Nippon Pulse
Your Partner in Motion Control

S160
Linear Shaft Motor

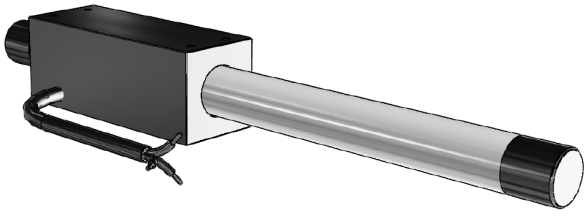
Visit nipponpulse.com to download 3D CAD drawings and 2D prints of this motor.

	S160D		S160T		S160Q		
Electrical Specs	S160D	S160D 1S	S160T	S160T 1S	S160Q	S160Q 2S	S160Q 1S
Continuous Force[1]	10N (2.25lbs)		15N (3.37lbs)		20N (4.5lbs)		
Continuous Current[1]	0.62Arms	1.2Arms	0.62Arms	1.9Arms	0.62Arms	1.2Arms	2.5Arms
Acceleration Force[2]	40N (9.0lbs)		60N (13.5lbs)		81N (17.78lbs)		
Acceleration Current[2]	2.5Arms	5Arms	2.5Arms	7.4Arms	2.5Arms	5Arms	9.9Arms
Force Constant (K_f)	16N/Arms (3.71lbs/amp)	8.1N/Arms (1.88lbs/amp)	24N/Arms (5.43lbs/amp)	8.1N/Arms (1.83lbs/amp)	33N/Arms (7.31lbs/amp)	16N/Arms (3.54lbs/amp)	8.1N/Arms (1.79lbs/amp)
Back EMF (K_e)	5.4V/m/s (0.14V/in/s)	2.7V/m/s (0.07V/in/s)	8.1V/m/s (0.2V/in/s)	2.7V/m/s (0.067V/in/s)	11V/m/s (0.28V/in/s)	5.4V/m/s (0.14V/in/s)	2.7V/m/s (0.069V/in/s)
Resistance 25°C[3]	21Ω	5.3Ω	33Ω	3.7Ω	43Ω	11Ω	2.7Ω
Inductance[3]	8.2mH	2.1mH	12mH	1.3mH	16mH	4mH	1mH
Electric Time Constant	0.39ms		0.36ms		0.37ms		
Max. Rated Voltage (AC)	240V						
Fundamental Motor Constant (K_m)	3.52N√W		4.21N√W		4.92N√W		
Magnetic Pitch (North-North)	60mm (2.36in)						

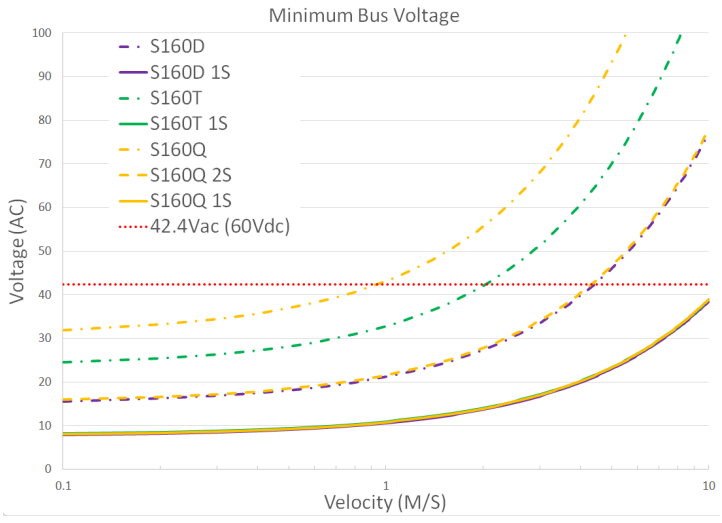
Is this the proper Linear Shaft Motor for your application? Use our SMART sizing program to assist in your decision.
This motor can be customized to fit your application demands; contact your application engineer for more information.
[1] Based on a temp rise of coil surface of 110°K over 25°C ambient temperature stalled forcer, and no external cooling or heat sinking.
[2] Can be maintained for a maximum of 40 seconds. Higher forces and current possible for short periods of time, consult Nippon Pulse for more information.
[3] All winding parameters listed are measured line-to-line (phase-to-phase).

Thermal Specs	S160D	S160T	S160Q
Max Phase Temperature[4]	135°C (275°F)		
Thermal Resistance (Coil) (K_q)	13.6°C/W	8.7°C/W	6.7°C/W

[4] The standard temperature difference between the coil and the forcer surface is 15°C.



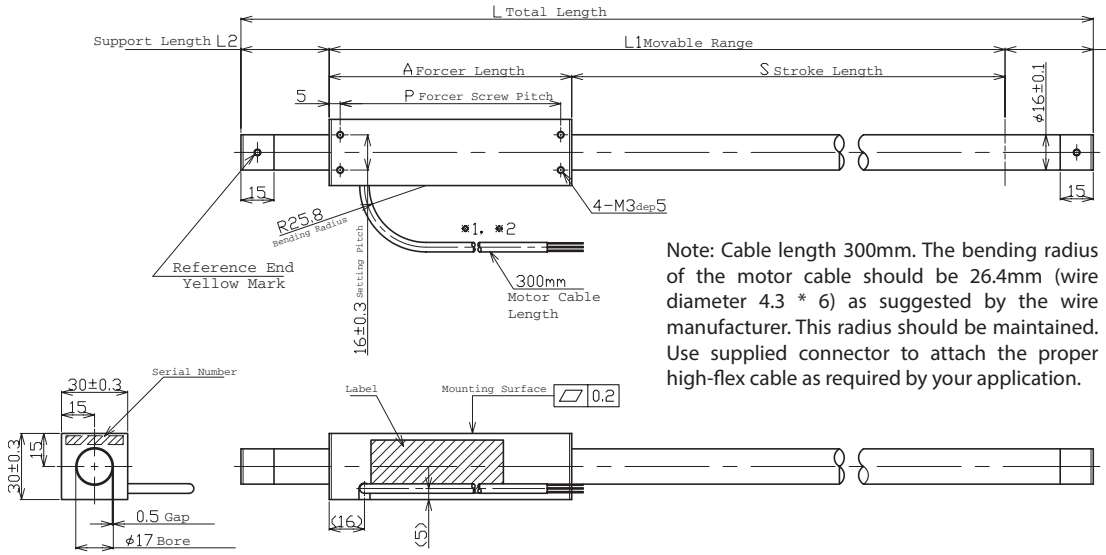
Bus Voltage



Part Numbering System

S	—	Shaft Size		Forcer Size (A)		Parallel Option		Usable Stroke (S)		Options		Options
		160		X	—	XX	—	XXXXst	—	XX	—	XX
				D: Double (2) windings T: Triple (3) windings Q: Quadruple (4) windings		Blank: Single Motor PL: Parallel Motors		100-1800mm		Blank: Standard WP: Water Resistant HA: Digital Hall Effect CE: CE type motor FG: Frame Ground		Blank: Standard FO: Forcer Only SO: Shaft Only

Forcer Specs	S160D	S160T	S160Q
Forcer Length (A)	80mm (3.15in)	110mm (4.33in)	140mm (5.51in)
Forcer Width	30mm ±0.3 (1.18in)		
Forcer Screw Pitch (P)	70mm (2.76in)	100mm (3.94in)	130mm (5.12in)
Forcer Weight	0.15kg (0.33lbs)	0.20kg (0.44lbs)	0.30kg (0.66lbs)
Gap	0.50mm (0.02in)		
Screw	M3		
Tightening torque	0.63 Nm		



Note: Cable length 300mm. The bending radius of the motor cable should be 26.4mm (wire diameter 4.3 * 6) as suggested by the wire manufacturer. This radius should be maintained. Use supplied connector to attach the proper high-flex cable as required by your application.

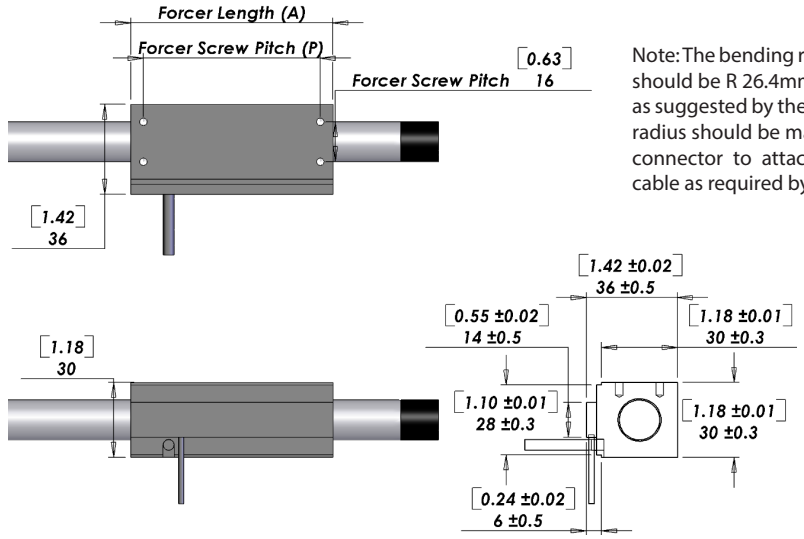
Tolerances are as follows:

Dimension (mm)	Tolerance (mm)
0 - 6	±0.1
7 - 30	±0.2
31 - 120	±0.3
121 - 315	±0.5
316 - 1000	±0.8
1001 - 2000	±1.2
2000 -	±1.5

L = See Shaft Length
L1 = Usable Stroke + A
L2 = See Support Length
A = See Forcer Length
P = See Forcer Screw Pitch

Unless otherwise specified, dimensions are in mm

Hall Effect Specs



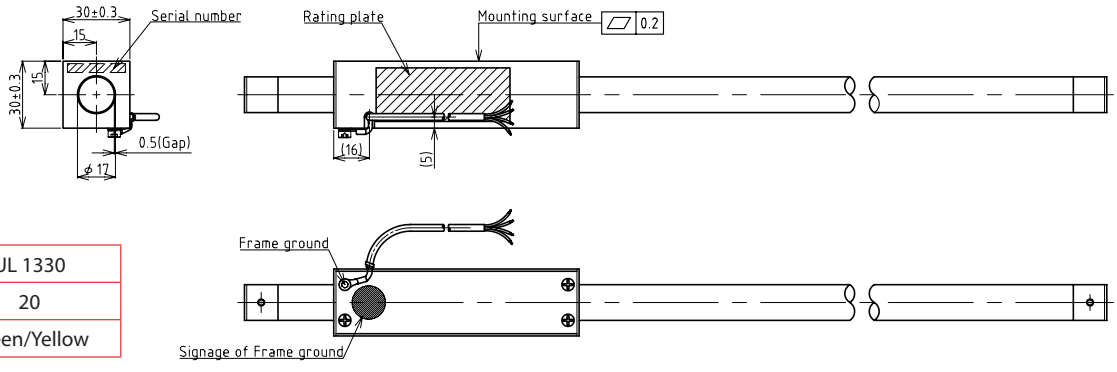
Note: The bending radius of the motor cable should be R 26.4mm (wire diameter 4.6 * 6) as suggested by the wire manufacturer. This radius should be maintained. Use supplied connector to attach the proper high-flex cable as required by your application.

Sensor Cable Specs

Wire Type	UL 758
Wire AWG	28
VCC	White/Red
GND	White/Black
Sensor 1	Orange/Red
Sensor 2	Orange/Black
Sensor 3	Gray/Red

The bending radius of the sensor cable should be R 27.6mm (wire diameter 4.4 * 6) as suggested by the wire manufacturer. This radius should be maintained. Attach the proper high flex cable as required by your application.

FG/FGA Type Motor Cable



Wire Type	UL 1330
Wire AWG	20
Frame Ground	Green/Yellow

Shaft Length (L)

Stroke	S160D	S160T	S160Q
100	230mm (9.1in)	260mm (10.2in)	290mm (11.4in)
150	280mm (11.0in)	310mm (12.2in)	340mm (13.4in)
200	330mm (3.0in)	360mm (14.2in)	390mm (15.4in)
250	380mm (15.0in)	410mm (16.1in)	440mm (17.3in)
300	430mm (16.9in)	460mm (18.1in)	490mm (19.3in)
350	480mm (18.9in)	510mm (20.1in)	540mm (21.3in)
400	560mm (22.1in)	590mm (23.2in)	620mm (24.4in)
450	610mm (24.0in)	640mm (25.2in)	670mm (26.4in)
500	660mm (26.0in)	690mm (27.2in)	720mm (28.4in)
550	710mm (28.0in)	740mm (29.1in)	770mm (30.3in)
600	760mm (29.9in)	790mm (31.1in)	820mm (32.3in)
650	810mm (31.9in)	840mm (33.1in)	870mm (34.3in)
700	860mm (33.9in)	890mm (35.0in)	920mm (36.2in)
750	910mm (35.8in)	940mm (37.0in)	970mm (38.2in)
800	960mm (37.8in)	990mm (39.0in)	1020mm (40.2in)
850	1050mm (41.3in)	1080mm (42.5in)	1110mm (43.7in)
900	1100mm (43.3in)	1130mm (44.5in)	1160mm (45.7in)
950	1150mm (45.3in)	1180mm (46.5in)	1210mm (47.6in)
1000	1200mm (47.2in)	1230mm (48.4in)	1260mm (49.6in)
1050	1250mm (49.2in)	1280mm (50.4in)	1310mm (51.6in)

Shaft Mass

Stroke	S160D	S160T	S160Q
100	0.28kg (0.63lb)	0.33kg (0.72lb)	0.37kg (0.81lb)
150	0.35kg (0.78lb)	0.4kg (0.87lb)	0.44kg (1lb)
200	0.42kg (0.94lb)	0.47kg (1lb)	0.51kg (1.1lb)
250	0.49kg (1.1lb)	0.54kg (1.2lb)	0.58kg (1.3lb)
300	0.56kg (1.2lb)	0.61kg (1.3lb)	0.65kg (1.4lb)
350	0.64kg (1.4lb)	0.68kg (1.5lb)	0.72kg (1.6lb)
400	0.72kg (1.6lb)	0.77kg (1.7lb)	0.81kg (1.8lb)
450	0.79kg (1.8lb)	0.84kg (1.8lb)	0.88kg (1.9lb)
500	0.86kg (1.9lb)	0.91kg (2lb)	0.95kg (2.1lb)
550	0.93kg (2.1lb)	1kg (2.2lb)	1kg (2.2lb)
600	1kg (2.2lb)	1kg (2.3lb)	1.1kg (2.4lb)
650	1.1kg (2.4lb)	1.1kg (2.5lb)	1.2kg (2.6lb)
700	1.1kg (2.5lb)	1.2kg (2.6lb)	1.2kg (2.7lb)
750	1.2kg (2.7lb)	1.3kg (2.8lb)	1.3kg (2.9lb)
800	1.3kg (2.8lb)	1.3kg (2.9lb)	1.4kg (3lb)
850	1.4kg (3lb)	1.4kg (3.1lb)	1.5kg (3.2lb)
900	1.5kg (3.2lb)	1.5kg (3.3lb)	1.5kg (3.4lb)
950	1.5kg (3.4lb)	1.6kg (3.4lb)	1.6kg (3.5lb)
1000	1.6kg (3.5lb)	1.6kg (3.6lb)	1.7kg (3.7lb)
1050	1.7kg (3.7lb)	1.7kg (3.8lb)	1.7kg (3.9lb)

Shaft Diameter (D) - 16mm ±0.1
Total Length (L)=Stroke (S)+Forcer Length (A)+(Support Length (L2)x2)

Additional stroke lengths are available. For longer strokes, see the datasheet for L160 Linear Shaft Motor. Contact Nippon Pulse for more information.

Connector (Motor Cable)

Receptacle Housing	XMR-03V
Plug Housing	XMP-03V
Retainer	XMS-03V
Pin Contact	SXM-001T-P0.6
Socket Contact	SXA-001T-P0.6

To be installed by the user.

Support and Bending

Stroke	Support Length (L2)	Max. Bending
0~350	25mm	0.00mm
351~500	40mm	0.30mm
501~800	40mm	0.50mm
801~max	60mm	0.50mm

Forcer Spacing Distance

Spec	S160T	S160Q
Forcer Spacing Distance	10mm	
Pole (N/S) Distance	30mm	
Forcer Length	110mm	140mm
Flip Forcers	No	Yes

Tandem S160D forcers are possible, but are equivalent to one (1) S160Q forcer and thus are not listed above.

Standard Lead Wire

Wire Type	UL 2464FA
Wire AWG	25
U Phase	Red
V Phase	White
W Phase	Black

300mm lead wire bare leads. The bending radius of the motor cable should be 26.4mm as suggested by the wire manufacturer.

Note: Metric units guaranteed. Imperial (United States customary) units are calculated.

FGA/CE Type Lead Wire

Ground Wire	CE
Wire Type	UL 1330
Wire AWG	24
U Phase	Red
V Phase	White
W Phase	Black

300mm lead wire bare leads. The bending radius of the motor cable should be 16.96mm as suggested by the wire manufacturer. FG type with insulating sheet between coils and case. Meets all requirements of EN60034-1 (1998).

Tandem Forcer

Forcer Spacing Distance

Not all motors on this datasheet have received a CE Declaration of Conformity. Only the standard S160D, S160T and S160Q motors have been certified to CE standards. The motors and motor options with the following designations have not received a CE Declaration of Conformity, and as such are designated FGA: S160D-1S, S160T-1S, S160Q-2S, S160Q-1S, any S160 motor with Hall Effects.

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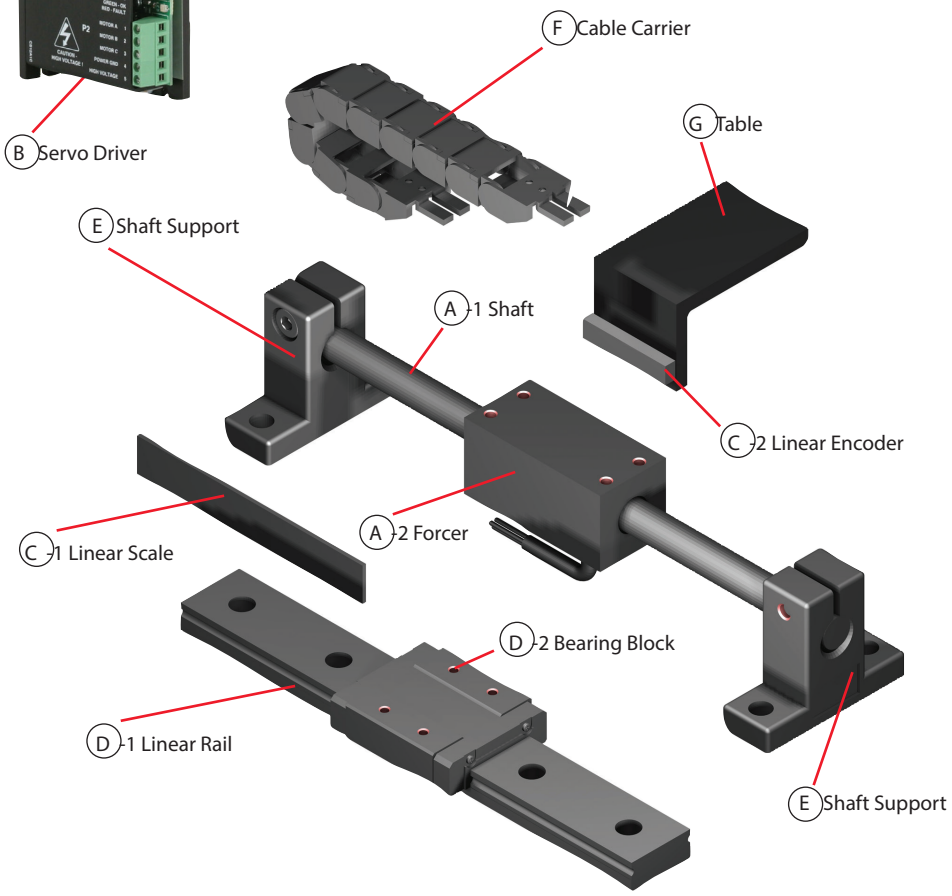
System Design
Linear Shaft Motor

The design of the Linear Shaft Motor allows you to replace traditional linear motion systems, such as a standard ball screw, with the Linear Shaft Motor and achieve higher speed and resolution.

To achieve the highest performance with the Linear Shaft Motor system, the entire system structure must be optimized.

Be aware there are various design considerations which are somewhat different from traditional servo system practices. These are the main components needed to make a Linear Shaft Motor system, as well as factors to consider when designing a system.



Steps to putting together a Linear Shaft Motor System

Choose the Linear Shaft Motor based on force and stroke requirements.

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Choose the shaft supports based on design and motor specifications.

↓

Choose the linear guide (bearings) based on cost and smoothness (performance) constraints.

↓

Choose the linear encoder to achieve the required position resolution.

↓

Choose the servo driver to match the power requirements of the Linear Shaft Motor.

↓

Choose the OTL, limit switches/other components and assemble the Linear Shaft Motor system.

Configuring the Linear Shaft Motor

To configure a system using the Linear Shaft Motor, the following peripheral devices are required:

A. Linear Shaft Motor
B. Servo Driver
C. Linear encoder (optical or magnetic)

Item D (Linear Guide) is a necessary part of a system, but consideration must be given to the application, demand specifications, environmental conditions, and which will be moving--the forcer or the shaft.

The other items, E through G, are optional and will need to be selected depending on the application.