

一體型 AC 伺服馬達 **1**  
**COOL MUSCLE**  
Integrated AC Servo System



一體型 AC 伺服馬達 **2**  
**COOL MUSCLE**  
Integrated AC Servo System

Motor  
•  
Encoder  
•  
Driver  
•  
Controller  
•  
PLC  
•  
Power Supply  
•  
•  
•

All in ONE Solution







# Do you need help?

您對於以下問題感到困擾嗎？

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維修

工作時數

成本

空間

惡劣環境

干擾

複雜的程式語言

設計

開發費用

工作現場存在各型各色的問題

Maintenance

Man-hour

Cost

Space

Bad environment

Noise

Complex programming

Design

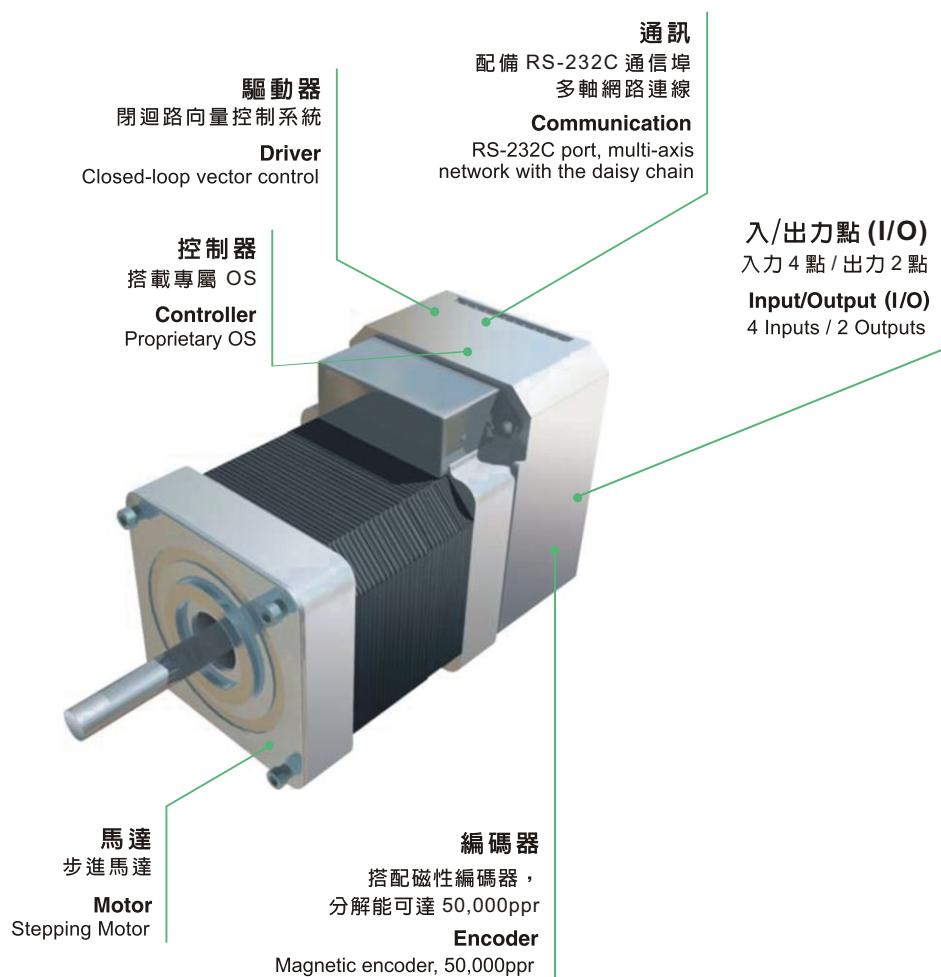
Development cost . . . .

There are various problems in the site.

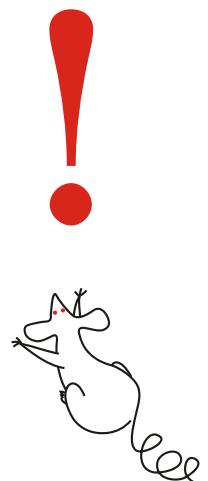


# Solution is COOL MUSCLE

COOL MUSCLE 解決方案



Cool Muscle 為蘊藏馬達、編碼器、驅動器、控制器、PLC 機能及電源裝置之一體型 AC 同服系統。可有效節省空間與配線問題，同時降低成本，邀您親身體驗前所未有的極致先進操控系統。



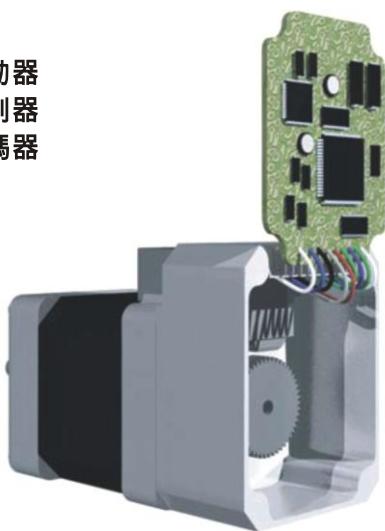
COOL MUSCLE is an All in One design AC servo system with built-in motor, encoder, driver and controller. It contributes to space-saving, the conserve wiring, and the cost reduction. You will experience a state-of-the-art motion control.

### 一體型 AC 伺服系統

Cool Muscle 為結合驅動器、控制器及編碼器之一體型 AC 伺服系統。馬達後端內藏磁性位置編碼器及搭載 32 位元 RISC CPU 智能化驅動基板，成功實現令人驚艷之極致精簡。

### All in One Solution

- 驅動器
- 控制器
- 編碼器



三項機能內藏之 Cool Muscle 可提供理想的運轉控制方式。

#### ■ 智慧型驅動器

馬達後端搭載智慧型驅動器，因此，無須額外的驅動器安裝空間。此外，高智能驅動部具備超強管理機能，僅供給與扭力相當之電流，可有效抑制馬達溫升及消費電力。

#### ■ 控制器

智慧型驅動部搭載 32 位元 CPU。藉由編寫動作程式，即可實現以馬達單體完成控制。無須外部控制器，利用馬達間之網路連線即可節省空間並降低成本。

#### ■ 高分解能磁性編碼器

高分解能磁性編碼器，最高分解能可達 50,000 pulse/rev。因擁有與 AC 伺服相同控制方式，即使低速，馬達亦可流暢運轉，此外閉迴路控制模式使馬達不致失步。

### Integrated AC Servo System

Cool Muscle is a closed loop vector drive servo system. Cool Muscle excels in performance, size, and cost efficiencies via fully integrated intelligent based 32-bit RISC CPU driver, magnetic encoder, and power management capabilities design and develop for motion control management.

### All in One Solution

\*Driver

\*Controller

\*Encoder

Cool Muscle is an all in one solution for your motion control needs.

#### ■ Integrated Driver

A 24VDC sinusoidal driver with regenerative braking capabilities. Cool Muscle's Vector Driven motion management system offers precision control. The closed loop architecture allows for optimal efficiencies, resulting in a low temperature long life servo system.

#### ■ Integrated Controller

Based upon a 32-bit RISC CPU, the integrated controller offers a wide range of hardware and software features. Motion programs can be stored within the motor, eliminating the need for driver and controller boxes. An added feature of networking capabilities allows communication between motors increasing efficiencies and capabilities while decreasing the need for additional hardware.

#### ■ High Resolution Magnetic Encoder

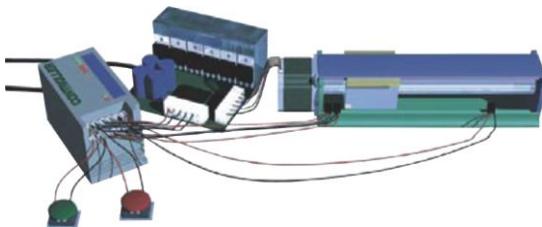
Minimizing position error and reducing motion ripple can only be achieved with an advanced encoder. The Cool Muscle standard magnetic encoder feeds back position changes as small as 0.0072° or 0.43 arch minutes.

# All in One Solution

省卻多餘配線，建構前所未有的精簡系統。藉此達成省空間、省配線、降低成本及縮短開發時間之目標。

## 傳統舊式控制系統

典型的傳統滑台系統因須容納驅動器、控制器、原點開關與極限開關，配線繁雜，難以達成精簡化。



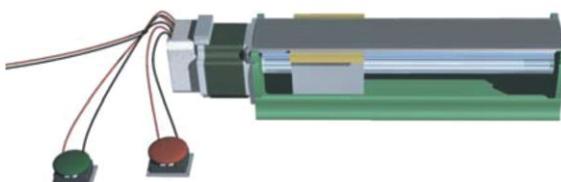
## ■ 因複雜機械構造所造成的諸多問題

- 複雜配線
- 系統整體難以精簡
- 高成本
- 機構設計，維修工作曠日費時



## COOL MUSCLE 創新系統

採用 Cool Muscle 無需額外的驅動部及控制器，亦不需原點開關與極限開關。可實現令人驚艷之精簡成效，同時降低成本。



## ■ COOL MUSCLE 實現精簡化之機械結構

- 省配線
- 實現精簡化之系統設計
- 降低成本
- 省卻開發時間、機械設計、維修時間

Cool Muscle allows you to save space to reduce wiring and cost, also to shorten development time.

## Conventional system

A typical conventional slider system requires a driver, controller, origin sensor, limit sensor and so on, making the entire system bulky and complicated.

## ■ Very hard to differentiate your product

- Bulk wiring
- Bulky and complicated system
- High cost
- Need development and maintenance time



## COOL MUSCLE system

Cool Muscle eliminates the need for an external driver box, controller and sensors making your system compact and simple.

## ■ Leave your competition behind with Cool Muscle!

- Wiring reduction
- Compact and simple system
- Cost reduction
- Shorten development and maintenance time



**COOL MUSCLE**

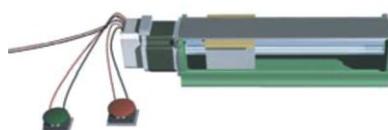
Cool Muscle 可對應電腦控制，脈波控制及電壓控制等多樣化介面模式，您可因應各種應用場合選擇最適合之控制模式。



C Type 於 Cool Muscle 三項控制模式中最具優勢。即使重複動作亦可藉由動作程式寫入 Cool Muscle 再透過電腦或 PLC 來執行。至於任意動作場合亦可連接專用電腦發送即時指令執行動作，亦可達成動作程式與任意動作組合之控制，及多軸連線控制模式等，可有效建構降低成本之系統網絡。

### 1. 程式編輯

重複多點位置動作無須重新編寫程式，僅需透過開關、電腦及 PLC 執行已編寫入的程式。



僅用簡單按鍵即可執行程式

### 2. 直接指令

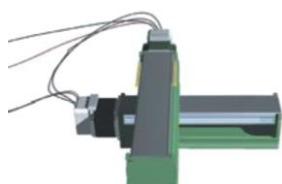
需執行複雜及任意動作時，可藉由電腦或專用控制器發送即時指令至 Cool Muscle 即可完成。



利用電腦傳送直接指令

### 3. 網路控制

可連結數個 C Type Cool Muscle 馬達多軸連接方式，進而達到精簡化及低成本的多軸控制開發應用。



多軸控制之 XY STAGE

Cool Muscle supports three different interfaces; C type for Computer, P type for Pulse control and V type for Analog controls. Choose a system that best fits for your needs.

#### < C type >

C type being the most versatile and feature packed solution among the three choices. It can be preprogrammed and controlled directly by PC or PLC, and networked in multi-axis applications. Also, digital signals can activate stored motion programs, creating a compact and powerful machine with the simplest of controls.

#### 1. Pre-program

If your application only requires repetitive motion, you can pre-program the motor, eliminating the need for an expensive and bulky controller. Preloaded programs can be executed via a simple switch, PC or PLC.

Pre-programmed slider system using a C type Cool Muscle system

#### 2. Direct Command

If your application requires complex or arbitrary motion, you can send commands directly to the Cool Muscle via PC or embedded computer.

A slider system with Cool Muscle controlled by direct command via PC

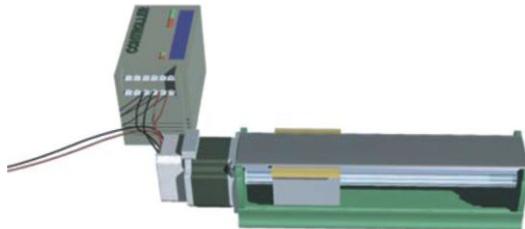
#### 3. Network

C type Cool Muscle systems can be daisy chained, providing a simple low cost network solution. Multiple methods to network the C type Cool Muscle system suiting your requirements and needs.

X-Y system using C type Cool Muscle in a daisy chain network system



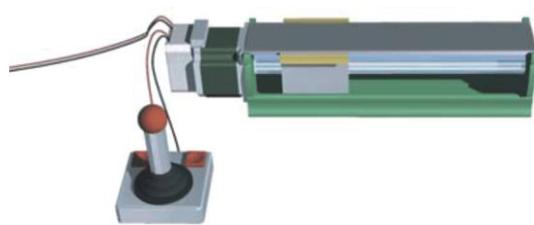
P Type 可直接利用現行的脈波控制系統更替使用，同時亦可解決步進馬達的失步及發熱等問題。可以極低成本更換成伺服馬達系統同時成就精簡化。



**P Type Cool Muscle 馬達使用例**  
A typical slider implementing P type Cool Muscle system



V Type 可依輸入電壓 (0~+5V) 進行位置及速度控制。利用參數可完成最高速度及移動距離之設定，最適合用於送料系統及閥門之應用。



**V Type 應用於操作桿控制使用例**  
Slider system with V type Cool Muscle controlled by a joy stick

#### < P type >

Replacing your current pulse driven configuration with P type Cool Muscle system will save space and remove problems associated with an open loop stepper. P type Cool Muscle system supports both CW/CCW and Pulse/Direction.

#### < V type >

V type Cool Muscle can vary speeds or positions in proportion to voltage input level. Set maximum speeds or travel distances with ease by selecting the parameters making it an ideal solution for constant feed systems, and valve applications.

#### 最適用類型？

#### Cool Muscle Type selection?

- 多重複動作
- 希望透過電腦或專用控制器執行任意動作
- 需多軸動作

- for a repetitive motion system
- to perform complicated motion with a digital signal
- to run a multi-axis machine



- 希望使用脈波控制
- 希望於維持現有機械結構前提下提升性能
- 希望解決步進馬達問題
- 需機械精簡化，並降低成本

- to continue with a pulse driver system
- to improve machine performance
- to remove problems associated with an open loop stepper
- to save space and reduce cost



- 希望藉由電壓類比訊號來控制位置及速度
- 需機械精簡化，並降低成本
- 希望獲取更精簡之系統模式

- to control speed or positions with an analog input
- to save space and reduce cost
- a simple solution

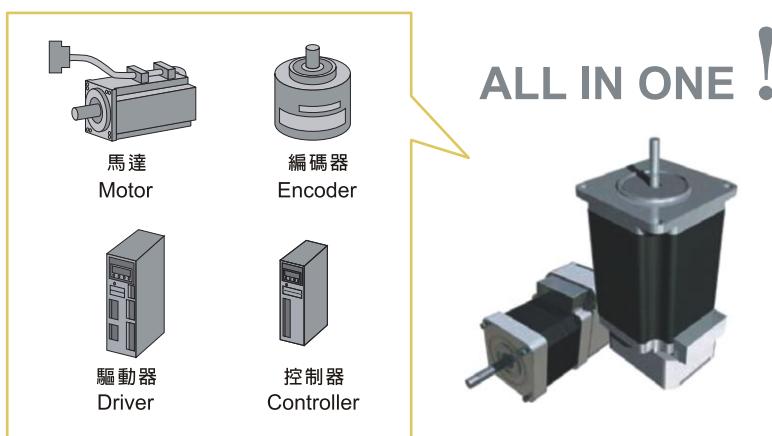


Cool Muscle 具備降低成本，機械精簡化，縮短開發時間等豐富機能及優點。

### 01 簡單 & 精簡化

結合 32 位元 RISC CPU 之智慧型驅動器、磁性編碼器、馬達於一體，透過簡化配線，實現機械精簡化。

- 省卻驅動器外殼空間
- 省空間
- 省配線
- 縮短開發時間



### 02 全閉迴路系統

Cool Muscle 為全閉迴路控制系統，馬達後端搭載高精度磁氣編碼器及高智能驅動部，可精準掌握馬達目前位置，免除失步疑慮。

Cool Muscle 具有電源管理機能，僅供可對應扭力之對等電流，可有效抑制馬達的溫升及消費電力，同時利用步進馬達優點以實現低速且大扭力之性能。

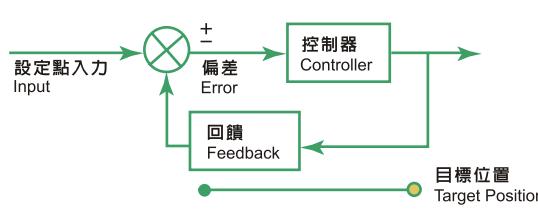
- 高定位精度
- 不失步
- 馬達壽命長，高效率
- 省能源
- 省卻減速機

#### 閉迴路控制

#### Closed Loop

經由感應器回授馬達目前位置，必要時進行位置補正動作。

By receiving position input from the sensor Cool Muscle know its position and can correct itself.



Cool Muscle is packed with features that help you reduce the size and cost of your machines while also shortening development time.

#### 01. Simple and Compact

An intelligent driver with a 32 bit RISC CPU, Magnetic encoder, and power management are all built in right on the motor.

- No more driver boxes
- Smaller machines
- Reduce wiring
- Shorted development time

#### 02. Full Closed Loop System

Cool Muscle is a full closed loop system, with the high resolution magnetic encoder and the intelligent driver board mounted on the back. Cool Muscle constantly monitors its position, eliminating any miss-steps.

Cool Muscle's power management monitors and provides the optimum current based on load, keeping the motor cool.

In addition, using a stepping motor, Cool Muscle generates high torque at low speed.

- Higher repeatability, stability, and accuracy.
- Longer motor life
- Increased power efficiency
- Reduced need for gear boxes

**開迴路控制**  
因馬達無法掌握馬達位置，發生失步現象而無法到達目標位置。

#### Open Loop System

Not knowing its position, often resulting in problems such as miss-steps and targets.

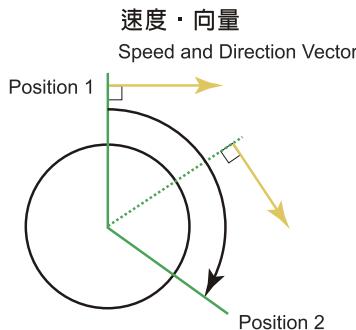
## 03 流暢運轉 & 高靜音

Cool Muscle高精度磁性編碼器之分解能可達50,000 ppr。同時向量控制可使馬達在低速時能穩定流暢運轉，使機械噪音降低。此外由於馬達線以金屬外罩包覆可有效避免雜訊干擾之問題。

- 以AC伺服馬達同等性能達成低成本
- 品質、性能不受長時間使用影響

### 向量控制

向量控制是伺服馬達所使用的控制方法，與一般的微步進馬達控制方式完全不同，可實現流暢運轉。



## 04 簡易參數設定

Cool Muscle參數可由使用者簡易完成設定。從原點復歸方法到PID調整等40種以上參數來調整馬達之特性，參數透過CML (Software) 軟體進行設定。

- 馬達特性靈活且設定簡易

### 簡單參數設定例 Easy Parameter Setting Example

K46.1=1	電源開啓時，利用機構擋板即可自動執行原點復歸動作 Baseline position is automatically set upon motor initialization using the mechanical stopper.
K28.1=7000	在 <input type="checkbox"/> 點4上設定原點復歸機能 Set Origin Search to Input4
K34.1=21	在 <input type="checkbox"/> 點2設定Alarm， <input type="checkbox"/> 點1設定到達位置訊號 Set Alarm to Output2, Inposition to Output1
K60.1=50	設定 <input type="checkbox"/> 模式扭力為50% Set the torque to 50% in Push Mode

### 省卻極限開關 / 原點開關以降低成本

### No more the Origin / Limit Sensor, saved the cost

#### ■ 軟體原點開關

利用馬達與機構輕觸即可完成原點復歸，無須另置原點復歸開關。

僅需馬達與機構輕觸後達到某程度電流值後，即完成原點復歸動作

#### ■ 軟體極限

透過參數即可簡單設定馬達運轉極限值。可設定CW / CCW兩方向極限，無須另置極限開關。

## 03. Smooth and Accurate Movements

The Cool Muscle's high resolution encoder gives you an exceptionally fine placement of 50,000 units per rotation. The Cool Muscle constantly monitors its position, eliminating any miss-steps.

- Performance levels similar to AC servo at a fraction of the price
- No harmful effect across the age

### Vector Drive Control

Vector Drive is a control technique used in servo systems. Vector Drive Control is a completely different technique from micro-stepping. Unlike micro-stepping, Vector Drive Control is not subject to resonance problems and produces smooth movements.

## 04. User Definable Parameters

Defined the character of your Cool Muscle to suit your needs. Cool Muscle gives you over 40 parameters. Parameters can easily be set by using CML.

- Flexibly change your motor characteristic

#### ■ Software Origin Search

By using Push Motion the need for origin sensors can be eliminated. Cool Muscle edges against the mechanical stopper (bumper) until it reaches a specified current, at which the motor reached the origin.

#### ■ Software Limit

Software Limits can be set using Cool Muscle parameters. Limits can be set on both the CW/CCW sides to eliminate the need for limit sensors.

### 05 簡單程式語言 ~ CML

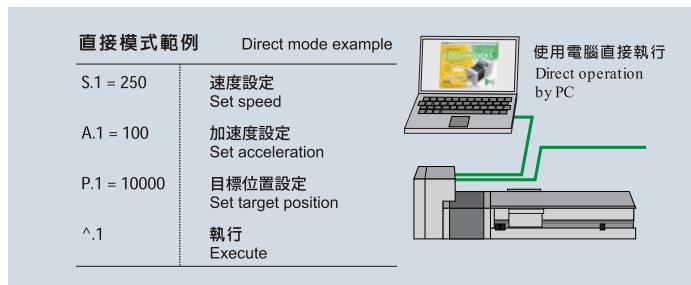
CML (Cool Muscle Language) 是 Cool Muscle 馬達專用程式語言的簡稱。CML 因使用 ASCII，而容易編寫程式。可使用免費提供的專用軟體 Cool Works Lite 來編輯程式，也可使用電腦的超級終端機 (Hyper Terminal) 編寫，再將程式存入馬達的記憶體內。

- 簡單編寫程式
- 縮短開發時間
- 免費下載專用軟體

### 06 操作簡單

#### [ Direct mode ]

使用 RS-232C 通訊，只需輸入 CML 指令即可直接讓馬達運轉。

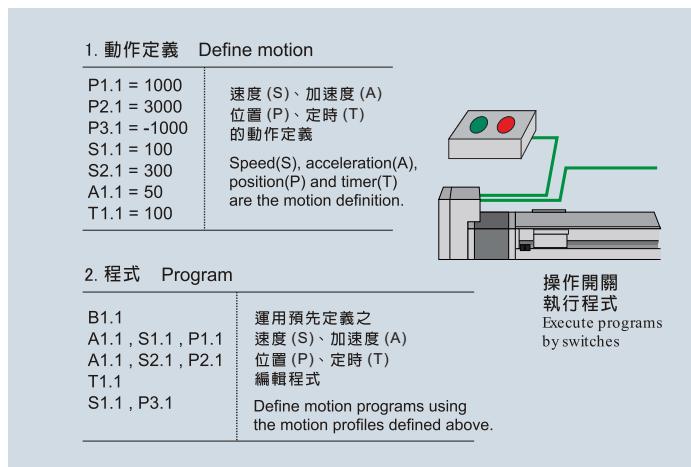


#### [ 程式模式 ] ( 僅限用 C TYPE )

Cool Muscle 可下載動作程式，因此可藉由開關或電腦簡單執行各種程式動作。

最多可以寫入 500 STEP。

- 最適合重複動作
- 可實現機械精簡化



### 05. Easy Programming Language

CML( Cool Muscle Language) is a programming language designed for Cool Muscle. Programs can be easily created by ASC II commands, free software Cool Works Lite or any standard terminal program.

- Easy programming
- Shorten development time
- Available the free open software

### 06. Easy to Use

#### <Direct Mode>

Cool Muscle can be directly operated by just entering the CML commands via RS-232C communication.

#### <Program Mode> (C type only)

Programs can be downloaded to Cool Muscle so that various motions can be executed by PC or simple switches. Programmable Max.500 steps.

- Great solution for repetitive motion
- Simple and compact machines

## 07 入出力機能配置

Cool Muscle 的入出力點可擴充複數機能。

Cool Muscle 中有具備 4 個入力點及 2 個出力點，這些入出力點可接受Digital/Analog/Serial/Pulse/Counter (僅限入力點) 等訊號使用，可完成原點復歸、執行程式、異常警告等功能配置選用。

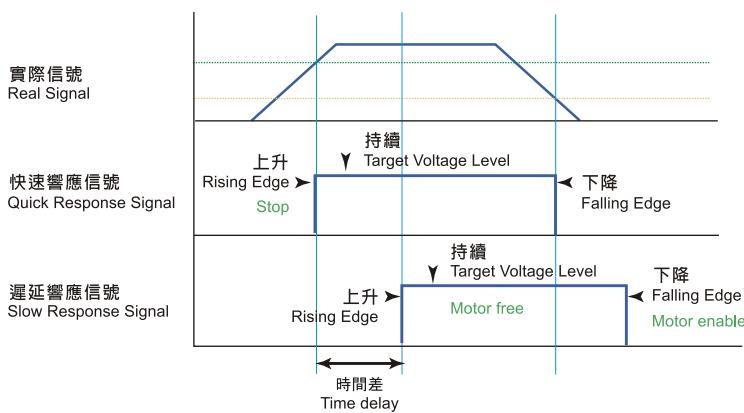
- 使用者可藉由入出力點機能配置輕鬆操作伺服系統

Input Function Example	
DC+24V	
GND 1	
Output 2	
Output 1	
Input 4	
Input 3	
Input 2	
Input 1	
GND 2	
DC+5V	
1	原點復歸
2	原點 sensor 入力
3	手動寸動
4	Bank 程式執行
5	馬達 free
6	馬達 free 解除
7	執行下一步
8	執行上一步
Output Function Example	
9	
10	
11	
12	
異常警告	Alarm
位置到達訊號	In-position
馬達類比訊號輸出	Analog output for monitoring

## 08 虛擬入力信號

Cool Muscle 具備獨特虛擬訊號，可有效利用於有限的入力點。 Cool Muscle 利用原始信號的時間差產生兩種入力信號，同時各信號又分割為上升、下降、持續等控制模式，該技術可促使一個入力點擴充為多項機能，使用者亦可簡單設定此參數。

- 不需外部 I/O 塊
- 可降低成本



## 07. Assignment I/O

Configure and assign multiple functions to I/Os on Cool Muscle system. Cool Muscle comes standard with 4 Inputs and 2 outputs. These ports can be either digital or analog I/O, serial or pulse counters (input only). Cool Muscle allows you assign a function to each signal point.

- User flexible applications of these powerfully built in features

## 08. Virtual Input Signal

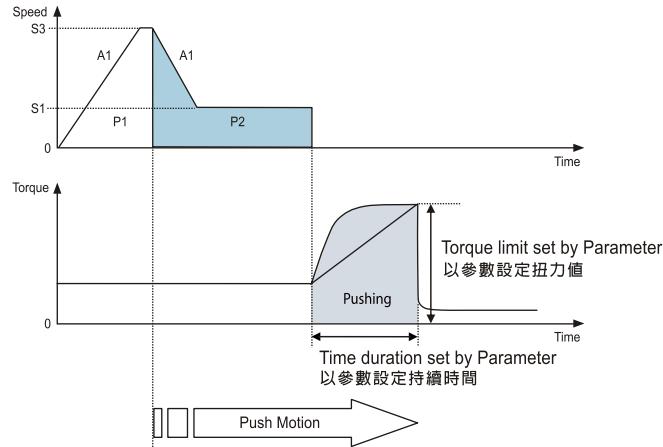
Make the most of the I/O ports by taking advantage of Cool Muscle's unique virtual signal technique. Cool Muscle system creates two signals. The initial based on an original input and the second utilizing a time delay from the same baseline. The difference between the two signals allowing you to assign multiple functions onto the same input.

- Eliminates the external I/O board
- Cost reduction



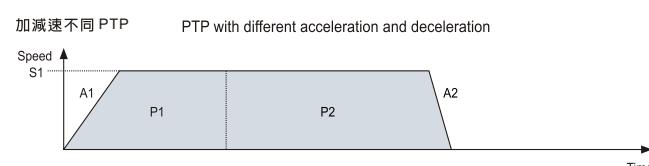
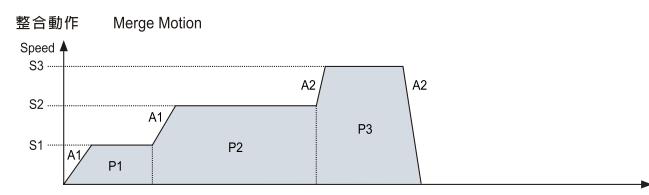
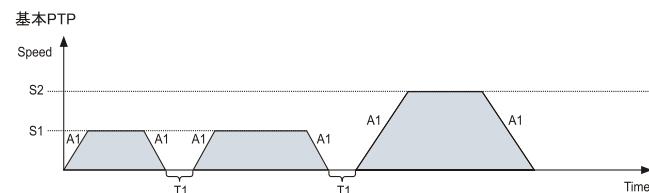
### 09 推擠模式 ( 僅限用 C TYPE )

利用已設定電流值及時間進行擠壓動作，可執行如氣壓缸之推擠工件物狀態模式。



### 10 支援多樣化之運動模式

Cool Muscle 可支援如 PTP 基本動作以至於多樣化高階動作模式。可自由設定加減速度，同時亦可完成諸如馬達作動中任意改變速度及加速度，在通過點不須需要停止動作即可改變速度及加速度等多種 PTP 動作執行。

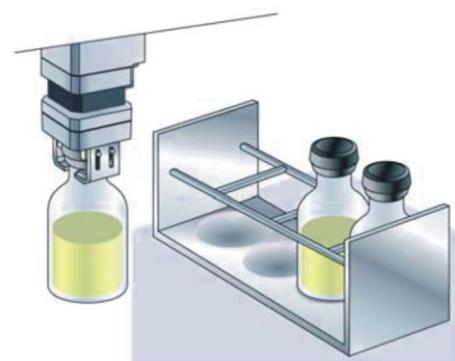


### 09. Push Motion (C type only)

Push Motion mimics typical pneumatic cylinder motion, continuous torque for a given time .

### 10. Advanced Motion

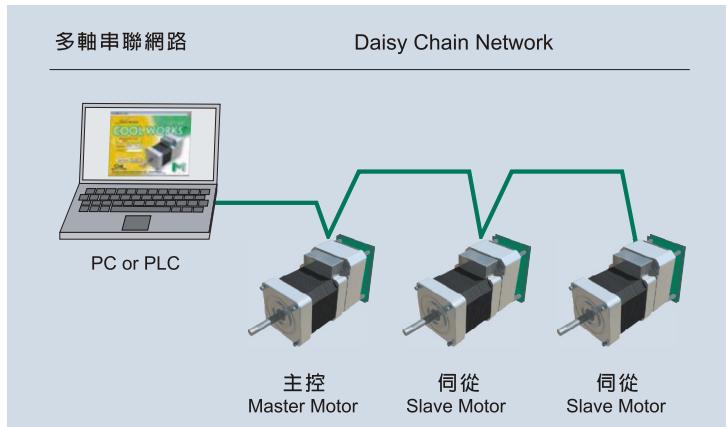
Cool Muscle supports standard PTP motion control, as well as wide variety of custom programmed movement. Speed or acceleration can be changed real-time while the motor is in operation (moving). Cool Muscle supports advanced functions such as continuous PTP motion (Merge Motion) with different acceleration, deceleration.



## 11 Network ( 網路 )

Cool Muscle 提供低成本之多樣化網路方案，僅藉由增加網路卡即可以串聯網路輕鬆連接數顆 Cool Muscle 馬達。網路連接線採用標準 D-SUB 9 PIN Cable 可有效降低成本，串聯網路亦可透過 CML 實現多軸動作程式。使用 Visual Basic 及 C++ 語言程式亦可簡易開發專屬介面。

- 可實現簡單低成本之網路控制
- 最多可同時連接 15 軸



## 11. Network

Cool Muscle System provides you with different networking solutions to best suits your needs. Connect individual Cool Muscle to a network card in a daisy chain style network. The daisy chained Cool Muscle System can communicate with each other to activate programs, as well as, receive commands from a computer or an embedded controller.

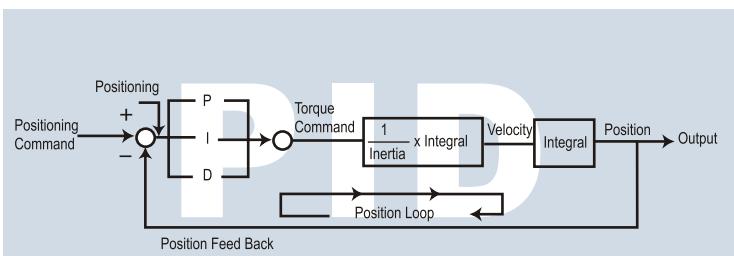
Multi-axis motion program by CML and also your original interface by Visual Basic, C++ or other., can be developed in a daisy chain style network.

- Simple and low cost network solutions
- Available the Multi-axis control of up to 15 axes

## 12 調整增益值

Cool Muscle 調整增益值機能是藉由 3 個參數來執行。

- 可精簡 PID 增益值調整時間
- 可縮短機械開發時間

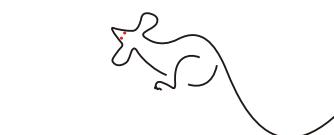


## 12. Gain Tuning

Cool Muscle systems can be tuned with three simple parameters.

- Simple tuning solution
- Shorten mechanical development time

Simple!



# Software

支援軟體

## COOLWORKS LITE

COOLWORKS LITE 為 COOL MUSCLE 專用之支援軟體系統。設計初衷即以人人皆可輕鬆上手、同時可利用 CM1 & 2 有效縮減系統開發時間為出發點，其內容已蘊藏參數設定、程式製作、及狀態確認等必備機能。

敬請多加利用 MUSCLE 網頁之免費下載資源：

[www.musclecorp.com](http://www.musclecorp.com) or [www.hhstc.com.tw](http://www.hhstc.com.tw)



COOLWORKS LITE is our free open software for COOL MUSCLE motors for ease of use and to shorten development time.

COOLWORKS LITE includes all the basic functions that are required for parameter settings, program creation, jogging and status monitoring.

COOLWORKS LITE is available for free at the Muscle's website.

[www.musclecorp.com](http://www.musclecorp.com)

設定資料及馬達情報現狀  
用以確認位置速度情報及設定值等

**Motor Data / Information**  
Confirmation of the speed data and parameters.

程式執行  
程式執行及暫停等功能

**Program Execution**  
Execution / Pause of program, etc.

傳送資料

顯示傳達至 CM 1 & 2 之資料內容

**Sent Data**

Display the data sent to CM 1 & 2

接收資料

顯示自 CM 1 & 2 馬達接收之資料內容

**Motor Response**

Display the data received from CM 1 & 2

CML 編輯視窗  
參數、指令等資料編輯與傳送

**CML Editor**  
Edit and send parameters and commands.

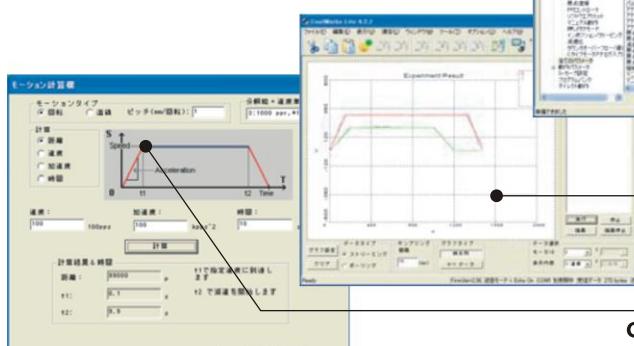
指令輸入區  
將指令逐行輸入傳送

**Command Line**  
Enter commands in a single line and send.



參數設定

**Set the parameter**



**動作演算**  
Calculate the motion

圖表繪製

**Draw the graph**

# Accessories

配件 / 應用製品

## 電線類 CABLE

馬達連接線 Motor Cable  
**CM1C1-400S (400mm)**

標準配線

Standard Motor Cable.



RS232 通訊線 RS232C Cable  
**CM1C2-2000A (2000mm)**

連結電腦序列埠為編輯參數或程式時所需

RS232C Cable is required to connect Cool Muscle to a serial port of PC. You would need it for various of setting.



網路連結線 Straight Cable  
**CM1DC1-SSC-1800 (1800mm)**

D-SUB9 PIN 網路連結線。  
為使用多軸串聯的網路界面卡時所需

Straight Cable is required for daisy chain networking using an interface card.



## 網路卡 NETWORK CARD

**CM1DC1-MBSC CM1DC1-SBSC CM1DC1-CASE**

Master Card Set Slave Card Set Network Card Case



Master Card Slave Card

## 電源 POWER SUPPLY

**CMPS-XMUS-150 CMPS-XMUS-240**

150W/6A 240W/10A

具有可承受瞬間最大電流對應的專用電源供應器，不易發生電流下降，可供應安定電流

Designed specifically for Cool Muscle, our power supply is built to withstand current draw spikes that hard stops or starts often require.



## 伺服電動缸 ACTUATOR

### 伺服電動缸

以 Cool Muscle 為標準裝備，蘊藏驅動器及控制器之一體型線性運動模組，可連接多達 15 軸之多種類電動線性模組，亦能以低成本輕鬆架構網絡系統。擁有 40 款 700 項機種以上之伺服線性運動模組，藉此提供更貼近顧客之多樣化需求。



## 減速機 GEAR

### 減速機

提供多樣化種類及減速比類型，以因應客戶需求進而選擇最佳減速機款式。藉由包含高精度、低背隙、免維修特點之減速機與 Cool Muscle 之完美結合，締造高效率性能。

### Gearbox

A wide range of high quality gearboxes are available to suit your application needs. Combine a high precision, low backlash, zero maintenance, durable gearbox with a Cool Muscle to maximize performance.



# Specifications

規格

■ 型式 Model Name

**CM1 - C - 17L 30C**

控制模式 Control Type	馬達尺寸 Motor Size	長度 Length	最高速度 Max. Speed
C… 電腦控制 Computer Type	11…28□	L… 長型 Long	30…3000 rpm
P… 脈波控制 Pulse Type	17…42□	S… 短型 Short	20…2000 rpm
V… 類比控制 Analog Type	23…56□		

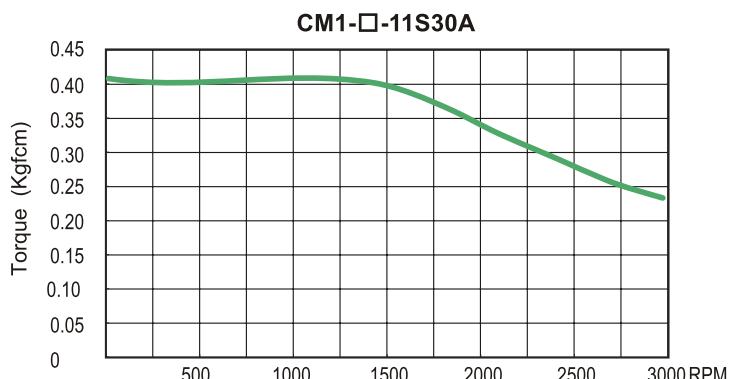
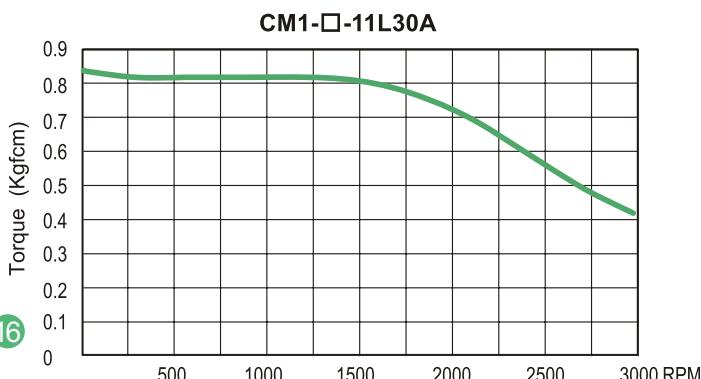
※ Cool Muscle 符合 EMC 及 RoHS 規範

\*Cool Muscle is the products that meet the EMC & RoHS.

■ CM1-□-11L / S

型號 MODEL	CM1-□-11L30A	CM1-□-11S30A
馬達出力 [W] Motor Output [W]	18	9
最高回轉數 [rpm] Max. Speed [rpm]	3000	3000
額定轉矩 [Kgfcm] (Nm) Rated Continuous Torque [Kgfcm] (Nm)	0.56 (0.055)	0.28 (0.027)
最大轉矩 [Kgfcm] (Nm) Peak Torque [Kgfcm] (Nm)	0.8 (0.078)	0.4 (0.039)
容許負載慣量 [g · cm <sup>2</sup> ] Load Inertia [g · cm <sup>2</sup> ]	180	80
馬達慣量 [g · cm <sup>2</sup> ] Motor Inertia [g · cm <sup>2</sup> ]	18  須依負載慣性大小調整馬達的增益值，在上述範圍內可用參數調整，其餘請另行洽詢 Depending on the load inertia, servo gain needs to be adjusted within the above range : adjustable by parameters	8
速度、位置檢知器 (編碼器) Encoder	增量型磁性編碼器 (50,000 Pulse / 回轉) Incremental Magnetic Encoder (50,000 pulses / Rotation)	
控制方式 Control Method	閉迴路向量控制方式 Closed Loop Vector Control	
入力電源電壓 Input Supply Voltage	DC24V ± 10%	
入力電源電流 Input Supply Current Rated	1.2 / 1.5 A 連續轉矩出力/最高轉矩出力 ( Continuous Torque / Rated Peak Torque )	0.8 / 1.0 A 連續轉矩出力/最高轉矩出力 ( Continuous Torque / Rated Peak Torque )
脈波指令分解能 (Pulse / 回轉) Resolution ( Pulse / Rotation )	200-50,000 參數選擇 From 200 to 50,000 Set by parameter	
質量 [g] Mass [g]	300	240
環境 Environment	使用 / 保存溫度 Operating/Storage Temperature 0°C ~ +40°C / -20°C ~ +60°C (無蒸氣凝結狀態) 0°C ~ +40°C / -20°C ~ +60°C (No Condensation condition)	
	使用溼度 Operating Humidity 90%RH 以下 Less Than 90% RH	
	衝擊 / 振動 Impact / Vibration 10G以下 / 1G以下 Less than 10G / Less than 1G	

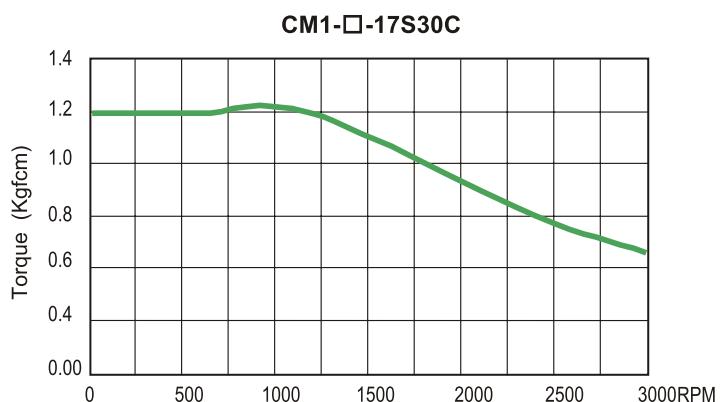
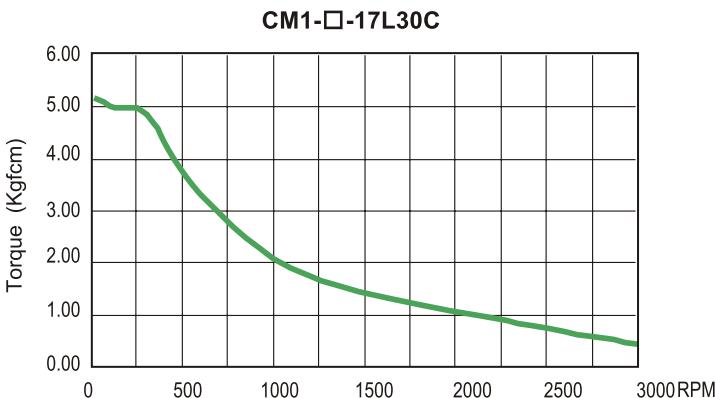
■ 扭力曲線 Torque Curve



## ■ CM1-□-17L / S

型號 MODEL	CM1-□-17L30C	CM1-□-17S30C
馬達出力 [W] Motor Output [W]	18	18
最高回轉數 [rmp] Max. Speed [rpm]	3000	3000
額定轉矩 [Kgfc·m] (Nm) Rated Continuous Torque [Kgfc·m] (Nm)	3.7 (0.36)	0.84 (0.082)
最大轉矩 [Kgfc·m] (Nm) Peak Torque [Kgfc·m] (Nm)	5.3 (0.518)	1.2 (0.117)
容許負載慣量 [g · cm <sup>2</sup> ] Load Inertia [g · cm <sup>2</sup> ]	760	380
馬達慣量 [g · cm <sup>2</sup> ] Motor Inertia [g · cm <sup>2</sup> ]	74  須依負載慣量大小調整馬達的增益值，在上述範圍內可用參數調整，其餘請另行洽詢 Depending on the load inertia, servo gain needs to be adjusted within the above range : adjustable by parameters	36
速度、位置檢知器 (編碼器) Encoder	增量型磁性編碼器 (50,000 Pulse / 回轉) Incremental Magnetic Encoder (50,000 pulses / Rotation)	
控制方式 Control Method	閉迴路向量控制方式 Closed Loop Vector Control	
入力電源電壓 Input Supply Voltage	DC24V ± 10%	
入力電源電流 Input Supply Current Rated	1.5 / 1.8 A 連續轉矩出力/最高轉矩出力 ( Continuous Torque / Rated Peak Torque )	0.8 / 1.0 A 連續轉矩出力/最高轉矩出力 ( Continuous Torque / Rated Peak Torque )
脈波指令分解能 (Pulse / 回轉) Resolution ( Pulse / Rotation )	200-50,000 可從參數選擇 From 200 to 50,000 Set by parameter	
質量 [g] Mass [g]	480	330
環境 Environment	使用 / 保存溫度 Operating/Storage Temperature 0°C ~ +40°C / -20°C ~ +60°C (無蒸氣凝結狀態) 0°C ~ +40°C / -20°C ~ +60°C (No Condensation condition)	
	使用溼度 Operating Humidity 90%RH 以下 Less Than 90% RH	
	衝擊 / 振動 Impact / Vibration 10G以下 / 1G以下 Less than 10G / Less than 1G	

## ■ 扭力曲線 Torque Curve



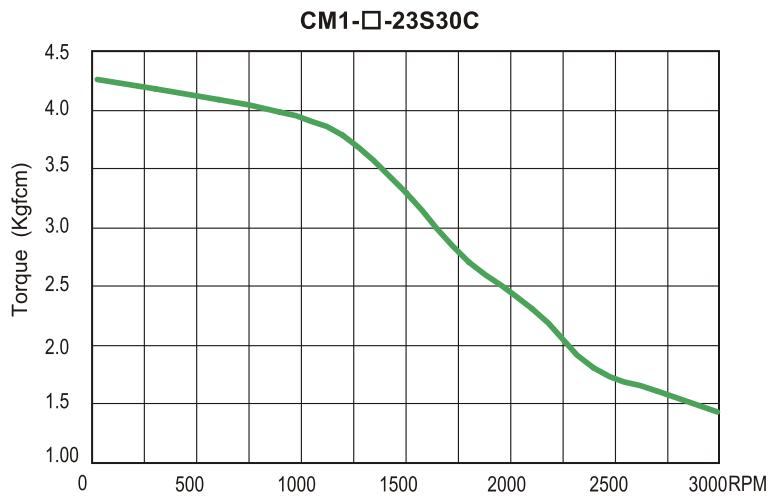
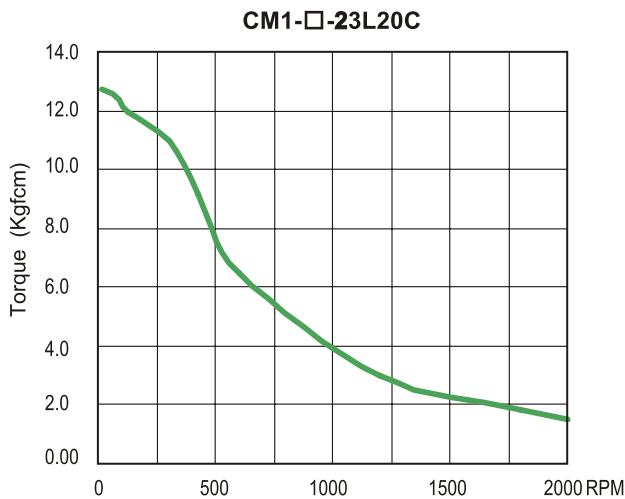
# Specifications

規格

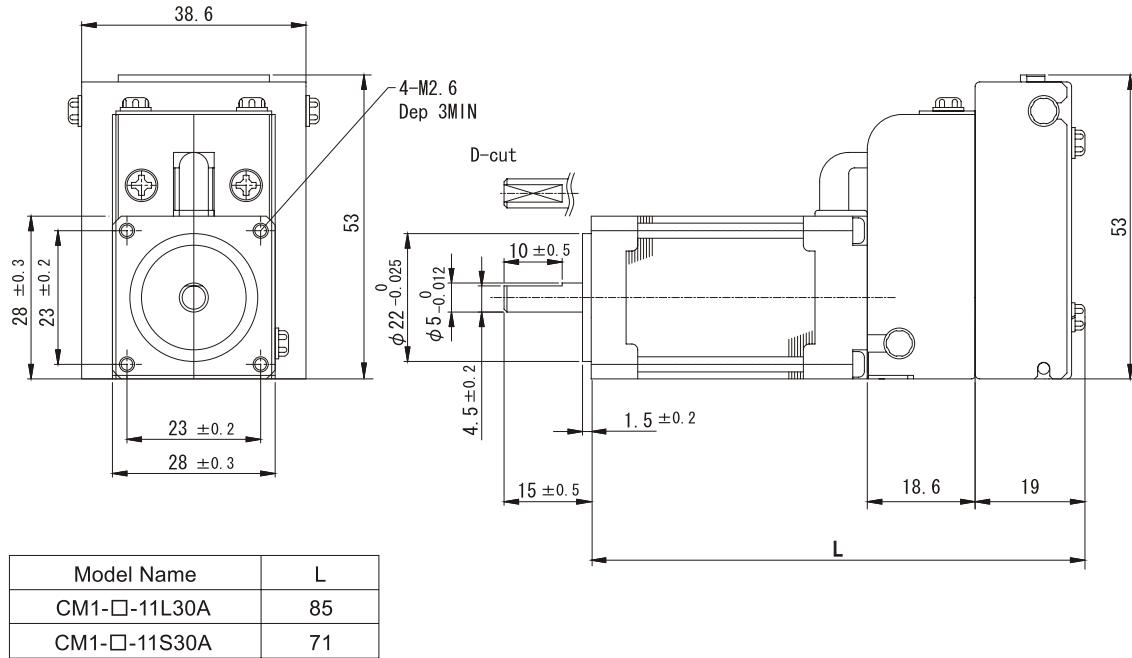
## CM1-□-23L / S

型式 MODEL	CM1-□-23L20C	CM1-□-23S30C
馬達出力 [W] Motor Output [W]	30	45
最高回轉數 [rmp] Max. Speed [rpm]	2000	3000
額定轉矩 [Kgfc·m] (Nm) Rated Continuous Torque [Kgfc·m] (Nm)	8.9 (0.87)	3.0 (0.294)
最大轉矩 [Kgfc·m] (Nm) Peak Torque [Kgfc·m] (Nm)	12.7 (1.24)	4.3 (0.42)
容許負載慣量 [g · cm <sup>2</sup> ] Load Inertia [g · cm <sup>2</sup> ]	4600	1400
馬達慣量 [g · cm <sup>2</sup> ] Motor Inertia [g · cm <sup>2</sup> ]	360	100
須依負載慣性大小調整馬達的增益值，在上述範圍內可用參數調整，其餘請另行洽詢 Depending on the load inertia, servo gain needs to be adjusted within the above range : adjustable by parameters		
速度、位置檢知器 (編碼器) Encoder	增量型磁性編碼器 (50,000 Pulse /回轉) Incremental Magnetic Encoder (50,000 pulses / Rotation)	
控制方式 Control Method	閉迴路向量控制方式 Closed Loop Vector Control	
入力電源電壓 Input Supply Voltage	DC24V ± 10%	
入力電源電流 Input Supply Current Rated	2.6 / 3.4 A 連續轉矩出力/最高轉矩出力 ( Continuous Torque / Rated Peak Torque )	3.9 / 5.1 A 連續轉矩出力/最高轉矩出力 ( Continuous Torque / Rated Peak Torque )
脈波指令分解能 (Pulse / 回轉) Resolution ( Pulse / Rotation )	200-50,000 可從參數選擇 From 200 to 50,000 Set by parameter	
質量 [g] Mass [g]	1100	550
環境 Environment	使用 / 保存溫度 Operating/Storage Temperature	0°C ~ +40°C / -20°C ~ +60°C ( 無蒸氣凝結狀態 ) 0°C ~ +40°C / -20°C ~ +60°C ( No Condensation condition )
	使用溼度 Operating Humidity	90%RH 以下 Less Than 90% RH
	衝擊 / 振動 Impact / Vibration	10G以下 / 1G以下 Less than 10G / Less than 1G

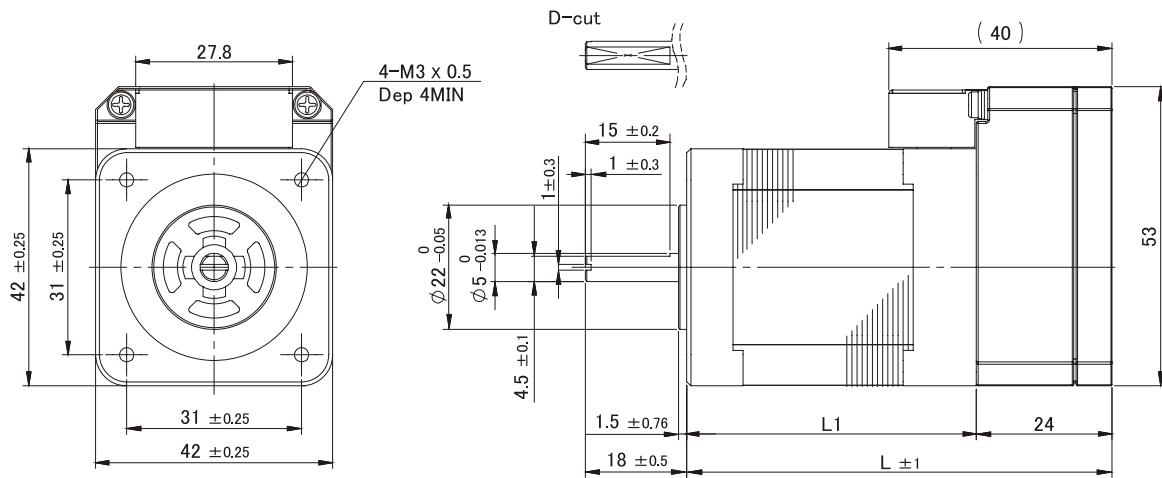
## 扭力曲線 Torque Curve



■ CM1-□-11L/S 外型尺寸 (單位:mm )  
Dimention (UNIT : mm)



■ CM1-□-17L/S 外型尺寸 (單位:mm )  
Dimention (UNIT : mm)

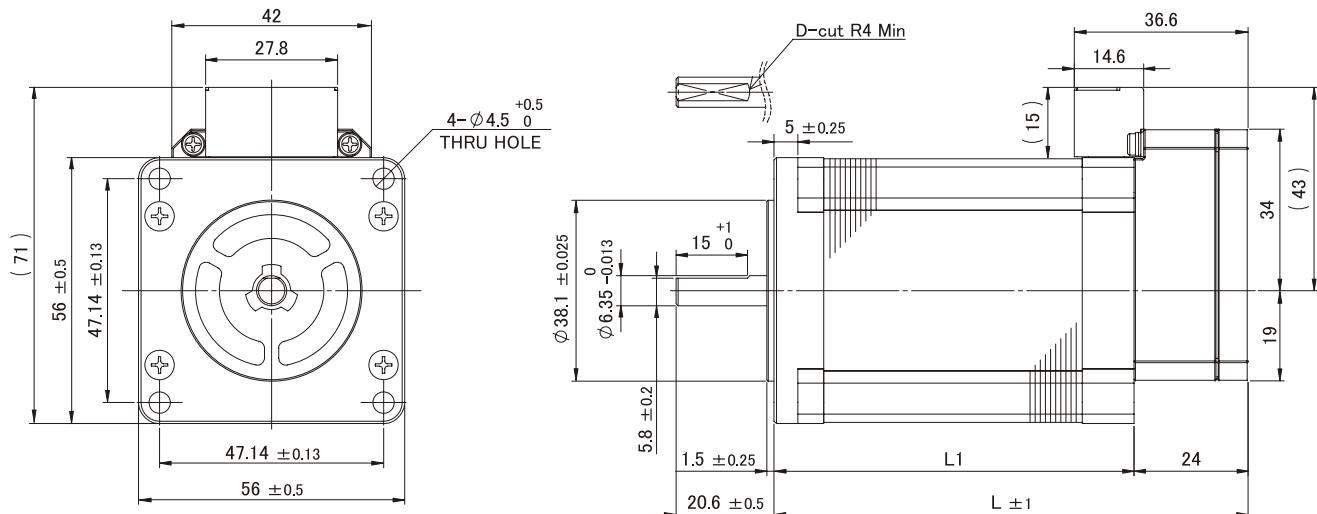


Model Name	L1	L
CM1-□-17L30C	51.5	75.5
CM1-□-17S30C	36.5	60.5

# Specifications

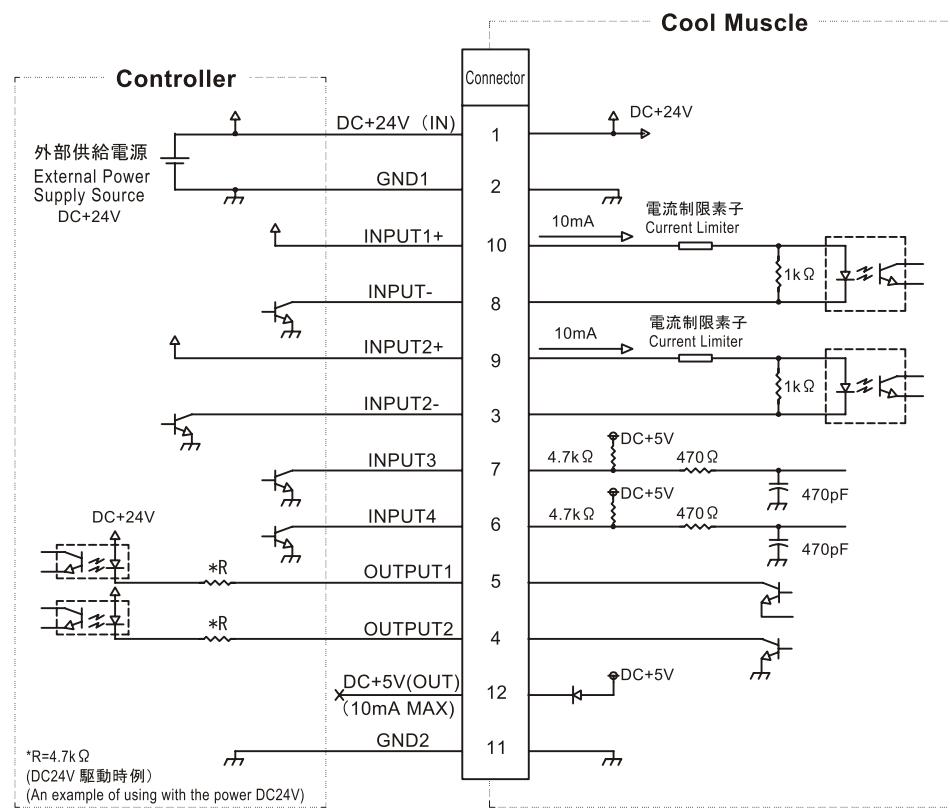
規格

■ CM1-□-23L/S 外型尺寸 (單位:mm)  
Dimention (UNIT : mm)



Model Name	L1	L
CM1-□-23L20C	76	100
CM1-□-23S30C	42	66

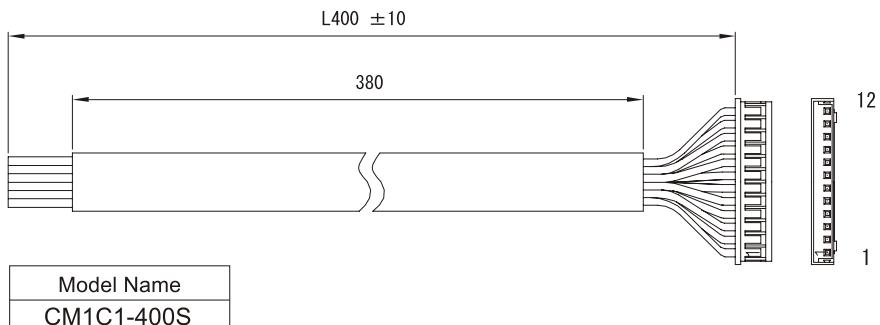
■ 接線範例 Connection Example



※1-12 PIN NO.  
\*Number of 1-12 is PIN No.

## ■ 馬達線外型尺寸 (單位:mm)

Accessory Motor Cable Dimension (UNIT : mm)



## ■ 接頭 PIN 位配置

PIN	顏色 Color	名稱 Name	機能 Function	脈波 Pulse		類比 Analog	通信 Computer
				CW / CCW	Step / Dir		
1	橘色 Orange	+24V DC IN	電源入力 Motor Power				
2	黑色 Black	GROUND 1	接地 GND				
3	棕色 Brown	INPUT 2-	PIN9 共同信號 Return For Pin 9	CCW-	Direction-		
4	黃色 Yellow	OUTPUT 2	數位 output, 類比 output, 串列訊號 TX Digital Output, Serial TX, Analog Output				下位側通信 Serial
5	綠色 Green	OUTPUT 1	類比 output, 串列訊號 TX Digital Output, Serial TX				上位側通信 Serial
6	藍色 Blue	INPUT 4	數位 input, 類比 input Digital Input, Analog Input			V+	
7	紫色 Purple	INPUT 3	數位 input Digital Input				
8	黑色 Black	INPUT 1-	PIN10 共同信號 Return For Pin10	CW-	Step-		
9	灰色 Gray	INPUT 2+	數位 input, 脈波輸入, 串列訊號 RX Digital Input, Pulse Counter, Serial RX	CCW+	Direction+		下位側通信 Serial
10	白色 White	INPUT 1+	數位 input, 脈波輸入, 串列訊號 RX Digital Input, Pulse Counter, Serial RX	CW+	Step +		上位側通信 Serial
11	黑色 Black	GROUND 2	接地 GND			V-	
12	紅色 Red	+5V DC OUT	5V 電壓輸出 (Max. 10mA) 5V Power Out (Max. 10mA)				

# Specifications

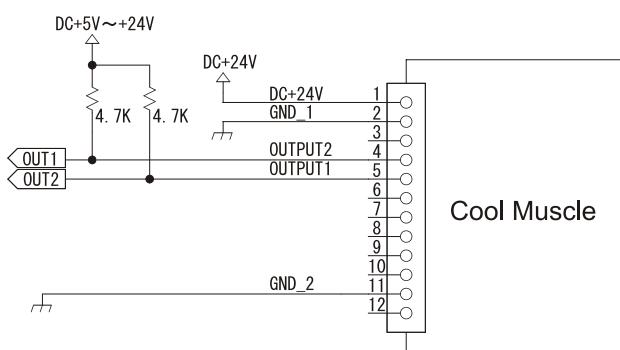
規格

## ■ 入力信號 Input Signal

電壓規格 Voltage Specification		
INPUT1+ ~ INPUT1-	高電位電壓 > 3V High Level > 3V	
INPUT2+ ~ INPUT2-	低電位電壓 < 0.8V Low Level < 0.8V	
INPUT3	高電位電壓 > 4.2V High Level > 4.2V	
INPUT4	低電位電壓 < 0.8V Low Level < 0.8V	
信號 / 動作 Signal and Motion		
電腦模式 Computer Type	數位 <input type="checkbox"/> 入力 Digital Input (RS232C)	
脈波模式 Pulse Type	脈波 <input type="checkbox"/> 入力 Pulse Signal (INPUT1/2)	
類比模式 Analog Type	類比 <input type="checkbox"/> 入力 (INPUT4) Analog Input (INPUT4)  *建議使用 OP Amp *OP Amp usage is recommended	位置控制 Position Control  以入力電壓 (0.2V~4.8V) 之比例控制馬達位置。 最大移動角度 (距離) 可由參數設定。 Position control by input voltage from 0V to DC+4.8V. Max. position range is settable by parameter
		速度控制 Speed Control  以入力電壓 (0.2V~4.8V) 之比例控制馬達速度。 最大回轉速度可由參數設定。 <ul style="list-style-type: none"><li>• 電壓 2.6V→4.8V : 由 CW 方向速度增加</li><li>• 電壓 2.4V→0.2V : 由 CCW 方向速度增加</li><li>• 電壓 0.2V→4.8V : 由 CW 或 CCW 方向速度增加</li></ul> The speed control in proportion to an input voltage from 0.2V to 4.8V. The max speed can be set by a parameter. <ul style="list-style-type: none"><li>▪ Analog Voltage 2.6V to 4.8V : Increase speed in CW direction</li><li>▪ Analog Voltage 2.4V to 0.2V : Increase speed in CCW direction</li><li>▪ Analog Voltage 0.2V to 4.8V : Increase speed either in CW or CCW direction</li></ul>

## ■ 出力信號 Output Signal

電壓規格 Voltage Specification	
高電位電壓 : DC+5V~24V (*推薦 5V)	High Level Output Voltage : DC+5V – 24V (*Recommended: 5V)
低電位電壓 : DC+0.8V	Low Level Output Voltage : Low Level DC+0.8V
出力信號測量條件 Condition for Output Signal Measurement	



## ■ 入力信號 Input / Output Function

Cool Muscle 具有 4 個點及 2 個點，各點皆可執行機能設定

Cool Muscle has 4 Inputs and 2 Outputs that can assign a function to each point of a signal.

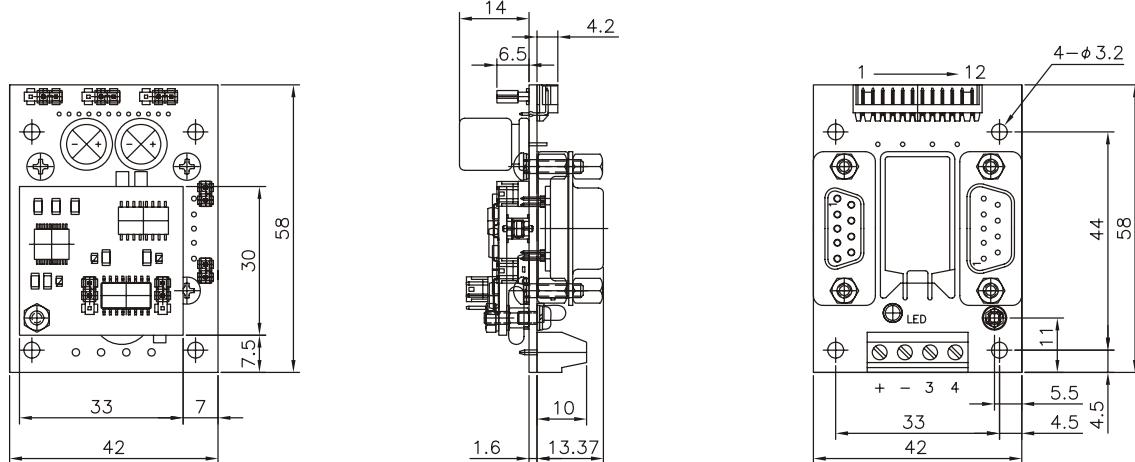
输入信號目標區時 機能設定		Input Functions for the Target Voltage Level
機能 Function	內容 Description	
一般輸入 General Use	使用特定指令 (僅限 C TYPE 可設定) Typically used for the I command (* C type only)	
原點 Sensor Origin Sensor	原點 Sensor 訊號分割 The signal from the origin sensor	
手動回饋 CW/CCW Manual Feed CW/CCW	馬達 ON 時，連續向 CW 方向 / CCW 方向回轉 Motor runs in a CW / CCW direction for the duration of the signal	
極限 Sensor CW/CCW Limit sensor CW/CCW	CW/CCW 方向極限 sensor ( CW/CCW 方向原點 Sensor 亦可使用 ) Limit sensor for CW / CCW direction ( This can work as an origin sensor )	
緊急停止 Emergency Stop	馬達瞬間停止 Emergency Stop	
程式完全停止 Full Stop	Bank Program 完全停止 Stop the Bank Program	
输入信號上升 / 下降時 機能設定		Input Functions at the Rising / Falling Edge
機能 Function	內容 Description	
解除異常警告 / 暫時停止 Reset Alarm / Pause	解除異常警報及暫時停止 Reset the alarm and pause a motor	
Motor Free Motor Free	設定 Motor free (※ 僅於上升時可設定) Make a motor go into a motor free	
解除 Motor Free Enable Motor	解除 Motor free (※ 僅於下降時可設定) Enable a motor from a motor free	
馬達位置重新設定 Position Reset	將現在位置重新設定為 0 Make the current position "0"	
執行次項欄位 Execute Next Line	執行次項程式欄 (※ 僅限 C TYPE 可設定) Execute the next line in a Bank (*C type only)	
執行前項欄位 Execute Previous Line	執行前項程式欄 (※ 僅限 C TYPE 可設定) Execute the Previous line in a Bank (*C type only)	
執行 1/2/3 Program Bank Execute Bank Program	執行 1/2/3 Program Bank (※ 僅限 C TYPE 可設定) Execute a 1/2/3 Bank (*C type only)	
原點復歸 Back to Origin	開始原點復歸 Go back to the origin	
手動寸動 CW/CCW Manual Jog CW/CCW	僅送出設定量向 CW 方向 / CCW 方向回轉 Motor runs in a CW / CCW direction	
输出信號 機能設定		Output Functions
機能 Function	內容 Description	
指令 Command	使用馬達多軸串聯時所需之输出信號 The necessary Output Signal in Daisy Chain	
定位信號 In-Position Signal	完成定位時信號輸出 In-Position signal when the motor reaches the target position	
異常警告 Alarm	異常警報發生時信號輸出 Alarm signal	
一般出力 General Use	使用特定指令 (※ 僅限 C TYPE 可設定) Typically used for the I command (* C type only)	
通過點出力 In-Position Signal in Merge Mode	合併模式時使於通過點輸出信號 Output a signal at the passing points in Merge Mode	
位置標示信號 Position Mark	一定脈波間隔時輸出信號 Output a signal at certain intervals	
Motor Free 時 Motor Free	Motor Free 時輸出信號 Output a signal during motor free	
推擠模式 Push Mode	推擠模式中輸出信號 Output a signal during the push mode	
類比輸出 Analog Out	螢幕用的波形輸出 Output analog waves for monitoring	

# Specifications

規格

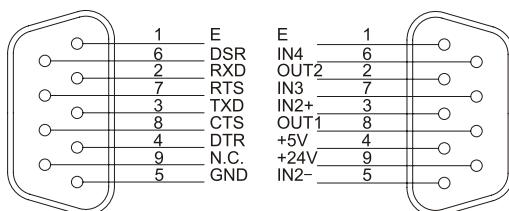
■ 網路卡外型尺寸 (單位 : mm)  
Network Card Dimension (UNIT : mm)

Master Card



Model Name
CM1DC1-MBSC

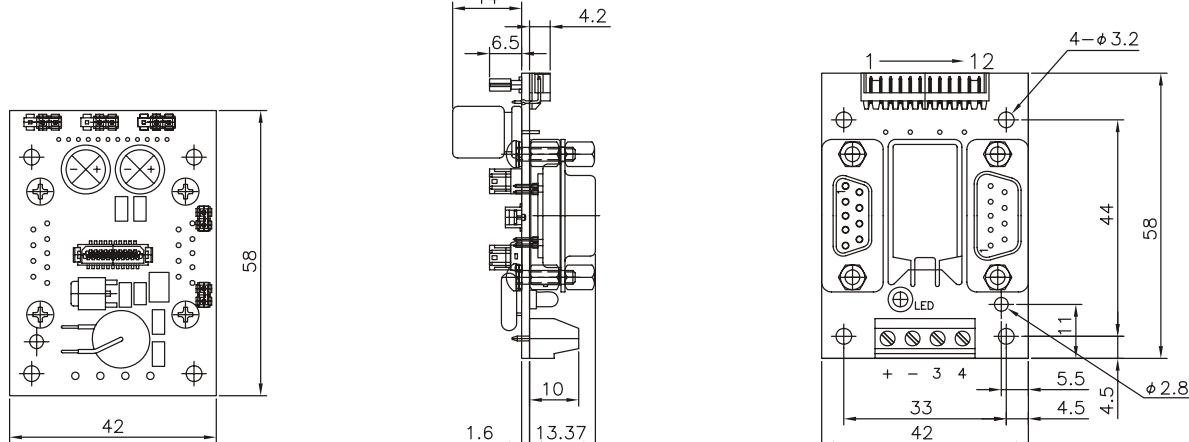
D-SUB Connector/Pin 位配置 D-SUB Connector / Pin



CN2 : D-Sub 9 Socket type

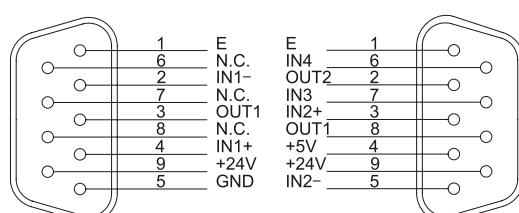
CN3 : D-Sub 9 Pin type

Slave Card



Model Name
CM1DC1-SBSC

D-SUB Connector/Pin 位配置 D-SUB Connector / Pin



CN2 : D-Sub 9 Socket type

CN3 : D-Sub 9 Pin type

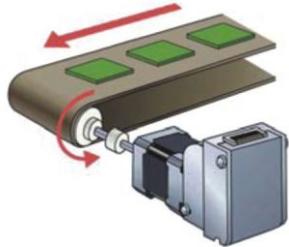
# Application

應用實例

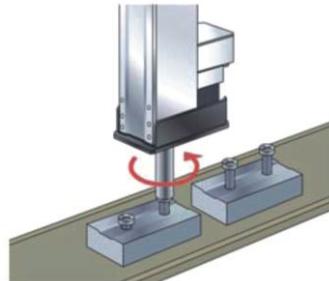
## Cool Muscle 應用實例

## Cool Muscle Application Example

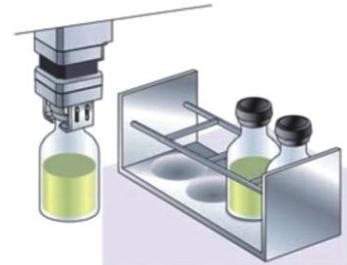
運用 Cool Muscle 的位置 / 速度 / 扭力控制模式，可自在靈活應用於各種場合。  
By controlling the position, speed, and torque, Cool Muscle supports various applications.



搬送機構  
Conveyor



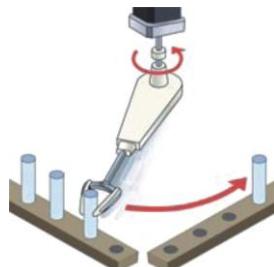
鎖螺絲機構  
Thread Fastening



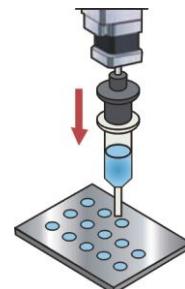
自動取放機構  
Pick & Place



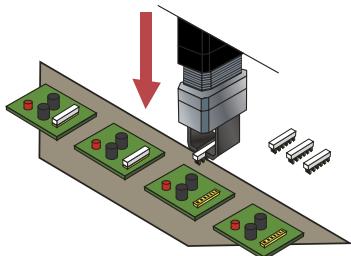
矩陣取放機構  
Palletization



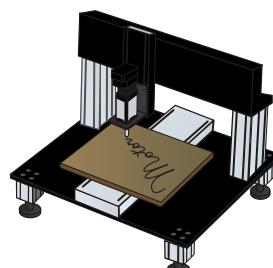
手臂取放  
Drive Arm



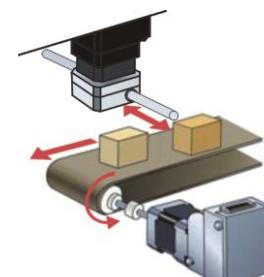
定量點膠機構  
Quantitative Embrocation



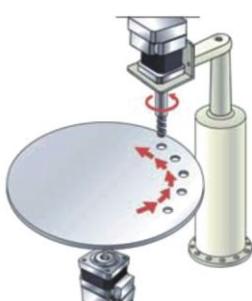
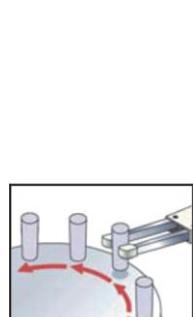
組裝機構  
Imposing Machine



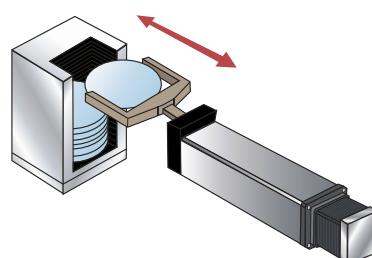
桌上型滑台模組  
Desktop Robot



包裝機 / 貼標機 / 物品篩檢機構  
Packing / Labeling / Sorting Machine



分割旋轉台取放機構  
Boring / Index Table



晶圓插件 / 取出機構  
Loading & Unloading the Wafer

2010年上海万国博覧会 日本産業館 「夢ROBO」に「クールマッスル2」搭載  
"COOL MUSCLE2", used in "YUME ROBO" at 2010 Shanghai Expo - Japan Industry Pavilion



YUME ROBO

Designed by Toshiyuki KITA  
Produced by Muscle Corporation

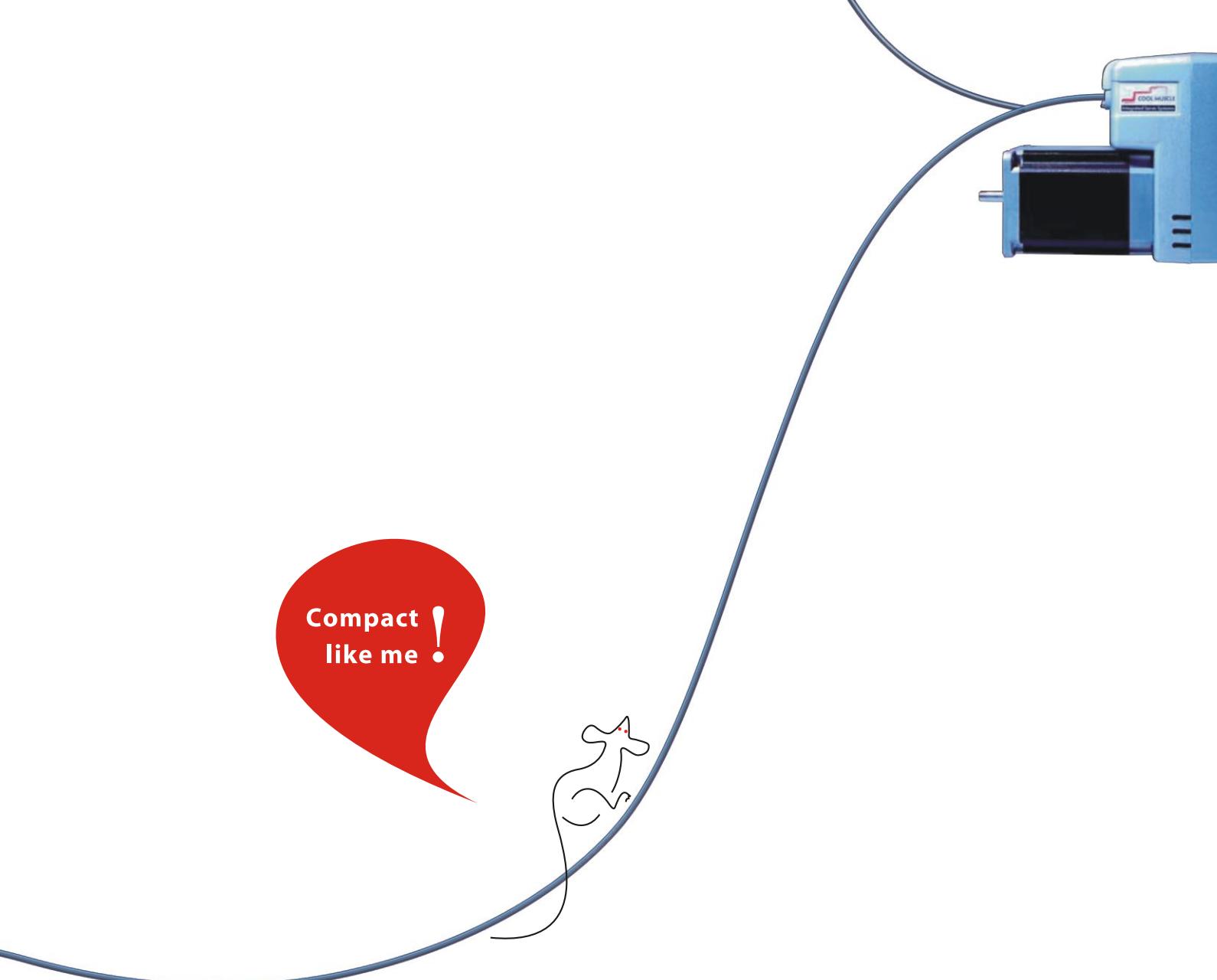
# 一體型 AC 伺服馬達 **2**

**COOL MUSCLE** 2

Integrated AC Servo System



- Motor
- 
- Encoder
- 
- Driver
- 
- Controller
- 
- PLC
- 
- Power Supply
- 
- 
- 
-



# COOL MUSCLE 2

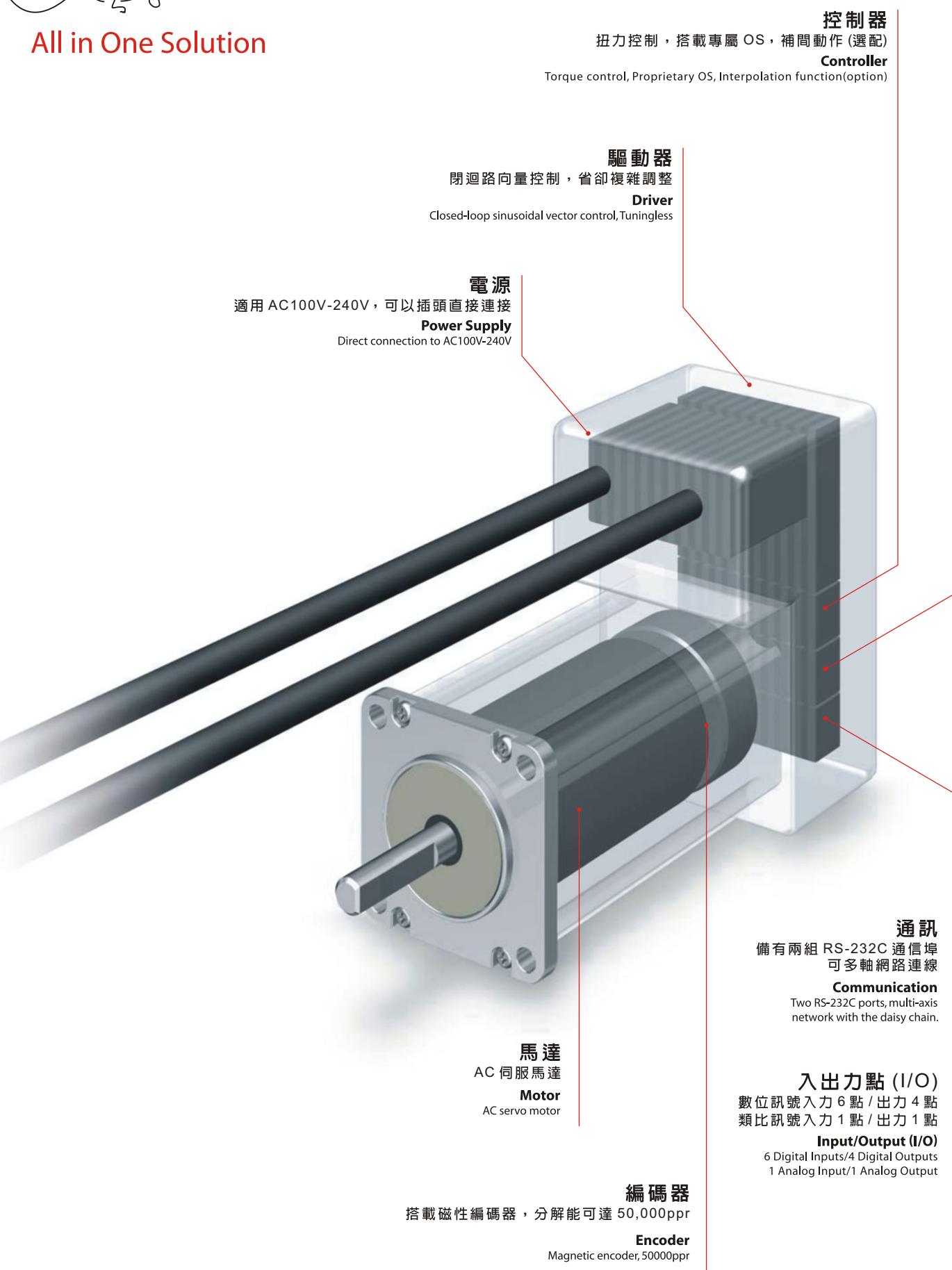
COOL MUSCLE2 蘊藏馬達、編碼器、驅動器、控制器、PLC、電源，堪稱  
『世界體積最小之一體型 AC 伺服系統』。業界新知識於此誕生！

The COOL MUSCLE 2 is the World Smallest Integrated AC Servo System combining a Motor, Encoder, Driver, Controller, PLC and Power Supply.

This is the birth of the new benchmark !

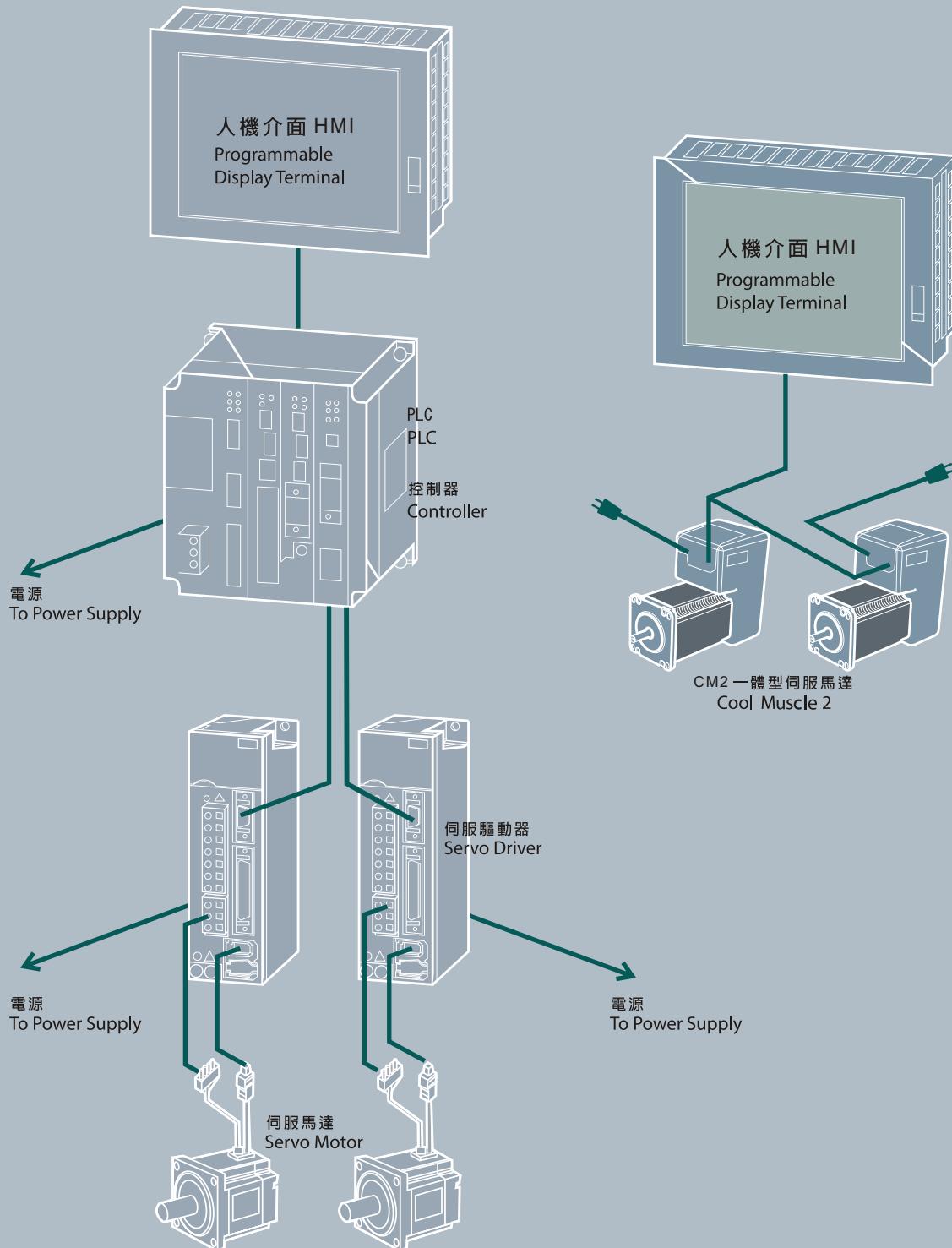


All in One Solution



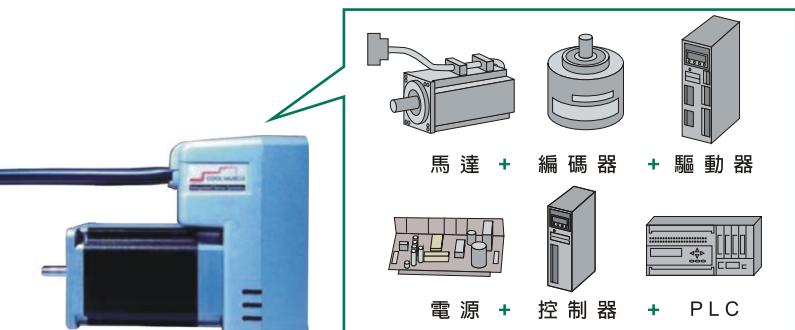
傳統伺服系統使用例  
Conventional system example

CM2 系統使用例  
COOL MUSCLE2 system example



世界最小的一體型 AC 伺服系統初探誕生！

Cool Muscle 2(CM2)為蘊藏馬達、編碼器、驅動器及控制器、PLC 機能、電源裝置之『一體型 AC 伺服馬達系統』。省卻所有多餘配線、實現伺服系統首創之極簡控制，締造節省空間、省配線、降低成本、縮短開發時間之多項優勢。



### 01 馬達

AC 伺服馬達之基本定格迴轉速  $6000\text{min}^{-1}$ 、最高迴轉速  $8000\text{min}^{-1}$ ，可達到高轉速的需求。

(轉速依機型各異)

### 02 編碼器

搭載獨家開發之磁性編碼器，可實現 50000 分解能，超靜音流暢運轉之高精度定位的完美呈現。由於為磁性編碼器，因此即使於惡劣環境及長時間使用下亦不致出現不安定現象。

### 03 驅動器 / 電源內藏

搭載閉迴路向量型控制系統，內藏控制 / 動力電源，馬達線內藏亦可減輕訊號干擾之產生，此外無需進行電壓 AC100-240V 切換、僅以一個插頭即可完成電源連線。

#### ■ 運轉特性無需調整

運用現代控制理論研發獨家控制技術，進而成功實現無需調整伺服增益值之嶄新階段，解除伺服馬達之增益值調整的繁複過程，成功實現於一定範圍內之負載下亦可安定作動的目標，從此無需調整增益值，因此將可有效大幅縮減作業時間。

The World Smallest Integrated AC Servo System !

COOL MUSCLE 2(CM2) is an "Integrated AC Servo System" combining a Motor, Encoder, Driver, Controller, PLC function and Power Supply into one fully integrated package.

Allowing for space saving, wiring and cost reduction, and also shorten development time.

#### 01. Motor

AC Servo motor speed rated at  $6000\text{min}^{-1}$ , with maximum speed of  $8000\text{min}^{-1}$ .(Speed depend on model)

#### 02. Encoder

The proprietary magnetic encoder provides a resolution of 50000ppr provides high precision positioning with smooth and quiet motion. The magnetic encoder will not be affected by harsh environmental conditions or age softening.

#### 03. Integrated Driver/Power Supply

CM2 is an AC servo system incorporates an enclosed closed-loop vector controller and control/drive power supply. All motor wiring is hidden minimizing any potential emitted motor noise and can be powered by simply connection to an AC100V-240V. No AC conversion is required.

#### ■ Tuningless

Utilizing Muscle's proprietary control technology and modern control theory, allows for a tuningless servo gain system under specified load conditions. By eliminating the need for gain adjustments, the CM2 dramatically shortens the time to customize the system to your specific needs and conditions.

## 04 控制器

舉凡各種參數設定、從基本以致於繁複動作皆可透過多樣化的程式指令輕鬆完成設定。

### CML

CML (Cool Muscle Language)，為 Cool Muscle 專用之程式語言系統。

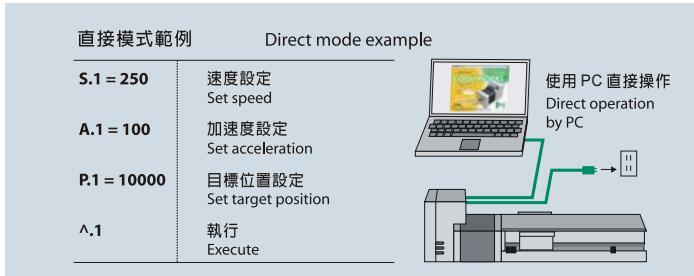
利用 CML 專用軟體 COOLWORKS 或 PC 超級終端機功能可輕鬆完成程式編輯，執行動作可藉由 CML 指令或開關完成。

簡單參數設定		Easy Parameter setting
K20.1 = 0		通訊傳輸速率設定為 38.4kbps Set Communication Baud Rate to 38.4kbps
K46.1 = 1		電源開啟時即自動進行原點復歸動作 Power on and start origin search automatically by pushing mechanical stopper.

### ■ 簡單操作

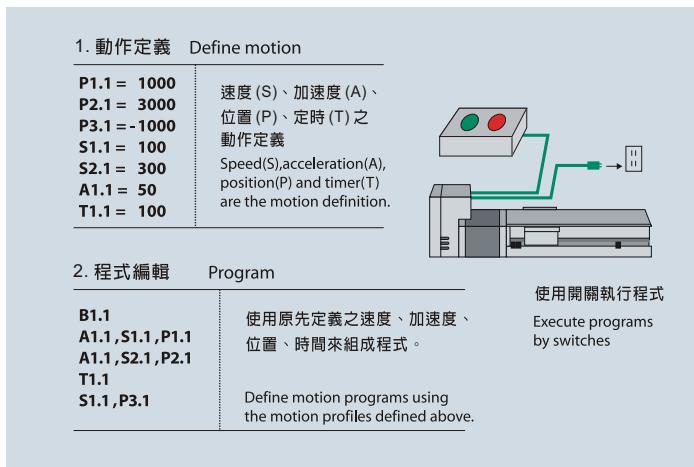
#### 【直接模式】

僅需利用 RS-232C 通信輸入 CML 指令即可直接操作馬達動作。



#### 【程式模式】(脈波模式除外)

程式可被下載於 CM2，因此可由 PC 或外部開關輕鬆達成各種程式動作。



### 04. Controller

Easy parameter setting and programming of various motions.

### CML

CML (Cool Muscle Language) is a programming language designed for CM2. Using CML can simplify any programming with COOLWORKS LITE or Hyper Terminal. Programmed motion can be executed by CML commands or simple switches.

### ■ Easy to Use

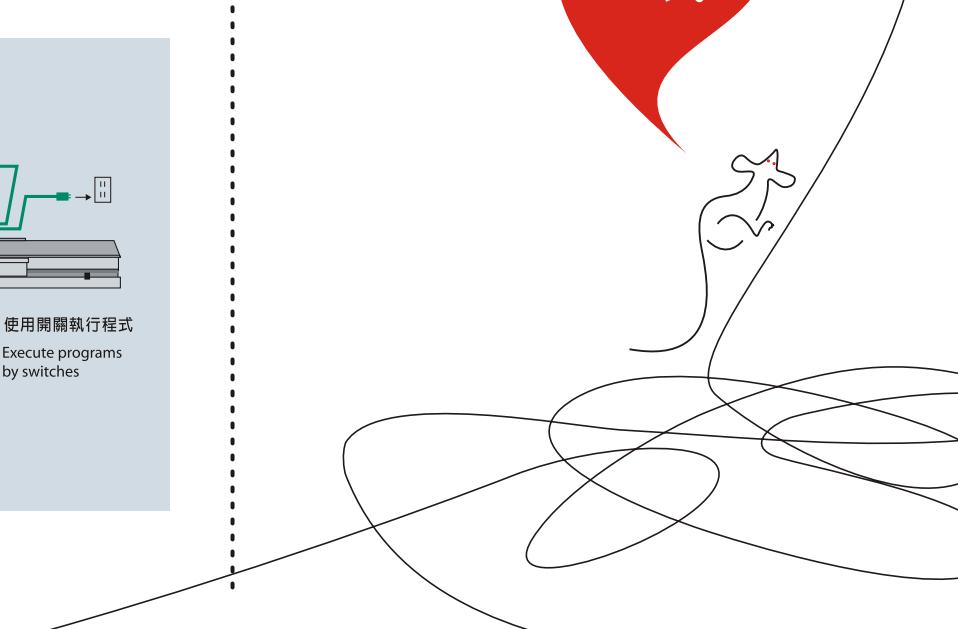
#### [Direct Mode]

CM2 can be directly operated by simply entering CML commands via RS-232C communication.

#### [Program Mode] (P type Excluded)

Programs can be downloaded to CM2 so that various motions can be executed by PC or simple switches.

Easy !

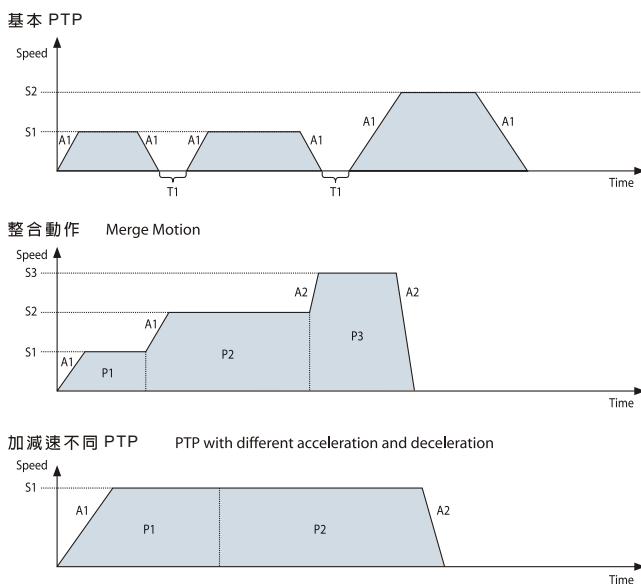


### ■ 多樣化動作

CM2 可提供從基本到繁複動作等多樣化的模式指令。

#### 【PTP 動作】

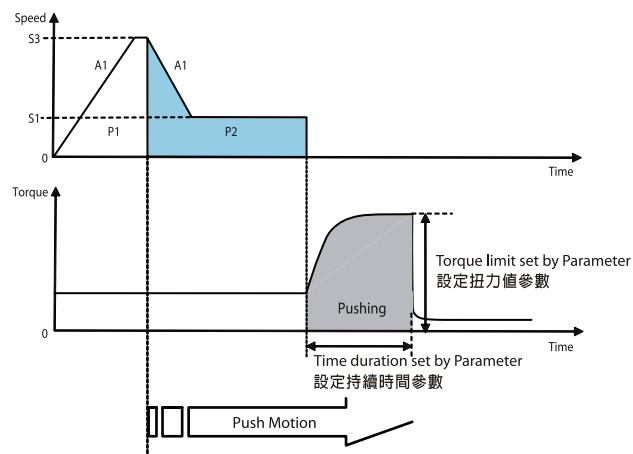
可任意設定加速度及減速度，不僅可於馬達動作中改變速度及加速度，於通過點亦無需停止即可完成速度及加速度變化(整合動作)等各式 PTP 動作。



#### 【扭力控制】

##### ◎ 推擠動作模式

CM2 可於已設定的扭力值與時間來進行推擠模式，可取代氣壓缸或機械夾爪的使用場合，操作容易的扭力控制模式可應用於各式各樣的機械設備。



##### ◎ 扭力限制

可限制動作時輸出的扭力，由於可在設定扭力下動作，因此最適合使用於搬送等相關用途。

##### ◎ 扭力回饋

CM2 可接受外部扭力感應器回饋的信號來控制，因此輸出的扭力可隨外部信號變換而自動變更，此特性最適合應用於固定推力及固定張力控制等機械類型。

### ■ Wide Variety of Motion

CM2 supports standard motion control, as well as, a wide variety of custom programmed movements.

#### 【Standard PTP】

Both acceleration and deceleration can be independently set. CM2 optionally supports various methods of PTP motion such as speed changes and accelerations during motion at passing points without stopping or jittery movement, (Merge Motion).

#### 【Torque Control】

##### ● Push Motion

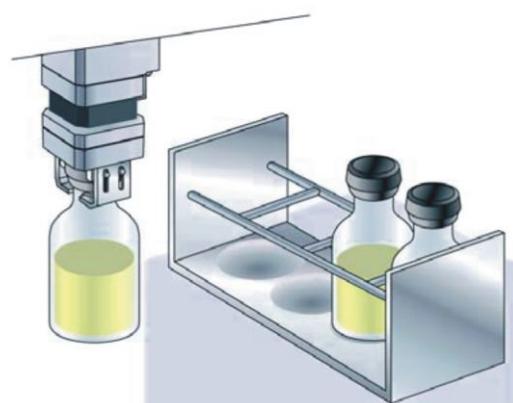
CM2 can continually push at a set torque rate for the set time period, replacing pneumatic cylinders and grippers. This flexible torque control is adaptable for multiple systems and use.

##### ● Torque Limit

Output torque limit can be set during motion. With this feature, CM2 operates below a specified load. It is an ideal solution for applications such as safety conveyors, etc.

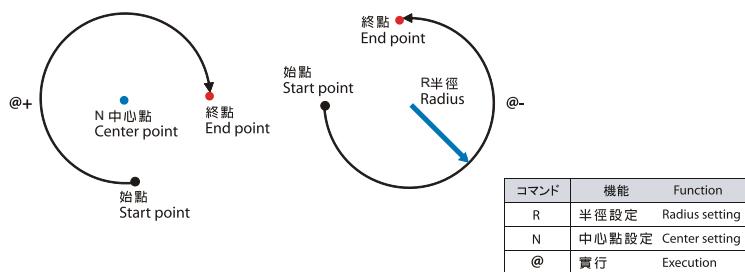
##### ● Torque Feedback

CM2 supports torque feedback control with an external torque sensor, which automatically changes the output torque according to the sensor signal. This feature is an ideal solution for applications that require constant tension such as pulling machines.



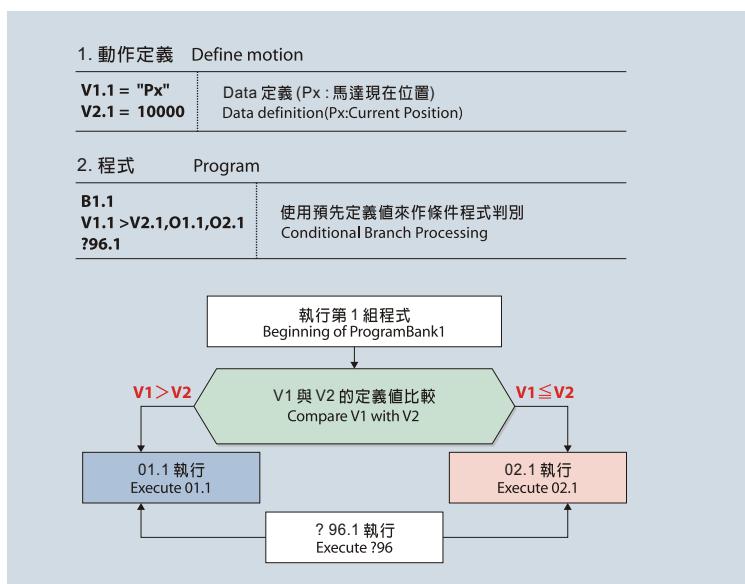
### 【補間功能】(選配)

僅需 3 個指令即可輕鬆完成圓弧 / 直線補間動作，補間機能已內建，因此無須另置外部補間控制器，如此亦可大幅縮減開發時間及節省成本。



### ■ 演算機能

程式內建置數值演算及邏輯演算功能，運用已定義之資料及馬達位置、速度、I/O 等情報即可於演算過程中完成複雜控制動作，由於可執行數值大小比較及理論演算等條件判別，因此利用演算機能即可增加動作控制範圍。



### ■ 教導機能

無須外接教導裝置即可完成位置教導功能，可依指令或入力信號記憶現在位置，即可完成指定位置之精準校正及輕易變更動作模式。

- ◎ 利用教導指令即可簡單完成任意動作設定
- ◎ 有效縮短開發 / 作業時間

### [Interpolation] (Optional)

Circular and linear interpolation can be executed with only 3 commands. This function is integrated into the CM2, eliminating the need for an external interpolation unit and dramatically shortening development time.

### ■ Arithmetic/Logical Operation

CM2 supports arithmetic and logic operation programs based on defined data, positions, speeds and I/O status, allowing for complex control. Arithmetic and logical operations enable value comparison and conditional branch processing, expanding applicable motion control.

### ■ Teaching Function

CM2 supports position teaching that was conventionally done by an external pendant. By entering commands or input signals, position can be captured and set in position memory, allowing fine adjustment and motion pattern change.

- Easy download of multiple motion patterns.
- Shortens development and setting time.

### 05 PLC 機能

搭載 PLC 軟體功能，使用 CML 即可完成定義動作。

#### ■ 多功能執行控制

利用多功能執行控制特性，即可同時完成馬達驅動控制、運動控制、I/O 控制、通信機能、PLC 機能等多項任務，由於 PLC 機能獨立於運動控制之外，更可有效提升系統即時性。

CM2 僅需依據馬達動作狀況 / 入出力狀況資料即可完成獨立運轉功能，此功能無須加裝其他 PLC 裝置。

### 06 入 / 出力機能

#### ■ 數位入 / 出力機能

透過入出力 (入力 6 點 / 出力 4 點) 可完成任意指定機能。可利用 PC 輕易完成數位信號執行機能的參數設定。使用內建機能即無須另接原點開關及極限開關，更可有效節省成本與安裝空間。

- ◎ 入力點機能範例：原點復歸 / 停止/程式執行 …
- ◎ 出力點機能範例：警告/定位完成信號輸出 …

#### ■ 類比入 / 出力

透過類比入力信號可達成位置、速度、扭力控制。另外利用類比出力亦可執行位置、速度、扭力監控功能。

#### ■ 脈波入力

CM2 之 P TYPE 亦可直接以現行脈波控制系統延續使用操作。

#### 05. PLC Functions

Integrated software PLC functions for defined motion sequencing via CML.

#### ■ Multitasking Control

With Multitasking Control, CM2 allows parallel processing of various tasks such as motor control, motion control, I/O control, communication functions, and PLC functions. By operating PLC functions in the background independently from motion control, CM2 provides true high "real-time" performance. CM2 can perform stand-alone motion control according to the motor and I/O status and does not require an external PLC.

#### 06. Input/ Output Functions

##### ■ Digital Input/Output

Specified functions can be assigned via 6 inputs and 4 PC outputs. Use of these integrated functions, eliminates the need for customized limit sensors, resulting in significant cost and space reduction.

- Input function examples: Origin search/Stop/Program Execution
- Output function examples: Alarm/In-position signal output

##### ■ Analog Input/Output

Position, speed, or torque can be controlled and monitored by simple analog input and output signals.

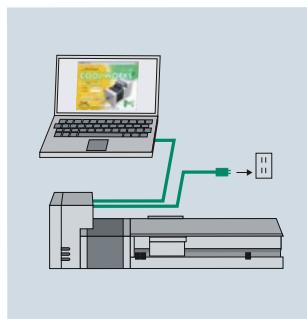
##### ■ Pulse Input

CM2 P type can be easily integrated into conventional pulse driver systems.

## 07 通信

### ■ RS-232C

CM2 擁有 2 組獨立 RS-232C 通信埠之標準裝備。包含各種參數設定及程式製作、多軸動作等多樣機能皆可輕易完成設定，此外亦可輕鬆與外部機器進行連接作業。

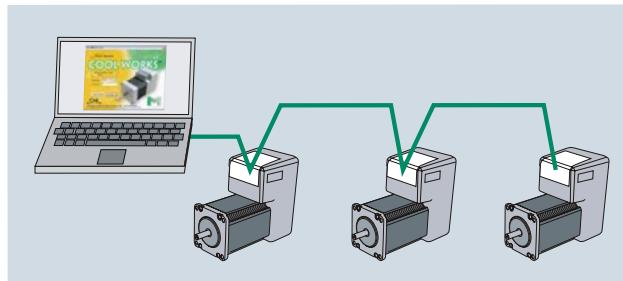


### ■ Modbus

CM2 支援 Host-and-Slave 主從架構之標準 Modbus 通信機能，CM2 亦可透過 Modbus 直接連接通用型人機介面及 PLC。

### ■ 多軸控制

利用多軸串聯方式可輕易達成多達 15 軸之多軸控制任務，除皆可獨立執行程式外，亦可完成與其他 CM2 動作狀況及 I/O 狀況之運動。此外可使用之 I/O 點數則依所連接 CM2 的數量等比擴張。



**+α** 狀態顯示 LED      +  $\alpha$  Status LED  
利用 2 色 LED 閃燈裝置顯示馬達 SERVO ON/OFF 以及故障等兩項狀態。

The blinking pattern of 2 colors of LEDs can tell you the status of Servo ON/OFF and Alarm.



## 07. Communications

### ■ RS-232C

CM2 has two independent RS-232C ports as a standard feature. It is easy to set up functions for various maneuvers such as parameters setting, creating programs and multi-axis motion. This also allows for easy connection to external equipment.

### ■ Modbus

CM2 accepts the sub-set commands of standard Modbus. CM2 can be connected directly to a programmable display terminal or PLC with Modbus protocol.

### ■ Multi-Axis Control

CM2 allows for Multi-Axis Control of up to 15 axes via simple Daisy Chain connection. Each unit can execute motion commands to the other axis I/O status allowing for communication among the axes. The number of available I/Os are expanded in proportion to the number of axes.



### 線性移動模組

### ACTUATOR

#### 伺服線性移動模組

#### Servo Actuator

以 CM2 為標準裝備，蘊藏驅動器及控制器之一體型線性運動模組，可連結多達 15 軸之多種類電動線性運動模組，然而亦能以低成本輕鬆架構網絡系統。擁有 40 款 600 項機種以上之伺服線性運動模組，藉此提供更貼近顧客之多樣化需求。

詳情請洽詢新協祥貿易有限公司  
相關聯絡窗口。

[www.hhstc.com.tw](http://www.hhstc.com.tw)

Servo Actuator is an ALL-IN-ONE solution actuator, with a integrated CM2 Driver and Controller. A total of 15-axis electric actuators of various types can be integrated into a low cost new network system. Over 40 models and 600 types of Servo Actuators can be easily combined to form ideal servo systems.

Please ask us for details.



### 減速機 GEARBOX

#### 減速機

提供多樣化種類及減速比類型，以因應顧客需求進而選擇最佳減速機款式。藉由包含高精度、低背隙、免維修特點之減速機與 CM2 的完美結合，締造高效率性能表現。

A wide range of high quality gearboxes are available to suit your application needs. Combine a high precision, low backlash, zero maintenance, durable gear box with a CM2 to maximize performance.

減速比 1:3, 1:4, 1:5, 1:6, 1:7, 1:8, 1:9, 1:10, 2:15, 2:20, 2:25, 2:30, 2:35, 2:40, 2:45, 2:50, 2:60, 2:70, 2:80, 2:90, 2:100

背隙 Backlash

精密型 High precision : 1:3~10≤3 2:15~100≤5

標準型 Standard : 1:3~10/≤5 2:15~100/≤7



### 選配連接線

### OPTION CABLES

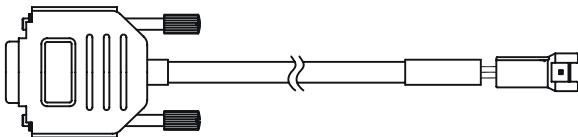
#### 通信連接線 Communication Cable

#### CM2RS2-2000W

CM2 用通信連接線 2000mm。

Communication Cable for CM2. 2000mm.

\* We recommend you to buy the Communication Cable in the first time, you would need it for various of setting.



#### 多軸串聯連接線

#### Daisy Chain Cable

#### CM2DC2-0500W (-1000W/-2000W)

CM2 多軸串聯連接線 (多軸專用)

長度 500mm/1000mm/2000mm

Daisy Chain Cable for daisy-chained CM2s. (For multi-axis)  
500mm/1000mm/2000mm.

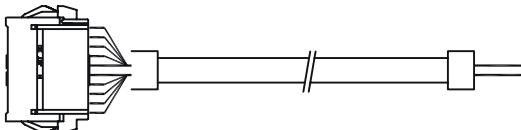


#### I/O 連接線 I/O Cable

#### CM2IO2-1000S (-2000S)

CM2 用 I/O 連接線 長度 1000mm/2000mm

I/O Cable for CM2. 1000mm/2000mm.

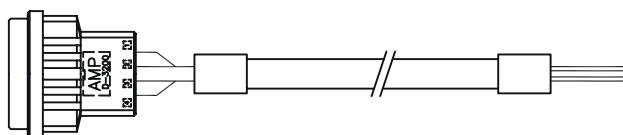


#### 電源連接線 Power Supply Cable

#### CM2PW2-1000S (-2000S)

CM2 用電源連接線 長度 1000mm/2000mm

Power Supply Cable for CM2. 1000mm/2000mm.



# Specifications

規格

■ 型號 Model Name

**CM2 - C - 56B 20A - R**

控制模式 Control Type  
P…脈波控制 Pulse Type  
C…電腦控制 Computer Type  
R…補間控制 Interpolation Type

馬達尺寸 Motor Size  
56…56□  
60…60□

馬達系列 Motor Series

馬達出力 Motor Output  
10…100W  
20…200W  
40…400W

軸端形狀 (選配)  
R…圓軸  
\*K…Keyway  
\*D…D-cut  
\*W…Double D-cut

■ 規格 Specifications

型式 MODEL	CM2-□-56B10A	CM2-□-60A10A	CM2-□-56B20A	CM2-□-60A40A
入力 AC 電壓 (V) Input AC Voltage [V]	單相或三相 AC100~240V ±10% Single-phase or Three-phase AC 100~240 ±10% 頻率 50/60HZ ±5% (Frequency : 50/60Hz ±5%)	單相或三相 AC100~240V ±10% Single-phase or Three-phase AC 100~240 ±10% 頻率 50/60HZ ±5% (Frequency : 50/60Hz ±5%)	單相或三相 AC100~240V ±10% Single-phase or Three-phase AC 100~240 ±10% 頻率 50/60HZ ±5% (Frequency : 50/60Hz ±5%)	單相或三相 AC100~240V ±10% Single-phase or Three-phase AC 100~240 ±10% 頻率 50/60HZ ±5% (Frequency : 50/60Hz ±5%)
入力電流 (A) Input Current [A] (定格運轉之參考值) (Reference value in ratings driving)	單相 100V/60Hz Single-phase 2.2  單相 200V/60Hz Single-phase 1.2	2.0	3.6	— 4.0
馬達出力 Motor Output [W]	100	100	200	400
額定轉速 Rated Speed [RPM]	5,000	3,000	6,000	3,500
最高轉速 Max.Speed [RPM]	8,000	5,000	8,000	5,000
額定轉矩 Rated Torque [N·m] (kgf·cm)	0.19 (1.95)	0.32(3.25)	0.32 (3.25)	1.09 (11.1)
最大轉矩 Max.Torque [N·m] (kgf·cm)	0.57 (5.85)	0.95 (9.7)	1.15 (11.7)	3.82 (39)
轉子慣量 Rotor Inertia Moment ( $\text{kg}\cdot\text{m}^2$ )	$0.091 \times 10^{-4}$	$0.09 \times 10^{-4}$	$0.18 \times 10^{-4}$	$0.34 \times 10^{-4}$
容許負載慣量 Allowable Inertia Moment Load	轉子慣量 10 倍以內 Less than 10 times of Rotor Inertia			
軸向容許荷重 Allowable Radial Load [N·m] (kgf·cm) (距安裝面 20mm 位置) (20mm off from the mounting surface)	58.8(6)	78.4(8)	58.8(6)	198(20)
徑向容許荷重 Allowable Thrust Load [N·m] (kgf·cm)	29.4(3)	39.2(4)	29.4(3)	68.6(7)
速度、位置檢知器 Encoder	增量型磁性式編碼器 Incremental Magnetic Encoder			
分解能 Resolution (ppr)	200~50,000 解析度由參數內設定 From 200 to 50,000 set by parameter			
控制方式 Control Method	全閉回路正旋波電壓控制 Closed Loop Sinusoidal Vector Control			
記憶容量 Memory Capacity	一般程式與邏輯判斷程式各 30 組 Number of Program banks / Ladder Logic banks : Each up to 30  每段程式可寫入 1,000 行 Number of Commands : Up to 1,000  資料數：位置 200 個、速度 15 個、加減速度 8 個、計時器 8 個、扭力限制 8 個、泛用變數 15 個 Number of data : Position 200/ Speed 15/ Acceleration 8/ Timer 8/ Torque limit 8/ General variable 15			
保護機能 Protective Function	位置偏差過大、過電壓、過負荷、溫度異常、推擠模式異常、緊急停止 Position error overflow, over voltage, overload, temperature error, push motion error, emergency stop			
入出力 I/O	制御入力 Control Input	數位信號入力 6 點 (含脈波命令 2 點) · 類比輸入 1 點 Digital Input : 6(including pulse Input 2), Analog Input : 1		
	制御出力 Control Output	數位信號出力 4 點 · 類比輸出 1 點 Digital Output : 4, Analog Output : 1		
	通信 Communication Port	Modbus 線路 2 port · RS232 標準介面 Host and Slave communication 2port. Conforming to RS-232C.		
冷卻方式 Cooling Method	自然空冷 Self-cooling			
質量 Mass [kg]	1.2	1.1	1.7	1.8
環境 Environment	使用溫度 Operating Temperature	0~40 °C (不可凍結) 0 ~ +40°C (non-freezing)		
	保存溫度 Storage Temperature	-20~+60 °C (不可凍結) -20 ~ +60°C (non-freezing)		
	使用 / 保存溼度 Operating/ Storage Humidity	90%RH 以下 (不可結露) 90%RH or less (non-condensing)		
	標準環境 Atmosphere	屋內使用 (日光不可直射), 避免腐蝕性及可燃性氣體, 粉塵及油汙 Indoor use only (no direct sunlight). No corrosive gas, inflammable gas, oil mist or dust.		
	標準高度 Altitude	海拔 1000m 以下 1,000m above sea level or lower		
	耐衝擊 Shock	10G (9.8m/s <sup>2</sup> ) 以下 10G (98m/s <sup>2</sup> ) or less		
	耐震動 Vibration	1G (9.8m/s <sup>2</sup> ) 以下 1G (9.8m/s <sup>2</sup> ) or less		

## ■ 入出力規格 I/O Specifications

於常溫 25 °C 下操作 Operating free-air temperature Ta is 25°C (unless otherwise noted)

項目 ITEMS	條件 CONDITIONS	MIN.	TYP.	MAX.	單位 UNIT
數位輸入 1 Digital Input 1 (IN1+~IN1-/IN2+~IN2-) *1	IN 1+ ~ IN 1-, IN 2+ ~ IN 2-	0	-	24	V
		0	-	0.8	
		3	-	24	
		-	-	500	
		0.8	-	-	
		-	-	0.1	
數位輸入 2 Digital Input 2 (IN3,4,5,6 / INCOM) *2	IN 3, 4, 5, 6 ~ INCOM	0	-	24	V
		0	-	0.8	
		3	-	24	
		-	-	-	
類比輸入 Analog Input	ANALOG IN ~ GND	0	-	5	V
		0.2	-	4.8	
		0.2	-	4.8	
		2.6	-	4.8	
		0.2	-	2.4	
數位輸出 Digital Output (OUT1,2,3,4 / OUTCOM) *3	OUT 1, 2, 3, 4 ~ OUTCOM	-	-	30	V
		-	-	20	
		-	0.1	1	
類比輸出 Analog Output (ANALOG OUT)	ANALOG OUT ~ GND	1	-	4	V
		-	-	7	
+5V 輸出 +5V Output	+5V ~ GND	4.5	5	5.5	V
		-	-	200	
通信 Communication Line (RXD0 / TXD0) (RXD1 / TXD1)	RXD0, RXD1 ~ GND	9.6	-	230.4	Kbps
		-25	-	25	
		-	1.8	2.4	
		0.8	1.5	-	
	TXD0, TXD1 ~ GND	3	5	7	KΩ
		-13.2	-	13.2	
		±5	±5.4	-	
		-	-	-	

\* 入力電壓的極性，IN1-(IN2-) 對應 IN1+(IN2+)。

入力 (IN1-,IN2-) 具備定電流二極體，入力電流為 8 ~ 12mA。

\* 在 IN3,4,5,6 ~ INCOM 之間輸入工作電壓之極性無限制

各入力點 (IN3,4,5,6) 具備了 10KΩ 阻抗。

\* 在 OUT 1,2,3,4 ~ OUTCOM 之間輸入工作電壓之極性無限制

各入力點 (OUT1,2,3,4,) 具備了 1KΩ 阻抗。

\*1 The polarity of input voltage for IN1+ (IN2+) is plus (+) to IN1- (IN2-).

As each input (IN1-,IN2-) is equipped with current regulative diode, the input current can be 8~12mA.

\*2 Plus or minus polarity is acceptable for the input voltage between IN3,4,5,6 and INCOM.

Each input (IN3,4,5,6) is equipped with resistor 10KΩ in series.

\*3 Plus or minus polarity is acceptable for the applied voltage between OUT1,2,3,4 and OUTCOM.

Each output (OUT1,2,3,4) is equipped with resistor 1KΩ in series.

# Specifications

規格

## ■ 連接器信號機能一覽表 Signal Arrangements

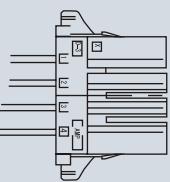
連接器 Connector			
名稱 Name	No. Pin No.	符號 Symbol	機能 Function
電源連接 Power Supply Connector	1	R / L1	三相 / 單相 AC 入力 3 phase AC input / Single phase AC
	2	S	三相 AC 入力 3 phase AC input
	3	T / L2	三相 / 單相 AC 入力 3 phase AC input / Single phase AC
	4	E	電源接地 Protective Earth
通信連接 Communication Connector	Host Connector	1	RS232 收信 HOST RS-232C Receive Data from Host
		2	RS232 送信 HOST RS-232C Transmit Data to Host
		3	通信接地 Communication GND
	Slave Connector	1	RS232 送信 SLAVE RS-232C Transmit Data to Slave
		2	RS232 收信 SLAVE RS-232C Receive Data to Slave
		3	通信接地 Signal GND
I/O 連接 I/O Connector	1	+5V	+5V 出力 (0.2A max) +5V Output (0.2A max)
	2	INPUT1+	數位輸入 1+ Digital Input 1+
	3	INPUT1-	數位輸入 1- Digital Input 1-
	4	INPUT2+	數位輸入 2+ Digital Input 2+
	5	INPUT2-	數位輸入 2- Digital Input 2-
	6	INPUT3	數位輸入 3 Digital Input 3
	7	INPUT4	數位輸入 4 Digital Input 4
	8	INPUT5	數位輸入 5 Digital Input 5
	9	INPUT6	數位輸入 6 Digital Input 6
	10	INPUT COM	數位輸入 3,4,5,6 的共同點 Common for Digital Input 3,4,5,6
	11	OUTPUT1	數位輸入 1 Digital Output 1
	12	OUTPUT2	數位輸入 2 Digital Output 2
	13	OUTPUT3	數位輸入 3 Digital Output 3
	14	OUTPUT4	數位輸入 4 Digital Output 4
	15	OUTPUT COM	數位輸入 3,4,5,6 的共同點 Common for Digital Output 1,2,3,4
	16	ANALOG IN	類比輸入 Analog Input
	17	ANALOG OUT	類比輸出 Analog Output
	18	N.C.	-
	19	GND	信號接地 Signal Ground
	20	GND	信號接地 Signal Ground

## ■ 連接器配置

## Connector Pin Configurations

電源連接器 1-178128-4 (Tyco Electronics AMP)

Power Supply Connector AMP

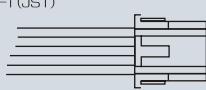


No	色	Wire Color
1	紅	Red
2	白	White
3	黒	Black
4	緑-黄	Green-Yellow

通信連接器

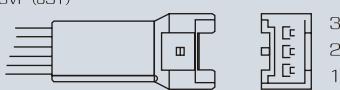
Communication Connector

HOST 連接器 XAP-03V-1 (JST)  
Host Connector



No	色	Wire Color
1	棕	Brown
2	紅	Red
3	橘	Orange

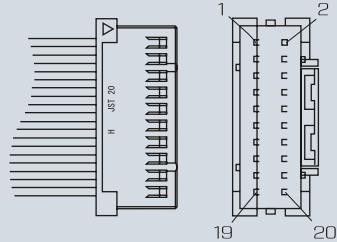
SLAVE 連接器 XARR-03VF (JST)  
Slave Connector



3	藍	Blue
2	綠	Green
1	黃	Yellow

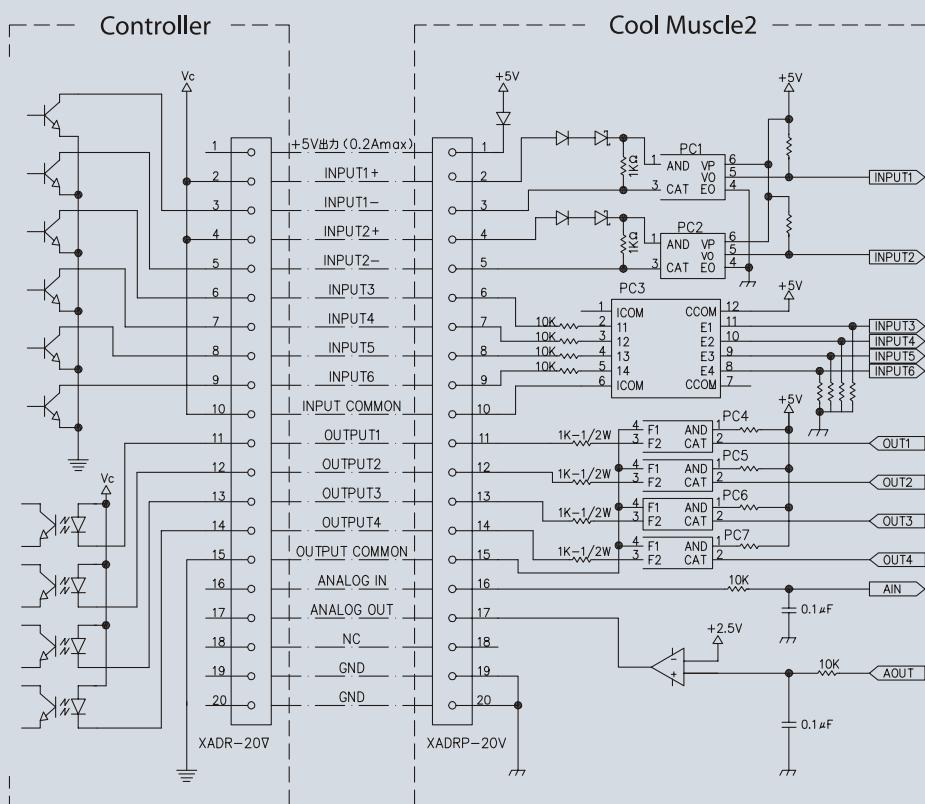
I/O 連接器 XADRP-20V (JST)

I/O Connector



No	色	Wire Color	No	色	Wire Color
1	棕	Brown	11	棕	Brown
2	紅	Red	12	紅	Red
3	橘	Orange	13	橘	Orange
4	黃	Yellow	14	黃	Yellow
5	綠	Green	15	綠	Green
6	藍	Blue	16	藍	Blue
7	紫	Purple	17	紫	Purple
8	灰	Gray	18	灰	Gray
9	白	White	19	白	White
10	黑	Black	20	黑	Black

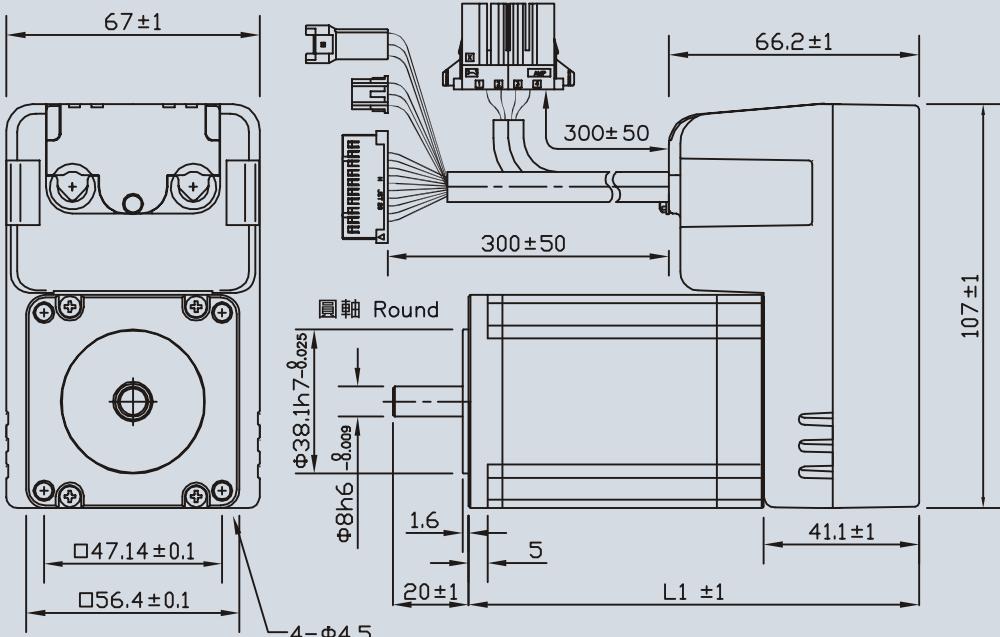
## ■ 接線範例 Connection Example



# Specifications

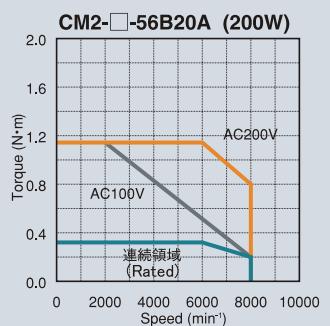
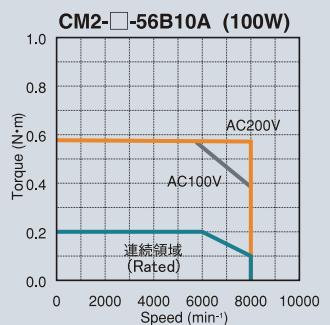
規格

■ CM2-□-56B10A / CM2-□-56B20A 外型尺寸 (單位:mm)  
Dimention (UNIT:mm)

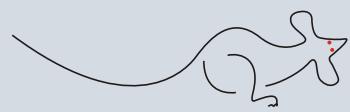
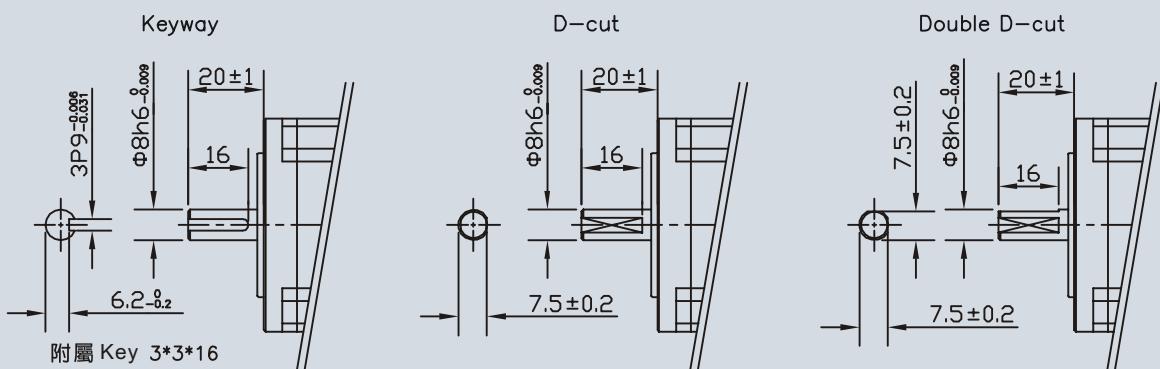


Model Name	L1
CM2-□-56B10A	93.2
CM2-□-56B20A	119.2

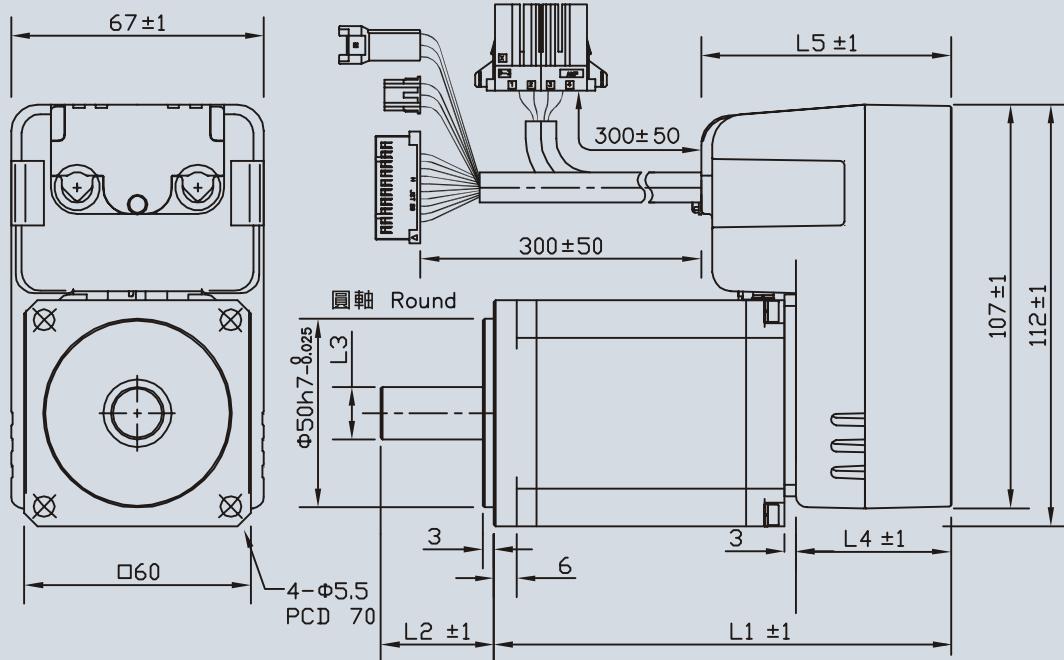
■ 扭力曲線圖 Torque Curve



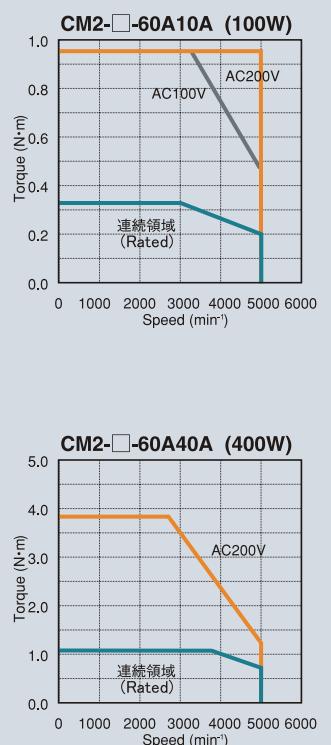
56B10A  
56B20A



■ CM2-□-60A10A / CM2-□-60A40A 外型尺寸 (單位:mm)  
Dimention (UNIT:mm)



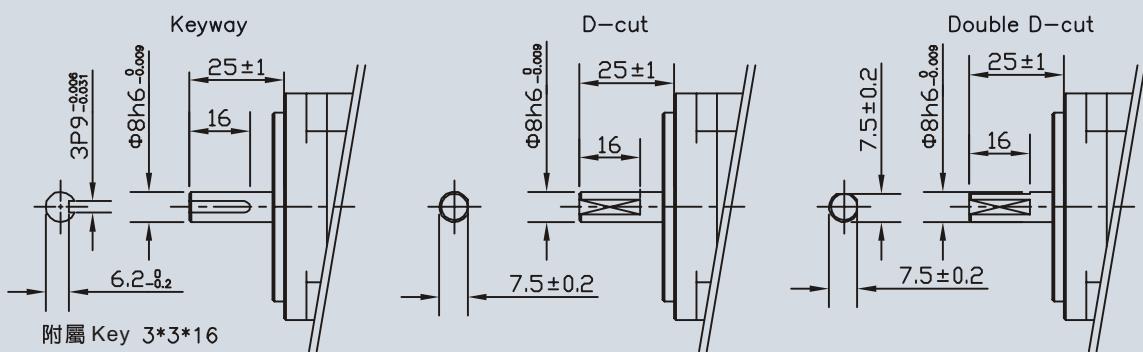
■ 扭力曲線圖 Torque Curve



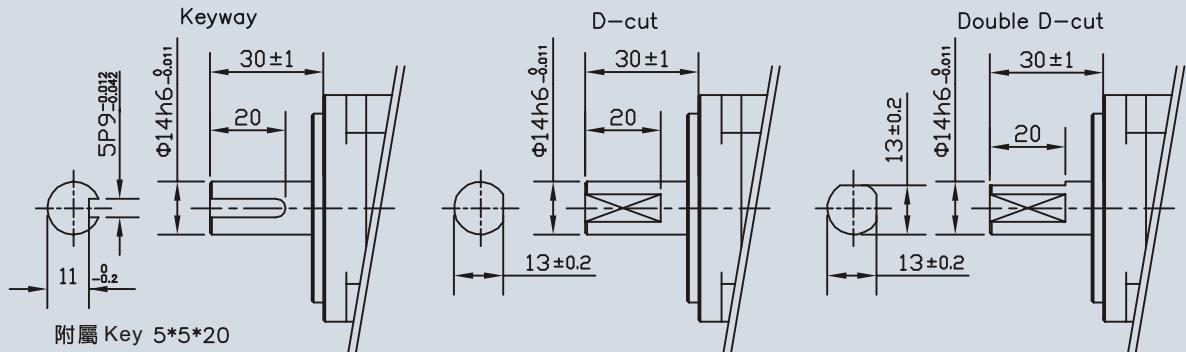
Model Name	L1	L2	L3	L4	L5
CM2-□-60A10A	88.1	25	φ8	41.1	66.2
CM2-□-60A40A	* 141.4	30	φ14	* 61.4	* 86.5

\* 附散熱片 With radiation fin

60A10A



60A40A





# COOL MUSCLE USER GUIDE

## 敬請遵守以下事項：



COOL MUSCLE 嚴禁遭受撞擊

COOL MUSCLE 若遭受撞擊將可能導致馬達後端編碼器 (Encoder) 毀損



COOL MUSCLE 切忌於電源 OFF 狀態下轉動軸心

若在電源 OFF 狀態下轉動軸心 400RPM 以上，馬達將可能因產生回生電力流而造成驅動器基板毀損



請務必使用穩定之直流電源

DC24V 之供給方面請使用穩定之直流電源

若使用穩定度不佳之電源將可能因瞬間電流上升 (SPIKE) 而造成 COOL MUSCLE 產品毀損



請避免於潮濕環境中使用 COOL MUSCLE 產品

由於 COOL MUSCLE 無法完全防水,若於充滿水氣之環境下將可能造成故障原因

若希望於此環境下使用之際請與敝社聯絡



請於型錄記載之可能使用範圍內使用 COOL MUSCLE 產品

請依各 COOL MUSCLE 規格記載之條件範圍內使用及保存該產品



請注意 CABLE 線之長度

請務必確保馬達信號線之長度上限為 3 公尺，電源供給線則以 2 公尺為上限

由於使用超過上述長度者則恐有引發誤動作及故障情形之虞,若有相關需求者請與敝社聯絡



請務必禁止於電源 ON 狀態下直接將接頭插入及拔除

COOL MUSCLE 若於電源開啓之際貿然將接頭插入及拔除 (熱插拔) 則可能造成驅動器毀損欲直接拔除接頭之際，請務必確認於電源完全 OFF 狀態下進行

如有任何疑問請立即與我們聯繫：

新協祥貿易有限公司 <http://www.hhstc.com.tw>

技術諮詢專線：02-8792-9888

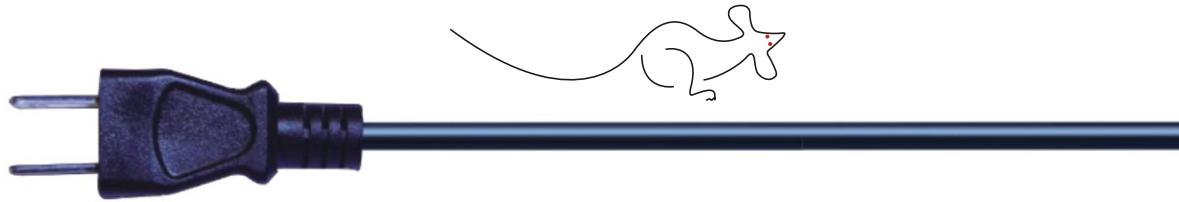


2010年上海万国博覧会 日本産業館 「夢ROBO」に「クールマッスル2」搭載  
"COOL MUSCLE2", used in "YUME ROBO" at 2010 Shanghai Expo - Japan Industry Pavilion



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