AIC-100 USER Manual

Arm-based IoT System
NXP i. MX6ULL Arm® Cortex®-A7 Processor, Rugged, Compact,
-25°C to 70°C Operation

Vecow

1.4.0 Edition 20230609

Record of Revision

Version	Date	Page	Description	Remark
1.00	2021/09/13	All	Official Release	
1.10	2021/11/08	All	Update	
1.20	2021/12/30	3, 4, 6, 7, 53	Update	
1.30	2022/02/07	14	Update	
1.40	2023/06/09	54	Update	

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Declaration of Conformity

FCC

This equipment has been tested and found to comply with the limits for a Class A 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 it is not installed and used in accordance with the instruction manual, it 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.

CE

The products described in this manual complies with all applicable European Union (CE) directives if it has a CE marking. For computer systems to remain CE compliant, only CE-compliant parts may be used. Maintaining CE compliance also requires proper cable and cabling techniques.

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Order Information

Part Number	Description
AIC-100	AIC-100, NXP i.MX6ULL Arm Cortex-A7 Processor, 512MB SDRAM, 512MB Flash, 2 LAN, 1 USB 2.0, 2 COM RS-232/485, 1 Micro SD, 1 Mini PCIe, 9V to 50V DC, -25°C to 70°C
AIC-110	AIC-110, NXP i.MX6ULL Arm Cortex-A7 Processor, 512MB SDRAM, 512MB Flash, 2 LAN, 1 USB 2.0, 2 COM RS-232/485, 2 CAN Bus, Isolated DIO, 1 Micro SD, 1 Mini PCIe, 9V to 50V DC, -25°C to 70°C

Optional Accessories

Part Number	Description
PWA-12W-US	12W, 12V, 90V AC to 264V AC Power Adapter with 3-pin Terminal Block (US Type)
PWA-12W-EU	12W, 12V, 90V AC to 264V AC Power Adapter with 3-pin Terminal Block (EU Type)
PWA-18W-WT	18W, 12V, 85V AC to 264V AC Power Adaptor with 3-pin Terminal Block, Wide Temperature -30°C to +70°C
DIN-RAIL	DIN Rail Kit
TMK2-20P-100	Terminal Block 20-pin to Terminal Block 20-pin Cable, 100cm
TMK2-20P-500	Terminal Block 20-pin to Terminal Block 20-pin Cable, 500cm
TMB-TMBK-20P	Terminal Board with One 20-pin Terminal Block Connector and DIN-Rail Mounting
4G Module	Mini PCIe 4G/GPS Module with Antenna
WiFi & Bluetooth Module	Mini PCIe WiFi & Bluetooth Module with Antenna

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1

GENERAL INTRODUCTION

1.1 Overview

Vecow AIC-100 is an Arm-based Embedded System. Powered by NXP i.MX6 series processor with Arm Cortex-A7 core, Vecow AIC-100 delivers exceptional power efficiency and scalability and is optimized for IoT applications including Energy Management, Traffic Vision, Charging Station, and any AIoT scenarios.

The compact and cableless AIC-100 measures 91mm x 91mm x 32m and is packed full of I/O including 2 LAN, 1 USB, 2 COM, 2 CAN Bus and 1 Mini PCIe for 4G/LTE/WiFi/BT/GPRS/UMTS. Vecow AIC-100 supports Node-RED to provide easy communication for demanding IoT applications that need robust wireless and seamless connection.

To meet the challenges of IoT applications in fields, AIC-100 supports temperature ranging from -25°C to 70°C and 9V to 50V DC-in. For the booming innovative IoT applications everywhere in our living like energy management, building automation and charging station, Vecow AIC-100 provides reliable connectivity and simplifies data acquisition and processing, and ultra-compact dimension to fit into narrow space in different application fields.

1.2 Features

- Industrial-grade NXP i.MX6ULL Arm Cortex-A7 Processor
- 9V to 50V wide range DC Power Input
- Supports Node-RED browser-based flow editor
- 2 LAN, 1 USB 2.0, 2 COM RS-232/485
- 12-bit Isolated DIO (8 DI, 4 DO), 2 CAN Bus
- Mini PCIe with SIM socket for 4G/LTE/WiFi/BT/GPRS/UMTS
- Pre-installed with Debian Stretch R01
- Compact & Cableless design, Low Power Consumption

1.3 Product Specification

1.3.1 Specifications of AIC-100

System	
Processor	NXP i.MX6 ULL 900MHz Arm® Cortex®-A7 processor
Memory	1 DDR3L SDRAM, 512MB
Flash	1 NAND Flash, 512MB
EEPROM	1, up to 16KB
OS	Debian Stretch R01
Ethernet	
LAN 1	10/100 Mbps Ethernet, RJ45 Connector
LAN 2	10/100 Mbps Ethernet, RJ45 Connector
I/O Interface	
USB	1 USB 2.0 Type A
Serial	2 COM RS-232/485
Console	1 Micro USB debug port
Button	• 1 User-define Button • 1 Reset Button
SIM	1 Nano SIM Card Socket
LED	Power, Ready, Serial
Antenna	3 Antenna for WiFi/4G/LTE/GPRS/UMTS
Expansion	
Mini PCIe	1 Full-size for USB/External SIM Card
Storage	
SD	1 Micro SD Socket supports SDHC, up to 128GB (External)
Power	
Power Input	9V to 50V, DC-in
Power Interface	3-pin Terminal Block : V+, V-, Frame Ground
Typical Consumption	12V DC @500mA
Others	
Watchdog Timer	Reset : 0.5 to 128 sec./min. per step
Mechanical	
Dimensions	91mm x 91mm x 32mm (3.6" x 3.6" x 1.2")
Weight	0.4 kg (0.9 lb)
Mounting	• Wallmount by mounting bracket • DIN Rail Mount (optional)
Environment	
Operating Temperature	-25°C to 70°C (-13°F to 158°F)
Storage Temperature	-40°C to 85°C (-40°F to 185°F)
Humidity	5% to 95% Humidity, non-condensing
Relative Humidity	95% at 70°C
Shock	IEC 60068-2-27
Vibration	IEC 60068-2-64
EMC	CE, FCC, EN50155, EN50121-3-2

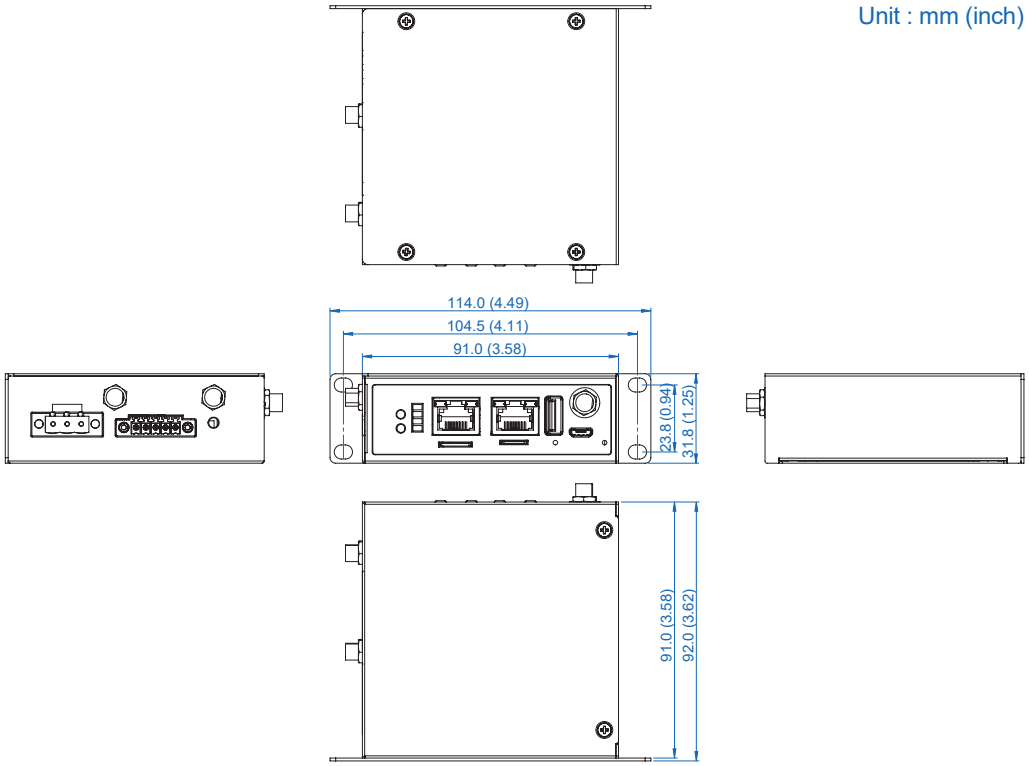
1.3.2 Specifications of AIC-110

System	
Processor	NXP i.MX6 ULL 900MHz Arm® Cortex®-A7 processor
Memory	1 DDR3L SDRAM, 512MB
Flash	1 NAND Flash, 512MB
EEPROM	1, up to 16KB
OS	Debian Stretch R01
Ethernet	
LAN 1	10/100 Mbps Ethernet, RJ45 Connector
LAN 2	10/100 Mbps Ethernet, RJ45 Connector
I/O Interface	
USB	1 USB 2.0 Type A
Serial	2 COM RS-232/485
Isolated DIO	12 Isolated DIO : 8 DI, 4 DO
CAN Bus	2 CAN Bus 2.0 A/B
Console	1 Micro USB debug port
Button	• 1 User-define Button • 1 Reset Button
SIM	1 Nano SIM Card Socket
LED	Power, Ready, Serial, CAN, DIO
Antenna	3 Antenna for WiFi/4G/LTE/GPRS/UMTS
Expansion	
Mini PCIe	1 Full-size for USB/External SIM Card
Storage	
SD	1 Micro SD Socket supports SDHC, up to 128GB (External)
Power	
Power Input	9V to 50V, DC-in
Power Interface	3-pin Terminal Block : V+, V-, Frame Ground
Typical Consumption	12V DC @500mA
Others	
Watchdog Timer	Reset : 0.5 to 128 sec./min. per step
Mechanical	
Dimensions	91mm x 91mm x 47mm (3.6" x 3.6" x 1.8")
Weight	0.4 kg (0.9 lb)
Mounting	• Wallmount by mounting bracket • DIN Rail Mount (optional)
Environment	
Operating Temperature	-25°C to 70°C (-13°F to 158°F)
Storage Temperature	-40°C to 85°C (-40°F to 185°F)
Humidity	5% to 95% Humidity, non-condensing
Relative Humidity	95% at 70°C
Shock	IEC 60068-2-27
Vibration	IEC 60068-2-64
EMC	CE, FCC, EN50155, EN50121-3-2

1.4 Mechanical Dimension

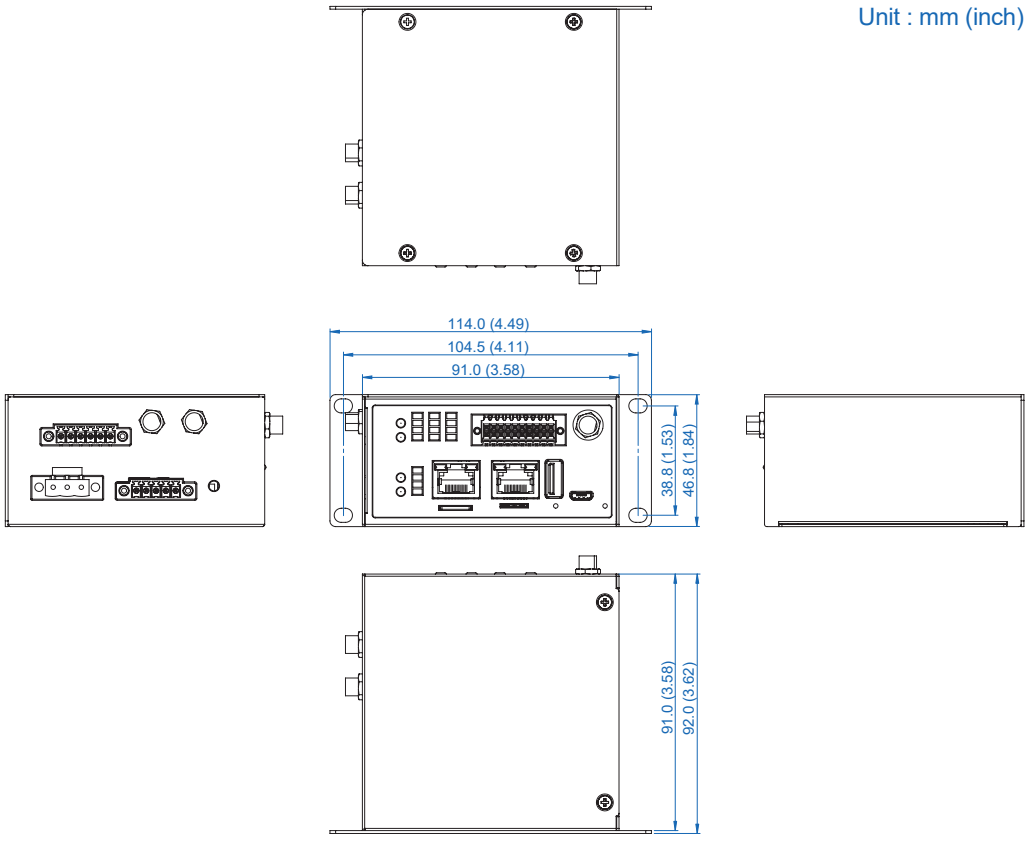
1.4.1 Dimensions of AIC-100

Unit : mm (inch)



1.4.2 Dimensions of AIC-110

Unit : mm (inch)



2

GETTING TO KNOW YOUR AIC-100/110

2.1 Packing List

2.1.1 AIC-100 Packing List

Item	Description	Qty
1	AIC-100 Industrial-grade Wireless IoT Gateway (According to the configuration of you order, AIC-100 may contain micro SD. Please verify these items if necessary.)	1

Item	Description	Outlook	Usage	P/N	Qty
1	P head_M2.5x6L_Ni		Mini PCIe	53-2426906-30B	1
2	Terminal block 3-pin (5.0mm)		DC-IN	51-2411R03-S1B	1
3	Terminal block5-pin (3.5mm)		Serial	51-2211R05-S1R	1
4	Terminal block 20-pin(2.54mm)		Isolated DIO/GPIO	51-2112R20-S1D	1
5	F head M3x4L		Wall mount	53-2470000-218	4
6	Wall mount		Wall mount	62-03P0795-000	1

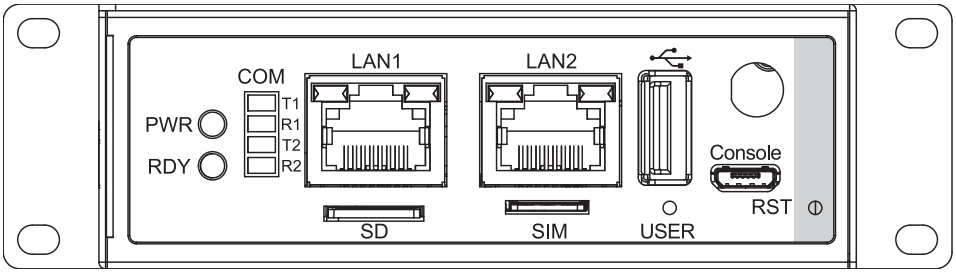
2.1.2 AIC-110 Packing List

Item	Description	Qty
1	AIC-110 Industrial-grade Wireless IoT Gateway (According to the configuration of you order, AIC-110 may contain micro SD. Please verify these items if necessary.)	1

Item	Description	Outlook	Usage	P/N	Qty
1	P head_M2.5x6L_Ni		Mini PCIe	53-2426906-30B	1
2	Terminal block 3-pin (5.0mm)		DC-IN	51-2411R03-S1B	1
3	Terminal block6-pin (3.5mm)		CAN	51-2411R06-S10	1
4	Terminal block5-pin (3.5mm)		Serial	51-2211R05-S1R	1
5	Terminal block 20-pin(2.54mm)		Isolated DIO/GPIO	51-2112R20-S1D	1
6	F head M3x4L		Wall mount	53-2470000-218	4
7	Wall mount		Wall mount	62-03P0796-000	1

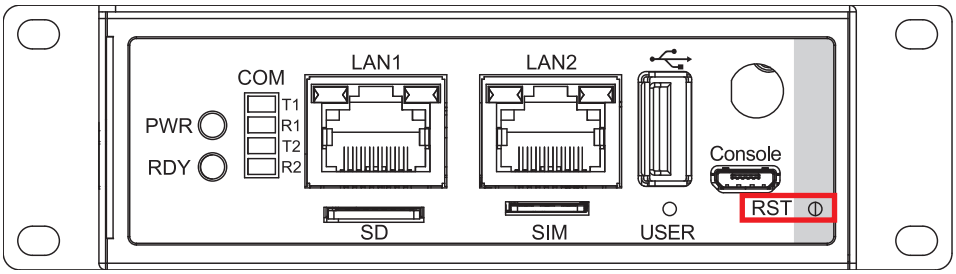
2.2 Front Panel I/O & Functions

2.2.1 Functions of AIC-100



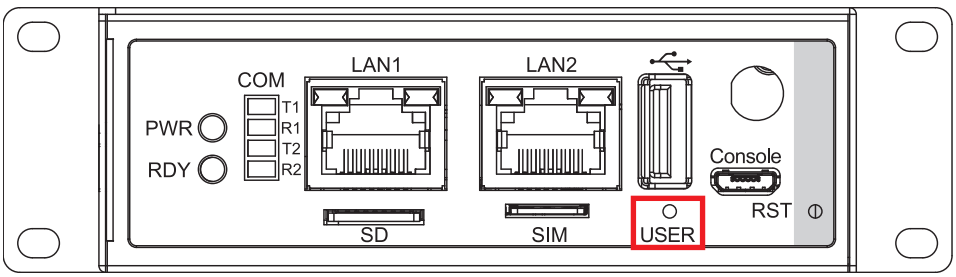
In Vecow AIC-100 series, all I/O connectors are located on the front and top panels. Most of the general connections to computer devices, such as USB, COM, LAN, Console port, Reset button, indicators are placed on the front panel.

2.2.1.1 Reset Button



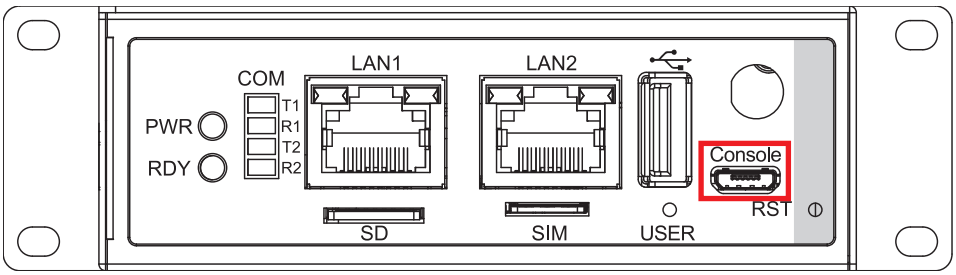
To boot on the system, please press H/W Reset button for 2 seconds. To shut down the system, please press the button for 7 seconds. If the system have error or frozen, you can press the Reset button to restart.

2.2.1.2 USER Button



AIC-100 is also equipped with a Programmable Button for users' easy maintenance.

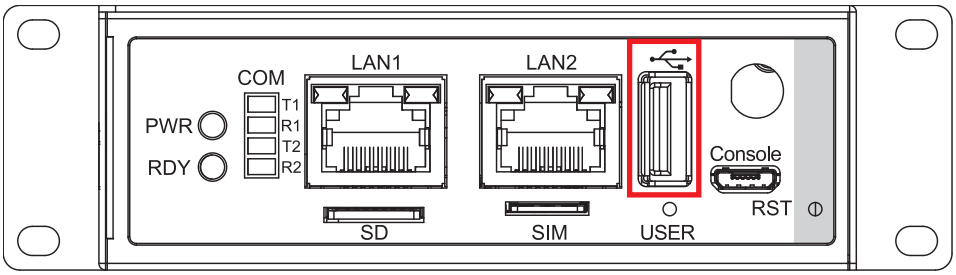
2.2.1.3 Console Port



Console Port Pin Out of Micro USB :

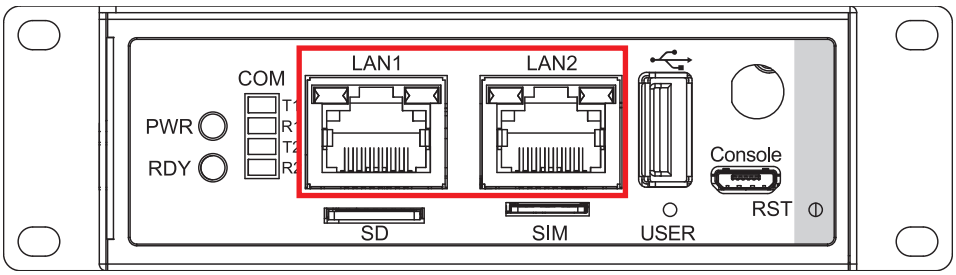
Pin No.	Function	Pin No.	Function
1	+V5	2	USB_DATA-
3	USB_DATA+	4	NC
5	GND		

2.2.1.4 USB 2.0



The USB interface supports 480 Mbps transfer rate complied with high speed USB specification Rev. 2.0.

2.2.1.5 10/100 Mbps Ethernet Port



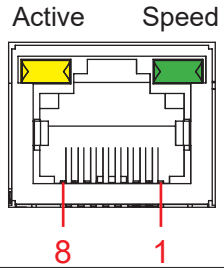
There are two Ethernet ports auto-sensing 10/100 Mbps in RJ45 connectors on the front side of AIC-100 series.

RJ-45 LAN 1 & 2 Pin Out :

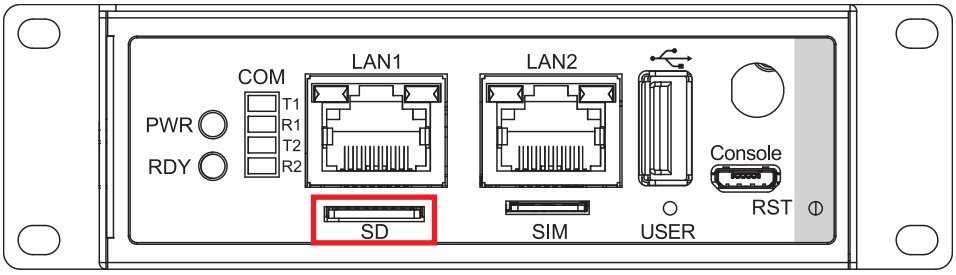
Pin No.	10/100 Mbps	Pin No.	10/100 Mbps
1	E_TX+	2	E_TX-
3	E_RX+	4	-----
5	-----	6	E_RX-
7	-----	8	-----

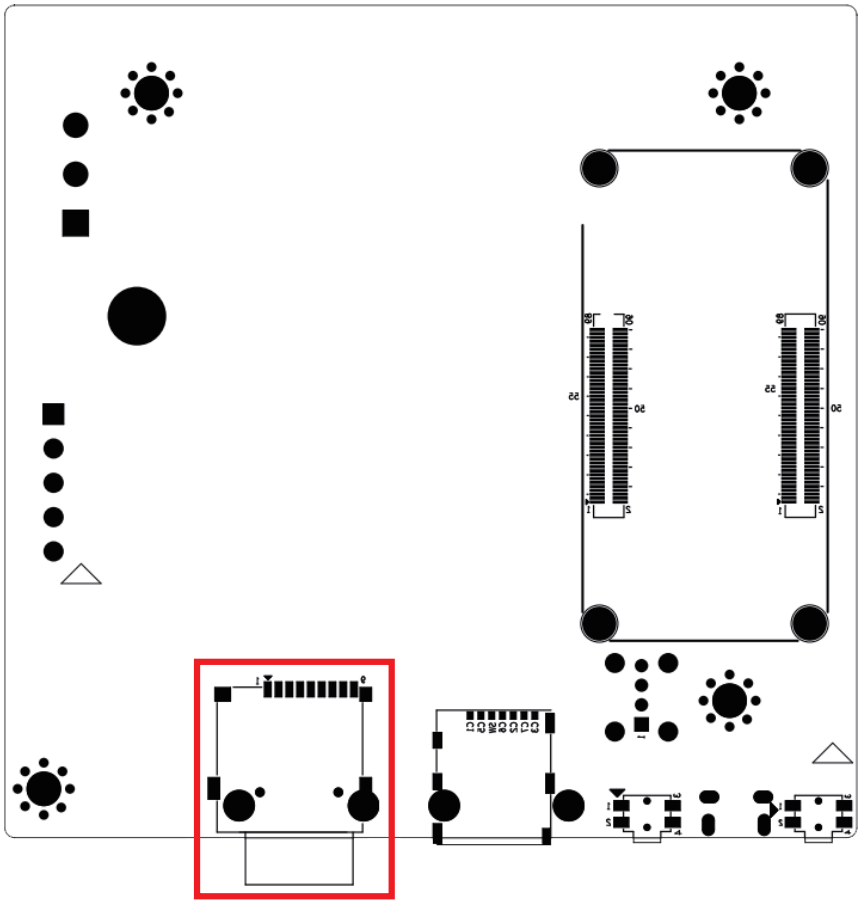
LAN 1 & 2 LED Table :

RJ-45 LED	10Mbps	100Mbps
Right LED Green	Off	Solid Green
Left LED Yellow	Flash Yellow	Flash Yellow



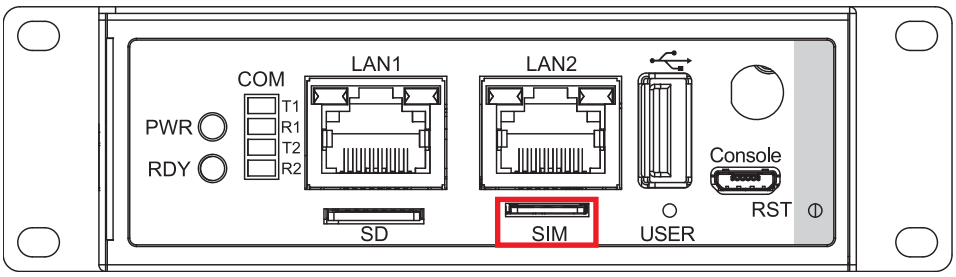
2.2.1.6 Micro SD

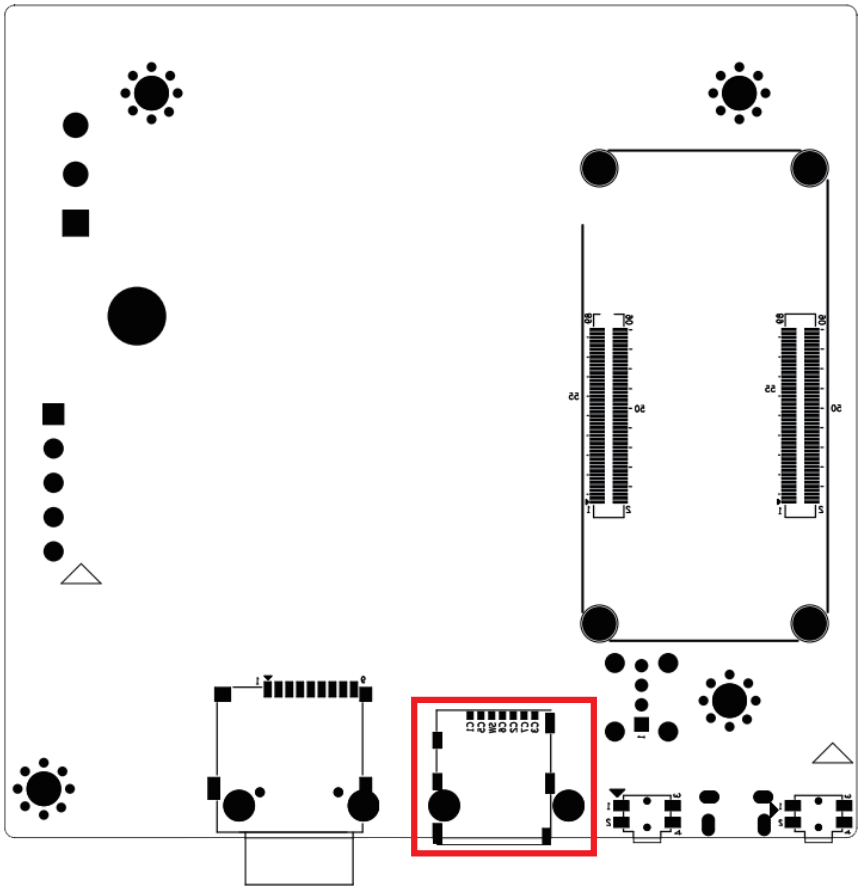




The external Micro SD card provides additional storage expansion. It is located behind the cover-plate on the bottom panel. If you would like to replace or insert the card, **it MUST be ensure the system is powered off**.

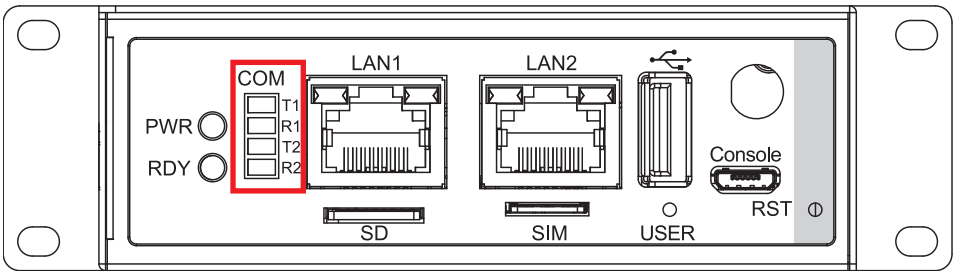
2.2.1.7 Nano SIM





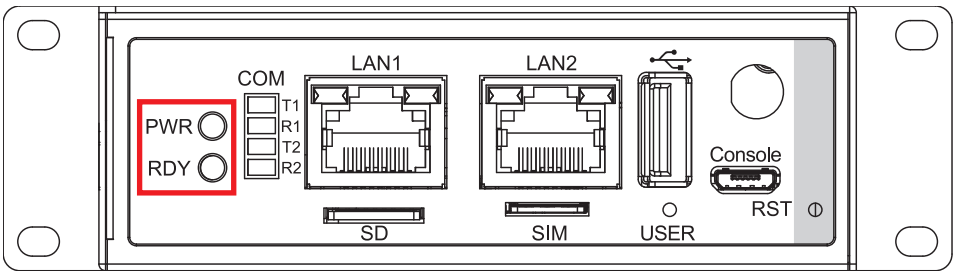
The external Nano SIM card offers wireless communication capability to the system.

2.2.1.8 COM LED Indicators



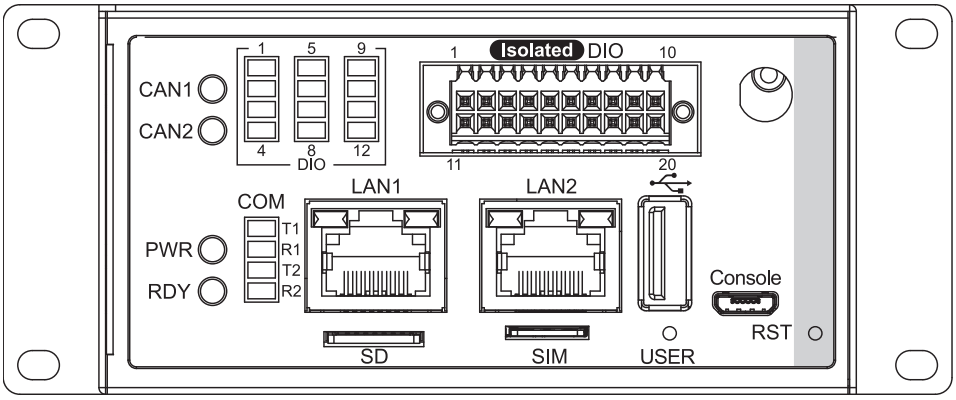
LED Define	LED Status	Solid Green
1	TXD1	COM1 TX Transmission Blinking
2	RXD 1	COM1 RX Transmission Blinking
3	TXD 2	COM2 TX Transmission Blinking
4	RXD 2	COM2 RX Transmission Blinking

2.2.1.9 PWR & Status LED Indicators



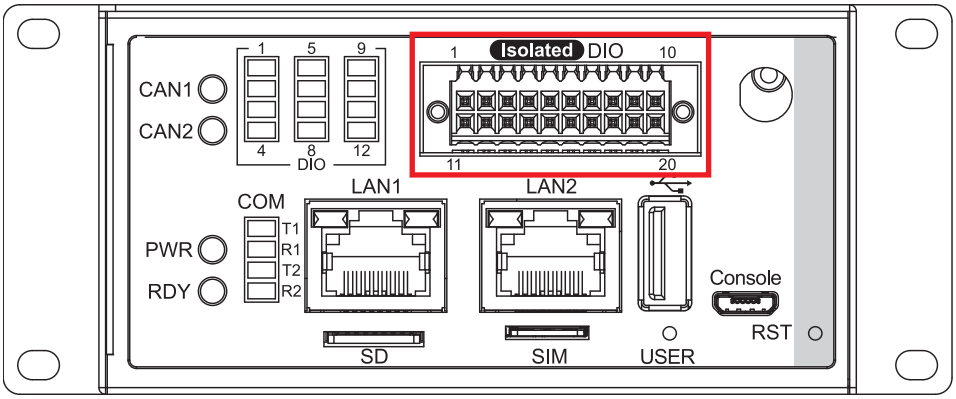
LED Color	System Status
Green (PWR LED)	+V3.3 Power Ready
Yellow (Status LED)	System Running

2.2.2 Functions of AIC-110



To boot on the system, please press H/W Reset button for 2 seconds. To shut down the system, please press the button for 7 seconds. If the system have error or frozen, you can press the Reset button to restart.

2.2.2.1 Isolated DIO



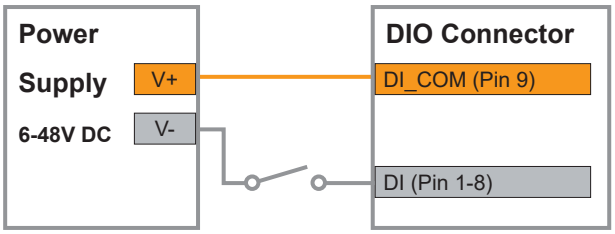
There is a 12-bit (8-bit DI, 4-bit DO) connectors in the front side. DI/DIO support NPN (sink) and PNP (Source) mode, Each DI pin is equipped with a photocoupler for isolated protection. Each DO pin is equipped with isolator function, DO Safety-Related Certifcations

- 4242-VPK Basic Isolation per DIN V VDE V 0884-10 and DIN EN 61010-1
- 3-KVRMS Isolation for 1 minute per UL 1577
- CSA Component Acceptance Notice 5A, IEC 60950-1 and IEC 61010-1 End Equipment Standards
- GB4943.1-2011 CQC Certified

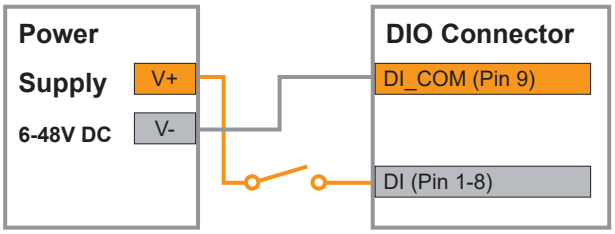
	Pin No.	Definition	Function
DIO	1	Input 0	SOC_GPI1
	2	Input 1	SOC_GPI2
	3	Input 2	SOC_GPI3
	4	Input 3	SOC_GPI4
	5	Input 4	SOC_GPI5
	6	Input 5	SOC_GPI6
	7	Input 6	SOC_GPI7
	8	Input 7	SOC_GPI8
	9	DI_COM	
	10	DIO_GND	
	11	Output 3	SOC_GPO12
	12	Output 2	SOC_GPO11
	13	Output 1	SOC_GPO10
	14	Output 0	SOC_GPO9
	15	--	
	16	--	
	17	--	
	18	--	
	19	DIO_GND	
	20	External 6-40VDC (NPN) External 6-48VDC (PNP)	

DI reference circuit :

Sink Mode (NPN)

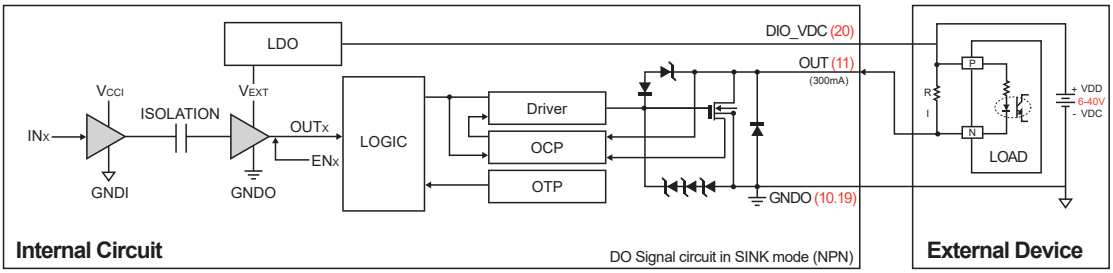


Source Mode (PNP)

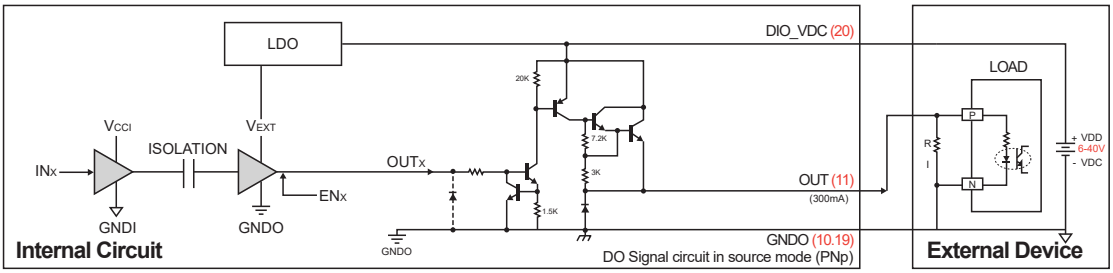


DO reference circuit :

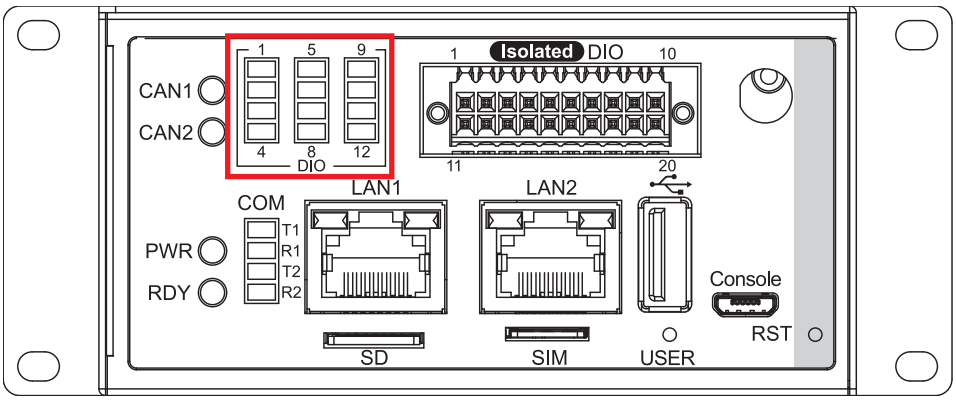
Sink Mode (NPN, Default)

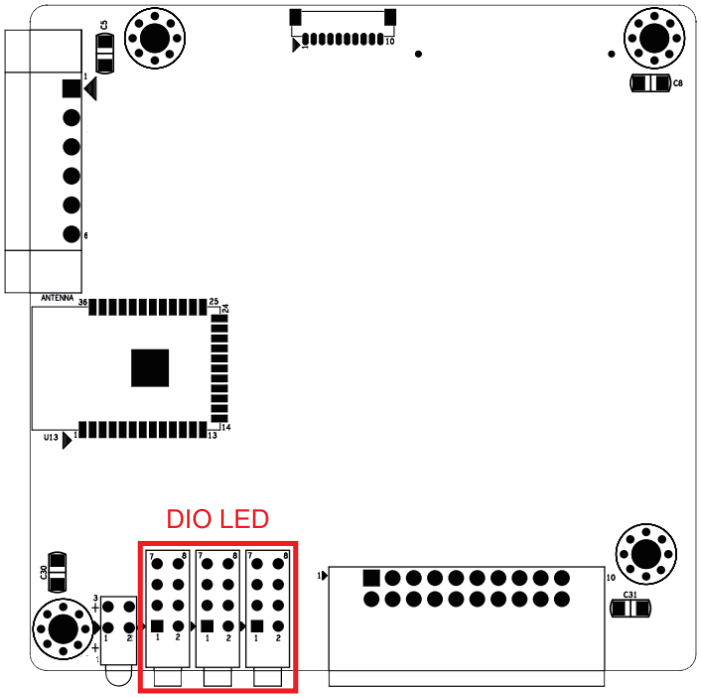


Source (PNP)



2.2.2.2 DIO LED

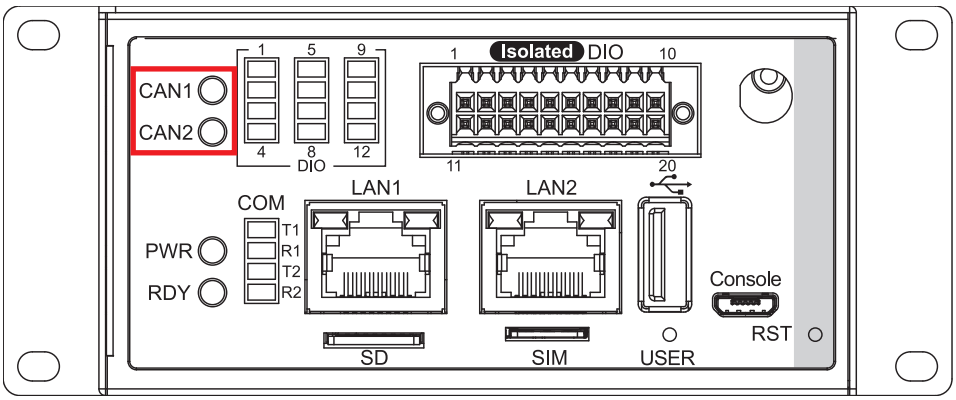




The LED active definition
Light on → High
Light off → Low

LED	Definition	LED	Definition
1	DI 1	2	DI 2
3	DI 3	4	DI 4
5	DI 5	6	DI 6
7	DI 7	8	DI 8
9	DO 9	10	DO 10
11	DO 11	12	DO 12

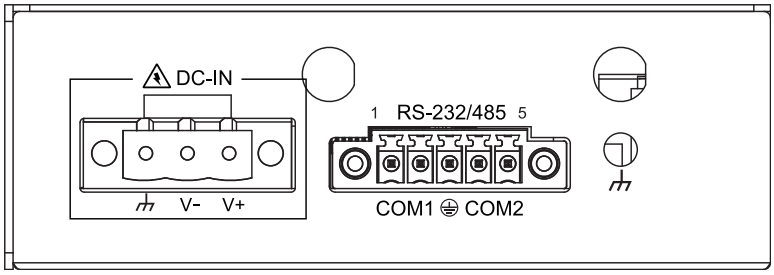
2.2.2.3 CAN LED



LED Color	System Status
Green (CAN1 LED)	CAN 1 Data Transmission
Yellow (CAN2 LED)	CAN 2 Data Transmission

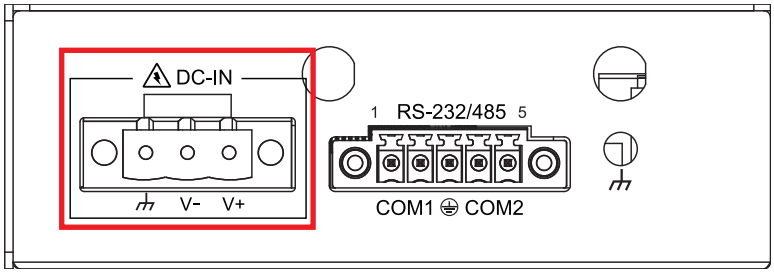
2.3 Top Panel I/O & Functions

2.3.1 Functions of AIC-100



On the Top panel side, there are two connectors Power input and COM Port in AIC-100 Series.

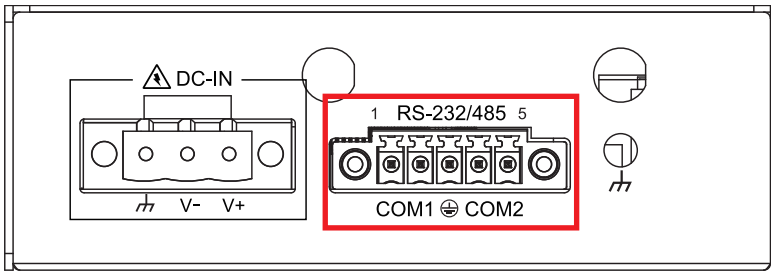
2.3.1.1 Power Terminal Block



AIC-100 supports 9V to 50V DC wide range power input by terminal block on the top side.

Pin No.	Definition
1	V+
2	V-
3	Chassis Ground

2.3.1.2 COM Port



There are two Serial ports (P1, P2) can be configured for RS-232 or RS-485 mode. No matter what the COM Mode is, it needs to change the Jumper setting to change terminal resistor. Please refer to CH 2.4.1.2.

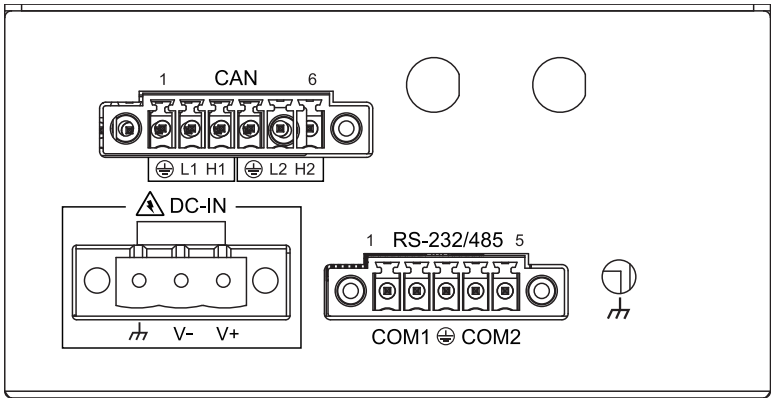
P1 & P2 Mode Configuration Table :

Mode	RS-232	RS-485
Port 1 (Mode 0)	High	Low
Port 2 (Mode 1)	High	Low

P1 & P2 Mode Pin Out Table :

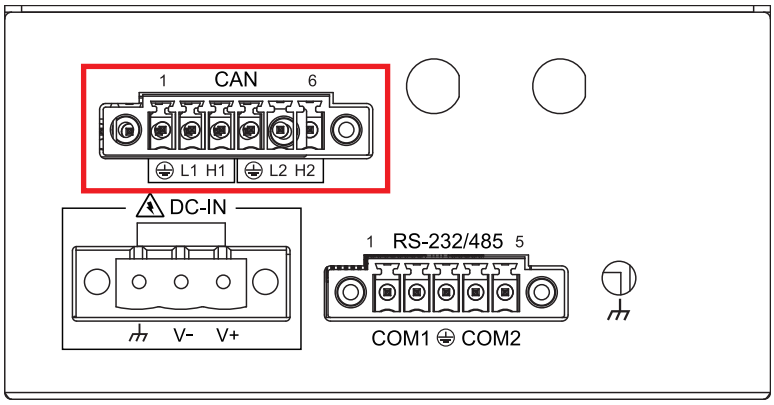
Pin No.	COM	RS-232	RS-485
1	COM1	RS232_TXD	RS485_A
2		RS232_RXD	RS485_B
3	--	GND	GND
4	COM2	RS232_TXD	RS485_A
5		RS232_RXD	RS485_B

2.3.2 Functions of AIC-110



There are have two connectors on the top panel side of AIC-100 Series. In AIC-110 Series, there is additional function CAN is located above Power input connector.

2.3.2.1 CAN Bus Port

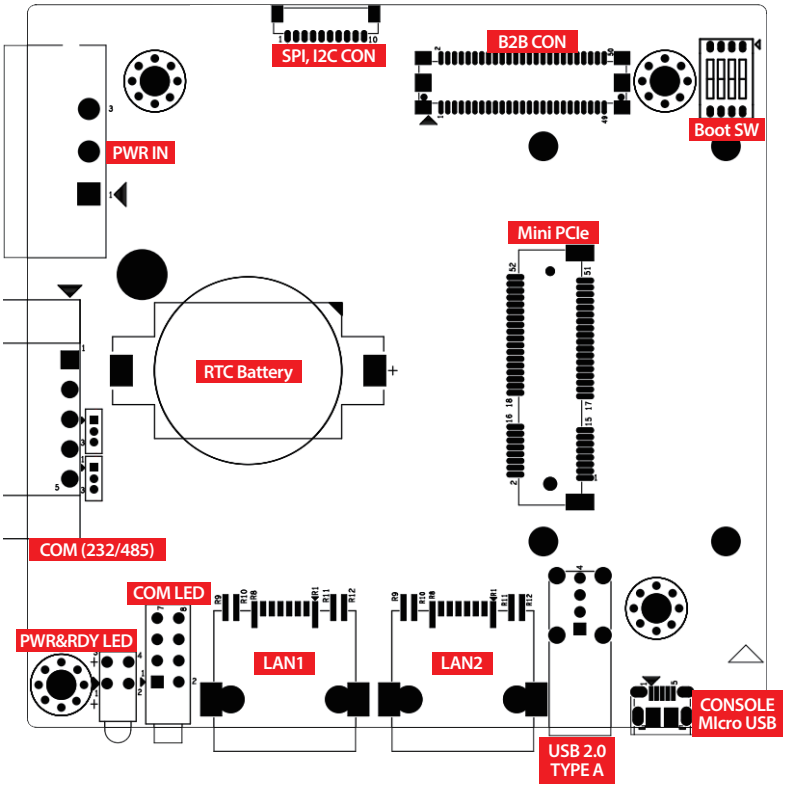


CAN Bus Connector Pin Out :

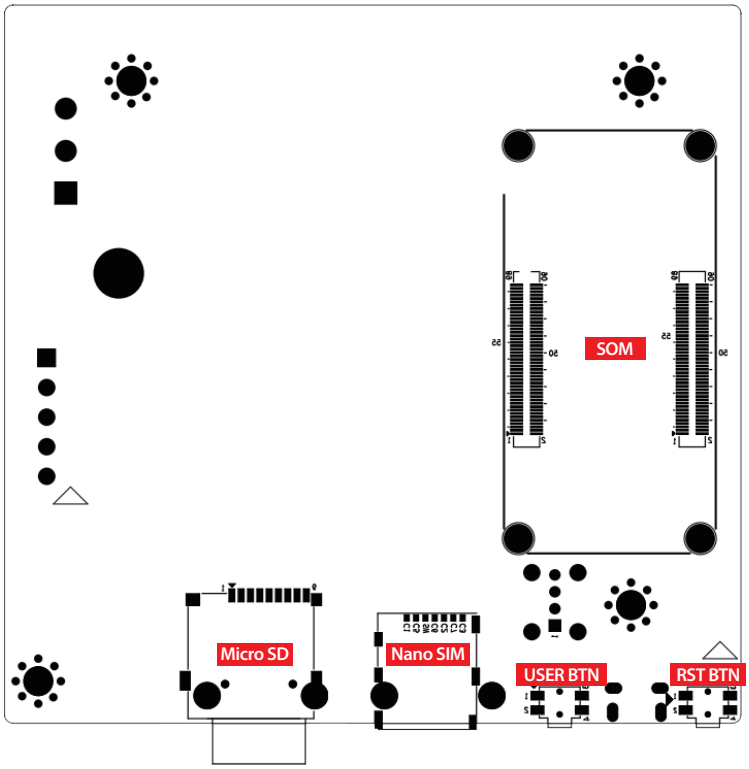
Pin No.	Definition	Pin No.	Definition
1	GND	2	CANL1
3	CANH1	4	GND
5	CANL2	6	CANH2

2.4 Main Board Connector & Jumper Locations

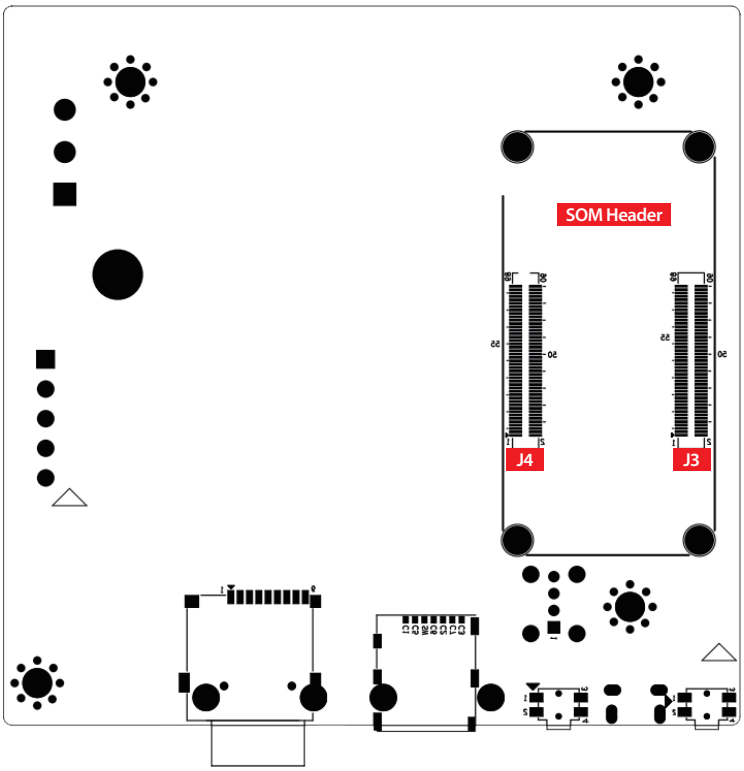
2.4.1 TOP View of MB



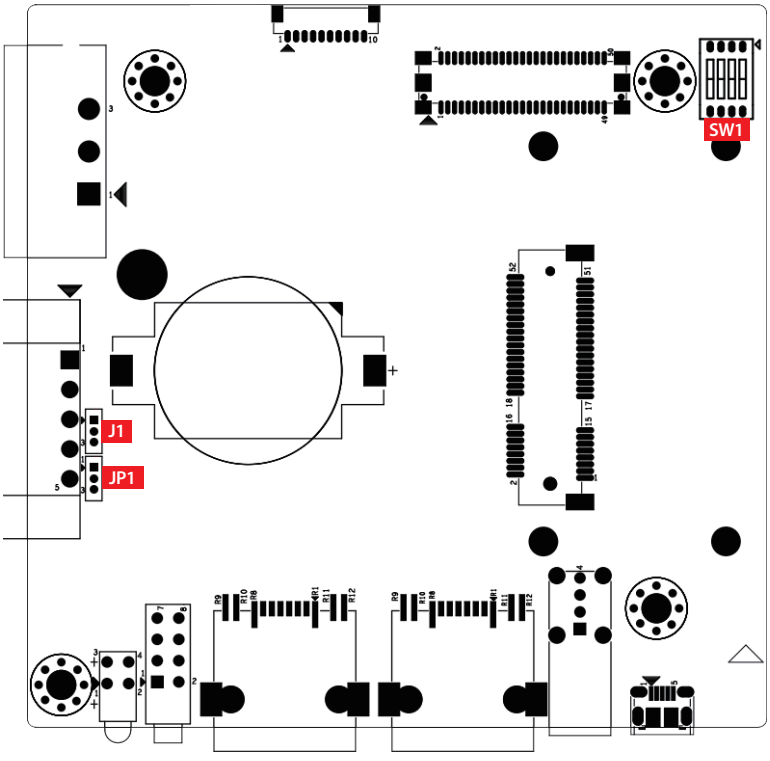
BOT View of MB



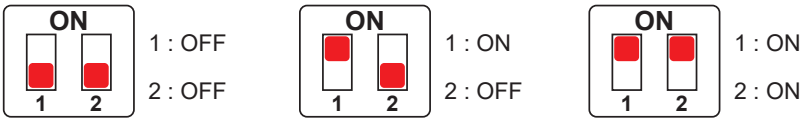
2.4.1.1 Bottom View of MB Main Board with Connector Locations



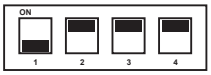
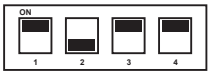
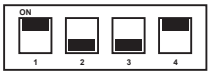
2.4.1.2 SW1 Boot Strap & COM Terminal Resistor



You may configure your card to match the needs of your application by DIP switch. As below show the deep switch on and off.



There is a SW1 set the boot strap in AIC-100. The 4th bit is no function, default setting "on".

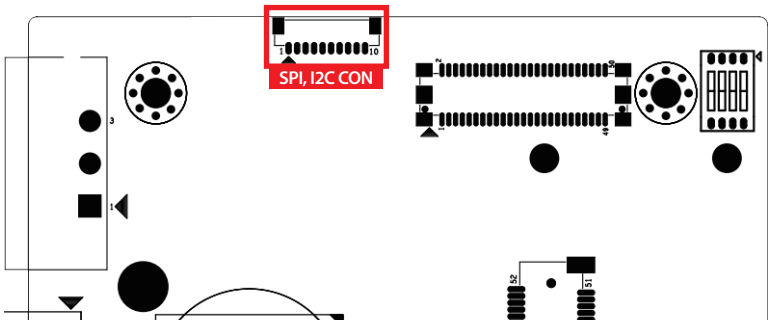
Item	Boot strap	Switch Position
1	NAND Mode	
2	eMMC Mode	
3	SD Card Mode	

There are two Pin Header to set terminal resistor of COM function.
Default setting is RS-232 mode, if want to set RS-485 mode, it must be shorted Pin 2 and Pin 3 of Header by Jumper, as below configuration table.

P1 & P2 Mode Terminal Resistor Configuration Table :

Jumper	Function Mode
1-2	RS-232
2-3	RS-485 (120 ohm)

2.4.1.3 JSPI_I2C : SPI, I2C Header

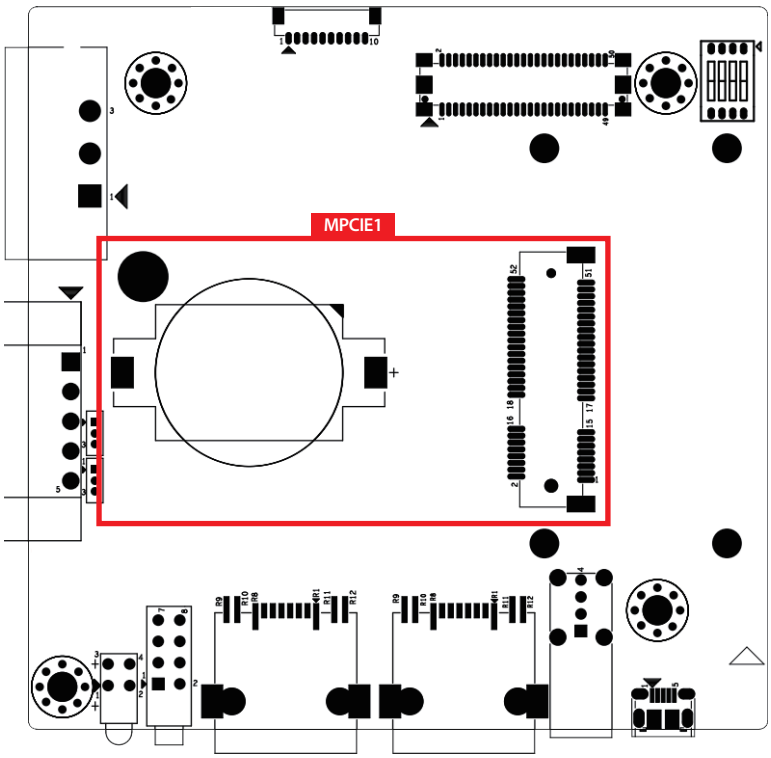


There is a SPI+I2C headers, it offered SPI Bus and I2C Bus, in AIC-100 series. Please note if the system have daughter board (AIC-110), and it have WLAN&BT module, the SPI Bus can't be used at the same time.

UART Header Pin Out :

Pin No.	Description	Pin No.	Description
1	I2C2_SCL	6	ESPI_MOSI
2	I2C2_SDA	7	ESPI_MISO
3	GND	8	GND
4	ESPI_SCLK	9	+3.3V
5	ESPI_SS0	10	GND

2.4.1.4 MPCIE1 : Mini PCIe Slot

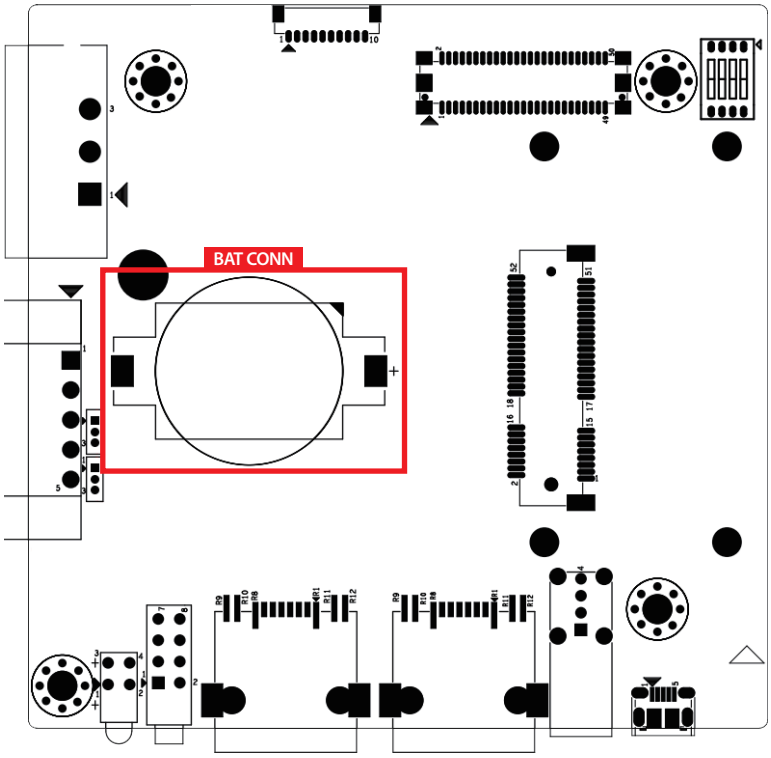


There is a Mini PCIe supported with USB signal in AIC-100.

Mini PCIe Pin Out :

Pin No.	Signal Name	Pin No.	Signal Name
51	Reserved	52	+V3.3
49	Reserved	50	GND
47	Reserved	48	+1.5V
45	Reserved	46	Reserved
43	Reserved	44	Reserved
41	+V3.3	42	Reserved
39	+V3.3	40	GND
37	GND	38	USB_D+
35	GND	36	USB_D-
33	Reserved	34	GND
31	Reserved	32	SMB_DATA
29	GND	30	SMB_CLK
27	GND	28	+1.5V
25	Reserved	26	GND
23	Reserved	24	+V3.3
21	GND	22	Reserved
19	Reserved	20	Reserved
17	Reserved	18	GND
Mechanical Key			
15	GND	16	UIM VPP
13	Reserved	14	UIM RESET
11	Reserved	12	UIM CLK
9	GND	10	UIM DATA
7	Reserved	8	UIM PWR
5	Reserved	6	1.5V
3	Reserved	4	GND
1	Reserved	2	+V3.3

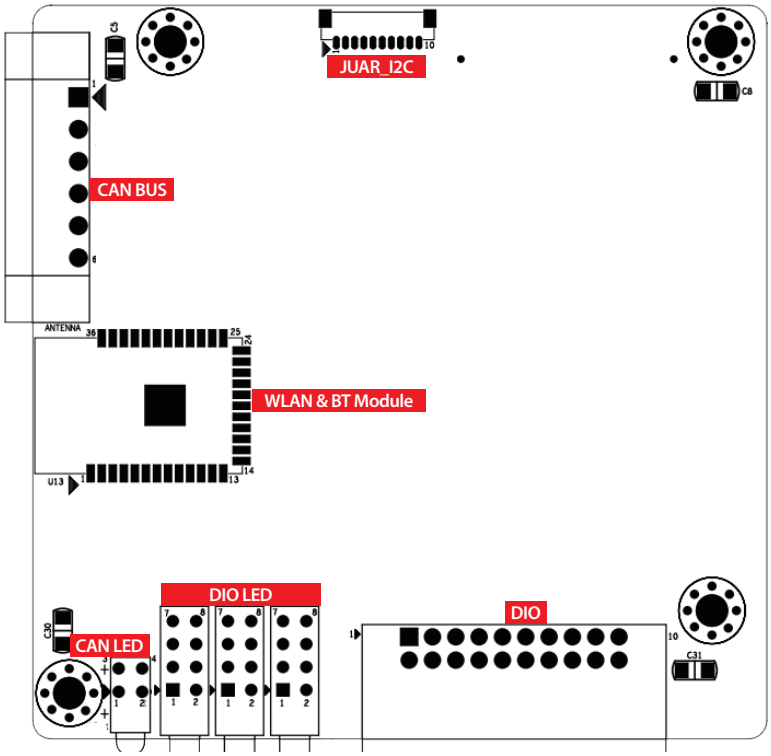
2.1.4.5 BAT1 : RTC Battery



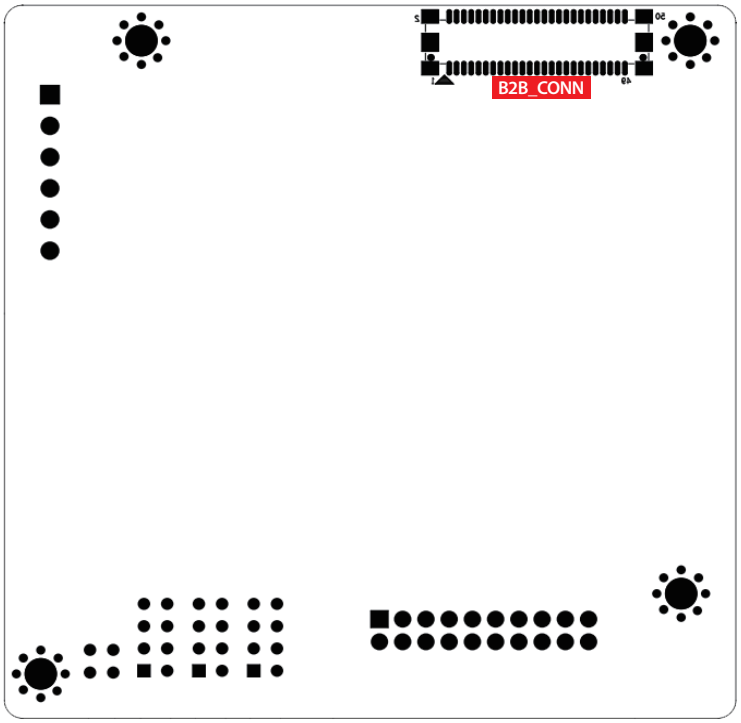
The real-time clock of AIC-100 is powered by a lithium battery. It is equipped with Panasonic BR2032 190mAh lithium battery. It is recommended that you not replace the lithium battery on your own. If the battery needs to be changed, please contact Vecow RMA service team.

2.5 Expansion Board Connectors & Jumper Locations

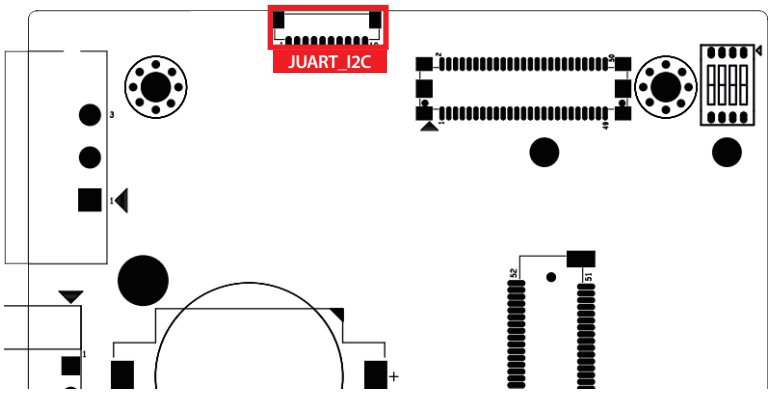
2.5.1 TOP View of Daughter Board



BOT View of Daughter Board



2.5.1.1 UART_I2C, UART, I2C Header

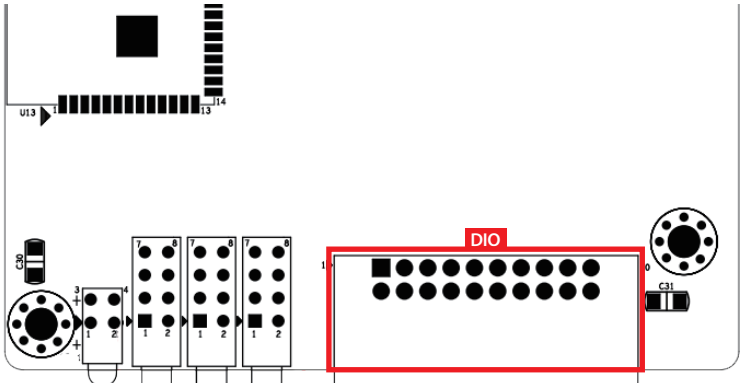


There is a UART, I2C header in AIC-100 series.

UART, I2C Header Pin Out :

Pin No.	Description	Pin No.	Description
1	I2C1_SCL	6	GND
2	I2C1_SDA	7	UART_RX
3	GND	8	UART_TX
4	I2C2_SCL	9	GND
5	I2C2_SDA	10	GND

2.5.1.2 Isolated DIO (AIC-110)



In AIC-110 series, it is offered with 12 isolated programmable I/O. In this 12 programmable I/O include 8 DI and 4 DO. The DO logic High and Low is controlled by SOC, and the DI logic is gotten from outside I/O High or Low. (Please refer to CH2.6 for detailed information.)

2.6 GPIO Pin Assignments Table

Item	SOM Module GPIO Definition	SAIC100 GPIO Definition	Function
1	GPIO 3_0	GPIO1	DIO Connector DI 1-8 DO 9-12
2	GPIO 5_5	GPIO2	
3	GPIO 5_3	GPIO3	
4	GPIO 4_24	GPIO4	
5	GPIO 3_3	GPIO5	
6	GPIO 3_2	GPIO6	
7	GPIO 3_4	GPIO7	
8	GPIO 4_18	GPIO8	
9	GPIO 5_9	GPIO9	
10	GPIO 1_2	GPIO10	
11	GPIO 5_7	GPIO11	
12	GPIO 5_8	GPIO12	
10	GPIO 3_28	P1_MODE0	COM 1
11	GPIO 3_23	P1_MODE1	COM 2
22	GPIO 1_8	Reset & Watch dog	Reset & Watch dog
23	GPIO 5_1	Programmable Button	Programmable User Button
27	I2C1_SDA	I2C1_SDA	Board ID Address 1010 000x
28	I2C1_SCL	I2C1_SCL	
29	I2C2_SDA	I2C2_SDA	I2C RTC Real time clock/ Calendar Address 1101 000x
30	I2C2_ SCL	I2C2_ SCL	

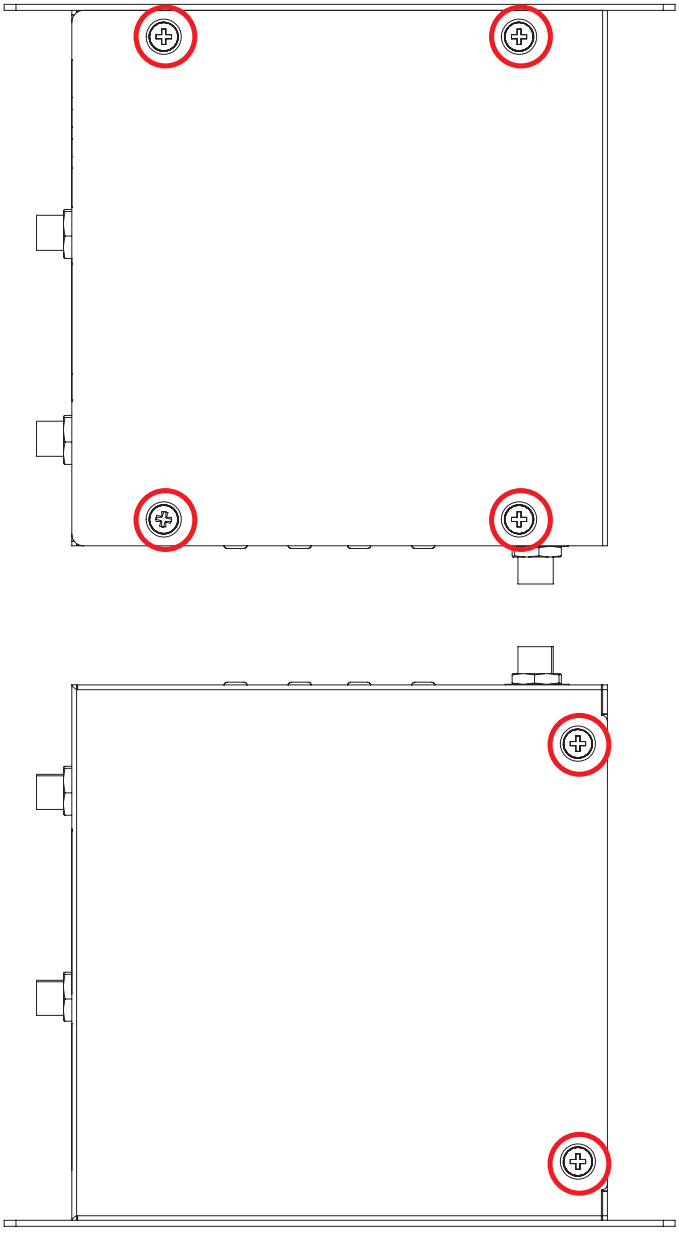
3

SYSTEM SETUP

3.1 How to Open Your AIC-100/110

3.1.1 AIC-100 & AIC-110 Series

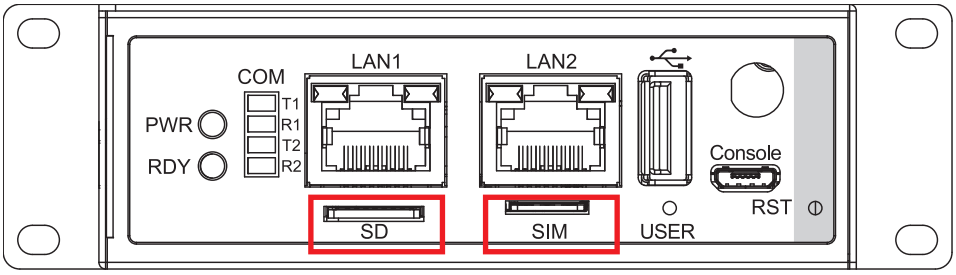
Step 1 Remove the screws indicated and separate Cover from the enclosure.



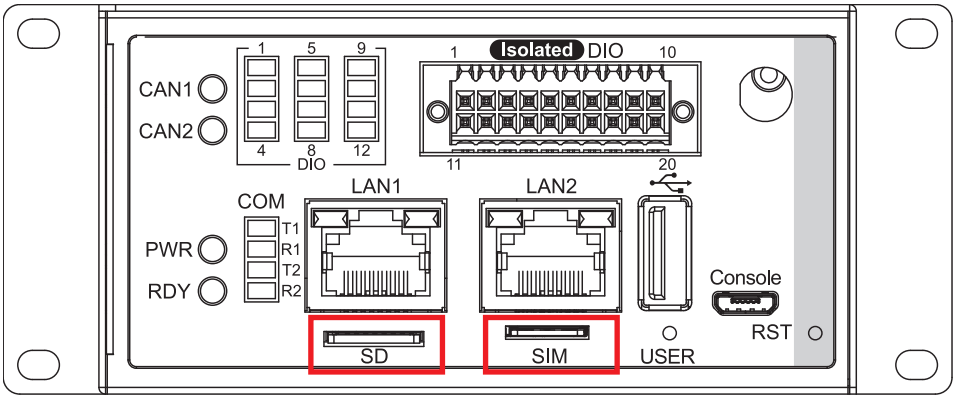
3.2 Installing SD/SIM Card

Step 1 Insert Nano SIM card.

AIC-100



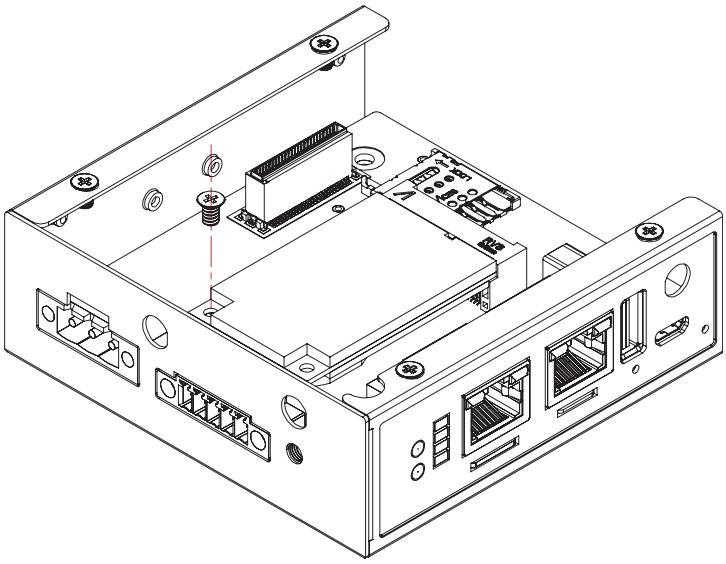
AIC-110



3.3 Installing Mini PCIe

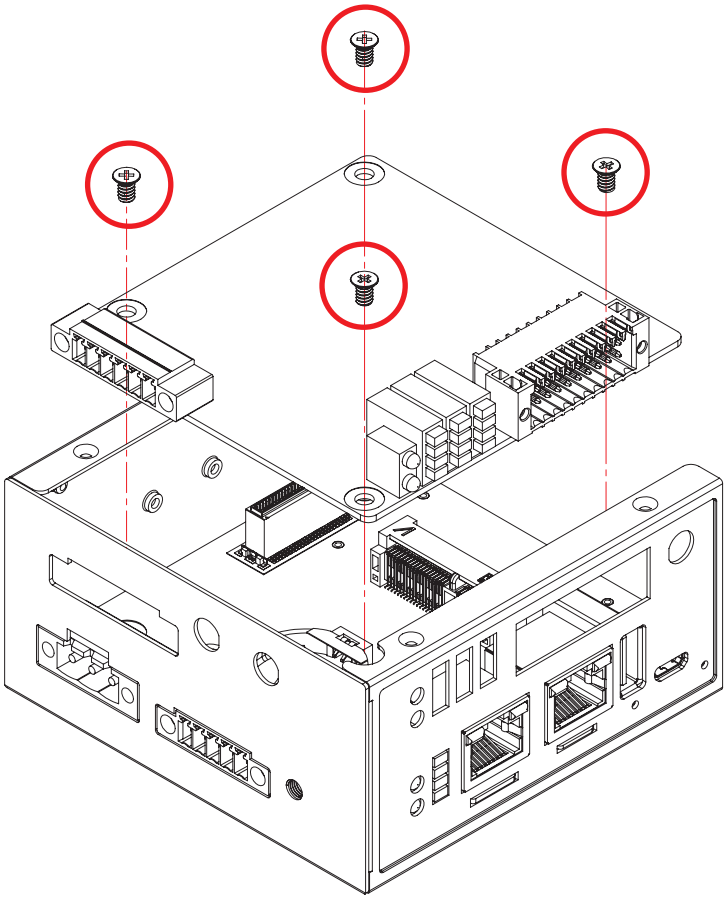
3.3.1 AIC-100

Step 1 Fasten the module with the screw indicated.

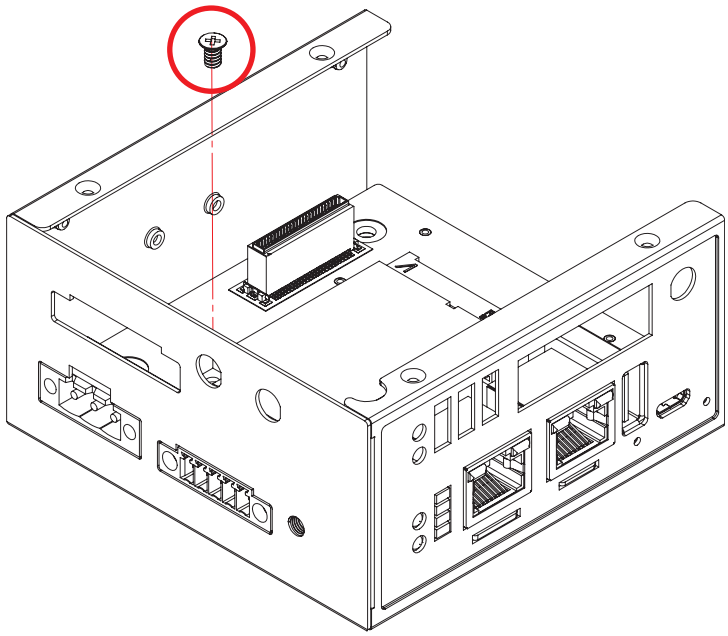


3.3.2 AIC-110

Step.1 Loosen four screws from isolated board.

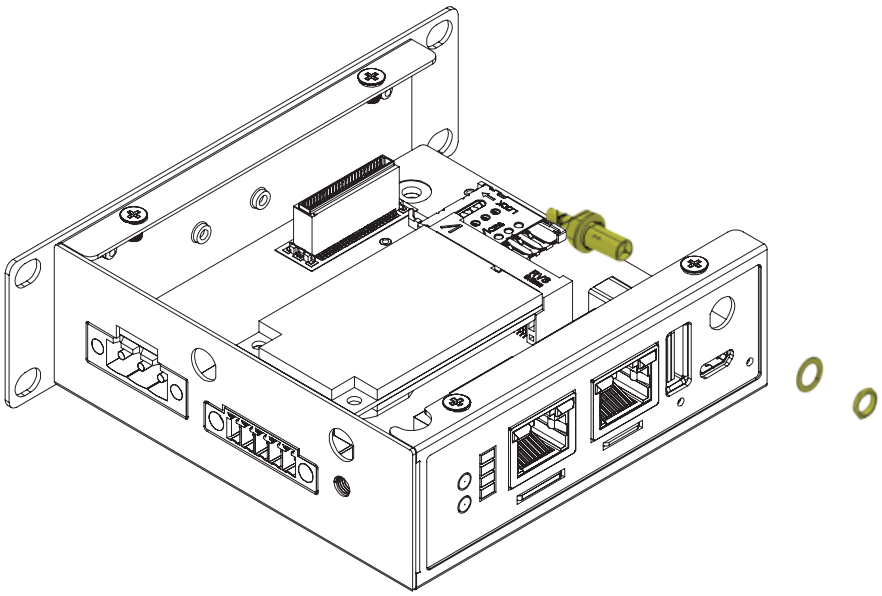


Step.2 Fasten the module with the screw indicated.



3.4 Installing Antenna Cable

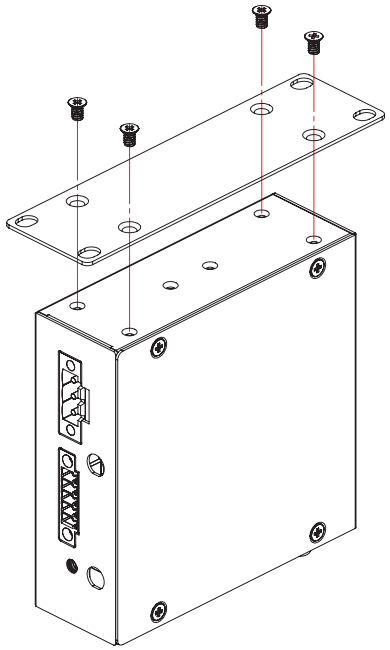
Step 1 Install the cable with nut and washer indicated.



3.5 Mounting Your AIC-100/110

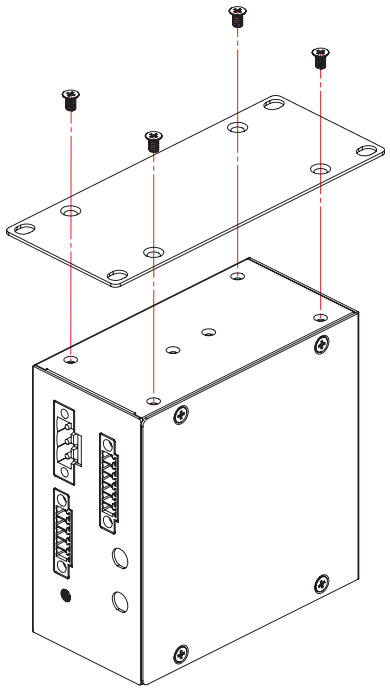
3.5.1 AIC-100

Step 1 Fasten the wall mount with the screw indicated



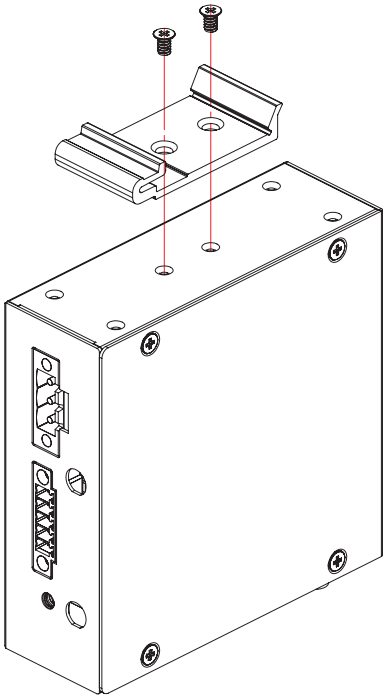
3.5.2 AIC-110

Step 1 Fasten the wall mount with the screw indicated

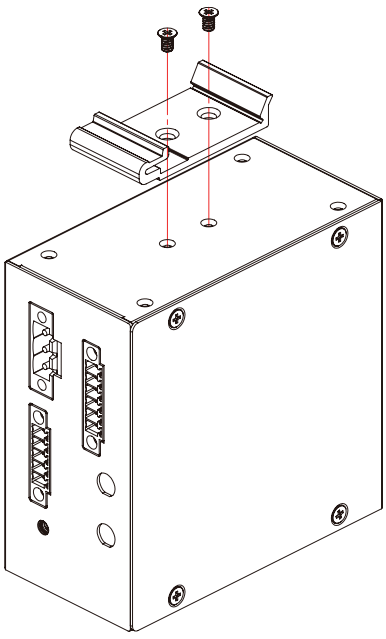


3.6 Installing DIN Rail

3.6.1 AIC-100



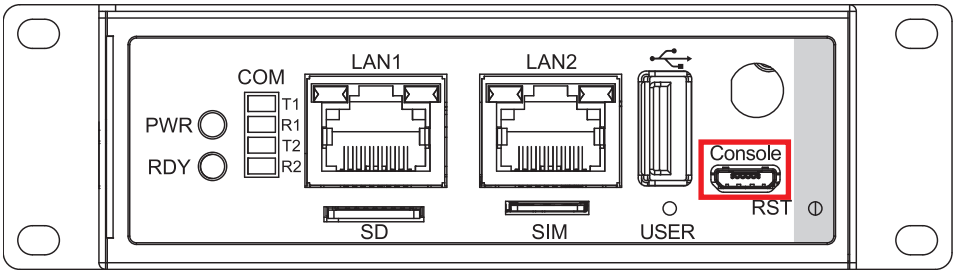
3.5.2 AIC-110



4

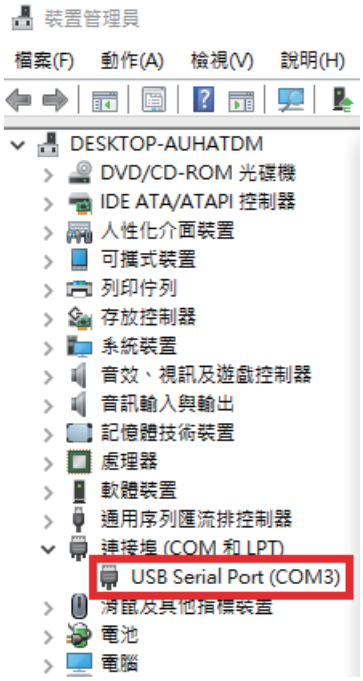
SOFTWARE SETUP

4.1 Power on and System Boot up



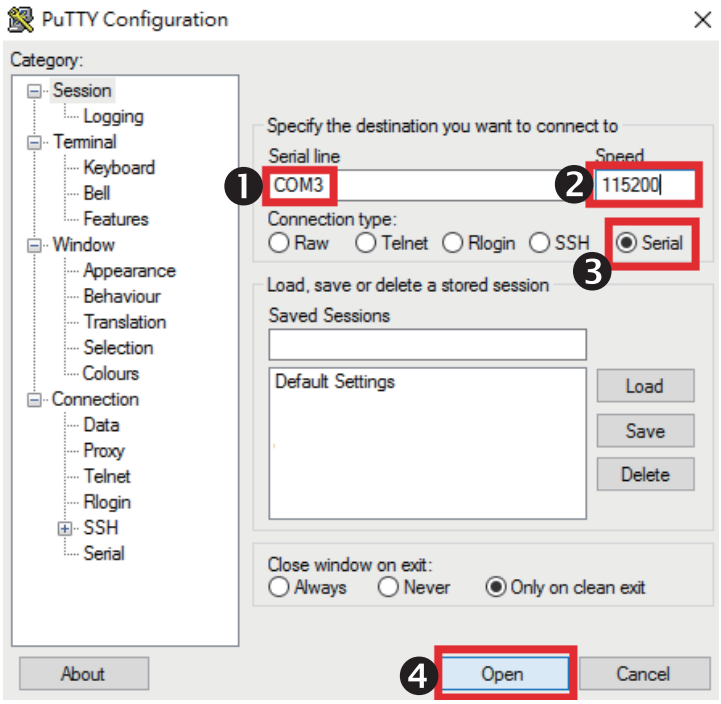
Establish a connection between your host computer and AIC-100 console port.

Step 1 Go to Device Manger check console serial Port.



Step 2 Right click on, click on "Run as administrator" to bring up the PuTTY Configuration window.

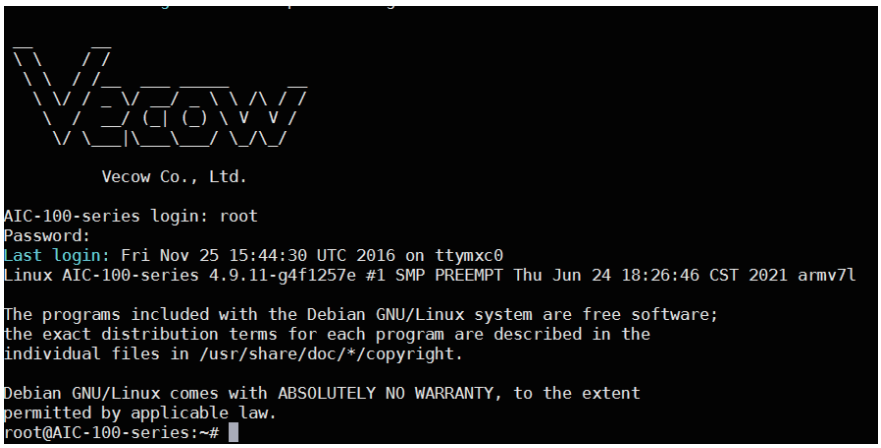
Step 3 Go to Category > Serial, enter the COM port you connected your host computer to AIC-100 and enter the following parameters :



Step 4 AIC-100 Power ON, A series of messages may appear.

Step 5 Enter username "root" password "root" to login.
Note : Please kindly note that the password is not shown while typing.

Step 6 root@ AIC-100-series: ~#" will appear. From here you may begin configuring your system.



4.2 Network Settings

Step 1 Type "cd /etc/network" to change directories.

```
root@AIC-100-series:~# cd /etc/network/
root@AIC-100-series:/etc/network#
```

Step 2 Type "nano interfaces" to edit the network configuration file in the nano editor. You can configure the AIC-100's Ethernet ports to use either static or dynamic (DHCP) IP addresses.

4.3 Serial Port Settings

Step 1 AIC-100 series have two RS-232/485 serial port for connection.

To switch your serial port type, you can type :

```
root@AIC-100-series:~# setcom
Example: setcom com mode
com  => 1/2
mode => 232/485
com1 => /dev/ttymxc2
com2 => /dev/ttymxc4
```

4.4 Isolated Digital I/O Operation

Step 1 AIC-100 series have 8 pins DI and 4 pins DO. For more information, you can refer to section 2.2.10.

To config those pins, you can type :

```
root@AIC-100-series:~# DIO_tool
Set DO:
DIO_tool number value mode
number  => 9~12
value => 0/1
mode(sink/source) => 0/1
Example: DIO_tool 9 0 1
Get DI:
DIO_tool number
number => 1~8
Example: DIO_tool 1
```

4.5 CAN Bus

AIC-110 has 2 CAN bus, to initial the CAN device, you can type :

```
root@AIC-100-series:~# ip link set can0 up type can bitrate 125000
IPv6: ADDRCONF(NETDEV_CHANGE): can0: link becomes ready
root@AIC-100-series:~# ip link set can1 up type can bitrate 125000
IPv6: ADDRCONF(NETDEV_CHANGE): can1: link becomes ready
```

4.6 I2C Interface

To detect the I2C device, you can type :

```
root@AIC-100-series:~# i2cdetect -y -r 1
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:          -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- UU -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: 50 51 -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- UU -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
root@AIC-100-series:~# i2cdetect -y -r 0
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:          -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: 50 51 52 53 54 55 56 57 -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
```

There are two different I2C buses on AIC-100 system, I2C-1 is for SOM internal use, and I2C-2 is connected to RTC and external I2C Header. If you want to use external I2C header, please avoid the occupied I2C address.

4.7 Determining Available Drive Space

To determine the amount of available drive space, you can type :

```
root@AIC-100-series:~# df -h
Filesystem      Size  Used Avail Use% Mounted on
ubi0:rootfs     435M  405M   31M  94% /
devtmpfs        247M     0  247M   0% /dev
tmpfs           248M     0  248M   0% /dev/shm
tmpfs           248M  3.9M  244M   2% /run
tmpfs           5.0M  4.0K  5.0M   1% /run/lock
tmpfs           248M     0  248M   0% /sys/fs/cgroup
tmpfs            50M  8.0K   50M   1% /run/user/1001
tmpfs            50M     0   50M   0% /run/user/0
```

4.8 Software Package Management

Follow these steps to update the package menu :

1. Make sure a network connection is available.
2. Use apt-get update to update the Debian package list.
3. Use apt-get upgrade to update the Debian package you installed.
4. Use apt-get install <software name> to install the latest version of your desired application from an online software repository.

4.9 Example Program – Hello World

4.9.1 Cross compile from Linux PC

Step 1 Get the cross compiler from http://releases.linaro.org/components/toolchain/binaries/6.3-2017.05/arm-linux-gnueabihf/gcc-linaro-6.3.1-2017.05-x86_64_arm-linux-gnueabihf.tar.xz.

Step 2 Create file called hello.c.

Step 3 Type the following code in the editor :

```
// hello.c
#include <stdio.h>

int main() {
  printf("Hello, world!\n");
  return 0;
}
```

Step 4 Export the cross-compiler path :

```
$ export CC=/path/to/CC/ gcc-linaro-6.3.1-2017.05-x86_64_arm-linux-gnueabihf/bin/arm-linux-gnueabihf-gcc
```

Step 5 Compile :

`$CC` hello.c `-o hello`

4.9.2 Compile on AIC-100

Step 1 Update the packages list :

```
$ apt update
```

Step 2 Install the gcc package :

```
$ apt install gcc
```

Step 3 Create file called hello.c.

Step 4 Type the following code in the editor :

```
// hello.c
#include <stdio.h>

int main() {
  printf("Hello, world!\n");
  return 0;
}
```

Step 5 Compile:

```
$ gcc hello.c -o hello
```

A

APPENDIX A : Sysfs Mapping

Category	Name	Path	Supported Properties
Button	User btn	/sys/class/gpio/gpio129/value	Active low
Digital Input	GPIO01	/sys/class/gpio/gpio64/value	
	GPIO02	/sys/class/gpio/gpio133/value	
	GPIO03	/sys/class/gpio/gpio131/value	
	GPIO04	/sys/class/gpio/gpio120/value	
	GPIO05	/sys/class/gpio/gpio67/value	
	GPIO06	/sys/class/gpio/gpio66/value	
	GPIO07	/sys/class/gpio/gpio68/value	
	GPIO08	/sys/class/gpio/gpio114/value	
Digital Output	GPIO09	/sys/class/gpio/gpio137/value	
	GPIO10	/sys/class/gpio/gpio2/value	
	GPIO11	/sys/class/gpio/gpio135/value	
	GPIO12	/sys/class/gpio/gpio136/value	
DIO1 SINK/ SOURCE configuration	DIO1_SINK_EN	/sys/class/gpio/gpio83/value	Active high
	DIO1_SOURCE_EN	/sys/class/gpio/gpio81/value	Active high
Watchdog	WDOG1	/dev/watchdog	
UART mode configuration	UART1_MODE0	/sys/class/gpio/gpio92/value	High : RS232 Low : RS485
	UART2_MODE0	/sys/class/gpio/gpio87/value	
SPI interface	SPI0	/dev/spidev0.0	
DIO LED Enable	EN_DIO_LED	/sys/class/gpio/gpio84/value	Active high

B

APPENDIX B : Node-RED Guide

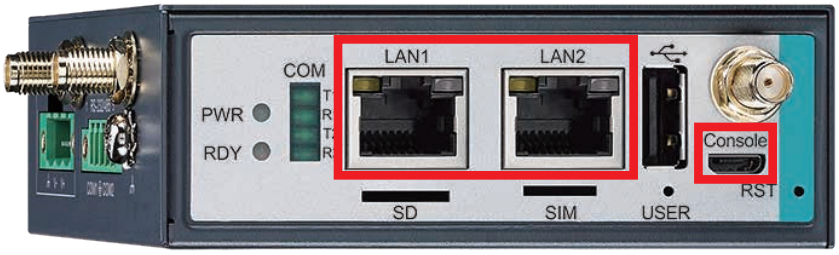
Node-RED is a graphical programming interface software that allows users to code programs by simply dragging and dropping nodes. Users can quickly and easily code programs without the knowledge of complex high-level programming languages. Node-RED also supports Java Script programming language and json format files and can be programmed directly on the web.

B.1 Installing the Node-RED Program

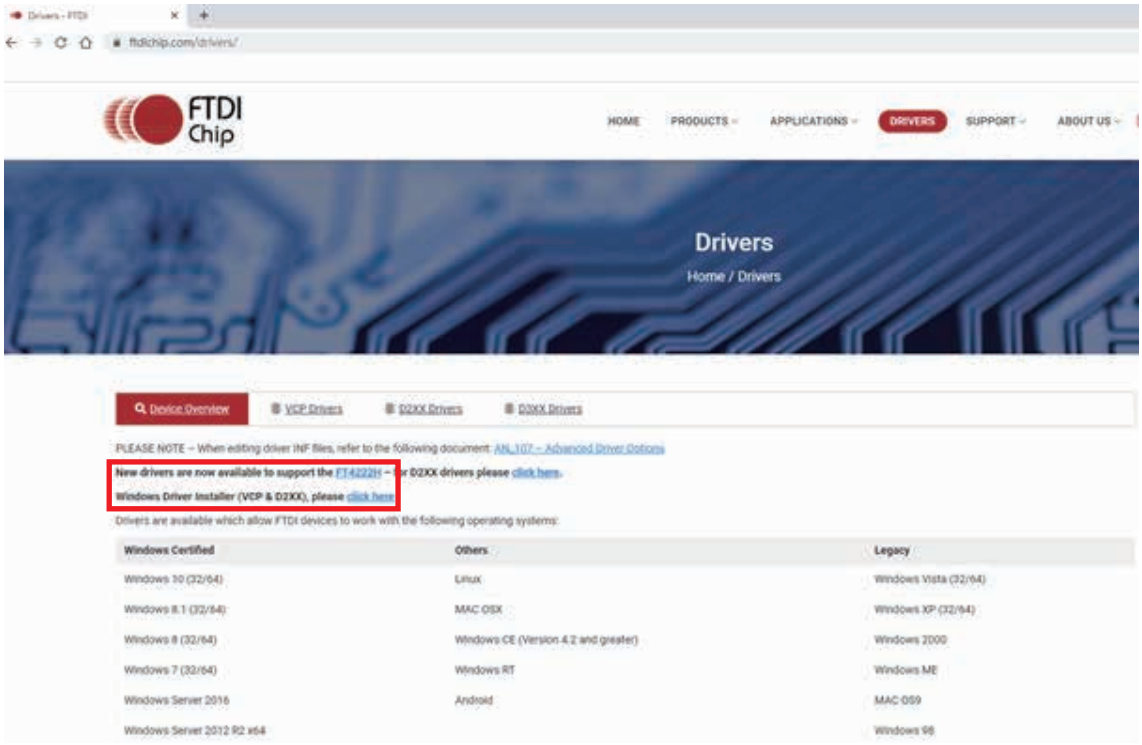
Step 1 Prepare a host computer to connect with AIC-100/110. Connect AIC-100/110 to the host computer through the LAN port or the console port.

LAN : The default DHCP connection, use the general CAT5e network cable.

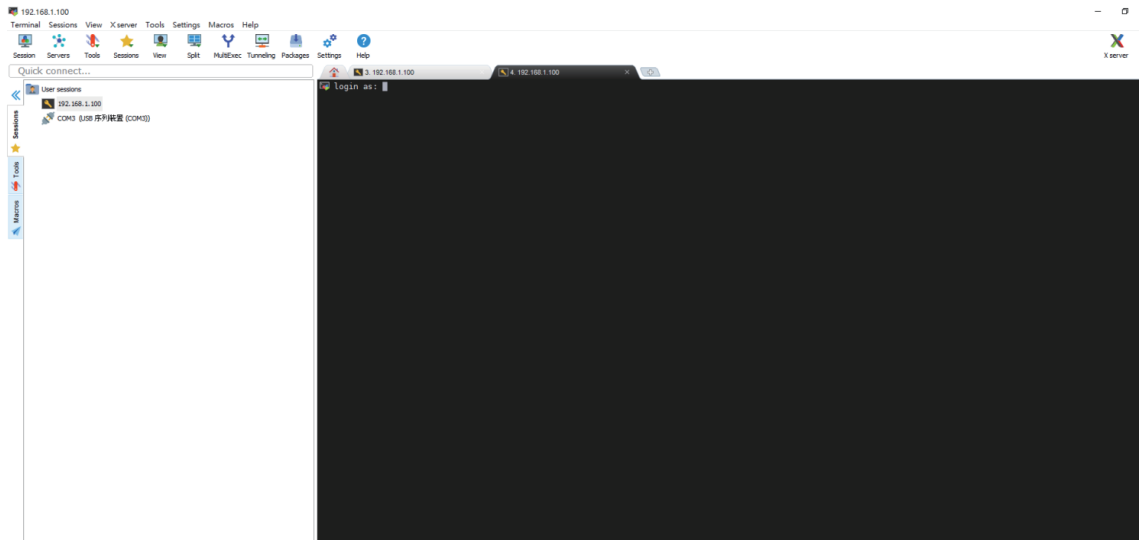
Console : Use USB 2.0 Type A to Micro B cable.



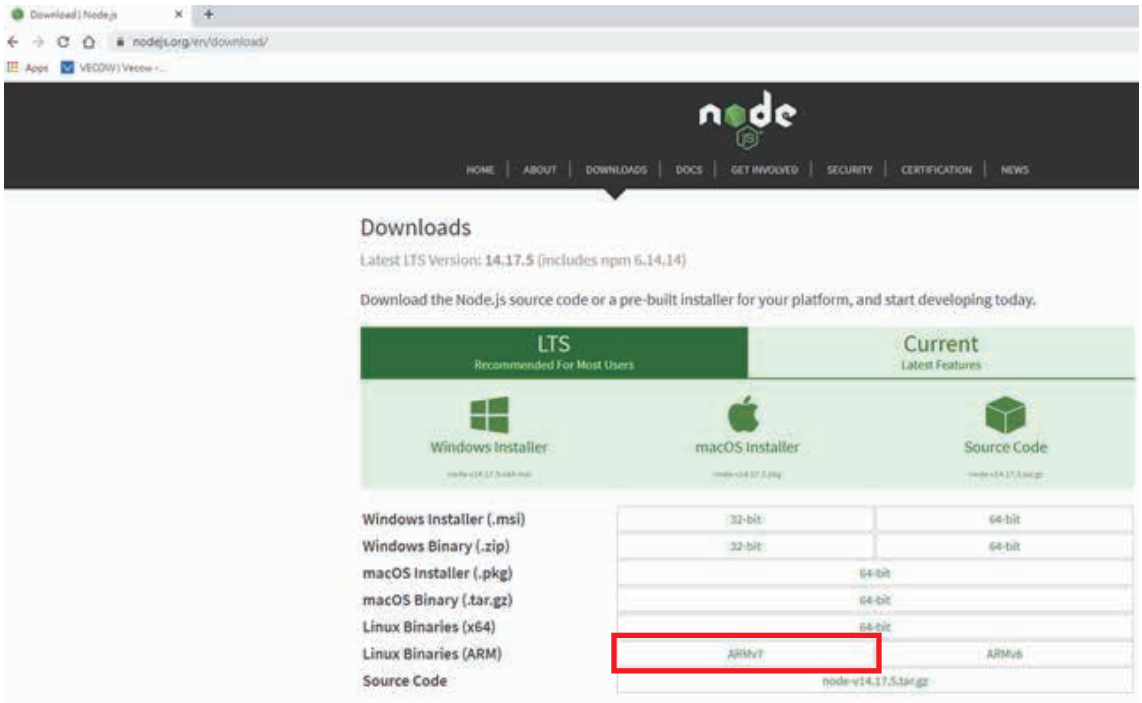
Step 2 Download the virtual serial port (Console) driver at https://ftdichip.com/drivers/vcp-drivers/



Step 3 Set up the connection between your host computer and AIC-100/110 by PuTTY.
Login Root : root
Root Password : root
Login User : user
User Password : user



Step 4 Download Node.js ARM 32bit installation compressed file at https://nodejs.org/en/download/.



Step 5 Copy the downloaded file (node-v14.17.5-linux-armv7l.tar.xz) to AIC-100/110 by USB device.

Step 6 Uncompressed Node.js on the AIC-100/110.

Command line input :

```
$ VERSION=v14.17.5
$ DISTRO=linux-armv7l
$ sudo mkdir -p /usr/local/lib/nodejs
$ export PATH=/usr/local/lib/nodejs/node-$VERSION-$DISTRO/bin:$PATH
$ sudo tar -xJvf node-$VERSION-$DISTRO.tar.xz -C /usr/local/lib/nodejs
```

Step 7 Test installation status

Command line input :

```
$ node –v
```

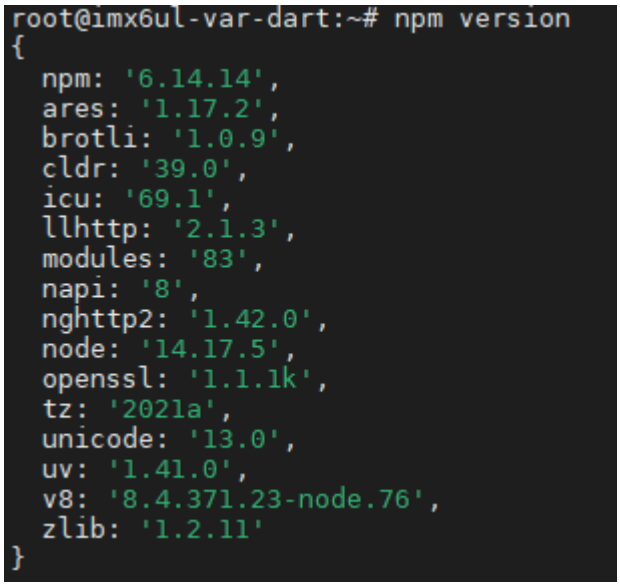
Displayed output :

```
v14.17.
```

Command line input :

```
$ npm version
```

Displayed output :



Command line input :

```
$ npx -v
```

Displayed output :

```
6.14.14
```

Step 8 Modify the environment variable in the ~/.profile file.

Command line input :

```
$ VERSION=v14.17.5
```

```
$ DISTRO=linux-armv7l
```

```
$ export PATH=/usr/local/lib/nodejs/node-$VERSION-$DISTRO/bin:$PATH
```

Step 9 Refresh profile

Command line input :

```
$ . ~/.profile
```

Step 10 Install Node-RED

Command line input :

```
$ npm install -g node-red
```

Displayed output:

```
root@imx6ul-var-dart:~# npm install -g node-red
/usr/local/lib/nodejs/node-v14.17.5-linux-armv7l/bin/node-red -> /usr/local/lib/nodejs/node-v14
.17.5-linux-armv7l/lib/node_modules/node-red/red.js
/usr/local/lib/nodejs/node-v14.17.5-linux-armv7l/bin/node-red-pi -> /usr/local/lib/nodejs/node-
v14.17.5-linux-armv7l/lib/node_modules/node-red/bin/node-red-pi

> bcrypt@5.0.1 install /usr/local/lib/nodejs/node-v14.17.5-linux-armv7l/lib/node_modules/node-r
ed/node_modules/bcrypt
> node-pre-gyp install --fallback-to-build

node-pre-gyp WARN Pre-built binaries not installable for bcrypt@5.0.1 and node@14.17.5 (node-v8
3 ABI, glibc) (falling back to source compile with node-gyp)
node-pre-gyp WARN Hit error EACCES: permission denied, mkdir '/usr/local/lib/nodejs/node-v14.17
.5-linux-armv7l/lib/node_modules/node-red/node_modules/bcrypt/lib'
gyp WARN EACCES current user ("nobody") does not have permission to access the dev dir "/root/.
cache/node-gyp/14.17.5"
```

Step 11 Connect to Node-RED on the host computer by a web browser. Check if the network IP address on AIC-100 is correct. The network segments of the host PC and AIC-100 should be the same.

```
root@imx6ul-var-dart:~# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: can0: <NOARP,ECHO> mtu 16 qdisc noop state DOWN group default qlen 10
    link/can
3: can1: <NOARP,ECHO> mtu 16 qdisc noop state DOWN group default qlen 10
    link/can
4: eth0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc pfifo_fast state DOWN group default
 qlen 1000
    link/ether f8:dc:7a:4a:30:ea brd ff:ff:ff:ff:ff:ff
5: eth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qle
n 1000
    link/ether f8:dc:7a:4a:30:eb brd ff:ff:ff:ff:ff:ff
    inet 192.168.137.142/24 brd 192.168.137.255 scope global dynamic eth1
       valid_lft 604757sec preferred_lft 604757sec
    inet6 fe80::d031:e171:2686:41c9/64 scope link
       valid_lft forever preferred_lft forever
6: sit0@NONE: <NOARP> mtu 1480 qdisc noop state DOWN group default qlen 1
    link/sit 0.0.0.0 brd 0.0.0.0
root@imx6ul-var-dart:~#
```

Example :

Host PC : 192.168.137.100

AIC-100 : 192.168.137.142

Step 12 Start Node-RED

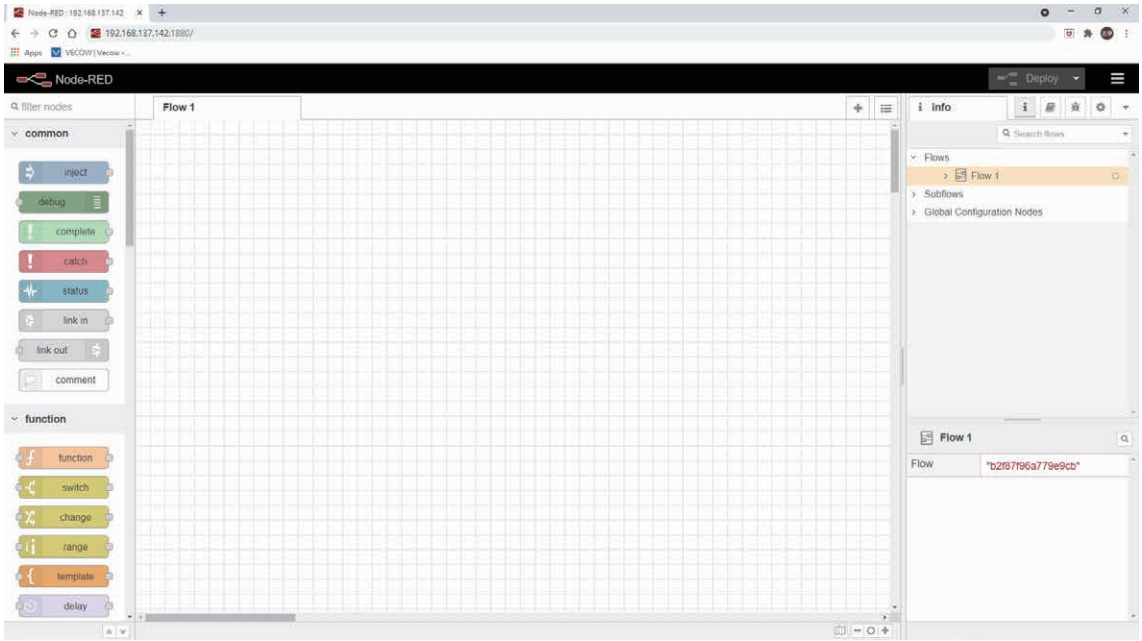
Command line input :

```
$ node-red
```

Displayed output :

```
root@imx6ul-var-dart:~# node-red
24 Aug 09:39:32 - [info]

Welcome to Node-RED
===================

24 Aug 09:39:32 - [info] Node-RED version: v2.0.5
24 Aug 09:39:32 - [info] Node.js  version: v14.17.5
24 Aug 09:39:32 - [info] Linux 4.9.11-02285-g8acc1a4 arm LE
24 Aug 09:39:36 - [info] Loading palette nodes
24 Aug 09:39:56 - [info] Dashboard version 2.30.0 started at /ui
24 Aug 09:39:56 - [info] Settings file  : /root/.node-red/settings.js
24 Aug 09:39:56 - [info] Context store  : 'default' [module=memory]
24 Aug 09:39:56 - [info] User directory : /root/.node-red
24 Aug 09:39:56 - [warn] Projects disabled : editorTheme.projects.enabled=false
24 Aug 09:39:56 - [info] Flows file     : /root/.node-red/flows.json
24 Aug 09:39:56 - [warn]

---------------------------------------------------------------------
Your flow credentials file is encrypted using a system-generated key.

If the system-generated key is lost for any reason, your credentials
file will not be recoverable, you will have to delete it and re-enter
your credentials.

You should set your own key using the 'credentialSecret' option in
your settings file. Node-RED will then re-encrypt your credentials
file using your chosen key the next time you deploy a change.
---------------------------------------------------------------------

24 Aug 09:39:57 - [info] Server now running at http://127.0.0.1:1880/
24 Aug 09:39:57 - [info] Starting flows
24 Aug 09:39:57 - [info] Started flows
```

Step 13 Type in IP address (based on your actual address, port default : 1880) on the web browser (using Chrome as an example) to see programming web page : http://192.168.137.142:1880.



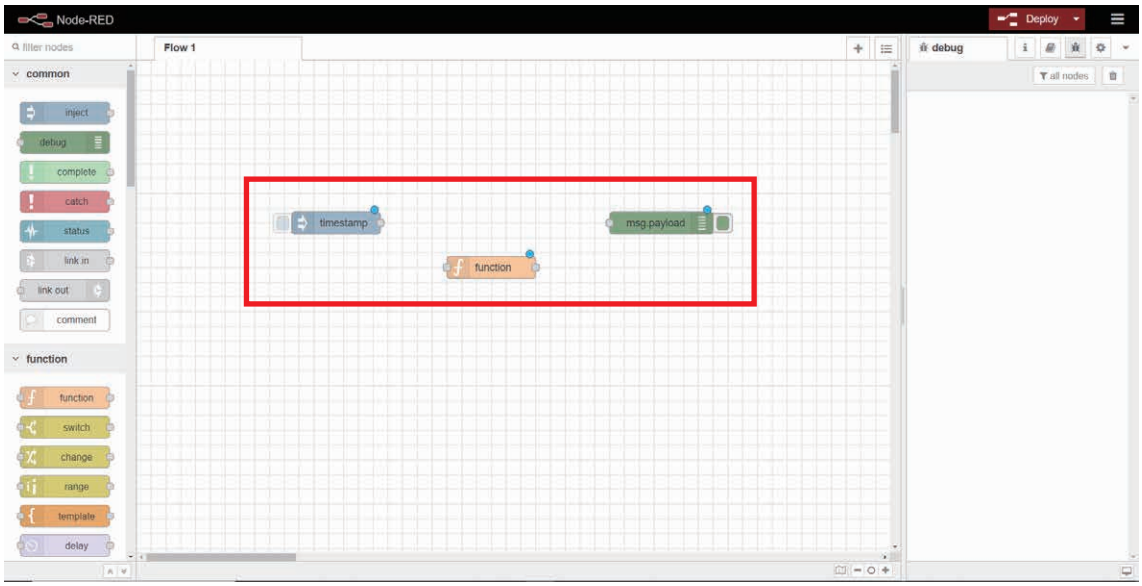
B.2 Creating a Hello World Example

After logging into the Node-RED program on the host computer, users can begin creating projects and coding programs.

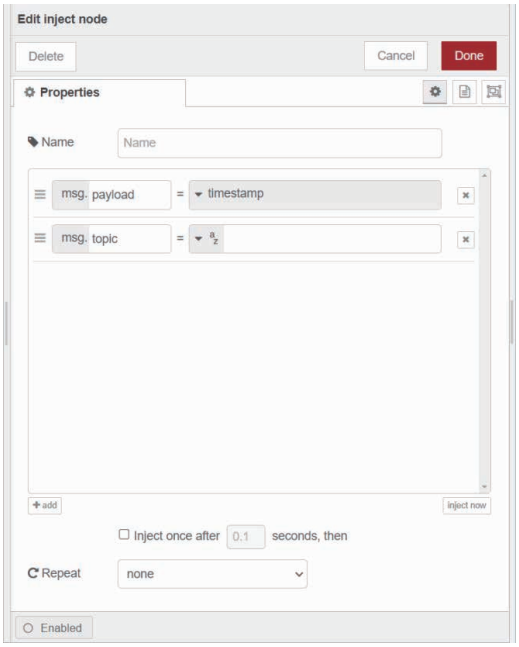
The node information is shown in the sidebar on the right of the interface. To connect hardware devices together, drag the node elements from the left-side palette and drop them into the edit area. Define the data and flow process by using wires to connect the endpoint of each node. Each node can meet various functional requirements. The data flow is left in and right out. You can also add customized functions by writing code in the function or template node. When the flow is finished, click "Deploy" to execute the flow.

Use the following steps to create a simple example.

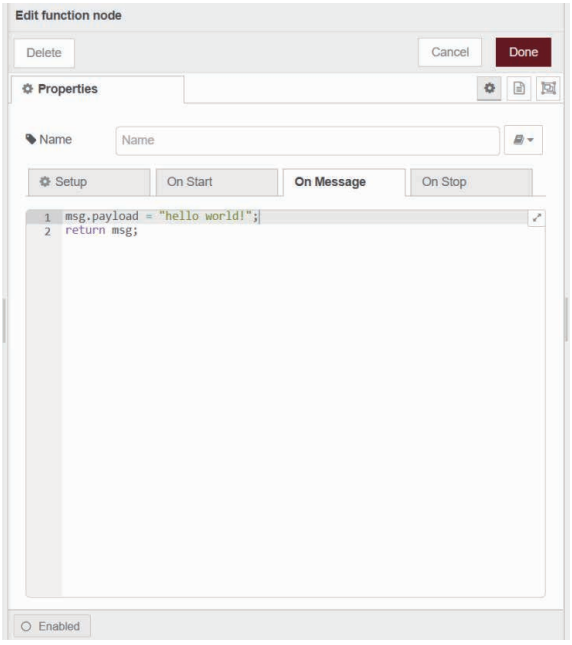
Step 1 Drag the timestamp, function, and debug blocks from the left-side palette and drop them into the edit area.



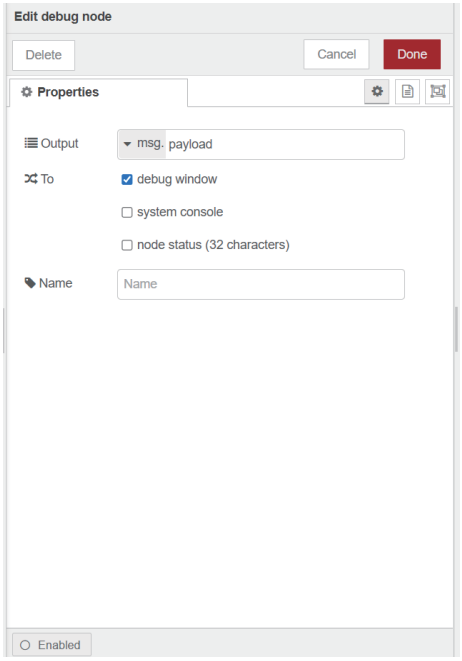
Step 2 Double-click on the node to enter the property setting or programming window. Set up the nodes to correspond with the following figures.



Inject node properties

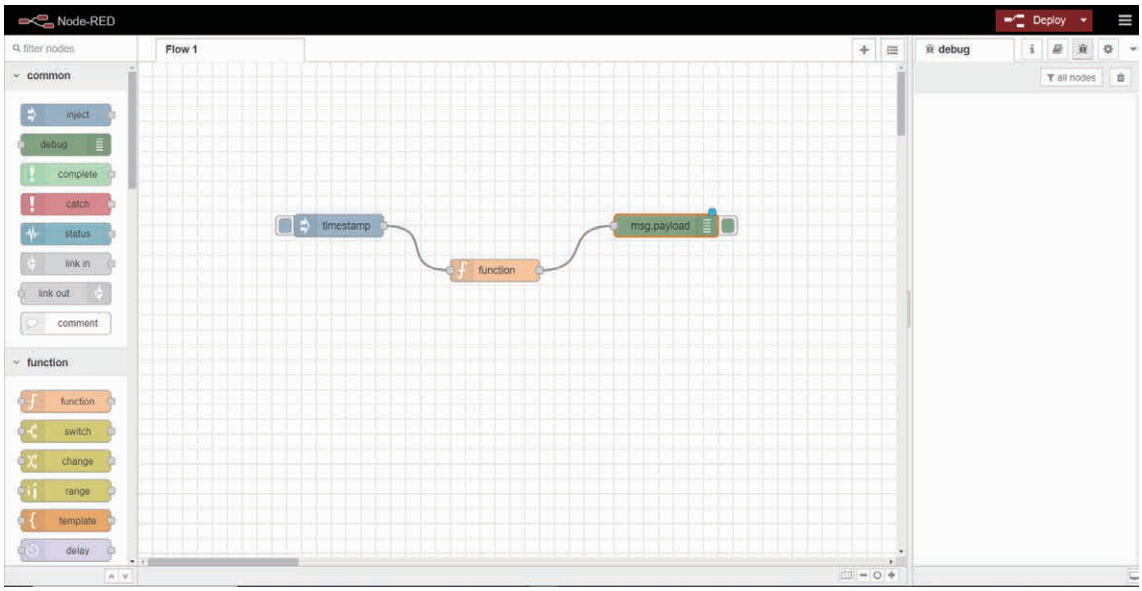


function node programming area

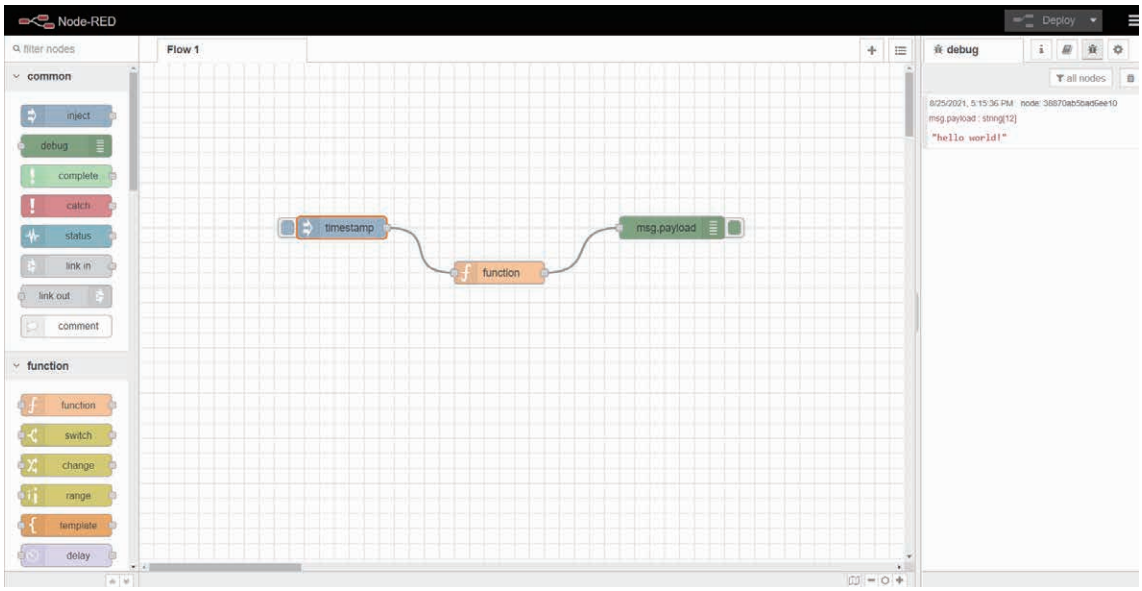


The debug message displays node properties

Step 3 Connect the endpoints of each node by the wiring. Click "Deploy" after finishing so the changes will be active.



Step 4 Press the event trigger button on the left of the Inject node, and you will see the "Hello World!" message in the debug message window on the right.



More node resources are also available online to suit any applications. For more information, visit https://flows.nodered.org/.

APPENDIX C : Power Consumption

Testing Board	AIC-100
RAM	512MB (On Board)
USB-1	USB Flash Transcend 2.0 16GB
LAN 1 (i219)	100 Mbps
LAN 2 (i210)	100 Mbps
Graphics Output	Micro USB cable (with Tera Term)
Power Source	Chroma 62006P-100-25
Test Program-1	Stress-ng

CPU	Power Input	Power on and boot to Win10 (64-bit)			
		Idle status CPU usage less 5%		Run 100% CPU usage	
		Max Current	Max Consumption	Max Current	Max Consumption
NXP i.MX6 ULL 900MHz Arm® Cortex®-A7 processor	09V	0.198A	01.78W	0.233A	02.09W
	12V	0.183A	02.19W	0.201A	02.41W
	24V	0.128A	03.07W	0.139A	03.32W
	36V	0.102A	03.69W	0.108A	03.90W
	48V	0.089A	04.29W	0.095A	04.55W
	50V	0.088A	04.40W	0.094A	04.69W

D

APPENDIX D : Supported Expansion Module List

D.1 Supported 4G/GPS List

Type	Model	Support Standard
mini PCIe	Quectel EC25 Series	LTE Category 4 UMTS/HSPA/GSM/GPRS/EDGE GPS/GLONASS/BeiDou/Galileo/QZSS

D.2 Supported Wi-Fi/Bluetooth List

Type	Model	Support Standard
mini PCIe	Bplus DUB802R	IEEE 802.11b/g/n (1T1R) BT 2.1/3.0/4.0
mini PCIe	jjPlus WMU6202	IEEE 802.11a/b/g/n/ac (2T2R) BT 2.1/3.0/3.0/4.1/4.2

Vecow

For further support information, please visit www.vecow.com

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