

Thomson Motorized Lead Screw Actuators

Installation Manual

Edition 2019-01

Version history

Edition	Reason for revision
2019-01	First edition

Warranty

The Thomson motorized lead screw actuator is warranted to be free from defects in materials and workmanship for a period of twelve (12) months from date of delivery. The application of this product is the responsibility of the buyer and Thomson makes no representation or warranty as to the suitability of the product for any particular use or purpose. For a copy of the entire warranty for this product that is contained in our standard terms and conditions of sale, please go to http://www.thomsonlinear.com/website/com/eng/support/terms_and_conditions.php.

Disclaimer

Technical changes to improve the performance of the equipment may be made without prior notice!

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1. General

1.1 About this manual

This manual contains mechanical and electrical installation instructions for the Thomson motorized lead screw actuator. It also contains, among other things:

- technical data
- installation data
- type designation key.

It is important to carefully read this manual before installing the actuator and to have the correct qualifications needed to perform the installation.

1.2 Target group

This manual addresses qualified mechanical and electrical personnel.

1.3 Symbols used



This symbol is shown to highlight a general warning, general instruction or as a warning for a mechanical hazard.

1.4 Transport and storage

The actuator may only be transported and stored in the original packaging supplied by Thomson. The temperature during transportation and storage must be between -40 to +85° C (-40 to +185° F). Avoid shocks to the package. If the package is damaged, check the actuator for visible damage and notify the carrier, and if appropriate also Thomson.

1.5 Packaging

The packaging consists of a cardboard box. The box contains the actuator and this manual. For large quantity orders, bulk packaging may be used in which case the packaging and the content will vary depending on the order agreement.

1.6 Disposal

Where required by law, used packaging and actuators are taken back by Thomson for professional disposal if the transportation cost is paid by the sender. Please contact Thomson for shipping information.

1.7 Support

If technical support or information is needed for this product, please contact the nearest Thomson Service Center. See the back of this manual. You can also visit www.thomsonlinear.com for information on this product and how to contact us.

2. Safety

2.1 Safety notes



- Only properly qualified personnel are permitted to perform mechanical and electrical installation of this product. Properly qualified personnel are familiar with mechanical or electrical installation work and have the appropriate qualifications for their job.
- Read this manual and any other available documentation before working on the equipment that the actuator is or shall be a part of.
- Conform strictly to the information contained in this manual and on the actuator product label. Never exceed the performance limits stated herein.
- Never work on the actuator or its installation with the power on.
- Never unplug any cables or connectors during operation or with power on.
- Immediately stop using the actuator if it seems faulty or damaged in any way and notify an appropriate person so that corrective actions can be taken.
- Never open the actuator as that will compromise the sealing and the function of the actuator. There are no serviceable components inside.
- Grease may be present on the extension tube. Contact is non-hazardous. Film should not be removed.

3. Standards

3.1 EC Declaration of incorporation of partly completed machinery



Declaration of Incorporation of Partly Completed Machinery (Annex II 1 B of Machinery Directive 2006/42/EC)

Manufacturer:

Thomson Industries Inc.
1500 N Mittel
Wood Dale, IL 60191
United States

Description and Identification of the Partly Completed Machinery:

Designation: Stepper Motor Linear Actuators
Series: MLS, MLN, MLA
Sizes: MLx08, MLx11, MLx14, MLx17, MLx23

The following essential requirements of Machinery Directive 2006/42/EC have been applied and fulfilled:

Annex I, sections 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.4, 1.6.4, 1.7.1, 1.7.3, 1.7.4, 2.2.2.2, 4.1.3

The relevant technical documentation has been compiled in accordance with Annex VII, part B of Machinery Directive 2006/42/EC. Upon reasonable request, Thomson will supply the documentation in an electronic format to the responsible governing authorities within a reasonable timeframe.

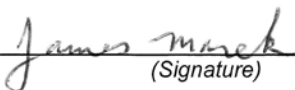
The party authorized to compile the technical documentation is:

Julian Anton (Product Design Engineer)

The partly completed machinery must not be put into service until the final machinery of which it is to be incorporated in has been declared to be in conformance of the Machinery Directive.

James Marek (VP of Engineering)

Wood Dale, 2019-01-07
(Location, date)



(Signature)

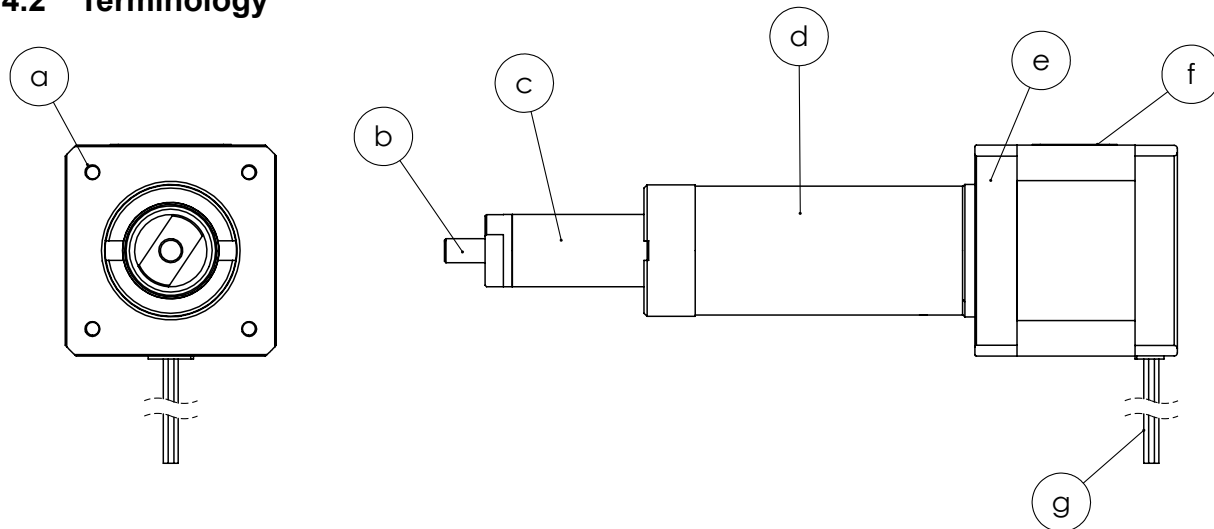
4. Installation

4.1 Product label

The product label can be found on the side of the motor case. It will tell you the model of the actuator and the manufactured date. Please review the product label to determine actuator type before starting any installation or service of the actuator. If you need any assistance from Thomson, please provide the part number and the manufacturing date of the actuator(s) in question.



4.2 Terminology



a. motor mounting holes

b. end mounting

c. extension tube

d. cover tube

e. motor

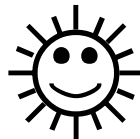
f. product label

g. lead wires

4.3 Operation environment



Min. -4° F (-20° C)



Max. +122° F (+50° C)



IP40

1. Operation temperature range is -4 to +122° Fahrenheit (-20 to 50° Celsius).
2. Protection degree against ingress of water and particles is IP40.
3. Max non-condensing humidity is 85%.

4.4 Mechanical installation

4.4.1 General installation safety notes



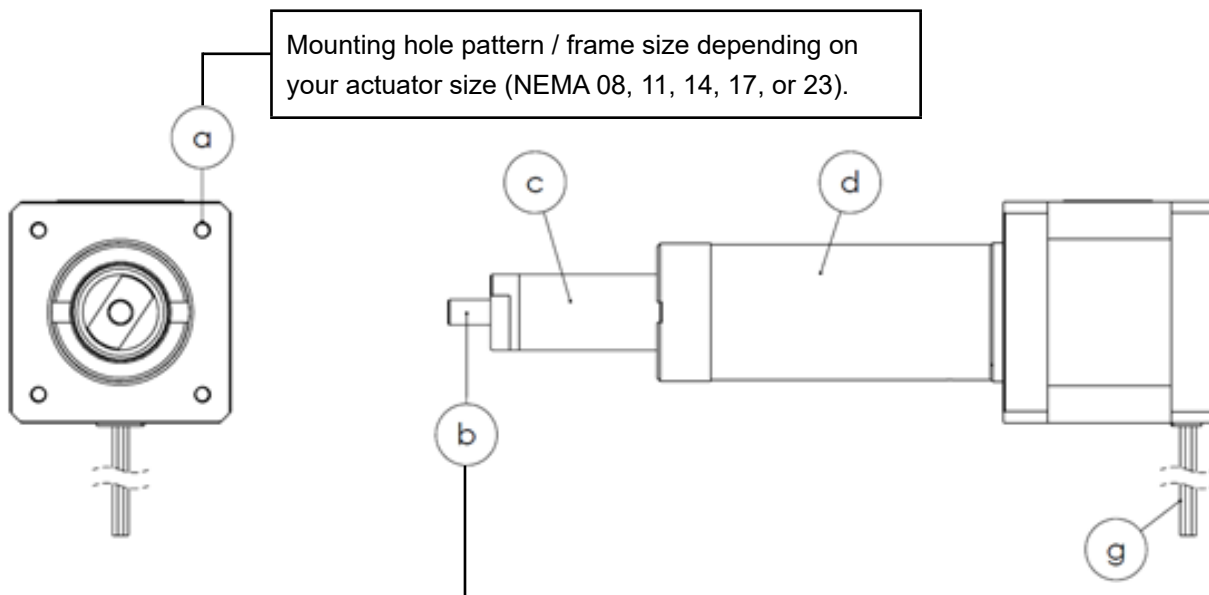
- Never work on the actuator with the power switched on.
- Do not hold the extension tube while the unit is energized.
- Failure modes of the actuator should be considered to ensure it does not create harm.

4.4.2 Basic installation considerations

1. Only mount the actuator using the designated mounting holes on the motor face (a) and end mounting (b). Do not mount directly on to extension tube (c) or cover tube (d). Check the part number on the product label (section 4.1) and cross reference with the ordering key (section 6.2) to determine which frame size and end mounting style is used in your assembly. See drawings below for end mounting dimensions.
2. Make sure that the actuator mounting position allows access to the lead wires (g) so that it can be properly connected and powered on.
3. Make sure that there is enough clearance surrounding the extension tube (c) to allow it to freely move.

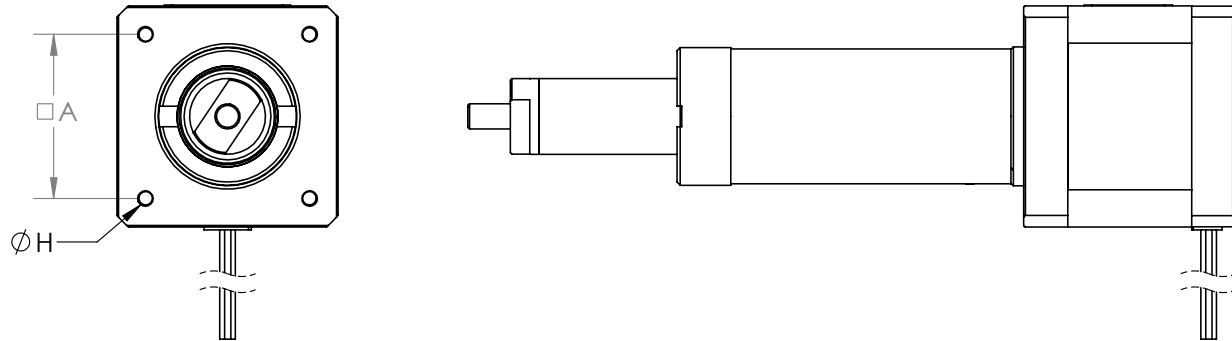


Do not mount actuator directly on to extension tube or cover tube.



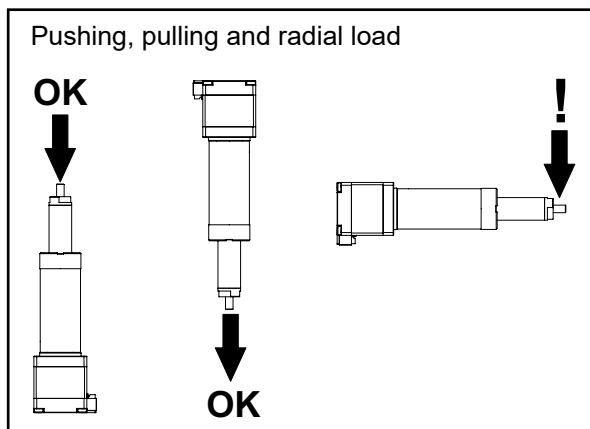
inch versions [in]							metric versions [mm]						
Type	THD	L2	L3	w	t	ØT	Type	THD	L2	L3	w	t	ØT
C1	#4-40	0.380	0.236	0.197	0.105	0.354	C4	M3X0.5	9.65	5.99	5.00	2.67	9.00
C2	#8-32	0.444	0.265	0.265	0.120	0.472	C5	M4X0.7	11.28	6.73	6.73	3.05	12.00
C3	1/4-20	0.714	0.500	0.433	0.135	0.866	C6	M6X1.0	18.14	12.70	11.00	3.43	22.00
E1	#4-40 \downarrow 0.236	0.276	-	0.315	0.236	0.354	E4	M3X0.5 \downarrow 5.99	7.01	-	8.00	5.99	9.00
E2	#8-32 \downarrow 0.265	0.324	-	0.394	0.265	0.472	E5	M4X0.7 \downarrow 6.73	8.23	-	10.01	6.73	12.00
E3	1/4-20 \downarrow 0.500	0.579	-	0.709	0.500	0.866	E6	M6X1.0 \downarrow 12.70	14.71	-	18.01	12.70	22.00

Motor mounting hole dimensions [in (mm)]			
Configuration	Frame size	A	H
MLA08xxx	NEMA 08	0.63 (16.0)	4X M2X0.4 ↓ 0.099 (2.5) MIN
MLA11xxx	NEMA 11	0.91 (23.1)	4X M2.5X0.45 ↓ 0.10 (2.5) MIN
MLA14xxx	NEMA 14	1.02 (25.9)	4X M3X0.5 ↓ 0.15 (3.8) MIN
MLA17xxx	NEMA 17	1.22 (31.0)	4X M3X0.5 ↓ 0.15 (3.8) MIN
MLA23xxx	NEMA 23	1.86 (47.2)	4X Ø0.20 (5.1) THRU



4.4.3 Mounting orientation and forces

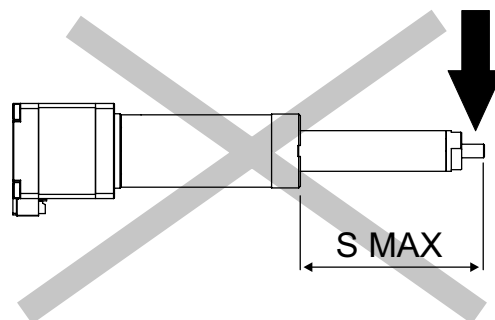
1. The actuator can be mounted in many orientations and can handle both pushing and pulling loads.
2. Minimize radial and moment loads applied to the actuator. If radial loads are present, please follow the table below for max recommended radial loads.
3. Only mount onto the actuator's end mounting and motor face mounting holes.
4. When mounting to end mount, use appropriate wrench to prevent torque onto the actuator as outlined in section 4.4.4.



Configuration	Recommended max radial load [lbf (N)]
MLA08Axx	0.1 (0.44)
MLA11Axx	1.5 (6.67)
MLA14Axx	3 (13.34)
MLA17Axx	4 (17.79)
MLA17Bxx	5 (22.24)
MLA23Axx	5 (22.24)
MLA23Bxx	5 (22.24)

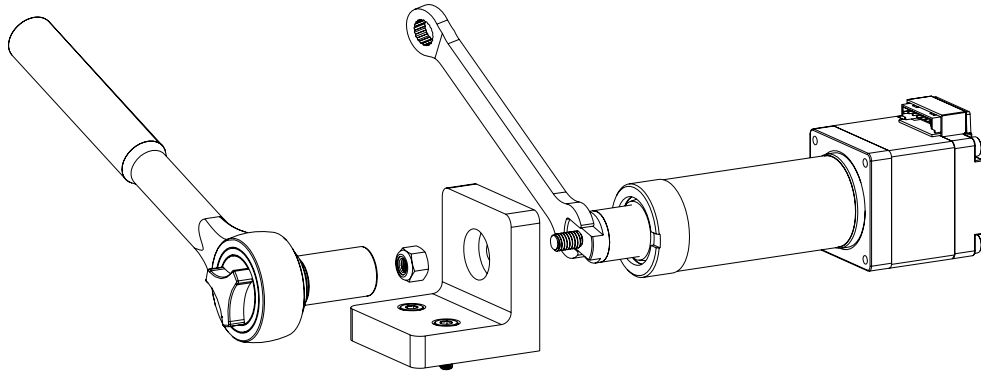


For optimal performance, avoid radial loads when the actuator is in the fully extended position (S MAX).



4.4.4 Mounting to end mounts

When mounting onto end mounts, always use the appropriate wrench to prevent damage to the actuator. The appropriate wrench can be selected based on the dimensions found on 4.4.2 (end mounting dimensions).



4.5 Electrical installation

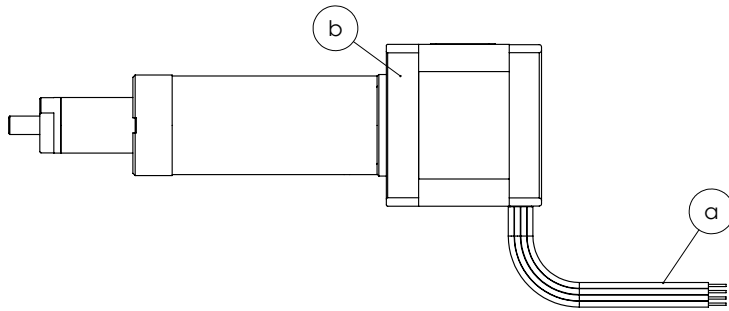
4.5.1 General notes



- Make sure the leads/cables leading to the motor can handle the maximum motor current.
- Do not exceed the peak current of the motor. Peak current is $1.41 \times$ RMS current.
- An emergency stop is recommended to reduce the chance of a crushing hazard.
- Never work on the actuator or the wiring with the power switched on.

4.5.2 Electrical connections

The actuator is always supplied with flying lead wires (a) that are attached to the stepper motor (b). These lead wires are used to connect to the stepper motor and drive the actuator. Depending on the configuration, motors have various wire gage sizes. The standard gages are outlined in the table below.



Configuration	Wire gage
MLA08Axx	26 AWG
MLA11Axx	26 AWG
MLA14Axx	26 AWG
MLA17Axx	26 AWG
MLA17Bxx	26 AWG
MLA23Axx	22 AWG
MLA23Bxx	22 AWG

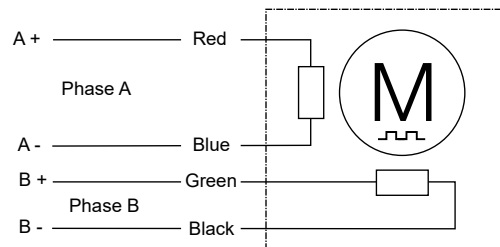
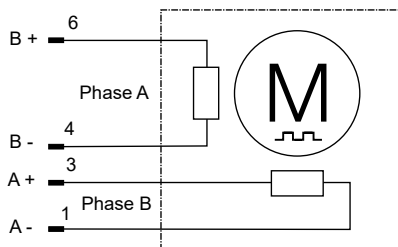
4.5.3 Wiring diagrams

The motor either has an integrated connector or the wires are coming directly out of it. Select the correct wiring diagram below depending on the type of motor on your actuator.

Configuration	Connector	Connector type
MLA08Axx	yes	JST ZHR-6
MLA11Axx	yes	Molex 51065-0600
MLA14 (17, 23)A(B)xx	no	-

Wiring of motors with connector		
Lead color	Connector pin	Motor phase
Blue	1	A -
-	2	not used
Red	3	A +
Black	4	B -
	5	not used
Green	6	B+

Wiring of motors without connector	
Lead color	Motor phase
Blue	A -
Red	A +
Black	B -
Green	B+



4.6 Stepper motor control

4.6.1 Driving the stepper motor

There are many possible ways to drive a stepper motor. The most common way is to use a constant current or “chopper” drive. A chopper drive works by limiting the current into the stepper motor and “chopping” the voltage, allowing for maximum torque output from the motor. When using this type of drive, it is important to input the appropriate amount of current to maximize torque output and prevent damage to the motor. Recommended drive currents are determined using the following equations, where RMS current is the motor rated current found in the brochure:

When full stepping:

Drive current = RMS current

When micro stepping:

Drive current = peak current = 1.41 × RMS current

Drive current of standard configurations			
Configuration	Rated RMS motor current [A]	Drive current @ full stepping [A]	Drive current @ micro stepping [A]
MLA08A05	0.50	0.50	0.71
MLA11A05	0.51	0.51	0.72
MLA11A10	1.00	1.00	1.41
MLA14A08	0.88	0.88	1.24
MLA14A13	1.35	1.35	1.90
MLA17A10	1.00	1.00	1.41
MLA17A15	1.50	1.50	2.12
MLA17B10	1.00	1.00	1.41
MLA17B15	1.50	1.50	2.12
MLA23A15	1.55	1.55	2.19
MLA23A30	3.00	3.00	4.23
MLA23B19	1.90	1.90	2.68
MLA23B39	3.90	3.90	5.50

4.6.2 Power supply voltage

When using a current limiting “chopper” drive, power supply voltage selection is completely dependent on your requirements and/or voltage availability. The voltage input into the motor impacts the performance of the stepper in regards to speed. For example, a stepper motor will usually perform better at higher speeds when a higher voltage is utilized. Typical voltage ranges are 12, 24 and 40 Vdc. All performance diagrams in the Stepper Motor Linear Actuator brochure are generated with either 24 or 40 Vdc power supplies.

5. Technical specifications

5.1 Technical data

5.1.1 Actuator performance

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.

5.1.2 Actuator weight

Approximate actuator weight [oz]*				
Configuration	Stroke 0.5 in	Stroke 1.0 in	Stroke 1.5 in	Stroke 2.5 in
MLA08Axx	2.8	3.0	3.3	N/A
MLA11Axx	5.7	6.1	6.5	7.3
MLA14Axx	8.4	8.8	9.2	10.1
MLA17Axx	8.3	8.7	9.1	10.0
MLA17Bxx	13.1	13.5	13.9	14.8
MLA23Axx	25.2	26.2	27.2	29.2
MLA23Bxx	34.4	35.3	36.3	38.3

* Conversion factor for ounce to gram: 1 oz = 28.35 gram

5.2 Ordering Key

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			5. Linear travel/rev (lead in 0.001 inch) 0013 = 0.013 in 0024 = 0.024 in 0192 = 0.192 in 0025 = 0.025 in 0197 = 0.197 in 0031 = 0.031 in 0200 = 0.200 in 0036 = 0.036 in 0236 = 0.236 in 0039 = 0.039 in 0250 = 0.250 in 0040 = 0.040 in 0300 = 0.300 in 0042 = 0.042 in 0333 = 0.333 in 0047 = 0.047 in 0375 = 0.375 in 0050 = 0.050 in 0394 = 0.394 in 0063 = 0.063 in 0400 = 0.400 in 0079 = 0.079 in 0472 = 0.472 in 0083 = 0.083 in 0500 = 0.500 in 0100 = 0.100 in 0750 = 0.750 in 0118 = 0.118 in 0787 = 0.787 in 0125 = 0.125 in 0800 = 0.800 in 0157 = 0.157 in 1000 = 1.000 in 0167 = 0.167 in 1200 = 1.200 in 1378 = 1.378 in			8. End-mounting 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			
2. Motor size¹ 08 = NEMA 08 11 = NEMA 11 14 = NEMA 14 17 = NEMA 17 23 = NEMA 23			6. Precision grade S = standard 0.010 in/ft (250 µm/300 mm) P = precision 0.003 in/ft (125 µm/300 mm)			9. Nut S01 = For ML08 S02 = For ML1x S03 = For ML23			
3. Motor stack A = single B = double			7. Stroke length (in 0.01 inch) 0150 = 1.50 in stroke length (always in inch)			10. Custom designation (blank) = standard configuration 001-999 = custom configuration			
4. Motor current rating (in 0.1 A) 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									

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