Stepper Motor Linear Actuators

Pre-engineered lead screw assemblies and actuators for precision applications

www.thomsonlinear.com

THOMSON®

Linear Motion. ***Optimized.***™

Stepper Motor Linear Actuator Assemblies

Combining cutting-edge motor and lead screw technologies

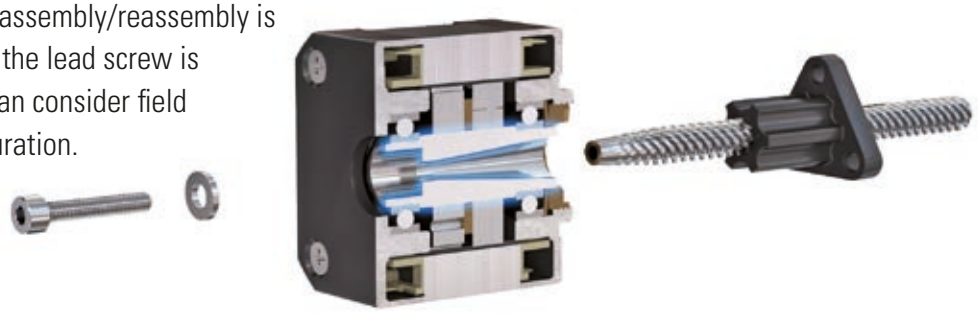
Thomson offers three basic configurations – rotating screw (MLS), rotating nut (MLN) and actuator (MLA). The open architecture rotating screw and rotating nut motorized lead screws suit applications where external guidance is present or a high level of design flexibility is required, while the closed assembly of the motorized lead screw actuator is ideal to further simplify the design process and remove requirements for external guidance.

Technology Overview

Rotating screw assemblies actuate by having the motor rotate a lead screw and translate a load that is attached to the lead nut. Rotating nut assemblies actuate by rotating a nut within the motor body. Motion is achieved by constraining the motor and translating a load attached to the lead screw or constraining the lead screw and translating a load attached to the motor.

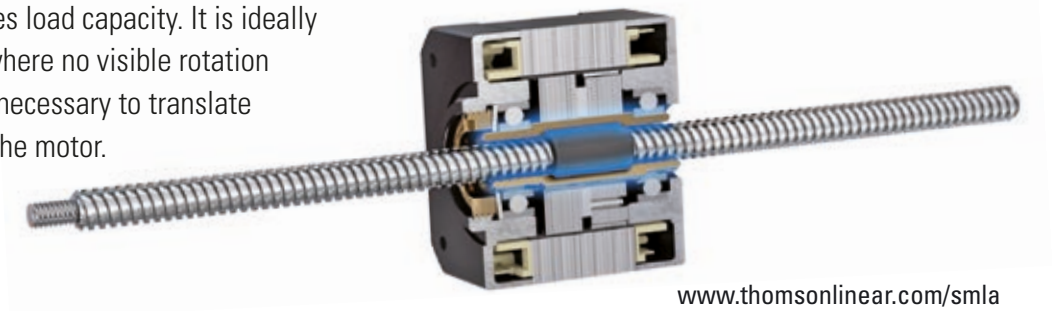
Rotating Screw Configuration MLS

The rotating screw design, which is ideal for rapid prototyping, features our patented Taper-Lock design to connect the lead screw to the motor shaft. It is best suited for applications where high levels of maintenance are anticipated, frequent disassembly/reassembly is required, or easy removal of the lead screw is necessary. Customers also can consider field serviceability for this configuration.



Rotating Nut Configuration MLN

The rotating nut design features our patented integration of a lead nut into the motor rotor to maximize screw diameter, which increases load capacity. It is ideally suited for applications where no visible rotation is desired or where it is necessary to translate a load on either side of the motor.



Motorized Lead Screws

Thomson motorized lead screws combine a hybrid stepper motor and a precision lead screw together in one compact envelope. Patented Taper-Lock technology allows quick decoupling and secure, properly aligned connections. This combination offers several advantages over a traditional solution.

Improved Efficiency

Thomson provides a more efficient solution to reduce power consumption, improve operating battery life, and decrease motor footprint. With this improved efficiency, an increase in system load performance or a reduction in power consumption can be expected – all while having a lower cost of ownership.

Increased Torque Density

Thomson motorized lead screws offer increased torque density over alternative solutions. By optimizing the motor performance and matching this with the ideal lead screw and nut design, Thomson has been able to increase the load capacity by up to 30% while maintaining the same motor footprint.

The Taper-Lock Advantage

The patented Taper-Lock design provides the ability to quickly decouple the lead screw from the stepper motor. The connection is secure, robust, and self-aligning.

Reduced Noise

Thomson can optimize your motor configuration and windings to limit motor harmonics and reduce motor noise at your application operating points.

Motorized Lead Screw Actuators

Thomson motorized lead screws are also available in an actuator configuration (MLA). The actuator is a fully housed solution in which the motion is taken care of for you – simply determine stroke length, linear travel per step or revolution (lead), and precision level to select an appropriate MLA. The actuator configuration offers a complete housing and integrates easily into your assembly with a similar range of end mounting and connection options as the rest of the motorized lead screw family.

Built-in Anti-Rotation

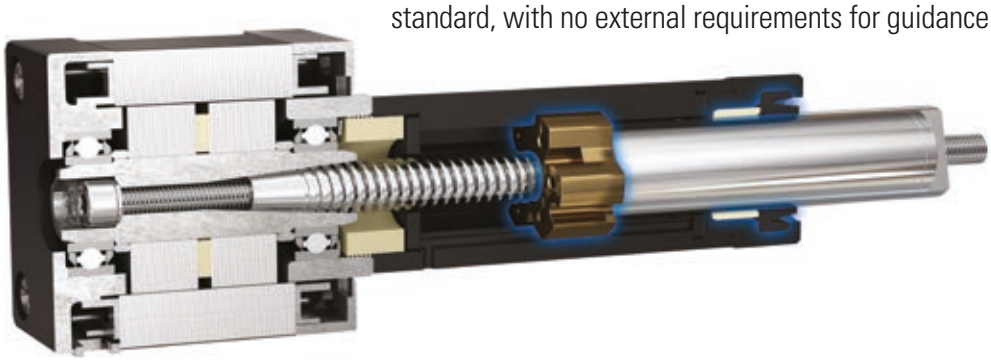
Our actuator configuration includes anti-rotation as standard with every product, eliminating the need for external guidance.

Side Load Capability

Actuator configurations are able to withstand some side and moment loading due to the bushing design included inside the assembly. Depending on load, speed and motion requirements, MLA assemblies can withstand a side load of up to 10% of axial capacity of the motor. For optimal performance, side and moment loads on MLA configurations should be minimized and avoided in the fully extended position.

Actuator Configuration MLA

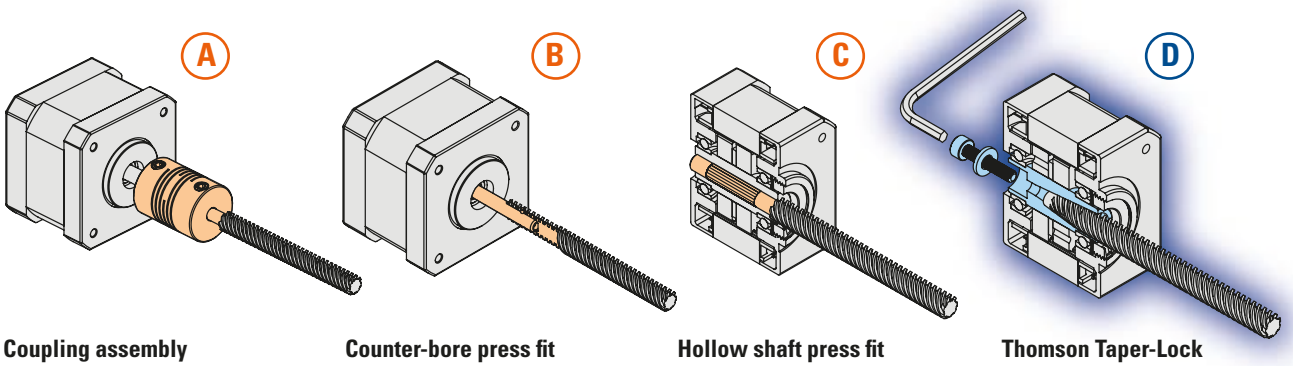
The actuator is a fully housed motorized lead screw with a rotating screw configuration and your choice of end machining. This version simplifies your design process by enabling you to select a product based on linear travel per motor rotation and by including anti-rotation as standard, with no external requirements for guidance.



Thomson Advantage

The Thomson Taper-Lock

Fixing the motor to the lead screw usually requires a coupling assembly (A), a counter-bore press fit (B) or a hollow shaft press fit (C). The assembly process may also entail the use of adhesives or welding, but the bottom line is that all these solutions make it difficult or impossible to change lead screws or perform maintenance. Thomson has solved this issue with our patented Taper-Lock coupling (D) that requires only a single retention fastener.



Coupling assembly
- space demanding
- reduces stroke
- increases system inertia
- requires radial support bearing
- may reduce accuracy

Counter-bore press fit
- reduces stroke
- requires machining
- difficult to assemble
- run-out and alignment issues
- difficult to replace quickly

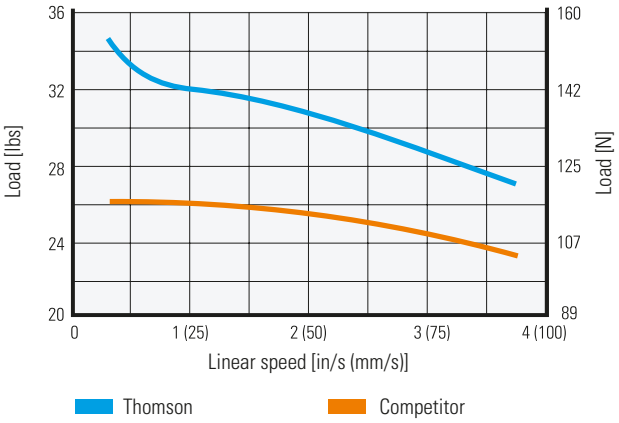
Hollow shaft press fit
- requires machining
- difficult to assemble
- run-out and alignment issues
- difficult to replace quickly

Thomson Taper-Lock
- high accuracy
- requires no extra space
- easy to replace quickly
- easy assembly and alignment

Thrust Force Comparison

Thomson optimized motors will result in up to a 30% increase in thrust over the competition. That means you will get a smaller and more efficient solution with the same power output.

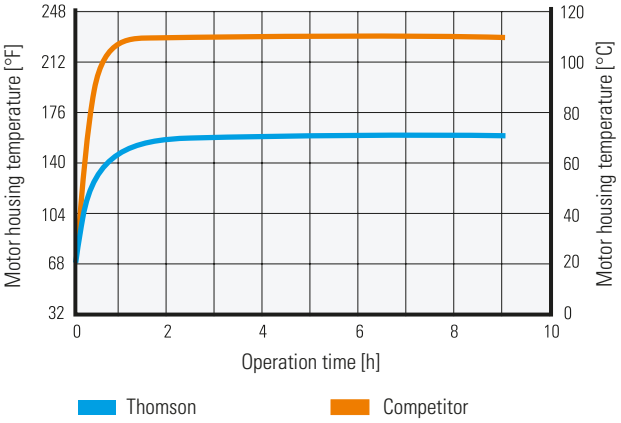
Load vs. Speed



Temperature Rise Comparison

Thomson offers more efficient motors where more torque can be output with less heat loss – meaning that our motors can be operated with higher power input while maintaining lower heat generation.

Temperature vs. Operation Time

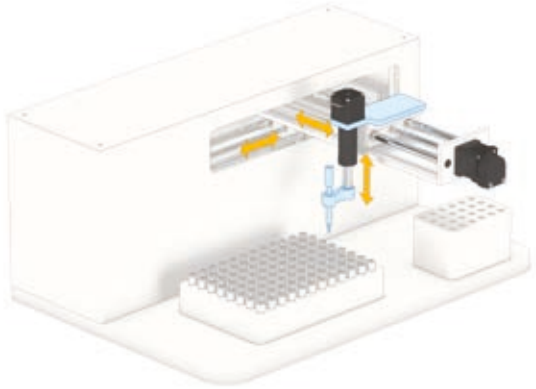


The curves where generated with a 1.5 A / 2.33 V, 1.8° NEMA 17 single stack, rotating screw stepper motor. Test ran with a 0.9°, 24 VDC chopper drive and a 4-2516 lead screw at an ambient temperature of 20 °C.

Application Examples

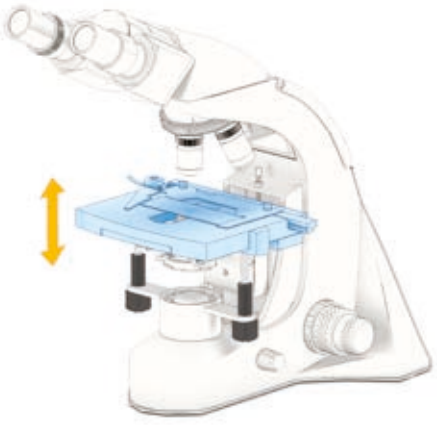
These common applications show that stepper motor linear actuators reduce the total number of components in your design, while minimizing space requirements, and making assembly and maintenance quicker and easier. Examples are shown for all three configurations - rotating screw (MLS), rotating nut (MLN) and actuator (MLA).

Pipetting MLA MLS



Tiny, precise, repeatable vertical motion is essential for accurate pipetting. Choose MLA to simplify your z-axis and MLS for precise, horizontal motion in pipetting applications.

Plate Vertical Postioning MLA

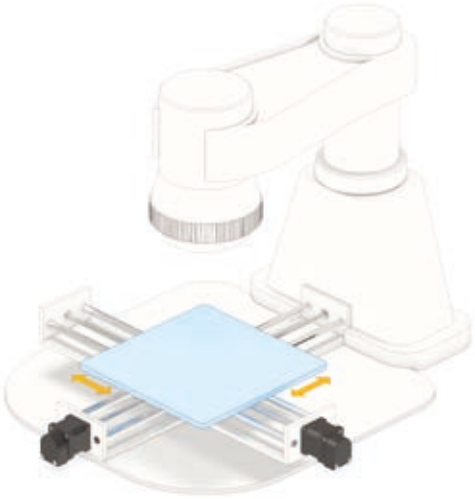


Actuator assemblies are self contained and ideal for simplified, leveling applications where small radial or moment loads may be present.

Fluid Pumps MLS MLN

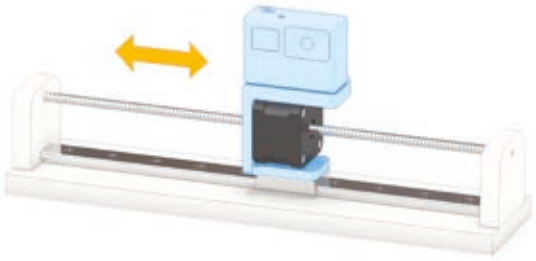
Regardless of the mounting configuration, a stepper motor linear actuator can increase pump pressure, reduce equipment footprint and more accurately disperse fluid.

XY Stages MLS



Stepper motor linear actuators optimize XY stage designs with their compactness and power.

Horizontal Positioning MLN

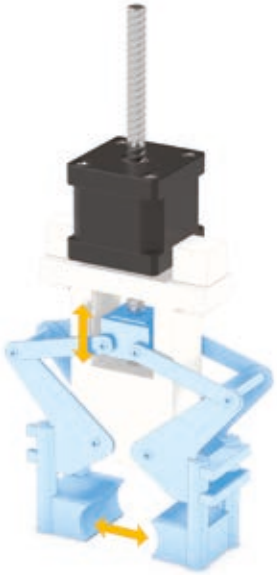


Cameras and other measurement devices need to be in just the right place at just the right time. MLN delivers reliable horizontal positioning and length selections to get your horizontal positioning job done right.

3D Printing MLS

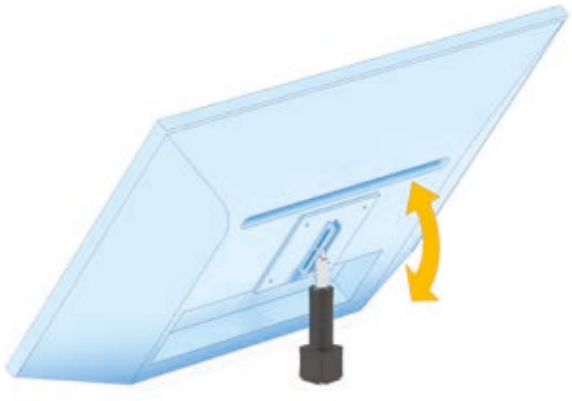
Utilizing a stepper motor linear actuator on a 3D printer can eliminate the need for couplings, bearings and supports while increasing stroke length and print volume.

Robotic Gripper MLN



MLN configurations excel in gripping applications, rotating and positioning gripper heads and attachments with ease.

Monitor Tilting MLA



Angle adjustment is made simple when the MLA configuration is applied in monitor and plate tilting applications.

Ordering Keys

MLS/MLN Ordering Key

1	2	3	4	5	6	7	8	9	10	11	12	13	14
MLS	**17**	**A**	**15**	**–**	**25**	**0250**	**P**	**06000**	**N**	**–**	**B2**	**00**	**–**	**RS**	**2**	

1. Series
MLS = Rotating screw
MLN = Rotating nut

2. Motor size[1]
08 = NEMA 08
11 = NEMA 11
14 = NEMA 14
17 = NEMA 17
23 = NEMA 23

3. Motor stack[1]
A = Single
B = Double

4. Motor current rating (in 0.1 amps)[1]
05 = 0.5 amps
08 = 0.8 amps
10 = 1.0 amps
13 = 1.3 amps
15 = 1.5 amps
19 = 1.9 amps
30 = 3.0 amps
39 = 3.9 amps

5. Screw diameter[2]
18 = 0.1875 in
25 = 0.2500 in
31 = 0.3125 in
37 = 0.3750 in
43 = 0.4375 in
50 = 0.5000 in
M04 = 4.0 mm
M06 = 6.0 mm
M08 = 8.0 mm
M10 = 10.0 mm
M12 = 12.0 mm

6. Linear travel/rev[2]
0013 = 0.013 in
0031 = 0.031 in
0036 = 0.036 in
0040 = 0.040 in
0042 = 0.042 in
0050 = 0.050 in
0063 = 0.063 in
0071 = 0.071 in
0079 = 0.079 in
0083 = 0.083 in
0098 = 0.098 in
0100 = 0.100 in
0118 = 0.118 in
0125 = 0.125 in
0157 = 0.157 in
0167 = 0.167 in
0192 = 0.192 in
0200 = 0.200 in
0236 = 0.236 in
0250 = 0.250 in
0300 = 0.300 in
0333 = 0.333 in
0375 = 0.375 in
0400 = 0.400 in
0500 = 0.500 in
0750 = 0.750 in
0800 = 0.800 in
1000 = 1.000 in
1200 = 1.200 in
1500 = 1.500 in
006 = 0.6 mm
010 = 1.0 mm
012 = 1.2 mm
020 = 2.0 mm
030 = 3.0 mm
040 = 4.0 mm
050 = 5.0 mm
060 = 6.0 mm
080 = 8.0 mm
100 = 10.0 mm
120 = 12.0 mm
150 = 15.0 mm
160 = 16.0 mm
180 = 18.0 mm
200 = 20.0 mm
250 = 25.0 mm
350 = 35.0 mm
450 = 45.0 mm

7. Precision grade
S = Standard 0.010 in/ft (250 µm/300 mm)
P = Precision 0.003 in/ft (125 µm/300 mm)

8. Lead screw overall length[1]
06000 = 6.000 in
15000 = 150.00 mm (when metric diameter is selected)

9. Lead screw coating
N = No coating on lead screw
T = PTFE-coated lead screw

10. Front-end machining[3]
A0 = No machining
Plain journal ends:
B1 = Ø 2.50 mm h7
B2 = Ø 4.00 mm h7
B3 = Ø 5.00 mm h7
B4 = Ø 6.00 mm h7
Male threaded ends:
C1 = #4-40 x 0.250 in
C2 = #8-32 x 0.250 in
C3 = #10-24 x 0.375 in
C4 = 1/4-20 x 0.500 in
C5 = M2.5x0.45 x 6.35 mm
C6 = M4x0.7 x 6.35 mm
C7 = M5x0.8 x 9.53 mm
C8 = M6x1.0 x 12.70 mm
Journal with snap ring groove:
D1 = Ø 2.50 mm and ring groove
D2 = Ø 4.00 mm and ring groove
D3 = Ø 5.00 mm and ring groove
D4 = Ø 6.00 mm and ring groove

11. Rear-end machining[3]
MLN same options as front-end
MLS is always 00

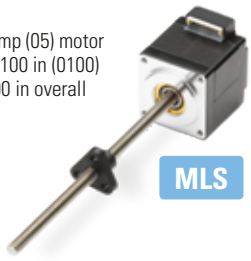
12. Nut. MLN is always XX[4]
XX = No nut or MLN
RS = Flange mount, acetal material (RSF Series nuts)
AF = Flange mount, alternative anti-backlash (AFT Series nuts)
BN = Threaded mount, bronze material (BN Series nuts)
MT = Flange mount, alternative to RS nut (MTS Series nuts)
RH = Flange mount, peek material (RSFH Series nuts)
SB = Thread mount, alternative anti-backlash (SNAB Series nuts)
SN = Threaded mount, acetal material (SN Series nuts)
XF = Triangular flange, anti-backlash (XC Series nuts)
XT = Threaded mount, anti-backlash (XC Series nuts)

13. Nut size. MLN is always X[4]
X = No nut or MLN
1 = 0.1875 in and 4 mm dia screws
2 = 0.2500 in and 6 mm dia screws
3 = 0.3125 in, 0.3750 in, 8 and 10 mm screws
5 = 0.4375 in, 0.500 in and 12 mm screws

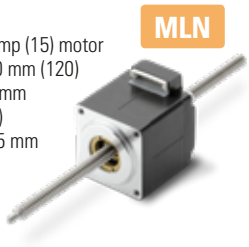
14. Custom designation
(blank) = Standard configuration
001-999 = Custom configuration

1. For available standard motors, see pages 17-28.
2. For compatible lead screws, see pages 12-13.
3. For compatible end-machining options, see page 15.
4. RS nut standard on MLS. For optional nut option compatibility, see pages 36-37.

MLS Example:
MLS11A05-180100S04000T-A000-RS1
MLS = Rotating screw (S) configuration
11A05 = NEMA 11 (11), single stack (A), 0.51 amp (05) motor
1801000S04000T = 0.1875 in (18) diameter x 0.100 in (0100) lead screw, standard grade accuracy (S) at 4.000 in overall length (04000) with PTFE screw coating (T)
A000 = No (A0) and MLS default N/A (00) end-machining on screw
RS1 = RSF1800 lead nut



MLN Example:
MLN17B15-M06120P15000N-A0C6-XXX
MLN = Rotating nut (N) configuration
17B15 = NEMA 17 (17), double stack (B), 1.50 amp (15) motor
M06120P15000N = 6 mm (M06) diameter x 12.0 mm (120) lead screw, precision grade accuracy (P) at 150 mm overall length (15000) with no screw coating (N)
A0C6 = No (A0) and M4x0.7 threaded end x 6.35 mm length (C6) end-machining on screw
XXX = no nut (required for MLN / rotating nut assemblies)



Please visit www.thomsonlinear.com/smla to access our stepper motor linear actuator selector and part number generator.

MLA Ordering Key

1	2	3	4	5	6	7	8	9	10
MLA	**17**	**A**	**15**	**– 0250**	**P**	**0150**	**– C5**	**– S02**	

1. Series
MLA = Motorized lead screw actuator

2. Motor size[1]
08 = NEMA 08
11 = NEMA 11
14 = NEMA 14
17 = NEMA 17
23 = NEMA 23

3. Motor stack[1]
A = Single
B = Double

4. Motor Current Rating (in 0.1 amps)[1]
05 = 0.5 amps
08 = 0.8 amps
10 = 1.0 amps
13 = 1.3 amps
15 = 1.5 amps
19 = 1.9 amps
30 = 3.0 amps
39 = 3.9 amps

1. For available standard motors, see pages 17-28.
2. For compatible linear travel/rev, see pages 12-13.
3. For more details on mounting options, see page 16.

5. Linear travel/rev (lead in 0.001 inch)[2]

0013 = 0.013 in	0192 = 0.192 in
0024 = 0.024 in	0197 = 0.197 in
0025 = 0.025 in	0200 = 0.200 in
0031 = 0.031 in	0236 = 0.236 in
0036 = 0.036 in	0250 = 0.250 in
0039 = 0.039 in	0300 = 0.300 in
0040 = 0.040 in	0333 = 0.333 in
0042 = 0.042 in	0375 = 0.375 in
0047 = 0.047 in	0394 = 0.394 in
0050 = 0.050 in	0400 = 0.400 in
0063 = 0.063 in	0472 = 0.472 in
0079 = 0.079 in	0500 = 0.500 in
0083 = 0.083 in	0750 = 0.750 in
0100 = 0.100 in	0787 = 0.787 in
0118 = 0.118 in	0800 = 0.800 in
0125 = 0.125 in	1000 = 1.000 in
0157 = 0.157 in	1200 = 1.200 in
0167 = 0.167 in	1378 = 1.378 in

6. Precision Grade
S = Standard 0.010 in/ft (250 µm/300 mm)
P = Precision 0.003 in/ft (125 µm/300 mm)

7. Stroke length (in 0.01 inch)
0150 = 1.50 in stroke length (always in inch) (max stroke length is 1.50 in for MLA08 and 2.50 in for MLA11, 14, 17 and 23 configurations)

8. End-mounting[3]
ML08:
C1 = #4-40 x 0.236 in male
E1 = #4-40 x 0.236 in female
C4 = M3x0.5 x 5.99 mm male
E4 = M3x0.5 x 5.99 mm female

ML1x:
C2 = #8-32 x 0.265 in male
E2 = #8-32 x 0.265 in female
C5 = M4x0.7 x 6.73 mm male
E5 = M4x0.7 x 6.73 mm female

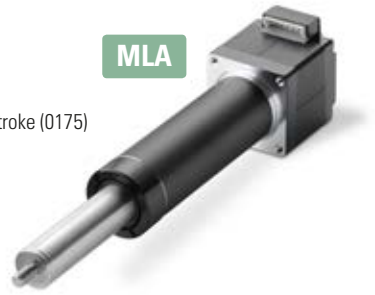
ML23:
C3 = 1/4-20 x 0.500 in male
E3 = 1/4-20 x 0.500 in female
C6 = M6x1.0 x 12.70 mm male
E6 = M6x1.0 x 12.70 mm female

9. Nut
S01 = For ML08
S02 = For ML1x
S03 = For ML23

10. Custom designation
(blank) = Standard configuration
001-999 = Custom configuration

MLA Example:
MLA14A08-0472S0175-E5-S02
MLA = Actuator (A) configuration
14A08 = NEMA 14 (14), single stack (A), 0.88 amp (08) motor
0472S0175 = 0.472 in lead (0472), standard grade accuracy (S) at 1.75 in stroke (0175)
E5 = Standard M4x0.7 female threaded end
S02 = Standard nut for size 11, 14, and 17 configurations

Please visit www.thomsonlinear.com/smla to access our stepper motor linear actuator selector and part number generator.

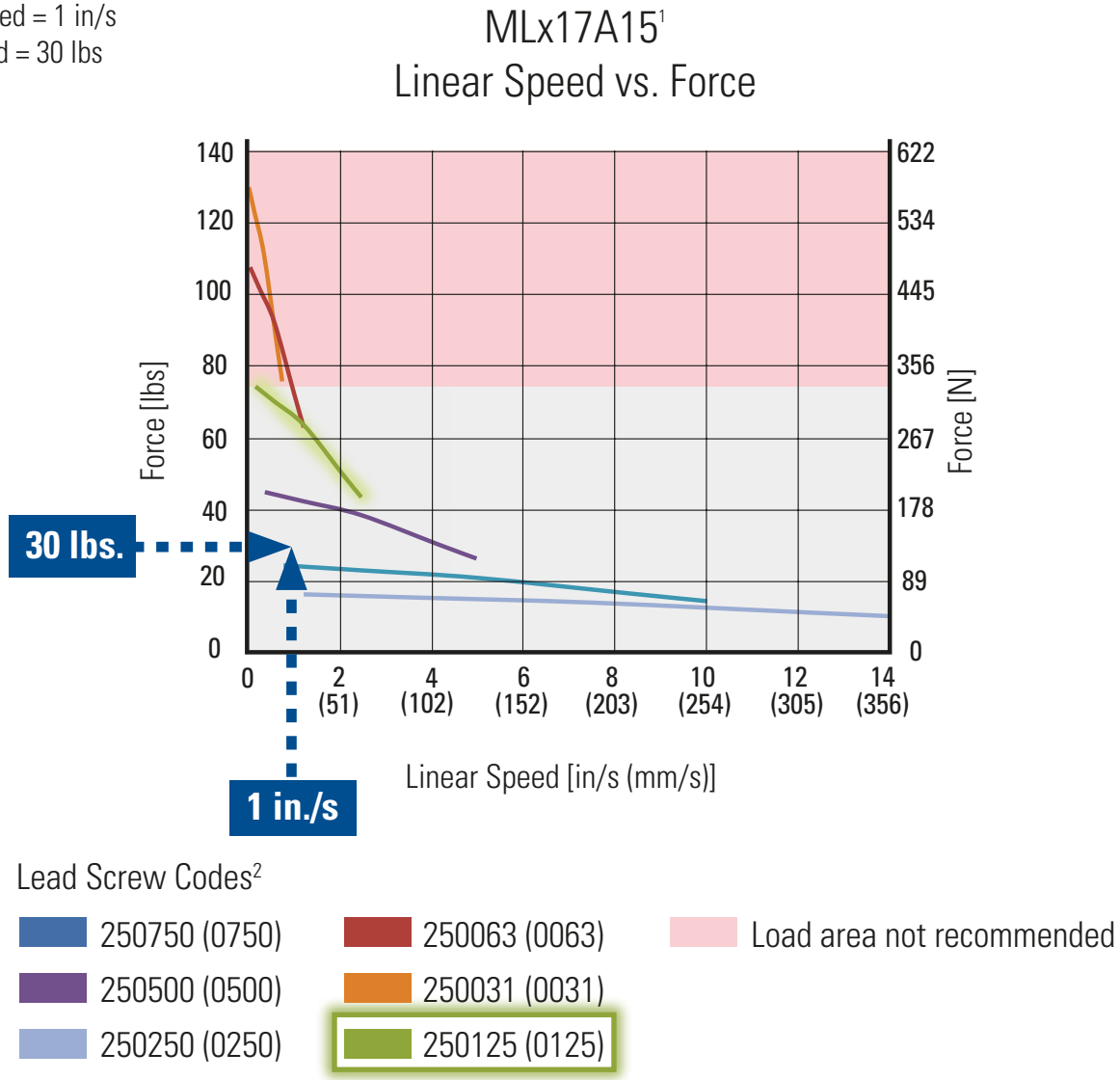


Sizing and Selection Guidelines

How to Select Motor and Lead Screw

For a basic sizing determination, use performance charts to find appropriate screw lead and diameter for desired motor size. Use linear travel speed and dynamic load.

Example:
Speed = 1 in/s
Load = 30 lbs



Given the speed and load requirements of 1 in./s and 30 lbs., respectively, a motor with a 0.25 in. diameter x 0.125 in. lead (250125) will be a sufficient stepper motor linear actuator assembly for this application[3].

Please visit www.thomsonlinear.com/smla for a more detailed sizing calculator or call Thomson to speak with a stepper motor linear actuator sizing specialist.

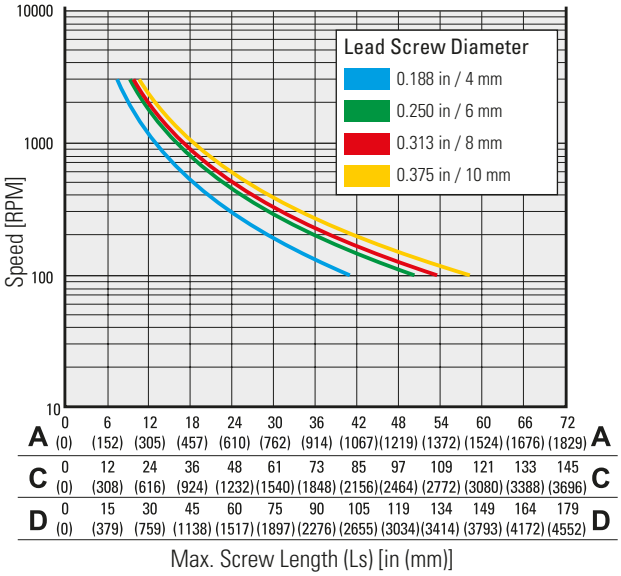
1. "x" denotes placeholder for S, N or A depending upon configuration.
2. Codes within parentheses are for MLA configurations.
3. Performance curve upper limits should be avoided for critical and/or high duty cycle applications. Generally a safety factor of 2 is recommended when sizing an application.

Sizing and Selection Guidelines

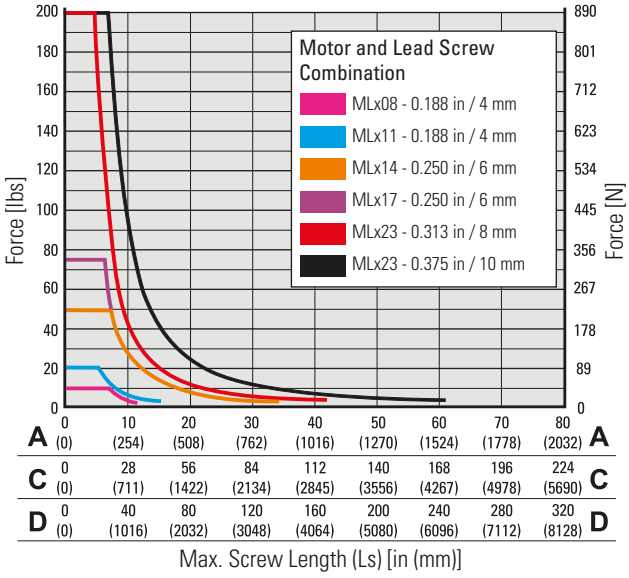
How to Determine Maximum Permissible Screw Length

For MLS and MLN configurations, in order to determine the maximum possible lead screw length for your stepper motor linear actuator assembly, the following charts can be used. These charts take in to consideration the maximum rotational speed and compression load as well as the end fixity of your system.

Critical Speed
Motor Speed vs. Maximum Screw Length



Column Load
Compression Force vs. Maximum Screw Length



Types of Screw End Fixity

1. Determine Maximum Motor Speed

Calculate what the maximum motor speed will be for your specific application.

2. Decide Type of Screw End Fixity

There are three basic types of end fixity (A, C and D). The maximum screw length (Ls) for a given motor speed, unit size and screw diameter will vary depending on the selection. For rotating screw assemblies, the end of the lead screw attached to the motor is considered fixed.

3. Check Critical Screw Speed

Check Critical Speed diagram for your maximum speed, lead screw diameter and end fixity to determine the maximum permissible screw length for your application.

4. Check Column Loading

Another limiting factor for the screw length is how sensitive it is to column loading and how likely it is to buckle under a compression load. Check the Column Load diagram to see that your load and desired maximum screw length are compatible with regards to the unit size, lead screw diameter and end fixity being used.

Lead Screw Sizes

Inch Lead Screws

S = Rotating Screw (MLS), N = Rotating Nut (MLN), A = Actuator (MLA)

Linear Travel / Full Step [µ in.]	Lead [in.]	Lead Designator	Motor									
			MLx08	MLx11		MLx14, MLx17			MLx23			
			Diameter Designator [hundredths of in. diameter]									
			18	18	25	25	31	37	31	37	43	50
0.063[2]	0.013	0013			S,A[1,3]	S,N,A[1,3]	S[1,3]	S[1,3]	S,N[1,3]	S,N,A[1,3]		S[1,3]
0.125[2]	0.025	0025			S,A[1,3]	S,N,A[1,3]		S[1]		S,N,A[1]		S[1,3]
0.157	0.031	0031			S,A	S,N,A		S[1]		S,N,A[1]		
0.165	0.033	0033										S[1,3]
0.179	0.036	0036			S,A[1,3]	S,N,A[1,3]						
0.200	0.040	0040						S[1]		S,N,A[1]		
0.209	0.042	0042			S,A[1,3]	S,N,A[1,3]	S[1,3]	S[1,3]	S,N[1,3]	S,N,A[1,3]		
0.250	0.050	0050	S,A	S,N	S,A[1]	S,N,A[1]		S[1]		S,N,A[1]	S[1,3]	S[1,3]
0.313	0.063	0063			S,A	S,N,A		S		S,N,A		S[1]
0.357	0.071	0071			S,A[1]	S,N,A[1]						
0.394	0.079	0079			S,A[1]	S,N,A[1]		S[1]		S,N,A[1]		
0.417	0.083	0083					S	S[1]	S,N	S,N,A[1]		
0.490	0.098	0098										S[1]
0.500	0.100	0100	S,A	S,N				S		S,N,A		S[1]
0.591	0.118	0118			S,A[1]	S,N,A[1]						
0.625	0.125	0125	S,A[1]	S,N[1]	S,A	S,N,A		S[1]		S,N,A[1]	S[1]	
0.787	0.157	0157			S,A[1]	S,N,A[1]						
0.833	0.167	0167					S	S	S,N	S,N,A		
0.960	0.192	0192			S,A[1]	S,N,A[1]						
1.000	0.200	0200	S,A	S,N	S,A[1]	S,N,A[1]		S[1]		S,N,A[1]		S[1]
1.180	0.236	0236									S[1]	
1.250	0.250	0250			S,A	S,N,A	S	S	S,N	S,N,A	S[1]	S[1]
1.500	0.300	0300						S[1]		S,N,A[1]		
1.665	0.333	0333	S,A[1,3]	S,N[1,3]								
1.875	0.375	0375	S,A[1,3]	S,N[1,3]				S[1]		S,N,A[1]		
2.000	0.400	0400	S,A	S,N								
2.500	0.500	0500	S,A[1,3]	S[1,3]	S,A	S,N,A	S	S	S,N	S,N,A	S[1]	S[1]
3.750	0.750	0750			S,A[1,3]	S,N,A[1,3]		S[1,3]		S,N,A[1,3]		
4.000	0.800	0800										S[1,3]
5.000	1.000	1000					S[3]	S[3]	S,N[3]	S,N,A[3]		S[1,3]
6.000	1.200	1200						S[1,3]		S,N,A[1,3]		
7.500	1.500	1500										S[1,3]

1. Some leads may not be available in high-performance nut material or some anti-backlash nuts. Contact Thomson for more detail.
2. Fine-pitched lead screws may have substantially lower load capacities compared to traditional lead screws.
3. Lead screw not available in precision grade accuracy (P).

Metric Lead Screws

S = Rotating Screw (MLS), N = Rotating Nut (MLN), A = Actuator (MLA)

Linear Travel / Full Step [µm]	Lead [mm]	Lead Designator[2]	Motor								
			MLx08	MLx11		MLx14, ML17			MLx23		
			Diameter Designator								
			M04	M04	M06	M06	M08	M10	M08	M10	M12
3	0.6	006 (0024)			S,A[1]	S,N,A[1]					
5	1.0	010 (0039)	S	S,N	S,A	S,N,A					
6	1.2	012 (0047)			S,A[1]	S,N,A[1]					
10	2.0	020 (0079)					S	S	S,N	S,N,A	S[1]
15	3.0	030 (0118)						S		S,N,A	S[1]
20	4.0	040 (0157)	S	S,N			S		S,N		S[1]
25	5.0	050 (0197)						S		S,N,A	
30	6.0	060 (0236)			S,A	S,N,A		S[1]		S,N,A[1]	S[1]
40	8.0	080 (0315)	S[3]	S,N[3]			S		S,N		
50	10.0	100 (0394)						S		S,N,A	S[1]
60	12.0	120 (0472)			S,A	S,N,A	S	S[1]	S,N	S,N,A[1]	
75	15.0	150 (0591)									S[1]
80	16.0	160 (0630)									S[1]
90	18.0	180 (0709)			S,A[1,3]	S,N,A[1,3]					
100	20.0	200 (0787)					S[3]	S	S,N[3]	S,N,A	
125	25.0	250 (0984)									S[1,3]
225	45.0	450 (1772)									S[1,3]

1. Some leads may not be available in high-performance nut material or some anti-backlash nuts. Contact Thomson for more detail.
2. Lead designations for MLA are shown in parenthesis.
3. Lead screw not available in precision grade accuracy (P).

Specifications

Basic Specifications

Lead Screw

Material		300 Series Stainless Steel
Standard Coating[1]		None
Standard Lead Accuracy	[in./ft. (µm/300 mm)]	0.010 (250)
Precision Lead Accuracy	[in./ft. (µm/300 mm)]	0.003 (75)
Straightness	[in./ft. (µm/300 mm)]	0.005 (125)

Lead Nut

Standard Material		Internally lubricated acetal
High Performance Material		Internally lubricated engineered thermoplastic
Nut Efficiency[2]	[%]	Up to 85
Typical Linear Travel Life	[in. (km)]	10×10^6 (250)
Positional Repeatability with Standard Nut[3]	[in. (mm)]	0.005 to 0.010 (0.127 to 0.254)
Positional Repeatability with Anti-Backlash Nut[4]	[in. (mm)]	<0.002 (0.051)

Motor

Frame Size		NEMA 8	NEMA 11	NEMA 14	NEMA 17	NEMA 23
Step Size	[°]	1.8	1.8	1.8	1.8	1.8
Max. Axial Load[5]	[lbs. (N)]	10 (44)	20 (89)	50 (222)	75 (334)	200 (890)
Axial Pre-Load[6]	[lbs. (N)]	10 (44)	20 (89)	30 (133)	40 (178)	40 (178)
Concentricity of Mounting Pilot to Shaft	[in. (mm)]	0.003 (0.08) TIR				
Perpendicularity of Shaft to Mounting Face	[in. (mm)]	0.003 (0.08) TIR				
Max. Case Temperature	[°F (°C)]	140 (60)		176 (80)		
Storage Temperature	[°F (°C)]	-4 to 122 (-20 to 50)				
Ambient Temperature	[°F (°C)]	-4 to 122 (-20 to 50)				
Max. Humidity (non-condensing)	[%]	85				
Magnet Wire Insulation		Class B 130 °C (266 °F)				
Insulation Resistance		100 Mohm @ 500 VDC				
Dielectric Strength		500 VAC for 1 minute				

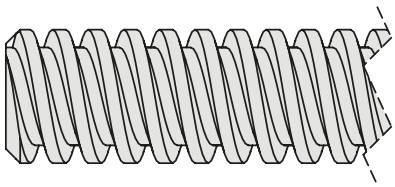
Assembly

Max. Backlash with Standard Nut[7]	[in. (mm)]	0.010 (0.25)
Max. Backlash with XC Anti-Backlash Nut	[in. (mm)]	0 (0)
Max Lead Screw Runout	[in./ft. (µm/300 mm)]	0.010 (250)
Operating Temperature	[°F (°C)]	15 to 125 (-10 to 50)
MLA Max Side Load[8]	[% of axial load]	10

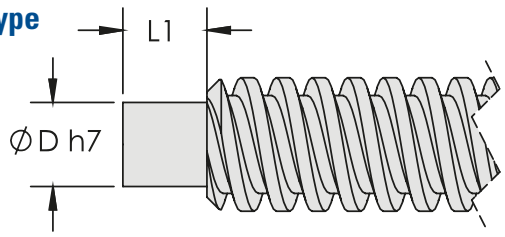
1. Contact Thomson for optional lead screw coatings.
2. Depending on lead, nut material and lubrication.
3. Depends on nut, load and orientation.
4. For best positional repeatability, load should be kept well below design load of nut.
5. Max. axial load based on a L10 life of 10000 hours of continuous motion at speeds of 100 to 300 RPM.
6. Can be adjusted based on application requirements. If axial load exceeds pre-load of motor, motor shaft may deflect up to 0.003 in. (0.08 mm) for configurations with axial load pulling away from motor face.
7. Nut fit can be adjusted depending on backlash requirements.
8. Max radial load on MLA assemblies depends on load orientation, speed, stroke and other factors. For optimal performance, side loads should be avoided at end of travel. Contact Thomson for application assistance.

Lead Screw Standard End Machining MLS MLN

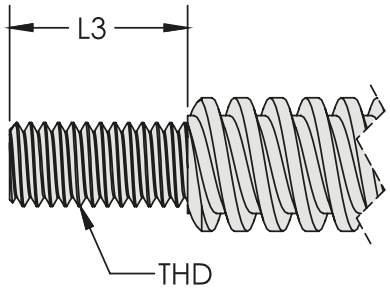
A0



B Type



C Type

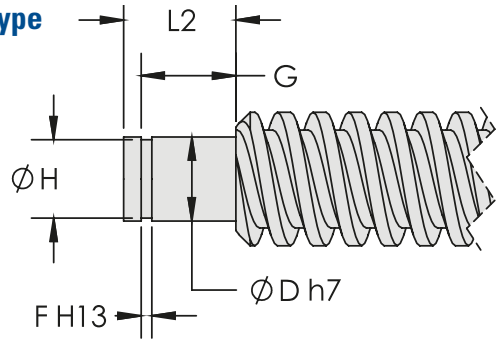


MACH.	in		mm		Compatible Lead Screws
	ØD	L1	ØD	L1	
B1	0.0984	0.098	2.50	2.50	0.188 in, 4 mm, 0.25 in, 6 mm, 0.313 in, 8 mm, 0.375 in, 10 mm
B2	0.1575	0.197	4.00	5.00	0.25 in, 6 mm, 0.313 in, 8 mm, 0.375 in, 10 mm
B3	0.1969	0.197	5.00	5.00	0.313 in, 8 mm, 0.375 in, 10 mm
B4	0.2362	0.236	6.00	6.00	0.375 in, 10 mm

MACH.	in	
	THD	L3
C1	#4-40	0.250
C2	#8-32	0.250
C3	#10-24	0.375
C4	1/4-20	0.500

MACH.	mm		Compatible Lead Screws
	THD	L3	
C5	M2.5X0.45	6.35	0.188 in, 4 mm, 0.25 in, 6 mm, 0.313 in, 8 mm, 0.375 in, 10 mm
C6	M4X0.7	6.35	0.25 in, 6 mm, 0.313 in, 8 mm, 0.375 in, 10 mm
C7	M5X0.8	9.53	0.313 in, 8 mm, 0.375 in, 10 mm
C8	M6X1.0	12.70	0.375 in, 10 mm

D Type

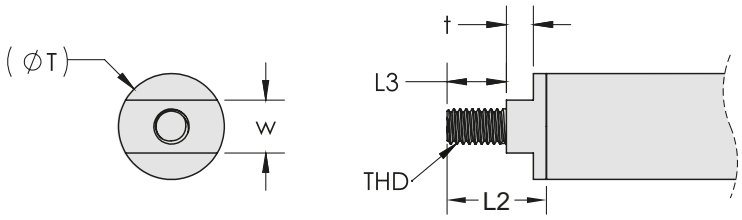


MACH.	in					mm					Compatible Lead Screws
	ØD	L2	G	F	ØH	ØD	L2	G	F	ØH	
D1	0.0984	0.157	0.120	0.022	0.075	2.50	4.00	3.05	0.56	1.91	0.188 in, 4 mm, 0.25 in, 6 mm, 0.313 in, 8 mm, 0.375 in, 10 mm
D2	0.1575	0.256	0.217	0.020	0.150	4.00	6.50	5.51	0.51	3.81	0.25 in, 6 mm, 0.313 in, 8 mm, 0.375 in, 10 mm
D3	0.1969	0.276	0.224	0.028	0.189	5.00	7.00	5.69	0.70	4.80	0.313 in, 8 mm, 0.375 in, 10 mm
D4	0.2362	0.315	0.266	0.030	0.220	6.00	8.00	6.76	0.76	5.59	0.375 in, 10 mm

Note: Machining is split into four different categories (A, B, C and D). Within each category are different sizes (X1, X2, X3,...). Please specify exact end machining when configuring part number. Above are examples of the standard end machining offered. Contact Thomson for custom end-machining options.

Standard End Mounting MLA

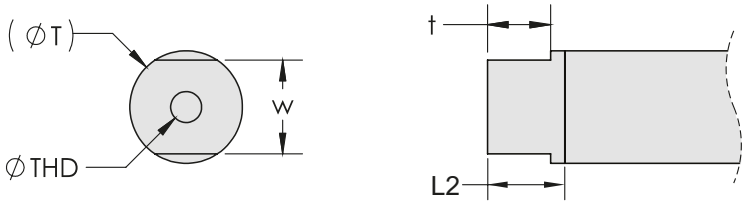
C Type



MACH.	in					
	THD	L2	L3	w	t	ØT
C1	#4-40	0.380	0.236	0.197	0.105	0.354
C2	#8-32	0.444	0.265	0.265	0.120	0.472
C3	1/4-20	0.714	0.500	0.433	0.135	0.866

MACH.	mm					
	THD	L2	L3	w	t	ØT
C4	M3X0.5	9.65	5.99	5.00	2.67	9.00
C5	M4X0.7	11.28	6.73	6.73	3.05	12.00
C6	M6X1.0	18.14	12.70	11.00	3.43	22.00

E Type

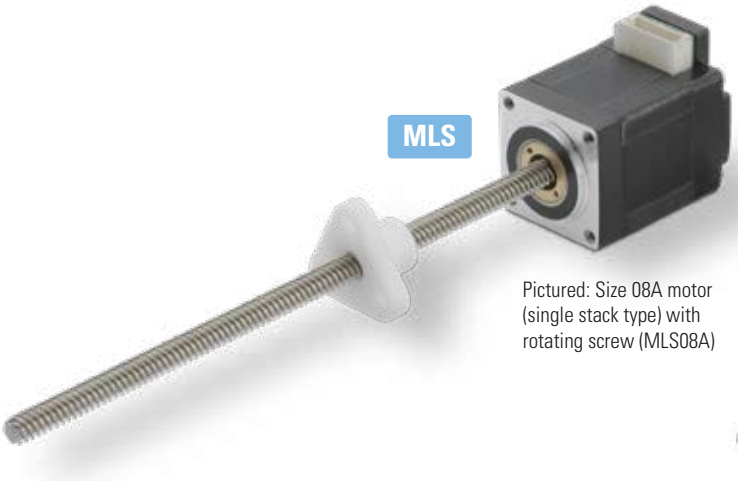


MACH.	in				
	THD	L2	w	t	ØT
E1	#4-40 ↧ 0.236	0.276	0.315	0.236	0.354
E2	#8-32 ↧ 0.265	0.324	0.394	0.265	0.472
E3	1/4-20 ↧ 0.500	0.579	0.709	0.500	0.866

MACH.	mm				
	THD	L2	w	t	ØT
E4	M3X0.5 ↧ 5.99	7.01	8.00	5.99	9.00
E5	M4X0.7 ↧ 6.73	8.23	10.01	6.73	12.00
E6	M6X1.0 ↧ 12.70	14.71	18.01	12.70	22.00

Note: When attaching load to end mounting, dimension "w" and "t" must be properly restrained in order to prevent damage to actuator.
Contact Thomson for custom end-machining options.

Specifications – MLx08 Motor Size



Pictured: Size 08A motor (single stack type) with rotating screw (MLS08A)

Pictured: Size 08A motor (single stack type) with actuator (MLA08A)

Features and Benefits

- NEMA 8 motor (size 21 mm)
- Available in rotating screw (MLS) and actuator (MLA) configurations
- Choose between a variety of inch and metric leads
- Recommended max. thrust force 10 lbs. (44 N)
- Recommended max. lead screw length of 4 in. (102 mm) for MLS and 1.5 in. (38 mm) stroke for MLA.
- Side load capacity of up to 10% of axial load for MLA configurations.[1]

Motor Options

Motor Code[2]	Holding Torque		Voltage/ phase[4]	Current/ phase	Resistance	Inductance	Power Draw	Step Angle	Motor Length, maximum (Lm)		Rotor Inertia	Motor Weight
	[oz-in]	[N-m]	[V]	[A]	[Ω]	[mH]	[W]	[°]	[in]	[mm]	[oz-in²]	[lbs]
MLx08A05[3]	1.8	13	4.5	0.50	9	2	2.3	1.8	1.16	29.5	0.01	0.13

Inch Lead Screw Options[5]

Screw Code[6]	Diameter	Lead	Travel/step
	[in.]	[in.]	[in.]
180050 (0050)	0.188	0.050	0.00025
180100 (0100)		0.100	0.00050
180200 (0200)		0.200	0.00100
180400 (0400)		0.400	0.00200

Metric Lead Screw Options[5]

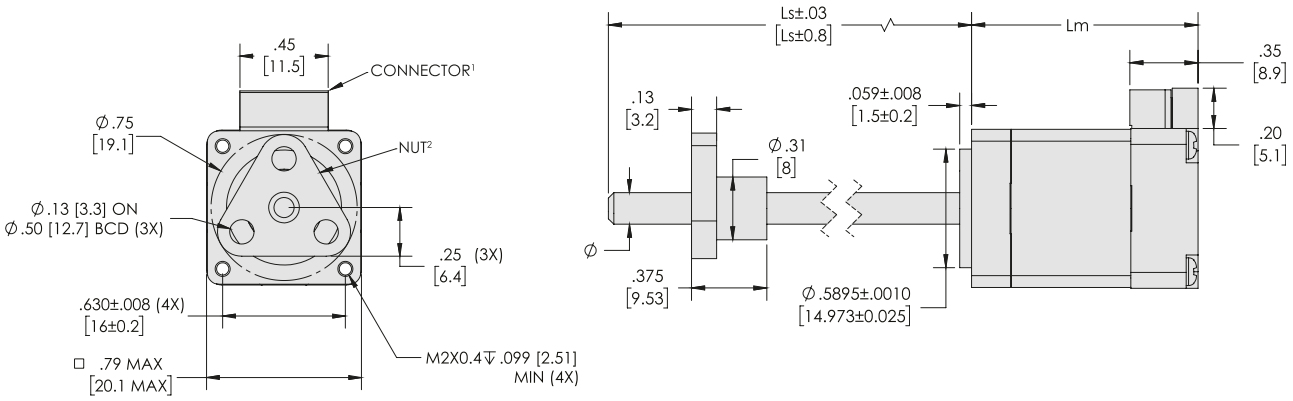
Screw Code[6]	Diameter	Lead	Travel/step
	[mm]	[mm]	[mm]
M04010 (0039)	4	1	0.00500
M04040 (0157)		4	0.02000
M04080 (0315)		8	0.04000

1. Maximum side load on MLA assemblies depends on load orientation, speed, stroke and other factors. For optimal performance, side loads should be avoided at end of travel. Contact Thomson for application assistance.
2. Contact Thomson for additional available motor windings.
3. "x" denotes placeholder for S or A depending upon configuration.
4. Applied voltage can be any value above this number as long as output current is controlled at the rated RMS current.
5. See lead screw selection matrix on pages 12-13 for other available lead screw configurations. Contact Thomson for more information about custom lead screw availability.
6. Codes within parentheses are for MLA configurations.

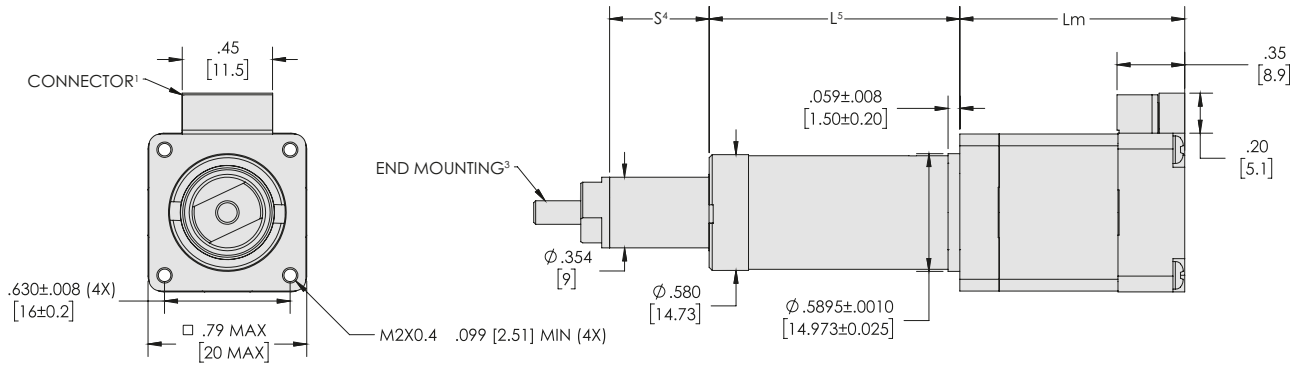
Dimensions – MLx08

MLS Configuration

Dimensions	Projection
Inch [mm]	



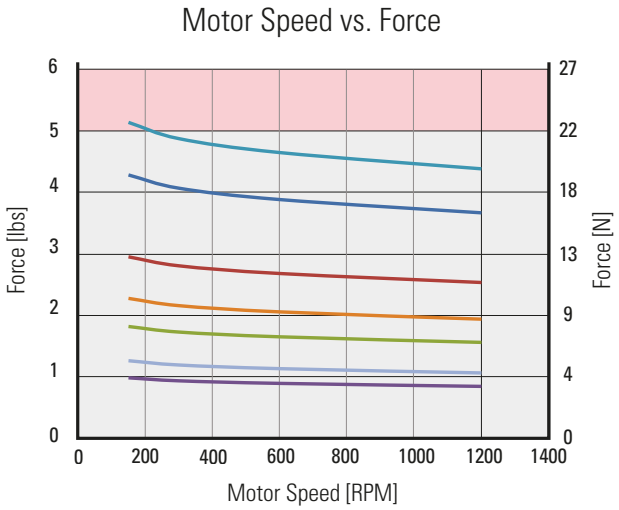
MLA Configuration

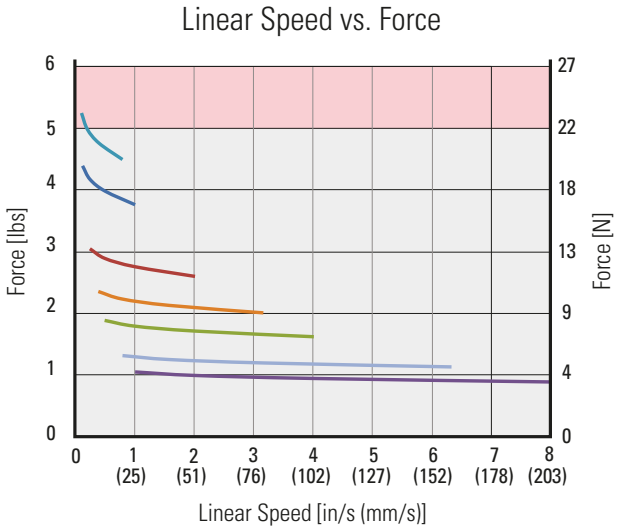


1. S6B-ZR(LF)(SN) connector shown. Wire harness with JST ZHR-6 mating connector and flying leads included with motor. For wiring diagram and connector details, see page 46.
2. RSF1800 (RS1) lead nut shown. For other nut options, see Nut Selection table on pages 36-37.
3. Standard M3x0.5 male end mounting (C4) shown. For other end mount options, see page 16.
4. Max stroke length for MLA08 configurations is 1.5 in. (38 mm). Contact Thomson for additional stroke lengths.
5. Cover tube length (L) = stroke (S) + 0.76 in. (19.3 mm).

MLx08 – Performance Diagrams

MLx08A05





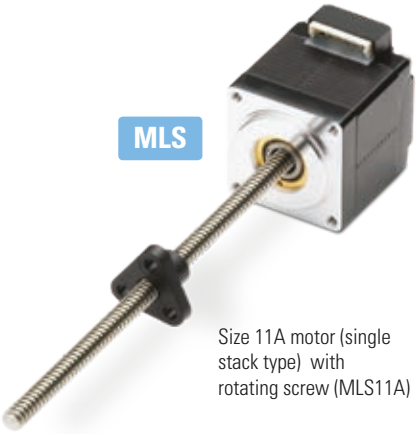
NOTE: Motor load curves were generated with a 24 VDC, 2-phase ON driver and half stepped at the motor rated current. Performance plots for other lead screw and motor winding configurations can be generated at thomsonlinear.com/smla.

Lead Screw Codes[1]

- 180050 (0050)
- 180100 (0100)
- M04040 (0157)
- 180400 (0400)
- M04010 (0039)
- Load area not recommended
- M04080 (0315)
- 180200 (0200)

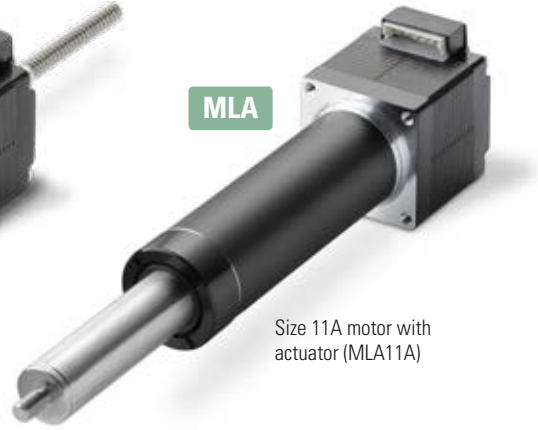
1. Codes within parentheses are for MLA configurations.

Specifications – MLx11 Motor Size



Size 11A motor (single stack type) with rotating screw (MLS11A)

Size 11A motor with rotating nut (MLN11A)



Size 11A motor with actuator (MLA11A)

Features and Benefits

- NEMA 11 motor (size 28 mm).
- Choose between a variety of inch and metric lead screws
- Recommended max. thrust force 20 lbs. (89 N).
- Recommended max. lead screw length of 4 in. (102 mm) for MLS / MLN and 2.5 in. (64 mm) stroke for MLA.
- Side load capacity of up to 10% of axial load for MLA configurations.
- MLS and MLA configurations are encoder ready. See pages 42-43 for more details.

Motor Options

Motor code[1]	Holding torque		Voltage / phase[3] [V]	Current / phase [A]	Resistance [Ω]	Inductance [mH]	Power draw [W]	Step angle [°]	Motor length, maximum (Lm)		Rotor inertia [oz-in²]	Motor weight [lbs]
	[oz-in]	[N-m]							[in]	[mm]		
MLx11A05[2]	9.3	0.066	3.85	0.51	7.54	5.22	1.96	1.8	1.26	32.0	0.06	0.24
MLx11A10[2]	10.1	0.071	2.19	1.00	2.19	1.53	2.19	1.8	1.26	32.0	0.06	0.24

Inch Lead Screw Options[4]

Screw code[5]	Diameter [in.]	Lead [in]	Travel / step [in]
180050 (0050)	0.188[6]	0.050	0.00025
180100 (0100)		0.100	0.00050
180200 (0200)		0.200	0.00100
180400 (0400)		0.400	0.00200
250031 (0031)	0.250[7]	0.0313	0.00016
250063 (0063)		0.0625	0.00031
250125 (0125)		0.1250	0.00063
250250 (0250)		0.2500	0.00125
250500 (0500)		0.5000	0.00250
250750 (0750)		0.7500	0.00375

Metric Lead Screw Options[4]

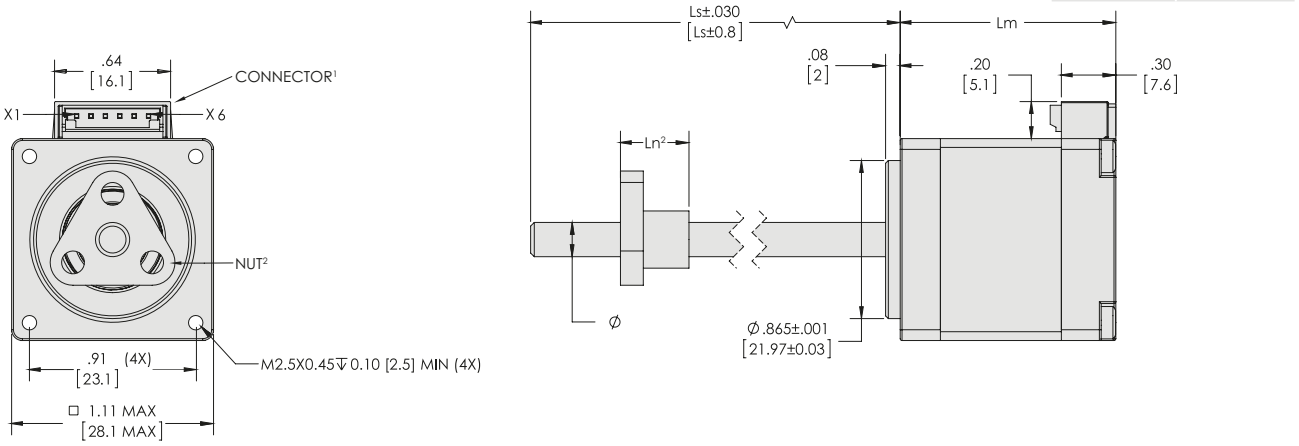
Screw code[5]	Diameter [mm]	Lead [mm]	Travel / step [mm]
M04010 (0039)	4[6]	1	0.00500
M04040 (0157)		4	0.02000
M04080 (0315)		8	0.04000
M06010 (0039)	6[7]	1	0.00500
M06060 (0236)		6	0.03000
M06120 (0472)		12	0.06000

1. Contact Thomson for additional available motor windings.
2. "x" denotes placeholder for S, N or A depending upon configuration.
3. Applied voltage can be any value above this number as long as output current is controlled at the rated RMS current.
4. See lead screw selection matrix on pages 12-13 for additional lead screw configurations.
5. Codes within parentheses are for MLA configurations.
6. Lead screw diameter not compatible with MLA configurations.
7. Lead screw diameter not compatible with MLN configurations.

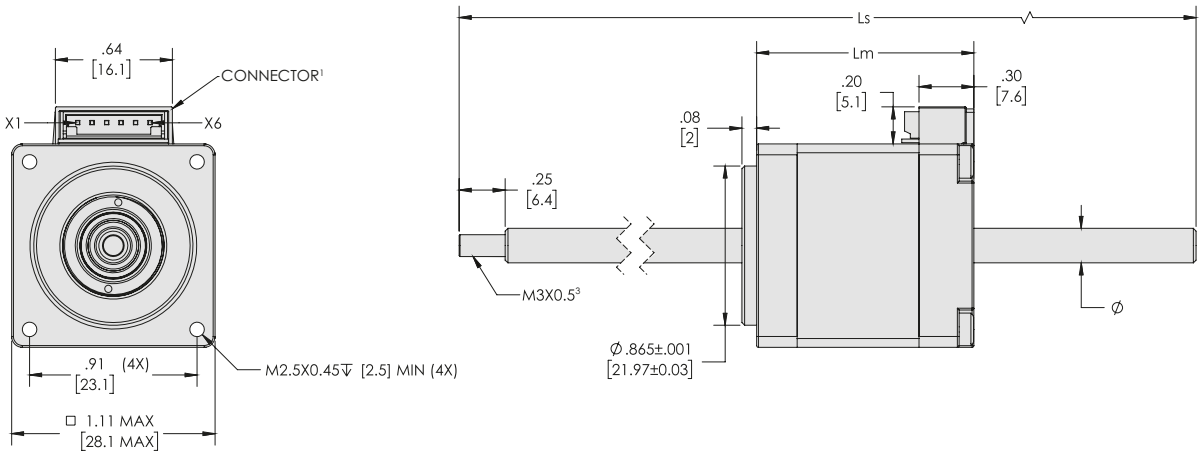
Dimensions – MLx11

Dimensions	Projection
Inch [mm]	

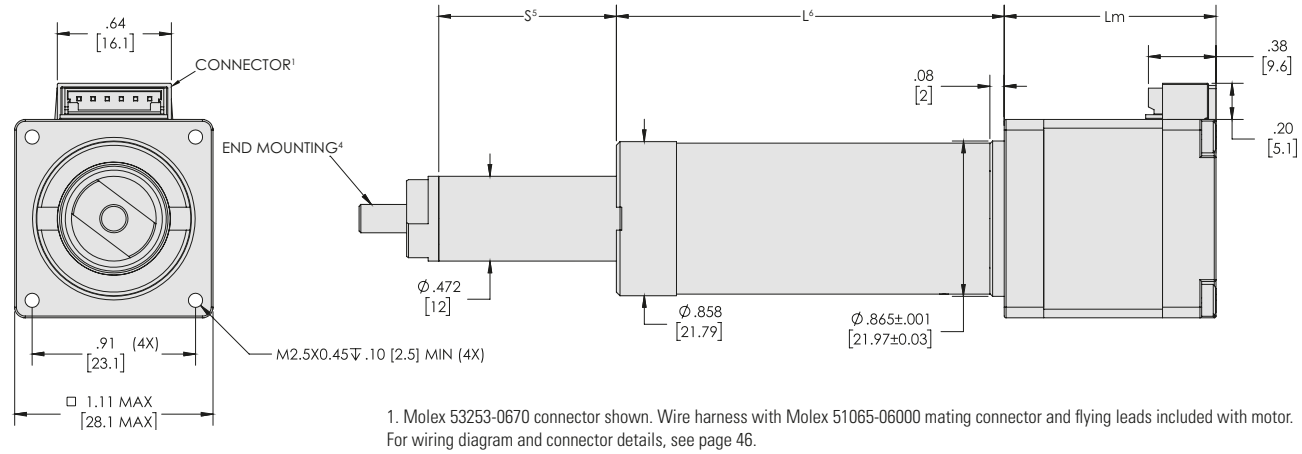
MLS Configuration



MLN Configuration



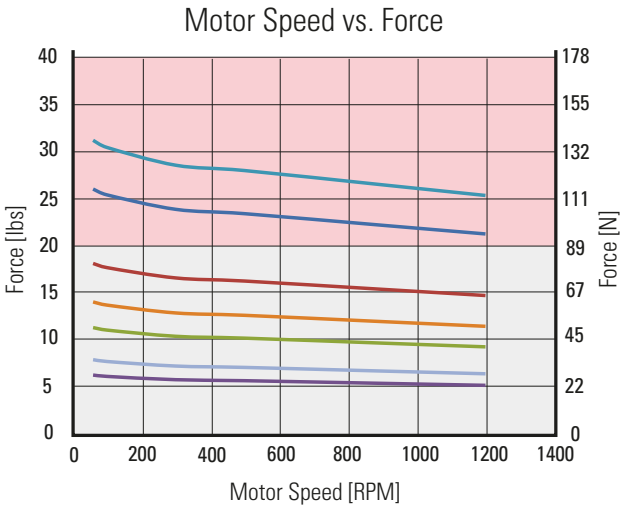
MLA Configuration

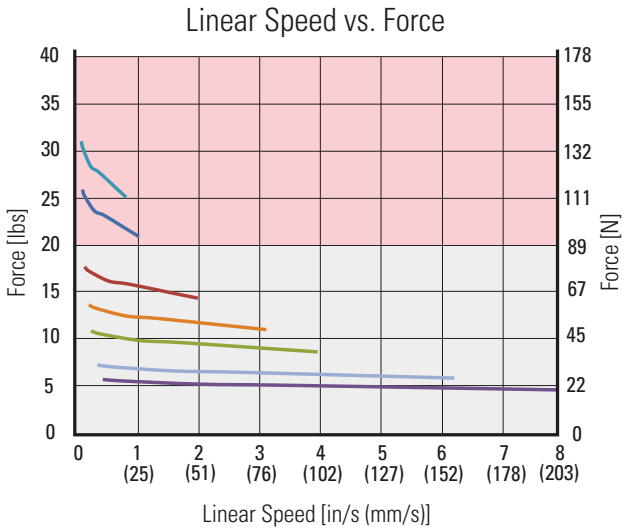


1. Molex 53253-0670 connector shown. Wire harness with Molex 51065-06000 mating connector and flying leads included with motor. For wiring diagram and connector details, see page 46.
2. RSF1800 (RS1) lead nut shown. For additional nut options, see Nut Selection table on pages 36-37.
3. Standard M3x0.5 male threaded end machining shown. For additional end-machining options, see page 15.
4. Standard M4x0.7 male end mounting (C5) shown. For additional end mount options, see page 16.
5. Max stroke length for MLA11 configurations is 2.5 in. (64 mm). Contact Thomson for additional stroke lengths.
6. Cover tube length (L) = stroke (S) + 1.16 in. (29.5 mm).

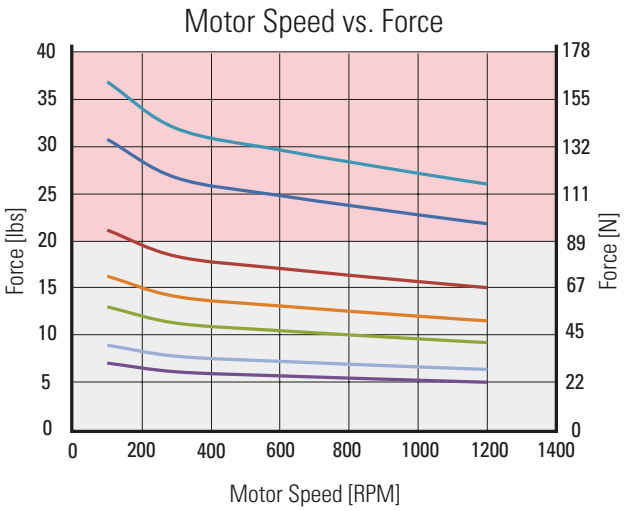
MLx11 – Performance Diagrams

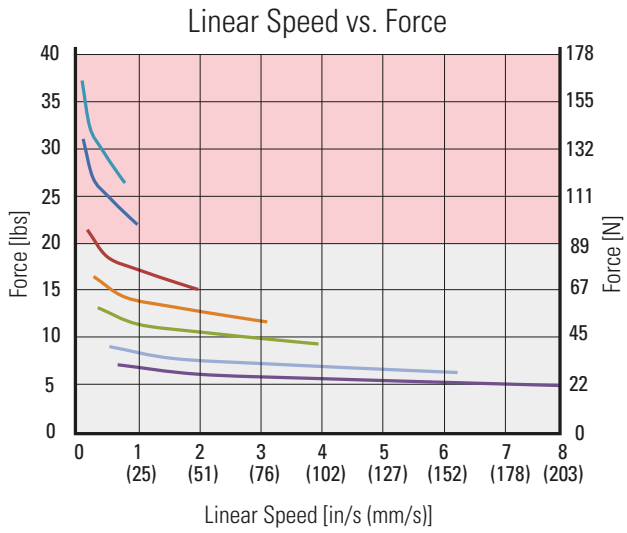
MLS11A05-18 or MLS11A05-M04
MLN11A05-18 or MLN11A05-M04





MLS11A10-18 or MLS11A10-M04
MLN11A10-18 or MLN11A10-M04





Note: All motor load curves were generated with a 40 VDC, 2-phase ON driver and full stepped at the motor rated current. Performance plots for other lead screw and motor winding configurations can be generated at thomsonlinear.com/smla.

Lead Screw Codes[1]

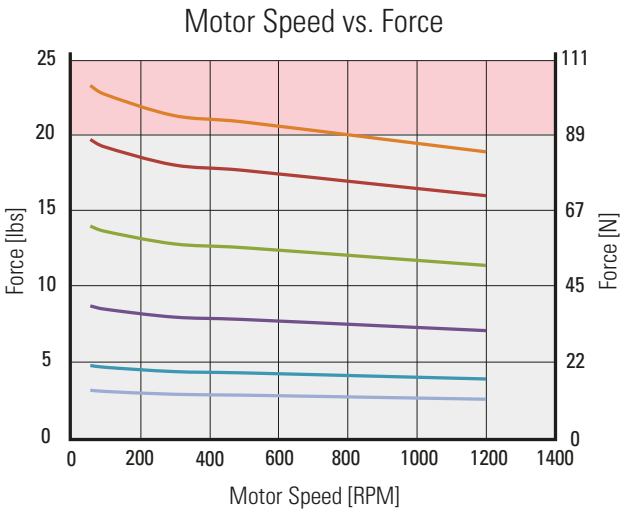
- 180050 (0050)
- 180100 (0100)
- M04040 (0157)
- 180400 (0400)
- M04010 (0039)
- Load area not recommended
- M04080 (0315)
- 180200 (0200)

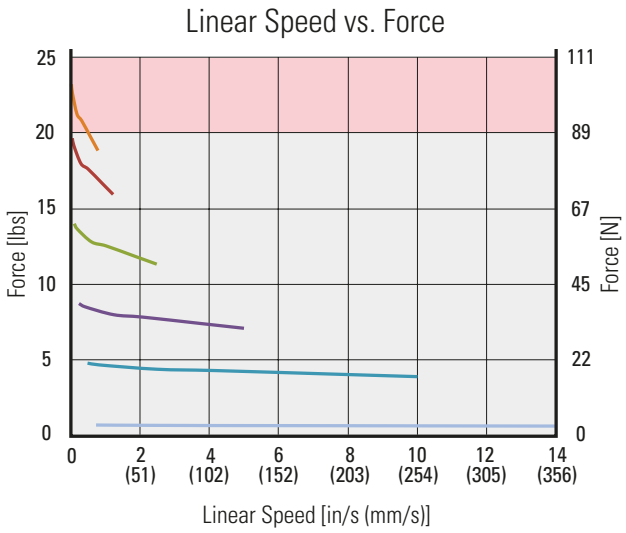
1. Codes within parentheses are for MLA configurations.

Please visit **www.thomsonlinear.com/smla** to access our stepper motor linear actuator selector and part number generator.

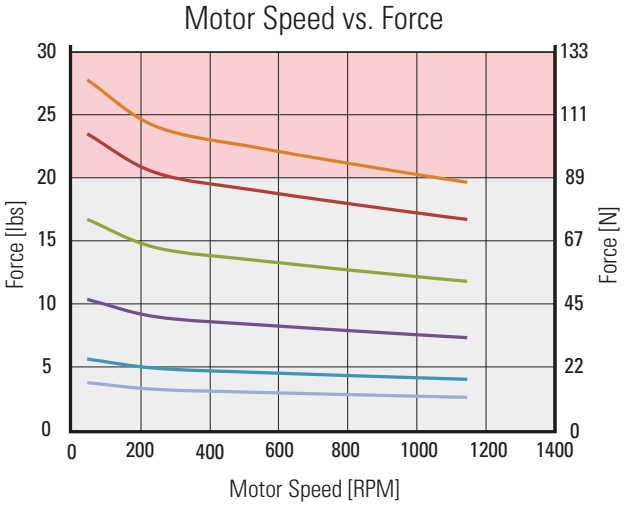
MLx11 – Performance Diagrams

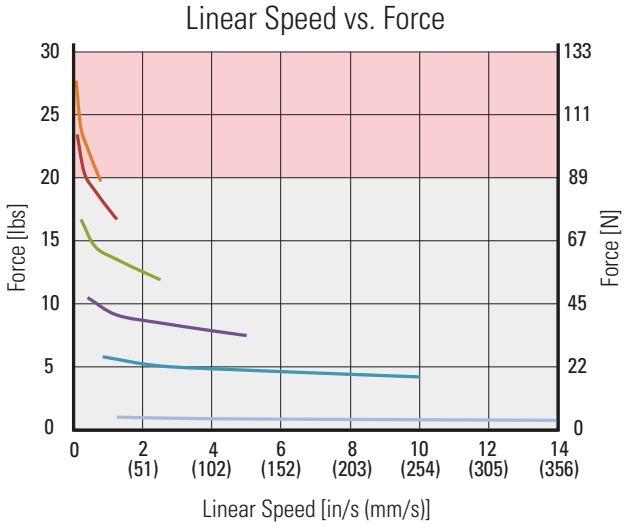
MLA11A05-25 or MLA11A05-M06
MLS11A05-25 or MLS11A05-M06





MLA11A10-25 or MLA11A10-M06
MLS11A10-25 or MLS11A10-M06





Note: All motor load curves were generated with a 40 VDC, 2-phase ON driver and full stepped at the motor rated current. Performance plots for other lead screw and motor winding configurations can be generated at thomsonlinear.com/smla.

Lead Screw Codes[1]

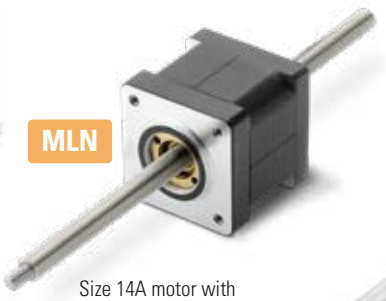
- 250031 (0031) / M06010 (0039)
- 250125 (0125)
- 250500 (0500) / M06120 (0472)
- 250063 (0063)
- 250250 (0250) / M06060 (0236)
- 250750 (0750)
- Load area not recommended

1. Codes within parentheses are for MLA configurations.

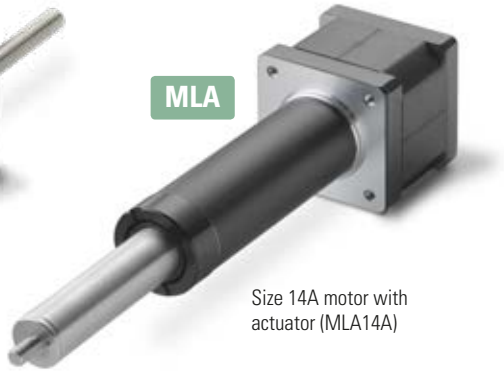
Please visit **www.thomsonlinear.com/smla** to access our stepper motor linear actuator selector and part number generator.

Specifications – MLx14 Motor Size

Size 14A motor (single stack type) with rotating screw (MLS14A)



Size 14A motor with rotating nut (MLN14A)



Size 14A motor with actuator (MLA14A)

Features and Benefits

- NEMA 14 motor (size 35 mm).
- Choose between a variety of inch and metric lead screws.
- Recommended max. thrust force 50 lbs. (222 N).
- Recommended max. lead screw length of 8 in. (203 mm) for MLS / MLN and 2.5 in (64 mm) stroke for MLA.
- Side load capacity of up to 10% of axial load for MLA configurations.
- MLS and MLA configurations are encoder ready. See pages 42-43 for more details.

Motor Options

Motor code[1]	Holding torque		Voltage / phase[3] [V]	Current / phase [A]	Resistance [Ω]	Inductance [mH]	Power draw [W]	Step angle [°]	Motor length, maximum (Lm)		Rotor inertia [oz-in²]	Motor weight [lbs]
	[oz-in]	[N-m]							[in]	[mm]		
MLx14A08[2]	25.8	0.182	3.42	0.88	3.89	5.51	3.01	1.8	1.34	34.0	0.10	0.41
MLx14A13[2]	23.0	0.162	1.71	1.35	1.27	1.79	2.31	1.8	1.34	34.0	0.10	0.41

Inch Lead Screw Options[4]

Screw code[5]	Diameter [in.]	Lead [in]	Travel / step [in]
250031 (0031)	0.250	0.0313	0.00016
250063 (0063)		0.0625	0.00031
250125 (0125)		0.1250	0.00063
250250 (0250)		0.2500	0.00125
250500 (0500)		0.5000	0.00250
250750 (0750)		0.7500	0.00375

Metric Lead Screw Options[4]

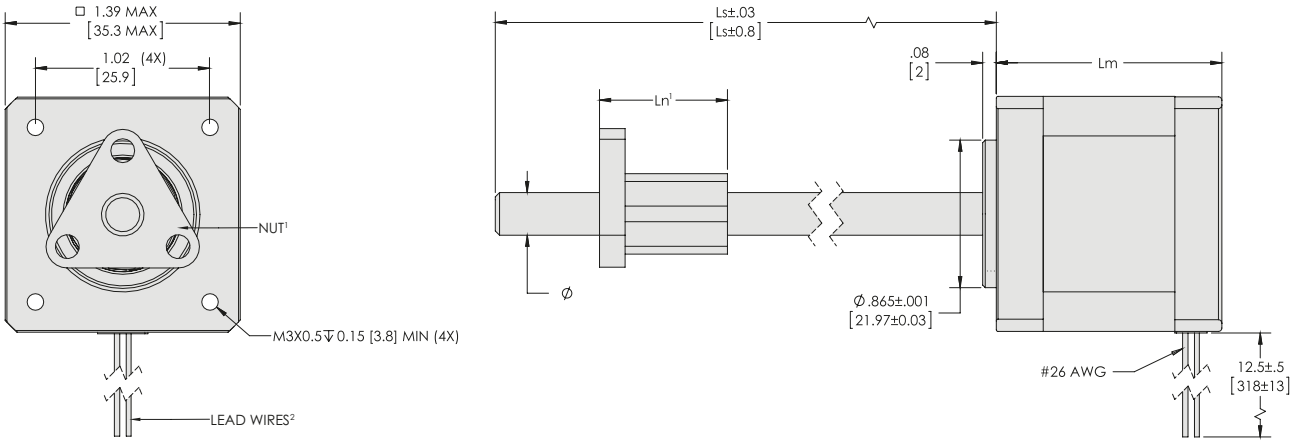
Screw code[5]	Diameter [mm]	Lead [mm]	Travel / step [mm]
M06010 (0039)	6	1	0.00500
M06060 (0236)		6	0.03000
M06120 (0472)		12	0.06000

1. Contact Thomson for additional available motor windings.
2. "x" denotes placeholder for S, N or A depending upon configuration.
3. Applied voltage can be any value above this number as long as output current is controlled at the rated RMS current.
4. See lead screw selection matrix on pages 12-13 for additional lead screw configurations.
5. Codes within parentheses are for MLA configurations.

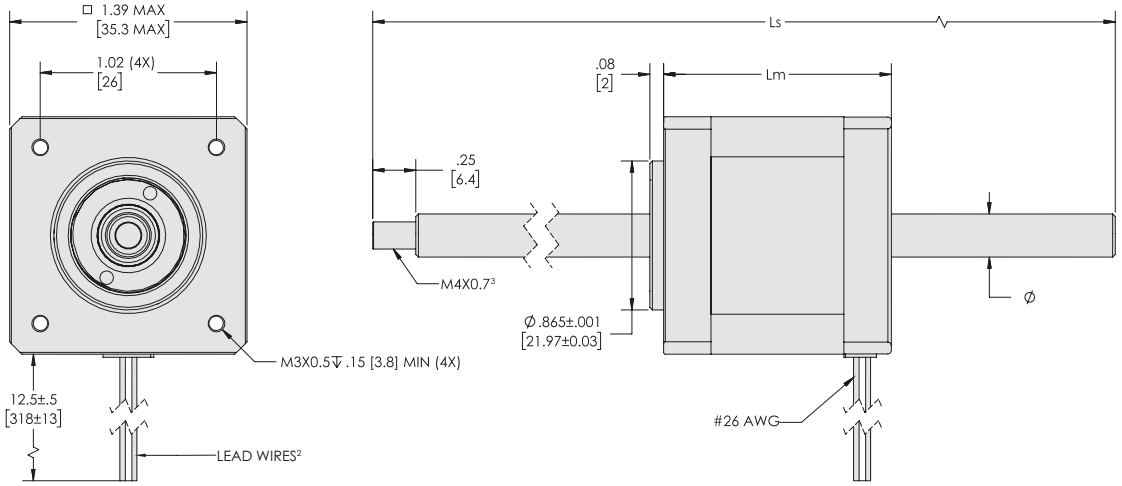
Dimensions – MLx14

Dimensions	Projection
Inch [mm]	

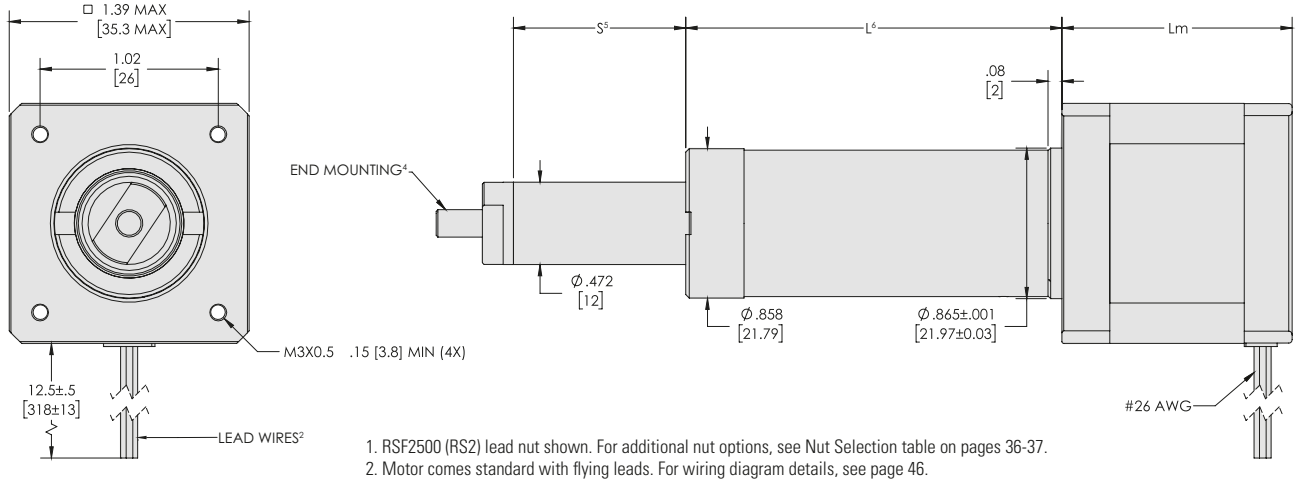
MLS Configuration



MLN Configuration



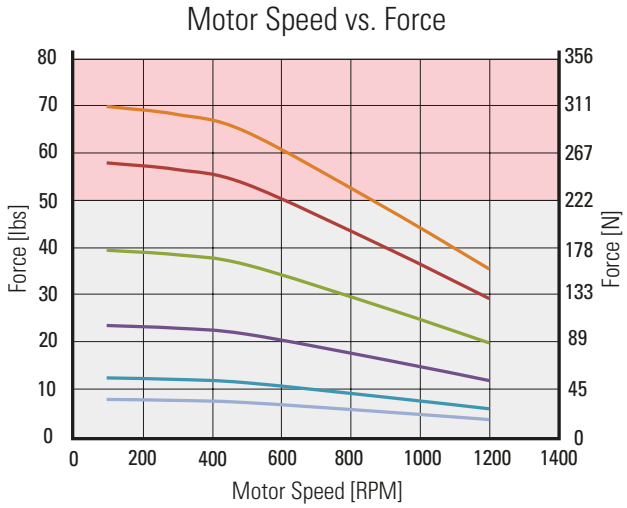
MLA Configuration

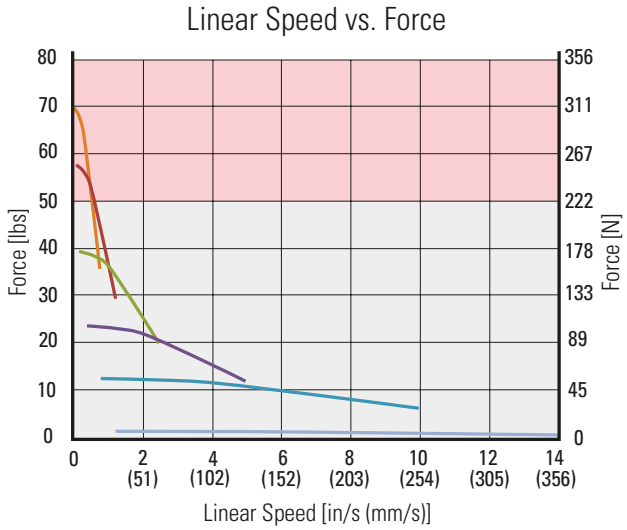


1. RSF2500 (RS2) lead nut shown. For additional nut options, see Nut Selection table on pages 36-37.
2. Motor comes standard with flying leads. For wiring diagram details, see page 46.
3. Standard M4x0.7 male threaded end machining shown. For additional end machining options, see page 15.
4. Standard M4x0.7 male end mounting (C5) shown. For additional end mount options, see page 16.
5. Max stroke length for MLA14 configurations is 2.5 in. (64 mm). Contact Thomson for additional stroke lengths.
6. Cover tube length (L) = stroke (S) + 1.16 in. (29.5 mm).

ML14 – Performance Diagrams

MLx14A08





Note: All motor load curves were generated with a 40 VDC, 2-phase ON driver and full stepped at the motor rated current. Performance plots for other lead screw and motor winding configurations can be generated at thomsonlinear.com/smla.

Lead Screw Codes[1]

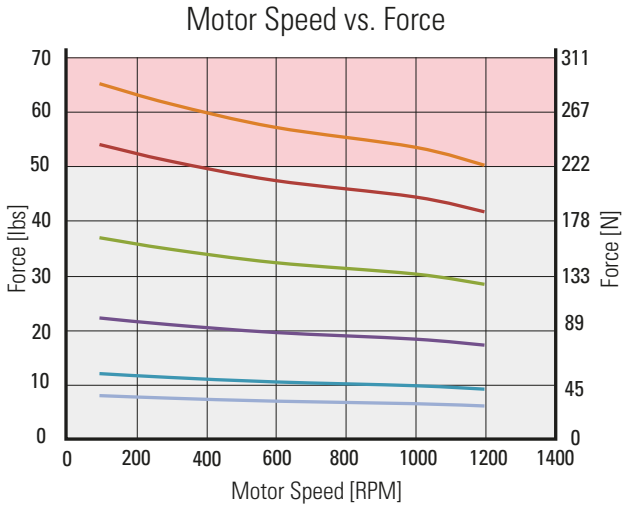
- 250031 (0031) / M06010 (0039)
- 250250 (0250) / M06060 (0236)
- 250125 (0125)
- 250750 (0750)
- 250500 (0500) / M06120 (0472)
- Load area not recommended
- 250063 (0063)

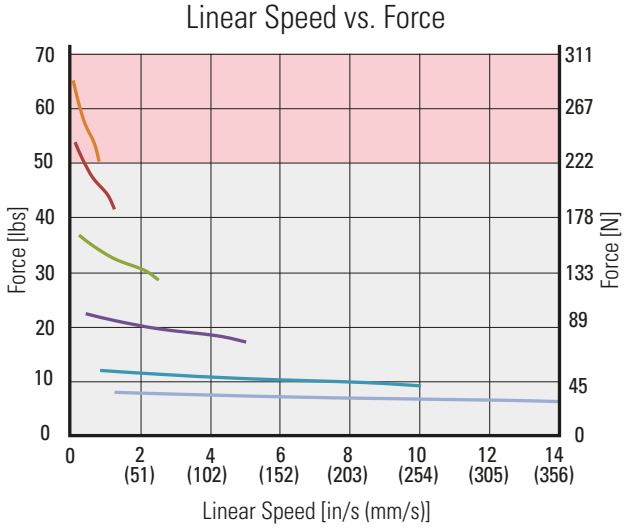
1. Codes within parentheses are for MLA configurations.

Please visit **www.thomsonlinear.com/smla** to access our stepper motor linear actuator selector and part number generator.

ML14 – Performance Diagrams

MLx14A13





Note: All motor load curves were generated with a 40 VDC, 2-phase ON driver and full stepped at the motor rated current. Performance plots for other lead screw and motor winding configurations can be generated at thomsonlinear.com/smla.

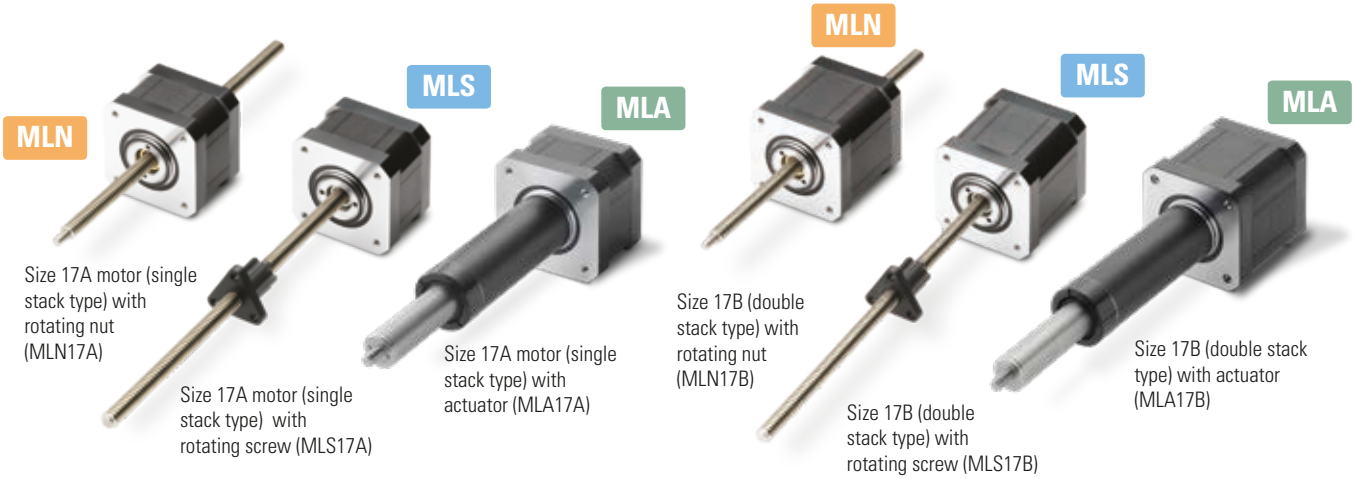
Lead Screw Codes[1]

- 250031 (0031) / M06010 (0039)
- 250250 (0250) / M06060 (0236)
- 250125 (0125)
- 250750 (0750)
- 250500 (0500) / M06120 (0472)
- Load area not recommended
- 250063 (0063)

1. Codes within parentheses are for MLA configurations.

Please visit **www.thomsonlinear.com/smla** to access our stepper motor linear actuator selector and part number generator.

Specifications – MLx17 Motor Size



Size 17A motor (single stack type) with rotating nut (MLN17A)

Size 17A motor (single stack type) with rotating screw (MLS17A)

Size 17A motor (single stack type) with actuator (MLA17A)

Size 17B (double stack type) with rotating nut (MLN17B)

Size 17B (double stack type) with rotating screw (MLS17B)

Size 17B (double stack type) with actuator (MLA17B)

Features and Benefits

- NEMA 17 motor (size 42 mm).
- Choose between a variety of inch and metric lead screws.
- Recommended max. thrust force 75 lbs (334 N).
- Recommended max. lead screw length of 8 in. (203 mm) for MLS / MLN and 2.5 in (64 mm) stroke for MLA.
- Side load capacity of up to 10% of axial load for MLA configurations.
- MLS and MLA configurations are encoder ready. See pages 42-43 for more details.

Motor Options

Motor code[1]	Holding torque		Voltage / phase[3] [V]	Current / phase [A]	Resistance [Ω]	Inductance [mH]	Power draw [W]	Step angle [°]	Motor length, maximum (Lm)		Rotor inertia [oz-in²]	Motor weight [lbs]
	[oz-in]	[N-m]							[in]	[mm]		
MLx17A10[2]	77.0	0.544	2.33	1.00	2.33	5.61	2.33	1.8	1.34	34.0	0.23	0.4
MLx17A15[2]	92.0	0.650	1.76	1.50	1.17	3.26	2.63	1.8	1.34	34.0	0.23	0.4
MLx17B10[2]	107.8	0.761	1.69	1.00	1.69	5.66	1.69	1.8	1.89	48.0	0.47	0.7
MLx17B15[2]	102.8	0.726	1.31	1.50	0.87	2.7	1.96	1.8	1.89	48.0	0.47	0.7

Inch Lead Screw Options[4]

Screw code[5]	Diameter [in]	Lead [in]	Travel / step [in]
250031 (0031)	0.250	0.0313	0.00016
250063 (0063)		0.0625	0.00031
250125 (0125)		0.1250	0.00063
250250 (0250)		0.2500	0.00125
250500 (0500)		0.5000	0.00250
250750 (0750)		0.7500	0.00375

Metric Lead Screw Options[4]

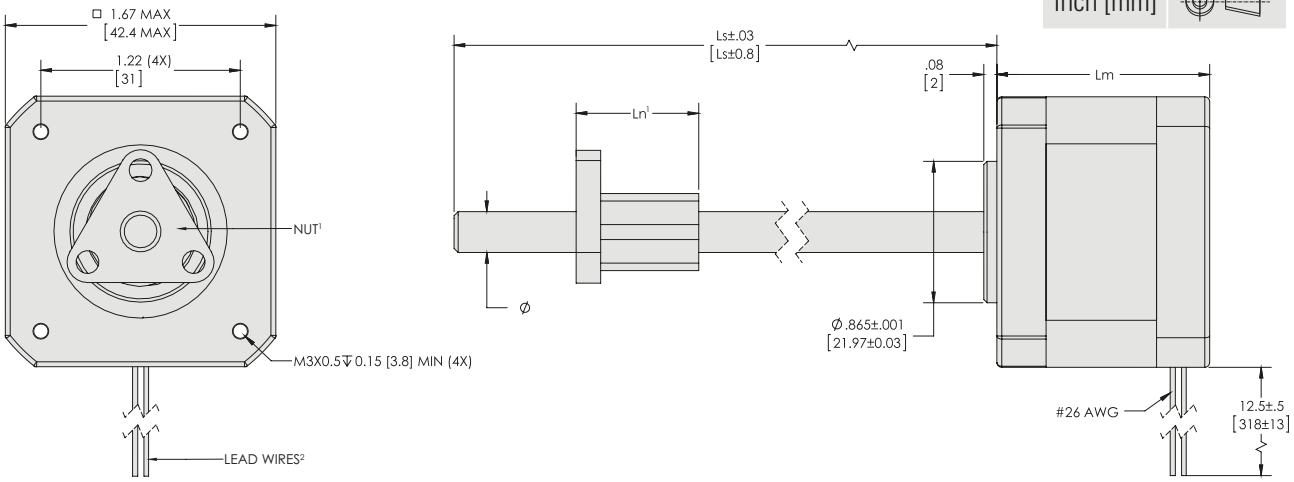
Screw code[5]	Diameter [mm]	Lead [mm]	Travel / step [mm]
M06010 (0039)	6	1	0.00500
M06060 (0236)		6	0.03000
M06120 (0472)		12	0.06000

1. Contact Thomson for additional available motor windings.
2. "x" denotes placeholder for S, N or A depending upon configuration.
3. Applied voltage can be any value above this number as long as output current is controlled at the rated RMS current.
4. See lead screw selection matrix on pages 12-13 for additional lead screw configurations.
5. Codes within parentheses are for MLA configurations.

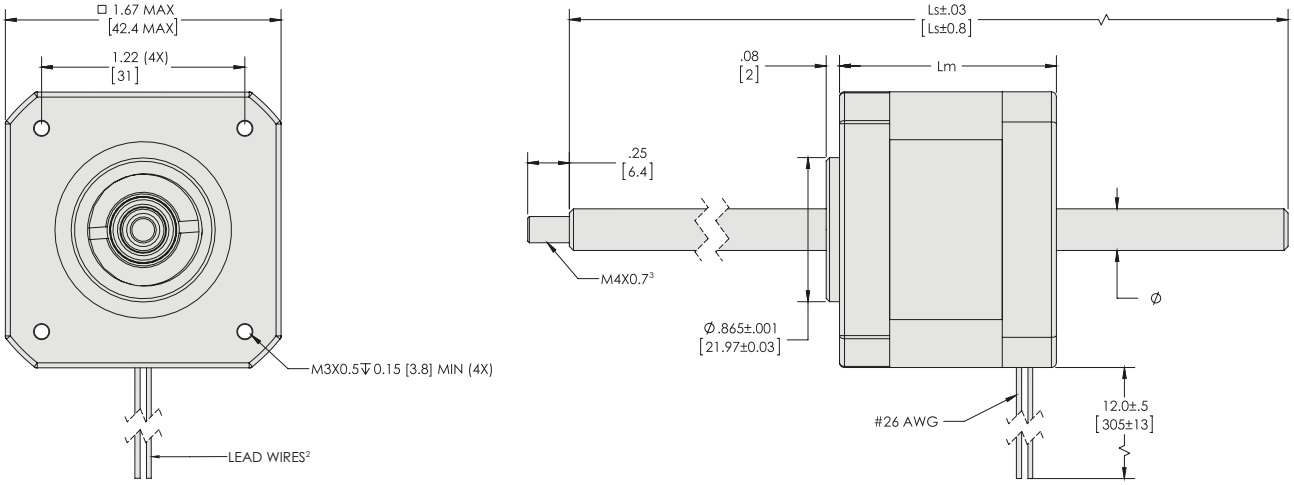
Dimensions – MLx17

MLS Configuration

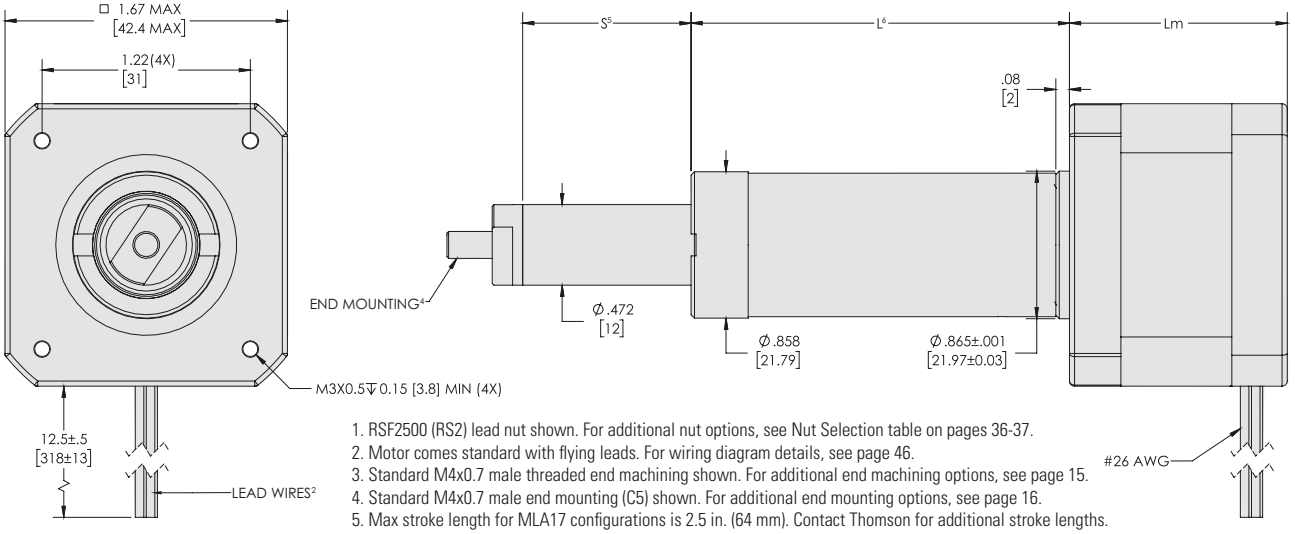
Dimensions	Projection
Inch [mm]	



MLN Configuration



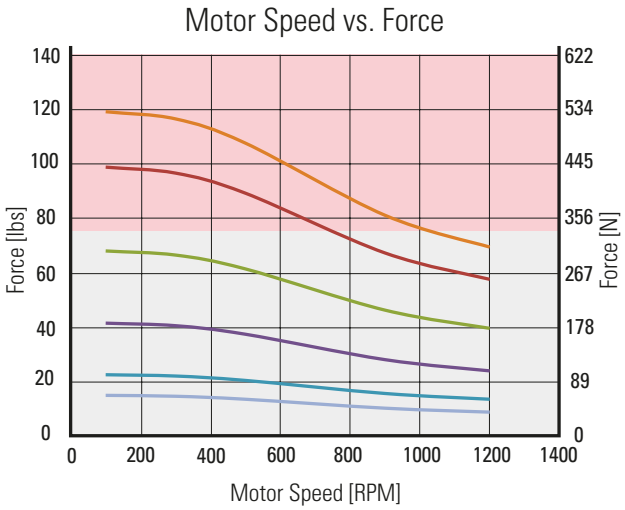
MLA Configuration

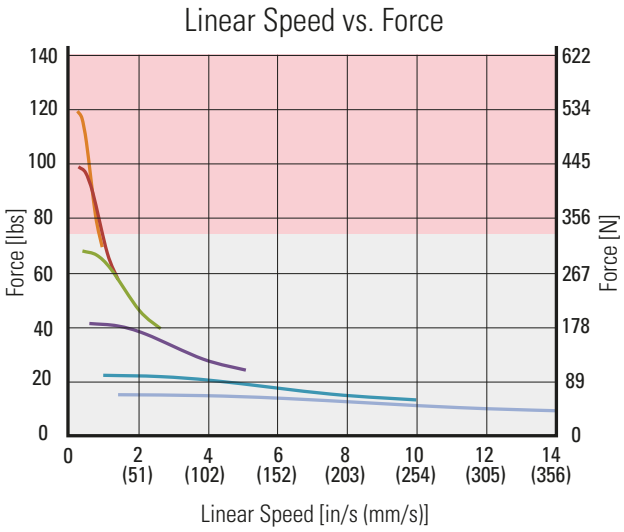


1. RSF2500 (RS2) lead nut shown. For additional nut options, see Nut Selection table on pages 36-37.
2. Motor comes standard with flying leads. For wiring diagram details, see page 46.
3. Standard M4x0.7 male threaded end machining shown. For additional end machining options, see page 15.
4. Standard M4x0.7 male end mounting (C5) shown. For additional end mounting options, see page 16.
5. Max stroke length for MLA17 configurations is 2.5 in. (64 mm). Contact Thomson for additional stroke lengths.
6. Cover tube length (L) = stroke (S) + 1.16 in. (29.5 mm).

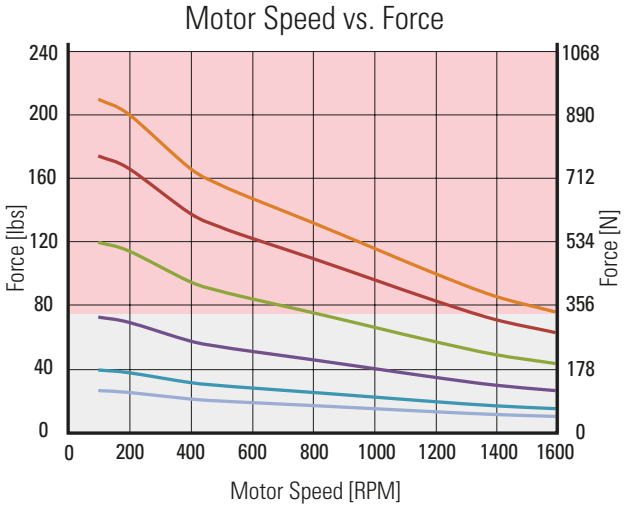
ML17 – Performance Diagrams

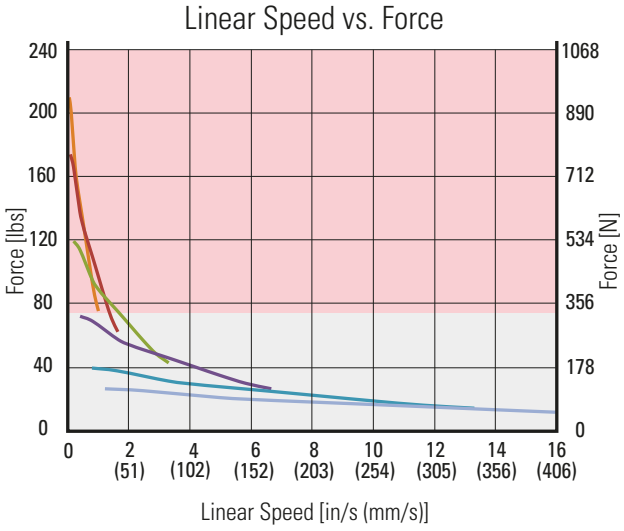
MLx17A10





MLx17B10





Note: All motor load curves were generated with a 40 VDC, 2-phase ON driver and full stepped at the motor rated current. Performance plots for other lead screw and motor winding configurations can be generated at thomsonlinear.com/smla.

Lead Screw Codes[1]

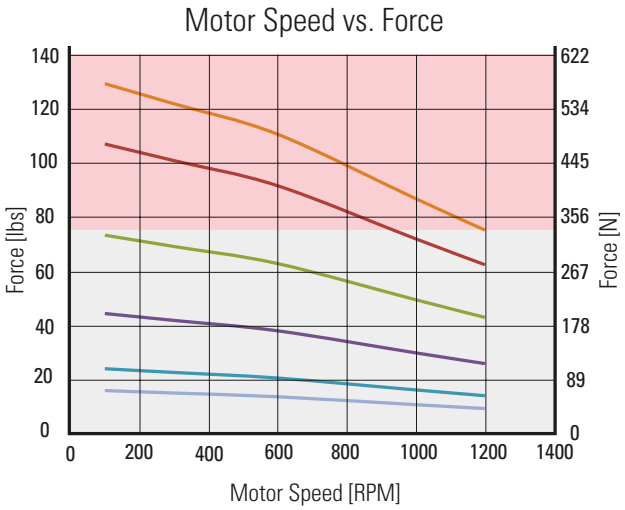
- 250031 (0031) / M06010 (0039)
- 250125 (0125)
- 250500 (0500) / M06120 (0472)
- 250063 (0063)
- 250250 (0250) / M06060 (0236)
- 250750 (0750)
- Load area not recommended

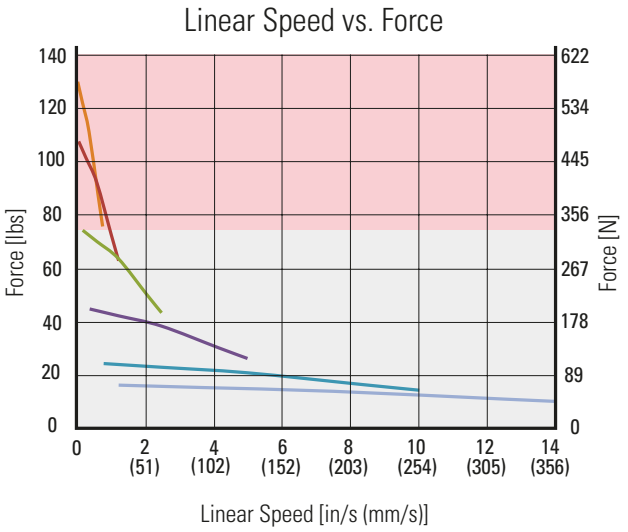
1. Codes within parentheses are for MLA configurations.

Please visit **www.thomsonlinear.com/smla** to access our stepper motor linear actuator selector and part number generator.

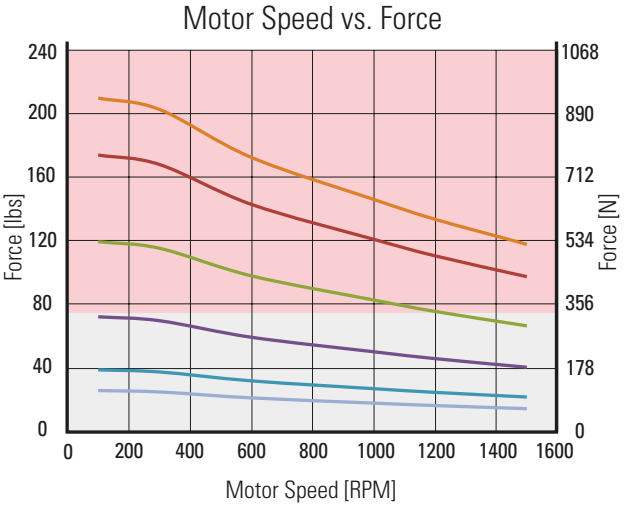
ML17 – Performance Diagrams

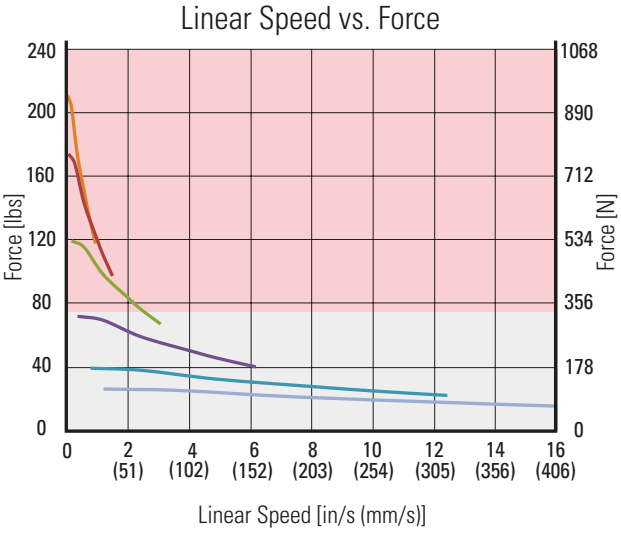
MLx17A15





MLx17B15





Note: All motor load curves were generated with a 40 VDC, 2-phase ON driver and full stepped at the motor rated current. Performance plots for other lead screw and motor winding configurations can be generated at thomsonlinear.com/smla.

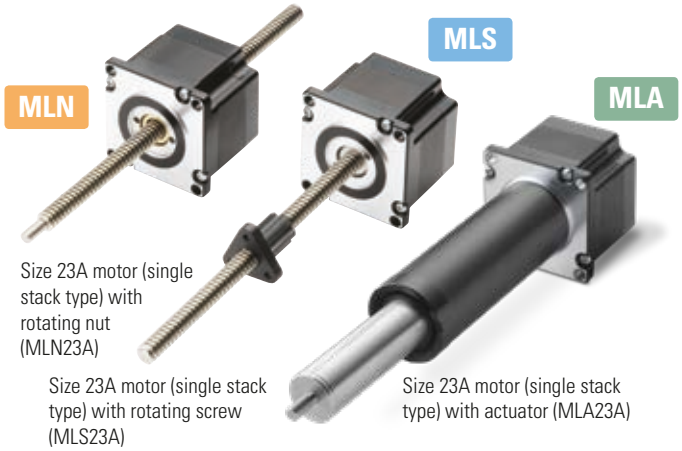
Lead Screw Codes[1]

- 250031 (0031) / M06010 (0039)
- 250125 (0125)
- 250500 (0500) / M06120 (0472)
- 250063 (0063)
- 250250 (0250) / M06060 (0236)
- 250750 (0750)
- Load area not recommended

1. Codes within parentheses are for MLA configurations.

Please visit **www.thomsonlinear.com/smla** to access our stepper motor linear actuator selector and part number generator.

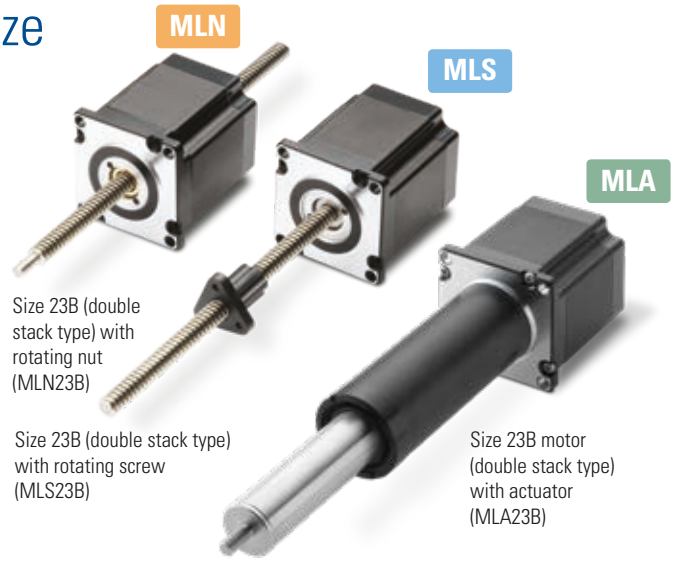
Specifications – MLx23 Motor Size



Size 23A motor (single stack type) with rotating nut (MLN23A)

Size 23A motor (single stack type) with rotating screw (MLS23A)

Size 23A motor (single stack type) with actuator (MLA23A)



Size 23B (double stack type) with rotating nut (MLN23B)

Size 23B (double stack type) with rotating screw (MLS23B)

Size 23B motor (double stack type) with actuator (MLA23B)

Features and Benefits

- NEMA 23 motor (size 57 mm).
- Choose between a variety of inch and metric lead screws.
- Recommended max. thrust force 200 lbs. (890 N).
- Recommended max. stroke length for MLA is 2.5 in. (64 mm).
- Side load capacity of up to 10% of axial load for MLA configurations.
- For MLS/MLN, recommended max. lead screw length for 0.313 in. (8 mm) diameter is 12 in. (305 mm) / max. lead screw length for 0.375 in. (10 mm) diameter is 16 in. (406 mm).
- MLS and MLA configurations are encoder ready. See pages 42-43 for more details.

Motor Options

Motor code[1]	Holding torque		Voltage / phase[3] [V]	Current / phase [A]	Resistance [Ω]	Inductance [mH]	Power draw [W]	Step angle [°]	Motor length, maximum (Lm)		Rotor inertia [oz-in²]	Motor weight [lbs]
	[oz-in]	[N-m]							[in]	[mm]		
MLx23A15[2]	121.0	0.854	3.77	1.55	2.43	4.20	5.84	1.8	1.78	45.2	1.04	1.13
MLx23A30[2]	123.8	0.875	1.74	3.00	0.58	1.16	5.22	1.8	1.78	45.2	1.04	1.13
MLx23B19[2]	251.2	1.774	3.80	1.90	2.00	5.84	7.22	1.8	2.59	65.8	2.13	1.70
MLx23B39[2]	260.8	1.842	1.99	3.90	0.51	1.45	7.76	1.8	2.59	65.8	2.13	1.70

Inch Lead Screw Options[4]

Screw code[5]	Diameter [in]	Lead [in]	Travel / step [in]
310083	0.313[6]	0.083	0.00042
310167		0.167	0.00083
310250		0.250	0.00125
310500		0.500	0.00250
311000		1.000	0.00500
370063 (0063)	0.375	0.063	0.00031
370100 (0100)		0.100	0.00050
370167 (0167)		0.167	0.00083
370250 (0250)		0.250	0.00125
370500 (0500)		0.500	0.00250
371000 (1000)		1.000	0.00500

Metric Lead Screw Options[4]

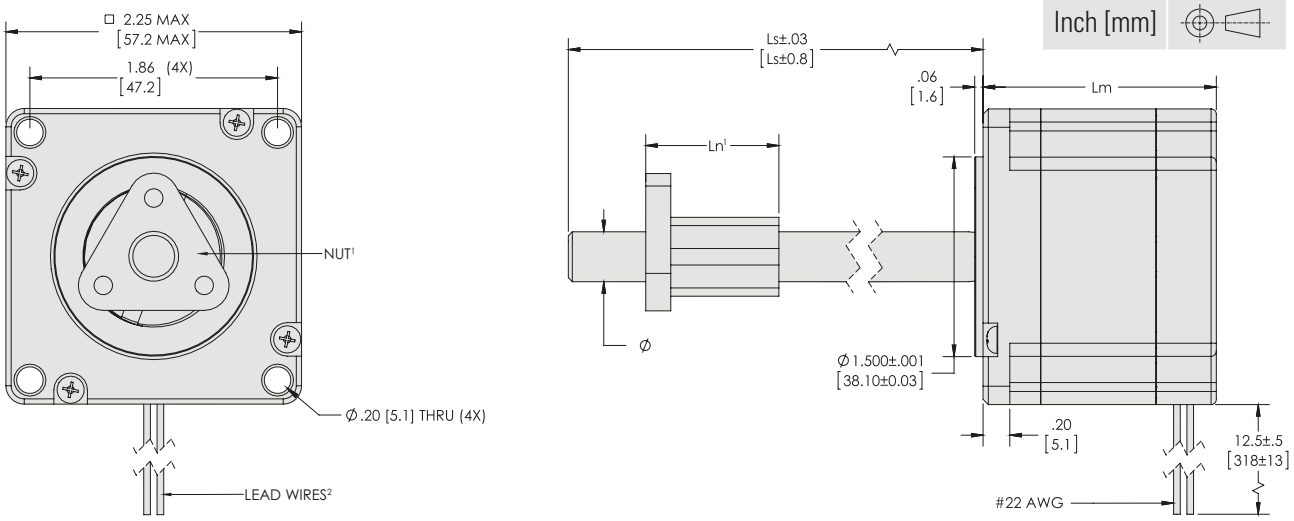
Screw code[5]	Diameter [mm]	Lead [mm]	Travel / step [mm]
M08020	8[6]	2	0.01000
M08040		4	0.02000
M08080		8	0.04000
M08120		12	0.06000
M08200		20	0.10000
M10020 (0079)	10	2	0.01000
M10030 (0118)		3	0.01500
M10050 (0197)		5	0.02500
M10100 (0394)		10	0.05000
M10200 (0787)		20	0.10000

1. Contact Thomson for additional available motor windings.
2. "x" denotes placeholder for S, N or A depending upon configuration.
3. Applied voltage can be any value above this number as long as output current is controlled at the rated RMS current.
4. See lead screw selection matrix on pages 12-13 for additional lead screw configurations.
5. Codes within parentheses are for MLA configurations.
6. Lead screw diameter not compatible with MLA configurations.

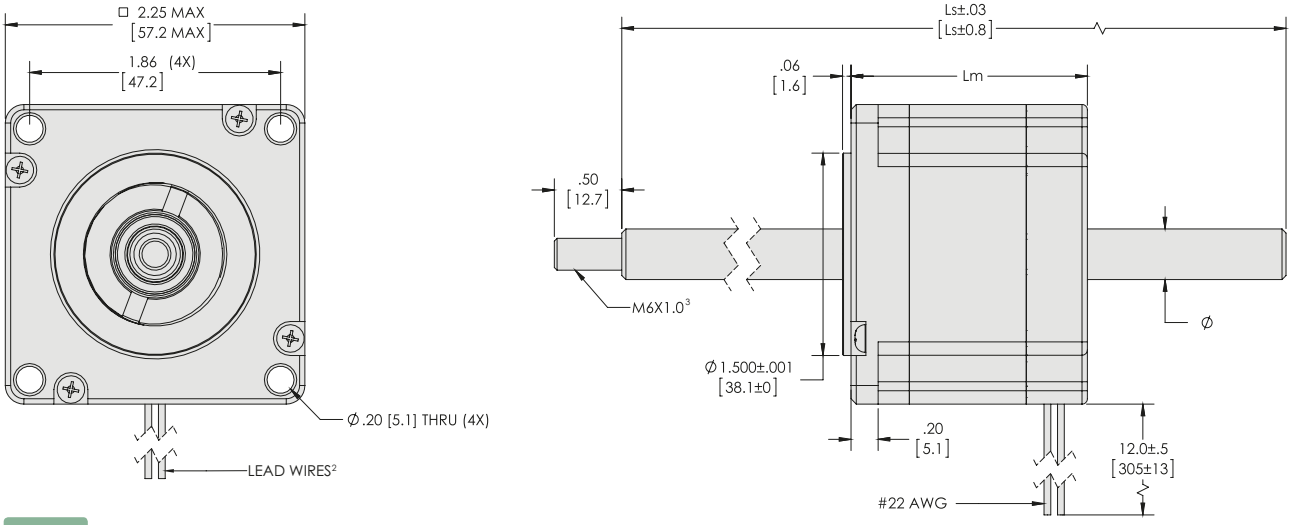
MLx23 – Dimensions

MLS Configuration

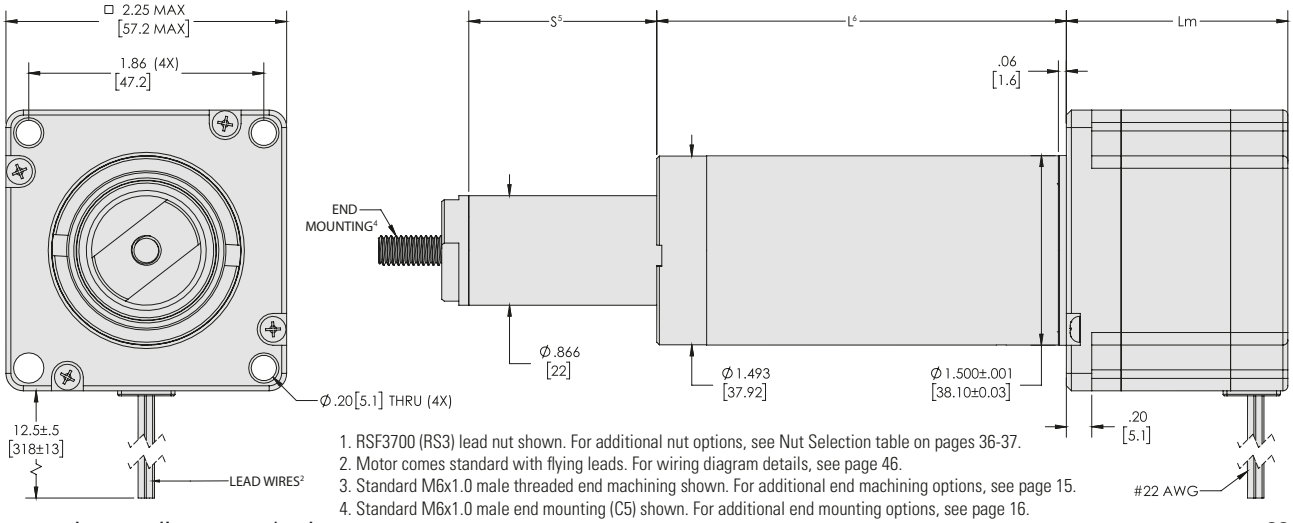
Dimensions	Projection
Inch [mm]	



MLN Configuration



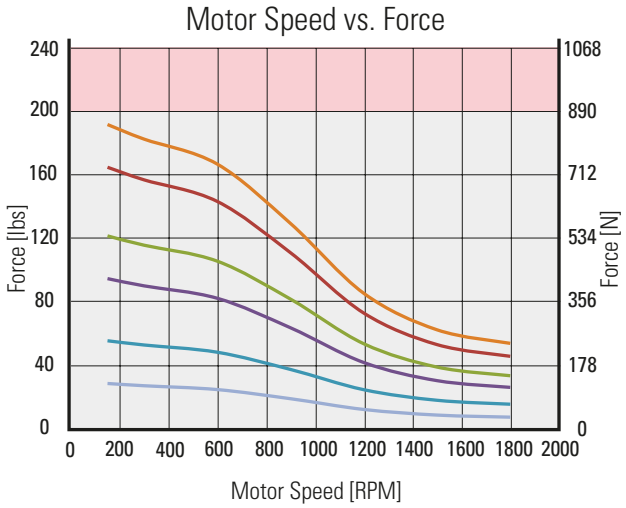
MLA Configuration

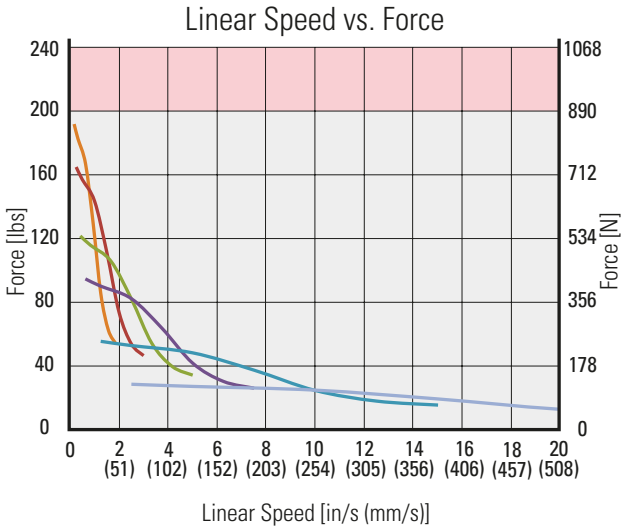


1. RSF3700 (RS3) lead nut shown. For additional nut options, see Nut Selection table on pages 36-37.
2. Motor comes standard with flying leads. For wiring diagram details, see page 46.
3. Standard M6x1.0 male threaded end machining shown. For additional end machining options, see page 15.
4. Standard M6x1.0 male end mounting (C5) shown. For additional end mounting options, see page 16.
5. Max stroke length for MLA23 configurations is 2.5 in. (64 mm). Contact Thomson for additional stroke lengths.
6. Cover tube length (L) = stroke (S) + 1.74 in. (44.2 mm).

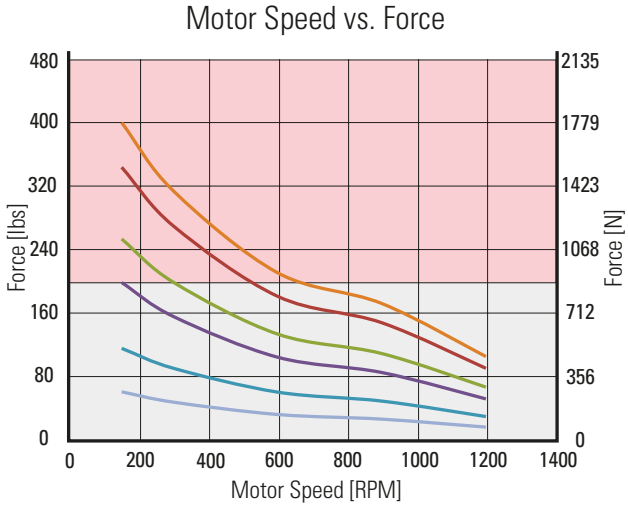
ML23 – Performance Diagrams

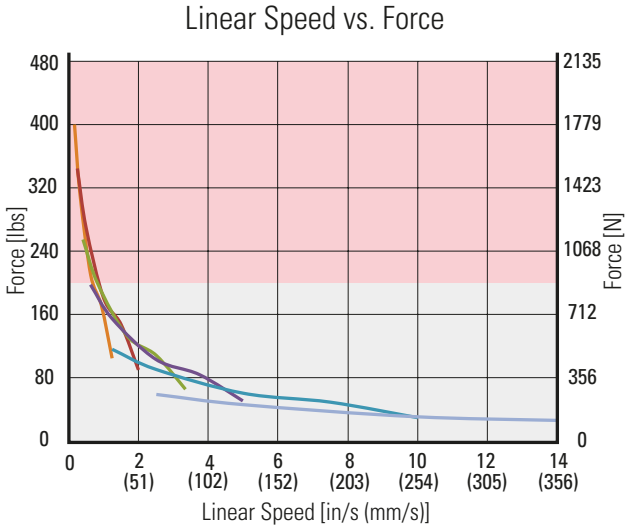
MLx23A15





MLx23B19





Note: All motor load curves were generated with a 40 VDC, 2-phase ON driver and full stepped at the motor rated current. Performance plots for other lead screw and motor winding configurations can be generated at thomsonlinear.com/smla.

Lead Screw Codes[1]

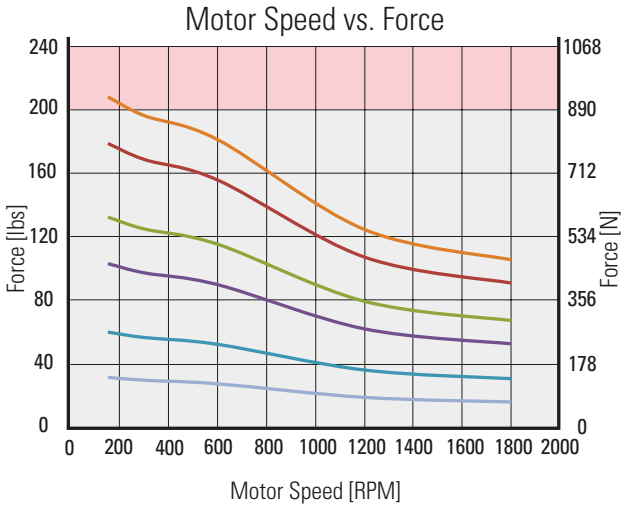
- 370063 (0063)
- 370167 (0167) / M10050 (0197)
- 370500 (0500) / M10100 (0394)
- 370100 (0100) / M10020 (0079) / M10030 (0118)
- 370250 (0250)
- 371000 (1000) / M10200 (0787)
- Load area not recommended

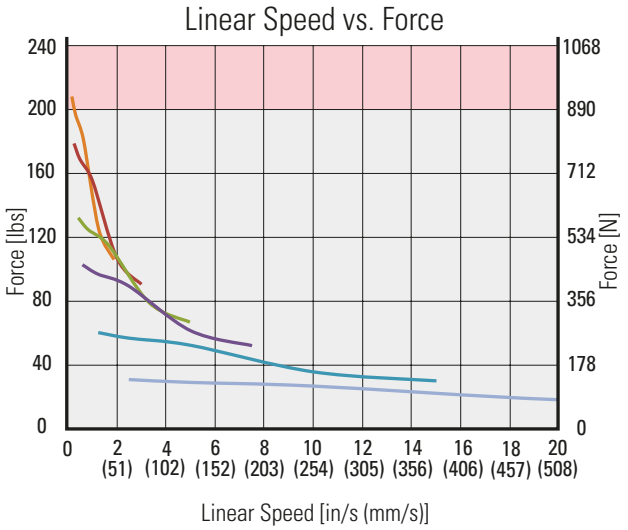
1. Codes within parentheses are for MLA configurations.

Please visit **www.thomsonlinear.com/smla** to access our stepper motor linear actuator selector and part number generator.

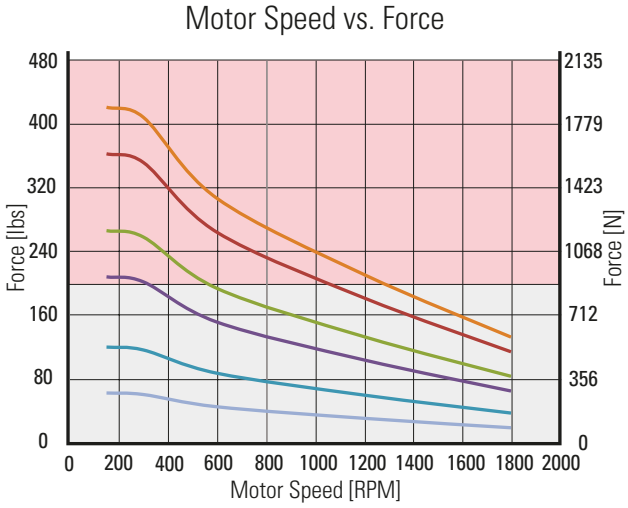
ML23 – Performance Diagrams

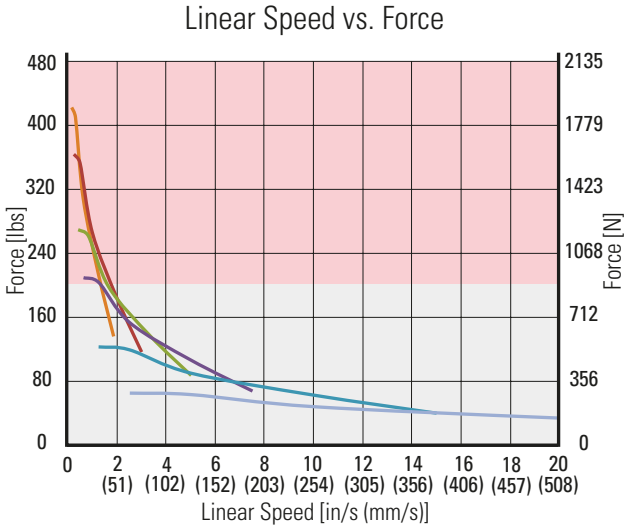
ML23A30





ML23B39





Note: All motor load curves were generated with a 40 VDC, 2-phase ON driver and full stepped at the motor rated current. Performance plots for other lead screw and motor winding configurations can be generated at thomsonlinear.com/smla.

Lead Screw Codes[1]

- 370063 (0063)
- 370167 (0167) / M10050 (0197)
- 370500 (0500) / M10100 (0394)
- 370100 (0100) / M10020 (0079) / M10030 (0118)
- 370250 (0250)
- 371000 (1000) / M10200 (0787)
- Load area not recommended

1. Codes within parentheses are for MLA configurations.

Please visit **www.thomsonlinear.com/smla** to access our stepper motor linear actuator selector and part number generator.

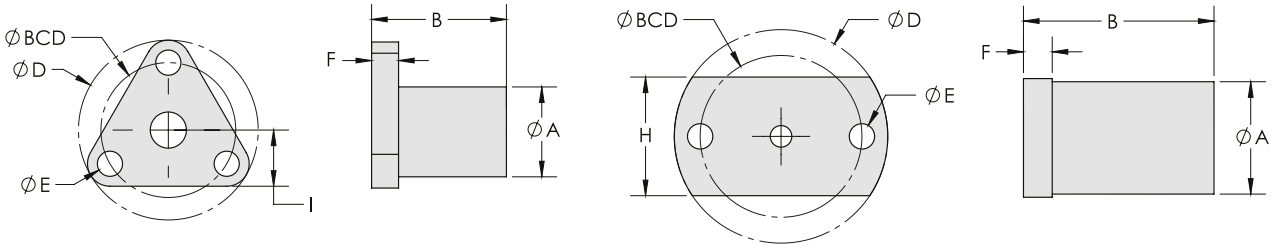
Nut Selection

	Lead Nut						
	Series	Image	Part Number	P/N Ref.[1]	Compatible Motor(s)	Catalog Design Load[2] (lbf)	
Stepper Motor Linear Actuator Standard Lead Nuts	RSF		RSF1800	RS1	08, 11	10	
			RSF2500	RS2	11, 14, 17	25	
			RSF3700	RS3	14, 17, 23	60	
	RSFH		RSFH1800	RH1	08, 11	20	
			RSFH2500	RH2	11, 14, 17	50	
			RSFH3700	RH3	14, 17, 23	120	
Stepper Motor Linear Actuator Alternative Lead Nuts	XC[3]		XCMF1800	XF1	08, 11	5	
			XCMT1800	XT1	08, 11	5	
			XCMF2500	XF1	11, 14, 17	5	
			XCMT2500	XT1	11, 14, 18	5	
			XCF3700SH	FS3	14, 17, 23	25	
			XCT3700SH	TS3	14, 17, 24	25	
			XCF3700	XF3	14, 17, 23	25	
			XCT3700	XT3	14, 17, 24	25	
			XCF5000	XF5	23	125	
			XCT5000	XT5	23	125	
			XCF2500	XF2	11, 14, 17	10	
			XCT2500	XT2	11, 14, 17	10	
	MTS		MTS1800	MT2	08, 11	10	
			MTS2500	MT2	14, 17	10	
			MTS3100	MT2	14, 17, 23	50	
			MTS3700	MT3	14, 17, 23	60	
			MTS4300	MT3	14, 17, 23	60	
			MTS5000	MT5	14, 17, 23	125	
	SN		SN1800	SN2	08, 11	30	
			SN2500	SN2	14, 17	45	
			SN3100	SN3	14, 17, 23	70	
			SN3700	SN3	14, 17, 23	70	
			SN5000	SN5	14, 17, 23	100	
	BN[4]		BN2500	BN2	14, 17	110	
			BN3700	BN3	14, 17, 23	300	
			BN5000	BN5	23	620	
	AFT		AFT2500	AF2	14, 17	5	
			AFT3700	AF3	14, 17, 23	10	
			AFT5000	AF5	23	25	
	SNAB[5]		SNAB1800	SB2	08, 11	10	
			SNAB2500	SB2	14, 17	25	
			SNAB3100	SB3	14, 17, 23	50	
			SNAB3700	SB3	14, 17, 23	70	
			SNAB5000	SB5	14, 17, 23	150	

1. Three-digit reference to be used within the full MLS part number.
2. Approximate max running load assuming 500 RPM and 50% duty cycle. For more detailed design limitations and sizing, contact Thomson.
3. Some high-lead configurations are not available for the XC nut.
4. Standard bronze material used on BN nut is not RoHS compliant.
5. Preload force is lower than stated design load. Exceeding preload force will cause spring to fully compress, and nut will lose anti-backlash properties. Preload force values: SNAB1800/SNAB2500 = 1-3 lbs, SNAB3100/3700 = 2-5 lbs, and SNAB5000 = 4-9 lbs.

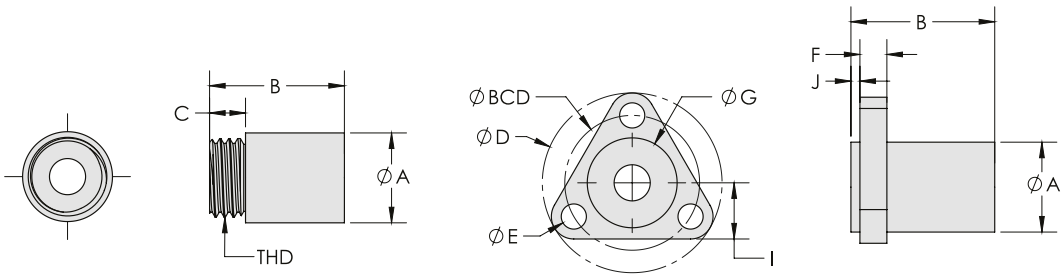
Lead Screw												
	0.188 in.	4 mm	0.25 in.	6 mm	0.313 in.	8 mm	0.375 in.	10 mm	0.43 in.	0.50 in.	12 mm	About
	x	x										Standard triangular flange bearing grade acetal nut used on stepper motor linear actuators.
			x	x								
					x	x	x	x				
	x	x										Higher performance bearing grade PEEK alternative to standard RSF nut used on stepper motor linear actuators. Capable of withstanding higher loads, speeds and temperature requirements.
			x	x								
					x	x	x	x				
	x	x										Standard triangular flange / thread mount XC nuts used for 0.188 in. (4 mm) lead screws.
	x	x										
			x	x								Standard triangular flange / thread mount XC nuts used for 0.25 in. (6 mm) lead screws.
			x	x								
					x	x	x	x				Standard triangular flange / thread mount XC nuts used for 0.313 in. (8 mm) and 0.375 in. (10 mm) lead screws with short nut body length.
					x	x	x	x				
					x	x	x	x				
					x	x	x	x				
									x	x	x	Standard triangular flange / thread mount XC nuts used for 0.5 in. (12 mm) lead screws.
									x	x	x	
			x	x								Flat flange (2-hole) and larger nut body alternative to XCM nut for 0.25 in. (6 mm) lead screws when a higher design load is required.
			x	x								
												Triangular and round flange alternative to RSF nut. Identical bearing grade material but with overall larger dimensions over RSF nut.
			x	x								
					x	x						
							x	x				
									x			
									x	x	x	
	x	x										Thread mount bearing grade acetal nut with standard backlash.
			x	x								
					x	x						
							x	x				
									x	x	x	
			x	x								Thread mount bronze nut with standard backlash. Grease required for proper operation.
							x					
									x	x	x	
			x	x								Triangular flange alternative anti-backlash nut.
							x	x				
									x	x	x	
	x	x										Thread mount alternative anti-backlash nut.
			x	x								
					x	x						
							x	x				
									x	x	x	

General Nut Dimensions



Lead Nut	Series	RSF/RSFH			XC							MTS			
	P/N	RSF1800 / RSFH1800 (RS1 / RH1)	RSF2500 / RSFH2500 (RS2 / RH2)	RSF3700 / RSFH3700 (RS3 / RH3)	XCMF1800 / XCMF2500 (XF1 / XF1)	XCF3700SH (FS3)	XCF5000 (XF5)	XCF2500 (XF2)	XCMT1800 / XCMT2500 (XT1 / XT1)	XCT3700SH (TS3)	XCT5000 (XT5)	XCT2500 (XT2)	MTS1800 / MTS2500 / MTS3100 (MT2 / MT2 / MT2)	MTS3700 / MTS4300 (MT3 / MT3)	MTS9000 (MT5)	
Dimensions [inch]	A	0.313	0.5	0.63	0.5	0.81	1.12	0.64	0.5	0.81	1.12	0.64	0.5	0.71	0.75	
	B[1]	0.375	0.75	1	0.9	1.34	2.25	1.18	0.9	1.34	2.25	1.18	0.75	1.5	1.5	
	C	-	-	-	-	-	-	-	0.2	0.25	0.375	0.187	-	-	-	
	D	0.75	1	1.25	1	1.53	1.75	1.19	-	-	-	-	1	1.5	1.5	
	E	0.13	0.14	0.14	0.14	0.197	0.2	0.141	-	-	-	-	0.14	0.2	0.2	
	F	0.13	0.15	0.19	0.18	0.2	0.3	0.16	-	-	-	-	0.15	0.2	0.25	
	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	H	-	-	-	-	-	-	0.66	-	-	-	-	-	-	-	
	I	0.25	0.31	0.41	0.31	0.48	-	-	-	-	-	-	-	0.469	-	
	BCD	0.5	0.75	0.875	0.75	1.125	1.406	0.9	-	-	-	-	0.75	1.125	1.125	
	TH[2]	-	-	-	-	-	-	-	7/16-20	5/8-18	15/16-16	9/16-18	-	-	-	

1. Dimension B shown is max length.
2. Metric mounting thread available. Contact Thomson for more information.

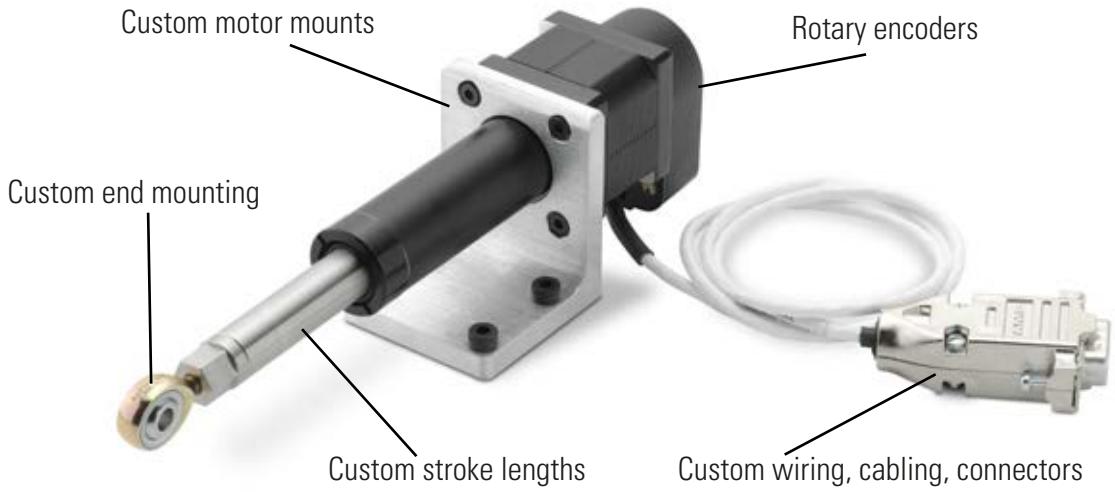


	Lead Nut	Series	SN			BN			AFT			SNAB		
		P/N	SN1800 / SN2500 (SN2 / SN2)	SN3100 / SN3700 (SN3 / SN3)	SN5000 (SN5)	BN2500 (BN2)	BN3700 (BN3)	BN5000 (BN5)	AFT2500 (AF2)	AFT3700 (AF3)	AFT500 (AF5)	SNAB1800 / SNAB2500 (SB2 / SB2)	SNAB3100 / SNAB3700 (SB3 / SB3)	SNAB500 (SB5)
	Dimensions [inch]	A	0.625	0.75	1	0.625	0.75	1	0.5	0.77	0.88	0.625	0.75	1
		B[1]	0.5	0.75	1	0.625	0.75	1	0.99	2	2.03	1.125	1.34	2
		C	0.187	0.25	0.375	0.187	0.25	0.375	-	-	-	1.25	0.25	0.375
		D	-	-	-	-	-	-	1	1.5	1.62	-	-	-
		E	-	-	-	-	-	-	0.14	0.2	0.2	-	-	-
		F	-	-	-	-	-	-	0.18	0.2	0.25	-	-	-
		G	-	-	-	-	-	-	-	0.71	-	-	-	-
		H	-	-	-	-	-	-	-	-	-	-	-	-
		I	-	-	-	-	-	-	0.313	0.469	0.5	-	-	-
		BCD	-	-	-	-	-	-	0.75	1.125	1.25	-	-	-
		TH[2]	9/16-18	5/8-18	15/16-16	9/16-18	5/8-18	15/16-16	-	-	-	9/16-18	5/8-18	15/16-16

Make it Yours By Customizing a Stepper Motor Linear Actuator

Thomson routinely collaborates with original equipment manufacturers globally to solve problems, boost efficiency and enhance the value passed on to their customers. Our technology and application experience can be harnessed to help you go beyond standard products to fit the exact needs on your next product.

Below you'll see an example of some common customizations for stepper motor linear actuator products. See next page for details on each option.



Let's Get Started

Call today and let's talk about how our vast offering of standard, modified standard and custom solutions can deliver the optimal balance of performance, life and installed cost for you. Global contact information is available at www.thomsonlinear.com/cs.

Custom lead screw end machining and MLA end mounting

Thomson standard end machining and end mounting offerings serve a wide variety of needs and applications. We can also accommodate special requests, including:

- Male or female threaded ends to your specified thread and pitch
- Custom-machined journals and ring groove
- Hex or square ends
- Keyways and cross holes
- Most custom end-machining and end-mounting options can be accommodated. Contact Thomson with a drawing to get started.

Custom lead nuts

For MLS configurations, Thomson can create a custom lead nut to your specifications. Simply contact us with a drawing, and we will work to meet your needs.

Custom motor mounts

A custom mount can provide increased design flexibility with regards to motor mounting in your assembly. Contact us if you'd like a special flange solution, and we'll work to create a mount to your exact dimensional requirements.

Rotary encoders

Applications often require extra information in the form of encoder feedback. Thomson has experience integrating encoders into our stepper motor linear actuator assemblies, and our selection delivers real-time information about position, speed and direction. Encoders can be seamlessly pre-assembled onto the backs of motors on Thomson ML products.

Custom wiring, cabling and connectors

To optimize integration of our motors in your assembly, Thomson offers custom connection methods, including:

- Flying wire leads or custom connectors
- Twisting wire leads to your specification
- Heat shrink or expandable tubing
- Custom cable housings
- Contact Thomson with your custom wiring requirements

Custom lead screw and MLA stroke lengths

Depending on the configuration, Thomson can provide a wide variety of lead screw and stroke lengths. For recommend maximums, see individual motor sections. For anything outside of these ranges, contact Thomson.

Screw coating

On MLS and MLN configurations requiring dry and maintenance-free lubrication, Thomson can offer PTFE coating.

Ball screw assemblies

If your application requires a higher load or duty cycle, improved efficiency, or a more predictable life, Thomson can provide a motorized ball screw assembly for MLS configurations.

Less common applications (MLA)

Consult Thomson engineering for assistance in any applications with the following characteristics:

- Motor speeds >500 rpm
- Side loads >10% and/or side loads at fully extended position for MLA configurations
- Vertically oriented configurations with a high load and lead
- Zero tolerance of grease leaking out of front seal n MLA configurations

Specifications – Encoders

Pictured: MLx23 motor (single stack type) with an E3 encoder

Features and Benefits

- All MLS and MLA configurations are available with rear-mounted optical encoders (except for size 8)
- Two channel quadrature square wave outputs with optional third channel index output
- Various cycles per revolution (CPR) or pulses per revolution (PPR) available – from 32 to 10,000 CPR or 128 to 40,000 PPR

Encoders

Motor Size	E2	E3	E5	E6
MLx11	•	•	•	•
MLx14	•	•	•	•
MLx17	•	•	•	•
MLx23		•		•

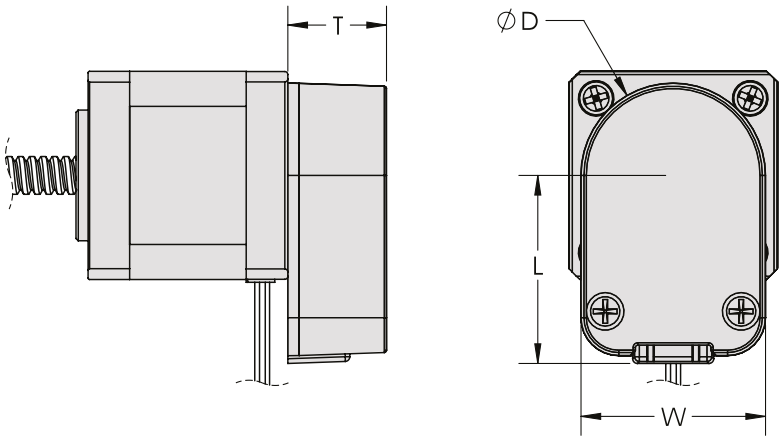
Available Configurations

Motors	Encoder	CPR	Index	Output
MLx11, MLx14, MLx17	E2	32, 50, 96, 100, 192, 200, 250, 256, 360, 400, 500, 512, 540, 720, 900, 1000, 1024, 1250, 2000[1], 2048[1], 2500[1], 4000[1], 4096[1], 5000[1]	Index or No Index	N/A
MLx11, MLx14, MLx17, MLx23	E3	64, 100, 200, 400, 500, 512, 1000, 1024, 1800, 2000, 2048, 2500, 3600[1], 4000[1], 4096[1], 5000[1], 7200[1], 8000[1], 8192[1]		
MLx11, MLx14, MLx17	E5	32, 50, 96, 100, 192, 200, 250, 256, 360, 400, 500, 512, 540, 720, 900, 1000, 1024, 1250, 2000[1], 2048[1], 2500[1], 4000[1], 4096[1], 5000[1]		Single-Ended or Differential
MLx11, MLx14, MLx17, MLx23	E6	64, 100, 200, 400, 500, 512, 1000, 1024, 1800, 2000, 2048, 2500, 3600[1], 4000[1], 4096[1], 5000[1], 7200[1], 8000[1], 8192[1], 10000[1]		

1. CPR available with Index only

Note: Please specify encoder model, CPR, Index and Output (if applicable)

Dimensions – Encoders



Encoder Specifications

Encoder	Dimensions (inch)				Input/Output (VDC)			Operating Temperature (°C)		Acceleration (rad/sec²)	Mating Connector[2]
	T[1]	L	D	W	Min	Typ	Max	Min	Max	Max	US Digital
E2	0.62	0.82	1.19	1.19	4.5	5.0	5.5	-40	100	250,000	CON-C5 CON-LC5
E3		0.57	2.20	1.62							
E5	0.65	1.24	1.22	1.22				-40 (CPR<2000) -25 (CPR≥2000)			CON-FC5 (5 PIN) CON-FC10 (10 PIN)
E6		1.42	2.22	1.39				-40 (CPR<3600) -25 (CPR≥3600)			

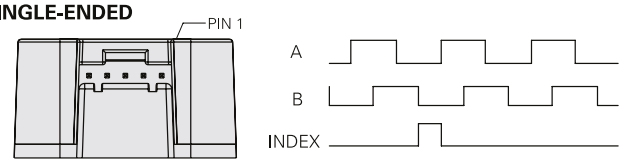
1. MLx17 motor requires mounting plate, which increases dimension T by approximately 0.15 in.
2. All single-ended encoders are 5 pin connections. All differential encoders are 10 pin connections.

Pinouts

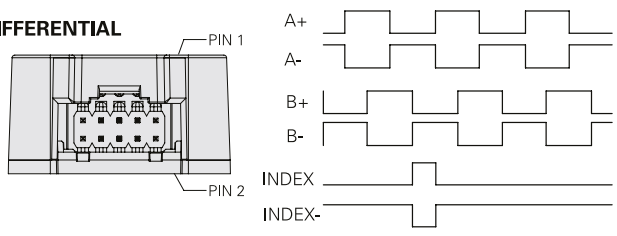
Pin	Single-Ended	Differential[3]
1	Ground	Ground
2	Index	
3	A Channel	Index-
4	+5 VDC Power	Index+
5	B Channel	A- Channel
6	-	A+ Channel
7	-	+5 VDC Power
8	-	
9	-	B- Channel
10	-	B+ Channel

3. E5 and E6 only

SINGLE-ENDED



DIFFERENTIAL



Product Selection Overview

The successful integration of a stepper motor linear actuator in an application is primarily dependent on the screw alignment and subsequent screw runout. If incorrectly mounted, a lead screw assembly will have significantly reduced system life and may be noisy or inaccurate. Thomson methodically straightens all screws prior to assembly to minimize vibration and runout. The Taper-Lock coupling method also was designed to provide a concentric interface and optimize alignment. Proper alignment, end support configuration and lead nut selection are important factors to achieve a well designed installation that will exceed expectations.

1. Select Stepper Motor Linear Actuator Configuration

Determine which of the configurations – rotating screw (MLS), rotating nut (MLN) or actuator (MLA) – the application requires. See pages 6-7 for application examples.

2. Select Motor Size

Select the appropriate size based on desired performance, motor frame size, etc. Thomson offers five base models (MLx08, MLx11, MLx14, MLx17 and MLx23) in various motor windings, linear travels and load capacities.

3. Select Lead Screw Configuration and End Machining or End Mounting

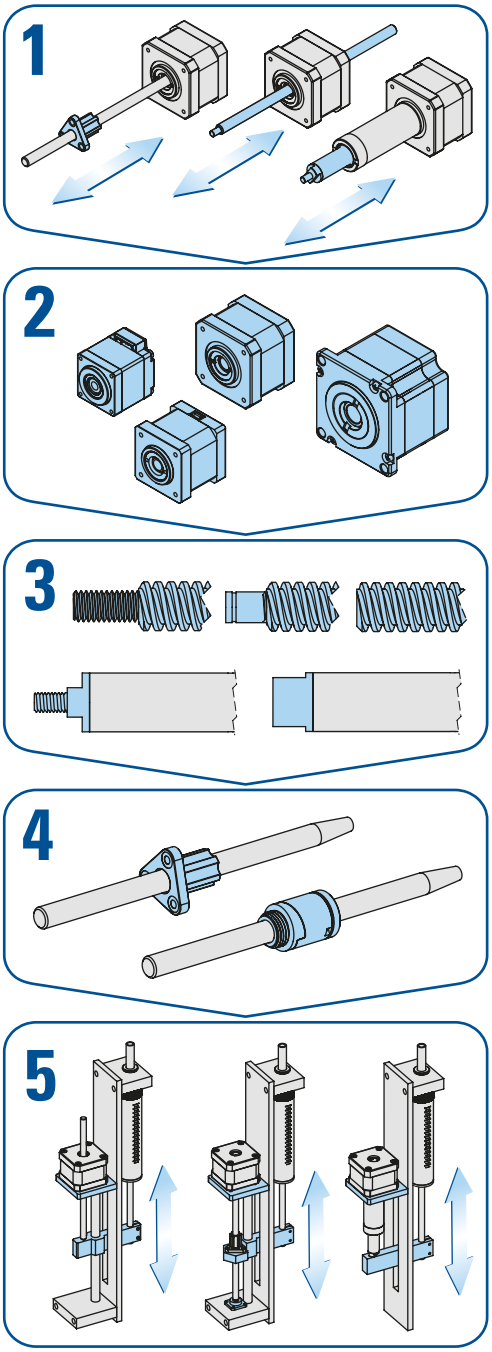
For MLS or MLN, select the lead screw diameter and length with regard to the required stroke of the application and the type of end machining the screw requires. For MLA, select desired lead or travel per step, stroke length and end mounting.

4. Select Nut

For rotating screw (MLS) configurations, choose between various nut mounting styles, materials, and backlash options. Rotating nut (MLN) configurations as default always come in a high performance material, standard backlash nut. As a default, all MLA configurations come with a standard backlash and performance material nut.

5. Mount the Stepper Motor Linear Actuator

Mount the unit into your assembly. For MLA, use the end mounting installation guidelines shown on page 45.

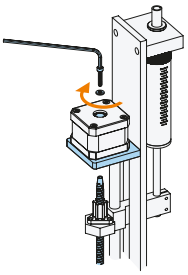


Comissioning, Service and Maintenance Advantages

Quick and easy comissioning, service and maintenance are some key points to a successfull installation. The stepper motor linear actuator will enable just that while keeping spare parts stock and tools required to a minimum.

Rotating Screw (MLS) Lead Screw Swapping

The unique Taper-Lock coupling allows for quick and easy assembly and disassembly. This means that one can easily try out different lead screw motor combinations in an application. This capability to swap out lead screws and motors enables the end user to rapidly prototype, validate designs, replace damaged parts or simply upgrade to higher performance components – all with a simple hex wrench.

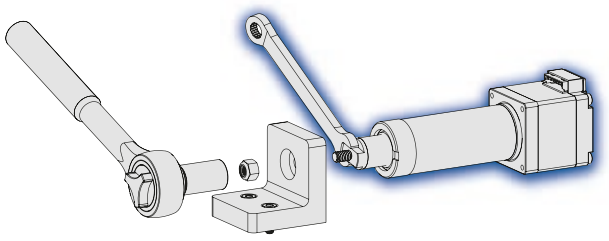


Taper-Lock Retaining Fastener Specifications

Motor code	Lead scew code	Fastener screw size	Recommended fastener screw length [mm]	Recommended fastener screw torque [lbs.-in. (Nm)]
MLx08A	18xxxx	M2.5x0.45	25	11 (1.2)
	M04xxxx	M2x0.4		7 (0.8)
MLx11AS	18xxxx	M2.5×0.45	18	11 (1.2)
	M04xxx			
MLx14AS	25xxxx	M3×0.5	22	20 (2.3)
	M06xxx			
MLx17AS	25xxxx	M3×0.5	14	20 (2.3)
	M06xxx			
MLx17BS	25xxxx	M3×0.5	22	20 (2.3)
	M06xxx			
MLx23AS	31xxxx	M4×0.7	18	45 (5.1)
	M08xxx			
MLx23BS	31xxxx	M4×0.7	35	45 (5.1)
	M08xxx			
MLx23AS	37xxxx	M5×0.8	25	90 (10.2)
	M10xxx			
MLx23BS	37xxxx	M5×0.8	45	90 (10.2)
	M10xxx			

MLA End Mounting Installation

When installing your load to the end mount of an MLA assembly, always use the dedicated flats shown below to prevent over-torquing and damaging the actuator's internal components.

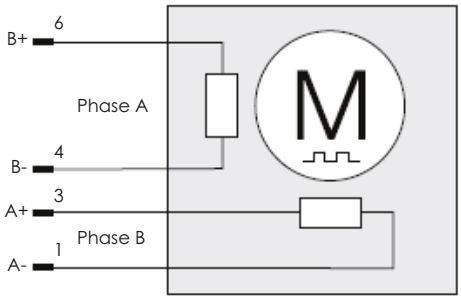


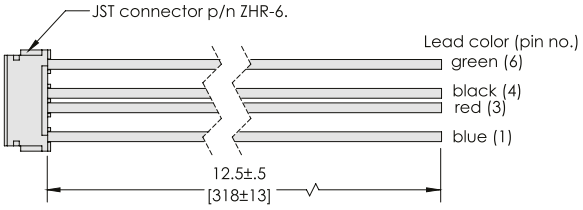
Wiring and Connectors

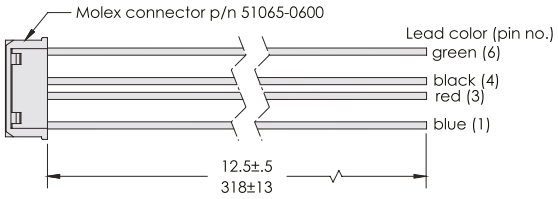
Thomson offers standard wiring and connector pin-outs (shown below). However, if you have unique application requirements such as a specific mating connector you'd like to easily plug into, we also offer custom wiring and connectors to match your needs. Just contact us with your request, and we'll find a solution.

MLx08, MLx11

Molex Connector	
Pin	Phase
1	A-
2	not used
3	A+
4	B-
5	not used
6	B+





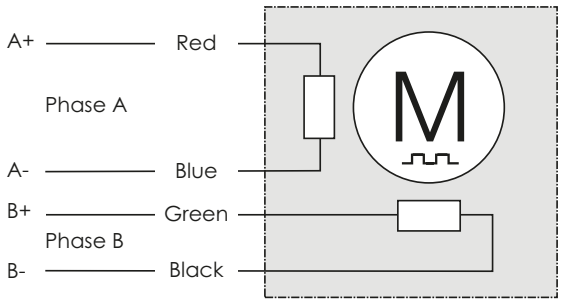


- Standard mating wire harness for MLx08 configurations
- 26 AWG lead wires

- Standard mating wire harness for MLx11 configurations
- 26 AWG lead wires

MLx14, MLx17 and MLx23

Flying Leads	
Lead Color	Phase
Red	A+
Blue	A-
Green	B+
Black	B-



- Standard wiring diagram for MLx14, MLx17 and MLx23 configurations
- 26 AWG lead wires for MLx14 and MLx17
- 22 AWG lead wires for MLx23

Glossary

Accuracy	A measurement of precision. Perfect accuracy, for example, means advancing a lead nut linearly one inch from any point on a screw will always require the exact same number of revolutions.
Axial Load	A load passing through the center axis of the lead screw.
Backdrive	Application of a force on a lead nut to cause rotation of the screw; in essence, converting linear to rotary motion.
Backlash	The axial or radial free motion between the lead nut and lead screw; a measure of system stiffness and repeatability.
Bipolar Motor	Motor with two phases and a single winding per phase (4 lead wires). All Thomson standard stepper motors are bipolar.
Chopper Drive	A constant current stepper motor drive that operates by quickly cycling power on and off, or "chopping."
Column Load	Column loading is the compression load on the screw. This load has a tendency to buckle the screw and is dependent on screw diameter, screw length and type of mounting.
Concentricity	Condition where the median points of two or more radially-disposed features are congruent with the axis (or center point).
Critical Speed	The condition where the rotary speed of the assembly sets up harmonic vibrations. These vibrations are the result of shaft diameter, unsupported length, type of bearing support, lead nut mounting method and/or screw rpm. Vibrations may also be caused by a bent screw or faulty installation alignment.
Drag Torque	The amount of torque required to drive the unloaded lead screw.
Driving Torque	The amount of effort required to turn the lead screw and move the load.
Dynamic Load	Load applied to stepper motor linear actuator assembly while in motion.
Efficiency (Lead Screw)	Expressed as a percentage, the ability of a lead screw assembly to convert torque to thrust with minimal mechanical loss. Thomson lead screws range in efficiency from 35 to 85%.
Efficiency (Motor)	Expressed as a percentage, the motor's ability to turn electrical energy into mechanical energy with minimal thermal loss. Thomson stepper motors range in efficiency from 65 to 90%.
End Fixity or End Bearing Support	How the ends of the lead screw are fixed or supported.
Holding Torque	Torque required to rotate motor shaft while all coils are fully energized with a steady state DC current.
Inertia	The level of rotational resistance of a lead screw or shaft.
Lead	The axial distance a screw travels during one revolution. If thread is 1 start, lead = pitch.
Microstepping	Dividing the motors natural full step by smaller increments. Example: 1.8 º step motor microstepped at 64× will mean that 1 pulse is now 1.8 º/64 = 0.028 º.
Perpendicularity	Condition of a surface, center plane, or axis at a right angle to a plane or axis.
Pitch	Distance measured between adjacent threads of the lead screw - if thread is 1 start, then pitch = lead.
Pulse Rate	The number of pulses per second (pps) applied to the windings of the motor. 1 pulse = 1 step.
Repeatability	A measure of constancy that is directly related to axial backlash. Higher backlash equates to lower repeatability and may be corrected by preloading the lead nut if required.
Resolution	The linear distance the stepper motor linear actuator will actuate the lead nut or screw per input pulse.
Resonance	Vibration occurring when a mechanical system operates within an unstable range.
Runout	Composite tolerance used to control the functional relationship of one or more features of a part to an axis.
Side Load (Radial)	A load applied perpendicular to the lead screw axis. Not recommended for lead screw applications as it will reduce functional life.
Static Load	Static load is the maximum non-operating load capacity above which failure of the motor and/or lead nut occurs.
Straightness	Condition where an element of a surface, or an axis, is in a straight line.
Stroke	The maximum length of extension of a lead nut on the lead screw.
Thrust Force or Thrust Load	Thrust load is loading parallel to and concentric with the centerline of the screw which acts continuously in one direction. Thrust loading is the proper method of attaching the load to the lead screw assembly.
Travel/Step or Travel Rate	The linear translation of a lead nut or screw for one full step of the motor.

EUROPE

United Kingdom
Thomson
Office 9, The Barns
Caddsdown Business Park
Bideford, Devon, EX39 3BT
Phone: +44 (0) 1271 334 500
E-mail: sales.uk@thomsonlinear.com

Germany
Thomson
Nürtinger Straße 70
72649 Wolfschlugen
Phone: +49 (0) 7022 504 403
Fax: +49 (0) 7022 504 405
E-mail: sales.germany@thomsonlinear.com

France
Thomson
Phone: +33 (0) 243 50 03 30
Fax: +33 (0) 243 50 03 39
E-mail: sales.france@thomsonlinear.com

Italy
Thomson
Via per Cinisello 95/97
20834 Nova Milanese (MB)
Phone: +39 0362 366406
Fax: +39 0362 276790
E-mail: sales.italy@thomsonlinear.com

Spain
Thomson
E-mail: sales.esm@thomsonlinear.com

Sweden
Thomson
Estridsväg 10
29109 Kristianstad
Phone: +46 (0) 44 24 67 00
Fax: +46 (0) 44 24 40 85
E-mail: sales.scandinavia@thomsonlinear.com

SOUTH AMERICA

Brasil
Thomson
Av. Tamboré, 1077
Barueri, SP – 06460-000
Phone: +55 (11) 3616-0191
Fax: +55 (11) 3611-1982
E-mail: sales.brasil@thomsonlinear.com

USA, CANADA and MEXICO

Thomson
203A West Rock Road
Radford, VA 24141, USA
Phone: 1-540-633-3549
Fax: 1-540-633-0294
E-mail: thomson@thomsonlinear.com
Literature: literature.thomsonlinear.com

ASIA

Asia Pacific
Thomson
E-mail: sales.apac@thomsonlinear.com

China
Thomson
Rm 2205, Scitech Tower
22 Jianguomen Wai Street
Beijing 100004
Phone: +86 400 6661 802
Fax: +86 10 6515 0263
E-mail: sales.china@thomsonlinear.com

India
Thomson
c/o Fortive India Pvt. Ltd.
Unit No. FF A 07
Art Guild House, A Wing, 1st Floor, L.B.S Marg
Kurla – West, Mumbai – 400070 India
Phone: +91 22 6249 5043
E-mail: sales.india@thomsonlinear.com

Japan
Thomson
Minami-Kaneden 2-12-23, Suita
Osaka 564-0044 Japan
Phone: +81-6-6386-8001
Fax: +81-6-6386-5022
E-mail: csjapan@scgap.com

Korea
Thomson ROA
704 ASEM Tower (Samsung-dong),
517 Yeongdong-daero,
Gangnam-gu, Seoul, S. Korea (06164)
Phone: +82 2 6917 5047 / 5048
Fax: +82 2 528 1456 / 1457
E-mail: sales.korea@thomsonlinear.com

www.thomsonlinear.com

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