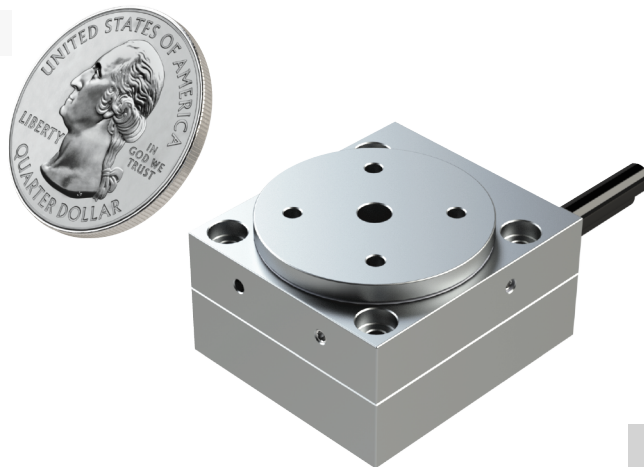


PR-20

Series



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

PR-20

Piezo Rotation Stage Reference Manual

Rev 2.0

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1. Introduction

1.1 Product Description

The PR-20 is an ultra-compact rotary piezo stage. Low profile, high load capacity, and high stiffness are achieved through the use of crossed roller bearings and a patented multi-phase piezo motor, enabling smooth 360° travel. The PR-20 can be fully integrated with a high-resolution absolute encoder (<1 m°) and vacuum versions are available.

Product Specifications	PR-20
Travel	Continuous 360°
Speed	10 °/s (MMC-100) 25 °/s (MMC-110)
Resolution	< 1 m°
Bi-directional Repeatability	± 5 m°
Max Load	100 g
Environment	Atmospheric, HV, UHV

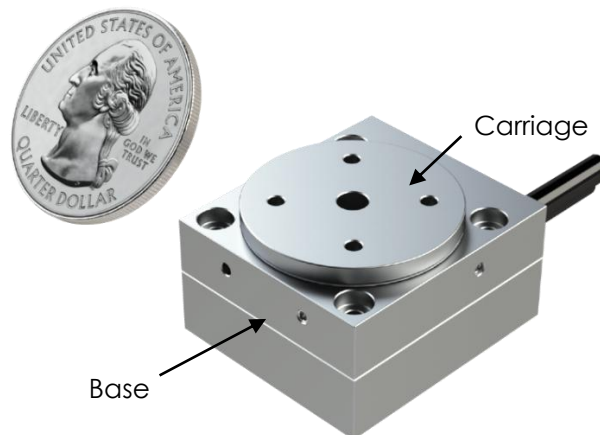


Figure 1-A. PR-20, Open Loop & Closed Loop Version

1.2 Recommended Controllers

The following controllers are available from MICRONIX USA:

Controller	Piezo Motor	Open Loop	Absolute Encoder
MMC-100	✓	✓	
MMC-110	✓	✓	✓
NanoDrive	✓	✓	✓
MMX-120	✓	✓	✓

CAUTION: Ensure the controller is compatible with the stage's motor and feedback signals and that connector types match before connecting. Improper connections or incompatibility may cause damage to the stage or controller.

1.3 Technical Data and Ordering Information

Detailed specifications and ordering information can be found on the [PR-20](#) product page on the MICRONIX USA website.

2. Preparing to Install the PR-20

2.1 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. The stage's performance and structural integrity are impacted by the mounting flatness.

The stage specification is tested at a temperature of $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ unless otherwise specified. Ensure the following conditions are met before operating the stage:

- Mounting surface is clean and free of debris, burrs or dings.
- Recommended mounting surface flatness is less than $25\text{ }\mu\text{m}$ for optimal performance.
- Indoor atmosphere is free of corrosive gases, excessive dust, and condensation.
- Operating temperature range of $5\text{-}40^{\circ}\text{C}$.
- Relative humidity between 20-80%.
- The stage is located away from water, heat, and electrical noise.

2.2 Product Handling

- The PR-20 rotary stage is a precision mechanical device and should be handled with care. Do not drop or mishandle the stage.
- Use proper cable management to ensure a clean and safe operating environment.
- Properly connect the stage to the controller before powering on the controller. Failure to do so can result in damage to the stage.
- Allow for easy access to the stage in case of servicing.

NOTE: Piezo stages use friction-based motion with ceramic components that are sensitive to oils. Wear powder-free nitrile gloves when handling the stage to avoid contamination.

NOTE: It is possible to gently move the carriage manually without damaging the stage.



WARNING: Keep hands clear of all moving parts while the stage is in motion to avoid personal injury.

2.3 Package Contents

The package contains all necessary components for the PR-20 stage setup. 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 Contents:

- PR-20 Rotary Stage
- Reference Manual
- Any other previously agreed upon components such as a controller

3. Installing the PR-20

Additional brackets and screws may be required for custom applications.

NOTE: It is possible to gently move the carriage manually without damaging the stage.

3.1 PR-20 Installation

Follow these steps to securely mount the PR-20 Stage.

1. Align and secure the stage to the mounting surface using at least four M1.6 socket head cap screws at 0.16 Nm recommended torque. The minimum screw length required for mounting is 14 mm.

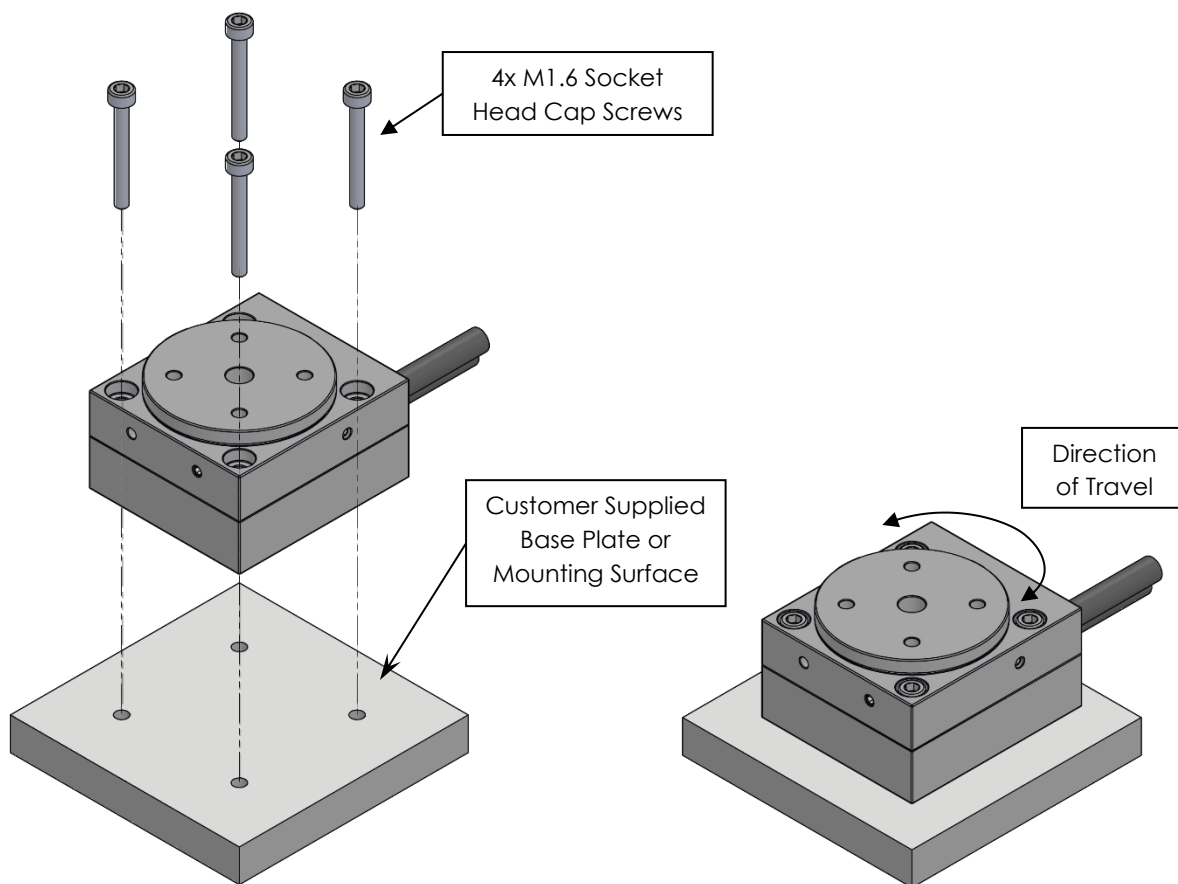
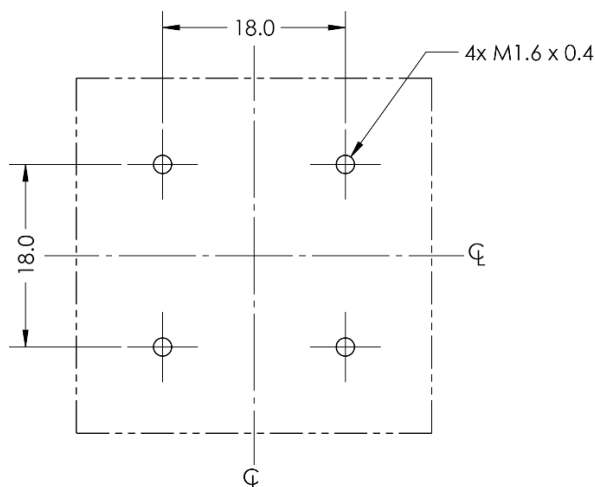


Figure 3-A. PR-20 Installation

3.1.1 General Mounting Pattern



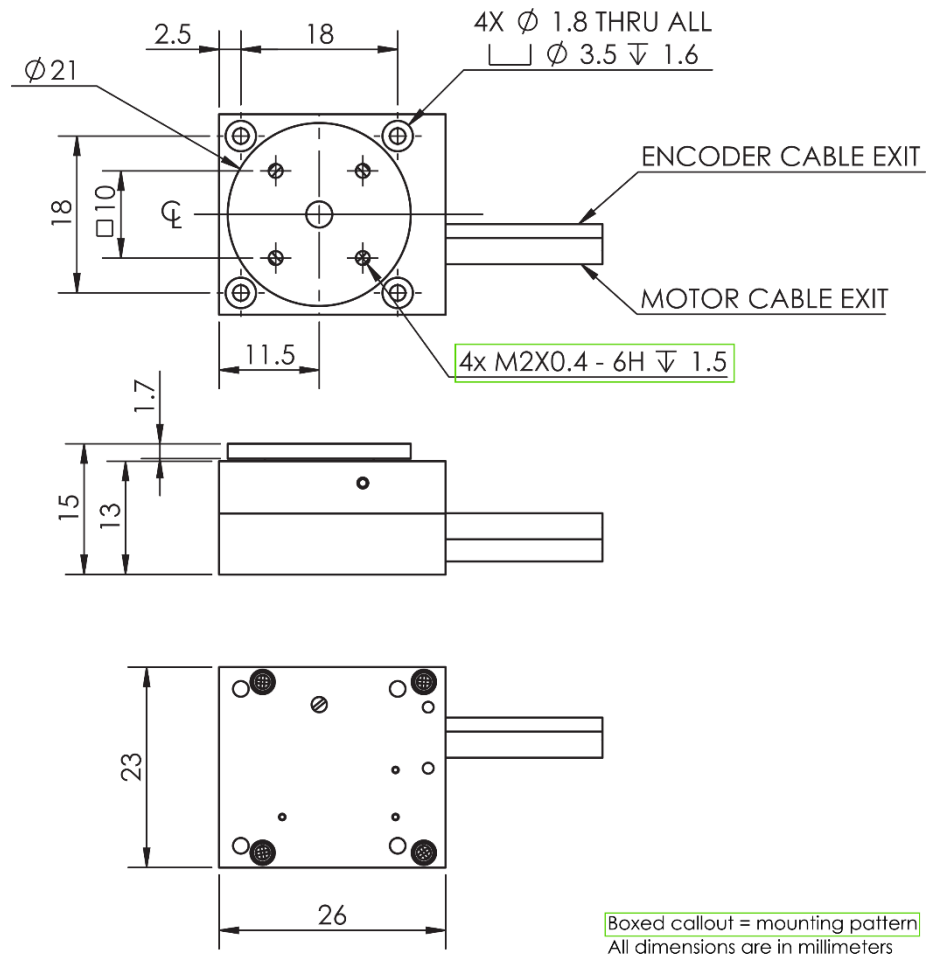
3.2 Mounting to the PR-20

The payload mounts to the PR-20 via the circular carriage on the top of the stage. The recommended specifications for mounting to the PR-20 are found below:

- Use 4 x M2X0.4 - 6H screws with a max depth of 1.5 mm according to the diagram in Section 4.1. Longer screws may damage the stage.
- For best performance, torque all 4 screws to 0.16 Nm.
- For best performance, the payload mating surface should have a flatness of 50 μm or better.

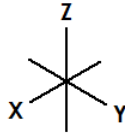
4. Dimensions

4.1 PR-20 Standard Dimensions



5. Stacking Configurations

- Additional configurations are available upon request.
- Images are positioned according to:



5.1 PR-20 Interface with Other MICRONIX Stages (Examples)

The PR-20 can be mounted onto a range of MICRONIX stages, enabling flexible multi-axis configurations. Below are examples of stages that support direct mounting without the need for an adapter bracket.

If an adapter is required, contact MICRONIX USA for assistance.

5.1.1 PR-20 + TRI-BOT-50, Rotation + 3 Degree of Freedom Platform

The PR-20 can be factory installed under the platform of the [TRI-BOT-50](#) adding rotational positioning to the tip-tilt and Z motion stage.



PR-20 & TRI-BOT-50

5.1.2 PR-20 + X-BOT-50, Rotation + 6 Degree of Freedom Platform

The PR-20 can be factory installed under the platform of the [X-BOT-50](#) adding rotational positioning to the 6 degree of freedom platform.



PR-20 & X-BOT-50

6. Connecting the PR-20 Stage (MMC-Controller)

6.1 Atmospheric Environments

For controller information refer to the appropriate MMC controller manual.

6.1.1 Open Loop, Atmospheric Wiring Diagram

Connecting the PR-20 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 needed. Connect the stage as shown below. For details regarding the pinout, see Appendix Section A.2.1.

Cable Descriptions:

A. Motor Cable (Male D-sub 9 Pin, 1.5m PVC Black Cable)

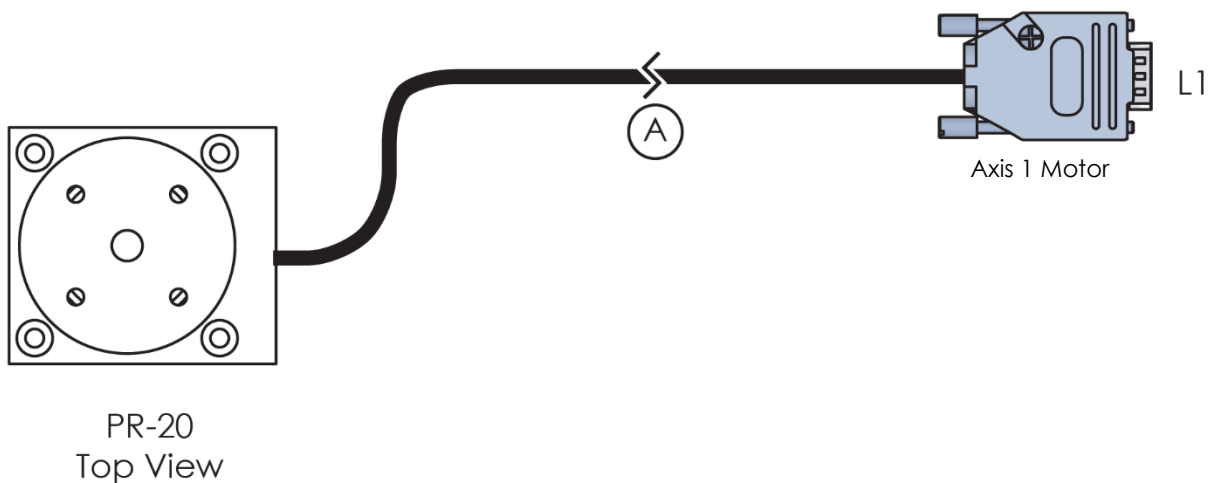


Figure 6-A. PR-20, Open Loop, Atmospheric Wiring Diagram

6.1.2 Closed Loop (Encoder), Atmospheric Wiring Diagram

See the Appendix Section A.2.2 for pinout information.

5.1.1.1 Absolute Encoder, Atmospheric Wiring Diagram

Cable Descriptions:

A. Motor Cable (Male D-sub 9 Pin to Male D-sub 9 Pin, 1.5m PVC Black Cable)

B. Encoder Cable (Female D-sub 9 Pin Module, 1.5m PVC Black Cable)

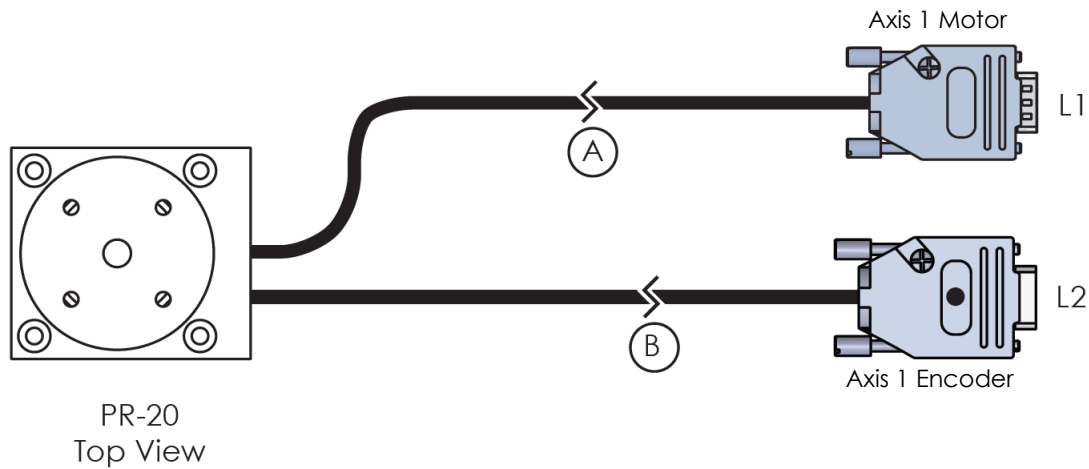


Figure 6-B. PR-20, Absolute Encoder, Atmospheric Wiring Diagram

6.2 Vacuum Environments

6.2.1 Handling and Preparation

When handling stages configured for vacuum use, take the necessary precautions, such as wearing powder-free nitrile gloves, clean room garments, etc. to avoid any contaminants. Maximum bake-out temperature is 100°C. As standard, the stage is supplied with non-vacuum-compatible connectors. MICRONIX USA optionally offers this stage supplied with vacuum-rated connectors installed, see chart below.

Connector Description	Connector Material	Contacts	Backshell
High Vacuum Glass- filled Diallyl Phthalate D-Subminiature	DAP	T2 Female Crimps, Gold Pins (Accuglass P/N: 111652)	Nickel-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^{-6} mbar)	9 Pin Female DAP	15 Pin Female DAP
Ultra-High Vacuum (10^{-9} mbar)	9 Pin Female PEEK	15 Pin Female PEEK

Connecting the PR-20 in a vacuum chamber requires the use of a feedthrough connector at the vacuum chamber wall. For final application, the customer is responsible for providing their own feedthrough connection.

The vacuum compatible PR-20 will be supplied with wiring for a straight through 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. See the Appendix Section A.4 for feedthrough pins.

6.2.2 Open Loop, Vacuum Wiring Diagram

See the Appendix Section A.2.3 for pinout information.

Cable Descriptions:

- A. Motor Cable (Female D-sub 9 Pin PEEK or DAP, 1.5m Silver Braided Cable)
- B. Atmospheric Motor Cable (Female D-sub 9 Pin to Male D-sub 9 Pin, 1.5m PVC Black Cable)

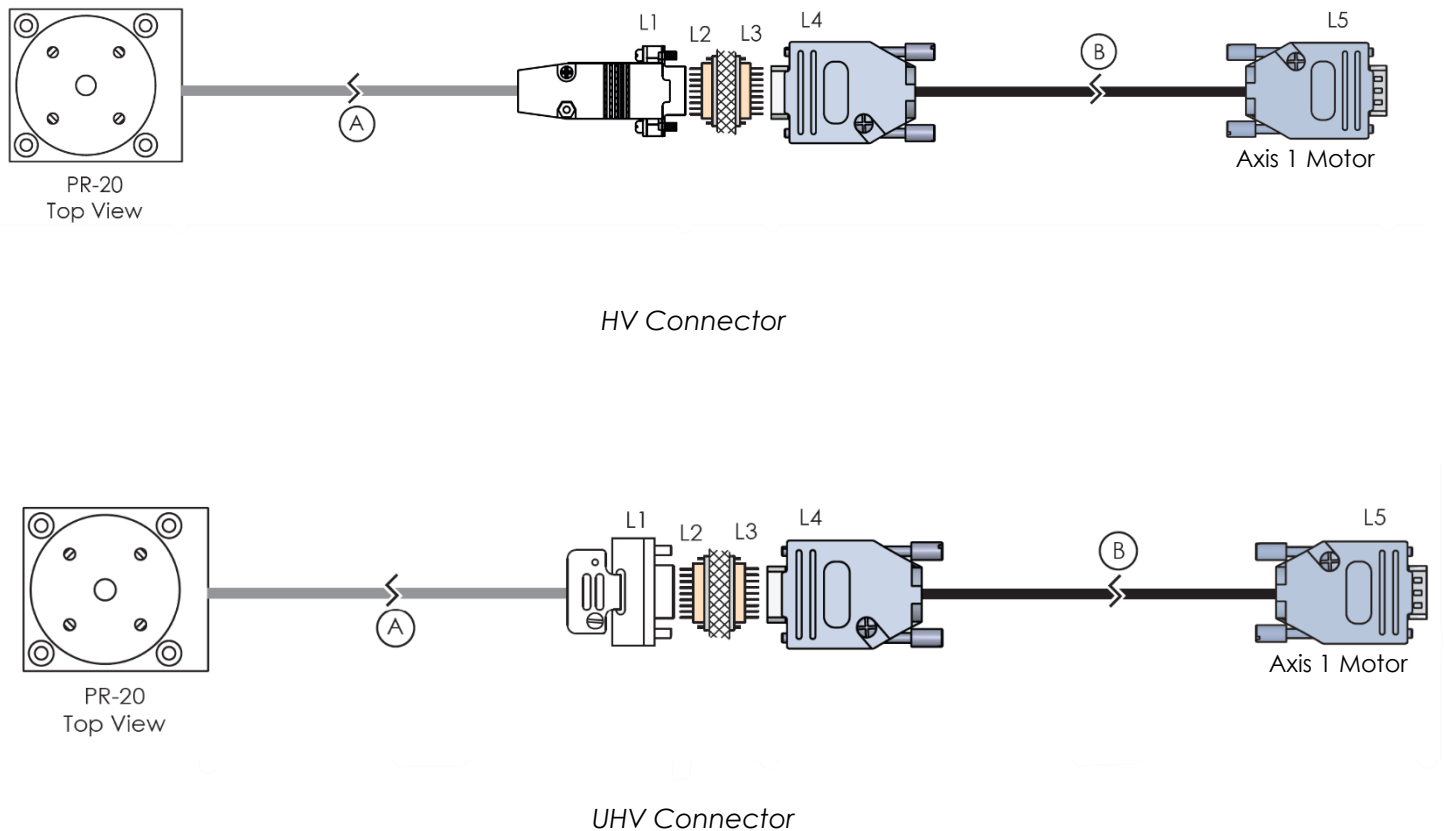


Figure 6-C. PR-20, Open Loop, Vacuum Wiring Diagram

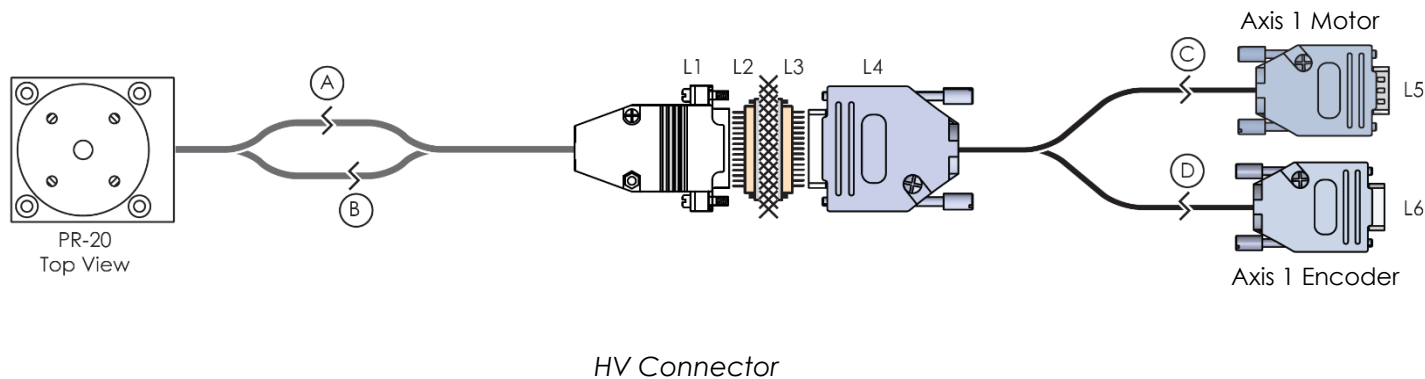
6.2.3 Closed Loop (Encoder), Vacuum Wiring Diagram

See the Appendix Section A.2.4 for pinout information.

6.2.3.1 Absolute Encoder, Vacuum Wiring Diagram

Cable Descriptions:

- A. Motor Vacuum Cable (Female D-sub 15 Pin PEEK or DAP, 1.5m Silver Braided Cable)
- B. Encoder Vacuum Cable (Female D-sub 15 Pin PEEK or DAP, 1.5m Silver Braided Cable)
- C. Motor Breakout Cable (Female D-sub 15 Pin to Male D-sub 9 Pin, 1.5m PVC Black Cable)
- D. Encoder Breakout Cable (Female D-sub 15 Pin to Female D-sub 9 Pin, 1.5m PVC Black Cable)



*Contact factory for UHV wiring diagram

Figure 6-D. PR-20, Absolute Encoder, Vacuum Wiring Diagram

7. Supplementary Information

7.1 Maintenance

The PR-20 series of rotary stages utilizes a maintenance free design. Do not modify the stage or perform any maintenance unless specifically instructed to do so by MICRONIX USA. If the stage is not performing up to the original specifications, please contact MICRONIX USA.

7.2 Units and Conversions

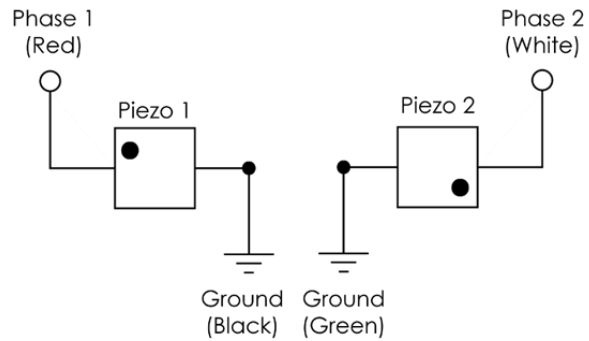
All measurements in this document are in the metric system of units.

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 Piezo Motor Electrical Specifications

A.1.1 2-Phase Piezo Motor Wiring Diagram



A.1.2 Piezo Motor Specifications

Voltage	60V maximum
Capacitance	150nF $\pm$ 15%

A.2 Piezo Motor Wiring Pinouts

A.2.1 Piezo Motor, Atmospheric, Open Loop Pinout

See Figure 6-A.

Motor	Pinout for PR-20-11000		Cable A D-sub 9M
	Description	Color	L1
	Phase 1	Red	1
	Phase 2	White (Green TP)	2
	Ground	Black/Green	5
	Shield	-	Casing

A.2.2 Piezo Motor, Atmospheric, Closed Loop Absolute Pinout

See Figure 6-B.

Motor	Pinout for PR-20-11500		Cable A D-sub 9M
	Description	Color	L1
	Phase 1	Red	1
	Phase 2	White (Green TP)	2
	Ground	Black/Green	5
	Shield	-	Casing

Encoder	Pinout for PR-20-11500		Cable B D-sub 9F
	Description	Color	L2
	SLO+ / DATA+	Blue	1
	MA+ / CLK+	Brown	2
	SLI+*	Violet	3
	GND	Grey	4
	+5V	White (Grey TP)	5
	SLO- / DATA-	White (Blue TP)	6
	MA- / CLK-	White (Brown TP)	7
	SLI-*	White (Violet TP)	8
	Shield	-	Casing

*SLI signals are available upon request

A.2.3 Piezo Motor, Vacuum, Open Loop Pinout

See UHV Connector

Motor	PR-20-11006/9		Cable A D-sub 9F		Feedthrough D-sub 9M D-sub 9M		Cable B D-sub 9F D-sub 9M	
	Description	Color	L1	L2	L3	Color	L4	L5
	Phase 1	Red	5	5	1	Red	1	1
	Phase 2	White (Green TP)	4	4	2	White (Green TP)	2	2
	Ground	Black/Green	1	1	5	Black/Green	5	5
	Shield	-	6	6	9	-	9	Casing

Figure 6-C.

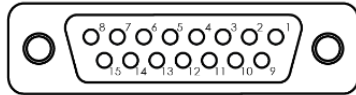
A.2.4 Piezo Motor, Vacuum, Closed Loop Absolute Pinout

See Figure 6-D.

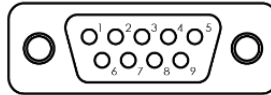
Encoder B & D	PR-20-11506/9		Feedthrough D-Sub 15M D-sub 15M		D-sub 15F		Cable C D-sub 9M	Cable D D-sub 9F
	Description	Color	L1	L2	L3	Color	L4	L5
	Phase 1	Red	1	1	8	Red	8	1
	Phase 2	White (Green TP)	2	2	7	White (Green TP)	7	2
	Ground	Black/Green	9	9	15	Black/Green	15	5
	Shield	-	10	10	14	-	14	Casing
	GND	Grey	8	8	1	Grey	1	-
	SLO+ / DATA+	Blue	7	7	2	Blue	2	-
	+5V	White (Grey TP)	6	6	3	White (Grey TP)	3	-
	SLO- / DATA-	White (Blue TP)	5	5	4	White (Blue TP)	4	-
	MA+ / CLK+	Brown	4	4	5	Brown	5	-
	MA- / CLK-	White (Brown TP)	12	12	12	White (Brown TP)	12	-
	SLI-*	White (Violet TP)	13	13	11	White (Violet TP)	11	-
	SLI+*	Violet	14	14	10	Violet	10	-
	Shield	-	15	15	9	-	9	-
								Casing

*SLI signals are available upon request

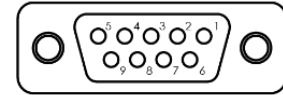
A.3 Standard D-sub Connector Pinout



Dsub15F - Front View
15 Pin Female Connector



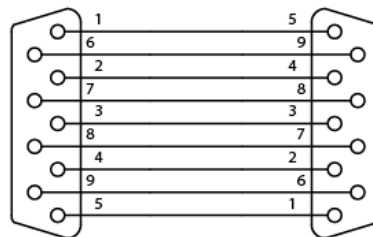
Dsub9M - Front View
9 Pin Male Connector



Dsub9F - Front View
9 Pin Female Connector

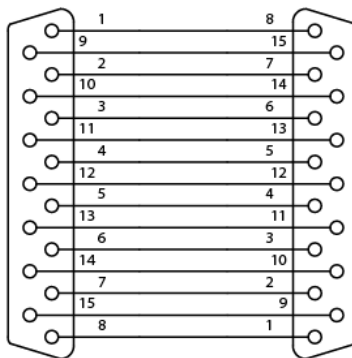
A.4 Vacuum Feedthrough Pinout

Recommended feedthrough pinout based on off the shelf feedthroughs.



Male DB9

Male DB9



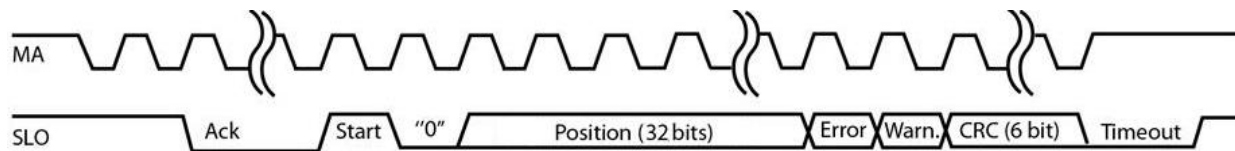
Male DB15

Male DB15

A.5 Using an Absolute Encoder

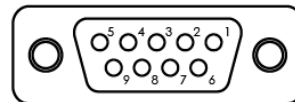
The MICRONIX USA absolute encoder operates using standard BiSS C-mode (continuous) interface, transmitting 32-bits of position data on each request. The controller will clock position acquisitions via the MA signal. The SLO signal will transmit position data from the encoder.

By default, the SLI signal is not used for the absolute encoder interface, however it can be made available on customer request.



A.5.1 Absolute Encoder Pinout

Pin	Description
1	SLO+ / DATA+
2	MA+ / CLK+
3	SLI+
4	Ground
5	+5V
6	SLO- / DATA-
7	MA- / CLK-
8	SLI-
9	Not In Use



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