

LLD-AIO-004

BeagleBone Green Module IoT Cap

操作手冊
版本: V2.0

1	產品簡介	1
1.1	硬功能載板規格	2
1.2	外接接頭定義	4
1.3	通訊及控制介面腳位定義	5
1.4	LED 指示燈說明	7
1.5	其他定義	7
1.6	各通訊及控制介面軟體定義	9
2	第一次操作 LLD-AIO-004	10
2.1	測試環境建議	10
2.2	主控口(Console)簡介	12
2.3	出廠設定值	12
2.4	操作 console 主控口	12
3	LLD-AIO-004 基本操作	19
3.1	變更網路設定	19
3.2	變更系統時間	20
3.3	下載新的 Linux 套件	20
3.4	BeagelBone Green SoM 核心模組參考技術資訊	22
附錄 A.	主機網路設定	23
附錄 B.	轉接線	26
附錄 C.	測試主機 COM 接口查詢	27



1 產品簡介

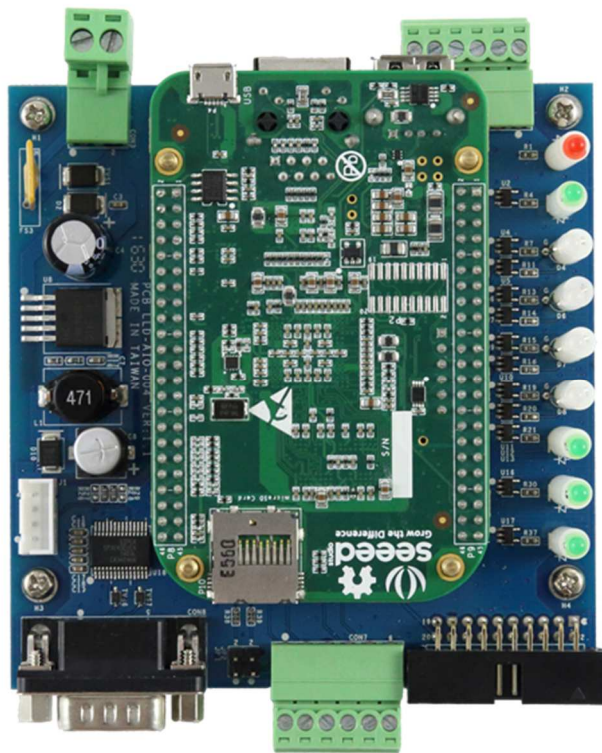
產品概述

LLD-AIO-004 是一款針對 Beglabone Green 核心模組做為 IoT 物聯網應用的功能載板，主要可應用於現場端設備或儀表的資料採集、即時監控、記錄及與遠端或雲端的數據傳輸。

LLD-AIO-004 搭配的 Beglabone Green 模組(簡稱 BBG)內建的 Linux 作業系統是一種開放式的架構，使用者可以利用公開的 GNU 軟體開發工具，安裝免費的嵌入式系統專用的 C/C++ 程式編譯器(Compiler)及函數庫(Lib)後或更高階的開發語言如 Python、PHP...，進行二次應用程式的開發，使 LLD-AIO-004 成為一款專用的物聯網應用控制器或閘道器(Gateway)。

LLD-AIO-004 具備多元的通訊及控制功能。有乙太網路介面，用來連接網路(LAN 或 WAN)與後台系統連接；具備 RS-485 通訊介面，讓 LLD-AIO-004 可連接更多不同類別的設備或儀表。充份扮演好一個設備監控或資料處理的閘道器角色。LLD-AIO-004 同時也具備數位控制(GPIO)的功能，搭配專用的 Digital I/O 轉換模組與外接模組就可以進行現場端的開關控制。

工業級的設計，無風扇、低功耗，適用於各類長時間不間斷的監控應用。採用金屬外殼，除了增加產品的強度外，壁掛及導軌安裝的設計，讓 LLD-AIO-004 可輕易的安裝使用在各類的場域。RJ45、可插拔的端子(Terminal Block)，都是常見的接頭，種種的設計，都是易於現場施工人員的配線。



1.1 硬功能載板規格

系統核心

- ▶ BeagleBone Green System Module

數位 I/O(GPIO)

- ▶ 數量：23 點
- ▶ 信號種類：3.3V CMOS
- ▶ 2.54mm 牛角針座 x 16 GPIO
- ▶ DIP Switch x 2 GPIO
- ▶ LED x 4 GPIO
- ▶ Beeper x 1 GPIO

RS-485 串列埠介面

- ▶ 數量：2 組
- ▶ RS-485 信號：Data+, Data-, GND (支援自動流向控制)
- ▶ Multi-Drop Nodes：128
- ▶ 信號終端電阻：120Ω可選 (by Jumper)
- ▶ 保護：15KV ESD 靜電保護, 400W 突波保護
- ▶ 接頭：3.50mm 可插拔端子座

RS-232 串列埠介面 (保留功能)

- ▶ 數量：1 組
- ▶ 信號：TxD, RxD, GND
- ▶ 保護：15KV ESD 靜電保護，400W 突波保護
- ▶ 接頭：DB9 公頭

UART 串列埠介面

- ▶ 數量：1 組
- ▶ UART(A)信號：TxD, RxD, GND
- ▶ 接頭：3.50mm 可插拔端子座

串列埠通訊參數

- ▶ Baud Rate：300 ~ 460,800 bps
- ▶ Parity：None, Even, Odd, Mark, Space
- ▶ Data Bits：5, 6, 7, 8
- ▶ Stop Bit：1, 2 bits

主控台串列埠(Console)

- ▶ 數量：1 組
- ▶ 信號：RS-232 (TxD, RxD, GND)
- ▶ 終端樣式：115,200 bps, VT-100
- ▶ 接頭：2.54mm 排針座

電源

- ▶ 工作電壓：DC 9~24VDC
- ▶ 電源接頭：5.00mm 端子座
- ▶ 功耗：<24W (不含 USB device)
- ▶ 電源輸出接點：併於 GPIO 牛角座及 UART 端子座

▶ 電源輸出：3.3V & 5V DC (1A max.)

其它

▶ Real Time Clock：1 組

▶ Beeper：1 組

▶ LED 指示燈：電源，網路，串列埠，控制信號，使用者自定義

▶ PCB 尺寸：98 x 102 mm

▶ 適用溫度：0~70°C

▶ 適用濕度：20%~80% RHG

▶ 認證：CE, FCC

核心板板載信號

連接介面

▶ 2x23 2.54 排針 2 組

VDC 工作電壓

UART 5 組

GPIO 22 點

RTC (I2C) 1 組

▶ 1x4 2.54 wafer 1 組

BBG Console 1 組

BeagleBone Green 內建通訊功能

▶ Ethernet：100Mbps, RJ45 x 1

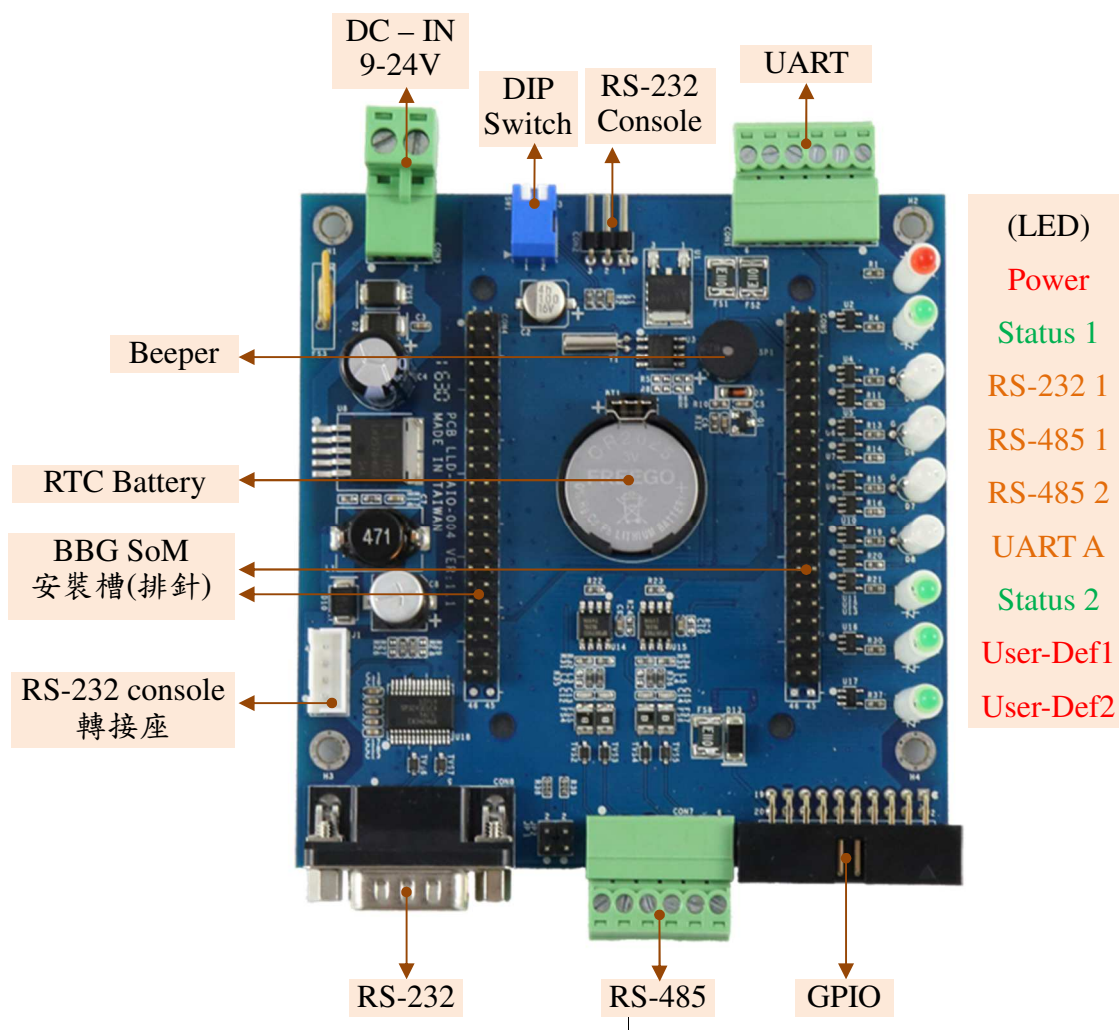
▶ USB Host：USB 2.0, Type A x 1

▶ USB Client：microUSB, Type B x 1 (無法做為 LLD-AIO-004 工作電源供電輸入)

▶ SD：MicroSD socket x 1

1.2 外接接頭定義

底板：LLD-AIO-004 Cape

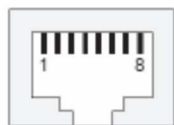


1.3 通訊及控制介面腳位定義

LAN1 Ethernet/乙太網路介面 (on BBG)

腳位	信號
1	ETX+
2	ETX-
3	ERX+
6	ERX-

RJ45

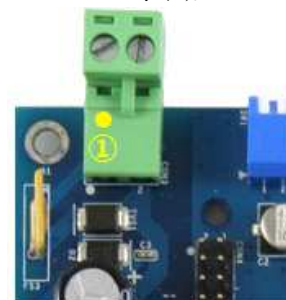


工作電壓輸入

腳位	信號
1	DC +
2	GND

- DC Range: 9-24V DC

5.00mm 端子座



RS-232

腳位	信號
1	DCD
2	RxD
3	TxD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	x

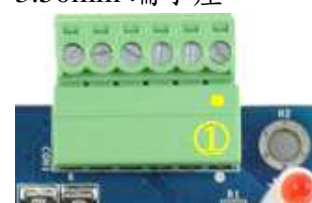
DB9



UART

腳位	信號
1	DC 5V
2	DC 3.3V
3	GND
4	TX(B)
5	RX(A)
6	TX(A)

3.50mm 端子座



RS-485

腳位	信號
1	D1+
2	D1-
3	GND
4	D2+
5	D2-
6	GND

3.50mm 端子座



RS-485 終端電阻-需開外殼

Short (短接)	有 終端電阻
Open (沒接)	無 終端電阻



RS-232 Console

腳位	信號
1	TxD
2	RxD
3	GND

3.50mm 端子座



腳位	信號
1	TxD
2	RxD
3	X
4	GND

Wafer 2.54 針座

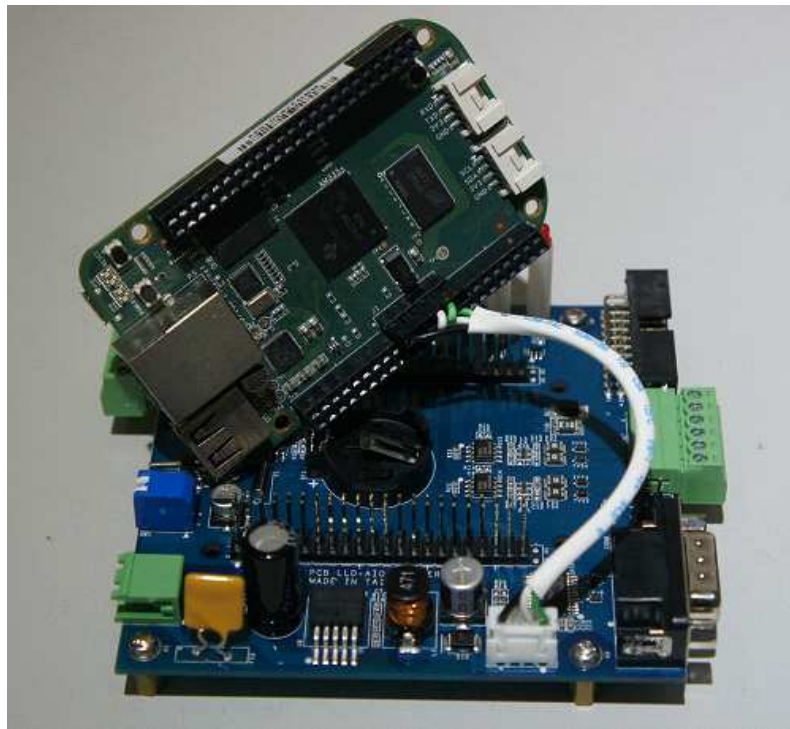


將所附的 LLD-AIO-004 專用 Console 線與 BeagleBone Green 核心板連接

- BeagleBone Green 核心板



使用專用線時，請注意接線順序，由右至左為黑白綠三色的順序



1.4 LED 指示燈說明

自上到下



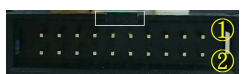
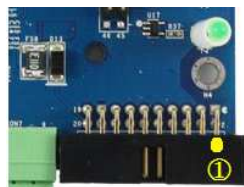
Power	電源指示燈 正確接上工作電壓
Status 1	狀態指示燈 使用者控制燈號 使用者以 DO(Digital Output)的方式控制
RS-232	RS-232 資料指示燈 紅色閃燈：資料接收中 綠色閃燈：資料傳輸中
RS-485(1)	RS-485(1)資料指示燈 紅色閃燈：資料接收中 綠色閃燈：資料傳輸中
RS-485(2)	RS-485(2)資料指示燈 紅色閃燈：資料接收中 綠色閃燈：資料傳輸中
UART(A)	UART(A)資料指示燈 紅色閃燈：資料接收中 綠色閃燈：資料傳輸中
Status 2	狀態指示燈 使用者控制燈號 使用者以 DO(Digital Output)的方式控制
U-def1	狀態指示燈 使用者控制燈號 使用者以 DO(Digital Output)的方式控制
U-def2	狀態指示燈 使用者控制燈號 使用者以 DO(Digital Output)的方式控制

1.5 其他定義

1.5.1 GPIO 定義

2.54mm

2x10 牛角排針座



零件編號: CON4

對應核心定義	定義	Pin#	Pin#	定義	對應核心定義
PIO_67	PIO-01	01	02	PIO-02	PIO_69
PIO_68	PIO-03	03	04	PIO-04	PIO_45
PIO_44	PIO-05	05	06	PIO-06	PIO_23
PIO_26	PIO-07	07	08	PIO-08	PIO_47
PIO_46	PIO-09	09	10	PIO-10	PIO_27
PIO_65	PIO-11	11	12	PIO-12	PIO_22
PIO_61	PIO-13	13	14	PIO-14	PIO_86
PIO_88	PIO-15	15	16	PIO-16	PIO_87
	GND	17	18	GND	
	X	19	20	X	

● 單雙號腳位”上下”並排

1.5.2 其它

RTC



- 以 I2C 控制
- 對應核心定義：I2C1
- RTC Battery size：CR2032
- 對應 RTC chip：DS3231

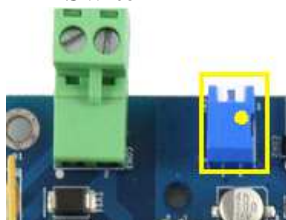
Beeper



- 以 GPIO 控制 (output)
- 對應核心定義：GPIO_120
- 動作

GPIO status	Beeper status
Low	OFF
High	ON

DIP Switch



- 以 GPIO 控制 (input)
- 對應核心定義：GPIO_115、GPIO_123
- 動作

GPIO status	Switch status
Low	ON
High	OFF

Programmable LED



Status 1 LED

- 以 GPIO 控制 (output)
- 對應核心定義：GPIO_60
- 動作

GPIO status	LED status
Low	Light ON
High	Off

Status 1 LED

- 以 GPIO 控制 (output)
- 對應核心定義：GPIO_07
- 動作

GPIO status	LED status
Low	Off
High	Light ON

U-def1 LED

- 以 GPIO 控制 (output)
- 對應核心定義：GPIO_50
- 動作

GPIO status	LED status
Low	Light ON
High	Off

U-def2 LED

- 以 GPIO 控制 (output)
- 對應核心定義：GPIO_51
- 動作

GPIO status	LED status
Low	Light ON
High	Off

1.6 各通訊及控制介面軟體定義

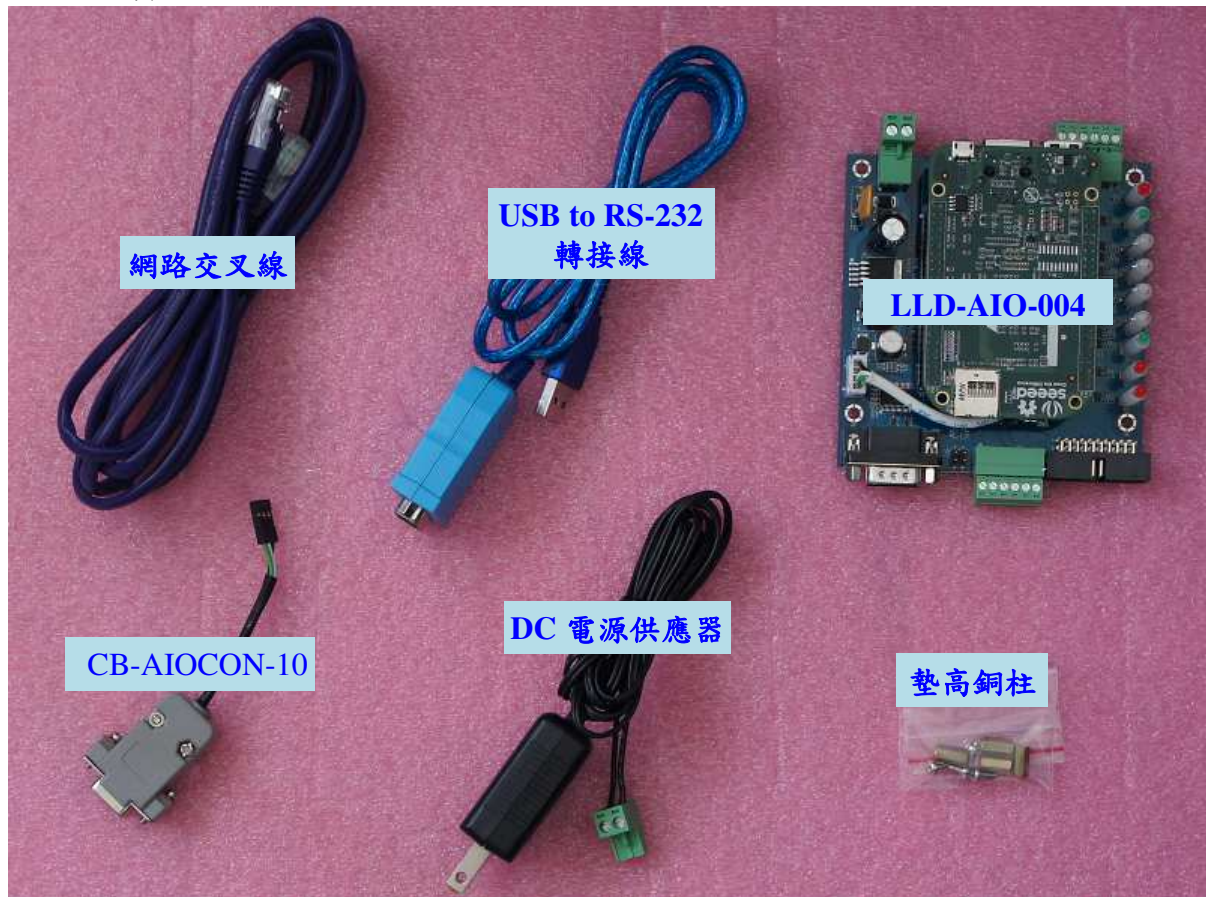
介面型態	標示	軟體定義
網路	LAN1	eth0
Console	RS-232	/dev/ttyS0
RS-485	RS-485 1	/dev/ttyS1
	RS-485 2	/dev/ttyS2
UART	UART	/dev/ttyS4
RS-232	RS-232	/dev/ttyS5
外掛記憶體	USB Disk	/dev/sda? (依設備先後插入順序有所不同)
	SD	/dev/mmc0

2 第一次操作 LLD-AIO-004

2.1 測試環境建議

2.1.1. 測試所需器材：

- LLD-AIO-004 一台
- DC 9~24V 電源供應器 一個(輸出功耗需大於>10W)
(如電源供應器接頭與 LLD-AIO-004 不同，可自製轉接線轉換為一般接線，參考附錄 B. 轉接線參考)
- 網路線或網路交叉線一條
- USB to RS-232 轉接線一條
- LLD-AIO-004 專用 RS-232 Console 線(品名: CB-AIOCON-10，自製方式請參考附錄 B. 轉接線參考)



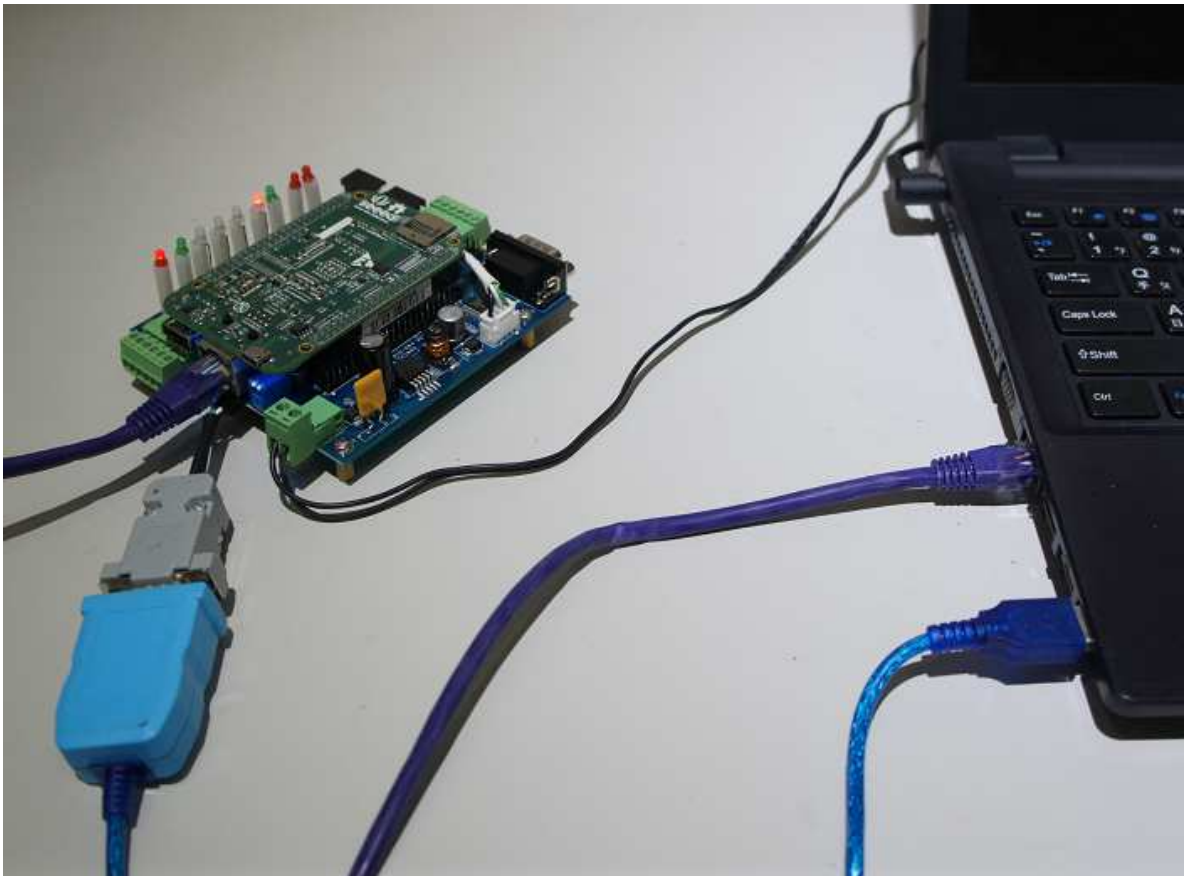
2.1.2. 連接安裝

建議先透過銅柱或其他絕緣部件將 LLD-AIO-004 墊高做隔離，以保護在開發及測試過程的產品的安全性



- ◆ 開發階段，建議把 BBG 核心板及 LLD-AIO-004 功能底板專用的 RS-232 console 接起 (詳細接線，請參 1.3. 章節的 RS-232 Console 腳位定義說明)

將網路與 RS-232 Console 都與測試主機連接，做為開發主機於 LLD-AIO-004 的通訊橋樑。



2.2 主控口(Console)簡介

LLD-AIO-004 出廠具備兩個主控口介面，一個是透過網路，另一個可透過 RS-232 介面，系統開發者可透過主控口對 LLD-AIO-004 進行完全的控制及開發。除了一般的參數變更外，更可以直接進行系統、程式開發或系統套件的安裝及更新。

2.3 出廠設定值

A. 登入密碼 (有大小寫之分)

管理者帳戶 一般登入	Login Name	debian	一般權限 只能透過系統指令進行信息的查詢 透過網路 console 登入，需先以 debian 身份登入
	Password	temppwd	
root 帳戶	Password	root	最高權限 可以變更設定，啟動或停止應用程序
		需先用 debian 登入	

B. 主控口通訊參數

網路	Ethernet (LAN1)	IP address : DHCP
RS-232	Console	Baud Rate : 115,200 bps Data Format : N-8-1 Flow Control : None Terminal Type :VT-100

2.4 操作 console 主控口

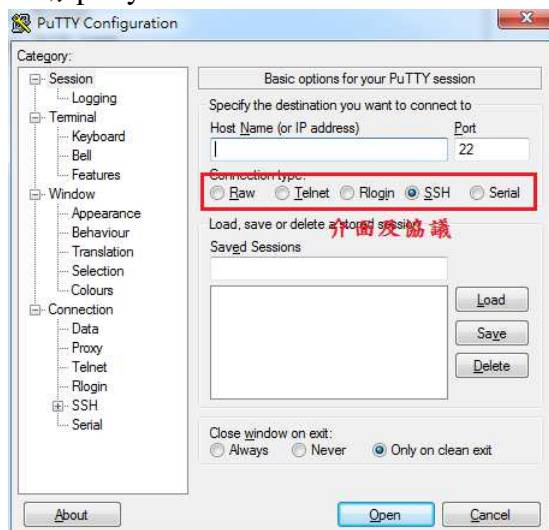
2.4.1 console 工具程式 - putty

putty 為 windows 作業系統中用來進行遠端通訊的一套工具軟體，常用連接於有主控接口的開發平台，如 LLD-AIO-004

■ 下載 putty

<https://putty.org>

■ 啟動 putty



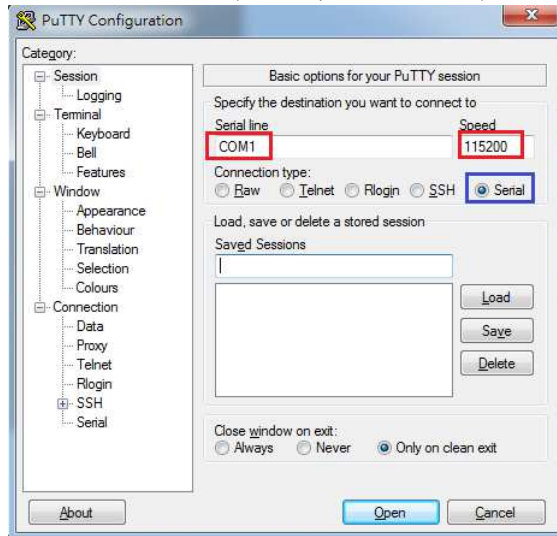
2.4.2 進入 RS-232 Console



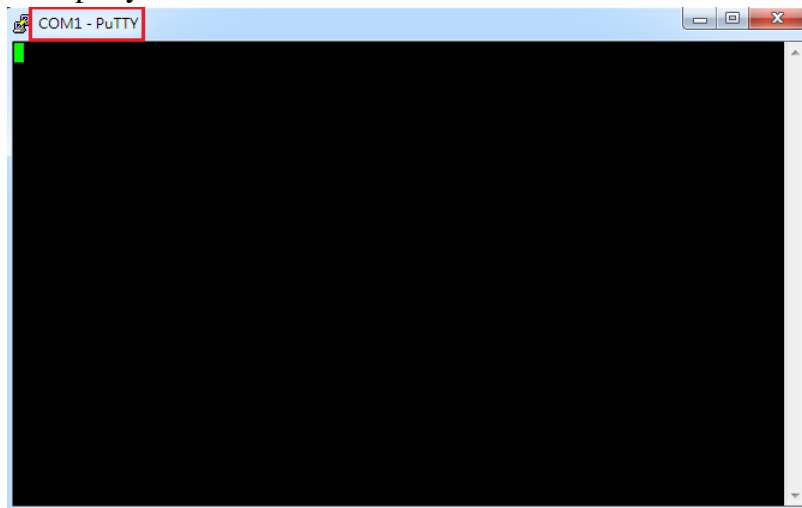
選擇 “Serial” 通訊介面

輸入 “COM1” (註*)及選擇通訊速度 ”115200”

註*: COM#為主機 RS-232 接口，統稱 COM 口的編號，透過 USB 轉接線擴充的編號需自主機系統中查詢。(可參考 “附錄 C.”)

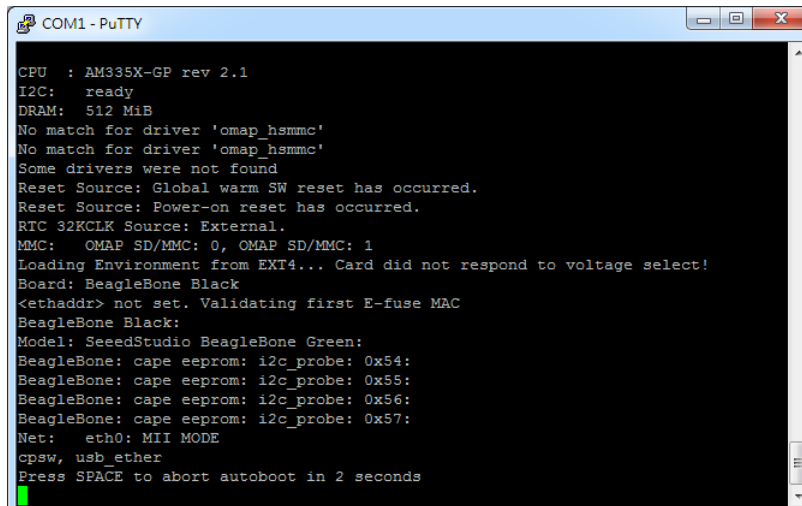


■ 啟動 putty



■ LLD-AIO-004 (通電)

顯示 Junminx-AIO-004 開機的信息



```
COM1 - PuTTY
uboot_overlays: loading /lib/firmware/BB-BONE-eMMC1-01-00A0.dtbo ...
1440 bytes read in 135 ms (9.8 KiB/s)
uboot_overlays: loading /lib/firmware/BB-ADC-00A0.dtbo ...
711 bytes read in 176 ms (3.9 KiB/s)
uboot_overlays: loading /lib/firmware/AM335X-PRU-RPROC-4-14-TI-00A0.dtbo ...
3513 bytes read in 18 ms (190.4 KiB/s)
loading /boot/initrd.img-4.14.71-ti-r80 ...
4794592 bytes read in 310 ms (14.7 MiB/s)
debug: [console=tty00,115200n8 bone_capemgr.uboot_capemgr_enabled=1 root=/dev/mm
chbklp1 ro rootfstype=ext4 rootwait coherent_pool=1M net.ifnames=0 quiet] ...
debug: [bootz 0x82000000 0x88080000:4928e0 88000000] ...
## Flattened Device Tree blob at 88000000
Booting using the fdt blob at 0x88000000
Loading Ramdisk to 8fb6d000, end 8ffff8e0 ... OK
reserving fdt memory region: addr=88000000 size=88000
Loading Device Tree to 8fae2000, end 8fb6cfff ... OK

Starting kernel ...

[ 0.002049] timer_probe: no matching timers found
[ 1.144558] wkup_m3_ipc 44e11324.wkup_m3_ipc: could not get rproc handle
[ 1.481531] omap_voltage_late_init: Voltage driver support not added
[ 1.488835] PM: Cannot get wkup_m3_ipc handle
```

開機步驟中途有些階段可能要等一些時間

```
COM1 - PuTTY
[+] (1 of 3) A start job is running for? 字ic Board Startup (32s / no limit
[**] (1 of 3) A start job is running for? 字ic Board Startup (33s / no limit
[***] (2 of 3) A start job is running for? 好etwork interfaces (33s / 5min 2s
[***] (2 of 3) A start job is running for? 好etwork interfaces (34s / 5min 2s
[***] (2 of 3) A start job is running for? 好etwork interfaces (34s / 5min 2s
[**] (1 of 3) A start job is running for? 字ic Board Startup (36s / no limit
[**] (1 of 3) A start job is running for? 字ic Board Startup (37s / no limit
[***] (1 of 3) A start job is running for? 字ic Board Startup (37s / no limit
[***] (2 of 3) A start job is running for? 好etwork interfaces (38s / 5min 2s
[***] (2 of 3) A start job is running for? 好etwork interfaces (38s / 5min 2s
[**] (2 of 3) A start job is running for? 好etwork interfaces (39s / 5min 2s
[***] (1 of 3) A start job is running for? 字ic Board Startup (41s / no limit
[***] (1 of 3) A start job is running for? 字ic Board Startup (41s / no limit
[***] (1 of 3) A start job is running for? 字ic Board Startup (42s / no limit
[**] (2 of 3) A start job is running for? 好etwork interfaces (42s / 5min 2s
[**] (2 of 3) A start job is running for? 好etwork interfaces (43s / 5min 2s
[***] (2 of 3) A start job is running for? 好etwork interfaces (43s / 5min 2s
[***] (1 of 3) A start job is running for? 字ic Board Startup (45s / no limit
[**] (1 of 3) A start job is running for? 字ic Board Startup (46s / no limit
[**] (1 of 3) A start job is running for? 字ic Board Startup (46s / no limit
[**] (2 of 3) A start job is running for? 好etwork interfaces (47s / 5min 2s
[***] (2 of 3) A start job is running for? 好etwork interfaces (47s / 5min 2s
[***] (2 of 3) A start job is running for? 好etwork interfaces (48s / 5min 2s
[***] (3 of 3) A start job is running for dev-ttyGS0.device (48s / 1min 30s)
```

LLD-AIO-004 系統啟動完成

```
COM1 - PuTTY
[ OK ] Started Serial Getty on ttyS0.
[ OK ] Reached target Login Prompts.
[ OK ] Started OpenBSD Secure Shell server.
[ OK ] Started dnsmasq - A lightweight DHCP and caching DNS server.
[ OK ] Reached target Host and Network Name Lookups.
Starting The Apache HTTP Server...
[ OK ] Started Generic Board Startup.
Starting BB WL18xx Bluetooth Service...
[ OK ] Started BB WL18xx Bluetooth Service.
[ OK ] Started The Apache HTTP Server.
[ OK ] Reached target Multi-User System.
[ OK ] Reached target Graphical Interface.
Starting Update UTMP about System Runlevel Changes...
[ OK ] Started Update UTMP about System Runlevel Changes.

Debian GNU/Linux 9 beaglebone ttyS0

BeagleBoard.org Debian Image 2018-10-07

Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian

default username:password is [debian:tempwd]

beaglebone login: █
```

出廠模式，透過 RS-232 Console 連接進入 LLD-AIO-004 需做密碼登入

例：以 root 身份登入（在出廠模式，只有 RS-232 console 可以做到）

```
COM1 - PuTTY
## Flattened Device Tree blob at 88000000
Booting using the fdt blob at 0x88000000
Loading Ramdisk to 8fb6d000, end 8ffff8e0 ... OK
reserving fdt memory region: addr=88000000 size=88000
Loading Device Tree to 8fae2000, end 8fb6cfff ... OK

Starting kernel ...

[ 0.002057] timer_probe: no matching timers found
[ 1.143594] wkup_m3_ipc 44e11324.wkup_m3_ipc: could not get rproc handle
[ 1.481614] omap_voltage_late_init: Voltage driver support not added
[ 1.488914] PM: Cannot get wkup_m3_ipc handle
rootfs: clean, 89535/238560 files, 552435/953344 blocks

Debian GNU/Linux 9 beaglebone ttyS0

BeagleBoard.org Debian Image 2018-10-07

Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian

default username:password is [debian:temppwd]

beaglebone login: root
Password:
```

```
COM1 - PuTTY

[ 1.143594] wkup_m3_ipc 44e11324.wkup_m3_ipc: could not get rproc handle
[ 1.481614] omap_voltage_late_init: Voltage driver support not added
[ 1.488914] PM: Cannot get wkup_m3_ipc handle
rootfs: clean, 89535/238560 files, 552435/953344 blocks

Debian GNU/Linux 9 beaglebone ttyS0

BeagleBoard.org Debian Image 2018-10-07

Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian

default username:password is [debian:temppwd]

beaglebone login: root
Password:
Last login: Wed Dec 26 10:14:30 UTC 2018 on ttyS0

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
root@beaglebone:~#
```

2.4.3 進入 Ethernet console

因 LLD-AIO-004 的出廠網路設定為 DHCP mode，所以需將 LLD-AIO-004 連接到有 DHCP server 的局網(LAN)中，才可以分配到有效的網路 IP address，也才能夠進行 Ethernet console 的接入。

■ 透過 RS-232 console 查看網路設定

可透過指令 ifconfig

◆ LLD-AIO-004 未連接到有 DHCP Server 的網路

```
COM1 - PuTTY
debian@beaglebone:~$
debian@beaglebone:~$ ifconfig eth0
eth0: flags=28669<UP,BROADCAST,MULTICAST,DYNAMIC> mtu 1500
       ether b0:d5:cc:84:77:42 txqueuelen 1000 (Ethernet)
       RX packets 0 bytes 0 (0.0 B)
       RX errors 0 dropped 0 overruns 0 frame 0
       TX packets 0 bytes 0 (0.0 B)
       TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
       device interrupt 55

debian@beaglebone:~$
```

◆ LLD-AIO-004 連接到有 SHCP Server 的網路

取得有效 IP address : 192.168.0.178

```

debian@beaglebone:~$
debian@beaglebone:~$ ifconfig eth0
eth0: flags=28605<UP,BROADCAST,RUNNING,MULTICAST,DYNAMIC> mtu 1500
    inet 192.168.1.100 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 fe80::b2d5:ccff:fe84:7742 prefixlen 64 scopeid 0x20<link>
    ether b0:d5:cc:84:77:42 txqueuelen 1000 (Ethernet)
    RX packets 90 bytes 8334 (8.1 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 127 bytes 15390 (15.0 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 55

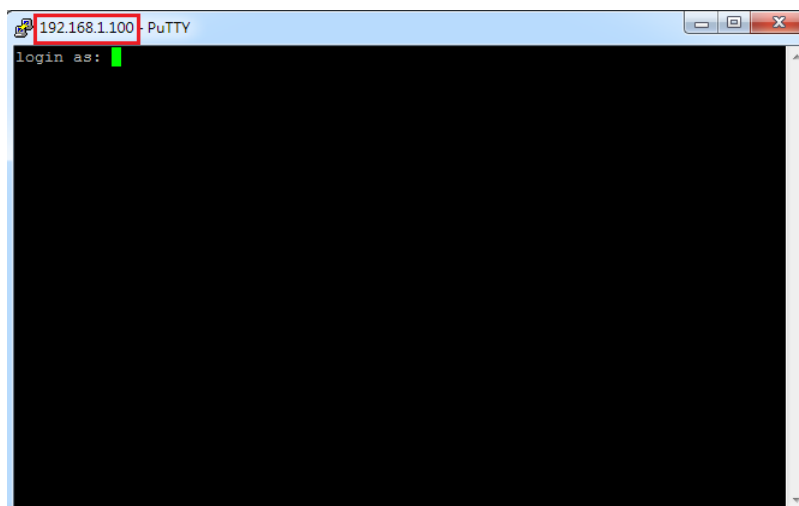
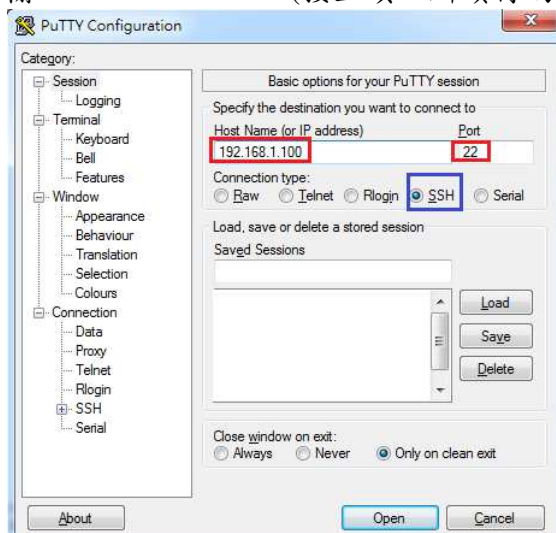
debian@beaglebone:~$

```

■ 啟動 putty

選擇 “SSH”通訊介面

輸入 “192.168.1.100 (接上續、所讀得的 LLD-AIO-004 IP address)”



■ 進入 LLD-AIO-004 Ethernet console

須以一般用戶的權限先登入，

Login Name	debian
Password	temppwd



```
192.168.1.100 - PuTTY
login as: debian
debian@192.168.1.100's password:

debian@beaglebone: ~
login as: debian
debian@192.168.1.100's password:

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Dec 26 10:00:25 2018
debian@beaglebone:~$ ^C
debian@beaglebone:~$
```

■ 變更為最高權限的用戶

輸入指令: "su"

輸入密碼: "root"

```
debian@beaglebone: ~
debian@beaglebone:~$
debian@beaglebone:~$
debian@beaglebone:~$ su
Password:
```

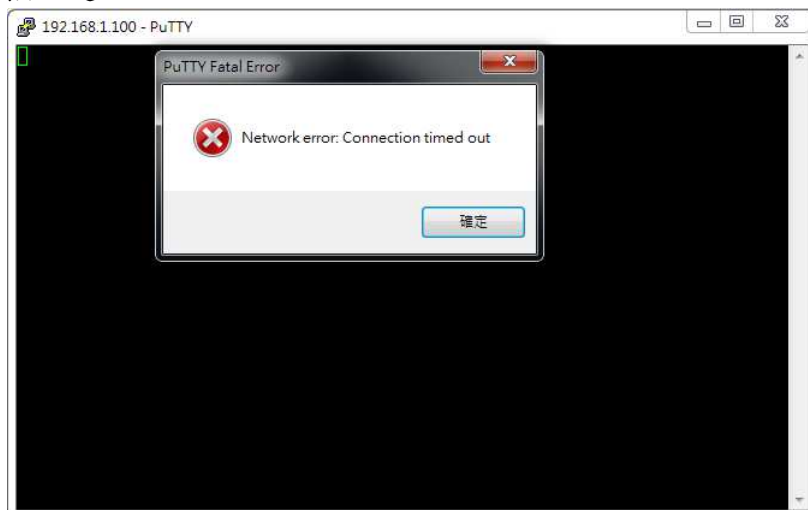


```
debian@beaglebone: ~  
debian@beaglebone:~$  
debian@beaglebone:~$  
debian@beaglebone:~$ su  
Password:  
root@beaglebone:/home/debian#
```

如果一開始就直接用”root”進行登入，會失敗

```
192.168.1.100 - PuTTY  
login as: root  
root@192.168.1.100's password:  
Access denied  
root@192.168.1.100's password:
```

■ 無法連入 LLD-AIO-004 Ethernet console



此狀況主要發生的原因常見有 3:

1. 輸入錯誤的 LLD-AIO-004 的 IP address
2. LLD-AIO-004 的網路有問題
 - LLD-AIO-004 的網路線沒接好
 - 不知 LLD-AIO-004 的網路 IP address 設定
3. LLD-AIO-004 和測試主機的網路設定在不同的網段
需查看主機的網路設定是否和 LLD-AIO-004 在同一 IP 網段，可參考 ”附錄 A”

3 LLD-AIO-004 基本操作

3.1 變更網路設定

LLD-AIO-004 的出廠設定是 DHCP mode，所連接的網路上需有一台 DHCP Server 功能的主機分配 IP address 給 LLD-AIO-004，如要將 LLD-AIO-004 變更為自定義的固定 IP 模式，需變更一系統設定檔 “interfaces”，所在路徑: "/etc/network"

```
root@NanoPi-NEO-Core: /etc/network
root@NanoPi-NEO-Core:~# cd /etc/network
root@NanoPi-NEO-Core:/etc/network# pwd
/etc/network
root@NanoPi-NEO-Core:/etc/network# ls -l
total 22
drwxr-xr-x 2 root root 4096 Jan 1 2016 if-down.d
drwxr-xr-x 2 root root 4096 Apr 25 05:34 if-post-down.d
drwxr-xr-x 2 root root 4096 Apr 25 05:34 if-pre-up.d
drwxr-xr-x 2 root root 4096 Jan 1 2016 if-up.d
-rw-r--r-- 1 root root 176 Feb 11 2016 interfaces
drwxr-xr-x 2 root root 4096 Apr 1 2016 interfaces.d
lrwxrwxrwx 1 root root 12 Oct 25 2017 run -> /run/network
root@NanoPi-NEO-Core:/etc/network#
```

■ DHCP 模式的設定

```
COM1 - PuTTY
#sudo connmanctl config <service> --ipv4 manual <ip_addr> <netmask> <gateway> --
nameservers <dns_server>

##connman: WiFi
#
#connmanctl
#connmanctl> tether wifi off
#connmanctl> enable wifi
#connmanctl> scan wifi
#connmanctl> services
#connmanctl> agent on
#connmanctl> connect wifi *_managed_psk
#connmanctl> quit

# Ethernet/RNDIS gadget (g_ether)
# Used by: /opt/scripts/boot/autoconfigure_usb0.sh
#iface usb0 inet static
#auto eth0
#iface eth0 inet static
# address 192.168.2.127
# netmask 255.255.255.0
# network 192.168.2.0
# gateway 192.168.2.1
root@beaglebone:/etc/network#
```

設定命令列前端多了 “#”，此命令列就不執行

■ 固定 IP Address 的設定

將 LLD-AIO-004 的 IP address 自定義為: 192.168.2.127



```
COM1 - PuTTY
#sudo connmanctl config <service> --ipv4 manual <ip_addr> <netmask> <gateway> --
nameservers <dns_server>

##connman: WiFi
#
#connmanctl
#connmanctl> tether wifi off
#connmanctl> enable wifi
#connmanctl> scan wifi
#connmanctl> services
#connmanctl> agent on
#connmanctl> connect wifi_*_managed_psk
#connmanctl> quit

# Ethernet/RNDIS gadget (g_ether)
# Used by: /opt/scripts/boot/autoconfigure_usb0.sh
#iface usb0 inet static
auto eth0
iface eth0 inet static
    address 192.168.2.127
    netmask 255.255.255.0
    network 192.168.2.0
    gateway 192.168.2.1
root@beaglebone:/etc/network#
```

3.2 變更系統時間

LLD-AIO-004 正常運行時，會有兩個時間同時運行，一個是系統時間，可透過 “date” 這個指令查看或變更，另一個是 HW RTC(實時時鐘)的時間，可透過 ”hwclock” 這指令查看及變更。

系統時間易受元件老化、運行的環境溫度等等影響，較容易發生時間不準的狀況，通常可透過網路校時，如 NTP 協議或命令，另外就是透過與 LLD-AIO-004 本機的 HW RTC 進行時間同步。

```
COM1 - PuTTY
root@beaglebone:/etc/network#
root@beaglebone:/etc/network#
root@beaglebone:/etc/network# date 查看系統時間
Sun Sep 15 11:23:14 UTC 2019
root@beaglebone:/etc/network#
root@beaglebone:/etc/network# date 091111112019 變更系統時間
Wed Sep 11 11:11:00 UTC 2019
root@beaglebone:/etc/network#
root@beaglebone:/etc/network# date
Wed Sep 11 11:11:06 UTC 2019
root@beaglebone:/etc/network#
root@beaglebone:/etc/network# hwclock -s 自RTC讀回時間
root@beaglebone:/etc/network#
root@beaglebone:/etc/network#
root@beaglebone:/etc/network# date
Sun Sep 15 11:23:49 UTC 2019
root@beaglebone:/etc/network#
root@beaglebone:/etc/network#
```

3.3 下載新的 Linux 套件

LLD-AIO-004 目前搭載的是 Linux 作業系統，開發或使用 LLD-AIO-004 可能需要安裝其它的開發套件或應用服務。

目前最常使用的方式，就是將 LLD-AIO-004 安裝在有連接到 Internet 的網路環境，透過”apt-get”這個安裝套件的工具程式進行軟體安裝。

註：需用管理者的最高權限身份，如 root，才可以進行系統操作，如安裝套件

```
COM1 - PuTTY
apt 1.4.8 (armhf)
Usage: apt-get [options] command
       apt-get [options] install|remove pkg1 [pkg2 ...]
       apt-get [options] source pkg1 [pkg2 ...]

apt-get is a command line interface for retrieval of packages
and information about them from authenticated sources and
for installation, upgrade and removal of packages together
with their dependencies.

Most used commands:
update - Retrieve new lists of packages
upgrade - Perform an upgrade
install - Install new packages (pkg is libc6 not libc6.deb)
remove - Remove packages
purge - Remove packages and config files
autoremove - Remove automatically all unused packages
dist-upgrade - Distribution upgrade, see apt-get(8)
dselect-upgrade - Follow dselect selections
build-dep - Configure build-dependencies for source packages
clean - Erase downloaded archive files
autoclean - Erase old downloaded archive files
check - Verify that there are no broken dependencies
--More--
```

- 例：安裝 MySQL Server
執行 `apt-get install mysql-server`

```
COM1 - PuTTY
root@beaglebone:~#
root@beaglebone:~# apt-get install mysql-server
```

安裝過程中，或許會有些提問要做確認

```
COM1 - PuTTY
libconfig-inifiles-perl libdbd-mysql-perl libdbi-perl libencode-locale-perl
libfcgi-perl libhtml-parser-perl libhtml-tagset-perl libhtml-template-perl
libhttp-date-perl libhttp-message-perl libio-html-perl libjemalloc1
liblwp-mediatypes-perl libmariadbclient18 libreadline5 libterm-readkey-perl
libtimedate-perl liburi-perl mariadb-client-10.1 mariadb-client-core-10.1
mariadb-common mariadb-server-10.1 mariadb-server-core-10.1 mysql-common
psmisc socat
Suggested packages:
gawk-doc libclone-perl libmldbm-perl libnet-daemon-perl
libsql-statement-perl libdata-dump-perl libipc-sharedcache-perl libwww-perl
mailx mariadb-test netcat-openbsd tinyc
The following NEW packages will be installed:
default-mysql-server galera-3 gawk libaio1 libcgi-fast-perl libcgi-pm-perl
libconfig-inifiles-perl libdbd-mysql-perl libdbi-perl libencode-locale-perl
libfcgi-perl libhtml-parser-perl libhtml-tagset-perl libhtml-template-perl
libhttp-date-perl libhttp-message-perl libio-html-perl libjemalloc1
liblwp-mediatypes-perl libmariadbclient18 libreadline5 libterm-readkey-perl
libtimedate-perl liburi-perl mariadb-client-10.1 mariadb-client-core-10.1
mariadb-common mariadb-server-10.1 mariadb-server-core-10.1 mysql-common
mysql-server psmisc socat
0 upgraded, 33 newly installed, 0 to remove and 103 not upgraded.
Need to get 24.0 MB of archives.
After this operation, 160 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```

不同的套件，安裝需要的時間不一樣

```
COM1 - PuTTY
libsql-statement-perl libdata-dump-perl libipc-sharedcache-perl libwww-perl
mailx mariadb-test netcat-openbsd tinyca
The following NEW packages will be installed:
default-mysql-server galera-3 gawk libaio1 libcgi-fast-perl libcgi-pm-perl
libconfig-inifiles-perl libdbd-mysql-perl libdbi-perl libencode-locale-perl
libfcgi-perl libhtml-parser-perl libhtml-tagset-perl libhtml-template-perl
libhttp-date-perl libhttp-message-perl libio-html-perl libjemalloc1
liblwp-mediatypes-perl libmariadbclient18 libreadline5 libterm-readkey-perl
libtimedate-perl liburi-perl mariadb-client-10.1 mariadb-client-core-10.1
mariadb-common mariadb-server-10.1 mariadb-server-core-10.1 mysql-common
mysql-server psmisc socat
0 upgraded, 33 newly installed, 0 to remove and 103 not upgraded.
Need to get 24.0 MB of archives.
After this operation, 160 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://deb.debian.org/debian stretch/main armhf gawk armhf 1:4.1.4+dfsg-1
[537 kB]
Get:2 http://deb.debian.org/debian stretch/main armhf mysql-common all 5.8+1.0.2
[5,608 B]
Get:3 http://deb.debian.org/debian stretch/main armhf mariadb-common all 10.1.41
-0+deb9u1 [28.5 kB]
Get:4 http://deb.debian.org/debian stretch/main armhf galera-3 armhf 25.3.19-2 [
912 kB]
7% [Working]
```

```
COM1 - PuTTY
Setting up libcgi-pm-perl (4.35-1) ...
Setting up libreadline5:armhf (5.2+dfsg-3+b1) ...
Setting up libfcgi-perl (0.78-2) ...
Setting up libdbi-perl (1.636-1+b1) ...
Setting up libhttp-date-perl (6.02-1) ...
Setting up mariadb-server-core-10.1 (10.1.41-0+deb9u1) ...
Setting up libhtml-template-perl (2.95-2) ...
Setting up mariadb-client-core-10.1 (10.1.41-0+deb9u1) ...
Setting up libcgi-fast-perl (1:2.12-1) ...
Setting up libhttp-message-perl (6.11-1) ...
Setting up libdbd-mysql-perl (4.041-2) ...
Setting up mariadb-client-10.1 (10.1.41-0+deb9u1) ...
Setting up mariadb-server-10.1 (10.1.41-0+deb9u1) ...
Created symlink /etc/systemd/system/mysql.service ? ? /lib/systemd/system/mariad
b.service.
Created symlink /etc/systemd/system/mysqld.service ? ? /lib/systemd/system/maria
db.service.
Created symlink /etc/systemd/system/multi-user.target.wants/mariadb.service ? ?
/lib/systemd/system/mariadb.service.
Setting up default-mysql-server (1.0.2) ...
Setting up mysql-server (5.5.999+default) ...
Processing triggers for libc-bin (2.24-11+deb9u3) ...
Processing triggers for systemd (232-25+deb9u6) ...
root@beaglebone:~#
```

確認 MySQL Server 已安裝，並且已運行

```
COM1 - PuTTY
avahi 998 1 0 04:11 ? 00:00:00 avahi-daemon: running [beaglebon
message+ 1001 1 0 04:11 ? 00:00:01 /usr/bin/dbus-daemon --system --
avahi 1009 998 0 04:11 ? 00:00:00 avahi-daemon: chroot helper
root 1025 1 0 04:11 ? 00:00:00 /lib/systemd/systemd-logind
root 1026 1 0 04:11 ? 00:00:00 /usr/sbin/connman -n --nodnspro
root 1134 1 0 04:12 tty1 00:00:00 /sbin/agetty --noclear tty1 linu
root 1146 1 0 04:12 ? 00:00:00 /sbin/wpa_supplicant -u -s -O /r
root 1149 1 0 04:12 ? 00:00:00 /usr/sbin/sshd -D
root 1177 2 0 04:12 ? 00:00:00 [file-storage]
root 1186 1 0 04:12 ? 00:00:00 /usr/sbin/apache2 -k start
www-data 1187 1186 0 04:12 ? 00:00:05 /usr/sbin/apache2 -k start
www-data 1188 1186 0 04:12 ? 00:00:05 /usr/sbin/apache2 -k start
dnsmasq 1286 1 0 04:12 ? 00:00:00 /usr/sbin/dnsmasq -x /run/dnsmas
root 1289 1 0 04:12 ttyS0 00:00:00 /bin/login --
root 1998 1 0 04:12 ttyGS0 00:00:00 /sbin/agetty --keep-baud 115200,
root 2043 1 0 05:19 ? 00:00:00 /lib/systemd/systemd --user
root 2045 2043 0 05:19 ? 00:00:00 (sd-pam)
root 2047 1289 0 05:19 ttyS0 00:00:00 -bash
root 2296 2 0 05:34 ? 00:00:00 [ptp0]
root 2308 2 0 05:40 ? 00:00:00 [kworker/0:0]
root 2573 2 0 05:46 ? 00:00:00 [kworker/0:1]
mysql 3290 1 1 05:47 ? 00:00:00 /usr/sbin/mysqld
root 3343 2047 0 05:48 ttyS0 00:00:00 ps -ef
root@beaglebone:~#
```

3.4 BeagleBone Green SoM 核心模組參考技術資訊

如需更詳細的系統核心模組的相關資訊，可至系統核心模組的產品官網進行查閱

Beaglebone Green：

http://wiki.seeedstudio.com/BeagleBone_Green/

附錄 A. 主機網路設定

WINDOWS 7 的環境設定

Step.01 開始 → 控制台 → 網路和網際網路-檢視網路狀態及工作。

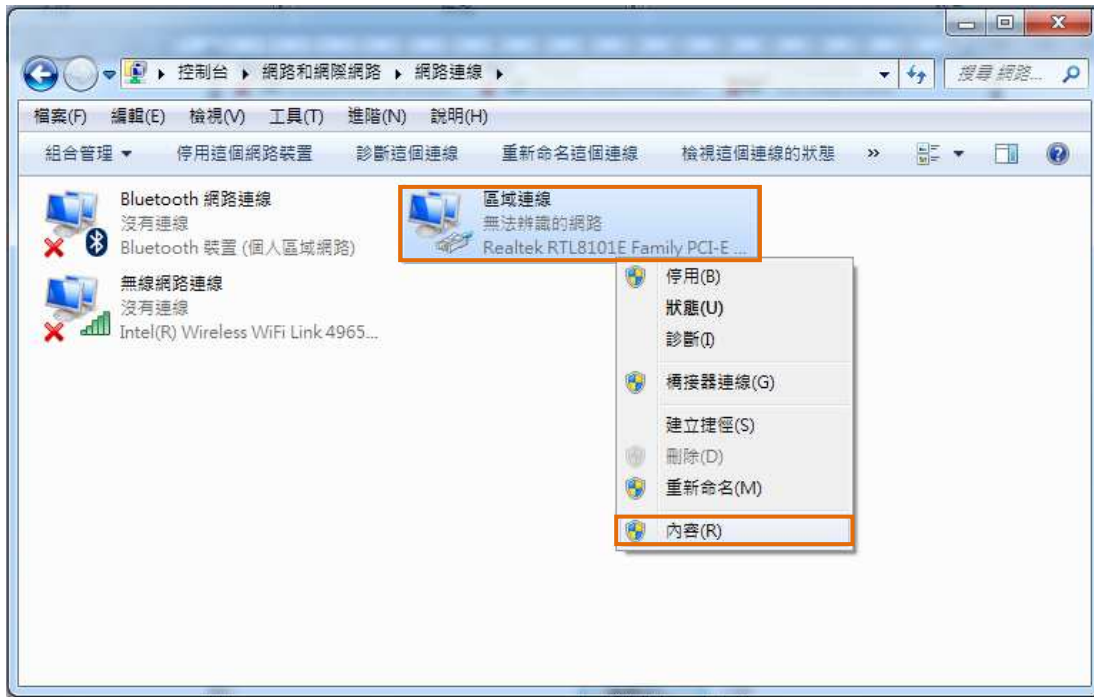


Step.02 變更介面卡設定。

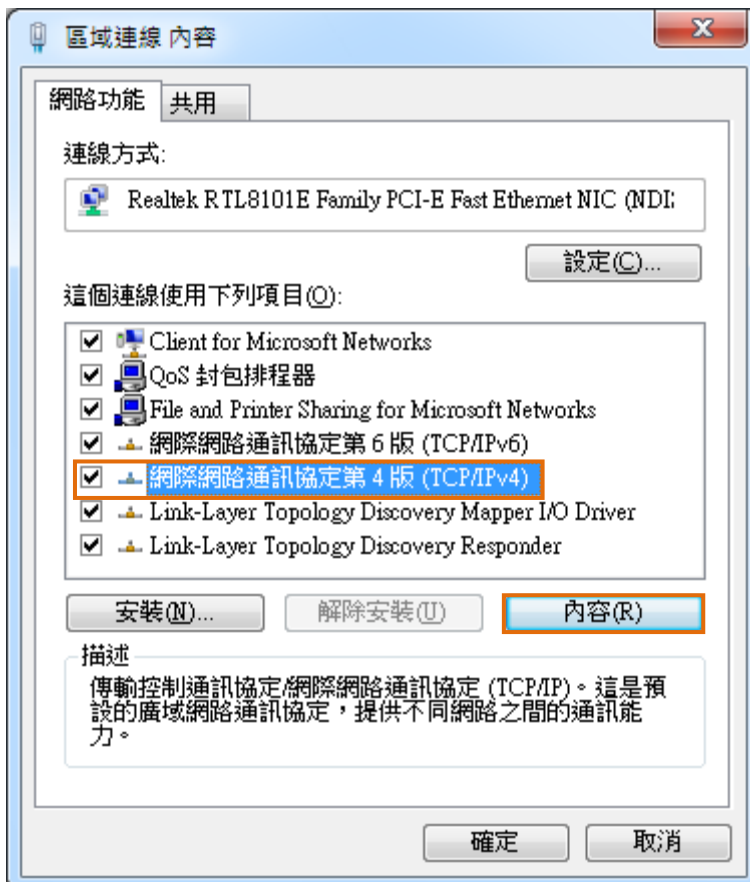




Step.03 區域連線 → 按右鍵 內容。

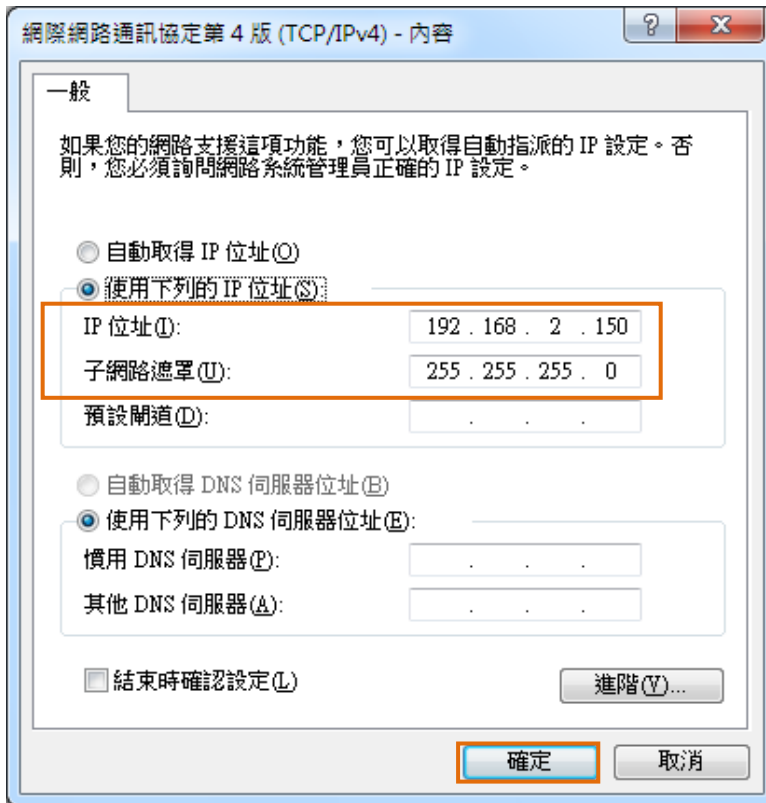


Step.04 網際網路通訊協定第 4 版(TCP/IPv4) → 內容。

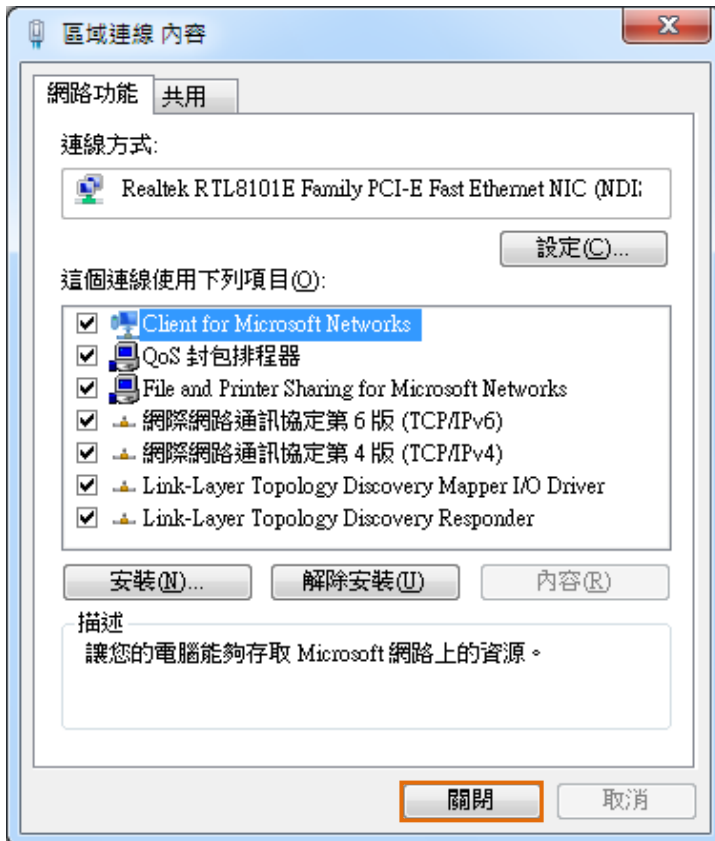




Step.05 IP 位址(I)：192.168.2.150；子網路遮罩(U)：255.255.255.0 → 確定鍵。



Step.06 設定完畢點擊關閉鍵。



附錄 B. 轉接線

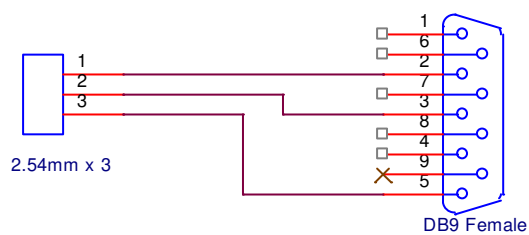
B1. Console 線

3-pin 2.54mm 排針座轉換 DB9 母頭



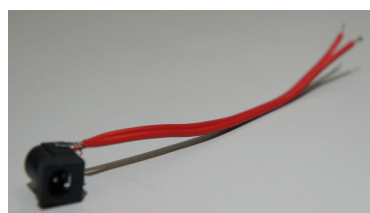
接腳定義

3-PIN HEADER 腳位編號	信號定義	DBB9 母 腳位編號
1	TxD	2
2	RxD	3
3	GND	5



B2. 電源轉接線

DC Power Jack 轉 Terminal Block



內徑 $\Phi 2.1\text{mm}$ powerjack

附錄 C. 測試主機 COM 接口查詢

