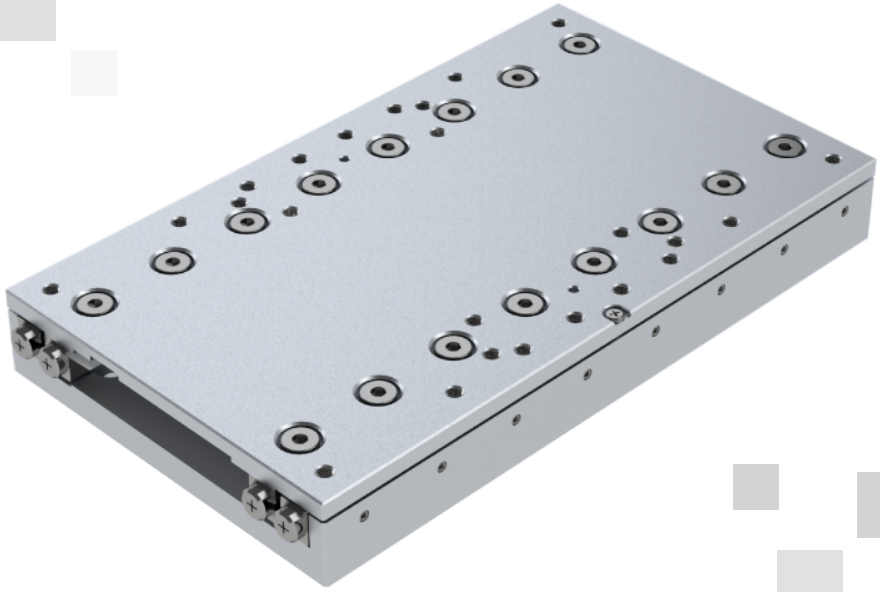
PPS-70

Series



Precision Positioning Stage

Reference Manual

(Piezo and Linear Motor Versions)

micronix USA
PRECISION MOTION SOLUTIONS

PPS-70

Piezo/Linear Motor
Precision Positioning Stage

Reference Manual

Rev X1

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1. Introduction

1.1 Product Description

The precision piezo stage PPS-70 allows nano-positioning of high loads with our patented multi-piezo motor, while the brushless linear motor stage PPS-70 allows nano-positioning at high speeds. Crossed roller bearings assure high stiffness for loads up to 30 N.

Both drive versions of the PPS-70 are fully integrated and optional high-resolution encoder (up to 1nm resolution) or absolute encoder (25nm resolution).

Both PPS-70 configurations are available with external NanoDrive controller. PPS-70 can be combined with selected rotary, elevation and gonio stages for ultimate motion flexibility.

Features:

- Standard travel ranges up to 100 mm
- Closed loop absolute encoder resolution to 25 nm
- Closed loop digital encoder resolution to 1 nm
- Load capacity up to 3 kg (higher on request)
- Crossed roller bearing (anti-creep)
- Low profile, 15 mm height
- Vacuum versions available (piezo drive only)

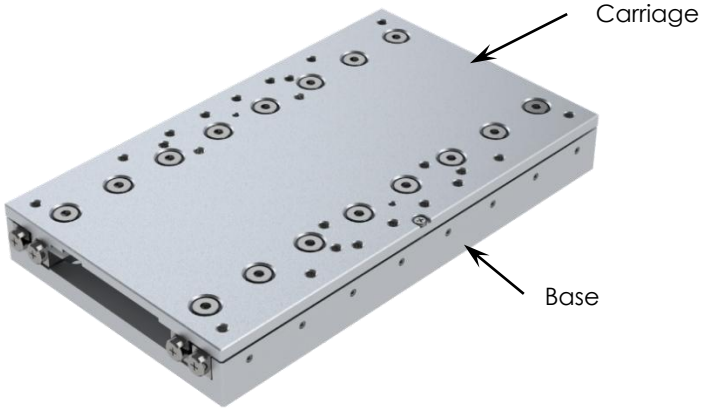


Figure 1-A. PPS-70 Linear / Piezo Motor

1.2 Recommended Controllers

The following controllers are available from MICRONIX USA:

- NanoDrive [Piezo or Linear Motor Versions]
- MMC-110 [Piezo Motor Versions]

1.3 Technical Data and Ordering Information

Detailed specifications and ordering information can be found on the PPS-70 product page on the MICRONIX USA website.

2. Preparing to Install the PPS-70 Stage

2.1 Installation Preparation

When mounting the stage, it is important to consider the flatness of the mounting surface, as the stage will conform to the shape of that surface. The stage's performance and structural integrity are impacted by the mounting flatness. It is required to have a mounting surface with flatness less than the overall specified flatness on the product datasheet.

The stage is calibrated and guaranteed to be within specification at 20°C ± 5°C unless otherwise specified. Ensure to use the stage under the following conditions:

- Mount to a clean surface which is free of debris, burrs or dings with a flatness to be less than the flatness of the base as specified on the product datasheet.
- An indoor atmosphere free of corrosive gases, excessive dust, and condensation.
- Operating temperature range of 5-40°C.
- Relative humidity between 20-80%.
- Locate away from water, heat, and electrical noise.

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

2.2 Package Contents

If the product is damaged or there are missing components, contact MICRONIX USA immediately. Do not discard product packaging in case of return shipment.

Package Should Contain:

- PPS-70 Linear Stage
- Reference Manual
- Any other previously agreed upon components such as a controller.

3. Installing the PPS-70 Stage

Refer to Section 3.1 for general mounting, 3.1.2 for XY Mounting. Additional brackets and screws may be required for custom applications, see Section 5 for stacking configuration examples.

Important: Mounting the PPS-70 requires M3 low profile socket head cap screws or screws with a maximum head height of 2 mm. Use non-magnetic materials for linear motor versions.

Recommended mounting screw:

- 92855A304, M3 Low Profile Socket Head Cap Screw (McMaster-Carr)

Note: *Stages assembled in factory do not require disassembly for general mounting.*

3.1 PPS-70 Installation

3.1.1 *General Mounting*

Recommended general mounting pattern sample can be found in Section 4.1.

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

Important: It is possible to move the carriage of the linear and piezo motor configurations manually without damaging the stage.

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

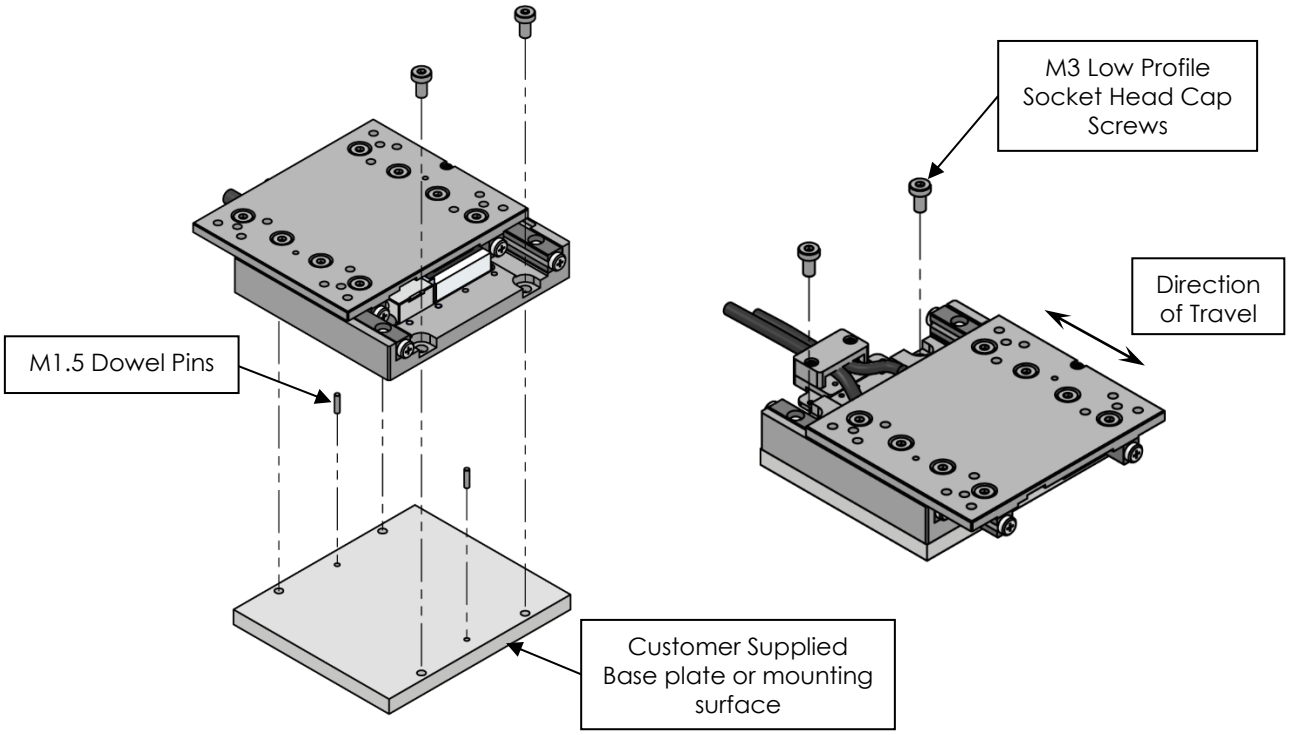


Figure 3-A. PPS-70 General Mounting Installation

3.1.2 *X-Y Mounting*

It is possible to mount all PPS-70 stage lengths onto XY configurations without the use of an adapter bracket.

1. Align the stage using two M1.5 x 5mm dowel pins and secure the stage using M3 x 5 mm MAX low profile socket head cap screws at 0.5 Nm recommended torque.

   Note: Do not use screws longer than specified to avoid damage to the bearings.

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

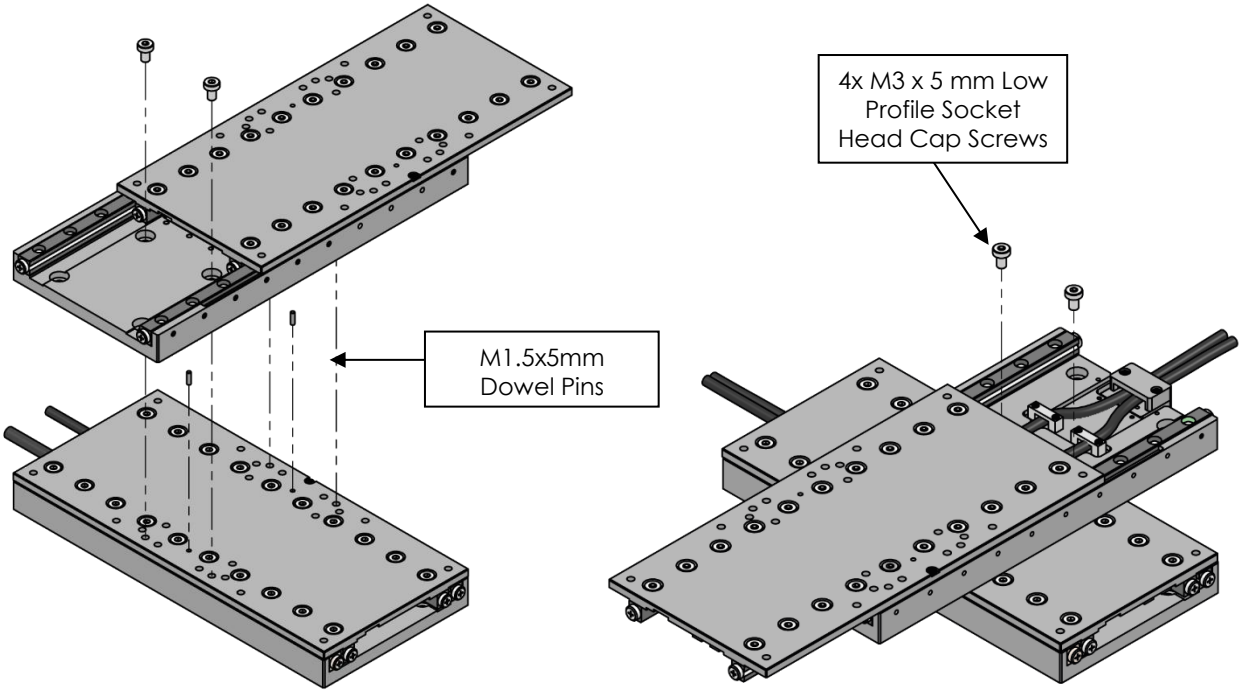
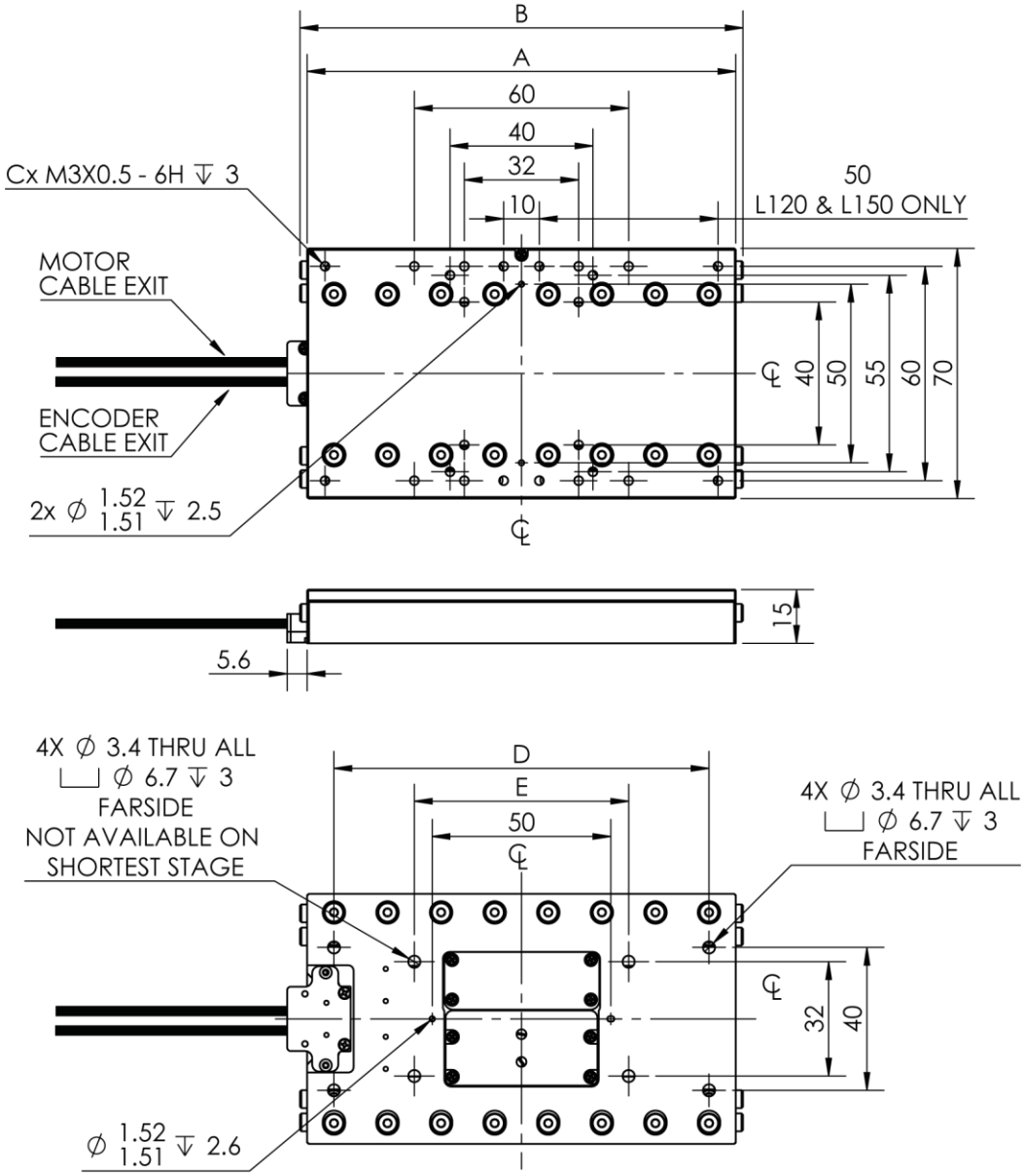


Figure 3-B. PPS-70 XY Mounting

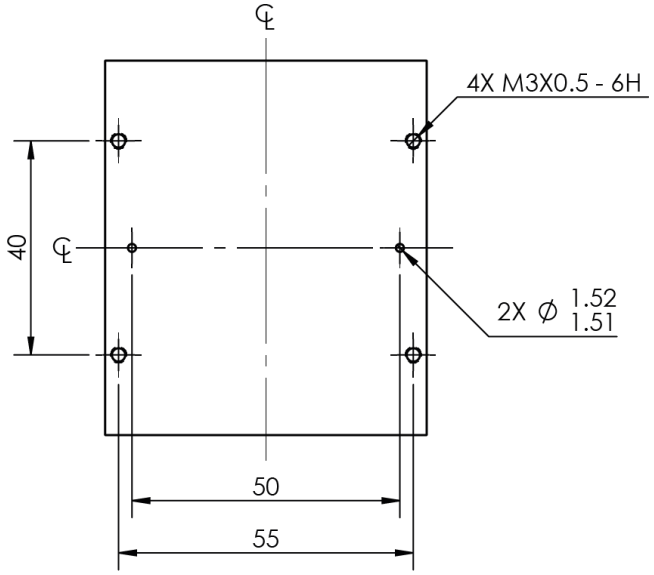
4. Dimensions



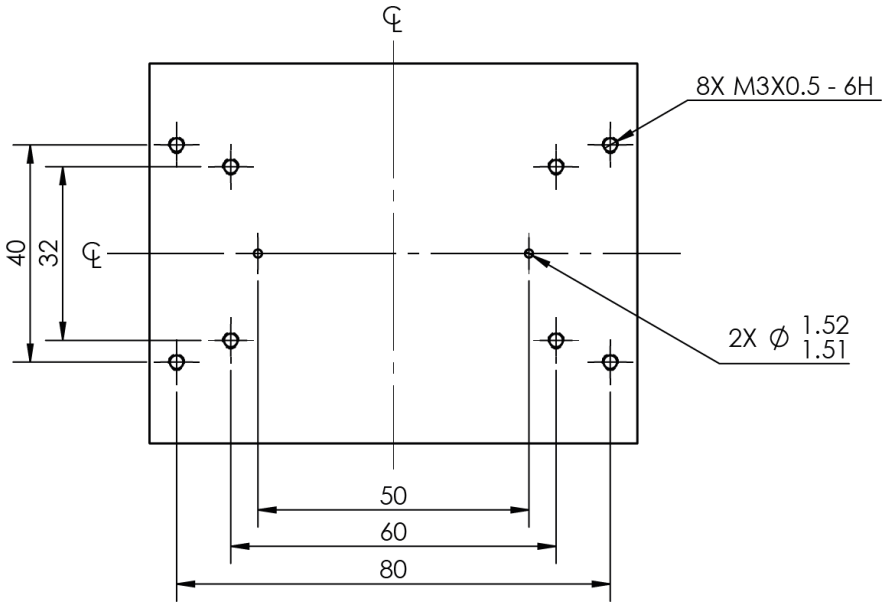
TRAVEL	A	B	C	D	E
30	60	64	16	55	-
50	90	94	16	80	60
75	120	124	24	105	60
100	150	154	24	135	60

4.1 Recommended General Mounting Pattern

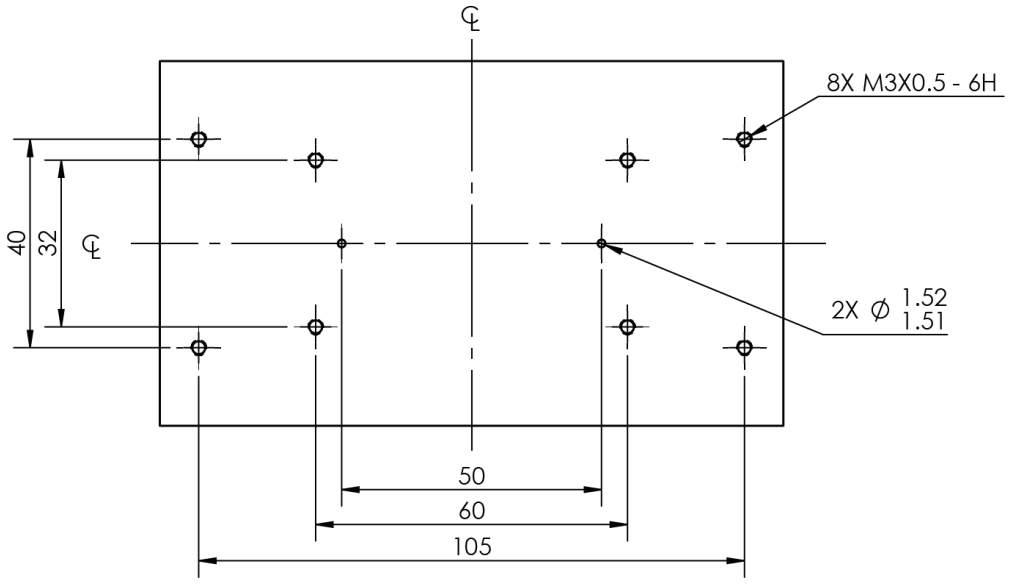
4.1.1 *32mm Stage Mounting Pattern*



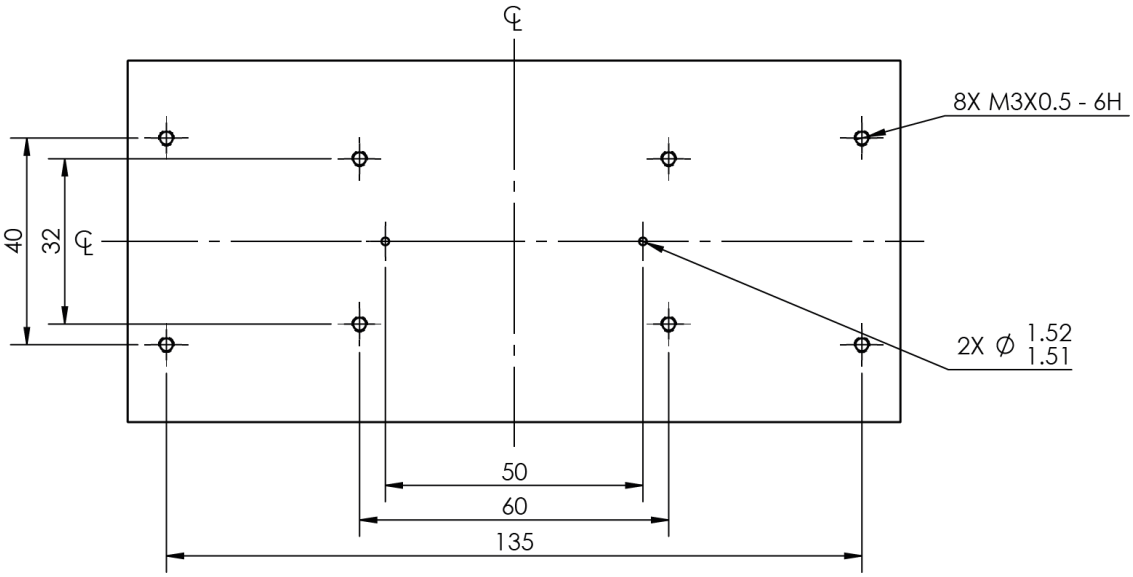
4.1.2 *50mm Stage Mounting Pattern*



4.1.3 *75mm Travel Stage Mounting Pattern*

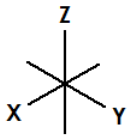


4.1.4 *100mm Travel Stage Mounting Pattern*



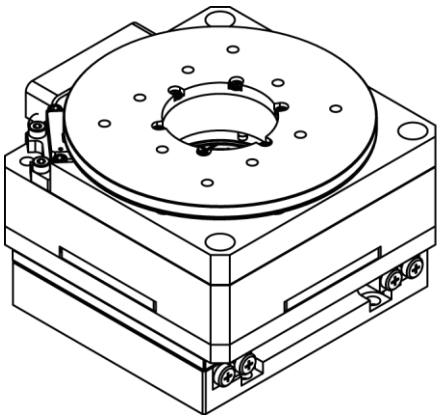
5. Stacking Configurations (Examples)

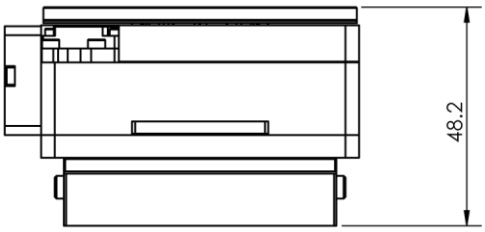
- Additional configurations available upon request
- Stacking compatibility for all motor configurations.
- Positioning according to:



5.1 PR-70, PPS-70 Short Stage Stack

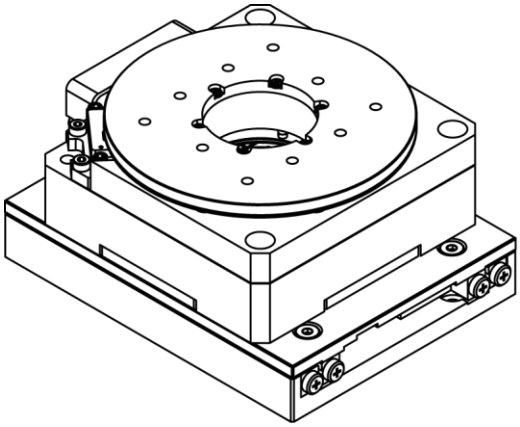
Only PPS-70 short stage requires an adapter plate (431898) to mount the PR-70.

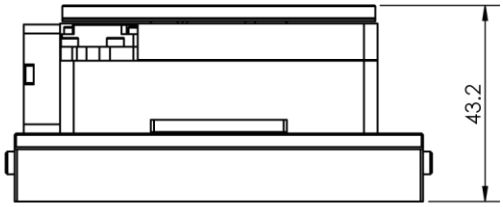




5.2 PR-70, PPS-70 Long Stage Stack

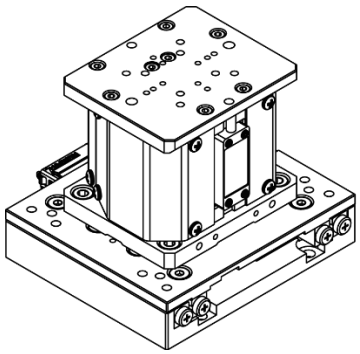
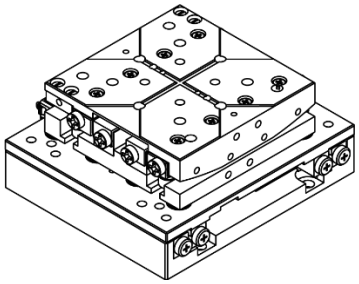
The PR-70 can be mounted directly on PPS-70 L90mm and longer stages.



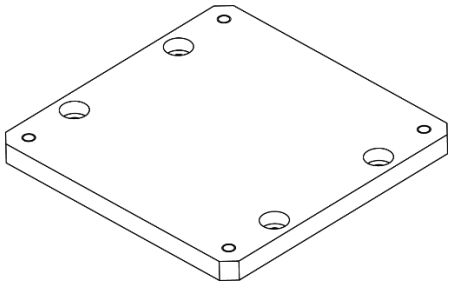


5.3 Other combinations

Supplement XY configurations with our variety of products.

	
Directly mounts ES-50PM Elevation stage for Z axis motion.	Directly mounts PG-50 gonio stage for axial + angular motion.

5.4 Accessories

 **PN: 431898**
Use to mount PR-70 onto the shortest 32mm Travel PPS-70

5.5 Wiring

Please contact MICRONIX USA for wiring diagrams and pinout information. If purchased with MMC controller, connect motor to motor and encoder to encoder, all connectors are labeled.
If purchased with NanoDrive, only connect the 26Pin cable to the controller. Refer to the respective controller manual for set-up information.

5.6 Vacuum Environments

5.6.1 Handling and Preparation

When preparing the stage for vacuum environments, take the necessary precautions, such as wearing latex gloves, clean room, clothing, etc. Avoid any contaminants. Maximum bake-out temperature is 100°C. MICRONIX USA optionally supplies the stage with vacuum compatible connectors, see chart below.

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

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

Connecting the PPS-70 stage in a vacuum chamber requires the use of a feed-through connector at the vacuum chamber wall.

The vacuum compatible PPS-70 will be supplied with wiring for a straight through feed-through, not a cross over gender changer. MICRONIX USA supplies test connectors that simulate the vacuum feed-through to allow for functionality testing prior to installation in a vacuum chamber, see Appendix A.3 for feedthrough pins.

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

6. Supplementary Information

6.1 Maintenance

- The PPS-70 series of modular 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.
- The PPS-70 stage is a precision mechanical device and should be handled with care. Do not drop or mishandle the stage.
- Do not touch the underside of the moving components with bare hands to avoid contaminating motor friction surfaces.
- Follow the *Installation Preparation* requirements and use proper cable management to ensure a clean and safe operating environment.

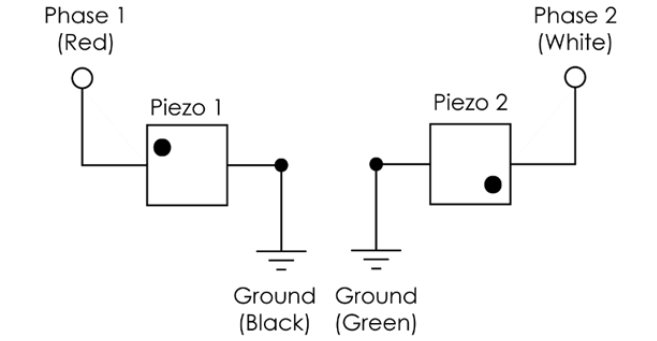
6.2 Units and Conversions

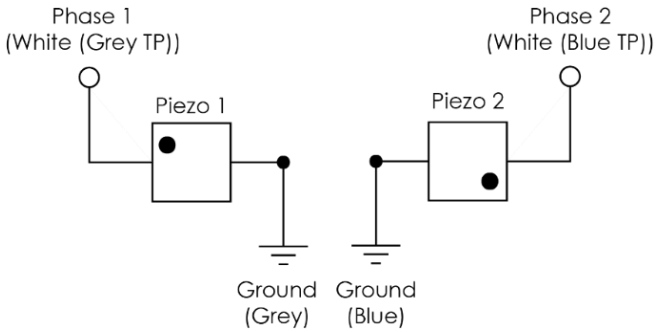
All measurements in this document are in the metric system of units.

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 Piezo Motor Operating and Electrical Specifications





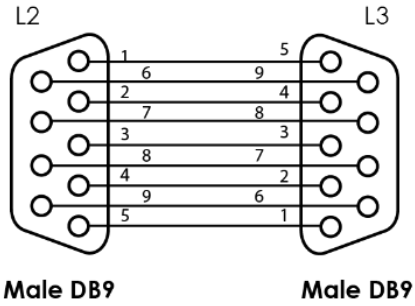
Voltage	60V maximum
Capacitance	150nF ±15%

A.2 Linear Motor Operating and Electrical Specifications

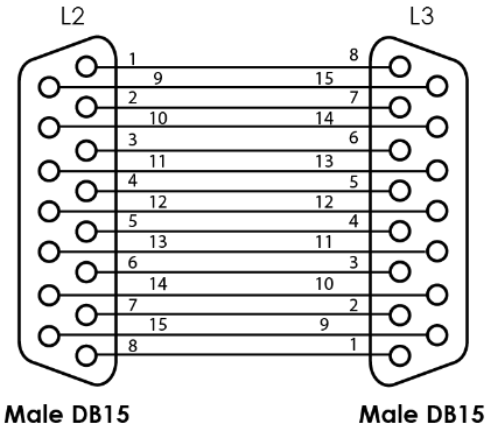
Linear Motor Type	Brushless DC
Continuous Force	2 N
Continuous Current	1.72 A_{rms}
Peak Force	5 N
Peak Current	4.31 A_{rms}
Force Constant (K_f)	1.16 N / A_{rms}
Back EMF (K_e)	1.0 V-sec/m
Resistance 25°C	2.8 Ohms
Inductance	0.25 mH
Magnetic Pitch (N-N)	12.49mm

A.3 Vacuum Feedthrough

Straight Through 9-Pin Feed-through



Straight Through 15-Pin Feed-through



A.4 Using a Digital Encoder

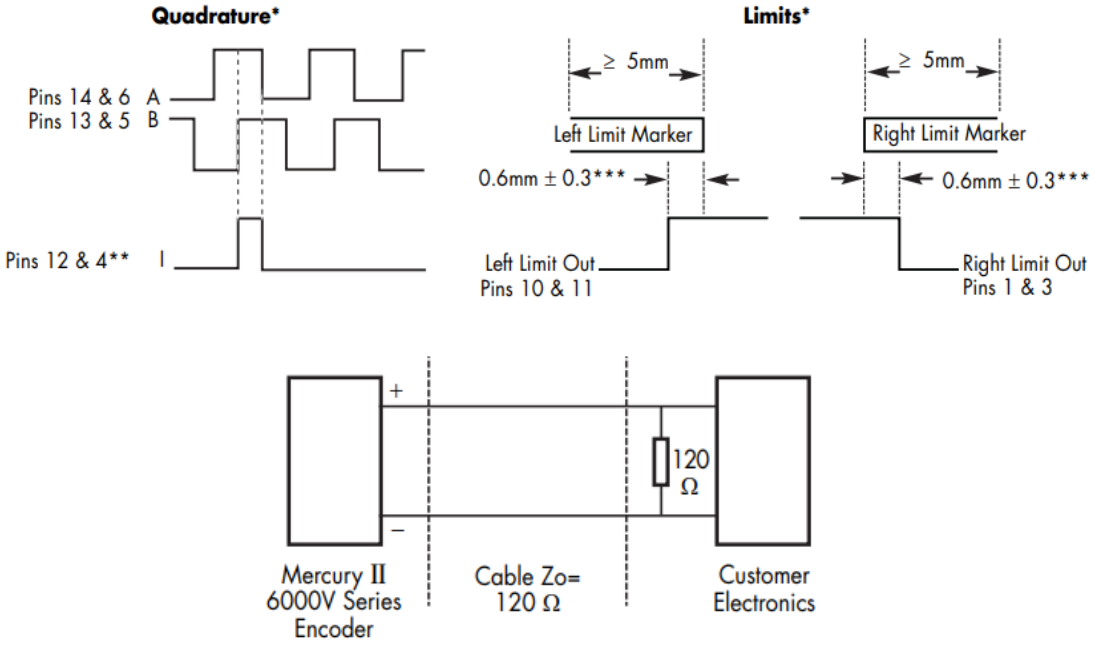
A.4.1 Digital Encoder Overview

A PPS-70 with Digital Encoder will need to be paired with an appropriate controller that supports RS-422 square wave AB signals. The PPS-70 vacuum configurations with an internal digital encoder will be supplied with a 15-pin vacuum connector that incorporates both motor and encoder signals, along with an atmospheric cable splitting the signals into their respective Dsub9 connectors.

A.4.1.1 Operating and Electrical Specifications

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

A.4.1.2 Output Signals & Signal Termination for A quad B, Index and limits (MMC Pins)



*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

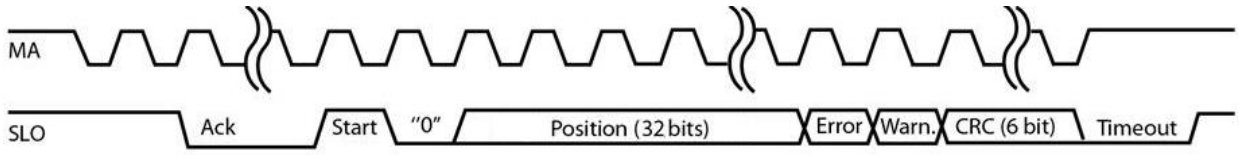
A.4.1.3 Resolution

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

A.5 Using an Absolute Encoder

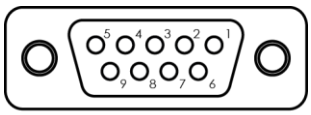
A.5.1 Absolute Encoder Signals BiSS C-Mode Interface

The Micronix absolute encoder operates using standard BiSS C-mode (continuous) interface, transmitting 32-bits of position data on each request. The controller will clock position acquisitions via the MA signal. The SLO signal will transmit position data from the encoder.



A.5.1.1 Absolute Encoder Pinout (MMC Controller)

Pin DE9S	Description
1	SLO+ / DATA+
2	MA+ / CLK+
3	SLI+
4	Ground
5	+5V
6	SLO- / DATA-
7	MA- / CLK-
8	SLI-
9	Not In Use



Dsub9F - Front View
9 Pin Female Connector

A.5.1.2 Absolute Encoder Setup

Absolute Encoder BiSS-C	
Absolute Resolution	32 Bits
Encoder BiSS Frequency	5 MHz
Encoder BiSS CRC Polynomial	0
Position Integer Type	Unsigned
Number of Status Bits	0
Error Bits Mask	0
CRC Error Suppression	None
Data Alignment	Left Justified