

PR-160

Series



Piezo Rotation Stage Reference Manual (Open and Closed Loop Versions)

PR-160

Piezo Rotation Stage

Reference Manual

Rev 3.3

MICRONIX USA, LLC
Tel: 949-480-0538
Fax: 949-480-0538
Email: info@micronixusa.com
<http://micronixusa.com>

Contents

1. Introduction	2
1.1 Product Description	2
1.2 Recommended Controllers	3
1.3 Technical Data	3
1.4 Load Characteristics	3
2. Model Configurations	4
2.1 PR-160 Order Numbers	4
3. Preparing to Install the PR-160	5
3.1 Installation Preparation	5
3.2 Package Contents	5
4. Installing the PR-160	6
4.1 General Mounting	6
4.1.1 Top Mounting	6
4.1.2 Side Mounting	8
5. Connecting the PR-160	9
5.1 Atmospheric Environments	9
5.1.1 Open Loop Installation & Wiring Diagram	9
5.1.2 Closed Loop/Encoder Installation & Wiring Diagram	9
5.2 Vacuum Environments	10
5.2.1 Handling and Preparation	10
5.2.2 Open Loop Installation & Wiring Diagram	10
5.2.3 Closed Loop/Encoder Installation & Wiring Diagram	11
6. Dimensions	12
7. Supplementary Information	13
7.1 Maintenance	13
7.2 Units and Conventions	13
A. Appendix	13
A.1 Standard Atmospheric DB-9 Male Motor Connector	13
A.2 Phase Piezo Motor Wiring Diagram	14
A.3 Open Loop Vacuum Wiring Diagram	14
A.3.1 9-Pin Feedthrough	15
A.4 Using an Analog Encoder	15
A.4.1 Analog Encoder	15
A.4.2 Encoder Pin-Out	15
A.4.3 Operating and Electrical Specifications	15
A.4.4 Analog Output (Pins 1, 2, 6, and 7)	16
A.4.5 Index Window (Pin 3)	16
A.4.6 Resolution	16
A.4.7 Analog Encoder Wiring Diagram	17
A.4.8 Straight-Through 15-Pin Feedthrough	17

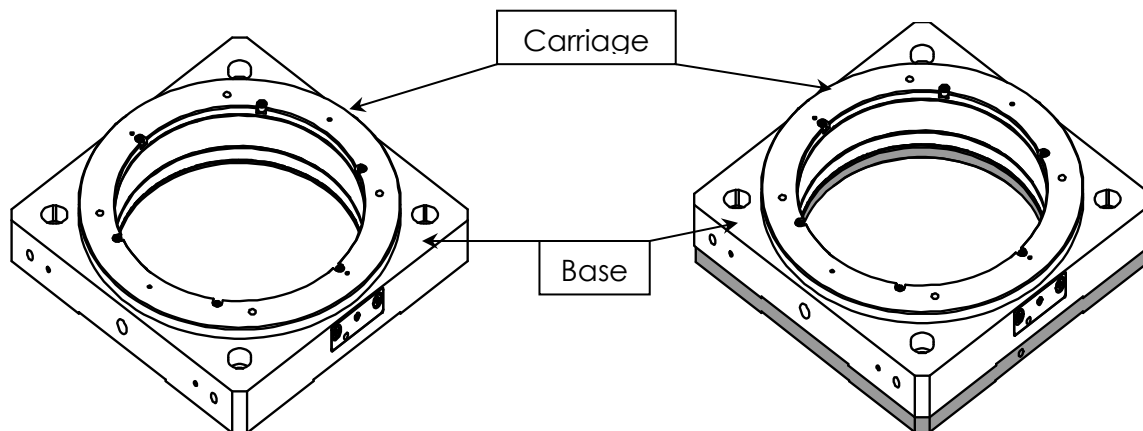
1. Introduction

1.1 Product Description

The PR-160 is a piezo rotation stage with unlimited travel and a 120 mm aperture. It utilizes our patented multi-phase piezo motor resulting in high speed ($> 10 \text{ }^\circ/\text{s}$) and high blocking torque. The cross roller bearing guarantees a motion profile of smooth, stable, and continuous 360° travel. The PR-160 can be combined with linear PPS-110 stage with an adapter bracket. Versions capable of operation in vacuum (10^{-9} mbar) are available.

Features:

- Continuous 360° travel
- Load capacity up to 10 kg
- Low profile, 23 mm height in open loop, 30 mm closed loop
- Vacuum versions available
- Available with closed aperture



PR-160 Open Loop

PR-160 with Encoder option

1.2 Recommended Controllers

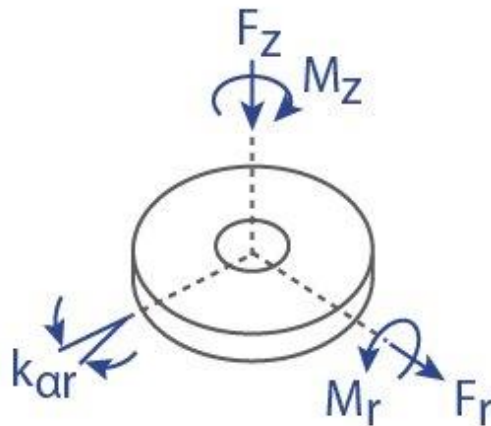
The following controllers are available from MICRONIX USA:

- MMC-103
- MMC-110

1.3 Technical Data

Motor	PM-005R
Speed, max. [°/sec]	5 (MMC-103); 10 (MMC-110)
Resolution, typical [μ°]	5 (open loop); 50 (Analog); 10 (Digital)
Repeatability, bi-directional [μ°]	N/A (open loop); ± 200 (with encoder)
Repeatability, uni-directional [μ°]	N/A (open loop); 200 (with encoder)

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-005R	20	100	5	0.3	150

2. Model Configurations

2.1 PR-160 Order Numbers

Order No.	PR-160-	1	1			
Piezo Motor, PM-005R.....	1					
360° Continuous.....	1					
None.....	0					
Analog (1 V _{pp}).....	2					
Digital (RS-422).....	3					
None.....	0					
*Magnetic Home Switch.....	1					
Atmospheric.....	0					
High Vacuum, 10 ⁻⁶ mbar.....	6					
Ultra High Vacuum, 10 ⁻⁹ mbar.....	9					

*only available in open loop

Contact MICRONIX USA for custom versions and stacking configurations.

3. Preparing to Install the PR-160

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-160 Piezo Rotation Stage
- Reference Manual
- Any other previously agreed upon components such as a controller

4. Installing the PR-160

Mounting patterns require M4 screws, as well as M1.5 dowel pins for precision alignment. Additional brackets and screws may be required for custom applications.

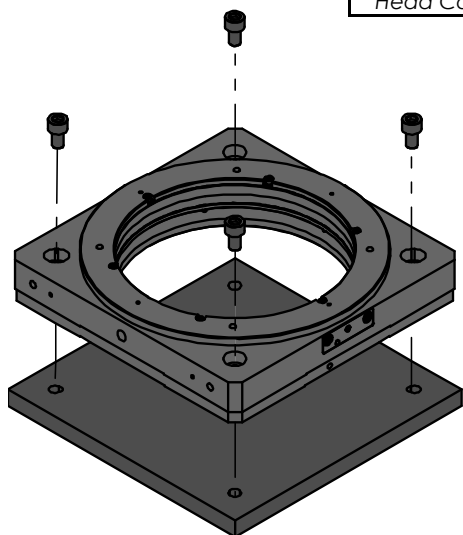
4.1 General Mounting

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

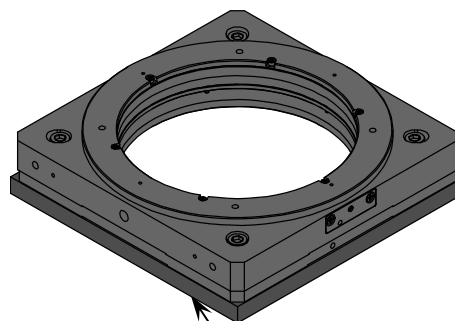
4.1.1 Top Mounting

4.1.1.1 Surface Mounting

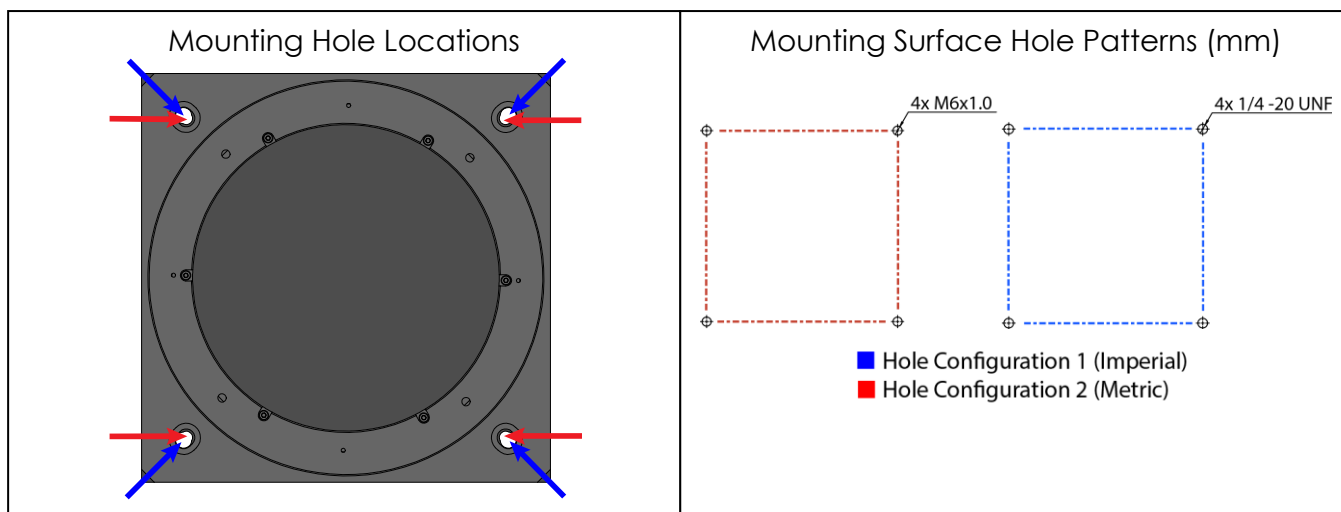
Open Loop Version: 4x M6x10mm Socket Head Cap Screws	Encoder Version: 4x M6x18mm Socket Head Cap Screws
---	---



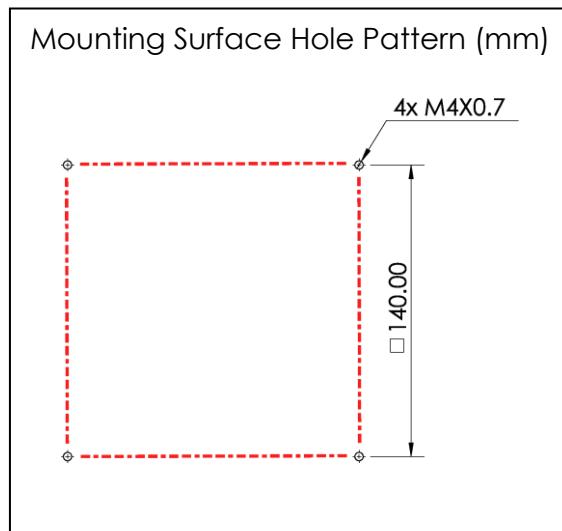
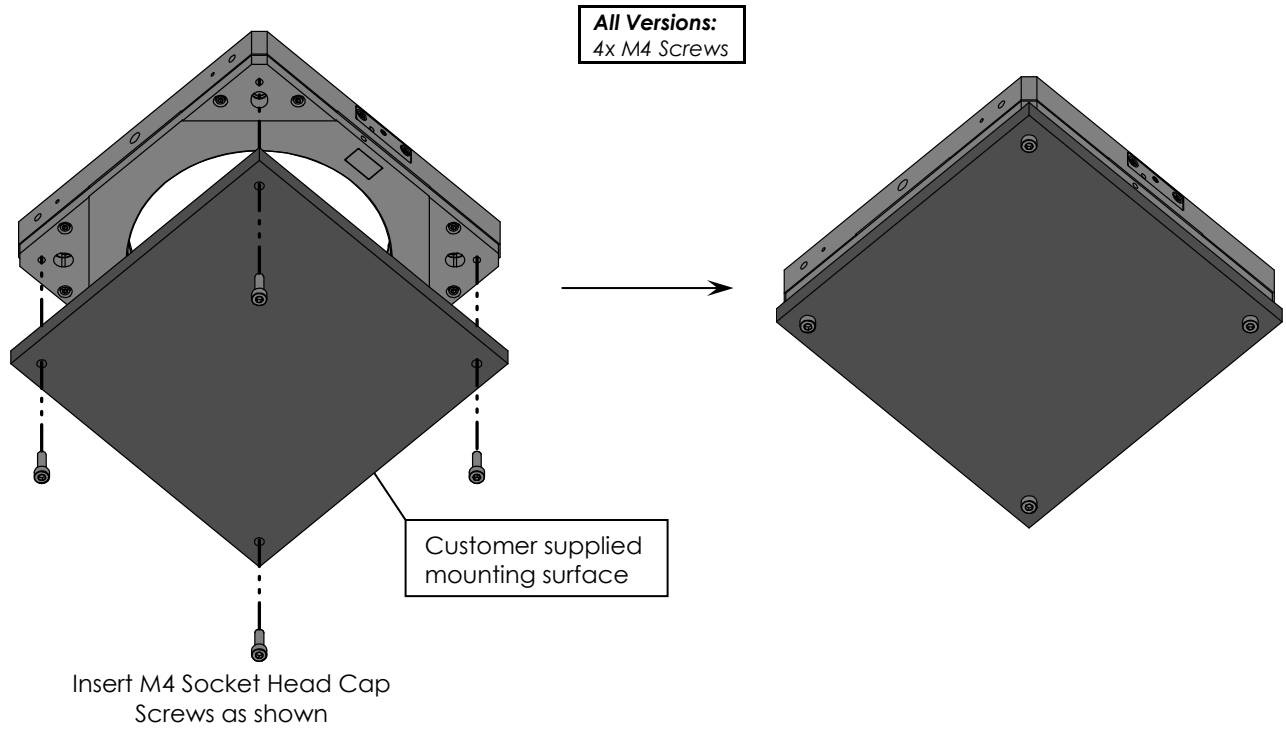
Insert M6 or 1/4 -20 Socket Head Cap Screws as shown



Customer supplied mounting surface

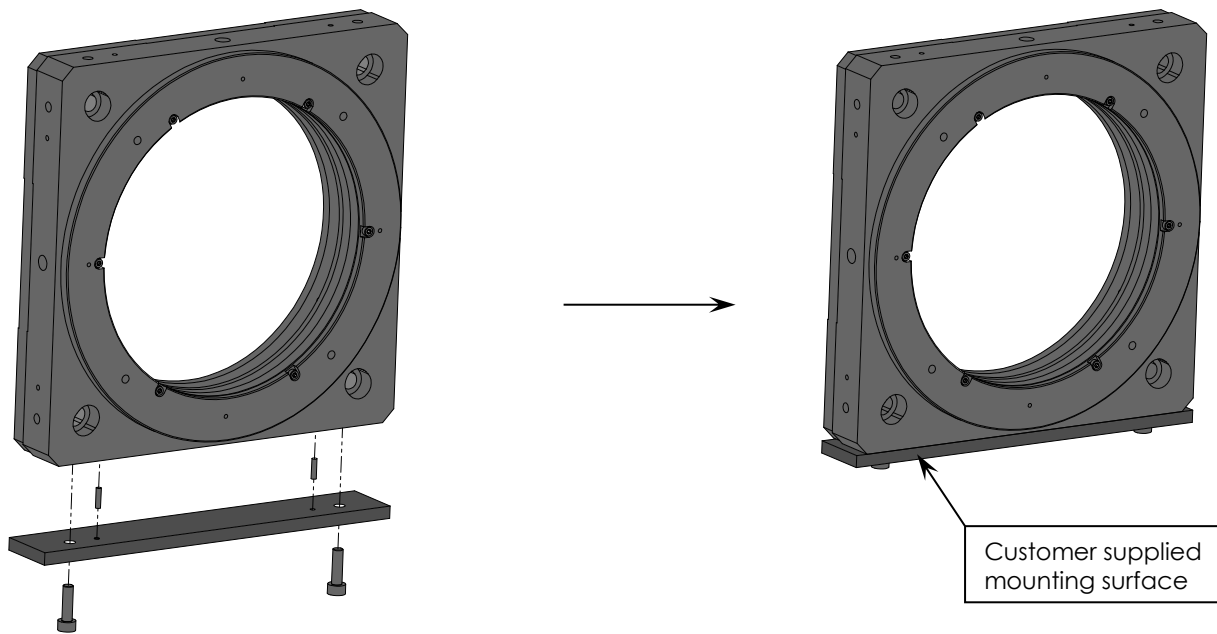


4.1.1.2 Bottom Mounting

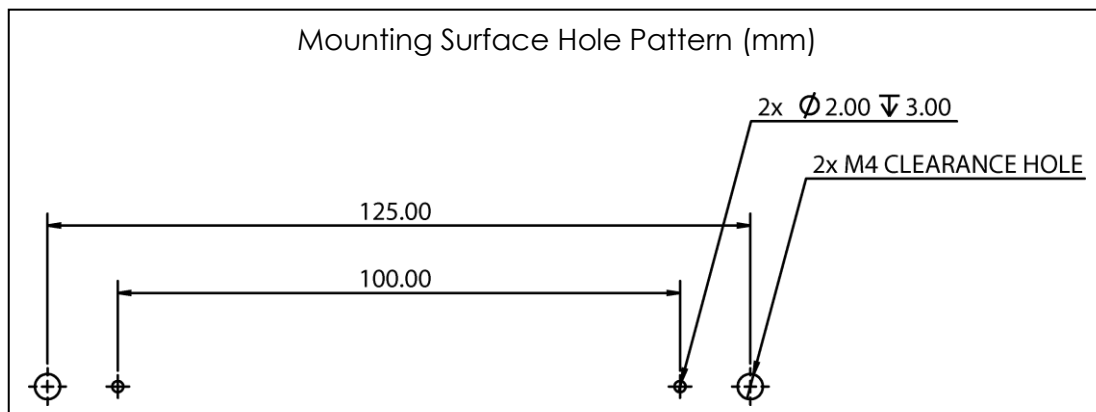


4.1.2 Side Mounting

All Versions:
 2x $\varnothing 2$ x 5mm Dowel Pins
 2x M4 Screws



Insert 2mm Dowel Pins and M4 Socket Head Cap Screws as shown



5. Connecting the PR-160

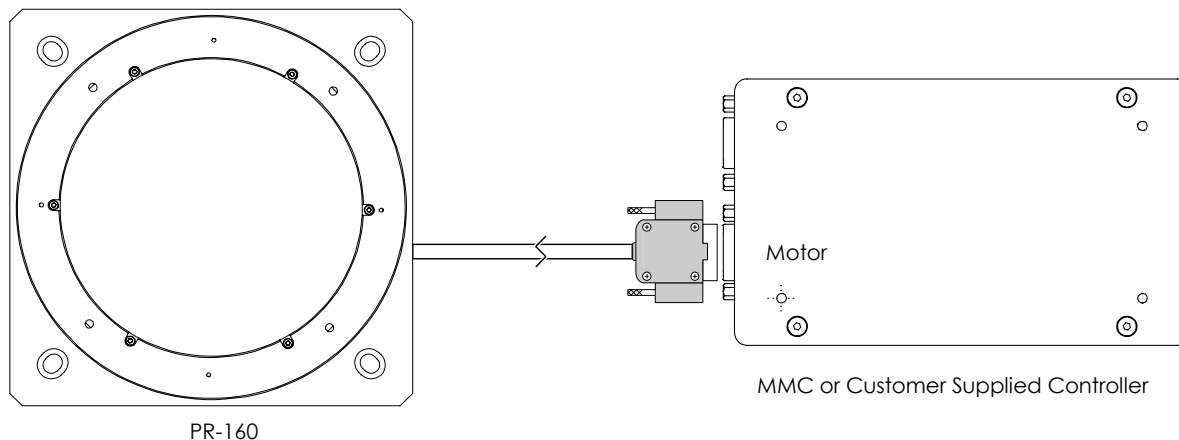
- ◆ Please note: The PR-160 Analog encoder version requires an analog MMC-103 or MMC-110. **Make sure that each stage is plugged into the correct axis on the controller.**

5.1 Atmospheric Environments

For controller information refer to the appropriate MMC controller manual.

5.1.1 Open Loop Installation & Wiring Diagram

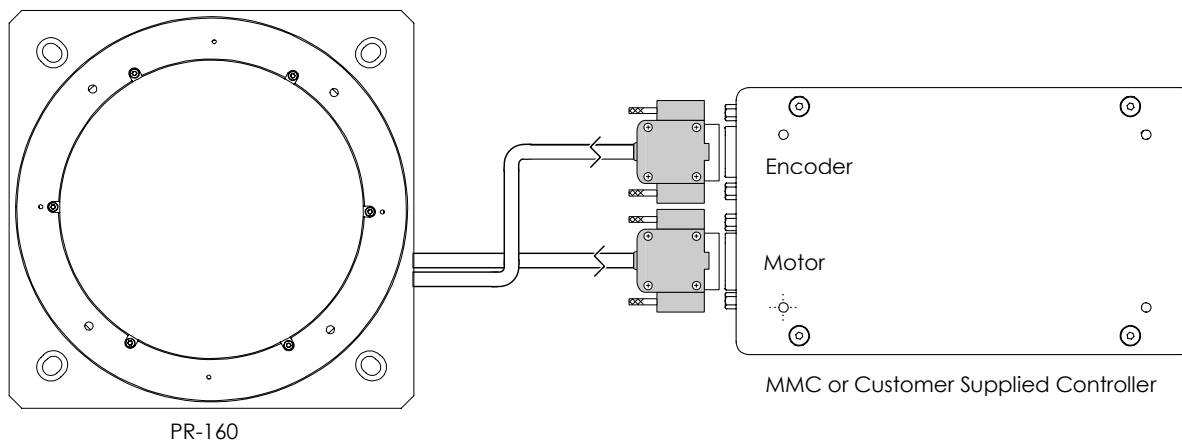
Connecting the PR-160 in an open loop configuration only requires that the Dsub 9 Pin Motor Cable be connected to a compatible controller. No other cables or components are required. Connect the stage as shown below. For details regarding the pinout see the Appendix section A.1.



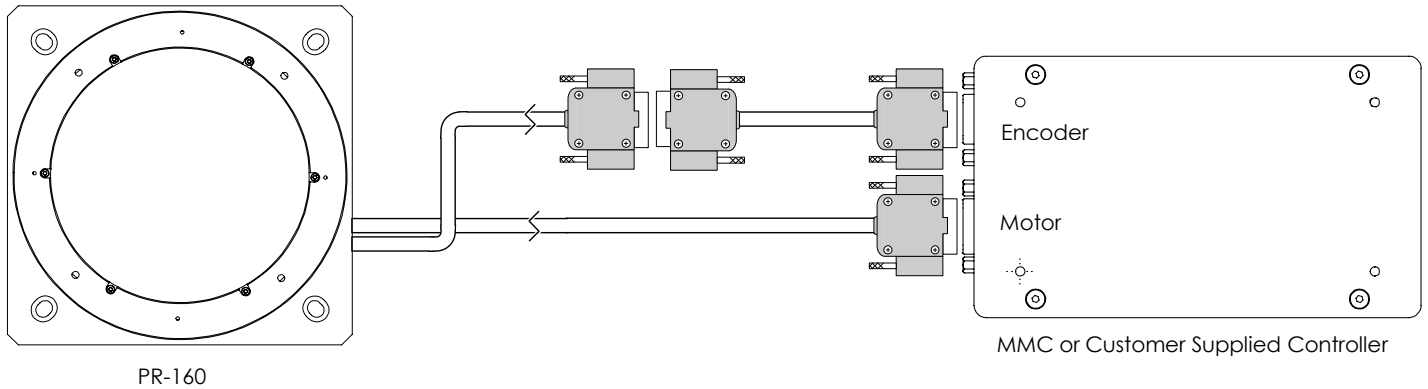
5.1.2 Closed Loop/Encoder Installation & Wiring Diagram

Using the PR-160 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



5.1.2.2 Digital Encoder Wiring Diagram



5.2 Vacuum Environments

5.2.1 Handling and Preparation

When preparing the stage for powder free latex or nitrite environments, take the necessary precautions (such as wearing gloves, clean room, clothing, etc.) when handling the stage 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 encoder.

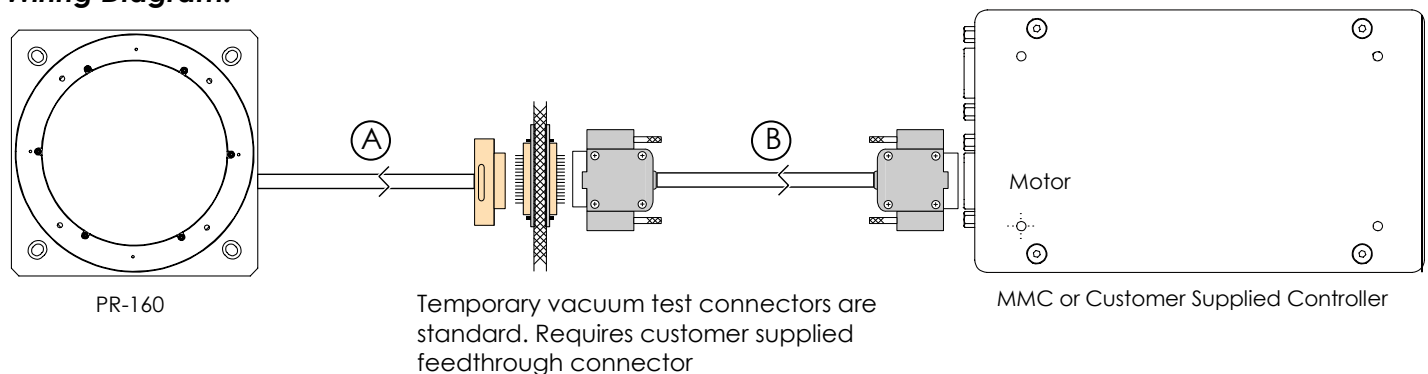
5.2.2 Open Loop Installation & Wiring Diagram

Connecting an open loop PR-160 in a vacuum chamber requires the use of a feedthrough connector at the vacuum chamber wall. The vacuum compatible PR-160 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-160 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-160 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.

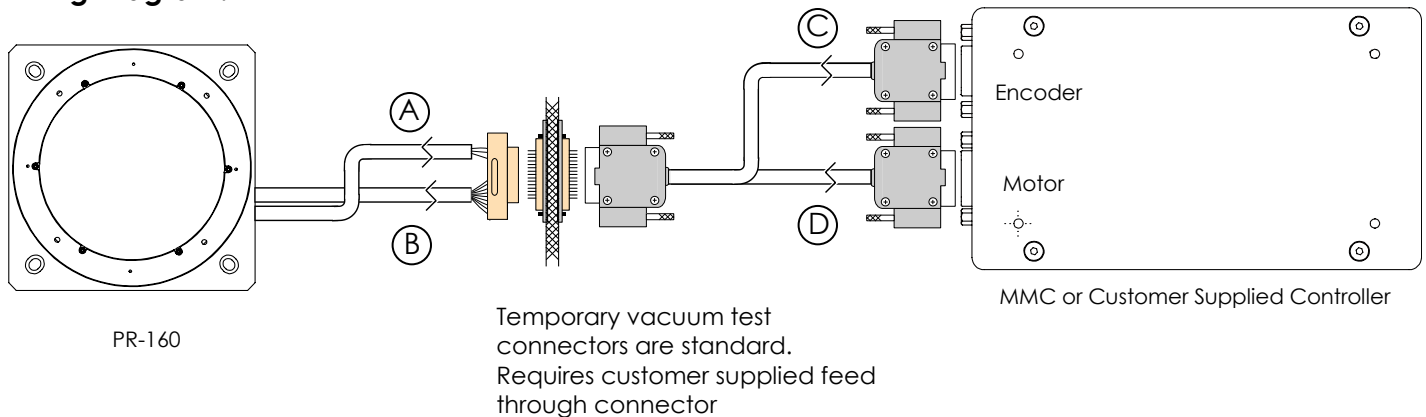
The vacuum compatible PR-160 will be supplied with wiring for a feedthrough, not a cross over gender changer. MICRONIX USA supplies test connectors that simulate the vacuum feedthrough to allow for functionality testing prior to installation in a vacuum chamber. For details regarding the pin-out and feedthrough specifications see the Appendix sections A.4 and A.5.5.

5.2.3.1 Analog Encoder Wiring Diagram

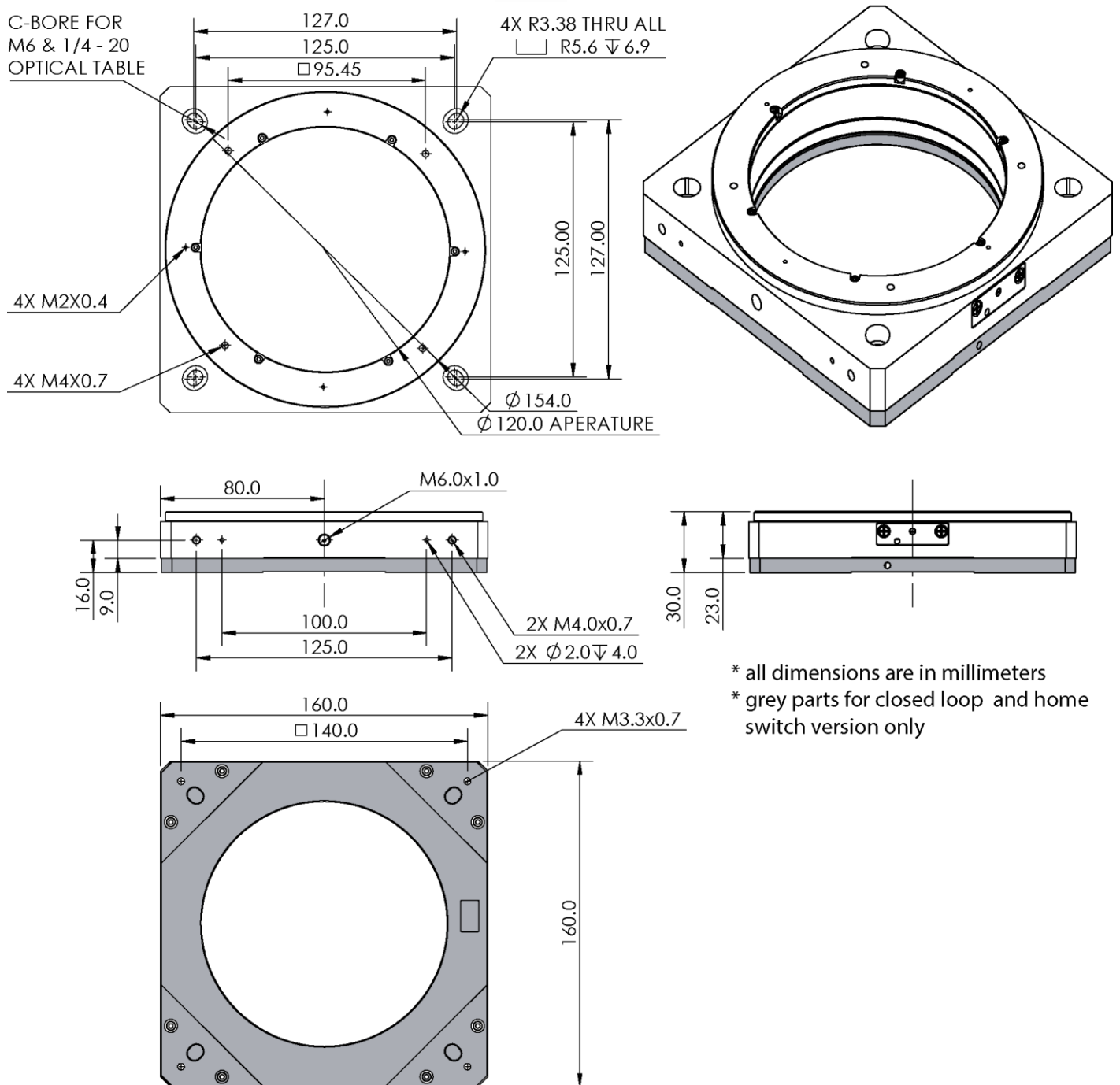
Standard Cable Descriptions:

- A. PR-160 Motor Cable (Female Dsub 15 Pin, 1.5m)
- B. PR-160 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



7. Supplementary Information

7.1 Maintenance

- The PR-160 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 personnel. If the stage is not performing up to the original specifications, please contact MICRONIX USA.
- The PR-160 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.

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

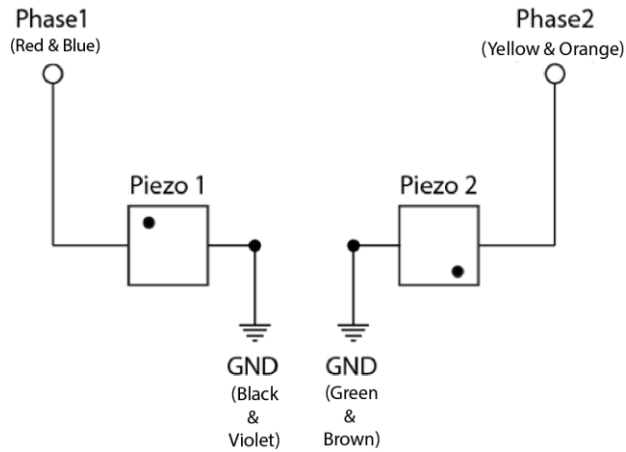
A.1 Standard Atmospheric DB-9 Male Motor Connector

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	N/C	N/C
7*	Home Switch*	(Violet)
8*	Not In Use (+5V)	N/C (Orange)
9*	Not in Use (Ground)	N/C (Brown)

♦ Please note: Vacuum prepared PR-160 stages use Kapton wires for the motor and the limit switch. All Kapton wires are the same color.

* Home Switch Version Only

A.2 Phase Piezo Motor Wiring Diagram

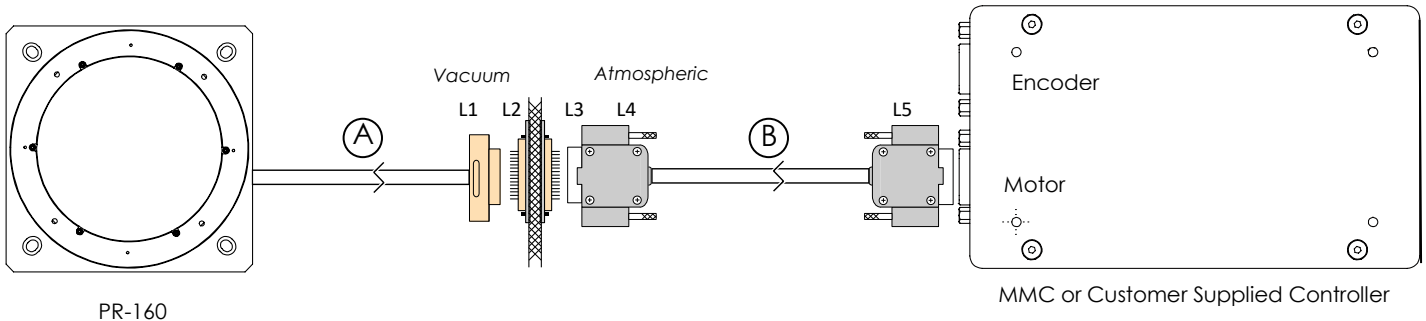


A.3 Open Loop Vacuum Wiring Diagram

Standard Cable Descriptions:

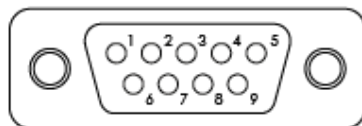
- A. PR-160 Vacuum Motor Cable (Female Dsub 9 Pin, 1.5m)
- B. Atmospheric Motor Cable (Female to Male Dsub 9 Pin, 1.5m)

Wiring Diagram:

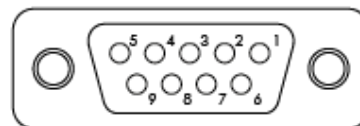


Motor Connector Pinout

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

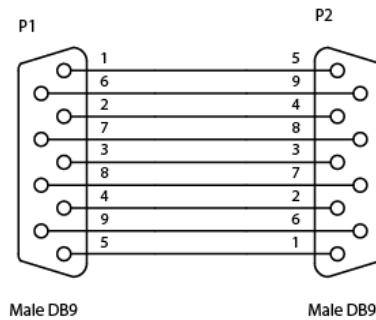


Female Dsub9 Connector - Rear View



Male Dsub9 Connector - Rear View

A.3.1 9-Pin Feedthrough



A.4 Using an Analog Encoder

A.4.1 Analog Encoder

A PR-160 with an analog encoder will need to be paired with an appropriate controller. For vacuum applications, the PR-160 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.

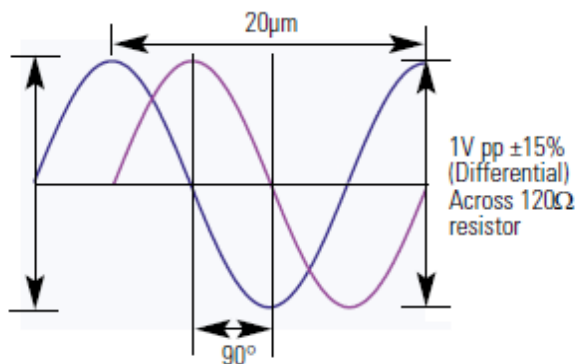
A.4.2 Encoder Pin-Out

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

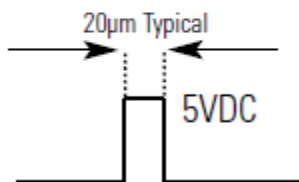
A.4.3 Operating and Electrical Specifications

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

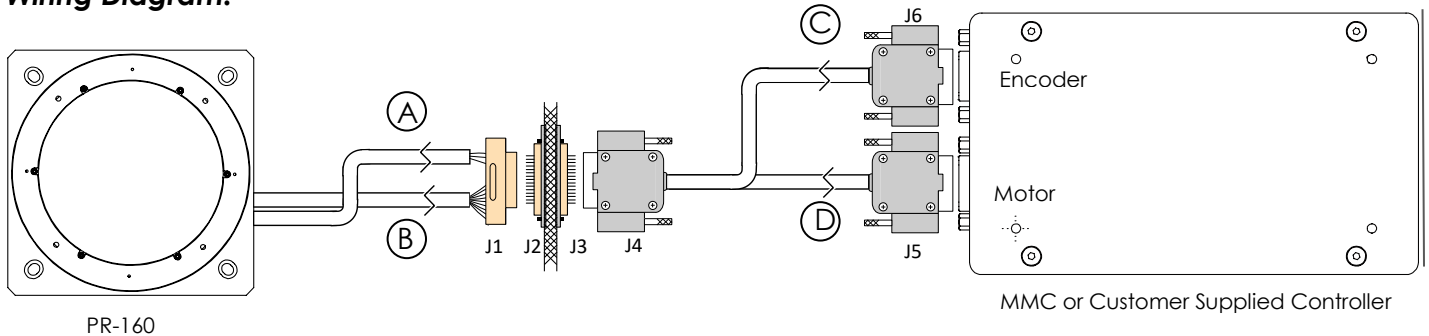
The analog signal interpolation is done in the controller to the resolution specified on the order.

A.4.7 Analog Encoder Wiring Diagram

Standard Cable Descriptions:

- A. PR-160 Motor Cable (Female Dsub 15 Pin, 1.5m)
- B. PR-160 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		1	1	8	Red/Blue	8	1	
	Phase2	Yellow		2	2	7	White (Green)/ Grey	7	2	
	Ground	Black/Green		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	

A.4.8 Straight-Through 15-Pin Feedthrough

