LSQ Series User's Manual

High-speed motorized linear stages

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 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.

Zaber’s motion control devices are precision instruments and must be handled with care. In particular, moving parts must be treated with care. Avoid axial loads in excess of the rated thrust load, axial and radial impact, dust and other contaminants and damage to the lead screw thread. These will reduce the performance of the device below stated specifications.

Lubrication of Linear Guide

The {{{Device}}} 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 cm^3 (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 cm^3 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.

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  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 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 peripheral.

To connect the peripheral to a controller:

1. Power off the controller.
2. Connect the LSQ 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 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	*reserved*
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 can be controlled by any 2-phase stepper motor controller with limit sensor 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

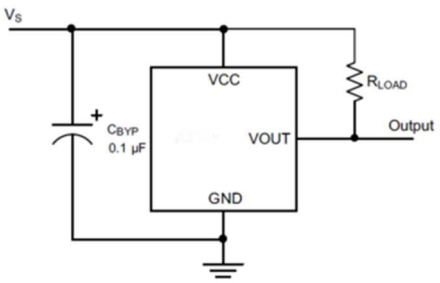
For motor information see the LSQ product page

Limit Sensors

Hall effect sensors are used in the LSQ 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 kΩ and for the bypass capacitor is 0.1 uF to 1 uF. The larger the capacitance, the better the noise filtering but the slower the response time.

Installation

Physical Installation

Mounting

There are several options available for mounting Zaber stages. Use the mounting holes in the bottom to mount to a surface or to another stage. You might have to move the carriage to access the bottom mounting holes. Some stages have mounting holes in the end plates for mounting vertically. Mounting screws are included with most stages.

Caution: Some stages have threaded through-holes in the top mounting plate of the carriage. Be sure not to install mounting screws too deep, causing them to interfere with inside parts of the stage.

Grounding

To prevent damage to the device due to static buildup, the device should be properly grounded.

Failure to ground the unit may result in the unit shutting down unexpectedly or ceasing to communicate with the computer. This problem can be minimized by not touching the unit during operation. If the unit fails due to static discharge, unplugging it and plugging it back in or sending a Restore Settings command will usually fix the problem.

Most Zaber devices are grounded via the shield wire of the data cables. This should normally provide a path to ground via the computer. For units which are being used without a computer, a ground lead should be connected to the shield of one of the data cables.

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.

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

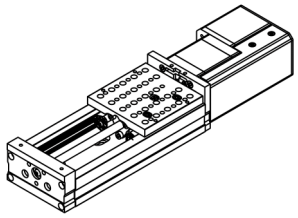
Appendix A: Default Settings

Please see the Zaber Support Page for default settings for this device.

Product Drawing

ZABER

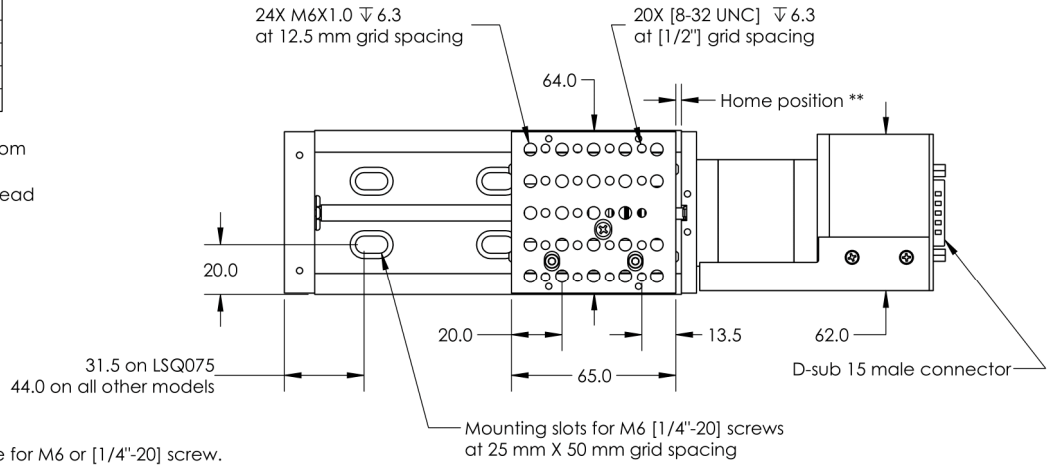
LSQ Motorized Linear Stage
dimensions in mm

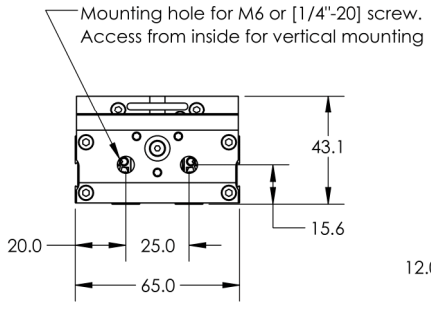


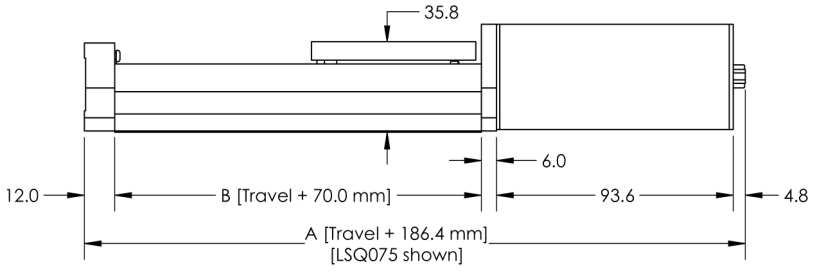
Model Number*	Travel	A	B
LSQ075	75.0	261.4	145.0
LSQ150	150.0	336.4	220.0
LSQ300	300.0	486.4	370.0
LSQ450	450.0	636.4	520.0
LSQ600	600.0	786.4	670.0

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

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







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Specifications

Specification	Value	Alternate Unit
Built-in Controller	No	
Recommended Controller	X-MCC (48 V) Recommended	
AutoDetect	Yes	
Encoder Type	None	
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	
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 and 8-32 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-T3A	0.09921875 µm	75 mm (2.953″)	35 µm (0.001378″)	< 2 µm (< 0.000079″)
LSQ075B-T3A	0.49609375 µm	75 mm (2.953″)	45 µm (0.001772″)	< 3 µm (< 0.000118″)
LSQ075D-T3A	1.984375 µm	75 mm (2.953″)	80 µm (0.003150″)	< 10 µm (< 0.000394″)
LSQ150A-T3A	0.09921875 µm	150 mm (5.905″)	45 µm (0.001772″)	< 2 µm (< 0.000079″)
LSQ150B-T3A	0.49609375 µm	150 mm (5.905″)	50 µm (0.001968″)	< 3 µm (< 0.000118″)

Part Number	Microstep Size (Default Resolution)	Travel Range	Accuracy (unidirectional)	Repeatability
LSQ150D-T3A	1.984375 µm	150 mm (5.905″)	100 µm (0.003937″)	< 10 µm (< 0.000394″)
LSQ300A-T3A	0.09921875 µm	300 mm (11.811″)	90 µm (0.003543″)	< 2 µm (< 0.000079″)
LSQ300B-T3A	0.49609375 µm	300 mm (11.811″)	65 µm (0.002559″)	< 3 µm (< 0.000118″)
LSQ300D-T3A	1.984375 µm	300 mm (11.811″)	145 µm (0.005709″)	< 10 µm (< 0.000394″)
LSQ450A-T3A	0.09921875 µm	450 mm (17.716″)	135 µm (0.005315″)	< 2 µm (< 0.000079″)
LSQ450B-T3A	0.49609375 µm	450 mm (17.716″)	75 µm (0.002953″)	< 3 µm (< 0.000118″)
LSQ450D-T3A	1.984375 µm	450 mm (17.716″)	185 µm (0.007283″)	< 10 µm (< 0.000394″)
LSQ600A-T3A	0.09921875 µm	600 mm (23.622″)	180 µm (0.007087″)	< 2 µm (< 0.000079″)
LSQ600B-T3A	0.49609375 µm	600 mm (23.622″)	100 µm (0.003937″)	< 3 µm (< 0.000118″)
LSQ600D-T3A	1.984375 µm	600 mm (23.622″)	230 µm (0.009055″)	< 10 µm (< 0.000394″)

Part Number	Backlash	Maximum Speed	Minimum Speed	Speed Resolution
LSQ075A-T3A	< 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-T3A	< 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-T3A	< 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-T3A	< 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-T3A	< 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-T3A	< 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-T3A	< 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-T3A	< 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-T3A	< 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-T3A	< 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-T3A	< 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-T3A	< 75 µm (< 0.002953″)	1000 mm/s (39.370″/s)	0.001212 mm/s (0.000048″/s)	0.001212 mm/s (0.000048″/s)

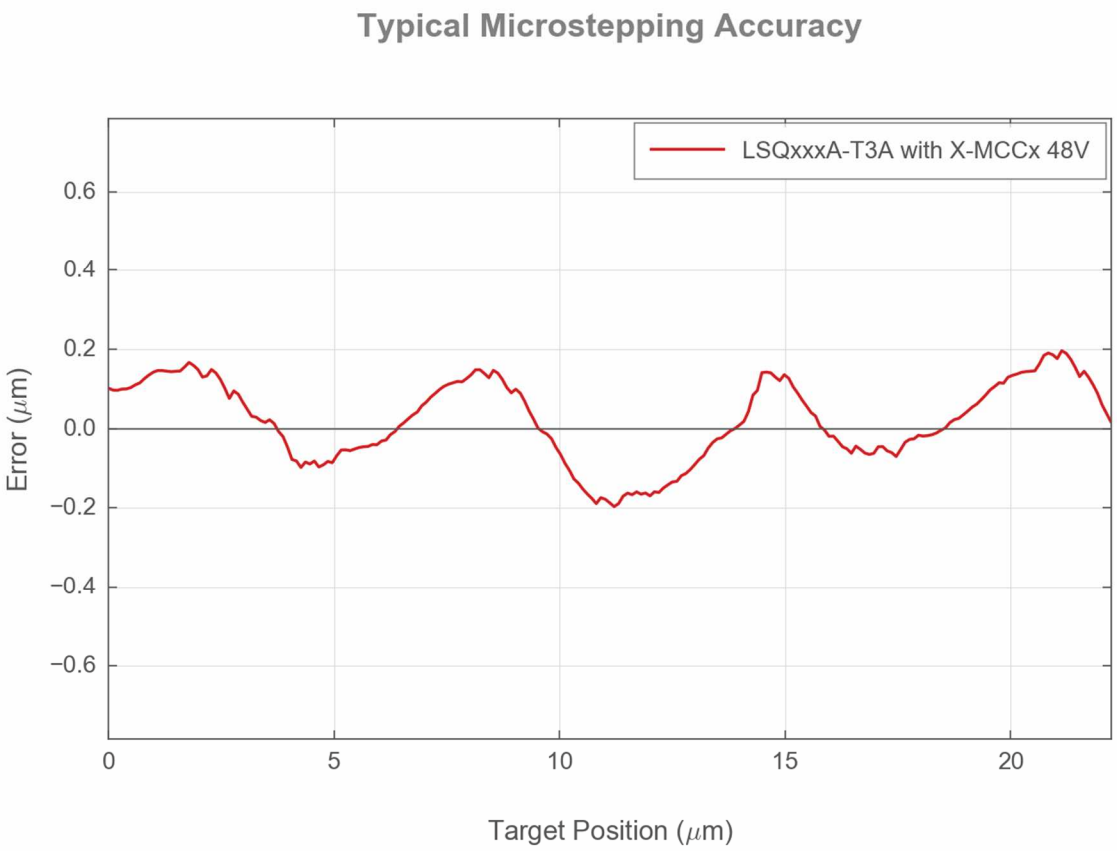
Part Number	Backlash	Maximum Speed	Minimum Speed	Speed Resolution
LSQ600A-T3A	< 15 µm (< 0.000591″)	42 mm/s (1.654″/s)	0.000061 mm/s (0.000002″/s)	0.000061 mm/s (0.000002″/s)
LSQ600B-T3A	< 18 µm (< 0.000709″)	225 mm/s (8.858″/s)	0.000303 mm/s (0.000012″/s)	0.000303 mm/s (0.000012″/s)
LSQ600D-T3A	< 75 µm (< 0.002953″)	800 mm/s (31.496″/s)	0.001212 mm/s (0.000048″/s)	0.001212 mm/s (0.000048″/s)

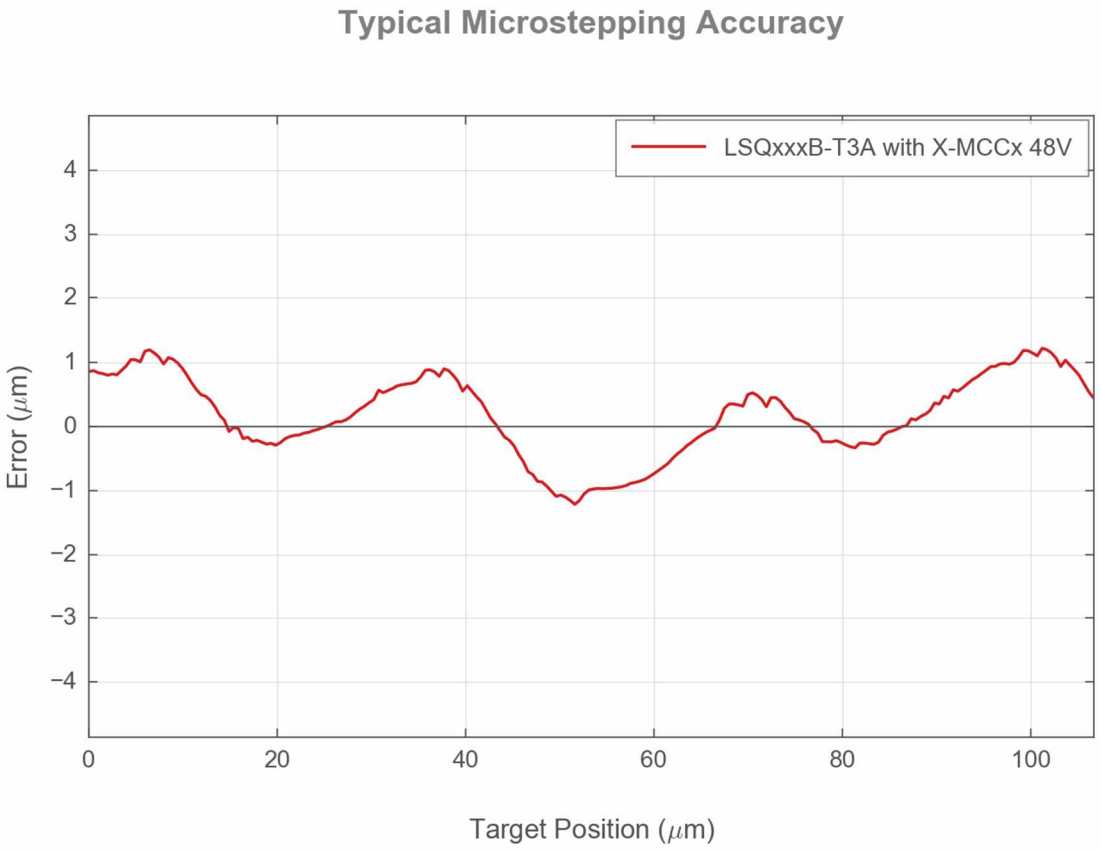
Part Number	Peak Thrust	Back-driving Force	Maximum Continuous Thrust	Horizontal Runout
LSQ075A-T3A	275 N (61.7 lb)	Non-back-driving	100 N (22.4 lb)	< 20 µm (< 0.000787″)
LSQ075B-T3A	120 N (26.9 lb)	44 N (9.9 lb)	75 N (16.8 lb)	< 20 µm (< 0.000787″)
LSQ075D-T3A	35 N (7.8 lb)	12 N (2.7 lb)	18 N (4.0 lb)	< 20 µm (< 0.000787″)
LSQ150A-T3A	275 N (61.7 lb)	Non-back-driving	100 N (22.4 lb)	< 30 µm (< 0.001181″)
LSQ150B-T3A	120 N (26.9 lb)	44 N (9.9 lb)	75 N (16.8 lb)	< 30 µm (< 0.001181″)
LSQ150D-T3A	35 N (7.8 lb)	12 N (2.7 lb)	18 N (4.0 lb)	< 30 µm (< 0.001181″)
LSQ300A-T3A	275 N (61.7 lb)	Non-back-driving	100 N (22.4 lb)	< 35 µm (< 0.001378″)
LSQ300B-T3A	120 N (26.9 lb)	44 N (9.9 lb)	75 N (16.8 lb)	< 35 µm (< 0.001378″)
LSQ300D-T3A	35 N (7.8 lb)	12 N (2.7 lb)	18 N (4.0 lb)	< 35 µm (< 0.001378″)
LSQ450A-T3A	275 N (61.7 lb)	Non-back-driving	100 N (22.4 lb)	< 40 µm (< 0.001575″)
LSQ450B-T3A	120 N (26.9 lb)	44 N (9.9 lb)	75 N (16.8 lb)	< 40 µm (< 0.001575″)
LSQ450D-T3A	35 N (7.8 lb)	12 N (2.7 lb)	18 N (4.0 lb)	< 40 µm (< 0.001575″)
LSQ600A-T3A	275 N (61.7 lb)	Non-back-driving	100 N (22.4 lb)	< 60 µm (< 0.002362″)
LSQ600B-T3A	120 N (26.9 lb)	44 N (9.9 lb)	75 N (16.8 lb)	< 60 µm (< 0.002362″)
LSQ600D-T3A	35 N (7.8 lb)	12 N (2.7 lb)	18 N (4.0 lb)	< 60 µm (< 0.002362″)

Part Number	Linear Motion Per Motor Rev	Weight
LSQ075A-T3A	1.27 mm (0.050″)	1.20 kg (2.646 lb)
LSQ075B-T3A	6.35 mm (0.250″)	1.20 kg (2.646 lb)
LSQ075D-T3A	25.4 mm (1.000″)	1.20 kg (2.646 lb)
LSQ150A-T3A	1.27 mm (0.050″)	1.40 kg (3.086 lb)
LSQ150B-T3A	6.35 mm (0.250″)	1.40 kg (3.086 lb)
LSQ150D-T3A	25.4 mm (1.000″)	1.40 kg (3.086 lb)
LSQ300A-T3A	1.27 mm (0.050″)	1.80 kg (3.968 lb)
LSQ300B-T3A	6.35 mm (0.250″)	1.80 kg (3.968 lb)

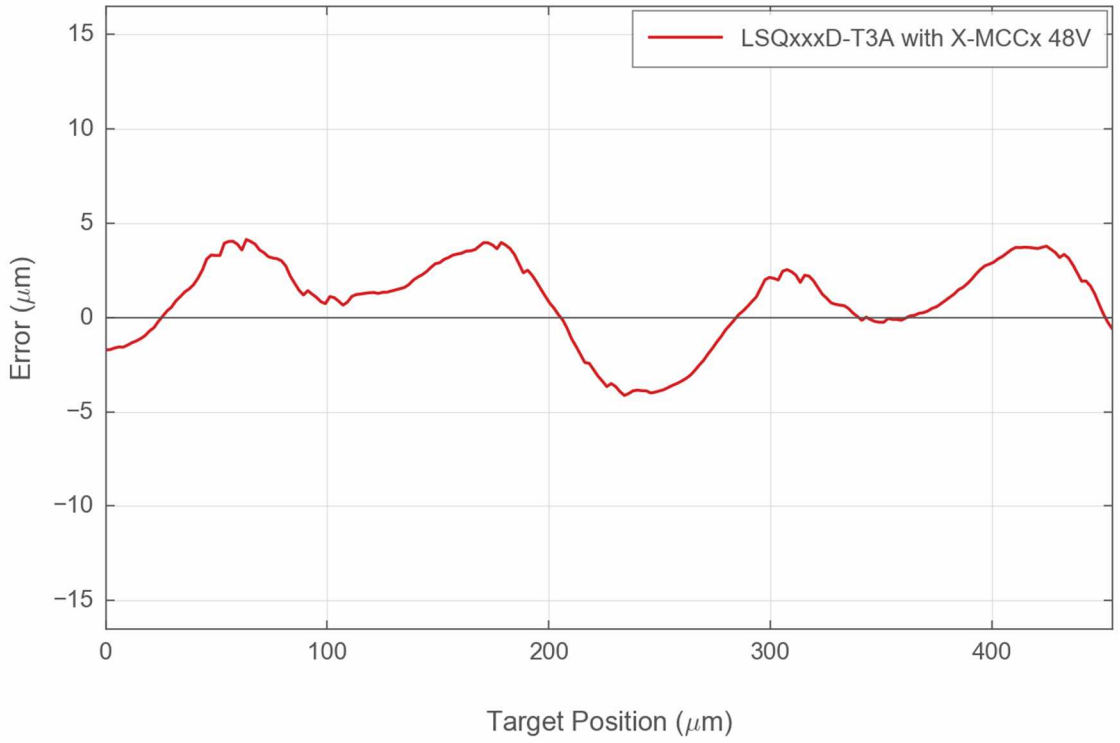
Part Number	Linear Motion Per Motor Rev	Weight
LSQ300D-T3A	25.4 mm (1.000″)	1.80 kg (3.968 lb)
LSQ450A-T3A	1.27 mm (0.050″)	2.30 kg (5.071 lb)
LSQ450B-T3A	6.35 mm (0.250″)	2.30 kg (5.071 lb)
LSQ450D-T3A	25.4 mm (1.000″)	2.30 kg (5.071 lb)
LSQ600A-T3A	1.27 mm (0.050″)	2.9 kg (6.393 lb)
LSQ600B-T3A	6.35 mm (0.250″)	2.9 kg (6.393 lb)
LSQ600D-T3A	25.4 mm (1.000″)	2.9 kg (6.393 lb)

Charts and Notes

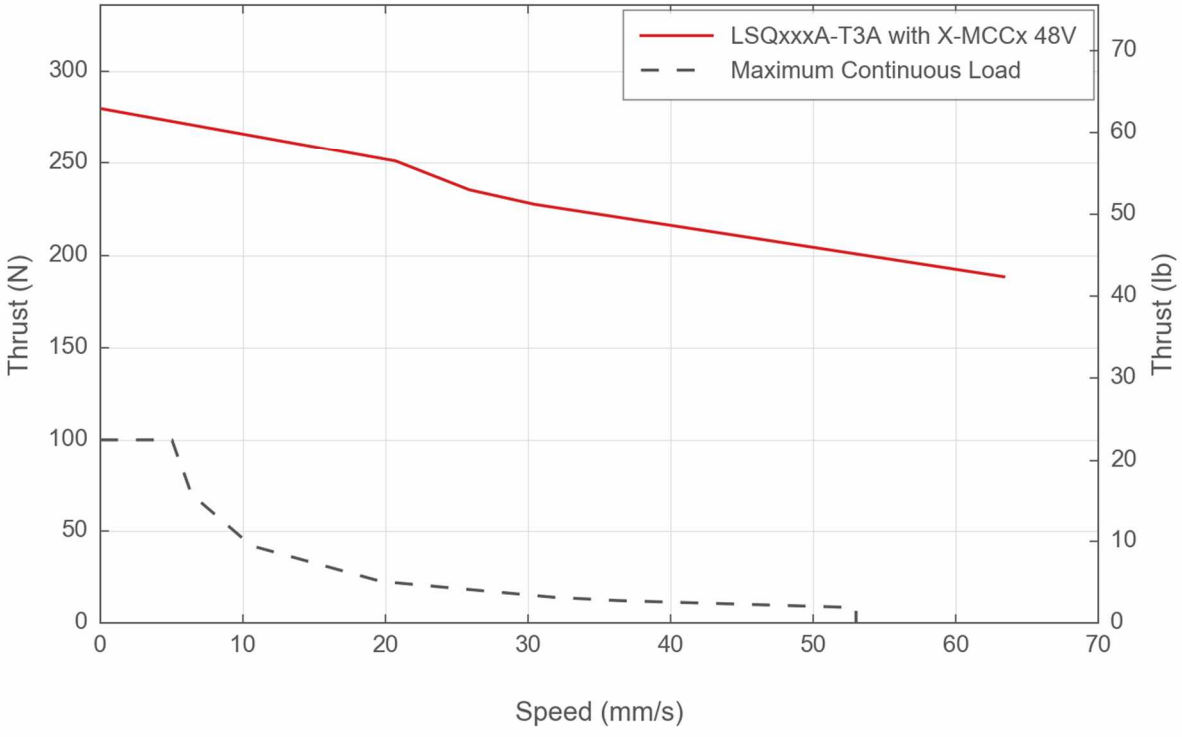




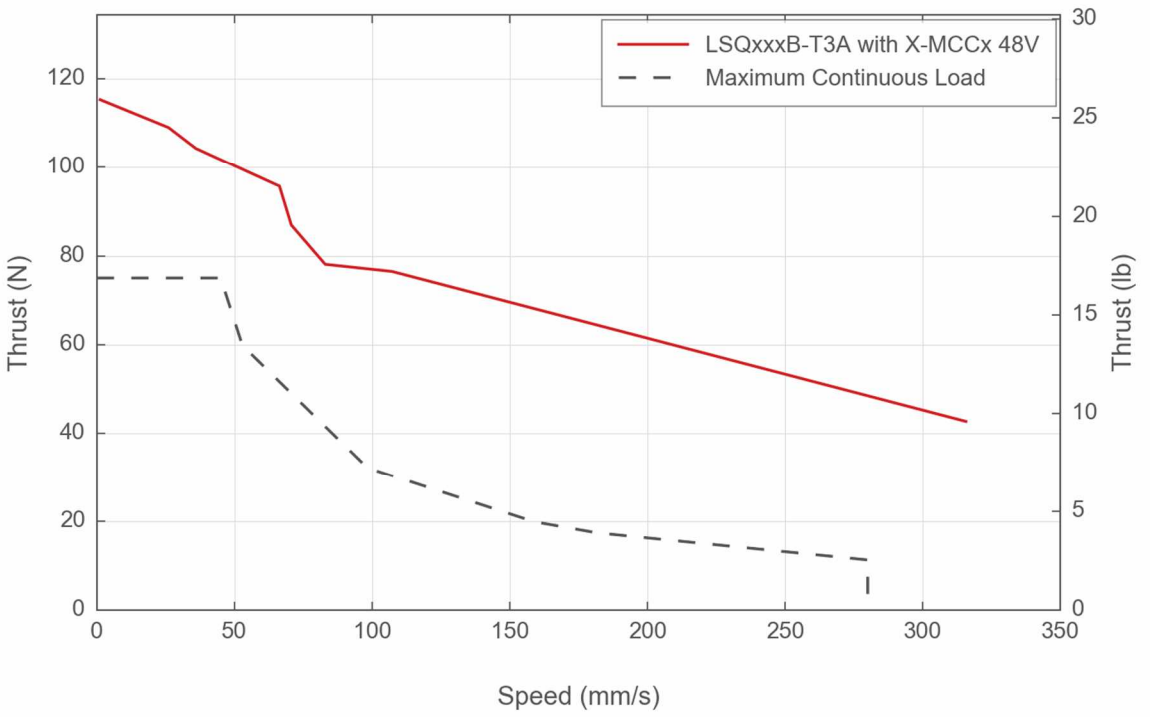
Typical Microstepping Accuracy



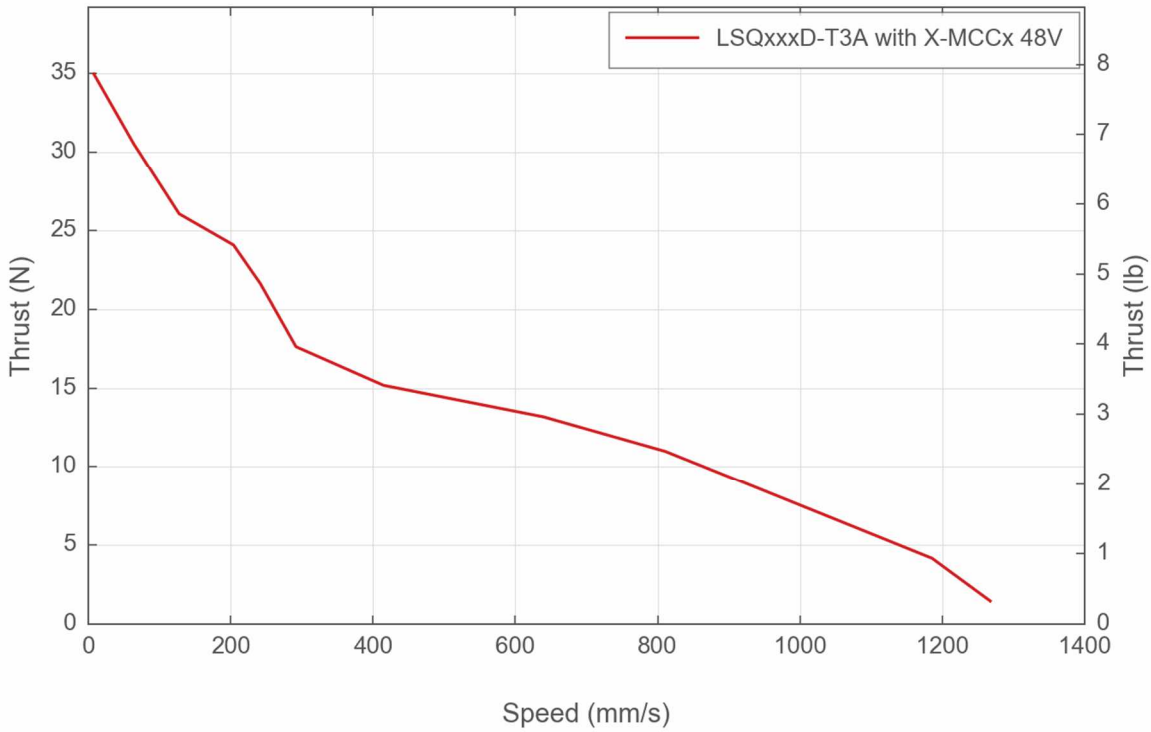
Thrust Speed Performance

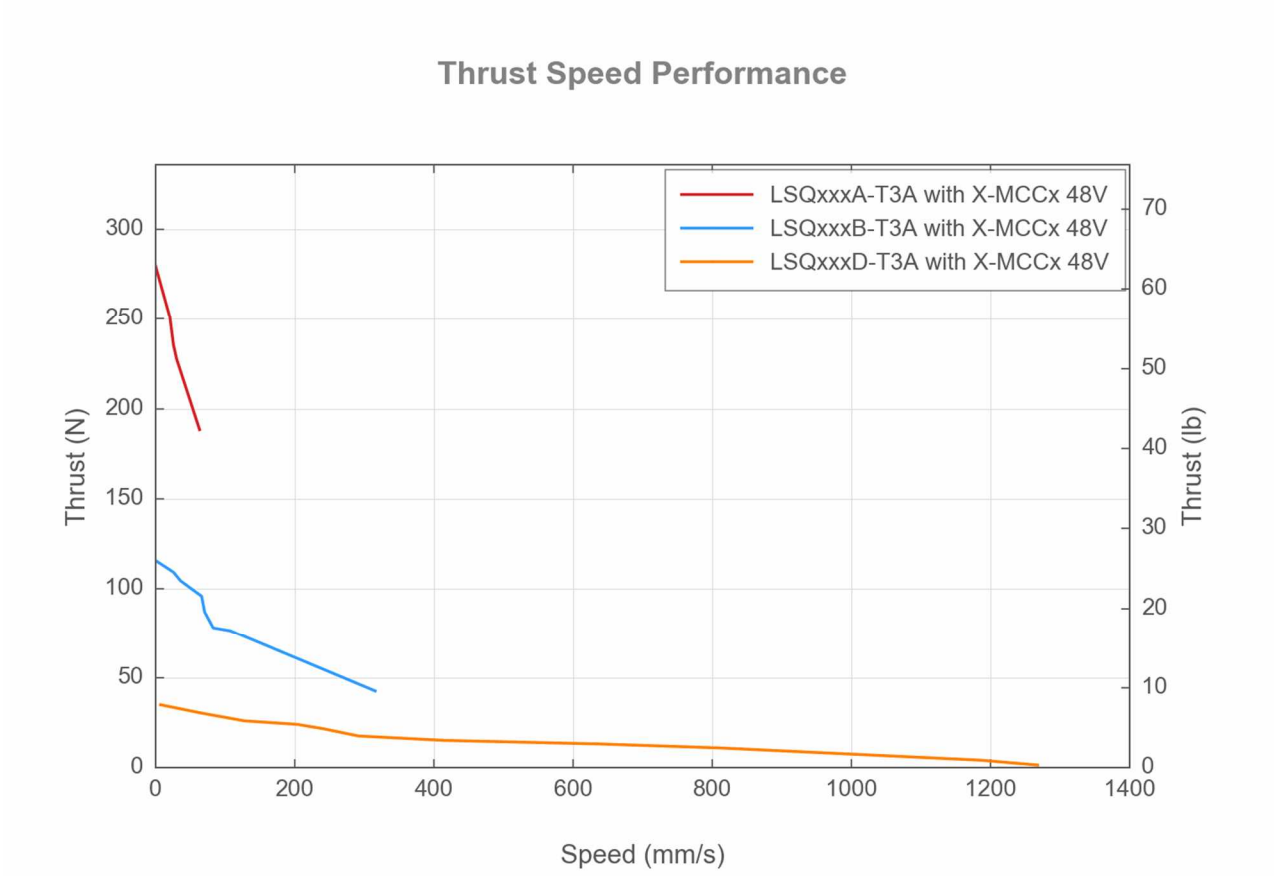


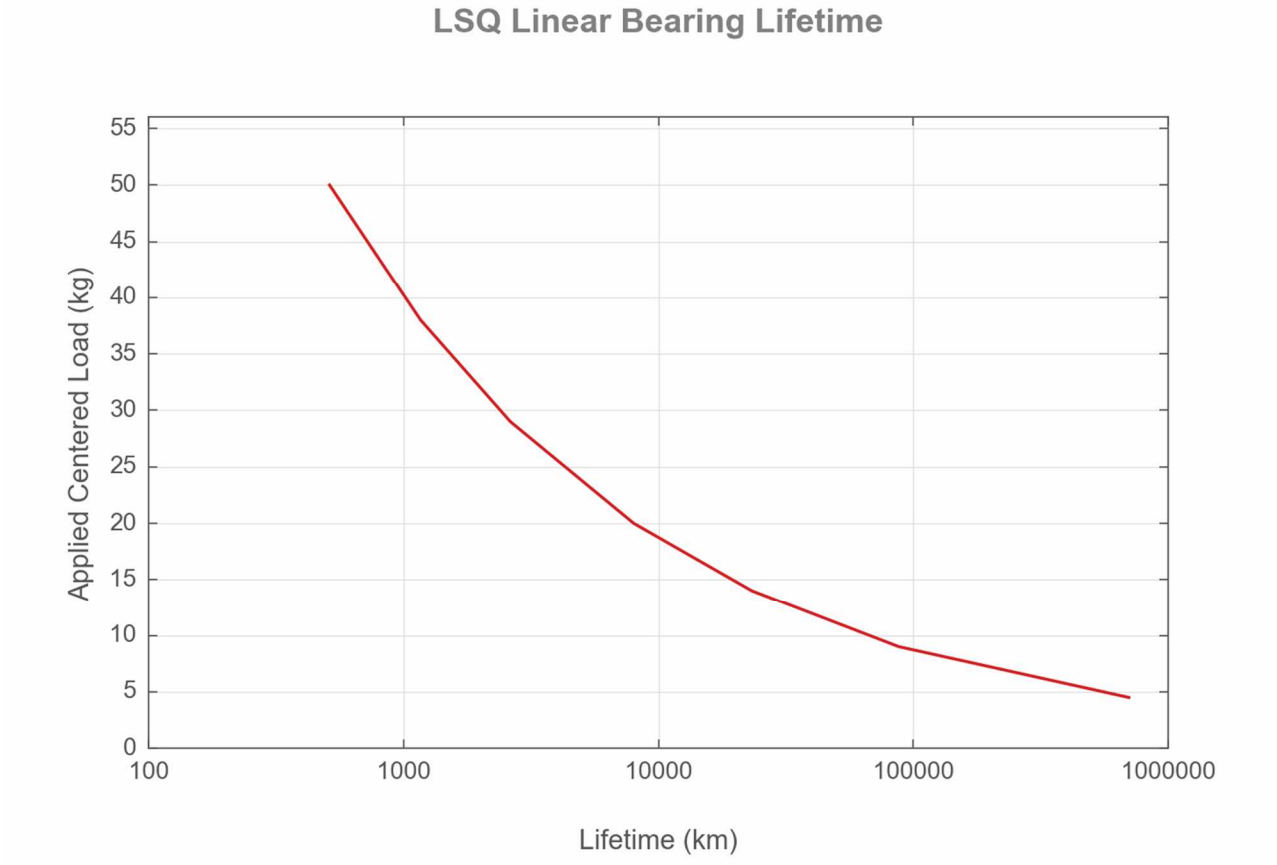
Thrust Speed Performance



Thrust Speed Performance







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