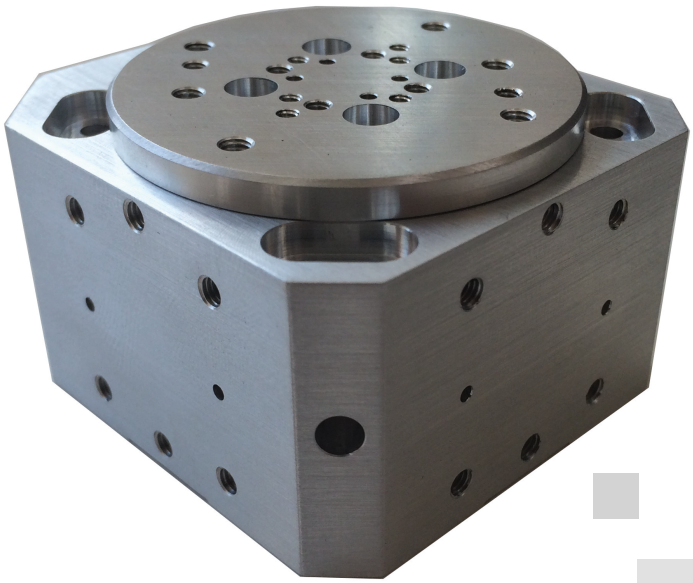
PR-50SM

Series



Precision Rotation Stage

Reference Manual

(Open and Closed Loop Versions)

micronix USA
PRECISION MOTION SOLUTIONS

PR-50SM

Precision Rotation Stage

Reference Manual

Rev 2.03

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Contents

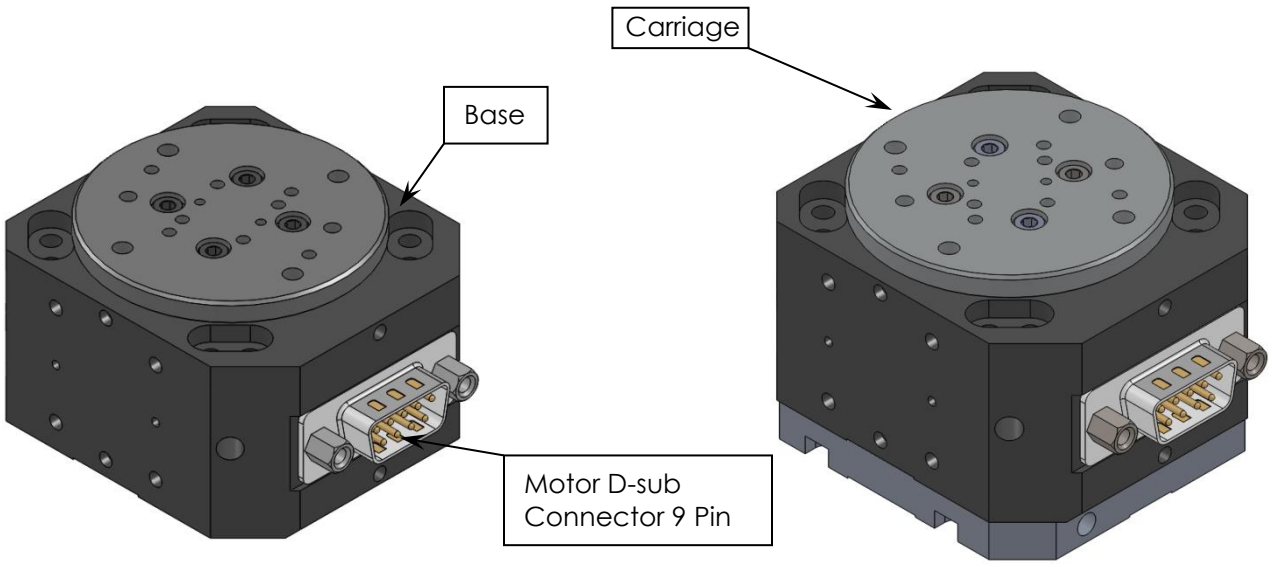
1. Introduction

1.1 Product Description

The PR-50 is a rotation stage incorporating a direct drive stepper motor for increased precision and high speed. The use of two mutually pre-loaded steel ball bearings guarantee a smooth, stable, and continuous 360° travel. An optional encoder provides up to 5 m° resolution. High Vacuum (10^{-9} mbar) compatible versions are possible.

Features:

- Continuous 360° travel
- Load capacity up to 2N
- 5 m° digital encoder resolution



PR-50 Open Loop

PR-50 with Analog Encoder or Limit Switch option

1.2 Recommended Controllers

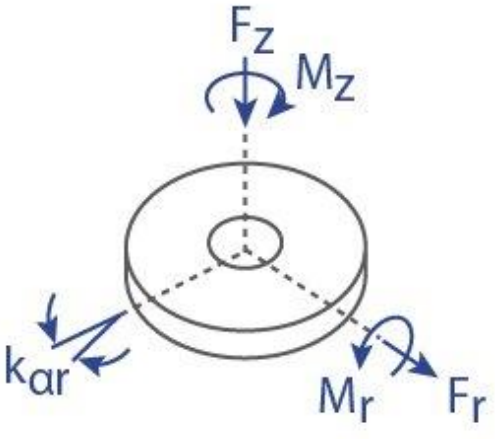
The following controllers are available from MICRONIX USA:

- MMC-200 – Stepper Motor Controller

1.3 Technical Data

Motor	SM-006
Speed, Max. (°/sec)	1800 (5 rev/sec)
PR-50 Speed, Max. (°/sec)	60
Resolution Typical (m°)	10 (open loop);5 (encoder resolution)
Bi-directional Repeatability (m°)	± 50 (open loop); ± 10 (encoder resolution)
Uni-directional Repeatability(m°)	50 (open loop); 10 (encoder resolution)

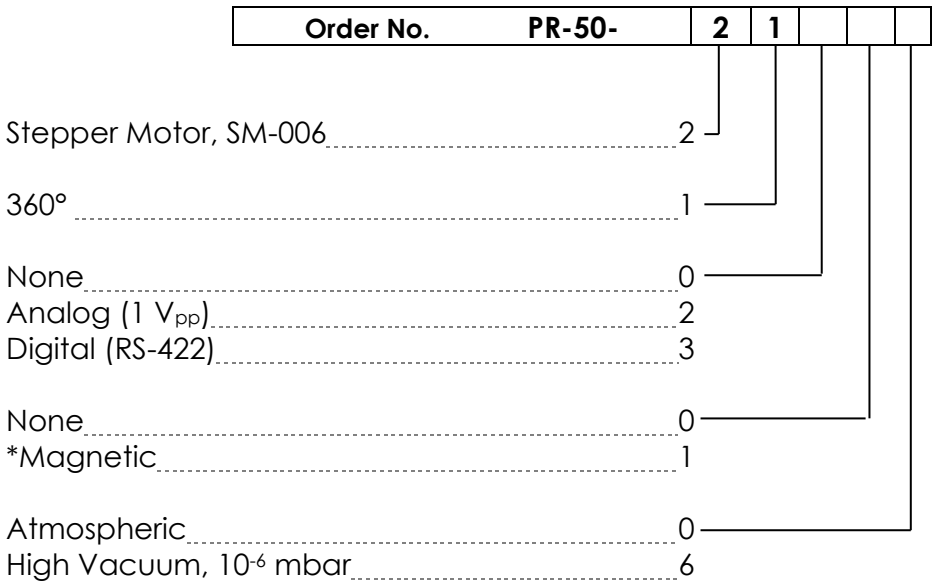
1.4 Load Characteristics



Load Characteristics	$F_{r\,(N)}$	$F_{z\,(N)}$	$M_{r\,(N\cdot m)}$	$M_{Z\,(N\cdot m)}$	$k_{\alpha r\,(\mu rad/N\cdot m)}$
SM-006	1	2	5	0.04	150

2. Model Configurations

2.1 PR-50 Order Numbers



* 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 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.

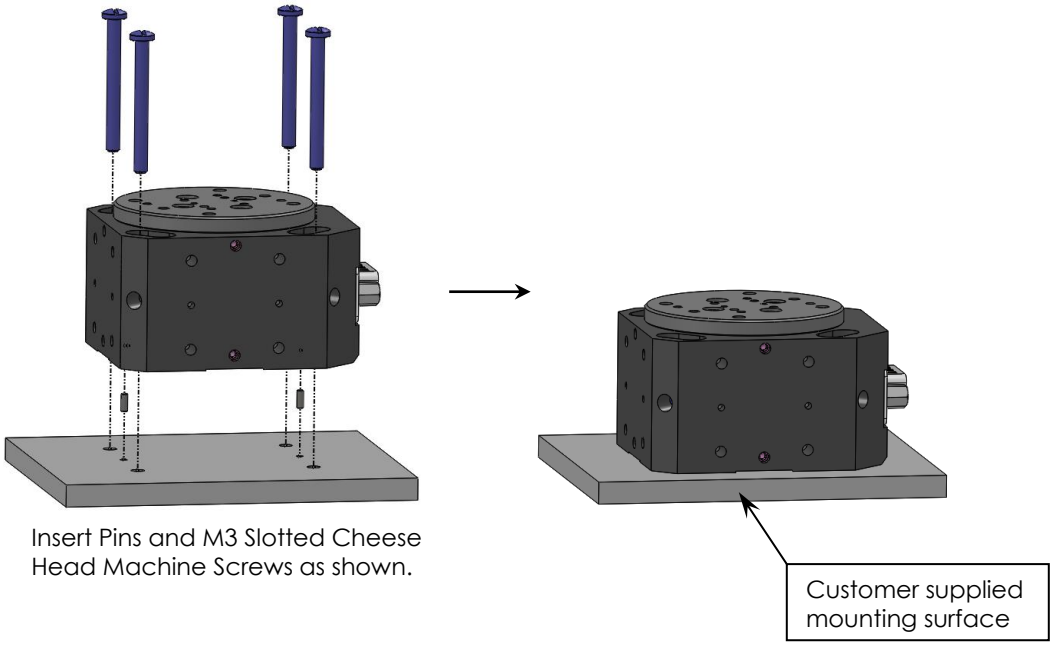
4.1 General Mounting

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

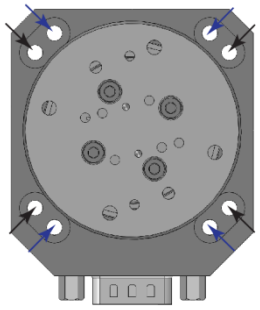
4.1.1 *Vertical Mounting*

4.1.1.1 Surface Mount

Open Loop Version:	***Analog Encoder Version:***	***Digital Encoder Version:***
2x M1.5 x 4mm Dowel Pins *4x M3x30mm Slotted Cheese Head Machine Screws*	*2x M1.5 x 4mm Dowel Pins* *4x M3x35mm Slotted Cheese Head Machine Screws*	*2x M1.5 x 4mm Dowel Pins* *4x M3x45mm Slotted Cheese Head Machine Screws*



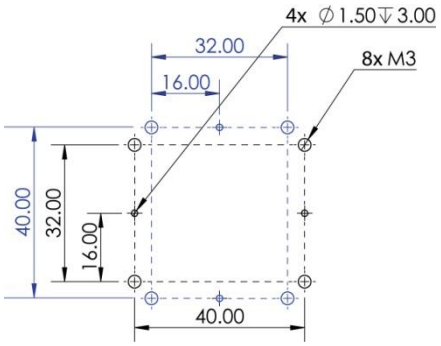
Mounting Hole Locations



Hole Configuration 1

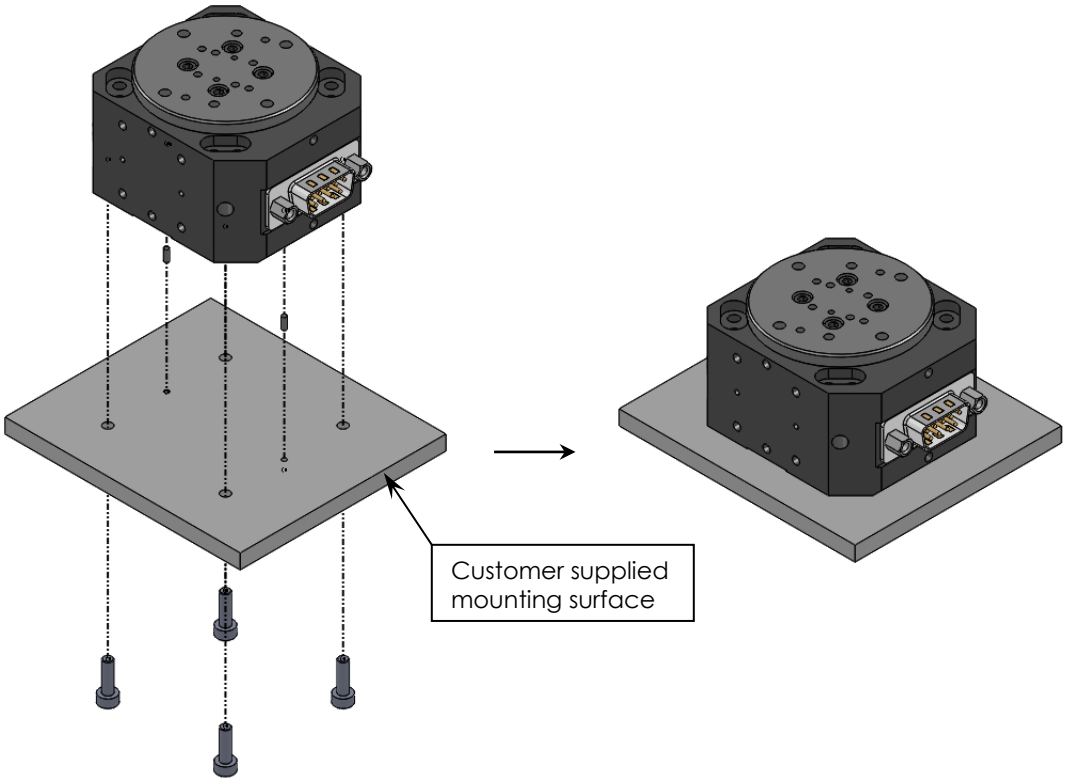
Hole Configuration 2

Mounting Surface Hole Pattern (mm)

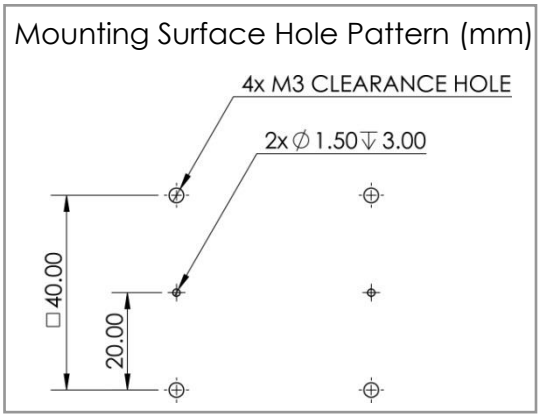


4.1.1.2 Stage Mount

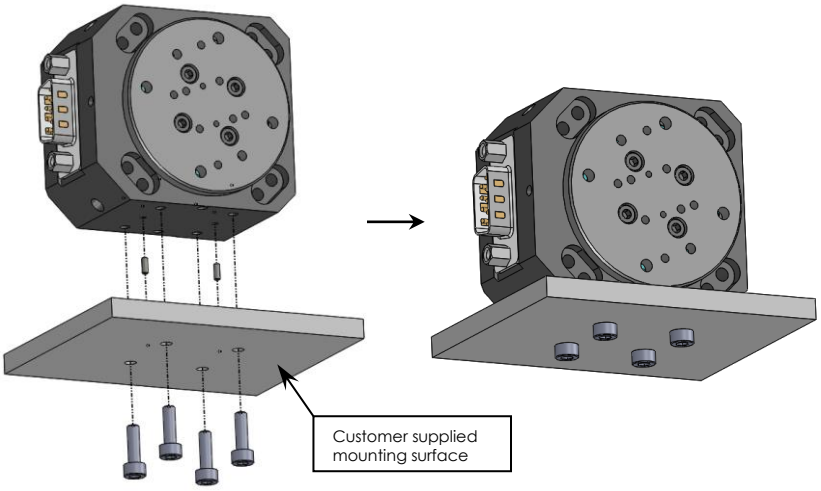
All Versions:
2x M1.5 x 4mm Dowel Pins
4x M3 Screws



Insert Pins and M3 Screws as shown.



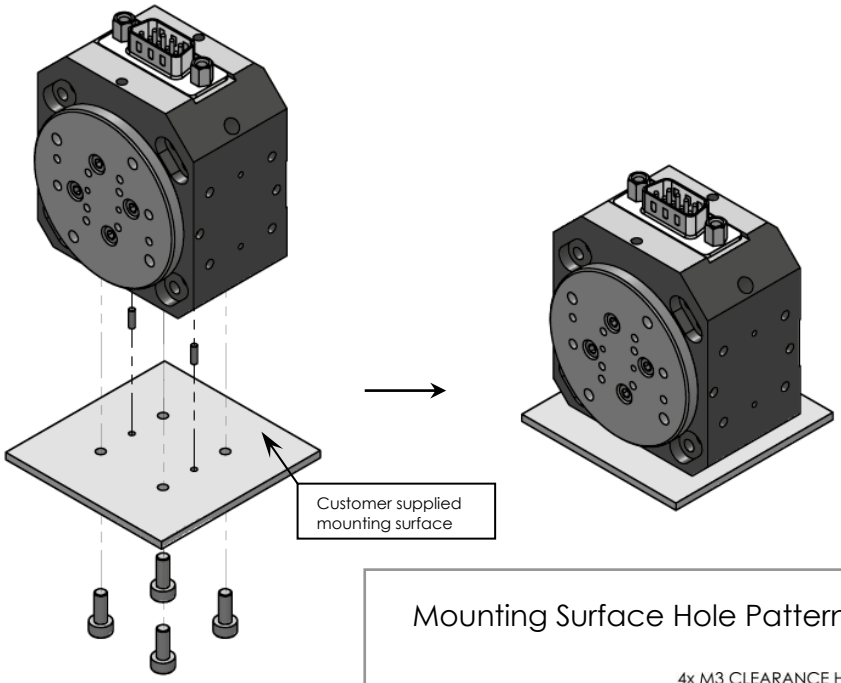
4.1.2 *Side Mounting*



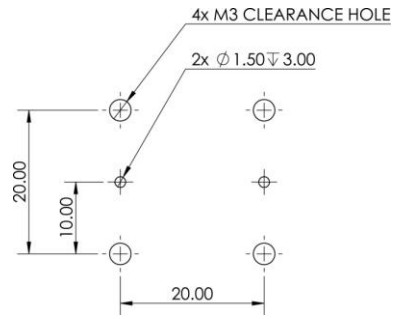
All Versions:
2x M1.5 x 5mm Dowel Pins
4x M3 Screws

Insert Pins and M4 SHCS as shown.
Insert Pins and M3 Screws as shown.

OR



Mounting Surface Hole Pattern (mm)



• *For additional mounting configurations see Section 7: Stacking Configurations.*

5. Connecting the PR-50

◆ Please note: The PR-50 axis on the MMC-200 is factory modified to provide an output with a higher current than other Micronix stages at 1.2 amps/phase. **Make sure** that each stage is plugged into the correct axis on the controller.

5.1 Atmospheric Environments

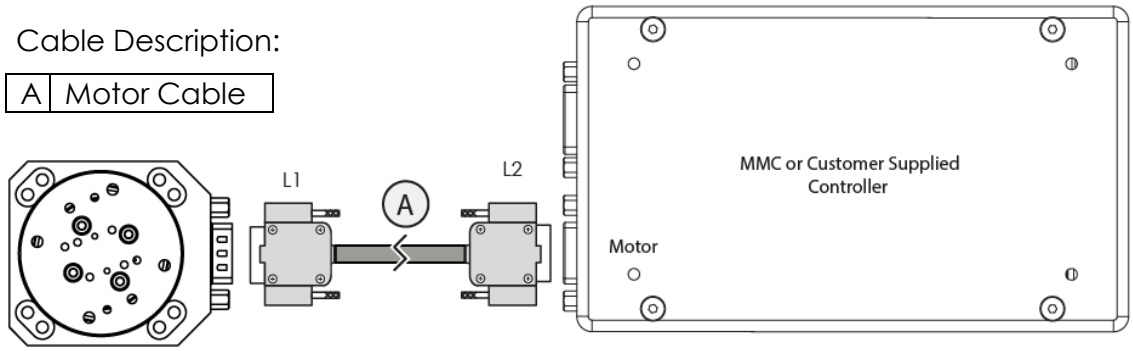
For controller information refer to the appropriate MMC controller manual.

5.1.1 *Open Loop Installation & Wiring Diagram*

Connecting the PR-50 in an open loop configuration only requires that the D-sub 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

Cable Description:

A	Motor Cable



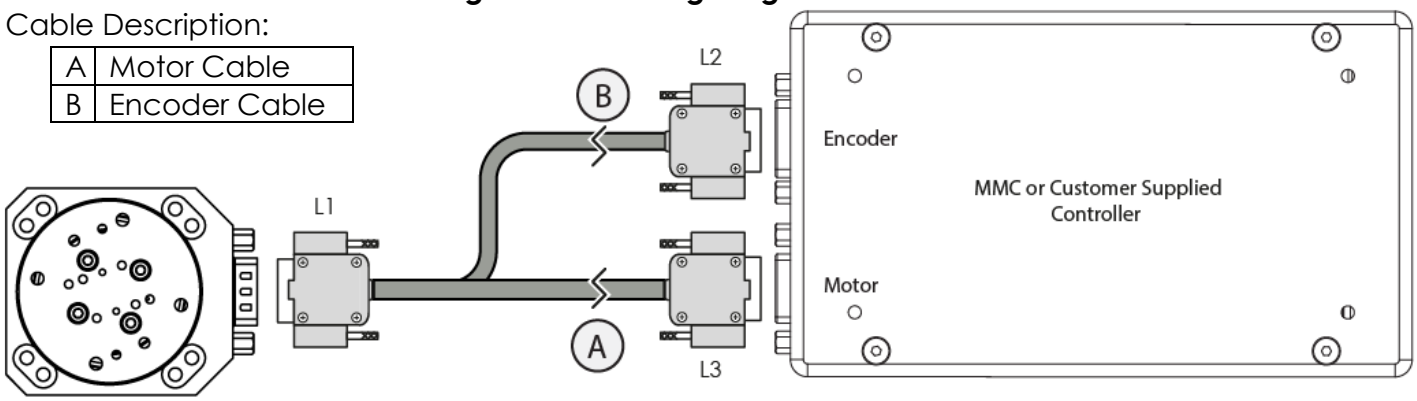
5.1.2 *Closed Loop/Encoder Installation & Wiring Diagram*

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

Cable Description:

A	Motor Cable
B	Encoder Cable



5.2 Vacuum Environments

5.2.1 Handling and Preparation

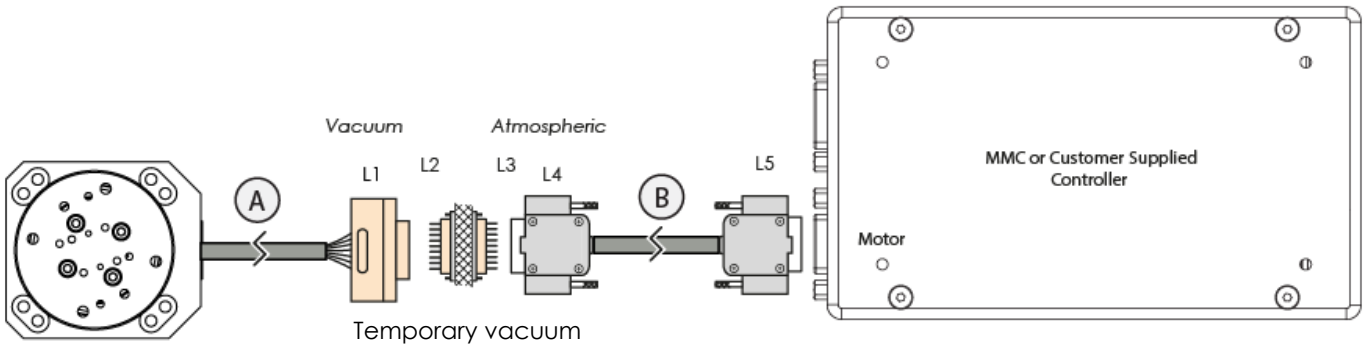
When preparing the stage for vacuum environments, take the necessary precautions (such as wearing gloves, clean room, clothing, etc.) when handling the stage as to avoid any contaminants. Maximum Bake-out temperature is 100°C. MICRONIX USA can supply the stage with vacuum compatible connectors: 9-pin female PEEK connector for open loop, 15-Pin female PEEK connector for closed loop with analog encoder, 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 feed through connector at the vacuum chamber wall. The vacuum compatible PR-50 will be supplied with wiring for a 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. For details regarding the pin-out and feed through 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)



5.2.3 Closed Loop/Encoder Installation & Wiring Diagram

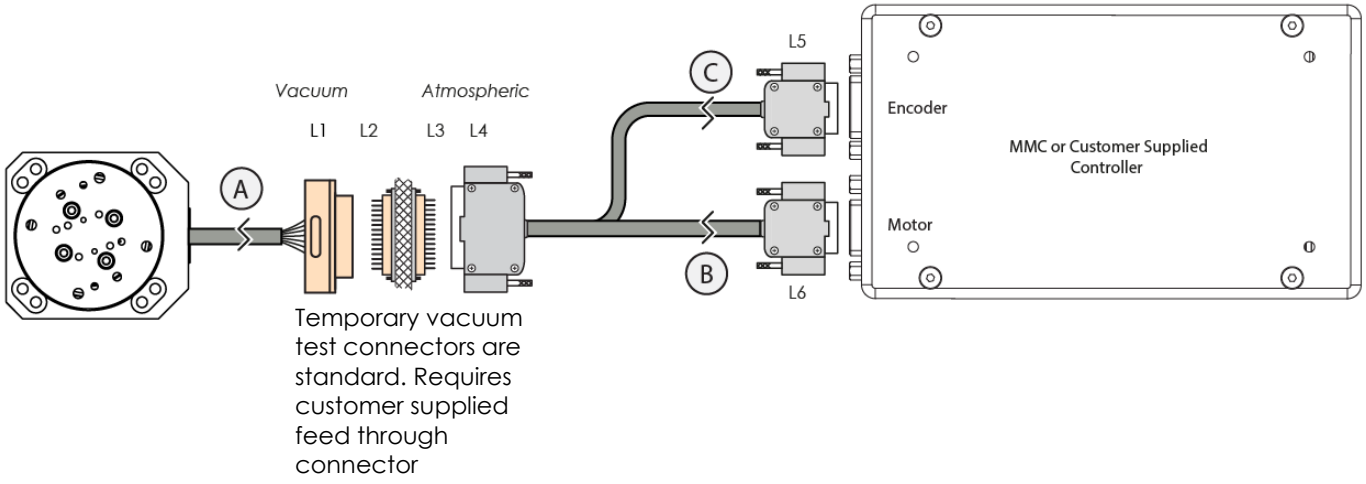
Closed loop installation of the PR-50 stage in vacuum environments requires an intermediate feed through connector at the vacuum chamber wall that can accommodate both the motor cable, and the encoder cable.

The vacuum compatible PR-50 will be supplied with wiring for a 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. For details regarding the pin-out and feed through specifications see the Appendix sections A.4 and A.5.5.

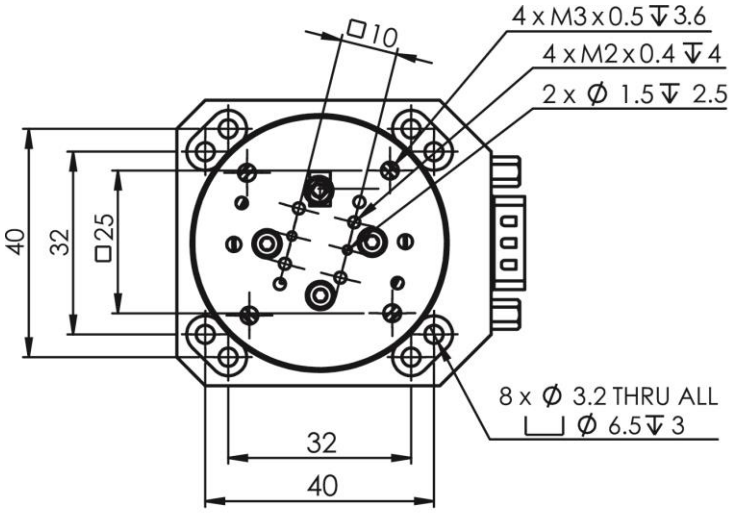
5.2.3.1 Analog Encoder Wiring Diagram

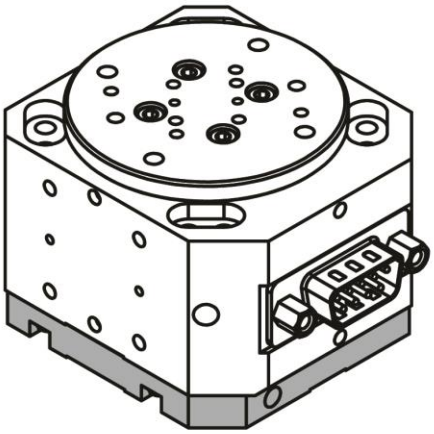
Standard Cable Descriptions:

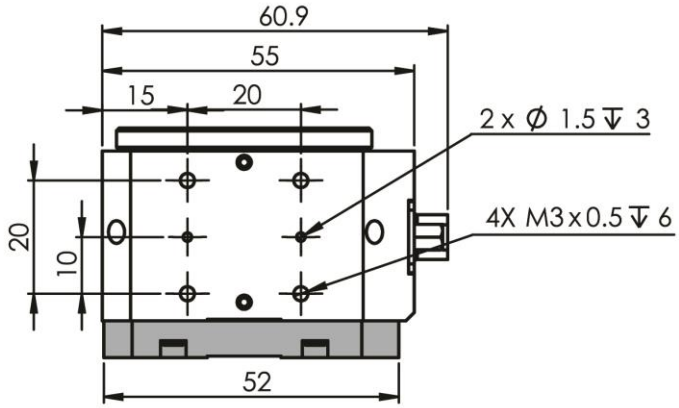
A. PR-50 Motor Cable (Female Dsub 15 Pin, 1.5m)
B. Atmospheric Motor Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m)
C. Atmospheric Encoder Cable (Female Dsub 15 Pin to Female Dsub 9 Pin, 1.5m)

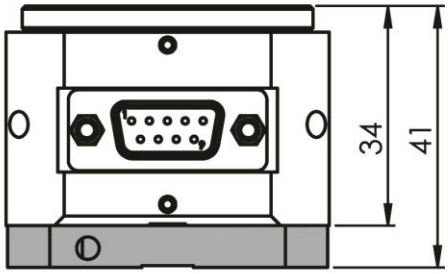


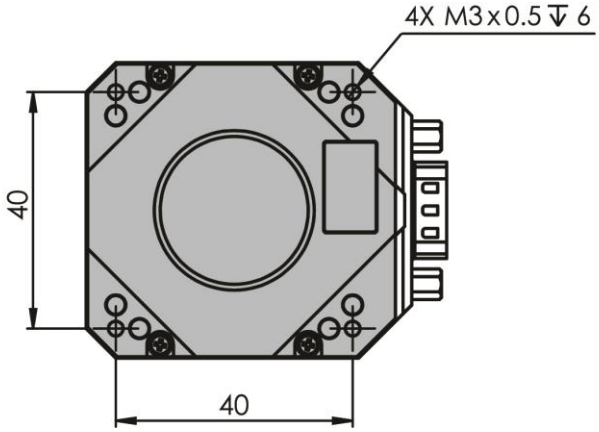
6. Dimensions











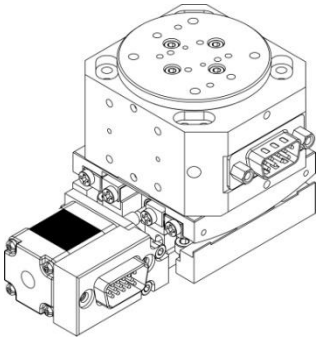
* all dimentions are in millimeter
*grey parts are for closed loop and home switch version only

7. Stacking Configurations

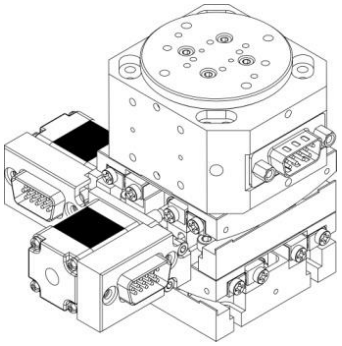
7.1 Configuration Examples

- Additional configurations available upon request

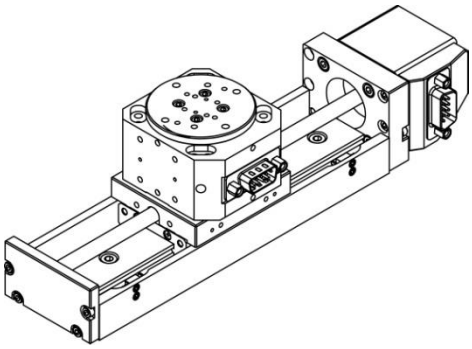
No Adapters



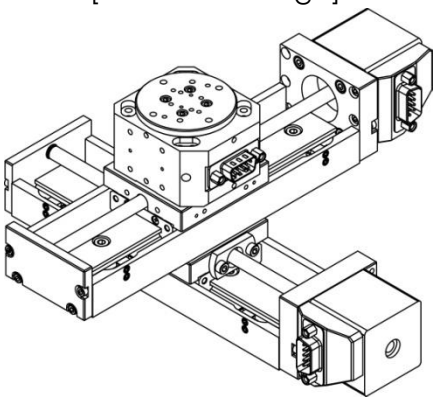
θ-θ 10°x360°
[with PG-50 Stage]



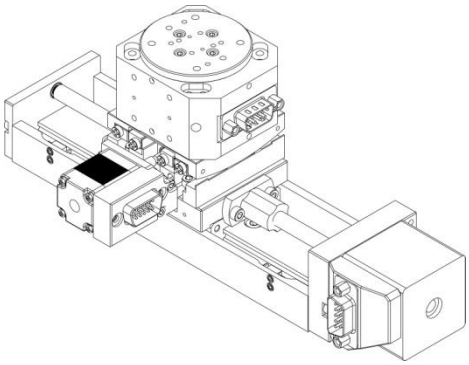
θ-θ-θ 10°x10°x360°
[with PG-50 Stages]



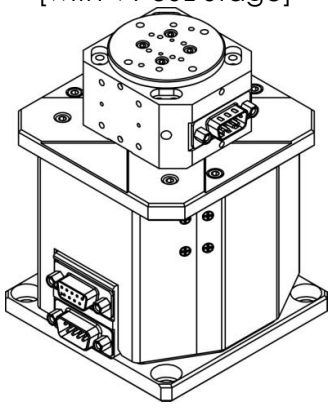
X-θ 100mmx360°
[with VT-50L Stage]



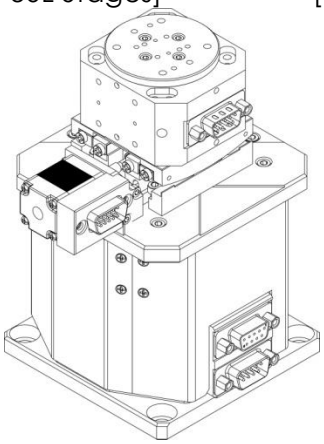
X-Y-θ 100x100mmx360°
[with VT-50L Stages]



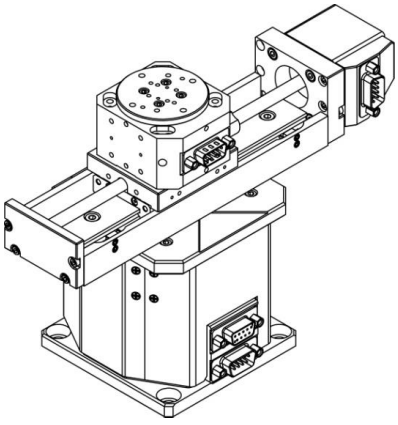
X-θ-θ 100mmx10°x360°
[with VT-50L & PG-50 Stages]



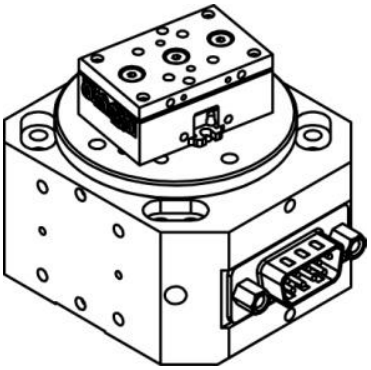
Z-θ 35mmx360°
[with PZS-90 Stage]



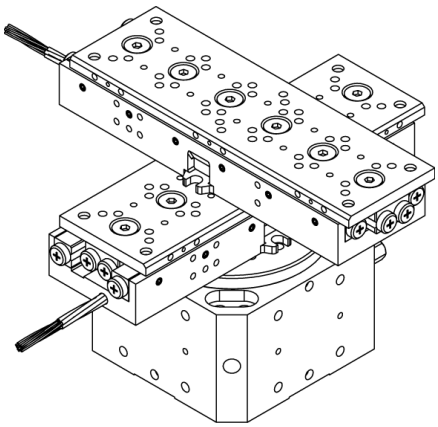
Z-θ-θ 35mmx10°x360°
[with PZS-90 & PG-50 Stages]



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

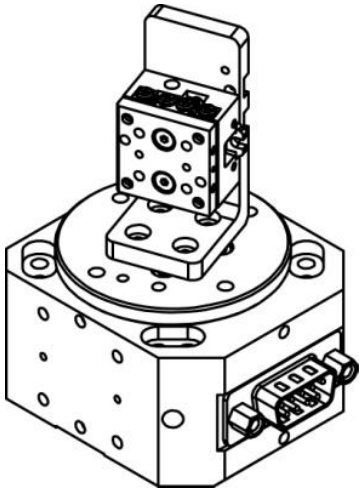


X-θ 18mmx360°
[with PPS-20 Stage]



X-θ 51mmx360°
[with PPS-28 Stage]

Using: Adapter Block (P/N 430507) & PPS-20 Linear Stages



X-θ 12mmx360°
[with PPS-20 Stage]

8. Supplementary Information

8.1 Maintenance

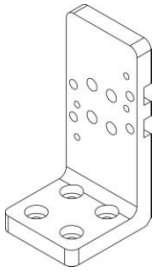
- The PR-50 series of rotation stages utilizes a maintenance free design. Do not modify the stage or perform any maintenance unless specifically instructed to do so by MICRONIX USA personal. If the stage is not performing up to the original specifications, please contact MICRONIX USA.
- The PR-50 rotation 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

430507 Z Bracket H45

Used to adapt the PPS-20 series to the PR-50 series of rotational stages for Θ-Z mounting configurations.

A. Appendix

A.1 Motor Specifications

A.1.1 Standard Atmospheric DB-9 Male Motor Connector

		Wire Color
Pin	***Function***	***Stepper SM-006***
1	***Motor A+***	***Red***
2	***Motor A-***	***Blue***
3	***Motor B+***	***Green***
4	***Motor B-***	***Black***
5	***N/C***	***N/C***
6	***N/C***	***N/C***
7	***Limit +***	***Violet***
8	***+5V***	***Orange***
9	***Ground***	***Brown***

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

A.1.2 Technical Specifications

Motor Type	Direct Drive Stepper
Phase Current	1.2 Amps/Phase
Step Angle	1.8°
Resistance	3 Ohms/Phase
Inductance	2 mH/Phase
Holding Torque	0.11 N-m

◆ Please note: The PR-50 axis on the MMC-200 is factory modified to provide an output with a higher current than other Micronix stages at 1.2 amps/phase. **Make sure** that each stage is plugged into the correct axis on the controller.

A.2 Limit Switches

The mechanical limit switch is factory calibrated and cannot be adjusted by the customer.

1. The PR-50 has one limit switch installed at the positive limit to respond to homing commands. The procedure to find this reference marker is as follows:

- On **power up,** input the following commands into the controller:
  1) #LCG2 //This command activates the limit switch so that the "home" position can be located.
  2) #MLP //This command sends the stage in axis number "#" to the positive limit, such that the stage finds "home"
  3) #ZR0 //This command sets the absolute zero position for the specified axis number "#"
  4) #6LCG0//This command disables the limit switch, allowing 360º, continuous travel of the rotation stage

2. The command #mvr360 should move the PR-50 stage one full rotation (360º) for axis number "#".

◆ NOTE: If the limit switch is not deactivated, the travel range of the stage will be restricted to 360º or less.

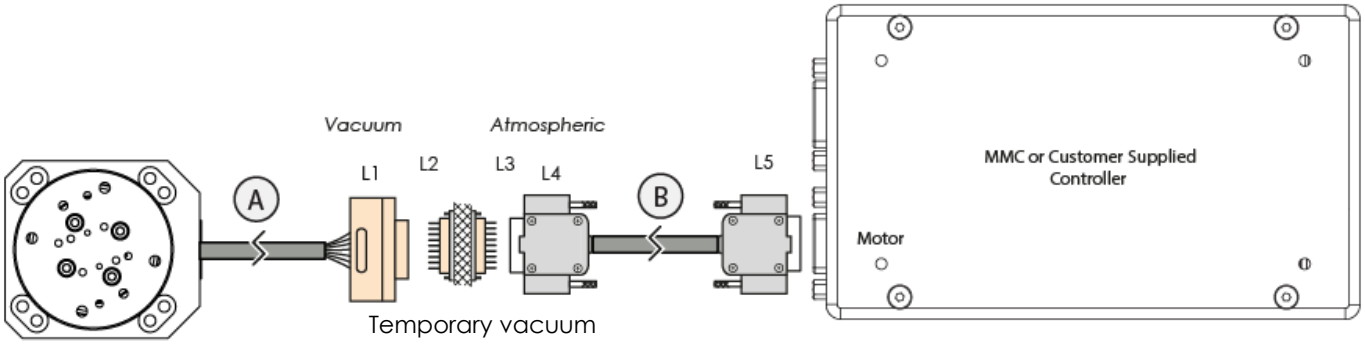
A.3 Open Loop Vacuum Wiring Diagram

Standard Cable Descriptions:

A. PR-50 Motor Cable - Vacuum Side (Female Dsub 9 Pin Peek Connector)

B. Atmospheric Motor Cable (Female Dsub 9 Pin to Male Dsub 9 Pin)

Wiring Diagram:



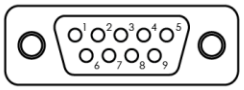
Temporary vacuum test connectors are standard. Requires customer supplied feed through connector

A	Vacuum Motor Cable
B	Atmospheric Encoder Cable

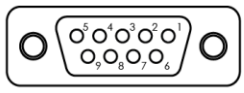
Connector Pinout

Description	*Color*	*L1*	*L2*	*L3*	*L4*	*L5*
Motor Phase A+	*Kapton*	*5*	*5*	*1*	*1 (Green)*	*1*
Motor Phase A-	*Kapton*	*4*	*4*	*2*	*2 (White - Green TP)*	*2*
Motor Phase B+	*Kapton*	*3*	*3*	*3*	*3 (Black)*	*3*
Motor Phase B-	*Kapton*	*2*	*2*	*4*	*4 (Red)*	*4*
Shield	*-*	*1*	*1*	*5*	*5 (Shield)*	*Casing*
Limit +	*Kapton*	*8*	*8*	*7*	*7 (Violet & White-Violet TP)*	*7*
+5V	*Kapton*	*7*	*7*	*8*	*8 (White - Brown TP)*	*8*
Ground	*Kapton*	*6*	*6*	*9*	*9 (Brown)*	*9*

-Motor

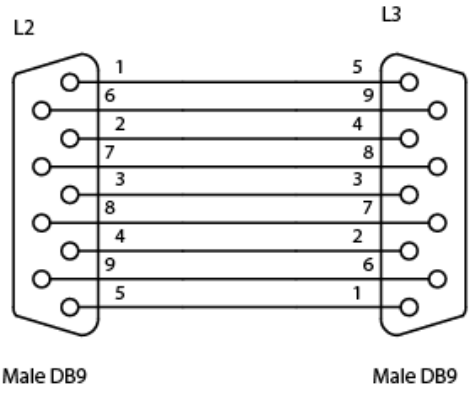


Female Dsub9 Connector - Rear View



Male Dsub9 Connector - Rear View

A.3.1 9-Pin Feed Through

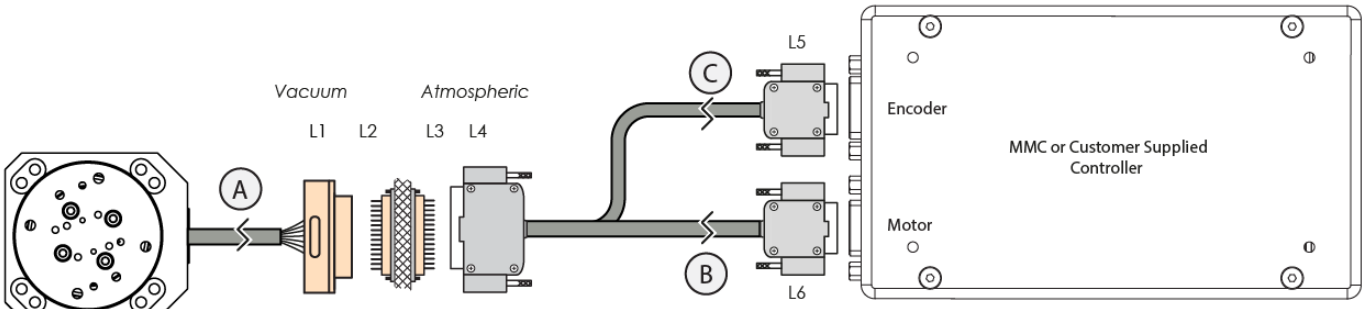


A.4 Analog Encoder Wiring Diagram

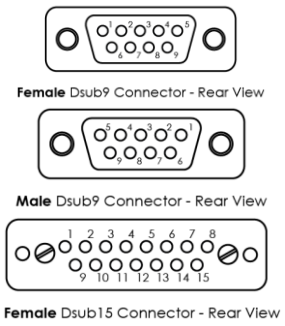
Standard Cable Descriptions:

A. PR-50 Motor & Encoder Cable - Vacuum Side (Female Dsub 15 Pin Peek Connector)
B. Atmospheric Motor Breakout Cable (Female Dsub 15 Pin to Male Dsub 9 Pin)
C. Atmospheric Encoder Breakout Cable (Female Dsub 15 Pin to Female Dsub 9 Pin)

Wiring Diagram:



Temporary vacuum test connectors are standard. Requires customer supplied feed through connector



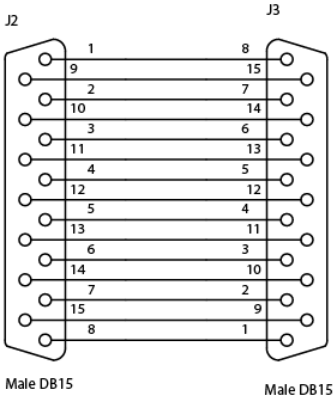
Connector Pinout

Description	*Color*	*L1*	*L2*	*L3*	*L4*	*L5*	*L6*
Motor Phase A+	*Kapton*	*1*	*1*	*8*	*8 (Green)*		*1*
Motor Phase A-	*Kapton*	*2*	*2*	*7*	*7 (White - Green TP)*		*2*
Motor Phase B+	*Kapton*	*9*	*9*	*15*	*15 (Black)*		*3*
Motor Phase B-	*Kapton*	*10*	*10*	*14*	*14 (Red)*		*4*
Shield		*11*	*11*	*13*	*13*	*Housing*	
Ground	*Black*	*8*	*8*	*1*	*1 (Black)*	*4*	
Cos+	*Brown*	*7*	*7*	*2*	*2 (Brown)*	*1*	
+5V	*Red*	*6*	*6*	*3*	*3 (Red)*	*5*	
Cos-	*Orange*	*5*	*5*	*4*	*4 (White - BrownTP)*	*6*	
Sin+	*Yellow*	*4*	*4*	*5*	*5 (Yellow)*	*2*	
Sin-	*Green*	*12*	*12*	*12*	*12 (White - YellowTP)*	*7*	
Index-	*Blue*	*13*	*13*	*11*	*11 (White - Violet TP)*	*8*	
Index+	*Violet*	*14*	*14*	*10*	*10 (Violet)*	*3*	
Shield		*15*	*15*	*9*	*9*	*Housing*	

-Encoder

-Motor

A.4.1 15-Pin Feed Through

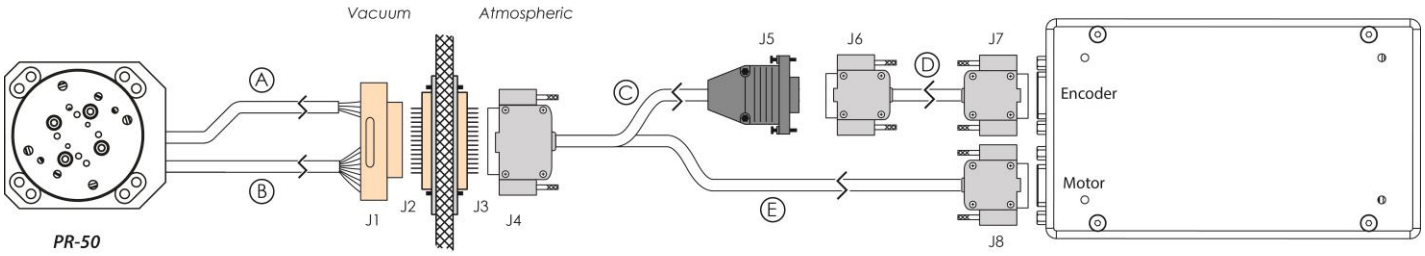


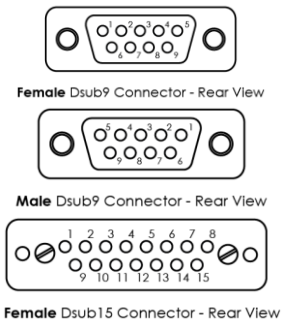
A.5 Digital Encoder Wiring Diagram

Standard Cable Descriptions:

A. PR-50 Motor & Encoder Cable - Vacuum Side (Female Dsub 15 Pin Peek Connector)
B. Atmospheric Motor Breakout Cable (Female Dsub 15 Pin to Male Dsub 9 Pin)
C. Atmospheric Encoder Breakout Cable (Female Dsub 15 Pin to Female Dsub 9 Pin)

Wiring Diagram:





Connector Pinout

	Description	Color	J1	J2	J3	J4	J8
A & E	Motor Phase A+	Kapton	1	1	8	8 (Green)	1
	Motor Phase A-	Kapton	2	2	7	7 (White - Green TP)	2
	Motor Phase B+	Kapton	9	9	15	15 (Black)	3
	Motor Phase B-	Kapton	10	10	14	14 (Red)	4
	Shield		11	11	13	13	Housing
B & C	Ground	Black	8	8	1	1 (Black)	
	Cos+	Brown	7	7	2	2 (Brown)	
	+5V	Red	6	6	3	3 (Red)	
	Cos-	Orange	5	5	4	4 (White - BrownTP)	
	Sin+	Yellow	4	4	5	5 (Yellow)	
	Sin-	Green	12	12	12	12 (White - YellowTP)	
	Index-	Blue	13	13	11	11 (White - Violet TP)	
	Index+	Violet	14	14	10	10 (Violet)	
	Shield		15	15	9	9	

-Encoder

-Motor

Connector Pinout for Cable D

	Description	J5	Color	J6	J7
D	Index-	4	White (PurpleTP)	4	8
	B-	5	White (YellowTP)	5	7
	A-	6	White (BrownTP)	6	6
	+5VDC	7	Red	7	5
	Ground	2	Black	2	4
	Index+	12	Purple	12	3
	B	13	Yellow	13	2
	A+	14	Brown	14	1
	Shield	Housing		Housing	Housing

A.5.1 15-Pin Feed Through