

# PR-20

Series



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

# **PR-20**

## **Piezo Rotation Stage**

### **Reference Manual**

Rev 1.0

**MICRONIX USA, LLC**  
Tel: 949-480-0538  
Fax: 949-480-0538  
Email: [info@micronixusa.com](mailto:info@micronixusa.com)  
<http://micronixusa.com>

## Table of Contents

<b>1. Introduction</b>	<b>2</b>
1.1 Product Description	2
1.2 Piezo Motor – (PM-002)	2
1.3 Recommended Controllers	2
1.4 Technical Data	2
<b>2. Model Configurations</b>	<b>3</b>
2.1 PR-20 Order Numbers	3
<b>3. Preparing to Install the PR-20 Stage</b>	<b>3</b>
3.1 Installation Preparation	3
3.2 Package Contents	3
<b>4. Installing the PR-20 Stage</b>	<b>4</b>
4.1 PR-20 Installation	4
4.1.1 General Mounting	4
<b>5. Dimensions</b>	<b>5</b>
5.1 PR-20 Open Loop and Absolute Configuration Dimensions	5
5.2 Recommended General Mounting Pattern	5
<b>6. Connecting the PR-20 Stage</b>	<b>6</b>
6.1 Atmospheric Environments	6
6.1.1 Open Loop, Atmospheric Wiring Diagram	6
6.1.2 Closed Loop (Encoder), Atmospheric Wiring Diagram	7
6.2 Vacuum Environments	8
6.2.1 Handling and Preparation	8
6.2.2 Open loop, Vacuum Wiring Diagram	8
6.2.3 Closed Loop (Encoder), Vacuum Wiring Diagram	9
<b>7. Supplementary Information</b>	<b>10</b>
7.1 Maintenance	10
7.2 Units and Conversions	10
<b>A. Appendix</b>	<b>11</b>
A.1 2-Phase Piezo Motor Wiring Diagram	11
A.1.1 Piezo Operating and Electrical Specifications	11
A.2 D-subminiature Connector Nomenclature & Pinouts	11
A.2.1 Piezo Motor Atmospheric Open Loop Pinout	12
A.2.2 Piezo Motor Atmospheric Closed Loop Absolute Pinout	12
A.2.3 Piezo Motor Vacuum Open Loop Pinout	13
A.2.4 Piezo Motor Vacuum Closed Loop Absolute Pinout	13
A.2.5 Feedthroughs	14
A.3 Using an Absolute Encoder	15
A.3.1 Absolute Encoder Pinout	15

## 1. Introduction

### 1.1 Product Description

The PR-20 is an ultra-compact rotational piezo stage. Low profile, high load, & high stiffness capacity are achieved through the use of crossed roller bearing and patented multi-phase piezo motor, which allows for smooth 360° travel. The PR-20 can be fully integrated with high resolution absolute encoder (<1 mdeg.). Vacuum versions are available. The PR-20 is compatible with the MMC-100 and MMC-110 controllers.

#### Features:

- Closed loop absolute encoder resolution to <1 mdeg.
- Crossed roller bearings
- Continuous 360° motion
- Load capacity up to 100 g
- Low profile, 14.5 mm height
- Vacuum versions available

### 1.2 Piezo Motor – (PM-002)

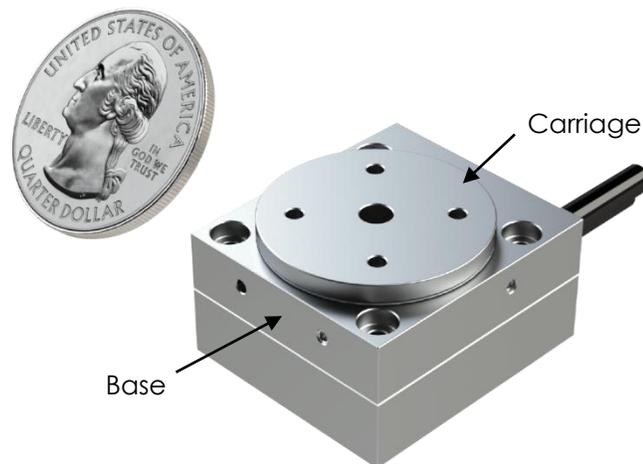


Figure 1-A. PR-20, Open Loop & Closed Loop Version

### 1.3 Recommended Controllers

The following controllers are recommended:

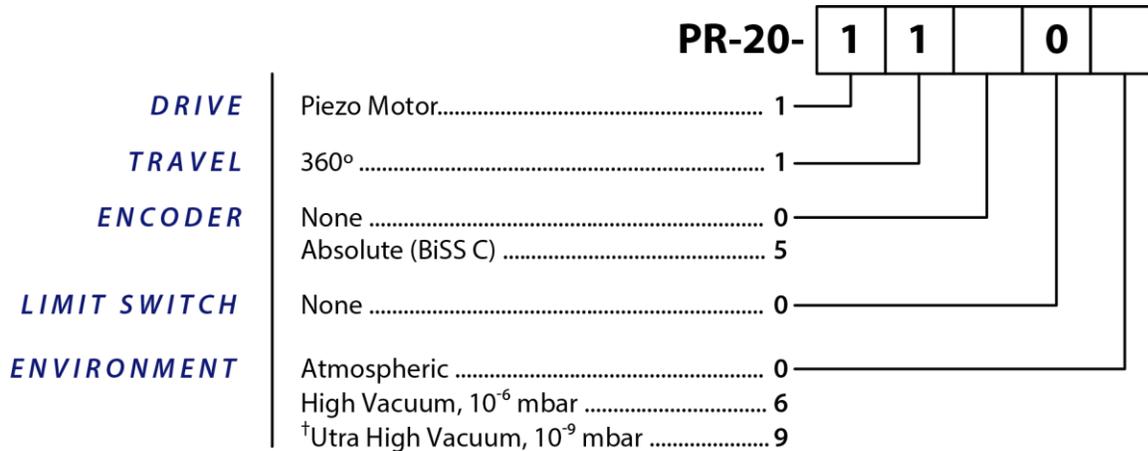
- MMC-100 (open loop only)
- MMC-110 (open loop or absolute encoder)

### 1.4 Technical Data

See Datasheet.

## 2. Model Configurations

### 2.1 PR-20 Order Numbers



Contact MICRONIX USA for custom versions and stacking configurations.

## 3. Preparing to Install the PR-20 Stage

### 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 and affect the stage's performance and structural integrity. It is required to have a mounting surface with flatness less than 25 µm for optimal performance.

The stage is calibrated and guaranteed to be within specification at 20°C ± 5°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 with a flatness to be less than the flatness of the base as specified on the product datasheet.
- 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.

### 3.2 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:

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

## 4. Installing the PR-20 Stage

Refer to Section 4.1.1 for general mounting. Additional brackets and screws may be required for custom applications.

### 4.1 PR-20 Installation

#### 4.1.1 General Mounting

Recommended general mounting pattern sample can be found in Section 5.2.

1. Ensure that the mounting surface is flat (Recommend flatness: Less than 25  $\mu\text{m}$ )
2. 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.

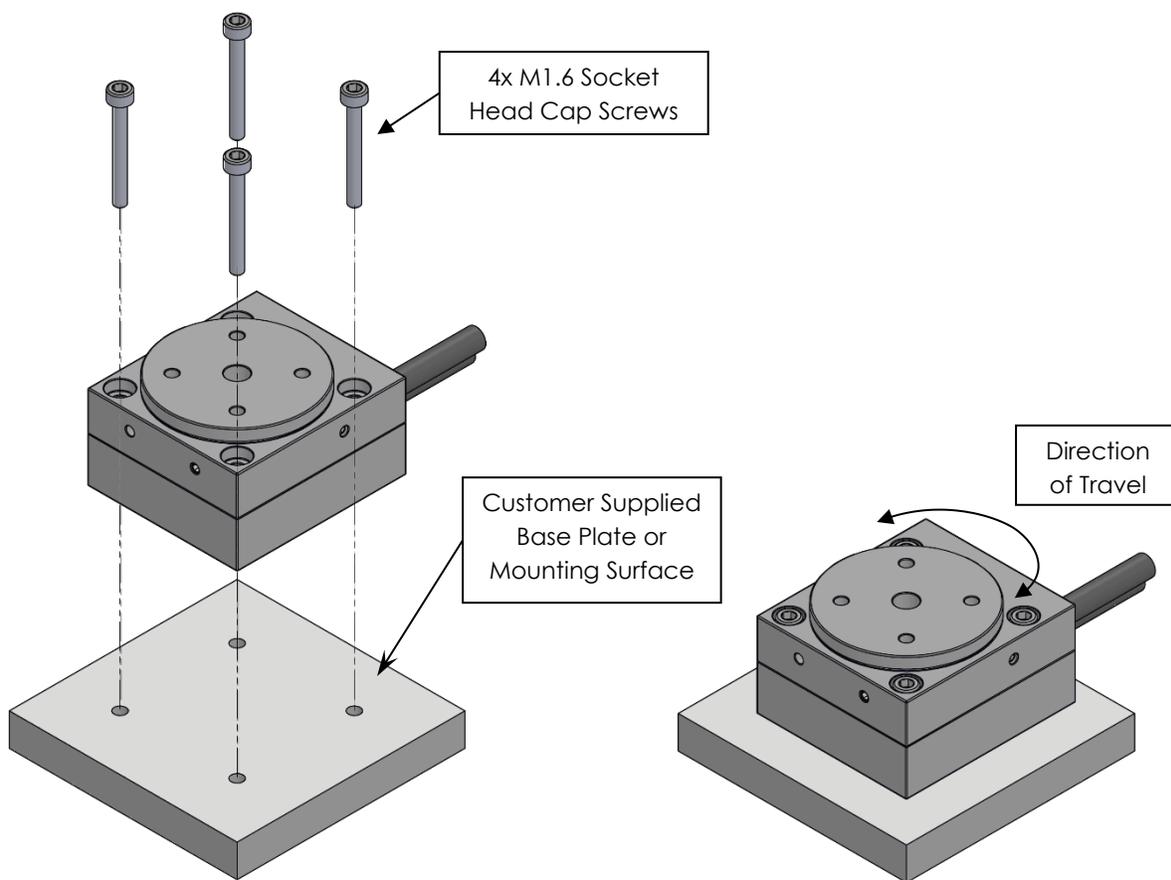
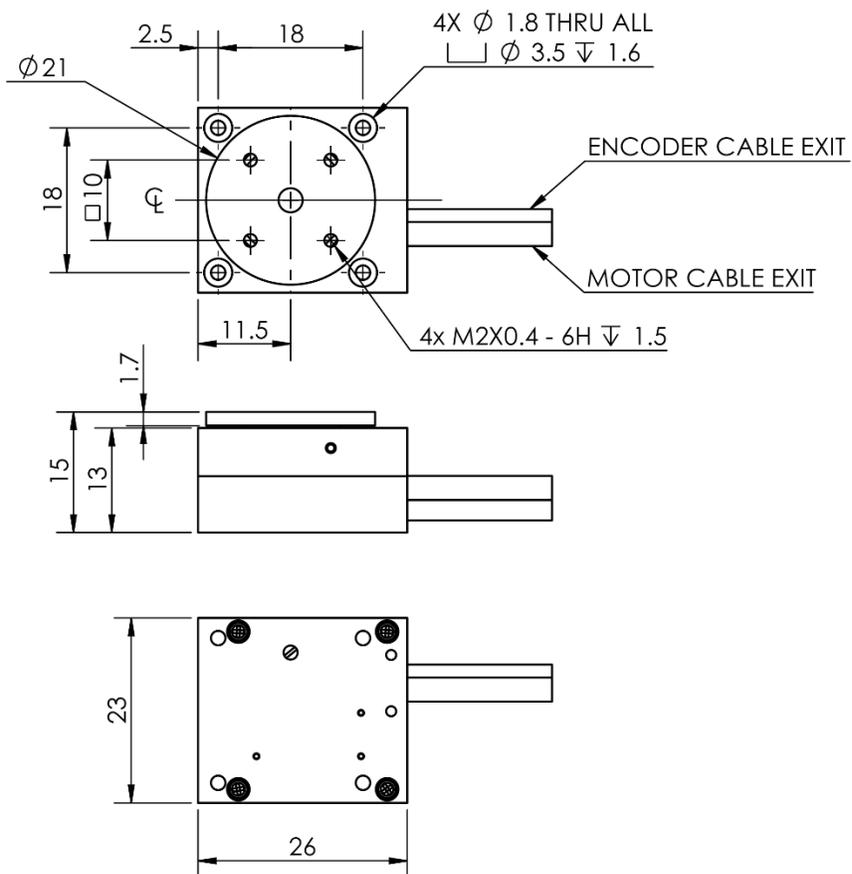


Figure 4-A. PR-20 Installation

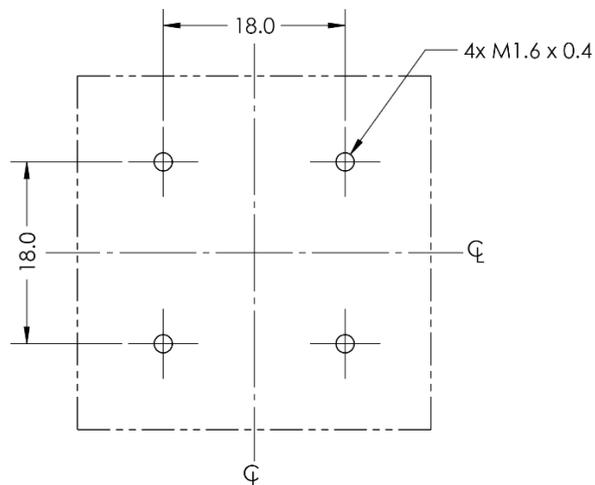
## 5. Dimensions

### 5.1 PR-20 Open Loop and Absolute Configuration Dimensions



\* all dimensions are in millimeters

### 5.2 Recommended General Mounting Pattern



## 6. Connecting the PR-20 Stage

### 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 A.2.1.

#### Cable Descriptions:

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

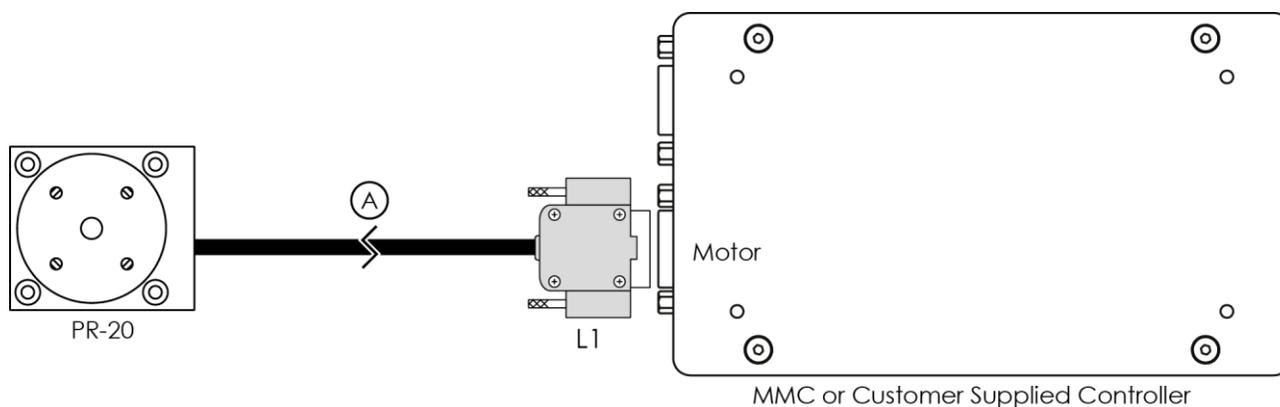


Figure 6-A. PR-20, Open Loop, Atmospheric Wiring Diagram

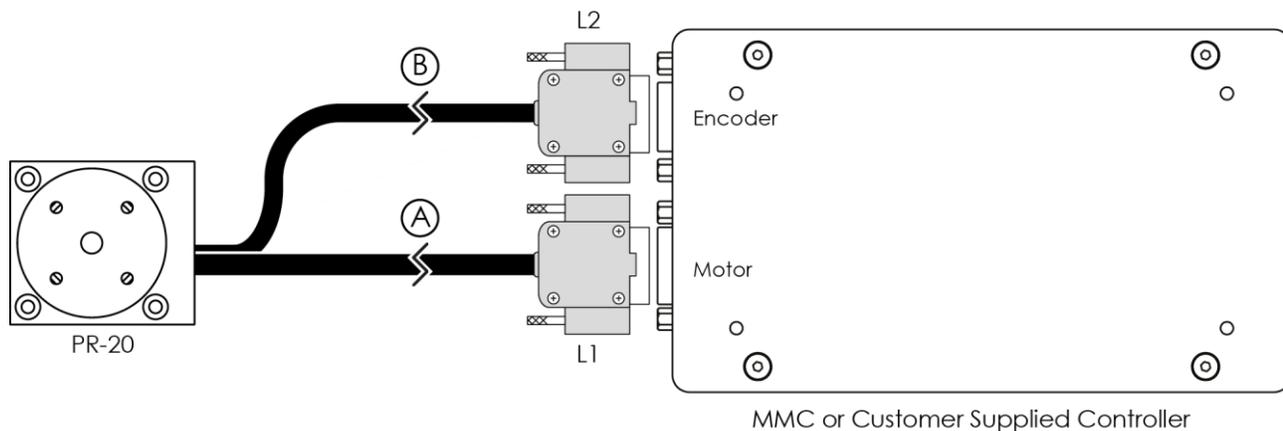
**6.1.2 Closed Loop (Encoder), Atmospheric Wiring Diagram**

Using the PR-20 stage with an encoder requires a closed loop compatible controller that recognizes the proper type of encoder feedback. Connect the stage as shown below. See Appendix A.2.2 for pinout information.

**6.1.2.1 Absolute Encoder, Atmospheric Wiring Diagram**

**Cable Descriptions:**

- A. Motor Cable (Male Dsub9 Pin to Male Dsub9 Pin, 1.5m PVC Black Cable)
- B. Encoder Cable (Female Dsub9 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 the stage 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 Dyiathilate D-Subminiature	DAP	T2 Female Crimps, Gold Pins (Accuglass P/N: 111652)	Nickle-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 <sup>-6</sup> mbar)	9 Pin Female DAP	15 Pin Female DAP
Ultra-High Vacuum (10 <sup>-9</sup> mbar)	9 Pin Female PEEK	15/25 Pin Female PEEK

Connecting an open loop PR-20 in a vacuum chamber requires the use of a feed-through connector at the vacuum chamber wall.

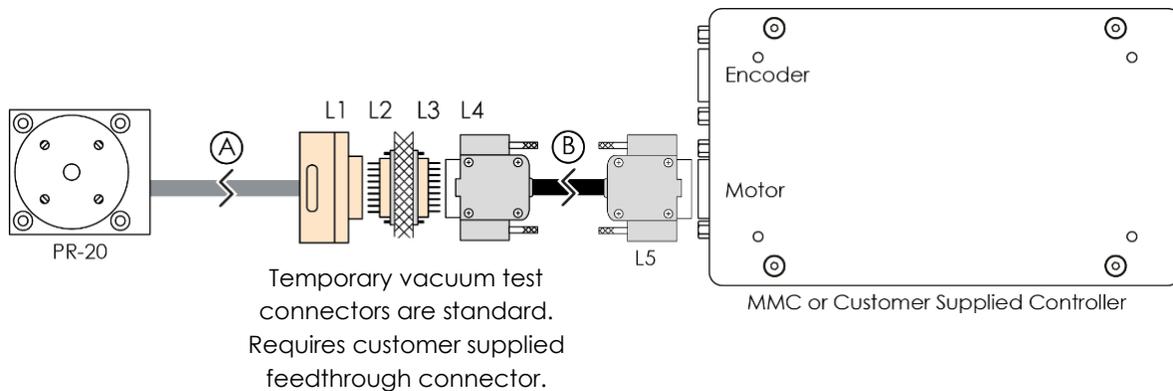
The vacuum compatible PR-20 will be supplied with wiring for a straight through feed-through not a cross over gender changer. MICRONIX USA supplies test connectors that simulate the vacuum feed-through to allow functionality testing prior to installation in a vacuum chamber, see Appendix A.2.5 for feedthrough pins.

### 6.2.2 Open loop, Vacuum Wiring Diagram

For details regarding the pin-out and feed-through specifications see the Appendix A.2.3.

#### Cable Descriptions:

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



**Figure 6-C. PR-20, Open Loop, 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.
- The PR-20 rotary stage is a precision mechanical device and should be handled with care.
- Follow the *Installation Preparation* requirements and use proper cable management to ensure a clean and safe operating environment.

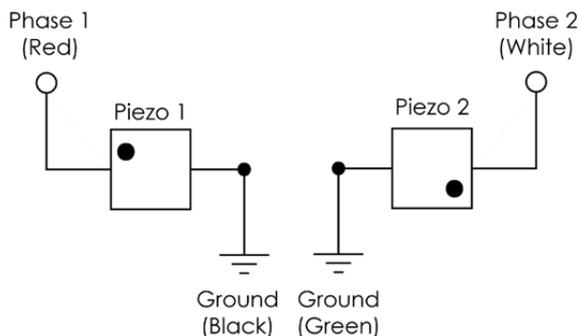
### 7.2 Units and Conversions

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 2-Phase Piezo Motor Wiring Diagram



#### A.1.1 Piezo Operating and Electrical Specifications

Voltage	60V maximum
Capacitance	150nf ±15%
Operating Temperature	50°C maximum

### A.2 D-subminiature Connector Nomenclature & Pinouts

**D E - 9 P**  
 1 2 3 4

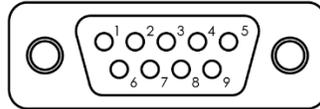
1. D : Calls out D Subminiature Connector
2. Shell Size E - A - B - C - D  
 Signal contacts  
 E : 9 (15)  
 A : 15 (26)  
 B : 25 (44)  
 C : 37 (62)  
 D : 50 (78)  
 (High Density Layout)
3. Contact Number
4. Contact Type  
 P - Pin (Male)  
 S - Socket (Female)

\*DB-9 is mistakenly refer as DE-9 since DB-9 is a size E Dsub Shell, not Size B

**A.2.1 Piezo Motor Atmospheric Open Loop Pinout**

See Figure 6-A.

Pinout for PR-20-11000		Cable A DE-9P
Description:	Color	L1
Phase 1	Red	1
Phase 2	White (Green TP)	2
Ground	Black/Green	5
Shield	-	Casing



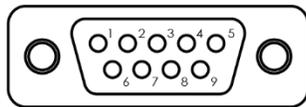
Male Dsub9 Connector (DE-9P) - Front View

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

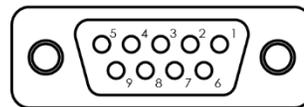
See Figure 6-B.

Pinout for PR-20-11500		Cable A DE-9P
Description:	Color	L1
Phase 1	Red	1
Phase 2	White (Green TP)	2
Ground	Black/Green	5
Shield	-	Casing

Pinout for PR-20-11500		Cable B DE-9S
Description:	Color	L2
SLO+ / DATA+	Blue	1
MA+ / CLK+	Brown	2
SI+	Violet	3
GND	Grey	4
+5V	White (Grey TP)	5
SLO- / DATA-	White (Blue TP)	6
MA- / CLK-	White (Brown TP)	7
SI-	White (Violet TP)	8
Shield	-	Casing



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

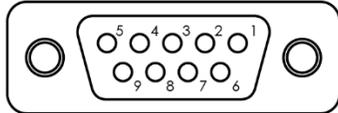


Female Dsub9 Connector (DE-9S) - Front View

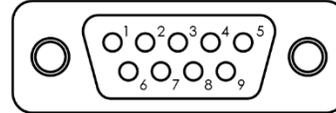
**A.2.3 Piezo Motor Vacuum Open Loop Pinout**

See Figure 6-C.

	Cable A			Feedthrough		Cable B	
	DE-9S	DE-9P	DE-9P	Color	DE-9S	DE-9P	
Pinout for PR-20-11006/11009	L1	L2	L3	Color	L4	L5	
<b>Description:</b>	<b>Color</b>	<b>L1</b>	<b>L2</b>	<b>L3</b>	<b>Color</b>	<b>L4</b>	<b>L5</b>
Motor Phase 1	Red	5	5	1	Red	1	1
Motor Phase 2	White (Green TP)	4	4	2	White (Green TP)	2	2
Motor Ground	Black/Green	1	1	5	Black/Green	5	5
Motor Shield	-	6	6	9	-	9	Casing



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

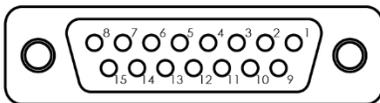


Male Dsub9 Connector (DE-9P) - Front View

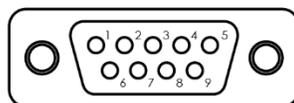
**A.2.4 Piezo Motor Vacuum Closed Loop Absolute Pinout**

See Figure 6-D.

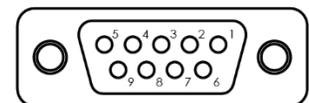
	Cable A/B		Feedthrough		Cable C		Cable D	
	DE-15S	DE-15P	DE-15P	DE-15S	DE-9P	DE-9S		
Pinout for PR-20-11506/11509	L1	L2	L3	Color	L4	L5	L6	
<b>Description:</b>	<b>Color</b>	<b>L1</b>	<b>L2</b>	<b>L3</b>	<b>Color</b>	<b>L4</b>	<b>L5</b>	<b>L6</b>
A&C Motor Phase 1	Red	1	1	8	Red	8	1	-
A&C Motor Phase 2	White (Green TP)	2	2	7	White (Green TP)	7	2	-
A&C Motor Ground	Black/Green	9	9	15	Black/Green	15	5	-
A&C Shield	-	10	10	14	-	14	Casing	-
B&D GND	Grey	8	8	1	Grey	1	-	4
B&D SLO+ / DATA+	Blue	7	7	2	Blue	2	-	1
B&D +5V	White (Grey TP)	6	6	3	White (Grey TP)	3	-	5
B&D SLO- / DATA-	White (Blue TP)	5	5	4	White (Blue TP)	4	-	6
B&D MA+ / CLK+	Brown	4	4	5	Brown	5	-	2
B&D MA- / CLK-	White (Brown TP)	12	12	12	White (Brown TP)	12	-	7
B&D SLI-	White (Violet TP)	13	13	11	White (Violet TP)	11	-	8
B&D SLI+	Violet	14	14	10	Violet	10	-	3
B&D Shield	-	15	15	9	-	9	-	Casing



Female Dsub15 Connector (DA-15S) - Front View



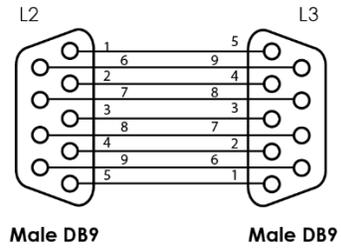
Male Dsub9 Connector (DE-9P) - Front View



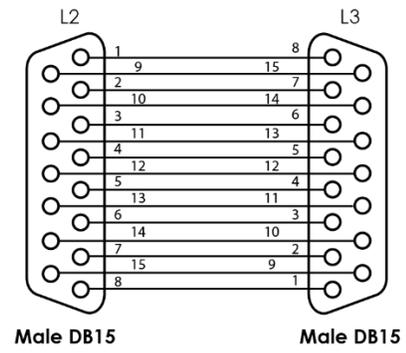
Female Dsub9 Connector (DE-9S) - Front View

A.2.5 Feedthroughs

**Straight Through 9-Pin Feed-through**

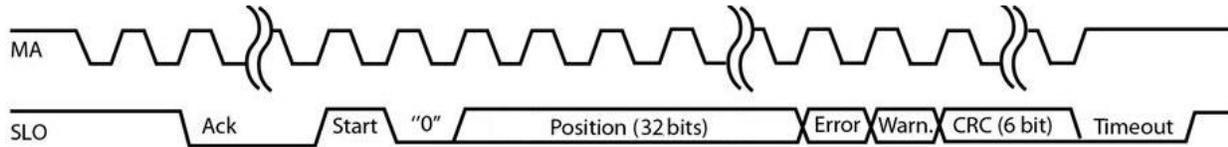


**Straight Through 15-Pin Feed-through**



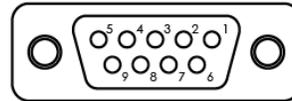
### A.3 Using an Absolute Encoder

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.



#### A.3.1 Absolute Encoder Pinout

Pin DE9S	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