

# MP-21

Series



## Micro Pusher Reference Manual

# **MP-21**

## **Linear Actuator**

### **Reference Manual**

Rev 3.1

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## Table of Contents

<b>1. Introduction</b>	<b>2</b>
1.1 Product Description	2
1.2 Stepper Motor (SM-001)	2
1.3 Recommended Controllers	2
1.4 Technical Data	2
<b>2. Model Configurations</b>	<b>3</b>
2.1 MP-21 Order Numbers	3
<b>3. Preparing to Install the MP-21 Linear Actuator</b>	<b>3</b>
3.1 Installation Preparation	3
3.2 Package Contents	3
<b>4. Installing the MP-21 Linear Actuator</b>	<b>4</b>
4.1 MP-21 12 mm & 25 mm Installation	4
4.1.1 Recommended Mounting Design	4
<b>5. Dimensions</b>	<b>5</b>
5.1 MP-21 12/25 mm Travel Actuator Dimensions	5
<b>6. Connecting the MP-21 Linear Actuator</b>	<b>6</b>
6.1 Atmospheric Environments	6
6.1.1 Atmospheric Wiring Diagram	6
6.2 Vacuum Environments	7
6.2.1 Handling and Preparation	7
6.2.2 Vacuum Wiring Diagram	7
<b>7. Supplementary Information</b>	<b>8</b>
7.1 Maintenance and Personal Safety	8
7.2 Units and Conventions	8
<b>A. Appendix</b>	<b>9</b>
A.1 Stepper Motor Operating Specifications	9
A.2 Pinouts	9
A.2.1 Stepper Motor Atmospheric Pinout	9
A.2.2 Stepper Motor Vacuum Pinout	10
A.2.3 Feedthrough	10
A.3 Limit Switches	11
A.3.1 Electrical Specification	11
A.3.2 Limit Switch Schematic	11
A.3.3 Direction of Motion	11

## 1. Introduction

### 1.1 Product Description

The MP-21 linear actuator is designed for applications with very limited space conditions. Typical applications include actuation of manual drive stages and mirror mounts. It utilizes a 2-phase stepper motor and a mechanical limit switch for homing (custom options include an integrated encoder). Versions capable of operation in vacuum ( $10^{-6}$  mbar) are available. The MP-21 is compatible with the MMC-200 and NanoDrive™ controllers.

#### Features:

- Travel range of 12 and 25 mm
- 0.1  $\mu\text{m}$  open loop resolution
- Maximum force of 20 N
- Ball spline with zero backlash, non-rotating tip
- Integrated mechanical limit switch
- Vacuum versions available
- Optional encoder available

### 1.2 Stepper Motor (SM-001)

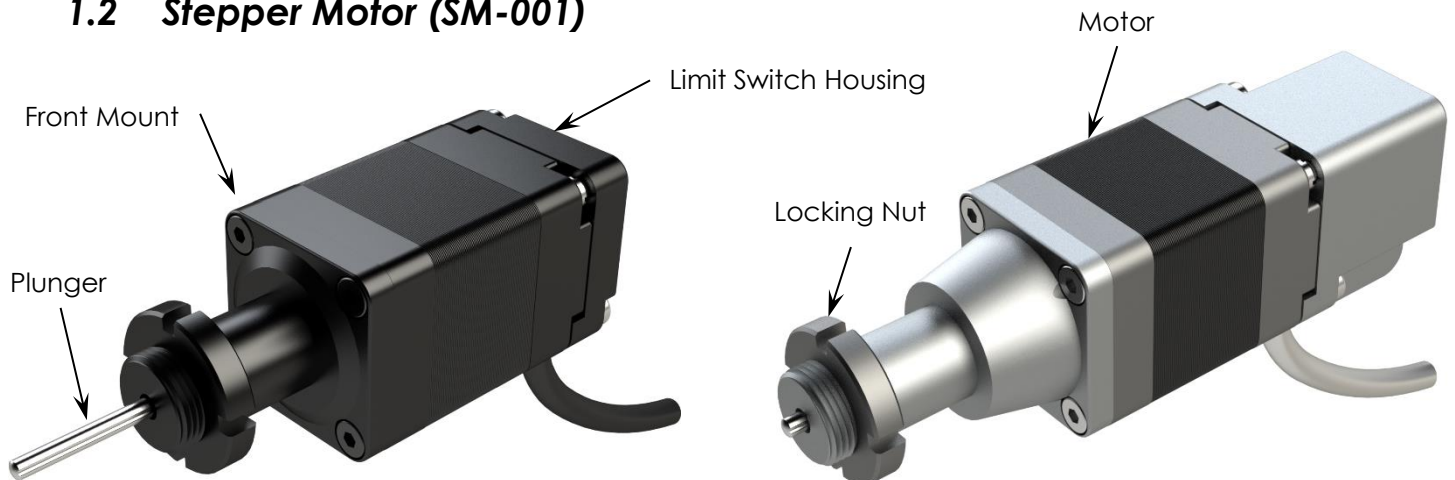


Figure 1-A. MP-21, 12mm Travel Version (left), 25mm Travel Version (right)

### 1.3 Recommended Controllers

The following controllers are available from MICRONIX USA:

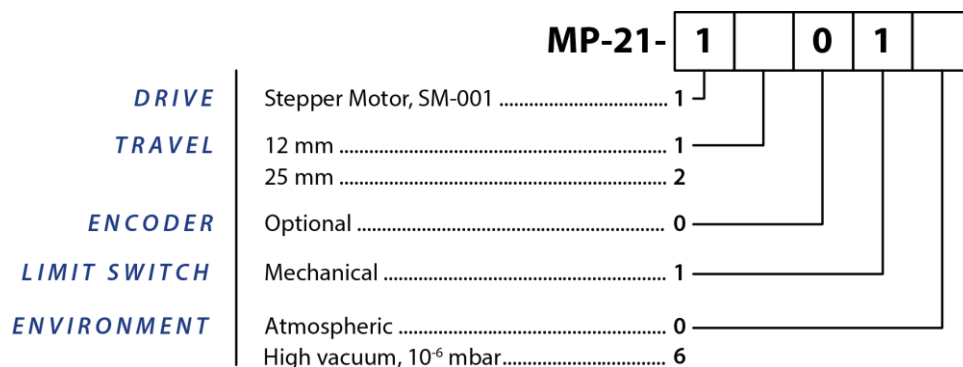
- MMC-200
- NanoDrive™

### 1.4 Technical Data

See Datasheet.

## 2. Model Configurations

### 2.1 MP-21 Order Numbers



Contact MICRONIX USA for custom versions and stacking configurations.

## 3. Preparing to Install the MP-21 Linear Actuator

### 3.1 Installation Preparation

The stage is calibrated and guaranteed to be within specification at 20°C ± 5°C unless otherwise specified. Be sure to use the stage under the following conditions:

- Mount to a clean surface which is free of debris, burrs or dings.
- An indoor atmosphere free of corrosive gases, excessive dust, and condensation.
- Temperature range of 5-40°C.
- Relative humidity between 20-80%.
- Locate away from water, heat, and electrical noise.

### 3.2 Package Contents

If the product is damaged or there are missing components, contact MICRONIX USA immediately. Do not discard product packaging in case of return shipment.

#### Package Should Contain:

- MP-21 Linear Actuator
- Locking Nut & Wrench
- Reference Manual
- Any other previously agreed upon components such as a controller and cable.

## 4. Installing the MP-21 Linear Actuator

The MP-21 can be installed to motorize manual drives, mirror mounts or other applications. The MP-21 is designed for axial loading; do not apply radial loads to the plunger.

### 4.1 MP-21 12 mm & 25 mm Installation

1. Unscrew the locking nut from the MP-21 and insert the MP-21 into the mounting surface.
2. Tighten the locking nut using the supplied wrench until secured and the body does not rotate. While installing, hold the MP-21 by the front mount to avoid applying torque to the limit switch housing.

**Important:** Do not apply radial loads to the plunger.

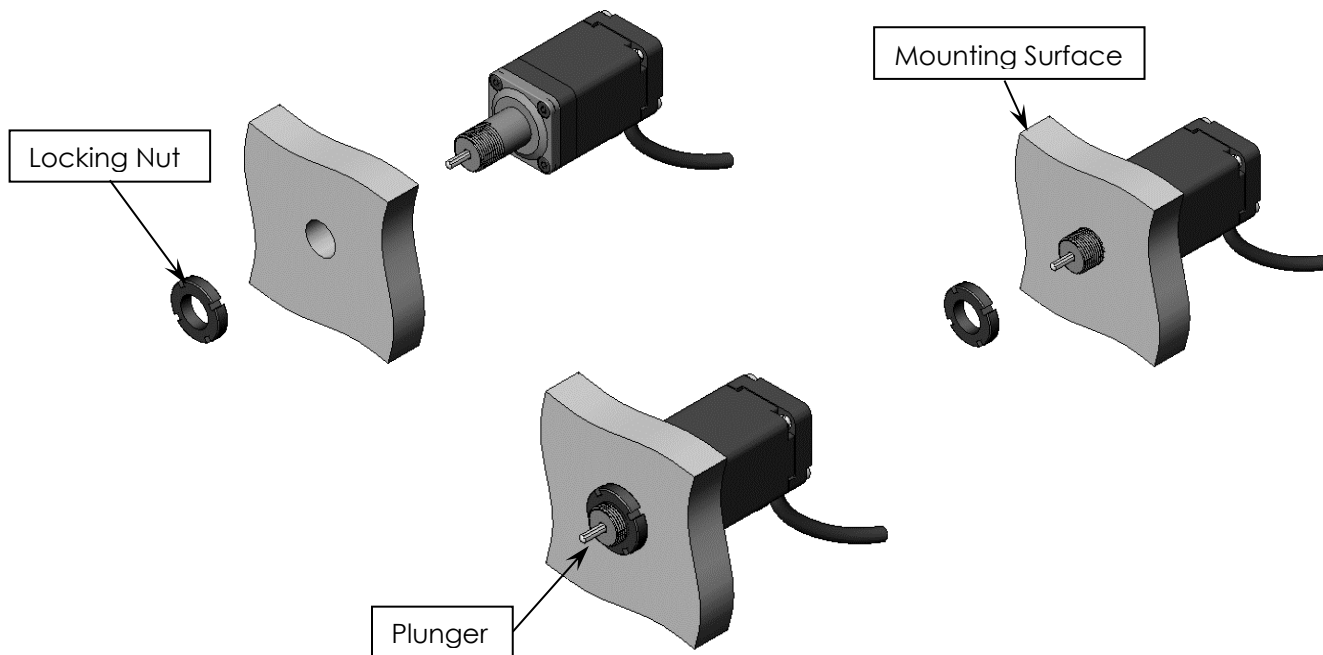
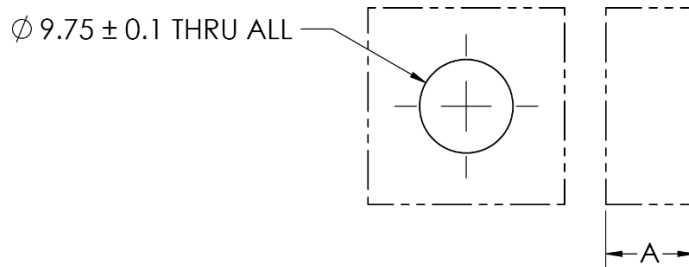


Figure 4-A. MP-21 12 mm & 25 mm General Installation

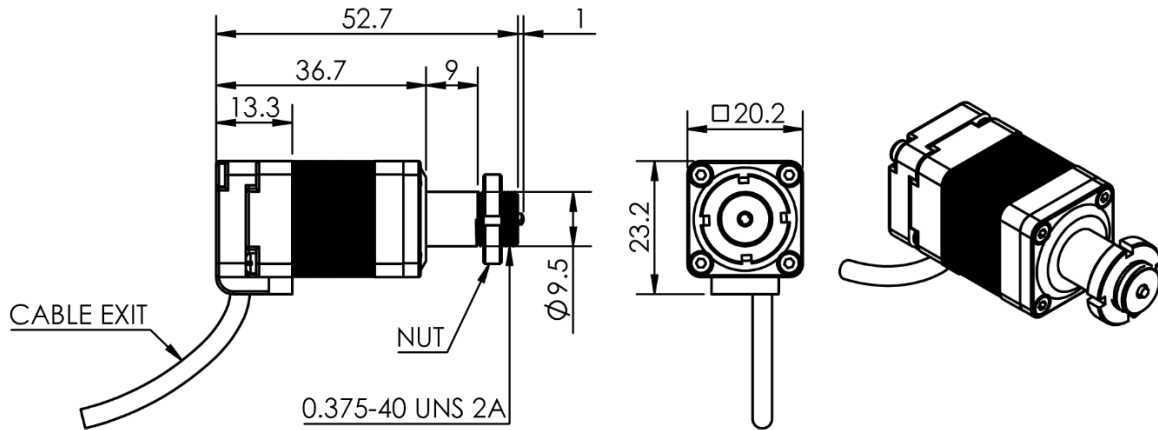
#### 4.1.1 Recommended Mounting Design



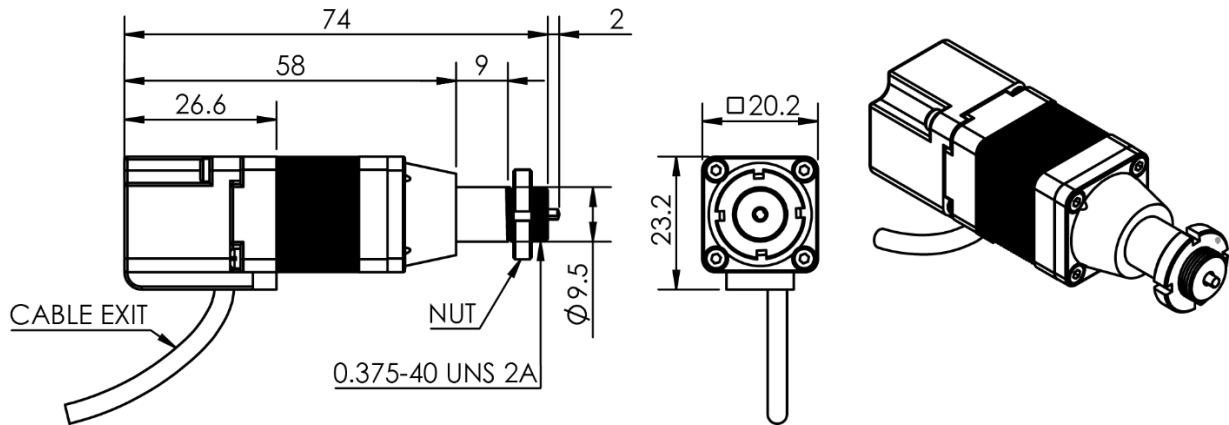
A (Mounting Thickness)	
Minimum (mm)	9
Maximum (mm)	16

5. Dimensions

5.1 MP-21 12/25 mm Travel Actuator Dimensions



\* 12 mm travel version shown above  
 \* 25 mm travel version shown below  
 \* all dimensions are in millimeters



## 6. Connecting the MP-21 Linear Actuator

### 6.1 Atmospheric Environments

For controller information refer to the appropriate MMC controller manual.

#### 6.1.1 Atmospheric Wiring Diagram

Connecting the MP-21 Linear Actuator in only requires that the D-sub 9 Pin male motor cable be connected to a compatible controller. No other cables or components are required. For details regarding pinout see Appendix A.2.1.

#### Cable Descriptions:

A. Motor Cable (Male Dsub9 Pin, 1.5m PVC Black Cable)

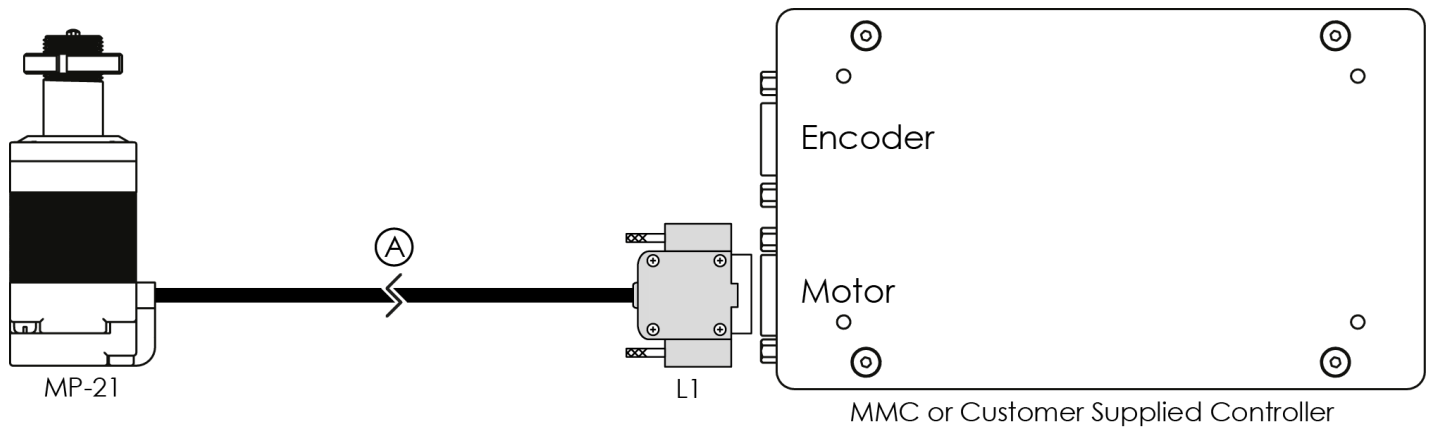


Figure 6-A. MP-21, Atmospheric Wiring Diagram



## 6.2 Vacuum Environments

### 6.2.1 Handling and Preparation

When handling the actuator for vacuum environments, take the necessary precautions, such as wearing clean latex gloves, clean room clothing, etc. Avoid any contaminants. Maximum bake-out temperature is 100°C. MICRONIX USA optionally supplies the stage with vacuum compatible connectors, see chart below.

Connector Description	Connector Material	Contacts	Backshell
High Vacuum Glass- filled Dyiathilate D-Subminiature	DAP	T2 Female Crimps, Gold Pins (Accuglass P/N: 111652)	Nickle-plated Zinc Backshell Strain Relief
Ultra High Vacuum D-Subminiature	PEEK	T1 Female Crimps, Gold Pins (Accuglass P/N: 100180)	PEEK UHV Strain Relief

Environment	Open Loop	Closed Loop
High Vacuum (10 <sup>-6</sup> mbar)	9 Pin Female DAP	15 Pin Female DAP
Ultra-High Vacuum (10 <sup>-9</sup> mbar)	9 Pin Female PEEK	15/25 Pin Female PEEK

Connecting the MP-21 in a vacuum chamber requires the use of a feed through connector at the vacuum chamber wall.

The vacuum compatible MP-21 will be supplied with wiring for a straight through feed through, not a cross over gender changer. MICRONIX USA supplies test connectors that simulate the vacuum feed through to allow for functionality testing prior to installation in a vacuum chamber, see Appendix A.2.3 for feedthrough pins.

### 6.2.2 Vacuum Wiring Diagram

For details regarding the pin-out and feed-through specifications see the Appendix section A.2.2.

#### Cable Descriptions:

- A. Motor Cable (Female Dsub9 Pin PEEK or DAP, 1.5m Silver Braided Cable)
- B. Atmospheric Motor Cable (Female Dsub9 Pin to Male Dsub9 Pin, 1.5m PVC Black Cable)

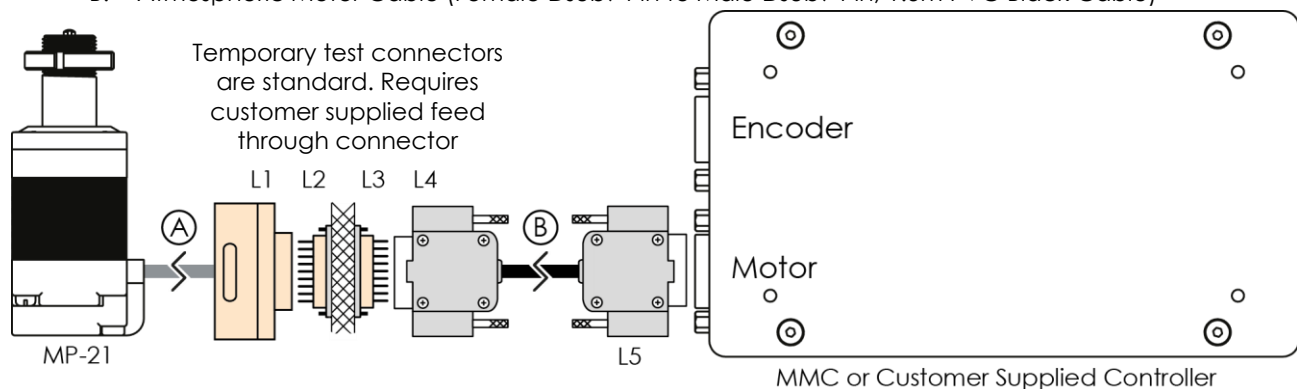


Figure 6-B. MP-21, Vacuum Wiring Diagram

## 7. Supplementary Information

### 7.1 Maintenance and Personal Safety

- The MP-21 linear actuator is a precision mechanical device and should be handled with care. Do not drop or mishandle the actuator.
- Follow the *Safe Operating Environment* requirements and use proper cable management to ensure a clean and safe operating environment.
- The MP-21 is designed to support axial loads only, do not apply radial loads.
- Allow for easy access to the stage in case of servicing.

### 7.2 Units and Conventions

All measurements in this document are in the metric system of units.

Metric Unit	English Unit
1 millimeter	0.0394 inches
1 micron	0.0000394 inches
1 Newton	0.2248 lbs
1 Newton-meter	8.85 in-lbs

## A. Appendix

### A.1 Stepper Motor Operating Specifications

Motor Type	2 Phase Bipolar
Phase Current	0.24 A max (RMS)*
Step Angle	1.8 °
Steps	200
Coil-Resistance	20.4 Ohms
Coil-Inductance	5 mH
Pitch	0.5 mm/rev
Resolution/Fullstep	2.5 µm

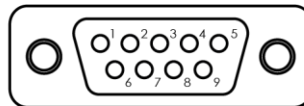
\*If a 3<sup>rd</sup> party controller is used it is essential to make sure the current is set properly to assure specifications.

### A.2 Pinouts

#### A.2.1 Stepper Motor Atmospheric Pinout

See Figure 6-A.

Pinout for MP-21-1X010		Cable A Dsub9M
Description:	Color	L1
Motor A+	Brown (White TP)	1
Motor A-	Green (White TP)	2
Motor B+	Violet (White TP)	3
Motor B-	Grey (White TP)	4
Limit GND	Black	5
Limit Switch-	Blue	6
Limit Switch+	Black (Jumper)	7
+5VDC	Red	8
Shield	-	Casing

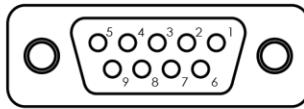


Dsub9M - Front View  
9 Pin Male Connector

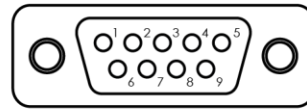
**A.2.2 Stepper Motor Vacuum Pinout**

See Figure 6-B.

Pinout for MP-21-1X016		Cable A			Feedthrough		Cable B	
		Dsub9F	Dsub9M		Dsub9M		Dsub9F	Dsub9M
Motor A	Description:	Color	L1	L2	L3	Color	L4	L5
	Motor A+	Brown (White TP)	1	5	1	Brown (White TP)	1	1
	Motor A-	Green (White TP)	2	4	2	Green (White TP)	2	2
	Motor B+	Violet (White TP)	3	3	3	Violet (White TP)	3	3
	Motor B-	Grey (White TP)	4	2	4	Grey (White TP)	4	4
	Limit GND	Black	5	1	5	Black	5	5
	Limit Switch-	Blue	6	9	6	Blue	6	6
	Limit Switch+	Black (Jumper)	7	8	7	Black (Jumper)	7	7
	+5VDC	Red	8	7	8	Red	8	8
	Shield	-	9	6	9	-	9	9

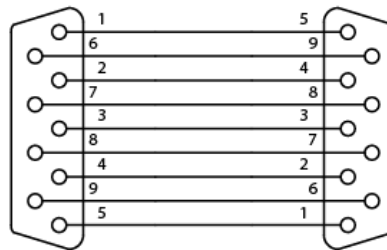


**Dsub9F** - Front View  
9 Pin Female Connector



**Dsub9M** - Front View  
9 Pin Male Connector

**A.2.3 Feedthrough**



Male DB9

Male DB9

### A.3 Limit Switches

The mechanical limit switch is normally closed (when not activated) and should be connected to a compatible controller that recognizes these settings. There is no positive mechanical limit switch; therefore, a software limit should be set up in the motion controller. Failure to properly set up the limit switches in the controller will mechanically damage the MP-21 Linear Actuator. We recommend the software limit (TLP command) be set according to the table below.

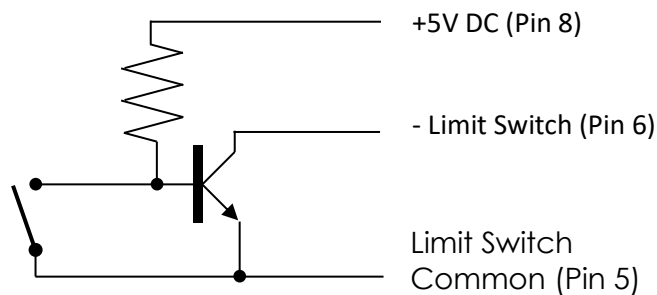
Travel Length (mm)	Software Limit Switch Position (mm)
12	12 or less
25	25 or less

The mechanical limit switch is factory calibrated and cannot be adjusted by the customer. For custom travel lengths, please contact MICRONIX USA.

#### A.3.1 Electrical Specification

Contact Rating	50 mA @ 30 V
Contact Type	Open collector (NPN)

#### A.3.2 Limit Switch Schematic



#### A.3.3 Direction of Motion

