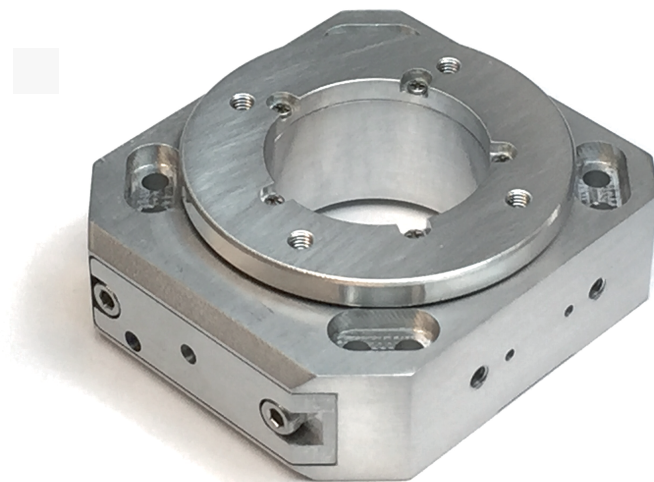


# PR-50

## Series



## Piezo Rotation Stage Reference Manual

(Open and Closed Loop Versions)

# **PR-50**

## **Piezo Rotation Stage**

### **Reference Manual**

Rev 2.02

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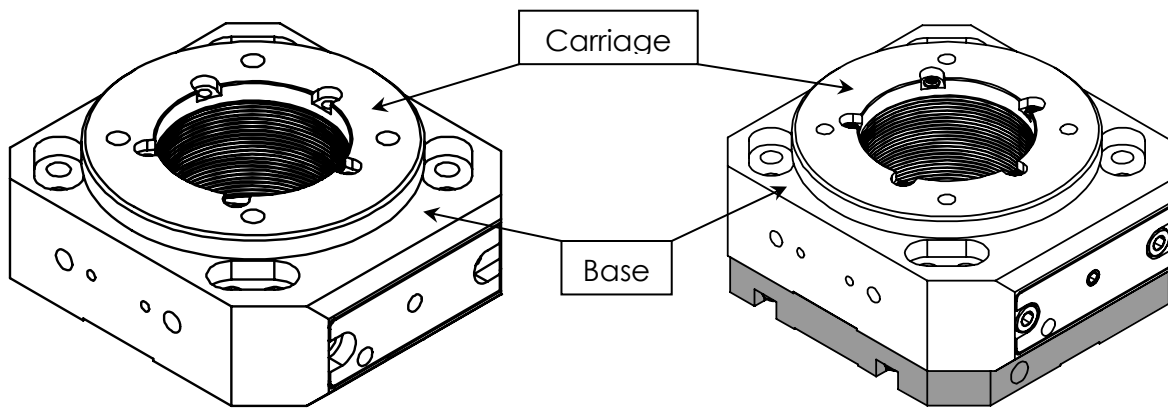
## 1. Introduction

### 1.1 Product Description

The PR-50 is a compact piezo rotation stage with unlimited travel and a 1-inch aperture. Two pre-loaded steel ball bearings ensure smooth motion, high stability and continuous 360° travel. It utilizes our patented multi-phase piezo motor resulting in high speed ( $> 25$  °/s) and high blocking torque. The PR-50 can be combined with the linear PPX-50, PPS-60, or VT-50 stages without an adapter bracket. Versions capable of operation in vacuum ( $10^{-9}$  mbar) are available.

**Features:**

- Continuous 360° travel
- Load capacity up to 3 kg
- Low profile, 20 mm height
- Vacuum versions available
- 1" clear aperture



PR-50 Open Loop

PR-50 with Analog Encoder option

## 1.2 Recommended Controllers

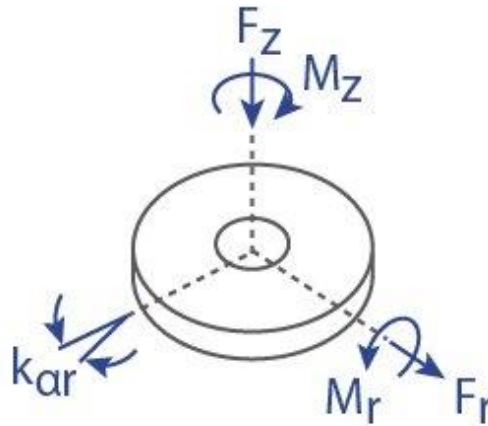
The following controllers are available from MICRONIX USA:

- MMC-100
- MMC-110

## 1.3 Technical Data

Motor	PM-003R
Speed, max. [°/sec]	15 (MMC-103); 25 (MMC-110)
Resolution, typical [ $\mu^\circ$ ]	1 (open loop); 50 (Analog); 10 (Digital)
Repeatability, bi-directional [ $\mu^\circ$ ]	N/A (open loop); $\pm 200$ (encoder resolution)
Repeatability, uni-directional [ $\mu^\circ$ ]	N/A (open loop); 200 (encoder resolution)

## 1.4 Load Characteristics



Load Characteristics	$F_r$ (N)	$F_z$ (N)	$M_r$ (N·m)	$M_z$ (N·m)	$k_{Or}$ ( $\mu\text{rad}/\text{N}\cdot\text{m}$ )
PM-003r	20	30	5	0.1	150

## 2. Model Configurations

### 2.1 PR-50 Order Numbers

Order No.	PR-50-	1	1		0	
Piezo Motor, PM-003R.....	1					
360° Continuous .....	1					
None.....	0					
Analog (1 V <sub>pp</sub> ).....	2					
Digital (RS-422).....	3					
None.....	0					
*Magnetic .....	1					
Atmospheric.....	0					
High Vacuum, 10 <sup>-6</sup> mbar.....	6					
Ultra-High Vacuum, 10 <sup>-9</sup> mbar.....	9					

\*only available in open loop

Contact MICRONIX USA for custom versions and stacking configurations.

### 3. Preparing to Install the PR-50

#### 3.1 **Installation Preparation**

When mounting the stage, it is important to consider the flatness of the mounting surface, as the stage will conform to the shape of that surface. A surface that is not flat can adversely affect the performance and structural integrity of the stage.

The stage is calibrated and guaranteed to be within specification at 20°C ±5°C, unless otherwise specified. The operational constraints of the stage are as follows:

- Mount to a clean and flat surface which is free of debris, burrs, and dings
- An indoor atmosphere free of corrosive gases, excessive dust, and condensation
- Temperature range of 0-40°C
- Relative humidity between 20-80%
- Locate away from water, heat, and electrical noise

#### 3.2 **Package Contents**

If 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:**

- PR-50 Piezo Rotation Stage
- Reference Manual
- Any other previously agreed upon components such as a controller

## 4. Installing the PR-50

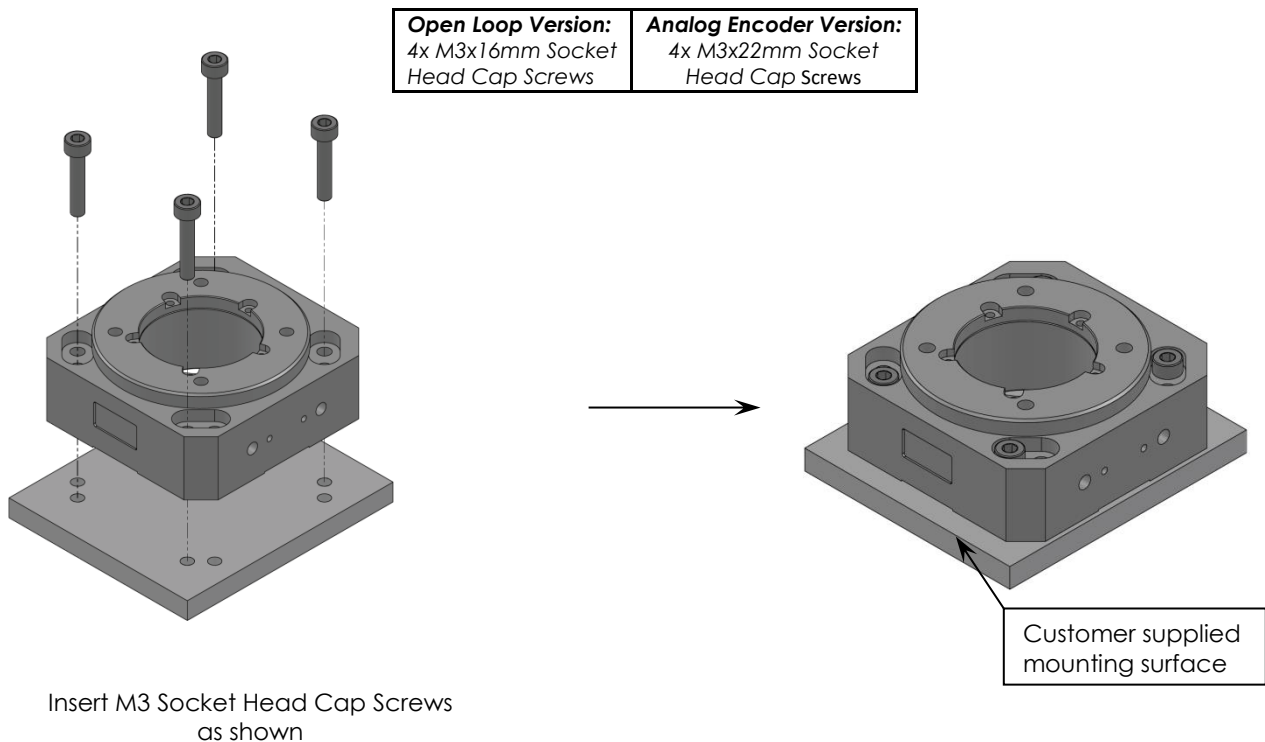
Mounting patterns require M3 screws, as well as M1.5 dowel pins for precision alignment. Additional brackets and screws may be required for custom applications.

### 4.1 General Mounting

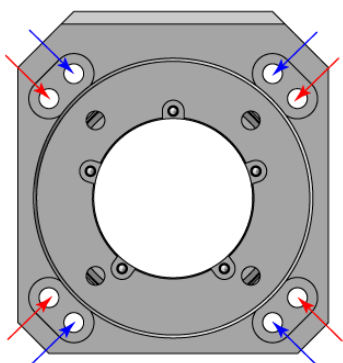
For general mounting configurations, mount the base to the mounting surface.

#### 4.1.1 Vertical Mounting

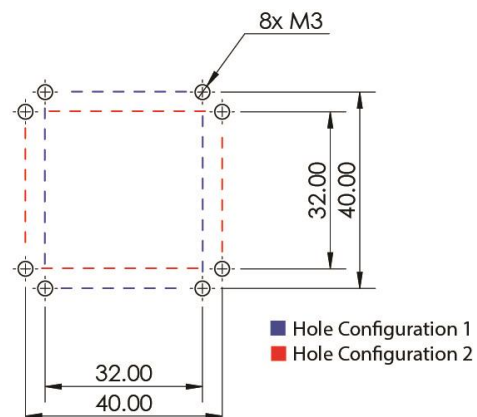
##### 4.1.1.1 Surface Mounting



Mounting Hole Locations

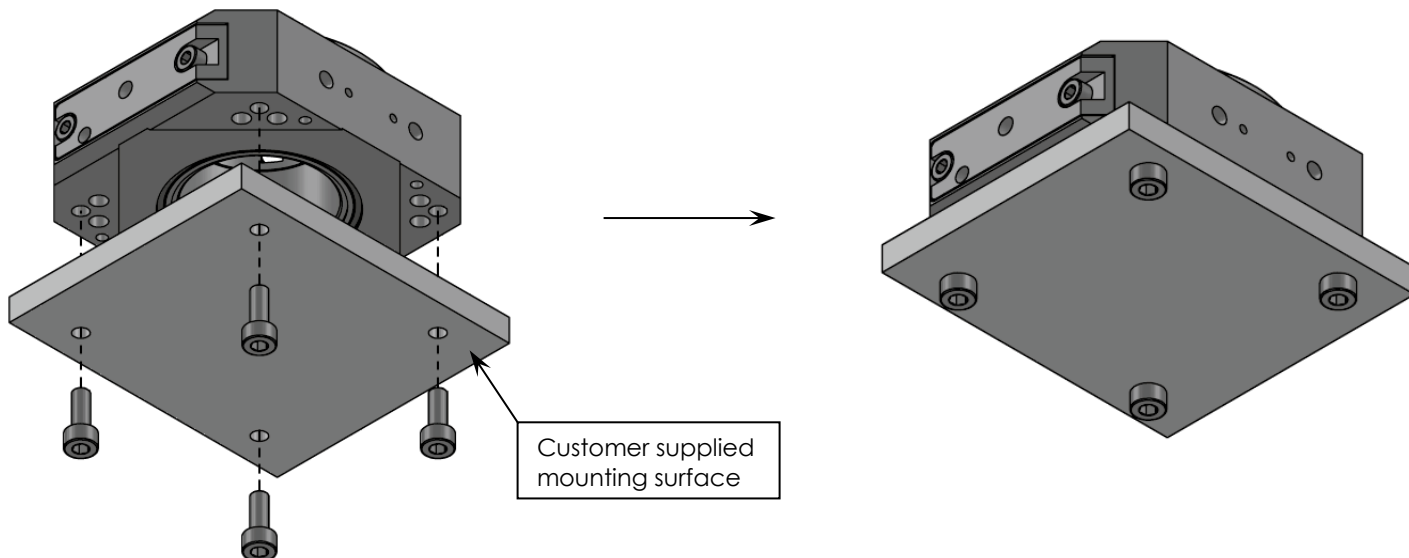


Mounting Surface Hole Pattern (mm)

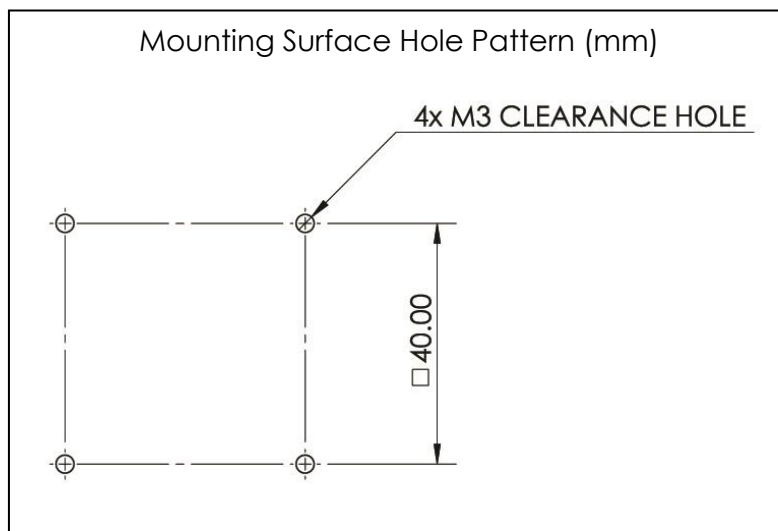


## 4.1.1.2 Stage Mounting

All Versions:  
4x M3 Screws

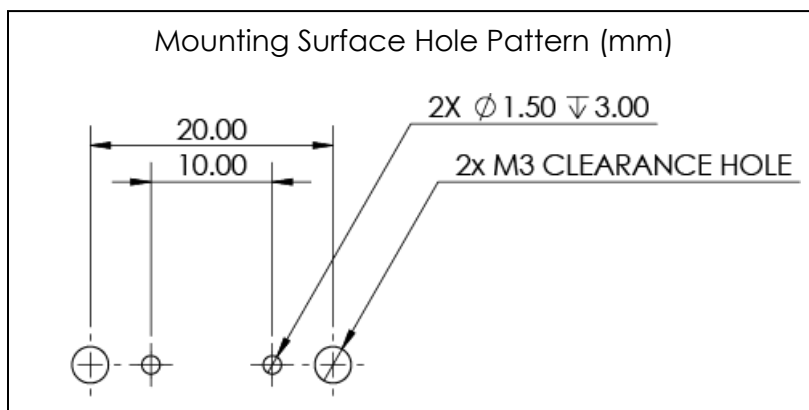
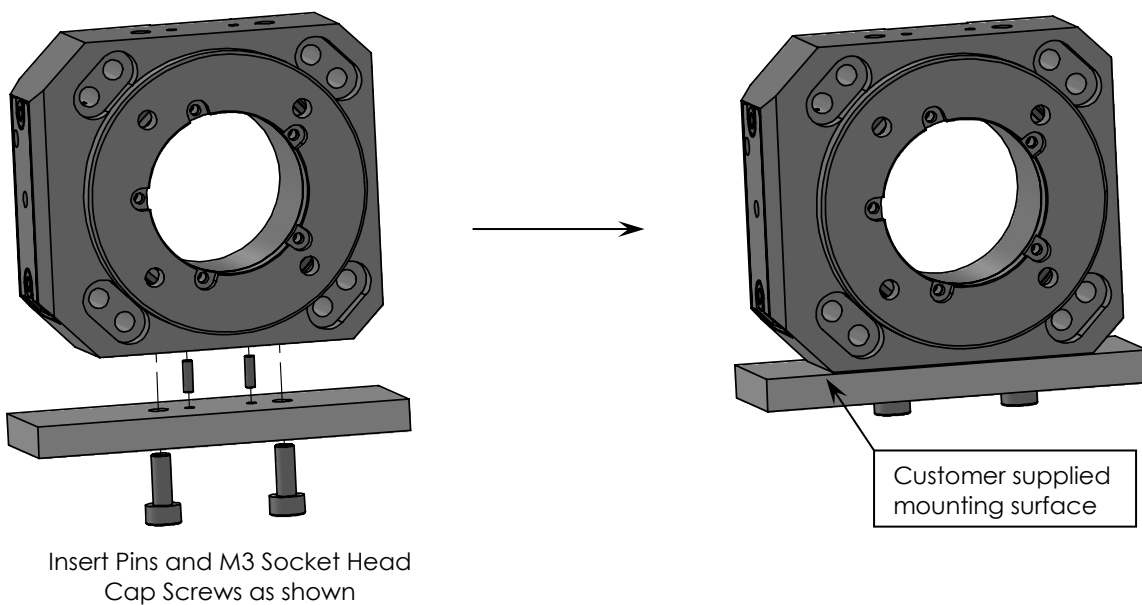


Insert M3 Slotted Cheese Head  
Machine Screws as shown



### 4.1.2 Side Mounting

**All Versions:**  
2x M1.5 x 5mm Dowel Pins  
4x M3 Screws



♦ For additional mounting configurations see Section 7: Stacking Configurations.

## 5. Connecting the PR-50

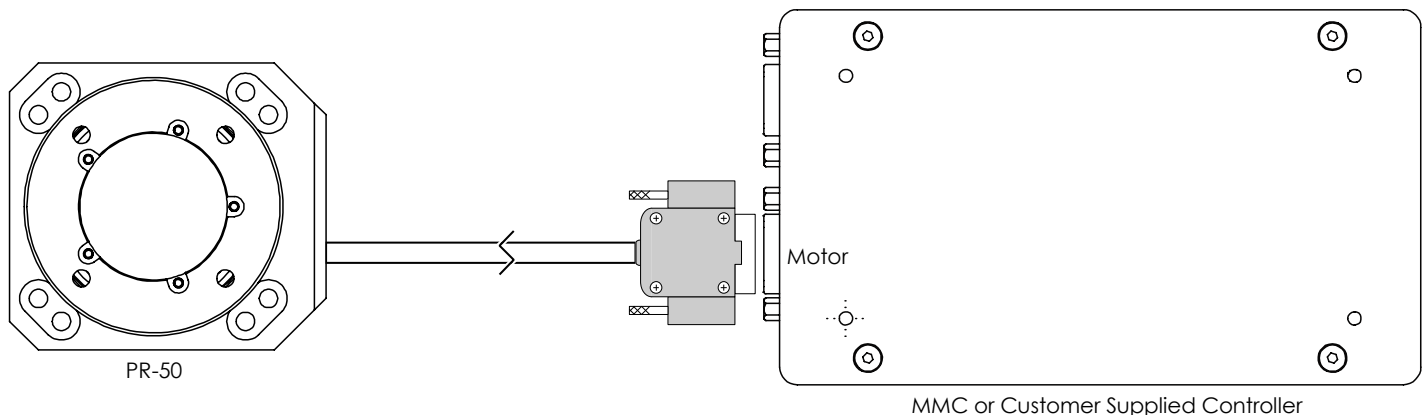
- ◆ Please note: The PR-50 Analog encoder version requires an analog chip on the MMC-103 or MMC-110. **Make sure that each stage is plugged into the correct axis on the controller.**

### 5.1 Atmospheric Environments

For controller information refer to the appropriate MMC controller manual.

#### 5.1.1 Open Loop Installation & Wiring Diagram

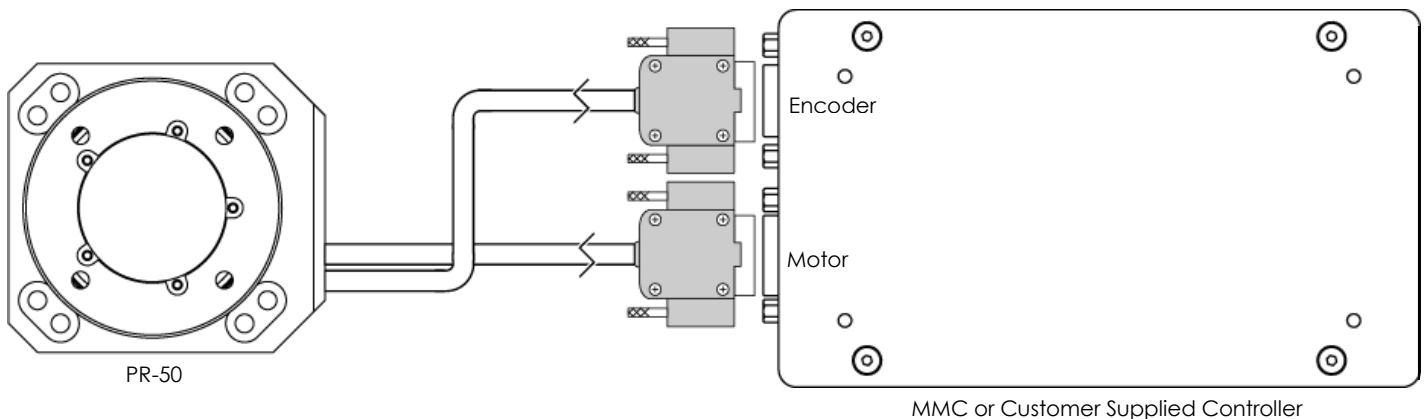
Connecting the PR-50 in an open loop configuration only requires that the Dsub 9 Pin Motor Cable be connected to a compatible controller. No other cables or components are required. Connect the stage as shown below. For details regarding the pinout see the Appendix section A.1.



#### 5.1.2 Closed Loop/Encoder Installation & Wiring Diagram

Using the PR-50 stage with an encoder requires a closed loop compatible controller that recognizes the proper type of encoder feedback. Connect the stage as shown below.

##### 5.1.2.1 Analog Encoder Wiring Diagram



## 5.2 Vacuum Environments

### 5.2.1 Handling and Preparation

When preparing the stage for vacuum environments, take the necessary precautions (such as wearing gloves, clean room, clothing, etc.) when handling the stage as to avoid any contaminants. Maximum bake-out temperature is 100°C. MICRONIX USA can supply the stage with vacuum compatible connectors: 9-pin female PEEK connector for open loop or 15-Pin female PEEK connector for closed loop with analog encoder.

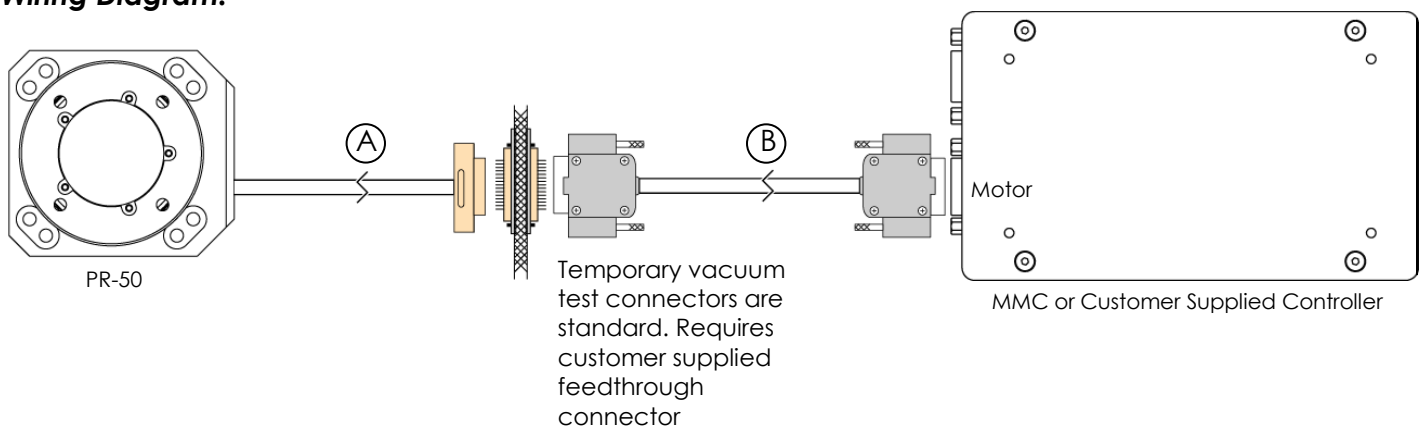
### 5.2.2 Open Loop Installation & Wiring Diagram

Connecting an open loop PR-50 in a vacuum chamber requires the use of a feedthrough connector at the vacuum chamber wall. The vacuum compatible PR-50 will be supplied with wiring for a feedthrough, not a cross over gender changer. MICRONIX USA supplies test connectors that simulate the vacuum feedthrough to allow for functionality testing prior to installation in a vacuum chamber. For details regarding the pin-out and feedthrough specifications see the Appendix section A.3.

#### Standard Cable Descriptions:

- A. PR-50 Vacuum Motor Cable (Female Dsub 9 Pin, 1.5m)
- B. Atmospheric Motor Cable (Female to Male Dsub 9 Pin, 1.5m)

#### Wiring Diagram:



### 5.2.3 Closed Loop/Encoder Installation & Wiring Diagram

Closed loop installation of the PR-50 stage in vacuum environments requires an intermediate feedthrough connector at the vacuum chamber wall that can accommodate both the motor cable, and the encoder cable.

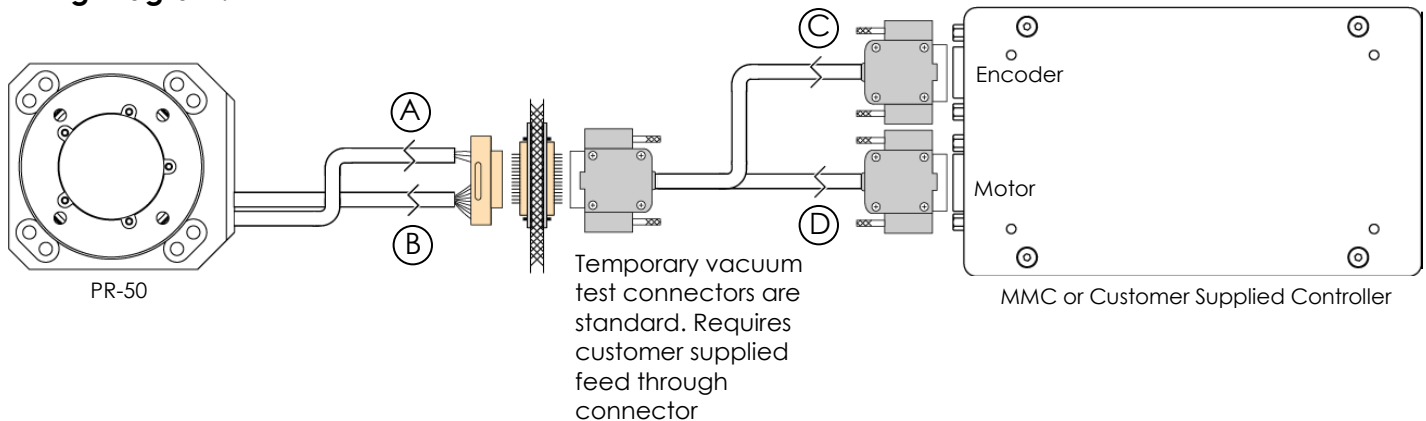
The vacuum compatible PR-50 will be supplied with wiring for a feedthrough, not a cross over gender changer. MICRONIX USA supplies test connectors that simulate the vacuum feedthrough to allow for functionality testing prior to installation in a vacuum chamber. For details regarding the pin-out and feedthrough specifications see the Appendix sections A.4 and A.5.5.

#### 5.2.3.1 Analog Encoder Wiring Diagram

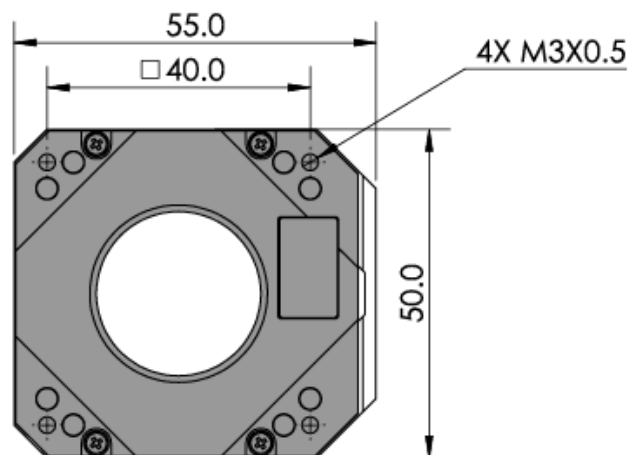
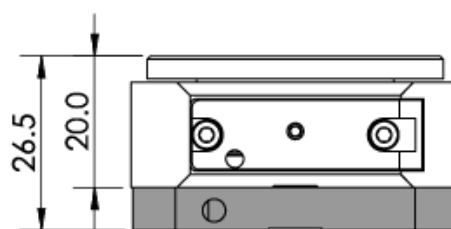
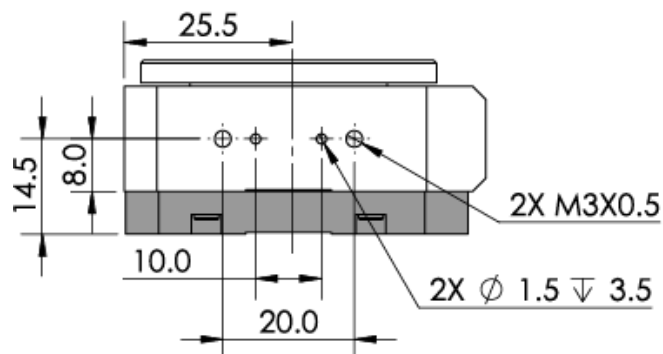
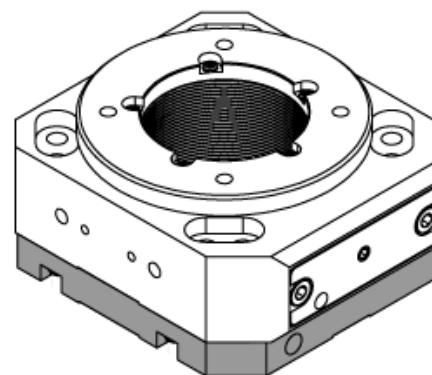
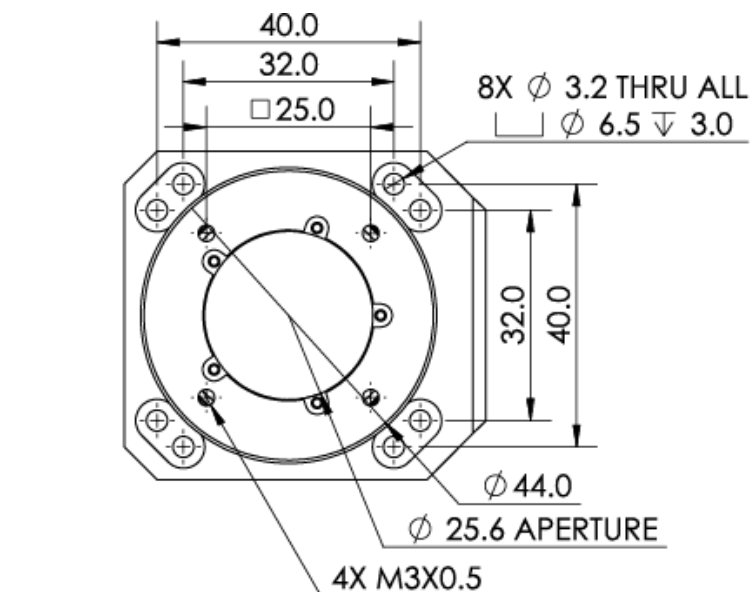
##### Standard Cable Descriptions:

- A. PR-50 Motor Cable (Female Dsub 15 Pin, 1.5m)
- B. PR-50 Encoder Cable (Female Dsub 15 Pin, 1.5m)
- C. Atmospheric Encoder Cable (Female Dsub 15 Pin to Female Dsub 9 Pin, 1.5m)
- D. Atmospheric Motor Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m)

##### Wiring Diagram:



## 6. Dimensions



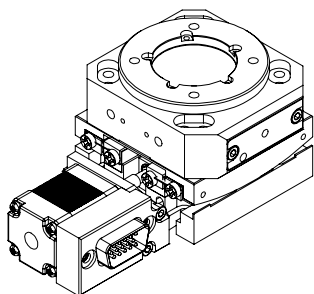
\*Gray Parts for Closed Loop Version Only

## 7. Stacking Configurations

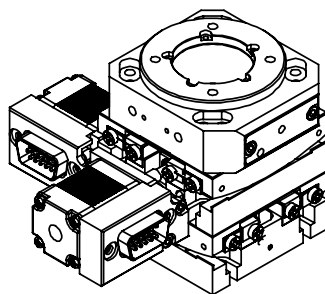
### 7.1 Configuration Examples

- Additional configurations available upon request

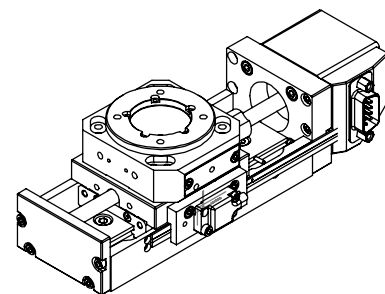
#### No Adapters



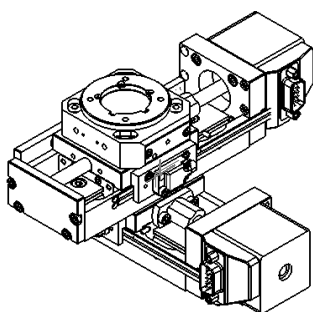
$\theta$ - $\theta$  14°x360°  
[with PG-50 Stage]



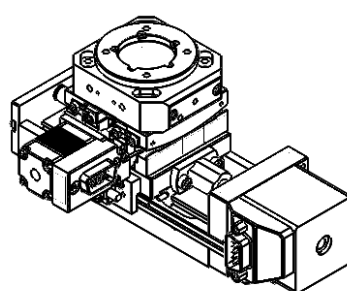
$\theta$ - $\theta$ - $\theta$  14°x14°x360°  
[with PG-50 Stages]



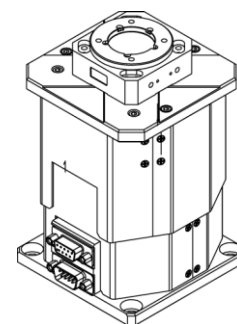
X- $\theta$  100mmx360°  
[with VT-50L Stage]



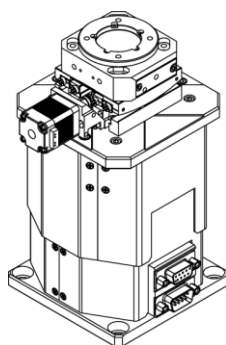
X-Y- $\theta$  100x100mmx360°  
[with VT-50L Stages]



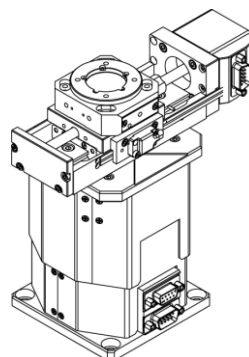
X- $\theta$ - $\theta$  100mmx14°x360°  
[with VT-50L & PG-50 Stages]



Z- $\theta$  35mmx360°  
[with PZS-90 Stage]



Z- $\theta$ - $\theta$  35mmx14°x360°  
[with PZS-90 & PG-50 Stages]



X-Z- $\theta$  100mmx35mmx360°  
[with PZS-90 & VT-50L Stages]

## 8. Supplementary Information

### 8.1 Maintenance

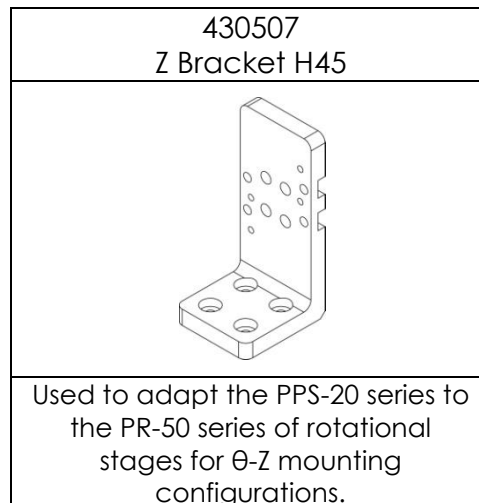
- The PR-50 series of rotation stages utilizes a maintenance free design. Do not modify the stage or perform any maintenance unless specifically instructed to do so by MICRONIX USA personal. If the stage is not performing up to the original specifications, please contact MICRONIX USA.
- The PR-50 rotation stage is a precision mechanical device and should be handled with care. Do not drop or mishandle the stage.
- Do not touch the bearings, as this will contaminate the lubrication and jeopardize the longevity of the stage.
- Follow the *Installation Preparation* requirements and use proper cable management to ensure a clean and safe operating environment.

### 8.2 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

### 8.3 Accessories



## A. Appendix

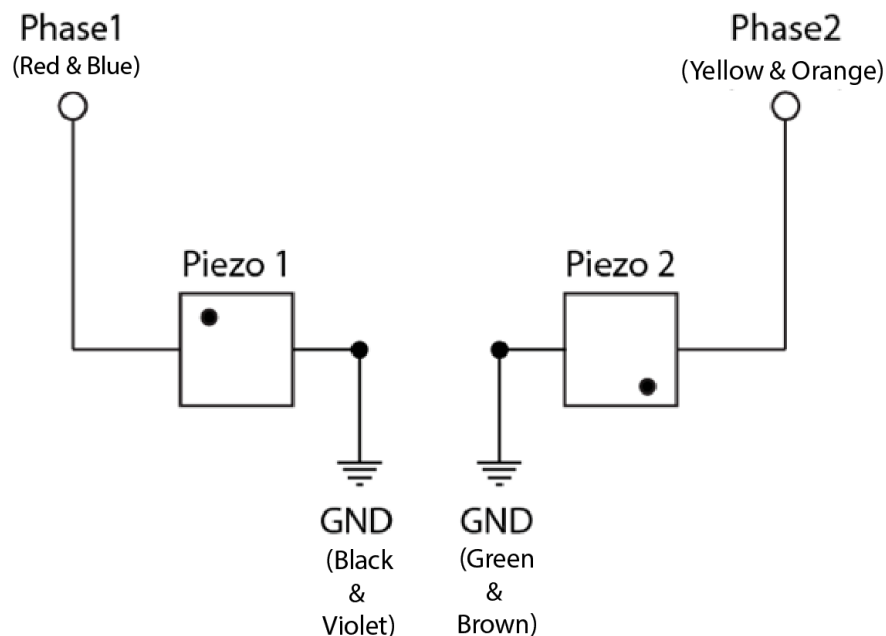
### A.1 Standard Atmospheric DB-9 Male Motor Connector

Pin	Description	Color
1	Phase 1	Red
2	Phase 2	Yellow
3	N/C	N/C
4	Not In Use	N/C
5	Ground	Black & Green
6	Not In Use	N/C
7*	Not In Use (Limit +)	N/C (Violet)
8*	Not In Use (+5V)	N/C (Orange)
9*	Not in Use (Ground)	N/C (Brown)

♦ Please note: Vacuum prepared PR-50 stages use Kapton wires for the motor and the limit switch. All Kapton wires are the same color.

\* Limit Switch Version Only

### A.2 Phase Piezo Motor Wiring Diagram

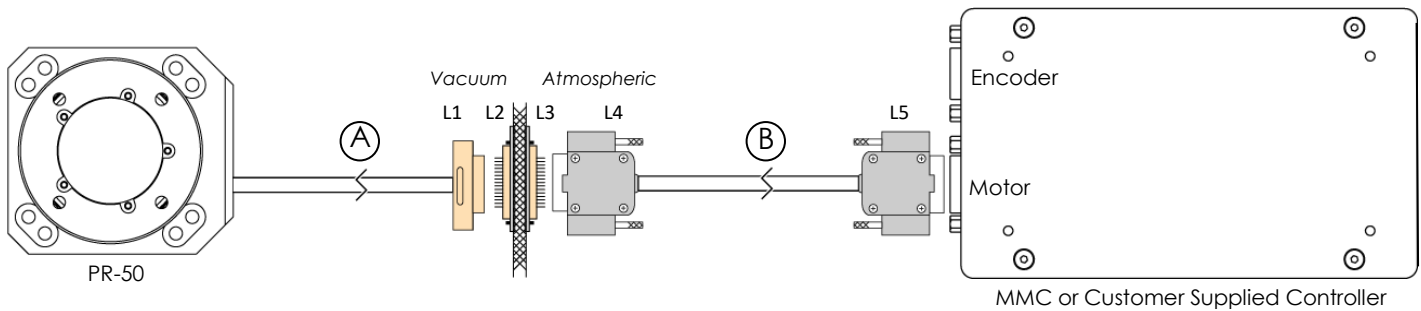


## A.3 Open Loop Vacuum Wiring Diagram

### Standard Cable Descriptions:

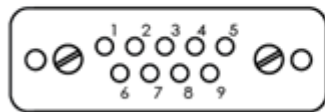
- A. PR-50 Vacuum Motor Cable (Female Dsub 9 Pin, 1.5m)
- B. Atmospheric Motor Cable (Female to Male Dsub 9 Pin, 1.5m)

### Wiring Diagram:

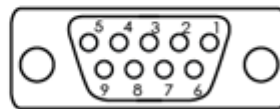


Motor Connector Pinout

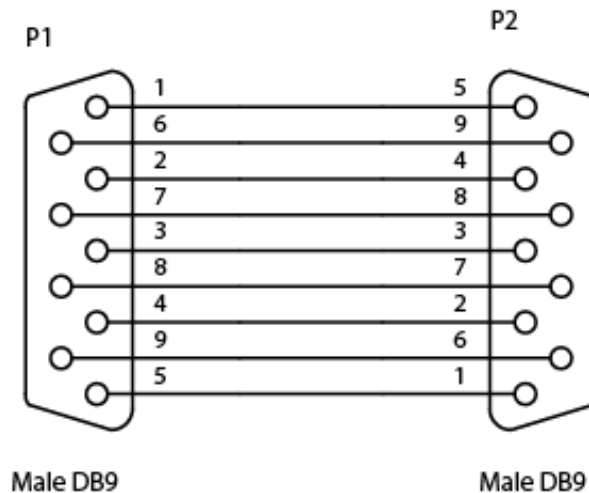
Description:	L1	L2	L3	L4	L5
Phase1	8	8	1	1	1
Phase2	7	7	2	2	2
GND	4	4	5	5	5
Shield	3	3	6	6	9



Female Dsub9 Connector - Rear View



Male Dsub9 Connector - Rear View



### A.3.1 9-Pin Feedthrough

## A.4 Using an Analog Encoder

### A.4.1 Analog Encoder

A PR-50 with an analog encoder will need to be paired with an appropriate controller. For vacuum applications, the PR-50 will be supplied with a 15 pin connector that incorporates both motor and encoder signals. For atmospheric applications, the encoder will be supplied with a 9 Pin connector with the pin-out shown below.

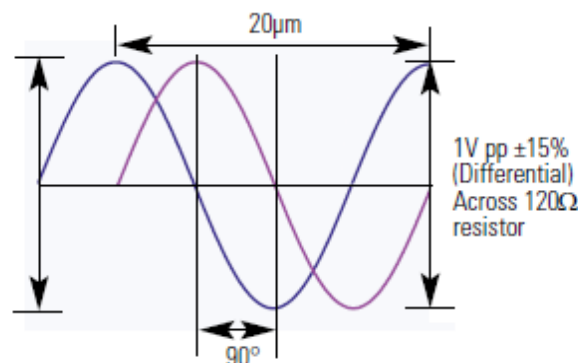
### A.4.2 Encoder Pin-Out

Pin	Color	Description
1	Brown	A+/Cos+
2	Yellow	B+/Sin+
3	Violet	Index +
4	Black	Ground
5	Red	+5V
6	Orange	A-/Cos-
7	Green	B-/Sin-
8	Blue	Index -
9	Not In Use	Not In Use

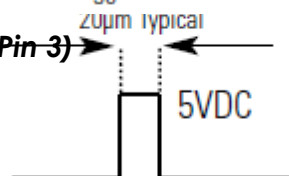
### A.4.3 Operating and Electrical Specifications

Power Supply	5VDC $\pm 5\%$ @ 330mA (60mA for sensor)
Operating Temperature	0 to 70°C
Humidity	10 - 90% RH non-condensing

### A.4.4 Analog Output (Pins 1, 2, 6, and 7)



### A.4.5 Index Window (Pin 3)



### A.4.6 Resolution

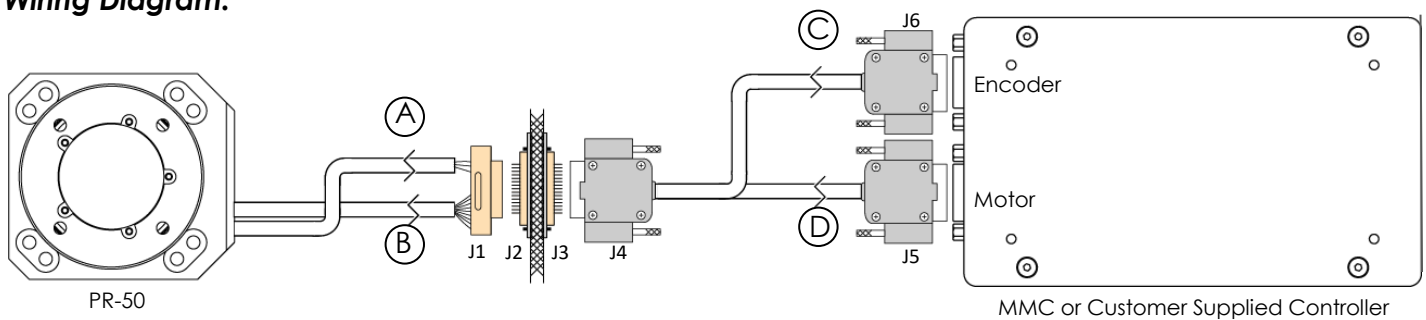
The analog signal interpolation is done in the controller to the resolution specified on the order.

### A.4.7 Analog Encoder Wiring Diagram

#### Standard Cable Descriptions:

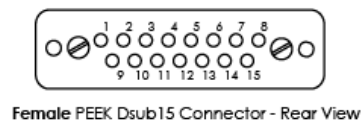
- A. PR-50 Motor Cable (Female Dsub 15 Pin, 1.5m)
- B. PR-50 Encoder Cable (Female Dsub 15 Pin, 1.5m)
- C. Atmospheric Encoder Cable (Female Dsub 15 Pin to Female Dsub 9 Pin, 1.5m)
- D. Atmospheric Motor Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m)

#### Wiring Diagram:

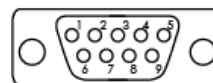


#### Pinout Cable A,B, C, D

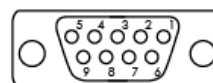
	Description	Color	J1	J2	J3	Color	J4	J5	J6
A & D	Phase1	Red/Blue	1	1	8	Red/Blue	8	1	
	Phase2	Yellow/Orange	2	2	7	White (Green)/ Grey	7	2	
	Ground	Black/Green & Violet/ Brown	9	9	15	Black/Green & White(Blue)/ White(Grey)	15	5	
	Shield	-	10	10	14	-	14	Casing	
B & C	GND	Black	8	8	1	Black	1	-	4
	Cos+	Brown	7	7	2	Brown	2	-	1
	+5V	Red	6	6	3	Red	3	-	5
	Cos-	Orange	5	5	4	White (Brown)	4	-	6
	Sin+	Yellow	4	4	5	Yellow	5	-	2
	Sin-	Green	12	12	12	White (Yellow)	12	-	7
	Index-	Blue	13	13	11	White (Violet)	11	-	8
	Index+	Violet	14	14	10	Violet	10	-	3
	Shield	-	15	15	9	-	9	-	Housing



Female PEEK Dsub15 Connector - Rear View



Female Dsub9 Connector - Rear View



Male Dsub9 Connector - Rear View

### A.4.8 Straight-Through 15-Pin Feedthrough

