HIWIN®

Ball Spline

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Feature /

The HIWIN Ball Spline is a rolling guide motion component, mainly composed of a nut(s), a screw shaft, and steel balls in retainers. The steel balls traveling between the nut and the screw, rolling in infinite cycles, allow the nut to move linearly along the screw shaft with high precision. The steel ball contact point in the Ball Spline is an angular contact structure, which can withstand both radial and torque load. The integrated nut/bearing design allows the Ball Spline to achieve high payloads with a compact structure.

The Ball Spline has three sets of steel balls loaded in retainers, with face-to-face angular contact with the screw shaft. The optimized retainer design provides guided movement with high speed, acceleration and deceleration and secures the steel balls firmly, even when the nut is removed from the shaft.

- Transmission of torque

  The steel balls traveling on the groove with angular contact offer relative movement between the nut and the screw to achieve torque transmission.

- Integral structure

  The integration of the nut and support bearings allows the Ball Spline to achieve high precision and a compact design.

- Easy installation

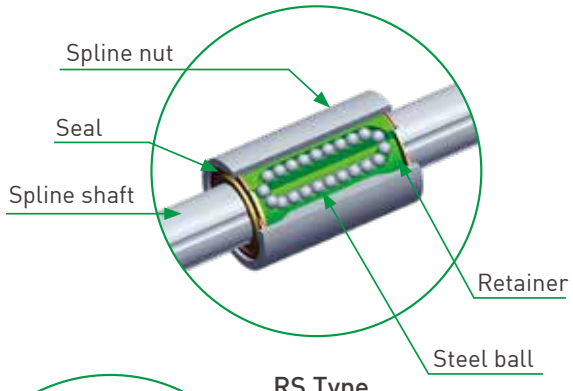
  With the optimized retainer design, the nut can easily be removed from the spline shaft and the steel balls will remain secure in the nut.

- Lubricant path

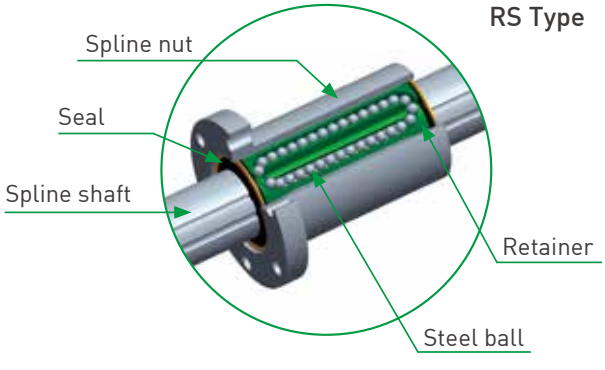
  The optimized lubricant path allows grease to be directly guided to the ball track improving lubrication and increasing service life.

RS, FS, FSR Type

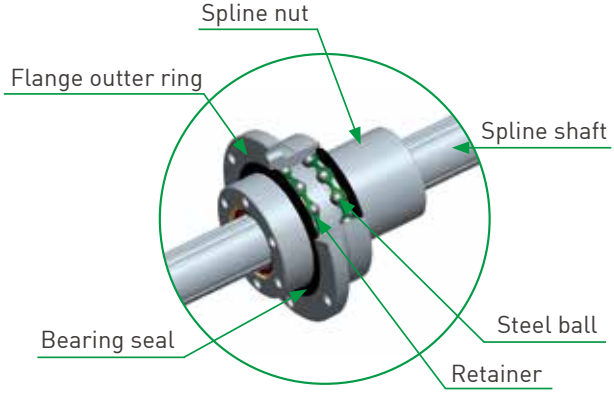
Structure /



RS Type



FS Type



FSR Type

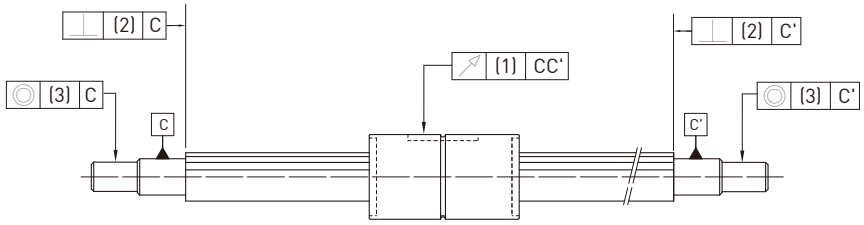
Specification Coding /

SP 20 - FS - 400 - 500 - H - S

- SP: Ball spline
- 20: Nominal shaft diameter
- FS: Nut type — RS: Round; FS: Flange; FSR:Rotation
- 400: Groove length
- 500: Total length
- H: Precision — C:Normal; H:High; P:Precise
- S: None: Hollow shaft; S: Solid shaft

Precision /

RS Type



Runout(1)

Unit:μm

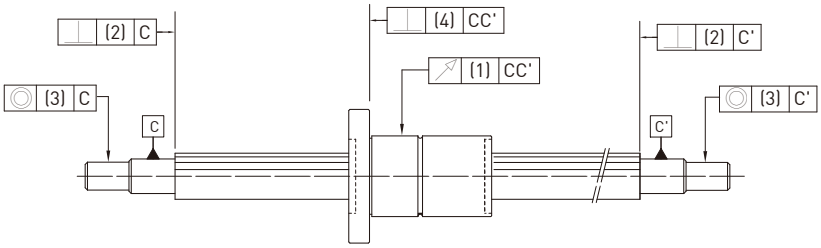
Nominal diameter / Shaft total length		16			20			25			32		
Above	Below	C	H	P	C	H	P	C	H	P	C	H	P
-	200	56	34	18	56	34	18	53	32	18	53	32	18
200	315	71	45	25	71	45	25	58	39	21	58	39	21
315	400	83	53	31	83	53	31	70	44	25	70	44	25
400	500	95	62	38	95	62	38	78	50	29	78	50	29
500	630	112			112			88	57	34	88	57	34
630	800							103	68	42	103	68	42
800	1000							124	83		124	83	

Geometric accuracy

Unit:μm

Accuracy / Nominal diameter	Verticality of end shaft (2)			Concentricity of end shaft (3)		
	C	H	P	C	H	P
16	27	11	8	46	19	12
20	27	11	8	46	19	12
25	33	13	9	53	22	13
32	33	13	9	53	22	13

FS Type



Runout(1)

Unit:μm

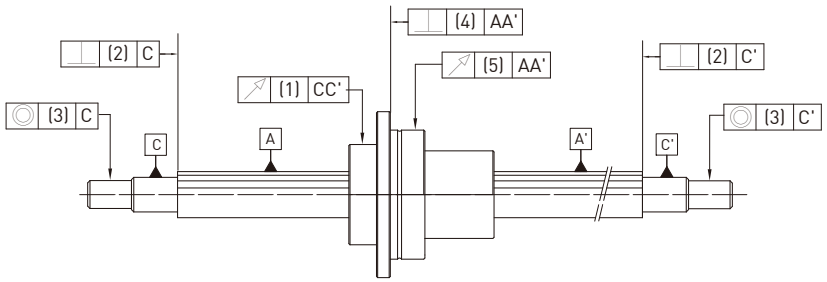
Nominal diameter / Shaft total length		16			20			25			32		
Above	Below	C	H	P	C	H	P	C	H	P	C	H	P
-	200	56	34	18	56	34	18	53	32	18	53	32	18
200	315	71	45	25	71	45	25	58	39	21	58	39	21
315	400	83	53	31	83	53	31	70	44	25	70	44	25
400	500	95	62	38	95	62	38	78	50	29	78	50	29
500	630	112			112			88	57	34	88	57	34
630	800							103	68	42	103	68	42
800	1000							124	83		124	83	

Geometric accuracy

Unit:μm

Nominal diameter / Accuracy	Verticality of end shaft (2)			Concentricity of end shaft (3)			Verticality (4)		
	C	H	P	C	H	P	C	H	P
16	27	11	8	46	19	12	39	16	11
20	27	11	8	46	19	12	39	16	11
25	33	13	9	53	22	13	39	16	11
32	33	13	9	53	22	13	39	16	11

FSR Type



Runout(1)

Unit:μm

Shaft total length / Nominal diameter		16			20			25			32		
Above	Below	C	H	P	C	H	P	C	H	P	C	H	P
-	200	56	34	18	56	34	18	53	32	18	53	32	18
200	315	71	45	25	71	45	25	58	39	21	58	39	21
315	400	83	53	31	83	53	31	70	44	25	70	44	25
400	500	95	62	38	95	62	38	78	50	29	78	50	29
500	630	112			112			88	57	34	88	57	34
630	800							103	68	42	103	68	42
800	1000							124	83		124	83	

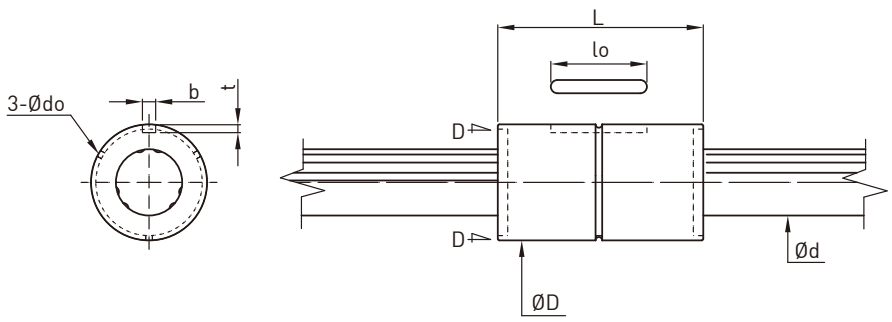
Geometric accuracy

Unit:μm

Nominal diameter / Accuracy	Verticality of end shaft (2)			Concentricity of end shaft (3)			Nut verticality (4)			Nut runout (5)		
	C	H	P	C	H	P	C	H	P	C	H	P
16	27	11	8	46	19	12	29	18	13	32	21	16
20	27	11	8	46	19	12	29	18	13	32	21	16
25	33	13	9	53	22	13	32	21	16	32	21	16
32	33	13	9	53	22	13	32	21	16	32	21	16

Size Table /

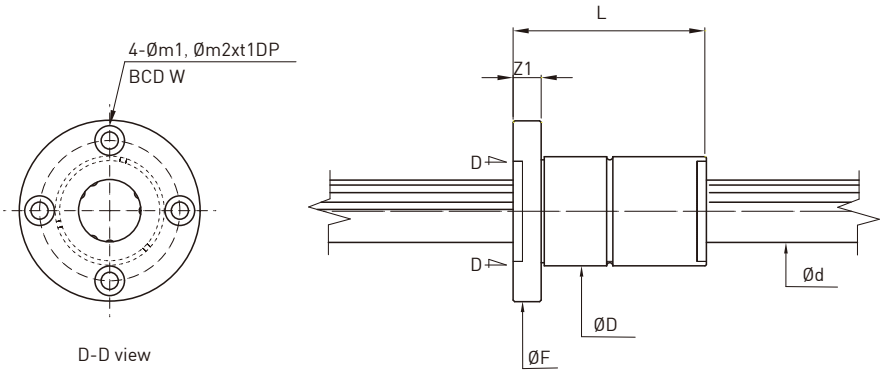
RS Type



Unit:mm

Nimonal diameter	Basic rated load		Basic rated torque		Permissible static moment	Diameter	Length	Keyway width	Keyway depth	Keyway length
	C (kN)	Co (kN)	C_T (N-m)	C_{oT} (N-m)	MA (N-m)	D	L	b	t	lo
16	7.2	13.5	32.1	34.4	67.6	31	50	3.5	2	17.5
20	10.4	20.0	57.8	63.2	118	35	63	4	2.5	29
25	15.4	27.5	106.5	108.8	210	42	71	4	2.5	36
32	20.5	34.4	181.5	173.1	290	49	80	4	2.5	42

FS Type

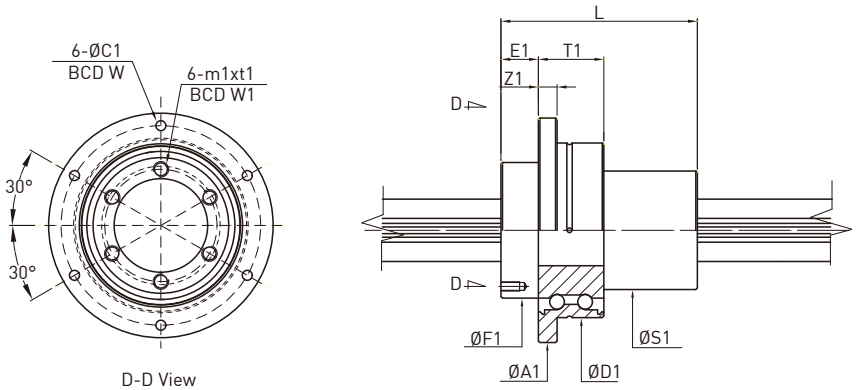


D-D view

Unit:mm

Nominal Diameter	Basic rated load		Basic rated torque		Permissible static moment	Diameter	Flange diameter	Length	Z1	W	m1	m2xt1
	C (kN)	Co (kN)	C_T (N-m)	C_{oT} (N-m)	MA (N-m)	D	F	L				
16	7.2	13.5	32.1	34.4	67.6	31	51	50	7	40	4.5	8x4.4
20	10.4	20.0	57.8	63.2	118	35	58	63	9	45	5.5	9.5x5.4
25	15.4	27.5	106.5	108.8	210	42	65	71	9	52	5.5	9.5x5.4
32	20.5	34.4	181.5	173.1	290	49	77	80	10	62	6.6	11x6.5

FSR Type



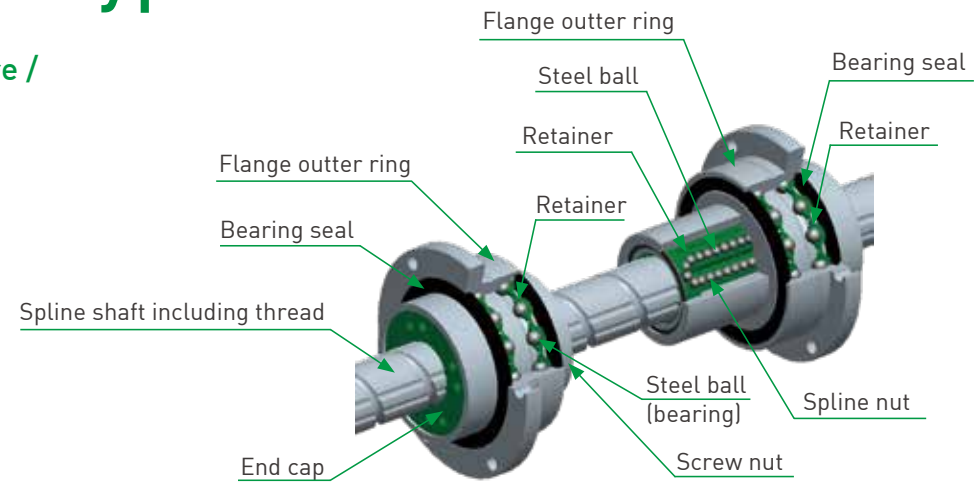
D-D View

Unit:mm

Nimonal diameter	Basic rated load		Basic rated torque		Permissible static moment	Diameter	Flange diameter	Length	F1	S1	T1	E1	Z1	W	W1	m1xt1	C1	Support bearing basic rated load	
	C(kN)	Co(kN)	C_T(N-m)	C_{oT}(N-m)	MA(N-m)	D	A1	L										Ca(kN)	Coa(kN)
16	7.2	13.5	32.1	34.4	67.6	48	64	50	36	31	21	10	6	56	30	M4x6	4.5	9.3	11.5
20	10.4	20.0	57.8	63.2	118	56	72	63	43.5	35	21	12	6	64	36	M5x8	4.5	9.8	13.3
25	15.4	27.5	106.5	108.8	210	66	86	71	52	42	25	13	7	75	44	M5x8	5.5	13.1	22
32	20.5	34.4	181.5	173.1	290	78	103	80	63	52	25	17	8	89	54	M6x10	6.6	13.7	25.2

FBR Type

Structure /



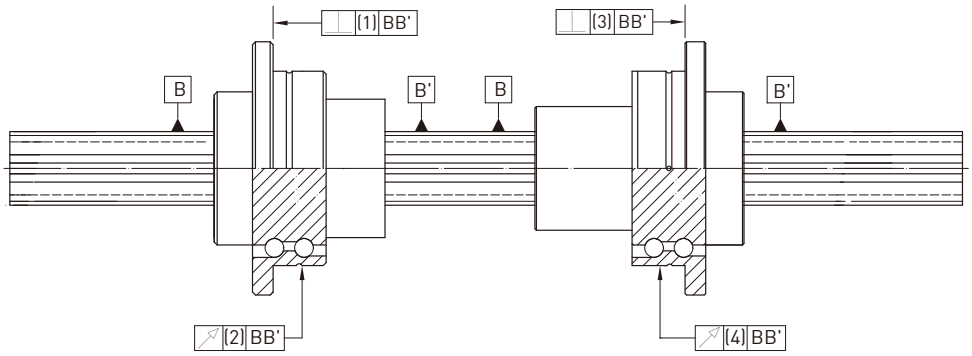
Ballscrew nut **Ball spline nut**

Specification Coding /

SP 20 - FBR - 400 - 500 - S

- SP: Ball spline
- 20: Nominal diameter
- FBR: Nut type (FBR:Right thread, FBL:Left thread)
- 400: Groove length
- 500: Total length
- S: None: Hollow shaft; S: Solid shaft

Geometric Accuracy /



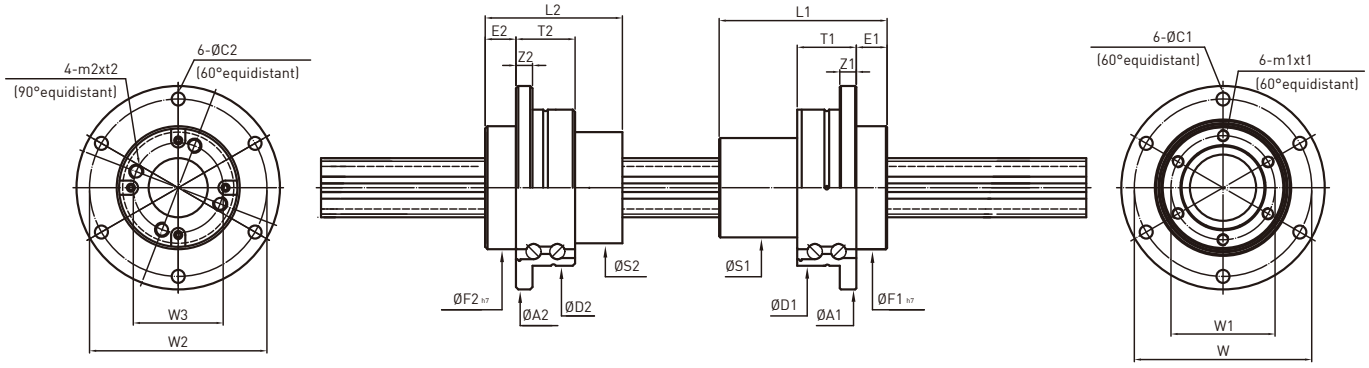
Ballscrew nut　　Ball spline nut

Unit:μm

Nominal diameter	Ballscrew nut		Ball spline nut	
	Verticality (1)	Runout (2)	Verticality (3)	Runout (4)
16	16	20	18	21
20	16	20	18	21
25	18	24	21	21
32	18	24	21	21

Size Table /

FBR Type



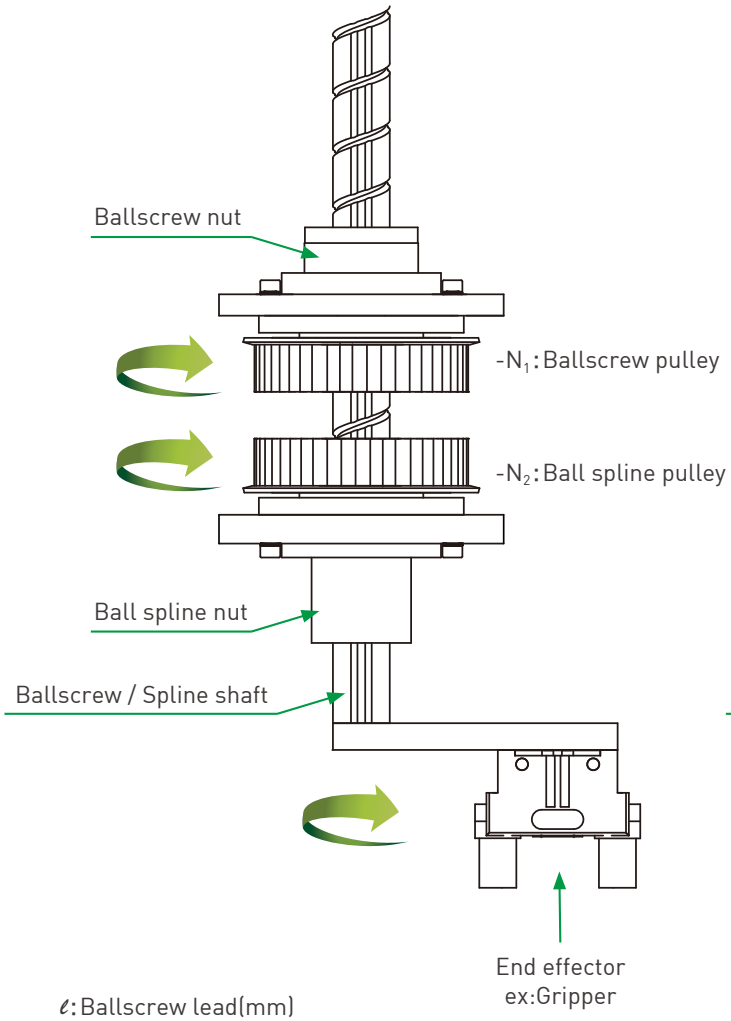
Ballscrew nut　　Ball spline nut

Unit:mm

Model no	Specification			Ballscrew nut														Support bearing basic rated load	
	Nominal outter diameter	Nominal inner diameter	Lead	Basic rated load		Diameter D2 g6	Flange diameter A2	Total length L2	F2	S2	T2	E2	Z2	W2	W3	m2xt2	C2		
				C(kN)	Co(kN)													Ca(kN)	Coa(kN)
16	16	11	16	4.7	9.6	48	64	40	36	32	21	10	6	56	25	M4x8	4.5	9.3	11.5
20	20	14	20	6.4	14	56	72	46	43.5	40	21	11	6	64	31	M5x8	4.5	9.8	13.3
25	25	18	25	9.5	21.9	66	86	58	52	47	25	13	7	75	38	M6x12	5.5	13.1	22
32	32	23	32	13	29.8	78	103	72	63	58	25	14	8	89	48	M6x10	6.6	13.7	25.2

Model no	Ball spline nut																Support bearing basic rated load	
	Basic rated load		Basic rated torque		Permissible static moment	Diameter D1	Flange diameter A1	Total length L1	F1	S1	T1	E1	Z1	W	W1	m1xt1	C1	
	C(kN)	Co(kN)	C_T(N-m)	C_{oT}(N-m)	Ma(N-m)												Ca(kN)	Coa(kN)
16	7.2	13.5	32.1	34.4	67.6	48	64	50	36	31	21	10	6	56	30	M4x6	4.5	9.3	11.5
20	10.4	20.0	57.8	63.2	118	56	72	63	43.5	35	21	12	6	64	36	M5x8	4.5	9.8	13.3
25	15.4	27.5	106.5	108.8	210	66	86	71	52	42	25	13	7	75	44	M5x8	5.5	13.1	22
32	20.5	34.4	181.5	173.1	290	78	103	80	63	52	25	17	8	89	54	M6x10	6.6	13.7	25.2

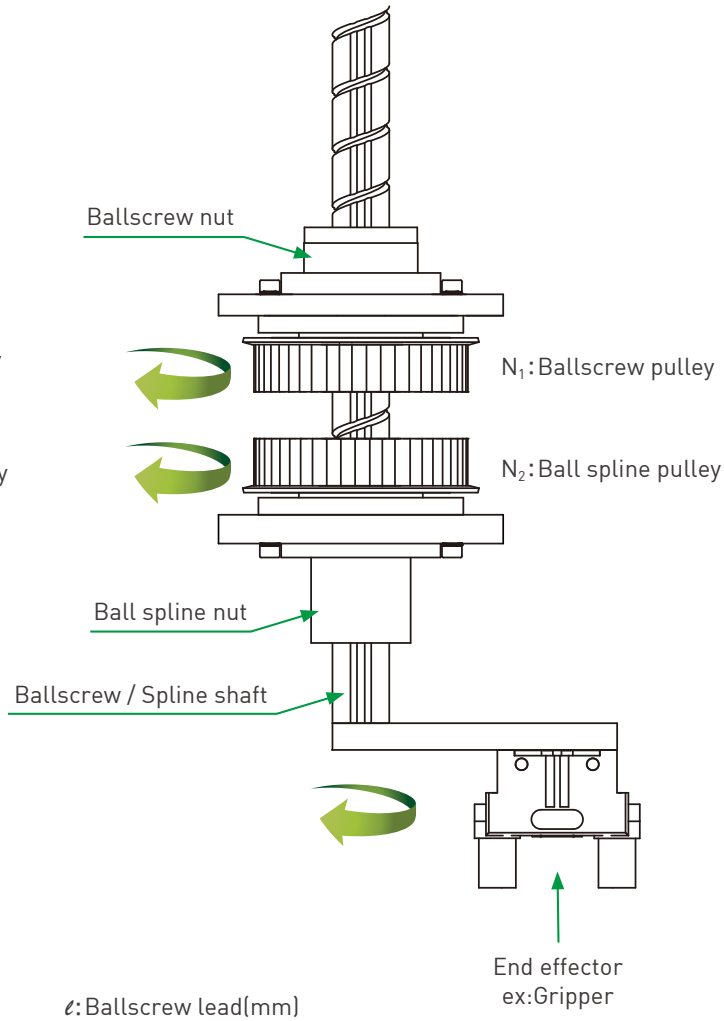
FBR Type Ball Spline Working Mode /



ℓ : Ballscrew lead(mm)

-N_1 : Ballscrew pulley rotating speed (counterclockwise)(min^{-1})

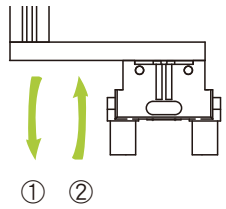
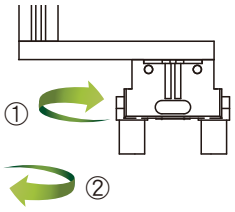
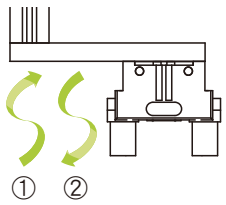
-N_2 : Ball spline pulley rotating speed (counterclockwise)(min^{-1})



ℓ : Ballscrew lead(mm)

N_1 : Ballscrew pulley rotating speed (counterclockwise)(min^{-1})

N_2 : Ball spline pulley rotating speed (counterclockwise)(min^{-1})

Work mode		Motion direction	Input		Shaft motion	
			Ballscrew pulley	Ball spline pulley	Vertical (speed)	Rotating direction (speed)
	1	Vertical→downward Rotating direction→0	N_1 (Forward)	0	$V=N_1 \times \ell$ ($N_1 \neq 0$)	0
	2	Vertical→Upward Rotating direction→0	$-N_1$ (Reverse)	0	$V=-N_1 \times \ell$ ($N_1 \neq 0$)	0
	1	Vertical→0 Rotating direction→Forward	N_1	N_2 (Forward)	0	N_2 ($N_1 \neq N_2 \neq 0$)
	2	Vertical→0 Rotating direction→Reverse	$-N_1$	$-N_2$ (Reverse)	0	$-N_2$ ($-N_1 \neq -N_2 \neq 0$)
	1	Vertical→Upward Rotating direction→Forward	0	N_2 ($N_2 \neq 0$)	$V=N_2 \times \ell$	N_2 (Forward)
	2	Vertical→Downward Rotating direction→Reverse	0	$-N_2$ ($-N_2 \neq 0$)	$V=-N_2 \times \ell$	$-N_2$ (Reverse)

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