-I/O Connector Pin Definition

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3.6 Power Button

The ROScube Pico is equipped with a Power On/Off button. This power button only function in “Power Button Mode”, when a jumper is installed at pins 5 and 6 on the Power Management Header (see *3.14 Power Management Header* on page 26). If the jumper is not installed, the device will operate in “Auto Power-On Mode.”

Power Button Mode

When power is connected to the DC power jack, the system can be turned on by pressing the power button. To turn off the system, press the power button again. A window will pop up in the operating system to confirm that the user wants to turn off the system.

Auto Power-On Mode

In this mode, pressing the power button has no effect. The system will turn on when power is connected to the DC power jack. To re-boot the system, disconnect and reconnect power to the DC power jack..

Mode	Power Management Header	Function
Power Button Mode (default setting)	Pins 5 and 6 shorted	Can turn on and off the system by clicking power button
Auto Power-On Mode	Pins 5 and 6 open	The system will not be turned on or off by clicking the power button.

Table 12: Power Button Mode Description

3.7 Reset Button

The The ROScube Pico is equipped with a reset button. Pressing the reset button executes a hard system reset.

3.8 DC Power Jack

Pin	Signal
1	+V12P0_IN
2	GND

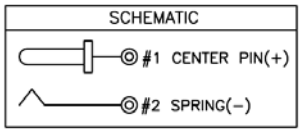


Table 13: DC Power Jack Pin Definition

Note: Please ensure that the power connector is securely inserted into the DC power jack. If the system does not power up correctly. the unplug and reinsert the power connector firmly into the DC power jack.

Please use an approved power source as certified by IEC or UL. The maximum ambient operating temperature is described in *2.1 Product Specifications* on page 3. Altitude during operation is up to 2000 m where output meets LPS and SELV circuit requirements.

	Voltage	Current
DC Power Source	8-20 VDC	6.25A- 2.5A
AC-to-DC Adapter	19 VDC	4.74A

Table 14: Power Source Rating

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3.9 NVIDIA Jetson Nano / Xavier NX Module Connector

The ROSCube Pico provides one 260-pin DDR4 SO-DIMM socket for a NVIDIA Jetson Nano or Xavier NX module.This SO-DIMM socket is located at U1 on the carrier board. The pin definition is as follows:

Odd-Pin	Signal	Type	Even-Pin	Signal	Type
1	GND	GND	2	GND	GND
3	CSI1_D0_N	IN	4	CSI0_D0_N	IN
5	CSI1_D0_P	IN	6	CSI0_D0_P	IN
7	GND	GND	8	GND	GND
9	CSI1_CLK_N	IN	10	CSI0_CLK_N	IN
11	CSI1_CLK_P	IN	12	CSI0_CLK_P	IN
13	GND	GND	14	GND	GND
15	CSI1_D1_N	IN	16	CSI0_D1_N	IN
17	CSI1_D1_P	IN	18	CSI0_D1_P	IN
19	GND	GND	20	GND	GND
21	CSI3_D0_N	IN	22	CSI2_D0_N	IN
23	CSI3_D0_P	IN	24	CSI2_D0_P	IN
25	GND	GND	26	GND	GND
27	CSI3_CLK_N	IN	28	CSI2_CLK_N	IN
29	CSI3_CLK_P	IN	30	CSI2_CLK_P	IN
31	GND	GND	32	GND	GND
33	CSI3_D1_N	IN	34	CSI2_D1_N	IN
35	CSI3_D1_P	IN	36	CSI2_D1_P	IN
37	GND	GND	38	GND	GND
39	DP0_TXD0_N	OUT	40	CSI4_D2_N	IN
41	DP0_TXD0_P	OUT	42	CSI4_D2_P	IN
43	GND	GND	44	GND	GND
45	DP0_TXD1_N	OUT	46	CSI4_D0_N	IN
47	DP0_TXD1_P	OUT	48	CSI4_D0_P	IN
49	GND	GND	50	GND	GND
51	DP0_TXD2_N	OUT	52	CSI4_CLK_N	IN
53	DP0_TXD2_P	OUT	54	CSI4_CLK_P	IN
55	GND	GND	56	GND	GND
57	DP0_TXD3_N	OUT	58	CSI4_D1_N	IN
59	DP0_TXD3_P	OUT	60	CSI4_D1_P	IN
61	GND	GND	62	GND	GND
63	DP1_TXD0_N	OUT	64	CSI4_D3_N	IN
65	DP1_TXD0_P	OUT	66	CSI4_D3_P	IN
67	GND	GND	68	GND	GND
69	DP1_TXD1_N	OUT	70	DSI_D0_N	OUT
71	DP1_TXD1_P	OUT	72	DSI_D0_P	OUT

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Odd-Pin	Signal	Type	Even-Pin	Signal	Type
73	GND	GND	74	GND	GND
75	DP1_TXD2_N	OUT	76	DSI_CLK_N	OUT
77	DP1_TXD2_P	OUT	78	DSI_CLK_P	OUT
79	GND	GND	80	GND	GND
81	DP1_TXD3_N	OUT	82	DSI_D1_N	OUT
83	DP1_TXD3_P	OUT	84	DSI_D1_P	OUT
85	GND	GND	86	GND	GND
87	GPIO00	IO	88	DP0_HPD/GPIO3_P*.0n[1]	IN/IO
89	SPI0_MOSI	OUT	90	DP0_AUX_N	IO
91	SPI0_SCK	OUT	92	DP0_AUX_P	IO
93	SPI0_MISO	IN	94	HDMI_CEC	IO
95	SPI0_CS0#	OUT	96	DP1_HPD	IN
97	SPI0_CS1#	OUT	98	DP1_AUX_N	IO
99	UART0_TXD	OUT	100	DP1_AUX_P	IO
101	UART0_RXD	IN	102	GND	GND
103	UART0_RTS#	OUT	104	SPI1_MOSI	OUT
105	UART0_CTS#/GPIO3_P*.0m[2]	IN/IO	106	SPI1_SCK	OUT
107	GND	GND	108	SPI1_MISO	IN
109	USB0_D_N	IO	110	SPI1_CS0#	OUT
111	USB0_D_P	IO	112	SPI1_CS1#[3]	IN
113	GND	GND	114	CAM0_PWDN	OUT
115	USB1_D_N	IO	116	CAM0_MCLK	OUT
117	USB1_D_P	IO	118	GPIO01/CAM2_MCKL	IO/OUT
119	GND	GND	120	CAM1_PWDN	OUT
121	USB2_D_N	IO	122	CAM1_MCLK	OUT
123	USB2_D_P	IO	124	GPIO02	IO
125	GND	GND	126	GPIO03	IO
127	GPIO04	IO	128	GPIO05	IO
129	GND	GND	130	GPIO06	IO
131	PCIE0_RX0_N	IN	132	GND	GND
133	PCIE0_RX0_P	IN	134	PCIE0_TX0_N	OUT
135	GND	GND	136	PCIE0_TX0_P	OUT
137	PCIE0_RX1_N	IN	138	GND	GND
139	PCIE0_RX1_P	IN	140	PCIE0_TX1_N	OUT
141	GND	GND	142	PCIE0_TX1_P	OUT

[1] Pin 88 will be reconfigured into a GPIO. NX name: GPIO3_PM.00 / Nano name: GPIO3_PCC.06 / Target: MRAA

[2] Pin 105 will be reconfigured into a GPIO. NX name: GPIO3_PX.07 / Nano name: GPIO3_PD.04 / Target: MRAA

[3] Pin 112 will be reconfigured as a GPIO for the TACHO function use. GPIO name Jetson Nano: GPIO3_PDD.00 / GPIO name Jetson Xavier NX: GPIO3_PY.04

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Odd-Pin	Signal	Type	Even-Pin	Signal	Type
143	CAN_RX	IN	144	GND	GND
			Key		
145	CAN_TX	OUT	146	GND	GND
147	GND	GND	148	PCIE0_TX2_N	OUT
149	PCIE0_RX2_N	IN	150	PCIE0_TX2_P	OUT
151	PCIE0_RX2_P	IN	152	GND	GND
153	GND	GND	154	PCIE0_TX3_N	OUT
155	PCIE0_RX3_N	IN	156	PCIE0_TX3_P	OUT
157	PCIE0_RX3_P	IN	158	GND	GND
159	GND	GND	160	PCIE0_CLK_N	OUT
161	USBSS_RX_N	IN	162	PCIE0_CLK_P	OUT
163	USBSS_RX_P	IN	164	GND	GND
165	GND	GND	166	USBSS_TX_N	OUT
167	PCIE1_RX0_N	IN	168	USBSS_TX_P	OUT
169	PCIE1_RX0_P	IN	170	GND	GND
171	GND	GND	172	PCIE1_TX0_N	OUT
173	PCIE1_CLK_N	OUT	174	PCIE1_TX0_P	OUT
175	PCIE1_CLK_P	OUT	176	GND	GND
177	GND	GND	178	MOD_SLEEP#	OUT
179	PCIE_WAKE#	OD	180	PCIE0_CLKREQ#	IO
181	PCIE0_RST#	OUT	182	PCIE1_CLKREQ#	IO
183	PCIE1_RST#	OUT	184	GBE_MDI0_N	IO
185	I2C0_SCL	OD	186	GBE_MDI0_P	IO
187	I2C0_SDA	OD	188	GBE_LED_LINK	OUT
189	I2C1_SCL	OD	190	GBE_MDI1_N	IO
191	I2C1_SDA	OD	192	GBE_MDI1_P	IO
193	I2S0_DOUT	OD	194	GBE_LED_ACT	OUT
195	I2S0_DIN	OD	196	GBE_MDI2_N	IO
197	I2S0_FS		198	GBE_MDI2_P	IO
199	I2S0_SCLK	OD	200	GND	
201	GND		202	GBE_MDI3_N	IO
203	UART1_TXD	OUT	204	GBE_MDI3_P	IO
205	UART1_RXD	IN	206	GPIO07/LCD_BL_PWM	IO/OUT
207	UART1_RTS#		208	GPIO08/SD_CARD_DET	IO
209	UART1_CTS#		210	CLK_32K_OUT	OUT
211	GPIO09	IO	212	GPIO10/LCD_BL_EN	IO/OUT
213	CAM_I2C_SCL	OD	214	FORCE_RECOVERY#	IN
215	CAM_I2C_SDA	OD	216	GPIO11	IO
217	GND		218	GPIO12	IO
219	SDMMC_DAT0	IO	220	I2S1_DOUT	OUT
221	SDMMC_DAT1	IO	222	I2S1_DIN	IN

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Odd-Pin	Signal	Type	Even-Pin	Signal	Type
223	SDMMC_DAT2	IO	224	I2S1_FS	IO
225	SDMMC_DAT3	IO	226	I2S1_SCLK	IO
227	SDMMC_CMD	IO	228	GPIO13/PWM	IO/OUT
229	SDMMC_CLK	OUT	230	GPIO14/PWM	IO/OUT
231	GND		232	I2C2_SCL	OD
233	SHUTDOWN_REQ#	IO	234	I2C2_SDA	OD
235	PMIC_BBAT	IO	236	UART2_TXD	OUT
237	POWER_EN	IN	238	UART2_RXD	IN
239	SYS_RESET#	IO	240	SLEEP/WAKE#	IN
241	GND	Power	242	GND	Power
243	GND	Power	244	GND	Power
245	GND	Power	246	GND	Power
247	GND	Power	248	GND	Power
249	GND	Power	250	GND	Power
251	VDD_IN	Power	252	VDD_IN	Power
253	VDD_IN	Power	254	VDD_IN	Power
255	VDD_IN	Power	256	VDD_IN	Power
257	VDD_IN	Power	258	VDD_IN	Power
259	VDD_IN	Power	260	VDD_IN	Power

Table 15: NVIDIA Jetson Nano / Xavier NX Module Connector Pin Definition

Notes:
Pins marked light red are not used/supported with the Carrier Board.
Pins marked light blue are only available with Jetson Xavier NX.
Pins marked with light green are only available with Jetson Nano.
Pins marked with yellow are reconfigured for a different use.
Direction IN is into the module, OUT is from the module.

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3.10 M.2 Socket Key E for Wi-Fi / BT (2230)

The ROSCube Pico provides one M.2 socket with E Key and a standoff for 2230 sized Wi-Fi/BT modules (Wi-Fi 5/Wi-Fi 6). This m.2 socket with E key is located at CN4 on the carrier board. The pin definition is as follows:

Type	Signal	Pin	Pin	Signal	Type
Ground	GND	1	2	+V3P3	Power
BI	U2_USB2_DP	3	4	+V3P3	Power
BI	U2_USB2_DN	5	6	N/C	N/C
Ground	GND	7	8	I2S1_SCLK	In
N/C	N/C	9	10	I2S1_LRCK	In
N/C	N/C	11	12	I2S1_DIN	Out
N/C	N/C	13	14	I2S1_DOUT	In
N/C	N/C	15	16	N/C	N/C
N/C	N/C	17	18	GND	Ground
N/C	N/C	19	20	N/C	N/C
N/C	N/C	21	22	M2_UART1_RX	Out
N/C	N/C	23			
Key (24-31)					
Ground	GND	33	32	M2_UART1_TX	In
In	PCIE0_TX0_P	35	34	M2_UART1_CTS#	Out
In	PCIE0_TX0_N	37	36	M2_UART1_RTS#	In
	GND	39	48	N/C	N/C
Out	PCIE0_RX0_P	41	40	N/C	N/C
Out	PCIE0_RX0_N	43	42	N/C	N/C
	GND	45	44	N/C	N/C
In	PCIE0_CLK_P	47	46	N/C	N/C
In	PCIE0_CLK_N	49	48	N/C	N/C
Ground	GND	51	50	N/C	N/C
Out	PCIE0_CLKREQ#	53	52	PCIE0_RST#	In
Out	PCIE0_WAKE#	55	54	N/C	N/C
Ground	GND	57	56	N/C	N/C
		59	58	N/C	N/C
		61	60	N/C	N/C
Ground	GND	63	62	N/C	N/C
		65	64	N/C	N/C
		67	66	N/C	N/C
Ground	GND	69	68	N/C	N/C
		71	70	N/C	N/C
		73	72	+V3P3	Power
Ground	GND	75	74	+V3P3	Power
Ground	GND	G1	G2	GND	Ground

Table 16: M.2 Socket with E key Pin Definition

Note: Pins marked light red will not be used/supported with this Carrier Board.

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3.11 M.2 Socket Key M for NVMe (2242)

The ROSCube Pico (NPN-2B only) provides one M.2 socket with M-Key and a stand-off for 2242 sized PCIe-NVMe, utilizing one PCIe lane. This M.2 socket with M key is located at CN17 on the carrier board. The pin definition is as follows:

Type	Signal	Pin	Pin	Signal	Type
Ground	GND_P01	1	2	+V3P3_NVME	Power
Ground	GND	3	4	+V3P3_NVME	Power
	PERn3	5	6	N/C	
	PERp3	7	8	N/C	
Ground	GND	9	10	NVME_ACT#	Out
	PETn3	11	12	+V3P3_NVME	Power
	PETp3	13	14	+V3P3_NVME	Power
Ground	GND	15	16	+V3P3_NVME	Power
	PERn2	17	18	+V3P3_NVME	Power
	PERp2	19	20	N/C	
Ground	GND	21	22	N/C	
	PETn2	23	24	N/C	
	PETp2	25	26	N/C	
Ground	GND	27	28	N/C	
	PERn1	29	30	N/C	
	PERp1	31	32	N/C	
Ground	GND	33	34	N/C	
	PETn1	35	36	N/C	
	PETp1	37	38	DEVSLP	
Ground	GND	39	40	N/C	
Out	PCIE1_RX0_N	41	42	N/C	
Out	PCIE1_RX0_P	43	44	N/C	
Ground	GND	45	46	N/C	
In	PCIE1_TX0_N	47	48	N/C	
In	PCIE1_TX0_P	49	50	PCIE1_RST#	In
Ground	GND	51	52	PCIE1_CLKREQ#	OD
In	PCIE1_CLK_N	53	54	PCIE1_WAKE#	OD
In	PCIE1_CLK_P	55	56	N/C	
Ground	GND	57	58	N/C	
Key M (59-66)					
	N/C	67	68	SUSCLK_NVME	In
	CONFIG1	69	70	+V3P3_NVME	Power
Ground	GND	71	72	+V3P3_NVME	Power
Ground	GND	73	74	+V3P3_NVME	Power
Ground	GND_P75	75			
Ground	GND	G1	G2	GND	Ground

Table 17: M.2 Socket with M key Pin Definition

Note: Pins marked light red will not be used/supported with this Carrier Board.

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3.12 Fan Connector (board level)

The ROScube Pico carrier board is equipped with a 4-pin fan header with PWM and tachometer function. The fan connector is located at CN1 position on the carrier board.

Pin	Signal	Pin	Signal
1	FAN_CN_PWM	3	+V5P0_FAN
2	FAN_CN_TACHO	4	GND

Table 18: Fan Connector Pin Definition

3.13 MRAA Connector (board level)

MRAA connector has 40 pins and is located at CN7 on the carrier board. The pinout for NVIDIA Jetson Nano and Jetson Xavier NX modules is provided in the following table:

MRAA Connector									
Module Pin	Jetson Nano	Jetson NX		Pin Header			Jetson NX	Jetson Nano	Module Pin
			+V3P3	01	02	+V5P0			
191	I2C1_SDA	I2C1_SDA	I2C1_SDA	03	04	+V5P0			
189	I2C1_SCL	I2C1_SCL	I2C1_SCL	05	06	GND			
127	GPIO04	GPIO04	GPIO_04	07	08	UART0_TX	UART0_TXD	UART0_TXD	99
			GND	09	10	UART0_RX	UART0_RXD	UART0_RXD	101
128	GPIO05	GPIO05	GPIO_05	11	12	GPIO1_0_PWM	EGPIO	EGPIO	
130	GPIO06	GPIO06	GPIO_06	13	14	GND			
126	GPIO03	GPIO03	GPIO_03	15	16	GPIO1_1_PWM	EGPIO	EGPIO	
			+V3P3	17	18	GPIO1_2_PWM	EGPIO	EGPIO	
89	SPI0_MOSI	SPI0_MOSI	SPI0_MOSI	19	20	GND			
93	SPI0_MISO	SPI0_MISO	SPI0_MISO	21	22	GPIO1_3_PWM	EGPIO	EGPIO	
91	SPI0 CLK	SPI0 CLK	SPI0 CLK	23	24	SPI0_CS0#	SPI0_CS0#	SPI0_CS0#	95
			GND	25	26	SPI0_CS1#	SPI0_CS1#	SPI0_CS1#	97
187	I2C0_SDA	I2C0_SDA	I2C0_SDA	27	28	I2C0_SCL	I2C0_SCL	I2C0_SCL	185
124	GPIO02	GPIO02	GPIO_02	29	30	GND			
212	GPIO10	GPIO10	GPIO_10	31	32	GPIO1_4_PWM	EGPIO	EGPIO	
218	GPIO12	GPIO12_PWM	GPIO_12	33	34	GND			
206	GPIO07	GPIO07	GPIO_07_PWM	35	36	GPIO1_5_PWM	EGPIO	EGPIO	
228	GPIO13_PWM	GPIO13_PWM	GPIO_13_PWM	37	38	GPIO1_6_PWM	EGPIO	EGPIO	
			GND	39	40	GPIO1_7_PWM	EGPIO	EGPIO	

Table 19: MRAA Connector Pin Definition

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3.14 Power Management Header (board level)

Power Management Header									
Module Pin	Jetson Nano	Jetson NX		Pin Header			Jetson NX	Jetson Nano	Module Pin
-/-	-/-	-/-	PC_LED_K	01	02	PC_LED_A (+V5P0)	-/-	-/-	-/-
238	UART2_ RXD	UART2_ RXD	3V3_UART2_RX	03	04	3V3_UART2_TX	UART2_TXD	UART2_TXD	236
-/-	-/-	-/-	LATCH_SET	05	06	LATCH_SET_BUT	-/-	-/-	-/-
			GND	07	08	SYS_RST#	SYS_RESET*	SYS_RESET*	239
			GND	09	10	FORCE_ RECOVERY#	FORCE_ RECOVERY*	FORCE_ RECOVERY*	214
			GND	11	12	PWR_BTN#	SLEEP*_WAKE*	SLEEP*_WAKE*	240

Table 20: Power Management Header Pin Definition

Notes:

- A jumper is installed shorting pins 5 and pin 6 by default to set the device to “Power Button Mode.” If the jumper is removed, the device will be set to “Auto Power-On Mode.” For a description of the power button functionality, refer to *3.6 Power Button* on page 18.
- Do not install jumpers on any other pins on the Power Mangement Header, as this may lead to system malfunction.

3.15 Microphone Connector (board level)

The ROScube Pico carrier board provides a mono microphone input.

Pin	Signal
1	AUD0_IN1_CN_P
2	AUD0_IN1_CN_N or GND_AUDIO

Table 21: Microphone Connector Pin Definition

3.16 Status LEDs (board level)

Refer to Figure 8: Carrier Board Connectors (top)and Figure 9: Carrier Board Connectors (bottom) for status LED locations.

LED	Color	Behavior
Standby	Blue	On when system in Standby mode.
Power	Green	On when system is powered up
SD Card	Green	On when SD card is detected Flashing when SD card is active
NVMe Module	Amber	On when NVMe module is detected Flashing when NVMe module is active

Table 22: Status LED Descriptions

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3.17 microSD Card Slot (board level)

The ROScube Pico is equipped with a microSD card slot on the carrier board (see *Figure 9: Carrier Board Connectors (bottom)* on page 12).

3.18 RTC Battery (board level)

The ROScube Pico Carrier Board is equipped with an RTC Battery CR2032 3V Li VARTA, The battery is glued to back of GbE ports.

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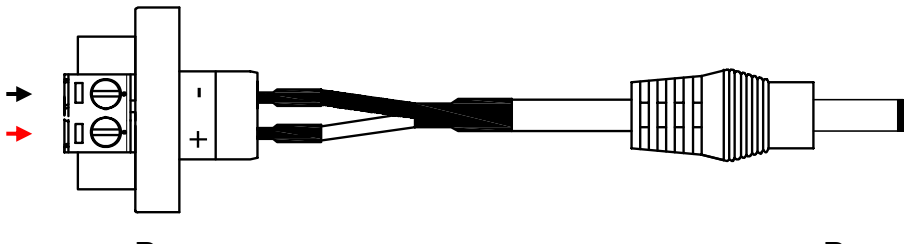
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4 Getting Started

4.1 Connect the DC plug adapter cable

Locate the DC plug adapter cable, included in the accessory box (shown below). Insert to the DC output wires of the AC adapter into the terminal block P1 as indicated: negative (black) to “-“ and positive (red) to “+”.



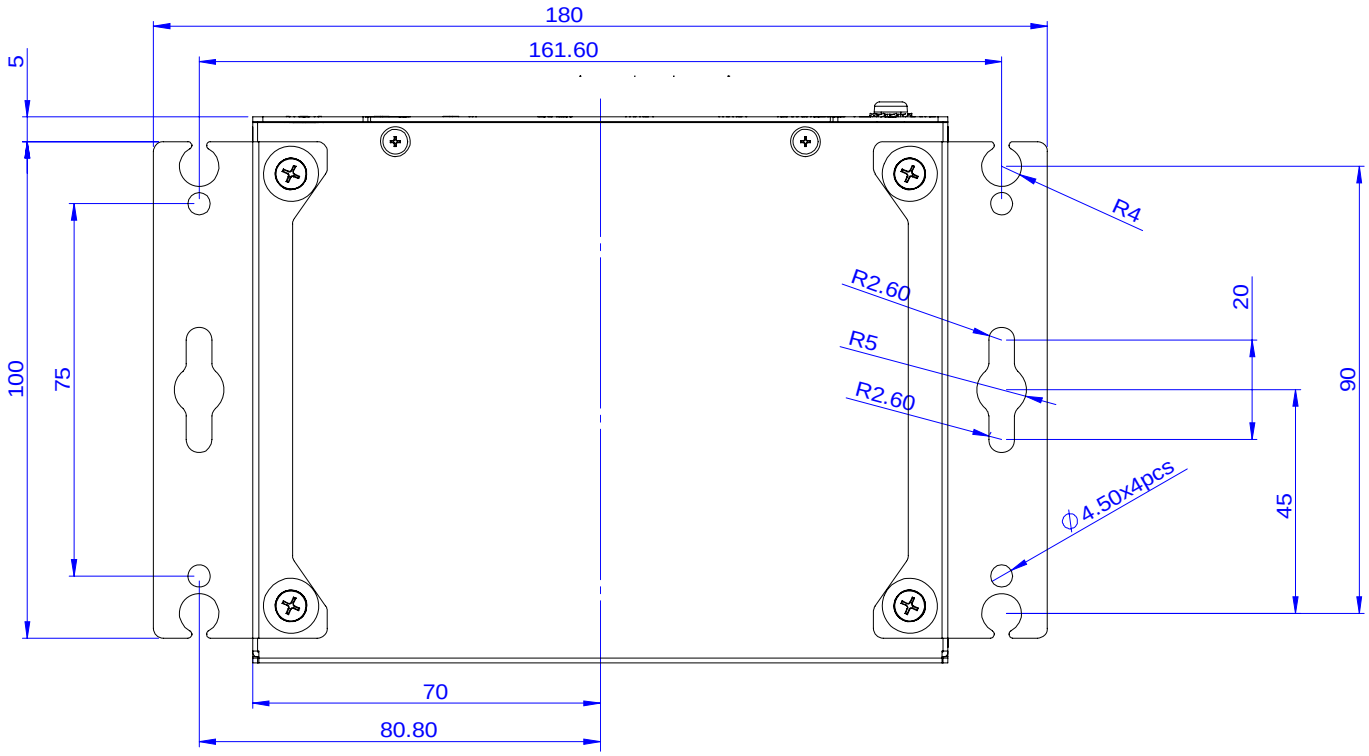
Insert the DC plug P2 into the DC power input jack on the front panel (see Figure 5: Front Panel I/O on page 9).

4.2 Mounting the ROSCube Pico

Attach the 2 included wall-mount brackets to the chassis as shown below.

Mount the device to a wall using the keyhole openings indicated or mounting holes, according to the spacing dimensions of the holes in the bracket as shown below.

All dimensions shown in millimeters



Safety Instructions

Read and follow all instructions marked on the product and in the documentation before you operate your system. Retain all safety and operating instructions for future use.

- Please read these safety instructions carefully.
- Please keep this User‘s Manual for later reference.
- Read the specifications section of this manual for detailed information on the operating environment of this equipment.
- When installing/mounting or uninstalling/removing equipment, turn off the power and unplug any power cords/cables.
- Operating temperature range:
  - -20°C to 50°C (-4°F to 122°F) with 0.6m/s airflow
  - -20°C to 65°C (-4°F to 149°F with 1.2GHz CPU) with 0.6m/s airflow
- To avoid electrical shock and/or damage to equipment:
  - Keep equipment away from water or liquid sources.
  - Keep equipment away from high heat or high humidity.
  - Keep equipment properly ventilated (do not block or cover ventilation openings).
  - Make sure to use recommended voltage and power source settings.
  - Always install and operate equipment near an easily accessible electrical socket-outlet.
  - Secure the power cord (do not place any object on/over the power cord).
  - Only install/attach and operate equipment on stable surfaces and/or recommended mountings.
  - If the equipment will not be used for long periods of time, turn off and unplug the equipment from its power source.
- Never attempt to fix the equipment. Equipment should only be serviced by qualified personnel.

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Getting Service

Ask an Expert: http://askanexpert.adlinktech.com

ADLINK Technology, Inc.
Address: No. 66, Huaya 1st Road, Guishan District
Taoyuan City 333, Taiwan
Tel: +886-3-216-5088
Fax: +886-3-328-5723
Email: service@adlinktech.com

Ampro ADLINK Technology, Inc.
Address: 6450 Via Del Oro, San Jose, CA 95119-1208, USA
Tel: +1-408-360-0200
Toll Free: +1-800-966-5200 (USA only)
Fax: +1-408-600-1189
Email: info@adlinktech.com

ADLINK Technology (China) Co., Ltd.
Address: 300 Fang Chun Rd., Zhangjiang Hi-Tech Park, Pudong New Area
Shanghai, 201203 China
Tel: +86-21-5132-8988
Fax: +86-21-5132-3588
Email: market@adlinktech.com

ADLINK Technology GmbH
Hans-Thoma-Straße 11
D-68163 Mannheim, Germany
Tel: +49-621-43214-0
Fax: +49-621 43214-30
Email: germany@adlinktech.com

Please visit the Contact page at www.adlinktech.com for information on how to contact the ADLINK regional office nearest you.

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