


有關 pdf 檔的 Makerslide CNC 課程中文概要說明如下(3): (詳細部分請看原英文講義)

**Stepper motors trouble ?** 1 The Steppers motors use in small CNC

See the QR code video



In summary have 3 kind of steppers motors

- Permanent magnet stepper ----> simple and cheap but not high resolution
- Variable reluctance stepper ----> can turn quickly but can't keep position
- Hybrid synchronous stepper ----> Mix of permanent and reluctance stepper motors  
Not expensive, high resolution, good torque and speed

Almost all steppers motors sale and use now are Hybrid steppers motors  
The steppers motors use in small CNC, 3D Printers and small robots are Hybrid steppers motors

**Hybrid steppers motors**

- Unipolar** The electronic to control unipolar stepper motor is simple
- Bipolar** Electronic control need a little more complicate, but for the same weight bipolar have more power

Now with improvement of electronic, specially microcontroller, drive bipolar hybrid steppers motors is easy

**So the steppers motors use actually for small CNC are Hybrid and Bipolar**

Be carefull don't use steppers motors with high inductance, for machine move quickly like CNC need low inductance more information in official wiki of smoothieboard "choosing stepper motors" section  
<http://smoothieware.org/stepper-motors>

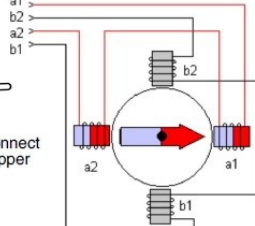
( P.3-1)

1.DIY 的小型 CNC 適用的步進馬達是 Hybrid 和 Bipolar

2.有關 Stepper Motor (步進馬達) 特性, 運用 ....請參考網站 <http://smoothieware.org/stepper-motors> 及 [https://en.wikipedia.org/wiki/Stepper\\_motor](https://en.wikipedia.org/wiki/Stepper_motor)


( wiki 語言可選擇中文已經有清楚的解釋)

General electric schema of bipolar stepper motor



Color usually used to connect the 4 coils of bipolar stepper motor

For more information about how works bipolar stepper motor See video behind this QR Code



**2 Wires colors of steppers motors**

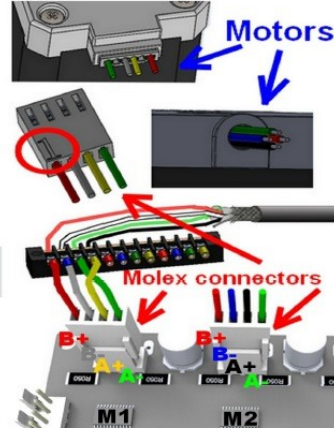
Many, many bipolar steppers motors have for colors

- Red, blue, green, black

But don't have rules sometimes it's ( Red, grey, green, yellow )

**One rule you can respect :**

Put the red wire first and if have "1" write in a connector connect the red wire.



1.馬達內部線路, black (A+)/ green(A-) /Red(B+) / Blue(B-), 可掃 QRcode 有更多資訊.

2.步進馬達的四條線顏色接到端子順序一般都是: red/blue/ green/black

但有時馬達線顏色也會是 red/grey/green/yellow (即 grey=blue, yellow=black)

3.注意標明 1 的就是開始接紅色線處,然後照順序接上

### 3 When wire of stepper motor is disconnect or invert

(P.3-2)

When a machining start...

- 1 - The microcontroller read Gcode in Sd-Card
  - 2 - The microcontroller create step in 3.3v for the stepper driver of correct motor
  - 3 - The stepper driver create step in 24V for the correct coils of motor
- This example is for small CNC use internal stepper drivers inside smoothieboard.  
The limit of current for internal steppers motors of smoothieboard is  
- 1.5A without cooling fan  
- 2A with cooling fan

People need more power can use external drivers outside smoothieboard  
For more information about external stepper driver with smoothieboard  
see the official wiki of smoothieboard project  
<http://smoothieware.org/general-appendixes#external-drivers>

When a wire is disconnect, can be disconnect :

- in the connectors ( 1 )
- in terminal block ( 2 ; 4 ; 5 )

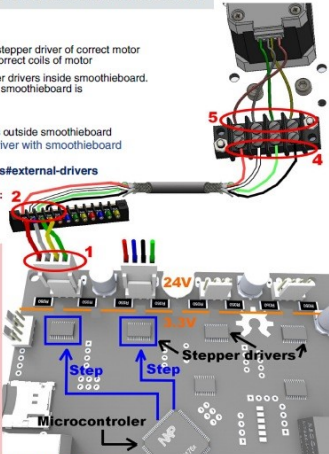


**Be careful !!**

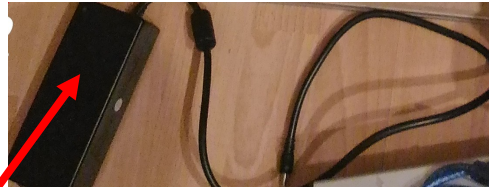
Before connect or disconnect wire for steppers motors, cut the 24V power. If you don't do this, have risk of damage smoothieboard

- 1) Disconnect, one wire of X axis stepper motor, where you want have 5 possibilities
- Try to move the X axis with pronterface and create a short movie of what happen with your phone.

Send your short movie by e-mail to [makerslide-machines@gmail.com](mailto:makerslide-machines@gmail.com).  
Turn off 24V power and connect the wire to overcome the problem



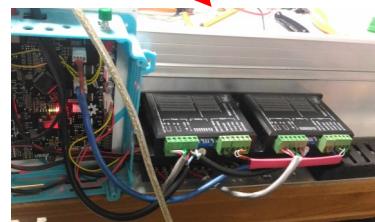
當馬達線路在標 1,2,4,5 處,(沒有 3 只是筆誤) 沒接好時,馬達會產生不正常聲音像卡卡粗粗的震動聲音.



注意: 在檢測或更改線路之前, 不可將 24V 電源供應器插進紅色盒(電路板), 以免損傷 Smoothieboard 電路板. (很重要)

- 1.機器開始啟動時,microcontroller(微型控制器)讀取 SD 卡內的 G-Code 碼.
- 2.microcontroller 用 3.3V 給 Stepper drivers
3. Stepper Drivers 產生 24V 到步進馬達轉動
4. 我們的 CNC 用的 Smoothieboard 電路板內是 1.5A.  
(1.5A 不需要用風扇),如果是 2A 則須用風扇)

如果需要多點 POWER 則需要另外加 Drivers 來增加 power. 可上 Smoothieboard 官網參考資料



**Homework(功課 1):** 嘗試 拆鬆一條 X 軸的馬達線(四條隨便挑一條), 拆之前勿插 24v 的電源供應器, 拆完一條線後再插上, 試一下就知道 當馬達在線路不正常的情況下聲音如何...

\* 測試時可拍短影片,作為經驗紀錄或傳送給我們, 當問題無法解決,我們也可透過影片告知您有可能在哪個環節出狀況.



- 2 ) Now invert some wire for X axis
- The red with the blue .....what happen ?
  - The black with the green .....what happen ?
  - The red with the black ..... what happen ?

Send the result of your experiences by e-mail to makerslide-machines@gmail.

3 ) See the wires of the two Y axis motor

You can see for one motor the 2 last wire are invert, it's not same between the two motor.

Try to gest why ? if you don't gest do experience with their wire of two Y motors

Send your explain by e-mail to makerslide-machines@gmail.



When a wire is disconnect, to check the continuity can use mutimeter

When a axis don't move in correct direction, no need to invert some wire  
Can change one setting in config file of SD card.  
This is explain in next lesson.



當馬達線路接到端子後, 可先用儀器測試是否通電.

**Homework(功課 2):**現在,可嘗試將 x 軸的馬達線倒置,譬如將紅線和藍線調換位置鎖上(記得電源供應器先拔掉喔),看看會發生甚麼狀況…馬達會產生甚麼聲音…...(不用害怕嘗試錯誤運作(測試前先拍照,測試完再看照片接回原位),這樣日後有問題才知道如何 DIY 檢測修復)

**Homework(功課 3):** Y 軸二個馬達其中有一邊的馬達線(僅一條)順序是不同的, 為甚麼…..?

注意: 當確定馬達線路都安裝妥當, 進到 **Pronterface** 分別做三軸測試, 如果發生下列狀況: 譬如測試 Z 軸時, 當用滑鼠點擊往上的箭頭時, 實際機器上的 Z 軸卻忘下移動, 點往下箭頭則實際機器 Z 軸就往上移動,表示 您的 **CNC 機器 Z 軸馬達線路 GREEN/BLACK 倒置**. (如果不想拆卸更改, 可以直接在 **SD 卡內的 Config** 資料檔做更改, 此部分課程下一課說明)