HIWIN®

Ball Spline

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Feature /

HIWIN Ball Spline is a rolling guide element, mainly composed of nuts, screws, steel balls and retainers. By the steel ball between the nut and the screw, the rolling of the infinite cycles allows the nut to move linearly along the screw with high precision. The ball contact point in ball spline is angular contact structure, which can withstand both radial and torque load. With the integrated design between nuts and bearings, it makes the ball spline achieve high payload with compact structure.

The ball spline has three sets of loaded balls, where the balls are under face-to-face angular contact and held by the retainer. The optimized retainer design provides the high speed, acceleration and deceleration guiding movement as well as hold the balls firmly without falloff when taking out the shaft.

- Transmission of torque

  Compared with the linear bearing, the balls rolling on the groove with the angular contact offer the relative movement between the nut and the screw in order to achieve the function of the torque transmission.

- Integral structure

  With the integration of the nut and support bearings, the ball spline can achieve high precision and the compact structure design.

- Easy installation

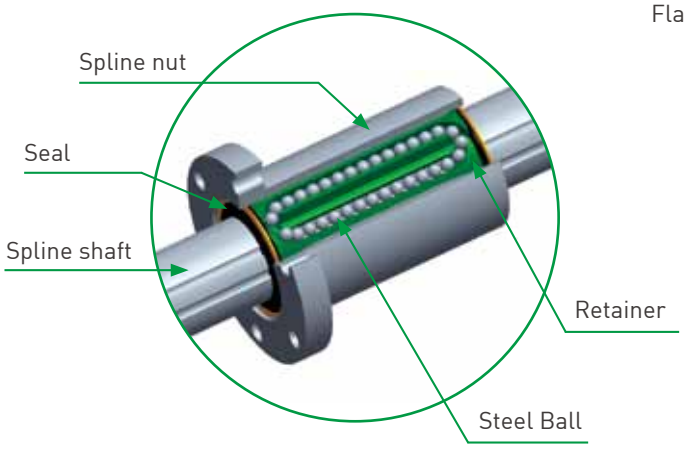
  With the optimized retainer design, the spline shaft can easily be removed without having the balls falloff from the nut.

- Lubricant path

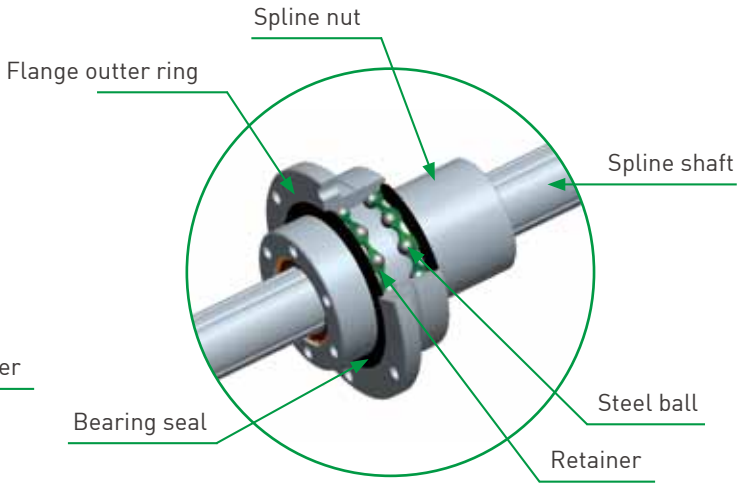
  With the optimization of the lubricant path, the grease will be directly guided to the ball track to improve the lubrication effect and enhance the service life.

FS, FSR Type

Structure /



FS Type



FSR Types

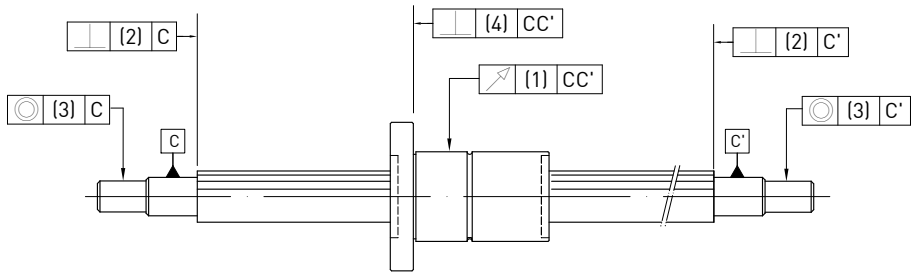
Specification Coding /

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

- SP: Ball spline
- 20: Nominal shaft diameter
- FS: Nut type (FS: Flange, FSR:Rotation)
- 400: Ditch length
- 500: Total length
- H: Precision (C:Normal, H:High, P:Precise)
- S: None: Hollow shaft, S: Solid shaft

Precision /

FS Type



Runout(1)

Unit: μm

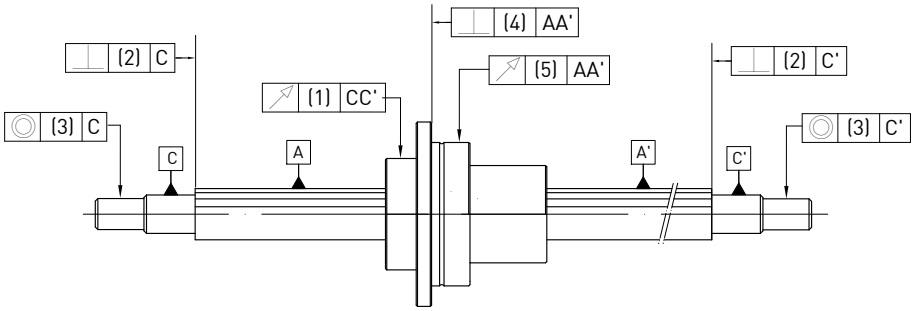
Nominal diameter / Shaft total length		16			20			25		
Above	Below	C	H	P	C	H	P	C	H	P
-	200	56	34	18	56	34	18	53	32	18
200	315	71	45	25	71	45	25	58	39	21
315	400	83	53	31	83	53	31	70	44	25
400	500	95	62	38	95	62	38	78	50	29
500	580	112			112			88	57	34

Geometric accuracy

Unit: μm

	Verticality (2)			Concentricity (3)			Verticality (4)		
Accuracy / Nominal diameter	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

FSR Type



Runout(1)

Unit: μm

Nominal diameter / Shaft total length		16			20			25		
Above	Below	C	H	P	C	H	P	C	H	P
-	200	56	34	18	56	34	18	53	32	18
200	315	71	45	25	71	45	25	58	39	21
315	400	83	53	31	83	53	31	70	44	25
400	500	95	62	38	95	62	38	78	50	29
500	580	112			112			88	57	34

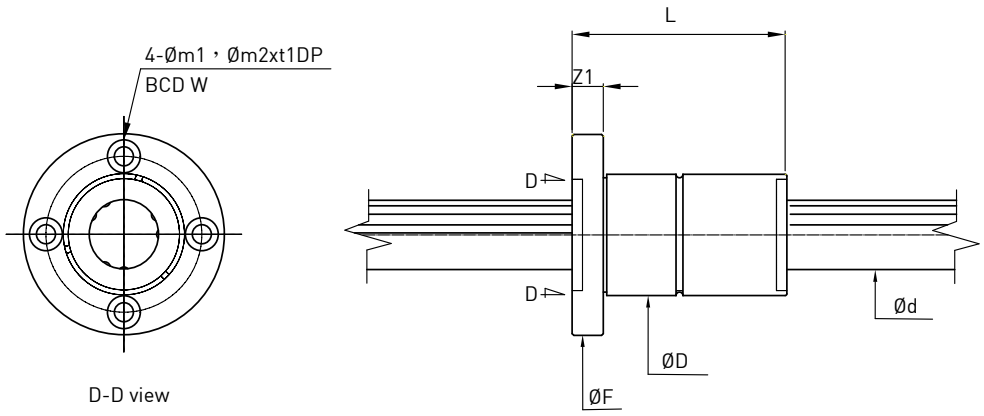
Geometric accuracy

Unit: μm

	End shaft Verticality (2)			End shaft Concentricity (3)			Nut Verticality (4)			Nut runout (5)		
Nominal diameter / Accuracy	C	H	P	C	H	P	C	H	P	C	H	P
16	27	11	8	46	19	12	29	18	13	39	21	16
20	27	11	8	46	19	12	29	18	13	39	21	16
25	33	13	9	53	22	13	32	21	16	42	24	19

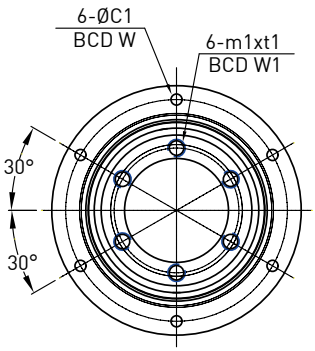
Size table /

FS Type

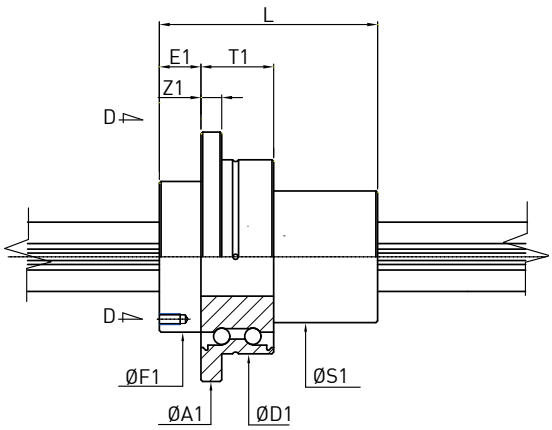


Unit:mm

Nominal Diameter	FS Type											
	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



D-D View

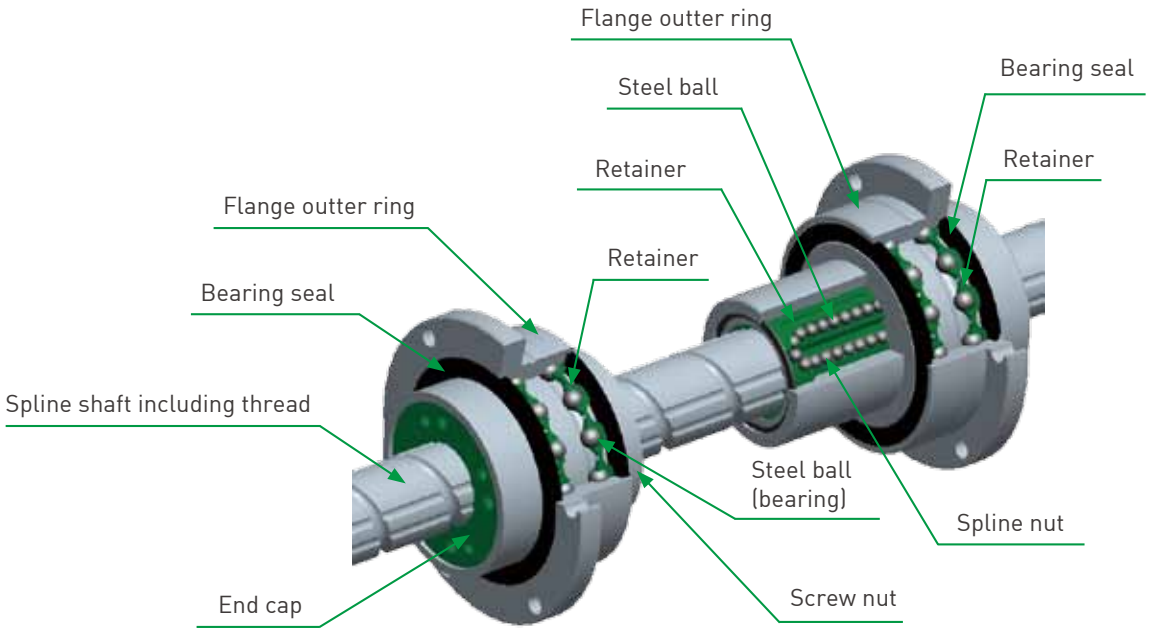


Unit:mm

Nimonal diameter	FSR Type																	Support bearing basic rated load	
	Basic rated load		Basic rated torque		Permissible static moment	Diameter	Flange diameter	Total length	F1	S1	T1	E1	Z1	W	W1	m1xt1	C1		
	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

FBR Type

Structure /



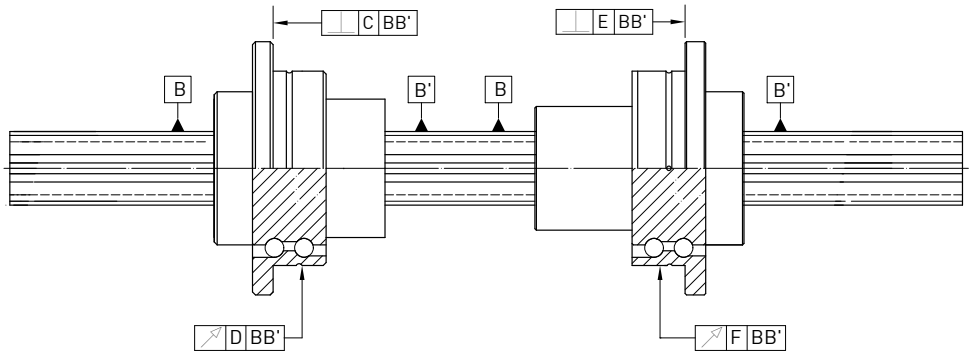
Ballscrew nut **Ball spline nut**

Specification Coding /

SP 20 - FBR - 400 - 500 - S

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

Geometric accuracy /



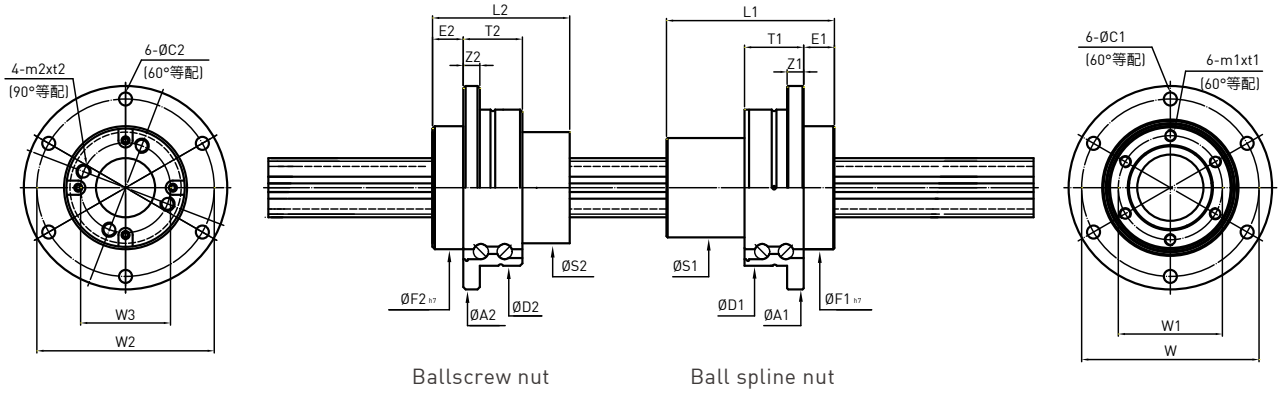
Ballscrew nut Ball spline nut

Unit: μm

Nominal diameter	Ballscrew nut		Ball spline nut	
	Verticality (C)	Runout (D)	Verticality (E)	Runout (F)
16	16	20	18	21
20	16	20	18	21
25	18	24	21	21

Size table /

FBR Type



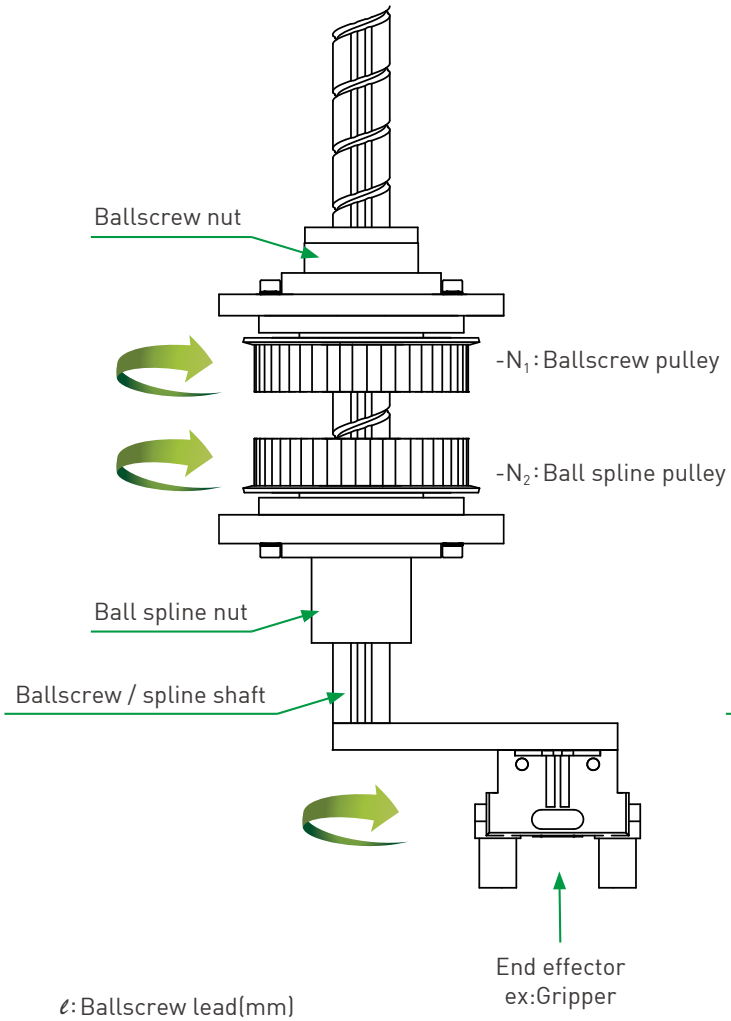
Ballscrew nut Ball spline nut

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		
				Ca(kN)	Coa(kN)													Ca(kN)	Coa(kN)
16	16	11	16	5.6	11.1	48	64	40	36	32	21	10	6	56	25	M4x8	4.5	9.3	11.5
20	20	14	20	6.3	14	56	72	46	43.5	40	21	11	6	64	30	M3x7.5	4.5	9.8	13.3
25	25	18	25	9.5	21.8	66	86	58	52	47	25	13	7	75	38	M5x12	5.5	13.1	22

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

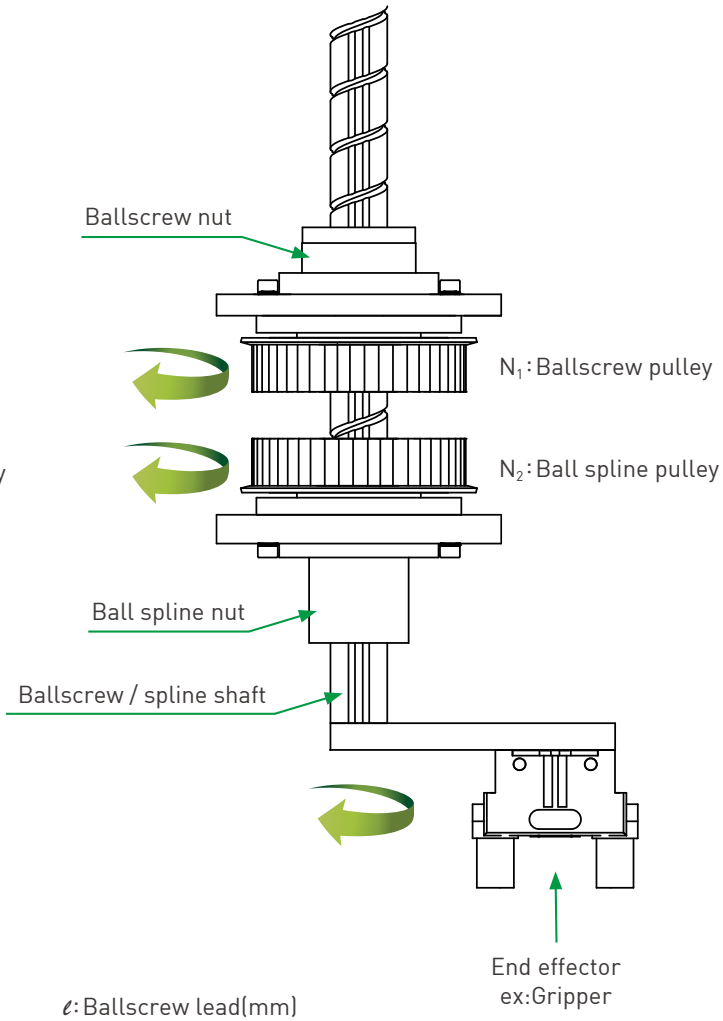
FBR Type Ball Spline Working Mode /



ℓ: Ballscrew lead(mm)

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

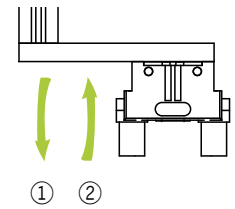
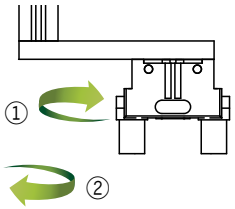
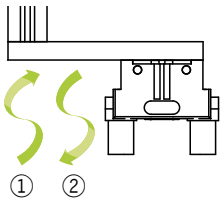
$-N_2$: Ball spline pulley rotating speed (counterclockwise)(min^{-1})



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 ②	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 ②	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 ②	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)

Subsidiaries / R&D Centers

HIWIN GmbH
OFFENBURG, GERMANY
www.hiwin.de
www.hiwin.eu
info@hiwin.de

HIWIN Schweiz GmbH
JONA, SWITZERLAND
www.hiwin.ch
info@hiwin.ch

HIWIN KOREA
SUWON · MASAN, KOREA
www.hiwin.kr
info@hiwin.kr

HIWIN JAPAN
KOBE · TOKYO · NAGOYA · NAGANO · TOHOKU · SHIZUOKA · HOKURIKU · HIROSHIMA · FUKUOKA · KUMAMOTO, JAPAN
www.hiwin.co.jp
info@hiwin.co.jp

HIWIN s.r.o.
BRNO, CZECH REPUBLIC
www.hiwin.cz
info@hiwin.cz

HIWIN CHINA
SUZHOU, CHINA
www.hiwin.cn
info@hiwin.cn

HIWIN USA
CHICAGO · SILICON VALLEY, U.S.A.
www.hiwin.com
info@hiwin.com

HIWIN SINGAPORE
SINGAPORE
www.hiwin.sg
info@hiwin.sg

Mega-Fabs Motion Systems, Ltd.
HAIFA, ISRAEL
www.mega-fabs.com
info@mega-fabs.com

HIWIN Srl
BRUGHERIO, ITALY
www.hiwin.it
info@hiwin.it

HIWIN TECHNOLOGIES CORP.
No. 7, Jingke Road,
Taichung Precision Machinery Park,
Taichung 40852, Taiwan
Tel: +886-4-23594510
Fax: +886-4-23594420
www.hiwin.tw
business@hiwin.tw

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