Nippon Pulse
Your Partner in Motion Control

S500
Linear Shaft Motor

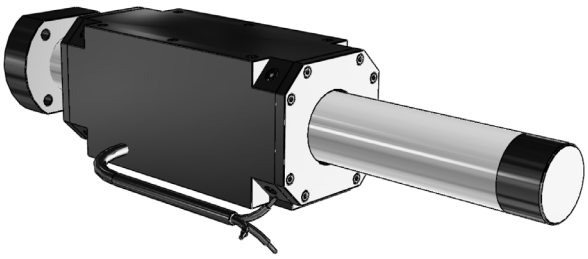
Visit nipponpulse.com to download 3D CAD drawings and 2D prints of this motor.

	S500D		S500T		S500Q		
Electrical Specs	S500D	S500D 2S	S500T	S500T 3S	S500Q	S500Q 4S	S500Q 2S
Continuous Force[1]	289N (65lbs)		440N (99lbs)		585N (132lbs)		
Continuous Current[1]	3.8Arms	1.9Arms	5.8Arms	1.9Arms	7.7Arms	1.9Arms	3.9Arms
Acceleration Force[2]	1156N (260lbs)	1157 (260.2lbs)	1760N (396lbs)		2340N (526lbs)		
Acceleration Current[2]	15.2Arms	7.6Arms	23Arms	7.7Arms	31Arms	7.7Arms	15Arms
Force Constant (K_f)	76N/Arms (17.1lbs/amp)	152N/Arms (34.2lbs/amp)	76N/Arms (17lbs/amp)	228N/Arms (51lbs/amp)	76N/Arms (17lbs/amp)	304N/Arms (68lbs/amp)	152N/Arms (34lbs/amp)
Back EMF (K_e)	25V/m/s (0.64V/in/s)	51V/m/s (1.31V/in/s)	25V/m/s (0.64V/in/s)	76V/m/s (1.95V/in/s)	25V/m/s (0.64V/in/s)	101V/m/s (2.59V/in/s)	51V/m/s (1.31V/in/s)
Resistance 25°C,[3]	4.4Ω	18Ω	3.3Ω	30Ω	2.2Ω	35Ω	8.8Ω
Inductance[3]	27mH	108mH	20mH	178mH	13mH	211mH	53mH
Electric Time Constant	6.14ms		6.0ms		6.0ms		
Max. Rated Voltage (AC)	240V						
Fundamental Motor Constant (K_m)	36.26N√W	36.28N√W	41.76N√W		51.22N√W		
Magnetic Pitch (North-North)	180mm (7.09in)						

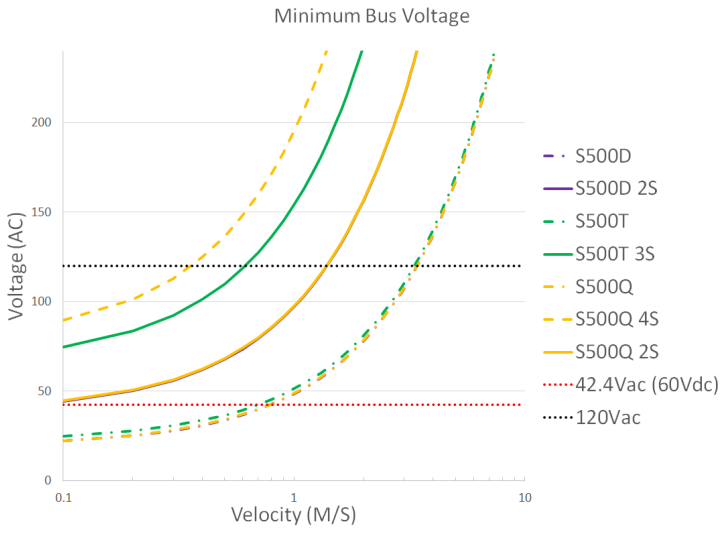
Is this the proper Linear Shaft Motor for your application? Use our SMART sizing program to assist in your decision.
This motor can be customized to fit your application demands; contact your application engineer for more information.
[1] Based on a temp rise of coil surface of 110°K over 25°C ambient 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	S500D	S500T	S500Q
Max Phase Temperature[4]	135°C (275°F)		
Thermal Resistance (Coil) (K_q)	1.7°C/W	1°C/W	0.8°C/W

[4] The standard temperature difference between the coil and the forcer surface is 40°C.



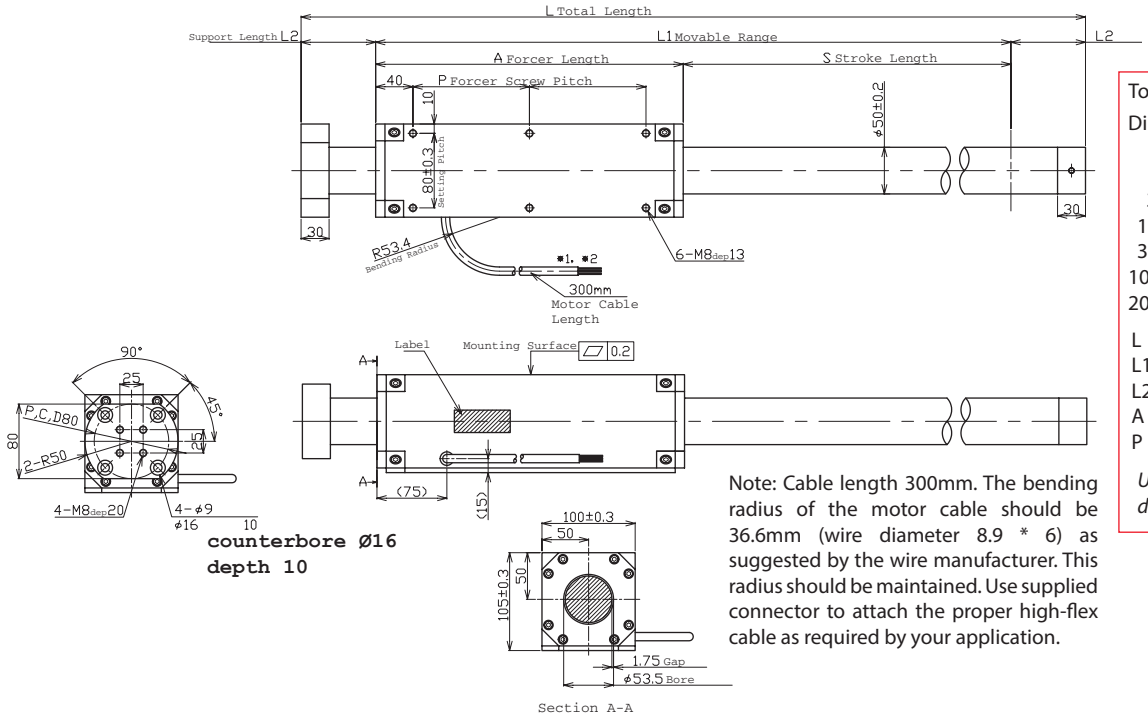
Bus Voltage



Part Numbering System

	Shaft Size	Forcer Size (A)		Parallel Option		Usable Stroke (S)		Options		Options
S	500	X	—	XX	—	XXXXst	—	XX	—	XX
		D: Double (2) windings T: Triple (3) windings Q: Quadruple (4) windings		Blank: Single Motor PL: Parallel Motors		200-2000mm		Blank: Standard WP: Water Resistant HA: Digital Hall Effect CE: CE type motor		Blank: Standard FO: Forcer Only SO: Shaft Only

Forcer Specs	S500D	S500T	S500Q
Forcer Length (A)	240mm (9.45in)	330mm (12.99in)	420mm (16.54in)
Forcer Width	100 x 105mm (3.94 x 4.13in)		
Forcer Screw Pitch (P)	80mm (3.15in)	125mm (4.9in)	170mm (6.7in)
Forcer Weight	10kg (22lbs)	13kg (28.7lbs)	15kg (33.1lbs)
Gap	1.75mm (0.07in)		
Screw	M8		
Tightening Torque	12.5 Nm		



Note: Cable length 300mm. The bending radius of the motor cable should be 36.6mm (wire diameter 8.9 * 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.

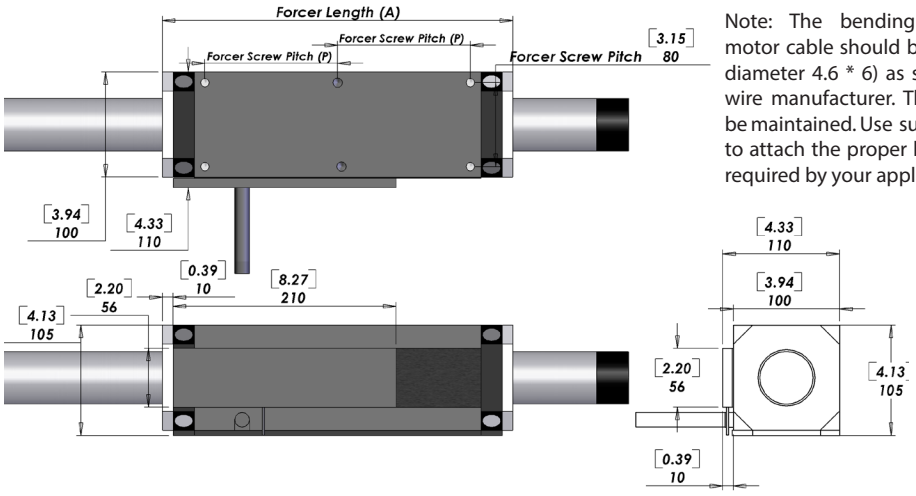
Tolerances are as follows:

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 R36.6mm (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 R27.6mm (wire diameter 6.1 * 6) as suggested by the wire manufacturer. This radius should be maintained. Attach the proper high flex cable as required by your application.

Forcer Spacing Distance

Spec	S500T	S500Q
Forcer Spacing Distance	30mm	
Pole (N/S) Distance	90mm	
Forcer Length	330mm	420mm
Flip Forcers	No	Yes

Tandem S500D forcers are possible, but are equivalent to one (1) S500Q forcer and thus are not listed above.

Tandem Forcer



Forcer Spacing Distance

Support and Bending

Stroke	Support Length (L2)	Max. Bending
0~750	80mm	0.00mm
800~max.	100mm	0.15mm

Shaft Diameter (D) - 50mm ±0.2
Total Length (L)=Stroke (S)+Forcer Length (A)+ (Support Length (L2)x2)

Shaft Length (L)

Stroke	S500D	S500T	S500Q
100	Stroke is less than the electrical cycle length. Contact Nippon Pulse.		
150			
200	600mm (23.6in)	690mm (27.2in)	780mm (30.7in)
250	650mm (25.6in)	740mm (29.1in)	830mm (32.7in)
300	700mm (27.6in)	790mm (31.1in)	880mm (34.6in)
350	750mm (29.5in)	840mm (33.1in)	930mm (36.6in)
400	800mm (31.5in)	890mm (35in)	980mm (38.6in)
450	850mm (33.5in)	940mm (37in)	1030mm (40.6in)
500	900mm (35.4in)	990mm (39in)	1080mm (42.5in)
550	950mm (37.4in)	1040mm (40.9in)	1130mm (44.5in)
600	1000mm (39.4in)	1090mm (42.9in)	1180mm (46.5in)
650	1050mm (41.3in)	1140mm (44.9in)	1230mm (48.4in)
700	1100mm (43.3in)	1190mm (46.9in)	1280mm (50.4in)
750	1150mm (45.3in)	1240mm (48.8in)	1330mm (52.4in)
800	1240mm (48.8in)	1330mm (52.4in)	1420mm (55.9in)
850	1290mm (50.8in)	1380mm (54.3in)	1470mm (57.9in)
900	1340mm (52.8in)	1430mm (56.3in)	1520mm (59.8in)
950	1390mm (54.7in)	1480mm (58.3in)	1570mm (61.8in)
1000	1440mm (56.7in)	1530mm (60.2in)	1620mm (63.8in)
1050	1490mm (58.7in)	1580mm (62.2in)	1670mm (65.7in)
1100	1540mm (60.6in)	1630mm (64.2in)	1720mm (67.7in)
1150	1590mm (62.6in)	1680mm (66.1in)	1770mm (69.7in)
1200	1640mm (64.6in)	1730mm (68.1in)	1820mm (71.7in)
1250	1690mm (66.5in)	1780mm (70.1in)	1870mm (73.6in)
1300	1740mm (68.5in)	1830mm (72in)	1920mm (75.6in)
1350	1790mm (70.5in)	1880mm (74in)	1970mm (77.6in)
1400	1840mm (72.4in)	1930mm (76in)	2020mm (79.5in)
1450	1890mm (74.4in)	1980mm (78in)	2070mm (81.5in)
1500	1940mm (76.4in)	2030mm (79.9in)	2120mm (83.5in)
1550	1990mm (78.3in)	2080mm (81.9in)	2170mm (85.4in)
1600	2040mm (80.3in)	2130mm (83.9in)	2220mm (87.4in)
1650	2090mm (82.3in)	2180mm (85.8in)	2270mm (89.4in)
1700	2140mm (84.3in)	2230mm (87.8in)	2320mm (91.3in)
1750	2190mm (86.2in)	2280mm (89.8in)	2370mm (93.3in)
1800	2240mm (88.2in)	2330mm (91.7in)	2420mm (95.3in)
1850	2290mm (90.2in)	2380mm (93.7in)	2470mm (97.2in)
1900	2340mm (92.1in)	2430mm (95.7in)	2520mm (99.2in)
1950	2390mm (94.1in)	2480mm (97.6in)	2570mm (101.2in)
2000	2440mm (96.1in)	2530mm (99.6in)	2620mm (103.1in)

Shaft Mass

Stroke	S500D	S500T	S500Q
100	Stroke is less than the electrical cycle length. Contact Nippon Pulse.		
150			
200	7.9kg (17.4lb)	9.1kg (20lb)	10.2kg (22.6lb)
250	8.5kg (18.8lb)	9.7kg (21.4lb)	10.9kg (24lb)
300	9.2kg (20.3lb)	10.4kg (22.9lb)	11.6kg (25.5lb)
350	9.8kg (21.7lb)	11kg (24.3lb)	12.2kg (26.9lb)
400	10.5kg (23.2lb)	11.7kg (25.8lb)	12.9kg (28.4lb)
450	11.2kg (24.6lb)	12.3kg (27.2lb)	13.5kg (29.8lb)
500	11.8kg (26.1lb)	13kg (28.7lb)	14.2kg (31.3lb)
550	12.5kg (27.5lb)	13.7kg (30.1lb)	14.8kg (32.7lb)
600	13.1kg (28.9lb)	14.3kg (31.6lb)	15.5kg (34.2lb)
650	13.8kg (30.4lb)	15kg (33lb)	16.1kg (35.6lb)
700	14.4kg (31.8lb)	15.6kg (34.4lb)	16.8kg (37.1lb)
750	15.1kg (33.3lb)	16.3kg (35.9lb)	17.5kg (38.5lb)
800	16.3kg (35.9lb)	17.5kg (38.5lb)	18.6kg (41.1lb)
850	16.9kg (37.3lb)	18.1kg (39.9lb)	19.3kg (42.6lb)
900	17.6kg (38.8lb)	18.8kg (41.4lb)	20kg (44lb)
950	18.3kg (40.2lb)	19.4kg (42.8lb)	20.6kg (45.4lb)
1000	18.9kg (41.7lb)	20.1kg (44.3lb)	21.3kg (46.9lb)
1050	19.6kg (43.1lb)	20.7kg (45.7lb)	21.9kg (48.3lb)
1100	20.2kg (44.6lb)	21.4kg (47.2lb)	22.6kg (49.8lb)
1150	20.9kg (46lb)	22.1kg (48.6lb)	23.2kg (51.2lb)
1200	21.5kg (47.5lb)	22.7kg (50.1lb)	23.9kg (52.7lb)
1250	22.2kg (48.9lb)	23.4kg (51.5lb)	24.6kg (54.1lb)
1300	22.8kg (50.4lb)	24kg (53lb)	25.2kg (55.6lb)
1350	23.5kg (51.8lb)	24.7kg (54.4lb)	25.9kg (57lb)
1400	24.2kg (53.3lb)	25.3kg (55.9lb)	26.5kg (58.5lb)
1450	24.8kg (54.7lb)	26kg (57.3lb)	27.2kg (59.9lb)
1500	25.5kg (56.2lb)	26.7kg (58.8lb)	27.8kg (61.4lb)
1550	26.1kg (57.6lb)	27.3kg (60.2lb)	28.5kg (62.8lb)
1600	26.8kg (59.1lb)	28kg (61.7lb)	29.1kg (64.3lb)
1650	27.4kg (60.5lb)	28.6kg (63.1lb)	29.8kg (65.7lb)
1700	28.1kg (61.9lb)	29.3kg (64.6lb)	30.5kg (67.2lb)
1750	28.8kg (63.4lb)	29.9kg (66lb)	31.1kg (68.6lb)
1800	29.4kg (64.8lb)	30.6kg (67.4lb)	31.8kg (70.1lb)
1850	30.1kg (66.3lb)	31.2kg (68.9lb)	32.4kg (71.5lb)
1900	30.7kg (67.7lb)	31.9kg (70.3lb)	33.1kg (72.9lb)
1950	31.4kg (69.2lb)	32.6kg (71.8lb)	33.7kg (74.4lb)
2000	32kg (70.6lb)	33.2kg (73.2lb)	34.4kg (75.8lb)

Additional stroke lengths are available (up to 3380mm for S500D, 3290mm for S500T, and 3200mm for S500Q). Contact Nippon Pulse for more information.

FGA/CE Type Motor Cable

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

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

300mm lead wire bare leads. The bending radius of the motor cable should be 16.96mm as suggested by the wire manufacturer.

Connector (Motor Cable)

Receptacle Housing	VLR-03V
Plug Housing	VLP-03V
Retainer	VLS-03V
Pin Contact	SVM-61T-P2.0
Socket Contact	SVF-61T-P2.0

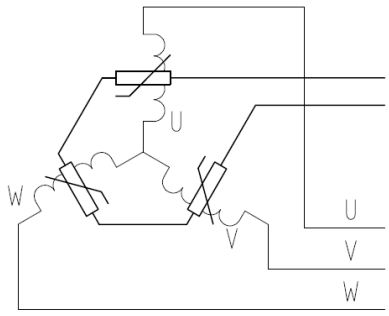
To be installed by the user.

Lead Wire

Wire Type	UL 2570FA
Wire AWG	14
U Phase	Red
V Phase	White
W Phase	Black

300mm lead wire bare leads. The bending radius of the motor cable should be 36.6mm as suggested by the wire manufacturer.

THM Option



Circuit Diagram

4. Thermistor
PTCSL20T071DBE(Vishay)

Thermocouple

Themal sensor
Thermocouple K type (marked each phase name)
Attached to the surface of inside of coil
Length 3000mm

These motors have not received a CE Declaration of Conformity, and as such are designated FGA.

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

NPM Nippon Pulse
Your Partner in Motion Control

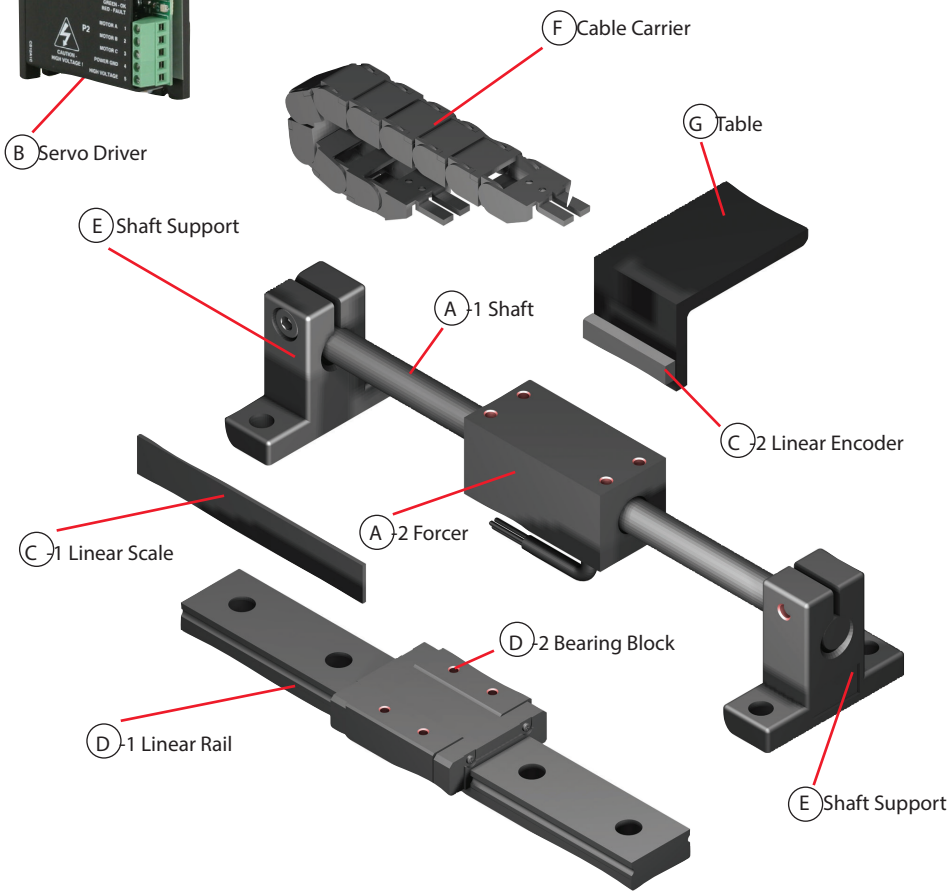
System Design
Linear Shaft Motor

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.

↓

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.