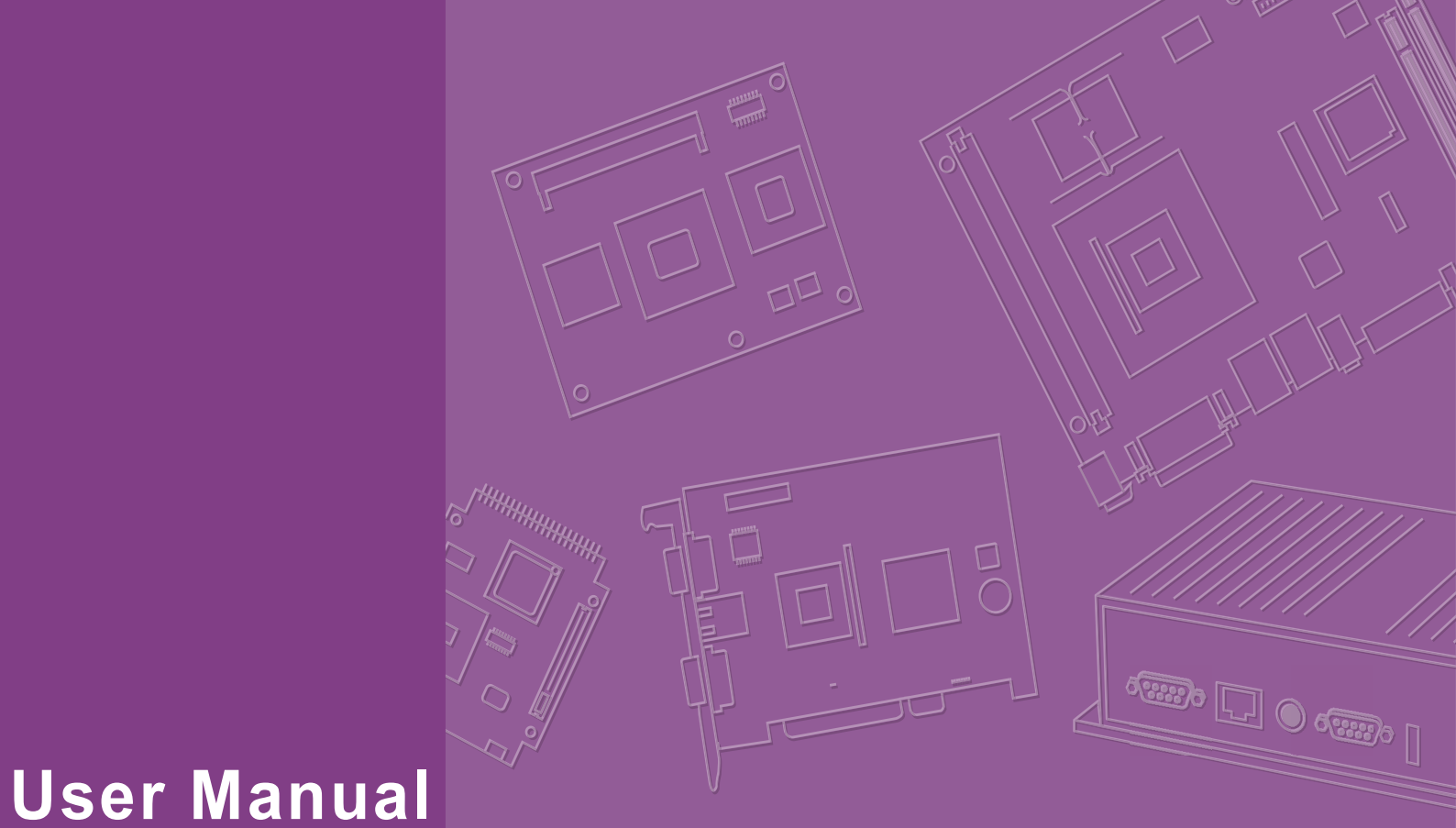




User Manual

AIR-055

Edge AI System

ADVANTECH

Enabling an Intelligent Planet

Attention!

This product contains a hard copy of the Chinese user manual for China CCC certification purposes. A PDF of the English user manual is included on the accompanying CD. Please disregard the hard copy Chinese user manual if the product is not sold and/or installed in China.

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Product Warranty (2 years)

Advantech warrants the original purchaser that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products that have been repaired or altered by persons other than repair personnel authorized by Advantech, or products that have been subject to misuse, abuse, accident, or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced free of charge during the warranty period. For out-of-warranty repairs, customers will be billed according to the cost of replacement materials, service time, and freight. Please consult your dealer for more details.

If you believe your product to be defective, follow the steps outlined below.

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages displayed when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain a return merchandise authorization (RMA) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a completed Repair and Replacement Order Card, and a proof of purchase date (such as a photocopy of your sales receipt) into a shippable container. Products returned without a proof of purchase date are not eligible for warranty service.
5. Write the RMA number clearly on the outside of the package and ship the package prepaid to your dealer.

Declaration of Conformity

FCC Class B

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 instruction manual, 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 or more 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 assistance.

Technical Support and Assistance

1. Visit the Advantech website at www.advantech.com/support to obtain the latest product information.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before calling:
 - Product name and serial number
 - Description of your peripheral attachments
 - Description of your software (operating system, version, application software, etc.)
 - A complete description of the problem
 - The exact wording of any error messages

Warnings, Cautions and Notes

Warning! Warnings indicate conditions that if not observed can cause personal injury!



Les avertissements indiquent des conditions qui, si elles ne sont pas observées, peuvent entraîner blessure!

Caution! Cautions are included to help prevent hardware damage and data losses. For example,



“Batteries are at risk of exploding if incorrectly installed. Do not attempt to recharge, force open, or heat the battery. Replace the battery only with the same or equivalent type as recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.”
Des précautions sont incluses pour éviter les dommages matériels et les données pertes.

Note! Notes provide additional optional information.



Packing List

Before system installation, check that the items listed below are included and in good condition. If any item does not accord with the list, contact your dealer immediately.

- 1 x AIR-055 unit
- 1 x Phoenix connector counterpart (1652004519)
- 1 x Simplified Chinese User Manuel
- 1 x Thermal-PAD kit (1 x M.2 M-key 2280 and 1 x M.2 B-key 3052 and LAN IC)

* In case of any changes, the actual packaging shall prevail.

Ordering Information

Model Number	Description
AIR-055D-U2A1	Edge AI IQ9075M 36GB inference system, CH
AIR-055D-U2A1U	Edge AI IQ9075M 36GB inference system, TW

* Suffix U means Made in Taiwan

Option Items

Part Number	Description
96PSA-A150W24T2-4	Power Adapter 24V 150W
1702002600	Power Cord UL 3P 10A 125V 183cm (US)
1702002605	Power Cord EU 3P 2.5A 250V 183cm (EU)
1702031801-11	Power Cord BSI 3P 2.5A 250V 183cm (UK)
1700000237	Power Cord PSE 3P 7A 125V 183cm (Japan)
1700013977	Power Cord CCC 3P 2.5A 250V 183cm (China)
MIOE-PSE-DPA1	MIOE-PSE POE module
1970006345T001	POE thermal kit for AIR-055
AIW-170BQ-001	Qualcomm Wifi6E M.2 2230 E-Key
1751000622-01	1x Cable Ant. L150mm for WIFI
1751000651-01	1x Antenna for WIFI
AIW-356DQ-E01	Qualcomm 5G M.2 3052 B-Key
1751000625-01	1x Cable Ant. L150mm for 5G
1750009372-01	1x Antenna for 5G
1700028870-01	F Cable 2x5P-2.0/D-SUB 9P(M) 25CM (debug cable)
1960086357N003	1pcs Wall Mount Kit for AIR-055(Need 2pcs for use)

Note! If Wi-Fi/5G module is required, the package must include the module, antenna, and antenna cable.



Note: If LAN1 and LAN2 need PoE function, please order MIOE-PSE and 1970006345T001.

Safety Instructions

1. Read these safety instructions carefully.
2. Retain this user manual for future reference.
3. Disconnect the equipment from all power outlets before cleaning. Use only a damp cloth for cleaning. Do not use liquid or spray detergents.
4. For pluggable equipment, the power outlet socket must be located near the equipment and easily accessible.
5. Protect the equipment from humidity.
6. Place the equipment on a reliable surface during installation. Dropping or letting the equipment fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. Do not cover the openings.
8. Ensure that the voltage of the power source is correct before connecting the equipment to a power outlet.
9. Position the power cord away from high-traffic areas. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage from transient overvoltage.
12. Never pour liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If any of the following occurs, have the equipment checked by service personnel:
 - The power cord or plug is damaged.
 - Liquid has penetrated the equipment.
 - The equipment has been exposed to moisture.
 - The equipment is malfunctioning, or does not operate according to the user manual.
 - The equipment has been dropped and damaged.
 - The equipment shows obvious signs of breakage.
15. Do not leave the equipment in an environment with a storage temperature of below -40 °C (-40 °F) or above 85 °C (185 °F) as this may damage the components. The equipment should be kept in a controlled environment.
16. Any unverified component may cause unexpected damage. To ensure correct installation, always use the components (e.g., screws) provided in the accessory box.
17. CAUTION: Batteries are at risk of exploding if incorrectly replaced. Replace only with the same or equivalent type as recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.
18. Always disconnect the power cord from the chassis before manually handling the hardware. Do not implement connections or configuration changes while the device is powered on. Sudden power surges may damage sensitive electronic components.
19. In accordance with IEC 704-1:1982 specifications, the sound pressure level at the operator's position does not exceed 70 dB (A).
20. DISCLAIMER: These instructions are provided according to IEC 704-1 standards. Advantech disclaims all responsibility for the accuracy of any statements contained herein.
21. This product is intended to be supplied by an UL Listed power Adapter, or DC power source, rated: 12~24Vdc, 12.5-6.25A, Tma=55 degrees C, if need further

assistance, please contact Advantech for further information (Tma 50 degree C = Operating temperature)

22. RESTRICTED ACCESS AREA: The equipment should only be installed in a Restricted Access Area.

Consignes de Sécurité

1. Veuillez lire attentivement ces instructions de sécurité.
2. Veuillez conserver ce manuel de l'utilisateur pour référence ultérieure.
3. Veuillez débrancher cet équipement de la prise secteur avant le nettoyage. Utilisez un chiffon humide. Ne pas utiliser de détergent liquide ou pulvérisé pour le nettoyage. Utilisez une feuille ou un chiffon humide pour le nettoyage.
4. Pour les équipements enfichables, la prise de courant doit être à proximité de l'équipement et doit être facilement accessible.
5. S'il vous plaît garder cet équipement de l'humidité.
6. Posez cet équipement sur une surface fiable lors de l'installation. Une chute ou une chute pourrait causer des blessures.
7. Les ouvertures sur le boîtier sont destinées à la convection d'air, protégeant ainsi l'équipement de la surchauffe. **NE COUVREZ PAS LES OUVERTURES.**
8. Au moyen d'un cordon d'alimentation connecté à une prise de courant avec mise à la terre.
9. Placez le cordon d'alimentation de sorte que personne ne puisse marcher dessus. Ne placez rien sur le cordon d'alimentation.
10. Tous les avertissements et mises en garde sur l'équipement doivent être notés.
11. Si l'appareil n'est pas utilisé pendant une longue période, débranchez-le du secteur pour ne pas être endommagé par une surtension transitoire.
12. Ne jamais verser de liquide dans les ouvertures de ventilation; Cela pourrait provoquer un incendie ou un choc électrique.
13. N'ouvrez jamais l'équipement. Pour des raisons de sécurité, seul le personnel de maintenance qualifié doit ouvrir l'équipement.
14. Si l'une des situations suivantes se présente, faites vérifier le matériel par le personnel de service:
 - Le cordon d'alimentation ou la fiche est endommagé.
 - Un liquide a pénétré dans l'appareil.
 - L'équipement a été exposé à l'humidité.
 - L'équipement ne fonctionne pas bien ou vous ne pouvez pas le faire fonctionner conformément au manuel d'utilisation.
 - Equipment L'équipement est tombé et a été endommagé.
 - Equipment L'équipement présente des signes évidents de rupture.
15. Ne laissez pas cet équipement dans un environnement où la température de stockage peut être inférieure à -40° C (-40° F) ou supérieure à 85° C (185° F). Cela pourrait endommager l'équipement. L'équipement doit être dans un environnement contrôlé.
16. Tout composant non vérifié peut causer des dommages inattendus. Pour garantir une installation correcte, veuillez toujours utiliser les composants (ex. Vis) fournis avec la boîte d'accessoires.
17. **ATTENTION:** L'ordinateur est équipé d'un circuit d'horloge temps réel alimenté par batterie. Il y a un risque d'explosion si la batterie est remplacée de manière incorrecte. Remplacez uniquement avec le même type ou un type équivalent recommandé par le fabricant. Jetez les piles usagées conformément aux instructions du fabricant.

18. Débranchez toujours complètement le cordon d'alimentation de votre châssis lorsque vous utilisez du matériel. Ne faites pas de connexion quand l'appareil est sous tension. Les composants électroniques sensibles peuvent être endommagés par des surtensions soudaines.
19. Niveau de pression acoustique au poste de l'opérateur selon la norme CEI 704-1: 1982 n'est pas supérieur à 70 dB (A).
20. **AVERTISSEMENT:** Cet ensemble d'instructions est donné conformément à la norme CEI 704-1. Advantech décline toute responsabilité quant à l'exactitude des déclarations contenues dans ce.
21. Ce produit est destiné à être alimenté par un adaptateur secteur répertorié UL ou une source d'alimentation CC, évalué: 12~24 Vcc, 12,5-6,25 A, Tma = 55 degrés C, si besoin d'assistance supplémentaire, veuillez contacter Advantech pour plus d'informations. (Tma 50 degrés C = Fonctionnement Température)
22. **ZONE D'ACCES RESTREINTE:** L'équipement ne doit être installé que dans une zone d'accès restreint.

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Chapter 1

General Introduction

This chapter gives background information on AIR-055 series.

1.1 Introduction

The AIR-055 is an ultra-compact Edge AI inference system powered by the Qualcomm Dragonwing IQ9 platform. Designed for high-performance edge computing, it delivers exceptional computing power with optimized energy consumption for advanced AI tasks. The system features a ruggedized industrial chassis capable of operating in extreme temperatures ranging from -20° C to 55° C, ensuring reliability across diverse and harsh deployment environments.

High-Performance Imaging & Modular Architecture

- Adopt Qualcomm IQ9 for optimized energy efficiency. Leverages high-performance computing with lower power draw to enable sophisticated AI analytics at the edge.
- Implement Quad-display output via dual HDMI and DisplayPort Supports four simultaneous 4K displays to enhance visualization and monitoring capabilities for complex industrial inspection tasks.
- Integrate dual 2.5GbE LAN ports with optional PoE support. Provides high-bandwidth data paths for real-time video streaming while simplifying cabling and reducing installation costs.
- Utilize hybrid UFS and NVMe high-speed storage design Combines default 128G UFS for fast booting with high volume NVMe expansion to balance system performance and cost.

Integrated AI Intelligence & Deployment Efficiency

- Deploy Advantech Edge AI Inference Kit for rapid scaling Provides a plug-and-play software environment that accelerates development cycles and ensures seamless over-the-air (OTA) management.

1.2 Product Features

1.2.1 General

Table 1.1: General

	AIR-055D-U2A1	AIR-055D-U2A1U
CPU	Qualcomm® Kryo Gen 6 CPU built on Arm v8.2 Cortex technology 2.36 GHz	
GPU	Adreno 663 GPU support safe GPGPU compute up to 800 MHz	
Memory	36GB 256-bit LPDDR5 DRAM	
Storage	Default built-in 128GB UFS3.1	
Serial Port	3x RS-232/422/ 485	
USB Type A	1 x USB 3.2 Gen2 Type A*	
	1 x USB 3.2 Gen1 Type A	
	2 x USB 2.0	
USB Type C	2 x USB 3.2 Gen1 Type C	
Expansion	M.2 M Key 2280 for storage, M.2 E key 2230 for WIFI/BT & M.2 B Key 3052 for 5G/LTE module with Nano SIM holder	

#1 Not only USB function but also Download Mode Support.

#2 Not support boot up from NVMe.

1.2.2 Display

■ **Resolution:**

- 2 x HDMI 1.4 (Max. resolution 3840 x 2160 @30Hz)
- 2 x DP 1.4 (Max. resolution 3840 x 2160 @ 60Hz)

Due to temporary OS limitation, quad-display is currently supported only in extended mode without hot-plugging or cloning.

1.2.3 Ethernet

■ **LAN PHY:**

- LAN1 Realtek RTL8221D
- LAN2 Realtek RTL8221D

■ **Speed:** 2.5 Gigabit Ethernet (10/100/1000/2500 Mbps, optional PoE support)

■ **Interface:** 2 x RJ45

■ **Standard:** compliant with IEEE 802.3u 100 Base-T, IEEE 802.3z/ ab 1000 Base-T and IEEE 802.3bz 2.5G BASE-T

■ **PoE out:** 50Vdc, each 15 W, total max. 30 W

1.2.4 I/O Ports and Expansion

- 2 x HDMI 1.4
2 x DP 1.4
- 1 x USB 3.2 Gen2 Type A (Download Mode Support)
1 x USB 3.2 Gen1 Type A
2 x USB 3.2 Gen1 Type C
2 x USB 2.0
- 1 x 8-bit DI/DO
- 3 x RS-232/RS-422/RS-485
- 1 x Combo Jack

- 2 x CANFD (8Mbps)
- 1 x M.2 3052 B Key (USB 3.2 Gen1), 1 x M.2 2230 E Key (PCIe x2/ USB2.0)
- 1 x M.2 2280 M key (PCIe x4)

1.2.5 CPU

- **AIR-055D-U2A1:** Qualcomm® Kryo Gen 6 CPU
- **AIR-055D-U2A1U:** Qualcomm® Kryo Gen 6 CPU

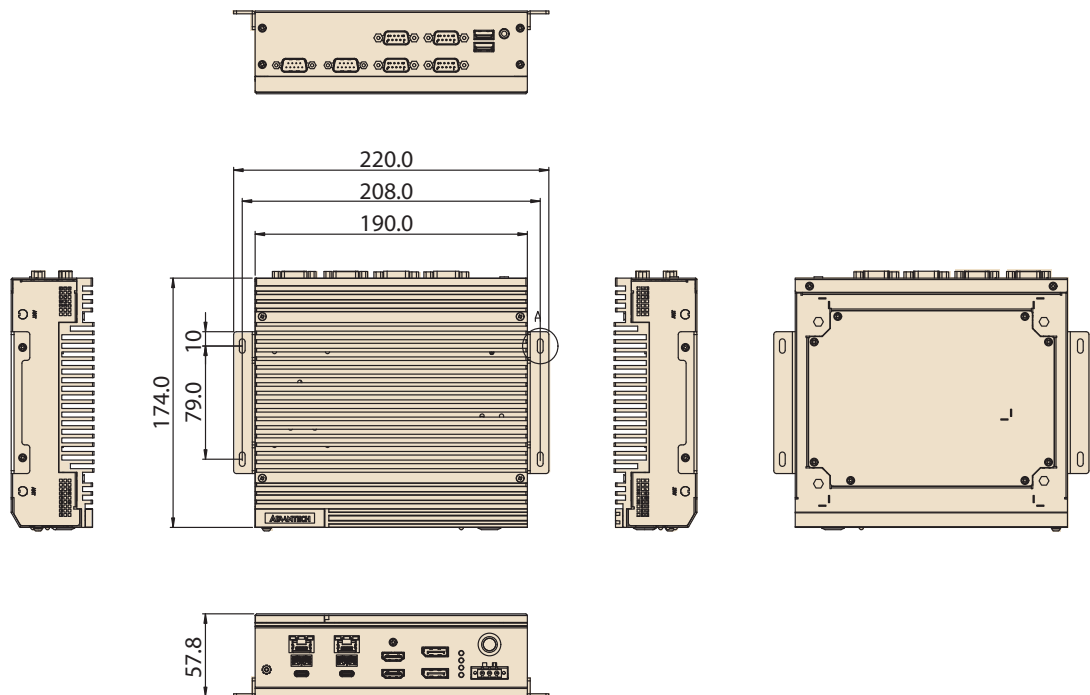
1.2.6 GPU

- **All AIR-055 SKU:** Adreno 663 GPU support safe GPGPU compute up to 840 MHz

1.3 Mechanical Specifications

1.3.1 System Dimensions

- 190 × 174 × 57.8 mm



1.3.2 Weight

- 2.14 kg

1.4 Power Requirements

1.4.1 System Power

- **Power Input:** DC In 12-24V

1.4.2 RTC Battery

- **Lithium:** 3 V/210 mAH

1.5 Environmental Specifications

1.5.1 Operating Temperature

- -20~55° C w/0.7 m/s airflow with non-POE & --20 ~ 55° C w/0.7 m/s airflow with POE

1.5.2 Relative Humidity

- 95% @ 40° C (104° F) (non-condensing)

1.5.3 Storage Temperature

- -40 ~ 85° C (-40 ~ 185° F)

1.5.4 Vibration Tolerance

- When the system is equipped with an M.2 SSD: 3 Grms, IEC 60068-2-64, random, 5 ~ 500Hz, 1 hr/axis, (x, y, z) 3 axes (operation)

1.5.5 Shock Tolerance

- When the system is equipped with an M.2 SSD: 30 G, IEC 60068-2-27, half sine, 11 ms duration, 6 faces, 3 times/per face (operation)

1.5.6 Safety Certification

- UL, CB, CCC

1.5.7 EMC Certification

- CE, FCC Class B, CCC, BSMI (No RED Certificate)

Chapter 2

Hardware Configuration

This chapter details instructions for installing AIR-055 hardware and external I/O.

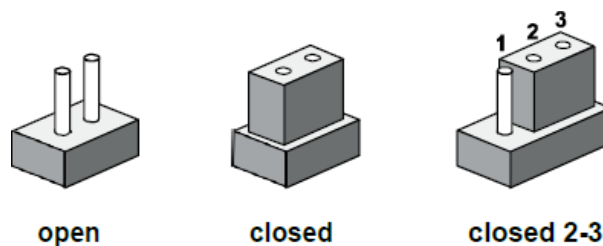
2.1 Introduction

The following sections demonstrate the internal jumper settings and the external connector pin assignments.

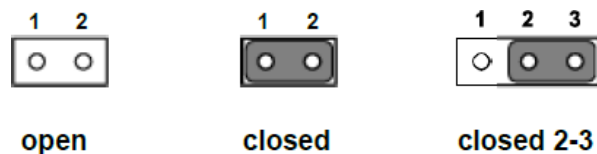
2.2 Jumpers

2.2.1 Jumper Description

AIR-055 can be configured to satisfy specific application requirements by setting jumpers. A jumper is a metal bridge used to close an electric circuit. It consists of two metal pins and a small metal clip (often protected by a plastic cover) that slides over the pins to connect them. To close a jumper, connect the pins with the clip. To open a jumper, remove the clip. Sometimes a jumper will have three pins, labeled 1, 2, and 3. For these jumpers, connect either pins 1 and 2, or 2 and 3.



The jumper settings are schematically diagrammed in this manual as follows:



A pair of needle-nose pliers may be helpful when working with jumpers. If you have any doubts about the best hardware configuration for your application, contact your local distributor or sales representative before you make any changes. Generally, you simply need a standard cable to make most connections.

2.2.2 Jumper List

Table 2.1: Jumper Setting

Location	Function
SW1	AT/ATX switch
SW2	M.2 B Key Power selection
SW3	Recovery mode switch
SW_422_1	COM1/2 Fail safe selection
SW_422_3	COM3 Fail safe selection

2.2.3 Jumper Location

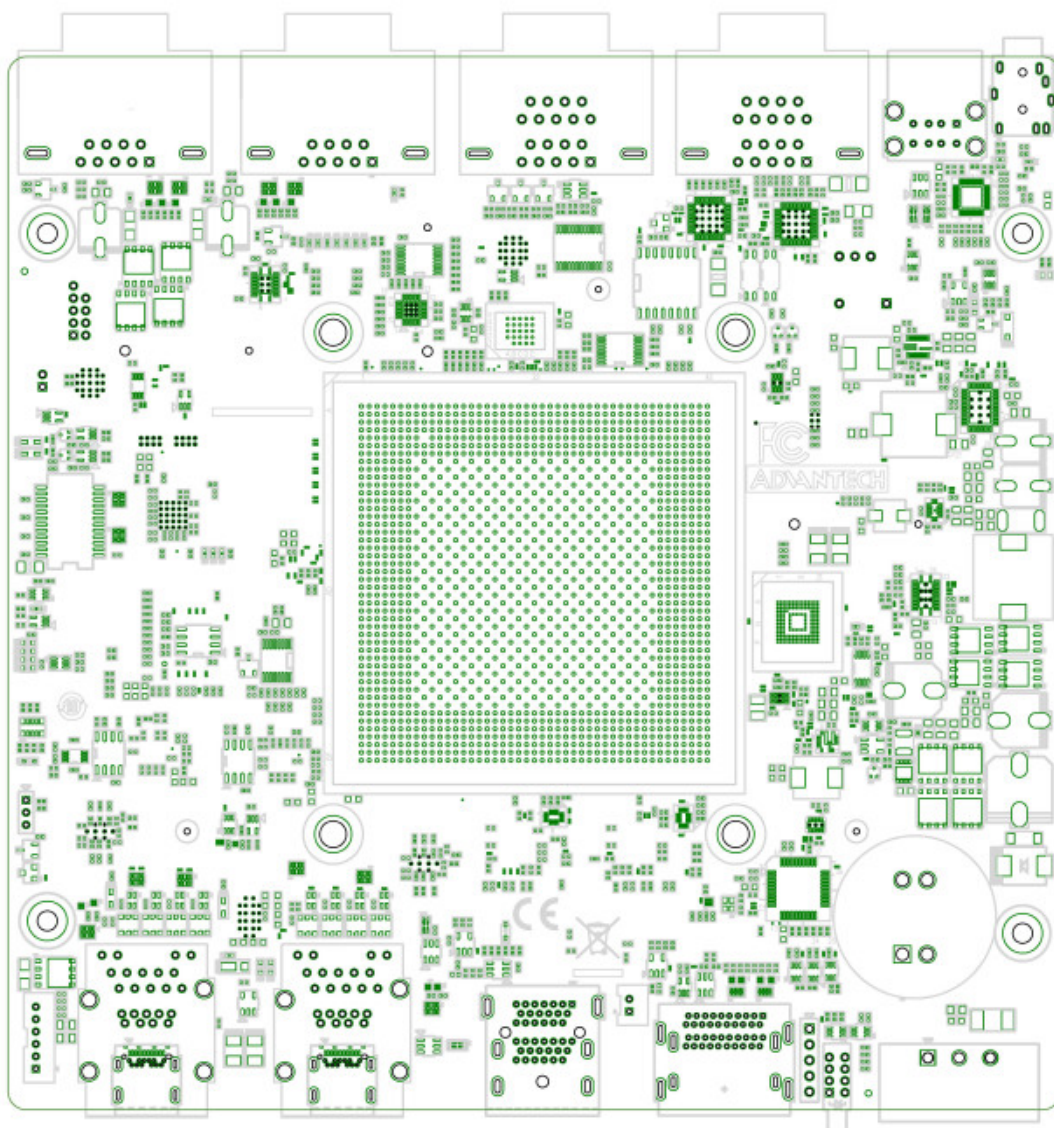


Figure 2.1 TOP Layer Overview

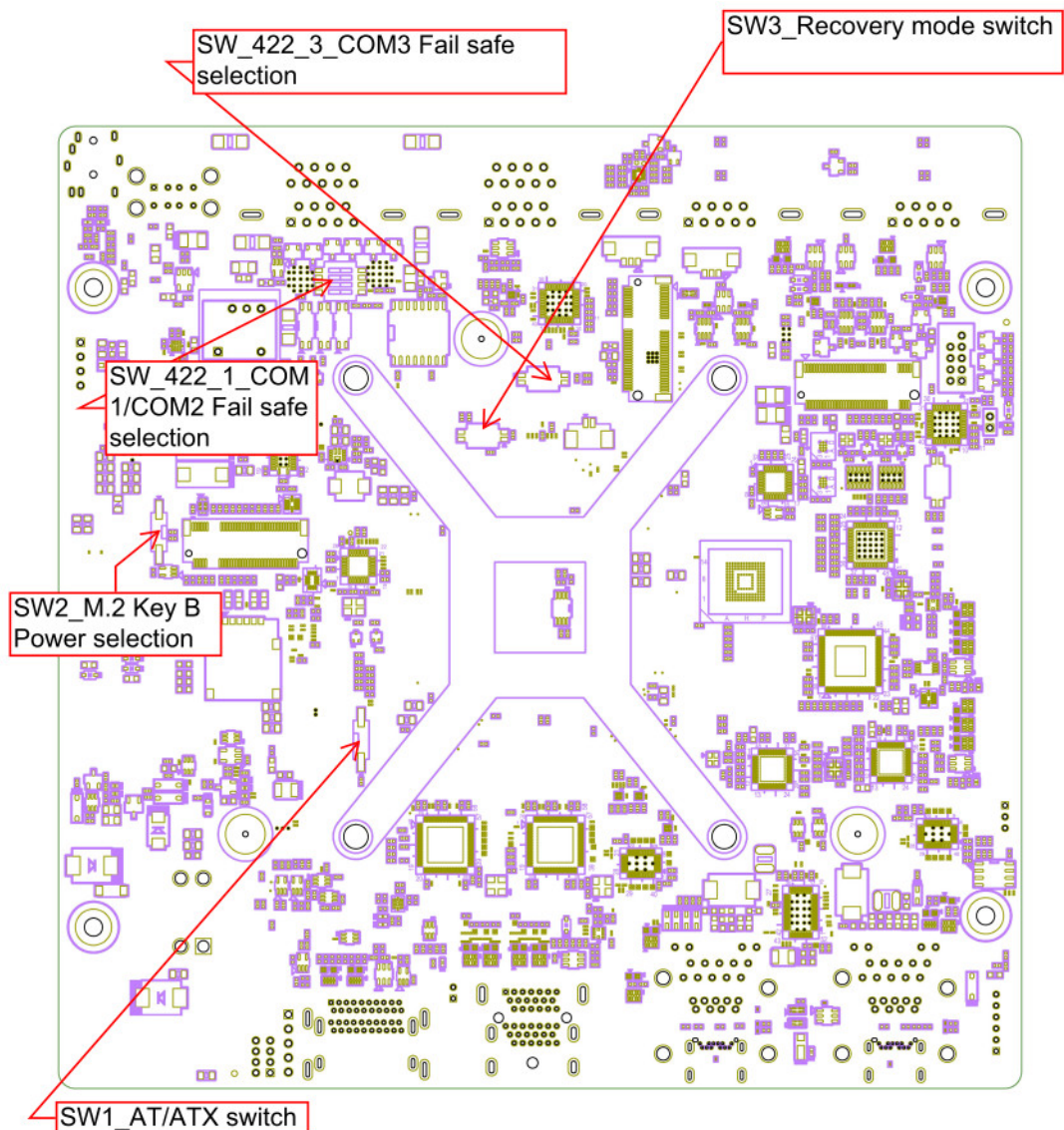


Figure 2.2 Bottom Layer Overview

Table 2.2: AT/ATX mode switch

AT/ATX mode switch (SW1)	Mode/Description	Pin1	Pin2
	ATX (Default)	ON	OFF
	AT	OFF	ON

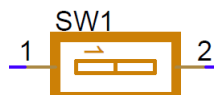
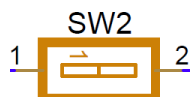
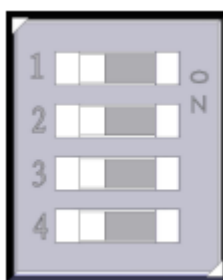


Table 2.3: M.2 Key B Power selection

	Mode/Description	Pin1	Pin2
M.2 Key B Power selection(SW2)	M.2 Key B VCC=3.3V (default)	ON	OFF
	M.2 Key B VCC=3.8V	OFF	ON

**Table 2.4: COM1/COM2 Fail safe selection**

	Mode/Description	Pin1	Pin2	Pin3	Pin4
COM1/COM2 Fail safe selection (SW_422_1)	Disable (default)	OFF	OFF	OFF	OFF
	COM1 fail safe enable	OFF	OFF	ON	ON
	COM2 fail safe enable	ON	ON	OFF	OFF

**Table 2.5: SW3_Recovery mode switch**

	Mode/Description	Pin1	Pin2
SW3	Boot Mode	OFF	OFF
	Download Mode	ON	ON

**Table 2.6: COM3 Fail safe selection**

	Mode/Description	Pin1	Pin2
COM3 Fail safe selection (SW_422_3)	Disable (default)	OFF	OFF
	COM3 fail safe enable	ON	ON



2.3 I/O Introduction

Front View

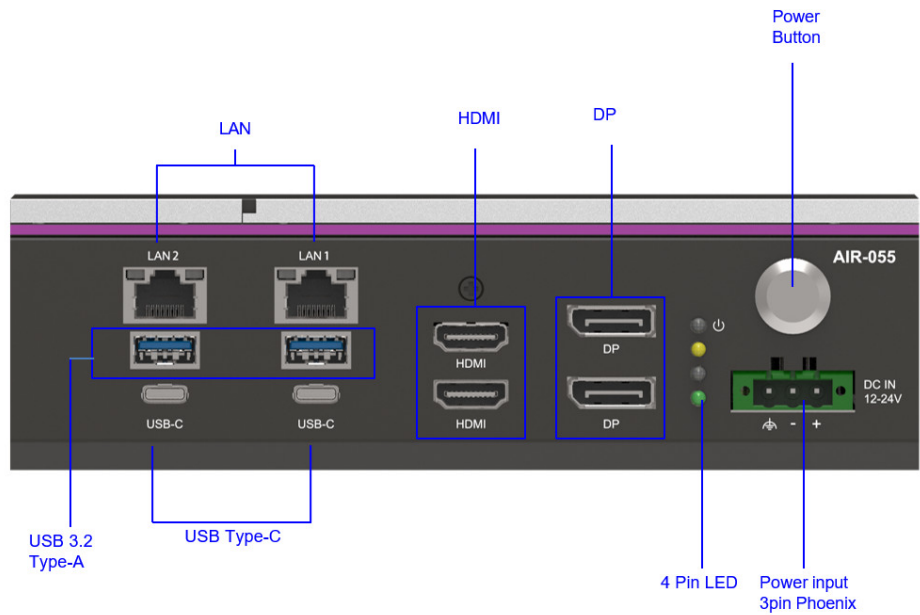
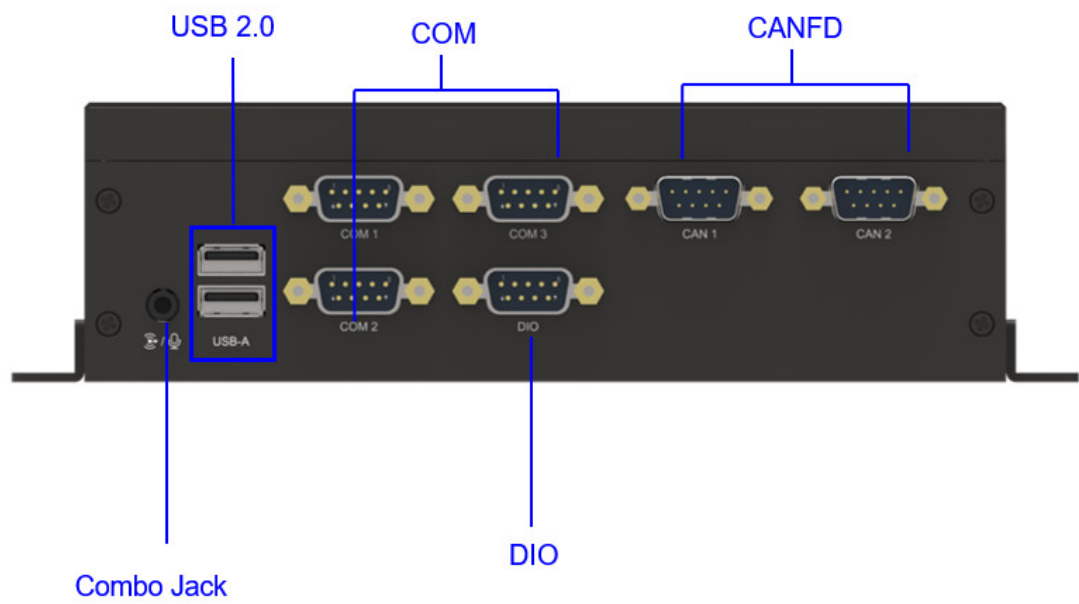


Figure 2.3 AIR-055 I/O

Rear View



Side View

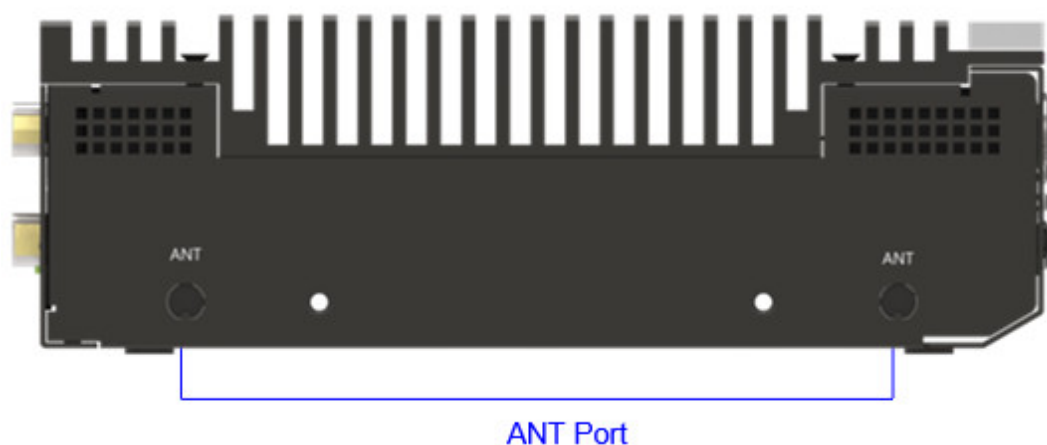


Figure 2.4 AIR-055 Side View I/O

2.4 External I/O

2.4.1 Power On/Off Button

AIR-055 features a Power On/Off button with an LED indicators on the top side that show On status (Green LED).



Figure 2.5 Power On/Off Button

2.4.2 Power Input Connector

The power input connector supports DC in 12-24V.

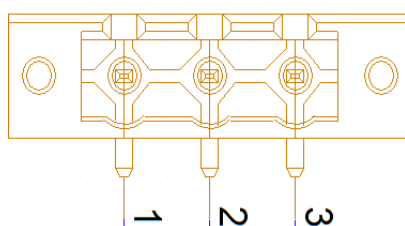


Figure 2.6 Power Input Connector

2.4.3 Ethernet Connector (LAN1/2)

AIR-055 is equipped with GbEs and the Ethernet controllers are compliant with IEEE 802.3z/ab 10/100/1000/2500 Mbps on LAN1/LAN2 with CSMA/CD standard. The Ethernet port provides a standard RJ45 jack connector with LED indicators on the front side to show its Active/Link status (Green LED) and Speed status (Yellow LED).

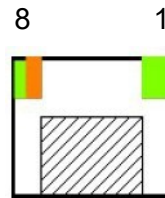


Figure 2.7 Ethernet Connector (LAN1/LAN2)

Table 2.7: LAN1/2

Right side LED: Green LED

Status	Always turn on without transmitting/receiving data
Activity status	Flash

Left side LED Green/Orange LED

Status	Display
10/100Mbps	Always off
1 Gbps	Orange
2.5Gbps	Green

Table 2.8: Ethernet Connector (LAN1/2) Pin Definition

Pin	10/100/1000/2500 Mbps Signal Name
AR1	MDI0+
AR2	MDI0-
AR3	MDI1+
AR4	MDI1-
AR7	MDI2+
AR8	MDI2-
AR9	MDI3+
AR10	MDI3-

2.4.4 USB 2.0 Connector

AIR-055 supports two USB 2.0 interfaces, which support Plug-and-Play functionality.

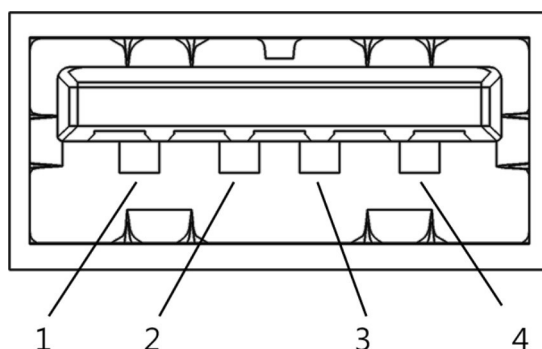


Figure 2.8 USB 2.0 Connector

Table 2.9: USB 2.0 Pin Definition

Pin	Signal Name
1	VCC
2	USB_data
3	USB_data+
4	GND

2.4.5 USB 3.2 Gen1/2 Type A Connector

AIR-055 supports 2x USB 3.2 Gen1/2 Type A interfaces, which support Plug-and-Play functionality and hot swapping. The USB interfaces comply with USB UHCI, Rev. 3.2. USB 3.2 connectors contain legacy pins to interface to USB 2.0 devices and a new set of pins for USB 3.2 connectivity.

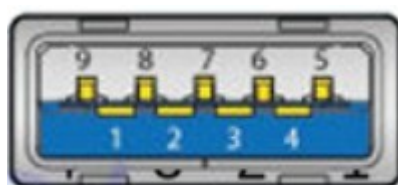


Figure 2.9 USB 3.2 Connector

Table 2.10: USB Connector Pin Definition

Pin	Signal Name
1	+5V
2	DATA-
3	DATA+
4	GND
5	SSRX-
6	SSRX+
7	GND
8	SSTX-
9	SSTX+

2.4.6 Combo Jack

AIR-055 features one phone jack connector that supports stereo Line-Out and Mic-In audio ports. The audio chip is controlled by ALC5682I and compliant with the Azalea standard.

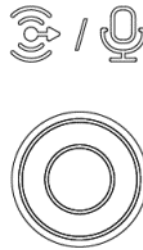


Figure 2.10 Combo Jack

2.4.7 COM Connector

AIR-055 provides three 9-pin D-sub connector, which supports 4-wire RS232/422/485 serial communication interface ports. The default setting is RS-232, if you want to use RS-422/485, you can use gpio to change the setting in OS. (Will introduce in later chapter).

PS: COM1/2 are isolation.

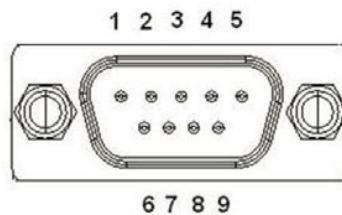


Figure 2.11 COM Connector

Table 2.11: COM Connector Pin Definition

Pin	RS-232	RS-422	RS-485
1	NC	Tx-	D-
2	RxD	Tx+	D+
3	TxD	Rx+	NC
4	NC	Rx-	NC
5	GND	GND	GND
6	NC	NC	NC
7	RTS	NC	NC
8	CTS	NC	NC
9	NC	NC	NC

NC represents "No Connection".

2.4.8 DP Connector

AIR-055 offers two DP interfaces. The DP link supports resolutions up to 3840 x 2160 @ 60 Hz.

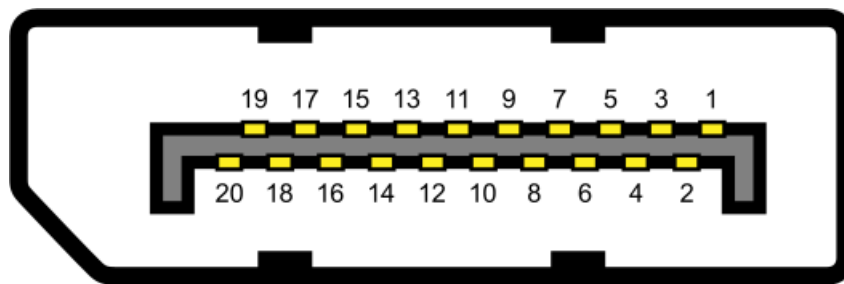


Figure 2.12 DP Connector

Table 2.12: DP Connector Pin Definition

Pin	Signal Name
1	D0+
2	GND
3	D0-
4	D1+
5	GND
6	D1-
7	D2+
8	GND
9	D2-
10	D3+
11	GND
12	D3-
13	DP_AUX_E#
14	GND
15	AUX+
16	GND
17	AUX-
18	HPD
19	GND
20	+3.3V

2.4.9 HDMI Connector

AIR-055 offers integrated 19-pin receptacle connector HDMI 1.4 interfaces. The HDMI link supports resolutions up to Max. resolution 3840 x 2160 @ 30Hz.

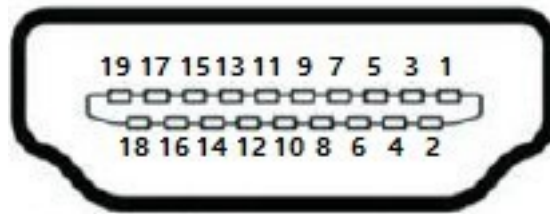


Figure 2.13 HDMI Connector

Table 2.13: HDMI Connector Pin Definition

Pin	Signal Name
1	HDMI_D2P
2	GND
3	HDMI_D2N
4	HDMI_D1P
5	GND
6	HDMI_D1N
7	HDMI_D0P
8	GND
9	HDMI_D0N
10	HDMI_D3P
11	GND
12	HDMI_D3N
13	NC
14	NC
15	HDMI_SCL
16	HDMI_SDA
17	GND
18	+5V
19	HDMI_HPD

NC represents "No Connection".

2.4.10 Antenna Socket

AIR-055 reserves four antenna sockets for installing wireless/LTE device antennas. Each antenna socket is labeled "ANT" for easy identification.



Figure 2.14 Antenna Socket

2.4.11 USB type C Connector (USBC2)

AIR-055 supports USB Type-C 24-pin USB connector.

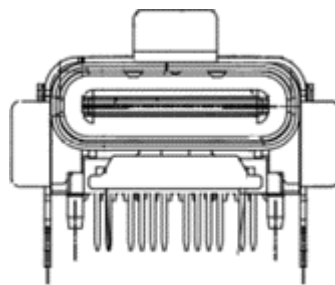


Table 2.14: USB Type C Pin Definition

Type-C receptacle A pin layout

Pin	Name	Description
A1	GND	Ground return
A2	SSTXp1	SuperSpeed differential pair #1, TX, positive
A3	SSTXn1	SuperSpeed differential pair #1, TX, negative
A4	Vbus	Bus power
A5	CC1	Configuration channel
A6	Dp1	USB 2.0 differential pair, position 1, positive
A7	Dn1	USB 2.0 differential pair, position 1, negative
A8	SBU1	Sideband use (SBU)
A9	Vbus	Bus power
A10	SSRXn2	SuperSpeed differential pair #4, RX, negative
A11	SSRXp2	SuperSpeed differential pair #4, RX, positive
A12	GND	Ground return

Type-C receptacle B pin layout

Pin	Name	Description
B12	GND	Ground return
B11	SSTXp1	SuperSpeed differential pair #2, RX, positive
B10	SSTXn1	SuperSpeed differential pair #2, RX, negative
B9	Vbus	Bus power
B8	SBU2	Sideband use (SBU)
B7	Dn2	USB 2.0 differential pair, position 2, negative[a]
B6	USB_DP	USB 2.0 differential pair, position 2, positive[a]
B5	CC2	Configuration channel
B4	Vbus	Bus power
B3	SSRXn2	SuperSpeed differential pair #3, TX, negative
B2	SSRXp2	SuperSpeed differential pair #3, TX, positive
B1	GND	Ground return

2.4.12 Digital IO

AIR-055 offers 8-bit DI/DO and pin definition as shown below.

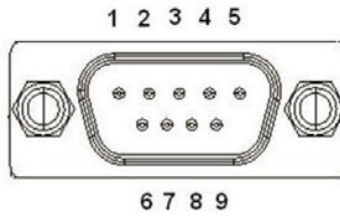


Figure 2.15 DIO Connector

Table 2.15: DIO Connector and Pin Definition

Pin	Signal Name
1	DIO bit 0
2	DIO bit 2
3	DIO bit 4
4	DIO bit 6
5	DIO bit 7
6	DIO bit 1
7	DIO bit 3
8	DIO bit 5
9	GND

Table 2.16: AIR-055 GPIO TCA9555

Item	Description
Output Type	Push-Pull only
VIH (Input High Voltage)	$\geq 3.5V$ (typical)
VIL (Input Low Voltage)	$\leq 1.5V$ (typical)
VOH (Output High Voltage)	$\geq 4V$ @ IOH = -10 mA (@Vcc = 4.75V)
VOL (Output Low Voltage)	≤ 0.5 @ IOL = 8 mA (@Vcc = 1,65V to 5.5V)

2.4.13 CANBUS IO

AIR-055 offers 2-bit CANFD (8Mbps) and pin definition as shown below.

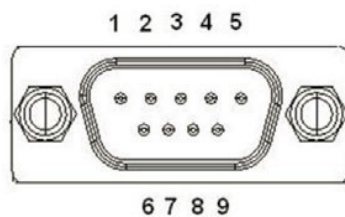


Figure 2.16 Canbus Connector

Table 2.17: CANBUS IO	
Pin	Signal Name
1	Blank
2	CAN1_D-
3	GND
4	Blank
5	Blank
6	Blank
7	CAN1_D+
8	Blank
9	Blank

2.4.14 Front LED

AIR-055 reserves four LED lights.

LED1: System power-on/off

LED2-4: User control by GPIO

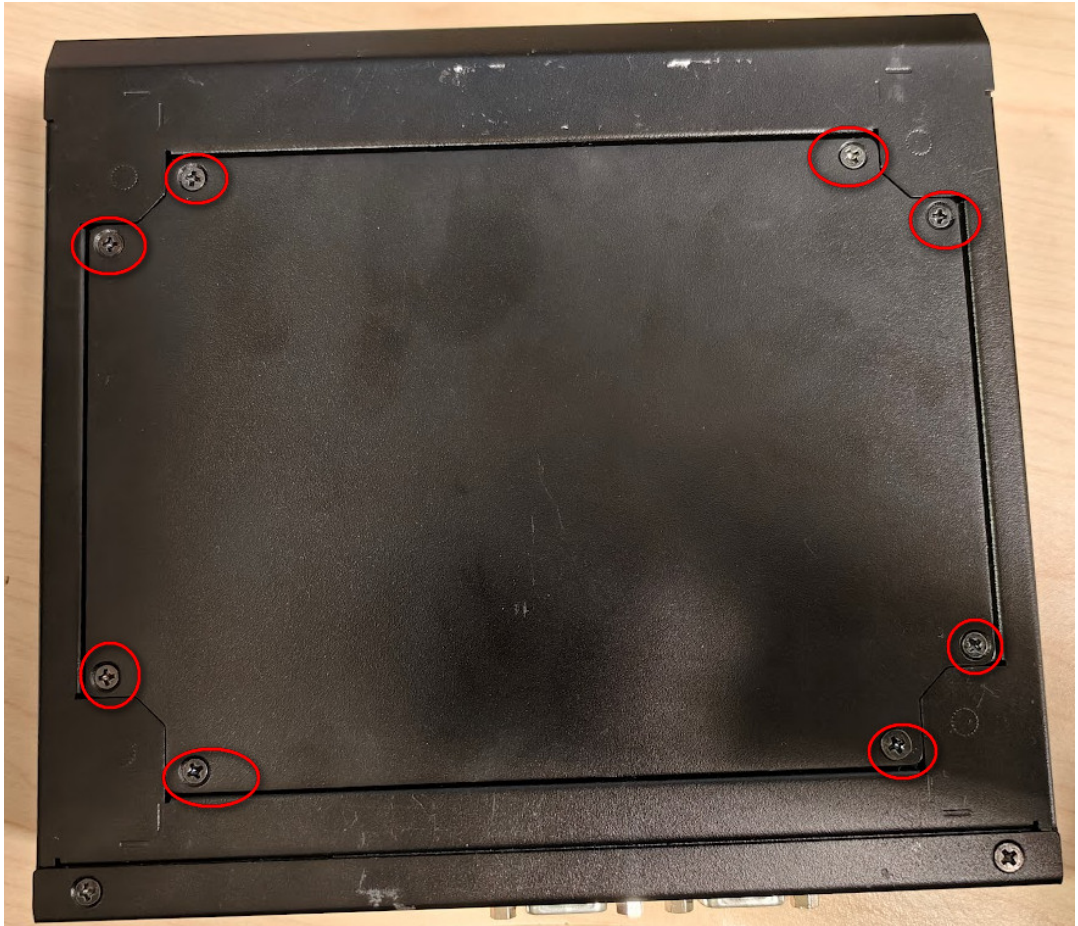


Figure 2.17 Front LED

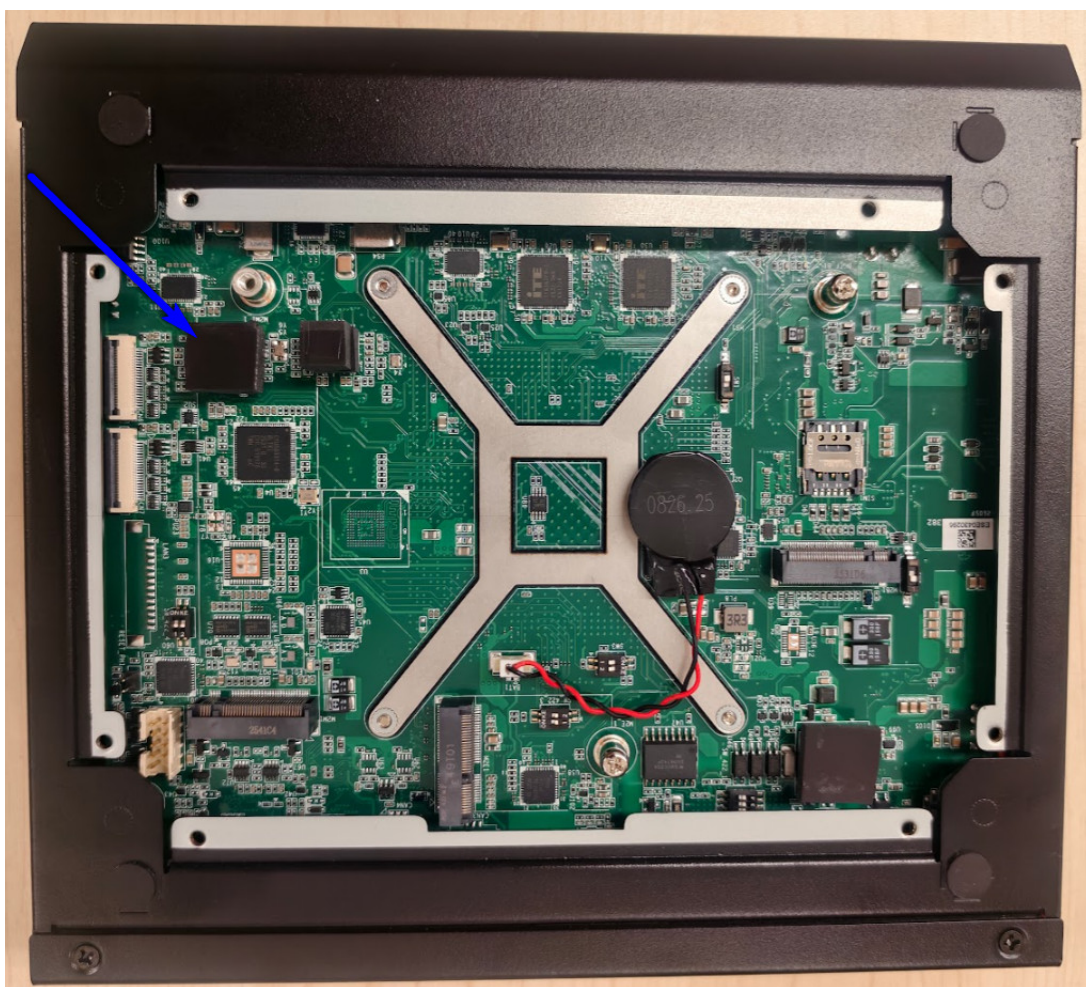
2.5 Installation

2.5.1 M.2 M-Key 2280 Installation

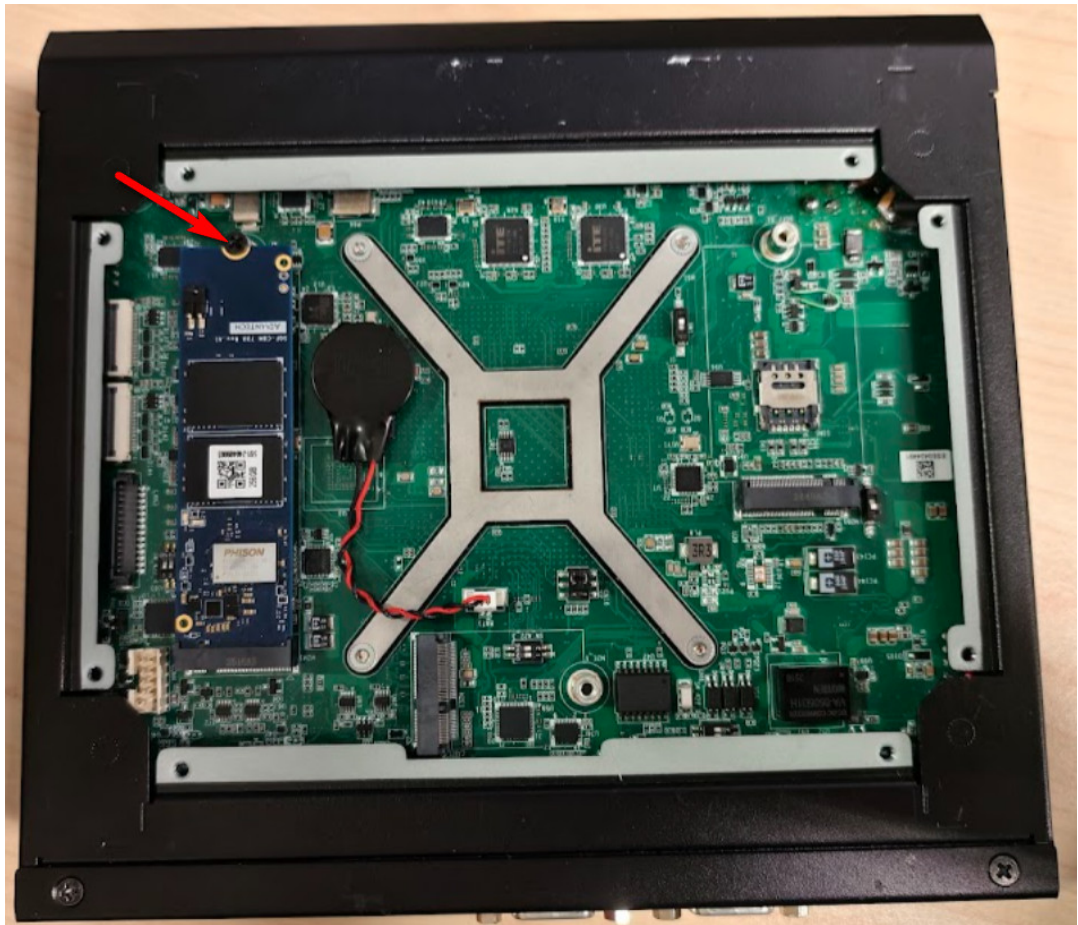
1. Remove the 8 screws and open the bottom cover.



2. Replace the LAN IC thermal pad at the bottom of the NVMe with the new one from the accessory pack (as shown by the blue arrow in the image).



3. Please install the screw at the location indicated by the arrow.

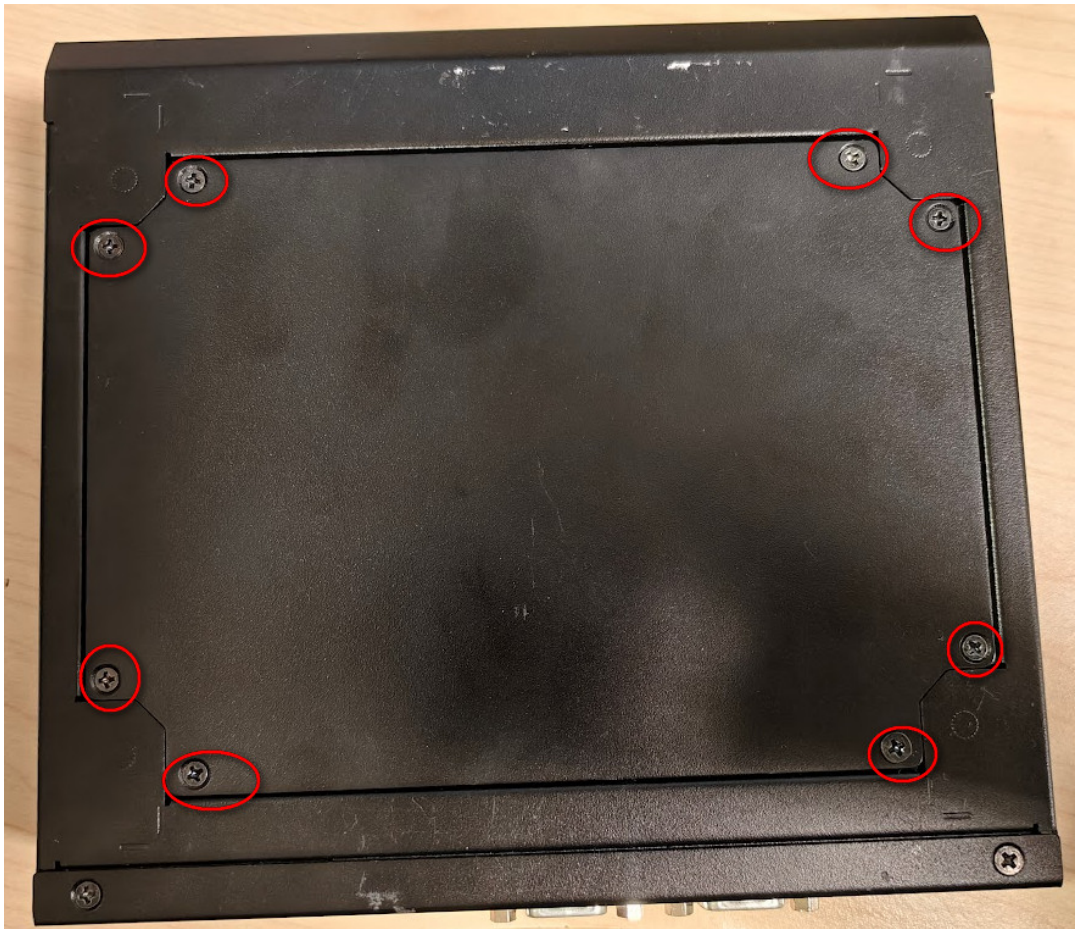


4. Affix the thermal pad onto the M.2 2280 SSD.



PS: "Peel off the release paper and affix the thermal pad to the M.2 SSD."

5. Reinstall the 8 screws into their original positions to secure the bottom cover.

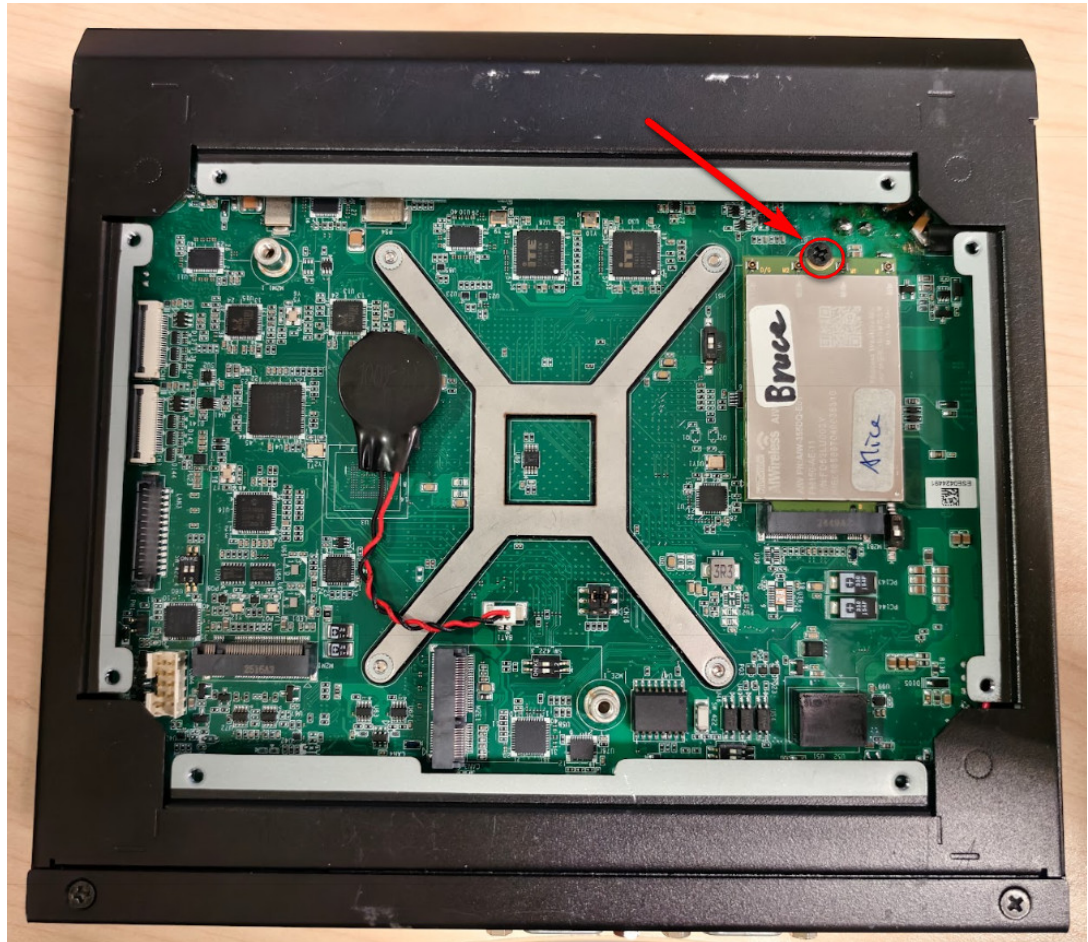


2.5.2 M.2 B Key/E Key Installation

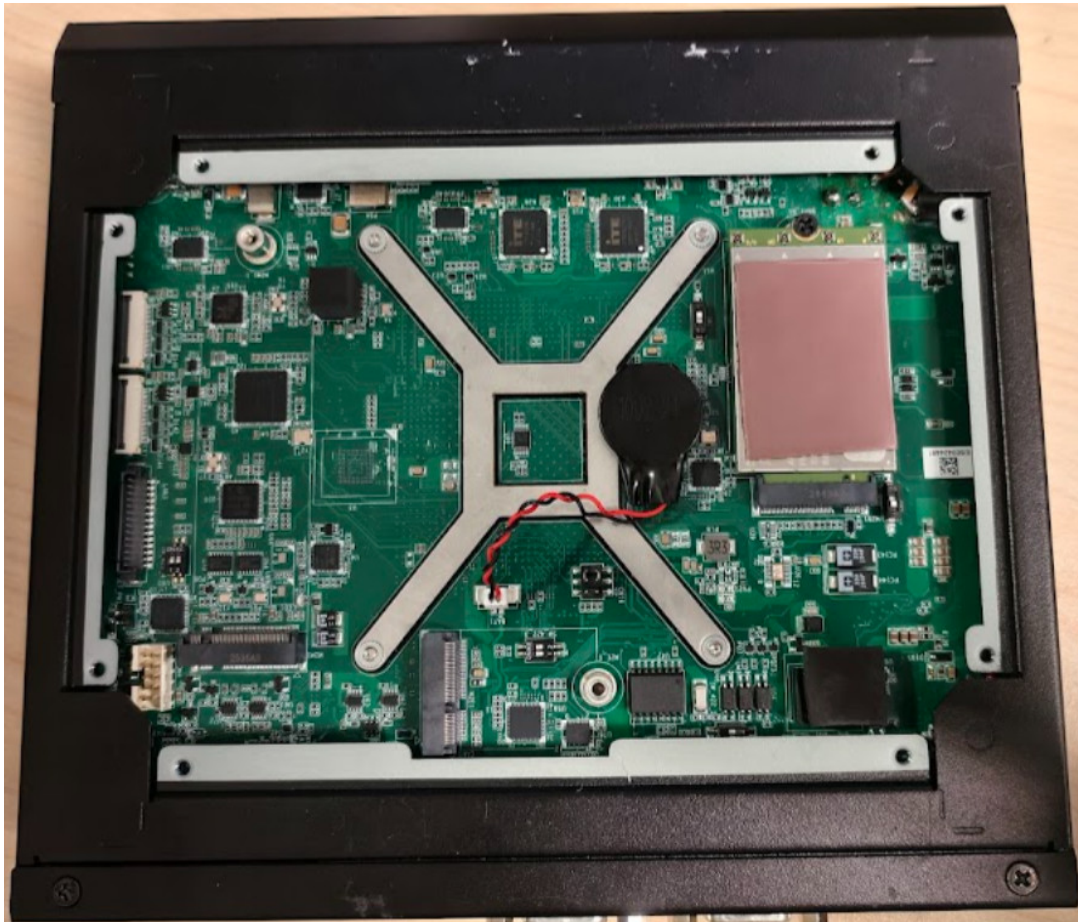
1. Remove the 8 screws and open the bottom cover.



2. Install B-Key 5G module.

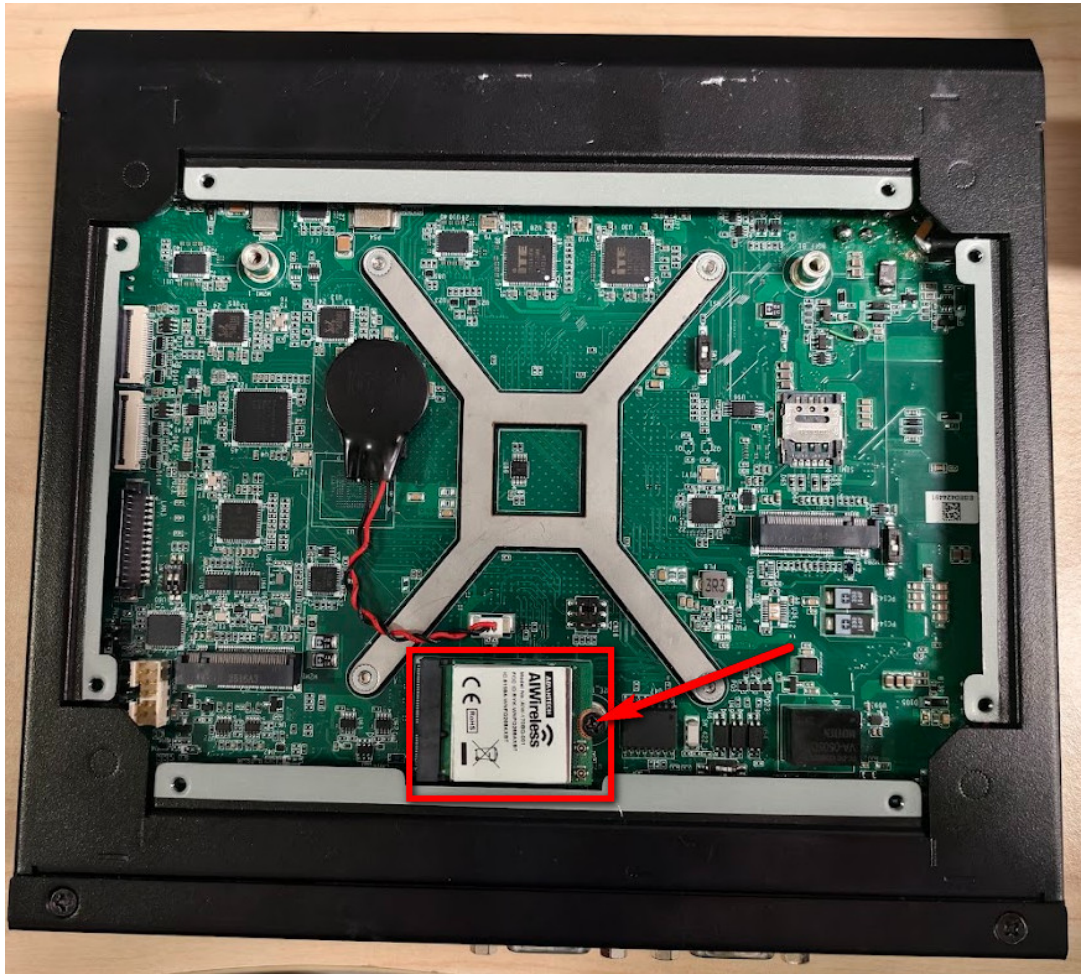


3. Install thermal pad for B key 5G module.



PS: "Peel off the release paper and affix the thermal pad to the M.2 SSD."

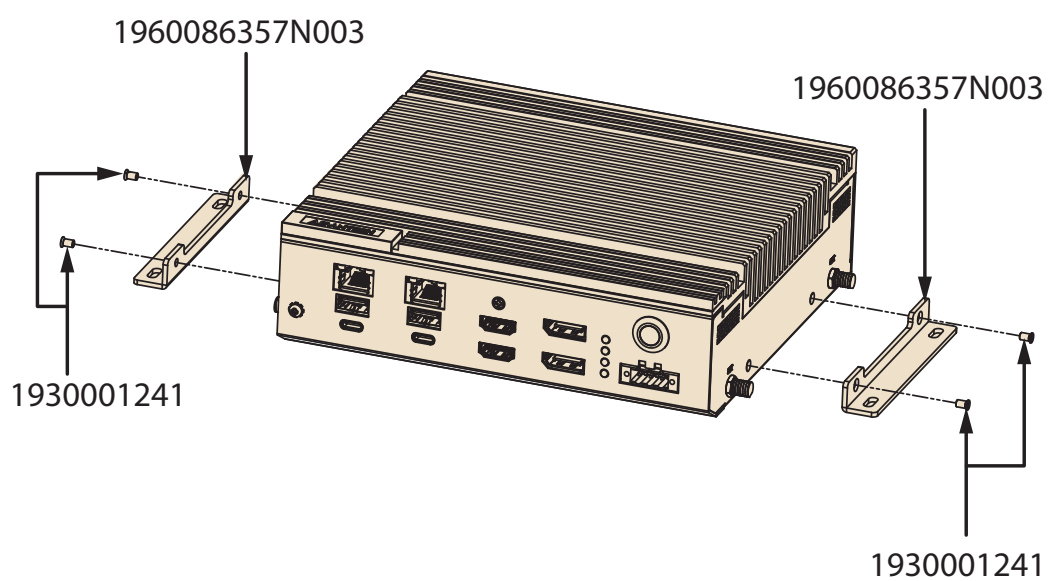
4. Install E-Key WIFI module.



5. Re-attach the bottom cover with screws.

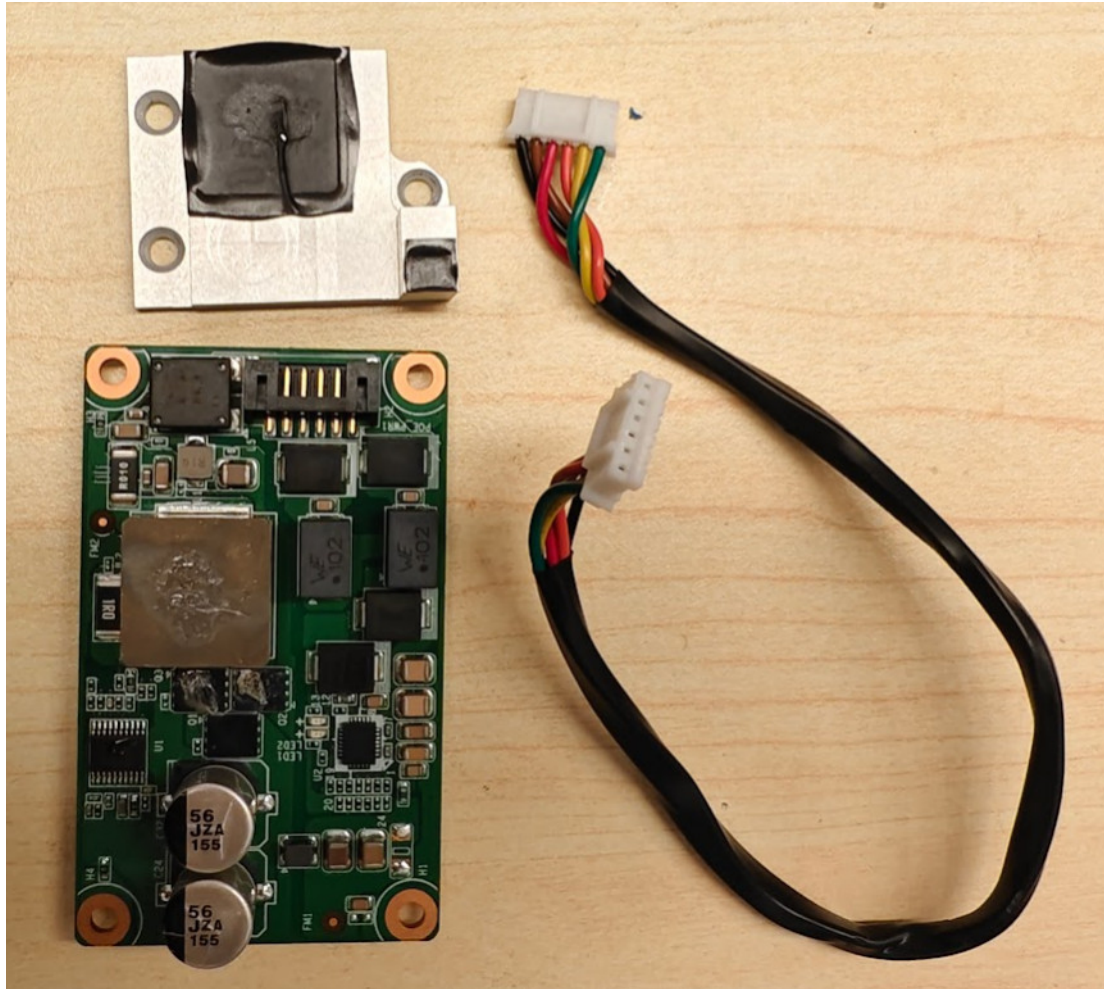


2.5.3 Wall Mount Installation



2.5.4 POE module Installation

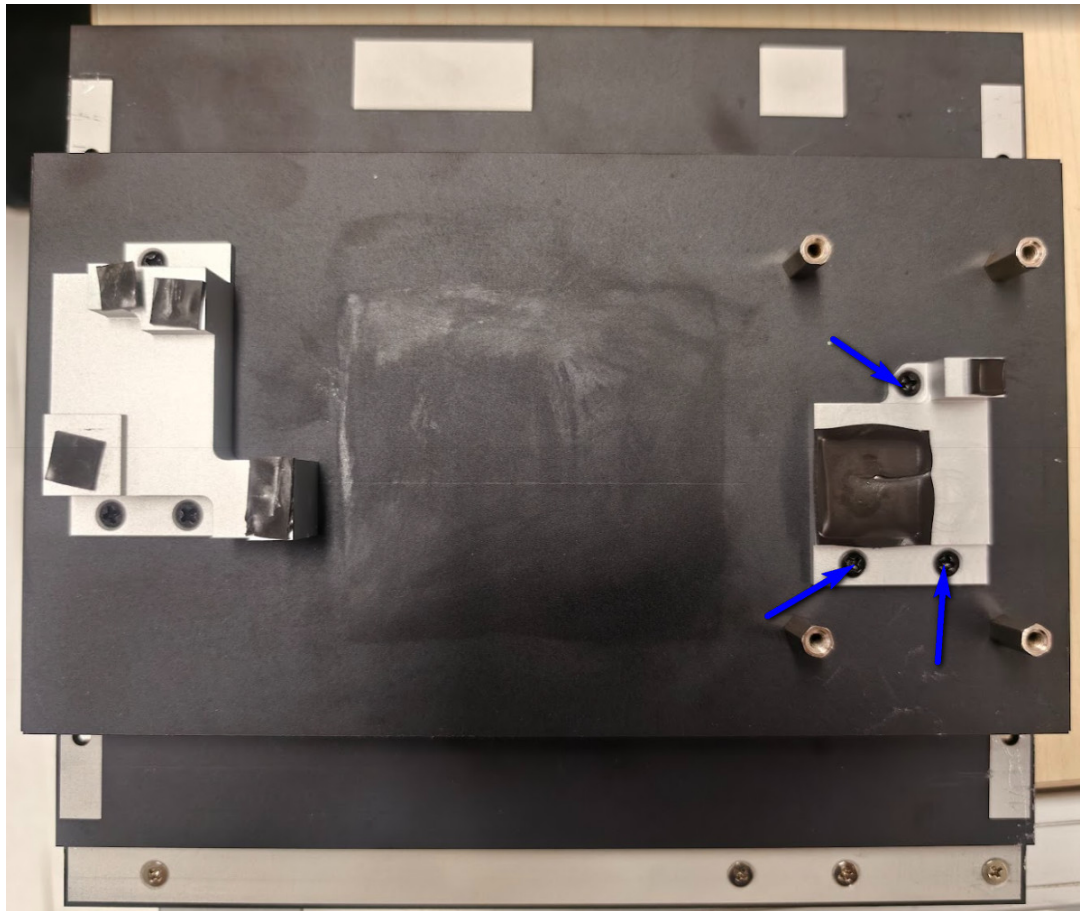
1. Please find the three item in the POE module box and thermal kit for POE.



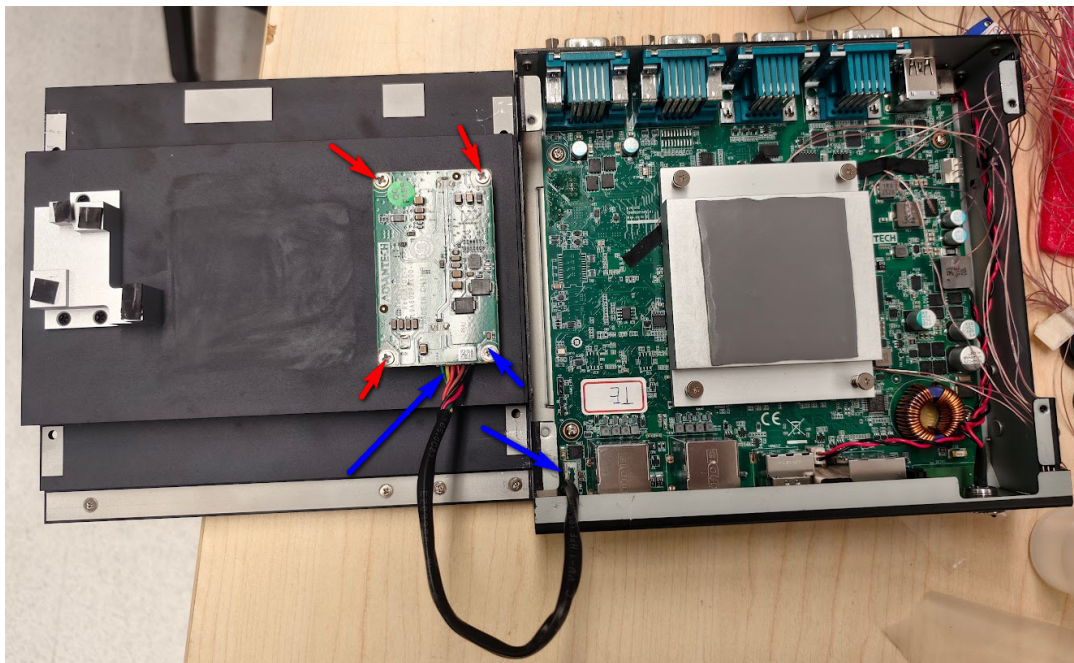
2. Remove the 4 screws and open the Top cover.



3. Secure the POE heatsink using these three screws (indicated by the blue arrows).

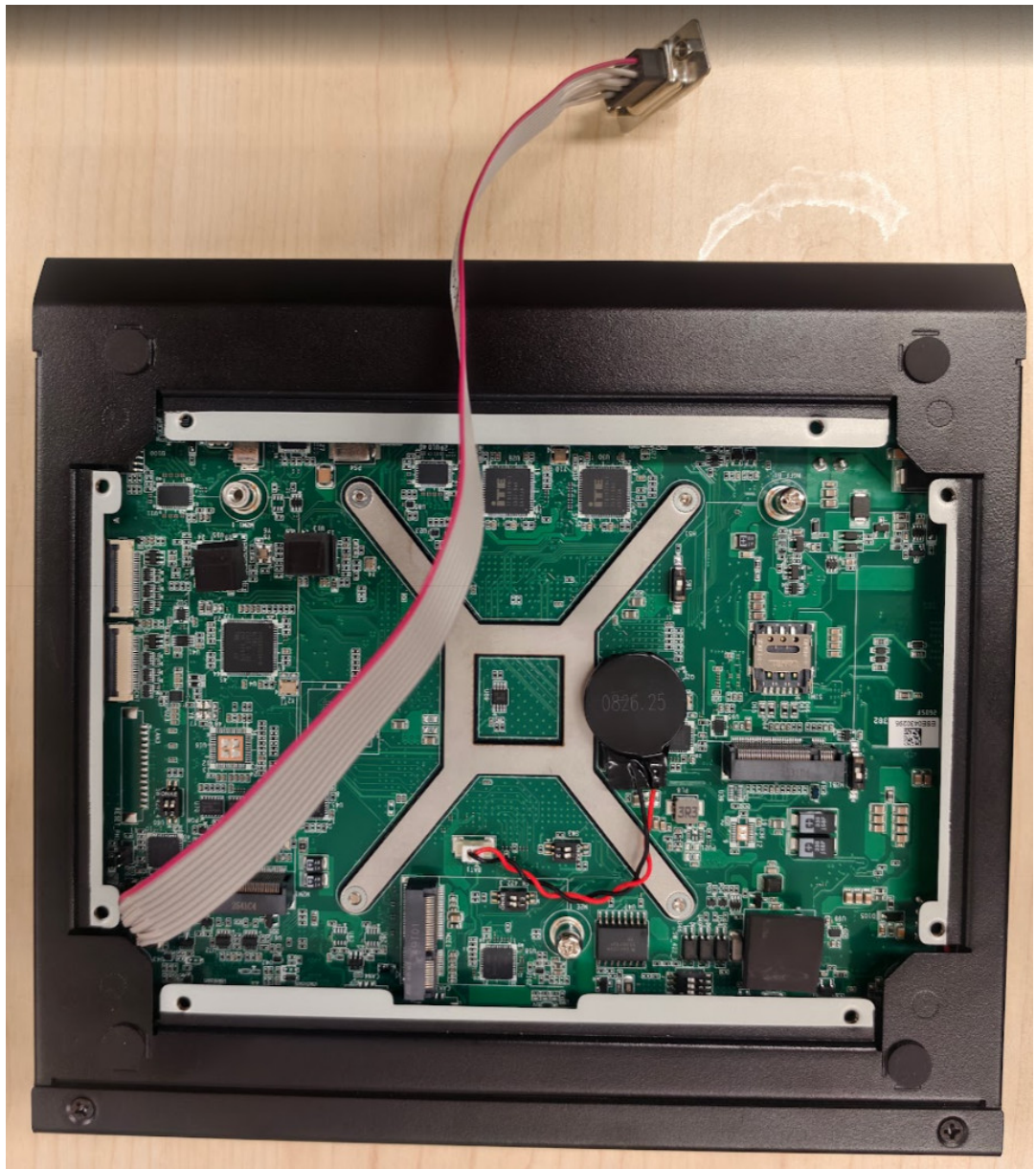


4. Connect one end of the 6-pin cable (blue arrows) on the motherboard, and the other end to the corresponding (blue arrows) on the PoE module. Then, use four screws to fasten POE module (red arrows).



5. Re-attach the bottom cover with 4 screws.

2.5.5 Debug Cable Installation



Chapter 3

Software Functionality

This chapter details the software functions on the AIR-055.

3.1 HDMI

Ubuntu GUI Settings -> Displays

3.2 CAN

Table 3.1: CAN

Connector	Interface
CAN 1	can1
CAN 2	can2

The CAN modules are preloaded by default. Use command brings up the CAN interface and enables CAN FD mode.

```
# ip link set can1 up type can bitrate 1000000 dbitrate 4000000 fd on
# ip link set can2 up type can bitrate 1000000 dbitrate 4000000 fd on
```

Set CAN1 as receiver

```
# candump can1
```

Set CAN2 as transmitter

```
# cansend can2 123#abcdabcd # send a single frame
# cangen can2 -L 8 # generate continuous frames
```

3.3 DIO

Table 3.2: Pin table with DIO Expander Number

DB9 Pin	Signal Name	sysfs	gpio (chip, offset)
1	DIO bit 0	710	5, 0
2	DIO bit 2	712	5, 2
3	DIO bit 4	714	5, 4
4	DIO bit 6	716	5, 6
5	DIO bit 7	717	5, 7
6	DIO bit 1	711	5, 1
7	DIO bit 3	713	5, 3
8	DIO bit 5	715	5, 5
9	GND	N/A	N/A

GPIOD

Set Pin2 as DO then pull high, set Pin4 as DO then pull low

```
Usage: gpio set [OPTIONS] <CHIP_NAME> <OFFSET 1>=<VALUE 1> ...
$ sudo gpio set 5 2=1
$ sudo gpio set 5 6=0
```

Set Pin6 as DI then read value

```
Usage: gpioget [OPTIONS] <CHIP_NAME> <OFFSET 1> ...
$ sudo gpioget 5 1
```

sysfs

Set Pin1 as DO then pull high

```
# echo 710 > /sys/class/gpio/export
# echo out > /sys/class/gpio/gpio710/direction
# echo 1 > /sys/class/gpio/gpio710/value
```

Set Pin3 as DI

```
# echo 714 > /sys/class/gpio/export
# echo in > /sys/class/gpio/gpio714/direction
```

Release Pin1

```
# echo 710 > /sys/class/gpio/unexport
```

3.4 Serial Ports

Default UART mode is 2-wire RS-232. AIR-055 is not equipped with a hardware switch. Please refer to the settings below to configure 4-wire RS-232, RS-422, or RS-485 mode. If the command including “</dev/ttyHSX>”, please fill in the COM port you use. For example, if you use COM1, please fill in “</dev/ttyHS1>”.

Table 3.3: Device Name

COM	tty
COM1 (isolation)	/dev/ttyHS1
COM2 (isolation)	/dev/ttyHS2
COM3	/dev/ttyHS3

3.4.1 RS-232

Table 3.4: RS-232

COM	Mode Setting
COM1	\$ sudo gpioset 4 14=0 \$ sudo gpioset 4 15=1
COM2	\$ sudo gpioset 4 16=0 \$ sudo gpioset 4 17=1
COM3	\$ sudo gpioset 4 18=1 \$ sudo gpioset 4 19=0

2-wire RS-232

```
$ sudo stty -F </dev/ttyHSX> -echo -onlcr 115200 raw
```

4-wire RS-232, please disable RS-485 first (default enabled)

```
$ sudo python3 /tool/uart/rs485_ctrl.py -d </dev/ttyHSX>
$ sudo stty -F </dev/ttyHSX> -echo -onlcr 115200 raw crtscts
```

3.4.2 RS-422

Table 3.5: RS-422

COM	Mode Setting
COM1	\$ sudo gpio set 4 14=0
	\$ sudo gpio set 4 15=0
COM2	\$ sudo gpio set 4 16=0
	\$ sudo gpio set 4 17=0
COM3	\$ sudo gpio set 4 18=1
	\$ sudo gpio set 4 19=1

RS-422

```
$ sudo stty -F </dev/ttyHSX> speed 115200 ignbrk -brkint -icrnl -
imaxbel -opost - onlcr -isig -icanon -iexten -echo -echoe -echok -
echoctl -echoke
```

3.4.3 RS-485

Table 3.6: RS-485

COM	Mode Setting
COM1	\$ sudo gpio set 4 14=1
	\$ sudo gpio set 4 15=0
COM2	\$ sudo gpio set 4 16=1
	\$ sudo gpio set 4 17=0
COM3	\$ sudo gpio set 4 18=0
	\$ sudo gpio set 4 19=1

RS-485 with auto flow control

```
$ sudo python3 /tool/uart/rs485_ctrl.py -e </dev/ttyHSX>
$ sudo stty -F </dev/ttyHSX> speed 115200 ignbrk -brkint -icrnl -
imaxbel -opost - onlcr -isig -icanon -iexten -echo -echoe -echok -
echoctl -echoke
```

3.4.4 Common Commands

Receiver

```
# cat </dev/ttyHSX> &
```

Transmitter

```
# echo "abcd" > </dev/ttyHSX>
```

3.5 Watchdog

Internal Watchdog

```
$ echo 6 | sudo tee /proc/sys/kernel/panic
$ echo c | sudo tee /proc/sysrq-trigger
```

The system will reboot after the system crash about 6 seconds

3.6 AIW Tool

3.6.1 AIW-356

Driver has pre-installed in OS.

Ubuntu GUI Settings -> Mobile Network

3.6.2 AIW-170

Driver has pre-installed in OS.

Ubuntu GUI Settings -> Wi-Fi

3.7 LED Lights

Table 3.7: LED2

LED	Color	Test Method
LED1	Green	On: Power on Off: Power off
LED2	Orange	On: <code>sudo gpioset 4 77=1</code> Off: <code>sudo gpioset 4 77=0</code>
LED3	Blue	On: <code>sudo gpioset 4 78=1</code> Off: <code>sudo gpioset 4 78=0</code>
LED4	Green	On: <code>sudo gpioset 4 79=1</code> Off: <code>sudo gpioset 4 79=0</code>

Chapter 4

System Recovery

This chapter details system recovery procedures for a damaged Linux OS.

4.1 Prepare Host

1. First, we need to prepare following things:
 - Host x86 based PC with Ubuntu 22.04 (recommended) or later with enough disk space ($\geq 128\text{GiB}$) (DON'T USE VM)
 - AIR-055
 - USB Type-A Cable with data capable cables



2. Download latest BSP Launcher.

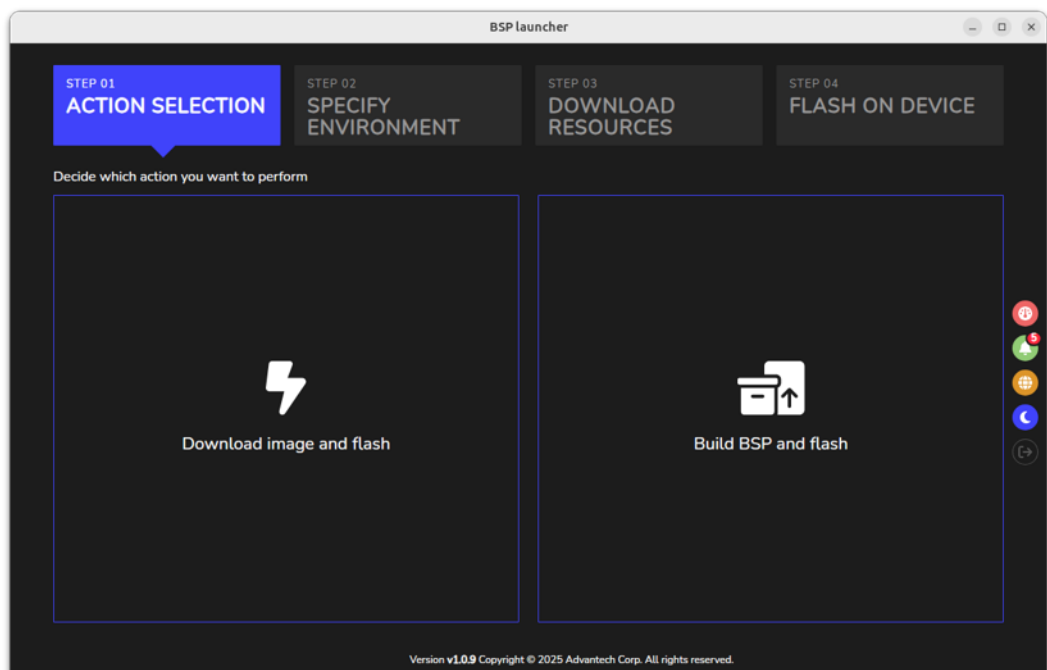
```
$ wget 'https://riscsw.blob.core.windows.net/bsp-launcher-app/BSP_Launcher_v1.0.8.zip' -k -O 'BSP_Launcher_v1.0.8.zip'
```

3. Unzip the package.

```
$ unzip BSP_Launcher_v1.0.8.zip
```

4. Install the BSP Launcher and update environment variables

```
$ sudo ./install && source ~/.profile
```

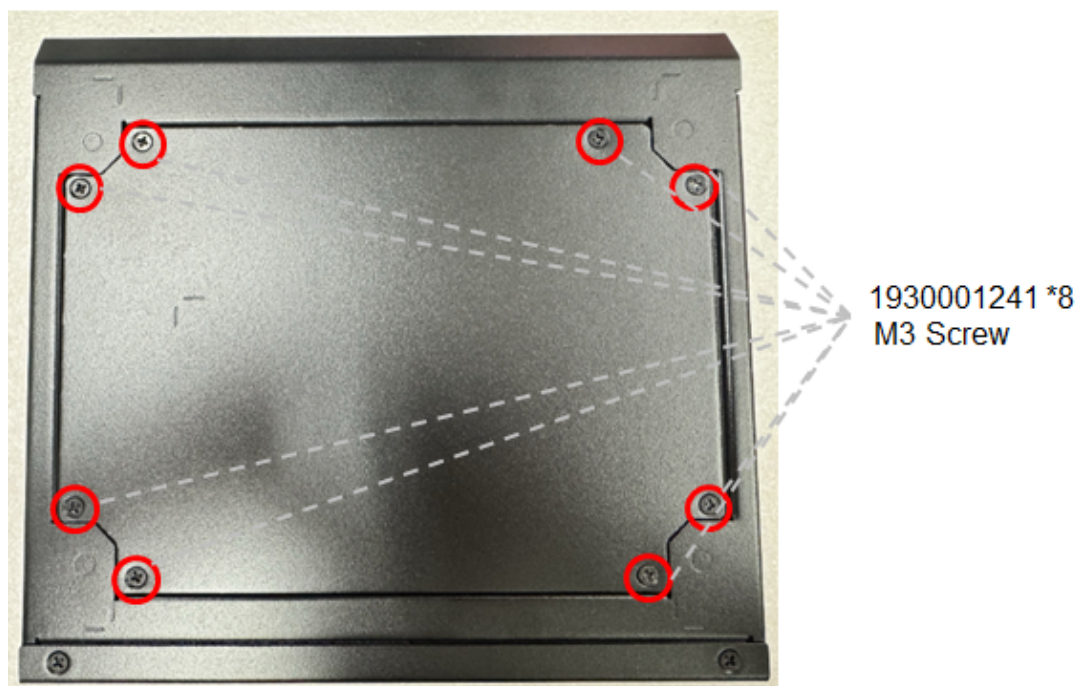


Note! *BSP Launcher is Advantech's GUI-driven automation tool for downloading validated images, building BSPs, and flashing targets.*

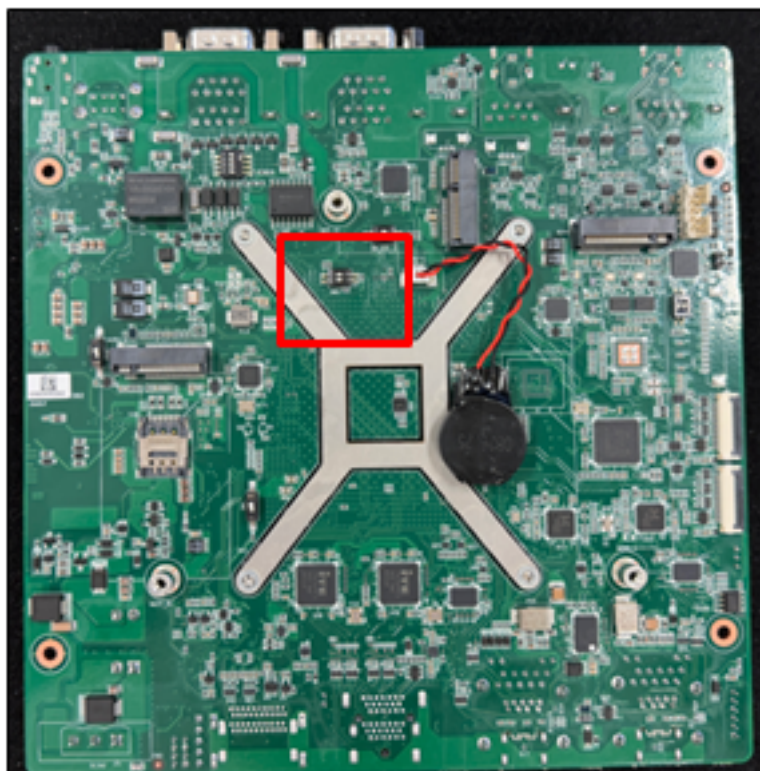


4.2 Set AIR-055 into Recovery Mode

1. Open the bottom cover.



2. Check SW3 has change to ON-ON.



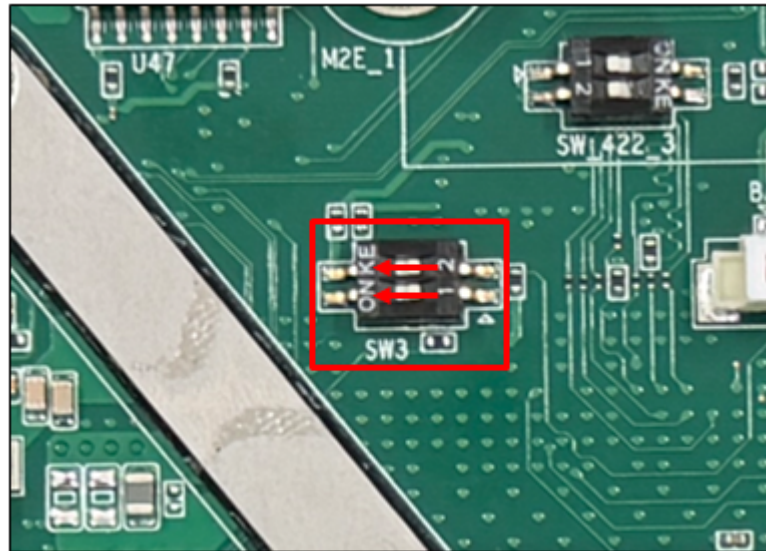
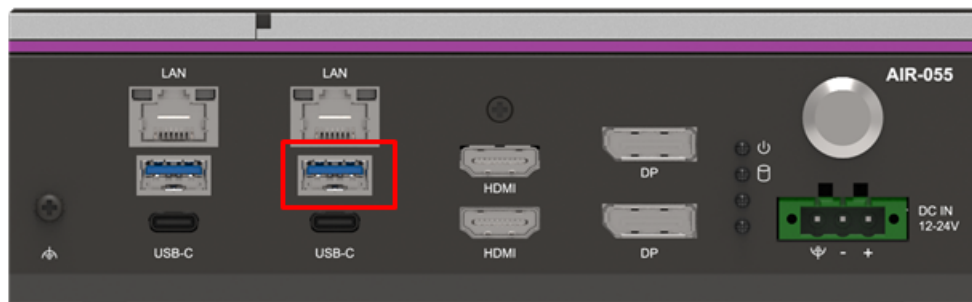


Table 4.1: Set AIR-055 into Recovery Mode

SW3	Pin1	Pin2
Boot Mode	OFF	OFF
Download Mode	ON	ON

3. Connect USB Type-A to Type-A flash cable from Host to AIR- 055 FLASH port (Right USB-A).
4. Connect the power then power-on.



Note! Only RIGHT USB-A supports download mode.



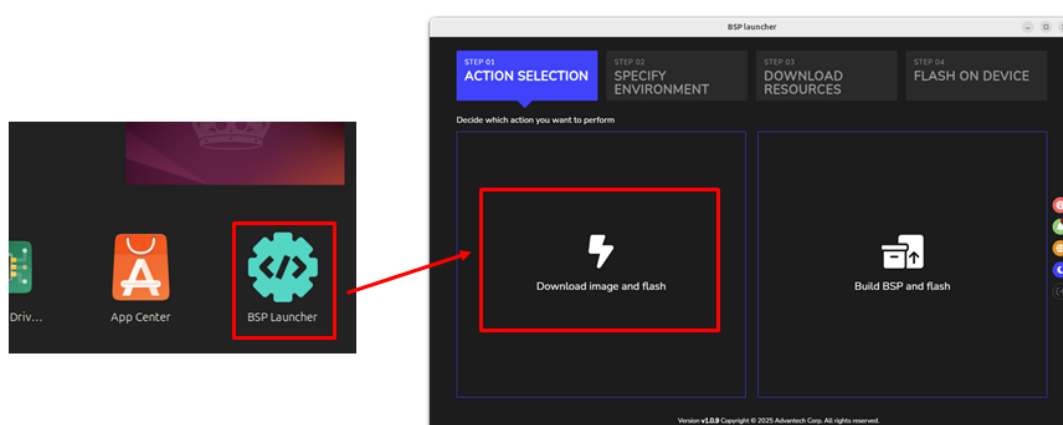
- On the host, open the terminal and execute the command "lsusb" to check AIR-055 in QDL mode.

```
jasper@jasper-Default-string:~$ lsusb
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 002 Device 016: ID 05c6:9008 Qualcomm, Inc. Gobi Wireless Modem (QDL mode)
jasper@jasper-Default-string:~$
```

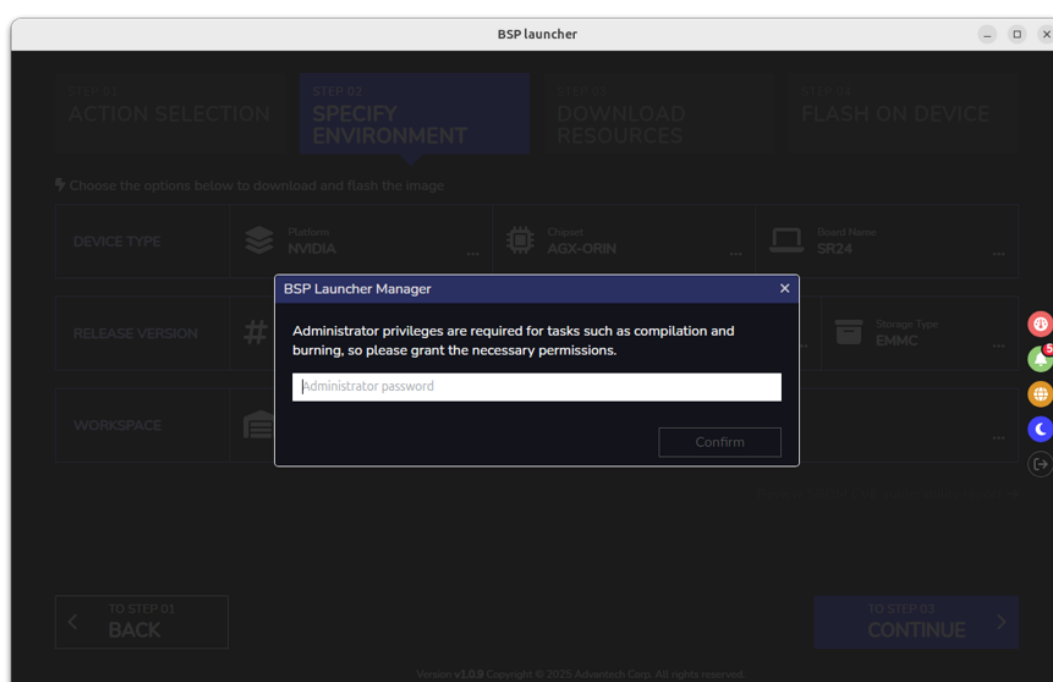
4.3 Download Image

- Open the BSP Launcher on GUI Desktop or command.

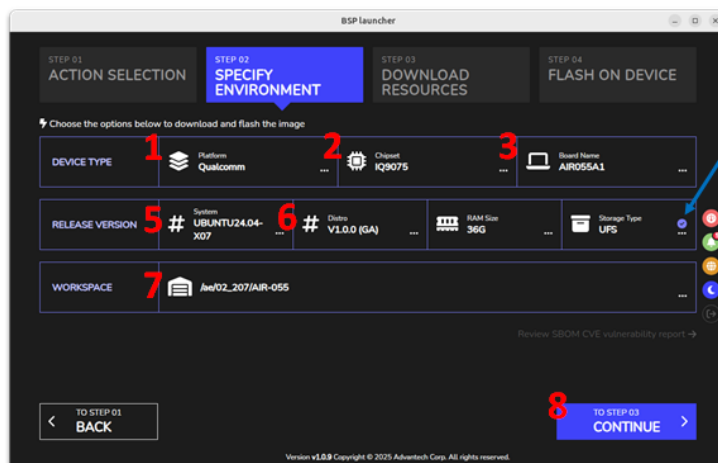
```
$ bsp-launcher
```



- Enter your password.



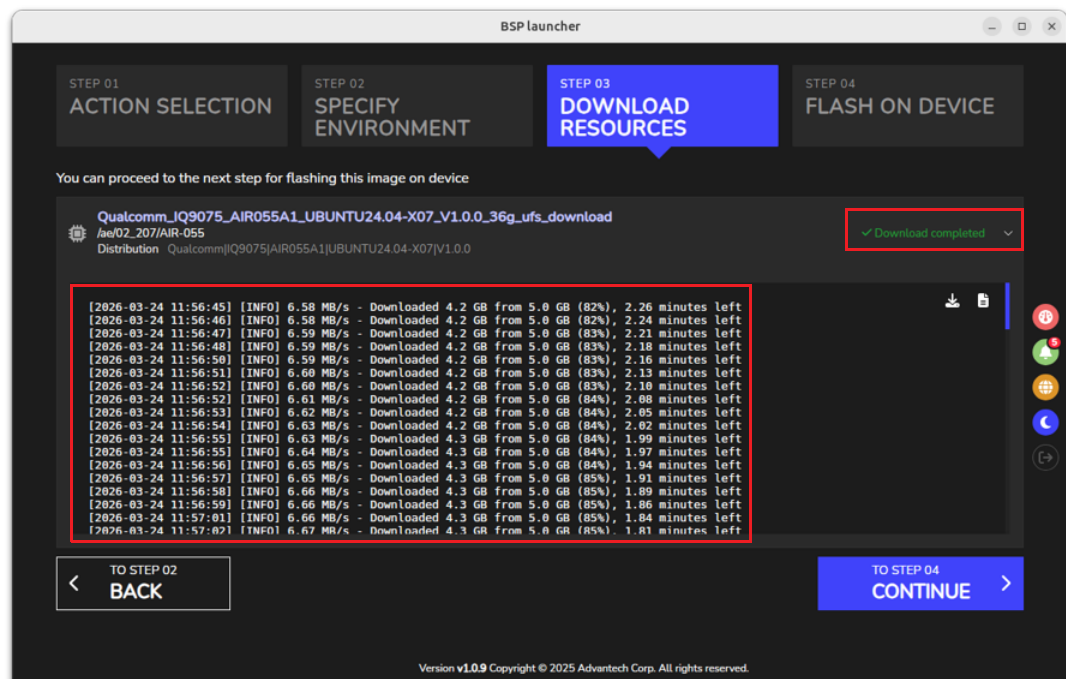
3. Follow below instruction to download the image.



Note! AIR-055 only supports Ubuntu24.04 on UFS now.

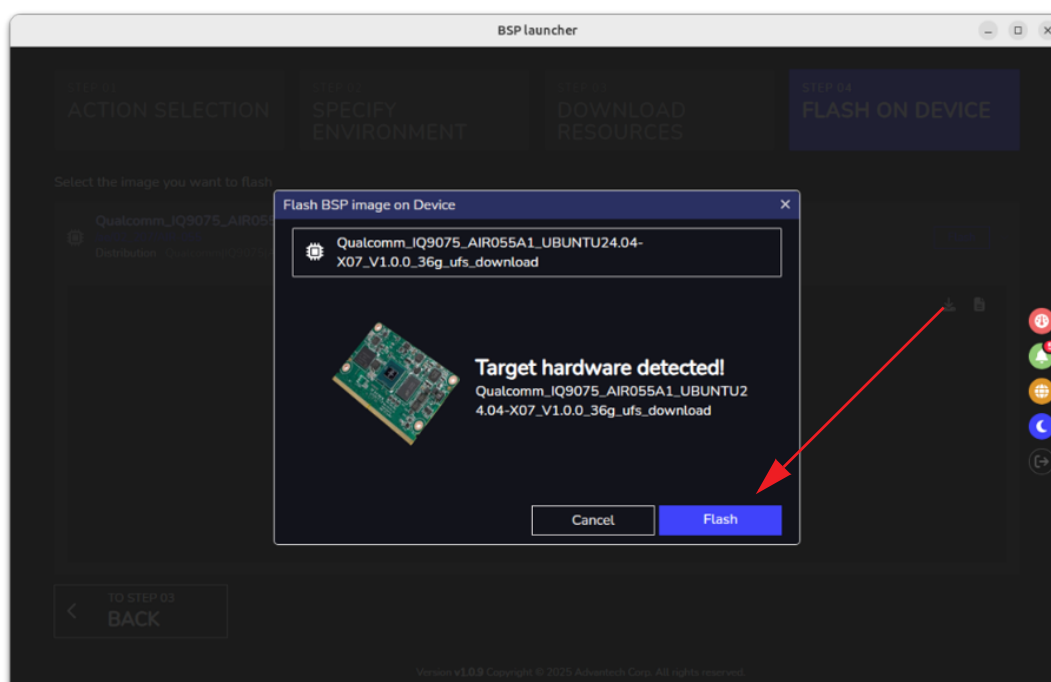
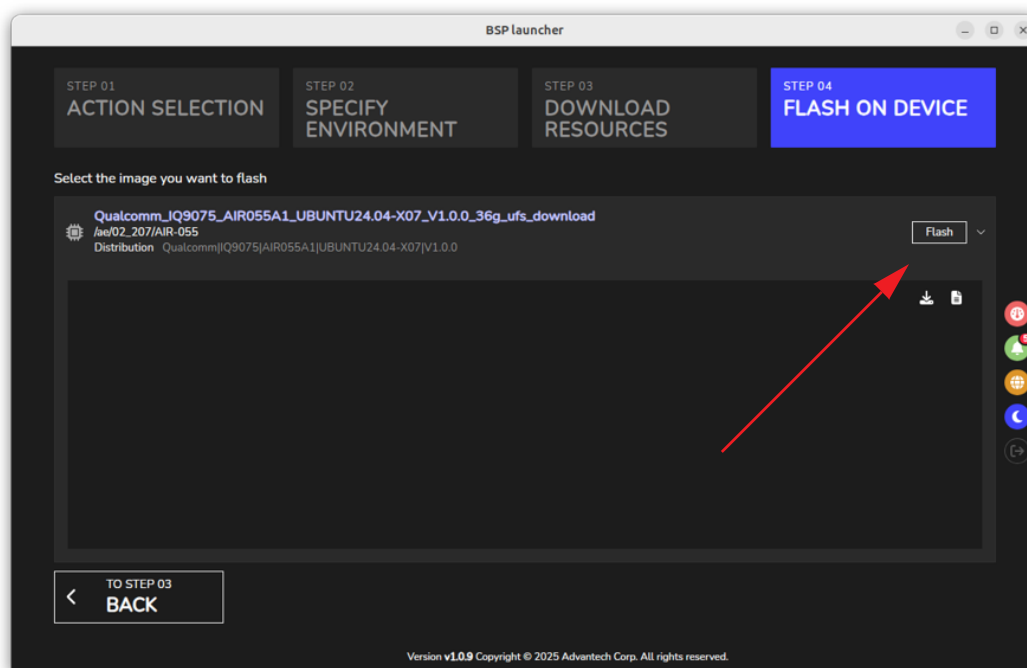


4. Follow below instruction to download the image.

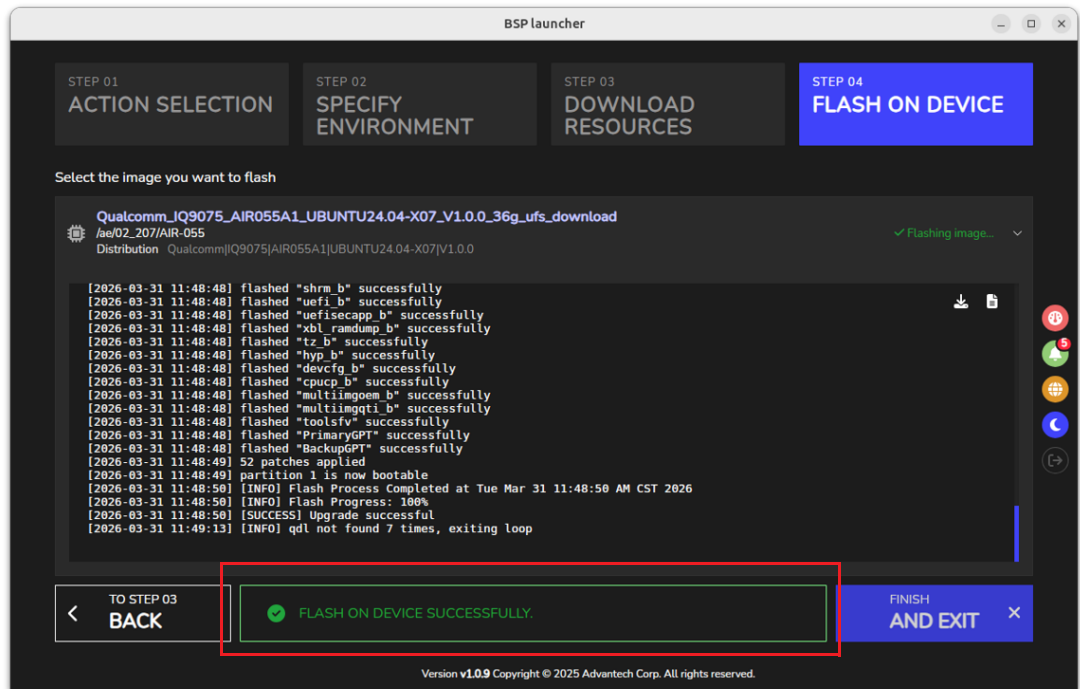


4.4 Flashing Image

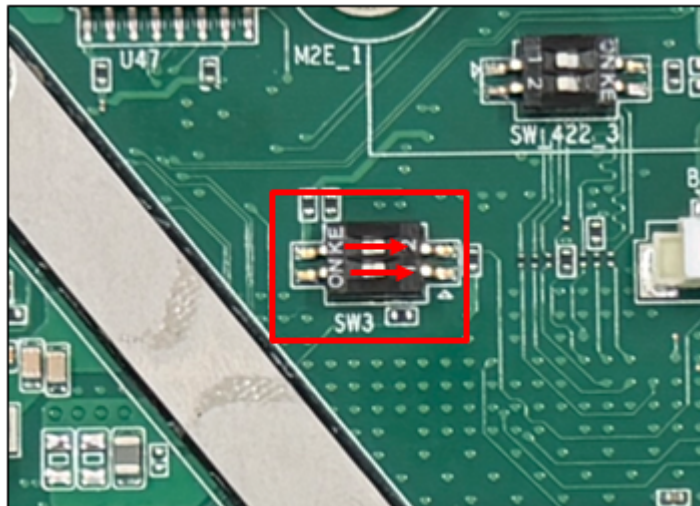
1. Click "Flash" to flash the image.



2. Flash done.



3. After flashing, disconnect the power of AIR-055.
- Change the SW3 switch back to OFF-OFF (boot mode).
 - Re-plug the power then power-on the system.
 - Default password: ubuntu.





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