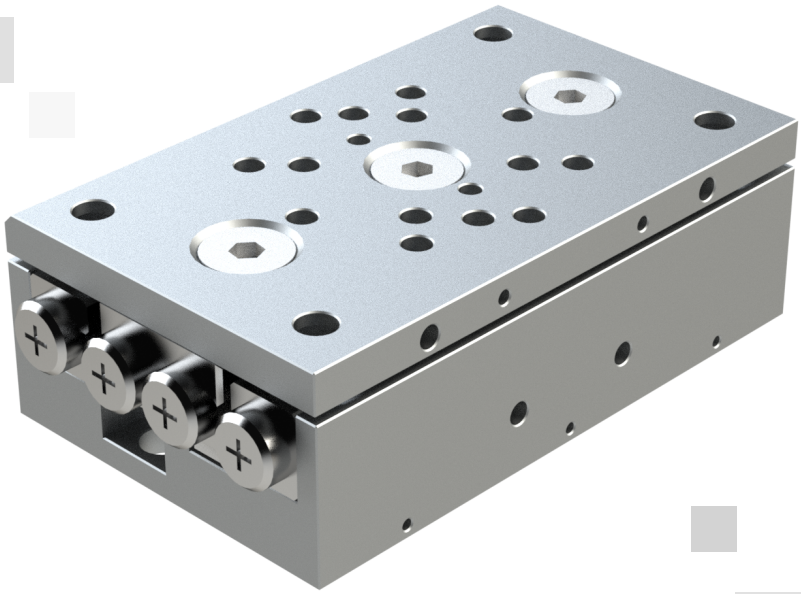
PPS-28 Series



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

micronix USA
PRECISION MOTION SOLUTIONS

PPS-28
Piezo Motor
Precision Positioner Stage
Reference Manual
Rev 4.0

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http://micronixusa.com

Table of Contents

1. Introduction

1.1 Product Description

The PPS-28 is a high-precision, long travel linear piezo stage. Miniature crossed roller bearings assure high stiffness and guiding accuracy for loads up to 20 N (horizonal orientation). It utilizes our patented multi-phase piezo motor resulting in high speed (> 10 mm/s) and high blocking force (> 2 N). The PPS-28 is available in open loop or with an external encoder. Closed-loop encoder resolution of 2 nm is achievable. Versions capable of operation in vacuum (10^{-9} mbar) are available. The PPS-28 is compatible with MMC-100, MMC-110 and NanoDrive controllers.

Features:

- Travel range of up to 102 mm
- 2 nm closed loop encoder resolution
- Load capacity up to 2 kg (horizontal orientation)
- Crossed roller bearing
- Low profile, 15 mm height
- Vacuum and non-magnetic versions available

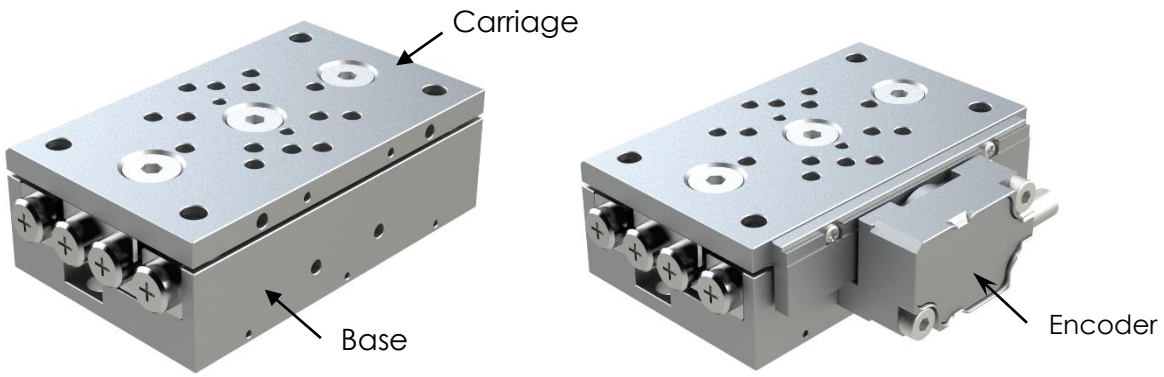


Figure 1-A. PPS-28PM, Piezo Motor, Open Loop Version (left), Closed Loop Version (right)

1.2 Recommended Controllers

The following controllers are available from MICRONIX USA:

- MMC-100
- MMC-110
- NanoDrive

1.3 Technical Data and Ordering Information

Detailed specifications and ordering information can be found on the PPS-28PM product page on the MICRONIX USA website.

2. Preparing to Install the PPS-28PM 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 the shape of that surface. The stage's performance and structural integrity are impacted by the mounting flatness. It is required to have a mounting surface with flatness less than the overall specified flatness of the base.

The stage specification is tested at a temperature of 20°C ± 5°C unless otherwise specified. Assure 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.
- Operating temperature range of 5-40°C.
- Relative humidity between 20-80%.
- Locate away from water, heat, and electrical noise.

2.2 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:

- PPS-28 Linear Stage
- Reference Manual
- Any other previously agreed upon components such as a controller.

3. Installing the PPS-28PM Stage

Refer to Section 3.1.1 for general mounting, 3.1.2 for XY Mounting. Additional brackets and screws may be required for custom applications, see Section 5 for stacking configuration examples.

3.1 PPS-28PM Installation

3.1.1 General Mounting

Recommended general mounting pattern sample can be found in Section 4.2.

1. Align the stage to the mounting surface using at least two M1.5 x 6 mm dowel pins.
2. Move the carriage to access the mounting holes. Secure the stage to the mounting surface using at least two M3 socket head cap screws at 0.5 Nm recommended torque.

Please note, it is possible to move the carriage of the piezo motor configurations manually without damaging the stage.

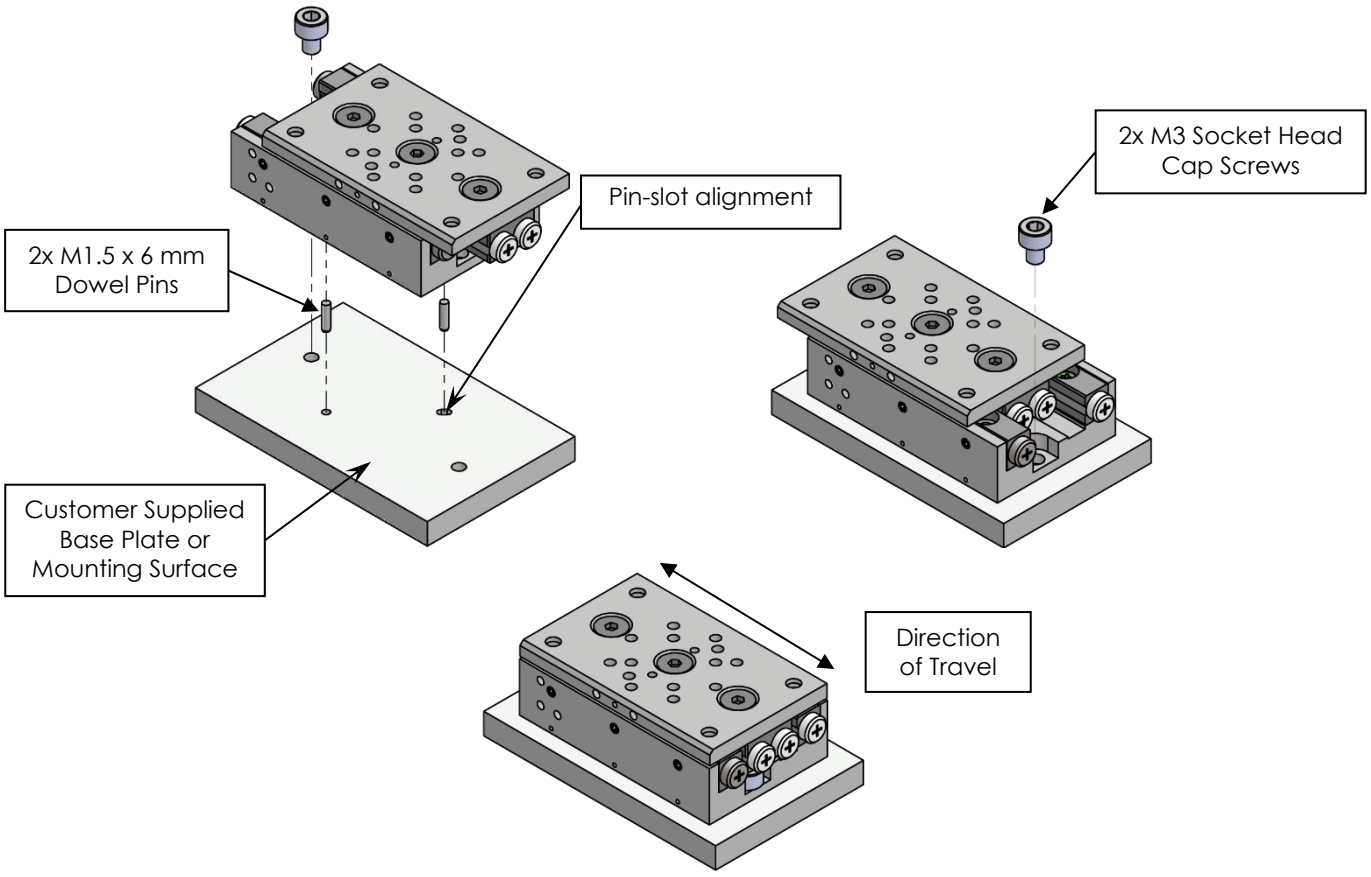


Figure 3-A. PPS-28PM Installation

*Ensure the dowel pin holes on the mounting plate are not over-constraining the stage, i.e. one of the two holes needs to be a slot, see section 4.2 for reference.

3.1.2 X-Y Mounting

An adapter plate is required to mount in XY. Contact MICRONIX USA for additional or custom mounting plates.

1. Install the bottom stage to the mounting surface as shown in Section 3.1.1.
2. Align the XY Bracket (PN: 430987) to the carriage using two M1.5 x 4 mm dowel pins and secure using four M2 x 4 mm socket head cap screws at 0.22 Nm recommended torque.

   Note: Do not use screws longer than specified to avoid damage to the bearings.
3. Place the stage onto the adapter bracket and move the carriage to access the mounting holes. Secure the stage using two M3 x 4 mm socket head cap screws at 0.5 Nm recommended torque.

Please note, it is possible to move the carriage of the piezo motor configurations manually without damaging the stage.

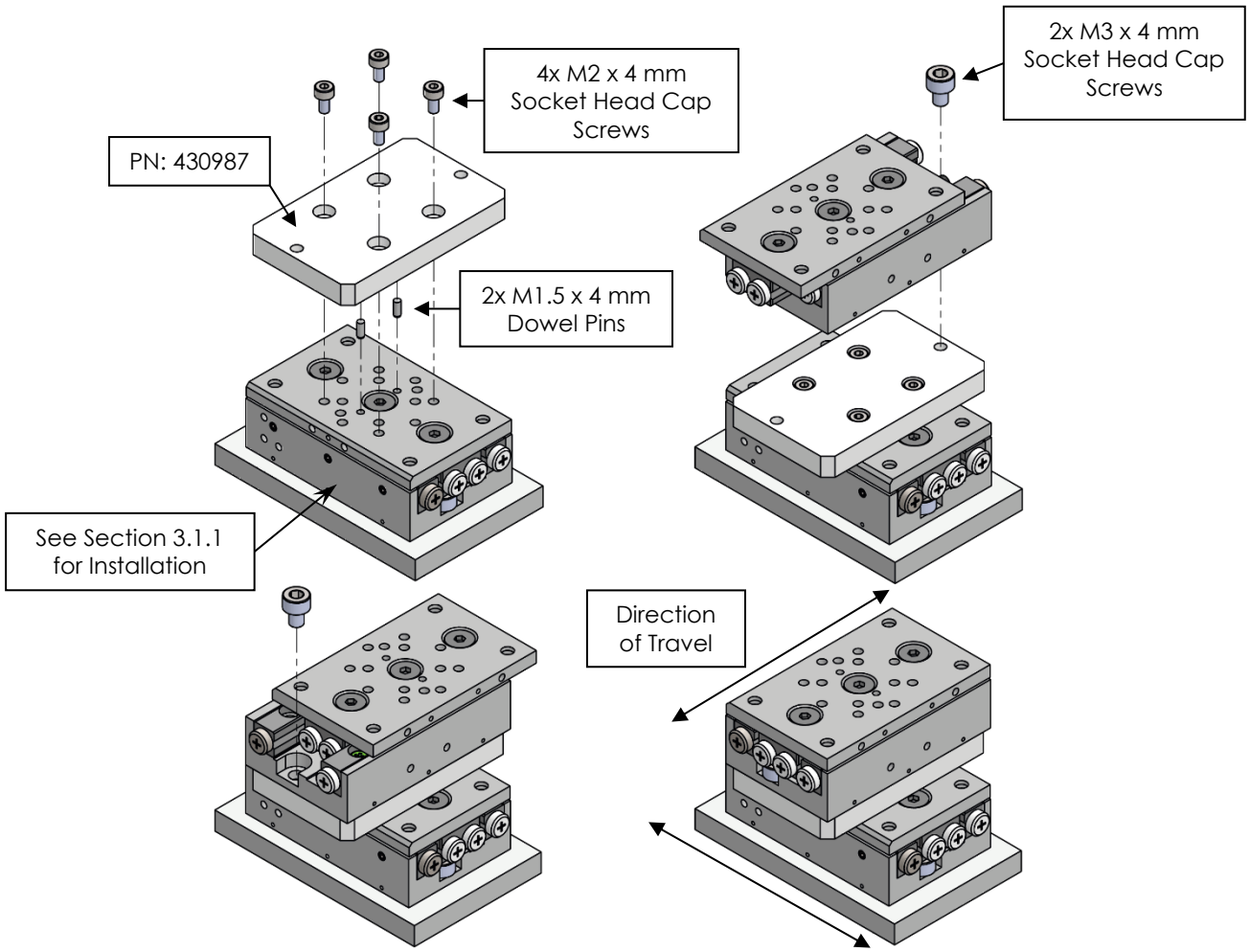
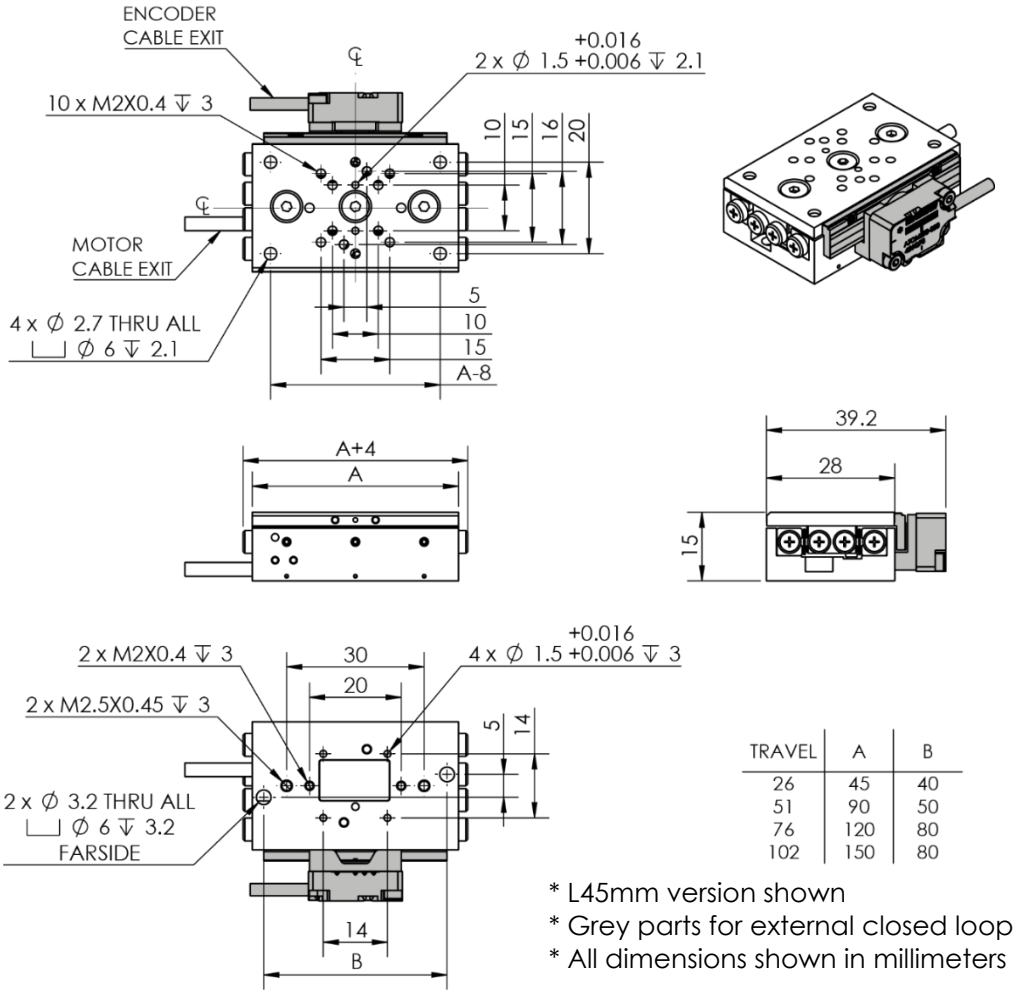


Figure 3-B. PPS-28PM XY Mounting Installation

4. Dimensions

4.1 PPS-28PM Standard Dimensions

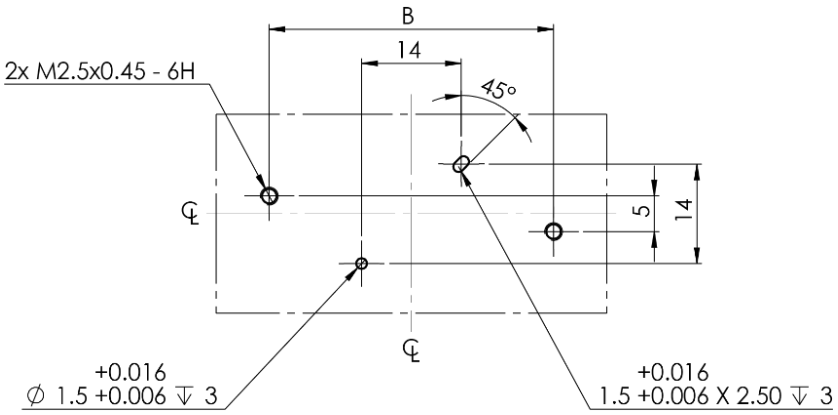


TRAVEL	A	B
26	45	40
51	90	50
76	120	80
102	150	80

* L45mm version shown
* Grey parts for external closed loop only
* All dimensions shown in millimeters

4.2 Recommended General Mounting Pattern

It is recommended to use a pin-slot hole pattern for dowel pin alignment.

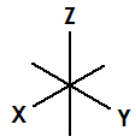


Travel	B
26mm	40
51mm	50
76mm	80
102mm	80

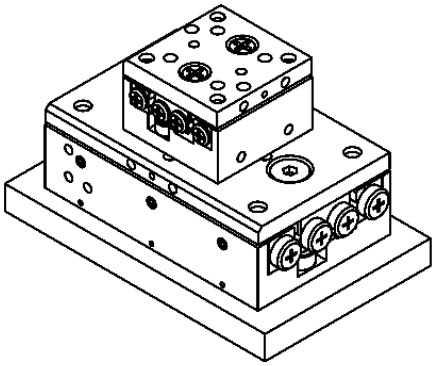
5. Stacking Configurations

5.1 Configuration Examples

- Additional configurations are available upon request
- Positioning according to:

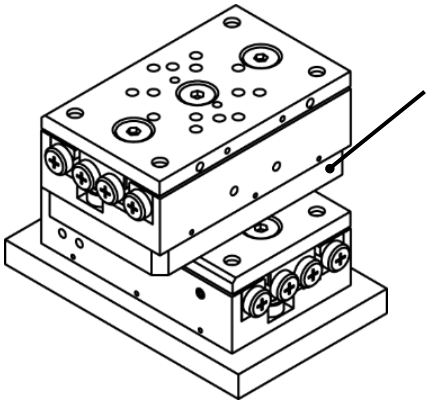


No Adapters

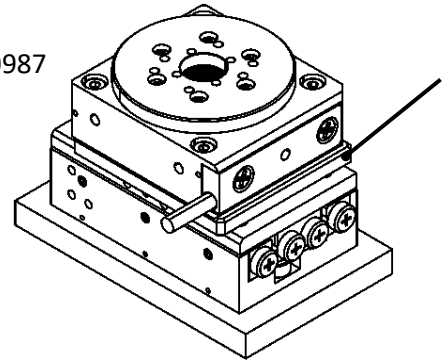


XY
PPS-20 12mm Travel by
PPS-28 26mm Travel

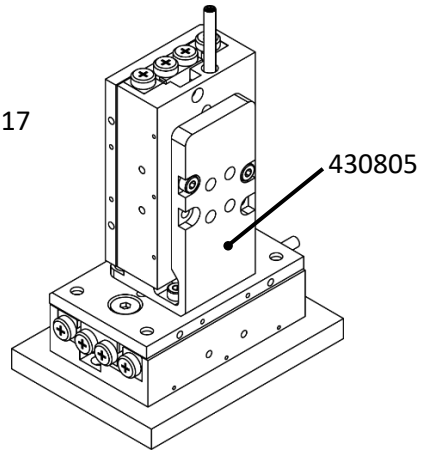
Using Adapter Brackets



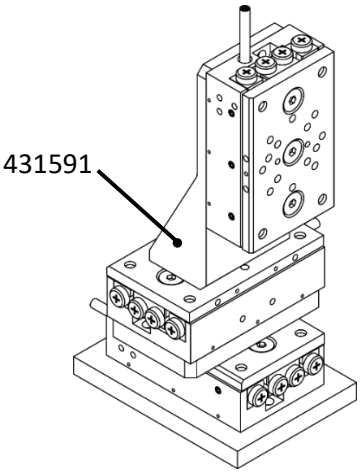
XY PPS-28, 26mm x 26mm
Adapter PN: 430987



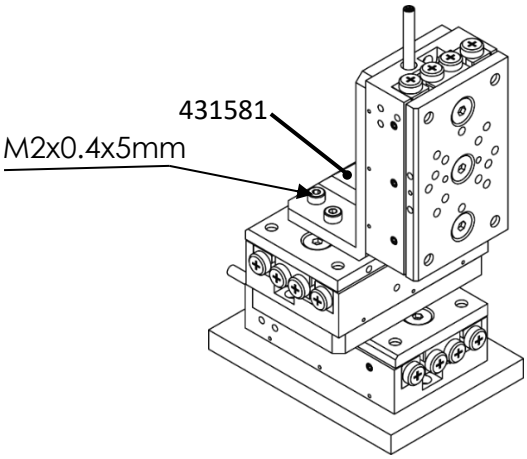
PPS-28, 26mm Travel with
Rotational Stage PR-32L
Adapter PN: 430517



YZ PPS-28, 26mm x 13mm
Adapter PN: 430805

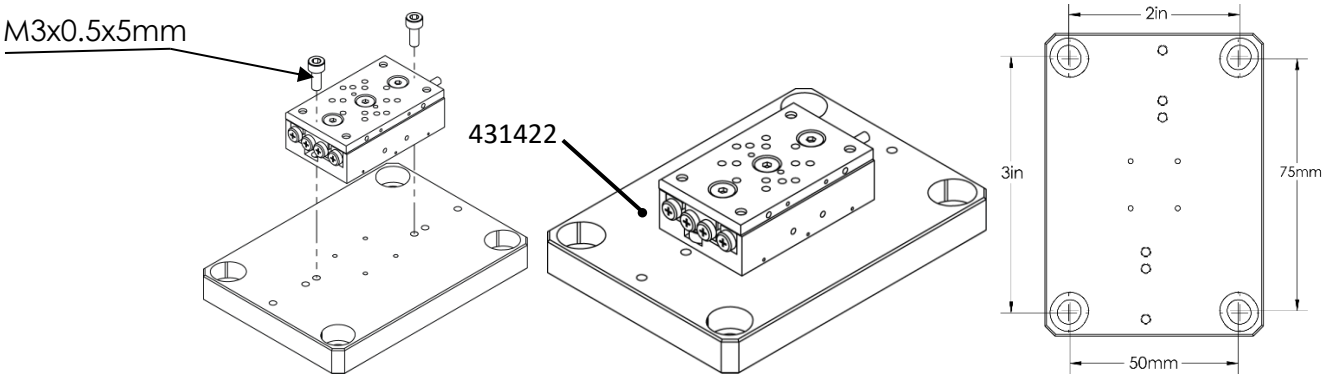


XYZ PPS-28, 26mm x 26mm x 26mm
Z-Bracket PN: 431591
Compatible with 26mm stage only.



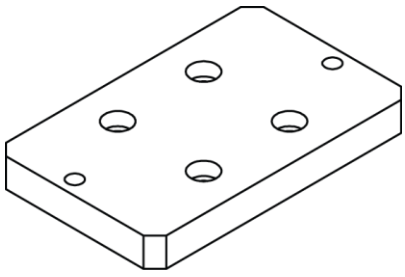
XYZ PPS-28, 26mm x 26mm x 26mm
Z-Bracket PN: 431581
Compatible with 26mm stage only.

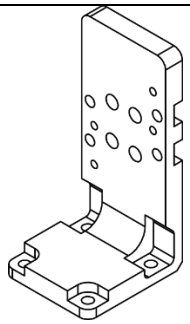
Using Optical Table Mounting Plate (PN:431422)

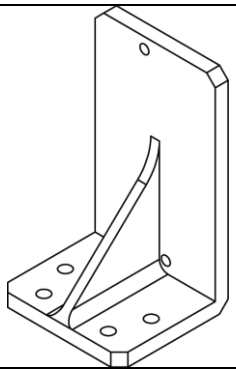


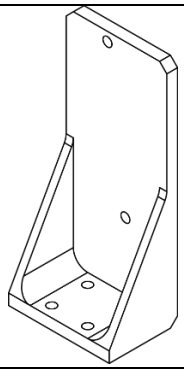
Metric/English Optical Table Mounting Plate for PPS-28 (Mounting Plate PN: 431422)

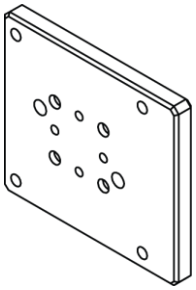
5.2 Accessories

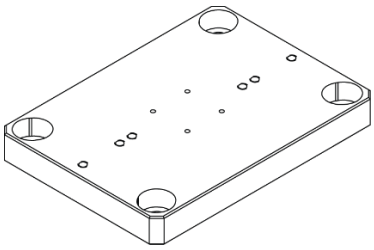
430987 XY-Bracket Adapter

Used to adapt the PPS-28 series to an assembly for a XY mounting configurations.

430805 Z-Bracket Adapter

Used to adapt the PPS-28 series to a perpendicular assembly for XZ mounting configurations.

431581 Z-Bracket Adapter

Used to adapt the PPS-28 series to a perpendicular assembly for XZ mounting configurations.

431591 Z-Bracket Adapter

Used to adapt the PPS-28 series to a perpendicular assembly for XZ mounting configurations.

430517 XY-Bracket Adapter

Used to adapt the PPS-28 series to mount a PR-32 Rotation stage.

431422 Optical Table Mounting Plate

Used to adapt the PPS-28 series to a Metric or English unit Optical Table.

Note: For longer or custom brackets contact MICRONIX USA

6. Connecting the PPS-28PM 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 PPS-28PM 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.

Cable Descriptions:

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

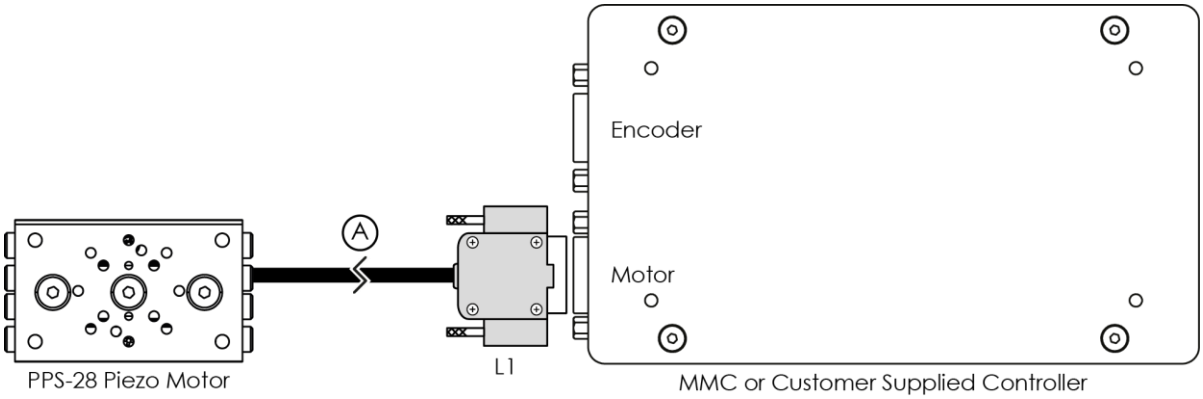


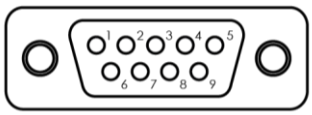
Figure 6-A. PPS-28PM, Piezo Motor, Open Loop, Atmospheric Wiring Diagram

6.1.1.1 Piezo Motor Atmospheric Open Loop Pinout

Cable A
Dsub9M

Pinout for PPS-28-1X000

	Description	Color	L1
Motor	Phase 1	Red	1
	Phase 2	White (Green TP)	2
	Ground	Black/Green	5
	Shield	-	Casing
PPS-28-1X010 Limit Switch (Optional)	Limit Switch -	White (Violet TP)	6
	Limit Switch +	Violet	7
	+5V	White (Grey)	8
	GND	Grey	9



Dsub9M - Front View
9 Pin Male Connector

6.1.2 Closed Loop (Encoder), Atmospheric Wiring Diagram

Using the PPS-28PM stage with an encoder requires a closed loop controller that recognizes the proper type of encoder feedback. Connect the stage as shown below.

Cable Descriptions:

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

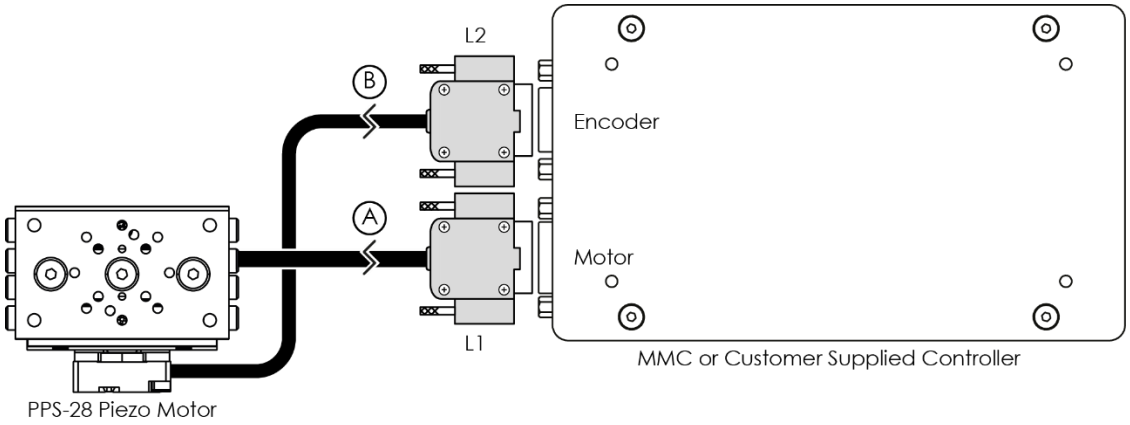


Figure 6-B. PPS-28PM, Piezo Motor, Closed Loop, Atmospheric Wiring Diagram

6.1.2.1 Piezo Motor Atmospheric Analog Encoder Pinout

Pinout for PPS-28-1X200 — Cable A Dsub9M

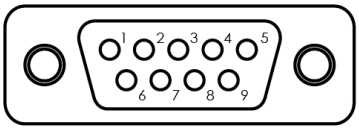
Motor

Description	Color	L1
Phase 1	Red	1
Phase 2	White (Green TP)	2
Ground	Black/Green	5
Shield	-	Casing

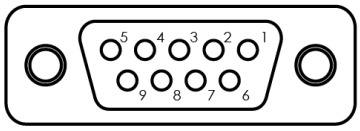
Pinout for PPS-28-1X200 — Cable B Dsub9F

Encoder

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



Dsub9M - Front View
9 Pin Male Connector



Dsub9F - Front View
9 Pin Female Connector

6.1.2.2 Piezo Motor Atmospheric Digital Encoder Pinout

Motor

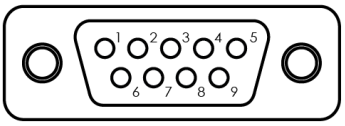
Pinout for PPS-28-1X300 — Cable A Dsub9M

Description	Color	L1
Phase 1	Red	1
Phase 2	White (Green TP)	2
Ground	Black/Green	5
Shield	-	Casing

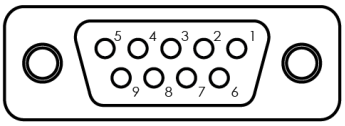
Encoder

Pinout for PPS-28-1X300 — Cable B Dsub9F

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



Dsub9M - Front View
9 Pin Male Connector



Dsub9F - Front View
9 Pin Female Connector

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^{-6} mbar)	9 Pin Female DAP	15 Pin Female DAP
Ultra-High Vacuum (10^{-9} mbar)	9 Pin Female PEEK	15/25 Pin Female PEEK

Connecting a PPS-28PM in a vacuum chamber requires the use of a feed-through connector at the vacuum chamber wall.

The vacuum compatible PPS-28PM 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 for functionality testing prior to installation in a vacuum chamber, see Appendix A.1.2 for feedthrough pins.

6.2.2 Open loop, Vacuum Wiring Diagram

Cable Descriptions:

A. Vacuum 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)

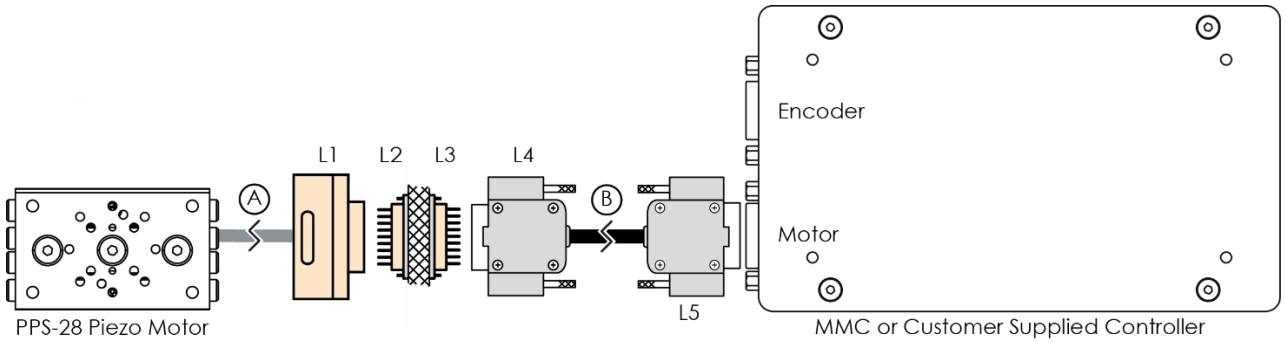
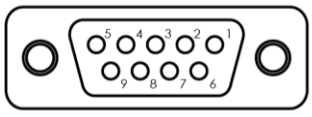


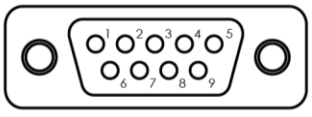
Figure 6-C. PPS-28PM, Piezo Motor, Open Loop, Vacuum Wiring Diagram

6.2.2.1 Piezo Motor Vacuum Open Loop Pinout

	Pinout for PPS-28-1X006/1X009		Cable A Dsub9F	Feedthrough Dsub9M			Cable B Dsub9F	Cable B Dsub9M
	Description	**Color**	**L1**	**L2**	**L3**	**Color**	**L4**	**L5**
Motor	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
PPS-28-1X016/ PPS-28-1X019 Limit Switch (Optional)	Limit Switch -	White (Violet TP)	9	9	6	White (Violet TP)	6	6
	Limit Switch +	Violet	8	8	7	Violet	7	7
	+5V	White (Grey)	7	7	8	White (Grey)	8	8
	GND	Grey	6	6	9	Grey	9	9



Dsub9F - Front View
9 Pin Female Connector



Dsub9M - Front View
9 Pin Male Connector

6.2.3 Closed Loop (Encoder), Vacuum Wiring Diagram

Cable Descriptions:

A. Vacuum Motor Cable (Female Dsub15 Pin Peek or DAP, 1.5m Silver Braided Cable)
B. Vacuum Encoder Cable (Female Dsub15 Pin Peek or DAP, 1.5m Silver Braided Cable)
C. Atmospheric Motor Breakout Cable (Female Dsub15 Pin to Male Dsub 9 Pin, 1.5m PVC Black Cable)
D. Atmospheric Encoder Breakout Cable (Female Dsub15 Pin to Female Dsub 9 Pin, 1.5m PVC Black Cable)

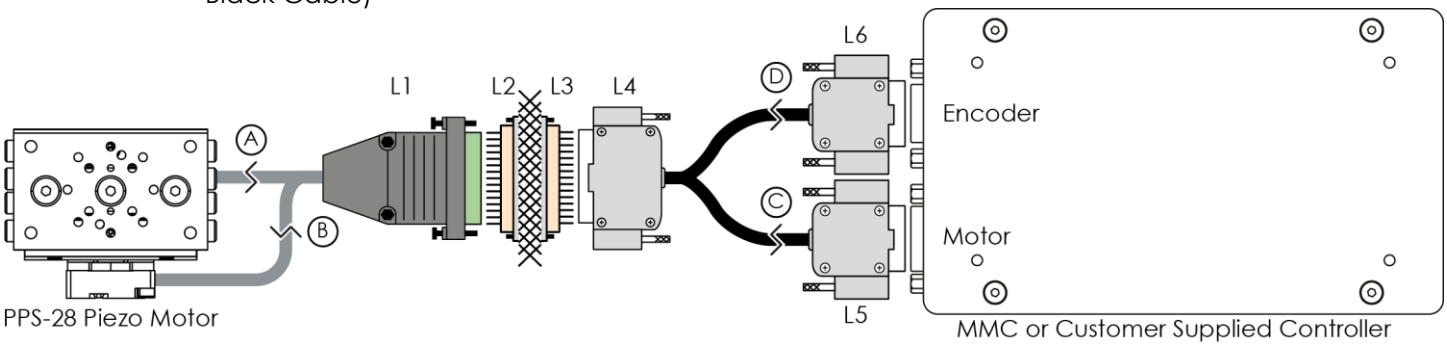
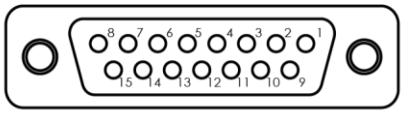


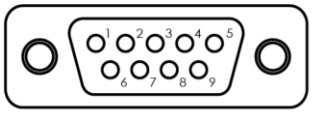
Figure 6-D. PPS-28PM, Piezo Motor, Closed Loop, Vacuum Wiring Diagram

6.2.3.1 Piezo Motor Vacuum Analog Encoder Pinout

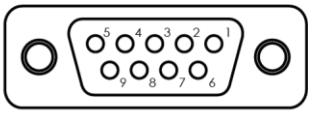
	Pinout for PPS-28-1X206/1X209		Cable A&B Dsub15F	Feedthrough Dsub15M			Dsub15F	Cable C Dsub9M	Cable D Dsub9F
	Description	**Color**	**L1**	**L2**	**L3**	**Color**	**L4**	**L5**	**L6**
Motor A & C	Phase 1	Red	1	1	8	Red	8	1	-
	Phase 2	White (Green TP)	2	2	7	White (Green TP)	7	2	-
	Ground	Black/Green	9	9	15	Black/Green	15	5	-
	Shield	-	10	10	14	-	14	Casing	-
Encoder B & D	Cos+	Blue	7	7	2	Blue	2	-	1
	Sin+	Brown	4	4	5	Brown	5	-	2
	Index+	Violet	14	14	10	Violet	10	-	3
	GND	Grey	8	8	1	Grey	1	-	4
	+5V	White (Grey TP)	6	6	3	White (Grey TP)	3	-	5
	Cos-	White (Blue TP)	5	5	4	White (Blue TP)	4	-	6
	Sin-	White (Brown TP)	12	12	12	White (Brown TP)	12	-	7
	Index-	White (Violet TP)	13	13	11	White (Violet TP)	11	-	8
	Shield	-	15	15	9	-	9	-	Casing



Dsub15F - Front View
15 Pin Female Connector



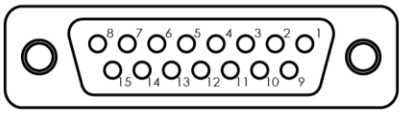
Dsub9M - Front View
9 Pin Male Connector



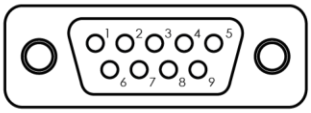
Dsub9F - Front View
9 Pin Female Connector

6.2.3.2 *Piezo Motor Vacuum Digital Encoder Pinout*

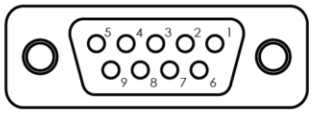
	Pinout for PPS-28-1X306/1X309		Cable A&B Dsub15F	Feedthrough Dsub15M			Dsub15F	Cable C Dsub9M	Cable D Dsub9F
	Description	**Color**	**L1**	**L2**	**L3**	**Color**	**L4**	**L5**	**L6**
Motor A & C	Phase 1	Red	1	1	8	Red	8	1	-
	Phase 2	White (Green TP)	2	2	7	White (Green TP)	7	2	-
	Ground	Black/Green	9	9	15	Black/Green	15	5	-
	Shield	-	10	10	14	-	14	Casing	-
Encoder B & D	A+	Blue	7	7	2	Blue	2	-	1
	B+	Brown	4	4	5	Brown	5	-	2
	Index+	Violet	14	14	10	Violet	10	-	3
	GND	Grey	8	8	1	Grey	1	-	4
	+5V	White (Grey TP)	6	6	3	White (Grey TP)	3	-	5
	A-	White (Blue TP)	5	5	4	White (Blue TP)	4	-	6
	B-	White (Brown TP)	12	12	12	White (Brown TP)	12	-	7
	Index-	White (Violet TP)	13	13	10	White (Violet TP)	10	-	8
	Shield	-	15	15	9	-	9	-	Casing



Dsub15F - Front View
15 Pin Female Connector



Dsub9M - Front View
9 Pin Male Connector



Dsub9F - Front View
9 Pin Female Connector

7. Supplementary Information

7.1 Maintenance

- The PPS-28 linear stage series 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 PPS-28 series of linear stages are precision mechanical devices and should be handled with care. Do not drop or mishandle the stage.
- Do not touch the scale, as this will contaminate and jeopardize the performance of the stage.
- Follow the *Installation Preparation* requirements and use proper cable management to ensure a clean and safe operating environment.

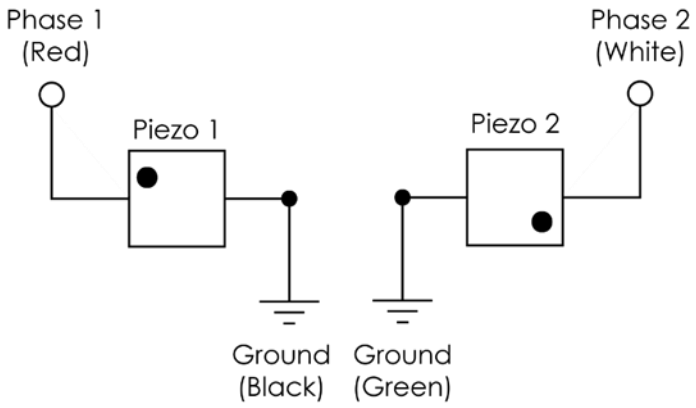
7.2 Units and Conventions

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 2 Phase Piezo Motor Wiring Diagram

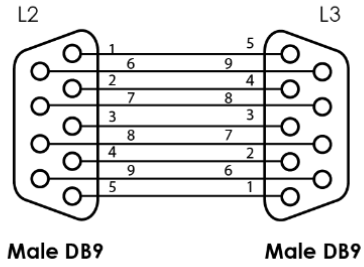


A.1.1 Piezo Operating and Electrical Specifications

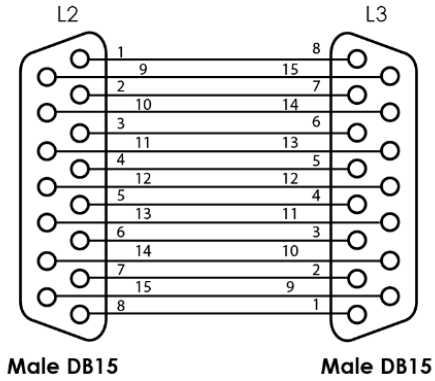
Voltage	60V maximum
Capacitance	150nf ±15%

A.1.2 Feedthroughs

Straight Through 9-Pin Feed-through



Straight Through 15-Pin Feed-through



A.2 Using an Analog Encoder

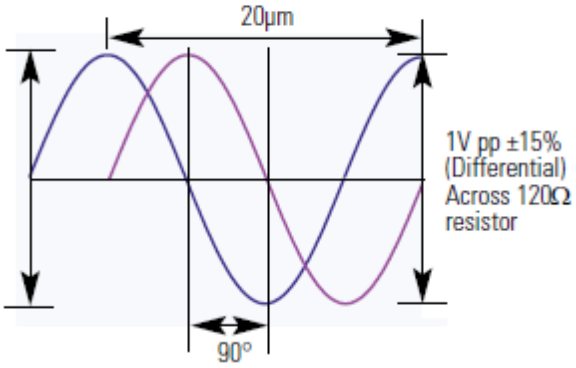
A.2.1 Encoder Overview

A PPS-28 with Analog Encoder will need to be paired with an appropriate controller that supports 1 V_{pp} sine/cosine encoders such as the MMC-100 and MMC-110. The PPS-28 with an analog encoder will be supplied with a 9 pin connector that incorporates these encoder signals.

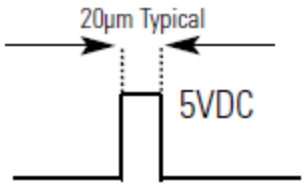
A.2.1.1 Encoder Operating and Electrical Specifications

Power Supply	5VDC ±5% @ 330mA (60mA for sensor)

A.2.1.2 Analog Output (Pins 1,2,6, and 7)



A.2.1.3 Index Window



A.2.1.4 Resolution

All closed loop stages are supplied with 20 µm scales. The interpolation is done in the MMC-100/MMC-110 to the resolution as specified in the order. With an analog encoder, the MMC-100/MMC-110 has an achievable resolution of 10 nm.

A.3 Using a Digital Encoder

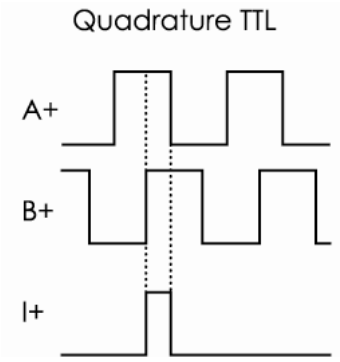
A.3.1 Encoder Overview

The PPS-28PM with Digital Encoder will need to be paired with an appropriate controller that supports RS-422 square wave AB signals. The PPS-28PM with a digital encoder will be supplied with a 9-pin connector that incorporates these encoder signals.

A.3.2 Operating and Electrical Specifications

Power Supply	5VDC ±5% @ 330mA (30mA for sensor)

A.3.3 Output Signals



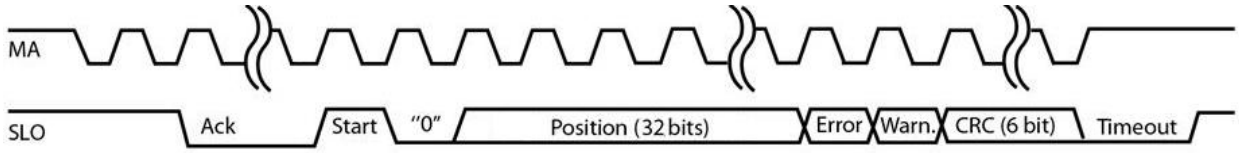
***Note:** The index pulse may be aligned with A- or B- at some interpolation values.

A.3.4 Resolution

All closed loop stages are supplied with 20µm scales. With a digital encoder, an MMC controller has an achievable resolution of 2nm.

A.4 Using an Absolute Encoder

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.

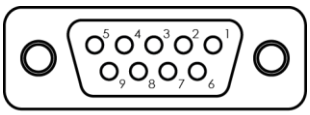


A.4.1 Operating and Electrical Specifications

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

A.4.2 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.4.3 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.5 Legacy Documentation

A.5.1 Legacy Digital Encoder, Atmospheric Wiring Diagram

Cable Descriptions:

A. Motor Cable (Male Dsub9 Pin, 1.5m PVC Black Cable)
B. Encoder Cable (Male Dsub15 Pin Module, 1m PVC Black Cable)
C. Encoder Module Adapter Cable (Female Dsub 15 Pin to Female Dsub 9 Pin, 0.5m PVC Black Cable)

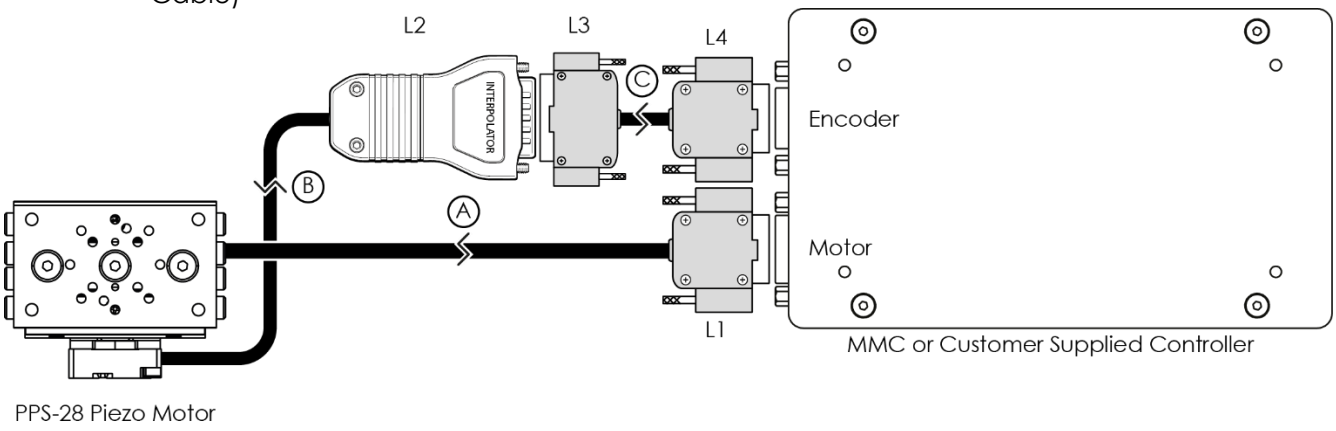


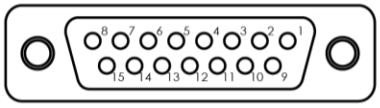
Figure A-A. PPS-28PM, Piezo Motor, Digital Encoder, Atmospheric Wiring Diagram

Motor

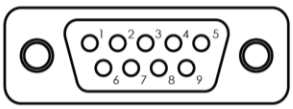
Pinout for PPS-28-1X300		Cable A Dsub9M
Description	**Color**	**L1**
Phase 1	Red	1
Phase 2	White (Green TP)	2
Ground	Black/Green	5
Shield	-	Casing

Encoder

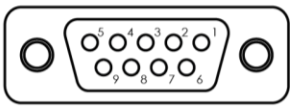
Pinout for PPS-28-1X300		Interpolator Dsub15M	Cable C Dsub15F	Cable C Dsub9F
Description	**Color**	**L2**	**L3**	**L4**
A+	Brown	14	14	1
B+	Blue	13	13	2
Index+	Violet	12	12	3
GND	Grey	2	2	4
+5V	White (Grey TP)	7	7	5
A-	White (Brown TP)	6	6	6
B-	White (Blue TP)	5	5	7
Index-	White (Violet TP)	4	4	8
Shield	-	Casing	Casing	Casing



Dsub15F - Front View
15 Pin Female Connector



Dsub9M - Front View
9 Pin Male Connector



Dsub9F - Front View
9 Pin Female Connector

A.5.2 Legacy Digital Encoder, Vacuum Wiring Diagram

Cable Descriptions:

A. Vacuum Motor Cable (Female Dsub 15 Pin DAP, 1.5m Silver Braided Cable)
B. Vacuum Encoder Cable (Female Dsub 15 Pin DAP, 1.5m Silver Braided Cable)
C. Atmospheric Motor Breakout Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m PVC Black Cable)
D. Atmospheric Encoder Module Breakout Cable (Female Dsub 15 Pin to Interpolator Module, 1m PVC Black Cable) Encoder Module Adapter Cable (Female Dsub 15 Pin to Female Dsub 9 Pin, 0.5m PVC Black

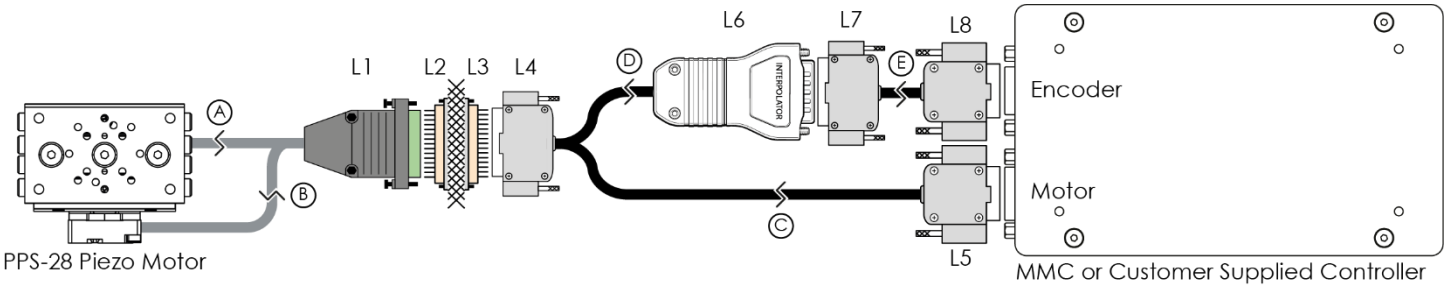
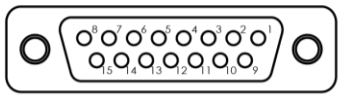


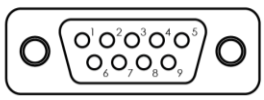
Figure A-B. PPS-28PM, Piezo Motor, Digital Encoder, Vacuum Wiring Diagram

			Cable A&B Dsub15F	Feedthrough Dsub15M			Dsub15F	Cable C Dsub9M
	Description	**Color**	**L1**	**L2**	**L3**	**Color**	**L4**	**L5**
Motor A & C	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
Encoder B & D	GND	Grey	8	8	1	Grey	1	*To Interpolator L6 (Cable D)*
	Cos+	Blue	7	7	2	Blue	2	
	+5V	White (Grey TP)	6	6	3	White (Grey TP)	3	
	Cos-	White (Blue TP)	5	5	4	White (Blue TP)	4	
	Sin+	Brown	4	4	5	Brown	5	
	Sin-	White (Brown TP)	12	12	12	White (Brown TP)	12	
	Index-	White (Violet TP)	13	13	11	White (Violet TP)	11	
	Index+	Violet	14	14	10	Violet	10	
	Shield	-	15	15	9	-	9	

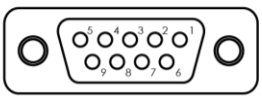
	Pinout for PPS-28-1X306		Interpolator Dsub15M	Cable E Dsub15F	Dsub9F
	Description	**Color**	**L6**	**L7**	**L8**
Encoder	A+	Brown	14	14	1
	B+	Blue	13	13	2
	Index+	Violet	12	12	3
	GND	Grey	2	2	4
	+5V	White (Grey TP)	7	7	5
	A-	White (Brown TP)	6	6	6
	B-	White (Blue TP)	5	5	7
	Index-	White (Violet TP)	4	4	8
	Shield	-	Casing	Casing	Casing



Dsub15F - Front View
15 Pin Female Connector



Dsub9M - Front View
9 Pin Male Connector

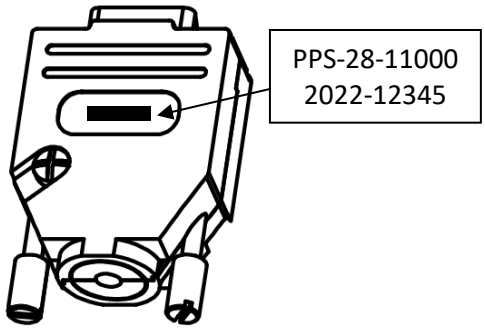


Dsub9F - Front View
9 Pin Female Connector

A.5.3 Legacy Cabling (8 Conductor Wiring)

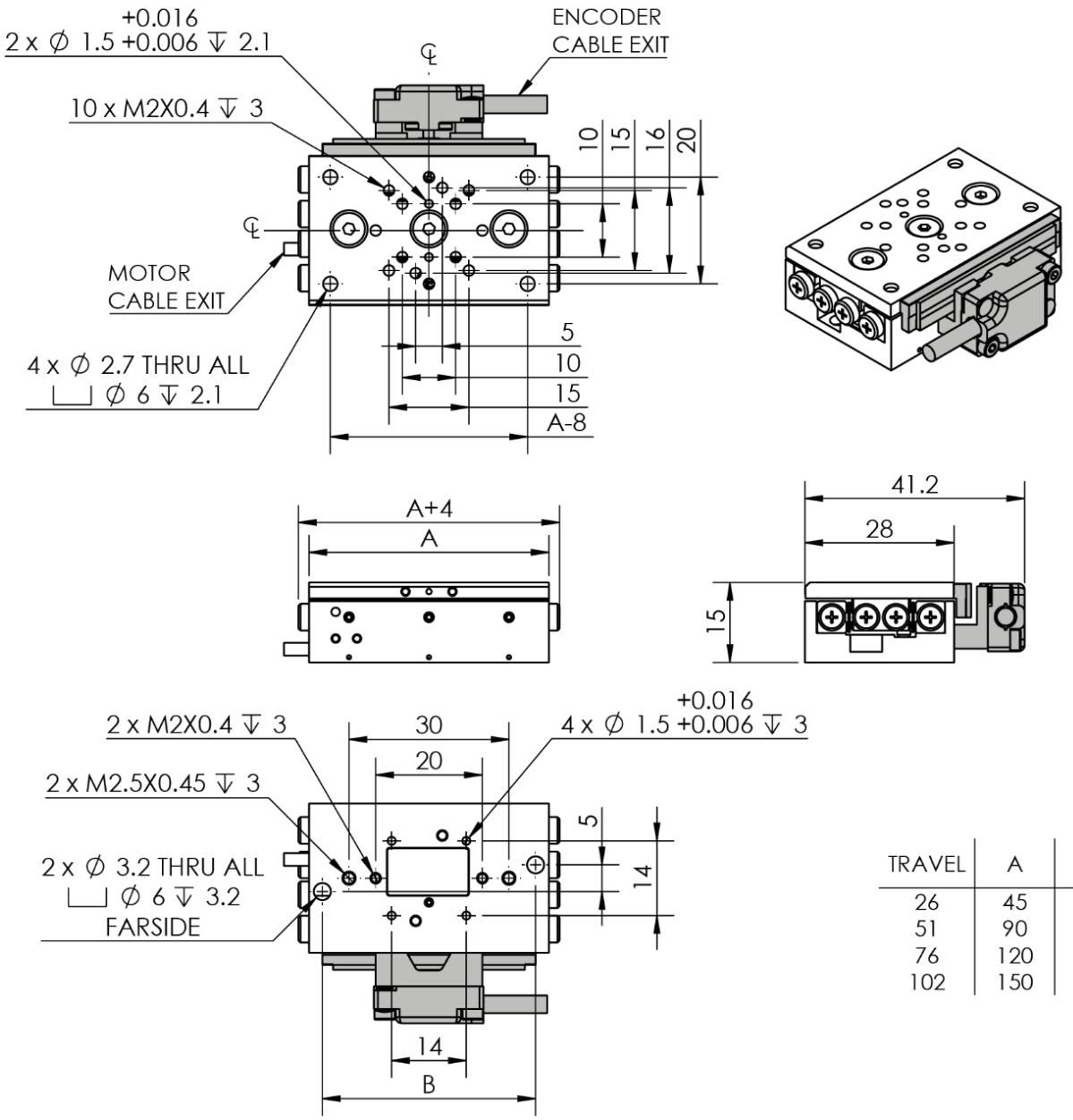
Stages delivered before 2022 used the 8 Conductor wiring scheme.
Stages delivered on 2022 and afterward use the 12 Conductor wiring scheme.

Customers can find the serial number of their stages which can usually be found on the Dsub 9 Male connector with the format: 1234-56789 where the first four digit is the year.



Description	8 Conductor Wiring	12 Conductor Wiring
Motor Phase 1	Red	Red
Motor Phase 2	Yellow	White (Green TP)
Motor Ground	Black & Green	Black & Green
A+ / COS+	Brown	Blue
A- / COS-	Orange	White (Blue TP)
B+ / SIN+	Yellow	Brown
B- / SIN-	Green	White (Brown TP)
Index +	Violet	Violet
Index -	Blue	White (Violet TP)
+5V	Red	White (Grey TP)
GND	Black	Grey

A.5.4 Legacy PPS-28PM with M1000 Analog Encoder Dimensions



TRAVEL	A	B
26	45	40
51	90	50
76	120	80
102	150	80

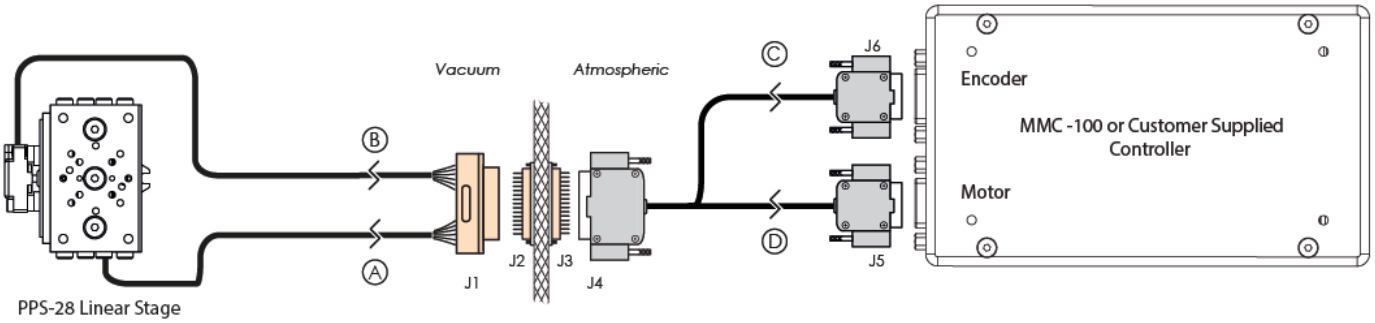
* L45mm version shown
* Grey parts for external closed loop only
* All dimensions shown in millimeters

A.5.5 Legacy Analog Encoder, Ultra High Vacuum Wiring Diagram

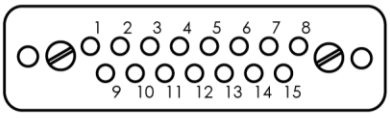
Standard Cable Description:

A. PPS-28 Motor Cable – Vacuum Side (Female D-Sub 15 pin, 1.5 m)
B. PPS-28 Encoder Cable – Vacuum Side (Female D-Sub 15 pin, 1.5 m)
C. Encoder Cable (Female D-sub 15 pin to D-sub 9 pin, 1.5 m)
D. Motor Breakout Cable (Female D-sub 15 pin to Male D-sub 9 pin, 1.5 m)

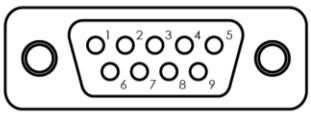
Wiring Diagram:



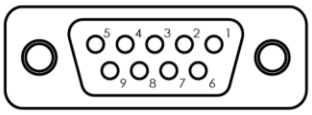
	Pinout for PPS-20-1X209		Cable A&B Dsub15F	Feedthrough Dsub15M			Dsub15F	Cable C Dsub9F	Cable D Dsub9M
	Description:	**Color**	**J1**	**J2**	**J3**	**Color**	**J4**	**J6**	**J5**
MOTOR A & D	Phase 1	Red	1	1	8	Red	8	-	1
	Phase 2	White (Green TP)	2	2	7	White (Green TP)	7	-	2
	GND	Black/Green	9	9	15	Black/Green	15	-	5
	Shield	-	10	10	14	-	14	-	Casing
Encoder B & C	GND	Black	8	8	1	Grey	1	4	-
	Cos+	Brown	7	7	2	Brown	2	1	-
	+5V	Red	6	6	3	White (Grey TP)	3	5	-
	Cos-	Orange	5	5	4	White (Brown TP)	4	6	-
	Sin+	Yellow	4	4	5	Blue	5	2	-
	Sin-	Green	12	12	12	White (Blue TP)	12	7	-
	Index-	Blue	13	13	11	White (Violet TP)	11	8	-
	Index+	Violet	14	14	10	Violet	10	3	-
	Shield	-	15	15	9	-	9	Casing	-



Female PEEK Dsub15 Connector - Rear View

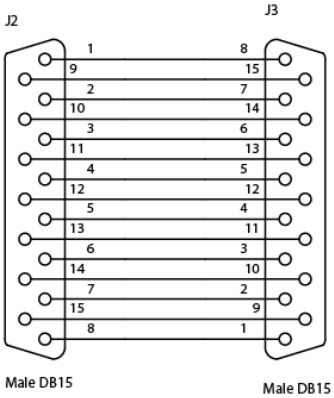


Female Dsub9 Connector - Rear View

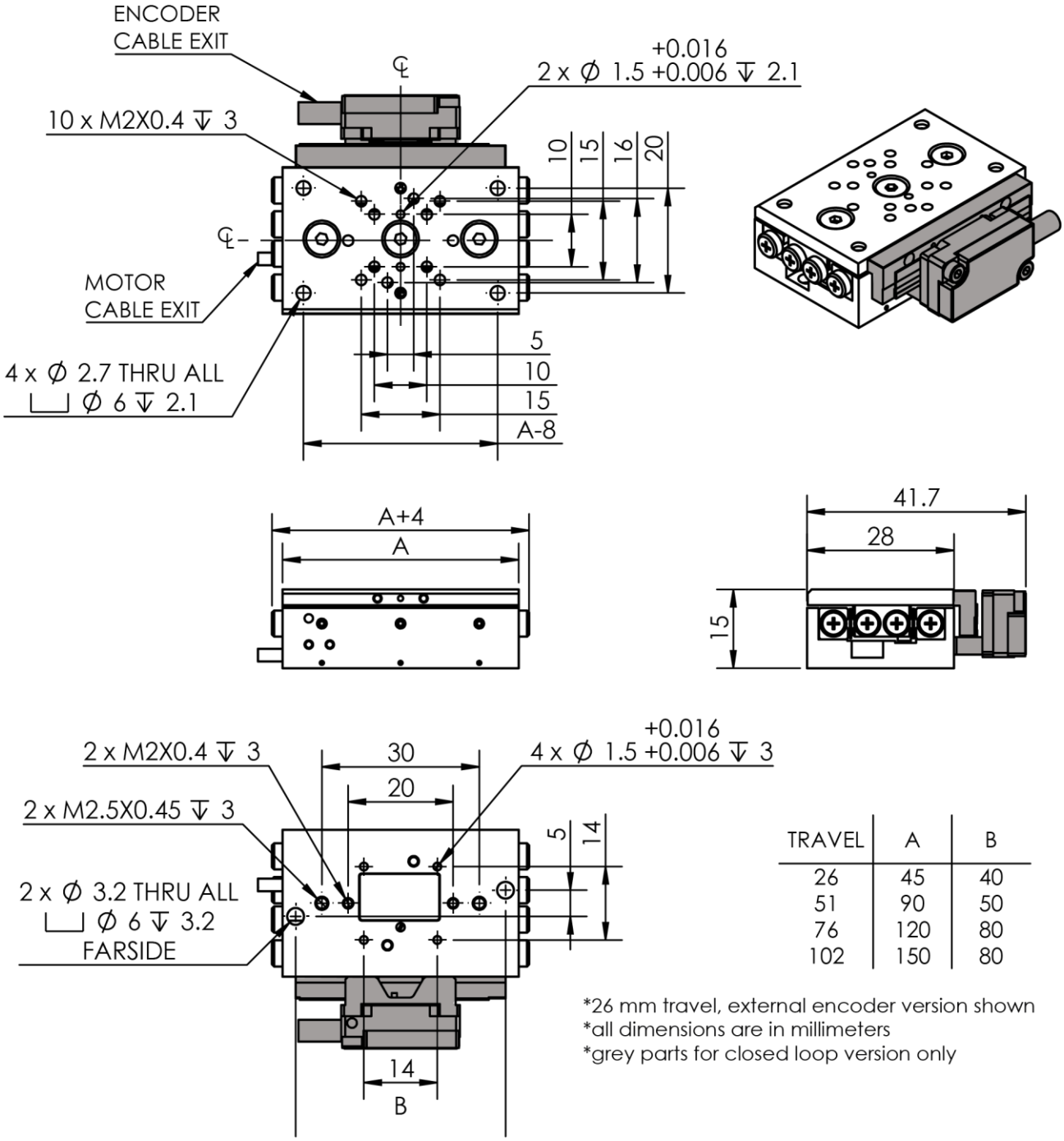


Male Dsub9 Connector - Rear View

A.5.5.1 Legacy Straight Through 15-Pin Feed Through



A.5.6 Legacy PPS-28PM with MII 6000 Digital Encoder Dimensions

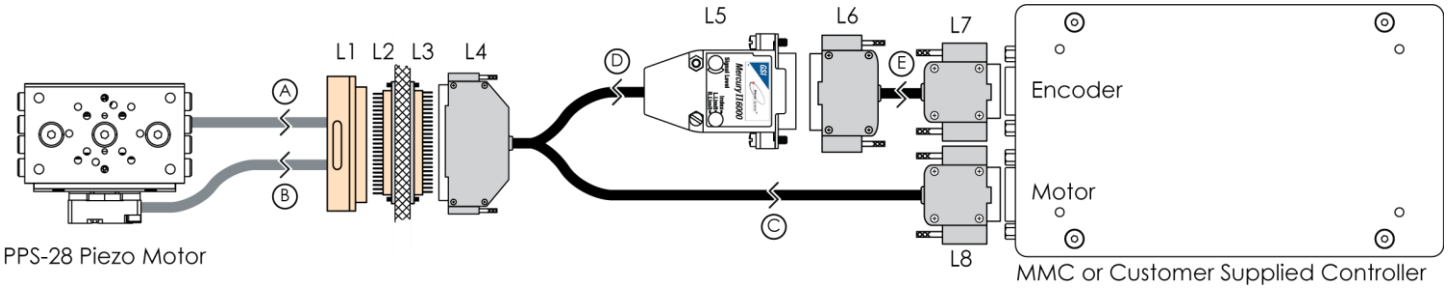


TRAVEL	A	B
26	45	40
51	90	50
76	120	80
102	150	80

*26 mm travel, external encoder version shown
*all dimensions are in millimeters
*grey parts for closed loop version only

A.5.7 Legacy Digital MII6000V Encoder, Ultra High Vacuum Wiring Diagram

A. Vacuum Motor Cable (Female Dsub 25 Pin DAP, 1.5m Silver Braided Cable)
B. Vacuum Encoder Cable (Female Dsub 25 Pin DAP, 1.5m Silver Braided Cable)
C. Atmospheric Motor Breakout Cable (Female Dsub 25 Pin to Male Dsub 9 Pin, 1.5m PVC Black Cable)
D. Atmospheric Encoder Module Breakout Cable (Female Dsub 25 Pin to Interpolator Module, 1m PVC Black Cable)
E. Encoder Module Adapter Cable (Female Dsub 15 Pin to Female Dsub 9 Pin, 0.5m PVC Black Cable)



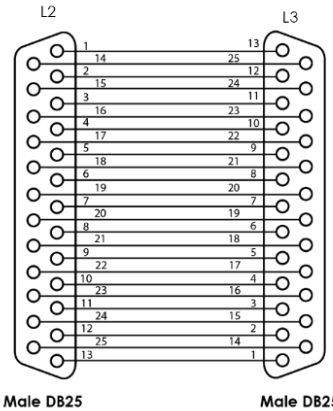
PPS-28 Piezo Motor

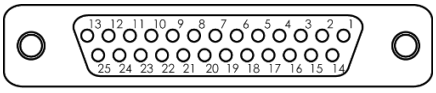
MMC or Customer Supplied Controller

			Cable A&B Dsub25F	Feedthrough Dsub25M			Dsub25F	Cable C Dsub9M
	Description:	**Color**	**L1**	**L2**	**L3**	**Color**	**L4**	**L8**
Motor A & C	Phase 1	Red	1	1	13	Red	13	1
	Phase 2	White (Green TP)	2	2	12	White (Green TP)	12	2
	Ground	Black/Green	14	14	25	Black/Green	25	5
	Shield	-	15	15	24	-	24	Casing
Encoder B & D	+5V	Red	4	4	10	Red	10	*To Interpolator L5 (Cable D)*
	GND	Black	17	17	22	Black	22	
	DCLK-	Grey	5	5	9	Grey	9	
	DCLK+	White (Grey TP)	18	18	21	White (Grey TP)	21	
	MISO-	Violet	6	6	8	Violet	8	
	MISO+	White (Violet)	19	19	20	White (Violet TP)	20	
	MOSI-	Blue	7	7	7	Blue	7	
	MOSI+	White (Blue TP)	20	20	19	White (Blue TP)	19	
	nSS-	Green	8	8	6	Green	6	
	nSS+	White (Green TP)	21	21	18	White (Green TP)	18	
	CLK-	Brown	9	9	5	Brown	5	
	CLK+	White (Brown TP)	22	22	17	White (Brown TP)	17	
	Shield	-	16	16	23	-	23	

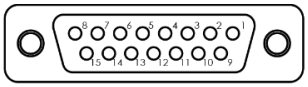
Straight Through 25-Pin Feed-through

	Pinout for PPS-28-1X309		Interpolator Dsub15M	Cable E Dsub15F	Dsub9F
	Description:	**Color**	**L5**	**L6**	**L7**
Encoder	A+	Brown	14	14	1
	B+	Blue	13	13	2
	Index+	Violet	12	12	3
	GND	Grey	2	2	4
	+5V	White (Grey TP)	7	7	5
	A-	White (Brown TP)	6	6	6
	B-	White (Blue TP)	5	5	7
	Index-	White (Violet TP)	4	4	8
	Shield	-	Casing	Casing	Casing

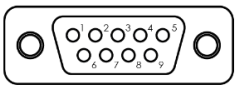




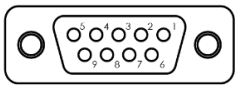
Dsub25F - Front View
25 Pin Female Connector



Dsub15F - Front View
15 Pin Female Connector



Dsub9M - Front View
9 Pin Male Connector



Dsub9F - Front View
9 Pin Female Connector

A.5.8 Legacy Using the UHV Digital Encoder Module

When using the digital external encoder configuration, the Encoder Module should display two green LED's indicating a power source and proper encoder alignment. A Red or Yellow Signal Level LED indicates misalignment of the Encoder Head, if this occurs contact MICRONIX USA. Do not adjust the Encoder Head or scale. For more information refer to MicroE Systems Mercury Encoders.

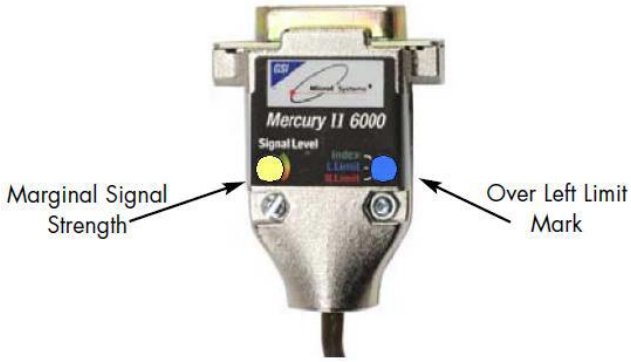
A.5.8.1 Encoder Module Pin-out

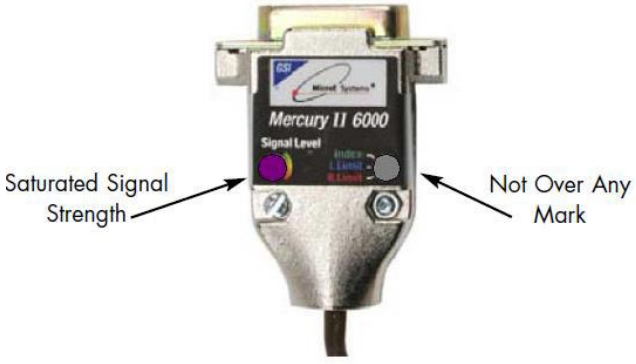
Pin	Description	Pin	Description
1	*Right Limit+	9	Ground
2	Ground	10	*Left Limit+
3	*Right Limit-	11	*Left Limit-
4	Index-	12	Index+
5	B-	13	B+
6	A-	14	A+
7	+5V	15	(not used)
8	+5V		

*-Limits must be specified at the time of order and calibrated at the factory.

Note: Tri-state alarm: A and B are tri-stated if the encoder signal becomes too low for reliable operation.

Normal Operation

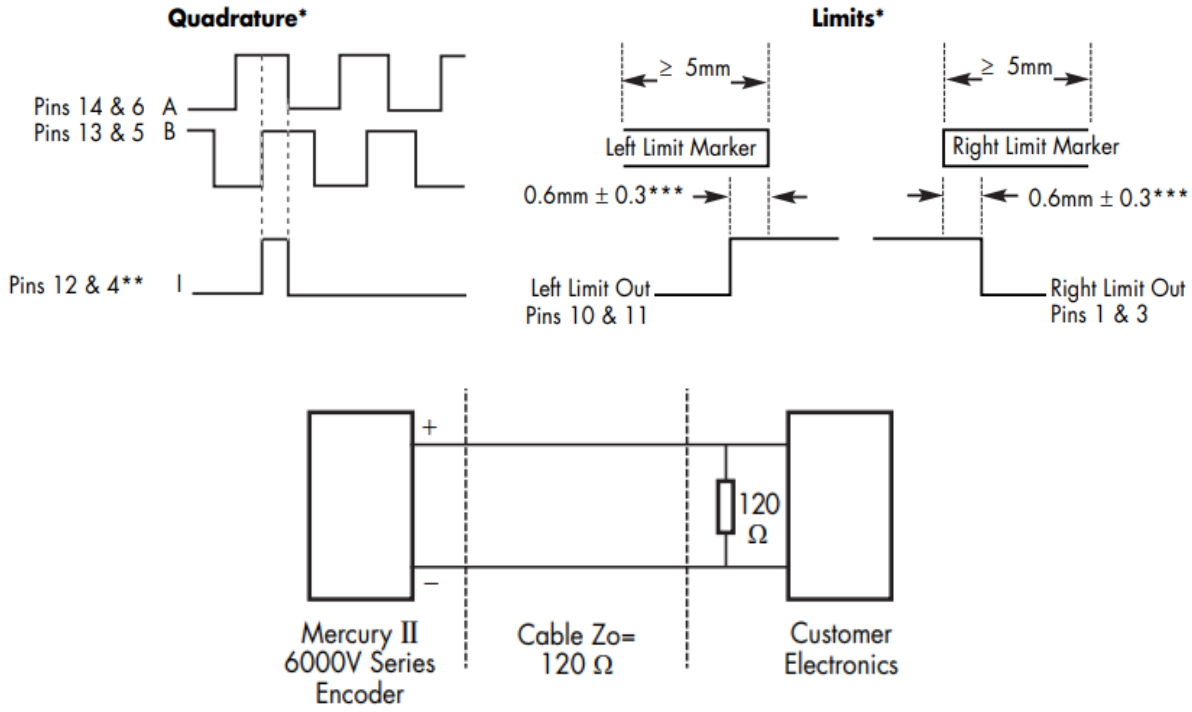




A.5.8.2 Operating and Electrical Specifications

Power Supply	5VDC ±5% @ 140mA (No outputs terminated) @ 180mA (A, B, I, and both limits terminated); 50mA at the sensor

A.5.8.3 Output Signals & Signal Termination for A quad B, Index and limits



*Output signals are differential. Inverse signals are not shown for clarity.

Note: At some interpolations values the index pulse may be aligned with other states of A or B than the ones shown. Above is with reference to the sensor's optical centerline.

A.5.8.4 Resolution

All closed loop stages are supplied with 20µm scales. The digital encoder module interpolates to a higher resolution as specified in the order. With a digital encoder an MMC controller has an achievable resolution of 2nm.