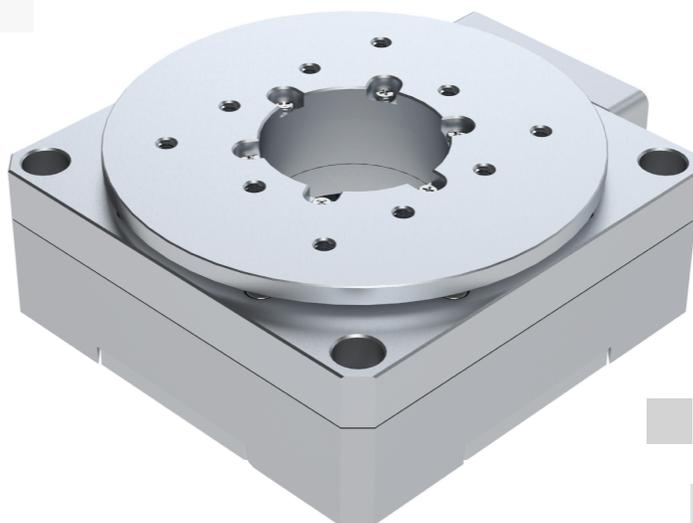


PR-70

Series



Precision Rotation Stage Reference Manual (Piezo and Torque Motor Versions)

PR-70

Precision Rotation Stage

Reference Manual

Rev 1.0

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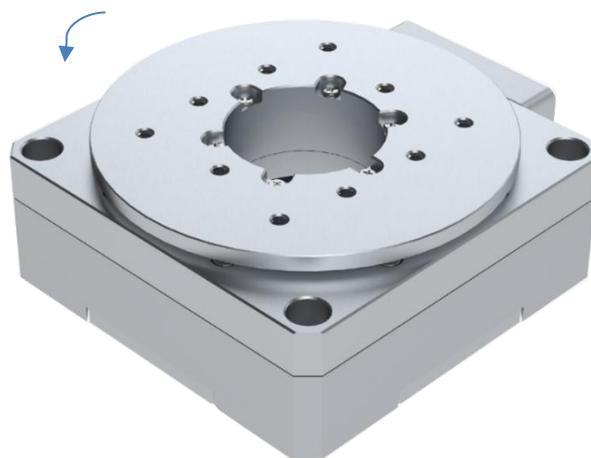
1. Introduction

1.1 Product Description

The PR-70 is a compact rotation stage with unlimited travel and a 1-inch aperture. Steel crossed roller bearings ensure smooth motion, high stability and continuous 360° travel.

Product Specifications	PR-70 Piezo Motor	PR-70 Torque Motor
Travel	360°, Limitless	
Max Speed	>15°/s	>720°/s
Open Loop Resolution	1 μ°	N/A
Digital Encoder Resolution	5 μ° (Prelim)	25 μ° (see section A.7.5)
Absolute Encoder Resolution	<50 μ°	<50 μ°
Max Load (Vertical)	3kg	

Direction of motion



1.2 Recommended Controllers

The following controllers are available from MICRONIX USA:

Controller	Piezo Motor	Torque Motor	Digital Encoder	Absolute Encoder
MMC-100	✓		✓	
MMC-110	✓		✓	✓
NanoDrive	✓	✓	✓	✓

1.3 Technical Data and Ordering Information

Detailed specifications and ordering information can be found on the PR-70 product page on the MICRONIX USA website.

2. Preparing to Install the PR-70 Stage

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 it as the performance and structural integrity are impacted. It is required to have a mounting surface with flatness less than the overall specified flatness on the product datasheet.

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.
- Mounting surface flatness is less than the flatness of the base as specified on the product sheet.
- 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 *Package Contents*

The package contains all necessary components for the PR-70 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 Should Contain:

- PR-70 Piezo Rotation Stage
- Reference Manual
- Any other previously agreed upon components such as a controller.

3. Installing the PR-70 Stage

3.1 PR-70 Installation

Follow these steps to securely mount the PR-70 Stage.

1. Secure the stage to the mounting surface using four M3 socket head cap screws at 0.5 Nm recommended torque.

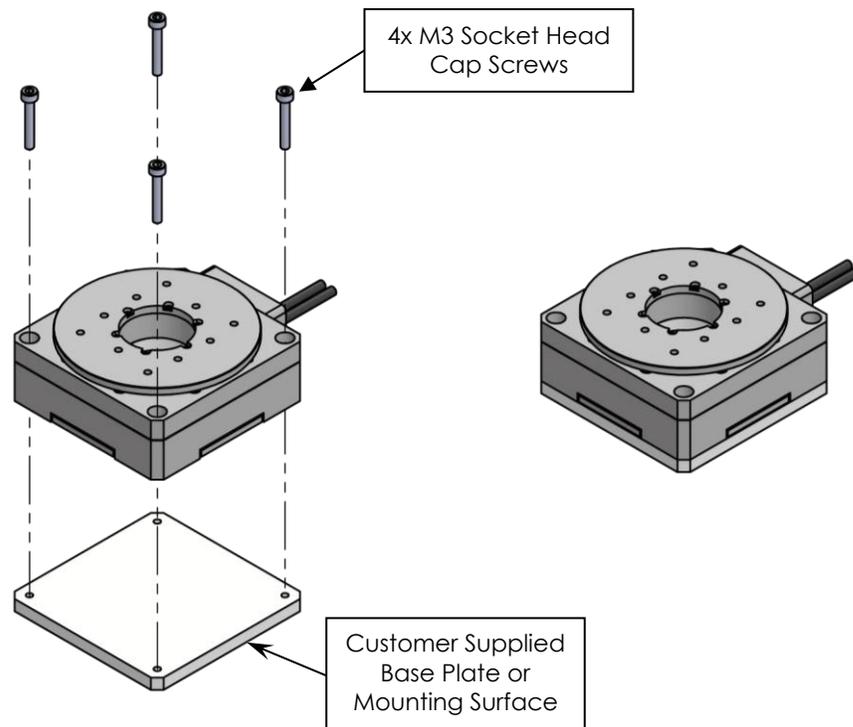
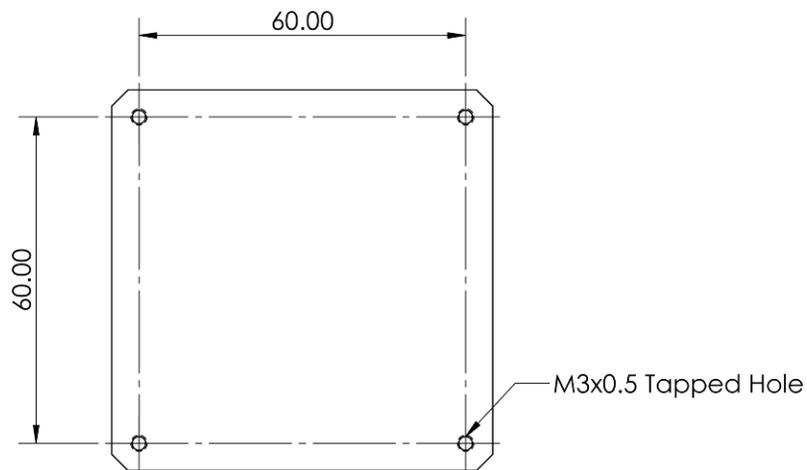


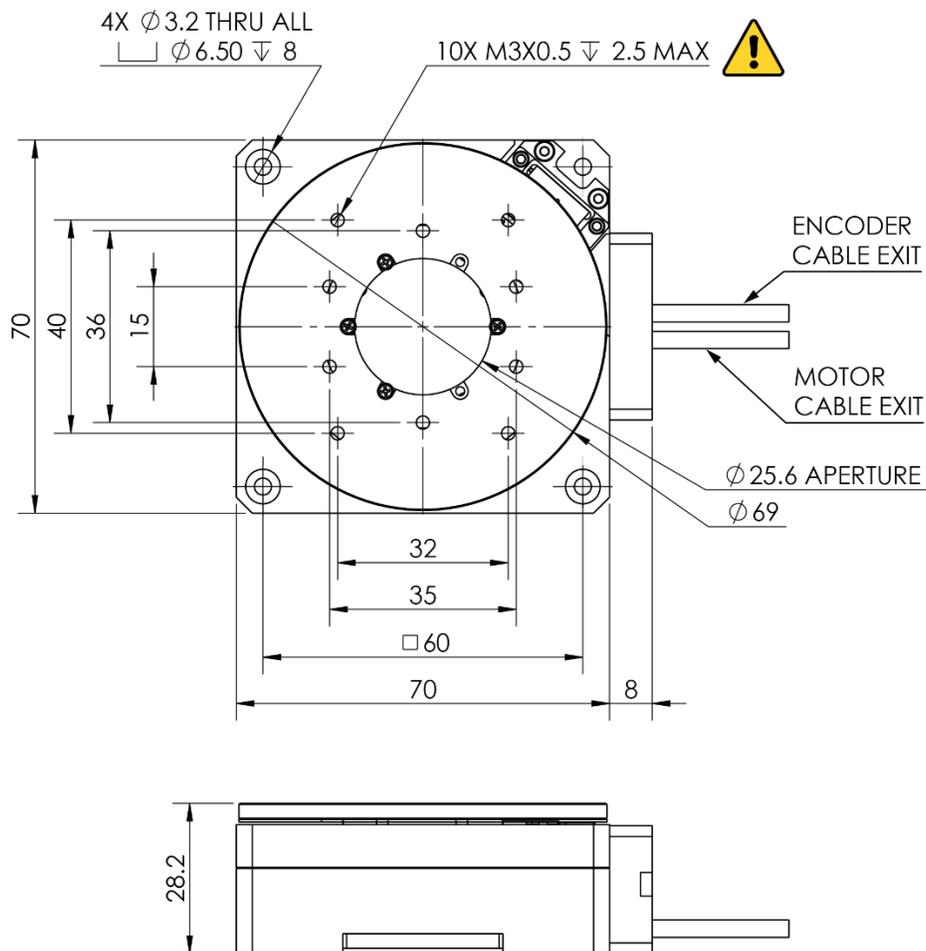
Figure 3-A. PR-70 General Mounting Installation

3.1.1 General Mounting Pattern



4. Dimensions

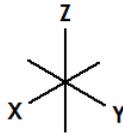
4.1 PR-70 Standard Dimensions



WARNING: Do not use screws with a thread depth exceeding 2.5mm into the carriage

5. Stacking Configurations (Examples)

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



5.1 PR-70 Interface with Other Micronix stages

The PR-70 can be mounted directly 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.

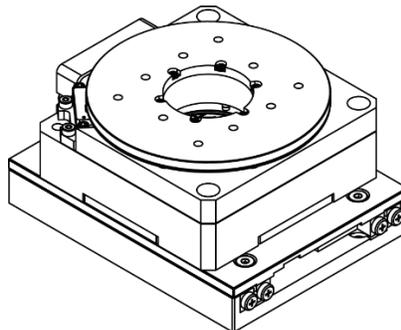
If an adapter is required, contact Micronix USA for assistance.

5.1.1 PR-70 + PPS-70, Rotation + Translation

The PR-70 can mount directly on PPS-70 for 360 deg + up to 100mm XY* travel.

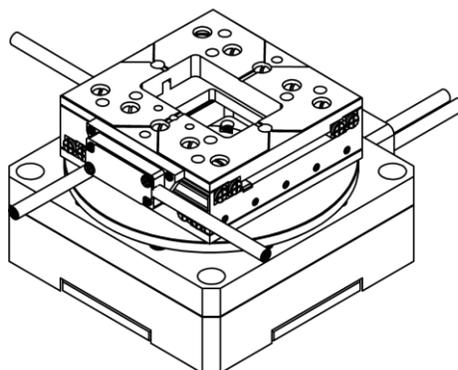
Note: To mount to PPS-70 32mm travel, 431898 adapter plate will be needed see accessories section 5.2 and PPS-70 Reference manual for details.

*See PPS-70 user manual for XY mounting details.



5.1.2 PR-70 + PPX-50, Rotation + XY Translation

The PPX-50 can mount directly on the PR-70 for 360 deg + low profile XY and 9.5x9.5mm center aperture.



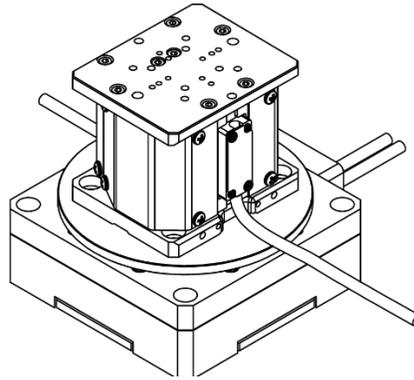
WARNING: Do not use screws with a thread depth exceeding 2.5mm into the carriage.



WARNING: Do not use screws with a thread depth exceeding 2.5mm into the carriage.

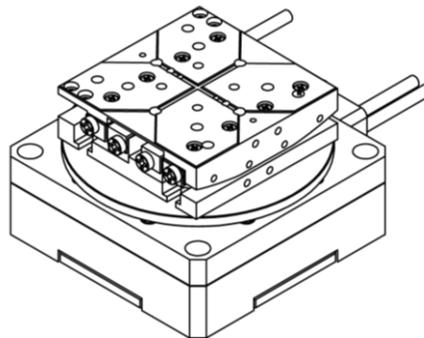
5.1.3 PR-70 + ES-50PM, Rotation + Elevation Stage

The ES-50PM can mount directly on the PR-70 for 360 deg + elevation of up to 10mm.

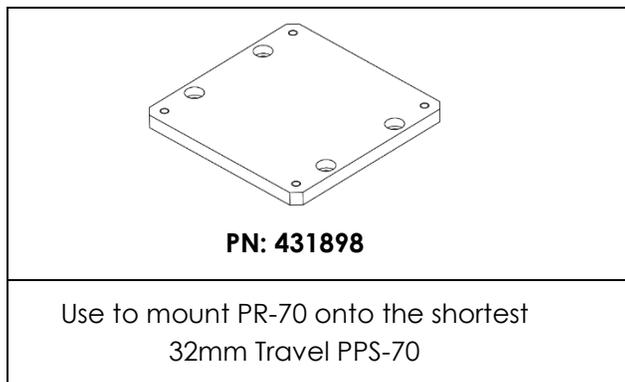


5.1.4 PR-70 + PG-50PM, Rotation + Gonio Stage

The PG-50PM can mount directly on the PR-70 for 360 deg + angular stage. See PG-50PM datasheet for additional radii available.



5.2 Accessories



6. Connecting the PR-70 Stage

6.1 Atmospheric Environments (MMC-Controller)

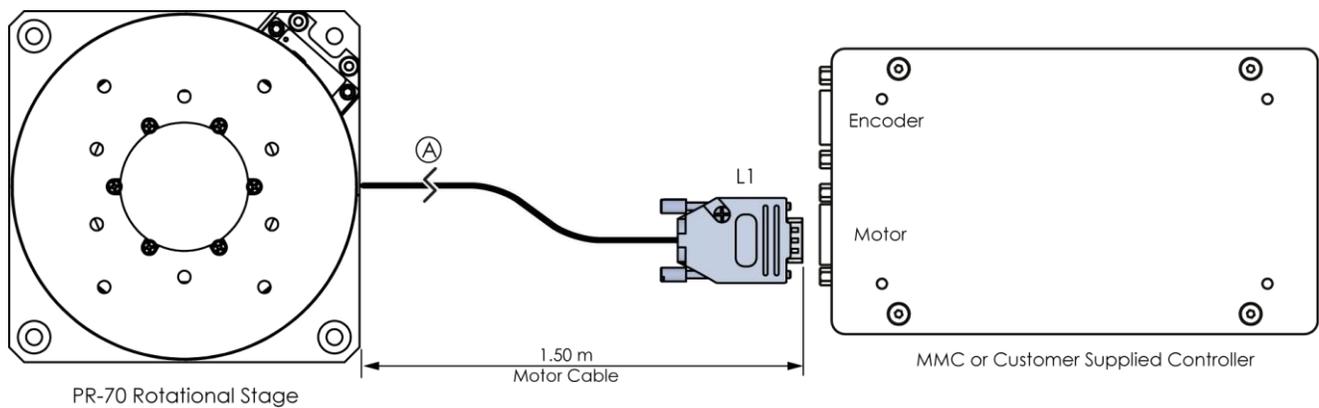
For controller information, refer to the appropriate MMC controller manual.
 Note: MMC controller is only compatible with PR-70 piezo motor version only.

6.1.1 Open Loop, Atmospheric Wiring Diagram

Connecting the PR-70 rotary stage 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. See Appendix section A.3.1 for pinout information.

Cable Descriptions:

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

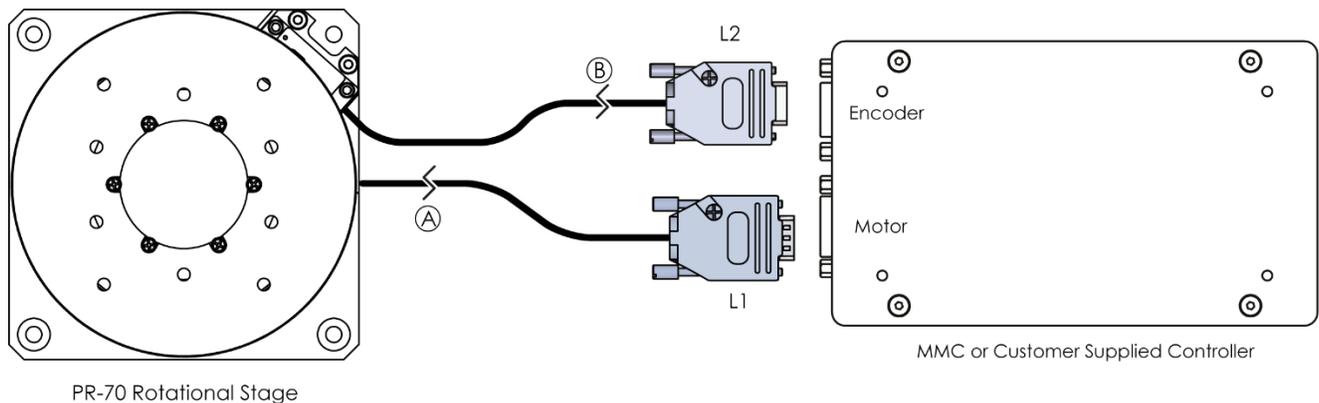


6.1.2 Closed Loop (Encoder), Atmospheric Wiring Diagram

Using the PR-70 stage with an encoder requires a closed loop controller that recognizes the proper type of encoder feedback. Connect the stage as shown below, see Appendix section A.3.2 , A.3.3 for digital and analog pinouts respectively.

Cable Descriptions:

- A. Motor Cable (Male Dsub9 Pin, 1.5m PVC Black Cable)
- B. Encoder Cable (Female Dsub9 Pin Module, 1.5m PVC Black Cable)



6.2 Atmospheric Environments (NanoDrive-Controller)

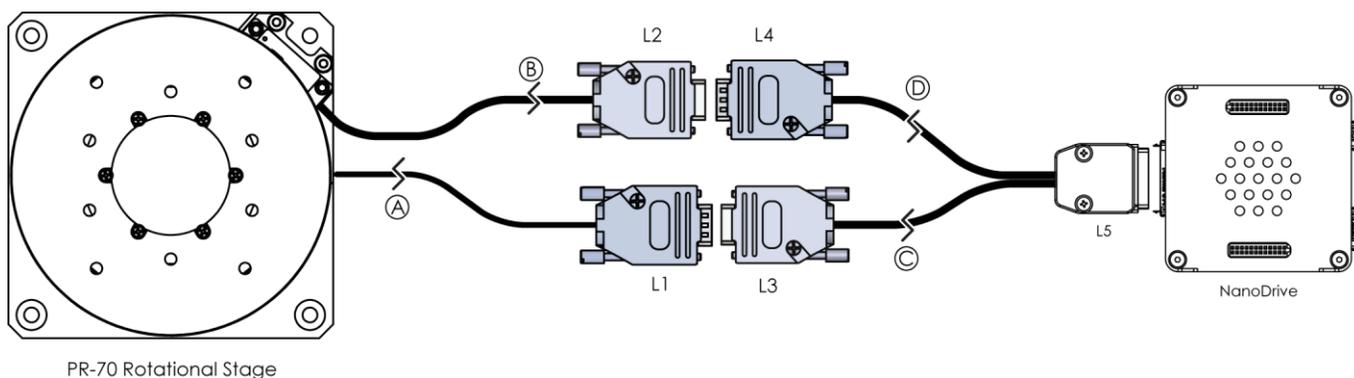
For controller information, refer to the appropriate NanoDrive controller manual. Refer to Appendix section A.4.1 for digital and A.4.2 for absolute encoder pin out details.

Note: The NanoDrive controller is compatible with both PR-70 piezo and torque motor versions. Contact MICRONIX USA for piezo version wiring details.

6.2.1 Closed Loop - Torque Motor, Atmospheric Wiring

Cable Descriptions:

- A. Motor Cable (Male Dsub9 Pin, 1.5m Sleeved Cable)
- B. Encoder Cable (Female Dsub9 Pin Module, 1.5m PVC Black Cable)
- C. Motor Adapter Cable (Female Dsub9 Pin to Female Harwin Gecko 26Pin, 1ft PVC Black Cable)
- D. Encoder Adapter Cable (Male Dsub9 Pin to Female Harwin Gecko 26Pin, 1ft PVC Black Cable)



6.3 Vacuum Environments (MMC-Controller)

6.3.1 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 Diallyl Phthalate 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^{-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 an open loop PR-70 in a vacuum chamber requires the use of a feed-through connector at the vacuum chamber wall.

The vacuum compatible PR-70 includes 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 Appendix A.6 for feedthrough pins.

For wiring diagram information please contact MICRONIX USA.

7. Supplementary Information

7.1 Maintenance and Handling

- The PR-70 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 personnel. If the stage is not performing up to the original specifications, please contact MICRONIX USA.
- The PR-70 rotary stage is a precision mechanical device and should be handled with care. Do not drop or mishandle the stage.
- Keep hands clear of all moving parts while the stage is in motion to avoid personal injury.
- 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.

7.2 Units and Conventions

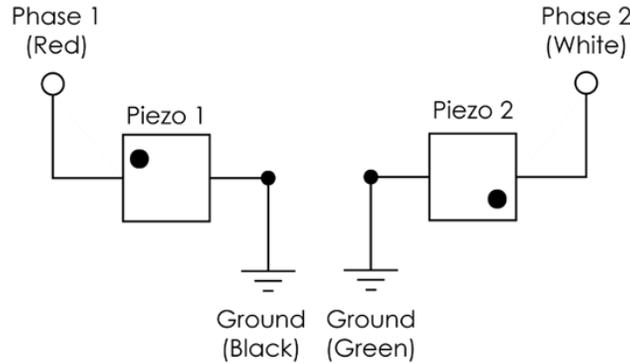
All measurements in this document are in the metric system of units.

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 Piezo Motor Electrical Specifications

A.1.1 2 Phase Piezo Motor Wiring Diagram

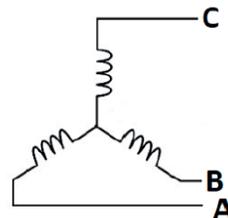


A.1.2 Piezo Motor Specifications

Voltage	60V maximum
Capacitance	150nf ±15%

A.2 Torque Motor Electrical Specifications

A.2.1 3 Phase Torque Motor Wiring Diagram



A.2.1 Torque Motor Specifications

Device Category	Direct Drive Rotary
Motor Type	Brushless DC
Winding Type	Wye, Ironless
Continuous Torque	20.4 oz-in
Continuous Current	3 A _{RMS} (Preliminary)
Peak Torque, M _z	34 oz-in
Peak Current	5 A _{RMS} (Preliminary)
Torque Constant (K _t)	6.90 (±10%) oz-in/A _{RMS}
Back EMF (K _e)	4.0 (±10%) V/KRPM
Resistance 25°C	1.4 (±10%) Ohms
Inductance	0.11 (± 30%) mH
Number of magnetic poles	20

A.3 Piezo Motor Wiring Pinouts

A.3.1 PR-70-11000/-51000 – Piezo, Open Loop, Atmospheric Pinout (MMC)

Pinout for PR-70-11000/-51000		Cable A Dsub9M
Description	Color	L1
Motor 1, Phase 1	Red	1
Motor 1, Phase 2	White (Green TP)	2
Motor 2*, Phase 1	White (Grey TP)	3
Motor 2*, Phase 2	White (Blue TP)	4
Motor 1, Ground	Black/Green	5
Motor 2*, Ground	Grey/Blue	5
Shield	-	Casing
PR-70-X1010, Open Loop with Limit Switch		
Home Switch (LSN)	White (Violet TP)	6
+5V	White (Grey)	8
GND	Grey	9

* Greyed out rows are for High Force Piezo option

A.3.2 PR-70-11300 – Piezo, Digital, Atmospheric Pinout (MMC)

Pinout for PR-70-11300/-51300		Cable A Dsub9M
Description	Color	L1
Motor 1, Phase 1	Red	1
Motor 1, Phase 2	White (Green TP)	2
Motor 2*, Phase 1	White (Grey TP)	3
Motor 2*, Phase 2	White (Blue TP)	4
Motor 1, Ground	Black/Green	5
Motor 2*, Ground	Grey/Blue	5
Shield	-	Casing

* Greyed out rows are for High Force Piezo option

Cable B Dsub9F		L2
Description	Color	L2
A +	Brown	1
B +	Blue	2
Index+	Violet	3
GND	Grey	4
+5V	White (Grey TP)	5
A -	White (Brown TP)	6
B -	White (Blue TP)	7
Index-	White (Violet TP)	8
Shield	-	Casing

A.3.3 PR-70-11500 – Piezo, Absolute, Atmospheric Pinout (MMC)

Pinout for PR-70-11500/-51500		Cable A Dsub9M
Description	Color	L1
Motor 1, Phase 1	Red	1
Motor 1, Phase 2	White (Green TP)	2
Motor 2*, Phase 1	White (Grey TP)	3
Motor 2*, Phase 2	White (Blue TP)	4
Motor 1, Ground	Black/Green	5
Motor 2*, Ground	Grey/Blue	5
Shield	-	Casing

* Greyed out rows are for High Force Piezo option

Cable B Dsub9F		L2
Description	Color	L2
SLO + / DATA +	Blue	1
MA + / CLK +	Brown	2
SLI +	Violet	3
GND	Grey	4
5V _{DC}	White (Grey TP)	5
SLO - / DATA -	White (Blue TP)	6
MA - / CLK -	White (Brown TP)	7
SLI -	White (Violet TP)	8
Shield	-	Casing

A.4 Torque Motor Wiring Pinouts

A.4.1 PR-70-31300 – Torque Motor, Digital, Atmospheric Pinout (NanoDrive)

Pinout for PR-70-31300 Cable A Cable B Cable C Cable D 26Pin
 Dsub9M Dsub9F Dsub9F Dsub9M HWG F

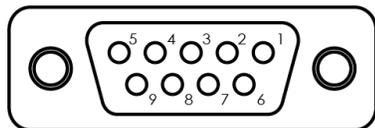
	Description	Color	Cables				Color	L5
			L1	L2	L3	L4		
Motor A & C	Motor Phase A	Black	1	-	1	-	Red	12/13
	Motor Phase B	Red	2	-	2	-	Green (White TP)	25/26
	Motor Phase C	White	5	-	5	-	White (Grey TP)	10/11
	Shield		Casing	-	Casing	-	-	Casing
Encoder B & D	A+	Brown	-	1	-	1	Brown	6
	B+	Blue	-	2	-	2	Blue	5
	Index+	Violet	-	3	-	3	Violet	4
	GND	Grey	-	4	-	4	Grey	20
	+5V	White (Grey TP)	-	5	-	5	White (Grey TP)	7
	A-	White (Brown TP)	-	6	-	6	White (Brown TP)	19
	B-	White (Blue TP)	-	7	-	7	White (Blue TP)	18
	Index-	White (Violet TP)	-	8	-	8	White (Violet TP)	17
	Shield	-	-	Casing	-	Casing	-	Casing

A.4.2 PR-70-31500 – Torque Motor, Absolute, Atmospheric Pinout (NanoDrive)

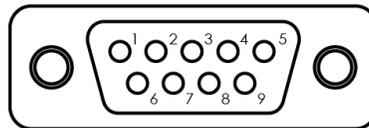
Pinout for PR-70-31500 Cable A Cable B Cable C Cable D 26Pin
 Dsub9M Dsub9F Dsub9F Dsub9M HWG F

	Description	Color	Cables				Color	L5
			L1	L2	L3	L4		
Motor A & C	Motor Phase A	Black	1	-	1	-	Red	12/13
	Motor Phase B	Red	2	-	2	-	Green (White TP)	25/26
	Motor Phase C	White	5	-	5	-	White (Grey TP)	10/11
	Shield		Casing	-	Casing	-	-	Casing
Encoder B & D	SLO + / DATA +	Brown	-	1	-	1	Brown	
	MA + / CLK +	Blue	-	2	-	2	Blue	
	SLI +	Violet	-	3	-	3	Violet	
	GND	Grey	-	4	-	4	Grey	
	5V _{DC}	White (Grey TP)	-	5	-	5	White (Grey TP)	
	SLO - / DATA -	White (Brown TP)	-	6	-	6	White (Brown TP)	
	MA - / CLK -	White (Blue TP)	-	7	-	7	White (Blue TP)	
	SLI -	White (Violet TP)	-	8	-	8	White (Violet TP)	
	Shield	-	-	Casing	-	Casing	-	Casing

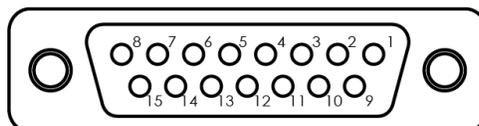
A.5 Standard Dsub Connector Pinout



Dsub9F - Front View
9 Pin Female Connector



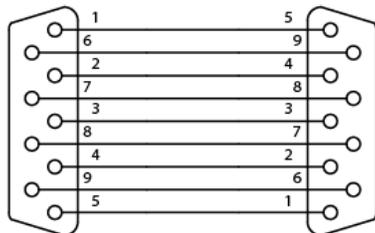
Dsub9M - Front View
9 Pin Male Connector



Dsub15F - Front View
15 Pin Female Connector

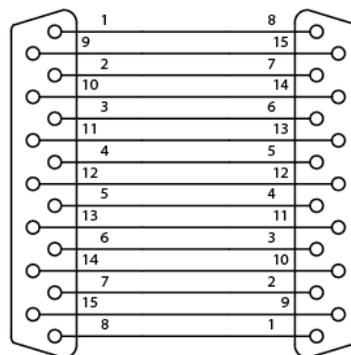
A.6 Vacuum Feedthrough Pinout

Recommended feedthrough pinout based on off the shelf feedthroughs.



Male DB9

Male DB9



Male DB15

Male DB15

A.7 Using the Digital Encoder

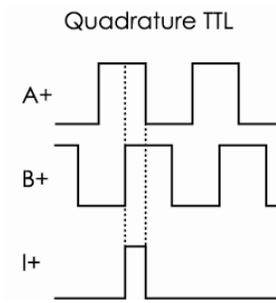
A.7.1 Encoder Overview

The PR-70 with Digital Encoder must be paired with an appropriate controller. The PR-70 with a digital encoder will be supplied with a 9-pin connector that incorporates these encoder signals.

A.7.2 Operating and Electrical Specifications

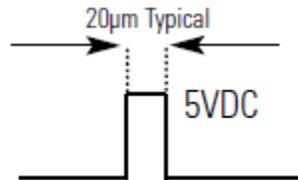
Power Supply	5VDC \pm 10% @ < 35mA (No outputs terminated) @ < 85mA (A, B, I, and both limits terminated); 50mA at the sensor
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A.7.3 Output Signals



***Note:** The index pulse may be aligned with A- or B- at some interpolation values.

A.7.4 Index Window



A.7.5 Resolution

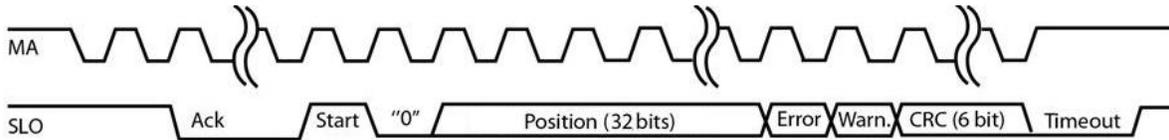
For piezo motor, digital encoder resolution of 5µ° is achievable (preliminary). Refer to the speed vs resolution table for torque motor versions. Resolution is a factory pre-set value.

Speed vs Resolution	
Max Speed (°/s)	Digital Encoder Res. (µ°)
1170	50
750	25 (Standard)
600	20
300	10
150	5

A.8 Using an Absolute Encoder

A.8.1 Encoder Overview

The Micronix 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.

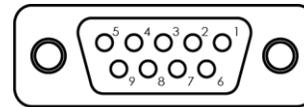


A.8.2 Operating and Electrical Specifications

Power Supply	5VDC ±10% (< 30mA for sensor)
--------------	-------------------------------

A.8.2.1 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



Dsub9F - Front View
9 Pin Female Connector

A.8.3 Absolute Encoder Setup

Absolute Encoder BiSS-C	
Absolute Resolution	32 Bits
Encoder BiSS Frequency	5 MHz
Encoder BiSS CRC Polynomial	0
Position Integer Type	Unsigned
Number of Status Bits	0
Error Bits Mask	0
CRC Error Suppression	None
Data Alignment	Left Justified

A.8.1 Resolution

Absolute encoder with an MMC or NanoDrive controller has an achievable resolution of <50 μ°.