

LLD-AIO-004

BeagleBone Green Module IoT Cap

操作手冊
版本: V2.1

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1 產品簡介

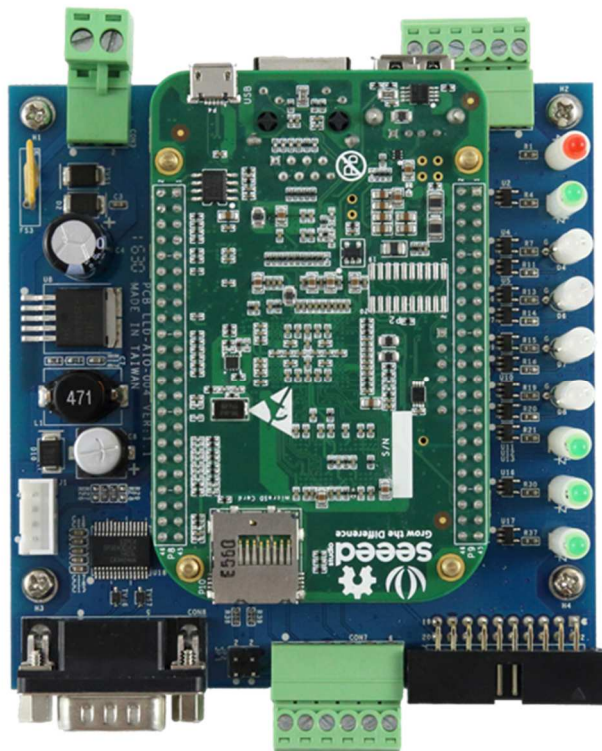
產品概述

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 BGG)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

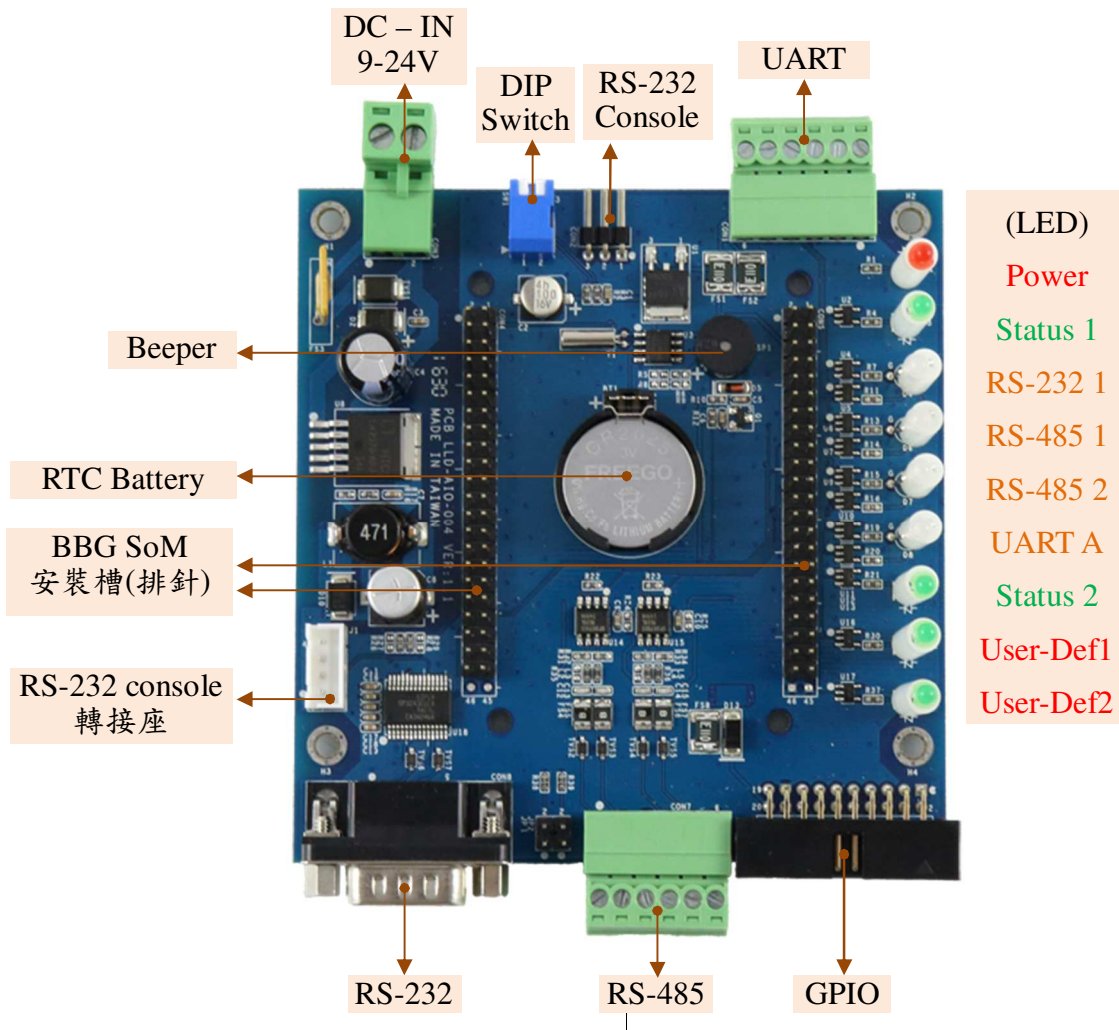
▷ USB Host：USB 2.0, Type A x 1

▷ 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

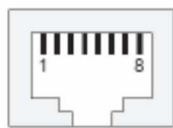


1.3 通訊及控制介面腳位定義

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

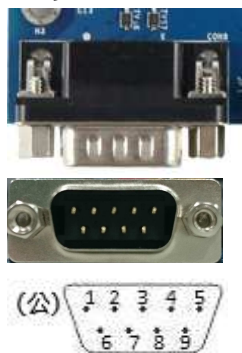
5.00mm 端子座



RS-232

| 腳位 | 信號 |
|----|-----|
| 1 | x |
| 2 | RxD |
| 3 | TxD |
| 4 | x |
| 5 | GND |
| 6 | x |
| 7 | x |
| 8 | x |
| 9 | x |

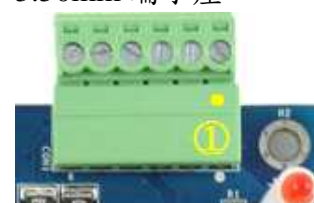
DB9



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

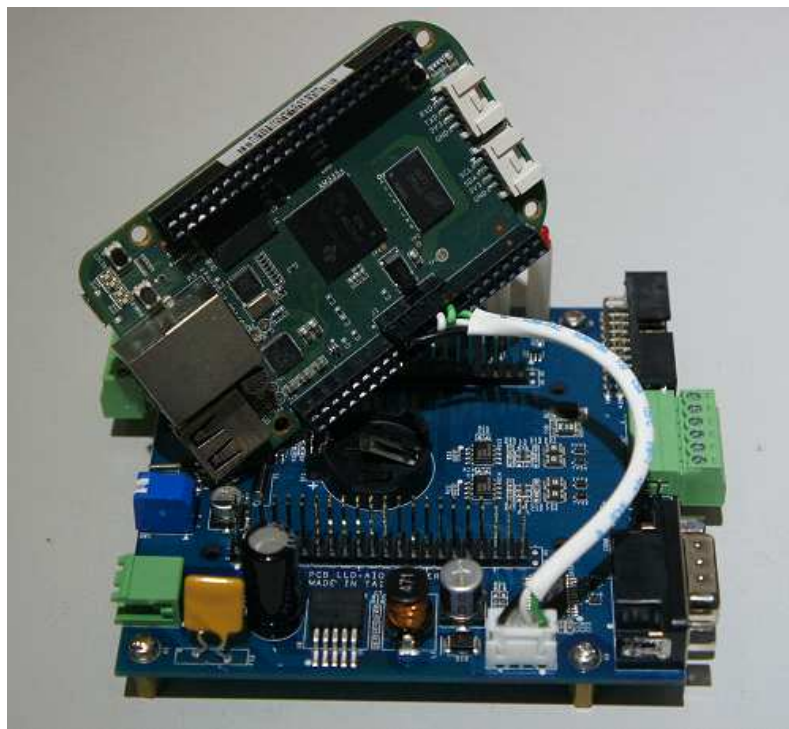


將所附的 LLD-AIO-004 專用 Console 線與 BeagleBone Green 核心板連接

- 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



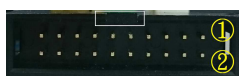
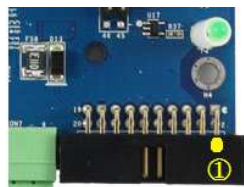
| | |
|------------------|--|
| Power | 電源指示燈 正確接上工作電壓 |
| Status 1 | 狀態指示燈 使用者控制燈號 使用者以 DO(Digital Output)的方式控制 |
| RS-232 | RS-232 資料指示燈 紅色閃燈：資料接收中 綠色閃燈：資料傳輸中 |
| RS-485(1) | RS-485(1)資料指示燈 紅色閃燈：資料接收中 綠色閃燈：資料傳輸中 |
| RS-485(2) | RS-485(2)資料指示燈 紅色閃燈：資料接收中 綠色閃燈：資料傳輸中 |
| UART(A) | UART(A)資料指示燈 紅色閃燈：資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

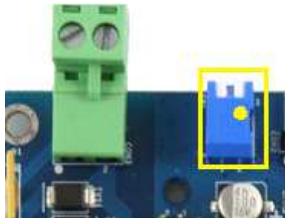
Beeper



- 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

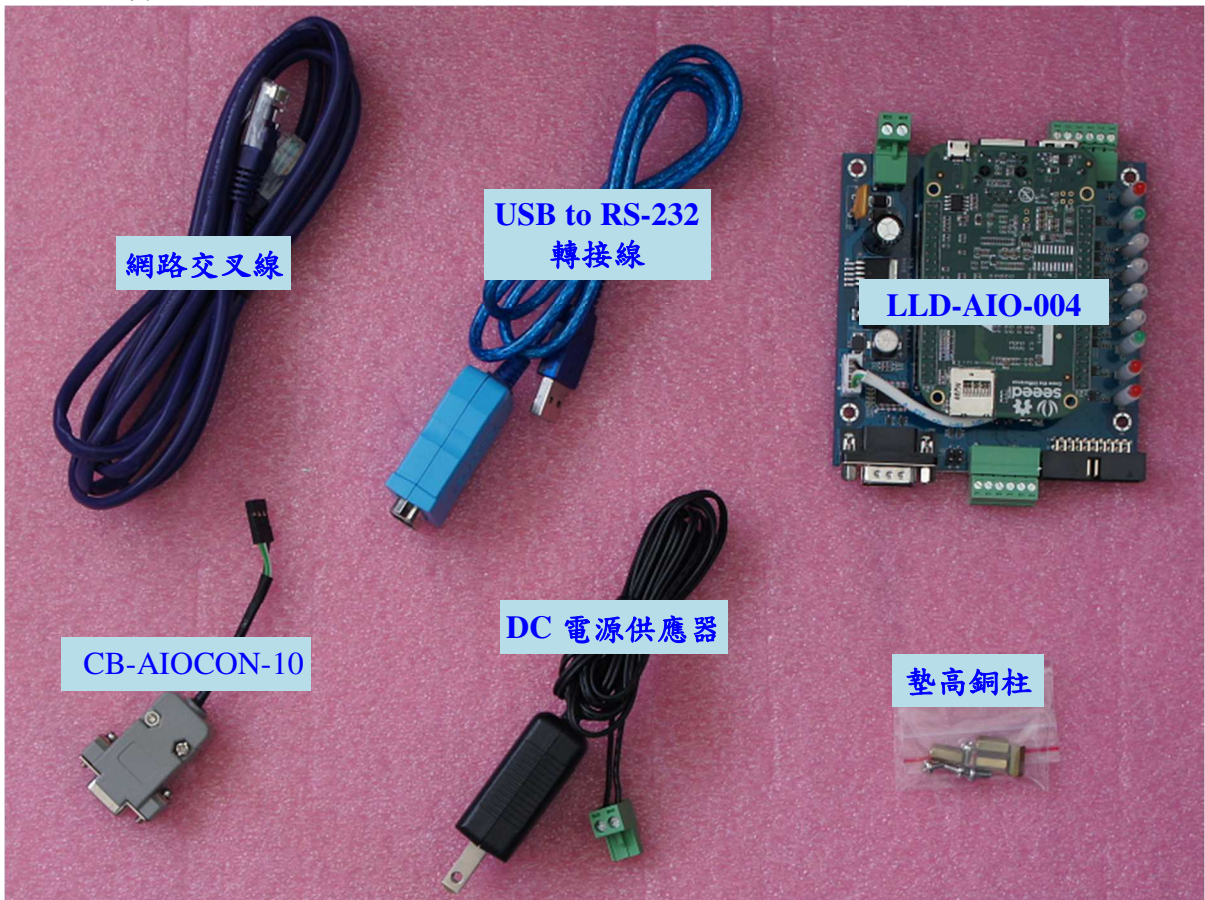
| 介面型態 | 標示 | 軟體定義 |
|---------|----------|------------------------------|
| 網路 | LAN1 | eth0 |
| Console | RS-232 | /dev/ttyS0 |
| RS-485 | RS-485 1 | /dev/ttyS1 |
| | RS-485 2 | /dev/ttyS2 |
| UART | UART | /dev/ttyS4 |
| RS-232 | RS-232 | /dev/ttyS5 |
| 外掛記憶體 | USB Disk | /dev/sda? (依設備先後插入順序有所不同)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

2 第一次操作 LLD-AIO-004

2.1 測試環境建議

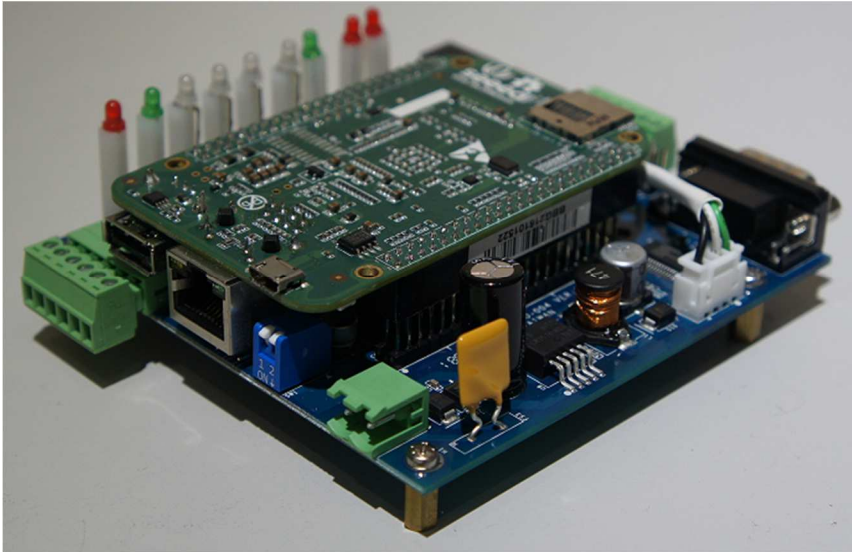
2.1.1. 測試所需器材：

- 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)



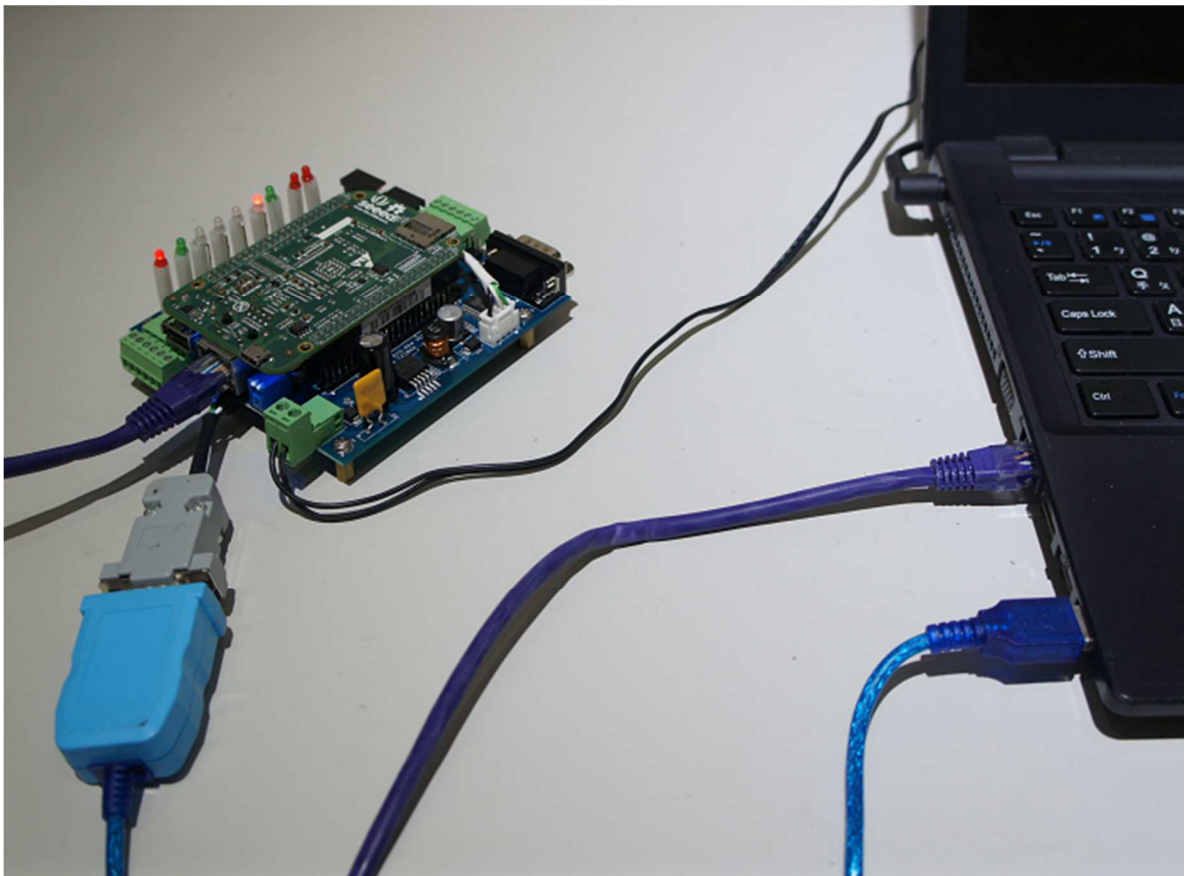
2.1.2. 連接安裝

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

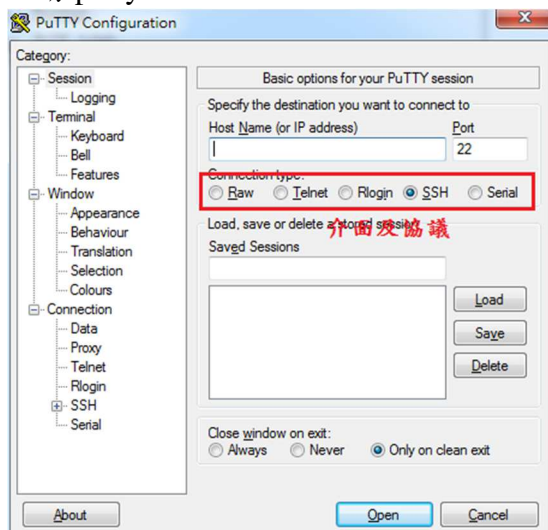
2.4.1 console 工具程式 - putty

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



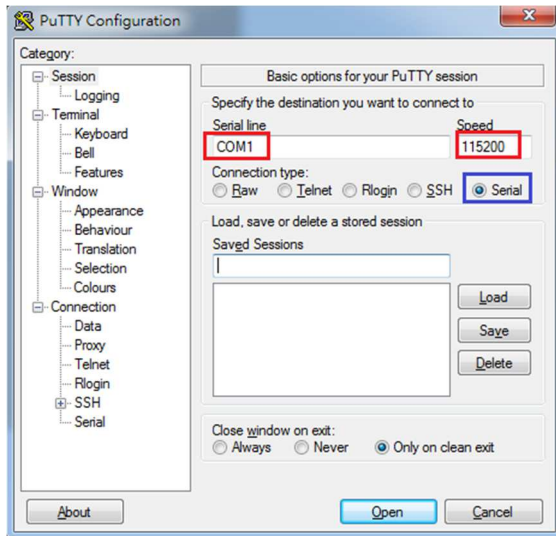
2.4.2 進入 RS-232 Console



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.”)

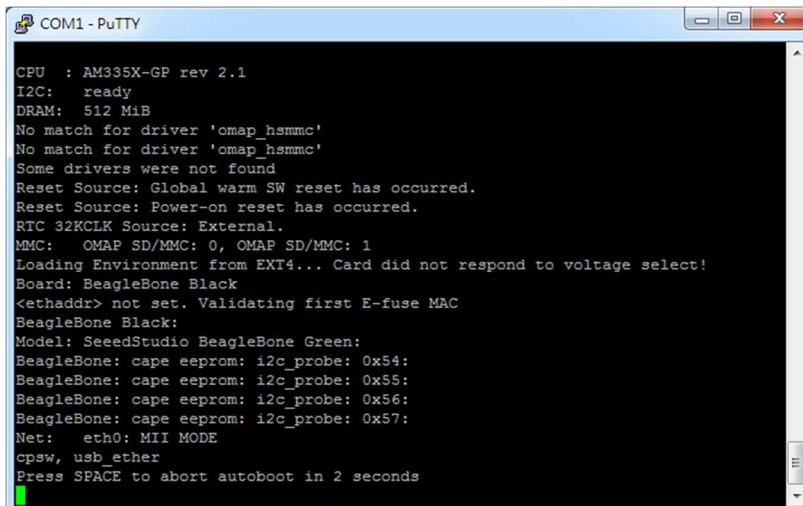


■ 啟動 putty



■ 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/mmc
cblk1p1 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:tempwd]

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:tempwd]

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

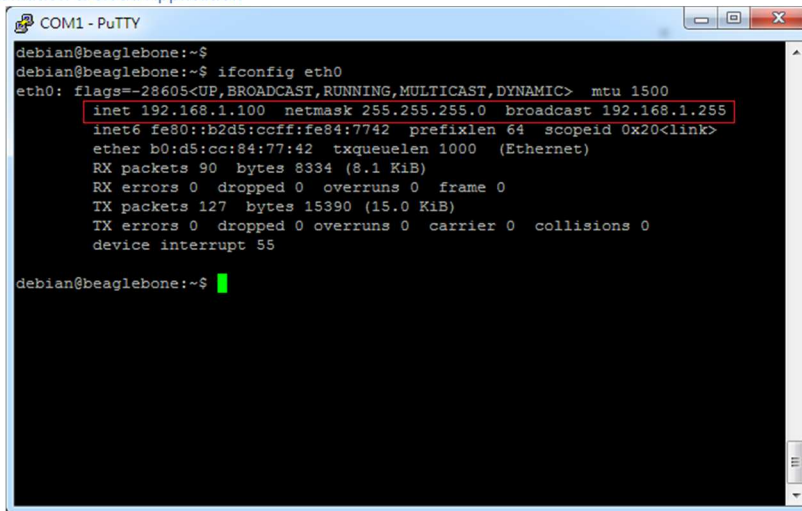
因 LLD-AIO-004 的出廠網路設定為 DHCP mode，所以需將 LLD-AIO-004 連接到有 DHCP server 的局網(LAN)中，才可以分配到有效的網路 IP address，也才能夠進行 Ethernet console 的接入。

- 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

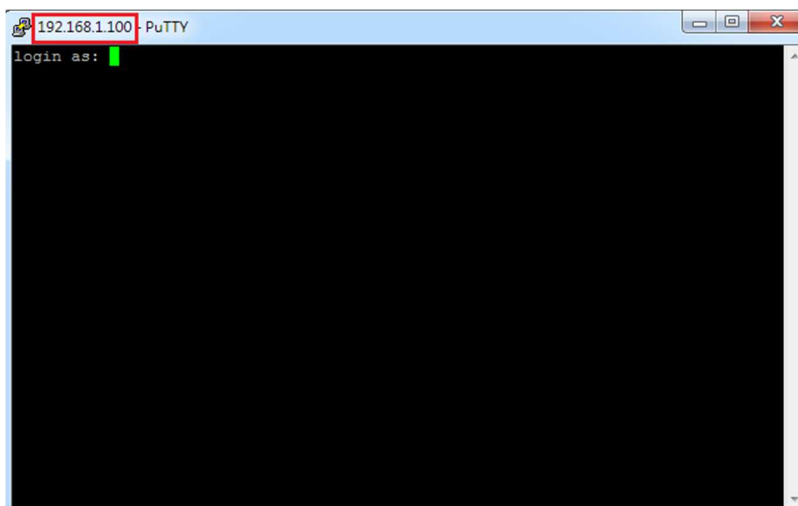
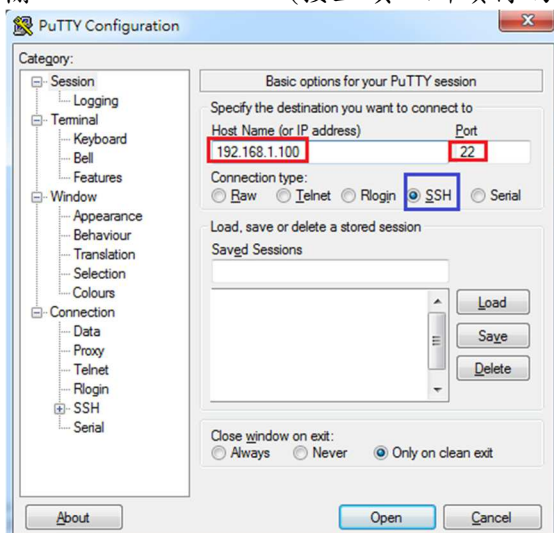
```
COM1 - PuTTY
debian@beaglebone:~$
debian@beaglebone:~$ ifconfig eth0
eth0: flags=--28669<UP,BROADCAST,MULTICAST,DYNAMIC> mtu 1500
       ether b0:d5:cc:84:77:42 txqueuelen 1000 (Ethernet)
       RX packets 0 bytes 0 (0.0 B)
       RX errors 0 dropped 0 overruns 0 frame 0
       TX packets 0 bytes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



- 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.

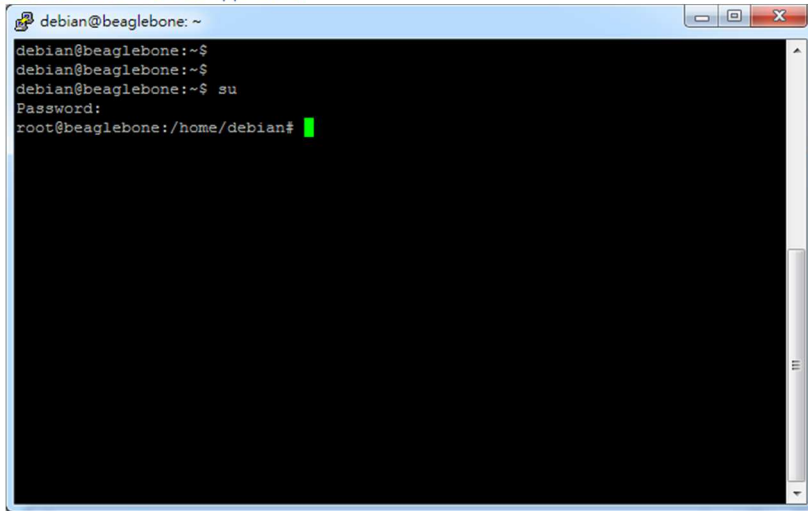
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Dec 26 10:00:25 2018
debian@beaglebone:~$ ^C
debian@beaglebone:~$ █
```

■ 變更為最高權限的用戶

輸入指令: "su"

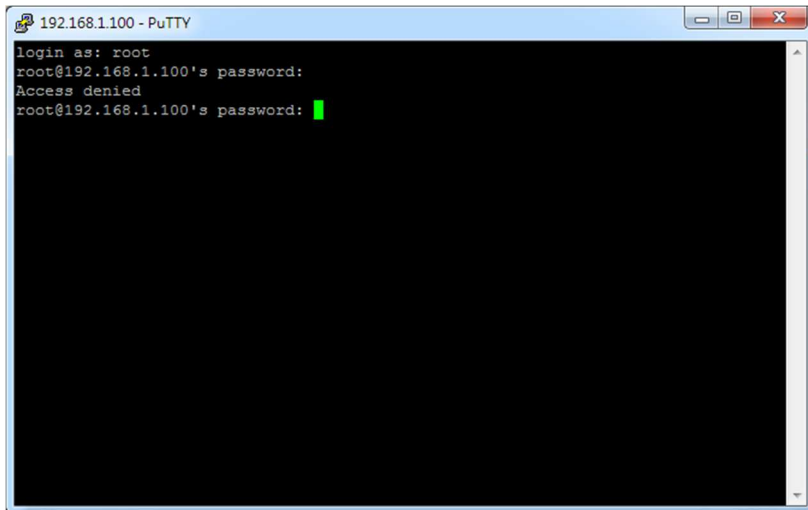
輸入密碼: "root"

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



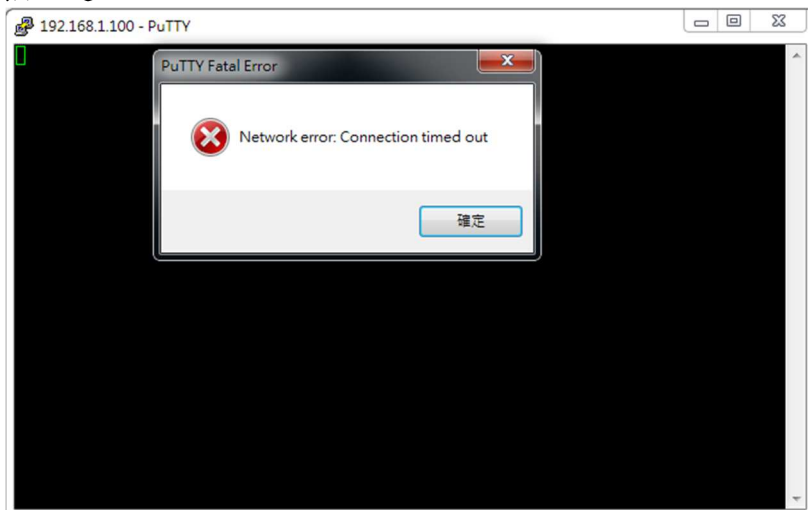
```
debian@beaglebone: ~  
debian@beaglebone:~$  
debian@beaglebone:~$  
debian@beaglebone:~$ su  
Password:  
root@beaglebone:/home/debian#
```

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



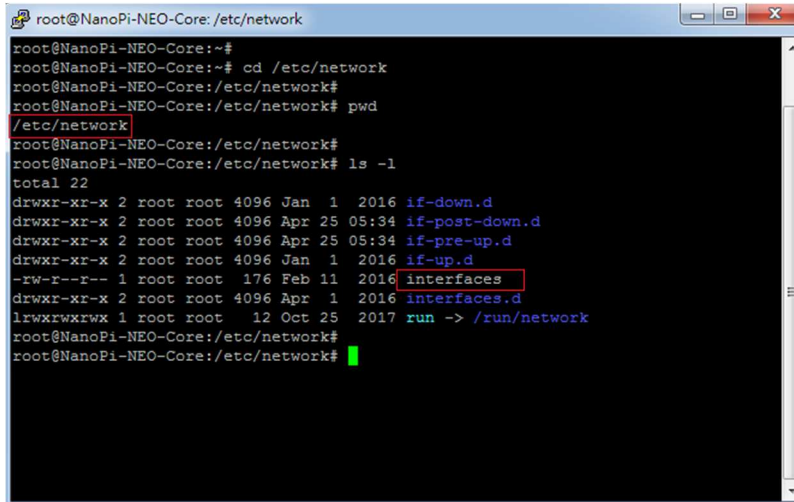
此狀況主要發生的原因常見有 3:

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

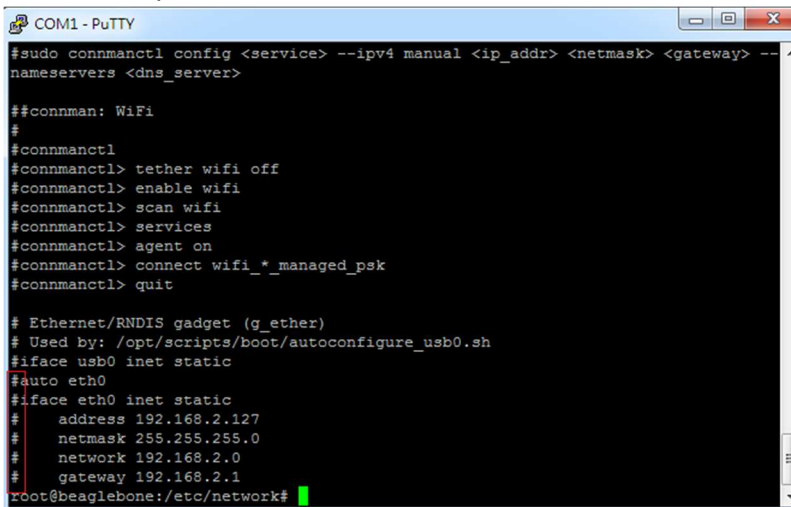
3.1 變更網路設定

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:~#
root@NanoPi-NEO-Core:~# cd /etc/network
root@NanoPi-NEO-Core:/etc/network#
root@NanoPi-NEO-Core:/etc/network# pwd
/etc/network
root@NanoPi-NEO-Core:/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#
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。

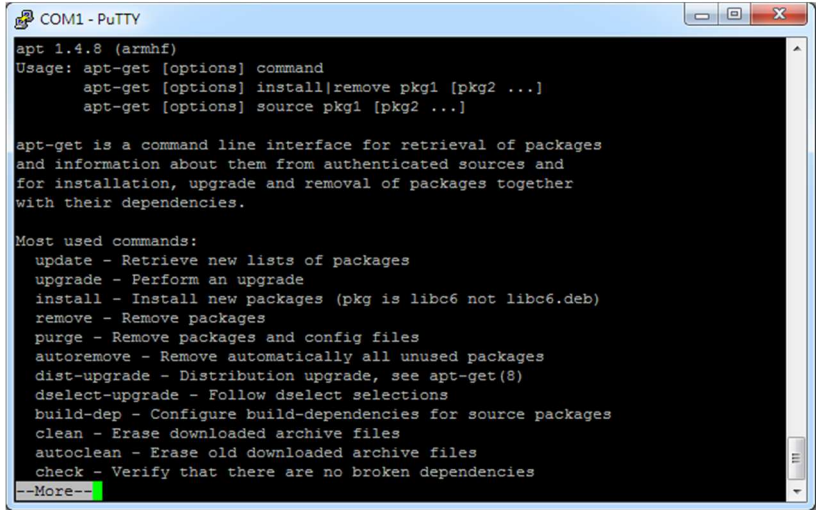
```
COM1 - PuTTY
root@beaglebone:/etc/network#
root@beaglebone:/etc/network#
root@beaglebone:/etc/network# date 查看系統時間
Sun Sep 15 11:23:14 UTC 2019
root@beaglebone:/etc/network#
root@beaglebone:/etc/network# date 091111112019 變更系統時間
Wed Sep 11 11:11:00 UTC 2019
root@beaglebone:/etc/network#
root@beaglebone:/etc/network# 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

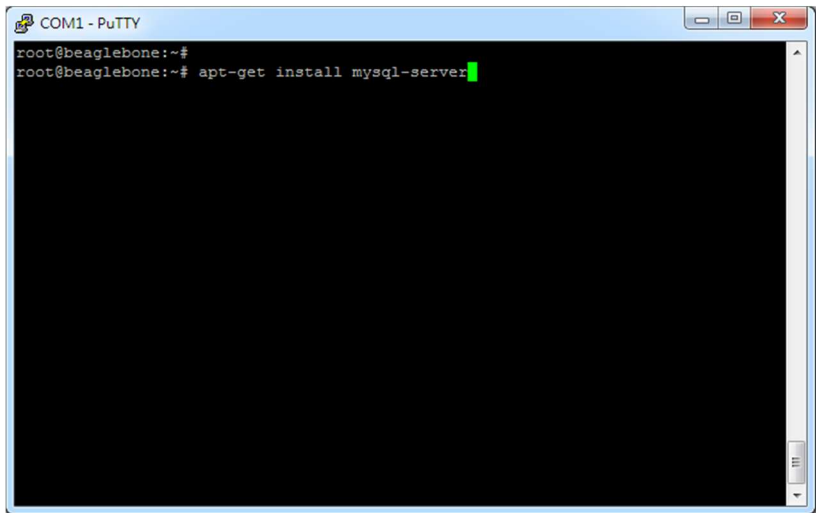


```
COM1 - PuTTY
apt 1.4.8 (armhf)
Usage: apt-get [options] command
       apt-get [options] install|remove pkg1 [pkg2 ...]
       apt-get [options] source pkg1 [pkg2 ...]

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.

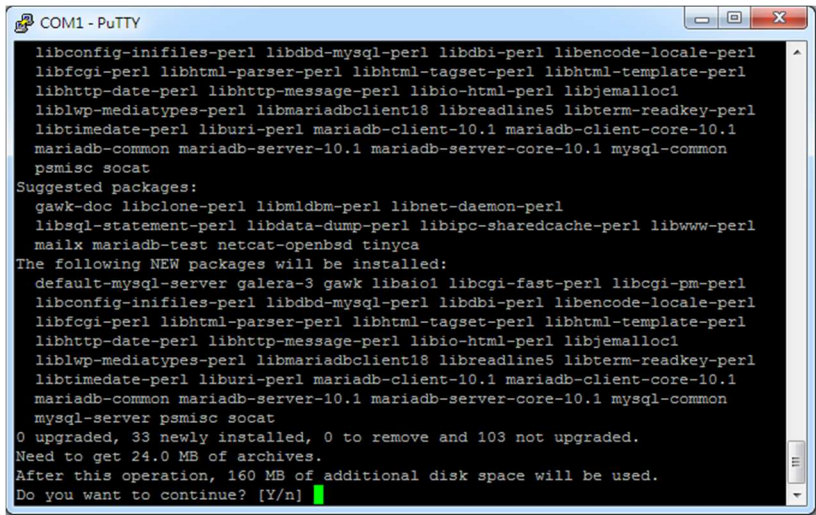
Most used commands:
update - Retrieve new lists of packages
upgrade - Perform an upgrade
install - Install new packages (pkg is libc6 not libc6.deb)
remove - Remove packages
purge - Remove packages and config files
autoremove - Remove automatically all unused packages
dist-upgrade - Distribution upgrade, 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 tinyca
The following NEW packages will be installed:
default-mysql-server galera-3 gawk libaiol1 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 libaiol 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/connmand -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.seedstudio.com/BeagleBone Green/](http://wiki.seedstudio.com/BeagleBone%20Green/)

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。

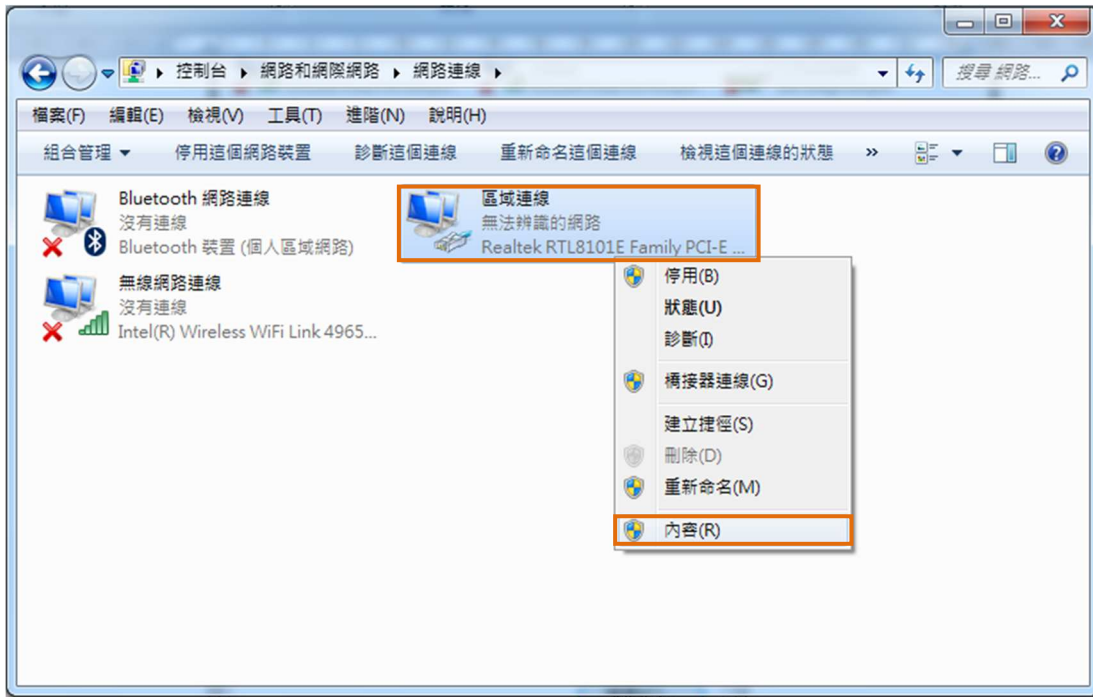


Step.02 變更介面卡設定。





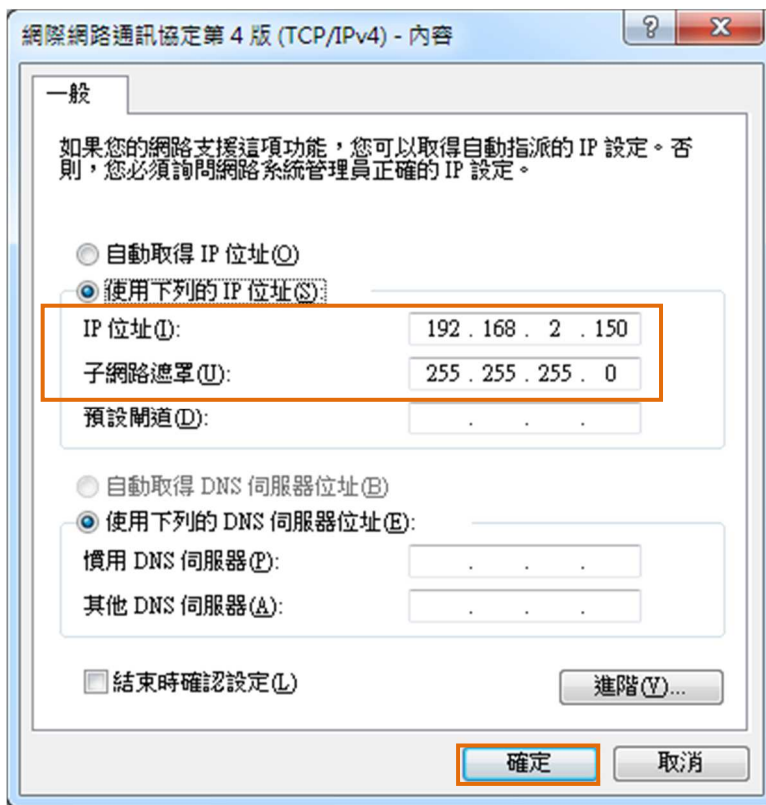
Step.03 區域連線 → 按右鍵 內容。



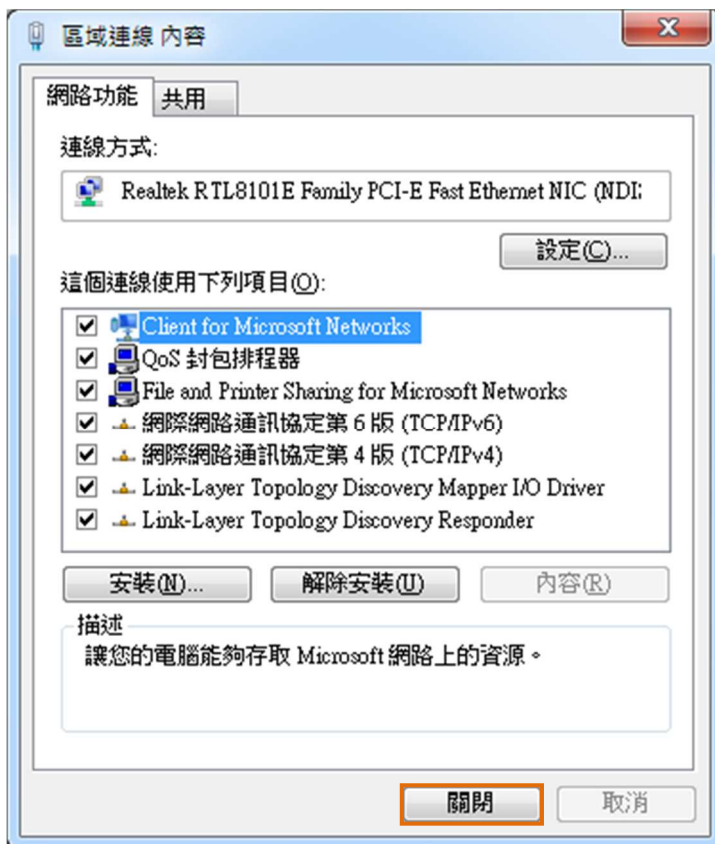
Step.04 網際網路通訊協定第 4 版(TCP/IPv4) → 內容。



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

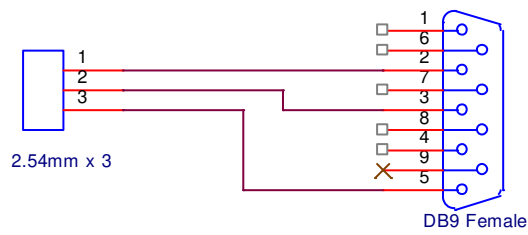
B1. Console 線

3-pin 2.54mm 排針座轉換 DB9 母頭



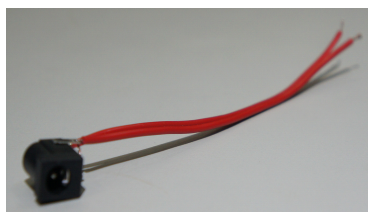
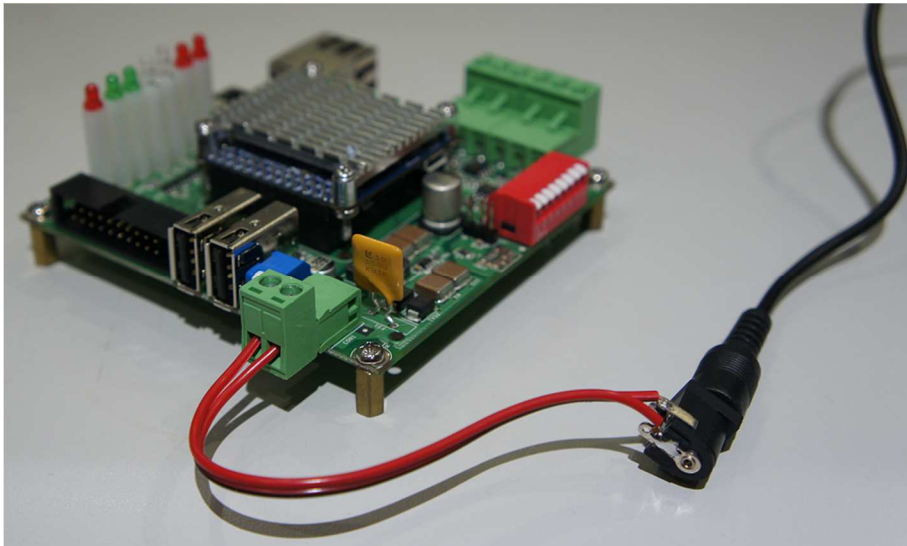
接腳定義

| 3-PIN HEADER 腳位編號 | 信號定義 | DB9 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

