



User Manual

EPC-R3220

**TI ARM® Cortex®-A8 Sitara
Computer Box/IOT Gateway**

ADVANTECH

Enabling an Intelligent Planet

Copyright

The documentation and the software included with this product are copyrighted 2019 by Advantech Co., Ltd. All rights are reserved. Advantech Co., Ltd. reserves the right to make improvements in the products described in this manual at any time without notice. No part of this manual may be reproduced, copied, translated or transmitted in any form or by any means without the prior written permission of Advantech Co., Ltd. Information provided in this manual is intended to be accurate and reliable. However, Advantech Co., Ltd. assumes no responsibility for its use, nor for any infringements of the rights of third parties, which may result from its use.

Acknowledgements

ARM is a trademark of ARM Corporation.

NXP is a trademark of NXP Corporation.

All other product names or trademarks are properties of their respective owners.

Product Warranty (2 years)

Advantech warrants to you, 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 which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which 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 of our customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult your dealer for more details.

If you think you have a defective product, follow these steps:

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 you get 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 an RMA (return merchandise authorization) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.
5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

Declaration of Conformity

FCC Class B

Note: 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 when the equipment is operated in a commercial environment. 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. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Technical Support and Assistance

1. Visit the Advantech web site at www.advantech.com/support where you can find the latest information about the product.
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 you call:
 - 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, which if not observed, can cause personal injury!*



Caution! *Cautions are included to help you avoid damaging hardware or losing data e.g. There is a danger of a new battery exploding if it is incorrectly installed. Do not attempt to recharge, force open, or heat the battery. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.*



Note! *Notes provide optional additional information.*



Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it 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. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. 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 by transient overvoltage.
12. Never pour any 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 one of the following situations arises, get the equipment checked by service personnel:
 - The power cord or plug is damaged.
 - Liquid has penetrated into the equipment.
 - The equipment has been exposed to moisture.
 - The equipment does not work well, or you cannot get it to work according to the user's manual.
 - The equipment has been dropped and damaged.
 - The equipment has obvious signs of breakage.

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

Safety Precaution - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

- To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.

Document Feedback

To assist us in making improvements to this manual, we would welcome comments and constructive criticism. Please send all such - in writing to: support@advantech.com

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 EPC-R3220 Box Computer
- 2 x 10P for COM/GPIO
- 1 x PLUG-IN BLOCK 2P for DC-In
- 1 x China Rohs

Optional Accessories

Part No.	Description
1950016423T101	DIN RAIL(BLACK WEAVE)ASS'Y FOR ICE-3105
1960056982T003	MOUNTING BRACKET 2U2X DS-780
ROM-ED20-00A1E	debug adapter board
1700020442-01	debug cable
1700023307-01	A cable DC JACK/Plug-in 1*2P-5.0 10cm
96PSA-A36W12R1	A/D 100 ~ 240 V, 36 W, 12 V
1700001524	Power cord 3P UL 10A 125 V 180 cm
170203180A	Power Code 3P UK 2.5A/3A 250V 1.83cm
170203183C	Power Code 3P Europe 183cm
1700019146	Power Cord CCC 3P 10A 250V 183cm
SQF-ISDM1-8G-21C	SQF I-SD UHS-I MLC 8G (0~70°C)
SQF-ISDM1-8G-21E	SQF I-SD UHS-I MLC 8G (-40~85°C)
968AD00479	EC20CEFAG-MINIPCIE R2.1 LTE Cat 4 for China
1750008424-01	LTE Antenna Dipole L=148.5mm 4dBi A9703021
1750008461-01	Cable Ant. SMA/F-R-BH R/A MHF/113 WHT L83 WWAN1
1750008800-01	Cable Ant.SMA/F-R-BH MFH4/113 BLK L100 for wifi
1750008772-01	2Dipole Ant.D.B 2.4+5G WIFI 3/4.4dBi SMA/M-R BLK for wifi
1750002842	Wireless Antenna R-AN2450-5701RS R/P SMA.M10.9cm for wifi

Ordering Information

P/N	Description
EPC-R3220IS-OLA1	EPC-R3220 AM3352 800MHz,1GDDR,8GeMMC,-20~70

Content

Chapter 1	General Introduction	1
1.1	Introduction	2
1.2	Product Features.....	2
1.2.1	Specifications.....	2
1.3	Mechanical Specifications.....	3
1.4	Electrical Specifications	3
1.5	Environmental Specifications	3
Chapter 2	H/W Installation.....	5
2.1	Introduction	6
2.2	EPC-R3220 I/O Overview	6
2.3	ECP-R3220 Connectors Outside	7
2.3.1	Ethernet	7
2.3.2	GPIO/COM.....	8
2.3.3	DC-IN	8
2.3.4	LED	9
2.3.5	SIM and SD Slot	9
2.3.6	Reset.....	9
2.3.7	USB OTG.....	10
2.3.8	Antenna Hole	10
2.3.9	DB9 Hole.....	10
2.4	ECP-R3220 Connectors Inside	11
2.4.1	I2C	11
2.4.2	SPI	12
2.4.3	Debug Port.....	12
2.5	Quick Start Guide.....	13
2.5.1	Debug Port Connection.....	13
2.5.2	Debug Port Settings.....	13
	Figure 2.1 HyperTerminal Settings for Terminal Setup	13
Chapter 3	Software Functionality	15
3.1	Test Tools	16
3.2	GPIO Test	16
3.2.1	Programmable GPIO Test	17
3.3	I2C Test.....	18
3.4	LAN Test	20
3.5	RS232 Test	22
3.6	RS485 Test	23
3.7	Use 4G	24
3.8	M.2 Mvnl. WIFI/BT Test	24
3.8.1	Wi-Fi Testing.....	24
3.8.2	Bluetooth Testing.....	25
3.9	Time And Date Settings	25
3.10	OTG Testing.....	26
Chapter 4	Embedded O.S	27
4.1	Introduction	28
4.2	Debug Message	28
	Figure 4.1 HyperTerminal Settings for Serial Console Setup	29

Chapter	5	Advantech Services	31
5.1		RISC Design-in Services	32
5.2		Contact Information.....	35
5.3		Global Service Policy	36
	5.3.1	Warranty Policy.....	36
	5.3.2	Repair Process	36

Chapter 1

General Introduction

This chapter gives background information on the EPC-R3220

Sections include:

- Introduction
- Specifications

1.1 Introduction

EPC-R3220 is a RISC-based box computer integrated with the TI Sitara AM3352 Cortex-A8 0.8GHz processor. It is designed for applications that require multiple connectivity points and low power consumption. The EPC-R3220 offers dual RS-232/485 serial ports with Modbus/OPC-UA protocol support for data collection, 6 GPIOs for indication or device control, dual 10/100/1000 Ethernet ports, one wifi/BT onboard solution, and one Mini-PCIE that can expand to an LTE solution. EPC-R3220 supports wide-ranging power input and temperature and supports both DIN-rail and wall mounting.

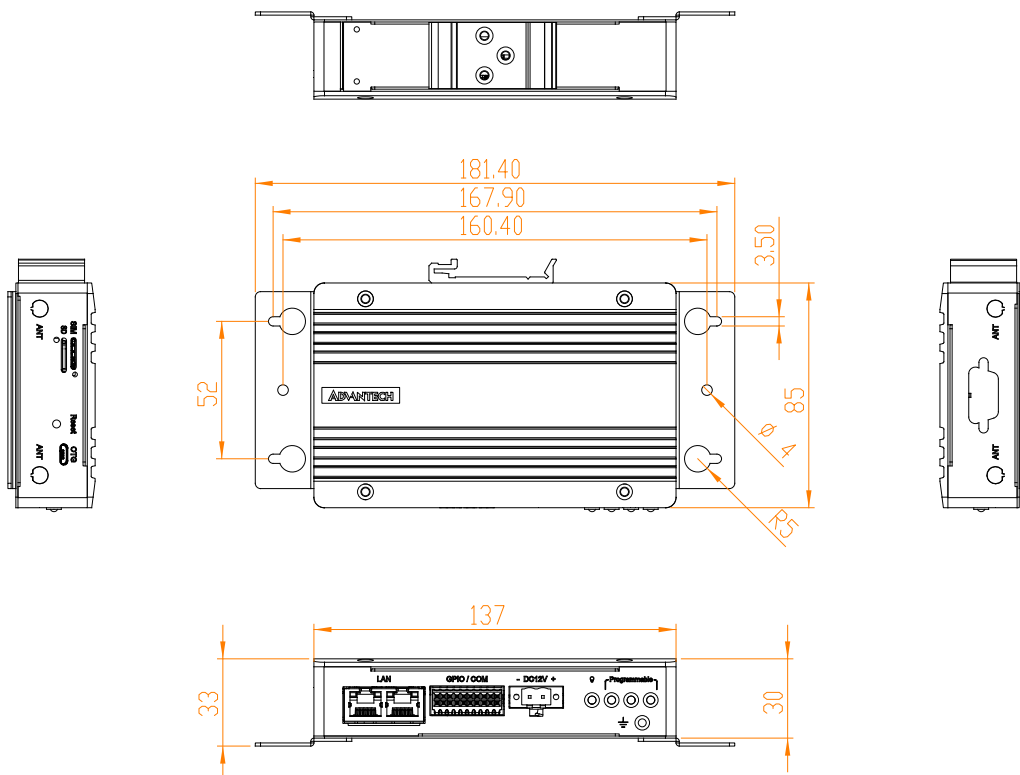
1.2 Product Features

1.2.1 Specifications

Module Name		EPC-R3220
Processor	SOC	TI AM3352
	Spec.	Cortex-A8 800MHz
Memory	Technology	DDR3L
	Capacity	onboard 1GB
	Flash	8GB eMMC NAND Flash / 4MB QSPI NOR FLASH
Ethernet	Chipset	RTL8211E
	Speed	2x10/100/1000Mbit
WLAN	WIFI/BT	IEEE 802.11ac/a/b/g/n 2*2 WLAN+BT 4.2 On board (option)
Watch Dog Timer		MSP430G2202 (timeout: 1 ~ 6553s, default 60s/power on/off 1s)
RTC		yes
I/O	GPIO	6
	RS232/485	2, 4wires,
	USB/OTG	1
	SPI	1
	I2C	1
	Debug	1
Expansion	Mini-PCIE	1/USB signal only
	SIM Slot	1 x Nano SIM slot
	SD socket	1 x Mirco SD slot
LED system indicators		4 (1 x Power on, 3 x User programmable)
Button		Reset button
Power	Power Supply	12~24V
	Power Type	2-pole lockable DC-in
	Consumption	4.7W (burning)
SW	OS	Linux yocto2.4
	Protocols	MQTT
		ModBUS/OPCUA
Mechanical	PCB	2.5 inch
	System	139x85x30mm
Mounting		Wall mount/Din rail mount (option)
Environment	Operating Temp.	-20~70°C
	Storage Temp.	-40~85°C
	Operating Humidity	5%~95% Relative Humidity, non-condensing
Certification		CE/FCC/CCC/BSMI ClassB

1.3 Mechanical Specifications

- **Dimension:** 139*85*30 mm
- **Reference Weight:** 1.26kg (including whole package)



1.4 Electrical Specifications

- **Power Supply Type:** DC-in 12V
- **RTC Battery:**
 - Typical voltage: 3V
 - Normal discharge capacity: 210 mAh

1.5 Environmental Specifications

- **Operating Temperature:** -20~70°C (-4~158°F)
- **Operating Humidity:** 0% ~ 90% relative humidity, non-condensing
- **Storage Temperature:** -40~85°C (-40~185°F)
- **Storage Humidity:** 60°C @ 95% RH Non-condensing

Chapter 2

H/W Installation

This chapter gives mechanical and connector information on the EPC-R3220

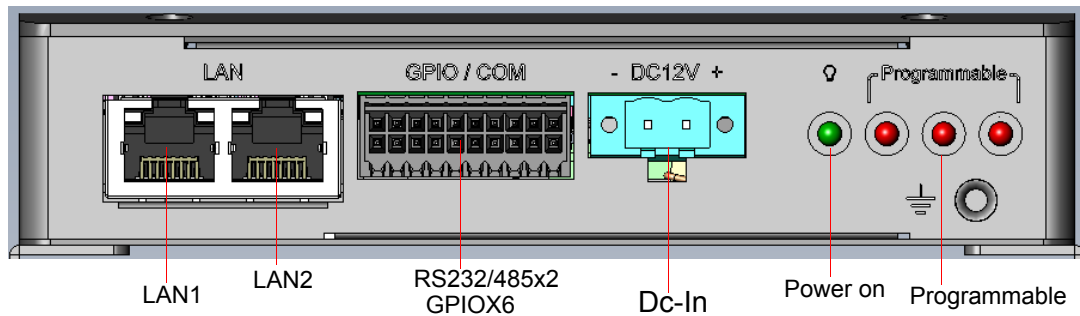
- Sections include:
- Connector Information
- Mechanical Drawing
- Quick Start Guide

2.1 Introduction

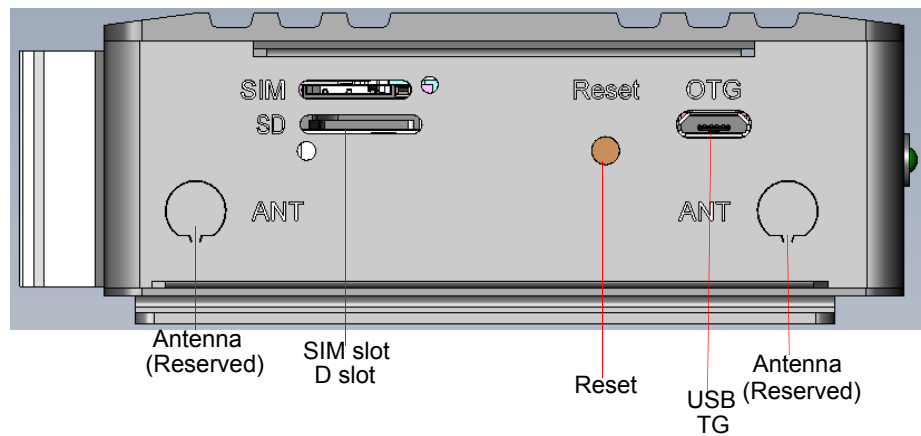
The following sections show the external connectors and pin assignments for applications.

2.2 EPC-R3220 I/O Overview

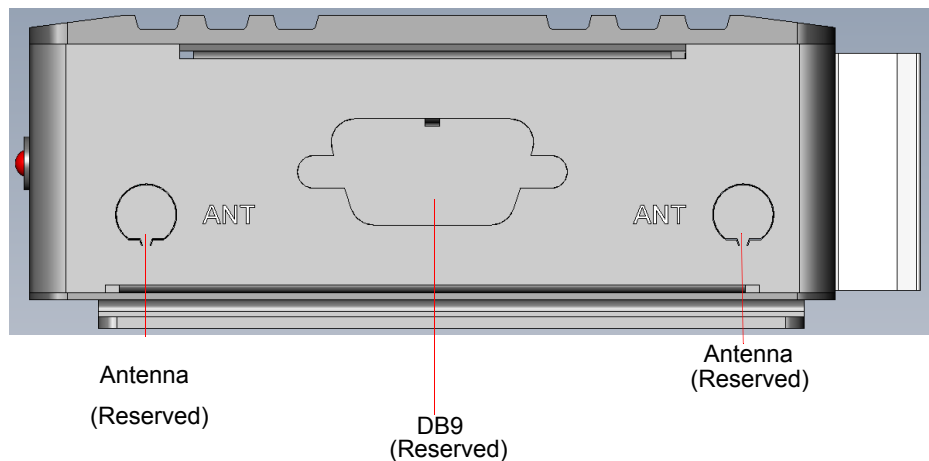
Front I/O



Left-Side



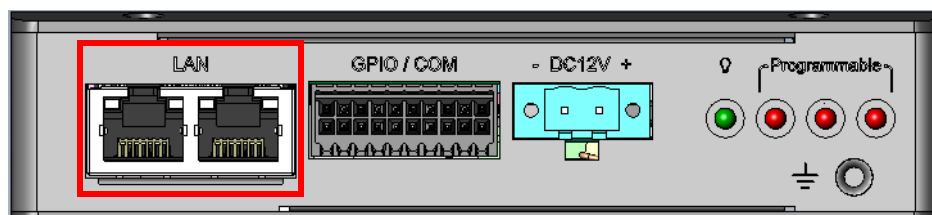
Right-Side



2.3 ECP-R3220 Connectors Outside

2.3.1 Ethernet

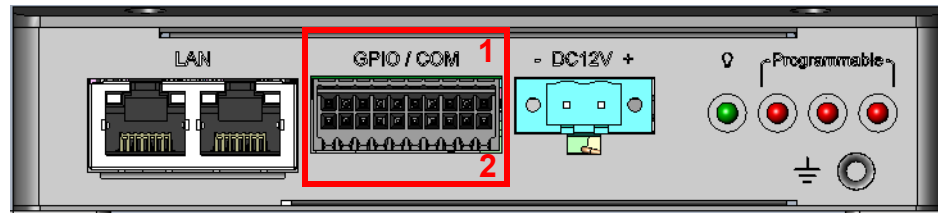
Here is the Dual RJ45 connector for Ethernet connectivity



Pin	Description	Pin	Description
A1	GND	B1	GND
A2	MDI10+	B2	MDI20+
A3	MDI10-	B3	MDI20-
A4	MDI11+	B4	MDI21+
A5	MDI11-	B5	MDI21-
A6	MDI12+	B6	MDI22+
A7	MDI12-	B7	MDI22-
A8	MDI13+	B8	MDI23+
A9	MDI13-	B9	MDI23-
A10	GND	B10	GND
LA1	LAN1_100_LINK	LB1	LAN2_100_LINK
LA2	LAN1_1000_LINK	LB2	LAN2_1000_LINK
LA3	LAN1_ACT	LB3	LAN2_ACT
LA4	+3.3V	LB4	+3.3V

2.3.2 GPIO/COM

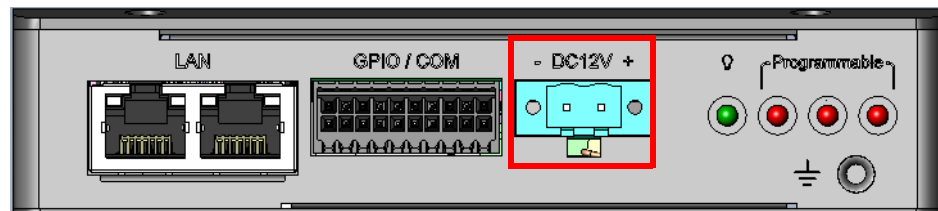
Here is a 20pin Terminal Block that supports 2xRS232/485 and GPIOs



Pin	Description	Pin	Description
1	+5V_OUT	2	+12V_OUT
3	COM1_DCD	4	COM2_DCD
5	COM1_RXD	6	COM2_RXD
7	COM1_TXD	8	COM2_RXD
9	COM1_RTS	10	COM2_RTS
11	COM1_CTS	12	COM2_CTS
13	GND	14	GND
15	EXT_GPIO0	16	EXT_GPIO3
17	EXT_GPIO1	18	EXT_GPIO4
19	EXT_GPIO2	20	EXT_GPIO5

2.3.3 DC-IN

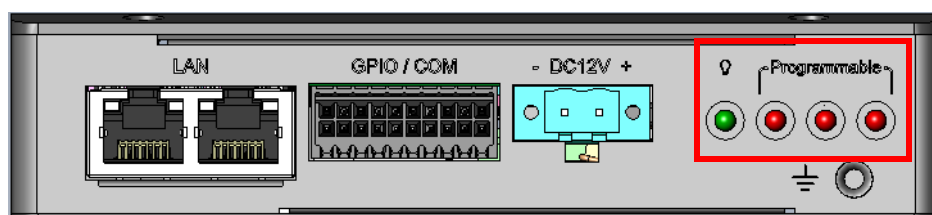
EPC-R3220 supports 12~24V DC-in



Pin	Description
1	DC12~24V
2	GND

2.3.4 LED

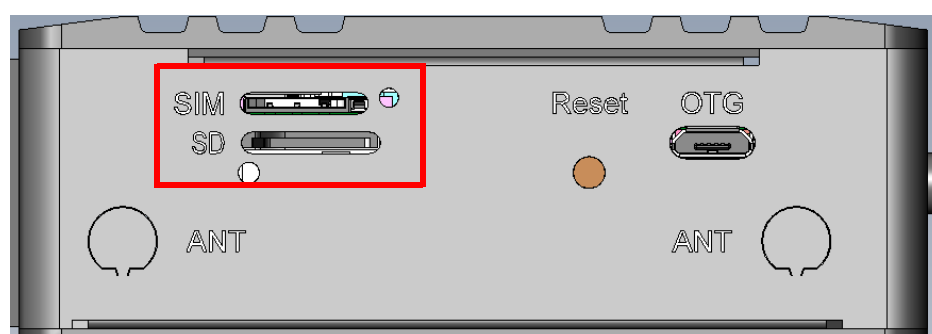
EPC-R3220 has four LEDs. One is for Power-on indication. The other three are programmable by customization.



Pin	Description	GPIO
1	Power on LED	NA
2	Programmable LED1	GPIO3_15
3	Programmable LED2	GPIO3_16
4	Programmable LED3	GPIO3_17

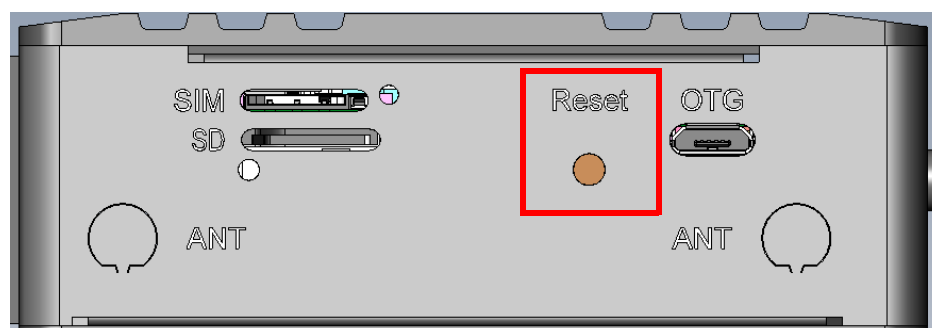
2.3.5 SIM and SD Slot

EPC-R322 supports a Nano SIM slot and Mirco SD slot



2.3.6 Reset

There is one Reset button for system HW reboot



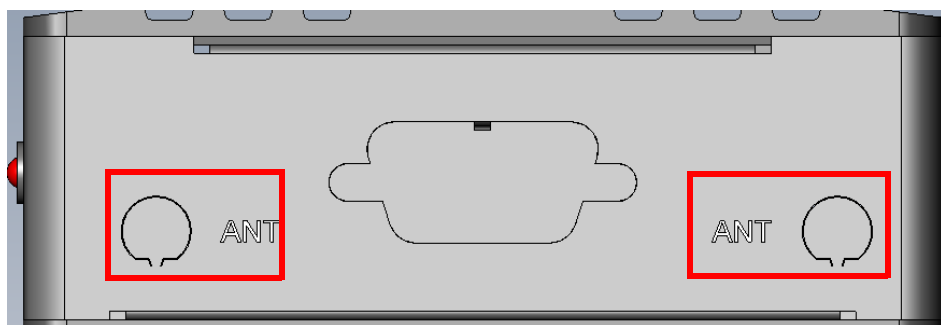
2.3.7 USB OTG

There is one OTG port for system debug



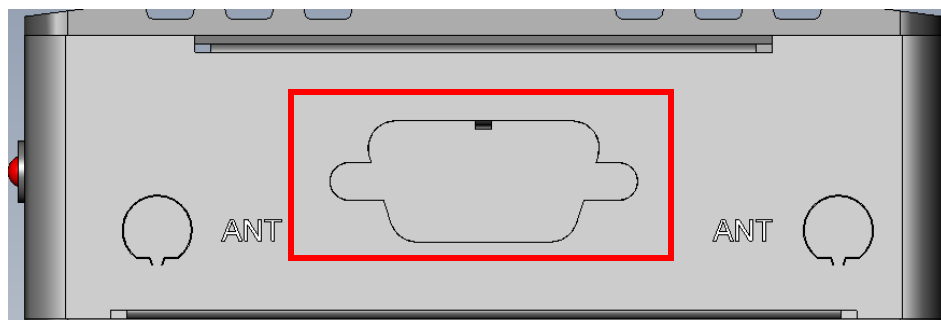
2.3.8 Antenna Hole

There are four antenna holes reserved for Wi-Fi/BT/LTE solution

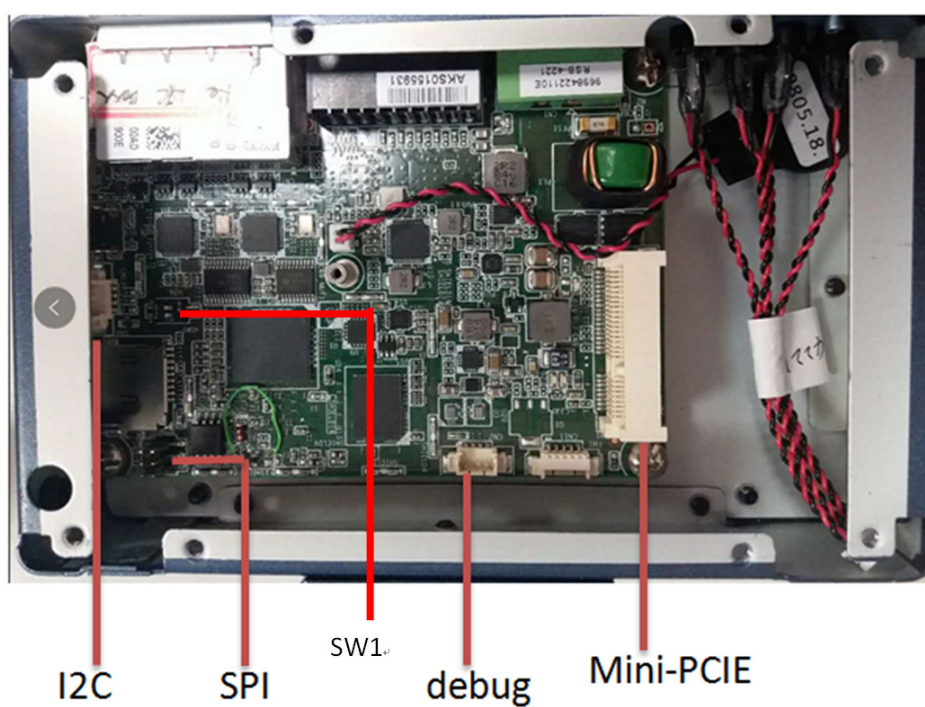


2.3.9 DB9 Hole

There is one DB9 hole for expansion

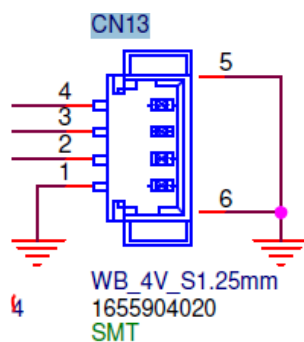


2.4 ECP-R3220 Connectors Inside



2.4.1 I2C

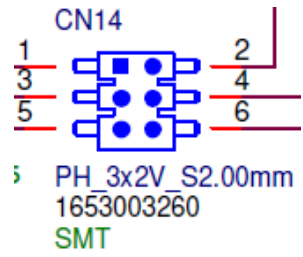
There is connector CN13 for I2C



Pin	Description
1	GND
2	I2C1_SDA
3	I2C1_SCL
4	+3.3V

2.4.2 SPI

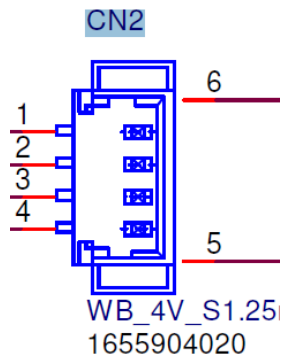
There is connector CN14 for SPI



Pin	Description
1	+3.3V
2	GND
3	SPI1_CS0
4	SPI1_SCLK
5	SPI1_D0
6	SPI1_D1

2.4.3 Debug Port

There is connector CN14 for Debugging





Pin	Description
1	+3.3V
2	UART_TXD
3	UART_RXD
4	GND

2.5 Quick Start Guide

2.5.1 Debug Port Connection

1. Connect debug cable to debug port
2. Connect the other side of debug adapter to USB-to-RS232 cable then connect to your PC

Item	PN	Picture
Debug cable	1700020442-01	
Debug adapter	ROM-ED20-00A1E	

2.5.2 Debug Port Settings

EPC-R3220 can communicate with a host server by using serial cables. Common serial communication programs such as HyperTerminal, Tera Term or PuTTY can be used in this case. The example below describes the serial terminal setup using HyperTerminal on a Windows host:

1. Connect EPC-R3220 with your PC by using a serial cable.
2. Open HyperTerminal on your Windows PC, and select the settings as shown in Figure 2-7.
3. After the bootloader is programmed on SD card, insert power adapter connector to DC jack on EPC-R3220 to power up the board. The bootloader prompt is displayed on the terminal screen.

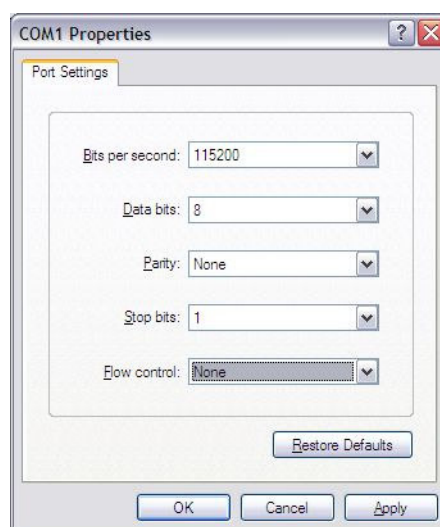


Figure 2.1 HyperTerminal Settings for Terminal Setup

Chapter 3

Software Functionality

This chapter details the software programs on the EPC-R3220 platform


```

root@am335xepcr3220a1:~# cd /sys/class/gpio
root@am335xepcr3220a1:/sys/class/gpio# ls
export          gpio492          gpio495          gpio500          gpio503
gpiochip490     gpiochip96
gpio490         gpio493          gpio498          gpio501          gpiochip0
gpiochip506     unexport
gpio491         gpio494          gpio499          gpio502          gpiochip32
gpiochip64

```

Example of testing GPIO

procedure A:

Connect GPIO0 with GPIO3.

Set GPIO0 GPO(out).

```

# cd /sys/class/gpio/
# echo out > ./gpio490/direction
# cat ./gpio490/direction
out

```

Set GPIO0 GPO value "1"

```

# echo 1 > ./gpio490/value

```

procedure B:

Set GPIO3 GPI (in)

```

# echo in > ./gpio493/direction
# cat ./gpio493/direction
in

```

Get GPIO3 GPI value

```

# cat ./gpio493/value
1

```

As you can see in above procedures A and B, we set gpio0 as GPO and GPIO3 as GPI. Once we send data out from GPIO0, it should be able to receive the same data from GPIO3.

3.2.1 Programmable GPIO Test

Pin	Description	GPIO	
1	Programmable LED1	GPIO3_15	GPIO111
2	Programmable LED2	GPIO3_16	GPIO112
3	Programmable LED3	GPIO3_17	GPIO113

Command:

```

echo 111>/sys/class/gpio/export
echo "out">/sys/class/gpio/gpio111/direction
echo 1>/sys/class/gpio/gpio111/value    ← Led will turn on

```

3.3 I2C Test

There are two I2C buses in EPC-R3220, but only one reserved as a pin header for customers while the other one is for EPC-R3220 internal use.

```
# ls /sys/class/i2c-dev
i2c-0  i2c-1
# i2cdetect -l
i2c-1  i2c      OMAP I2C adapter          I2C
adapter
i2c-0  i2c      OMAP I2C adapter          I2C
adapter
```

Please try the command below to see if there is any device connected to i2c bus 0.

```
# i2cdetect -y -r 0
      0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:      -- -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- UU -- -- -- -- -- UU -- -- -- UU -- --
30: UU UU UU UU UU UU UU UU -- -- -- -- -- -- --
40: -- -- -- -- 44 -- -- -- -- -- -- -- -- -- --
50: -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- -- --
```

You can try below command to know I2C bus is work or not.

```
# i2cdump -y -f 0 0x2d
No size specified (using byte-data access)
      0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
0123456789abcdef
00: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
.....
10: 00 00 00 00 00 00 00 00 00 00 00 00 00 9f 0d 09 00
.....???.
20: 41 2d 2b 00 25 2b 00 05 00 00 00 00 00 00 00 00  A-
+.%+.?.....
30: 09 0d 01 0d 0d 0d 09 01 0d 00 00 00 00 00 00 28 70
?????????.....(p
40: 35 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
5.....
50: 12 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
??.....
60: 0a 0a 0a 0a 0a 0a 00 00 00 00 00 00 00 00 00 00 00
??????.....
70: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
.....
80: 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
?.....
90: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
.....
a0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
.....
b0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
.....
c0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
.....
d0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
.....
e0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
.....
f0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
.....
```

3.4 LAN Test

EPC-R3220 sets DHCP as default network protocol

```
# ifconfig -a
eth0      Link encap:Ethernet  HWaddr C4:00:AD:38:3E:A9
           inet  addr:192.168.2.191    Bcast:192.168.2.255
Mask:255.255.255.0
           inet6 addr: fe80::c600:adff:fe38:3ea9%775872/64
Scope:Link
           UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
           RX packets:361564 errors:0 dropped:734 overruns:0
frame:0
           TX packets:798076 errors:0 dropped:0 overruns:0 car-
rier:0
           collisions:0 txqueuelen:1000
           RX bytes:25659968 (24.4 MiB)  TX bytes:1135201297
(1.0 GiB)
           Interrupt:47

eth1      Link encap:Ethernet  HWaddr C4:00:AD:38:3E:AA
           UP BROADCAST MULTICAST  MTU:1500  Metric:1
           RX packets:0 errors:0 dropped:0 overruns:0 frame:0
           TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
           collisions:0 txqueuelen:1000
           RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

lo        Link encap:Local Loopback
           inet addr:127.0.0.1  Mask:255.0.0.0
           inet6 addr: ::1%775872/128 Scope:Host
           UP LOOPBACK RUNNING  MTU:65536  Metric:1
           RX packets:95235 errors:0 dropped:0 overruns:0
frame:0
           TX packets:95235 errors:0 dropped:0 overruns:0 car-
rier:0
           collisions:0 txqueuelen:1000
           RX bytes:4989929 (4.7 MiB)  TX bytes:4989929 (4.7
MiB)

mlan0     Link encap:Ethernet  HWaddr A8:1D:16:3C:50:8D
           BROADCAST MULTICAST  MTU:1500  Metric:1
           RX packets:0 errors:0 dropped:0 overruns:0 frame:0
           TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
           collisions:0 txqueuelen:1000
           RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
```

```

sit0      Link encap:IPv6-in-IPv4
          NOARP  MTU:1480  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

uap0      Link encap:Ethernet  HWaddr A8:1D:16:3C:51:8D
          BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

wfd0      Link encap:Ethernet  HWaddr AA:1D:16:3C:50:8D
          BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

```

If you would like to config IP manually, please use command below:

```
# ifconfig eth0 xxx.xxx.xxx.xxx netmask xxx.xxx.xxx.xxx up
```

Here is a real case for your reference. The hosts (EPC-R3220) IP is 192.168.0.10; the target (A desktop computer) IP is 192.168.0.12

```

# ifconfig eth0 down
# ifconfig eth0 192.168.0.10 netmask 255.255.255.0 up
# ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:04:9F:01:30:E0
          inet  addr:192.168.0.10  Bcast:192.168.0.255
Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

```

The target computer (Client) IP address is 192.168.0.12, so we can use below command to see if we can get any response from the client.

```
# ping 192.168.0.12

PING 192.168.0.12 (192.168.0.12): 56 data bytes
64 bytes from 192.168.0.12: seq=0 ttl=128 time=7.417 ms
64 bytes from 192.168.0.12: seq=1 ttl=128 time=0.203 ms
64 bytes from 192.168.0.12: seq=2 ttl=128 time=0.300 ms

--- 172.17.20.192 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
```

Note! The target computer (Client) firewall needs to be closed.



3.5 RS232 Test

As you can see below, there are 2 UART supported by EPC-R3220. /dev/ttyO0 is reserved for EPC-R3220 debug port, /dev/ttyO3 and /dev/ttyO4 could be applied by user. Connect loopback to UART3.

```
# ls /dev/ttyO*
/dev/ttyO0 /dev/ttyO3 /dev/ttyO4
# cd /unit_tests
# ./Loop_uart232 /dev/ttyO3

====loopback test rs232!====

+-----+
| [RS232] Test Pass! |
+-----+
```

3.6 RS485 Test

Both /dev/ttyO3 and /dev/ttyO4 support RS485 communication. You can switch to RS485 mode by modifying the GPIO state.

UART3:

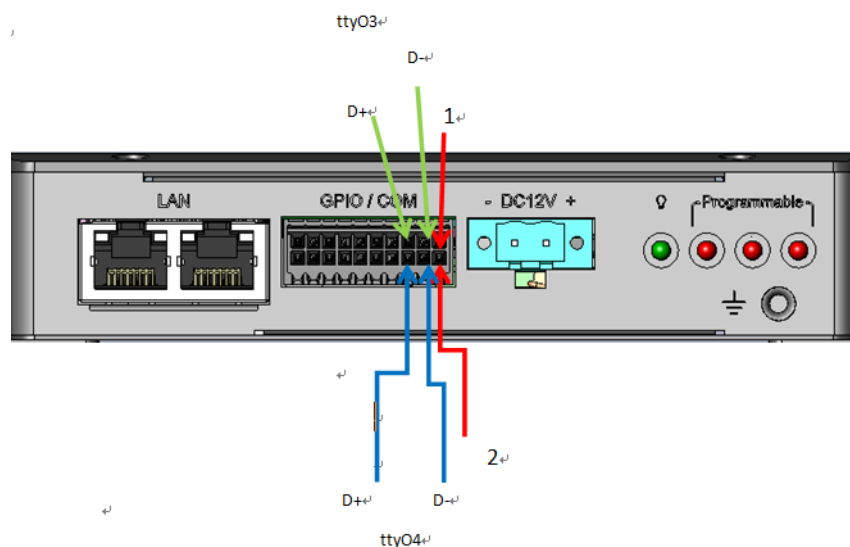
	gpio498	gpio499	gpio500
RS232	1	0	1
RS485	0	1	1

UART4:

	gpio501	gpio502	gpio503
RS232	1	0	1
RS485	0	1	1

If you want to make the serial port work at 485 mode by default when the system starts up, you can do this by modifying the device tree. The boot directory of rootfs has a device tree named am335x-epcr3220a1-rs485.dtb. Using this device tree when the system is started, then the working mode of all serial ports, has been changed to RS485.

When the serial port is changed to RS485 mode, you can use Minicom to communicate with other machines. If communication is normal, RS485 function is normal.



3.7 Use 4G

EPC-R3220 supports QUECTEL EC20 4G module:

Please modify your APN in /etc/ppp/peers/quectel-chat-connect firstly. The default configuration is Unicom's APN(3gnet). Then start the PPP dial using the following command:

```
# pppd call quectel-ppp &
```

Use the ifconfig command to see if there is a network device named ppp0:

```
# ifconfig -a
```

If the ppp0 exists, then use the following methods to test whether the network is normal:

```
# ping -I ppp0 www.advantech.com.cn
```

3.8 M.2 Mrvl. WIFI/BT Test

EPC-R3220 supports MarverlISD8897 wifi/bt modules throught M.2.

3.8.1 Wi-Fi Testing

Connect the marverll WIFI module to M.2 interface under EPC-R3220 board, the supported module is sd8897. Run program wpa_test.sh to connect WIFI.

```
# rfkill unblock all
# ifconfig wlan0 up
[ 34.200883] IPv6: ADDRCONF(NETDEV_UP): wlan0: link is not ready
# killall wpa_supplicant
killall: wpa_supplicant: no process killed
# echo "ctrl_interface=/var/run/wpa_supplicant" > /tmp/wpa.conf
# wpa_passphrase "advantech for guest" 12345678 >> /tmp/wpa.conf
# wpa_supplicant -B Dwext -imlan0 -c /tmp/wpa.conf
Successfully initialized wpa_supplicant
[ 113.720243] get_channel when STA is not connected
[ 113.757030] get_channel when STA is not connected
[ 113.767415] get_channel when STA is not connected
[ 113.936748] wlan: wlan0 START SCAN
[ 116.166626] wlan: SCAN COMPLETED: scanned AP count=19
[ 116.216666] supplicantQueryPassphraseAndEnable RSNEabled=0 ssid=advantech for guest
[ 116.224454] supplicantQueryPassphraseAndEnable RSNEabled=0 ssid=advantech for guest
[ 116.306725] wlan: Connected to bssid 6c:XX:XX:XX:d2:f8 successfully
[ 116.313056] IPv6: ADDRCONF(NETDEV_CHANGE): wlan0: link becomes ready
```



```
# wpa_cli -imlan0 scan
[ 132.335222] wlan: mlan0 START SCAN
OK
[ 134.826645] wlan: SCAN COMPLETED: scanned AP count=15
# udhcpc -i mlan0
udhcpc (v1.24.1) started
Sending discover...
Sending select for 172.21.195.56...
Lease of 172.21.195.56 obtained, lease time 28800
/etc/udhcpc.d/50default: Adding DNS 61.177.7.1
/etc/udhcpc.d/50default: Adding DNS 221.6.4.66
# ping -I mlan0 www.advantech.com.cn
```

3.8.2 Bluetooth Testing

Check the mac address of your Bluetooth device:

```
# hciconfig hci0
hci0: Type: BR/EDR Bus: SDIO
BD Address: 28:C2:DD:95:56:92 ACL MTU: 1021:7 SCO MTU: 120:6
UP RUNNING PSCAN
RX bytes:984 acl:0 sco:0 events:35 errors:0
TX bytes:794 acl:0 sco:0 commands:35 errors:0
```

Send file through Bluetooth:

```
# ussp-push 34:23:87:B7:B2:CA@ bt-test bt-test
```

Note! 34:23:87:B7:B2:CA is Mac address of the opposite device!



Receive file through Bluetooth:

```
# obexpushd -B
```

Note! The file will be received under current directory.



3.9 Time And Date Settings

```
# date -s "%Y-%m-%d %H:%M:%S"
```

If you want set 2019/9/20 12:25.you can set as below:

```
# date -s "2019-09-20 12:25:00"
```

3.10 OTG Testing

Step 1: Use USB Type A- Type A cable to connect the USB-OTG port of EUT and the USB port of PC.

Step 2: Copy 20MB xx file to EUT from PC

Step 3: Check the EUT xx file size was 20MB

Chapter 4

Embedded O.S

This chapter introduces how to build Linux systems and develop based the Android system

4.1 Introduction

EPC-R3220 platform is an embedded system with Linux kernel 4.14.79 inside. It contains all system-required shell commands and drivers ready for the EPC-R3220 platform. We do not offer IDE developing environment in EPC-R3220 BSP, users can evaluate and develop under Ubuntu 16.04 LTS environment.

There are five major boot components for Linux, “u-boot.img”, “zImage”, “am335xepcr3220xx.dtb” and “File System”. The “u-boot.img” is for initializing peripheral hardware parameters; the “zImage” is the Linux kernel image and the “File System” is for Linux O.S. used.

You will not be able to boot into the Linux environment successfully if one of above five files is missing from booting media (SD card or onboard flash).

The purpose of this chapter is to introduce software configuration and development of EPC-R3220 to you, so that you can develop your own application(s) efficiently.

EPC-R3220 application development is only in Linux host PC and you cannot develop your application on Windows/Android host PC. For now the official supported host version is Ubuntu 16.04 LTS, host PC in any other Linux version may have compatibility issue. In this case, we strongly recommend using Ubuntu 16.04 LTS installed to your host PC before start EPC-R3220 evaluation/development.

For detailed operation, please refer to Yocto Linux BSP Ver.4 User Guide for AM57xx/AM335x series from Wiki: http://ess-wiki.advantech.com.tw/view/Yocto_Linux_BSP_Ver.4_User_Guide_for_AM57xx/AM335x_series

If you already have a compiled BSP, please refer to Local development Section to build image and Create a Linux System Boot Media Section to create a boot media.

4.2 Debug Message

EPC-R3220 can connect to a host PC (Linux or Windows) by using the console cable and debug port adapter. In order to communicate with a host PC, serial communication programs such as HyperTerminal, Tera Term or PuTTY are required. Below are the detailed instructions for how to set up a serial console, a "HyperTerminal" on a Windows host:

1. Connect EPC-R3220 to your Windows PC by using serial cable, debug port adapter and console cable.
2. Open HyperTerminal on your Windows PC, and select the settings as shown in Figure 4.1.
3. Press "POWER" key to power up the board. The bootloader prompt is displayed on the terminal screen as shown in Figure 4.2.

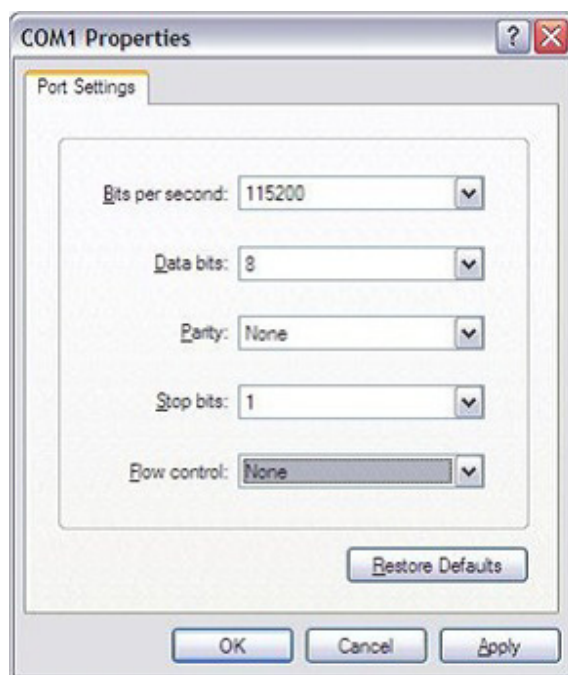
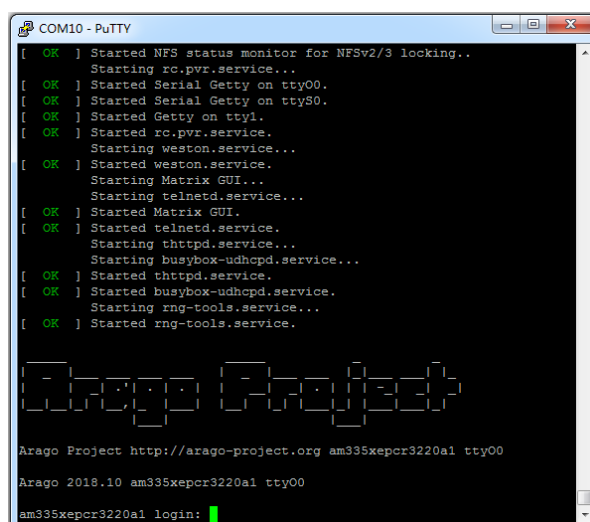


Figure 4.1 HyperTerminal Settings for Serial Console Setup

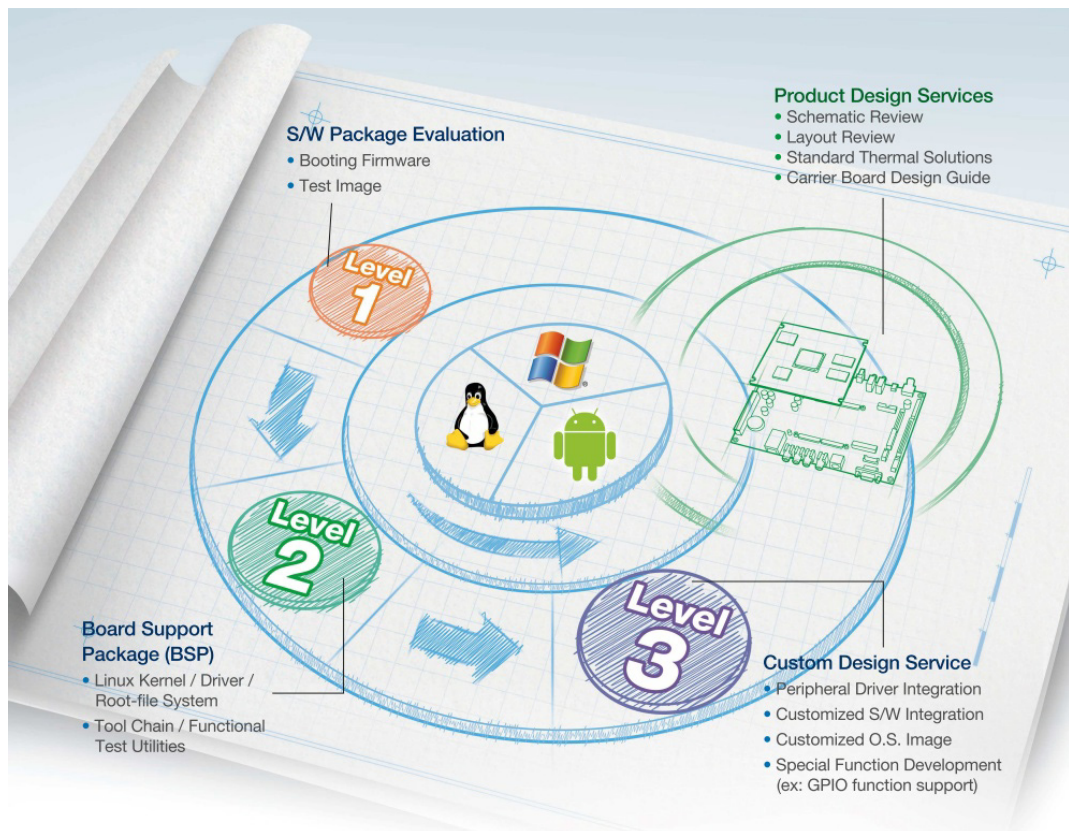


Chapter 5

Advantech Services

This chapter introduces Advantech design-in serviceability, technical support, and warranty policy for the EPC-R3220 evaluation kit

5.1 RISC Design-in Services



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

Easy Development

Advantech has support firmware, root file-system, BSP or other develop tools for customers. It helps customers to easy 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 easily 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. It helps to save a lot of time and cost with regard to developing 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 customer's thermal designs. Advantech provides thermal solution services including 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 lot of time and focus on their core development.

- Embedded Linux/ Android OS
- Advantech Bootloader Customization

With the spread of industrial computing, a whole range of new applications have been developed, resulting in a fundamental change in the IPC industry. In the past System Integrators (SI) were used to completing projects without outside assistance but now such working models have moved on. 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 module 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 found that customers usually have the following questions when implementing modular designs.

General I/O Design Capability

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

The Acquisition of Information

Even if the individual client is able to obtain sufficient information to make the right decision for the specialized vertical application, some customers encounter difficult problems dealing with platform design in general and communicating with CPU or chipset manufacturers, thereby increasing carrier board design difficulties and risk as well as seriously impacting on

Time-to-market and lost 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, SIs 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 design, so it's difficult for SIs to have an environment for software development.

In view of this, Advantech proposed the concept of Streamlined Design-in Support Services for RISC-based Computer On Modules (COM). With a dedicated professional design-in services team, 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 Freescale, Advantech helps solve communication and technical support difficulties and reduce the uncertainties of product development. Advantech's professional software team also focuses on providing a complete Board Support Package and assists customers to build up 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 to the following different phases:

Planning Stage

Before deciding to adopt Advantech RISC COM, customers must go through a complete survey process, including product features, specification, and compatibility testing with software. So, 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 evaluation board to assess RISC modules and test peripheral hardware. What's more, Advantech provides standard software Board Support

Package (BSP) for RISC COM allows customers to 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 WiFi, 3G, BT). Resolving customer concerns is Advantech's main target at this stage. Since product evaluation is a key task in the planning period, especially for performance and specifications, 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 design guide of the carrier board for reference. The carrier board design guide provides pin definitions of the COM connector with limitations and recommendations for carrier board design, so customers can have a clear guideline to follow 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 to review the placement/layout and schematics to ensure the carrier board design meets their full requirements. For software development, Advantech RISC software team can assist customers to establish an environment for software development and evaluate the amount of time and resources needed. If customers outsource software development to a 3rd party, Advantech can also cooperate with the 3rd party and provide proficient consulting services. With Advantech's professional support, the design process becomes much easier and product quality will be improved to meet their targets.

Integration Stage

This phase comprises of 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 on analyzing integration problems. In addition, peripheral module implementation has a lot to do with driver designs on carrier boards, RISC platforms usually have less support for ready-made drivers on the carrier board, therefore the customer has to learn from trial and error and finally get the best solution with the least effort. Advantech's team has years of experience in customer support and HW/SW development knowledge. Consequently, we can support customers with professional advice and information as well as shortening development time and enabling more effective product integration.

Validation stage

After customer's ES sample is completed, the next step is a series of verification steps. 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.

As a supportive role, Advantech primarily 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 reach our service team through the website below. Our technical support engineers 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 Global Service Policy

5.3.1 Warranty Policy

Below is the warranty policy of Advantech products:

5.3.1.1 Warranty Period

Advantech branded off-the-shelf products and 3rd party off-the-shelf products used to assemble Advantech Configure to Order products are entitled to a 2 years complete and prompt global warranty service. Product defect in design, materials, and workmanship, are covered from the date of shipment.

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

All 3rd 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) during the first 30 days of the purchase, thru your original ADVANTECH supplier to arrange DOA replacement if the products were purchased directly from ADVANTECH and the product is DOA (Dead-on-Arrival). The DOA Cross-Shipment excludes any shipping damage, 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 at the customers' expense. The shipping fee for reconstructive products from ADVANTECH back to customers' sites will be at 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 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/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 RMA (Return Merchandise Authorization) 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 ADVAN-

TECH'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 and describe the problems encountered in detail in "Problem Description". Vague entries such as "does not work" and "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 the Product for Repair

It's possible customers can save time and meet end-user requirements by returning defective products to an authorized ADVANTECH repair facility without an extra cross-region charge. It is required that you contact the local repair center before offering global repair service.

It is recommended to 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 clearly that they are included. 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 are requested to 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 carton, 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 unrepaired items at the customer's cost if inappropriately packed.

Besides that, "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 lightning strike, flood, earthquake, etc.
- Product updates and tests upon the request of customers who are without warranty.

If a product has been repaired by ADVANTECH, 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 failure caused which ADVANTECH is not responsible whether by accident or other cause.

Please contact your nearest regional service center for detail service quotation.

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.



Enabling an Intelligent Planet

www.advantech.com

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

All product specifications are subject to change without notice.

No part of this publication may be reproduced in any form or by any means, electronic, photocopying, recording or otherwise, without prior written permission of the publisher.

All brand and product names are trademarks or registered trademarks of their respective companies.

© Advantech Co., Ltd. 2019