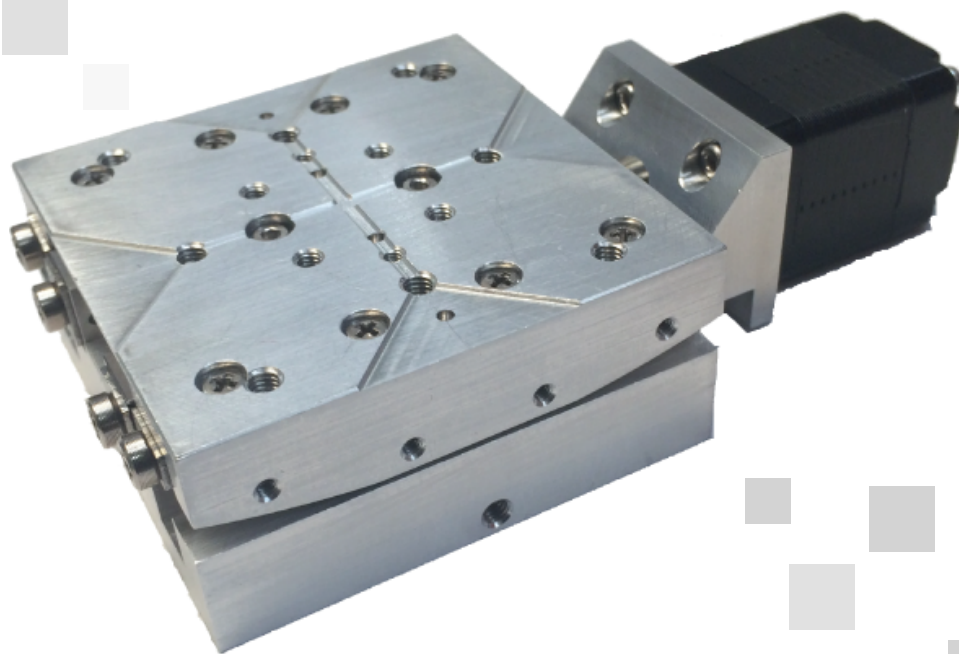


PG-50SM

Series



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

PG-50SM

Precision Gonio Stage

Reference Manual

Rev 1.03

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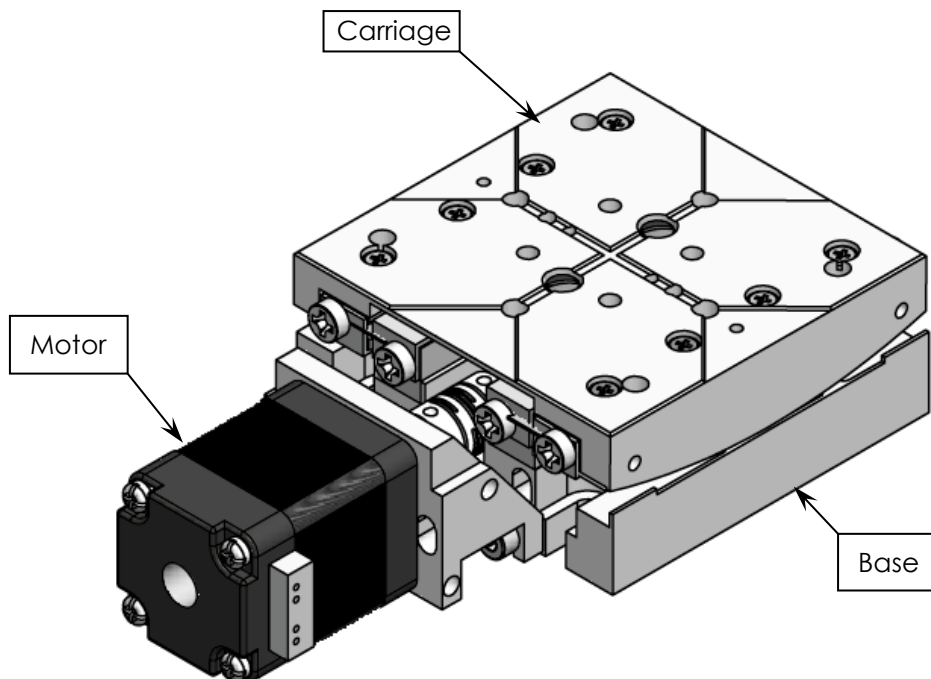
1. Introduction

1.1 Product Description

The PG-50 is a gonio stage incorporating a 2-phase stepper motor for increased precision and load carrying capacity. The PG-50 stage performs best in limited space applications due to its compact design. High stiffness motion is achieved through pre-loaded crossed-roller bearings and a precision worm drive. These stages may be mounted in an orthogonal, space-saving arrangement to achieve pitch and roll adjustment. Versions capable of operation in vacuum (10^{-6}) are available.

Features:

- Travel range of $\pm 5^\circ$ motion
- Load capacity up to 2 kg
- Optional internal analog encoder
- Matching radii available for common center of rotation
- Center of rotations are available on request
- 1 m° encoder resolution



1.2 Recommended Controllers

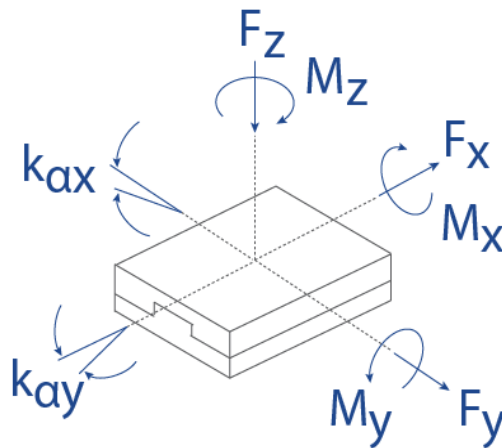
The following controllers are available from MICRONIX USA:

- MMC-200 – Stepper Motor Controller

1.3 Technical Data

| | |
|-----------------------------------|--|
| Motor | SM-001, 2 Phase Stepper Motor |
| Speed, Max. (°/sec) | 5 |
| Resolution Typical (m°) | 1 (open loop); 1 (encoder resolution) |
| Bi-directional Repeatability (m°) | ± 10 (open loop); ± 2 (encoder resolution) |
| Uni-directional Repeatability(m°) | 10 (open loop); 2 (encoder resolution) |

1.4 Load Characteristics



| Load Characteristics | F_x [N] | F_y [N] | F_z [N] | M_x [Nm] | M_y [Nm] | M_z [Nm] | k_{ax} [μ rad/Nm] | k_{ay} [μ rad/Nm] |
|----------------------|-----------|-----------|-----------|------------|------------|------------|--------------------------|--------------------------|
| SM-001 | 15 | 15 | 20 | 0.75 | 4 | 4 | 80 | 80 |

2. Model configurations

2.1 PG-50 Order Numbers

| Order No. | PG-50- | 2 | 1 | | | |
|---|--------|---|---|--|--|--|
| Stepper Motor, SM-001..... | 2 | | | | | |
| ± 5°..... | 1 | | | | | |
| None..... | 0 | | | | | |
| Analog (1V _{pp})..... | 2 | | | | | |
| Digital (RS-422)..... | 3 | | | | | |
| None..... | 0 | | | | | |
| Magnetic..... | 1 | | | | | |
| Atmospheric..... | 0 | | | | | |
| High Vacuum, 10 ⁻⁶ mbar..... | 6 | | | | | |

Contact MICRONIX USA for custom applications and stacking configurations.

3. Preparing to Install the PG-50

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 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, unless otherwise specified. The operational constraints of the stage are as follows:

- Mount to a clean and flat surface which is free of debris, burrs, and dings
- An indoor atmosphere free of corrosive gases, excessive dust, and condensation
- Temperature range of 0-40°C
- Relative humidity between 20-80%
- Locate away from water, heat, and electrical noise

3.2 Package Contents

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

Package Should Contain:

- PG-50 Gonio Stage
- Reference Manual
- Any other previously agreed upon components such as a controller

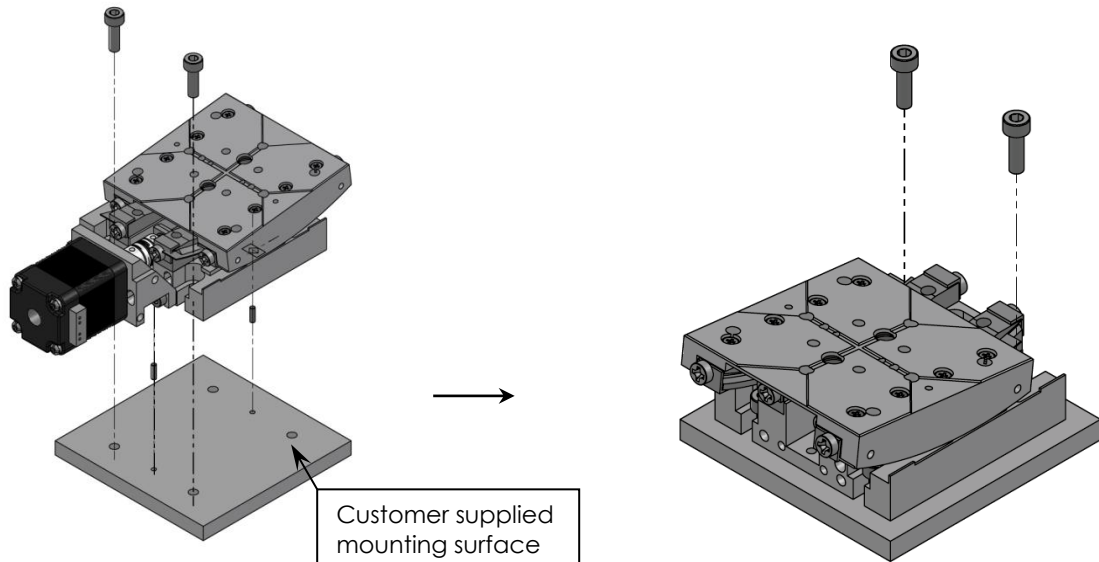
4. Installing the PG-50

Mounting patterns require M3 screws. Additional brackets and screws may be required for custom applications.

4.1 General Mounting

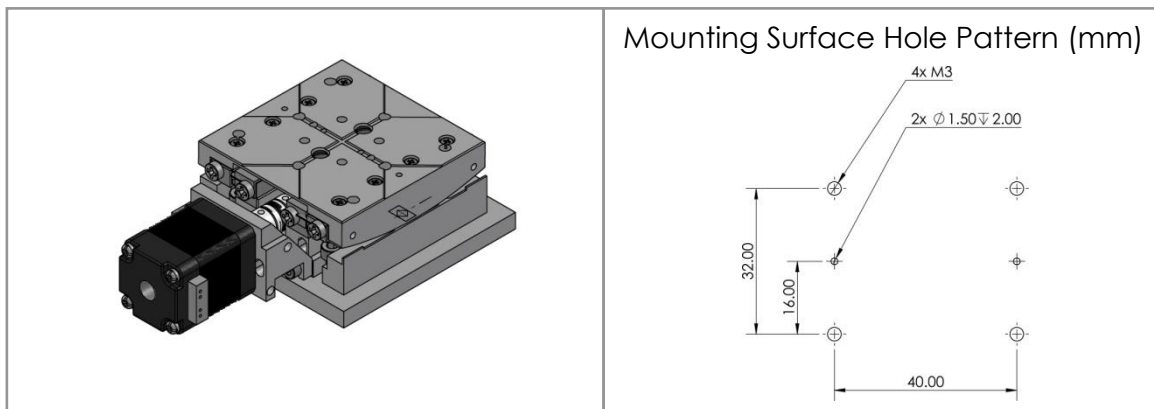
For general mounting configurations, mount the base to the mounting surface.

Requires:
 4x M3x0.5x8mm Socket Head Cap Screws
 2x M1.5x4mm Dowel Pins



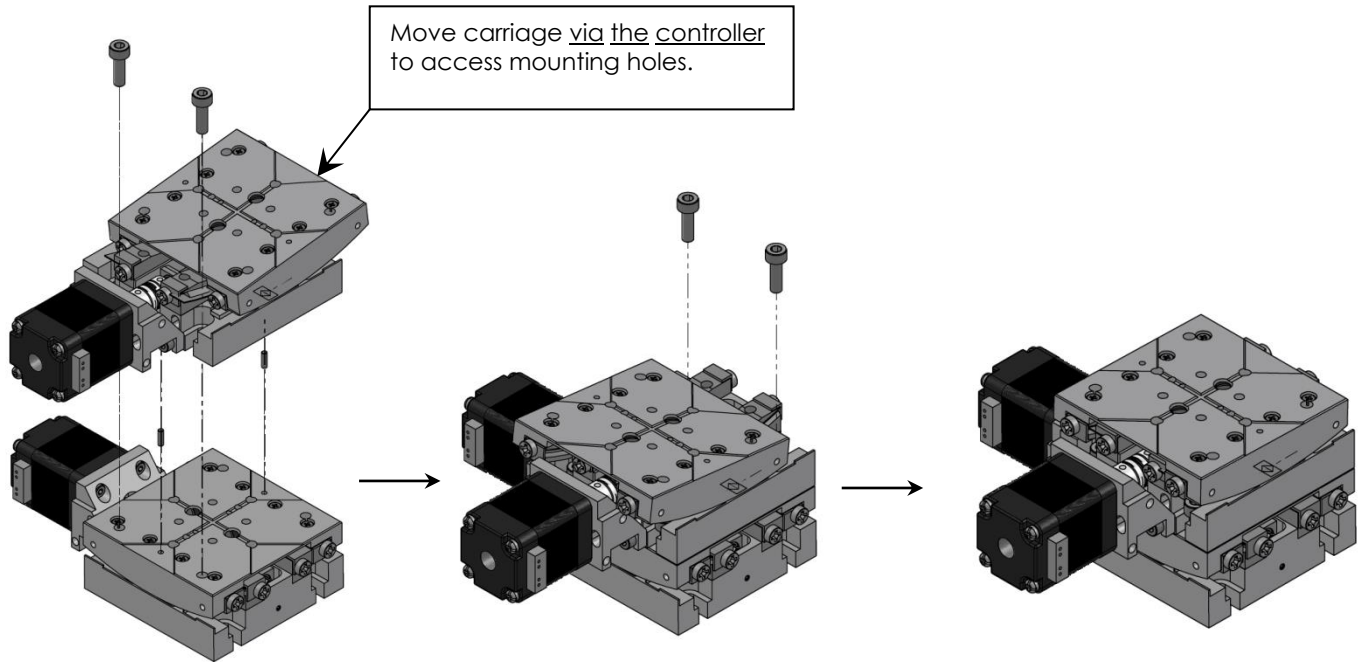
1. Move carriage via controller to access two mounting holes. Insert two M3x0.5x8mm Socket Head Cap Screws and two M1.5x4mm Dowel Pins as shown.

2. Move carriage via controller to access the remaining two mounting holes. Insert two M3x0.5x8mm Socket Head Cap Screws as shown.



4.2 X-Y Mounting

Requires:
4x M3x0.5x8mm Socket Head Cap Screws
2x M1.5x4mm Dowel Pins



1. Move carriage via controller to access two mounting holes. Insert two M3x0.5x8mm Socket Head Cap Screws and two M1.5x4mm Dowel Pins as shown.

2. Move carriage via controller to access the remaining two mounting holes. Insert two M3x0.5x8mm Socket Head Cap Screws as shown.

♦ For additional mounting configurations see Section 7: Stacking Configurations.

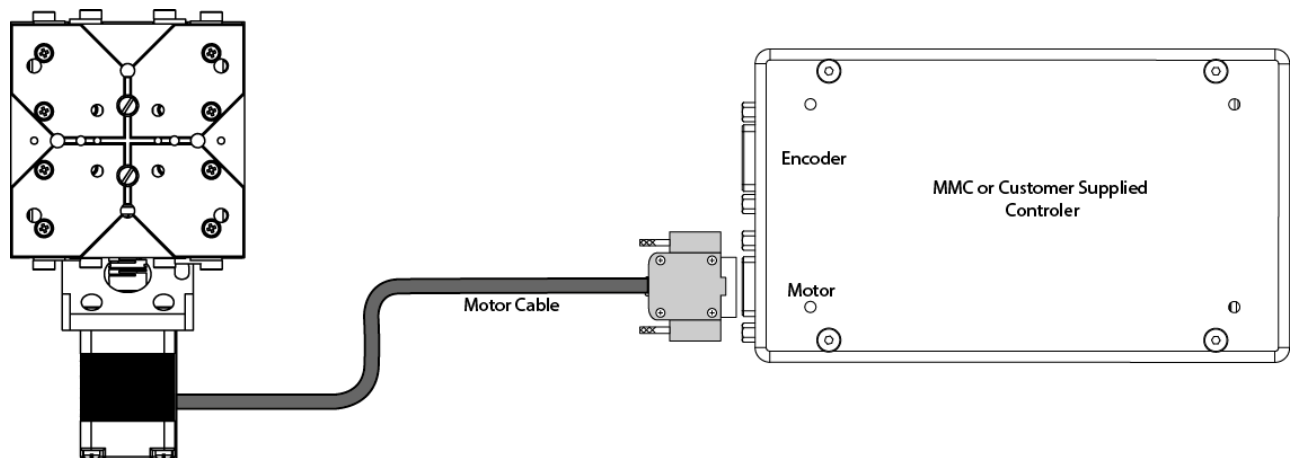
5. Connecting the PG-50

5.1 Atmospheric Environments

For controller information refer to the appropriate MMC controller manual.

5.1.1 Open Loop Installation & Wiring Diagram

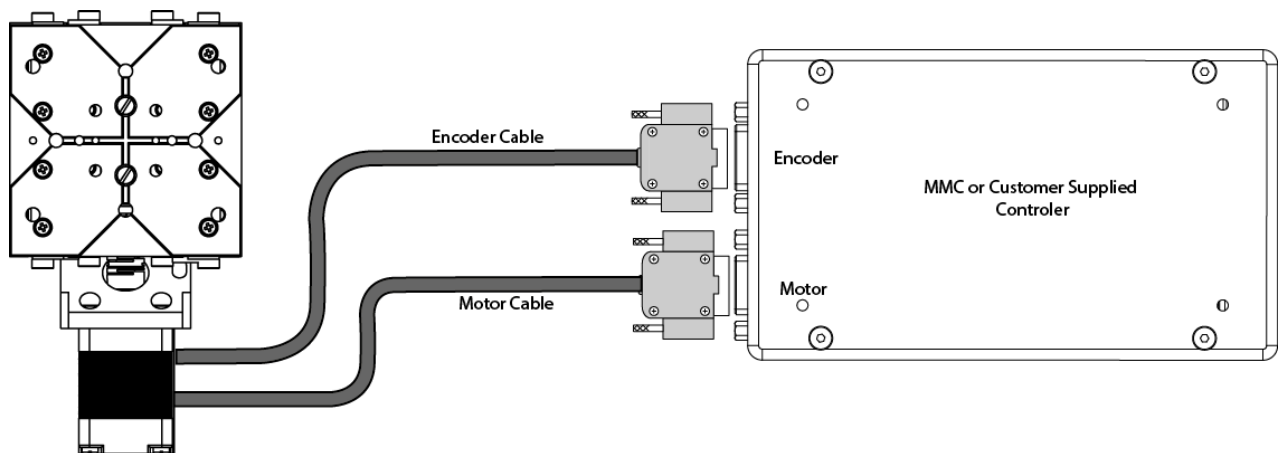
Connecting the PG-50 in an open loop configuration only requires that the D-sub 9 Pin Motor Cable be connected to a compatible controller. No other cables or components are required. Connect the stage as shown below. For details regarding the pinout see the Appendix section A.1.



5.1.2 Closed Loop/Encoder Installation & Wiring Diagram

Using the PG-50 stage with an encoder requires a closed loop compatible controller that recognizes the proper type of encoder feedback. Connect the stage as shown below.

5.1.2.1 Analog Encoder Wiring Diagram



5.2 Vacuum Environments

5.2.1 Handling and Preparation

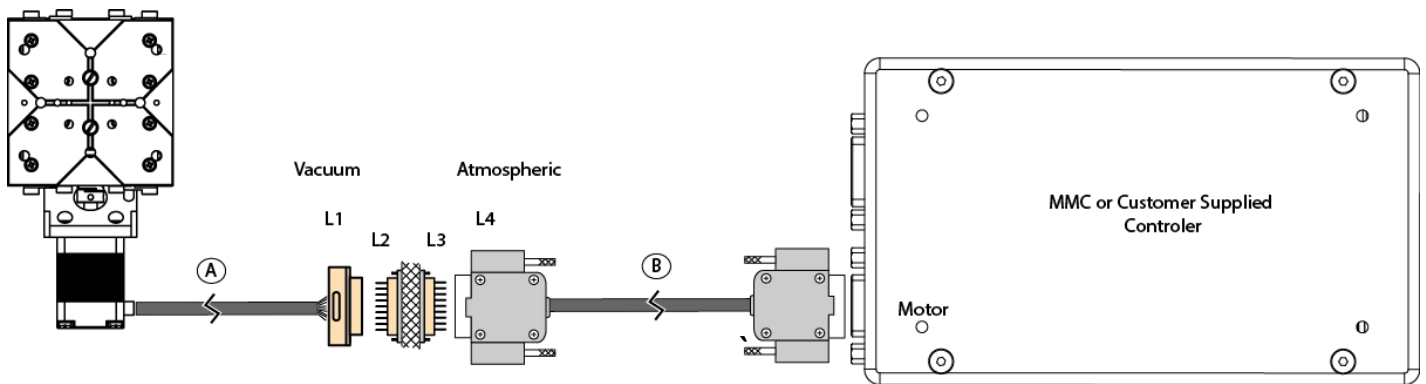
When preparing the stage for vacuum environments, take the necessary precautions (such as wearing powder free latex gloves, clean room, clothing, etc.) when handling the stage as to avoid any contaminants. Maximum Bake-out temperature is 100°C. MICRONIX USA can supply the stage with vacuum compatible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

5.2.2 Open loop Installation & Wiring Diagram

Connecting an open loop PG-50 in a vacuum chamber requires the use of a feed through connector at the vacuum chamber wall. The vacuum compatible PG-50 will be supplied with wiring for a feed through, not a cross over gender changer. MICRONIX USA supplies test connectors that simulate the vacuum feed through to allow for functionality testing prior to installation in a vacuum chamber. For details regarding the pin-out and feed through specifications see the Appendix section A.2.

Standard Cable Descriptions:

- A. PG-50 Vacuum Motor Cable (Female Dsub 9 Pin, 1.5m)
- B. Atmospheric Motor Cable (Female to Male Dsub 9 Pin, 1.5m)



Temporary vacuum test connectors are standard. Requires customer supplied feed through connector

5.2.3 Closed Loop/Encoder Installation & Wiring Diagram

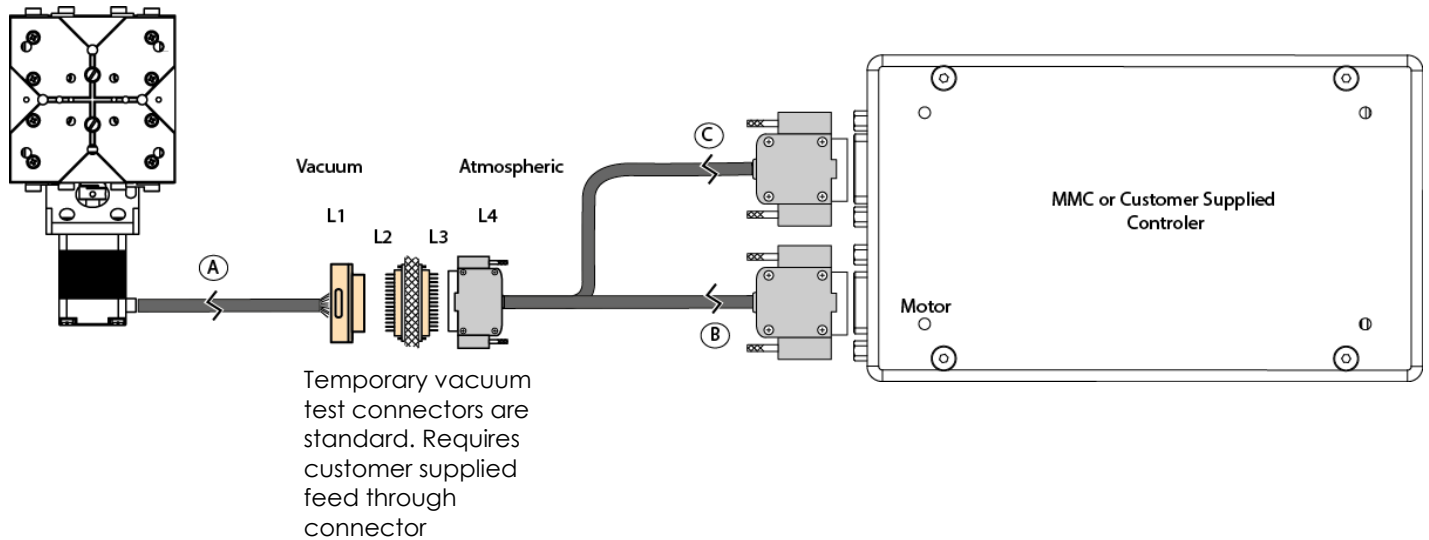
Closed loop installation of the PG-50 stage in vacuum environments requires an intermediate feed through connector at the vacuum chamber wall that can accommodate both the motor cable, and the encoder cable.

The vacuum compatible PG-50 will be supplied with wiring for a feed through, not a cross over gender changer. MICRONIX USA supplies test connectors that simulate the vacuum feed through to allow for functionality testing prior to installation in a vacuum chamber. For details regarding the pin-out and feed through specifications see the Appendix sections A.3.

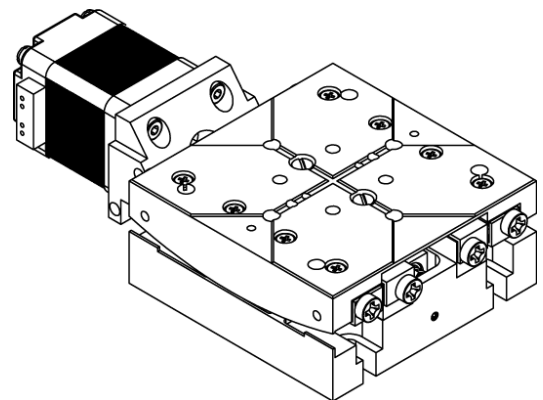
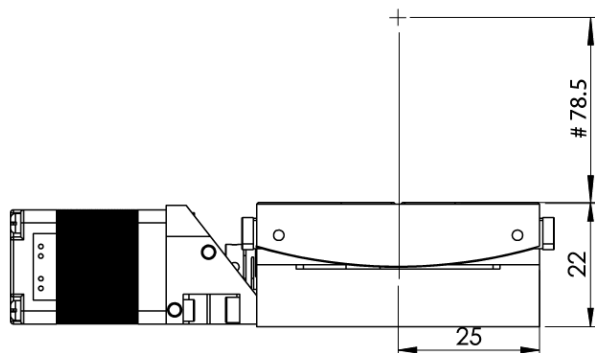
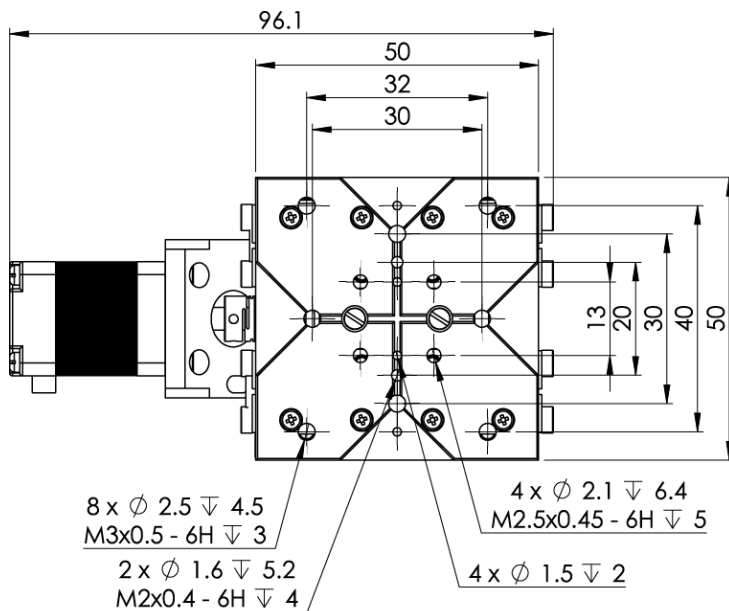
5.2.3.1 Analog Encoder Wiring Diagram

Standard Cable Descriptions:

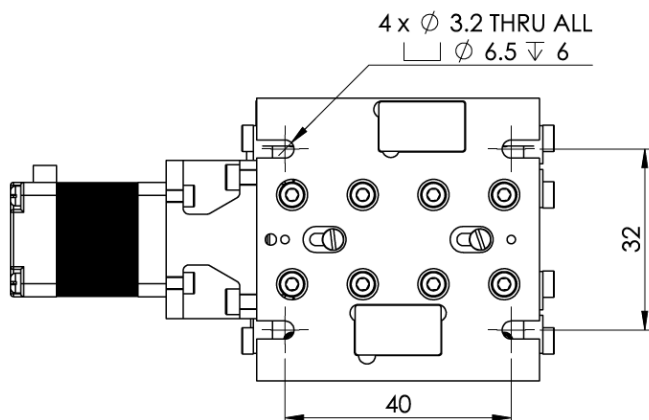
- A. PG-50 Motor Cable (Female Dsub 15 Pin, 1.5m)
- B. Atmospheric Motor Cable (Female Dsub 15 Pin to Male Dsub 9 Pin, 1.5m)
- C. Atmospheric Encoder Cable (Female Dsub 15 Pin to Female Dsub 9 Pin, 1.5m)



6. Dimensions



* All dimensions are in millimeters
Available with other center radii

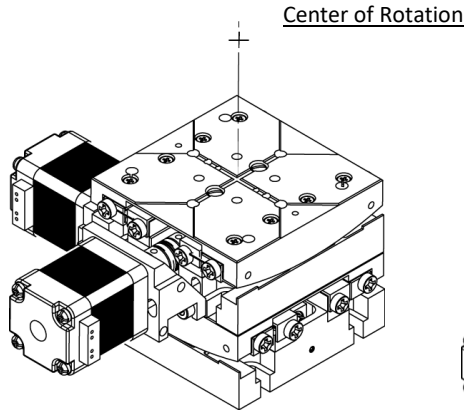


7. Stacking Configurations

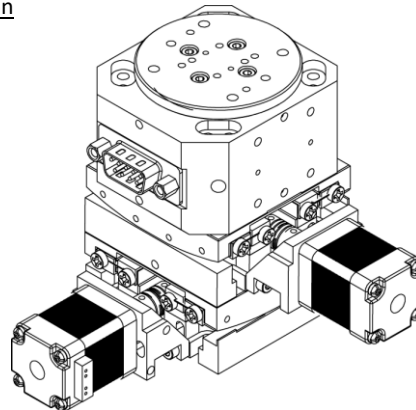
7.1 Configuration Examples

➤ Additional configurations available upon request

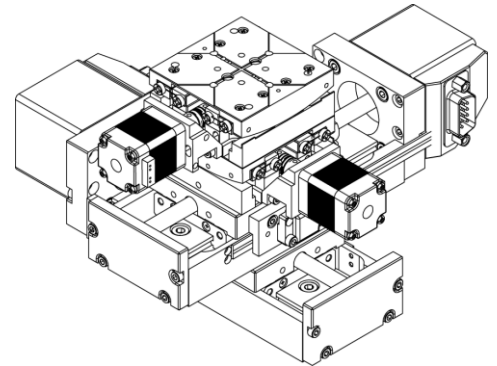
No Adapters



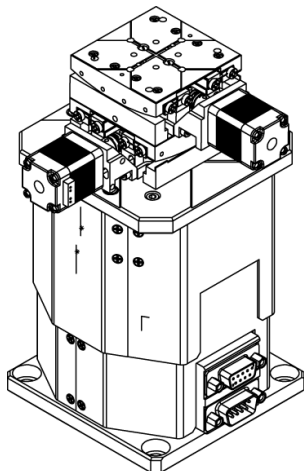
θ - θ 10°x10°



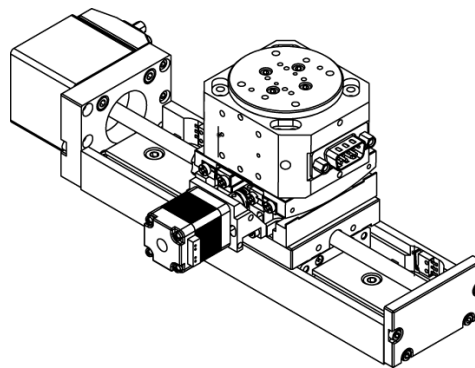
θ - θ - θ 10°x10°x360°
[with PR-50 Stage]



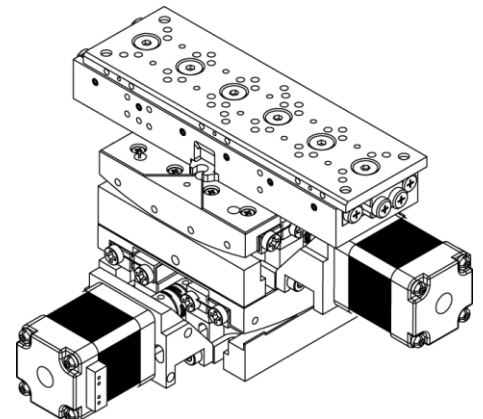
X-Y- θ - θ 100mmx100mmx10°x10°
[with VT-50L Stage]



Z- θ - θ 35mmx10°x10°
[with PZS-90 Stage]

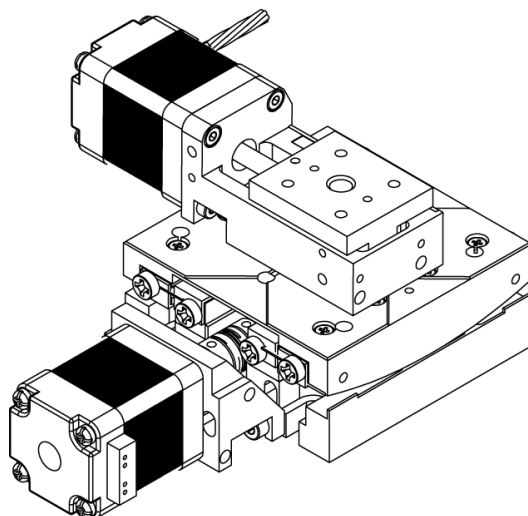


X- θ - θ 100mmx10°x360°
[with VT-50L & PR-50 Stages]



θ - θ -X 10°x10°x51mm
[with PPS-28 Stage]

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



\ominus -X 10mmx10°
[with VT-21 Stage]

8. Supplementary Information

8.1 Maintenance

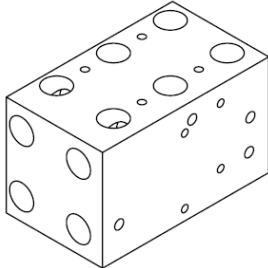
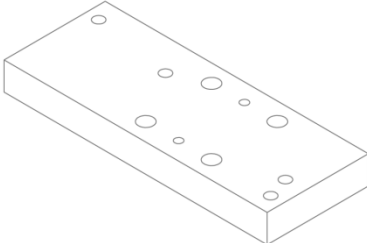
- The PG-50 series of gonio stages utilizes a maintenance free design. Do not modify the stage or perform any maintenance unless specifically instructed to do so by MICRONIX USA personnel. If the stage is not performing up to the original specifications, please contact MICRONIX USA.
- The PG-50 gonio 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. |

8.3 Accessories

| 430141-B Adapter Block VT-21 | 430169-B Adapter Plate XY Base VT-21 |
|---|---|
|  |  |
| Used to adapt the VT-21 series to the PG-50 series of gonio stages for θ -X and θ -Z mounting configurations. | Used to adapt the VT-21 series to the PG-50 series of gonio stages for θ -X mounting configurations. |

A. Appendix

A.1 Motor Specifications

A.1.1 Standard Atmospheric DB-9 Male Motor Connector

| Pin | Function | Wire Color |
|-----|----------------|---------------|
| | | SM-001 |
| 1 | Motor A+ | Green |
| 2 | Motor A- | Green & White |
| 3 | Motor B+ | Red & White |
| 4 | Motor B- | Red |
| 5 | N/C | N/C |
| 6 | Limit Switch - | Violet |
| 7 | Limit Switch+ | White |
| 8 | +5V | Orange |
| 9 | Ground | Brown |

- ◆ For vacuum prepared wiring, blue may be substituted for green/white, and black for red/white.

A.1.2 Technical Specifications

| | |
|---------------|----------------------|
| Motor Type | Direct Drive Stepper |
| Phase Current | 0.24 Amps/Phase |
| Step Angle | 1.8° |
| Steps | 200 |
| Resistance | 20.4 Ohms/Phase |
| Inductance | 5mH/Phase |

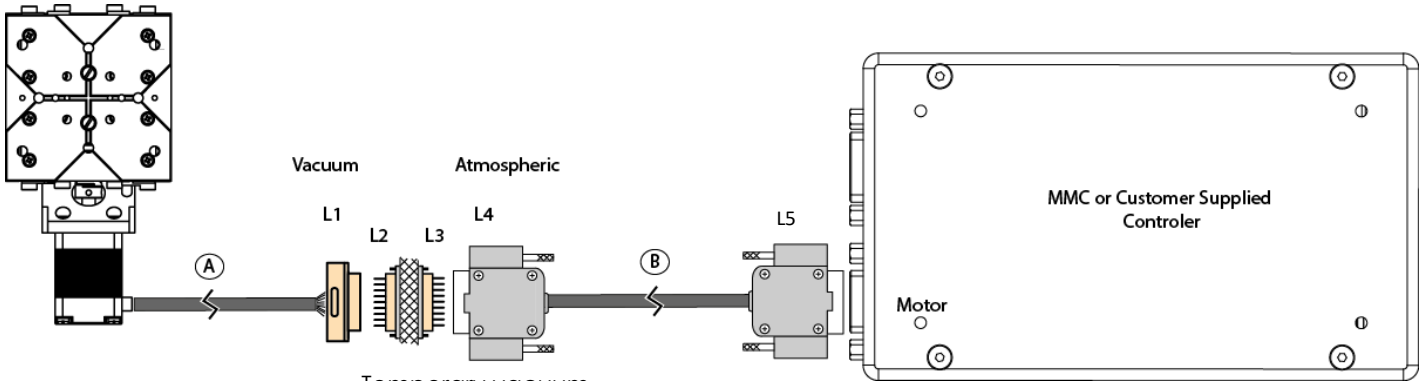
- ◆ Please note: The PG-50 controller axis is factory modified to provide an output with a higher current than other Micronix stages at 0.24 amps/phase. **Make sure** that each stage is plugged into the correct axis of the controller.

A.2 Open Loop Vacuum Wiring Diagram

Standard Cable Descriptions:

- A. PG-50 Motor Cable - Vacuum Side (Female Dsub 9 Pin Peek Connector)
- B. Atmospheric Motor Cable (Female Dsub 9 Pin to Male Dsub 9 Pin)

Wiring Diagram:

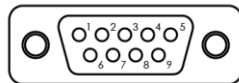


Temporary vacuum test connectors are standard. Requires customer supplied feed through connector

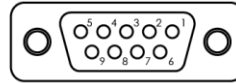
Connector Pinout

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

-Motor

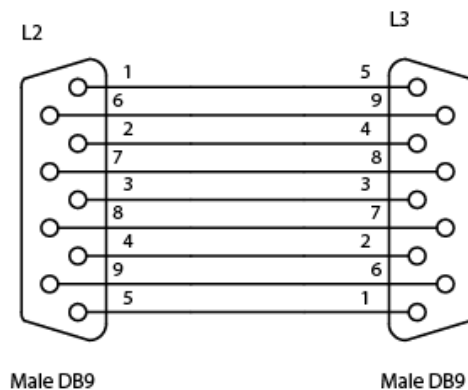


Female Dsub9 Connector - Rear View



Male Dsub9 Connector - Rear View

A.2.1 9-Pin Feed Through



Male DB9

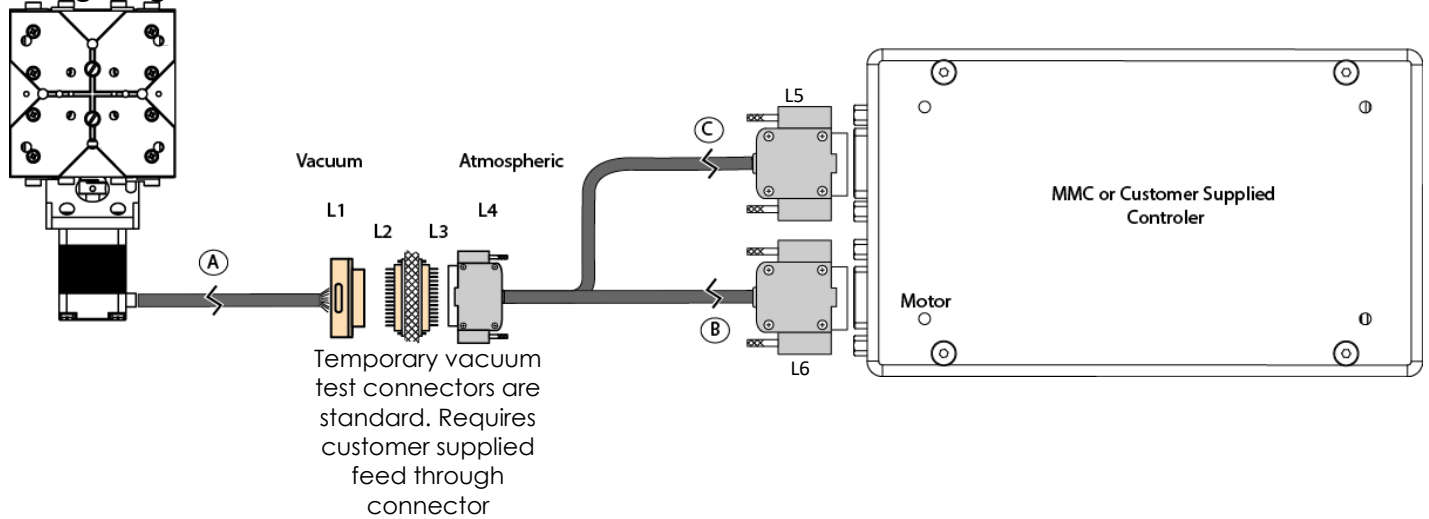
Male DB9

A.3 Analog Encoder Wiring Diagram

Standard Cable Descriptions:

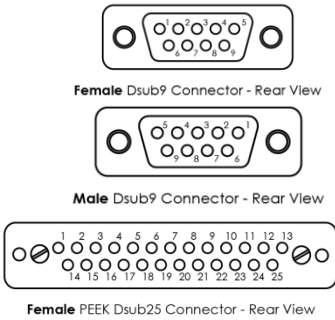
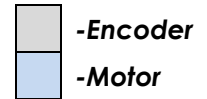
- A. PG-50 Motor & Encoder Cable - Vacuum Side (Female Dsub 25 Pin Peek Connector)
- B. Atmospheric Motor Breakout Cable (Female Dsub 25 Pin to Male Dsub 9 Pin)
- C. Atmospheric Encoder Breakout Cable (Female Dsub 25 Pin to Female Dsub 9 Pin)

Wiring Diagram:



Connector Pinout

| Description | Color | L1 | L2 | L3 | L4 | L5 | L6 |
|----------------|---------------|----|----|----|------------------------|----|--------|
| Motor Phase A+ | Green | 13 | 13 | 1 | 1 (Green) | | 1 |
| Motor Phase A- | Green & White | 12 | 12 | 2 | 2 (White - Green TP) | | 2 |
| Motor Phase B+ | Red & White | 11 | 11 | 3 | 3 (Black) | | 3 |
| Motor Phase B- | Red | 10 | 10 | 4 | 4 (Red) | | 4 |
| Limit Switch - | Violet | 25 | 25 | 14 | 14 (Violet) | | 6 |
| Limit Switch + | White | 24 | 24 | 15 | 15 (White - Violet TP) | | 7 |
| +5V | Orange | 23 | 23 | 16 | 16 (White - Brown TP) | | 8 |
| Ground | Brown | 22 | 22 | 17 | 17 (Brown) | | 9 |
| Shield | - | 21 | 21 | 18 | 18 (Shield) | | Casing |
| A+ | Brown | 1 | 1 | 13 | 13 (Brown) | 1 | |
| A- | Orange | 2 | 2 | 12 | 12 (White - Brown TP) | 6 | |
| B+ | Yellow | 3 | 3 | 11 | 11 (Blue) | 2 | |
| B- | Green | 4 | 4 | 10 | 10 (White - Blue TP) | 7 | |
| R+ | Violet | 5 | 5 | 9 | 9 (Violet) | 3 | |
| R- | Blue | 14 | 14 | 25 | 25 (White - Violet TP) | 8 | |
| +5V | Red | 15 | 15 | 24 | 24 (White - Gray TP) | 5 | |
| Ground | Black | 16 | 16 | 23 | 23 (Gray) | 4 | |
| Enc Shield | - | 17 | 17 | 22 | 22 (Shield) | | Casing |



A.3.1 25-Pin Feed Through

