

Nidec
All for dreams



Smart-FLEXWAVE
B u i l t - i n M u l t i S e n s o r

WP series

NIDEC DRIVE TECHNOLOGY CORPORATION

Built-in Multi Sensor Gearbox

Smart-FLEXWAVE

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

TORQUE SENSOR

The system's performance is optimized by accurately measuring the output torque from the gearbox.

02

TEMPERATURE SENSOR

The system's stability is improved by continuously monitoring the gearbox temperature.

03

ANGLE SENSOR

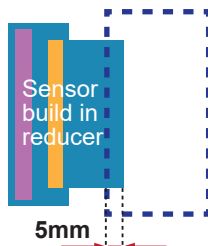
The torque sensor achieves high-accuracy torque measurement by angle compensation.

Built-in Multi Sensor



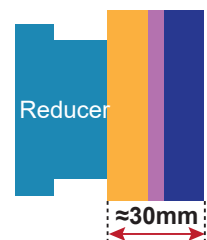
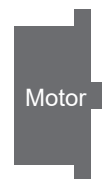
External Sensor

Smart-FLEXWAVE



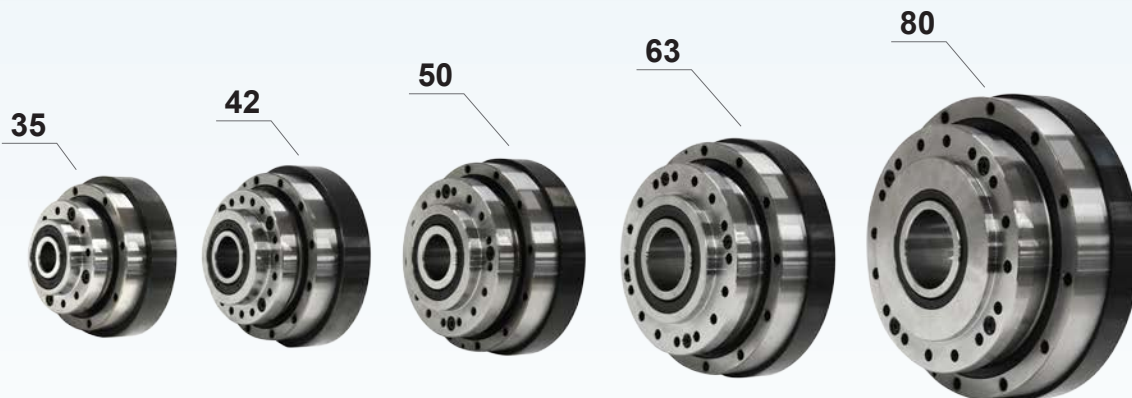
- 1 Light weight
- 2 Space saving
- 3 Cost-effective
- 4 High rigidity

Conventional Gearbox



- 1 Heavy weight
- 2 Large size
- 3 Expensive
- 4 Low rigidity

Sizes

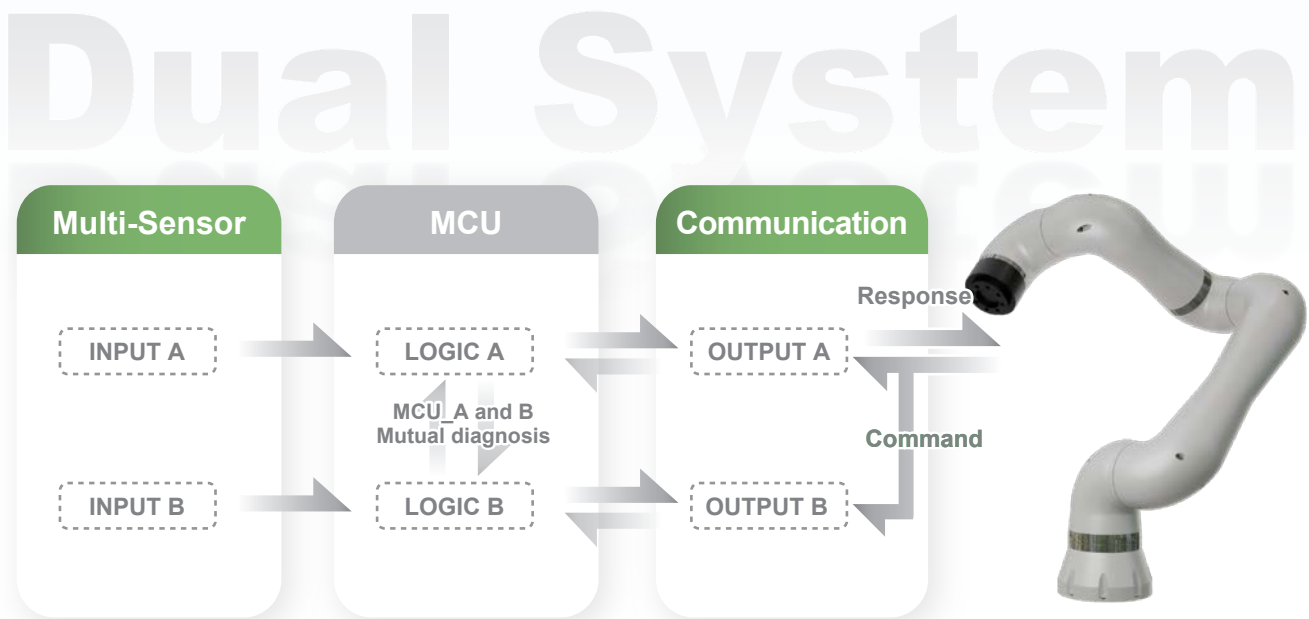


Dual system + Collaborative robots



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.

WP Series



Designed for Safety Built for Trust

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.

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



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.

Model Nomenclature

WP	U	35	50	SRH	BD
Series name	Type	Size	Ratio	Shaft code	Sensor code
WP Series	Unit type • Hollow shaft unit • Input shaft unit	35 42 50 63 80	50 80 100 120 160	SRH SRJ	BD

● Availability

Ratio	50	80	100	120	160
Frame size					
35					
42					
50					
63					
80					

Gearbox Specification

		* 1	* 2	* 3	* 4	* 5	* 6
Size	Ratio	Nominal output torque	Maximum output torque	Emergency stop torque	Nominal input speed	Maximum input speed	Life
		[Nm]	[Nm]	[Nm]	[r/min]	[r/min]	[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 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.

Sensor Specification

Sensor type	Item	Specification	Remarks
Torque sensor	Rated torque	The same as that of the maximum torque of the gearbox	
	Limited torque	The same as the emergency stop torque of the gearbox	
	Durability	The same as that of the gearbox	
	Non-linearity	± 3%FS or less	Range to rated torque
	Hysteresis	3%FS or less	Range to rated torque
	Cross-axis sensitivity	± 1%FS or less	Range to moment of gearbox
	Measurement range(Full scale)	Determined by the size of the gearbox	See attached table
	Resolution	-2000d to +2000d	LSB : See attached table
	Compliance standards (Functional safety)	PLd, Category 3 /EN ISO13849-1: 2023 SIL2 /IEC 61508: 2010 maximum SIL2 /EN IEC 62061:2021	
Temperature sensor	Accuracy	± 5°C	
	Measurement range	0°C to 80°C	
	Resolution	0 to 800d	LSB: 0.1°C
General	Power supply voltage	24V DC+10%/15%	
	Consumption current	0.06A or less	
	Communication method	2-wire RS-485	
	Baud rate	3.0Mbps	
	Operating temperature limit	0°C to 80°C	

Sensor Measurement Range

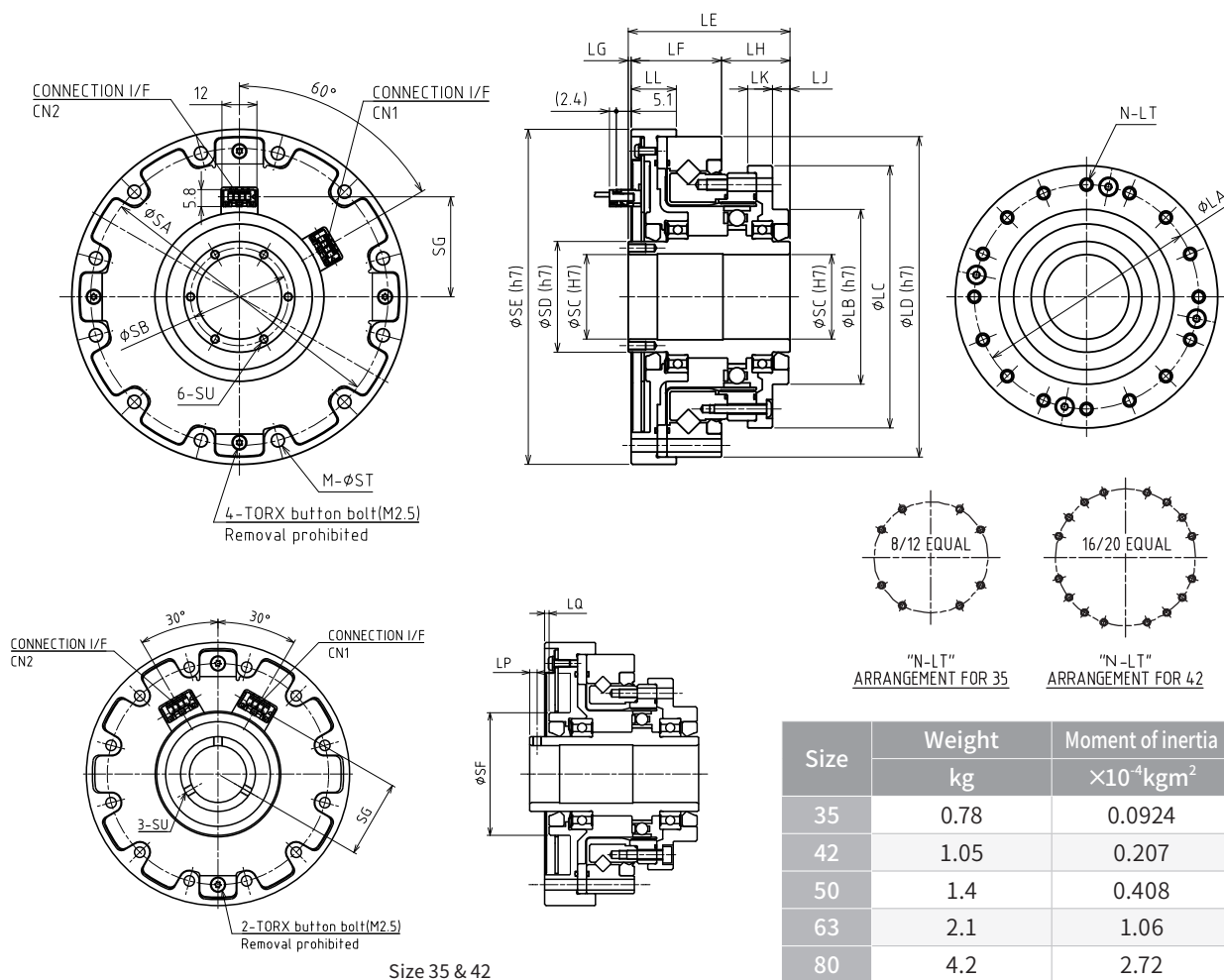
Size	Ratio	Rated torque	Full Scale	LSB
		[Nm]	[Nm]	[Nm]
35	50	23	± 50	0.025
	80	30		
	100	36		
42	50	44	± 100	0.05
	80	56		
	100	70		
	120	70		
50	50	73	± 150	0.075
	80	96		
	100	107		
	120	113		
	160	120		
63	50	127	± 300	0.15
	80	178		
	100	204		
	120	217		
	160	229		
80	50	281	± 600	0.3
	80	395		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

* 1 “+” sign indicates clockwise (CW) torque.

* 2 LSB is an abbreviation for Least Significant Bit.

SRH Hollow Shaft Unit

WPU- □ - □ -SRH-BD



Size	Weight	Moment of inertia
	kg	$\times 10^{-4} \text{kgm}^2$
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

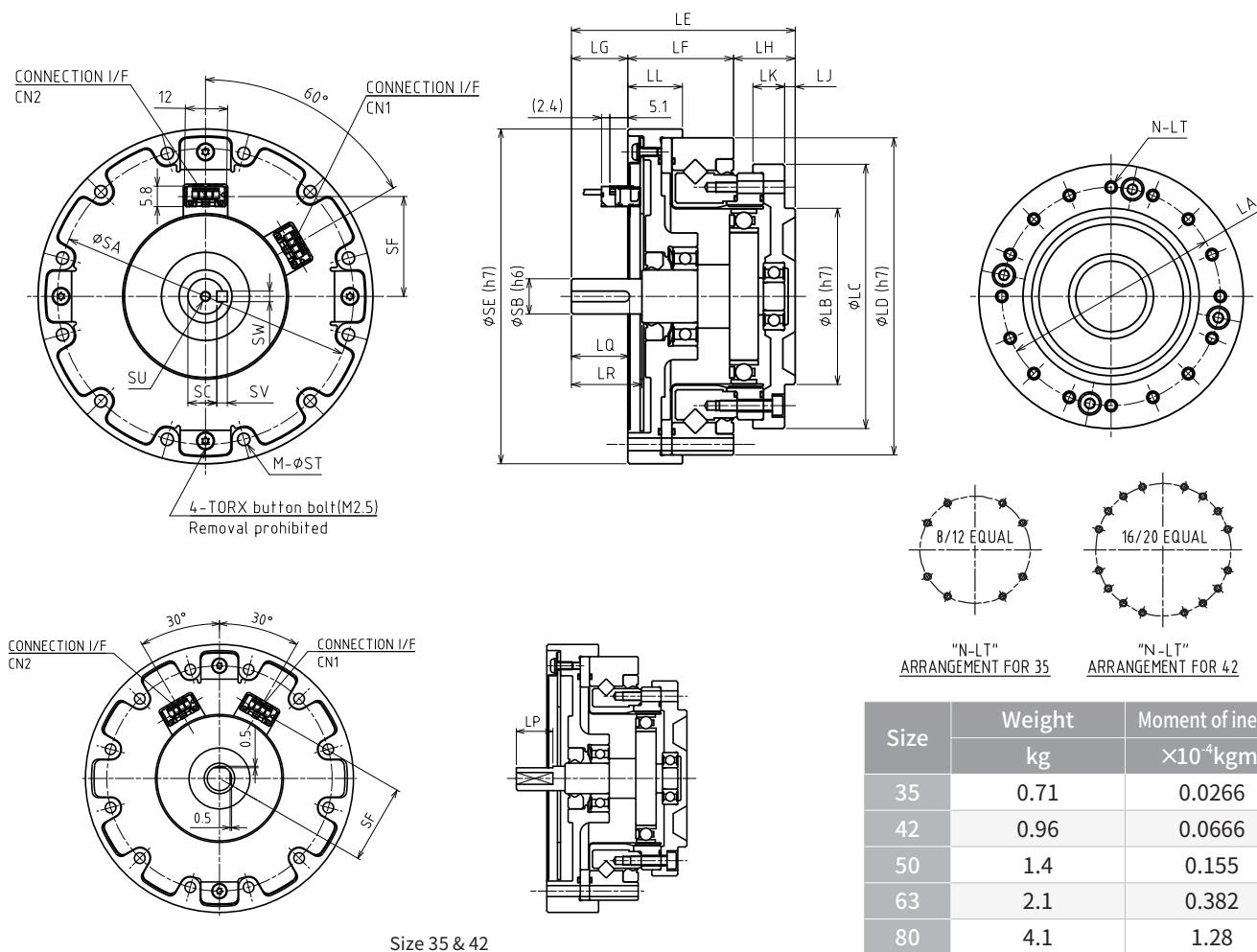
[mm]

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	-	-

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 $\times$ 5, ϕ 3.5 $\times$ 11.5
42	74	-	19	25	88	41	25.8	12	3.5	M3	16	M3 $\times$ 6, ϕ 3.5 $\times$ 12
50	84	25.5	21	30	95	-	28.3	12	3.5	M3 $\times$ 6	16	M3 $\times$ 6, ϕ 3.5 $\times$ 13.5
63	102	33.5	29	38	115	-	34.3	12	4.5	M3 $\times$ 6	16	M4 $\times$ 7, ϕ 4.5 $\times$ 15.5
80	132	40.5	36	45	147	-	42.9	12	5.5	M3 $\times$ 6	16	M5 $\times$ 8, ϕ 5.5 $\times$ 20.5

SRJ Input Shaft Unit

WPU- □ - □ -SRJ-BD



[mm]

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

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, φ 3.5 × 11.5
42	74	8	-	88	25.8	-	-	12	3.5	-	16	M3 × 6, φ 3.5 × 12
50	84	10	8.2	95	28.3	3	3	12	3.5	M3 × 6	16	M3 × 6, φ 3.5 × 13.5
63	102	14	11	115	34.3	5	5	12	4.5	M5 × 10	16	M4 × 7, φ 4.5 × 15.5
80	132	14	11	147	42.9	5	5	12	5.5	M5 × 10	16	M5 × 8, φ 5.5 × 20.5

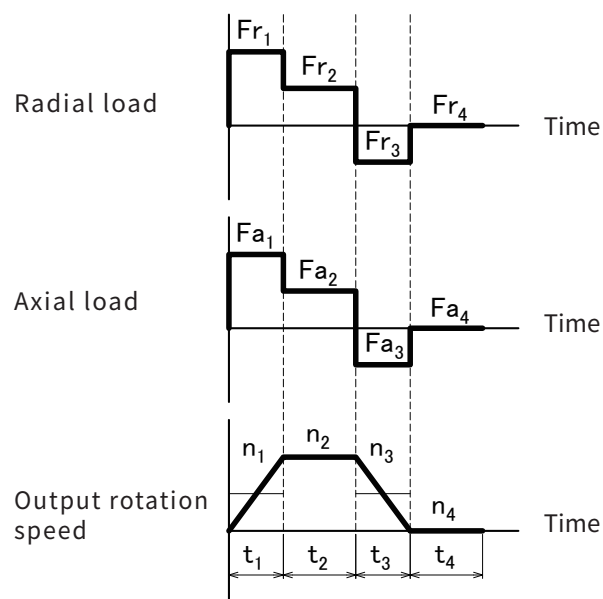
Lifespan Estimation

■ Main bearing specification(Cross roller bearing)

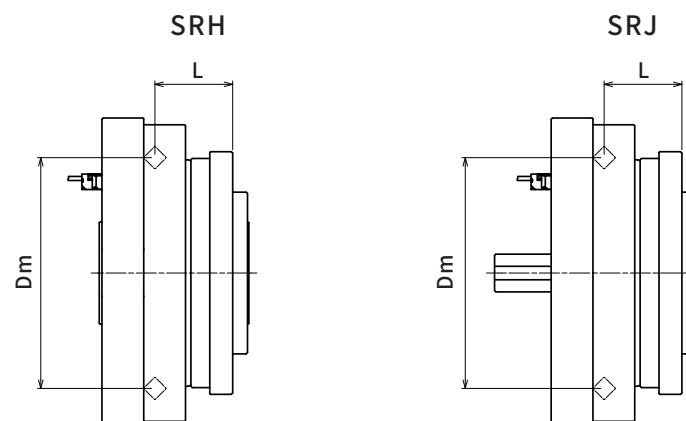
Series	Size	Pitch circle diameter of the bearing rollers	Offset	Basic dynamic load rating	Basic static load rating	Allowable moment	Moment rigidity
		Dm	L	C	Co	Mal	Km
		m	m	N	N	Nm	$\times 10^4 \text{ Nm/rad}$
WPU-□-□-SRH WPU-□-□-SRJ	35	0.0500	0.0217	5800	8600	74	8.5
	42	0.0600	0.0239	10400	16300	124	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

Lifespan for the main bearing

■ Operation cycle example



■ External load



Lifespan Estimation (Main bearing)

① Calculation formula for the largest working moment

Peak working moment	Mm	Nm	$Mm = Frm \cdot (Lr + L) + Fam \cdot La$
Peak radial load	Frm	N	$Frm = \text{Largest among } Fr_1, Fr_2, \dots, Fr_n$
Peak axial load	Fam	N	$Fam = \text{Largest among } Fa_1, Fa_2, \dots, Fa_n$

Please make sure the peak working moment is below the maximum allowable moment.

② Calculation formula for the average radial load, average axial load, average output rotation speed, average working moment

Average radial load	Fra	N	$Fra = \sqrt[10]{\frac{n_1 \cdot t_1 \cdot Fr_1 ^{10/3} + n_2 \cdot t_2 \cdot Fr_2 ^{10/3} + \dots + n_n \cdot t_n \cdot Fr_n ^{10/3}}{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}}$
Average axial load	Faa	N	$Faa = \sqrt[10]{\frac{n_1 \cdot t_1 \cdot Fa_1 ^{10/3} + n_2 \cdot t_2 \cdot Fa_2 ^{10/3} + \dots + n_n \cdot t_n \cdot Fa_n ^{10/3}}{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}}$
Average output rotation speed	nao	r/min	$nao = \frac{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}{t_1 + t_2 + \dots + t_n}$
Average working moment	Ma	Nm	$Ma = Fra \cdot (Lr + L) + Faa \cdot La$

③ Calculation formula for the loading factor, equivalent radial load

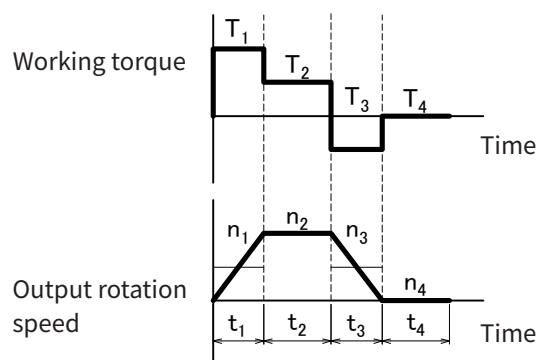
Loading factor	Xc, Yc	-	In case of $\frac{Faa}{Fra + 2Ma / Dm} \leq 1.5$ $Xc = 1.0, Yc = 0.45$
			In case of $\frac{Faa}{Fra + 2Ma / Dm} > 1.5$ $Xc = 0.67, Yc = 0.67$
Equivalent radial load	Pc	N	$Pc = Xc \cdot (Fra + 2Ma / Dm) + Yc \cdot Faa$

④ Lifespan for the main bearing

Life span for the main bearing	Lhc	h	$Lhc = \frac{10^6}{60 \cdot nao} \cdot \left(\frac{C}{fw \cdot Pc} \right)^{\frac{10}{3}}$
Impact factor	fw	-	1.0 : no shock
			1.2 : with some shock
			1.5 : with shock and vibration

Lifespan Estimation (Elastic bearing)

Operation cycle example



① Calculation formula for output torque

Average output torque	T_{ao}	Nm	$T_{ao} = \sqrt[3]{\frac{n_1 \cdot t_1 \cdot T_1 ^3 + n_2 \cdot t_2 \cdot T_2 ^3 + \dots + n_n \cdot t_n \cdot T_n ^3}{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}}$
Peak output torque value	T_{mo}	Nm	$T_{mo} = \text{Largest among } T_1, T_2, \dots, T_n$

Please make sure the peak output torque is below the maximum output torque in the specification table.

② Calculation formula for input speed

Average output rotation speed	n_{ao}	r/min	$n_{ao} = \frac{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}{t_1 + t_2 + \dots + t_n}$
Peak output rotation speed	n_{mo}	r/min	$n_{mo} = \text{Largest among } n_1, n_2, \dots, n_n$
Average input speed	n_{ai}	r/min	$n_{ai} = n_{ao} \times R \quad (R = \text{ratio})$
Peak input speed value	n_{mi}	r/min	$n_{mi} = n_{mo} \times R \quad (R = \text{ratio})$

Please make sure the peak input speed value is below the maximum input speed in the specification table.

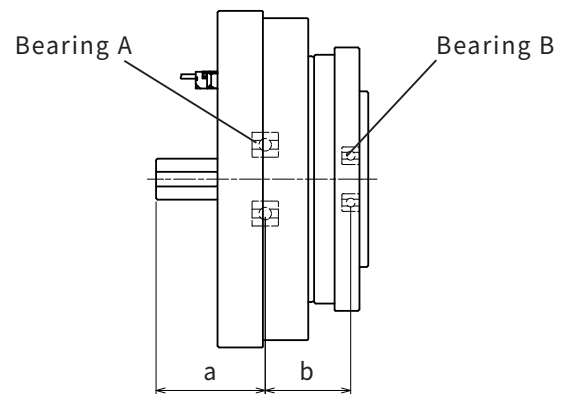
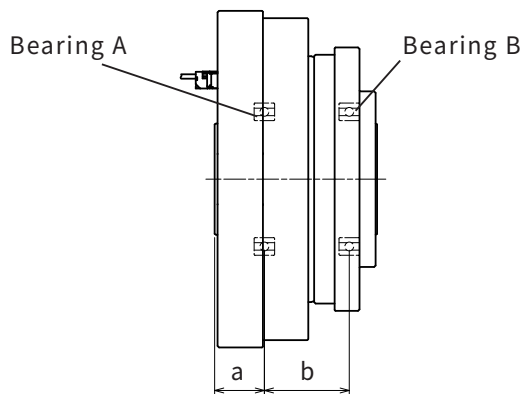
③ Calculation formula for life span

Part life span for the elastic bearing	L_{he}	h	$L_{he} = 7692 \times \left(\frac{T_{ar}}{T_{ao}} \right)^3 \times \left(\frac{n_{ar}}{n_{ai}} \right)$
Rating torque	T_{ar}	Nm	Nominal output torque in the specification table
Rating input rotation speed	n_{ar}	r/min	2000 r/min

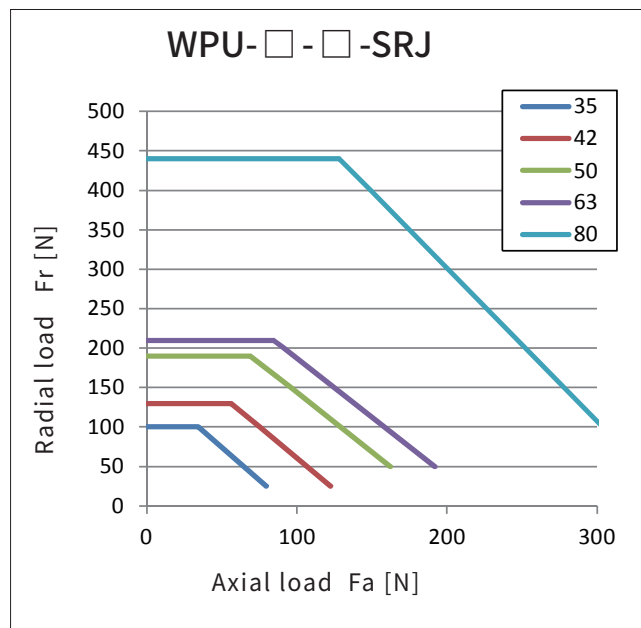
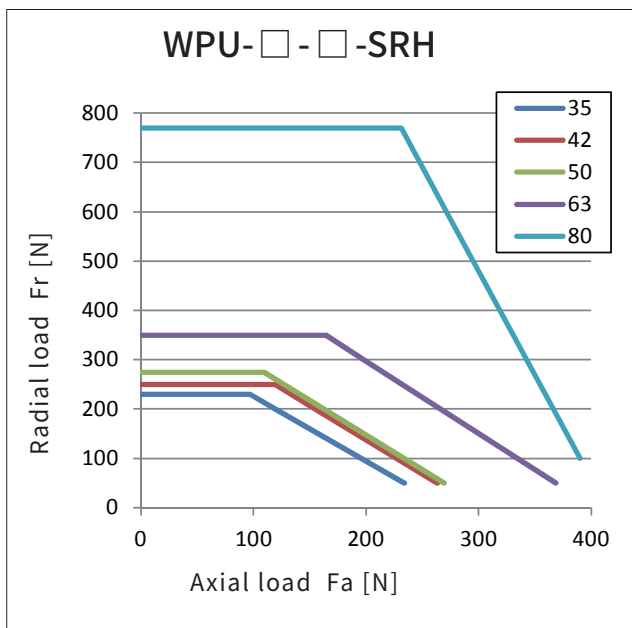
Maximum Load at Input Shaft

■ Bearing specification (Open type, Unit)

Series	Size	Bearing A		Bearing B		a	b
		Basic dynamic load rating	Basic static load rating	Basic dynamic load rating	Basic static load rating		
		C	Co	C	Co		
		N	N	N	N		
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



■ Maximum load (Average input rotation speed : 2000r/min, Lifespan : 10000h)



Application

* This example of application is not included in scope of safety certification.

Collision detection /
Overload monitoring



Monitoring torque
for screw tightening



Arm heat effect compensation /
Overheat monitoring

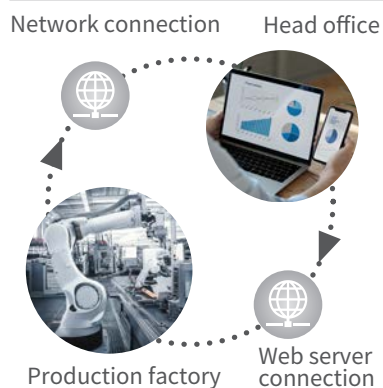


Robot stop position /
Angle monitoring

* Please consult with us.



Network monitoring system



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