

LSQ-EC Series User's Manual

High-speed motorized linear stages with built-in motor encoders and covers



Disclaimer

Zaber's devices are not intended for use in any critical medical, aviation, or military applications or situations where a product's use or failure could cause personal injury, death, or damage to property. Zaber disclaims any and all liability for injury or other damages resulting from the use of our products.

Precautions

Zaber's autodetect peripheral axes are designed to be used effortlessly with Zaber's line of autodetect controllers. The LSQ-EC includes onboard memory that allows Zaber's controllers to autodetect the model and set reasonable parameters. See the [Protocol Manual](#) for more information on how to modify the settings. Damage to the axis may result if the settings are not correct. To use your Zaber peripheral with a third-party controller, review the motor, sensor, and encoder specifications and pin-outs carefully.

Lubrication of Linear Guide

The LSQ-EC carriage is supported by an integrated recirculating ball bearing linear guide which requires lubrication in order to achieve the longest possible lifetime. At the rated load of the device, it is recommended to re-lubricate at a 500 km service interval. For applications in dirty environments or applications with extremely high duty cycles, more frequent inspection and lubrication is recommended. We recommend using 0.1 cm³ (1 mL) of a NLGI Grade 2, lithium soap based grease in each grease port. The grease ports are located on both ends of the carriage (see pictures below) and both sides of the belt. Simply inject about 0.1 cm³ of grease into each port. Cycle the stage through its travel several times and wipe off any excess grease from the rails. All guides come pre-lubricated and are ready to go out of the box. This grease is only intended for lubricating ball bearing guide, and is not suitable for use on any other locations on the stage.



SG133 relubrication kit



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LSQ linear guide relubricating ports. Located on both ends of the carriage



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Re-lubricating LSQ linear guide

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Noise Emissions

The A-weighted emission sound pressure level (SPL) of this device does not exceed 70 dB(A) during intended use.

Conventions used throughout this document

- Fixed width type indicates communication to and from a device. The ↵ symbol indicates a carriage return, which can be achieved by pressing enter when using a terminal program.
- An [ASCII command](#) followed by (T:xx) indicates a legacy T-Series [Binary Protocol](#) command that achieves the same result. For example, `move abs 10000 (T:20:10000)` shows that a move abs ASCII command can also be achieved with Binary command number 20. Not all ASCII commands have an equivalent Binary counterpart.

Device Overview

AutoDetect

Your LSQ-EC peripheral is equipped with AutoDetect, a feature that allows a Zaber controller to automatically configure its settings for the peripheral when it is connected.



Important: The controller should always be powered down before disconnecting or connecting your LSQ-EC peripheral.

To connect the peripheral to a controller:



1. Power off the controller.
2. Connect the LSQ-EC peripheral.
3. Power on the controller.
4. The controller will activate the peripheral shortly after it is powered on.

Connectors

Recommended controller(s) for your LSQ-EC peripheral are provided in the product specifications. Zaber's controllers and peripherals are designed for ease of use when used together. Optimal settings for each peripheral are automatically detected by Zaber's controllers when the device is connected.

For reference, the pinout for the peripheral cable connectors is shown below:

Pinout for D-sub 15 Connectors (peripherals)

T3A Peripheral (male)		
T4A Peripheral (male)		
Pin #	Function	
1	+5V for Limits & Encoder	
2	AutoDetect Data	
3	<i>reserved</i>	
4	Away Sensor	
5	Home Sensor	
6	Ground	
7	Motor B1	
8	Motor A1	
9	AutoDetect Clock	
10	Encoder A	
11	Encoder B	
12	Encoder Index	
13	Ground	
14	Motor B2	
15	Motor A2	

Not all pins are used for all models

Alternate Controllers

The LSQ-EC can be controlled by any 2-phase stepper motor controller with limit sensor and appropriate encoder input. **We do not recommend using your own controller unless you are familiar with how to control a stepper motor with hall sensor limit switches.** Damage to the stage due to incorrect wiring is not covered by warranty.

Motors & Encoders

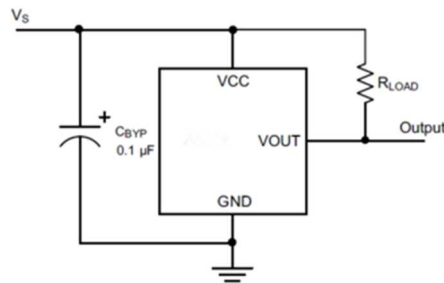
For motor and encoder information see the [LSQ-EC product page](#)

Limit Sensors

Hall effect sensors are used in the LSQ-EC as home sensors. The Hall sensors used are part number A1120LLHLT-T made by Allegro. [Click here for data sheet](#). Your controller should be configured so the stage stops immediately (quick deceleration) when the sensors are triggered.

- PCB wire colour code:
 - 3.6-24 Vdc input - red
 - Home signal - yellow
 - Away signal - white
 - Ground - black

The Hall sensor has an open-collector output. The default output is high impedance when the Hall sensor is not active. When the sensor detects a magnet, the Hall sensor pulls the output low to ground.

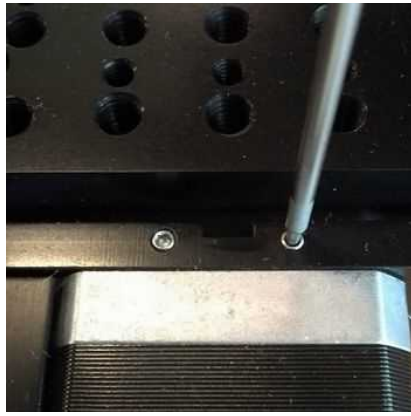


If you are not using a Zaber controller, ensure that your controller has a pull-up resistor on the output line of each Hall sensor as shown in the diagram. The bypass capacitor is optional, but may help to eliminate false triggering in noisy environments. The typical value for the pull-up resistor (R_{LOAD}) is 10 k Ω and for the bypass capacitor is 0.1 μ F to 1 μ F. The larger the capacitance, the better the noise filtering but the slower the response time.

Installation

Dust Cover Installation and Removal

The LSQ-EC stage comes with a removable dust cover. Temporary removal is required to access stage mounting holes and to re-lubricate the linear bearings.



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Loosen the two set screws on the motor end plate using a 1.5 mm hex key.



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Remove the two M3 screws on the end of the LSQ device.



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Slide the dust cover and spacer plate out from the end plate and through the carriage. The carriage top can remain in place or be removed.



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To reinstall the dust cover, simply slide the cover back into place and tighten the two M3 set screws on the motor end plate using a 1.5 mm hex key.

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Slide the spacer plate back under the end of the dust cover and align the M3 holes. Reinstall the two M3 screws using 2 mm hex key.



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If the stage top was removed, install the four M3 x 16 mm screws. Make sure the stage top edge is aligned to the carriage edge. Tighten screws to 1.3 Nm using a 2.5 mm hex key.

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Warranty and Repair

For Zaber's policies on warranty and repair, please refer to the [Ordering Policies](#).

Standard products

Standard products are any part numbers that do not contain the suffix ENG followed by a 4 digit number. Most, but not all, standard products are listed for sale on our website. All standard Zaber products are backed by a one-month satisfaction guarantee. If you are not satisfied with your purchase, we will refund your payment minus any shipping charges. Goods must be in brand new saleable condition with no marks. Zaber products are guaranteed for one year. During this period Zaber will repair any products with faults due to manufacturing defects, free of charge.

Custom products

Custom products are any part numbers containing the suffix ENG followed by a 4 digit number. Each of these products has been designed for a custom application for a particular customer. Custom products are guaranteed for one year, unless explicitly stated otherwise. During this period Zaber will repair any products with faults due to manufacturing defects, free of charge.

How to return products

Customers with devices in need of return or repair should contact Zaber to obtain an RMA form which must be filled out and sent back to us to receive an RMA number. The RMA form contains instructions for packing and returning the device. The specified RMA number must be included on the shipment to ensure timely processing.

Email Updates

If you would like to receive our periodic email newsletter including product updates and promotions, please sign up online at www.zaber.com ([news section](#)). Newsletters typically include a promotional offer worth at least \$100.

Contact Information

Contact Zaber Technologies Inc by any of the following methods:

Phone	1-604-569-3780 (direct) 1-888-276-8033 (toll free in North America)
Fax	1-604-648-8033
Mail	#2 – 605 West Kent Ave. N., Vancouver, British Columbia, Canada, V6P 6T7
Web	www.zaber.com
Email	Please visit our website for up to date email contact information.

The original instructions for this product are available at <https://www.zaber.com/manuals/LSQ-EC>.

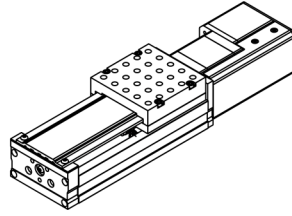
Appendix A: Default Settings

Please see [the Zaber Support Page](#) for default settings for this device.

Product Drawing

ZABER

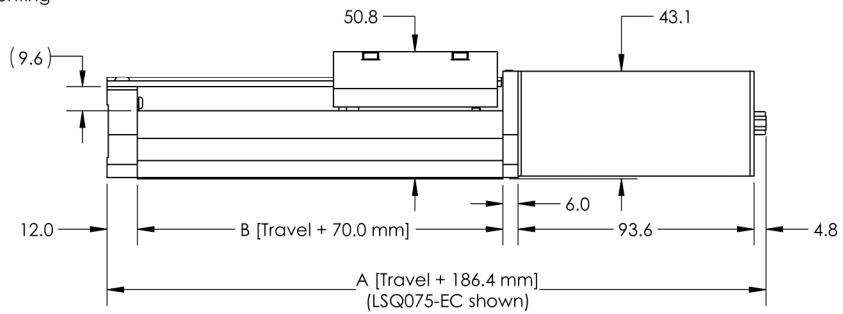
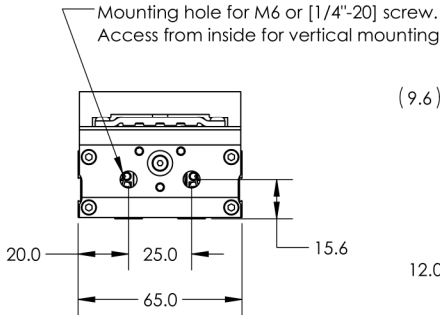
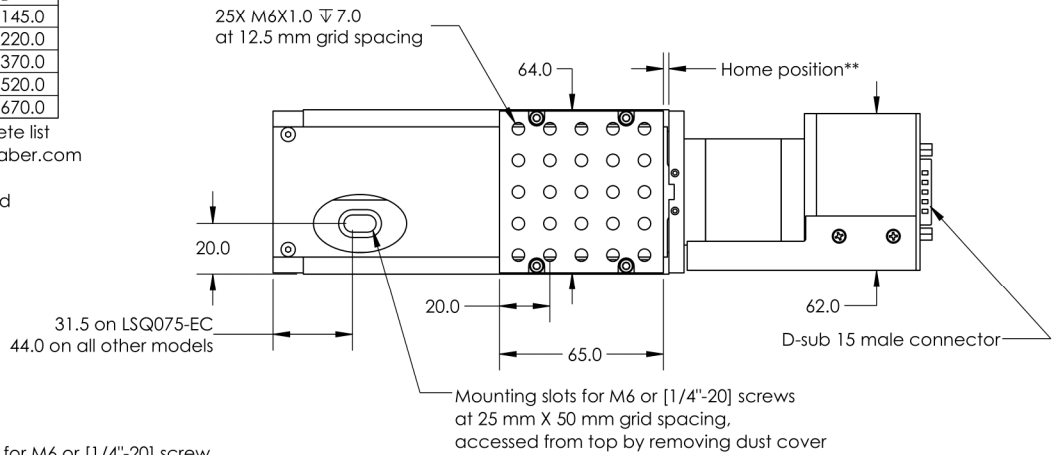
LSQ-EC Motorized Linear Stage
dimensions in mm



Model Number*	Travel	A	B
LSQ075-EC	75.0	261.4	145.0
LSQ150-EC	150.0	336.4	220.0
LSQ300-EC	300.0	486.4	370.0
LSQ450-EC	450.0	636.4	520.0
LSQ600-EC	600.0	786.4	670.0

*See product page for complete list of available models at www.zaber.com

**Home position based on lead screw pitch:
A - 2.0 +/- 0.4 mm
B - 2.2 +/- 0.4 mm
D - 2.8 +/- 0.4 mm



DWG 3243 R01

Specifications

Specification	Value	Alternate Unit
Built-in Controller	No	
Recommended Controller	X-MCC (48 V) Recommended	
AutoDetect	Yes	
Encoder Resolution	500 CPR	2000 states/rev
Encoder Type	Rotary quadrature encoder	
Maximum Centered Load	500 N	112.1 lb
Maximum Cantilever Load	2000 N · cm	2832.2 oz · in
Guide Type	Recirculating Ball Linear Guide	
Vertical Runout	< 30 μm	< 0.001181"
Pitch	0.06°	1.047 mrad
Roll	0.03°	0.523 mrad
Yaw	0.03°	0.523 mrad
Stiffness in Pitch	150 N · m/°	116 μrad/N · m
Stiffness in Roll	225 N · m/°	78 μrad/N · m
Stiffness in Yaw	150 N · m/°	116 μrad/N · m
Motor Steps Per Rev	200	
Motor Type	Stepper (2 phase)	
Motor Rated Current	2300 mA/phase	

Specification	Value	Alternate Unit
Inductance	2.2 mH/phase	
Motor Connection	D-sub 15	
Default Resolution	1/64 of a step	
Mechanical Drive System	Precision lead screw	
Limit or Home Sensing	Magnetic home sensor	
Axes of Motion	1	
Mounting Interface	M6 threaded holes	
Operating Temperature Range	0 to 50 ° C	
Vacuum Compatible	No	
RoHS Compliant	Yes	
Stage Parallelism	< 100 µm	< 0.003937"
CE Compliant	Yes	

Comparison

Part Number	Microstep Size (Default Resolution)	Travel Range	Accuracy (unidirectional)	Repeatability
LSQ075A-E01CT3A	0.09921875 µm	75 mm (2.953")	35 µm (0.001378")	< 2 µm (< 0.000079")
LSQ075B-E01CT3A	0.49609375 µm	75 mm (2.953")	45 µm (0.001772")	< 3 µm (< 0.000118")
LSQ075D-E01CT3A	1.984375 µm	75 mm (2.953")	80 µm (0.003150")	< 10 µm (< 0.000394")
LSQ150A-E01CT3A	0.09921875 µm	150 mm (5.905")	45 µm (0.001772")	< 2 µm (< 0.000079")
LSQ150B-E01CT3A	0.49609375 µm	150 mm (5.905")	50 µm (0.001968")	< 3 µm (< 0.000118")
LSQ150D-E01CT3A	1.984375 µm	150 mm (5.905")	100 µm (0.003937")	< 10 µm (< 0.000394")
LSQ300A-E01CT3A	0.09921875 µm	300 mm (11.811")	90 µm (0.003543")	< 2 µm (< 0.000079")
LSQ300B-E01CT3A	0.49609375 µm	300 mm (11.811")	65 µm (0.002559")	< 3 µm (< 0.000118")
LSQ300D-E01CT3A	1.984375 µm	300 mm (11.811")	145 µm (0.005709")	< 10 µm (< 0.000394")
LSQ450A-E01CT3A	0.09921875 µm	450 mm (17.716")	135 µm (0.005315")	< 2 µm (< 0.000079")
LSQ450B-E01CT3A	0.49609375 µm	450 mm (17.716")	75 µm (0.002953")	< 3 µm (< 0.000118")
LSQ450D-E01CT3A	1.984375 µm	450 mm (17.716")	185 µm (0.007283")	< 10 µm (< 0.000394")
LSQ600A-E01CT3A	0.09921875 µm	600 mm (23.622")	180 µm (0.007087")	< 2 µm (< 0.000079")
LSQ600B-E01CT3A	0.49609375 µm	600 mm (23.622")	100 µm (0.003937")	< 3 µm (< 0.000118")
LSQ600D-E01CT3A	1.984375 µm	600 mm (23.622")	230 µm (0.009055")	< 10 µm (< 0.000394")

Part Number	<u>Backlash</u>	<u>Maximum Speed</u>	<u>Minimum Speed</u>	<u>Speed Resolution</u>
LSQ075A-E01CT3A	< 15 μm (< 0.000591")	53 mm/s (2.087"/s)	0.000061 mm/s (0.000002"/s)	0.000061 mm/s (0.000002"/s)
LSQ075B-E01CT3A	< 18 μm (< 0.000709")	280 mm/s (11.024"/s)	0.000303 mm/s (0.000012"/s)	0.000303 mm/s (0.000012"/s)
LSQ075D-E01CT3A	< 75 μm (< 0.002953")	1000 mm/s (39.370"/s)	0.001212 mm/s (0.000048"/s)	0.001212 mm/s (0.000048"/s)
LSQ150A-E01CT3A	< 15 μm (< 0.000591")	53 mm/s (2.087"/s)	0.000061 mm/s (0.000002"/s)	0.000061 mm/s (0.000002"/s)
LSQ150B-E01CT3A	< 18 μm (< 0.000709")	280 mm/s (11.024"/s)	0.000303 mm/s (0.000012"/s)	0.000303 mm/s (0.000012"/s)
LSQ150D-E01CT3A	< 75 μm (< 0.002953")	1000 mm/s (39.370"/s)	0.001212 mm/s (0.000048"/s)	0.001212 mm/s (0.000048"/s)
LSQ300A-E01CT3A	< 15 μm (< 0.000591")	53 mm/s (2.087"/s)	0.000061 mm/s (0.000002"/s)	0.000061 mm/s (0.000002"/s)
LSQ300B-E01CT3A	< 18 μm (< 0.000709")	280 mm/s (11.024"/s)	0.000303 mm/s (0.000012"/s)	0.000303 mm/s (0.000012"/s)
LSQ300D-E01CT3A	< 75 μm (< 0.002953")	1000 mm/s (39.370"/s)	0.001212 mm/s (0.000048"/s)	0.001212 mm/s (0.000048"/s)
LSQ450A-E01CT3A	< 15 μm (< 0.000591")	53 mm/s (2.087"/s)	0.000061 mm/s (0.000002"/s)	0.000061 mm/s (0.000002"/s)
LSQ450B-E01CT3A	< 18 μm (< 0.000709")	280 mm/s (11.024"/s)	0.000303 mm/s (0.000012"/s)	0.000303 mm/s (0.000012"/s)
LSQ450D-E01CT3A	< 75 μm (< 0.002953")	1000 mm/s (39.370"/s)	0.001212 mm/s (0.000048"/s)	0.001212 mm/s (0.000048"/s)
LSQ600A-E01CT3A	< 15 μm (< 0.000591")	42 mm/s (1.654"/s)	0.000061 mm/s (0.000002"/s)	0.000061 mm/s (0.000002"/s)
LSQ600B-E01CT3A	< 18 μm (< 0.000709")	225 mm/s (8.858"/s)	0.000303 mm/s (0.000012"/s)	0.000303 mm/s (0.000012"/s)
LSQ600D-E01CT3A	< 75 μm (< 0.002953")	800 mm/s (31.496"/s)	0.001212 mm/s (0.000048"/s)	0.001212 mm/s (0.000048"/s)

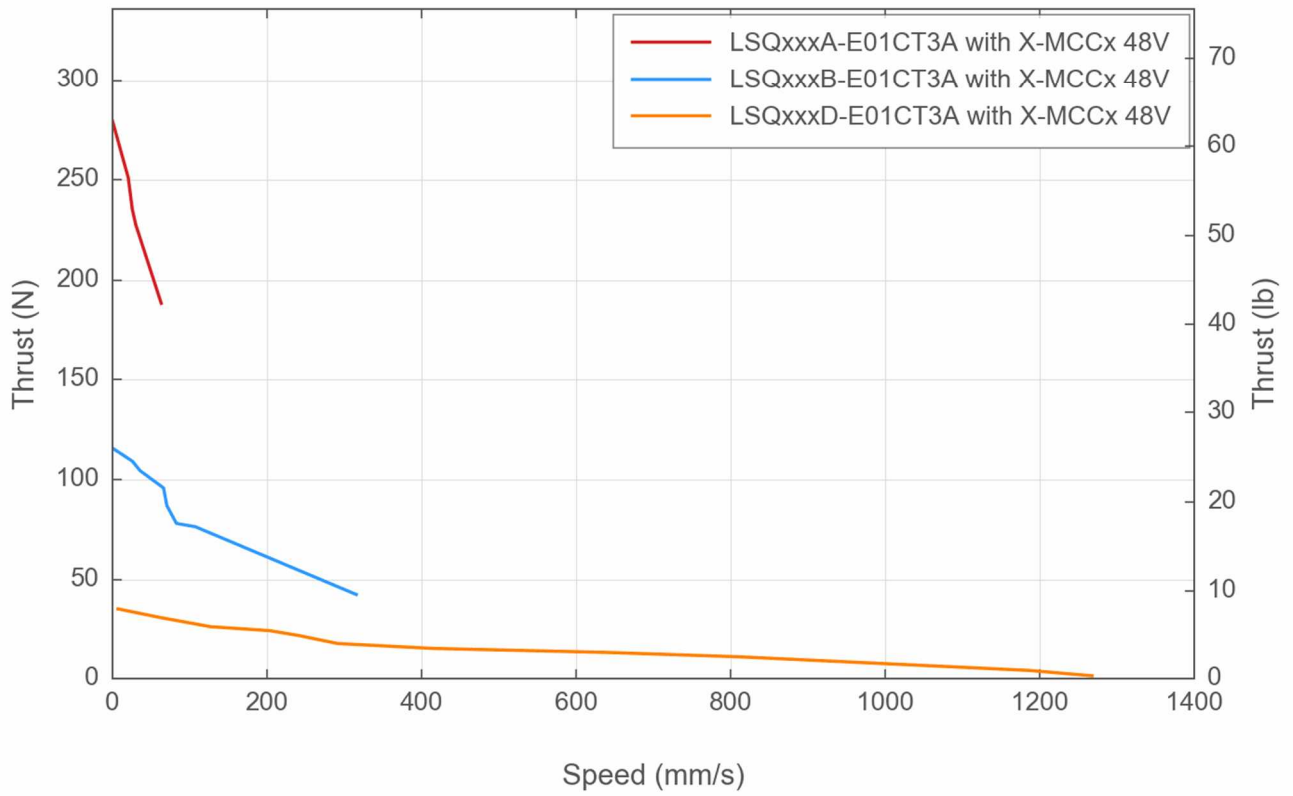
Part Number	<u>Peak Thrust</u>	<u>Back-driving Force</u>	<u>Maximum Continuous Thrust</u>	<u>Horizontal Runout</u>
LSQ075A-E01CT3A	275 N (61.7 lb)	Non-back-driving	100 N (22.4 lb)	< 20 μm (< 0.000787")
LSQ075B-E01CT3A	120 N (26.9 lb)	44 N (9.9 lb)	75 N (16.8 lb)	< 20 μm (< 0.000787")
LSQ075D-E01CT3A	35 N (7.8 lb)	12 N (2.7 lb)	18 N (4.0 lb)	< 20 μm (< 0.000787")
LSQ150A-E01CT3A	275 N (61.7 lb)	Non-back-driving	100 N (22.4 lb)	< 30 μm (< 0.001181")
LSQ150B-E01CT3A	120 N (26.9 lb)	44 N (9.9 lb)	75 N (16.8 lb)	< 30 μm (< 0.001181")
LSQ150D-E01CT3A	35 N (7.8 lb)	12 N (2.7 lb)	18 N (4.0 lb)	< 30 μm (< 0.001181")
LSQ300A-E01CT3A	275 N (61.7 lb)	Non-back-driving	100 N (22.4 lb)	< 35 μm (< 0.001378")

Part Number	<u>Peak Thrust</u>	<u>Back-driving Force</u>	<u>Maximum Continuous Thrust</u>	<u>Horizontal Runout</u>
LSQ300B-E01CT3A	120 N (26.9 lb)	44 N (9.9 lb)	75 N (16.8 lb)	< 35 μ m (< 0.001378")
LSQ300D-E01CT3A	35 N (7.8 lb)	12 N (2.7 lb)	18 N (4.0 lb)	< 35 μ m (< 0.001378")
LSQ450A-E01CT3A	275 N (61.7 lb)	Non-back-driving	100 N (22.4 lb)	< 40 μ m (< 0.001575")
LSQ450B-E01CT3A	120 N (26.9 lb)	44 N (9.9 lb)	75 N (16.8 lb)	< 40 μ m (< 0.001575")
LSQ450D-E01CT3A	35 N (7.8 lb)	12 N (2.7 lb)	18 N (4.0 lb)	< 40 μ m (< 0.001575")
LSQ600A-E01CT3A	275 N (61.7 lb)	Non-back-driving	100 N (22.4 lb)	< 60 μ m (< 0.002362")
LSQ600B-E01CT3A	120 N (26.9 lb)	44 N (9.9 lb)	75 N (16.8 lb)	< 60 μ m (< 0.002362")
LSQ600D-E01CT3A	35 N (7.8 lb)	12 N (2.7 lb)	18 N (4.0 lb)	< 60 μ m (< 0.002362")

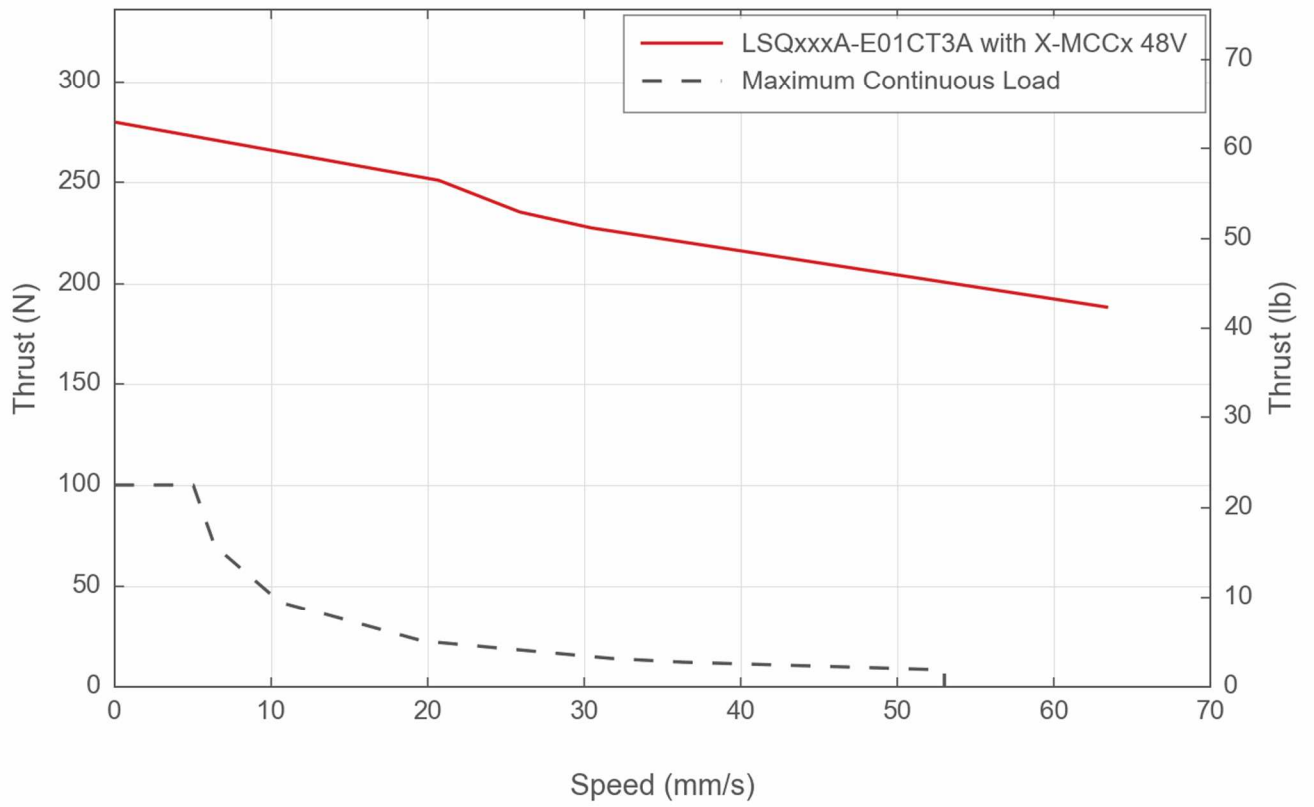
Part Number	<u>Linear Motion Per Motor Rev</u>	<u>Weight</u>
LSQ075A-E01CT3A	1.27 mm (0.050")	1.36 kg (2.998 lb)
LSQ075B-E01CT3A	6.35 mm (0.250")	1.36 kg (2.998 lb)
LSQ075D-E01CT3A	25.4 mm (1.000")	1.36 kg (2.998 lb)
LSQ150A-E01CT3A	1.27 mm (0.050")	1.6 kg (3.527 lb)
LSQ150B-E01CT3A	6.35 mm (0.250")	1.6 kg (3.527 lb)
LSQ150D-E01CT3A	25.4 mm (1.000")	1.6 kg (3.527 lb)
LSQ300A-E01CT3A	1.27 mm (0.050")	2.05 kg (4.519 lb)
LSQ300B-E01CT3A	6.35 mm (0.250")	2.05 kg (4.519 lb)
LSQ300D-E01CT3A	25.4 mm (1.000")	2.05 kg (4.519 lb)
LSQ450A-E01CT3A	1.27 mm (0.050")	2.6 kg (5.732 lb)
LSQ450B-E01CT3A	6.35 mm (0.250")	2.6 kg (5.732 lb)
LSQ450D-E01CT3A	25.4 mm (1.000")	2.6 kg (5.732 lb)
LSQ600A-E01CT3A	1.27 mm (0.050")	3.25 kg (7.165 lb)
LSQ600B-E01CT3A	6.35 mm (0.250")	3.25 kg (7.165 lb)
LSQ600D-E01CT3A	25.4 mm (1.000")	3.25 kg (7.165 lb)

Charts and Notes

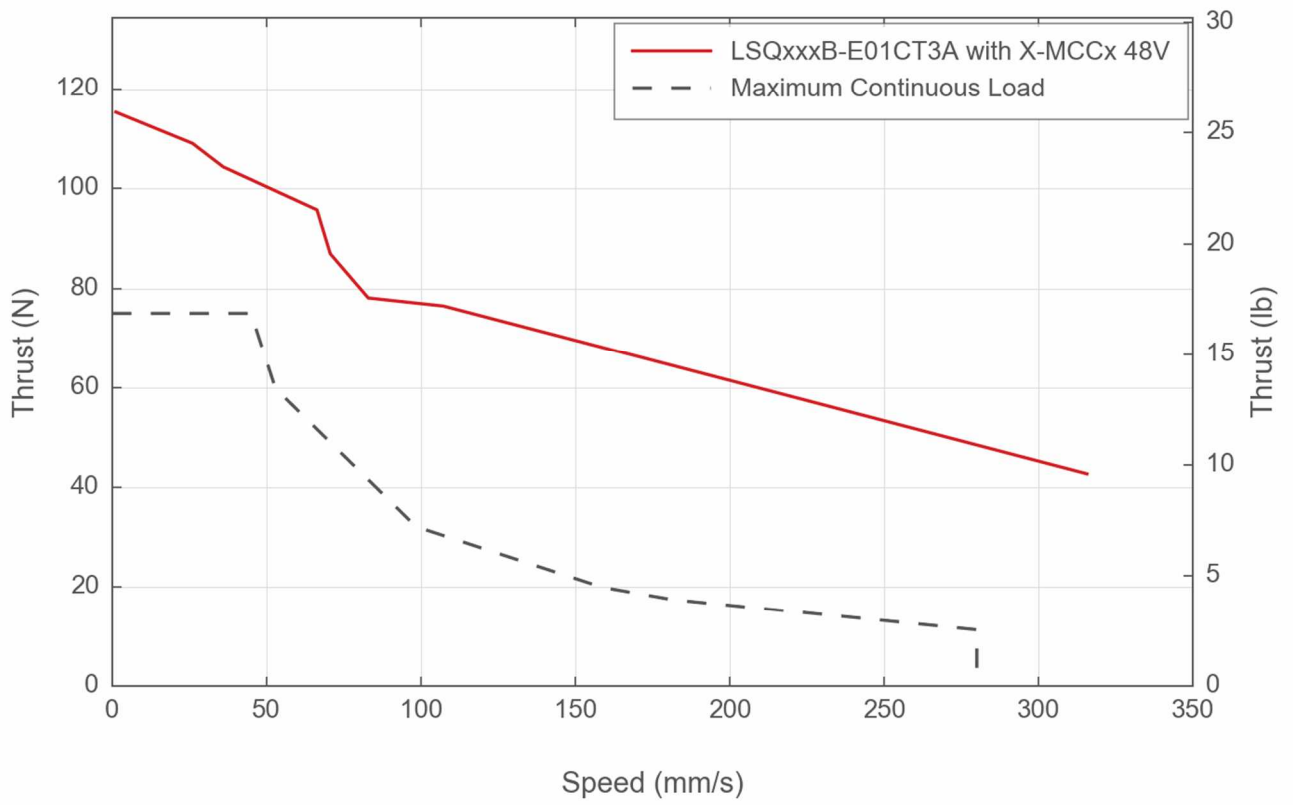
Thrust Speed Performance



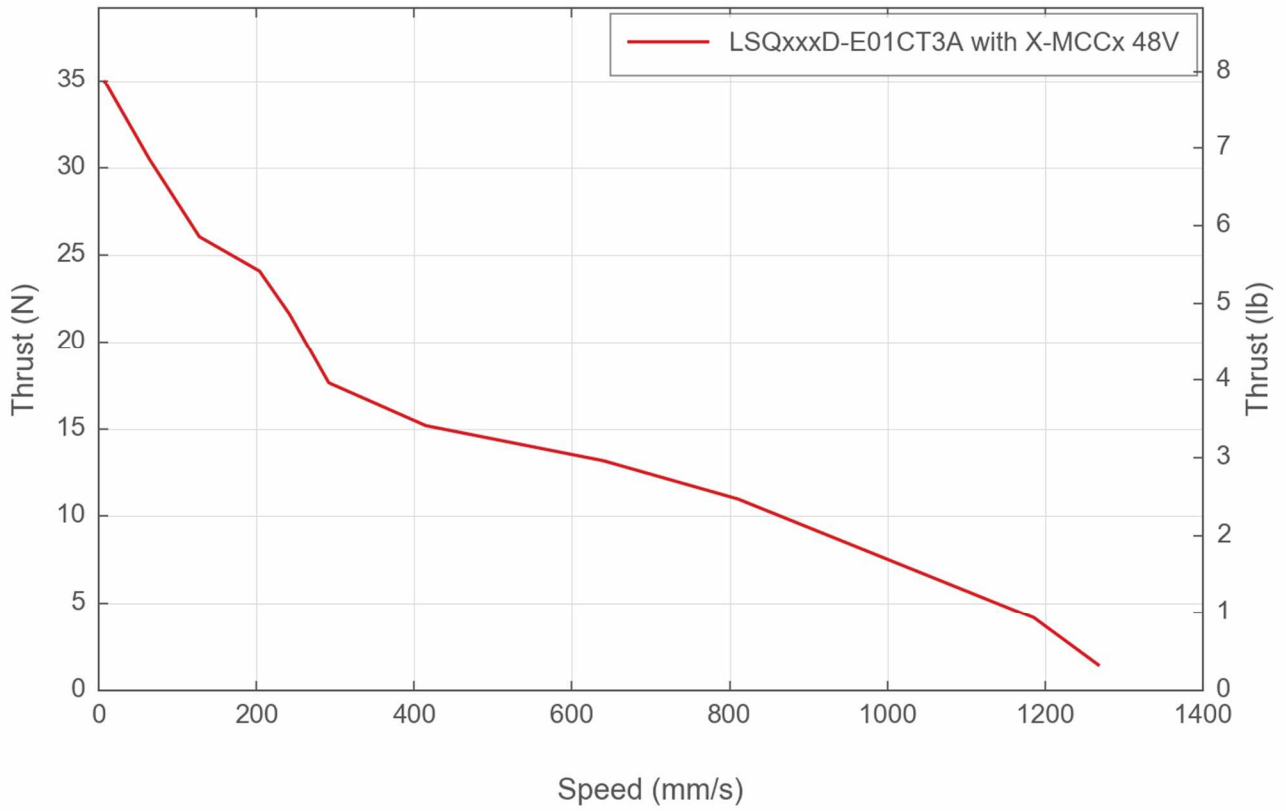
Thrust Speed Performance



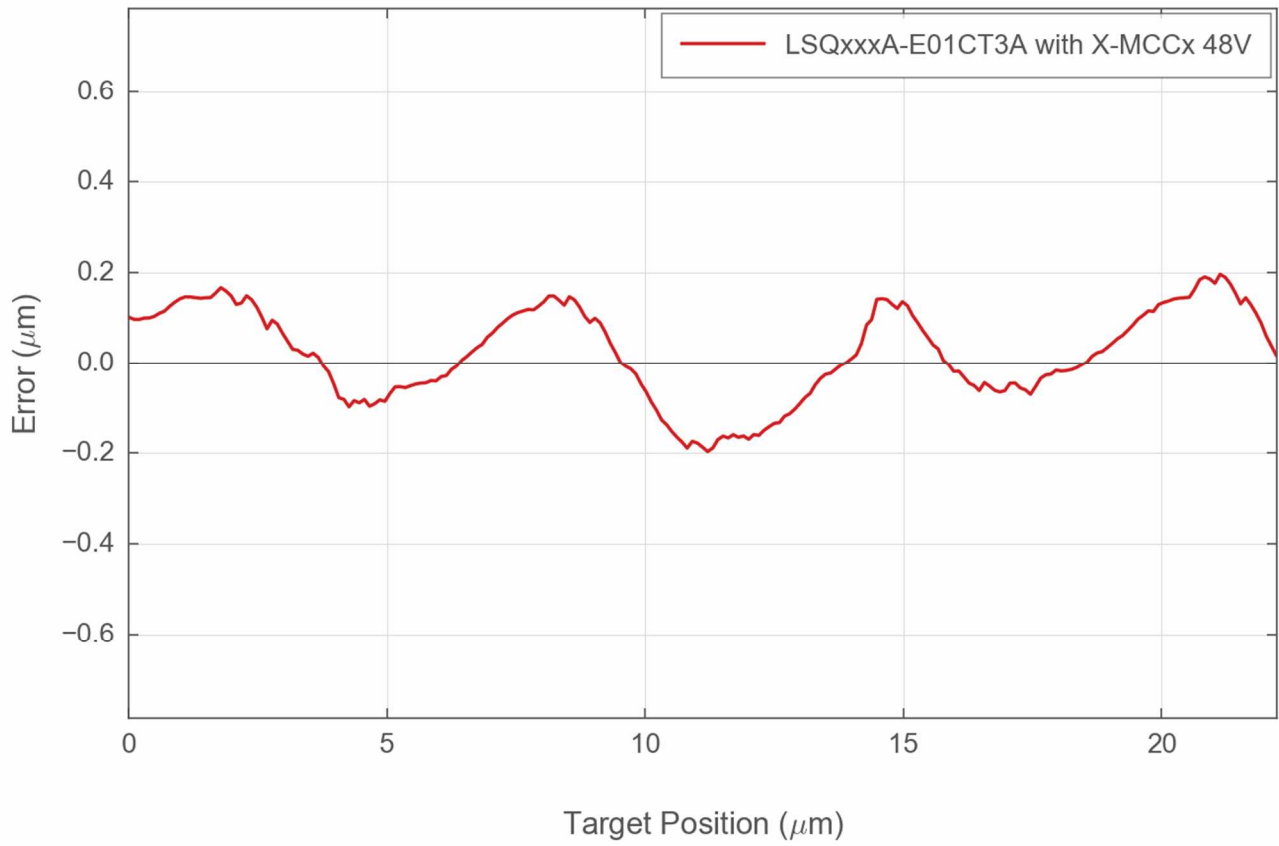
Thrust Speed Performance



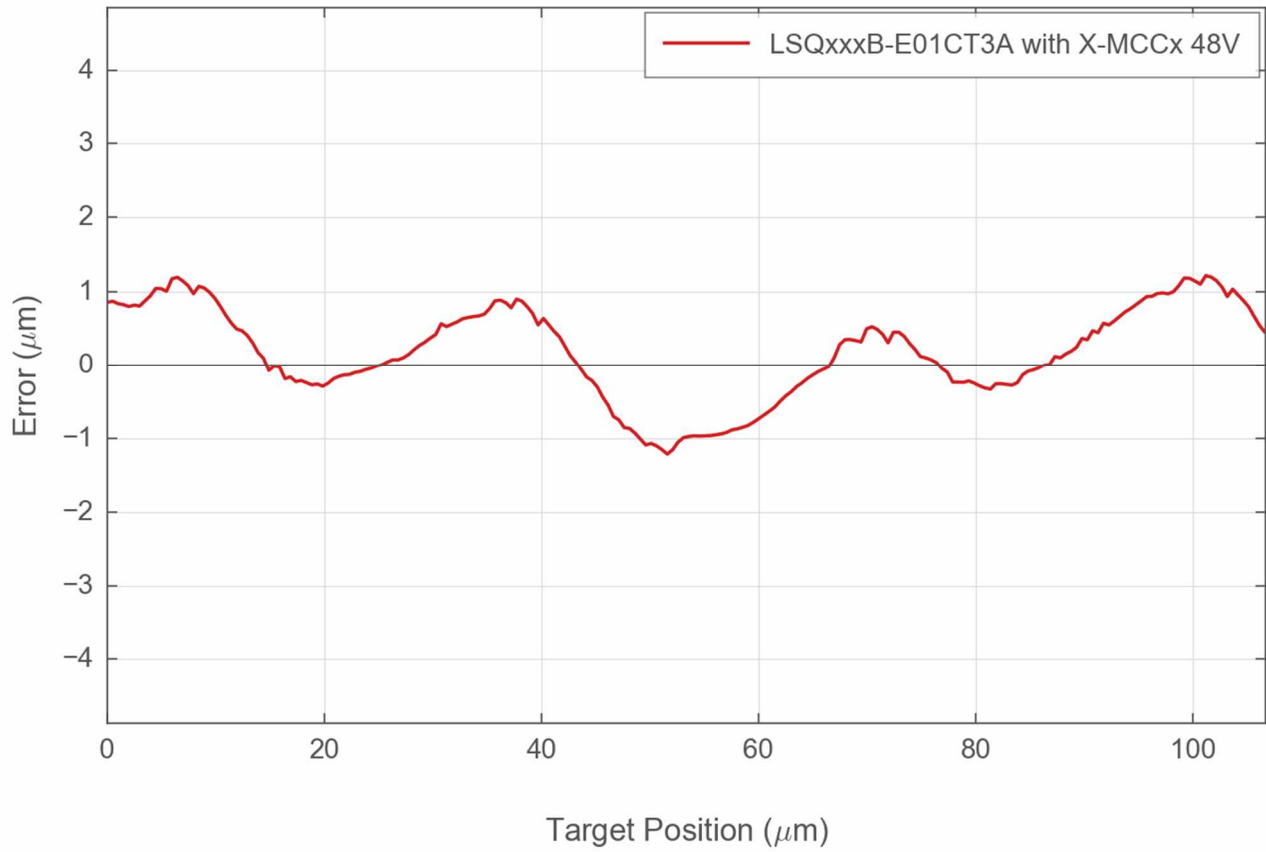
Thrust Speed Performance



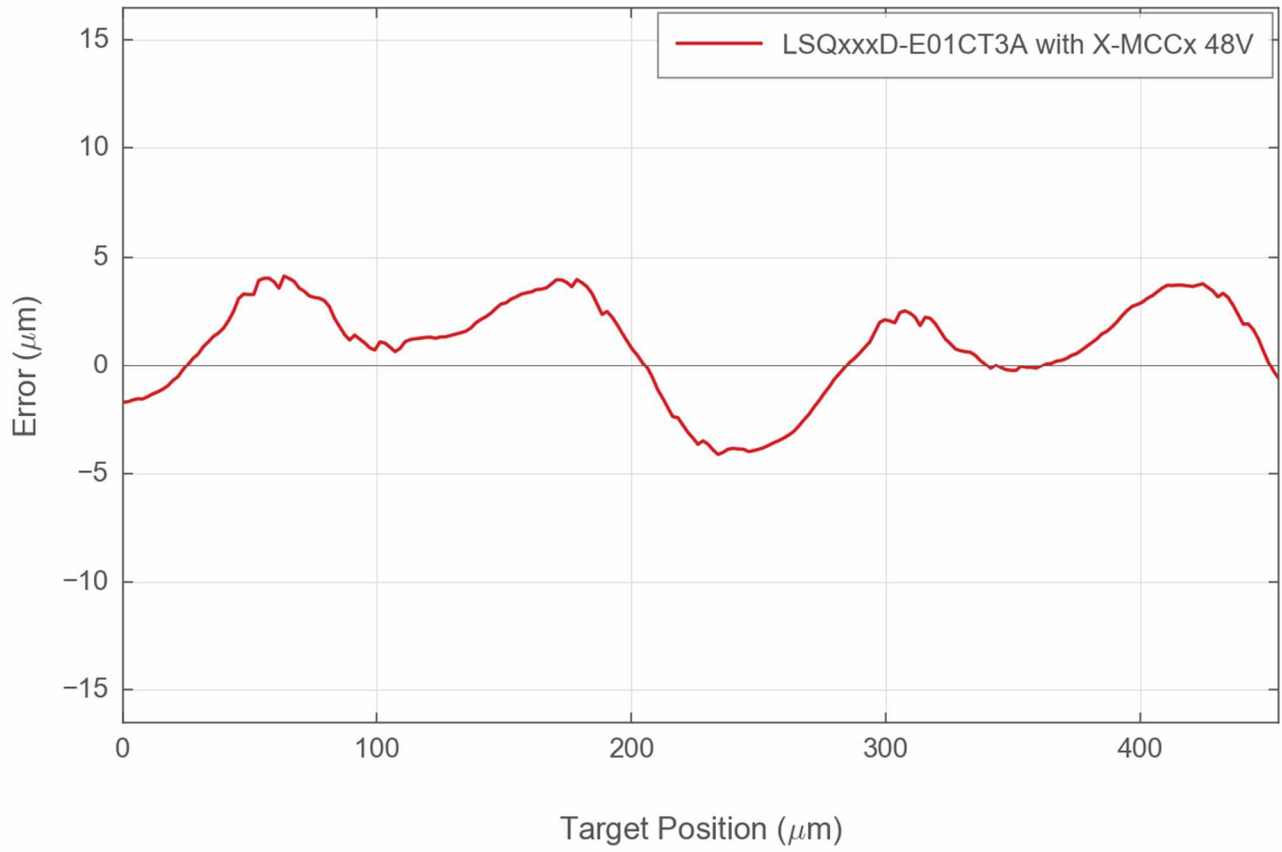
Typical Microstepping Accuracy



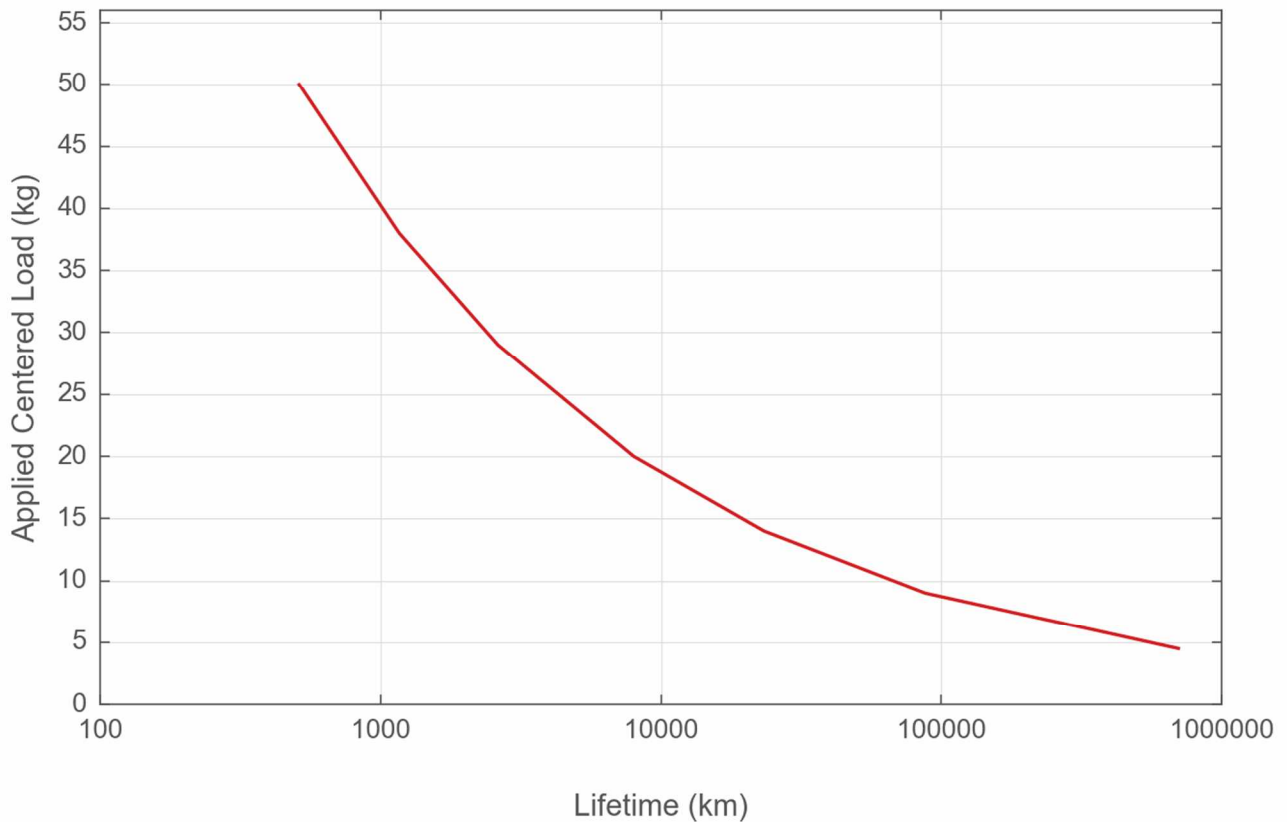
Typical Microstepping Accuracy



Typical Microstepping Accuracy



LSQ Linear Bearing Lifetime



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