Thundercomm
AIOT ENABLER

Thundercomm EB5S Edge AI Station

Hardware User Manual

Rev. V0.2
November 21, 2023

Revision History

Revision	Date	Description
0.1	2023-11-21	Initial release
0.2	2023-11-21	Add FCC warning content according to certification requirements.

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, *turbox_flash_flat.sh*.

Content

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 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:**

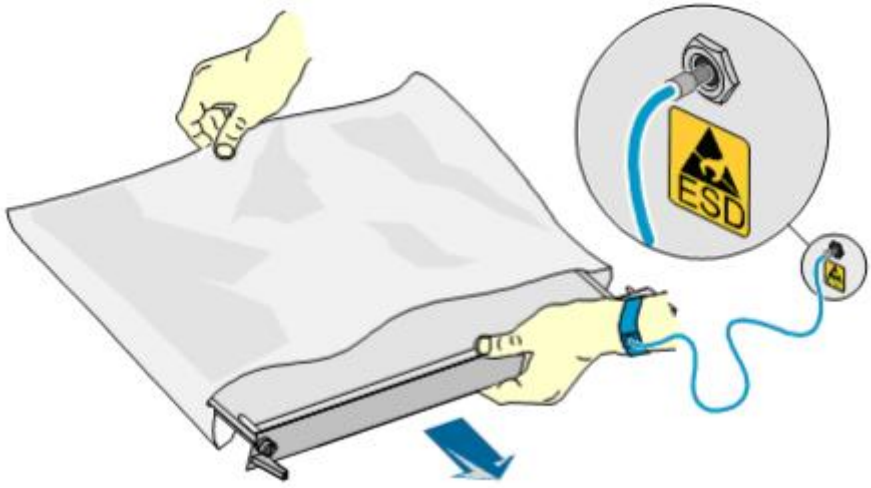


Figure 1-1. Anti-static wristband

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 / 3.15 A, 60W, 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 distanceof20cm(8inches) 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

EB5S Edge AI box is a lightweight edge device, featuring powerful AI and video decode capabilities. With edge side management software: EdgeOS, EB5S 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.

EB5S 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. EB5S 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: EB5S can deal with the data locally and provide real-time response.
- Low bandwidth: EB5S 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 rapid deployment of algorithms and applications.

Video analysis capability

- Support 8K30 encode / 8K60 decode.
- Support 24-channel 1080p@30FPS decoding.
- Support 16-channel 1080p@30FPS coding.

Strong environmental adaptability

- Industrial grade full metal structure design, high equipment reliability.
- Fan-less passive thermal design, convenient for equipment deployment and maintenance.

Flexible Ethernet connection selection

- Support 2*RJ45(Gigabits-Ethernet) for Network Isolation
- Support M.2 connector to extend 5G/4G/3G cellular function.
- Support M. 2 connector to extend WiFi6/WiFi7 etc. function.

Remote maintenance and upgrade

- Remote view of IP cameras surveillance video screen connected to EB5S.
- Configure the camera parameters of IP cameras remotely.
- Remote firmware upgrade for EB5S.

2.3. Usage scenario

EB5S 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 end devices.
- Edge: Edge implements value information extraction, storage and uploading.
- Cloud: Data center model management, development, and application.

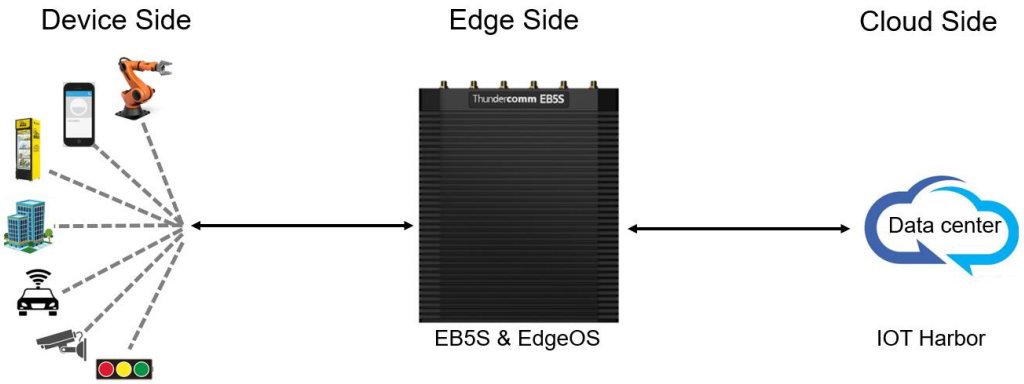


Figure 2-5. Usage Scenario Diagram

Chapter 3. Hardware Description

3.1. Hardware system architecture

EB5S provides a rich IO interface, flexible access to a variety of peripherals. The EB5S design includes a Locking Power connector (+12V to +24V), 2* Ethernet, 2* HDMI video, 3* USB 3.0 Type A, Micro USB 2.0 (connector located inside the box, is used to get system debug log), Type -C, MIC, Earphone, Micro SD Slot, SIM Card Slot, 2* Phoenix terminal (10pin) (Isolated RS485 *2, RS232 *2, DO*2, DI*4), M.2 (B-Key, M-Key), RTC battery, and Power push button with LED instructor.

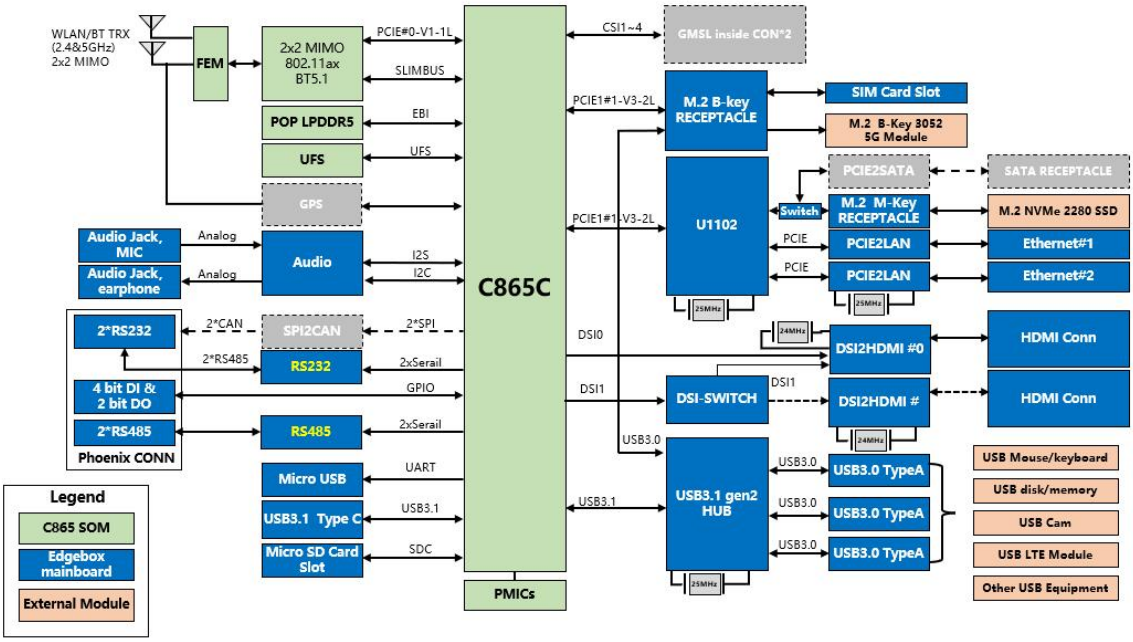


Figure 3-1 Hardware logic architecture

3.2. EB5S Six-faces View

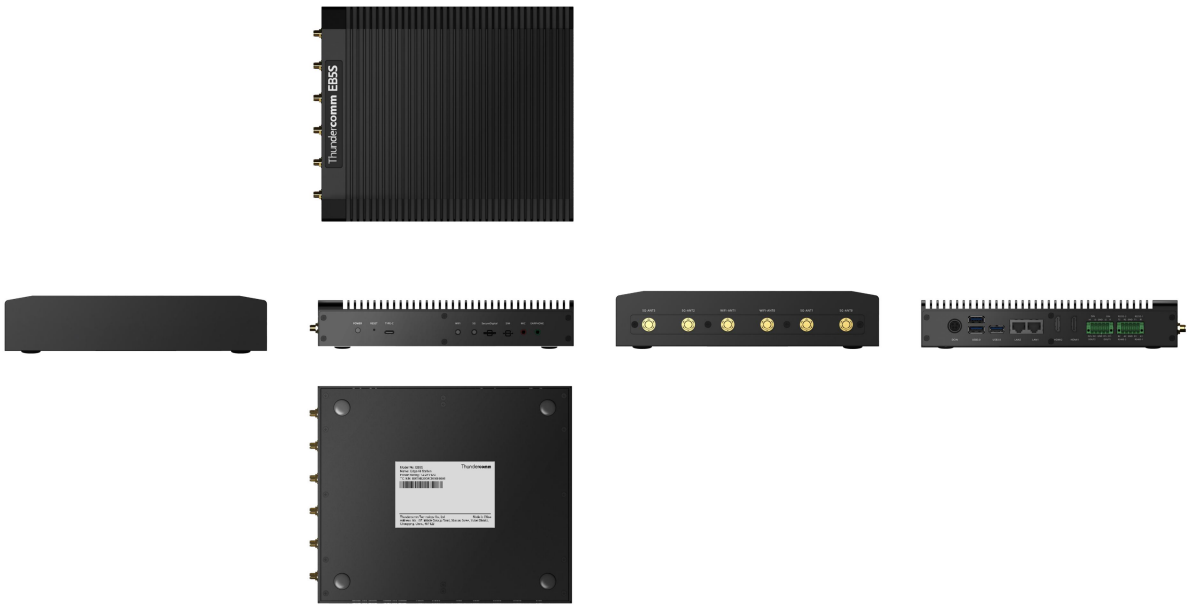


Figure 3-2. Six-Faces View

3.3. Hardware Descriptions

3.3.1. Front panel descriptions

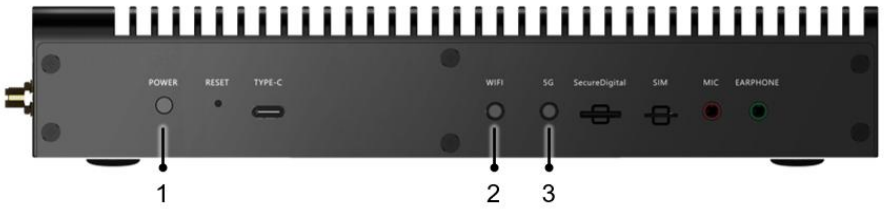


Figure 3-3. Front View Light Location

Table 3-1. Front view light location and specification

No.	Name	Instruction
1	Power Indicator/Button	Instruction of electric indicator light under safety condition: ➢ EB5S 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. EB5S power button supports **Power ON/OFF** and power indicator. Power status indicator: ➢ Green (bright): EB5S is working; ➢ Green (flashing): EB5S is being powered on; ➢ Light extinguished: EB5S shutdown;
2	Wi-Fi Light	➢ Green (bright): EB5S is working; ➢ Red (bright): EB5S connection is broken; ➢ Light extinguished: WIFI off;
3	5G Light	➢ Green (bright): EB5S is working; ➢ Red (bright): EB5S connection is broken; ➢ Light extinguished: 5G/4G function off;

Figure 3-4. Front View Connector Location

Table 3-2. Front view connector location and specification

No.	Name	Instruction
1	USB Type-C	Used for ADB debugging.
2	Micro SD	Used for SD card storage extension.

3	SIM Card Slot	Used for cellular function extension.
4	MIC	3.5-inch MIC input interface, the cable picture as below 
5	Earphone	3.5-inch Earphone output interface, the cable picture as below 

Figure 3-5. Front View Button Location

Table 3-3. Front view button location and specification

No.	Name	Instruction
1	POWER Button	Instruction of electric indicator light under safety condition: ➢ EB5S 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. EB5S power button supports **Power ON/OFF** of the platform and power indicator. Power status indicator: ➢ Green (bright): EB5S is working; ➢ Green (flashing): EB5S is being powered on; ➢ Light extinguished: EB5S shutdown;
2	RESET Button	The EB5S implements a pushbutton for reset ➢ Long press the button for 8 seconds in the state of power on, and the system reset to factory status. **Notice：** Restoring factory Settings will cause business interruption, please use this button with caution.

3.3.2. Rear panel descriptions

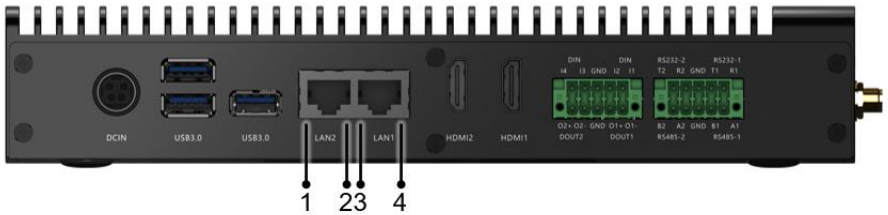


Figure 3-6. Rear View Ethernet Light Location

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

No.	Name	Instruction
1, 3	Light on RJ45 connector: Connection Status Light	➢ Light extinguished: Network not connected ➢ Green (bright)： Network connected
2, 4	Light on RJ45 connector: Data Transmission Status Light	➢ Light extinguished: No data transfer ➢ Yellow (flashing): Data in transit

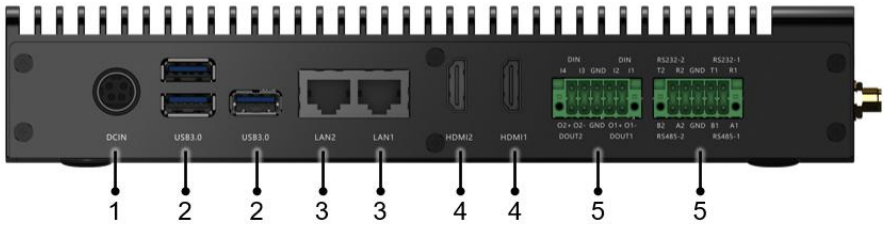
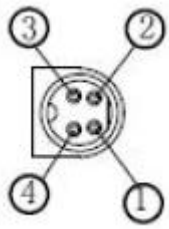


Figure 3-7. Rear View Connector Location

Table 3-5.Rear view connector location and specification

No.	Name	Instruction
1	POWER Connector	The Edge box implements a DC JACK+12V to +24V DC power  S terminal / Voltage ① / - ② / - ③ / + ④ / + Protect / -
2	USB3.0 Type-A Connector	The EB5S incorporates 3 vertical USB 3.0 Type-A connectors. All USB 3.0 Type-A ports are 5Gbps capable.
3	HDMI Connector	The EB5S module will output video via the Edge box vertical HDMI connector that is HDMI 1.4 capable.
4	RJ45 Gits Ethernet Connector	The EB5S 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.
5	Phoenix Terminal connector	If the user uses smoke detector, infrared detector, access control, alarm and other alarm output equipment. Connect the cable terminal to the EB5S Phoenix terminal interface and ensure that both the alarm input device and the EB5S are connected to the ground.

Phoenix terminal

Description

The Edge box implements 2 Phoenix terminals for CAN/RS232/RS485/DI/DO

Table 3-6. Phoenix terminal 1 description

No	Name	Description	Interface Figure

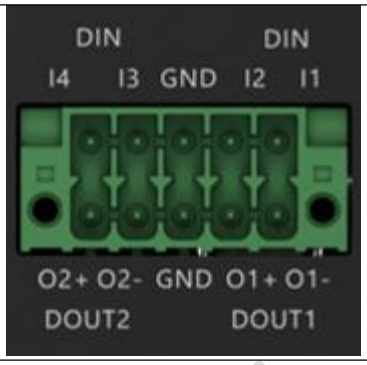
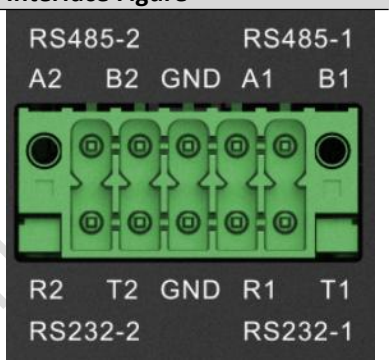
1	DIN.I4	DIN.I4 work with GND, Short with GND or open.	
2	DIN.I3	DIN.I3 work with GND, Short with GND or open.	
3	GND	GND	
4	DIN.I2	DIN.I2 work with GND, Short with GND or open.	
5	DIN.I1	DIN.I1 work with GND, Short with GND or open.	
6	DOUT2.O2+	DOUT2.O2+ interface, work with DOUT2.O2- of channel 2	
7	DOUT2.O2-	DOUT2.O2- interface, work with DOUT2.O2+ of channel 2	
8	GND	GND	
9	DOUT1.O1+	DOUT1.O1+ interface, work with DOUT1.O1- of channel 1	
10	DOUT1.O1-	DOUT1.O1- interface, work with DOUT1.O1+ of channel 1	

Table 3-7. Phoenix terminal 2 description

No	Name	Description	Interface Figure
1	RS485-2.A2	RS485 A2 interface, work with B2 of channel 2	
2	RS485-2.B2	RS485 A2 interface, work with B2 of channel 2	
3	GND	GND	
4	RS485-2.A1	RS485 A2 interface, work with B2 of channel 2	
5	RS485-2.B1	RS485 A2 interface, work with B2 of channel 2	
6	RS232-2.R2	RS232-2 R2 interface, work with T2 of channel 2	
7	RS232-2.T2	RS232 T2 interface, work with R2 of channel 2	
8	GND	GND	
9	RS232-1.R2	RS232-1 R2 interface, work with T2 of channel 2	
10	RS232-1.T2	RS232-1 T2 interface, work with R2 of channel 2	

3.3.3. Side panel descriptions

Figure 3-8. Left View Antenna Location

Table 3-9. Left view antenna description

No.	Name	Type	Instructions
1	Antenna Connectors	SMA-K	The EB5S chassis implements 6x SMA Antenna Connectors (optional) for WiFi and cellular.

Chapter 4. Hardware Operation

4.1 Power on

- EB5S power on automatically after connecting power.
- If the power is cut off when the equipment is turned on, the equipment will start automatically when the power is restored.

Please check that EB5S and the power adapter in the package are in good condition. Perform boot operation according to our operation guide. EB5S starts automatically when it is plugged in.

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

Figure 4-1. Power connector location Instruction

Figure 4-2. Power Button/instructor Location Instruction

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

➲ **NOTE**: Power indicator:
- LED light (green): EB5S is working
- LED light (off): EB5S is powered off

4.2 Power off

Force power down EB5S edge AI Station

Step 1: press the power button over 10 seconds.

Until the status indicator is off, it indicates that the EB5S edge AI Station has been power down. The position of the status indicator is shown in the red square in Fig. 4-2.

Step 2: Unplug the power cord.
----End

4.3 Install SIM & SD Card

4.3.1 Install SIM card

Operation step

Step 1: power down EB5S edge AI station. See 4.2 power down for details.

Step 2: put the EB5S edge AI station on the anti-static platform.

Step 3: find the location of the SIM card slot.

Figure 4-3. SIM card slot location instruction

Step 4: take out SIM card from the anti-static packaging bag.

Step 5: insert the SIM card into the SIM card slot.

4.3.2 Install SD card

Operation step

Step 1: power down EB5S edge AI station. See 4.2 power down for details.

Step 2: put the EB5S edge AI station on the anti-static platform.

Step 3: find the location of the SIM card slot.

Figure 4-4. SD card slot location instruction

Step 4: take out SIM card from the anti-static packaging bag.

Step 5: insert the SIM card into the SIM card slot.

4.4 Mount method

Figure 4-5. EB5S Mount method

Chapter 5. Product Specifications

5.1 System Specifications

Table 5-1. System Specifications

Item	Specifications
OS	Android or Ubuntu
Qualcomm®Artificial Intelligence (AI) Engine (AI Performance: 15 TOPS)	CPU: Qualcomm® Kryo™ 585 CPU, CPU Clock Speed: Up to 2.84 GHz
	GPU: Qualcomm® Adreno™ 650 GPU
	DSP: Qualcomm® Hexagon™ 698 Processor
System Memory	RAM: 8GB, LPDDR5(POP)
Storage	Flash: 128G UFS3.0 on board
	Expansion: SD Card, M.2 connector for NVME 2*Lane SSD
Display	2x HDMI out, 1080p@60fps
USB	3x 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
DI/DO	4x DI, 2x DO
Wireless Connectivity	M.2 connector for M.2 WiFi module
	M.2 connector for 3042 4G module, 3052 5G module, support PCIe/USB3.0 multimode support: 2G/3G/4G//5G NR sub-6
	Antenna: 6x Antenna connector for 5G/4G/WiFi function
Audio	1x MIC, 1x Earphone
Debug Port	1x Micro USB (for debug) 1x Micro USB (for 5G)
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)
Certification	FCC[note1], PTCRB, TSCA, CP65

5.2 Environment Specifications

Table 5-2. Environment Specifications

Item	Specifications
Operation Temperature	-20 ~ +60 centigrade[note2]
Storage Temperature	-40 ~ +70 centigrade
Operation Humidity	10%~90%, non-condensing
Storage Humidity	5%~95%, non-condensing
Proof Level	IP40

Note2： Test under typical application.

5.3 Physical Specifications

Table 5-3. Physical Specifications

Item	Specifications
Dimension	235mm*200mm*42mm
Net Weight	1750g
AC/DC Adaptor Weight	168g
Power	Typical Power: 20W Maximum power: 60W
Mount method	Desktop, Wall mount

Figure 5-1. EB5S size -1

Figure 5-2. EB5S size -2

Note1

Federal Communication Commission Interference Statement

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.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution:

- Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
- This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
- Operations in the 5.15-5.25GHz band are restricted to indoor usage only.

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Note: The country code selection is for non-US model only and is not available to all US model. Per FCC regulation, all WiFi product marketed in US must fixed to US operation channels only.

Chapter 6. Warranty & Product Support Service

6.1 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)

6.2 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.

6.3 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.).

- EB5S 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 a n 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

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