

PPX-50

Series



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

PPX-50

Piezo Positioner Stage

Reference Manual

Rev 3.02

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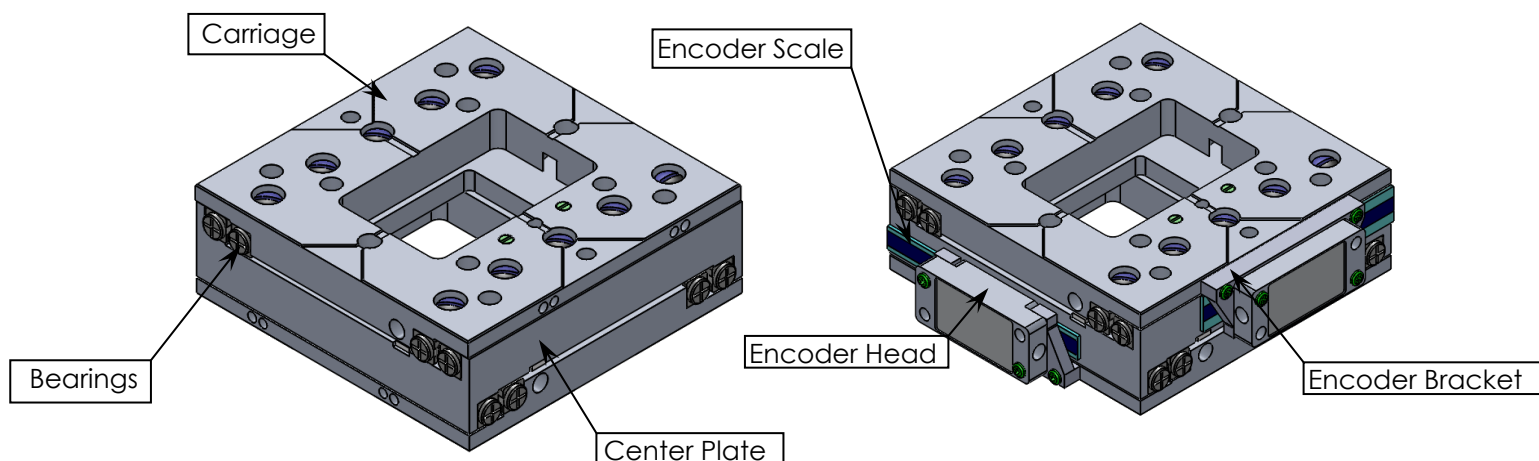
1. Introduction

1.1 Product Description

The PPX-50 is a low profile, long travel, integrated XY-stage designed for space saving applications where nano positioning is required. Cross roller bearings guarantee smooth and stable motion for loads up to 30 N. It utilizes a multi-phase piezo motor resulting in high speed (> 10 mm/s) and high blocking force (> 2 N). Optional linear encoders provide nanometer repeatability. The PPX-50 can also be combined with the PR-50 rotation stage and PG-50 gonio stage without the use of an adapter plate.

Features:

- Travel ranges of 28 mm x 28 mm
- Load capacity up to 3 kg
- Closed loop resolution of 2 nm
- Low Profile, 17.5 mm stage height



PPX-50 Open Loop

(Shown in center position)

PPX-50 Closed Loop

(Shown in center position)

1.2 Recommended Controllers

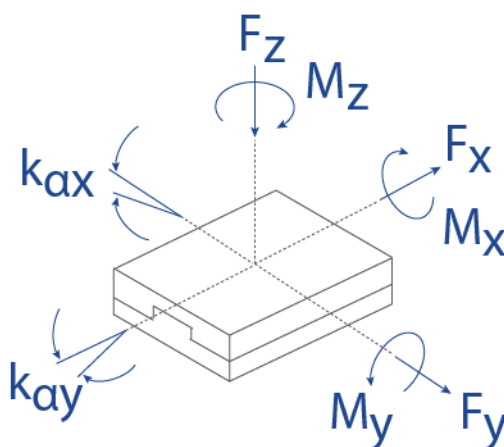
The following controllers are available from MICRONIX USA:

- MMC-100
- MMC-110

1.3 Technical Data

Motor	PM-002
Speed Max. (mm/sec)	2 (MMC-100), 10 (MMC-110)
Resolution Typical (nm)	1 (open loop), 10 (Analog), 2 (Digital)
Bi-directional Repeatability (nm)	N/A (open loop), ± 50 (Analog), ± 50 (Digital)
Uni-directional Repeatability (nm)	N/A (open loop), 50 (Analog), 50 (Digital)

1.4 Load Characteristics



Load Characteristics	$F_{x(N)}$	$F_{y(N)}$	$F_{z(N)}$	$M_{x(Nm)}$	$M_{y(Nm)}$	$M_{z(Nm)}$	k_{ax} [$\mu\text{rad/Nm}$]	k_{ay} [$\mu\text{rad/Nm}$]
PM-002	2	2	30	0.6	0.6	0.6	-	-

2. Model configurations

2.1 PPX-50 Order Numbers

Order No.	PPX-50-	1	1		0	
Piezo Motor, PM-002.....	1					
28x28 mm.....	1					
None.....	0					
Analog (1V _{pp}).....	2					
Digital (RS-422).....	3					
None.....	0					
Atmospheric.....	0					
High Vacuum, 10 ⁻⁶ mbar.....	6					
Ultra-High Vacuum, 10 ⁻⁹ mbar.....	9					

Contact MICRONIX USA for custom version and stacking configurations.

3. Preparing to Install the PPX-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 mounting 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. Be sure to use the stage under the following conditions:

- Mount to a clean and flat surface which is free of debris, burrs or dings
- An indoor atmosphere free of corrosive gasses, 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:

- PPX-50 Linear Stage
- Reference Manual
- Any other previously agreed upon components such as a controller

4. Installing the PPX-50

All mounting patterns require M3 screws for mounting. Additional brackets and screws may be needed for custom applications.

4.1 Mounting to the PPX-50 top plate

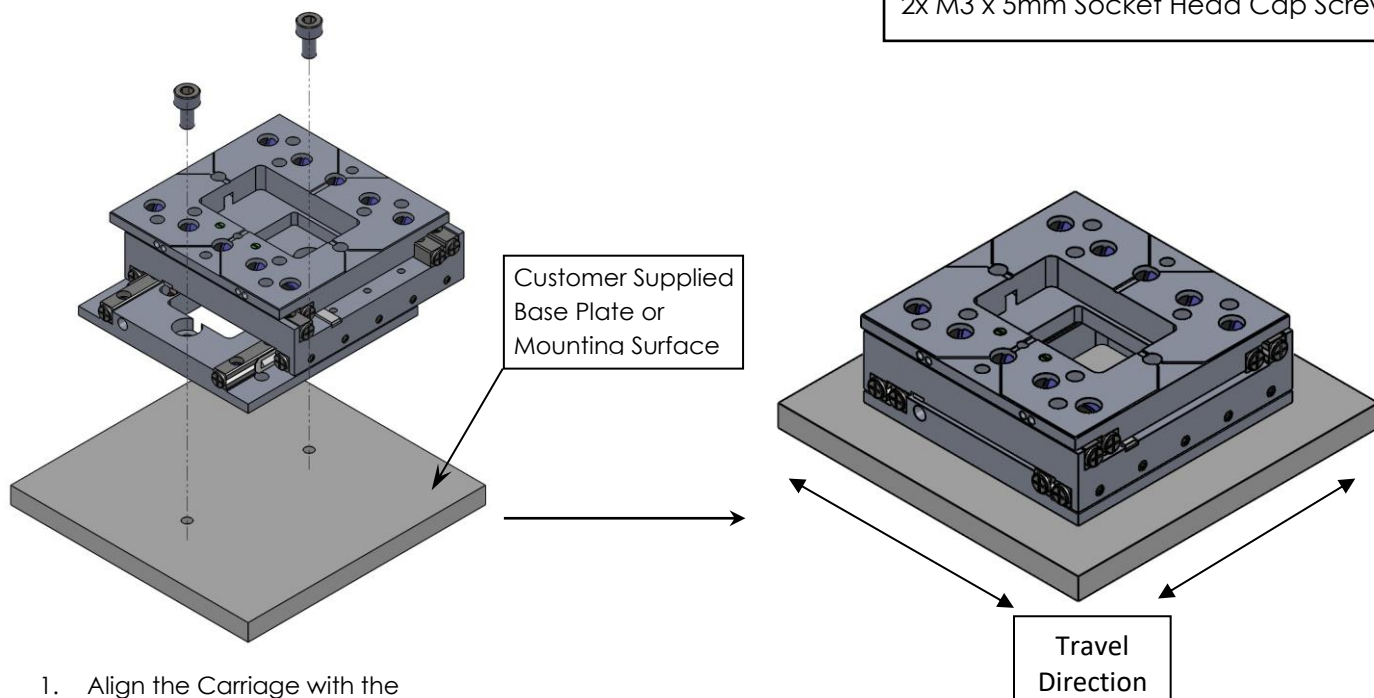
When mounting to the top of the carriage of the PPX-50 it is important to not exceed a screw thread depth of 2.3 mm.

4.2 PPX-50 Installation

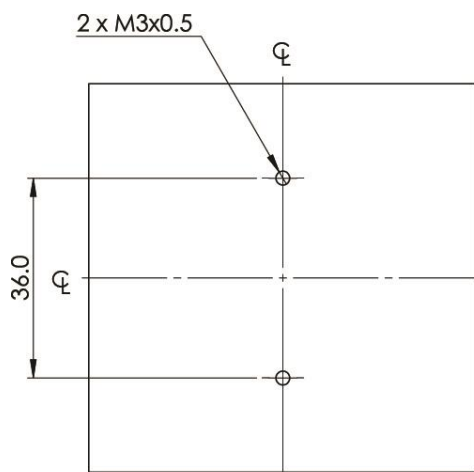
4.2.1 General Mounting

For general mounting configurations, mount the base to the mounting surface. Align carriage with clearance holes to access base mounting pattern.

Requires:
2x M3 x 5mm Socket Head Cap Screws



1. Align the Carriage with the Base Clearance Hole. Install M3 Socket Head Cap Screws.



Base Mounting Plate

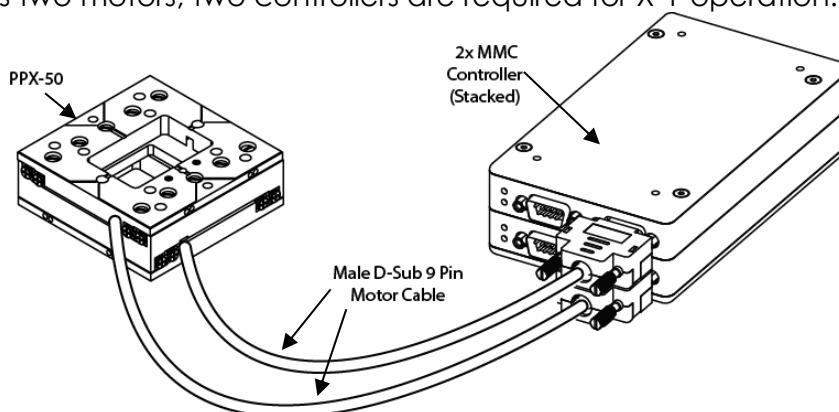
5. Connecting the PPX-50

5.1 Atmospheric Environments

For controller information refer to the appropriate MMC controller manual.

5.1.1 Open Loop Installation & wiring Diagram

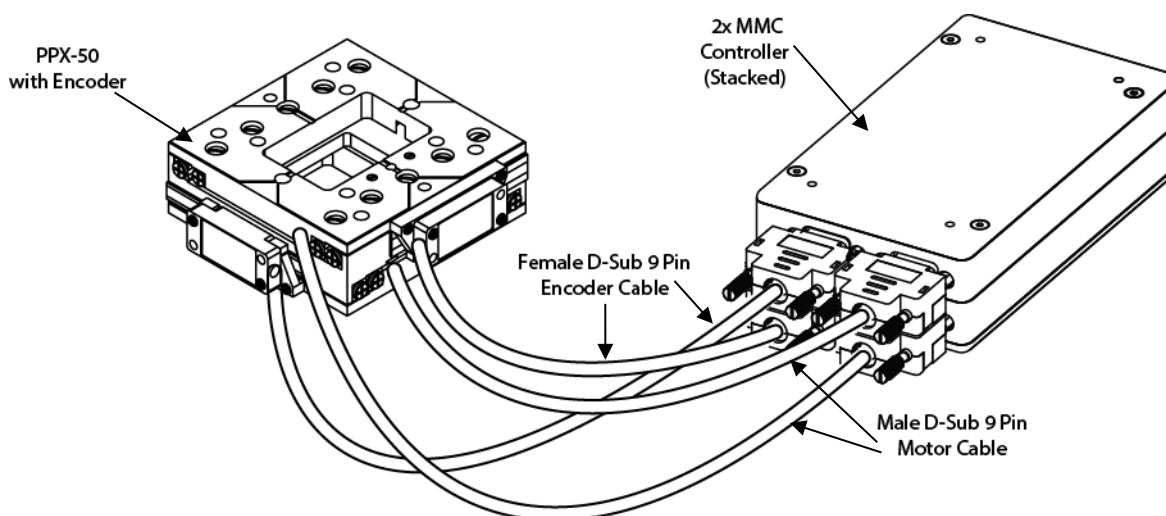
Connecting the PPX-50 in an open loop only requires that the D-sub 9 Pin Motor Cable be connected to a compatible controller (MMC-100 or MMC-110). Since the PPX-50 has two motors, two controllers are required for X-Y operation.



For all setups, the MMC-100 controllers may be stacked (as shown above) or connected separately (as shown below), depending on the application.

5.1.2 Closed Loop / Encoder Installation & Wiring Diagram

Using the PPX-50 stage with an encoder requires a closed loop compatible controller (MMC-100 or MMC-110) that recognizes encoder feedback. Connect the stage as shown below.



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 supplies the stage with vacuum compatible connectors: a 9-pin female PEEK connector for open loop, 15-Pin female PEEK connector for closed loop

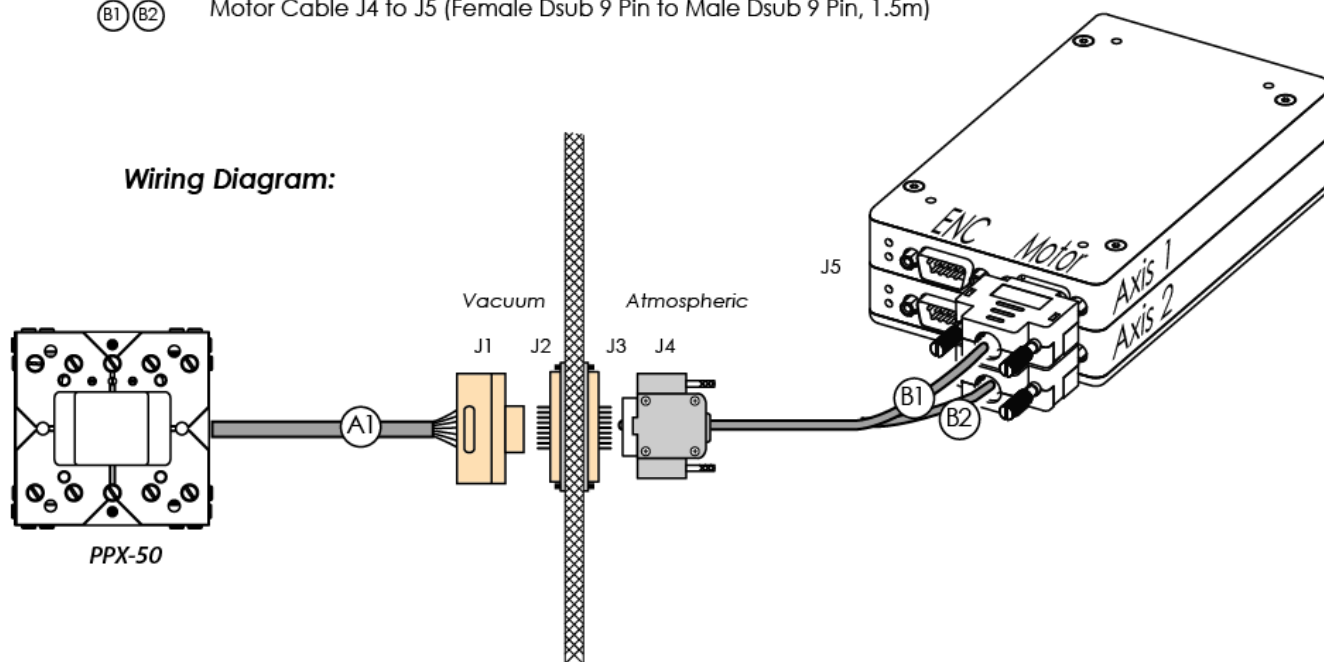
5.2.2 Open loop Installation & Wiring Diagram

Connecting an open loop PPX-50 in a vacuum chamber requires the use of a feedthrough connector at the vacuum chamber wall. The vacuum compatible PPX-50 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. For details regarding the pin-out and feedthrough specifications see the Appendix A.3.

Standard Cable Descriptions:

- (A1) PPX-50 Motor to J1 (Female PEEK Dsub 9 pin, 1.5m)
- (B1) (B2) Motor Cable J4 to J5 (Female Dsub 9 Pin to Male Dsub 9 Pin, 1.5m)

Wiring Diagram:



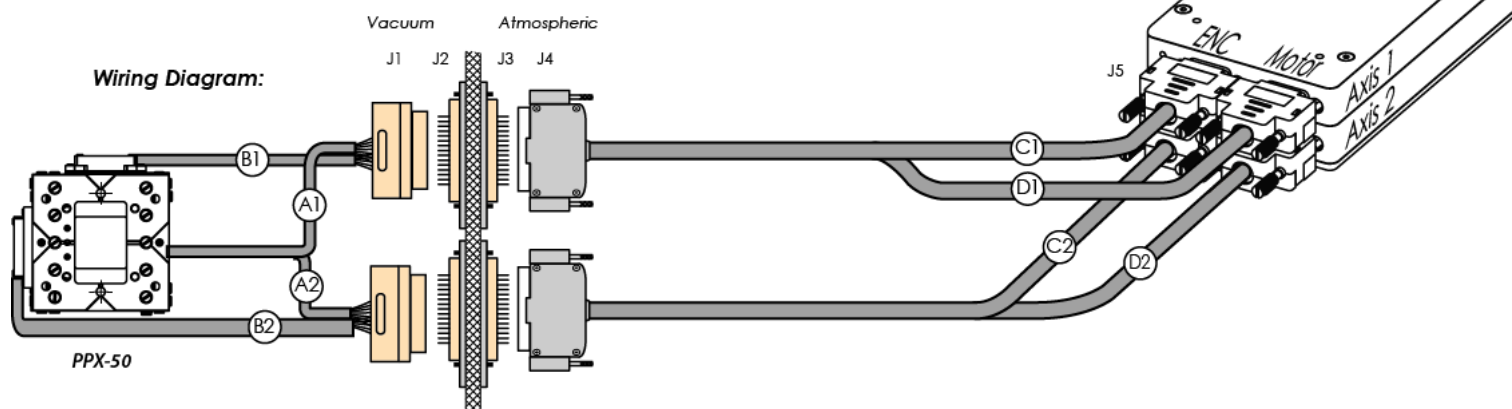
5.2.3 Closed Loop / Encoder Installation & Wiring Diagram

Closed loop installation of the PPX-50 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 PPX-50 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. For details regarding the pin-out and feed through specifications see the Appendix A.4.5.

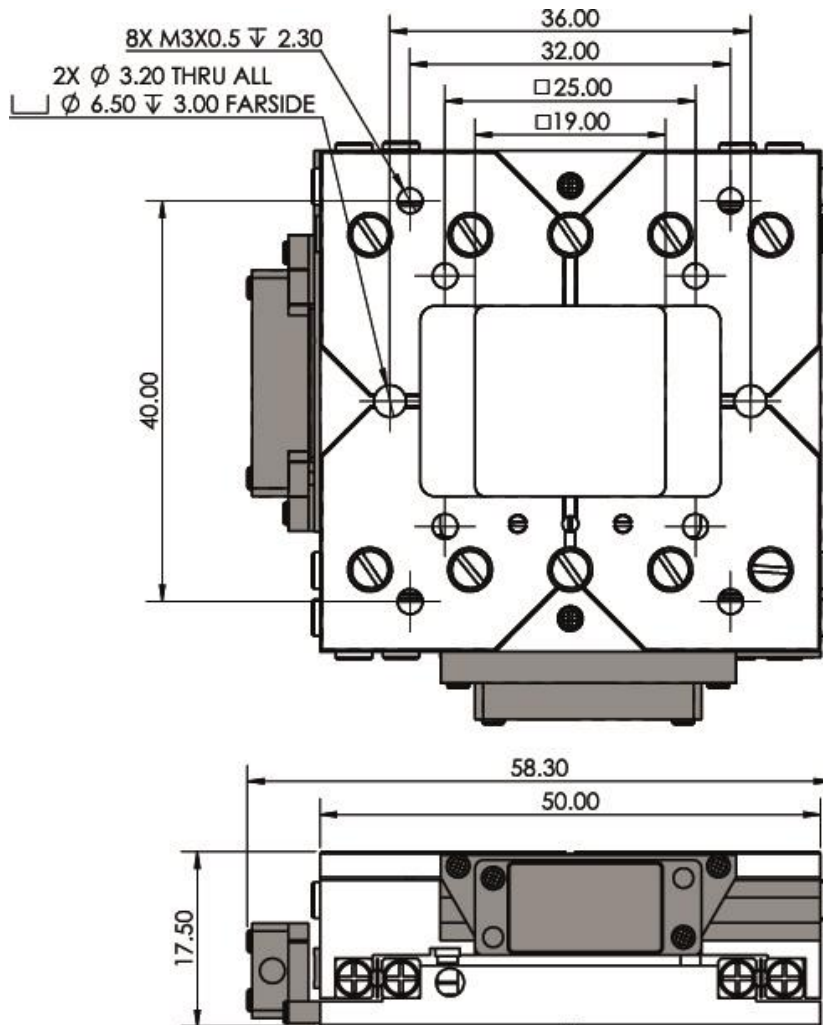
Standard Cable Descriptions:

- (A1) (A2) PPX-50 Motor to J1 (Female PEEK Dsub 15pin, 1.5m)
- (B1) (B2) PPX-50 Encoder to J1 (Female PEEK Dsub 15pin, 1.5m)
- (C1) (C2) Encoder Cable J4 to J5 (Female Dsub 15 Pin to Female Dsub 9 Pin, 1.5m)
- (D1) (D2) Motor Cable J4 to J5 (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m)

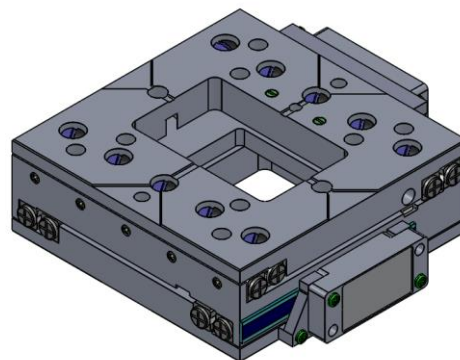


6. Technical Specifications

6.1 Dimensions

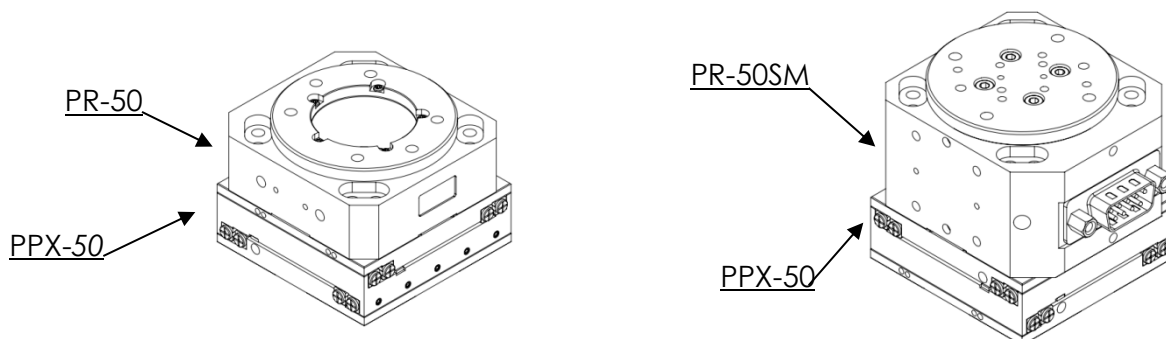


*Grey components are for the closed loop version only



7. Stacking Configuration

7.1 Configuration Examples *(Additional configurations available upon request)*



8. Supplementary Information

8.1 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.

8.2 Maintenance

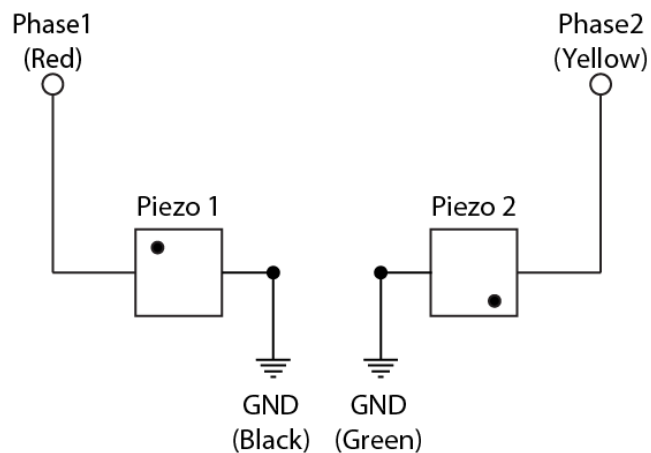
- The PPX-50 series of linear X-Y stages utilizes a maintenance free design. Do not modify the stage or perform any maintenance unless specifically instructed to do so by MICRONIX USA personal. If the stage is not performing up to the original specifications, please contact MICRONIX USA.
- The PPX-50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

A. Appendix

A.1 DB-9 Male Motor Connector

Pin	Description	Color
1	Phase 1	Red or Blue
2	Phase 2	Yellow or Orange
3	N/C	N/C
4	N/C	N/C
5	Ground	Black & Green or Brown & Violet
6	N/C	N/C
7	N/C	N/C
8	N/C	N/C
9	SHIELD	N/C

A.2 2-Phase Piezo Motor Wiring Diagram



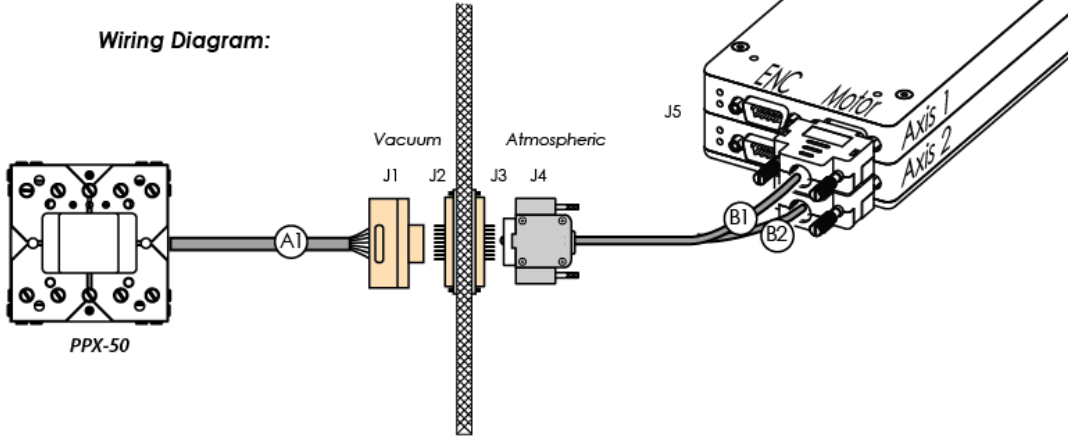
A.3 Open Loop Vacuum Wiring Diagram

A.3.1 Db9 Straight Through Feed Through

Standard Cable Descriptions:

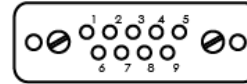
- (A1) PPX-50 Motor to J1 (Female PEEK Dsub 9 pin, 1.5m)
- (B1) (B2) Motor Cable J4 to J5 (Female Dsub 9 Pin to Male Dsub 9 Pin, 1.5m)

Wiring Diagram:

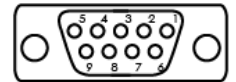


Pinout for Axis 1&2 Cables A1, B1, B2

Description:	Color	J1	J2	J3	J4	J5
X-Phase 1	Red	1	1	5	5 (Red)	1
X-Phase 2	Yellow	2	2	4	4 (White - Green TP)	2
X-Ground	Black/Green	6	6	9	9 (Black & Green)	5
Shield	-	7	7	8	8 (Shield)	Casing
Y-Phase 1	Blue	5	5	1	1 (Blue)	1
Y-Phase 2	Orange	4	4	2	2 (Violet)	2
Y-Ground	Violet/Brown	9	9	6	6 (White - Blue&Viol. TP)	5
Shield	-	8	8	7	7 (Shield)	Casing



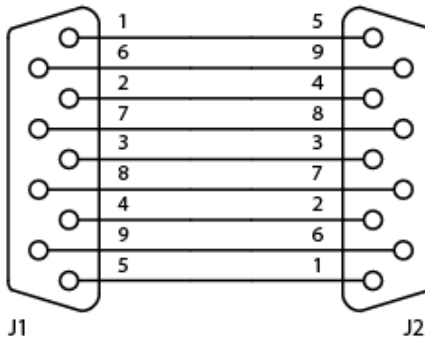
Female Dsub9 Connector - Rear View



Male Dsub9 Connector - Rear View

Male DB9

Male DB9



A.4 Using an Analog encoder

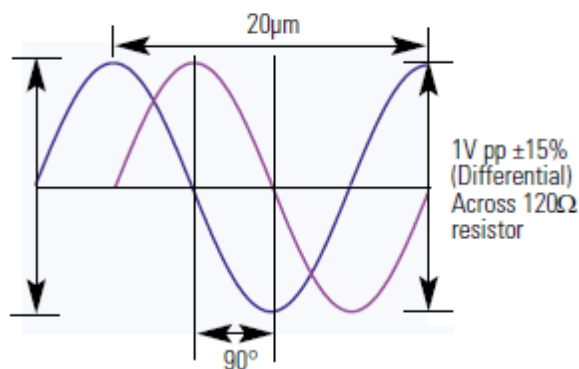
A.4.1 Encoder Pin-out

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

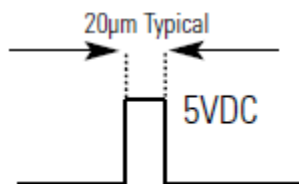
A.4.2 Operating and Electrical Specifications

Power Supply	5VDC \pm 5% @ 330mA (60mA for sensor)
Operating Temperature	0 to 70°C
Humidity	10 - 90% RH non-condensing

A.4.3 Analog Output (Pins 1,2,6, and 7)



A.4.4 Index Window (Pin 3)



A.4.5 Resolution

Interpolation done in controller to a higher resolution as specified in the sales order. With an analog encoder the MMC-100 has an achievable Resolution down to 10nm.

A.4.6 Closed Loop Vacuum Wiring Diagram (Analog)

Pinout for Axis 1 Cables A1, B1, C1, D1

Description:	Color	J1	J2	J3	J4	J5	
A1 & D1	Phase 1	Red	1	1	8	8 (Red)	1
	Phase 2	Yellow	2	2	7	7 (White - Green TP)	2
	Ground	Black/Green	9	9	15	15 (Black & Green)	5
	Shield	-	10	10	14	14 (Shield)	Casing
B1 & C1	GND	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-Brown TP)	6
	Sin+	Yellow	4	4	5	5 (Yellow)	2
	Sin-	Green	12	12	12	12 (White - Yellow TP)	7
	Index-	Blue	13	13	11	11 (White - Violet TP)	8
	Index+	Violet	14	14	10	10 (Violet)	3
	Shield	-	15	15	9	9 (Shield)	Casing

Pinout for Axis 2 Cables A2, B2, C2, D2

Description:	Vac Color	J1	J2	J3	J4	J5	
A2 & D2	Phase 1	Red	1	1	8	8 (Red)	1
	Phase 2	Yellow	2	2	7	7 (White - Green TP)	2
	Ground	Black/Green	9	9	15	15 (Black&Green)	5
	Shield	-	10	10	14	14 (Shield)	Casing
B2 & C2	GND	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 - Brown TP)	6
	Sin+	Yellow	4	4	5	5 (Yellow)	2
	Sin-	Green	12	12	12	12 (White - Yellow TP)	7
	Index-	Blue	13	13	11	11 (White - Violet TP)	8
	Index+	Violet	14	14	10	10 (Violet)	3
	Shield	-	15	15	9	9 (Shield)	Casing

Standard Cable Descriptions:

- (A1) (A2) PPX-50 Motor to J1 (Female PEEK Dsub 15pin, 1.5m)
- (B1) (B2) PPX-50 Encoder to J1 (Female PEEK Dsub 15pin, 1.5m)
- (C1) (C2) Encoder Cable J4 to J5 (Female Dsub 15 Pin to Female Dsub 9 Pin, 1.5m)
- (D1) (D2) Motor Cable J4 to J5 (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m)

Wiring Diagram:

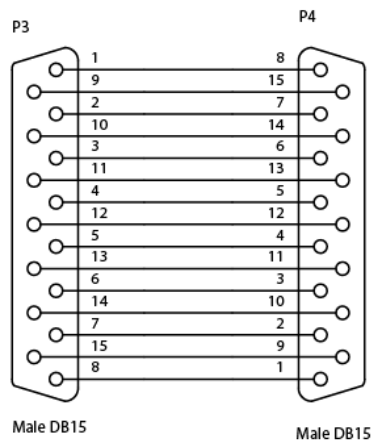
The diagram shows the PPX-50 motor and encoder connected to vacuum (J1, J2) and atmospheric (J3, J4) feedthroughs. The motor and encoder cables are labeled A1, B1, A2, and B2. The encoder and motor cables are connected to the atmospheric feedthroughs J3 and J4. The atmospheric feedthroughs are connected to the MMC-100 controller via cables C1, D1, C2, and D2. The controller has a 15-pin connector J5. The controller is shown in a perspective view with labels for ENC, Motor, and Axis 1/2. Below the controller is a rear view of the Female PEEK Dsub15 Connector with pins numbered 1-15.

Female PEEK Dsub15 Connector - Rear View

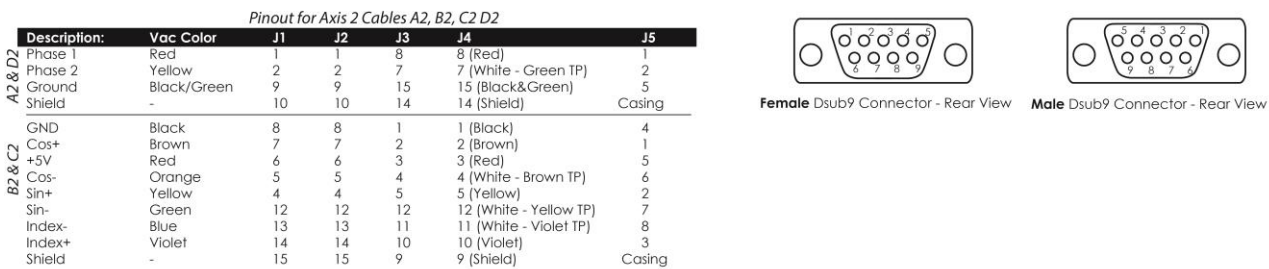
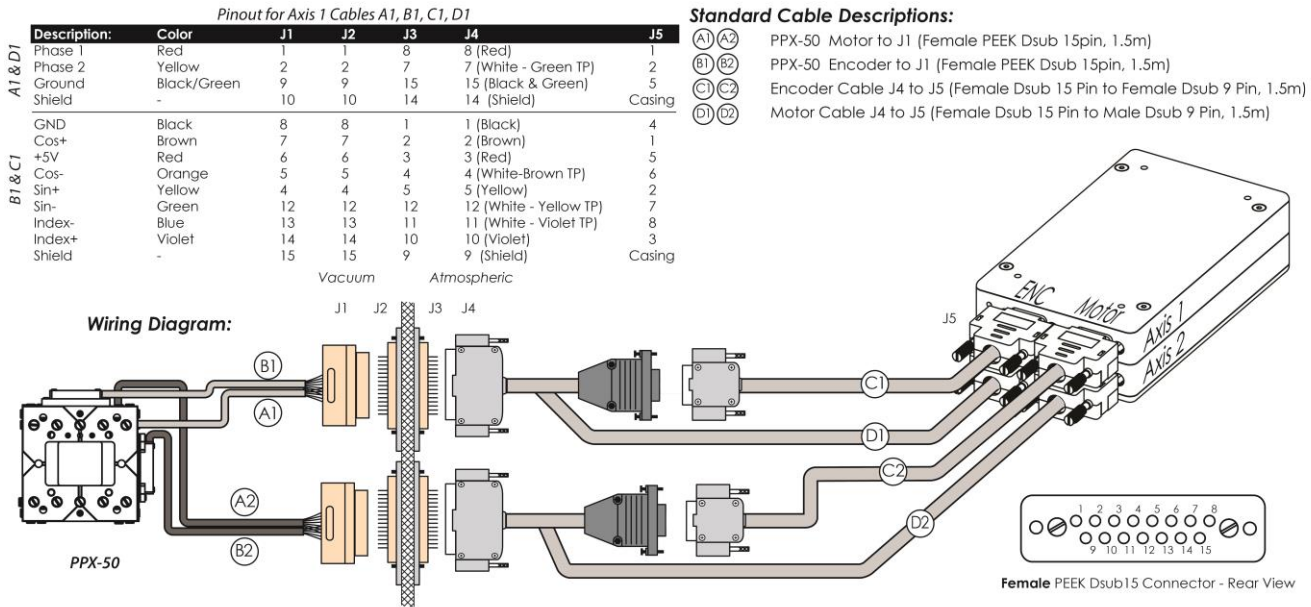
Female Dsub9 Connector - Rear View

Male Dsub9 Connector - Rear View

A.4.7 Straight Through 15-Pin Feedthrough



A.4.8 Closed Loop Vacuum Wiring Diagram (Digital)



A.4.9 Straight Through 15-Pin Feedthrough

