

LRT-EC Series User's Manual

High-load motorized linear stages with built-in motor encoders, dust 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 LRT-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.

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 LRT-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 LRT-EC peripheral.

To connect the peripheral to a controller:



1. Power off the controller.
2. Connect the LRT-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 LRT-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 LRT-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

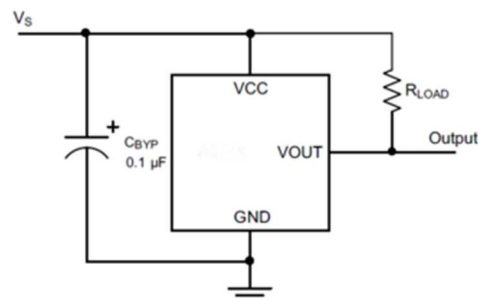
For motor and encoder information see the [LRT-EC product page](#)

Limit Sensors

Hall effect sensors are used in the LRT-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

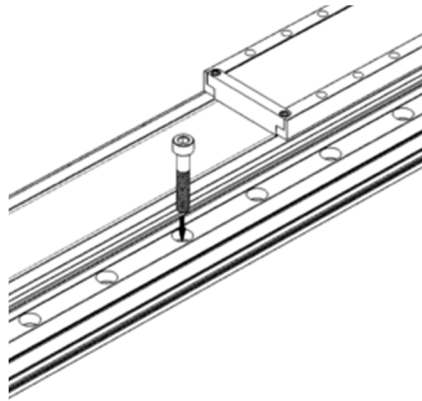
The Hall sensor has an open-collector output. The default output is high impedance when the Hall sensor is not active. When the sensor detects a magnet, the Hall sensor pulls the output low to ground.



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.

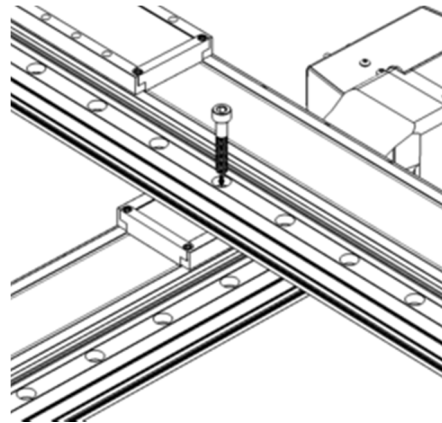
Installation

Physical Installation



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Secure stages with M6 (or 1/4"-20) socket cap screws, 35 mm or longer.



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Two stages can be mounted directly in XY configuration.

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Tip: To obtain the best pitch, roll, yaw and runout accuracy, mount the stage to a known flat, stiff surface. Our tests were performed on a granite table, grade A flatness.



Tipping Hazard! Ensure stage is fastened to a secure surface before mounting load on carriage. An unmounted stage with a load presents a tipping hazard. Ensure loads are mounted securely to the carriage of the stage.

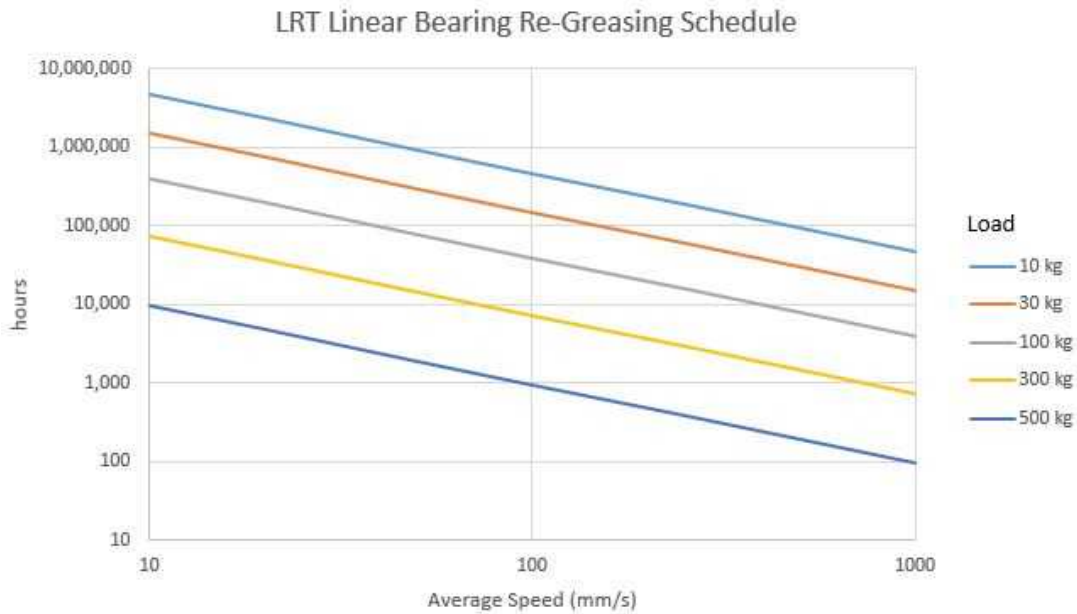


Back-driving Hazard! When mounting stages vertically where they will lift a load, do not exceed the values in the following table. Exceeding this load could backdrive the device, especially during loss of power, and could damage its controller and cause injury.

Drive Screw Version	Back-driving Force (N)
A	Non-back-driving
B	420
D	40
H	157

Maintenance

We recommend greasing the linear bearings to prolong service life. Many factors affect the lifetime of the grease and bearings including temperature, contamination, and loading configurations but the following chart provides a guideline. Grease with Shell Gadus S2 V220 2 or similar lithium thickened petroleum grease.



Remove dust cover



Careful, dust cover edges are sharp!



Pinch Hazard! You will need to move the stage with the power on while greasing. Be careful not to squish anything, especially fingers or hands, between the carriage and the end plates.



Remove the dust cover clamps at each end of the stage by removing their M3 screws.



- Remove the carriage ramps by removing their screws.



- Slide out the carriage cover.



- Slide out the dust cover. **CAUTION! DUST COVER EDGES ARE SHARP!**



- Insert angled syringe tip into grease hole in bearing end cap. With the power on and using the manual control knob (if equipped), move the stage about 100 mm (4") while squeezing grease in from the syringe.

Don't drive the carriage close to the ends of the stage where the risk is greater of squishing the syringe or your fingers. Repeat with the other three end caps.

Reinstall dust cover



Slide dust cover into carriage, above angled sliding pads but below thin channel near the top. Position the dust cover so it's about even at both ends



Install one carriage end ramp and slide the top sheet in the thin channel near the top.



Attach the other carriage end ramp.



Position the dust cover so it comes close to the clamp holes at each end.



Loosely attach the clamps at each end. Run the stage back and forth once to position the dust cover. Gradually tighten the clamp screws, alternating between the two at each clamp. If part of the dust cover isn't seated properly, loosen the nearest clamp and re-tighten.

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.

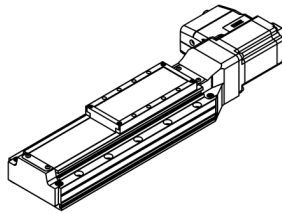
The original instructions for this product are available at <https://www.zaber.com/manuals/LRT-EC>.

Appendix A: Default Settings

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

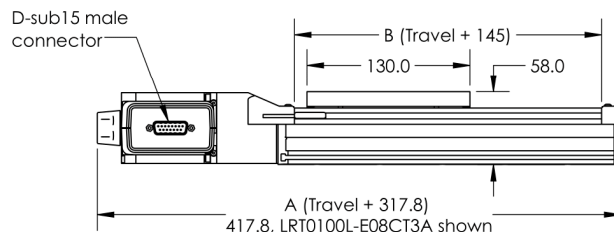
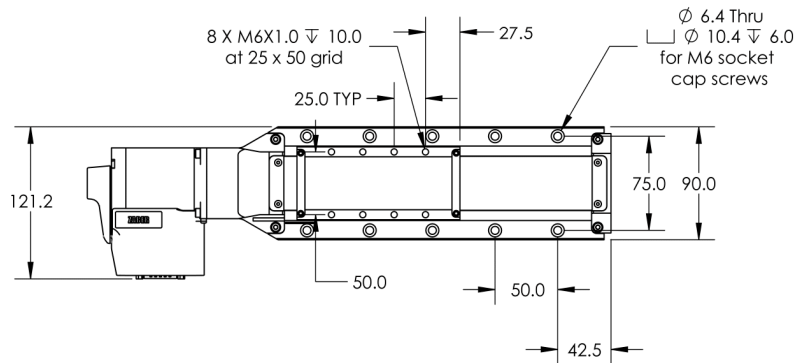
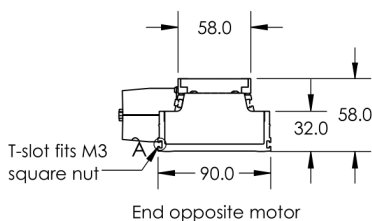
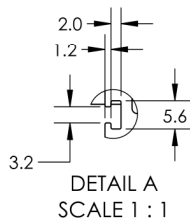
Product Drawing

ZABER
LRT-EC Motorized Stage
dimensions in mm



Model Number*	Travel	A	B
LRT0100xL-ECT3A	100	417.8	245
LRT0250xL-ECT3A	250	567.8	395
LRT0500xL-ECT3A	500	817.8	645
LRT0750xL-ECT3A	750	1067.8	895
LRT1000xL-ECT3A	1000	1317.8	1145
LRT1500xL-ECT3A	1500	1817.8	1645

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



Specifications

Specification	Value	Alternate Unit
Built-in Controller	No	
Recommended Controller	X-MCC (48 V) Recommended	
AutoDetect	Yes	
Encoder Resolution	400 CPR	1600 states/rev
Encoder Type	Rotary quadrature encoder	
Maximum Centered Load	5000 N	1121.3 lb
Maximum Cantilever Load	120 N·m	88.6 ft·lb
Guide Type	Recirculating Ball Linear Guide	
Vertical Runout	< 10 µm	< 0.000394"
Horizontal Runout	< 18 µm	< 0.000709"
Pitch	0.013°	0.227 mrad
Roll	0.01°	0.174 mrad
Yaw	0.017°	0.297 mrad
Stiffness in Pitch	1400 N·m/°	12 µrad/N·m
Stiffness in Roll	700 N·m/°	25 µrad/N·m
Stiffness in Yaw	1200 N·m/°	15 µrad/N·m
Motor Steps Per Rev	200	
Motor Type	Stepper (2 phase)	
Motor Rated Current	4200 mA/phase	
Motor Winding Resistance	0.53 ohms/phase	
Inductance	2 mH/phase	
Motor Connection	D-sub 15	
Default Resolution	1/64 of a step	
Limit or Home Sensing	Magnetic home sensor	
Axes of Motion	1	
Operating Temperature Range	0 to 50 ° C	
Vacuum Compatible	No	
RoHS Compliant	Yes	
CE Compliant	Yes	

Comparison

Part Number	Microstep Size (Default Resolution)	Travel Range	Accuracy (unidirectional)	Repeatability
LRT0100AL-E08CT3A	0.124023438 µm	100 mm (3.937")	25 µm (0.000984")	< 4 µm (< 0.000157")
LRT0100BL-E08CT3A	0.49609375 µm	100 mm (3.937")	25 µm (0.000984")	< 4 µm (< 0.000157")
LRT0100DL-E08CT3A	1.984375 µm	100 mm (3.937")	25 µm (0.000984")	< 8 µm (< 0.000315")
LRT0100HL-E08CT3A	0.390625 µm	100 mm (3.937")	45 µm (0.001772")	< 4 µm (< 0.000157")
LRT0250AL-E08CT3A	0.124023438 µm	250 mm (9.843")	63 µm (0.002480")	< 4 µm (< 0.000157")
LRT0250BL-E08CT3A	0.49609375 µm	250 mm (9.843")	63 µm (0.002480")	< 4 µm (< 0.000157")

Part Number	<u>Microstep Size</u> (Default Resolution)	<u>Travel Range</u>	<u>Accuracy</u> (unidirectional)	<u>Repeatability</u>
LRT0250DL-E08CT3A	1.984375 μm	250 mm (9.843")	63 μm (0.002480")	< 8 μm (< 0.000315")
LRT0250HL-E08CT3A	0.390625 μm	250 mm (9.843")	113 μm (0.004449")	< 4 μm (< 0.000157")
LRT0500AL-E08CT3A	0.124023438 μm	500 mm (19.685")	125 μm (0.004921")	< 4 μm (< 0.000157")
LRT0500BL-E08CT3A	0.49609375 μm	500 mm (19.685")	125 μm (0.004921")	< 4 μm (< 0.000157")
LRT0500DL-E08CT3A	1.984375 μm	500 mm (19.685")	125 μm (0.004921")	< 8 μm (< 0.000315")
LRT0500HL-E08CT3A	0.390625 μm	500 mm (19.685")	225 μm (0.008858")	< 4 μm (< 0.000157")
LRT0750AL-E08CT3A	0.124023438 μm	750 mm (29.528")	188 μm (0.007402")	< 4 μm (< 0.000157")
LRT0750BL-E08CT3A	0.49609375 μm	750 mm (29.528")	188 μm (0.007402")	< 4 μm (< 0.000157")
LRT0750DL-E08CT3A	1.984375 μm	750 mm (29.528")	188 μm (0.007402")	< 8 μm (< 0.000315")
LRT0750HL-E08CT3A	0.390625 μm	750 mm (29.528")	338 μm (0.013307")	< 4 μm (< 0.000157")
LRT1000AL-E08CT3A	0.124023438 μm	1000 mm (39.370")	250 μm (0.009842")	< 4 μm (< 0.000157")
LRT1000BL-E08CT3A	0.49609375 μm	1000 mm (39.370")	250 μm (0.009842")	< 4 μm (< 0.000157")
LRT1000DL-E08CT3A	1.984375 μm	1000 mm (39.370")	250 μm (0.009842")	< 8 μm (< 0.000315")
LRT1000HL-E08CT3A	0.390625 μm	1000 mm (39.370")	450 μm (0.017716")	< 4 μm (< 0.000157")
LRT1500AL-E08CT3A	0.124023438 μm	1500 mm (59.055")	375 μm (0.014764")	< 4 μm (< 0.000157")
LRT1500BL-E08CT3A	0.49609375 μm	1500 mm (59.055")	375 μm (0.014764")	< 4 μm (< 0.000157")
LRT1500DL-E08CT3A	1.984375 μm	1500 mm (59.055")	375 μm (0.014764")	< 8 μm (< 0.000315")

Part Number	<u>Backlash</u>	<u>Maximum Speed</u>	<u>Minimum Speed</u>	<u>Speed Resolution</u>
LRT0100AL-E08CT3A	< 12 μm (< 0.000472")	45 mm/s (1.772"/s)	0.000076 mm/s (0.000003"/s)	0.000076 mm/s (0.000003"/s)
LRT0100BL-E08CT3A	< 45 μm (< 0.001772")	175 mm/s (6.890"/s)	0.000303 mm/s (0.000012"/s)	0.000303 mm/s (0.000012"/s)
LRT0100DL-E08CT3A	< 75 μm (< 0.002953")	700 mm/s (27.559"/s)	0.001212 mm/s (0.000048"/s)	0.001212 mm/s (0.000048"/s)
LRT0100HL-E08CT3A	< 25 μm (< 0.000984")	140 mm/s (5.512"/s)	0.000239 mm/s (0.000009"/s)	0.000239 mm/s (0.000009"/s)
LRT0250AL-E08CT3A	< 12 μm (< 0.000472")	45 mm/s (1.772"/s)	0.000076 mm/s (0.000003"/s)	0.000076 mm/s (0.000003"/s)

Part Number	Backlash	Maximum Speed	Minimum Speed	Speed Resolution
LRT0250BL-E08CT3A	< 45 µm (< 0.001772")	175 mm/s (6.890"/s)	0.000303 mm/s (0.000012"/s)	0.000303 mm/s (0.000012"/s)
LRT0250DL-E08CT3A	< 75 µm (< 0.002953")	700 mm/s (27.559"/s)	0.001212 mm/s (0.000048"/s)	0.001212 mm/s (0.000048"/s)
LRT0250HL-E08CT3A	< 25 µm (< 0.000984")	140 mm/s (5.512"/s)	0.000239 mm/s (0.000009"/s)	0.000239 mm/s (0.000009"/s)
LRT0500AL-E08CT3A	< 12 µm (< 0.000472")	45 mm/s (1.772"/s)	0.000076 mm/s (0.000003"/s)	0.000076 mm/s (0.000003"/s)
LRT0500BL-E08CT3A	< 45 µm (< 0.001772")	175 mm/s (6.890"/s)	0.000303 mm/s (0.000012"/s)	0.000303 mm/s (0.000012"/s)
LRT0500DL-E08CT3A	< 75 µm (< 0.002953")	700 mm/s (27.559"/s)	0.001212 mm/s (0.000048"/s)	0.001212 mm/s (0.000048"/s)
LRT0500HL-E08CT3A	< 25 µm (< 0.000984")	140 mm/s (5.512"/s)	0.000239 mm/s (0.000009"/s)	0.000239 mm/s (0.000009"/s)
LRT0750AL-E08CT3A	< 12 µm (< 0.000472")	45 mm/s (1.772"/s)	0.000076 mm/s (0.000003"/s)	0.000076 mm/s (0.000003"/s)
LRT0750BL-E08CT3A	< 45 µm (< 0.001772")	175 mm/s (6.890"/s)	0.000303 mm/s (0.000012"/s)	0.000303 mm/s (0.000012"/s)
LRT0750DL-E08CT3A	< 75 µm (< 0.002953")	700 mm/s (27.559"/s)	0.001212 mm/s (0.000048"/s)	0.001212 mm/s (0.000048"/s)
LRT0750HL-E08CT3A	< 25 µm (< 0.000984")	140 mm/s (5.512"/s)	0.000239 mm/s (0.000009"/s)	0.000239 mm/s (0.000009"/s)
LRT1000AL-E08CT3A	< 12 µm (< 0.000472")	38 mm/s (1.496"/s)	0.000076 mm/s (0.000003"/s)	0.000076 mm/s (0.000003"/s)
LRT1000BL-E08CT3A	< 45 µm (< 0.001772")	140 mm/s (5.512"/s)	0.000303 mm/s (0.000012"/s)	0.000303 mm/s (0.000012"/s)
LRT1000DL-E08CT3A	< 75 µm (< 0.002953")	573 mm/s (22.559"/s)	0.001212 mm/s (0.000048"/s)	0.001212 mm/s (0.000048"/s)
LRT1000HL-E08CT3A	< 25 µm (< 0.000984")	110 mm/s (4.331"/s)	0.000239 mm/s (0.000009"/s)	0.000239 mm/s (0.000009"/s)
LRT1500AL-E08CT3A	< 12 µm (< 0.000472")	15 mm/s (0.591"/s)	0.000076 mm/s (0.000003"/s)	0.000076 mm/s (0.000003"/s)
LRT1500BL-E08CT3A	< 45 µm (< 0.001772")	60 mm/s (2.362"/s)	0.000303 mm/s (0.000012"/s)	0.000303 mm/s (0.000012"/s)
LRT1500DL-E08CT3A	< 75 µm (< 0.002953")	240 mm/s (9.449"/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	Linear Motion Per Motor Rev
LRT0100AL-E08CT3A	1200 N (269.1 lb)	Non-back-driving	1200 N (269.1 lb)	1.5875 mm (0.062")
LRT0100BL-E08CT3A	600 N (134.6 lb)	420 N (94.2 lb) (± 30%)	600 N (134.6 lb)	6.35 mm (0.250")
LRT0100DL-E08CT3A	200 N (44.9 lb)	40 N (9.0 lb) (± 30%)	200 N (44.9 lb)	25.4 mm (1.000")
LRT0100HL-E08CT3A	1200 N (269.1 lb)	157 N (35.2 lb) (± 30%)	1200 N (269.1 lb)	5 mm (0.197")
LRT0250AL-E08CT3A	1200 N (269.1 lb)	Non-back-driving	1200 N (269.1 lb)	1.5875 mm (0.062")
LRT0250BL-E08CT3A	600 N (134.6 lb)	420 N (94.2 lb) (± 30%)	600 N (134.6 lb)	6.35 mm (0.250")

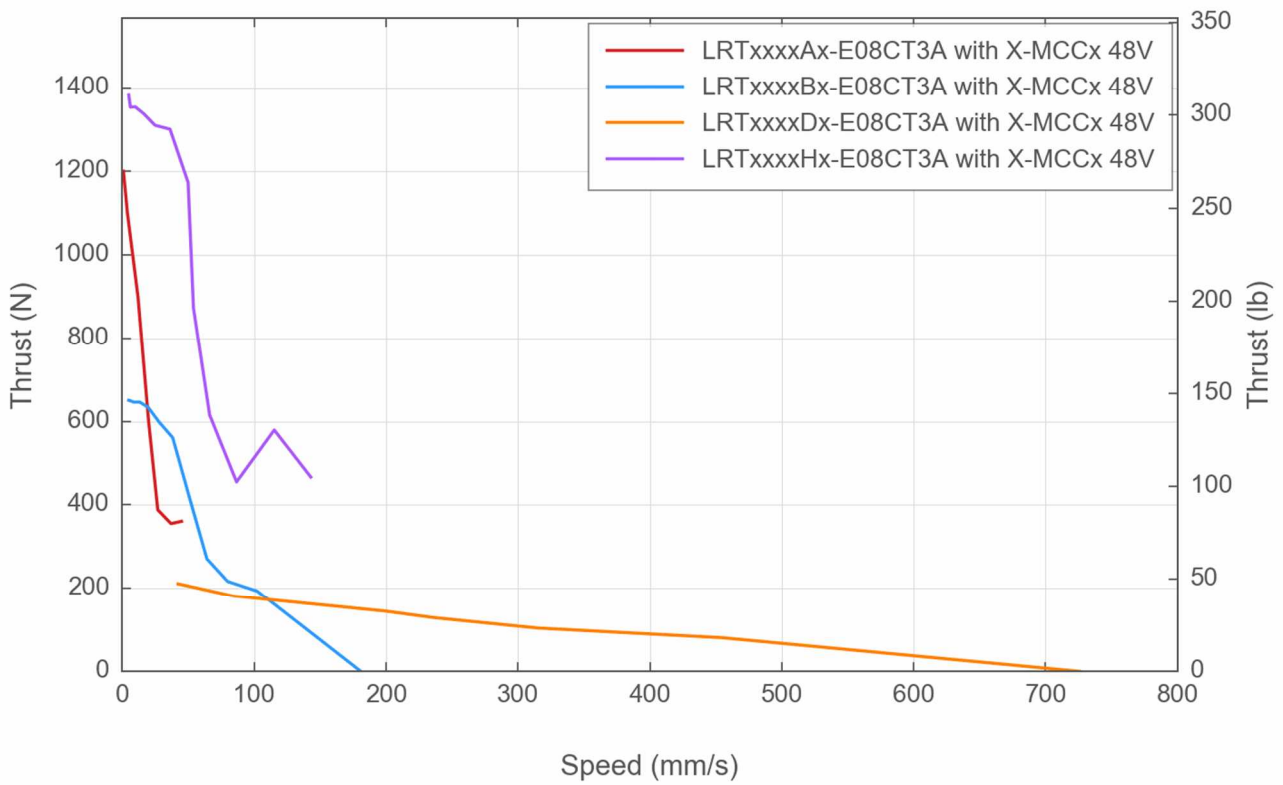
Part Number	Peak Thrust	Back-driving Force	Maximum Continuous Thrust	Linear Motion Per Motor Rev
LRT0250DL-E08CT3A	200 N (44.9 lb)	40 N (9.0 lb) (± 30%)	200 N (44.9 lb)	25.4 mm (1.000")
LRT0250HL-E08CT3A	1200 N (269.1 lb)	157 N (35.2 lb) (± 30%)	1200 N (269.1 lb)	5 mm (0.197")
LRT0500AL-E08CT3A	1200 N (269.1 lb)	Non-back-driving	1200 N (269.1 lb)	1.5875 mm (0.062")
LRT0500BL-E08CT3A	600 N (134.6 lb)	420 N (94.2 lb) (± 30%)	600 N (134.6 lb)	6.35 mm (0.250")
LRT0500DL-E08CT3A	200 N (44.9 lb)	40 N (9.0 lb) (± 30%)	200 N (44.9 lb)	25.4 mm (1.000")
LRT0500HL-E08CT3A	1200 N (269.1 lb)	157 N (35.2 lb) (± 30%)	1200 N (269.1 lb)	5 mm (0.197")
LRT0750AL-E08CT3A	1200 N (269.1 lb)	Non-back-driving	1200 N (269.1 lb)	1.5875 mm (0.062")
LRT0750BL-E08CT3A	600 N (134.6 lb)	420 N (94.2 lb) (± 30%)	600 N (134.6 lb)	6.35 mm (0.250")
LRT0750DL-E08CT3A	200 N (44.9 lb)	40 N (9.0 lb) (± 30%)	200 N (44.9 lb)	25.4 mm (1.000")
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LRT1000BL-E08CT3A	600 N (134.6 lb)	420 N (94.2 lb) (± 30%)	600 N (134.6 lb)	6.35 mm (0.250")
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LRT1500AL-E08CT3A	1200 N (269.1 lb)	Non-back-driving	1200 N (269.1 lb)	1.5875 mm (0.062")
LRT1500BL-E08CT3A	600 N (134.6 lb)	420 N (94.2 lb) (± 30%)	600 N (134.6 lb)	6.35 mm (0.250")
LRT1500DL-E08CT3A	200 N (44.9 lb)	40 N (9.0 lb) (± 30%)	200 N (44.9 lb)	25.4 mm (1.000")

Part Number	Mechanical Drive System	Weight
LRT0100AL-E08CT3A	Precision lead screw	3.65 kg (8.047 lb)
LRT0100BL-E08CT3A	Precision lead screw	3.65 kg (8.047 lb)
LRT0100DL-E08CT3A	Precision lead screw	3.65 kg (8.047 lb)
LRT0100HL-E08CT3A	Precision ball screw	3.65 kg (8.047 lb)
LRT0250AL-E08CT3A	Precision lead screw	4.441 kg (9.791 lb)
LRT0250BL-E08CT3A	Precision lead screw	4.441 kg (9.791 lb)
LRT0250DL-E08CT3A	Precision lead screw	4.441 kg (9.791 lb)
LRT0250HL-E08CT3A	Precision ball screw	4.441 kg (9.791 lb)
LRT0500AL-E08CT3A	Precision lead screw	5.758 kg (12.694 lb)
LRT0500BL-E08CT3A	Precision lead screw	5.758 kg (12.694 lb)
LRT0500DL-E08CT3A	Precision lead screw	5.758 kg (12.694 lb)
LRT0500HL-E08CT3A	Precision ball screw	5.758 kg (12.694 lb)
LRT0750AL-E08CT3A	Precision lead screw	7.076 kg (15.600 lb)
LRT0750BL-E08CT3A	Precision lead screw	7.076 kg (15.600 lb)
LRT0750DL-E08CT3A	Precision lead screw	7.076 kg (15.600 lb)
LRT0750HL-E08CT3A	Precision ball screw	7.076 kg (15.600 lb)
LRT1000AL-E08CT3A	Precision lead screw	8.393 kg (18.503 lb)
LRT1000BL-E08CT3A	Precision lead screw	8.393 kg (18.503 lb)

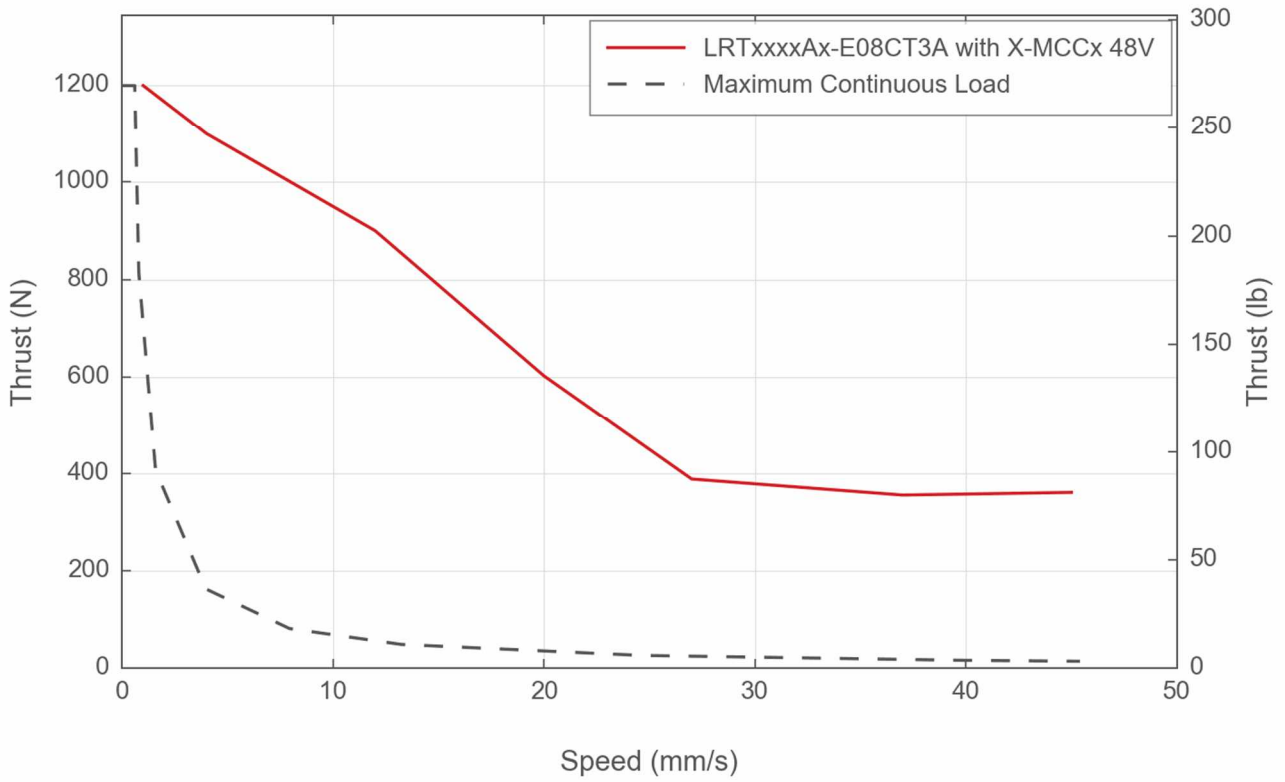
Part Number	Mechanical Drive System	Weight
LRT1000DL-E08CT3A	Precision lead screw	8.393 kg (18.503 lb)
LRT1000HL-E08CT3A	Precision ball screw	8.393 kg (18.503 lb)
LRT1500AL-E08CT3A	Precision lead screw	11.028 kg (24.313 lb)
LRT1500BL-E08CT3A	Precision lead screw	11.028 kg (24.313 lb)
LRT1500DL-E08CT3A	Precision lead screw	11.028 kg (24.313 lb)

Charts and Notes

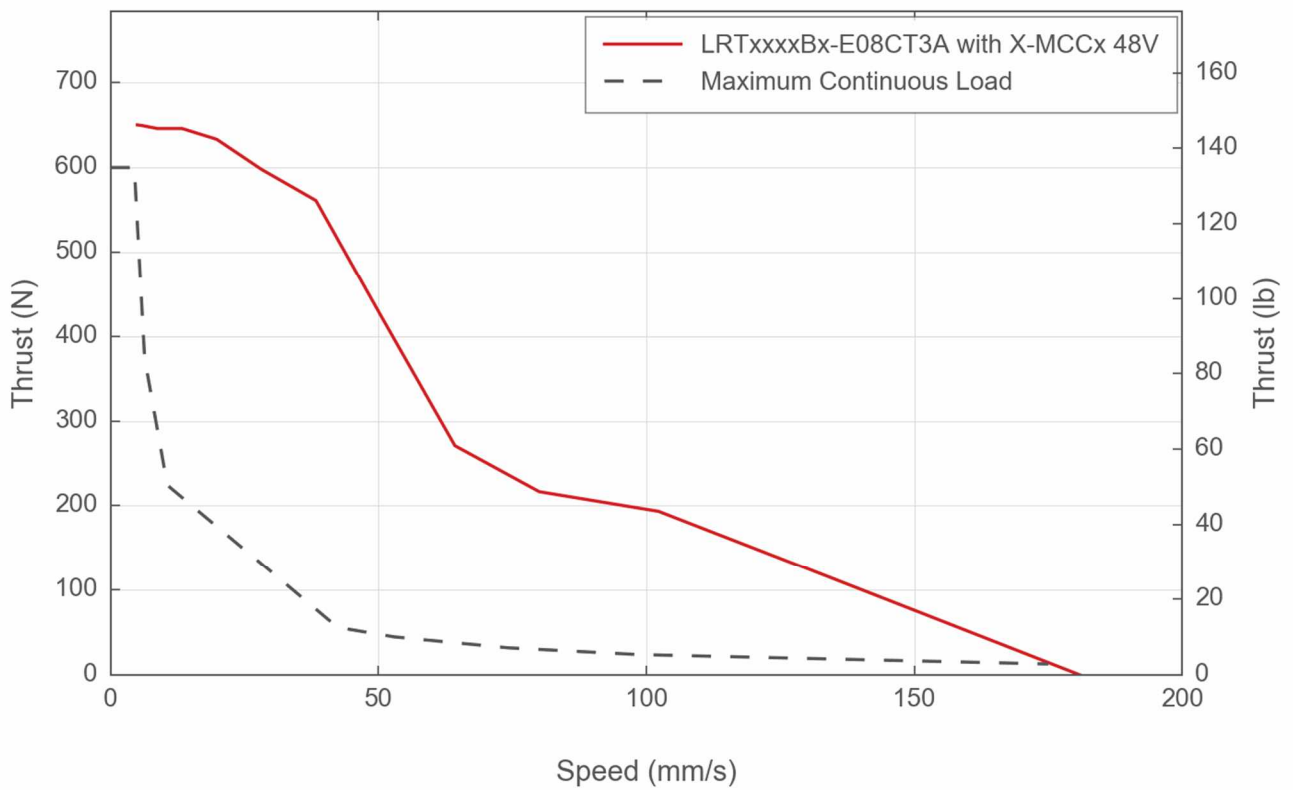
Thrust Speed Performance



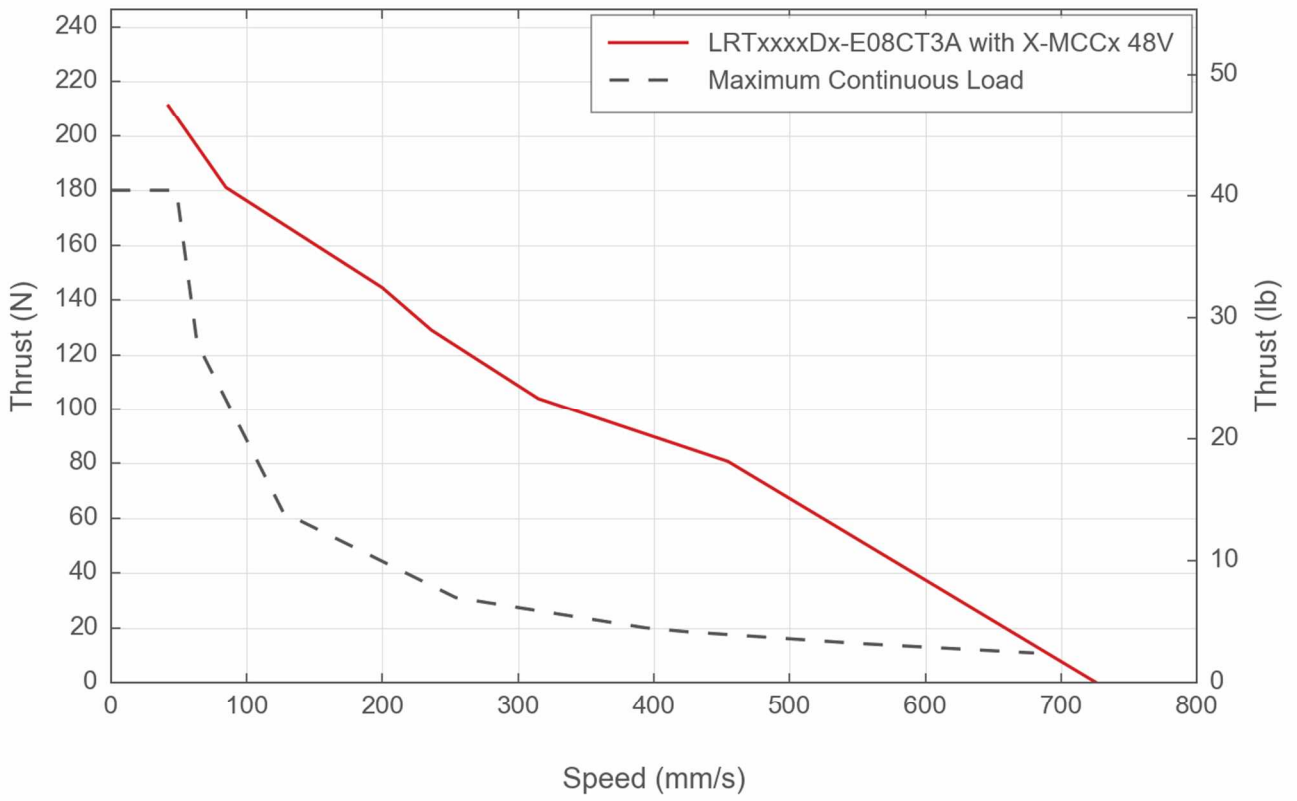
Thrust Speed Performance



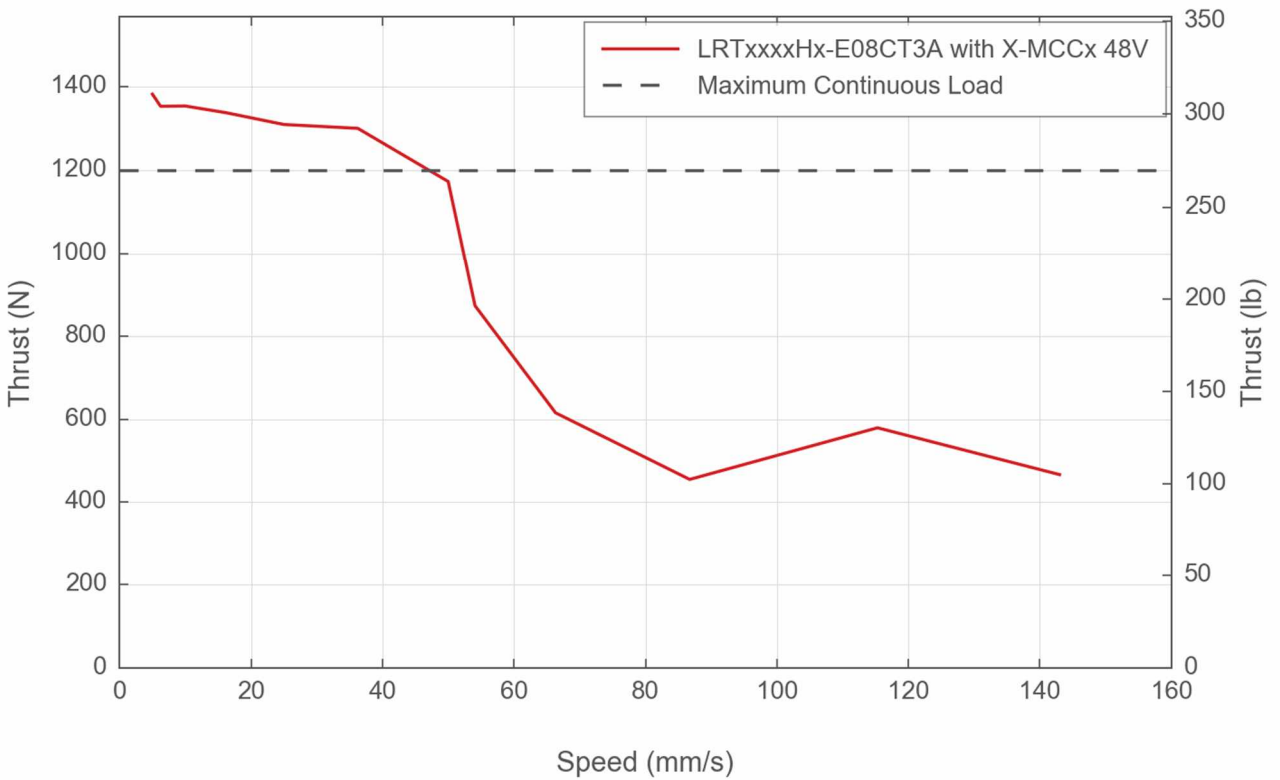
Thrust Speed Performance



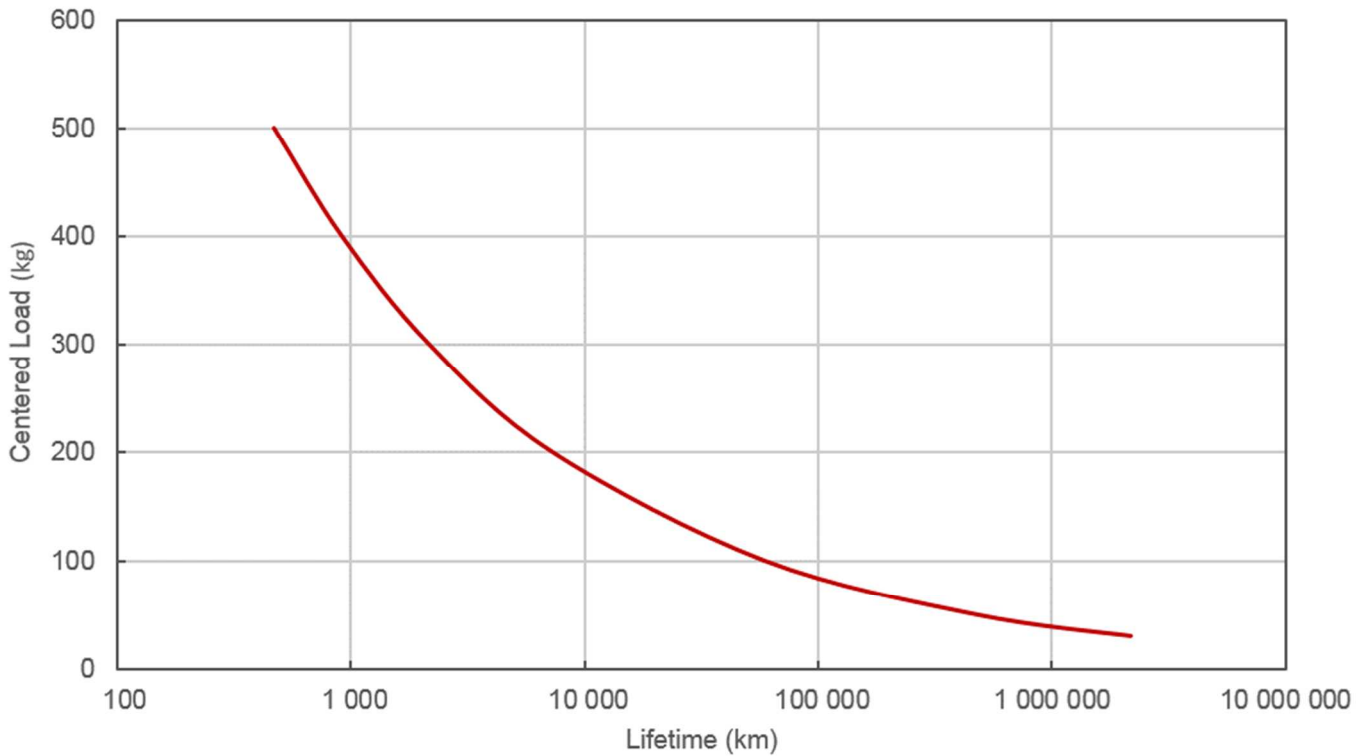
Thrust Speed Performance



Thrust Speed Performance



Typical LRT Bearing Lifetime



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