ROScube-I Series

Embedded Real-Time Robotic Controller with
Intel® Xeon®/Core™ Processor

RQI-58/57/55/53, RQI-58-E/57-E/55-E/53-E

User's Manual





Manual Rev.: 1.2

Revision Date: December 18, 2020

Part No: 50-1Z314-1020

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Leading **EDGE COMPUTING**

Revision History

Revision	Release Date	Description of Change(s)
1.0	2020-07-15	Initial release
1.1	2020-09-04	Updated section 4 and Appendix D; Updated Important Safety Information and warning and caution notes in Appendix B
1.2	2020-12-18	Updated CANbus module info, AC/DC adapter P/N, airflow info, power source requirements; added wall mounting note; updated WDT info, paths in Appendix D: I/O Operation

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Preface

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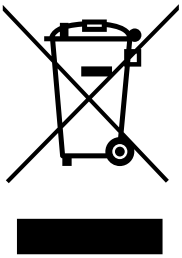
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Conventions

Take note of the following conventions used throughout this manual to make sure that users perform certain tasks and instructions properly.

NOTE:

Additional information, aids, and tips that help users perform tasks.

CAUTION:

Information to prevent ***minor*** physical injury, component damage, data loss, and/or program corruption when trying to complete a task.
ATTENTION: Informations destinées à prévenir les blessures corporelles mineures, les dommages aux composants, la perte de données et/ou la corruption de programme lors de l'exécution d'une tâche.

WARNING:

Information to prevent ***serious*** physical injury, component damage, data loss, and/or program corruption when trying to complete a specific task.
AVERTISSEMENT: Informations destinées à prévenir les blessures corporelles graves, les dommages aux composants, la perte de données et/ou la corruption de programme lors de l'exécution d'une tâche spécifique.

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1 Introduction

1.1 Overview

The ADLINK ROScube-I Series Embedded Real-Time Robotic Controller is powered by the Intel® Xeon®/Core™ processor, and features exceptional I/O connectivity enabling a wide variety of sensors and actuators for unlimited robotic applications. Also supported are Intel® VPU and NVIDIA GPU cards for computation of AI algorithms and inference calculations. ROScube-I is a perfect platform for development of industrial use service robotic applications such as autonomous mobile robots (AMR) and autonomous mobile industrial robots (AMIR).

1.2 Features

- x86-64 mainstream architecture for ROS 2 development
- Comprehensive I/O for connecting a wide range of devices
- Ruggedized, secure connectivity with locking USB ports
- External PCIe Gen3 expansion with ruggedized cassette ("E" expansion box models only)
- Integrated hard and soft real-time mechanism

1.3 Packing List

Before unpacking, check the shipping carton for any damage. If the shipping carton and/or contents are damaged, inform your dealer immediately. Retain the shipping carton and packing materials for inspection. Obtain authorization from your dealer before returning any product to ADLINK. Ensure that the following items are included in the package.

- ROScube-I Series Fanless Embedded Computer
- Accessory Box
  - DC power terminal block
  - Wall-mount brackets
  - Screw pack
  - CANbus cable x2 (one for PEAK, one for FARO-FP900)

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1.4 Optional Accessories

- **AC/DC Adapter**
  - 160W (P/N: 31-62120-0010)
  - 220W (P/N: 31-62149-0000)
  - 280W (P/N: 31-62162-1010-A0, for “E” expansion box models)
- **Wi-Fi Module:** Intel® Wireless-AC9260 M.2 2230, Dual-Band 2x2 Wi-Fi + Bluetooth 5 kit (P/N: TBD)
- **CANbus Module:** Dual channel: FARO-FP900 (P/N: 92-97142-0020)
- **DDR4 SO-DIMM Memory**
  - 8 GB DDR4 2400 MHz Dual Channel non-ECC memory (P/N: 29-6B800-L430)
  - 16 GB DDR4 2400 MHz Dual Channel non-ECC memory (P/N: 29-6BC00-L430)

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2 Specifications

2.1 RQI-58(-E), RQI-57(-E)

	RQI-58(-E)	RQI-57(-E)
System Core		
Processor	Intel® Xeon® E-2276ME 45W	Intel® Core™ i7-9850HE 45W
Cores	6	6
Base Freq.	2.8 GHz	2.7 GHz
MAX Turbo Freq.	4.5 GHz	4.4 GHz
Chipset	Mobile Intel® CM246	
Memory	32GB DDR4 2400MHz installed, dual SODIMMs	
I/O Interface		
Display	2x DP++ and 1x HDMI	
Ethernet	4x Intel® GbE: 3x i211AT + 1x i219 iAMT support	
Serial Ports	COM1/2: RS-232/422/485	
USB	2x USB 3.1 Gen1 Type A with lockable connectors 4x USB 3.1 Gen 1 Type A 4x USB 2.0 Type A	
Multi-I/Os on DB 50 connector (supports real time OS)	• Two channels I^2C • 8x Digital Input: VIH: 2 to 5.25V; VIL: 0 to 0.8V • 8x Digital Output: VOH: 2.4 to 5V; VOL: 0 to 0.5V; current: 24mA/per channel Optional (if modules installed on system): • Dual Channel: FARO-FP900, PEAK IPEH-003049* • Single Channel: PEAK IPEH-003048* *Note: Modules support real time OS	
Mini PCIe	2x full size (one for CANbus, one for Wi-Fi or LTE)	
M.2	1x Socket 1, Key A and A+E key, 2230 for Wi-Fi	
USIM	1 for Mini PCIe	
TPM 2.0	Supported	
LED Indicators	• Watchdog Timer • Drive Activity • Diagnostic • 5x User Defined	

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	RQI-58(-E)	RQI-57(-E)
Storage		
M.2 B Key or B+M Key	256GB mSATA SSD	
PCIe Expansion (“E” models w/ expansion box only)		
PCIe Slots	1x PCIe x16 Gen3 1x PCIe x4 Gen3	
Physical		
Dimensions	Standard: 210 (W) x 240 (D) x 86 (H) mm (8.27" x 9.45" x 3.39") “E” models w/ expansion box: 210 (W) x 240 (D) x 165(H) mm (8.27” x 9.45” x 6.5”)	
Weight	Standard: 3.6 kg (8 lbs) “E” models w/ expansion box: 4.6 kg (10.1 lbs)	
Mounting	Wall mount	
Power		
DC Input	9 to 32V (± 10% tolerance)	
AC Input	Optional: 160W, 220W or 280W AC/DC power adapter (see “Optional Accessories” on page 2, 280W for “E” expansion box models)	
Power Switch	1x power ON/OFF button	
System Reset	Hardware reset button	
Ext. Power Header	1x extended power on/off button for robot system	
Environmental		
Operating Temperature	(w/ ind. storage, 0.6m/s airflow) -20°C to 70°C (-4°F to 158°F) (single SODIMM only) -20°C to 60°C (-4°F to 140°F) (w/ dual SODIMMs)	
Storage Temperature	-40°C to 85°C (-40°F to 185°F) (excluding storage)	
Humidity	approx. 95% @ 40°C (104°F) (non-condensing)	
Vibration	IEC 60068-2-6: 1G, 5-500Hz, 3 axes IEC 60068-2-64: Operating 5Grms, 5-500 Hz, 3 axes w/ M.2 SSD	
Shock	MIL-STD-202G Method 213B,Table 213-I Condition A Operating: 100G, half sine 11ms duration w/ M.2 SSD	

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	RQI-58(-E)	RQI-57(-E)
Environmental (cont'd)		
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)	
EMI	CE & FCC Class B with validated AC/DC adapter (EN61000-6-4/-2)	
Safety	UL/cUL, CB	

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2.2 RQI-55(-E), RQI-53(-E)

	RQI-55(-E)	RQI-53(-E)
System Core		
Processor	Intel® Core™ i5-8400H 45W	Intel® Core™ i3-9100HL 25W
Cores	4	4
Base Freq.	2.5 GHz	1.6 GHz
MAX Turbo Freq.	4.2 GHz	2.9 GHz
Chipset	Mobile Intel® CM246	
Memory	16GB DDR4 2400MHz installed, single SODIMM (max 32GB)	8GB DDR4 2400MHz installed, single SODIMM (max 32GB)
I/O Interface		
Display	2x DP++ and 1x HDMI	
Ethernet	4x Intel® GbE: 3x i211AT + 1x i219 iAMT support	
Serial Ports	COM1/2: RS-232/422/485	
USB	2x USB 3.1 Gen1 Type A with lockable connectors 4x USB 3.1 Gen 1 Type A 4x USB 2.0 Type A	
Multi-I/Os on DB 50 connector (supports real time OS)	• Two channels I^2C • 8x Digital Input: VIH: 2 to 5.25V; VIL: 0 to 0.8V • 8x Digital Output: VOH: 2.4 to 5V; VOL: 0 to 0.5V; current: 24mA/per channel Optional (if modules installed on system): • Dual Channel: FARO-FP900, PEAK IPEH-003049* • Single Channel: PEAK IPEH-003048* *Note: Modules support real time OS	
Mini PCIe	2x full size (one for CANbus, one for Wi-Fi or LTE)	
M.2	1x Socket 1, Key A and A+E key, 2230 for Wi-Fi	
USIM	1 for Mini PCIe	
TPM 2.0	Supported	
LED Indicators	• Watchdog Timer • Drive Activity • Diagnostic • 5x User Defined	

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	RQI-55(-E)	RQI-53(-E)
Storage		
M.2 B Key or B+M Key	128GB mSATA SSD	64GB mSATA SSD
PCIe Expansion (“E” models w/ expansion box only)		
PCIe Slots	1x PCIe x16 Gen3 1x PCIe x4 Gen3	
Physical		
Dimensions	Standard: 210 (W) x 240 (D) x 86 (H) mm (8.27" x 9.45" x 3.39") “E” models w/ expansion box: 210 (W) x 240 (D) x 165(H) mm (8.27” x 9.45” x 6.5”)	
Weight	Standard: 3.6 kg (8 lbs) “E” models w/ expansion box: 4.6 kg (10.1 lbs)	
Mounting	Wall mount	
Power		
DC Input	9 to 32V (± 10% tolerance)	
AC Input	Optional: 160W, 220W or 280W AC/DC power adapter (see “Optional Accessories” on page 2, 280W for “E” expansion box models)	
Power Switch	1x power ON/OFF button	
System Reset	Hardware reset button	
Ext. Power Header	1x extended power on/off button for robot system	
Environmental		
Operating Temperature	(w/ ind. storage, 0.6m/s airflow) -20°C to 70°C (-4°F to 158°F) (single SODIMM only) -20°C to 60°C (-4°F to 140°F) (w/ dual SODIMMs)	
Storage Temperature	-40°C to 85°C (-40°F to 185°F) (excluding storage)	
Humidity	approx. 95% @ 40°C (104°F) (non-condensing)	
Vibration	IEC 60068-2-6: 1G, 5-500Hz, 3 axes IEC 60068-2-64: Operating 5Grms, 5-500 Hz, 3 axes w/ M.2 SSD	
Shock	MIL-STD-202G Method 213B,Table 213-I Condition A Operating: 100G, half sine 11ms duration w/ M.2 SSD	

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	RQI-55(-E)	RQI-53(-E)
Environmental (cont'd)		
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)	
EMI	CE & FCC Class B with validated AC/DC adapter (EN61000-6-4/-2)	
Safety	UL/cUL, CB	

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2.3 ROScube-I Series Functional Block Diagram

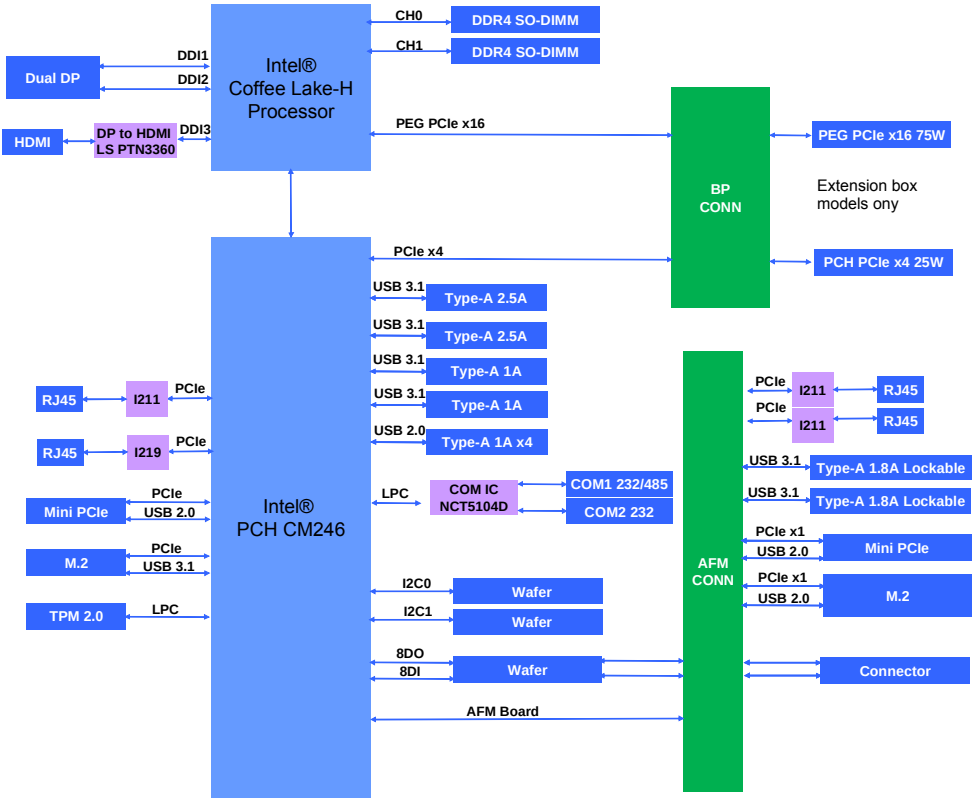


Figure 2-1: ROScube-I Series Functional Block Diagram

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2.4 Display Options

With computing and graphic performance enhancement from its 8th and 9th Generation Intel® processors, the ROScube-I Series controller can support three independent displays in the following configurations.

	Port	Resolution
Display Option 1	DisplayPort1	4096x2304@60Hz
Display Option 2	DisplayPort2	4096x2304@60Hz
Display Option 3	HDMI 1.4 (Native)	4096x2160@30Hz

Table 2-1: Maximum Display Resolution Configurations

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2.5 Mechanical Dimensions

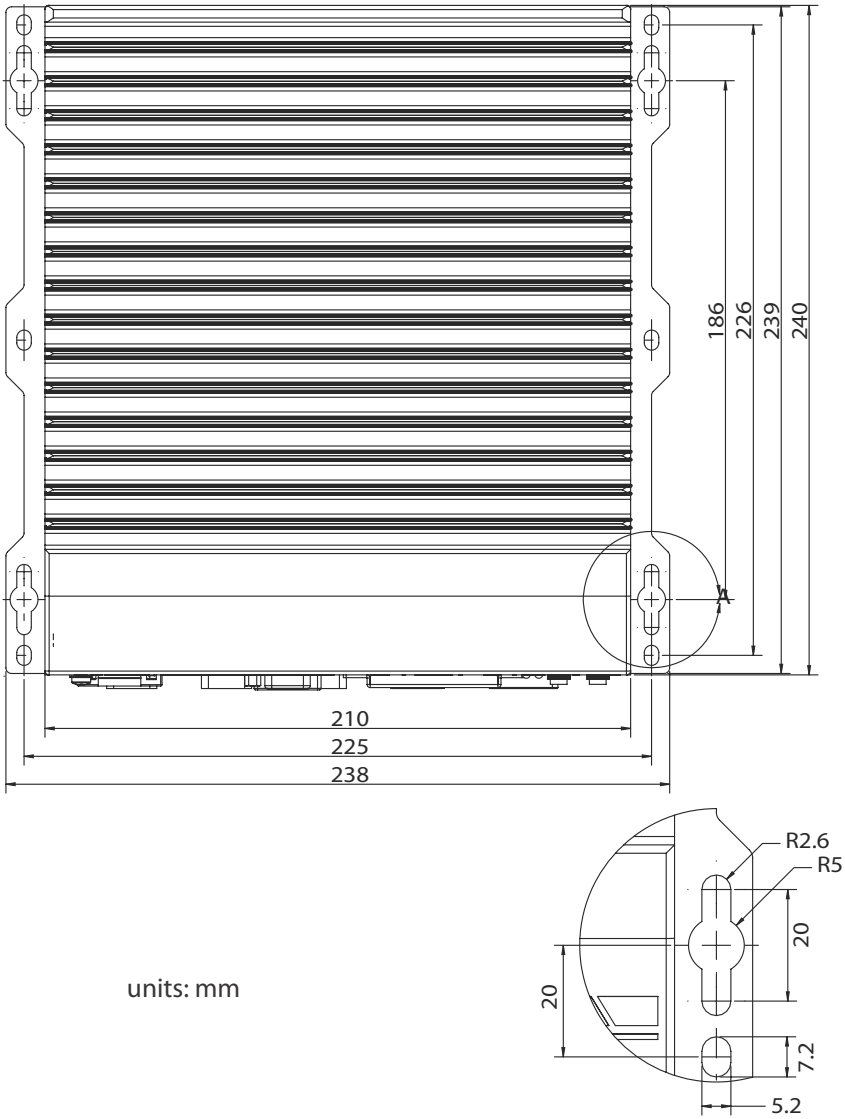


Figure 2-2: ROScube-I Series Top View

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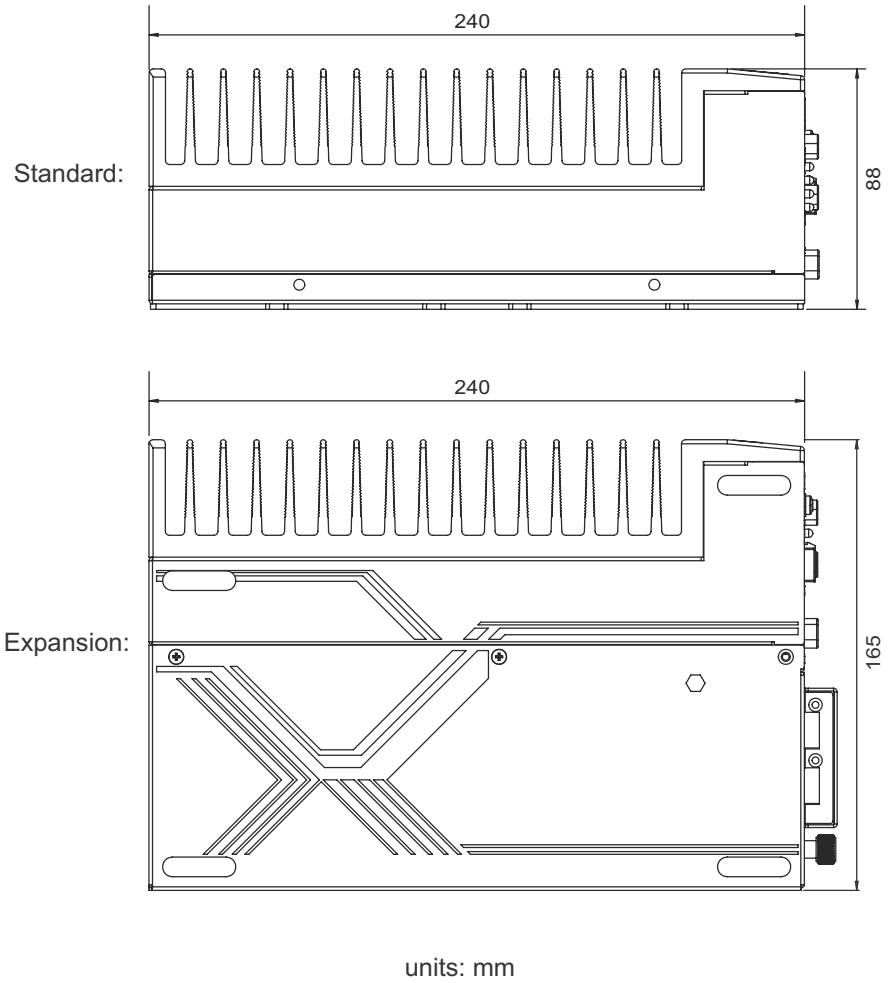


Figure 2-3: ROScube-I Series Side View

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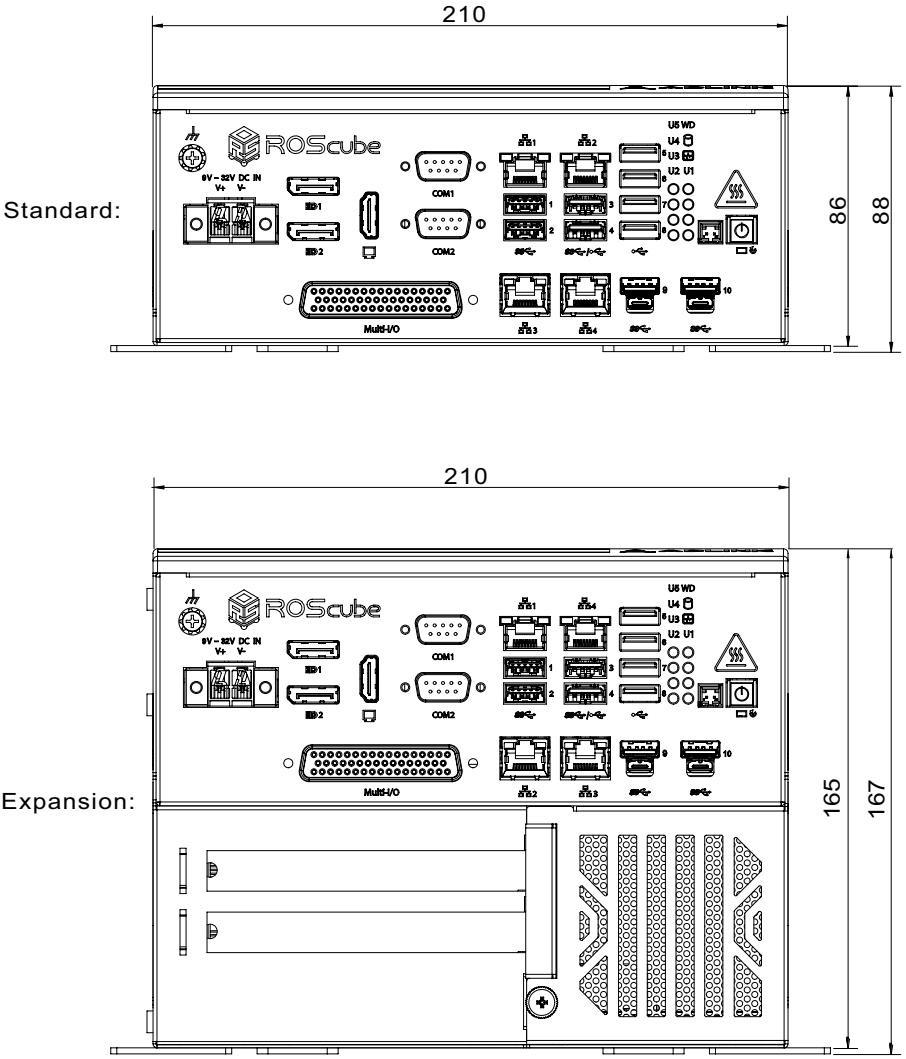


Figure 2-4: ROScube-I Series Front View

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3 System Layout

3.1 Front Panel

The ROScube-I Series provides the following front panel access features.

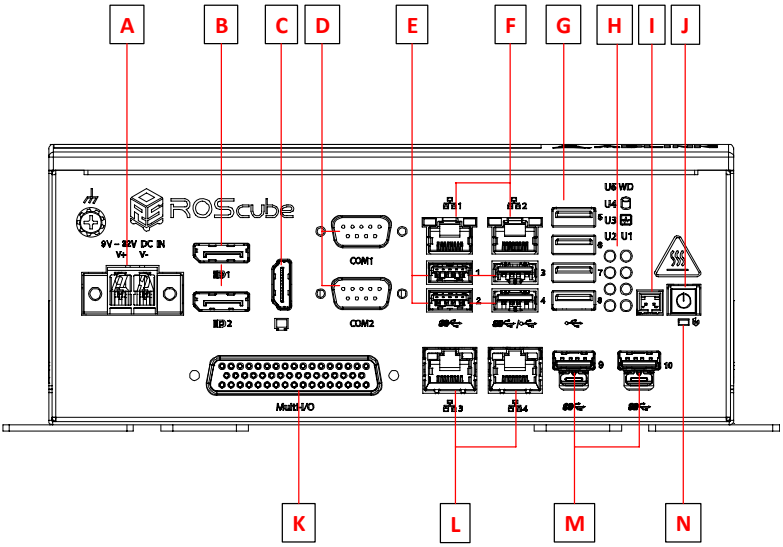


Figure 3-1: Front Panel I/O

A	DC Power Supply	**H**	LED Indicators
B	DisplayPort x2	**I**	Extend Power Button Connector
C	HDMI Connector	**J**	Power Button
D	COM Port x2	**K**	Multi-I/O port
E	USB 3.1 Type-A x4	**L**	Gigabit Ethernet x2
F	Gigabit Ethernet x2	**M**	USB 3.1 Type-A x2 (lockable)
G	USB 2.0 Type-A x4	**N**	Reset Button

Table 3-1: Front Panel I/O Legend

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The ROScube-I Series “E” models with expansion box provide two PCI Express expansion slots.

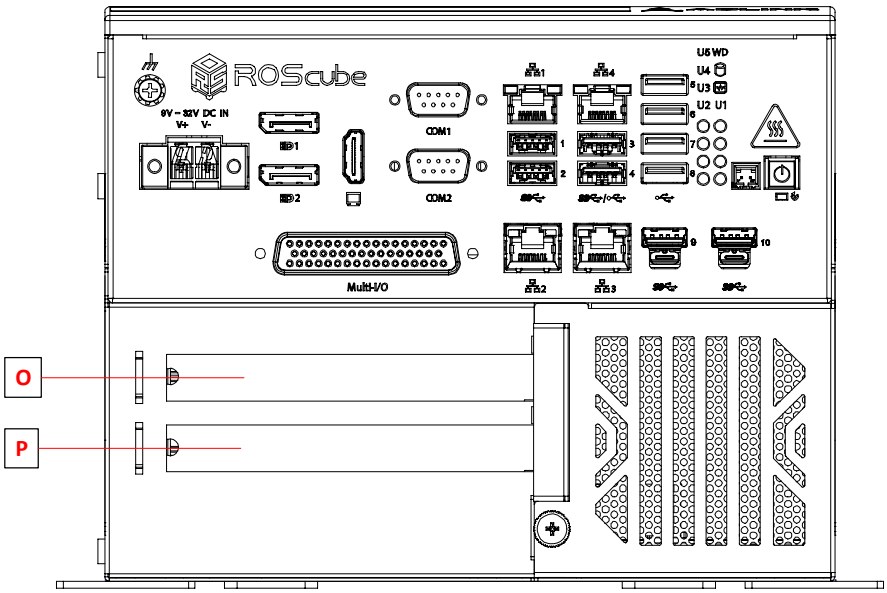


Figure 3-2: Front Panel I/O - Expansion Box

O	PCIe x16 slot (max. power 75W)
P	PCIe x4 slot (max. power 25W)

Table 3-2: Front Panel I/O - Expansion Box Legend

3.1.1 Power Button

The power button is a non-latched push button with a blue LED indicator. The system is turned on when the button is pressed, and the power LED lights. If the system hangs, press and hold the button for 5 seconds to turn it off.

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3.1.2 LED Indicators

In addition to the power button, eight LEDs on the front panel indicate the following.

LED Indicator	Color	Description
Watchdog (WD)	Yellow	Indicates watchdog timer status. When watchdog timer starts, the LED flashes. When the timer is expired, the system will auto reboot.
Hard disk drive (HD)	Orange	Indicates the HDD operating state. When the SATA hard drive or CFast card is active, the LED indicator flashes.
Diagnostic (DG)	Green	When continuously lit, indicates no physical storage is connected, and if blinking, indicates no memory is installed in either SODIMM socket.
User defined (U1)	Red	User defined.
User defined (U2)	Green	User defined.
User defined (U3)	Green	User defined.
User defined (U4)	Green	User defined.
User defined (U5)	Green	User defined.

3.1.3 Reset Button

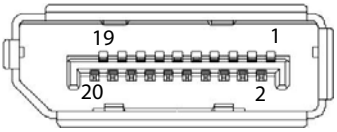
The reset button executes a hard system reset.

3.1.4 DisplayPort Connectors

Two DisplayPort connectors on the front panel can connect to VGA, DVI, HDMI and DisplayPort monitors via DisplayPort to VGA

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adapter cable, DisplayPort to DVI adapter cable, or DisplayPort to HDMI adapter cable and DisplayPort cable.



Pin	Signal	Pin	Signal
1	CN_DDPx0+	11	GND
2	GND	12	CN_DDPx3-
3	CN_DDPx0-	13	CN_DDPx_AUX_SEL
4	CN_DDPx1+	14	CN_DDPx_CONFIG2
5	GND	15	CN_DDPx_AUX+
6	CN_DDPx1-	16	GND
7	CN_DDPx2+	17	CN_DDPx_AUX-
8	GND	18	CN_DDPx_HPD
9	CN_DDPx2-	19	GND
10	CN_DDPx3+	20	+V3.3_DDPx_PWR_CN

Table 3-3: DisplayPort Pin Definition

P/N	Description
30-01119-0010	Active DisplayPort to HDMI adapter cable
30-01120-0010	Active DisplayPort to DVI adapter cable
30-01121-0010	Active DisplayPort to VGA adapter cable

Table 3-4: Applicable Cable Types

3.1.5 Multi-I/O DB-50 Connector

The ROScube-I provides comprehensive I/O for autonomous robotics including two channels CANbus, two channels I2C and eight channels DI/DO.

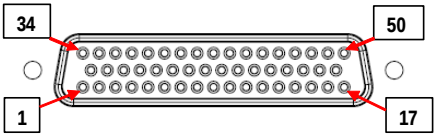
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8-channel Digital Input

- VIH: 2 to 5.25V
- VIL: 0 to 0.8V

8-channel Digital Output

- Output type: Open drain N-channel
- MOSFET driver with internal pull high of 200Ω resistance.
- Source/Sink current for all channels: 24mA
- VOH: 2.4 to 5V
- VOL: 0 to 0.5V



Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	CN_DI0	14	P_+5V_S_CN	27	GND	40	CN_DO6
2	CN_DI1	15	P_+3V3_S_CN	28	GND	41	CN_DO7
3	CN_DI2	16	CON_I2C1_SDA	29	GND	42	GND
4	CN_DI3	17	CON_I2C1_SCL	30	GND	43	CON_PORT0_CAN-H
5	CN_DI4	18	GND	31	GND	44	CON_PORT1_CAN-H
6	CN_DI5	19	GND	32	GND	45	GND
7	CN_DI6	20	GND	33	GND	46	PCH_I2C0_GPIO
8	CN_DI7	21	GND	34	CN_DO0	47	GND
9	GND	22	GND	35	CN_DO1	48	PCH_AFM_GPIO5
10	CON_PORT0_CAN-L	23	GND	36	CN_DO2	49	GND
11	CON_PORT1_CAN-L	24	GND	37	CN_DO3	50	GND
12	CON_I2C0_SDA	25	GND	38	CN_DO4		
13	CON_I2C0_SLC	26	GND	39	CN_DO5		

Table 3-5: Multi-I/O DB-50 Connector Pin Definition

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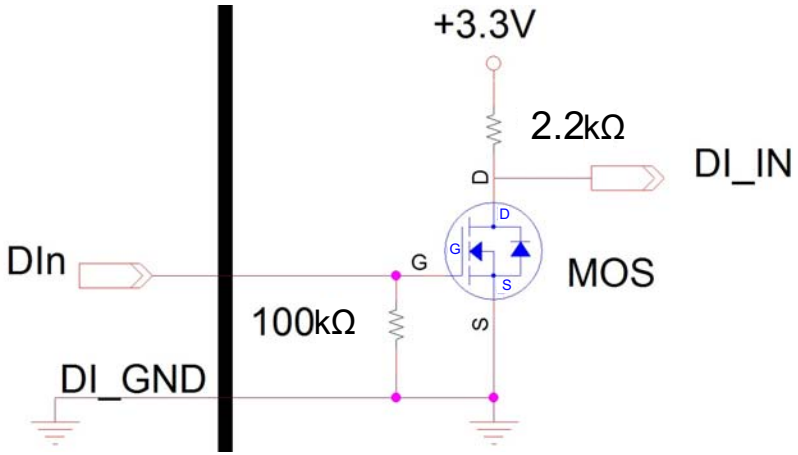


Figure 3-3: Digital Input Circuit

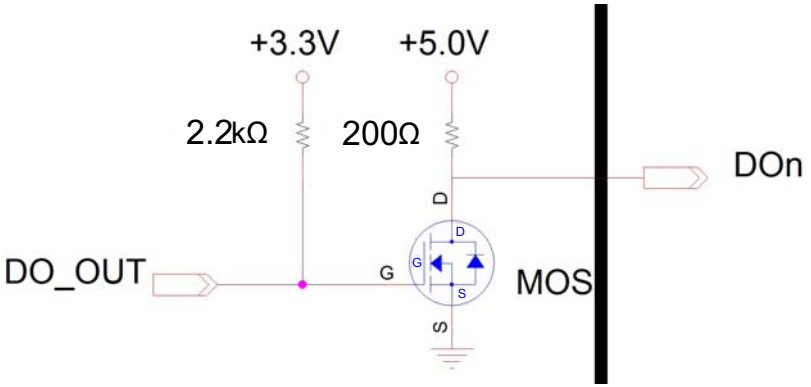


Figure 3-4: Digital Output Circuit

CANbus

By default, a CANbus module is not installed on the system. Tested module types and vendor information are listed in the table below. The PEAK CANbus module has been integrated into our RTOS software and this module can be selected for real-time systems.

PEAK system		ANTZER
Single Channel	Dual Channel	Dual Channel
IPEH-003048	IPEH-003049	FARO-FP900 (P/N: 92-97142-0020)
RT-Linux	RT-Linux	-

Table 3-6: CANbus Module Support Table

Eight channels digital input and digital output are provided for event/trigger. See the parameter table below.

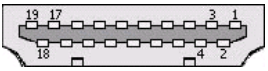
	Digital Input	Digital Output
Channels	8	8
VIH	2 to 5.25 VDC	—
VIL	0 to 0.8 VDC	—
VOH	—	2.4 to 5V
VOL	—	0 to 0.5V
Current	—	24mA per channel

Table 3-7: DI/DIO Parameter Table

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3.1.6 HDMI Connector

The ROScube-I Series provides one HDMI connector for connection to an external monitor.



Pin #	Signal	Pin #	Signal
1	TMDS Data2+	2	TMDS Data2 Shield
3	TMDS Data2–	4	TMDS Data1+
5	TMDS Data1 Shield	6	TMDS Data1–
7	TMDS Data0+	8	TMDS Data0 Shield
9	TMDS Data0–	10	TMDS Clock+
11	TMDS Clock Shield	12	TMDS Clock–
13	CEC	14	Reserved
15	SCL	16	SDA
17	DDC/CEC Ground	18	+5 V Power
19	Hot Plug Detect		

Table 3-8: HDMI Connector Pin Definition

3.1.7 USB 2.0 Ports

The ROScube-I Series provides four USB 2.0 ports supporting Type-A USB connection on the front panel. All USB ports are compatible with high-speed, full-speed and low-speed USB devices. The ROScube-I Series supports multiple boot devices, including USB flash drive, USB external hard drive, USB floppy, USB CD-ROM and others. The boot priority and boot device can be configured in BIOS.

USB 5-8
• Speed: 480Mbps • Color: Black • Voltage: 5V • Current: 500mA continue • Inrush current: 550mA max • Protection: OVP, OCP

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3.1.8 USB 3.1 Ports

The ROScube-I provides 2x USB 3.1 Gen1 Type A lockable ports and 4x USB 3.1 Gen1 Type A standard ports on the front panel. All USB 3.1 ports are compatible with SuperSpeed Gen1, high-speed, full speed, and low-speed USB device.

USB 1-2	USB 3-4	USB 9-10 (lockable)
• Speed: 5G/bps • Color: Red • Voltage: 5V • Current: 2.5A continue • Inrush current: 3A max • Protection: OVP, OCP	• Speed: 5G/bps • Color: Blue • Voltage: 5V • Current: 1A continue • Inrush current: 1.1A max • Protection: OVP, OCP	• Speed: 5G/bps • Color: Black • Voltage: 5V • Current: 1.8A continue • Inrush current: 2A max • Protection: OVP, OCP

3.1.9 Gigabit Ethernet Ports

Four Gigabit Ethernet ports on the front panel support Intel WGI211AT and WGI219LM Gigabit Ethernet PHY controller and connection, providing

- IEEE 802.3az Energy Efficient Ethernet
- IEEE 1588/802.1AS precision time synchronization
- IEEE 802.3Qav traffic shaper
- Interrupt moderation, VLAN support, IP checksum offload
- RSS and MSI-X to lower CPU utilization in multi-core systems
- ECC - error correcting memory in packet buffers
- Wake-On-LAN
- Preboot eXecution Environment (PXE) flash interface
- Jumbo frame support

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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 3-9: Ethernet Port Pin Definition

Speed LED Green/Orange	Active/Link Yellow

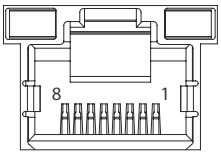


Figure 3-5: Ethernet Port and LEDs

LED Color	Status	Description
Yellow	OFF	Ethernet port is disconnected.
	ON	Ethernet port is connected with no activity.
	Flashing	Ethernet port is connected and active.

Table 3-10: Active/Link LED Indicators

LED Color	Status	Description
Green/Orange	OFF	10 Mbps
	Green	100 Mbps
	Orange	1000 Mbps

Table 3-11: Speed LED Indicators

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3.1.10 DC Power Input

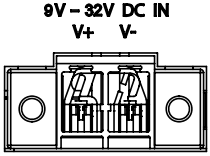


Figure 3-6: DC Power Input

Pin	Signal
1	V+ (DC_IN)
2	V- (DGND)

Table 3-12: DC Power Input Pin Definition

Refer to Section 4.1: Attaching the DC Power Connector on page 33 to install the DC Power Connector to the DC Power Input.

Please use an approved power source as certified by IEC or UL. The maximum ambient operating temperature (Tma) is described in “Important Safety Instructions”. Altitude during operation is up to 2000 m where output meets LPS and SELV circuit requirements.

Power Source Requirements

RQI-5x Models (w/o extension box)

	Voltage	Current
DC Power Source	9 to 32V DC	16.7 to 4.7A min.
AC-to-DC Adapter[1]	24V DC	6.6A min.

RQI-5x-E Models (w/ extension box)

	Voltage	Current
DC Power Source	9 to 32V DC	29 to 8.75A min.
AC-to-DC Adapter[2]	24V DC	11.6A min.

NOTE:

[1]Use the 160W or 220W AC/DC adapter for RQI-5x models.
[2]Use the 280W AC/DC adapter for RQI-5x-E models.
See “Optional Accessories” on page 2 for ordering information.

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WARNING:

Before providing DC power, ensure the voltage and polarity provided are compatible with the DC input. Improper input voltage and/or polarity can be responsible for system damage.
AVERTISSEMENT: Avant de fournir une alimentation CC, assurez-vous que la tension et la polarité fournies sont compatibles avec l'entrée CC. Une tension d'entrée et / ou une polarité incorrectes peuvent être responsables de dommages au système.

3.1.11 COM Port Connectors

The ROScube-I provides two COM ports through D-sub 9-pin connectors. COM1 and COM2 port support RS-232/422/485 mode. To change the mode for your device, please see Section B.2.7: Onboard Devices Configuration on page 51.

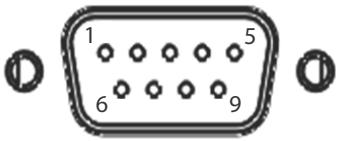


Figure 3-7: COM Port Pin Definition

Pin	Signal Name		
	RS-232	RS-422	RS-485
1	DCD#	TXD422-	485DATA-
2	RXD	TXD422+	485DATA+
3	TXD	RXD422+	N/S
4	DTR#	RXD422-	N/S
5	GND	N/S	N/S
6	DSR#	N/S	N/S
7	RTS#	N/S	N/S
8	CTS#	N/S	N/S
9	RI#	N/S	N/S

Table 3-13: COM Port D-Sub 9-pin Signal Functions

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3.2 Internal I/O Connectors

3.2.1 Board Layout

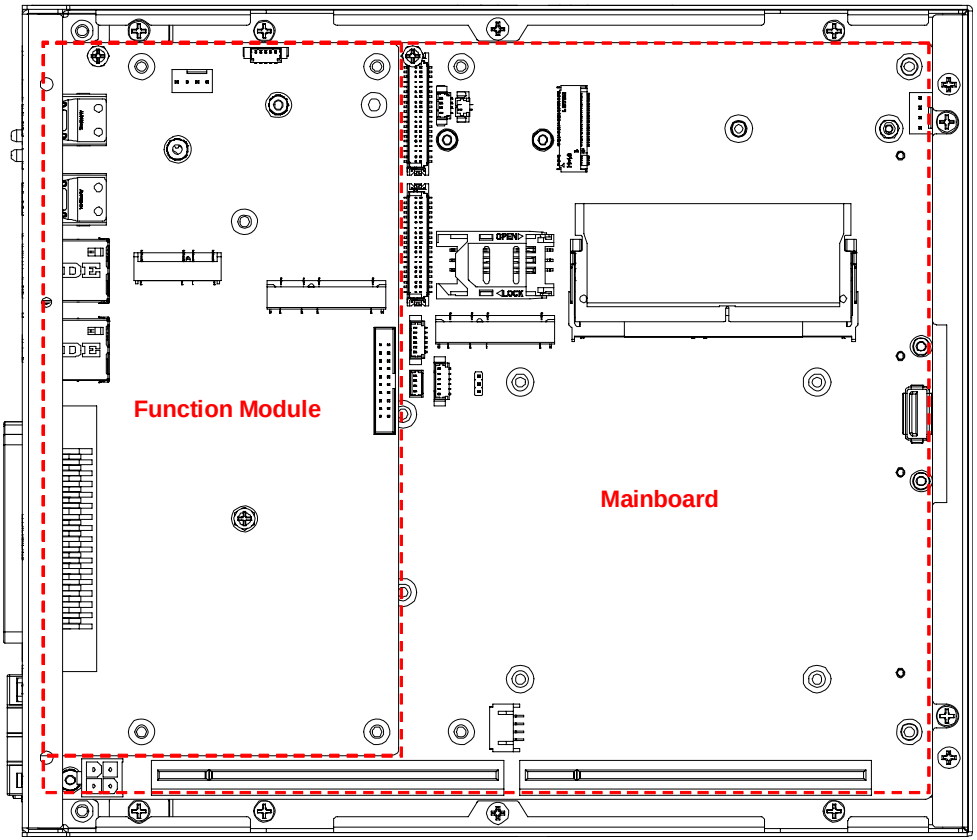


Figure 3-8: Board Layout

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3.2.2 Mainboard Connector Locations

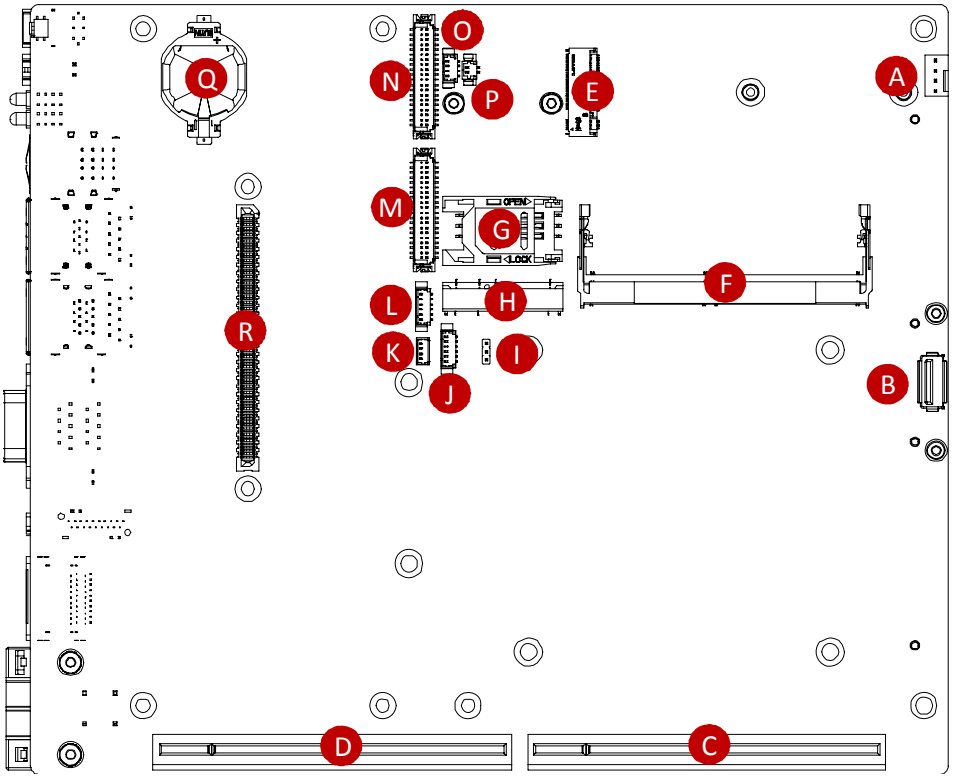


Figure 3-9: Mainboard Connectors

A	Fan connector	**J**	I^2C1 connector
B	USB 2.0 dongle	**K**	Power and Reset header
C	Backplane slot	**L**	I^2C0 connector
D	Backplane slot	**M**	COM port 3 and 4 connectors
E	M.2 connector (for storage)	**N**	DIO, COM port 5/6, Audio connector
F	DDR4 SO-DIMM slot	**O**	Speaker connector
G	SIM card socket for Mini PCIe	**P**	GPS module power header
H	Mini PCIe socket	**Q**	Battery socket
I	Clear CMOS connector	**R**	FM board-to-board connector

Table 3-14: Mainboard Connector Legend

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3.2.3 Function Module Connector Locations

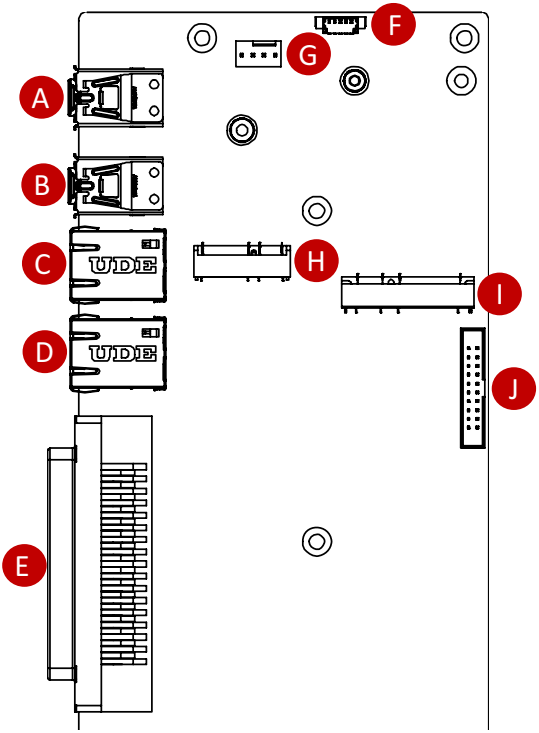


Figure 3-10: Function Module Connectors

A	USB 3.1 Gen 1 lockable connector
B	USB 3.1 Gen 1 lockable connector
C	Gigabit RJ-45 port
D	Gigabit RJ-45 port
E	Multi-I/O DB 50-pin connector
F	CANbus connector (CN3)
G	Fan connector
H	M.2 A+E Key connector (CN4)
I	Mini PCIe connector (CN2)
J	DIO connector

Table 3-15: Function Module Connector Legend

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3.2.4 GPS Module Power Header

Power supply via cable for Mini PCIe GPS module card (5V).



Figure 3-11: GPS Module Power Header Pin Definition

Pin	Signal
1	+5V_GPS
2	GND

Table 3-16: GPS Module Power Header Pin Definition

3.2.5 USB 2.0 Connector

One USB 2.0 Type-A connector is provided on the mainboard for internal USB dongle, with another on the PCIe expansion slot riser card.

3.2.6 Mini PCIe Connector

The internal Mini PCIe connectors (Rev. 1.2) support full size Mini PCIe cards.

3.2.7 Clear CMOS Jumper

Upon encountering an abnormal condition preventing the device from booting, the jumper can clear the BIOS content stored in CMOS and restore default settings. To clear CMOS, short pin #1 to pin #2 for a minimum of 3 seconds, and then remove the jumper to return to normal mode (replace to pins #2 and #3, default).



Figure 3-12: Clear CMOS Jumper Setting

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3.2.8 Extended Power/Reset Header

An internal header is provided for the Power and Reset buttons, with pin definition as shown.



Figure 3-13: PWR/RESET Header Pin Definition

Pin	Signal
1	PWR_BTN-L
2	GND
3	GND
4	RESET_BTN-L

Table 3-17: Power/Reset Header Pin Definition

3.2.9 SIM Card Socket

The SIM card socket connects to the Mini PCIe slot on the mainboard.

3.2.10 CANbus Connector (CN3)

The ROScube-I provides single and dual CANbus interfaces for autonomous robotics. A cable must be connected to the CANbus module and the signal will be available at the DB50 Multi-I/O connector on the front panel. By default, a CANbus module is not installed on the system.



Pin	Signal	Pin	Signal
1	PORT0_CAN-L	4	PORT1_CAN-L
2	PORT0_CAN-H	5	PORT1_CAN-H
3	GND		

Table 3-18: CANbus Wafer Connector Pin Definition

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4 Getting Started

This chapter describes how to set up and install the ROScube-I Series.

4.1 Attaching the DC Power Connector

Locate the DC power connector shown below that is included in the accessory box. Insert the power connector into DC power input “A” shown in **Figure 3-1** on page 15 and secure it to the chassis using the captive screws.



Connect a DC power source as described in **Section 3.1.10: DC Power Input on page 25** to the inputs of the DC power connector, making sure to use the correct input voltage andpolarity.

WARNING:

Before providing DC power, ensure the voltage and polarity provided are compatible with the DC input. Improper input voltage and/or polarity can be responsible for system damage.
AVERTISSEMENT: Avant de connecter à une source de courant continu, veuillez vous assurer de la polarité de la tension conformément à l'entrée CC du PC. Une tension et/ou une polarité incorrectes peuvent causer des dommages irréversibles sur le système.

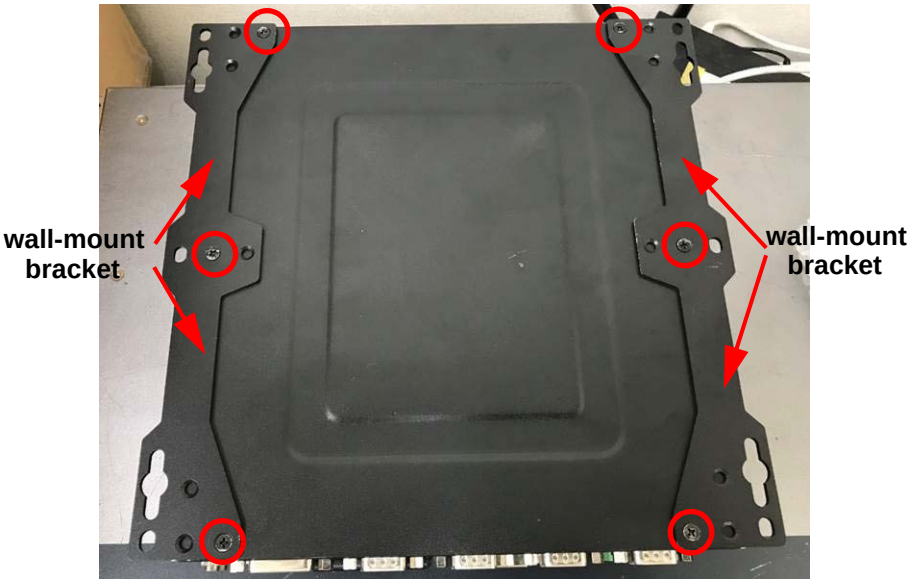
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4.2 Mounting the ROScube-I Series

4.2.1 Install the Wall-mount Brackets

Use the 6x M4 6mm screws included in the accessory box to attach the 2 included wall-mount brackets to the chassis as indicated by the red circles below.

Utilisez les 6 vis M4 6 mm incluses dans la boîte d'accessoires pour fixer les 2 supports de montage mural inclus au châssis, comme indiqué par les cercles rouges ci-dessous.

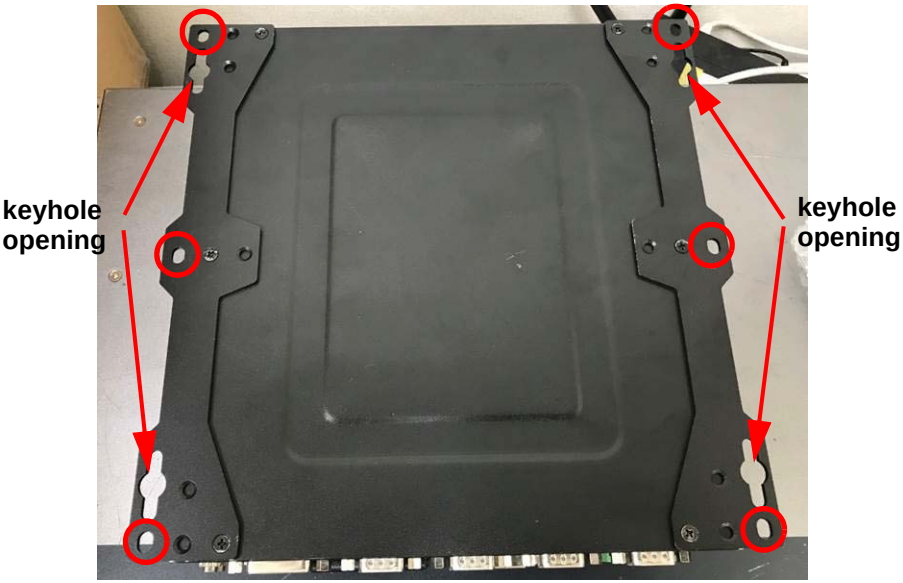


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Mounting the Device / Montage de l'Appareil

Mount the device to a wall using the 4 keyhole openings indicated or the 6 mounting holes circled in red, according to the spacing dimensions of the holes in the bracket as shown in Figure 2-2 ROScube-I Series Top View.

Montez l'appareil sur un mur à l'aide des 4 ouvertures de trou de serrure en fonction des dimensions d'espacement des trous dans le support, comme indiqué dans Figure 2-2 ROScube-I Series Top View.



NOTE:

Do **not** wall mount the device with the I/O connectors facing downwards.
Ne fixez pas l'appareil au mur avec les connecteurs d'E/S orientés vers le bas.

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Appendix A Power


NOTE:

Information in this Appendix is for power budget planning and design purposes only. Actual power consumption may differ based on final application.

A.1 Power Consumption Reference

Power consumption as follows is based on lab data in which 24V DC is applied and current is measured by the DC power supply. The power consumption (W) is calculated as the product of applied voltage (V) and the current (A).

Platforms tested for this data have available external I/O interfaces, and are attached to supported devices such as DP and HDMI monitors, CFast card, PS2 keyboard/mouse, USB dummy load, COM loopback, and audio loopback, and an internal hard disk driver is installed.

Information is presented for reference only. Actual power consumption will vary with different attached devices and operating system.

System	Power Off	System Idle	Processor Full Load	System Full Load	Recommended Power Supply
RQI-58(-E) Intel® Xeon®	6.8W	23W	78W	115W	160W or 220W (280W for “E” expansion models)
RQI-57(-E) Intel® Core™ i7	6.7W	23W	78W	115W	
RQI-55(-E) Intel® Core™ i5	6.8W	23W	77W	115W	
RQI-53(-E) Intel® Core™ i3	6.8W	22W	55W	75W	

Table A-1: Power Consumption

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NOTE:

- Sufficient power supply for the entire system is required to meet these specifications. At least 100W at 24V input is recommended.
- Heat generated by add-on PCI/PCIe adapters affects thermal stability. Additional heat dissipation is required when the system operates at high temperatures or in harsh environments with add-on adapters.

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Appendix B BIOS Setup

The Basic Input/Output System (BIOS) is a program that provides a basic level of communication between the processor and peripherals. In addition, the BIOS also contains codes for various advanced features applied to the ROScube-I Series. The BIOS setup program includes menus for configuring settings and enabling features of the ROScube-I Series. Most users do not need to use the BIOS setup program, as the ROScube-I Series ships with default settings that work well for most configurations.

Enter BIOS setup by selecting DEL when the system is powered on the POST (Power On Self Test) message is displayed.The ROScube-I Series controller supports one-time Boot Menu allowing selection of boot device. Enter the Boot Menu by selecting F7 at POST.


NOTE:

- BIOS options listed are for reference only.
- Different configurations can affect BIOS behavior.
- Displayed material may reflect only the BIOS version corresponding to initial release and may differ from that of the purchased motherboard.
- Users are welcome to download the latest BIOS version from our official website.

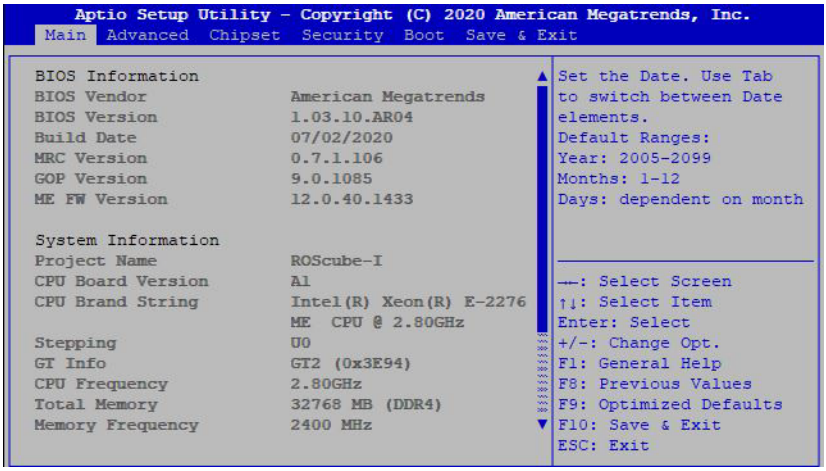
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B.1 Main

Contains basic system information for the ROScube-I Series.

WARNING:

Changing BIOS settings may lead to incorrect controller behavior and possible inability to boot. In such a case, Section 3.2.7:Clear CMOS Jumper provides instruction on clearing the CMOS and restoring default settings.
AVERTISSEMENT: La modification des paramètres du BIOS peut entraîner un comportement incorrect du contrôleur et une éventuelle incapacité à démarrer. Dans un tel cas, la section 3.2.7: Clear CMOS Jumper fournit des instructions sur l'effacement du CMOS et la restauration des paramètres par défaut.



BIOS Information

Shows current system BIOS Vendor, BIOS Version, Build Date, MRC Version, GOP Version and ME FW Version.

System Information

Shows current system Project Name, CPU Board Version, CPU Branding String, CPU Stepping, GT Info, CPU Frequency, Total Memory, Memory Frequency, PCH SKU and Stepping.

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System Time/System Date

Allows adjustment of system time and date, as follows.

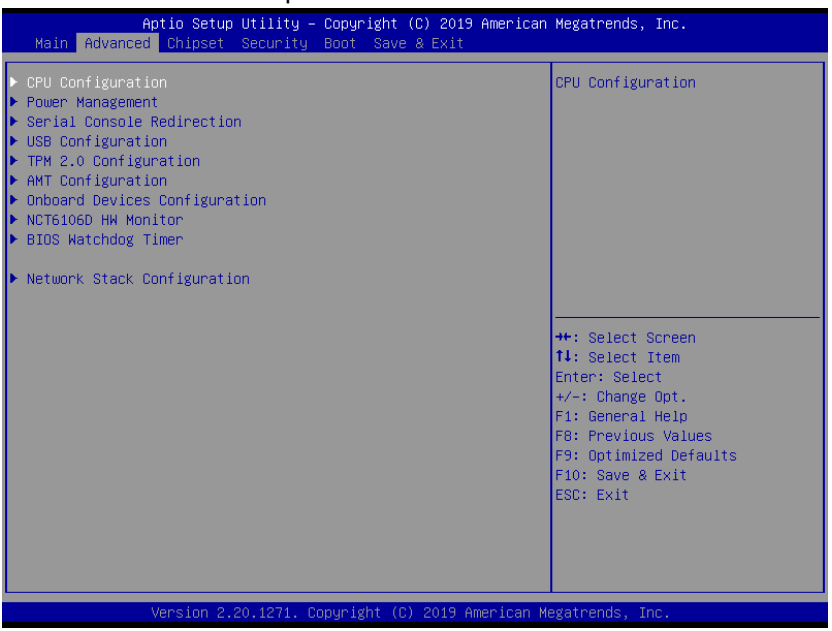
1. Highlight System Time or System Date using the up and down <Arrow> keys
2. Enter new values using the keyboard and select <Enter>
3. Select < Tab > to move between fields.

NOTE:

- The date must be entered in MM/DD/YY format, and the time in HH:MM:SS.
- The time is in 24-hour format. For example, 5:30 A.M. appears as 05:30:00, and 5:30 P.M. as 17:30:00.

B.2 Advanced

Accesses advanced options of the ROScube-I Series.

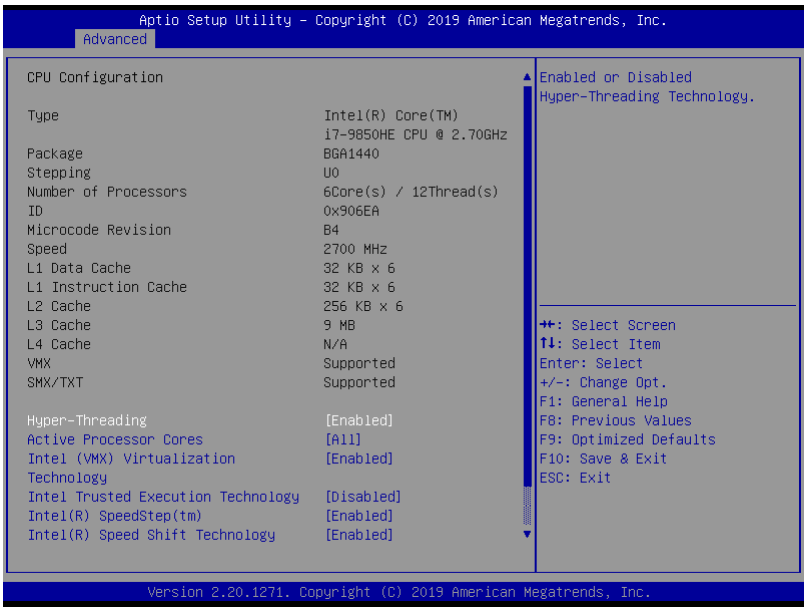


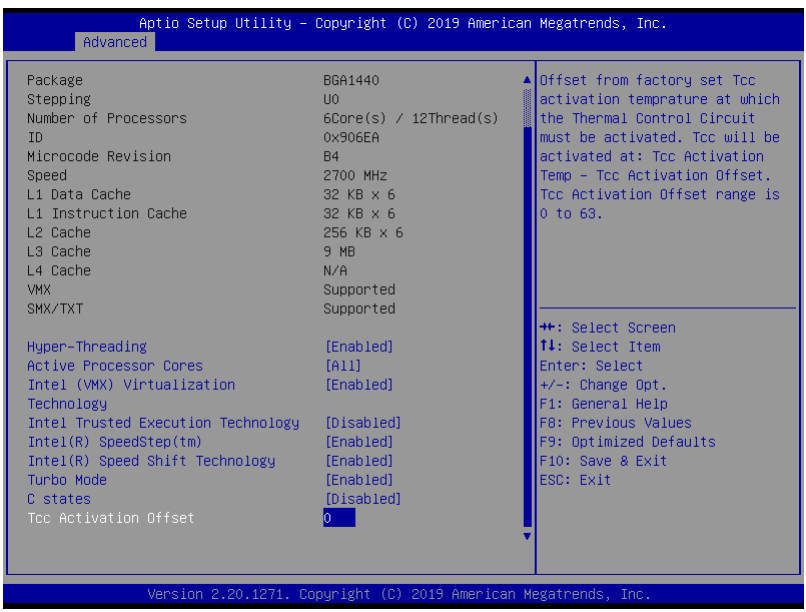
CAUTION:

Setting incorrect or conflicting values in Advanced BIOS Setup may cause a system malfunction.
MISE EN GARDE: L'application de valeurs incorrectes ou contradictoires dans la configuration avancée du BIOS peut entraîner un dysfonctionnement du système.

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B.2.1 CPU Configuration





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Hyper-Threading

Enabled for Windows 7, 10 IoT Enterprise, and Linux (optimized for Hyper-Threading Technology). When Disabled only one thread per enabled core is enabled.

Active Processor Cores

Number of cores to enable in each processor package.

Intel (VMX) Virtualization Technology

When enabled, a VMM can utilize the additional hardware capabilities provided by Vanderpool Technology.

Intel Trusted Execution Technology

Enables/Disables Intel TXT feature.

Intel(R) SpeedStep(tm)

Allows more than two frequency ranges to be supported.

Intel(R) Speed Shift Technology

Enables/Disables Intel(R) Speed Shift Technology support. Enabling will expose the CPPC v2 interface to allow for hardware controlled P-states.

C States

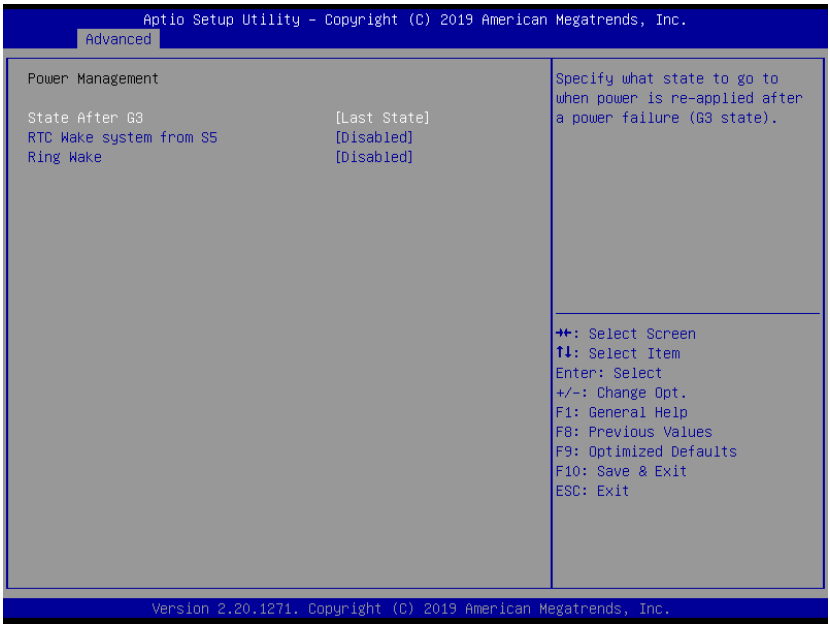
Enables/Disables CPU Power Management. Allows CPU to go to C states when it is not 100% utilized.

TCC Activation Offset

Offset from factory set Tcc activation temprature at which the Thermal Control Circuit must be activated. Tcc will be activated at: Tcc Activation Temp - Tcc Activation Offset. The Tcc Activation Offset range is 0 to 63.

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B.2.2 Power Management



State After G3

Specify what state to go to when power is re-applied after a power failure (G3 state).

RTC Wake system from S5

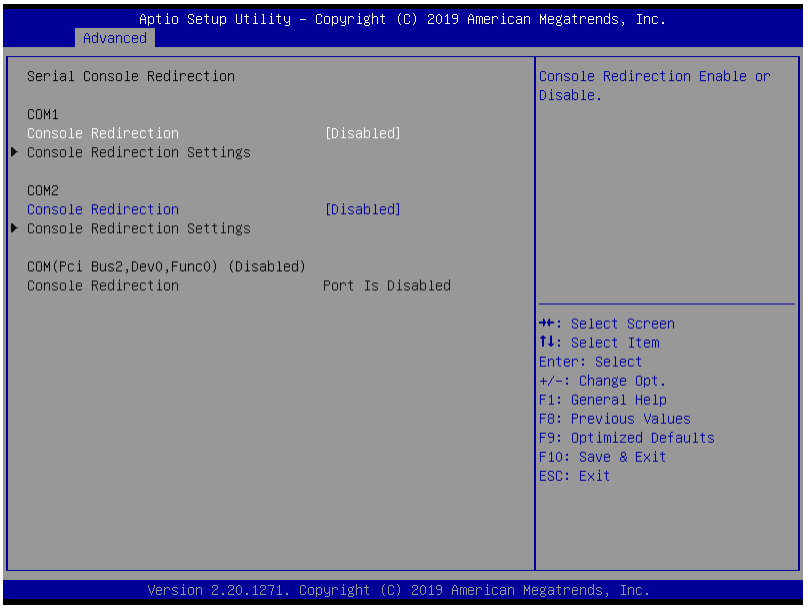
Enables/Disables the system wake on alarm event. Select Fixed-Time, and the system will wake on the hr::min::sec specified. Select DynamicTime, the system will wake on the current time + Increase minute(s).

Ring Wake

Enables/Disables RI ping for Wake On Ring function (PCH PME# signal).

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B.2.3 Serial Console Configuration



COM1

Console Redirection

Enables/Disables SIO COM1 Console Redirection.

Console Redirection Settings

The settings specify how the host computer and the remote computer (which the user is using) will exchange data. Both computers should have the same or compatible settings.

COM2

Console Redirection

Enables/Disables SIO COM2 Console Redirection.

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Console Redirection Settings

The settings specify how the host computer and the remote computer (which the user is using) will exchange data. Both computers should have the same or compatible settings.

COM SOL (Pci Bus0, Dev22.Fun3)

Console Redirection

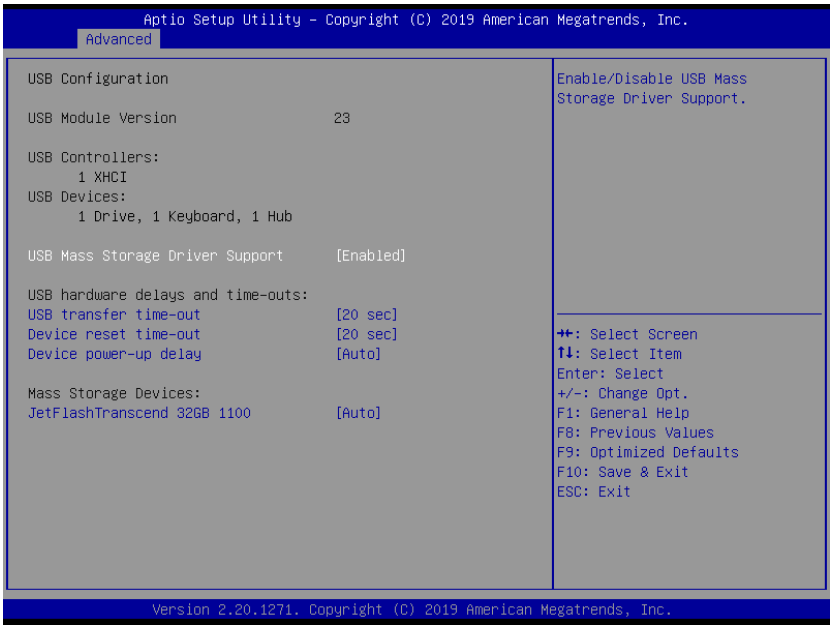
Enables/Disables AMT PCI SOL Console Redirection.

Console Redirection Settings

The settings specify how the host computer and the remote computer (which the user is using) will exchange data. Both computers should have the same or compatible settings.

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B.2.4 USB Configuration



USB Mass Storage Driver Support

Enables/Disables USB mass storage driver support.

USB transfer time-out

Timeout value for Control, Bulk, and Interrupt transfers.

Device reset time-out

USB mass storage device Start Unit command timeout.

Device power-up delay

Maximum time taken before the device reports itself to the Host Controller, with Auto using a default value of 100 ms for a Root port, and for a Hub port the delay is taken from the Hub descriptor.

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B.2.5 TPM 2.0 Configuration



Security Device Support

Enables/Disables BIOS support for security devices. The operating system will not show the security device. The TCG EFI protocol and INT1A interface will not be available.

SHA-1 PCR Bank

Enables/Disables SHA-1 PCR Bank.

SHA256 PCR Bank

Enables/Disables SHA256 PCR Bank.

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Pending operation

Schedule an operation for the security device.



The computer will reboot in order to change the state of the security device.

Platform Hierarchy

Enables/Disables Platform Hierarchy.

Storage Hierarchy

Enables/Disables Storage Hierarchy.

Endorsement Hierarchy

Enables/Disables Endorsement Hierarchy.

TPM2.0 UEFI Spec Version

Select the TCG2 specification support version.

Physical Presence Spec Version

Select to specify support for PPI specification version 1.2 or 1.3.



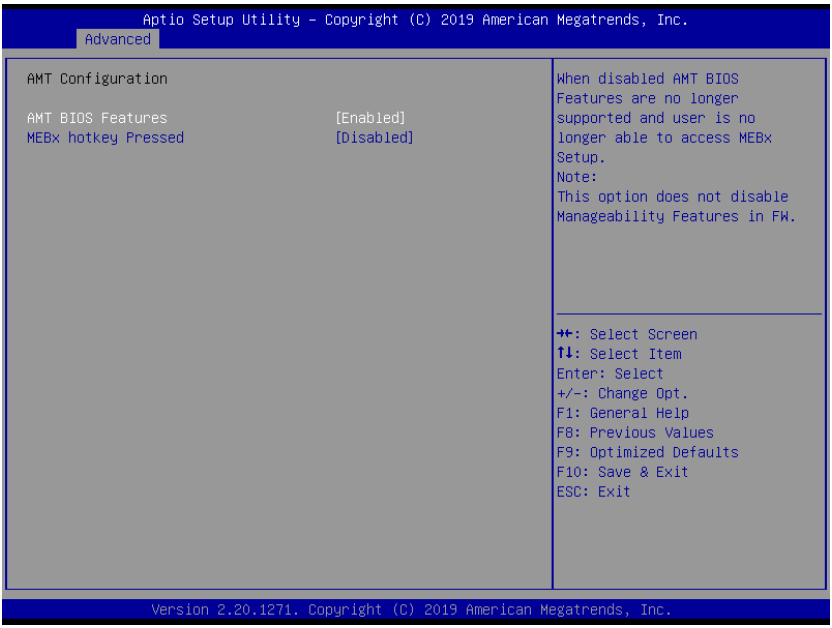
Some HCK tests might not support version 1.3.

Device Select

TPM 1.2 will restrict support to TPM 1.2 devices, TPM 2.0 will restrict support to TPM 2.0 devices, Auto will support both with the default set to TPM 2.0 devices if not found, and TPM 1.2 devices will be enumerated.

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B.2.6 AMT Configuration



AMT BIOS Features

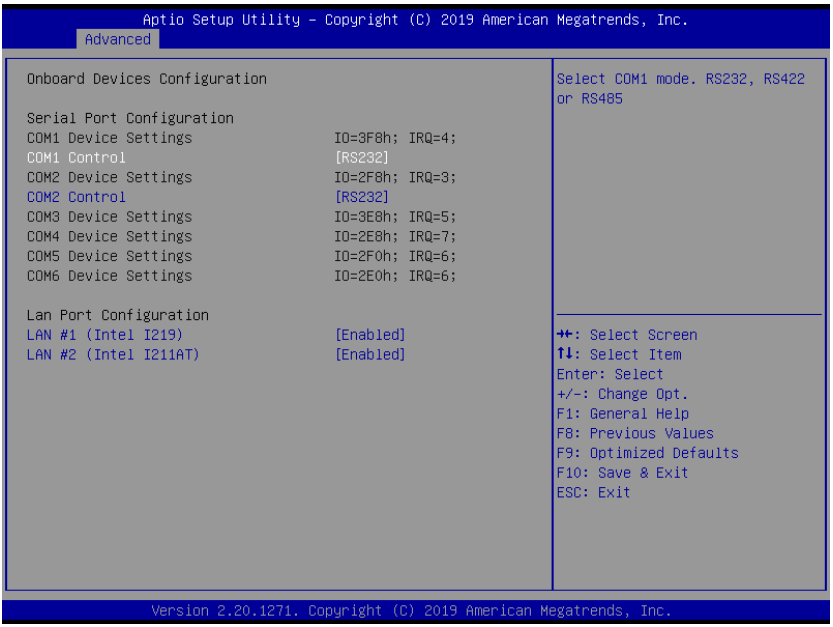
When disabled, AMT BIOS Features are no longer supported and the user is no longer able to access MEBx Setup.

MEBx hotkey Pressed

Enable automatic MEBx hotkey press.

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B.2.7 Onboard Devices Configuration



COM1 Control

Sets port type (RS-232/422/485) for COM1 serial port.

COM2 Control

Sets port type (RS-232/422/485) for COM2 serial port.

LAN #1 (Intel I219)

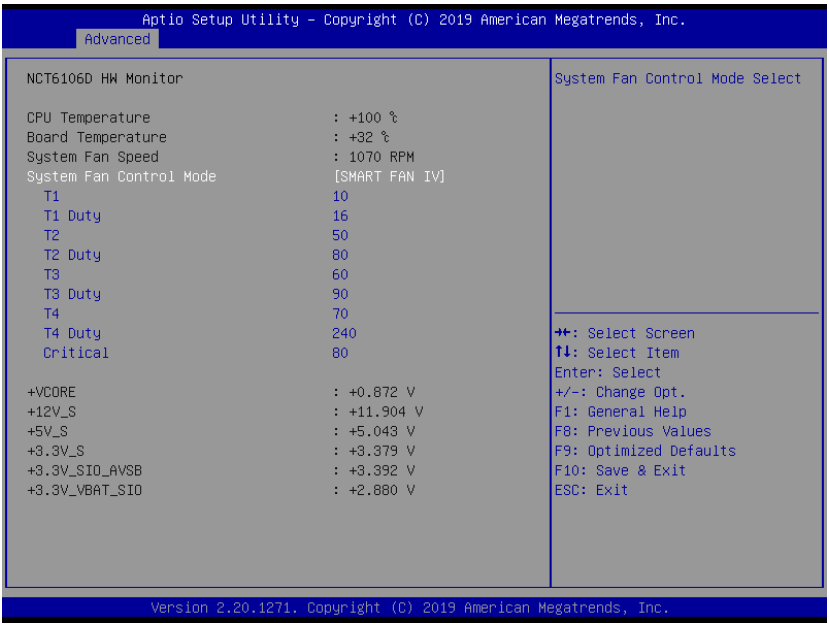
Enables/Disables onboard Intel I219 LAN controller.

LAN #2 (Intel I211AT)

Enables/Disables onboard Intel I211AT LAN controller.

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B.2.8 NCT6106D HW Monitor



NCT6106D HW Monitor

Displays CPU/board temperatures, system fan speed and various voltages.

System Fan Control Mode

Sets the system fan control mode.

T1

T1 (Temperature 1), Range: 1-100

T1 Duty

Set T1 related DC/PWM value, Range: 0-255

T2

T2 (Temperature 2), Range: 1-100

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T2 Duty

Set T2 related DC/PWM value, Range: 0-255

T3

T3 (Temperature 3), Range: 1-100

T3 Duty

Set T3 related DC/PWM value, Range: 0-255

T4

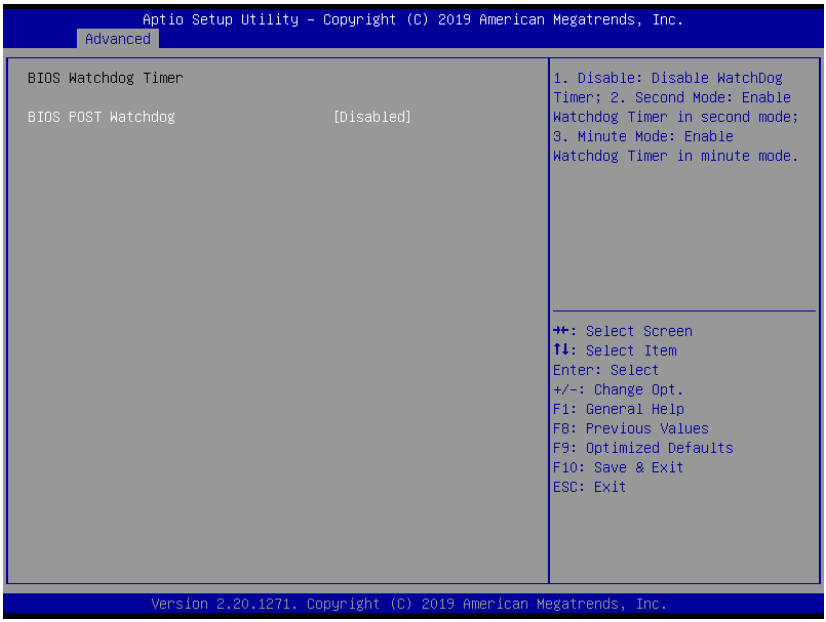
T4 (Temperature 4), Range: 1-100

T4 Duty

Set T4 related DC/PWM value, Range: 0-255

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B.2.9 BIOS Watchdog Timer



BIOS POST Watchdog

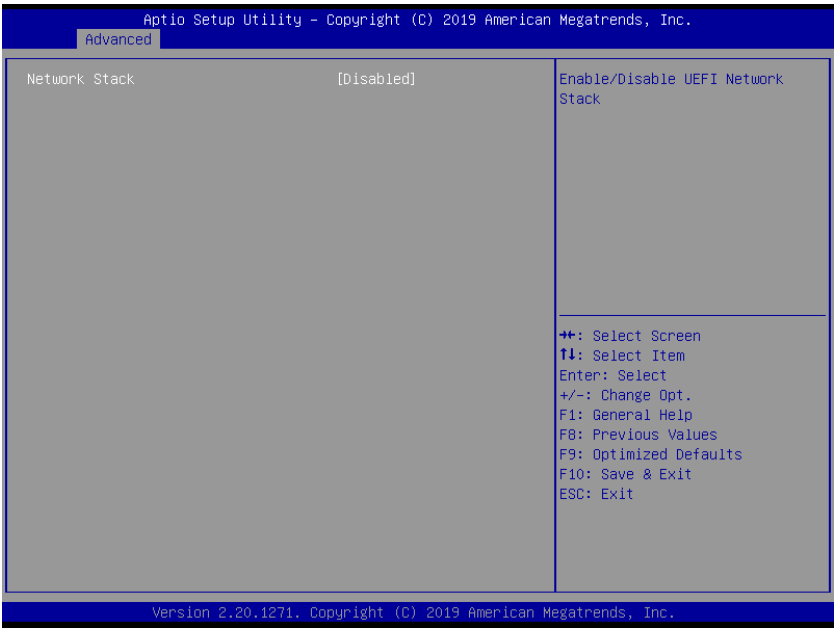
Disable: Disables watchdog timer.

Second Mode: Enables watchdog timer in seconds mode.

Minute Mode: Enables watchdog timer in minutes mode.

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B.2.10 Network Stack Configuration

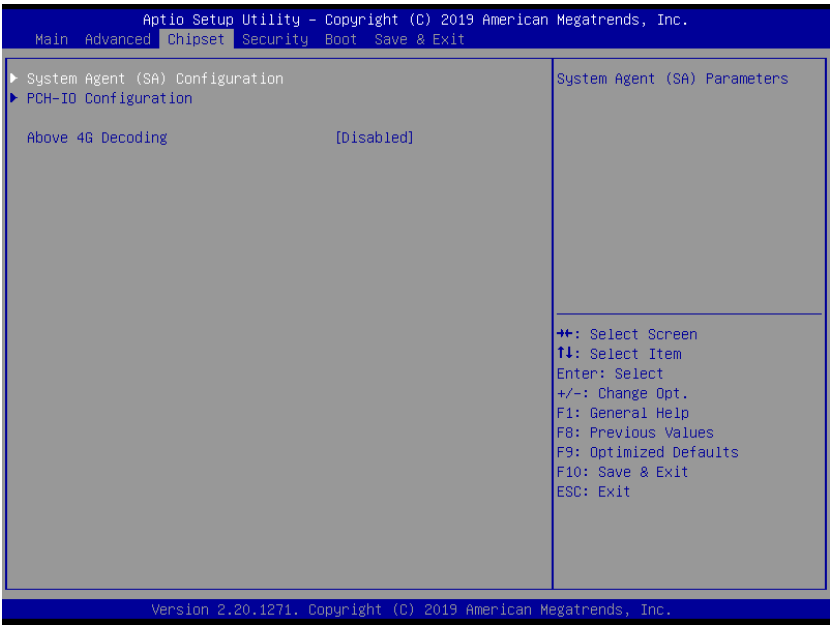


Network Stack

Enables/Disables UEFI network stack.

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B.3 Chipset

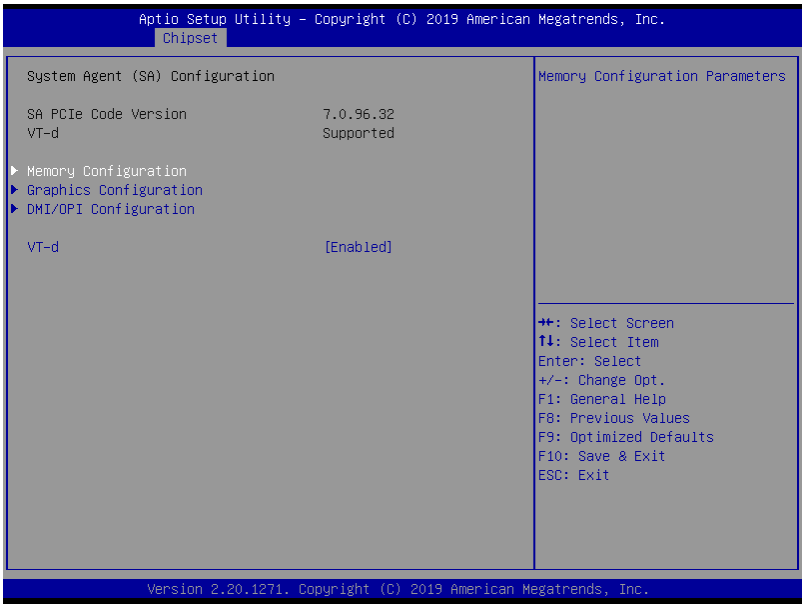


CAUTION:

Setting incorrect or conflicting values in Chipset BIOS Setup may cause a system malfunction.
MISE EN GARDE: L'application de valeurs incorrectes ou contradictoires dans la configuration du BIOS du chipset peut entraîner un dysfonctionnement du système.

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B.3.1 System Agent (SA) Configuration

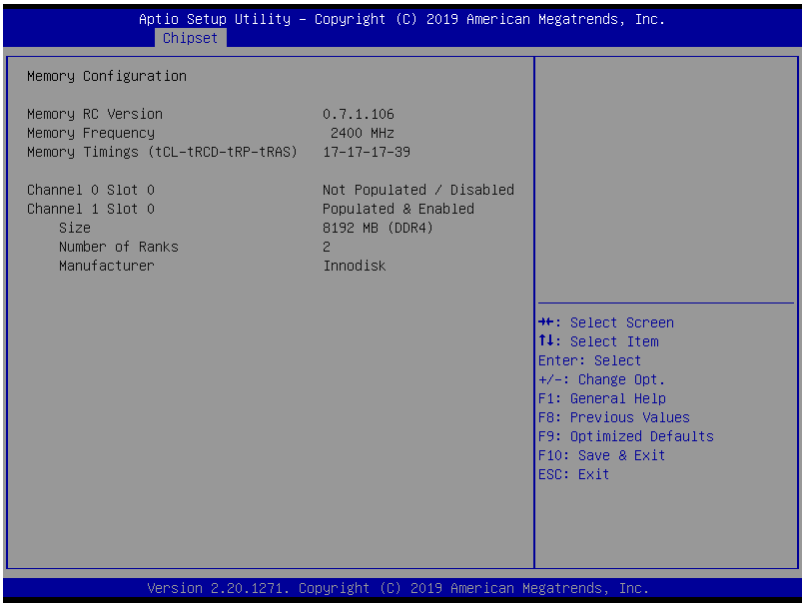


System Agent (SA) Configuration

Display and configure VT-d's capability and provide settings for memory, graphics and DMI/OPI configuration.

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B.3.1.1 Memory Configuration

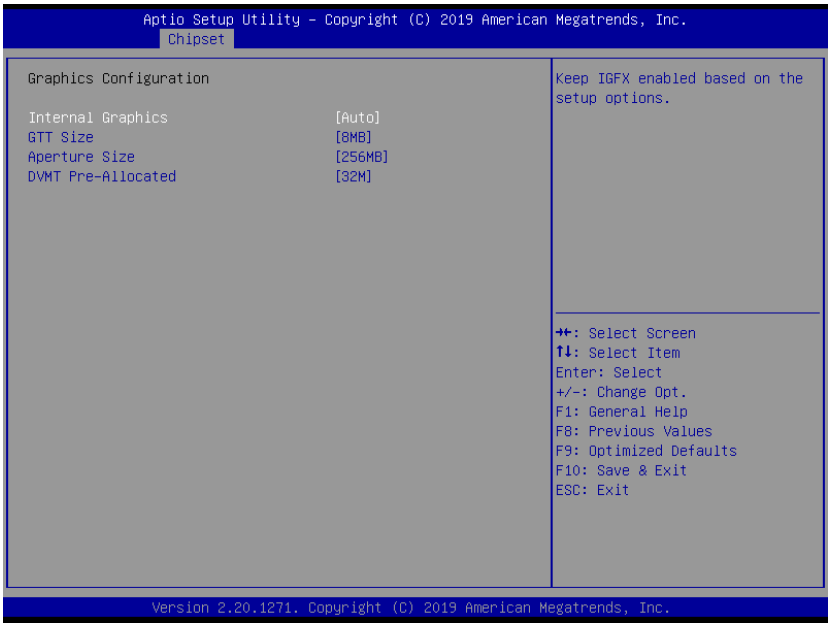


Memory Configuration

Display memory speed, size, brand and configuration.

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B.3.1.2 Graphics Configuration



Internal Graphics

Keep IGFX enabled based on the Setup options.

GTT Size

Sets GTT size.

Aperture Size

Sets aperture size.

DVMT Pre-Allocated

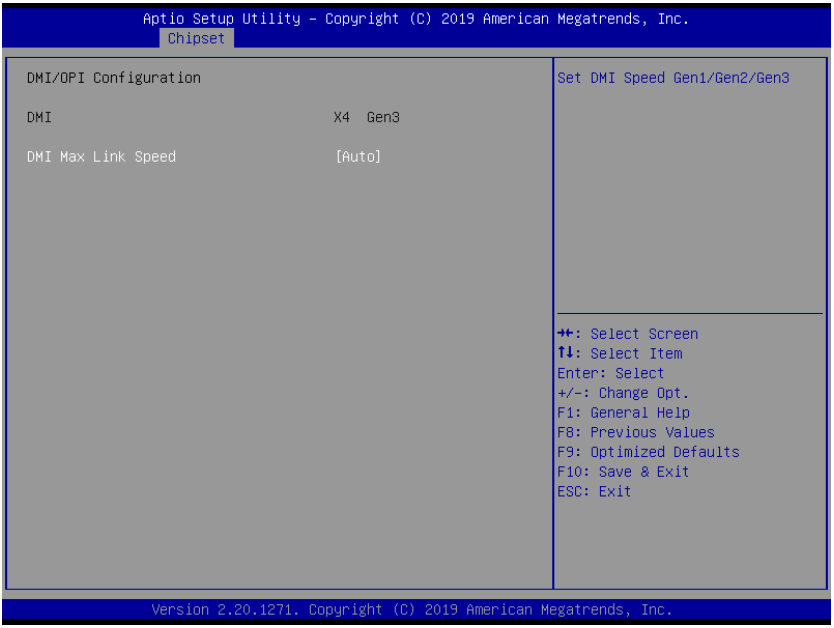
Sets size of DVMT 5.0 pre-allocated (fixed) graphics memory used by the internal graphics device.

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DVMT Total Gfx Mem

Sets size of DVMT5.0 total graphic memory used by the internal graphics device.

B.3.1.3 DMI/OPI Configuration



DMI/OPI Configuration

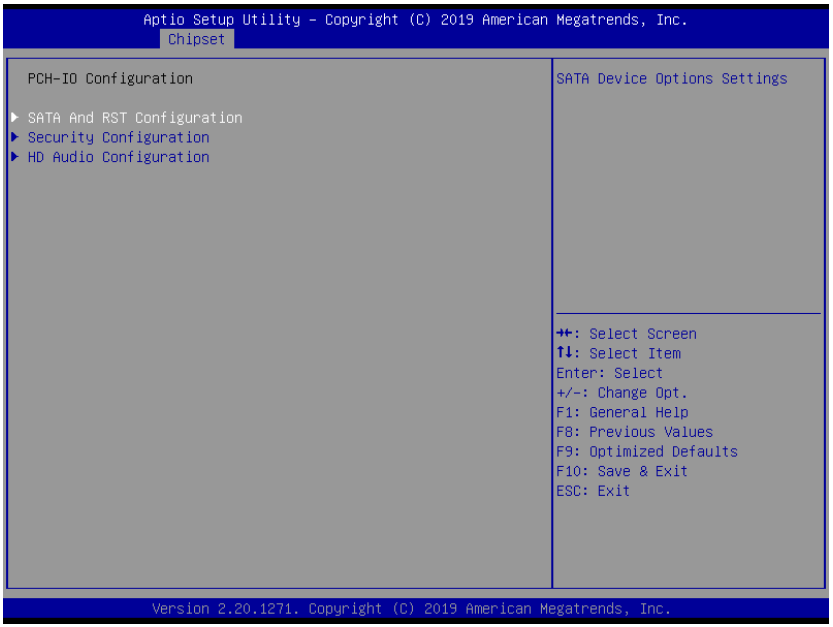
Display DMI link speed and width.

DMI Max Link Speed

Set sDMI speed to Gen1/Gen2/Gen3.

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B.3.2 PCH-IO Configuration

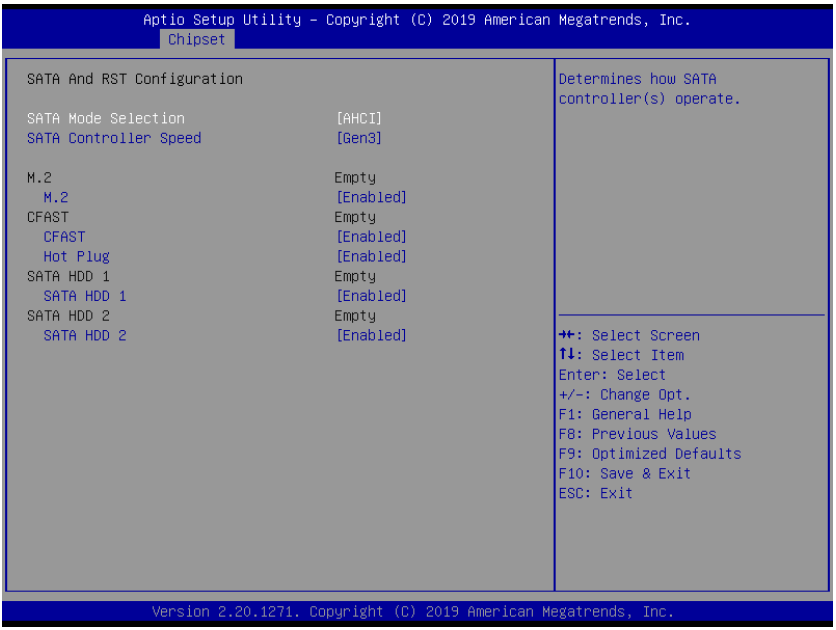


PCH-IO Configuration

Provides for SATA, Security and HD Audio configuration.

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B.3.2.1 SATA And RST Configuration



SATA Mode Selection

Determines how SATA controller(s) operate.

SATA Controller Speed

Sets the maximum speed the SATA controller can support.

M.2 Storage

Enables/Disables M.2 storage.

CFast Card

Enables/Disables CFast card.

Hot Plug

Designates selected port as hot pluggable.

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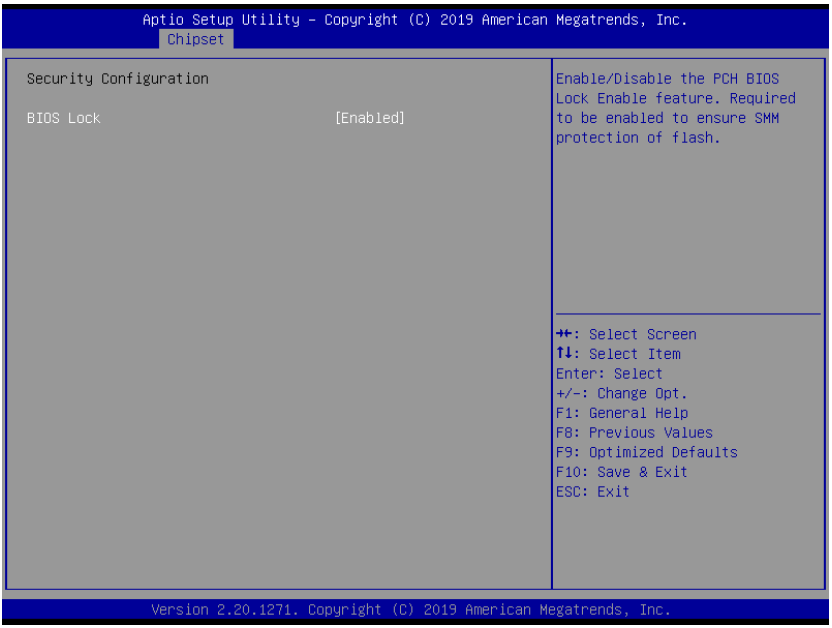
SATA HDD 1

Enables/Disables SATA HDD 1

SATA HDD 2

Enables/Disables SATA HDD 2

B.3.2.2 Security Configuration

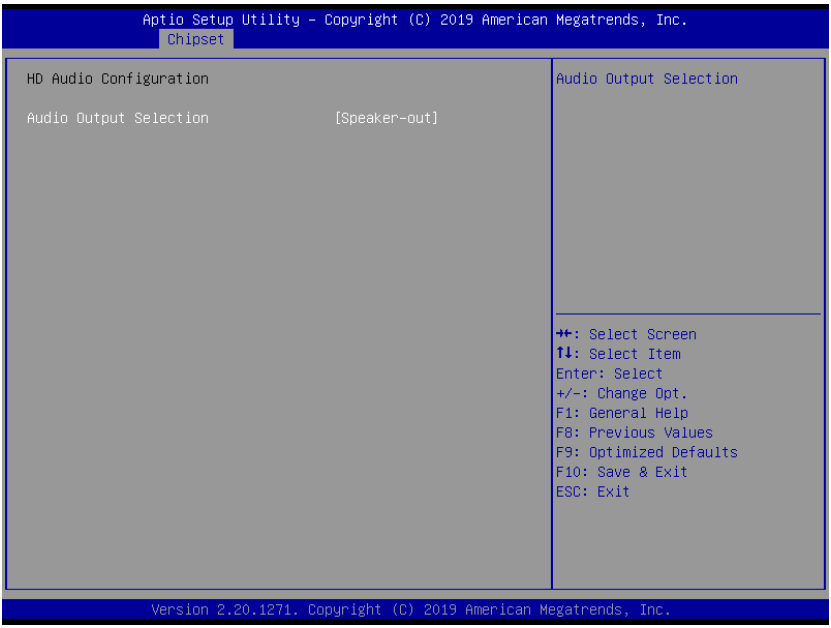


BIOS Lock

Enable/Disable the PCH BIOS Lock Enable feature. Required to be enabled to ensure SMM protection of flash.

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B.3.2.3 HD Audio Configuration

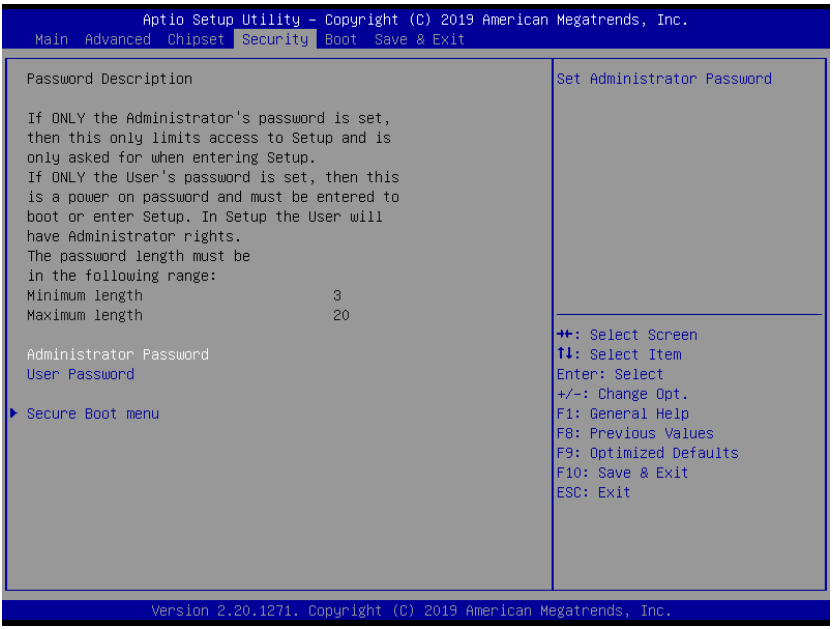


Audio Output Selection

Selects the audio output device.

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B.4 Security



If only the Administrator password is set, access s limited and the password requested on Setup. If User password is set, it acts as a power-on password and must be entered to boot or enter setup. In Setup the user receives

Administrator Password

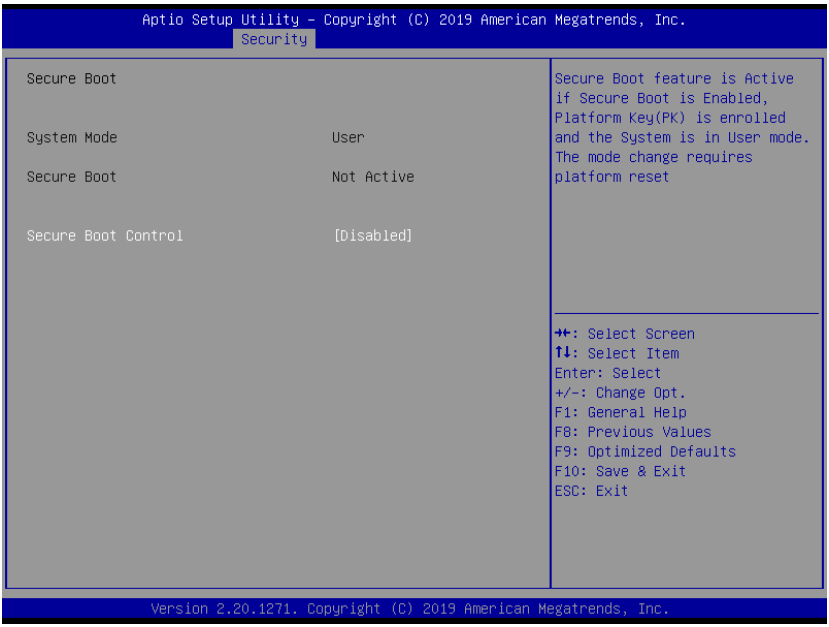
Sets Administrator Password.

User Password

Sets User Password.

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B.4.1 Secure Boot Menu

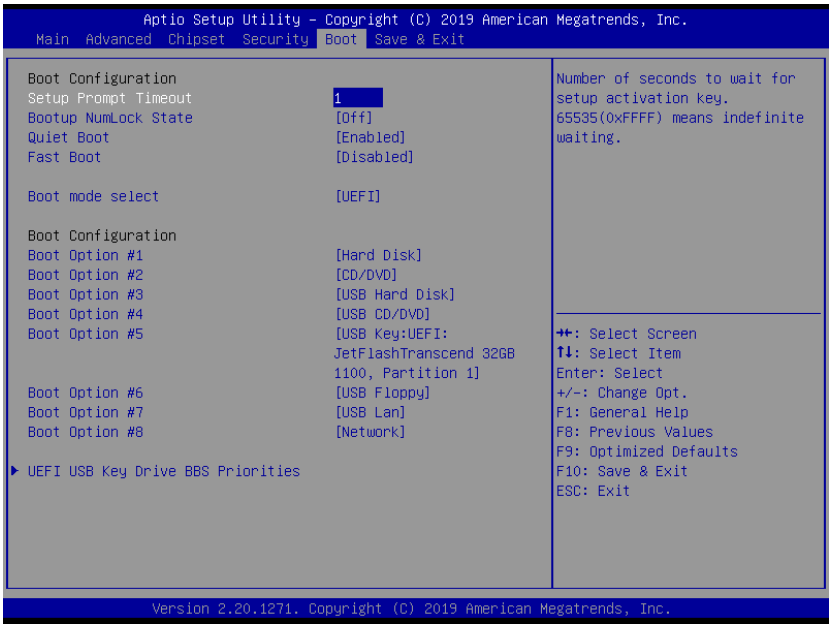


Secure Boot Control

The Secure Boot feature is Active if Secure Boot is enabled, Platform Key (PK) is enrolled and the system is in User mode. Changing the system mode requires a platform reset.

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B.5 Boot



Setup Prompt Timeout

Number of seconds before setup activation key is launched, with 65535(0xFFFF) setting an indefinite wait time.

Bootup Num-Lock State

Sets keypad Number Lock status following boot.

Quiet Boot

Option	Description
Disabled	Directs BIOS to display POST messages
Enabled	Directs BIOS to display the OEM logo.

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Fast Boot

Option	Description
Disabled	Directs BIOS to perform all POST tests.
Enabled	Directs BIOS to skip certain POST tests to boot faster.

While enabling Fast Boot can reduce system ready time, some prerequisites can reduce effectiveness

Boot mode select

Sets legacy or UEFI boot mode.

Boot Configuration

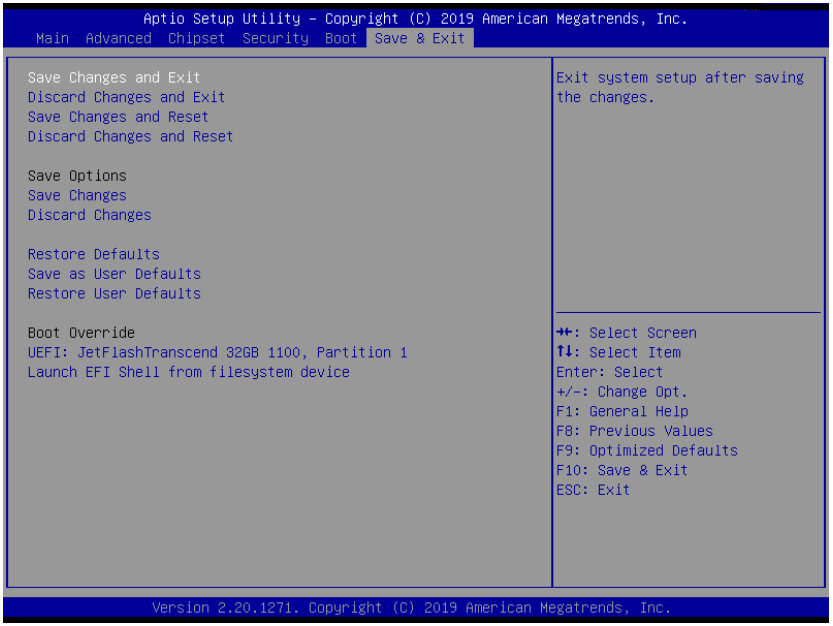
Specifies the priority of boot devices, all of which are detected during POST and displayed. Target Boot Option # and click to select the desired device.

UEFI USB Hard Drive Disk Drives BBS Priorities

Specifies the Boot Device Priority sequence from available UEFI USB drives.

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B.6 Save & Exit



Save Changes and Exit

Saves all changes before exiting Setup.

Discard Changes and Exit

Discards all changes and exits Setup.

Save Changes and Reset

Saves all changes and reboots the system with the new settings.

Discard Changes and Reset

Discards all changes and reboots the system.

Save Changes

Saves all changes without exiting Setup.

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Discard Changes

Discards all changes without exiting Setup.

Restore Defaults

Sets all BIOS options to default settings, designed for maximum system stability but less than maximum performance. Select Restore Defaults if the computer encounters system configuration problems.

Save as User Defaults

Save the current changes as user defaults.

Restore User Defaults

Restores user defaults to all Setup options.

Launch EFI Shell from filesystem device

Attempts to launch EFI Shell application (Shell.efi) from one of the available filesystem devices.

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Appendix C Watchdog Timer

This appendix describes use of the watchdog timer (WDT) for the ROScube-I Series controller. The Watchdog Timer (WDT) on Linux is used to monitor if a system is still running. It is designed to reboot a hung system automatically.

C.1 WDT with Linux

To use the WDT on Linux, do the following:

1. Check if the w83627hf_wdt module exists on your Linux.

```
modinfo w83627hf_wdt
```

```
ros@ros-ROScube-I:~$ modinfo w83627hf_wdt
filename:       /lib/modules/5.4.0-51-generic/kernel/drivers/watchdog/w83627hf_wdt.ko
description:    w83627hf/thf WDT driver
author:         Pádraig  Brady <P@draigBrady.com>
license:        GPL
srcversion:     BD3DA026584D807340E1B83
depends:
retpoline:      Y
intree:         Y
name:           w83627hf_wdt
vermagic:       5.4.0-51-generic SMP mod_unload
sig_id:         PKCS#7
signer:         Build time autogenerated kernel key
sig_key:        56:AA:1E:D4:49:F6:D7:44:76:6B:68:17:21:DC:0C:4D:B1:40:9F:BB
sig_hashalgo:   sha512
signature:      21:E6:56:84:EA:7E:7F:95:13:DA:09:4F:40:9C:36:88:67:3B:4D:1E:
                28:85:0B:A4:11:9C:7F:74:D0:84:0A:24:A5:26:B7:BC:A7:E2:36:90:
                A4:F2:C9:31:72:89:DE:A7:9F:04:41:6E:08:DD:F8:6B:30:08:DE:DE:
                9E:08:F4:89:96:9C:B7:5B:66:3A:B3:72:2D:9E:CF:83:E9:BB:DA:B3:
                28:E2:B1:41:18:81:63:42:2B:1C:F8:22:98:2B:55:39:2B:37:C9:DE:
                B8:C3:37:A1:8D:8F:47:93:D6:D1:84:FC:3F:46:0B:EF:92:A6:63:D8:
                62:9E:E6:CD:B3:9F:9D:54:9E:F3:1E:E1:D3:65:A9:91:6B:B6:8C:02:
                68:A6:E9:CD:21:6C:97:9F:67:3D:F9:AD:C4:86:20:73:4F:FC:97:F2:
                AE:E3:65:D3:32:A3:67:FC:4C:A4:72:80:45:E5:49:7C:17:ED:0F:BE:
                43:BF:63:89:56:A6:DE:87:7B:72:CF:62:17:06:7A:A5:B3:CC:78:89:
                8D:05:6A:E0:C9:86:0B:EF:8A:22:5B:86:AE:C8:80:90:6E:14:DB:8C:
                20:D3:29:FF:42:54:0E:C6:0B:F9:2C:22:07:ED:59:EB:5A:E8:06:FF:
                1F:24:BC:63:6A:66:58:C5:BD:8D:93:E4:1C:D1:D0:E4:7E:60:7B:FE:
                AC:E6:FB:75:29:D7:47:09:3C:6F:3E:6A:F8:8F:1D:51:64:C7:74:E8:
                22:EC:5D:96:96:49:CB:E6:CE:DF:5D:72:47:CE:01:F0:E6:54:F9:FB:
                0E:C0:6C:B9:1D:E5:39:A5:1C:BB:D9:A0:EC:E4:6A:46:A2:93:1F:0B:
                D8:40:9C:61:85:71:A3:30:97:1C:17:F0:F5:E9:01:E4:F9:A2:4A:C3:
                40:DE:C7:8C:EC:45:EF:D3:2C:9D:CC:10:8D:3C:3A:96:87:B5:5D:22:
                E8:5C:E2:59:84:41:A7:6A:47:BF:DE:61:F7:76:3E:F3:BD:2E:66:C3:
                DE:EC:57:C8:7A:4D:0F:CD:21:46:4B:C0:68:6B:D4:3D:6B:70:BE:DA:
                2D:31:7B:42:60:69:2B:B0:8A:E2:7D:FB:F2:58:0C:FC:44:F8:68:A2:
                90:FF:94:39:9E:B3:A5:69:57:D8:B7:C9:C8:FC:79:AA:25:B2:B5:2C:
                DF:0C:61:75:CB:B0:F9:27:23:BD:60:40:D0:DC:C6:1F:F5:A4:7C:6E:
                D4:58:4B:BE:FB:41:95:B6:80:F6:C1:81:43:94:86:A3:22:0F:EF:B9:
                B8:00:39:49:4E:79:E9:58:EC:3E:9B:A8:94:8A:DE:1A:12:CE:9B:8A:
                B3:43:15:BE:8D:D8:E2:75:94:0E:11:1F
parm:           timeout:Watchdog timeout in seconds. 1 <= timeout <= 255, default=60. (int)
parm:           nowayout:Watchdog cannot be stopped once started (default=0) (bool)
parm:           early_disable:Disable watchdog at boot time (default=0) (int)
```

2. Start and set the WTD to 60 seconds by using:

```
sudo modprobe w83627hf_wdt timeout=60
```

   After starting the WTD using this command, you need to reset the WTD continuously, or the system will reboot in 60 seconds.

3. To reset the WTD, you can echo any character to /dev/watchdog. The following command uses 'a' as example:

```
sudo sh -c "echo 'a' > /dev/watchdog"
```

4. Stop the WTD by removing module w83627hf_wdt.

```
sudo modprobe -r w83627hf_wdt
```

5. To reset the watchdog automatically, you can install the watchdog package.

```
sudo apt install watchdog
```

   For more information on this package, use the command below.

```
man watchdog
```

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Appendix D I/O Operation

The ROScube-I Series supports several Linux-based Neuron libraries for interfaces such as DI/O and I2C. ADLINK provides function libraries and sample code for easy application of each interface. The steps below illustrate how to use these libraries with the bash command line.

D.1 DI/O

D.1.1 DI0 to DI7

DI0	GPIO220
DI1	GPIO221
DI2	GPIO222
DI3	GPIO223
DI4	GPIO224
DI5	GPIO225
DI6	GPIO226
DI7	GPIO227

These GPIO ports are used only for input and are mapped to **/sys/class/gpio/gpio220** through **/sys/class/gpio/gpio227**.

1. Open the bash terminal and set to root.

```
sudo su
```

2. Initialize the CN-DI you want to use (for example: CN-DI0, or GPIO220).

```
echo 220 > /sys/class/gpio/export
echo in > /sys/class/gpio/gpio220/direction
```

3. Read the signal from the port.

```
cat /sys/class/gpio/gpio220/value
```

The return value will be 1 (low) or 0 (high).

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D.1.2 DO0 to DO7

DO0	GPIO253
DO1	GPIO254
DO2	GPIO255
DO3	GPIO256
DO4	GPIO257
DO5	GPIO258
DO6	GPIO259
DO7	GPIO260

These GPIO ports are used only for output and are mapped to **/sys/class/gpio/gpio253** through **/sys/class/gpio/gpio260**.

1. Open the bash terminal and set to root.

```
sudo su
```

2. Initialize the DO you want to use. (For example: DO0, or GPIO253.)

```
echo 253 > /sys/class/gpio/export
echo out > /sys/class/gpio/gpio253/direction
```

3. Control the output.

```
#Set output to high.
echo 0 > /sys/class/gpio/gpio253/value
#Set output to low.
echo 1 > /sys/class/gpio/gpio253/value
```

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D.2 I2C

I2C0	/dev/i2c-0
I2C1	/dev/i2c-1

I2C ports on DB-50 are mapped to I2C-0 and I2C-1.

1. Open the bash terminal and install I2C-tools to control the I2C devices.

```
sudo apt install i2c-tools
```

2. Set to root.

```
sudo su
```

3. Scan the I2C bus on the ROScube-I.

```
i2cdetect -l
```

```
root@ROScube-I:/home/ros# i2cdetect -l
i2c-3   i2c             i915 gmbus dpc                          I2C adapter
i2c-1   i2c             Synopsys DesignWare I2C adapter         I2C adapter
i2c-8   i2c             DPDDC-E                                 I2C adapter
i2c-6   i2c             DPDDC-B                                 I2C adapter
i2c-4   i2c             i915 gmbus misc                         I2C adapter
i2c-2   i2c             i915 gmbus dpb                          I2C adapter
i2c-0   i2c             Synopsys DesignWare I2C adapter         I2C adapter
i2c-7   i2c             DPDDC-C                                 I2C adapter
i2c-5   i2c             i915 gmbus dpd                          I2C adapter
```

4. Scan an I2C bus for devices (An I2C device must be connected).

```
i2cdetect -r -y 0
```

```
root@ROScube-I:/home/ros# i2cdetect -r -y 0
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:          -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: 50 51 -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
```

On this I2C bus, EEPROM was detected at 0x50 and 0x51.

5. List every piece of data on one EEPROM (e.g., 0x50).

```
i2cdump -f -y 0 0x50
```

```
root@ROScube-I:/home/ros# i2cdump -f -y 0 0x50
No size specified (using byte-data access)
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f    0123456789abcdef
00: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
10: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
20: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
30: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
40: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
50: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
60: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
70: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
80: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
90: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
a0: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
b0: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
c0: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
d0: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
e0: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
f0: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
```

6. Write the byte value 0x01 to the ROM address 0x00.

```
i2cset -f -y 0 0x50 0x00 0x01
```

```
root@ROScube-I:/home/ros# i2cset -f -y 0 0x50 0x00 0x01
root@ROScube-I:/home/ros# i2cdump -f -y 0 0x50
No size specified (using byte-data access)
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f    0123456789abcdef
00: 01 ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ?...............
10: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
20: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
30: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
40: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
50: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
60: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
70: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
80: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
90: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
a0: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
b0: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
c0: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
d0: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
e0: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
f0: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff    ................
```

7. (Optional) You can also get the value from a specific device.

```
i2cset -f -y 0 0x50 0x00
```

```
root@ROScube-I:/home/ros# i2cget -f -y 0 0x50 0x00
0x01
root@ROScube-I:/home/ros#
```

D.3 LEDs

LED0	GPIO276
LED1	GPIO277
LED2	GPIO278
LED3	GPIO279
LED4	GPIO280
LED5	GPIO281



These LEDs are mapped to **/sys/class/gpio/gpio276** through **/sys/class/gpio/gpio281**.

1. Open the bash terminal and set to root.

```
sudo su
```

2. Initialize the DI you want to use. (For example: LED0, or GPIO276.)

```
echo 276 > /sys/class/gpio/export
echo out > /sys/class/gpio/gpio276/direction
```

3. Control the LED.

```
#Set LED on.
echo 0 > /sys/class/gpio/gpio276/value
#Set LED off.
echo 1 > /sys/class/gpio/gpio276/value
```

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D.4 Serial Ports

The ROScube-I has two serial ports located at **/dev/ttyS0** and **/dev/ttyS1**. The following steps illustrate how to test the serial ports using gtkterm.

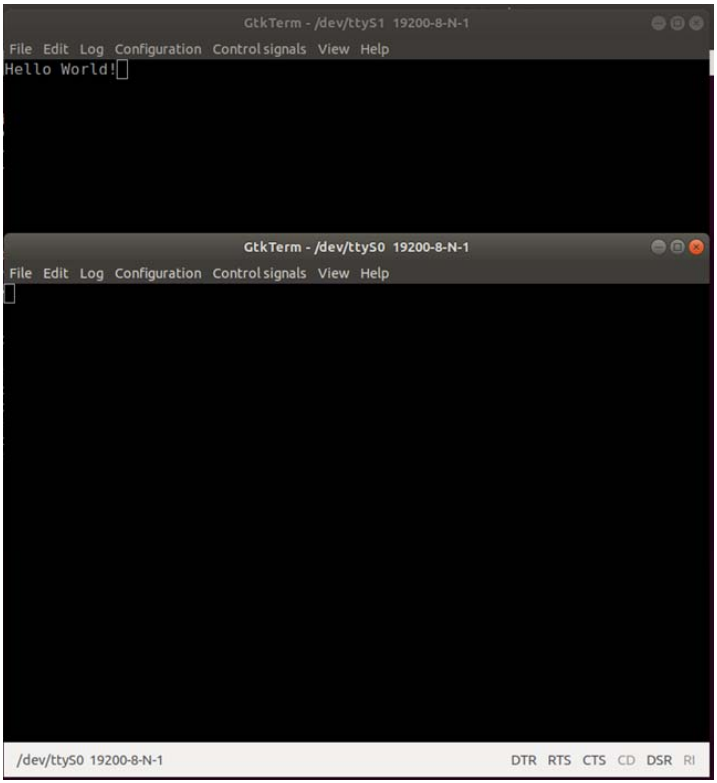
1. Install gtkterm.

```
sudo apt install gtkterm
```

2. Run gtkterm using root.

```
sudo gtkterm
```

Example:



Here, two serial ports are connected, and “Hello World!” was sent from **/dev/ttyS0** to **/dev/ttyS1**.

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Important Safety Instructions

For user safety, please read and follow all instructions, Warnings, Cautions, and Notes marked in this manual and on the associated device before handling/operating the device, to avoid injury or damage.

- Read these safety instructions carefully.
- Keep the User's Manual for future reference.
- Read the Specifications section of this manual for detailed information on the recommended operating environment.
- The device can be operated at an ambient temperature of 50ºC using the DC power input and 35ºC using a DC adapter.
- It is recommended that the device be installed in Information Technology Rooms that are in accordance with Article 645 of the National Electrical Code and NFPA 75.
- To avoid electrical shock and/or damage to device:
  - Keep device away from water or liquid sources.
  - Keep device away from high heat or humidity.
  - Keep device properly ventilated (do not block or cover ventilation openings).
  - Always use recommended voltage and power source settings.
  - Always install and operate device near an easily accessible electrical outlet.
  - Secure the power cord (do not place any object on/over the power cord).
  - Only install/attach and operate device on stable surfaces and/or recommended mountings.
  - The power cord must be connected to a socket or outlet with a ground connection.
- If the device will not be used for long periods of time, turn off and unplug from its power source.
- Never attempt to repair the device, which should only be serviced by qualified technical personnel using suitable tools.

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- A Lithium-type battery may be provided for uninterrupted backup or emergency power.



Risk of explosion if battery is replaced with one of an incorrect type; please dispose of used batteries appropriately.

- This equipment is not suitable for use in locations where children are likely to be present.
- The device must be serviced by authorized technicians when:
  - The power cord or plug is damaged
  - Liquid has entered the device interior
  - The device has been exposed to high humidity and/or moisture
  - The device is not functioning or does not function according to the User's Manual
  - The device has been dropped and/or damaged and/or shows obvious signs of breakage
- Disconnect the power supply cord before loosening the thumbscrews and always fasten the thumbscrews with a screwdriver before starting the system up
- It is recommended that the device be installed only in a server room or computer room where access is:
  - Restricted to qualified service personnel or users familiar with restrictions applied to the location, reasons therefor, and any precautions required
  - Only afforded by the use of a tool or lock and key, or other means of security, and controlled by the authority responsible for the location



BURN HAZARD

Hot surface! Do not touch! Touching this surface could result in bodily injury. To reduce risk, allow the surface to cool before touching.

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Consignes de Sécurité Importante

S'il vous plaît prêter attention stricte à tous les avertissements et mises en garde figurant sur l'appareil, pour éviter des blessures ou des dommages.

- *Lisez attentivement ces consignes de sécurité.*
- *Conservez le manuel de l'utilisateur pour pouvoir le consulter ultérieurement.*
- *Lisez la section Spécifications de ce manuel pour des informations détaillées sur l'environnement d'exploitation recommandé.*
- *L'appareil peut fonctionner à une température ambiante de 50°C en utilisant l'entrée d'alimentation CC et de 35°C en utilisant un adaptateur CC.*
- *Il est recommandé d'installer l'appareil dans des salles de technologie de l'information conformes à l'article 645 du National Electrical Code et à la NFPA 75.*
- *Pour éviter les chocs électriques et/ou d'endommager l'appareil:*
  - *Tenez l'appareil à l'écart de toute source d'eau ou de liquide.*
  - *Tenez l'appareil à l'écart d'une forte chaleur ou d'une humidité élevée.*
  - *Maintenez l'appareil correctement ventilé (n'obstruer ou ne couvrez pas les ouvertures de ventilation).*
  - *Utilisez toujours les réglages de tension et de source d'alimentation recommandés.*
  - *Installez et utilisez toujours l'appareil près d'une prise de courant facilement accessible.*
  - *Fixez le cordon d'alimentation (ne placez aucun objet sur le cordon d'alimentation).*
  - *Installez/fixez et utilisez l'appareil uniquement sur des surfaces stables et/ou sur les fixations recommandées.*
  - *Le cordon d'alimentation doit être connecté à une prise ou à une prise de courant avec mise à la terre.*

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- Si l'appareil ne doit pas être utilisé pendant de longues périodes, éteignez-le et débranchez-le de sa source d'alimentation
- *N'essayez jamais de réparer l'appareil, qui ne doit être réparé que par un personnel technique qualifié à l'aide d'outils appropriés*
- *Une batterie de type Lithium peut être fournie pour une alimentation de secours ininterrompue ou d'urgence.*



ATTENTION: Risque d'explosion si la pile est remplacée par une autre de type incorrect. Veuillez jeter les piles usagées de façon appropriée.

- *Cet équipement ne convient pas à une utilisation dans des lieux pouvant accueillir des enfants.*
- *L'appareil doit être entretenu par des techniciens agrees lorsque:*
- *Le cordon d'alimentation ou la prise est endommagé(e)*
- *Un liquide a pénétré à l'intérieur de l'appareil.*
- *L'appareil a été exposé à une forte humidité et/ou de la buée.*
- *L'appareil ne fonctionne pas ou ne fonctionne pas selon le manuel de l'utilisateur.*
- *L'appareil est tombé et/ou a été endommagé et/ou présente des signes évidents de dommage.*
- *Débranchez le cordon d'alimentation avant de desserrer les vis à oreilles et serrez toujours les vis à oreilles avec un tournevis avant de mettre le système en marche.*
- *Il est recommandé d'installer l'appareil uniquement dans une salle de serveurs ou une salle informatique où l'accès est:*
  - *Réservé au personnel de service qualifié ou aux utilisateurs familiarisés avec les restrictions appliquées à l'emplacement, aux raisons de ces restrictions et toutes les précautions requises*
  - *Uniquement autorisé par l'utilisation d'un outil, d'une serrure et d'une clé, ou d'un autre moyen de sécurité, et contrôlé par l'autorité responsable de l'emplacement.*

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	***RISQUE DE BRÛLURES*** ***Partie chaude!*** *Ne touchez pas cette surface, cela pourrait entraîner des blessures. Pour éviter tout danger, laissez la surface refroidir avant de la toucher.*

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Getting Service

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