



設定流程如下:

1. 先確認光學尺編碼器接腳定義, 各線腳為要連接至 HDT 對應的腳位. Pin7 及 pin8 溫度 sensor 要短路.

PIN	J5 connector description							
1	A + / SIN+	Differential line driver (5V) input for incremental channel A.						
A - / SIN -		Differential input for Resolver channel SIN.						
2	А	Single (5V) Open Collector and Push Pull input for incremental channel A.						
3	B + / COS+	Differential line driver (5V) input for incremental channel B.						
	B - / COS -	Differential input for Resolver channel COS.						
4	В	Single (5V) Open Collector and Push Pull input for incremental channel B.						
5	Z+/CK+/EXC+	Differential line driver (5V) input for channel Z of incremental encoder.						
		Differential line driver (5V) output for CLOCK data for SSI absolute encoder.						
6	Z - / CK - / EXC-	Differential output for reference to Resolver feedbacl.						
	Z	Single (5V) Open Collector and Push Pull input for incremental channel Z.						
7	PTC+	Digital input for motor PTC. If motor is devoid of PTC, ensure to short pin 7 and 8						
8	PTC-							
9	+5E	+5V encoder supply.						
10	GND	Common Ground for encoder supply and signals.						
11	D -	Differential line driver (51/) input for DATA for SSI absolute encoder						
12	(HA) / D +	Differential line driver (5V) input for DATA for 551 absolute encoder.						
12	HA / (D +)	HALL sensor A signal						
13	НВ	HALL sensor B signal						
14	HC	HALL sensor C signal						
15	SHIELD	Foodback and signal cable shield This pip is connecte to drive Derver Forth (DF)						
16	SHIELD	Feedback and signal cable shield. This pin is connecte to drive Power Earth (PE)						



2. 檢查馬達參數設定及編馬器參數設定及 auto-phasing. 相關設定如下:

Menu	Drive Data		
Field Bus	Motor Data		
Feedback	Type Motor	- PM linear motor	•
 Observer Thermistor 	Nominal Speed [mm/s]		2500 ÷
Advanced Setup	Nominal current		2.10 ÷
i⊞ Control Set	Peak Current		10.10
	Stall Current		2.10 +
	Nominal Voltage		220 ÷
	Motor Poles		2
	Phase Resistor		0.20
	Synchrony Inductance		0.02 +
	Magnet Flow [Wb]		0.080
	I2t Time		10 🕂
	Pole pitch		32.000

其中下圖,因為光學尺的精度是 1um,

所以 Resolution/magnet pitch = 32000um, Pulse/magnet pitch = 32000/4 = 8000

Menu	Drive Data	
Field Bus	Feedback	
E B Motor Data	Type Motor 1 - PM linear motor	
Observer	Reverse feedback Off 1000h	
	Selection feedback	
	Feedback type 0 - Incr. Encoder without Halls - J5	
	Cogging compensation Off 1000h	
	Pulses/magnet pitch 8000	
	Resolution/magnet pitch 32000	
	Mode phase search 1 - Standstill axis 💌 1000h	
	Mode encoder phasing At the first start 🚽 1000h	
	Encoder autophasing @Reset 0	
	Encoder input 0 - Line driver/TTL 1000h	

將滑塊移到中間位置, 然後再做 auto-phasing 的動作.

- 2. Master driver J8 的 A+, A-, B+, B-及 GND 分別連接到 Slave driver J4 的 pin 11(CHA+), 12(CHA-), 13(CHB+), 14(CHB-), 及 pin 8 (GND).
- 3. Caliper 連線
- 4. Factor 先設定為 1mm 單位.

線性馬達機構在使用時,必須先針對 Factor, Homing 歸原點及 Jog 做設定後,確認位移,速度及加速度等單位是正確,才可以通電移動機構,必免機構因單位錯誤而爆走,非常重要.

Menu		Drive Data					
Observer /	- II	Unit of measu	е			Application	
Advanced Setup		Position	[02] millimeters	•	mm	Application type	PM Linear Mot
		Velocity	[02] millimeters/s	•	mm/s	Data transmission	
		Acceleration	[02] millimeters/s?	•	mm/s	D Passo polare	32.000 mm
— 獶 Alarm Memory — 粂 Alarm Mode — 洪 Limit		Custom (label)	Label •	Pole p	oitches		
₩ Notch Filter ₩ Iq Filter ∰ Output		Factors	ct. 🗃 🔒 Counts/	rev (Normalized	65536		
Generic data		Polarity	sition	0	ff 0020h		
Control Set		Reverse Sp	eed	0	ff 0000h		
Factors		Pos factor - nur	n		2048 :		F
Position Setting		Pos factor - fee	d		1 🕂		
		Vel enc factor -	num		2048 :		
GearBox Mode		Vel enc factor -	div		1 :		
€ Folde € Eletronic Cam ⊕ 15 Press		Accel factor - nu	ım		2048		

位置單位為 mm 設定流程, 按下 Calculate 後, 最後的 Pos factor 如上所示.

(1) 設定 Homing 的速度和偏移量. 如下所示:

6	a 🖪 🐴 🛤 🕲 🖪 🖼 👘 🙈	(i
4	*♣ [1.3] Jog- ➡; [1.4] Home Pos.	© [I.7]
6	Drive Data	
	Home Position	
	Homing method 33-Index Pulse	CCW -
	Velocity/Acceleration	
	Speed switch search	50 ÷
	Speed zero search	50 📩
	Acceleration	1000
	Mechanic stop data	
	Current max	70.0
	Time	
	Home shift	50 🕂
11		

(2) 設定 Jog 寸動的移動速度,如下所示:

ľ	🗣 [l.3]Jog-	[I.4]Home Pos.	# [1.5]Reset 🔘 [1.6] 🔘 [1.7]
6	Drive Dat	a	
	Jog		
	Velocity		100 -
	Accel.		10000
	Decel.		10000 -

4. 設定 Slave Cam 的 Engagement type = immediate,

Cam Disengagement, Cyclic, Diseng. type = immediate-dec. speed, Deceleration = 10000

am							
🔤 Caliper[TOMCAT EVO] Ver	rsion: 4.22						
<u>File C</u> ommands <u>P</u> rint <u>L</u> ar	nguage <u>A</u> bout						
210g/Tmc Evo - NTT 🔄 🦪 01-[TMC]Slave_Green 🔄 🖷 🖪 💁 🕾 🛤 📽 📾 📾 🕬							
🗏 🔄 🎦 🖉	[I.0]Power 3 [I.1]Enable Ref. 3 [I.2]Jog+	1 13] Jog- 21 [1.4]Home Pos.					
Data Monitor	Menu	Drive Data					
Drive 6,0-12,0 [230 V]	Field Bus	Cam disengagement					
Bus Input/OutPut	🖶 👜 Motor Data						
Mode [4]Electr. Cam	Advanced Setup	Cyclic Acyclic					
Current 0.00 A	E-S Control Set	Diseng. type Immediate - dec. speed -					
Temp. 39.1 °C	Control Setting						
Speed [Mot 0 rpm	E Digital Input	Disengagement dec. speed					
Position (Rev/Offset)[Mot]	- Factors	Deceleration 10000					
0 79 Counts	- Position Setting						
70 Counte							

5. 設定 Master 的 Position Parameters → Position set.==> Mode end position = ending cycle

Calipe	r[TOMCAT EVO]	/ersion: 4.22						
2)Dg/Tm	c Evo - NTT	Image: Second state						
Data M	anitor	Menu	Drive Data	_ ilreinome Pos.	# Irolkeset	[ro] (@ [r.7]		
Drive Bus Mode Current	tive 6.0-12.0 [230 V] us Input/OutPut ode [3]Position urrent -0.06 A - St Advanced Setup urrent -0.06 A		Position Parameters Position Par. Positions Set. Impostazione Quote					
Temp.	43.4 °C	Control Setting	Recovery Posit.			Current Position		
Speed [Mot 0 rpm Position (Rev/Offset)[Mot] 200 0 Counts		B B B Digital Input	Mode end position			Ending cycle	•	
		Position Setting	Target reached					
13107200 Counts P Positio		B P Position	Time target reached [ms]			<u>0</u> ÷		
Input I.0 Powe I.1 Enab	er on le Ref.	Item Position Image: Second	Threshold	d position reached	đ		910 🗄	

6. 線性馬達凸輪時序圖如下,

線性馬達 pole pitch = 32mm, 光學尺解析度 1um, 光學尺編碼器接腳定義如附件 1.



因為 8000 pulse = 32mm, 由凸輪時序凸得知 Master 走 100mm 為一個 cycle, Master module =

8000*(100/32) = 25,000 pulse.

因為 65535 counts = 32mm, 由凸輪時序凸得知 Slave 走 50mm 為最大值, Slave module =

65535*(50/32) = 102,398 counts

5. 由上面說明可知, 設定 Master Module = 25,000; Slave Module = 102,398

Menu	-Drive D	ata						
Field Bus	Eletro	onic Cam						
	Т	Tabella Camme						
E Scontrol Set	Encoder Master							
Control Setting	Frequency Mode Channel A - B 🔹 0000h							
Factors						1 :		
Position Setting	Postactual value 0 Selection index (N2Cam)					,	[N2= 1]	
						ick [Ni Odin]	•,	list: - il
	N?	Cam points	Master module	Slave	e module	Num. cams	Mode cam	
Eletronic Cam		64	2500	0	102398	1	Cyclic	
Sync/Shift	0	64	1000	0	10000	1	Cyclic	
Data engaging	3	64	1000	0	10000	1	Cyclic	
Home Position	4	64	1000	0	10000	1	Cyclic	
Cam Jog	5	64	1000	0	10000	1	Cyclic	
	6	64	1000	0	10000	1	Cyclic	
		64	1000	0	10000	1	Cyclic	
	8	64	1000	0	10000	1	Cyclic	

6. (a) 進入 Electronic CAM 的選項畫面, 輸入 CAM points =100, 表示 Master motor 用 100 個位置表示 100mm, 方便. 可以解釋為 Master 0~100mm 的位置.

(b) 注意: CAM points + Points available = 576; (576 是最大值, 要注意).

(c) 然後, enable function, 在 Index 及 Value 欄位分別輸入 Slave motor 的角度及位移, 注意: O<=Index<=100,可以當作是 Master motor 的 mm; Value 是輸入 0~65535 的數字, 是 Slave motor 的 accounts 數. (0 表示 Slave motor 不動, 65535 表示 Slave 走 50mm, 以此類推)

(d) 要先輸入 Final 的 2 個數值, 接著才輸入 Initial 的 2 個數值.

(e) 分別輸入座標(0,0); (40, 65535); (60, 65535); (99,0)



7. 然後要將CAM的資料upload 到驅動器, 才算設定完成. 在CAM的畫面, 右上角有眼睛符號的ICON. PS: 要將 power on 及 Enable Ref. 都放掉, 才可以 Re-load 新的 CAM data, 右上角有眼睛符號的 ICON 才可以用.

8. 在 Master, Position → Pos. management = Pos-Tab cyclic, 設定如下:

因為總行程為 580mm, 則每 100mm 就執行一次 CAM, 580mm 會執行 5.8 次. 注意.

	<u>e</u> 2							
F	Position							
	Pos. ma	anagement	Pos-Tab cyc	lic	-			
ľ	Pos-Tal	b cyclic						
Maximum Speed 2500 - Selection index								
Pos. actual value 0 Pos number								4
Cyclic Positions								
	Mode		Automatic	<u> </u>	1			
	Cycle		Cyclic	<u>v</u> 0001h	Index		4	
	Table							
	N?	Position	Velocity	Accel.	Decel.	Time	Abso./Rela.	Vel. mode
ľ			100	10000	10000	600	Absolute	Tab-rec data
	2	580	100	5000	10000	600	Absolute	Tab-rec data
	3	0	100	10000) 10000	600	Absolute	Tab-rec data
	4	580	100	5000) 10000	600	Absolute	Tab-rec data
	5	150	500	5000	5000	500	Absolute	Tab-rec data
l								

Position Parameters → Position Set.==> Mode end position = Ending cycle → 表示在中途按下 enable ref. 時, 會跑完此單節才停止. 此為安全考量.

W L	15 -		_	25 吉绅傅坦式委钉的委之几龄庭田33	字 0728 2020 Microsoft Word
🔤 Caliper	S Caliper[TOMCAT EVO] Version: 4.22				
<u>F</u> ile <u>C</u> om	mands <u>P</u> rint <u>L</u> a	nguage <u>A</u> bout			
2)Dg/Tmc	Evo - NTT 💌	01-[TMC]Master_white	é	3 Q 2 B B C B F	5 (1) (1) (1) (1)
🖳 📴 🎇 🔕 💽 [1.0]Power 🕸 [1.1]Enable Ref. 🕸 [1.2]Jo				🕼 [I.3]Jog- 📑 [I.4]Home Pos. 🛛 🖇	7 [1.5]Reset 🛞 [1.6]
Data Mo	nitor	Menu	Г	Drive Data	
Drive	6,0-12,0 [230 V]	Field Bus		Position Paramotoro	
Bus	Input/OutPut	Motor Data		FOSILION Farameters	1
Mode	[3]Position	Advanced Setup		Position Par. Positions Set.	
Current	0.08 A	E Control Set		Impostazione Quote	
Temp.	44.7 °C	Control Setting		Recovery Posit	Current Position
Speed [Mot	60 rpm				
Position (F	Rev/Offset)[Mot]-			Mode end position	Ending cycle
6402	32 Counts	Position Setting		-Target reached	
4	19561504 Counts	D Position		largerreacheu	
Innut				Time target reached [ms]	
				Threshold position reached	010 -
1.0 Power	on C	nr Home Position		The shou position reached	910 .
1.1 Enable	rtei.	Bosition Jog			
1.2 Jog+	e	III III Pos - Input x			

8. 啟動方式: (a) 先設定好 Slave 的 Cam profile, 然後傳送到 driver(Slave), 如上述 step 7., **然後將 Master 移到 0 點的位置(Homing), Slave 也移到 0 點的位置(Homing).** 然後將 Slave power on, Enable ref.; 等待. (b) 在 Master, 將 power on, Enable ref.; 則看到行程 580mm, 每 100mm 執行一次凸輪曲線, 共會執行 5.8 次. 經測試 OK.

其他參考資料如下:

Note:

(1). 在 Electronic Cam→Data Disengaging, Cyclic→Diseng. Type 下→Immediate Position, 其中若設定
 Position = 65536, 則在 Master 在 Power on 的狀況下,當 release Ref., 此時 Master 馬達會以 500rpm
 的速度轉到 65536 度, 就是 182 圈左右, 是設定的問題. 不論是在 Master 或是在 Slave, 都是一樣狀況, 可以分開設定. 設定如下圖所示:

Drive 6,0-12,0 [230 V] Bus Input/OutPut Motor Data Mode [4]Electr. Cam disengagement Cyclic Acyclic Cyclic Acyclic	
Control Set Diseng.type Temp. 28.5 °C Speed [Mot 0 rpm Position (Rev/Offset)[Mot] Factors 11930429 counts Position Setting Input Position Setting Input Position Setting Ise 2 2877 counts Position Setting Position Rev/Offset)[Mot] Position Setting Ise 2 counts Position Setting Ise 2 counts Position Setting Source C Torque Corrous Sync/Shift Sync/Shift	Immediate - position Absolute 00000 65536 500 1000 1000

(2) . The "Master module" indicates **master encoder pulse number** used to calculate shape of cam profile. **The result of the division** of "Master module" and "Number of table points" gives the space range between two consecutive points of the table. The profile of the cam between two points is calculated using a cubic interpolation.

"主模塊"指示用於計算凸輪輪廓形狀的主編碼器脈衝數。"主模塊"和"表點數"的劃分結果給出 了表的兩個連續點之間的間隔範圍。使用三次插值計算兩點之間的凸輪輪廓.

PS: 現在用的 Master motor 馬達編碼器的脈衝數=2500, 並且我們的凸輪軸旋轉一圈 360 度是一個週 期,所以 Master module 輸入 2500, 表示我們凸輪用 2500 個 pulses 數輸入時,用來當 1 圈用. 4. The "Slave module" represent the excursion of the cam measured in terms of resolver pulses (the numbers of resolver pulses in a single revolution of the motor shaft is 65535), Every point of the cam table (that can range from 0 to 65535) is multiply for the "Slave module" and divided for 65536, in this way every point of the cam table can take an effective value ranging from 0 and "Slave module". 這裡的 numbers = accounts

"從動模塊"表示以旋轉變壓器脈衝的形式測量的凸輪的偏移(電動機軸單轉中旋轉變壓器脈衝的數量為 65535),凸輪表的每個點(範圍從 0 到 65535)與"從站模塊"相乘,再除以 65536,這樣凸輪表的每個點都可以取有效值,範圍從 0 到"從站模塊"。

$$\Delta space_{:_{cam.point}} = \frac{MODULE_{MASTER}}{N_{table.point}^{\circ} - 1} \qquad Value_{:_{cam.point}} = \frac{MODULE_{SLAVE} \cdot Value_{:_{table.point}}}{65536}$$

附件 1: 編碼器接腳定義

的科学生的意 20 Bf;粉蓝(2) 一番 : 粉红(3) 臣唐度 2 5V. Fe (1) 柳定美 A-:友鹫((4) B-: 橘藍(15) 2-:桶红(16) Ate 光學尺: [儿m 01, 西生工 (24) LTFIS Coil mass : 0.6 kg 毫限; 3.[고 hate current: 2.1A 電感: [7.] Pak Currant: 10.1A pole pench: 32 mm KE: 40.2 N/A 反電到教: ₩13.4 V/N/S 0.43 V/Hz Speed: 2500 mm/s

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