SANMOTION

DC SERVO SYSTEMS

K

DC Servo Systems

SANYO DENKI

Ver.1

SANMOTION K

DC SERVO SYSTEMS

Input voltage 24 VDC, 75 VDC

Servo motor

Flange size 42, 54, 76, 88 mm

Rated output 23 to 500 W

Complies with EN, UL (cUL) Standards

All the products in this catalog comply with CE/EN standards and cUL as standard.

Complies with the EU Restriction of Hazardous Substances (RoHS) Directive

All the products in this catalog comply with concentration limits for the specified hazardous substances (cadmium, lead, mercury, tetravalent chromium, PBB, PBDE, DEHP, BBP, DBP, and DIBP) listed in Appendix II of the EU RoHS Directive (2011/65/EU).

Contents

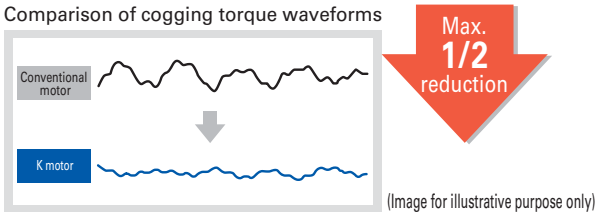
SANMOTION K
DC SERVO SYSTEMS

The SANMOTION K DC servo motors achieve smooth operation, high efficiency, and low noise. These motors are suitable for applications requiring high precision, including precision measuring instruments and medical equipment.

Features

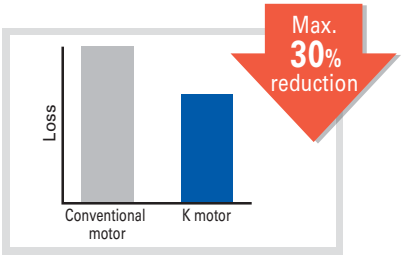
High accuracy (Smooth operation)

Cogging torque has been reduced by up to half compared with our conventional DC servo motors.* This enables smooth motor operation even at low speeds, improving the accuracy of equipment movements.



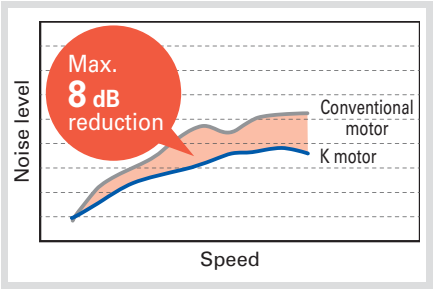
Energy-saving (High efficiency)

Power loss has been reduced by up to approximately 30% and efficiency has been increased by 10% compared with our conventional DC servo motors.* This reduces heat generation within equipment and contributes to energy savings.



Low noise

Brush vibrations have been reduced, and the rigidity of motor parts has been improved. Compared with our conventional DC servo motors,* noise levels have been reduced by up to 8 dB.



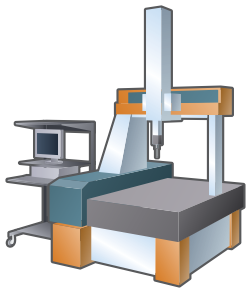
Low-voltage models available

In addition to 75 VDC class models, low-voltage (24 VDC class) models are also available. The low-voltage models are safe for use in medical equipment and other applications close to people.

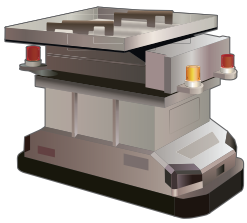
IP43 protection rating →page 14

All servo motors have a protection rating of IP43.

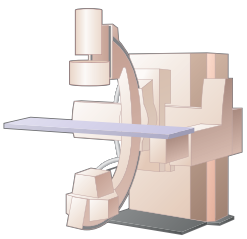
Application examples



Coordinate measuring machine



Automated guided vehicle (AGV)

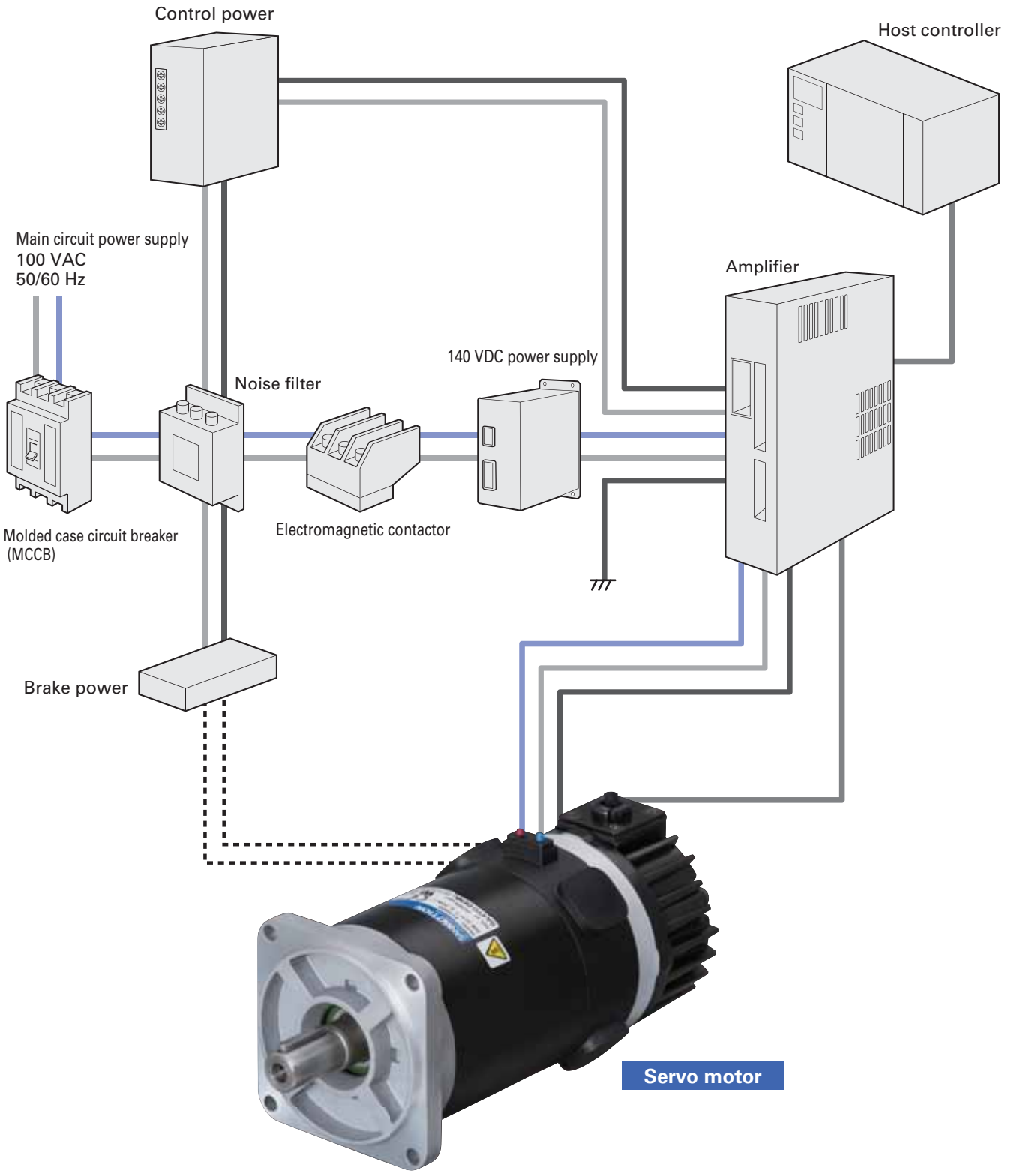


X-ray diagnostic device

* Compared with our conventional SANMOTION T DC servo motors.

System Configuration Example

Contact us if you need an amplifier.



Servo motor

Low Cogging Torque, Low Loss, Low Noise

Output capacity: 23 to 500 W

For 42 and 54 mm motors, low-voltage (24 VDC) models are also available.

■ How to read model numbers

Not all combinations of descriptions below are valid.
For model numbers valid as standard products, refer to "Standard Model Number List."

K A 7 30 B S0

K series

Input voltage

Code	Input voltage	Remarks
A	75 VDC class	
B	24 VDC class	Only for 42 and 54 mm sizes

Flange size

Code	Specifications
4	42 mm sq.
5	54 mm sq.
7	76 mm sq.
8	88 mm sq.

Rated output

Code	Specifications	Remarks
02	23 W	
04	40 W	
06	60 W	
08	80 W	
11	80 W	For 24 VDC input voltage
	110 W	For 75 VDC input voltage
20	200 W	
30	300 W	
40	400 W	
50	500 W	

Holding brake / Tachogenerator

Code	Brake	Tachogenerator	Remarks
X	—	–	Standard
B	90 VDC		Options
C	24 VDC		
D	48 VDC		
T	—	✓	Standard
J	90 VDC		Options
H	24 VDC		
K	48 VDC		

Incremental encoder

Code	Pulses per revolution	Output circuit	Remarks
XX	—	—	Standard
S0	2000	Line driver	Options
S6	200		
S7	500		
S8	1000		
C0	2000	Open collector	
C6	200		
C7	500		
C8	1000		

Standard Model Number List

Input voltage 24 VDC class (Low-voltage model)

Flange size	Rated output	Encoder	Tachogenerator	Holding brake (90 VDC)	Model no.	Page	
						Specifications	Dimensions
42 mm sq.	23 W	—	—	—	KB402XXX	p. 10	p. 16
		✓	—	—	KB402XS0	p. 10	p. 17
		—	✓	—	KB402TXX	p. 10	p. 18
	40 W	—	—	—	KB404XXX	p. 10	p. 16
		✓	—	—	KB404XS0	p. 10	p. 17
		—	✓	—	KB404TXX	p. 10	p. 18
	60 W	—	—	—	KB406XXX	p. 10	p. 16
		✓	—	—	KB406XS0	p. 10	p. 17
		—	✓	—	KB406TXX	p. 10	p. 18
54 mm sq.	60 W	—	—	—	KB506XXX	p. 11	p. 16
		✓	—	—	KB506XS0	p. 11	p. 17
		—	✓	—	KB506TXX	p. 11	p. 18
		—	—	✓	KB506BXX	p. 11	p. 19
		✓	—	✓	KB506BS0	p. 11	p. 20
		—	✓	✓	KB506JXX	p. 11	p. 21
		✓	✓	—	KB506TS0	p. 11	p. 22
		✓	✓	✓	KB506JS0	p. 11	p. 23
	80 W	—	—	—	KB511XXX	p. 11	p. 16
		✓	—	—	KB511XS0	p. 11	p. 17
		—	✓	—	KB511TXX	p. 11	p. 18
		—	—	✓	KB511BXX	p. 11	p. 19
		✓	—	✓	KB511BS0	p. 11	p. 20
		—	✓	✓	KB511JXX	p. 11	p. 21
		✓	✓	—	KB511TS0	p. 11	p. 22
		✓	✓	✓	KB511JS0	p. 11	p. 23

■Options

Brush (Maintenance parts)

Applicable product	Model no.	Quantity
For 42 mm sq. motors	AL-01027427	2 pcs
For 54 mm sq. motors	AL-01027428	2 pcs (60 W, 110 W), 4 pcs (80 W)
For 76 mm sq. motors	AL-01027429	4 pcs
For 88 mm sq. motors	AL-01027430	4 pcs
For 42 mm sq. tachogenerators	S813053-1A-87	2 pcs
For 54 mm sq. tachogenerators	S782281-1A-87	2 pcs
For 76 and 88 mm sq. tachogenerators	S782279-1A-87	2 pcs

Input voltage 75 VDC class

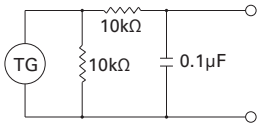
Flange size	Rated output	Encoder	Tachogenerator	Holding brake (90 VDC)	Model no.	Page	
						Specifications	Dimensions
42 mm sq.	40 W	—	—	—	KA404XXX	p. 12	p. 16
		✓	—	—	KA404XS0	p. 12	p. 17
		—	✓	—	KA404TXX	p. 12	p. 18
	60 W	—	—	—	KA406XXX	p. 12	p. 16
		✓	—	—	KA406XS0	p. 12	p. 17
		—	✓	—	KA406TXX	p. 12	p. 18
54 mm sq.	60 W	—	—	—	KA506XXX	p. 12	p. 16
		✓	—	—	KA506XS0	p. 12	p. 17
		—	✓	—	KA506TXX	p. 12	p. 18
		—	—	✓	KA506BXX	p. 12	p. 19
		✓	—	✓	KA506BS0	p. 12	p. 20
		—	✓	✓	KA506JXX	p. 12	p. 21
		✓	✓	—	KA506TS0	p. 12	p. 22
		✓	✓	✓	KA506JS0	p. 12	p. 23
	110 W	—	—	—	KA511XXX	p. 12	p. 16
		✓	—	—	KA511XS0	p. 12	p. 17
		—	✓	—	KA511TXX	p. 12	p. 18
		—	—	✓	KA511BXX	p. 12	p. 19
		✓	—	✓	KA511BS0	p. 12	p. 20
		—	✓	✓	KA511JXX	p. 12	p. 21
		✓	✓	—	KA511TS0	p. 12	p. 22
		✓	✓	✓	KA511JS0	p. 12	p. 23
76 mm sq.	200 W	—	—	—	KA720XXX	p. 13	p. 16
		✓	—	—	KA720XS0	p. 13	p. 17
		—	✓	—	KA720TXX	p. 13	p. 18
		—	—	✓	KA720BXX	p. 13	p. 19
		✓	—	✓	KA720BS0	p. 13	p. 20
		—	✓	✓	KA720JXX	p. 13	p. 21
		✓	✓	—	KA720TS0	p. 13	p. 22
		✓	✓	✓	KA720JS0	p. 13	p. 23
	300 W	—	—	—	KA730XXX	p. 13	p. 16
		✓	—	—	KA730XS0	p. 13	p. 17
		—	✓	—	KA730TXX	p. 13	p. 18
		—	—	✓	KA730BXX	p. 13	p. 19
		✓	—	✓	KA730BS0	p. 13	p. 20
		—	✓	✓	KA730JXX	p. 13	p. 21
		✓	✓	—	KA730TS0	p. 13	p. 22
		✓	✓	✓	KA730JS0	p. 13	p. 23
88 mm sq.	400 W	—	—	—	KA840XXX	p. 13	p. 16
		✓	—	—	KA840XS0	p. 13	p. 17
		—	✓	—	KA840TXX	p. 13	p. 18
		—	—	✓	KA840BXX	p. 13	p. 19
		✓	—	✓	KA840BS0	p. 13	p. 20
		—	✓	✓	KA840JXX	p. 13	p. 21
		✓	✓	—	KA840TS0	p. 13	p. 22
		✓	✓	✓	KA840JS0	p. 13	p. 23
	500 W	—	—	—	KA850XXX	p. 13	p. 16
		✓	—	—	KA850XS0	p. 13	p. 17
		—	✓	—	KA850TXX	p. 13	p. 18
		—	—	✓	KA850BXX	p. 13	p. 19
		✓	—	✓	KA850BS0	p. 13	p. 20
		—	✓	✓	KA850JXX	p. 13	p. 21
		✓	✓	—	KA850TS0	p. 13	p. 22
		✓	✓	✓	KA850JS0	p. 13	p. 23

Specifications

Input voltage 24 VDC class (Low-voltage model)

Servo motor model no. Inside 《 》 indicates motor flange size					KB402 《42 mm sq.》	KB404 《42 mm sq.》	KB406 《42 mm sq.》
		Condition	Symbol	Unit			
Motor	Rated output	☆☆	P_R	W	23	40	60
	Rated armature voltage	☆☆	V_R	V	20	24	24
	Rated torque	☆☆	T_R	N·m	0.074	0.13	0.19
	Rated armature current	☆☆	I_R	A	1.8	2.7	4.1
	Rated speed	☆☆	N_R	min^{-1}	3000	3000	3000
	Continuous stall torque	☆☆	T_S	N·m	0.08	0.14	0.20
	Peak stall torque	☆☆	T_P(N)	N·m	0.42	0.76	1.2
	Armature stall current	☆☆	I_S	A	1.8	2.7	4.1
	Peak armature stall current	☆☆	I_P(N)	A	10	14	23
	Maximum speed		N_{max}	min^{-1}	5000	5000	5000
	Rated power rate	☆☆	Q_R	kW/s	1.2	2.0	3.3
	Torque constant	☆	K_T	N·m/A	0.047	0.057	0.056
	Voltage constant	☆	K_E	$\times10^{-3}$V/min^{-1}	4.9	6.0	5.9
	Rotor inertia		J_M	$\times10^{-4}kg{\cdot}m^2$	0.047	0.084	0.108
	Armature winding resistance	☆	Ra	Ω	3.2	1.7	0.94
	Armature inductance	☆	La	mH	0.9	0.7	0.5
	Mechanical time constant	☆	tm	ms	6.9	4.4	3.2
	Electrical time constant	☆	te	ms	0.28	0.41	0.53
Tachogenerator	Coefficient of voltage generated	☆	K_{EG}	V/min^{-1}	$3\times10^{-3}\pm10\%$		
	Effective (rms) ripple	☆	ε_s	%	2		
	Peak-to-peak ripple	☆	ε_s	%	5		
	Linearity	☆	δ_L	%	1		
	Armature winding resistance	☆	R_1	Ω	37		
	Armature inductance	☆	L_1	mH	5		
	Minimum load resistance	☆	R_L	kΩ	10		
	Rotor inertia		J_{TG}	$\times10^{-4}kg{\cdot}m^2$	0.011		
Brake	Voltage	☆	V_B	V	——		
	Current	☆	I_B	A	——		
	Holding torque	☆☆	T_B	N·m	——		
	Inertia		J_B	$\times10^{-4}kg{\cdot}m^2$	——		
	Resistance	☆	R_B	Ω	——		
Mass					See the Dimensions section		
Size of aluminum plates for heat dissipation during measurement					250 × 250 × 6 mm		
Pulses per revolution for encoder		Line driver			Standard: 2000 P/R Optional: 200, 500, 1000 P/R		
		Open collector			Optional: 200, 500, 1000, 2000 P/R		
Oil seal					——		Can be used

The values in the row with "☆" are for when the ambient temperature and armature winding temperature are 25°C.
The values in the row with "☆☆" are after thermal equilibrium is established.
The values in the table above are for when operated with a stable DC current at ambient temperatures below 40°C.
The values for the tachogenerator are for when the test circuit shown below is used.

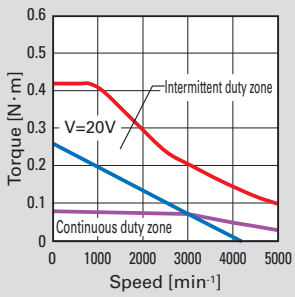


Encoders can not be installed to KB4 models with a tachogenerator.
The holding brake cannot be used for dynamic braking.
Holding brakes are also available in 24 and 48 V. (Optional)
Specifications are subject to change without notice.

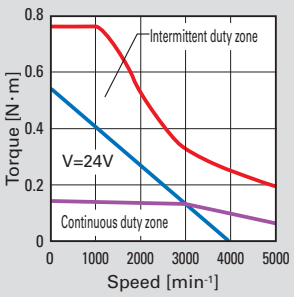
■ Speed-Torque Characteristics

Servo motor model no. / Flange size / Rated output

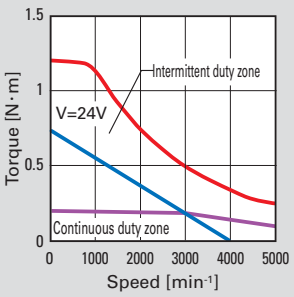
KB402/42 mm/23 W



KB404/42 mm/40 W



KB406/42 mm/60 W

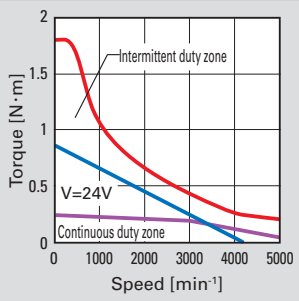


KB506 《54 mm sq.》	KB511 《54 mm sq.》	Servo motor model no. Inside 《 》 indicates motor flange size				
		Unit	Symbol	Condition		
60	80	W	P_R	☆☆	Rated output	Motor
24	24	V	V_R	☆☆	Rated armature voltage	
0.19	0.26	N·m	T_R	☆☆	Rated torque	
3.9	5.0	A	I_R	☆☆	Rated armature current	
3000	3000	min^{-1}	N_R	☆☆	Rated speed	
0.24	0.32	N·m	T_S	☆☆	Continuous stall torque	
1.8	2.16	N·m	T_P(N)	☆☆	Peak stall torque	
4.5	5.2	A	I_S	☆☆	Armature stall current	
31	40	A	I_P(N)	☆☆	Peak armature stall current	
5000	5000	min^{-1}	N_{max}		Maximum speed	
1.6	1.8	kW/s	Q_R	☆☆	Rated power rate	
0.057	0.06	N·m/A	K_T	☆	Torque constant	
6.0	6.3	$\times10^{-3}$V/min^{-1}	K_E	☆	Voltage constant	
0.22	0.37	$\times10^{-4}kg·m^2$	J_M		Rotor inertia	
1.1	0.44	Ω	Ra	☆	Armature winding resistance	
0.5	0.3	mH	La	☆	Armature inductance	
7.4	4.5	ms	tm	☆	Mechanical time constant	
0.45	0.61	ms	te	☆	Electrical time constant	
7×10^{-3}±10%		V/min^{-1}	K_{EG}	☆	Coefficient of voltage generated	Tachogenerator
1		%	ε_s	☆	Effective (rms) ripple	
3		%	ε_s	☆	Peak-to-peak ripple	
1		%	δ_L	☆	Linearity	
26		Ω	R_1	☆	Armature winding resistance	
4.1		mH	L_1	☆	Armature inductance	
10		kΩ	R_L	☆	Minimum load resistance	
0.12		$\times10^{-4}kg·m^2$	J_{TG}		Rotor inertia	
90±10%		V	V_B	☆	Voltage	Brake
0.06		A	I_B	☆	Current	
0.29		N·m	T_B	☆☆	Holding torque	
0.01		$\times10^{-4}kg·m^2$	J_B		Inertia	
1600		Ω	R_B	☆	Resistance	
See the Dimensions section		Mass				
305 × 305 × 12 mm		Size of aluminum plates for heat dissipation during measurement				
Standard: 2000 P/R Optional: 200, 500, 1000 P/R		Line driver			Pulses per revolution for encoder	
Optional: 200, 500, 1000, 2000 P/R		Open collector				
Can be used		Oil seal				

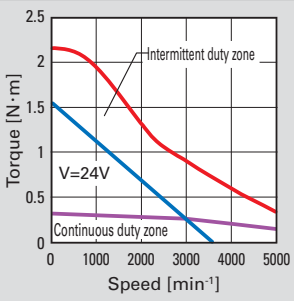
■ Speed-Torque Characteristics

Servo motor model no. / Flange size / Rated output

KB506/54 mm/60 W



KB511/54 mm/80 W

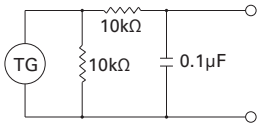


Specifications

Input voltage 75 VDC class

Servo motor model no. Inside 《》 indicates motor flange size					KA404 《42 mm sq.》	KA406 《42 mm sq.》	KA506 《54 mm sq.》	KA511 《54 mm sq.》
		Condition	Symbol	Unit				
Motor	Rated output	☆☆	P_R	W	40	60	60	110
	Rated armature voltage	☆☆	V_R	V	72	70	75	75
	Rated torque	☆☆	T_R	N·m	0.13	0.19	0.19	0.35
	Rated armature current	☆☆	I_R	A	0.9	1.2	1.1	2.0
	Rated speed	☆☆	N_R	min^{-1}	3000	3000	3000	3000
	Continuous stall torque	☆☆	T_S	N·m	0.14	0.20	0.24	0.42
	Peak stall torque	☆☆	T_P(N)	N·m	0.76	1.2	1.8	3.4
	Armature stall current	☆☆	I_S	A	0.9	1.2	1.4	2.1
	Peak armature stall current	☆☆	I_P(N)	A	4.7	7.6	10	18
	Maximum speed		N_{max}	min^{-1}	5000	5000	5000	5000
	Rated power rate	☆☆	Q_R	kW/s	2.0	3.3	1.6	3.3
	Torque constant	☆	K_T	N·m/A	0.174	0.177	0.17	0.20
	Voltage constant	☆	K_E	$\times10^{-3}$V/min^{-1}	18.2	18.5	17.8	20.8
	Rotor inertia		J_M	$\times10^{-4}kg{\cdot}m^2$	0.084	0.108	0.22	0.37
	Armature winding resistance	☆	Ra	Ω	16.8	9.8	9.4	4.8
	Armature inductance	☆	La	mH	7.6	4.5	4.4	3.0
	Mechanical time constant	☆	tm	ms	4.7	3.4	7.2	4.5
	Electrical time constant	☆	te	ms	0.45	0.46	0.47	0.63
Tachogenerator	Coefficient of voltage generated	☆	K_{EG}	V/min^{-1}	$3\times10^{-3}\pm10\%$		$7\times10^{-3}\pm10\%$	
	Effective (rms) ripple	☆	ε_s	%	2		1	
	Peak-to-peak ripple	☆	ε_R	%	5		3	
	Linearity	☆	δ_L	%	1		1	
	Armature winding resistance	☆	R_1	Ω	37		26	
	Armature inductance	☆	L_1	mH	5		4.1	
	Minimum load resistance	☆	R_L	kΩ	10		10	
	Rotor inertia		J_{TG}	$\times10^{-4}kg{\cdot}m^2$	0.011		0.12	
Brake	Voltage	☆	V_B	V	——		90±10%	
	Current	☆	I_B	A	——		0.06	
	Holding torque	☆☆	T_B	N·m	——		0.29	
	Inertia		J_B	$\times10^{-4}kg{\cdot}m^2$	——		0.01	
	Resistance	☆	R_B	Ω	——		1600	
Mass					See the Dimensions section			
Size of aluminum plates for heat dissipation during measurement					250 × 250 × 6 mm		305 × 305 × 12 mm	
Pulses per revolution for encoder		Line driver			Standard: 2000 P/R Optional: 200, 500, 1000 P/R			
		Open collector			Optional: 200, 500, 1000, 2000 P/R			
Oil seal					——		Can be used	

The values in the row with "☆" are for when the ambient temperature and armature winding temperature are 25°C.
The values in the row with "☆☆" are after thermal equilibrium is established.
The values in the table above are for when operated with a stable DC current at ambient temperatures below 40°C.
The values for the tachogenerator are for when the test circuit shown below is used.

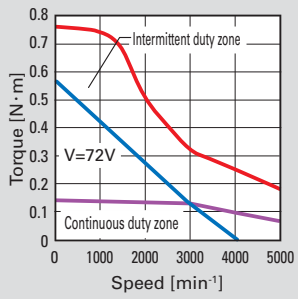


Encoders can not be installed to KB4 models with a tachogenerator.
The holding brake cannot be used for dynamic braking.
Holding brakes are also available in 24 and 48 V. (Optional)
Specifications are subject to change without notice.

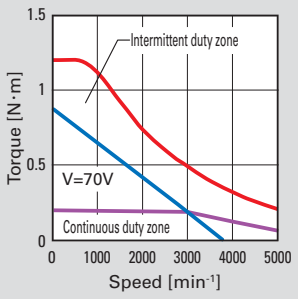
■ Speed-Torque Characteristics

Servo motor model no. / Flange size / Rated output

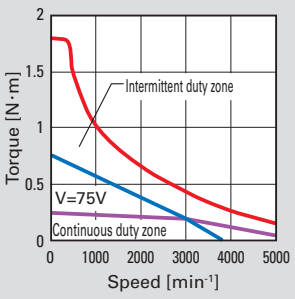
KA404/42 mm/40 W



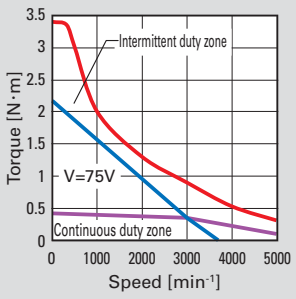
KA406/42 mm/60 W



KA506/54 mm/60 W



KA511/54 mm/110 W

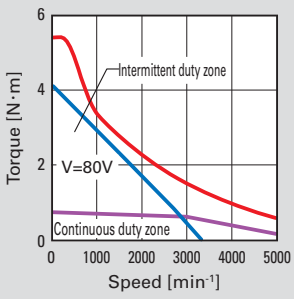


KA720 《76 mm sq.》	KA730 《76 mm sq.》	KA840 《88 mm sq.》	KA850 《88 mm sq.》	Servo motor model no. Inside 《 》 indicates motor flange size				
				Unit	Symbol	Condition		
200	300	400	500	W	P_R	☆☆	Rated output	Motor
80	75	85	80	V	V_R	☆☆	Rated armature voltage	
0.64	1.15	1.53	1.91	N·m	T_R	☆☆	Rated torque	
3.4	4.8	5.7	7.4	A	I_R	☆☆	Rated armature current	
3000	2500	2500	2500	min^{-1}	N_R	☆☆	Rated speed	
0.77	1.43	1.70	2.16	N·m	T_S	☆☆	Continuous stall torque	
5.4	9.8	12	16.7	N·m	T_P(N)	☆☆	Peak stall torque	
3.6	5.4	6.0	7.6	A	I_S	☆☆	Armature stall current	
25	40	40	62	A	I_P(N)	☆☆	Peak armature stall current	
5000	4000	4000	3000	min^{-1}	N_{max}		Maximum speed	
2.8	4.9	4.7	6.1	kW/s	Q_R	☆☆	Rated power rate	
0.23	0.27	0.31	0.286	N·m/A	K_T	☆	Torque constant	
24.2	28.6	32.9	30.0	$\times10^{-3}$V/min^{-1}	K_E	☆	Voltage constant	
1.47	2.7	5.0	6.0	$\times10^{-4}$kg·m^2	J_M		Rotor inertia	
2.2	1.05	0.95	0.53	Ω	Ra	☆	Armature winding resistance	
3.3	1.7	1.5	0.86	mH	La	☆	Armature inductance	
6.1	3.8	4.8	3.9	ms	tm	☆	Mechanical time constant	
1.5	1.6	1.5	1.6	ms	te	☆	Electrical time constant	
7×10^{-3}±10%				V/min^{-1}	K_{EG}	☆	Coefficient of voltage generated	Tachogenerator
1				%	ε_s	☆	Effective (rms) ripple	
3				%	ε_R	☆	Peak-to-peak ripple	
1				%	δ_L	☆	Linearity	
26				Ω	R_1	☆	Armature winding resistance	
4.1				mH	L_1	☆	Armature inductance	
10				kΩ	R_L	☆	Minimum load resistance	
0.12				$\times10^{-4}$kg·m^2	J_{TG}		Rotor inertia	
90±10%		90±10%		V	V_B	☆	Voltage	Brake
0.11		0.11		A	I_B	☆	Current	
1.47		1.96		N·m	T_B	☆☆	Holding torque	
0.09		0.2		$\times10^{-4}$kg·m^2	J_B		Inertia	
820		820		Ω	R_B	☆	Resistance	
See the Dimensions section				Mass				
305 × 305 × 12 mm				Size of aluminum plates for heat dissipation during measurement				
Standard: 2000 P/R Optional: 200, 500, 1000 P/R				Line driver			Pulses per revolution for encoder	
Optional: 200, 500, 1000, 2000 P/R				Open collector				
Can be used				Oil seal				

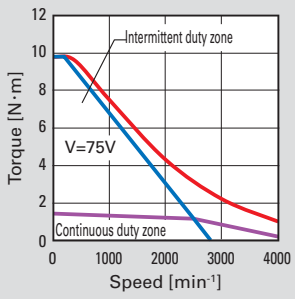
■ Speed-Torque Characteristics

Servo motor model no. / Flange size / Rated output

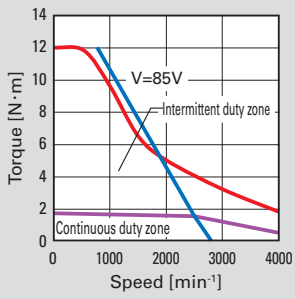
KA720/76 mm/200 W



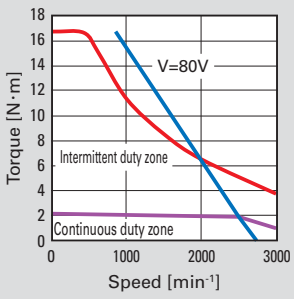
KA730/76 mm/300 W



KA840/88 mm/400 W



KA850/88 mm/500 W

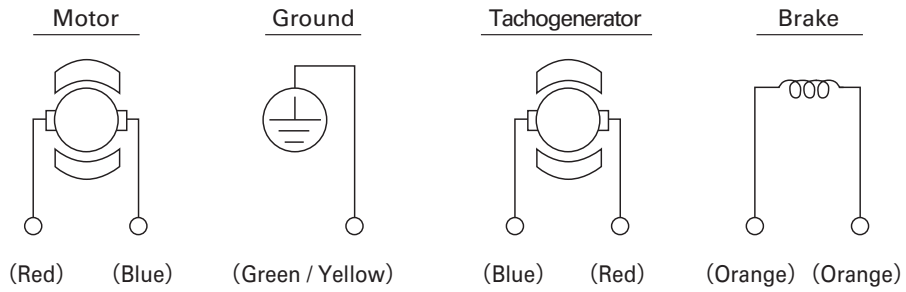


Common Specifications

■Specifications common to all motors

Items	Specifications
Rated	Continuous (S1)
Thermal class	F
Excitation system	Permanent magnet
Insulation resistance	10 MΩ or more (with a 500 VDC megger)
Dielectric strength	50/60 Hz, 1500 VAC (600 V for 24 V class and TG models), for 1 minute (However, do not measure dielectric strength between encoder and motor)
Rotation	Forward and reverse rotations possible
Ambient temperature	0 to 40˚C
Humidity	20 to 90% RH (non-condensing)
Paint color	Black
Protection	Fully enclosed (IP43)
Lead wire length	1000 mm

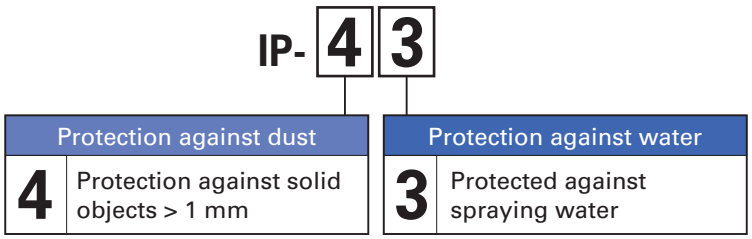
■How to connect



Motor rotation direction
When (Red): + and (Blue): -, counterclockwise as viewed from the output axis
Tachogenerator polarity
When rotating counterclockwise as viewed from the output axis, (Red): + and (Blue): -

■Protection rating

The protection ratings of our servo motors comply with IEC standards (IEC 60034-5 Edition 4.1, 2006-11).



■Compliance with International Standards and Directives

RoHS

European EC Directive (CE marking)	Directive	Standards	
	Low Voltage Directive (2014/35/EU)	IEC 60034-1, Edition 12, 2010-02; IEC 60034-5, Edition 4.1, 2006-11	
	RoHS directive	Compliant	
UL standards	Classification	Standards	File no.
	cUL	CSA C22.2 No.100, UL 1004-1, UL 1004-6	E179832(PRHZ8)

Encoder Specifications

Items	Unit	Specifications
Encoder type		Incremental encoder
Pulses per revolution	$^{P}/_{R}$	Standard: 2000 (Optional: 200, 500, 1000)
Output circuit		Line driver
Number of channels		3
Power supply	VDC	+5±5%
Current consumption	mA	160 max.
Output circuit voltage	VDC	V_{OH}=2.4 min., V_{OL}=0.5 max. at I_0 = ±20 mA
Output circuit current	mA	20 max.
Response frequency	kHz	200
PWM duty cycle		$T_1 = 1/2T_0 \pm 1/8T_0$
Output phase difference		$T_{2\ to\ 5} = 1/4T_0 \pm 1/8T_0$
Zero-point signal		$T_6 = T_0 \pm 0.4T_0$
Operating temperature	˚C	0 to +85 (inside the encoder)
Inertia	$\times 10^{-4}kgm^2$	0.005

Note: An open collector output type is also available as an option.

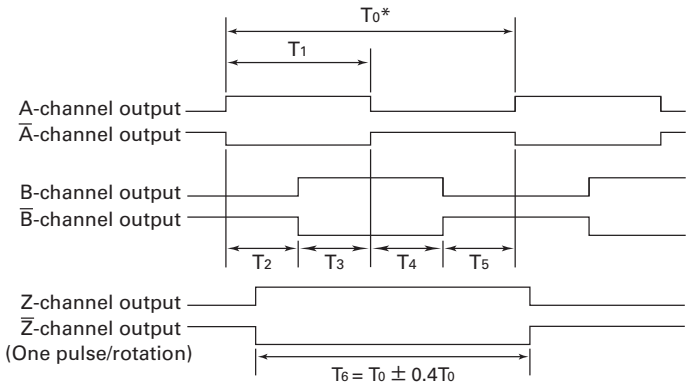
■External connection

Lead wire color	Application
Red	+5 VDC
Black	GND(0 V)
Shielded	Chassis ground
Blue	A-channel output
Brown	$\overline{A}$-channel output
Green	B-channel output
Purple	$\overline{B}$-channel output
White	Z-channel output (zero point)
Yellow	$\overline{Z}$-channel output (zero point)

■Output waveform

●Line driver output

(When rotating counterclockwise as viewed from the motor output shaft)

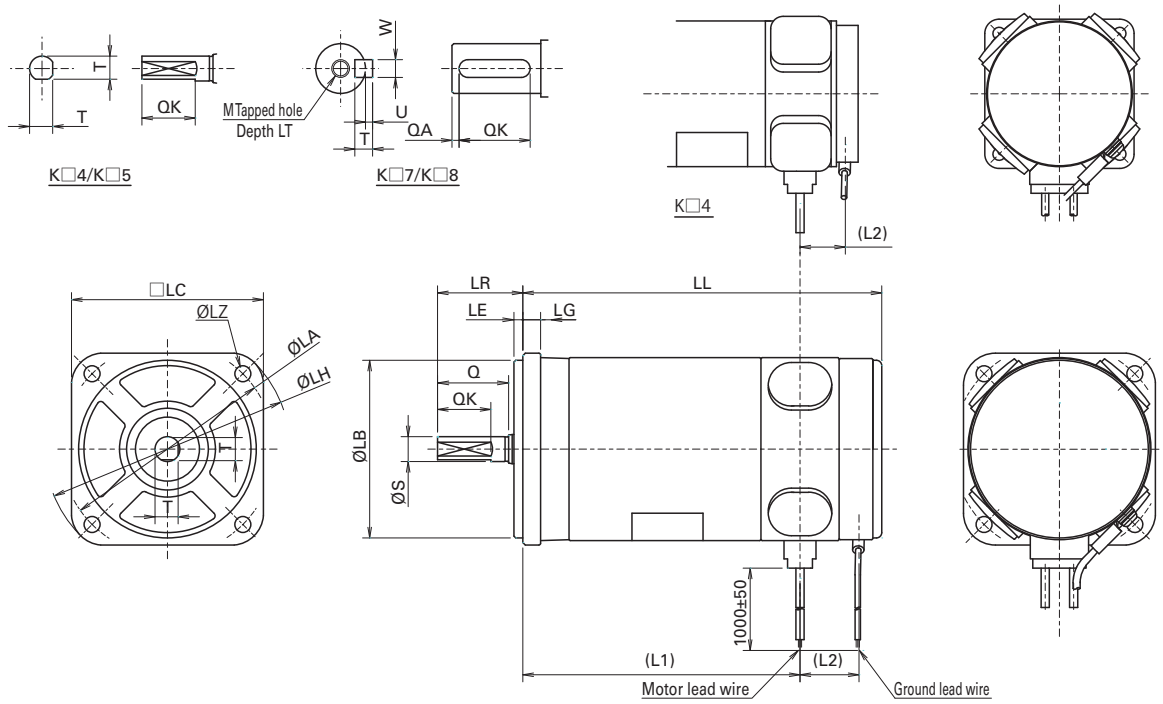


*T_0 is the average time for one encoder rotation when the encoder is rotated at a constant speed.

- Do not exert forces in the axial direction when handling.
- Do not perform insulation resistance or dielectric strength testing as it may damage the electronic circuit.
- The specifications above do not take deviations arising from motor dependencies into account.

Dimensions

■Servo motor

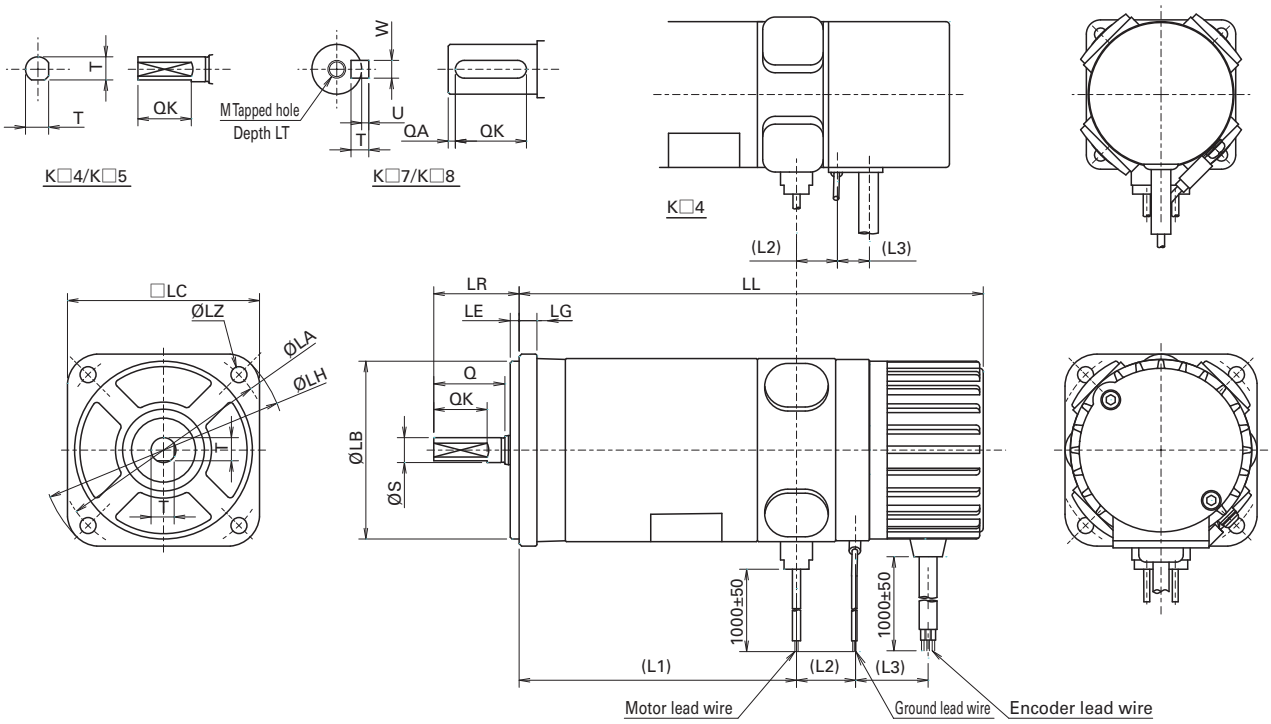


(Unit: mm)

Model No.	LL	LG	L1	L2	LA	LB	LE	LH	LC	LZ	LR
KB402XXX	56±1	5±0.5	40.5	11.5	48±0.2	0 34-0.025	2±0.3	56	42±0.5	4-ϕ3.5	24±0.8
K□404XXX	69±1		53.5								
K□406XXX	82±1		66.5								
K□506XXX	81±1		58	17	60±0.3	0 50-0.025	2.5±0.3	69	54±0.5	4-ϕ4.5	
K□511XXX	101±2		78								
KA720XXX	100.5±2	8±0.5	74.5	17.5	90±0.3	0 70-0.030	3±0.4	100	76±0.8	4-ϕ5.5	30±0.8
KA730XXX	124.5±2		98.5								
KA840XXX	134±2		103.5	22	100±0.3	0 80-0.030		112	88±0.8	4-ϕ6.6	35±0.8
KA850XXX	149±2		118.5								

Model No.	S	Q	QA	QK	W	T	U	M	LT	Mass [kg]
KB402XXX	0 7 -0.009	20±0.5	–	15±1.5	Two slots 6.5±0.2			–	–	0.30
K□404XXX										0.40
K□406XXX										0.50
K□506XXX										0.70
K□511XXX										0.90
KA720XXX	0 14 -0.011	25±0.5	2	20±0.7	+0.024 5+0.012	5	0 2-0.2	M5	8	1.80
KA730XXX										2.50
KA840XXX	0 16 -0.011	30±0.5		25±0.7				M6	10	3.40
KA850XXX										4.10

■Servo motor with encoder



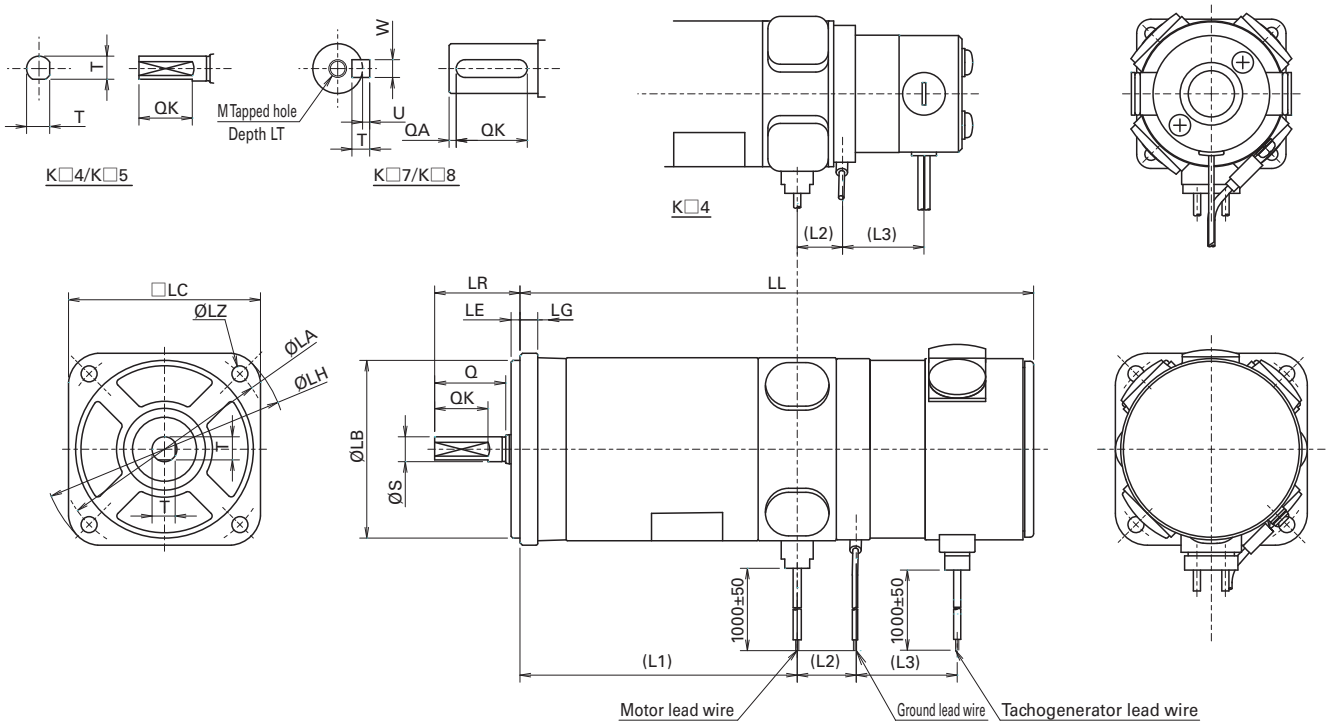
(Unit: mm)

Model No.	LL	LG	L1	L2	L3	LA	LB	LE	LH	LC	LZ	LR
KB402XS0	83±1	5±0.5	40.5	11.5	9	48±0.2	0 34-0.025	2±0.3	56	42±0.5	4-ϕ3.5	24±0.8
K□404XS0	96±1		53.5									
K□406XS0	109±2		66.5									
K□506XS0	110.5±2		58	17	20	60±0.3	0 50-0.025	2.5±0.3	69	54±0.5	4-ϕ4.5	
K□511XS0	130.5±2		78									
KA720XS0	134.5±2	8±0.5	74.5	17.5	27	90±0.3	0 70-0.030	3±0.4	100	76±0.8	4-ϕ5.5	30±0.8
KA730XS0	158.5±2		98.5									
KA840XS0	166±2		103.5	22	25	100±0.3	0 80-0.030		112	88±0.8	4-ϕ6.6	35±0.8
KA850XS0	181±2		118.5									

Model No.	S	Q	QA	QK	W	T	U	M	LT	Mass [kg]
KB402XS0	0 7 -0.009	20±0.5	–	15±1.5	Two slots 6.5±0.2			–	–	0.40
K□404XS0										0.55
K□406XS0										0.65
K□506XS0										0.80
K□511XS0										1.10
KA720XS0	0 14 -0.011	25±0.5	2	20±0.7	+0.024 5+0.012	5	0 2-0.2	M5	8	2.10
KA730XS0										3.10
KA840XS0	0 16 -0.011	30±0.5		25±0.7				M6	10	3.65
KA850XS0										4.25

Dimensions

■Servo motor with tachogenerator

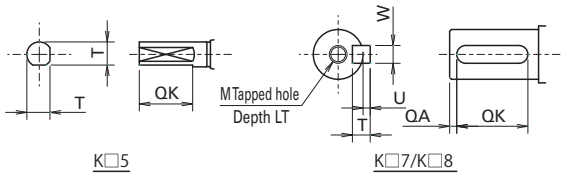


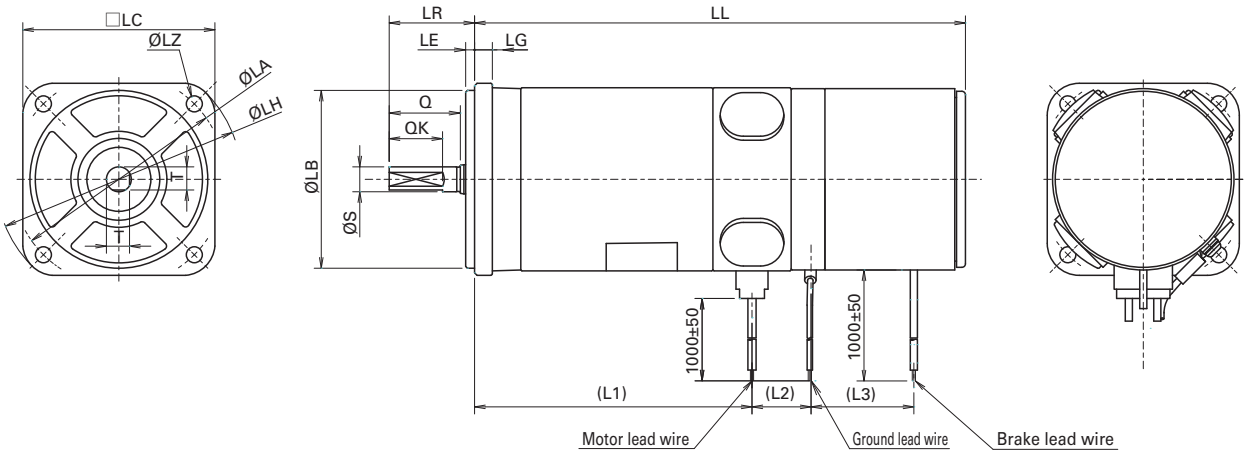
(Unit: mm)

Model No.	LL	LG	L1	L2	L3	LA	LB	LE	LH	LC	LZ	LR
KB402TXX	85±1	5±0.5	40.5	11.5	23	48±0.2	0 34-0.025	2±0.3	56	42±0.5	4-ϕ3.5	24±0.8
K□404TXX	98±1		53.5									
K□406TXX	111±2		66.5									
K□506TXX	124.5±2		58	17	28	60±0.3	0 50-0.025	2.5±0.3	69	54±0.5	4-ϕ4.5	
K□511TXX	144.5±2		78									
KA720TXX	148.5±2	8±0.5	74.5	17.5	34	90±0.3	0 70-0.030	3±0.4	100	76±0.8	4-ϕ5.5	30±0.8
KA730TXX	172.5±2		98.5									
KA840TXX	183±2		103.5	22	33	100±0.3	0 80-0.030		112	88±0.8	4-ϕ6.6	35±0.8
KA850TXX	197.5±2		118.5									

Model No.	S	Q	QA	QK	W	T	U	M	LT	Mass [kg]
KB402TXX	0 7 -0.009	20±0.5	–	15±1.5	Two slots 6.5±0.2			–	–	0.34
K□404TXX										0.49
K□406TXX										0.59
K□506TXX										1.0
K□511TXX										1.21
KA720TXX	0 14 -0.011	25±0.5	2	20±0.7	+0.024 5+0.012	5	0 2-0.2	M5	8	2.15
KA730TXX										2.85
KA840TXX	0 16 -0.011	30±0.5		25±0.7				M6	10	3.85
KA850TXX										4.45

■Servo motor with holding brake





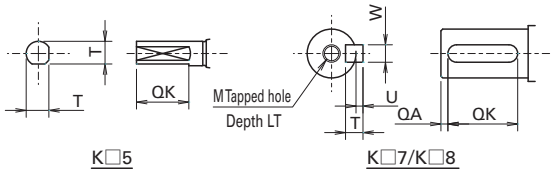
(Unit: mm)

Model No.	LL	LG	L1	L2	L3	LA	LB	LE	LH	LC	LZ	LR
K□506BXX	118±2	5±0.5	58	17	28.5	60±0.3	0 50-0.025	2.5±0.3	69	54±0.5	4-ϕ4.5	24±0.8
K□511BXX	138±2		78									
KA720BXX	138.5±2	8±0.5	74.5	17.5	30.5	90±0.3	0 70-0.030	3±0.4	100	76±0.8	4-ϕ5.5	30±0.8
KA730BXX	162.5±2		98.5									
KA840BXX	169.5±2		103.5	22	27	100±0.3	0 80-0.030		112	88±0.8	4-ϕ6.6	35±0.8
KA850BXX	184.5±2		118.5									

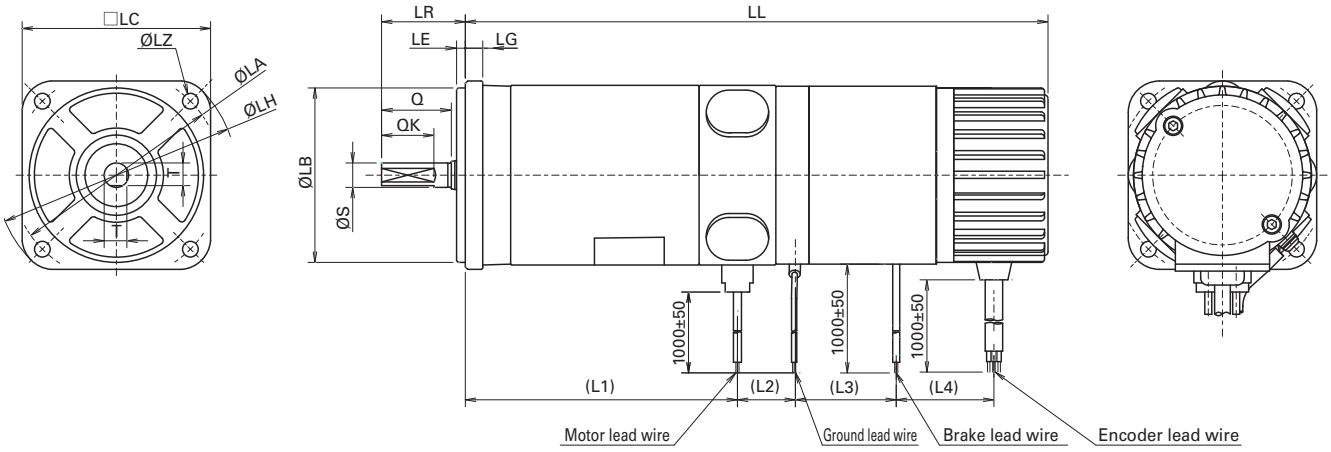
Model No.	S	Q	QA	QK	W	T	U	M	LT	Mass [kg]
K□506BXX	0 7 -0.009	20±0.5	—	15±1.5	Two slots 6.5±0.2			—	—	0.91
K□511BXX										1.21
KA720BXX	0 14 -0.011	25±0.5	2	20±0.7	+0.024 5+0.012	5	0 2-0.2	M5	8	2.39
KA730BXX										3.09
KA840BXX	0 16 -0.011	30±0.5		25±0.7				M6	10	4.20
KA850BXX										4.79

Dimensions

■Servo motor with encoder and holding brake



K□5 K□7/K□8

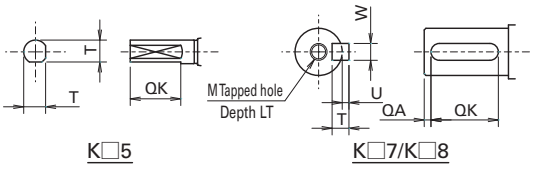


(Unit: mm)

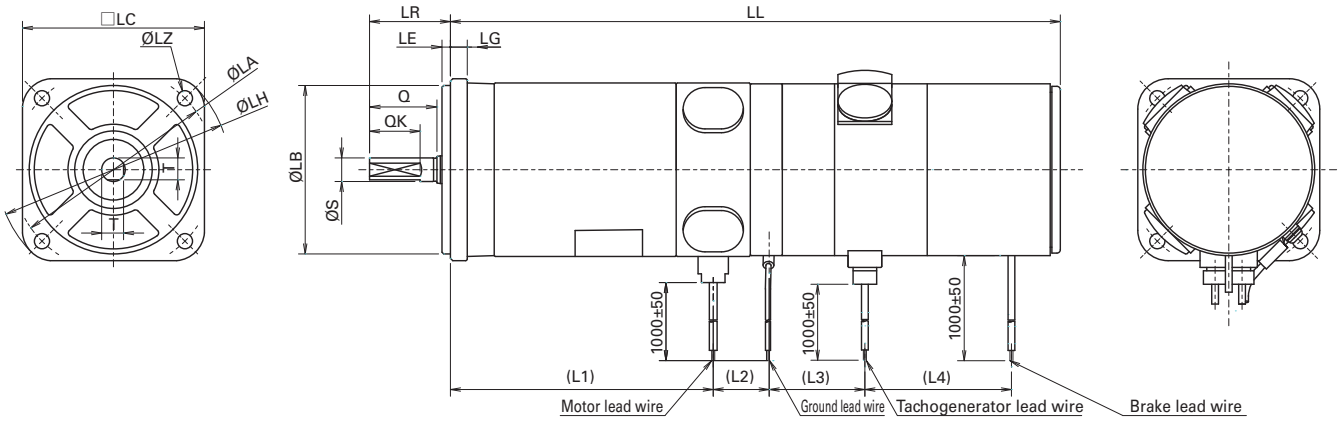
Model No.	LL	LG	L1	L2	L3	L4	LA	LB	LE	LH	LC	LZ
K□506BS0	147±2	5±0.5	58	17	28.5	28	60±0.3	0 50-0.025	2.5±0.3	69	54±0.5	4-ϕ4.5
K□511BS0	167±2		78									
KA720BS0	172.5±2	8±0.5	74.5	17.5	30.5	34.5	90±0.3	0 70-0.030	3±0.4	100	76±0.8	4-ϕ5.5
KA730BS0	196.5±2		98.5									
KA840BS0	203±3		103.5	22	27	35	100±0.3	0 80-0.030		112	88±0.8	4-ϕ6.6
KA850BS0	218±3		118.5									

Model No.	LR	S	Q	QA	QK	W	T	U	M	LT	Mass [kg]
K□506BS0	24±0.8	0 7 -0.009	20±0.5	—	15±1.5	Two slots 6.5±0.2			—	—	1.16
K□511BS0											1.46
KA720BS0	30±0.8	0 14 -0.011	25±0.5	2	20±0.7	+0.024 5+0.012	5	0 2-0.2	M5	8	2.64
KA730BS0											3.44
KA840BS0	35±0.8	0 16 -0.011	30±0.5		25±0.7				M6	10	4.44
KA850BS0											5.04

■Servo motor with tachogenerator and holding brake



K□5 K□7/K□8



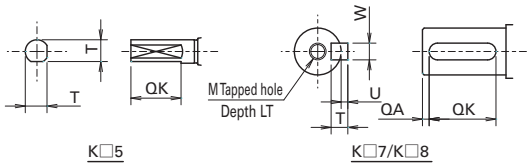
(Unit: mm)

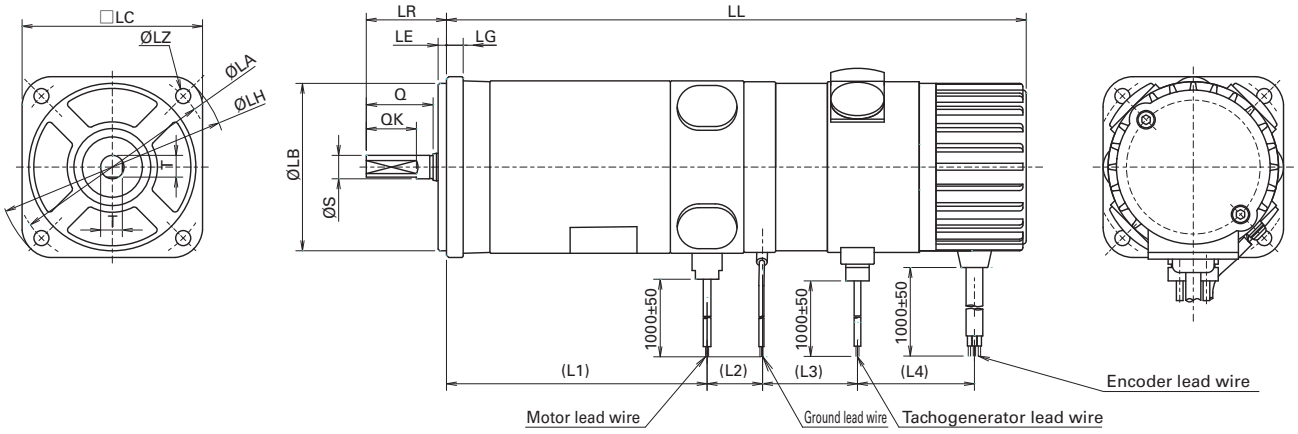
Model No.	LL	LG	L1	L2	L3	L4	LA	LB	LE	LH	LC	LZ
K□506JXX	161±2	5±0.5	58	17	28	43.5	60±0.3	0 50-0.025	2.5±0.3	69	54±0.5	4-ϕ4.5
K□511JXX	181±2		78									
KA720JXX	186.5±2	8±0.5	74.5	17.5	34	43.5	90±0.3	0 70-0.030	3±0.4	100	76±0.8	4-ϕ5.5
KA730JXX	210.5±3		98.5									
KA840JXX	219.5±3		103.5	22	33	44	100±0.3	0 80-0.030		112	88±0.8	4-ϕ6.6
KA850JXX	234.5±3		118.5									

Model No.	LR	S	Q	QA	QK	W	T	U	M	LT	Mass [kg]
K□506JXX	24±0.8	0 7 -0.009	20±0.5	—	15±1.5	Two slots 6.5±0.2			—	—	1.30
K□511JXX											1.47
KA720JXX	30±0.8	0 14 -0.011	25±0.5	2	20±0.7	+0.024 5+0.012	5	0 2-0.2	M5	8	2.80
KA730JXX											3.40
KA840JXX	35±0.8	0 16 -0.011	30±0.5		25±0.7				M6	10	4.64
KA850JXX											5.24

Dimensions

■Servo motor with encoder and tachogenerator



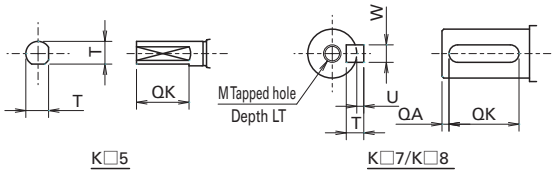


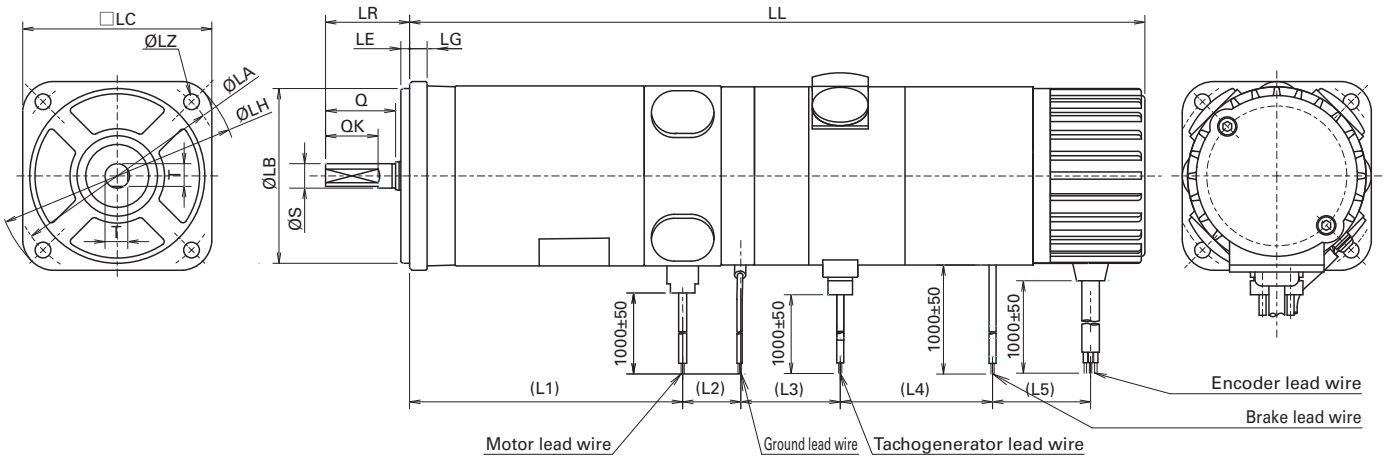
(Unit: mm)

Model No.	LL	LG	L1	L2	L3	L4	LA	LB	LE	LH	LC	LZ
K□506TS0	153.5±2	5±0.5	58	17	28	35	60±0.3	0 50-0.025	2.5±0.3	69	54±0.5	4-ϕ4.5
K□511TS0	173.5±2		78									
KA720TS0	182±2	8±0.5	74.5	17.5	34	40	90±0.3	0 70-0.030	3±0.4	100	76±0.8	4-ϕ5.5
KA730TS0	206±3		98.5									
KA840TS0	216±3		103.5	22	33	42	100±0.3	0 80-0.030		112	88±0.8	4-ϕ6.6
KA850TS0	231±3		118.5									

Model No.	LR	S	Q	QA	QK	W	T	U	M	LT	Mass [kg]
K□506TS0	24±0.8	0 7 -0.009	20±0.5	—	15±1.5	Two slots 6.5±0.2			—	—	1.16
K□511TS0											1.36
KA720TS0	30±0.8	0 14 -0.011	25±0.5	2	20±0.7	+0.024 5+0.012	5	0 2-0.2	M5	8	2.40
KA730TS0											3.10
KA840TS0	35±0.8	0 16 -0.011	30±0.5		25±0.7				M6	10	4.10
KA850TS0											4.70

■Servo motor with encoder, tachogenerator, and holding brake





(Unit: mm)

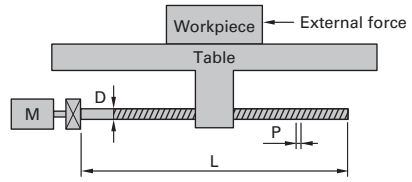
Model No.	LL	LG	L1	L2	L3	L4	L5	LA	LB	LE	LH	LC
K□506JS0	190±2	5±0.5	58	17	28	43.5	28	60±0.3	0 50-0.025	2.5±0.3	69	54±0.5
K□511JS0	210±3		78									
KA720JS0	220±3	8±0.5	74.5	17.5	34	43.5	34.5	90±0.3	0 70-0.030	3±0.4	100	76±0.8
KA730JS0	244±3		98.5									
KA840JS0	253±3		103.5	22	33	44	35	100±0.3	0 80-0.030		112	88±0.8
KA850JS0	268±3		118.5									

Model No.	LZ	LR	S	Q	QA	QK	W	T	U	M	LT	Mass [kg]
K□506JS0	4-ϕ4.5	24±0.8	0 7 -0.009	20±0.5	—	15±1.5	Two slots 6.5±0.2			—	—	1.42
K□511JS0												1.62
KA720JS0	4-ϕ5.5	30±0.8	0 14 -0.011	25±0.5	2	20±0.7	+0.024 5+0.012	5	0 2-0.2	M5	8	3.0
KA730JS0												3.70
KA840JS0	4-ϕ6.6	35±0.8	0 16 -0.011	30±0.5		25±0.7				M6	10	4.90
KA850JS0												5.50

Selection Guide By mechanism

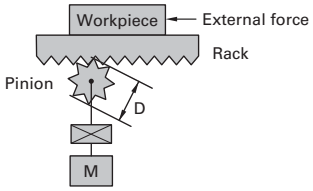
Typical examples of mechanisms and items that require selection are shown below. Provide this information when placing an order.

Ball screw



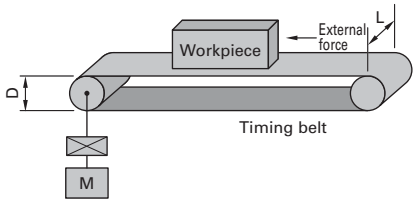
External force	F	N
Workpiece + table mass	W	kg
Ball screw diameter	D	m
Ball screw length	L	m
Ball screw lead	P	m
Ball screw density	ρ	kg/m^3
Friction coefficient	μ	
Gear ratio *	G	
Machine efficiency	η	

Rack & pinion



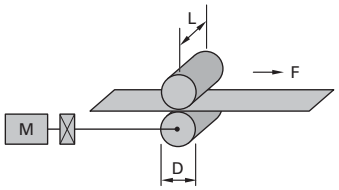
External force	F	N
Workpiece + rack mass	W	kg
Pinion diameter	D	m
Pinion thickness	L	m
Pinion density	ρ	kg/m^3
Friction coefficient	μ	
Gear ratio *	G	
Machine efficiency	η	

Belt drive



External force	F	N
Workpiece + belt mass	W	kg
Pulley diameter	D	m
Pulley width	L	m
Pulley density	ρ	kg/m^3
Pulley moment of inertia	J	kg·m^2
Gear ratio *	G	
Machine efficiency	η	

Roll feed



Sheet tension	F	N
Roll diameter	D	m
Roll width	L	m
Roll density	ρ	kg/m^3
Roll moment of inertia	J	kg·m^2
Gear ratio *	G	
Machine efficiency	η	

Rotary indexing table

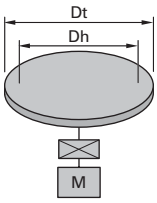
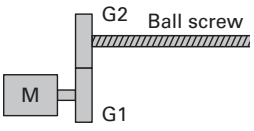


Table mass	W	kg
Table diameter	Dt	m
Table support diameter	Dh	m
Table moment of inertia	J	kg·m^2
Friction coefficient of table support	μ	
Gear ratio *	G	
Machine efficiency	η	

* Derivation of gear ratio (G)



$$G = \frac{\text{Number of screw threads (G2)}}{\text{Number of motor gear teeth (G1)}}$$

Safety Precautions

The products in this catalog are designed to be used with general industrial devices.
Pay sufficient attention to the following:

- Read the Instruction Manual carefully prior to installation, assembly, or operation for the correct usage. The Instruction Manual is available for download from our website.
- Refrain from modifying or processing the product in any way.
- Contact your point of sale or specialized service provider for installation or maintenance services of the product.
- Consult with us when using the product for the following uses, as these require special considerations for operations, maintenance, and management such as redundancy and emergency power generators.

  ❶ Use in medical equipment or other devices that may directly affect people's lives or cause bodily injury
  ❷ Use in transportation systems or transport-related equipment such as trains or elevators, that may affect people's lives or cause bodily injury
  ❸ Use in computer systems that may have a major impact on society or on the public
  ❹ Use in other devices that have a significant impact on human safety or on maintaining public operations

- Consult with us when using the product in an environment where vibrations occur, such as in a moving vehicle or during transportation.
- Use the product only after becoming thoroughly proficient with relevant product knowledge, safety information, and precautions.

General

1. Only technically qualified personnel should perform the transportation, installation, wiring, operation, maintenance, and inspection of the product. Failure to follow this may result in electric shock, injury, or fire.
2. Prior to installation, operation, maintenance servicing or inspection, be sure to read the Instruction Manual and follow the instructions. Otherwise, it may result in electric shock, injury, or fire.
3. Do not work on wiring, maintenance servicing, or inspection with power on. Ensure that you wait at least one minute after turning off the power before working on them. Otherwise, it may result in electric shock.
4. Do not use the product in explosive environments. Otherwise, it may result in injury or fire.
5. When performing inspection, cleaning, or replacement, ensure that the power is turned off before working on them. Failure to do so may result in electric shock.
6. Do not use motors outside the specified operating ranges. Otherwise, it may result in electric shock, injury, or product damage.
7. Do not use motors that are damaged. Otherwise, it may result in injury or fire.
8. Do not remove the nameplate.
9. Lay out your system so that maintenance and inspection can be performed easily and the nameplate is visible.
10. Be careful when handling motors and peripheral devices. They become hot during and after operation and may result in burns.

Unpacking

11. Unpack the box right side up. Failure to do so may result in injury.
12. Ensure that the product you receive is the one you purchased. Using the wrong product may result in injury or product damage.
13. Do not apply static electricity to encoder wires. Otherwise, it may result in malfunctions.

Installation

14. Do not stand on the product or place heavy objects on top of it. Otherwise, it may result in injury.
15. Do not subject the product to excessive shock. Otherwise, it may result in product failures.
16. During installation, be careful that the product does not fall or tip over, as this can be dangerous.
17. Never install the product in a location exposed to water, in a corrosive or flammable gas atmosphere, or in the vicinity of flammable materials. Otherwise, it may result in fire or product malfunctions.
18. Install the product to incombustible materials, such as metals. Failure to do so may result in fire.

Wiring

19. Perform the wiring according to the dimensional drawing or the wiring diagram in the Instruction Manual. Failure to do so may result in electric shock or fire.
20. Perform wiring according to your local electrical codes. Failure to do so may result in motor burnout or fire.
21. Make sure to connect the grounding wire of the motor to the protective grounding terminals. Failure to do so may result in electric shock.
22. Do not damage, apply excessive stress to, put heavy things on, or tuck down cables. Otherwise, it may result in electric shock.
23. Perform wiring correctly and securely. Incorrect wiring may result in motor runaway and injury.
24. Do not perform insulation resistance or dielectric strength testing for encoders. Otherwise, it may result in product damage. Contact us If you need these tests.
25. Do not apply static electricity to encoder cables. Otherwise, it may result in malfunctions.

Operation

26. Never touch the rotating part of motors during operation. Otherwise, it may result in injury.
27. Never touch terminals and connectors while the power is on. Otherwise, it may result in electric shock.
28. Never remove the motor cover during operation. Otherwise, it may result in electric shock.
29. Protection devices are not supplied with motors. Prepare an overvoltage protection device, earth leakage breaker, overheat protection device, and emergency stop device to ensure safe operation. Failure to do so may result in injury or fire.
30. Never touch motors as they reach high temperatures in operation and remain hot for a while after the power is turned off. Otherwise, it may result in burns.
31. Stop operations immediately when an emergency occurs. Failure to do so may result in electric shock, injury, or fire.
32. Conduct a test operation of motors only when they are disconnected from machinery and secured. Connect them to machinery after the test is done. Failure to do so may result in injury.
33. The holding brake cannot be used as a dynamic brake to secure the safety of machinery. Install a stopping device to machinery to ensure safety. Failure to do so may result in injury.
34. In the case of an alarm, make sure to eliminate the cause and ensure safety before resuming operations. Failure to do so may result in injury.
35. When power is restored after an outage, do not approach machinery because it may suddenly restart. (Design a system so that safety can be secured even in such occasions.) Otherwise, it may result in injury.
36. Ensure that the power supply matches the product voltage.

Maintenance

37. Motor frames become very hot, so be careful when performing maintenance or inspection. Failure to do so may result in injury.
38 Contact us for repairs. Disassembling the product by yourself may result in product failures and render it inoperable.

Transportation

39. Handle the product with care during transportation to prevent it from dropping or falling. Failure to do so may result in injury.
40. When transporting, do not hold cables or motor shafts. Otherwise, it may result in product damage or injury.

Disposal

41. Dispose of motors as industrial waste.

Safety Precautions

- Read the accompanying Instruction Manual carefully prior to using the product.
- Do not use this product in an environment where vibration is present, such as in moving vehicles or shipping vessels.
- Do not perform any retrofitting, re-engineering, or modification to the product.

Please contact us beforehand if you intend to use this product in the following applications.

- Medical equipment that may have an effect on human life
- Systems or equipment that may have a major impact on society or on the public
- Special applications related to aviation and space, nuclear power, electric power, submarine repeaters, etc.

SANYO DENKI CO., LTD. 3-33-1 Minami-Otsuka, Toshima-ku, Tokyo 170-8451, Japan TEL: +81 3 5927 1020 https://www.sanyodenki.com

CATALOG No. S1052B001 '20.1