

SATA

斜齒行星減速機

Helical Planetary Reducer



特性 (Features)

1: 螺旋行星齒輪齧合傳動比同樣大小的正齒輪行星齒輪齧合傳動具有更高的齧合率，而且運轉平穩，噪音低，準確率更高，壽命更長

1: Helical planetary gear meshing transmission has higher meshing ratio than the same size spur planetary gear meshing transmission, and it runs smoothly, with low noise, higher accuracy and longer life.

2: 螺桿行星齒輪傳動是準確的傳動，噪音低和運轉平穩而聞名。與普通正齒輪行星傳動相比，輸出扭矩可提高33%以上，而且齒面接觸負載穩定

2: The screw-shaped planet gear drive is known for its accurate transmission, low noise and smooth operation. Compared with the ordinary spur gear drive, the output torque can be increased by more than 33%, and the tooth surface contact load is stable.

3: 採用筒夾式鎖緊機構，可消除傳動滑動和結合背隙問題

3: The use of a collet-type locking mechanism eliminates the problem of drive slip and backlash

4: 齒輪材質選用高級合金鋼，獨特中空滲碳及熱處理至最佳硬度，兼具表面硬度及心部韌度，並經過齒輪研磨加工，達到最大的精度，高耐磨耗及高耐衝擊韌性

4: The gear material is made of high-grade alloy steel, unique hollow carburizing and heat treatment to the best hardness, with surface hardness and core toughness, and through gear grinding to achieve maximum precision, high wear resistance and high impact toughness.

5: 本體齒輪箱與內環齒一體加工成型，具有高精度，高扭力。

5: The body gear box and the inner ring teeth are integrally formed and formed with high precision and high torque.

6: 獨特馬達連接板和軸承支撐系統，使得全部伺服和步進電機安裝容易，無須零位定製馬達連接板

6: Unique motor connecting plate and bearing support system make all servo and stepper motors easy to turn, no need to customize the motor connecting plate

參數表 Parameter table

規格 Specifications		節數 Number	減速比 Reduction ratio	PR042	PR060	PR090	PR115
額定輸出力矩 T _{2N} Prescribed Output Force Distance	Nm		3	–	40	130	208
			4	19	50	140	290
			5	22	60	160	330
		1	6	20	55	150	310
			7	19	50	140	300
			8	17	45	120	260
			10	14	40	100	230
			15	–	55	130	208
			20	19	50	140	290
			25	22	60	160	330
			30	–	55	150	310
			35	19	50	140	300
		2	40	17	45	120	260
			50	22	60	160	330
			60	20	55	150	310
			70	19	50	140	300
			80	17	45	120	260
			100	14	40	100	230
急停扭矩 T _{2NOT} Emergency stop torque	Nm	1,2	3 ~ 100	三倍額定輸出力矩 3 times the specified output force distance			
額定輸入轉速 n _{1N} Prescribed input speed	rpm	1,2	3 ~ 100	5000	5000	4000	4000
最大輸入轉速 n _{1B} Maximum Input Speed		1,2	3 ~ 100	10000	10000	8000	8000
超精密背隙 P0 Precise backlash	arcmin	1	3 ~ 10	–	≤1	≤1	≤1
		2	15 ~ 100	–	≤3	≤3	≤3
標準背隙 P1 Back standard clearance	arcmin	1	3 ~ 10	≤3	≤3	≤3	≤3
		2	15 ~ 100	≤5	≤5	≤5	≤5
經濟背隙 P2 Economic Gap	arcmin	1	3 ~ 10	≤5	≤5	≤5	≤5
		2	15 ~ 100	≤7	≤7	≤7	≤7
扭轉剛性 Torsional rigidity	Nm/arcmin	1,2	3 ~ 100	3	7	14	25
容許徑向力 F _{2rB} Allowable radial force	N	1,2	3 ~ 100	780	1530	3250	6700
容許軸向力 F _{2aB} Permissible axial force	N	1,2	3 ~ 100	390	765	1625	3350
使用壽命 Service life	hr	1,2	3 ~ 100	20000			
效率 Efficiency	%	1	3 ~ 10	≥97%			
		2	15 ~ 100	≥94%			
重量 Weight	kg	1	3 ~ 10	0.6	1.3	3.7	7.8
		2	15 ~ 100	0.8	1.5	4.1	9
使用溫度 Service temperature	℃	1, 2	3 ~ 100	–10℃ ~ 90℃			
潤滑 lubrication		1,2	合成潤滑油脂 synthetic lubricating oil and grease				
防護等級 Protection grade		1,2	3 ~ 100	IP65			
安裝方向 Installation direction		1,2	3 ~ 100	任意方向 Any direction			
噪音值 (n ₁ =3000rpm, 無負載) Noise value	dB(A)	1,2	3 ~ 100	≤56	≤58	≤60	≤63

規格 Specifications	節數 Number	減速比 Reduction ratio	PR042	PR060	PR090	PR115
轉動慣量 J_1 Moment of inertia	1	3	—	0.16	0.61	3.25
		4	0.03	0.14	0.48	2.74
		5	0.03	0.13	0.47	2.71
		6	—	0.13	0.45	2.65
		7	0.03	0.13	0.45	2.62
		8	0.03	0.13	0.44	2.58
		10	0.03	0.13	0.44	2.57
		15	—	0.03	0.13	0.47
		20	0.03	0.03	0.13	0.47
		25	0.03	0.03	0.13	0.47
	2	30	0.03	0.03	0.13	0.47
		35	0.03	0.03	0.13	0.47
		40	0.03	0.03	0.13	0.47
		50	0.03	0.03	0.13	0.44
		60	0.03	0.03	0.13	0.44
		70	0.03	0.03	0.13	0.44
		80	0.03	0.03	0.13	0.44
		100	0.03	0.03	0.13	0.44

1. 減速比 ($i=N_{in}/N_{out}$) 2. 最大加速力矩 $T_{2B} = 60\%$ of T_{2NOT} 3. 輸出轉數 100rpm, 作用於輸出軸中心位置
 Reduction ratio Maximum acceleration moment Output speed 100rpm, Acting on the center position of output shaft

PR - 042 - 010 - P1 - S1 - M100W

系列
Series

型號
Model

減速比
reduction ratio

P1: P1背隙
P1 Backlash
P2: P2背隙
P2 Backlash

軸型
Axle
S1: 無鍵槽型
No keyway
S2: 帶鍵槽型
With keyway

馬達廠牌及出力

Motor brand and output

H 上銀 Hiwin
X 西門子 Siemens
M 三菱 Mitsubishi
Y 安川 Yaskawa
P 松下 Panasonic
F 富士 Fuji
T 台達 Delta

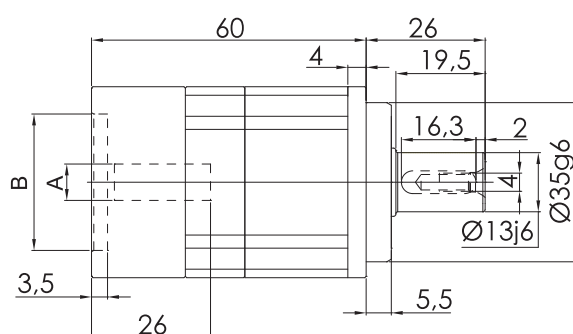
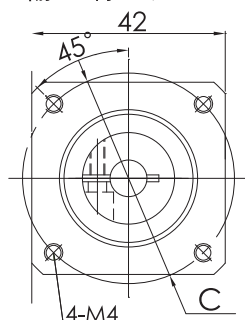
PR減速機參數表 Parameter chart

型號 Model	PR042		PR060		PR090		PR115	
減速比 reduction ratio	L1	L2	L1	L2	L1	L2	L1	L2
	4,5 7,10	12, 20 21,28,35 40,50,70 100	3,4,5,6 7,8,10	12,15,16 20,25,28 30,35,35 40,50,60 70,80,100	3,4,5,6 7,8,10	12,15,16 20,25,28 30,35,35 40,50,60 70,80,100	3,4,5,6 7,8,10	12,15,16 20,25,28 30,35,35 40,50,60 70,80,100
馬達孔徑 Motor axle diameter	A:(4-8)		A:(6-14)		A:(14-19)		A:(16-24)	
輸入端 Input	A,B,C-根據電機制定 A,B,C-according to the motor							
額定輸入轉速 Rated speed	5000rpm		5000rpm		4000rpm		4000rpm	
扭矩剛性 torque	3Nm/arcmin		7Nm/arcmin		14Nm/arcmin		25Nm/arcmin	
容許軸向力 axial forc	390N		765N		1625N		3350N	
容許徑向力 radial force	770N		1530N		3250N		6700N	
精密背隙 Precision backlash arcmin	—	—	≤3	≤5	≤3	≤5	≤3	≤5
標準背隙 Standard backlash arcmin	≤5	≤8	≤5	≤8	≤5	≤8	≤5	≤8
使用壽命 Lifespan	100000hr							
效率 efficiency	> 97%	> 94%	> 97%	> 94%	> 97%	> 94%	> 97%	> 94%
重量 weight	0.6kg	0.8kg	1.3kg	1.5kg	3.7kg	5.3kg	7.8kg	9kg
使用溫度 temperature	-10℃-80℃							
防護等級 Protection	IP65							
潤滑油 Lubricating oil	合成潤滑油脂 synthetic lubricating oil and grease							
噪音值 Noise	< 58		< 58		< 60		< 63	

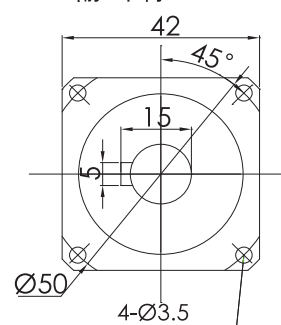
註:上述數據相應規格, 主要為使用各型號5比減速機所測數據。最大徑向力及最大軸向力, 施力於出軸重心位置, 週期負載時間50%, 輸出轉速100rpm, 條件所測得數據。運轉負載週期 < 60%狀況下, 平均使用壽如列表數據值: > 60%運轉下, 平均壽命可能會降至正常的50%以下。噪音值: 距離50cm,空載運轉, 額定轉速, 條件下所測得數據。

PR042-L1

輸入端 (Input)

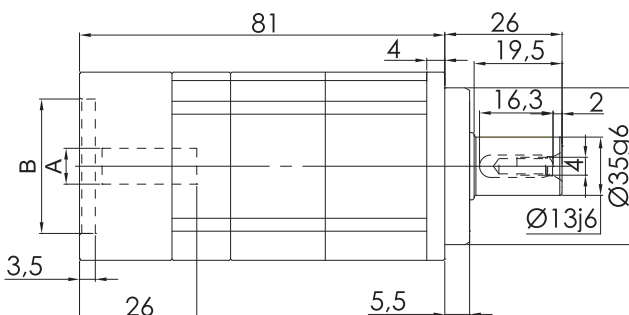
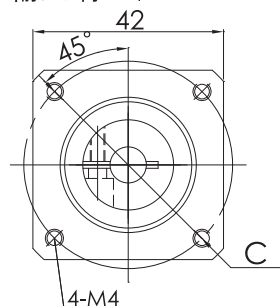


輸出端 (OUTPUT)

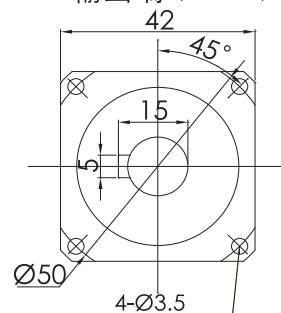


PR042-L2

輸入端 (Input)

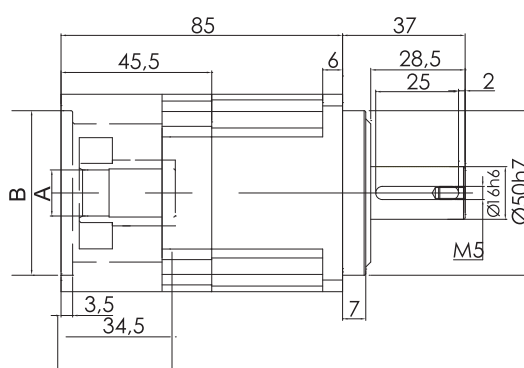
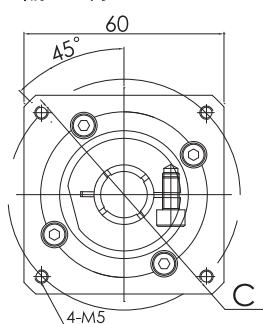


輸出端 (OUTPUT)

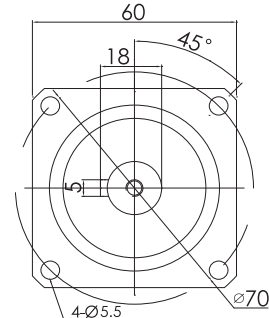


PR060-L1

輸入端 (Input)

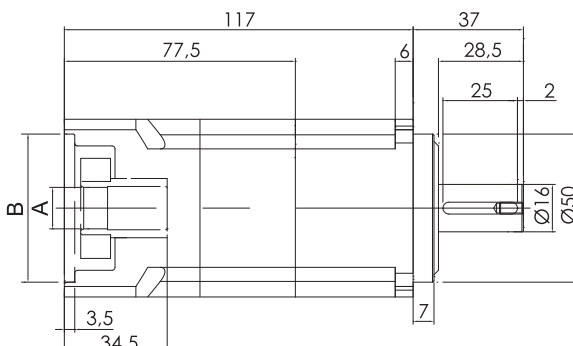
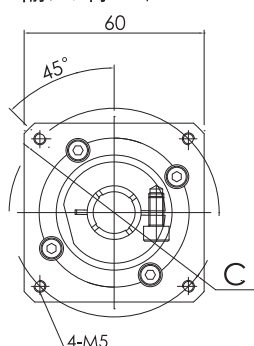


輸出端 (OUTPUT)

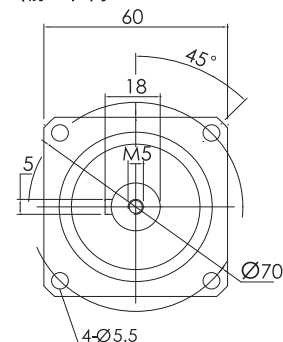


PR060-L2

輸入端 (Input)



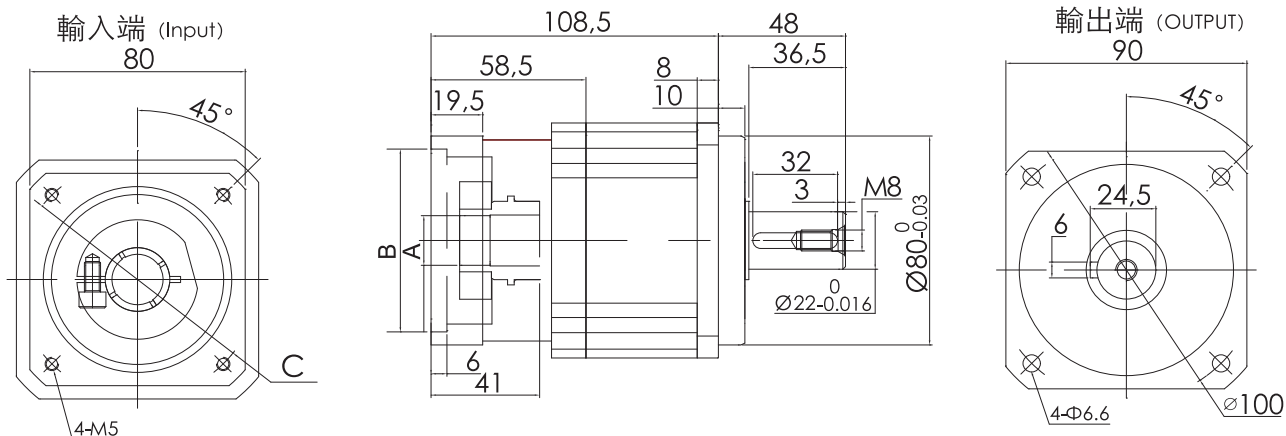
輸出端 (OUTPUT)



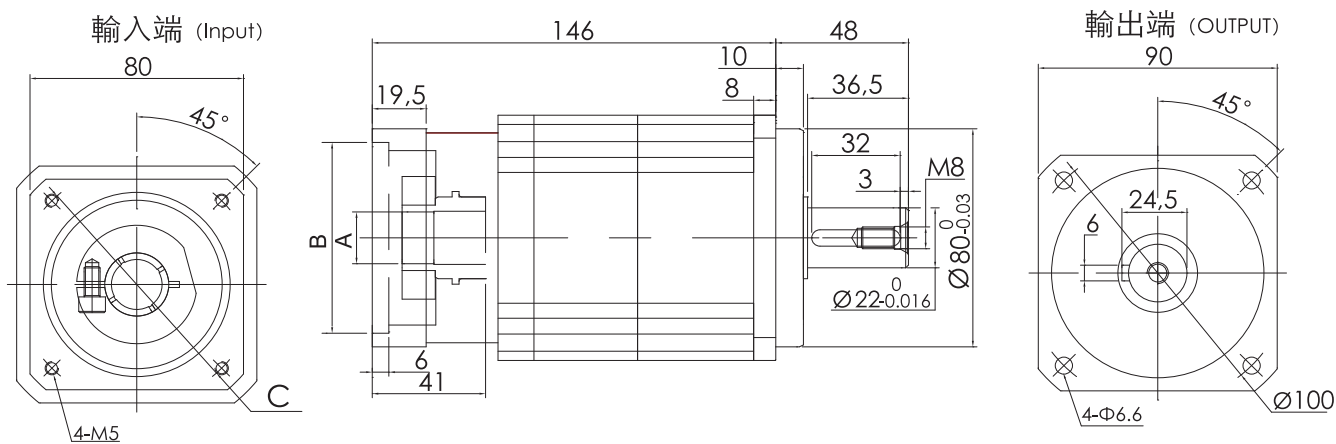
A,B,C-根據電機制定

A,B,C-according to the motor

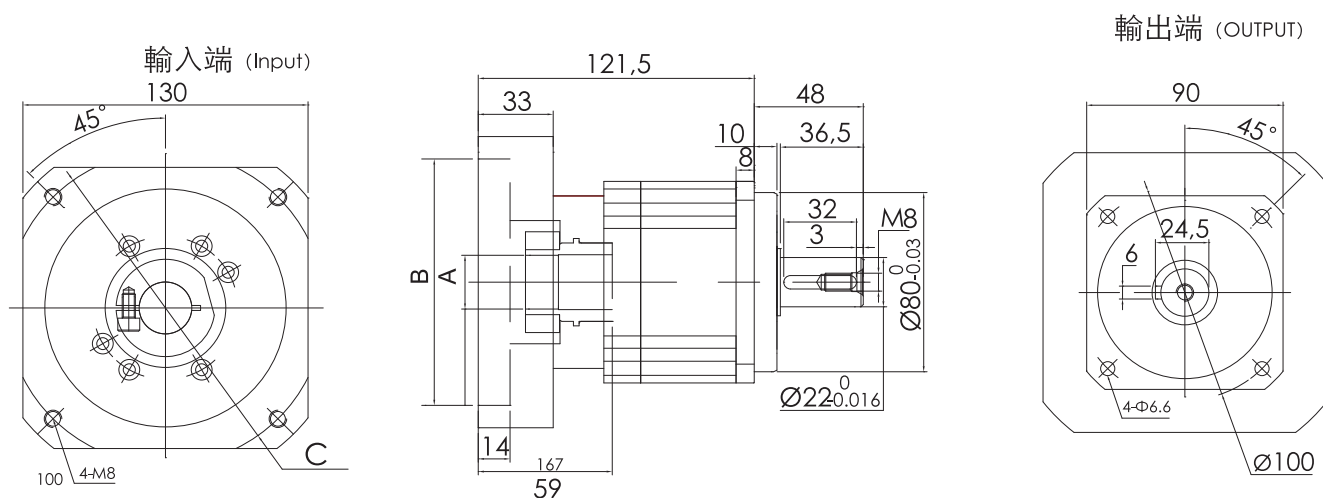
PR090-L1



PR090-L2



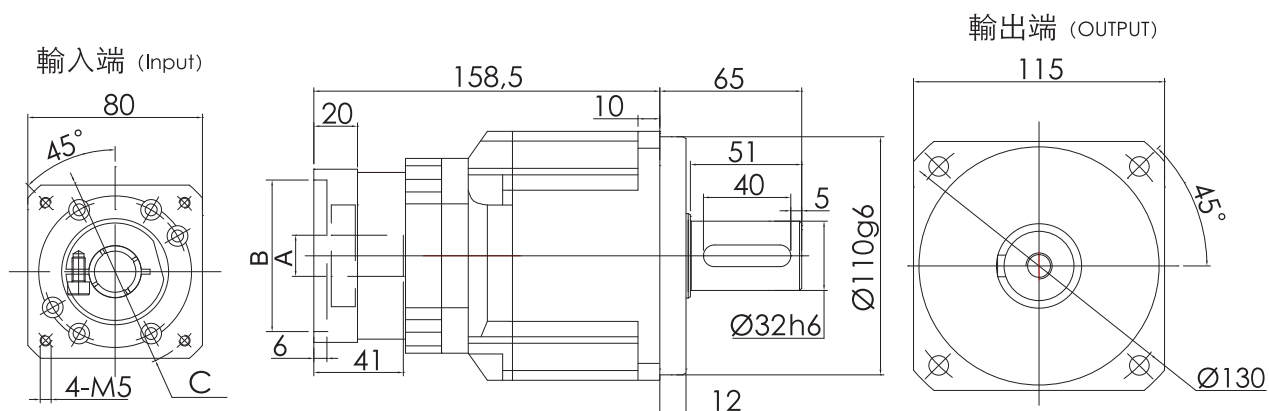
PR090-1KW



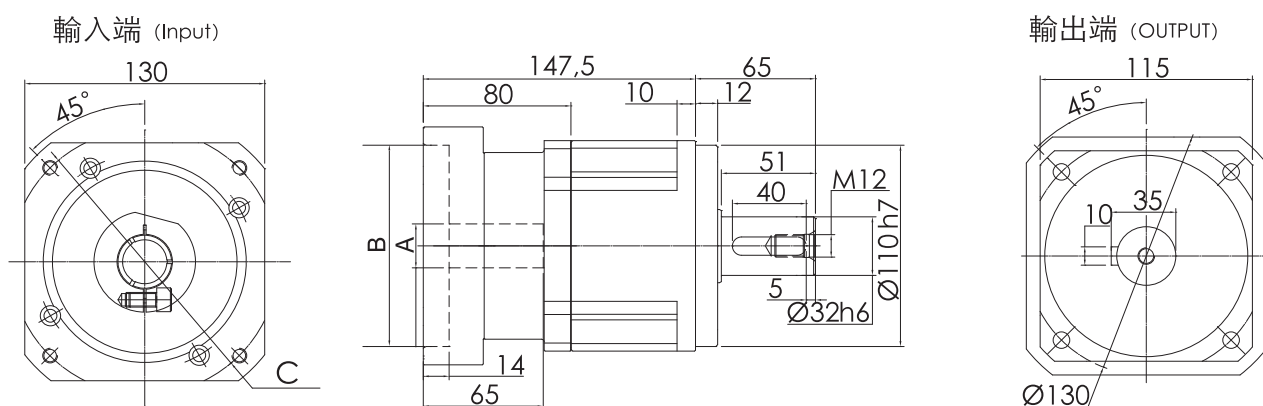
A,B,C-根據電機制定

A,B,C-according to the motor

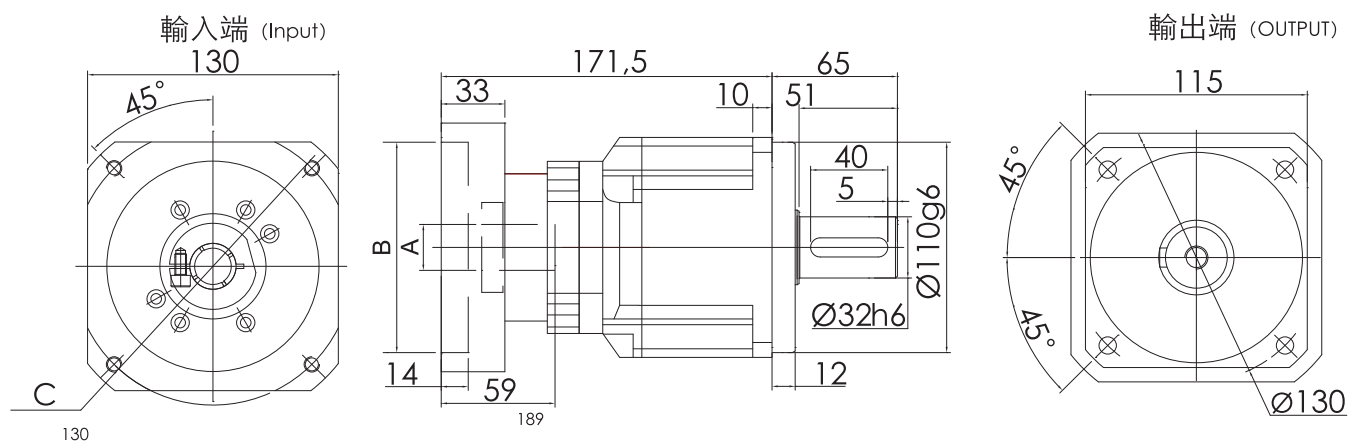
PR115-L1



PR115-L2



PR115-750W



A,B,C-根據電機制定

A,B,C-according to the motor

S5 周期運轉之建議事項

一般的應用慣量須符合以下公式：
S5 Suggestions for periodic operation
The general application inertia shall conform to the following formula

$$\frac{J_L}{i^2} \leq 4 \times J_m$$

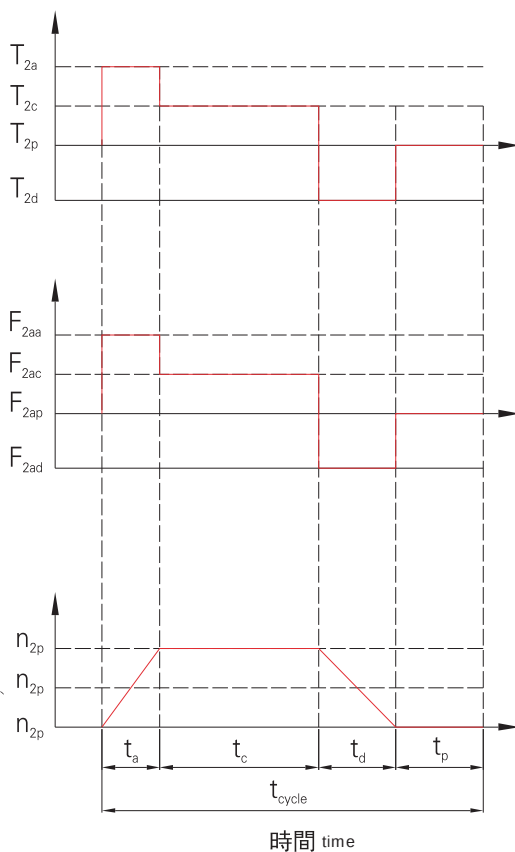
J_L : 負載慣量
load inertia

J_m : 馬達慣量
Motor inertia

最適當的應用慣量須符合以下公式：
The most appropriate application inertia shall comply with the following formula

$$\frac{J_L}{i^2} \approx J_m$$

● 輸出軸扭矩
Output shaft torque



● 輸出軸力
Force on output shaft

● 輸出轉速
Output speed

1

$$ED = \frac{t_a + t_c + t_d}{t_{cycle}} \times 100\%, \quad t_{work} = t_a + t_c + t_d$$

下標說明：

a. 加速, c. 等速, d. 減速, p. 停止 (Eq.1)

Description:

a. acceleration, c. constant speed, d. deceleration, p. stop

2

$$i \approx \frac{n_m}{n_{work}}$$

n_m : 馬達輸出速度
Motor output speed
 n_{work} : 實際應用速度
Actual application speed (Eq.2)

3

$$T_{2m} = 3 \sqrt{\frac{n_{2a} \times t_a \times T_{2a}^3 + n_{2c} \times t_c \times T_{2c}^3 + n_{2d} \times t_d \times T_{2d}^3}{n_{2a} \times t_a + n_{2c} \times t_c + n_{2d} \times t_d}} \quad (\text{Eq.3})$$

4

$$T_{2max} = T_{mb} \times i \times k_s \times \eta$$

K_s	K_s	周期次數/小時
K_s 負載 系 數	1.0	0~1000
	1.1	1000~1500
	1.3	1500~2000
	1.6	2000~3000
	1.8	3000~5000

T_{mb} 馬達最大輸出扭矩
Maximum output torque of motor (Eq.4)

η 減速機運轉效率

Reducer operating efficiency

5

$$n_{2a} = n_{2d} = \frac{1}{2} \times n_{2c}$$

$$n_{2m} = \frac{n_{2a} \times t_a + n_{2c} \times t_c + n_{2d} \times t_d}{t_a + t_c + t_d}$$

$$n_{2N} = \frac{n_{1N}}{i} \quad (\text{Eq.5})$$

6

$$F_{2m} = 3 \sqrt{\frac{n_{2a} \times t_a \times F_{2a}^3 + n_{2c} \times t_c \times F_{2c}^3 + n_{2d} \times t_d \times F_{2d}^3}{n_{2a} \times t_a + n_{2c} \times t_c + n_{2d} \times t_d}}$$

$$F_{2am} = 3 \sqrt{\frac{n_{2a} \times t_a \times F_{2aa}^3 + n_{2c} \times t_c \times F_{2ac}^3 + n_{2d} \times t_d \times F_{2ad}^3}{n_{2a} \times t_a + n_{2c} \times t_c + n_{2d} \times t_d}} \quad (\text{Eq.6})$$

開機前的注意事項

Matters that need attention before shutting down

- 出廠時已按規定量加入潤滑油，因此到貨後可直接使用。
- 首次運轉時，請先確認輸出軸的轉向，然後逐漸增加負荷。
- The specified amount of lubricant has been added before delivery, so the machine can be used directly when arrived.
- Confirm the rolling direction of the output shaft and increase the load gradually the first time operating.

動轉中的注意事項

Matters that need attention during operating

- 請注意不得過載。
- 輸出軸的轉速不得大於規定轉速。
- 出現以下情況時，請停機檢查。
 - 1、溫度突然開始升高
 - 2、突然發出很大異響
 - 3、轉速突然開始不穩定。
- 可能的原因如下，請及時處理。
 - 1、是否處於過載狀態？
 - 2、軸承、齒輪、傳動面有無損傷？
 - 3、機器連接條件有無異常？
- Do not overloaded.
- The rolling speed of the output shaft should not be faster than the specified one.
- Please shut the machine down when following situation shows.
 - 1、The temperature rise suddenly.
 - 2、Strange noise are emerged.
 - 3、The rolling speed becomes unstable.
- The possible reasons are as follows, and please make sure to deal with it in time.
 - 1、Whether it is overloaded or not?
 - 2、Are the axletrees, gear wheels and the rolling side damaged?
 - 3、Is the connecting condition abnormal?

潤滑油管理

The lubricant managing

- 油脂不能更換
- The grease can not be replaced.

每日檢查

Daily check

- 運轉中減速機外殼溫度有無異常上升？(最高不大於90℃)
- 軸承、齒輪等部位有無異響？
- 減速機有無異常振動？(出現此類異常時，請立即停機並聯系我公司。)
- 有無潤滑油漏油？(出現油脂泄漏時，請聯系我公司。)
- Whether the temperature of the reducer shell rises abnormally?(Maximum 90 degree)
- Are there any abnormal conditions on axletrees or chain wheels?
- Is the reducer vibrating abnormally? (If it happens, please shut down the machine and contact our company.)
- Is the lubricant leaking? (If it happens, please contact our company.)

定期檢查

Regular check

- 有無過載狀態，有無異常旋轉？
- 皮帶輪、鏈輪、減速機安裝螺栓等有無鬆動？
- 主要部件的檢查與維護。(出現異常現象時，請立即停機並聯系我公司。)
- Whether it is overloaded or rolling abnormally?
- Is the belt pulley、chain wheel、the installation bolt of the reducer loose?
- The check and maintenance of main components. (When there is an abnormal phenomenon, please shut down the machine and contact our company.)