



Thundercomm EB5 Edge AI Box

Hardware User Manual

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April 26, 2022

Revision History

Revision	Date	Description
1.0	Jan 25, 2021	Initial release
1.1	May 25, 2021	Update the pictures of figure
1.2	June 7,2021	Update some points
1.3	June 8,2021	Update some points
1.4	June 22,2021	Change description of Phoenix terminal
1.5	June 28,2021	Add certification information in 2.4.Product Specifications
1.6	July 8,2021	Delete the Bluetooth discription in Table 3-9
1.7	July 14,2021	Add Chapter 5.Warranty & Product Support Service
1.8	Feb 22, 2022	Add Appendix 1. Warnings .
1.9	April 26,2022	Update the documents according to the software and hardware status of the existing equipment.

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About This Document

- Illustrations in this documentation might look different from your product.
- Depending on the model, some optional accessories, features, and software programs might not be available on your device.
- Depending on the version of operating systems and programs, some user interface instructions might not be applicable to your device.
- Documentation content is subject to change without notice. Thundercomm makes constant improvements on the documentation of your computer, including this guidebook.
- Button, tool, and key names appear in bold font, for example, click **Save** or press **Enter**.
- Folders and files are formatted in italic, for example, *turbobox_flash_flat.sh*.

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Chapter 1. Safety

Read this chapter first before installing, operating, or maintaining equipment developed by Thundercomm.

1.1. General safety precautions

- To ensure the safety of person and equipment, follow all the safety precautions on the device identification and in this manual when installing, operating, and maintaining equipment.
- Notes, warnings, and hazards in the manual do not represent all safety matters that should be observed. It is intended only as a supplement to all safety considerations.

1.1.1. Local laws and regulations

When you operate the device, please comply with local laws and regulations. Safety precautions in this manual are intended only as a supplement to local safety regulations.

1.1.2. Basic installation requirements

The person responsible for installing and maintaining Thundercomm equipment must first be trained strictly and know all kinds of safety precautions. He must also master the correct operating methods before he can install, operate, and maintain the equipment.

- Only qualified and trained personnel are allowed to install, operate and maintain the equipment.
- Only qualified professionals are allowed to remove safety facilities and repair equipment.
- Replacing and changing equipment or parts, including software, must be done by a person certified or authorized by Thundercomm.
- The operator shall promptly report to the person in charge any failure or error that may cause a safety problem.

1.1.3. Grounding requirements

The following requirements apply only to equipment requiring grounding:

- When installing equipment, it is necessary to first ground; When removing the equipment, remove the ground wire last.
- Do not destroy the ground conductor.
- Do not operate equipment without a grounded conductor installed.
- The equipment shall be permanently attached to the protected area. Check electrical connections before operating equipment. Please ensure that the equipment is reliably grounded.

1.1.4. On operator

- Do not operate equipment and cables during thunderstorms.
- When thunderstorm weather, you should unplug the AC power connector, prohibit the use of fixed terminals, do not touch the terminal and antenna connector.
Instructions: The above two requirements apply to wireless fixed station terminals.
- To avoid shock hazards, do not connect safety extra low Voltage (SELV) circuit terminals to communication network voltage (TNV) circuit terminals.
- It is forbidden to look directly at the fiber outlet with the open eye to prevent the laser beam from burning the eye.
- Before operating the equipment, you should wear antistatic work clothes and anti-static gloves or wristbands. Remove conductive objects such as jewelry and watches to avoid being shocked or burned.
- If there is a fire, you should evacuate the building or equipment area and press the fire alarm bell, or call the fire

alarm number. No re-entry into the burning building is allowed under any circumstances.





1.1.5. On equipment

- Before operation, the equipment should be reliably fixed on the floor or other stable objects, such as walls or mounting frames.
- Do not block the vent when the system is running.
- When installing the panel, if the screws need to be tightened, you must use tools.
- After installing the equipment, please clear the empty packing materials in the equipment area.

1.1.6. Marks on equipment

Refer to the table below to comprehend safety signs.

Table 1-1. Safety sign list

Graphic	Name	Instructions
	Warning signs	The logo indicates that improper operation may result in equipment damage or personal injury.
	External ground marking	This mark is the grounding mark outside the equipment. The two ends of the grounding cable are connected to different equipment, which means that the equipment must be earthed at the connecting point, so as to ensure the normal operation of the equipment and the personal safety of operators.
	Internal ground mark	This mark is the grounding mark inside the equipment. Both ends of the grounding cable are connected to different components of the same equipment, which means that the equipment must be grounded through the connecting point to ensure the normal operation of the equipment and the personal safety of operators.
	Antistatic mark	This mark indicates an electrostatic sensitive area. Do not touch the device with your bare hands. When operating in this area, take strict anti-static measures, such as wearing anti-static wrist bands or anti-static gloves.

1.1.7. Electrical safety

- **High Pressure**



Notice:

- High voltage power supply provides power for the operation of equipment. Direct contact with high voltage power supply or indirect contact with high voltage power supply through wet object will bring fatal danger.
- Improper and incorrect operation of high voltage may cause accidents such as fire or electric shock.

- **Thunderstorm Weather**

This requirement applies only to wireless base stations or devices with skylines.



Notice: It is forbidden to operate the tower and mast under the thunderstorm, otherwise there will be danger of life.

- **Big Leakage Current**



Notice:

- The equipment must be grounded before the power is switched on, otherwise it will endanger the safety of person and equipment.
 - If there is a "large leakage current" sign pasted near the power terminal of the equipment, the protective grounding terminal of the equipment housing must be grounded before connecting the AC input power to prevent the leakage current of the equipment from causing electric shock to the human body.
-

- **Power Cord**



Notice:

- Do not install or remove the power cord live. The moment the power core touches the conductor, it will produce electric arc or spark, which can lead to fire or eye injury.
 - The power switch must be turned off before the power cord is installed or removed.
 - Before connecting the power cord, make sure that the power cord label is correctly identified before connecting.
-

- **Fuse**



Notice: To ensure the safe operation of the equipment, when the fuse on the equipment is blown, the fuse of the same model and specification should be replaced.

- **Electrostatic Discharge**

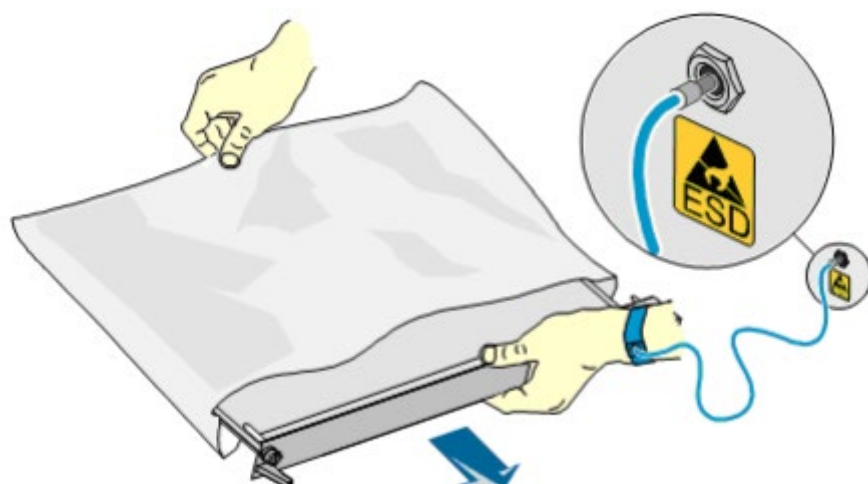


Notice:

- Static electricity generated by the human body will damage electrostatic sensitive components on the single board, such as large-scale integrated circuit (LSI) and so on.
 - In the case of human body movement, clothing friction, shoes and floor friction or holding ordinary plastic products, the human body will generate electrostatic electromagnetic field, not easy to disappear before discharge.
 - Before touching the equipment and holding the single board or special integrated circuit (ASIC) chip, the anti-static wrist band must be worn and the other end of the anti-static wrist band must be well grounded to prevent the body's electrostatic damage to sensitive components.
-

- **Anti-static wristband:**

Figure 1-1. Anti-static wristband



1.2. Safety and caution information

AC Power Adapter: Risk of electric shock, fire, or burn if using an AC adapter other than the one provided with this device, Indoor use only and in dry locations. Device must only be repaired by a professional, do not open enclosure. The rated parameter of the adapter is 19v / 4.74 A, 90W, please use the socket with grounding wire.

- Risk of explosion if the battery is replaced with an incorrect type. Batteries should be recycled where possible. Disposal of used batteries must be in accordance with local environmental regulations.
- Failure to use the included power adapter shall violate regulatory compliance requirements and may expose the user to safety hazards.

Medical: This device may interfere with the operation of some pacemakers, hearing aids or other medical devices. To reduce the risk, maintain a separation distance of 20cm (8 inches) between the device and the medical device. Refer to the medical device for additional information.

Modify: Modification of the wireless solution, thermal solution, device components or enclosure shall violate regulatory compliance requirements and may induce safety hazards.

Chapter 2. Introduction

2.1. Overview

EB5 Edge AI box is a lightweight edge device, featuring powerful AI and video decode capabilities. It supports device-edge-cloud synergy, remote algorithm and application deployment, FOTA and DM. It can be widely used in complex environments such as industrial park, urban residential areas and shopping mall.

EB5 is Thundercomm lightweight edge device for a wide range of edge applications, featuring strong AI computing performance, flexible configuration, wide temperature range support, environmental adaptability, and easy maintenance and management. EB5 is mainly used as edge gateway and edge intelligent analysis device to deploy in various edge application scenarios such as smart building, smart car, smart retail etc.



Figure 2-1. Top View

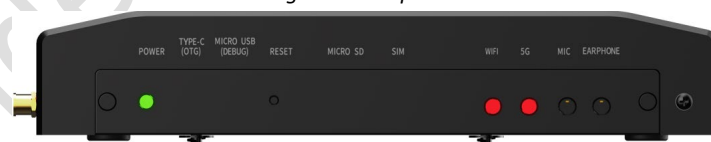


Figure 2-2. Front View



Figure 2-3. Rear View



Figure 2-4. Side View

2.2. Key features

Easy to use for edge scenes

- Real-time: EB5 can deal with the data locally and provide real-time response.
- Low bandwidth: EB5 can only transfer necessary information to the cloud.
- Privacy protection: you can decide to save your information either to the cloud or to local directories. All information sent to the cloud can be encrypted.
- Support standard containers engine.
- Support rapid deployment of algorithms and applications.

24-channel video analysis

- Support 24-channel 1080p@30FPS decoding.
- Support 16-channel 1080p@30FPS coding.
- Support 24-channel 1080p@30FPS video AI analysis.

Strong environmental adaptability (Support for edge environment deployment)

- Industrial protection grade: IP40 Level design.

Flexible Ethernet connection selection

- Support WiFi6, 2*RJ45(Gigabits-Ethernet) and optional 5G module.

High reliability

- All firmware in the system supports cluster backup. (Under development)
- Support software and hardware fault detection and Alarm.
- Provide cluster backup solution, built-in cluster backup software. (Under development)

Remote maintenance and upgrade

- Remote view of IP cameras surveillance video screen connected to EB5.
- Configure the camera parameters of IP cameras remotely.
- Remote firmware upgrade for EB5.

2.3. Usage scenario

EB5 can be used in many scenarios, including safe city, smart safety supervision, smart transportation, smart manufacturing, smart retail, smart care, etc. Typical architectures in these application scenarios are as follows:

- Terminal: Wirelessly connect to IPC (IP Camera) or other front-end devices.
- Edge: Edge implements value information extraction, storage and uploading.
- Cloud: Data center model management, development, and application.

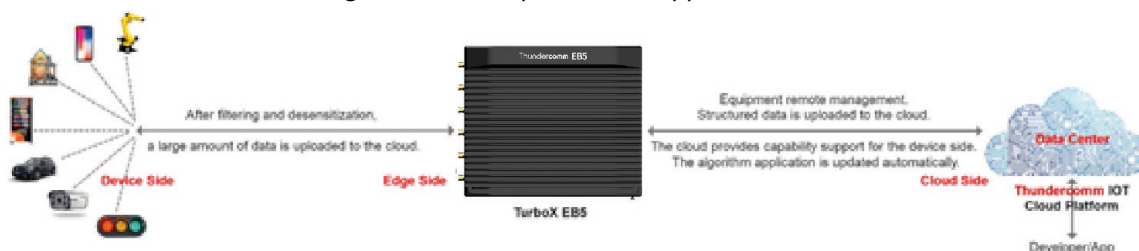


Figure 2-5. Usage Scenario Diagram

2.4. Product specifications

Table 2-1.EB5 Specifications

Item	Specifications
OS	Ubuntu18.04 or Android
Platform (Snapdragon™ QRB5165, AI Performance: 15 TOPS)	CPU: Qualcomm® Kryo™ 585 CPU, CPU Clock Speed: up to 2.84GHz
	GPU: Qualcomm® Adreno™ 650 GP
	DSP: Qualcomm® Hexagon™ 698 Processor
	VPU: Adreno™ 665 VPU, H264 & H265 codec support; video decoding: 8k@60fps; video encode: 8k@30fps
	ISP: Qualcomm Spectra™ 480 image processing
System Memory	RAM: 8GB, LPDDR5(POP)
Storage	Flash: 128G UFS3.0 on board
	Expansion: SD Card, SSD
Display	2x HDMI out, 1080p@60fps
USB	4x USB 3.0 Type A, 1x USB3.1 Type C(OTG)
Micro SD	1x Micro SD Slot
SIM	1x Nano SIM card slot
Ethernet	2x RJ45, support gigabits Ethernet(10/100M/1000M)
COM Port	2x RS232, 2x RS485
CAN	2x CAN bus
DI/DO	8 DI/DO (4 DI, 4 DO)
Wireless Connectivity	WIFI: 802.11a/b/g/n/ac/ax, 2x2 MIMO
	5G: M.2 5G module(optional), multimode support:2G/3G/4G/5G NR sub-6
	Antenna: 6x Antenna connector (2x for WIFI,4x for 5G)
Audio	1x MIC, 1x Earphone
Debug Port	1x Micro USB (for debug)
Input & Indicators	Buttons: Power key, Reset key
	LEDs: Power status, WIFI status,5G status
Others	CR2032 RTC Battery
DC input	19V DC (can support 12V ~ 24V DC)
Mechanical	Waterproof: IP40 level Design
	Dimension: 200mm*235.5mm*44mm
	Net weight: 2200g (box body only), 2638g (body and adaptor included)
	Mount: Desktop, Wall Mount
Environment	Operation Temperature: -10 ~ 50 centigrade ^{note1}
	Storage Temperature: -20 ~ 70 centigrade
	Storage Humidity: 10%~90%, non-condensing
	Anti-Vibration: 0.5Grms @ 5 ~ 500 Hz, random
Certification	CE, FCC ^{note2} , JATE/TELEC, RoHS/Reach

Note:

Note1: Test under typical application.

Note2: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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Chapter 3. Hardware Description

3.1. Hardware system architecture

EB5 provides a rich IO interface, flexible access to a variety of peripherals. Connect Tech's EB5 brings deployable Snapdragon 865 5G Mobile Platform to the market. The EB5 design includes a Locking Power Input (+12V to +24V), 2* Ethernet, 2* HDMI video, 4* USB 3.0 Type A, Micro USB 2.0 (for debug), Type -C, MIC, Earphone, Micro SD Card, SIM Card, 3* Phoenix terminal (10pin) (Isolated Full Duplex CAN *2, Isolated RS485 *2, RS232 *2, DO*4, DI*4), M.2 (B-Key, M-Key), RTC battery, and a dual-purpose Power push button with LED.

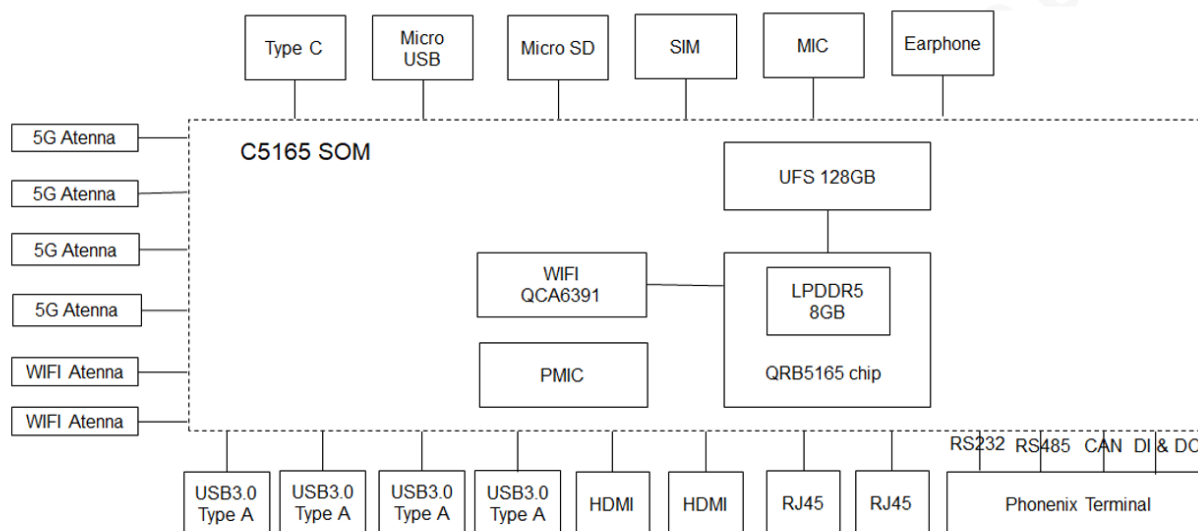


Figure 3-1 Hardware logic architecture

3.2. System architecture



Figure 3-2. Top View



Figure 3-3. Side View

3.3. Hardware specifications



Figure 3-4. Front View Light Location

Table 3-1. Front view light location and specification

No.	Name	Instruction
1	Power Indicator/Button	<p>Instruction of electric indicator light under safety condition:</p> <ul style="list-style-type: none"> ➤ EB5 supports power-on startup ➤ Press the button in the state of power on and the system will start the safe power down process. ➤ Long press the button for 10 seconds in the state of power on, and the system starts to force the power flow down ➤ Under the state of power down, press the button briefly and the system starts the power up process. <p>EB5 power button supports Power ON/OFF of the platform and power indicator.</p> <p>Power status indicator:</p> <ul style="list-style-type: none"> ➤ Green (bright): EB5 is working; ➤ Green (flashing): EB5 is being powered on; ➤ Green (put out): EB5 complete operation;
2	Wi-Fi Light	<ul style="list-style-type: none"> ➤ Green (bright): EB5 is working; ➤ Red (bright): EB5 connection is broken; ➤ Light extinguished: WIFI off;
3	5G Light	<ul style="list-style-type: none"> ➤ Green (bright): EB5 is working; ➤ Red (bright): EB5 connection is broken; ➤ Light extinguished: 5G off;

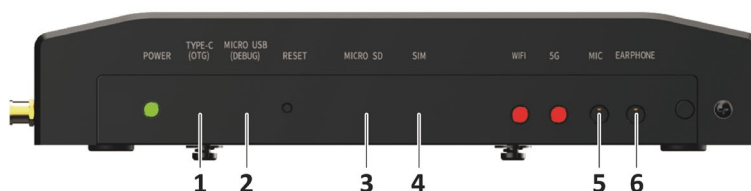


Figure 3-5. Front View Connector Location

Table 3-2. Front view connector location and specification

No.	Name	Instruction
1	Type-C	Behind the baffle, used for ADB debugging.
2	Micro USB	Behind the baffle, used for UART debugging Port.
3	Micro SD	Behind the baffle, used for ADB debugging.
4	SIM Card	Behind the baffle, used for storage extension.
5	MIC	3.5-inch MIC input interface
6	Earphone	3.5-inch Earphone output interface



Figure 3-6. Front View Button Location

Table 3-3. Front view button location and specification

No.	Name	Instruction
1	POWER Button	<p>Instruction of electric indicator light under safety condition:</p> <ul style="list-style-type: none"> ➤ EB5 supports power-on startup ➤ Press the button in the state of power on and the system will start the safe power down process. ➤ Long press the button for 10 seconds in the state of power on, and the system starts to force the power flow down ➤ Under the state of power down, press the button briefly and the system starts the power up process. <p>EB5 power button supports Power ON/OFF of the platform and power indicator.</p> <p>Power status indicator:</p> <ul style="list-style-type: none"> ➤ Green (bright): EB5 is working; ➤ Green (flashing): EB5 is in the process of the electric; ➤ Green (put out): EB5 complete operation;
2	RESET Button	<p>The EB5 implements a pushbutton for reset</p> <p>Notice:</p> <p>Restoring factory Settings will cause business interruption, please use this button with caution.</p>

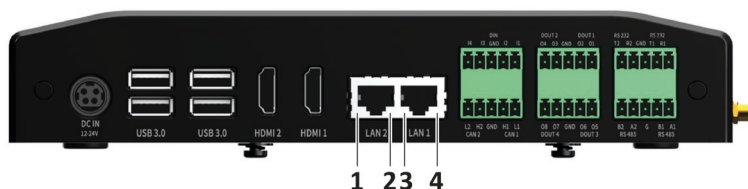


Figure 3-7. Rear View Ethernet Light Location

Table 3-4. Rear view Ethernet light location and specification

No.	Name	Instruction
1, 3	Gigabit Ethernet Connector Connection Status Light	<ul style="list-style-type: none"> ➤ Light extinguished: Network not connected ➤ Green (bright): Network connected
2, 4	Gigabit Ethernet Connector Data Transmission Status Light	<ul style="list-style-type: none"> ➤ Light extinguished: No data transfer ➤ Yellow (flashing): Data in transit

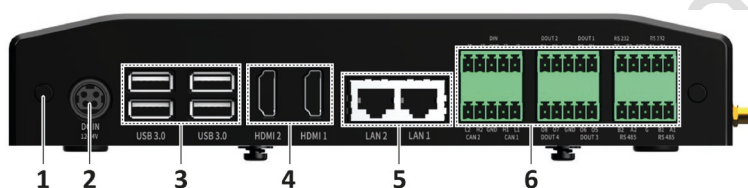
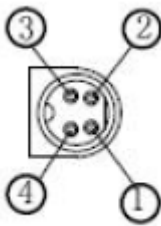


Figure 3-8. Rear View Connector Location

Table 3-5. Rear view connector location and specification

No.	Name	Instruction												
1	GND	Use a screwdriver to connect one end of the protective ground wire to the grounding terminal of the device and the other end to the connection point of the cabinet or workbench.												
2	POWER Connector	<div><div>The Edge box implements a DC JACK+12V to +24V DC power</div><div><table><tr><th>S terminal</th><th>Voltage</th></tr><tr><td>①</td><td>-</td></tr><tr><td>②</td><td>-</td></tr><tr><td>③</td><td>+</td></tr><tr><td>④</td><td>+</td></tr><tr><td>Protect</td><td>-</td></tr></table></div></div>	S terminal	Voltage	①	-	②	-	③	+	④	+	Protect	-
S terminal	Voltage													
①	-													
②	-													
③	+													
④	+													
Protect	-													
3	Type-A USB 3.0 Connector	The EB5 incorporates 4 vertical USB 3.0 Type-A connectors with a 1A current limit per connector. All USB 3.0 Type-A ports are 5Gbps capable.												
4	HDMI Connector	The EB5 module will output video via the Edge box vertical HDMI connector that is HDMI 1.4 capable.												
5	GE Connector	The EB5 implements 2 x RJ-45 ethernet connectors for internet communication. Connector A and Connector B are connected through a PCIe Gigabit Ethernet PHY to a PCIe switch.												
6	Phoenix Terminal connector	<div>If the user uses smoke detector, infrared detector, access control, alarm and other alarm output equipment.</div> <div>Connect the cable terminal to the EB5 Phoenix terminal interface and ensure that both the alarm input device and the EB5 are connected to the ground.</div>												

Phoenix terminal

Description

The Edge box implements 3 Phoenix terminals for CAN/RS232/RS485/DI/DO

Table 3-6. Phoenix terminal 1 description

No	Name	Description	Interface Figure
1	CAN1.L	CAN interface 1 L level.	
2	DI1	DI work with GND, Short with GND or open.	
3	CAN1.H	CAN interface 1 H level.	
4	DI2	DI work with GND, Short with GND or open.	
5	GND(ISO)	GND work with DI signal.	
6	GND(ISO)	GND work with DI signal	
7	CAN2.H	CAN interface 2 H level.	
8	DI3	DI work with GND, Short with GND or open.	
9	CAN2.L	CAN interface 2 L level.	
10	DI4	DI work with GND, Short with GND or open.	

Table 3-7. Phoenix terminal 2 description

No	Name	Description	Interface Figure
1	DO5	DO5 work with DO6, two pins are short and open	
2	DO1	DO1 work with DO2, two pins are short and open	
3	DO6	DO5 work with DO6, two pins are short and open	
4	DO2	DO1 work with DO2, two pins are short and open	
5	GND(ISO)		
6	GND(ISO)		
7	DO7	DO7 work with DO8, two pins are short and open	
8	DO3	DO3 work with DO4, two pins are short and open	
9	DO8	DO7 work with DO8, two pins are short and open	
10	DO4	DO3 work with DO4, two pins are short and open	

Table 3-8. Phoenix terminal 3 description

No	Name	Description	Description
1	RS232(1) TX	RS232 output signal of channel 1	
2	RS232(2) TX	RS232 output signal of channel 2	
3	RS232(1) RX	RS232 input signal of channel 1	
4	RS232(2) RX	RS232 input signal of channel 2	
5	GND(RS232)	RS232 GND signal.	
6	GND(RS232)	RS232 GND signal.	
7	RS485(1). D-	RS485 D- interface, work with D+ of channel 1	
8	RS485(2). D-	RS485 D- interface, work with D+ of channel 2	
9	RS485(1). D+	RS485 D+ interface, work with D- of channel 1	
10	RS485(2). D+	RS485 D+ interface, work with D- of channel 2	

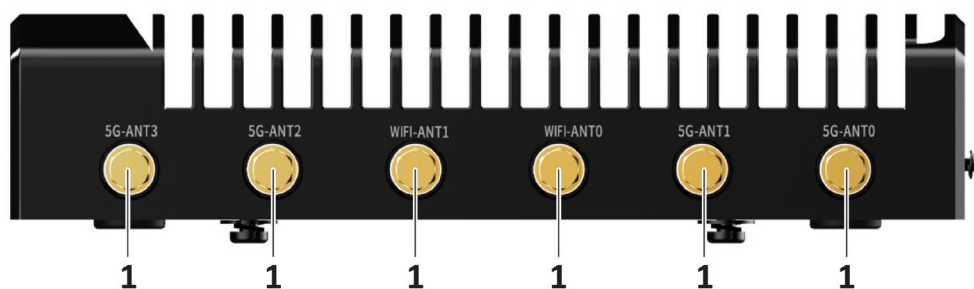


Figure 3-9. Left View Antenna Location

Table 3-9. Left view antenna description

No.	Name	Type	Instructions
1	Antenna Connectors	SMA-K	The EB5 chassis implements 6x SMA Antenna Connectors (optional) for WiFi and M.2 3052 B-Key (5G).

Chapter 4. Hardware Operation

Power On

Please check that EB5 and the power adapter in the package are in good condition. Perform boot operation according to our operation guide. EB5 starts automatically when it is plugged in.

Step 1. Plug the power adapter into the power socket.

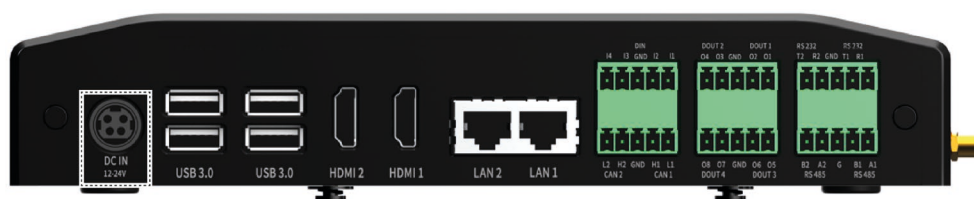


Figure 4-1. Power Button Location Instruction

Step 2. Check the working status of the power indicator.

➤ **NOTE:** Power indicator:

- LED light (green): EB5 is working
- LED light (off): EB5 is powered off

Remarks:

Press the power button for a short time and wait for the power to power down after the power light flashes.

Or long press for more than 10 seconds to force the system to shut down.

EB5 can be powered off by unplugging the power cord.

Chapter 5. Warranty & Product Support Service

5.1. Customer support have two methods:

E-mail support: customer can get support from writing to: service@thundercomm.com

Customer service platform: customers can report bugs on platform directly and our engineers will give feedback on platform (It will be opened in August this year)

5.2. Fix broken device

Warranty Period: one year

The period of warranty shall start from the date of purchase of the product and shall cover a period of one (1) year.

5.3. Scope of Warranties:

Our products are manufactured under a thorough quality control system, but in any case in which our products failed under proper operating conditions within the warranty period, we will repair the product or deliver an alternate product without charge.

Please note that the warranty mentioned here means the warranty for the individual product, and does not include any damage resulting from a fault in our product (damages and loss incurred to products other than our products, lost profits, lost business opportunities, transportation costs, construction costs, etc.).

- EB5 is limited warranty, the guarantee does not include:
Defects caused by inappropriate transport, bad usage inconsistent with manuals, neglect as well as some dirt or items which have got through the appliances.
- Mechanical, thermal and chemical damages caused by external forces (lightning, surges) as well as corrosion.

Appendix 1. Warnings

A1.1. Product powered by external power adapter

The equipment is supplied by external power adapter which is considered to be Pluggable Equipment Type-A. The socket outlets shall be installed near the equipment and be easily accessible.

A1.2. Product with built-in button battery

- Risk of fire or explosion or defeat the safeguard of equipment if the battery is replaced by an incorrect type. Replace only with the same or equivalent type.
- Disposal of a battery into fire or a hot oven, or mechanically crushing or cutting of a battery, that can result in an explosion.
- High or low extreme temperatures or low air pressure at high altitude that the battery can be subjected to during use, storage or transportation.

Leaving the battery in an extremely high temperature and/or low air pressure surrounding environment that can result in an explosion or the leakage of flammable liquid or gas.

Appendix 2. Notices

Thundercomm may have patents or pending patent programs covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries to service@thundercomm.com.

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