

# MP-21

Series



## Micro Pusher Reference Manual

# **MP-21**

## **Linear Actuator**

### **Reference Manual**

Rev 3.2

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## 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. The unit incorporates a ball spline with zero backlash and a non-rotating tip. It utilizes a 2-phase stepper motor and a mechanical limit switch for homing. Versions capable of operation in high vacuum ( $10^{-6}$  mbar) are available. The MP-21 is compatible with the MMC-200 controller.

Product Specifications	MP-21	
Travel	12mm	25mm
Open Loop Resolution	0.1 $\mu$ m	
Max Force	20 N	
Limit Switch	Mechanical	
Environment	Atmospheric / HV	
Encoder	Upon Request	
Custom Adapter Tip	Upon Request See <a href="#">section 5</a> for more info	

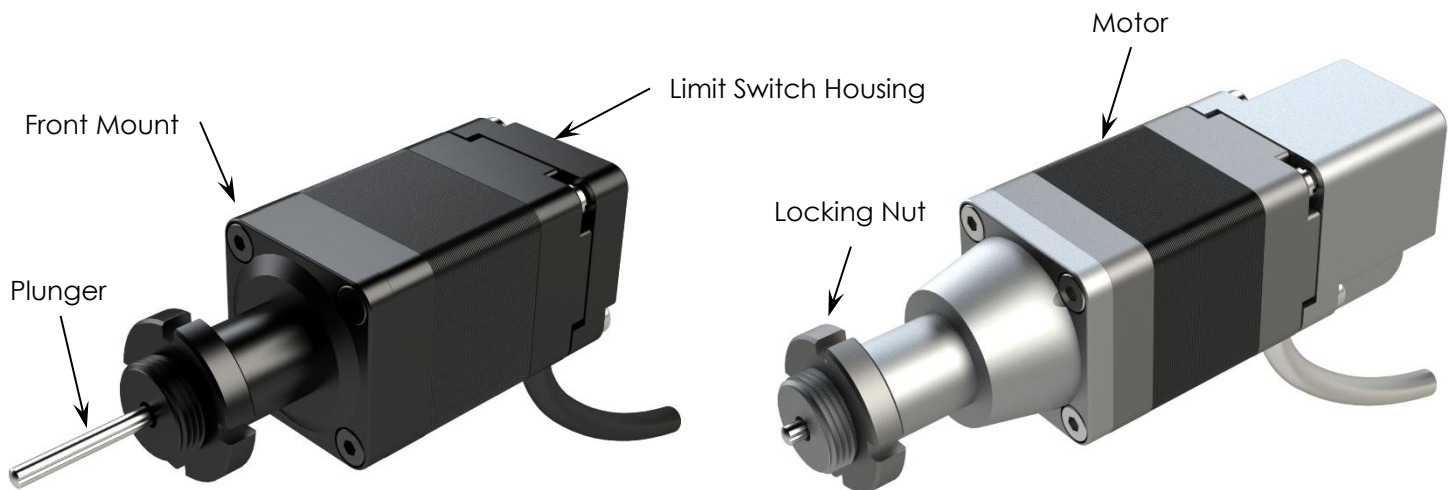


Figure 1-A. MP-21, Atmospheric 12mm Travel Version (left),  
HV 25mm Travel Version (right)

### 1.2 Recommended Controllers

The following controllers are available from MICRONIX USA:

Controller	Stepper Motor	Encoder
<a href="#">MMC-200</a>	✓	Consult with Factory

## 1.3 Technical Data and Ordering Information

Detailed specifications and ordering information can be found on the [MP-21](#) product page on the MICRONIX USA website.

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

### 2.1 Installation Preparation

The stage is calibrated to be within specification at  $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$  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.

### 2.2 Product Handling

- The MP-21 linear actuator is a precision mechanical device and should be handled with care. Do not drop or mishandle the actuator.
- 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.

### 2.3 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.

### 3. Installing the MP-21 Linear Actuator

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

#### 3.1 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.

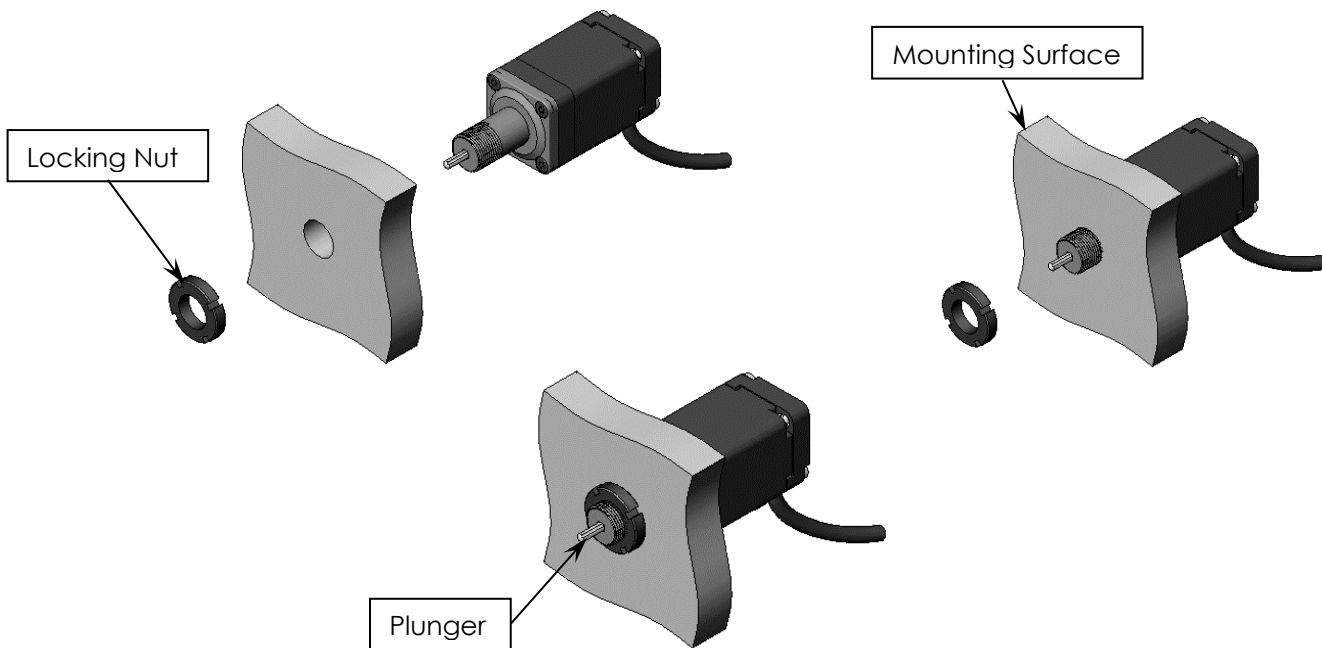


Figure 3-A. MP-21 12 mm & 25 mm General Installation

3.1.1 Mirror Mount Installation

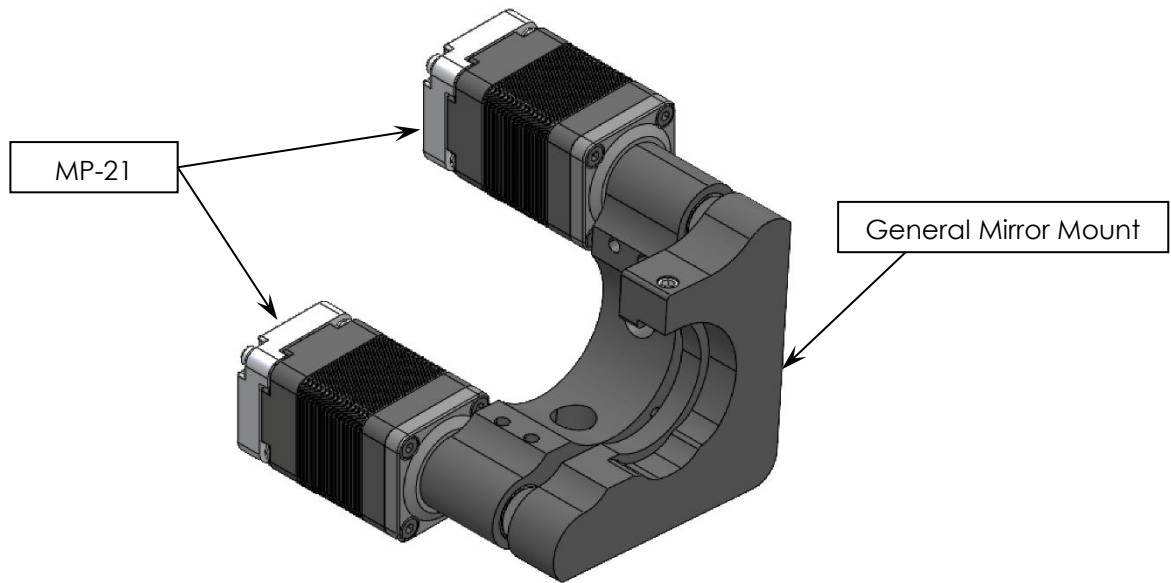
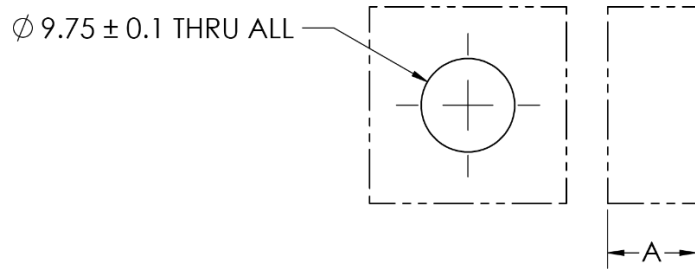


Figure 3-B. MP-21 Mirror Mount Application Example

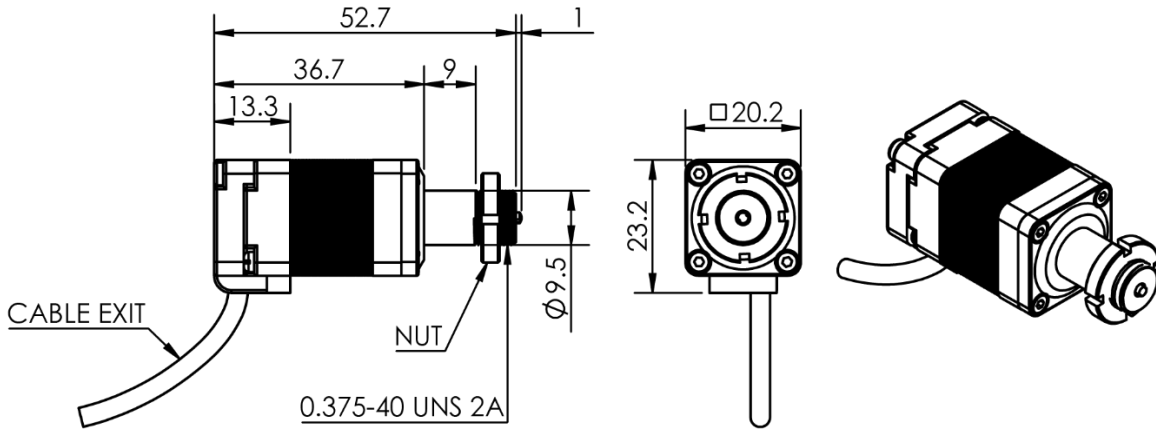
3.1.2 Recommended Mounting Design



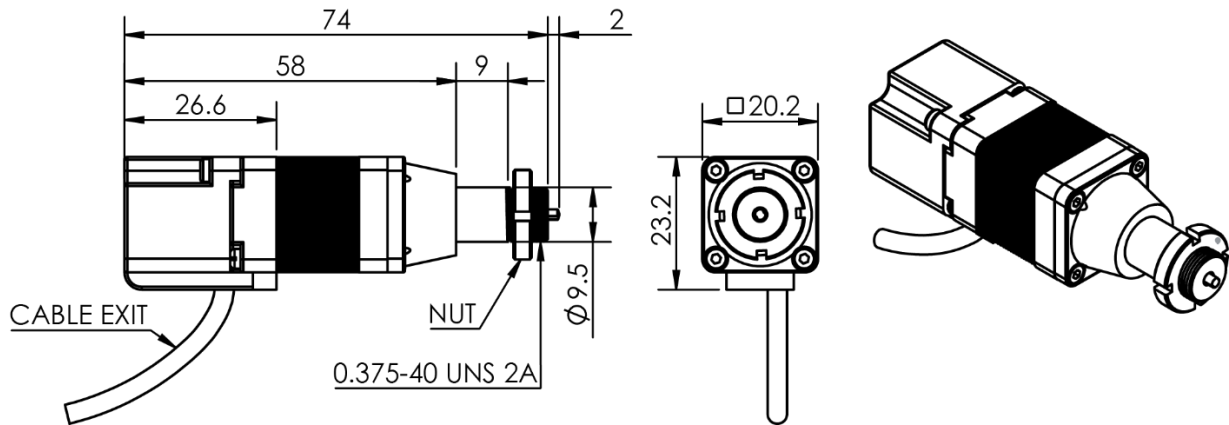
A (Mounting Thickness)	
Minimum (mm)	9
Maximum (mm)	16

4. Dimensions

4.1 MP-21 12/25 mm Travel Actuator Dimensions

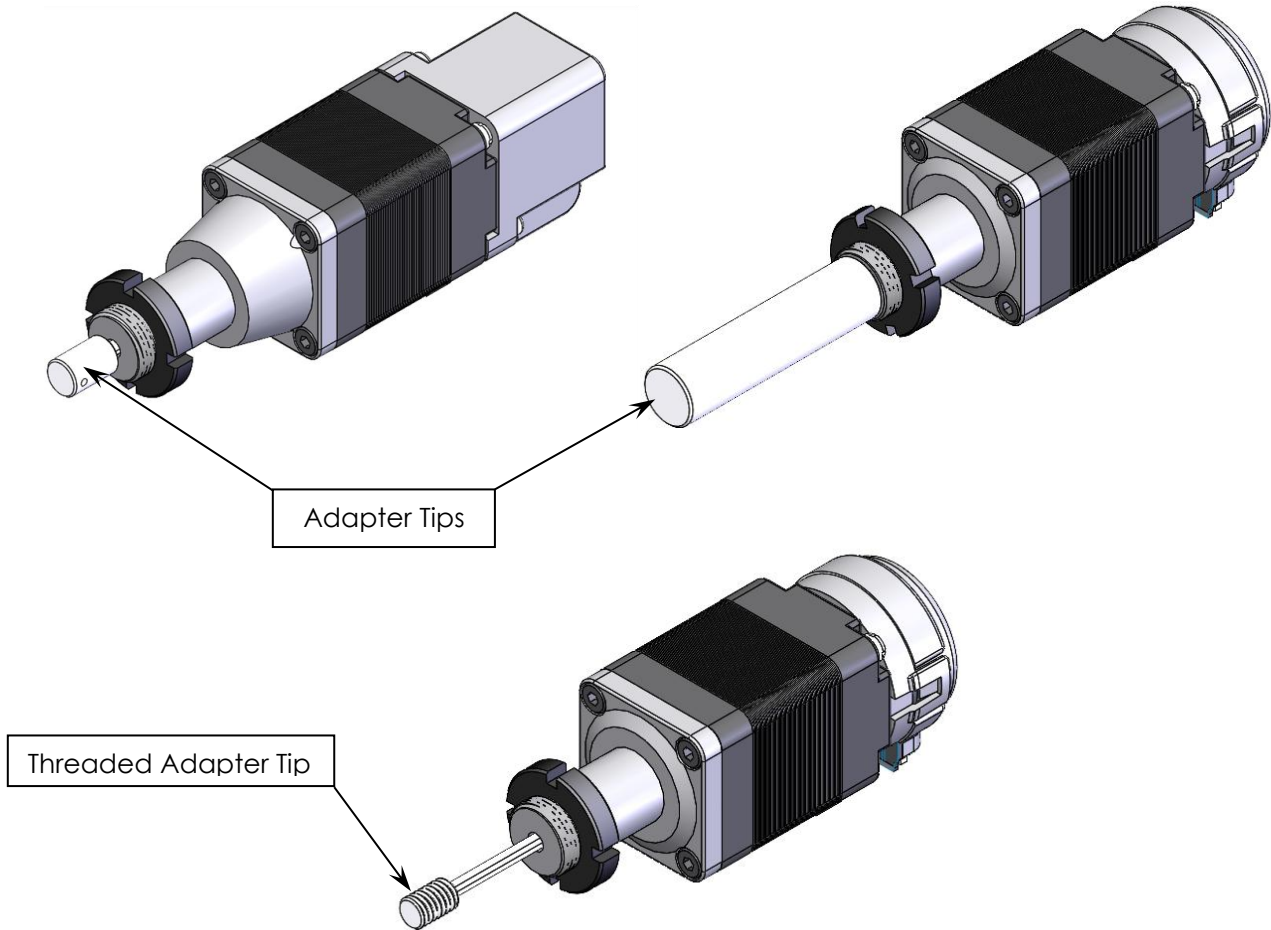


- \* 12 mm travel version shown above
- \* 25 mm travel version shown below
- \* all dimensions are in millimeters



## 5. Customization

### 5.1 Adapter Tip Examples



## 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.

##### Cable Descriptions:

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

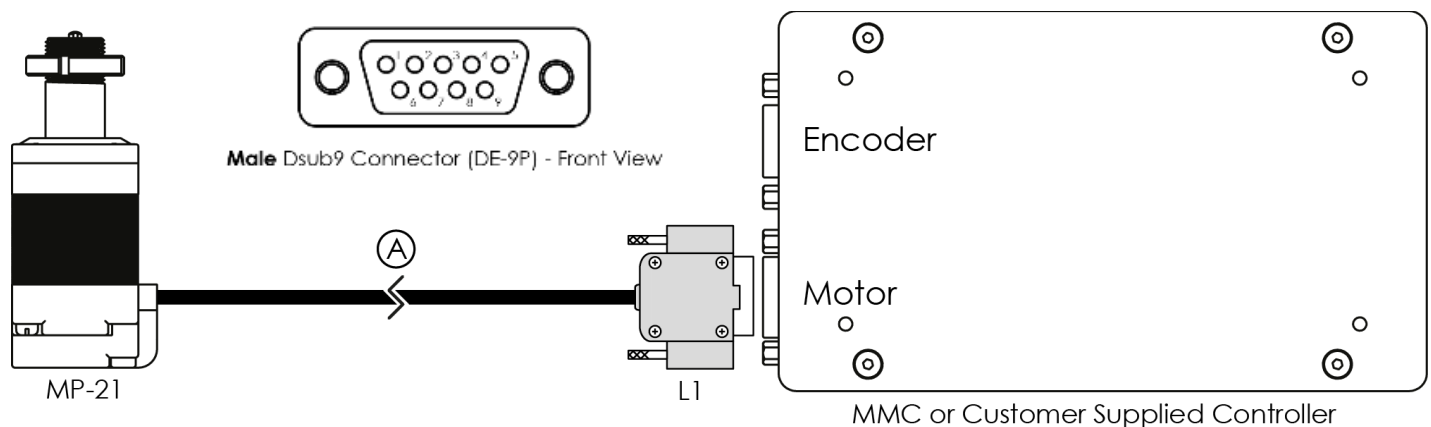


Figure 6-A. MP-21, Atmospheric Wiring Diagram

#### 6.1.2 Atmospheric Pinout

Pinout for MP-21-1X010		Cable A Dsub9M	
	Description	Color	
Motor	Motor A+	Brown & White (Brown TP)	L1
	Motor A-	Green & White (Green TP)	1
	Motor B+	Violet & White (Violet TP)	2
	Motor B-	Grey & White (Grey TP)	3
	Limit GND	Black	4
	Limit Switch -	Blue	5
	Limit Switch +	Black (Jumper Shorted to Pin 5)	6
	Limit +5 VDC	Red	7
	Not Used	Not Used	8
		9	

**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 Diallyl Phthalate D-Subminiature	DAP (Diallyl Phthalate)	T2 Female Crimps, Gold Pins (Accuglass P/N: 111652)	Nickle-plated Zinc Backshell Strain Relief

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

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 for feedthrough pins.

6.2.2 Vacuum Wiring Diagram

For details regarding the pinout and feedthrough specifications, see Appendix section A.2.

Cable Descriptions:

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

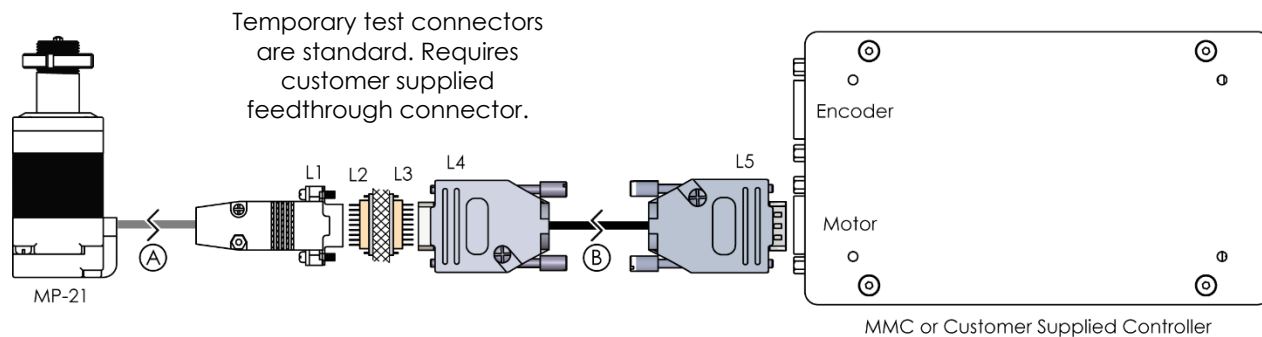
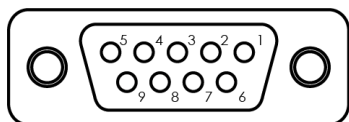


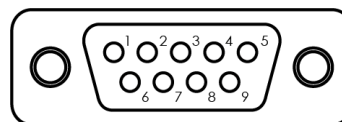
Figure 6-B. MP-21, Vacuum Wiring Diagram

6.2.3 Vacuum Pinouts

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



Female Dsub9 Connector (DE-9S) - Front View



Male Dsub9 Connector (DE-9P) - Front View

## 7. Supplementary Information

### 7.1 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

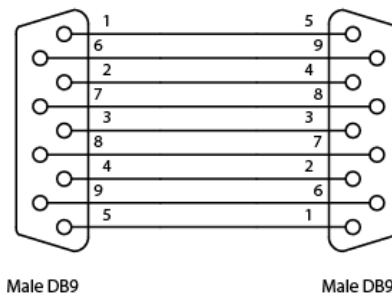
## A. Appendix

### 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/Full step	2.5 µm

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

### A.2 Feedthrough



### A.3 Limit Switches

#### A.3.1 Negative End of Travel

The MP-21 includes a mechanical limit switch and inverting NPN circuit located at the negative end of travel, used for overtravel protection and homing of the device. The switch is normally closed and pulled to GND when not activated and must be connected to a compatible controller configured for this operation. The mechanical limit switch is factory installed and is not user adjustable. Refer to the applicable controller user manual for additional information on homing and calibration procedures.

#### A.3.2 Positive End of Travel

The MP-21 does not include a positive-end mechanical limit switch; therefore, a software limit must be configured in the motion controller to prevent overtravel. Failure to properly configure the controller limits will cause mechanical damage to the device. Recommended positive software limit values are provided on the table below. Refer to the applicable controller user manual for additional information on configuring software limits.

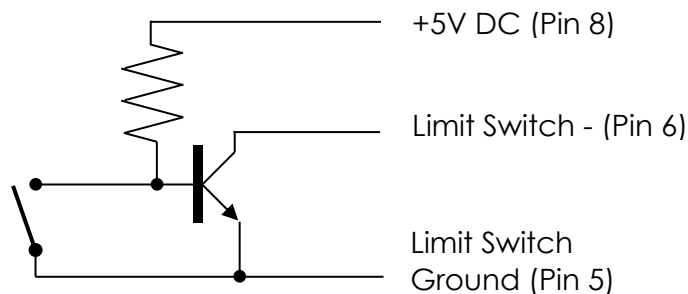
Travel Length (mm)	Software Limit Switch Position (mm)
12	12 or less
25	25 or less

\*For custom travel length actuators, please contact MICRONIX USA for recommended soft limit position.

#### A.3.3 Electrical Specification

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

#### A.3.4 Limit Switch Schematic



#### A.3.5 Direction of Motion

