# BOXER-8641AI

AI@Edge Compact Fanless Embedded
AI System with NVIDIA® AGX Orin™

User's Manual 3rd Ed

*Last Updated: February 10, 2025*

## Copyright Notice

## Acknowledgements

## Packing List

Before setting up your product, please make sure the following items have been shipped:

| Item | Quantity |
|---|---|
| ● BOXER-8641AI | 1 |
| ● Wallmount Bracket | 2 |
| ● Screw Package | 1 |
| ● Power Adapter | Optional |

If any of these items are missing or damaged, please contact your distributor or sales representative immediately.

## About this Document

This User's Manual contains all the essential information, such as detailed descriptions and explanations on the product's hardware and software features (if any), its specifications, dimensions, jumper/connector settings/definitions, and driver installation instructions (if any), to facilitate users in setting up their product.

Users may refer to the product page at AAEON.com for the latest version of this document.

## Safety Precautions

Please read the following safety instructions carefully. It is advised that you keep this manual for future references

1. All cautions and warnings on the device should be noted.
2. All cables and adapters supplied by AAEON are certified and in accordance with the material safety laws and regulations of the country of sale. Do not use any cables or adapters not supplied by AAEON to prevent system malfunction or fires.
3. Make sure the power source matches the power rating of the device.
4. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
5. Always completely disconnect the power before working on the system's hardware.
6. No connections should be made when the system is powered as a sudden rush of power may damage sensitive electronic components.
7. If the device is not to be used for a long time, disconnect it from the power supply to avoid damage by transient over-voltage.
8. Always disconnect this device from any power supply before cleaning.
9. While cleaning, use a damp cloth instead of liquid or spray detergents.
10. Make sure the device is installed near a power outlet and is easily accessible.
11. Keep this device away from humidity.
12. Place the device on a solid surface during installation to prevent falls
13. Do not cover the openings on the device to ensure optimal heat dissipation.
14. Watch out for high temperatures when the system is running.
15. Do not touch the heat sink or heat spreader when the system is running
16. Never pour any liquid into the openings. This could cause fire or electric shock.

17. As most electronic components are sensitive to static electrical charge, be sure to ground yourself to prevent static charge when installing the internal components. Use a grounding wrist strap and contain all electronic components in any static-shielded containers.

18. If any of the following situations arises, please the contact our service personnel:

    i. Damaged power cord or plug
    ii. Liquid intrusion to the device
    iii. Exposure to moisture
    iv. Device is not working as expected or in a manner as described in this manual
    v. The device is dropped or damaged
    vi. Any obvious signs of damage displayed on the device

19. DO NOT LEAVE THIS DEVICE IN AN UNCONTROLLED ENVIRONMENT WITH TEMPERATURES BEYOND THE DEVICE'S PERMITTED STORAGE TEMPERATURES (SEE CHAPTER 1) TO PREVENT DAMAGE.

## FCC Statement


This device complies with Part 15 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.

*Caution:*

*There is a danger of explosion if the battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions and your local government's recycling or disposal directives.*

*Attention:*

*Il y a un risque d'explosion si la batterie est remplacée de façon incorrecte.*
*Ne la remplacer qu'avec le même modèle ou équivalent recommandé par le constructeur.*
*Recycler les batteries usées en accord avec les instructions du fabricant et les directives gouvernementales de recyclage.*

## China RoHS Requirements (CN)

产品中有毒有害物质或元素名称及含量

AAEON System QO4-381 Rev.A2

| 部件名称 | 有毒有害物质或元素 | | | | | |
|---|---|---|---|---|---|---|
| | 铅 (Pb) | 汞 (Hg) | 镉 (Cd) | 六价铬 (Cr(VI)) | 多溴联苯 (PBB) | 多溴二苯醚 (PBDE) |
| 印刷电路板及其电子组件 | × | ○ | ○ | ○ | ○ | ○ |
| 外部信号连接器及线材 | × | ○ | ○ | ○ | ○ | ○ |
| 外壳 | ○ | ○ | ○ | ○ | ○ | ○ |
| 中央处理器与内存 | × | ○ | ○ | ○ | ○ | ○ |
| 硬盘 | × | ○ | ○ | ○ | ○ | ○ |
| 液晶模块 | × | ○ | ○ | ○ | ○ | ○ |
| 光驱 | × | ○ | ○ | ○ | ○ | ○ |
| 触控模块 | × | ○ | ○ | ○ | ○ | ○ |
| 电源 | × | ○ | ○ | ○ | ○ | ○ |
| 电池 | × | ○ | ○ | ○ | ○ | ○ |

本表格依据 SJ/T 11364 的规定编制。

○：表示该有毒有害物质在该部件所有均质材料中的含量均在 GB/T 26572 标准规定的限量要求以下。

×：表示该有害物质的某一均质材料超出了 GB/T 26572 的限量要求，然而该部件仍符合欧盟指令 2011/65/EU 的规范。

环保使用期限(EFUP (Environmental Friendly Use Period)) : 10 年

备注：

一、此产品所标示之环保使用期限，系指在一般正常使用状况下。

二、上述部件物质中央处理器、内存、硬盘、光驱、电源为选购品。

三、上述部件物质液晶模块、触控模块仅一体机产品适用。

## China RoHS Requirement (EN)

Name and content of hazardous substances in product

AAEON System QO4-381 Rev.A2

| Part Name | Hazardous Substances | | | | | |
|---|---|---|---|---|---|---|
| | 铅 (Pb) | 汞 (Hg) | 镉 (Cd) | 六价铬 (Cr(VI)) | 多溴联苯 (PBB) | 多溴二苯醚 (PBDE) |
| PCB Assemblies | × | O | O | O | O | O |
| Connector and Cable | × | O | O | O | O | O |
| Chassis | O | O | O | O | O | O |
| CPU and Memory | × | O | O | O | O | O |
| Hard Disk | × | O | O | O | O | O |
| LCD Modules | × | O | O | O | O | O |
| CD-ROM/DVD-ROM | × | O | O | O | O | O |
| Touch Modules | × | O | O | O | O | O |
| Power | × | O | O | O | O | O |
| Battery | × | O | O | O | O | O |

The table is prepared in accordance with the provisions of SJ/T 11364.

O：Indicates that said hazardous substance contained in all of the homogenous materials for this product is below the limit requirement of GB/T 26572.

×：Indicates that said hazardous substance contained in at least one of the homogenous materials used for this part is above the limit requirement of GB/T 26572. But this product still be compliance with 2011/65/EU Directive (allowed with 2011/65/EU Annex III of RoHS exemption with number 6(c),7(a),7(c)-1).

EFUP (Environment Friendly Use Period) value: 10 years.

Notes：

1. This product defined period of use is under normal condition.
2. In above part, CPU/Memory/ Hard Disk/CD-ROM/DVD-ROM/ Power are optional.
3. In above part, LCD Modules/ Touch Modules are for all-in-one product model.

# Table of Contents

# Chapter 1

Product Specifications

## 1.1 Specifications

| System | |
|---|---|
| AI Accelerator | NVIDIA® Jetson AGX Orin™ |
| CPU | NVIDIA® Jetson AGX Orin™ 32GB: |
| | 8-core Arm® Cortex®-A78AE v8.2 64-bit CPU |
| | NVIDIA® Jetson AGX Orin™ 64GB: |
| | 12-core Arm® Cortex®-A78AE v8.2 64-bit CPU |
| System Memory | 32GB LPDDR5 |
| | 64GB LPDDR5 |
| Storage Device | 64GB eMMC 5.1 x 1 |
| | MicroSD Slot x 1 |
| | SATA Drive Bay x 1 |
| Display Interface | HDMI 2.0 x 1 |
| Ethernet | RJ-45 x 2 (GbE LAN) |
| I/O | USB 3.2 Gen 2 x 2 (USB Type A) |
| | USB 3.2 Gen 2 x 1 (USB Type C) |
| | USB 2.0 x 1 (USB Type A) |
| | Micro USB x 1 for OS Flash |
| | DB-9 x 2 for RS-232/422/485 |
| | DB-9 x 1 for DIO x 8 |
| | Mic-in and Line-out x 1 |
| | MicroSD Card Slot x 1 |
| | Reset Button x 1 |
| | Recovery Button x 1 |

## System

| | |
|---|---|
| | Antenna Opening x 4 |
| | Power Button x 1 |
| **Expansion** | M.2 2230 E-Key x 1 (for Wi-Fi/BT) |
| | M.2 3052 B-Key x 1 |
| | M.2 2280 M-Key (for NVMe) x 1 |
| | 2.5" SATA Port Drive x 1 |
| | SIM Slot x 1 |
| **Indicator** | Power LED x 1 |
| **OS Support** | Linux (NVIDIA Jetpack™ 5.0 or above) |

## Power Supply

| | |
|---|---|
| **Power Requirement** | 12V DC with lockable DC Jack |

## Mechanical

| | |
|---|---|
| **Mounting** | Wall mount kit |
| **Dimensions (W x D x H)** | 7.09 " x 5.35 " x 3.11" |
| | (180.0mm x 136.0mm x 79.1mm) |
| **Gross Weight** | 7.8 lb. (3.5Kg) |
| **Net Weight** | 5.5 lb. (2.5Kg) |

## Environmental

| | |
|---|---|
| **Operating Temperature** | -4°F ~ 131°F (-20°C ~ 55°C) with 0.5 m/s airflow and |
| | Industrial Wide Temp. SSD |
| **Storage Temperature** | -40°F ~ 158°F (-40°C ~ 70°C) |

## Environmental

| | |
|---|---|
| **Storage Humidity** | 5 ~ 95% @ 40°C, non-condensing |
| **Anti-Vibration** | 3.5Grm / 5~500Hz / operation:<br>eMMC, MicroSD or SSD |
| **Anti-Shock** | 50G peak acceleration (11 msec. duration: eMMC, Micro SD, or SSD) |
| **Certification** | CE/FCC Class B |

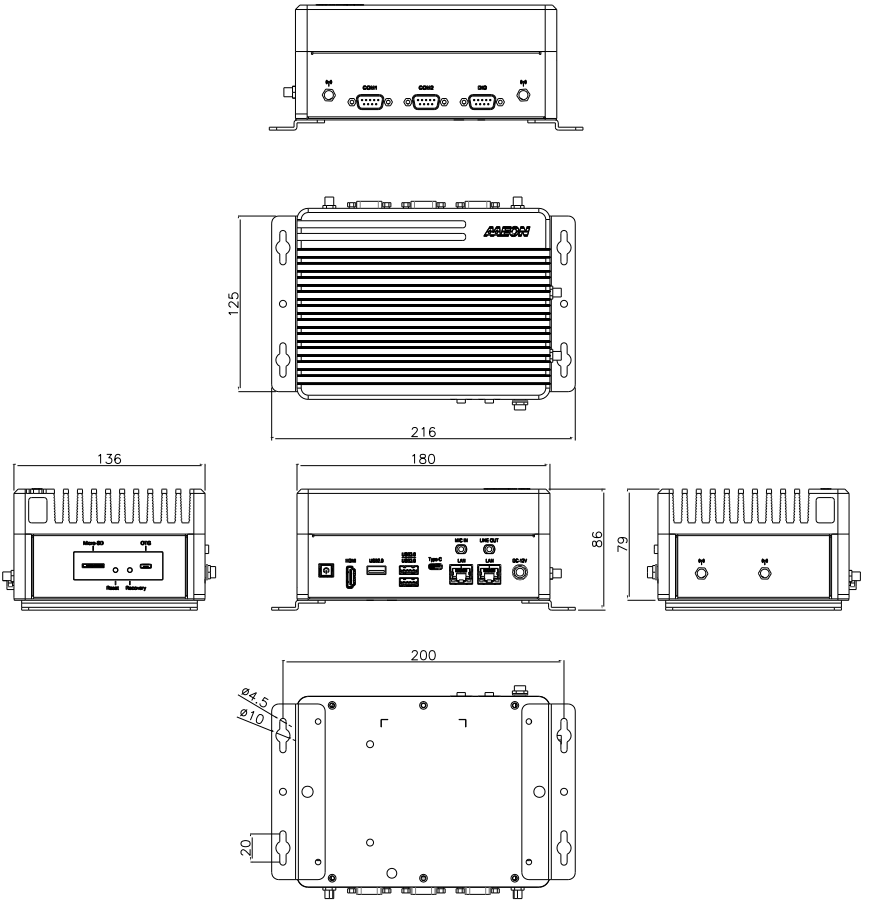
**Note**: AAEON recommends using industrial wide-temperature Gen 3 storage. If using Gen 4 storage, a thermal solution is required for adequate heat dissipation. For any queries regarding these requirements, please contact your AAEON representative.

**Note**: The real USB, LAN and COM transmission rate depends on the user scenario and the real USB, LAN and COM transmission rate depends on the user scenario and HW design.

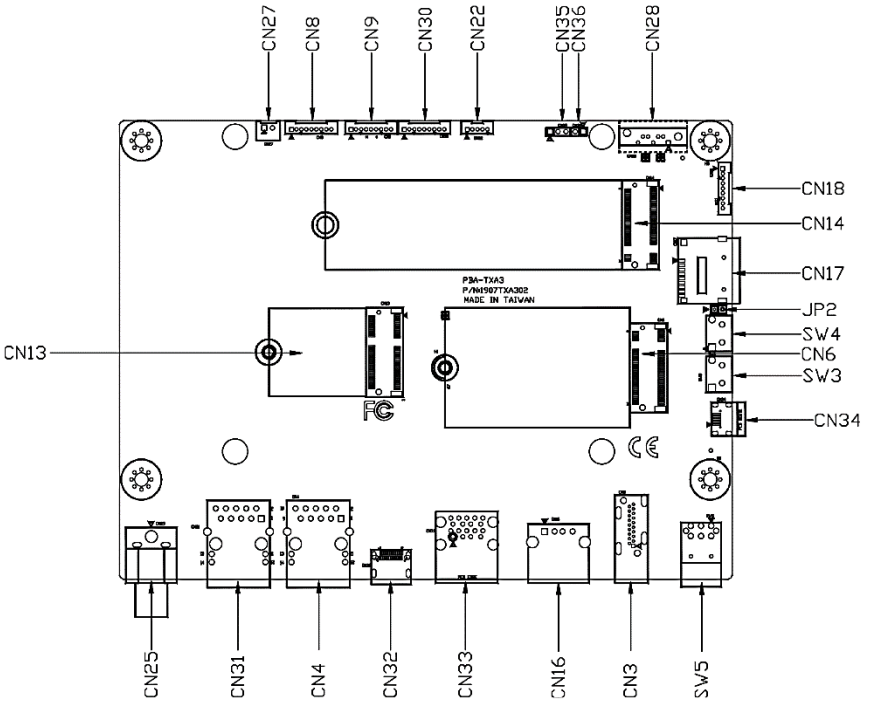
# Chapter 2

Hardware Information

## 2.1 Dimensions



## 2.2 Jumpers and Connectors



## 2.3 List of Jumpers

The board has a number of jumpers that allow you to configure your system to suit your application.

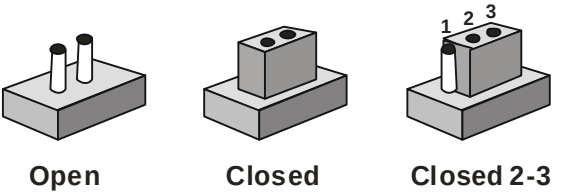
The table below shows the function of each of the board's jumpers

| Label | Function |
|---|---|
| JP1 | M.2 SATA/PCIe Mode Select |
| JP2 | AT/ATX Mode Select |
| JP3 | FAN Voltage Select |
| JP4 | AGX Orin Select |

### 2.3.1 Setting Jumpers

You configure your card to match the needs of your application by setting jumpers. A jumper is the simplest kind of electric switch. 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 you connect the pins with the clip.

To "open" a jumper you remove the clip. Sometimes a jumper will have three pins, labeled 1, 2 and 3. In this case you would connect either pins 1 and 2 or 2 and 3.




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 change.

Generally, you simply need a standard cable to make most connections.

### 2.3.2 M.2 SATA/PCIe Mode (JP1)

| JP1 | Function |
|---|---|
| 1-2 | SATA |
| 2-3 | PCIe (Default) |

### 2.3.3 Auto Power Mode (JP2)

| JP2 | Function |
|---|---|
| 1-2 Open | ATX (Default) |
| 1-2 Closed | AT |

### 2.3.4 FAN Voltage Mode (JP3)

| JP3 | Function |
|---|---|
| 1-2 | +5V (Default) |
| 2-3 | +12V |

### 2.3.5 AGX Orin RTC Mode (Default) (JP4)

| JP4 | Function |
|---|---|
| 2-4, 4-6 | AGX |

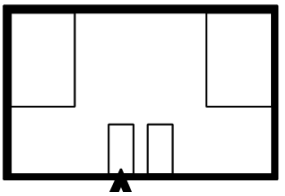
## 2.4 List of Connectors

The board has a number of connectors that allow you to configure your system to suit your application.

The table below shows the function of each of the board's connectors

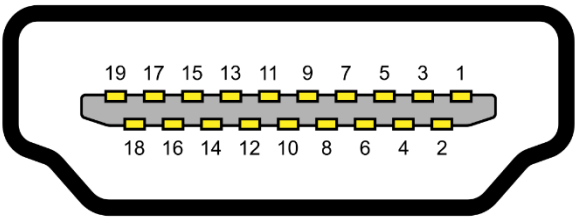
| Label | Function |
|---|---|
| CN1 | RTC Battery Connector |
| CN3 | HDMI Connector |
| CN4 | Giga LAN Connector |
| CN6 | M.2 B-Key (USB3.0+PCIe) Connector |
| CN7 | SIM Card |
| CN8 | COM Port Connector (/dev/ttyTHS1) |
| CN9 | COM Port Connector (/dev/ttyTHS4) |
| CN12 | Audio Connector |
| CN13 | M.2 2230 E-Key Connector |
| CN14 | M.2 2280 M-Key (SATA or NVM) Connector |
| CN16 | USB 2.0 Type-A Connector |
| CN17 | MicroSD Connector |
| CN18 | Front Panel Connector |
| CN20 | FAN Connector |
| CN22 | UART Debug Port |
| CN25 | DC 12V Plug Connector |
| CN27 | 5V SATA Power Connector |
| CN28 | SATA Connector |
| CN30 | 8-bit GPIO |
| CN31 | Giga LAN Connector |
| CN32 | USB 3.2 Type-C Connector |
| CN33 | Dual USB 3.2 Type-A Connector |
| CN34 | Micro USB for Flash OS |
| SW3 | Recovery Switch |
| SW4 | Reset Switch |
| SW5 | Power On/Off Switch |

### 2.4.1 RTC Connector (CN1)



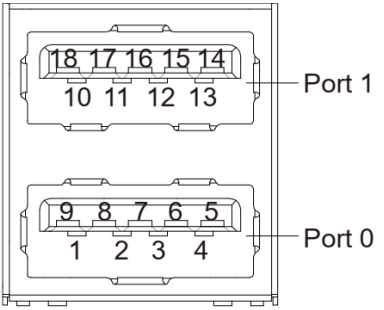
| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | +3V | 2 | GND |

### 2.4.2 HDMI Connector (CN3)




| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | HDMI_DATA2_P | 2 | GND |
| 3 | HDMI_DATA2_N | 4 | HDMI_DATA1_P |
| 5 | GND | 6 | HDMI_DATA1_N |
| 7 | HDMI_DATA0_P | 8 | GND |
| 9 | HDMI_DATA0_N | 10 | HDMI_CLK_P |
| 11 | GND | 12 | HDMI_CLK_N |
| 13 | NC | 14 | NC |
| 15 | HDMI_SCL | 16 | HDMI_SDA |
| 17 | GND | 18 | HDMI_PWR |
| 19 | HDMI_HDP | | |

### 2.4.3 Dual USB 3.2 Type-A Connector (CN33)

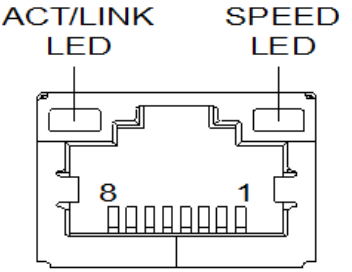



| Pin | Signal | Pin | Signal |
|---|---|---|---|
| U1 | VBUS_1 | U10 | VBUS_2 |
| U2 | (A)D- | U11 | (B)D- |
| U3 | (A)D+ | U12 | (B)D+ |
| U4 | GND | U13 | GND |
| U5 | (A)SSRX- | U14 | (B)SSRX- |
| U6 | (A)SSRX+ | U15 | (B)SSRX+ |
| U7 | GND | U16 | GND |
| U8 | (A)SSTX- | U17 | (B)SSTX- |
| U9 | (A)SSTX+ | U18 | (B)SSTX+ |

### 2.4.4 Power-In Connector (CN25)

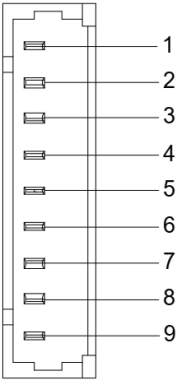
| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | PWR_IN | 2 | GND |

### 2.4.5 Giga LAN Connector (CN4/CN31)

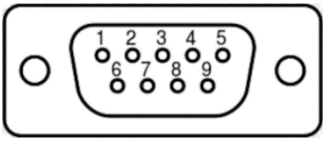



| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | MDI0+ | 2 | MDI0- |
| 3 | MDI1+ | 4 | MDI1- |
| 5 | MDI2+ | 6 | MDI2- |
| 7 | MDI3+ | 8 | MDI3- |

### 2.4.6 COM Port Connector (/dev/ttyTHS1) (CN9, SW2)

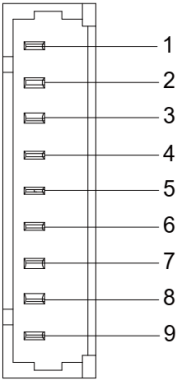



| Pin | RS-232 | RS-422 | RS-485 |
|---|---|---|---|
| 1 | | TXD- | TXD- |
| 2 | | | |
| 3 | RXD | RXD+ | TXD+ |
| 4 | | | |
| 5 | TXD | TXD+ | |
| 6 | | | |
| 7 | | RXD- | |
| 8 | | | |
| 9 | GND | GND | GND |

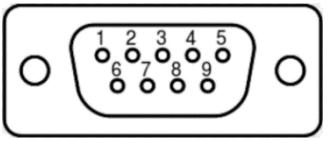



| Pin | RS-232 | RS-422 | RS-485 |
|---|---|---|---|
| 1 | | TX- | D- |
| 2 | RXD | TX+ | D+ |
| 3 | TXD | RX+ | |
| 4 | | RX- | |
| 5 | GND | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |

### 2.4.7 COM Port Connector (/dev/ttyTHS4) (CN8, SW1)

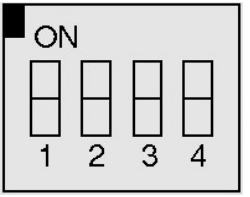



| Pin | RS-232 | RS-422 | RS-485 |
|---|---|---|---|
| 1 | | TXD- | TXD- |
| 2 | | | |
| 3 | RXD | RXD+ | TXD+ |
| 4 | | | |
| 5 | TXD | TXD+ | |
| 6 | | | |
| 7 | | RXD- | |
| 8 | | | |
| 9 | GND | GND | GND |




| Pin | RS-232 | RS-422 | RS-485 |
|---|---|---|---|
| 1 | | TX- | D- |
| 2 | RXD | TX+ | D+ |
| 3 | TXD | RX+ | |
| 4 | | RX- | |
| 5 | GND | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |

### 2.4.8 RS-232/422/485 Select (SW1, SW2)

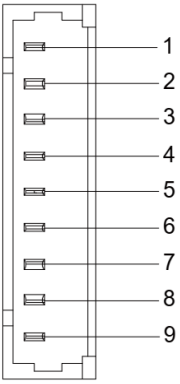



| Mode | S-1 | S-2 | S-3 | S-4 |
|---|---|---|---|---|
| 1T/1R RS-232 | On | On | | |
| 1T/1R RS-422 | On | Off | | |
| 1T/1R RS-485 | Off | On | | |
| Low power shutdown | Off | Off | | |
| Enable RS-422/RS-485 bias and termination resistors. | | | On | |
| Disable RS-422/RS-485 bias and termination resistors. | | | Off | |
| 250kbps for RS-232 and RS-485/RS-422 | | | | On |
| RS-232 to 3Mbps and RS-485/RS-422 to 20Mbps | | | | Off |

### 2.4.9 UART Debug Port Connector (CN22)

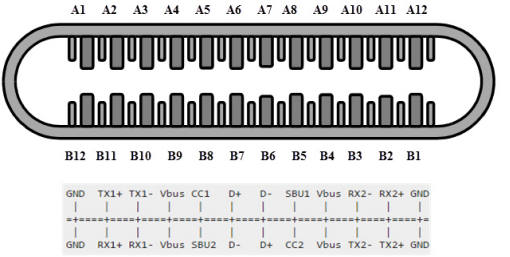
| Pin | Signal |
|---|---|
| 1 | VCC 3.3V |
| 2 | UART RX |
| 3 | GND |
| 4 | UART TX |
| 5 | GND |

### 2.4.10 Front Panel Connector (CN18)




| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | Carrier board standby | 2 | GND |
| 3 | Button power | 4 | CVM_PRSNT1 |
| 5 | System Overcurrent indicator | 6 | GND |
| 7 | LED Green | 8 | LED Blue |
| 9 | LED Power (105ohm Pu) | | |

### 2.4.11 USB 3.0 Type-C Connector (CN32)

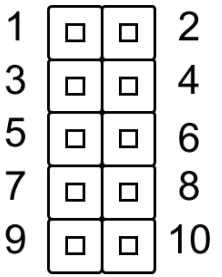



| Pin | Signal | Pin | Signal |
|---|---|---|---|
| A1 | GND | B12 | GND |
| A2 | (A)SSTX+ | B11 | (B)SSRX+ |
| A3 | (A)SSTX- | B10 | (B)SSRX- |
| A4 | VBUS_1 | B9 | VBUS_2 |
| A5 | CC1 | B8 | SBU2 |
| A6 | (A)D+ | B7 | (B)D- |
| A7 | (A)D- | B6 | (B)D+ |
| A8 | SBU1 | B5 | CC2 |
| A9 | VBUS_1 | B4 | VBUS_2 |
| A10 | (A)SSRX- | B3 | (B)SSTX- |
| A11 | (A)SSRX+ | B2 | (B)SSTX+ |
| A12 | GND | B1 | GND |

### 2.4.12 MicroSD Connector (CN17)

| SD Card Pin Map | | |
|---|---|---|
| Pin No (Card) | Pin No (Connector) | Function |
| 1 | #1 | DAT2 |
| 2 | #2 | CD/DAT3 |
| 3 | #3 | CMD |
| 4 | #4 | VDD |
| 5 | #5 | CLK |
| 6 | #6 | VSS |
| 7 | #7 | DAT0 |
| 8 | #8 | DAT1 |

### 2.4.13 Audio Connector (CN12)




| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | MIC1 | 2 | GND |
| 3 | MIC2 | 4 | GPIO4 |
| 5 | HPO_R | 6 | MIC_IN_DET |
| 7 | GND | 8 | |
| 9 | HPO_L | 10 | GPIO3 |

GPIO3: Headphone or jack detection.

GPIO4: Presence – detects if audio dongle is connected to header.

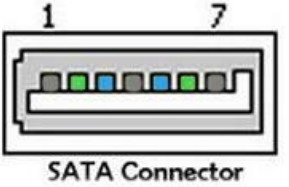
## 2.4.14 M.2 2230 E-Key Connector (CN13)

| | | | |
|---|---|---|---|
| 74 | 3.3V | GND | 75 |
| 72 | 3.3V | RESERVED/REFCLKn1 | 73 |
| 70 | UIM_POWER_SRC/GPIO1/PEWAKE1# | RESERVED/REFCLKp1 | 71 |
| 68 | UIM_POWER_SNK/CLKREQ1# | GND | 69 |
| 66 | UIM_SWP/PERST1# | RESERVED/PETn1 | 67 |
| 64 | RESERVED | RESERVED/PETp1 | 65 |
| 62 | ALERT# (O)(0/3.3V) | GND | 63 |
| 60 | I2C_CLK (I)(0/3.3V) | RESERVED/PERn1 | 61 |
| 58 | I2C_DATA (I/O)(0/3.3V) | RESERVED/PERp1 | 59 |
| 56 | W_DISABLE1# (I)(0/3.3V) | GND | 57 |
| 54 | W_DISABLE2# (I)(0/3.3V) | PEWAKE0# (I/O)(0/3.3V) | 55 |
| 52 | PERST0# (I)(0/3.3V) | CLKREQ0# (I/O)(0/3.3V) | 53 |
| 50 | SUSCLK(32kHz) (I)(0/3.3V) | GND | 51 |
| 48 | COEX1 (I/O)(0/1.8V) | REFCLKn0 | 49 |
| 46 | COEX2(I/O)(0/1.8V) | REFCLKp0 | 47 |
| 44 | COEX3(I/O)(0/1.8V) | GND | 45 |
| 42 | VENDOR DEFINED | PETn0 | 43 |
| 40 | VENDOR DEFINED | PETp0 | 41 |
| 38 | VENDOR DEFINED | GND | 39 |
| 36 | UART CTS (I)(0/1.8V) | PERn0 | 37 |
| 34 | UART RTS (O)(0/1.8V) | PERp0 | 35 |
| 32 | UART RXD (I)(0/1.8V) | GND | 33 |
| | Module Key | Module Key | |
| | Module Key | Module Key | |
| | Module Key | Module Key | |
| | Module Key | Module Key | |
| 22 | UART TXD (O)(0/1.8V) | SDIO RESET# (I)(0/1.8V) | 23 |
| 20 | UART WAKE# (O)(0/3.3V) | SDIO WAKE# (O)(0/1.8V) | 21 |
| 18 | GND | SDIO DATA3(I/O)(0/1.8V) | 19 |
| 16 | LED2# (O)(OD) | SDIO DATA2(I/O)(0/1.8V) | 17 |
| 14 | PCM_IN/I2S SD_IN (I)(0/1.8V) | SDIO DATA1(I/O)(0/1.8V) | 15 |
| 12 | PCM_OUT/I2S SD_OUT (O)(0/1.8V) | SDIO DATA0(I/O)(0/1.8V) | 13 |
| 10 | PCM_SYNC/I2S WS (I/O)(0/1.8V) | SDIO CMD(I/O)(0/1.8V) | 11 |
| 8 | PCM_CLK/I2S SCK (I/O)(0/1.8V) | SDIO CLK(I)(0/1.8V) | 9 |
| 6 | LED1# (O)(OD) | GND | 7 |
| 4 | 3.3V | USB_D- | 5 |
| 2 | 3.3V | USB_D+ | 3 |
| | | GND | 1 |

## 2.4.15 M.2 2280 M-Key Connector (SATA or NVM) (CN14)

| | | | |
|---|---|---|---|
| 74 | 3.3V | GND | 75 |
| 72 | 3.3V | GND | 73 |
| 70 | 3.3V | GND | 71 |
| 68 | SUSCLK(32kHz) (O)(0/3.3V) | PEDET (NC-PCIe/GND-SATA) | 69 |
| | | N/C | 67 |
| | Connector Key | Connector Key | |
| | Connector Key | Connector Key | |
| | Connector Key | Connector Key | |
| | Connector Key | Connector Key | |
| 58 | N/C | GND | 57 |
| 56 | N/C | REFCLKp | 55 |
| 54 | PEWAKE# (I/O)(0/3.3V) or N/C | REFCLKn | 53 |
| 52 | CLKREQ# (I/O)(0/3.3V) or N/C | GND | 51 |
| 50 | PERST# (O)(0/3.3V) or N/C | PETp0/SATA-A+ | 49 |
| 48 | N/C | PETn0/SATA-A- | 47 |
| 46 | N/C | GND | 45 |
| 44 | N/C | PERp0/SATA-B- | 43 |
| 42 | N/C | PERn0/SATA-B+ | 41 |
| 40 | N/C | GND | 39 |
| 38 | DEVSLP (O) | PETp1 | 37 |
| 36 | N/C | PETn1 | 35 |
| 34 | N/C | GND | 33 |
| 32 | N/C | PERp1 | 31 |
| 30 | N/C | PERn1 | 29 |
| 28 | N/C | GND | 27 |
| 26 | N/C | PETp2 | 25 |
| 24 | N/C | PETn2 | 23 |
| 22 | N/C | GND | 21 |
| 20 | N/C | PERp2 | 19 |
| 18 | 3.3V | PERn2 | 17 |
| 16 | 3.3V | GND | 15 |
| 14 | 3.3V | PETp3 | 13 |
| 12 | 3.3V | PETn3 | 11 |
| 10 | DAS/DSS# (I/O)/LED1# (I)(0/3.3V) | GND | 9 |
| 8 | N/C | PERp3 | 7 |
| 6 | N/C | PERn3 | 5 |
| 4 | 3.3V | GND | 3 |
| 2 | 3.3V | GND | 1 |

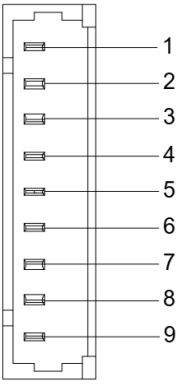
### 2.4.16 SATA Connector (CN28)



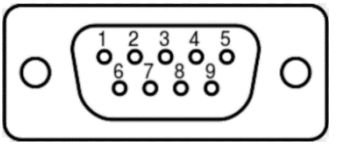
SATA Connector

| Pin | Signal |
|---|---|
| 1 | GND |
| 2 | TX+ |
| 3 | TX- |
| 4 | GND |
| 5 | RX+ |
| 6 | RX- |
| 7 | GND |

### 2.4.17 DIO Port Connector (CN30)

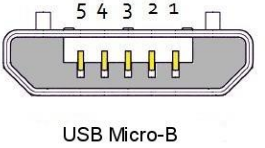



| Pin | Function | Voltage Level |
|---|---|---|
| 1 | GPIO493 | 3.3V- |
| 2 | GPIO492 | 3.3V- |
| 3 | GPIO491 | 3.3V- |
| 4 | GPIO494 | 3.3V- |
| 5 | GPIO495 | 3.3V- |
| 6 | GPIO422 | 3.3V- |
| 7 | GPIO393 | 3.3V- |
| 8 | GPIO344 | 3.3V- |
| 9 | GND | GND |




| Pin | Function | Pin Name | GPIO No. | Voltage Level |
|---|---|---|---|---|
| 1 | GPIO493 | PZ.05 | 483 | 3.3V- |
| 2 | GPIO491 | PZ.07 | 485 | 3.3V- |
| 3 | GPIO495 | PZ.03 | 481 | 3.3V- |
| 4 | GPIO393 | PN.01 | 433 | 3.3V- |
| 5 | GND | GND | GND | GND |
| 6 | GPIO492 | PZ.04 | 482 | 3.3V- |
| 7 | GPIO494 | PQ.06 | 454 | 3.3V- |
| 8 | GPIO422 | PZ.06 | 484 | 3.3V- |
| 9 | GPIO344 | PH.00 | 391 | 3.3V- |

### 2.4.18 Micro USB Connector (Flash OS) (CN34)




| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | +5V | 2 | USB1- |
| 3 | USB1+ | 4 | |
| 5 | GND | | |

## 2.4.19 M.2 3052 B-Key (USB3+PCIe) Connector (CN6)

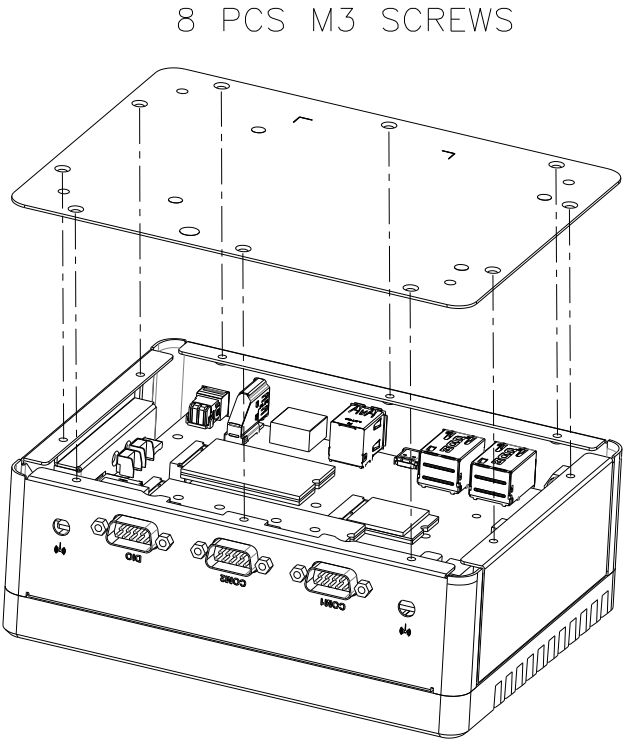
| | | | |
|---|---|---|---|
| 74 | 3.3 V/VBAT | CONFIG_2 | 75 |
| 72 | 3.3 V/VBAT | GND | 73 |
| 70 | 3.3 V/VBAT | GND | 71 |
| 68 | SUSCLK(32kHz) (O)(0/3.3V) | CONFIG_1 | 69 |
| 66 | SIM DETECT (O) | RESET# (O)(0/1.8V) | 67 |
| 64 | COEX_RXD (I)(0/1.8V) | ANTCTL3 (I)(0/1.8V) | 65 |
| 62 | COEX_TXD (O)(0/1.8V) | ANTCTL2 (I)(0/1.8V) | 63 |
| 60 | COEX3 (I/O)(0/1.8V) | ANTCTL1 (I)(0/1.8V) | 61 |
| 58 | NC | ANTCTL0 (I)(0/1.8V) | 59 |
| 56 | NC | GND | 57 |
| 54 | PEWAKE# (I/O)(0/3.3V) | REFCLKp | 55 |
| 52 | CLKREQ# (I/O)(0/3.3V) | REFCLKn | 53 |
| 50 | PERST# (O)(0/3.3V) | GND | 51 |
| 48 | GPIO_4 (I/O)(0/1.8V) | PETp0 | 49 |
| 46 | GPIO_3 (I/O)(0/1.8V) | PETn0 | 47 |
| 44 | GPIO_2 (I/O)/ALERT# (I)/(0/1.8V) | GND | 45 |
| 42 | GPIO_1 (I/O)/SMB_DATA (I/O)/(0/1.8V) | PERp0 | 43 |
| 40 | GPIO_0 (I/O)/SMB_CLK (I/O)/(0/1.8V) | PERn0 | 41 |
| 38 | DEVSLP (O) | GND | 39 |
| 36 | UIM-PWR (I) | PETp1/USB3.1-Tx+/SSIC-TxP | 37 |
| 34 | UIM-DATA (I/O) | PETn1/USB3.1-Tx-/SSIC-TxN | 35 |
| 32 | UIM-CLK (I) | GND | 33 |
| 30 | UIM-RESET (I) | PERp1/USB3.1-Rx+/SSIC-RxP | 31 |
| 28 | GPIO_8 (I/O) (0/1.8V) | PERn1/USB3.1-Rx-/SSIC-RxN | 29 |
| 26 | GPIO_10 (I/O) (0/1.8V) | GND | 27 |
| 24 | GPIO_7 (I/O) (0/1.8V) | DPR (O) (0/1.8V) | 25 |
| 22 | GPIO_6 (I/O)(0/1.8V) | GPIO_11 (I/O) (0/1.8V) | 23 |
| 20 | GPIO_5 (I/O)(0/1.8V) | CONFIG_0 | 21 |
| | Key B | Key B | |
| | Key B | Key B | |
| | Key B | Key B | |
| | Key B | Key B | |
| | Key B | GND | 11 |
| 10 | GPIO_9/DAS/DSS (I/O)/LED_1# (I)(0/3.3V) | USB_D- | 9 |
| 8 | W_DISABLE1# (O)(0/3.3V) | USB_D+ | 7 |
| 6 | FULL_CARD_POWER_OFF# (O)(0/1.8V or 3.3V) | GND | 5 |
| 4 | 3.3 V | GND | 3 |
| 2 | 3.3 V | CONFIG_3 | 1 |

## 2.5 Hardware Assembly

This section details the steps needed to install various hardware components for the BOXER-8641AI.

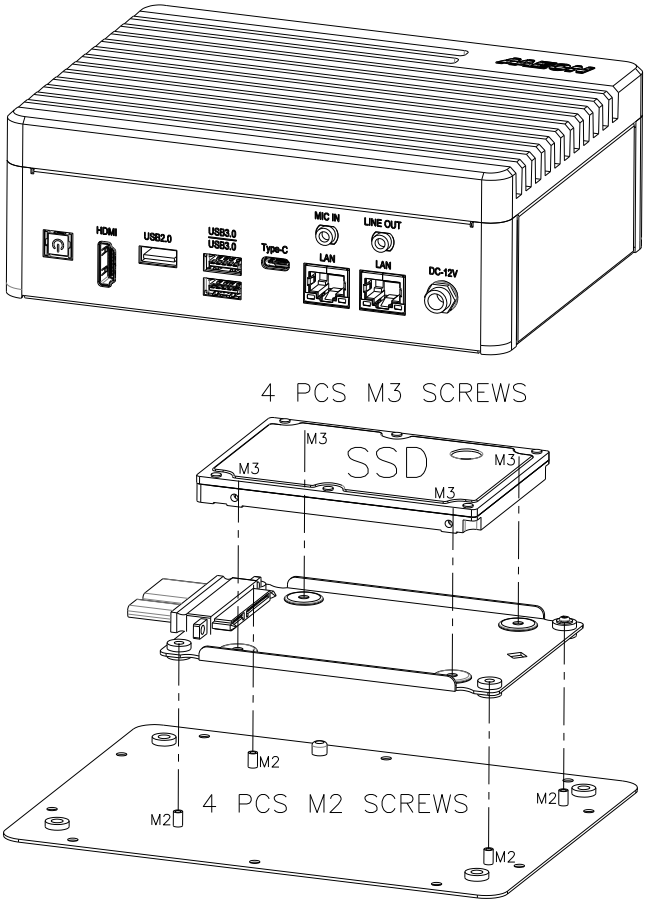
### 2.5.1 M.2 Expansion Module Installation

The M.2 2280 M-Key, M.2 2230 E-Key, and M.2 3052 B-Key slots can be accessed via removable covers on the bottom panel of the BOXER 8641AI system as shown in the following diagram.



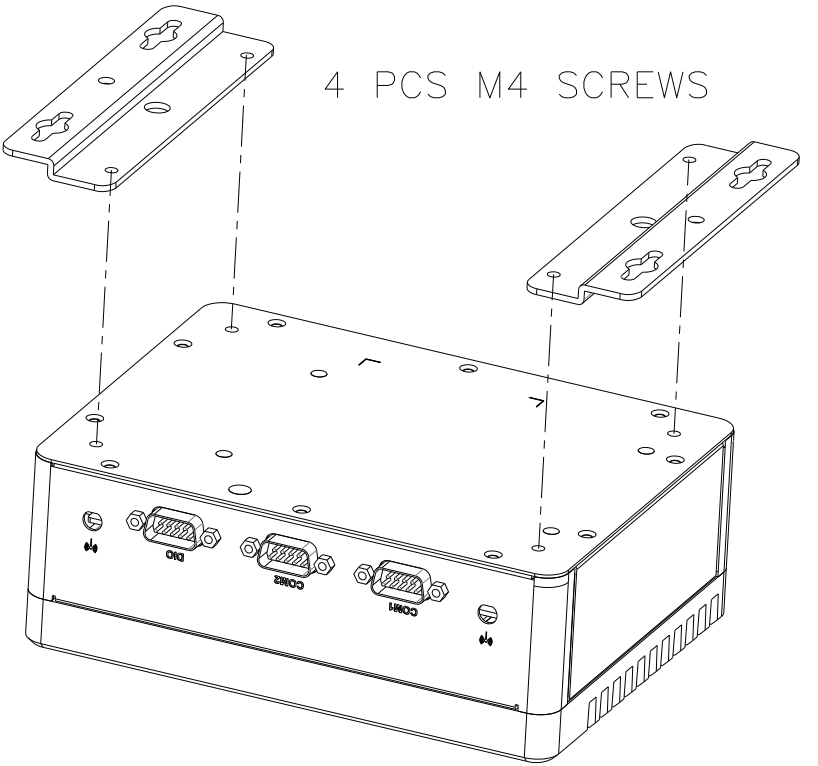
## 2.5.2 2.5″ HDD or SSD Installation

The 2.5″ HDD or SSD drive bay can accessed for drive installation via removable covers on the bottom panel of the BOXER 8641AI system as shown in the following diagram.



### 2.5.3 Wall Mount Installation

The BOXER 8641AI can be secured via a wall mount as shown in the following diagram.



# Chapter 3

BSP Flash Guide

## 3.1 Before Installation

Before starting the process make sure your BOXER-8641AI system is turned off and the power is disconnected. You will need a Host PC running Ubuntu 18.04, and make sure the NVIDIA Jetson Orin AGX module is installed onto the BOXER-8641AI carrier board system.

**Note:** Do not use a virtual machine as a host PC, as some virtual machines may have unstable USB connections which can cause the flash procedure to fail.


Download the compressed BSP image file "**Internal.tar.gz**" into the Host Ubuntu 18.04 PC directory.

**Note**: No spaces, special characters, or non-English characters can be used for the name of the folder where the file is stored, or its parent folder.
Ensure the language settings of Ubuntu 18.04 are set to English, and the format setting is the United States, to prevent flash failure.

## 3.2 Connecting to PC/ Force Recovery Mode

Step 1:

On the Host computer, open Linux terminal and enter the following command to extract the compressed BSP image files (BSP file name may vary):

```
$ sudo tar -zxvf Internal.tar.gz
```

Note: Do not decompress the file (Internal.tar.gz) using a Windows OS, BSP should only be decompressed in a Linux EXT3/4 file system.

Step 2:

Perform the following actions to force the system to start in USB Recovery Mode:

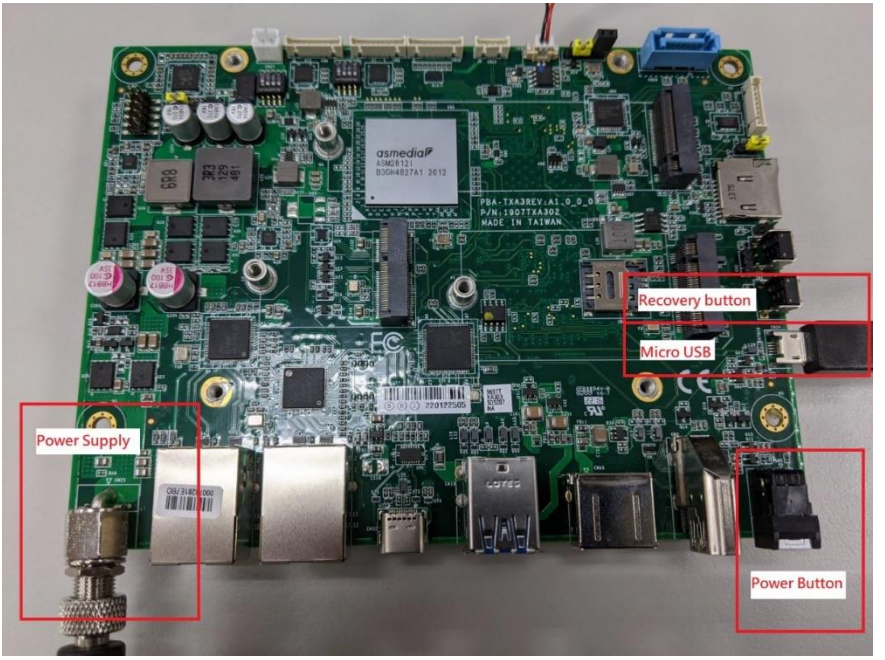
1. Connect the Micro-USB plug on the USB cable to the Recovery Port on the BOXER-8641AI, and the other end to an available USB port on the Host PC.
2. Connect the BOXER-8641AI to a power supply.
3. Press and hold the recovery key button. While holding the recovery key button, power on the system, and continue to hold the recovery key button for two seconds, then release. The BOXER-8641AI should then enter recovery mode.
4. To check if device is in recovery mode, enter the command lsusb in terminal on Host.

```
$ lsusb | grep "0955:7223"
```

If successful, the command will return "0955:7223 Nvidia Corp"

```
Bus 001 Device 003: ID 0955:7223 NVidia Corp.
```

**Note:** Recovery mode cannot be initiated if the NVIDIA Jetson Orin AGX module is disassembled. Ensure the NVIDIA Jetson Orin AGX module is installed and refer to the image below to perform the steps:



## 3.3 Flash Image to Board

Use the following steps to flash the OS to the BOXER-8641AI.

1) Open terminal on the Ubuntu Host PC, then access the folder you extracted in the previous section.

2) Enter the following command in terminal to flash the image:

```
$ sudo ./flashboxer.sh
```

3) Wait as the image is installed. Once complete you should see the following:

```
[ 883.0285 ] Flashing completed

[ 883.0287 ] Coldbooting the device
[ 883.0328 ] tegrarcm_v2 --chip 0x23 --ismb2
[ 883.0363 ] MB2 version 01.00.0000
[ 883.1397 ]
[ 883.1399 ] Coldbooting the device
[ 883.1443 ] tegrarcm_v2 --chip 0x23 --reboot coldboot
[ 883.1479 ] MB2 version 01.00.0000
[ 883.2727 ]
*** The target t186ref has been flashed successfully. ***
Reset the board to boot from internal eMMC.
```

## 3.4 Check BSP Version

Once the flash image is successfully installed, the BOXER-8641AI will reboot automatically, then check the BSP version to see if the system is flashing the correct version of BSP.

Open a Terminal, and type command "**cat /proc/product**"

```
aaeon@localhost:~$ cat /proc/product
BOXER-8641AI_J5.0.2_E00_1.0.0_20220817
BOXER-8641AI.Ubuntu20.04_AGXORINJP5.0.2_V1.0.0_17/08/2022
```

The version name will follow the format of:

{PJ_IF}. {OS_IF}_{PLF_IF}{JPV_IF}_{IMGV_IF}_{BD_IF}

For example:

BOXER-8641AI.Ubuntu20.04_AGXORINJP5.0.2_V1.0.0_17/08/2022

Note: Filename may differ from this example.

{OS_IF} is OS Information; e.g. Ubuntu20.04

{PLF_IF} is Platform Information; e.g. AGXORIN

{PJ_IF} is Project Information; e.g. BOXER-8641AI

{IMGV_IF} is Build Number; e.g. v1.0.0

{JPV_IF} is Jetpack Version; e.g. jp5.0.2

{BD_IF} is Build Date; e.g. 17/08/2022

# Chapter 4

OS User Guide

## 4.1 Introduction

The BOXER-8641AI's OS, Ubuntu/Linux version, and preinstalled SDK components are as follows:

For Jetpack 5.0.2 (l4t 35.1)

1. Ubuntu/Linux version:
    a. Ubuntu version: 20.04.4
    b. Kernel version: 5.10.104-tegra
    c. UEFI version: EFI v2.70 by EDK II
2. Built-in Jetson SDK Components:
    a. CUDA Toolkit for L4T 11.4
    b. cuDNN 8.4
    c. TensorRT 8.4
    d. OpenCV 4.5
    e. VPI 2.1
    f. NVIDIA Container Runtime 1.10
    g. Multimedia API 35.1
    h. Nsight Systems 2022.3
    i. Nsight Graphics 2022.3
    j. Nsight Compute 2022.2
    k. Compute Sanitizer 2022.2
    l. Nsight DL Designer 2022.1
    m. Deepstream 6.1.1
3. Built-in Allxon DMS:
    a. Please refer to vendor website at https://www.allxon.com/solutions

Default login user/password is:

Account: aaeon

Password: aaeon.

## 4.2 Update Note

Running **$ sudo apt upgrade** command in terminal will overwrite the **Aaeon kernel device tree(.dtb)/kernel image(Image)/bootloader** in the OS, which can lead to unexpected results, including the loss of I/O ports.

So Aaeon default disable Nvidia apt Repo for updating Nvidia apt package.

AAEON maintains updated versions of BSP on the product page, which follow updates to the NVIDIA Jetpack software. Contact your AAEON representative or visit the product page to download the latest version of Aaeon BSP for your system:

https://www.aaeon.com/en/p/ai-edge-solutions-boxer-8641ai

## 4.3 BOXER-8641AI Power Mode

NVIDIA Jetson Orin AGX power mode can be selected and monitored by GUI, please refer to the following picture: