

PZS-90

Series



Elevation Stage Reference Manual

PZS-90

Elevation Stage

Reference Manual

Rev 2.02

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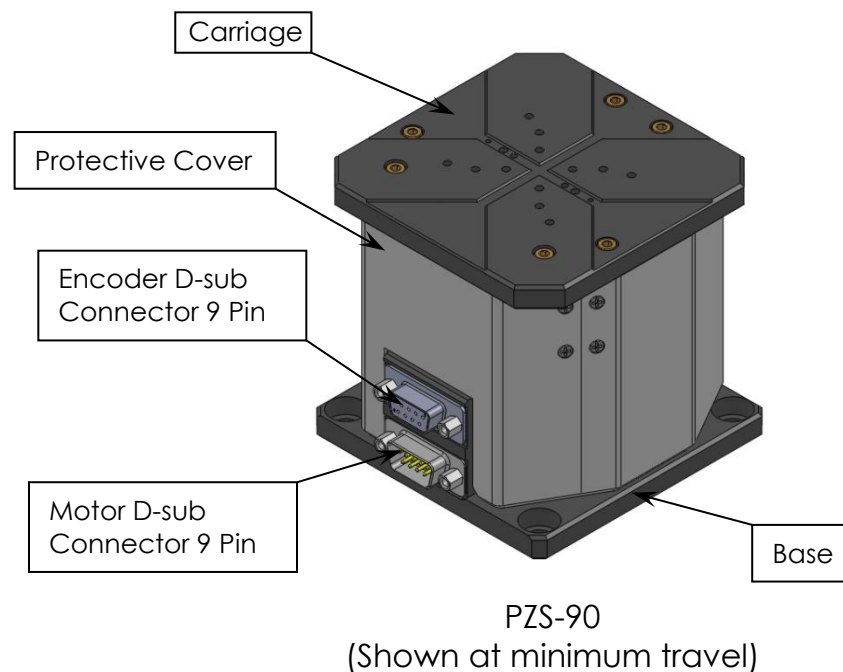
1. Introduction

1.1 Product Description

The PZS-90 with encoder is an elevation stage designed for limited space applications. Pre-loaded cross roller bearings allow for loads up to 15kg while providing high stiffness and smooth motion. A stepper motor with a leadscrew reduces backlash while allowing for a travel length of 35 mm. The PZS-90 allows for a highly rigid XZ or XYZ setup without the need for adapter brackets when combined with the VT-50L series & PPS-60 series of linear stages. Versions capable of operation in vacuum (10^{-6} mbar) are available. A 100 nm digital encoder provides the user with sub-micron repeatability, when paired with an MMC-200 controller.

Features:

- Travel range of 35mm
- Load capacity up to 15kg
- Integrated mechanical limit switches



1.2 Recommended Controllers

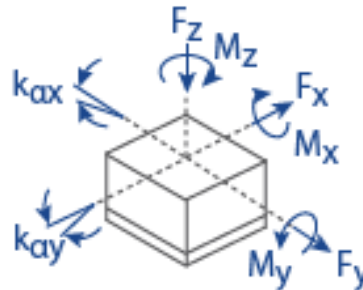
The following controllers are available from MICRONIX USA:

- MMC-200

1.3 Technical Data

Motor	SM-003
Lead Screw Pitch (mm)	1.0
Speed Max. (mm/sec)	10
Resolution Typical (μm)	0.5 (Open Loop); 0.1 (Closed Loop), 0.5 (Closed Loop Low Cost)
Bi-directional Repeatability (μm)	± 2 (Open Loop); ± 0.1 (Closed Loop); ± 1 (Closed Loop Low Cost)
Uni-directional Repeatability (μm)	0.5 (Open Loop); 0.1 (Closed Loop); 1 (Closed Loop Low Cost)

1.4 Load Characteristics



Load Characteristics	$F_{x(N)}$	$F_{y(N)}$	$F_{z(N)}$	$M_{x(Nm)}$	$M_{y(Nm)}$	$M_{z(Nm)}$	$k_{ax} \left(\frac{\mu\text{rad}}{N \cdot m} \right)$	$k_{ay} \left(\frac{\mu\text{rad}}{N \cdot m} \right)$
SM-003	75	75	150	50	50	100	50	50

2. Model Configurations

2.1 PZS-90 Order Numbers

Order No.	PZS-90-	1	1		1	
SM-003.....	1					
35 mm.....	1					
None.....	0					
Analog (1V _{pp}).....	2					
Digital (RS-422).....	3					
Digital low cost, 0.5μm.....	4					
Mechanical Limit Switch.....	1					
Atmospheric.....	0					
High Vacuum, 10 ⁻⁶ mbar.....	6					

Please contact MICRONIX USA for custom versions and stacking configurations.

3. Preparing to Install the PZS-90

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 $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$. 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 gases, excessive dust, 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:

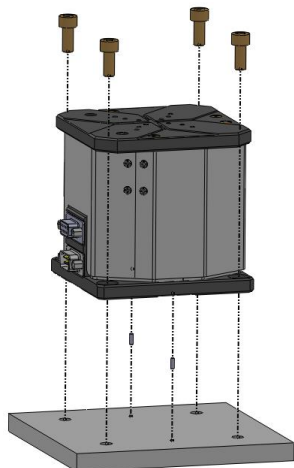
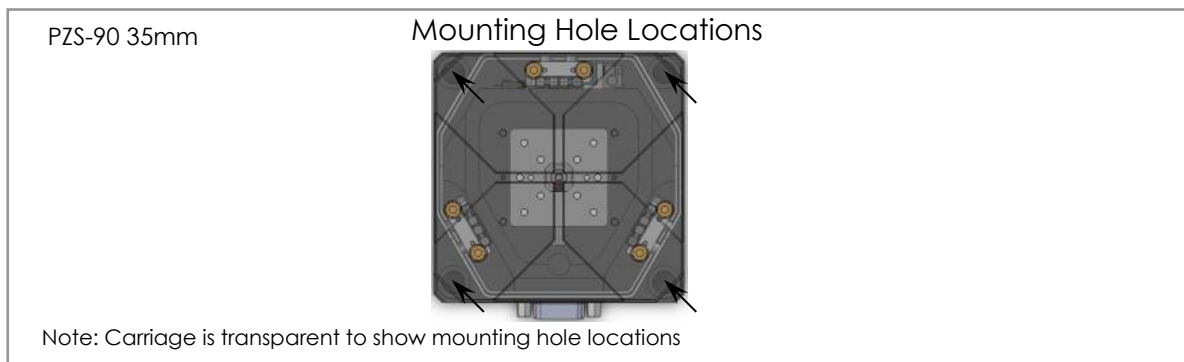
- PZS-90 Elevation Stage (with encoder)
- Reference Manual
- Any other previously agreed upon components such as a controller and cable

4. Installing the PZS-90

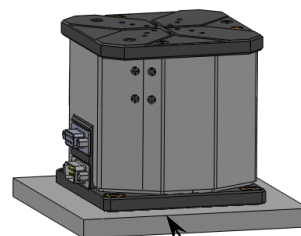
All mounting patterns require M6 or 1/4"-20 socket head cap screws for mounting and M2 x 6mm dowel pins for precision alignment. Additional brackets may be required for custom applications. Mounting holes fit both 1 inch and 25mm optical table hole layouts.

4.1 PZS-90 Installation

4.1.1 General Mounting



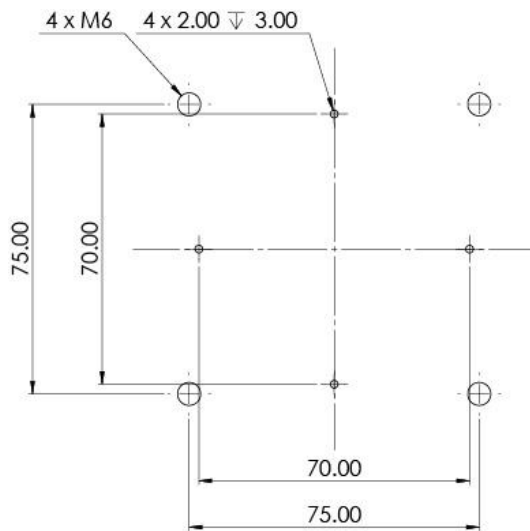
Requires:
2x M2 x 6mm Dowel Pins
4x M6 (1/4" -20) x 8mm Socket Head Cap Screws



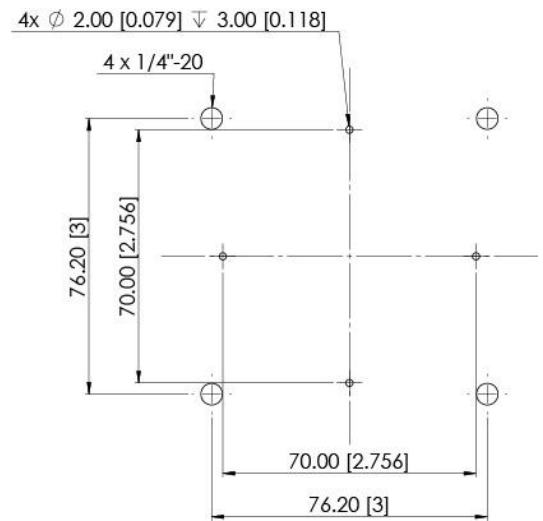
1. Insert Pins and M6 [or 1/4"-20] SHCS as shown. Use a M5 [or 3/16"] ball head allen key. Only 2 pins required, per mounting pattern shown below.

Customer supplied mounting surface

Metric Mounting Pattern

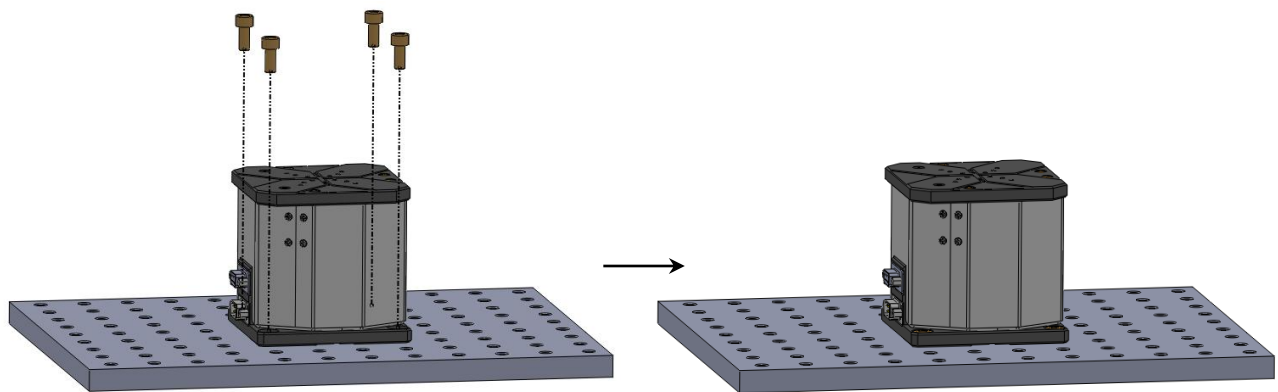


Imperial Mounting Pattern



4.1.2 Mounting to Metric Optical Table (25mm x 25mm spacing)

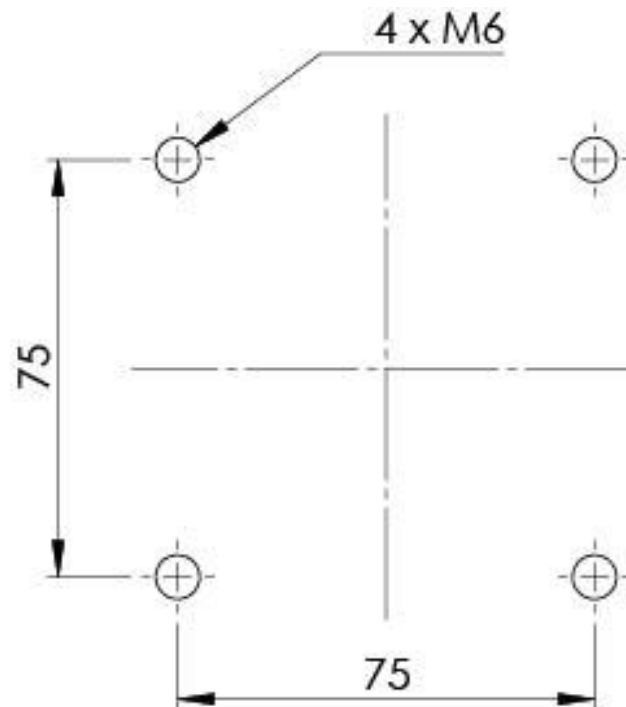
Requires:
4x M6 Socket Head Cap Screws



1. Insert four M6 SHCS as shown.
Use a M5 ball head allen key.

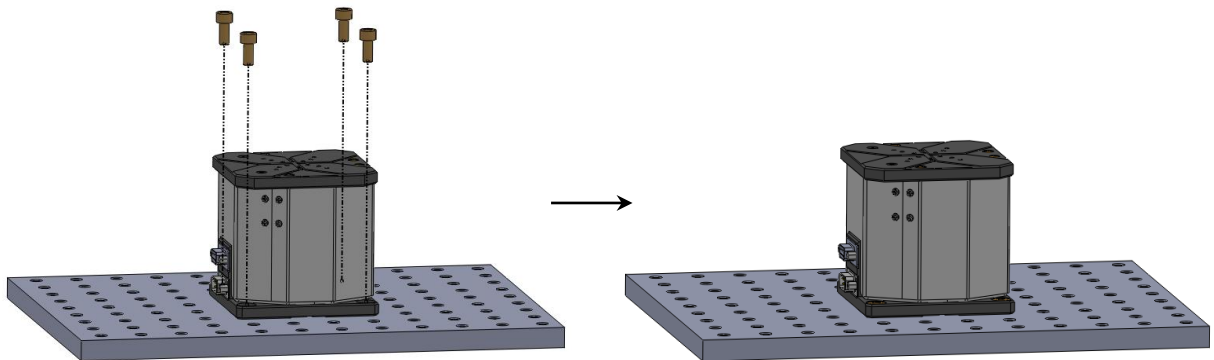
Metric Optical Table Mounting Pattern

- ♦ Assuming 25mm optical table hole spacing.
- ♦ Check manufacturing tolerances of the optical table for precision fit.



4.1.3 Mounting to Imperial Optical Table (1" x 1" spacing)

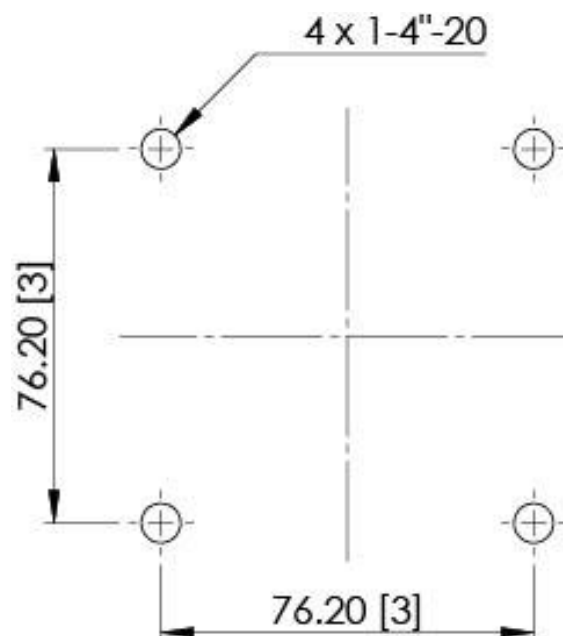
Requires:
4x 1/4"-20 Socket Head Cap Screws



1. Insert four 1/4"-20 SHCS as shown.
Use a 3/16" ball head allen key.

Imperial Base Mounting Pattern

- ♦Assuming 25.40mm [1 inch] optical table hole spacing.
- ♦Check manufacturing tolerances of the optical table for precision fit.

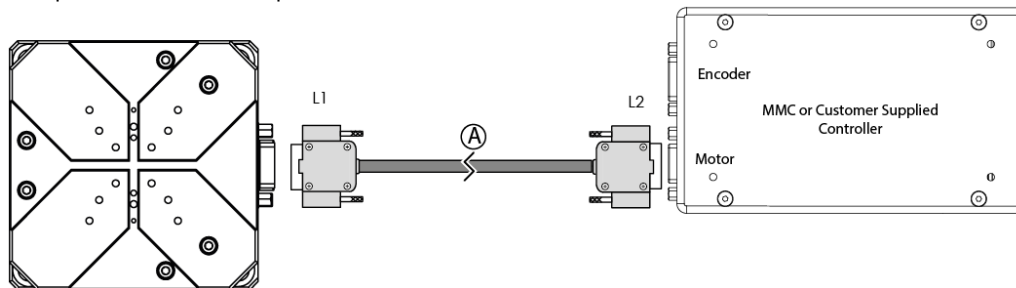


5. Connecting the PZS-90

5.1 Atmospheric Environments

5.1.1 Open Loop Installation & Wiring Diagram

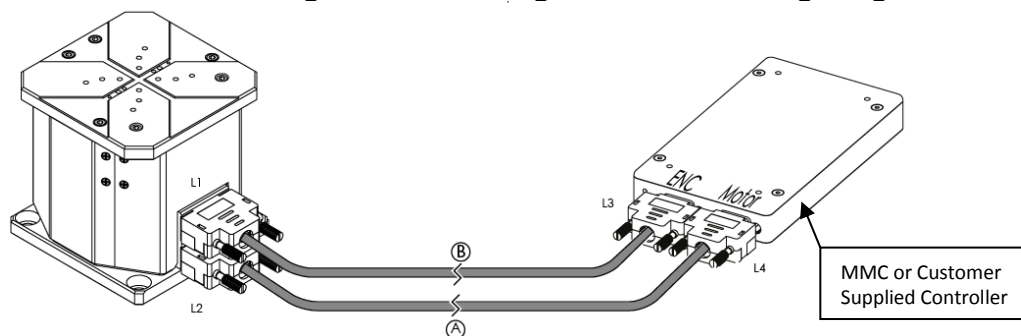
Connecting the PZS-90 in an open loop configuration only requires that the D-sub 9 Pin Motor Cable be connected to a compatible controller. No other cables or components are required.



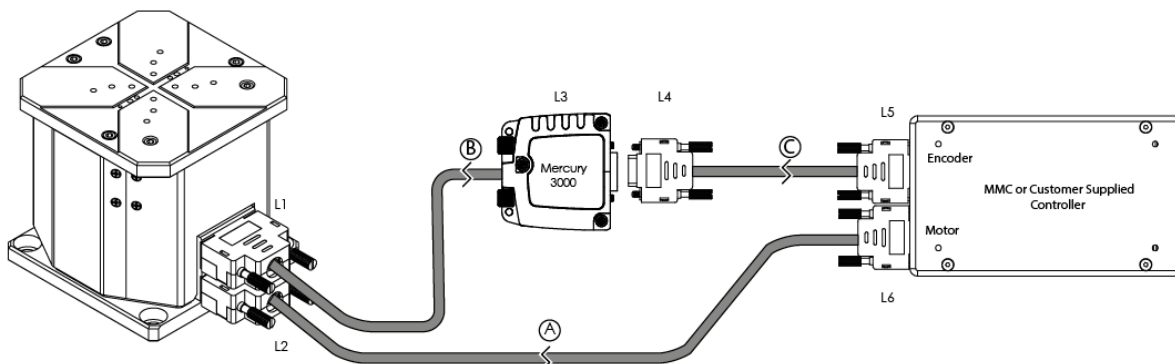
5.1.2 Closed Loop/Encoder Installation & Wiring Diagram

The PZS-90 stage with encoder requires a closed loop compatible controller that recognizes encoder feedback. Connect the stage as shown below in the *Encoder Wiring Diagram*.

5.1.2.1 Analog or Low-Cost Digital Encoder Wiring Diagram



5.1.2.2 Digital Encoder Wiring Diagram



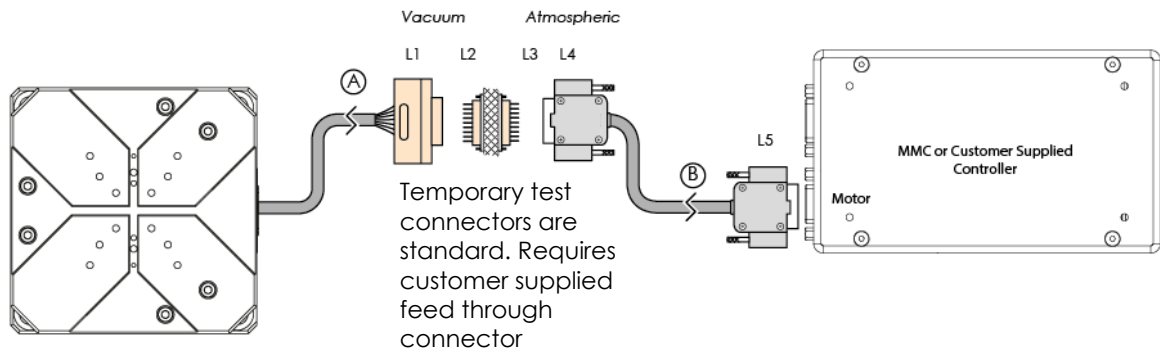
5.2 Vacuum Environments

5.2.1 Handling and Preparation

When preparing the stage for vacuum environments, take the necessary precautions (such as wearing gloves, clean room and clothing, etc.) when handling the stage as to avoid any contaminants. Maximum Bake-out temperature is 100°C. MICRONIX USA can supply the stage with vacuum compatible connectors: 9-pin female PEEK connectors for open loop, 15-Pin female PEEK connector for closed loop with analog encoder, and 15-pin female PEEK connector for closed loop with digital encoder.

5.2.2 Open Loop Installation & Wiring Diagram

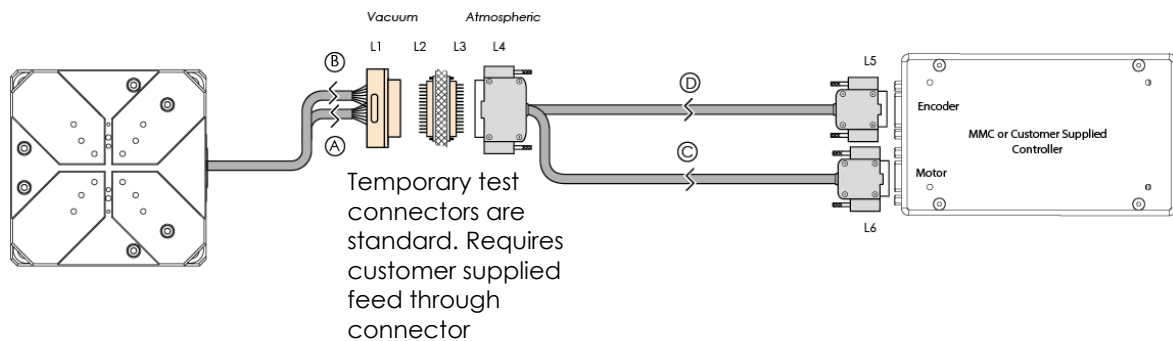
Connecting an open loop PZS-90 in a vacuum chamber requires the use of a feed through connector at the vacuum chamber wall. The vacuum compatible PZS-90 will be supplied with wiring for a straight through feed through not a cross over gender changer. MICRONIX USA supplies test connectors that simulate the vacuum feed through to allow for functionality testing prior to installation in a vacuum chamber. For details regarding the pin-out and feed through specifications see the Appendix A.2.



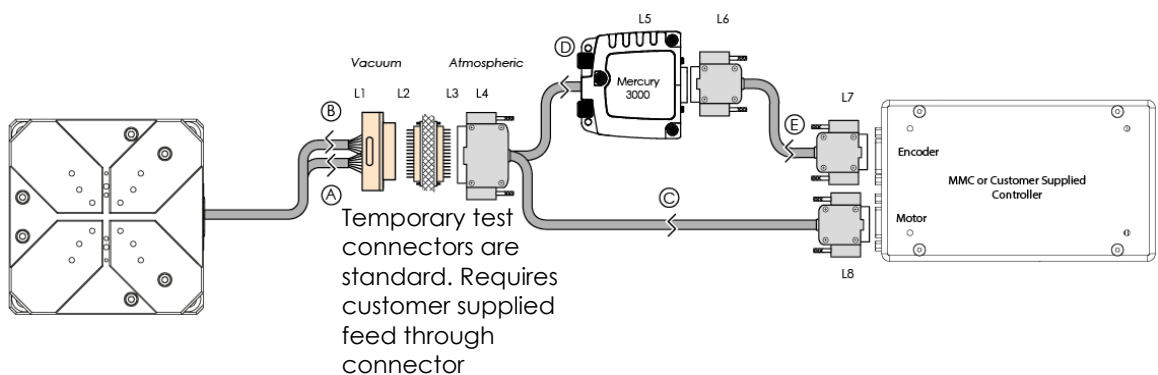
5.2.3 Closed Loop/Encoder Installation & Wiring Diagram

Installing the PZS-90 stage with encoder in vacuum environments requires an intermediate feed through connector at the vacuum chamber wall. Important: Match wire colors when connecting the encoder head (vacuum side) to the encoder module (atmospheric side). Also, connect the shield of the encoder head to the shield of the encoder module through the feed through connector. For details regarding the pin-out and feed through specifications see the Appendix A.3, A.4, A.5.

5.2.3.1 Analog Encoder Wiring Diagram

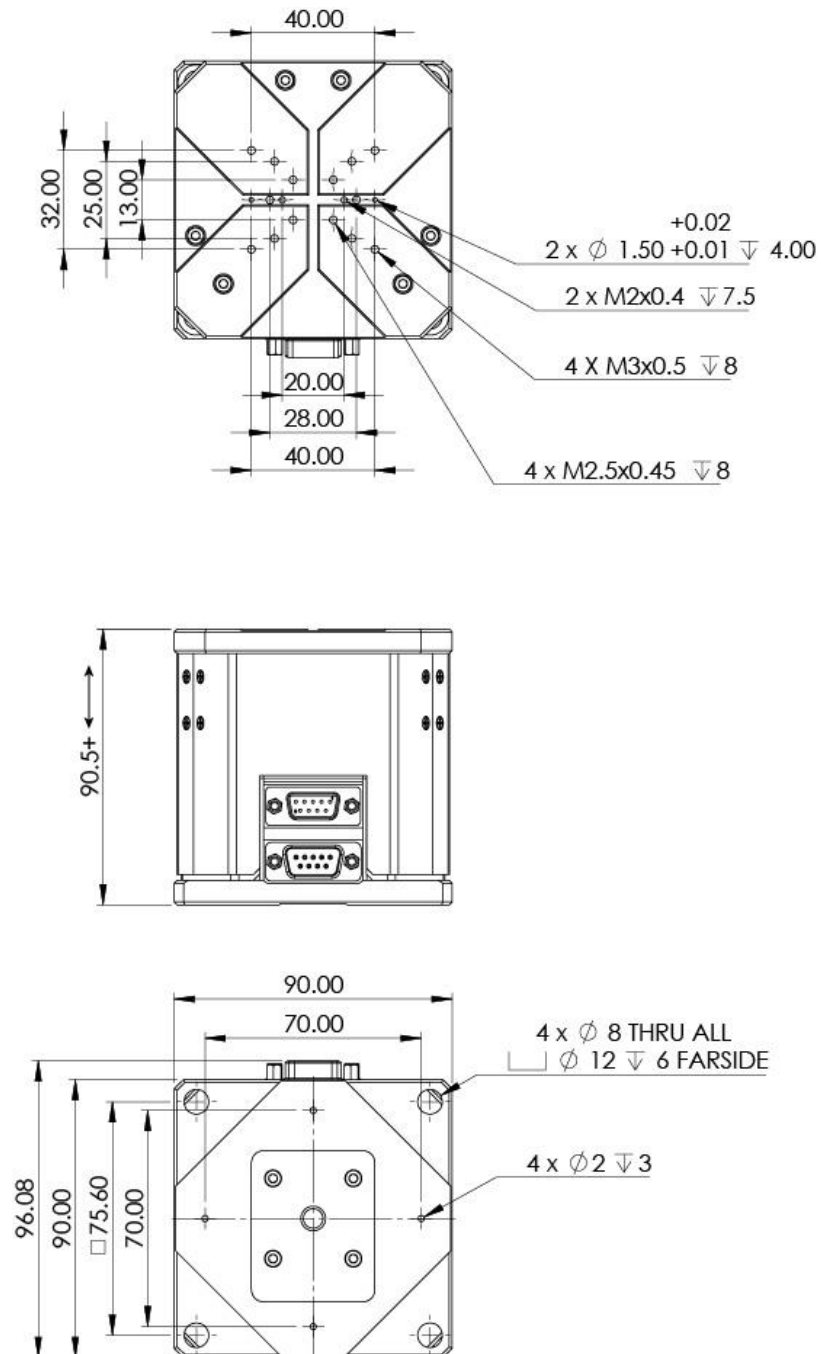


5.2.3.2 Digital Encoder Wiring Diagram



6. Dimensions

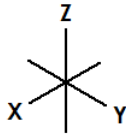
6.1 PZS-90 with Encoder



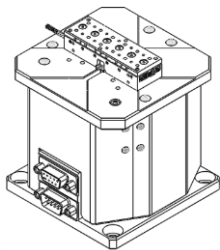
7. Stacking Configurations

7.1 Configuration Examples

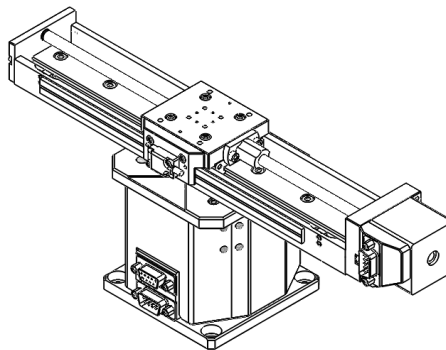
- Additional configurations available upon request
- Note: Stacking compatibility for all motor configurations.
- Positioning according to:



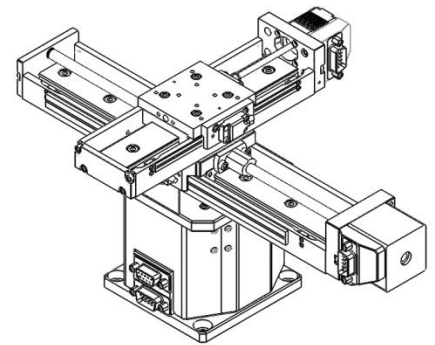
No Adapters



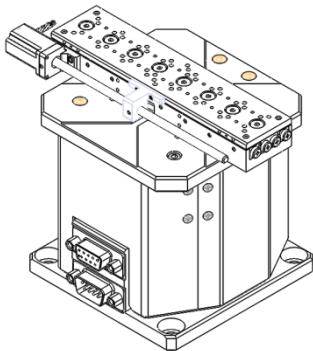
Y-Z 60x35mm
[with PPS-20 Linear Stage]



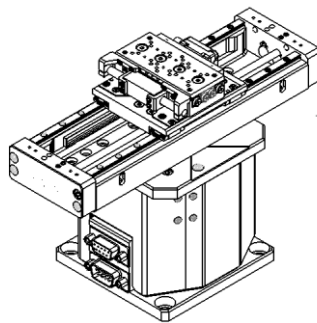
Y-Z 200x35mm
[with VT-50 Linear Stage]



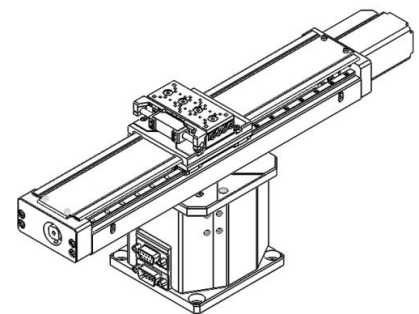
X-Y-Z 100x200x35mm
[with VT-50 Linear Stages]



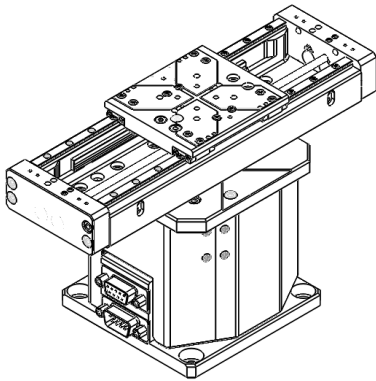
Y-Z 76x35mm
[with PPS-28 Linear Stage]



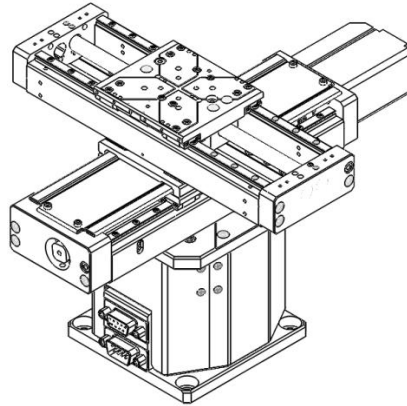
X-Y-Z 100x60x35mm
[with PPS-60 & PPS-28 Linear Stages]



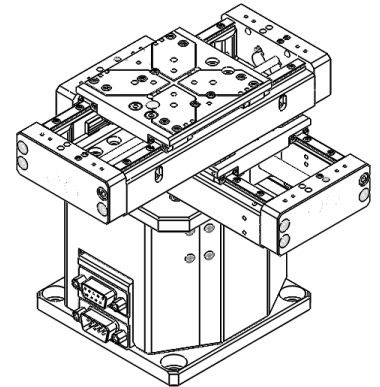
X-Y-Z 200x60x35mm
[with PPS-60 & PPS-28 Linear Stages]



X-Z 100x35mm
[with PPS-60 Linear Stage]

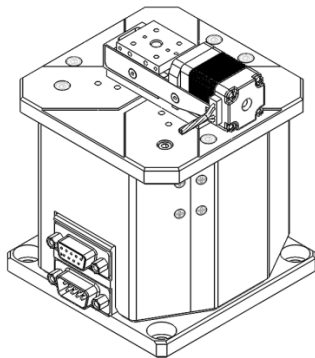


X-Y-Z 100x100x35mm
[with PPS-60 Linear Stages]

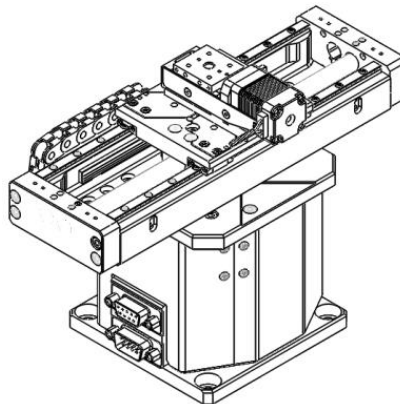


X-Y-Z Off-Center
50x50x35mm
[with PPS-60 Linear Stages]

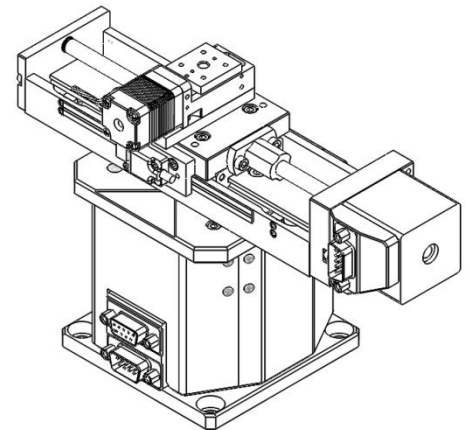
Using: XY Bracket (P/N 430169) & VT-21 Linear Stages



Y-Z 10x35mm



X-Y-Z 100x10x35mm
[with PPS-60 Linear Stage]



X-Y-Z 10x100x35mm
[with VT-50 Linear Stage]

8. Supplementary Information

7.1 Maintenance

- The PZS-90 elevation stage is a delicate 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.
- Do not touch or manually turn the leadscrew, as this will contaminate the lubrication and jeopardize the longevity of the stage.
- Use proper cable management to ensure a clean and safe operating environment.
- Properly wire the feedback to the controller before powering on the stage. 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 n-lbs.

A. Appendix

A.1 Technical Specifications

A.1.1 Electrical Connections

A.1.1.1 Standard Motor Pinout & Cable (Male D-sub 9)

Pin	Description
1	A+
2	A-
3	B+
4	B-
5	Ground
6	Limit +
7	Limit -
8	Not in Use
9	Not in Use

- ♦ For vacuum prepared wiring, blue may be substituted for green/white, and black for red/white.
- ♦ Limit Switch Common (pin 5) is connected to ground in MICRONIX USA controllers

A.1.1.2 Stepper Motor Specifications

Motor Type	2 Phase Bipolar
Phase Current	0.57 A max.
Step Angle	1.8 °
Steps	200
Coil-Resistance	8.8 Ohms
Coil-Inductance	13 mH
Pitch	1.0 mm/rev
Resolution/Full step	2.5 µm

A.1.1.3 Standard Encoder Pinout (Female D-sub 9)

MMC-100 (Female D-sub 9)	Description
1	A+ / Cos+
2	B+ / Sin+
3	Index+
4	GND
5	+5V
6	A- / Cos-
7	B- / Sin-
8	Index-
9	N/A

A.1.2 Limit Switches

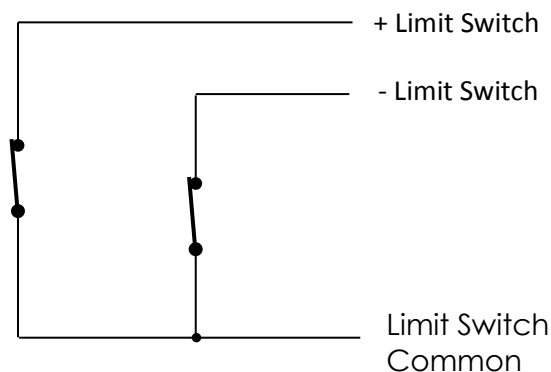
The limit switches are normally closed (when not activated) and should be connected to a compatible controller that recognizes these settings. A hard stop is designed into the PZS-90 body which will prevent the carriage from running away should the limit switches fail.

The limit switches are factory calibrated to ensure advertised travel length and cannot be adjusted by the customer. For custom travel lengths, please contact MICRONIX USA.

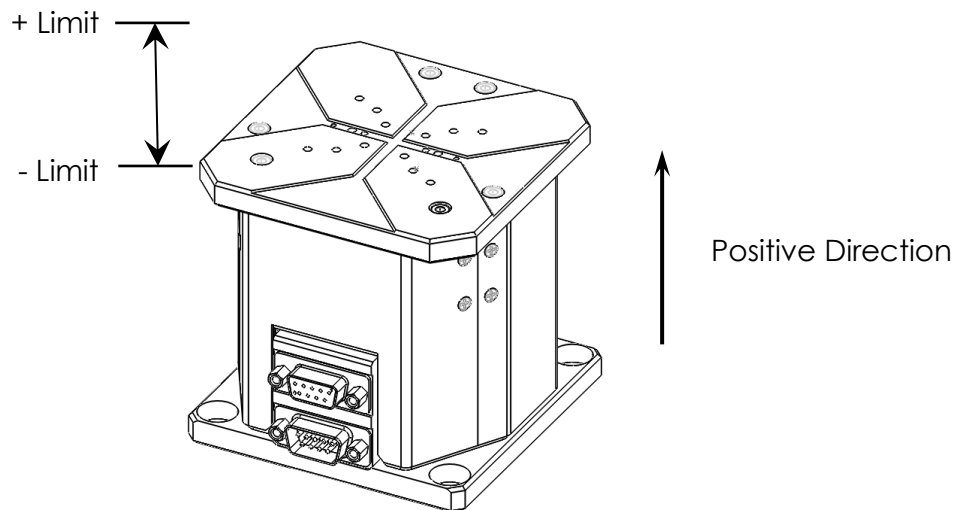
A.1.2.1 Mechanical Limit Switches

Contact Rating	100 mA @ 30 V
Contact Type	Normally Closed
Operating Temperature	-25 to +70 °C

A.1.2.2 Limit Switch Schematic



A.1.2.3 Direction of Motion

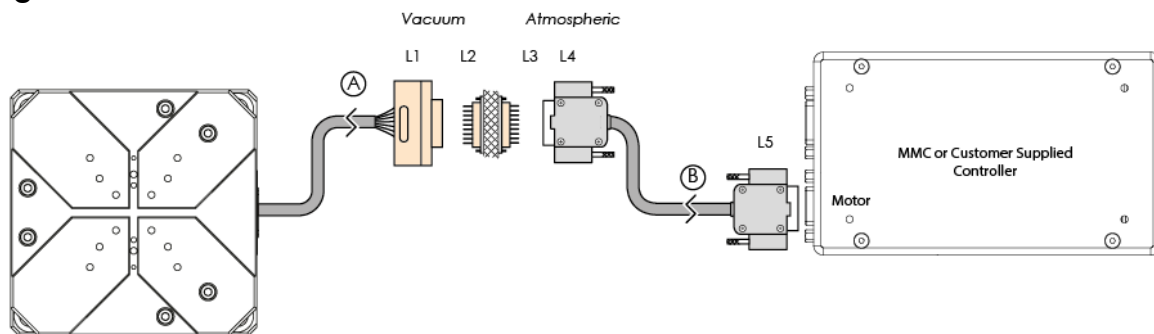


A.2 Open Loop Vacuum Wiring Diagram

Standard Cable Descriptions:

- A. PZS-90 Motor Cable - Vacuum Side (Female Dsub 9 Pin Peek Connector)
- B. Atmospheric Motor Connector (Female Dsub 9 Pin to Male Dsub9)

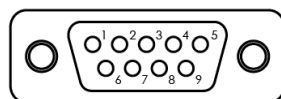
Wiring Diagram:



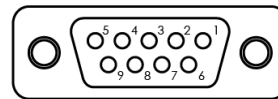
Connector Pinout

Description	Color	L1	L2	L3	L4	L5
Motor Phase A-	Green & White	5	5	1	1 (White - Green TP)	1
Motor Phase A+	Green	4	4	2	2 (Green)	2
Motor Phase B+	Red & White	3	3	3	3 (Black)	3
Motor Phase B-	Red	2	2	4	4 (Red)	4
Limit Ground	Brown	1	1	5	5 (Brown)	5
Limit Switch+	White	9	9	6	6 (White - Violet TP)	6
Limit Switch-	Violet	8	8	7	7 (Violet)	7
Shield	-	6	6	9	9 (Shield)	Casing

 -Motor

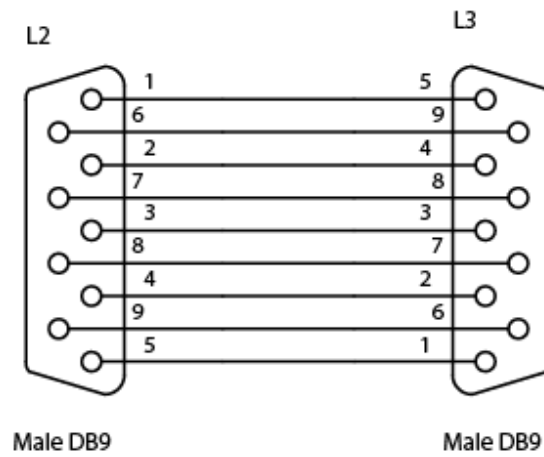


Female Dsub9 Connector - Rear View



Male Dsub9 Connector - Rear View

A.2.1 Straight Through 9-Pin Feed Through



A.3 Using an Analog Encoder

A.3.1 Analog Encoder Overview

A PZS-90 with Analog encoder will need to be paired with an appropriate controller. The MMC-200 has an Analog option. The PZS-90 with internal Analog encoder will be supplied with a 15-pin connector that incorporates both motor and encoder signals.

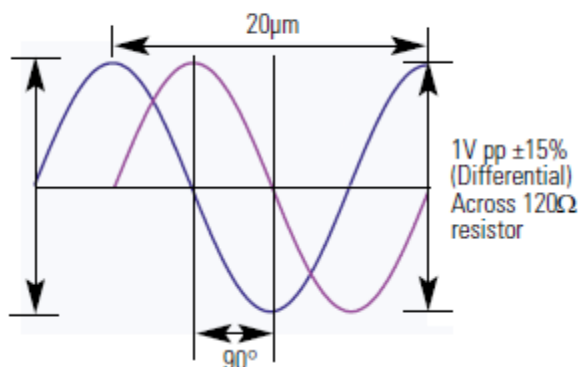
A.3.2 Encoder Pin-out

Pin	Color	Description
1	Brown	Cos+
2	Yellow	Sin+
3	Violet	Index +
4	Black	Ground
5	Red	+5V
6	Orange	Cos-
7	Green	Sin-
8	Blue	Index -
9	Not in Use	Not In Use

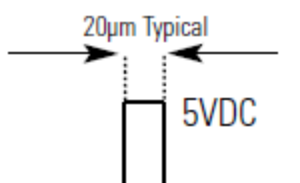
A.3.3 Operating and Electrical Specifications

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

A.3.4 Analog Output (Pins 1,2,6, and 7)



A.3.5 Index Window (Pins 3)



A.3.6 Resolution

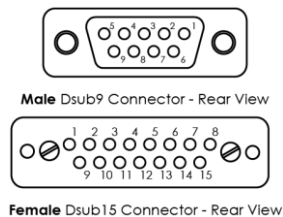
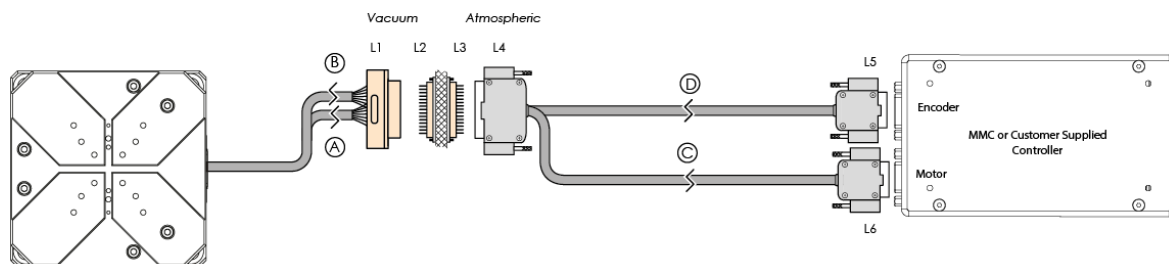
All closed loop stages are supplied with 20µm scales. The interpolation is done in the MMC-200 to a higher resolution as specified in the order. With an analog encoder the MMC-200 has an achievable resolution of 10nm.

A.3.7 Analog Encoder Wiring Diagram

Standard Cable Descriptions:


- A. PZS-90 Motor Cable - Vacuum Side > (Female Dsub 15 Pin Peek Connector)
- B. PZS-90 Encoder Cable - Vacuum Side
- C. Atmospheric Motor Connector (Female Dsub 15 Pin to Male Dsub9)
- D. Atmospheric Encoder Module (Female Dsub 15 Pin to Female Dsub9)


Wiring Diagram:



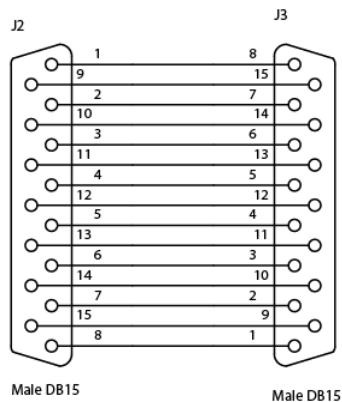
Connector Pinout

Description	Color	L1	L2	L3	L4	L5	L6
Motor Phase A-	Green & White	1	1	8	8 (Brwn & Brwn Wht TP)		1
Motor Phase B+	Red & White	2	2	7	7 (Vio & Vio Wht TP)		3
Limit Switch +	White	3	3	6	6 (Blue)		6
Enc Shield	Shield	4	4	5	5 (Shield)	Casing	
+5V	Red	5	5	4	4 (Red)	5	
Index+	Violet	6	6	3	3 (Violet)	3	
Cos+	Brown	7	7	2	2 (Brown)	1	
Sin-	Green	8	8	1	1 (White - Yellow TP)	7	
Motor Phase A+	Green	9	9	15	15 (Grn & Grn Wht TP)		2
Motor Phase B-	Red	10	10	14	14 (Yellow & Yellow Wht TP)		4
Limit Switch-	Violet	11	11	13	13 (White - Blue TP)		7
Ground	Brown	Black	12	12	12 (Black/Black)	4	5
Index-	Blue	13	13	11	11 (White - Violet TP)	8	
Cos-	Orange	14	14	10	10 (White - Brown TP)	6	
Sin+	Yellow	15	15	9	9 (Yellow)	2	

 -Encoder

 -Motor

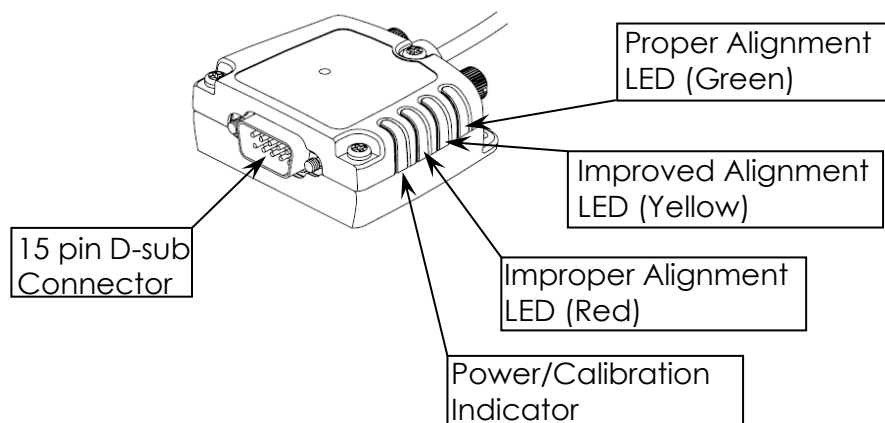
A.3.8 Straight Through 15-Pin Feed Through



A.4 Using the Encoder Module

When connected, the encoder module should display two green LED's indicating a power source and proper encoder alignment. A red or yellow LED indicates misalignment of the encoder head. If this occurs contact MICRONIX USA. Do not manually adjust the encoder head or scale. For more information refer to MicroE Systems Mercury Encoders

A.4.1 Encoder Module Overview



A.4.2 Encoder Module Pinout

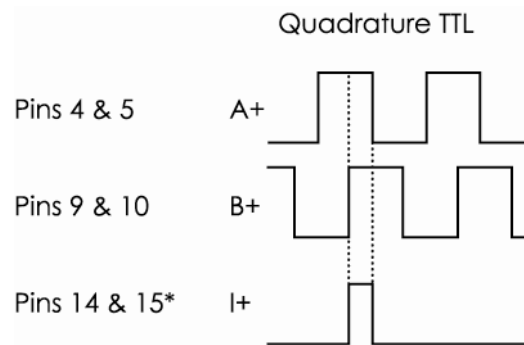
Pin	Description	Pin	Description
1	Reserved	9	B-
2	Transmit**	10	B+
3	Receive**	11	Alarm**
4	A-	12	+5V
5	A+	13	Ground
6	Reserved	14	Index +
7	Reserved	15	Index -
8	Reserved		

*Note: Proprietary pins reserved for manufacturer programming, not required to be connected to controller.

A.4.3 Operating and Electrical Specifications

Power Supply	5VDC $\pm 5\%$ @ 330mA (30mA for sensor)
Operating Temperature	0 to 70°C
Humidity	10 - 90% RH non-condensing

A.4.4 Output Signals



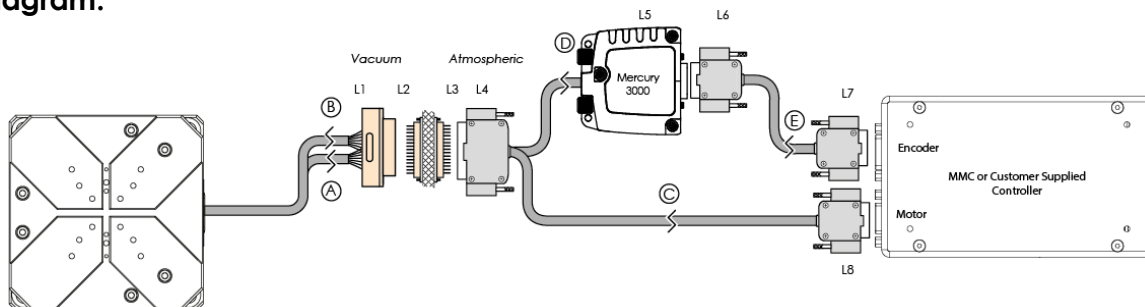
*Note: The index pulse may be aligned with A- or B- at some interpolation values.

A.4.5 Digital Encoder Wiring Diagram

Standard Cable Descriptions:

- A. PZS-90 Motor Cable - Vacuum Side
- B. PZS-90 Encoder Cable - Vacuum Side > (Female Dsub 15 Pin Peek Connector)
- C. Atmospheric Motor Cable (Female Dsub 15 Pin to Male Dsub9)
- D. Atmospheric Encoder Module Cable (Female Dsub 15 Pin to Mercury 3000 Interpolator Module)
- E. Encoder Module Adapter Cable (Female Dsub 15 to Female Dsub 9)

Wiring Diagram:

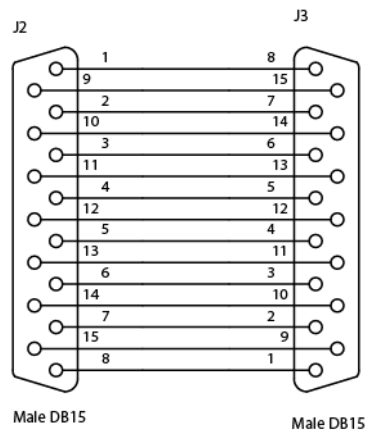


Connector Pinout

Description	Color	L1	L2	L3	L4	L8	
Motor Phase A-	Green & White	1	1	8	8 (Brwn & Brwn Wht TP)	1	-Encoder
Motor Phase B+	Red & White	2	2	7	7 (Vio & Vio Wht TP)	3	-Encoder
Limit Switch +	White	3	3	6	6 (Blue)	6	-Motor
Enc Shield	Shield	4	4	5	5 (Shield)		
+5V	Red	5	5	4	4 (Red)		
Index+	Violet	6	6	3	3 (Violet)		
Cos+	Brown	7	7	2	2 (Brown)		
Sin-	Green	8	8	1	1 (Green)		
Motor Phase A+	Green	9	9	15	15 (Grn & Grn Wht TP)	2	
Motor Phase B-	Red	10	10	14	14 (Yellow & Yellow Wht TP)	4	
Limit Switch-	Violet	11	11	13	13 (White - Blue TP)	7	
Ground	Black	12	12	12	12 (Black/Black)	5	
Index-	Blue	13	13	11	11 (Blue)		
Cos-	Orange	14	14	10	10 (Orange)		
Sin+	Yellow	15	15	9	9 (Yellow)		

♦ Note: For the pinout of cable E, refer to the appropriate MMC manual.

A.4.6 Straight Through 15-Pin Feed Through



A.5 Using a Micro Tape (Low Cost) Digital Encoder

A.5.1 Micro Tape Encoder Overview

The tri-color status LED in the sensor shows system status at all times.

Green = power is on, alignment is good. Blink off when passing over index.

Yellow = alignment not optimal, but encoder counting integrity is still good.

Red = alignment poor, discontinue use and realign sensor to scale.



Technical Specifications

Resolution	Linear: 0.5 μ m
Linearity	Tape Scale: $\leq \pm 8 \mu$ m/m
Outputs	A-quadr-B, Bidirectional Optical Index Pulse
Scales	Linear Tape
Grating Pitch	20 μ m
Maximum Speed	7200mm/s

A.5.2 Encoder Pin-out.

Pin	Function	Wire Color
1	A+	Brown
2	B+	Grey
3	Index +	Violet
4	Ground	Black
5	+5V	Red
6	A-	Orange
7	B-	White
8	Index -	Blue
9	Not in Use	Not in Use

A.5.3 Operating and Electrical Specifications

Power Supply	5VDC $\pm 5\%$ @ 95mA (40mA for sensor)
Operating Temperature	0 to 70°C
Storage	-20 to 85°C
Humidity	10 - 90% RH non-condensing

A.5.4 Output Signals

