BOXER-8642AI

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

User's Manual 1st Ed

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Packing List

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

Item	Quantity
● BOXER-8642AI	1
● Wall Mount Bracket	2
● Screw Package	1
● Power Connector	1
● Power Adapter (Optional)	1
● Power Cord (Optional)	1

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

Warning!

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.

产品中有毒有害物质或元素名称及含量

AAEON System   QO4-381 Rev.A0

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。

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。

Hazardous and Toxic Materials List

AAEON System   QO4-381 Rev.A0

Component Name	Hazardous or Toxic Materials or Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr(VI))	Polybrominated biphenyls (PBBs)	Polybrominated diphenyl ethers (PBDEs)
PCB and Components	X	O	O	O	O	O
Wires & Connectors for Ext.Connections	X	O	O	O	O	O
Chassis	O	O	O	O	O	O
CPU & RAM	X	O	O	O	O	O
HDD Drive	X	O	O	O	O	O
LCD Module	X	X	O	O	O	O
Optical Drive	X	O	O	O	O	O
Touch Control Module	X	O	O	O	O	O
PSU	X	O	O	O	O	O
Battery	X	O	O	O	O	O

This form is prepared in compliance with the provisions of SJ/T 11364.

O: The level of toxic or hazardous materials present in this component and its parts is below the limit specified by GB/T 26572.

X: The level of toxic of hazardous materials present in the component exceed the limits specified by GB/T 26572, but is still in compliance with EU Directive 2011/65/EU (RoHS 2).

Notes:
1. The Environment Friendly Use Period indicated by labelling on this product is applicable only to use under normal conditions.
2. Individual components including the CPU, RAM/memory, HDD, optical drive, and PSU are optional.
3. LCD Module and Touch Control Module only applies to certain products which feature these components.

AI@Edge Compact Fanless Embedded AI System   BOXER-8642AI

Chapter 1

Product Specifications

1.1 Specifications

System	
AI Accelerator	NVIDIA® Jetson AGX Orin™
CPU	AGX Orin 32GB: 8-core Arm® Cortex®-A78AE CPU
	AGX Orin 64GB: 12-core Arm® Cortex®-A78AE CPU
System Memory	32GB LPDDR5
	64GB LPDDR5
Storage Device	64GB eMMC 5.1 x 1
	2.5" SATA SSD Drive Bay x 1
Display Interface	HDMI 2.0 x 1
Ethernet	RJ-45 x 2 for GbE LAN
I/O	USB 3.2 Gen 2 (Type-A) x 8
	DB-9 x 2 for RS-232/422/485(Rx/Tx) & CANBus FD
	Mic-in x 1
	Line-Out x 1
	Power Button x 1
	Recovery Button x 1
	Micro USB x 1 for OS Flash
	SMA Antenna Hole x 2
Expansion	M.2 2230 E-Key x 1 (Wi-Fi/BT)
	2.5" SATA SSD Drive Bay x 1
Indicator	Power LED x 1
OS Support	Linux (NVIDIA Jetpack™ 5.1.2 and above)

Power Supply	
Power Requirement	12V ~ 24V DC-in with 2-pin Terminal Block x 1

Mechanical

|	
Mounting	Wall Mount Kit
Dimensions (W x D x H)	TBD
Gross Weight	TBD
Net Weight	TBD

Environmental

Operating Temperature	-13°F ~ 131°F (-25°C ~ 55°C), according to IEC60068-2 with 0.7 m/s AirFlow (w/Industrial wide Temp. SSD)
Storage Temperature	-40°F ~ 185°F (-40°C ~ 85°C)
Storage Humidity	5 ~ 95% @ 40°C, non-condensing, non-operation
Anti-Vibration	3.5 Grms/ 5 ~ 500Hz/ operating
Anti-Shock	50G peak acceleration
Certification	CE/FCC Class A

Chapter 2

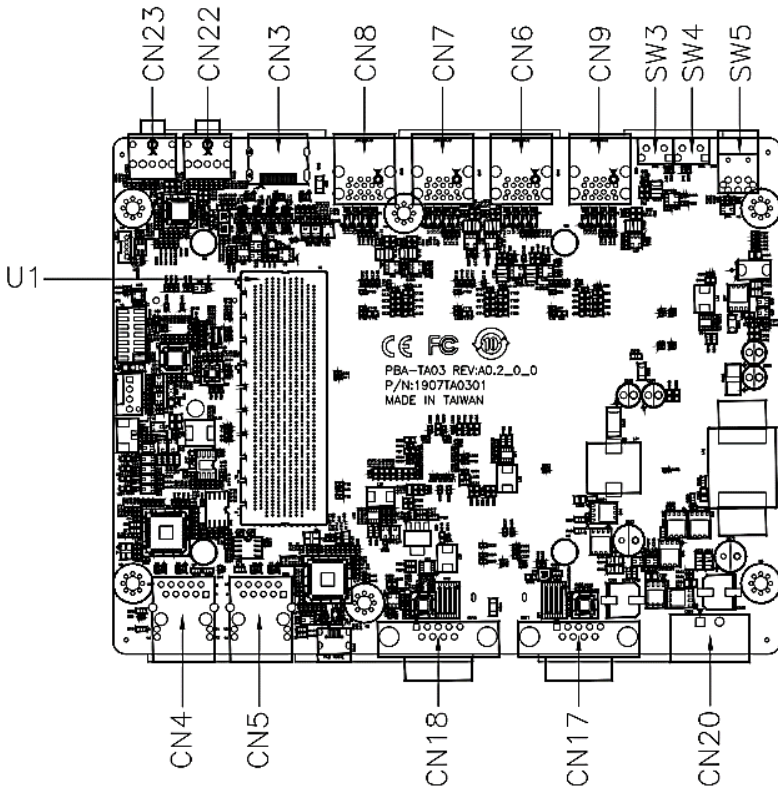Hardware Information

2.1   Dimensions
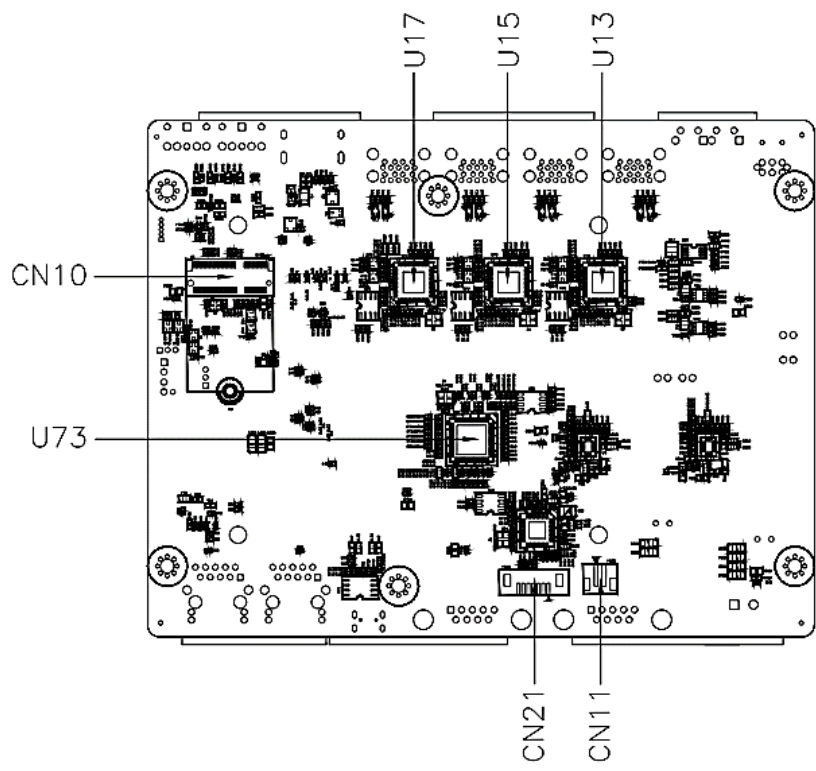
System
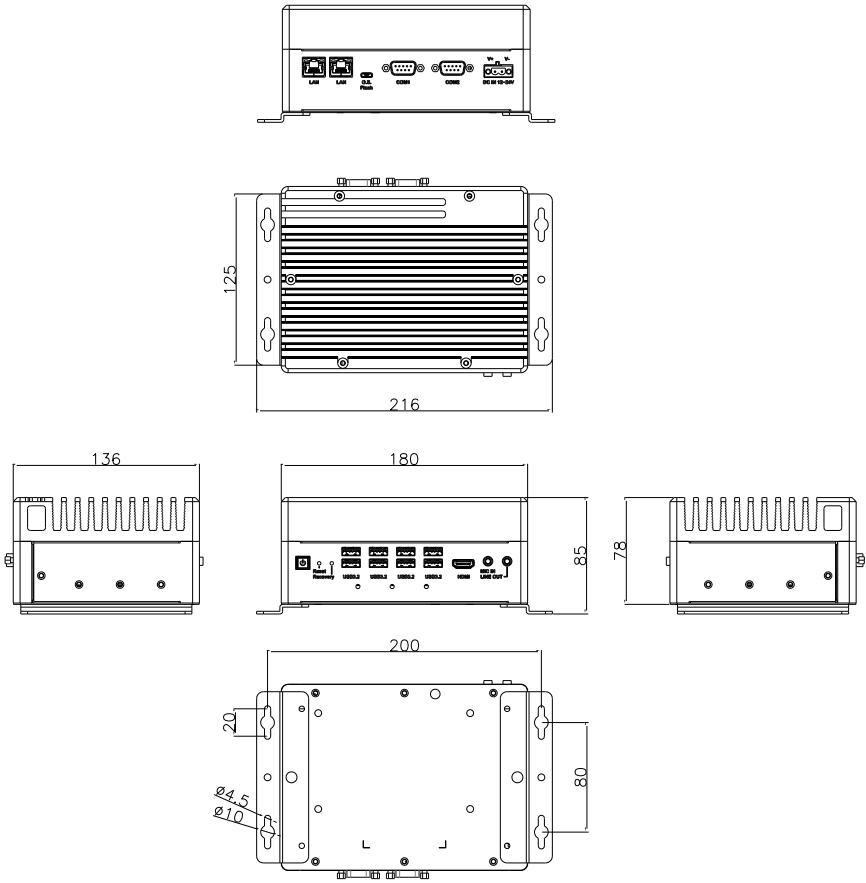
2.2   Jumpers and Connectors

Top

Note: For information regarding how to access the system's PCB, please see section

2.5.

Bottom

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(2-3)	FAN Voltage Select
JP2(1-2)	AT/ATX Mode Select

2.3.1   Jumper Settings

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.

Open   Closed   Closed 2-3
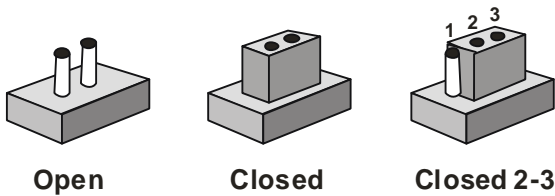
A pair of needle-nose pliers may be helpful when working with jumpers.

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   Auto Power Button (JP2)

Enable (Default)   Disable
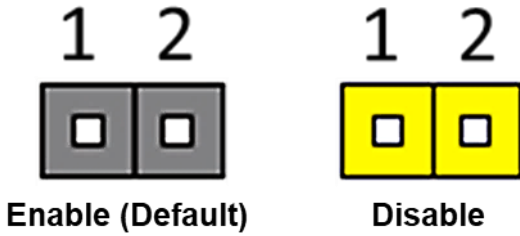
| CN1	Function
1-2	Open ATX (Default)
1-2	Close AT

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	RJ-45 LAN Port
CN5	RJ-45 LAN Port
CN6	USB 3.2 Gen 2 Port
CN7	USB 3.2 Gen 2 Port
CN8	USB 3.2 Gen 2 Port
CN9	USB 3.2 Gen 2 Port
CN10	M.2 2230 E-Key Slot
CN11	SATA Power Connector
CN14	Fan Connector
CN15	UART Debug Connector
CN16	Micro USB (Flash)
CN17	RS-232/485/CANBus Connector
CN18	RS-232/485/CANBus Connector
CN20	DC-In Power Connector
CN21	SATA Connector
CN22	Audio Mic Connector
CN23	Audio Line-out Connector
CN25	NC-SI OOB Connector
JP1	Fan Voltage Select
SW1	RS-232/422/485 Switch
SW2	RS-232/422/485 Switch
SW3	Recovery Switch
SW4	Reset Switch
SW5	Power Switch

Label	Function
U1	Jetson AGX Orin Module Connector

2.4.1   RTC Battery Connector (CN1)
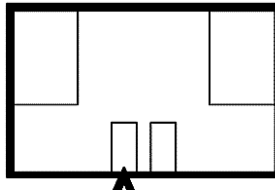
Pin	Signal	Pin	Signal
1	+3V	2	GND

2.4.2   HDMI Connector (CN3)
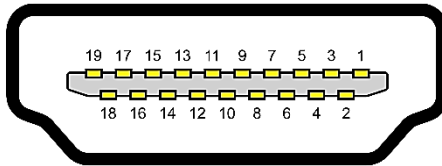
Pin	Signal	Pin	Signal
1	HDMI_DATA2_P	2	GND
3	HDMI_DATA2_N	4	HDMI_DATA1_P
5	GND	6	HDMI_DATA1_N
7	HDMI_DATA0_P	8	GND
9	HDMI_DATA0_N	10	HDMI_CLK_P
11	GND	12	HDMI_CLK_N
13	NC	14	NC
15	HDMI_SCL	16	HDMI_SDA
17	GND	18	HDMI_PWR
19	HDMI_HDP		

2.4.3 Dual USB 3.2 Gen 2 Ports 1 ~ 4 (CN6/CN7/CN8/CN9)
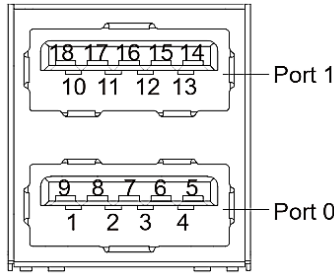
Pin	Signal	Pin	Signal
U1	VBUS_1	U10	VBUS_2
U2	(A)D-	U11	(B)D-
U3	(A)D+	U12	(B)D+
U4	GND	U13	GND
U5	(A)SSRX-	U14	(B)SSRX-
U6	(A)SSRX+	U15	(B)SSRX+
U7	GND	U16	GND
U8	(A)SSTX-	U17	(B)SSTX-
U9	(A)SSTX+	U18	(B)SSTX+

2.4.4 DC-in Power Connector (CN20)
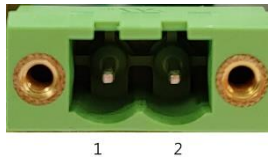
Pin	Signal	Pin	Signal
1	PWR_IN	2	GND

2.4.5   RJ-45 LAN Port (CN4/CN5)
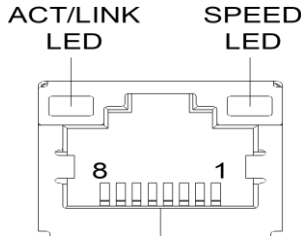
Pin	Signal	Pin	Signal
1	MDI0+	2	MDI0-
3	MDI1+	4	MDI1-
5	MDI2+	6	MDI2-
7	MDI3+	8	MDI3-

2.4.6   COM 1/2 (CN18/CN17)
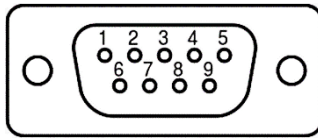
Pin	RS-232	RS-422	RS-485
1		TX-	D-
2	RXD	TX+	D+
3	TXD	RX+	
4		RX-	
5	GND		
6			
7	CAN_L	CAN_L	CAN_L
8	CAN_H	CAN_H	CAN_H
9			

2.4.7   RS-232/422/485 Switch (SW1/SW2)
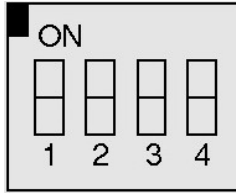
Mode	S-1	S-2	S-3	S-4
1T/1R RS-232	On	On		
1T/1R RS-422	On	Off		
1T/1R RS-485	Off	On		
Low Power Shutdown	Off	Off		
250kbps for RS-232 and RS-485/RS-422				On
RS-232 to 3Mbps and RS-485/RS-422 to 20Mbps				Off
Enable RS-422/RS-485 Bias and Termination Resistors.			On	
Disable RS-422/RS-485 Bias and Termination Resistors.			Off	

2.4.8   Audio Connector (CN22/CN23)
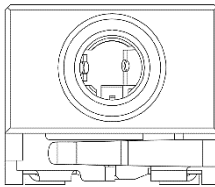
Pink: Mic in

Green: Line out

2.4.9   UART Debug Port Connector (CN15)

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

2.4.10   SATA Connector (CN21)

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

2.4.11 M.2 2230 E-Key Slot (CN10)

Pin	Signal	Signal	Pin
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	
		SDIO RESET# (I)(0/1.8V)	23
22	UART TXD (O)(0/1.8V)	SDIO WAKE# (O)(0/1.8V)	21
20	UART WAKE# (O)(0/3.3V)	SDIO DATA3(I/O)(0/1.8V)	19
18	GND	SDIO DATA2(I/O)(0/1.8V)	17
16	LED2# (O)(OD)	SDIO DATA1(I/O)(0/1.8V)	15
14	PCM_IN/I2S SD_IN (I)(0/1.8V)	SDIO DATA0(I/O)(0/1.8V)	13
12	PCM_OUT/I2S SD_OUT (O)(0/1.8V)	SDIO CMD(I/O)(0/1.8V)	11
10	PCM_SYNC/I2S WS (I/O)(0/1.8V)	SDIO CLK(I)(0/1.8V)	9
8	PCM_CLK/I2S SCK (I/O)(0/1.8V)	GND	7
6	LED1# (O)(OD)	USB_D-	5
4	3.3V	USB_D+	3
2	3.3V	GND	1

2.4.12   Micro USB (Flash OS) (CN16)
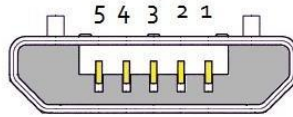
USB Micro-B

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

2.4.13   NC-SI OOB Connector (CN25)
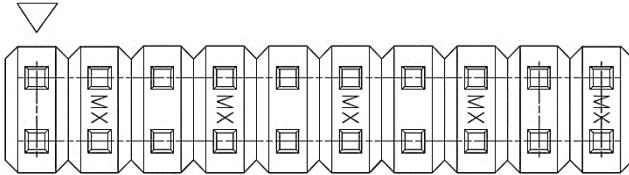
| Pin	Signal	Pin	Signal
1	VDD_3V3	2	3V3_AO
3	Debug UART TX	4	NC_SI_TXD0
5	Debug UART RX	6	NC_SI_TXD1
7	I2C1 SCL	8	NC_SI_RXD0
9	I2C1 SDA	10	NC_SI_RXD1
11	System Reset	12	NC_SI_CLK_IN
13	GND	14	NC_SI_CRB
15	Button power	16	NC_SI_TX_EN
17	GND	18	OOB UART TX
19	5V_AO	20	OOB UART RX

2.5 Hardware Installation

2.5.1 Expansion Module Installation

Note: Before installing expansion modules, ensure the system is powered down and disconnect the power cord from the system.

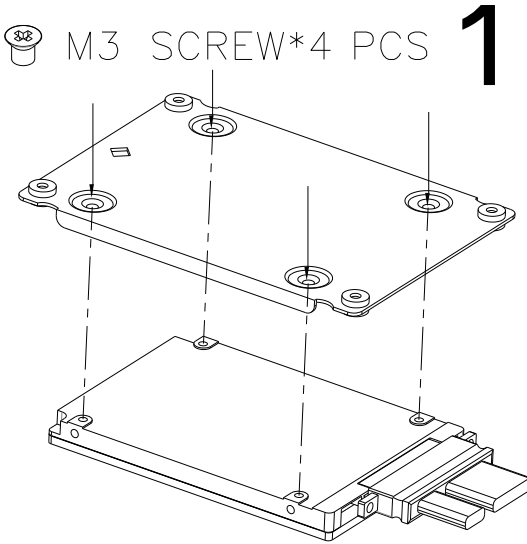Step 1: Remove the six (6) screws from the bottom panel of the system's chassis, as shown.

M3 Screw*6 pcs
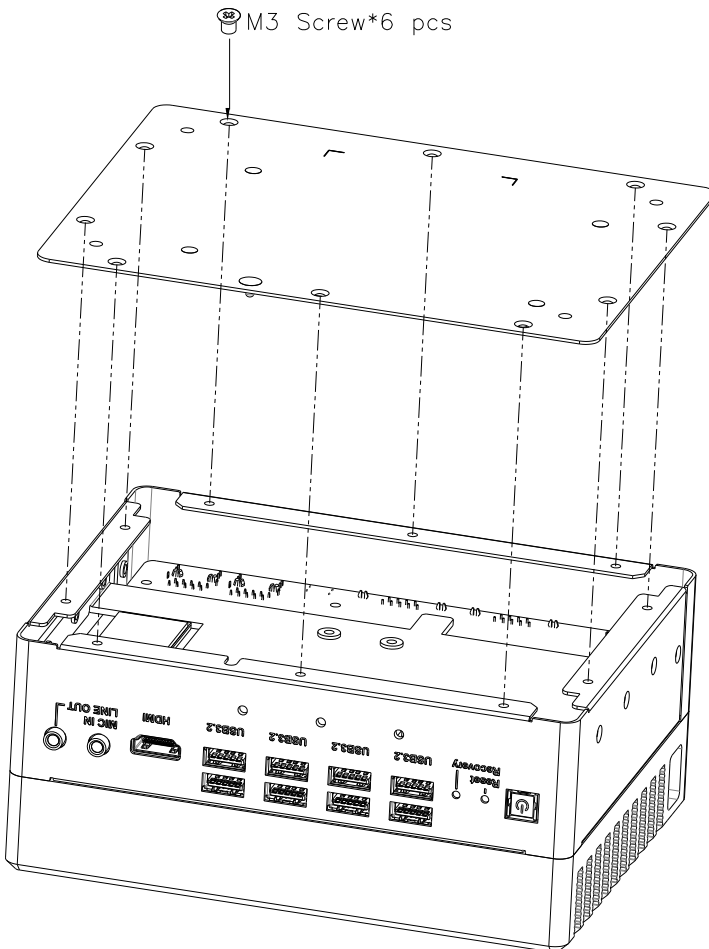
Step 2: Install expansion module by first inserting at an angle (approx. 30°), then gently press down to secure. Refer to the images below for M.2 Key slot location.
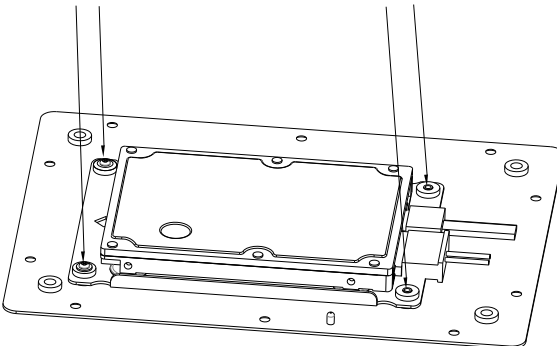

M.2 E-KEY
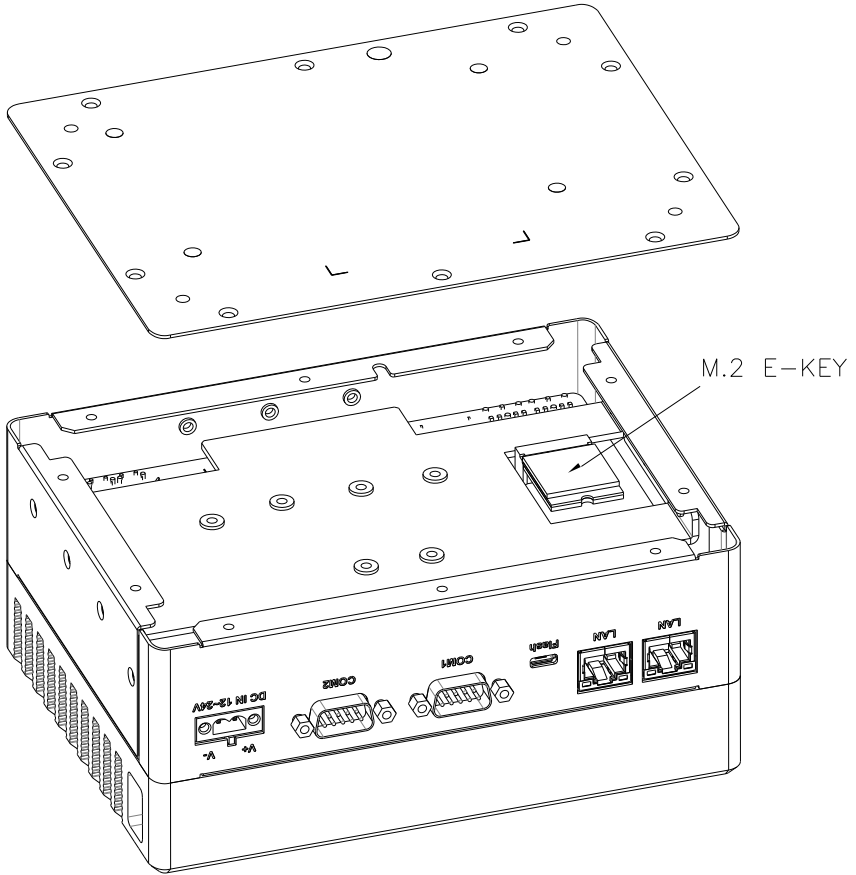
2.5.2   HDD Installation

Step 1: Affix the SATA drive to the drive bay using the four (4) M3 screws provided.
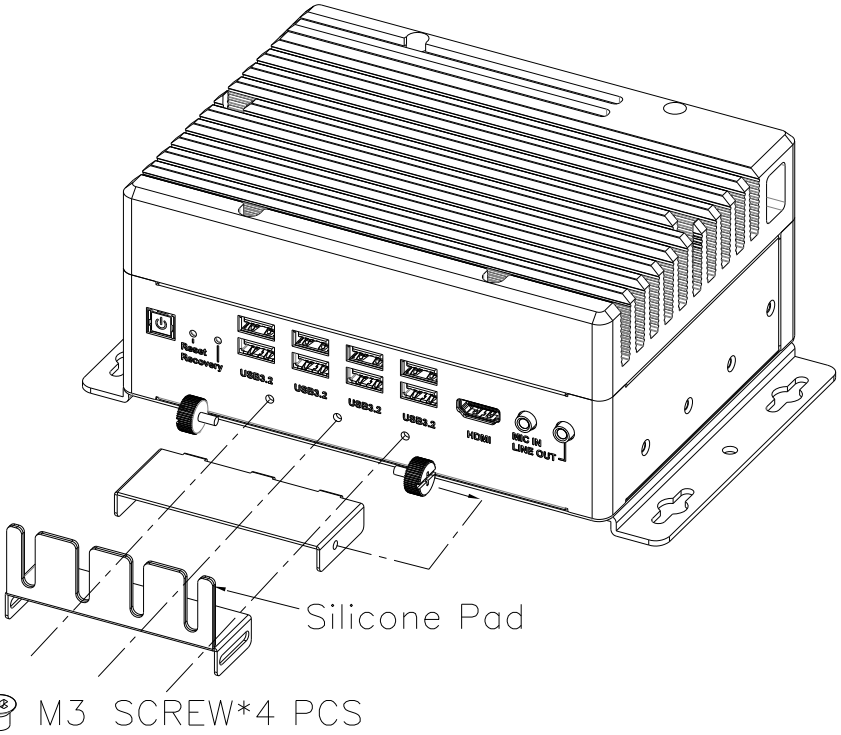

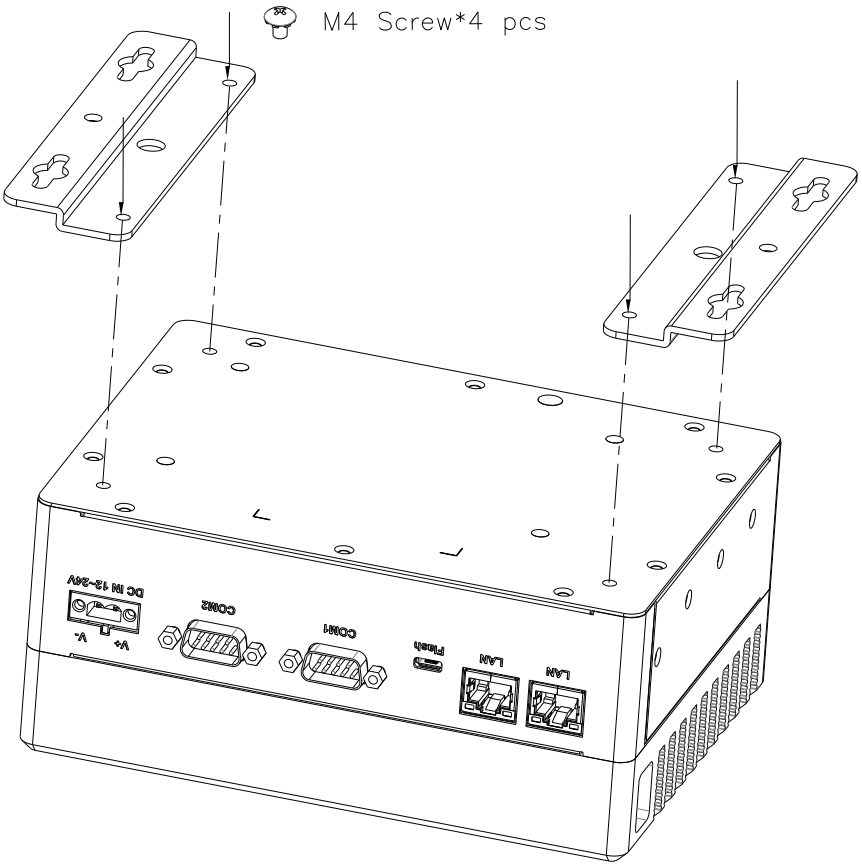**Step 2**: Secure the drive bay to the panel using the four (4) M2 screws provided.

2.5.3   USB Cable Lock Installation

Silicone Pad

M3 SCREW*4 PCS

2.5.4   Wall Mount Installation

M4 Screw*4 pcs

Chapter 3

BSP Flash Guide

3.1   Before Installation

Before beginning the process, make sure that your BOXER-8642AI system is powered off and disconnected from any power sources. You'll also need a Host PC running Ubuntu 18.04 or 20.04. Additionally, ensure that the NVIDIA Jetson AGX Orin module is properly installed on the BOXER-8642AI 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 "**BOXER-8642AI_J5.1.2_A00_1.0.0_20240223.tar.gz**" into the Host Ubuntu 18.04/20.04 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.

Note: Ensure the language settings of Ubuntu 18.04/20.04 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 PC, open a Linux terminal and enter the following command to extract the compressed BSP image files (note that the BSP file name may vary):

`$ sudo tar -zxvf BOXER_8642AI_J5.1.2_A00_1.0.0_20240223.tar.gz`

Note: Do not decompress the file 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 of the USB cable to the Recovery Port on the BOXER-8642AI and the other end to an available USB port on the Host PC.
2. Connect the power supply to the BOXER-8642AI.
3. Press and hold the recovery key button. While holding the button, power on the system, and continue to hold the recovery key button for two seconds before releasing it. The BOXER-8642AI should now enter recovery mode.
4. To verify if the device is in recovery mode, enter the following command in the terminal on the Host PC:

`$ 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 AGX Orin module is disassembled. Ensure the NVIDIA Jetson AGX Orin module is installed and refer to the image below to perform the force recovery mode steps:
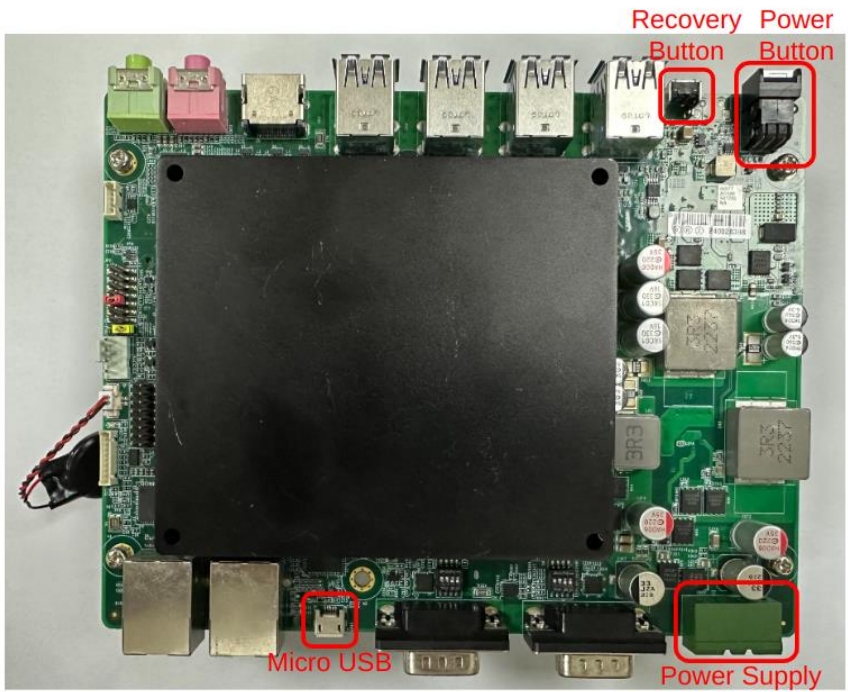
3.3   Flash Image to Board

Use the following steps to flash the OS to the BOXER-8642AI.

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:

`$ ./flashboxer emmc`

3)   Please wait until the image is fully installed. Once the installation is complete, you

should see a similar message prompt to the one shown in the picture below:

```
tar: Read checkpoint 660000
tar: Read checkpoint 670000
writing item=17, 9:0:secondary_gpt, 32008902144, 16896, gpt_secondary_9_0.bin, 16896, fixed-<reserved>-0, 99780b7732fdeff330529d8178dfa2cf89e3298c
[ 597]: l4t_flash_from_kernel: Successfully flash the external device
[ 597]: l4t_flash_from_kernel: Flashing success
[ 597]: l4t_flash_from_kernel: The device size indicated in the partition layout xml is smaller than the actual size. This utility will try to fix the GPT.
Flash is successful
Reboot device
Cleaning up...
Log is saved to Linux_for_Tegra/initrdlog/flash_1-2_0_20240410-165418.log
Flash target board Success
```

4)   After Steps 2 and 3, mass-flash image is built up internally, so you can flash up to

10 targets at once by using the following command:

`$ ./flashboxer -m emmc`

3.4   Check BSP Version

After flashing successfully, the system will reboot automatically. Then, we can check the BSP version to confirm whether the correct version was flashed.

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

You will see the product name with version and date

BOXER-8642AI_J5.1.2_A00_1.0.0_20240223

The version name will follow the format of:

{PJ_IF}_{JPV_IF}_A00_{IMGV_IF}_{BD_IF}

For example:

BOXER-8642AI_J5.1.2_A00_1.0.0_20240223

Note: Filename may differ from this example.

{PJ_IF} is Project Information; e.g. BOXER-8642AI

{JPV_IF} is Jetpack Version; e.g. J5.1.2

{IMGV_IF} is Build Version; e.g. 1.0.0

{BD_IF} is Build Date; e.g. 20240223

Chapter 4

OS User Guide

4.1   Introduction

The BOXER-8642AI's OS, Ubuntu/Linux version, and preinstalled SDK components are as follows:

For **Jetpack 5.1.2** (**l4t 35.4.1**)

1. Ubuntu/Linux version

    a. Ubuntu version: 20.04.6
    b. Kernel version: 5.10.120-tegra
    c. UEFI version: 4.1-33958178

2. Built-in all Jetson SDK Components

    a. CUDA Toolkit for L4T 11.4.19
    b. cuDNN 8.6.0
    c. TensorRT 8.5.2
    d. OpenCV 4.5.4
    e. VPI 2.3
    f. NVIDIA Container Runtime 2.11
    g. Multimedia API 35.4
    h. Nsight Systems 2023.2
    i. Nsight Graphics 2023.2
    j. Nsight Compute 2022.2
    k. Nsight DL Designer 2022.2
    l. Deepstream 6.3

3. Built-in Allxon DMS

    a. Please refer https://www.allxon.com/solutions

Default login user/password is:

Account: **aaeon**

Password: **aaeon**

4.2   Update Note

Running the sudo apt upgrade command in the terminal may overwrite the AAEON kernel device tree (.dtb), kernel image (Image), and bootloader in the OS. This can result in unexpected issues, such as the loss of I/O port functionality. To prevent this, AAEON disables the NVIDIA apt repository by default to avoid updating NVIDIA apt packages.

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/

4.3 Power Mode for the BOXER-8642AI

The power mode of the NVIDIA Jetson AGX Orin can be selected and monitored using the GUI. Please refer to the following picture for guidance.
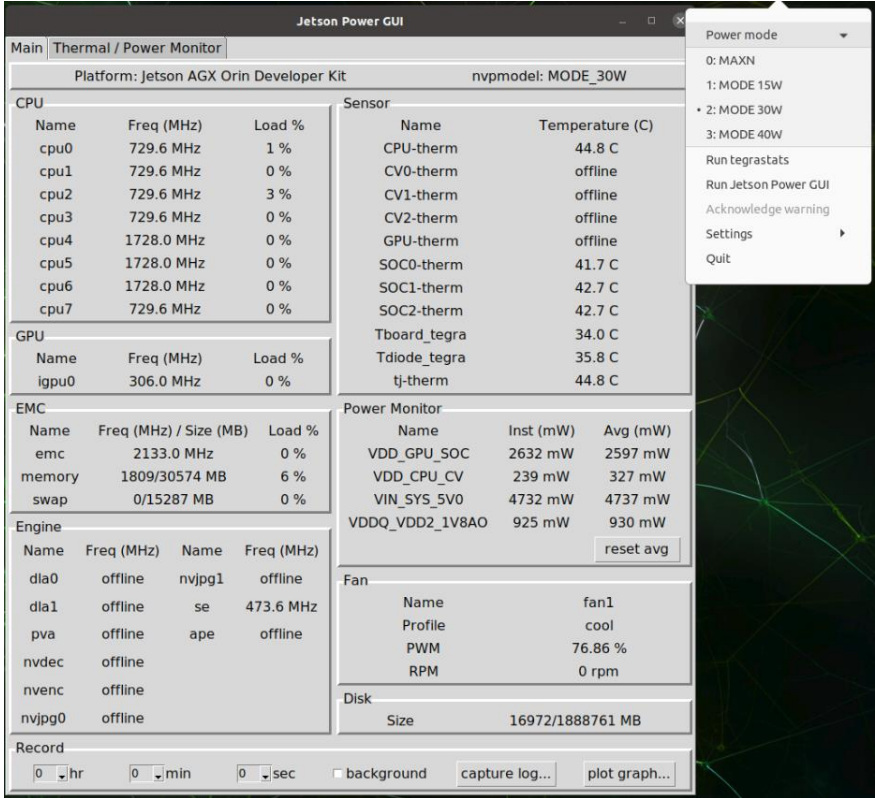
Note: Power mode is dependent on DRAM size. For more detailed information please visit: https://developer.nvidia.com/embedded/jetson-modules