

M-LSM Series User's Manual

Motorized micromanipulators



Disclaimer

Zaber's products 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 warranty of fitness for a particular purpose. The user of this product agrees to [Zaber's general terms and conditions of sale](#).

Precautions

Zaber's autodetect peripheral axes are designed to be used effortlessly with Zaber's line of autodetect controllers. The M-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.

Conventions used throughout this document

- Fixed width type indicates communication to and from a device. The μ 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 M-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 M-LSM peripheral.

To connect the peripheral to a controller:

- Power off the controller.
- Connect the M-LSM peripheral.
- Power on the controller.
- The controller will activate the peripheral shortly after it is powered on.

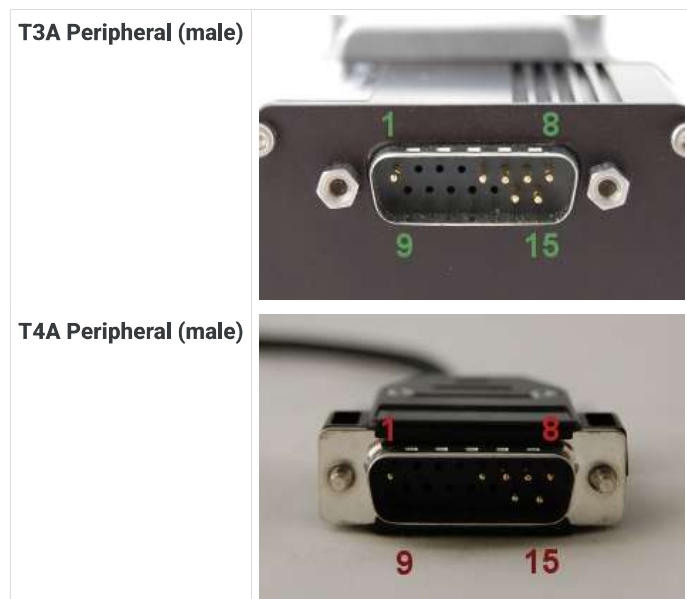
See the Zaber controller user manual for more details on peripheral activation and control.

Connectors

Recommended controller(s) for your M-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)



Pin #	Function
1	+5V for Limits & Encoder
2	AutoDetect Data
3	N.C.
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 M-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 device due to incorrect wiring is not covered by warranty.

Motors

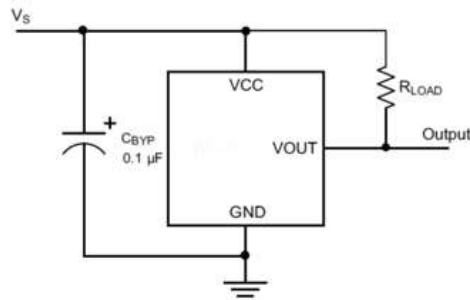
For motor information see the [M-LSM product page](#)

Limit Sensors

Hall effect sensors are used in the M-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:
 - 5 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

Zaber's M-LSM series of Micromanipulators are used to position probes under a microscope with a joystick or computer. They can be mounted to either metric or imperial optical breadboards. An adjustable probe holder allows mounting of probe diameters between 2 and 13 mm. The controller connects to the RS-232 or USB port of any computer.

Mounting

The M-LSM micromanipulator is specified either with a flat base or an adaptor plate to mount to an optical post.

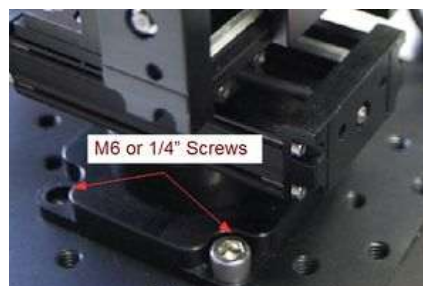
Installing a M-LSM with a flat base



Right hand M-LSM that mounts to a flat base. Ships assembled as shown above.



Bracket to mount to flat base shown for clarity, but remains assembled during installation.



Using either four [M6 screws on a 50mm grid](#) or [1/2" screws on a 2" grid](#) attach M-LSM micromanipulator to a flat base.

Installing a M-LSM to an Optical Post



Left hand post mounted M-LSM. Ships assembled as shown above, excluding the optical post.



Bracket to mount to an optical post for either a 1/2" or 12.7mm optical post.



Slide bracket over optical post into desired position and tighten M6 screw with 5 mm allen key to lock M-LSM in position.



Ensure that the optical post doesn't extend too far, or it will interfere. The above image shows incorrect installation where the optical post will obstruct the movement.

Powering up an M-LSM



Main components of M-LSM



Each LSM stage has dangling cable connectors labelled AXIS 1, 2 & 3 to be connected to appropriate X-MCC3 driver axes.



The X-JOY3 is connected to the X-MCC3 through the X-DC06 cable

Once the system has been installed, verify that each axis is working correctly by moving the joystick. Please note that each stage needs to be homed before it is able to move the full length of travel. Homing the devices is done by using the joystick to move each axis to the end of travel on the side of the motor.

Should you wish to mount alternative probes to the M-LSM custom adaptor plates are available upon request. Please contact Zaber technical support at 1-888-276-8033 or contact@zaber.com for more information.

Operation

The joystick is pre-programmed with the following settings.



Axis numbers are labelled on the corresponding stage cables.

Joystick Settings				
Key	Event 1	Event 2	Event 3	Event 4
1		Stop	Set active axis 3 (Z)	Set axis velocity scale 0 (Deactivate Z)
2		Set Reference Position	Go to Reference Position	
3		Set Reference Position	Go to Reference Position	
4		Set Reference Position	Go to Reference Position	
5		Set Reference Position	Go to Reference Position	
6	Set active axis 1 (X)	Set axis velocity scale 3000	Set axis velocity scale 80000	
7	Set active axis 2 (Y)	Set axis velocity scale 3000	Set axis velocity scale 80000	
8	Set active axis 3 (Z)	Set axis velocity scale 3000	Set axis velocity scale 80000	

Button 8 re-activates the Z-axis.

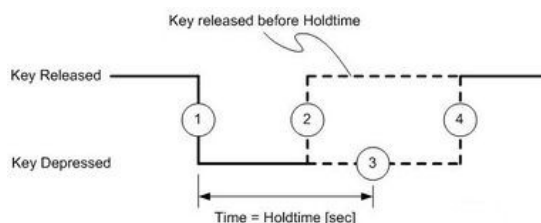


Diagram of the event path for each key. The events are numbered from 1-4. This diagram shows what events are issued depending on how long you hold the key.

Accessing key events			
Event 1	Event 2	Event 3	Event 4
Press button	Quick release of button, less than 2 seconds	Hold button longer than 2 seconds	Release button after holding longer than 2 seconds

The orange led will flash after about 2 seconds to signify that event 3 has been triggered.

If you would like to change the settings of the joystick refer to the [X-JOY3 user manual](#).

Most of the information you will need to operate the stage using the X-MCC controller can be found in the [X-MCC User Manual](#).

Trajectory Control and Behaviour

This section describes the behaviour of the axis trajectory when a movement command is issued.

Software Position Limits

The travel range of the axis is limited by the Minimum Position and Maximum Position settings. The factory settings for the axis are configured to match the physical travel range. If a customized range is desired, it can be changed by configuring the [limit.min \(T:106\)](#) and [limit.max \(T:44\)](#) settings to appropriate values. For the Current Position, query [pos \(T:60\)](#).

Minimum Position

When the Current Position is less than the Minimum Position value, the axis cannot move in the negative direction (towards the motor).

Maximum Position

When the Current Position is greater than the Maximum Position value, the axis cannot move in the positive direction (away from the motor).

Movement Speed

The movement speed of the axis depends on axis status and various speed settings. If the axis has not been initialized by the [home \(T:1\)](#) command or by moving towards the home end of the axis, movement speed will be constrained to fail-safe values. The home status of the axis can be determined by reading the [limit.home.triggered\(T:53:103\)](#) setting.

Movement speed of the axis is specified below:

[move vel \(T:22\)](#)

The axis will move at the specified speed regardless of home status.

Knob movement in Velocity Mode

The axis will move at the specified speed regardless of home status.

The speed is specified by the [knob.speedprofile \(T:112\)](#) and [knob.maxspeed \(T:111\)](#) settings.

Other movement commands - when the axis has not been homed

The axis will move at the slower of the [maxspeed \(T:42\)](#) and [limit.approach.maxspeed \(T:41\)](#) settings.

Other movement commands - when the axis has been homed

The axis will move at the speed specified by the [maxspeed \(T:42\)](#) setting.

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.

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/M-LSM>.

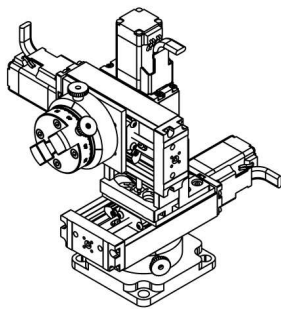
Appendix A: Default Settings

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

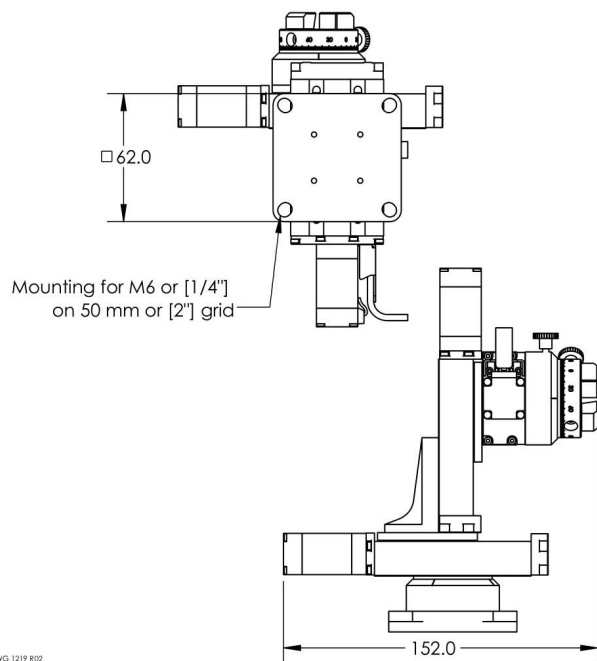
Product Drawings

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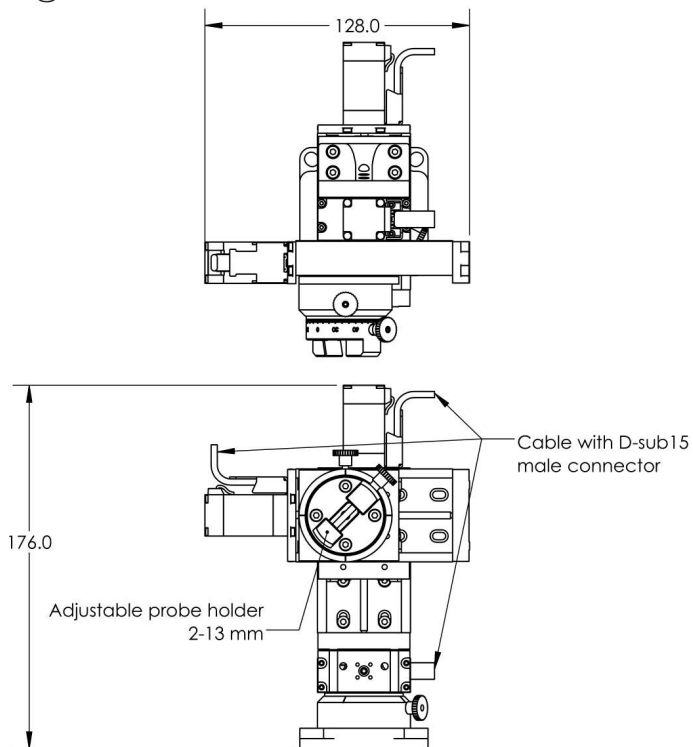
M-LSM-LHF Motorized Micromanipulator
dimensions in mm



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

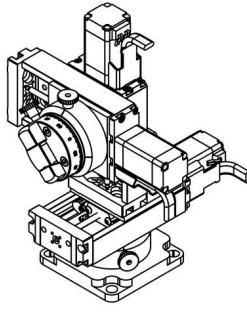


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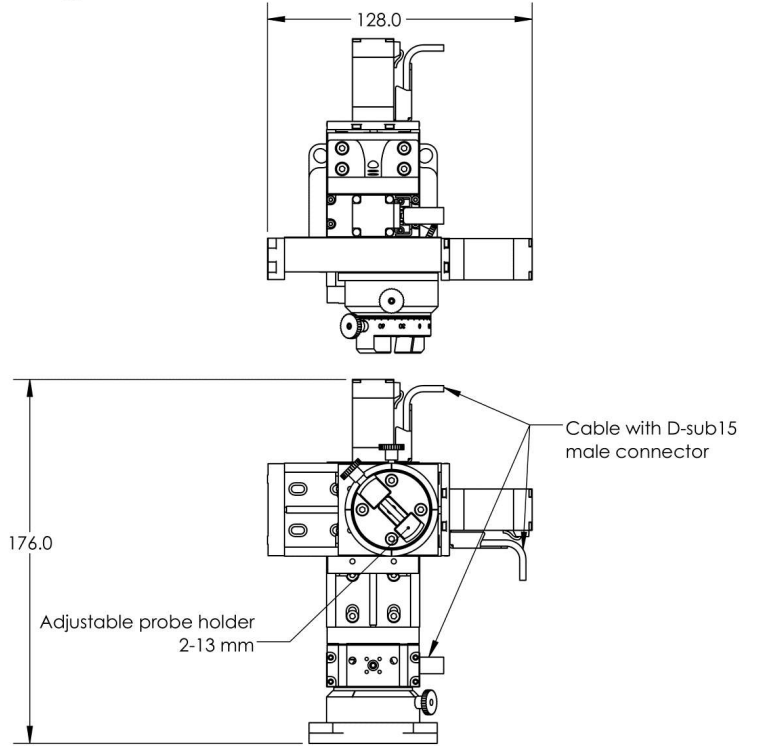
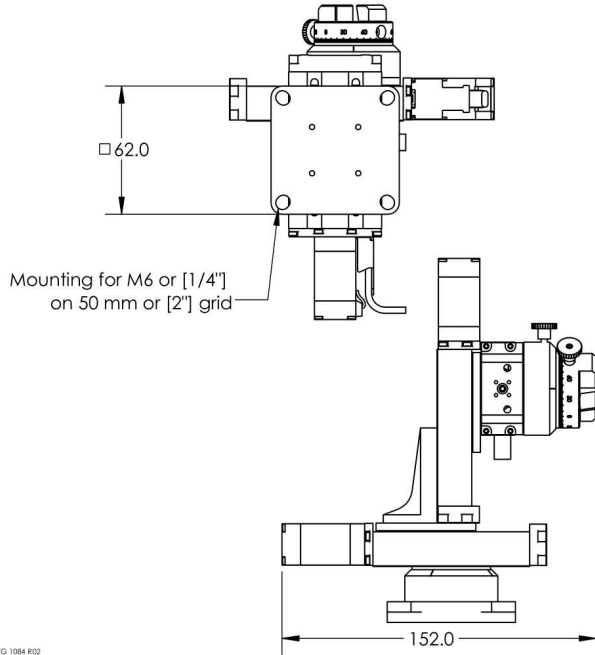


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M-LSM-RHF Motorized Micromanipulator
dimensions in mm

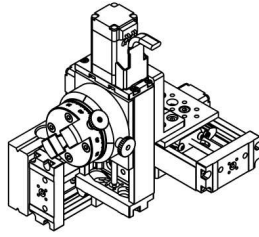


*See product page for complete list
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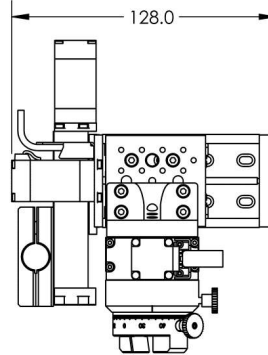
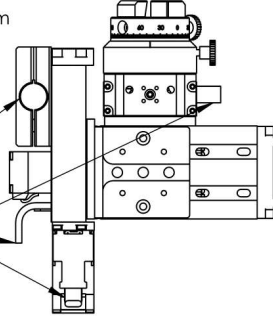
M-LSM-LHP Motorized Micromanipulator
dimensions in mm



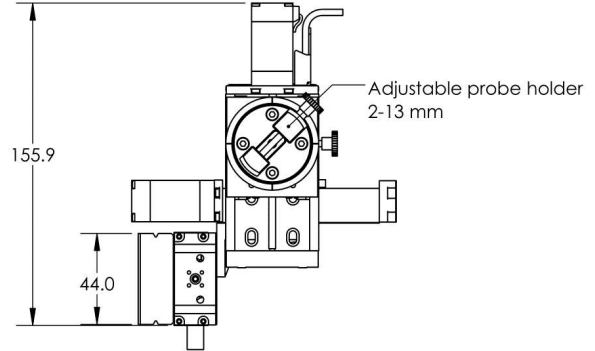
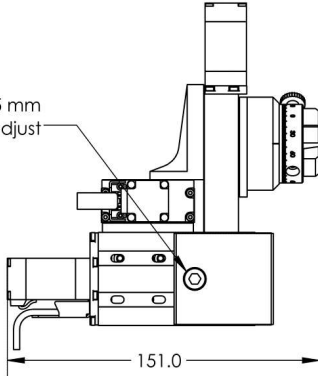
*See product page for complete list
of available models at www.zaber.com

Mounting to 12.7 mm or [1/2"]
optical post

Cable with D-sub15 male
connector

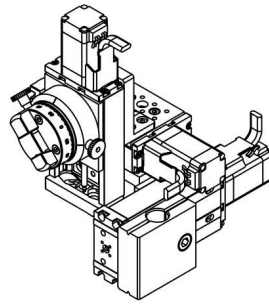


M6 screw 5 mm
Hex key to adjust

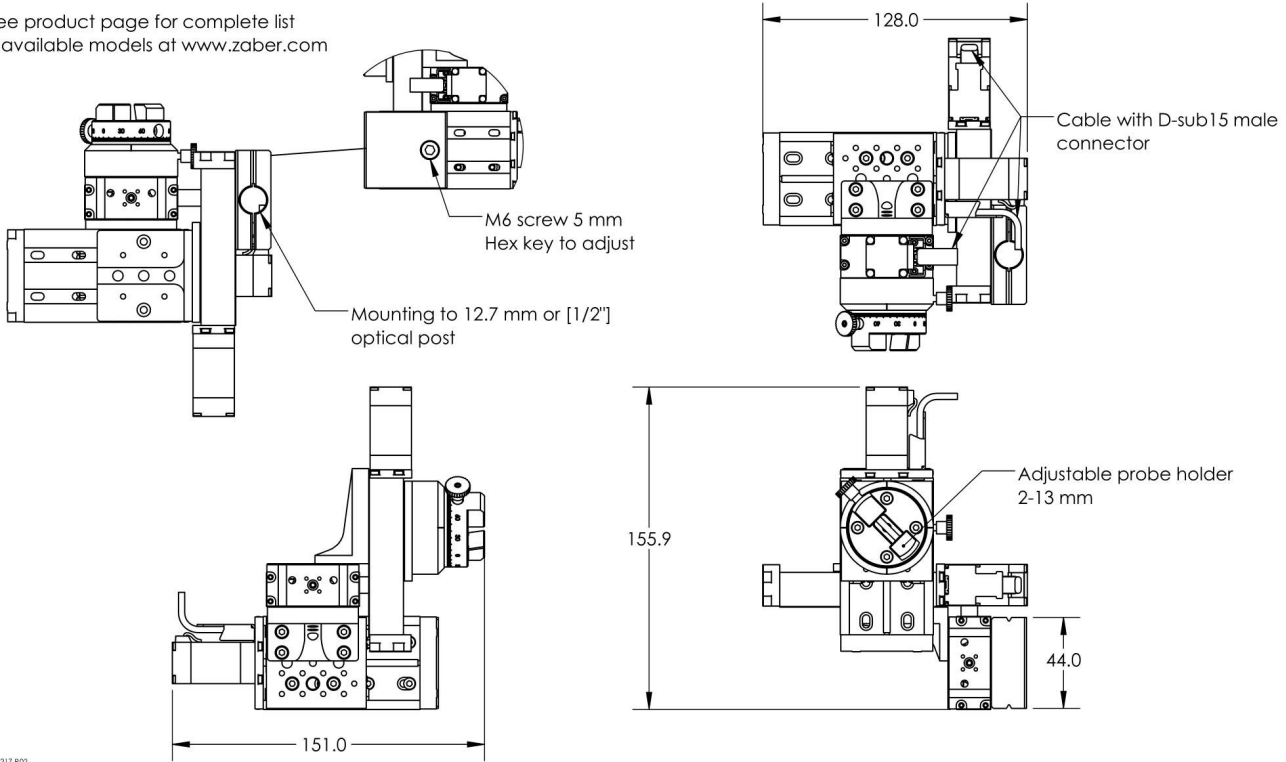


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M-LSM-RHP Motorized Micromanipulator
dimensions in mm



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



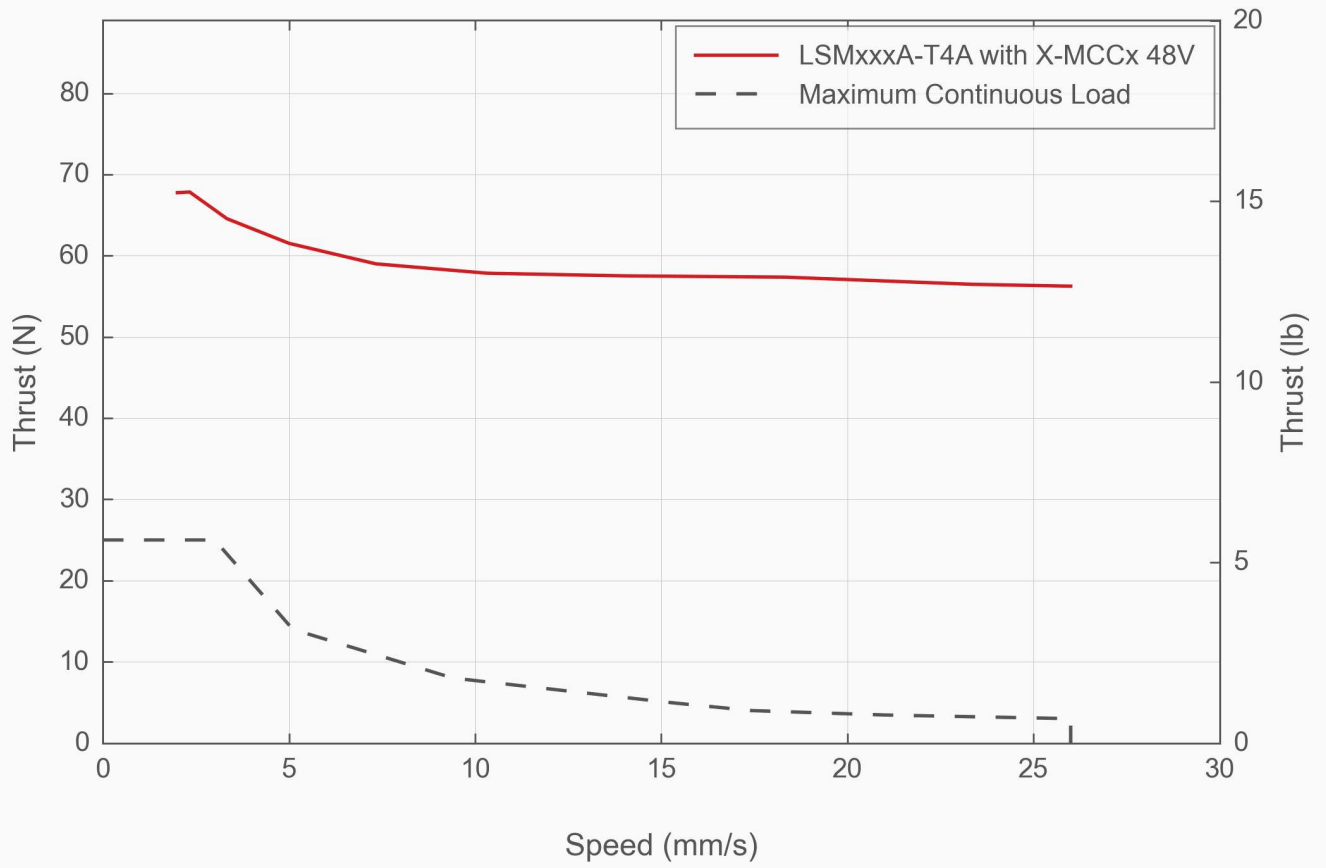
DWG 1217 R02

Specifications

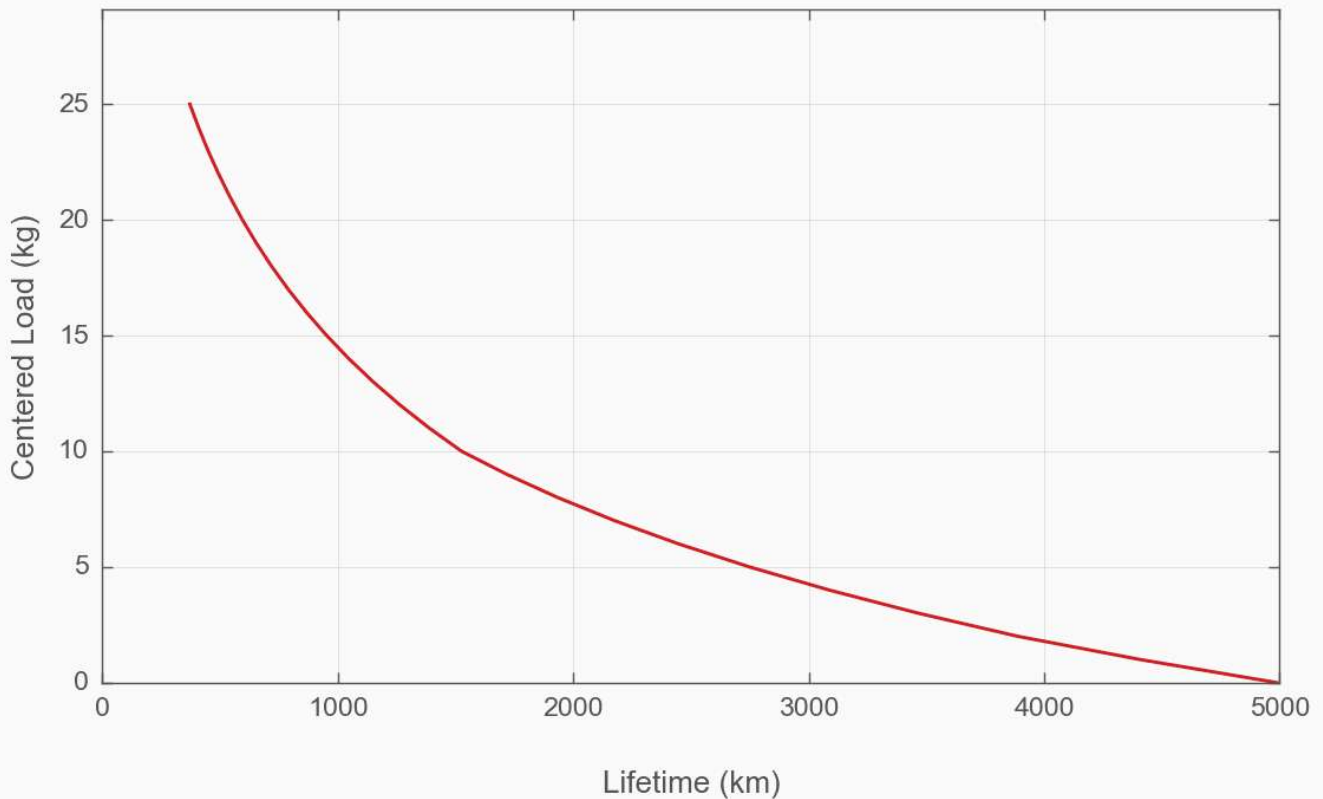
Specification	Value	Alternate Unit
Microstep Size (Default Resolution)	0.047625 μm	
Recommended Controller	MCC (48 V) Recommended	
AutoDetect	Yes	
Travel Range	25.4 mm	1.000"
Accuracy (unidirectional)	15 μm	0.000591"
Repeatability	< 3 μm	< 0.000118"
Backlash	< 12 μm	< 0.000472"
Maximum Speed	26 mm/s	1.024"/s
Minimum Speed	0.000029 mm/s	0.000001"/s
Speed Resolution	0.000029 mm/s	0.000001"/s
Encoder Type	None	
Peak Thrust	55 N	12.3 lb
Communication Interface	RS-232, USB 2.0	
Communication Protocol	Zaber ASCII (Default), Zaber Binary	
Vertical Runout	< 8 μm	< 0.000315"
Horizontal Runout	< 12 μm	< 0.000472"
Pitch	0.02°	0.349 mrad
Roll	0.02°	0.349 mrad

Specification	Value	Alternate Unit
Yaw	0.03°	0.523 mrad
Probe Diameter Range	2-13 mm	
Probe Angle Range	360°	6.283 rad
Linear Motion Per Motor Rev	0.6096 mm	0.024"
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 Connection	D-sub 15	
Default Resolution	1/64 of a step	
Guide Type	Recirculating ball bearing	
Mechanical Drive System	Precision lead screw	
Limit or Home Sensing	Magnetic hall sensor	
Axes of Motion	3	
Stage Parallelism	< 25 µm	< 0.000984"
Joystick Control	Velocity Mode	
Operating Temperature Range	0-50 °C	
CE Compliant	Yes	
Vacuum Compatible	No	
Weight	1.032 kg	2.275 lb

Thrust Speed Performance



LSM Linear Bearing Lifetime



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