LSM Series User's Manual

Miniature 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 LSM 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.

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 LSM 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 LSM peripheral.

To connect the peripheral to a controller:

1. Power off the controller.
2. Connect the LSM 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 LSM 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 LSM 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

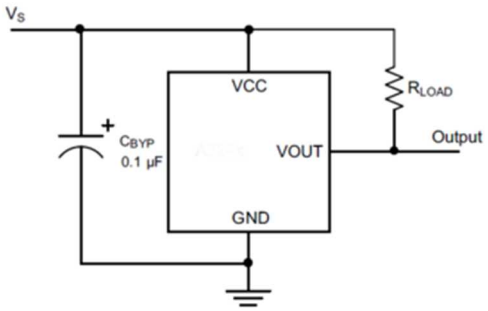
For motor information see the LSM product page

Limit Sensors

Hall effect sensors are used in the LSM 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

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.

LSM stages can be mounted to a standard metric or imperial breadboard with our AP101 adaptor plates.

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:

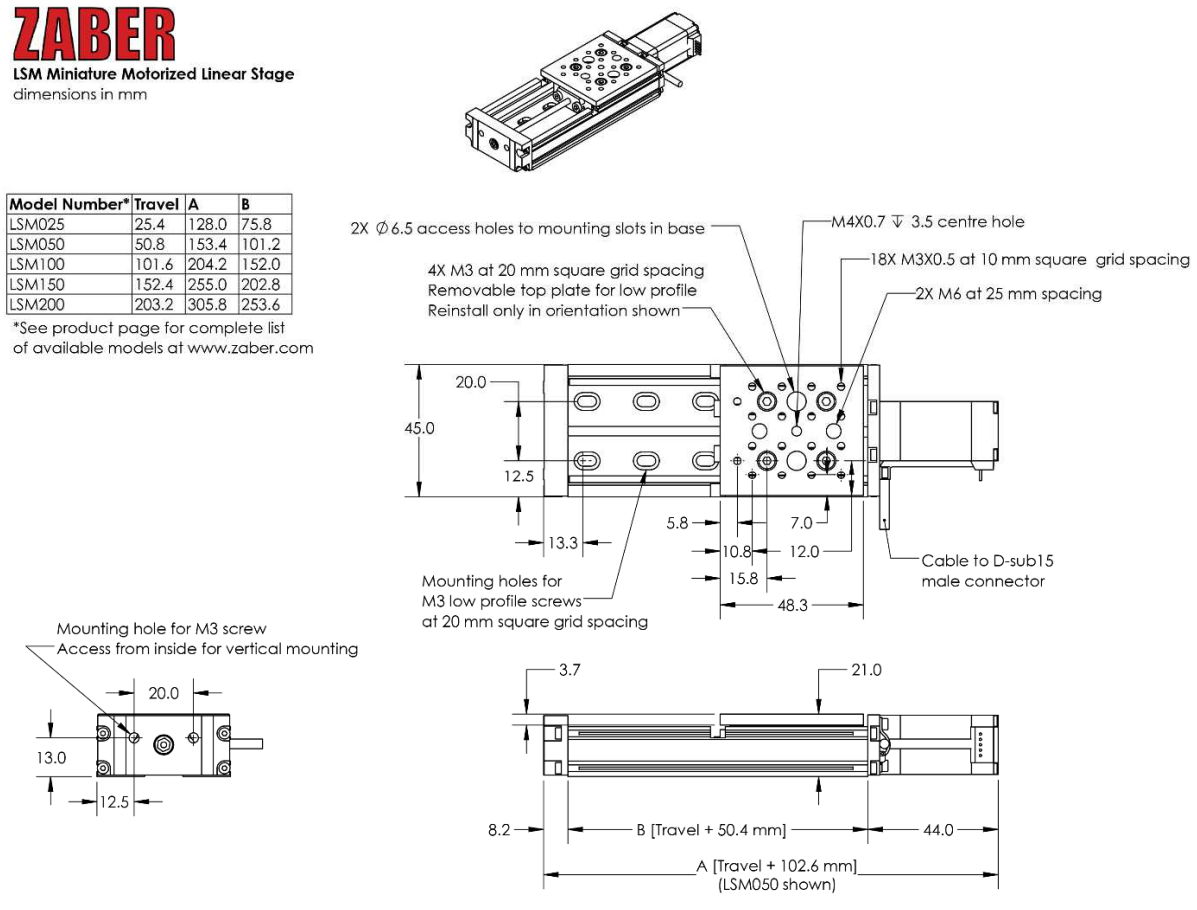
Phone	1-604-569-3780 (direct) 1-888-276-8033 (toll free in North America)
Fax	1-604-648-8033
Mail	#2 - 605 West Kent Ave. N., Vancouver, British Columbia, Canada, V6P 6T7
Web	www.zaber.com
Email	Please visit our website for up to date email contact information.

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

Appendix A: Default Settings

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

Product Drawing



Specifications

Specification	Value	Alternate Unit
Built-in Controller	No	
Recommended Controller	X-MCC (48 V) Recommended	
AutoDetect	Yes	
Encoder Type	None	
Maximum Continuous Thrust	25 N	5.6 lb
Maximum Centered Load	100 N	22.4 lb
Maximum Cantilever Load	300 N·cm	424.8 oz·in
Guide Type	Needle roller bearing	
Stiffness in Pitch	55 N·m/°	317 µrad/N·m
Stiffness in Roll	52.5 N·m/°	332 µrad/N·m
Stiffness in Yaw	85 N·m/°	205 µrad/N·m
Motor Steps Per Rev	200	
Motor Type	Stepper (2 phase)	
Motor Rated Current	600 mA/phase	
Motor Winding Resistance	6.5 ohms/phase	
Inductance	3.5 mH/phase	
Motor Rated Power	6.9 Watts	
Motor Rotor Inertia	2.9 g·cm²	
Motor Connection	D-sub 15	
Default Resolution	1/64 of a step	
Motor Frame Size	NEMA 08	
Mechanical Drive System	Precision lead screw	
Limit or Home Sensing	Magnetic hall sensor	
Axes of Motion	1	
Mounting Interface	M3 and M6 threaded holes and M4 threaded center hole	
Operating Temperature Range	0 to 50 ° C	
Vacuum Compatible	No	
RoHS Compliant	Yes	
Stage Parallelism	< 25 µm	< 0.000984″
CE Compliant	Yes	

Comparison

Part Number	Microstep Size (Default Resolution)	Travel Range	Accuracy (unidirectional)	Repeatability
LSM025A-T4A	0.047625 µm	25.4 mm (1.000″)	15 µm (0.000591″)	< 3 µm (< 0.000118″)
LSM025B-T4A	0.1905 µm	25.4 mm (1.000″)	15 µm (0.000591″)	< 6 µm (< 0.000236″)
LSM050A-T4A	0.047625 µm	50.8 mm (2.000″)	20 µm (0.000787″)	< 3 µm (< 0.000118″)
LSM050B-T4A	0.1905 µm	50.8 mm (2.000″)	25 µm (0.000984″)	< 6 µm (< 0.000236″)
LSM100A-T4A	0.047625 µm	101.6 mm (4.000″)	35 µm (0.001378″)	< 3 µm (< 0.000118″)

Part Number	Microstep Size (Default Resolution)	Travel Range	Accuracy (unidirectional)	Repeatability
LSM100B-T4A	0.1905 µm	101.6 mm (4.000″)	45 µm (0.001772″)	< 6 µm (< 0.000236″)
LSM150A-T4A	0.047625 µm	152.4 mm (6.000″)	50 µm (0.001968″)	< 3 µm (< 0.000118″)
LSM150B-T4A	0.1905 µm	152.4 mm (6.000″)	65 µm (0.002559″)	< 6 µm (< 0.000236″)
LSM200A-T4A	0.047625 µm	203.2 mm (8.000″)	60 µm (0.002362″)	< 3 µm (< 0.000118″)
LSM200B-T4A	0.1905 µm	203.2 mm (8.000″)	85 µm (0.003346″)	< 6 µm (< 0.000236″)

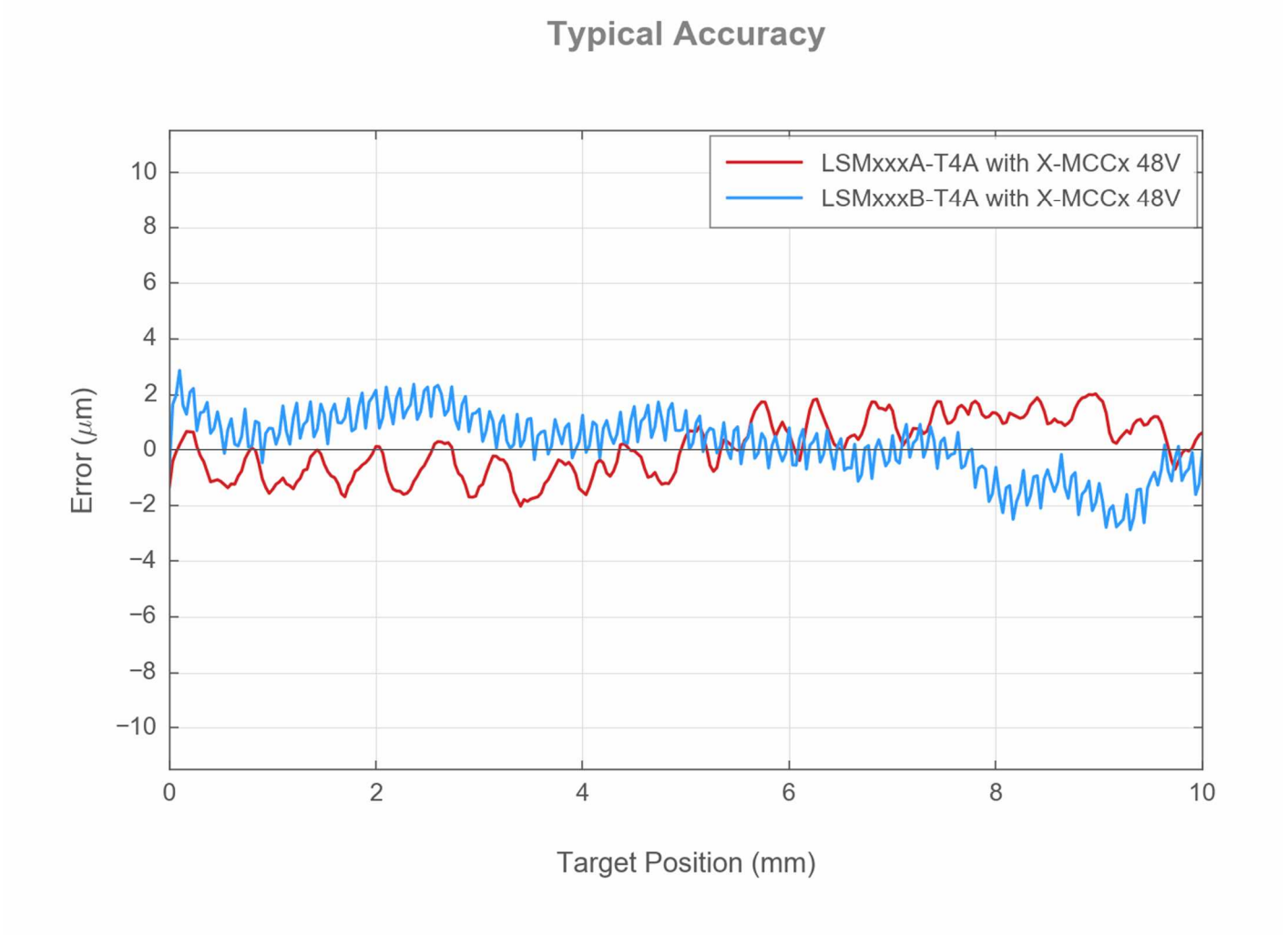
Part Number	Backlash	Maximum Speed	Minimum Speed	Speed Resolution
LSM025A-T4A	< 12 µm (< 0.000472″)	26 mm/s (1.024″/s)	0.000029 mm/s (0.000001″/s)	0.000029 mm/s (0.000001″/s)
LSM025B-T4A	< 16 µm (< 0.000630″)	104 mm/s (4.094″/s)	0.000116 mm/s (0.000005″/s)	0.000116 mm/s (0.000005″/s)
LSM050A-T4A	< 12 µm (< 0.000472″)	26 mm/s (1.024″/s)	0.000029 mm/s (0.000001″/s)	0.000029 mm/s (0.000001″/s)
LSM050B-T4A	< 16 µm (< 0.000630″)	104 mm/s (4.094″/s)	0.000116 mm/s (0.000005″/s)	0.000116 mm/s (0.000005″/s)
LSM100A-T4A	< 12 µm (< 0.000472″)	26 mm/s (1.024″/s)	0.000029 mm/s (0.000001″/s)	0.000029 mm/s (0.000001″/s)
LSM100B-T4A	< 16 µm (< 0.000630″)	104 mm/s (4.094″/s)	0.000116 mm/s (0.000005″/s)	0.000116 mm/s (0.000005″/s)
LSM150A-T4A	< 12 µm (< 0.000472″)	26 mm/s (1.024″/s)	0.000029 mm/s (0.000001″/s)	0.000029 mm/s (0.000001″/s)
LSM150B-T4A	< 16 µm (< 0.000630″)	104 mm/s (4.094″/s)	0.000116 mm/s (0.000005″/s)	0.000116 mm/s (0.000005″/s)
LSM200A-T4A	< 12 µm (< 0.000472″)	26 mm/s (1.024″/s)	0.000029 mm/s (0.000001″/s)	0.000029 mm/s (0.000001″/s)
LSM200B-T4A	< 16 µm (< 0.000630″)	104 mm/s (4.094″/s)	0.000116 mm/s (0.000005″/s)	0.000116 mm/s (0.000005″/s)

Part Number	Peak Thrust	Vertical Runout	Horizontal Runout	Pitch
LSM025A-T4A	55 N (12.3 lb)	< 8 µm (< 0.000315″)	< 12 µm (< 0.000472″)	0.02° (0.349 mrad)
LSM025B-T4A	25 N (5.6 lb)	< 8 µm (< 0.000315″)	< 12 µm (< 0.000472″)	0.02° (0.349 mrad)
LSM050A-T4A	55 N (12.3 lb)	< 11 µm (< 0.000433″)	< 14 µm (< 0.000551″)	0.03° (0.523 mrad)
LSM050B-T4A	25 N (5.6 lb)	< 11 µm (< 0.000433″)	< 14 µm (< 0.000551″)	0.03° (0.523 mrad)
LSM100A-T4A	55 N (12.3 lb)	< 18 µm (< 0.000709″)	< 18 µm (< 0.000709″)	0.04° (0.698 mrad)
LSM100B-T4A	25 N (5.6 lb)	< 18 µm (< 0.000709″)	< 18 µm (< 0.000709″)	0.04° (0.698 mrad)
LSM150A-T4A	55 N (12.3 lb)	< 25 µm (< 0.000984″)	< 23 µm (< 0.000906″)	0.04° (0.698 mrad)

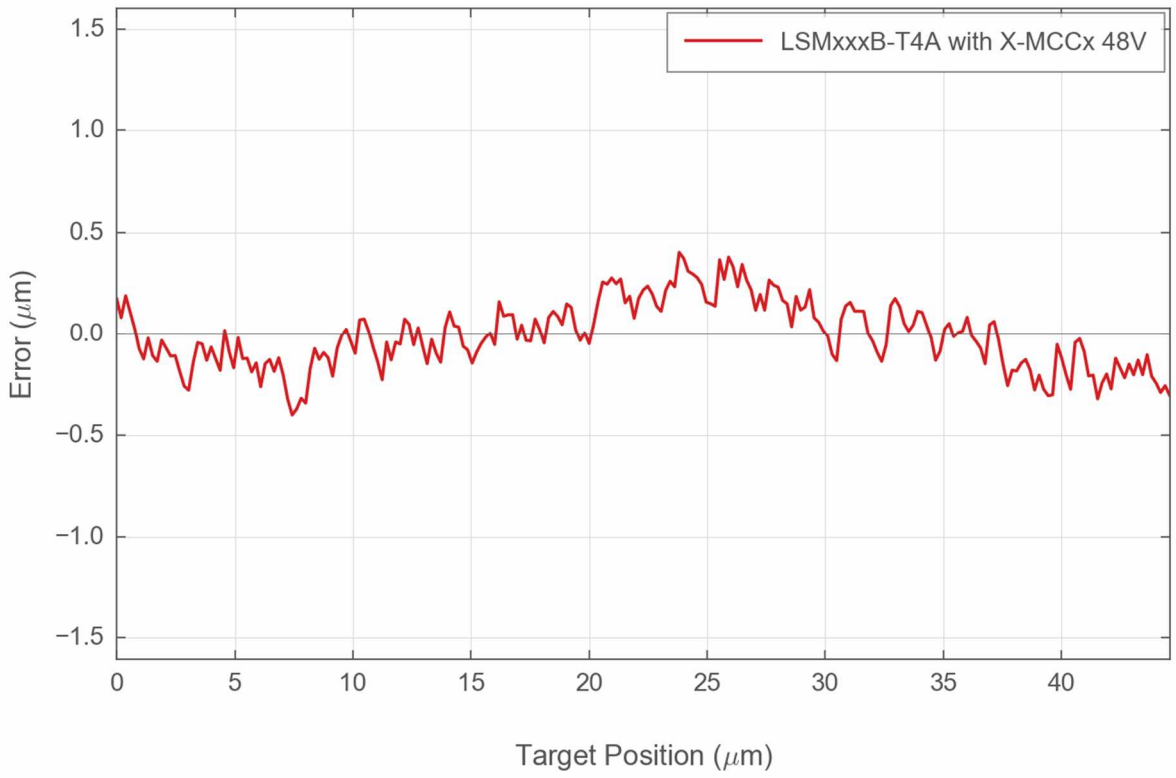
Part Number	Peak Thrust	Vertical Runout	Horizontal Runout	Pitch
LSM150B-T4A	25 N (5.6 lb)	< 25 µm (< 0.000984″)	< 23 µm (< 0.000906″)	0.04° (0.698 mrad)
LSM200A-T4A	55 N (12.3 lb)	< 32 µm (< 0.001260″)	< 27 µm (< 0.001063″)	0.04° (0.698 mrad)
LSM200B-T4A	25 N (5.6 lb)	< 32 µm (< 0.001260″)	< 27 µm (< 0.001063″)	0.04° (0.698 mrad)

Part Number	Roll	Yaw	Linear Motion Per Motor Rev	Weight
LSM025A-T4A	0.02° (0.349 mrad)	0.03° (0.523 mrad)	0.6096 mm (0.024″)	0.2 kg (0.441 lb)
LSM025B-T4A	0.02° (0.349 mrad)	0.03° (0.523 mrad)	2.4384 mm (0.096″)	0.2 kg (0.441 lb)
LSM050A-T4A	0.03° (0.523 mrad)	0.03° (0.523 mrad)	0.6096 mm (0.024″)	0.21 kg (0.463 lb)
LSM050B-T4A	0.03° (0.523 mrad)	0.03° (0.523 mrad)	2.4384 mm (0.096″)	0.21 kg (0.463 lb)
LSM100A-T4A	0.04° (0.698 mrad)	0.04° (0.698 mrad)	0.6096 mm (0.024″)	0.24 kg (0.529 lb)
LSM100B-T4A	0.04° (0.698 mrad)	0.04° (0.698 mrad)	2.4384 mm (0.096″)	0.24 kg (0.529 lb)
LSM150A-T4A	0.05° (0.873 mrad)	0.05° (0.873 mrad)	0.6096 mm (0.024″)	0.28 kg (0.617 lb)
LSM150B-T4A	0.05° (0.873 mrad)	0.05° (0.873 mrad)	2.4384 mm (0.096″)	0.28 kg (0.617 lb)
LSM200A-T4A	0.05° (0.873 mrad)	0.05° (0.873 mrad)	0.6096 mm (0.024″)	0.31 kg (0.683 lb)
LSM200B-T4A	0.05° (0.873 mrad)	0.05° (0.873 mrad)	2.4384 mm (0.096″)	0.31 kg (0.683 lb)

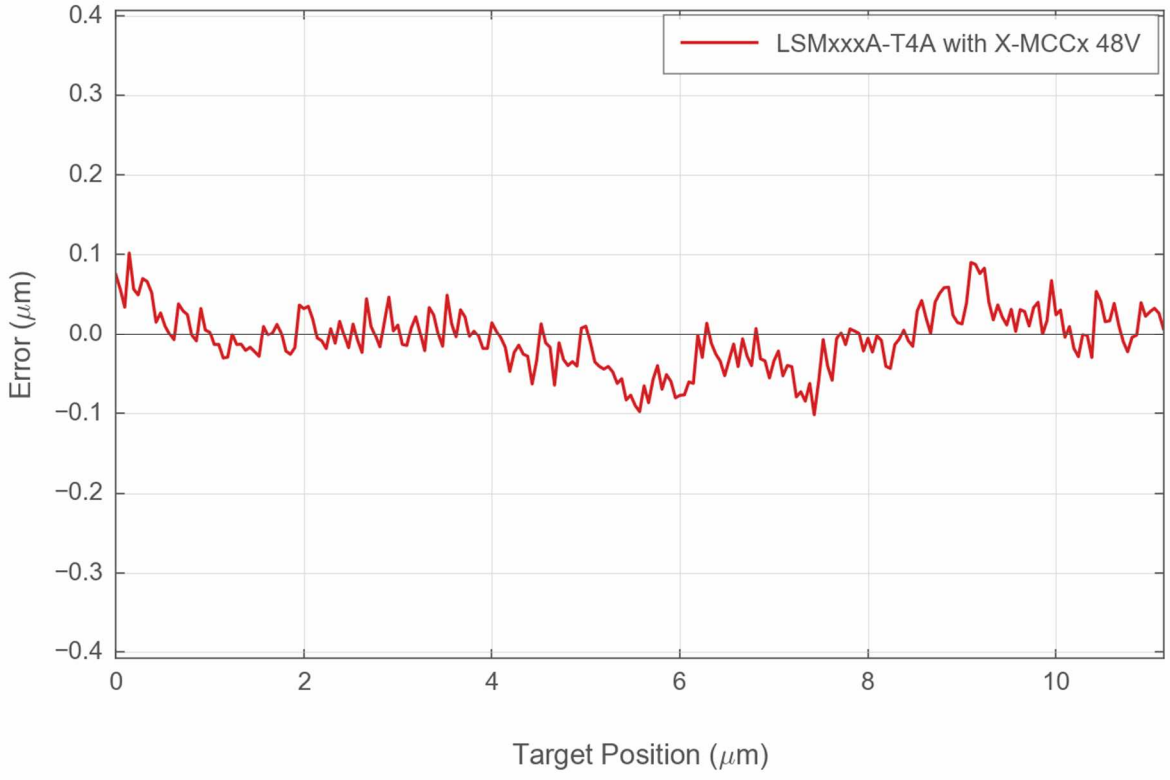
Charts and Notes



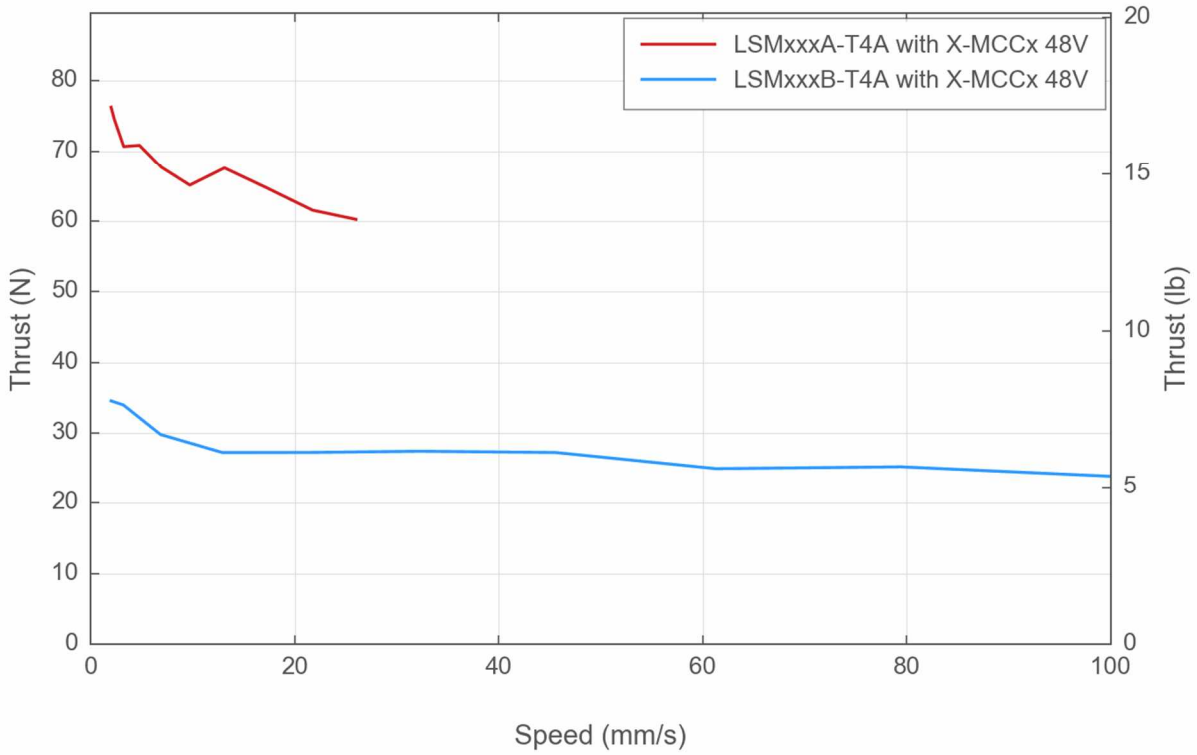
Typical Microstepping Accuracy



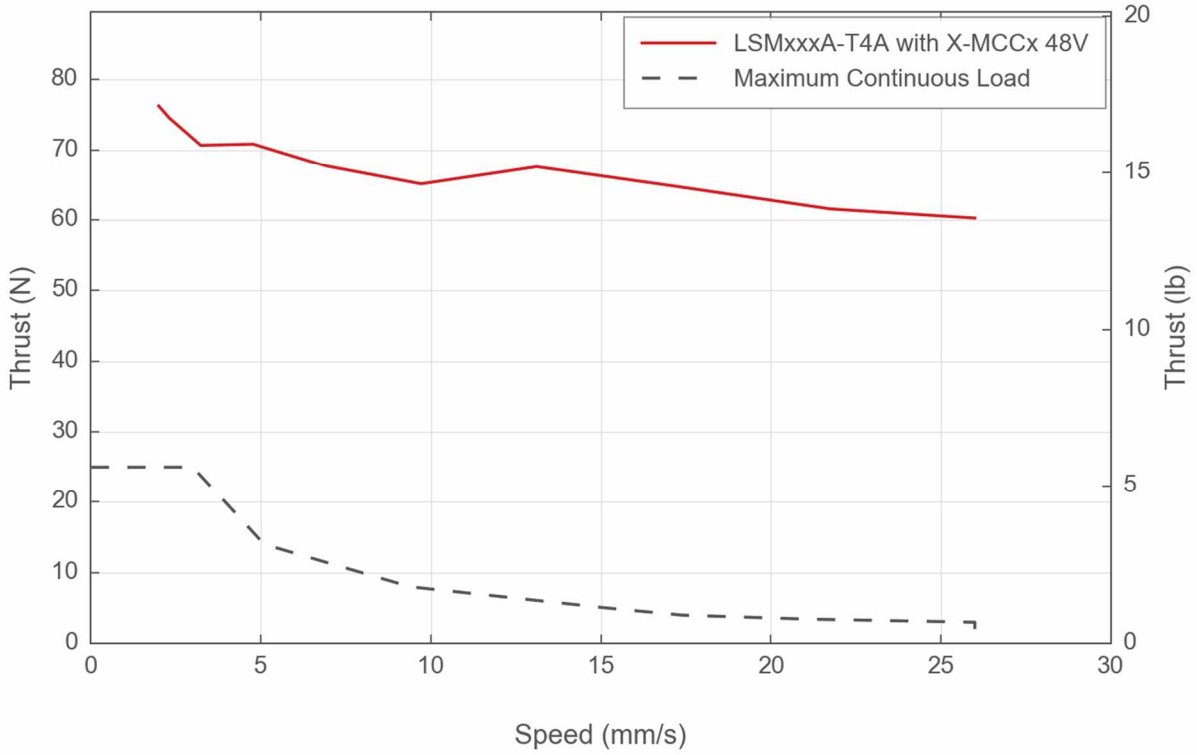
Typical Microstepping Accuracy



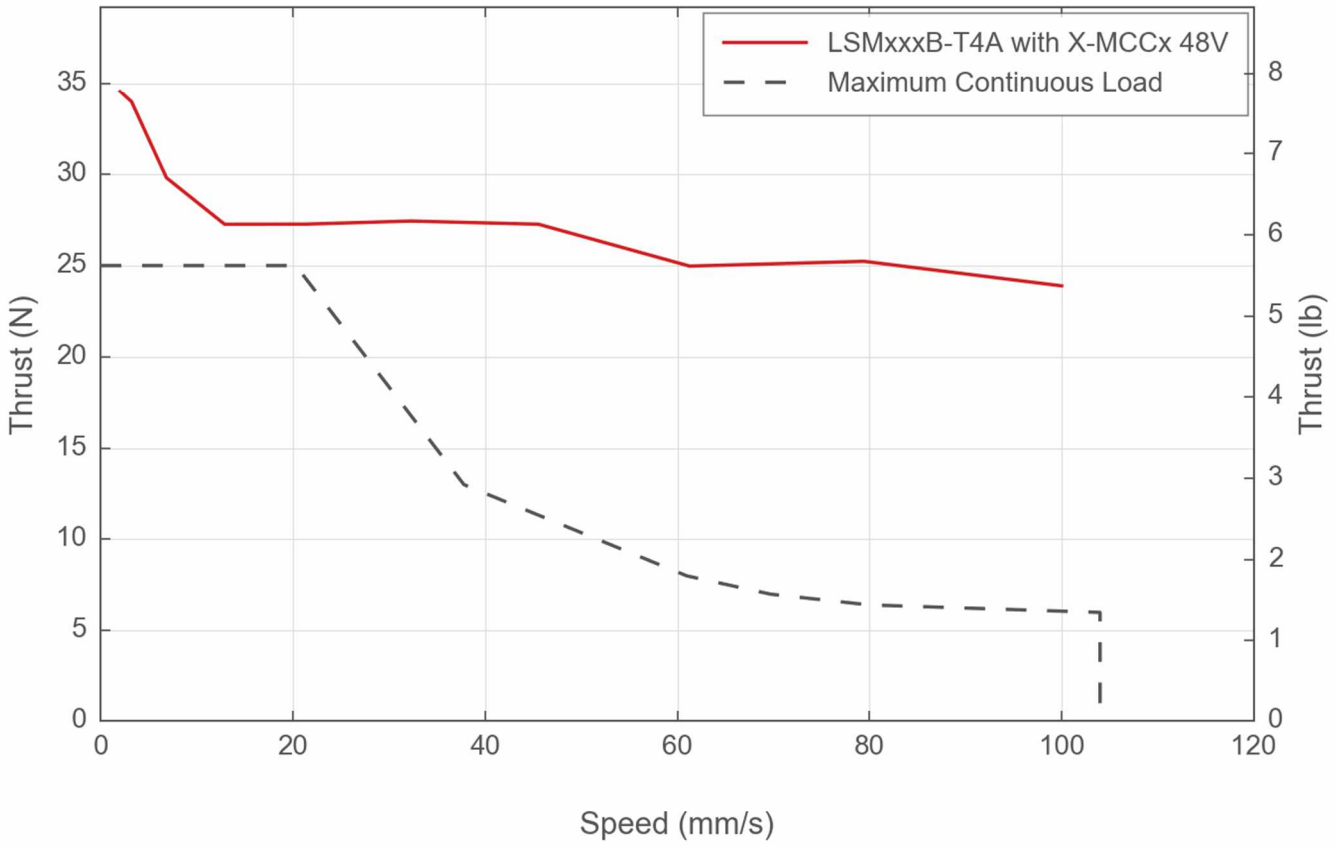
Thrust Speed Performance



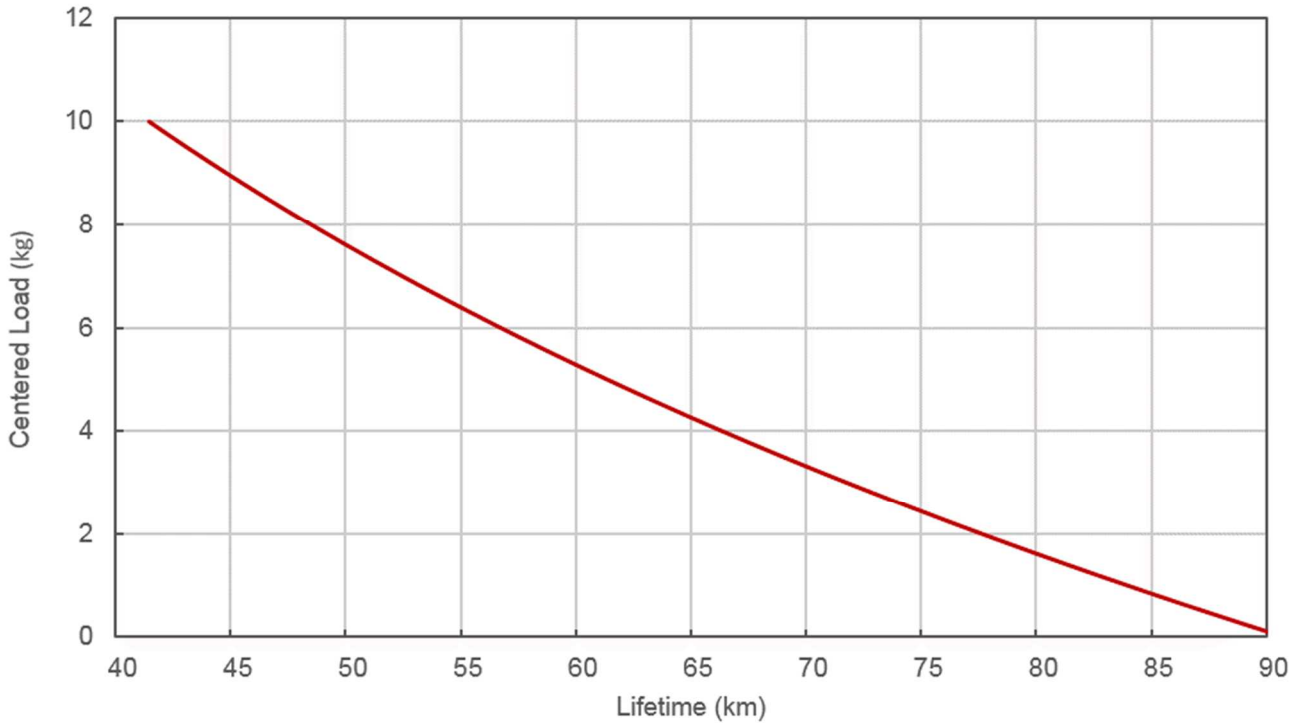
Thrust Speed Performance



Thrust Speed Performance



LSM Linear Bearing Lifetime



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