ZABER *Simplifying Motion Control*

LRM Series User's Manual

Steel linear stages requiring external controller

Table of Contents

1. 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.

2. Precautions

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 leadscrew thread. These will reduce the performance of the device below stated specifications.

2.1. Care for Ground Steel Surfaces

The LRM base and carriage are constructed from steel alloys specifically chosen for their dimensional stability, wear resistance and hardness. These parts are not made from stainless steel. As such, a small amount of care is necessary to maintain the ground mounting surfaces on the base and carriage.

The bare steel surfaces on LRM stages are treated with Boeshield T9 corrosion protection before shipping. In our testing, this coating has proven very effective in preventing corrosion. We recommend re-applying as needed to maintain corrosion resistance. To prevent contamination of the linear bearings, spray the Boeshield onto a clean rag and wipe onto the carriage top and stage base. WD40 is an effective alternative if Boeshield is not available.

2.2. Lubrication of Linear Guide

The LRM 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. 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 the motor end of the carriage (see pictures below). Simply remove the set screw plugs using a 1.5 mm hex key and 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 the lead screw or any other locations on the stage.

2.3. Noise Emissions

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

2.4. Physical Installation

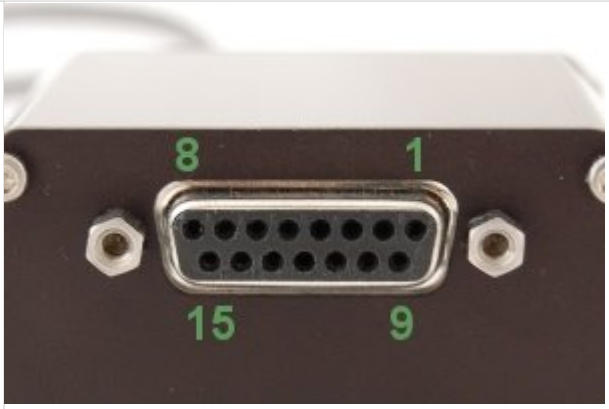
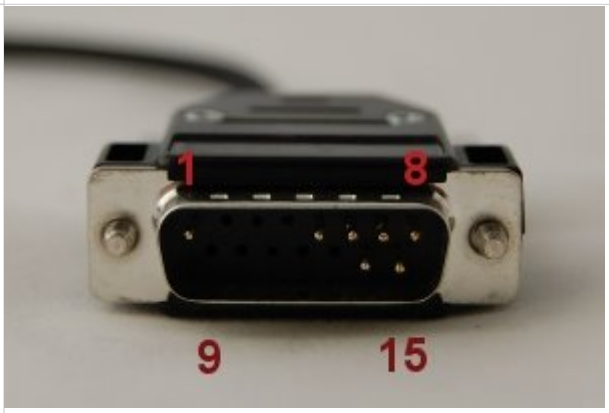
LRM stages can be mounted horizontally or vertically without additional hardware.

Low profile M6 (supplied) or 1/4-20 fasteners must be used. Additional fasteners can be purchased from McMaster-Carr, Fastenal, or other fastener suppliers.

3. Operation

The LRM-T3 stages are designed to be controlled with any of Zaber's X-Series or A-Series Stepper Motor Controllers. Zaber's controllers and peripherals are designed for ease of use when used together. Optimal settings for each peripheral (such as the default current, speed, acceleration, and limit settings) can be loaded by setting the peripheralid (T:66) on the controller. The peripheral ID is listed as the ID on the peripheral's label. A list of IDs is also available on the ID Mapping page. For more information on device operation, refer to the controller's user manual.

3.1. Pinout for D-sub 15 Connectors (A-series and X-Series controllers and peripherals)

A- or X-series controller (female)	
T3 Peripheral (male)	
T4 Peripheral (male)	

Pin #	Function
1	+5V
2	Encoder Error ****
3	reserved
4	Away Sensor ***

5	Home Sensor
6	Ground
7	Motor B1
8	Motor A1
9	+5V *
10	Encoder A *
11	Encoder B *
12	Encoder Index **
13	Ground *
14	Motor B2
15	Motor A2

* encoder embedded peripherals only
** devices with encoders with index only
*** devices with away sensors only
**** devices with linear or direct-reading encoders only

3.2. Alternate Controllers

The actuators may be controlled by any 2-phase stepper motor controller with home sensor input. Warning: Operating the stage without correctly wiring up the home sensor can cause permanent damage to the sensor. We do not recommend using your own controller unless you are familiar with how to control a stepper motor with a hall sensor limit switch. The following information is provided for reference only. Damage to the stage or hall sensor due to incorrect wiring is not covered by warranty.

3.2.1. Motor

The LRM stage uses a NEMA size 08 stepper motor.

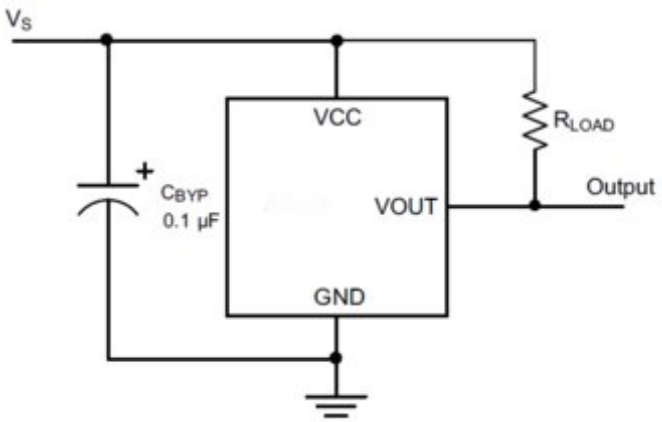
- 0.6 A / Phase
- 3.5 mH / phase

3.3. Home Sensor Wiring

A Hall effect sensor is mounted in the device for use as a home sensor. It is part number A1120LLHLT-T made by Allegro. Click here for data sheet. Your controller should be configured so the stage stops immediately (little deceleration) when the home sensor is triggered.

- Wire colour code:
  - 3.6-24 Vdc input - red
  - Home signal - yellow
  - 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 the 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) is 10k and for the bypass capacitor is 0.1uF to 1uF. The larger the capacitance, the better the noise filtering but the slower the response time.

4. Warranty and Repair

For Zaber's policies on warranty and repair, please refer to the Ordering Policies.

4.1. 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.

4.2. 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.

4.3. 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.

5. 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.

6. Contact Information

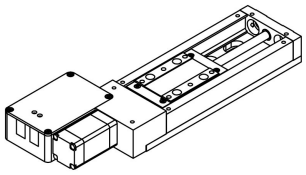
Contact Zaber Technologies Inc by any of the following methods:

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/LRM.

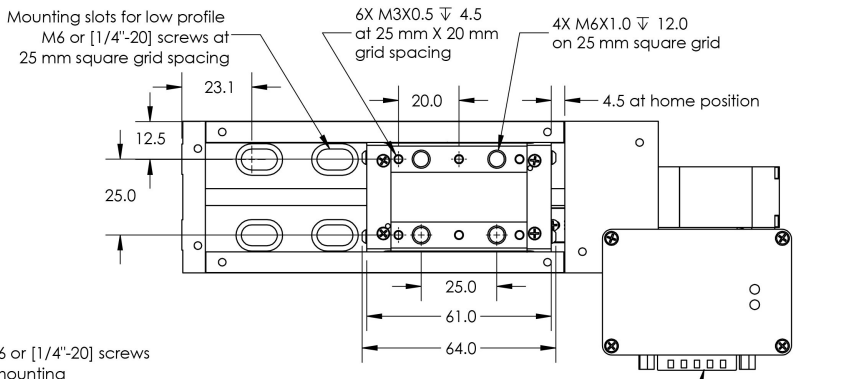
7. Product Drawing

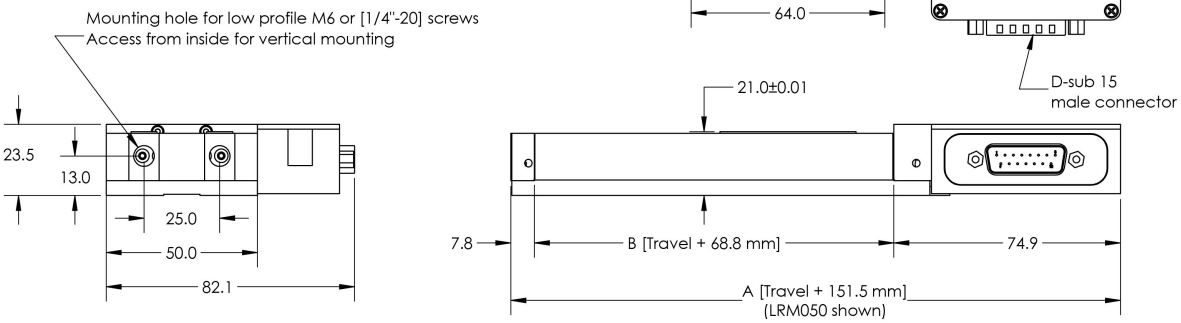
LRM Motorized Linear Stage
dimensions in mm



Model Number*	Travel	A	B
LRM025	25.0	176.5	93.8
LRM050	50.0	201.5	118.8
LRM100	100.0	251.5	168.8
LRM150	150.0	301.5	218.8
LRM200	200.0	351.5	268.8

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





DWG 1465 R01A

8. Specifications

Specification	Value	Alternate Unit
Built-in Controller	No	
Recommended Controller	X-MCB1 (48 V) Recommended	
Encoder Type	None	
Maximum Continuous Thrust	25 N	5.6 lb
Maximum Centered Load	500 N	112.1 lb
Maximum Cantilever Load	1500 N-cm	2,124.2 oz-in
Guide Type	Recirculating ball bearing	
Vertical Runout	< 8 µm	< 0.000315 "
Horizontal Runout	< 12 µm	< 0.000472 "
Pitch	0.02°	0.349 mrad
Roll	0.02°	0.349 mrad
Yaw	0.02°	0.349 mrad
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	
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	
Vacuum Compatible	No	
Operating Temperature Range	0 to 50 °C	

Stage Parallelism	< 10 µm	< 0.000394 "
RoHS Compliant	Yes	
CE Compliant	Yes	
Stiffness in Pitch	750 N-m/°	23 µrad/N-m
Stiffness in Roll	550 N-m/°	32 µrad/N-m
Stiffness in Yaw	400 N-m/°	44 µrad/N-m

8.1. Comparison

Part Number	Microstep Size (Default Resolution)	Travel Range	Accuracy (unidirectional)	Repeatability
LRM025A-T3	0.047625 µm	25 mm (0.984 ")	8 µm (0.000315 ")	< 1 µm (< 0.000039 ")
LRM025B-T3	0.1905 µm	25 mm (0.984 ")	8 µm (0.000315 ")	< 3 µm (< 0.000118 ")
LRM050A-T3	0.047625 µm	50 mm (1.969 ")	15 µm (0.000591 ")	< 1 µm (< 0.000039 ")
LRM050B-T3	0.1905 µm	50 mm (1.969 ")	15 µm (0.000591 ")	< 3 µm (< 0.000118 ")
LRM100A-T3	0.047625 µm	100 mm (3.937 ")	30 µm (0.001181 ")	< 1 µm (< 0.000039 ")
LRM100B-T3	0.1905 µm	100 mm (3.937 ")	30 µm (0.001181 ")	< 3 µm (< 0.000118 ")
LRM150A-T3	0.047625 µm	150 mm (5.906 ")	45 µm (0.001772 ")	< 1 µm (< 0.000039 ")
LRM150B-T3	0.1905 µm	150 mm (5.906 ")	45 µm (0.001772 ")	< 3 µm (< 0.000118 ")
LRM200A-T3	0.047625 µm	200 mm (7.874 ")	60 µm (0.002362 ")	< 1 µm (< 0.000039 ")
LRM200B-T3	0.1905 µm	200 mm (7.874 ")	60 µm (0.002362 ")	< 3 µm (< 0.000118 ")

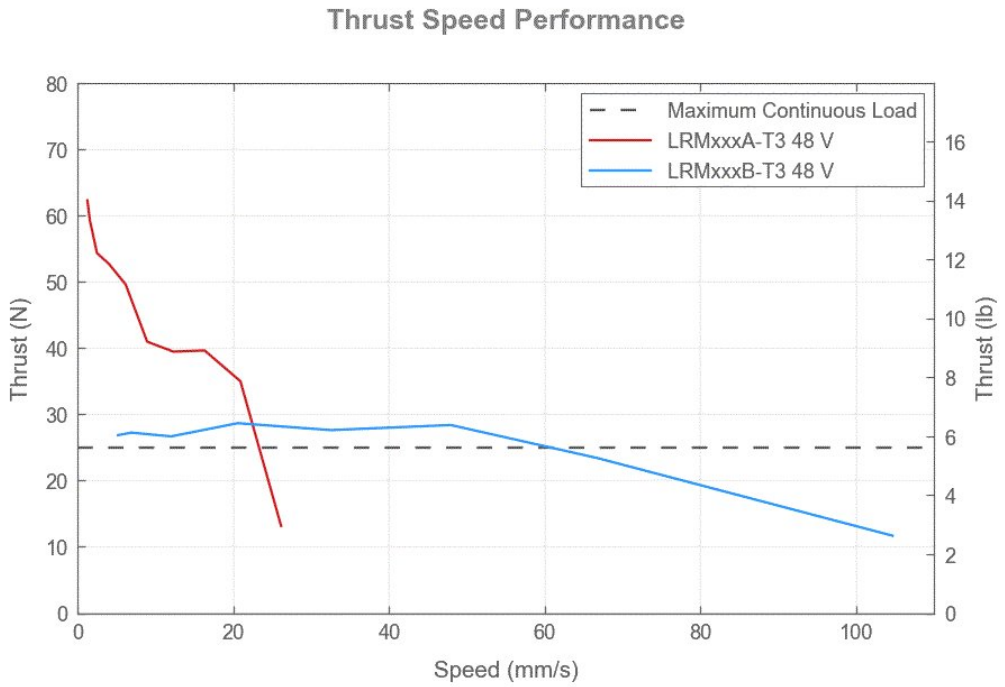
Part Number	Backlash	Maximum Speed	Minimum Speed	Speed Resolution
LRM025A-T3	< 5 µm (< 0.000197 ")	25 mm/s (0.984 "/s)	0.000029 mm/s (0.000001 "/s)	0.000029 mm/s (0.000001 "/s)
LRM025B-T3	< 12 µm (< 0.000472 ")	100 mm/s (3.937 "/s)	0.000116 mm/s (0.000005 "/s)	0.000116 mm/s (0.000005 "/s)
LRM050A-T3	< 5 µm (< 0.000197 ")	25 mm/s (0.984 "/s)	0.000029 mm/s (0.000001 "/s)	0.000029 mm/s (0.000001 "/s)
LRM050B-T3	< 12 µm (< 0.000472 ")	100 mm/s (3.937 "/s)	0.000116 mm/s (0.000005 "/s)	0.000116 mm/s (0.000005 "/s)
LRM100A-T3	< 5 µm (< 0.000197 ")	25 mm/s (0.984 "/s)	0.000029 mm/s (0.000001 "/s)	0.000029 mm/s (0.000001 "/s)

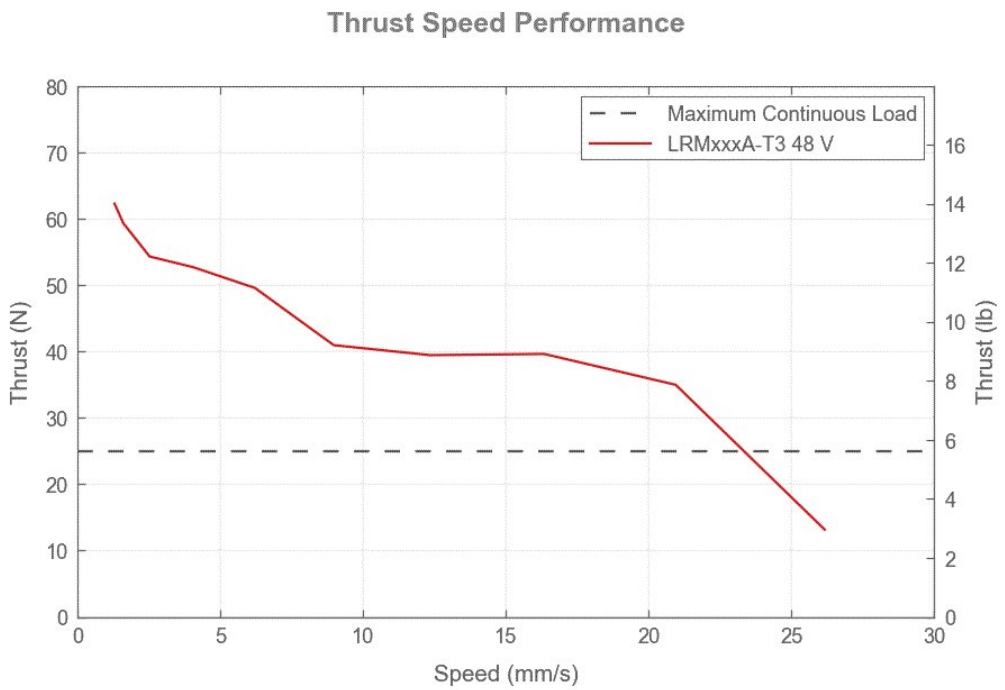
LRM100B-T3	< 12 µm (< 0.000472 ")	100 mm/s (3.937 "/s)	0.000116 mm/s (0.000005 "/s)	0.000116 mm/s (0.000005 "/s)
LRM150A-T3	< 5 µm (< 0.000197 ")	25 mm/s (0.984 "/s)	0.000029 mm/s (0.000001 "/s)	0.000029 mm/s (0.000001 "/s)
LRM150B-T3	< 12 µm (< 0.000472 ")	100 mm/s (3.937 "/s)	0.000116 mm/s (0.000005 "/s)	0.000116 mm/s (0.000005 "/s)
LRM200A-T3	< 5 µm (< 0.000197 ")	25 mm/s (0.984 "/s)	0.000029 mm/s (0.000001 "/s)	0.000029 mm/s (0.000001 "/s)
LRM200B-T3	< 12 µm (< 0.000472 ")	100 mm/s (3.937 "/s)	0.000116 mm/s (0.000005 "/s)	0.000116 mm/s (0.000005 "/s)

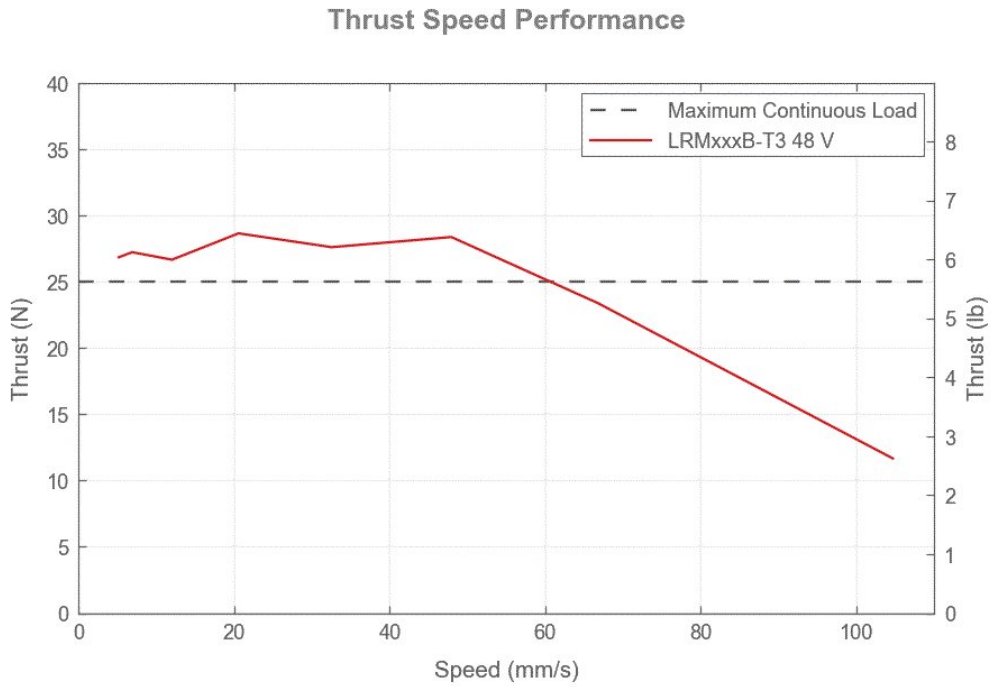
Part Number	Peak Thrust	Linear Motion Per Motor Rev	Weight	
LRM025A-T3	50 N (11.2 lb)	0.6096 mm (0.024 ")	0.71 kg (1.565 lb)	
LRM025B-T3	25 N (5.6 lb)	2.4384 mm (0.096 ")	0.71 kg (1.565 lb)	
LRM050A-T3	50 N (11.2 lb)	0.6096 mm (0.024 ")	0.79 kg (1.742 lb)	
LRM050B-T3	25 N (5.6 lb)	2.4384 mm (0.096 ")	0.79 kg (1.742 lb)	
LRM100A-T3	50 N (11.2 lb)	0.6096 mm (0.024 ")	0.95 kg (2.094 lb)	
LRM100B-T3	25 N (5.6 lb)	2.4384 mm (0.096 ")	0.95 kg (2.094 lb)	
LRM150A-T3	50 N (11.2 lb)	0.6096 mm (0.024 ")	1.11 kg (2.447 lb)	
LRM150B-T3	25 N (5.6 lb)	2.4384 mm (0.096 ")	1.11 kg (2.447 lb)	
LRM200A-T3	50 N (11.2 lb)	0.6096 mm (0.024 ")	1.29 kg (2.844 lb)	
LRM200B-T3	25 N (5.6 lb)	2.4384 mm (0.096 ")	1.29 kg (2.844 lb)	

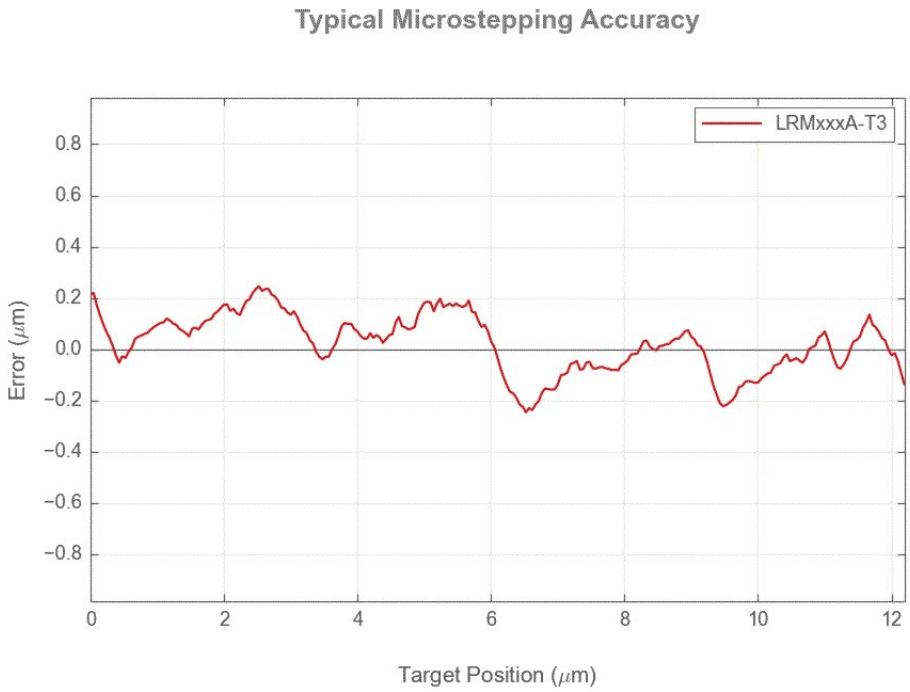
8.2. Charts and Notes

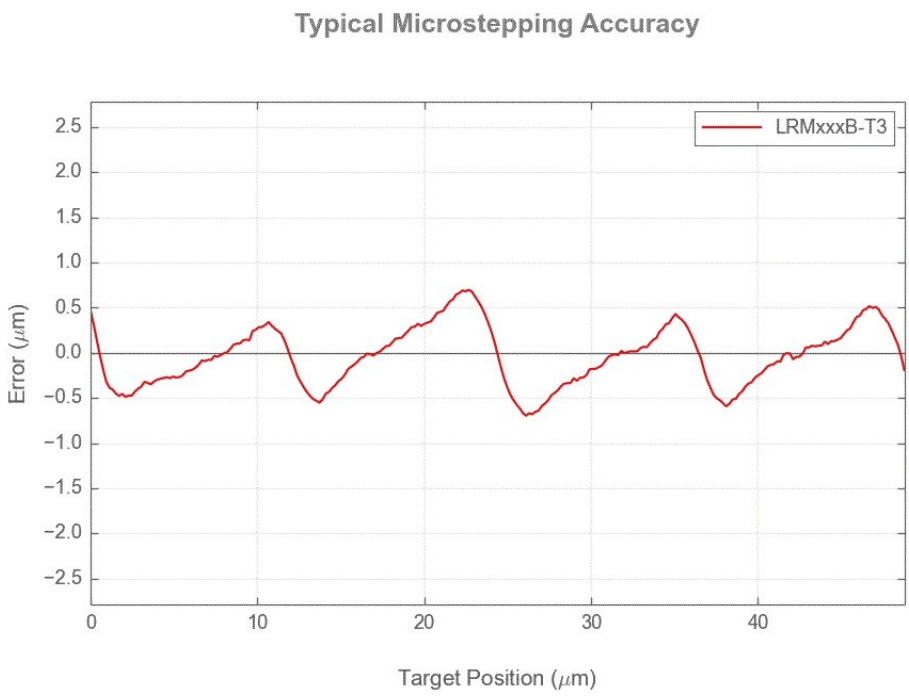
Thrust or torque is a function of speed. The values given above are maximums. These values cannot both be achieved simultaneously (i.e. at maximum speed, the unit will not produce maximum thrust).


Thrust Speed Performance
Maximum Continuous Load
LRMxxxA-T3 48 V
LRMxxxB-T3 48 V
Thrust (N)
Thrust (lb)
Speed (mm/s)
0
10
20
30
40
50
60
70
80
0
2
4
6
8
10
12
14
16
0
20
40
60
80
100


Thrust Speed Performance
Maximum Continuous Load
LRMxxxA-T3 48 V
Thrust (N)
Thrust (lb)
Speed (mm/s)
0
10
20
30
40
50
60
70
80
0
2
4
6
8
10
12
14
16
0
5
10
15
20
25
30


Thrust Speed Performance
Maximum Continuous Load
LRMxxxB-T3 48 V
Thrust (N)
Thrust (lb)
Speed (mm/s)
0
5
10
15
20
25
30
35
40
0
1
2
3
4
5
6
7
8
0
20
40
60
80
100


Typical Microstepping Accuracy
LRMxxxA-T3
Error (μm)
Target Position (μm)
0.8
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
−0.8
0
2
4
6
8
10
12


Typical Microstepping Accuracy
LRMxxxB-T3
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
Error (μm)
0
10
20
30
40
Target Position (μm)