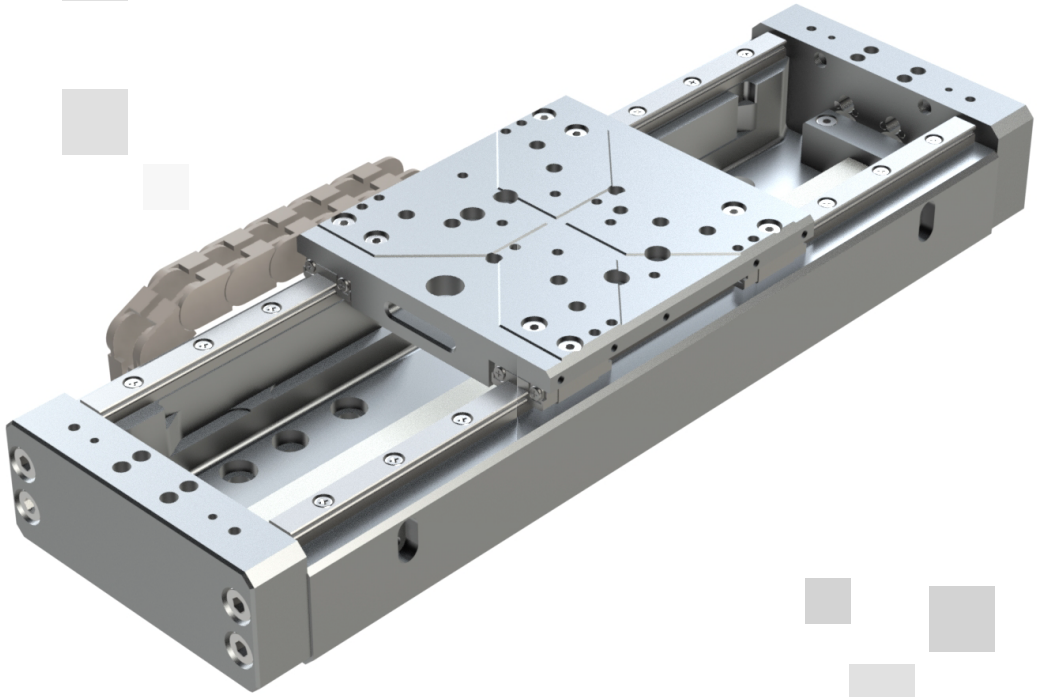
PPS-60 Series



Precision Positioning Stage

Reference Manual

(Open and Closed Loop Versions)

micronix USA
PRECISION MOTION SOLUTIONS

PPS-60

Piezo/Linear/Stepper Motor Precision Positioner Stage Reference Manual

Rev 2.0

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http://micronixusa.com

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1. Introduction

1.1 Product Description

The PPS-60 is a high-precision, long travel linear stage available with piezo, stepper, or linear motor drives, all within the same compact form factor. This flexibility allows users to select the drive technology best suited to their application without changing their mechanical setup. Precision ball bearings ensure high stiffness and guiding accuracy for loads up to 150 N (horizontal orientation). Standard travel lengths of up to 300 mm are available, and an optional linear encoder provides nanometer-level resolution and repeatability. Vacuum and Ultra-High Vacuum (10^{-9} mbar) versions are offered, with longer travel and covered versions available upon request.

Piezo Motor

Specification	Open Loop	Analog Encoder	Digital Encoder	Absolute Encoder
Travel Range	25 – 300 mm			
Max Speed	2 mm/s (MMC-100), 5 mm/s (MMC-110)			5 mm/s (MMC-110)
Resolution	1 nm	10 nm	2 nm	
Bi-dir. Repeatability	NA	± 500 nm	± 100 nm	
Max Load	15 kg			
Environment	Atmospheric, HV, UHV			

Linear Motor

Specification	Analog/Digital/Absolute Encoder
Travel Range	25 – 300 mm
Max Speed	100 mm/s
Resolution	10 nm
Bi-directional Repeatability	± 100 nm
Max Load	15 kg
Environment	Atmospheric, HV

Stepper Motor

Specification	Internal Stepper Motor	External Stepper Motor
Travel Range	25 – 300 mm	
Max Speed	5 mm/s	10 mm/s
Open Loop Resolution	100 nm	
Closed Loop Resolution (Analog)	50 nm	
Closed Loop Resolution (Digital)	50 nm	
Bi-directional Repeatability	± 200 nm	
Max Load	15 kg	
Environment	Atmospheric, HV	Atmospheric, HV, UHV



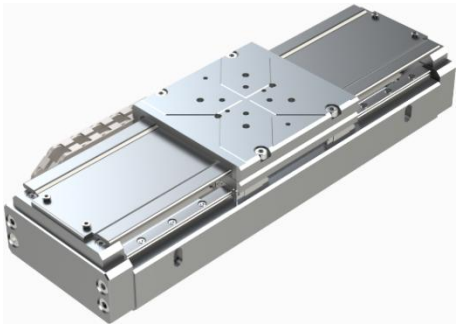
Figure 1-A. PPS-60PM, Piezo Motor



Figure 1-B. PPS-60SM, External Stepper Motor (left), Internal Stepper Motor (right)



Figure 1-C. PPS-60LM, Linear Motor



*Covered Versions Available Upon Request

Figure 1-D. PPS-60, Covered Version

1.2 Recommended Controllers

The following controllers are available from MICRONIX USA:

Controller	Piezo Motor	Stepper Motor	Linear Motor	Analog Encoder	Digital Encoder	Absolute Encoder
MMC-100	✓			✓	✓	
MMC-110	✓			✓	✓	✓
MMC-200		✓		✓	✓	
NanoDrive	✓	✓	✓		✓	✓
MMX-120	✓			✓	✓	✓
MMX-220		✓				✓
MMX-320			✓	✓	✓	✓

CAUTION: Ensure the controller is compatible with the stage's motor and feedback signals. Improper connections or incompatibility may cause damage to the stage or controller.

NOTE: MMC-200 has a fixed encoder interface, and encoder compatibility depends on MMC-200 ordering configuration.

1.3 Technical Data and Ordering Information

Detailed specifications and ordering information can be found on the PPS-60 piezo motor, PPS-60 stepper motor, and PPS-60 linear motor product pages on the MICRONIX USA website.

2. Preparing to Install the PPS-60

2.1 Installation Cautionary Notes

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.

2.2 Installation Requirements

The stage specification is tested at a temperature of 20°C ± 5°C unless otherwise specified. Ensure the following conditions are met before operating the stage:

- Mounting surface is clean and free of debris, burrs or dings.
- Recommended mounting surface flatness is less than 25 µm for optimal performance.
- Indoor atmosphere is free of corrosive gases, excessive dust, and condensation.
- Operating temperature range of 5-40°C.
- Relative humidity between 20-80%.
- The stage is located away from water, heat, and electrical noise.

2.3 Product Handling

- The PPS-60 is a precision mechanical device and should be handled with care. Do not drop or mishandle the stage.
- Do not touch the scale or ceramic track, as this will contaminate and jeopardize the performance of the stage.
- Use proper cable management to ensure a clean and safe operating environment.
- Properly connect the stage to the controller before powering on the controller. Failure to do so can result in damage to the stage.
- Allow for easy access to the stage in case of servicing.

NOTE: Wear powder-free nitrile gloves when handling the stage to avoid contamination.

NOTE: Piezo stages use friction-based motion with ceramic components that are sensitive to oils. Do not directly touch to avoid contamination.

NOTE: The screw of a stepper driven stage cannot be moved by hand or when unpowered. Do not touch or manually turn the leadscrew, as this will contaminate the lubrication and jeopardize the longevity of the stage.

NOTE: For piezo and linear motor stages, it is possible to gently move the carriage manually without damaging the stage.

WARNING: Powerful magnets are installed in linear motor configurations. Keep magnetic hardware away when installing the stage.

WARNING: Keep hands clear of all moving parts while the stage is in motion to avoid personal injury.

2.4 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 Contents:

- PPS-60 piezo, linear, or stepper motor stage
- Reference manual
- Any additional components specified in the order, such as a controller

3. Installing the PPS-60

Additional brackets and screws may be required for custom applications.

NOTE: It is possible to move the carriage of the linear and piezo motor configurations manually without damaging the stage. For stepper motor versions, the motor must be driven by a controller to reposition the carriage

3.1 PPS-60 Installation

3.1.1 General Top Mounting

1. Align the stage to the mounting surface using at least two customer supplied M2 x 5 mm dowel pins.
2. Move the carriage to access the mounting holes. Secure the stage using at least four customer supplied M3 socket head cap screws at 0.35 Nm recommended torque.

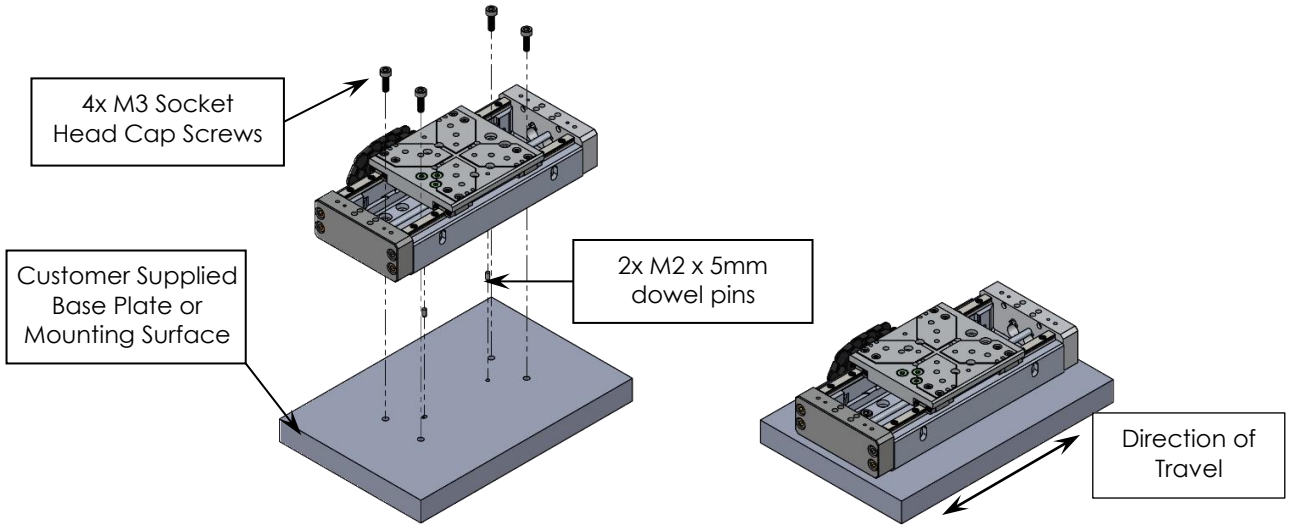


Figure 3-A. PPS-60 Top Mounting Installation

CAUTION: For internal stepper motor versions, the mounting screws must be flush with the base surface.

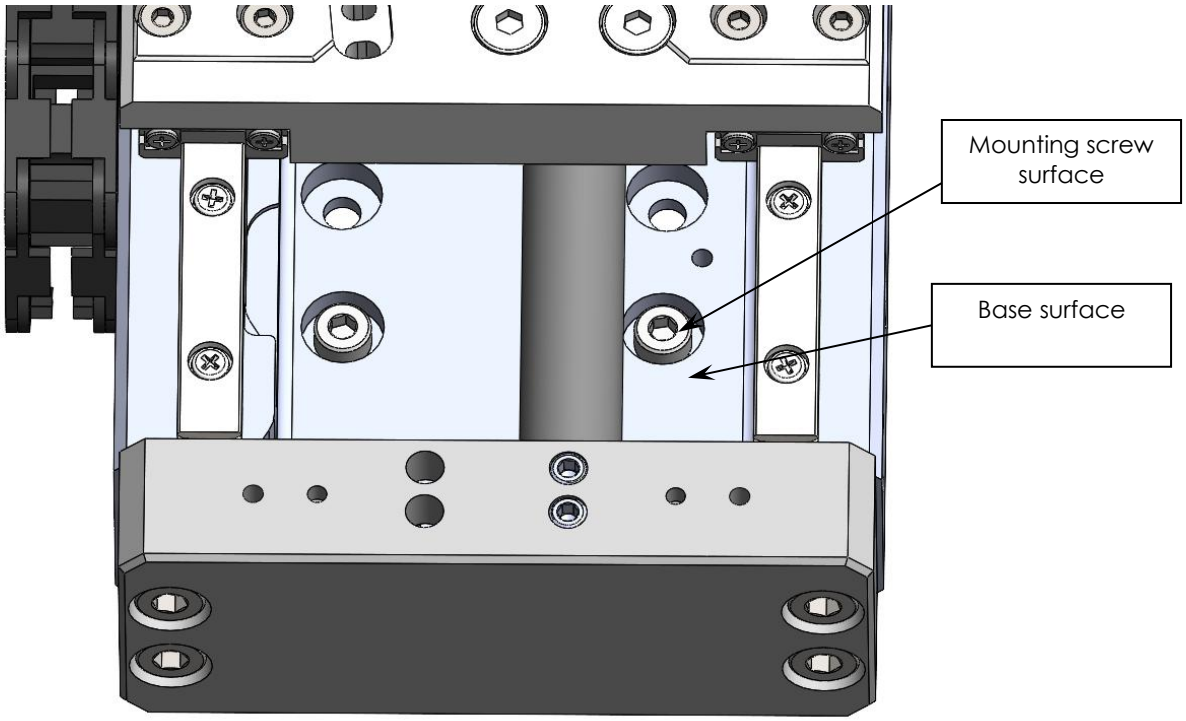
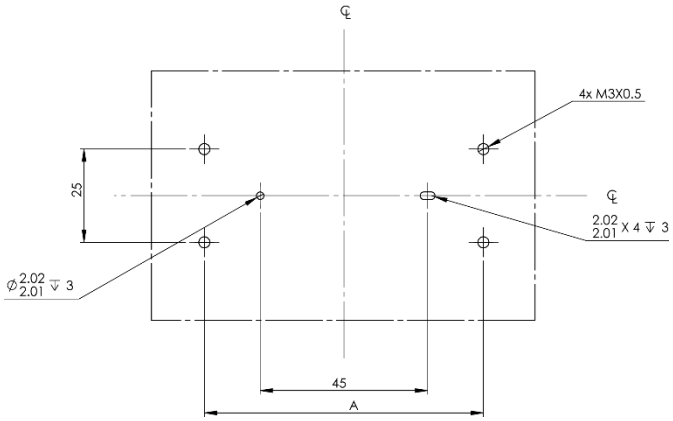


Figure 3-B. PPS-60 Mounting Screw Flush with Base Surface

3.1.2 Recommended General Top Mounting Pattern



Travel	*A [mm]*
25mm	*75*
50mm	*75*
100mm	*125*
200mm	*225*
300mm	*325*

3.1.3 Bottom Mounting

1. Align the stage to the mounting surface using at least two M2 x 5mm dowel pins.
2. Move the carriage to access the mounting holes. Secure the stage using at least four M4 socket head cap screws at 0.6 Nm recommended torque.

CAUTION: Ensure that the screws do not exceed more than 4mm past the mounting surface to prevent damage to the stage.

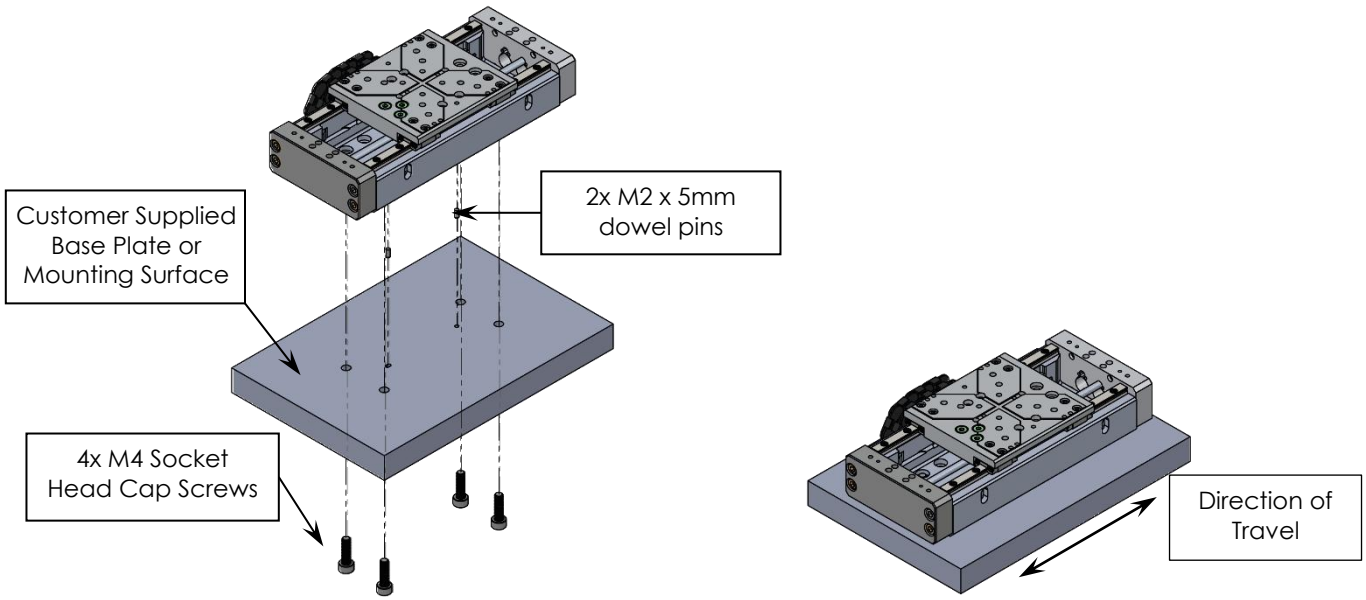
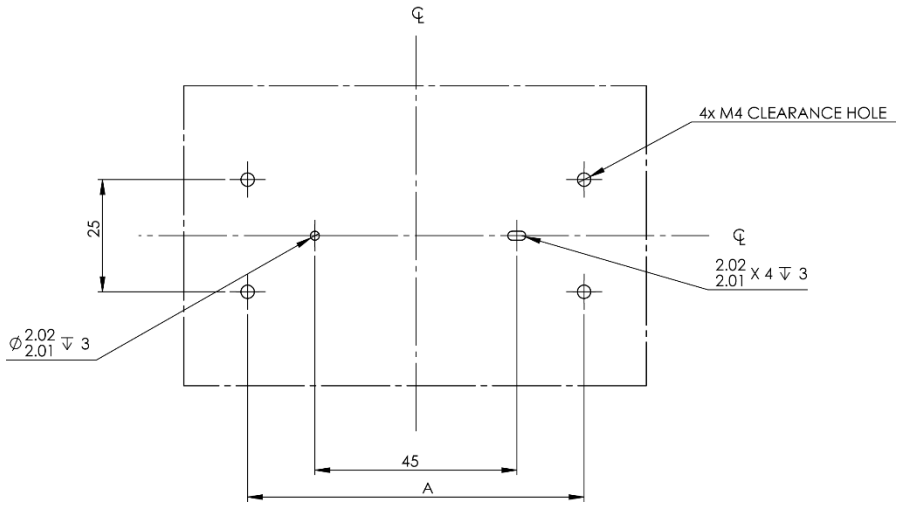


Figure 3-C. PPS-60 Bottom Mounting Installation

3.1.4 Recommended Bottom Mounting Pattern



Travel	*A [mm]*
25mm	*75*
50mm	*75*
100mm	*125*
200mm	*225*
300mm	*325*

3.1.5 Metric Optical Table Mounting (25mm x 25mm Spacing)

NOTE: Check the manufacturing tolerances of the optical table for precision fit.

Mounting the PPS-60 to an optical table requires the use of thread adapters to secure the stage to the mounting surface.

1. Move the carriage to access the mounting holes. Secure the stage using four M3 socket head cap screws and four M3 to M6 thread adapters at 0.5 Nm recommended torque.

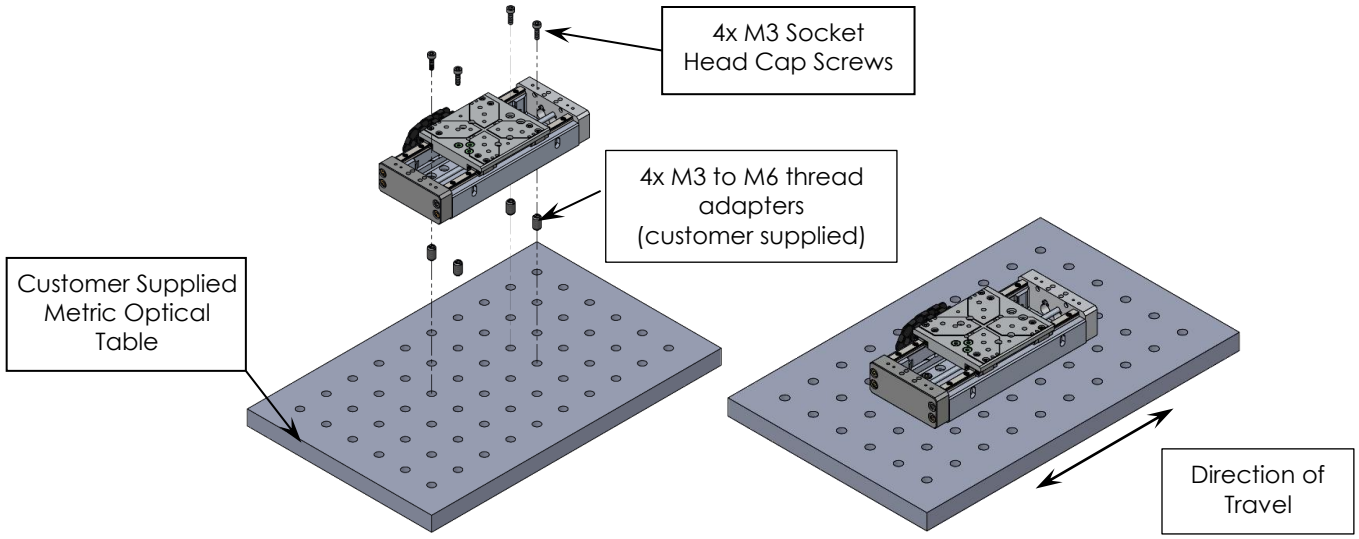
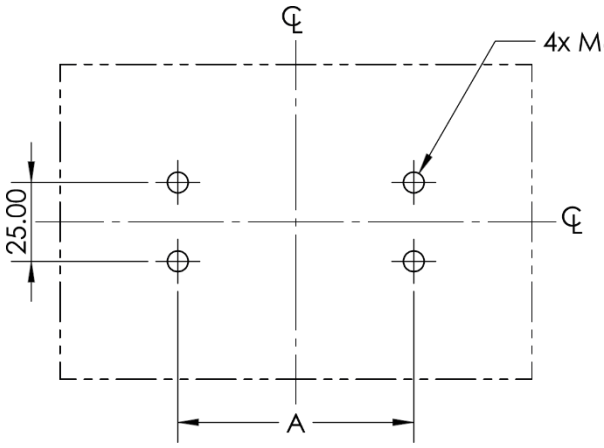


Figure 3-D. PPS-60 Metric Optical Table Mounting Installation

3.1.6 Metric Optical Table Mounting Pattern



Travel	*A [mm]*
25mm	*75*
50mm	*75*
100mm	*125*
200mm	*225*
300mm	*325*

3.1.7 Imperial Optical Table Mounting (1" x 1" Spacing)

NOTE: Check the manufacturing tolerances of the optical table for precision fit.

Mounting the PPS-60 to an optical table requires the use of thread adapters to secure the stage to the mounting surface.

1. Move the carriage to access the mounting holes. Secure the four 4-40 pan head machine screws and four ¼ - 20 to 4-40 thread adapters at 0.5 Nm recommended torque.

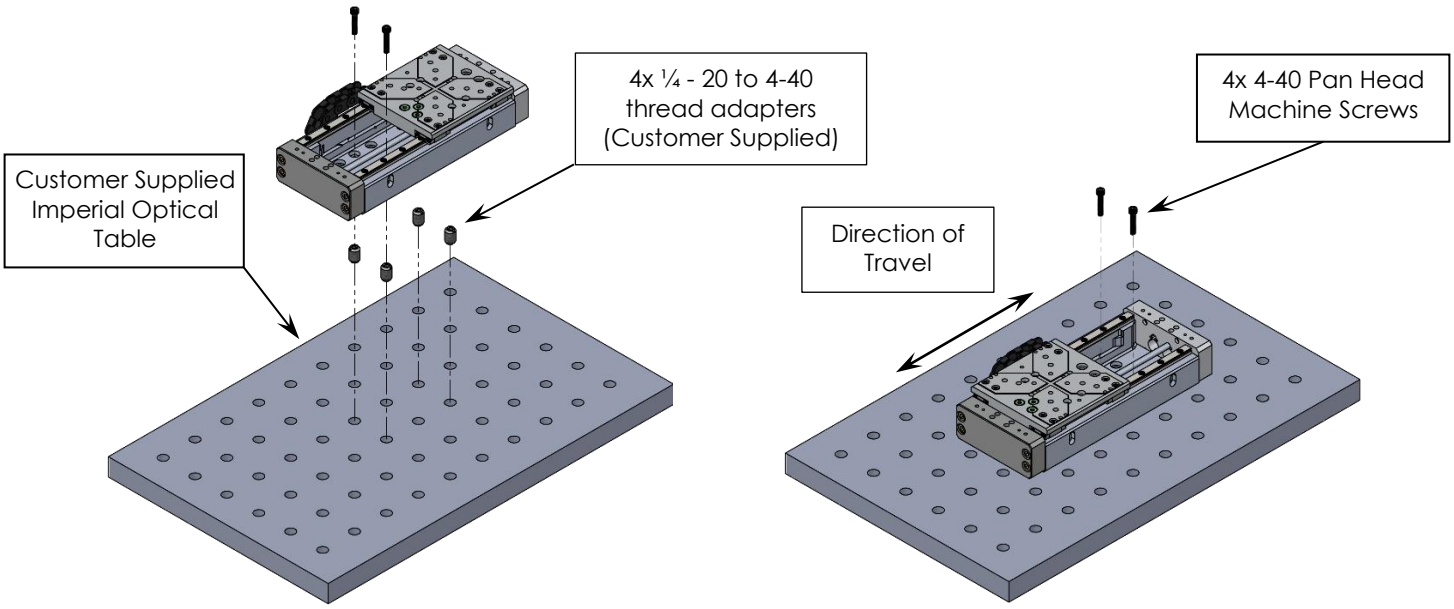
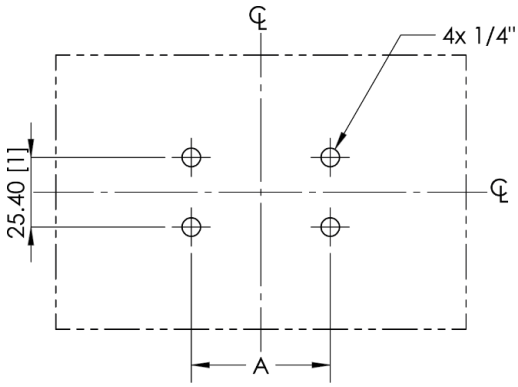


Figure 3-E. PPS-60 Imperial Optical Table Mounting Installation

3.1.8 Imperial Optical Table Mounting Pattern



Travel	*A mm [in]*
25mm	*50.8 [2]*
50mm	*50.8 [2]*
100mm	*101.6 [4]*
200mm	*203.2 [8]*
300mm	*304.8 [12]*

3.1.9 X-Y Mounting

1. Install the bottom stage to the mounting surface as shown through Section 3.
2. Align the top stage to the bottom stage using two M2 x 5 mm dowel pins.
3. Move the top stage carriage to access the mounting holes and secure the stage using four M3 x 6 mm socket head cap screws at 0.5 Nm recommended torque.

CAUTION: Do not use screws longer than specified to avoid internal damage.

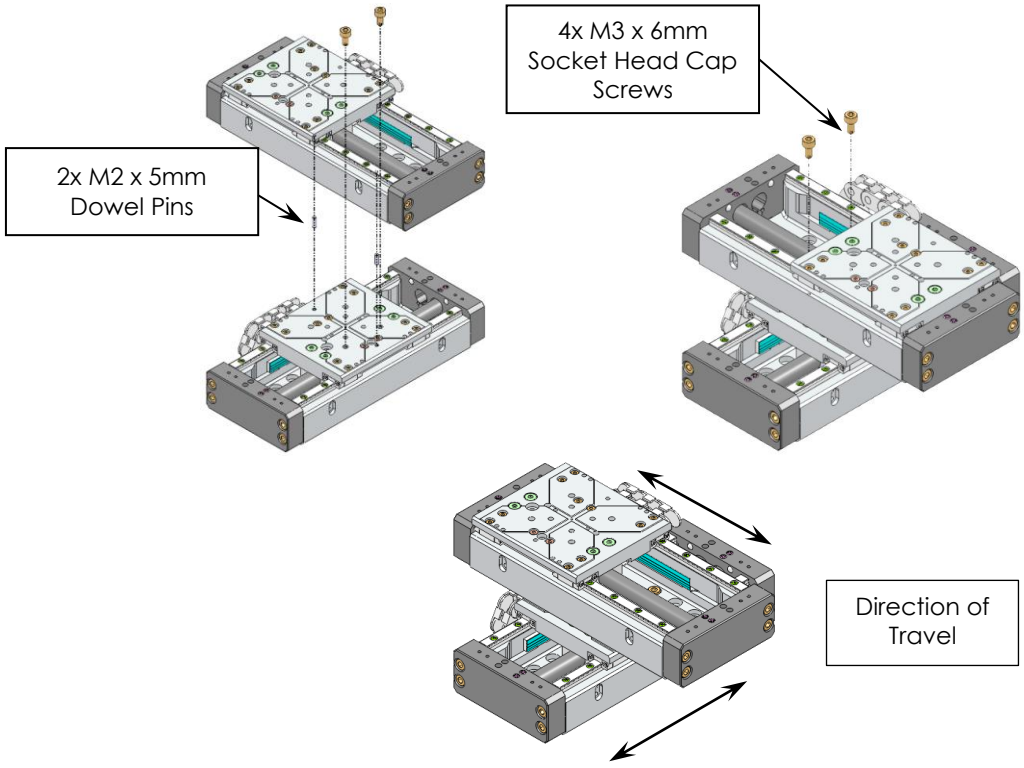
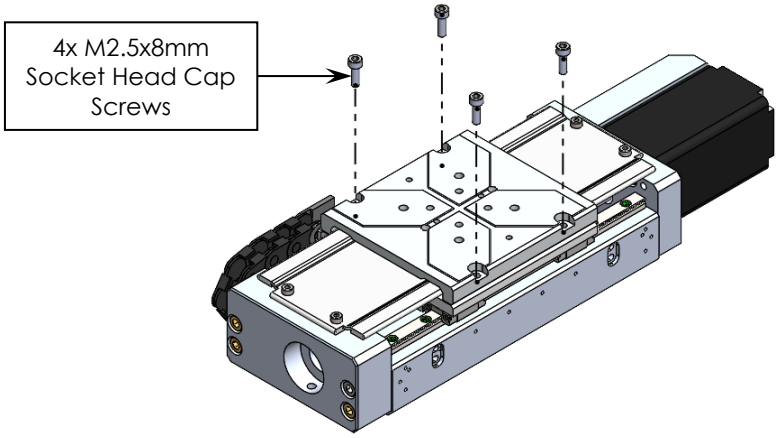


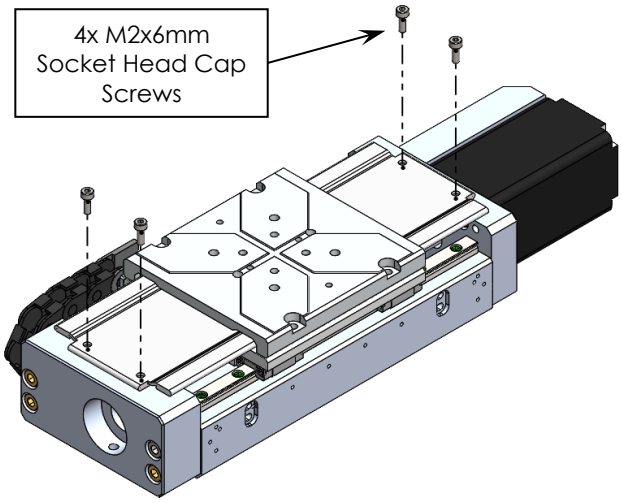
Figure 3-F. PPS-60 X-Y Mounting Installation

3.1.10 Top Cover Removal

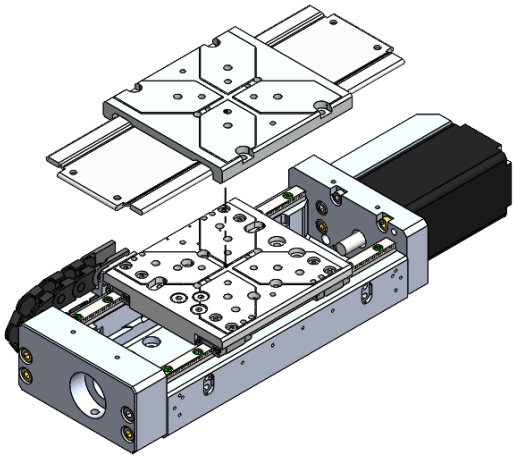
1. Remove the four M2.5 SHCS from the second carriage using a 2mm hex tool



2. Remove the four M2 SHCS using a 1.5mm hex tool to detach the cover from the endplates



3. Remove the cover and secondary carriage from stage carriage.



3.2 Mounting to the PPS-60

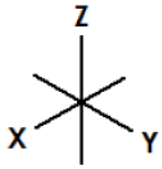
The payload mounts to the PPS-60 carriage on top of the stage. The recommended specifications for mounting to the PPS-60 are found below:

3. Use M2 screws with a max thread depth 4mm. Exceeding the specified screw length will result in damage to the stage's internal components.
4. For best performance, the payload mating surface should have a flatness of 25 µm or better.
5. Ensure the payload does not exceed the rated load capacity of the stage.

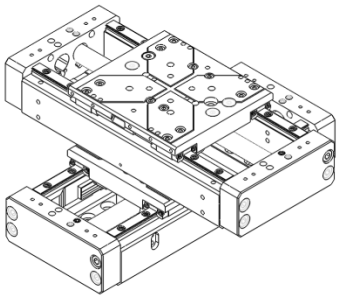
4. Stacking Configurations

4.1 Configuration Examples *(additional configurations available upon request)*

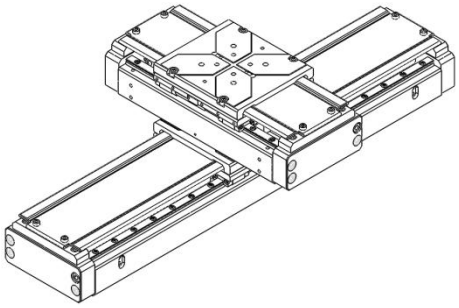
- Additional configurations are available upon request.
- Stacking compatibility for all motor configurations.
- Positioning according to:



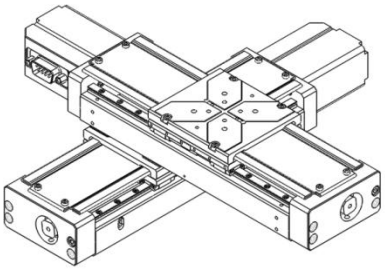
No Adapters



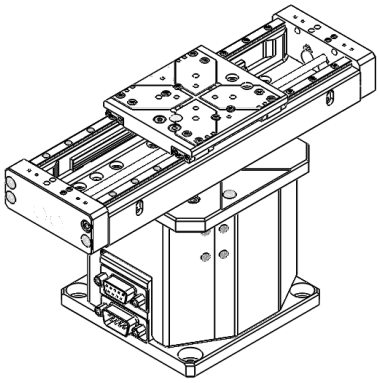
X-Y 50x50mm



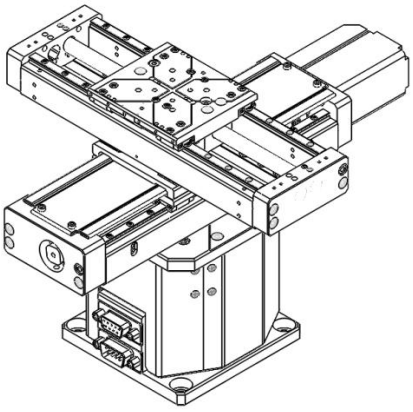
X-Y 200x50mm



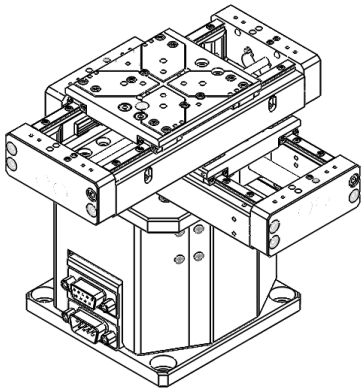
X-Y Off-Center 100x100mm



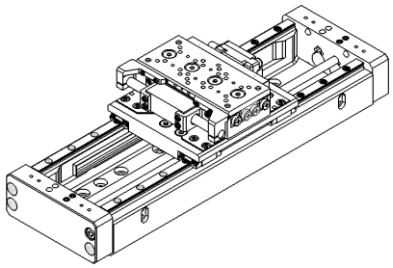
X-Z 100x35mm
[with PZS-90 Elevation Stage]



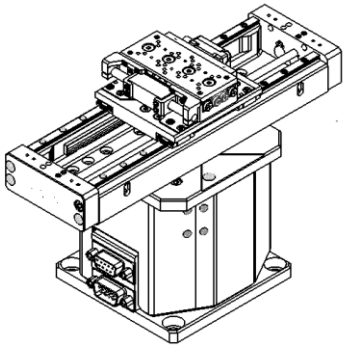
X-Y-Z 100x100x35mm
[with PZS-90 Elevation Stage]



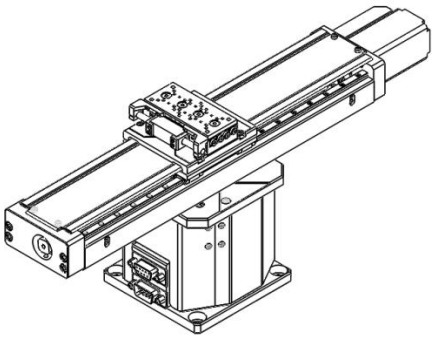
X-Y-Z Off-Center
50x50x35mm
[with PZS-90 Elevation Stage]



X-Y 100x26mm
[with PPS-28 Linear Stage]

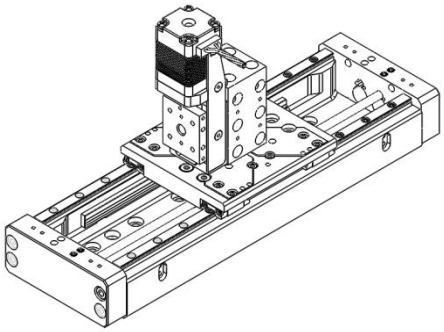


X-Y-Z 100x26x35mm
[with PPS-28 Linear Stage
& PZS-90 Elevation Stage]

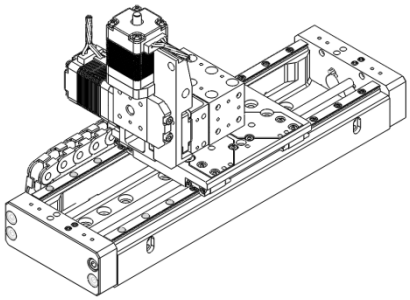


X-Y-Z 200x26x35mm
[with PPS-28 Linear Stage
& PZS-90 Elevation Stage]

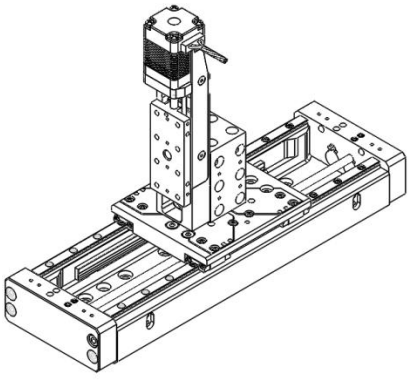
Using: Adapter Block (P/N 430141) & VT-21 Linear Stages



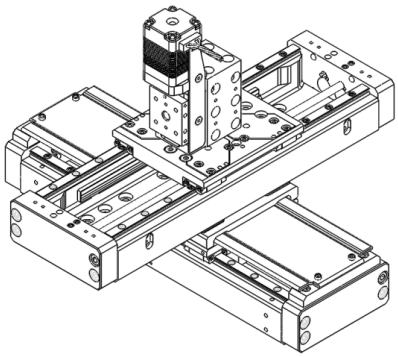
X-Z 100x10mm



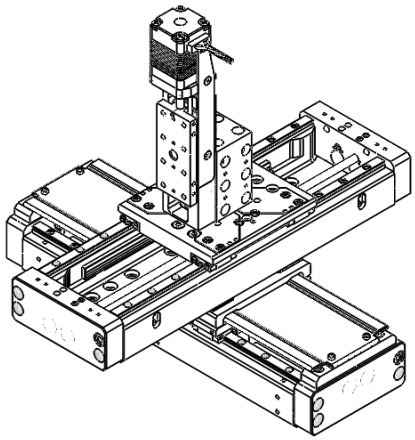
X-Y-Z 100x10x10mm



X-Z 100x26mm

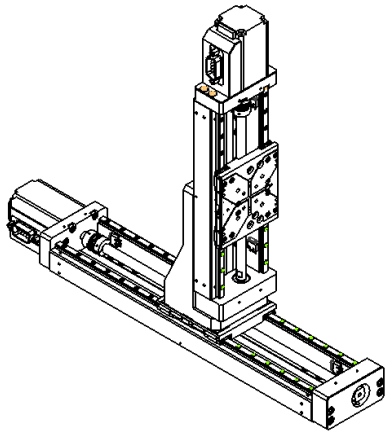


X-Y-Z 100x100x10mm

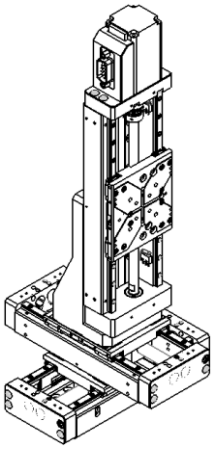


X-Y-Z 100x100x26mm

Using: Z Bracket (P/N 430613)

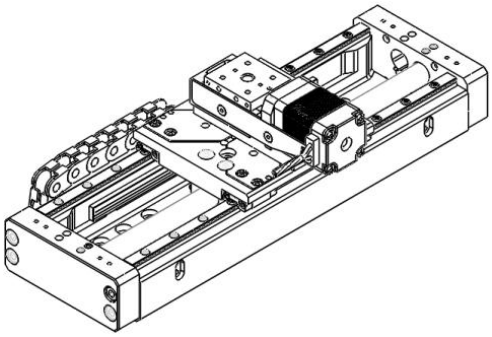


X-Y 200x100mm

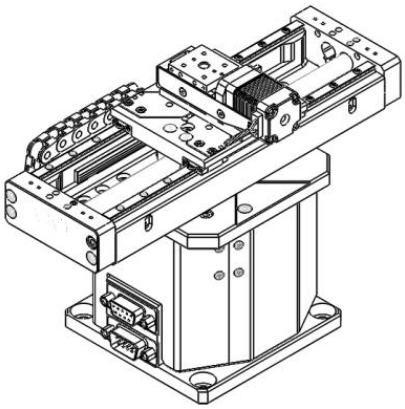


X-Y-Z 50x50x100mm

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

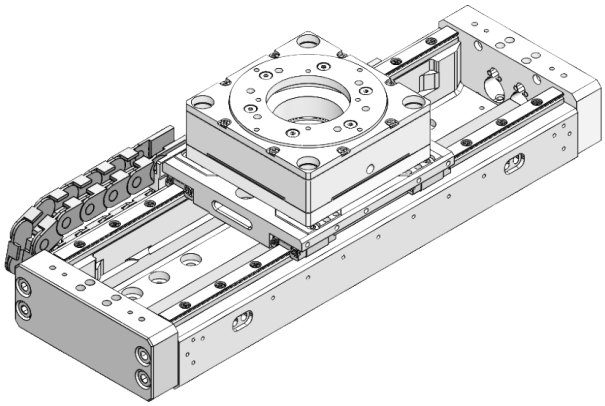


X-Y 100x10mm



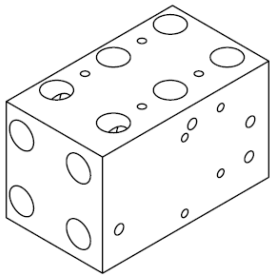
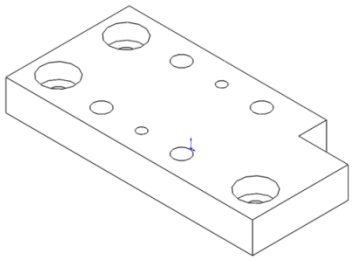
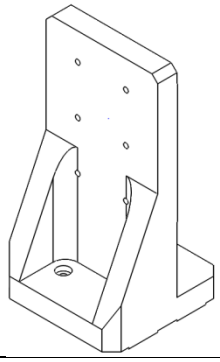
X-Y-Z 100x10x35mm
[with PZS-90 Elevation Stage]

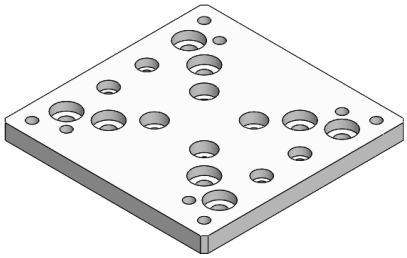
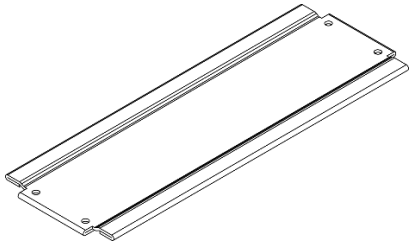
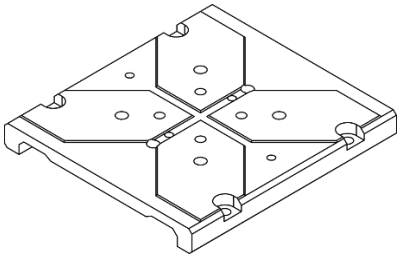
Using: θ-X Bracket (432144) & PR-50CR



θ-X

4.2 Accessories

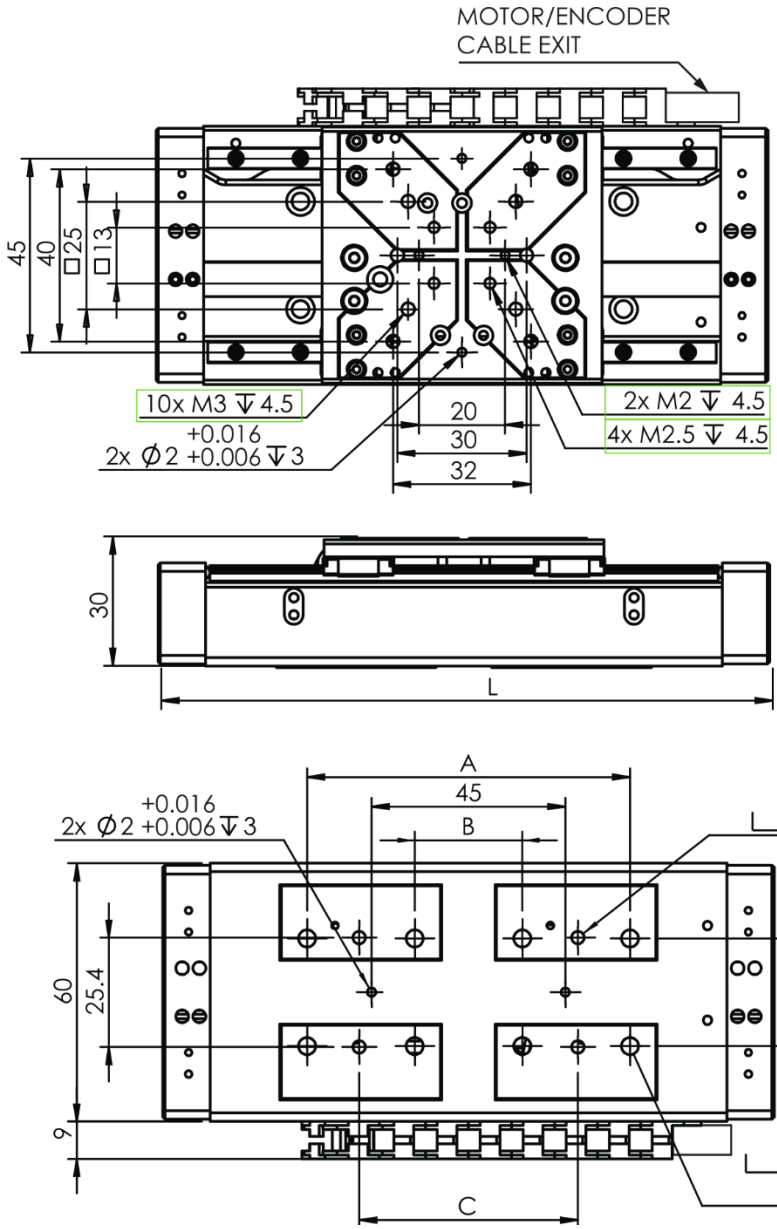
430141-B Adapter Block VT-21	430104-B Adapter Plate XY Side VT-21	430613 Z Bracket PPS-60
		
Used to adapt the VT-21 series to the PPS-60 series of linear stages for XY and XZ mounting configurations.	Used to adapt the VT-21 series to the PPS-60 series of linear stages for XY mounting configurations.	Used to adapt the PPS-60 series to a perpendicular assembly for XZ mounting configurations.

432144 PR-50CR Adapter Plate	430xxx (see chart below) PPS-60 Top Cover	430603 PPS-60 Secondary Carriage
		
Used to adapt the PR-50CR rotary stage to the PPS-60 series of linear stages for θ-X mounting configurations	Used to cover the internals of the PPS-60. Mounted on top of the carriage as shown in Section 3.1.10. 430598 shown here.	Used to provide mounting options when the PPS-60 Top Cover is installed.

PPS-60 Top Cover Part Number Guide	
Part number	**Compatible travel length**
430879	25mm
430598	50mm
430599	100mm
430600	200mm
430612	300mm

5. Dimensions

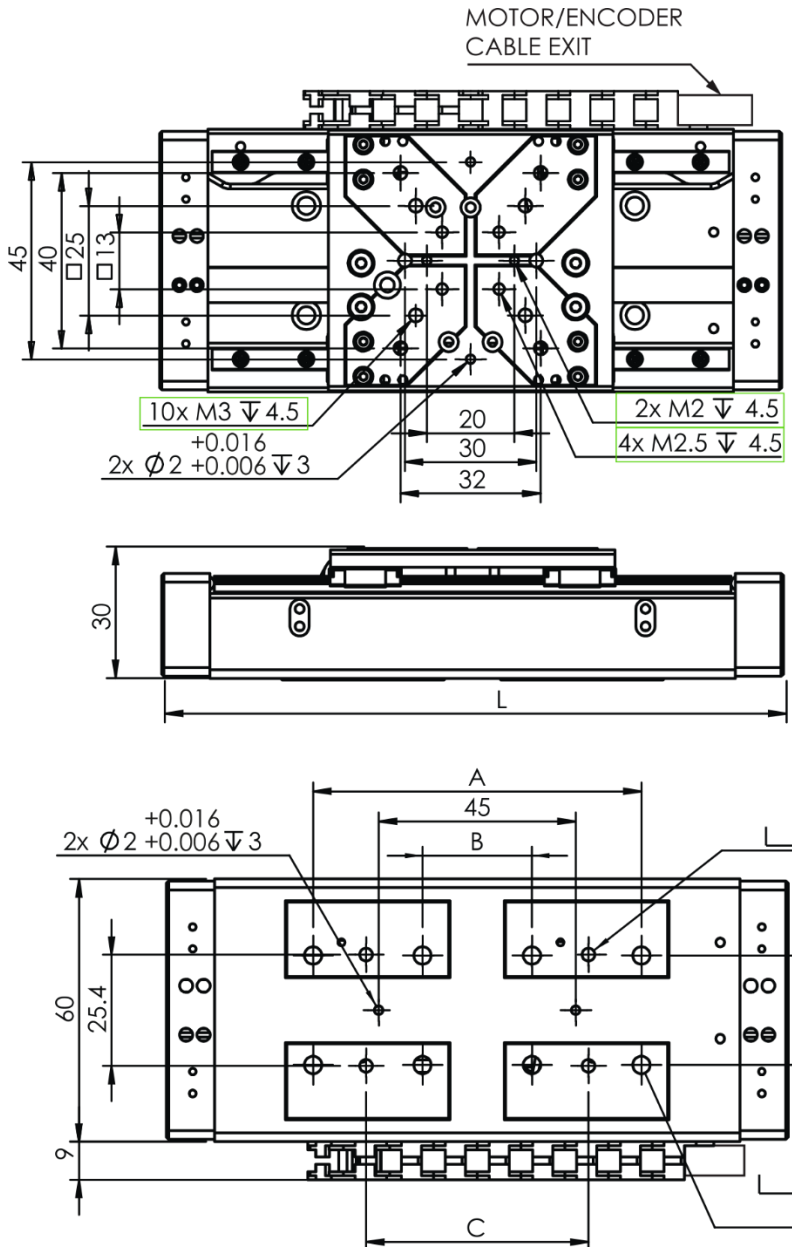
5.1 PPS-60PM



Travel	L	A	B	C
25	117	75	25	50.8
50	142	75	25	50.8
100	192	125	75	101.6
200	292	225	175	203.2
300	392	325	275	304.8

* 50 mm travel version shown
* All dimensions are in millimeters
* Boxed callout = mounting pattern

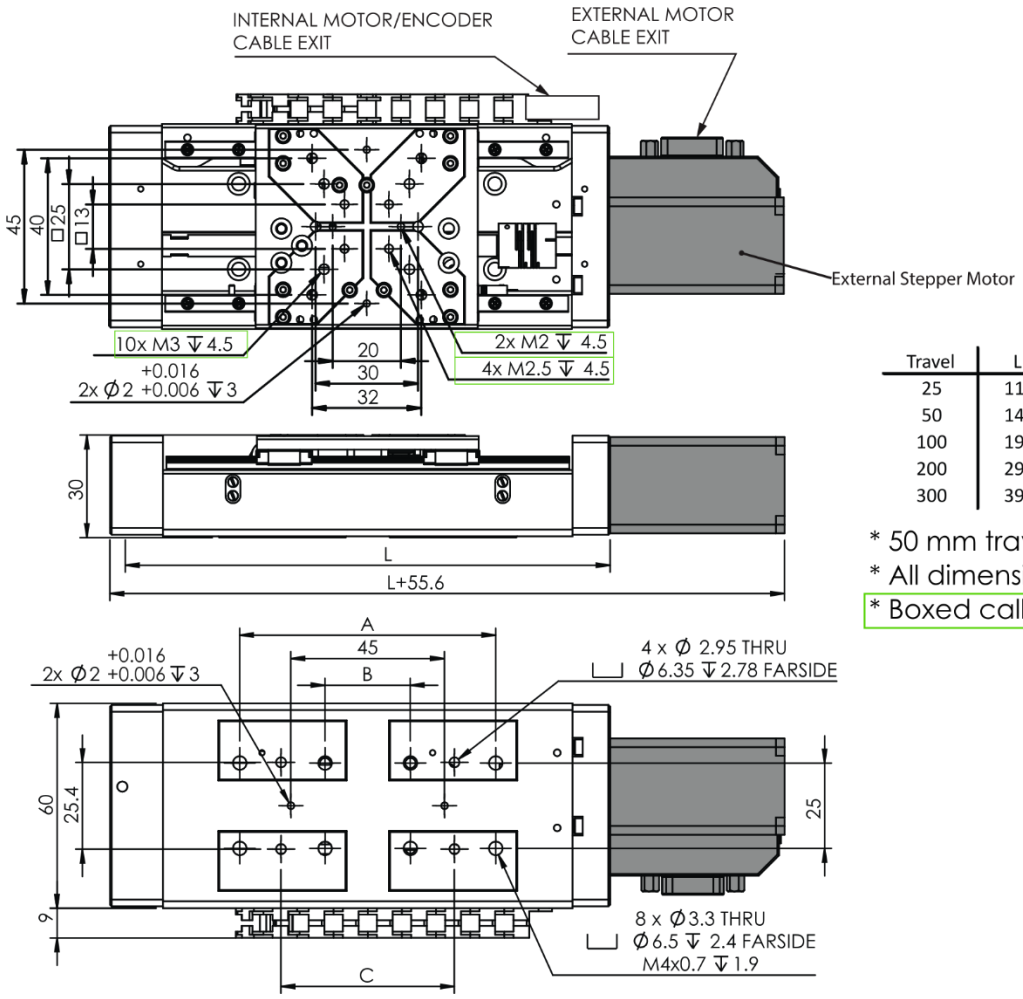
5.2 PPS-60 LM



Travel	L	A	B	C
25	117	75	25	50.8
50	142	75	25	50.8
100	192	125	75	101.6
200	292	225	175	203.2
300	392	325	275	304.8

* 50 mm travel version shown
* All dimensions are in millimeters
* Boxed callout = mounting pattern

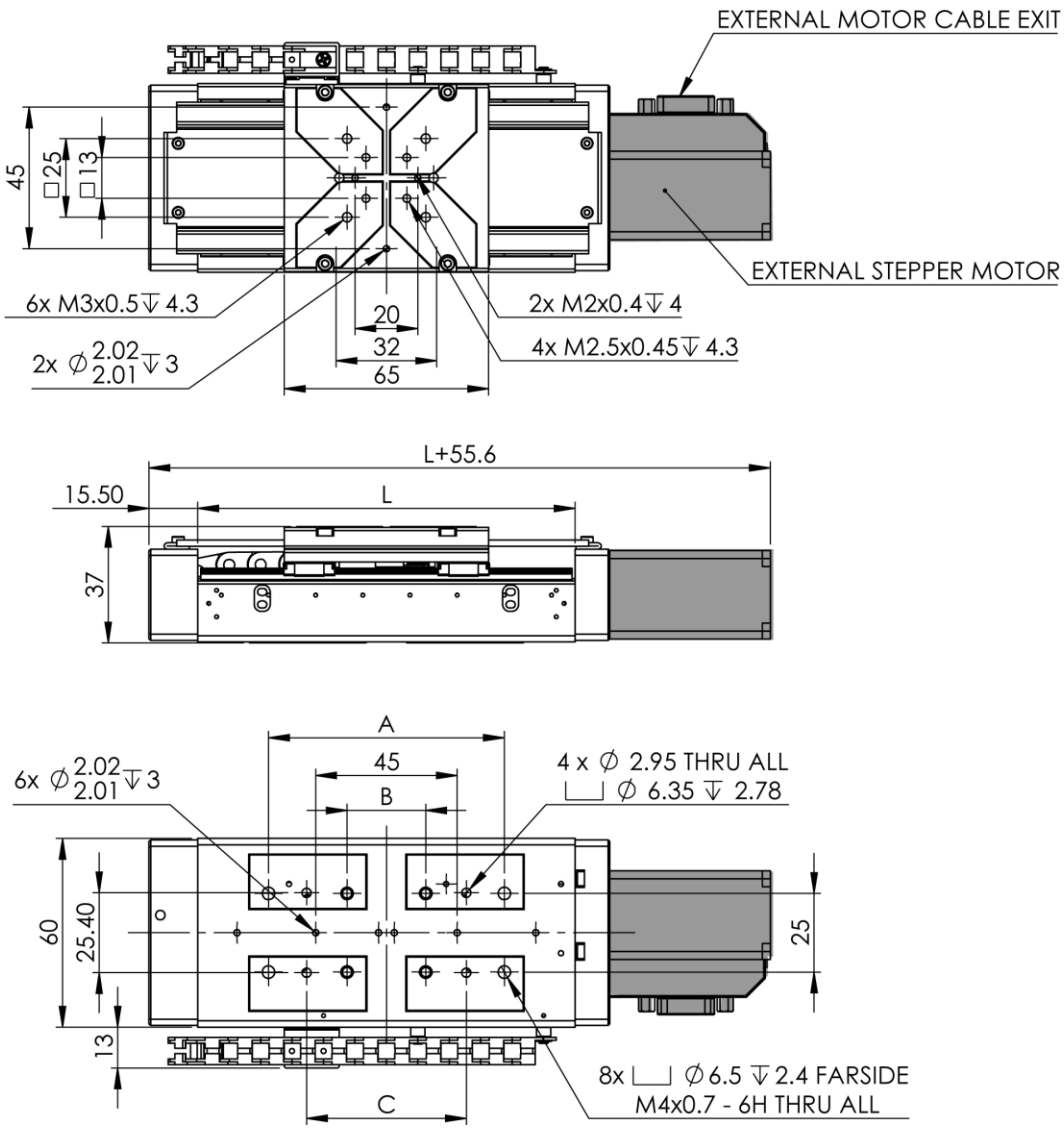
5.3 PPS-60SM (Internal/External)



Travel	L	A	B	C
25	117	75	25	50.8
50	142	75	25	50.8
100	192	125	75	101.6
200	292	225	175	203.2
300	392	325	275	304.8

* 50 mm travel version shown
* All dimensions are in millimeters
* Boxed callout = mounting pattern

5.4 PPS-60 Covered Stage



6. Connecting the PPS-60 Stage

This section provides information for connecting to MMC controllers unless noted otherwise. For controller information, refer to the appropriate controller manual.

6.1 Atmospheric Environments

6.1.1 Open Loop, Atmospheric Wiring Diagram

See the Appendix Section A.2.3 and Section A.2.1 for piezo or stepper motor pinouts, respectively.

Note: Open loop configurations are only available for stepper or piezo motor versions.

PPS-60PM or SM (internal) Cable Descriptions:
A. Motor Cable (Male D-sub 9 Pin, 1.5m PVC Black Cable)

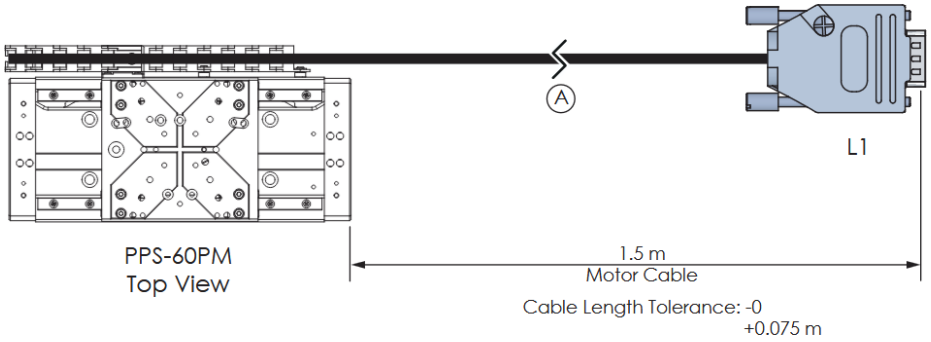


Figure 6-A. PPS-60PM & SM (internal), Open Loop, Atmospheric Wiring Diagram

PPS-60SM (external) Cable Descriptions :

A. PPS-60SM Motor Cable (Male Dsub9 Pin to Male Dsub9 Pin, 1.5m PVC Black Cable)

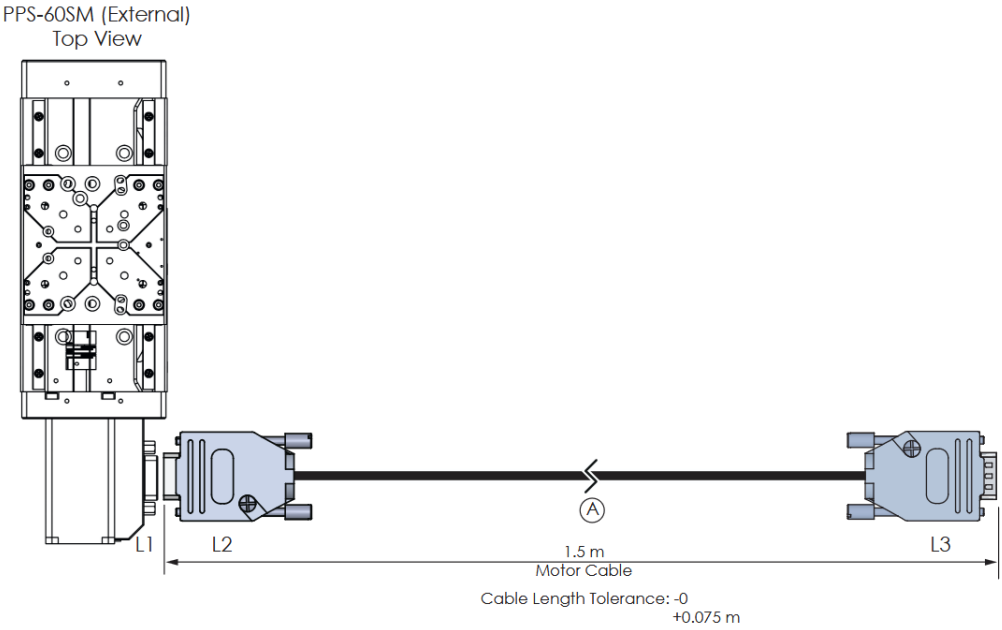


Figure 6-B. PPS-60SM (external), Open Loop, Atmospheric Wiring Diagram

6.1.2 Closed Loop (Encoder), Atmospheric Wiring Diagram

Using the PPS-60 stage with an encoder requires a closed loop compatible controller that recognizes the proper type of encoder feedback. Connect the stage as shown below. For encoder pinouts, see Appendix Section A.2.3, A.2.2, and A.2.1 for piezo, linear, or stepper motor pinouts respectively.

6.1.2.1 Analog Encoder, Atmospheric Wiring Diagram

PPS-60PM, LM, & SM (internal) Cable Descriptions:

A. Motor Cable (Male D-sub 9 Pin, 1.5m PVC Black Cable)
B. Encoder Cable (Female D-sub 9 Pin, 1.5m PVC Black Cable)

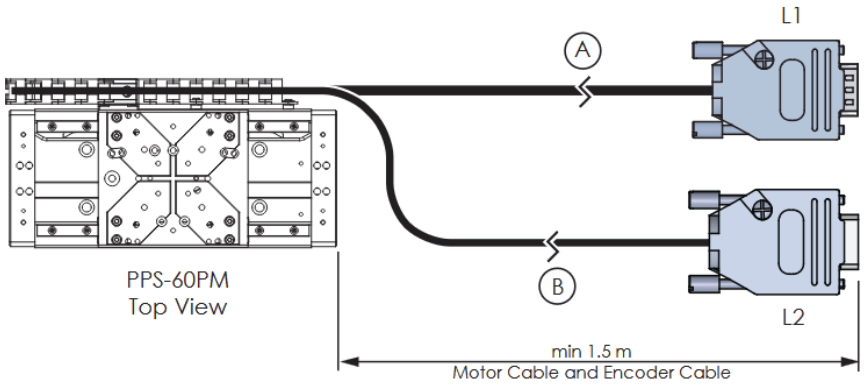


Figure 6-C. PPS-60PM, LM, & SM (internal), Analog Encoder, Atmospheric Wiring Diagram

PPS-60SM (external) Cable Descriptions:

A. PPS-60SM Motor Cable (Male Dsub9 Pin to Male Dsub9 Pin, 1.5m PVC Black Cable)
B. Encoder Cable (Female Dsub9 Pin Module, 1.5m PVC Black Cable)

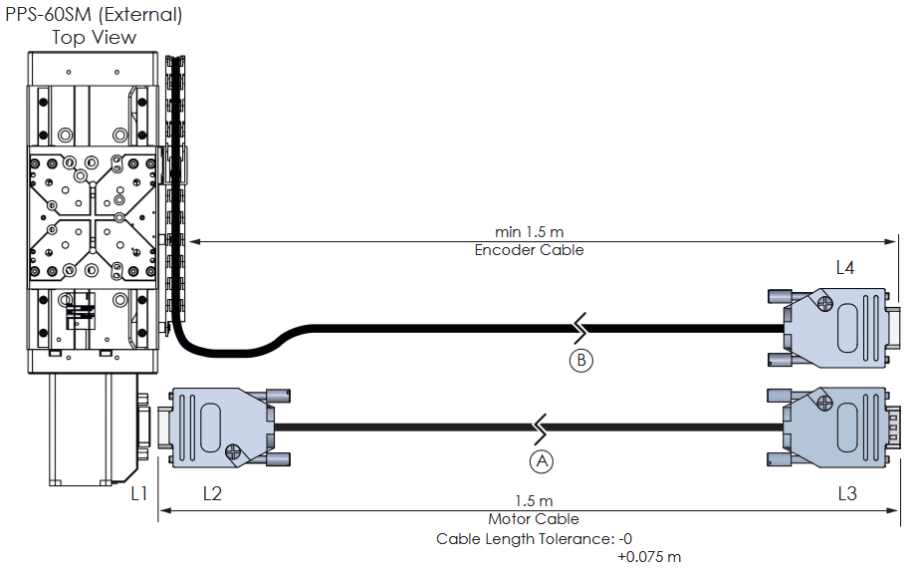


Figure 6-D. PPS-60SM (external), Analog Encoder, Atmospheric Wiring Diagram

6.1.2.2 *Digital Encoder, Atmospheric Wiring Diagram*

PPS-60PM, LM, & SM (internal) Cable Descriptions:

A. PPS-60PM, LM, or SM Motor Cable (Male Dsub9 Pin, 1.5m PVC Black Cable)
B. Encoder Cable (Male Dsub15 Pin Module, 1m PVC Black Cable)

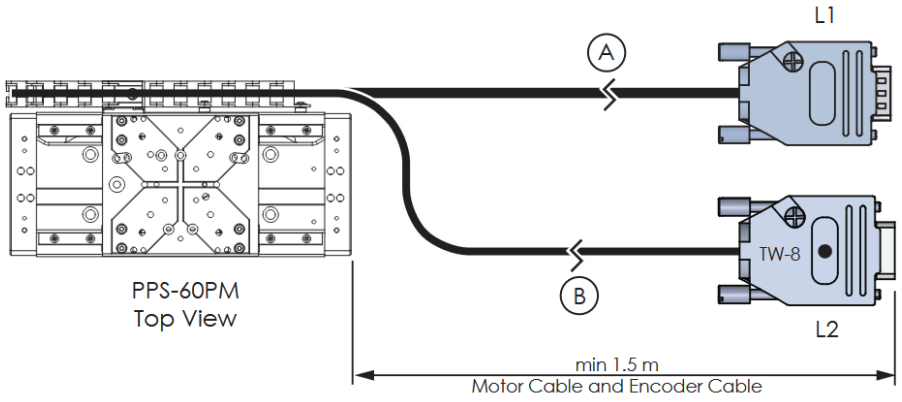


Figure 6-E. PPS-60PM, LM, & SM (internal), Digital Encoder, Atmospheric Wiring Diagram

PPS-60SM (external) Cable Descriptions:

A. PPS-60SM Motor Cable (Male Dsub9 Pin to Male Dsub9 Pin, 1.5m PVC Black Cable)
B. Encoder Cable (Male Dsub15 Pin Module, 1m PVC Black Cable)

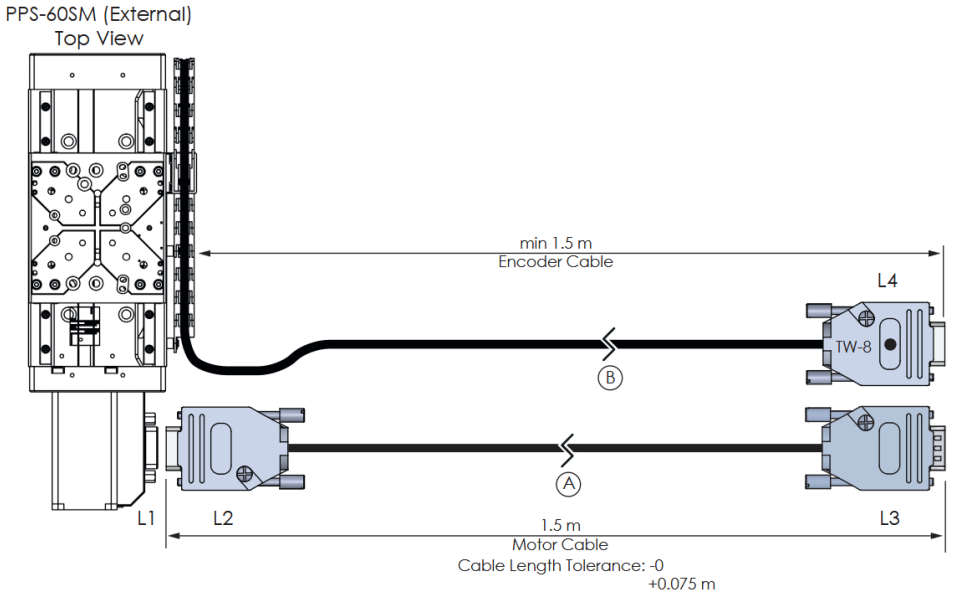


Figure 6-F. PPS-60SM (external), Digital Encoder, Atmospheric Wiring Diagram

6.2 *Vacuum Environments*

6.2.1 Handling and Preparation

When handling stages configured for vacuum use, take the necessary precautions, such as wearing powder-free nitrile gloves, clean room garments, etc. to avoid any contaminants. Maximum bake-out temperature is 100°C. As standard, the stage is supplied with non-vacuum-compatible connectors. MICRONIX USA optionally offers this stage supplied with vacuum-rated connectors installed, see chart below.

Connector Description	Connector Material	Contacts	Backshell
High Vacuum Glass- filled Diallyl Phthalate D-Subminiature	DAP	T2 Female Crimps, Gold Pins (Accuglass P/N: 111652)	Nickel-plated Zinc Backshell Strain Relief
Ultra-High Vacuum D-Subminiature	PEEK	T1 Female Crimps, Gold Pins (Accuglass P/N: 100180)	PEEK UHV Strain Relief

Environment	Open Loop	Closed Loop
High Vacuum (10^{-6} mbar)	9 Pin Female DAP	15 Pin Female DAP
Ultra-High Vacuum (10^{-9} mbar)	9 Pin Female PEEK	15 Pin Female PEEK

Connecting the PPS-60 in a vacuum chamber requires the use of a feedthrough connector at the vacuum chamber wall. For final application, the customer is responsible for providing their own feedthrough connection.

The vacuum compatible PPS-60 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. See Appendix Section A.4 for feedthrough pins.

Note: Linear motor versions are not available for ultra-high vacuum environments.

6.2.2 Open Loop, Vacuum Wiring Diagram

See Appendix Section A.2.3 and A.2.1 for piezo or stepper motor pinouts respectively.

PPS-60PM & SM (internal) Cable Descriptions:

A. PPS-60PM or SM 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)

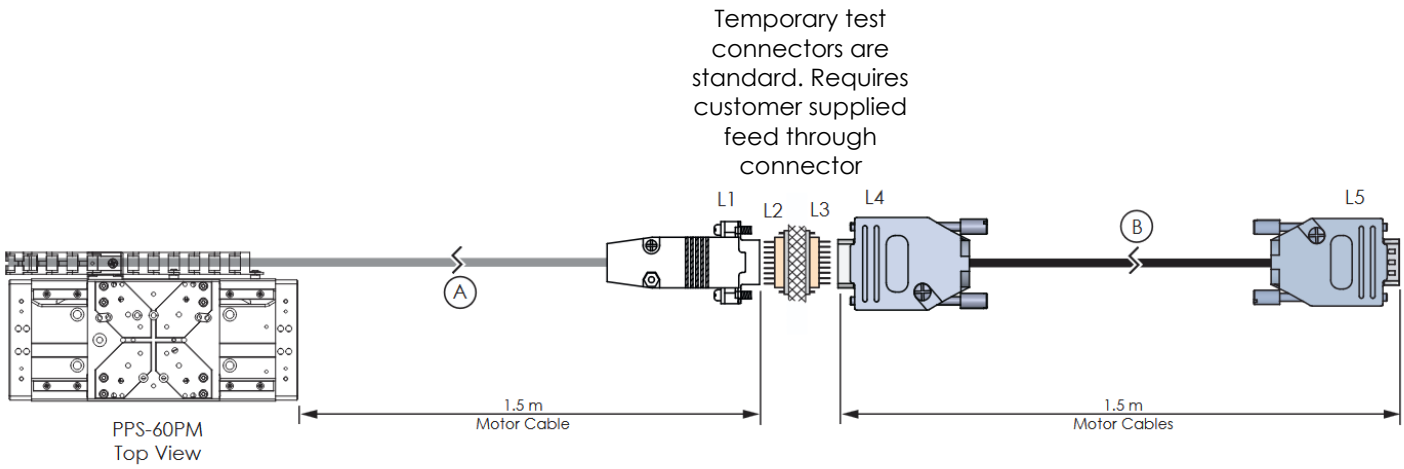


Figure 6-G. PPS-60PM & SM (internal), Open Loop, Vacuum Wiring Diagram

PPS-60SM (external) Cable Descriptions:

A. PPS-60SM 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)

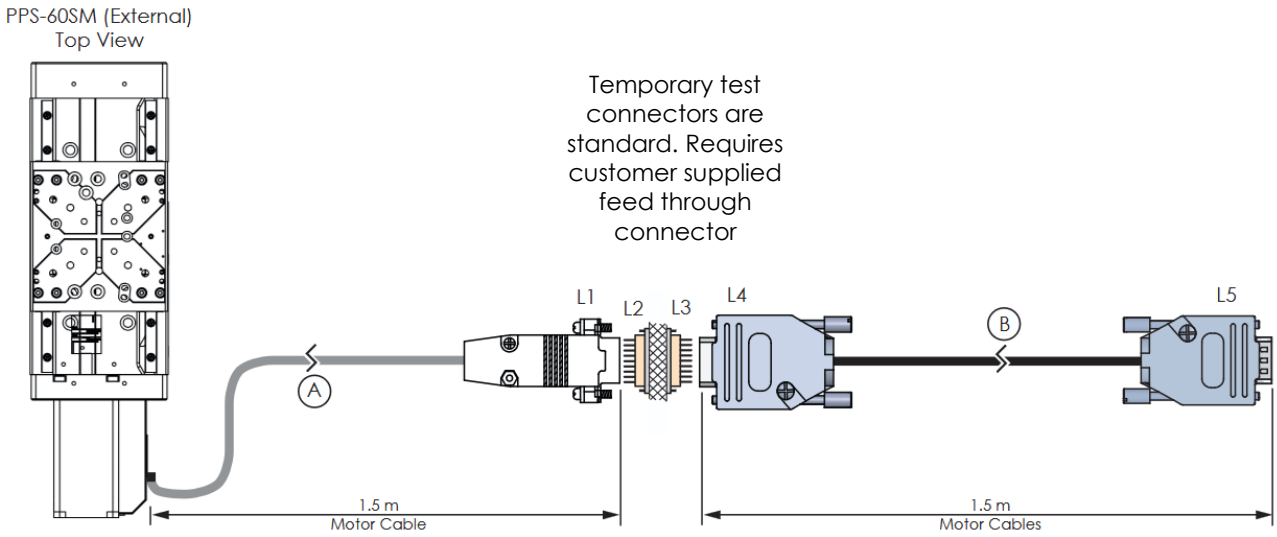


Figure 6-H. PPS-60SM (external), Open Loop, Vacuum Wiring Diagram

6.2.3 Closed Loop (Encoder), Vacuum Wiring Diagram

For encoder pinouts, see the Appendix Section A.2.3 and A.2.1 for piezo or stepper motor pinouts respectively.

6.2.3.1 Analog Encoder, Vacuum Wiring Diagram

PPS-60PM & SM (internal) Cable Descriptions:

A. PPS-60PM or SM Motor Vacuum Cable (Female Dsub 15 Pin DAP, 1.5m Silver Braided Cable)
B. Encoder Vacuum Cable (Female Dsub 15 Pin DAP, 1.5m Silver Braided Cable)
C. Motor Breakout Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m PVC Black Cable)
D. Encoder Breakout Cable (Female Dsub 15 Pin to Female Dsub 9 Pin, 1.5m PVC Black Cable)

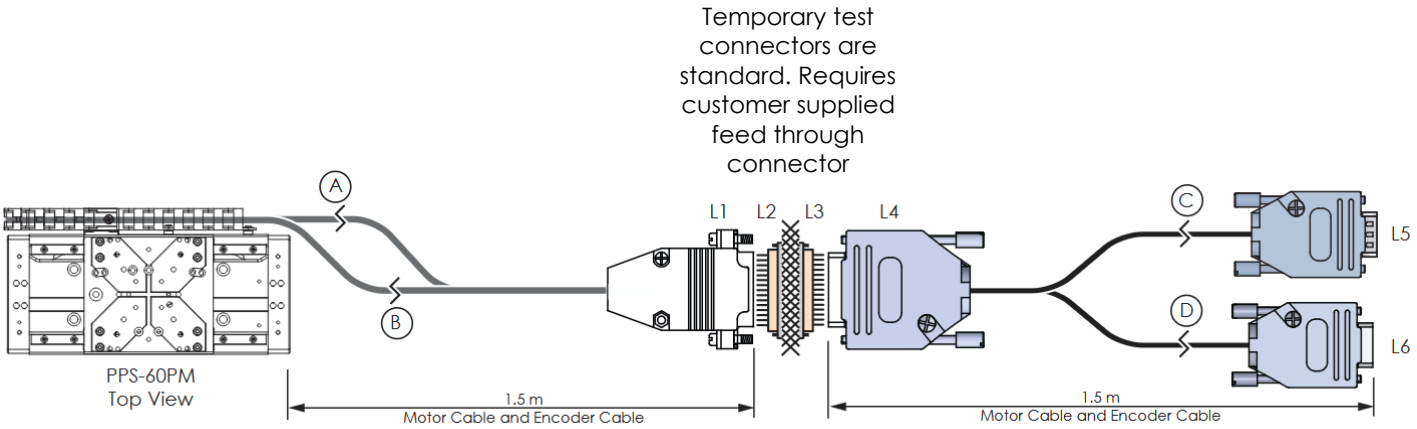


Figure 6-I. PPS-60PM & SM (internal), Analog Encoder, Vacuum Wiring Diagram

PPS-60SM (external) Cable Descriptions:

A. PPS-60SM Motor Vacuum Cable (Female Dsub 15 Pin DAP, 1.5m Silver Braided Cable)
B. Encoder Vacuum Cable (Female Dsub 15 Pin DAP, 1.5m Silver Braided Cable)
C. Motor Breakout Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m PVC Black Cable)
D. Encoder Breakout Cable (Female Dsub 15 Pin to Female Dsub 9 Pin, 1.5m PVC Black Cable)

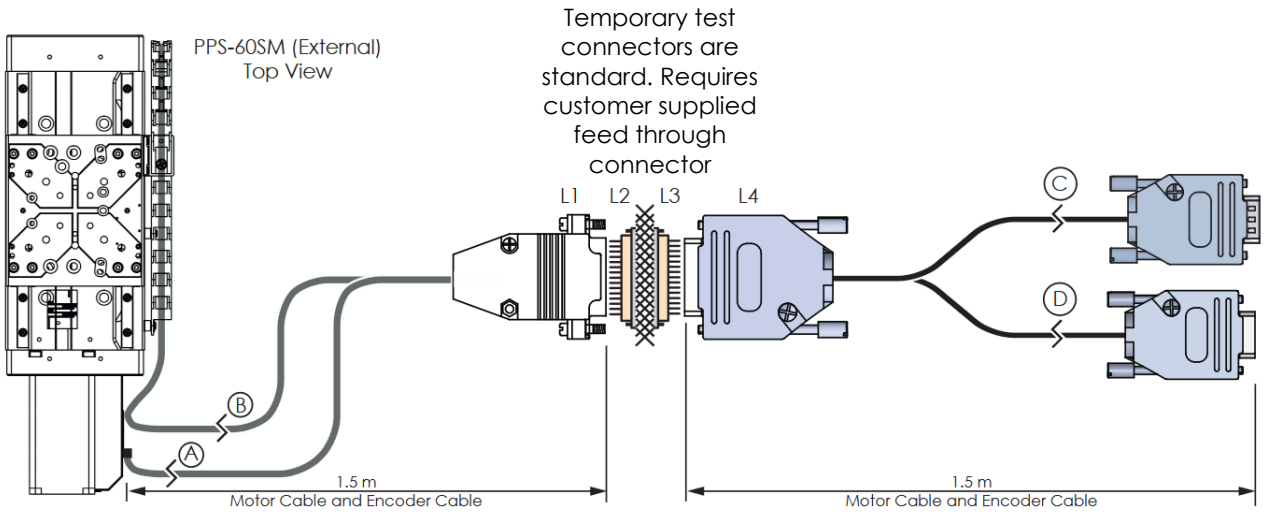


Figure 6-J. PPS-60SM (external), Analog Encoder, Vacuum Wiring Diagram

6.2.3.2 Digital Encoder, Vacuum Wiring Diagram

PPS-60PM & SM (internal) Cable Descriptions:

A. PPS-60PM or SM Motor Vacuum Cable (Female Dsub 15 Pin DAP, 1.5m Silver Braided Cable)
B. Encoder Vacuum Cable (Female Dsub 15 Pin DAP, 1.5m Silver Braided Cable)
C. Motor Breakout Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m PVC Black Cable)
D. Encoder Module Breakout Cable (Female Dsub 15 Pin to Interpolator Module, 1m PVC Black Cable)

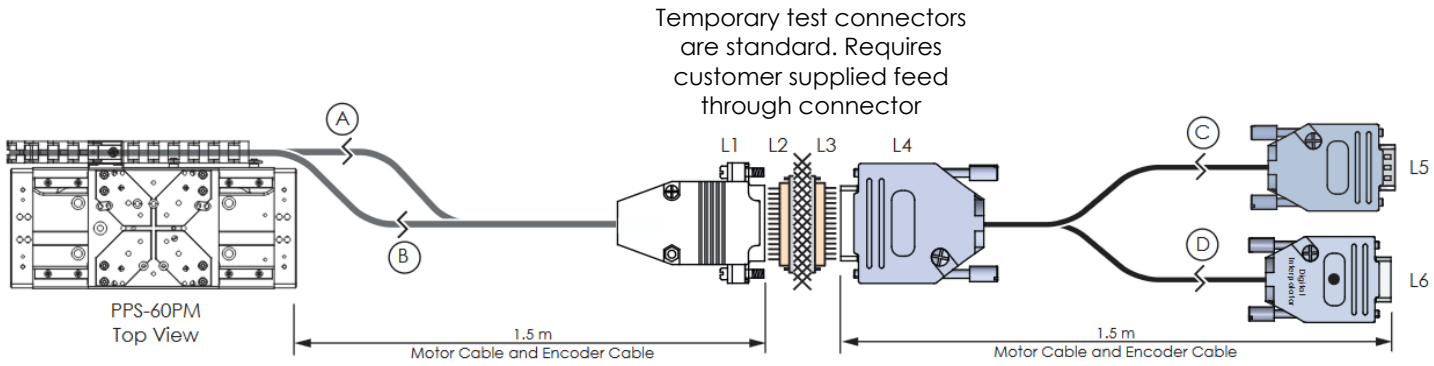


Figure 6-K. PPS-60PM & SM (internal), Digital Encoder, Vacuum Wiring Diagram

PPS-60SM (internal) Cable Descriptions:

A. PPS-60SM Motor Vacuum Cable (Female Dsub 15 Pin DAP, 1.5m Silver Braided Cable)
B. Encoder Vacuum Cable (Female Dsub 15 Pin DAP, 1.5m Silver Braided Cable)
C. Motor Breakout Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m PVC Black Cable)
D. Encoder Module Breakout Cable (Female Dsub 15 Pin to Interpolator Module, 1m PVC Black Cable)

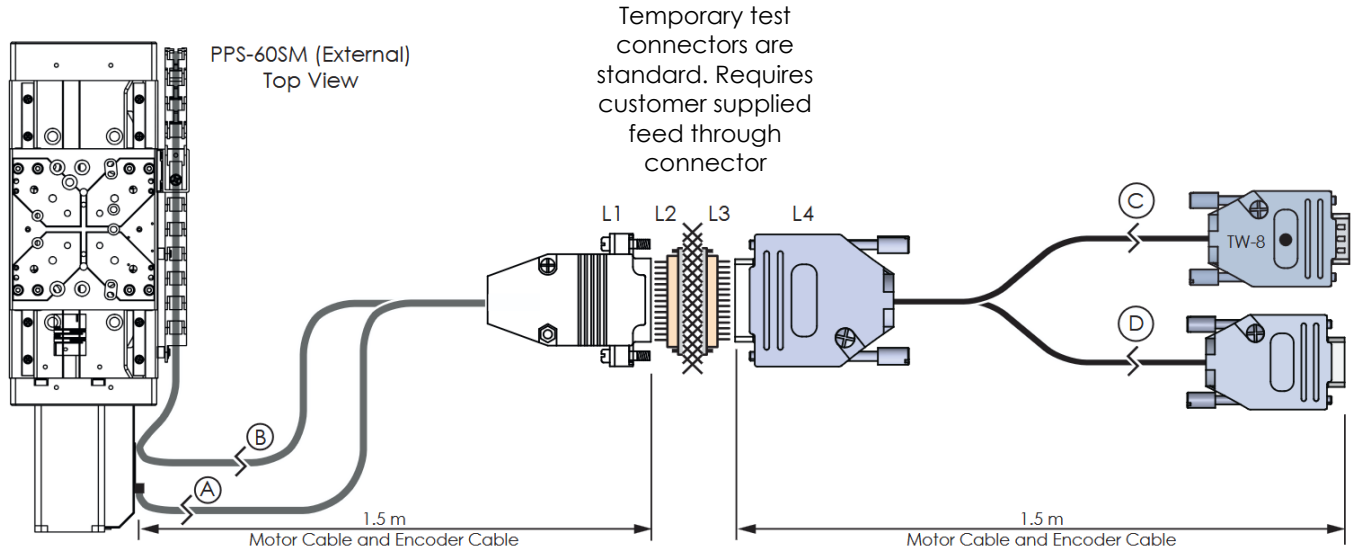


Figure 6-L. PPS-60SM (external), Digital Encoder, Vacuum Wiring Diagram

7. Supplementary Information

7.1 Maintenance

The PPS-60 series of Linear 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.

7.2 Units and Conversions

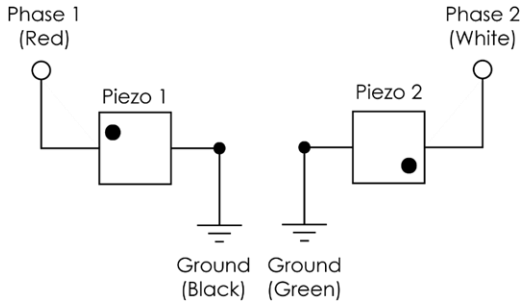
All measurements in this document are in the metric system of units.

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 Motor Specifications

A.1.1 2 Phase Piezo Motor Wiring Diagram



Voltage	60V maximum
Capacitance	150nF ±15%

A.1.2 Stepper Motor Specifications

External Stepper Motor

Motor Type	2 Phase Bipolar
Phase Current	1.3 A_{RMS}
Step Angle	1.8°
Steps	200
Coil-Resistance	1.9 Ohms
Coil-Inductance	1.5 mH
Pitch	1 mm/rev
Resolution/Full step	5 µm

Internal Stepper Motor

Motor Type	2 Phase Bipolar
Phase Current	0.24 A_{RMS}
Step Angle	1.8°
Steps	200
Coil-Resistance	20.4 Ohms
Coil-Inductance	5 mH
Pitch	0.5 mm/rev
Resolution/Full step	2.5 µm

A.1.3 Linear Motor Specifications

Linear Motor

Continuous Force	2.7 N
Continuous Current	0.8 Arms
Acceleration Force	11 N
Acceleration Current	3.4 Arms
Force Constant (K_f)	3.2 N/Arms
Back EMF (K_e)	1.1 V/m/s
Resistance 25°C	6.8 Ohms
Inductance	1.0 mH
Electric Time Constant	0.147ms
Rated Voltage (AC)	240 V
Fundamental Motor Constant (K_m)	1.23 N$\sqrt{W}$
Magnetic Pitch (North-North)	30mm

A.2 Wiring Pinouts

A.2.1 Stepper Motor

A.2.1.1 Atmospheric Open Loop Pinout

Internal Stepper Motor Pinout

			Male Dsub9
	Description:	**Color**	**L1**
A	Motor Phase A+	Green	1
	Motor Phase A-	Green & White	2
	Motor Phase B+	Red & White	3
	Motor Phase B-	Red	4
	Limit GND	Brown	5
	Limit Positive	Violet	6
	Limit Negative	White	7
	Shield	-	Casing

External Stepper Motor Pinout

			Male Dsub9		Female Dsub9	Male Dsub9
	Description:	**Color**	**L1**	**Color**	**L2**	**L3**
A	Motor Phase A+	Red	1	Blue & White (Blue TP)	1	1
	Motor Phase A-	Blue	2	Green & White (Green TP)	2	2
	Motor Phase B+	Green	3	Grey & White (Grey TP)	3	3
	Motor Phase B-	Black	4	Red & Black	4	4
	Limit GND	Brown	5	Brown	5	5
	Limit Negative	White	6	Violet	6	6
	Limit Positive	Violet	7	White (Violet TP)	7	7
	Shield	-	Casing	-	Casing	Casing

See Figure 6-A, Figure 6-B.

A.2.1.2 Atmospheric Closed Loop Analog Pinout

Internal Stepper Motor Pinout

			Male Dsub9
	Description:	**Color**	**L1**
A	Motor Phase A+	Green	1
	Motor Phase A-	Green & White	2
	Motor Phase B+	Red & White	3
	Motor Phase B-	Red	4
	Limit GND	Brown	5
	Limit Positive	Violet	6
	Limit Negative	White	7
	Shield	-	Casing

			Female Dsub9
	Description:	**Color**	**L2**
B	COS+	Brown	1
	SIN+	Blue	2
	Index+	Violet	3
	GND	Grey	4
	+5V	White (Grey TP)	5
	COS-	White (Brown TP)	6
	SIN-	White (Blue TP)	7
	Index-	White (Violet TP)	8
	Shield	-	Casing

External Stepper Motor Pinout

			Male Dsub9		Female Dsub9	Male Dsub9
	Description:	**Color**	**L1**	**Color**	**L2**	**L3**
A	Motor Phase A+	Red	1	Blue & White (Blue TP)	1	1
	Motor Phase A-	Blue	2	Green & White (Green TP)	2	2
	Motor Phase B+	Green	3	Grey & White (Grey TP)	3	3
	Motor Phase B-	Black	4	Red & Black	4	4
	Limit GND	Brown	5	Brown	5	5
	Limit Negative	White	6	Violet	6	6
	Limit Positive	Violet	7	White (Violet TP)	7	7
	Shield	-	Casing	-	Casing	Casing

			Female Dsub9
	Description:	**Color**	**L4**
B	COS+	Brown	1
	SIN+	Blue	2
	Index+	Violet	3
	GND	Grey	4
	+5V	White (Grey TP)	5
	COS-	White (Brown TP)	6
	SIN-	White (Blue TP)	7
	Index-	White (Violet TP)	8
	Shield	-	Casing

See Figure 6-C, Figure 6-D.

A.2.1.3 Atmospheric Closed Loop Digital Pinout

Internal Stepper Motor Pinout

			Male Dsub9
	Description:	**Color**	**L1**
A	Motor Phase A+	Green	1
	Motor Phase A-	Green & White	2
	Motor Phase B+	Red & White	3
	Motor Phase B-	Red	4
	Limit GND	Brown	5
	Limit Positive	Violet	6
	Limit Negative	White	7
	Shield	-	Casing

			Female Dsub9
	Description:	**Color**	**L2**
B	A+	Brown	1
	B+	Blue	2
	Index+	Violet	3
	GND	Grey	4
	+5V	White (Grey TP)	5
	A-	White (Brown TP)	6
	B-	White (Blue TP)	7
	Index-	White (Violet TP)	8
	Shield	-	Casing

External Stepper Motor Pinout

A

		Male Dsub9		Female Dsub9	Male Dsub9
Description:	**Color**	**L1**	**Color**	**L2**	**L3**
Motor Phase A+	Red	1	Blue & White (Blue TP)	1	1
Motor Phase A-	Blue	2	Green & White (Green TP)	2	2
Motor Phase B+	Green	3	Grey & White (Grey TP)	3	3
Motor Phase B-	Black	4	Red & Black	4	4
Limit GND	Brown	5	Brown	5	5
Limit Negative	White	6	Violet	6	6
Limit Positive	Violet	7	White (Violet TP)	7	7
Shield	-	Casing	-	Casing	Casing

B

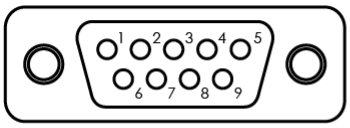
		Female Dsub9
Description:	**Color**	**L4**
A+	Brown	1
B+	Blue	2
Index+	Violet	3
GND	Grey	4
+5V	White (Grey TP)	5
A-	White (Brown TP)	6
B-	White (Blue TP)	7
Index-	White (Violet TP)	8
Shield	-	Casing

See Figure 6-E, Figure 6-F.

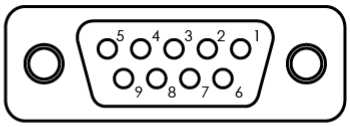
A.2.1.4 HV Open Loop Pinout

Internal Stepper Motor

			Female Dsub9	Male Dsub9 Feedthrough			Female Dsub9	Male Dsub9
	Description:	**Color**	**L1**	**L2**	**L3**	**Color**	**L4**	**L5**
A & B	Motor Phase A+	Green	5	5	1	Blue & White (Blue TP)	1	1
	Motor Phase A-	Green/White	4	4	2	Green & White (Green TP)	2	2
	Motor Phase B+	Red/White	3	3	3	Grey & White (Grey TP)	3	3
	Motor Phase B-	Red	2	2	4	Red & Black	4	4
	Limit GND	Brown	1	1	5	Brown	5	5
	Limit Positive	Violet	9	9	6	Violet	6	6
	Limit Negative	White	8	8	7	White (Violet TP)	7	7
	Shield	-	6	6	9	-	9	Casing



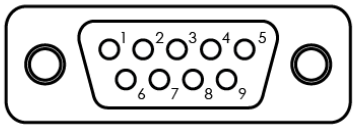
Female Dsub9 Connector - Rear View



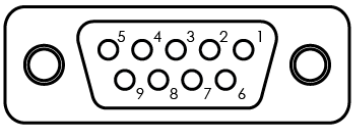
Male Dsub9 Connector - Rear View

External Stepper Motor

			Female Dsub9	Male Dsub9 Feedthrough			Female Dsub9	Male Dsub9
	Description:	**Color**	**L1**	**L2**	**L3**	**Color**	**L4**	**L5**
A & B	Motor Phase A+	Red	5	5	1	Blue & White (Blue TP)	1	1
	Motor Phase A-	Blue	4	4	2	Green & White (Green TP)	2	2
	Motor Phase B+	Green	3	3	3	Grey & White (Grey TP)	3	3
	Motor Phase B-	Black	2	2	4	Red & Black	4	4
	Limit GND	Brown	1	1	5	Brown	5	5
	Limit Negative	White	9	9	6	Violet	6	6
	Limit Positive	Violet	8	8	7	White (Violet TP)	7	7
	Shield	-	6	6	9	-	9	Casing



Female Dsub9 Connector - Rear View



Male Dsub9 Connector - Rear View

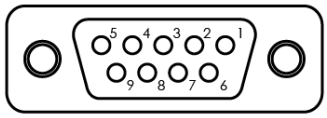
See Figure 6-G, Figure 6-H.

A.2.1.5 HV Closed Loop Analog Pinout

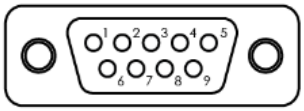
Internal Stepper Motor

			Female Dsub15	Male Dsub15 Feedthrough			Female Dsub15	Male Dsub9	Female Dsub9
	Description:	**Color**	**L1**	**L2**	**L3**	**Color**	**L4**	**L5**	**L6**
A&C	Motor Phase A+	Green	1	1	8	Blue & White (Blue TP)	8	1	-
	Motor Phase A-	Green/White	9	9	15	Green & White (Green TP)	15	2	-
	Motor Phase B+	Red/White	2	2	7	Grey & White (Grey TP)	7	3	-
	Motor Phase B-	Red	10	10	14	Red & Black	14	4	-
	Limit GND*	Brown	12	12	12	Brown	12	5	-
	Limit Positive	Violet	11	11	13	Violet	13	6	-
	Limit Negatve	White	3	3	6	White (Violet TP)	6	7	-
B&D	COS+	Brown	7	7	2	Brown	2	-	1
	SIN+	Blue	15	15	9	Blue	9	-	2
	Index+	Violet	6	6	3	Violet	3	-	3
	Encoder GND*	Grey	12	12	12	Grey	12	-	4
	+5V	White (Grey TP)	5	5	4	White (Grey TP)	4	-	5
	COS-	White (Brown TP)	14	14	10	White (Brown TP)	10	-	6
	SIN-	White (Blue TP)	8	8	1	White (Blue TP)	1	-	7
	Index-	White (Violet TP)	13	13	11	White (Violet TP)	11	-	8
	Encoder Shield	-	4	4	5	-	5	-	Casing

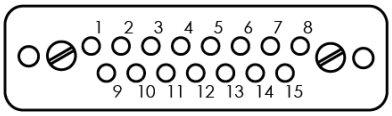
*** Limit GND and Encoder GND are tied together.**
**** Do not trim the Green and White (Green TP) wires on L1, leave them easily accessable and strip 3 - 5 mm**



Male Dsub9 Connector - Rear View



Female Dsub9 Connector - Rear View

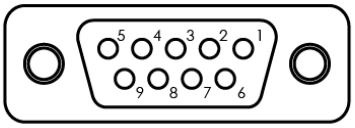


Female Dsub15 Connector - Rear View

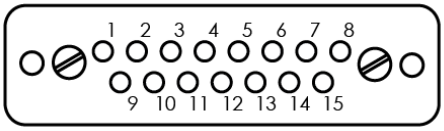
External Stepper Motor

			Female Dsub15	Male Dsub15 Feedthrough			Female Dsub15	Male Dsub9	Female Dsub9
	Description:	**Color**	**L1**	**L2**	**L3**	**Color**	**L4**	**L5**	**L6**
A&C	Motor Phase A+	Red	1	1	8	Blue & White (Blue TP)	8	1	-
	Motor Phase A-	Blue	9	9	15	Green & White (Green TP)	15	2	-
	Motor Phase B+	Green	2	2	7	Grey & White (Grey TP)	7	3	-
	Motor Phase B-	Black	10	10	14	Red & Black	14	4	-
	Limit GND*	Brown	12	12	12	Brown	12	5	-
	Limit Negative	White	11	11	13	Violet	13	6	-
	Limit Positive	Violet	3	3	6	White (Violet TP)	6	7	-
B&D	COS+	Brown	7	7	2	Brown	2	-	1
	SIN+	Blue	15	15	9	Blue	9	-	2
	Index+	Violet	6	6	3	Violet	3	-	3
	Encoder GND*	Grey	12	12	12	Grey	12	-	4
	+5V	White (Grey TP)	5	5	4	White (Grey TP)	4	-	5
	COS-	White (Brown TP)	14	14	10	White (Brown TP)	10	-	6
	SIN-	White (Blue TP)	8	8	1	White (Blue TP)	1	-	7
	Index-	White (Violet TP)	13	13	11	White (Violet TP)	11	-	8
	Encoder Shield	-	4	4	5	-	5	-	Casing

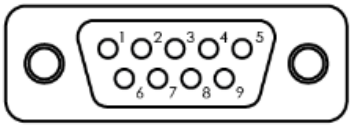
*** Limit GND and Encoder GND are tied together.**
**** Do not trim the Green and White (Green TP) wires on L1, leave them easily accessable and strip 3 - 5 mm**



Male Dsub9 Connector - Rear View



Female Dsub15 Connector - Rear View



Female Dsub9 Connector - Rear View

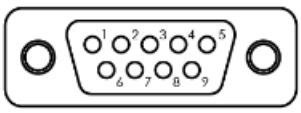
See Figure 6-I, Figure 6-J.

A.2.1.6 HV Closed Loop Digital Pinout

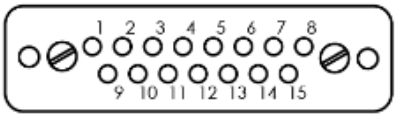
Internal Stepper Motor

			Female Dsub15	Male Dsub15 Feedthrough			Female Dsub15	Male Dsub9	Female Dsub9
	Description:	**Color**	**L1**	**L2**	**L3**	**Color**	**L4**	**L5**	**L6**
A&C	Motor Phase A+	Green	1	1	8	Blue & White (Blue TP)	8	1	-
A&C	Motor Phase A-	Green/White	9	9	15	Green & White (Green TP)	15	2	-
A&C	Motor Phase B+	Red/White	2	2	7	Grey & White (Grey TP)	7	3	-
A&C	Motor Phase B-	Red	10	10	14	Red & Black	14	4	-
A&C	Limit GND*	Brown	12	12	12	Brown	12	5	-
A&C	Limit Positive	Violet	11	11	13	Violet	13	6	-
A&C	Limit Negatve	White	3	3	6	White (Violet TP)	6	7	-
B&D	A+	Brown	7	7	2	Brown	2	-	1
B&D	B+	Blue	15	15	9	Blue	9	-	2
B&D	Index+	Violet	6	6	3	Violet	3	-	3
B&D	Encoder GND*	Grey	12	12	12	Grey	12	-	4
B&D	+5V	White (Grey TP)	5	5	4	White (Grey TP)	4	-	5
B&D	A-	White (Brown TP)	14	14	10	White (Brown TP)	10	-	6
B&D	B-	White (Blue TP)	8	8	1	White (Blue TP)	1	-	7
B&D	Index-	White (Violet TP)	13	13	11	White (Violet TP)	11	-	8
B&D	Encoder Shield	-	4	4	5	-	5	-	Casing

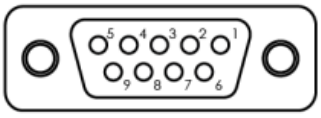
*** Limit GND and Encoder GND are tied together.**
**** Do not trim the Green and White (Green TP) wires on L1, leave them easily accessable and strip 3 - 5 mm**



Female Dsub9 Connector - Rear View



Female Dsub15 Connector - Rear View



Male Dsub9 Connector - Rear View

External Stepper Motor

			Female Dsub15	Male Dsub15 Feedthrough			Female Dsub15	Male Dsub9	Female Dsub9
	Description:	**Color**	**L1**	**L2**	**L3**	**Color**	**L4**	**L5**	**L6**
A&C	Motor Phase A+	Red	1	1	8	Blue & White (Blue TP)	8	1	-
A&C	Motor Phase A-	Blue	9	9	15	Green & White (Green TP)	15	2	-
A&C	Motor Phase B+	Green	2	2	7	Grey & White (Grey TP)	7	3	-
A&C	Motor Phase B-	Black	10	10	14	Red & Black	14	4	-
A&C	Limit GND*	Brown	12	12	12	Brown	12	5	-
A&C	Limit Negative	White	11	11	13	Violet	13	6	-
A&C	Limit Positive	Violet	3	3	6	White (Violet TP)	6	7	-
B&D	A+	Brown	7	7	2	Brown	2	-	1
B&D	B+	Blue	15	15	9	Blue	9	-	2
B&D	Index+	Violet	6	6	3	Violet	3	-	3
B&D	Encoder GND*	Grey	12	12	12	Grey	12	-	4
B&D	+5V	White (Grey TP)	5	5	4	White (Grey TP)	4	-	5
B&D	A-	White (Brown TP)	14	14	10	White (Brown TP)	10	-	6
B&D	B-	White (Blue TP)	8	8	1	White (Blue TP)	1	-	7
B&D	Index-	White (Violet TP)	13	13	11	White (Violet TP)	11	-	8
B&D	Encoder Shield	-	4	4	5	-	5	-	Casing

*** Limit GND and Encoder GND are tied together.**
**** Do not trim the Green and White (Green TP) wires on L1, leave them easily accessable and strip 3 - 5 mm**

See Figure 6-K, Figure 6-L.

A.2.2 Linear Motor

A.2.2.1 Atmospheric Closed Loop Analog Pinout

A

Description:	Color	Male Dsub9 L1
Motor Phase A/U	Red	1
Motor Phase B/V	Black	2
Motor Phase C/W	White	3
Limit GND	Brown	5
Limit Negative	White	6
Limit Positive	Violet	7
Shield	-	Casing

B

Description:	Color	Female Dsub9 L2
COS+	Brown	1
SIN+	Blue	2
Index+	Violet	3
GND	Grey	4
+5V	White (Grey TP)	5
COS-	White (Brown TP)	6
SIN-	White (Blue TP)	7
Index-	White (Violet TP)	8
Shield	-	Casing

See Figure 6-C.

A.2.2.2 Atmospheric Closed Loop Digital Pinout

A

Description:	Color	Male Dsub9 L1
Motor Phase A/U	Red	1
Motor Phase B/V	Black	2
Motor Phase C/W	White	3
Limit GND	Brown	5
Limit Negative	White	6
Limit Positive	Violet	7
Shield	-	Casing

B

Description:	Color	Female Dsub9 L2
A+	Brown	1
B+	Blue	2
Index+	Violet	3
GND	Grey	4
+5V	White (Grey TP)	5
A-	White (Brown TP)	6
B-	White (Blue TP)	7
Index-	White (Violet TP)	8
Shield	-	Casing

See Figure 6-E.

A.2.3 Piezo Motor

A.2.3.1 Atmospheric Open Loop Pinout

			Male Dsub9
	Description:	**Color**	**L1**
A	Motor Phase 1	Red	1
	Motor Phase 2	White(Green TP)	2
	Motor GND	Black/Green	5
	Shield	-	Casing

See Figure 6-A.

A.2.3.2 Atmospheric Closed Loop Analog Pinout

			Male Dsub9
	Description:	**Color**	**L1**
A	Motor Phase 1	Red	1
	Motor Phase 2	White(Green TP)	2
	Motor GND	Black/Green	5
	Shield	-	Casing

			Female Dsub9
	Description:	**Color**	**L2**
B	COS+	Brown	1
	SIN+	Blue	2
	Index+	Violet	3
	GND	Grey	4
	+5V	White (Grey TP)	5
	COS-	White (Brown TP)	6
	SIN-	White (Blue TP)	7
	Index-	White (Violet TP)	8
	Shield	-	Casing

See Figure 6-C.

A.2.3.3 Atmospheric Closed Loop Digital Pinout

			Male Dsub9
	Description:	**Color**	**L1**
A	Motor Phase 1	Red	1
	Motor Phase 2	White(Green TP)	2
	Motor GND	Black/Green	5
	Shield	-	Casing

			Female Dsub9
	Description:	**Color**	**L2**
B	A+	Brown	1
	B+	Blue	2
	Index+	Violet	3
	GND	Grey	4
	+5V	White (Grey TP)	5
	A-	White (Brown TP)	6
	B-	White (Blue TP)	7
	Index-	White (Violet TP)	8
	Shield	-	Casing

See Figure 6-E.

A.2.3.4 HV Open Loop Pinout

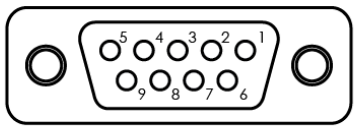
			Female Dsub9	Male Dsub9 Feedthrough			Female Dsub9	Male Dsub9
	Description:	**Color**	**L1**	**L2**	**L3**	**Color**	**L4**	**L5**
A&B	Motor Phase 1	Red	5	5	1	Red	1	1
	Motor Phase 2	White (Green TP)	4	4	2	White (Green TP)	2	2
	Motor GND	Black/Green	1	1	5	Black/Green	5	5
	Shield	-	6	6	9	-	9	Casing

See Figure 6-G.

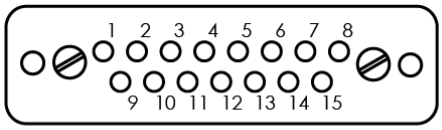
A.2.3.5 HV Closed Loop Analog Pinout

			Female Dsub15	Male Dsub15 Feedthrough			Female Dsub15	Male Dsub9	Female Dsub9
	Description:	**Color**	**L1**	**L2**	**L3**	**Color**	**L4**	**L5**	**L6**
A&C	Motor Phase 1	Red	1	1	8	Red	8	1	-
A&C	Motor Phase 2	White (Green TP)	2	2	7	White (Green TP)	7	2	-
A&C	Motor GND	Black/Green	9	9	15	Black/Green	15	5	-
A&C	Motor Shield	-	10	10	14	-	14	Casing	-
B&D	Encoder GND	Grey	8	8	1	Grey	1	-	4
B&D	COS+	Brown	7	7	2	Brown	2	-	1
B&D	+5V	White (Grey TP)	6	6	3	White (Grey TP)	3	-	5
B&D	COS-	White (Brown TP)	5	5	4	White (Brown TP)	4	-	6
B&D	SIN+	Blue	4	4	5	Blue	5	-	2
B&D	SIN-	White (Blue TP)	12	12	12	White (Blue TP)	12	-	7
B&D	Index-	White (Violet TP)	13	13	11	White (Violet TP)	11	-	8
B&D	Index+	Violet	14	14	10	Violet	10	-	3
B&D	Encoder Shield	-	15	15	9	-	9	-	Casing

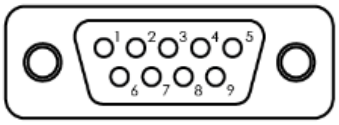
See Figure 6-I.



Male Dsub9 Connector - Rear View



Female Dsub15 Connector - Rear View

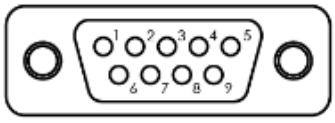


Female Dsub9 Connector - Rear View

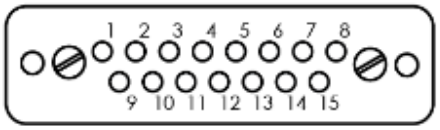
A.2.3.6 HV Closed Loop Digital Pinout

			Female Dsub15	Male Dsub15 Feedthrough			Female Dsub15	Male Dsub9	Female Dsub9
	Description:	**Color**	**L1**	**L2**	**L3**	**Color**	**L4**	**L5**	**L6**
A&C	Motor 1, Phase 1	Red	1	1	8	Red	8	1	-
A&C	Motor 1, Phase 2	White (Green TP)	2	2	7	White (Green TP)	7	2	-
A&C	Motor 1 GND	Black/Green	9	9	15	Black/Green	15	5	-
A&C	Motor Shield	-	10	10	14	-	14	Casing	-
B&D	Encoder GND	Grey	8	8	1	Grey	1	-	4
B&D	A+	Brown	7	7	2	Brown	2	-	1
B&D	+5V	White (Grey TP)	6	6	3	White (Grey TP)	3	-	5
B&D	A-	White (Brown TP)	5	5	4	White (Brown TP)	4	-	6
B&D	B+	Blue	4	4	5	Blue	5	-	2
B&D	B-	White (Blue TP)	12	12	12	White (Blue TP)	12	-	7
B&D	Index-	White (Violet TP)	13	13	11	White (Violet TP)	11	-	8
B&D	Index+	Violet	14	14	10	Violet	10	-	3
B&D	Encoder Shield	-	15	15	9	-	9	-	Casing

See Figure 6-K.

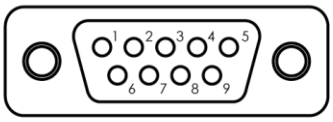


Female Dsub9 Connector - Rear View

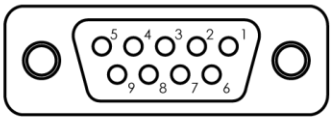


Female Dsub15 Connector - Rear View

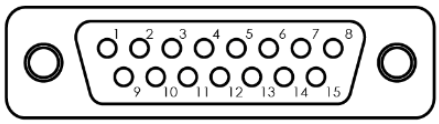
A.3 D-sub Connector Pinout



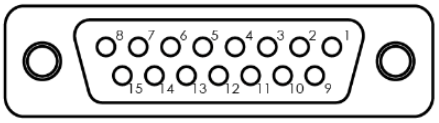
Male Dsub9 Connector (Dsub9M) - Front View



Female Dsub9 Connector (Dsub9F) - Front View

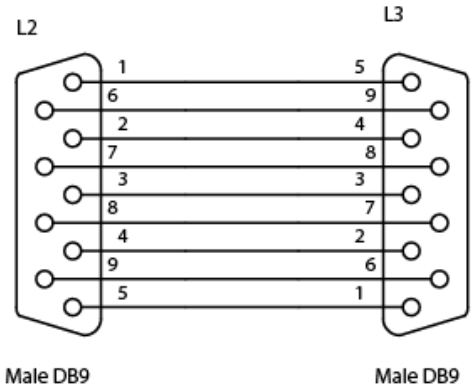


Male Dsub15 Connector (Dsub-15M) - Front View



Female Dsub15 Connector (Dsub-15F) - Front View

A.4 Vacuum Feedthrough Pinout



A.5 Limit Switches

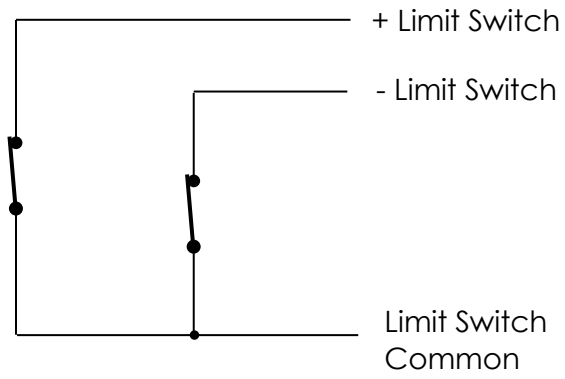
The limit switches are normally closed (when not activated) and should be connected to a compatible controller that recognizes these settings. A hard stop is designed into the PPS-60 body which will prevent the carriage from running away should the limit switches fail.

The mechanical 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.5.1 Mechanical Limit Switches

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

A.5.2 Limit Switch Schematic



A.6 Using an Analog Encoder

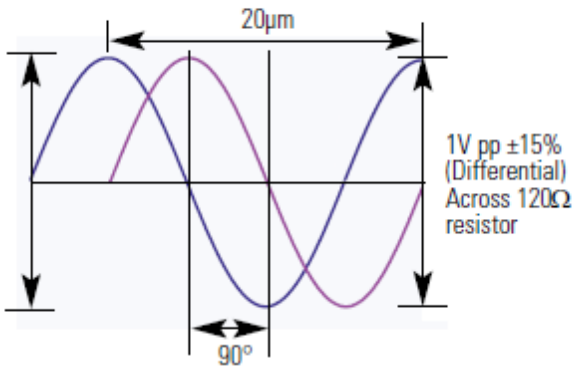
A.6.1 Analog Encoder Overview

A PPS-60 with analog encoder will need to be paired with an appropriate controller that supports 1 Vpp sine/cosine encoders. Refer to Section 1.2 for compatibility between encoder type, motor type, and controller. The PPS-60 with an analog encoder will be supplied with a D-sub 9 pin connector that incorporates these encoder signals.

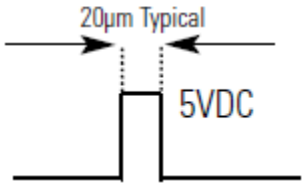
A.6.2 Operating and Electrical Specifications

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

A.6.3 Analog Output



A.6.4 Index Window



A.6.5 Resolution

All closed loop stages are supplied with 20µm scales. The interpolation is done in an MMC controller to a higher resolution as specified in the order. See datasheet for resolution.

A.7 Using a Digital Encoder

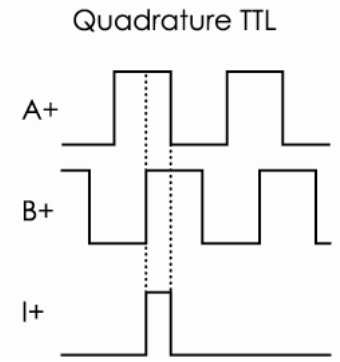
A.7.1 Encoder Overview

The PPS-60 with the digital encoder must be paired with an appropriate controller. The PPS-60 with a digital encoder will be supplied with a D-sub 9-pin connector that incorporates these encoder signals.

A.7.2 Operating and Electrical Specifications

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

A.7.3 Output Signals



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

A.7.4 Resolution

All closed loop stages are supplied with 20µm scales. The digital encoder module interpolates to a higher resolution as specified in the order. See datasheet for resolution.

A.8 Legacy

A.8.1 Legacy Internal Stepper Motor HV Closed Loop Digital Pinout

Internal Stepper Motor Connector Pinout

Description	Color	L1	L2	L3	L4	L8
Motor Phase A+	Green	1	1	13	13 (Green)	1
Ground	Brown	14	14	25	25 (Brown)	5
Motor Phase A-	Green & White	2	2	12	12 (White - Green TP)	2
Limit Switch +	Violet	15	15	24	24 (Violet)	6
Motor Phase B+	Red & White	3	3	11	11 (Black)	3
Limit Switch -	White	16	16	23	23 (White - Violet TP)	7
Motor Phase B-	Red	4	4	10	10 (Red)	4
Shield	-	5	5	9	9 (Shield)	Casing
+5VDC	Red	8	8	6	6 (Red)	
GND	Black	20	20	19	19 (Black)	
DCLK-	Gray	9	9	5	5 (Gray)	
DCLK+	White - Gray TP	21	21	18	18 (White - Gray TP)	
MISO-	Violet	10	10	4	4 (Violet)	
MISO+	White - Violet TP	22	22	17	17 (White - Violet TP)	
MOSI-	Blue	11	11	3	3 (Blue)	
MOSI+	White - Blue TP	23	23	16	16 (White - Blue TP)	
nSS-	Green	12	12	2	2 (Green)	
nSS+	White - Green TP	24	24	15	15 (White - Green TP)	
CLK-	Brown	13	13	1	1 (Brown)	
CLK+	White - Brown TP	25	25	14	14 (White - Brown TP)	
Shield	-	7	7	7	7 (Shield)	

-Encoder

-Motor

A.8.2 Legacy Piezo Digital MII6000V Encoder, Ultra High Vacuum Wiring Diagram

Piezo Motor Connector Pinout

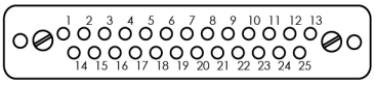
Description	Color	L1	L2	L3	L4	L8
Phase 1	Red	1	1	13	13 (Red)	1
Phase 2	Yellow	2	2	12	12 (White - Green TP)	2
Ground	Green&Blk	14	14	25	25 (Green&Blk)	5
Shield	Shield	15	15	24	24 (Shield)	Casing
+5VDC	Red	4	4	10	10 (Red)	
GND	Black	17	17	22	22 (Black)	
DCLK-	Gray	5	5	9	9 (Gray)	
DCLK+	White - Gray TP	18	18	21	21 (White - Gray TP)	
MISO-	Violet	6	6	8	8 (Violet)	
MISO+	White - Violet TP	19	19	20	20 (White - Violet TP)	
MOSI-	Blue	7	7	7	7 (Blue)	
MOSI+	White - Blue TP	20	20	19	19 (White - Blue TP)	
nSS-	Green	8	8	6	6 (Green)	
nSS+	White - Green TP	21	21	18	18 (White - Green TP)	
CLK-	Brown	9	9	5	5 (Brown)	
CLK+	White - Brown TP	22	22	17	17 (White - Brown TP)	
Shield	Shield	16	16	23	N/C	

-Encoder

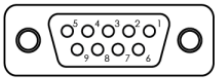
-Motor

External Stepper Motor Connector Pinout

Description	Color	L1	L2	L3	L4	L8
Motor Phase A+	Red	1	1	13	13 (Red)	1
Ground	Brown	14	14	25	25 (Brown)	5
Motor Phase A-	Blue	2	2	12	12 (Blue)	2
Limit Switch +	White	15	15	24	24 (White - Violet TP)	6
Motor Phase B+	Green	3	3	11	11 (Green)	3
Limit Switch -	Violet	16	16	23	23 (Violet)	7
Motor Phase B-	Black	4	4	10	10 (Black)	4
Shield	-	5	5	9	9 (Shield)	Casing
+5VDC	Red	8	8	6	6 (Red)	
GND	Black	20	20	19	19 (Black)	
DCLK-	Gray	9	9	5	5 (Gray)	
DCLK+	White - Gray TP	21	21	18	18 (White - Gray TP)	
MISO-	Violet	10	10	4	4 (Violet)	
MISO+	White - Violet TP	22	22	17	17 (White - Violet TP)	
MOSI-	Blue	11	11	3	3 (Blue)	
MOSI+	White - Blue TP	23	23	16	16 (White - Blue TP)	
nSS-	Green	12	12	2	2 (Green)	
nSS+	White - Green TP	24	24	15	15 (White - Green TP)	
CLK-	Brown	13	13	1	1 (Brown)	
CLK+	White - Brown TP	25	25	14	14 (White - Brown TP)	
Shield	-	7	7	7	7 (Shield)	



Female PEEK Dsub25 Connector - Rear View



Male Dsub9 Connector - Rear View

A.8.3 Legacy 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. Optical limit switches can be factory adjusted to custom travel lengths.

A.8.4 Legacy UHV Encoder Module Pin-out

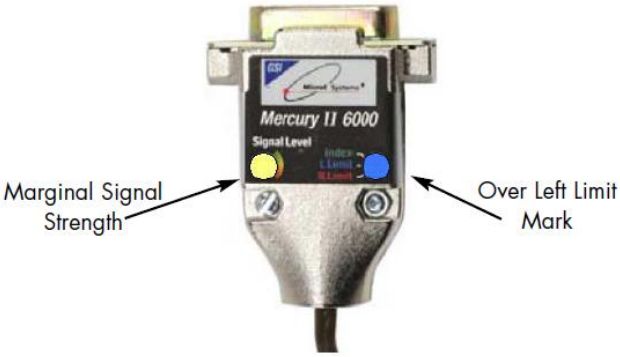
Pin	Description	Pin	Description
1	*Right Limit+	9	Ground
2	Ground	10	*Left Limit+
3	*Right Limit-	11	*Left Limit-
4	Index-	12	Index+
5	B-	13	B+
6	A-	14	A+
7	+5V	15	(not used)
8	+5V		

*-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.

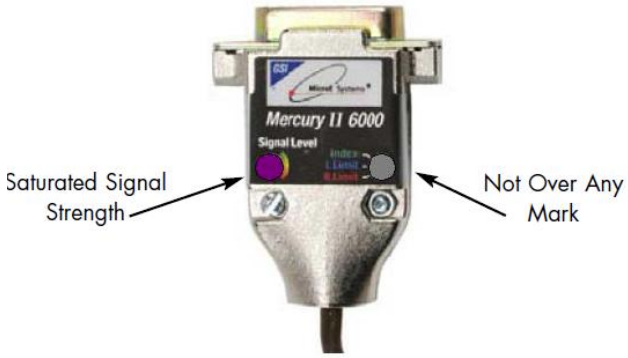
Normal Operation











A.8.5 Digital Encoder. Atmospheric Wiring Diagram

PPS-60PM, LM, & SM (internal) Cable Descriptions

A. PPS-60PM, LM, or SM Motor Cable (Male Dsub9 Pin, 1.5m PVC Black Cable)
B. Encoder Cable (Male Dsub15 Pin Module, 1m PVC Black Cable)
C. Encode Module Adapter Cable (Female Dsub 15 Pin to Female Dsub 9 Pin, 0.5m PVC Black Cable)

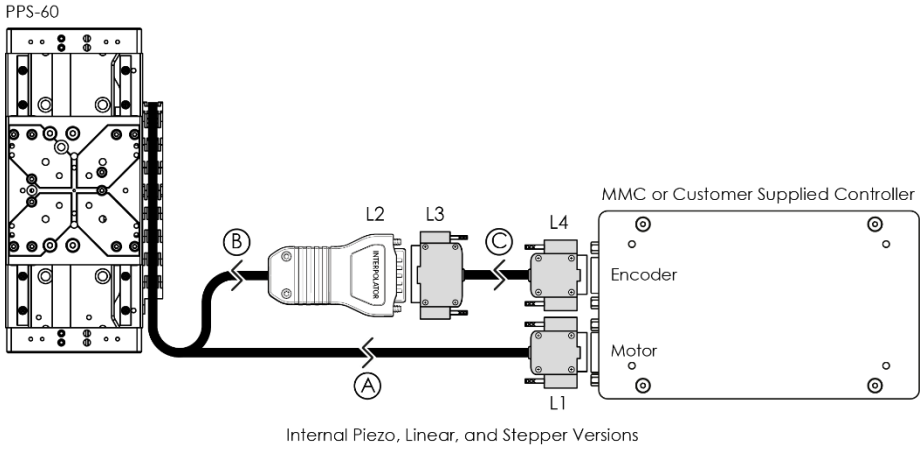


Figure A-A. Legacy PPS-60PM, LM, & SM (internal), Digital Encoder, Atmospheric Wiring Diagram

PPS-60SM (external) Cable Descriptions:

A. PPS-60SM Motor Cable (Male Dsub9 Pin to Male Dsub9 Pin, 1.5m PVC Black Cable)
B. Encoder Cable (Male Dsub15 Pin Module, 1m PVC Black Cable)
C. Encode Module Adapter Cable (Female Dsub 15 Pin to Female Dsub 9 Pin, 0.5m PVC Black Cable)

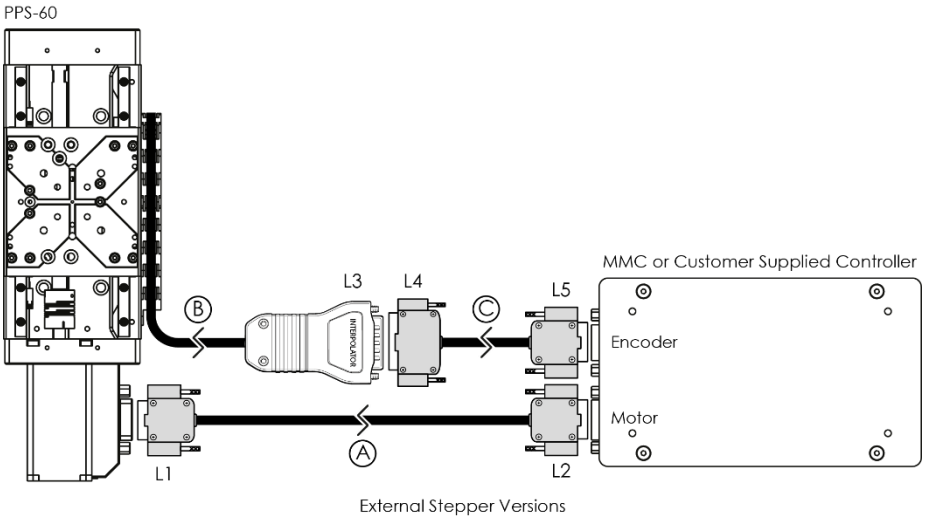


Figure A-B. Legacy PPS-60SM (external), Digital Encoder, Atmospheric Wiring Diagram

A.8.6 Digital Encoder, Vacuum Wiring Diagram

PPS-60PM & SM (internal) Cable Descriptions:

A. PPS-60PM or SM Motor Vacuum Cable (Female Dsub 15 Pin DAP, 1.5m Silver Braided Cable)
B. Encoder Vacuum Cable (Female Dsub 15 Pin DAP, 1.5m Silver Braided Cable)
C. Motor Breakout Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m PVC Black Cable)
D. Encoder Module Breakout Cable (Female Dsub 15 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)

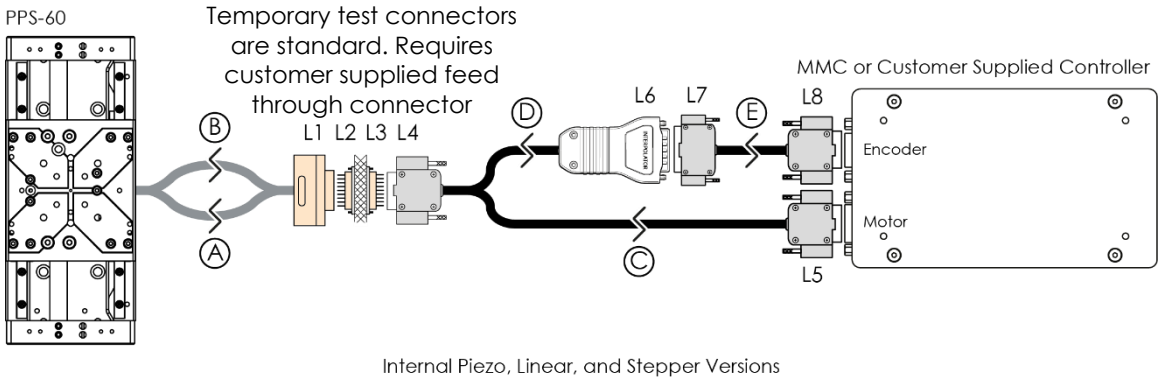


Figure A-C. Legacy PPS-60PM & SM (internal), Digital Encoder, Vacuum Wiring Diagram

PPS-60SM (internal) Cable Descriptions:

A. PPS-60SM Motor Vacuum Cable (Female Dsub 15 Pin DAP, 1.5m Silver Braided Cable)
B. Encoder Vacuum Cable (Female Dsub 15 Pin DAP, 1.5m Silver Braided Cable)
C. Motor Breakout Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m PVC Black Cable)
D. Encoder Module Breakout Cable (Female Dsub 15 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)

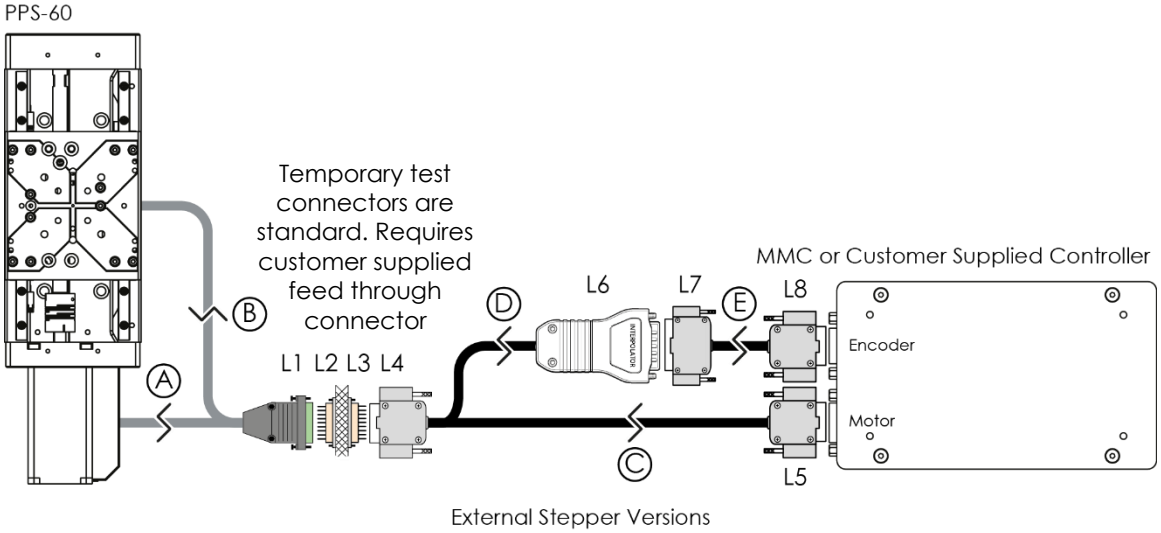


Figure A-D. Legacy PPS-60SM (external), Digital Encoder, Vacuum Wiring Diagram

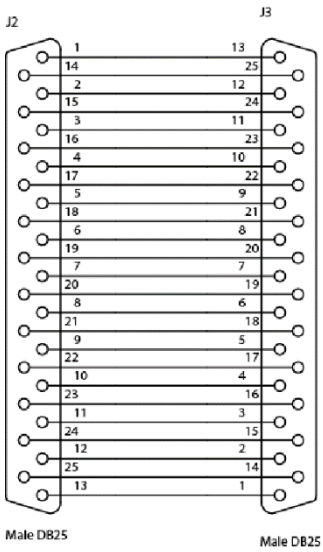
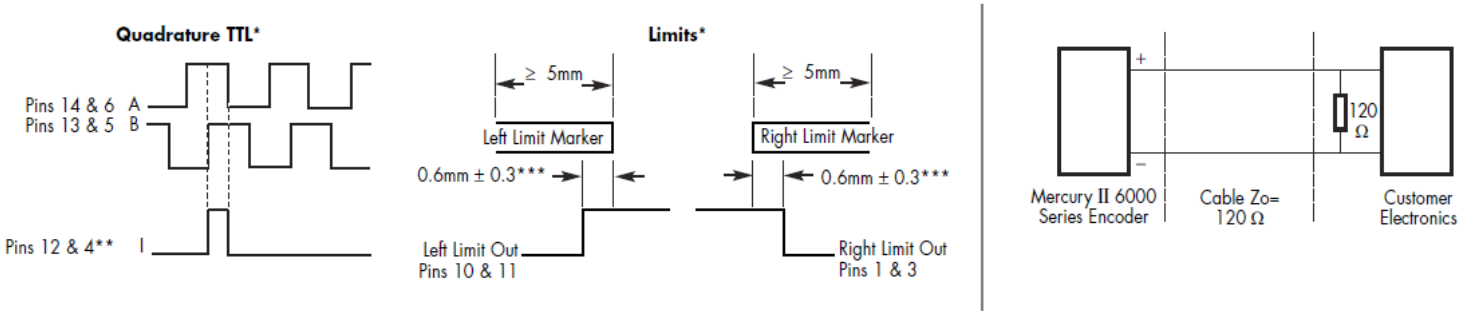


Figure A-E. Legacy Vacuum Feedthrough Pinout

A.8.7 Operating and Electrical Specifications

Power Supply	5VDC ±5% @ 140mA (No outputs terminated) @ 180mA (A, B, I, and both limits terminated); 50mA at the sensor
Operating Temperature	0 to 70°C
Humidity	10 - 90% RH non-condensing

A.8.8 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 are with reference to the sensor's optical centerline

A.8.9 Resolution

All closed loop stages are supplied with 20µm scales. The digital encoder module interpolates to a higher resolution as specified in the order. See datasheet for resolution.