ES-50PM

Series

Elevation Stage

Reference Manual

ES-50PM

Piezo Elevation Stage

Reference Manual

Rev 1.02

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Contents

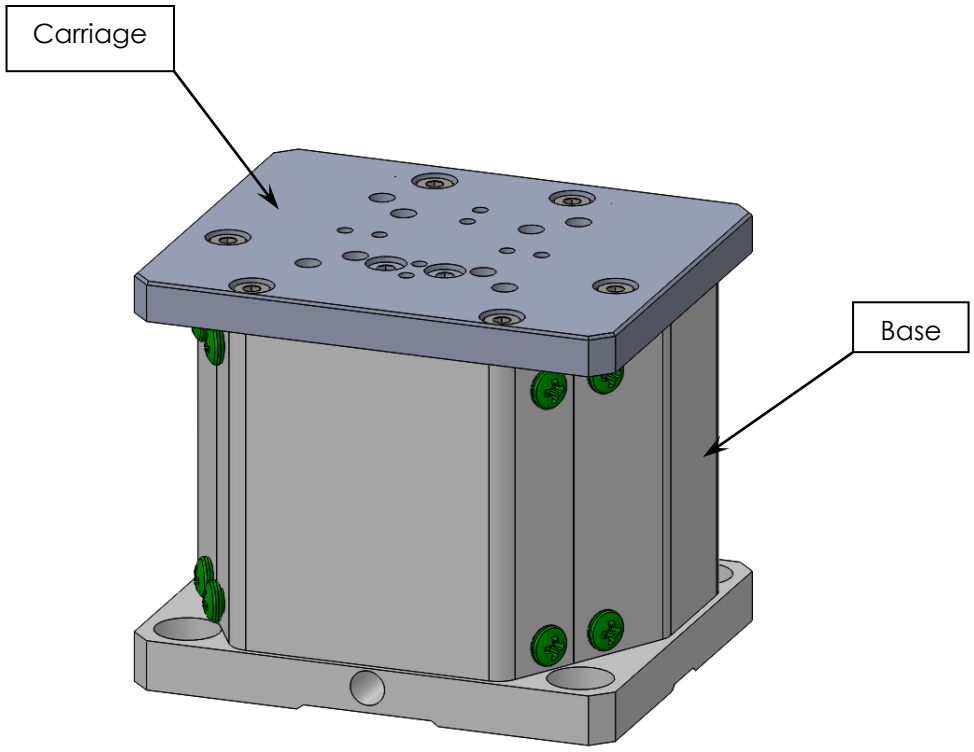
1. Introduction

1.1 *Product Description*

The ES-50PM is a piezo elevation stage designed for limited-space applications. ES-50Pm stage is driven by a patented multi-phase piezo motor. High stiffness and smooth motion are achieved through 3 cross roller bearings. These stages may be combined with the PPS-60, VT-50 series, and PPX-50 of linear stages to achieve a highly rigid XZ or XYZ setup without the need for adapter brackets. Vacuum (10^{-9} mbar) compatible versions are available.

Features:

- Travel range of 10 mm
- 2 nm closed loop encoder resolution
- Load capacity up to 1 kg
- Cross roller bearings
- Mechanical limit switch option
- Vacuum versions available



ES-50PM
(Shown in center position)

1.2 *Recommended Controller*

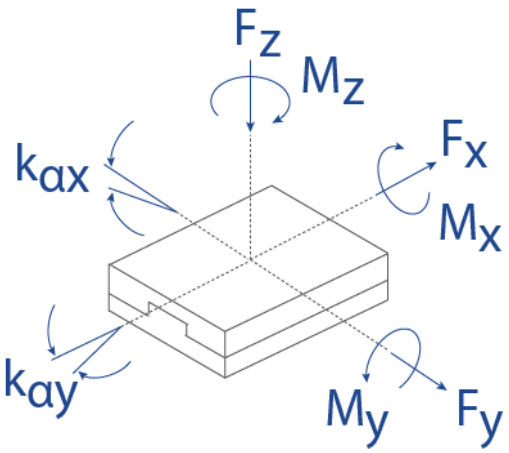
The following controller is available from MICRONIX USA:

- MMC-100
- MMC-110

1.3 *Technical Data*

Motor	PM-003
Speed Max. (mm/sec)	>1 (MMC-100), >5 (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)

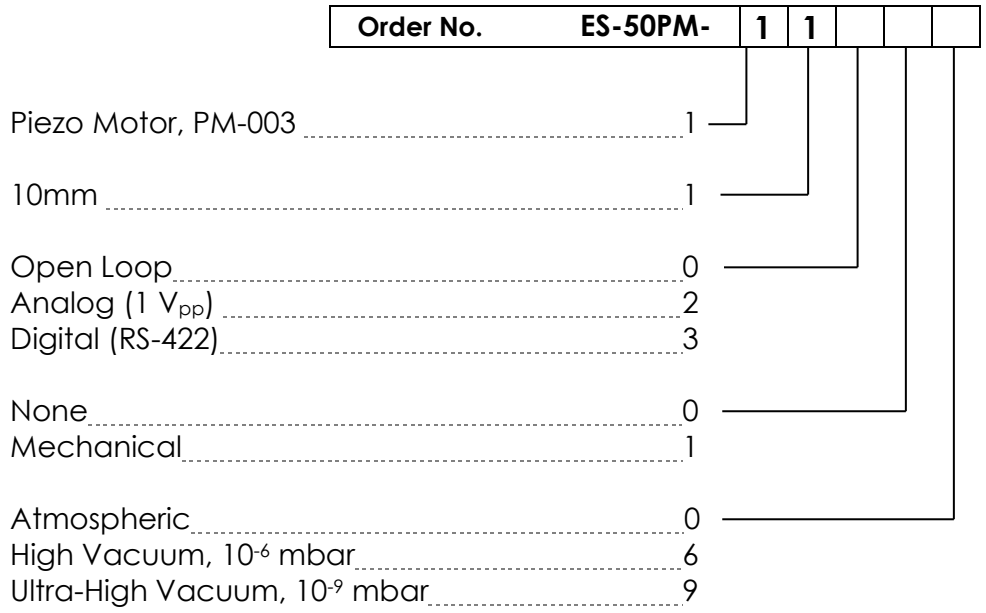
1.4 *Load Characteristics*



Load Characteristics	$Fx_{(N)}$	$Fy_{(N)}$	$Fz_{(N)}$	$Mx_{(Nm)}$	$My_{(Nm)}$	$Mz_{(Nm)}$	k_{ax} [µrad/Nm]	k_{ay} [µrad/Nm]
PM-003	5	5	10	1	1	1	-	-

2. Model Configurations

2.1 *ES-50PM Order Numbers*



Contact MICRONIX USA for custom versions and stacking configurations.

3. Preparing to Install the ES-50PM

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 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:

- ES-50PM Elevation Stage
- Reference Manual
- Any other previously agreed upon components such as a controller and cable

4. Installing the ES-50PM

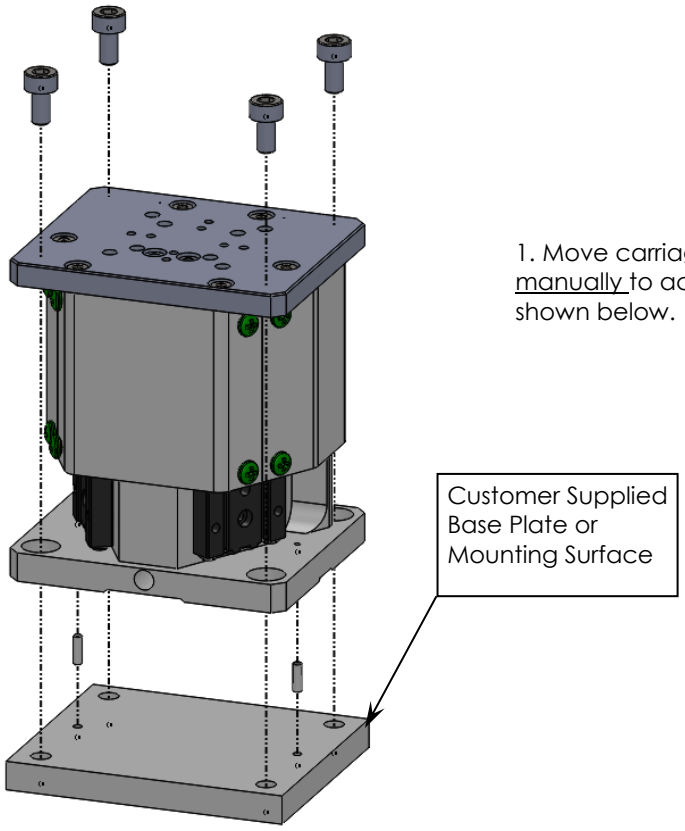
All mounting patterns require M3 screws for mounting and M1.5 x 4mm dowel pins for precision alignment. Additional brackets and screws may be needed for custom applications.

4.1 *ES-50PM Installation*

4.1.1 *General Mounting*

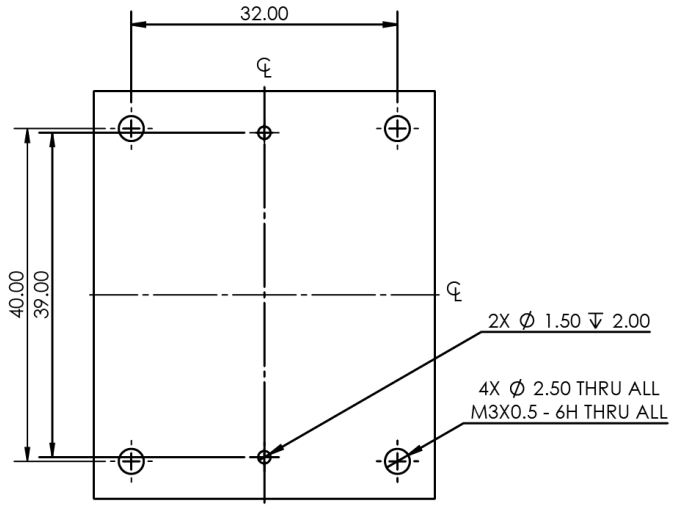
For general mounting configurations, mount the base to the mounting surface.

Requires:
2x M1.5 x 5mm Dowel Pins
4x M3 x 10mm Socket Head Cap Screws



1. Move carriage via controller or manually to access the mounting holes as shown below.

Top View
Stage Mounting Pattern



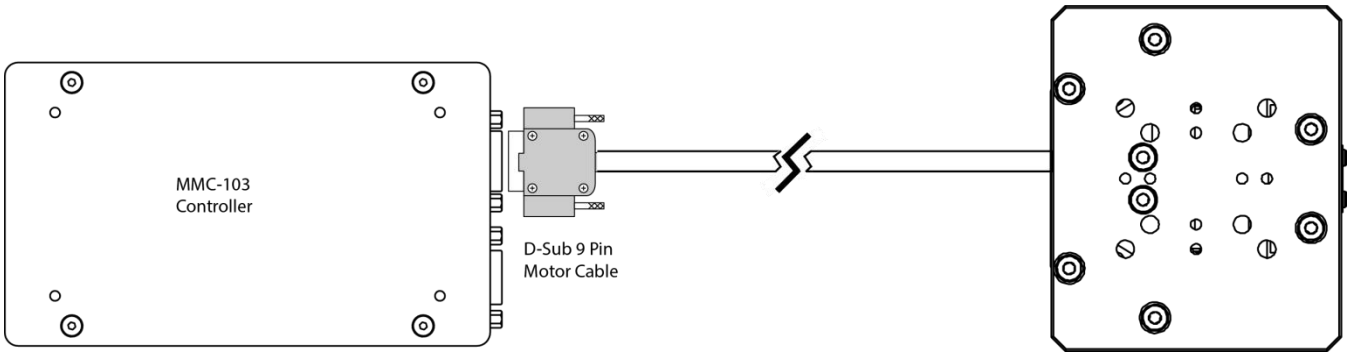
5. Connecting the ES-50 PM

5.1 *Atmospheric Environments*

For controller information refer to the appropriate MMC controller manual.

5.1.1 *Open Loop Installation & Wiring Diagram*

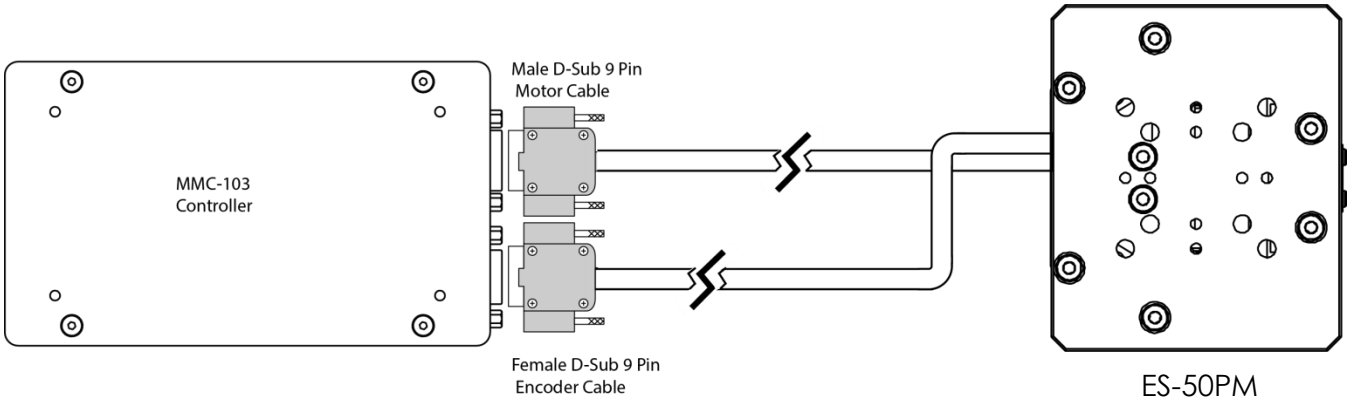
Connecting the ES-50PM in an open loop configuration only requires that the D-sub 9 Pin Motor Cable be connected to a compatible controller. No other cables or components are needed.



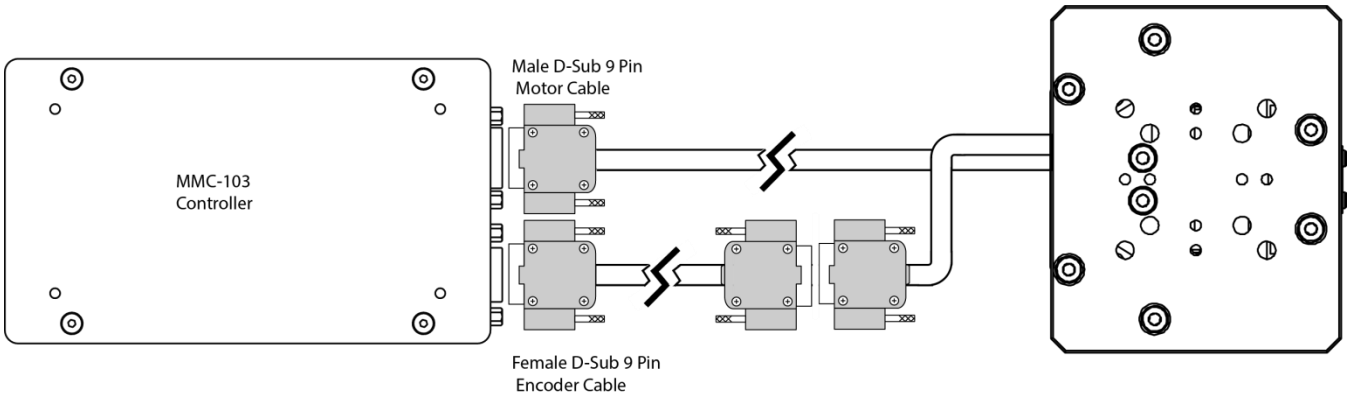
5.1.2 *Closed Loop/Encoder Installation & Wiring Diagram*

Using the ES-50PM stage with an encoder requires a closed loop compatible controller that recognizes encoder feedback.

5.1.2.1 *Wiring Diagram for Atmospheric System with Analog Encoder*



5.1.2.1 *Wiring Diagram for Atmospheric System with Digital Encoder*



5.2 *Vacuum Environments*

5.2.1 *Handling and Preparation*

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

5.2.2 *Open loop Installation & Wiring Diagram*

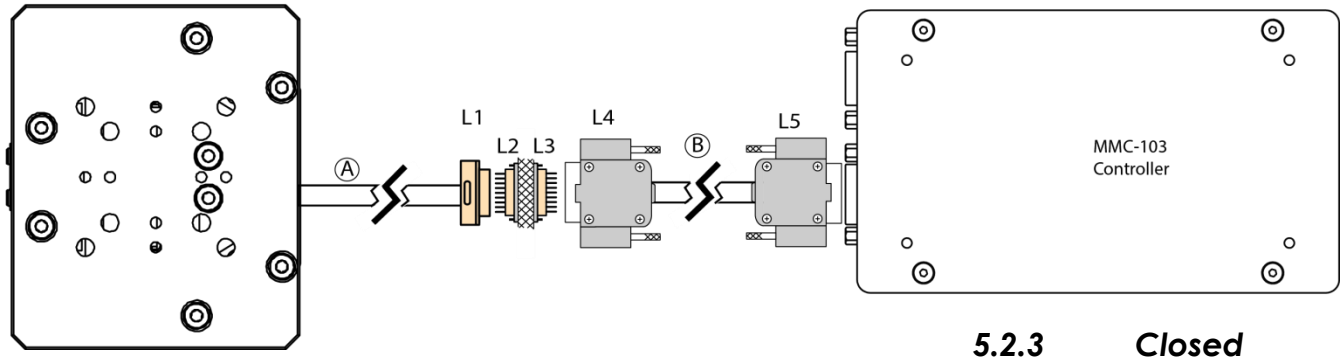
Connecting an open loop ES-50PM in a vacuum chamber requires the use of a feed through connector at the vacuum chamber wall. The vacuum compatible ES-50PM will be supplied with wiring for a straight through feed through not a cross over gender changer. MICRONIX USA supplies test connectors that simulate the vacuum feed through to allow functionality

test prior to installation in a vacuum chamber. For details regarding the pin-out and feed through specifications see the Appendix A.3.

Standard Cable Description:

A. ES-50PM, Vacuum Motor Cable (Female Dsub 9 Pin. 1.5m)
B. Atmosperic Motor Cable (Female to Male Dsub 9 Pin, 1.5m)

Wiring Diagram:



5.2.3 Closed Loop/Encoder Installation & Wiring Diagram

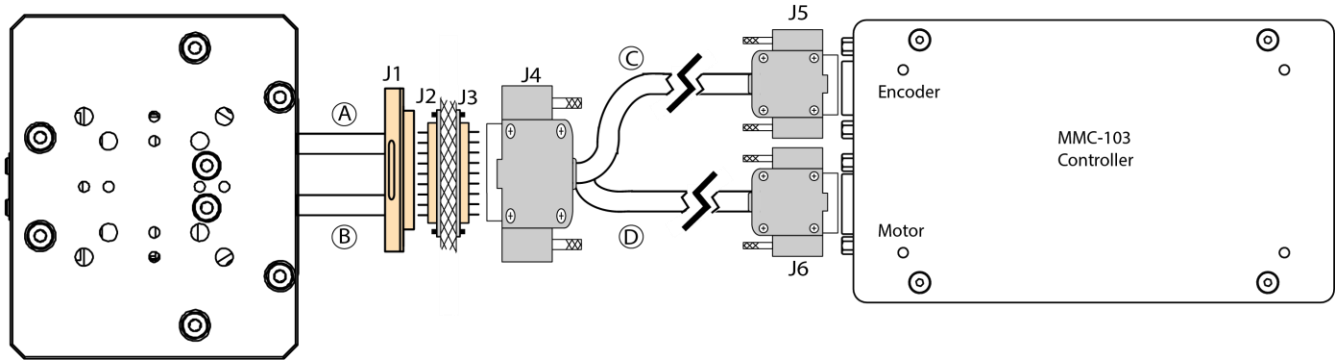
Closed loop installation of the ES-50PM stage in vacuum environments requires the use of a feed through connector at the vacuum chamber wall. The vacuum compatible ES-50PM will be supplied with wiring for a straight through feed through not a cross over gender changer. MICRONIX USA supplies test connectors that simulate the vacuum feed through to allow functionality test prior to installation in a vacuum chamber. For details regarding the pin-out and feed through specifications see the Appendix A.4.

5.2.3.1 Wiring Diagram for System with Analog Encoder

Standard Cable Description:

A. ES-50PM, Motor Cable - Vacuum Side (Female Dsub 9 Pin. 1.5m)
B. ES-50PM, Encoder Cable - Vacuum Side (Female Dsub 9 Pin. 1.5m)
C. Encoder Cable (Female Dsub 15 Pin to Female Dsub 9 Pin, 1.5m)
D. Motor Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m)

Wiring Diagram:



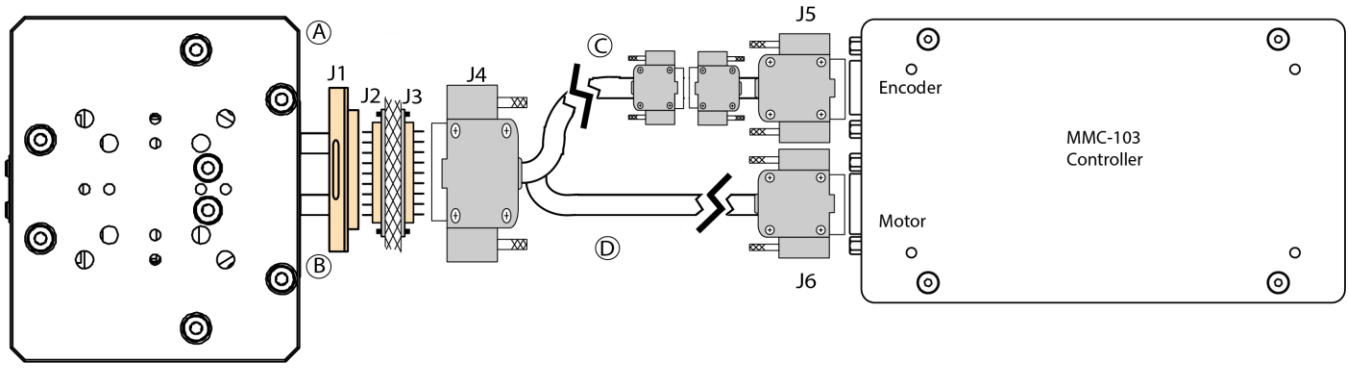
ES-50PM

5.2.3.2 Wiring Diagram for System with Digital Encoder

Standard Cable Description:

A. ES-50PM, Motor Cable - Vacuum Side (Female Dsub 9 Pin. 1.5m)
B. ES-50PM, Encoder Cable - Vacuum Side (Female Dsub 9 Pin. 1.5m)
C. Encoder Cable (Female Dsub 15 Pin to Female Dsub 9 Pin, 1.5m)
D. Motor Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m)

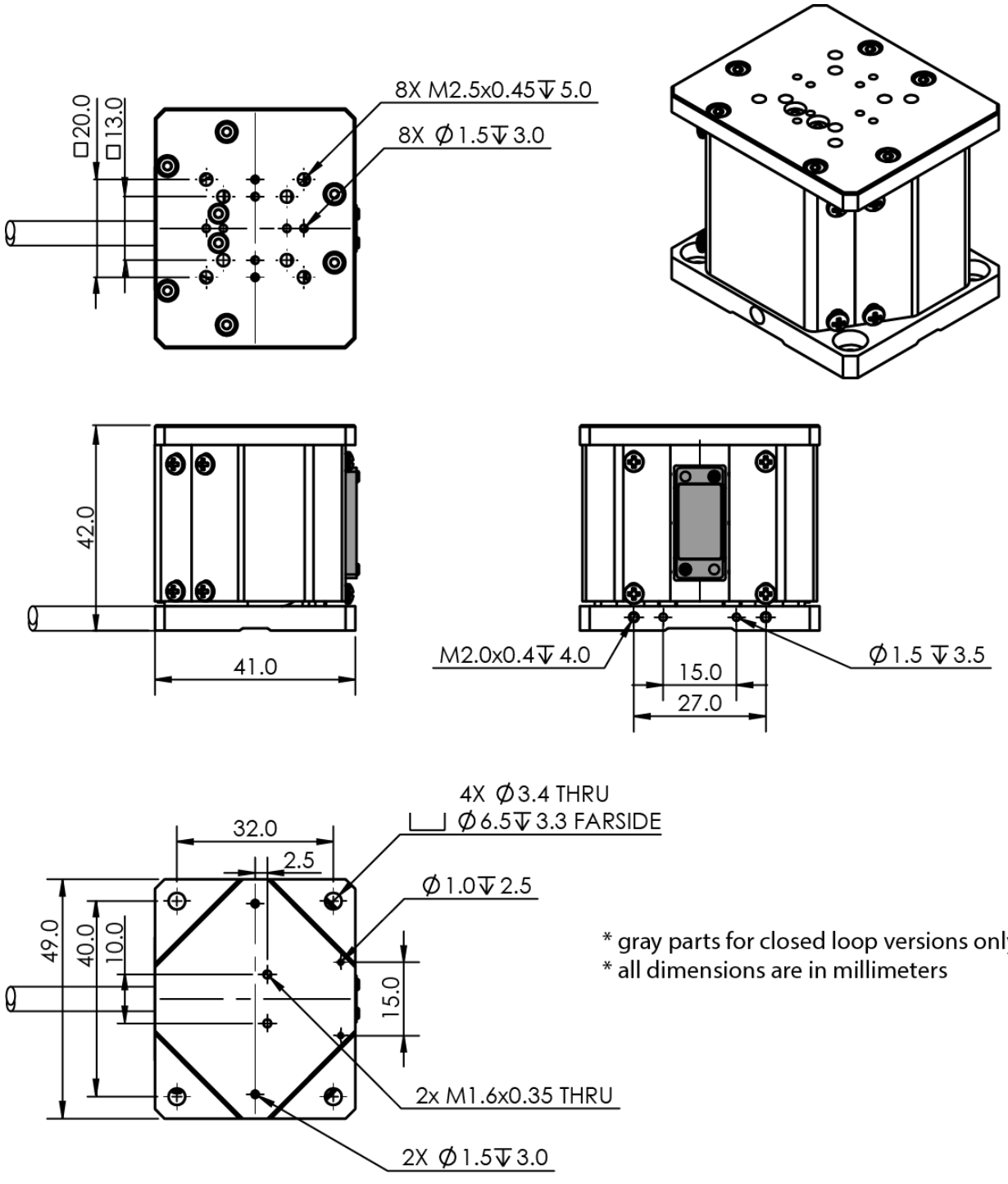
Wiring Diagram:



ES-50PM

6. Technical Specifications

6.1 *Dimensions*

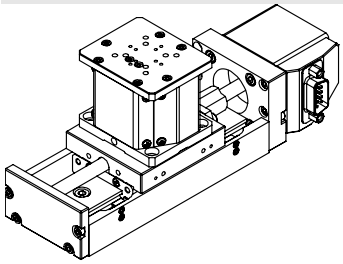


* gray parts for closed loop versions only
* all dimensions are in millimeters

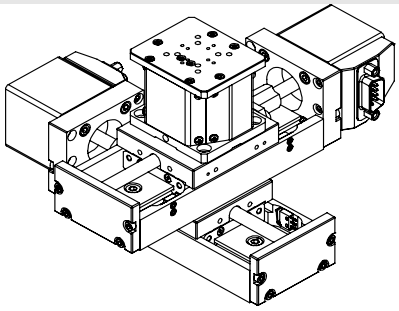
7.Stacking Configurations

7.1 *Possible Configurations*

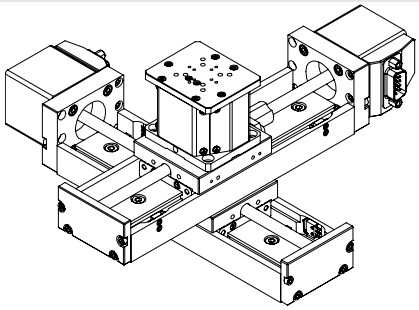
Using the ES-50PM Elevation Stage and VT-50 Linear Stage



X-Z 55x10 mm

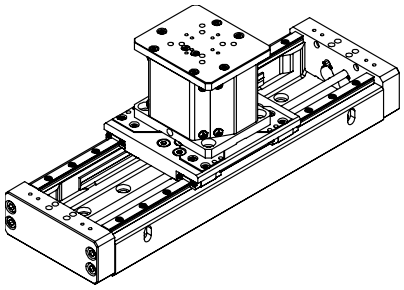


X-Y-Z 55x55x10 mm

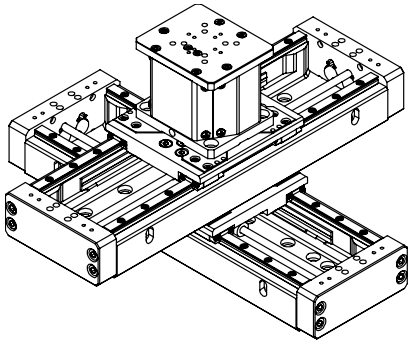


X-Y-Z 100x100x10 mm

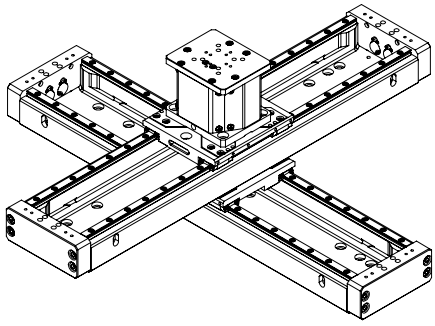
Using the ES-50PM Elevation Stage and PPS-60 Precision Stage



X-Z 100x10 mm

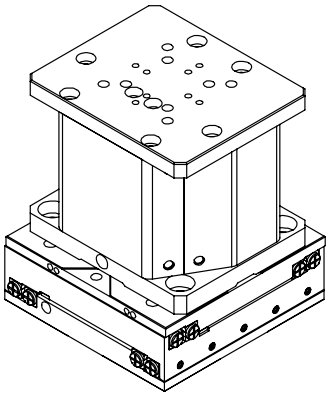


X-Y-Z 100x100x10 mm



X-Y-Z 200x200x10 mm

Using the ES-50PM Elevation Stage and PPX-50 Piezo Positioner Cross Stage



X-Y-Z 28x28x10 mm

Other Combinations available on request

8. Supplementary Information

8.1 *Maintenance*

- The ES-50PM series of elevation 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 ES-50PM elevation 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 Section 3.1 *Installation Preparation* requirements and use proper cable management to ensure a clean and safe operating environment.

8.2 *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.

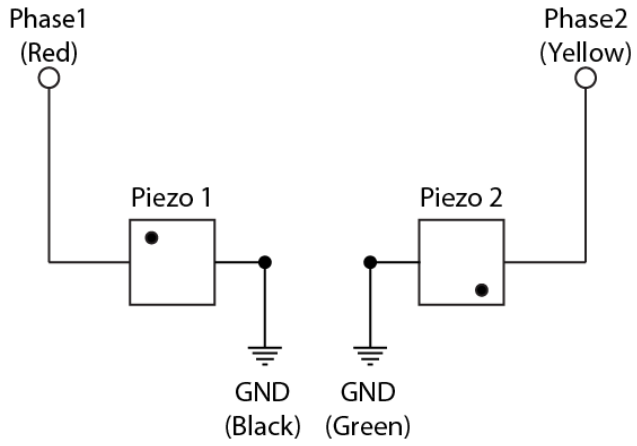
A. Appendix

A.1 DB-9 Male Motor Connector

Pin	Description	Color*
1	Phase 1, Motor 1	Red
	Phase 1, Motor 2	Blue
2	Phase 2, Motor 1	Yellow
	Phase 2, Motor 2	Orange
5	Phase 1 GND, Motor 1	Black
	Phase 1 GND, Motor 2	Green
	Phase 2 GND, Motor 1	Violet
	Phase 2 GND, Motor 2	Brown

* 8 Conductor, Silver Braided Copper Cable. Colors may differ for custom wiring.

A.2 Phase Piezo Motor Wiring Diagram

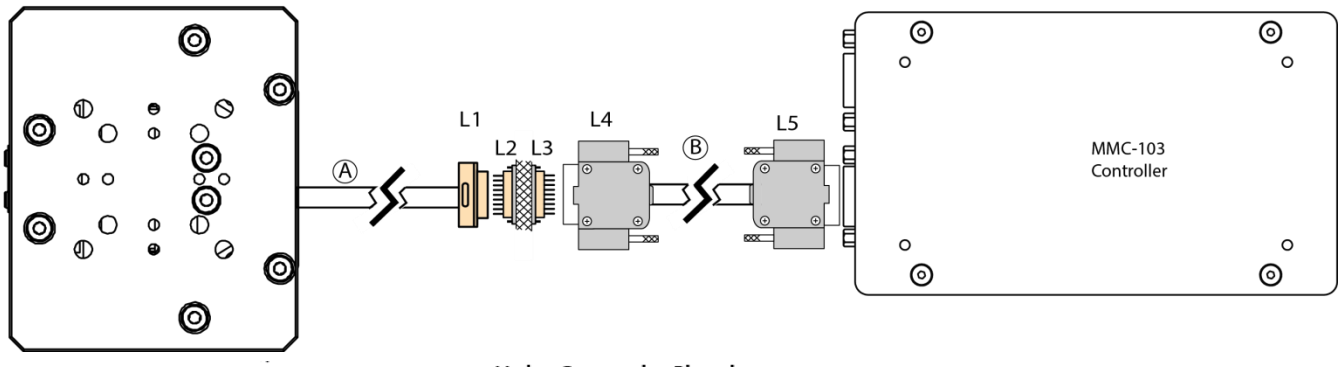


A.3 Open Loop Vacuum Wiring Diagram

Standard Cable Description:

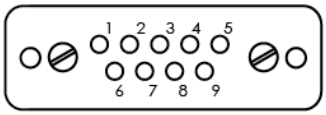
A. ES-50PM, Vacuum Motor Cable (Female Dsub 9 Pin. 1.5m)
B. Atmosperic Motor Cable (Female to Male Dsub 9 Pin, 1.5m)

Wiring Diagram:

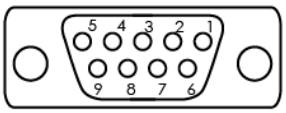


Motor Connector Pinout

Description:	L1	L2	L3	L4	L5
Phase1	8	8	1	1	1
Phase2	7	7	2	2	2
GND	4	4	5	5	5
Shield	3	3	6	6	9



Female Dsub9 Connector - Rear View

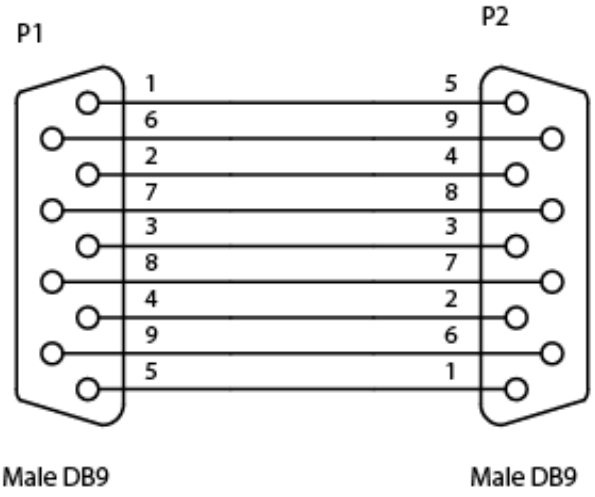


Male Dsub9 Connector - Rear View

Motor Connector Pin Out

Description:	L1	L2	L3	L4	L5
Phase 1	5	5	1	1	1
Phase 2	4	4	2	2	2
Ground	1	1	5	5	5
Shield	6	6	9	9	9

A.3.1 Straight Through 9-Pin Feed Through



Using an Analog Encoder

A.4.1 Analog Encoder Overview

An ES-50-PM with Analog encoder will need to be paired with an appropriate controller. The MMC-100 has an Analog option. The ES-50PM with an analog encoder will be supplied with a 15-pin connector that incorporates both motor and encoder signals.

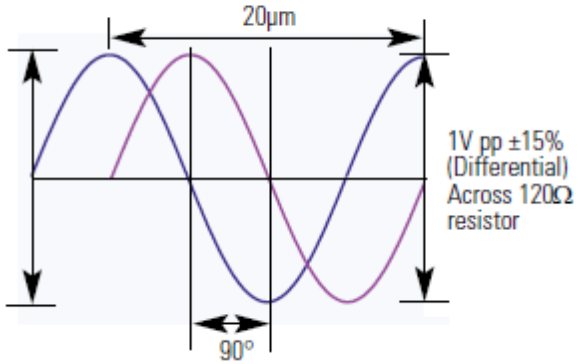
A.4.2 Encoder Pin-Out

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

A.4.3 Operating and Electrical Specifications

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

A.4.4 Analog Output (Pins 1,2,6, and 7)

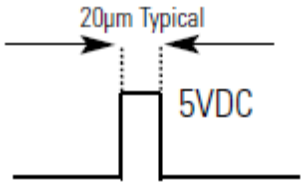


A.4.5 Index Window (Pins 3)

A.4.6 Resolution

Interpolation done in controller to a higher resolution as specified in the order. With an analog encoder the MMC-100 has an achievable Resolution down to 44µ°.

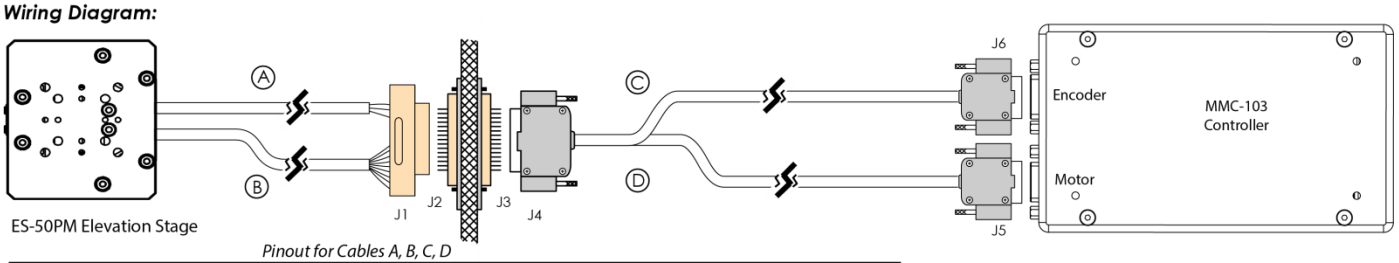
A.4.7 Closed Loop Vacuum Wiring Diagram



Standard Cable Descriptions:

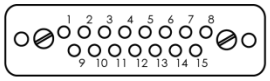
- (A) ES-50PM Motor Cable (Female Dsub 15 Pin, 1.5m)
- (B) ES-50PM Encoder Cable (Female Dsub 15pin, 1.5m)
- (C) Encoder Cable (Female Dsub 15 Pin to Male Dsub 15 Pin Encoder Module, 1.0m)
- (D) Motor Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m)

Wiring Diagram:

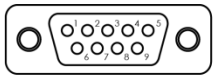


Pinout for Cables A, B, C, D

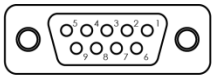
Description:	Color	J1	J2	J3	J4	J5	J6
Phase 1, Motor 1	Red	1	1	8	8 (Red)	1	
Phase 1, Motor 2	Blue	1	1	8	8 (Red)	1	
Phase 2, Motor 1	Yellow	2	2	7	7 (White-Green TP)	2	
Phase 2, Motor 2	Orange	2	2	7	7 (White-Green TP)	2	
Phase 1 GND, Motor 1	Red&Black	5	5	4	4 (Black&Green)	5	
Phase 1 GND, Motor 2	Blue&Violet	5	5	4	4 (Black&Green)	5	
Phase 2 GND, Motor 1	Yellow&Green	5	5	4	4 (Black&Green)	5	
Phase 2 GND, Motor 2	Orange&Brown	5	5	4	4 (Black&Green)	5	
Ground	Black/Green	9	9	15	15 (Black&Green)	5	
Shield	-	10	10	14	14 (Shield)	Casing	
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



Female PEEK Dsub15 Connector - Rear View

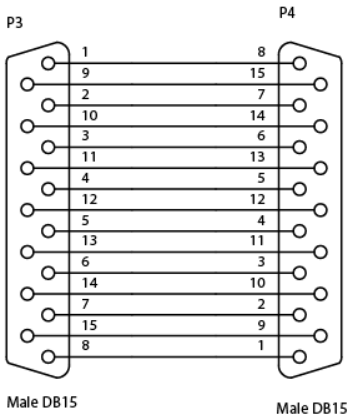


Female Dsub9 Connector - Rear View



Male Dsub9 Connector - Rear View

A.4.8 Straight Through 15-Pin Feed Through



A.4 Using a Digital Encoder

A.5.1 Digital Encoder Overview

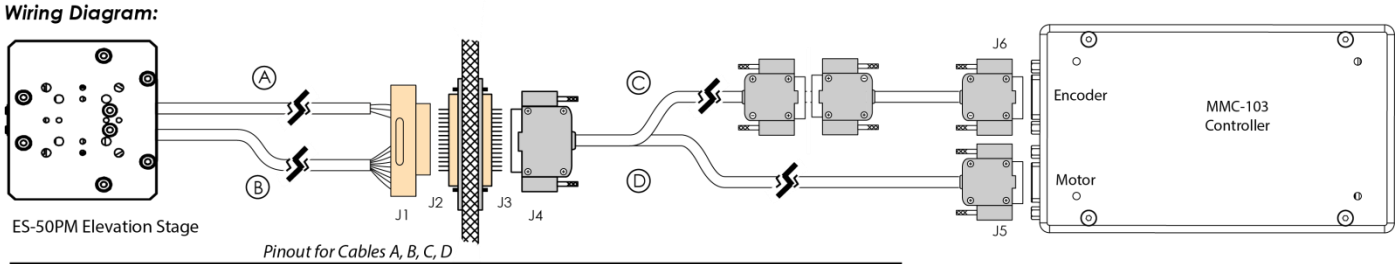
An ES-50PM with Digital encoder will need to be paired with an appropriate controller. The MMC-100 has a Digital option. The ES-50PM with an analog encoder will be supplied with a 15-pin connector that incorporates both motor and encoder signals.

A.5.2 Closed Loop Vacuum Wiring Diagram

Standard Cable Descriptions:

- (A) ES-50PM Motor Cable (Female Dsub 15 Pin, 1.5m)
- (B) ES-50PM Encoder Cable (Female Dsub 15pin, 1.5m)
- (C) Encoder Cable (Female Dsub 15 Pin to Male Dsub 15 Pin Encoder Module, 1.0m)
- (D) Motor Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m)

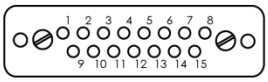
Wiring Diagram:



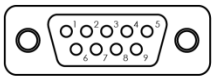
ES-50PM Elevation Stage

Pinout for Cables A, B, C, D

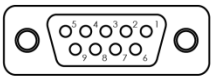
Description:	Color	J1	J2	J3	J4	J5	J6
Phase 1, Motor 1	Red	1	1	8	8 (Red)	1	
Phase 1, Motor 2	Blue	1	1	8	8 (Red)	1	
Phase 2, Motor 1	Yellow	2	2	7	7 (White-Green TP)	2	
Phase 2, Motor 2	Orange	2	2	7	7 (White-Green TP)	2	
Phase 1 GND, Motor 1	Red&Black	5	5	4	4 (Black&Green)	5	
Phase 1 GND, Motor 2	Blue&Violet	5	5	4	4 (Black&Green)	5	
Phase 2 GND, Motor 1	Yellow&Green	5	5	4	4 (Black&Green)	5	
Phase 2 GND, Motor 2	Orange&Brown	5	5	4	4 (Black&Green)	5	
Ground	Black/Green	9	9	15	15 (Black&Green)	5	
Shield	-	10	10	14	14 (Shield)	Casing	
GND	Black	2	2	2	2 (Black)		4
+5V	Red	7	7	7	7 (Red)		5
Cos+	Brown	14	14	14	14 (Brown)		1
Cos-	Orange	6	6	6	6 (White - Brown TP)		6
Sin+	Yellow	13	13	13	13 (Yellow)		2
Sin-	Green	5	5	5	5 (White - Yellow TP)		7
Index+	Violet	12	12	12	12 (Violet)		3
Index-	Blue	4	4	4	4 (White - Violet TP)		8
Shield	-	Shield	Shield	Shield	(Housing)		Casing



Female PEEK Dsub15 Connector - Rear View



Female Dsub9 Connector - Rear View



Male Dsub9 Connector - Rear View