کلاس آموزش ساخت CNC در یک روز

گروه صنعتی CNCkaran

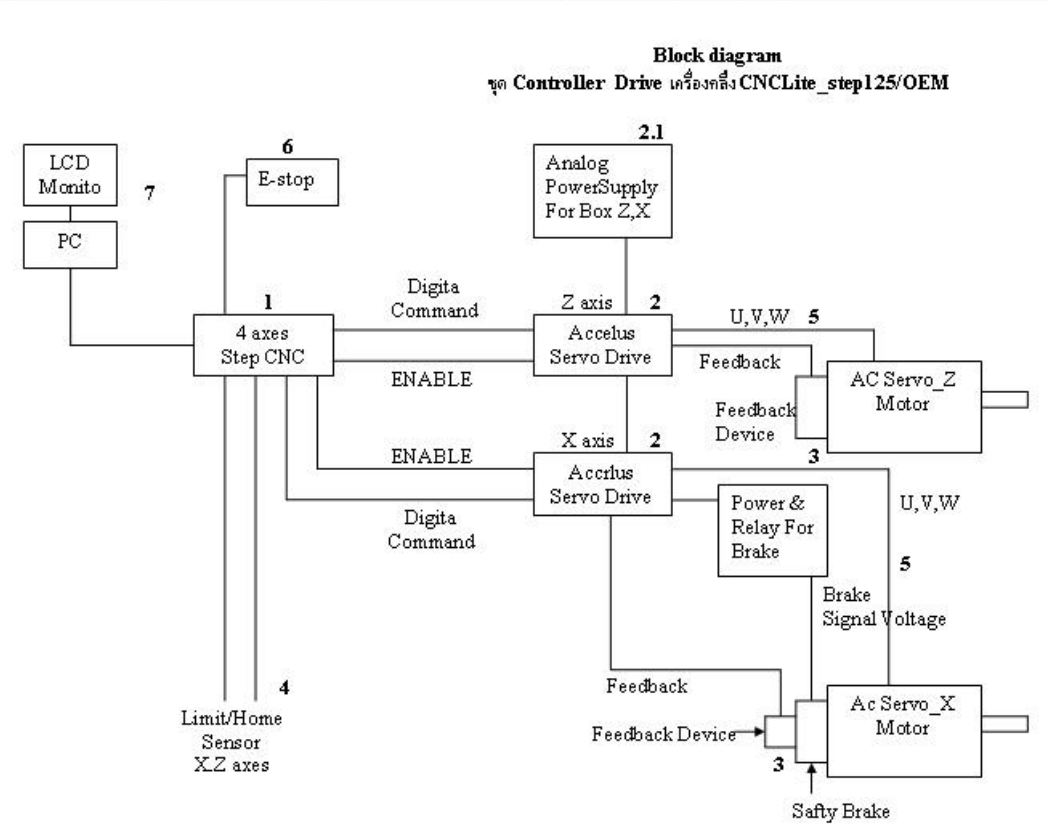
استاد درس : احمد شخم گر

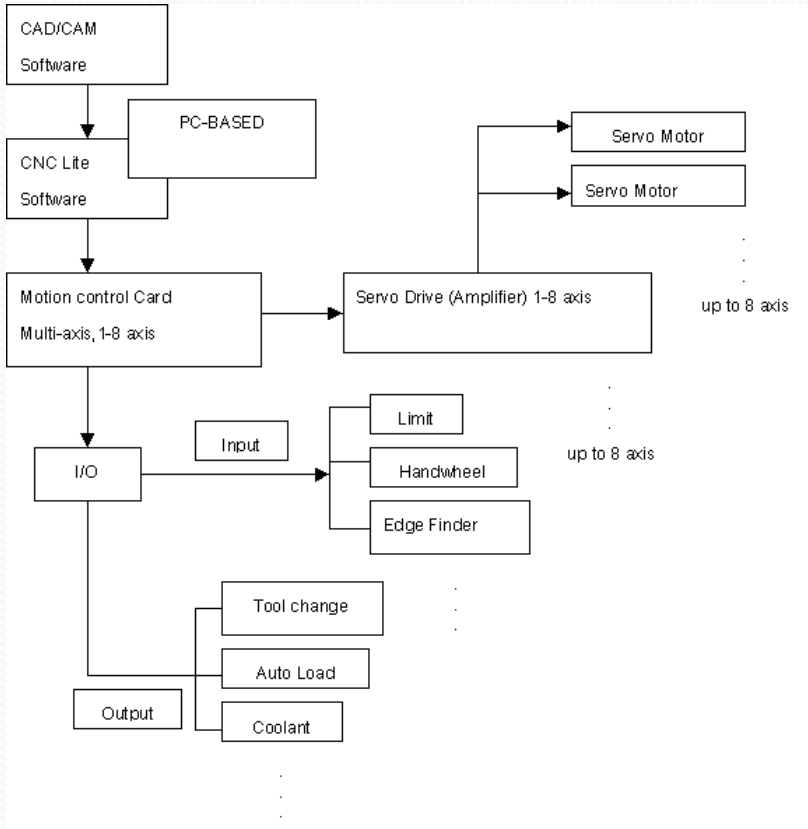
بهار ۱۳۹۱

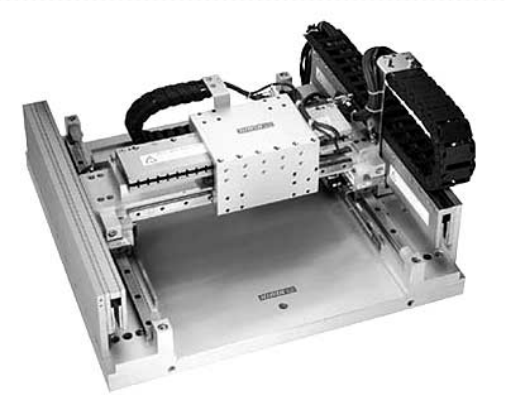
سیلابس دوره

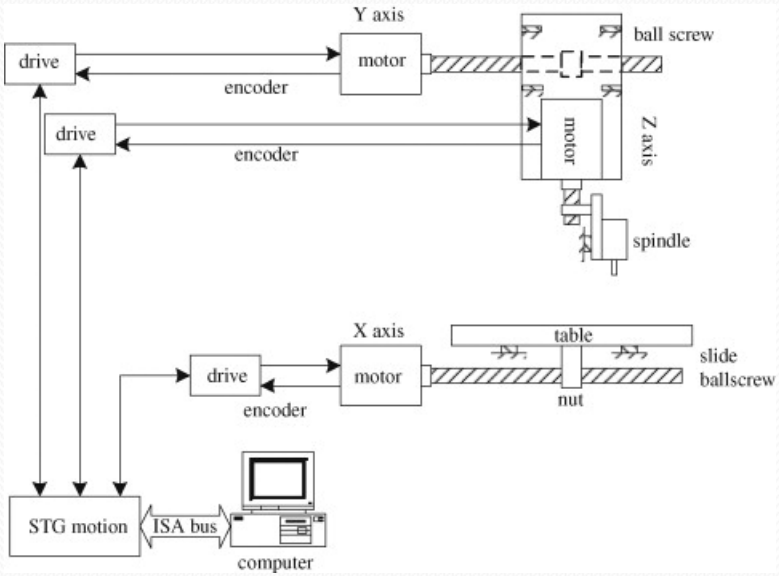
- اصول دستگاههای CNC
- اصول الکتریک و الکترونیک
- اصول مکانیک
- کنترلر
- اینورتر
- انکودر
- سرو موتور
- اسپیندل
- تابلو برق
- ریل های حرکتی
- بال اسکرو
- شاسی

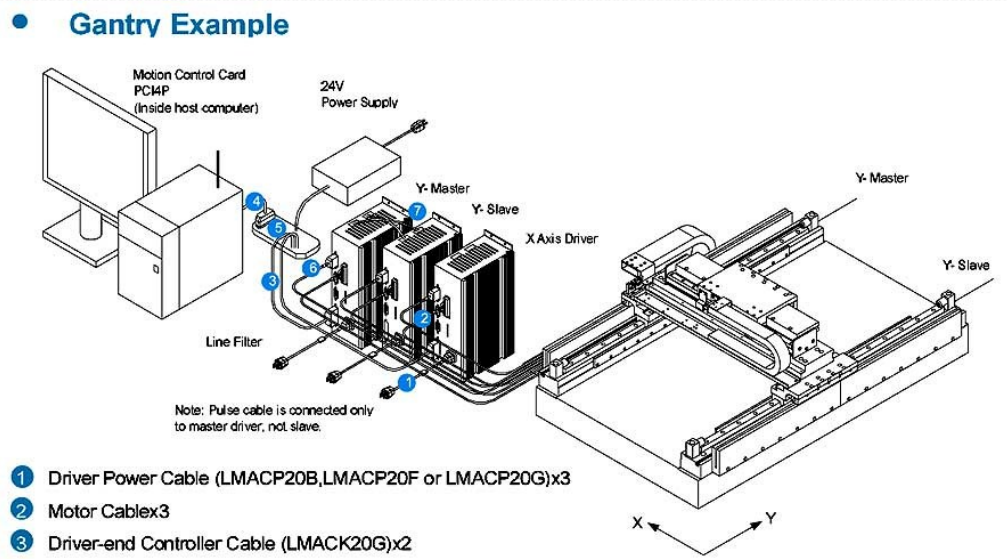
بلوک دیاگرام دستگاههای CNC



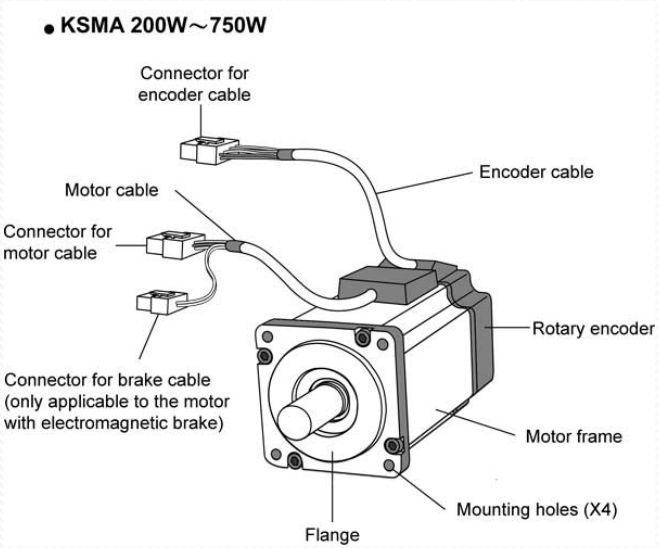








الکتریک



انکودر

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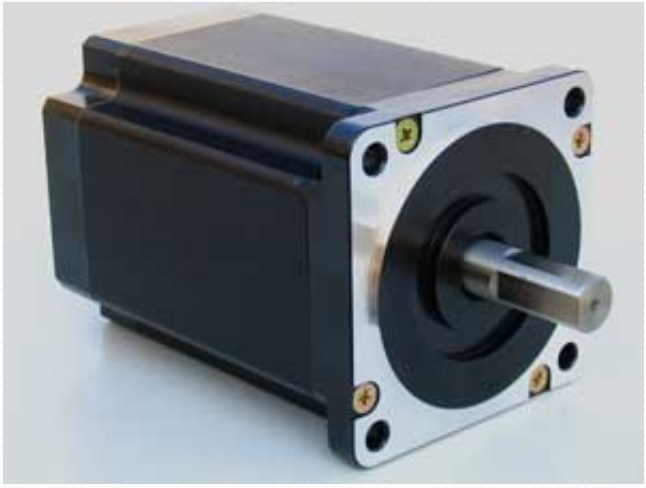
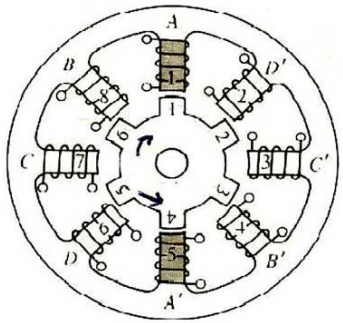
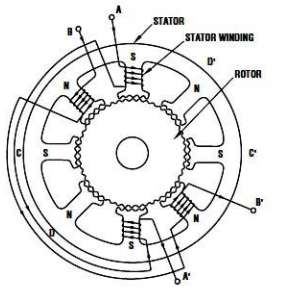
اینورتر

استپر موتور







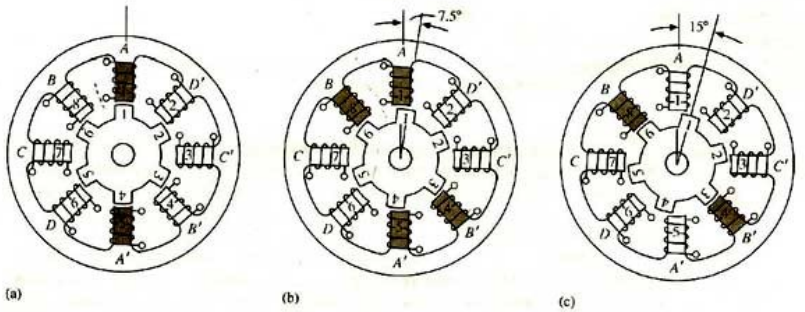
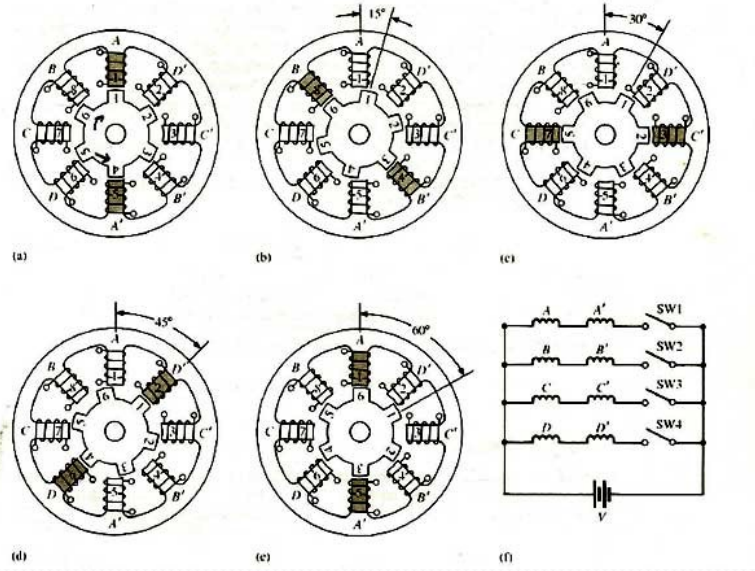


FIGURE 3 The switching sequence for the eight-step input (half-step mode).



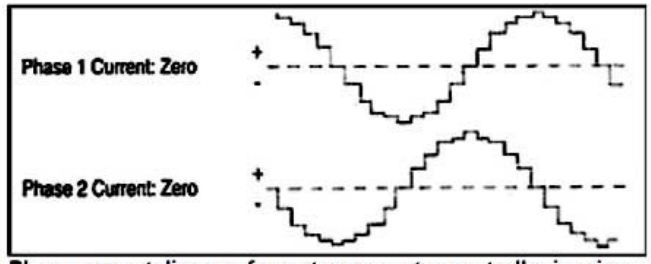
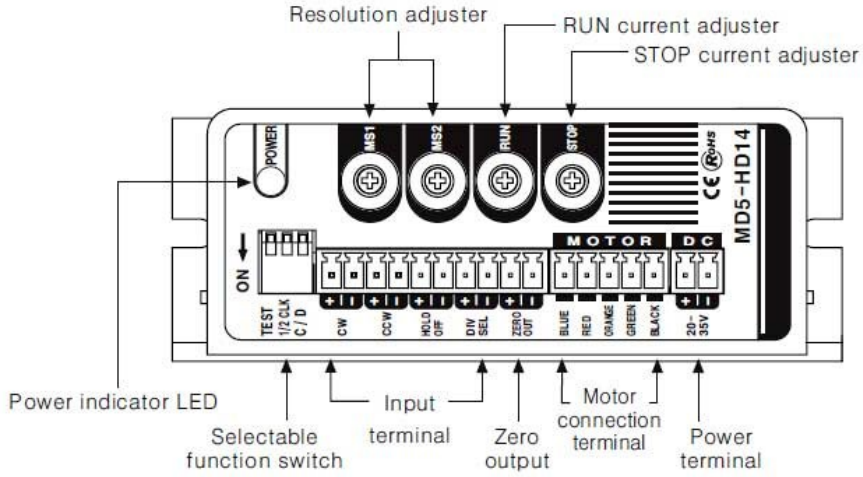


FIGURE 4. Phase-current diagram for a stepper motor controller in micro step mode.

استپر موتور



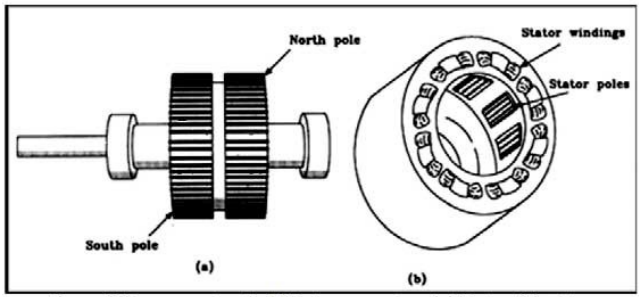


Figure 6 Components of a PM stepper motor: (a) Rotor; (b) stator

◎RUN current setting

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current (A/Phase)	0.4	0.5	0.57	0.63	0.71	0.77	0.84	0.9	0.96	1.02	1.09	1.15	1.22	1.27	1.33	1.4

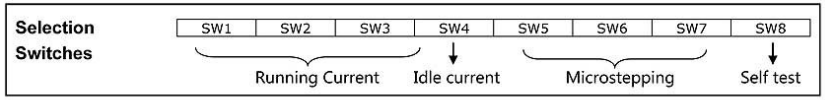
※RUN current is phase current provided to 5-phase stepping motor.
※RUN current is set under the rated current of motor, it may cause loss of torque.
※Torque is increased as raise RUN current, but, motor emits heat too much, therefore select depending on the load.

◎STOP current setting

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
%	27	31	36	40	45	50	54	58	62	66	70	74	78	82	86	90

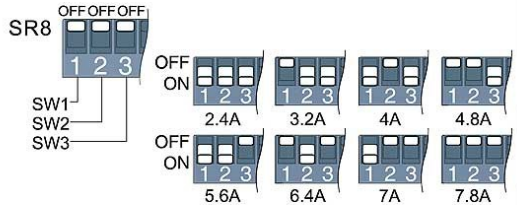
※It sets current when motor is at standstill.
※Set STOP current is percentage of RUN current.
※It is operated when HOLD OFF is [L]. Current supplied to each phase is cut in [H], auto Current Down function does not work.

استپر موتور



Running Current

The output current of the SR8 Step Drive is set by the SW1, SW2, and SW3 switches and can be changed as necessary. There are 8 settings available according to the ON/OFF combination of the switches.

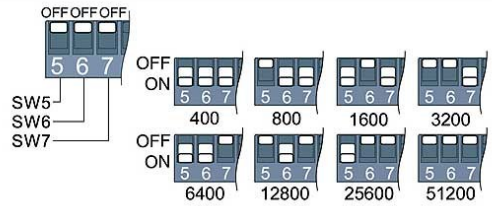


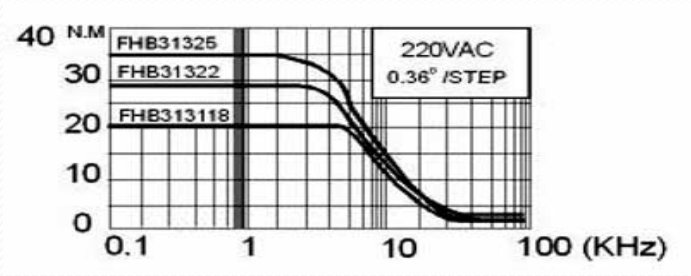
Idle Current

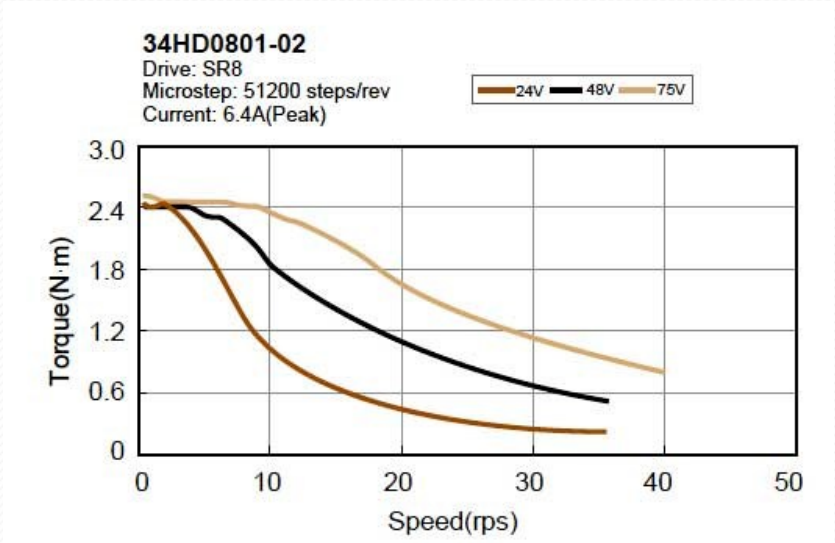
The running current of the SR8 drive is automatically reduced anytime the motor isn't moving. Setting the SW4 switch to ON reduces the current to 50% of it running value. Setting this switch to OFF maintains 90% of the running current. This 90% setting is useful when a high holding torque is required. To minimize motor and drive heating it is highly recommended that the idle current reduction feature be set to 50% unless the application requires the higher setting.

Microstepping

The microstep resolution is set by the SW5, SW6 and SW7 switches. There are 8 settings.







سوالات

- فرض کنیم یک محور با موتور استپ داریم . درایو ما میکرو استپ باشد و تقسیمات موتور را بر روی ۲۰ گذاشته باشیم . در هر سه حالت زیر دقت و سرعت حرکت را در ۳۰۰ دور بر دقیقه محاسبه کنید ۱- سیستم بال اسکرو با گام ۱۰ باشد ۲- چرخدنده شانه ای به قطر ۳ سانتیمتر و ۳ – تسمه تایمینگ با قطر پولی ۱۵ سانتیمتر

- درصورتیکه موتور ما ۱ نیوتن متر گشتاور داشته باشد در هر سه حالت فوق نیروی جلوبرنده را محاسبه کنید

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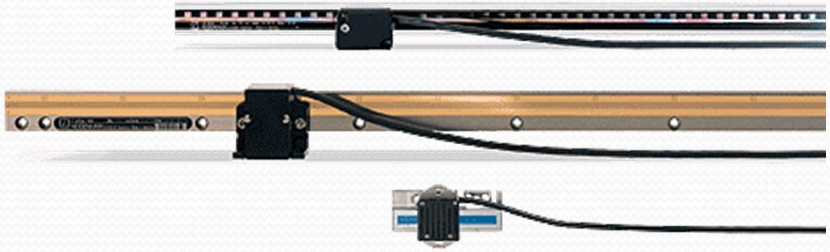

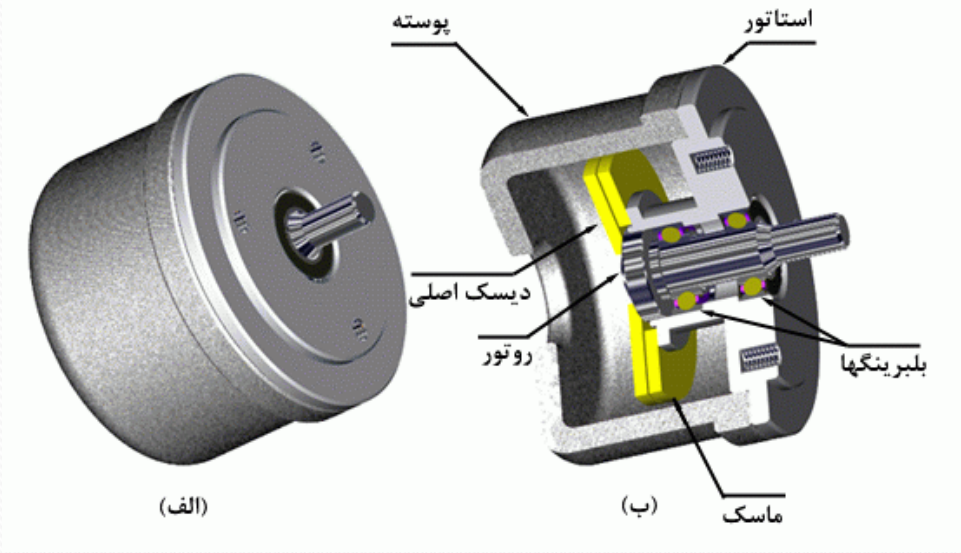

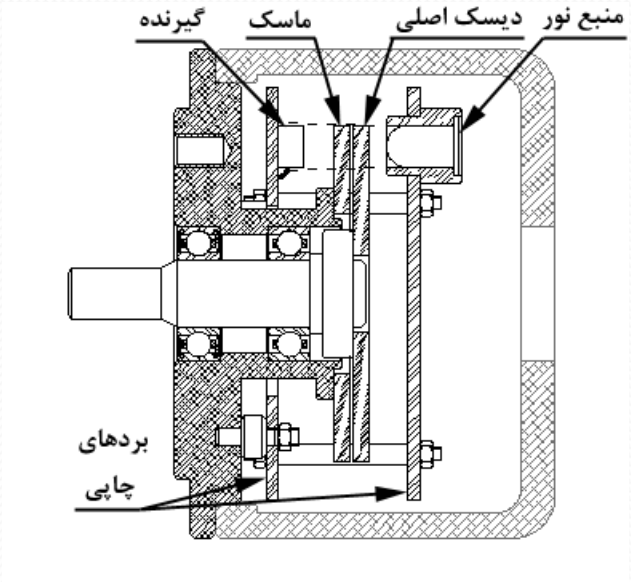

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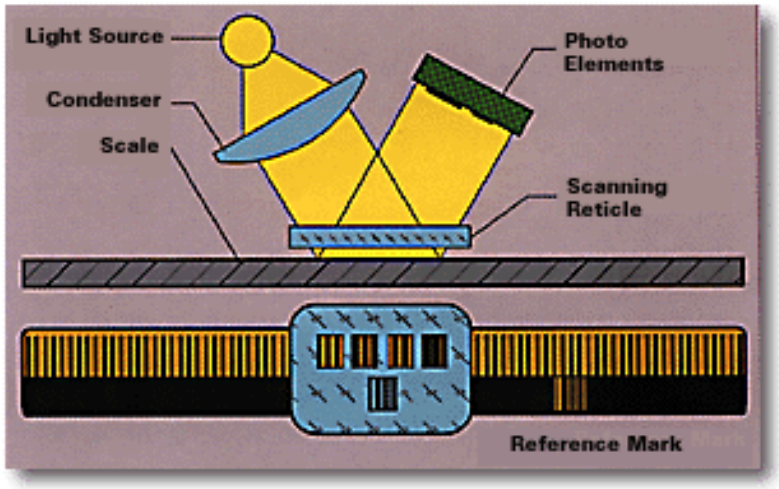

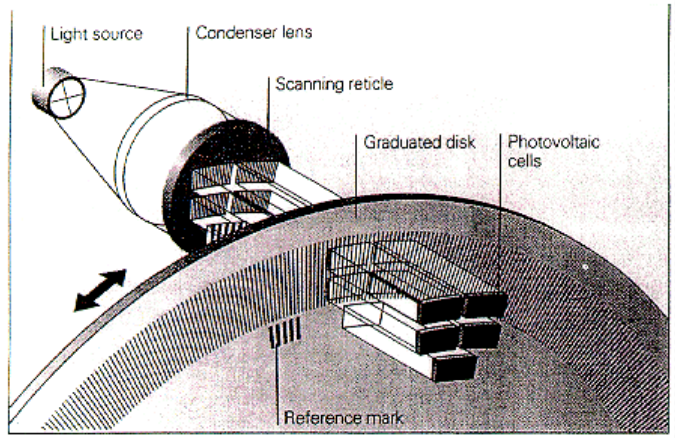

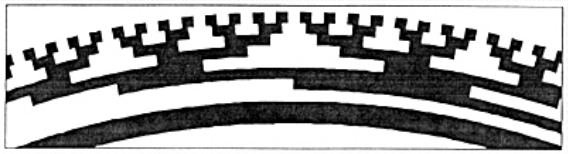

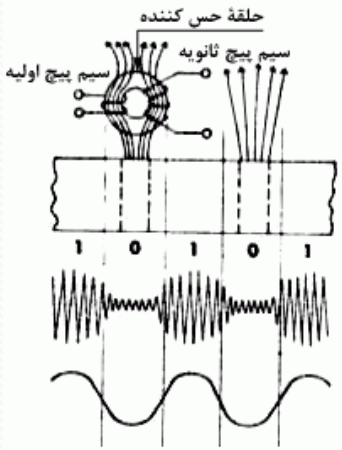

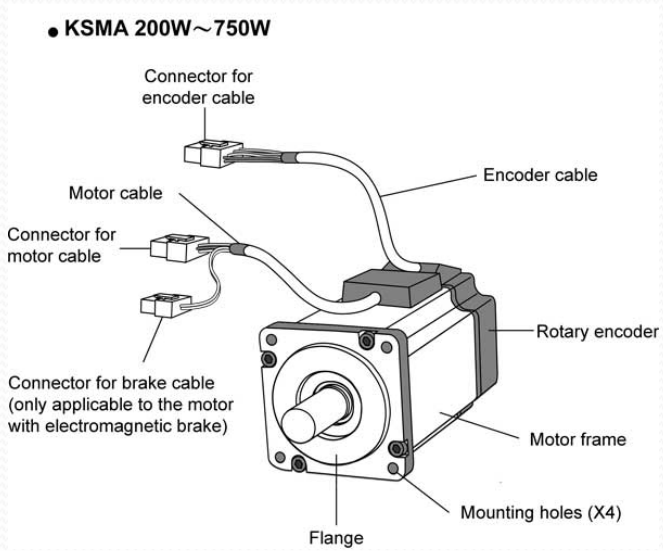

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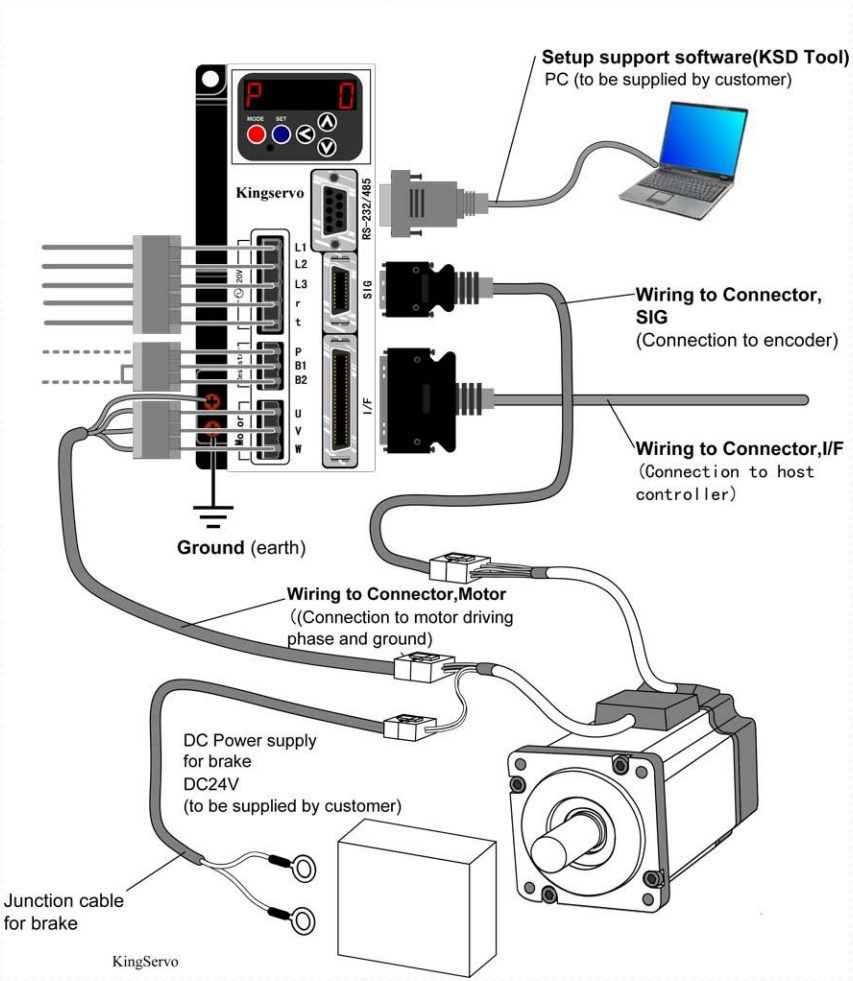

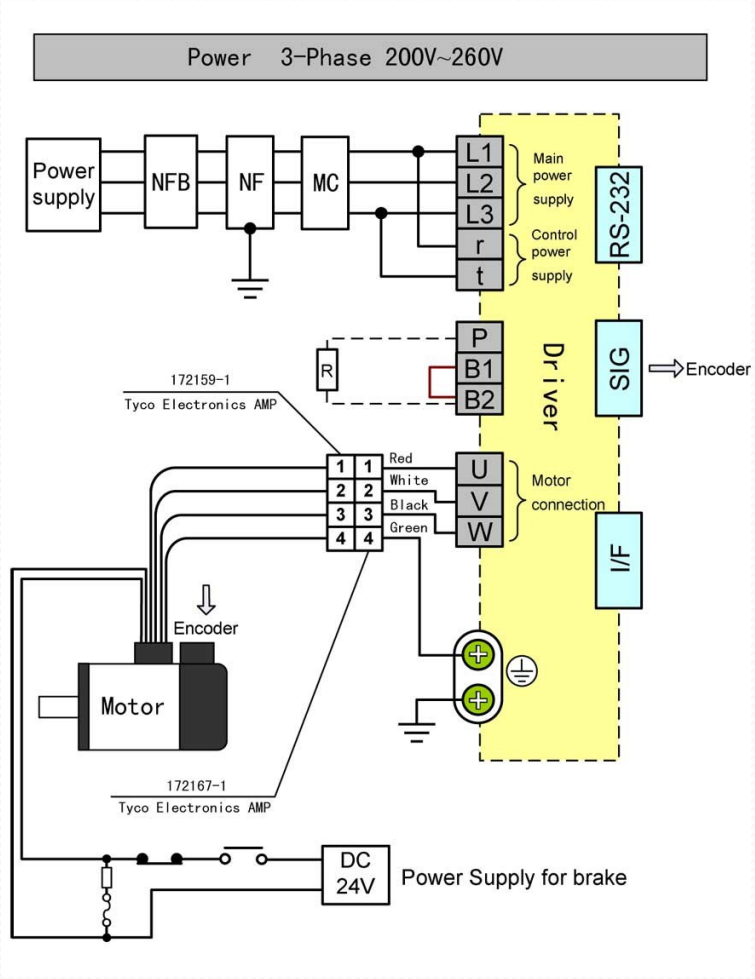

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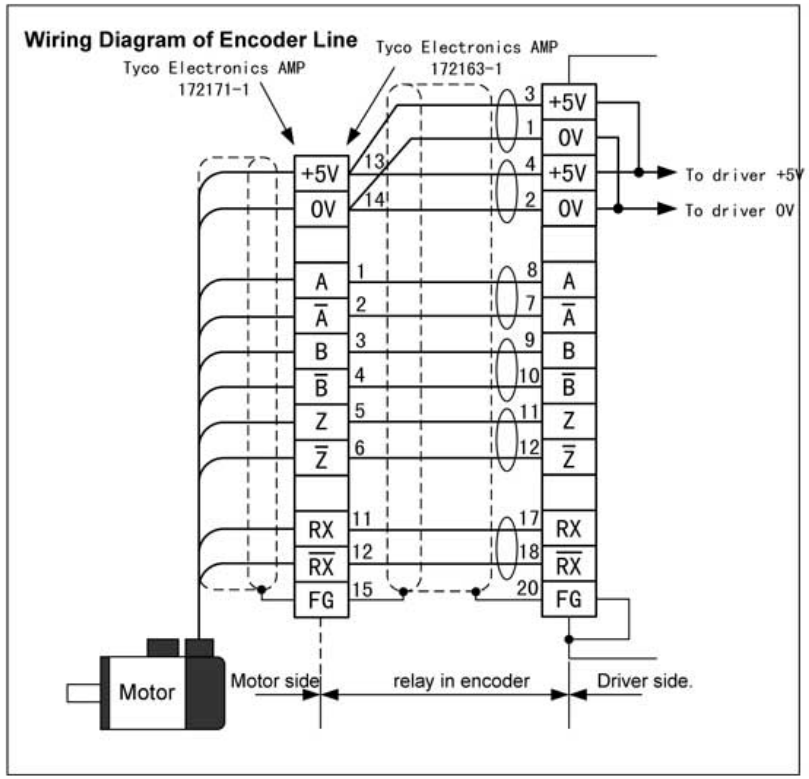
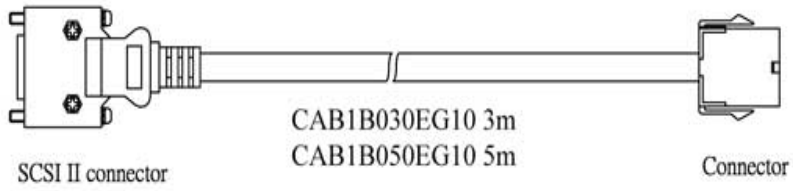
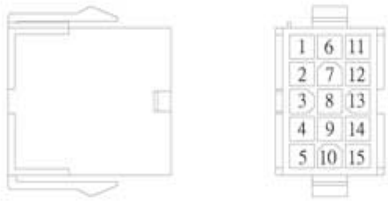
.Wiring Diagram of Encoder Line



2-3-1Cable of Encoder



Connector



15 PIN

NO.	1	2	3	4	5	6	7-10	11	12	13	14	15
Pin Definition	A	/A	B	/B	Z	/Z	NC	RX	/RX	VCC	GND	FG
Color	Red	Green	Black	White	Yellow	Blue		Gray	Orange	Brown/ Light RED	Purple/ Ligth Green	Grounding Line of Isolation Net

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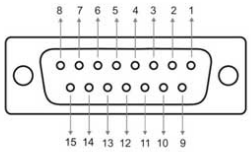
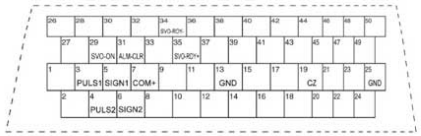
Connection between RadonixPC+ and Kingservo KSDG



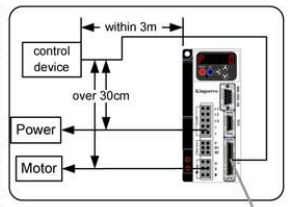
RadonixPC+ (DB15F)



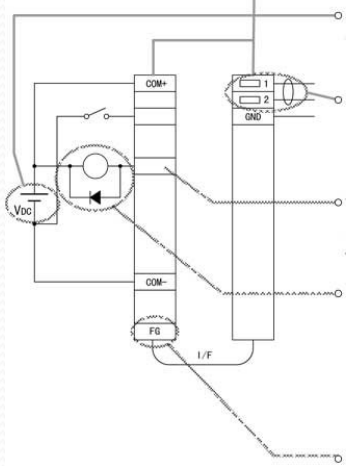
KSDG (50 Pins)

RadonixPC+ Pin	Description	KSDG Pin
1	VCC +24 V	7
2	Direction -	6
3	Direction +	5
4	Pulse -	4
5	Pulse +	3
6	Servo On	29
7	Ready	35
8	Encoder Zero	19
9	Alarm Reset	31
10	Ground	
11	Ground	
12	Ground	
13	Ground	34
14	Ground	13
15	Ground	25

2-5 Wiring of Connector I/F

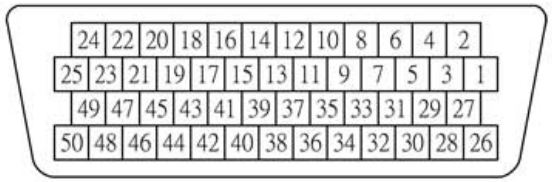


- Wiring connecting to pheripheral devices such as upper-level controller shall be shorter than 3 meters.
- Keep 30 cm with wiring of main line. Donot bind them together through the same groove.



- Prepare the VDC between COM+~COM- by the user. The Voltage is DC +12~+24V.
- Use shielded twisted pair as the wiring of command pulse input and signal output of encoder etc.
- The voltage of output terminal of controlling signal shall not be over 24V or current of that shall not be over 50mA.
- While using output of controlling signal directly to drive relay, a diode and relay shall be in parallel according to the direction of diagram. If a diode is not installed or installed in wrong direction, it would damage driver.
- Earth terminal shall be connected with grounding line within the driver.

2-5-1 Pins of Connector I/F(SCSI II)



2-5-2Pin Signal ModeTable

Pin No.	Position Mode	Function		Speed Mode	Function		Torque Mode	Function	
1	OPC1	Position command Pulse 1	input						
2	OPC2	Position command Pulse 2	input						
3	PULS1	Position command Pulse 2	input						
4	PULS2	Position command Pulse 2	input						
5	SIGN1	Position command Signal 2	input						
6	SIGN2	Position command Signal 2	input						
7	COM+	Signal Power (+)		COM+	Signal Power (+)		COM+	Signal Power (+)	
8	CW-LIMIT	CW-inhibition limit	input	CW-LIMIT	CW-inhibition limit	input	CW-LIMIT	CW-inhibition limit	input
9	CCW-LIMIT	CCW-inhibition limit	input	CCW-LIMIT	CCW-inhibition limit	input	CCW-LIMIT	CCW-inhibition limit	input
10	BK-OFF-	Brake release(-)	output	BK-OFF-	Brake release(-)	output	BK-OFF-	Brake release(-)	output
11	BK-OFF+	Brake release(+)	output	BK-OFF+	Brake release(+)	output	BK-OFF+	Brake release(+)	output
12	ZSP	Zero-speed detection	output	ZSP	Zero-speed detection	output	ZSP	Zero-speed detection	output
13	GND	Signal ground							
14				SPR	Speed command	input	SPR/TRQR	Torque command or speed command	input
15	GND	Signal ground		GND	Signal ground		GND	Signal ground	
16	CCWTL	CCW Torque Limit	input	CCWTL	CCW Torque Limit	input	CCWTL/TRQR	Torque command	input
17	GND	Signal ground		GND	Signal ground		GND	Signal ground	
18	CWTL	CW Torque limit	input	CWTL	CW Torque limit	input			
19	CZ	Z-phase output (OPC)	output	CZ	Z-phase output (OPC)	output	CZ	Z-phase output (OPC)	output
20									
21	OA+	A-phase output(+)	output	OA+	A-phase output(+)	output	OA+	A-phase output(+)	output
22	OA-	A-phase output(-)	output	OA-	A-phase output(-)	output	OA-	A-phase output(-)	output
23	OZ+	Z-phase output(+)	output	OZ+	Z-phase output(+)	output	OZ+	Z-phase output(+)	output

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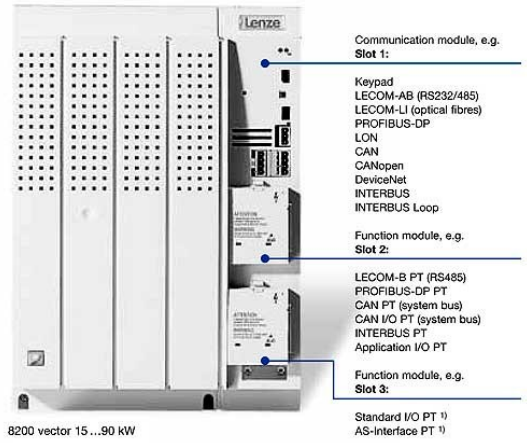
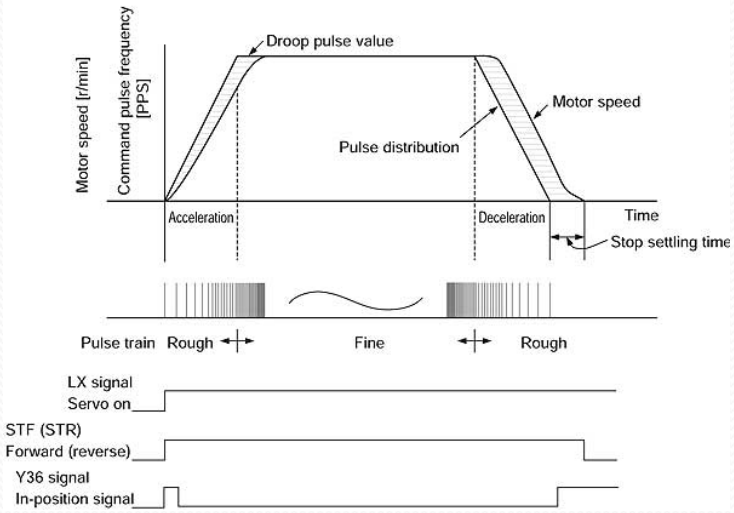
23	OZ+	Z-phase output(+)	output	OZ+	Z-phase output(+)	output	OZ+	Z-phase output(+)	output
24	OZ-	Z-phase output(-)	output	OZ-	Z-phase output(-)	output	OZ-	Z-phase output(-)	output
25	GND	Signal ground		GND	Signal ground		GND	Signal ground	
26				ZERO-SPD	Speed zero clamp input	input	ZERO-SPD	Speed zero clamp input	input
27	GAIN	Gain switching input	input	GAIN	Gain switching input	input	GAIN	Gain switching input	input
28	DIV	Electronic gear selection	input	INSP3	internal speed selection 3	input			
29	SVO-ON	Servo-ON input	input	SVO-ON	Servo-ON input	input	SVO-ON	Servo-ON input	input
30	CLR	Deviation counter clear input	input	INSP2	internal speed selection 2	input			
31	ALM-CLR	Alarm clear input	input	ALM-CLR	Alarm clear input	input	ALM-CLR	Alarm clear input	input
32	C-MODE	Control mode switching input	input	C-MODE	Control mode switching input	input	C-MODE	Control mode switching input	input
33	PULS-INH	Inhibition input of command pulse	input	INSP1	internal speed selection 1	input			
34	SVO-RDY-	Servo-Ready output(-)	output	SVO-RDY-	Servo-Ready output(-)	output	SVO-RDY-	Servo-Ready output(-)	output
35	SVO-RDY+	Servo-Ready output(+)	output	SVO-RDY+	Servo-Ready output(+)	output	SVO-RDY+	Servo-Ready output(+)	output
36	SVO-ALM-	Servo-Alarm output(-)	output	SVO-ALM-	Servo-Alarm output(-)	output	SVO-ALM-	Servo-Alarm output(-)	output
37	SVO-ALM+	Servo-Alarm output(+)	output	SVO-ALM+	Servo-Alarm output(+)	output	SVO-ALM+	Servo-Alarm output(+)	output
38	ON-POS-	Positioning complete output(	output	AT-SP-	Velocity complete output(-)	output	AT-SP-	Velocity complete output(-)	output
39	ON-POS+	Positioning complete output(	output	AT-SP+	Velocity complete output(+)	output	AT-SP+	Velocity complete output(+)	output
40	TLC	Torque limit detection	output	TLC	Torque limit detection	output	TLC	Torque limit detection	output
41	COM-	Signal power(-)		COM-	Signal power(-)		COM-	Signal power(-)	
42	IM	Torque monitor	output	IM	Torque monitor	output	IM	Torque monitor	output
43	SPM	Speed monitor	output	SPM	Speed monitor	output	SPM	Speed monitor	output
44	PULSH1	Position command Pulse 1	input						
45	PULSH2	Position command Pulse 1	input						
46	SIGNH1	Position command Signal 2	input						
47	SIGNH2	Position command Signal 2	input						
48	OB+	B-phase output(+)	output	OB+	B-phase output(+)	output	OB+	B-phase output(+)	output
49	OB-	B-phase output(-)	output	OB-	B-phase output(-)	output	OB-	B-phase output(-)	output
50	FG	Frame ground		FG	Frame ground		FG	Frame ground	

اینورتر



“ Global standard iC5,



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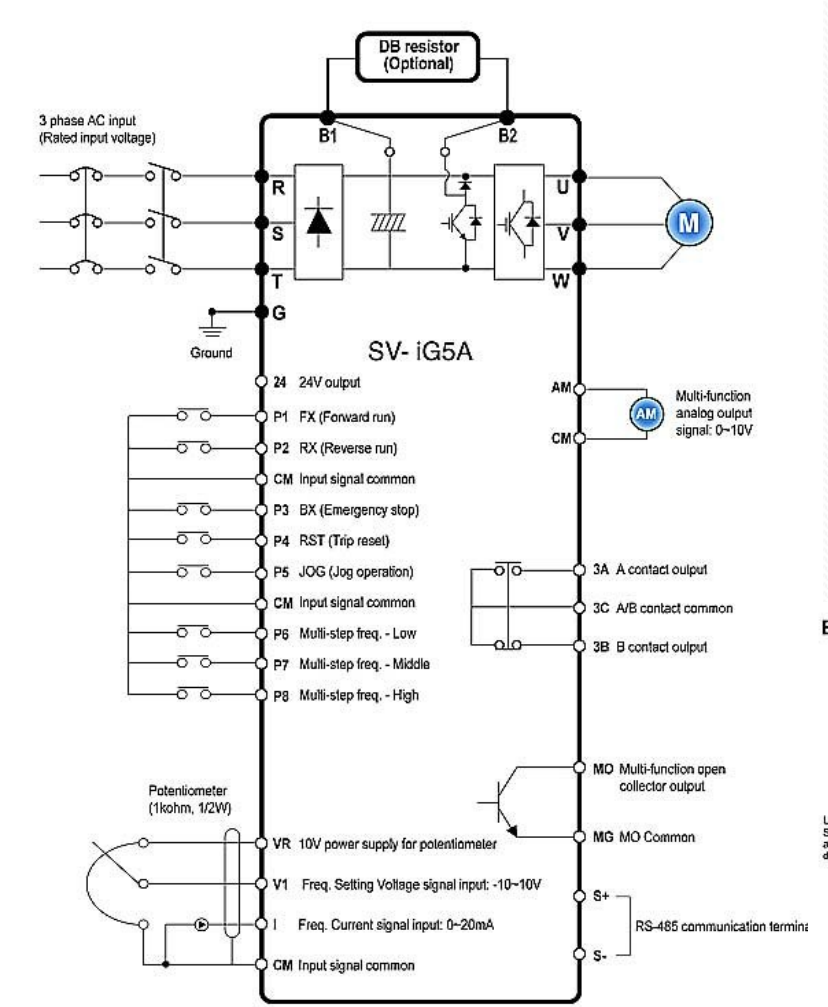
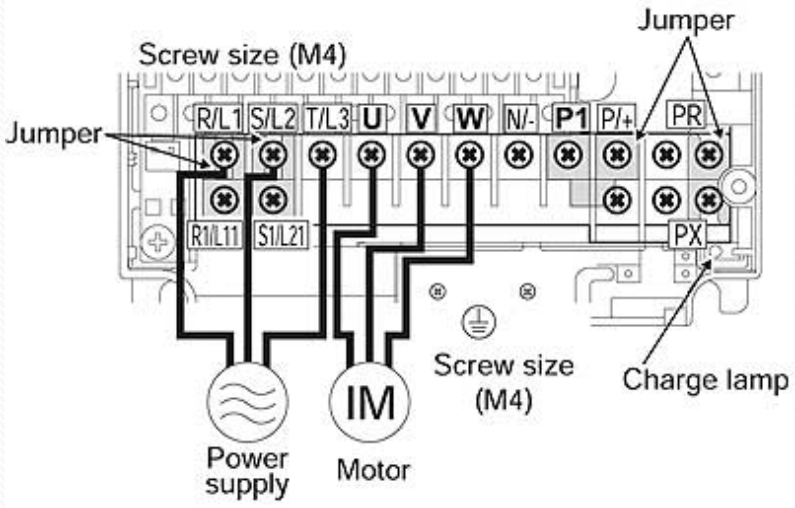
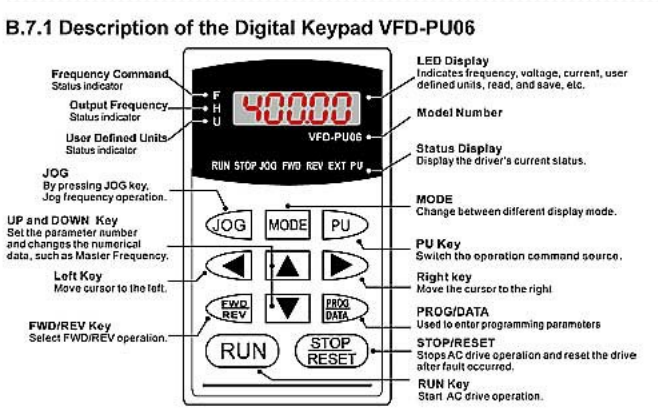
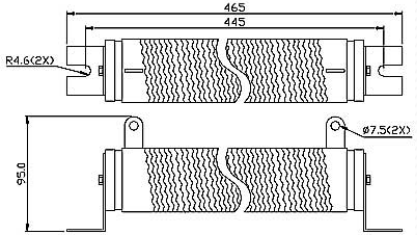








Chapter 6 Fault Code Information and Maintenance

6.1 Fault Code Information

The AC motor drive has a comprehensive fault diagnostic system that includes several different alarms and fault messages. Once a fault is detected, the corresponding protective functions will be activated. The following faults are displayed as shown on the AC motor drive digital keypad display. The five most recent faults can be read from the digital keypad or communication.

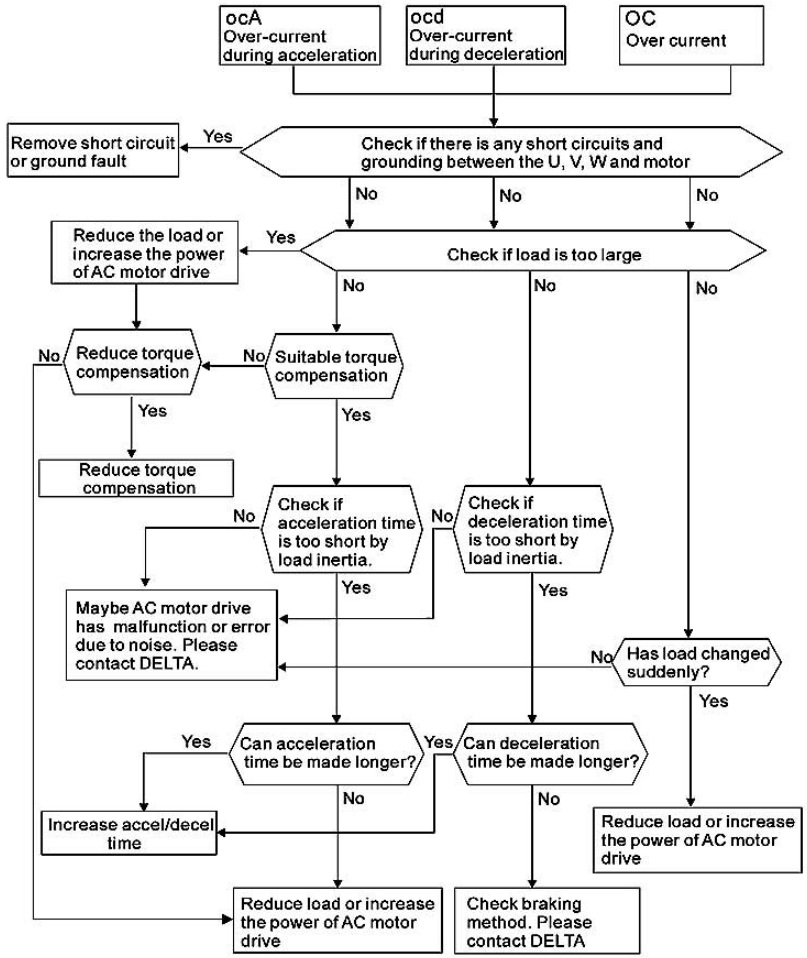
NOTE

Wait 5 seconds after a fault has been cleared before performing reset via keypad of input terminal.

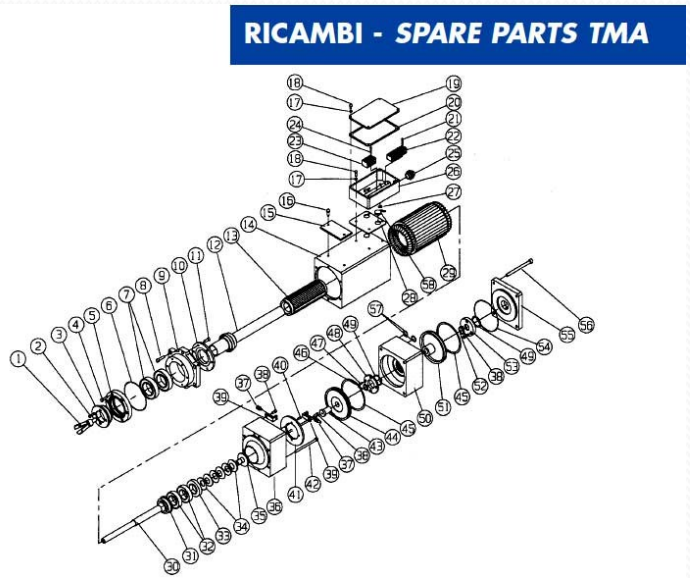
6.1.1 Common Problems and Solutions

Fault Name	Fault Descriptions	Corrective Actions
oc	**Over current** Abnormal increase in current.	1. Check if motor power corresponds with the AC motor drive output power. 2. Check the wiring connections to U/T1, V/T2, W/T3 for possible short circuits. 3. Check the wiring connections between the AC motor drive and motor for possible short circuits, also to ground. 4. Check for loose contacts between AC motor drive and motor. 5. Increase the Acceleration Time. 6. Check for possible excessive loading conditions at the motor. 7. If there are still any abnormal conditions when operating the AC motor drive after a short-circuit is removed and the other points above are checked, it should be sent back to manufacturer.
ou	**Over voltage** The DC bus voltage has exceeded its maximum allowable value.	1. Check if the input voltage falls within the rated AC motor drive input voltage range. 2. Check for possible voltage transients. 3. DC-bus over-voltage may also be caused by motor regeneration. Either increase the Decel. Time or add an optional brake resistor (and brake unit). 4. Check whether the required brake power is within the specified limits.

5.1 Over Current (OC)



اسپیندل موتور



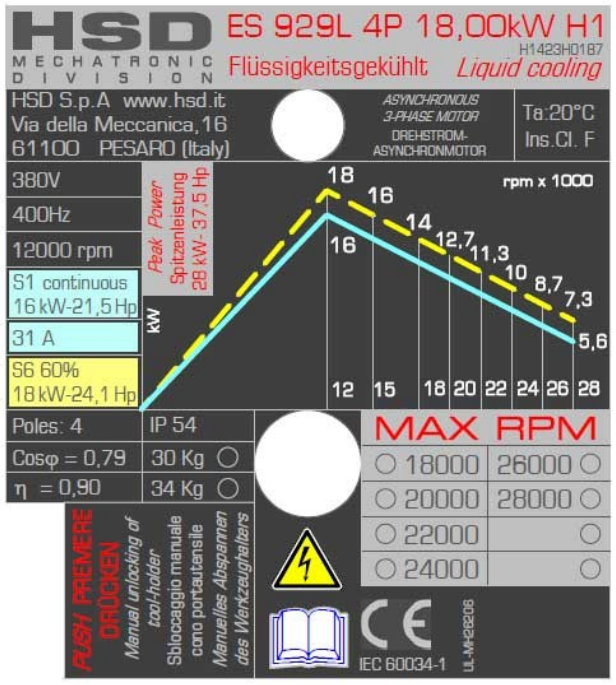
اسپیندل موتور

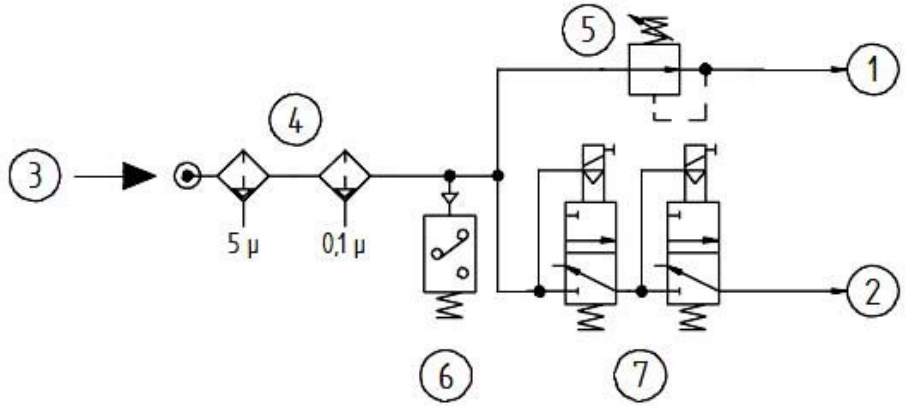
Serie PEO TMPEO

TIPO TYPE	TENSIONE VOLTAGE (VOLT)			FREQU. (HZ)	GIRI (rpm)	POT. RESA OUT. POW. (KW)	ASSORB. ABSORB. (amp)			COS φ	PESO WEIGHT (Kg)
	Standard	a richiesta *on request*					Standard	a richiesta *on request*			
PEO 3.5/2	220	380	220/380	200	12000	0.08	0.60	0.34	0.60/0.34	0.65	1.2
PEO 3.5/2	380	220	220/380	300	18000	0.12	0.45	0.78	0.78/0.45	0.69	1.2
PEO 6/2	380	220	220/380	100	6000	0.05	0.26	0.45	0.45/0.26	0.61	1.5
PEO 6/2	220	380	220/380	200	12000	0.15	0.80	0.45	0.80/0.45	0.68	1.5
PEO 6/2	380	220	220/380	300	18000	0.30	1.00	1.70	1.70/1.00	0.70	1.5
PEO 7.5/2	380	220	220/380	100	6000	0.07	0.32	0.55	0.55/0.32	0.61	1.8
PEO 7.5/2	220	380	220/380	200	12000	0.18	1.20	0.69	1.20/0.69	0.64	1.8
PEO 7.5/2	380	220	220/380	300	18000	0.35	1.00	1.70	1.70/1.00	0.70	1.8
Per frequenze superiori contattare ns. ufficio tecnico. *For higher frequencies please contact our technical dept.*											
TMPEO 3.5/2	220	380	220/380	200	12000	0.08	0.60	0.34	0.60/0.34	0.65	1.4
TMPEO 3.5/2	380	220	220/380	300	18000	0.12	0.45	0.78	0.78/0.45	0.69	1.4
TMPEO 3.5/2	380	220	220/380	400	24000	0.15	0.52	0.90	0.90/0.52	0.70	1.4
TMPEO 6/2	380	220	220/380	100	6000	0.05	0.26	0.45	0.45/0.26	0.61	1.7
TMPEO 6/2	220	380	220/380	200	12000	0.15	0.80	0.45	0.80/0.45	0.68	1.7
TMPEO 6/2	380	220	220/380	300	18000	0.30	1.00	1.70	1.70/1.00	0.70	1.7

اسپیندل موتور

HSD
MECHATRONIC
DIVISION

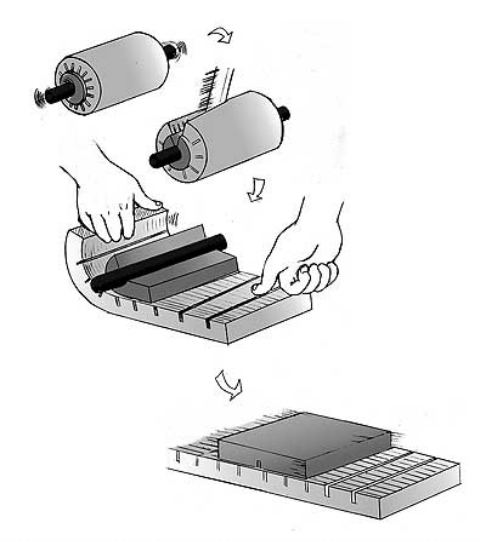


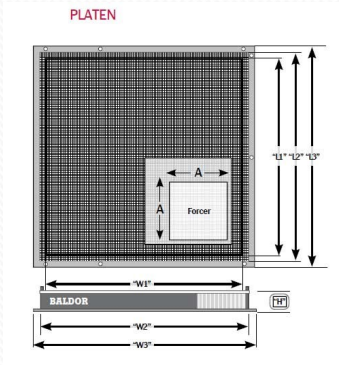


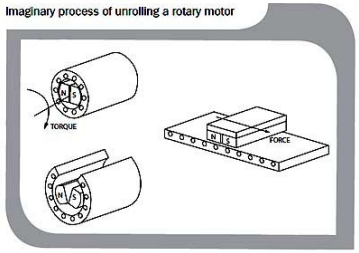
Typical compressed air connection diagram

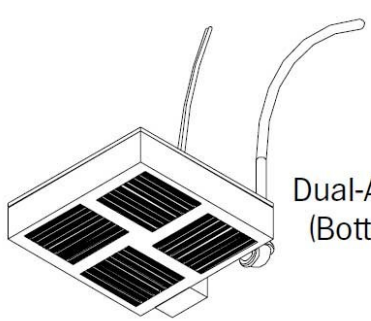
1	Cone cleaning and pressure air inlet	ES775	4 bar (58 PSI)
		ES779 , ES789	4 bar (58 PSI)
2	Tool holder release air inlet	ES775	6 / 7 bar (85/100 PSI)
		ES779 , ES789	10/12 bar (145/174 PSI)
3	Factory air supply inlet	ES775	6 / 7 bar (85/100 PSI)
		ES779 , ES789	10/12 bar (145/174 PSI)
4	Compressed air filtration/drying group with automatic condensate drain: first stage 5µ and second stage 0.1µ		
5	4 bar (58 PSI) pressure regulator		
6	Pressure switch		
7	Pair of 3 way, monostable solenoid valves		

لاینیر موتور





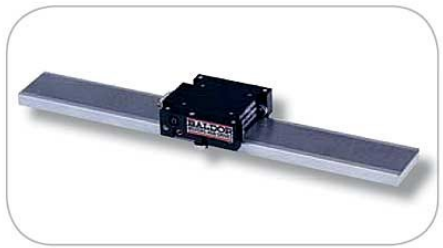


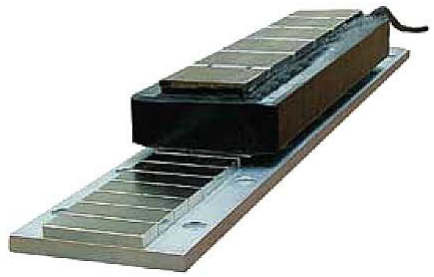


Dual-Axis Forcer
(Bottom view)

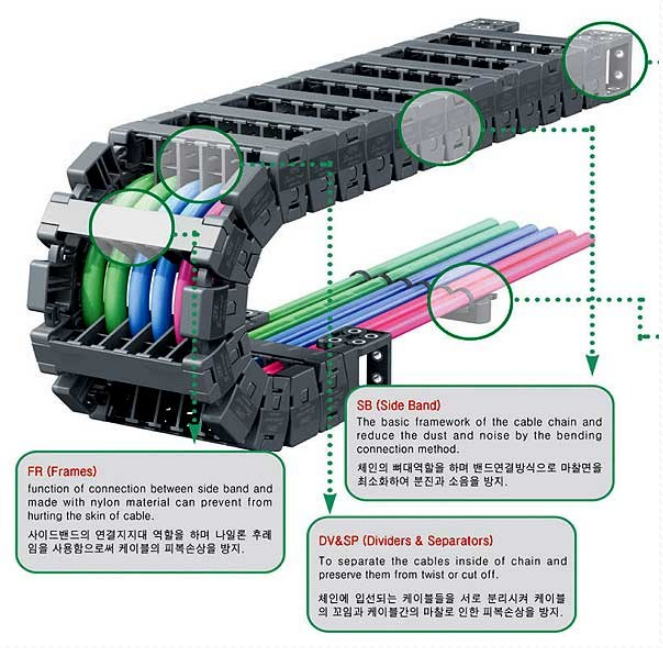
Single-Axis Stepper Motor

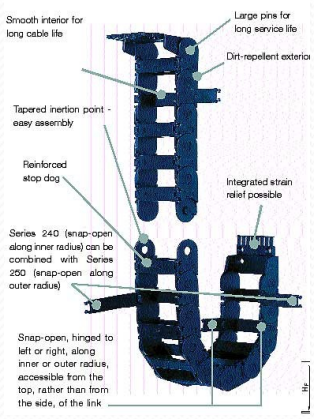
- Cost effective linear motion
- Open loop - no tuning or encoder are necessary
- Use with microstepping drive
- Multiple forcers with overlapping trajectories on a single platen
- Ceiling or wall mountable
- 9.8 m/s² [1g] typical accelerations @ 1 m/s [40 Ips]
- Acceleration up to 59 m/s² [6g] under 0.25 m/s [10 Ips]
- Forces to 222.4N [50 Lbs.]
- High repeatability 10 µm [0.0004 in]
- Unlimited travel
- Rapid settling times
- Roller bearings on 0600 and 1300 series. High stiffness air bearings on 2000 and 2500 series

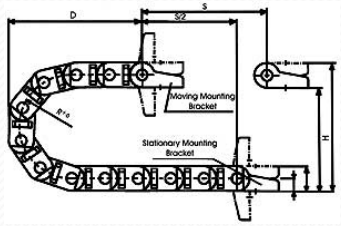


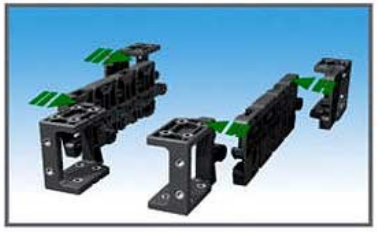


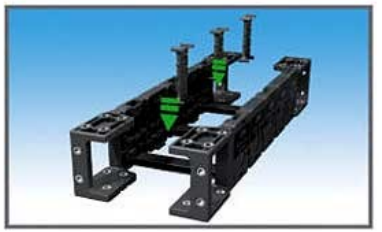
انرژی گاید – انرژی چین





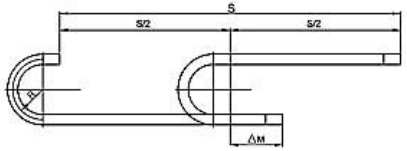






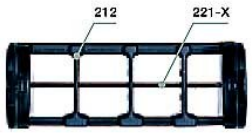
This formula is valid if the fixed end is outside the center of the travel.

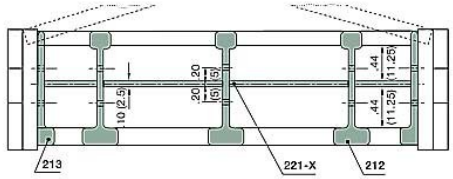
$$L_K = \frac{S}{2} + \Delta M + K$$



Option 2: full-width shelf

This option is available for the snap-open Series 240/250 chains. It is ideal for use in applications involving many thin cables with similar or identical diameters. This shelf slides into place and spans the entire width of the chain.





Side Plates	
Unassembled	Part No. 202
Assembled	Part No. 212

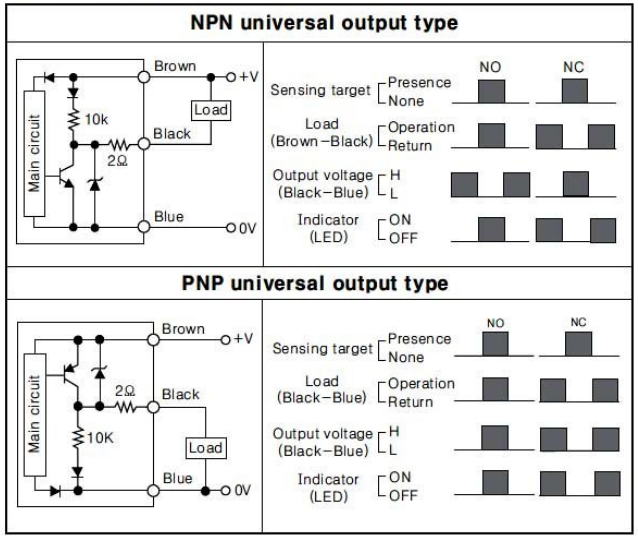
Side Plates	
Unassembled	Part No. 203
Assembled	Part No. 213

Width X in.	(mm)	Part No. Unassembled	Part No. Assembled
.98	(25)	220-25	221-25
1.50	(38)	220-38	221-38
2.24	(57)	220-57	221-57
3.03	(77)	220-77	221-77
3.54	(90)	220-90	221-90
4.06	(103)	220-103	221-103
4.92	(125)	220-125	221-125

میکروسویچ و پرکسیمیتی سویچ

▣Control output diagram

◎DC 3-wire type



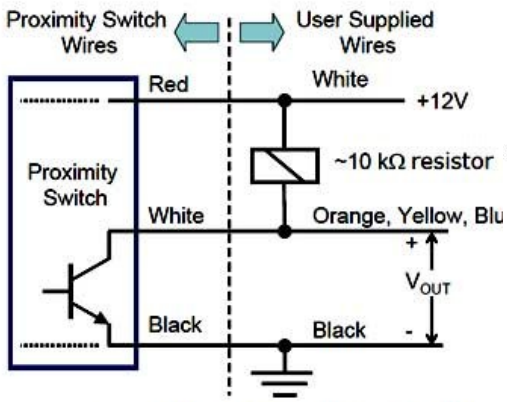
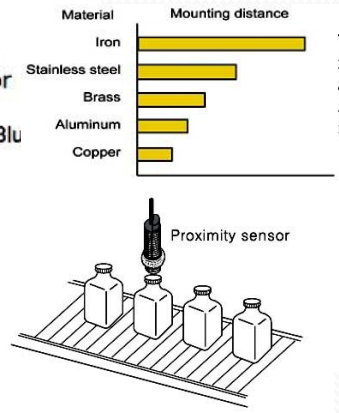
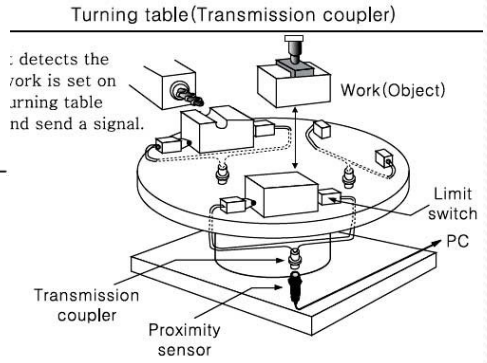


Figure 1. Typical Proximity Switch Wirin





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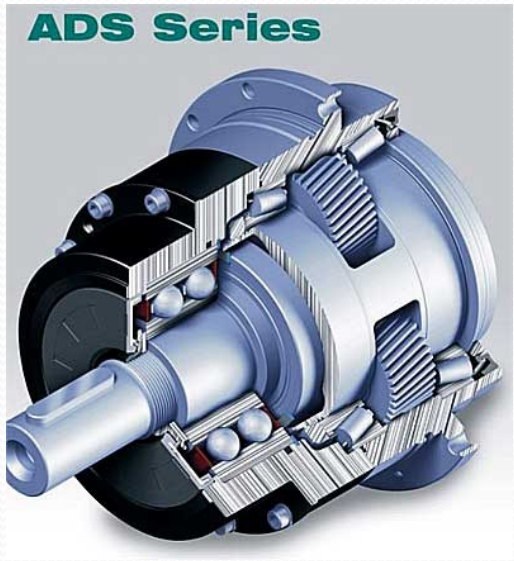
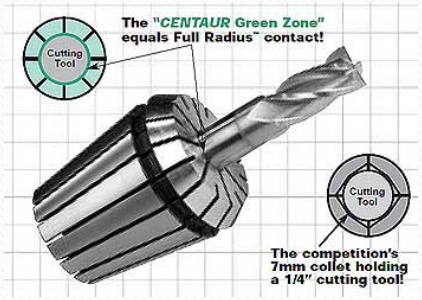




ال ام گاید

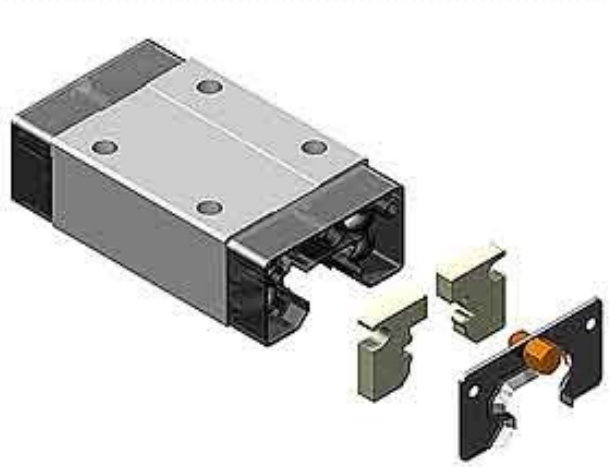
بوش ساچمه ای

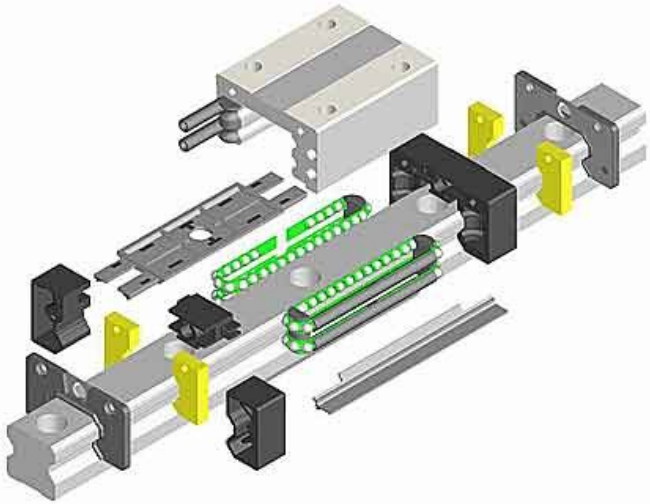
بال اسکرو

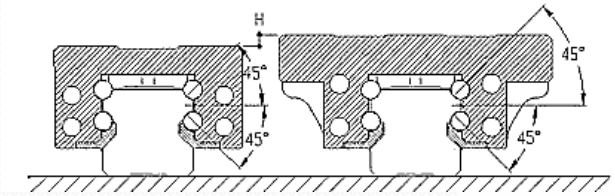
گیربکس

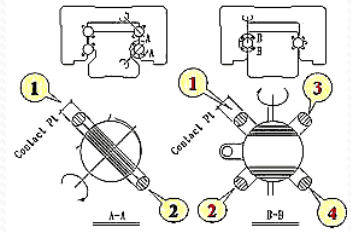
کولت

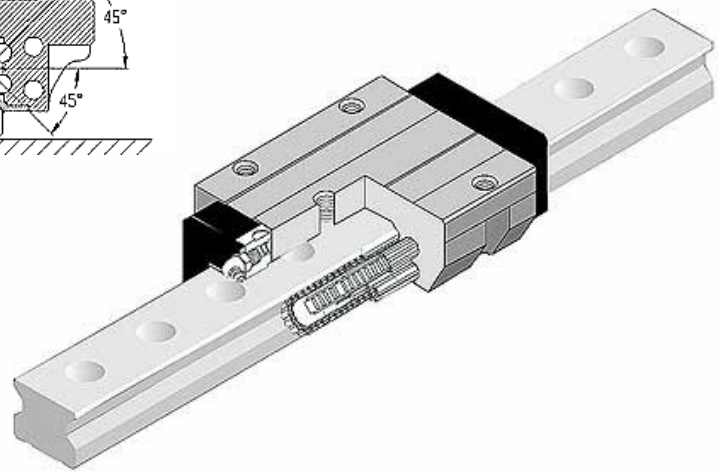
ال ام گاید











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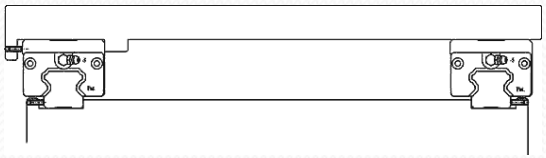

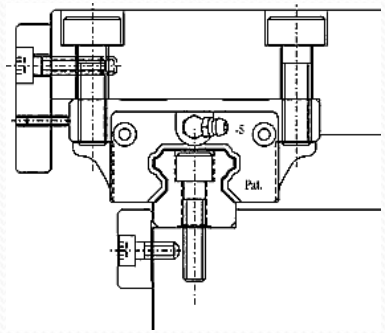

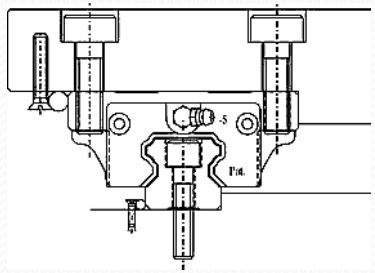

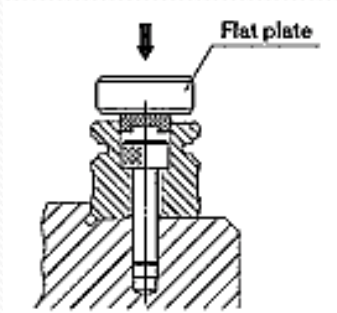

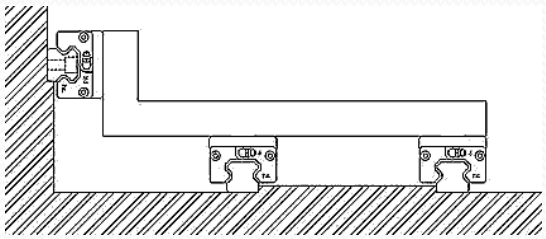

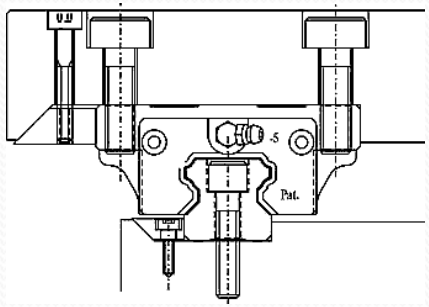

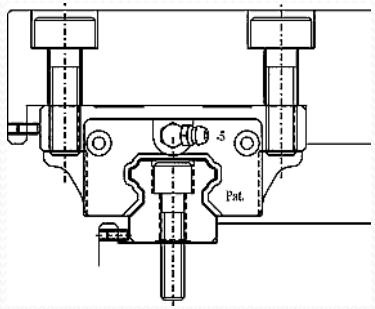

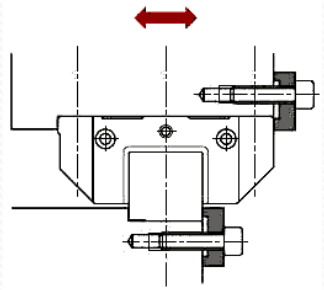

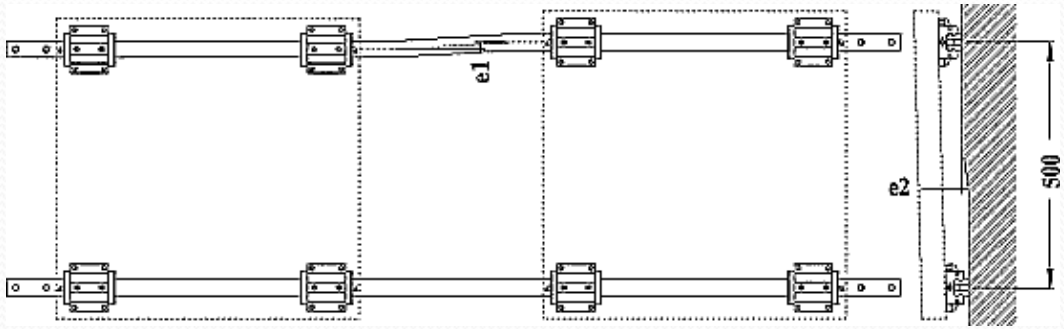

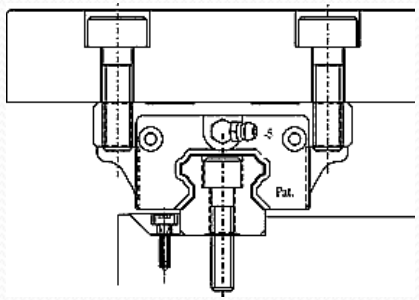

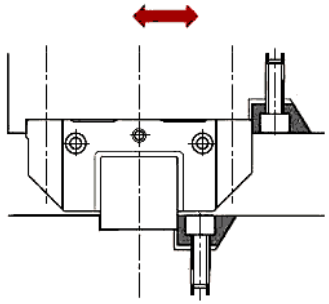

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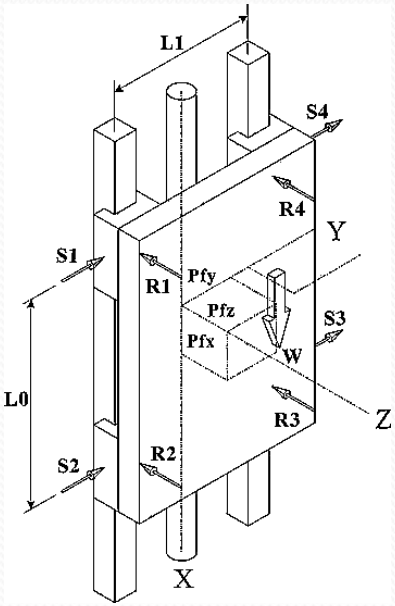
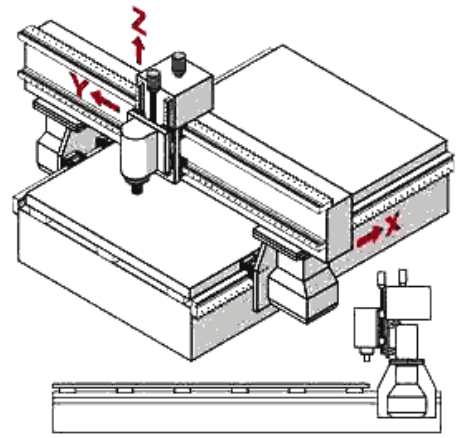
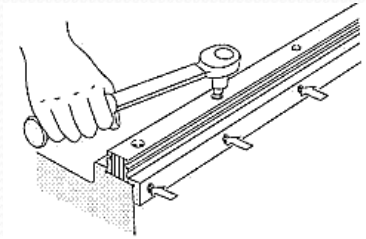
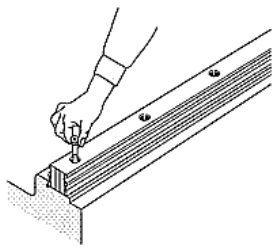
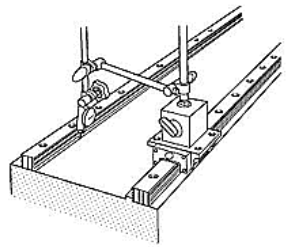
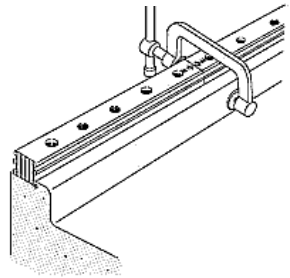












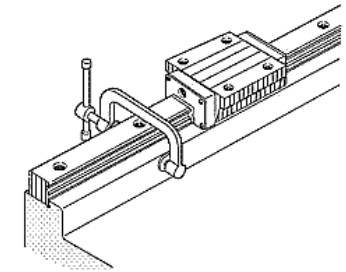
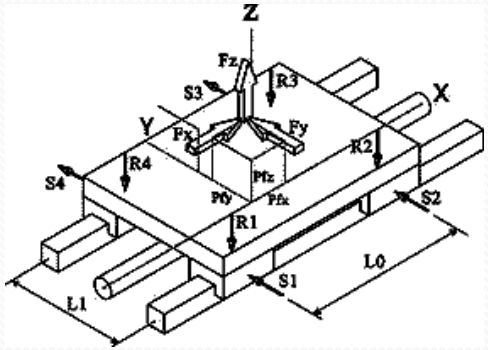
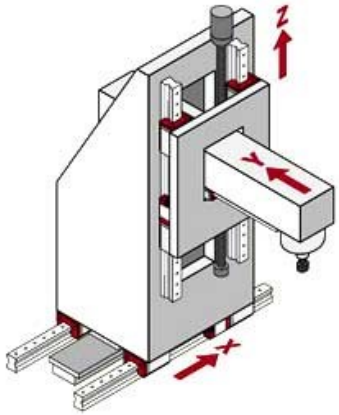


Fig. 24 Fixing of datum side track rail to the bed





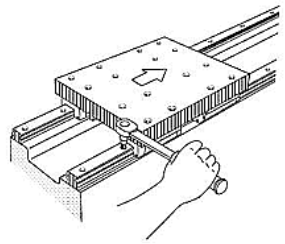
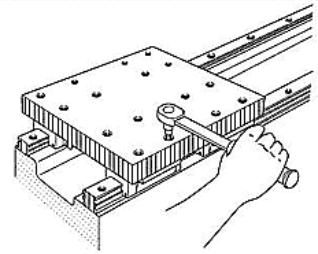


Fig. 26 Fixing of attendant side track rail



(1) Load on one block

Table 1.3 Caculation example of loads on block

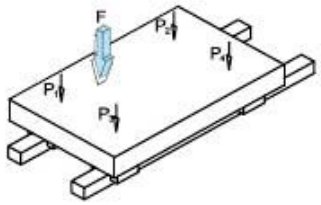
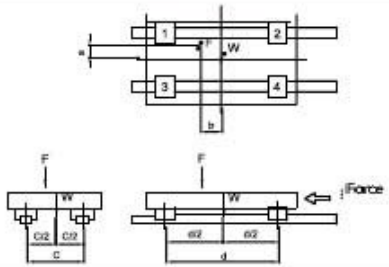
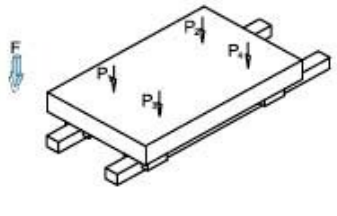
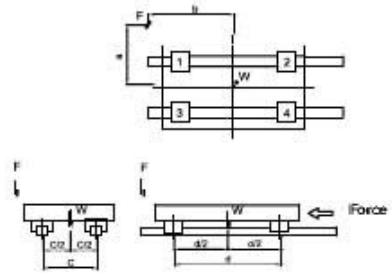
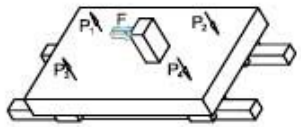
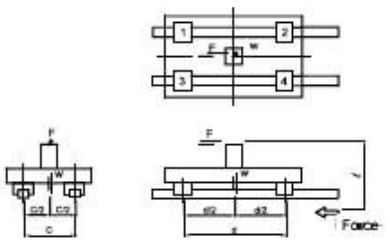
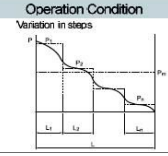
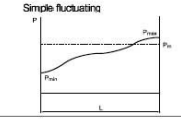
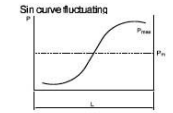
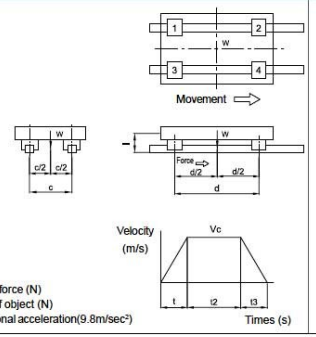
Patterns	Loads layout	Load on one block
		$P_1 = \frac{W}{4} + \frac{F}{4} + \frac{F \times a}{2c} + \frac{F \times b}{2d}$ $P_2 = \frac{W}{4} + \frac{F}{4} + \frac{F \times a}{2c} - \frac{F \times b}{2d}$ $P_3 = \frac{W}{4} + \frac{F}{4} - \frac{F \times a}{2c} + \frac{F \times b}{2d}$ $P_4 = \frac{W}{4} + \frac{F}{4} - \frac{F \times a}{2c} - \frac{F \times b}{2d}$
		$P_1 = \frac{W}{4} + \frac{F}{4} + \frac{F \times a}{2c} + \frac{F \times b}{2d}$ $P_2 = \frac{W}{4} + \frac{F}{4} + \frac{F \times a}{2c} - \frac{F \times b}{2d}$ $P_3 = \frac{W}{4} + \frac{F}{4} - \frac{F \times a}{2c} + \frac{F \times b}{2d}$ $P_4 = \frac{W}{4} + \frac{F}{4} - \frac{F \times a}{2c} - \frac{F \times b}{2d}$
		$P_1 = P_3 = \frac{W}{4} + \frac{F \times \ell}{2d}$ $P_2 = P_4 = \frac{W}{4} + \frac{F \times \ell}{2d}$

Table 1.5 Calculation Examples for Mean Load (P_m)

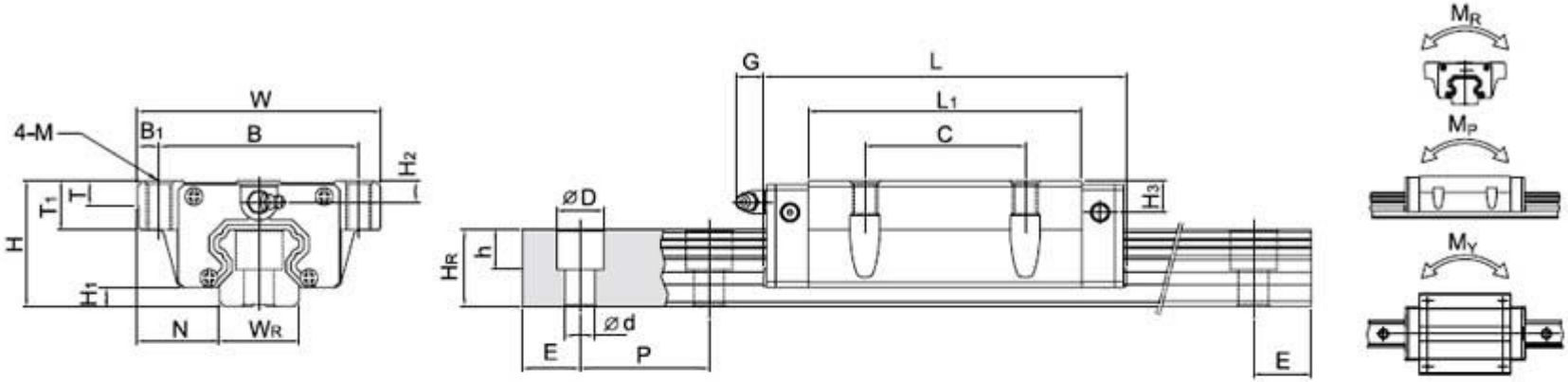
Operation Condition	Mean load
Variation in steps 	$P_m = \sqrt[3]{1/L\,(P_1^3 \times L_1 + P_2^3 \times L_2 + \ldots + P_n^3 \times L_n)}$ P_m : Mean load P_n : Fluctuating load L : Total running distance L_n : Running distance under load P_n
Simple fluctuating 	$P_m = 1/3(P_{min} + 2 \times P_{max})$ P_m : Mean load P_{min} : Min. load P_{max} : Max. load
Sin curve fluctuating 	$P_m = 0.65 \times P_{max}$ P_m : Mean fluctuating load P_{max} : Max. fluctuating load

(2) Loads with inertia forces

Table 1.4 Calculation Examples for Loads with Inertia Forces

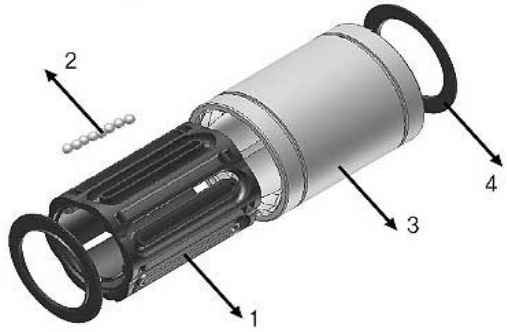
Considering the acceleration and deceleration	Load on one block
 F : External force (N) W : Weight of object (N) g : Gravitational acceleration(9.8m/sec²)	▸ Constant velocity $P_1 \sim P_4 = \frac{W}{4}$ ▸ Acceleration $P_1 = P_3 = \frac{W}{4} + \frac{1}{2} \times \frac{W}{g} \times \frac{V}{t1} \times \frac{\ell}{d}$ $P_2 = P_4 = \frac{W}{4} - \frac{1}{2} \times \frac{W}{g} \times \frac{V}{t1} \times \frac{\ell}{d}$ ▸ Deceleration $P_1 = P_3 = \frac{W}{4} - \frac{1}{2} \times \frac{W}{g} \times \frac{V}{t3} \times \frac{\ell}{d}$ $P_2 = P_4 = \frac{W}{4} + \frac{1}{2} \times \frac{W}{g} \times \frac{V}{t3} \times \frac{\ell}{d}$

ال ام گاید

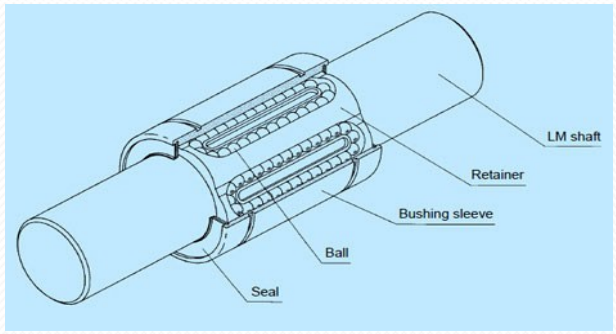


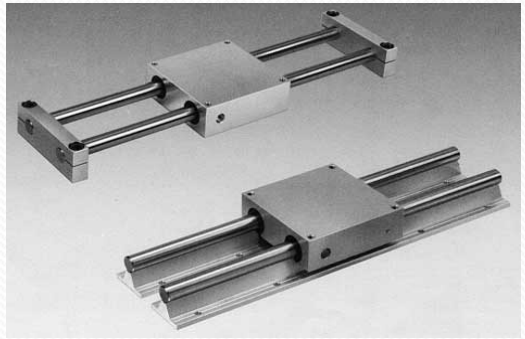
Model No.	Dimensions of Assembly (mm)			Dimensions of Block (mm)												Dimensions of Rail (mm)							Mounting Bolt for Rail (mm)	Basic Dynamic Load Rating C (kN)	Basic Static Load Rating C_0 (kN)	Static Rated Moment			Weight	
	H	H_1	N	W	B	B_1	C	L_1	L	G	M	T	T_1	H_2	H_3	W_R	H_R	D	h	d	P	E				M_R (kN-m)	M_P (kN-m)	M_Y (kN-m)	Block (kg)	Rail (kg/m)
HGW 15CA	24	4.3	16	47	38	4.5	30	39.4	61.4	5.3	M5	6	8.9	4.5	5.5	15	15	7.5	5.3	4.5	60	20	M4x16	11.38	25.31	0.17	0.15	0.15	0.17	1.45
HGW 20CA	30	4.6	21.5	63	53	5	40	50.5	75.6	12	M6	8	10	6	7	20	17.5	9.5	8.5	6	60	20	M5x16	17.75	37.84	0.38	0.27	0.27	0.51	2.21
HGW 20HA								65.2	90.3															21.18	48.84	0.48	0.47	0.47	0.52	
HGW 25CA	36	5.5	23.5	70	57	6.5	45	58	83	12	M8	8	14	6	9	23	22	11	9	7	60	20	M6x20	26.48	56.19	0.64	0.51	0.51	0.78	3.21
HGW 25HA								78.6	103.6															32.75	76.00	0.87	0.88	0.88	0.80	
HGW 30CA	42	6	31	90	72	9	52	70	97.4	12	M10	8.5	16	6.5	10.8	28	26	14	12	9	80	20	M8x25	38.74	83.06	1.06	0.85	0.85	1.42	4.47
HGW 30HA								93	120.4															47.27	110.13	1.40	1.47	1.47	1.44	
HGW 35CA	48	7.5	33	100	80	9	62	80	112.4	12	M10	10.1	18	9	12.6	34	29	14	12	9	80	20	M8x25	49.52	102.87	1.73	1.20	1.20	2.03	6.3
HGW 35HA								105.8	138.2															60.21	136.31	2.29	2.08	2.08	2.06	
HGW 45CA	60	9.5	37.5	120	100	10	80	97	138	12.9	M12	15.1	22	8.5	20.5	45	38	20	17	14	105	22.5	M12x35	77.57	155.93	3.01	2.35	2.35	3.54	10.41
HGW 45HA								128.8	169.8															94.54	207.12	4.00	4.07	4.07	3.69	
HGW 55CA	70	13	43.5	140	116	12	95	117.7	165.7	12.9	M14	17.5	26.5	12	19	53	44	23	20	16	120	30	M14x45	114.44	227.81	5.66	4.06	4.06	5.38	15.08
HGW 55HA								155.8	203.8															139.35	301.26	7.49	7.01	7.01	5.96	
HGW 65CA	90	15	53.5	170	142	14	110	144.2	198.2	12.9	M16	25	37.5	15	15	63	53	26	22	18	150	35	M16x50	163.63	324.71	10.02	6.44	6.44	9.17	21.18
HGW 65HA								203.6	257.6															208.36	457.15	14.15	11.12	11.12	12.89	

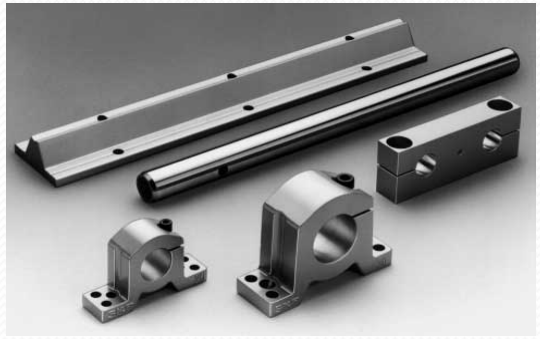
بوش ساچمه ای



Part	Material	Special features and function
1 Retainer	– POM – Stainless Steel	– Guide ball's Motion – An essential element of unlimited linear stroke
2 Ball	– High carbon bearing steel – Stainless steel – Ceramic	– the support of the load by direct contact between shaft and ball plate – An essential element for low friction, high load capacity, high precision and high speed stroke
3 Outer Sleeve	– High carbon bearing steel – Stainless steel * available Corrosion resistance plating	– Direct contact with the ball to the receiving portion of the load – Direct contact part to housing – An essential element for high load capacity – Interchangeability
4 Rubber Seal	– NBR * optional item	– Blocking a foreign substance from outside – Blocking outflow of lubricant by sealing linear bushing



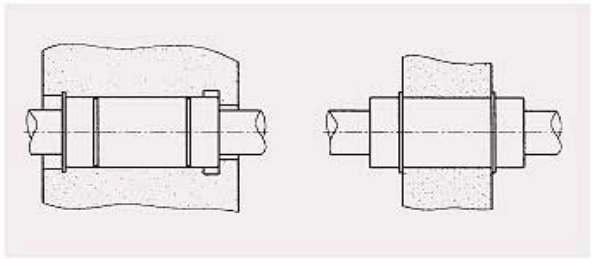




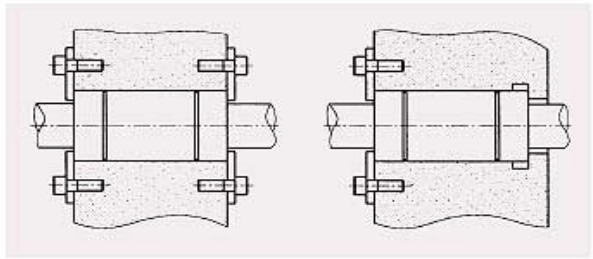
بوش ساچمه ای

Standard type

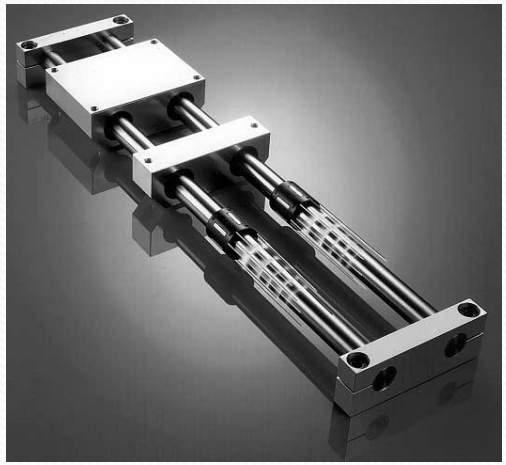
Feasible mounting methods are illustrated in Fig 8 and Fig 9. At this moment, fix the linear bushing with retaining rings and cover plates



Mounting with retaining rings

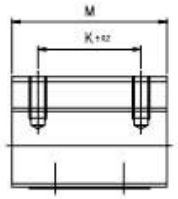


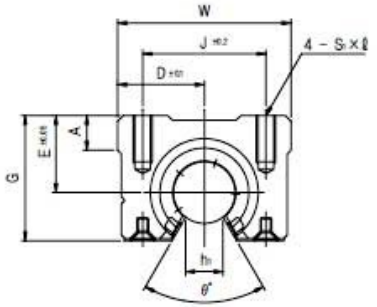
Mounting with cover plates



بوش ساچمه ای

SBR ALUMINUM CASE UNIT OPEN





Aluminum Case Unit(Open type)	SBR	20	UU	–	A	S								
Nominal Shaft Diameter														
Seal	Blank : No Seal U : One Side Seal UU : Both Side Seal													
Retainer	Blank : Resin retainer(Standard) A : Steel retainer(High temperature)													
Ball type (by corrosion resistance)	Blank : High carbon bearing steel ball (standard) S : Stainless steel ball													

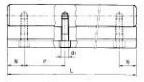
PART NUMBER	L/B	D	W	G	θ	A	M	S×ℓ	h1	E	J	K	BASIC LOAD RATING(N) DYNAMIC(C)	STATIC(Co)	WEIGHT (gf)
SBR16UU	LM16UUOP	22.5	45	33	80°	9	45	M5×12	11	20	32	30	770	1170	0.15
SBR20UU	LM20UUOP	24	48	39	60°	11	50	M6×12	11	23	35	35	860	1370	0.20
SBR25UU	LM25UUOP	30	60	47	50°	14	65	M6×12	12	27	40	40	980	1560	0.45
SBR30UU	LM30UUOP	35	70	56	50°	15	70	M8×18	15	33	50	50	1560	2740	0.63
SBR35UU	LM35UUOP	40	80	63	50°	18	80	M8×18	17	37	55	55	1660	3130	0.92
SBR40UU	LM40UUOP	45	90	72	50°	20	90	M10×20	20	42	65	65	2150	4010	1.33
SBR50UU	LM50UUOP	60	120	91	50°	25	110	M10×20	25	53	94	80	3820	7930	3.00

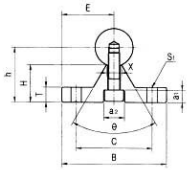
SK Shaft Support

SHAFT SUPPORT	SK	20										
Samick Shaft Support(Aluminum)												
Shaft Diameter												

PART NUMBER	Shaft Outer diameter	h	A	W	H	T	E	D	C	B	S	J	WEIGHT (gf)
SK8	8	20	21	42	32.8	6	18	5	32	14	5.5	M4	24
SK10	10	20	21	42	32.8	6	18	5	32	14	5.5	M4	24
SK12	12	23	21	42	38	6	20	5	32	14	5.5	M4	30
SK13	13	23	21	42	38	6	20	5	32	14	5.5	M4	30
SK16	16	27	24	48	44	8	25	5	38	16	5.5	M4	40
SK20	20	31	30	60	51	10	30	7.5	45	20	6.6	M5	70
SK25	25	35	35	70	60	12	38	7	56	24	6.6	M6	130
SK30	30	42	42	84	70	12	44	10	64	28	9	M6	180
SK35	35	50	49	98	85	15	50	12	74	32	11	M8	270
SK40	40	60	57	114	96	15	60	12	90	36	11	M8	420

TBS SUPPORT RAIL UNIT

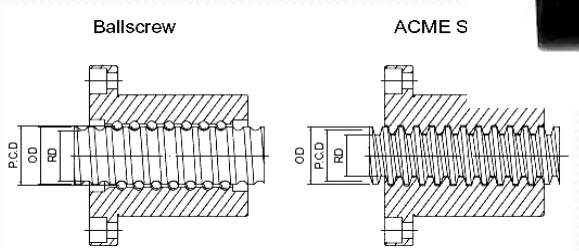


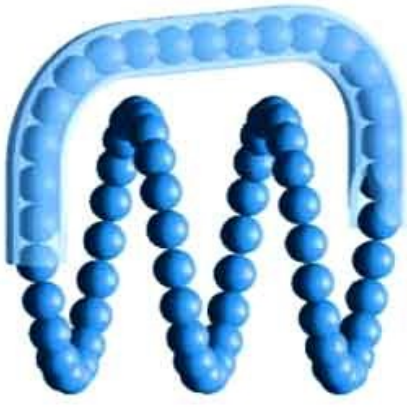


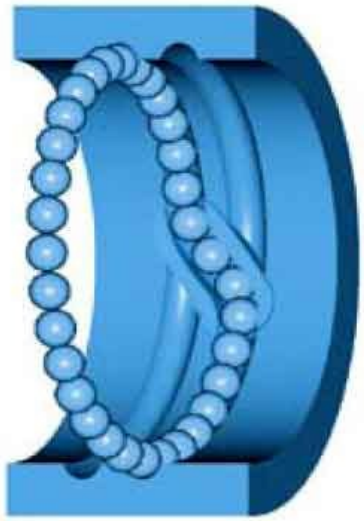
SUPPORT RAIL UNIT	TBS	C	h6	30	–	1000	L										
Type																	
Support Rail Unit for TBR : TBS																	
Shaft(by corrosion resistance)																	
No plating (Standard) : Blank Chrome plated shaft : C Nickel plated shaft : N Raydent treated shaft : R																	
Shaft tolerance																	
Asian standard g6 tolerance shaft : Blank European standard h6 tolerance shaft : h6																	
Shaft Diameter	16~50mm																
Shaft Length	100~3000mm																

PART NUMBER	OUTER DIAMETER	E	h	B	H	T	X	C	θ	S1	a1	a2	d1	WEIGHT (kgf/m)
TBS16A	Φ16	25	22	50	14.79	6	8	37	60°	Φ5.5	6	9.5	5.5	2.66
TBS20A	Φ20	27.5	29	55	19.72	8	8	40	50°	Φ5.5	6.5	11	6.6	4.23
TBS25A	Φ25	32.5	32	65	20.13	10	8	45	50°	Φ6.6	6.5	11	6.6	5.85
TBS30A	Φ30	37.5	36.5	75	22.35	12	10.3	55	50°	Φ6.6	8.5	14	9	8.28

بال اسکرو







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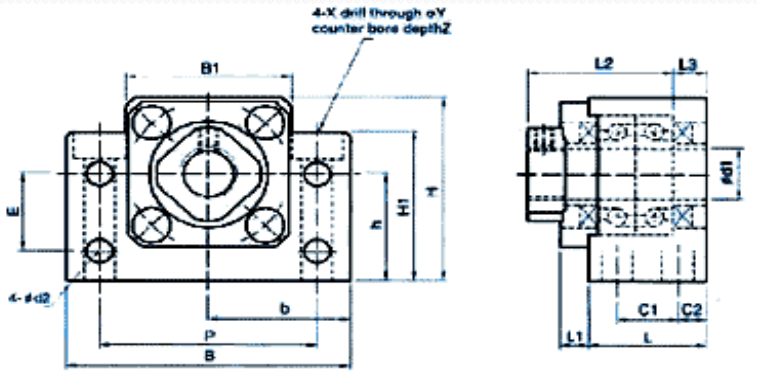
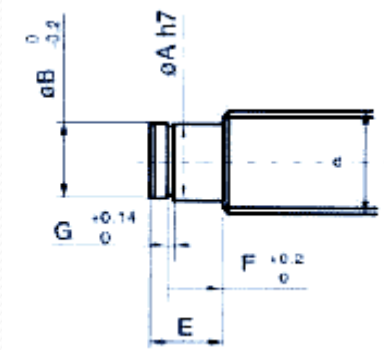
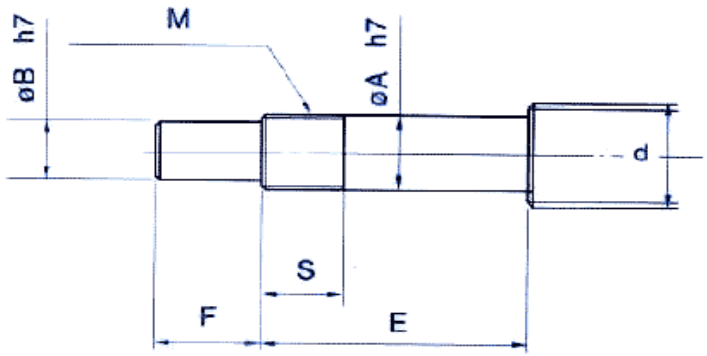
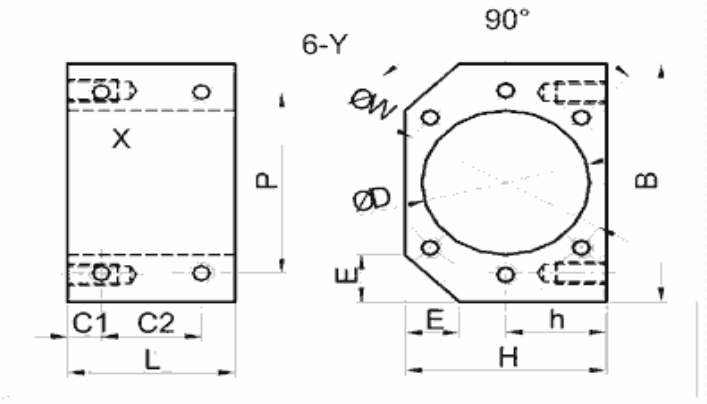


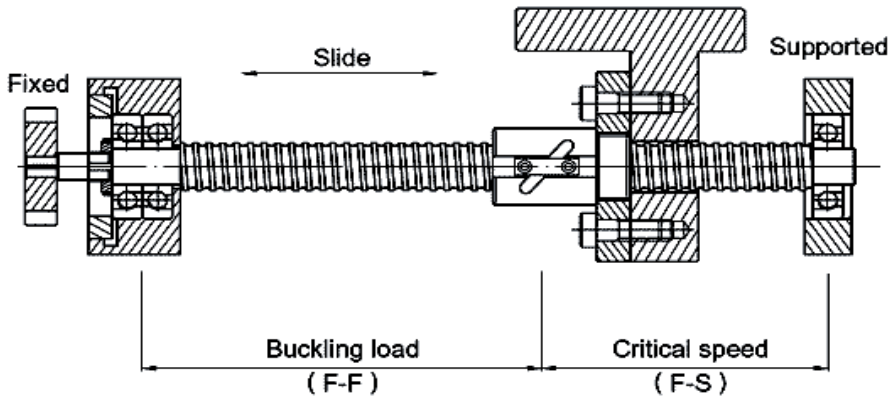




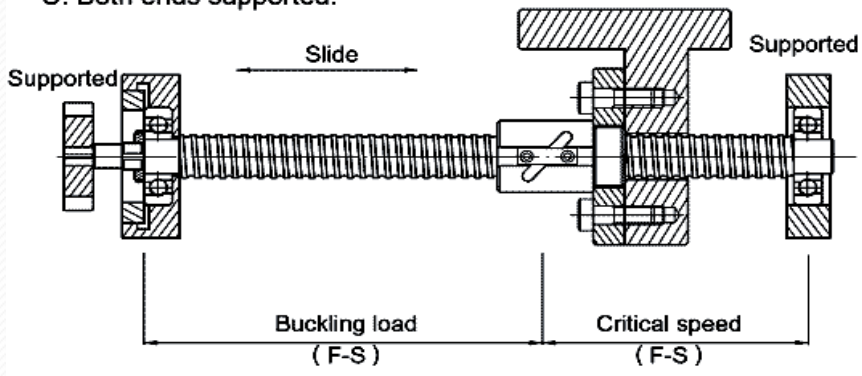


بال اسکرو

B. One end fixed other end supported.



C. Both ends supported.



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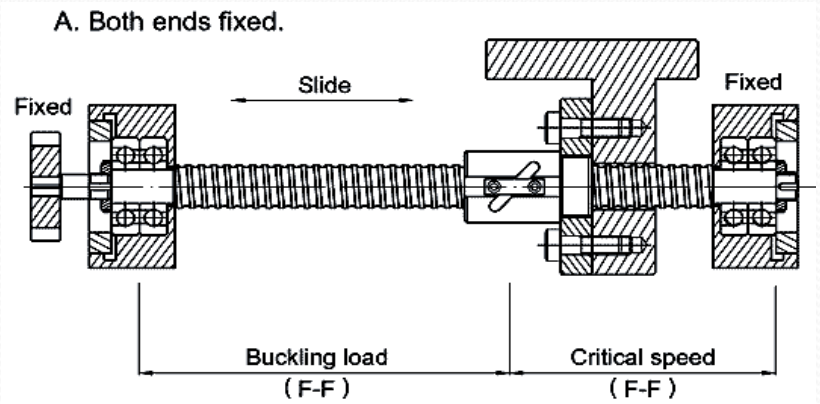
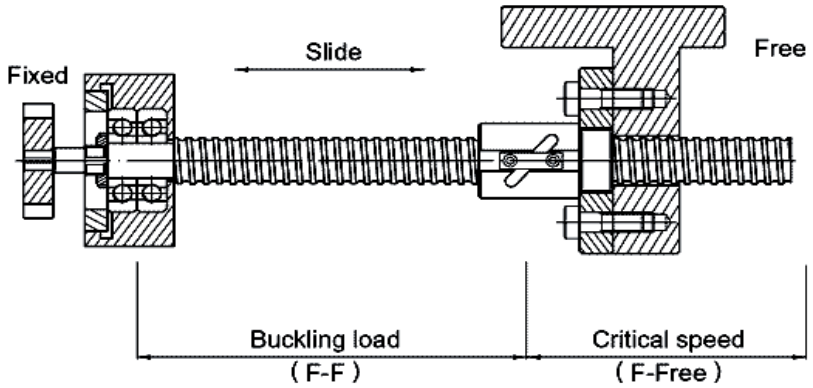


D. One end fixed other end free.



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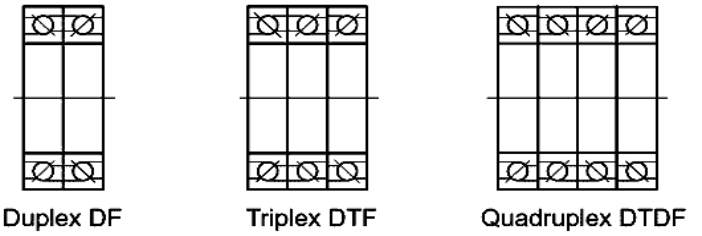
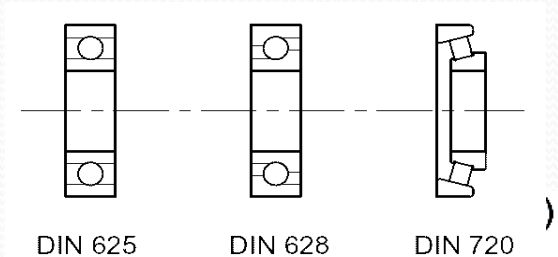
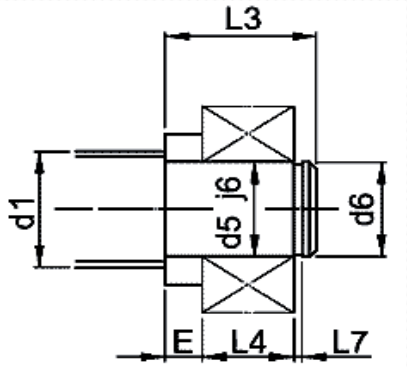
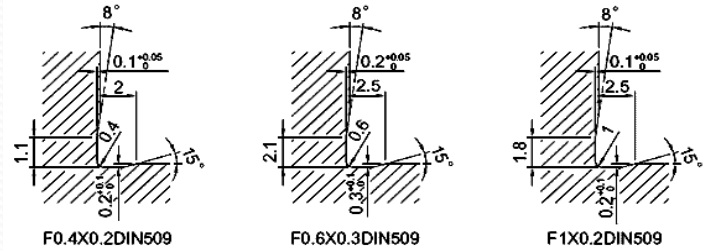
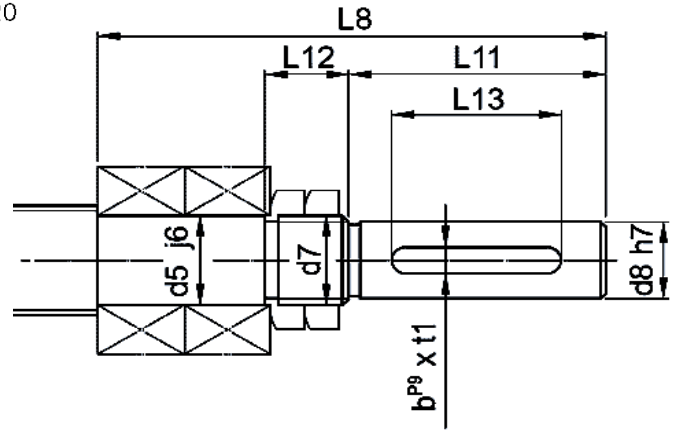
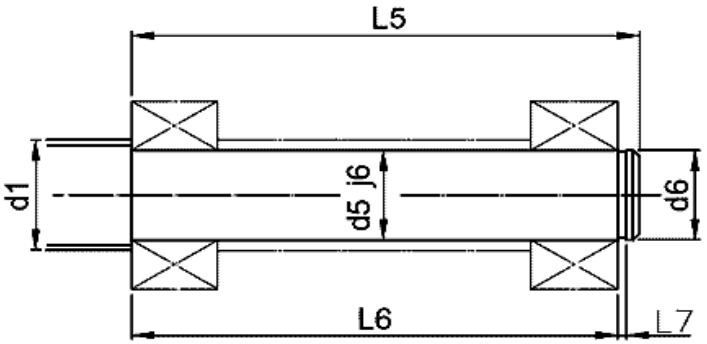




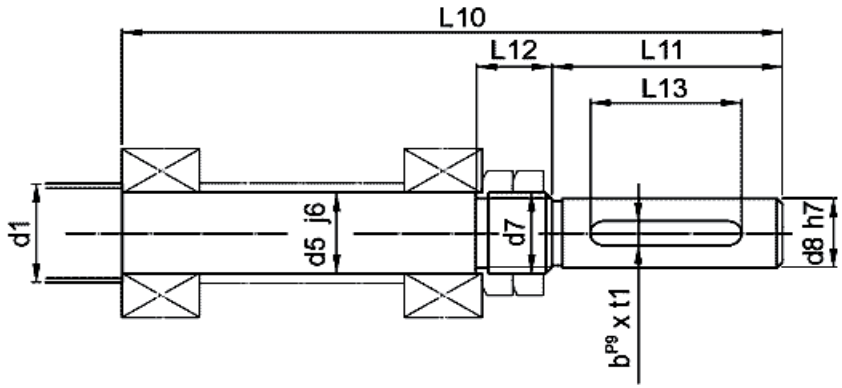








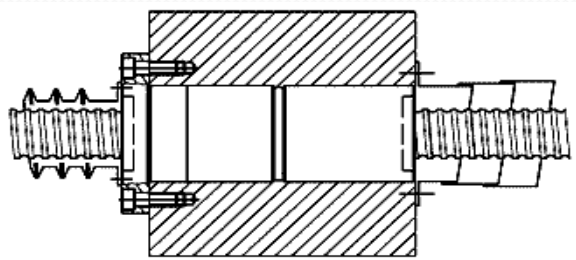
(V)

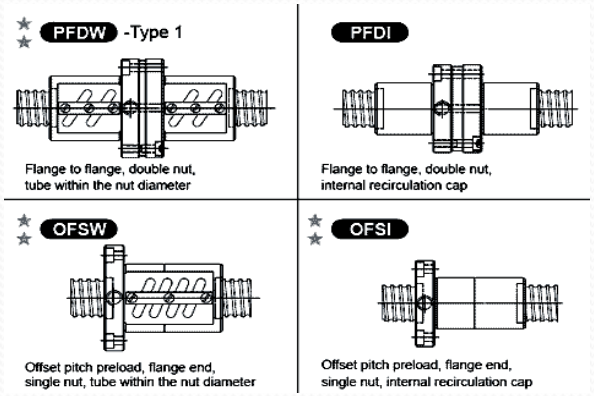


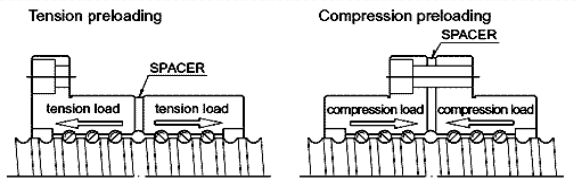
بال اسکرو

Table 4.1 Ballscrew selection procedure

Step	Design operation condition (A)	Ballscrew parameter (B)	Reference formula(C)
Step 1	Positioning accuracy	Lead accuracy	Table 5.2
Step 2	(1) Max. speed of DC motor (Nmax) (2) Rapid feed rate (Vmax)	Ballscrew lead	$\ell \geq \frac{V_{max}}{N_{max}}$
Step 3	Total travel distance	Total thread length	Total length = thread length+journal end length Thread length = stroke+nut length+100 mm (unused thread)
Step 4	(1) Load condition (%) (2) Speed condition (%)	Mean axial load Mean speed	M7~M10
Step 5	Mean axial force (≤1/5 C is the best)	Preload	M1
Step 6	(1) Service life expectancy (2) Mean axial load (3) Mean speed	Basic dynamic load	M13~M14
Step 7	(1) Basic dynamic load (2) Ballscrew lead (3) Critical speed (4) Speed limited by Dm-N value	Screw diameter and nut type (select some range)	M31~M33 and dimension table
Step 8	(1) Ballscrew diameter (2) Nut type (3) Preload (4) Dynamic load	Stiffness (check the best one via lost motion value)	M34~M40
Step 9	(1) Surrounding temperature (2) Ballscrew length	Thermal displacement and target value of cumulative lead (T)	M41 and 4.6 temperature rising effect
Step 10	(1) Stiffness of screw spindle (2) Thermal displacement	Pretension force	M45
Step 11	(1) Max. table speed (2) Max. rising time (3) Ballscrew specification	Motor drive torque and motor specification	M19~M28







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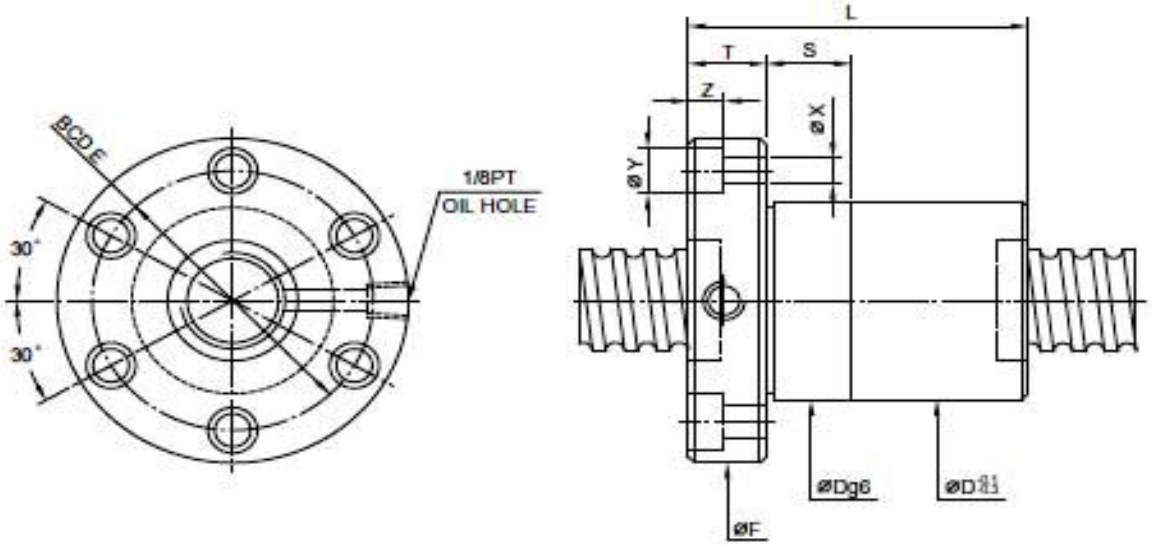
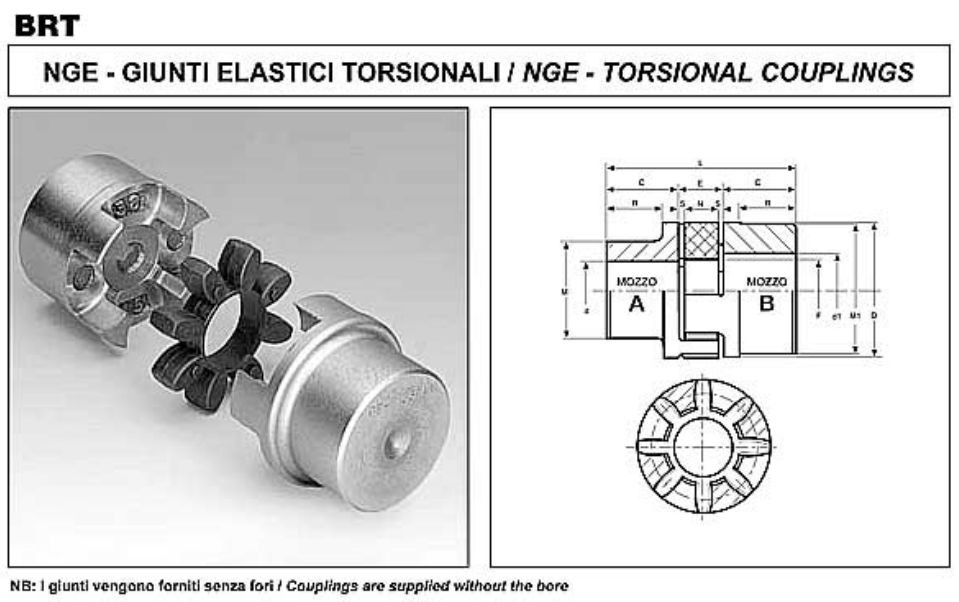


Model	Size		Ball Dia.	Circuits	Stiffness kgf / µm K	Dynamic Load 1x10⁶ revs C (kgf)	Static Load Co (kgf)	Nut			Flange			Bolt			Fit
	Nominal Dia.	Lead						D		L	F	T	BCD-E	X	Y	Z	S
32-5T3	32	5	3.175	3	33	1117	3081	44	48	46	74	12	60	6.6	11	6.5	12
32-5T4				4	42	1431	4108	44	48	53	74	12	60	6.6	11	6.5	12
32-5T6				6	63	2027	6162	44	48	66	74	12	60	6.6	11	6.5	12
32-6T3		6	3.969	3	33	1446	3620	45	50	51	76	12	62	6.6	11	6.5	12
32-6T4				4	43	1852	4826	45	50	61	76	12	62	6.6	11	6.5	12
32-6T6				6	65	2625	7239	45	50	75	76	12	62	6.6	11	6.5	12
32-8T3		8	4.763	3	35	1810	4227	47	52	63	78	16	64	6.6	11	6.5	12
32-8T4				4	47	2317	5635	47	52	74	78	16	64	6.6	11	6.5	12
32-10T3		10	6.350	3	35	2539	5327	51	56	72	82	16	68	6.6	11	6.5	12
32-10T4				4	48	3252	7102	51	56	83	82	16	68	6.6	11	6.5	12
40-5T4	40	5	3.175	4	50	1599	5280	51	54	53	80	16	66	6.6	11	6.5	12
40-5T6				6	74	2265	7919	51	54	66	80	16	66	6.6	11	6.5	12
40-5.08T6		5.08	3.175	6	74	2265	7919	53	56	65	90	15	72	9	14	8.5	15
40-6T4		6	3.969	4	50	2136	6420	53	56	65	88	16	72	9	14	8.5	15
40-6T6				6	74	3028	9630	53	56	79	88	16	72	9	14	8.5	15
40-8T4		8	4.763	4	52	2132	6421	55	60	78	92	16	75	9	14	8.5	15

کوپلینگ



کوپلینگ

FUNCTION

Model No.	Rated Torque (N.m)	Max Torque (N.m)	Max Rotational Frequency (min^{-1})	Static torsion spring stiffness (N.m/rad)	Dynamic torsion spring stiffness (N.m/rad)
SRJ-20C	5	10	15200	51.0	151
SRJ-30C	12.5	25	10200	170.9	505
SRJ-40C	17	34	7600	857.5	2571
SRJ-55C	60	120	5600	2060	6163
SRJ-65C	160	320	4700	3430	10291

Model No.	Weight (kg)		Mass moment of inertia J (kgm^2)		Radial (mm)	Angular (°)	Axial (mm)
	each hub	spider	each hub	spider			
SRJ-20C	$8.5x10^{-3}$	$1.7x10^{-3}$	$0.46x10^{-4}$	$0.073x10^{-4}$	0.10	1.0	0.8
SRJ-30C	$18x10^{-3}$	$4.2x10^{-3}$	$2.5x10^{-4}$	$0.45x10^{-4}$	0.15	1.0	1
SRJ-40C	$64x10^{-3}$	$6.5x10^{-3}$	$20.1x10^{-4}$	$1.44x10^{-4}$	0.15	1.0	1.2
SRJ-55C	$130x10^{-3}$	$17.4x10^{-3}$	$50.5x10^{-4}$	$7.3x10^{-4}$	0.2	1.0	1.4
SRJ-65C	$250x10^{-3}$	$28.6x10^{-3}$	$200.1x10^{-4}$	$16.3x10^{-4}$	0.2	1.0	1.5

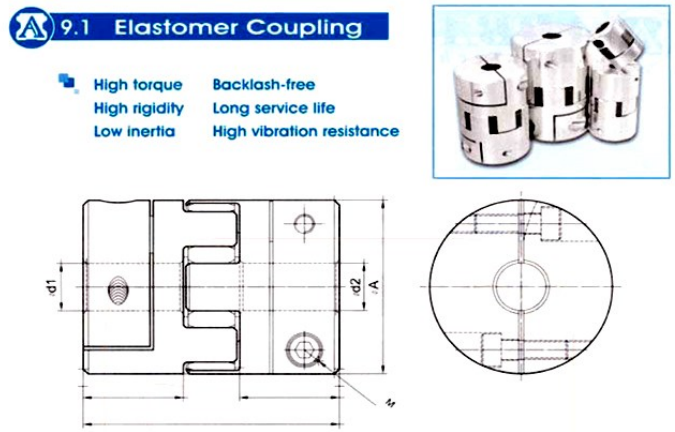
DIMENSION

unit : mm

Model No.	A	L	L1	dmax	d1Xd2		M
					d1	d2	
SRJ-20C	20	30	10	10	4 · 5 · 6 · 6.35 · 7 · 8 · 10		M3
SRJ-30C	30	35	11	16	5 · 6 · 6.35 · 8 · 9 · 9.5 · 10 · 11 · 12 · 14 · 15		M4
SRJ-40C	40	66	25	22	8 · 9.5 · 10 · 11 · 12 · 14 · 15 · 16 · 18 · 19 · 20		M5
SRJ-55C	55	78	30	28	12 · 15 · 16 · 18 · 19 · 20 · 22 · 24 · 25		M6
SRJ-65C	65	90	35	38	20 · 22 · 24 · 25 · 28 · 30 · 32 · 35 · 38		M8

Buffer Material : Engineering Class Plastic Material : Aluminum Alloy

Product No : SRJ-AC-d1xd2 **ex:SRJ-30C-6x8**



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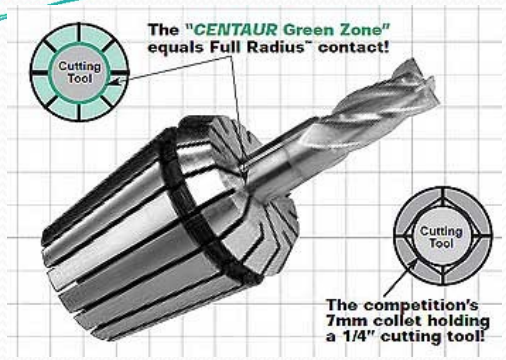
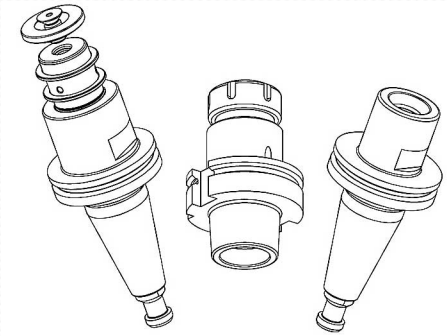
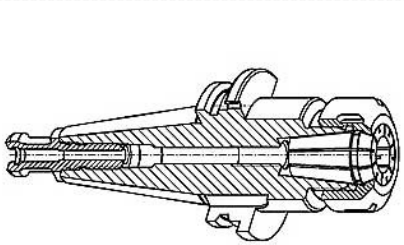
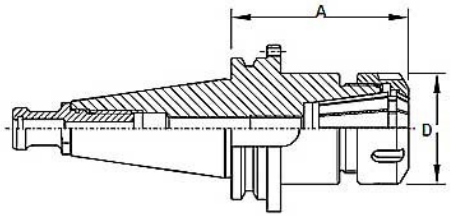
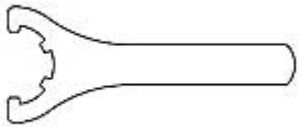
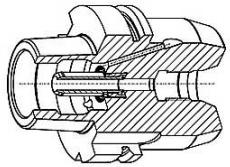


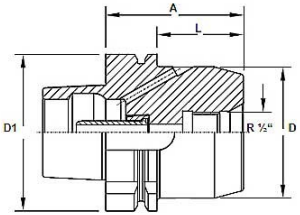


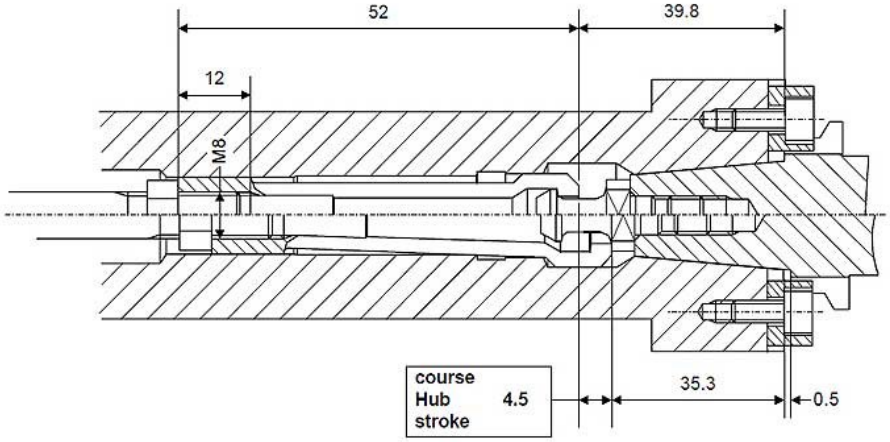






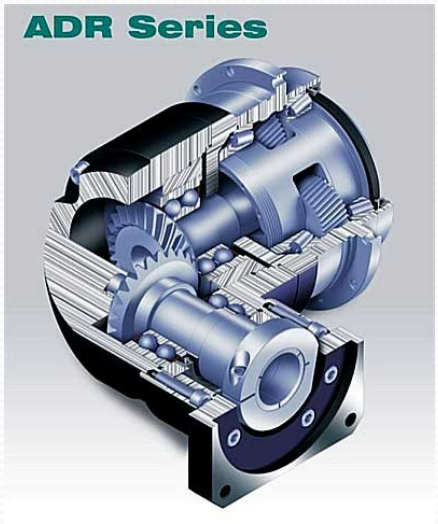


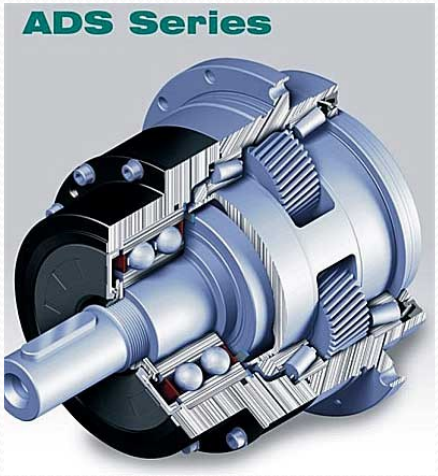


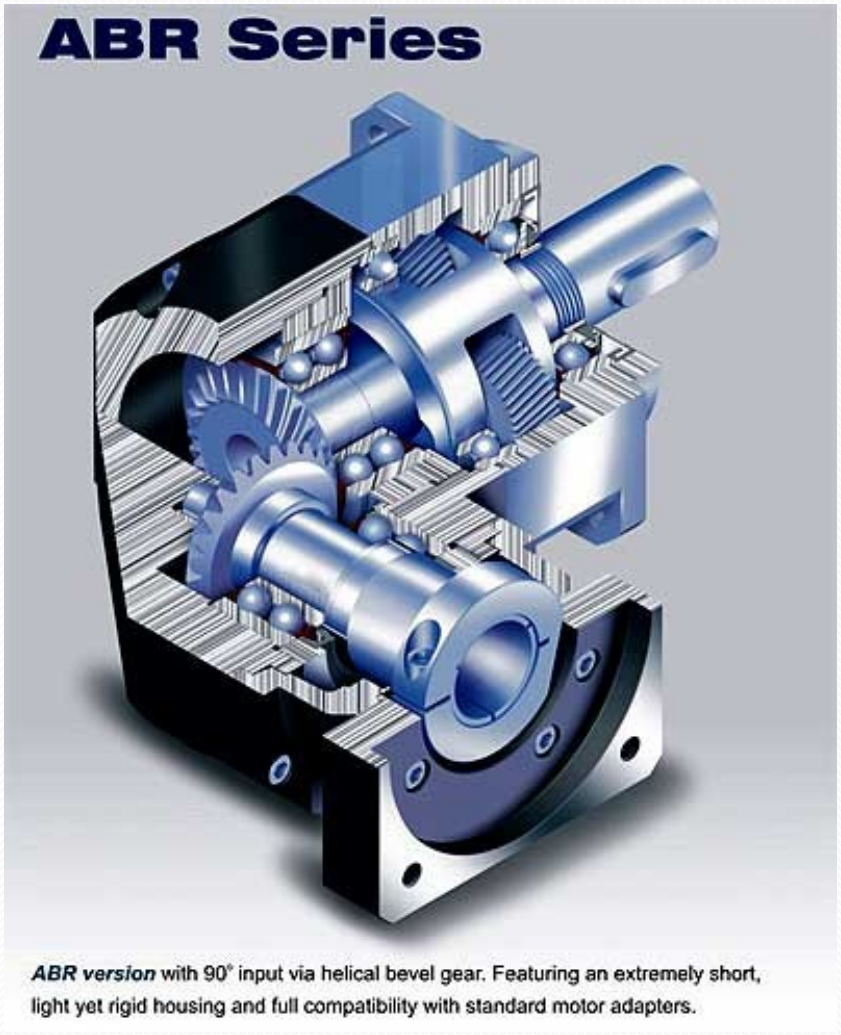


Series	Inch Capacity	Metric Capacity
RD 8	1/32-3/16	.25mm-5.0mm
RD 11	1/16-1/4	.25mm-7.0mm
RD 12	1/32-1/4	.5mm-7.0mm
RD 16	1/16-13/32	.25mm-10.0mm
RD 20	1/16-1/2	.5mm-13mm
RD 25	1/16-5/8	.5mm-16mm
RD 32	3/32-3/4	.2mm-20mm

گیربکس







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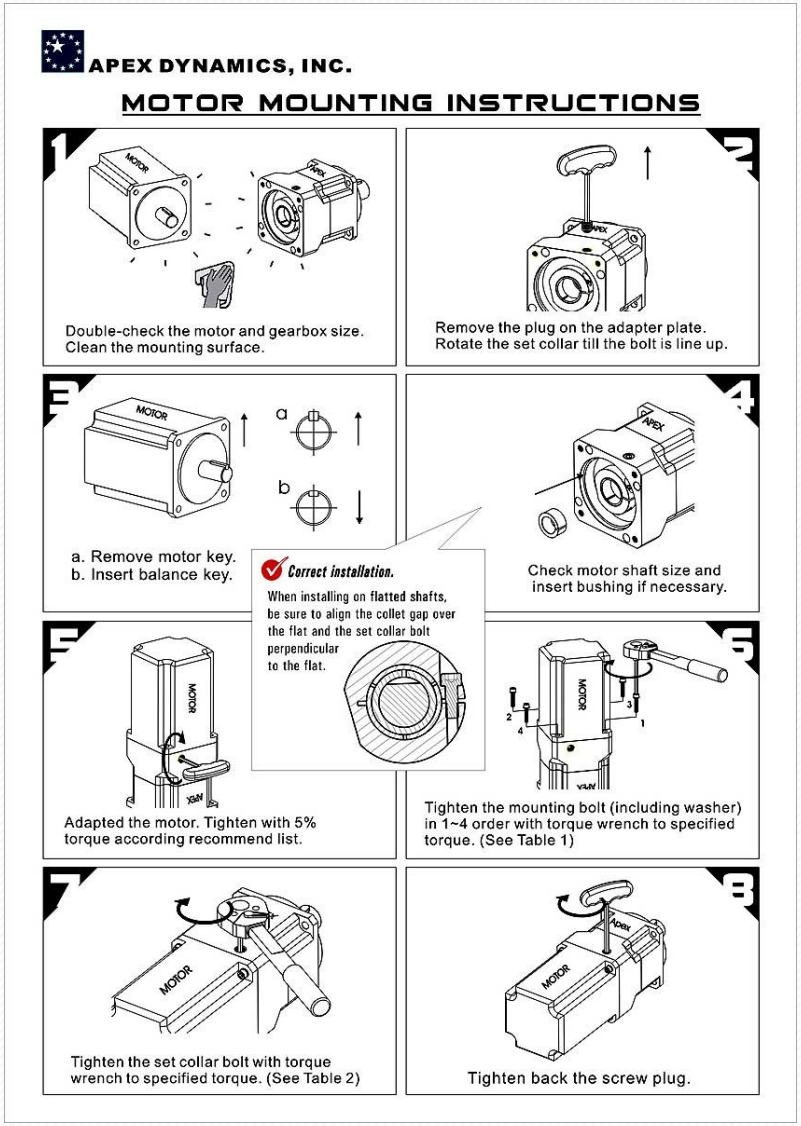

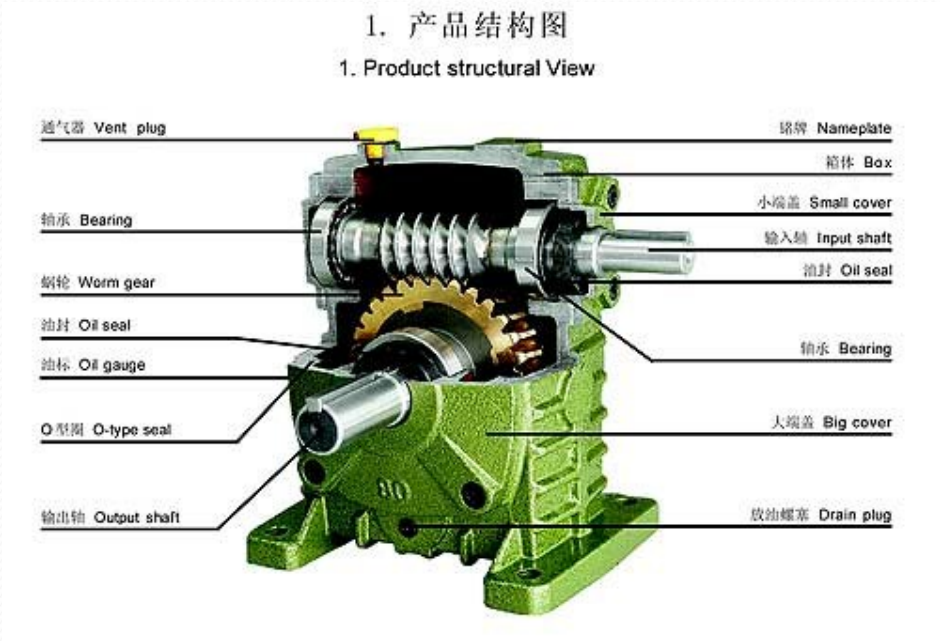

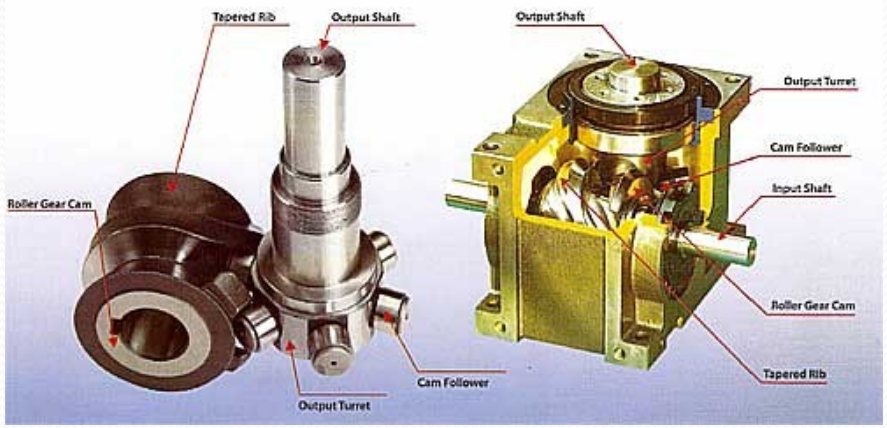

با سپاس از همه عزیزانی که در
صنعت اتوماسیون کشور زحمات
بی دریغ می کشند

احمد شخم گر