Motorised Lead Screws

Stepper Motor Linear Actuator

www.thomsonlinear.com

THOMSON®

Linear Motion. ***Optimized.***™

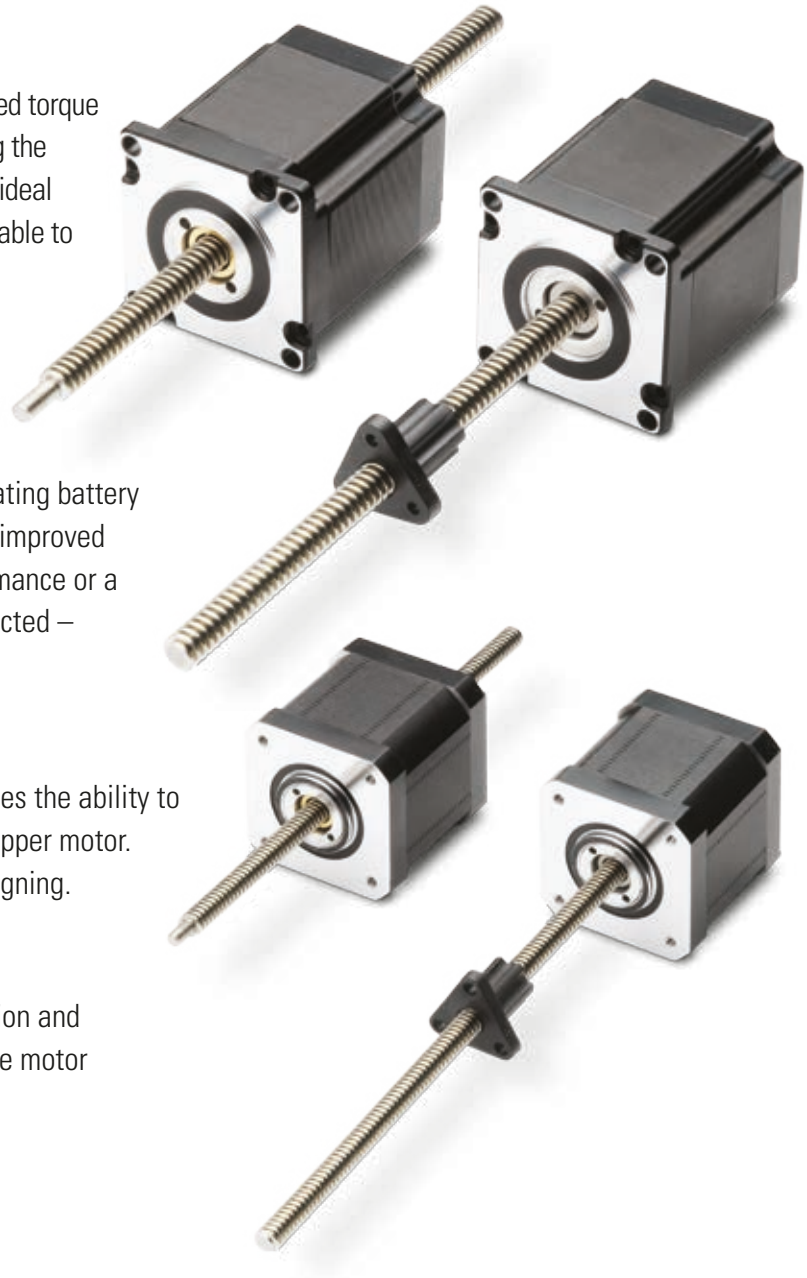
Motorised Lead Screws

Precision engineered to be compact, powerful, quiet and efficient

New Motorised Lead Screws from Thomson combine a hybrid stepper motor and a precision lead screw together in one compact envelope. Patent-pending Taper-Lock technology allows quick decoupling and secure, properly aligned connections. This combination offers several advantages over a traditional solution.

Increased Torque Density

Thomson Motorised 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.



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.

The Taper-Lock Advantage

The patent-pending 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

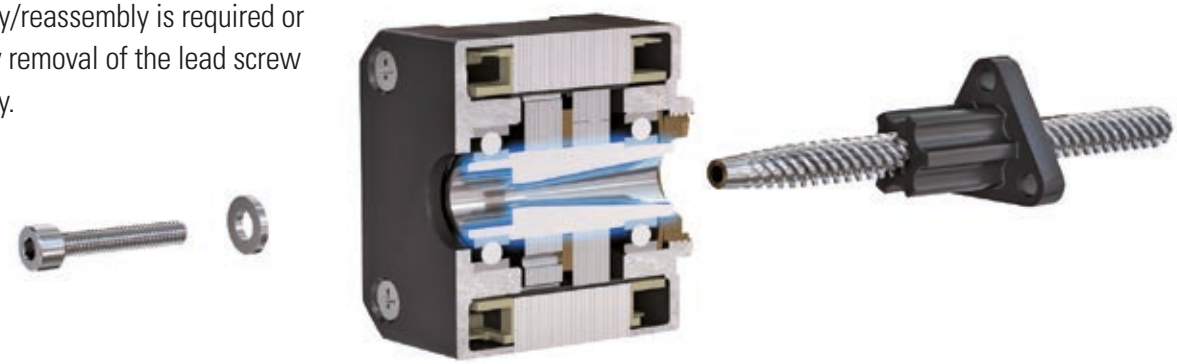
Thomson can optimize your motor configuration and windings to limit motor harmonics and reduce motor noise at your application operating points.

Technology Overview

Thomson Motorised Lead Screws come in two basic configurations – rotating screw (S) and rotating nut (N). 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.

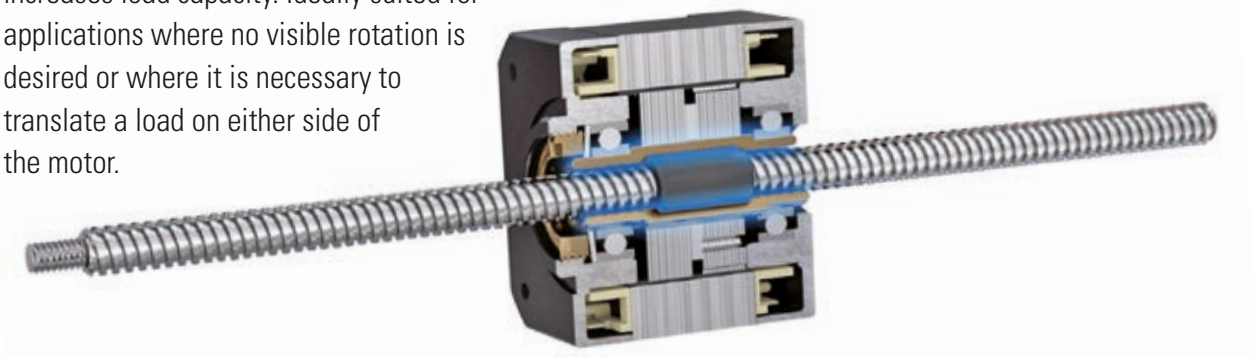
Rotating Screw Configuration (S)

The rotating screw design features our patent-pending Taper-Lock design to connect the lead screw to the motor shaft. This design allows for rapid prototyping, field serviceability and reduced inventory. Ideally suited for applications where high levels of maintenance are anticipated, frequent disassembly/reassembly is required or where easy removal of the lead screw is necessary.



Rotating Nut Configuration (N)

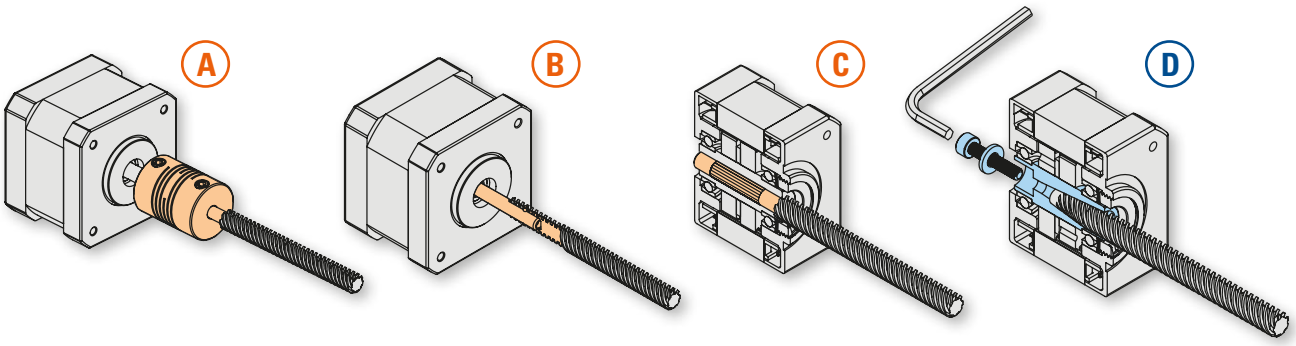
The rotating nut design features our patent-pending integration of a lead nut into the motor rotor to maximize screw diameter which increases load capacity. Ideally suited for applications where no visible rotation is desired or where it is necessary to translate a load on either side of the motor.



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 patent-pending 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

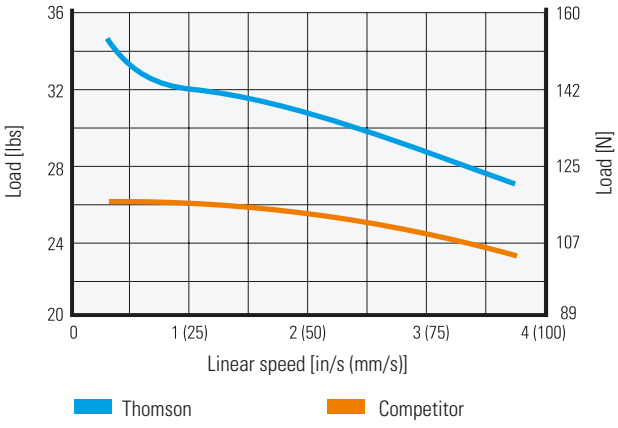
Hollow shaft press fit
- requires machining
- difficult to assemble
- run-out and alignment issues
- difficult to replace quickly

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.

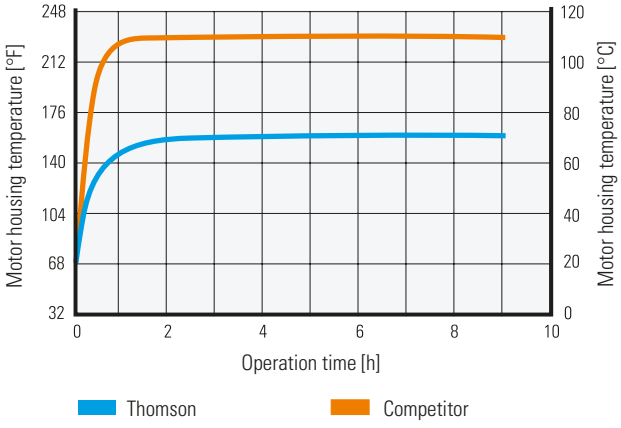
Load vs. Speed



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

Where to Use Motorised Lead Screws

Lead screws convert rotary motion into linear motion. Stepper motors and lead screws are complementary products. They operate within the same design specifications for speed, load and life. A typical method to marry these products into an application is by using external bearing supports and a drive coupling. Although this is acceptable, it is not the most economical approach, requires more components and a larger footprint. The ideal solution is to directly couple the screw and motor, eliminating the external supports and coupling.

Rotating Screw Applications

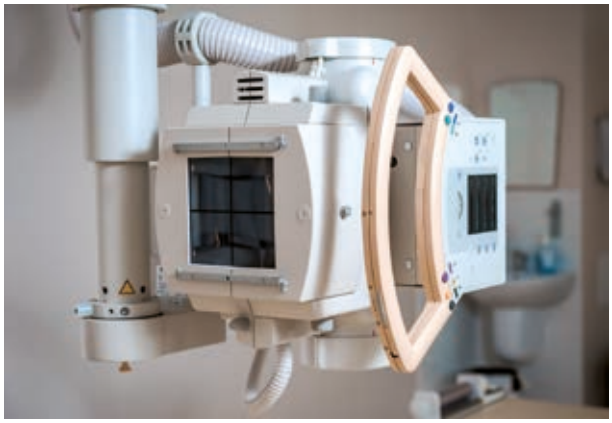
A rotating screw Motorised Lead Screw is ideal for applications that require precise linear motion and have dedicated external supports such as linear bearings or profile rails. Examples are:

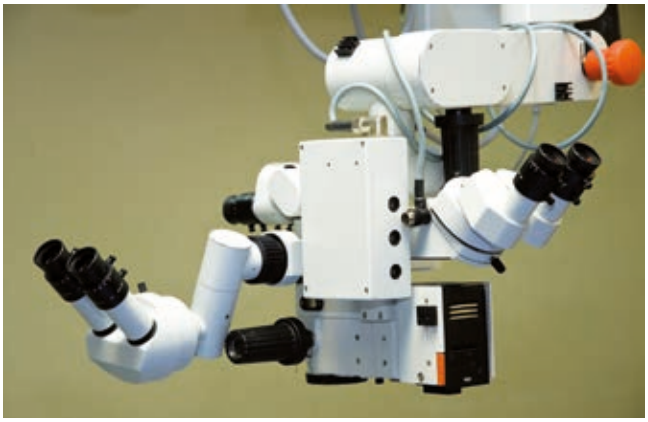
- Medical devices
- X-Y stages
- 3D printers

Rotating Nut Applications

A rotating nut Motorised Lead Screw is ideal for applications that require precise linear motion and also have integrated anti-rotation. Examples includes:

- Fluid/syringe pumps
- HVAC control valves
- Pipetting devices
- CNCs



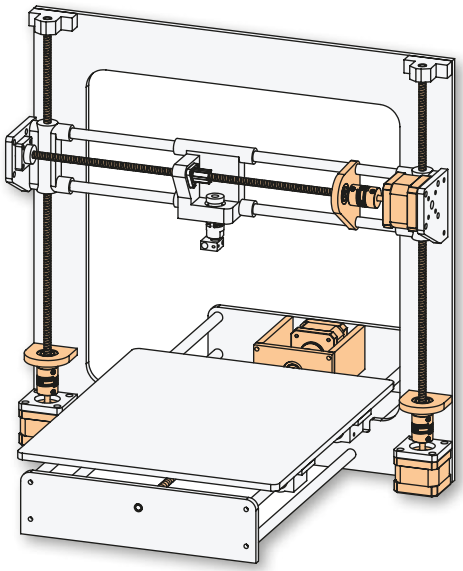


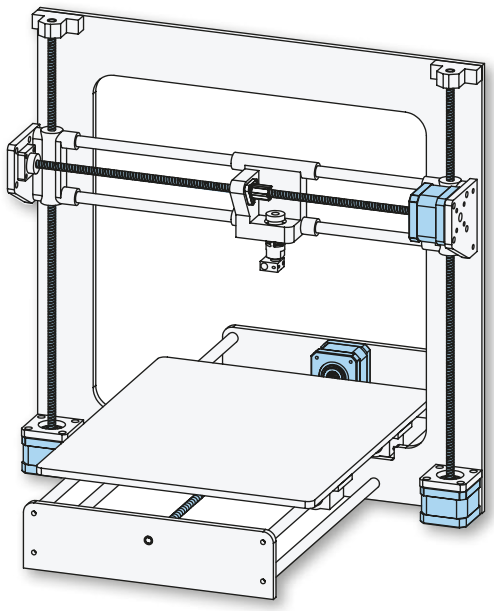
Application Examples

These common applications show that the Motorised Lead Screw will not only reduce the total number of components but also will reduce the overall footprint and make assembly and maintenance quicker and easier.

3D Printing

Innovative multi-axis printers are revolutionizing rapid prototyping and consumer products. A printer equipped with the Motorised Lead Screw can achieve key design advantages as outlined in the table below. Elimination of supports and couplings improves the print volume while reducing the component count and system cost.





Generic design

Thomson Motorised Lead Screw design!

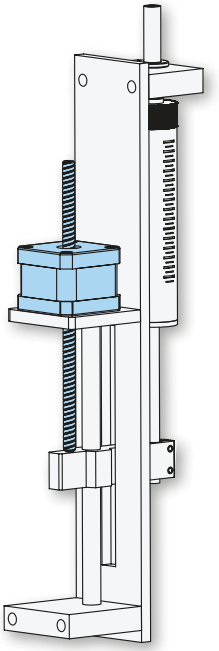
Generic vs. Thomson		
	Generic	Thomson
Z-Axis Stroke [in (mm)]	9.6 (244)	11.4 (289)
XY-Stroke [in (mm)]	8.7 × 14.2 (220 × 360)	10.6 × 16.8 (270 × 427)
Number of Unique Linear Motion Components	28	16
Interchangeable Lead Screws	Yes	Yes
Self-Aligning Assembly	No	Yes
External Support Bearing Required	Yes	No

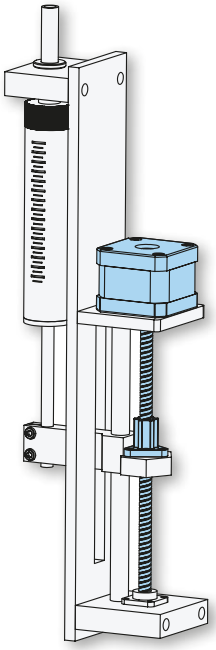
Application Examples

Fluid Pump

Syringe pumps represent a significant segment of the medical industry and the design requirements depend upon high torque density and efficiency. Regardless of the mounting configuration, a Motorised Lead Screw can increase pump pressure, reduce equipment footprint, and more accurately disperse fluid.

Rotating Nut
(configuration N)



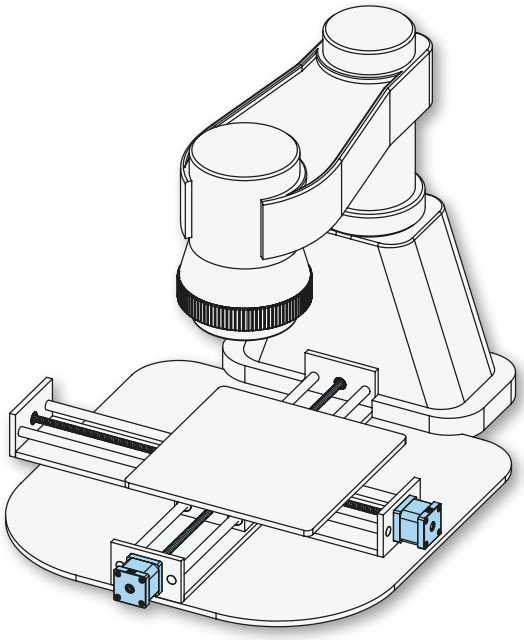


Rotating Screw
(configuration S)

Other Applications

The Motorised Lead Screw provides higher performance in a smaller and less complicated package. Designed for simple transport or critical applications, a Motorised Lead Screw solution eliminates redundant components, increases stroke length, provides greater axial force, and reduces power consumption. Other applications include:

- X-Y stages
- HVAC control valves
- CNCs
- Pipetting
- Robotics
- Packaging
- Scanning
- Lens focusing
- Plumbing
- Laser cutting



Medical Scanner

When it comes to planar motion, a Motorised Lead Screw can outperform the competition by delivering more thrust, more stroke, and lead screw interchangeability – making it the easiest to maintain Motorised Lead Screw on the market.

Lead Screw Sizes

Inch Lead Screws

Linear travel / full step [in]	Lead [in]	Type and screw diameter [in]				
		ML11	ML14	ML17	ML23	
		0.188	0.250	0.250	0.313	0.375
0.00015625	0.0313		•	•		
0.00025000	0.0500	•				
0.00031250	0.0625		•	•		•
0.00041670	0.0833				•	
0.00050000	0.1000	•				•
0.00062500	0.1250		•	•		
0.00083300	0.1666				•	•
0.00100000	0.2000	•				
0.00125000	0.2500		•	•	•	•
0.00200000	0.4000	•				
0.00250000	0.5000		•	•	•	•
0.00375000	0.7500		•	•		
0.00500000	1.0000				•	•

Metric Lead Screws

Linear travel / full step [mm]	Lead [mm]	Type and screw diameter [mm]				
		ML11	ML14	ML17	ML23	
		4	6	6	8	10
0.005	1.00	•	•	•		
0.010	2.00				•	•
0.015	3.00					•
0.020	4.00	•			•	
0.025	5.00					•
0.030	6.00		•	•		
0.040	8.00	•			•	
0.050	10.00					•
0.060	12.00		•	•	•	
0.100	20.00				•	•

Note: Other sizes and leads available – please contact Thomson for more information about custom lead screw availability.

Specifications

Basic Specifications

Lead Screw

Material		303 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]	[%]	35 to 85			
Typical Linear Travel Life	[in (km)]	10×10^6 (250)			

Motor

Frame Size		NEMA 11	NEMA 14	NEMA 17	NEMA 23
Step Size	[°]	1.8	1.8	1.8	1.8
Max. Axial Load [3]	[lbs (N)]	20 (89)	50 (222)	75 (334)	200 (890)
Max. Radial Play	[in @ lbs (mm @ N)]	0.001 @ 1 (0.03 @ 4)			
End Play	[in @ lbs (mm @ N)]	0.002 @ 2 (0.05 @ 9)			
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)			
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			

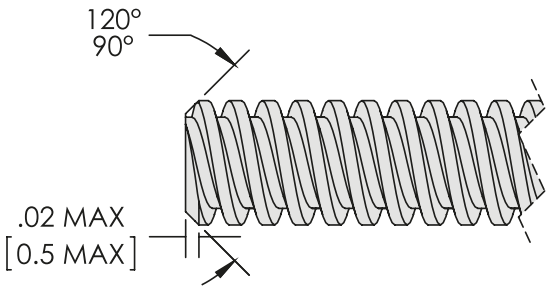
Assembly

Max. Backlash with Standard Nut	[in (mm)]	0.010 (0.25)
Max. Backlash with XC Anti-Backlash Nut	[in (mm)]	0 (0)
Runout	[in/ft (µm/300 mm)]	0.007 (175)
Operating Temperature	[°F (°C)]	15 to 125 (- 10 to 50)

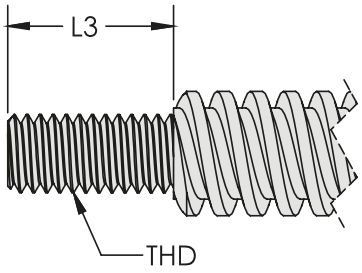
(1) Contact Thomson for optional lead screw coatings.
(2) Depending on lead.
(3) Max. axial load based on a L10 life of 10000 hours of continuous motion at speeds of 100 to 300 RPM.

Lead Screw End Machining

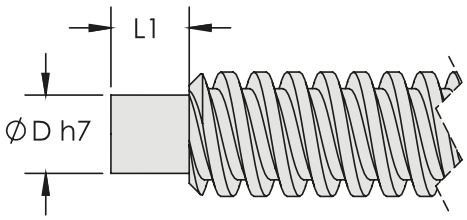
Standard For Rotating Screw (S) Configurations



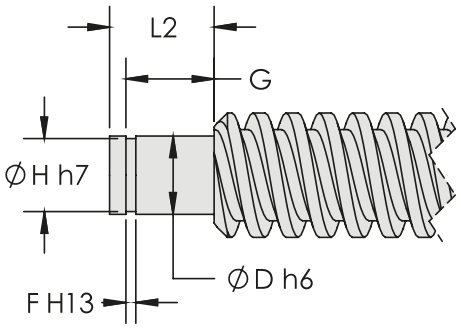
Standard For Rotating Nut (N) Configurations



Non Standard End Machining Alternative*



Non Standard End Machining Alternative*



* These are just some examples of non standard end-machining alternatives that are available. Please contact Thomson for more information.

Inch Lead Screw End Machining Dimensions

Screw Diameter [in]	Screw Lead [in]	Recommended Bearing				Dimensions [in]							
		OD [mm]	ID [mm]	W [mm]	Bearing Trade No.	ØD	L1	L2	F	G	ØH	L3	THD
0.188	all	7	2.5	2.5	692X	0.098	0.098	0.157	0.022	0.120	0.075	0.250	#4-40
0.250	all	13	4	5	624	0.157	0.197	0.256	0.020	0.217	0.150	0.250	#8-32
0.313	all	16	5	5	625	0.197	0.197	0.276	0.028	0.224	0.189	0.375	#10-24
0.375	all	19	6	6	626	0.236	0.236	0.315	0.030	0.266	0.220	0.500	1/4-20

Metric Lead Screw End Machining Dimensions

Screw Diameter [mm]	Screw Lead [mm]	Recommended Bearing				Dimensions [mm]							
		OD [mm]	ID [mm]	W [mm]	Bearing Trade No.	ØD	L1	L2	F	G	ØH	L3	THD
4	all	7	2.5	2.5	692X	2.50	2.50	4.00	0.56	3.05	1.91	6.35	M3X0.5
6	all	13	4	5	624	4.00	5.00	6.50	0.51	5.51	3.81	6.35	M4X0.7
8	all	16	5	5	625	5.00	5.00	7.00	0.70	5.70	4.80	9.53	M5X0.8
10	all	19	6	6	626	6.00	6.00	8.00	0.76	6.76	5.59	12.70	M6X1.0

Ordering Key

Ordering Key

1	2	3	4	5	6	7	8
ML	**23A155**	**S**	**M08-02**	**-23000**	**S**	**FSS**	**-001**

1. Product type
ML = motorised lead screw

2. Motor code [1]
xxxyyy = see Motor Options tables

3. Configuration
N = rotating nut
S = rotating screw

4. Lead screw code [2]
xyy-zzzz = see Lead Screw Options tables

5. Lead screw length (Ls)
-xxxxx = xx.xxx inch (for inch lead screw units only)
-xxxxx = xxx.xx mm (for metric lead screw units only)

6. Lead screw accuracy
S = standard
P = precision

7. Nut configuration code [3]
XXX = rotating nut configuration default
FSS = rotating screw configuration with standard flanged nut
FSH = rotating screw configuration with standard flanged nut in high performance material
FAS = rotating screw configuration with standard flanged anti-backlash nut
TAS = rotating screw configuration with standard threaded anti-backlash nut

8. Custom design code (issued by Thomson)
-001 = default (standard design)

(1) The exact motor codes are found in the Motor Options tables on the product pages.
The code consist of two parts (xxxyyy) where "xxx" describes frame size and stack number, and "yyy" the current draw of the motor.

(2) The exact lead screw codes are found in the Lead Screw Options tables on the product pages. The code consist of three parts (xyy-zzzz) where "x" describes if the lead screw is inch (no letter) or metric (letter M), "yy" the diameter and "zzzz" the lead of the screw.

(3) Rotating nut configurations must always have code "XXX" in this position while rotating screw configurations must have one of the other codes. For custom threaded nut dimensions contact Thomson.

Example 1:

ML11A051 S 18-0100-04000S FSS-001

ML11A051 S: NEMA 11 motor, single stack, 0.51 A, rotating screw.
18-0100-04000S: Lead screw with a 0.1875 inch diameter, 0.100 inch lead, 4 inch length and standard accuracy.
FSS: Flanged nut, standard backlash, standard performance material.
-001: Default Motorised Lead Screw configuration.

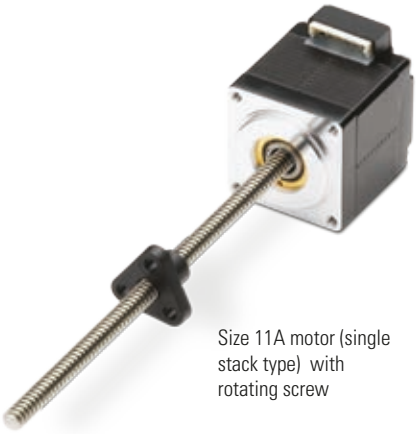
Example 2:

ML17B150 N M06-12-20000S XXX-001

ML17B150 N: NEMA 17 motor, double stack, 1.50 A, rotating nut.
M06-12-20000S: Lead screw with a 6 mm diameter, 12 mm lead, 200 mm length and standard accuracy.
XXX: Default nut sequence for rotating nut.
-001: Default Motorised Lead Screw configuration.

Note: Please visit www.thomsonlinear.com/mls to access our online Motorised Lead Screw selector and part number generator.

Specifications – ML11



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

Features and Benefits

- Higher torque density than the competition.
- NEMA 11 motor (size 28 mm).
- Rotating screw version only.
- 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 optimal performance. Longer length lead screws available, see diagrams on page 24.

Motor Options

Motor code	Holding torque		Voltage / phase* [V]	Current / phase [A]	Resistance [Ω]	Inductance [mH]	Power draw [W]	Step angle [°]	Motor length, maximum (Lm)		Rotor inertia [oz/in² (kg/cm²)]	Motor weight [lbs (kg)]
	[oz-in]	[N-m]							[in]	[mm]		
11A051	9.3	0.066	3.85	0.51	7.54	5.22	1.96	1.8	1.26	32.0	0.06 (0.011)	0.24 (0.11)
11A100	10.1	0.071	2.19	1.00	2.19	1.53	2.19	1.8	1.26	32.0	0.06 (0.011)	0.24 (0.11)

* Applied voltage can be any value above this number as long as the driver output current is controlled at the rated RMS current.

Inch Lead Screw Options

Screw code	Diameter [in]	Lead [in]	Travel / step [in]
18-0050	0.188	0.050	0.00025
18-0100		0.100	0.00050
18-0200		0.200	0.00100
18-0400		0.400	0.00200

Metric Lead Screw Options

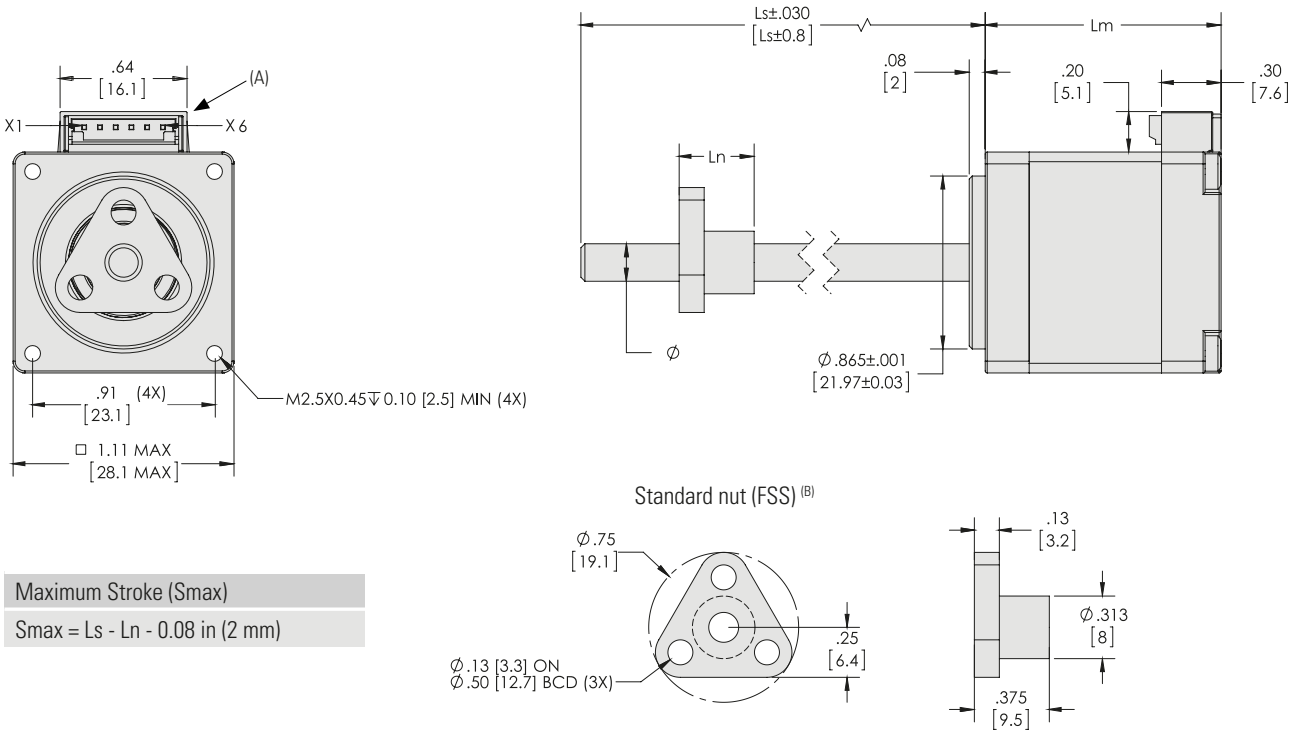
Screw code	Diameter [mm]	Lead [mm]	Travel / step [mm]
M04-01	4	1	0.00500
M04-04		4	0.02000
M04-08		8	0.04000

Note: Other diameters and leads available – please contact Thomson for more information about custom lead screw availability.

Dimensions – ML11

ML11xxxxxxS (rotating screw)

Dimensions	Projection
Inch [mm]	

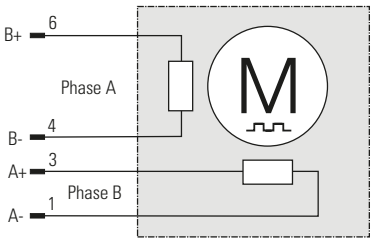


Maximum Stroke (Smax)
Smax = Ls - Ln - 0.08 in (2 mm)

(A) 6-pin connector as standard (X1 = pin 1, X6 = pin 6). Custom connection solutions possible. Contact Thomson for more information.
(B) For dimensions and data on anti-backlash nut, please contact Thomson for more information.

Motor Connection

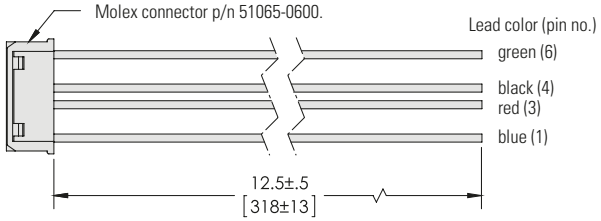
Molex Connector *	
Pin	Phase
1	A-
2	not used
3	A+
4	B-
5	not used
6	B+



* Molex connector p/n 53253-0670. Mates with Molex connector p/n 51065-0600.

Motor Connector Kit with Flying Leads - Optional

- Compatible with the above motor connector.
- Lead length 12.5 in (318 mm).
- 26 AWG lead wires.
- Part number MC11-001.
- Contact Thomson for more information.



Specifications – ML14

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

Features and Benefits

- Higher torque density than the competition.
- NEMA 14 motor (size 35 mm).
- Rotating screw versions only.
- 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 optimal performance. Longer length lead screws available, see diagrams on page 24.

Motor Options

Motor code	Holding torque		Voltage / phase* [V]	Current / phase [A]	Resistance [Ω]	Inductance [mH]	Power draw [W]	Step angle [°]	Motor length, maximum (Lm)		Rotor inertia [oz/in² (kg/cm²)]	Motor weight [lbs (kg)]
	[oz-in]	[N-m]							[in]	[mm]		
14A088	25.8	0.182	3.42	0.88	3.89	5.51	3.01	1.8	1.34	34.0	0.10 (0.018)	0.41 (0.19)
14A135	23.0	0.162	1.71	1.35	1.27	1.79	2.31	1.8	1.34	34.0	0.10 (0.018)	0.41 (0.19)

* Applied voltage can be any value above this number as long as the driver output current is controlled at the rated RMS current.

Inch Lead Screw Options

Screw code	Diameter [in]	Lead [in]	Travel / step [in]
25-0031	0.250	0.0313	0.00016
25-0063		0.0625	0.00031
25-0125		0.1250	0.00063
25-0250		0.2500	0.00125
25-0500		0.5000	0.00250
25-0750		0.7500	0.00375

Metric Lead Screw Options

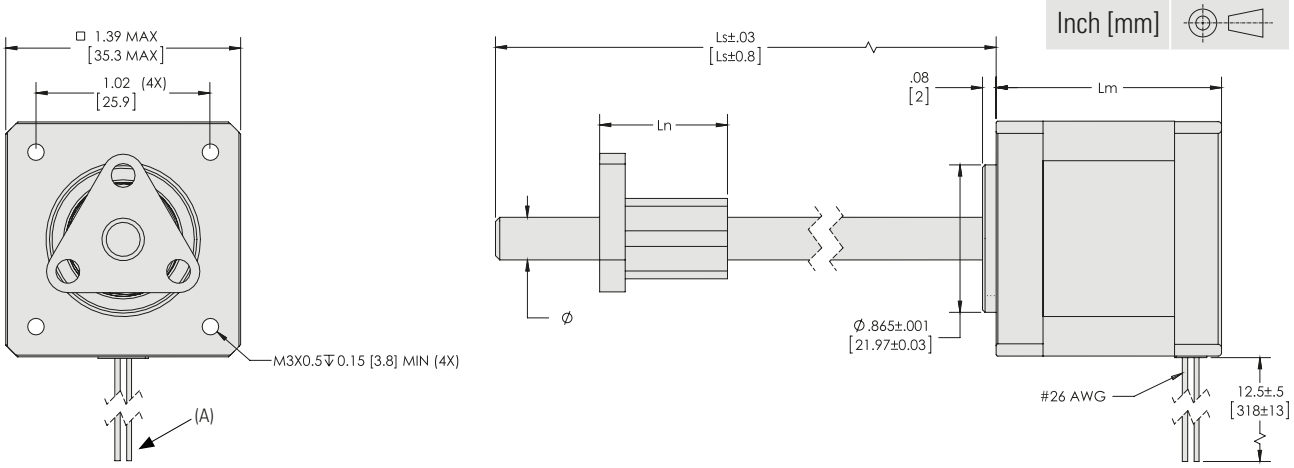
Screw code	Diameter [mm]	Lead [mm]	Travel / step [mm]
M06-01	6	1	0.00500
M06-06		6	0.03000
M06-12		12	0.06000

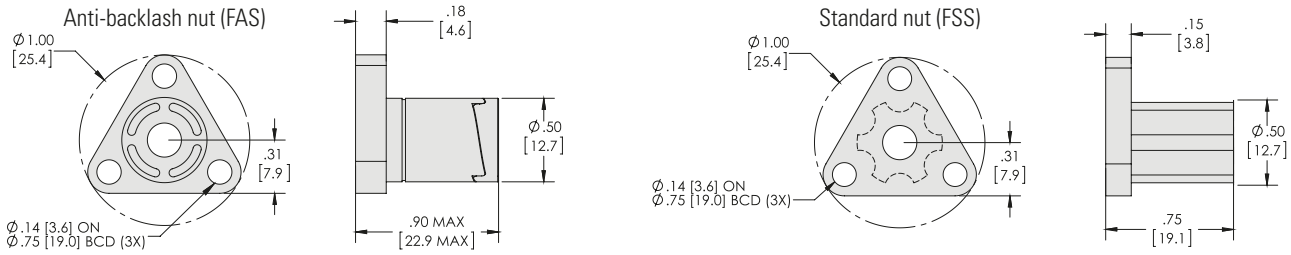
Note: Other diameters and leads available – please contact Thomson for more information about custom lead screw availability.

Dimensions – ML14

ML14xxxxxxS (rotating screw)

Dimensions	Projection
Inch [mm]	





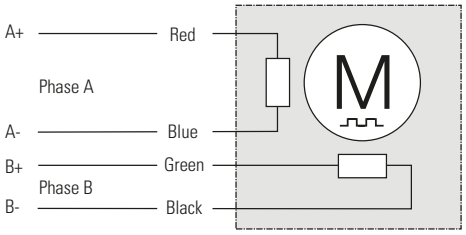
Maximum Stroke (Smax)
Smax = Ls - Ln - 0.08 in (2 mm)

(A) Flying leads are standard. Custom connection solutions possible. Contact Thomson for more information.

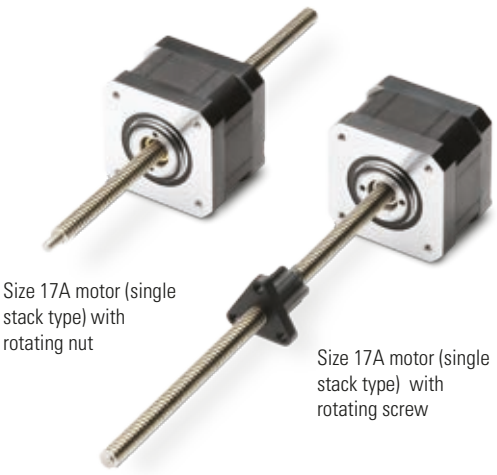
Motor Connection*

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

*Table valid for ML14, ML17 and ML23 motors.

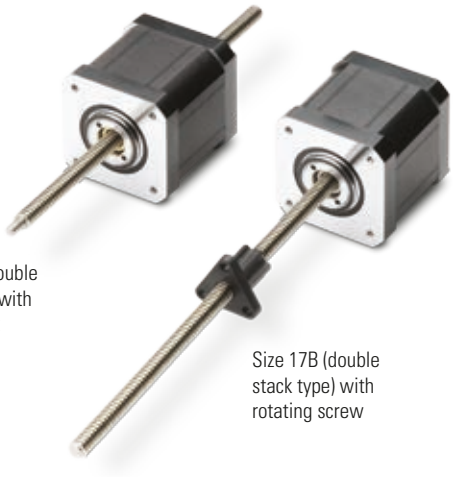


Specifications – ML17



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

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



Size 17B (double stack type) with rotating nut

Size 17B (double stack type) with rotating screw

Features and Benefits

- Higher torque density than the competition.
- NEMA 17 motor (size 42 mm).
- Rotating screw and rotating nut versions available.
- 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 optimal performance. Longer length lead screws available, see diagrams on page 24.

Motor Options

Motor code	Holding torque		Voltage / phase* [V]	Current / phase [A]	Resistance [Ω]	Inductance [mH]	Power draw [W]	Step angle [°]	Motor length, maximum (Lm)		Rotor inertia [oz/in² (kg/cm²)]	Motor weight [lbs (kg)]
	[oz-in]	[N-m]							[in]	[mm]		
17A100	77.0	0.544	2.33	1.00	2.33	5.61	2.33	1.8	1.34	34.0	0.23 (0.042)	0.4 (0.18)
17A150	92.0	0.650	1.76	1.50	1.17	3.26	2.63	1.8	1.34	34.0	0.23 (0.042)	0.4 (0.18)
17B100	107.8	0.761	1.69	1.00	1.69	5.66	1.69	1.8	1.89	48.0	0.47 (0.085)	0.7 (0.32)
17B150	102.8	0.726	1.31	1.50	0.87	2.7	1.96	1.8	1.89	48.0	0.47 (0.085)	0.7 (0.32)

* Applied voltage can be any value above this number as long as the driver output current is controlled at the rated RMS current.

Inch Lead Screw Options

Screw code	Diameter [in]	Lead [in]	Travel / step [in]
25-0031	0.250	0.0313	0.00016
25-0063		0.0625	0.00031
25-0125		0.1250	0.00063
25-0250		0.2500	0.00125
25-0500		0.5000	0.00250
25-0750		0.7500	0.00375

Metric Lead Screw Options

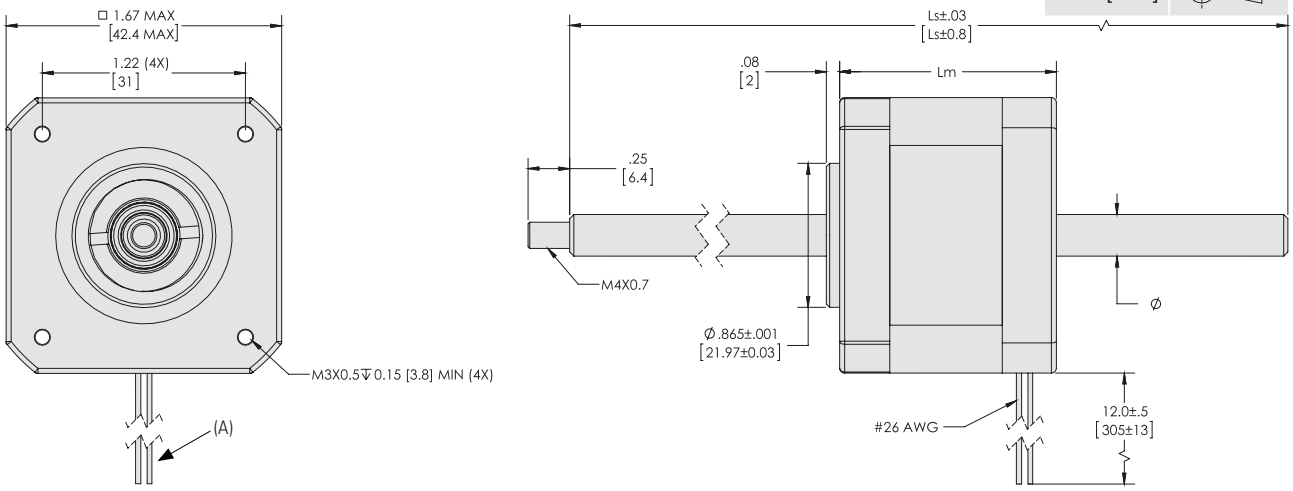
Screw code	Diameter [mm]	Lead [mm]	Travel / step [mm]
M06-01	6	1	0.00500
M06-06		6	0.03000
M06-12		12	0.06000

Note: Other diameters and leads available – please contact Thomson for more information about custom lead screw availability.

Dimensions – ML17

ML17xxxxxxN (rotating nut)

Dimensions	Projection
Inch [mm]	



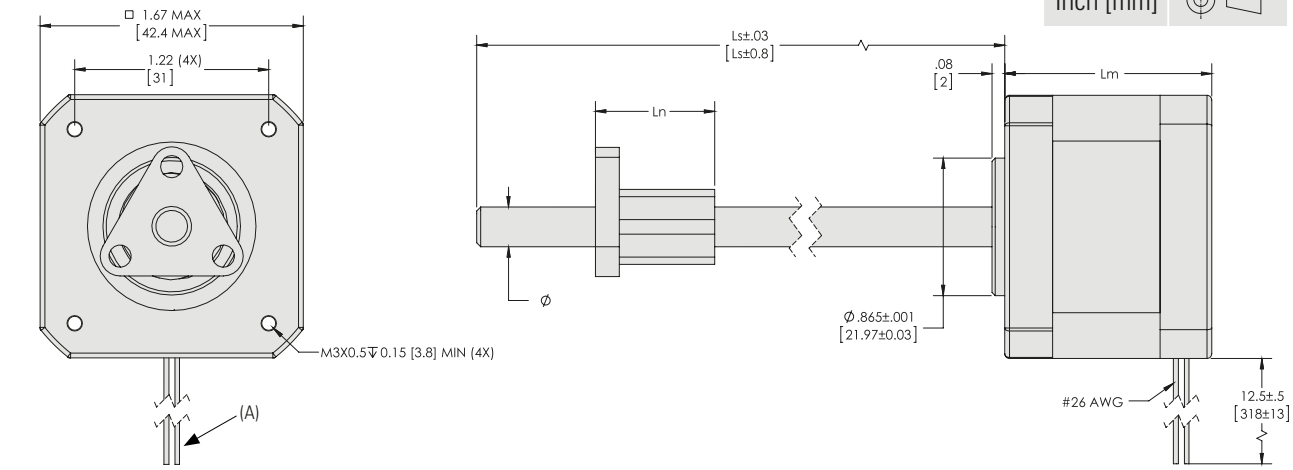
Maximum Stroke (Smax)
Smax = Ls - Lm - 0.08 in (2 mm)

(A) Flying leads are standard. Custom connection solutions possible. Contact Thomson for more information.

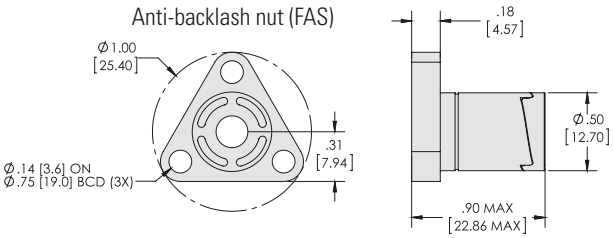
Motor connection information! See table on page 15.

ML17xxxxxxS (rotating screw)

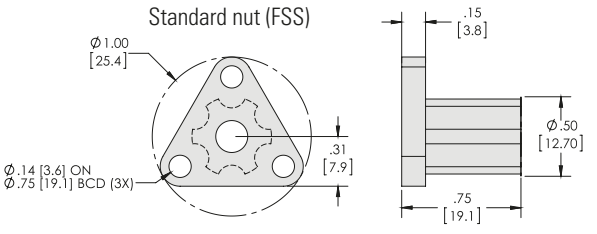
Dimensions	Projection
Inch [mm]	



Anti-backlash nut (FAS)



Standard nut (FSS)

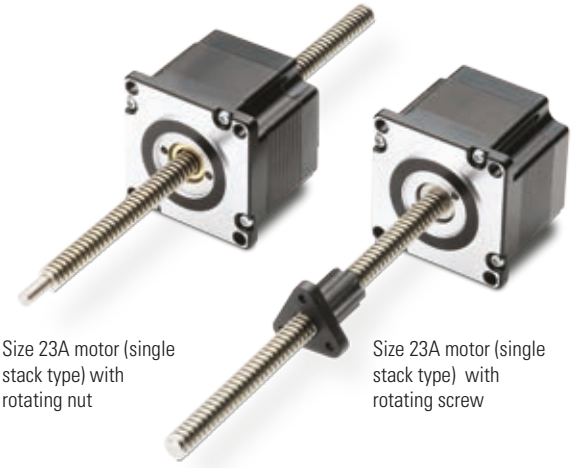


Maximum Stroke (Smax)
Smax = Ls - Ln - 0.08 in (2 mm)

(A) Flying leads are standard. Custom connection solutions possible. Contact Thomson for more information.

Motor connection information! See table on page 15.

ML23 – Specifications



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

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

Size 23B (double stack type) with rotating nut

Size 23B (double stack type) with rotating screw

Features and Benefits

- Higher torque density than the competition.
- NEMA 23 motor (size 57 mm).
- Rotating screw and rotating nut versions available.
- Choose between a variety of inch and metric lead screws.
- Recommended max. thrust force 200 lbs (890 N).
- Recommended max. lead screw length of 12 in (305 mm) for diameter 0.313 in and 8 mm, and 16 in (406 mm) for diameter 0.375 in and 10 mm for optimal performance. Longer length lead screws available, see diagrams on page 24.

Motor Options

Motor code	Holding torque		Voltage / phase* [V]	Current / phase [A]	Resistance [Ω]	Inductance [mH]	Power draw [W]	Step angle [°]	Motor length, maximum (Lm)		Rotor inertia [oz/in^2 (kg/cm^2)]	Motor weight [lbs (kg)]
	[oz-in]	[N-m]							[in]	[mm]		
23A155	121.0	0.854	3.77	1.55	2.43	4.20	5.84	1.8	1.78	45.2	1.04 (0.19)	1.13 (0.51)
23A300	123.8	0.875	1.74	3.00	0.58	1.16	5.22	1.8	1.78	45.2	1.04 (0.19)	1.13 (0.51)
23B190	251.2	1.774	3.80	1.90	2.00	5.84	7.22	1.8	2.59	65.8	2.13 (0.389)	1.70 (0.77)
23B390	260.8	1.842	1.99	3.90	0.51	1.45	7.76	1.8	2.59	65.8	2.13 (0.389)	1.70 (0.77)

* Applied voltage can be any value above this number as long as the driver output current is controlled at the rated RMS current.

Inch Lead Screw Options

Screw code	Diameter [in]	Lead [in]	Travel / step [in]
31-0083	0.313	0.083	0.00042
31-0167		0.167	0.00083
31-0250		0.250	0.00125
31-0500		0.500	0.00250
31-1000		1.000	0.00500
37-0063	0.375	0.063	0.00031
37-0100		0.100	0.00050
37-0167		0.167	0.00083
37-0250		0.250	0.00125
37-0500		0.500	0.00250
37-1000		1.000	0.00500

Metric Lead Screw Options

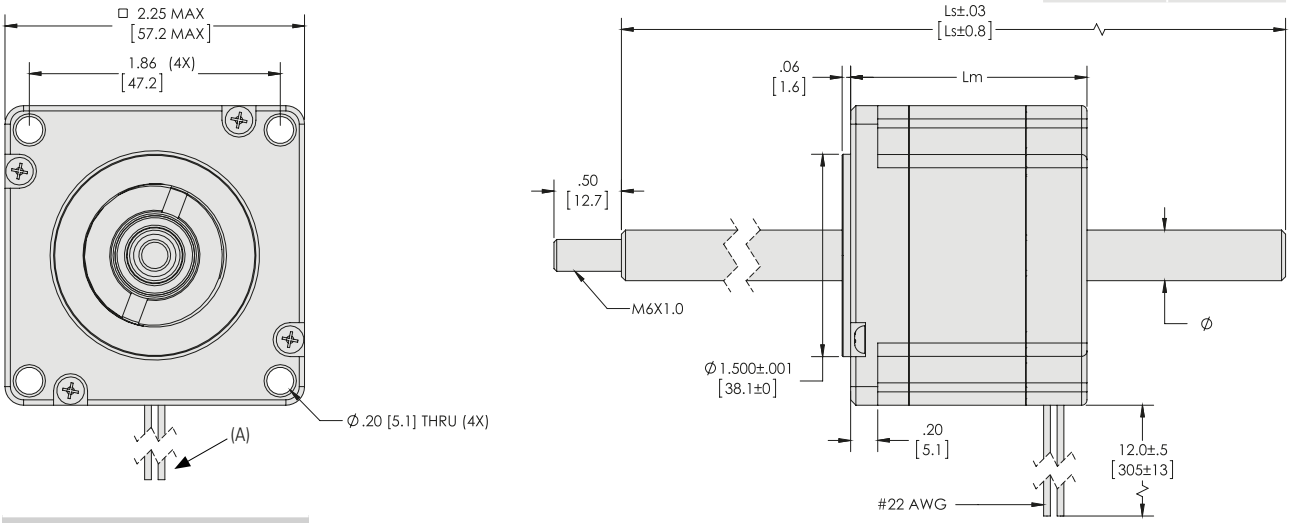
Screw code	Diameter [mm]	Lead [mm]	Travel / step [mm]
M08-02	8	2	0.01000
M08-04		4	0.02000
M08-08		8	0.04000
M08-12		12	0.06000
M08-20		20	0.10000
M10-02	10	2	0.01000
M10-03		3	0.01500
M10-05		5	0.02500
M10-10		10	0.05000
M10-20		20	0.10000

Note: Other diameters and leads available – please contact Thomson for more information about custom lead screw availability.

ML23 – Dimensions

ML23xxxxxxN (rotating nut)

Dimensions	Projection
Inch [mm]	



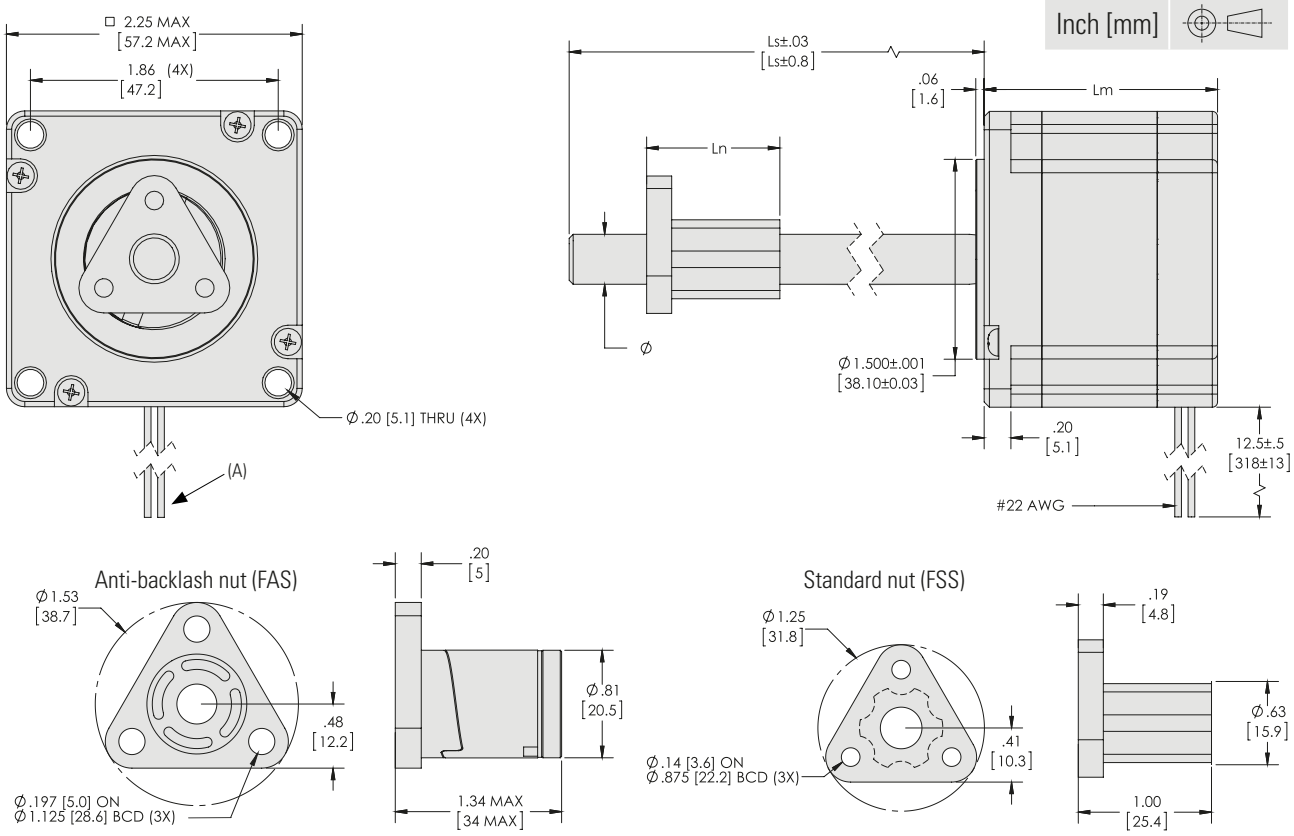
Maximum Stroke (Smax)
Smax = Ls - Lm - 0.06 in (1.6 mm)

(A) Flying leads are standard. Custom connection solutions possible. Contact Thomson for more information.

Motor connection information! See table on page 15.

ML23xxxxxxS (rotating screw)

Dimensions	Projection
Inch [mm]	



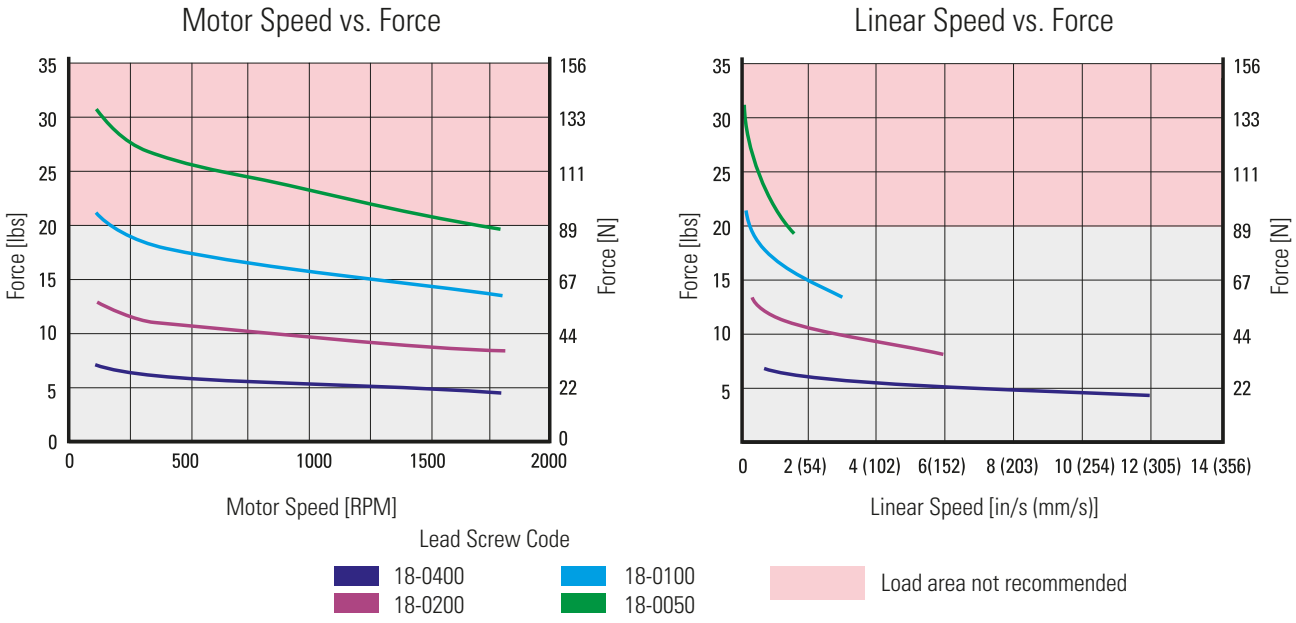
Maximum Stroke (Smax)
Smax = Ls - Ln - 0.06 in (1.6 mm)

(A) Flying leads are standard. Custom connection solutions possible. Contact Thomson for more information.

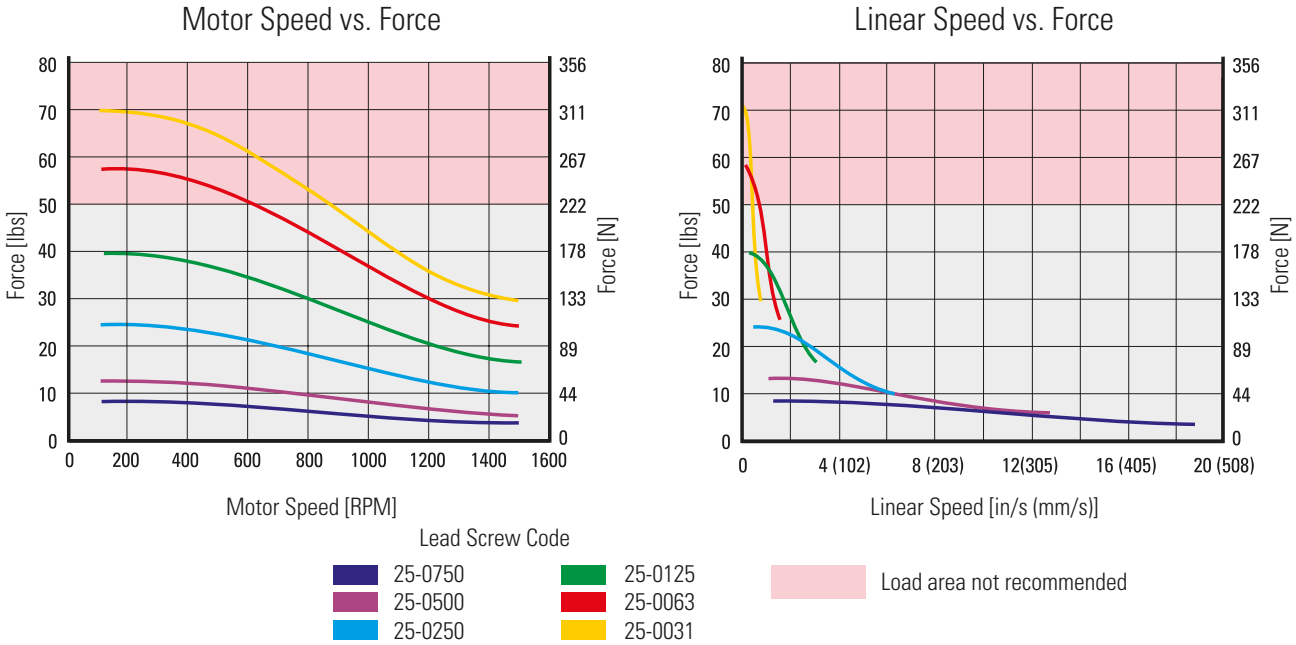
Motor connection information! See table on page 15.

ML11, ML14 – Performance Diagrams

ML11A100



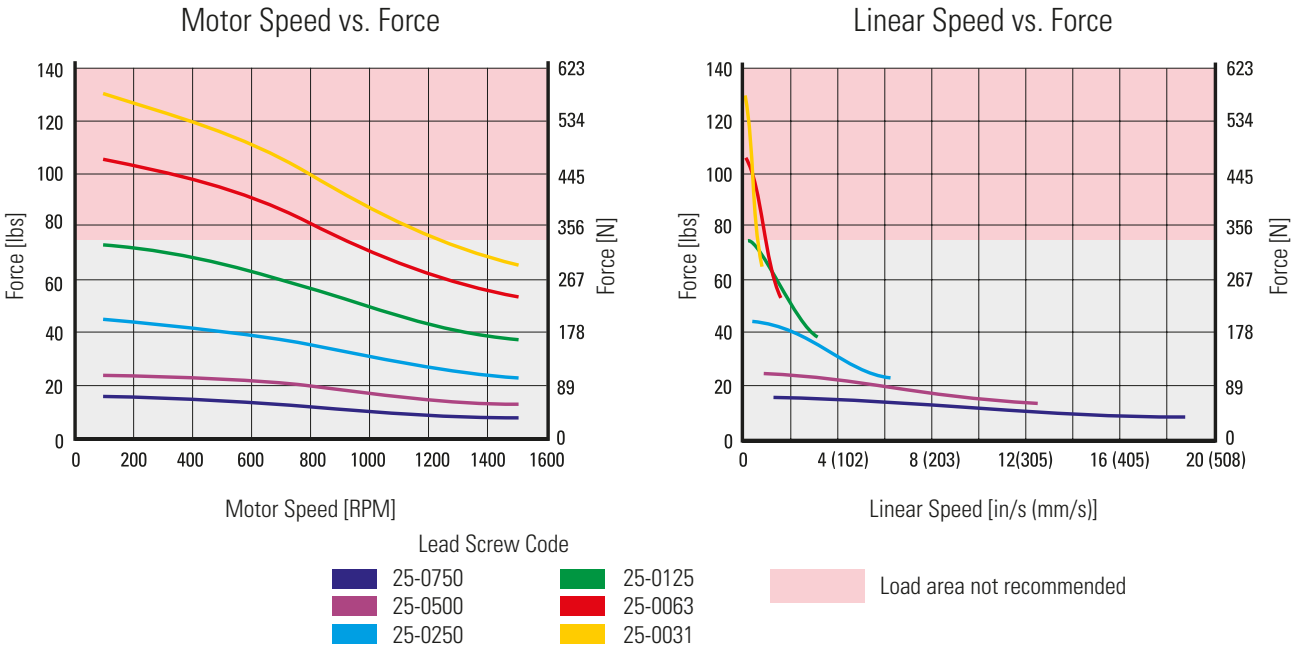
ML14A088



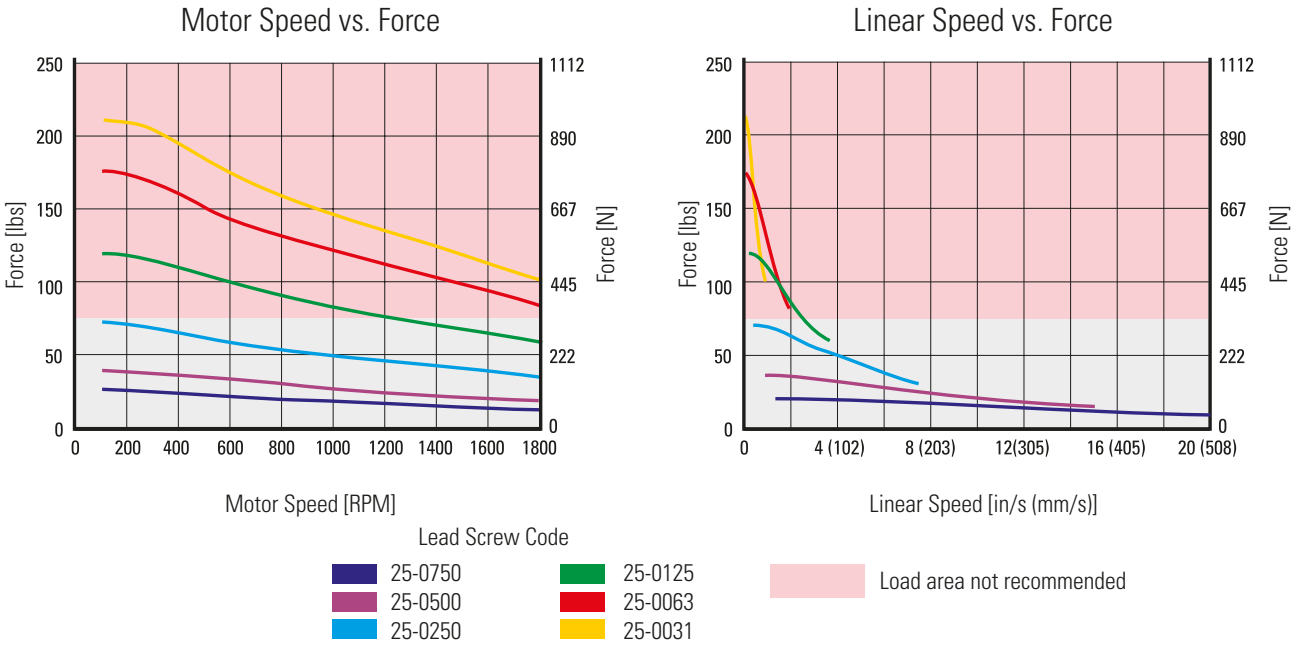
Note! All motor load curves were generated with a 40 VDC, 2-phase ON driver and full stepped at the motor rated current. Performance plots for other lead screw and motor winding configurations can be generated at www.thomsonlinear.com/mls.

ML17 – Performance Diagrams

ML17A150



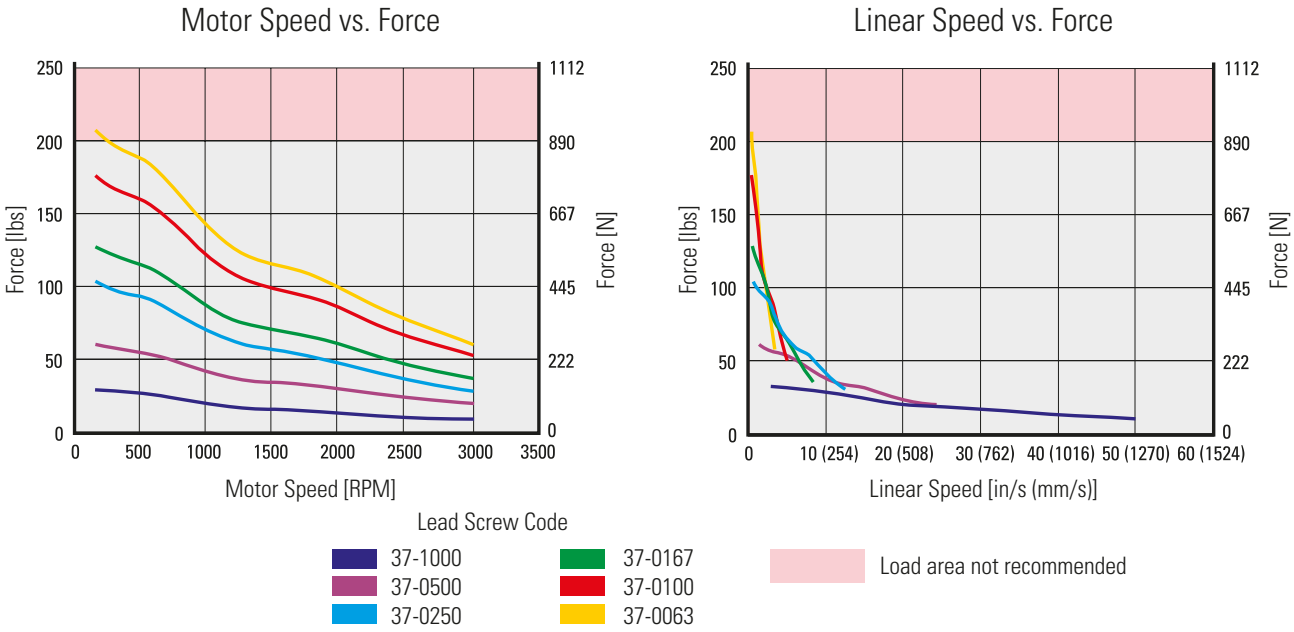
ML17B150



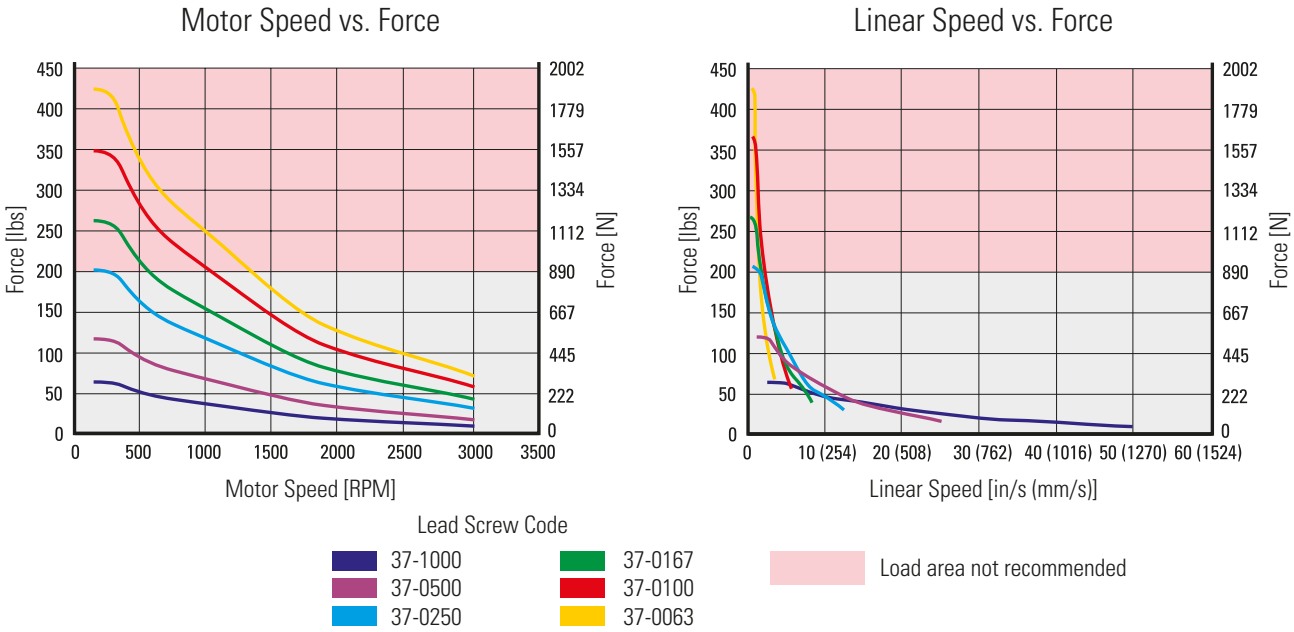
Note! All motor load curves were generated with a 40 VDC, 2-phase ON driver and full stepped at the motor rated current. Performance plots for other lead screw and motor winding configurations can be generated at www.thomsonlinear.com/mls.

ML23 – Performance Diagrams

ML23A300



ML23B390



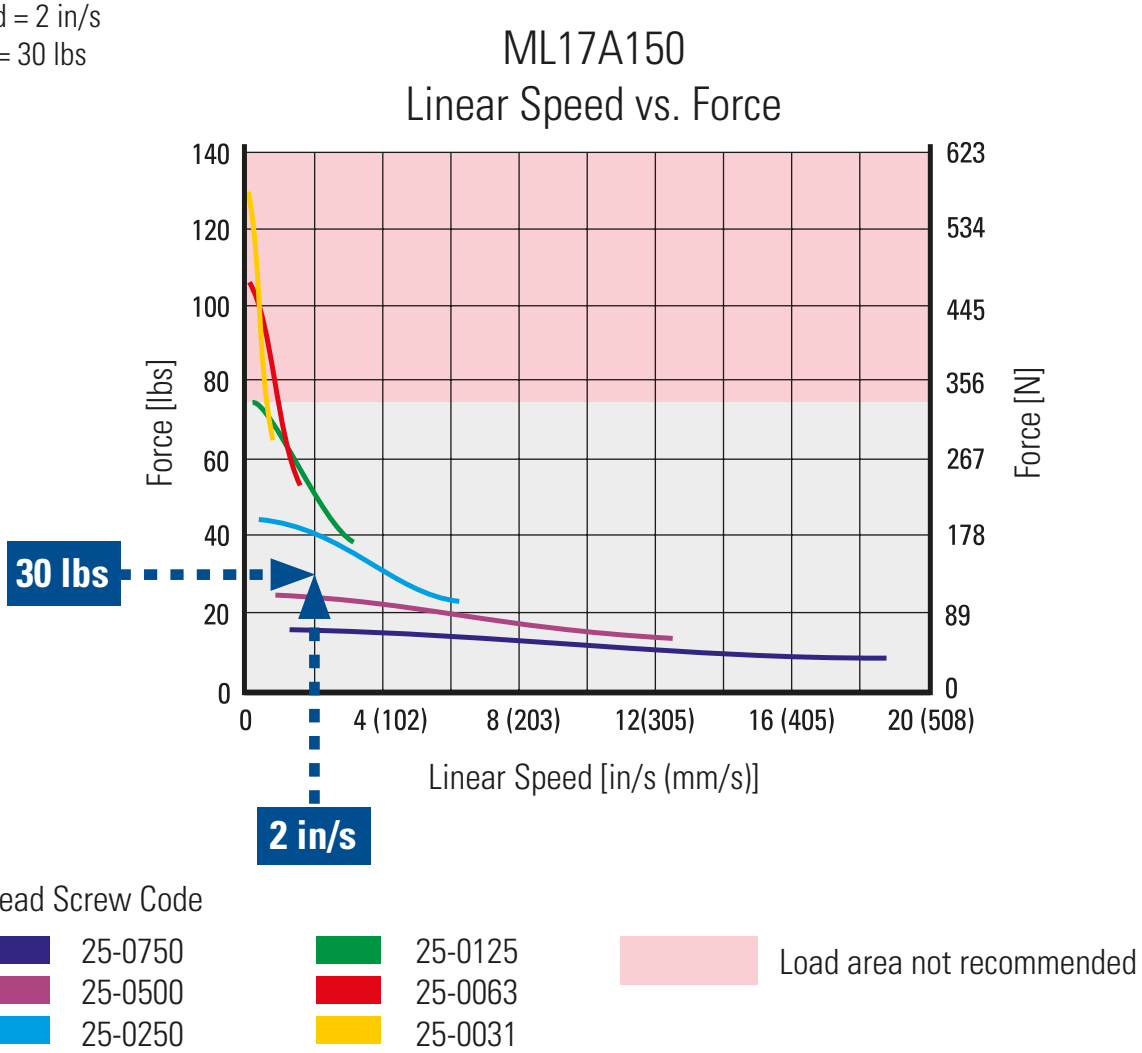
Note! All motor load curves were generated with a 40 VDC, 2-phase ON driver and full stepped at the motor rated current. Performance plots for other lead screw and motor winding configurations can be generated at www.thomsonlinear.com/mls.

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 = 2 in/s
Load = 30 lbs



Given the speed and load requirements of 2 in/s and 30 lbs, respectively, a ML17A150 motor with an inch lead screw with a diameter and lead of 0.25 inch (25-0250) will be a sufficient Motorised Lead Screw assembly for this application*.

Please visit www.thomsonlinear.com/mls for a more detailed sizing calculator or call Thomson to speak with a Motorised Lead Screw sizing specialist.

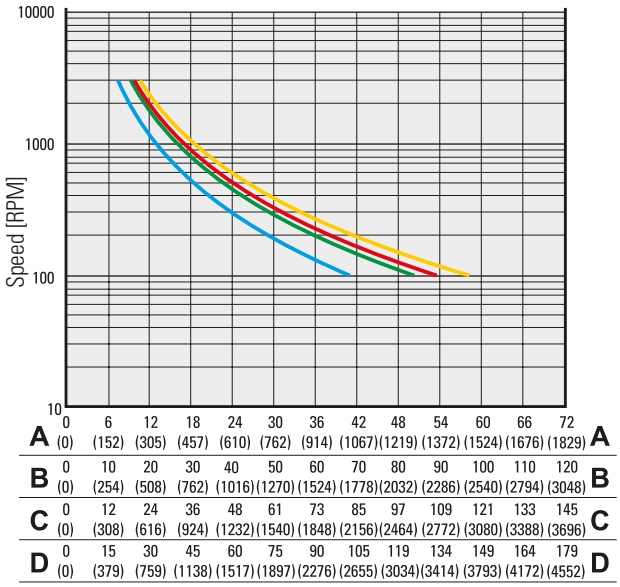
*Performance curve upper limits should be avoided for critical and/or high duty cycle applications. Generally a safety factor of 2 is recommended when sizing an application.

Sizing and Selection Guidelines

How to Determine Maximum Permissible Screw Length

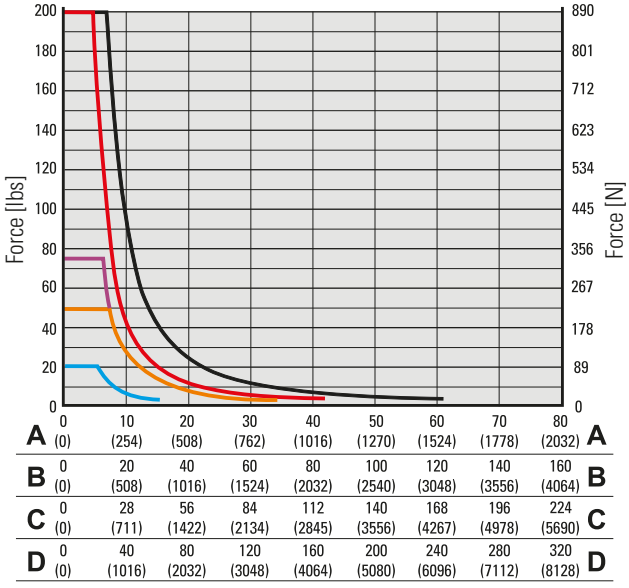
In order to determine the maximum possible lead screw length for your Motorised Lead Screw assembly, the following charts can be used. These charts take in to consideration the maximum rotational speed and compression load as well as the end fixity of your system.

Critical Speed
Motor Speed vs. Maximum Screw Length



Max. Screw Length (Ls) [in (mm)]

Column Load
Compression Force vs. Maximum Screw Length



Max. Screw Length (Ls) [in (mm)]

Unit Size and Lead Screw Diameter Combination

ML11 0.188 in 4 mm
ML14 ML17 0.250 in 6 mm
ML23 0.313 in 8 mm
ML23 0.375 in 10 mm
ML14 0.250 in 6 mm
ML17 0.250 in 6 mm
ML23 0.375 in 10 mm

Type of Screw End Fixity

Fixed / Free | Simple / Simple | Fixed / Simple | Fixed / Fixed

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 four basic types of end fixity (A, B, C and D). The maximum screw length (Ls) for a given motor speed, unit size and screw diameter will vary depending on the selection.

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. For rotating screw configurations (S), the Taper-Lock connection within the motor can be considered fixed.

4. Check Column Loading

Another limiting factor for the screw length is how much column loading (buckling) the screw is subjected to. 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.

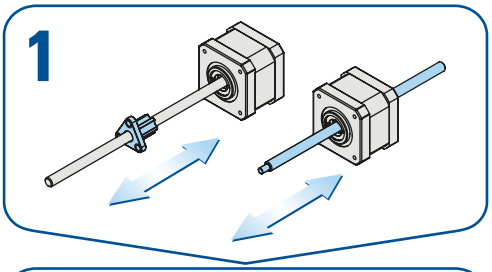
Installation Guidelines

Installation

The successful integration of a Motorised Lead Screw 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.

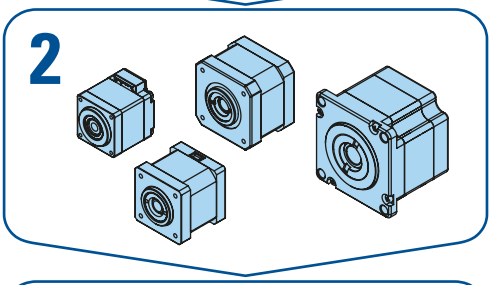
1. Select Motorised Lead Screw Configuration

Determine which of the two types of configurations – rotating screw (S) or rotating nut (N) – the application requires. See page 3 and 5 for more information.



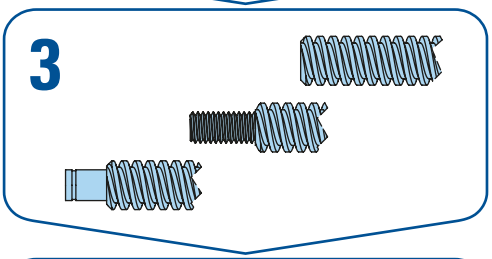
2. Select Motor Size

Select the appropriate size based on desired performance, motor frame size, etc. Thomson offers four base models (ML11, ML14, ML17 and ML23) with optional motor windings, linear travel and load capacity selection.



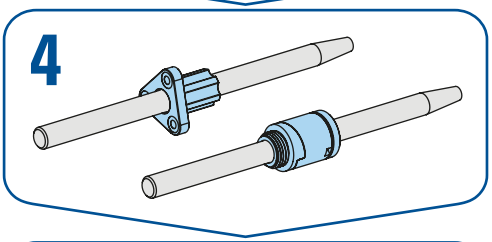
3. Select Lead Screw

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.



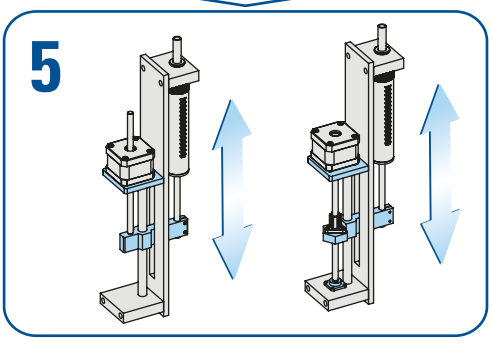
4. Select Nut

For rotating screw (S) configurations, choose between various nut mounting styles, materials, and backlash options. Rotating nut (N) configurations as default always come in a high performance material, standard backlash nut.



5. Mount the Motorised Lead Screw

Mount the unit into the application using the tolerance guidelines shown on page 9.

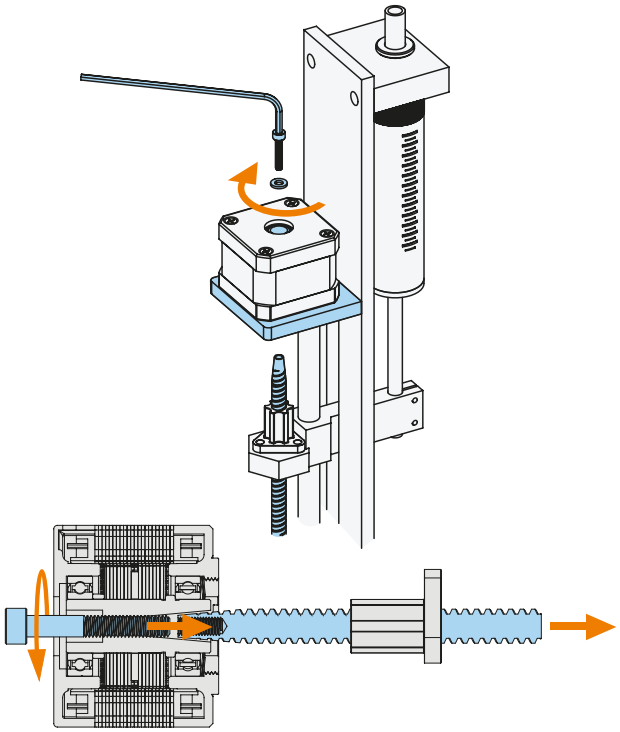


Comissioning, Service and Maintenance Advantages

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

Rotating Screw 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.



Lead Screw Removal - Optional

Due to the secure connection of the Taper-Lock coupling, an additional feature may be added to facilitate the removal of the lead screw. Remove the fastener securing the lead screw and use the oversize removal screw to gently push the lead screw out. Removal screw thread sizes are shown in the table below.*

Taper-Lock Removal Thread Specifications

Motor code	Lead scew code	Fastener screw size	Recommended fastener screw length [mm]	Recommended fastener screw torque [lbs-in (Nm)]	Removal screw size
ML11AxxxS	18-xxxx M04-xx	M2.5×0.45	18	11 (1.2)	M3×0.5
ML14AxxxS	25-xxxx M06-xx	M3×0.5	22	20 (2.3)	M4×0.7
ML17AxxxS	25-xxxx M06-xx	M3×0.5	14	20 (2.3)	M4×0.7
ML17BxxxS	25-xxxx M06-xx	M3×0.5	22	20 (2.3)	M4×0.7
ML23AxxxS	31-xxxx M08-xx	M4×0.7	18	45 (5.1)	M5×0.8
ML23BxxxS	31-xxxx M08-xx	M4×0.7	35	45 (5.1)	M5×0.8
ML23AxxxS	37-xxxx M10-xx	M5×0.8	25	90 (10.2)	M6×1.0
ML23BxxxS	37-xxxx M10-xx	M5×0.8	45	90 (10.2)	M6×1.0

*Removal thread does not come standard in Motorised Lead Screw assemblies – contact Thomson if internal shaft thread is required.

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 Motorised Lead Screw 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 ° step motor microstepped at 64× will mean that 1 pulse is now 1.8 °/64 = 0.028 °.
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 Motorised Lead Screw 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.

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