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All for dreams

Smart-FLEXWAVE

内置多传感器

Built-in Multi Sensor

WP 系列

WP series

尼得科传动技术(浙江)有限公司

NIDEC DRIVE TECHNOLOGY (ZHEJIANG) CORPORATION

内置多传感器减速机 Built-in Multi Sensor Gearbox

Smart-FLEXWAVE

内置多传感器减速机可助力客户的制造与自动化能力实现最大化。
该系列为客户最严苛的应用场景提供简洁的适配方案，通过紧凑轻便的设计实现空间节省。

Built-in Multi Sensor Gearbox assists in maximizing your manufacturing and automation capabilities.
It delivers a streamlined addition to your most demanding applications, saving space with its compact and lightweight design.

01 扭矩传感器 TORQUE SENSOR

通过精确测量减速机输出扭矩优化系统性能。
The system's performance is optimized by accurately measuring the output torque from the gearbox.

02 温度传感器 TEMPERATURE SENSOR

通过持续监测减速机温度提升系统稳定性。
The system's stability is improved by continuously monitoring the gearbox temperature.

03 角度传感器 ANGLE SENSOR

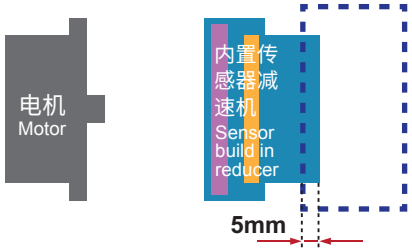
扭矩传感器通过角度补偿实现高精度扭矩测量。
The torque sensor achieves high-accuracy torque measurement by angle compensation.

内置多传感器 Built-in Multi Sensor

VS

外部传感器 External Sensor

Smart-FLEXWAVE

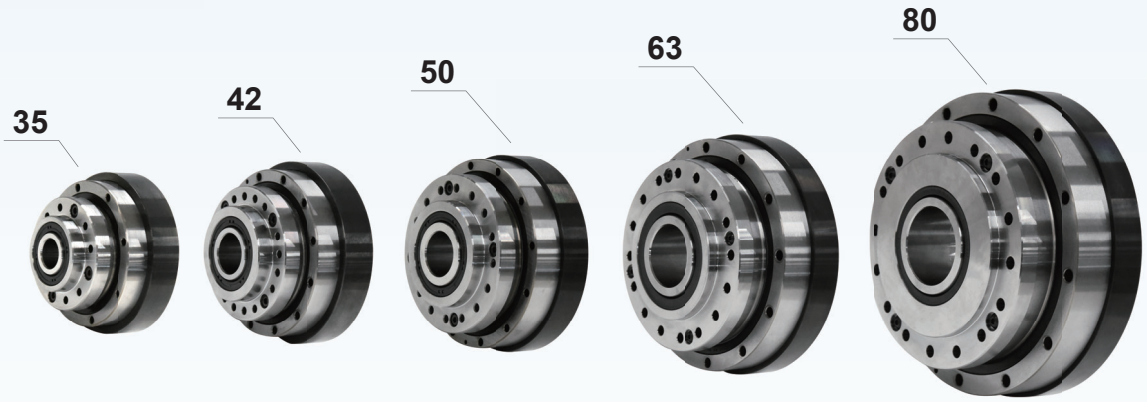


1. 轻量化 Light weight
2. 节省空间 Space saving
3. 成本效益 Cost-effective
4. 高刚性 High rigidity

传统减速机 Conventional Gearbox

1. 大重量 Heavy weight
2. 体积大 Large size
3. 成本高昂 Expensive
4. 低刚性 Low rigidity

尺寸 Sizes



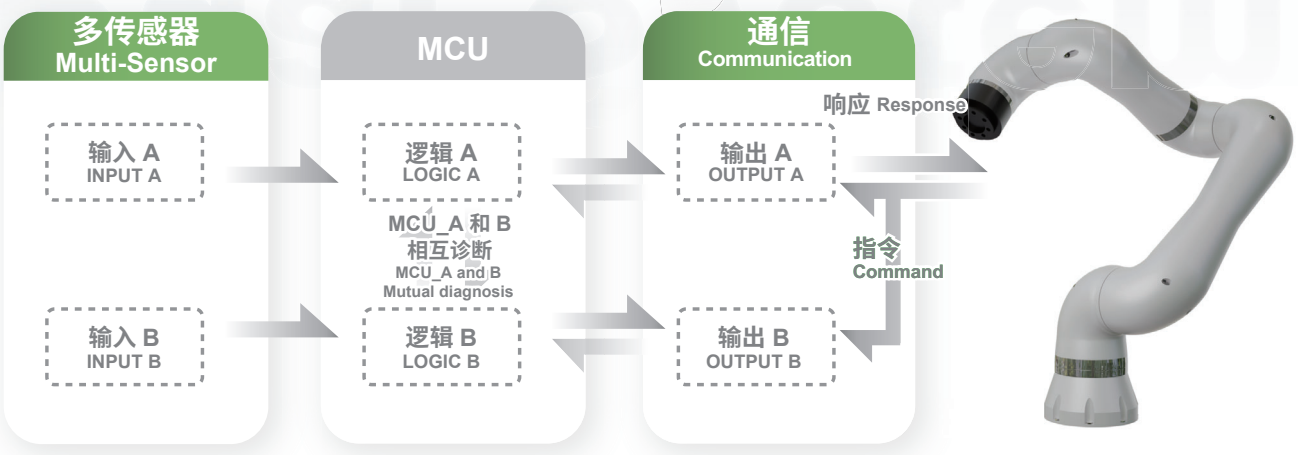
双系统 + 协作机器人
Dual system + Collaborative robots

WP 系列
WP Series

适用于协作机器人的双通道多传感器系统，为操作人员提供高水平的安全保障。多点连接功能支持通过简化布线实现最多 8 轴连接。

The dual-channel multi-sensor system for collaborative robots ensures high level safety for operator. The multi-drop connection allows for the connection of up to 8 axes with simplified wiring.

Dual System



安全设计 Designed for Safety
值得信赖 Built for Trust

Smart-FLEXWAVE BD 型号作为安全扭矩传感器，符合工业设备功能安全标准，并已获得认证机构 TÜV SÜD 的安全认证。

Smart-FLEXWAVE BD model complies with the functional safety standards for industrial equipment as a safety torque sensor and has obtained safety certification from the certification body, TÜV SÜD.

适用标准：
Applicable Standards:
EN ISO 13849-1:2023
IEC 61508: 2010
EN IEC 62061: 2021

注：如将本产品集成至整机系统，则不保证满足功能安全标准的基本要求。

Note: The integration of this product into the overall machine system does not guarantee that the essential requirements of the functional safety standards will be met.

型号 Model Nomenclature

WP	U	—	35	—	50	-	SRH	-	BD
系列名称 Series name	类型 type		尺寸 Size		减速比 Ratio		轴代码 Shaft code		传感器代码 Sensor code
WP 系列 WP Series	组合型 Unit type • 中空轴型 • 输入轴型 • Hollow shaft unit • Input shaft unit		35 42 50 63 80		50 80 100 120 160		SRH SRJ		BD

●段位表 Availability

Frame size \ Ratio 减速比 / 尺寸	50	80	100	120	160
35	■	■	■		
42	■	■	■	■	
50	■	■	■	■	■
63	■	■	■	■	■
80	■	■	■	■	■

减速机规格 Gearbox Specification

尺寸 Size	减速比 Ratio	＊1 容许平均力矩 Nominal output torque [Nm]	＊2 容许最大力矩 Maximum output torque [Nm]	＊3 紧急最大力矩 Emergency stop torque [Nm]	＊4 容许平均输入转速 Nominal input speed [r/min]	＊5 容许最高输入转速 Maximum input speed [r/min]	＊6 寿命时间 Life [hours]
35	50	7	23	46	3000	8500	7692
	80	10	30	61			
	100	10	36	70			
42	50	21	44	91	3000	7300	
	80	29	56	113			
	100	31	70	143			
	120	31	70	112			
50	50	33	73	127	3000	6500	
	80	44	96	165			
	100	52	107	191			
	120	52	113	191			
	160	52	120	191			
63	50	51	127	242	3000	5600	
	80	82	178	332			
	100	87	204	369			
	120	87	217	365			
	160	87	229	408			
80	50	99	281	497	3000	4800	
	80	153	395	738			
	100	178	433	841			
	120	178	459	892			
	160	178	484	892			

＊1　输入转速为2000r/min 时的容许最大值
＊2　启动、停止时的容许最大值
＊3　发生撞击时的容许最大值
＊4　运转过程中，平均输入转速的容许最大值
＊5　运转过程中，输入转速的容许最大值
＊6　输入转速2000r/min，容许额定力矩负荷时的寿命时间

＊1　The maximum allowable value at the input rotation speed of 2000r/min.
＊2　The maximum torque when starting and stopping.
＊3　The maximum torque when it receives shock.
＊4　The maximum average input speed.
＊5　The maximum input speed.
＊6　The life time at the input rotation speed of 2000 r/min and nominal output torque.

传感器规格 Sensor Specification

传感器类型 Sensor type	项目 Item	规格 Specification	备注 Remarks
扭矩传感器 Torque sensor	额定扭矩 Rated torque	与减速机最大扭矩一致 The same as that of the maximum torque of the gearbox	
	限定扭矩 Limited torque	与减速机急停扭矩一致 The same as the emergency stop torque of the gearbox	
	耐久性 Durability	与减速机一致 The same as that of the gearbox	
	非线性度 Non-linearity	±3%FS 以下 ±3%FS or less	测量范围至额定扭矩 Range to rated torque
	滞后性 Hysteresis	3%FS 以下 3%FS or less	测量范围至额定扭矩 Range to rated torque
	横轴灵敏度 Cross-axis sensitivity	±1%FS 以下 ±1%FS or less	测量范围至减速机力矩 Range to moment of gearbox
	测量范围（满量程） Measurement range(Full scale)	由减速机规格决定 Determined by the size of the gearbox	见附表 See attached table
	分辨率 Resolution	-2000d 至 +2000d -2000d to +2000d	LSB：见附表 LSB：See attached table
	合规标准（功能安全） Compliance standards (Functional safety)	PLd, 类别 3 /EN ISO13849-1: 2023 SIL2 /IEC 61508: 2010 最高 SIL2 /EN IEC 62061:2021 PLd, Category 3 /EN ISO13849-1: 2023 SIL2 /IEC 61508: 2010 maximum SIL2 /EN IEC 62061:2021	
温度传感器 Temperature sensor	精度 Accuracy	±5℃	
	测量范围 Measurement range	0℃ 至 80℃ 0℃ to 80℃	
	分辨率 Resolution	0 至 800d 0 to 800d	LSB: 0.1℃
常规 General	电源电压 Power supply voltage	24V DC+10%/15%	
	消耗电流 Consumption current	0.06A 以下 0.06A or less	
	通信方式 Communication method	二线制 RS-485 2-wire RS-485	
	波特率 Baud rate	3.0Mbps	
	工作温度范围 Operating temperature limit	0℃ 至 80℃ 0℃ to 80℃	

传感器测量范围 Sensor Measurement Range

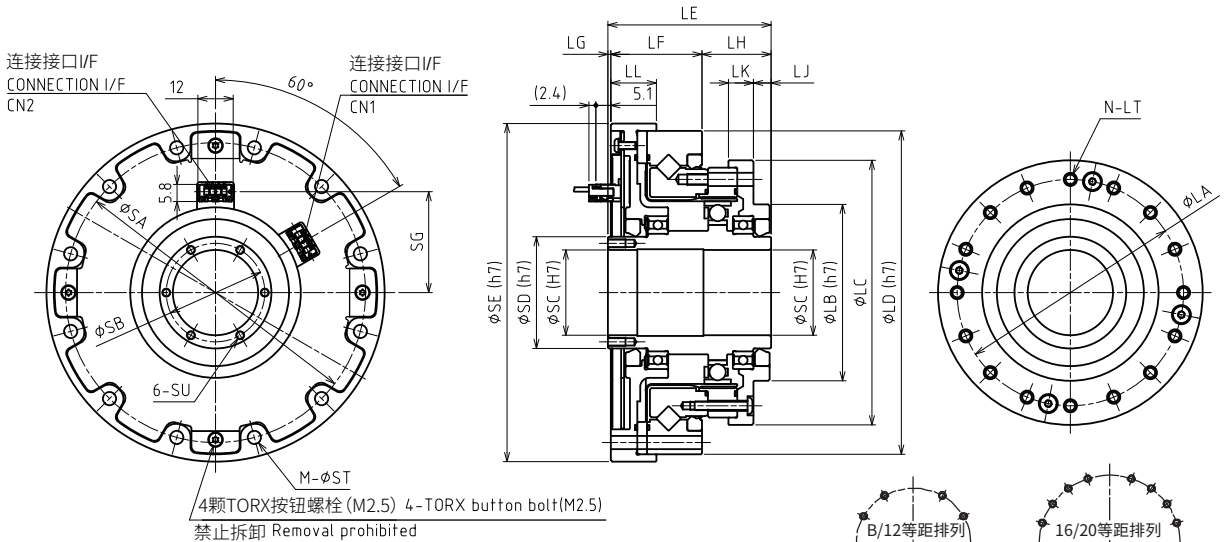
尺寸 Size	减速比 Ratio	额定扭矩 Rated torque ＊1 [Nm]	满量程 Full Scale [Nm]	LSB ＊2 [Nm]
35	50	23	± 50	0.025
	80	30		
	100	36		
42	50	44	± 100	0.05
	80	56		
	100	70		
	120	70		
50	50	73	± 150	0.075
	80	96		
	100	107		
	120	113		
	160	120		
63	50	127	± 300	0.15
	80	178		
	100	204		
	120	217		
	160	229		
80	50	281	± 600	0.3
	80	395		
	100	433		
	120	459		
	160	484		

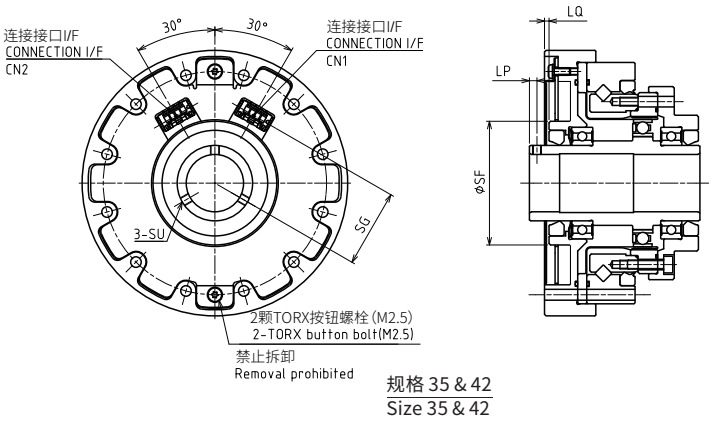
＊1 “+” 号表示顺时针（CW）扭矩。
＊2 LSB 是 “最低有效位” 的缩写。

＊1 “+” sign indicates clockwise (CW) torque.
＊2 LSB is an abbreviation for Least Significant Bit.

SRH 中空轴型 Hollow Shaft Unit

WPU-□-□-SRH-BD





规格 35 & 42
Size 35 & 42

尺寸 Size	重量 Weight	惯性惯量 Moment of inertia
	kg	$\times 10^{-4} kgm^2$
35	0.78	0.0924
42	1.05	0.207
50	1.4	0.408
63	2.1	1.06
80	4.2	2.72

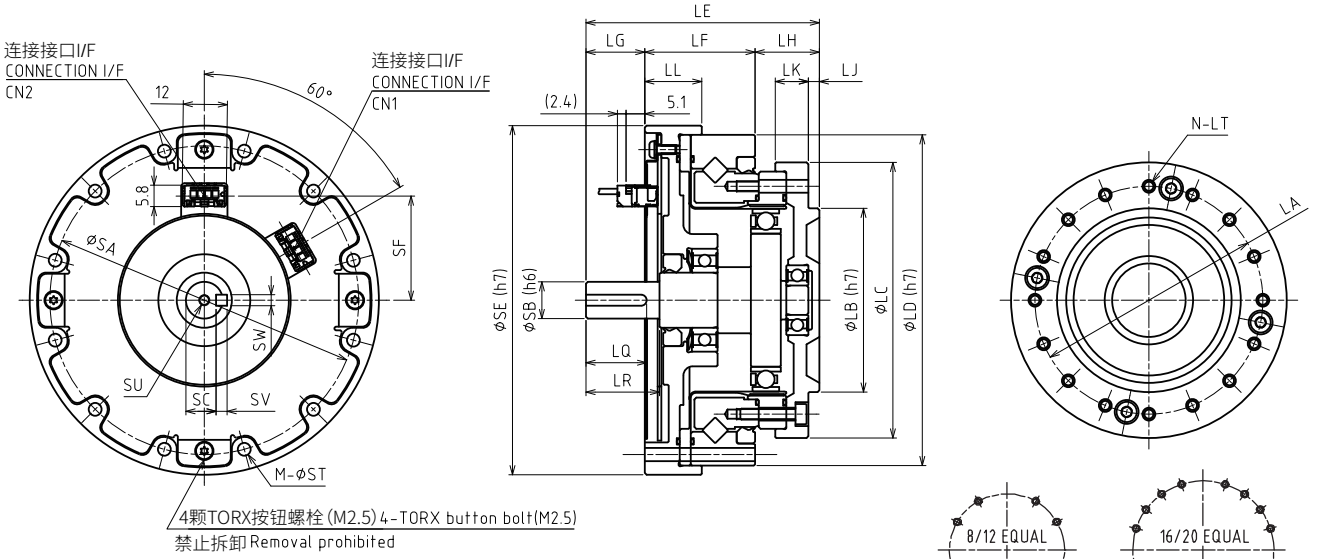
[mm]

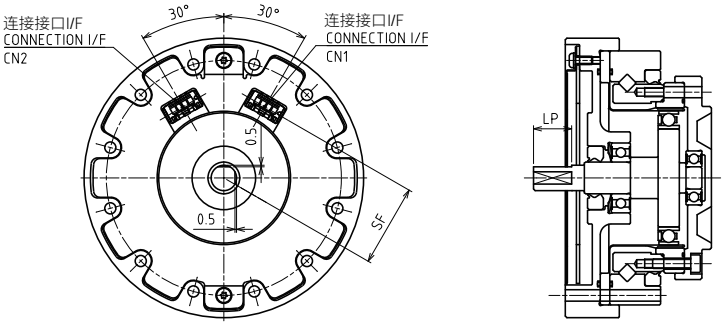
尺寸 Size	LA	LB	LC	LD	LE	LF	LG	LH	LJ	LK	LL	LP	LQ
35	44	36	54	70	52.5	27.5	5	20	7.5	8	16	2.5	1.5
42	54	45	64	80	56.5	30	5	21.5	8.5	8.5	17	2.5	1.5
50	62	50	75	90	51.5	30	0	21.5	7	9	15.5	-	-
63	77	60	90	110	55.5	31	1	23.5	6	8.5	15.5	-	-
80	100	85	115	142	65.5	37	2	26.5	5	9.5	17	-	-

尺寸 Size	SA	SB	SC	SD	SE	SF	SG	M	ST	SU	N	LT
35	64	-	14	20	78	36	21.6	8	3.5	M3	8	M3 × 5, ϕ 3.5 × 11.5
42	74	-	19	25	88	41	25.8	12	3.5	M3	16	M3 × 6, ϕ 3.5 × 12
50	84	25.5	21	30	95	-	28.3	12	3.5	M3 × 6	16	M3 × 6, ϕ 3.5 × 13.5
63	102	33.5	29	38	115	-	34.3	12	4.5	M3 × 6	16	M4 × 7, ϕ 4.5 × 15.5
80	132	40.5	36	45	147	-	42.9	12	5.5	M3 × 6	16	M5 × 8, ϕ 5.5 × 20.5

SRJ 输入轴型 Input Shaft Unit

WPU- □ - □ -SRJ-BD





规格 35 & 42
Size 35 & 42

尺寸 Size	重量 Weight	惯性惯量 Moment of inertia
	kg	$\times 10^{-4}$kgm^2
35	0.71	0.0266
42	0.96	0.0666
50	1.4	0.155
63	2.1	0.382
80	4.1	1.28

[mm]

尺寸 Size	LA	LB	LC	LD	LE	LF	LG	LH	LJ	LK	LL	LP	LQ	LR
35	44	36	54	70	50.5	27.5	8	15	2.5	8	16	11	-	-
42	54	45	64	80	56	30	10	16	3	8.5	17	12	-	-
50	62	50	75	90	63.5	30	16	17.5	3	9	15.5	-	16.5	20
63	77	60	90	110	72.5	31	21	20.5	3	8.5	15.5	-	22.5	25
80	100	85	115	142	84.5	37	21	26.5	5	9.5	17	-	22.5	25

尺寸 Size	SA	SB	SC	SE	SF	SV	SW	M	ST	SU	N	LT
35	64	6	-	78	21.6	-	-	8	3.5	-	8	M3 × 5, ϕ3.5 × 11.5
42	74	8	-	88	25.8	-	-	12	3.5	-	16	M3 × 6, ϕ3.5 × 12
50	84	10	8.2	95	28.3	3	3	12	3.5	M3× 6	16	M3 × 6, ϕ3.5 × 13.5
63	102	14	11	115	34.3	5	5	12	4.5	M5× 10	16	M4 × 7, ϕ4.5 × 15.5
80	132	14	11	147	42.9	5	5	12	5.5	M5× 10	16	M5 × 8, ϕ5.5 × 20.5

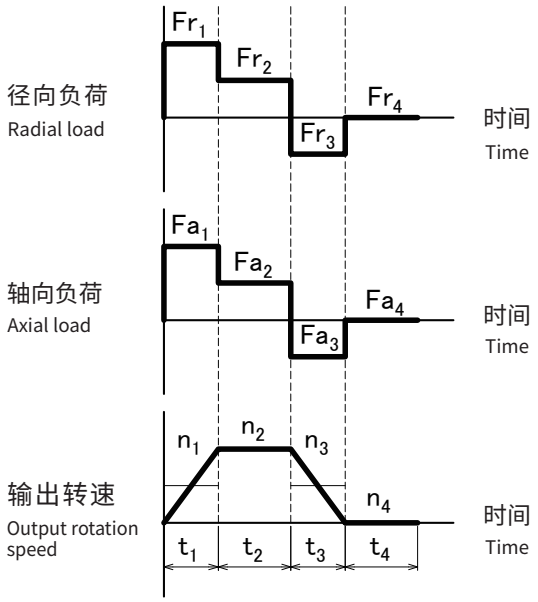
寿命计算 Lifespan Estimation

主轴承规格(交叉滚子轴承) Main bearing specification (Cross roller bearing)

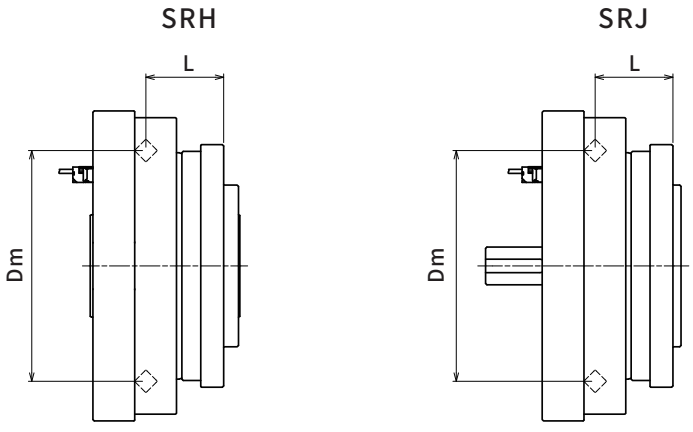
系列 Series	尺寸 Size	滚轴节圆直径 Pitch circle diameter of the bearing rollers	偏移量 Offset	基本动态额定负荷 Basic dynamic load rating	基本静态额定负荷 Basic static load rating	容许力矩 Allowable moment	力矩刚性 Moment rigidity
		Dm	L	C	Co	Mal	Km
		m	m	N	N	Nm	$\times 10^4$Nm/rad
WPU-□-□-SRH WPU-□-□-SRJ	35	0.0500	0.0217	5800	8600	74	8.5
	42	0.0600	0.0239	10400	16300	124	15.4
	50	0.0700	0.0255	14600	22000	187	25.2
	63	0.0850	0.0296	21800	35800	258	39.2
	80	0.111	0.0364	38200	65400	580	100

主轴承寿命计算 Lifespan for the main bearing

运转类型 Operation cycle example



外部负荷 External load



寿命计算（主轴承）Lifespan Estimation (Main bearing)

①最大负荷惯量的计算 Calculation formula for the largest working moment

最大负荷惯量 Peak working moment	Mm	Nm	$Mm = Frm \cdot (Lr + L) + Fam \cdot La$
最大径向负荷 Peak radial load	Frm	N	$Frm = Fr_1,\ Fr_2 \cdots Fr_n$ 的最大值 Frm = Largest among Fr_1, $Fr_2 \cdots Fr_n$
最大轴向负荷 Peak axial load	Fam	N	$Fam = Fa_1,\ Fa_2, \cdots Fa_n$ 的最大值 Fam = Largest among Fa_1, Fa_2, $\cdots Fa_n$

请确认最大负荷惯量为容许惯量值以下
Please make sure the peak working moment is below the maximum allowable moment.

②平均径向负荷/ 平均轴向负荷/ 平均输出转速/ 平均负荷惯量的计算
Calculation formula for the average radial load, average axial load, average output rotation speed, average working moment

平均径向负荷 Average radial load	Fra	N	$Fra = \sqrt[10/3]{\dfrac{n_1 \cdot t_1 \cdot \lvert Fr_1 \rvert^{10/3} + n_2 \cdot t_2 \cdot \lvert Fr_2 \rvert^{10/3} + \cdots + n_n \cdot t_n \cdot \lvert Fr_n \rvert^{10/3}}{n_1 \cdot t_1 + n_2 \cdot t_2 + \cdots + n_n \cdot t_n}}$
平均轴向负荷 Average radial load	Faa	N	$Faa = \sqrt[10/3]{\dfrac{n_1 \cdot t_1 \cdot \lvert Fa_1 \rvert^{10/3} + n_2 \cdot t_2 \cdot \lvert Fa_2 \rvert^{10/3} + \cdots + n_n \cdot t_n \cdot \lvert Fa_n \rvert^{10/3}}{n_1 \cdot t_1 + n_2 \cdot t_2 + \cdots + n_n \cdot t_n}}$
平均输出转速 Average output rotation speed	nao	r/min	$nao = \dfrac{n_1 \cdot t_1 + n_2 \cdot t_2 \cdots n_n \cdot t_n}{t_1 + t_2 + \cdots + t_n}$
平均负荷惯量 Average working moment	Ma	Nm	$Ma = Fra \cdot (Lr + L) + Faa \cdot La$

③负荷系数/ 动态等价径向负荷的计算
Calculation formula for the loading factor, equivalent radial load

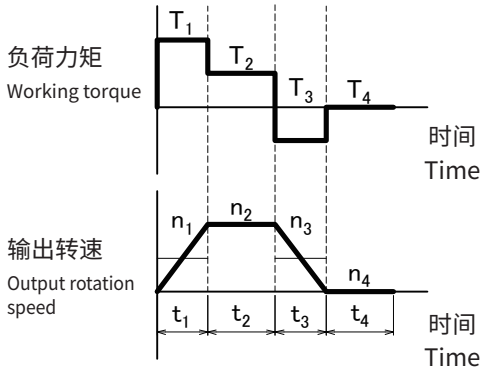
负荷系数 Loading factor	Xc, Yc	-	$\dfrac{Faa}{Fra + 2Ma / Dm} \leqq 1.5$ 时，$Xc = 1.0$, $Yc = 0.45$
			$\dfrac{Faa}{Fra + 2Ma / Dm} > 1.5$ 时，$Xc = 0.67$, $Yc = 0.67$
动态等价径向负荷 Equivalent radial load	Pc	N	$Pc = Xc \cdot (Fra + 2Ma/Dm) + Yc \cdot Faa$

④主轴承寿命时间的计算
Lifespan for the main bearing

主轴承寿命时间 Life span for the main bearing	Lhc	h	$Lhc = \dfrac{10^6}{60 \cdot nao} \cdot \left(\dfrac{C}{fw \cdot Pc} \right)^{\frac{10}{3}}$
冲击系数 Impact factor	fw	-	1.0：未伴随冲击时　no shock
			1.2：伴随些许冲击时 with some shock
			1.5：伴随振动冲击时 with shock and vibration

寿命计算 (薄壁轴承) Lifespan Estimation (Elastic bearing)

运转类型
Operation cycle example



①平均输出力矩 / 最大输出力矩的计算
Calculation formula for output torque

平均输出力矩 Average output torque	Tao	Nm	$Tao = \sqrt[3]{\frac{n_1 \cdot t_1 \cdot \lvert T_1 \rvert^3 + n_2 \cdot t_2 \cdot \lvert T_2 \rvert^3 + \cdots + n_n \cdot t_n \cdot \lvert T_n \rvert^3}{n_1 \cdot t_1 + n_2 \cdot t_2 \cdots n_n \cdot t_n}}$
最大输出力矩 Peak output torque value	Tmo	Nm	$Tmo = T_1, T_2, \cdots T_n$ 的最大值 Tmo = Largest among $T_1, T_2, \cdots T_n$

请确认最大输出力矩为容许最大输出值以下
Please make sure the peak output torque is below the maximum output torque in the specification table.

②平均输入转速 / 最高输入转速的计算
Calculation formula for input speed

平均输出转速 Average output rotation speed	nao	r/min	$nao = \frac{n_1 \cdot t_1 + n_2 \cdot t_2 \cdots n_n \cdot t_n}{t_1 + t_2 + \cdots + t_n}$
最高输出转速 Peak output rotation speed	nmo	r/min	$nmo = n_1, n_2, \cdots n_n$ 的最大值 nmo = Largest among $n_1, n_2, \cdots n_n$
平均输入转速 Average input speed	nai	r/min	$nai = nao \times R$ （R = 减速比）（R = ratio）
最高输入转速 Peak input speed value	nmi	r/min	$nmi = nmo \times R$ （R = 减速比）（R = ratio）

请确认最高输入转速为容许最高输入转速值以下
Please make sure the peak input speed value is below the maximum input speed in the specification table.

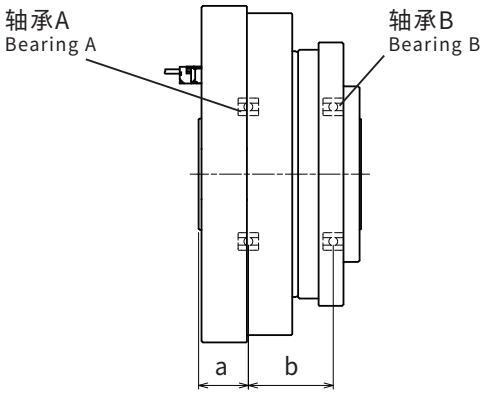
③寿命时间的计算
Calculation formula for life span

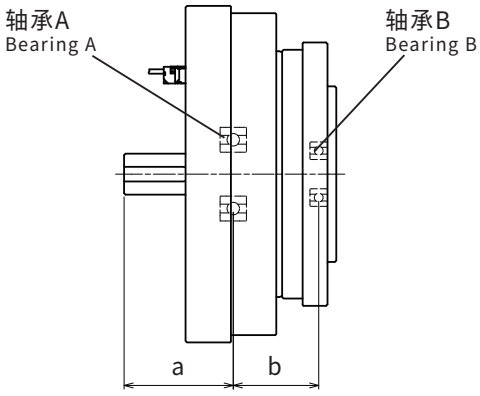
薄壁轴承寿命时间 Part life span for the elastic bearing	Lhe	h	$Lhe = 7692 \times \left(\frac{Tar}{Tao}\right)^3 \times \left(\frac{nar}{nai}\right)$
额定力矩 Rating torque	Tar	Nm	性能表中所记容许平均力矩 Nominal output torque in the specification table
额定输入转速 Rating input rotation speed	nar	r/min	2000 r/min

输入轴容许负荷 Maximum Load at Input Shaft

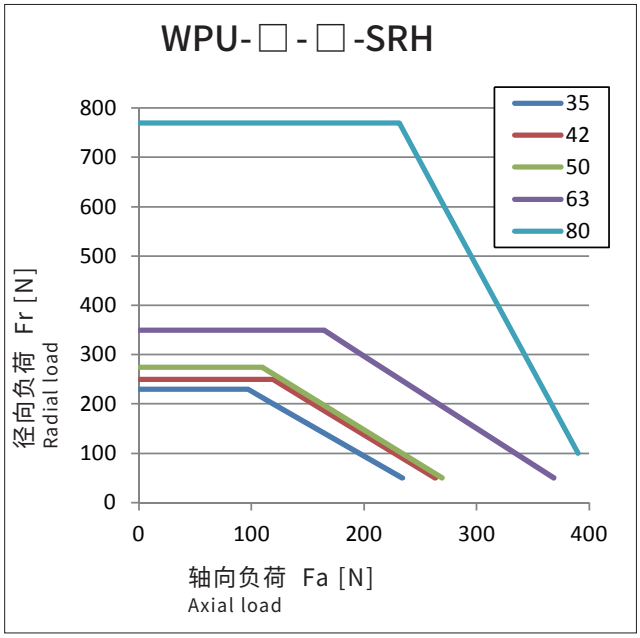
轴承规格（开放型，组合型）Bearing specification (Open type, Unit)

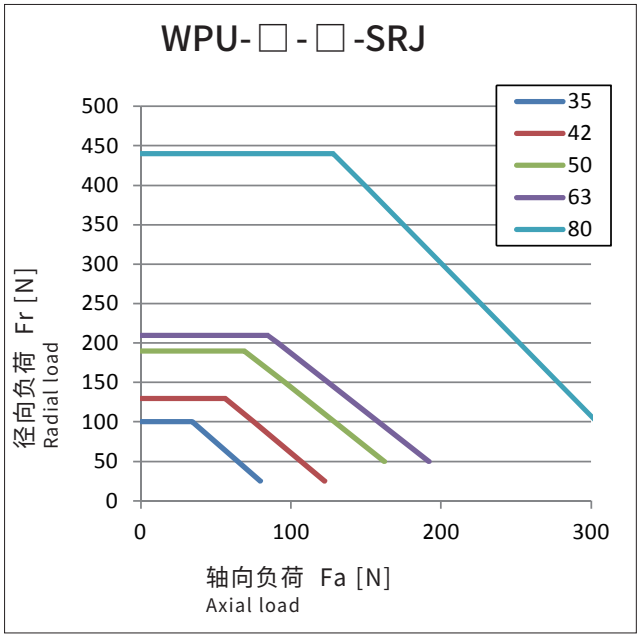
系列 Series	尺寸 Size	轴承 A Bearing A		轴承 B Bearing B		a	b
		基本动态额定负荷 Basic dynamic load rating	基本静态额定负荷 Basic static load rating	基本动态额定负荷 Basic dynamic load rating	基本静态额定负荷 Basic static load rating		
		C	Co	C	Co		
		N	N	N	N	mm	mm
WPU-□-□-SRH	35	4000	2470	4000	2470	16.5	26.5
	42	4300	2950	4300	2950	17.5	29.5
	50	4500	3450	4500	3450	16	26
	63	4900	4350	4900	4350	17	29
	80	14100	10900	5350	5250	20	35.5
WPU-□-□-SRJ	35	2240	910	1080	430	24.5	21
	42	2700	1270	1610	710	27.5	23
	50	4350	2260	2240	910	32.3	25.2
	63	5600	2830	2700	1270	37.3	29.2
	80	9400	5000	4350	2260	39.4	38.1





容许负荷（平均输入转速：2000r/min、寿命时间：10000h）
Maximum load (Average input rotation speed : 2000r/min, Lifespan : 10000h)



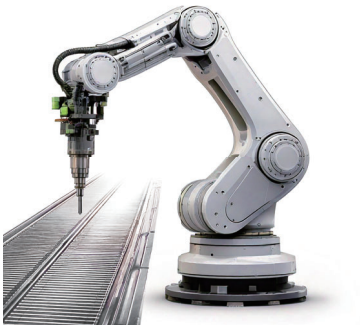


应用 Application

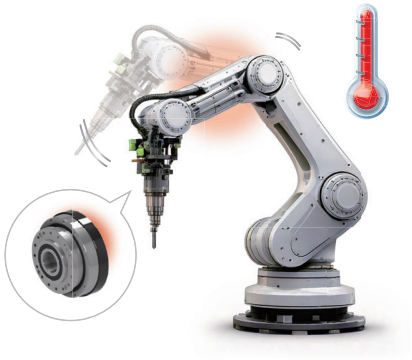
＊此应用示例不在安全认证范围内。
＊This example of application is not included in scope of safety certification.

碰撞检测 / 过载监测
Collision detection /
Overload monitoring

螺钉紧固扭矩监测
Monitoring torque
for screw tightening

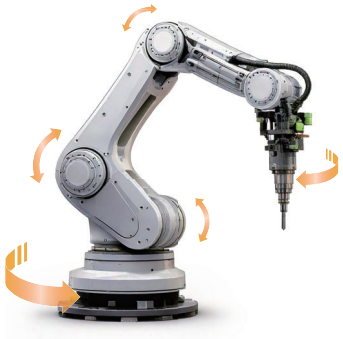


手臂热效应补偿 / 过热监测
Arm heat effect compensation /
Overheat monitoring



机器人停止位置 / 角度监测
Robot stop position / Angle monitoring

＊ 如需咨询，请联系我们。
＊ Please consult with us.



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Network monitoring system

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