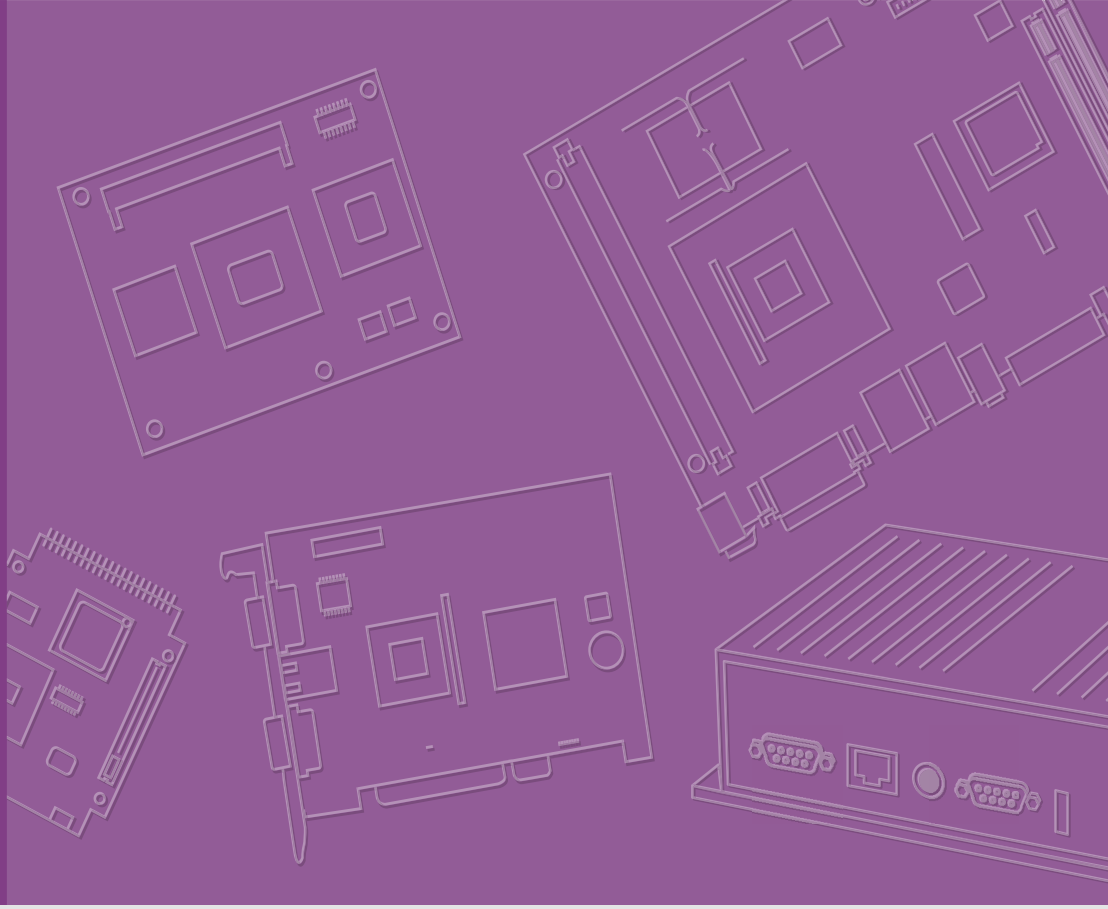

User Manual

AFE-R761 (Motherboard:ASR-A501)

Rockchip RK3588 Cortex-A76, A55
AMR control system

ADVANTECH

Enabling an Intelligent Planet

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Acknowledgments

For more information on this and other Advantech products, please visit our websites at:

http://www.advantech.com

This manual is for the AFE-R761.

Part No. 2006R76100 Edition 1

July 2025

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 could cause personal injury if not observed!*

Caution! *Cautions are included to help prevent hardware damage and data loss. 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."

Note! *Notes provide additional and/or optional information.*

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=60°C, if need further assistance, please contact Advantech for further information
22. RESTRICTED ACCESS AREA: The equipment should only be installed in a Restricted Access Area.

Packing List

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

- 1 x AFE-R761 Unit
- 1 x China RoHS
- 1 x Wall Mount kit & screws
- 1 x Terminal Plug 2Pin for Power In, 3 x Terminal Plug 2x4Pin for CAN, RS232/485

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

Ordering Information

Part Number	Description
AFE-R761-U0A1	Rockchip RK3588 8GB DDR, 64GB eMMC, 0 - 60°C
AFE-R761-U1A1	Rockchip RK3588J 8GB DDR, 64GB eMMC, -40 - 70°C
AFE-R761-U1B1	Rockchip RK3588J 8GB DDR, 64GB eMMC, w/4 AHD, -40 - 70°C
AFE-R761-U1C1	Rockchip RK3588J 8GB DDR, 64GB eMMC, w/4 GMSL, -40 - 70°C
AFE-R761-U2C1	Rockchip RK3588J 8GB DDR, 64GB eMMC, w/6 GMSL, -40 - 70°C
AFE-R761-U0D1	Rockchip RK3588J 8GB DDR, 64GB eMMC, w/DIO, 0 - 60°C
AFE-R761-U1D1	Rockchip RK3588J 8GB DDR, 64GB eMMC, w/DIO, -40 - 70°C

Optional Accessories

Part Number	Description
96PSA-A60W24T2-3	AC to DC adapter, DC 24V 60W, 0 ~ 40°C
1702002600	Power cable 3-pin 183 cm (6 ft), USA type
1702002605	Power cable 3-pin 183 cm (6 ft), EU type
1702031801	Power cable 3-pin 183 cm (6 ft), UK type
1700009652	Power cord CCC 3P 10A 250V 183cm
199L000041S000	USB Bracket Nylon for fixing USB cable
1990040953S000-CM	Cable tie 120x2.5x1.1 Black Nylon for fixing USB cable
1960116712N000	5G Bracket
1960116713N000	WIFI Bracket
1938030530	NUT D=6.5 B=5.5 H=2.3 M3 ST Zn for 5G & WIFI Bracket
1960018849T071	Din-rail Bracket
EWM-W179M201E	WiFI6+BT Module,M.2 KeyA/E, RTL8852BE, 0-70°C
1751000651-01	Dipole Ant. WiFi 6E SMA/M-R BLK L111.7mm IP54
1751000649-01	Cable Ant. SMA/F MHF4L/113 BLK L100mm
1751000621-01	Cable Ant. SMA/F-R MHF4L/113 BLK L250mm
968DD0342*	5G Module, RM520NGLAA-M20-SGASA M.2 Key-B
1750009372-01	Ant.SMA/M 90/180 5G BLK 167mm RG178
1751000633-01	Cable Ant. SMA/F MHF4L/113 BLK L200mm
1751000649-01	Cable Ant. SMA/F MHF4L/113 BLK L100mm
1751000624-01	Cable Ant. SMA/F MHF4L/113 BLK L250mm
968DD00443*	4G Module, EM05CNFD-128-SGAS M.2 Key-B
1750009372-01	Ant.SMA/M 90/180 5G BLK 167mm RG178
1751000633-01	Cable Ant. SMA/F MHF4L/113 BLK L150mm
1751000649-01	Cable Ant. SMA/F MHF4L/113 BLK L100mm
1990029618N000	Thermal-Pad 39x29.5x1mm for 5G Bracket
1990027162N010	Thermal Pad 19.5X19.5X1.5mm for WIFI Bracket
EAI-1200-00A1	M.2 key B+M 1x Hailo-8 AI module
1990010451N000	Thermal Pad 15X15X2mm for Hailo-8 AI module

Contents

Chapter 1

General Information

1.1 Introduction

AFE-R761 is powered by a Rockchip RK3588 SoC, which features a quad-core Arm Cortex-A76 and quad-core Cortex-A55 processors, a 6Tops NPU, and a high-performance Arm Mali-G610 3D graphics engine. The AFE-R761 provides a variety of interfaces, including 2 x USB 3.0, 4 x USB 2.0, 4 x Gigabit Ethernet, 2 x CAN FD, 1 x M.2 B-Key, 1 x M.2 E-Key, 1 x M.2 M-Key, 4 x COM, 1 x HDMI, and multi-camera inputs (GMSL or AHD).

The AFE-R761 supports multiple operating systems, including Debian 12 with RT patches and Android 14. It also integrates the Advantech Power Suite, ROS, and EtherCAT to accelerate customer design processes.

1.2 Specifications

Table 1.1: Specifications

Model		AFE-R761-U0A1	AFE-R761-U1B1	AFE-R761-U1C1	AFE-R761-U0D1
Processor	CPU	Rockchip RK3588 Arm Quad Cortex-A76 2.4 GHz and Quad Cortex-A55 1.8 GHz			
	NPU	Up to 6Tops			
Memory	Technology	LPDDR4 2112MHz			
	Max. Capacity	Onboard 4/8 GB LPDDR4, maximum supported is 32 GB			
	Flash	32/64 GB eMMC NAND Flash for OS and boot loader			
Graphics	Graphics Engine	Arm Mali-G610 MP4 GPU, high-performance OpenGL ES 1.1, 2.0 and 3.2, OpenCL 2.2, Vulkan 1.2, etc.			
	H/W Video Codec	Decoder: H.265/VP9 8K @ 60 fps, H.264 8K @ 30 fps, H.263, VC-1, VP8, MVC, AV1, MPEG-4/2/1 Encoder: H.265/H.264 8K @ 30 fps, parallel encoder for multi-channel, lower resolution			
	HDMI	1 x HDMI2.0, up to 3821 x 2160 @30Hz			
Ethernet	Chipset	2 x RTL8211, 1 x RTL8119, 1 x Intel I226			
	Speed	1 x 2.5Gbps, 3 x 10/100/1000 Mbps			
Watchdog Timer	1~6553s, default 60s, power on/off 1s by MCU				
TPM	TPM2.0				
Front I/O	USB	1 x USB3.2 Gen1 by 1 TypeA 1 x USB3.2 Gen1 by 1 TypeA/OTG	1 x USB3.2 Gen1 by 1 TypeA 1 x USB3.2 Gen1 by 1 TypeA/OTG 4 x USB2.0 TypeA		
	Audio	1x Line out/Mic in			
	LAN	4 x RJ45 (1x2.5GbE, 3xGbE)			
	Display	1 x HDMI			
	Button	1 x Power Button with LED			
	DI	-	4 x DI w 2500VDC isolation protection (terminal block) -Wet contact: Logic: 0~3VDC(max);Logic 1: 10~30VDC -Dry contact: Logic 0: Shorted to GND; Logic 1: Open (Default)		

Table 1.1: Specifications					
Front I/O	DO	-	4 x DO w 2500VDC isolation protection (terminal block) - Output voltage: 5-30VDC - Output capability Sink(NPN): 500mA per channel		
	GMSL	-	-	4 x GMSL via FAKRA MAX-96712GTB	-
	AHD	-	4 x AHD via wafer box (Default 12V, support 5V by BOM option)	-	-
Side I/O	Serial Port	2 x RS-232/485 (Default RS-232, s/w configured) 2 x RS-485 1 x Debug			
	CAN	2 x CAN FD(5M)			
Rear I/O	SD Socket	1 x Micro SD Slot			
	Button	1 x Reset, 1x Maskrom, 1 x Recovery			
Expansion	Mini-PCIE	-			
	SIM Slot	1 x Nano SIM Slot			
	M.2 Socket	1 x E-Key 2230 (PCIe2.1, USB2.0) 1 x B-Key 3052 (SATA/PCIe*, USB3.0)			
		-	1 x M-Key 2242*/2280 (2 x PCIE3.0)		
Power	Power Supply Voltage	12-24V			
	Connector	2P Phoenix			
	Power Consumption	Typical(Idle mode) 5.65W@12V Max.(Full loading) 11.68W@12V			
	Power Management	AT mode (Default), ATX mode			
Environ-ment	Operating Temperature	0 ~ 60°C/-40 ~ 70°C with air flow 0.7m/s			
	Operating Humidity	40C,95% relative humidity, non-condensing			
Mechanical	Dimensions	175mm L x 120mm W x 56.7 mm H			
Operation System	Linux Debian12, Android14				
Certifica-tions	CE EMC/FCC Class B/UKCA/IC/CCC				

*Note: Supported by request.

1.3 Mechanical Specifications

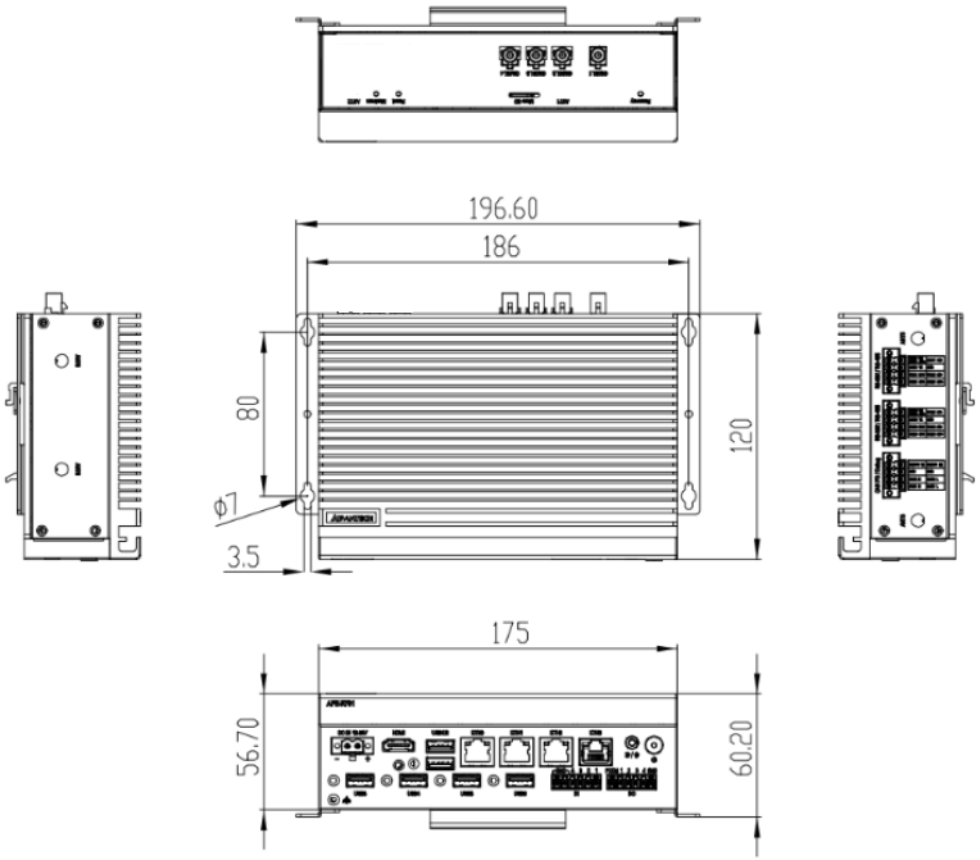


Figure 1.1 AFE-R761 Mechanical Diagram

Chapter 2

H/W Installation

This chapter details mechanical and connector information for the AFE-R761.

Sections include:

- Connector Information
- Installation

2.1 Jumper & Switches

The AFE-R761 has a number of jumpers that allow you to configure your system to suit your application. The table below lists the functions of the various jumpers.

2.1.1 Miscellaneous Selection Jumper: SW1

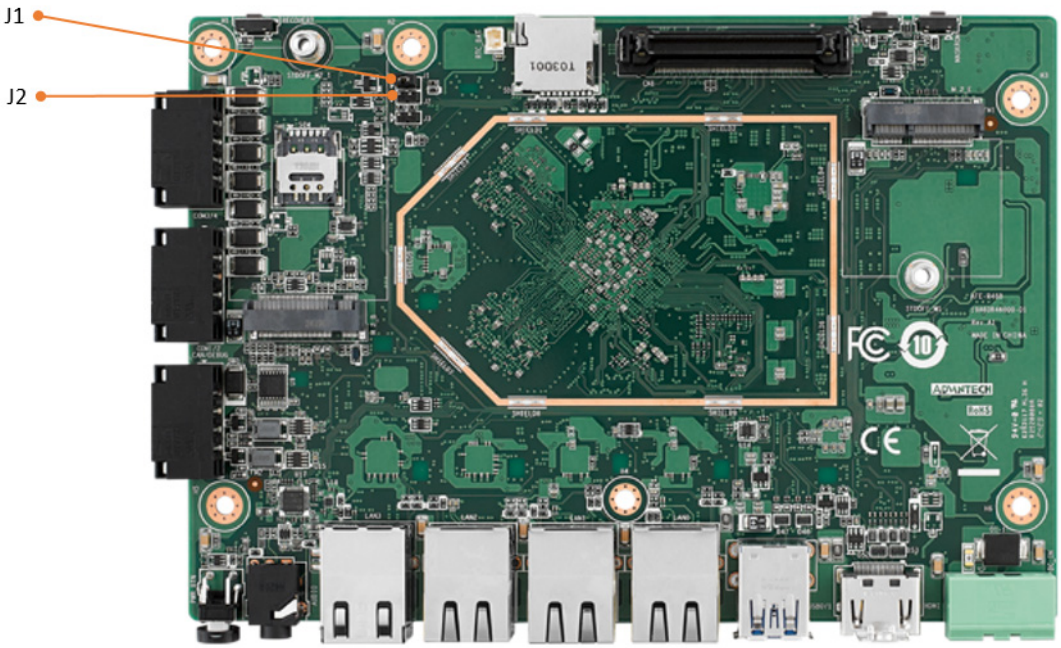
Unscrew the 4 screws on the rear cover, and remove the rear cover. Please refer to the picture to find J1, J2 location.

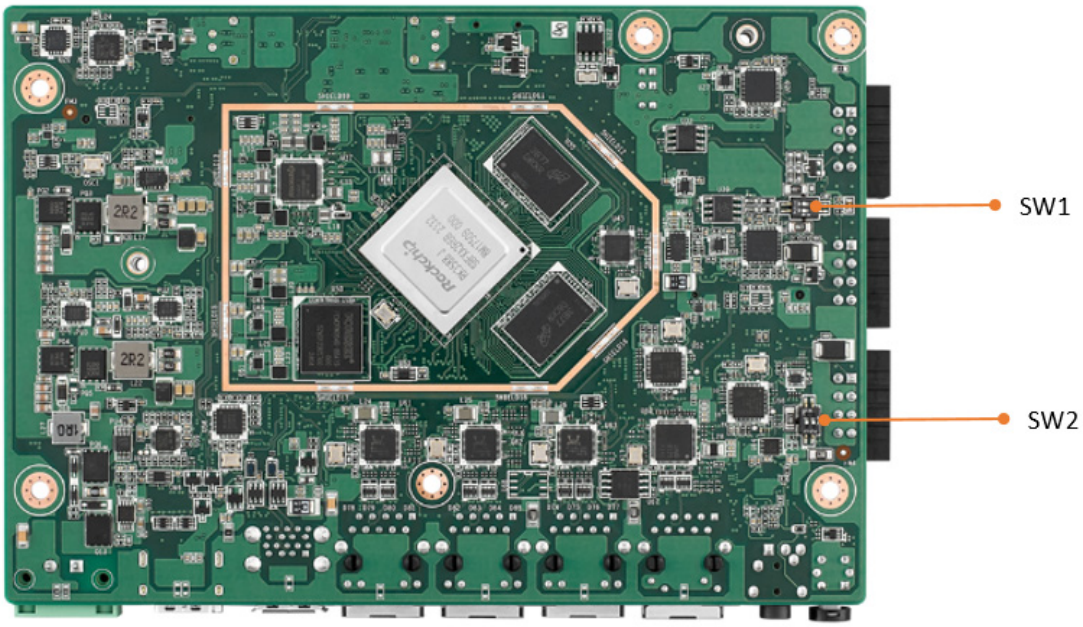
2.1.2 Jumper List

Table 2.1: Jumper List

Position	Description
SW1	COM2/4 RS-485 Terminal
SW2	CAN FD Terminal
J1	USB0 OTG Mode selection, default USB3.0 host
J2	ATX/AT Mode Selection, default AT mode

2.1.3 Jumper Locations





2.1.4 Jumper Settings

Table 2.2: SW1: COM2/4 RS-485 Terminal

Setting	Function
1 ON	COM2 Terminal 120 ohm (Default)
1 OFF	COM2 NO Terminal 120 ohm
2 ON	COM4 Terminal 120 ohm (Default)
2 OFF	COM4 NO Terminal 120 ohm

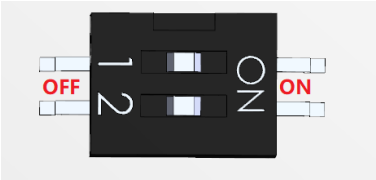
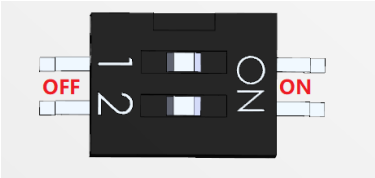


Table 2.3: SW2: CAN1/2 Terminal	
Setting	**Function**
1 ON	CAN2 Terminal 120 ohm (Default)
1 OFF	CAN2 NO Terminal 120 ohm
2 ON	CAN1 Terminal 120 ohm (Default)
2 OFF	CAN1 NO Terminal 120 ohm



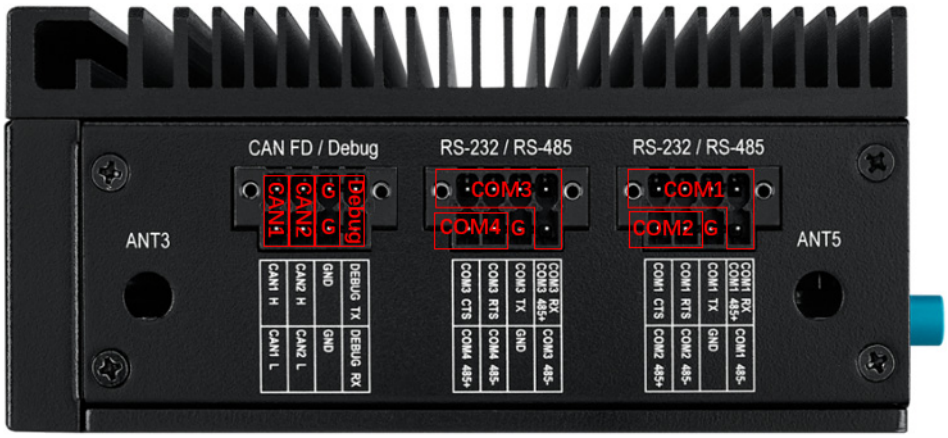


Table 2.4: J1: USB0_OTG Mode Select	
Setting	**Function**
1-2	OTG Host (Default)
1-X	OTG Slave

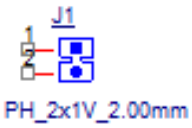
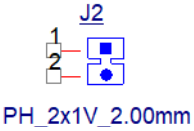


Table 2.5: J2: ATX/AT Mode Select	
Setting	**Function**
1-2	ATX Mode
1-X	AT Mode (Default)

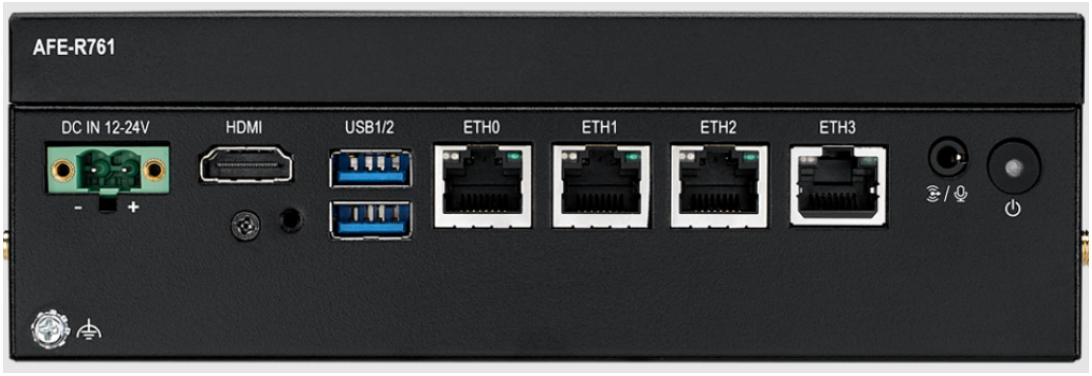


2.2 Connectors

2.2.1 AFE-R761 External I/O Locations

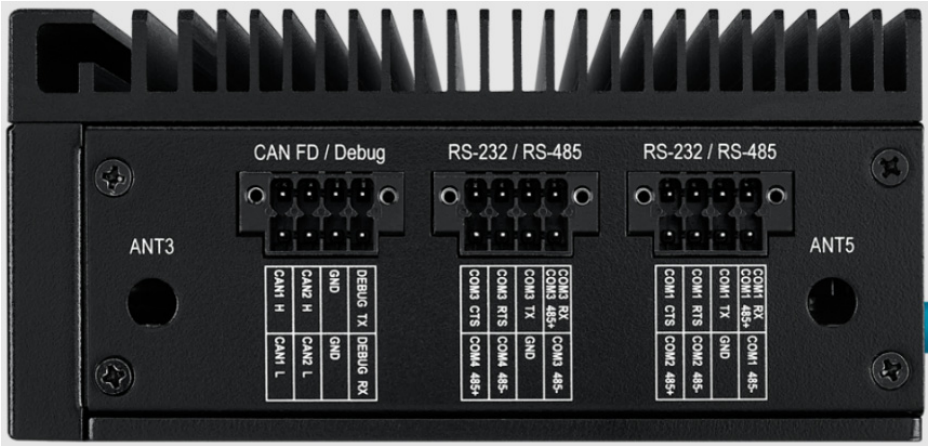
Front I/O:

AFE-R761-U0A1



AFE-R761-UxB1/ AFE-R761-UxC1/ AFE-R761-UxD1

Side I/O:



Rear I/O:

AFE-R761-UxA1/AFE-R761-UxD1

AFE-R761-UxB1

AFE-R761-UxC1

Figure 2.1 AFE-R761 Front and Side I/O Connector Diagram

2.3 Connector Pin Definitions

2.3.1 DC-IN

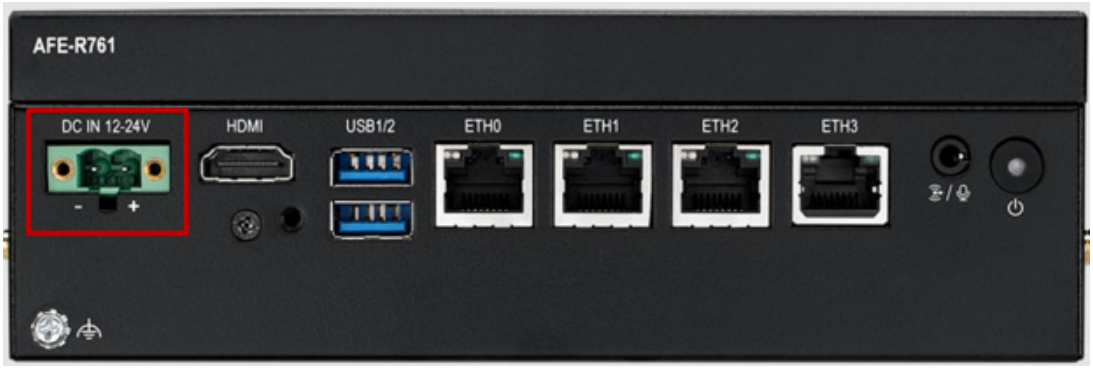


Table 2.6: DC_IN: 12~24V DC IN

Pin	Pin Name
1	DC-IN (12~24V)
2	GND

2.3.2 HDMI

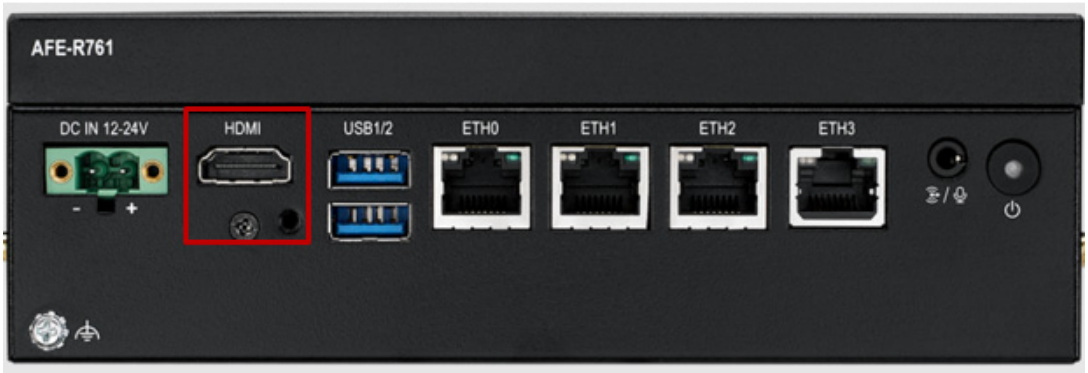


Table 2.7: HDMI: HDMI Connector

Pin	Pin Name	Pin	Pin Name
1	HDMI1_z_DATA2+	2	GND
3	HDMI1_z_DATA2-	4	HDMI1_z_DATA1+
5	GND	6	HDMI1_z_DATA1-
7	HDMI1_z_DATA0+	8	GND
9	HDMI1_z_DATA0-	10	HDMI1_z_CLK+
11	GND	12	HDMI1_z_CLK-
13	HDMI1_z_CEC	14	NL
15	HDMI1_DDC_CLK	16	HDMI1_DDC_DATA
17	GND	18	+5V_HDMI
19	HDMI1_HPD		

2.3.3 USB1/2

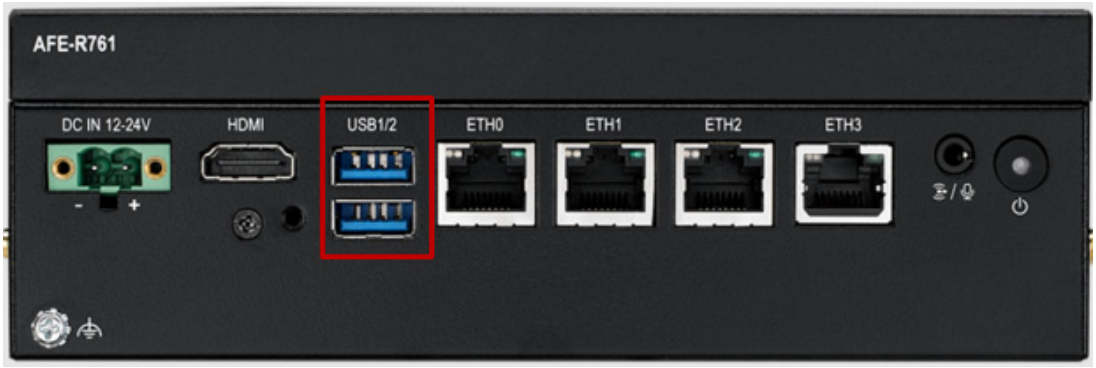


Table 2.8: USB: USB1/2 Connector

Pin	Pin Name	Pin	Pin Name
1	+USB0_5V	10	+USB1_5V
2	USB0_OTG_D-	11	USB1_D-
3	USB0_OTG_D+	12	USB1_D+
4	GND	13	GND
5	USB0_RX-	14	USB1_RX-
6	USB0_RX+	15	USB1_RX+
7	GND	16	GND
8	USB0_TX-	17	USB1_TX-
9	USB0_TX+	18	USB1_TX+

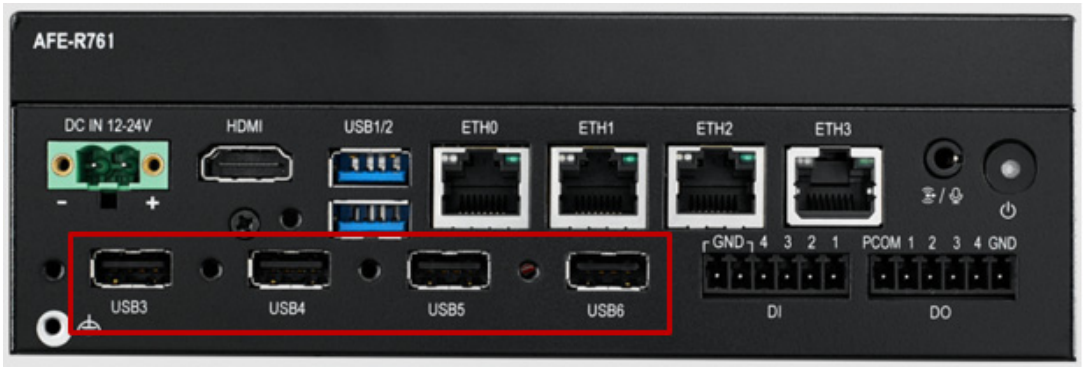


Table 2.9: USB: USB3/4/5/6 Connector

Pin	Pin Name
1	+USB_5V_A/B/C/D
2	USB1/2/3/4_D-
3	USB1/2/3/4_D+
4	GND

2.3.4 ETH

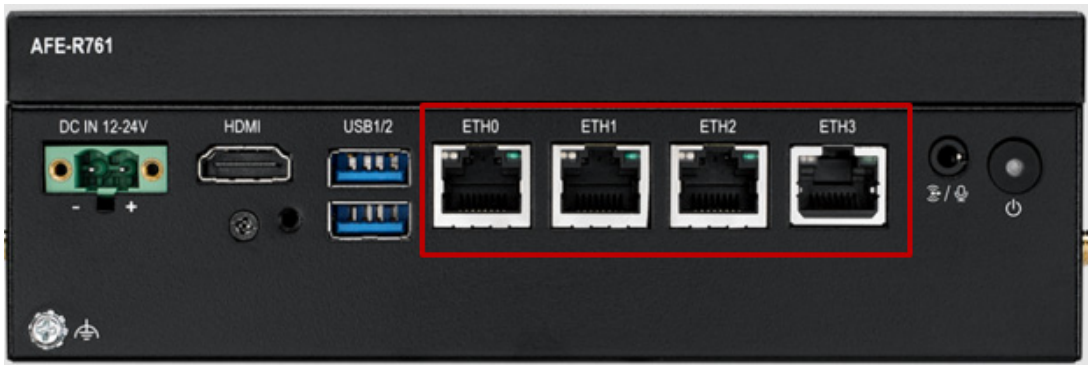


Table 2.10: LAN: LAN0/LAN1/LAN2 Connector

Pin	Pin Name	Pin	Pin Name
1	LAN0/1/2_z_MDI0+	11	VCC_3V3_S0
2	LAN0/1/2_z_MDI0-	12	LAN0/1/2_ACT
3	LAN0/1/2_z_MDI1+	13	LAN0/1/2_LINK100
4	LAN0/1/2_z_MDI1-	14	LAN0/1/2_LINK1000
5	GND (CAP)	H1	NL
6	GND (CAP)	H2	NL
7	LAN0/1/2_z_MDI2+	H3	GND_F
8	LAN0/1/2_z_MDI2-	H4	GND_F
9	LAN0/1/2_z_MDI3+		
10	LAN0/1/2_z_MDI3+		

Table 2.11: LAN: LAN3 Connector

Pin	Pin Name	Pin	Pin Name
R1	LAN3_MDI_A_P	L1	LAN3_LED1_2.5G#
R2	LAN3_MDI_A_N	L2	LAN3_LED0_1G#
R3	LAN3_MDI_B_P	L3	LAN3_LED2_ACT#
R4	LAN3_MDI_B_N	L4	LED_ACT3_PWR
R5	GND (CAP)	H1	NL
R6	GND (CAP)	H2	NL
R7	LAN3_MDI_C_P	H3	GND_F
R8	LAN3_MDI_C_N	H4	GND_F
R9	LAN3_MDI_D_P		
R10	LAN3_MDI_D_N		

2.3.5 Audio

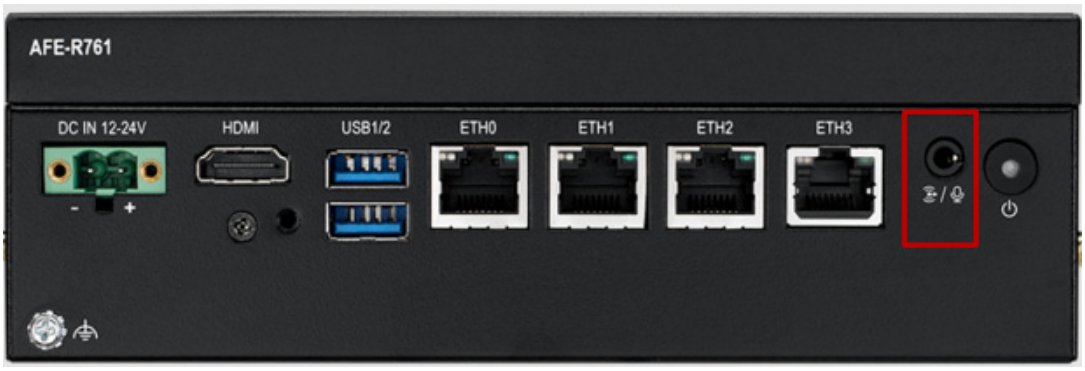


Table 2.12: Audio: Audio Connector

Pin	Pin Name
1	NL
2	HP_DET#
3	GND_AUDIO
4	HP_LOUT
5	HP_ROUT
6	GND_AUDIO
7	MIC_IN

2.3.6 Power Button

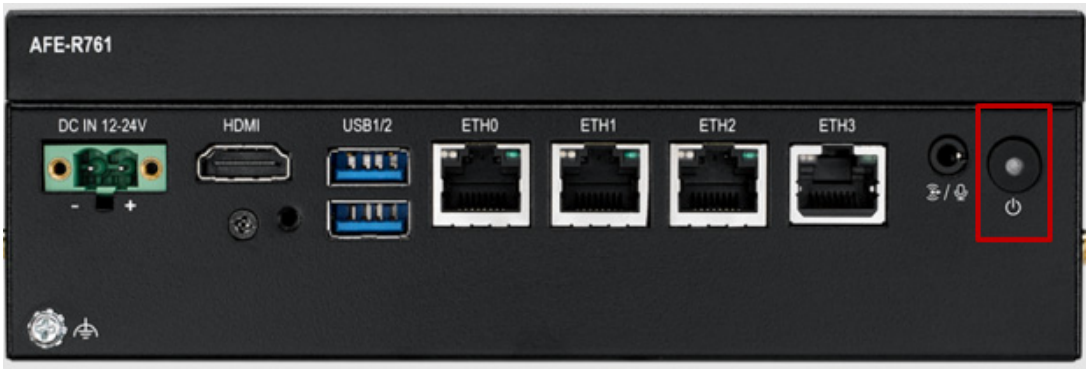


Table 2.13: Button: Power Button

Pin	Pin Name
1	GND
2	GND
3	PWR_SW#
4	PWR_SW#
5	GND
6	PWR_LED

2.3.7 DI, DO

There are 4x digital inputs and 4x digital outputs for on/off triggering and status reading.

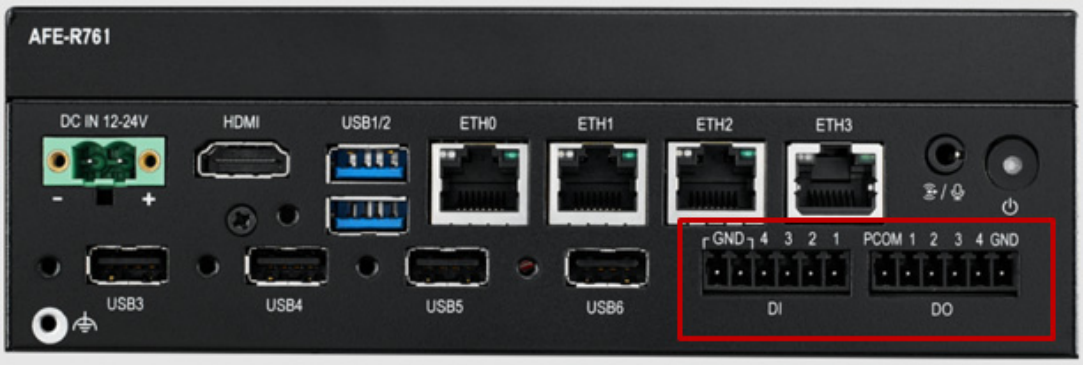


Table 2.14: DI: Digital Input Connector

Pin	Pin Name
1	GND_ISO
2	GND_ISO
3	DI4
4	DI3
5	DI2
6	DI1

Table 2.15: DO: Digital Output Connector

Pin	Pin Name
1	PCOM
2	DO1
3	DO2
4	DO3
5	DO4
6	GND_ISO

Digital Input

4 x DI w 2500VDC isolation protection (terminal block)

- Wet contact: Logic: 0~3VDC(max); Logic 1: 10~30VDC
- Dry contact: Logic 0: Shorted to GND; Logic 1: Open (Default)

Digital Output

4 x DO w 2500VDC isolation protection (terminal block)

- Output voltage: 5-30VDC
- Output capability Sink(NPN): 500mA per channel

2.3.8 RS-232/RS-485

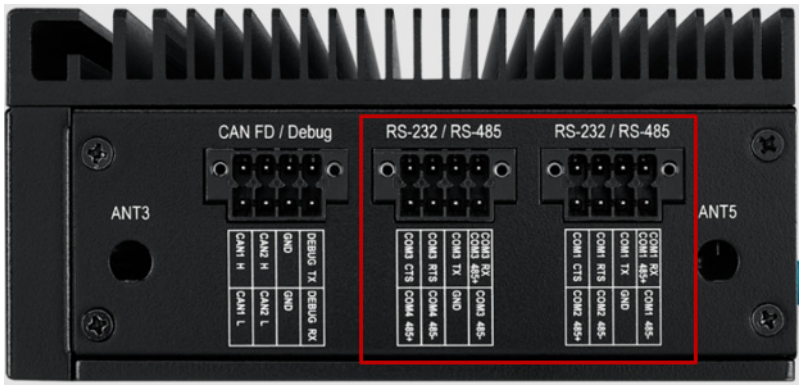


Table 2.16: COM1/2: RS232/485 Connector

Pin	Pin Name
1	COM1_RX_485+
2	COM1_485-
3	COM1_TX
4	GND
5	COM1_RTS#
6	COM2_485-
7	COM1_CTS#
8	COM2_485+

Table 2.17: COM3/4: RS232/485 Connector

Pin	Pin Name
1	COM3_RX_485+
2	COM3_485-
3	COM3_TX
4	GND
5	COM3_RTS#
6	COM4_485
7	COM3_CTS#
8	COM4_485+

2.3.9 CAN FD/Debug

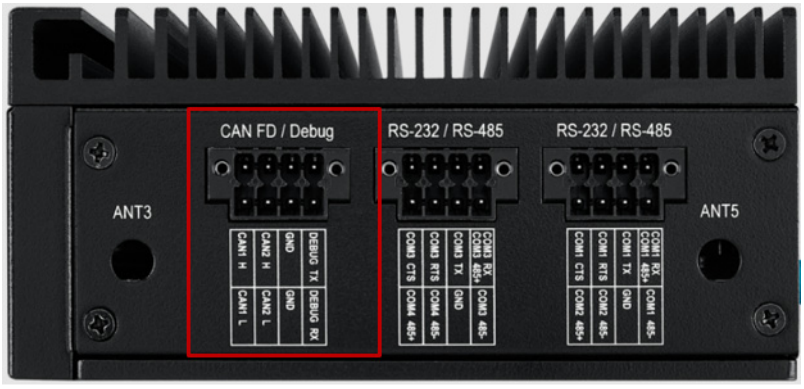


Table 2.18: CAN/DEBUG: CAN FD / Debug Connector

Pin	Pin Name
1	TX_DEBUG
2	RX_DEBUG
3	GND
4	GND
5	CAN2_H
6	CAN2_L
7	CAN1_H
8	CAN1_L

2.3.10 AHD

AFE-R761-UxB1 series supports 4 to 6 AHD camera inputs. Please note that the supported voltage/current is 12V/200mA.

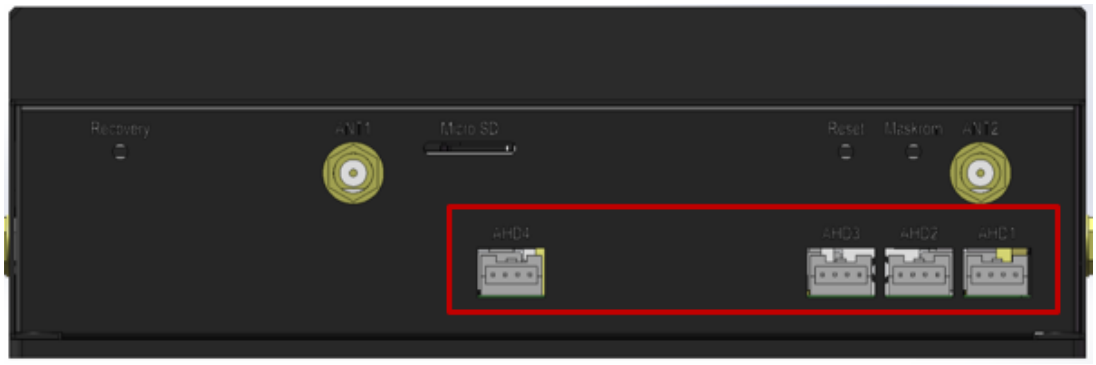


Table 2.19: AHD: AHD Camera Connector

Pin	Pin Name
1	AHD_GND
2	AHD_VIN
3	12V
4	GND

2.3.11 GMSL

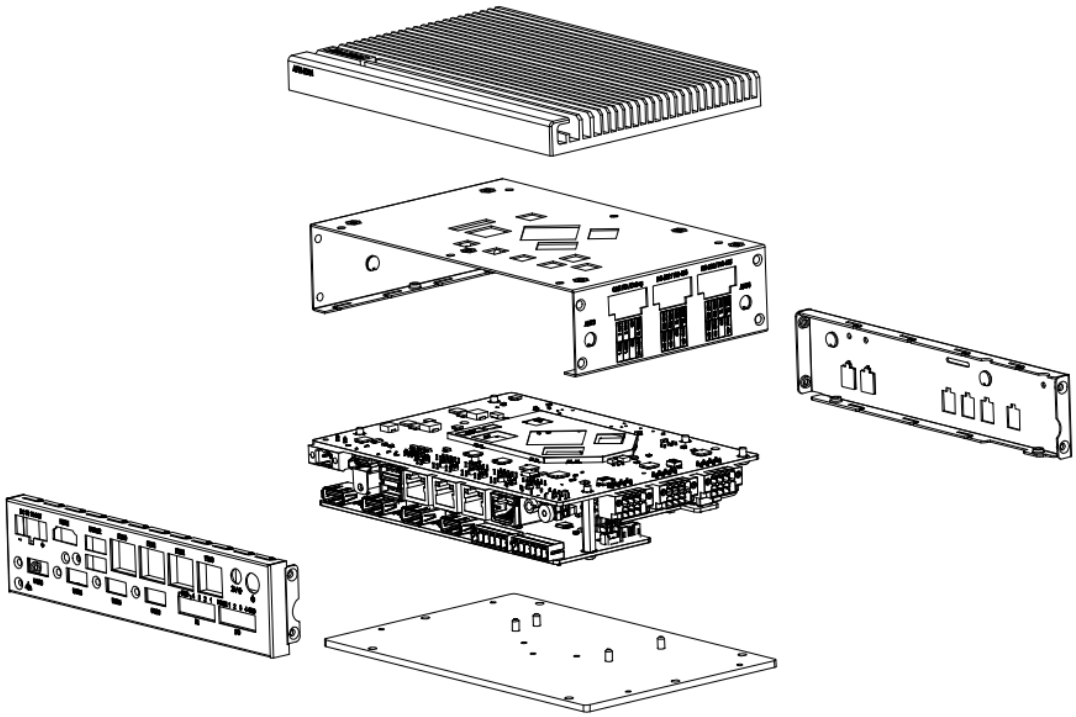
AFE-R761-UxC1 series supports 4 to 6 GMSL camera inputs via Farka connectors. Please note that the supported voltage is 12V.

Table 2.20: GMSL: GMSL Camera Connector

Pin	Pin Name
1	GMSL_IN_P (12V)
2	GND
3	GND
4	GND
5	GND

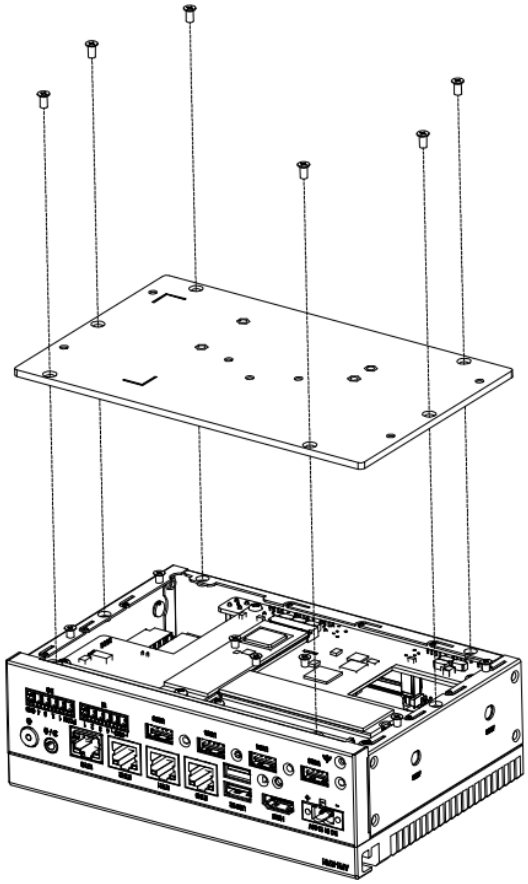
2.4 Installation

2.4.1 Exploded View



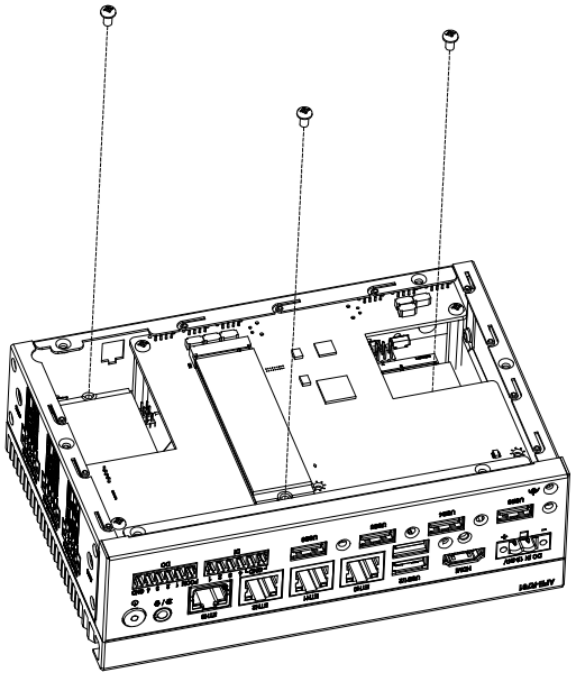
2.4.2 Remove the Bottom Cover

Unscrew the 6 x M3x6L screws on the bottom cover.



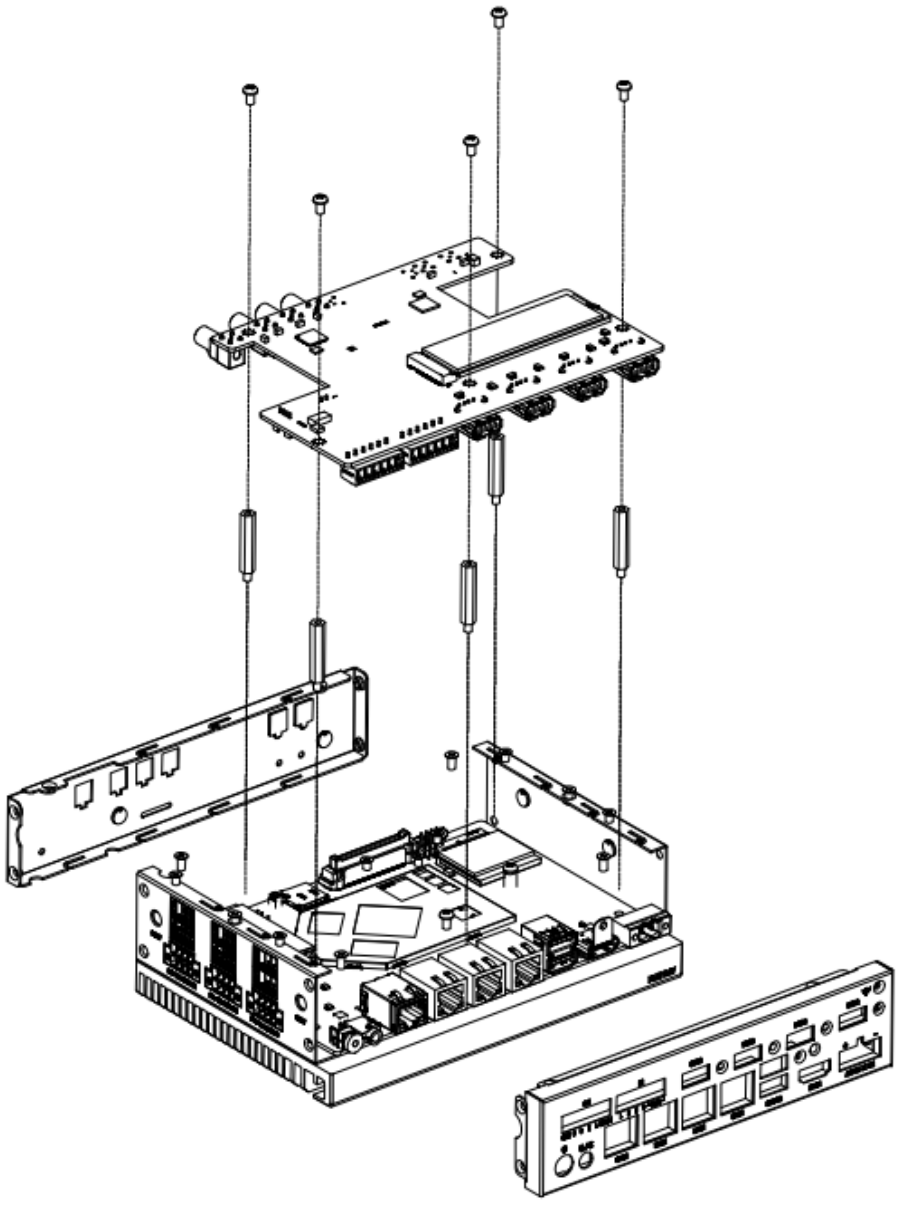
2.4.3 M.2 Module Installation

1. Remove the bottom cover (2.1.2).
2. Install the M.2 module with 1 x M3x5L screw (per socket).
3. Replace the bottom cover and fix it in place with 4 x M3x5L screws.



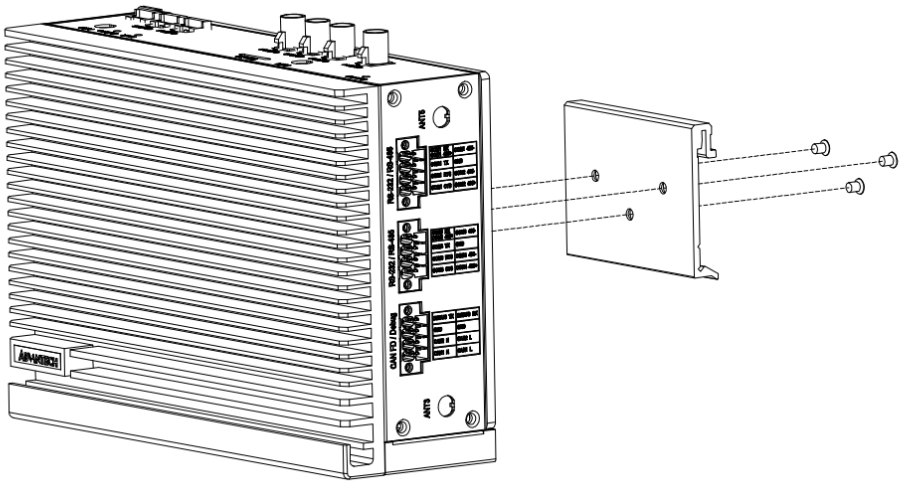
2.4.4 GMSL/AHD Board Installation

1. Remove the bottom cover.
2. Remove 6 x M3x6L screws on the bottom cover and 8 x M3x4L screws on the side I/O brackets.
3. Install AHD/GMSL board (AFE-RM01/AFE-RM02) via CN1 connector.
4. Fix board with 5 x M3x6L screws and 5 x posts (F=M3x8L M=M3x4L B=5 H=25mm).
5. Replace the I/O bracket and bottom cover.



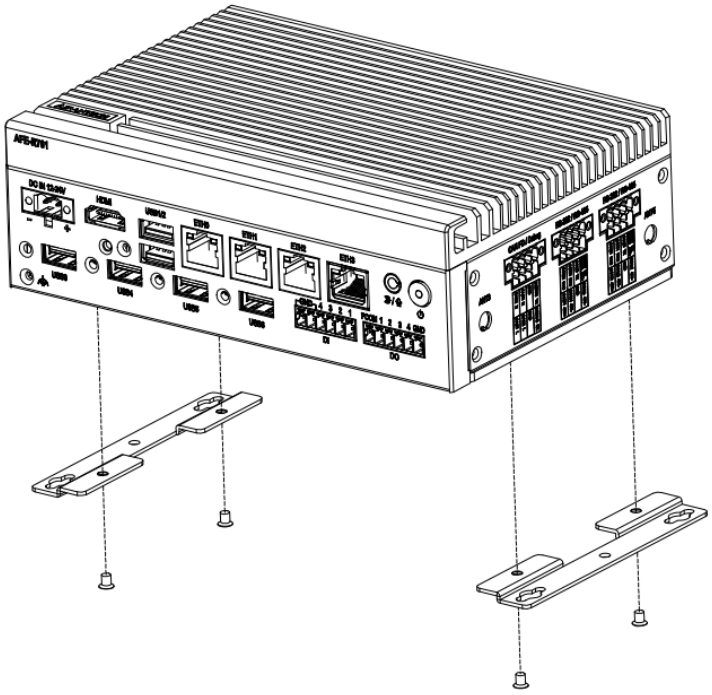
2.4.5 DIN RAIL Kit Installation

1. Unscrew the 3 x M3x4L screws from the back side of AFE-R761.
2. Secure the DIN-rail bracket using 3 x M3x4L screws on the back.



2.4.6 Wall Mount Kit Installation

1. Secure the 2 x Wall mount bracket using 4 x M3x4L screws on the bottom.



2.5 Quick Start Guide

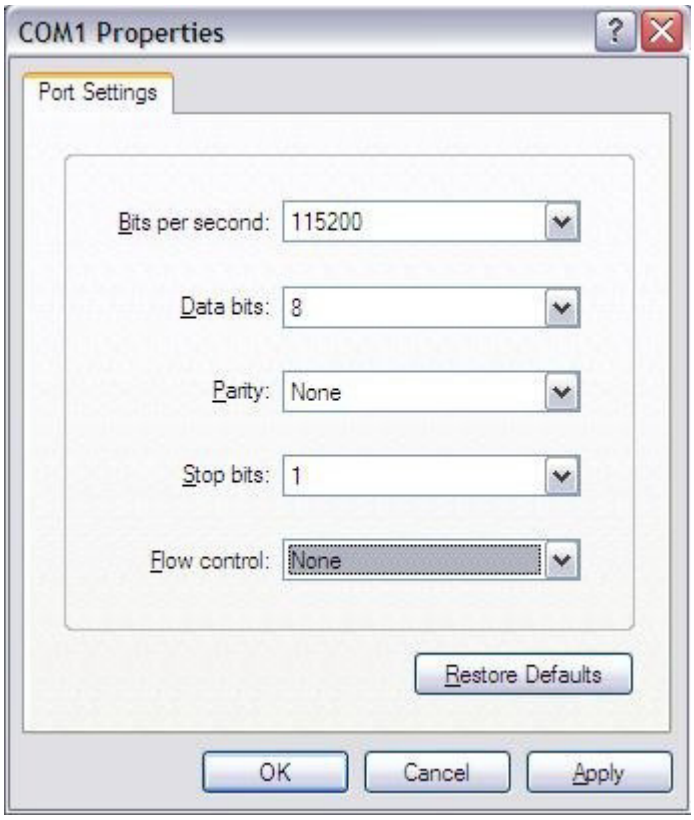
2.5.1 Debug Port Connection

1. Connect the debug port cable (1700035538-01) to the Debug port on AFE-R761.
2. Connect it to your PC using the USB to RS-232 Cable

2.5.2 Debug Port Settings

AFE-R761 can communicate with a host server using serial cables. Common serial communication programs such as HyperTerminal, Tera Term, or PuTTY can be used in these applications. The example below describes the serial terminal setup using HyperTerminal on a Windows host:

1. Connect AFE-R761 with your PC using a serial cable.
2. Open HyperTerminal on your Windows PC, and select the settings demonstrated in the photo below.



3. Insert power adapter to DC jack and power up the board. The Debug console log will be displayed on the terminal screen

Chapter 3

Software Functionality

This chapter details the software programs on the AFE-R761.

3.1 Introduction

It is essential to validate all testing tools with the AFE-R761 evaluation kit. Ensure that you have the necessary test fixtures ready before verifying each designated I/O. If you encounter any issues during testing, please reach out to Advantech for assistance.

3.2 Command Overview

All commands in this document should be entered after the operating system has booted up and under "root" user if no special notice.

The terminal may appear as shown in the following example.

```
root@linaro-alip:/#
```

If the user is not "root", use the following command to switch to "root"

```
linaro@linaro-alip:/$
linaro@linaro-alip:/$ sudo su root
root@linaro-alip:/#
```

3.2.1 Command Format

1. Commands in single line start with "# " :

```
# command
```

Copy and run commands without "#"

2. Commands in multi-lines :

First line starts with "# " and ends with " \"

Next line starts with "   " and ends with " \"

Last line starts with "   " and ends with " "

```
# command1 \
command2 \
command3 \
command4
```

Copy and run multi-line commands without "#" simultaneously.

3. Annotations in single line start with "# #---- " and end with " ----# #" :

```
# #---- annotations ----# #
```

3.3 Debian Desktop Operating System

AFE-R761 is equipped with an embedded Debian Desktop operating system, which is user-friendly.

3.3.1 User and Password

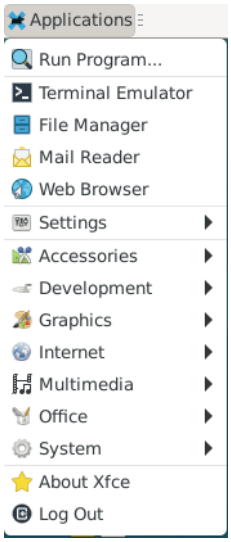
AFE-R761 has two users: root/linaro and their passwords are "123456" by default.

After the Debian Desktop system boots up, it will automatically log in to the "linaro" user.

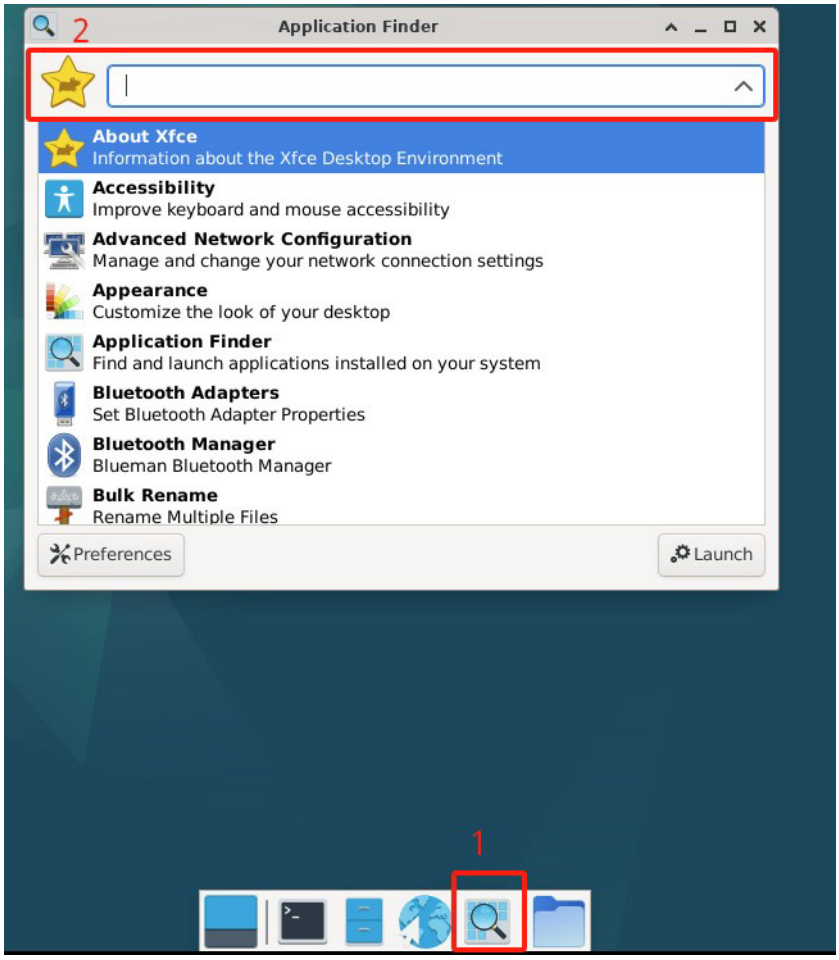
If there is a debugging serial port connected, the serial terminal automatically logs in to the "root" user.

3.3.2 Find Application

1. You can find an application in "Applications".



2. Alternatively, you can search for it in the "Application Finder" list.

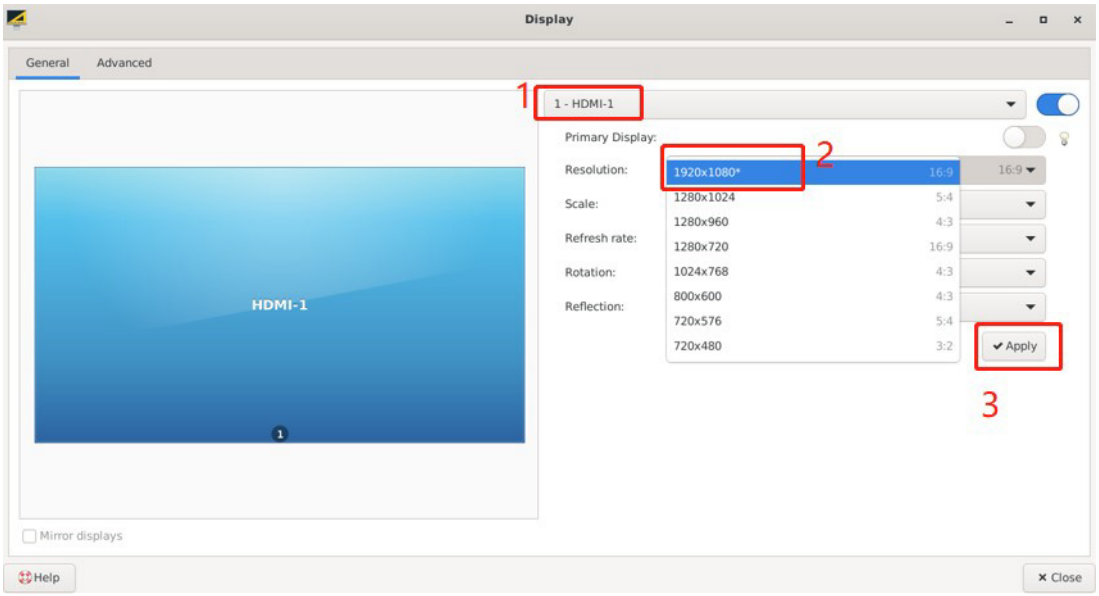


3.4 HDMI Screen

HDMI supports multiple resolutions, which can be set up using a graphical user interface (GUI).

3.4.1 Configure Resolution for HDMI Screen

1. Click "Applications" -> "Settings"->"Display".
2. Choose "HDMI-1", then choose "Resolution".
3. Click "Apply".

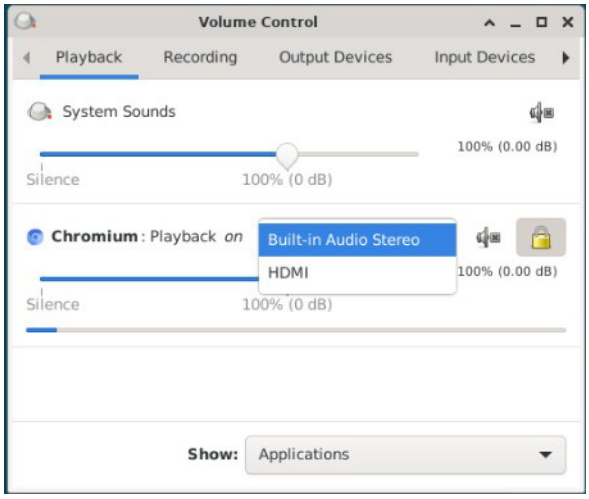


3.5 Audio

AFE-R761 supports two kinds of sound cards: "0 hdmi" and "1 es8326c".

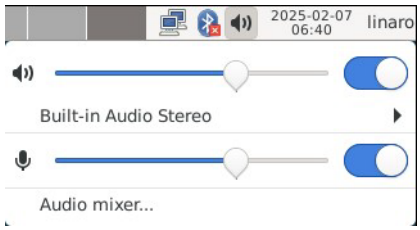
To set the default audio output for media playback, follow these steps:

1. Click "Applications" ->"Multimedia"->"PulseAudio Volume Control".
2. Select "Build-in Audio stereo" for es8326c-codec output,
   or select "HDMI" for HDMI output.



3.5.1 Mute and Volume Control

Mute and volume can be configured by GUI.



3.5.2 Audio Test

1. Get sound card ID

```
# cat /proc/asound/cards
0 [rockchiphdmi0  ]: rockchip-hdmi0 - rockchip-hdmi0
                     rockchip-hdmi0
1 [rockchipes8326c]: simple-card - rockchip,es8326-codec
                     rockchip,es8326-codec
```

2. Record

Take Card ID 1 for example:

```
# arecord -Dplughw:1,0 -f S16_LE -r 16000 -d 10 -t wav test.wav
```

3. Playback

Take Card ID 0 for example:

```
# aplay -Dplughw:0,0 -t wav test.wav
```

See details of the usage of "aplay":

```
# aplay --help
… …
-D, --device=NAME       select PCM by name
-t, --file-type TYPE    file type (voc, wav, raw or au)
… …
```

3.6 4G/5G

3.6.1 Configure 4G/5G

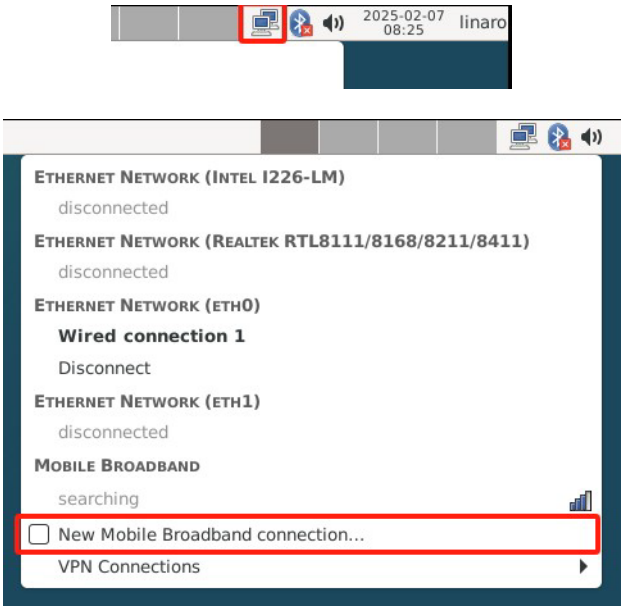
Default supported 4G module: EM05-CNFD-128-SGAS (Advantech PN: 968DD00443)

Default supported 5G module: RM520NGLAA-M20-SGASA (Advantech PN: 968DD00342)

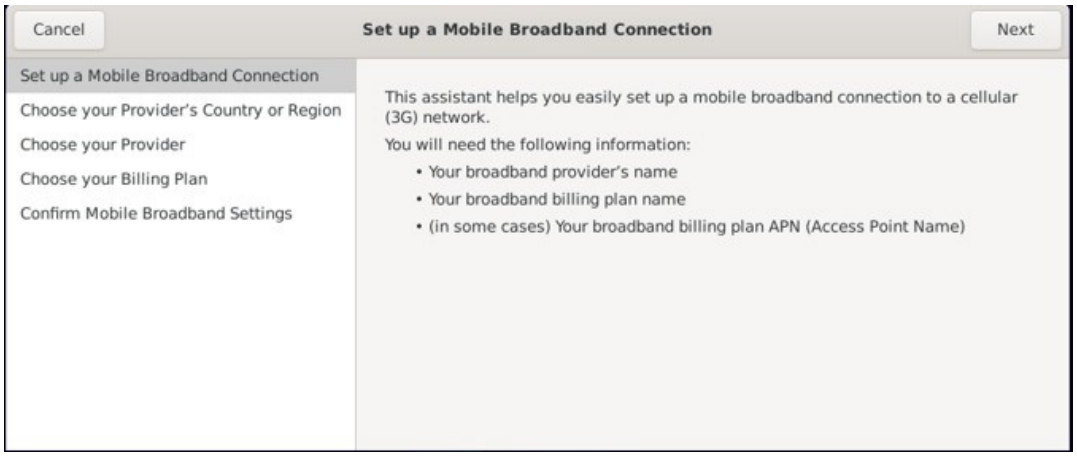
STEP 1: Power off the device, then insert 4G/5G module and SIM card.

Note! *Make sure the device is powered off before inserting the 4G/5G module and SIM card, otherwise the device, 4G/5G module and/or SIM card may be damaged.*

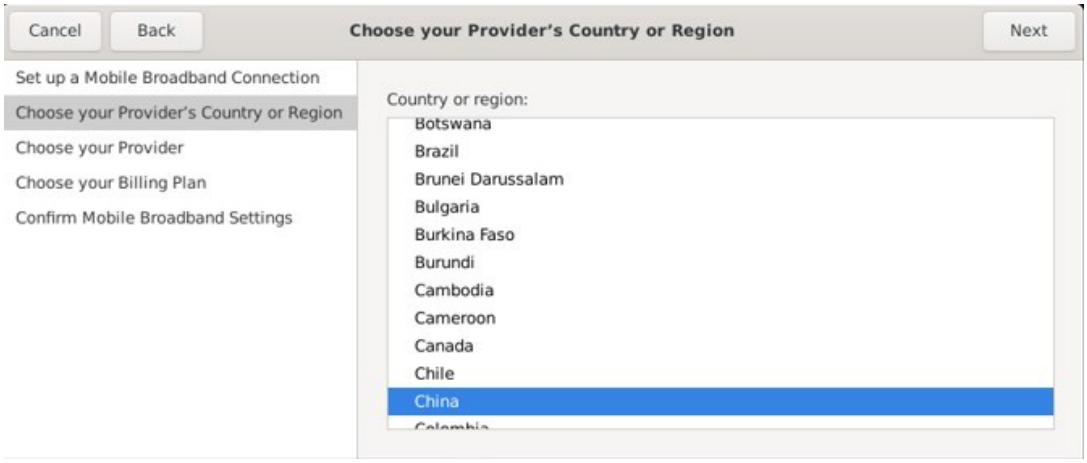
STEP 2: Power on the device, Click network connection icon, then choose "New Mobile Broadband connection".



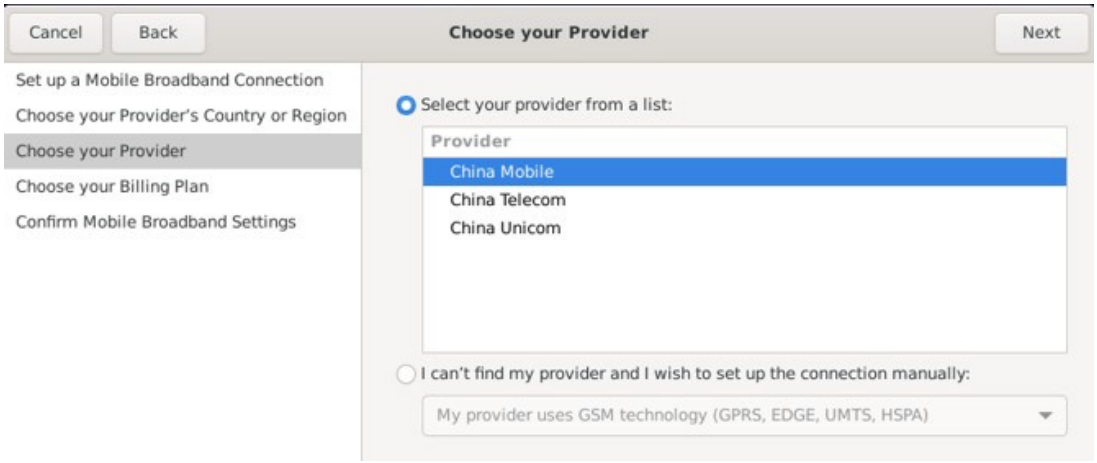
Then you will see the following window, click "Next" button to proceed.



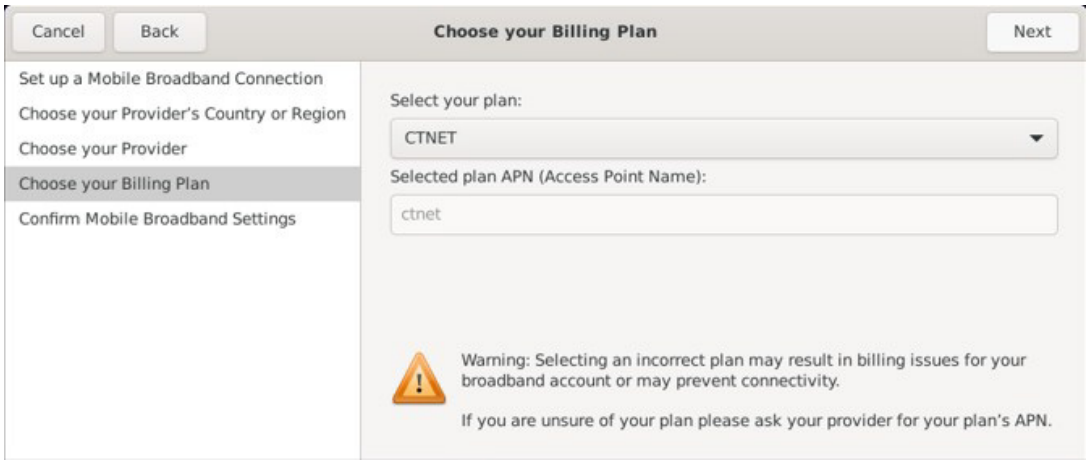
STEP 3: Choose Provider's country or region of the SIM card you insert in STEP 0.



STEP 4: Choose or Set the Provider's name.



STEP 5: Choose or Set APN.



STEP 6: Confirm your configuration and finish.

3.6.2 4G/5G Test

After connection, 4G/5G will create a net point called "wwan0".

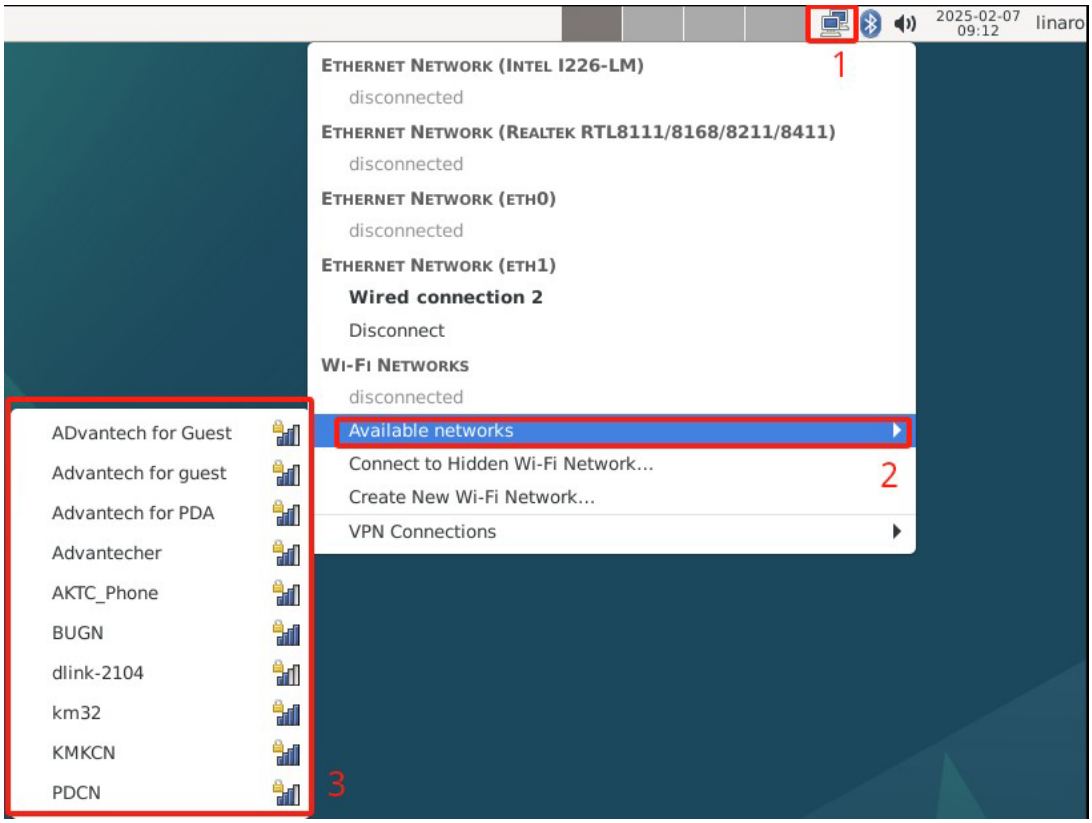
```
# ping -I wwan0 www.advantech.com
```

3.7 WIFI/BT

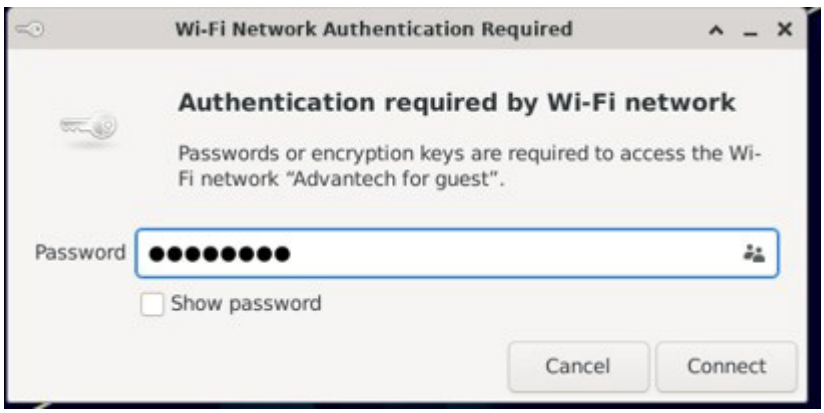
3.7.1 Configure WIFI

The default supported ADVANTECH Wi-Fi6 module is: EWM-W179M201E

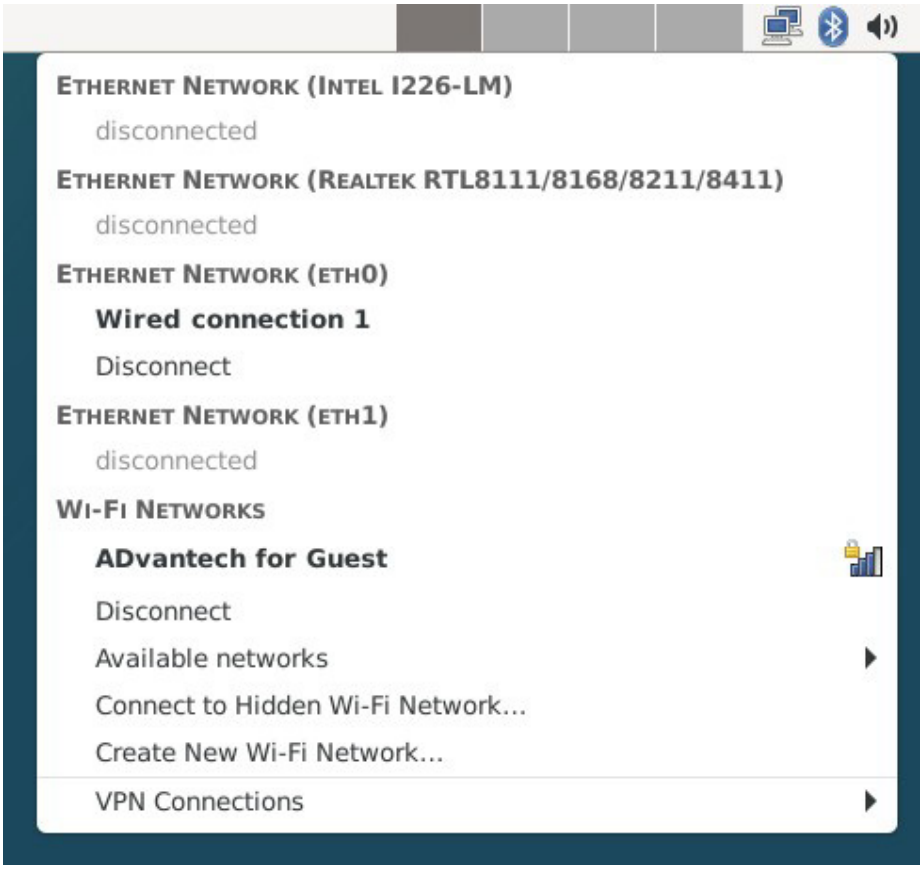
1. Click the network icon in the top right corner of the screen and click the line of "Available networks" to select a Wi-Fi connection (for example: Advantech for guest).



2. Enter the Wi-Fi password to connect to the device.



3. If the password is correct, the device will connect quickly.



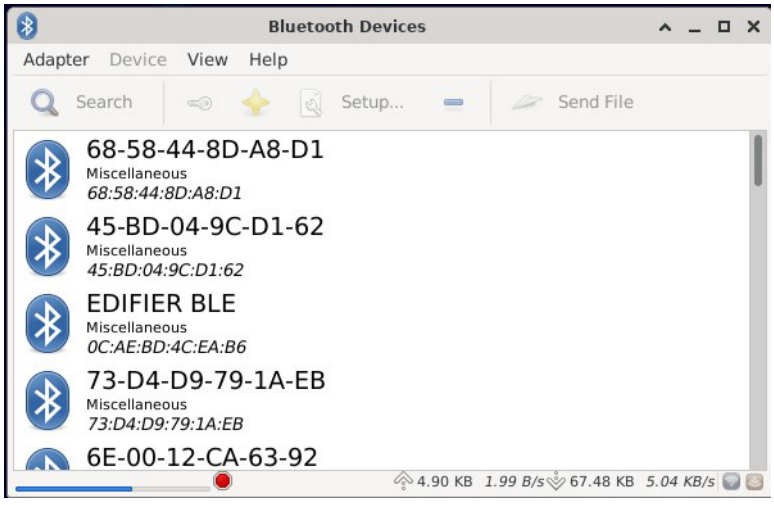
3.7.2 WIFI Test

After connection, Wi-Fi will create a net point "wlan0".

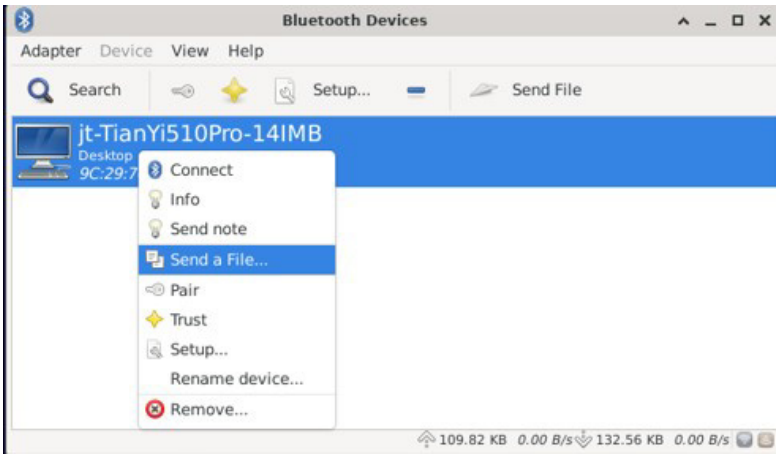
```
# ping -I wlan0 www.advantech.com
```

3.7.3 BT Test

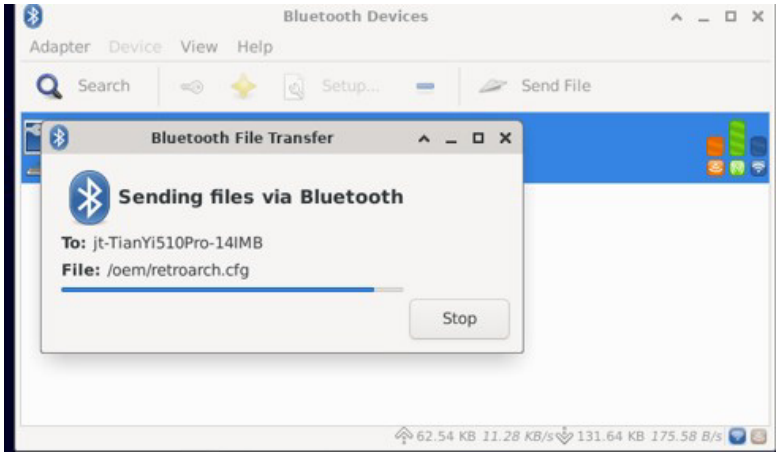
1. Click "Applications" -> "Settings"-> "Bluetooth manager".
   Click the "Search" button to search for Bluetooth devices.



2. Right-click to select a device, such as "jt-TianYi510Pro-14IMB", and send a file.



3. AFE-R761 will start sending files when the receiver device, such as "jt-TianYi510Pro-14IMB", confirms blue tooth reception.

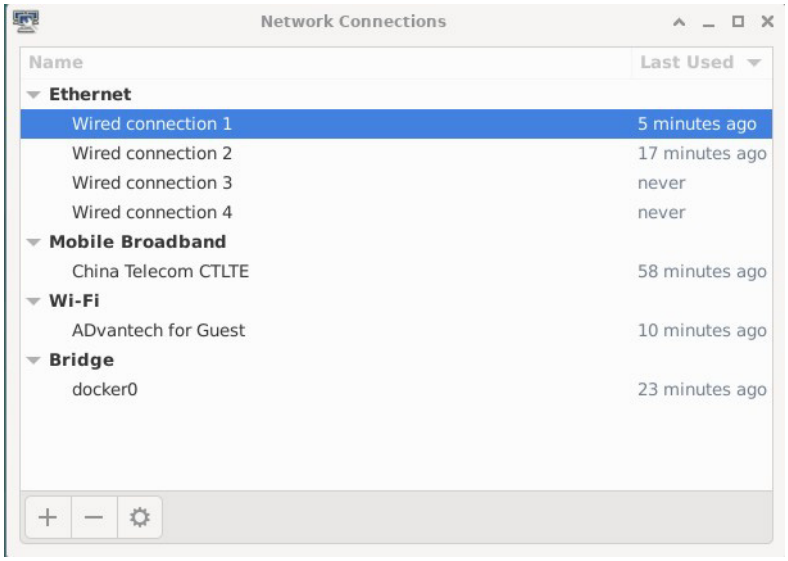


3.8 Ethernet

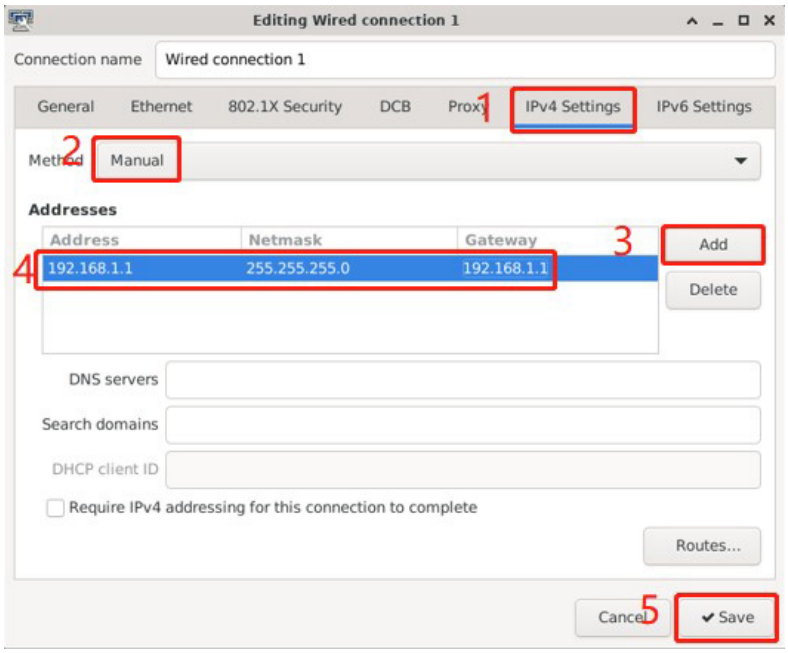
AFE-R761 supports four Ethernet ports: eth0, eth1, eth2, eth3.All ports are using the "DHCP" mode by default. The following configurations and tests are taking eth0 as an example.

3.8.1 Configure to Static IP

1. Click "Applications" -> "Settings" -> "Advanced Network Configration".

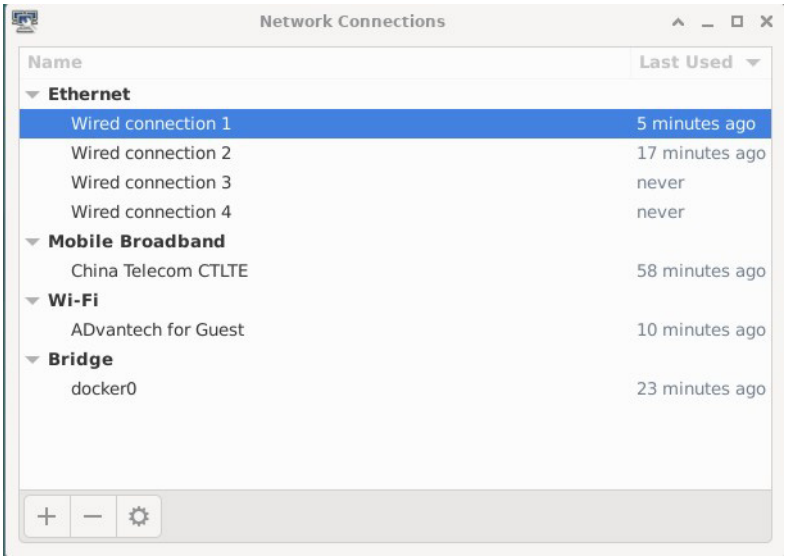


2. Double-click "Wired Connection 1" to configure it.

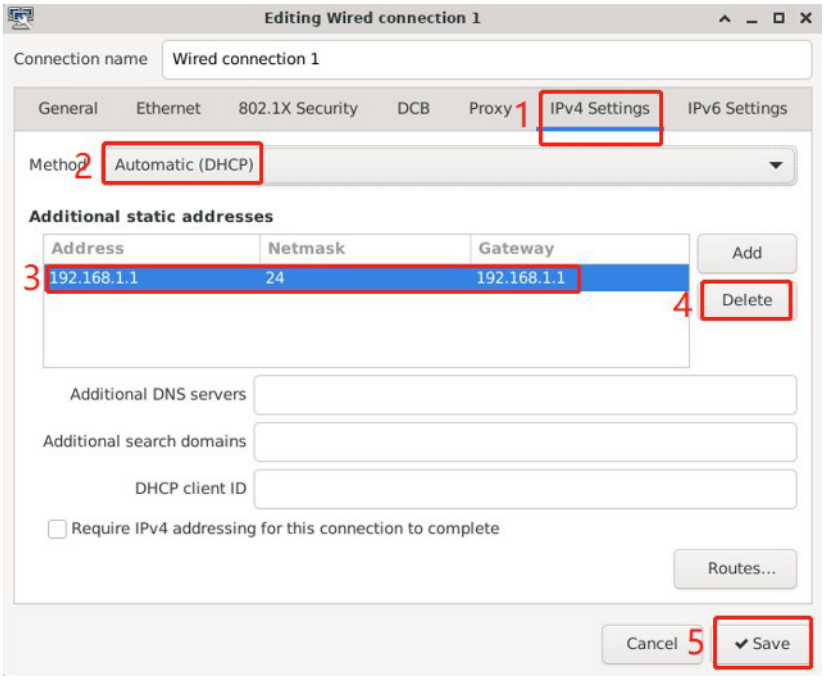


3.8.2 Configure to DHCP

1. Click "Applications" -> "Settings -> "Advanced Network Configration".



2. Double-click "Wired Connection 1" to configure it.



3.8.3 Ethernet Test

After connection, Ethernet will create a net point "eth0","eth1". "eth2" and "eth3".

```
# #---- Test eth0 ----# #
# ping -I eth0 www.advantech.com

# #---- Test eth1 ----# #
# ping -I eth1 www.advantech.com

# #---- Test eth2 ----# #
# ping -I eth2 www.advantech.com

# #---- Test eth3 ----# #
# ping -I eth3 www.advantech.com
```

3.9 UART

User Debian/Linux UART/serial port access is through the tty-devices. The tty-devices have different names depending on UART drivers for different boards.

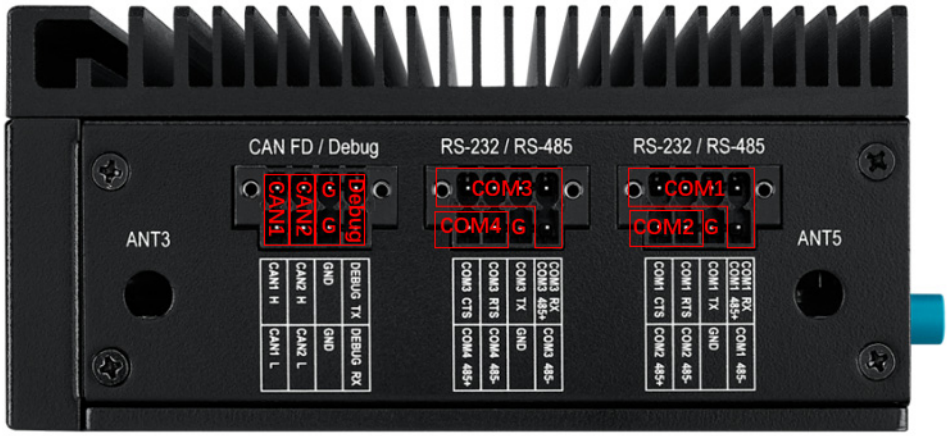


Table 3.1: UART

Device Node	AFE-R761	COM Port Name
/dev/ttyFIQ0	CAN/DEBUG_DEBUG	Debug
/dev/ttyS3	COM2	RS485
/dev/ttyS5	COM4	RS485
/dev/ttyS6	COM3	RS232 4-wire or RS485 (Default RS232)
/dev/ttyS9	COM1	RS232 4-wire or RS485 (Default RS232)

3.9.1 Configure RS232 or RS485

ttyS3 and ttyS5 support only RS485 mode, whereas ttyS6 and ttyS9 support configuration for both RS232 and RS485 modes. The default mode is RS232.

Set RS232 or RS485 separately (0 means RS232;1 means RS485):

Set ttyS6 to RS232 mode and ttyS9 to RS232 mode.

```
# fw_setenv uart_mode_cpu 6:0,9:0
# reboot
```

Set ttyS6 to RS232 mode and ttyS9 to RS485 mode.

```
# fw_setenv uart_mode_cpu 6:0,9:1
# reboot
```

Set ttyS6 to RS485 mode and ttyS9 to RS232 mode.

```
# fw_setenv uart_mode_cpu 6:1,9:0
# reboot
```

Set ttyS6 to RS485 mode and ttyS9 to RS485 mode.

```
# fw_setenv uart_mode_cpu 6:1,9:1
# reboot
```

3.9.2 Configure Parameters

Use "stty" command to configure serial port parameters. The commonly used parameters include "Baud rate", "Data bits", "Stop bits", "Parity", "Flow control".

See details of the usage of "stty":

```
# stty --help
… …
csN          set character size to N bits, N in [5..8]
[-]cstopb     use two stop bits per character (one with '-')
[-]parenb     generate parity bit in output and expect parity bit in input
[-]crtscts     enable RTS/CTS handshaking
… …
```

For example, set COM4

"Baud rate" to 115200

"Data bits" to 8

"Stop bits" to 1

"Parity" to None

"Flow control" to None

```
# stty -F /dev/ttyS3 115200 cs8 -parenb -cstopb -crtscts
```

3.9.3 Send and Receive Data

Taking COM4 as receiver and COM2 as sender:

```
# #---- COM2 as receiver ----# #
# stty -F /dev/ttyS3 115200 cs8 -cstopb -parenb -crtscts
# cat /dev/ttyS3 &

# #---- COM4 as sender ----# #
# stty -F /dev/ttyS5 115200 cs8 -cstopb -parenb -crtscts
# echo pass > /dev/ttyS5

# #----If no error, the receiver will receive "pass"----# #
pass
```

Note! *1.Receiver should run before sender.*

2.The "serial port parameters" should be the same for sender and receiver.

3.10 TPM

The Trusted Platform Module (TPM) is a hardware chip that safeguards the security of computer systems. It can securely store sensitive data, preventing it from being stolen. It generates unique identifiers based on hardware and software configurations, which are used for platform authentication. Additionally, it can serve as a hardware random number generator and an encryption accelerator.

AFE-R761 supports one external tpm.

3.10.1 Check TPM Device

List tpm device.

```
# ls /dev/tpm*
/dev/tpm0 /dev/tpmrm0
```

It is also possible to check tpm activity with the following command.

```
# i2cdump -f -y 6 0x2e
```

3.10.2 Usage

Here are two ways to use tpm:

1. Python scripts

Python scripts can be used to send simple commands to the TPM device. For instance, hereafter is a simple script for sending a TPM2_GetRandom command and requesting 16 random bytes.

```
import binascii
with open('/dev/tpm0','r+b',buffering=0) as tpm :
   tpm.write(binascii.unhexlify(b'80010000000c0000017b0010'))
   print(tpm.read())
```

After writing the desired code to a file (for instance named TPM2_GetRandom.py), execute it with the following command:

```
# python3 TPM2_GetRandom.py
```

2. C language scripts

In the same way as Python scripts, C language scripts can be used to send commands to the TPM device. The previous example for sending a TPM2_GetRandom command and requesting 16 random bytes is also achieved with the following code:

```
#include <stdio.h>
int main()
{
      FILE *tpm;
      char str[] = "\x80\x01\x00\x00\x00\x0c\x00\x00\x01\x7b\x00\x10";
      char buffer[100];
      int i, n;
      tpm = fopen("/dev/tpm0", "rb+");
      if (tpm == NULL){
               printf("ERROR: Could not open driver file.\n");
               return -1;
      }
      n=fwrite(str, 1, sizeof(str), tpm);
      if (n != sizeof(str)){
               printf("ERROR: Could not write bytes to TPM.\n");
               fclose(tpm);
               return -1;
      }
      n = fread(buffer, 1, sizeof(buffer), tpm);
      printf("TPM Response: ");
      for (i=0; i<n; i++){
               printf("%x ", buffer[i]);
      }
      printf("\n");
      fclose(tpm);
      return 0;
}
```

Save these instructions to a TPM2_GetRandom.c file. C language scripts are different from Python scripts because they have to be compiled before they are executed by the terminal. To compile the script, use the following command:

```
# gcc TPM2_GetRandom.c -o TPM2_GetRandom
```

Then to execute the script:

```
# ./TPM2_GetRandom
```

3.11 RTC

Set the system to the current time then set the RTC.

```
# date 021710452016 && hwclock -w && date
Wed Feb 17 10:45:00 UTC 2016
Wed Feb 17 10:45:01 UTC 2016
```

Set one incorrect time, then read RTC to verify.

```
# date 010100002000 && hwclock -r && date
Sat Jan  1 00:00:00 UTC 2000
2016-02-17 10:49:08.417688+00:00
Sat Jan  1 00:00:00 UTC 2000
```

Restore the RTC time to system time.

```
# hwclock -s && date
Wed Feb 17 10:46:58 UTC 2016
```

3.12 Watchdog

A Watchdog Timer (WDT) is a hardware circuit that can reset the computer system in case of a software fault.

AFE-R761 supports one external watchdog.

The default value of timeout is 60 seconds, and it can be set from 1 second to 6527 seconds.

3.12.1 Check Watchdog Device

List watchdog device.

```
# ls /dev/watchdog
/dev/watchdog
```

3.12.2 Usage

Here are two ways to use watchdog:

1. Use "echo" command

Writing any character except the specific magic character 'V' will open the watchdog, and write once before the timeout (60 seconds by default) passes, otherwise the system will reboot.

```
# echo A > /dev/watchdog
```

Writing the specific magic character 'V' to stop the watchdog.cc

```
# echo V > /dev/watchdog
```

2. Write a program using "ioctl"

See more details in [BSP]/kernel/Documentation/watchdog/watchdog-api.rst

3.13 CAN

AFE-R761 has two CAN ports.

Use the "candump" and "cansend" tools directly to send and receive messages. The tools have been embedded into the system.

3.13.1 Check Network Ports

Check network ports of can0 and can1:

```
# ifconfig -a
… …
can0: flags=193<UP,RUNNING,NOARP>  mtu 16
     unspec 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00  txqueuelen 10
(UNSPEC)
     RX packets 0  bytes 0 (0.0 B)
     RX errors 0  dropped 0  overruns 0  frame 0
     TX packets 0  bytes 0 (0.0 B)
     TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

can1: flags=193<UP,RUNNING,NOARP>  mtu 16
     unspec 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00  txqueuelen 10
(UNSPEC)
     RX packets 0  bytes 0 (0.0 B)
     RX errors 0  dropped 0  overruns 0  frame 0
     TX packets 0  bytes 0 (0.0 B)
     TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
… …
```

3.13.2 Configure

Use "ip" command to configure can port.

See details of the usage of "ip link":

```
# ip link help
… …
ip link set { DEVICE | dev DEVICE | group DEVGROUP }
[ { up | down } ]
[ type TYPE ARGS ]
… …
```

```
# ip link help can
… …
ip link set DEVICE type can
[ bitrate BITRATE [ sample-point SAMPLE-POINT] ] |
[ dbitrate BITRATE [ dsample-point SAMPLE-POINT] ] |
[ fd { on | off } ]
… …
```

For example, set can0
"birate rate" to 1000000
"dbitrate rate" to 2000000
"fd" to on

```
# #---- For can0 ----# #
# ip link set can0 down
# ip link set can0 type can bitrate 1000000 dbitrate 2000000 fd on
# ip link set can0 up
```

3.13.3 Send and receive data

As receiver

```
# #---- As receiver ----# #
# ip link set can0 down
# ip link set can0 type can bitrate 1000000 dbitrate 2000000 fd on
# ip link set can0 up
# candump can0 &
```

As sender

```
# #---- As sender ----# #
# ip link set can1 down
# ip link set can1 type can bitrate 1000000 dbitrate 2000000 fd on
# ip link set can1 up
# cansend can1 123##155

# #----If no error, the receiver will receive the following data----# #
can0  123  [01]  55
```

See more details of the usage of "candump" and "cansend":

```
# candump --help
# cansend --help
```

Note! *1. Receiver should run before sender.*

2. The "bitrate" and "dbbitrate" should be the same for sender and receiver.

3.14 PCIE

AFE-R761 supports two PCIE ports. Using the PCIE disk (SQF-C8BV2-128G-EDE) to test the M.2_B-KEY PCIE interface. Using the WIFI module (EWM-W179M201E)Wi-Fi functionality to test the M.2_E-KEY PCIE interface.

M.2_B-KEY PCIE TEST Preparation:

Insert PCIE disk.

Note!

- *Make sure the device is power off before inserting PCIE disk, otherwise the device and/or PCIE disk may be damaged.*
- *Make sure PCIE disk is partitioned and formatted.*

List disk information.

```
# fdisk -l /dev/nvme0n1
Disk /dev/nvme0n1: 119.24 GiB, 128035676160 bytes, 250069680 sectors
Disk model: SQF-C3AV1-128GDEDE
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x217a69bc

Device         Boot Start       End   Sectors   Size Id Type
/dev/nvme0n1p1       2048 250069679 250067632 119.2G 83 Linux
```

Check mount point

```
# mount | grep nvme
/dev/nvme0n1p1 on /run/media/nvme0n1p1 type ext4 (rw,relatime)
```

Speed Test.

Read Speed

```
# echo 3 > /proc/sys/vm/drop_caches
# dd if=/dev/nvme0n1 of=/dev/zero bs=1M count=400
400+0 records in
400+0 records out
419430400 bytes (419 MB, 400 MiB) copied, 0.728982 s, 575 MB/s
```

Write Speed

```
# echo 3 > /proc/sys/vm/drop_caches
# dd if=/dev/zero of=/dev/nvme0n1 bs=1M count=400
400+0 records in
400+0 records out
419430400 bytes (419 MB, 400 MiB) copied, 0.915896 s, 458 MB/s
```

M.2_E-KEY PCIE TEST:

Please refer to Section 3.7 for the connection of the WIFI module EWM-W179M201E.If the WIFI function works properly it indicates that the PCIE function is normal and in use.

3.15 SATA

The M.2_B-KEY interface of the AFE-R761 supports two types of signals, and the specific type depends on the configuration you have purchased. One is the PCIE signal, and the other is the SATA signal. To test the M.2_B-KEY SATA signal, can use the SATA disk (model: IM2S3334 - 512GCTB4).

M.2_B-KEY SATA TEST Preparation:

Insert SATA disk.

Note!

- *Make sure the device is power off before inserting SAYTA disk, otherwise the device and/or PCIE disk may be damaged.*
- *Make sure PCIE disk is partitioned and formatted.*

List disk information.

```
# fdisk -l /dev/sda
Disk /dev/sda: 476.94 GiB, 512110190592 bytes, 1000215216 sectors
Disk model: ADATA_IM2S3334-5
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: FFB00BF9-6A9C-4985-9940-119F64E2245F

Device         Start        End     Sectors     Size  Type
/dev/sda1       2048     616447    614400   300M  EFI System
/dev/sda2     616448     878591    262144   128M  Microsoft reserved
/dev/sda3     878592  630026239 629147648   300G  Microsoft basic data
/dev/sda4  630026240 1000215182 370188943  176.5G  Microsoft basic data
```

Check mount point

```
# mount | grep sda
/dev/sda1 on /run/media/sda1 type vfat (rw,rela-
time,gid=6,fmask=0007,dmask=0007,allow_utime=0020,codepage=936,iochar-
set=utf8,shortname=mixed,errors=remount-ro)
/dev/sda4 on /run/media/sda4 type fuseblk (rw,rela-
time,user_id=0,group_id=0,allow_other,blksize=4096)
/dev/sda3 on /run/media/sda3 type fuseblk (rw,rela-
time,user_id=0,group_id=0,allow_other,blksize=4096)
```

Speed Test.

Read Speed

```
# echo 3 > /proc/sys/vm/drop_caches
# dd if=/dev/sda of=/dev/zero bs=1M count=400
400+0 records in
400+0 records out
419430400 bytes (419 MB, 400 MiB) copied, 0.866038 s, 484 MB/s
```

Write Speed

```
# echo 3 > /proc/sys/vm/drop_caches
# dd if=/dev/zero of=/dev/sda bs=1M count=400
400+0 records in
400+0 records out
419430400 bytes (419 MB, 400 MiB) copied, 0.234872 s, 1.8 GB/s
```

3.16 AHD & GMSL CAMERA

3.16.1 AHD Ports

AFE-R761-UxB1 can support 4 ~ 6 AHD cameras via AFE-RM01 expansion board. The default supported resolution is 1920 x 1080 @ 30fps.

Table 3.2: AHD Ports

Camera Num	Video Port	Note
Camera 1	3	AHD1
Camera 2	11	AHD2
Camera 3	12	AHD3
Camera 4	0	AHD4
Camera 5	1	AHD5
Camera 6	2	AHD6

3.16.2 GMSL Ports

AFE-R761-UxC1 can support 4 ~ 6 GMSL cameras via AFE-RM02-xPA1 expansion board. The default supported resolution is 1920 x 1080 @ 30fps.

Table 3.3: GMSL Port

Camera Num	Video Port	Note
Camera 1	0	GMSL1
Camera 2	1	GMSL2
Camera 3	2	GMSL3
Camera 4	3	GMSL4
Camera 5	11	GMSL5
Camera 6	12	GMSL6

3.16.3 View Resolution

Taking port 0 as an example, you can enter the following instructions to view information such as the resolution, pixel format, Field, Number of planes, Flags, Colorspace, Transfer Function, YCbCr/HSV Encoding, Quantization, Bytes per Line and Size Image.

```
# v4l2-ctl -d /dev/video0 --get-fmt-video
Format Video Capture Multiplanar:
        Width/Height      : 1920/1080
        Pixel Format      : 'NV12' (Y/UV 4:2:0)
        Field             : None
        Number of planes  : 1
        Flags             :
        Colorspace        : Rec. 709
        Transfer Function : Rec. 709
        YCbCr/HSV Encoding: Rec. 709
        Quantization      : Default
        Plane 0           :
           Bytes per Line : 1920
           Size Image     : 3110400
```

3.16.4 Set Resolution

Taking port 0 as an example, you can enter the following commands to set the resolution to 1920*1080.

```
# v4l2-ctl -d /dev/video0 --set-fmt-video=width=1920,height=1080,pixelformat='NV12'
```

3.16.5 Preview Camera

Taking port 0 as an example, you can set the preview of the camera video by using the following command.

```
# export DISPLAY=:0.0
# export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:/usr/lib/aarch64-linux-gnu/gstreamer-1.0
#gst-launch-1.0 v4l2src device=/dev/video0 \
! video/x-raw,format=NV12,width=1920,height=1080,framerate=30/1 ! xvimagesink
```

3.16.6 Camera Photography

Taking port 0 as an example, the following command can be used to take a camera photo, and the save address is picture.jpg in the current directory

```
# gst-launch-1.0 v4l2src device=/dev/video0 num-buffers=10 \
! video/x-raw,format=NV12,width=1920,height=1080 ! jpegenc \
! multifilesink location=picture_%02d.jpg && \
rm picture_0{0..8}.jpg && mv picture_09.jpg picture.jpg
```

3.16.7 Camera Screen Recording

Taking port 0 as an example, the following command can be used to record videos with the camera, and the save address is video.mp4 in the current directory.

```
# gst-launch-1.0 -e \
v4l2src device=/dev/video0 \
! video/x-raw,format=NV12,width=1920,height=1080,framerate=25/1 \
! videoconvert \
! x264enc bitrate=5000 speed-preset=ultrafast tune=zerolatency \
! h264parse \
! mp4mux \
! filesink location= video.mp4
```

3.17 DI,DO

AFE-R761 supports 4x digital inputs and 4x digital outputs.

3.17.1 Show DI/DO Ports

List DI/DO supported ports:

```
# #---- Show DI ports ----# #
# cd /dev/
# ls DI*
DI1  DI2  DI3  DI4

# #---- Show DO ports ----# #
# cd /dev/
# ls DO*
DO1  DO2  DO3  DO4
```

3.17.2 Get DI Status

Take DI1 for example

```
# cat /dev/DI1
1
```

Note!

1. *DI ports have two types : Dry or Wet.*
2. *For Dry ports*
   0 means the external circuit is conductive.
   1 means the external circuit is NOT conductive.
3. *For Wet ports*
   0 means the voltage of input is between 10-30V
   1 means the voltage of input is between 0-3V
   3-10V is unstable status.

3.17.3 Set and Get DO Status

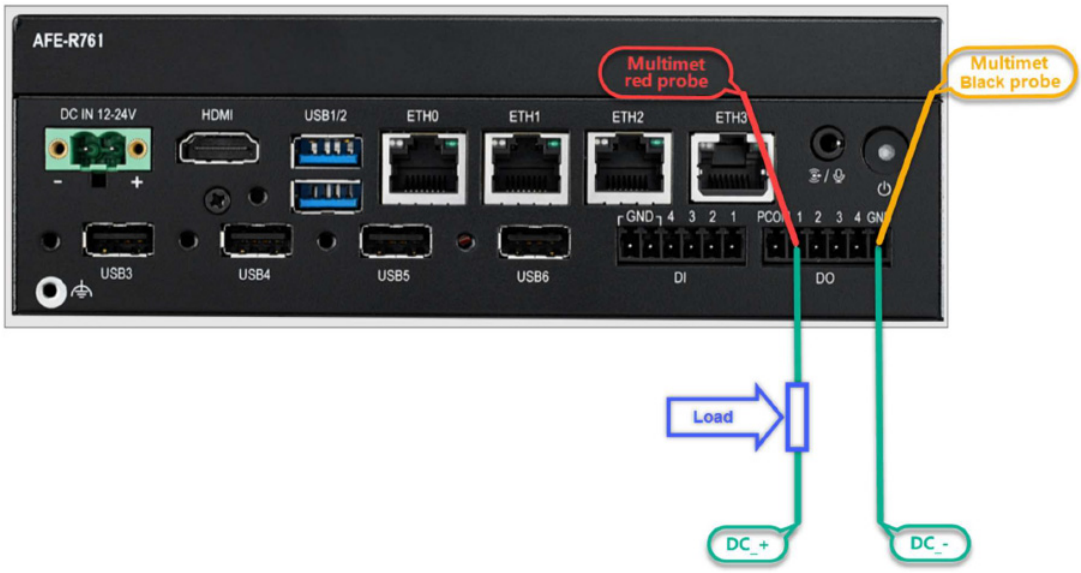
Take DO1 for example:

```
# #---- Set 0 to DO1 ----# #
# echo 0 > /dev/DO1

# #---- Set 1 to DO1 ----# #
# echo 1 > /dev/DO1

# #---- Get DO1 status ----# #
# cat /dev/DO1
1
```

Note! *Setting 0 to make the external circuit NOT conductive.*
Setting 1 to make the external circuit conductive.

The wiring and measurement methods can be referred to as shown in the following diagram.

Export DO1



Note!

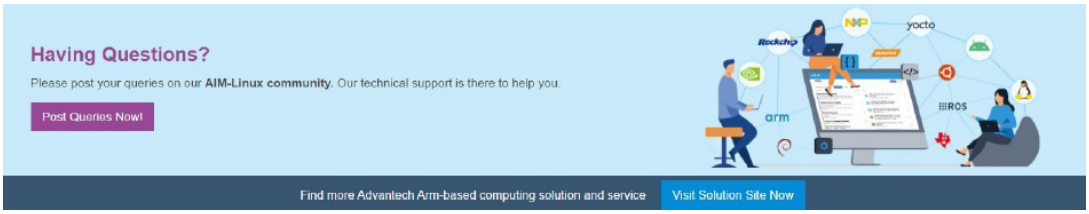
- *There are no specific requirements for the power supply. Just make sure it is within the product specification of 5 to 30V DC and ensure that the overshoot at the moment of power-on does not exceed 30V. Please be sure to confirm the overshoot at power-on of the POWER Supply being used.*
- *When echo is "0", the DO on the UIO is open mode and the level state is high.*
- *When echo is "1", the DO on the UIO is closed mode and the level is low.*

3.18 More Technical Support and Assistance

Click on the screenshot or link below to get more information about Advantech Arm computing products.

ESS-WIKI (advantech.com.tw)
http://ess-wiki.advantech.com.tw/view/RISC

Also, you can post your questions or queries on our AIM-Linux community.
Click on the screenshot or link below to join us now.



Advantech AIM-Linux Community - Welcome to the Advantech AIM-Linux Community!
https://forum.aim-linux.advantech.com

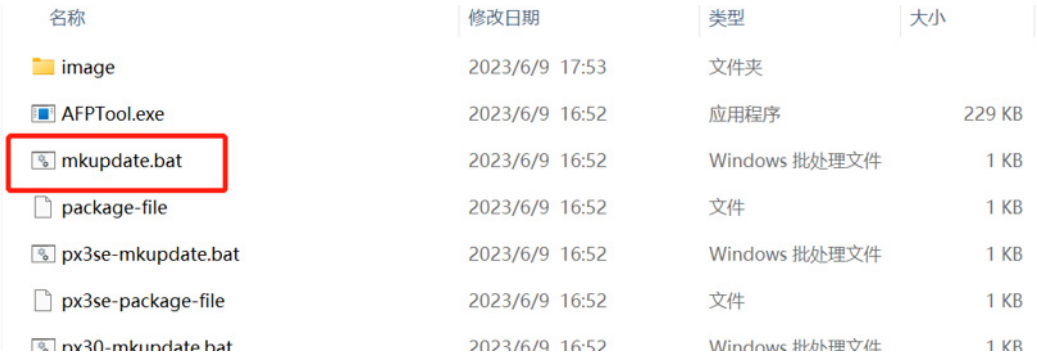
Chapter 4

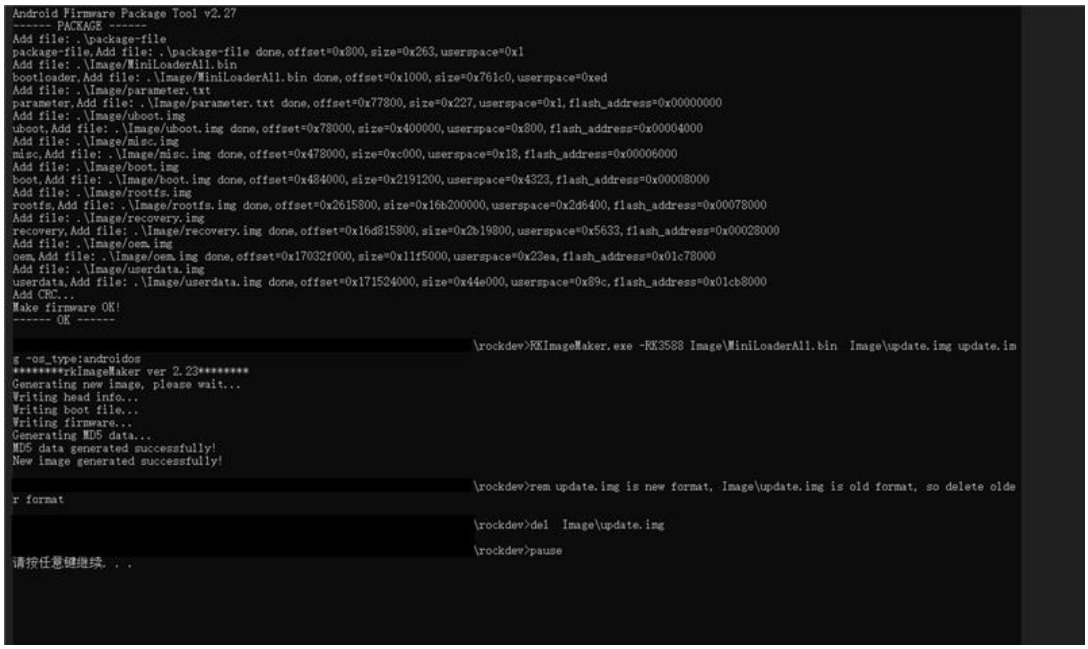
System Recovery

This chapter introduces how to recover the Linux operating system if it is damaged accidentally.

4.1 Create “update.img”

1. Download Release Image to PC (Windows OS).
2. Decompress the Image, double click mkupdate.bat in folder “rockdev”.

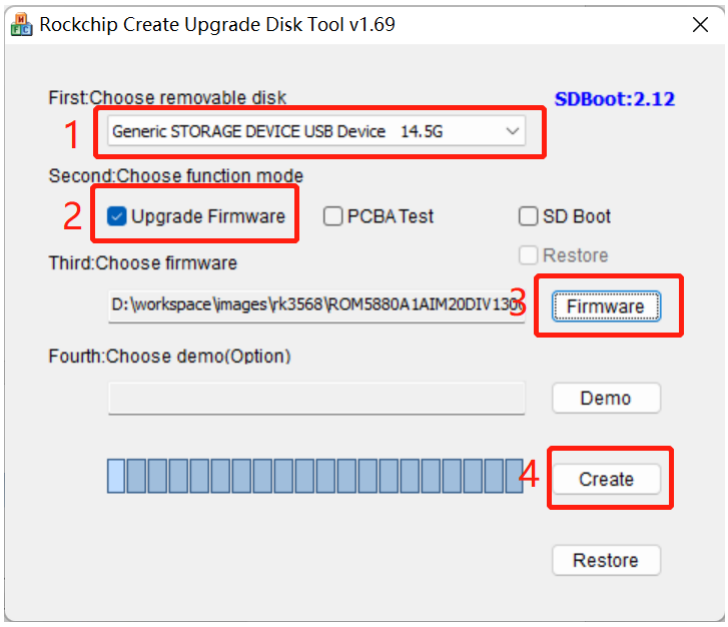




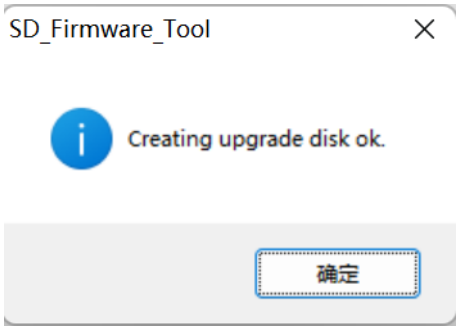
Then you can find “update.img” in folder “rockdev”.

4.2 Using SDDiskTool to Create Upgrade SD

1. Insert SD Card to PC (Windows OS).
2. Decompress SDDiskTool, double click SD_Firmware_Tool.exe
3. Create upgrade SD card
   (1) Choose the SD device.
   (2) Choose the "Upgrade firmware"
   (3) Choose the update.img path
   (4) Create the update SD



4. Create the upgrade SD card Success



4.3 Upgrade or Recovery AFE-R761

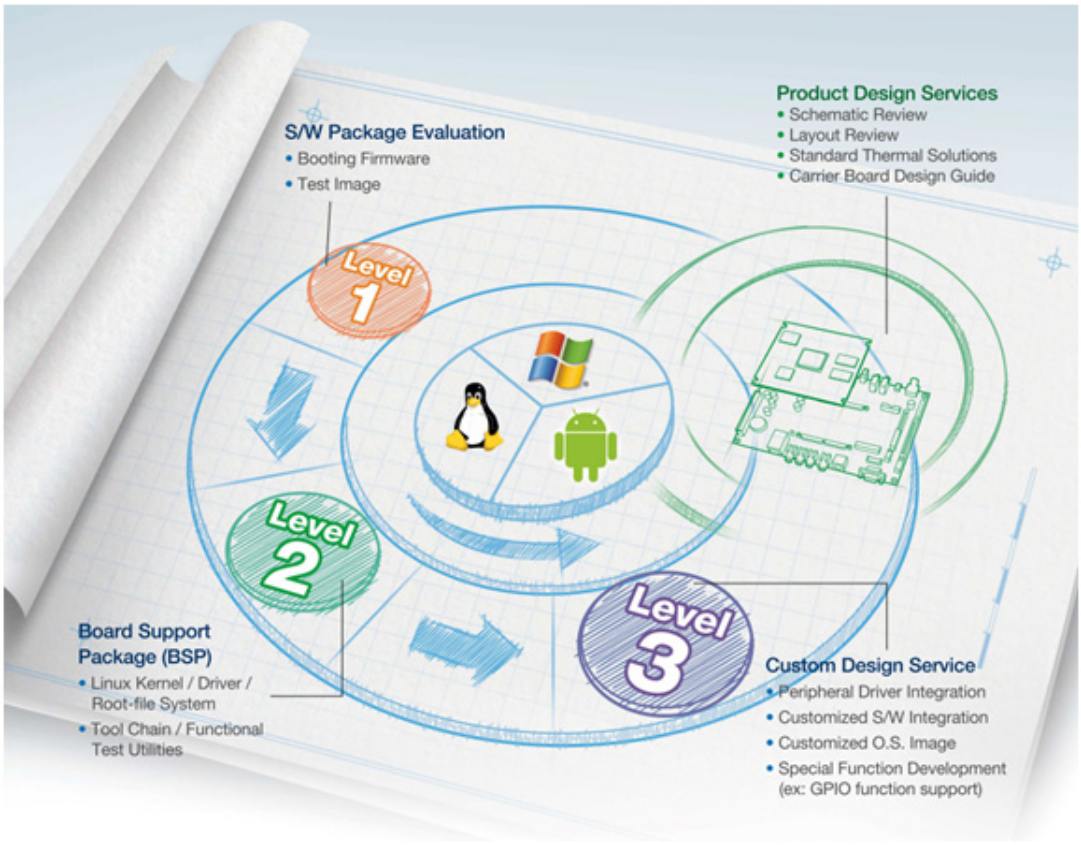
1. Power off AFE-R761.
2. Insert the upgrade SD card to AFE-R761.
3. Power on AFE-R761. It will automatic enter recovery mode to upgrade system.
4. If upgrade success, you will get the message “Please remove SD CARD!!!, wait for reboot” on screen and debug console.
5. Remove SD card.

Chapter 5

Advantech Services

This chapter details Advantech Design-In serviceability, technical support and warranty policy for AFE-R761.

5.1 RISC Design-In Services



Advantech RISC Design-in Services help customers reduce the time and work involved in designing new carrier boards. We handle the complexities of technical research and greatly minimize the development risk associated with carrier boards.

Easy Development

Advantech features support firmware, root file-system, BSP, or other development tools for customers. These tools help customers develop their carrier board and differentiate their embedded products and applications.

- Full Range of RISC Product Offerings
- Comprehensive Document Support

Design Assistance Service

Advantech provides a check list for engineers to check their schematics and also review service based on customer carrier board schematics. Those services are preventative and help to catch design errors before they happen. This helps to save time and costs related to the development of carrier boards.

- Schematic Review
- Placement and Layout Review
- Debugging Assistance Services
- General/Special Reference Design Database

Thermal Solution Services

In order to provide quicker and more flexible solutions for customers' thermal designs. Advantech provides a thermal solution service—with reference to modularized thermal solutions and customized thermal solutions.

- Standard Thermal Solutions
- Customized Thermal Solutions

Embedded Software Services

Supports driver/software integration, or customized firmware, root file-system, and Linux image. Customer can save time and focus on their core development.

- Embedded Linux/ Android OS
- Advantech Boot Loader Customization

With the spread of industrial computing, a whole range of new applications have been developed, resulting in a fundamental change to the IPC industry. In the past, System Integrators (SI) were accustomed to completing projects without outside assistance. Now such working models are obsolete. Due to diverse market demands and intense competition, cooperation for (both upstream and downstream) vertical integration has become a much more effective way to create competitive advantages. As a result, ARM-based CPU modules were born out of this trend. Concentrating all necessary components on the CPU modules and placing other parts on the carrier board in response to market requirements for specialization, provides greater flexibility while retaining low power consumption credentials.

Advantech has been involved in the industrial computer industry for many years and finds that customers usually have the following questions when implementing modular designs.

General I/O Design Capability

Although customers often possess the ability to perform vertical integration and have enough know-how and core competitiveness in the professional application field, the lack of general expertise and experience in power and I/O design causes many challenges for them; especially when integrating CPU modules into carrier boards.

The Acquisition of Information

Even if an individual client is able to obtain sufficient information to make the right decision for a specialized vertical application, some customers encounter problems dealing with general platform design and communicating with CPU or chipset manufacturers, thereby increasing carrier board design difficulties and risk as well as seriously impacting time-to-market and losing potential market opportunities.

Software Development and Modification

Compared to x86 architectures—RISC architectures use simpler instruction sets. Therefore the software support for x86 platforms cannot be used on RISC platforms. System integrators need to develop software for their system and do the hardware and software integration themselves. Unlike x86 platforms, RISC platforms have less support for Board Support Packages (BSP) and drivers as well. Even though driver support is provided, SI still have to make a lot of effort to integrate it into the system core. Moreover, the BSP provided by CPU manufacturers are usually for carrier board designs, so it's difficult for SI to have an environment for software development.

In view of this, Advantech proposed the concept of Streamlined Design-in Support Services for RISC-based Computers On Modules (COM). With dedicated professional design-in services, Advantech actively participates in carrier board design and problem solving. Our services not only enable customers to effectively distribute their resources, but also reduce R&D manpower cost and hardware investment.

By virtue of a close interactive relationship with leading original manufacturers of CPUs and chipsets such as ARM, TI, and NXP, Advantech helps solve communication and technical support difficulties, which, in turn, can reduce the uncertainties of product development. Advantech's professional software team also focuses on providing a complete Board Support Package and assists customers in building a software development environment for their RISC platforms.

Advantech RISC design-in services helps customers overcome their problems to achieve the most important goal of faster time to market through a streamlined RISC Design-in services.

Along with our multi-stage development process, which includes: planning, design, integration, and validation, Advantech's RISC design-in service provides comprehensive support through the following different phases:

Planning Stage

Before deciding to adopt Advantech RISC COM, customers must go through a complete survey process detailing product features, specifications, and compatibility testing with software. Advantech offers a RISC Customer Solution Board (CSB) as an evaluation tool for carrier boards which are simultaneously designed when developing RISC COMs. In the planning stage, customers can use this evaluator board to assess RISC modules and test peripheral hardware. What's more, Advantech provides standard software Board Support Package (BSP) for RISC COM, so that customers can define their product's specifications as well as verifying I/O and performance at the same time. We not only offer hardware planning and technology consulting, but also software evaluation and peripheral module recommendations (such as Wi-Fi, 3G, and BT). At this stage, resolving customer concerns is Advantech's primary goal. Since we all know that product evaluation regarding performance and specification is the key task in the planning period, we try to help our customers conduct all the necessary tests for their RISC COM.

Design Stage

When a product moves into the design stage, Advantech will supply a reference design guide for the carrier board. The carrier board design guide provides pin definitions for the COM connector with limitations and recommendations for carrier board design. Customers have access to a clear guideline during their carrier board development. Regarding different form factors, Advantech offers a complete pin-out check list for different form factors such as Q7, ULP, and RTX2.0, so that customers can examine the carrier board signals and layout design accordingly. In addition, our team is able to assist customers review the placement/layout and schematics to ensure the carrier board design meets their full requirements. For software development, Advantech RISC software team can help customers establish an environment for software development and evaluate the amount of time and resources needed. If customers outsource software development to a third party, Advantech can also cooperate with the third party to provide proficient consulting services. With Advantech's professional support, the design process becomes much easier and product quality will be improved to meet customer targets.

Integration Stage

This phase comprises HW/SW integration, application development, and peripheral module implementation. Due to the lack of knowledge and experience on platforms, customers need to spend a certain amount of time analyzing integration problems. In addition, peripheral module implementation is relevant to driver designs on carrier boards, RISC platforms usually have less support for ready-made drivers on the carrier board, therefore customers have to learn by trial and error to get the best solution with the least effort. Advantech's team has years of experience in customer support and HW/SW development. We can support customers with professional advice and information to shorten development time and enable more effective product integration.

Validation stage

After customer's ES sample is completed, the next step is a series of verification procedures. In addition to verifying a product's functionality, the related test of the product's efficiency is also an important part at this stage especially for RISC platforms.

Advantech helps customers solve their problems in the testing process and will give suggestions and tips as well. Through an efficient verification process backed by our technical support, customers are able to optimize their applications with less fuss. Furthermore, Advantech's team can provide professional consulting services about further testing and equipment usage, so customers can find the right tools to efficiently identify and solve problems to further enhance their products quality and performance.

5.2 Contact Information

Below is the contact information for Advantech customer service

Region/Country	Contact Information
America	1-888-576-9688
Brazil	0800-770-5355
Mexico	01-800-467-2415
Europe (Toll Free)	00800-2426-8080
Singapore & SAP	65-64421000
Malaysia	1800-88-1809
Australia (Toll Free)	1300-308-531
China (Toll Free)	800-810-0345 800-810-8389 Sales@advantech.com.cn
India (Toll Free)	1-800-425-5071
Japan (Toll Free)	0800-500-1055
Korea (Toll Free)	080-363-9494 080-363-9495
Taiwan (Toll Free)	0800-777-111
Russia (Toll Free)	8-800-555-01-50

You can also reach our service team through the website below; our technical support engineer will provide quick response once the form is filled out:

http://www.advantech.com.tw/contact/default.aspx?page=contact_form2&subject=Technical+Support

5.3 Technical Support and Assistance

5.3.1 Warranty Policy

Below is the warranty policy for Advantech products:

5.3.1.1 Warranty Period

Advantech branded off-the-shelf products and third party off-the-shelf products used to assemble Advantech's Configure-to-Order products are entitled to a two year complete and prompt global warranty service. Product defects in design, materials, and workmanship are covered from the date of shipment.

All customized products will, by default, carry a 15-month regional warranty service. The actual product warranty terms and conditions may vary based on sales contract.

All third party products purchased separately will be covered by the original manufacturer's warranty and time period, and shall not exceed one year of coverage through Advantech.

5.3.1.2 Repairs Under Warranty

It is possible to obtain a replacement (Cross-Shipment) within the first 30 days of purchase through your original Advantech supplier. Arrange Dead on Arrival (DOA) replacement if the products purchased directly from Advantech are DOA. The DOA Cross-Shipment excludes any shipping damage to customized and/or build-to-order products.

For those products which are not DOA, the return fee to an authorized ADVANTECH repair facility will be the customers' expense. The return shipping fee for refurbished products from Advantech to the customers' sites will be Advantech's expense.

5.3.1.3 Exclusions From Warranty

The product is excluded from warranty if:

- The product has been found to be defective after expiry of the warranty period.
- Warranty has been voided by removal or alternation of product or part identification labels.
- The product has been misused, abused, or subjected to unauthorized disassembly/modification; placed in an unsuitable physical or operating environment, improperly maintained by the customer, or a failure for which Advantech is not responsible—whether by accident or other cause. Such conditions will be determined by Advantech at its sole unfettered discretion.
- The product is damaged beyond repair due to a natural disaster such as a lighting strike, flood, earthquake, etc.
- Product updates/upgrades and tests upon the request of customers who are without warranty.

5.3.2 Repair Process

5.3.2.1 Obtaining an RMA Number

All returns from customers must be authorized with an Advantech Return Merchandise Authorization (RMA) number. Any returns of defective units or parts without valid RMA numbers will not be accepted; they will be returned to the customer at the customer's cost without prior notice.

An RMA number is only an authorization for returning a product; it is not an approval for repair or replacement. When requesting an RMA number, please access Advantech's RMA web site: http://erma.Advantech.com.tw with an authorized user ID and password.

You must fill out basic product and customer information as well as describe the problems encountered in detail in "Problem Description". Vague entries such as "does not work" or "failure" are not acceptable.

If you are uncertain about the cause of the problem, please contact Advantech's Application Engineers (AE). They may be able to find a solution that does not require sending the product for repair.

The serial number of the whole set is required if only a key defective part is returned for repair. Otherwise, the case will be regarded as out-of-warranty.

5.3.2.2 Returning Products for Repair

It's possible customers can save time and meet end-user requirements by returning defective products to any authorized Advantech repair facility without an extra cross-region charge. You are required to contact the local repair center before requesting global repair services.

It is recommended that you send cards without accessories (manuals, cables, etc.). Remove any unnecessary components from the card, such as CPU, DRAM, and CF Card. If you send all these parts back (because you believe they may be part of the problem), please note their inclusion clearly. Otherwise, Advantech is not responsible for any items not listed. Make sure the "Problem Description" is enclosed.

European Customers that are located outside European Community should use UPS as the forwarding company. We strongly recommend adding a packing list to all shipments. Please prepare a shipment invoice according to the following guidelines to decrease goods clearance time:

1. Give a low value to the product on the invoice, or additional charges will be levied by customs that will be borne by the sender.
2. Add information "Invoice for customs purposes only with no commercial value" on the shipment invoice.
3. Show RMA numbers, product serial numbers and warranty status on the shipment invoice.
4. Add information about Country of origin of goods.
   In addition, please attach an invoice with RMA number to the package, then write the RMA number on the outside of the carton and attach the packing slip to save handling time. Please also address the parts directly to the Service Department and mark the package "Attn. RMA Service Department".

All products must be returned in properly packed ESD material or anti-static bags. ADVANTECH reserves the right to return un-repaired items at the customer's cost if they are inappropriately packed.

"Door-to-Door" transportation such as speed post is recommended for delivery, otherwise, the sender should bear additional charges such as clearance fees if Air-Cargo is adopted.

Should DOA cases fail, Advantech will take full responsibility for the product and transportation charges. If the items are not DOA, but fail within warranty, the sender will bear the freight charges. For out-of-warranty cases, customers must cover the cost and take care of both outward and inward transportation.

5.3.2.3 Service Charges

The product is excluded from warranty if:

- The product is repaired after expiry of the warranty period.
- The product is tested or calibrated after expiry of the warranty period, and a No Problem Found (NPF) result is obtained.
- The product, though repaired within the warranty period, has been misused, abused, or subjected to unauthorized disassembly/modification; placed in an unsuitable physical or operating environment; improperly maintained by the customer; or failure caused which Advantech is not responsible whether by accident or other cause. Such conditions will be determined by Advantech at its sole unfettered discretion.
- The product is damaged beyond repair due to a natural disaster such as a lighting strike, flood, earthquake, etc.
- Product updates and tests upon the request of customers who are without warranty.

If a product has been repaired by V, and within three months after such a repair the product requires another repair for the same problem, Advantech will do this repair free of charge. However, such free repairs do not apply to products which have been misused, abused, or subjected to unauthorized disassembly/modification; placed in an unsuitable physical or operating environment; improperly maintained by the customer; or have failed for reasons in which Advantech is not responsible whether by accident or other cause.

Please contact your nearest regional service center for detailed service quotations.

Before we start out-of-warranty repairs, we will send you a pro forma invoice (P/I) with the repair charges. When you remit the funds, please reference the P/I number listed under "Our Ref". Advantech reserves the right to deny repair services to customers that do not return the DOA unit or sign the P/I. Meanwhile, Advantech will scrap defective products without prior notice if customers do not return the signed P/I within 3 months.

5.3.2.4 Repair Report

Advantech returns each product with a "Repair Report" which shows the result of the repair. A "Repair Analysis Report" is also provided to customers upon request. If the defect is not caused by Advantech design or manufacturing, customers will be charged US$60 or US$120 for in-warranty or out-of-warranty repair analysis reports respectively.

5.3.2.5 Custody of Products Submitted for Repair

Advantech will retain custody of a product submitted for repair for one month while it is waiting for return of a signed P/I or payment (A/R). If the customer fails to respond within such period, Advantech will close the case automatically. Advantech will take reasonable measures to stay in proper contact with the customer during this one month period.

5.3.2.6 Shipping Back to Customer

The forwarding company for RMA returns from Advantech to customers is selected by Advantech. Per customer requirement, other express services can be adopted, such as UPS, FedEx and etc. The customer must bear the extra costs of such alternative shipment. If you require any special arrangements, please indicate this when shipping the product to us.

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Please verify specifications before quoting. This guide is intended for reference purposes only.

All product specifications are subject to change without notice.